Analyzing Residential Land Use Impacts along the Sheppard Subway Corridor

by
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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revision, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Matthew Lee

Abstract

Urban economic theory states that transit improvements result in travel time savings and consequently warrant higher rents particularly with proximity to surrounding stations. This research uses the Sheppard subway corridor as a case study to test the established theories by measuring the changes to residential intensification and property values (1) as a function of time before and after the construction, and (2) as a function of distance to subway stations. Two metrics are established to observe residential intensification and property value: Dwelling Density and Value Density respectively. Dwelling Density is the number of dwellings contained in its property parcel divided by property area; Value Density is total property value of a given property parcel divided by its property area.

Using obtained property sales data in four identified analysis years (1991, 1996, 2001, and 2006) and ArcGIS, spatial interpolation surfaces are generated to visualize the changes on a geographical plane through time. Dwelling and Value Density scatterplots are generated by extracting values from the interpolated surfaces and computing its distance to the nearest subway station and to major development nodes.

The generated interpolated surfaces show a strong increase in Dwelling and Value Density in North York Centre which suggest that (1) planning policies succeeded in guiding residential growth, (2) a time lag is present of which the full benefits of rapid transit construction are realized, and (3) there may be positive network effects associated with the completion of the Sheppard subway.

The scatterplot results demonstrated moderate change in Dwelling and Value Density at the Bayview station area and little change for the remaining stations (Bessarion, Don Mills, and Leslie) based on observations up to December 2006. The results warrant a degree of optimism about Sheppard subway's ability to attract residential intensification and raise property values, especially

given that data was analyzed only up to four years after the subway corridor began revenue service. It is recommended that a similar methodology be performed at a later date when the corridor's ridership and surrounding development reaches maturity. A preliminary forecasting exercise determined that Dwelling and Value Density will rise, particularly surrounding stations that have since demonstrated little change in residential land use.

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First and foremost, I like to thank my advisor, Dr. Jeff Casello. It has been a long and winding road to reach this destination, and I could not have produced this thesis without his patience, knowledge, and support for my research. Dr. Casello has taken on a very important mentorship role in my graduate studies—his commitment to promoting public transit in research, in the industry, and in the community is truly inspiring. It has certainly been a pleasure working with him.

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Special thanks to Bowie, Erica, and Eugene who took the time to edit my thesis on short notice. Your feedback and insights have absolutely improved the quality of my work.

I also want to thank my family: Mom, Dad, Mah Mah, Bonnie, and Adam. Thank you for your continued support and for allowing me to put my thesis work in first priority, not matter what family obligations may arise. I would not be where I am without your love, encouragement, and support.

Dedication

In memory of Pau Pau and Yee Gung.

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List of Definitions

1-9

1-Sample T-Test
A statistical hypothesis test community used to determine the mean (based on a identified degree of confidence) of a normally distributed array of samples.

A

Analysis Year
A selected year in which analysis occurred. In relation to the thesis research, four Analysis Years were selected: 1991, 1996, 2001, and 2006. These were chosen to coincide with available Census data.

Accessibility
Ease of ability of people to reach goods, services and activities

Agricultural Economic Theory
Body of literature related the economics of supply, demand, and the use of farmland based on proximity to desired markets. Considered to be the basis for subsequent works related to urban economic theory.

B

Bid Rent Curve
An urban spatial structure outlining how the price and demand for land increases with proximity to the Central Business District.

C

Census Tracts
The second smallest standard geographic area for which Census data are disseminated. Delineated areas are much more stable than Dissemination Areas and Enumeration Areas and are used more often for temporal analyses.

Central Business District
The business and commercial core of a given city, also known as the Downtown

Condominium Plan
A legal document held by a condominum property which includes the detailed floor plans, land surveys, governance, and bylaws related to the property.

D

Dissemination Area
The smallest standard geographic area for which Census data are disseminated. They are often are uniform in terms of population size, which is targeted from 400 to 700 persons and are relatively stable through time.

Dwelling
A self-contained residential unitdesigned for or converted for human habitation in which a person or group of persons reside or could reside (based on the Statistics Canada definition).

Dwelling Density
The number of dwellings contained within a property parcel normalized by the area of the property. It is a unit of measurement used to quantify changes in residential development within a given area.

E

Enumeration Area
Prior to 1996, it is the smallest standard geographic area for which Census data are disseminated. It has since transitioned to Dissemination Area.

H

Hedonic Modelling
A form of multivariate regression which attempts to isolate the effect of each housing chracteristic on a property's sale value.

Household
Any number of people living within the same dwelling. They do not need to be related to one another (based on the Statistics Canada definition).

L

Land Parcel
An uniquely defined area of land for ownership

Leasehold Condominium Property
A property usually consisting of subdivided Leasehold Condominum Units owned wholly by a condominium corporation. Once a condominium property is registered under the Condominium Act, the ownership is transferred from the developer to the established condominium corporation.

Leasehold Condominum Unit
A single unit within a Leasehold Condominum Property and is never legally "owned" by the purchaser. The purchaser instead buys a leasehold interest in the dwelling suite and the common areas associated with the Leasehold Condominum Property.

M

Macro-level Analysis
The examination of spatial and temporal changes Dwelling and Value Density within the identified study area as a function of distance to identifed major development nodes. (see also Station-level Analysis).

M (Continued)

Major Development Node
An high-density, amenity-rich community with a high concentration of employment. Two major development nodes are identified in the thesis study area: the Central Business Distrct and North York Centre.

Multi-Dwelling Freehold
A property which includes more than one dwelling where complete ownership is legally permiitted by the purchaser(s).

O

Orthophoto
An aerial photgraphic image whose relief displacement and radial distortions have been eliminated (Korte, 2000).

R

Raster Surfaces
Geospatial layers generated through spatial interpolation

Rent Density
A unit of measurement used to quantify changes in development, intensification and overall property value within a given area. It is measured by dividing the total potential rent to be collected within the property by the area of the property. This unit of measurement was not used in the analysis.

S

Sample Point
A system of grid points established in GIS as a means to extract the values based on the generated interpolated raster surfaces. There are two types of sample points: macro- and station-level. See Section 3.5.8 Part A for details.

Sign Test
A non-parametric statistical hypothesis test used to determine the median value (based on an identifieed degree of confidence) of a given distribution of values. Considered to be less rigourous test than the Wilcoxon Signed Ranks Test (Triola, 2008)

S (Continued)

Single-Dwelling Freehold
A property which includes only one dwelling where complete ownership is legally permiitted by the purchaser(s).

Spatial Interpolation
A GIS process which facilitates the extrapolation of sample point data to a larger area by estimating of the value of an attribute for any point location within a given study area based on the available data of known locations (Chou, 1997).

Station Area
The area formed by creating a 1 km buffer from each rapid transit station.

Station-level Analysis
The examination of spatial and temporal changes Dwelling and Value Density within a 1 km buffer from each individual rapid transit station. (see also Macro-level Analysis)

Study Area
The geographic area in which analysis was undertaken. It is defined by Yonge Street to the west; Highway 401 to the south; Highway 404 to the east; and Finch Avenue, Leslie Street and Van Horne Avenue to the north.

U

Urban Economic Theory
The general body of works related to study of the interaction between land use and transportation and its impact on the urban structure of a region

Urban Form
The physical attributes, such as the land uses, of an urban area.

Urban Interation
The connection and interrelatedness of the urban form within a given geographic area.

Urban Structure
The theoretical mechanism that attempts to explain the urban form and urban interaction phenomenon.

V

Value Density
A unit of measurement used to quantify changes in total property value within a given area. It is measured by dividing the actual or estimated total value of the property by the area of the property.

W

Wilcoxon Signed Ranks Test
A non-parametric statistical hypothesis test used to determine the median value (based on an identifieed degree of confidence) of a given distribution of values. Considered to be more rigourous test than the Sign Test (Triola, 2008).

List of Abbreviations

CBD
Central Business District

CPN
Condominium Plan Number

CT
Census Tract

DA
Dissemination Area

EA
Enumeration Area

GIS
Geographic Information Systems

IDW
Inverse Distance Weighted

LCP
Leasehold Condominium Property

LRO
Land Registry Office

MFP
Multi-Dwelling Freehold Property

MPAC
Municipal Property Assessment Corporation

NYC Plan
North York Centre Secondary Plan

P3s
Public Private Partnerships

PIN
Property Identification Number

Sheppard East Plan
Sheppard East Subway Corridor Secondary Plan

TIF
Tax Increment Financing

TIN
Triangulated Irregular Network

Chapter 1:
Introduction

1.1 Background and Research Motivation

Ontario, like many jurisdictions across the country, is in the midst of a major infrastructure rebuild and expansion program. The purpose of these investments is to address the infrastructure deficit after years, and even decades, of poor planning and underinvestment in infrastructure. This past practice of poor planning and underinvestment has led to an infrastructure deficit affecting a number of key public sectors including roads, transit, educational facilities, hospitals, and water and wastewater management facilities.

To tackle the rising infrastructure deficit, all three orders of government have committed to a number of infrastructure funding programs (Canada Strategic Infrastructure Program Build Canada, Renew Ontario, Metrolinx's *The Big Move*) and long term revenue streams (Dedicated Provincial and Federal Gas Tax), many of which are aimed for public transit capital expansion. However, the committed funds are arguably not being delivered quickly enough. For instance, of the 41 rapid transit projects proposed for the Greater Toronto and Hamilton Area under Metrolinx's *The Big Move* 15-year plan (Metrolinx, 2008), only seven have been committed funding[1]. In addition to the looming deficit from senior levels of government (Benzie & Ferguson, 2009; Vieira, 2009), it

[1] The committed projects as of March 6, 2010 are as follows: (1) Spadina Subway Extension, (2) Queen Street Züm, (3) Viva Highway 7 BRT, (4) Viva Yonge BRT, (5) Finch West LRT, (6) Sheppard East LRT, and (7) Scarborough RT upgrade and extension (Ministry of Finance, 2006; Queen's Printer for Ontario, 2009b, 2009c).

is anticipated that capital budgets for infrastructure such as rapid transit expansion may be reduced. Meanwhile, as automobile reliance remains prevalent, roads continue to be congested, and greenhouse gas emissions continue to grow, investment in public transit becomes more desirable.

One of the ways government agencies are accelerating public investment is through the adoption of innovative financing strategies to align infrastructure funding shortfalls from the cash-strapped public sector. For instance, Tax Increment Financing (TIF) and Public Private Partnerships (P3s) are increasingly common in many infrastructure sectors including highway expansion, parking capacity provision, hospital expansion, etc. (AASHTO Center for Excellence in Project Finance, 2009). However, using these innovative financing tools for the expansion of rapid transit has been less common, mainly because the anticipated revenue stream as a result of a rapid transit improvement is mixed or unclear (Diaz, 1999; Hess & Almeida, 2007). There is great difficulty in measuring the exact influence the piece of infrastructure (e.g. the expansion of a rapid transit corridor) has on redevelopment, intensification, and property values. The answer to this problem is pivotal to developing policies to encourage the private sector to partake in P3s for transit capital projects. It is this key problem to which this thesis aims to provide answers.

1.2 Research objective and scope

The objective of this thesis is to quantify the changes to residential intensification and value appreciation before and after the construction of the Sheppard subway, a newly constructed rapid transit corridor in northern Toronto (see Section 4.1.1). The research purpose is to reveal to real estate professionals, policy makers, and citizens, through conducting a case study, about the positive externalities related to investment in rapid transit. Specifically, this thesis aims to quantify how such investment can be an appropriate instrument in realizing the planning objectives shared by many of Canada's urban centres: (1) curbing urban sprawl and managing growth through intensification and (2) stimulating reinvestment in targeted areas and neighbourhoods.

This thesis applies Geographic Information Systems (GIS) tools as a means not only to quantify the changes in residential intensification and value appreciation along the Sheppard subway before and after construction but also to present the findings in a way that can be easily understood. Thus, the effective use of graphical solutions plays a key component in ensuring the accessibility of the information presented in this thesis. With the above points in mind, this thesis aims to address the following research questions:

1. How has the Dwelling Density and Value Density change at the property level over time along the Sheppard subway along the corridor?
2. What relationships, if any, exist in the Study Area between Dwelling and Value Density based on the property's distance to (1) a subway station and (2) to major development nodes?
3. What opportunities exist through the use of graphical solutions to better communicate these Value Density and Dwelling Density effects over time?
4. What other factors may be contributing to the current state of redevelopment along the corridor?

1.3 Content of thesis

This chapter has introduced the key objectives and research questions that this research seeks to address. Chapter 2 presents the literature review related to the interactions between land use and transportation, as well as the methods in modelling the impacts of transit on residential property value and investment. Chapter 3 outlines the methodology applied in the research. Chapter 4 presents and discusses the application of the methodology to the selected Study Area. Chapter 5 presents and discusses the analytical findings of the research. Chapter 6 summarizes this project, draws conclusions from the findings, and identifies areas for further research.

Chapter 2:
Literature Review

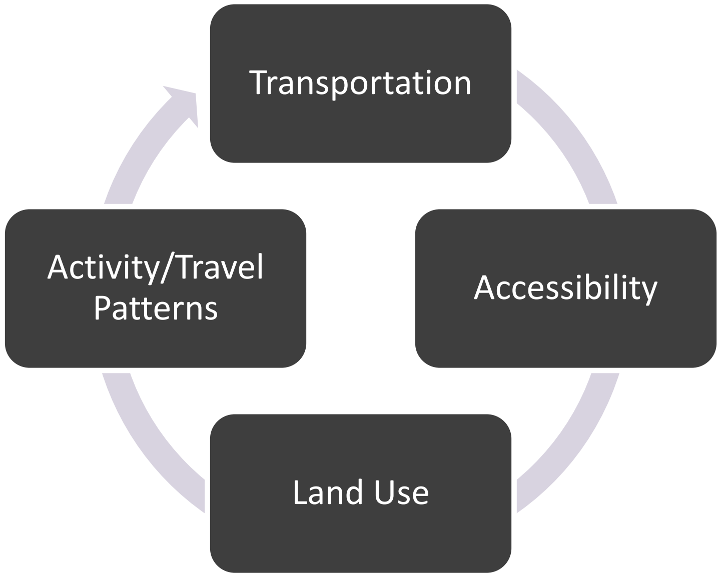
Transportation economist Herbert Mohring stated that "the basic benefit of an investment—[whether it is] highways or anything else—is the value of the resources it releases for other uses" (Koutsopoulos, 1976, p. 4). The premise of this thesis research is to quantify these "resources it releases to other uses." If in fact a rapid transit project, such as the Sheppard subway, does produce some additional value intake, these values should be observable in the changes in land use and property values surrounding the improvement.

Before undertaking this research, it is important to identify the nature of the changes that could be expected based on previous literature. This chapter begins by introducing the concepts related to land-use transportation interaction. It is then followed by a discussion of the evolution of classical urban economic theories. Finally the literature review concludes by examining the techniques in modelling the impacts of rapid transit investment on property values, namely the hedonic model and the spatial interpolation mode.

2.1 Land-use transportation interaction

Land use and transportation often parallels the "chicken and egg" phenomenon, as change in land uses affects transportation just as changes in transportation infrastructure affect land use (Giuliano, 2004). This mutually dependent connection is pivotal to the understanding and rationale of the thesis research, and it is best illustrated in Figure 2-1.

Figure 2-1: Transportation and land use relationship (Giuliano, 2004; Handy, 2005)

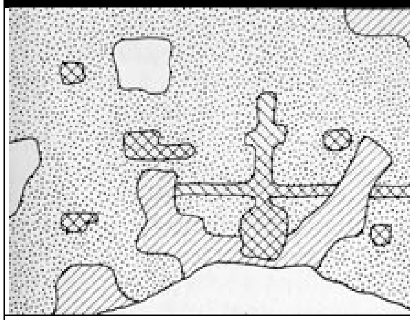
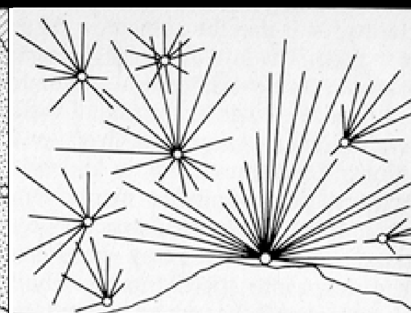
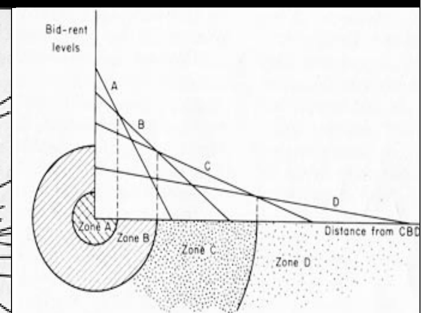


Following the perpetual cycle illustrated above, the nature of the transportation system determines its accessibility, or the ease of moving from one place to another. Meanwhile, accessibility determines the types and forms of development that takes place in a given location, which in turn affects the travel patterns that are associated from those land uses (McDonald & McMillen, 2007). These changes in travel patterns then affect the transportation system. This dynamic relationship is a pivotal concept in understanding the goals and challenges of quantifying the land use impacts of transportation investments, as it involves examining each component in isolation through time (Giuliano, 2004).

Understanding this land-use transportation interaction concept requires a close review of the theories of urban economics and how land values are influenced by its proximity to markets and centres of activity. Before the theories are reviewed, a set of working definitions need to be established as to avoid misinterpretation within the discussion of the literature.

Among these terms, urban form is defined as the physical attributes of an urban area. For instance, characteristics that describe urban form include: type of land uses; and the compactness, height, and mass of structures. Urban interaction is how urban forms connect and interrelate within a given geographic area. Features that describe urban interaction for instance are flows of passengers, money, goods, knowledge, and resources. Lastly, Urban Structure is the theoretical mechanism that attempts to explain the urban form and urban interaction phenomena (Bourne, 1982). Bid rent curves, for instance, are a representation that considers urban form and urban interaction and attempts to infer a general theory behind rent and distance from the CBD. Figure 2-2 defines these key terms in detail.

Figure 2-2: Key terms used in the literature review (Bourne, 1982)

<table>
<tr><th>Urban Form</th><th>Urban Interaction</th><th>Urban Structure</th></tr>
<tr><td></td><td></td><td>
</td></tr>
<tr><td>Spatial pattern of individual elements within an urban area For example: buildings, land uses, social groups, economic activities) (e.g. Density, Land uses)</td><td>Interrelationships, linkages and flows that draw the patterns and behaviours brought on by the individual elements within the urban area (e.g. Passenger flows, money flows, fow of goods)</td><td>Combines the characteristics of urban form, patterns of behaviour, and interactions with subareas with a set of rules of spatial organization that make up a city (e.g. Organizing mechanism via bid rent curves)</td></tr>
</table>

Having explored these three terms, the objective of the literature discussions contained in Sections 2.1.1 to 2.1.5 is to draw upon a conceptual urban structure that fits each of the models of urban economic theory. Ultimately through this exercise, an appropriate urban structure is developed for the Toronto urban area and a formal research hypothesis is developed for the Study Area.

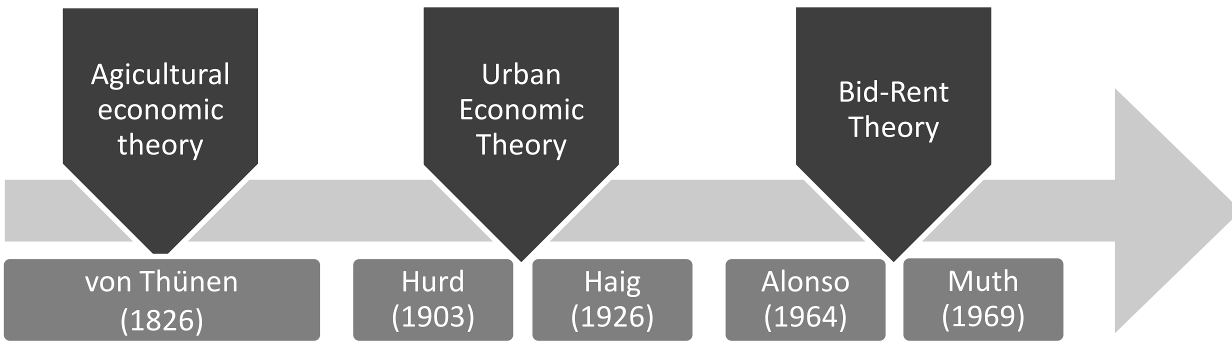
The review begins with an exploration of classical monocentric urban economic theories (Section 2.1.1), followed by a discussion of the adapted mononcentric radial model (Section 2.1.2) as well as a critique of the monocentric model altgether (Section 2.1.3). From there, the review concludes by examining the emerging ideas about polycentric urban structures (Section 2.1.4).

2.1.1 Classical monocentric urban economic theories

Considerations regarding the land-use and transportation relationship began in the 19th Century with the pioneering work of von Thünen's (1966) location analysis of the agricultural landscape[2]. He hypothesized that a city was organized according to a series of concentric rings, each with a distinct level of agricultural activity, spanning from the core of the city.

These spatial distinctions were based on a farmer's willingness to pay a premium to offset the general costs of transporting crops to markets. Assuming that farmers are completely rational only to their farming practices, he predicted that the greater the cost of goods transport, the more central the farm would be situated in the city (O'Sullivan, 2009).

Figure 2-3: Timeline of the evolution of classical location theory in the Concentric era (Grass, 1992)



Taking the works of von Thünen, Hurd (1903) explained that the highest values and rents are based on "nearness" to the centre of an urban area. Given the monocentric nature of cities of the early 20th Century, the urban centre held a comparative advantage of having a greater number of transportation linkages (primarily rail and marine) not available in its peripheral areas. These key transport linkages provided a maximizing effect on labour availability and consumer market flows in the urban centre, and thus enabled a premium in land rents. Meanwhile, Haig (1926) complemented the work of Hurd by stressing the correlation between transport and rent costs. He suggested that the rent premium an owner could charge was directly related to the saving in transport costs that would be generated from the site. In other words, a perfect residential location is one that offers the desired level of accessibility at the lowest costs of transport (Wrigley & Wyatt, 2001).

Alonso (1964) later extended the ideas of von Thünen and Hurd and developed an urban structure called *Bid Rent Model*. Assuming (1) that each household is identical and (2) that employment and amenities are located only in the central city, Alonso's model asserts that

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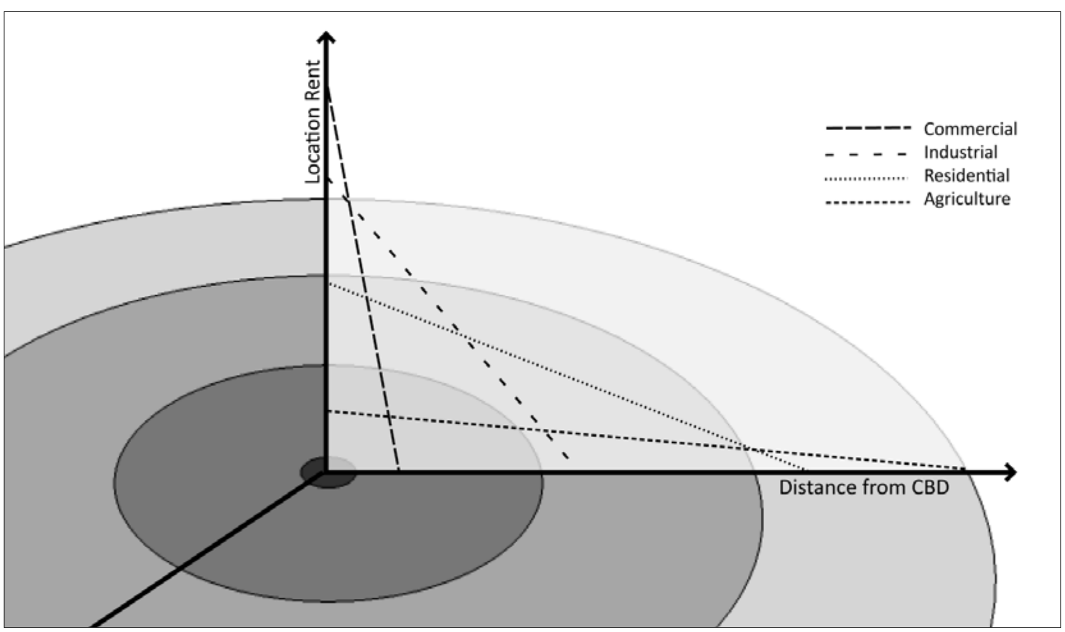
[2] von Thünen's work was developed in 1826 in German; an English publication exists in 1966.

households would be indifferent about housing location choice in a given urban area because the spatial variations in housing prices would offset the utility of living on the property.

Meanwhile, Muth (1969) developed a revised urban structure concept similar to Alonso's, where he assumed that all employment and other amenities are situated in the central city. Instead, Muth assumed that wages in outlying employment areas are comparatively lower and thus, workers would feel indifferent about working in either area.

Regardless of subtle differences, both Alonso (1964) and Muth (1969) upheld the assumption that land rents are determined solely by accessibility to the city centre (Fina, 1999). Under their framework, one would expect an inverse relationship between housing costs per unit area and transportation costs to employment and amenities. The highest residential rents would occur at the city centre and decline with distance from the city; the lowest cost of transport would exist also at the city centre and increase with distance away from the city. A similar logic can be made for commercial and industrial location situations. As described by Cadwallader (1996), commercial and industrial land uses are more sensitive to accessibility than residential uses, and thus are more elastic to location rent as a function of distance. Figure 2-4 illustrates a conceptual urban spatial structure for a monocentric city. Notice that commercial and industrial bid rent curves have a relatively steeper slope, due to greater price sensitivity to accessibility.

Figure 2-4: Concentric land use zones generated by the bid rent curves for commercial, industrial and residential land uses (Cadwallader, 1996)



2.1.2 Time-space convergence, and the emergence of the radial model

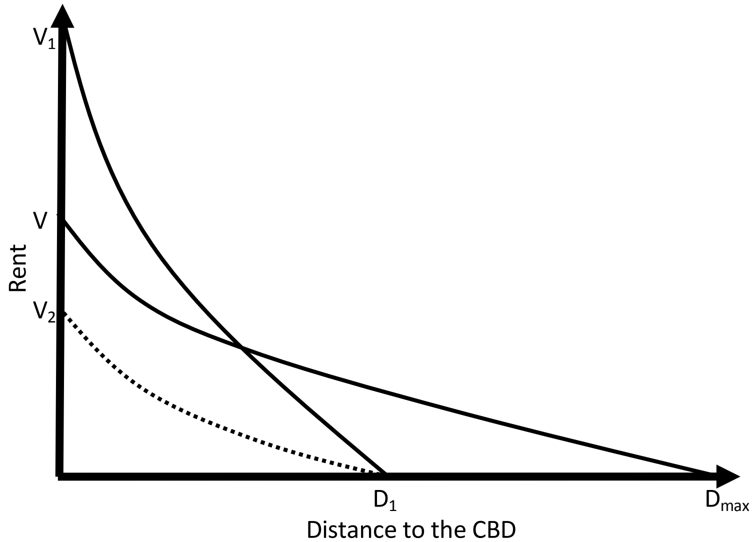
Koutsopoulos (1976) noted that while considerations of transportation was a major part of the classical theories of urban land values, the effect of transportation on the structure of a city was always executed on a macro level, namely that (1) transportation services are uniform throughout the city, and (2) bid rents are a function of distance from the Central Business District (CBD), and not the time required to get to the CBD.

Researchers such as Hoyt (1939) filled the research gap in recognizing the concept of time-space convergence as a result of transportation. He stated that gradient models like those presented in Figure 2-4 do not properly represent North America's metropolitan areas, like his study of Chicago in 1939. He concluded that land use patterns in a given city were not defined only by concentric circles, but that it was dictated also by the established transportation corridors, including rail lines and major roads. As he notes, this is due to the fact that transportation improvements result in travel time savings; thus, areas surrounding stations and corridors are likely to warrant higher rents given its lower transportation costs (per unit time) relative to distance. Consequently, urban expansion would not necessarily expand based on the proximity to the CBD. Rather, activity was more likely to occur along transportation corridors radiating from the core.

Giuliano (2004) points out how the bid rent curve would respond to a change in transport costs. V_1D_1 in Figure 2-5 illustrates a hypothetical bid rent function before the transportation improvement, and VD_{max} shows the post-improvement function after adjusting to the decrease in travel costs, differentials between the CBD and the urban fringe, as well as the elasticity of demand for land.

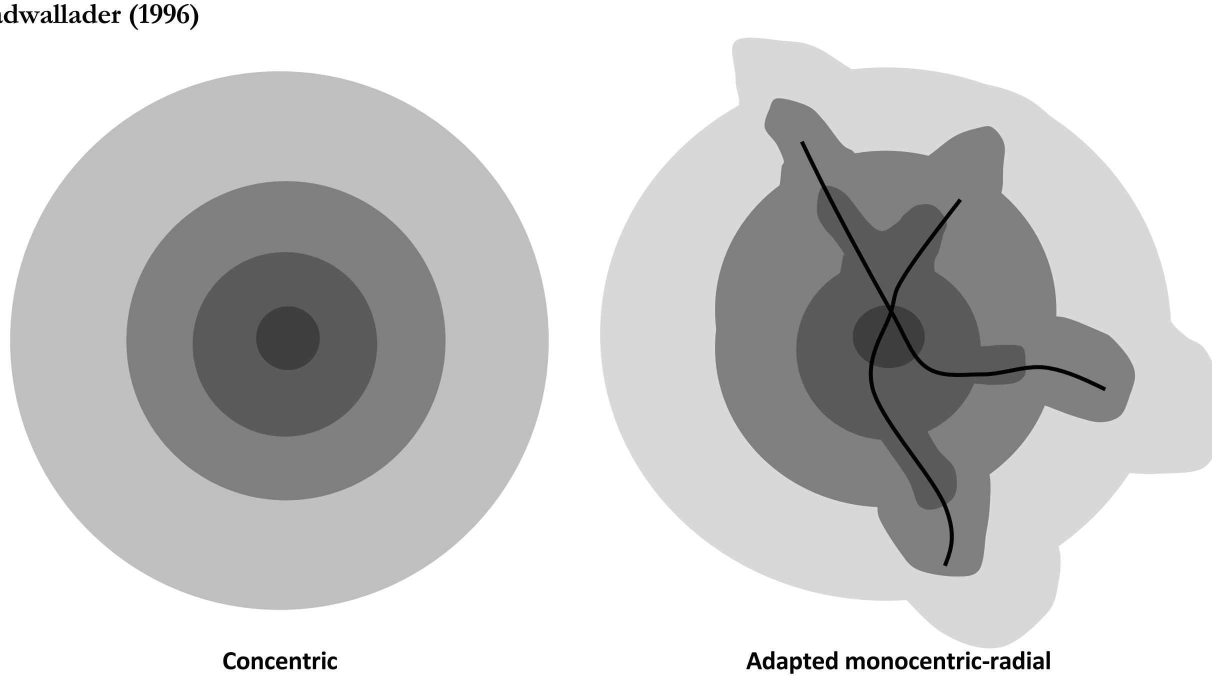
A similar phenomenon would occur with a radial transportation improvement like the construction of a rapid transit line, where the pre-improvement structure of land values is illustrated by $V_1D_{1.}$ The transportation improvement then causes a decrease in travel costs to the CBD, causing the gradient to first decline to the dotted line at V_2D_1. Meanwhile, consumers (1) move into the area close to capitalize on the travel savings, and (2) escalate the level of demand for land in the nearby radial line as a result of the price decrease, causing an upward shift to a new equilibrium VD_{max} (Koutsopoulos, 1976).

Figure 2-5: Response to rent function of a uniform and radial transportation improvement (Koutsopoulos, 1976)



In summary, urban structures and the gradients of land values are not only structured by concentric circles, but also structured by slight radial (or circumferential) variations as evident in radial transportation improvements prevalent in North American cities. Figure 2-6 illustrates the differences between the concentric model and the adapted monocentric-radial model.

Figure 2-6: Concentric model versus the adapted monocentric-radial model. Adapted from Cadwallader (1996)



While Hoyt's (1939) work primarily focused his research mainly on the organization of a city's urban form— particularly with identifying sectoral patterns in land uses— his work is crucial for bridging the knowledge gap between the classical theories of land use and time-space convergence as a result of the prevalent improvements in transportation infrastructure. This concept is important in the understanding of the development within this Study Area.

2.1.3 Demise of the classical monocentric theories

Given the rapid change in urban development—especially in North America since the 1950s—classical concentric urban land models are an "inaccurate depiction of today's urban spatial structure" (McMillen, 2006, p.128). While these classic monocentric theories provide a fundamental understanding about urban land use and value, they have since been widely criticized due to (1) their simplifying assumptions, (2) their lack of relevance to modern North American cities, and (3) their decreasing relevance on home-and-employment urban interaction. Figure 2-7 provides a summary of drawbacks related to the concentric models of urban land values.

Figure 2-7: Summary of criticisms of the monocentric model (Berry & Kim, 1993; Cadwallader, 1996; Wrigley & Wyatt, 2001)

1. **The CBD is the only and prominent centre of employment and activity in a city**
   - Modern cities no longer have one single centre or CBD
   - Subcentres are increasingly prevalent, each generating its own set of concentric land use zones
2. **The transportation costs is a direct function of distance from the CBD**
   - The assumption that transportation costs increases with increasing distance from the CBD no longer holds true
   - The construction of highways and rail infrastructure, has dramtically improved transportation costs along radial and ring transportation networks
3. **The real estate market operates in a free-market economy with no intervention**
   - Variations in property tax from different municipalities will influence locational decisions
   - Zoning restricts certain land uses, and thus, each plot of land is no longer utilized by the use that generates the highest value.
4. **The city is located on a uniform plane**
   - Land use and value patterns respond to variations in local topography and underlying geology
5. **The real estate market has no regard for land use interdependence**
   - The value of an urban land parcel is determined in part by its adjacent land uses
   - Adjacent land uses are likely to cause either positive or negative externalities

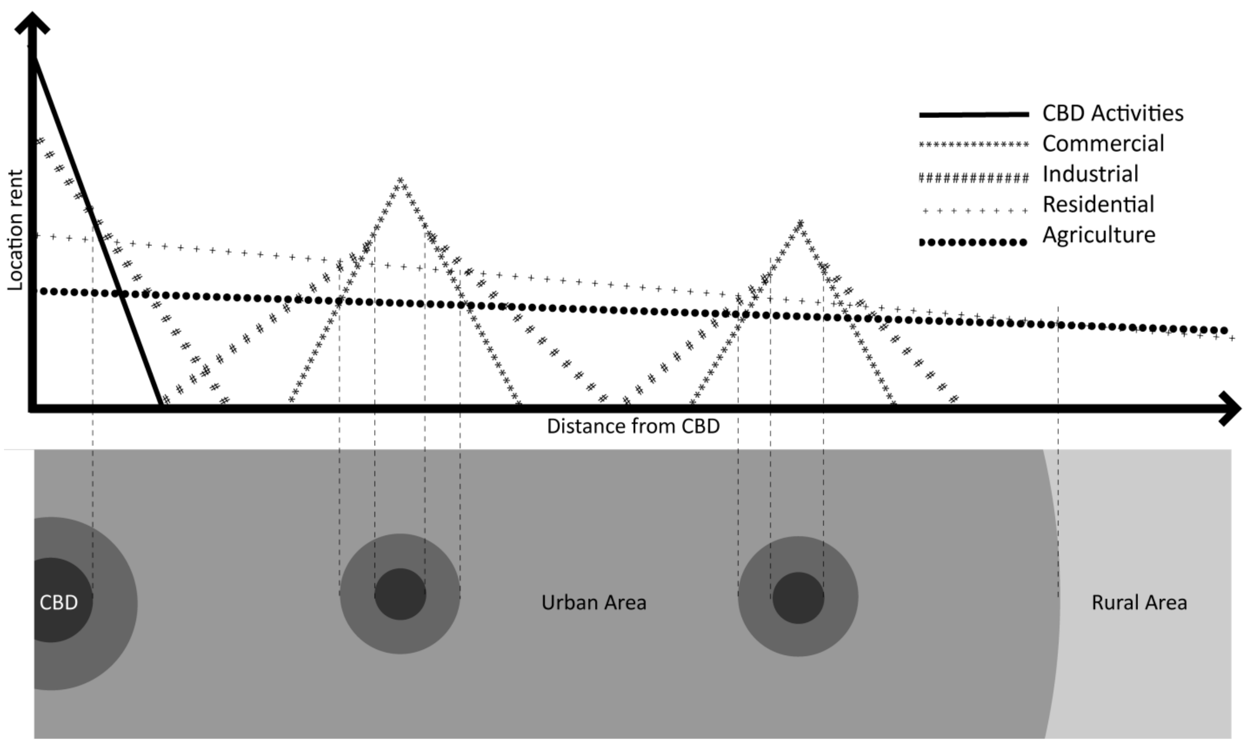
As a result of these criticisms, adaptations of the traditional concentric and radial model are presented, namely the polycentric model. This model is discussed in Section 2.1.4.

2.1.4 Emergence of the polycentric model

With the rise of the automobile and the middle class after the Second World War, the spatial structure of North American metropolitan areas began to further evolve. The increased accessibility as a result of automobile use and road expansion resulted in North American cities no longer recognizing the CBD as the sole location where urban development was centred around (Harris & Ullman, 1945). Instead, a number of distinct development nodes have since emerged without the influence or relation to the distance from the urban core (McMillen & McDonald, 2004).

With the direct attempt to correct the assumptions of the monocentric model that is no longer accurate in the North American urban spatial structure, a new body of literature emerged describing what is now understood as the polycentric model. The critical element of the polycentric model is the "endogenous generation of subcenters" (Cadwallader, 1996., p. 67). These emerging subcenters are defined as suburban areas with greater concentrations of economic and employment activity. Because the subcenters create their own centres of economic activity, Yeates (1990) hypothesized that each node would produce its own set of land use concentric zones. From this concept, Yeates borrowed concepts from Alonso's *Bid Rent Model* and developed a notable polycentric spatial structure that is more applicable to many North American cities. As evident in Figure 2-8, Yeates (1990) postulated that the polycentric city is not entirely different conceptually from the monocentric city, except for having a more complex set of bid rent curves.

Figure 2-8: Hypothetical polycentric land-use zones generated by the bid rent model. Adapted from Yeates (1990)



Cadwallader (1996) points out that the formation of subcenters occurred mainly as individual firms and developers acknowledged that it was in their interest to forego the advantages of agglomeration of economies found in the CBD in an attempt to reduce overall rent. For instance, the development suburban activity centres such as North York Centre and Scarborough Centre were supported by Toronto regional and local governments for the exact same reason (City of North York, 1992; Municipality of Metropolitan Toronto, 1980) (See Section 4.1.2). Section 4.1.3 translates the urban economic theories described in this chapter and assesses its relevance to the City of Toronto and the Study Area.

2.1.5 Empirical studies on transportation land use impacts

Wegener & Fürst (1999) states that while there is a great deal of empirical studies investigating the impact of urban form on transport behaviour, the reverse direction of impacts (i.e. the impact of transport on urban form) has attracted much less attention from empirical researchers. They attribute this trend mainly to the fact that land use changes occur much more slowly, and that its impacts are often subjected to many other influences.

Nevertheless, there are still a number of empirical studies analyzing the impacts of transportation on land use. The earliest work cited by Wegener & Fürst (1999) is by Hansen (1959) through a case study of Washington, DC, where he demonstrated a correlation between accessibility to employment and residential land use density. However, it is Knight & Trygg's (1977) seminal work on the land use impacts of rapid transit that generated empirical interest on this topic and its policy implications on North American cities. They suggest that rail rapid transit improvements have a significant impact on land use when supported by other equally important factors such as land use controls, the availability of land, attractiveness of surroundings and general regional demand. Through an evaluation of case studies in North America, their work focused on four relevant themes: (1) growth refocusing, (2) impacts of different transit modes, (3) role of land use policy, and (4) other factors influencing land use impacts. The conclusions identified from the study are summarized in Table 2-1.

Table 2-1: Relevant findings regarding land use impacts of rapid transit from Knight & Trygg (1977)

Land Use Impact Issues	Description
Growth focusing	• Rail rapid transit improvements influenced intensification, but only when matched with favourable conditions, including: o Absence of neighbourhood opposition towards intensification o Social and physical charcteristics of the area which may conflict with development forces o Ease of access of developable lands to the station site o Availability and ease of acquiring developable (or redevelopable) land o Planning policies that support development
Impacts of different transit modes	• Conventional rail and commuter rail modes contribute to land use intensification • Light rail and busways' impact on land use has been inconclusive • In all cases, rapid transit improvements must be aligned with other planning policies to guide land use change
Role of land use policy	• Land use policies have often facilitated rapid transit's land use impacts, where: o Land use policies and policy incentives raised the competitive advantage of targetted lands over other areas, which increases development potential o The same policies have also effectively stopped development by restricting the assembly of land and the development of higher-density structures
Factors influencing land use impacts	• Rapid transit is one instrument to guide land use patterns, but it cannot happen on its own nor if other factors oppose it o Thus policies must be coordinated to meet identified goals for land use change

Knight & Trygg (1977) also recognized the variations to the extent of impacts in a number of North America cities, ranging from significant in Boston, Montreal, Philadelphia and Toronto to negligible in Cleveland and Chicago.

There are a number of recorded positive effects of rapid transit on land use. Cervero & Seskin (1995) concluded that heavy rail transit provides the largest incremental increase in accessibility and are expected to provide the most measurable land use impacts. Hunt et al. (1994) found that residential location preferences in Calgary are strongly influenced by distance to light-rail stations. Badoe and Miller (2000) cited case studies in Philadelphia (Knight & Trygg, 1977), San Francisco (Workman, 1997), and Portland (Arrington, 1989) that found increases in property value and in total development surrounding transit stations. Green and Jones' (1993) study of Washington, DC found that development closer to rapid transit stations increased at a higher rate than other areas. Meyer & Gomez-Ibanez (1981) and Smith (1984) found that the expansion of rail rapid transit was responsible for the decentralization of people and jobs away from the central city but have also demonstrated clustering effects in nodes outside of the central city. This resulted in the development of a more polycentric urban structure than if rapid transit was not introduced.

On the other hand, numerous studies have found inconclusive or negative effects of rapid transit on land use. Cervero & Landis' (1997) case study of the Bay Area Rapid Transit (BART) found that the land use changes associated with BART had been largely localized and was limited to downtown San Francisco and Oakland and a number of suburban stations. In a separate study of BART, Giuliano (1995) found that that access to stations was a minor consideration in household location choice, while the most important decision factors include: housing characteristics, general access to work, and neighbourhood characteristics. Landis & Cervero (1995) reported decreases in residential property values with proximity to a number of station areas along the CalTrain—however, it was mainly attributed to possible conflicting industrial and commercial land uses. Mixed or inconclusive results were evident in rapid transit case studies related to property value increases in Portland (Nelson, 1997) and population increases in Atlanta (Al-Mosaind, Deuker, & Strathman, 1993). For a more in-depth discussion of property value impacts associated with rapid transit, refer to Section 2.1.1.

The core concepts to recognize from these empirical studies related to land-use transportation impacts is that accessibility is what creates value and that this accessibility is gained with proximity to stations—this is the reason for increases in the supply or price in properties adjacent to stations. While negative externalities (e.g. pollution, noise, and aesthetic unpleasantness) may offset the benefits associated with accessibility (Kilpatrick, Troupe, Carruthers, & Krause, 2007), a greater number of studies have observed net benefits to land use as a result of rapid transit.

2.1.6 Conclusions regarding land-use transportation interaction

There is a wealth of literature related to land-use transportation interaction. Von Thünen's (1966) seminal work postulated that different types of agricultural activity would occur according to its distance to markets, namely to the CBD. Hurd (1903) and Haig (1926) later refined Von Thünen's work to better suit the context of industry, who theorized that individual firms could increase competitive advantage by being near the CBD and would pay a rent premium to obtain such lands. The later expansion of rail infrastructure reduced transportation costs in the peripheral areas, promoted development along rail corridors, and increased access of firms and individuals to centrally located markets and amenities (Hoyt, 1939). The core assumption in each of the discussed land use concepts rely on the presence of a centrally located market within a single city, a concept based on the monocentric model. However, with the increased prevalence of automobile use, the relative importance of the CBD diminished and the emergence of suburban subcenters is common in cities particularly in North America.

The urban spatial structure of Toronto reflected well with the evolving theories of land use theories. Toronto's initial monocentric growth evolved to a radial-moncentric fashion following the introduction the subway network in the 1950 to 1970. In parallel, the prevalent use of the automobile caused tremendous growth in road infrastructure, which was one of the motivations leading to the development of suburban subcenters like North York Centre. The increased significance of suburban subcenters led the desire to provide higher-order transit linkages between these nodes—the original intent of the Sheppard subway was based on this premise (see Section 4.1.1). Applying the same logic as Hoyt (1939), the reduced transportation costs led by the construction of the Sheppard subway will in theory boost rents within the areas surrounding the corridor. These predictions based on the literature are to be validated by modelling the property value impacts as a result of rapid transit construction. Section 2.2 examines these modelling techniques in detail.

2.2 Modelling impacts of rapid transit on residential property value

Based on the literature, there are two primary methods to model the impacts of rapid transit on property values: (1) hedonic modelling, and (2) spatial interpolation. Each of the techniques is discussed in Sections 2.2.1 and 2.2.2, respectively.

2.2.1 Hedonic modelling

Unlike other goods normally studied in economics, housing is a unique product that holds three exceptional characteristics: durability, heterogeneity, and spatial fixity (Wen, Jia, & Guo, 2005). The significance of each feature is described in Table 2-2.

Table 2-2: Unique characteristics of residential properties (Alhashimi & Dwyer, 2004)

Characteristic	Explanation
Durability	Residential properties have useful life greater than most consumer goods. Depending on the structure, older properties may need to be upgraded or outright reconstructed.
Heterogeneity	Residential properties are never completely alike and can be characteristized by a multitude of different factors, including number of bedrooms, number of baths, extent of property upgrades, property size, structure area, property location, etc.
Spatial fixity	Residential properties occupy a fixed location. Its location has a great influence on both positive and negative externalities and thus ultimately has an impact on price.

Due to the unique nature of housing as a consumer good, a statistical method called *hedonic modelling* is widely used as a way to derive a statistical relationship between a value of a property and its individual locational, structural, and neighbourhood attributes (Freeman, 1979; Wrigley & Wyatt, 2001). In effect, hedonic modelling is a disaggregate analysis of the entire housing "package" that makes up the bundled price of a housing unit in a given housing market (Saccomanno, 1979).

In a typical hedonic modelling exercise, approximately 10 to 20 variables are identified for statistical disaggregate analysis. However, they are mainly determined by the availability of the housing data. To introduce typical explanatory variables used in property value hedonic regression, Figure 2-9 is a non-exhaustive list of variables that are applied in four select studies. Included in the table is the effect of each variable on property value.

Figure 2-9: Typical dependent variables and their effects on housing price from four hedonic model studies (Basu & Thibodeau, 1998; Bowes & Ihlanfeldt, 2001; McDonald & McMillen, 2007; McMillen & McDonald, 2004)

Independent Variable	
Selling Price / Assessed Price	
Dependent Variables	
Structural Attributes	
Building area	Positive effect with increasing area
Lot area	Positive effect with increasing area
Age of structure	Negative effect with increasing age
Number of bedrooms	Positive effect with increasing number of bedrooms
Number of baths	Positive effect with increasing number of baths
Number of car spaces in garage	Positive effect with increasing number of spaces
Central air conditioning	Positive effect
Locational Attributes	
Proximity to CBD / activity centres	Positive effect with increasing proximity
Proximity to transit station, stop	Positive effect with increasing proximity
Proximity to retail	Positive effect with increasing proximity
Proximity to employment	Positive effect with increasing proximity
Proximity to highway interchange	Positive effect with increasing proximity
Neighbourhood attributes	
Area's crime rate	Negative effect with increasing crime rate
Area's air/noise pollution levels	Negative effect with increasing pollution levels
Area's school quality	Positive effect with increasing school quality
Area's racial composition	Negative effect with increasing concentration of ethnic minority groups
Area's Dwelling Density	Positive effect with increasing density

The hedonic modelling method has been widely used in empirical research to determine to what extent transportation investment has impacts on nearby property values. Hess & Almeida

(2007) highlighted key studies that measure the effect of proximity to rail transit on residential property values. As they point out, a majority of the research suggests a positive relationship between proximity to rapid transit and land values, with some variations in magnitude. In some instances, however, there was a statistical price decrease for properties that are too close to a transit station. There were also a handful of studies that provided no significant effects on property values. While there were two studies citing decreases in property values, they were both attributed to negative land use externalities (unrelated to transit) surrounding transit stations. Figure 2-10 is a summary list of findings from hedonic analyses of property value and proximity to rapid transit stations.

Figure 2-10: Findings from select hedonic analyses of property value and proximity to rapid transit stations (Diaz, 1999; Hess & Almeida, 2007)

Research	Method	Findings
DART Dallas, TX Weinsteinand Clower, 2002	Straight-line distance to station ¼ mile from station, compared with properties located in a control group	Positive Findings Property value increased 32 per cent near DART stations compared with 20 per cent in control group areas not served by rail
MTA Queens, NY Lewis-Workman and Brod, 1997	Network distance to station One mile radius	Positive Findings Property value decreased $2300 for every100 feet further from station
SEPTA Philadelphia, PA Voith,1993	Proximity to rail service measured for Census Tracts.	Positive Findings Property value of single-family homes with access to rail stations is approximately 8 per cent higher than other homes
MAX Eastside line Portland, Oregon Al-Mosaind, Musaad, et al. (1993)	500 metre radius from station, compared to control group	Positive Findings 10.6% for homes within 500 metres
BART San Francisco Bay Area Cervero, Robert (1996)	¼ mile from station, compared to control group	Positive Findings Increase of 10-15% in rent for rental units within 1/4 mile of BART
Sacramento Light Rail Sacramento, CA Landis et al., 1995	Network distance to station	No Significant Findings No statistically significant effect on home prices
MARTA Atlanta, GA Bowes and Ihlanfeldt, 2001	Distance rings of ¼ mile from station: ¼ to ½ mile, ½ mile to 1 mile, 1 to 2 miles 2 to 3 miles	Mixed Findings Property value between 1 to 3 miles of stations increased relative to comparable properties located more than three miles. Properties within ¼ mile decreased by 19 per cent compared with properties beyond three miles
San Jose Light Rail San Jose, CA Landis et al., 1995	Network distance to station	Negative Findings Property value decreased $197 for every 100 m closer to station

2.2.2 Empirical issues with hedonic regression

While hedonic methods are widely used for determining the extent of which rapid transit influences residential property value, these techniques are met with great criticism. Chin & Chau's (2003) review outlined four major empirical issues. They include: (1) the proper choice of hedonic functions, (2) the issue of proper market segmentation, (3) the misspecification of variables, and (4) the lack of data to achieve a proper hedonic price analysis. From the reasons summarized in Figure 2-11, the inherent shortcomings of the hedonic approach are apparent.

Figure 2-11: Shortcomings of the hedonic regression modelling (Chin & Chau, 2003)

(1) Choice of functional form
- Estimates in the hedonic coefficients are based on the choice of functional forms
- Functional forms such as linear, linear-log, log-log functions are applied to the hedonic model
- Despite the long history of the use of hedonic models, very little literature provides guidance for the selection of appropriate function forms

(2) Market segmentation concerns
- Real estate is often segmented into submarkets, as housing markets are not uniform
- Hedonic modelling assumes all real estate in any geographical location is part of the same market

(3) Misspecification of variables
- Refers to the situation where an irrelevant independent variable is included or where a relevant independent variable is omitted, known as *underspecification*
- Inevitably, errors are likely to exist, as hedonic modelling involves the quantification of implicit prices of a variety of attributes within a given group of homes

(4) Lack of data
- While an independent variable may be considered relevant, there are many instances where the data are simply unavailable or too costly to collect
- If important variables are missed in the analysis, the output result will be inconsistent with what is observed in reality

As it relates to the research, insufficient data is the biggest barrier to the execution of hedonic modelling methods. Performing a reliable and valid hedonic model requires the collection of a multitude of structural information regarding individual properties, which are extremely expensive to obtain (see Section 3.5.8).

While hedonic modelling may be the closest approach to understanding how the introduction of a rapid transit corridor may affect property values, it is met with some very large assumptions, specifically through the conscious inclusion or exclusion of key housing structural and location variables for hedonic analysis. The misspecification of variables may have a profound impact on the reliability and validity of the statistical results.

2.2.3 Spatial Interpolation

An alternative to the use of hedonic multivariate statistical modelling is a more rigorous spatial analysis of property prices called *spatial interpolation*. Spatial interpolation facilitates the extrapolation of sample point data to a larger area by estimating the value of an attribute, known as the 'z-variable', for any point location within a given study area based on the available data of known locations (Chou, 1997). The product of spatial interpolation activities is the creation of a continuous surface model of the observed attribute.

The relevance of spatial interpolation emerged from the problem that a spatial dataset would never provide an observed value at every spatial location (with the exception of remote sensing disciplines). In the practical sense, data are more often observed and/or collected in the following ways:

(1) in stratifications, where values are observed in regularly spaced intervals

(2) in patches, where values are observed in clusters in specific locations

(3) in a random array in space, where values are observed in space randomly

(Heywood, Cornelius, & Carver, 2002)

The practice of spatial interpolation relates back to the seminal work of Tobler's theory of the *First Law of Geography*. He states that "[e]verything is related to everything else, but near things are more related than distant things" (Kemp, 2008, p. 146). This theoretical concept is the basis for guessing the conditions that exist in places where no observations were made. Applying Tobler's theory, the best guess about the value of a field at a point is the value measured at the closest observation points. For example, the sale price of one home is likely to be more similar to the sale price of a closer home than one that is farther away. Thus in the absence of better information, it is reasonable to assume that a field may demonstrate a relatively smooth variation between observed points (Longley, Goodchild, Maguire, & Rhind, 2005).

Chou (1997) states two fundamental assumptions made in the use of spatial interpolation modelling. First, the surface of the z-variable is continuous; thus data values are estimated at any location in the Study Area, if sufficient information about the surface is provided. Second, the z-variable is spatially dependent; thus, each attribute value of the interpolated surface is extracted based on the sample values from surrounding known locations.

Within a GIS framework, surface interpolation techniques may be used to produce three-dimensional visualizations of property values as they vary geographically. From the literature, there are four common methods to interpolate the spatial variations of an observed variable. They include: *Triangulated Irregular Network* (TIN), *Inverse Distance Weighted* (IDW), *Spline,* and *Kriging* (McCluskey, Deddis, Lamont, & Borst, 2000). Figure 2-12 describes the differences between these four techniques and summarizes the advantages and disadvantages of each method.

Figure 2-12: Grid interpolation methods and associated of advantages and disadvantages (Chou, 1997; Han, 2004; Heywood et al., 2002; Longley et al., 2005; NOAA Coastal Services Center, n.d.)

Interpolation Method	Description	Advantages / Disadvantages
Triangulated Irregular Network (TIN)	• Connects adjacent data points by lines to form a network of irregular triangles • Produces an interpolated surface based on its relative distance to known values and to the connected lines drawn	✓ Incorporates original sample points, allowing for greater accuracy of the model stores *z* surface representations efficiently ✓ Allows for the easy calculation of elevation, slope, aspect and line-of-sight between points ✕ Generates hard rigid interplated surfaces
Inverse distance weighted (IDW)	• Interpolates values by computing a weighted average of sample points nearest to the specific z-variable. • Computes weightings based on a sample points' relative distance to the interpolation point in question	✓ Achieves the objective of providing a smooth interpolated surface ✕ Produces possible counter-intuitive results in areas of peaks and pits, and outside areas covered by data points
Spline	• Interpolates a surface through the use of piecewise polynomial line of best fit among related z-values • Joins all line segments with the same z-value, forming one continuous line or loop	✓ Reveals trends efficiently within the entire dataset and within a small neighbourhood of sample points around the predicted value ✕ Produces possibly counter-intuitive results, similar to, but not as intensive as IDW
Kriging	• Interpolates values similar to IDW, but weights are estimated based on spatial autocorrelation between sample points • Determines the statistical relationship between sampled points, and this is incorporated in the prediction of unknown values.	✓ Incorporates the ability to assess error of the predicted values ✕ Requires a great solid statistical knowledge, as it requires many instances of user discretion of mathematical functions

Based on the assessment of these common interpolation techniques, the IDW method is identified as the most suitable application for modelling the quantified changes in residential intensification and value appreciation. The IDW method is an easily understandable approach to undertake and is easily explainable to all individuals. While more sophisticated statistical methods to generate interpolated surfaces, the use of Spline and Kriging methods are ruled out because it is more difficult to explain to individuals the mathematical theories behind the methods and it is questionable whether it generates more valid results. While there are no major concerns for using the TIN method, IDW is identified to be more favourable because the generated surfaces are comparatively more smoothed out through the use of raster (rather than vector) surfaces.

2.2.4 Empirical issues with spatial interpolation

Aside from the shortcomings of the specific interpolation methods described in the previous section, McCluskey et al. (2000) cite some general concerns about this approach. Issues such as autocorrelation, multicollinearlity, distribution of sample points and distortion of surfaces are summarized in Figure 2-13.

Figure 2-13: Criticisms of spatial interpolation (Dubin, 1992; Longley et al., 2005; McCluskey et al., 2000)

Criticism	Description
Autocorrelation	• Clustering of actual values leads to problems because depending on the sampled locations, the values between points may be smoothed out, when in actuality, there is an abrupt change in values
Distribution of sample points	• Depending on the location and quantity of sample points, it is likely that the interpolated output will vary dramatically • Vast geographic areas without a sample point may display an inaccurate interpolated surface
Distortion of surfaces	• Depending on the type of spatial interpolation method, it is likely that the interpolated output will vary significantly • The interpolation methods may not accurately estimate the true values

Autocorrelation and the distribution of sample points are pertinent concerns when conducting spatial interpolation of residential property value. Assuming that we interpolate only properties that are sold in a given year, abrupt spatial changes in, or clustering of property values may not be represented in the generated interpolated surface—due to the smoothing out of values between actual sale samples.

Additionally, the distribution of sample points also poses some concerns. In cases where large sections of the study area are without a sample sale point, it is more likely to encounter an inaccurate interpolated surface. Condominium properties add to the problem of applying spatial interpolation. Because a condominium structure is composed of smaller individual units, it is more appropriate for these properties to be valued through the summation of each individual unit in the property. Simply applying individual sale values for a given year without addressing the unique sale characteristics of condominiums will cause an inaccurate interpolated surface.

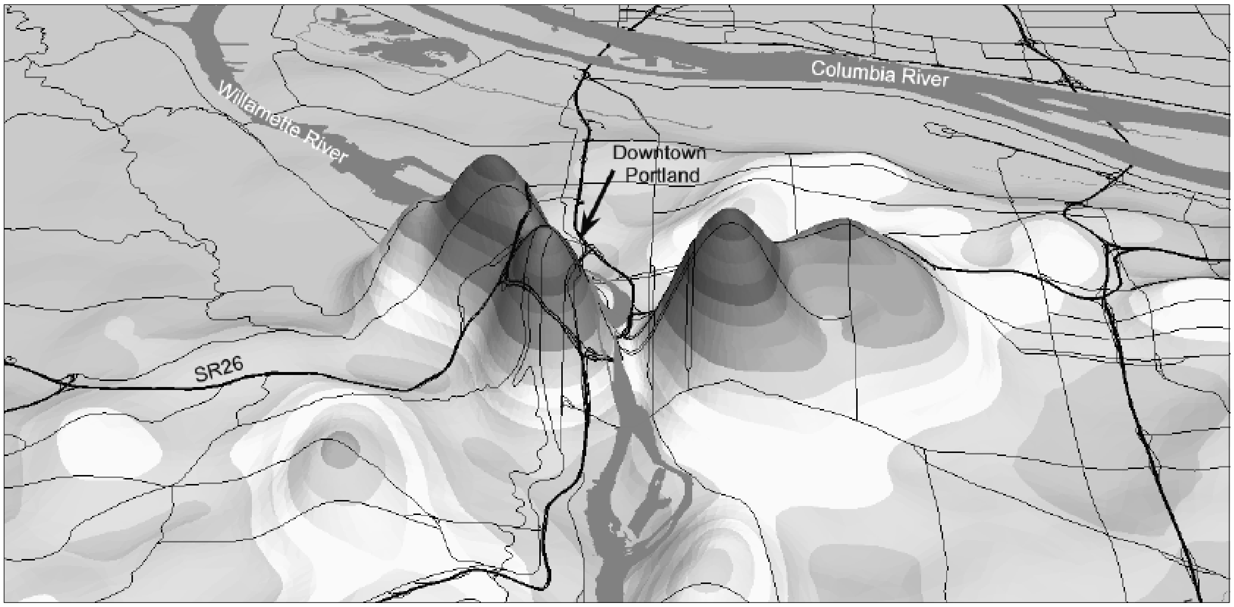
2.2.5 Geovisualization

Geovisualization is the process of creating and viewing geographically referenced images of data with the intention of understanding and learning more effectively in a visual and spatial form, rather than text and numerical data (Kwan & Lee, 2004). Particularly when working with large and complex data sets, like those related to the thesis research, it may become difficult to represent the many facets of the information through conventional tabular or graphical forms. In addition, traditional quantitative methods such as the use of hedonic regression modelling tend to reduce the dimensionality of data in the process of analysis. Thus, geovisualizations play an emerging role in handling, analyzing and managing a large set of attributes (Longley et al., 2005), while at the same time, retaining the complexity of the original data to the extent that human visual processing is still capable of handling (Kwan & Lee, 2004).

By incorporating a spatial dimension to the visualization process, users may explore, synthesize, present, and analyze an array of complex data (Longley et al., 2005). Spatial analyses related to the transportation and land-use connection has focused primarily on representing information in a two dimensional plane. However, with the increased availability of spatially referenced land use data, and the increasingly popular use of three-dimensional (3D) functions in GIS software packages, there is an increased appetite in the use of GIS-based 3D geovisualization in examining human activity patterns in space-time (Kwan & Lee, 2004).

One of the ways to visualize geospatial data in a three-dimensional plane is through the use of a density surface model, whereby the X and Y dimensions represent the physical location of a given data point, while the Z vertical dimension represents the spatial intensity of the variable at the given location. Figure 2-14 is a close up view of a density surface of trip origins in the Portland Metropolitan Area. As evident in the diagram, there are a number of peaks in the Downtown Portland area, and it is highlighted by a darker shade surface.

Figure 2-14: Close-up view of a density surface of trip origins in Portland (Kwan & Lee, 2004)



2.2.6 Conclusions regarding modelling impacts of rapid transit on property value

Both hedonic modelling and spatial interpolation are methods that are used to observe distinctions in property value given a set of property characteristics. Hedonic modelling is an approach widely taken by researchers either (1) to quantify the extent of variation in property values as a function of proximity to a rapid transit station, or (2) to quantify the temporal changes to property values before and after construction. However, despite its wide application in the academic field, one often encounters the issue of the lack of adequate data to properly perform a hedonic regression analysis (see Section 2.2.2). Spatial interpolation is an alternative method to make inferences between property values changes as a function of (1) distance to rapid transit and (2) time before and after rapid transit construction. The use of spatial interpolation and geovisualization facilitates the identification and interpretation of spatial patterns and relationships in complex data in the geographical context of a given study area (Kwan & Lee, 2004). In addition, because this alternative approach allows for analysis without the need for data related to the specific structural characteristics of a given property, this is the ideal method to advance the proposed research.

Chapter 3:
Methodology

3.1 Objectives

As discussed in Section 1.2, the objective of this thesis is to quantify the changes to residential intensification and value appreciation before and after the construction of a rapid transit corridor. In order to do this, four research questions are established:

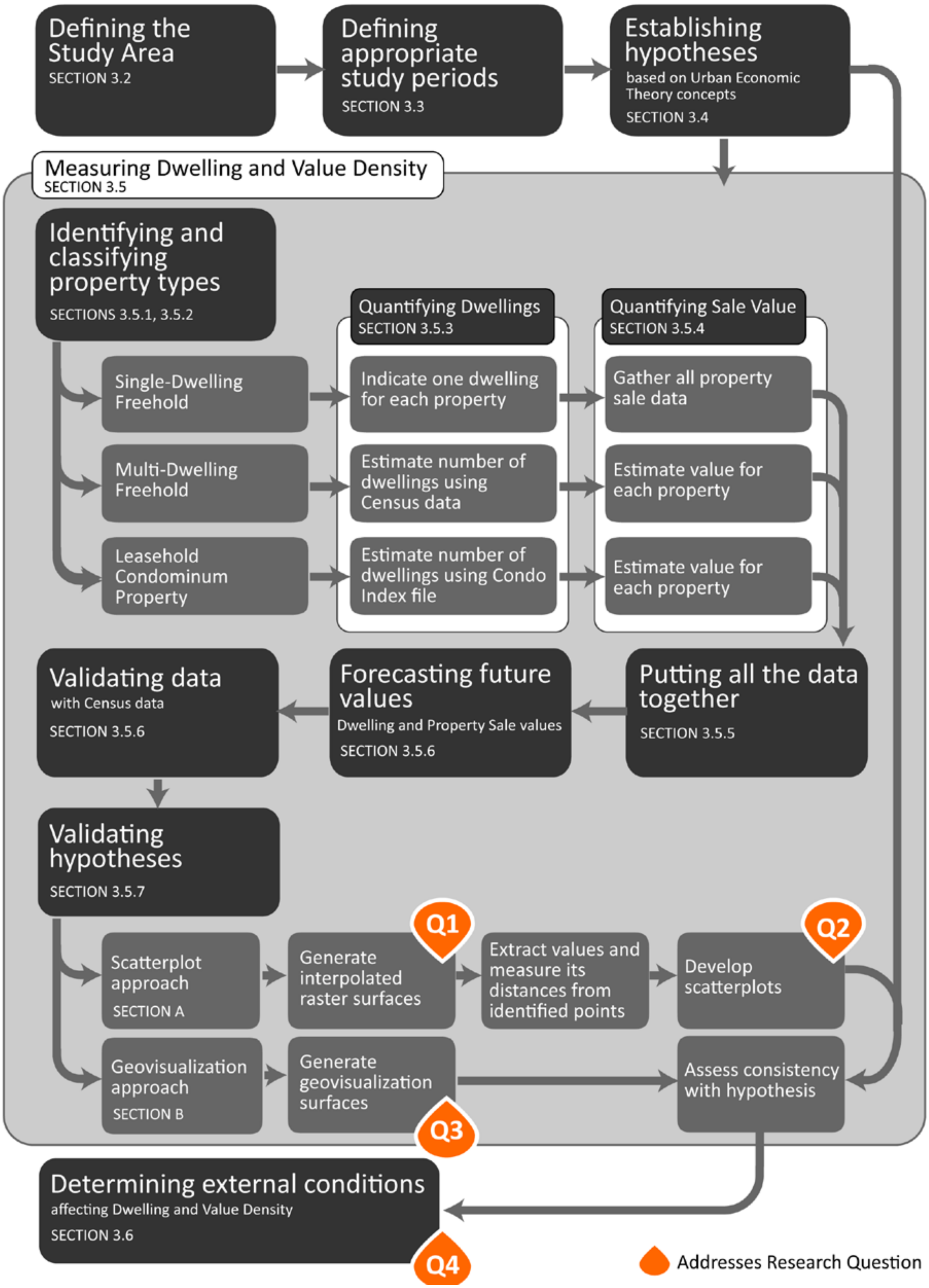
1. How has the Dwelling Density[3] and Value Density[3] changed at the property level over time along the Sheppard subway along the corridor?
2. What relationships, if any, exist in the Study Area between Dwelling and Value Density based on the property's distance to (1) a subway station and (2) to major development nodes?
3. What opportunities exist through the use of graphical solutions to better communicate these Value Density and Dwelling Density effects over time?
4. What other factors may be contributing to the current state of redevelopment along the corridor?

Answering the first two research questions requires property sales data and ArcGIS geospatial analysis tools to generate interpolated surfaces for each identified study year based on two

[3] For definitions, see Section 3.5

identified metrics: Dwelling and Value Density[3]. The interpolated surfaces are used to observe the effects on Dwelling and Value Density as a function of time (Question 1) and of distance to stations and nodes (Question 2). The third question is answered by using *ArcGIS* geovisualization techniques to investigate the ways to best visualize the changes in Dwelling and Value Density in geographic space. The last question is addressed by studying appropriate planning policies to understand potential influences, external to urban economic theory, which may influence the observed results. Figure 3-1 presents a methodological flowchart of this research thesis and how it responds to the four identified research questions.

Figure 3-1: Thesis methodological flowchart and its relationship to answering research questions



3.2 Defining the study area

The first step in conducting this analysis is to define a suitable study area. Naturally, the defined study area is to be within proximity to new transit stations.

Hess & Almeida (2007) cite that planners typically assume that people will comfortably walk approximately 400 m to reach transit stops and stations, thus within this area is where we expect to observe the greatest amount of residential intensification and value appreciation. However, a number of previous studies measuring the effect of proximity to rapid transit on residential property values have identified 1.6 km radius around transit stations as an appropriate delineation of the study area. Ideally, we would apply a 1.5-kilometre buffer around the new transit stations to best capture the spatial variations in residential densities and property values as a function of proximity to rapid transit stations through time.

While the ideal situation is presented, it is recognized that each study area has a unique set of land use characteristics and that there may be conditions outside of rapid transit investment that may influence residential density and value. For example, a highway or greenbelt corridor may contribute to a major discord in land use characteristics occurring on either side. Therefore, special area-specific considerations may need to be exercised to refine the initially delineated study area.

3.3 Defining the appropriate study time periods

To lay the proper groundwork in the thesis, the study time span and time periods of analysis are to be identified. Since the objective of the research is to examine the changes of the residential intensification and value appreciation prior to and after rapid transit construction, it is important to begin observation and analysis from as early as the project's funding announcement to the present. While the direct transport cost savings brought on by the corridor are not realized until it begins revenue service, highly competitive and speculative real estate firms may have already entered the market at the time of—and arguably even prior to—the funding announcement in order to best capture the potential increase in property values.

It is anticipated that changes in residential intensification and value appreciation from the rapid transit corridor may occur generally at the time of announcement by government officials. Thus ideally, the analysis of all property sales data for several years prior to the initial funding announcement to the present should be undertaken.

However, the study of property sales data through a year-by-year trends analysis is excessively time consuming, expensive, and unnecessary. Instead, analysis of property sales data should be undertaken every five years and aligned with established Census study years. In other words, research begins with the Census year before the date of the project's funding announcement and continues with each subsequent Census year thereafter. The selected study years are defined in this thesis as 'Analysis Years'. For example, if a project was first announced in 1994, research would be conducted for years 1991, 1996, 2001 and 2006.

The reason for the alignment with Census years in the selection of study time periods is that it allows for the property data to be validated through the use of household- and dwelling-related Census data. The time span between funding announcement to the present should yield at least three study time period observations to ensure that there is a sufficient temporal comparison.

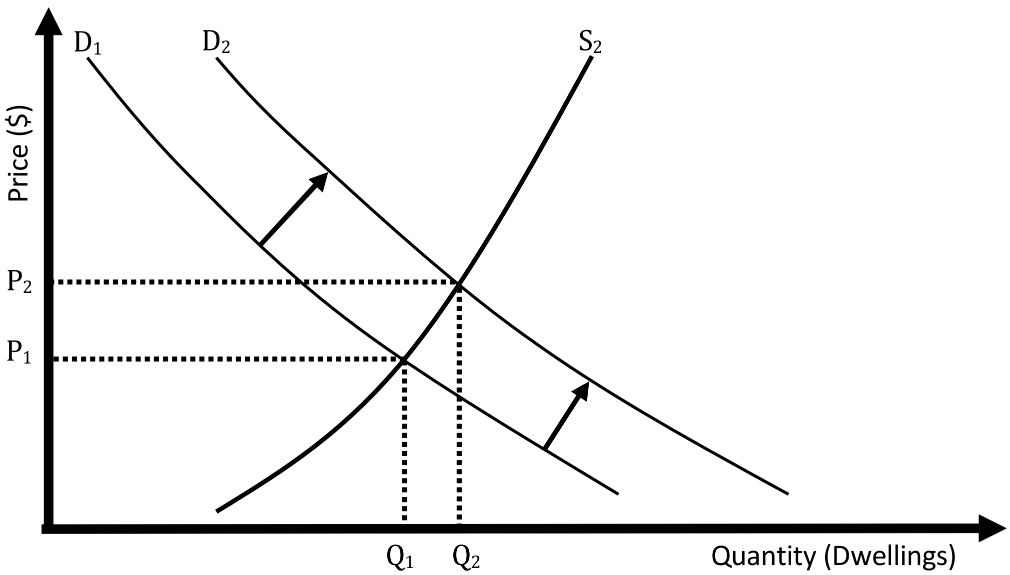
3.4 Defining residential intensification and value appreciation

Residential intensification is the creation of new residential units on previously developed, serviced land. Examples of residential intensification generally include: creation of accessory apartments; conversion of non-residential structure to residential use; infill; and redevelopment (Roseland & Connelly, 2005). Closely linked to residential intensification is residential value appreciation. While intensification refers to the addition of new residential units, residential value appreciation refers to the increase in residential real estate value applied to previously developed and serviced land. This residential value appreciation includes not only the organic increases in real estate values of existing properties, but also the increases in real estate value as a result of the addition of dwelling units. In other words, residential intensification is measured by the change in the number of dwellings, and residential value appreciation is measured by the change total property value in a finite study area over time. The subsequent sections describe in detail the two concepts as they relate to time and distance.

3.4.1 Residential intensification and property value as a function of time

The literature review revealed that the construction of rapid transit brings about a decrease in transport costs in the areas along its corridor and specifically at its stations. This decrease in transport costs according to Hoyt (1939), Giuliano (2004) and Koutsopoulos (1976) creates greater demand for land in areas nearby rapid transit stations. This increased demand in nearby properties is reflected in property value increases in the area. Figure 3-2 illustrates what is expected to occur with property values if demand in the areas adjacent to new rapid transit stations were to increase, assuming that planning policy provisions and developer interest bring about changes to dwelling supply.

Figure 3-2: Hypothetical supply and demand model for properties adjacent to rapid transit stations, assuming intensification-encouraging planning policies and developer interest



D_1 in Figure 3-2 illustrates a hypothetical demand curve for nearby properties before the transportation improvement. Upon the completion of the rapid transit project, demand for properties near new rapid transit stations increase, causing the demand curve to shift to the right, as exemplified in D_2.

Because higher-order transit projects include planning policies which encourage intensification along newly-built transit corridors, there is an expected degree of elasticity in the supply curve, as demonstrated by S in Figure 3-2. The shape of the supply curve and the shift in the demand curve from D_1 to D_2 causes not only an increase in price but also an increase in the quantity of dwellings in areas adjacent to rapid transit stations. The change is evident by the shift from Q_1P_1 to Q_2P_2.

3.4.2 Residential intensification and property value as a function of distance

Hoyt's (1939) work acknowledged that land use patterns in a given city were organized not just by concentric circles from the CBD but also along established transportation corridors due to their ability to reduce overall transport costs relative to distance. As an extension to his work, he noted that areas surrounding transportation corridors and stations likely warrant higher rents given its lower transportation costs. Thus it is expected that there are established density and property value gradients centred around transit stations. In other words, higher residential unit density and property values are expected to occur close to rapid transit stations and decline with distance away from stations.

3.5 Measuring Dwelling and Value Density

Two metrics have been selected to measure the temporal and spatial changes in the quantity of housing stock and in property values along a new rapid transit corridor: Dwelling Density and Value Density. Dwelling Density is defined as the number of dwellings contained within a property parcel normalized by the area of the property (see Equation 3-1). Correspondingly, Value Density refers to the total value (expressed in constant dollars) of a given property parcel normalized by the area of the property (see Equation 3-2).

Equation 3-1: Dwelling Density Equation

$$dd = \frac{\mathrm{d}}{\mathrm{a}}$$

Equation 3-2: Value Density Equation

$$vd = \begin{cases} \dfrac{d \times \bar{v}}{a}, & d > 1 \\ \dfrac{v}{a}, & d = 1 \end{cases}$$

Where,

z : dwelling density (dwellings/m^2)

vd : value density (\$/m^2)

d : number of dwellings

$\bar{v}$: estimated mean sale value of dwellings wzithin the property (see Section 3.5.4 Parts A and C) ($)

v : recorded sale value of the property ($)

a : property parcel area (m^2)

If there were no funding limitations to the research, one would obtain sales and assessment data for all properties in the study area in the identified study periods. Ideally, both sets of property data are obtained, however it is noted that such data are extremely expensive. In Ontario for instance, the *propertyline* web query tool administered by the Municipal Property Assessment Corporation (MPAC) lists a cost of $14 per property with no subscription opportunities for unlimited queries (Municipal Property Assessment Corporation, 2010), while the *Geowarehouse* web query tool administered by *Teranet*[4] lists a cost of $8 per property query (Brown, 2008), however there are subscription programs available. There are no educational discount options from either organization.

If only one type of data could be obtained, the use of property sale data is preferred over property assessment data mainly because the data are gathered from actual sale prices rather than merely appraised property values. The problem is that sales prices are only observed and recorded when the property is sold. Data from property assessment however is more complete since all properties are assessed regularly, no matter if the property was sold in a given period or not.

Due to funding limitations, an alternative approach using historical sales data is taken to compute Dwelling and Value Density for relevant residential properties. The approach involves:

1. Identifying different residential property types (Section 3.5.1)
2. Classifying residential property based on the identified property types (Section 3.5.2)
3. Quantifying dwellings for all residential property parcels (Section 3.5.3)
4. Quantifying and estimating the sale value for relevant property parcels (Section 3.5.4)
5. Compiling all the computed estimated dwelling and value data together (Section 3.5.5)
6. Validating the compiled data with Census Data (Section 3.5.6)
7. Forecasting future dwelling and sale values (Section 3.5.7)
8. Validating the hypotheses (based on the principles in Section 3.4) with generated results (Section 3.5.8) by:
    a. Generating interpolated raster surfaces from computed Dwelling and Value Density figures
    b. Extracting Dwelling and Value Density figures from the developed surfaces
    c. Measuring the distances of sample points to stations and nodes
    d. Plotting and evaluating the relationships
    e. Visualizing the data over time on a spatial plane
9. Determining other conditions affecting Dwelling and Value Density (Section 3.6)

[4] *Teranet* is a private company that maintains and operates the electronic land registration system under an exclusive contract with the Ontario government until 2017. See Section 3.5.4 for details.

Each of the nine steps is described in the subsequent sections.

3.5.1 Identifying residential property types

In this step, we will define three different residential property types that will frame the process for quantifying dwellings (see Section 3.5.3), and quantifying sale value (see Section 3.5.4). The three identified types of residential properties are: Leasehold Condominium Property (LCP), Single-Dwelling Freehold (SDF), and Multi-Dwelling Freehold (MDF). SDFs and MDFs are classified as freeholds, while LCPs are classified as leaseholds. Freehold in common law refers to the ownership of real property where it is held for an uncertain duration. By contrast, leasehold refers to the right to possession and use of land for a fixed period of time (Brueggeman & Fisher, 2008).

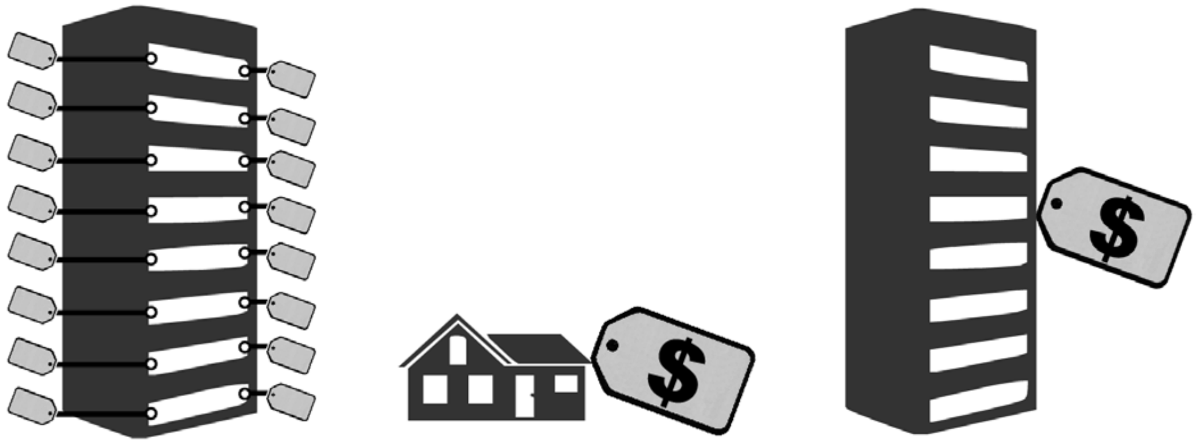
An LCP is described as a property usually consisting of individual condominium units owned wholly by a condominium corporation. An LCP is leased by a developer and is never necessarily 'owned' by the purchaser. Instead, dwellers of Leasehold Condominium buy and sell a leasehold interest in the dwelling suite, as well as the property's supplied common elements (e.g. common amenities, hallways, lobby). An LCP can exist as one or more multi-storey structures, a collection of ground-level homes, or a combination thereof.

An SDF is defined as a property which includes only one dwelling where complete ownership is legally permitted by the purchaser(s) without the limitation of time. The exact definition of dwelling in this instance is taken from Statistics Canada (2007), which refers "to a separate set of living quarters which has a private entrance either directly from outside or from a common hall, lobby, vestibule or stairway leading to the outside […]" Thus, given this definition, single-detached homes are a good example of an SDF. Semi-detached and row houses may also be classified as an SDF, as long as only one dwelling sits on a given property parcel.

In contrast, an MDF refers to a property which includes more than one dwelling where complete ownership is legally permitted by the purchaser(s) without the limitation of time. While MDFs include individual dwellings that are rented out to tenants in most cases, the real ownership of the entire property remains with the purchaser. Tenants only pay for the right to exclusive possession of a given unit. A rental apartment structure is an example of this kind of property. It is noted that this research is not concerned with property rental prices, only property sale prices.

Table 3-1 visually summarizes the differences between the three types of properties.

Table 3-1: Identified residential property types



Leasehold Condominium *Each unit Leasehold Condominium Property is sold separately*	**Single-Dwelling Freehold** *Each Single-Dwelling Freehold property consists only of one dwelling*	**Multi-Dwelling Freehold** *Each Multi-Dwelling Freehold property consists only of more than one dwelling, but the property is sold together*

The next step is to classify each residential parcel in the study area based on three identified property types. Section 3.5.2 describes this task in detail.

3.5.2 Classifying residential property types

Classifying residential property types involve (1) excluding all non-residential property parcels and (2) examining the structural characteristics of the remaining parcels to classify which of the three identified property types is most appropriate.

Excluding all non-residential properties from the analysis requires (1) overlaying an Official Plan land use shapefile with an obtained property shapefile and (2) selecting only those properties classified residential. If an Official Plan land use shapefile is not available, one may digitally scan a hard copy of a land use map and overlay it on the property shapefile. At least one GIS shapefile (preferably the most current) containing all the properties within the study area must be obtained to carry out the proposed methodology.

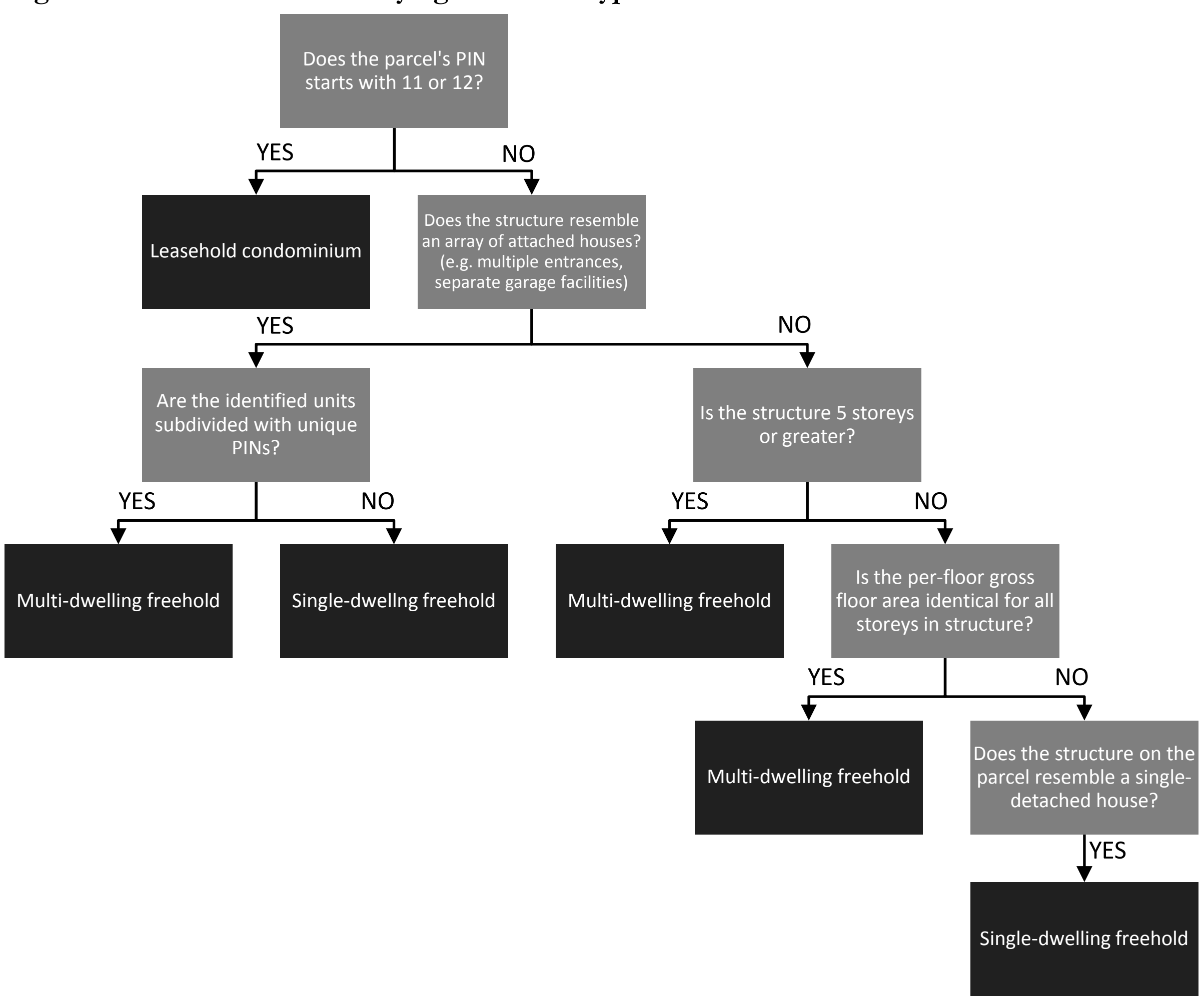
Once the non-residential properties are omitted, the classification of residential properties based on the identified types is completed using property geospatial shapefiles; condominium plan records from the Land Registry Offices (LRO); orthographic and photos; and bird's eye view photos.

The classification of LCPs requires using a Condominium Plan index file. In Ontario, such tables list the number of dwelling units within each Condominium Plan. Regardless of which LRO in Ontario the properties are located, there are conventions for identifying LCPs through their 9-

digit PIN. For LCPs located in Toronto, the PINs begin with either numbers 11 or 12 (e.g. 112340000, 112350000, etc). In Waterloo Region and York Region for instance, PINs begin with 22 and 29 respectively (Teranet Inc., 2010). Thus, through the use of parcel shapefiles, Leasehold Condominium PINs are identified through the *Select by Attributes* command within *ArcGIS*.

The differentiation between the remaining two types of properties— Single-Dwelling and Multi-Dwelling Freehold—requires greater diligence. Since there is no definitive method for classifying these remaining properties using available data (nor is there observed literature on such a classification process), a decision flowchart is developed (see Figure 3-3) to provide a system for classifying all residential parcel properties to one of the three types.

Figure 3-3: Flowchart for identifying residential types



Undertaking the process in Figure 3-3 requires the use of land parcel shapefiles and orthophotos in *ArcGIS*, as well as web search tools from online maps. Depending on the area of study, one provider allows users the ability to view the urban landscape in a Bird's Eye view, rather than the traditional orthographic view. The former allows users to identify the exterior structure of a property more easily.

3.5.3 Quantifying dwellings

In the next step, we quantify dwellings for each residential parcel for each of the identified Analysis Years. The process for quantifying dwellings varies depending on the type of residential property as classified in Section 3.5.2. Table 3-2 summarizes the methods used for quantifying dwellings.

Table 3-2: Summary of methods used for quantifying dwellings

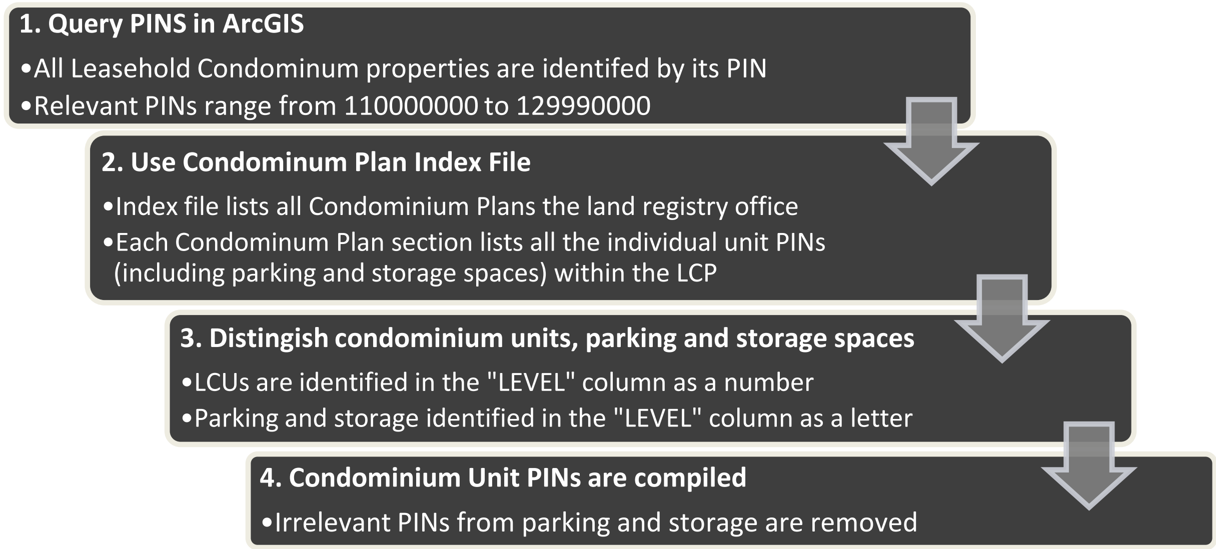
Residential Property Type	Quantification Method
Leasehold Condominium Properties	Use the Condominum Plan Index[5] file available for each Land Registry Office (LRO) in Ontario
Single-Dwelling Freehold	Assume each identified property contains one dwelling
Multi-Dwelling Freehold	Retrieve information available from planning agencies Estimate through the use of Census data

The purpose of quantifying dwellings for each residential parcel is ultimately to generate a Dwelling Density interpolated surface for the study area and to make inferences about its variations through space and time. A detailed discussion of this step is organized by the type of property.

Quantifying dwellings for individual LCPs requires the use of Condominium Plan index files supplied by the appropriate LRO[5]. To obtain the number of dwellings for each LCP, four steps are followed. See Figure 3-4 for details.

[5] The same Condominium Plan index file can also be obtained from the *Teraview* website: http://www.teraview.ca/ereg/pol_condo.html

Figure 3-4: Process for obtaining the number of dwellings for each Leasehold Condominium Property (LCP)



Quantifying dwellings for SDF properties is straightforward because each property is observed to contain only one dwelling. Thus, each identified Single-Dwelling Freehold is assumed to contain one dwelling.

Lastly, quantifying dwellings from MDF properties pose some challenges because there is no readily available source of such data. Municipal property assessment and planning agencies would hold such information; however the retrieval of this data was difficult without incurring significant financial costs and time. Alternatively, Census household and dwelling data was used at the Dissemination Area/Enumeration Area level to estimate the number of dwellings for each MDF property parcel.

Note that this process is repeated for each Analysis Year, as the purpose is ultimately to use this data to measure the changes in Dwelling Density. Ideally, the analysis can be performed by obtaining property shapefile specific to each identified Analysis Year. Unfortunately, in most cases, it is difficult to obtain GIS data or even hard copy maps specifically for the past Analysis Years. An alternative solution is to track the residential inventory through historical orthophotos. Orthophotos are often more widely available and they provide a simple alternative for examining the evolution of residential development through time.

3.5.4 Quantifying property value

This step is to estimate the sale value of individual residential parcels for each identified Analysis Year. The sale value for a given property is computed according to its classified property type (see Section 3.5.2). Table 3-3 summarizes the methods used for quantifying property value.

Table 3-3: Summary of methods used for quantifying property value

Residential Property Type	Quantification Method
Leasehold Condominium Properties	[Mean/Median of observed sales in given property] ✕ [Number of dwellings in given property]
Single-Dwelling Freehold	No calculations required. Values simply obtained from observed sale values.
Multi-Dwelling Freehold	[Estimated average per-dwelling value of the given property] ✕ [Number of dwellings in given property]

The proceeding sections discuss the procedures taken to quantifying property value for each of the three identified property types.

A. Quantifying property value of Leasehold Condominium Properties

The purpose in this section is to compute the value of each individual LCP for each Analysis Year within the study area. This value is computed by multiplying the number of dwellings in the given property by the mean or median[6] ("central tendency") value based on all sale prices occurring with each individual LCP for each analysis year. The central tendency figure is computed by (1) examining the distribution of sales values for each LCP for each analysis year, and (2) applying the appropriate statistical test (e.g. *T-Test*, *Wilcoxon Signed Ranks Test*, and *Sign Test*) based on the observed distribution. The statistical test generates a confidence interval of the mean or median[6] based on an identified level of confidence.

Due to the small sample of sale values expected to occur for one LCP in a given analysis year, the distribution is unlikely to be normal; thus a random value is taken within the given confidence interval for a given LCP and for each Analysis Year.

Equation 3-3 reveals how each LCP is computed.

---

[6]The use of mean or median is dependent on the statistical test applied.

Equation 3-3: Estimating the value of a Leasehold Condominium Property (LCP)

$$V_t = (V_{lo} + (V_{up} - V_{lo})\lambda)\, n$$

Where,

V_t : predicted value of an LCP($)

V_{lo} : lower range central tendency predicted value of a dwelling in an LCP($)

V_{up} : upper range central tendency predicted value of a dwelling in an LCP($)

λ : u (0,1)

n : number of dwellings in the LCP

The lower (V_{lo}) and upper (V_{up})central tendency confidence range is determined through one of three statistical tests, which are applied to each LCP for each Analysis Year depending on the distribution of the sample. The three statistical tests used are as follows: *1-Sample T-Test*, *Wilcoxon Signed-Ranks Test*, and the *Sign Test*. Refer to Appendix A for details about the process taken to determine the application of the appropriate statistical test based on its observed distribution.

Once the central tendency confidence range for each LCP is computed, Equation 3-3 is applied accordingly.

B. Quantifying property value of Single-Dwelling Freeholds

This section discusses how to quantifying property value for individual SDF properties for each Analysis Year. There are two aspects that are unique to quantifying property values of SDF:

1. **no calculations are required:** the recorded sale values equate to the value of the given property , and
2. **no estimation of unknown values is required:** only actual sale values are required produce an interpolated Value Density surface.

The basis for using only actual sale values for SDFs is the assumption that that the sale value of properties is consistent with the *First Law of Geography* (see Section 2.2.3), whereby the sale price of an SDF property are generally similar to others within a given residential community. This is because communities consisting of SDFs generally have similar structural characteristics, and thus, its value is likely to be similar to neighbouring properties. For instance, when a realtor informs clients about the suggested price of a given property, he or she often generates neighbourhood sales reports to see how much other properties in the area have sold for.

With regards to SDF properties, only those properties that were sold within selected study periods are used to generate an interpolated raster surface. All SDFs with no associated sale values for a given year are automatically generated through the use of spatial interpolation tools.

C. Quantifying property value for Multi-Dwelling Freeholds

This section explains how to compute property value for individual MDF properties. Like LCPs, the values of each MDF must be computed in order to produce an accurate interpolated Value Density surface. The obstacle faced with estimating the value of MDFs is that these properties are rarely sold in each of the specified Analysis Years. Three estimation options are developed to overcome this obstacle. The three options include:

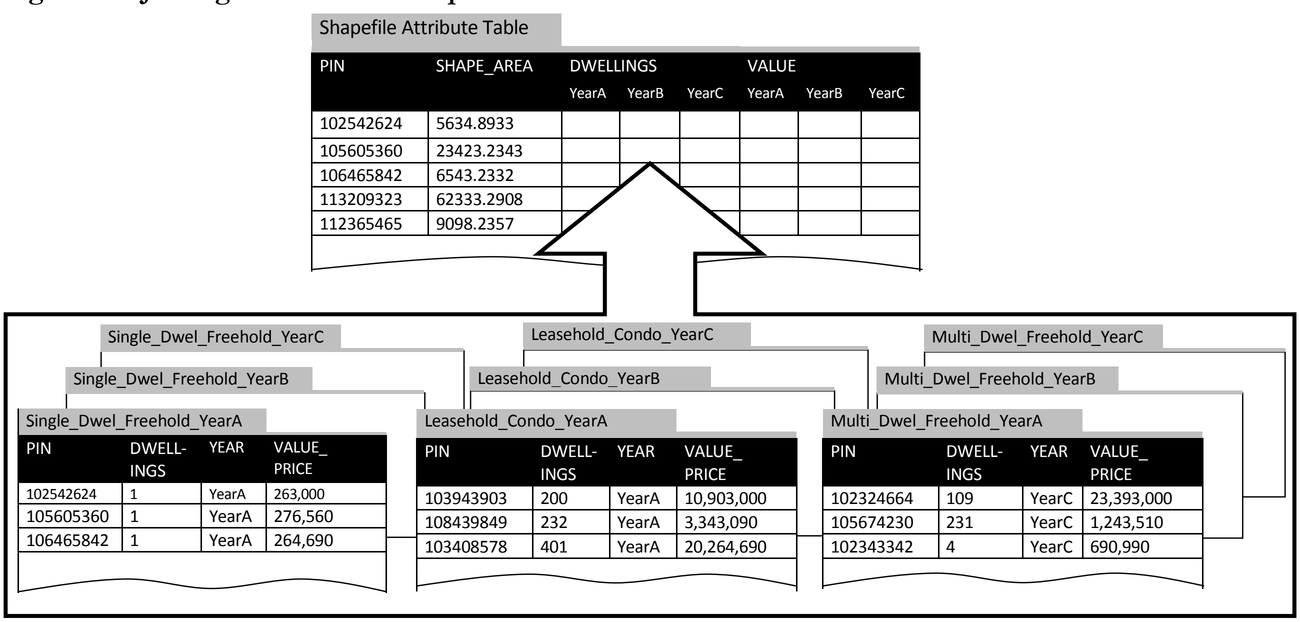
- **Option 1: Line of best fit extrapolation**, which requires:
    1. computing value per dwelling measure for each property using actual MDF sale values
    2. generating a line of best fit plot for value per dwelling as a function of time (year)
    3. interpolating value per dwelling figure for each identified Analysis Year
    4. computing the total MDF value for each analysis year as appropriate
- **Option 2: Leasehold condominium value substitution**, which requires:
    1. identifying an LCP that is similar to the MDF under consideration
    2. identifying the mean/median value of dwellings sold in the identified LCP for each Analysis Year
    3. using the identified mean/median value to compute the total MDF value for each analysis year as appropriate
- **Option 3: Spatial interpolation**, which requires:
    1. computing value-per-dwelling for each property using actual MDF sale values
    2. using ArcGIS spatial interpolation to generate a value per dwelling surface for each Analysis Year
    3. extracting the value-per-dwelling based on the location of MDFs for each Analysis Year
    4. using the identified mean/median value to compute the total MDF value for each analysis year as appropriate

The option whose results best reflects the set of actual MDF sale values samples is then applied to compute all MDFs for each Analysis Year in the study area. Details about the application of these three options for quantifying value for MDF properties are discussed in Appendix B.

3.5.5 Putting the data together

Now that all the required value points from each of the three property types are computed and compiled, they can then be joined with the geospatial property data to interpolate Dwelling and Value Density surfaces. The area of the residential parcels is calculated using the *Calculate Geometry* function and its centroids are generated using the *Calculate Values* function. Finally, the geospatial data are then joined with the three sets of value and dwelling data for each Analysis Year.

Figure 3-5: Joining data tables to shapefile attribute table



3.5.6 Forecasting dwellings and sales values

Dwellings and sales values are forecasted using obtained residential sale releases published in periodicals and from development applications from the appropriate municipal agency. The forecasting exercise is not based necessarily based on an identified year in the future, but rather only attempts to reveal expected changes in intensification and property value from documented sources.

Because it is unlikely that all the land use effects from the investment in a rapid transit corridor occurs immediately after beginning revenue service, the identified case study corridor should ideally have reached a level of service maturity. Service maturity is realized when the corridor's ridership stabilizes and when all development potential along the corridor is principally realized. However due to the recency of some rapid transit projects, observing residential intensification and value appreciation up to a time of service maturity may not be possible. In these cases, there is a benefit to forecast future dwelling and sale values.

Ideally, the dwelling and sale value forecasting exercise is undertaken by obtaining developments under construction, currently available for sale, or currently undergoing planning approval. Municipal development planning departments are expected to have such information readily available. Provided that such information is obtained, Section 3.5.4 and 3.5.5 is to be conducted again for each identified future Analysis Year. Quantifying dwellings for each proposed property is straightforward, as each development proposal indicates the number of dwellings to be constructed. However, quantifying sales values is a more difficult task especially for properties that have yet been open for sale.

In those cases where the development is currently for sale, the listed sale price is used for the sale value for a proposed SDF and MDF property, and the average listed sale price multiplied by the number of dwellings is used for a proposed LCP property. However in cases where the development is only in the planning approval stages, the sale value of an equivalent home nearby is used for the sale value for a proposed SDF and MDF property, and the average sale price of an equivalent condominium development multiplied by the number of proposed dwellings is used for a proposed LCP property.

3.5.7 Validating data with Census data

Census data are used to validate the computed dwelling and property value data discussed in the previous sections. Census data also serve as effective "pretests" in examining the expected changes to residential land-use conditions prior to and after the construction of the rapid transit corridor. Data are analyzed at the Census Tract (CT) level due to its stable geographic boundaries through different Census years, which facilitates temporal comparative analyses. Figure 3-6 lists the variables that are obtained and analyzed for each CT in the Study Area.

Figure 3-6: Variables obtained from Census data

Variables	Sub-variables	Unit of measurement
Population		Quantity of persons
Period of construction	Before 1946	Tally of dwellings identified based on the listed year periods
	1946-1960	
	1961-1970	
	1971-1980	
	1981-1990	
	1991-1995	
	1996-2001	
	2001-2006	
Structural characteristics	Single-detached house	Tally of households identified based on the listed structural characteristics
	Semi-detached house	
	Row house	
	Apartment detached duplex	
	Apartment 5+ storeys	
	Apartment < 5 storeys	
	Other single attached house	
	Movable dwelling	
Dwelling Value, Gross Rent	Dwelling Value	Average dwelling value
Persons in Private Households	1 person	Tally of households identified as having the listed number of persons
	2 persons	
	3 persons	
	4-5 persons	
	6 or more persons	

In instances where CTs were subdivided in later Census years, the data from the split CTs are merged to ensure a consistent set of geographic spatial boundaries through time. From there, the study design aims to examine the Census data and to record any dramatic changes to housing characteristics throughout the identified Analysis Years.

3.5.8 Validating the hypothesis

Section 3.4 discussed that the introduction of a new rapid transit corridor will not only increase property values in areas adjacent to the corridor, but also increase the quantity of housing stock in the same area. Specifically, urban economic theory explains that the degree of intensification and value appreciation peaks in the areas nearest to rapid transit stations and declines as a function of distance away from rapid transit stations.

Ideally, a researcher would want to able to use empirical evidence to be able to make the following statements:

- the rapid transit corridor caused an X increase property values within a given buffer area along the corridor;
- the rapid transit corridor caused Y increase in the number of dwellings within a given buffer area along the corridor; and
- every metre closer to a rapid transit station within a define area causes an X percent premium in property values.

The key word in all three statements is 'cause', but demonstrating causality requires controlling for all other factors influencing dwelling supply and property values. For instance, the literature review of hedonic modelling in Section 2.2.1 described the many variables that influence the value of a given property, which all need to be controlled to prove causality. There are two major challenges in performing these causation and association analyses: (1) the difficulty in accounting for all other factors affecting dwelling supply and property values, and (2) the lack of property data encompassing all variables that would dictate dwelling supply and property values. Once again, if cost is not a factor, structural details[7] for all properties can be obtained through MPAC's *propertyline* web-based data query service at $30 for each property. However, even with such an astronomical cost, not all the required residential variables that influence sales value can be obtained to fully prove causality.

Alternatively, the research objective is to examine the changes to residential intensification and value appreciation as a function of time before and after the introduction of rapid transit service and to test the validity of the identified hypotheses based on urban economic theory—using Dwelling and Value Density as appropriate metrics of observation. Two approaches are devised to satisfy the set objectives: the scatterplot approach and the geovisualization approach.

A major strength in the application of scatterplots and geovisualization techniques is that it quantifies and presents the changes in residential intensification and value appreciation as a function of (1) time before the construction of a rapid transit corridor and (2) distance from rapid transit stations within a given area. These methods allow for the presentation and organization of findings in a more visually direct way, especially when compared to the use of statistical regression methods such as Hedonic Modelling. The selected research approach provides the understanding of the temporal and spatial changes to residential Dwelling and Value Density to a broader audience. The

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[7] Includes data regarding the number of bedrooms, number of full bathrooms, number of half bathrooms, site area, and total finished basement area

execution of this research approach is particularly relevant within the planning field because policy makers and planners require clear and understandable ways of communicating with the public about the benefits of building rapid transit in their communities.

Another strength in the selected approach is that the application of scatterplots and geovisualization techniques allows for a more dynamic observation of spatial variations in Dwelling and Value Density, while hedonic modelling however, relies on rigid criterion-based specifications of relative distance to transit stations and nodes (i.e. a property is within 0-250 m, 250-500 m from a rapid transit station). Observation through the selected research approach need not be confined to pre-established spatial scales.

As expected, a major weakness of the proposed methodology for hypothesis validation is its inability to affirm causality. Specifically, it cannot provide evidence that the possible changes in Dwelling and Value Density are a consequence of the construction and operation of a nearby rapid transit corridor. Instead, the proposed method can only state that the Dwelling and Value Density changes are evident as a function of time but not that it was caused by a new rapid transit corridor.

Additionally, this method does not extensively consider other factors which may influence the quantity of dwellings or value of a given property within the study area. As a means to mitigate this problem, it is important to conduct a contextual review of the study area to fully recognize the evolution of the study area and its possible influence on residential development through time. Upon the completion of the research findings, this research proposes to explore broadly and qualitatively regarding factors (institutional, social, political, and economic) which may influence the state of residential intensification and redevelopment along the rapid transit corridor under study.

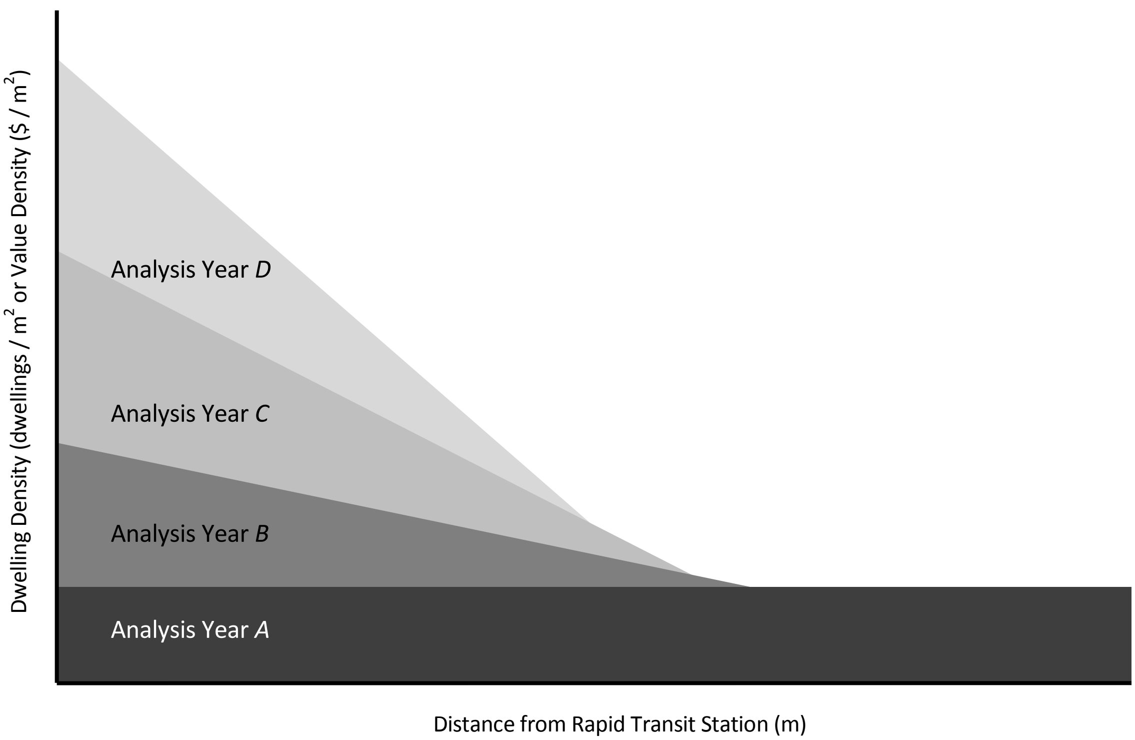
A. Scatterplot approach

The scatterplot approach graphs Dwelling and Value Density data in two dimensions as a function of:

1. distance to the nearest rapid transit station ("station-level analysis"), and
2. distance to the CBD and identified major development nodes ("macro-level analysis").

The station-level analysis tests whether Dwelling and Value Density within 1 km of rapid transit stations ("Station Area") (1) increase as a function of time prior to the announcement of the transit corridor, and (2) decrease as a function of distance away from a station after the completion of the rapid transit corridor. Conceptually, it is anticipated that the scatterplot would reveal an increase in both Dwelling and Value density as a function of distance as demonstrated in Figure 3-7. Analysis Year *A* would exemplify the time prior to the announcement for funding of the rapid transit project and would demonstrate negligible or no increases in Dwelling and Value Density over time. Over the construction period and inevitably when the rapid transit corridor begins operation, it is anticipated that Dwelling and Value Density will increase over time. However, the increase will be more evident in areas closer to the rapid transit station. This anticipated gradual increase in Dwelling and Value Density is demonstrated in areas show in Analysis *B*, *C*, and *D* in Figure 3-7.

Figure 3-7: Conceptual area scatterplot of anticipated Dwelling and Value Density increases over time with distance from a rapid transit station



The macro-level analysis examines function of proximity to major activity centres rather than to rapid transit stations. The purpose of this macro-level analysis is to understand if the specific nodes, such as the CBD and other metropolitan centres, have any bearing on Dwelling and Value Density as a function of time and distance.

i. Generating interpolated raster surfaces

The first objective of the Scatterplot approach is to generate interpolated raster surfaces based on the two selected metrics for each Analysis Year. Two datasets are required for the development of interpolated raster surfaces. They include: (1) the compiled Dwelling and Value Density data from the previous steps, and (2) a property parcel shapefile with PINs in its attribute table. Property parcel centroids are generated in *ArcGIS* based on the property parcel shapefile layer. Then, the compiled Dwelling and Value Density data are joined with the property centroid layer. From there, the preparatory work for spatial interpolation is complete.

Based on the evaluation of spatial interpolation methods in Section 2.2.3, Inverse Distance Weighted (IDW) is executed because it provides an easily understandable method for spatial interpolation that properly achieves the objectives of the thesis research. Spatial interpolation is not only useful for spatially observing the variations in Dwelling and Value Density throughout the Study Area (see Section 2.2.3), but it generates more precise observations through the extrapolation of static data points for each Analysis Year.

ii. Extracting data from developed interpolated raster surfaces

Now that the two variables are interpolated, the values are extracted based on the interpolated raster surfaces from each Analysis Year. Two sets of grid points ("sample points") are developed for the station-level analysis and macro-level analysis. Table 3-4 provides a summary of the two types of sampling methods.

Table 3-4: Characteristics of the two types of Sample Point methods

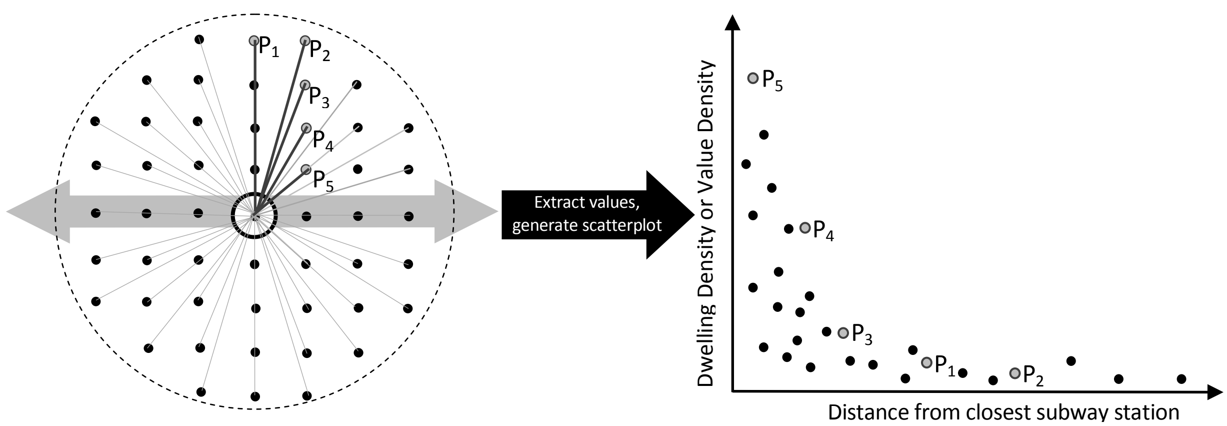
Sampling method	Point intervals	Geographic scope	Purpose
Station-level analysis sampling	100 m apart	Within 1 km buffer from rapid transit station	To understand variations in Dwelling and Value Density as a function of distance to stations
Macro-level analysis sampling	250 m apart	Throughout the entire Study Area	To understand variations in Dwelling and Value Density as a function of distance to nodes (e.g. CBD , Metropolitan Centres)

Once the sets of spatial points are created, the *ArcGIS* Sampling tool allows for values to be extracted from the interpolated surfaces based on the location of each specified Sample Point.

iii. Measuring the sample points to stations and nodes

The distance of sample points to rapid transit stations and nodes are established in order to evaluate the Value/Dwelling Density and distance relationship. The straight-line distance from sample points to stations and nodes is determined by using the *Network Analyst OD Cost Matrix* tool, whereby sample points are set as the *Origins*. The *Destinations* within the station-level analysis are the rapid transit stations whereas the centres of the specified nodes are the *Destinations* at the macro-level analysis. Figure 3-8 illustrates what a hypothetical station-level analysis map would look like after applying the *Network Analyst OD Cost Matrix* tool.

Figure 3-8: Hypothetical station-level analysis map after applying Network Analyst OD Cost Matrix tool



iv. Plotting and evaluating the relationships

At this point, the data preparation is complete and the Value and Dwelling Density and distance relationship can be determined for each Analysis Year. Scatterplots are developed for each variable combination and for each Analysis Year, under both the station-level and macro-level analysis. The developed Dwelling and Value Density scatterplots are then used to examine whether they are consistent with the hypotheses developed in Section 3.4.

B. Geovisualization approach

The Scatterplot approach incorporated the compiled Dwelling and Value Density data into a GIS program to develop spatially interpolated raster surfaces of the two selected variables for each of the selected Analysis Years. The interpolated Dwelling and Value Density data embedded in the surfaces are then extracted for the development of scatterplots. Meanwhile, the Geovisulization approach is an extension of the Scatterplot approach whereby the generated interpolated raster surfaces are further applied through the use of geovisualization techniques.

As discussed in Section 2.2.5, geovisualization allows for greater understanding in a visual and spatial form, rather than through numerical data (Kwan & Lee, 2004). The primary purpose of performing these techniques in this research is to improve the way the conditions of residential intensification and value appreciation are communicated. As discussed in Section 3.5.8, there is an increasing need to find clear and understandable ways of communicating with the public about the benefits of building rapid transit in their communities. The Geovisualization approach involves two methods for visualizing the interpolated raster surfaces produced in Section A through time: (1) the *Raster Math* toolset method, and (2) the *ArcScene* method.

i. Raster Math toolset method

This method visualizes the changes to Dwelling and Value Density through time by using *Raster Math*. *Raster Math* allows for the combining of values in multiple rasters on a cell-by-cell basis (ESRI, 2006). In this method, percentage change in Dwelling and Value Density between the two select Analysis Years will be applied to understand the degree of changes in intensification and value appreciation at two given points in time. This percentage change is computed as follows:

Equation 3-4: Calculating percentage change with Raster Math

$$\Delta S_{n,i} = \frac{S_n - S_i}{S_i}$$

Where,

$\Delta S_{n,i}$: Percentage change in value or Dwelling Density raster surface layers from Year n and Year i

S_n : Value or Dwelling Density raster surface layer from Year n

S_i : Value or Dwelling Density raster surface layer from Year i

ii. ArcScene method

This method visualizes the changes to Dwelling and Value Density in a three-dimensional (3D) plane through time by using the different functions of the *ArcScene*. *ArcScene* allows users to overlay one or multiple layers of data in a 3D environment (ESRI, 2008). Features are placed in 3D by adding a height dimension to the otherwise 2D raster plane based on a feature attribute. This height value component is known as the Z-value, just like how the vertical dimension is also called the Z-axis. In this case, the Z-value is Dwelling and Value Density.

Using *ArcScene*, the appropriate raster layers are added. Under the *Layer Properties* window is a *Base Heights* tab. Within this tab is a field specifying the feature layer containing the Z-values—users can also apply a *Z-unit Conversion Factor* to exaggerate or minimize the variations in the height on the Z-axis.

The most compelling part of this method is *ArcScene*'s ability to produce animations based on the evolution of each Analysis Year's 3D surface. Through *Create Group Animation* command in the *Animation Toolbar*, *ArcScene* can produce a model that toggles the visibility of successive layers to animate a progression between surfaces from each Analysis Year. A smooth blending between the layers in the progression can be seen by modifying the transition settings (ESRI, 2007).

3.6 Determining other conditions affecting Dwelling and Value Density

As discussed in Section 3.5.8, it is ideal to be able to demonstrate causation of rapid transit investment on the observed changes in Dwelling and Value Density. Unfortunately, demonstrating causality requires the normalization of that all factors influencing dwelling supply and property values. An alternative method aims to examine the changes to residential intensification and value appreciation as a function of time before and after the introduction of rapid transit service. This alternative method does not attempt to understand whether rapid transit investment directly triggered residential intensification and value appreciation, but instead paints a descriptive picture about what has happened to residential conditions from a transit project's first announcement to the present. Despite assuming this alternative method, there still is great value to determine whether other conditions may be affecting Dwelling and Value Density in the areas surrounding rapid transit stations.

Because of the uniqueness of each identified Study Area, it is difficult to provide general methodological instructions to broadly identify external conditions affecting Dwelling and Value Density. The discussions on housing and neighbourhood characteristics for hedonic modelling in Figure 2-9 provide a list of examples of conditions to observe that may influence Dwelling and Value Density.

One primary condition that is missing in Figure 2-9—which may have a direct affect on Dwelling and Value Density—is the associated change in planning policies often prompted by rapid transit investment. Thus, it is important to understand how planning ordinances, policies, and bylaws may have supported change in Dwelling and Value Density along the corridor. Specifically, careful attention must be emphasized in explaining residential land use situations which is considered in conflict with urban economic theory. If such conflicts exist, the first step is to understand if planning policies may be governing these considered anomalies. If established planning policies cannot explain the anomalies, the listed residential and neighbourhood conditions in Figure 2-9 can be used as a guide to determining the basis for the observed inconsistency.

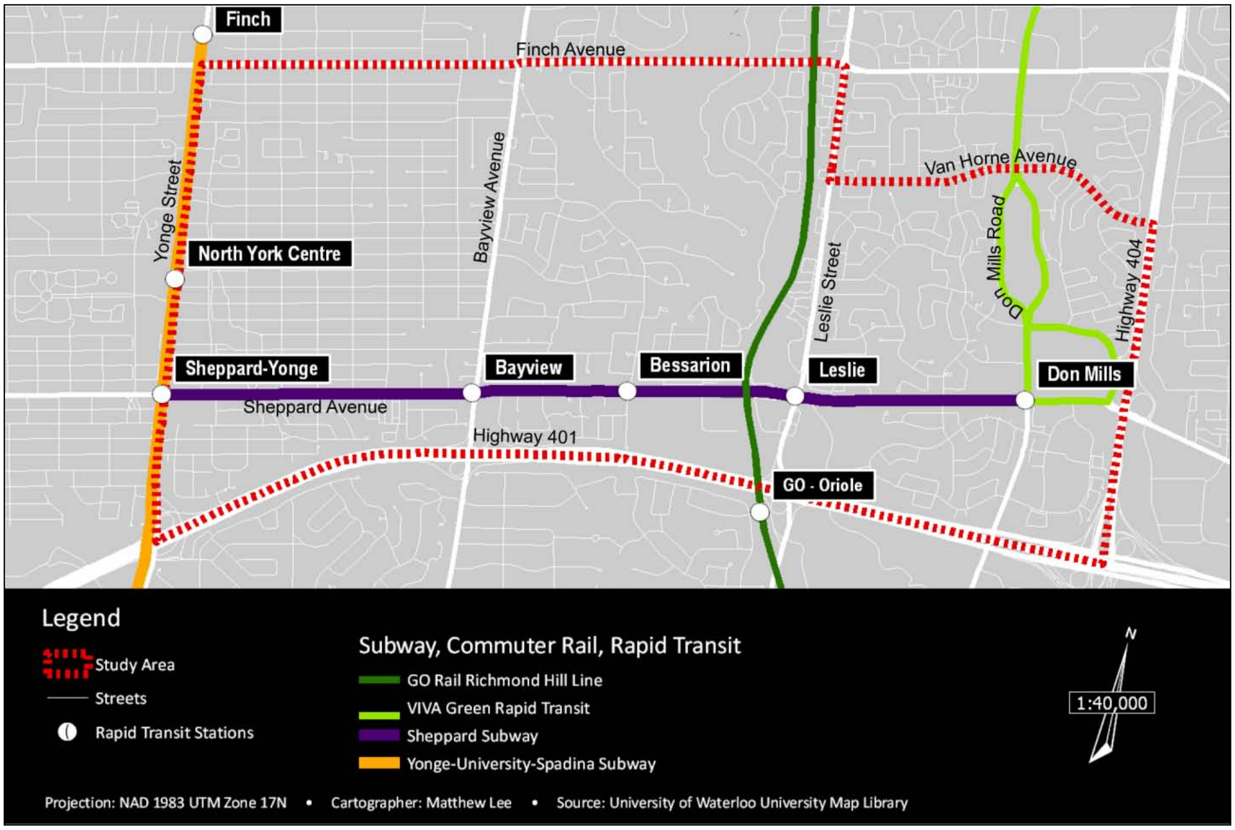
Chapter 4:

Application of the methodology: A Sheppard subway case study

The primary objectives of this thesis are twofold: (1) to quantify the changes to residential intensification and value appreciation before and after the construction of the Sheppard subway and (2) to validate whether the intensification and value appreciation findings are consistent with urban economic theory. The methodological process described in Chapter 3 is applied to a defined area along the Sheppard subway corridor, about 15 km from the Toronto CBD.

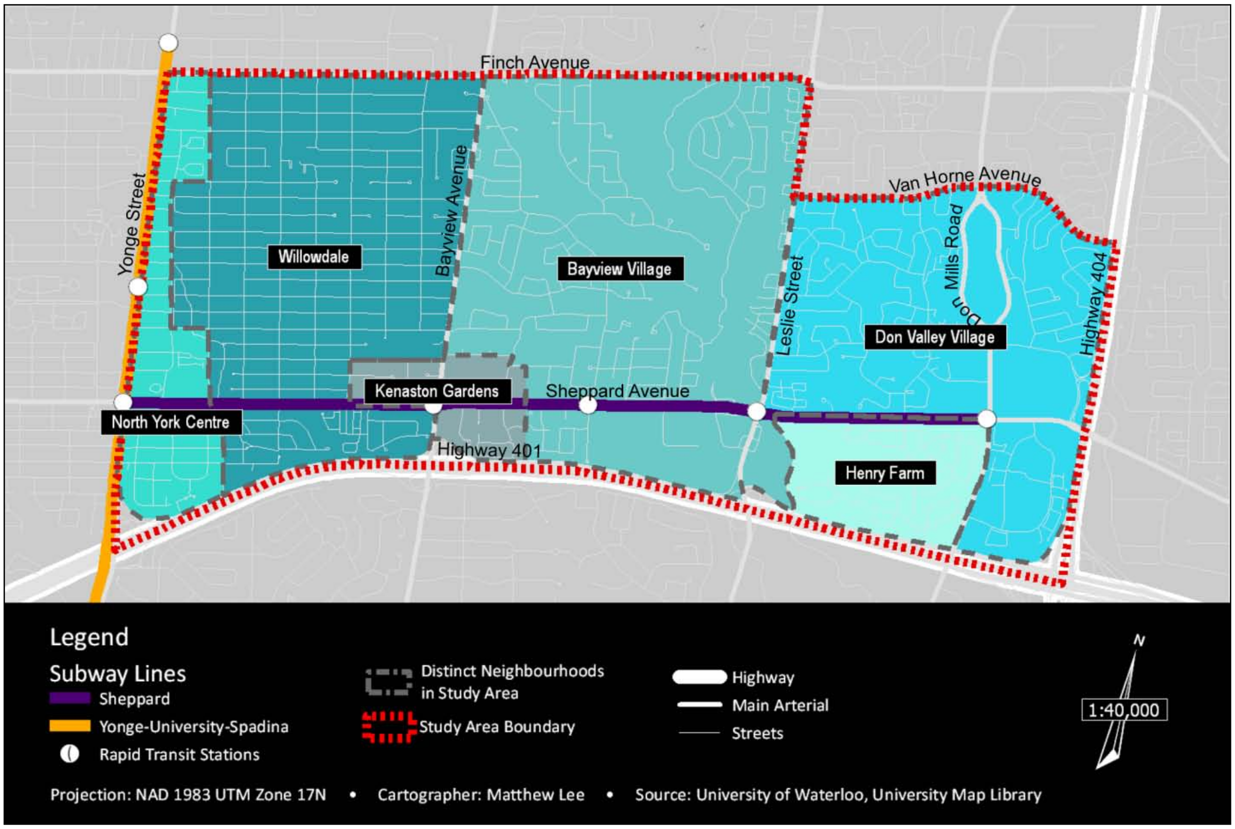
The Sheppard subway is a 5.5 km rapid transit line operating beneath Sheppard Avenue East in the Toronto community of North York. The line consists of five stations: Sheppard-Yonge, Bayview, Bessarion, Leslie and Don Mills. Sheppard-Yonge station is the western terminus of the line and makes connections to the perpendicular Yonge-University-Spadina subway. Sheppard subway passengers also have access to GO Train service at Oriole Station approximately 400 m south of Leslie Station. Don Mills Station is the eastern terminus of the line and provides a connection to a regional mall as well as direct connections to local transit, York Region Transit, and *Viva* Bus Rapid Transit services. Figure 4-1 illustrates the Sheppard subway corridor and how it connects to other rapid transit services.

Figure 4-1: Sheppard subway corridor and the Study Area



The selected research study area ("Study Area") is bounded by Yonge Street to the west; Highway 401 to the south; Highway 404 to the east; and Finch Avenue, Leslie Street and Van Horne Avenue to the north. Section 4.2.1 summarizes the process taken to define the Study Area. Figure 4-2 shows the general location and the six distinct neighbourhoods—North York Centre, Willowdale, Kenaston Gardens, Bayview Village, Don Valley Village and Henry Farm—identified within the Study Area.

Figure 4-2: Study area boundaries and the general residential neighbourhoods



Among the six neighbourhoods, North York Centre is the westernmost neighbourhood in the Study Area. Due to its location close to the Yonge-University-Spadina subway, this neighbourhood is made up predominately of highrise residential structures, commercial office towers and shopping retail. Additionally, this area is designated as a major centre in the former Metropolitan Toronto (see Section 4.1) and is consequently home to a number of civic and cultural amenities, including the North York Civic Centre, North York Central Library, Mel Lastman Square, Douglas Snow Aquatic Centre, Toronto Centre for the Arts, and Gibson House Museum.

Kenaston Gardens is an emerging neighbourhood located around Bayview Station. This area—which was originally composed of bungalows similar to Willowdale's housing stock—has since been replaced by high-density condominium towers (ranging from 8 to 28 storeys) and townhomes.

Don Valley Village, located mainly north of Sheppard Avenue and east of Leslie Street, includes a variety of housing types built in the 1960s and 1970s. Condominium townhouse and rental apartment buildings are present along the main thoroughfares of this neighbourhood, while the interior areas include split-level, semi-detached, and single-family detached homes (Toronto Life, 2009).

There are three neighbourhoods in the Study Area made up only almost entirely of low-density homes: Willowdale, Bayview Village, and Henry Farm. Willowdale is located just east of North York Centre and includes nearly all single family homes ranging from 1910 to 1950 bungalows to large two-storey homes replacing the original bungalows. Just east of Willowdale is Bayview Village, a neighbourhood that has retained almost all of the original ranch-style bungalows that were built in the 1960s and 1970s (Toronto Life, 2009). Finally, Henry Farm is located south of Sheppard Avenue and east of the Don Valley. This neighbourhood consists of two-storey single-family homes constructed in the 1960s. Refer to Appendix C for details about six distinct neighbourhoods in the Study Area.

4.1 Planning policy context

The current state of the Sheppard subway and the development within the Study Area materialized from an evolutionary array of provincial, regional and municipal planning and transportation policies. This section examines the planning documents that have provided guidance to building the Sheppard subway and to the high magnitude of redevelopment within the Study Area.

4.1.1 Sheppard subway planning policies

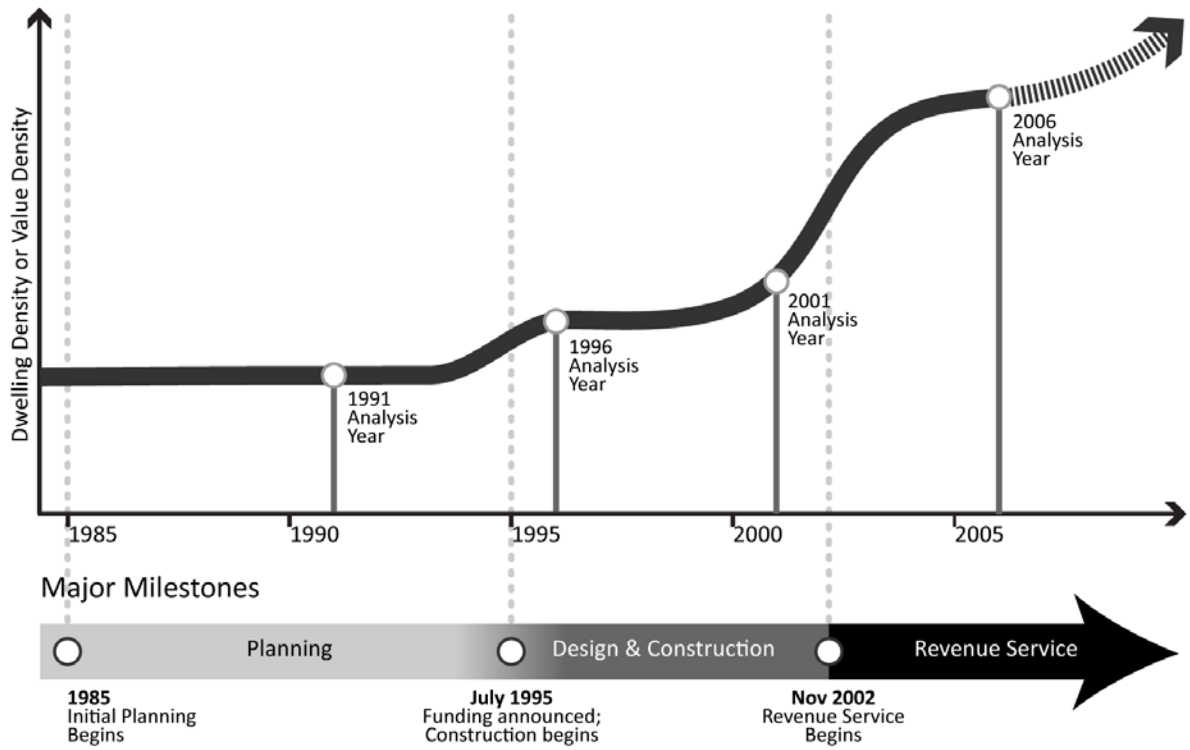
The planning process leading up to the funding and construction of the Sheppard subway dates back to as early as 1985. The major milestones for the project are as follows:

- **1985:** Early planning for the Sheppard subway begins by Metropolitan Toronto and North York municipal councils.
- **July 1995:** After suspensions in committed funding, the provincial government reinstates funding. Design and construction commences shortly after announcement.
- **November 2002:** Revenue service begins on the Sheppard subway.

It is anticipated that changes in intensification and value appreciation will occur according to the three identified milestones. Figure 4-3 illustrates the expected increase in Dwelling and Value

Density[8] in response to the announcement of funding and to the commencement of revenue service. For a full description of the plans and events leading up to the completion of the Sheppard subway project, refer to Appendix D.

Figure 4-3: Major Sheppard subway milestones and the expected changes to Dwelling and Value Density



From the Figure 4-3, a small increase in Dwelling and Value Density is anticipated subsequent to the commitment of funding and the commencement of construction of the subway corridor in 1995. The desirability of the area is expected to rise as a result of the anticipated decrease in transport costs causing the possible increase in dwelling supply and per-unit value. However, the increase may be negated by the traffic flow disruptions caused by construction. As construction nears completion leading to introduction of service in 2002, a surge in Dwelling and Value Density is anticipated as existing and prospective residents can or wish to capitalize on the lowered transport costs as a result of the new subway service.

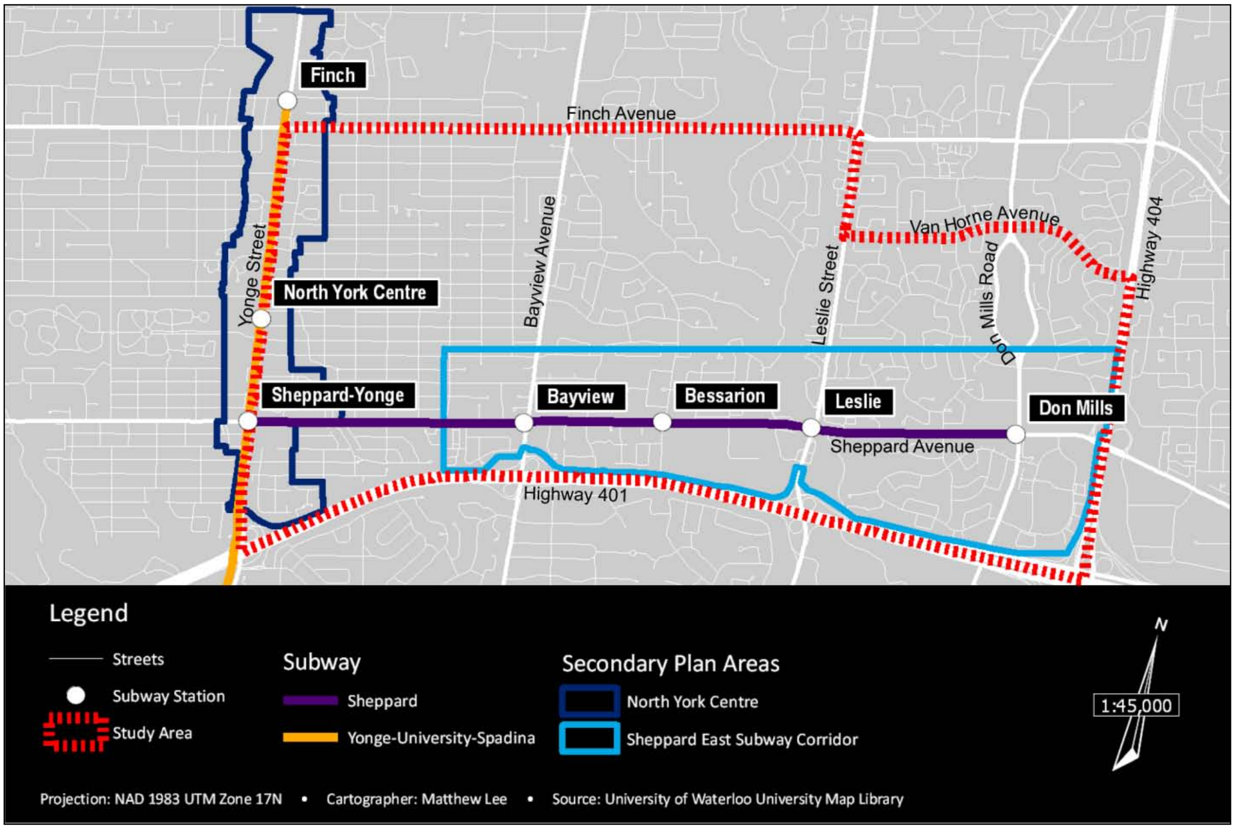
[8] the selected metrics for quantifying intensification and value appreciation

4.1.2 Planning documents pertaining to the development of the Study Area

There are three key planning documents which helped guide development within the Study Area: the Metro Toronto, North York and the subsequent amalgamated City of Toronto official plans. The first two documents, the Metro Toronto and North York official plans, were the key policies (1) in the creation of a North York city centre and (2) in the guidance of redevelopment and intensification of lands along the Sheppard subway corridor (details about these historical planning policies are in Appendix E). However, in 2007 the City of Toronto adopted a new Official Plan as a result of a municipal restructuring effort in 1998. This plan called for uniting official plans from six local and one regional government entities, while also developing new planning policies that reflect the emerging needs and opportunities of the amalgamated city.

Three specific sections of the new Official Plan are relevant to the Study Area; they include policies from (1) the North York Centre Secondary Plan ("NYC Plan"), (2) the Sheppard East Subway Corridor Secondary Plan ("Sheppard East Plan"), and (3) the *Neighbourhoods* and *Apartment Neighbourhoods* designation. Figure 4-4 outlines the area of the NYC Plan and the Sheppard East Plan.

Figure 4-4: North York Centre and Sheppard subway Corridor secondary plan areas, adapted from City of Toronto(2007f)



The areas not identified by the two secondary plans are guided by the *Neighbourhoods* and *Apartment Neighbourhoods* policies in the planning document. Each of the designations is discussed in the following subsections.

A. North York Centre Secondary Plan

The origins of the NYC Plan began as a framework policy strategy for the future development of a "borough centre." Included in the strategy document are elements typical of a secondary plan including (1) prescribed development forms, (2) infrastructure and service provisions, and (3) its relationship to the adjacent neighbourhoods (City of North York, 1992). Despite the plan having been transferred and embedded over the years into numerous planning documents as a result of planning reforms and municipal reorganization, the general intent of the secondary plan remains fairly consistent, with the exception of changes to the defined boundaries, anticipated employment numbers, and the planned road network.

The primary objectives of the NYC Plan, as stated in City of Toronto Official Plan (2002) are outlined in Table 4-1.

Table 4-1: Highlights from the North York Centre Secondary Plan (City of Toronto, 2007c)

Theme	Description
General intent	• Designate the area as important centre of activity for the city • Allocate major concentrations of employment and residents in the area
Access	• Capitalize on the superior rapid transit access to and from the area • Reduce car reliance through a progressive parking policy • Diffuse traffic along Yonge Street by continuing with initiatives through the construction of "ring" service roads
Area character	• Maintain a mixture of office, retail, service, institutional, hotel entertainment, residential and open space uses. • Identify the area as a preferred location for cultural and governmental uses
Urban Design	• Encourage continuous building frontages, and a grid pattern street network • Establish a comfortable human scale and create a sense of spatial containment • Ensure the livelihood of street trees
Relationship with stable areas	• Recognize existing neighbourhoods adjacent to North York centre are to be protected, preserved and enhanced

B. Sheppard East Subway Corridor Secondary Plan

The Sheppard East Plan was first adopted as an amendment to the City of North York Official Plan in 1996. Similar to the NYC Plan, the Sheppard East Plan was transferred to the new Toronto Official Plan in 2007. The purpose of the plan was primarily "to manage, direct, and ensure quality development in support of this significant public investment in rapid transit" (City of Toronto, 2007c, p. 1). Having said that, the City of Toronto developed this plan with the objective to generate increased transit ridership and "to support a revenue base from redevelopment to help underwrite [the high] levels of public investment" (Watty, 2001, p. 2). The primary objectives of the Sheppard East Plan are outlined in Table 4-2.

Table 4-2: Highlights from Sheppard East Subway Corridor Secondary Plan (City of Toronto, 2007d)

Theme	Description
General intent	• Allow for greater densities near Highway 401, at major intersections and transit stations.
Access	• Capitalize on the rapid transit access to development nodes • Support transportation demand management techniques • Construction of a continuous east-west access road is explicitly not planned
Area character	• Allow for non-residential retail and office uses • Provide long frontages on Sheppard Avenue, Leslie Street, and Bayview Avenue • Identify development nodes for each of the station areas, each calling for the maximization of development potential
Urban Design	• Encourage the creation of street block pattern, while simultaneously calling for only minor changes to street network • Designate Sheppard Avenue as a pedestrian main street • Buildings set back from Sheppard Ave to allow for potential widening
Relationship with stable areas	• Recognize existing properties outside of the plan area to be protected as stable residential communities as discussed in the *Neighbourhoods and Apartment Neighbourhoods* policies

C. Neighbourhoods and Apartment Neighbourhoods designations

The neighbourhoods within the Study Area not represented by (1) the NYC Plan and (2) the Sheppard East Plan are identified as what Toronto Official Plan calls the *Neighbourhoods* and *Apartment Neighbourhoods* designations. The City expressed strong planning objectives under these two designations to preserve the identified neighbourhoods as "stable residential areas" by "minimizing the unacceptable impacts of physical, economic, and environmental effects from the subway expansion" (Watty, 2001, p. 2). The primary policies of the *Neighbourhoods* and *Apartment Neighbourhoods* are outlined in Table 4-3.

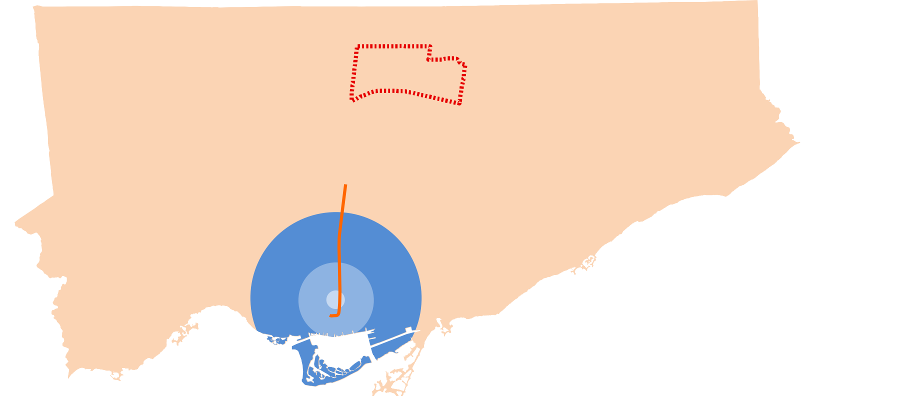
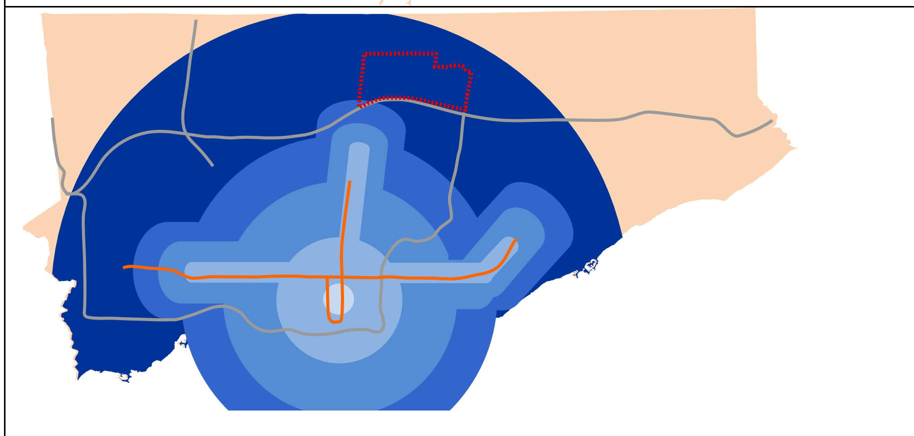
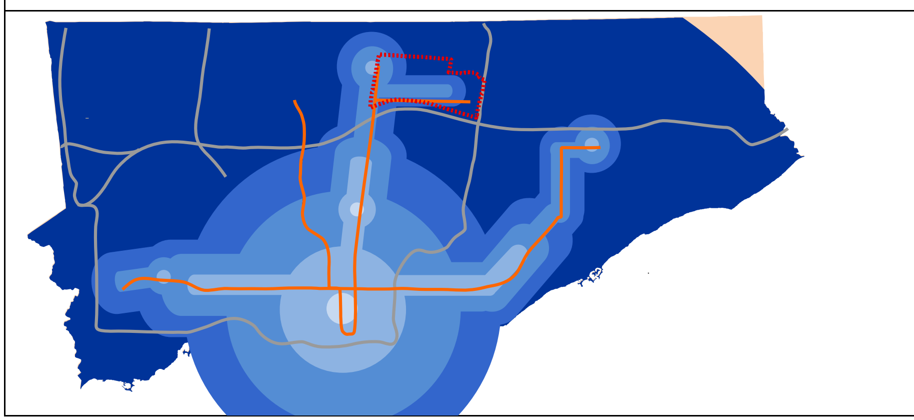
Table 4-3: Highlights from the Neighbourhoods and Apartment Neighbourhoods designation (City of Toronto, 2007b)

Theme	Description
Neighbourhoods	
General intent	• Designate areas that are physically stable areas and are made up of low scale buildings
Area character	• Reinforce the preservation of the physical character of neighbourhood, including street pattern, building types, building envelope dimensions, setbacks, lot sizes, etc. • Allow small-scale retail or office, so long as it is compatible to the area, as a means to provide local amenity
Intensification	• Discourage intensification in major streets
Apartment Neighbourhoods	
General intent	• Designate areas that are physically stable areas where significant growth is not anticipated
Area character	• Allows for sensitive redevelopment that improves existing conditions, including: improvements in shadow impacts, better transitions to low-density neighbourhoods, street-level amenities, clear sightlines.
Intensification	• Discourages significant growth, but permits compatible infill development on a site containing an existing apartment, if it shows that it will improve the quality of life of local residents

4.1.3 Theory to reality: translating theory to the Study Area

Having presented an extensive background from this chapter about the planning policies that led to the creation of a North York suburban downtown and eventually to the construction of the Sheppard subway, it is hypothesized that Toronto's urban spatial structure corresponds well to the sequence of theoretical models discussed in the Sections 2.1.1 to 2.1.4. These similarities are most evident when observing the changes to urban form in Toronto throughout the decades. Following the timeline of urban spatial evolutionary activities related to density described by Murdie & Teixeira (2000) and Filion (2007), Table 4-4 provides an illustrative evolution of Toronto's urban spatial structure. The purpose of translating the urban spatial structure concepts to the Toronto case is to establish a theoretical framework for the Study Area. It is this framework that will guide the development of a hypothesis regarding the changes in property value as a result of the Sheppard subway.

Table 4-4: Conceptual evolution of Toronto's urban spatial structure (Graphic source: author)

	**Concentric** *Before 1955* • Development focused along the local streetcar transit network • Development outside the urban core remain largely rural • Construction of the Yonge Subway began a radial but still monocentric development pattern (Murdie & Teixeira, 2000)
	**Radial** *1955 to 1975* • Development expands further away from the CBD • Development continues along Yonge Street to Eglinton Avenue • Development node emerge at Yonge-St Clair, Yonge-Eglinton • Focused high density developments within close proximity to the Bloor-Danforth Subway • Development node emerge at Main, Victoria Park, High Park, Islington stations (Filion, 2007)
	**Polycentric** *1975 to Present* • Toronto municipal area largely developed • Development booms in North York Centre and Scarborough Centre through due to its designation as major metropolitan centres • Development also focused at Islington-Kipling (Etobicoke Centre) and Yonge-Eglinton due to its designation as intermediate metropolitan centres (Filion, 2007)

4.1.4 Context conclusions

The decision to build the Sheppard subway can be attributed mainly to three planning and political conditions: (1) the early promotion of a multi-centred metropolitan region with Downtown, Scarborough, and North York being the key development areas, (2) the continued political strength in North York that stressed the Sheppard subway's importance to sustain its city centre, and (3) the provincial government's political actions to demonstrate commitment to public transit. Regardless of whether or not the construction of the subway corridor is justified, attracting development to the neighbourhoods along Sheppard may be the subway's greatest success (McGran, 2003). The NYC Plan and the Sheppard East Plan help to guide the redevelopment along the corridor, while the *Neighbourhoods* and *Apartment Neighbourhoods* designations help to preserve the existing character of the secondary plans' periphery. It is this premise, the draw of new residential development along the corridor, which motivates the current research.

4.2 Applying the method to the Study Area

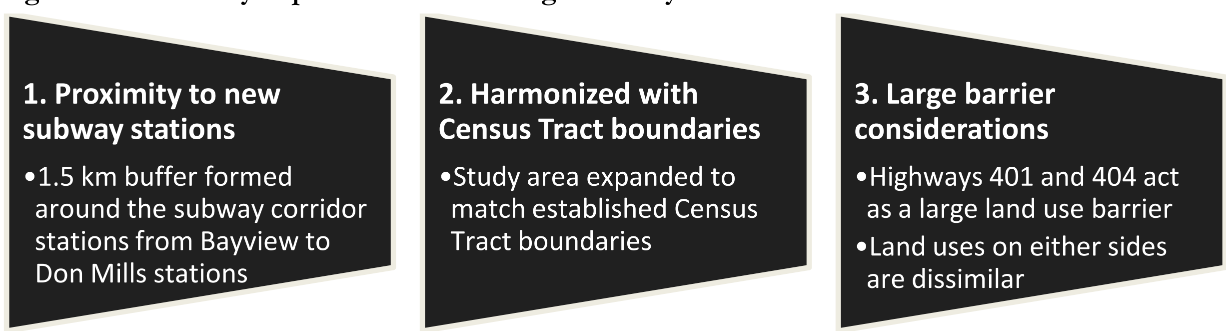
Having provided a background on the selected Study Area, Sections 4.2.1 to 4.2.8 describe how the methodological process discussed in Chapter 3 is applied to the selected Study Area. The following sections describe the specific process taken to quantify the changes to residential intensification and value appreciation before and after the construction of the Sheppard subway and to validate its consistency with urban economic theory. To achieve the thesis objectives, the following analysis steps are taken:

1. Defining the Study Area (Section 4.2.1)
2. Defining the appropriate study time periods (Section 4.2.2)
3. Establishing the hypotheses (Section 4.2.3)
4. Measuring Dwelling and Value Density (Section 4.2.4)
5. Forecasting future dwellings and sales values (Section 4.2.6)
6. Putting it all together (Section 4.2.5)
7. Validating data from Census data (Section 4.2.7)
8. Validating the hypotheses (Section 4.2.8)
9. Determining other conditions affecting Dwelling and Value Density (Section 4.3)

4.2.1 Defining the study area

As discussed in the introduction to Chapter 4, the selected Study Area is bounded by Yonge Street to the west; Highway 401 to the south; Highway 404 to the east; and Finch Avenue, Leslie Street and Van Horne Avenue to the north. Ideally, the creation of a 1.5-kilometre buffer around the new transit stations would appropriately serve the outlined objectives of the research (see Section 3.2). However, the section also specifies that area-specific considerations need to be exercised to refine the selected 1.5-kilometre buffer area. In the case of the Sheppard subway, the study boundary is defined based on three criteria: (1) proximity to new subway stations, (2) harmonization with established Census Tract boundaries, and (3) considerations for large land-use barriers. Figure 4-5 provides a summary of the process.

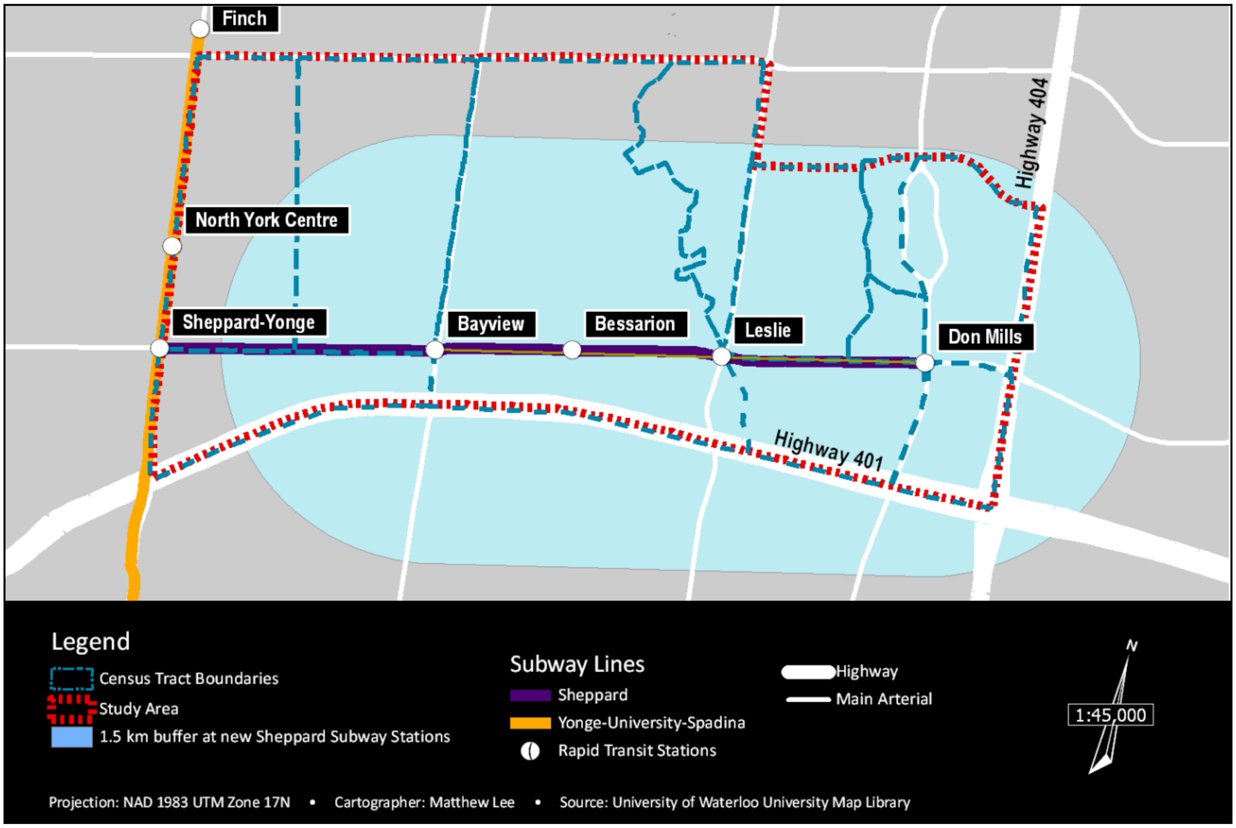
Figure 4-5: Summary of process of delineating the Study Area



A 1.5-kilometre buffer is formed around the Sheppard subway corridor from Bayview to Don Mills Stations. Because Sheppard-Yonge Station existed before Sheppard as part of the Yonge-University-Spadina subway, it is excluded from the initial Study Area delineation. From there, because of the heavy reliance of Census data to augment and validate property data, the boundary is expanded to be consistent with established Census Tract boundaries.

Lastly, it is recognized that Highways 401 and 404 act as major barriers to pedestrians and influence the dynamics and characteristics of the neighbourhoods on either side. For example, the York Mills and Pleasantview communities south of Highway 401 and west of Highway 404 respectively are very distinct from the neighbourhoods on the other side of the expressway. As such, the areas are removed from the Study Area. See Figure 4-6 to understand graphically how the eventual Study Area is defined.

Figure 4-6: Process map in the delineation of the established Study Area



4.2.2 Defining the appropriate study time periods

As described in Section 4.1.1, the Sheppard subway project was first announced in 1990 and the provincial government committed funds for the project as part of its *Let's Move* transit expansion plan. To define the appropriate study periods, it is established in Section 3.3 that the analysis should ideally start at the Census year prior to the announcement of the Sheppard subway and include each subsequent Census year to the present. Thus in this case, five Analysis Years should be identified: 1986, 1991, 1996, 2001, and 2006. Unfortunately, the repositories of property and Census data are extremely limited for the 1986 Analysis Year. For instance, only 16 sales records are available from the *Geowarehouse* web query tool[9] and a number of variables related to housing characteristics are unavailable for the 1986 Census. Thus instead, four Analysis Years are identified for analysis: 1991, 1996, 2001, and 2006.

[9] Refer to Section 4.2.4 for information regarding collection of property data.

4.2.3 Establishing a hypothesis

Section 3.4 defined residential intensification as the creation of new residential units on previously developed, serviced land (Roseland & Connelly, 2005). As an extension of that definition, residential value appreciation refers to the additional real estate value applied to previously developed and service land.

Based on the two identified metrics (see Section 3.4)—Dwelling Density and Value Density—the gathered data are used to validate the Study Area's consistency with urban economic theory. The findings in Section 2.1 postulate that Dwelling Density and Value Density will change as a function of time and distance. The following subsections describe the hypotheses specific to the Study Area. It is organized based on the predicted changes in residential intensification and value appreciation as a function of time (Section A) and as a function of distance (Section B).

A. Residential intensification and value appreciation as a function of time

Section 2.1.2 revealed that the construction of rapid transit brings about a decrease in transport costs in the areas along its corridor and specifically at its stations. Thus, it is hypothesized that the areas around the unique stations[10] along the Sheppard subway will experience an increase in Dwelling and Value Density starting as early as the announcement of funding for the project (1990) but will increase dramatically when the subway begins revenue service (2002). However, given that the earliest identified Analysis Year is 1991, changes in Dwelling and Value Density can be observed only as early as 1996.

B. Residential intensification and value appreciation as a function of distance

Section 2.1.2 explained that land use patterns in a given city are organized not just by concentric circles from the CBD but also along established transportation corridors due to their ability to reduce overall transport costs relative to distance (Hoyt, 1939). It is also noted that areas

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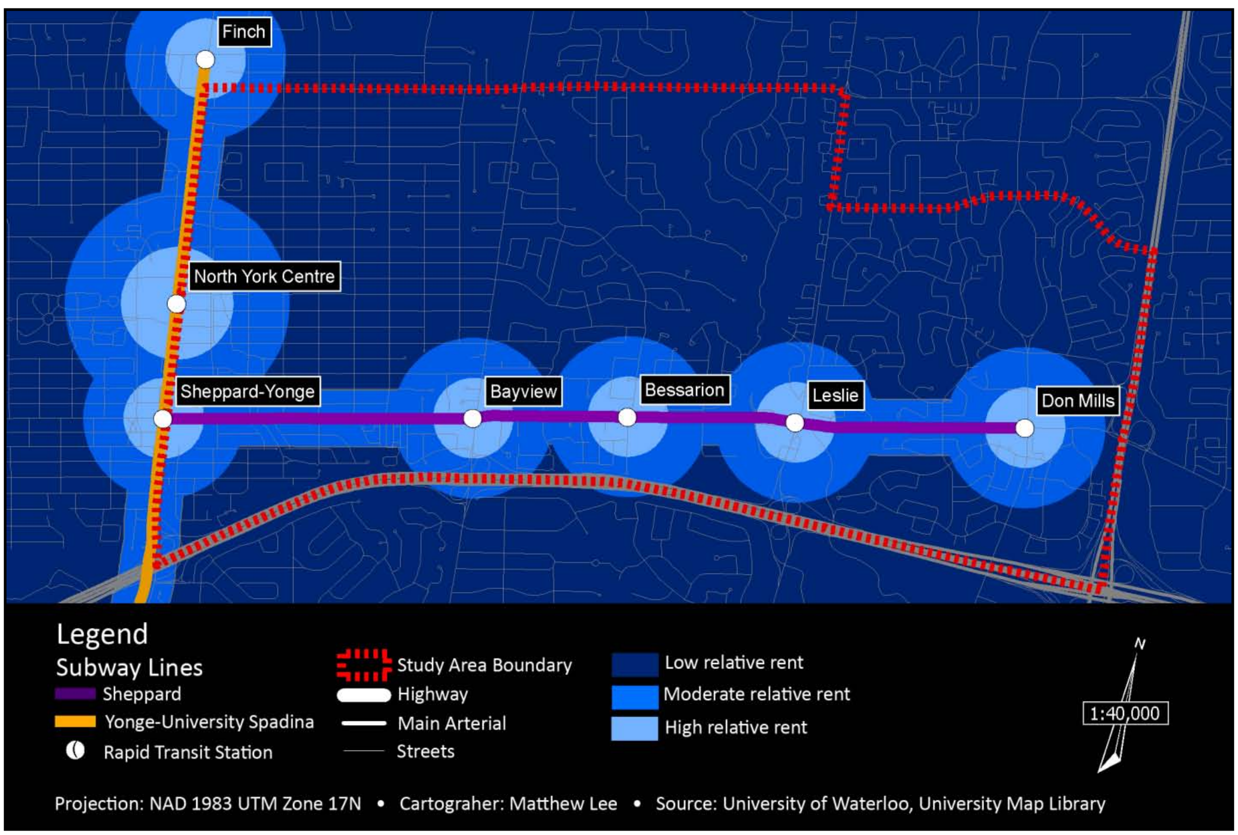
[10] The unique stations along the Sheppard subway include: Bayview, Leslie, Bessarion, and Don Mills. Sheppard-Yonge is not considered a unique station because it is also part of the Yonge-University-Spadina subway and was built prior to the Sheppard subway

surrounding transportation corridors and stations demonstrate higher rents given their lower transportation costs. Thus, it is hypothesized that:

1. Dwelling and Value Density will peak at the North York Centre development node and steadily decline concentrically outward;
2. Dwelling and Value Density will gradually increase with proximity to the CBD node, but will not outcompete North York Centre;
3. Dwelling and Value Density at each Station Area will experience smaller peaks and decline outward from the station; and
4. Dwelling and Value Density will modestly increase along remaining areas along the Yonge and Sheppard subway corridors not covered in points 2 and 3.

Figure 4-7 provides a conceptual map of the hypothesized results as discussed in the above points.

Figure 4-7: Conceptual map of predicted results of relative residential land rents



4.2.4 Measuring Dwelling and Value Density

The next step is to quantify dwellings and property values for relevant residential parcels in the Study Area for each of the identified Analysis Years. The purpose of quantifying dwellings and estimating the value of each parcel is to use the developed data to compute Dwelling Density and Value Density, which are then later used for geospatial interpolation and statistical analysis. The work of measuring Dwelling and Value Density is outlined as follows:

1. Classifying residential property types (Section A)
2. Quantifying dwellings (Section B)
3. Obtaining property data (Section C)
4. Quantifying dwellings and sales values (Section D)

A. Classifying residential property types

As explained in Section 3.5.1, the next step in preparing residential sales data is to classify all residential properties by three identified types: Leasehold Condominium Property (LCP), Single-Dwelling Freehold (SDF), and Multi-Dwelling Freehold (MDF). The 2006 property parcel shapefile is obtained with the Map and Data Library from the University of Toronto. Unfortunately, there are no geospatial data available for the other Analysis Years. Thus, orthophotos from 1990 to 2002 are obtained from the University of Waterloo Map Library to track the changes to residential development in the Study Area. The process outlined in Figure 3-3 describes how each residential property parcel is classified.

Table 4-5 shows a tally of residential property parcels identified by residential type for each Analysis Year.

Table 4-5: Tally of residential property parcels for each Analysis Year and residential type

Residential Type	1991	1996	2001	2006
Single-Dwelling Freehold	8,675	8,632	8,622	8,626
Multi-Dwelling Freehold	89	88	88	89
Leasehold Condominium	27	35	47	84
Total	8,791	8,755	8757	8,799

B. Quantifying dwellings

Once the property parcels are classified, the next step is to quantify the number of dwellings for each residential property parcel. The process for quantifying dwellings varies depending on the identified type of residential property. The steps taken to quantify dwellings under each of the three residential property types are followed precisely as directed in Section 3.5.3. Table 4-6 provides a tally of dwellings for each Analysis Year and for each residential type.

Table 4-6: Tally of dwellings for each Analysis Year and residential type

Residential Type	1991	1996	2001	2006
Single-Dwelling Freehold	8,675	8,632	8,622	8,626
Multi-Dwelling Freehold	9,830	9,734	9,734	9,959
Leasehold Condominium	3,229	4,407	7,246	18,442
Total	21,734	22,773	25,602	37,027

C. Obtaining property sales data

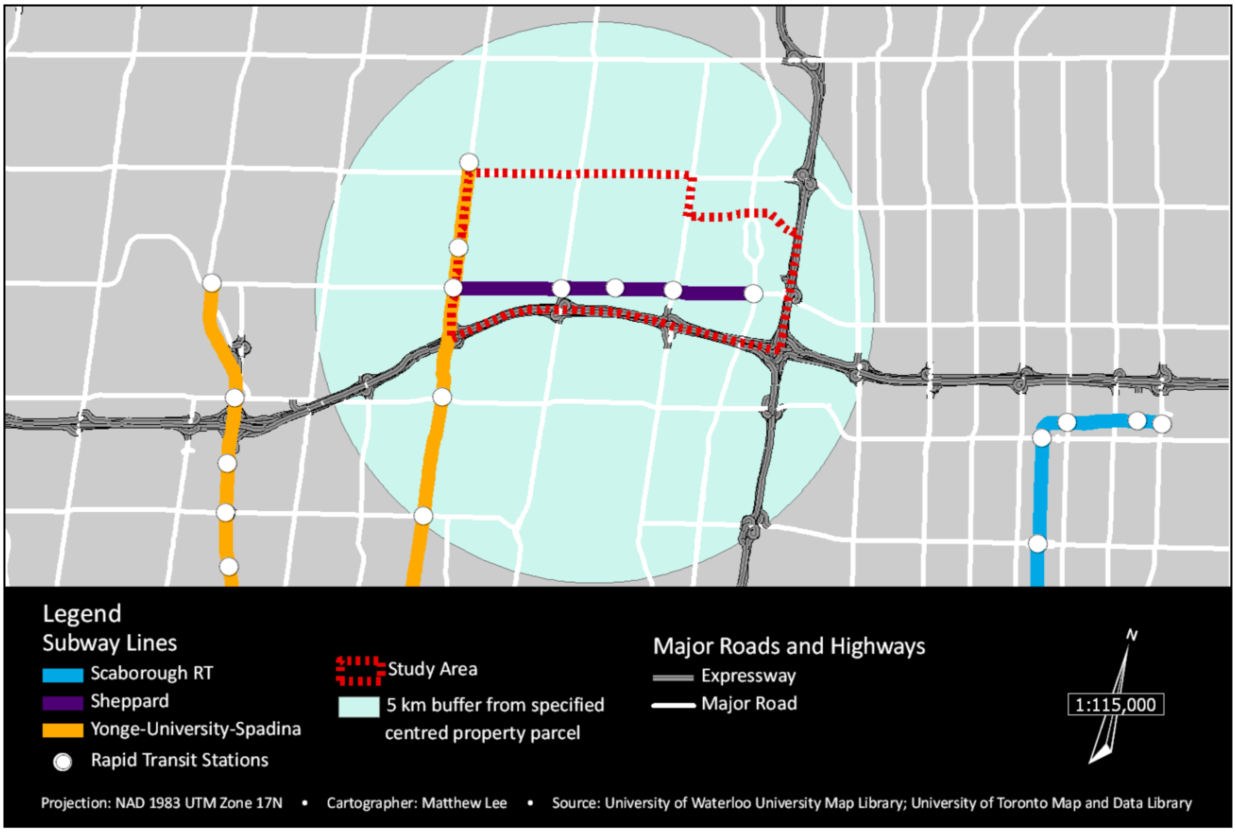
Before the sales values are quantified for each relevant residential property parcel, property sales data must first be obtained. Property sales data are obtained from *Teranet's Geowarehouse* web-based data retrieval application. *Teranet* is a private company that maintains and operates the electronic land registration system under an exclusive contract with the Ontario government until 2017 (Queen's Printer for Ontario, 2006). Under the terms of its exclusive contract, *Teranet* maintains and operates the electronic land registration system in Ontario. While the government maintains ownership of the *Province of Ontario Land Registration Information System (POLARIS)* land registration database, the technology in which the data are queried and processed are privately-owned by *Teranet* (Queen's Printer for Ontario, 2009a).

Residential property sales data are retrieved for all properties in the defined Study Area for each Analysis Year. Data are retrieved and analyzed only within Census years because it leaves provision for the supplementary use of Census data should one encounter insufficient data from property sales.

The necessary property data are obtained using *Geowarehouse*'s *Neighbourhood Sales Report* web query tool. This tool enables users to obtain sales data for all properties within a given (1) date range, (2) specified radius buffer (limited to 250 m, 500 m, 1 km, and in some cases 5 km) of a given queried property address.

In the Study Area, *Geowarehouse* permits the querying of a 5 km catchment area of a given property. Figure 4-8 illustrates how a five-kilometre buffer of a strategically selected property allowed for all properties in the Study Area to be obtained within a given specified date with just one query.

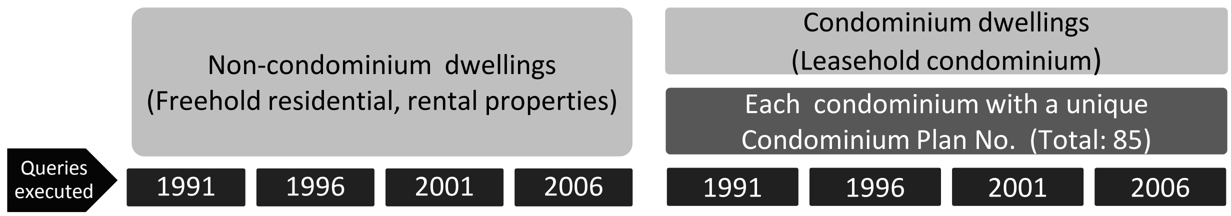
Figure 4-8: 5 km radius catchment of a strategically chosen property



To ensure that all the property sales data are collected in the Study Area, *ArcGIS* is used to create catchment circles based on the largest radius buffer the *Neighbourhood Sales Report* web query tool allows for the given Study Area.

Upon querying from the *Neighbourhood Sales Report* query tool, two caveats are recognized. First, *Geowarehouse* lists only the most recent sale of a property based on the inputted date range from the query. In other words, if a property was sold more than once in the specified date range, the report would only generate the most recent purchase between the specified dates. To address this issue, queries are executed by each individual year (e.g. Jan 1, 1991 – Dec 31, 1991, Jan 1, 1996 – Dec 31, 1996…), as this at least permits more property sale samples to be included in the analysis. Secondly, Leasehold Condominium parcels are considered a distinct "neighbourhood" external to other properties in is vicinity. Thus sales from Leasehold Condominiums are not included in the general five-kilometre catchment *Neighbourhood Sales Report* query. In order to retrieve all the residential sales data in the Study Area, each condominium structure with a distinct Condominium Plan Number needs to be queried individually. Figure 4-9 provides an illustrative summary of the executed property sales data queries for the *Geowarehouse* tool. In total, 344 queries were made.

Figure 4-9: Summary of executed property sales data queries for the Neighbourhood Sales Report tool



Once all sales data are collected and compiled into a spreadsheet, a preliminary test for data validity is preformed to ensure there are no observable anomalies. One expected and recurring anomaly is the large number of sales records with values ranging from $0 to $10. These anomaly figures denote either that there is (1) a transfer of the property title from one individual to another or (2) that data are simply missing (Share, 2009; C. Smith, 2009). These data are removed from further analysis. Table 4-7 provides a summary of sales data entries with the discussed anomaly figures. Also included is a tally of sales data entries within and outside the Study Area.

Table 4-7: Summary figures of sales data entries from Geowarehouse tool

	Valid versus invalid entries			**Number of sales data entries**		
Residential Type	With Values from $0-10	Valid sales data entries	Total	Within Study Area	Outside Study Area	Total
Single-dwelling and multi-dwelling freeholdproperties	2,782	2,988	5,770	5,770	7,015	12,785
Leasehold condominium dwellings	1,064	13,758	14,822	14,822	N/A	14,822
Total	**3,846**	**16,746**	**20,592**	**20,592**	**7,015**	**27,607**

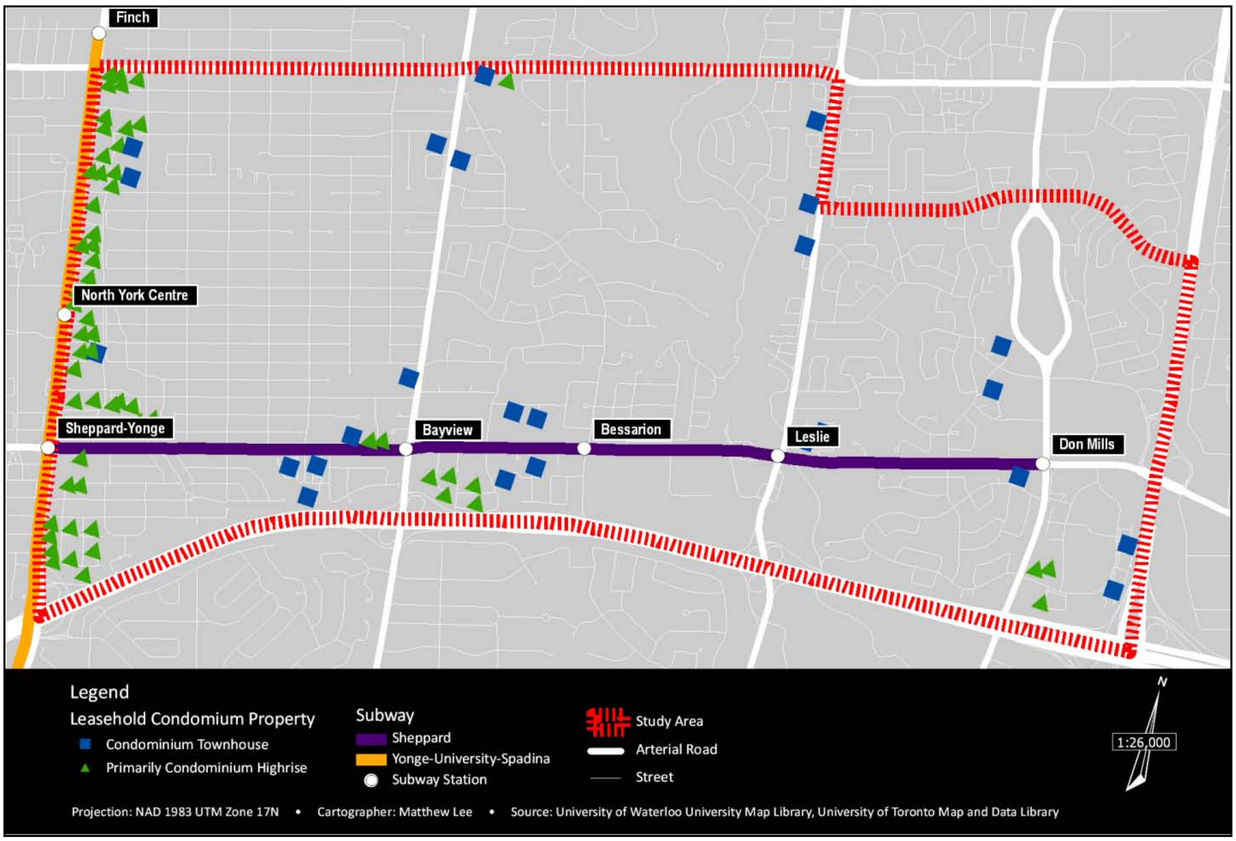
D. Quantifying property value

Like quantifying dwellings, the process for quantifying value also depends on the type of residential property. The discussion is organized according to the three identified property types.

i. Estimating property values of Leasehold Condominium Properties

Property sales data from each Leasehold Condominium Property are queried from *Geowarehouse*, and the irrelevant sales (e.g. parking, storage) are removed accordingly. Figure 4-10 provides a map summary of all the Leasehold Condominium properties in the Study Area from 1991 to 2006. In total, there are 82 LCPs in the Study Area.

Figure 4-10: Leasehold Condominium properties in the Study Area from 1991 to 2006



From there, a central tendency confidence interval is computed for property sales from each Analysis Year within each LCP. The process to decide which statistical test to use depends on the conditions of the data as illustrated in Figure 3-3. Refer to Appendix F for details regarding the computation of the central tendency range for each LCP. Using the central tendency confidence interval and the quantity of dwellings, Equation 3-3 is applied to compute the total value of each LCP.

ii. Estimating property values for Single-Dwelling Freeholds

As stated in Section 3.5.4, the interpolation of value surfaces for SDFs rely only on known sales records and does not require the computation of properties with unknown values. Table 4-8 provides a tally of SDF property sales within the Study Area during the four Analysis Years.

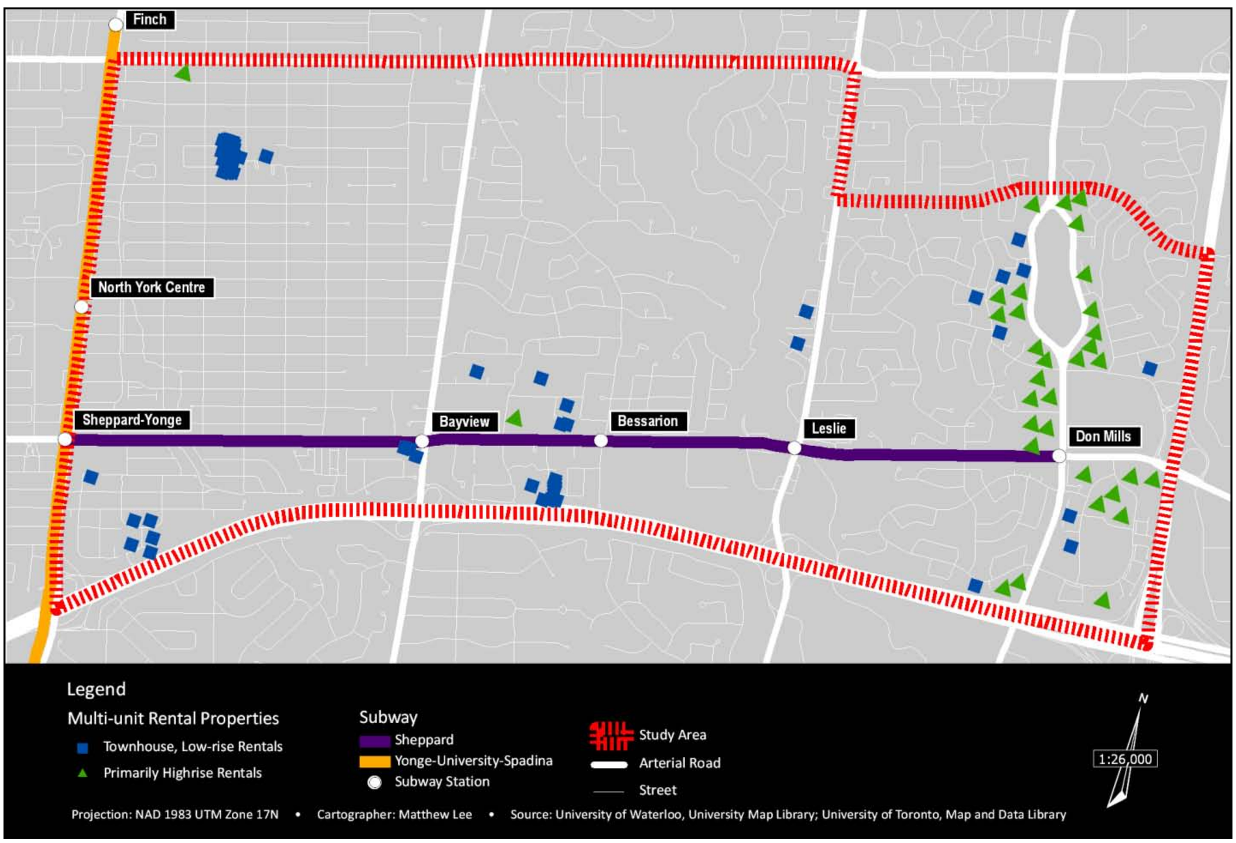
Table 4-8: Summary figures of sales data entries of Single-Dwelling Freehold

	1991	1996	2001	2006
Single-Dwelling Freehold Sales	319	355	468	458

iii. Estimating property values for Multi-Dwelling Freeholds

As shown in Table 4-5, a range of 88 to 89 properties are classified as a MDF property. Figure 4-11 illustrates all the Multi-Dwelling Freehold properties in the Study Area that existed, at least at some point, from 1991 to 2006.

Figure 4-11: Multi-Dwelling Freehold properties in the Study Area from 1991 to 2006



As discussed in Section 3.5.4, there are three options for estimating the values of Multi-Dwelling Freeholds: (1) Line of best fit extrapolation, (2) Leasehold condominium value substitution, and (3) spatial interpolation. With respect to Option 2, Appendix G shows precisely which substitute LCP values are used to estimate the per-dwelling value of a given MDF.

Table 4-9 lists the Multi-Dwelling Freehold properties sold in one of the Analysis Years, and how it compares to estimated values from each of the three options. A ratio measure is used to quantify the closeness of an estimated value to the actual sale value. The ratio figure is computed by dividing the estimated value by the actual price value.

Table 4-9: Estimated values under the three options versus actual sale price for Multi-Dwelling Freeholds

		Option 1		Option 2		Option 3	
PIN - Name	Actual Price	Value	Ratio	Value	Ratio	Value	Ratio
1991							
100470395 - Royale Towers	4,850,000	4,791,550	0.99	16,166,250	3.33	5,582,554	1.15
100780129 - 26 Annapearl Ct	100,000	230,133	2.30	359,250	3.59	225,733	2.26
100780134 - 23 Charlemagne Dr	368,700	434,940	1.18	718,500	1.95	184,878	0.50
100780165 - 12 Annapearl Ct	247,000	214,355	0.87	359,250	1.45	227,186	0.92
100890510 - Havenbrook Towers	6,611,400	6,693,046	1.01	22,752,500	3.44	7,032,348	1.06
1996							
100570036 - Valleyview Towers	8,950,000	8,465,030	0.95	15,225,000	1.70	13,230,833	1.48
100600081 - 22 Elkhorn Dr	11,895,000	9,276,462	0.78	28,917,500	2.43	9,308,426	0.78
100600192 - 11 Elkhorn Dr	1,325,000	2,100,450	1.59	1,614,000	1.22	1,215,171	0.92
100610137 - 2911 Bayview Av	20,500,000	22,450,581	1.10	25,665,000	1.25	17,229,131	0.84
100780193 - 17 Charlemagne Dr	270,000	242,620	0.90	261,000	0.97	130,698	0.48
100780194 - 19 Charlemagne Dr	275,000	241,710	0.88	261,000	0.95	130,329	0.47
100850010 - Parkway Towers	7,164,000	6,256,802	0.87	9,831,000	1.37	6,364,061	0.89
100900130 - 65 Talara Dr	520,000	502,030	0.97	522,000	1.00	323,709	0.62
100900228 - 25 Greenbriar Rd	544,000	428,701	0.79	522,000	0.96	299,157	0.55
100900229 - 23 Greenbriar Rd	510,500	428,813	0.84	522,000	1.02	299,203	0.59
101040005 - 2818 Bayview Av	800,000	1,140,416	1.43	1,827,000	2.28	972,649	1.22
101040785 - 343 Sheppard Av E	325,000	299,602	0.92	435,000	1.34	224,101	0.69
2001							
100780099 - 19 Annapearl Ct	500,000	360,798	0.72	395,400	0.79	419,307	0.84
100780127 - 22 Annapearl Ct	332,000	438,188	1.32	395,400	1.19	419,307	1.26
100780128 - 24 Annapearl Ct	325,000	316,213	0.97	395,400	1.22	419,307	1.29
100780131 - 32 Annapearl Ct	595,000	537,230	0.90	790,800	1.33	452,476	0.76
100900131 - 67 Talara Dr	700,000	563,455	0.80	790,800	1.13	461,930	0.66
101040787 - 341 Sheppard Av E	150,000	340,203	2.27	659,000	4.39	458,456	3.06
2006							
100470397 - 12 Deerford Rd	6,705,000	9,112,972	1.36	19,740,420	2.94	17,976,644	2.68
100560067 - Majorca Towers	5,199,480	15,312,384	2.94	34,545,735	6.64	10,932,426	2.10
100570040 - Attache South	12,800,000	9,622,470	0.75	21,150,450	1.65	10,805,515	0.84
100581115 - Willoway Towns	8,160,000	10,568,632	1.30	44,221,417	5.42	12,616,721	1.55
100780101 - 20 Charlemagne Dr	1,100,000	1,129,214	1.03	846,018	0.77	914,001	0.83
100780126 - 20 Annapearl Ct	470,000	614,585	1.31	423,009	0.90	427,039	0.91
100780132 - 34 Annapearl Ct	370,000	839,173	2.27	846,018	2.29	740,165	2.00
100780359 - 16 Annapearl Ct	500,000	487,391	0.97	423,009	0.85	350,805	0.70
100850002 - Poplar Grove	27,547,376	20,683,849	0.75	21,855,465	0.79	21,896,742	0.79
100850009 - Forest Manor Towns	13,745,630	11,194,386	0.81	26,136,000	1.90	16,083,985	1.17
100850011 - Laurel Grove	28,795,168	19,352,794	0.67	40,185,855	1.40	31,386,532	1.09
100850122 - Elm Grove	48,375,880	32,109,110	0.66	69,091,470	1.43	49,702,843	1.03
100850183 - Willow Grove	20,732,520	14,839,885	0.72	29,610,630	1.43	28,159,843	1.36
100850184 - Pine Grove	20,732,520	14,841,281	0.72	29,610,630	1.43	28,009,882	1.35
100850185 - Ash Grove	20,732,520	14,841,964	0.72	29,610,630	1.43	28,356,088	1.37
100900091 - 11 Dervock Cres	14,000,000	11,973,059	0.86	11,280,240	0.81	10,340,964	0.74
100900226 - 29 Greenbriar Rd	390,000	750,972	1.93	846,018	2.17	789,670	2.02
100900227 - 27 Greenbriar Rd	725,000	758,503	1.05	846,018	1.17	794,184	1.10
Average			**1.13**		**1.85**		**1.14**
Number of First Ranks			**18**		**7**		**17**
Shaded cell denotes the estimated figure is closest to the actual sale value							

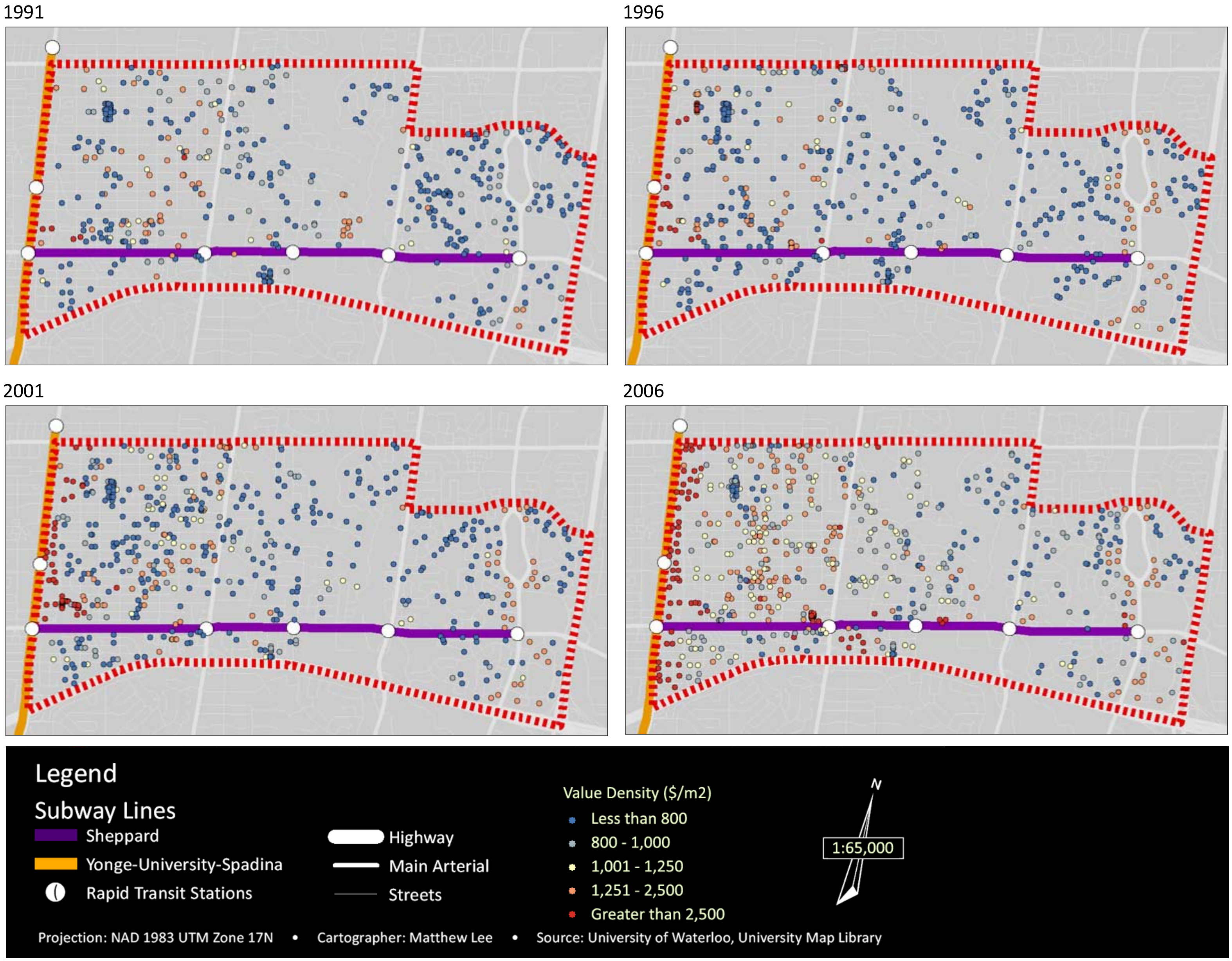
Statistically, the estimated values from Option 1 demonstrated the best results producing an overall ratio index figure closest to 1 (at 1.13) and demonstrated the highest number of first ranks (18 records) for individual properties. Meanwhile, the values from Option 3 are in a very close second, with a ratio and number of first ranks of 1.14 and 17 respectively.

Due to the closeness of estimated values from both Options 1 and 3, either method is appropriate for subsequent analysis. However, after further evaluation it is determined that Option 3 would render better estimates because spatial variations in property value are recognized. There is a greater degree of validity for Option 3 than if all Multi-Dwelling Freeholds are treated equally, regardless of its location in the Study Area, as demonstrated in Option 1. Thus, Option 3 (Spatial interpolation-extrapolation) is selected as the method for determining all unknown Multi-Dwelling Freehold values during each Analysis Year. The estimates from this Option are carried over for spatial interpolation.

4.2.5 Putting the computed data together

As discussed in Section 3.5.5, the next objective is to compile all the computed data and prepare the data for spatial interpolation. First, the area and centroid of each residential parcel is generated by using the *Calculate Geometry* function and *Calculate Values* functions respectively. Once the area of each parcel is computed and the parcel centroid layer is developed, the geospatial data are then joined with the three sets of value and dwelling data for each Analysis Year. Figure 4-12 illustrates the computed Value Density sales points geographically within each Analysis Year.

Figure 4-12: Computed Value Density sales points for each Analysis Year



Once all the table data are joined to the parcel centroid shapefile, the property centroid points are then spatially interpolated based on two variables: Dwelling Density and Value Density.

4.2.6 Forecasting future dwellings and sales values

Because dwelling and sale value data is available and analyzed only up to December 2006—four years after the Sheppard subway corridor began revenue service, there is value to forecast future dwelling and sales values to examine what degree of intensification and value appreciation is expected along the Sheppard subway corridor in the future.

To achieve this, a list of anticipated residential redevelopment projects are compiled from City of Toronto staff reports and newspaper sources. The process of the data collection focused on potential Leasehold Condominium Properties and Multi-Dwelling Freehold Properties only, since these kinds of development are expected to generate the biggest impact on Dwelling and Value Density in the future. Based on gathered anticipated project data, two types of properties are identified.

Table 4-10: Identified property types for Dwelling and Value Density forecasting

Identified property types	Definition
Class I Future Property: Properties under construction or released for sale	• Properties under construction based on field study and can be verified by muncipal government and/or media sources • Properties that are released for sale to the public and can be verified by muncipal government and/or media sources • Properties that were registered on or after January 1, 2007, and before December 31, 2008, which were omitted from the analysis
Class II Future Property: Properties in the planning stages	• Properties that are being planned and can be verified by City of Toronto planning staff reports • Sale of the units to the public have not been publicized and expected unit prices have not yet been established.

Based on these definitions, a predicted number of dwellings and a property value are computed and assigned to all proposed residential properties in both Class I and II. The properties values are calculated based on Equation 4-1 and Equation 4-2.

Equation 4-1: Estimating the value of a Class I Future Property

$$V_t = V_{\mathrm{u}} \times n$$

Where,

V_t : predicted value of a Class I Future Property ($ in 2006)

V_{u} : value of one dwelling on the development property as indicated on newspaper condominium features, usually expressed with the least expensive unit

N : number of dwellings in the property as indicated on newspaper condominium features and/or City of Toronto planning staff reports

Equation 4-2: Estimating the value of a Class II Future Property

$$V_t = V_{\mathrm{est}} \times n$$

Where,

V_t : predicted value of a Class I Future Property ($ in 2006)

V_{est} : average value of a Leasehold Condominium Unit in 2006, which was calculated to $225,000

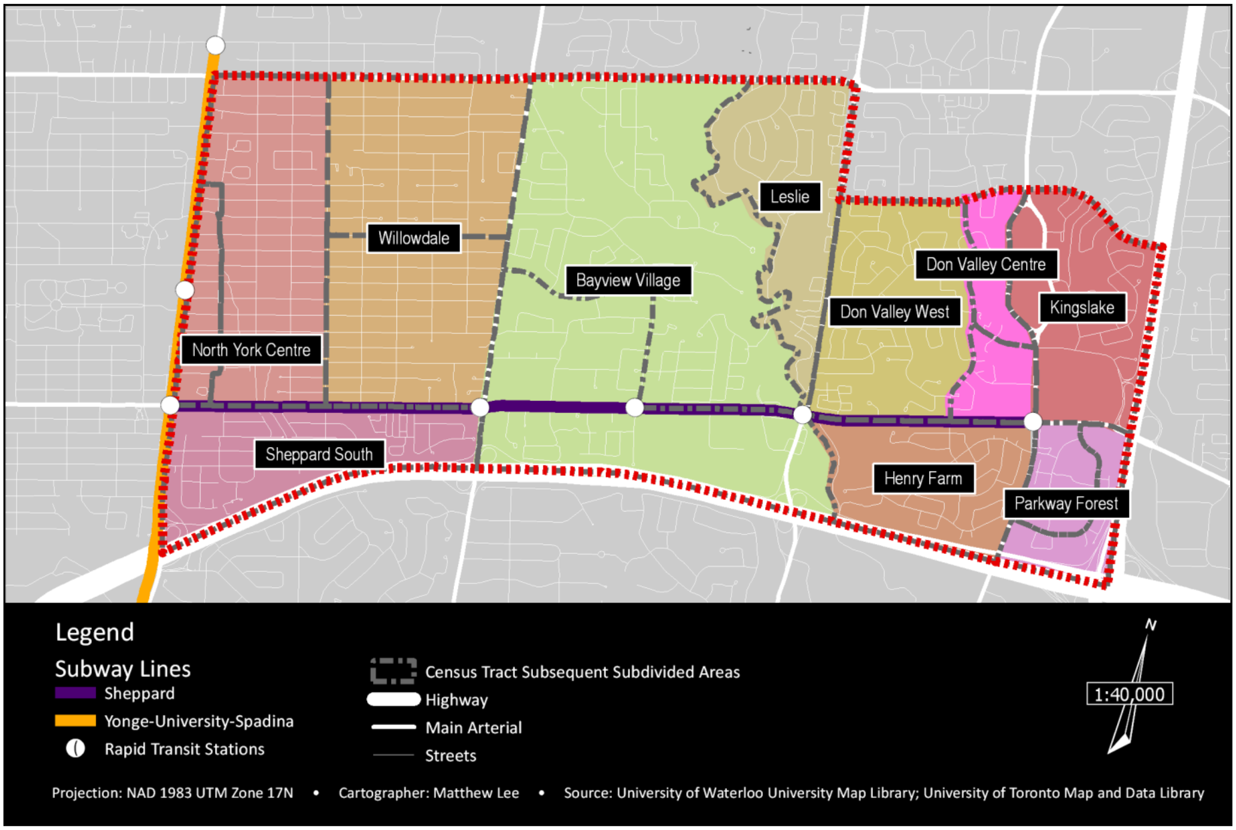
N : number of dwellings in the property as indicated on City of Toronto planning staff reports

See Appendix H to view the listing of Class I and Class II properties and the computed property values and number of dwellings. Based on this data, the following figures are then applied to GIS to generate another two sets of interpolated raster surfaces and scatterplots.

4.2.7 Validating data with Census Data

As described in Section 3.5.7, Census data are used to validate the trends in computed dwelling and property value data discussed in the previous sections. The Census data are used as an effective initial test to examine the expected changes to residential land-use conditions prior to and after the construction of the rapid transit corridor. Census data are obtained from *TriUniversity Data Resources*, a joint venture between the University of Guelph, the University of Waterloo, and Wilfrid Laurier University. Data are obtained and analyzed at the Census Tract (CT) level for four Analysis Years: 1991, 1996, 2001, and 2006. The Census variables that are obtained mirrored the list in Figure 3-6. In total, there are 11 CTs in 1991 and 1996, and 15 CTs in 2001 and 2006; this increase is due to the splitting of former CTs as a result of population growth. The overall geographic scope under all four analysis periods remained static. In order to ensure a consistent set of spatial boundaries through time, data from split CTs are merged together. Figure 4-13 graphically illustrates the different CTs in the Study Area. CTs are usually labelled by a unique identification number, but for the rest of the discussion and analysis, they are conveniently referred by community name as specified by the thesis author. Appendix I illustrates summary of findings from Census data.

Figure 4-13: Relevant Census Tracts in the Study Area



4.2.8 Validating the hypothesis

The objective of the research is to examine the changes to residential intensification and value appreciation as a function of time before and after the introduction of rapid transit service and to test the validity of the identified hypotheses based on urban economic theory. Dwelling and Value Density are used as appropriate metrics of residential intensification and value appreciation. Two approaches are devised to satisfy the set objectives: the scatterplot approach and the geovisualization approach. The two approaches are discussed in Sections A and B respectively.

A. Scatterplot approach

The scatterplot approach involves applying Dwelling and Value Density data to observe changes in residential intensification and value appreciation as a function of time and distance by means of statistical scatterplots. In brief, the Dwelling and Value Density figures are interpolated using the Inverse Distance Weighted (IDW) method, as explained in Section 3.5.5. See Appendix J to view the Dwelling and Value Density interpolated surfaces. From there, a systematic set of sample points are established in GIS, and Dwelling and Value Density figures are retrieved based on the location of the sample points on the interpolated surfaces. These values, along with the sample point's distance to nodes and stations, are used for the scatterplot analysis.

As discussed in Section 3.5.8, two sets of sample points are developed for the purpose of extracting values from the interpolated raster surfaces: station-level analysis and macro-level analysis sample points. The station-level analysis examines the spatial variations in Dwelling and Value Density for each Analysis Year as a function of distance to rapid transit stations, while the macro-level analysis studies the variations in Dwelling and Value Density as a function of distance to major activity centres. The geographic scope of the station-level analysis is limited within 1 km from each of the seven rapid transit stations, while the macro-level analysis examines the entire Study Area. For the macro-level analysis, two activity centres have been identified to possibly affect variations in Dwelling and Value Density: the Toronto CBD and North York Centre. The intersection of Queen and Yonge Streets has been identified as the geographic centre of the Toronto CBD, while Mel Lastman Square at 5100 Yonge Street has been identified as the geographic centre of North York Centre.

Based on these two types of analyses, Figure 4-14 and Figure 4-15 illustrates the established sample points based on the two types of sampling methods.

Figure 4-14: Station-level sample points and its measured distances to the closest rapid transit station

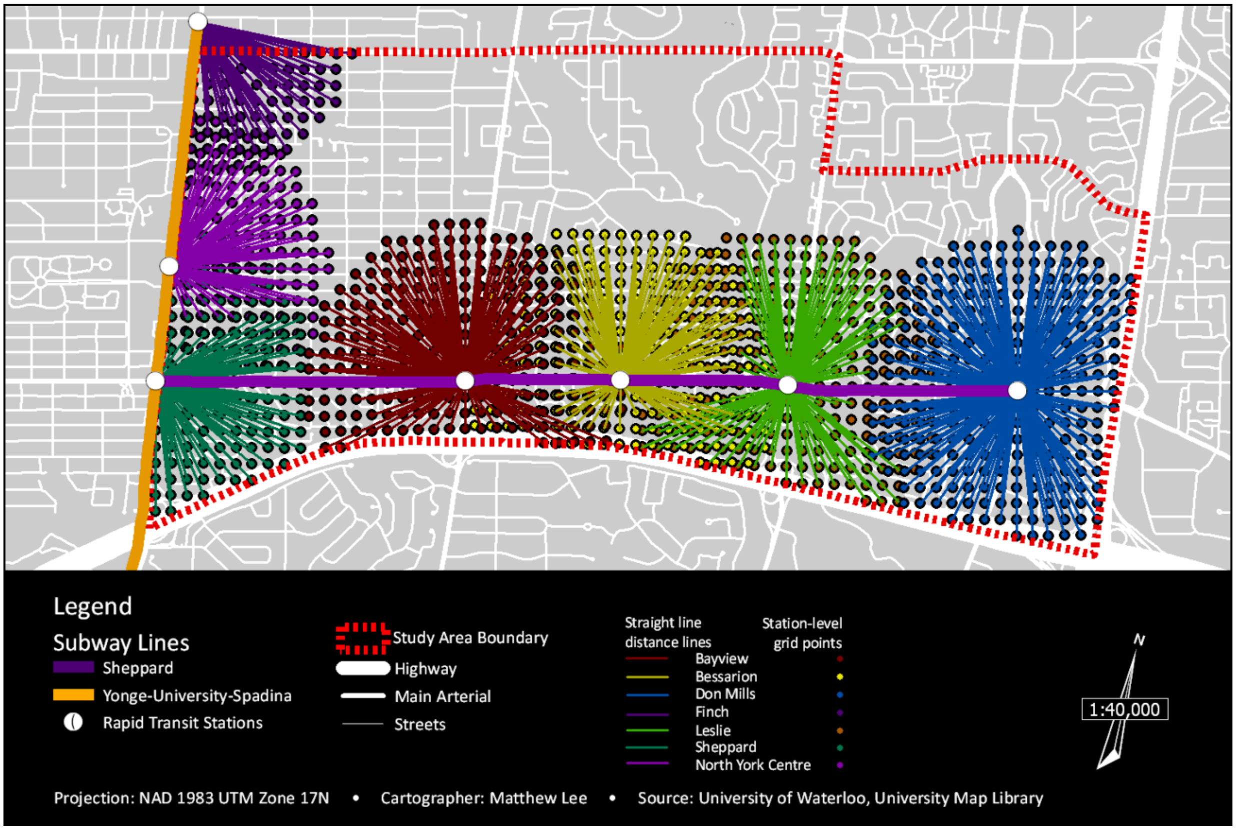
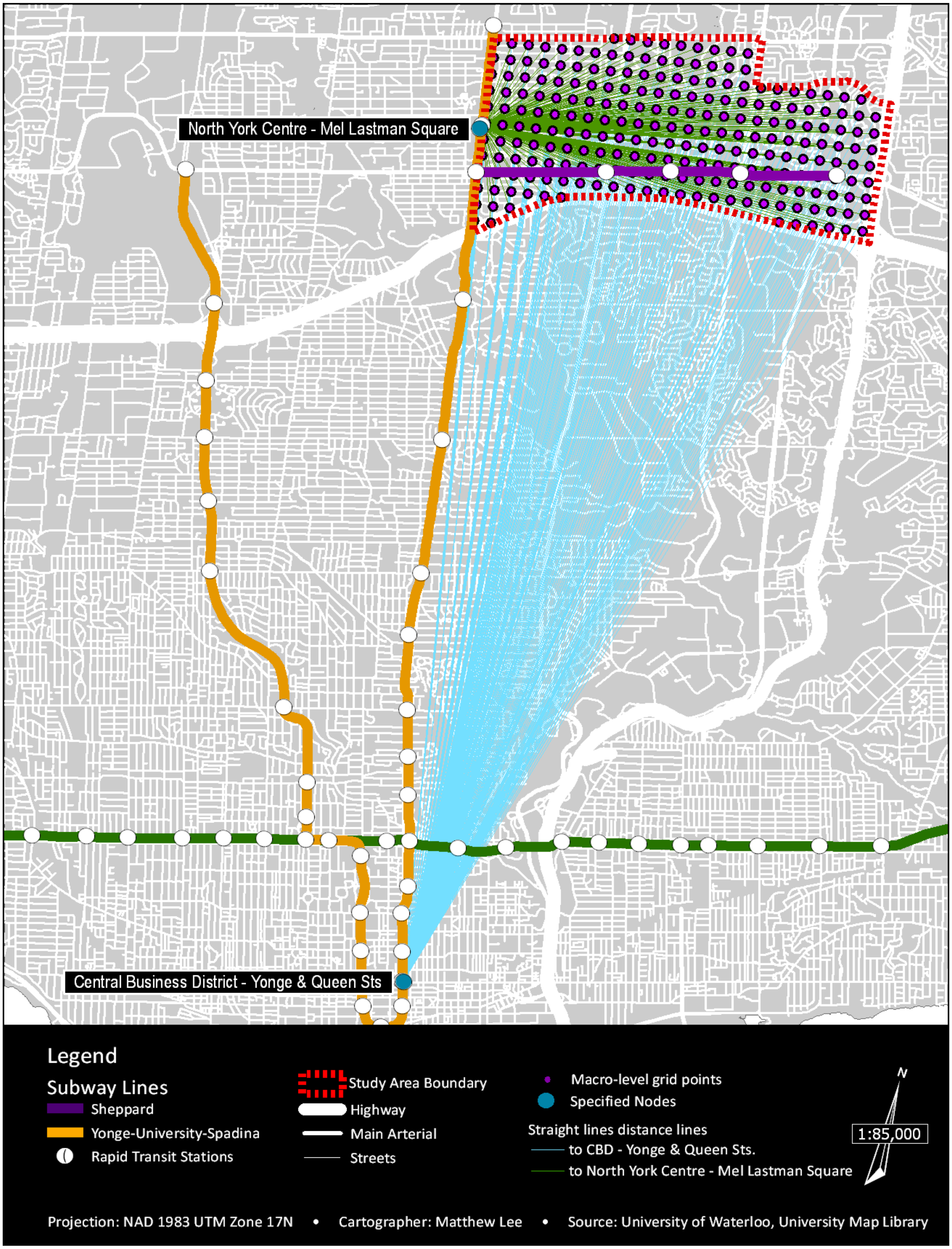


Figure 4-15: Macro-level sample points and its measured distances to the CBD and North York Centre



Using the *Network Analyst* tools from *ArcGIS*, the distance of each station-level sample point to the nearest rapid transit station are measured and the distances of each macro-level sample point to both North York Centre and the Toronto CBD are also measured. Once the data has been extracted from the interpolated raster surfaces from each Analysis Year and the distances of each sample point to stations and nodes is measured, scatterplots can be produced for each variable combination and for each Analysis Year, under both the station-level and macro-level analysis. Appendix K and Appendix L display the Dwelling and Value Density scatterplots as a function of distance for each Analysis Year from the station-level and macro-level analysis respectively. The developed Dwelling and Value Density scatterplots are then used to examine whether they are consistent with the hypotheses developed in Section 4.2.3.

One may question why it is necessary to undertake such a long process of establishing sample points, extracting values from Dwelling and Value Density interpolated surfaces, and measuring the distances of sample points, when it is simpler just to use the actual computed Dwelling and Value Density points and measure their distance to nodes and stations. The latter alternative approach is not taken because many station areas do not contain residential property centroids that are within a very close proximity to rapid stations; the former approach ensures that a Dwelling and Value Density figure can be observed regardless of location within the Study Area. Nevertheless, Appendix M shows the developed Dwelling and Value Density scatterplots based on the actual property points, rather than from extracting surface data from sample points.

B. Geovisualization Approach

As discussed in Section 3.5.8, the Geovisualization Approach is intended to improve the way the conditions of residential intensification and value appreciation are communicated. As there is an increasing need to find clear ways of communicating with and persuading the public about the benefits of building rapid transit in their communities.

Specifically, the *Raster Math* and *ArcScene* methods are used for demonstrating the changes in Dwelling and Value Density in the Study Area through time. With regards to the *Raster Math* method, the objective is to calculate the percentage change in Dwelling and Value Density between two select Analysis Years on a cell-by-cell basis. Equation 3-4 is applied in ArcGIS by using the *Minus* and *Divide* tools to create the specified raster output. In total, 12 new surfaces are developed:

six for Dwelling Density and six for Value Density. Table 4-11 lists the six combinations. All 12 surfaces are presented in Appendix N.

Table 4-11: Combination of Analysis Year pairs for new raster surfaces

Surface #	S_i	S_n
Surface 1	1991	1996
Surface 2	1991	2001
Surface 3	1991	2006
Surface 4	1996	2001
Surface 5	1996	2001
Surface 6	2001	2006

The output from the *ArcScene* Method allows users to visualize the changes to Dwelling and Value Density in a three-dimensional (3D) plane through time. Features are placed in 3D by adding a height dimension to the otherwise 2D raster plane based on a feature attribute.

The directions outlined in Section 3.5.8 are followed precisely. Due to the dramatic spatial variations in Dwelling and Value Density within the surface area, a Z-unit Conversion Factor of 10,000 and 0.05 is used for Dwelling Density and Value Density respectively to moderate the value variations of the raster surface. One aspect of each 3D Dwelling and Value Density surface is presented for each Analysis Year in Appendix O.

4.3 Determining external conditions affecting Dwelling and Value Density

Section 3.6 expressed that the identified methodology aims to describe the changes in Dwelling and Value Density in the areas close to the Sheppard subway and not precisely to determine the causality of rapid transit investment on Dwelling and Value. There is still great value to determine whether other conditions may be affecting Dwelling and Value Density in the areas surrounding rapid transit stations.

The first step in satisfying this task is to identify residential land use situations observed in the Scatterplot (Section 4.2.8 Part A) and Geovisualization (Section 3.5.8 Part B) approaches that are considered to be in conflict with urban economic theory—and by extension in violation of the stated hypotheses identified in Section 4.2.3. Once the residential land use inconsistencies have been identified, planning policies and bylaws (e.g. City of Toronto Official Plan, City of North York Zoning By-Law, and Provincial Policy Statements, Places to Grow Act) are obtained and examined to identify specific clauses which may explain possible inconsistencies between the observed Dwelling and Value Density results and the hypotheses identified in Section 4.2.3. If there are no planning policies or bylaws that help to explain deemed land use inconsistencies, a quantitative investigation of neighbourhood characteristics variables (see Figure 2-9) is to be performed as a means to provide an explanation for the considered land use anomalies.

In some cases, there may be an observed land use condition that is inconsistent with the concepts of urban economic theory which cannot be sufficiently explained. If the quantitative analysis of neighbourhood characteristics does not provide a satisfactory explanation of the observed inconsistencies associated with principles of urban economic theory, it is deemed inconsistent without explanation.

Chapter 5:
Findings

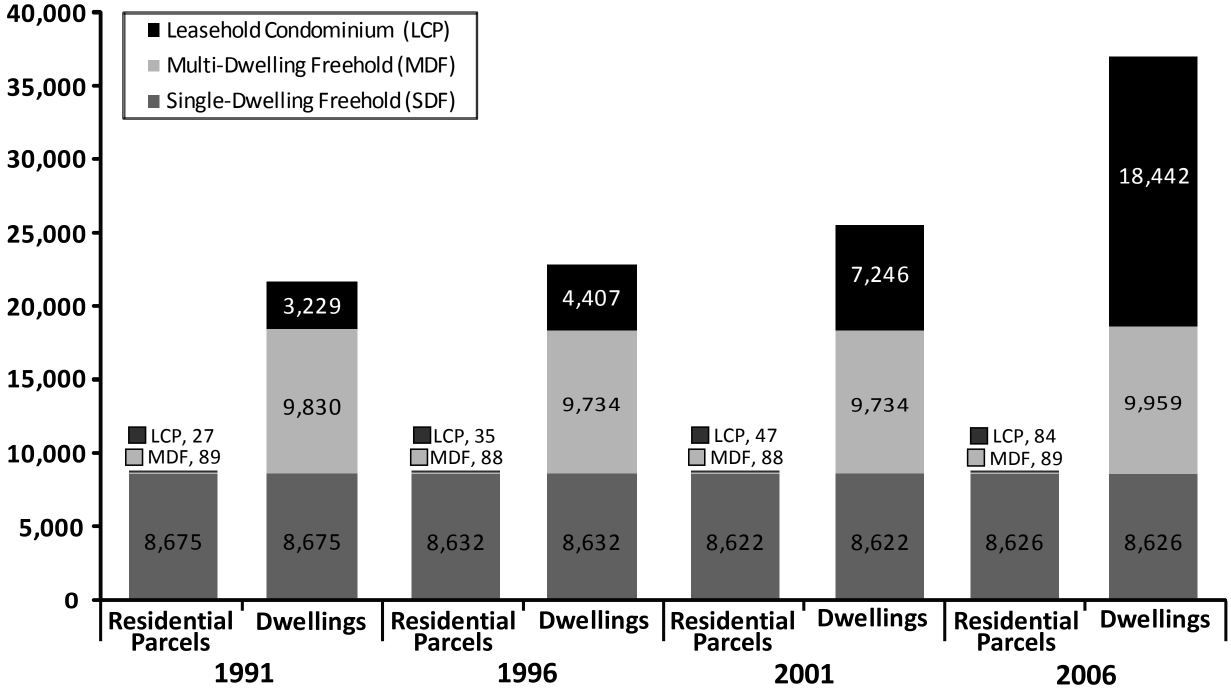
This section presents and discusses the results based on the application of the methods discussed in Chapter 4 to the Sheppard subway Study Area. To review, the aims of this thesis are to (1) quantify the changes to residential intensification and value appreciation before and after the construction of the Sheppard subway and (2) to validate whether the intensification and value appreciation findings are consistent with urban economic theory. To achieve this, the defined steps outlined in Section 4.2 are followed. The activities outlined in the first five steps have already been established or preformed accordingly. Table 5-1 summarizes the steps already established.

Table 5-1: Summary of steps already established or preformed

Steps	Desciption
Defining the study area (See Section 4.2.1)	• Delineated Study Area is bounded by: o Yonge Street to the west; o Highway 401 to the south; o Highway 404 to the east; and o Finch Avenue, Leslie Street and Van Horne Avenue to the north
Defining the appropriate study time periods (See Section 4.2.2)	• Identified Analysis Years are: 1991, 1996, 2001, 2006
Establishing a hypothesis (See Section 4.2.3)	• Established hypothesis for residential intensification and value appreciation as a function of time: o Areas around unique stations along Sheppard subway will experience increase in Dwelling and Value Density from time of annoucment of funding to beginning revenue service and beyond • Established hypothesis for residential intensification and value appreciation as a function of distance: o Dwelling and Value Density will peak at the North York Centre development node and steadily decline concentrically outward o Dwelling and Value Density will gradually increase with proximity to the CBD node, but will not outcompete North York Centre o Dwelling and Value Density at each Station Area will experience smaller peaks and decline outward from the station o Dwelling and Value Density will modestly increase along remaining areas along the Yonge and Sheppard subway corridors
Measuring Dwelling and Value Density (See Section 4.2.4)	• Classified residential property types • Quantified dwellings and sales values for each of the following property types o Leasehold Condominium Properties o Single-Dwelling Freehold o Multi-Dwelling Freehold
Putting the computed data together (See Section 4.2.5)	• Compiled all the estimated dwelling and sales values • Computed area of each residential property parcel within ArcGIS • Generated centroids for each of the residential parcels in the obtained property shapefile • Computed Dwelling Density and Value Density through dividing dwellings and sale values respectively by the area of the property

Figure 5-1 tallies the residential property parcels and dwellings observed in the Study Area.

Figure 5-1: Tally of residential property parcels and dwellings in the Study Area



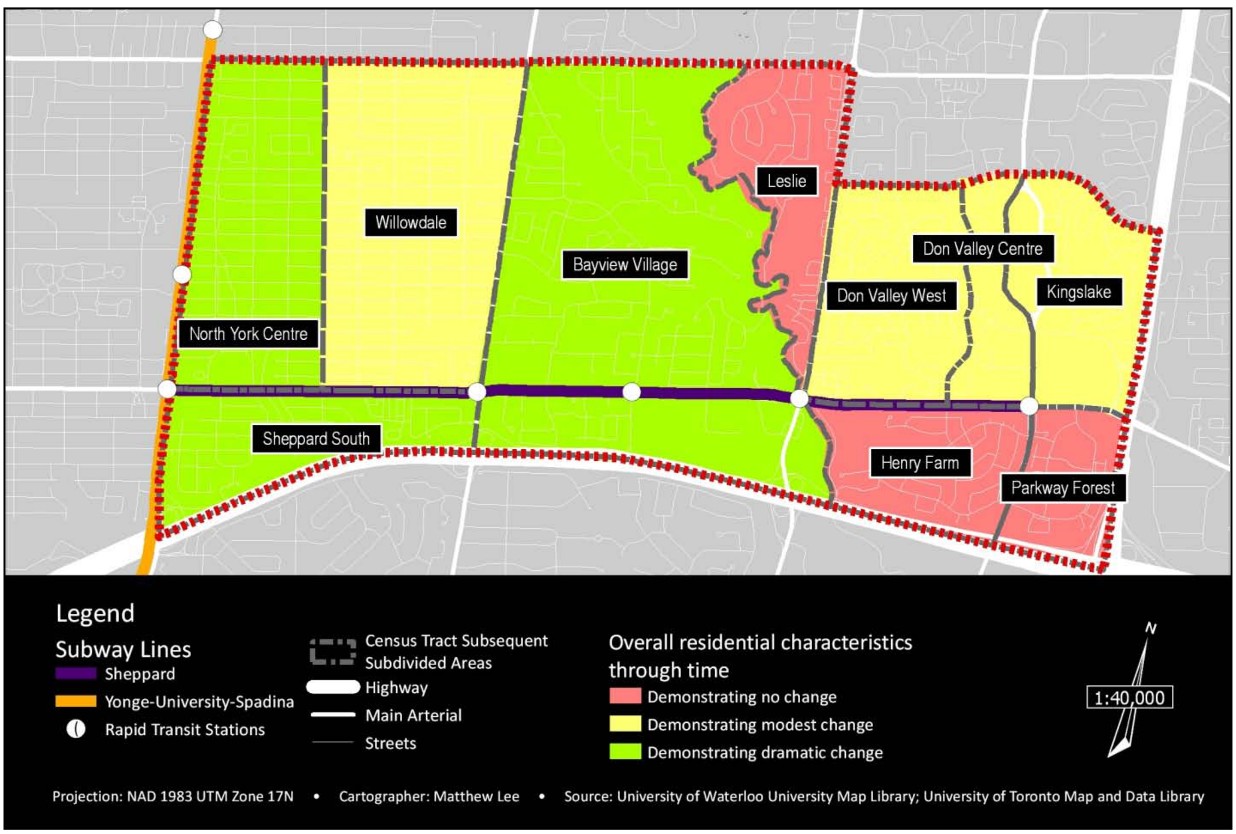
5.1 Validating the data

Census data are used to validate the obtained and computed dwelling and property value data as described in Sections 4.2.4 and 4.2.5. The Census data are used as an effective initial test to examine the expected changes to residential land-use conditions (i.e. changes in dwellings and sales value) prior to and after the construction of the Sheppard subway corridor. As illustrated in Figure 4-13, there are 10 identified Census Tracts (CT) in the Study Area. Starting from the westernmost CT, they include: North York Centre, Sheppard South, Willowdale, Bayview Village, Leslie, Don Valley West, Henry Farm, Don Valley Centre, Parkway Forest and Kingslake.

Based on the hypotheses listed in Section 4.2.3, it is anticipated that the areas within the North York Centre and Sheppard CTs will house the highest number of dwellings, the highest residential property sales values, and yield the greatest change in dwellings and sales values from 1991 to 2006. It is also anticipated that the CTs adjacent to the unique Sheppard subway stations—namely Willowdale, Bayview Village, and Parkway Forest—will experience increases in the number of dwellings and in sale value between 1991 and 2006, but most specifically in the latter Analysis Years.

Based on the analysis of Census data from 1991 to 2006, the CTs with most dramatic changes in residential land-use conditions are those that are in closest proximity to North York Centre and along the two subway corridors—namely Sheppard South, Bayview Village, and North York Centre. There are no other relevant spatial patterns observed from the Census data analysis: Willowdale and CTs in the northeast regions of the Study Area (i.e. Don Valley West, Don Valley Centre, and Kingslake) demonstrated a modest change in residential land-use characteristics, while Leslie and CTs in the southeast showed no change in residential characteristics during the four Analysis Years. For detailed graphs from Census data from each of the CTs, refer to Appendix I. Figure 5-2 provides a map summary of the Census data findings. Appendix P outlines the parameters used to classify whether a CT demonstrates no change, modest change, or dramatic change.

Figure 5-2: Summary of changes to residential land-use conditions by Census Tract from 1991 to 2006



The detailed discussion of the Census data validation analysis is organized according to the degree of residential land-use change, as identified in Figure 5-2 above.

5.1.1 Census Tracts demonstrating dramatic residential land-use change

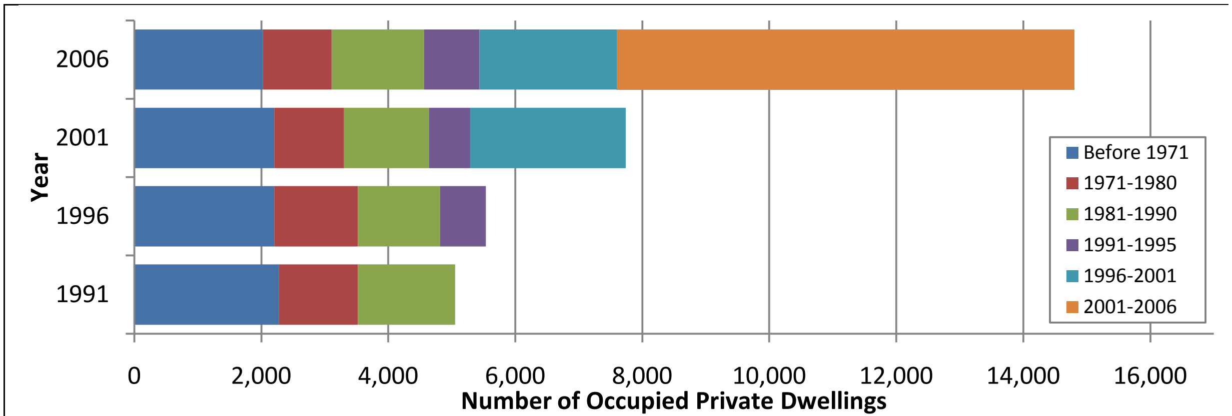
The North York Centre and Sheppard South CTs experienced the greatest change in residential land use. This phenomenon is best demonstrated by the change in population. North York Centre experienced growth at a rate much higher than the Toronto average in 1996, 2001, and in 2006. Meanwhile, Sheppard South's population remained steady from 1991 to 2001 and increased by 187% from 2001 to 2006. Table 5-2 lists the population change for the two CTs for each Census year.

Table 5-2: Population change in North York Centre and Sheppard South

Population	1991	1996		2001		2006		Overall
	Absolute	Absolute	% chg 96-91	Absolute	% chg 01-96	Absolute	% chg 06-01	% chg 06 -91
Sheppard South	2,840	2,758	-3%	2,917	6%	8,360	187%	194%
North York Centre	8,188	10,196	25%	15,757	55%	23,928	52%	192%
City of Toronto	*3,893,046*	*4,263,757*	*10%*	*4,682,897*	*10%*	*5,113,149*	*9%*	*31%*

Similarly, population growth in these CTs is attributed to the increase in the number of households. As evident in Figure 5-3, the number of dwellings remained relatively stable from 1991 to 2001, and nearly doubled (from 7,740 to 14,800 dwellings) from 2001 to 2006. There appears to be some slightly unusual figures particularly in 2001, where the number of dwellings constructed before 1971 grew from the previous Census year. This is likely attributed to Statistics Canada's sampling techniques, as only 20% of the population was sampled for this Census variable.

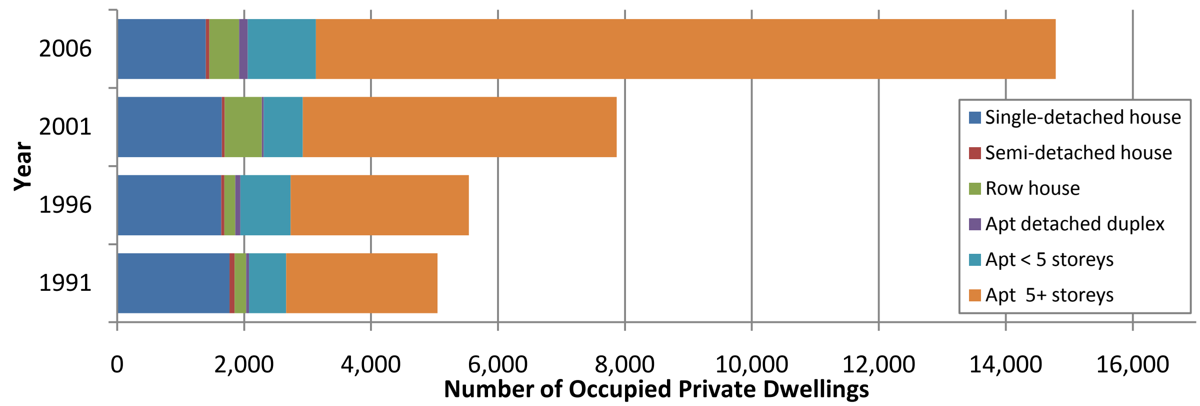
Figure 5-3: Number of dwellings by period of construction in North York Centre and Sheppard South



Period of Construction	1991		1996		2001		2006	
	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total
Before 1971	2,275	45%	2,205	40%	2,205	28%	2,025	14%
1971-1980	1,245	25%	1,315	24%	1,100	14%	1,080	7%
1981-1990	1,530	30%	1,295	23%	1,335	17%	1,460	10%
1991-1995	0	0%	720	13%	650	8%	870	6%
1996-2001	0	0%	0	0%	2,450	32%	2,165	15%
2001-2006	0	0%	0	0%	0	0%	7,200	49%
Total	5,050	100%	5,535	100%	7,740	100%	14,800	100%

Examining the number of occupied dwellings by type of structure also tells an interesting story. As illustrated in Figure 5-4, the majority of residential growth in these CTs is attributed to residential structures greater than five storeys, encompassing nearly 80% of total dwellings in 2006 from 47% in 1991. The reason for this dramatic increase is due to the high level of condominium development particularly in the 2001 and 2006 Analysis Years. While a dramatic increase in dwelling units since 1991 is apparent, a majority of the observed increases in dwellings are located along Yonge Street—an area already served by the Yonge-University-Spadina subway.

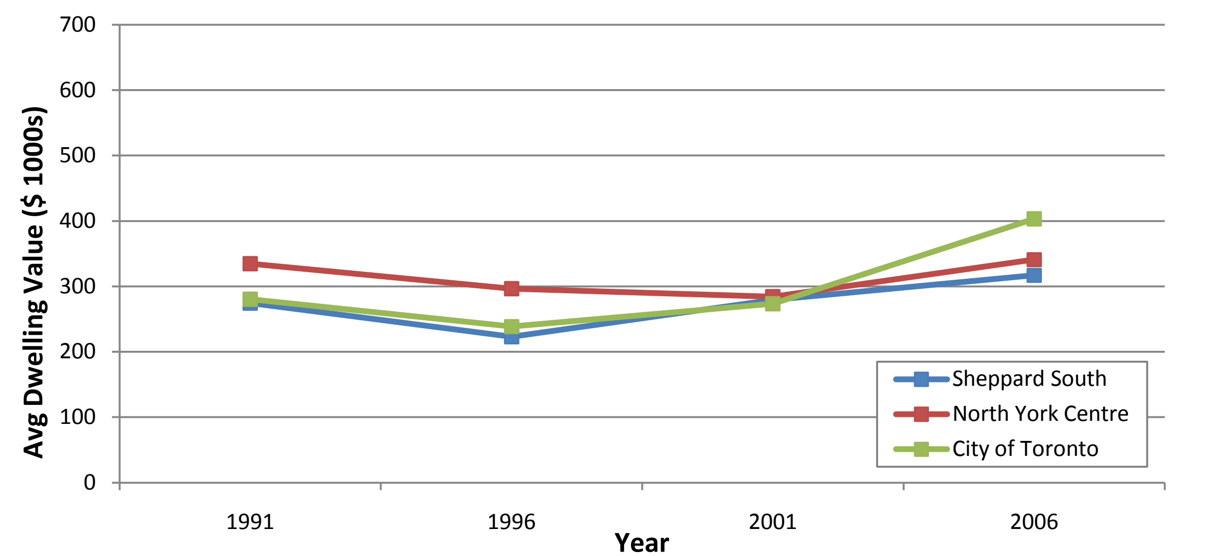
Figure 5-4: Number of dwellings by structural type in North York Centre and Sheppard South



Structural Type	1991		1996		2001		2006	
	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total
Single-detached house	1,770	35%	1,640	30%	1,650	21%	1,400	9%
Semi-detached house	80	2%	50	1%	45	1%	55	0%
Row house	185	4%	170	3%	585	7%	465	3%
Apartment detached duplex	45	1%	80	1%	30	0%	140	1%
Apartment < 5 storeys	585	12%	795	14%	615	8%	1,070	7%
Apartment 5+ storeys	2,380	47%	2,805	51%	4,945	63%	11,655	79%
Total	5,045	100%	5,540	100%	7,870	100%	14,785	100%

Finally, Figure 5-5 summarizes the average dwelling value in the two CTs. Both CTs experienced lower increases in average dwelling values compared to the city-wide average in the Analysis Years leading up to 2006. North York Centre and Sheppard South achieved a dwelling value increase of 13% and 20% from 2001 to 2006 respectively, which is much lower than the city-wide rate of 47%. The main reason for this is due to the significant construction of condominium units during this period, which counteracts with the more costly (in absolute terms) single- and semi-detached dwellings that dominated the housing stock in 1991 and 1996.

Figure 5-5: Average dwelling value in North York Centre and Sheppard South



Census Tracts	1991	1996		2001		2006		Overall
	Average	Average	% chg 96-91	Average	% chg 01-96	Average	% chg 06-01	% chg 06 -91
North York Centre	274,301	222,834	-19%	279,508	25%	316,792	13%	15%
Sheppard South	334,767	296,420	-11%	284,381	-4%	340,792	20%	2%
City of Toronto	*280,390*	*238,511*	-15%	*273,397*	15%	*403,112*	47%	44%

5.1.2 Census Tracts demonstrating moderate residential land-use change

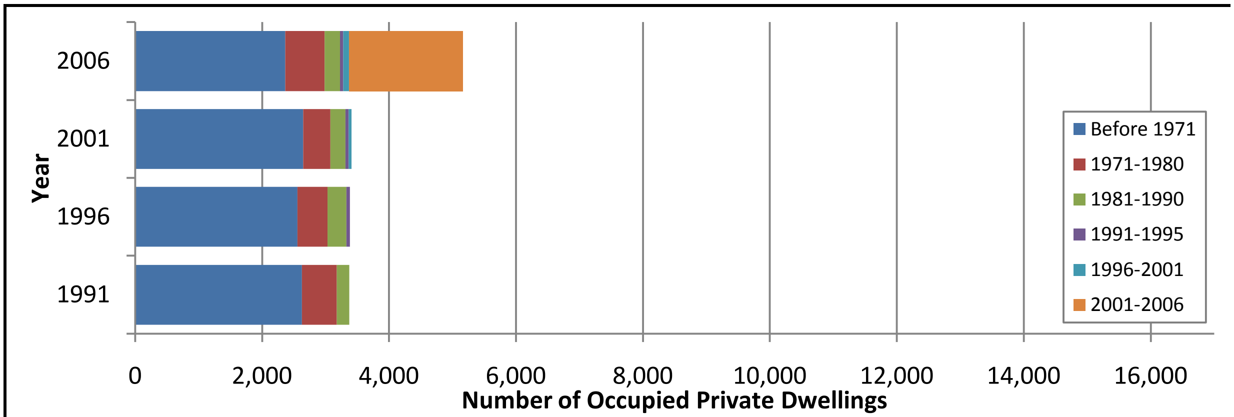
The Bayview Village is the only CT demonstrating moderate residential land-use change. The analysis of population change partially explains this phenomenon. For instance, Bayview Village experienced little or no change in population from 1991 to 2001 but grew by 34% from 2001 to 2006. Table 5-3 compares the population change for Bayview Village with the overall City of Toronto figures for each Analysis Year. As evident, the CT grew at a rate of 37% from 1991 to 2006, while the City of Toronto grew at 31% in the same period.

Table 5-3: Population change since 1991 in Bayview Village

Population	1991	1996		2001		2006		Overall
	Absolute	Absolute	% chg 96-91	Absolute	% chg 01-96	Absolute	% chg 06-01	% chg 06 -91
Bayview Village	8,992	9,256	3%	9,192	-1%	12,280	34%	37%
City of Toronto	*3,893,046*	*4,263,757*	*10%*	*4,682,897*	*10%*	*5,113,149*	*9%*	*31%*

Similar to the findings in Section 5.1.1, this change in population can be attributed to the increase in the number of households in the CT. Figure 5-6 illustrates a 51% increase in recorded dwellings (from 3,140 to 5,160 dwellings) from 2001 to 2006. The number of dwellings from 1991 to 2001 remained virtually stagnant. The swift increase between the last two Analysis Years is attributed to a surge in new condominium development played in part by the construction of the Sheppard subway.

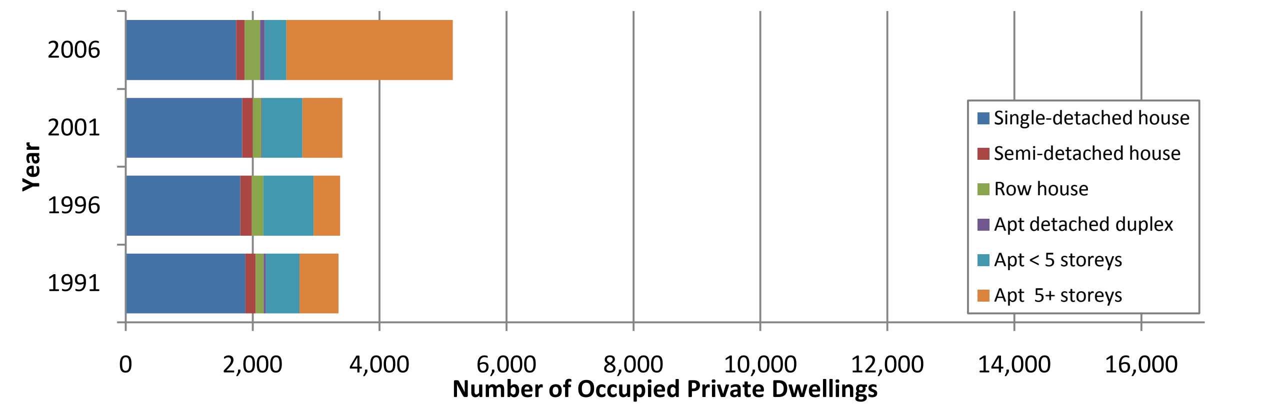
Figure 5-6: Number of dwellings by period of construction in Bayview Village



Period of Construction	1991		1996		2001		2006	
	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total
Before 1971	2,630	78%	2,555	75%	2,650	78%	2,365	46%
1971-1980	545	16%	475	14%	425	12%	620	12%
1981-1990	200	6%	300	9%	240	7%	240	5%
1991-1995	0	0%	55	2%	50	1%	55	1%
1996-2001	0	0%	0	0%	45	1%	90	2%
2001-2006	0	0%	0	0%	0	0%	1,790	35%
Total	3,375	100%	3,385	100%	3,410	100%	5,160	100%

As evident in Figure 5-7, dwellings from structures with five storeys or more make up most of the residential growth up to 2006. In 2006, dwellings in these highrises make up 51% of total dwellings in Bayview Village, up from 18% in 1991. There is a slight decrease in the number of dwellings in structures with fewer than five storeys from 2001 to 2006; this is due to the replacement of these properties with denser and higher condominium developments.

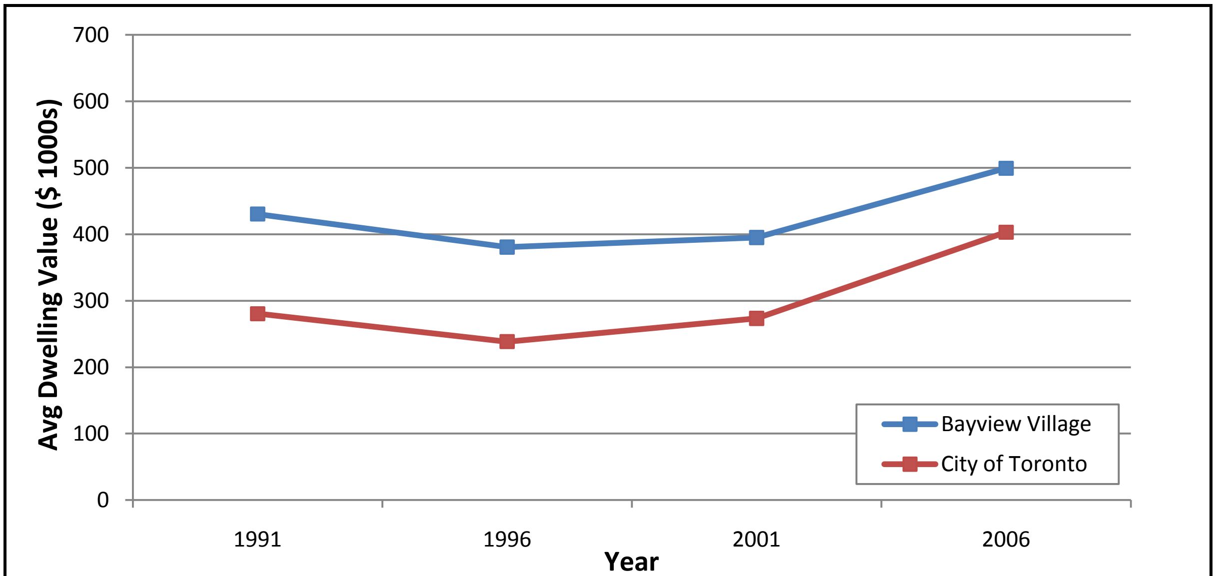
Figure 5-7: Number of dwellings by structural type in Bayview Village



Structural Type	1991		1996		2001		2006	
	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total
Single-detached house	1,885	56%	1,805	53%	1,835	54%	1,740	34%
Semi-detached house	165	5%	180	5%	165	5%	135	3%
Row house	125	4%	185	5%	140	4%	245	5%
Apartment detached duplex	35	1%	0	0%	10	0%	70	1%
Apartment < 5 storeys	530	16%	790	23%	635	19%	340	7%
Apartment 5+ storeys	615	18%	420	12%	630	18%	2,625	51%
Total	3,355	100%	3,380	100%	3,415	100%	5,155	100%

As summarized in Figure 5-8, the changes in average dwelling value in this CT roughly follows the trends of the city-wide average. In particular, there is a slight narrowing of the gap in average dwelling value between Bayview and the city-wide average in 2006. This is attributed to proliferation of smaller and slightly lower-priced condominium dwellings built between 2001 and 2006.

Figure 5-8: Average Dwelling Value in Bayview Village



Census Tracts	1991	1996		2001		2006		Overall
	Average	Average	% chg 96-91	Average	% chg 01-96	Average	% chg 06-01	% chg 06 -91
Bayview Village	430,429	380,673	-12%	395,243	4%	499,306	26%	16%
City of Toronto	*280,390*	*238,511*	-15%	*273,397*	15%	*403,112*	47%	44%

5.1.3 Census Tracts demonstrating modest or no residential land-use change

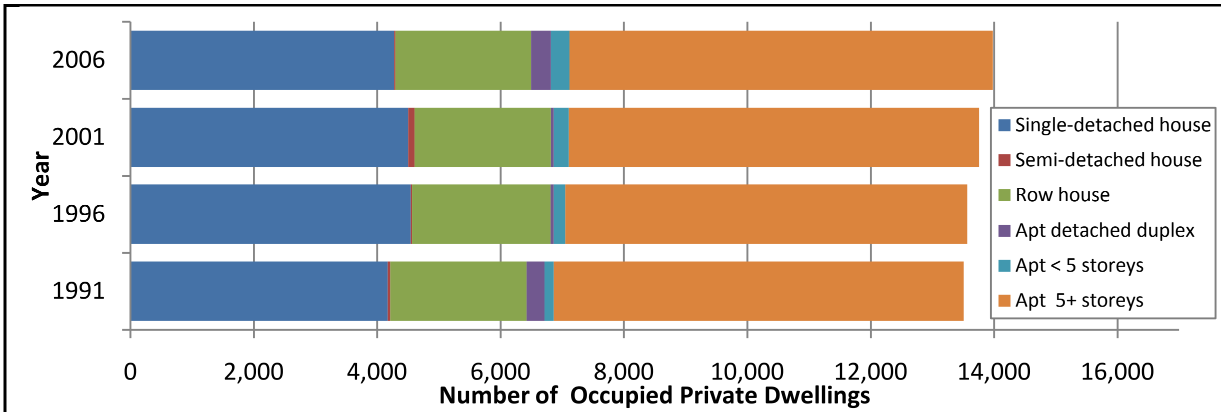
The majority of the CTs demonstrate modest or no residential land-use change. Parkway Forest, Don Valley Centre, Willowdale, and Kingslake showed an overall increase in population from 1991 to 2006, but at a rate less than the general City of Toronto average. Henry Farm, Leslie, and Don Valley West however experienced population decline during the same time period. Table 5-4 summarizes the population change in these CTs since 1991.

Table 5-4: Population change since 1991 in stable Census Tracts

Population	1991	1996		2001		2006		Overall
	Absolute	Absolute	% chg 96-91	Absolute	% chg 01-96	Absolute	% chg 06-01	% chg 06 -91
Parkway Forest	7,149	8,221	15%	8,737	6%	8,498	-3%	19%
Don Valley Centre	7,079	7,851	11%	8,485	8%	8,373	-1%	18%
Willowdale	7,570	7,920	5%	8,322	5%	8,766	5%	16%
Kingslake	5,118	5,591	9%	5,751	3%	5,562	-3%	9%
Henry Farm	2,820	2,957	5%	2,964	0%	2,790	-6%	-1%
Leslie	3,296	3,422	4%	3,212	-6%	3,096	-4%	-6%
Don Valley West	4,003	3,936	-2%	3,871	-2%	3,740	-3%	-7%
City of Toronto	*3,893,046*	*4,263,757*	*10%*	*4,682,897*	*10%*	*5,113,149*	*9%*	*31%*

The composition of the dwellings by structural type (see Figure 5-9) has remained virtually unchanged from 1991 to 2006. Single-detached dwellings make up 31 to 34% of total dwellings in these CTs, and dwellings in structures with five storeys and over make up 48% to 49% of all dwellings in stable CTs.

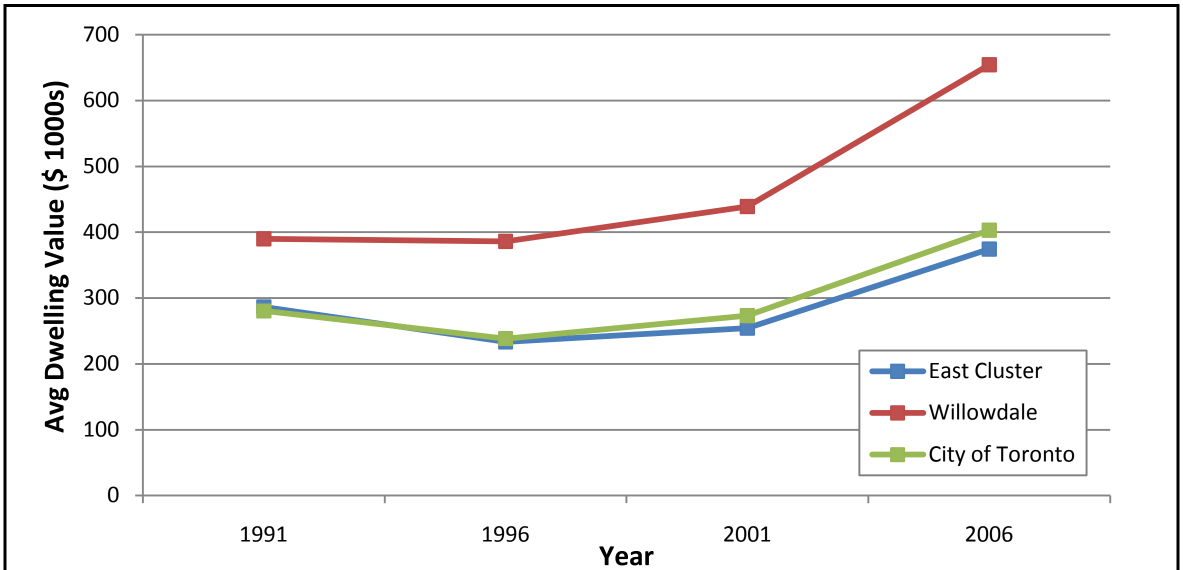
Figure 5-9: Number of dwellings by structural type in stable Census Tracts



Structural Type	1991		1996		2001		2006	
	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total	# of dwellings	% of total
Single-detached house	4,170	31%	4,545	34%	4,500	33%	4,275	31%
Semi-detached house	40	0%	20	0%	105	1%	20	0%
Row house	2,210	16%	2,245	17%	2,210	16%	2,200	16%
Apartment detached duplex	290	2%	50	0%	50	0%	320	2%
Apartment < 5 storeys	150	1%	190	1%	240	2%	300	2%
Apartment 5+ storeys	6,645	49%	6,515	48%	6,650	48%	6,865	49%
Total	13,505	100%	13,565	100%	13,755	100%	13,980	100%

Lastly, consistent with the findings from the previous two analysis variables, the rate of change of average dwelling values within these CTs are roughly in line with the rate of change of averages city-wide. Figure 5-10 illustrates the trends in these stable CTs. Due to the similar characteristics of many of these CTs and for simplicity's sake, Don Valley West, Don Valley Centre, Henry Farm, Leslie, Parkway Forest, and Kingslake are merged and entitled "East Cluster" in the Figure. A weighted average[11] was computed to offer a general measure for the cluster.

Figure 5-10: Average Gross Dwelling Value in stable Census Tracts



Census Tracts	1991	1996		2001		2006		Overall
	Average	Average	% chg 96-91	Average	% chg 01-96	Average	% chg 06-01	% chg 06 -91
East Cluster (Wtd Avg)	286,514	233,541	-18%	254,435	9%	374,580	47%	31%
Don Valley West	293,982	265,319	-10%	288,873	9%	418,923	45%	42%
Henry Farm	229,849	177,221	-23%	204,583	15%	320,488	57%	39%
Don Valley Centre	354,469	311,491	-12%	341,586	10%	540,062	58%	52%
Parkway Forest	159,044	113,244	-29%	129,764	15%	179,919	39%	13%
Kingslake	447,344	257,945	-42%	267,382	4%	451,443	69%	1%
Leslie	283,693	254,989	-10%	279,078	9%	393,726	41%	39%
Willowdale	389,944	386,199	-1%	439,143	14%	654,636	49%	68%
City of Toronto	*280,390*	*238,511*	-15%	*273,397*	15%	*403,112*	47%	44%

[11] Weighted by the number of dwellings in each Census Tract

5.1.4 Summary of Census-based findings

When comparing the anticipated versus the actual findings, there are some similarities and differences worth noting. As expected, North York Centre and Sheppard South demonstrated the highest density of dwellings in the Study Area and experienced a dramatic increase in the number of dwellings amongst the four Analysis Years. For instance, the number of dwellings in the two CTs doubled from 7,740 to 14,800 dwellings between 2001 and 2006. The high Dwelling and Value Density at and around North York Centre, as hypothesized in Section 4.2.3, reflects well with the results from the Census data findings from the Sheppard South and North York Centre CTs. The high accessibility and amenity-rich area, in conjunction with strong planning policy provisions for high density, spurred on the dramatic increase in condominium dwelling units. While a majority of the observed dwelling increases are served by stations along the existing Yonge-University-Spadina subway [12], the network effects associated with the addition of the Sheppard subway may have positively contributed to the increase in the supply of dwellings as evident in the two CTs.

On the other hand, the results from the Bayview Village CT show some evidence of Sheppard subway's impact on residential land-use characteristics on its adjacent areas and neighbourhoods. Bayview Village demonstrated a high increase in population and in the quantity of dwellings (namely highrises) between 2001 and 2006. The surge in highrise development within this CT coincides clearly with the start of revenue service of the Sheppard subway in 2002.

Based on these preliminary findings from Census data, it is determined that the data are consistent with (1) the property sales data collected from the *Geowarehouse* web query tool, and (2) the observed changes through historical orthophotos. Based on the performed general comparisons, the property sales data are deemed reliable and valid and its use for developing Dwelling and Value Density raster surfaces, scatterplots, and geovisualizations is to be performed.

While the use of Census data has indeed provided a preliminary understanding of the trends occurring within the Study Area, its major drawback is its inability to detect notable analytical features occurring within individual CTs. The CT boundaries are fairly large in area, and it is impractical to believe that the data presented for each CT is spread evenly within its boundaries. It is likely that the data represents some areas within the CT better than others. For instance, while

[12] The section of Yonge-University-Spadina subway between Finch and Sheppard stations were complete in 1974

Sheppard South demonstrated dramatic increases in the quantity of dwellings from 1991 to 2006, orthoimages explains that almost all of the residential land-use change is occurring in the northwest quadrant.

5.2 Scatterplot and Geovisualization results

As discussed in Section 3.5.8, the aim of the research is (1) to measure the changes to residential intensification and value appreciation as a function of time before and after the introduction of rapid transit service and (2) to test the validity of the identified hypotheses based on urban economic theory. To achieve this, the appropriate Study Area and appropriate study time periods have been defined. Using property data from the *Geowarehouse* web query tool and appropriate orthophotos, dwellings and sales values are quantified for each residential property within the Study Area. To measure the changes in intensification and value appreciation, Dwelling and Value Density have been identified as appropriate metrics. Two approaches are devised to satisfy the established research objectives: the scatterplot approach and the geovisualization approach. The two approaches are discussed in Sections 5.2.1 and 5.2.2 respectively.

5.2.1 Scatterplot approach

The scatterplot approach involves applying the estimated Dwelling and Value Density data to observe changes in residential intensification and value appreciation as a function of time and distance by means of statistical scatterplots. As discussed in Section 4.2.8, there are two different types of analyses undertaken for the scatterplot approach. The station-level analysis examines the spatial variations in Dwelling and Value Density for each Analysis Year as a function of distance to rapid transit stations, while the macro-level analysis studies the variations in Dwelling and Value Density as a function of distance to major activity centres. The discussion of the findings from the scatterplot approach is organized based on these two types of analyses; Section B and Section C reveal the results of the macro-level and station-level analysis respectively. Before the results are discussed, Section A introduces the anticipated results for the scatterplot approach.

A. Anticipated results

With regards to residential intensification and value appreciation as a function of distance, it is anticipated that the peak of Dwelling and Value Density will occur within the North York Centre, with slightly smaller peaks at Finch and Sheppard-Yonge subway stations. It is also expected that the

Sheppard subway station areas will also experience peaks, but at a lesser extent than the station areas along the Yonge-University-Spadina subway. Among the Sheppard subway stations, Dwelling and Value Density will be the highest in the areas around the westernmost station and decline at each station eastward. Additionally, the peak of Dwelling and Value Density within each Station Area will occur closest to the station and decline going outward from the rapid transit station.

With regards to residential intensification and value appreciation as a function of time, it is anticipated that the areas around the unique stations along the Sheppard subway will experience an increase in Dwelling and Value Density starting from the announcement of funding for subway construction to the commencement of subway revenue service and beyond.

B. Macro-level analysis

This section presents the findings based on the macro-level sampling method explained in Section 4.2.8 Part A.

i. Findings from generated interpolated surfaces

Based on the Dwelling Density computations for each residential property in the Study Area, Figure 5-11 illustrates the evolution of Dwelling Density (dwellings/metre^2) for each Analysis Year from 1991 to 2006. The range of Dwelling Density extends from nearly zero to just shy of 0.12 dwellings/metre^2. Because only a very small portion of interpolated surfaces demonstrate dwelling densities even remotely close to 0.12, the map symbology display range was manually adjusted to a maximum of 0.03 dwellings/metre^2; any raster cell greater than 0.03 dwellings/metre^2 will be displayed by the deepest shade of green. Figure 5-11 illustrates the Dwelling Density surfaces in 1991 to 2006. To view an enlarged version of the maps, refer to Appendix J.

As evident in the map results, there is a surge in Dwelling Density within 400-metres around the Yonge-University-Spadina corridor from 1991 to 2006. On the other hand, there is no observed change to Dwelling Density within a 400-metre buffer of the Sheppard corridor, with the exception for a small area about 500-metres southwest of Bayview station. This exceptional area experienced a dramatic change only specifically from 2001 to 2006.

Figure 5-11: Dwelling Density interpolated surfaces in 1991 to 2006

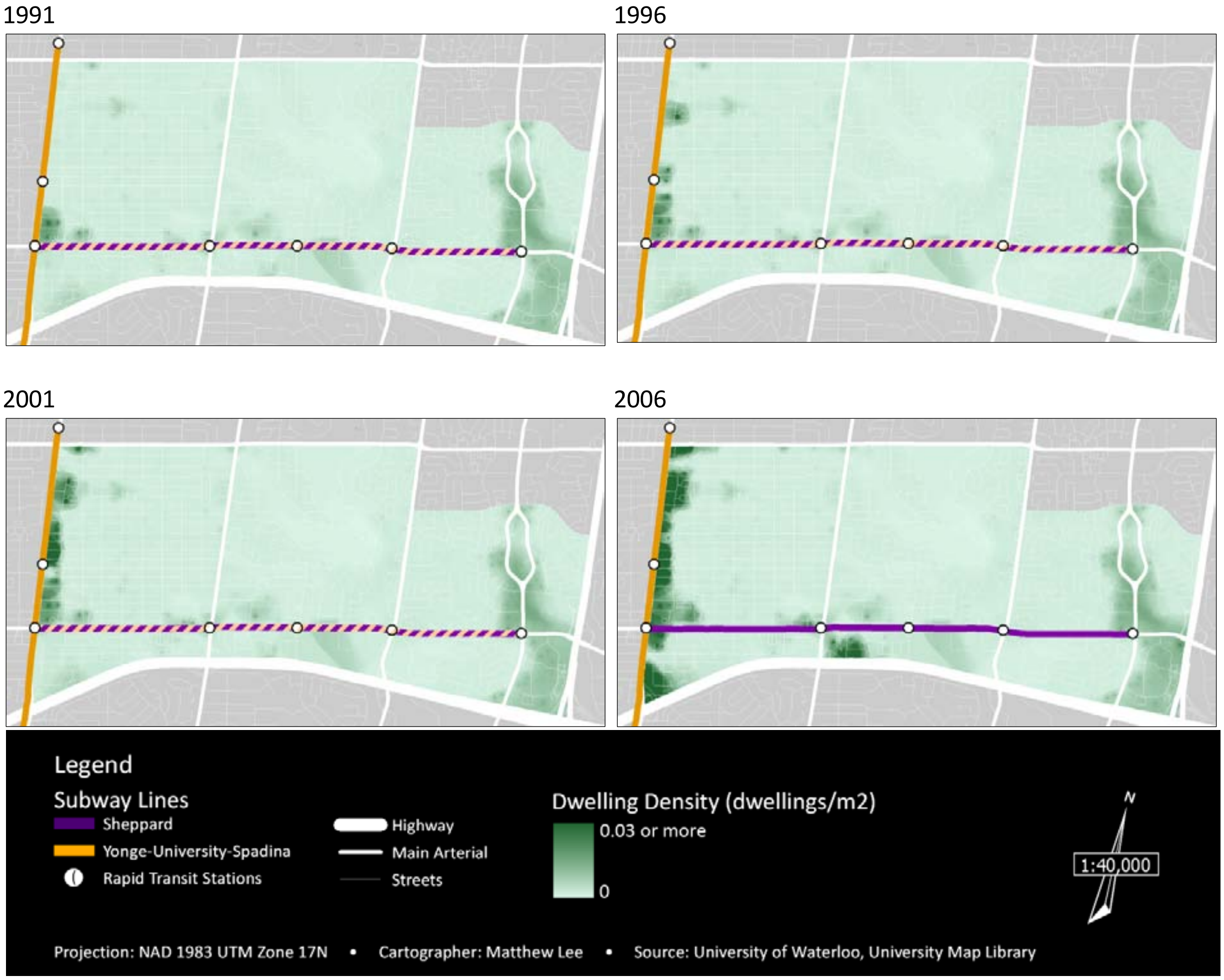
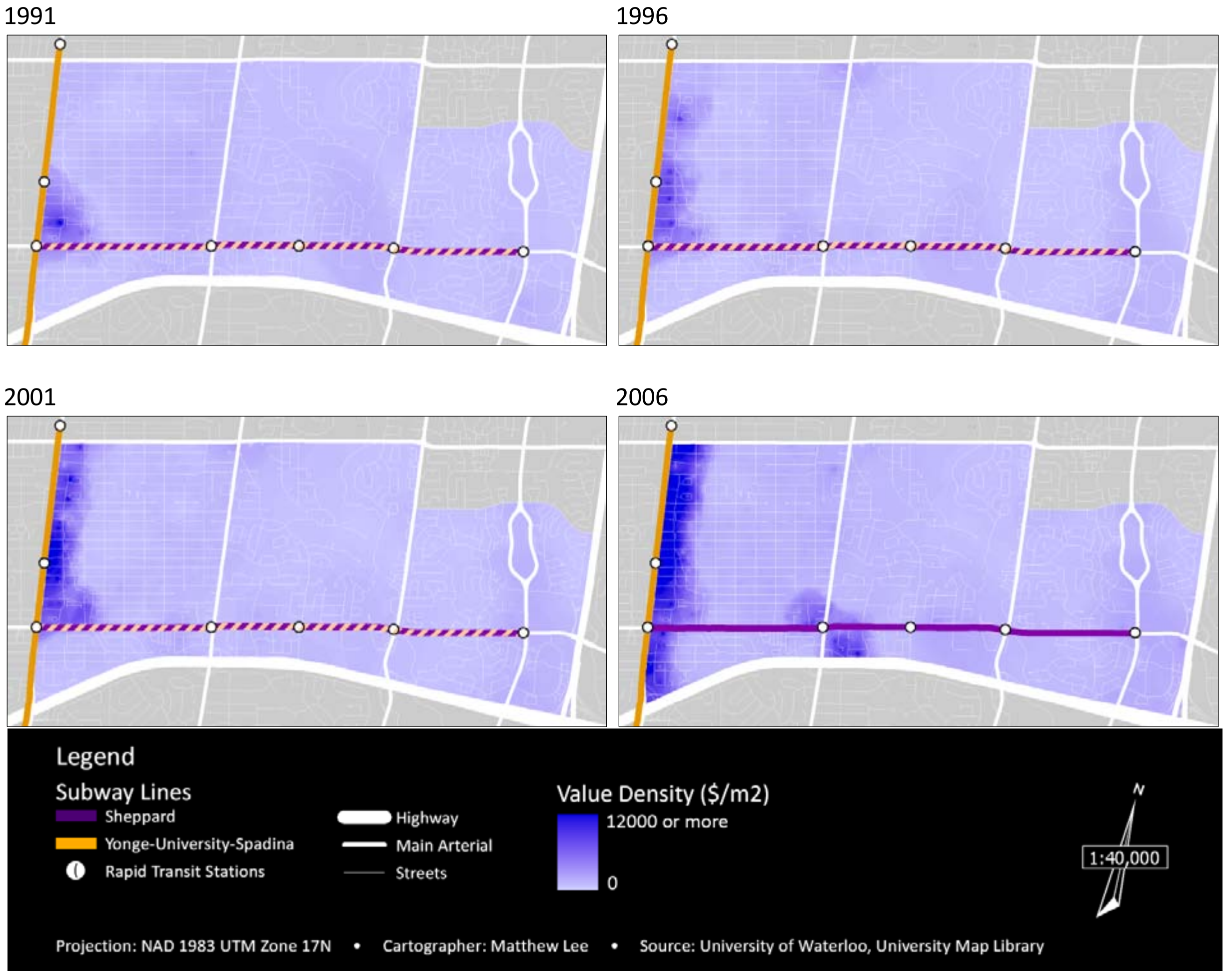


Figure 5-12 illustrates the evolution of Value Density (dollars/metre^2) for each Analysis Year from 1991 to 2006. Figures for Value Density range from nearly zero to as high as \$27000/ m^2. Similar to the Dwelling Density mapping exercise, the map symbology display range was manually adjusted to a maximum of \$12000/metre^2; any raster cell greater than \$12000/m^2 will be displayed by the deepest shade of blue. To view an enlarged version of the maps, refer to Appendix J.

Similar to the Figure 5-11 findings, the most pronounced change in Value Density from 1991 to 2006 occurs within a 400-metre buffer along the Yonge-University-Spadina corridor. Like the previous exercise, the Value Density around the Sheppard corridor remains virtually unchanged, except for a small portion southwest of Bayview Station. What appears different in Figure 5-12 is the absence of high Value Density in the areas along Don Mills Road, which experienced a high Dwelling Density figure. This is attributed to the large cluster of rental apartment highrises in the neighbourhood, where a dense quantity of dwellings exist but the per-unit value of each dwelling is disproportionately lower than other properties.

Figure 5-12: Value Density interpolated surfaces in 1991 to 2006



As discussed in Section 4.2.8 Part A, Value Density and Dwelling Density data was extracted from the interpolated surfaces in Figure 5-12 through a series of systematic sample points throughout the Study Area. Distances were measured using GIS for each Sample Point and its distance to the two established nodes: (1) CBD at Queen and Yonge Streets and (2) North York Centre at Mel Lastman Square located at 5100 Yonge Street. Refer to Figure 4-14 and Figure 4-15 for maps of the established sample points and the measured distances to the two nodes.

ii. Findings from macro-level scatterplots

Once the interpolated surfaces are generated, the data are expressed by means of a scatterplot. The purpose of producing scatterplots is to examine closely the changes to Dwelling and Value Density with respect to distances to prominent nodes and transit stations.

iii. Changes to Dwelling Density

The graphical output illustrated in Figure 5-13 and Figure 5-14 show the change in Dwelling Density as a function of distance to North York Centre and to the CBD. Because of the complexity of the scatterplots, separate graphs were made for the 1996, 2001, and 2006 Analysis Years, with 1991 as a benchmark. Because many points have remained static from 1991 to the other Analysis Years, the 1991 plots may not be fully visible in the scatterplots.

As discussed in Section 4.2.3, it is predicted that the highest peak in property rents will occur at the North York Centre development node and decline concentrically outward, and that an increase in property rents, given the proper policy provisions, generates an increase in Dwelling Density.

The Dwelling Density scatterplots illustrated in Figure 5-13 (distance to North York Centre) provide some validation for the anticipated results. In each Analysis Year, the highest peak in Dwelling and Value Density occurs very close to the node centre at Mel Lastman Square, then declines sharply beyond 1-2 km. The plot remains relatively low and flat for the remainder of the scatterplot up until approximately 5 km from the node centre, where it rises slightly. This rise is attributed to the large cluster of high-density rental apartment structures in the Don Valley Village area. Specifically, the 2006 scatterplot shows an emerging secondary peak in Dwelling Density in the Bayview station area located around 3 km from Mel Lastman Square.

Figure 5-13: Dwelling Density and straight line distance to North York Centre (Mel Lastman Square)

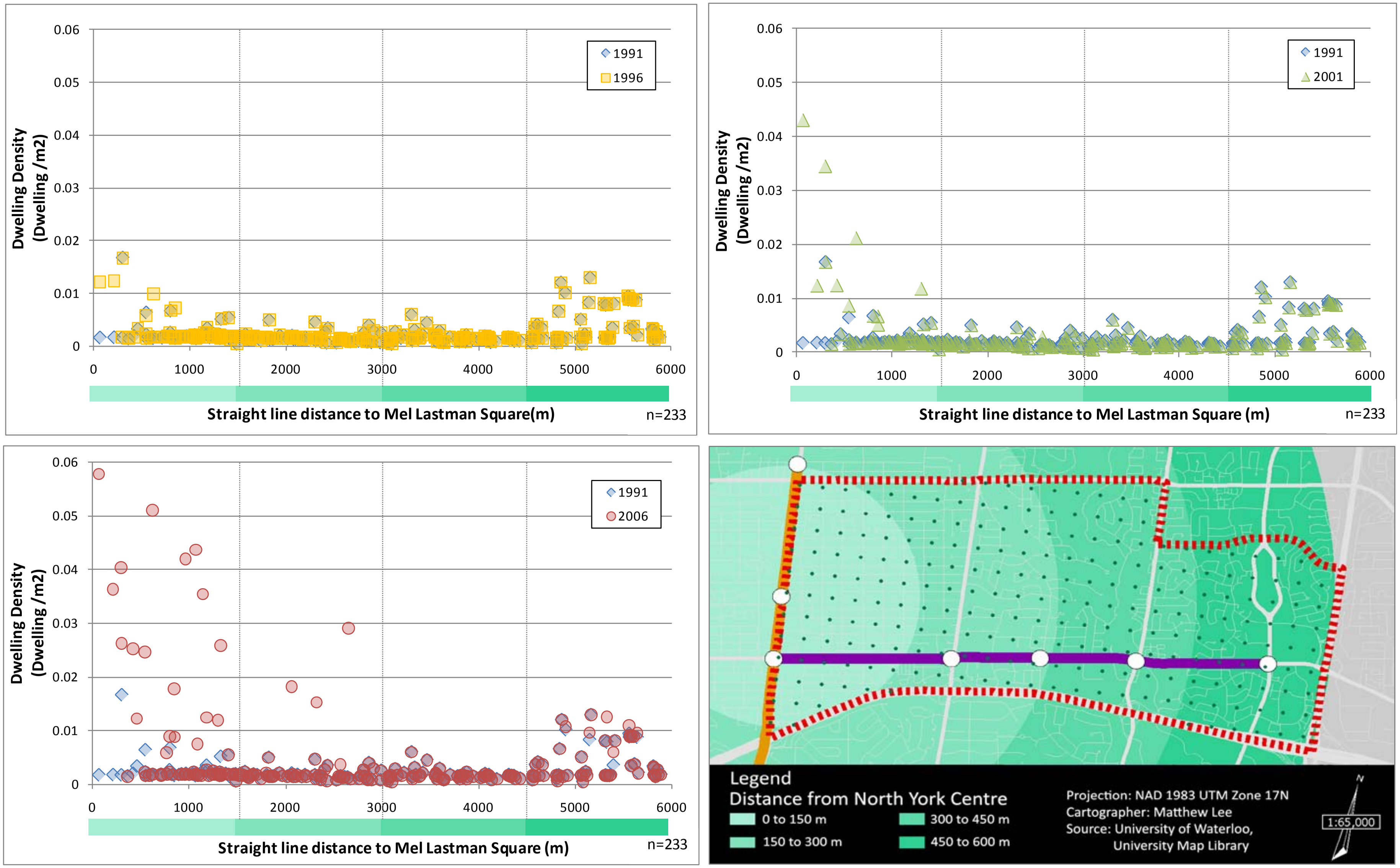
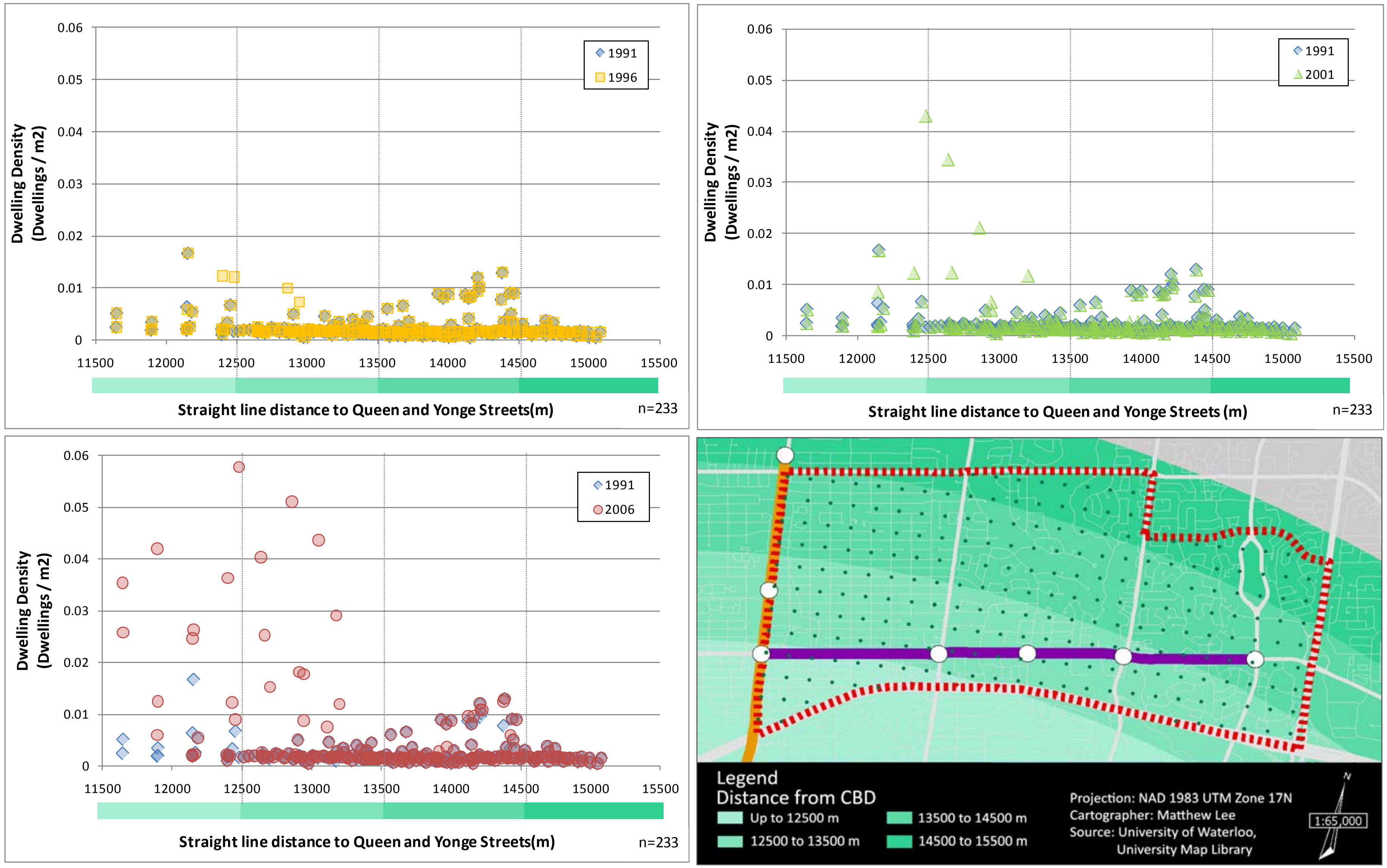


Figure 5-14: Dwelling Density and straight line distance to the CBD (Queen & Yonge Streets)



Conversely, the Dwelling Density scatterplots based on proximity to the CBD in Figure 5-14 are not consistent with the anticipated results. There are no observed gradual increases in Dwelling Density with proximity to the CBD, and the peak in Dwelling Density does not occur at the point closest to Queen and Yonge Streets. In 1991 and 1996, an identifiable peak is not apparent. However in 2001 and 2006, the peak Dwelling Density occurs at approximately 13 km of Queen and Yonge Streets, which precisely represents properties located close to Mel Lastman Square.

iv. Changes to Value Density

The scatterplot presented in Figure 5-15 and Figure 5-16 show change in Value Density as a function of distance to the CBD and to North York Centre. Aside from the longer distance between the sample points to the CBD compared to North York Centre, the two sets of scatterplots demonstrate very similar findings for each corresponding Analysis Year. The 1991 benchmark year demonstrates a slight increase in Value Density upon proximity to identified nodes in the Study Area. When superimposed with 1996 figures, the sampled points present a marginal increase in Value Density compared to 1991 figures. Meanwhile, the 2001 and 2006 scatterplots show considerable increases in Value Density within 0 to 1 km of North York Centre (Figure 5-15) and within 11.5 to 12.5 km of the CBD (Figure 5-16).

Similar to the findings from the Dwelling Density section of the analysis, the scatterplots in Figure 5-15 validates the anticipated results. In each Analysis Year, the highest peak in Dwelling and Value Density occurs very close to Mel Lastman Square, and then steeply declines within one kilometre of the node centre. The scatterplot remains relatively flat for the remainder of the scatterplot. The 2006 plot in Figure 5-15 shows an emerging peak between 1.5 and 2.5 km from Mel Lastman Square. This secondary peak is attributed to the emerging condominium community surrounding the Bayview Station Area.

Another noteworthy observation is the disappearance of the peak around 5 km from Mel Lastman Square that was evident the Dwelling Density plots from Figure 5-13. As explained in the previous subsection, this peak in Dwelling Density is attributed to the large cluster of high-density rental apartment structures in the Don Valley Village area. Furthermore, while these rental apartment structures house many dwellings, each apartment dwelling is valued much lower than a Single-Dwelling Freehold and a Leasehold Condominium dwelling. Thus, the peak in Value Density within that area is not apparent.

Figure 5-15: Value Density and straight line distance to North York Centre (Mel Lastman Square)

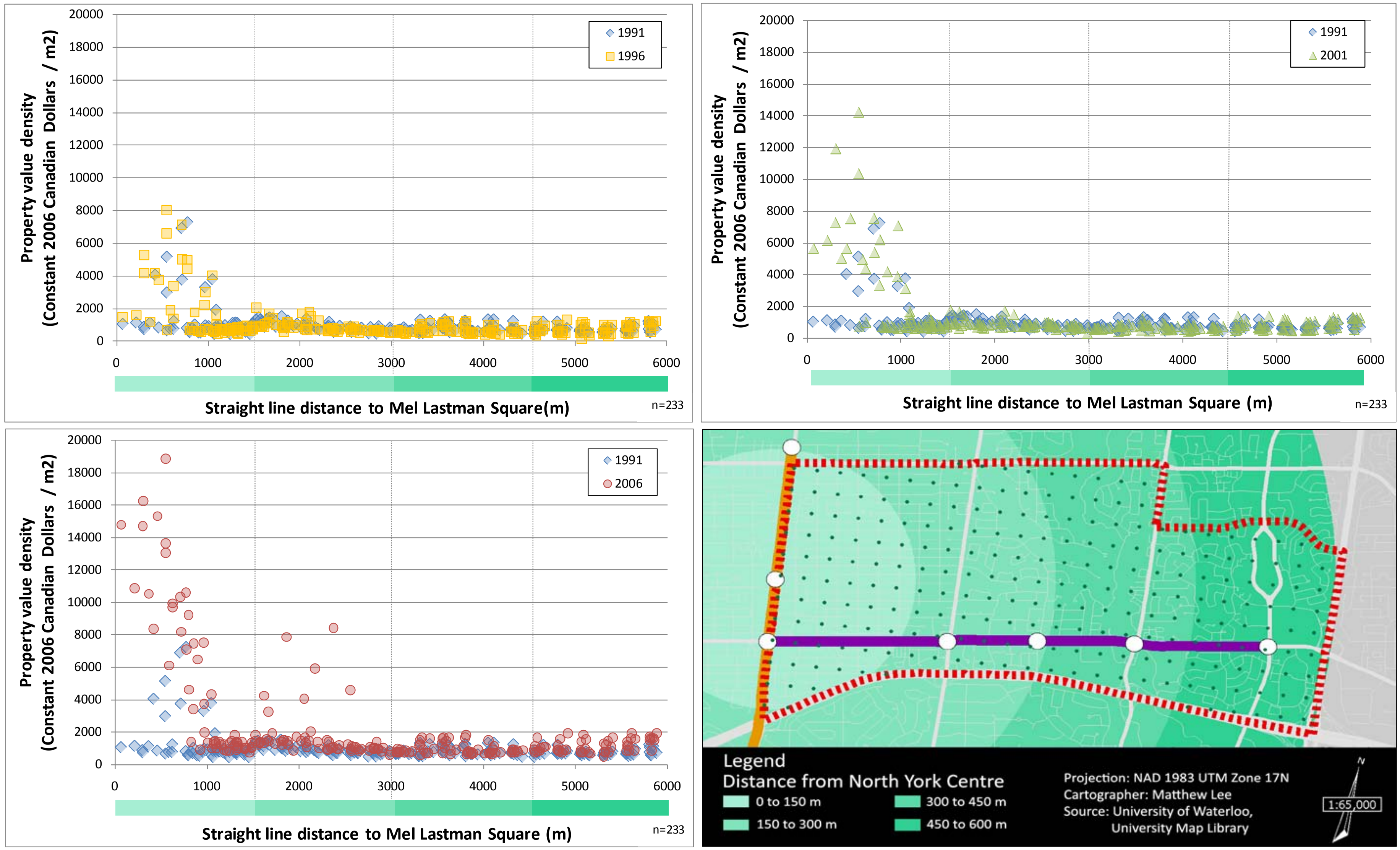
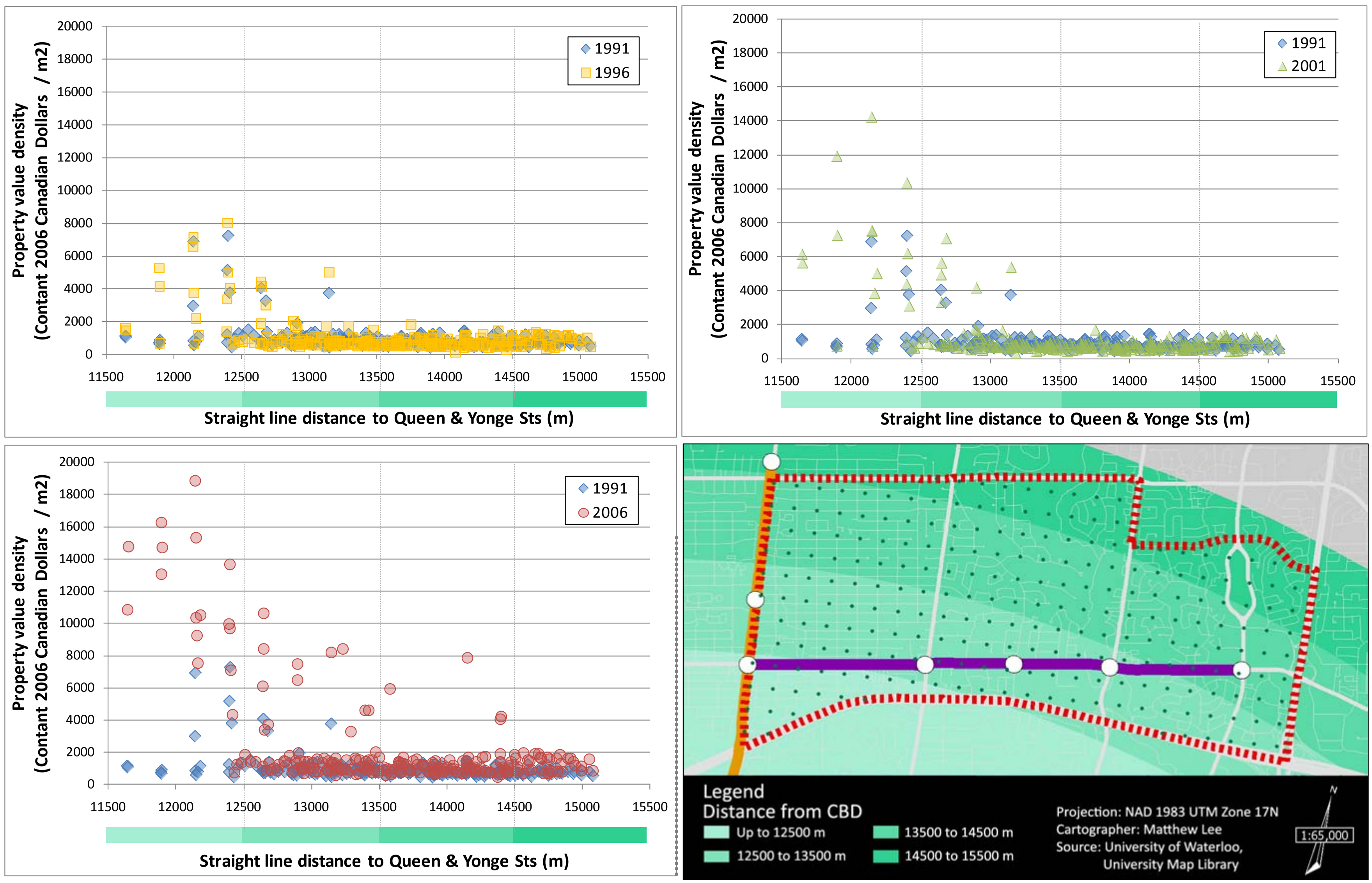


Figure 5-16: Value Density and straight line distance to the CBD (Queen & Yonge Streets)



Contrary to the findings regarding Dwelling Density and proximity to the CBD, the associated Value Density scatterplots illustrated in Figure 5-16 corresponds relatively well with the expected results, as the Value Density peak occurs at one of the closest points to Queen and Yonge Streets within the Study Area. However, the property causing the 2006 Value Density peak is deemed an exceptional property. The subject property is the *Skymark at Avondale* development at 78 and 80 Harrison Garden Boulevard (BlockID: 12556) and is located approximately 12 km from the CBD. This property is the reason for the peak occurring in the Value Density scatterplot while demonstrating only a modest increase in Dwelling Density. The explanation for this unique observation is that the property consists predominately of two to three bedroom suites, which is highly unique to other developments in the area. Thus, this property yields a lower number of dwellings but its dwellings are sold at a much higher price, due to the larger size and niche market share of these units. For instance, the average dwelling price was almost $300,000 in 2006, compared to an average of $225,000[13] for nearby condominium properties erected in the same year.

v. General conclusions from the macro-level analysis

Based on the macro-level scatterplot and conditional probability analyses, the following inferences are made:

<u>Dwelling and Value Density with proximity to North York Centre deliver anticipated results</u>

The highest peak in Dwelling and Value Density occurs very close to the node centre at Mel Lastman Square, then declines sharply after 1 to 2 km. If a spatial reclassification of Dwelling and Value Density figures are to be formed for the Study Area, it would be possible to produce a set of concentric elliptical (rather than circular) rings with its length along Yonge Street with the centre at Mel Lastman Square.

Through this observation, it is concluded that North York Centre is a true node within a polycentric region and the observations are consistent with what was devised in the polycentric

[13] Based on the figures from the following nearby condominium developments:
Mansions of Avondale (BlockID: 12495), Spectrum (BlockID: 12526), Residences of Avondale (BlockID: 12633), Cosmo II (BlockID: 12768), Cosmo I (BlockID: 12782)

urban spatial structure presented in Table 4-4 and is slightly modified from the anticipated results in relative residential land rents.

Dwelling and Value Density with proximity to the CBD is not consistent with anticipated results

As stated in Section 4.2.3, it is expected Dwelling and Value Density will gradually increase with proximity to the CBD, but with a lesser influence than North York Centre. Based on the Dwelling Density plots in Figure 5-14, there is no support of any gradual increase in Dwelling Density along with proximity to the CBD. The peak Dwelling Density points in the 2001 plot between 12 and 13 km are attributed to condominium developments located the close to North York Centre and no observable increases are evident in Dwelling Density from any point closer than 12 km from the CBD.

The Value Density scatterplots provide very similar conclusions to those discussed regarding Dwelling Density. For the most part, there is no observable evidence of gradual increases in Value Density with proximity to the CBD from any of the Analysis Years. In 2001, the Value Density plot demonstrated results very similar to Dwelling Density, where the peak Value Density are attributed by a group of properties near North York Centre. However in the corresponding 2006 scatterplot, the peak in Value Density occurs at a distance closest to the CBD within the defined Study Area, which is not consistent with the findings regarding Dwelling Density. Nevertheless, the property was identified as an exception to others in the area and thus is regarded as an anomaly rather than a conclusive finding.

Relationships between Dwelling Density and Value Density

Generally, the change in Dwelling Density influences a similar change in Value Density. With respect to the Study Area, the redevelopment of former one- and two-storey freehold properties to condominium highrises is a major driver in the increase in Dwelling Density through the different Analysis Years. Thus, the increase in dwellings within a given area often yields an associated increase in Value Density.

C. Station-level analysis

This section examines closely the changes to Dwelling and Value Density specific to Station Areas. As explained in Section 4.2.8 Part A, a series of station-level sample points were established within a one-kilometre radius of each of the seven stations in the Study Area. The findings from the station-level analysis are organized based on the Station Area's extent of Dwelling and Density change within the Analysis Years.

i. Station areas demonstrating dramatic change from 1991-2006

The areas surrounding Finch, North York Centre and Sheppard-Yonge stations demonstrate dramatic change in Dwelling and Value Density from 1991 to 2006. Consistent with the findings from the Census Method from Section 5.1.1, the three identified Study Areas are part of the North York Centre and Sheppard South CTs, which demonstrated the most dramatic change in residential development. The scatterplots in Figure 5-17 and Figure 5-18 show the evolution of Dwelling Density and Value Density respectively, as a function of straight line distance to one of the three subway stations.

Figure 5-17: Dwelling Density and straight line distance to Finch, North York Centre, and Sheppard-Yonge stations

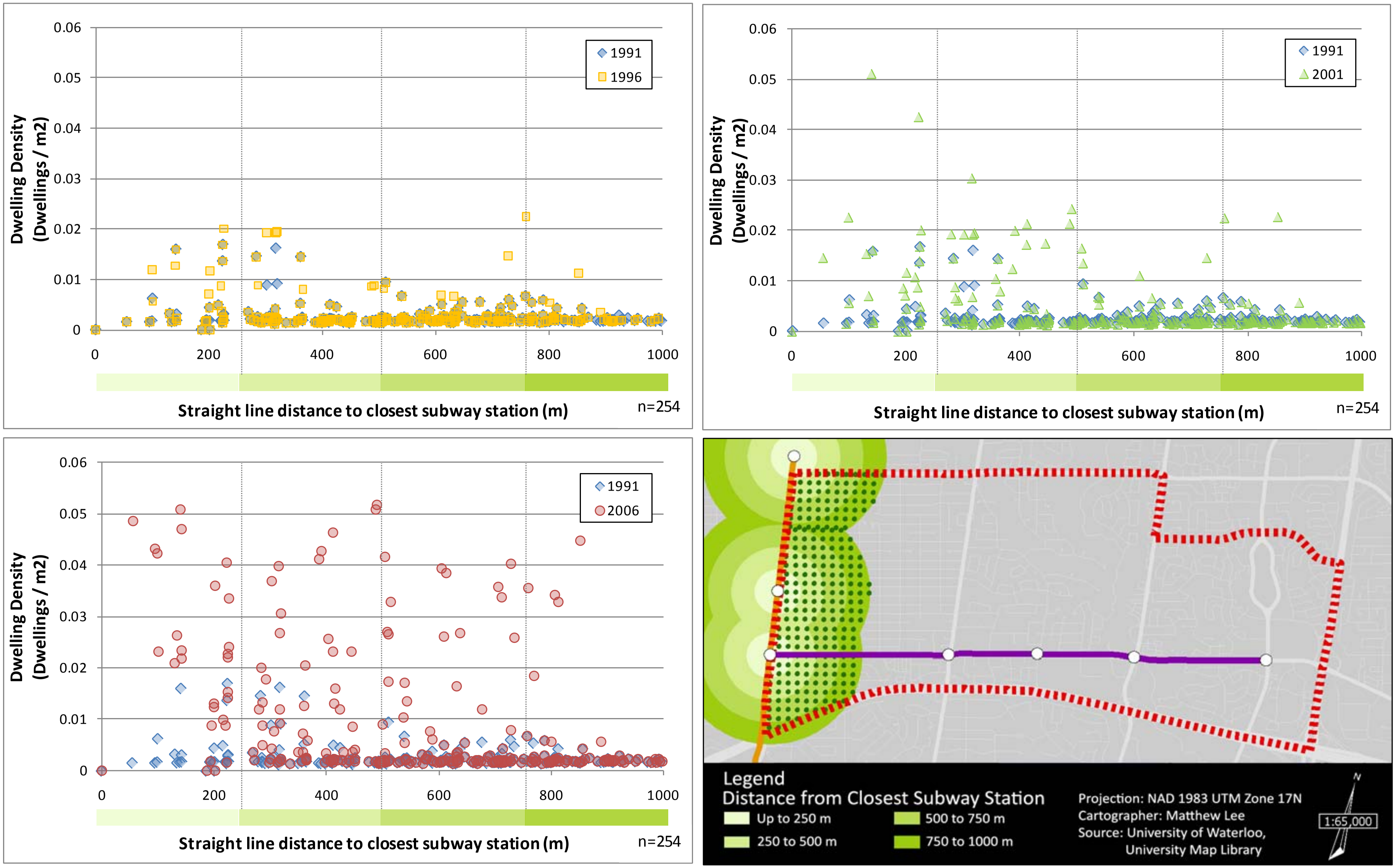
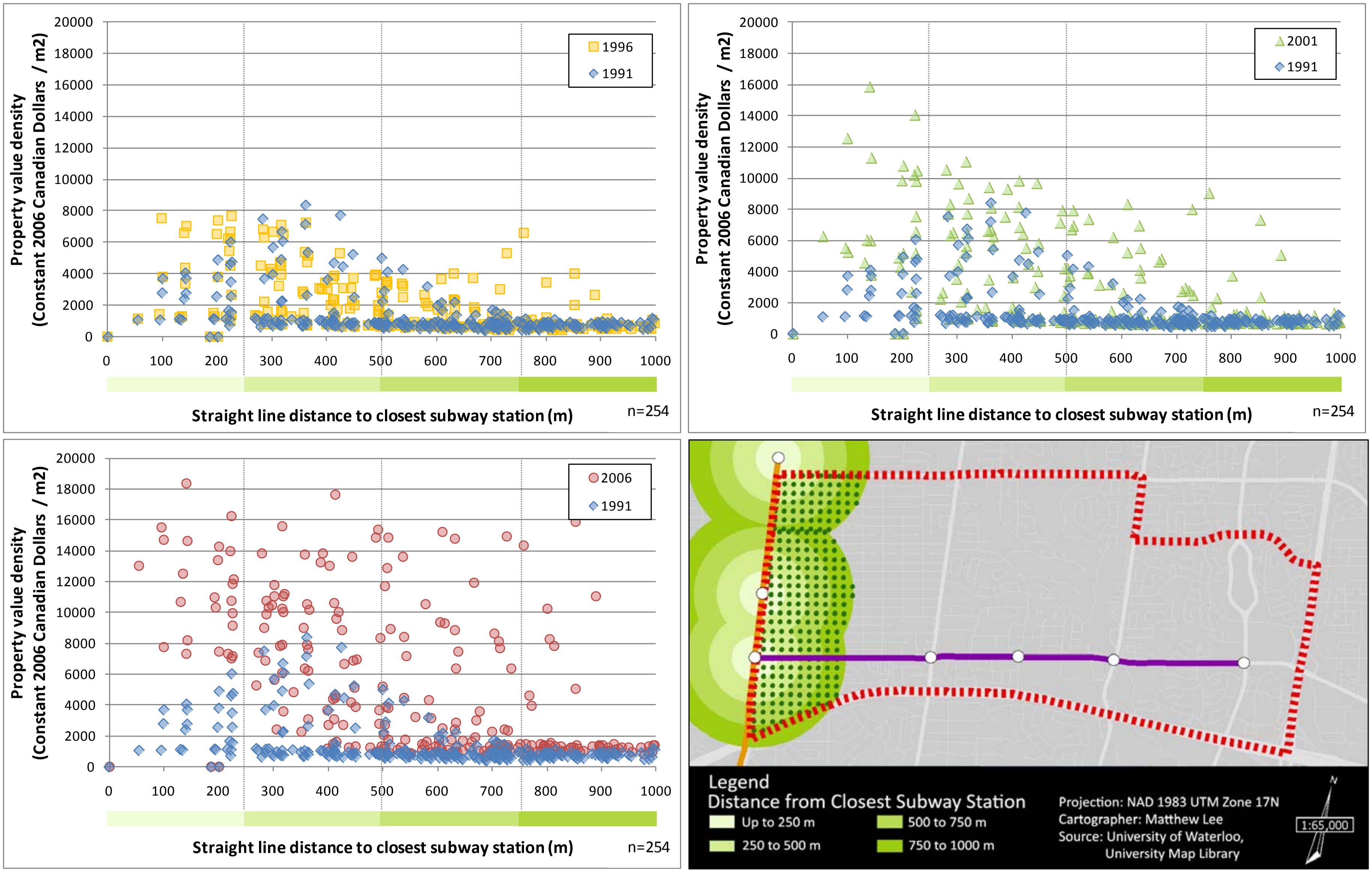


Figure 5-18: Value Density and straight line distance to Finch, North York Centre, and Sheppard-Yonge stations



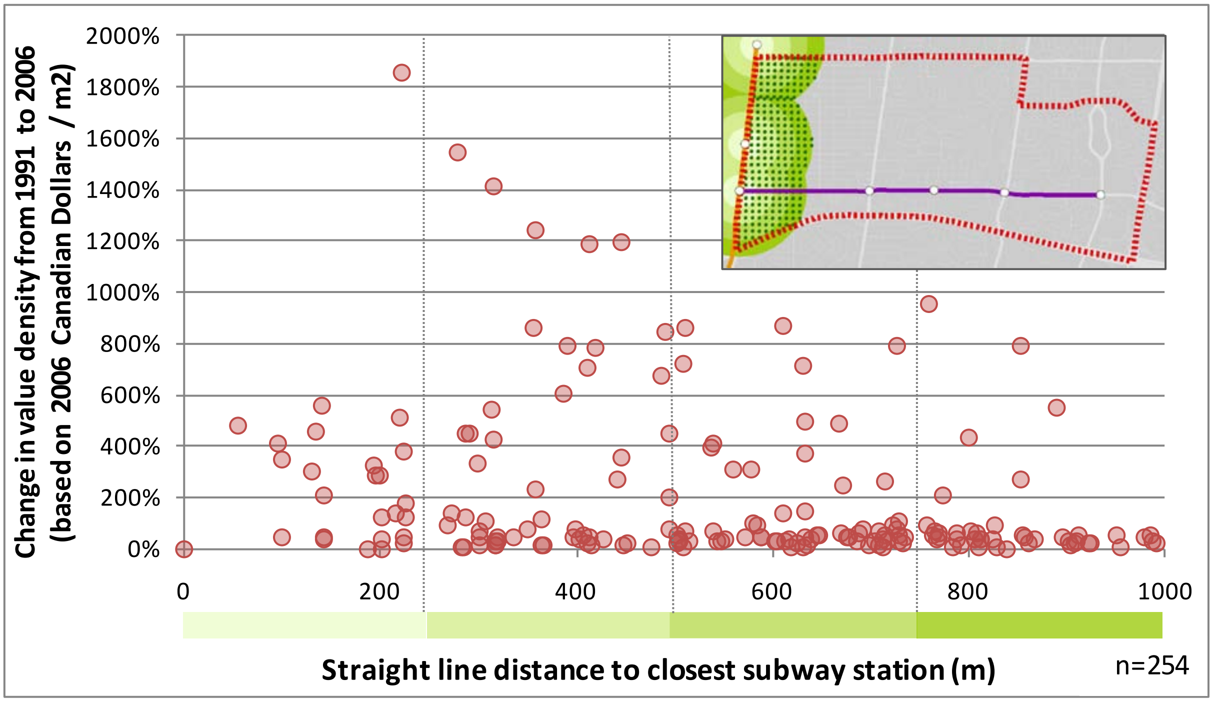
Based on the scatterplots in Figure 5-17 and Figure 5-18, Dwelling and Value Density figures increased moderately in 1996 and then increased significantly in 2001 and 2006 in contrast to the 1991 benchmark year.

One noteworthy difference between the two sets of plots is that the latter Value Density plots reveal a more pronounced increase in each of the Analysis Years when compared to the benchmark figures. For instance, there is a greater increase in Value Density than Dwelling Density in 1996 relative to 1991, as evident in the greater number of yellow points in Figure 5-18. This observation also holds true for 2001 and 2006.

Nevertheless, the two collections of scatterplots reveal a parallel between the rates of increase in Dwelling Density and in Value Density throughout each of the Analysis Years. An increase in Dwelling Density is most often associated with an increase in Value Density. This observation is reasonable given the prevalence of condominium redevelopment in these Station Areas. The increase in the number of dwellings within a given property parcel, yields greater returns in total property value. Thus the dramatic increase in Value Density can be attributed primarily by the increase in Dwelling Density. Refer to Appendix L to view the Dwelling and Value Density scatterplots for each of the individual station areas.

Figure 5-19 illustrates the percentage change in Value Density between 1991 and 2006 as a function of its distance to the nearest subway station. Figure 5-19 reveals that the surge in condominium development along the entire stretch of Yonge Street has resulted in an increase in Value Density higher than 2000% in some sampled areas. While the extent of the increase in Value Density is exceptionally high, the regression of these value variables goes beyond the research scope of this thesis. Thus based on the plot, no assertions are made about any relationships or trends in Value Density as a function of straight line distance to the nearest subway station. However, based on a cursory interpretation of Figure 5-19, it is evident that there is a positive trend in the Value Density change (from 1991 to 2006) with proximity to subway stations.

Figure 5-19: Percentage change in Value Density from 1991 to 2006 and straight line distance to Finch, North York Centre, and Sheppard-Yonge stations



ii. Station areas demonstrating moderate change from 1991-2006

The Bayview station area demonstrated moderate change in Dwelling Density and Value Density between 1991 and 2006. It is also the only station area along the unique section of the Sheppard subway not shared by the Yonge-University-Spadina subway that evidenced some change in Dwelling and Value Density. This station area experienced no change in dwelling density from 1991 to 2001, and dramatically increased in the 2006 analysis year. Figure 5-20 and Figure 5-21 show the Dwelling and Value Density scatterplots as a function of distance to Bayview station for the 1991, 1996, 2001, and 2006 Analysis Years.

Figure 5-20: Dwelling density and straight line distance to Bayview station

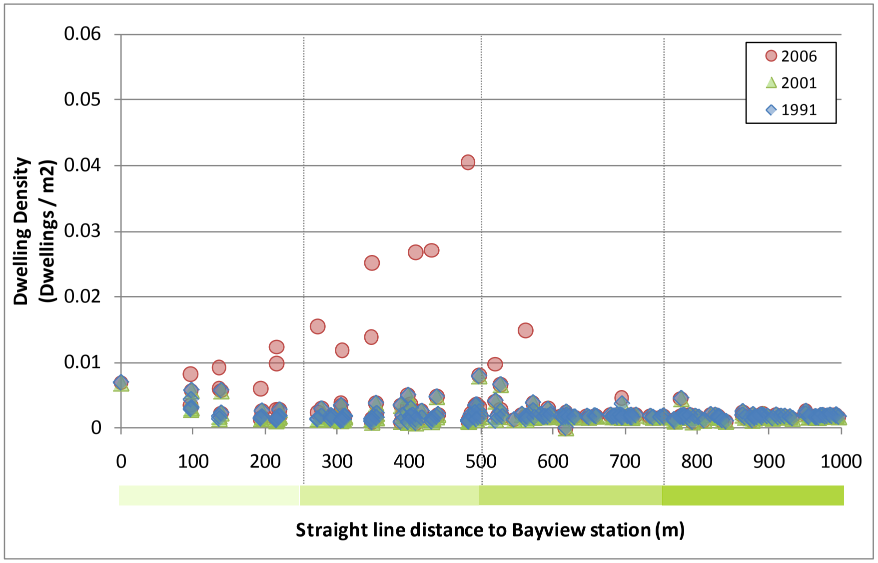
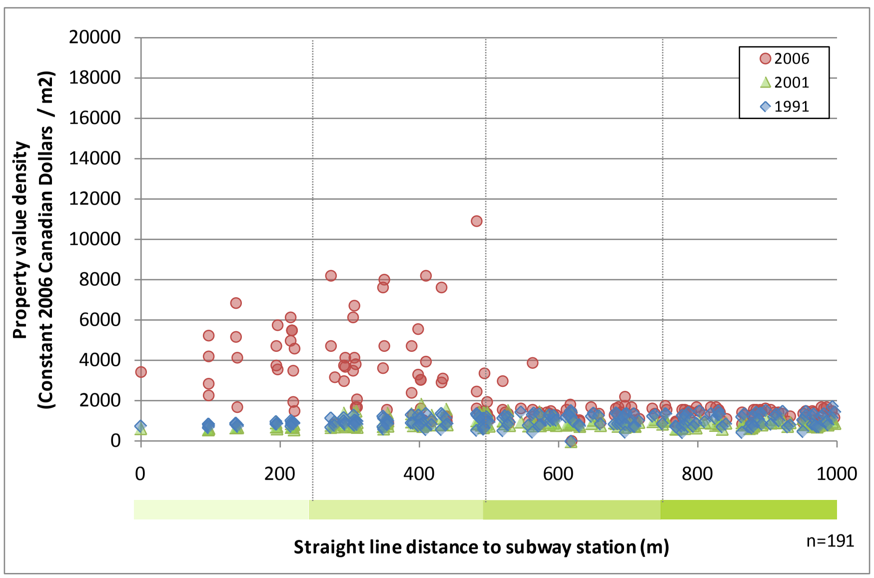
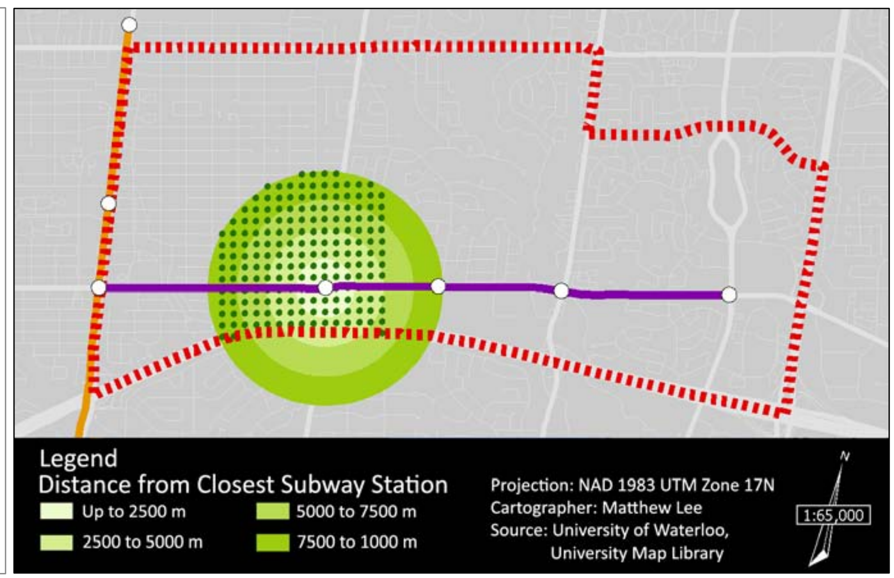


Figure 5-21: Value density and straight line distance to Bayview station





As evident in the overlapping green and blue points in Figure 5-20, there is no observed change in Dwelling Density in the 1991 and 2001 analysis years. 1996 figures demonstrated the same results as 1991 and 2001, and thus are removed from the scatterplot to reduce the complexities and to increase legibility of the diagram. In 2006 however, several condominium developments emerged in the Station Area. This increase in condominium developments, as observed by the red points in Figure 5-20, is likely spurred on by the construction of the Sheppard subway.

The scatterplot results however do not conform to the anticipated results in Section 4.2.3. From the plot findings, the peak in Dwelling Density does not increase with proximity to Bayview subway station. The peak point in the scatterplot is located approximately 500 m from the station and is attributed mainly to the *Chrysler Towers* (Block ID: 12496) located at 1 and 3 Rean Drive and *Empire Condominiums* (Block ID: 12687) at 17 Barberry Place. Both properties are situated almost at the southern border of the Study Area adjacent to Highway 401. This introduces a very important finding regarding planning policy measures which may systemically contradict the established anticipated findings. This will be further discussed in Section 5.3.

Figure 5-21 demonstrated findings fairly similar to the Dwelling Density scatterplot. The only considerable increase in Value Density occurs between 2001 and 2006, which appropriately is during the time when the Sheppard subway began revenue service.

Specifically, the pattern formed by maximum Value Density figures for each respective Analysis Year is similar to its corresponding Dwelling Density figure. However, the Value Density plot is much more "filled in," particularly for 2006 figures. In other words, the increase in 2006 Value Density is more spatially uniform, while Dwelling Density demonstrates a much more isolated set of increasing figures. The rationale for this difference is due to a higher average dwelling value for Leasehold Condominium properties closer to Bayview Station than those situated adjacent to Highway 401.

Refer to Appendix L to view the Dwelling and Value Density scatterplots for each of the individual station area.

Figure 5-22: Percentage change in Value Density from 1991 to 2006 and straight line distance to Bayview station

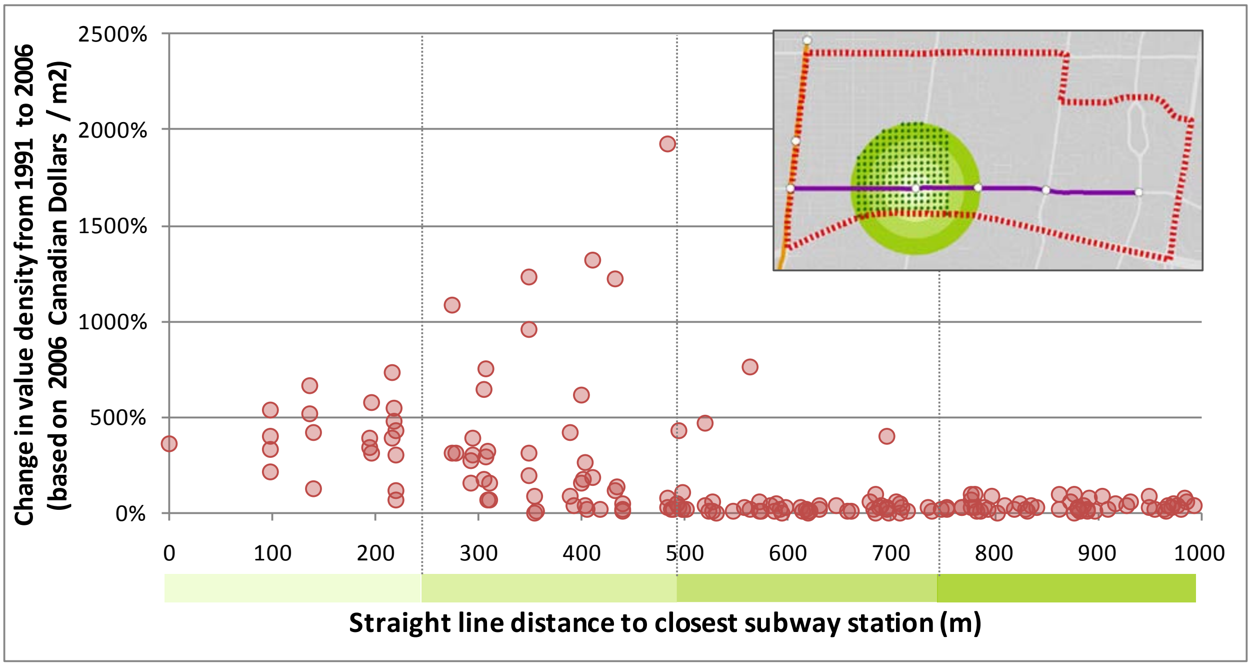


Figure 5-22 shows the percentage change in Value Density from 1991 to 2006 as a function of its distance to Bayview Station. In 1991 as illustrated in Figure 5-21, Value Density remained fairly uniform across the Station Area, ranging from $427 to $1696 /m^2. The Value Density figures remained stable for 1996 and 2001, and most of the change observed in Figure 5-22 is attributed chiefly from 2001 to 2006. On average, average Value Density within the Bayview station area achieved an increase of 151%, and the highest point attained an increase in Value Density by 1929%. Because Value Density has remained steady and only experienced dramatic increase from 2001 to 2006, it is possible that the construction of the Sheppard subway is a major contributor to the residential redevelopment of the Bayview station area as observed today.

iii. Station areas demonstrating modest or no change from 1991-2006

The Bessarion, Don Mills and Leslie station areas are identified as demonstrating modest or no change in Dwelling and Value Density between 1991 and 2006. Based on the scatterplots, the Sheppard subway has yet to spur changes to Dwelling and Value Density to these three easternmost station areas. Figure 5-23 is a scatterplot showing Dwelling Density with proximity to the nearest identified station for 1991 and for 2006. The plot indicates that most of the 2006 Dwelling Density points mirror the 1991 points. The observed 1996 and 2001 figures yielded the exact same results as

1991, and were consequently removed from the figure to enhance the clarity of the scatterplot. The only reported residential redevelopment in the four Analysis Years occurs in 2006, where a new rental apartment structure was erected at 121 Parkway Forest Drive at the southwest corner of Sheppard Avenue and Highway 404. 232 dwelling units were erected on the property and because there are very similar highrise properties in its vicinity, the spatial interpolation function did not render any major changes to Dwelling Density. Instead it managed to "fill in" the areas already exhibiting high Dwelling Density. The subtle differences in 2006 points (approximately 400 m from the nearest station) are attributed to this property.

Figure 5-24 shows the Value Density scatterplot for the station areas demonstrating modest or no change. Even with the 1991 Value Density figures adjusted to 2006 equivalent values, only a hint of increase is evident for these three Station Areas.

Refer to Appendix L to view the Dwelling and Value Density scatterplots for each of the individual station area.

Figure 5-23: Dwelling Density and straight line distance to Bessarion, Don Mills, and Leslie stations

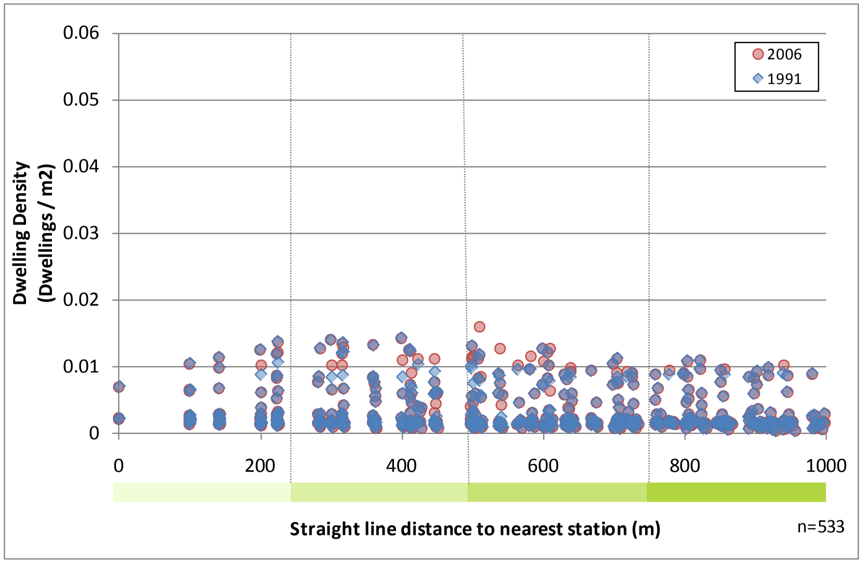
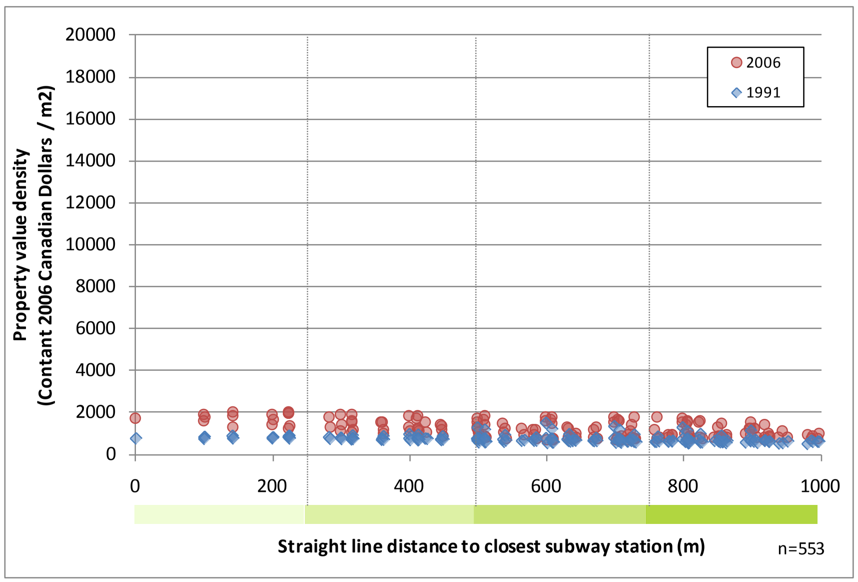
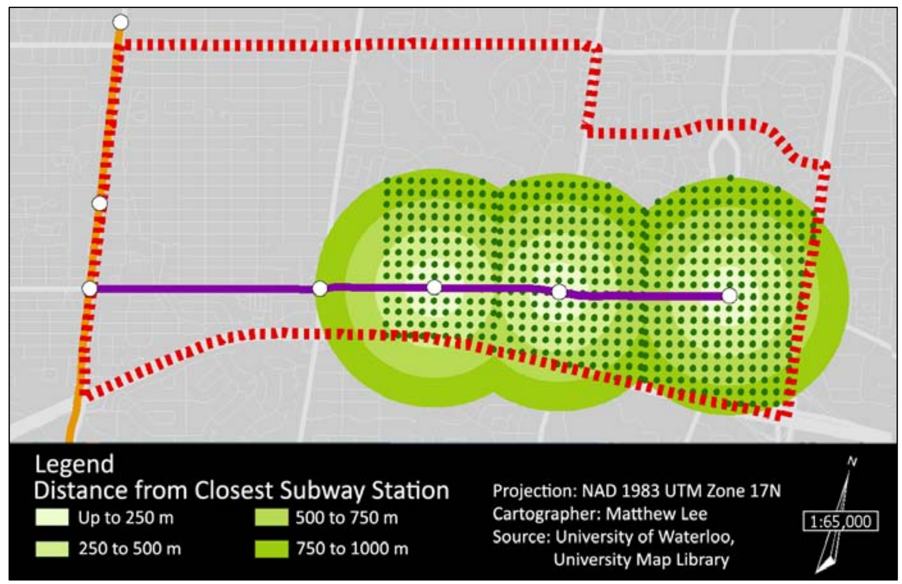


Figure 5-24: Value Density and straight line distance to Bessarion, Don Mills, and Leslie stations

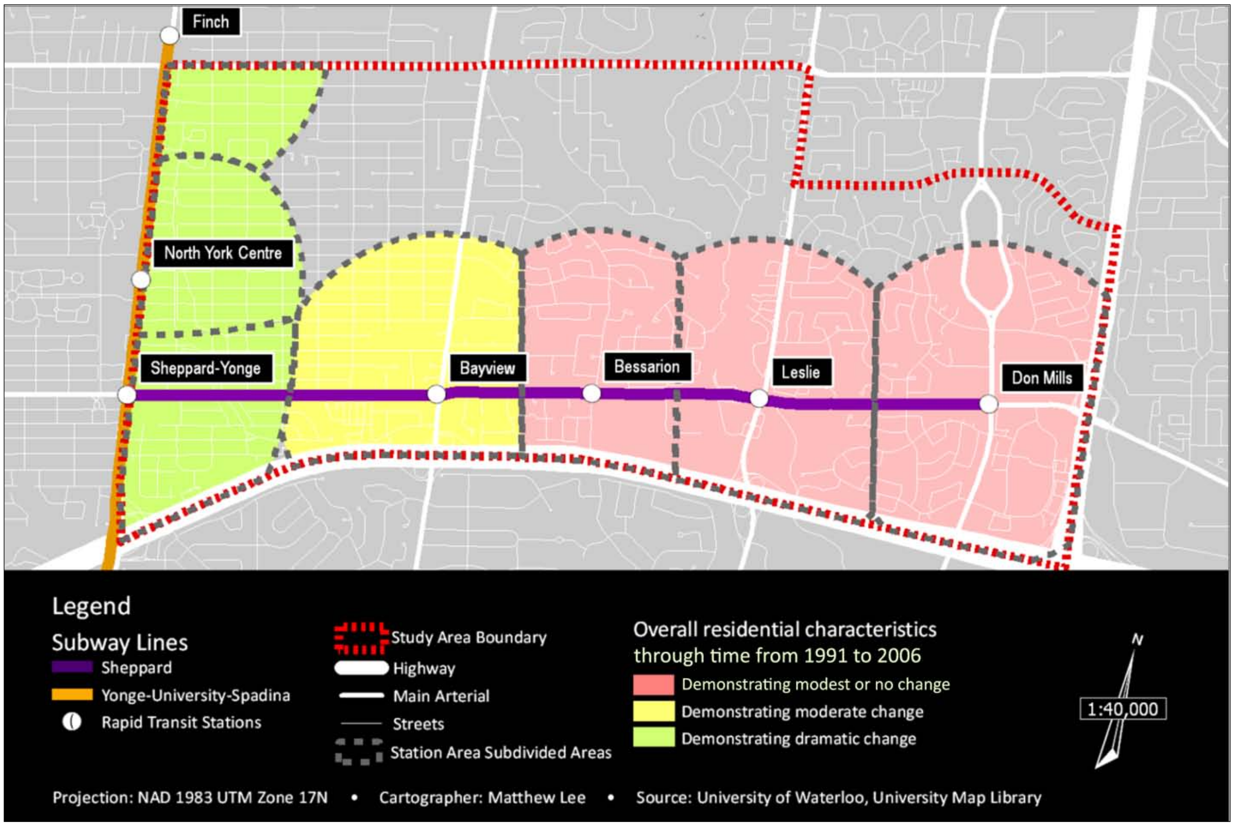




iv. General conclusions from the station-level analysis

Figure 5-25 is a map summary of the general findings from the station-level analysis.

Figure 5-25: Summary of changes to residential land-use conditions by Census Tract



Based on the station-level scatterplot and conditional probability analyses, the following inferences are made:

<u>Station Areas along Yonge Street demonstrates the greatest change in Dwelling and Value Density</u>

The Station Areas along Yonge Street (Finch, North York Centre, and Sheppard-Yonge) demonstrated the greatest change in residential Dwelling and Value Density during the four Analysis Years. The dramatic increase in Value Density is attributed to the surge in highrise condominium development within the observed 15 year time span. Despite the results, these three Station Areas that have good access to subway service along the Yonge-University-Spadina subway even prior to 1991, as the subway corridor from Finch to Sheppard-Yonge stations opened as early as 1974. Because of this, the observed increase in Dwelling and Value Density in these station areas may not necessarily be attributed of the Sheppard subway. However, it is possible that the network effects associated with the completion of the Sheppard subway, such as the increased ease of access to destinations within North York, has contributed to the observed growth in Dwelling and Value Density in the three Station Areas.

<u>Station Areas exclusively served by the Sheppard subway demonstrate some Dwelling and Value Density change but the degree of change is limited as of 2006</u>

The Station Areas served only by the Sheppard subway (e.g. excluding Sheppard-Yonge) demonstrated a moderate increase in Dwelling and Value Density at best during the four Analysis Years. Specifically, the Bayview Station Area showed no change in Dwelling and Value Density from 1991 to 2001 but experienced a surge from 2001 to 2006. Coincidentally, the Sheppard subway was completed and began revenue service during the same time frame. The remaining Station Areas (Bessarion, Leslie, and Don Mills) exhibited almost no increase in Dwelling and Value Density from the scatterplots within the observed 15-year time span.

Based on these scatterplot results, Sheppard subway's influence on residential redevelopment and intensification is evident but the extent of its influence is limited as of 2006. While Bayview is emerging as a mature residential development node, new development applications in the City of Toronto reveal increased redevelopment and intensification potential particularly around Don Mills and Leslie stations. These potential developments are discussed further in Section D.

v. Dwelling and Value Density station area peaks do not occur at the subway station

Based on the Dwelling and Value Density Scatterplots observations, the Dwelling and Value Density peak does not occur at a location closest to the subway station. Among the Station Areas that experienced dramatic change, no Value Density peak is evident in 2006—as highrise redevelopment and intensification has nearly reached maturity. Meanwhile, the Bayview Station Area demonstrates a clear Value Density peak in 2006. However it is located just shy of 500 m from Bayview Station. Finally, the remaining Station Areas demonstrate no clear Value Density peak and there are no indications of residential intensification and redevelopment in these Station Areas as of 2006.

D. Forecasting future dwelling and sales values

Because of the lowered degree of confidence in the validity and reliability of these forecasted Dwelling and Value Density figures, the forecasting and analysis of dwelling and property sales values are intentionally discussed separately from core scatterplot analysis in Section B and C.

As discussed in Section 4.2.6, because 2006 is the only Analysis Year observed after the Sheppard subway began revenue service, there is value to forecast future dwelling and sales values to facilitate a better understanding of the trends in residential intensification and value appreciation along the Sheppard subway corridor. Based on the data available to and obtained by the researcher, two different types of properties were identified[14]:

- **Class I Future Property** – Properties under construction or released for sale
- **Class II Future Property** – Properties undergoing and requiring the planning approval

Table 4-10 describes the two types of future properties in detail. The quantity of dwellings and related property sale values for each future property was computed according to Equation 4-1 and Equation 4-2 on Page 82. These forecasted figures are then incorporated with the 2006 Dwelling and Value Density spatial data to generate interpolated raster surfaces based the Class I and the combined Class I and II properties.

Figure 5-26 and Figure 5-27 illustrate the Dwelling and Value Density raster surfaces for 2006, 2006 including all Class I properties, and 2006 including both Class I and II properties.

[14] The identification of developments proposed, for sale, or under construction is as current as October 2009

Figure 5-26: Dwelling Density interpolated surfaces for 2006, with the inclusion of Class I and II forecasted properties

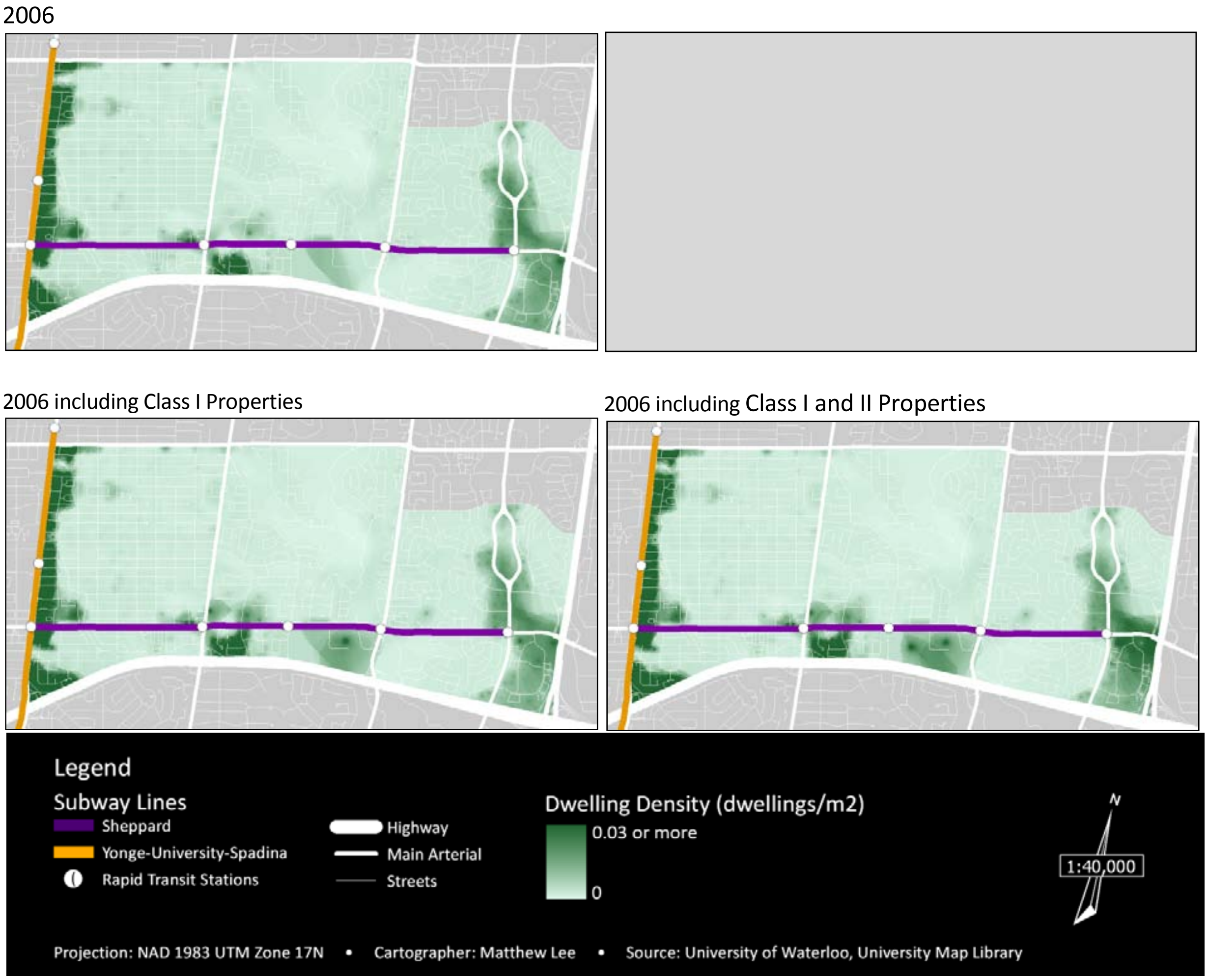
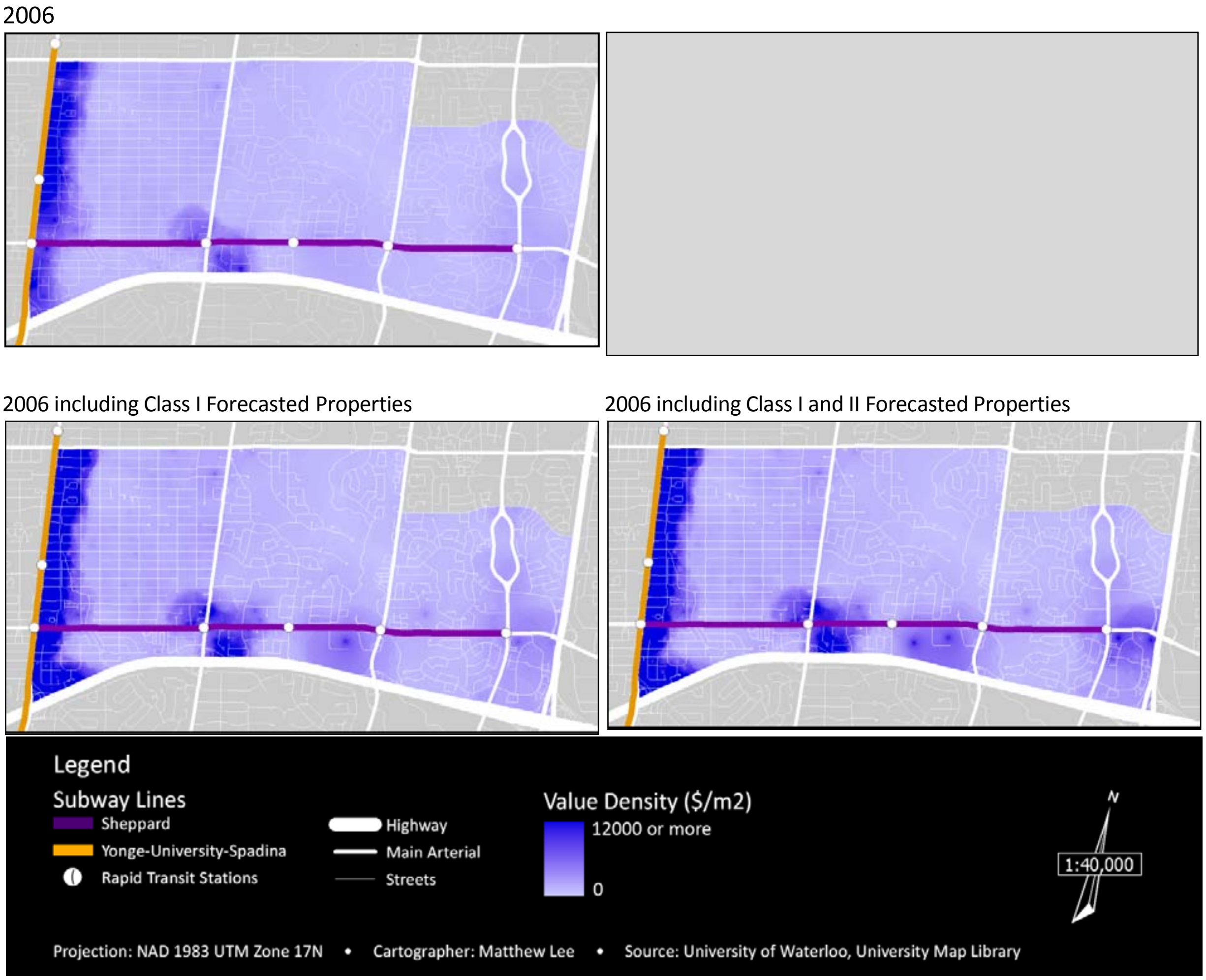


Figure 5-27: Value Density interpolated surfaces for 2006, with the inclusion of Class I and II forecasted properties



The most noteworthy change in Dwelling and Value Density with the addition of these Class I and Class II properties occurs at the Station Areas that demonstrated modest or no change up to 2006, namely Bessarion, Don Mills and Bessarion Stations. Figure 5-28 and Figure 5-29 illustrate the possible change in Dwelling and Value Density within three Station Areas based on the two classes. While the increases in Dwelling and Value Density are fairly modest based on the scatterplots, especially when compared with the Station Areas along Yonge Street, the figures are certainly understated. In the calculation of Class I properties, the publicized per-unit price used to extrapolate the total cost of a given Class I property is often the price of the least expensive unit (e.g. "units priced from $199,000"). As for the Class II properties, the property boundaries are often not yet delineated and areas not used for residential purposes (e.g. roadways, parks, institutional uses) have not been removed in the calculation of the parcel area. For example, there has yet to be any documented site plans for 14 of the 16 condominium properties (Terrance Belford, 2008; City of

Toronto, 2009b) that are expected to be developed by *Concord Adex* on the former Canadian Tire warehouse lands at 1001-1019 Sheppard Ave East. In this instance, the entire unsubdivided parcel area is used in the calculation of the Dwelling and Value Density figures.

Figure 5-28: Forecasted Dwelling Density figures and straight line distance to Bessarion, Don Mills, and Leslie stations

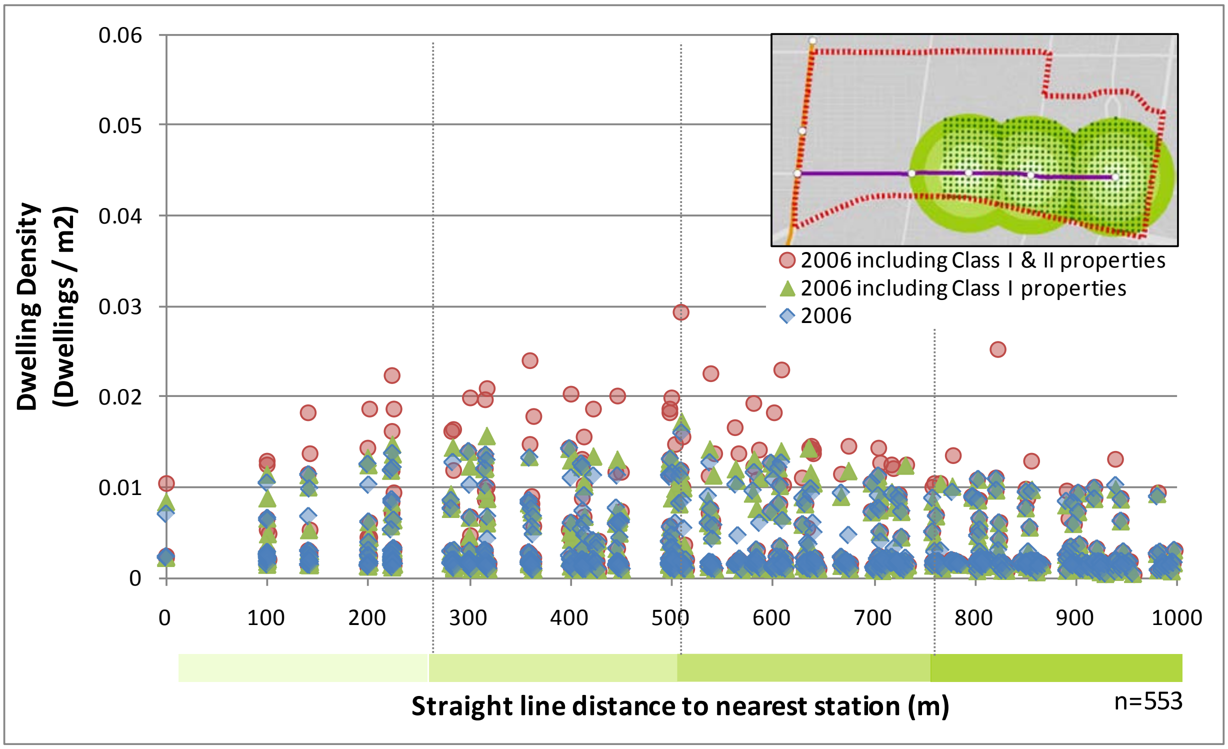
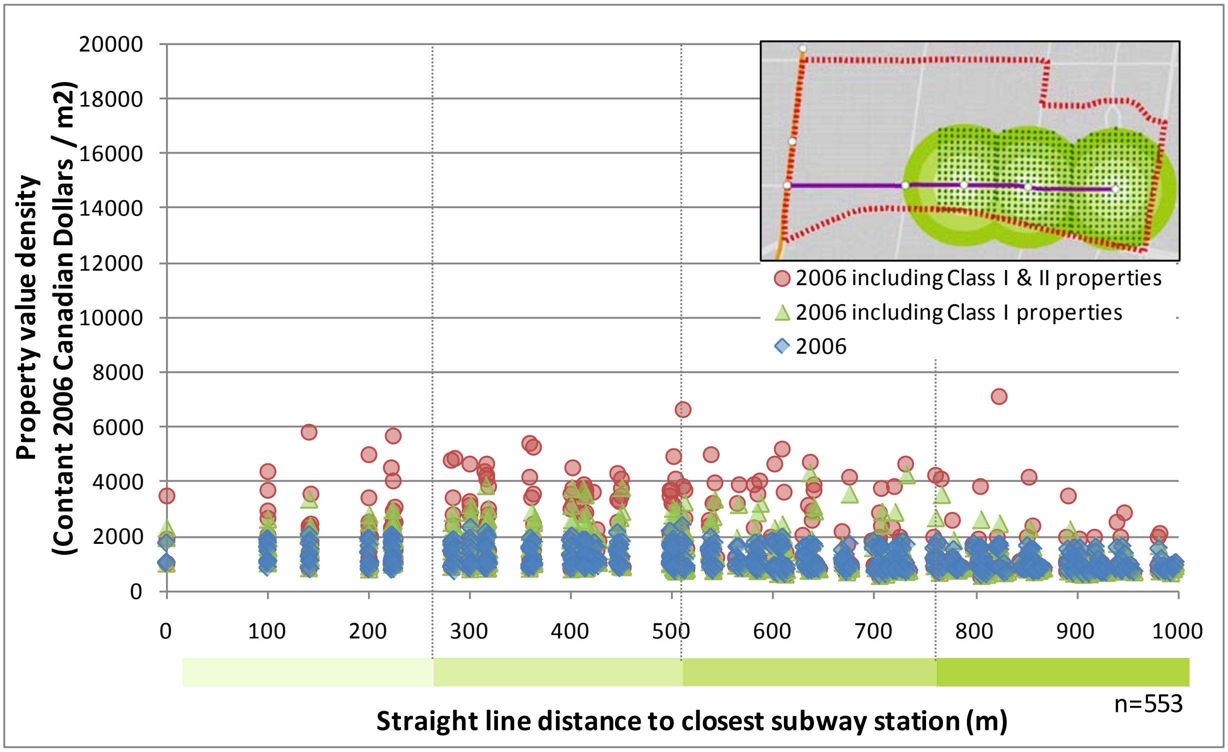


Figure 5-29: Forecasted Value Density figures and straight line distance to Bessarion, Don Mills, and Leslie stations



Refer to Appendix L and Appendix M for the scatterplots for each Station Area based on interpolated and actual sample points respectively. To see the all the interpolated surfaces, including the forecasted Class I and Class II properties, refer to Appendix J.

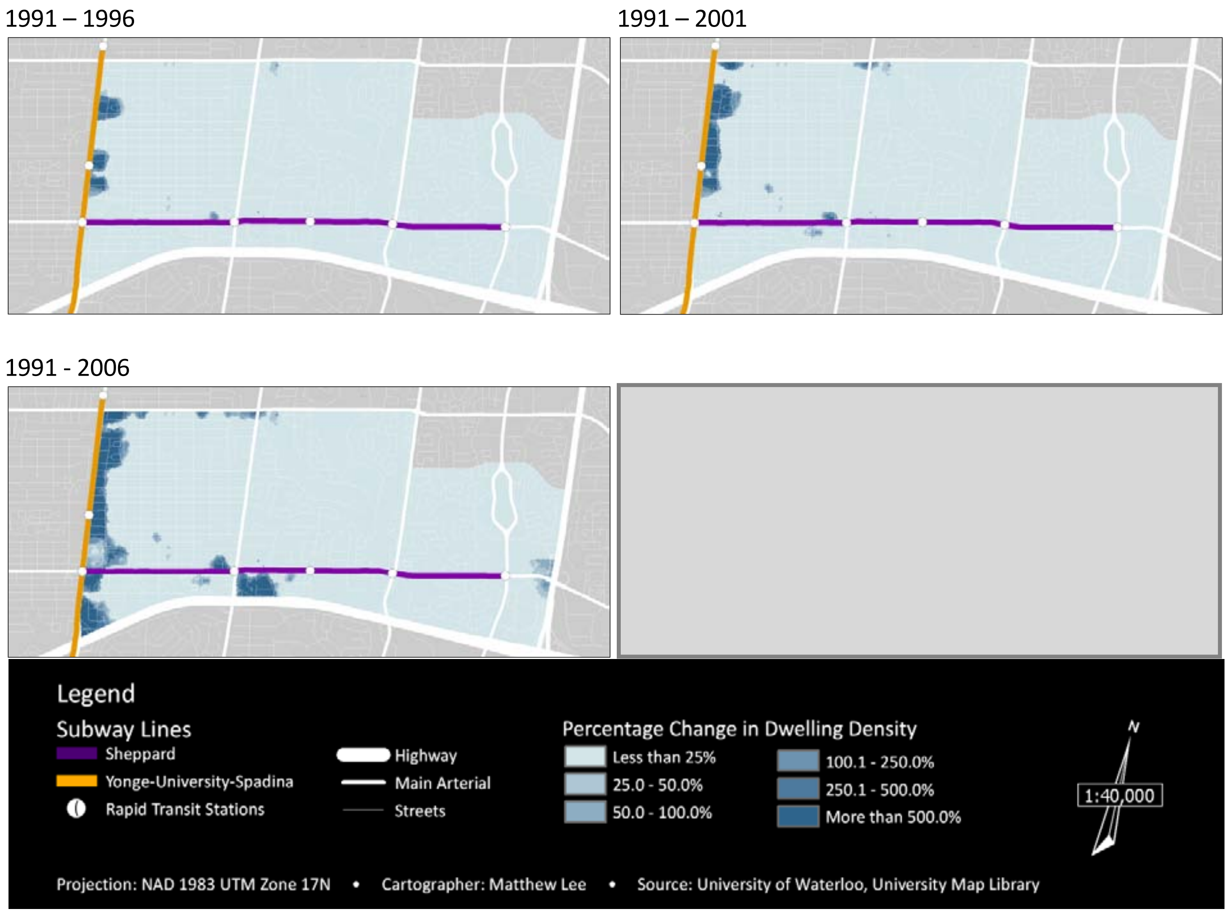
5.2.2 Geovisualization approach

As discussed Section 2.2.5 and Section 4.2.8 Part B, geovisualization allows people to understand and learn more effectively in a visual and spatial form, rather than through numerical data (Kwan & Lee, 2004). Section 5.2.1 already introduced some geovisualization outputs by presenting spatially interpolated Dwelling and Value Density surfaces individually for each of the four Analysis Years. The following sections will present geovisualization opportunities specifically for the purpose of visualizing the changes through space and time.

A. Raster method

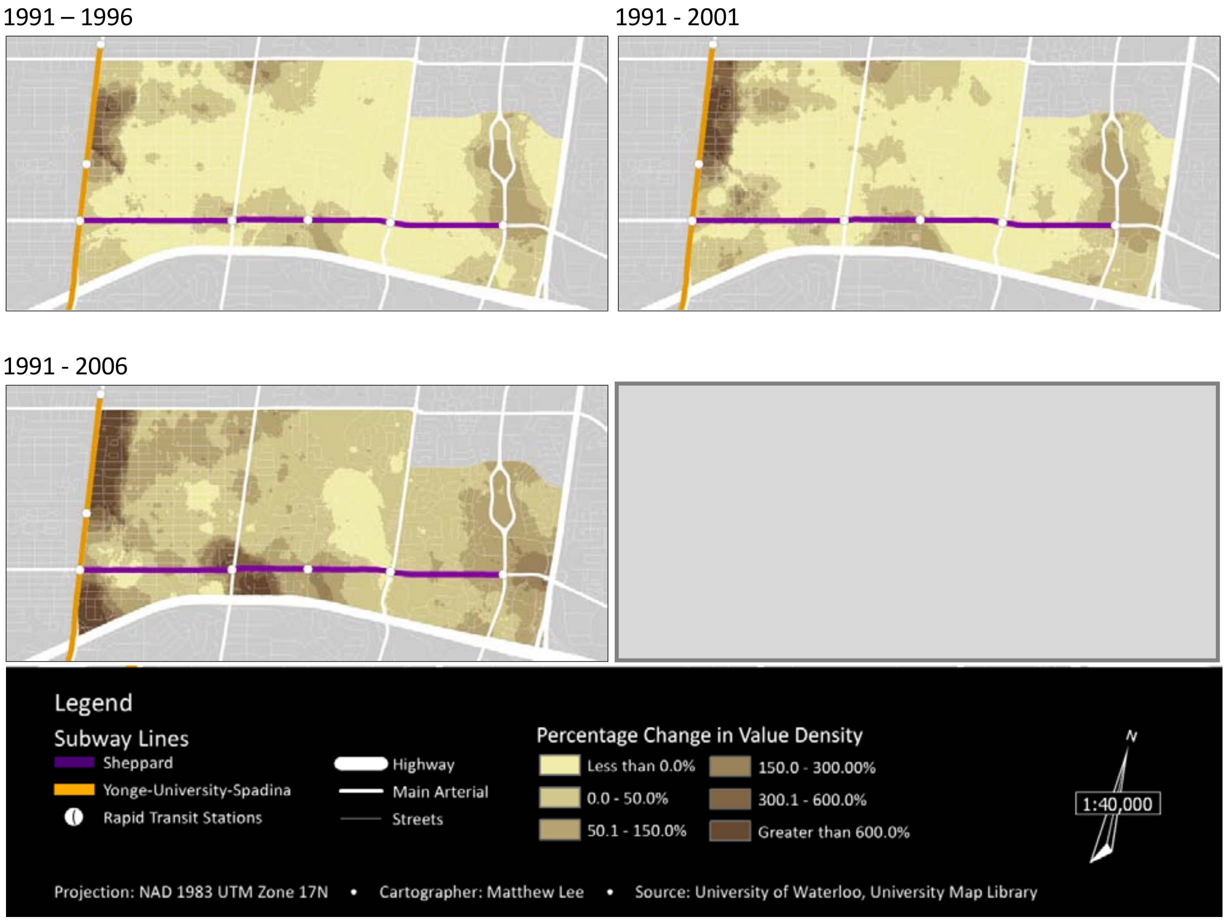
As discussed in Section 3.5.8 Part B, the Raster Method visualizes the changes to Dwelling and Value Density through time by using *ArcGIS's Raster Math* toolset functions. *Raster Math* allows for the combining of values in multiple rasters on a cell-by-cell basis (ESRI, 2006). Thus it is possible to observe the percentage change in Dwelling and Value Density between a pair of Analysis Years. Figure 5-30 maps out the percentage change in Dwelling Density from 1991 to 1996, 1991 to 2001, and 1991 to 2006. To view the maps for the remaining Analysis Year combinations, refer to Appendix N.

Figure 5-30: Generated raster surfaces of percentage change in Dwelling Density



Similarly, Figure 5-31 maps out the percentage change in Value Density from 1991 to 1996, 1991 to 2001, and 1991 to 2006. Appendix N includes the maps for the remaining Analysis Year combinations.

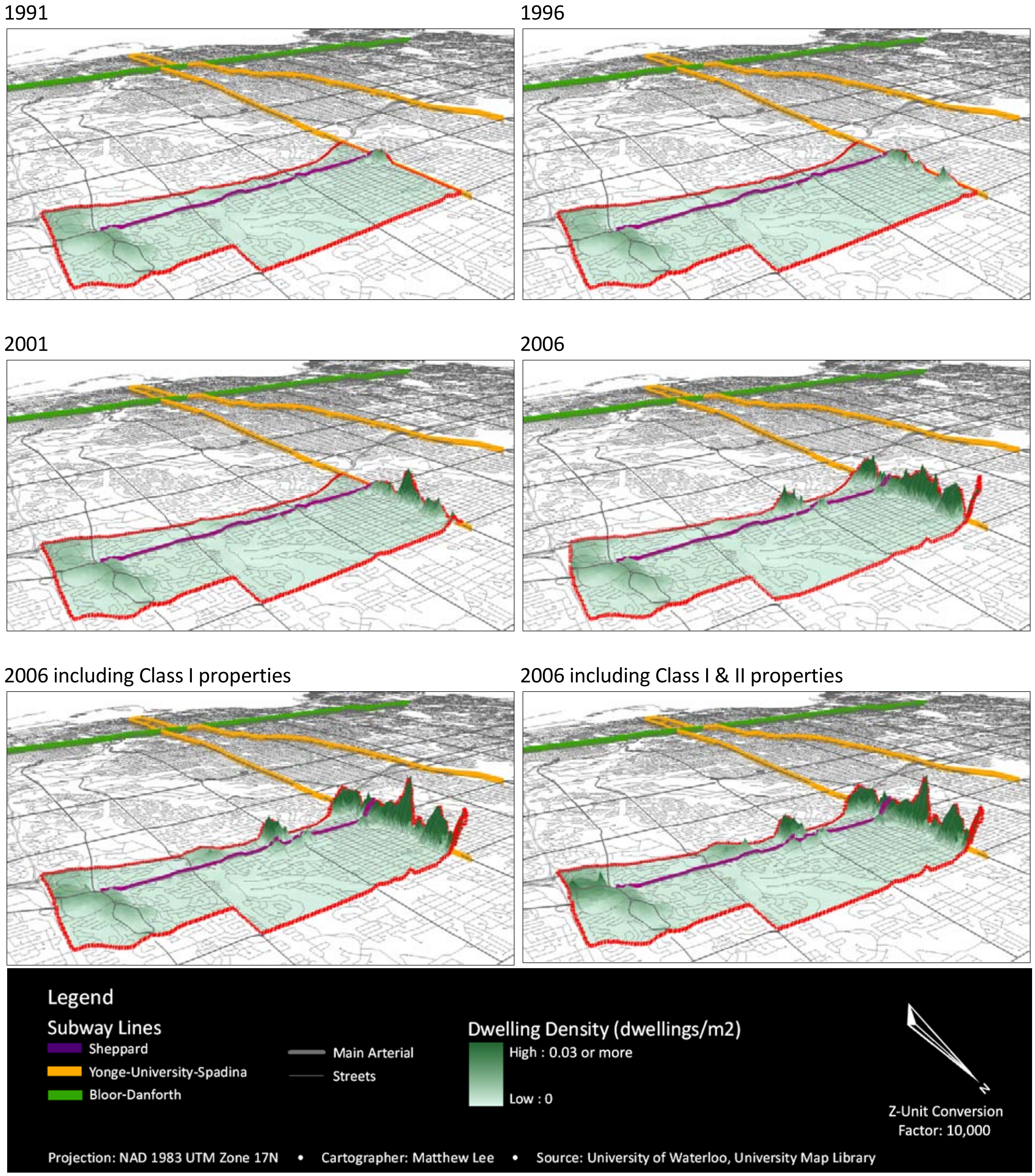
Figure 5-31: Generated raster surfaces of percentage change in Value Density



B. ArcScene Method

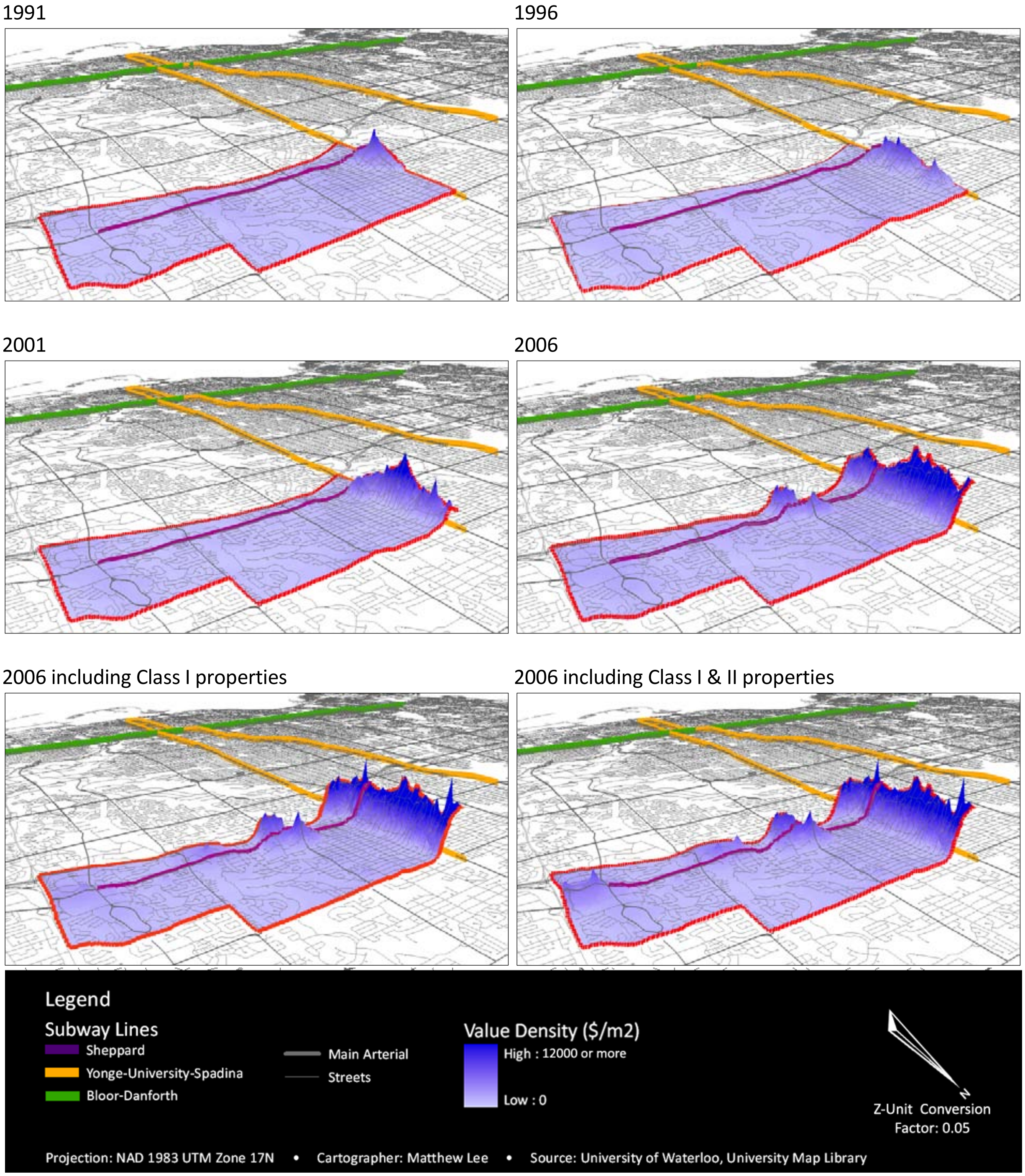
Section 3.5.8 Part B discussed ways to visualizing the interpolated raster surfaces in a 3D plane through space and time by using ArcScene. ArcScene has the ability to take interpolated raster surfaces and extrude each raster cell on a vertical (Z-axis) plane based on the embedded value of each cell in the raster layer. Figure 5-32 maps out the 3D Dwelling Density surfaces for each individual Analysis Year. Refer to Appendix O for the remaining 3D surfaces not displayed in Figure 5-32, including the surfaces for the Class I and Class II forecasted dwelling values.

Figure 5-32: Generated 3D Surfaces of Dwelling Density from 1991 to 2006



Similarly, Figure 5-33 maps out the 3D Value Density surfaces for each individual Analysis Year. Refer to Appendix O for an enlarged view of the 3D surfaces.

Figure 5-33: 3D Surfaces of Value Density in the Study Area from 1991 to 2006



C. Visualization conclusions

The 3D visualizations generated by the ArcScene Method proved to be very useful as it effectively provided a new dimension in the comparison of Dwelling and Value Density, not just temporally but spatially as well. While the use of coloured gradient symbology in the 2D interpolated raster surfaces helped to identify the varying degrees of Dwelling and Value Density, the drawback of these 2D maps is that it was difficult to determine to scale the relative differences between one location to another.

The 3D visualization functions take the quantitative dimension in the flat raster surfaces and extrudes it to scale according to the value associated to that raster cell. Temporal comparisons can easily be made simply by flipping between different 3D surfaces to understand the change in values within a specific location in the Study Area through time.

The greatest value of the 3D visualization capabilities from ArcScene is the ability to organize data from many dimensions and present it in a way that is meaningful to all types of users.

5.3 Determining external conditions affecting Dwelling and Value Density

A. Planning policies

Having examined the conditions and changes in residential development and explored the planning policies and conditions that have guided growth in the Study Area, there are a number of conditions to suggest that the nature of the development within the Study Area is very much shaped by the planning policies, and less to do with the effects of urban economic theory.

Provincial planning legislation across Canada mandates all municipalities to develop an Official Plan and to ensure that all proposed development are consistent with the developed Plan (McAllister, 2004). Thus, planning policy is a major driver in guiding the state of development in all communities, and the Study Area holds no exception. The presence of North York Centre as a development node was driven by Metro Government's (and subsequently the City of Toronto) planning policy to manage growth issues occurring in the CBD, and the Sheppard subway corridor was initiated by the need to link the emerging suburban "downtowns" of Scarborough and North York (see Section 4.1.2). Finally the rationale for intensification along the Sheppard subway is a policy direction driven by the need to direct and encourage development in support of the significant piece of rapid transit infrastructure. While influences from the principles of urban economic theory contributed greatly in the development of a polycentric Toronto metropolitan area, the realization of those effects may be limited or varied by planning policy directions. For instance, there a number of observations within the Study Area that is compatible with planning policies while not consistent with the expected results based on urban economic theory. Table 5-5 provides a summary of observed results that are contrary to the anticipated conditions based on urban economic theory.

Table 5-5: Summary of observed results not consistent with anticipated results

Anticipated results based on urban economic theory	Observed conditions
Peak in residential density within the Bayview Station Area should occur at the station due to increased accessibility (see Section 4.2.3 and Section 5.2.1 Part A)	1. Peak in residential density within the Bayview Station Area does not occur at the station but rather adjacent to Highway 401 (see Section 5.2.1 Part C Subsection ii)
Urban spatial structure in North York Centre is organized by concentric circles from the node (see Section 4.2.3)	2. Urban spatial structure in North York Centre is organized by concentric ellipses along Yonge street rather than circles from the node (see Section 5.2.1 Part B Subsection v)
Peak in density will occur at the North York Centre development node and steadily decline concentrically outward (see Section 4.2.3)	3. Clear land-use boundaries exists between the high density areas within the North York Centre Secondary Plan and the low density areas outside of it (see Section 5.2.1 Part B Subsection i)

The observed conditions from Table 5-5 that were proved to be contrary to the anticipated results based on urban economic theory can be explained by specific policy guidelines outlined in the City of Toronto Official Plan, namely the North York Centre and Sheppard East Subway Corridor secondary plans. Table 5-6 provides a summary of planning policies that are consistent with the observed results but are contrary to the anticipated results based on urban economic theory.

Table 5-6: Consistencies in planning policies and observed residential development conditions

Planning policy conditions	Observed conditions
North York Centre Secondary Plan	
1. Areas of focus for higher density	
Focus the highest density along Yonge Street, in the immediate vicinity of subway stations, and at Highway 401 on the east side of Yonge Street (City of Toronto, 2007c)	Interpolated raster surfaces for 2006 in Figure 5-11 showed very high Dwelling Density along the entire length of Yonge Street, and the areas nearest to Highway 401. Thus creating an elliptical ring of higher, more intensive development.
2. Interface between North York Centre and Adjoining Neighbourhoods	
Recognize that existing neighbourhoods adjacent to North York centre are to be protected, preserved and enhanced Delineate a well-defined boundary in North York Centre to facilitate a stable buffer from the surrounding residential areas (City of Toronto, 2007c)	Interpolated raster surfaces for 2006 in Figure 5-11 showed a dramatic increase in Dwelling Density west of Doris and Kenneth Avenues (these streets define the eastern border of North York Centre) ınterpolated raster surfaces for 2006 in Figure 5-11 showed negligible change in Dwelling Density in areas outside of the NYC Plan area
Sheppard East Corridor Secondary Plan	
1. Focus for high density development	
Allow for greater densities along Highway 401, at major intersections and transit stations (City of Toronto, 2007d)	Interpolated raster surfaces for 2006 in Figure 5-11 and associated scatterplots showed a highest density development within the Bayview Station Area occuring adjacent to Highway 401 but not at major intersections and transit stations
2. Maintaining Stable Neighbourhoods	
Recognize existing properties outside of the plan area to be protected as stable residential communities Ensure proper transition between higher density areas and stable residential areas where no change in land use policy is introduced (City of Toronto, 2007d)	Interpolated raster surfaces for 2006 in Figure 5-11 showed negligible change in Dwelling Density in areas outside of the Sheppard East Plan Given the few samples of high density developments in the 2006 data, it is difficult to observe whether adequate transition is provided for between high and low density neighbourhoods
3. Ensuring medium density along Sheppard Avenue	
Introduce a "mainstreet" approach along Sheppard Avenue, with mid-rise building heights compatible with the uses north of Sheppard Avenue (City of Toronto, 2007d)	ArcScene generated surfaces for 2006 show a peak in Dwelling Density for the Bayview Station Area occuring close to Highway 401 and declining when approaching north to Sheppard Avenue

The observations from Table 5-5 and Table 5-6 give evidence that planning policy directions are proven to guide the type of development that occurs within the Study Area and these policies have a profound influence on the detailed urban form of the station areas. However, this observation still does not preclude the urban economic theory's influence in driving residential land use change in the Study Area, especially when viewed at the macro-level. For instance, while the specific spatial variations in Dwelling and Value Density within the Bayview Station Area were not consistent with the anticipated results, the fact that the Station Area overall experienced tremendous growth speaks volumes about the desirability of decreased transport costs and of increased accessibility—all of which stem from urban economic theory.

B. Commercial development

This thesis did not examine the changes to the quantity and value of commercial development before and after the completion of the Sheppard subway. However, Smith, Gihring, & Litman (2009) highlighted a number of North American case examples where the construction of a rapid transit line spurred increases in office rent, retail space rent, and in the supply of office space and retail space. Like residential development, businesses want to take advantage of the increase in pedestrian traffic around transit stations and the increased accessibility to and from areas within the corridor. Thus, it is expected that the value and quantity of commercial space may increase as a result.

If the findings from Smith, Gihring, & Litman (2009) are applicable to the Study Area, commercial development in the Study Area may experience growth similar to what is observed for residential development in this study. For instance, Fairview Mall, a shopping centre located at the northeast corner of Don Mills Station, just recently underwent an $84 million redevelopment project to modernize the property and changed its tenant mix to promote products and services of higher selling points. Office suites located within the shopping centre were also renovated (Kryhul, 2008). In addition, with the development of a "main street" along Sheppard Avenue (see Section 4.1.2), it is anticipated that retail floor space along the corridor will increase along with the construction of higher density residential structures.

Chapter 6:
Conclusions and future work

6.1 Study Goals

This thesis focuses on quantifying and assessing the changes to residential intensification and value appreciation before and after the construction of a rapid transit corridor. Using the Sheppard subway as a case study, the main objective of this research is to measure and analyze the changes in the area surrounding the subway stations based on two identified metrics: Dwelling Density and Value Density. Through the use of Geographic Information Systems (GIS) and statistical tools, the measurement of Dwelling and Value Density is then used (1) to understand possible relationships between the two metrics with respect to distance and time, (2) to validate the case study's consistency with urban economic theory concepts, (3) to exploit spatial graphic representations as a means to communicate land use intensification and redevelopment observations, and (4) to isolate for externalities, such as established planning policies, affecting Dwelling and Value Density.

Based on these goals, this thesis addressed the following research questions:

1. How has the Dwelling Density and Value Density change at the property level over time along the Sheppard subway along the corridor?
2. What relationships, if any, exist in the Study Area between Dwelling and Value Density based on the property's distance to (1) a subway station and (2) to major development nodes?

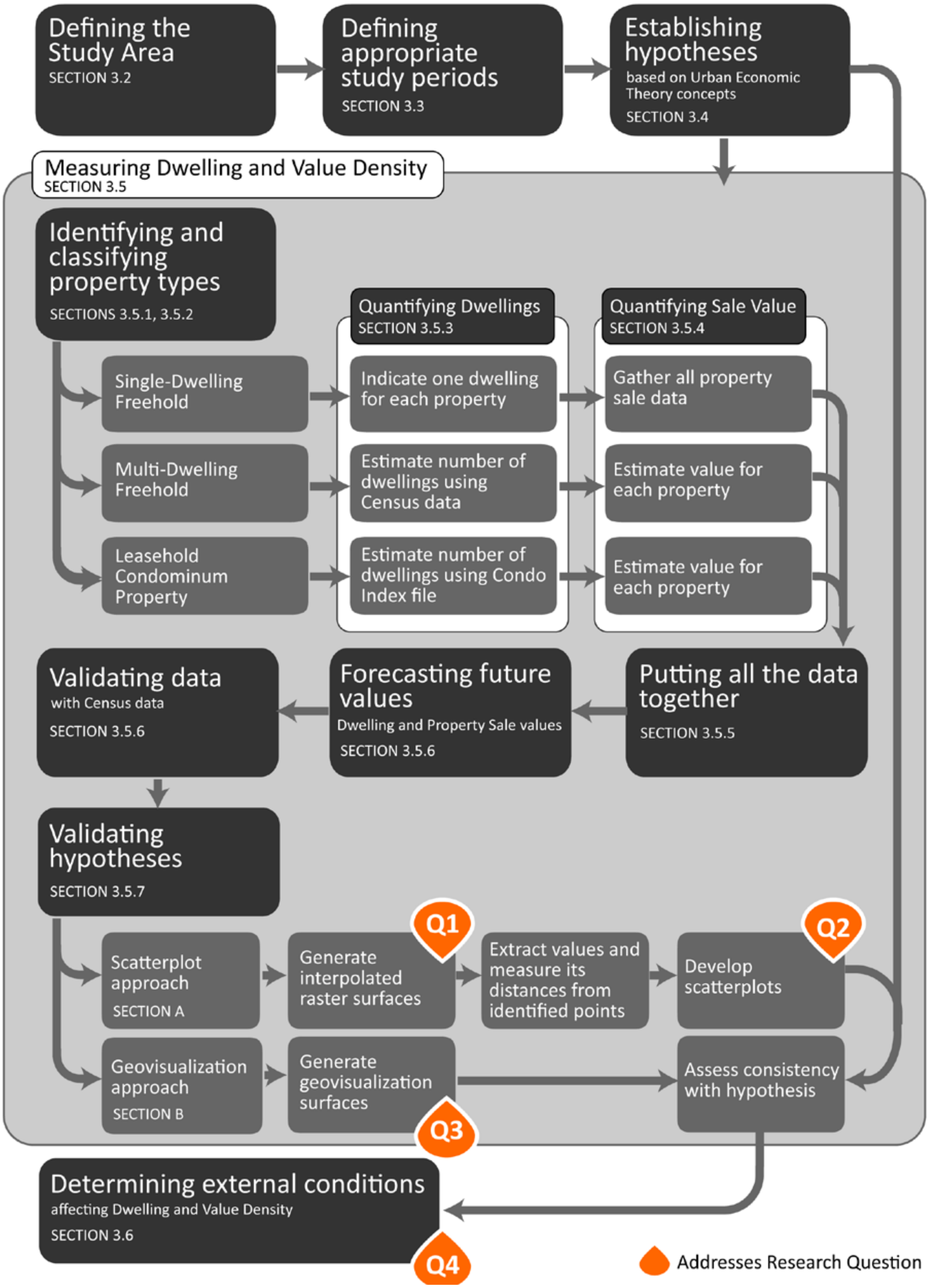
3. What opportunities exist through the use of graphical solutions to better communicate these Value Density and Dwelling Density effects over time?
4. What other factors may be contributing to the current state of redevelopment along the corridor?

From these outlined research questions, Section 6.2 discusses how each identified goal and research question was accomplished. Section 6.3 summarizes the chief conclusions presented from this thesis study. Finally, Section 6.4 explains opportunities for future research that builds upon the shortcomings of the current research and also to expand the research to other methods as a means to uncover more about the given Study Area.

6.2 Accomplishment of goals

Each step in the methodology has a specific aim to answer the specified research questions. This section briefly describes the methodological process that led to the accomplishment of the research goals, namely the response to the research questions. Figure 6-1 presents a methodological flowchart of this research thesis and how it responds to the four identified research questions.

Figure 6-1: Thesis methodological flowchart and its relationship to answering research questions



i. Addressing Question 1

With the objective to examine the changes in Dwelling and Value Density of surrounding residential properties before and after the Sheppard subway (see Question 1), dwelling and sales data for all properties in the Study Area were obtained and computed as appropriate to develop interpolated raster surfaces for Dwelling and Value Density for each of the identified Analysis Years. Based on the interpolated raster surfaces, it was concluded that Dwelling and Value Density have certainly increased from 1991 to 2006 in key areas within the Study Area. Specifically, the areas along the Yonge Street corridor (see the North York Centre Secondary Plan boundary in Figure 4-4) and at the Bayview Station Area made up the vast majority of the Dwelling and Value Density increases in the Study Area. These results were consistent with findings from Census data, given that the only Census Tracts demonstrating a notable increase in the number of dwellings and households were those located in the same areas identified as showing increases in Dwelling and Value Density.

ii. Addressing Question 2

Secondly, in order to examine possible relationships between Dwelling and Value Density and distance to a rapid transit station or to major development nodes (see Question 2), sets of sample points were identified and established in *ArcGIS* based on two levels of analysis: the macro-level analysis and the station-level analysis. The station-level analysis examines the spatial variations in Dwelling and Value Density for each Analysis Year as a function of distance to rapid transit stations, while the macro-level analysis studies the variations in Dwelling and Value Density as a function of distance to identified major activity centres (see Section 4.2.8 Part A for details).

The established macro-level and station-level sample points (see Figure 4-14 and Figure 4-15) were used to extract the Dwelling and Value Density values based on their location on the interpolated raster surfaces. By measuring the distances between the sample points to their closest stations and to identified nodes, scatterplots were generated by placing the respective distances to nodes and stations on the independent X-axis and Dwelling/Value Density values in the dependent Y-axis.

From the generated scatterplots, it was concluded that the North York Centre node delivered results consistent with urban economic theory, as there is a strong propensity for both Dwelling and Value Density to rise with proximity to North York Centre (see Figure 5-13 and

Figure 5-15). However, the increase in Dwelling and Value Density with proximity to the CBD (see Figure 5-14 and Figure 5-16) was not as apparent as the results for North York Centre—especially as the peak in Dwelling and Value Density occurred reasonably far away from the points closest to the CBD within the Study Area.

The Dwelling and Value Density results for North York Centre are consistent with the hypothesized results based on urban economic theory and demonstrate that it is a major driver in residential intensification and value appreciation in the Study Area. While the results for the CBD were not consistent with the established hypotheses, it is still recognized as a major driver in residential development in the Study Area. The strong subway connections within the Study Area to the CBD are a strong attributor to the increases in Dwelling and Value Density in the four Analysis Years, because the progress for intensification and redevelopment in the Study Area would likely not have occurred to the same extent without the continued prominence of the CBD.

In the station-level analysis, established planning policies have limited or altered the anticipated results based on urban economic theory. Dwelling and Value Density increased significantly in 4 of the 7 identified Station Areas[15] from 1991 to 2006; the observed values did not gradually decrease from the station. Given this conclusion, it is stated that the findings from the station-level analysis do not entirely support the anticipated results described in Section 4.2.3.

It must be noted that no assertions can be made about any specific causal relationships related to the changes in Dwelling and Value Density as a direct result of the construction of the Sheppard subway. To demonstrate causality requires normalizing for other possible contributing factors to Dwelling and Value Density. Unfortunately, Section 3.5.8 revealed the high cost of obtaining structural information at the property parcel level and the difficulty in fulfilling the requirement for accounting for all other factors affecting dwelling supply and property values to demonstrate causality. For those reasons, the investigation of causal relationships was deemed beyond the scope of this thesis project.

[15] The remaining 3 Station Areas are expected to experience increases in Dwelling and Value Density in the near future (see Section 5.2.1 Part D)

iii. Addressing Question 3

Thirdly, to explore the use of graphical solutions to better present Value Density and Dwelling Density effects over time, two methods are executed: (1) the Raster Method and (2) the ArcScene Method. The Raster Method uses *ArcGIS Raster Math* tools to calculate on a raster cell-by-cell basis, the changes to Dwelling and Value Density between two specified Analysis Years. Meanwhile, the ArcScene Method takes the developed interpolated surfaces and extrudes it along the vertical Z-axis—thus generating a 3D model surface of Dwelling and Value Density. The height of each raster cell is scaled based on the degree of the Dwelling or Value Density value of that raster cell.

Based on the outputs from both methods, it is concluded that the Raster Method generated a host of new maps without adding much value to the objectives of the research. The information generated by the Raster Method map could be achieved simply by making visual comparisons between the initial raster maps generated by spatial interpolation.

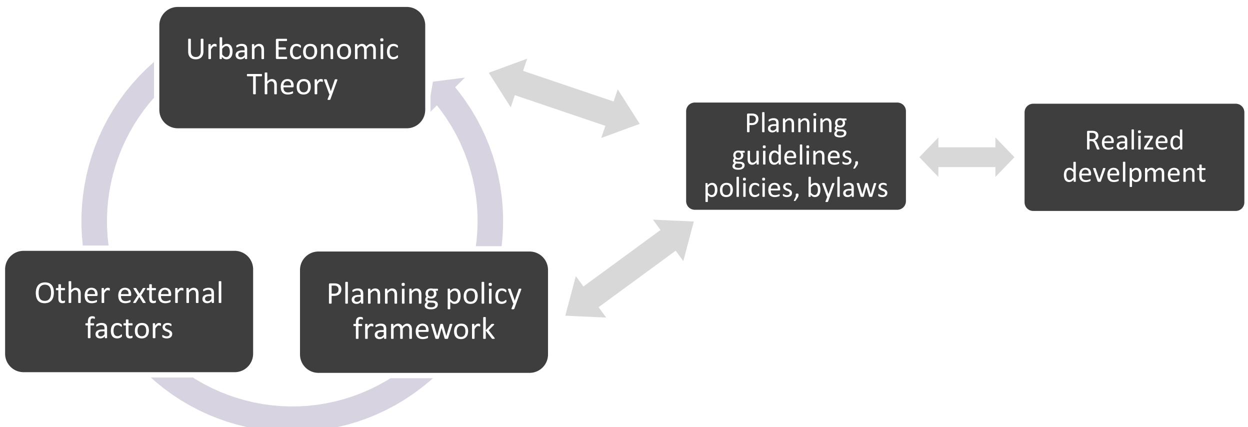
On the other hand, the outputs from the ArcScene Method proved to be very useful as it takes the quantitative dimension of flat raster surfaces and extrudes them to scale according to the value associated with that raster cell. The ArcScene Method is a simple and effective graphic development solution to communicate the fundamental elements of this research in a clear way that can be easily understood by people of a diverse range of educational backgrounds.

iv. Addressing Question 4

Lastly, the final research question is to determine whether other factors may be contributing to the current state of redevelopment along the corridor. Based on the planning policy analysis in Section 5.3, it was recognized that the observed results were more consistent with planning policies and less to do with the principles of urban economic theory.

While the urban economic theory certainly contributed to the kind of development that is realized today, the nature of today's urban development is assisted by guiding planning policies. Meanwhile, the guiding planning policies are often developed in response to pressures which sometimes are based on urban economic theory. While the relationships between the planning policy framework and urban economic theory are interlinked, ultimately it is the planning policies that bring about the development realized today. Figure 6-2 presents a relationship diagram between the forces of urban economic theory; planning environment and planning bylaws guidelines; and the realized development.

Figure 6-2: Theoretical model of the link between urban economic theory and the planning policy environment



To test whether planning policy influences or possibly goes against the forces of urban economic theory, the discrepancies between the anticipated results (based on urban economic theory) and the observed results were noted and relevant planning policies were reviewed. It is concluded that many of the observations that were inconsistent with urban economic theory can be attributed to planning policies outlined in the City of Toronto Official Plan and pertinent Secondary Plans. Thus, the nature of the development is very much shaped by the planning policies and less to do with the effects explained in urban economic theory concepts.

6.3 Chief conclusions

There are four chief conclusions that can be made in this thesis. They are briefly described below.

i. Sheppard subway demonstrate only modest increase in intensification and property value within observed Analysis Years

The interpolated surfaces, scatterplots, and visualizations show only a modest increase in Dwelling Density and Value Density in the areas along the Sheppard subway from Bayview to Don Mills Station. The Bayview Station Area accounts for almost all of the Dwelling and Value Density increases along the unique section of the Sheppard subway corridor within the four identified Analysis Years. While only modest increases are evident, it is important to note that only a four-year time span exists between the opening of Sheppard subway corridor (November 2002) and the latest observed Analysis Year (up to December 2006). Thus, it is premature to make solidly conclusive statements about the modest increases in Dwelling and Value Density, especially as more residential development is slated at all Station Areas along the corridor. For example, based on the forecasted figures in Dwelling and Value Density (see Section 5.2.1 Part D), a master-planned development by developer *Concord Adex* at the Leslie and Bessarion Station Areas will add 4,500 condominium and townhouse units to the corridor, of which 850 units are under construction as of March 2010 (City of Toronto, 2009b; Harness, 2008b). Another developer, the *El-Ad Group* is expected to bring significant change to the Don Mills Station Area—with plans to replace over 550 existing rental units with a total of 3,300 new condominium and rental units (City of Toronto, 2007b; WZMH Architects, 2007). Currently the 550 replacement rental units are under construction as of March 2010. While the confirmed construction of these replacement rental units yield no increase in residential units in the Don Mills Station Area, the developer's direct investment to replace current rental units demonstrates that it has strong intentions to implement the remaining parts of its redevelopment plan.

ii. North York Centre is a node within a polycentric region

The Dwelling and Value Density scatterplots in each of the four Analysis Years demonstrate peaks close to the node centre at Mel Lastman Square and decline sharply 1-2 km from the centre. The results from the interpolated raster surfaces (see Figure 5-11 and Figure 5-12) demonstrate a conceptual spatial structure organized by a set of concentric elliptical (rather than circular) rings with its length along Yonge Street with the centre of the ellipsis at Mel Lastman Square. This demonstrated conceptual spatial structure is coherent with identified hypotheses in Section 4.2.3, which states that Dwelling and Value Density will peak at the Mel Lastman Square and steadily decline concentrically outward.

The observed high Dwelling and Value Density at North York Centre, in conjunction with the amenity-rich nature of the area, classifies the area as an identifiable node within a polycentric region. This is also affirmed by the designation of the North York Centre (see Section 4.1.2) as a principal Metropolitan Centre in the Metro Toronto multi-centred growth plan, and later adapted in the official plans of the City of North York and the amalgamated City of Toronto.

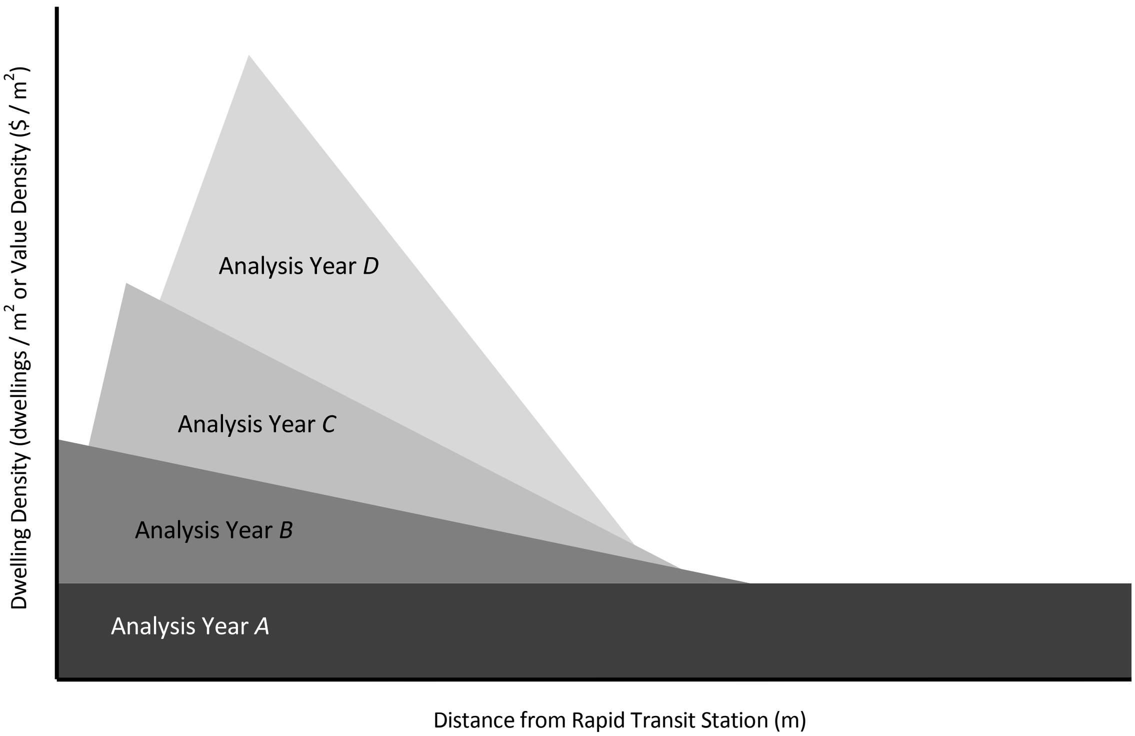
iii. There exists a relationship between planning policy and the forces of urban economic theory

Figure 6-2 illustrates that the forces related to urban economic theory and planning policy are intertwined. Planning policies are established to promote or control, for example, certain forces led by urban economic theory (i.e. zoning bylaws permits only low-density residential within a major transportation hub), and conversely urban economic theory forces react to specific planning policy (i.e. demand for land increases with a transportation improvement). Despite the recognition of this relationship, it is planning policies that ultimately guide a city's development, which may promote or defy the forces of urban economic theory. This conclusion was validated when identified Dwelling and Value Density observations inconsistent with urban economic theory were explained by established planning policies and guidelines, for instance:

- the observed peak in Dwelling and Value Density does not occur at or close to Bayview Station because secondary plan policies encourage the highest density development adjacent to Highway 401, about 300 m away from Bayview Station
- the urban spatial structure of North York Centre is not organized by concentric circles but by concentric ellipses because secondary plan policies allow high-density development to occur within around 350 m from the Yonge Street corridor
- the anticipated increase in Dwelling and Value Density as a result of improved accessibility from the Sheppard subway did not occur at all stations because, for instance, planning policies and processes may have slowed or prohibited its redevelopment progress such as the Parkway Forest redevelopment at the Don Mills Station Area

Given these findings, Figure 6-3 shows a revised conceptual area scatterplot based on overall observed Dwelling and Value Density increases over time within the Study Area. Compared to the Figure 3-7, it is still expected that Dwelling and Value Density will increase over time, but the peak is more likely to occur close to, but not precisely at the point closest to, a rapid transit station.

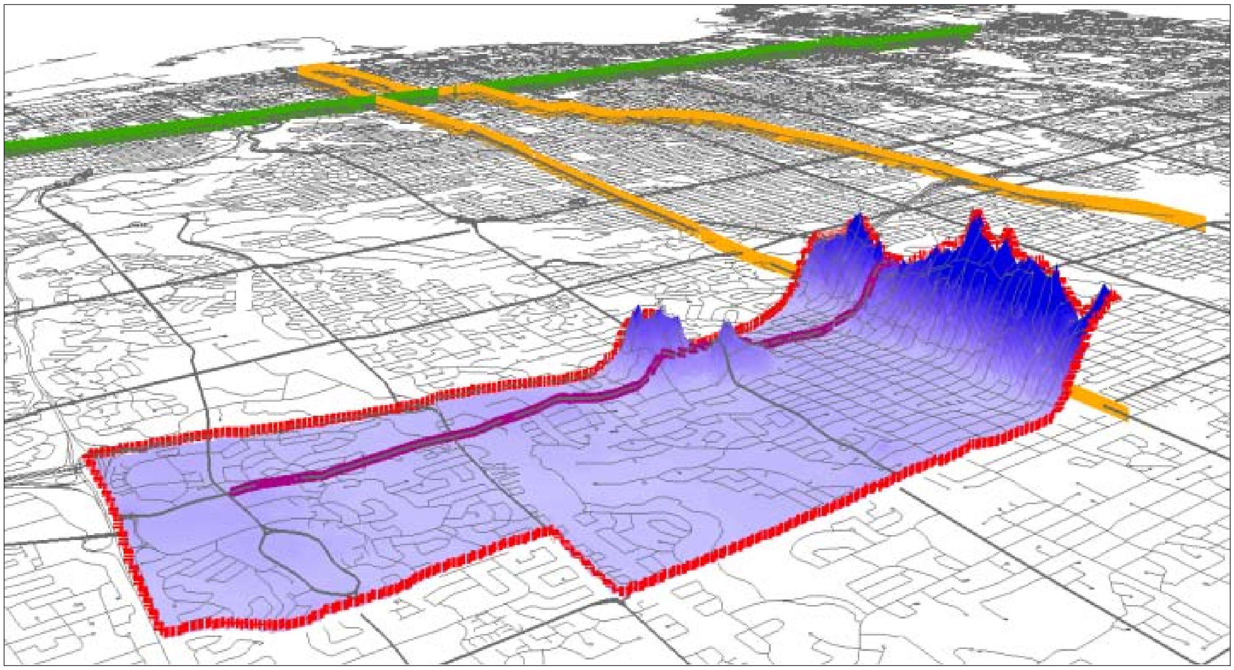
Figure 6-3: Revised conceptual area scatterplot based on observed Dwelling and Value Density increases in the Study Area



iv. 3D geovisualizations help to communicate concepts effectively

The 3D visualization functions, like the surfaces generated by the ArcScene Method, have the ability to extract the Dwelling or Value Density values embedded at each raster cell and extrude it to scale according to the value associated to the specific raster cell. The generated geovisualizations help build a stronger understanding about variations and trends in Dwelling and Value Density within the Study Area as well as between different Analysis Years. The geographic outputs from the ArcScene Method demonstrate how data can be organized from its many dimensions and presented it in a way that is meaningful to all types of users. Figure 6-4 illustrates a sample surface developed from the ArcScene Method.

Figure 6-4: Sample output from the ArcScene Method illustrating Dwelling Density in 2006



6.4 Recommendations for future research

6.4.1 Perform spatial interpolation analysis at a later date

The results based on the Dwelling and Value Density scatterplots demonstrated only a moderate change in Dwelling and Value Density at the Bayview Station Area and virtually no change for the remaining Sheppard subway Stations (Bessarion, Don Mills, and Leslie). This can be attributed mainly to the fact that dwelling and value data was available and analyzed only up to December 2006, only four years after the subway corridor began revenue service. Therefore, it is recommended that the process be replicated for future Analysis Years including 2011 and perhaps 2016 to observe if there are further signs of redevelopment and intensification particularly at the Stations Areas have yet to experience any signs of residential redevelopment and intensification. While future dwelling and sale values were projected in this thesis research (see Section 5.2.1 Part D) based on documented planning proposal documents and periodicals, the reliability and validity of the forecasted data is uncertain and its translation to reality is questionable—especially when proposed developments do not always come to fruition. Thus, there is tremendous value in assessing the changes in Dwelling and Value Density for future Analysis Years.

6.4.2 Measuring Population Density rather than Dwelling Density

The use of Dwelling Density as an observed measure was a convenient alternative to examine changes in population density within the Study Area because the data was readily available and inexpensive. While Dwelling Density is a different unit of measurement that does not equate to the measure of population density, the application of Dwelling Density adds value to the understanding of the spatial variations and temporal changes in residential intensification that is expected in the Study Area.

Some attempt was made in the initial planning stages of this thesis research to yield an assumed population density as a function of Dwelling Density. It was proposed that assumptions be made about the number of residents that were to reside in each type of dwelling, as it is more plausible for a larger property to house more residents than, for example, smaller condominium-type dwellings. However, the execution of this method was abandoned because it was considered to hold too many unsupported assumptions, and thus would yield questionable results.

In short, the best way to examine the changes in population density within the Study Area is to measure population density at the property parcel level. While Census data can uncover population density at the Census Tract and Enumeration Area/Dissemination Area levels, such aggregate data does not satisfy the data needs of the methodology.

One way to overcome this is to obtain survey data specifically with information on the characteristics of each household and the people residing in it. The use of this data can assist in the development of a population density figure at the property parcel level. One way to retrieve such data is by accessing the microdata files through the Southwestern Ontario Research Data Centre. In order to access such microdata however, a rigorous application and approvals process is required because these Research Data Centres, whose responsibility is to facilitate social research, must ensure that the highly sensitive data is used effectively and responsibly (Southwestern Ontario Research Data Centre, n.d.).

6.4.3 Examining rental housing data

The use of monthly rent as a metric to quantify residential development changes within the four Analysis Years would provide another valuable dimension to the research analysis. In the research, only actual (and estimated) residential sale values were observed, even though the likelihood of the sale of some properties being sold at each Analysis Year (e.g. Multi-Dwelling Freehold properties) is low. This inclusion of monthly rent as an observed measure was deliberated for the research, but unfortunately, it was difficult to obtain disaggregated historical monthly rents at the property level. While the Census does provide average rental prices at the Enumeration Area/Dissemination Area level, it is not detailed enough to generate the kind of density surfaces that was illustrated in Figure 5-11 and Figure 5-12.

If such data are obtained, it is recommended that a rent density measure be introduced to understand the changes in rent (normalized by the area of the unit or property) within the Study Area for each of the four Analysis Years. Based on the Census data analysis (see Appendix I), average monthly rent results changes in monthly rent over time is less responsive than property sale values; thus it is important to compare rent density within the Study Area with rent density outside of the Study Area. Similar to the anticipated results outlined in Section 4.2.3, rent density is expected to increase around Sheppard subway Station Areas throughout the four Analysis Years, but the North York Centre node will continue to draw a concentration of high rent densities.

6.4.4 Performing a survey about purchasing attitudes in the area

The objective of this thesis is to quantify the changes in Dwelling and Value Density of the housing stock before and after the construction of the Sheppard subway. While it was concluded that the Sheppard subway Station Areas are demonstrating some residential intensification and value appreciation, little is known about the actual decisions that led to the purchasing of a property along the Sheppard subway. Section 3.6 discussed the difficulties in empirically demonstrating the extent to which the Sheppard subway caused changes to Dwelling and Value Density within the Study Area over time. For instance, did the construction of the Sheppard subway cause an increased demand in residential dwellings in the area? Did the construction of the Sheppard subway heighten developer interest in this area? These questions could be revealed by carrying out a survey on the purchasing attitudes of current residents within an identified buffer area along the Sheppard subway. Specifically, the researcher could ask current residents about (1) the primary reasons for purchasing/renting their current property, (2) their current travel patterns to work and/or school, (3) their general travel patterns within the region (4) their transit patronage, particularly on the Sheppard subway, and (5) other reasons outside of convenient rapid transit access that led to their purchasing/renting of a property near the Sheppard subway.

6.4.5 Examining commercial properties

Smith, Gihring, & Litman (2009) cited a number North American examples where office rents, retail space rents, and the overall supply of commercial space increased before and after the completion of a rapid transit line. Like residential properties, commercial developments can also benefit from increased accessibility and potential decreases in transport costs (see Section 5.3). Consequently, it may be valuable to observe the changes in office rent and in commercial floor space during the same study horizon from 1991 to 2006.

If rent and floor space data can be obtained, it is recommended that two metrics be established to observe changes to commercial land use: total commercial floor space, and commercial rent density. Total commercial floor space is simply measured by a property's gross floor area in metres squared, while commercial rent density is measure by rent per square metre. It is cautioned that obtaining such data is a very difficult endeavour. As an alternative, it is recommended that in-person interviews be conducted with business owners, local employees, property management organizations, and commercial property owners, to understand how commercial development and its economics have changed over time within the Study Area

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Appendices

Appendix A:

Statistical 4est 3election 0rocess

> This appendix section is a supplementary discussion from Section 3.5.4 Part C. It discusses the application of the identified three options for estimating the total value of individual Multi-Dwelling Freehold Properties (MDF).

The *1-Sample T-Test* is a parametric test used to determine whether the population mean is equal to the test sample mean, assuming that the population is normally distributed. This test is also applicable despite not being normally distributed when sample sizes are greater than 30, provided the observations are collected randomly and the data are unimodal, continuous, and symmetric (Minitab Inc, 2003).

The *Wilcoxon Signed-Ranks Test* is considered a nonparametric equivalent of a *1-Sample T-Test*, (Triola, 2008). The test can be used to determine an estimated range of median values of the single population based on the samples and a specified confidence level. Lastly, the *Sign Test* is another nonparametric test used to produce a claim about the range of possible median values of a single population based on a specified level of confidence (Triola, 2008). The major difference between the *Wilcoxon Signed-Ranks Test* and the *Sign Test* is that the former requires that the distribution be symmetric, while the latter does not.

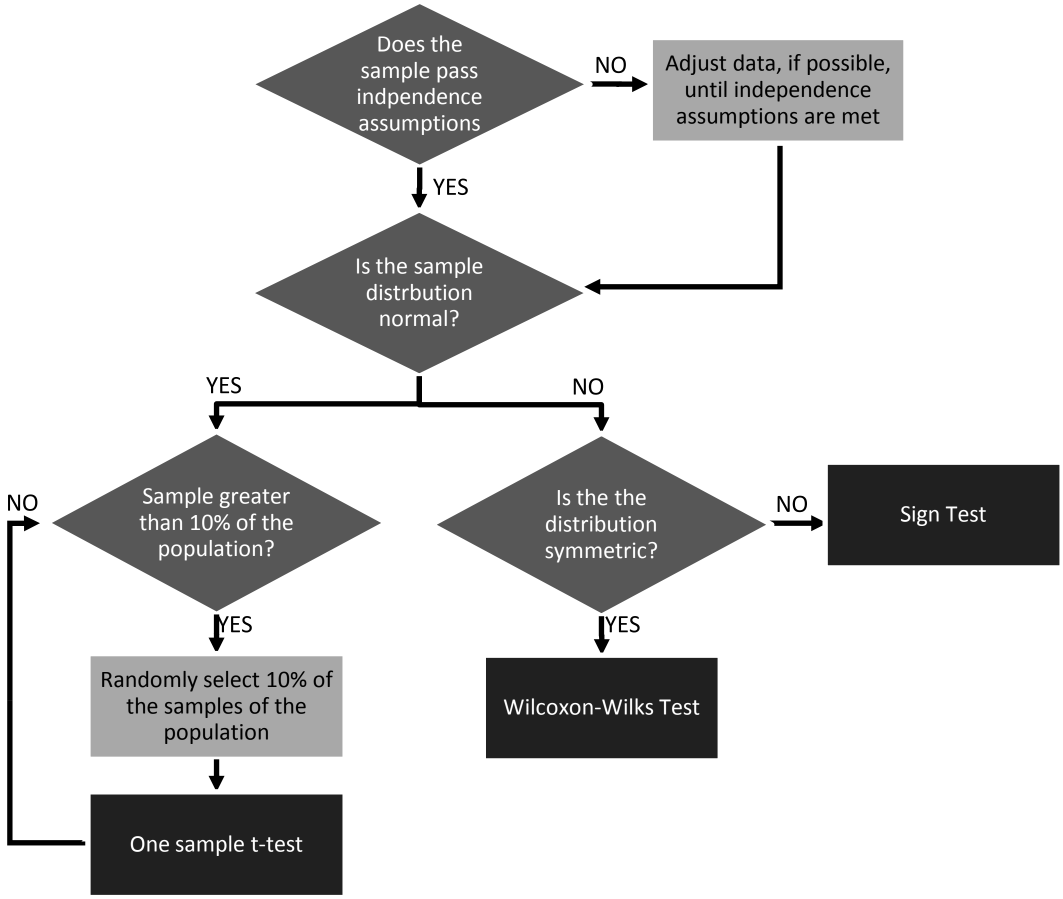
The decision to use which statistical test is based on four conditions. Figure A-1 is a matrix summarizing the assumptions that pertain to each statistical test.

Figure A-1: Assumptions for the use of the three statistical tests to construct a confidence interval of LCP populations. Adapted from Triola (2008).

		Applies to		
Assumption	**Description**	**T-Test**	**Wilcoxon Signed Ranks Test**	**Sign test**
Sample values are independent	Samples should be independent of one another; it may be difficult to check for independence by looking at the sample	✓	✓	✓
Sample is no more than 10% of the population	Samples larger than 10% may lead to the over- or under-representation of data in some areas, causing an independence problem	✓	✓	✓
Sample is randomly selected	Sample should be drawn randomly to achieve greater sample independence	✓	✓	✓
Sample distribution is normal or sample is greater than 30	Samples must either (1) come from a normal distribution or (2) is greater than 30 and is unimodal, continuous and symmetric.	✓		
Sample distribution is symmetric	Samples need not be normal, but the distribution must be symmetric		✓	
Sample distribution is nonnormal	Samples should not follow a normal distribution, otherwise, the more robust t-test should be used			✓

Earlier in this section, it was stated that the decision to use which statistical test is based on four assumptions in Figure A-1. A flowchart in Figure A-2 illustrates the detailed process to determine which statistical test to use for samples of each LCP for each of the four Analysis Years.

Figure A-2: Process taken to determine the application of which statistical test



The exercise of determining the range of central tendency was repeated for each Analysis Year for each LCP. For each instance, a 90% confidence interval is specified. Once the confidence range is computed, Equation 3-3 is applied accordingly.

Appendix B:

Estimating 4otal 6alue of Multi-Dwelling Freehold 0roperties

> This appendix section is a supplementary discussion from Section 3.5.4 Part C. It discusses the application of the identified three options for estimating the total value of individual Multi-Dwelling Freehold Properties (MDF).

Option 1: Line of best fit extrapolation

This option requires developing a trend line for value per dwelling as a function of time (expressed in years). The trend line is used to estimate the appropriate value per dwelling figure for each identified Analysis Year.

The first step in this method is to classify all the MDF sale value samples into three groups: (1) townhouse, (2) structures below five storeys, and (3) structures five storeys and up. From there, the sale value per dwelling from each of the three groups is plotted as a function of the year in which the property was sold. The average is taken when more than one sale occurred within a given year. If there are no samples in the given Analysis Year, a weighted average is taken from neighbouring years. The points are then connected chronologically to create a line of best fit;

the sale value per dwelling figure is extrapolated for each group in each Analysis Year. The sale value per dwelling figure is then applied to Equation B-1 accordingly.

Equation B-1: Estimating the value of a Multi-Dwelling Freehold (MDF) - Option 1

$$V_{i,j} = \overline{V}_{i,j} \times n$$

$V_{i,j}$: predicted value of the Multi-Dwelling Freehold property($)

$\overline{V}_{i,j}$: weighted average sale value per dwelling ($/dwelling) based on known MDF sales within a given Analysis Year (i) and a given MDF type (j)

n : number of dwellings in the MDF

Option 2: Leasehold condominium value substitution

This option assumes that an MDF's per-dwelling value is equivalent to the per-dwelling value of a comparable LCP. Under this method, an MDF is identified with a corresponding (or a series of) condominium units based on (1) exterior structural characteristics (e.g. type of dwelling, height of building structure, building materials used, etc) and (2) proximity to the identified property. Not all properties may be appropriately matched with an equivalent property based on the specified characteristics, and therefore, some discretion is required when executing this option.

After each MDF is matched, the average per-dwelling value used to value an LCP is then applied to the associated freehold property. Equation B-2 is applied to all MDFs in the Study Area under this option.

Equation B-2: Estimating the value of a Multi-Dwelling Freehold (MDF) - Option 2

$$V_{t_{i,j,k}} = \overline{V}_{i,j,k} \times n$$

$V_{i,j,k}$: predicted value of the Multi-Dwelling Freehold property($)

$\overline{V}_{i,j,k}$: average per-dwelling value ($/dwelling) of similar LCPs within a given Analysis Year (i) based on exterior structural characteristics (j), and proximity to the MDF property (k),

n : number of dwellings in the MDF

Option 3: Spatial interpolation and extrapolation

This method generates an interpolated raster surface based on a per-dwelling value of all MDF sales occurring in a given Analysis Year. Then a per-dwelling value is extracted for all MDFs based on its location relative to the study area. This method assumes that unknown values can be determined by its closeness to known sale values. By using *ArcGIS* spatial interpolation techniques, a raster surface is created based on the known sale values per dwelling in each of the specified Analysis Years. Once the interpolated surface is created, a value-per-dwelling figure is extrapolated for each unknown MDF based on its spatial location. From there, each figure is multiplied by the number of given dwellings within the property, as presented in Equation B-3.

Equation B-3: Estimating the value of a Multi-Dwelling Freehold (MDF) - Option 3

$$V_{i,j} = \bar{V}_{i,j} \times n$$

$V_{i,j}$	: predicted value of the Multi-Dwelling Freehold property($)
$\overline{V}_{i,j}$	: estimated per-dwelling value ($/dwelling) within a given Analysis Year (i) based on the spatial interpolation model (j)
N	: number of dwellings in the MDF

Evaluating the options

Once the values from all MDFs under are computed, the three options are evaluated based on how well the computed values compare to the properties that have actual sales values. Naturally the selected option is one that generates values that are closest to the actual sales figures. However, it should be noted that the estimated figures computed from Options 1 and 3 will most likely present the closest figures due to the self-fulfilling nature of the estimation process. The estimated values are being extrapolated (and subsequently compared to) are the very sales points used for extrapolation. Nevertheless, one MDF valuation method is to be selected and their computed values are used for subsequent analysis.

Appendix C:

Summary of . eighbourhoods in the Study Area

This appendix section is a supplementary discussion from Section 4.0. It provides a brief summary of the distinct neighbourhoods in the Study Area.

North York Centre

(Global Photos, 2003; Pictometry International Corp., 2009)

- Subarea of the Willowdale community
- Area of major transformation from a traditional town main street to a centre of commercial and residential towers
- Narrow strip area with a grid street pattern with a converted ring service roads along its [perimeter

Willowdale

(Canadian Real Estate Association, n.d.)

- Housing stock largely built in the late 1940s to 1960s
- Expansive lots on quiet, tree-lined gridded streets
- Large demolitions of previous post-war bungalows (left) to larger two-storey mansions (right) since the 1990s (Toronto Life, 2009)

Kenaston Gardens

(Canadian Real Estate Association, n.d.; Pictometry International Corp., 2009)

- Subarea of the Bayview Village community
- Experiencing tremendous redevelopment from once post-war bungalows to highrise condominium units
- Podium supported highrises that brings structure to the curvilinear street pattern (right) (Toronto Life, 2009)

Bayview Village

(Canadian Real Estate Association, n.d.)

- Housing stock largely built in the 1960s, with some redevelopment on ravine-adjacent lots
- Expansive lots with tree-lined curvilinear streets
- Consists mainly of ranch-style brick bungalows (left) or split levels homes (right) (Toronto Life, 2009)

Henry Farm

(Canadian Real Estate Association, n.d.)

- Housing stock mainly from the 1960s
- Expansive lots with tree-lined curvilinear streets
- Consists primarily of bungalows and two-storey homes with brick veneer facades on the ground floor and aluminum siding on the second storey (left)(Maple Tree Publishing, 1999)

Don Valley Village

(Canadian Real Estate Association, n.d.; Krawczyk, 2008)

- LeCorbusier-style tower apartments (left) built in the 1960s and 1970s dominate along the Don Mills Road corridor (Toronto Life, 2009)
- Off-corridor areas consist largely of bungalows and two-storey homes (right)

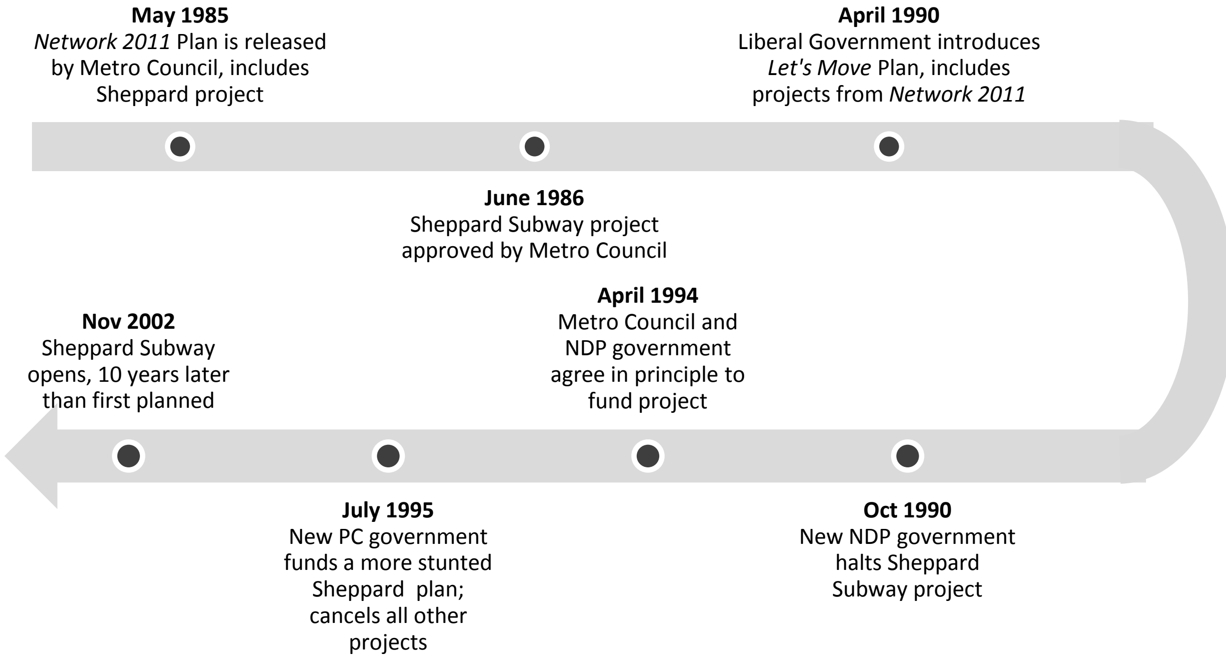
Appendix D:

Sheppard Subway Planning Policies

> This appendix section provides a more comprehensive description of the planning policies and events that led to the funding, construction and completion of the Sheppard subway project. Refer to Section 4.1.1 for the summarized version in the thesis body.

The planning process leading up to the funding and construction of the Sheppard subway was an arduous process dating back to as early as 1985. This section provides a brief summary of the planning and political events that led to the eventual opening of the Sheppard subway in 2002. Figure D-1 provides a brief illustrative summary.

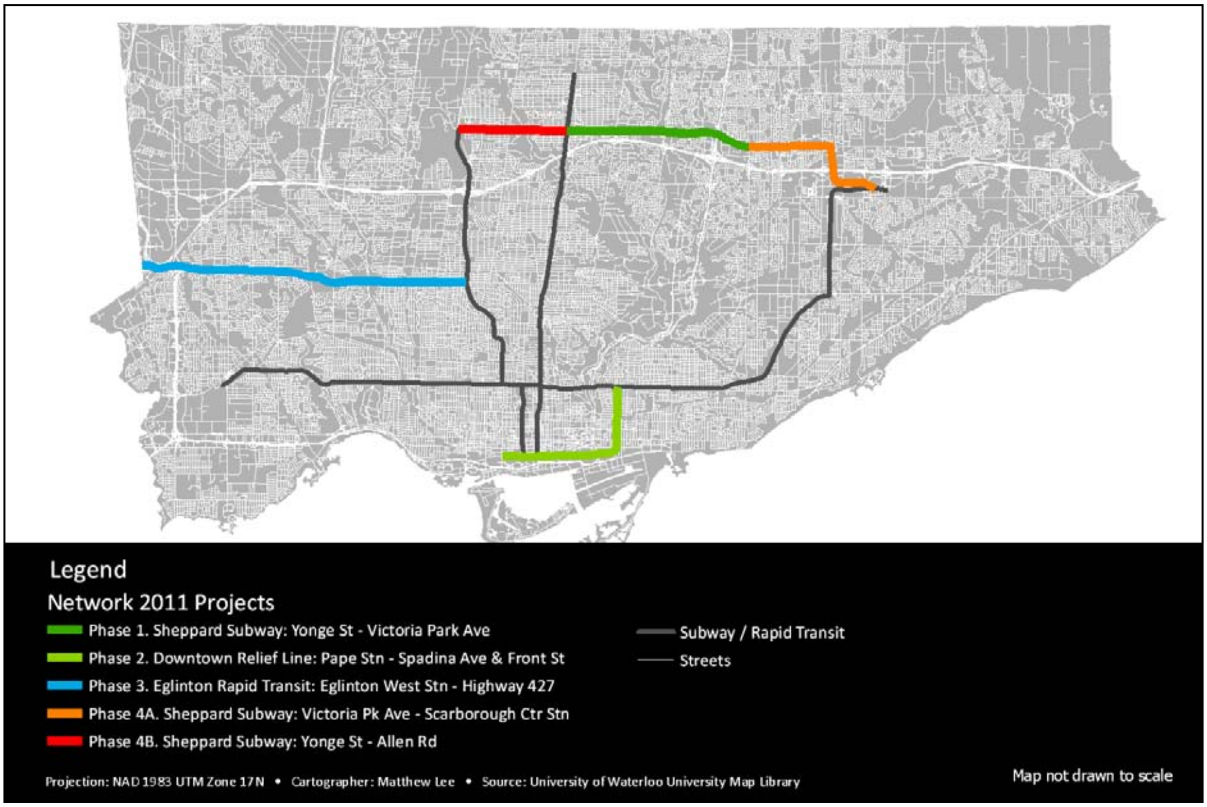
Figure D-1: Timeline of major planning events of the Sheppard subway project



In May 1985, the now defunct Metro Toronto regional government ("Metro"), along with the Toronto Transit Commission (TTC), released a landmark planning report dubbed *Network 2011* aimed at accommodating population growth in Downtown Toronto and the emerging suburban centres in neighbouring North York, Scarborough and York municipalities. Figure D-2 shows the planned projects in Network 2011.

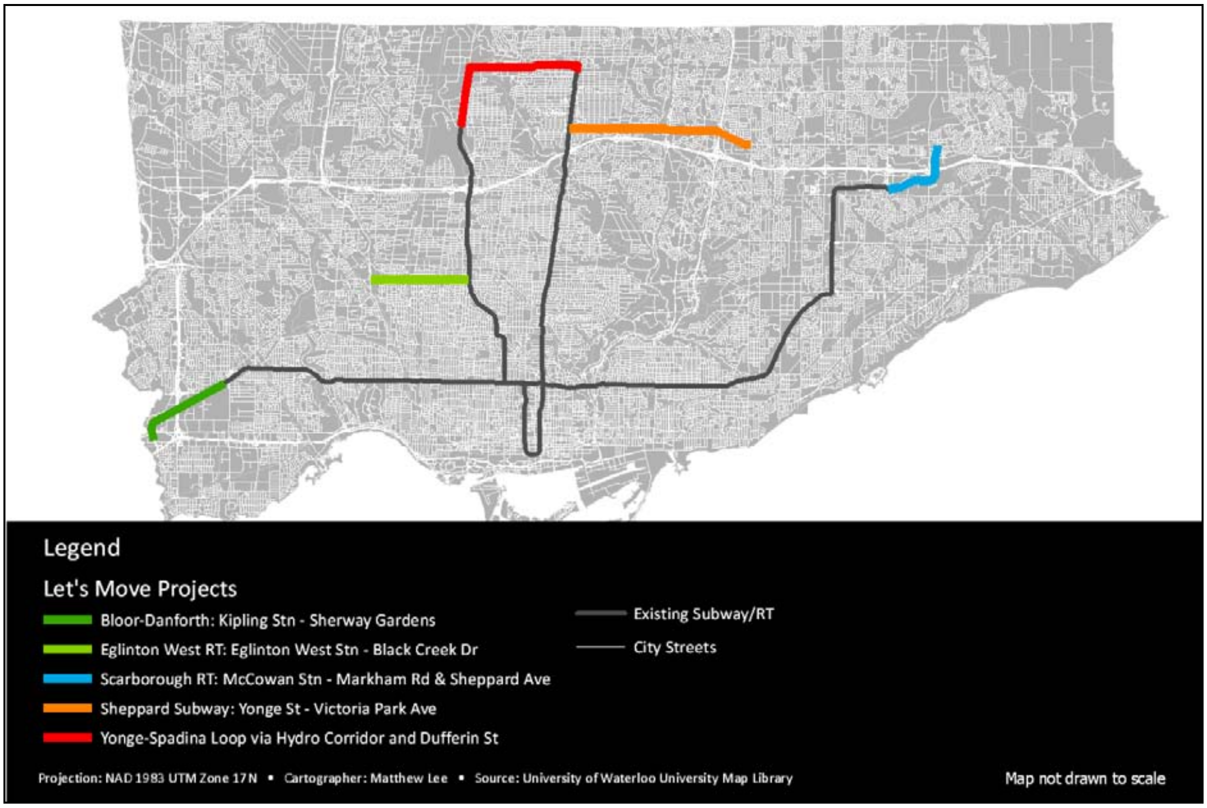
This 25-year rapid transit expansion plan was an amalgam of three distinct transit projects, which were to be implemented in four phases. Specifically, the report identified a segment of the planned Sheppard subway, from Yonge Street to Victoria Park Avenue, as the first phase in the transit network development with the aim to accommodate new traffic across the northern area part the metropolitan region (Kingwell, 1985). The planning of this primarily suburban subway service was unprecedented in Toronto. Despite the low levels of expected ridership patronage of this service (Baker, 1986a), Metro and TTC cited Sheppard subway's importance in spurring development in Metro's suburban regions (particularly North York Centre) and in providing convenience to transit riders located within and north of Metro (Kingwell, 1985).

Figure D-2: Planned transit projects in Network 2011



Network 2011, while approved by Metro council, could only materialize with the assumption that the Ontario Government contributes 75% of the construction cost, as well as 16% of its operating cost (Baker, 1986b). Unfortunately, due to a number of reasons including strong municipal polarization regarding the prioritization of routes, there was no provincial funding commitment until April 1990 when the Ontario government introduced a regional-scale transit investment plan called *Let's Move*. The new plan, which appeared much less bold than Metro's *Network 2011*, was much more expansive in its geographic reach. Projects included not only subway expansion (such as Sheppard) in Metro, but also the introduction of bus transitways in Mississauga, and the expansion of GO Transit services in regions outside Metro. See Figure D-3 for the planned projects in the Let's *Move* plan.

Figure D-3: Planned projects in Let's Move



Soon after the provincial commitment of *Let's Move* in 1990, the momentum was halted by a looming economic recession and rising political instability. In a course of six years, the province underwent three changes in government, and the Sheppard subway, among other projects from *Let's Move*, suffered through a series of funding announcements, project amendments, and cancellations. Over this time, however, effective lobbying by North York Mayor Mel Lastman helped to prevent the cancellation of the Sheppard Line in its entirety (Chow, 2009). Ultimately in July 1995, the newly formed government approved funding for Sheppard. However, throughout the course of its construction, the province introduced a number of cost cutting measures, including:

1. cancelling the construction of the segment from Don Mills Road to Victoria Park Avenue,
2. cancelling the construction of a station at Willowdale Avenue, and
3. cancelling the installation of planned automatic train control mechanisms and safety barriers on subway platforms (Chow, 2009).

The scaled-down nature of this once highly anticipated project has since been dubbed a "stubway," due to its short reach at only four stations. Nevertheless, despite continued budgetary complications and project modifications, the Sheppard subway took eight years to build and began revenue service on November 24, 2002 (Toronto Transit Commission, 2002). Since its opening, the Sheppard subway has been heavily criticized for its low expected ridership. However, it is experiencing steady increases over the past seven years, particularly during the weekday daytime periods (Toronto Transit Commission, 2007).

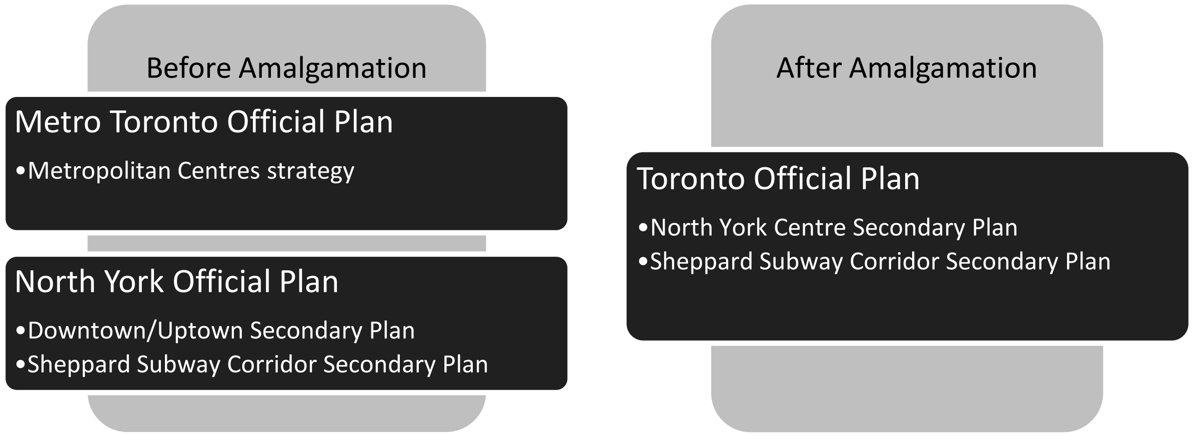
Appendix E:
Planning $ocuments 0ertaining to the Study Area

> This appendix section provides a more comprehensive description of the historical planning policies related to the identified Study Area. Refer to Section 4.1.2 for the summarized version in the thesis body.

There are three key planning documents which helped guide development within the Study Area. The first two documents, the Metro Toronto and North York official plans, were the key policies (1) in the creation of a North York city centre and (2) in the guidance of redevelopment and intensification of lands along the Sheppard subway corridor.

In 1998 however, the provincial government, through a municipal restructuring program, called for (1) the dissolution of regional government in Metro, and (2) the amalgamation of Metro's six local municipalities (including the City of North York) into a single municipal body called the City of Toronto. Since municipal reform, the new City of Toronto developed its own Official Plan by merging and refining the plans developed from its former municipalities. This section will discuss the relevant planning policies that pertain to the Study Area. Figure E-1 outlines the relevant documents before and after amalgamation.

Figure E-1: Planning documents governing the Study Area before and after Toronto's amalgamation



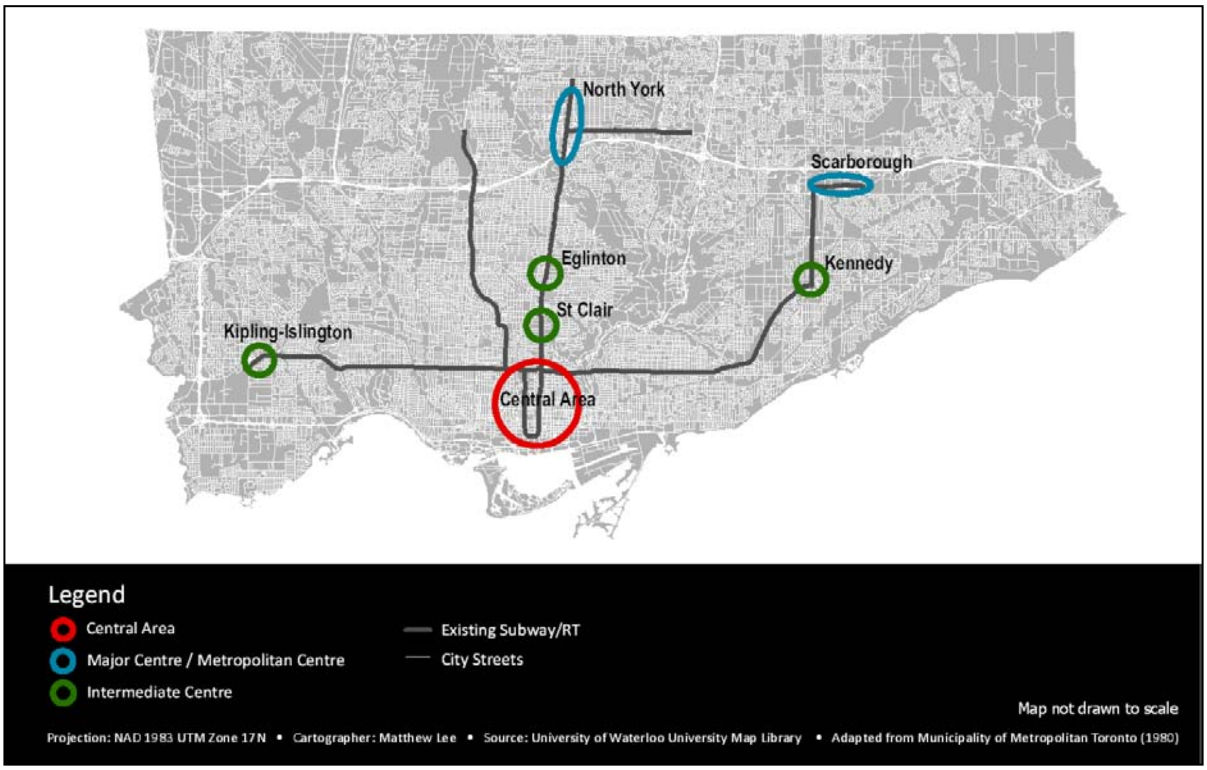
Metropolitan Toronto and North York official plans

The planning of the Sheppard subway dates back to around 1980 when Metro adopted a transformative Official Plan aimed at creating a multi-centred urban structure in the region. This plan was a direct result of the challenges in accommodating the influx of regional employment in the Downtown Toronto. Through this, Metro promoted a series of "deconcentration" measures called the *Metropolitan Centres* strategy to mitigate the "social and environmental impacts inherent in [the] continued reliance on a centrally oriented urban structure" (Municipality of Metropolitan Toronto, 1980, p. 25). The Metropolitan Centres strategy called for identification of key areas of intensification and/or strategic investment (Municipality of Metropolitan Toronto, 1980). The 1980 plan classifies these centres into three groups, each with a unique set of objectives. An area along Yonge Street in North York was identified as a Major Centre, mainly due to its already superior subway access from the Yonge-University-Spadina subway, as well as good expressway access from Highway 401. Table E-1 describes these identified centres in detail.

Table E-1: Types of Metropolitan Centres (Municipality of Metropolitan Toronto, 1980)

Name	Centres Identified	Description
Central Area	Downtown Toronto	• Provide continued focus for urban activity in the region • Uphold as the continued principal centre for employment, retail, government, communications, culture, and the arts
Major Centre / Metropolitan Centre	North York Scarborough	• Promote compact and pedestrian-oriented urban environments • Encourage a wide array of housing types • Support for retailing, institutional services, restaurants, employment, • Serve as transportation hubs for local transit
Intermediate Centre	Kennedy Eglinton Islington-Kipling	• Supports themes similar to Major Centres, but at a rate of intensity more suitable to its surroundings

Figure E-2: Location of Metropolitan Centres, adapted from Municipality of Metropolitan Toronto (1980)



Concurrently, the City of North York[1] developed a plan coherent with the objectives of Metro's multi-centred growth plan called the *Yonge Street "Centre" Strategy,* which provided a planning framework for the development of a "downtown" for North York. The impetus of moving forward with this strategy was threefold:

[1] Now dissolved into an amalgamated City of Toronto

1. to provide an increased stream of land development revenues as greenfield development becomes increasingly scarce,
2. to shed North York's image as a borough of Toronto to becoming a key player in the development of Metro Toronto economic region, and
3. to support the multi-centred urban structure policies outlined by Metro (City of North York, 1979).

It was through this initial designation of North York Centre as a *Major Centre* in the 1980 Metro plan and the work of the City of North York that sparked a catalyst for concentrated employment, dwellings, institutional and cultural uses into North York (Municipality of Metropolitan Toronto, 1980). In order to foster and sustain concentrated development at North York Centre, city planners recommended that it would require major improvements in the area's transportation capacity, and the funding for the Sheppard subway to connect North York and Scarborough was believed to achieve that goal (Municipality of Metropolitan Toronto, 1989).

In 1996, amendments were adopted to the City of North York Official Plan to include an Uptown/Downtown Secondary Plan, which provided specific schedules and policies shaping North York Centre as a regional activity centre. In addition, a similar plan was adopted for the Sheppard Avenue East corridor, as a means to better manage anticipated redevelopment as a result of subway construction (City of Toronto, 2007c, 2007d). Section 0 provides details about the specific policies for these two special planning districts.

City of Toronto Official Plan

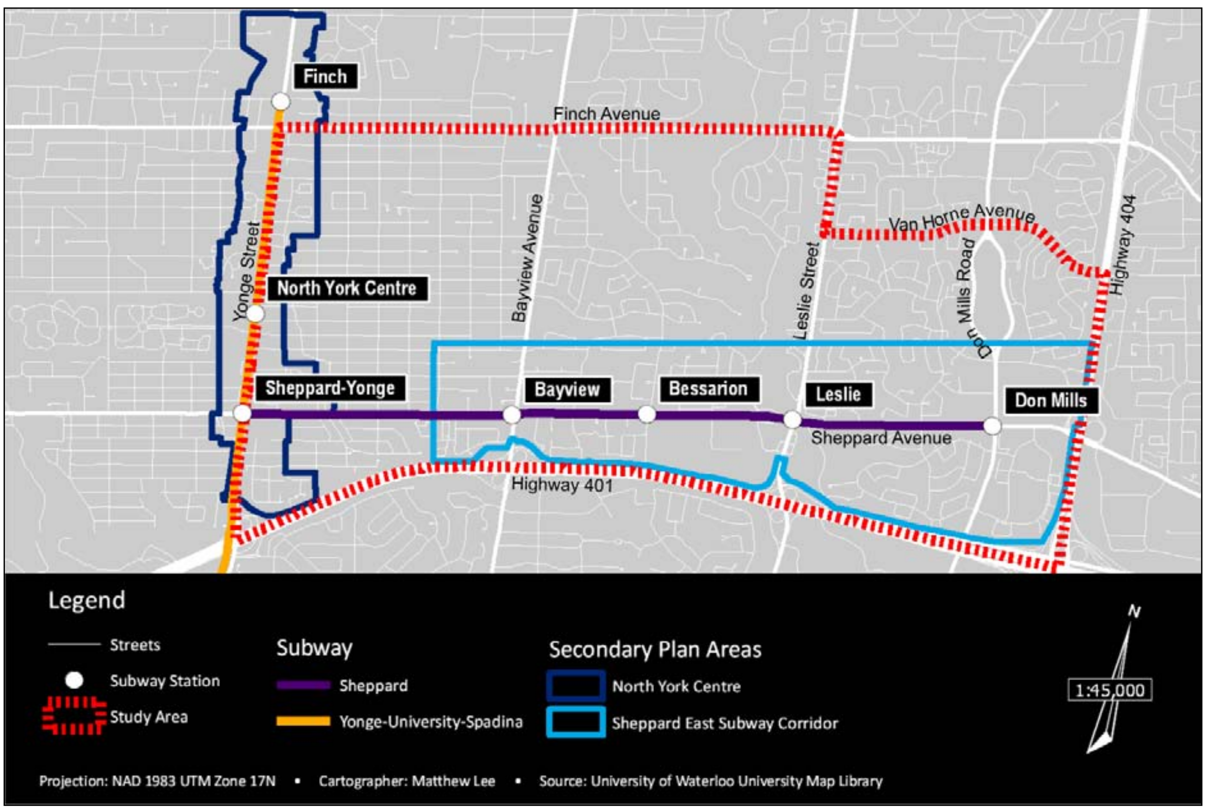
In 2007, the City of Toronto adopted a new Official Plan as a result of a municipal restructuring effort in 1998. This plan is considered revolutionary not only because it involves the task of amalgamating the official plans from six local and one regional government entities, but it also takes a uniquely prescribed approach to planning policy. During the new Official Plan's development, Abbate & Alphonso (2000) comment the city planners' committed to answering the question "what do we want and how to do we get there?"—rather than simply describing "what is."

Three specific sections of the new Official Plan are relevant to the Study Area; they include policies from (1) the North York Centre Secondary Plan ("NYC Plan"); (2) the Sheppard

East Subway Corridor Secondary Plan ("Sheppard East Plan"); and (3) the *Neighbourhoods* and *Apartment Neighbourhoods* designation.

The NYC Plan is bounded along a narrow strip on Yonge Street from Highway 401 in the south to Cummer Avenue in the North. The Study Area dissects the secondary plan area in half along Yonge Street. Meanwhile, the Sheppard East Plan is bounded at Highway 404 to the east, Highway 401 to the south, Wilfred Avenue to the west, and an arbitrary boundary about a half-kilometre north of Sheppard Avenue East. Lastly, the areas not identified by the two secondary plans are guided by the Neighbourhoods and Apartment Neighbourhoods policies in the planning document. Each of the designations is discussed in the following subsections.

Figure E-3: North York Centre and Sheppard subway Corridor secondary plan areas, adapted from City of Toronto(2007f)



North York Centre Secondary Plan

The origins of the North York Centre Secondary Plan ("NYC Plan") began as a framework policy strategy for the future development of a "borough centre." Included in the strategy document are elements typical of a secondary plan including (1) prescribed development forms, (2) infrastructure and service provisions, and (3) its relationship to the adjacent neighbourhoods (City of North York, 1992). Despite the plan having been transferred and embedded over the years into numerous planning documents as a result of planning reforms and municipal reorganization, the general intent of the secondary plan remains fairly consistent, with the exception of changes to the defined boundaries, anticipated employment numbers, and the planned road network.

The primary objectives of the NYC Plan, as stated in City of Toronto Official Plan (2002) are outlined in Table E-2.

Table E-2: Highlights from the North York Centre Secondary Plan (City of Toronto, 2007c)

Theme	Description
General intent	• Designate the area as important centre of activity for the city • Allocate major concentrations of employment and residents in the area
Access	• Capitalize on the superior rapid transit access to and from the area • Reduce car reliance through a progressive parking policy • Diffuse traffic along Yonge Street by continuing with initiatives through the construction of "ring" service roads
Area character	• Maintain a mixture of office, retail, service, institutional, hotel entertainment, residential and open space uses. • Identify the area as a preferred location for cultural and governmental uses
Urban Design	• Encourage continuous building frontages, and a grid pattern street network • Establish a comfortable human scale and create a sense of spatial containment • Ensure the livelihood of street trees
Relationship with stable areas	• Recognize existing *Neighbourhoods* adjacent to North York centre are to be protected, preserved and enhanced

Sheppard East Subway Corridor Secondary Plan

The Sheppard East Subway Corridor Secondary Plan ("Sheppard East Plan") was first adopted as an amendment to the City of North York Official Plan in 1996. Similar to the NYC Plan, the Sheppard East Plan was transferred to the new Toronto Official Plan in 2007. The purpose of the plan was primarily "to manage, direct, and ensure quality development in support of this significant public investment in rapid transit" (City of Toronto, 2007c, p. 1). Having said that, the City of Toronto developed this plan with the objective to generate increased transit ridership and "to support a revenue base from redevelopment to help underwrite [the high] levels of public investment" (Watty, 2001, p. 2).

The primary objectives of the Sheppard East Plan are outlined in Table E-3.

Table E-3: Highlights from Sheppard East Subway Corridor Secondary Plan (City of Toronto, 2007d)

Theme	Description
General intent	• Allow for greater densities near Highway 401, at major intersections and transit stations.
Access	• Capitalize on the rapid transit access to development nodes • Support transportation demand management techniques • Construction of a continuous east-west access road is explicitly not planned
Area character	• Allow for non-residential retail and office uses • Provide long frontages on Sheppard Avenue, Leslie Street, and Bayview Avenue • Identify development nodes for each of the station areas, each calling for the maximization of development potential
Urban Design	• Encourage the creation of street block pattern, while simultaneously calling for only minor changes to street network • Designate Sheppard Avenue as a pedestrian main street • Buildings set back from Sheppard Ave to allow for potential widening
Relationship with stable areas	• Recognize existing properties outside of the plan area to be protected as stable residential communities as discussed in the *Neighbourhoods and Apartment Neighbourhoods* policies

Neighbourhoods and Apartment Neighbourhoods designations

The neighbourhods within the Study Area not represented by (1) the NYC Plan and (2) the Sheppard East Plan are identified as what Toronto Official Plan calls the *Neighbourhoods* and *Apartment Neighbourhoods* designations. The City expressed strong planning objectives under these two designations to preserve the identified neigbourhoods as "stable residential areas" by "minimizing the unacceptable impacts of physical, economic, and environmental effects from the subway expansion" (Watty, 2001, p. 2). The primary policies of the Neighourhoods and Apartment Neighbourhoods are outlined in Table E-4.

Table E-4: Highlights from the Neighbourhoods and Apartment Neighbourhoods designation (City of Toronto, 2007b)

Theme	Description
Neighbourhoods	
General intent	• Designate areas that are physically stable areas and are made up of low scale buildings
Area character	• Reinforce the preservation of the physical character of neighbourhood, including street pattern, building types, building envelope dimensions, setbacks, lot sizes, etc. • Allow small-scale retail or office, so long as it is compatible to the area, as a means to provide local amenity
Intensification	• Discourage intensification in major streets
Apartment Neighbourhoods	
General intent	• Designate areas that are physically stable areas where significant growth is not anticipated
Area character	• Allows for sensitive redevelopment that improves existing conditions, including: improvements in shadow impacts, better transitions to low-density neighbourhods, street-level amenities, clear sightlines.
Intensification	• Discourages significant growth, but permits compatible infill development on a site containing an existing apartment, if it shows that it will improve the quality of life of local residents

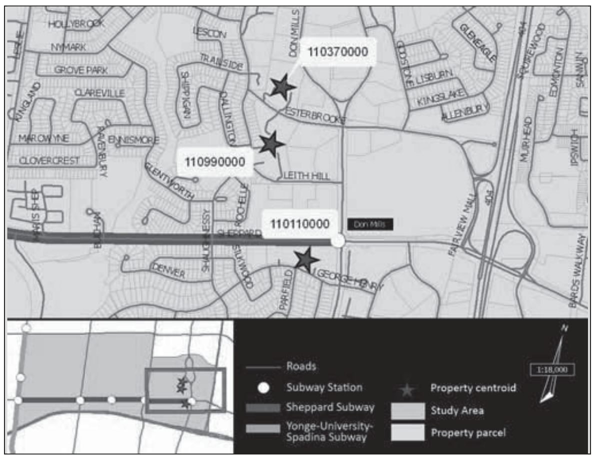
Appendix F:

Leasehold Condominium Property Estimates

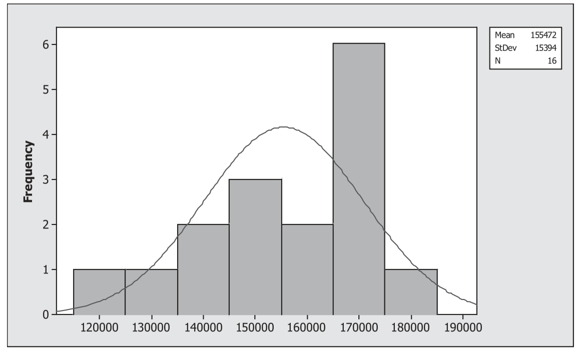
Don Valley Townhouse Cluster

BLOCK ID

11011/11037/
11099



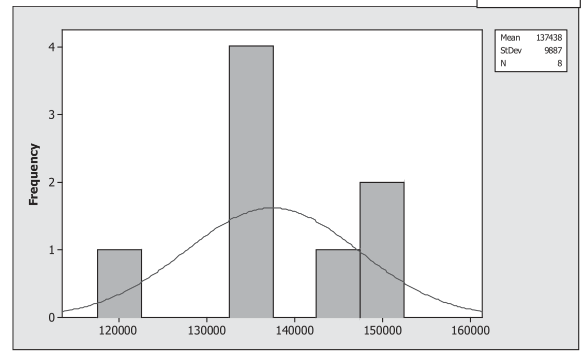
Municipal Address	11001	1700 Sheppard Avenue East
	11037	6-10 Esterbrooke Avenue
	11099	9-25 Esterbrooke Avenue, 9-25 Leith Hill Road, 125 Shaughnessy Boulevard
Community	Don Valley Village	
Property Type	Townhouse Leasehold Condominium	
Highrise Units	0	
Townhouse Units	11001	110
	11037	97
	11099	160
	Total	367
Year Erected	N/A	



1991

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

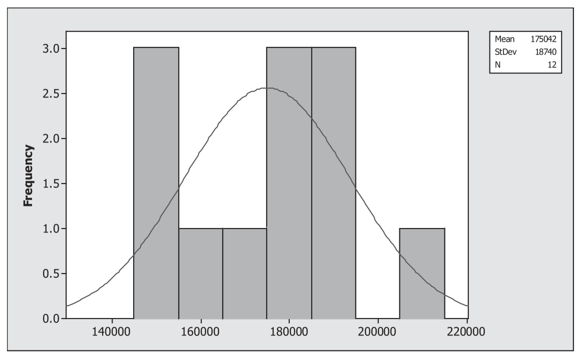
LOWER	MEAN/MEDIAN	UPPER
149937	162000	165342



1996

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

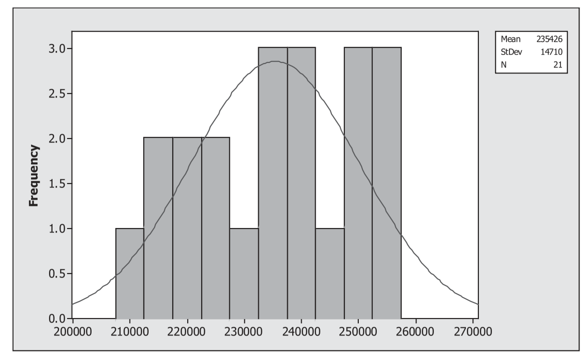
LOWER	MEAN/MEDIAN	UPPER
132660	135500	147039



2001

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
154900	176250	187100



2006

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

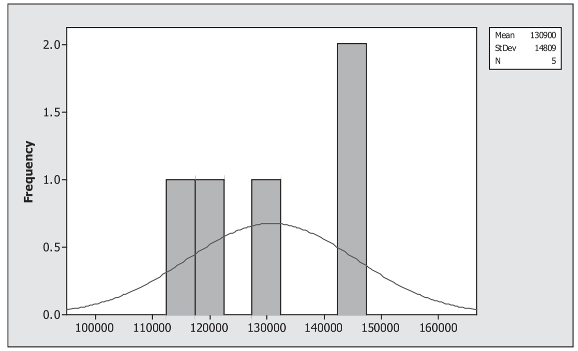
LOWER	MEAN/MEDIAN	UPPER
228633	236000	242020

5-7 Parkway Forest Drive, 2-194 Village Greenway (Highrise)

BLOCK ID
11016

(Krawczyk, 2008)

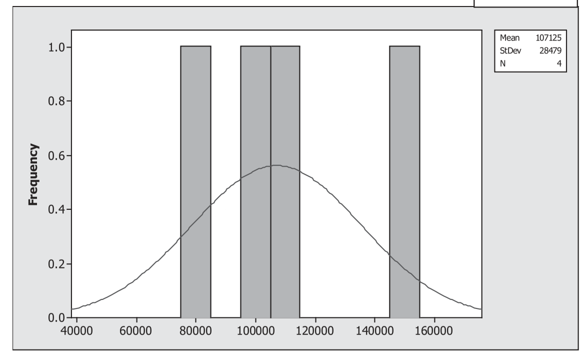
Municipal Address	5-7 Parkway Forest Drive, 2-194 Village Greenway
Community	Parkway Forest
Property Type	Highrise Leasehold Condominium Townhouse Surrounding
Highrise Units	299
Townhouse Units	100
Year Erected	1969



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 87.5%

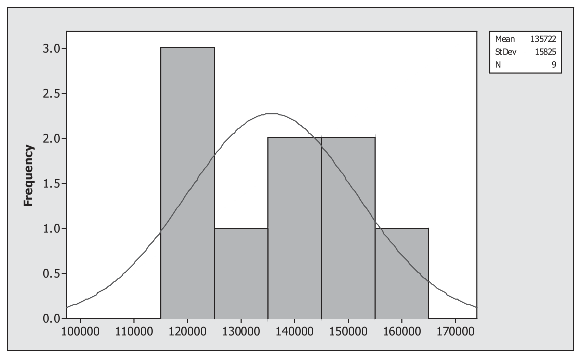
LOWER	MEAN/MEDIAN	UPPER
116412	128000	146618



1996

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

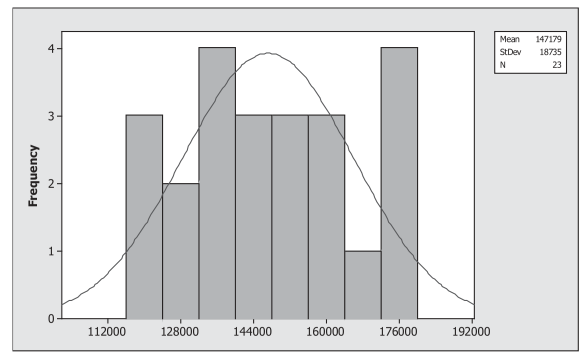
LOWER	MEAN/MEDIAN	UPPER
80000	101000	146500



2001

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 87.5%

LOWER	MEAN/MEDIAN	UPPER
119364	137000	148544



2006

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence IntervaL at 75%

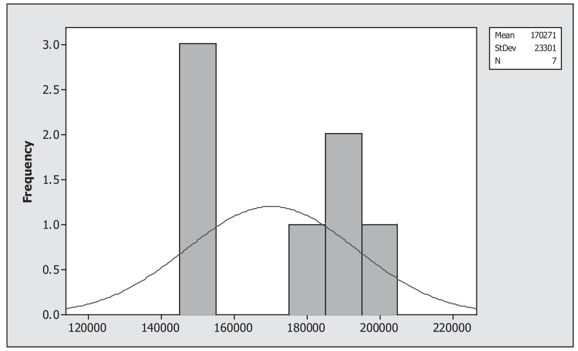
LOWER	MEAN/MEDIAN	UPPER
134167	145000	159529

5-7 Parkway Forest Drive, 2-194 Village Greenway (Townhomes)

BLOCK ID 11016

(Krawczyk, 2008)

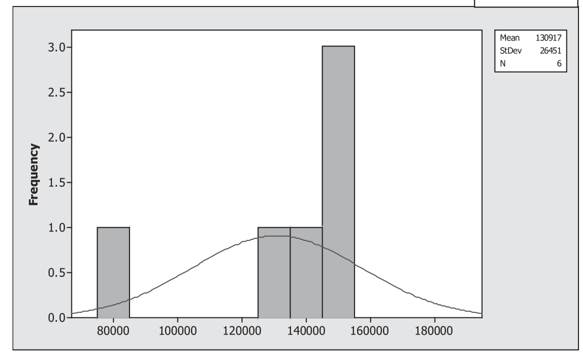
Municipal Address	5-7 Parkway Forest Drive, 2-194 Village Greenway
Community	Parkway Forest
Property Type	Highrise Leasehold Condominium Townhouse Surrounding
Highrise Units	299
Townhouse Units	100
Year Erected	1969



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

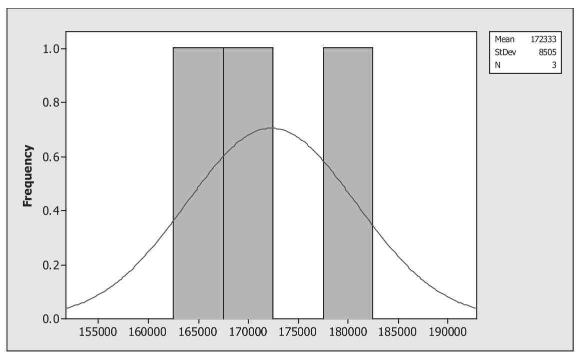
LOWER	MEAN/MEDIAN	UPPER
145000	175000	190466



1996

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

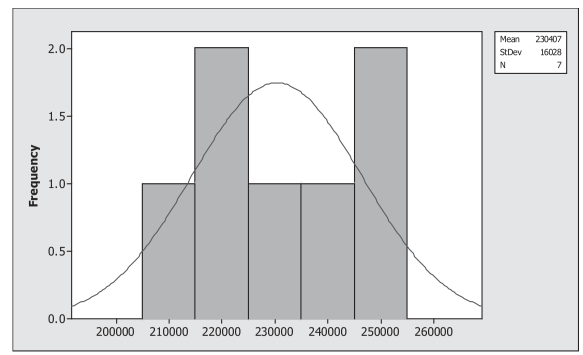
LOWER	MEAN/MEDIAN	UPPER
113446	142000	147399



2001

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 75%

LOWER	MEAN/MEDIAN	UPPER
164000	172000	181000



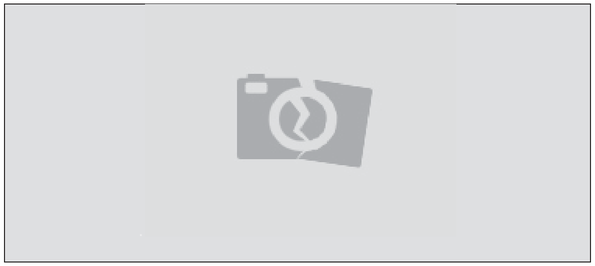
2006

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 75%

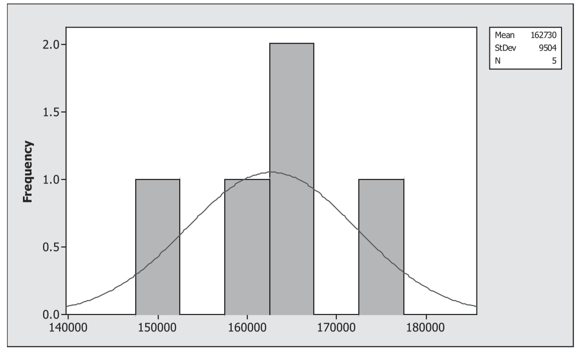
LOWER	MEAN/MEDIAN	UPPER
215812	226150	248282

Starway Townhomes

BLOCK ID
11024/11058



Municipal Address	11024	1-93 Capella Starway, 1-25 Cetus Starway, 1-20 Lepus Starway, 1-36 Nebula Starway
	11058	12-20 Capella Starway, 2-46 Corvus Starway, 1-7 Leo Starway, 1-19 Lyra Starway, 1-23 Ursa Starway, 1-23 Vega Starway, 2-49 Virgo Starway
Community	Parkway Forest	
Property Type	Townhouse Leasehold Condominium	
Highrise Units	0	
Townhouse Units	11024	72
	11058	95
	Total	167
Year Erected	N/A	

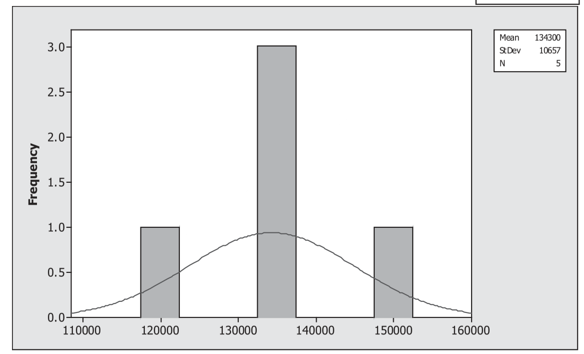


1991

Distribution Characteristics	Too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
152721	165000	171406

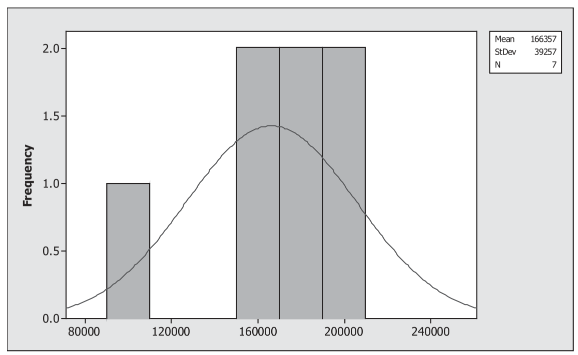


1996

Distribution Characteristics	Too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124412	134500	144529

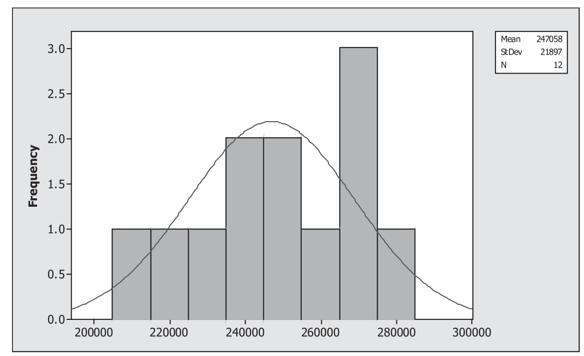


2001

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
149559	180000	193253



2006

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

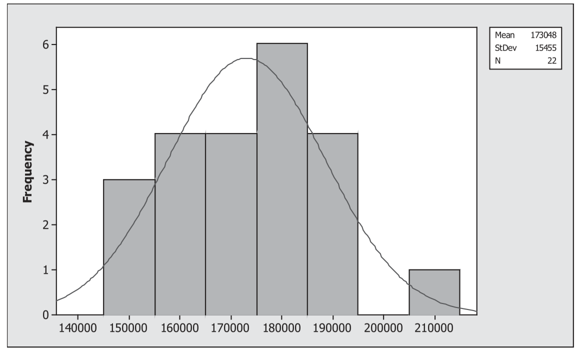
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
233803	247500	267360

Briarway-Vineway Townhouse Cluster

BLOCK ID
11064/11065/11116

Municipal Address	11064	2-119 Wild Briarway
	11065	1-118 Tangle Briarway
	11116	1-20 Curly Vineway, 1-91 Elsa Vineway, 1-58 Pepper Vineway, 1-144 Thorny Vineway, 2-164 Wood Vineway
Community	Bayview Village	
Property Type	Townhouse Leasehold Condominium	
Highrise Units	0	
Townhouse Units	11064	80
	11065	70
	11116	90
	Total	210
Year Erected	N/A	

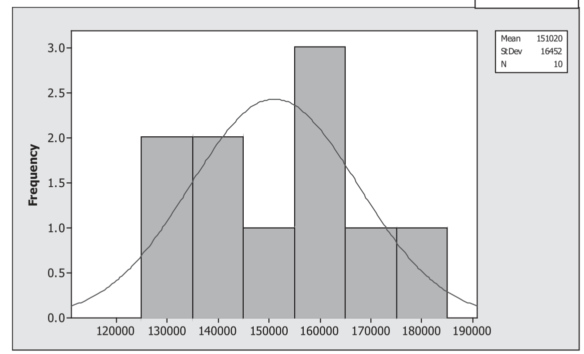


1991

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
164252	175750	180748

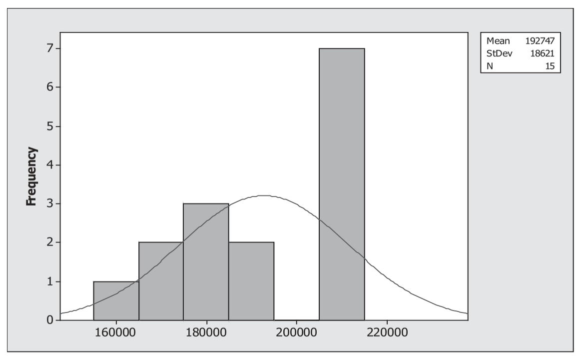


1996

Distribution Characteristics	Unimodal, too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
134971	155000	158339

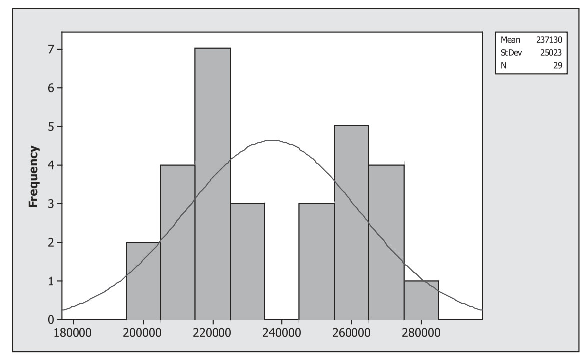


2001

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
176812	194000	208800



2006

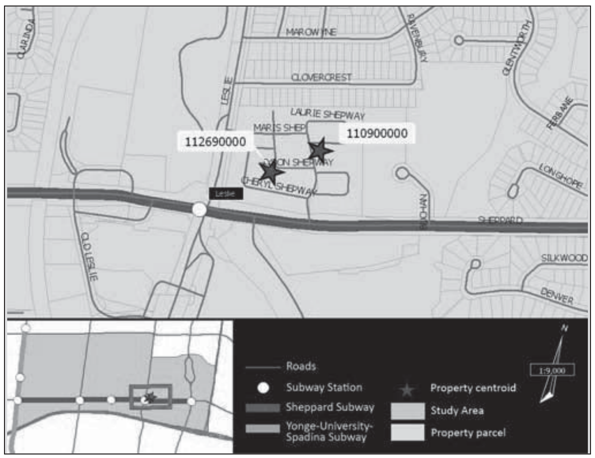
Distribution Characteristics	Bimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

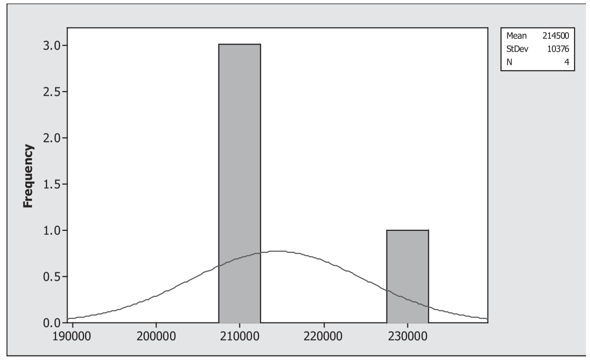
LOWER	MEAN/MEDIAN	UPPER
224269	228000	250978

Shepway Townhomes

BLOCK ID
11090/11269



Municipal Address	1-66 Carl Shepway, 2-85 Laurie Shepway, 75-89 Maris Shepway, 1-34 Yetta Shepway, 1-90 Cheryl Shepway, 60-96 Maris Shepway, 1-25 Tyson Shepway
Community	Don Valley Village
Property Type	Townhouse Leasehold Condominium
Highrise Units	0
Townhouse Units	230
Year Erected	N/A



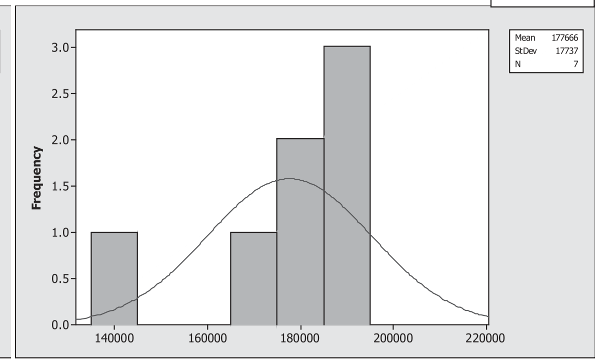
1991

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 87.5%

LOWER	MEAN/MEDIAN	UPPER
208000	210000	230000



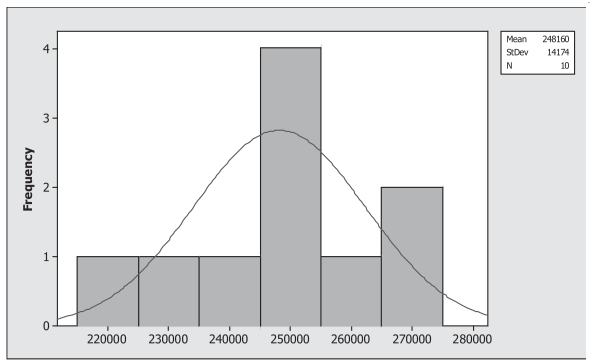
1996

Distribution Characteristics Unimodal, too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
164689	182000	192000



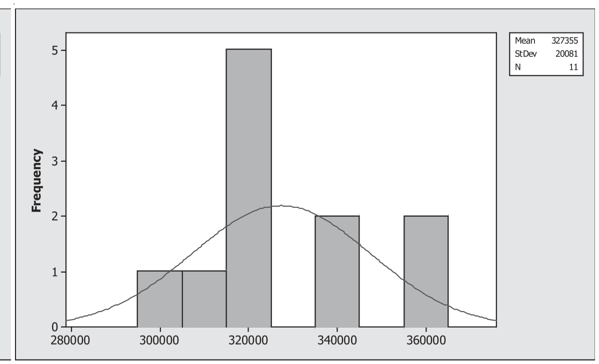
2001

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.7%

LOWER	MEAN/MEDIAN	UPPER
240700	248250	257450



2006

Distribution Characteristics Unimodal, asymmetric

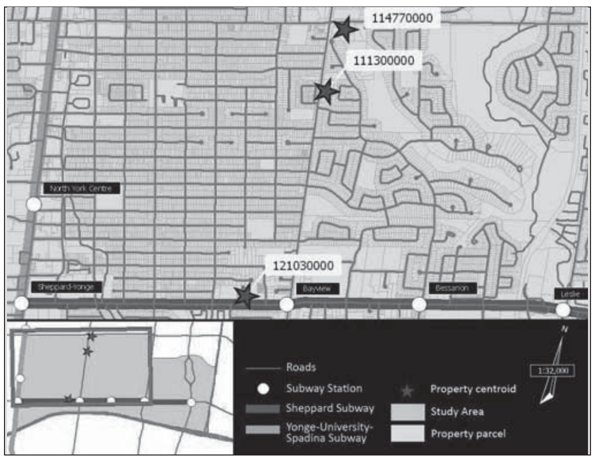
Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
315000	319000	340471

Foxway-Hycrest-555 Finch Avenue East Townhouse Cluster

BLOCK ID
11130/11477/12103



Municipal Address	11477	555 Finch Avenue
	11130	1-65 James Foxway
	12103	1-15 Hycrest Avenue
Community	Bayview Village, Willowdale	
Property Type	Townhouse Leasehold Condominium	
UPPERrise Units	0	
Townhouse Units	11477	22
	11130	24
	12103	16
	Total	42
Year Erected	N/A	

INSUFFICIENT DATA

Only one sample

1991

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
N/A	280000	N/A

INSUFFICIENT DATA

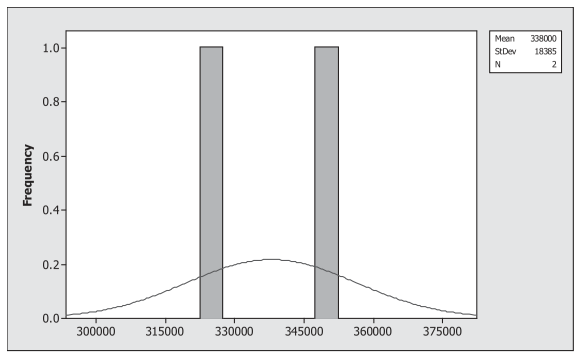
Only one sample

1996

Distribution Characteristics	Unimodal, too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
N/A	275000	N/A



2001

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 50%

LOWER	MEAN/MEDIAN	UPPER
325000	338000	351000

INSUFFICIENT DATA

Only one sample

2006

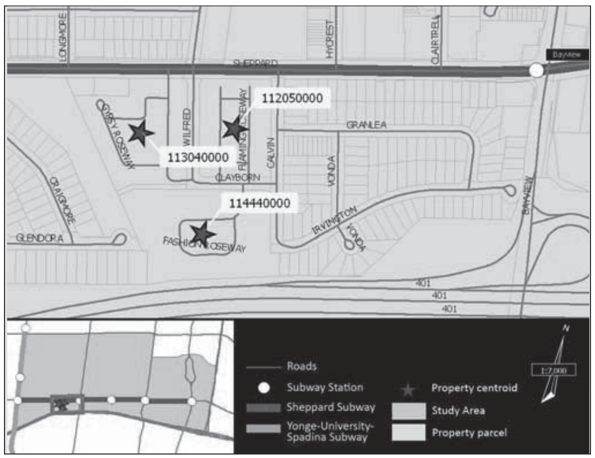
Distribution Characteristics	Bimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

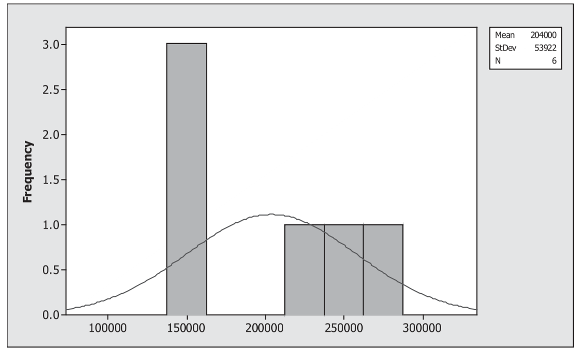
LOWER	MEAN/MEDIAN	UPPER
N/A	390000	N/A

Roseway Townhomes

BLOCK ID
11205/11304/11444



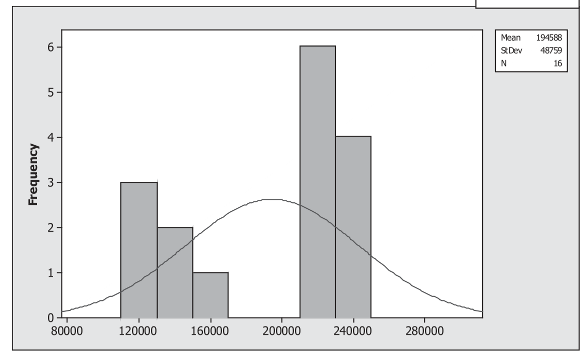
Municipal Address	11205	2-110 Flaming Roseway
	11304	1-147 Gypsy Roseway, 2-12 Texas Roseway
	11444	10-30 Fashion Roseway
Community	Willowdale	
Property Type	Townhouse Leasehold Condominium	
UPPERise Units	0	
Townhouse Units	11205	64
	11304	87
	11444	239
	Total	440
Year Erected	N/A	



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

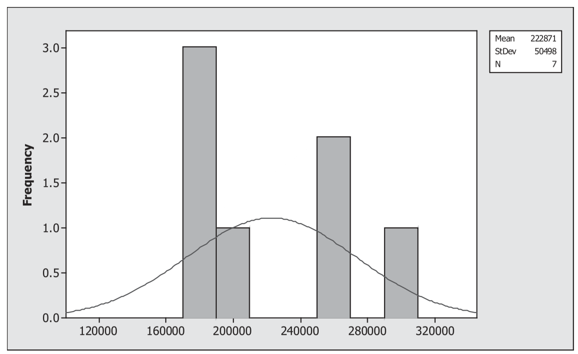
LOWER	MEAN/MEDIAN	UPPER
155203	197500	259541



1996

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

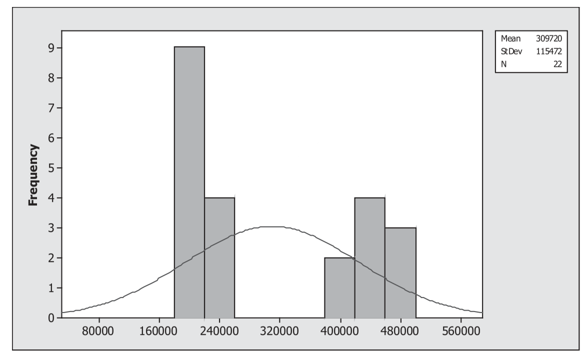
LOWER	MEAN/MEDIAN	UPPER
145472	219000	227734



2001

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
180048	192000	267365



2006

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

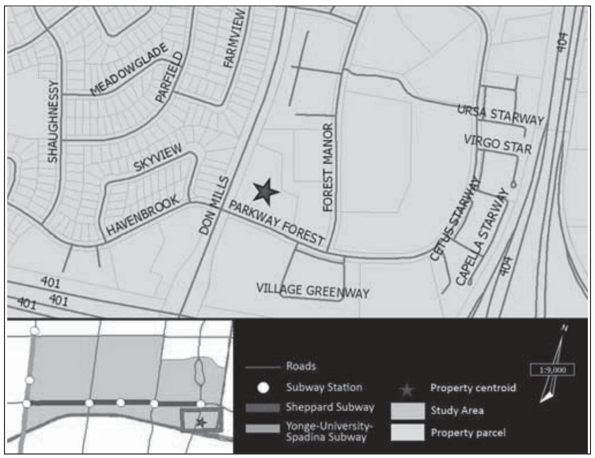
LOWER	MEAN/MEDIAN	UPPER
216502	236750	418994

BLOCK ID

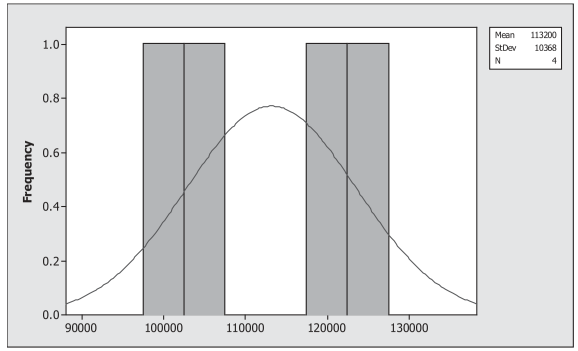
11290

20 Forest Manor Drive

(Krawczyk, 2008)



Municipal Address	20 Forest Manor Drive
Community	Parkway Forest
Property Type	Highrise Leasehold Condominium
Highrise Units	190
Townhouse Units	0
Year Erected	1969



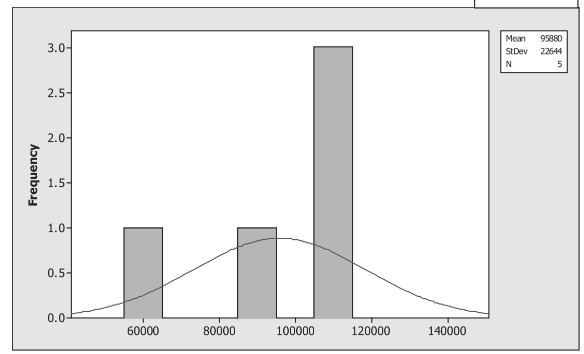
1991

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 87.5%

LOWER	MEAN/MEDIAN	UPPER
102000	113500	123800



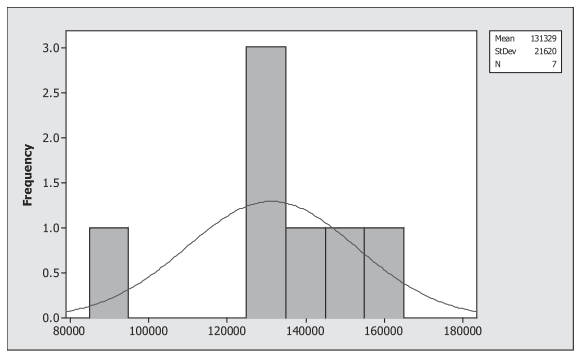
1996

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
69529	107500	112612



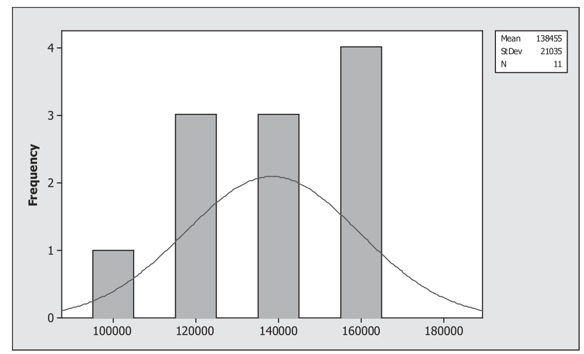
2001

Distribution Characteristics Unimodal, too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124115	132500	145706



2006

Distribution Characteristics Too few samples

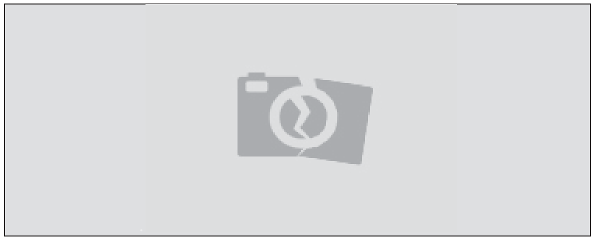
Statistical test used Sign Test

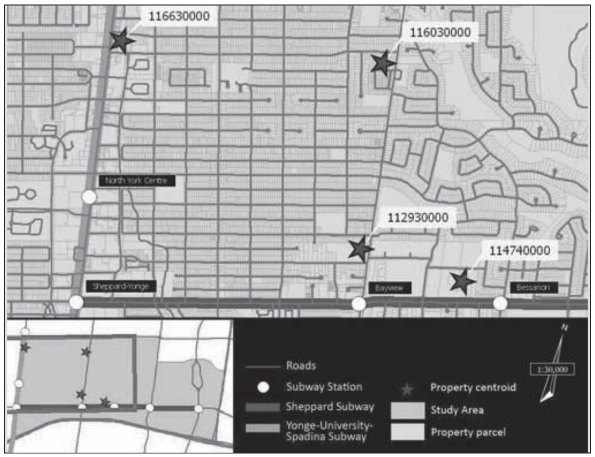
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
120000	140500	159050

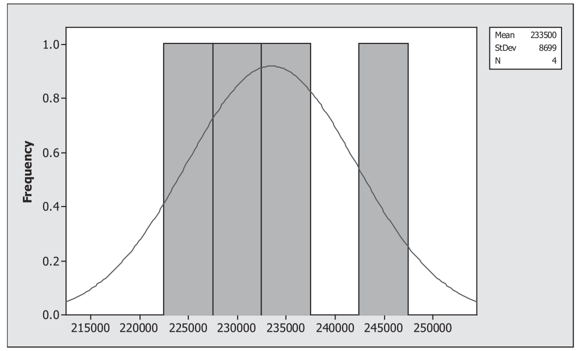
Bayview-Holmes-Mapleway Townhouse Cluster

BLOCK ID
11293/11474/ 11603/11663





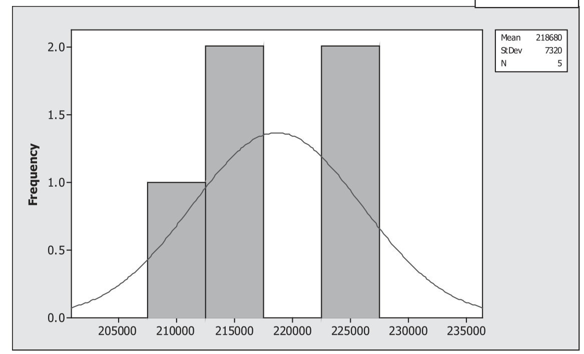
Municipal Address	11293	2922 Bayview Avenue, 1-9 Meadow Larkway
	11474	1-46 Red Mapleway
	11603	3130 Bayview Avenue
	11663	4 Holmes Avenue
Community	Willowdale, North York Centre, Bayview Village	
Property Type	Townhouse Leasehold Condominium	
Highrise Units	0	
Townhouse Units	11293	9
	11474	33
	11603	8
	11663	17
	Total	67
Year Erected	N/A	



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 87.5%

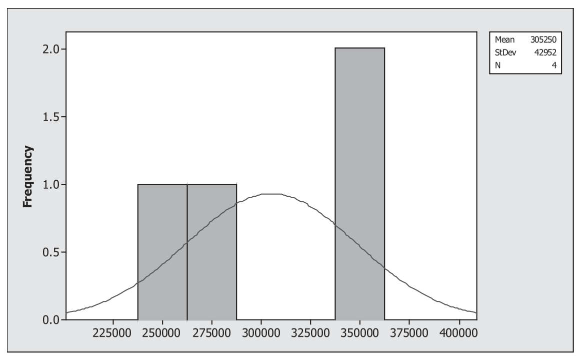
LOWER	MEAN/MEDIAN	UPPER
225000	232000	245000



1996

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

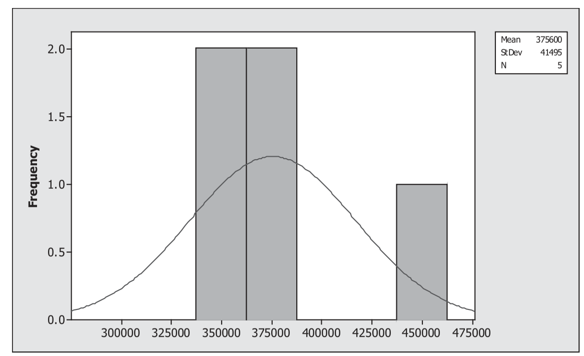
LOWER	MEAN/MEDIAN	UPPER
211765	215900	226618



2001

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 87.5%

LOWER	MEAN/MEDIAN	UPPER
255000	312000	342000



2006

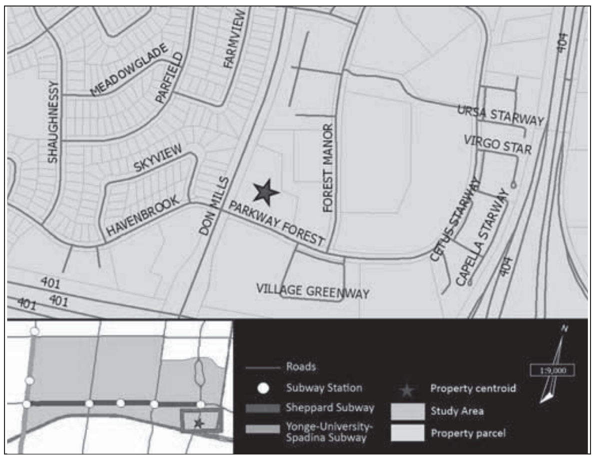
Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
343765	365000	421706

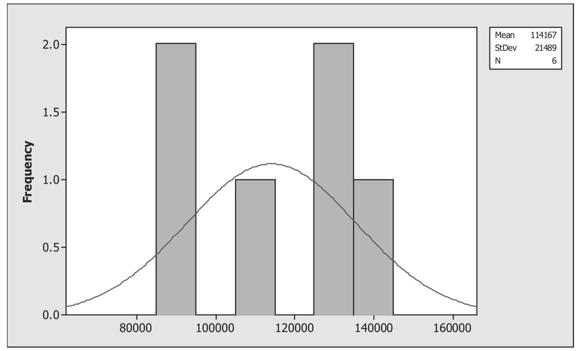
10 Parkway Forest Drive

BLOCK ID
11301


(Krawczyk, 2008)



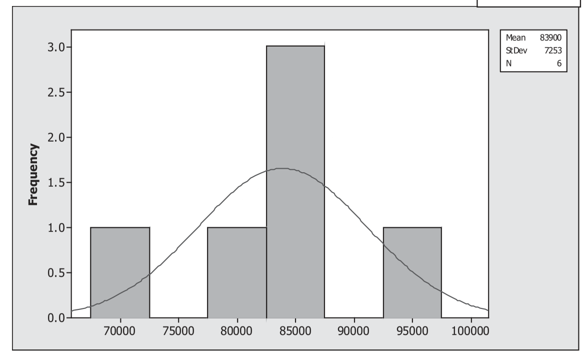
Municipal Address	10 Parkway Forest Drive
Community	Parkway Forest
Property Type	Highrise Leasehold Condominium
Highrise Units	192
Townhouse Units	0
Year Erected	1969



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 87.5%

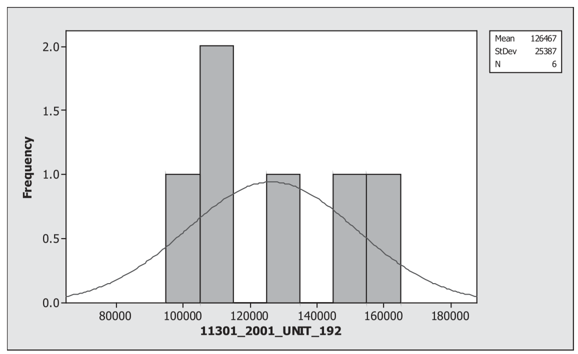
LOWER	MEAN/MEDIAN	UPPER
89486	118500	132568



1996

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

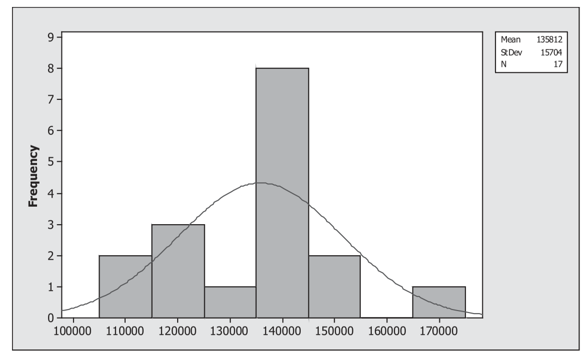
LOWER	MEAN/MEDIAN	UPPER
77872	86000	87926



2001

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
105459	118500	152959



2006

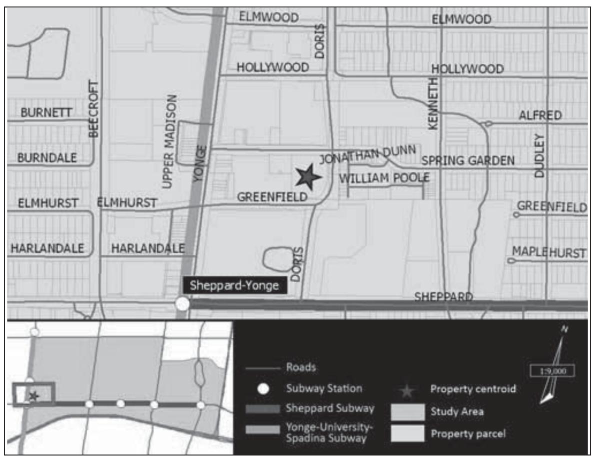
Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.2%

LOWER	MEAN/MEDIAN	UPPER
129000	135500	142000

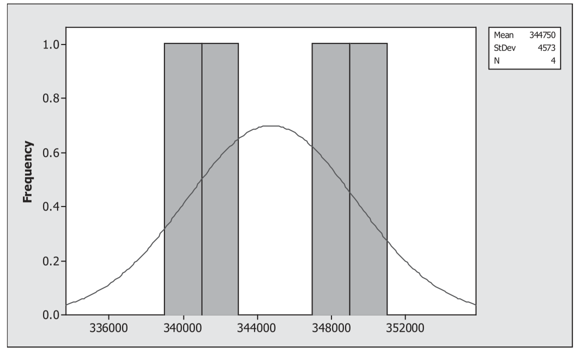
Atrium II

BLOCK ID
11650

(Krawczyk, 2008)



Municipal Address	10 Kenneth Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	140
Townhouse Units	0
Year Erected	1988



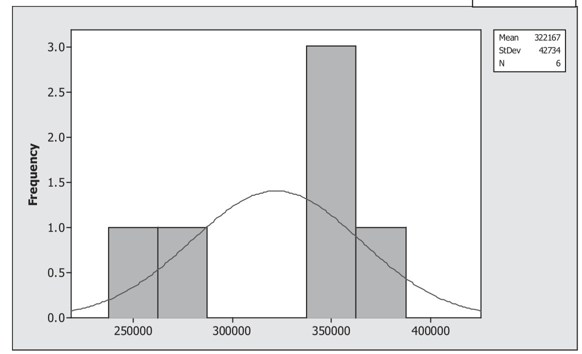
1991

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 87.5%

LOWER	MEAN/MEDIAN	UPPER
340,000	344,500	350,000



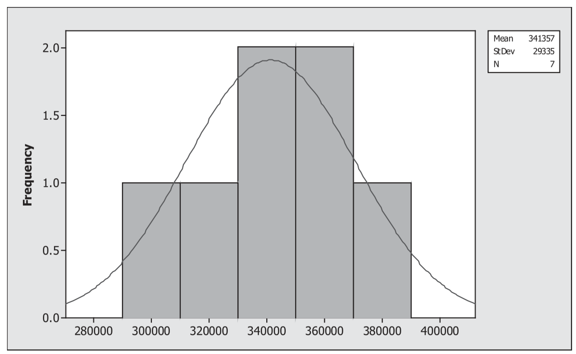
1996

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
276,554	341,000	351,622



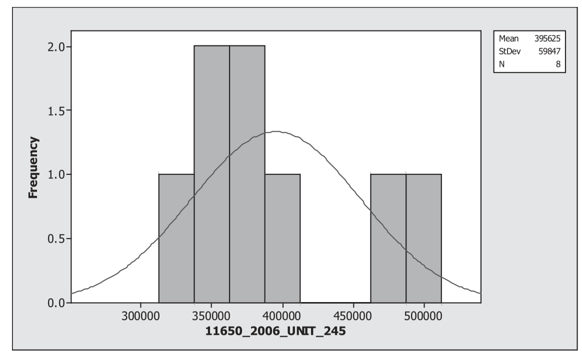
2001

Distribution Characteristics Unimodal, too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
318,824	344,000	358,935



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

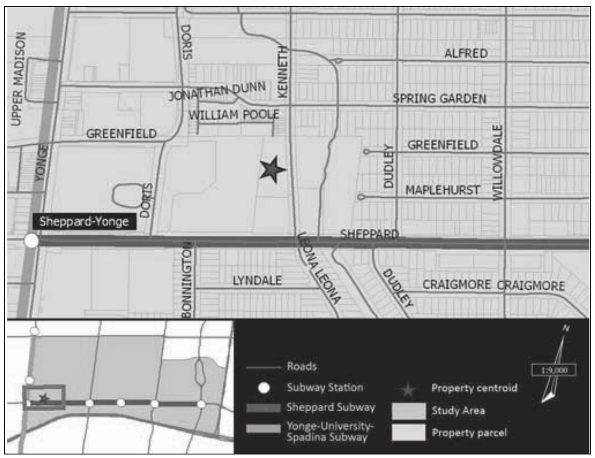
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
353,202	380,000	450,983

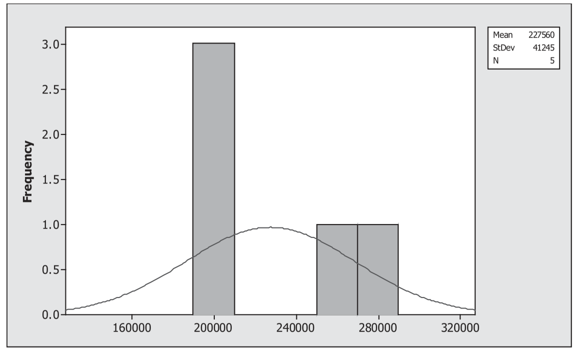
Pavillion

BLOCK ID
11733

(Krawczyk, 2008)



Municipal Address	5 Kenneth Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	201
Townhouse Units	0
Year Erected	1986



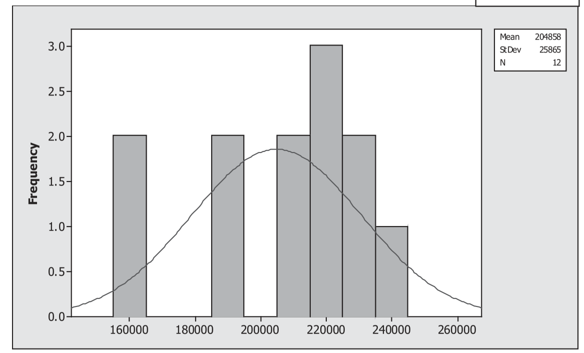
1991

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
192824	208802	275059



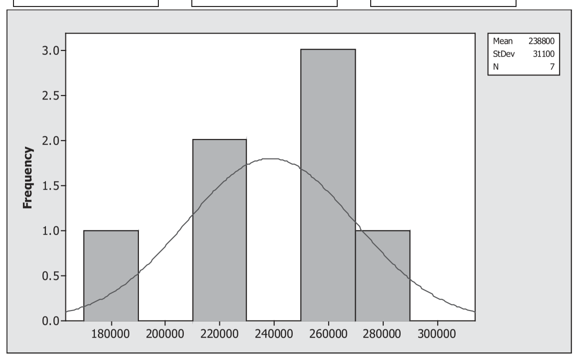
1996

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
189700	211900	219398



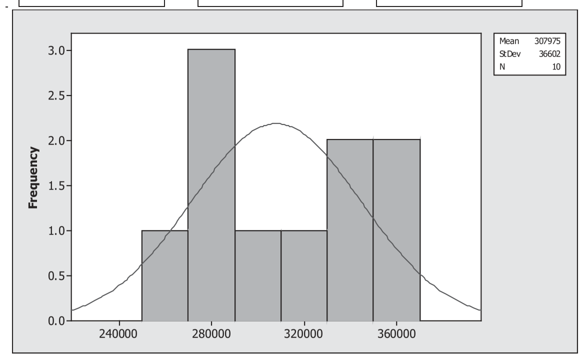
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
218353	255000	262853



2006

Distribution Characteristics Bimodal, asymmetric

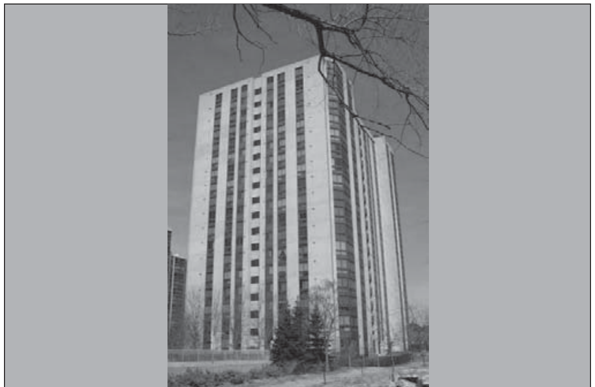
Statistical test used Sign Test

Confidence Interval at 90%

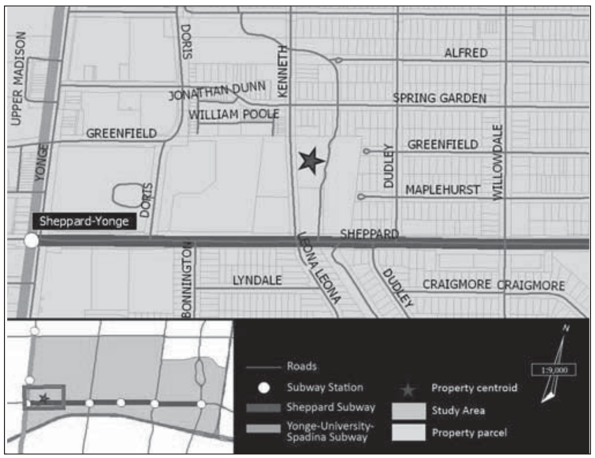
LOWER	MEAN/MEDIAN	UPPER
274913	309500	340290

Pavillion del Sol

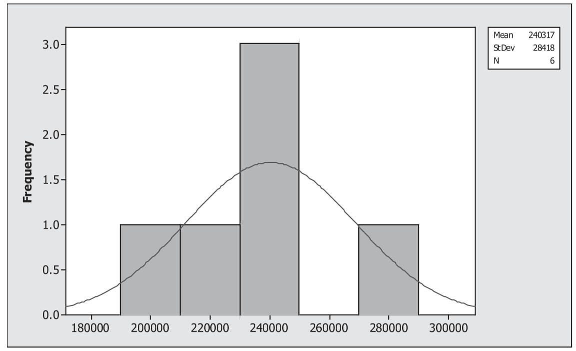
BLOCK ID
11804



(Krawczyk, 2008)



Municipal Address	10 Kenneth Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	140
Townhouse Units	0
Year Erected	1988

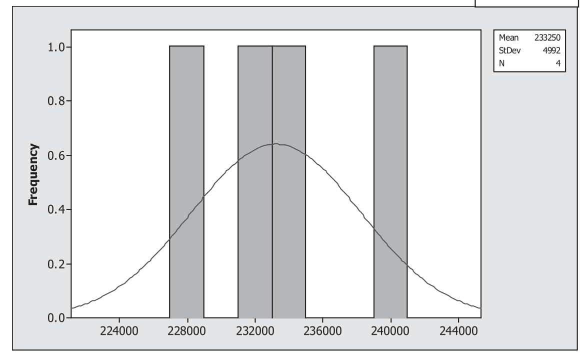


1991

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
219351	239000	258731

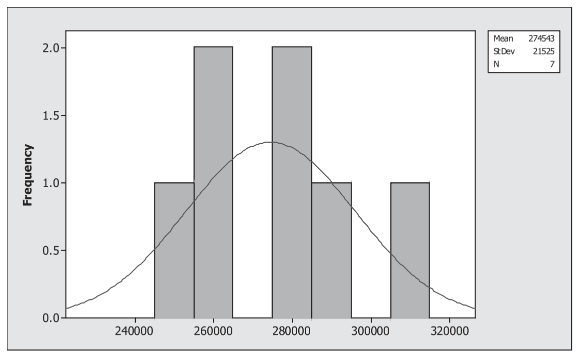


1996

Distribution Characteristics	Too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
228000	232500	240000

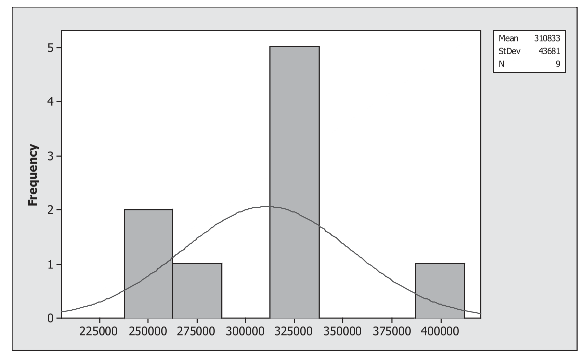


2001

Distribution Characteristics	Bimodal, too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
254906	275000	291035



2006

Distribution Characteristics	Unimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

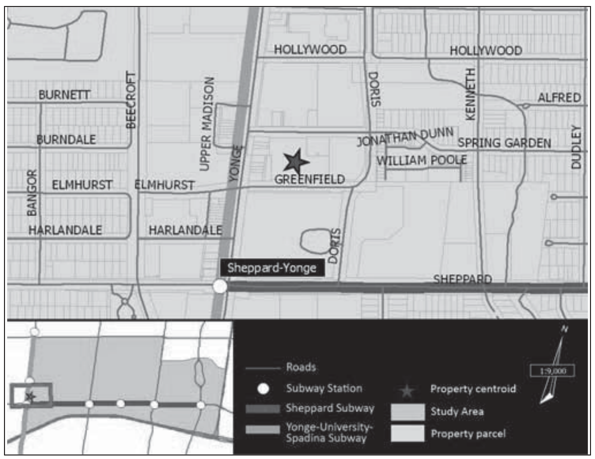
LOWER	MEAN/MEDIAN	UPPER
272288	317000	328544

BLOCK ID

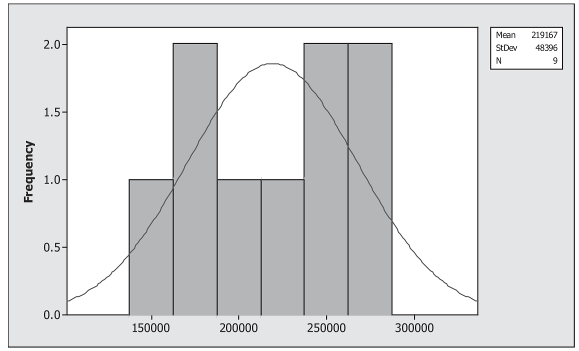
11877

Rodeo Walk

(Krawczyk, 2008)



Municipal Address	30 Greenfield Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	339
Townhouse Units	0
Year Erected	1989



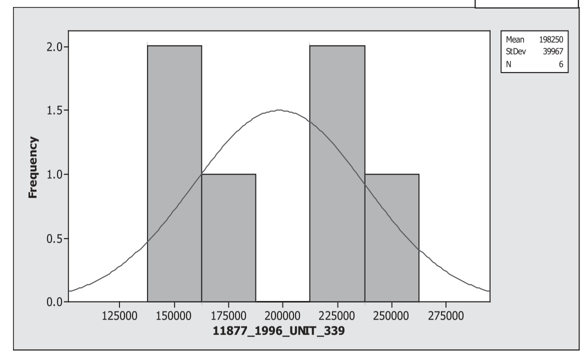
1991

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
174100	217000	261360



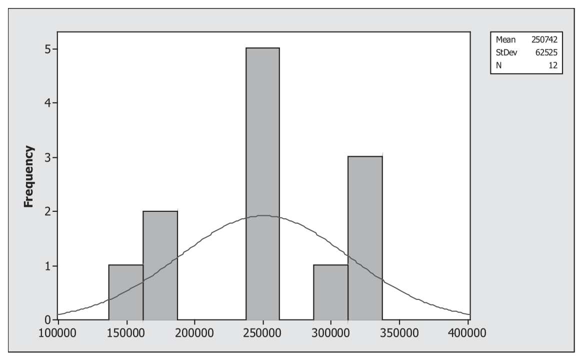
1996

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
159230	197500	236926



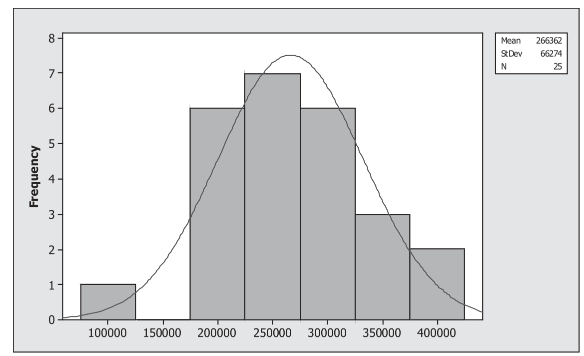
2001

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.2%

LOWER	MEAN/MEDIAN	UPPER
210000	247100	285000



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.9%

LOWER	MEAN/MEDIAN	UPPER
245000	269000	287050

Hollywood Plaza I & II

BLOCK ID
12006/12088

(Krawczyk, 2008)

Municipal Address	12006	18 Hollywood Avenue
	12088	28 Hollywood Avenue
Community	North York Centre	
Property Type	Highrise Leasehold Condominium	
Highrise Units	12006	148
	12088	150
	Total	398
Townhouse Units	0	
Year Erected	1996	

NO DATA

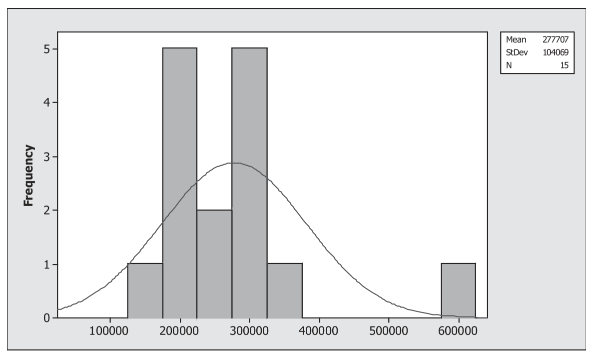
Structure not yet built

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



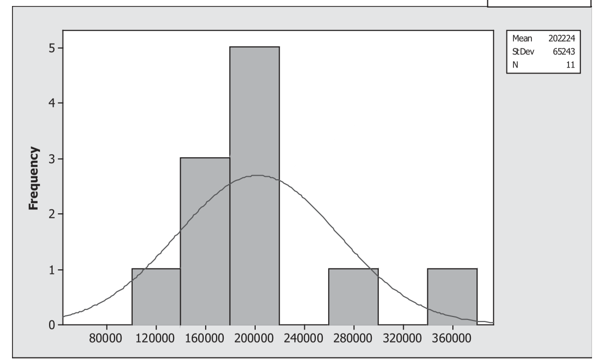
2001

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.4%

LOWER	MEAN/MEDIAN	UPPER
235500	260200	302000



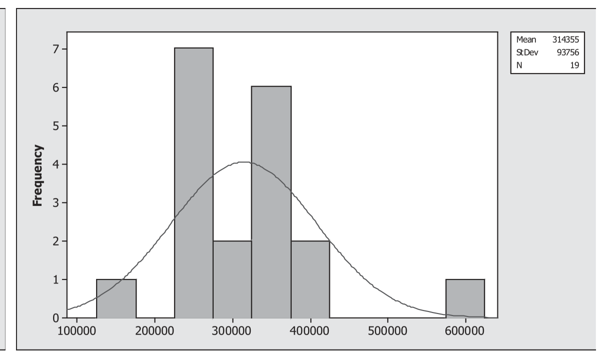
1996

Distribution Characteristics Unimodal, asymmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
149306	200000	212893



2006

Distribution Characteristics Bimodal, symmetric

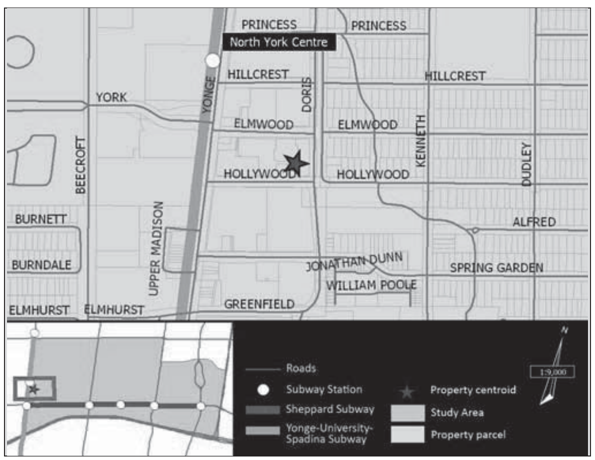
Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.7%

LOWER	MEAN/MEDIAN	UPPER
280000	303361	338000

Hollywood Plaza Townhomes

BLOCK ID
12070



Municipal Address	38 Hollywood Avenue
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	0
Townhouse Units	48
Year Erected	N/A

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

INSUFFICIENT DATA

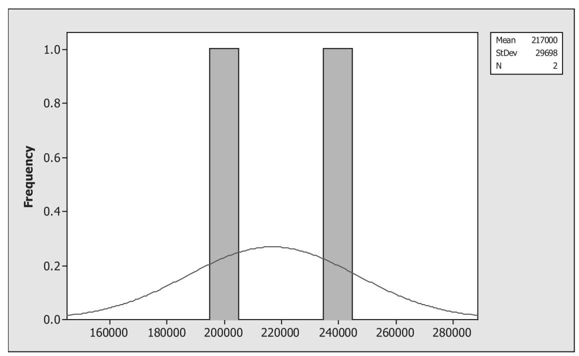
Only one sample

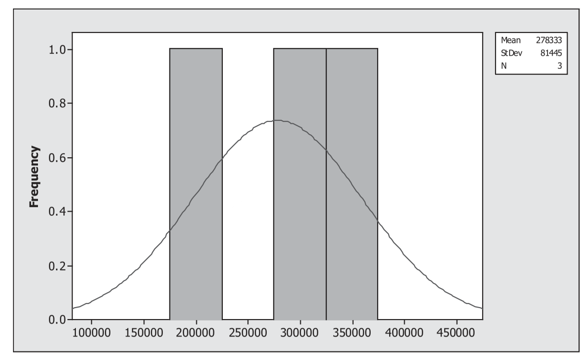
1996

Distribution Characteristics	Too few samples
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
N/A	186000	N/A





2001

Distribution Characteristics	Too few samples
Statistical test used	Sign Test

Confidence Interval at 50%

LOWER	MEAN/MEDIAN	UPPER
196000	217000	238000

2006

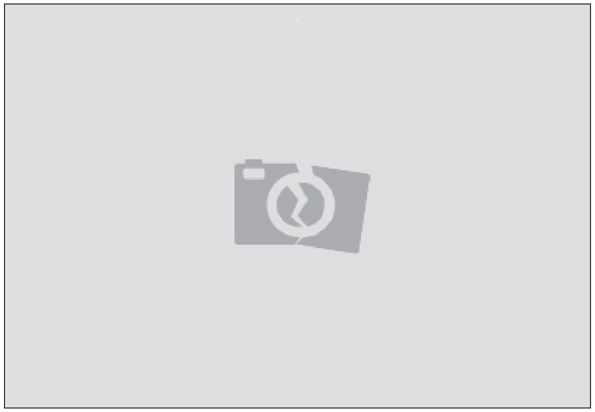
Distribution Characteristics	Too few samples
Statistical test used	Sign Test

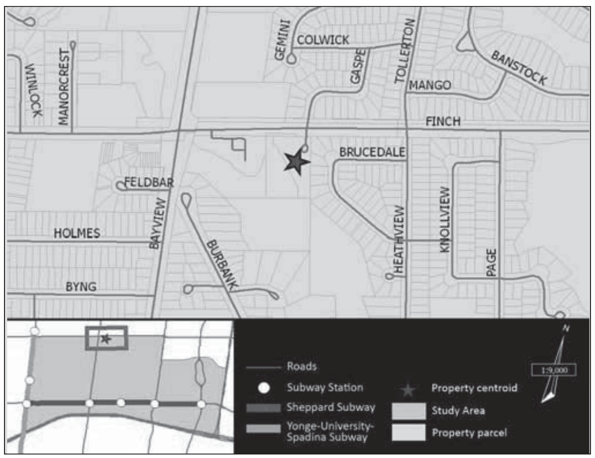
Confidence Interval at 75%

LOWER	MEAN/MEDIAN	UPPER
185000	315000	335000

1 Watergarden Way

BLOCK ID
12081





Municipal Address	1 Watergarden Way
Community	Bayview Village
Property Type	Highrise Leasehold Condominium
Highrise Units	0
Townhouse Units	30
Year Erected	N/A

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

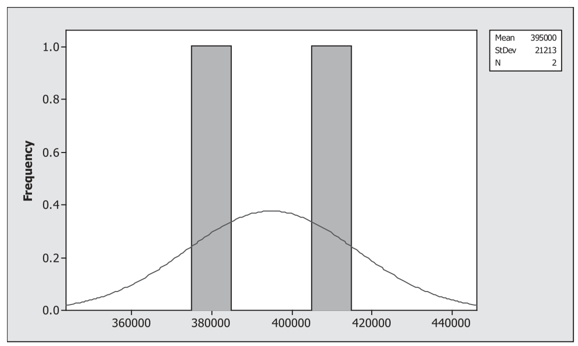
INSUFFICIENT DATA

Only one sample

1996

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
N/A	297196	N/A



2001

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 50%

LOWER	MEAN/MEDIAN	UPPER
380000	395000	410000

INSUFFICIENT DATA

Only one sample

2006

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
N/A	525000	N/A

Empress Plaza I & II

BLOCK ID
12099/12125

(Krawczyk, 2008)

Municipal Address	12099	35 Empress Avenue
	12125	18 Hillcrest Avenue
Community	North York Centre	
Property Type	Highrise Leasehold Condominium	
Highrise Units	12099	224
	12125	224
	Total	448
Townhouse Units	0	
Year Erected	1996	

NO DATA

Structure not yet built

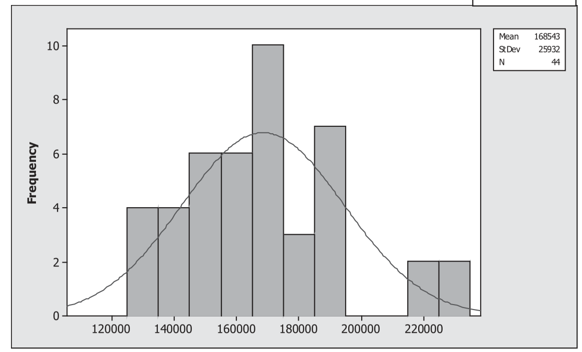
1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



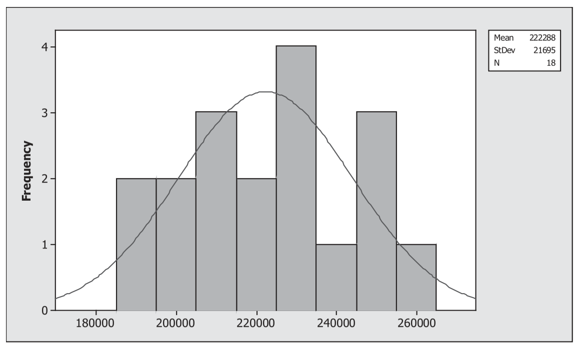
1996

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.9%)

LOWER	MEAN/MEDIAN	UPPER
160745	166963	173473



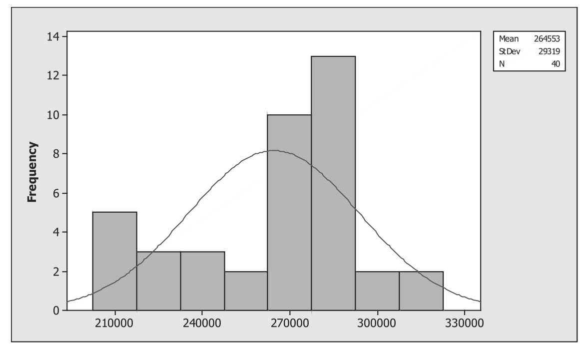
2001

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 90.2%

LOWER	MEAN/MEDIAN	UPPER
212500	222000	231900



2006

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

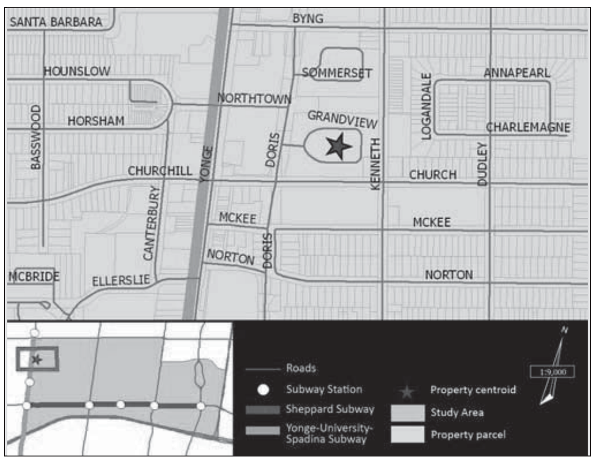
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
257250	267500	275500

Grandview Townhomes

BLOCK ID

12113



Municipal Address	28-822 Grandview Way
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	0
Townhouse Units	197
Year Erected	N/A

NO DATA

Structure not yet built

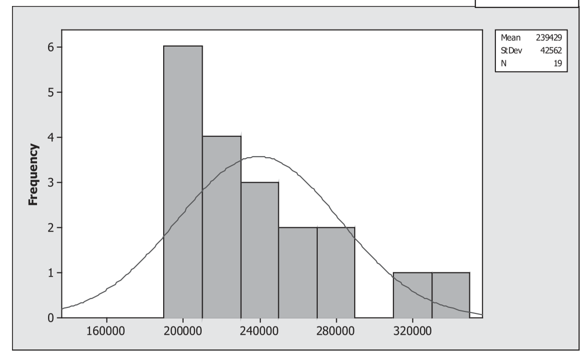
1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



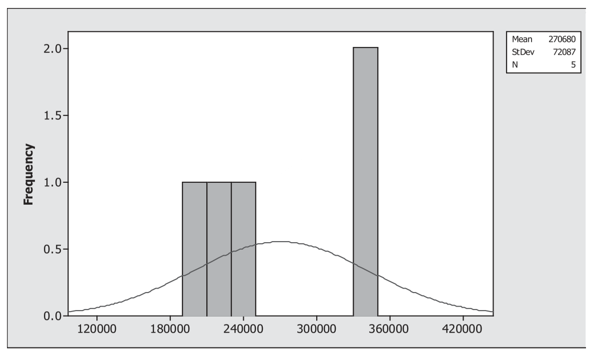
1996

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
208578	221573	249341



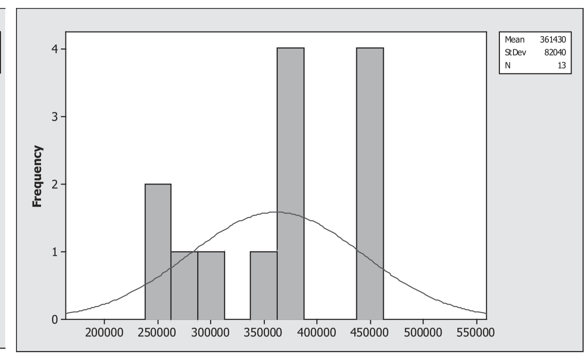
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
205729	241000	348000



2006

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
302183	370000	436219

Grandview at Northtown

BLOCK ID
12132


(Krawczyk, 2008)

Municipal Address	88 Grandview Way
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	157
Townhouse Units	0
Year Erected	1996

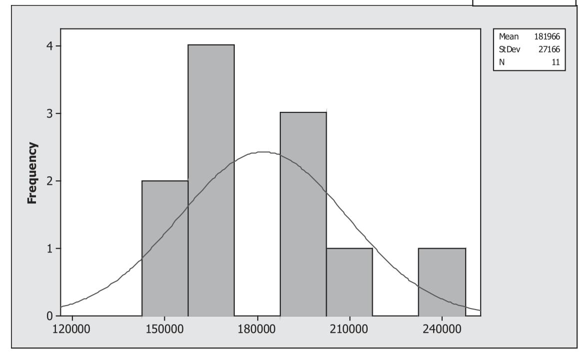
NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

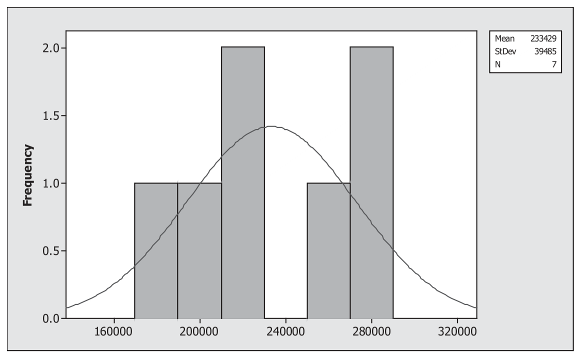
LOWER	MEAN/MEDIAN	UPPER



1996

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

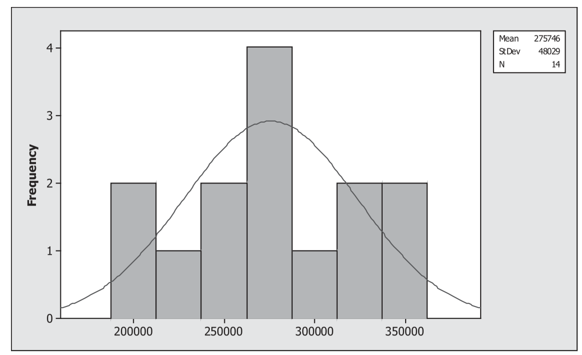
LOWER	MEAN/MEDIAN	UPPER
158615	171228	201357



2001

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
205494	225000	275547



2006

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 89.7%

LOWER	MEAN/MEDIAN	UPPER
252900	275750	298750

Kingsdale

BLOCK ID 12137

(Krawczyk, 2008)

Municipal Address	238 Doris Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	200
Townhouse Units	0
Year Erected	1997

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

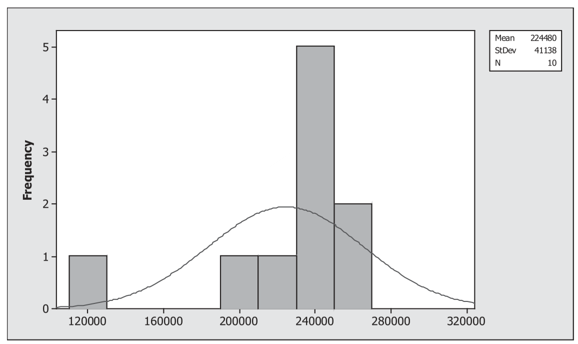
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



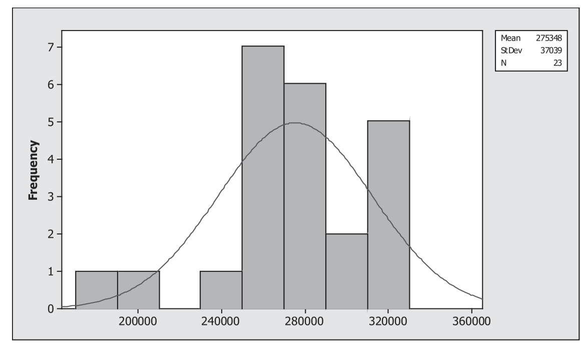
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
222174	237500	243348



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

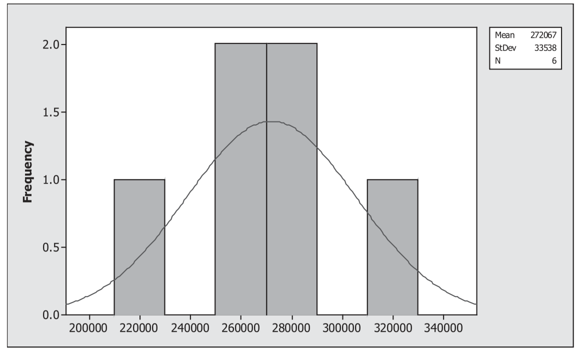
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
267000	274400	284367

Sommerset at Northtown

BLOCK ID
12138

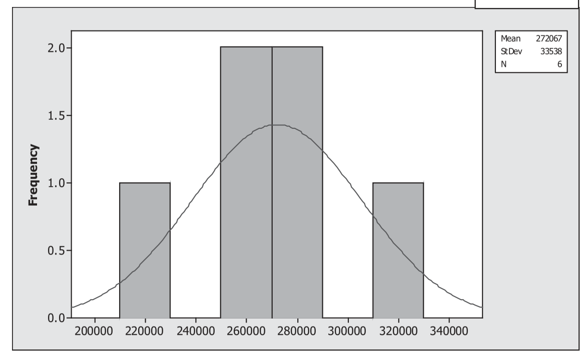
Municipal Address	28-88 Sommerset Way
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	180
Townhouse Units	0
Year Erected	1999



1991

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.7%

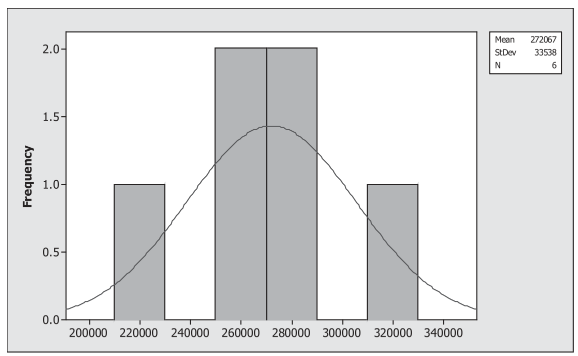
LOWER	MEAN/MEDIAN	UPPER
245500	271400	302300



1996

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.7%

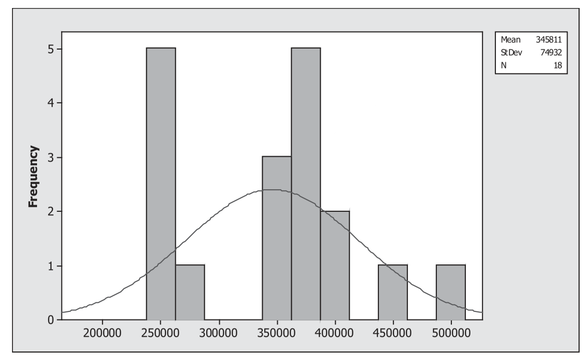
LOWER	MEAN/MEDIAN	UPPER
245500	271400	302300



2001

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.7%

LOWER	MEAN/MEDIAN	UPPER
245500	271400	302300



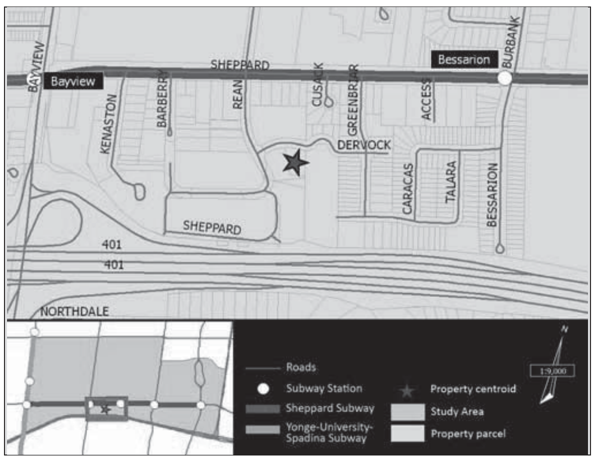
2006

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
277805	366500	380000

Dervock Townhomes

BLOCK ID 12159



Municipal Address	7 Dervock Crescent
Community	Kenaston Gardens
Property Type	Townhouse Leasehold Condominium
Highrise Units	9
Townhouse Units	0
Year Erected	1998

NO DATA

Structure not yet built

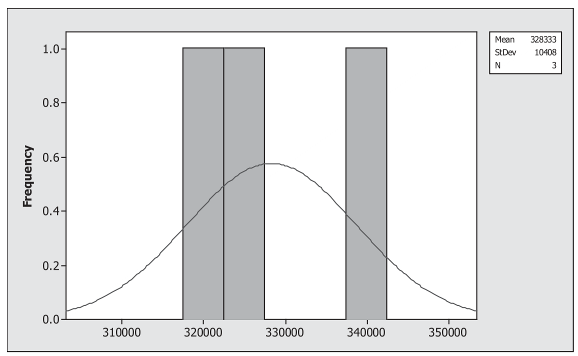
1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2001

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
320000	325000	340000

NO DATA

Structure not yet built

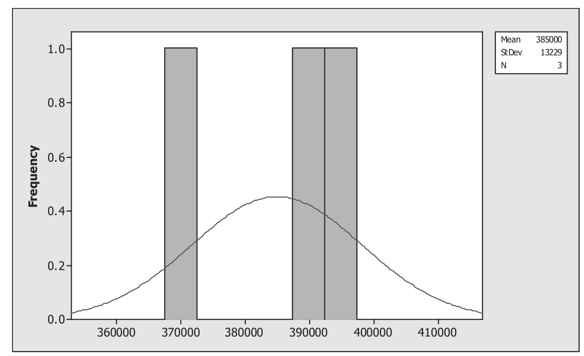
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Too few samples

Statistical test used Sign Test

Confidence Interval at 90%

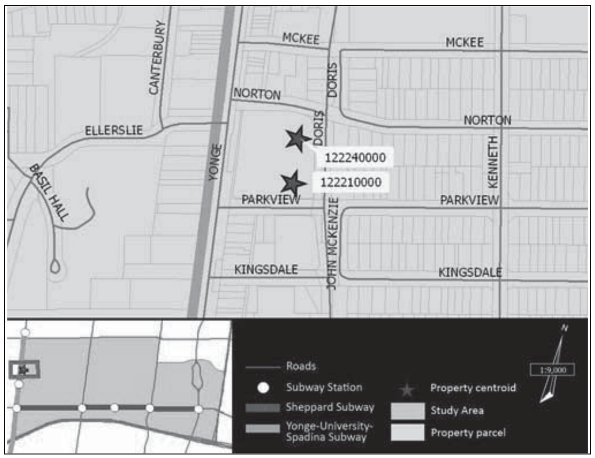
LOWER	MEAN/MEDIAN	UPPER
370000	390000	395000

Imperial I & II

BLOCK ID

12221/12224

(Krawczyk, 2008)



Municipal Address	12221	256 Doris Avenue
	12224	260 Doris Avenue
Community	North York Centre	
Property Type	Highrise Leasehold Condominium	
Highrise Units	12221	188
	12224	146
	Total	334
Townhouse Units	0	
Year Erected	1998	

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Intervals at 90%

LOW	MEDIAN	HIGH

NO DATA

Structure not yet built

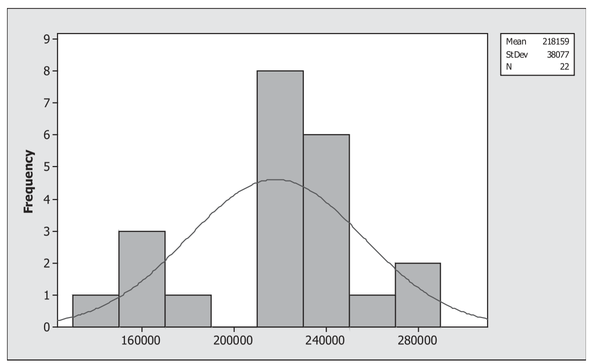
1996

Distribution Characteristics

Statistical test used

Confidence Intervals at 90%

LOW	MEDIAN	HIGH



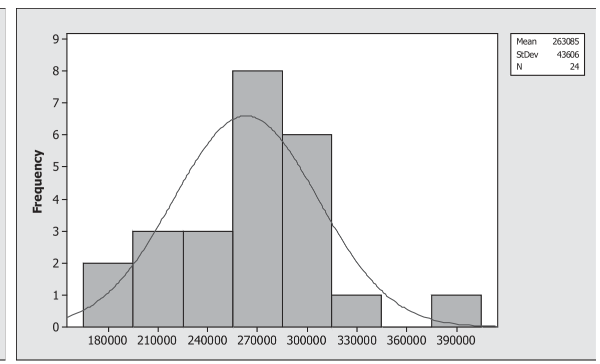
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Intervals at 90%

LOW	MEDIAN/MEAN	HIGH
218003	224500	236125



2006

Distribution Characteristics Normal

Statistical test used T Test

Confidence Intervals at 90%

LOW	MEDIAN/MEAN	HIGH
247830	263085	278341

Sommerset at Northtown

BLOCK ID
12273

(Krawczyk, 2008)

Municipal Address	18 Sommerset Way
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	568
Townhouse Units	0
Year Erected	1999

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

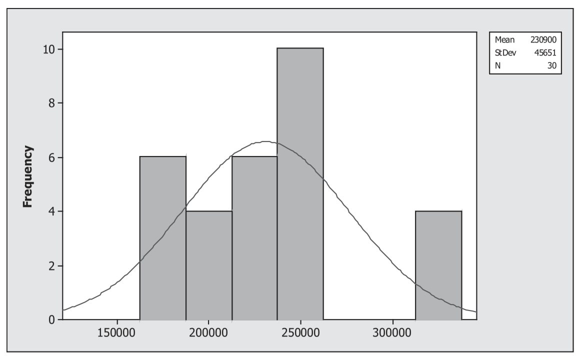
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



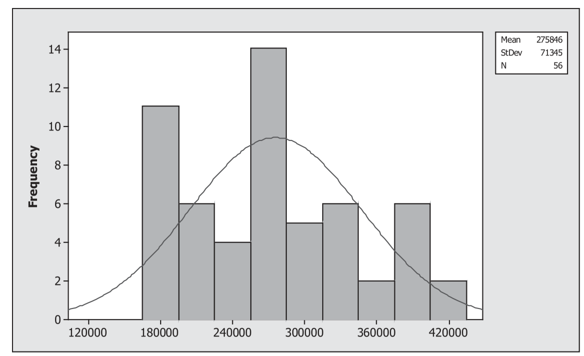
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
225000	237000	238000



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

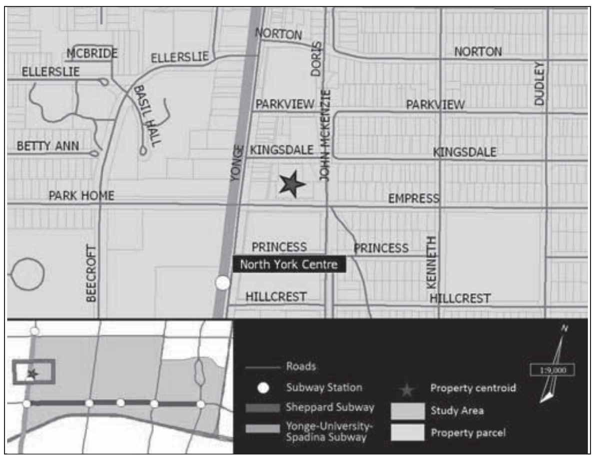
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
265000	277000	283000

Majestic

BLOCK ID
12319

(Krawczyk, 2008)



Municipal Address	28 Empress Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	269
Townhouse Units	0
Year Erected	1999

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

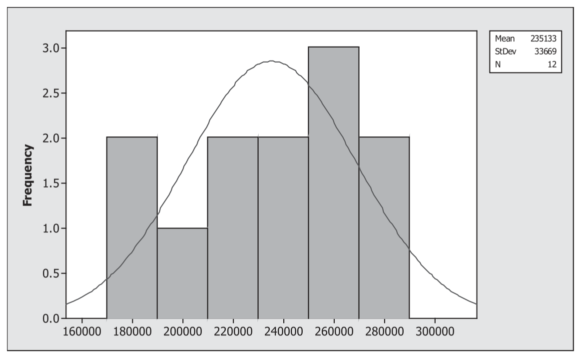
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



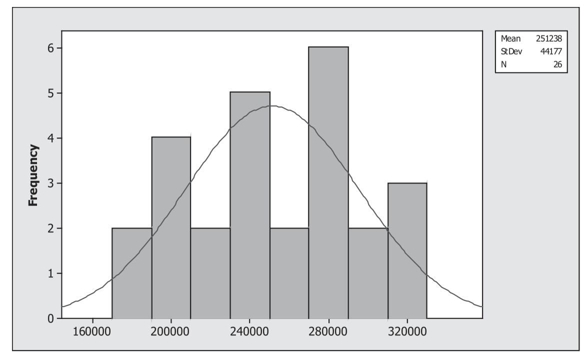
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
213602	246850	252776



2006

Distribution Characteristics Multimodal, symmetric

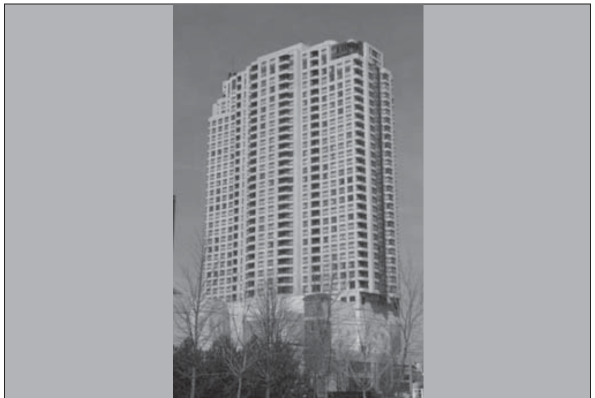
Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
235500	252000	265500

Royal Pinnacle

BLOCK ID
12343



(Krawczyk, 2008)

Municipal Address	33 Empress Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	380
Townhouse Units	0
Year Erected	1999

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

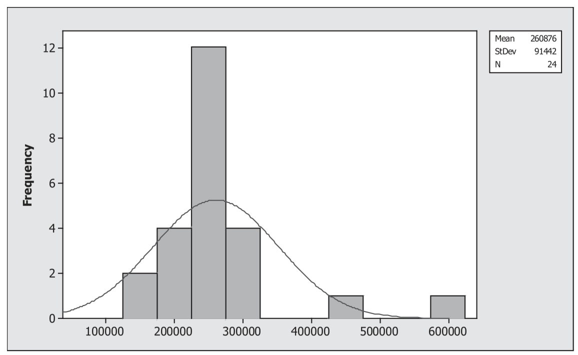
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



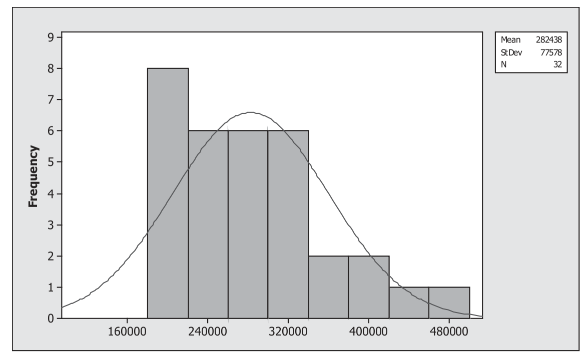
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
243,426	257,181	269,871



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
224,865	277,750	306,352

Pinnacle

BLOCK ID
12362

(Krawczyk, 2008)

Municipal Address	8 Hillcrest Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	380
Townhouse Units	0
Year Erected	1999

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

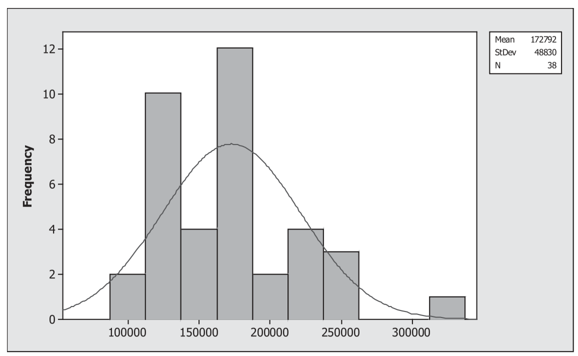
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



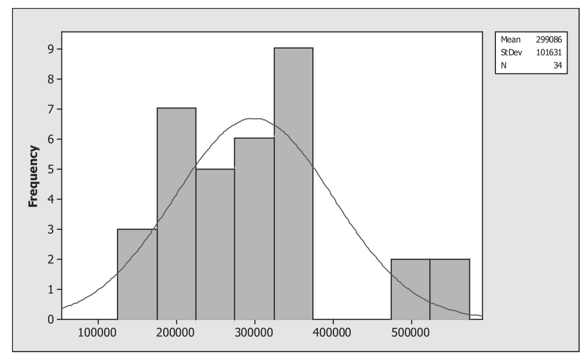
2001

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.9%

LOWER	MEAN/MEDIAN	UPPER
154780	170759	181692



2006

Distribution Characteristics Nearly normal

Statistical test used T Test

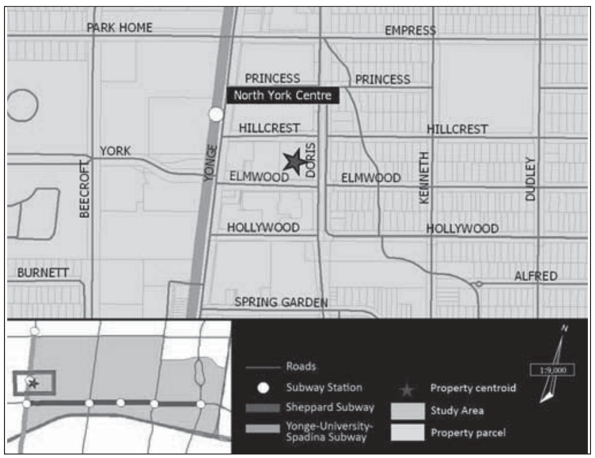
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
269589	299086	328583

Boulevard

BLOCK ID
12377

(Krawczyk, 2008)



Municipal Address	188 Doris Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	250
Townhouse Units	0
Year Erected	2001

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

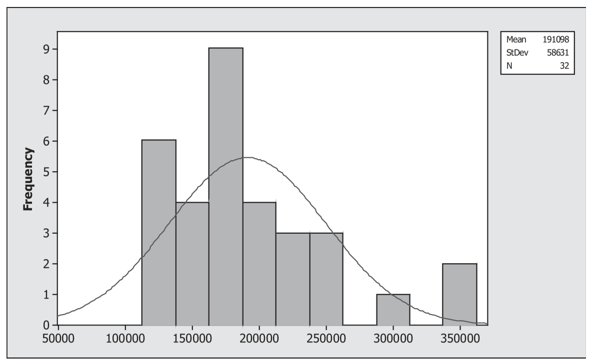
1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



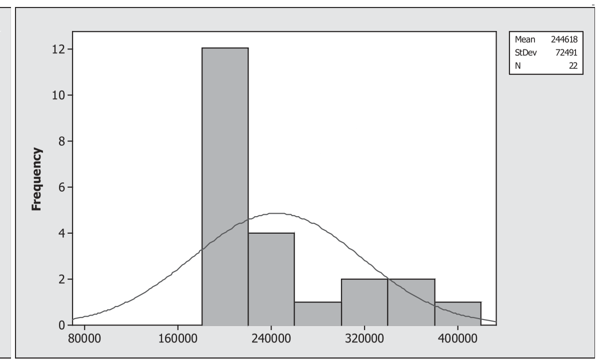
2006

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.8%

LOWER	MEAN/MEDIAN	UPPER
170,011	184,153	202,221



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
194,601	206,500	242,738

Chicago

BLOCK ID 12405


(Krawczyk, 2008)

Municipal Address	35 Finch Avenue East
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	251
Townhouse Units	0
Year Erected	2001

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

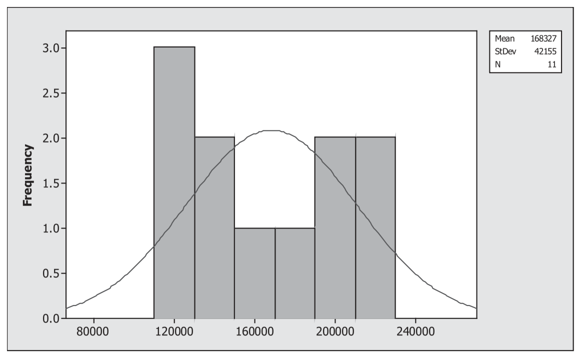
NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

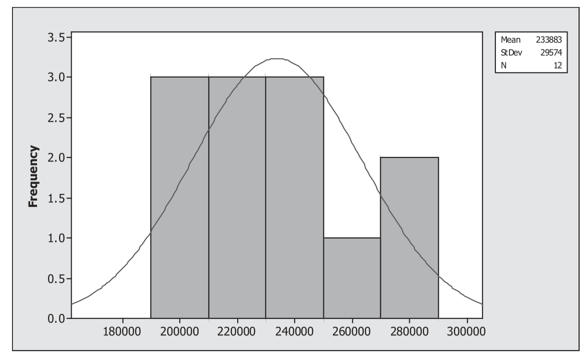
LOWER	MEAN/MEDIAN	UPPER



2001

Distribution Characteristics Bimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
144,274	171,090	187,273



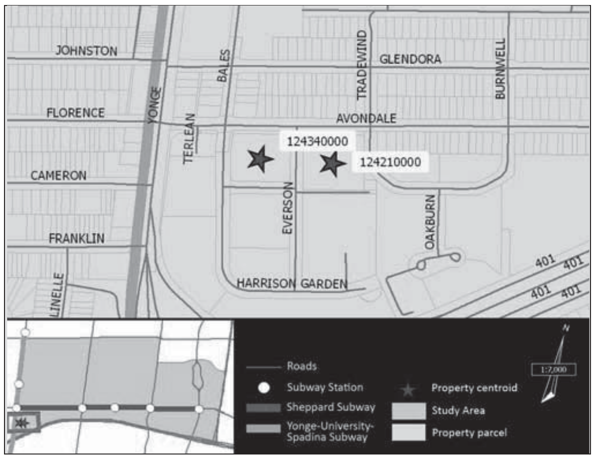
2006

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
216,405	227,500	249,238

Mansions of Avondale Townhomes

BLOCK ID
12421/12434



Municipal Address	12421	11 Everson Drive
	12434	25-37 Avondale Avenue, 18 Everson Drive, 8-16 Humberstone Drive
Community	North York Centre	
Property Type	Townhouse Leasehold Condominium	
Highrise Units	12421	88
	12434	72
	Total	160
Townhouse Units	0	
Year Erected	2002	

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

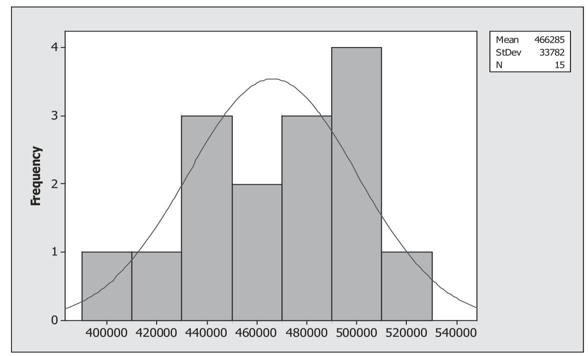
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



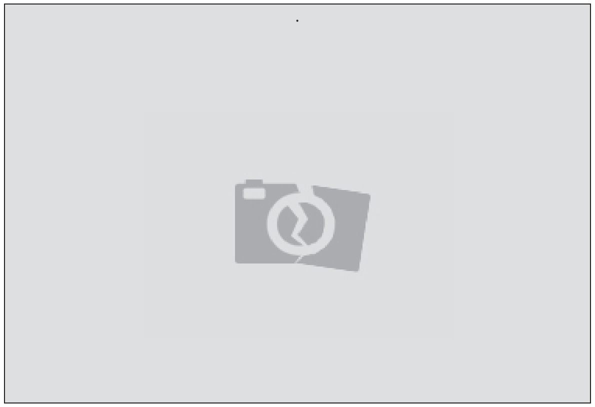
2006

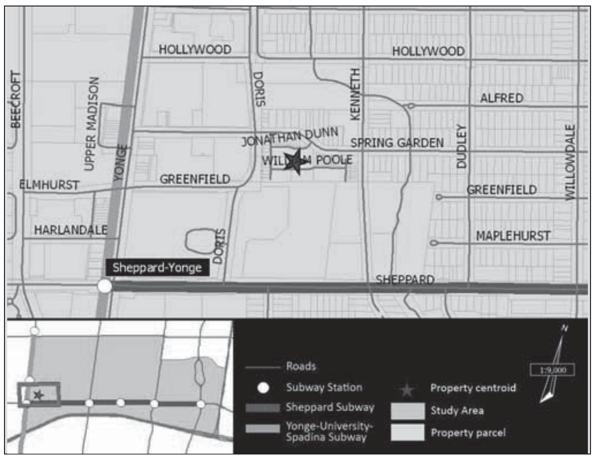
Distribution Characteristics Nearly Normal
Statistical test used T Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
450,922	466,285	481,648

William Poole-Jonathan Dunn Townhomes

BLOCK ID
12425





Municipal Address	1-23 Jonathan Dunn way 17-30 William Poole Way
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	26
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

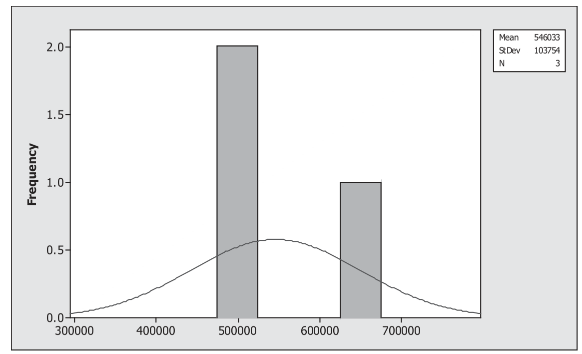
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 75%

LOWER	MEAN/MEDIAN	UPPER
475,000	498,000	665,100

Parkside at Northtown

BLOCK ID
12446

(Krawczyk, 2008)

Municipal Address	880 Grandview Way
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	148
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

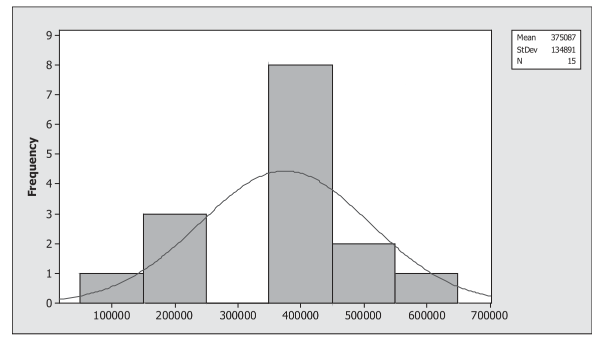
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Almost Normal

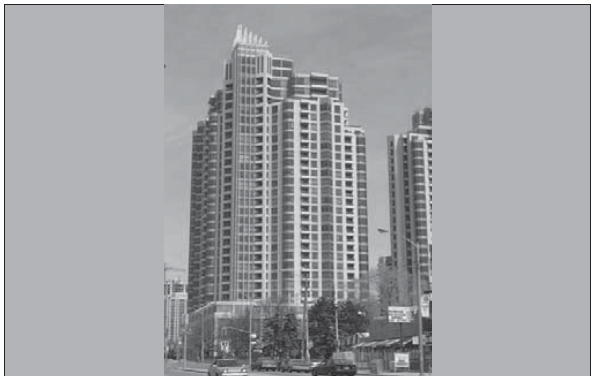
Statistical test used T Test

Confidence Interval at 90%

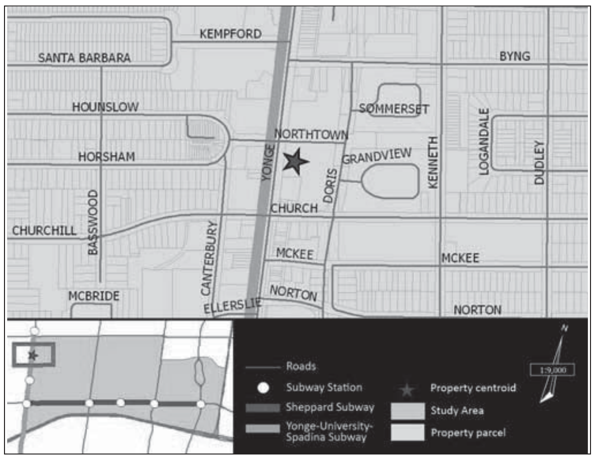
LOWER	MEAN/MEDIAN	UPPER
313743	375087	436431

Triomphe at Northtown

BLOCK ID
12448



(Krawczyk, 2008)



Municipal Address	5 Northtown Way
Community	North York Centre
Property Type	Highrise Leasehold Condominium Retail, Parking Podium
Highrise Units	311
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

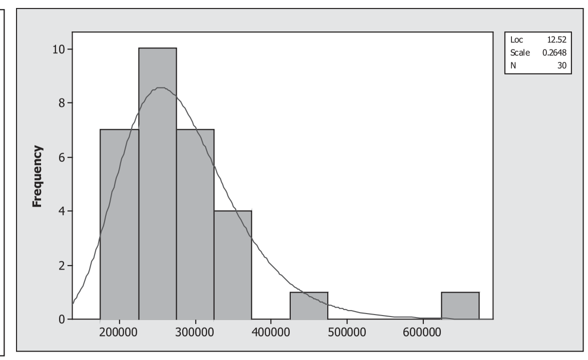
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Lognormal

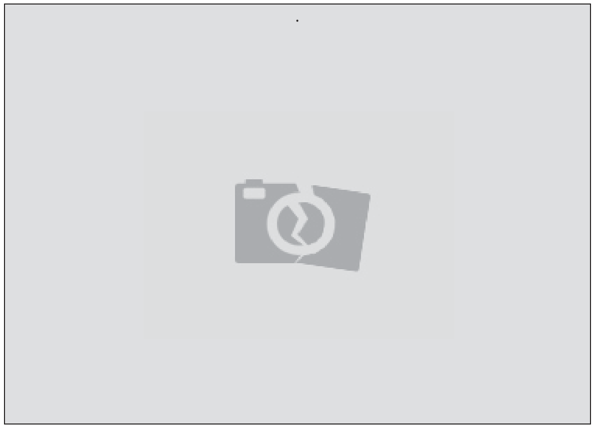
Statistical test used T Test of Log(x)

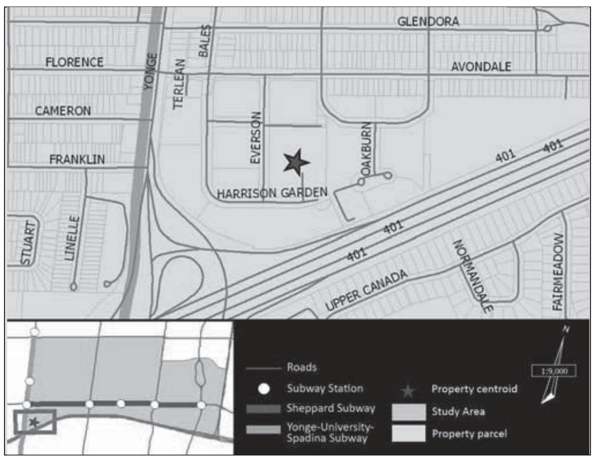
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
252715	269568	297760

Mansions of Avondale Townhomes

BLOCK ID
12456





Municipal Address	3 & 5 Everson Drive
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	0
Townhouse Units	252
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

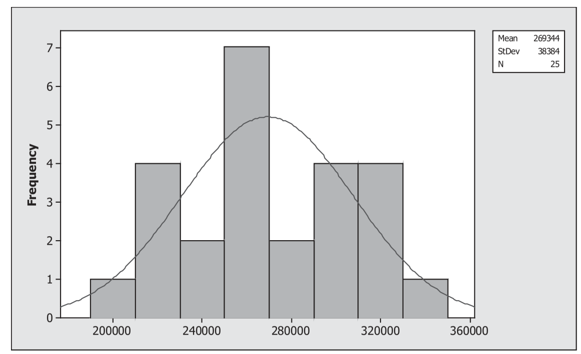
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



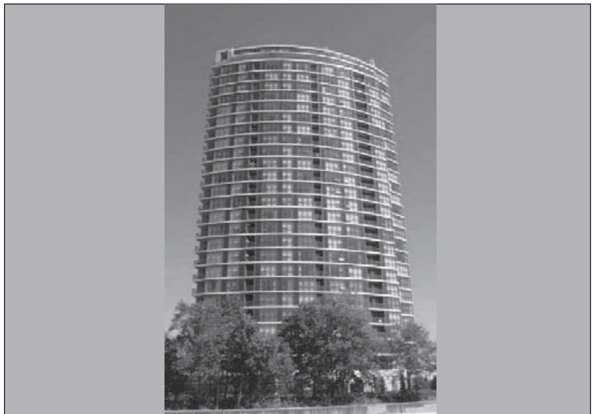
2006

Distribution Characteristics Slightly Normal
Statistical test used T Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
256210	269344	282478

Spectrum I

BLOCK ID
12466



(Krawczyk, 2008)

Municipal Address	30 Harrison Garden Boulevard
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	274
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

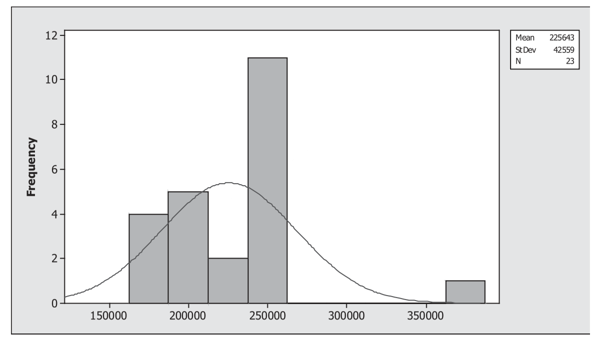
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

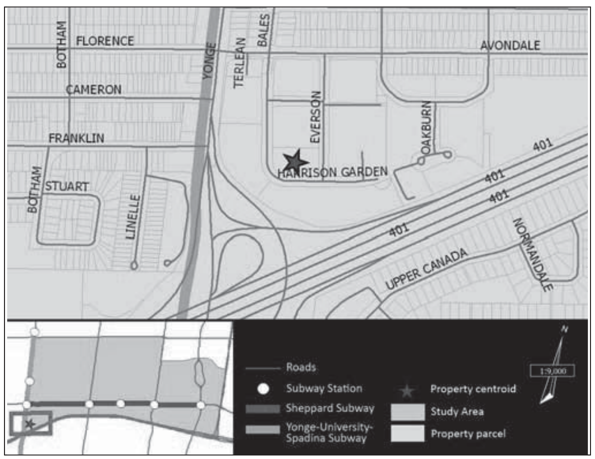
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
196,105	240,000	243,000

Mansions of Avondale I & II

BLOCK ID
12495

(Krawczyk, 2008)



Municipal Address	51 & 55 Harrison Garden Boulevard
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	252
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

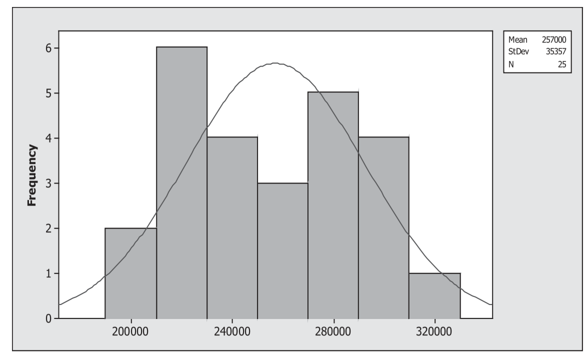
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

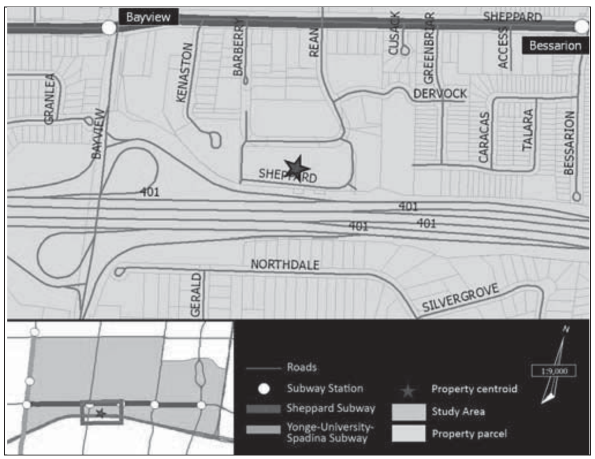
Confidence Interval at 89.9%

LOWER	MEAN/MEDIAN	UPPER
245000	257000	269000

Chrysler I and II (Highrises)

BLOCK ID
12496

(Krawczyk, 2008)



Municipal Address	1 & 3 Rean Drive
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	640
Townhouse Units	619
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

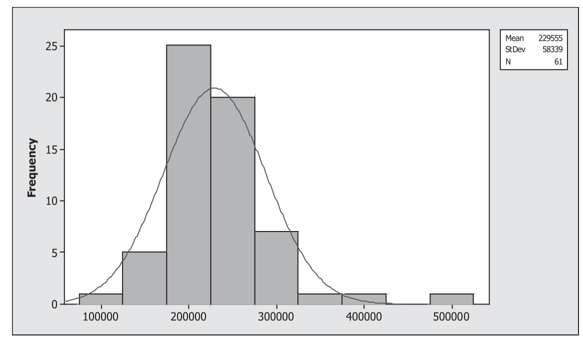
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Normal
Statistical test used T Test
Confidence Interval at 90%

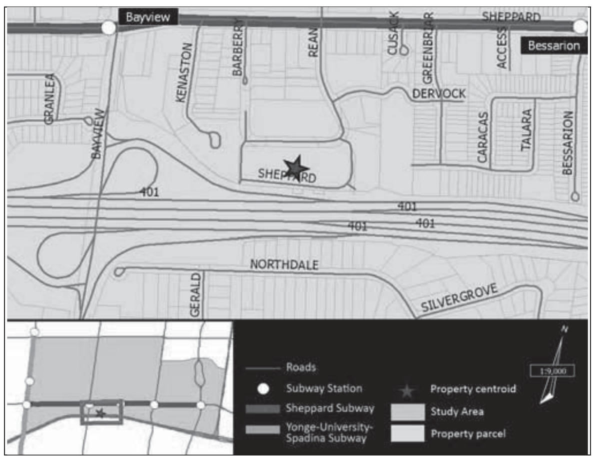
LOWER	MEAN/MEDIAN	UPPER
217,076	229,555	242,034

Chrysler I and II (Townhomes)

BLOCK ID

12496

(Krawczyk, 2008)



Municipal Address	1 & 3 Rean Drive
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	640
Townhouse Units	619
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

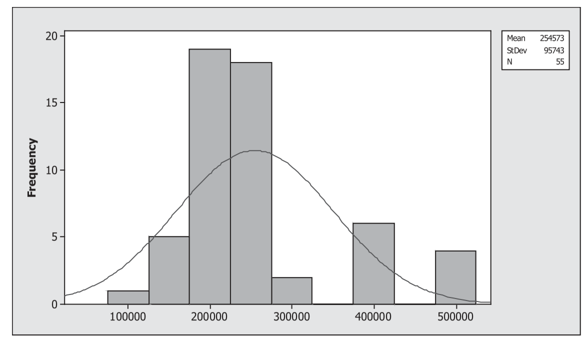
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

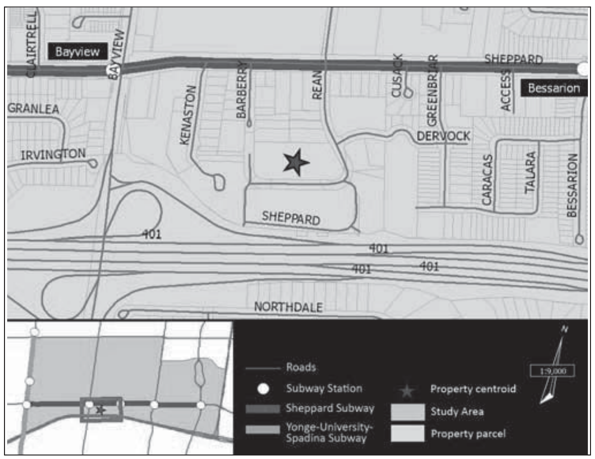
Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
217,500	234,000	252,500

Waldorf I and II (Highrise)

BLOCK ID
12498

(Krawczyk, 2008)



Municipal Address	2 & 8 Rean Drive
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	452
Townhouse Units	86
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

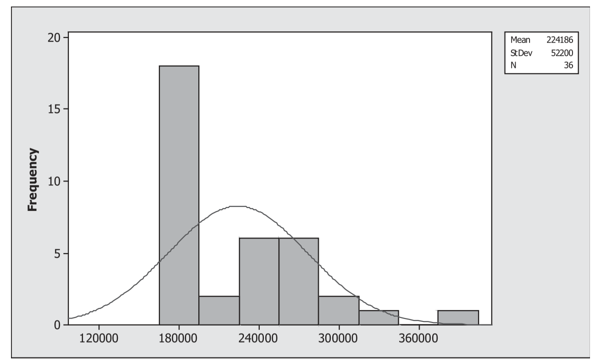
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

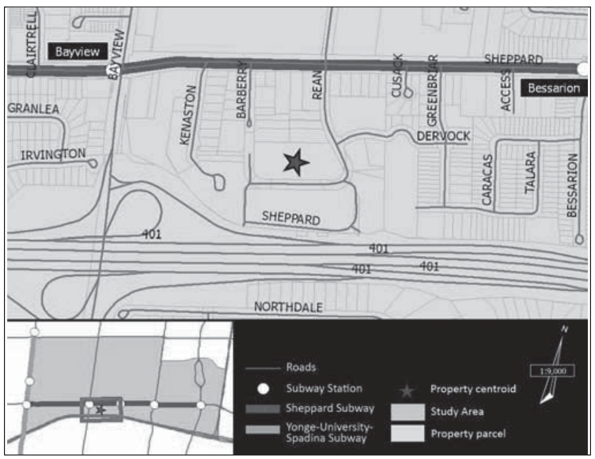
LOWER	MEAN/MEDIAN	UPPER
187,000	194,500	233,860

Waldorf I and II (Townhomes)

BLOCK ID

12498

(Krawczyk, 2008)



Municipal Address	2 & 8 Rean Drive
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	452
Townhouse Units	86
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

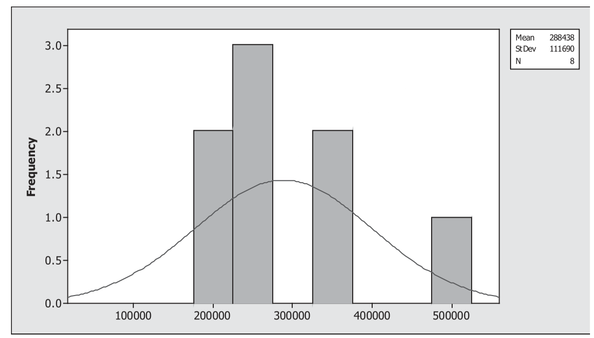
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric

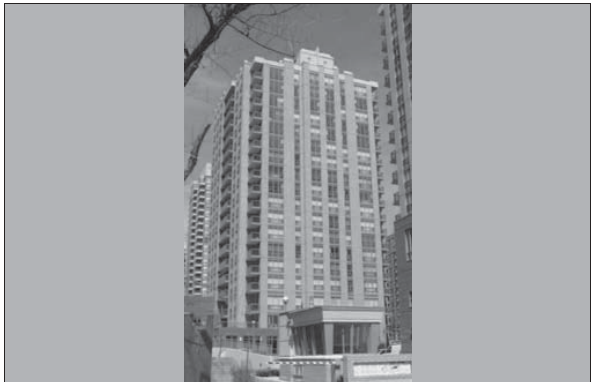
Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
202,169	244,500	357,629

Princess Place I

BLOCK ID
12506


(Krawczyk, 2008)

Municipal Address	26 Olive Avenue
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	198
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

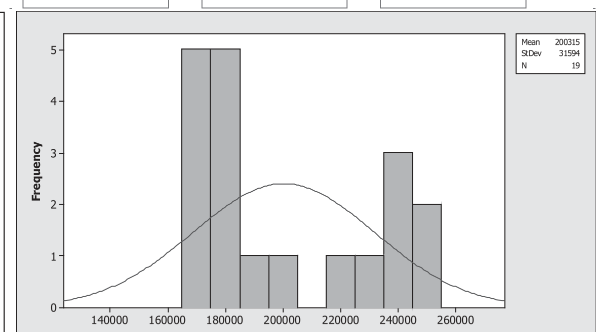
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

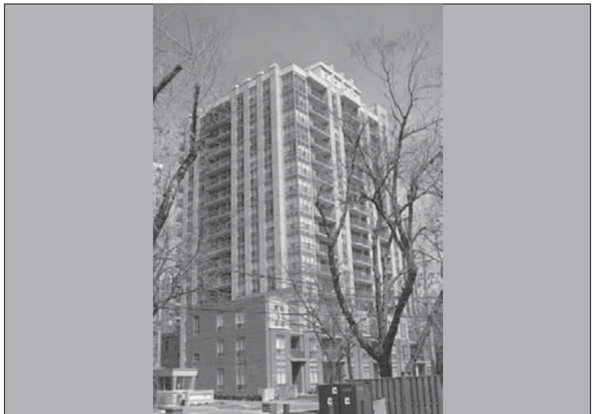
Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
175,770	180,500	224,837

Princess Place II

BLOCK ID

12515



(Krawczyk, 2008)

Municipal Address	28 Olive Avenue
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	176
Townhouse Units	0
Year Erected	2002

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

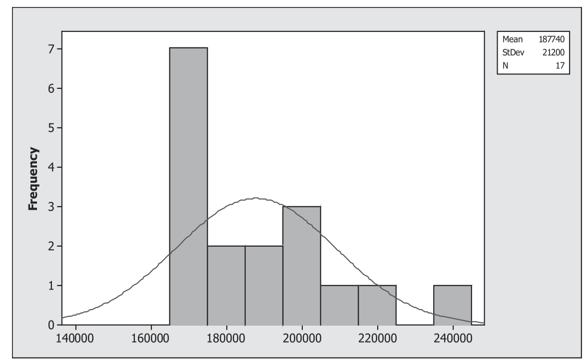
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
172,607	180,000	195,787

Spectrum II

BLOCK ID
12526

(Krawczyk, 2008)

Municipal Address	28 Harrison Garden Boulevard
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	234
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

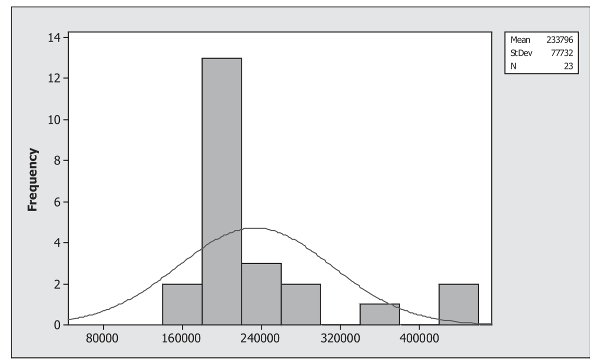
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



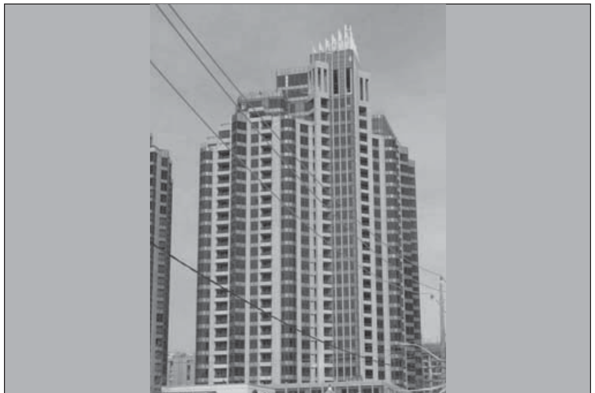
2006

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.3%

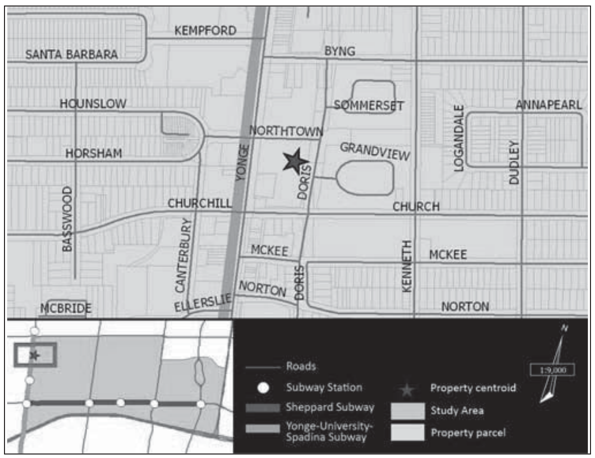
LOWER	MEAN/MEDIAN	UPPER
194500	213750	243500

Triomphe at Northtown II

BLOCK ID
12531



(Krawczyk, 2008)



Municipal Address	15 Northtown Way
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium Retail Podium
Highrise Units	323
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

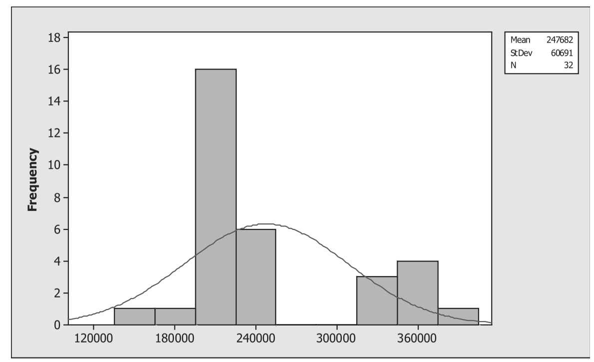
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric

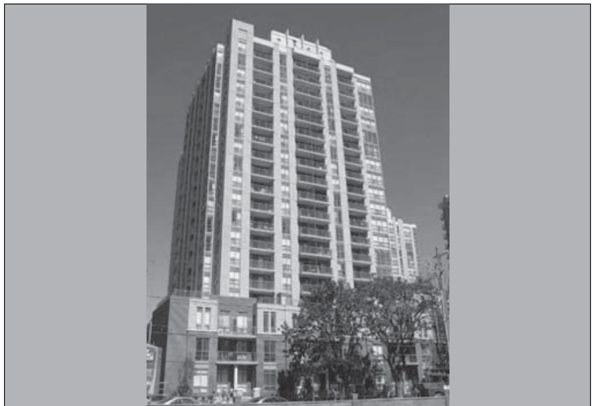
Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
211807	222000	240676

Princess Place III

BLOCK ID
12540



(Krawczyk, 2008)

Municipal Address	20 Olive Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	242
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

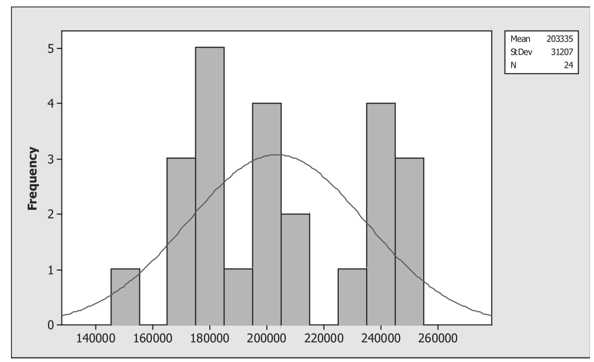
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Multimodal, asymmetric

Statistical test used Sign Test

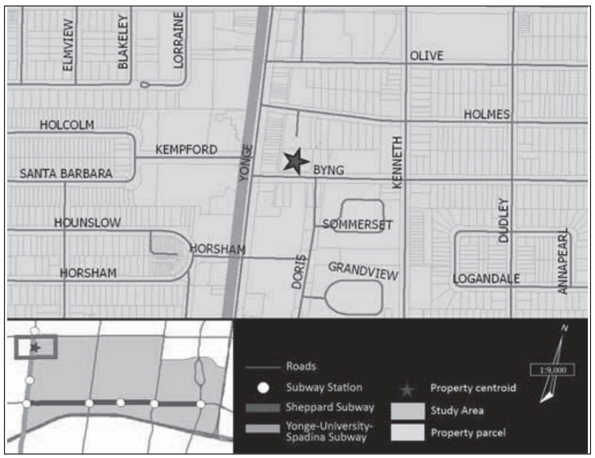
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
181,207	195,000	220,296

Monaco

BLOCK ID: 12543

(Krawczyk, 2008)



Municipal Address	28 Byng Avenue
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	142
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

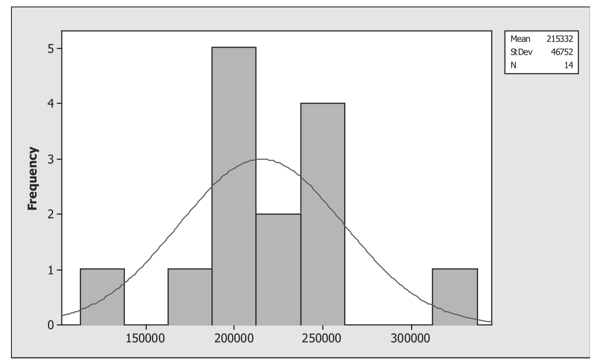
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

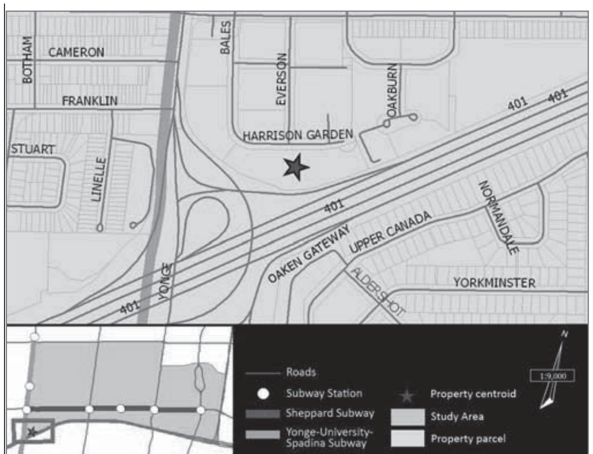
Confidence Interval at 89.7%

LOWER	MEAN/MEDIAN	UPPER
190,500	214,500	236,500

Skymark at Avondale I and II (Highrise)

BLOCK ID

12556



Municipal Address	78 & 80 Harrison Gardens Boulevard
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium Townhouse Podium
Condominium Units	362
Townhouse Units	53
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics	
Statistical test used	

Confidence Intervals at 90%

LOW	MEDIAN	HIGH

NO DATA

Structure not yet built

1996

Distribution Characteristics	
Statistical test used	

Confidence Intervals at 90%

LOW	MEDIAN	HIGH

NO DATA

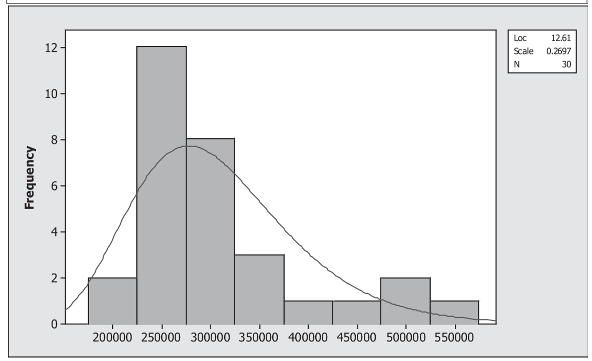
Structure not yet built

2001

Distribution Characteristics	
Statistical test used	

Confidence Intervals at 90%

LOW	MEDIAN	HIGH



2006

Distribution Characteristics	Lognormal
Statistical test used	T Test

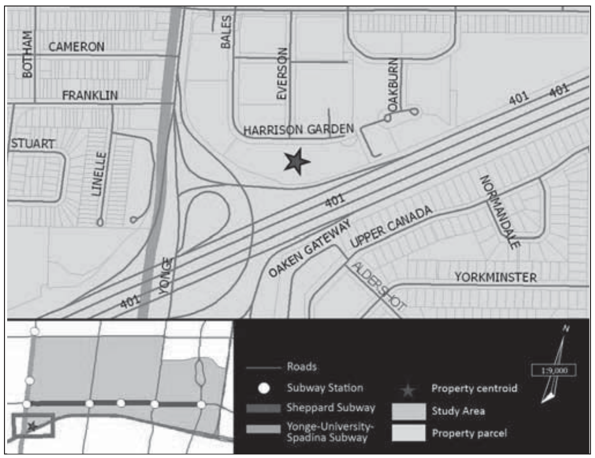
Confidence Intervals at 90%

LOW	MEDIAN/MEAN	HIGH

Skymark at Avondale I and II (Highrise)

BLOCK ID
12556

(Krawczyk, 2008)



Municipal Address	78 & 80 Harrison Garden Boulevard
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	362
Townhouse Units	53
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

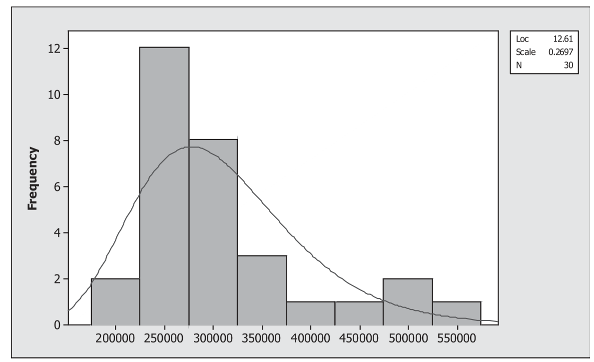
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

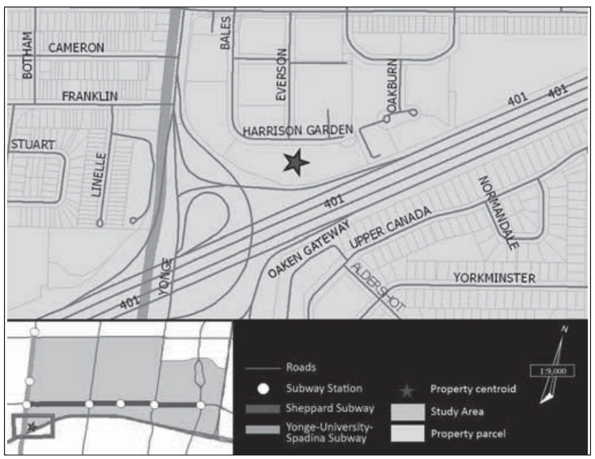
Distribution Characteristics Lognormal
Statistical test used T Test of Log(x)
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
278934	299139	323189

Skymark at Avondale I and II (Highrise)

BLOCK ID 12556

(Krawczyk, 2008)



Municipal Address	78 & 80 Harrison Garden Boulevard
Community	NorthYork Centre
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	362
Townhouse Units	53
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

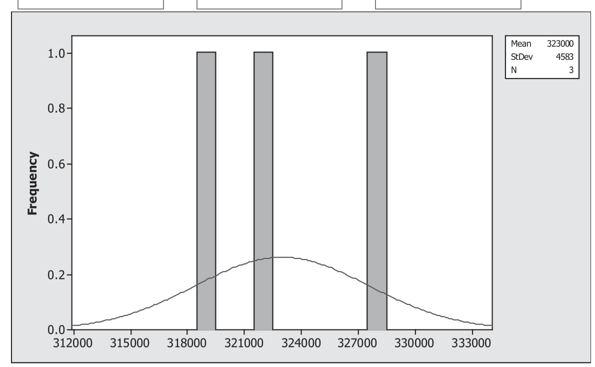
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

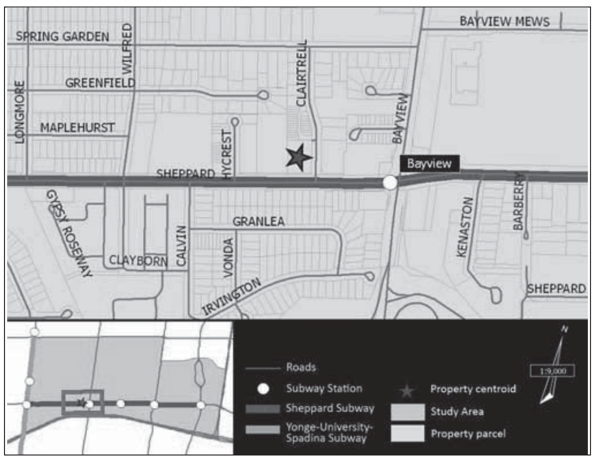
Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 75%

LOWER	MEAN/MEDIAN	UPPER
319000	322000	328000

Bayview Mansions I

BLOCK ID
12574


(Krawczyk, 2008)



Municipal Address	2 Clairtrell Avenue
Community	Clairtrell
Property Type	Highrise Leasehold Condominium
Highrise Units	138
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

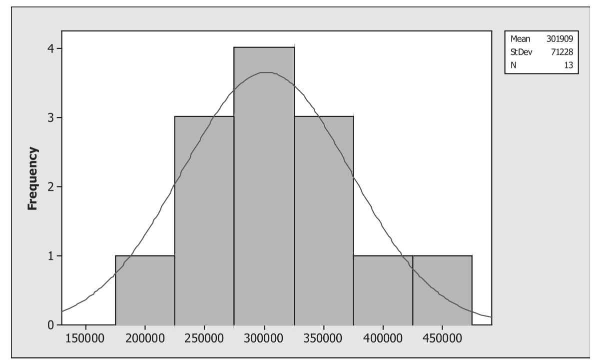
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Normal
Statistical test used T Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
266,700	301,909	337,118

21 Hillcrest Avenue

BLOCK ID
12582


(Krawczyk, 2008)

Municipal Address	21 Hillcrest Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	241
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

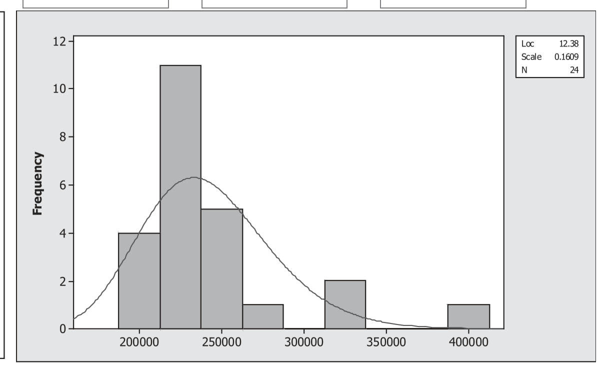
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



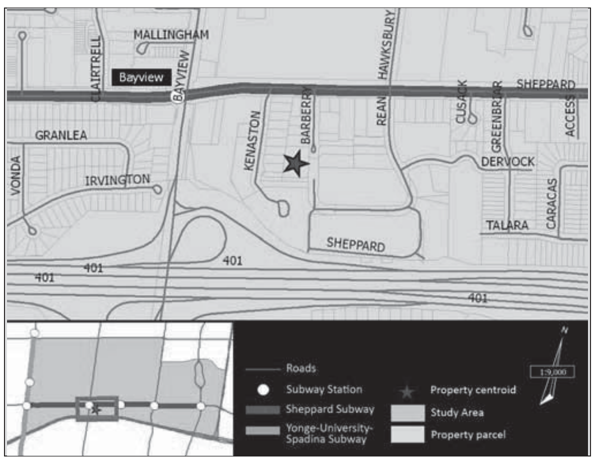
2006

Distribution Characteristics Lognormal
Statistical test used T Test of Log(x)
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
225544	236111	277626

Chelsea

BLOCK ID
12593



Municipal Address	19 Barberry Place
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium
Highrise Units	129
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

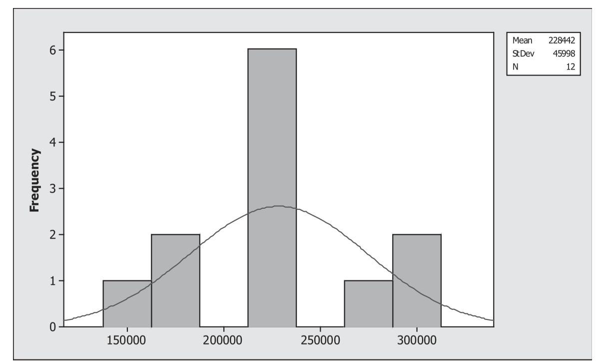
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Unimodal, asymmetric

Statistical test used Wilcoxon Signed-Ranks Test

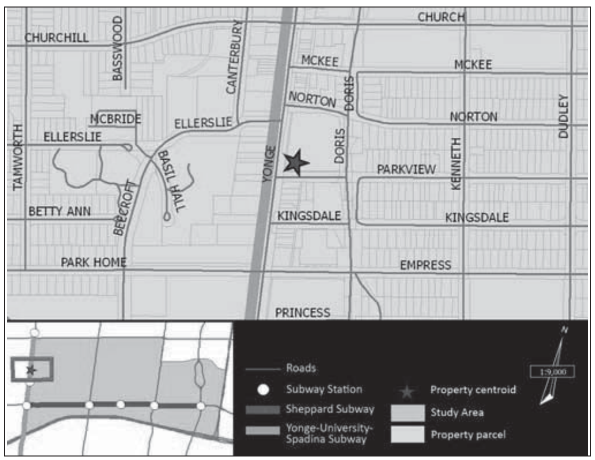
Confidence Interval at 89.2%

LOWER	MEAN/MEDIAN	UPPER
201,250	228,250	256,500

Majestic II

BLOCK ID
12599

(Krawczyk, 2008)



Municipal Address	18 Parkview Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium Retail Podium
Highrise Units	291
Townhouse Units	0
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

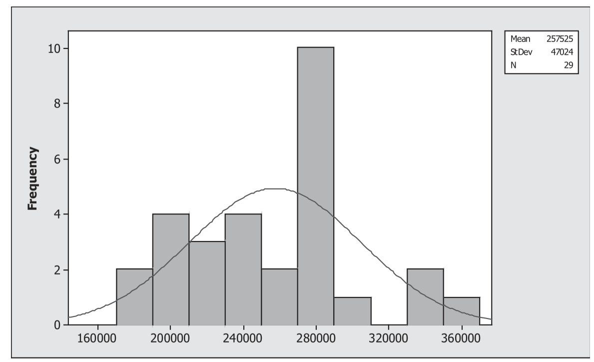
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

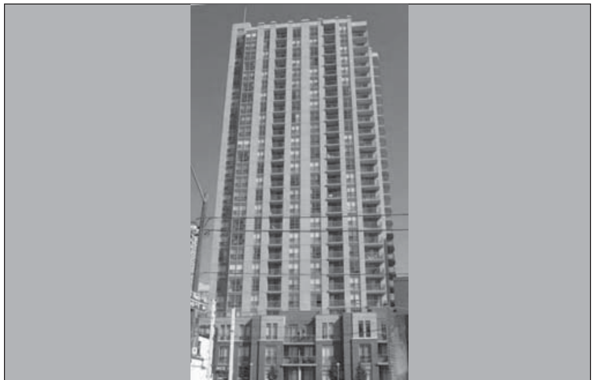
Distribution Characteristics Normal
Statistical test used T Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
242,671	257,525	272,380

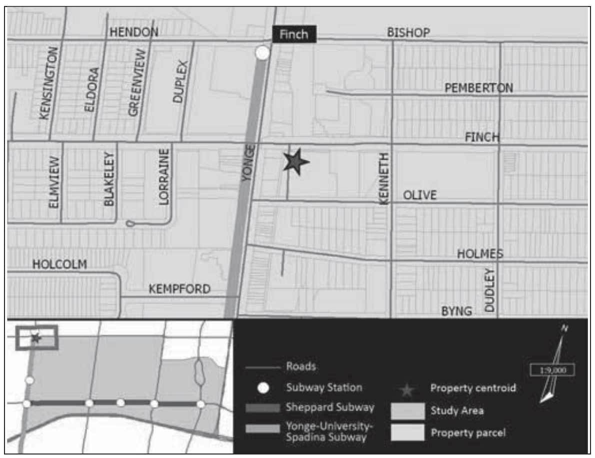
Princess Place IV (Highrise)

BLOCK ID

12602



(Krawczyk, 2008)



Municipal Address	22 Olive Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	283
Townhouse Units	110
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

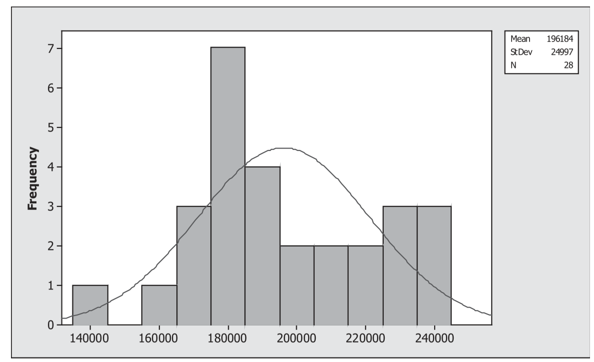
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Normal

Statistical test used T Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
188,137	196,184	204,230

Princess Place IV (Townhomes)

BLOCK ID
12602

(Krawczyk, 2008)

Municipal Address	22 Olive Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	283
Townhouse Units	110
Year Erected	2003

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

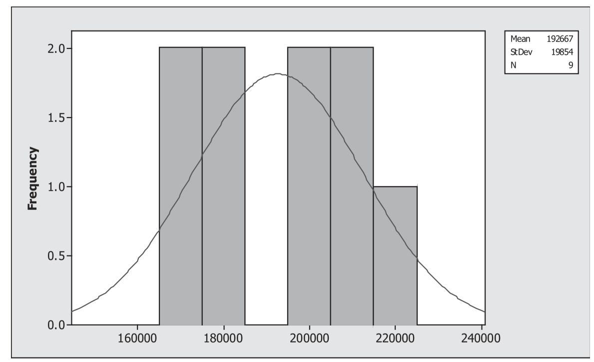
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

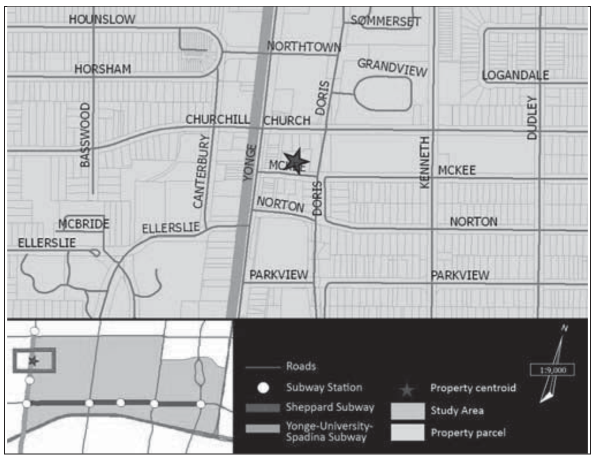
Distribution Characteristics Bimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90.3%

LOWER	MEAN/MEDIAN	UPPER
181,500	191,000	205,250

Marquis at Northtown

BLOCK ID
12608

(Krawczyk, 2008)



Municipal Address	8 McKee Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	121
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

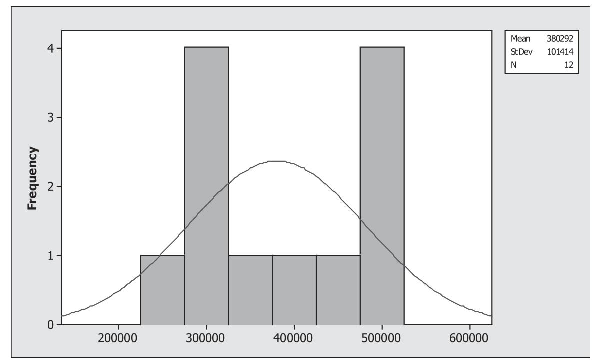
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

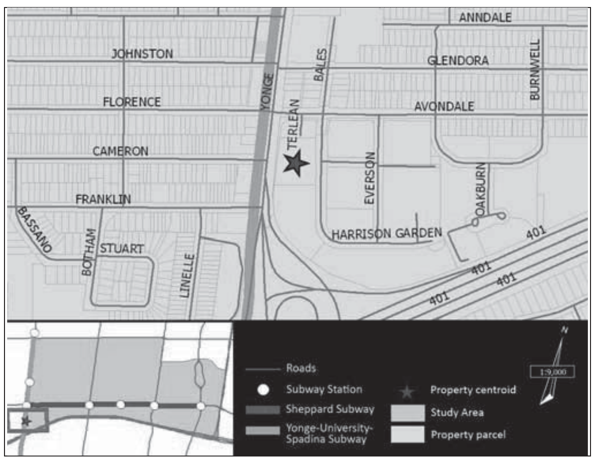
LOWER	MEAN/MEDIAN	UPPER
284,401 `	379,500	475,799

Residences of Avondale I and II

BLOCK ID

12633

(Krawczyk, 2008)



Municipal Address	16-18 Harrison Garden Boulevard
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	624
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

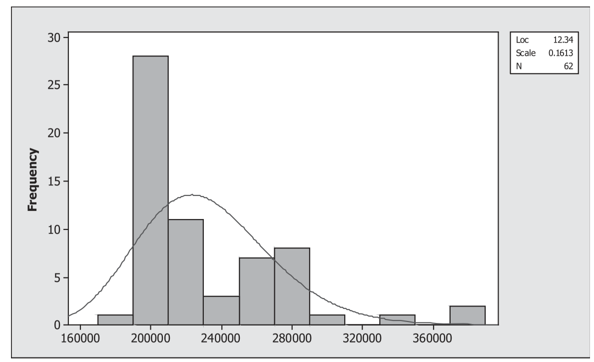
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Lognormal, slightly bimodal

Statistical test used T Test of Log(x)

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
224789	229377	231879

Monet

BLOCK ID
12642

(Krawczyk, 2008)

Municipal Address	60 Byng Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	312
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

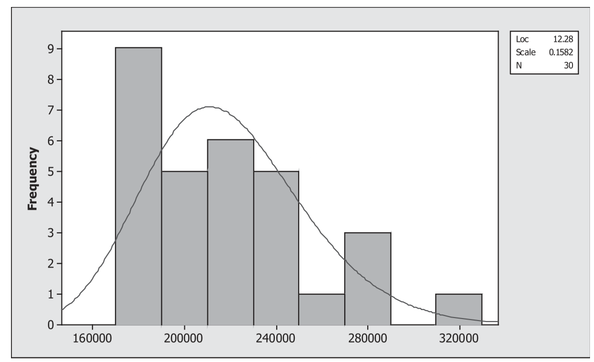
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

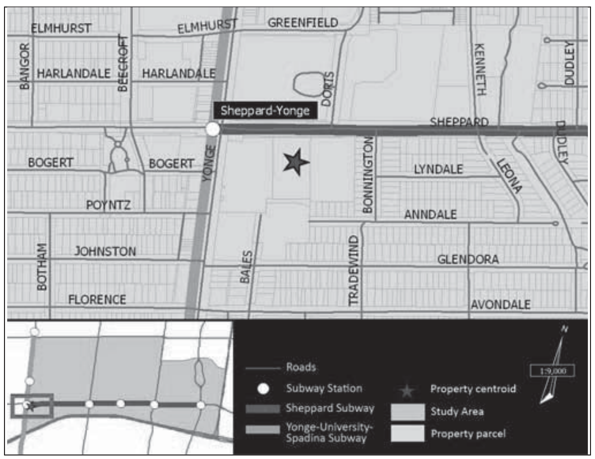
Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
197,064	214,500	226,000

Radiance at Minto Gardens

BLOCK ID
12645

(Krawczyk, 2008)



Municipal Address	33 Sheppard Avenue East
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	388
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

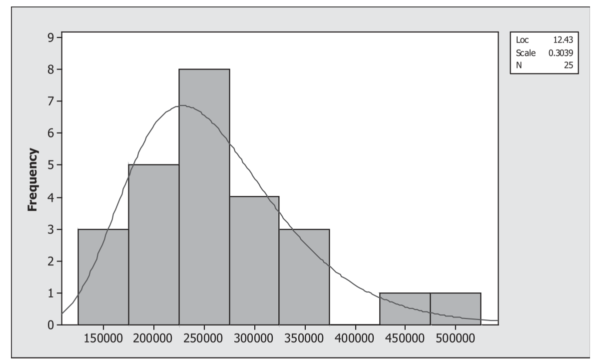
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

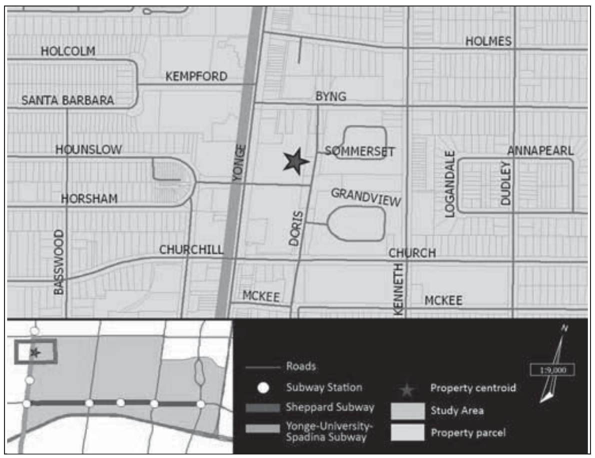
Distribution Characteristics Lognormal
Statistical test used T Test of Log(x)
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
222429	256829	271005

Grand Triomphe at Northtown

BLOCK ID
12677

(Krawczyk, 2008)



Municipal Address	10 Northtown Way
Community	North York Centre
Property Type	Highrise Leasehold Condominium Retail, Parking Podium
Highrise Units	411
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

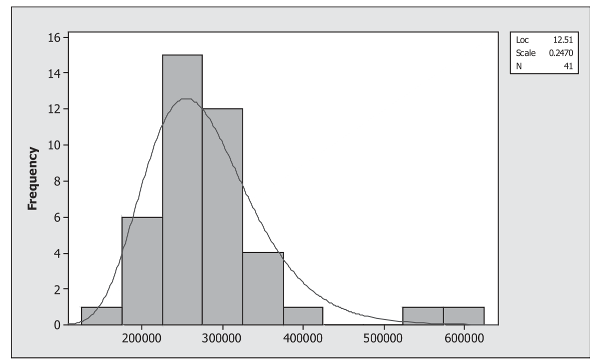
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



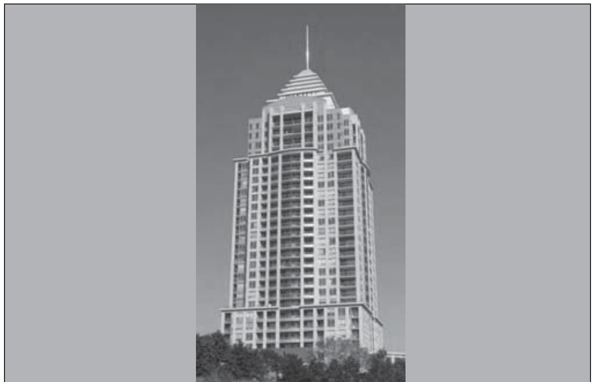
2006

Distribution Characteristics Lognormal
Statistical test used T Test of Log(x)
Confidence Interval at 90%

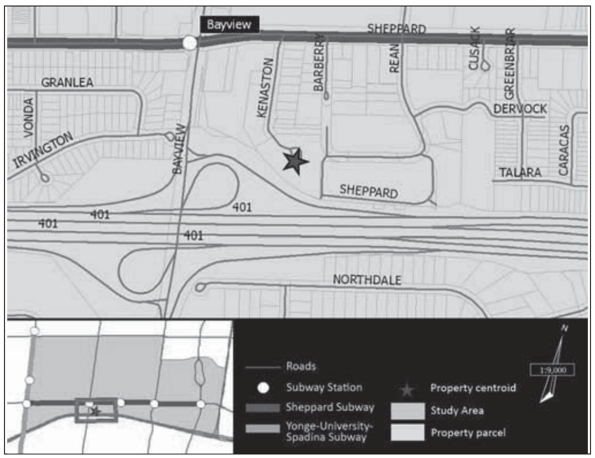
LOWER	MEAN/MEDIAN	UPPER
243093	264612	292327

Empire (Highrise)

BLOCK ID
12687



(Krawczyk, 2008)



Municipal Address	17 Barberry Place, 32-38 Kenaston Gardens
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	363
Townhouse Units	231
Year Erected	2005

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

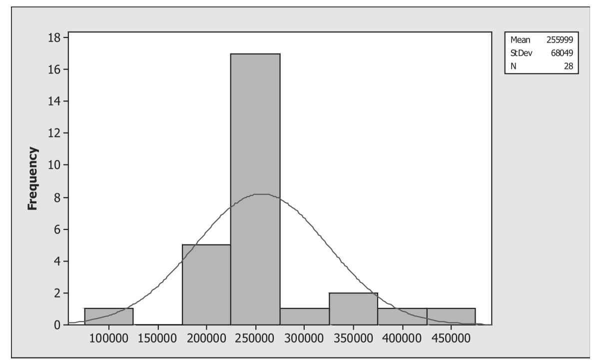
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



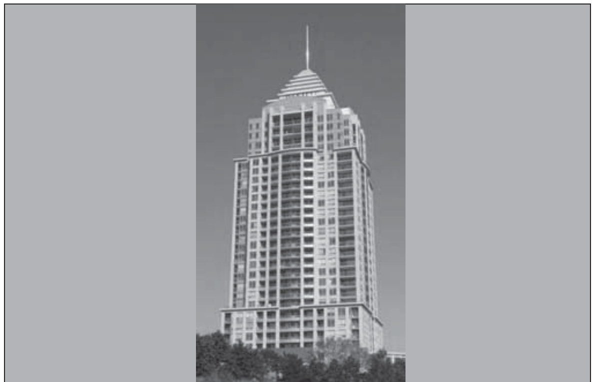
2006

Distribution Characteristics Normal
Statistical test used T Test
Confidence Interval at 90%

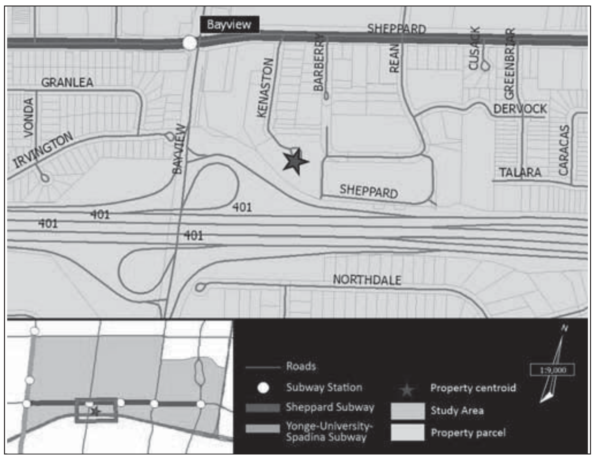
LOWER	MEAN/MEDIAN	UPPER
234,095	255,999	277,904

Empire (Townhouse)

BLOCK ID 12687



(Krawczyk, 2008)



Municipal Address	17 Barberry Place, 32-38 Kenaston Gardens
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium Townhouse Podium
Highrise Units	363
Townhouse Units	231
Year Erected	2005

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

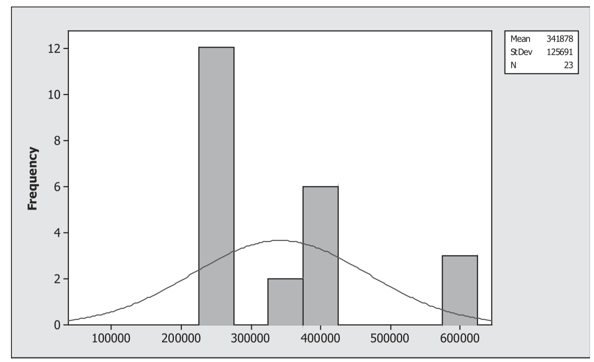
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

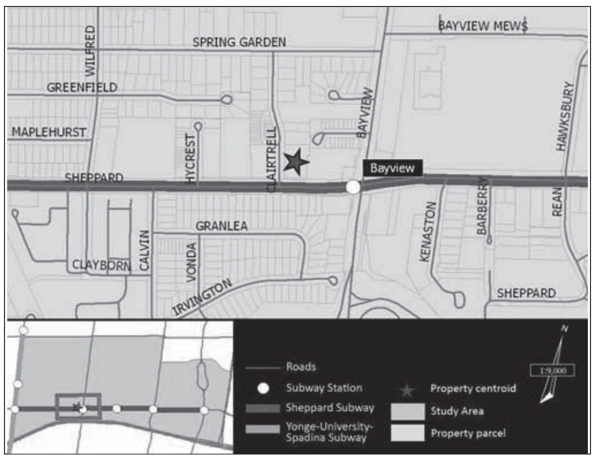
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
249,000	260,000	400,000

Bayview Mansions II

BLOCK ID
12688

(Krawczyk, 2008)



Municipal Address	1 Clairtrell Road
Community	Clairtrell
Property Type	Highrise Leasehold Condominium
Highrise Units	142
Townhouse Units	0
Year Erected	2004

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

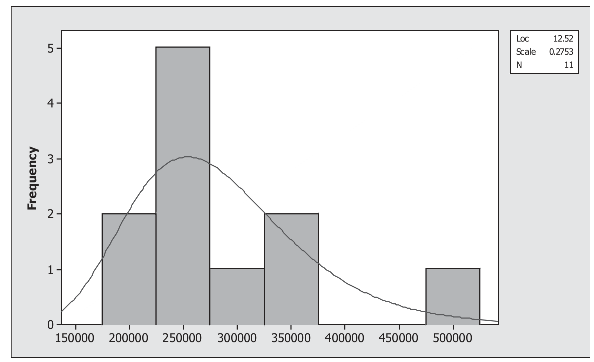
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

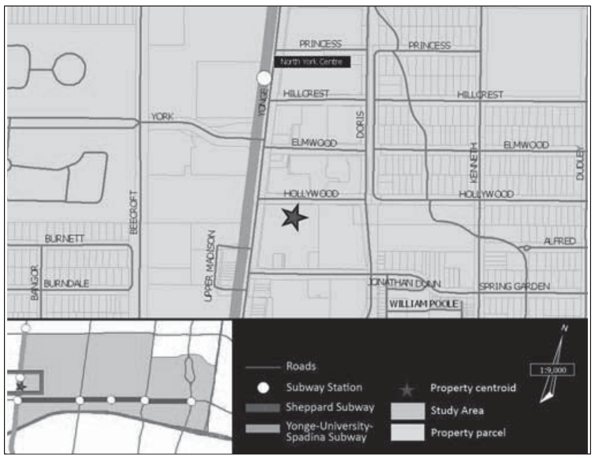
Distribution Characteristics Lognormal
Statistical test used T Test of Log(x)
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
238063	291480	325353

Platinum Towers I

BLOCK ID
12738

(Krawczyk, 2008)



Municipal Address	22 Hollywood Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	344
Townhouse Units	0
Year Erected	2005

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

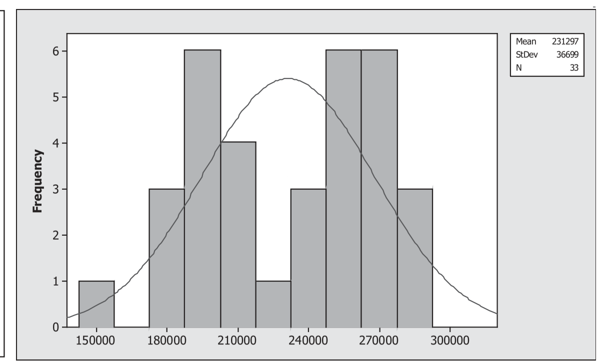
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

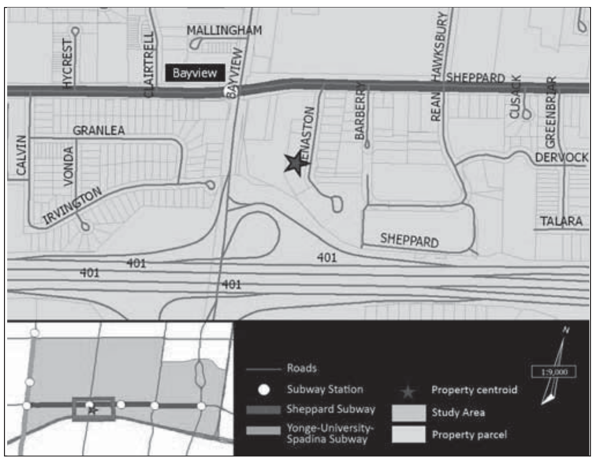
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
221,463	231,991	242,519

Rockefeller

BLOCK ID: 12763

(Krawczyk, 2008)



Municipal Address	18 Kenaston Gardens
Community	Kenaston Gardens
Property Type	Highrise Leasehold Condominium
Highrise Units	232
Townhouse Units	0
Year Erected	2006

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

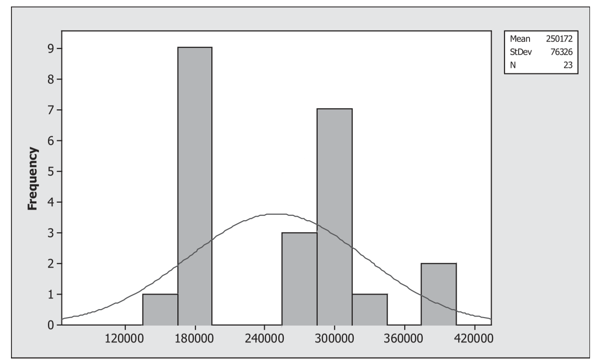
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



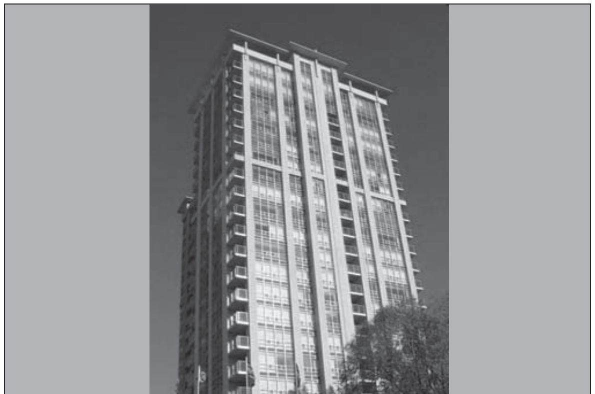
2006

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

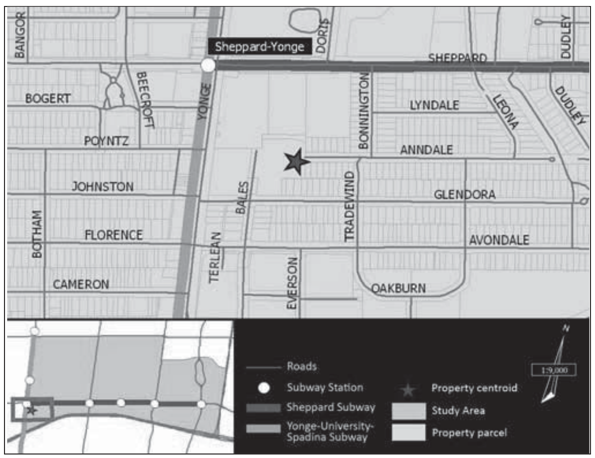
LOWER	MEAN/MEDIAN	UPPER
176,616	264,000	298,471

Cosmo II

BLOCK ID
12768



(Krawczyk, 2008)



Municipal Address	32 Glendora Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	287
Townhouse Units	0
Year Erected	2006

NO DATA

Structure not yet built

1991

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

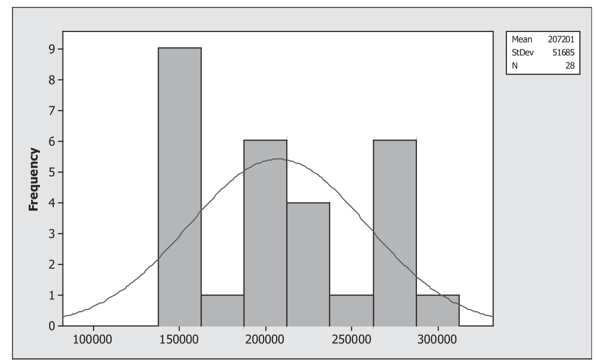
NO DATA

Structure not yet built

2001

Distribution Characteristics
Statistical test used
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



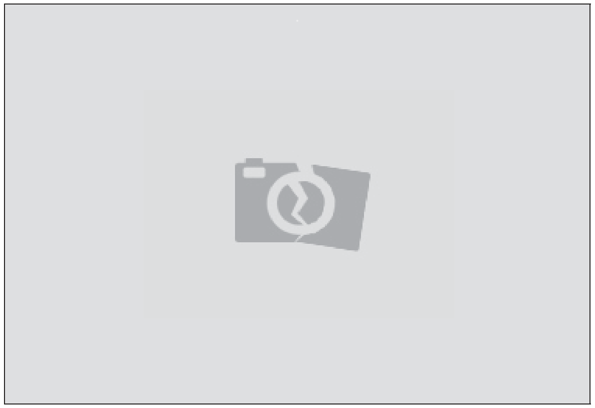
2006

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
169,084	198,297	214,664

Kenneth Avenue Townhomes

BLOCK ID 12776



Municipal Address	70 Byng Avenue, 420-422 Kenneth Avenue
Community	North York Centre
Property Type	Townhouse Leasehold Condominium
Highrise Units	0
Townhouse Units	71
Year Erected	2006

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

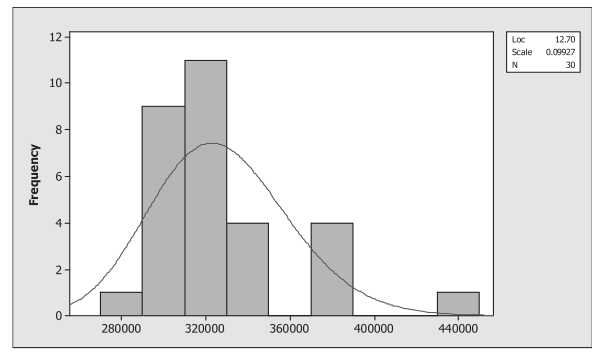
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Lognormal

Statistical test used T Test of Log(x)

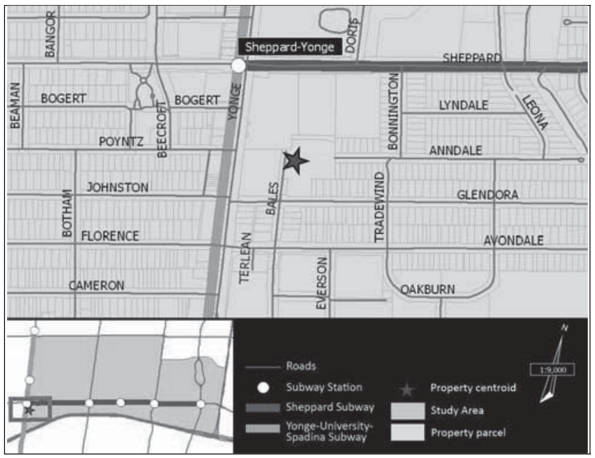
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
303696	324675	336325

Cosmo I

BLOCK ID 12782

(Krawczyk, 2008)



Municipal Address	31 Bales Avenue, 26-30 Glendora Avenue
Community	North York Centre
Property Type	Highrise Leasehold Condominium
Highrise Units	300
Townhouse Units	0
Year Erected	2006

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

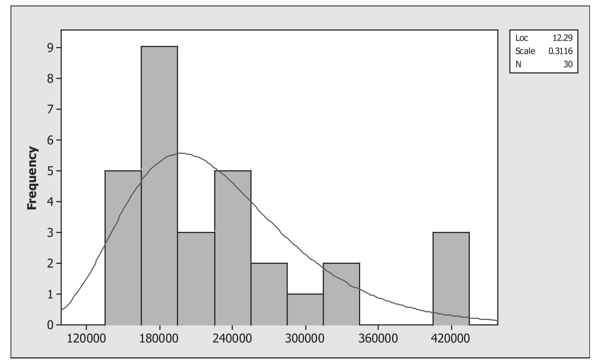
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Lognormal

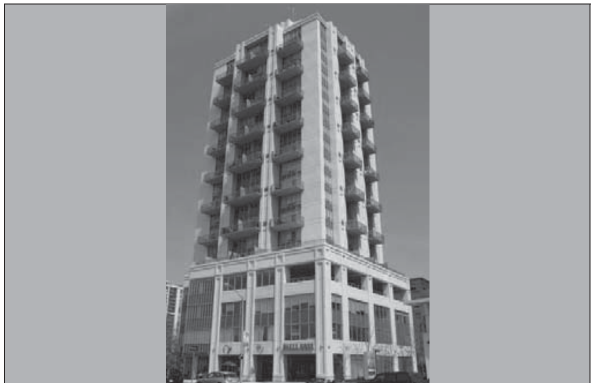
Statistical test used T Test of Log(x)

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
202710	224460	239106

Avondale Lofts

BLOCK ID
12809



(Krawczyk, 2008)

Municipal Address	1-19 Avondale Avenue, 4665 Yonge Street
Community	North York Centre
Property Type	Highrise Leasehold Condominium Retail podium
Highrise Units	202
Townhouse Units	0
Year Erected	2006

NO DATA

Structure not yet built

1991

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

1996

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER

NO DATA

Structure not yet built

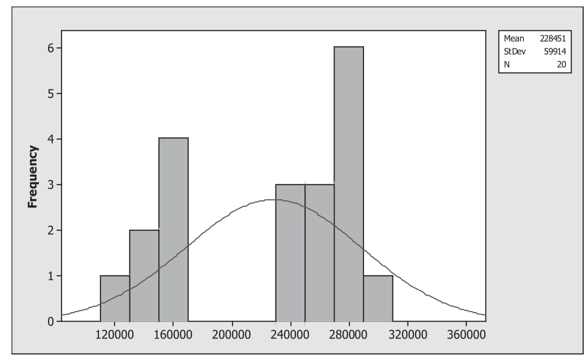
2001

Distribution Characteristics

Statistical test used

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER



2006

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

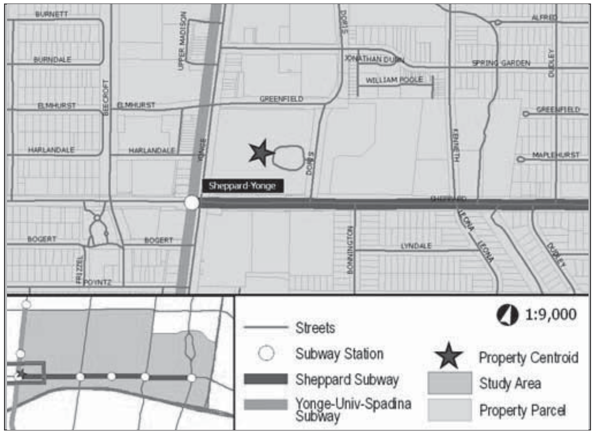
LOWER	MEAN/MEDIAN	UPPER
165,483	254,499	271,445

Appendix G:

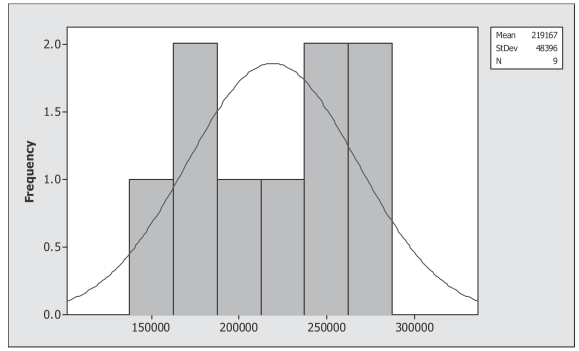
Multi-Dwelling Freehold Property Estimates

Rental Apartment Value Estimate - North York Centre South – Highrise

APT ID
1



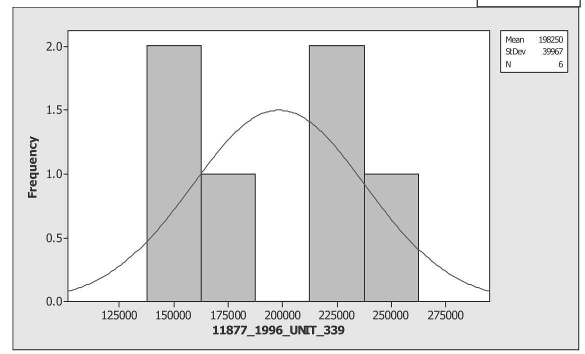
APT ID	1		
Condos extrapolated	BLOCK_ID: 11877		
Apartment properties PINs and addresses	100849503	2	Sheppard Avenue East
Other comments			



1991

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

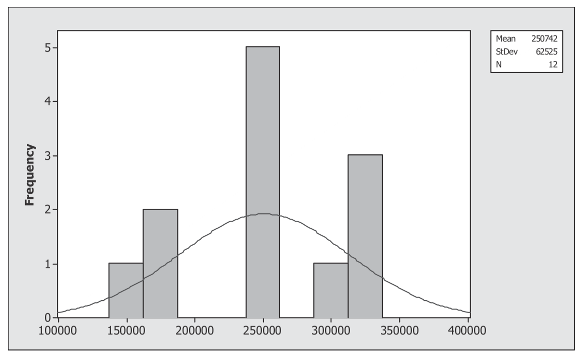
LOWER	MEAN/MEDIAN	UPPER
174,100	217,000	261,360



1996

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

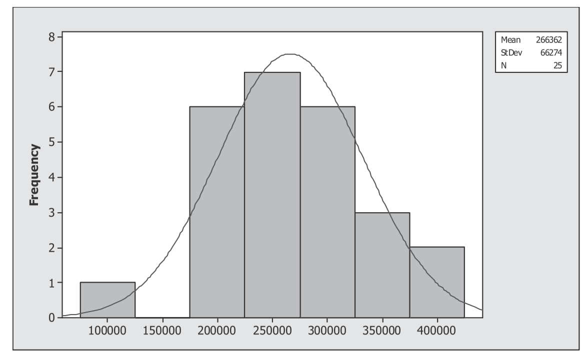
LOWER	MEAN/MEDIAN	UPPER
159,230	197,500	236,926



2001

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 89.2%

LOWER	MEAN/MEDIAN	UPPER
210,000	247,100	285,000



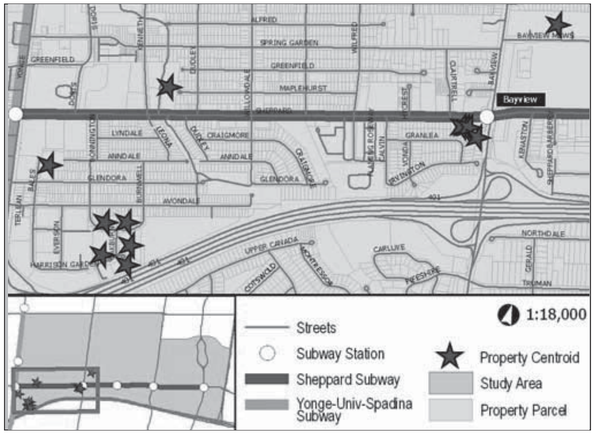
2006

Distribution Characteristics Unimodal, asymmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 89.9%

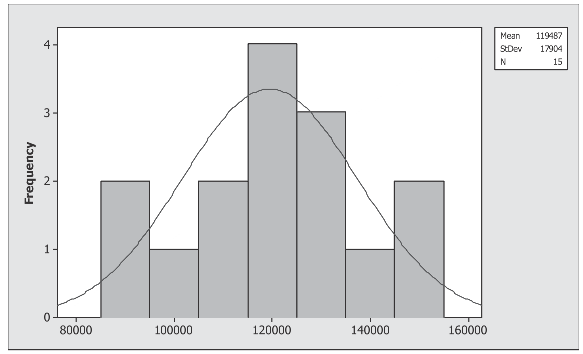
LOWER	MEAN/MEDIAN	UPPER
245,000	269,000	287,050

Rental Apartment Value Estimate - North York Centre South – Midrise

APT ID
2



APT ID	2		
Condos extrapolated	BLOCK_ID: 11016, 11290, 11301		
Apartment properties PINs and addresses	101049510	2	Bales Avenue
	101040005	2818	Bayview Avenue
	100610137	2911	Bayview Avenue
	100750238	100	Maplehurst Avenue
	101041583	1	Oakburn Place
	101041584	2	Oakburn Place
	101041585	3	Oakburn Place
	101041586	4	Oakburn Place
	101041587	5	Oakburn Place
	101040787	341	Sheppard Avenue East
	101040785	343	Sheppard Avenue East
	101040789	345	Sheppard Avenue East
Other comments			



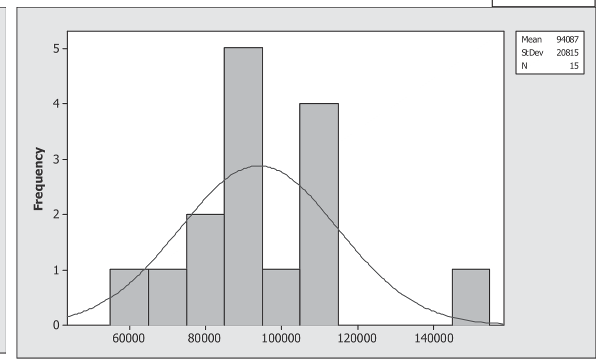
1991

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.4%

LOWER	MEAN/MEDIAN	UPPER
111,000	119,750	127,500



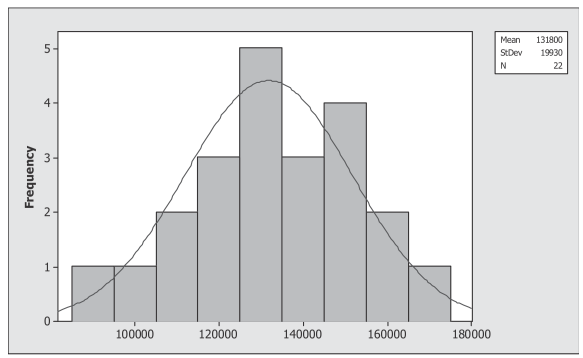
1996

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
85,437	87,000	107,047



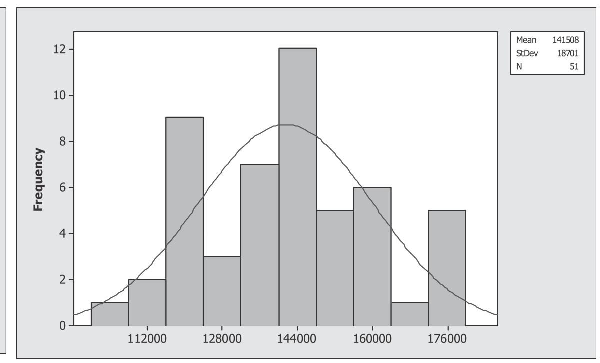
2001

Distribution Characteristics Almost Normal

Statistical test used T Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124,488	131,800	139,112



2006

Distribution Characteristics Unimodal, almost symmetric

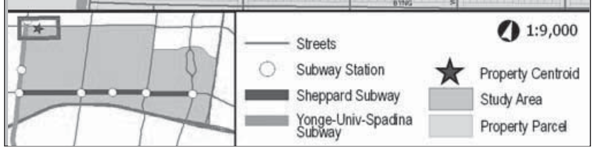
Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

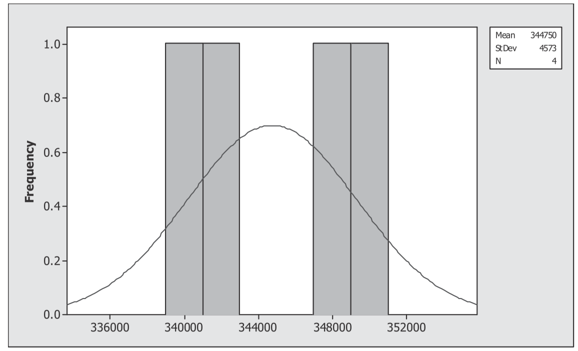
LOWER	MEAN/MEDIAN	UPPER
137,000	141,003	146,000

Rental Apartment Value Estimate - North York Centre North - Highrise

APT ID
3



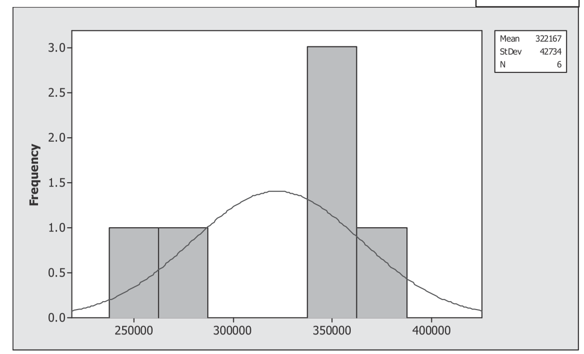
APT ID	3	
Condos extrapolated	BLOCK_ID: 11650	
Apartment properties PINs and addresses	100790154	77 Finch Avenue East
Other comments		



1991

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 87.5%

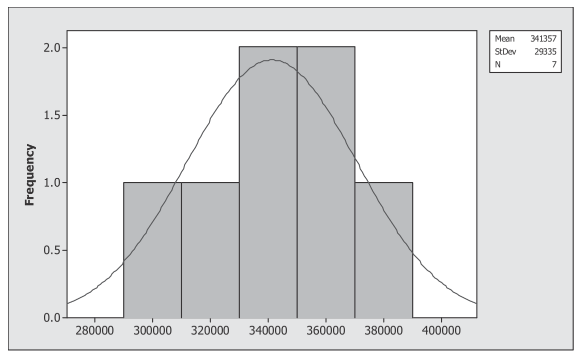
LOWER	MEAN/MEDIAN	UPPER
340,000	344,500	350,000



1996

Distribution Characteristics Too few samples
Statistical test used Sign Test
Confidence Interval at 90%

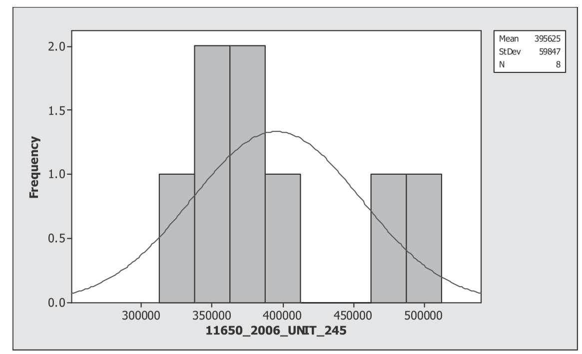
LOWER	MEAN/MEDIAN	UPPER
276,554	341,000	351,622



2001

Distribution Characteristics Unimodal, too few samples
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
318,824	344,000	358,935



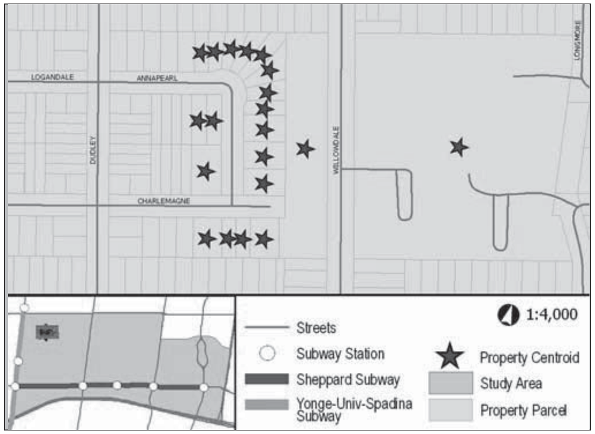
2006

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

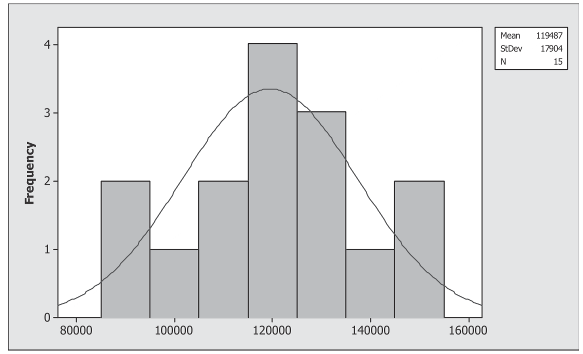
LOWER	MEAN/MEDIAN	UPPER
353,202	380,000	450,983

Rental Apartment Value Estimate - North York Centre North – Midrise

APT ID
4



APT ID	4	
Condos extrapolated	BLOCK_ID: 11016, 11290, 11301	
Apartment properties PINs and addresses	100780165	12 Annapearl Court
	100780166	14 Annapearl Court
	100780359	16 Annapearl Court
	100780360	16 Annapearl Court
	100780099	19 Annapearl Court
	100780126	20 Annapearl Court
	100780100	21 Annapearl Court
	100780127	22 Annapearl Court
	100780128	24 Annapearl Court
	100780129	26 Annapearl Court
	100780130	28 Annapearl Court
	100780131	32 Annapearl Court
	100780132	34 Annapearl Court
	100780193	17 Charlemagne Drive
	100780194	19 Charlemagne Drive
	100780101	20 Charlemagne Drive
	100780134	23 Charlemagne Drive
	100780136	25 Charlemagne Drive
	100710079	415 Willowdale Avenue
	100780133	450 Willowdale Avenue
Other comments		

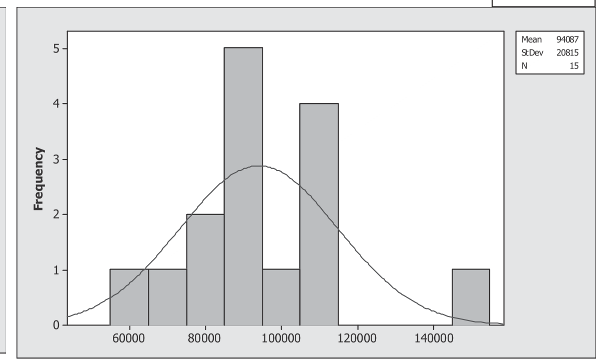


1991

Distribution Characteristics	Unimodal, symmetric
Statistical test used	Wilcoxon Signed-Ranks Test

Confidence Interval at 89.4%

LOWER	MEAN/MEDIAN	UPPER
111,000	119,750	127,500

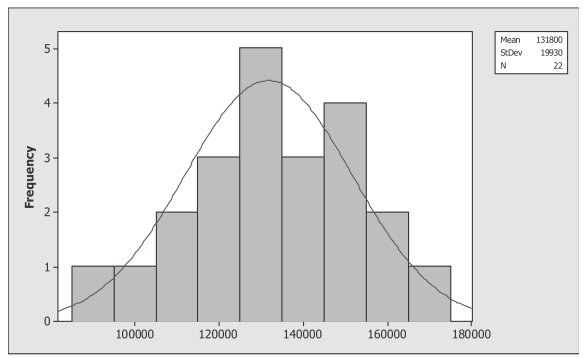


1996

Distribution Characteristics	Bimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
85,437	87,000	107,047

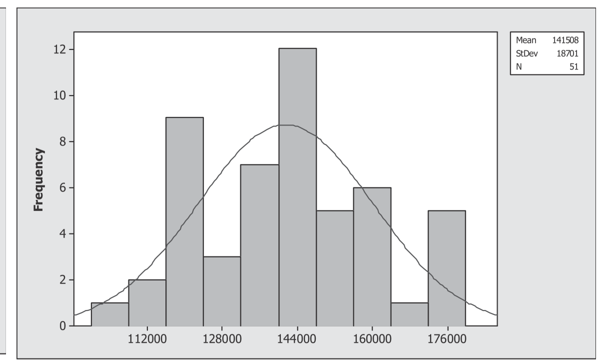


2001

Distribution Characteristics	Almost Normal
Statistical test used	T Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124,488	131,800	139,112



2006

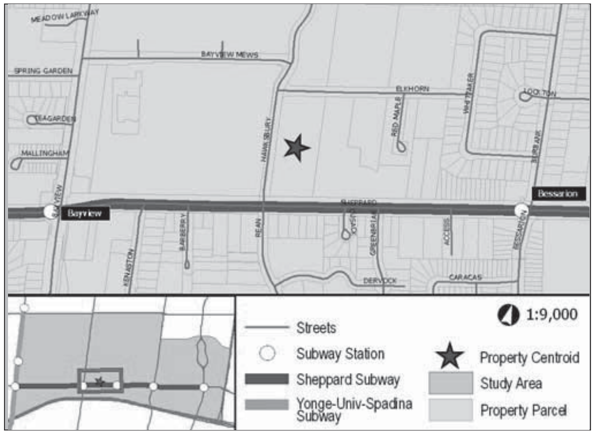
Distribution Characteristics	Unimodal, almost symmetric
Statistical test used	Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

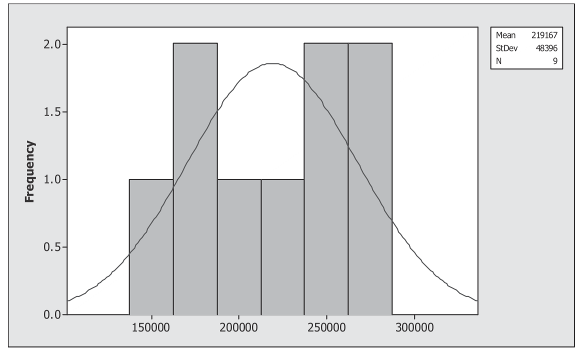
LOWER	MEAN/MEDIAN	UPPER
137,000	141,003	146,000

Rental Apartment Value Estimate – Bayview Village – Highrise

APT ID
5



APT ID	5	
Condos extrapolated	BLOCK_ID: 11877	
Apartment properties PINs and addresses	100600194	644 Sheppard Avenue East
Other comments		



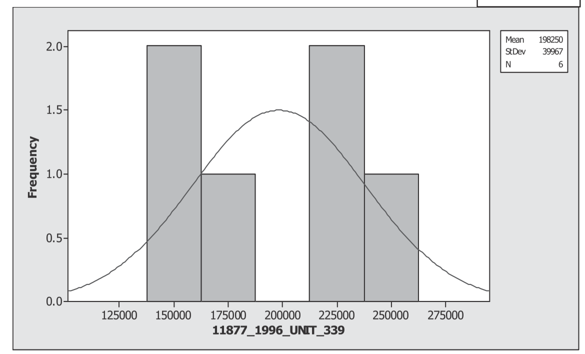
1991

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
174,100	217,000	261,360



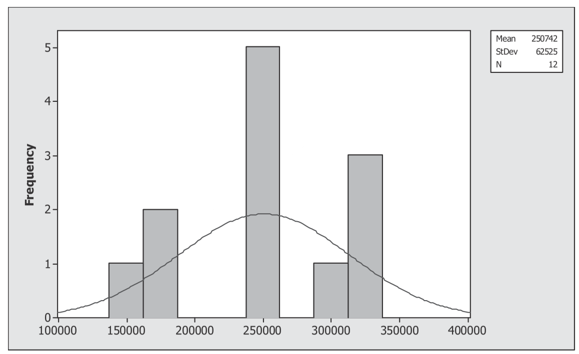
1996

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
159,230	197,500	236,926



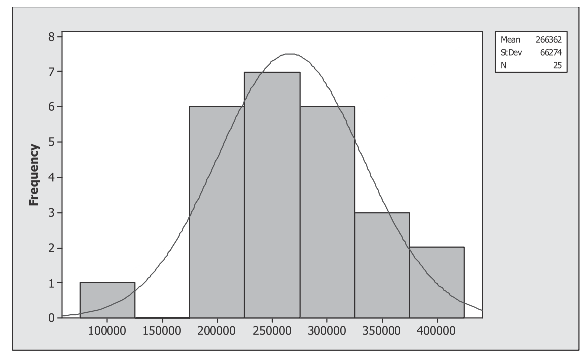
2001

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.2%

LOWER	MEAN/MEDIAN	UPPER
210,000	247,100	285,000



2006

Distribution Characteristics Unimodal, asymmetric

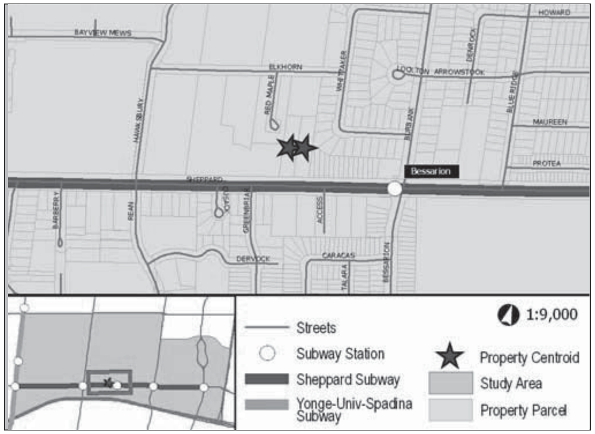
Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.9%

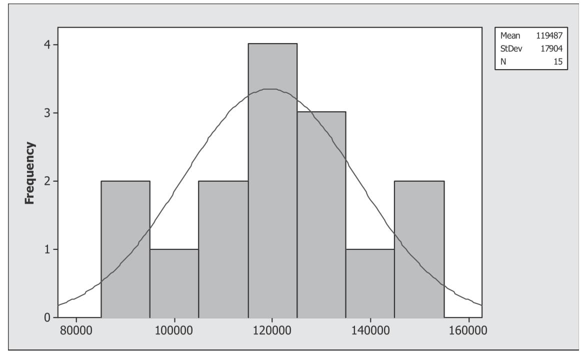
LOWER	MEAN/MEDIAN	UPPER
245,000	269,000	287,050

Rental Apartment Value Estimate – Bayview Village – Midrise

APT ID
6



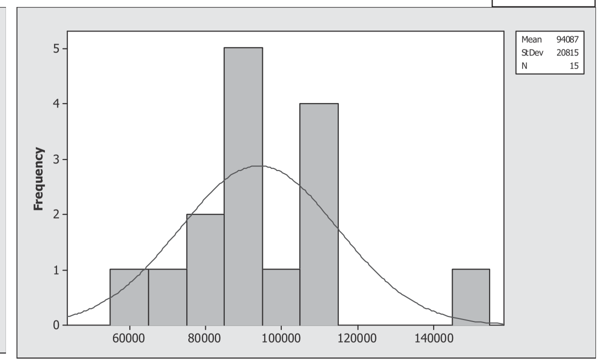
APT ID	6	
Condos extrapolated	BLOCK_ID: 11016, 11290, 11301	
Apartment properties PINs and addresses	100600190	688 Sheppard Avenue East
	100600191	690 Sheppard Avenue East
Other comments		



1991

Distribution Characteristics Unimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 89.4%

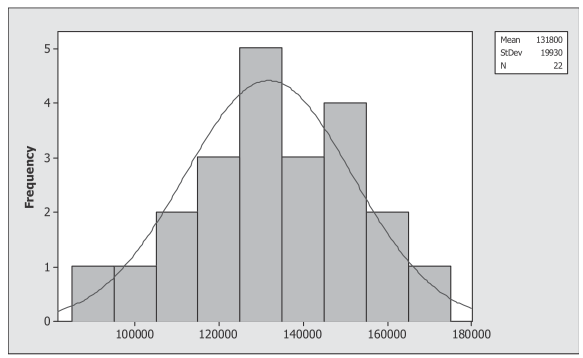
LOWER	MEAN/MEDIAN	UPPER
111,000	119,750	127,500



1996

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

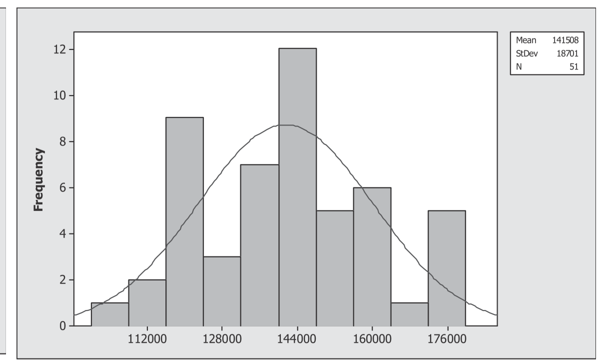
LOWER	MEAN/MEDIAN	UPPER
85,437	87,000	107,047



2001

Distribution Characteristics Almost Normal
Statistical test used T Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124,488	131,800	139,112



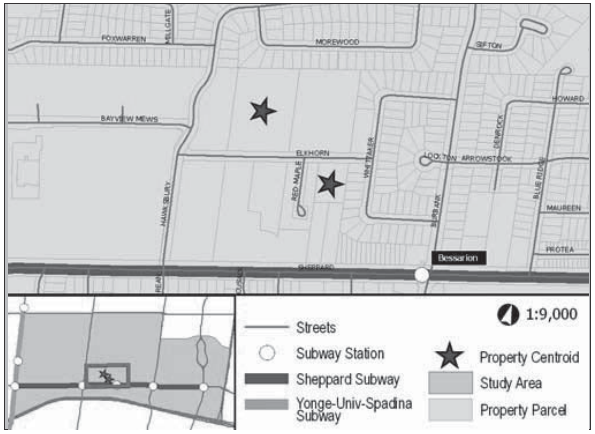
2006

Distribution Characteristics Unimodal, almost symmetric
Statistical test used Wilcoxon Signed-Ranks Test
Confidence Interval at 90%

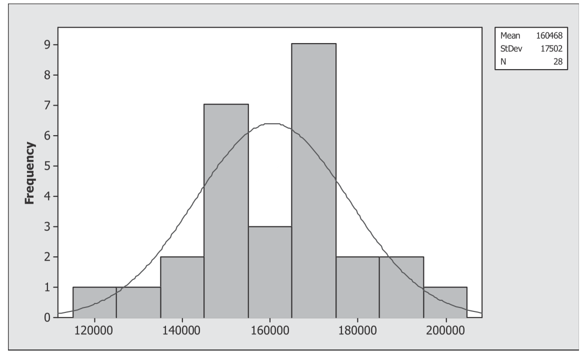
LOWER	MEAN/MEDIAN	UPPER
137,000	141,003	146,000

Rental Apartment Value Estimate - Bayview Village - Townhouse

APT ID
7



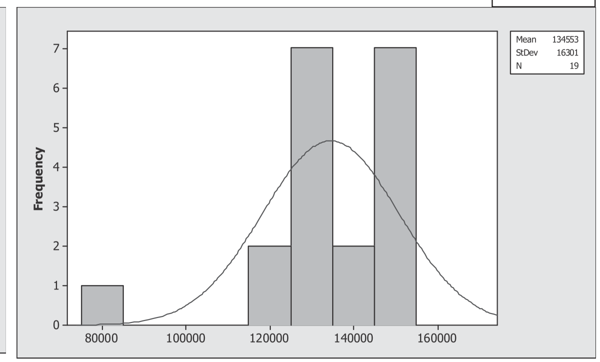
APT ID	7	
Condos extrapolated	BLOCK_ID: 11024, 11058, 11011, 11037, 11099, 11016	
Apartment properties PINs and addresses	100600192	11 Elkhorn Drive
	100600081	22 Elkhorn Drive
Other comments		



1991

Distribution Characteristics Bimodal, symmetric
Statistical test used Wilcoxon Signed-Ranks test
Confidence Interval at 90.1%

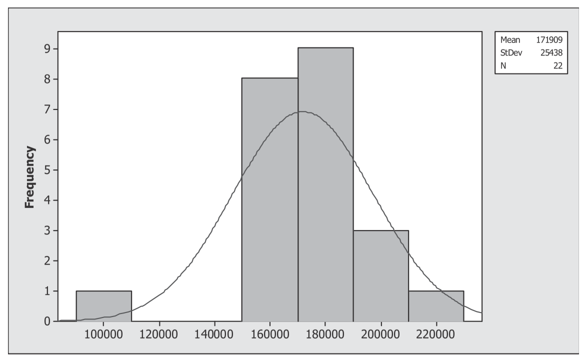
LOWER	MEAN/MEDIAN	UPPER
155,000	160,000	165,500



1996

Distribution Characteristics Bimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

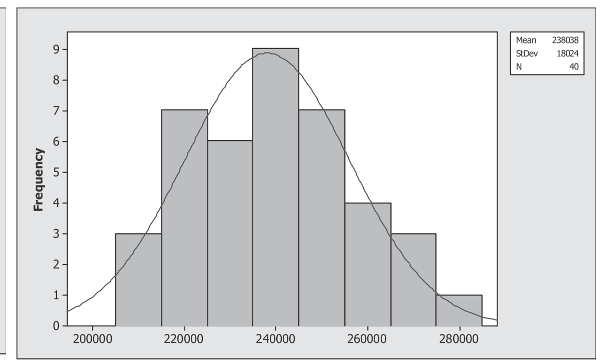
LOWER	MEAN/MEDIAN	UPPER
132,770	134,500	145,000



2001

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
161,757	176,250	184,748



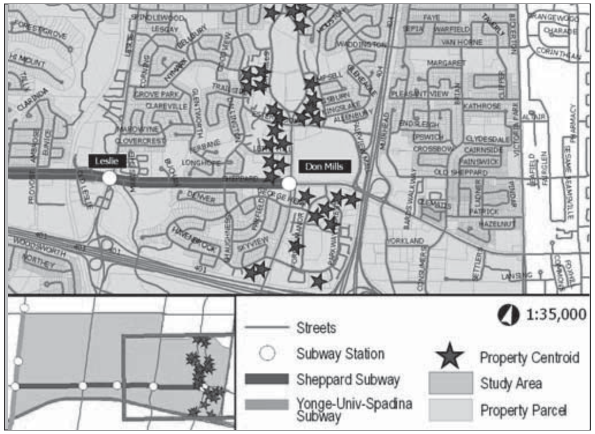
2006

Distribution Characteristics Unimodal, asymmetric
Statistical test used Wilcoxon Signed-Ranks test
Confidence Interval at 90%

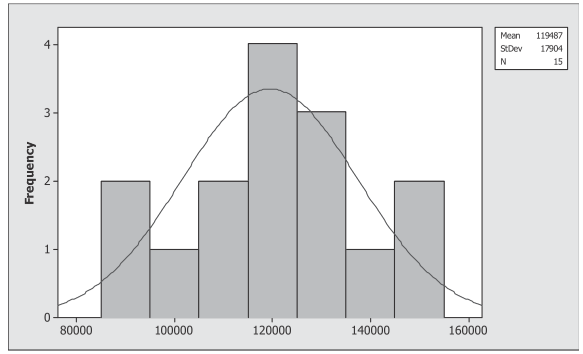
LOWER	MEAN/MEDIAN	UPPER
232,500	237,600	243,000

Rental Apartment Value Estimate – Don Valley Village – Highrise

APT ID
8



APT ID	8		
Condos extrapolated	BLOCK_ID: 11016, 11290, 11301		
Apartment properties PINs and addresses	100470397	12	Deerford Drive
	100480022	2600	Don Mills Road
	100470409	2775	Don Mills Road
	100570035	2960	Don Mills Road
	100570036	2980	Don Mills Road
	100570038	20	Esterbrooke Avenue
	100570037	30	Esterbrooke Avenue
	100480037	35	Esterbrooke Avenue
	100850010	24	Forest Manor Road
	100850185	65	Forest Manor Road
	100850122	80	Forest Manor Road
	100470410	8	Godstone Road
	100470408	20	Godstone Road
	100470407	30	Godstone Road
	100470406	40	Godstone Road
	100890511	75	Havenbrook Boulevard
	100890510	95	Havenbrook Boulevard
	100480039	24	Leith Hill Road
	100480021	25	Leith Hill Road
	100480038	34	Leith Hill Road
	100850011	25	Parkway Forest Drive
	100850183	100	Parkway Forest Drive
	100850184	110	Parkway Forest Drive
	100850189	121	Parkway Forest Drive
	100850002	125	Parkway Forest Drive
	100570040	175	Shaughnessy Boulevard
	100570041	185	Shaughnessy Boulevard
	100480024	1650	Sheppard Avenue East
	100560067	201	Van Horne Avenue
	100470396	225	Van Horne Avenue
	100470395	335	Van Horne Avenue



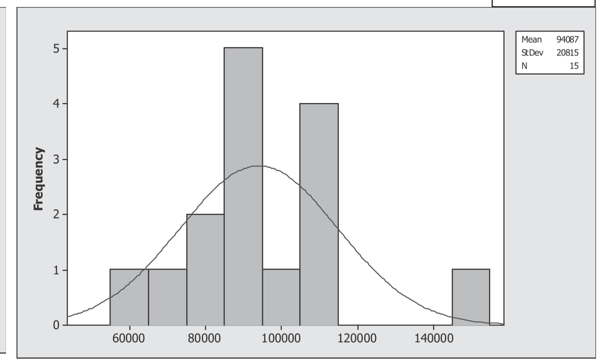
1991

Distribution Characteristics Unimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 89.4%

LOWER	MEAN/MEDIAN	UPPER
111,000	119,750	127,500



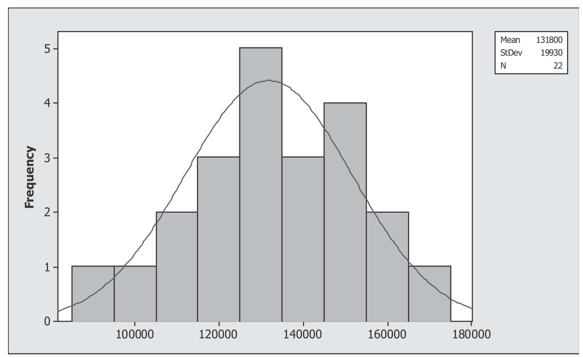
1996

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
85,437	87,000	107,047



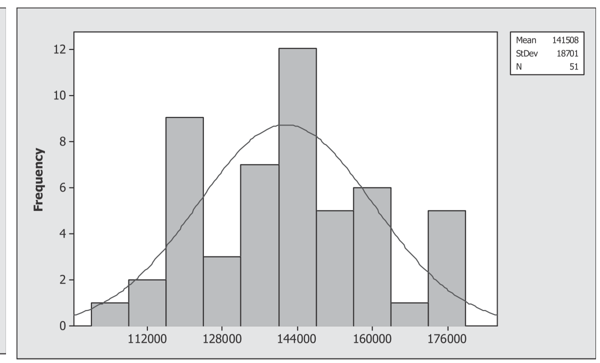
2001

Distribution Characteristics Almost Normal

Statistical test used T Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124,488	131,800	139,112



2006

Distribution Characteristics Unimodal, almost symmetric

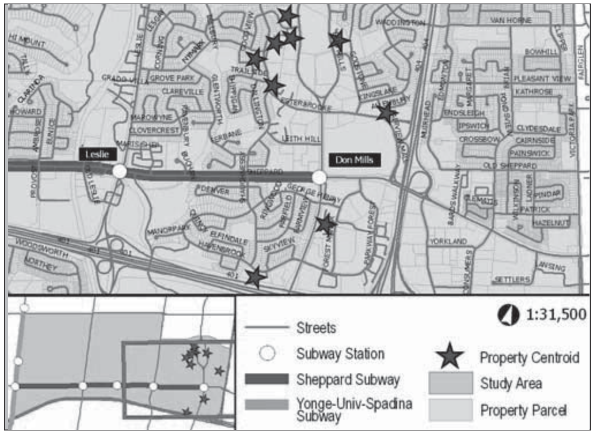
Statistical test used Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

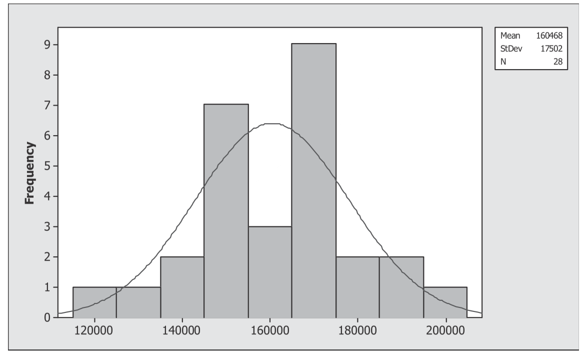
LOWER	MEAN/MEDIAN	UPPER
137,000	141,003	146,000

Rental Apartment Value Estimate – Don Valley Village - Townhouse

APT ID
9



APT ID	7		
Condos extrapolated	BLOCK_ID: 11024, 11058, 11011, 11037, 11099, 11016		
Apartment properties PINs and addresses	100470411	21	Allenbury Gardens
	100560066	2982	Don Mills Road
	100570034	2986	Don Mills Road
	100850009	90	Forest Manor Road
	100470399	71	Godstone Road
	100890512	63	Havenbrook Boulevard
	100570095	115	Nymark Avenue
	100570039	165	Shaughnessy Boulevard
	100570042	215	Shaughnessy Boulevard
Other comments			



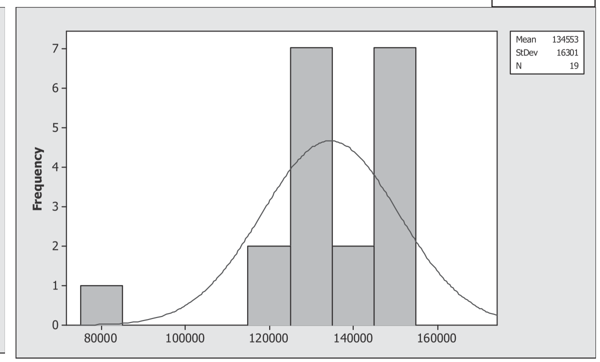
1991

Distribution Characteristics Bimodal, symmetric

Statistical test used Wilcoxon Signed-Ranks test

Confidence Interval at 90.1%

LOWER	MEAN/MEDIAN	UPPER
155,000	160,000	165,500



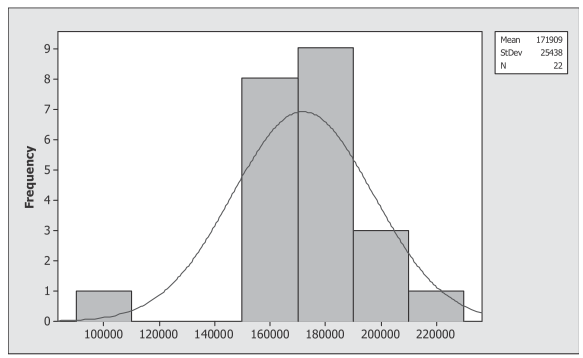
1996

Distribution Characteristics Bimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
132,770	134,500	145,000



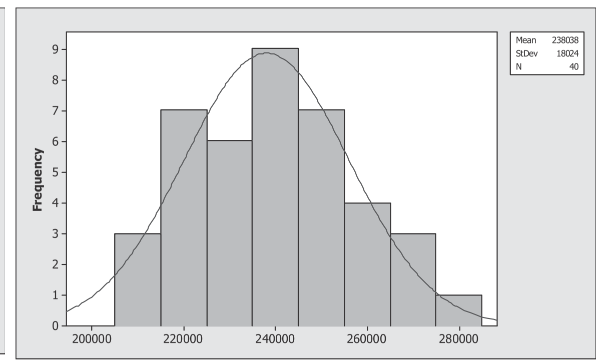
2001

Distribution Characteristics Unimodal, asymmetric

Statistical test used Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
161,757	176,250	184,748



2006

Distribution Characteristics Unimodal, asymmetric

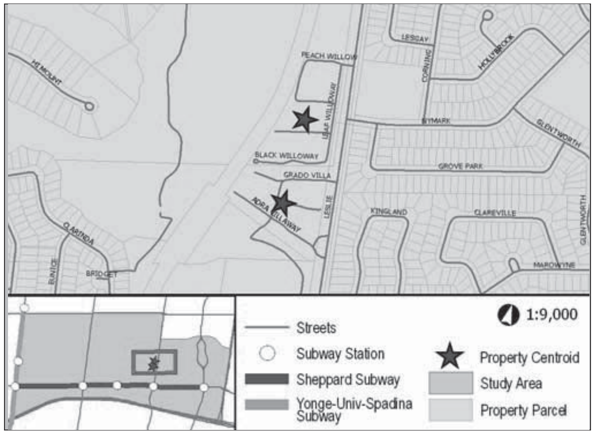
Statistical test used Wilcoxon Signed-Ranks test

Confidence Interval at 90%

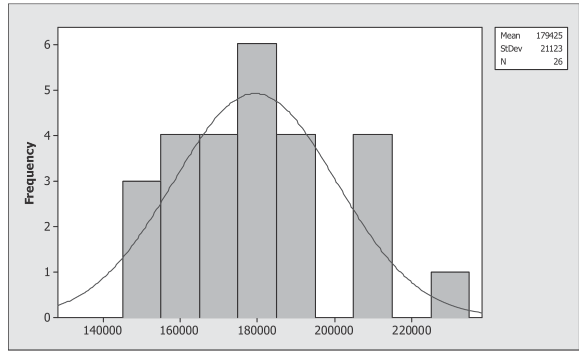
LOWER	MEAN/MEDIAN	UPPER
232,500	237,600	243,000

Rental Apartment Value Estimate - Leslie

APT ID 10



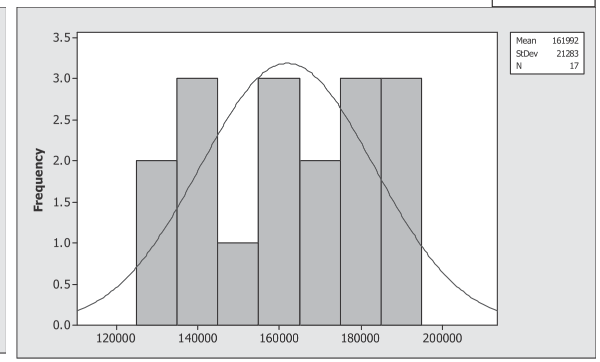
APT ID	10	
Condos extrapolated	BLOCK_ID: 11064, 11065, 11116, 11090, 11269	
Apartment properties PINs and addresses	100580213	Grado Villaway Orca Villaway Arda Villaway Tomar Villaway
	100581115	Peach Willoway Leaf Willoway Sandbar Willoway Black Willoway
Other comments		



1991

Distribution Characteristics Unimodal, symmetric
Statistical test used Sign Test
Confidence Interval at 90%

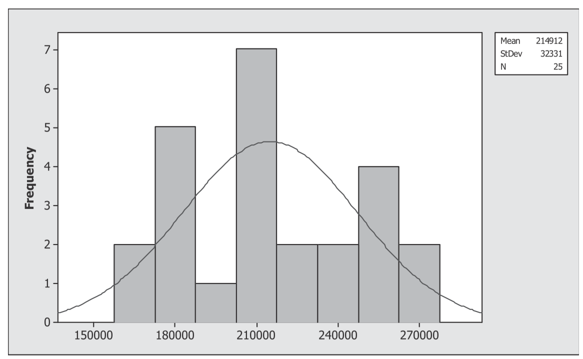
LOWER	MEAN/MEDIAN	UPPER
170,686	179,000	184,792



1996

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

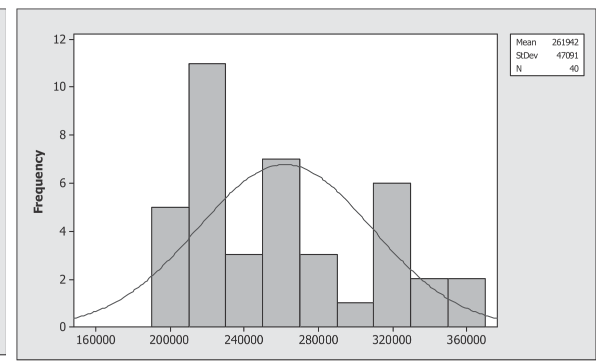
LOWER	MEAN/MEDIAN	UPPER
149,696	158,000	178,867



2001

Distribution Characteristics Unimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
207,906	210,000	232,268



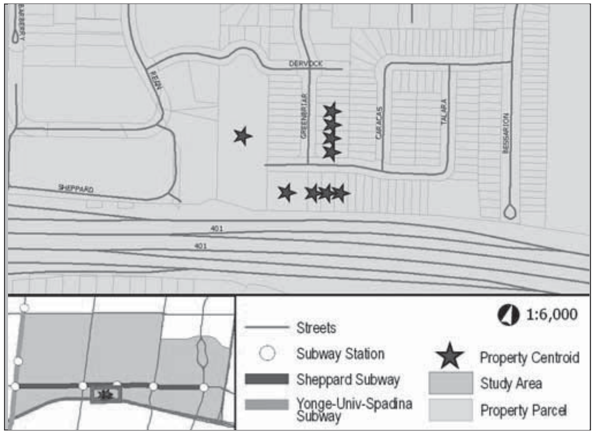
2006

Distribution Characteristics Multimodal, asymmetric
Statistical test used Sign Test
Confidence Interval at 90%

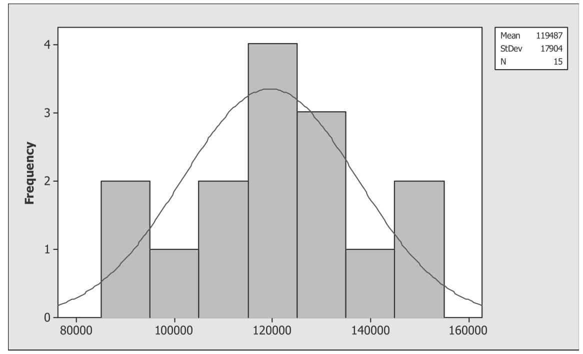
LOWER	MEAN/MEDIAN	UPPER
228,711	257,000	267,126

Rental Apartment Value Estimate – Bessarion – Midrise

APT ID
11



APT ID	11		
Condos extrapolated	BLOCK_ID: 11016, 11290, 11301		
Apartment properties PINs and addresses	100900091	11	Dervock Crescent
	100900229	23	Greenbriar Road
	100900228	25	Greenbriar Road
	100900227	27	Greenbriar Road
	100900226	29	Greenbriar Road
	100900129	61	Talara Drive
	100900130	65	Talara Drive
	100900131	67	Talara Drive
Other comments			

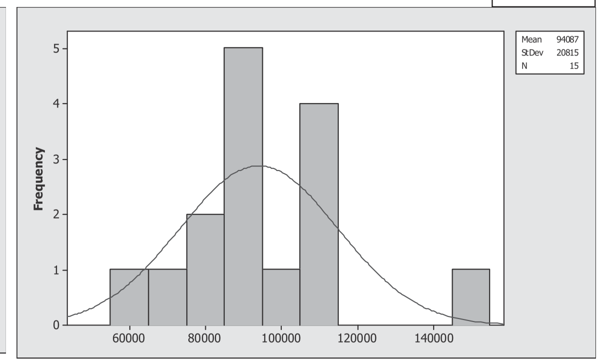


1991

Distribution Characteristics	Unimodal, symmetric
Statistical test used	Wilcoxon Signed-Ranks Test

Confidence Interval at 89.4%

LOWER	MEAN/MEDIAN	UPPER
111,000	119,750	127,500

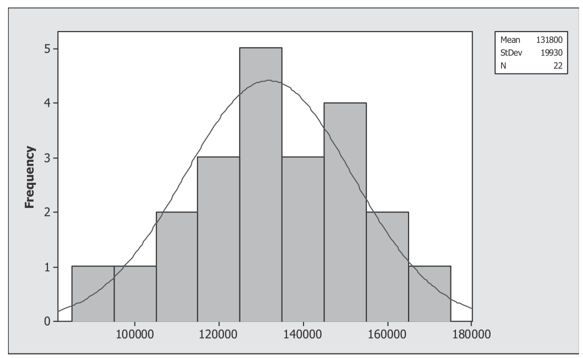


1996

Distribution Characteristics	Bimodal, asymmetric
Statistical test used	Sign Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
85,437	87,000	107,047

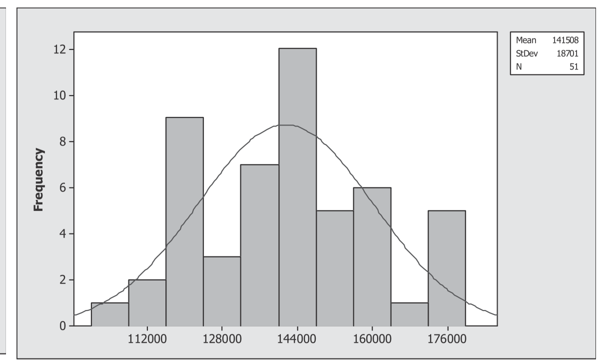


2001

Distribution Characteristics	Almost Normal
Statistical test used	T Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
124,488	131,800	139,112



2006

Distribution Characteristics	Unimodal, almost symmetric
Statistical test used	Wilcoxon Signed-Ranks Test

Confidence Interval at 90%

LOWER	MEAN/MEDIAN	UPPER
137,000	141,003	146,000

Appendix H:

Projected Developments Tabular Summaries

Projected Developments Tabular Summaries

Class I Future Properties

PIN*	Name	Address	Number of Units	Recorded Price Per Unit	Source
128410000	Claridges at Amica	12 Rean Drive	125	225,000	(City of Toronto, 2004; Stapells, 2004)
129310000	St Gabriels Terraces - Towns	650 Sheppard Avenue East	23	1,110,000	(Harness, 2008a)
129740000	Platinum XO	18 Spring Garden Avenue	341	295,390	(Harness, 2007)
400000001	Arc Condominiums	2601 Bayview Avenue	447	349,900	(Harness, 2008e)
400000002	Discovery at Concord Park Place	1019 Sheppard Avenue East	600	233,000	(Harness, 2008a)
400000003	Discovery II at Concord Park Place	1019 Sheppard Avenue East	250	233,000	(Harness, 2008a)
400000004	St Gabriels Terraces, St Gabriels Village and Lanes	650 Sheppard Avenue East	421	241,000	(Harness, 2008a)
400000007	Spring @ MintoGardens	23 Sheppard Avenue East	342	488,800	(City of Toronto, 2007c; Yu, 2008)
400000008	Spring Gardens	16, 38 Clairtrell Avenue	19	775,000	(City of Toronto, 2005b; Harness, 2008a)
400000009	Tridel Avonshire I	100 Harrison Garden Blvd	229	367,000	(City of Toronto, 2008a; Tierney, 2009)
400000010	Tridel Avonshire II	100 Harrison Garden Blvd	229	367,000	(City of Toronto, 2008a; Tierney, 2009)
400000011	Tridel Avonshire Townhomes	100 Harrison Garden Blvd	42	760,000	(City of Toronto, 2008a; Tierney, 2009)
400000012	Tridel Avonshire Rental	105 Harrison Garden Blvd	311	367,000	(City of Toronto, 2008a; Tierney, 2009)
400000013	Hullmark Centre I	2 Anndale Drive, 5 Sheppard Avenue East	684	292,250	(Belford, 2008; Tridel, 2009)
400000014	Savvy	34 Glendora Ave	275	269,990	(City of Toronto, 2008a; The Toronto Star 2008)
400000015	Pearl Condominiums	35 Hollywood Ave	351	199,900	(City of Toronto, 2008c; Harness, 2008d)
400000016	Merci Le Condominum	603-615 Sheppard Avenue East, 9-17 Rean Drive, 6-10 Dervock Crescent	160	250,000	(City of Toronto, 2006b; Harness, 2008b)
400000017	The Bayview, Manor House	603-615 Sheppard Avenue East, 9-17 Rean Drive, 6-10 Dervock Crescent	111	300,000	(City of Toronto, 2006b; The Toronto Star, 2008)
400000018	Amica at Bayview	15 Barberry Place	130	97,596	(Amica Mature Lifestyles, 2009a)
400000019	Emerald City Condos	100 Parkway Forest Drive	943	200,000	(Harness, 2008c)
400000025	Amica at Bayview Gardens	19 Rean Drive	130	97,760	(Amica Mature Lifestyles, 2009b)
400000031	El-Ad Rental Replacement Addition	South of Forest Manor Drive & Parkway Forest Drive	270	209,849	(City of Toronto, 2007b, 2008e)
400000032	El-Ad Rental Replacement Addition	West of Parkway Forest Drive	287	119,427	(City of Toronto, 2007b, 2008e)
400000033	Grand Triomphe 2	5435 Yonge Street	307	235,000	(City of Toronto, 2008d)
400000034	Northtown Manor	5435 Yonge Street	115	92,939	(City of Toronto, 2008d)
400000035	Mona Lisa Residences	18, 22-28, & 32 Holmes Avenue, 19-23, 27-33 & 37 Olive Avenue	384	269,990	(City of Toronto, 2007a)
400000036	Aria	25 Buchan Court	645	234,900	(City of Toronto, 2005a, 2006a)

* Condominium properties do not have PIN numbers if they have not been registered as a Condominium Plan. These properties were assigned a unique ID starting with 4.

Projected Developments Tabular Summaries

Class II Future Properties

PIN*	Name	Address	Number of Units	Estimated Price Per Unit**	Source
400000020	Daniels Development	17, 19, 21, 23 Kenaston Gardens	129	225,000	(City of Toronto, 2008b)
400000021	Tridel Avonshire Development Highrise A	1-12 Oakburn Crescent and 14-40 Oakburn Place	229	225,000	(City of Toronto, 2007a)
400000038	Tridel Avonshire Development Highrise B	1-12 Oakburn Crescent and 14-40 Oakburn Place	175	225,000	(City of Toronto, 2007a)
400000022	Tridel Avonshire Development Townhouse A	1-12 Oakburn Crescent and 14-40 Oakburn Place	41	225,000	(City of Toronto, 2007a)
400000023	Concord Adex Development (excluding Discovery I and II)	1001-1019 Sheppard Ave East	3,650	225,000	(City of Toronto, 2009b)
400000024	El-Ad Parkway Forest Development Block A	100, 102, 110 & 125 Parkway Forest Drive, 120 & 130 George Henry Blvd, 32-50, 65 & 80 Forest Manor Road	1,619	225,000	(City of Toronto, 2007b; WZMH Architects, 2007)
400000026	El-Ad Parkway Forest Development Block C	100, 102, 110 & 125 Parkway Forest Drive, 120 & 130 George Henry Blvd, 32-50, 65 & 80 Forest Manor Road	397	225,000	(City of Toronto, 2007b; WZMH Architects, 2007)
400000027	El-Ad Parkway Forest Development Block D	100, 102, 110 & 125 Parkway Forest Drive, 120 & 130 George Henry Blvd, 32-50, 65 & 80 Forest Manor Road	926	225,000	(City of Toronto, 2007b; WZMH Architects, 2007)
400000029	El-Ad Parkway Forest Development Block E	100, 102, 110 & 125 Parkway Forest Drive, 120 & 130 George Henry Blvd, 32-50, 65 & 80 Forest Manor Road	382	225,000	(City of Toronto, 2007b; WZMH Architects, 2007)
400000030	Abdul Mujib Cadili	5 & 7 Kenaston Gardens	56	225,000	(City of Toronto, 2009a)
400000037	Tridel Avonshire Development Townhouse B	No identified address	15	225,000	(City of Toronto, 2007a)

* Condominium properties do not have PIN numbers if they have not been registered as a Condominium Plan. These properties were assigned a unique ID starting with 4.

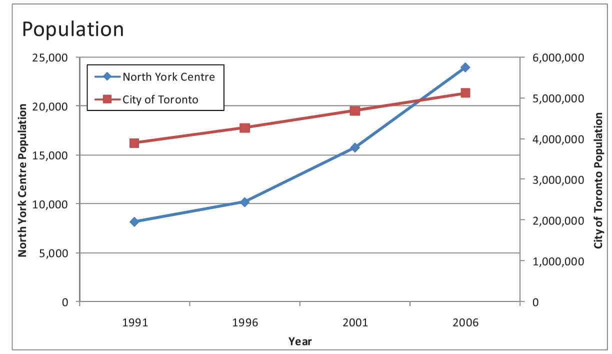
** Because no prices are given for these Class II properties, an average Leasehold Condominium Unit price of $225,000 was used for the purposes of computing a total property value

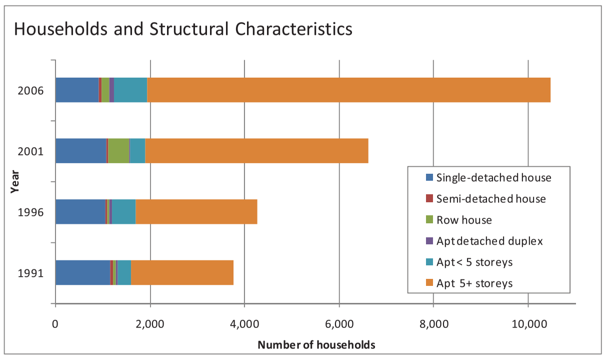
Appendix I:

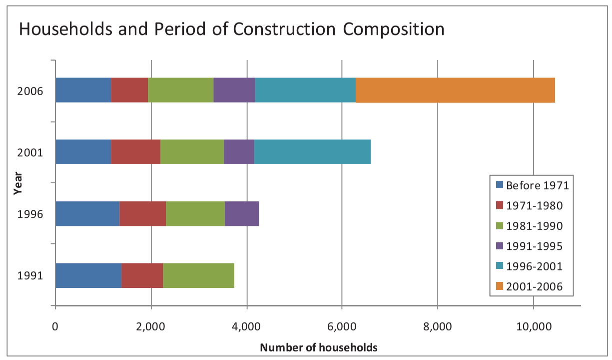
Census Tract Data Analysis Results

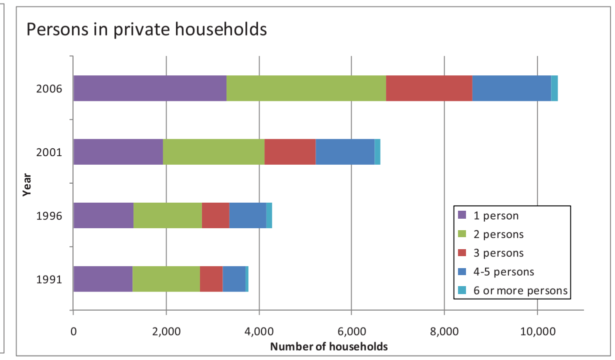
Census Data Analysis

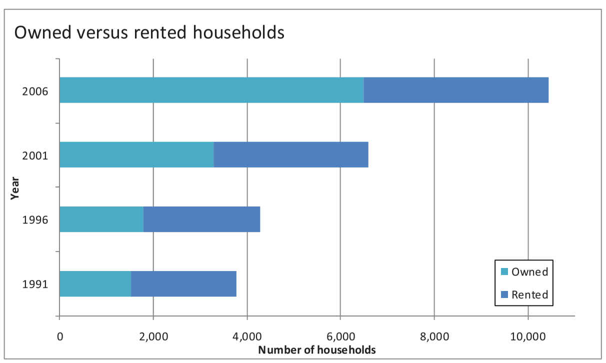
North York Centre

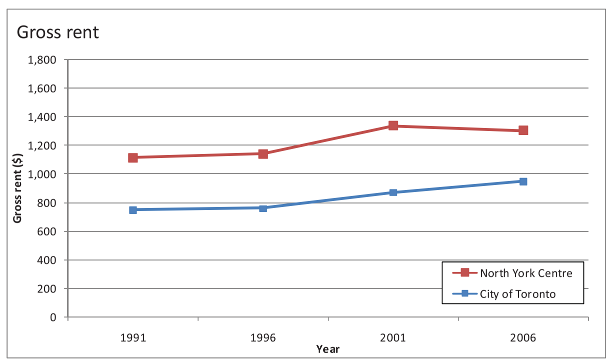


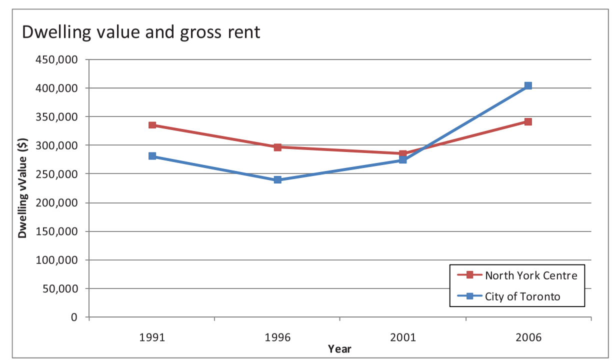






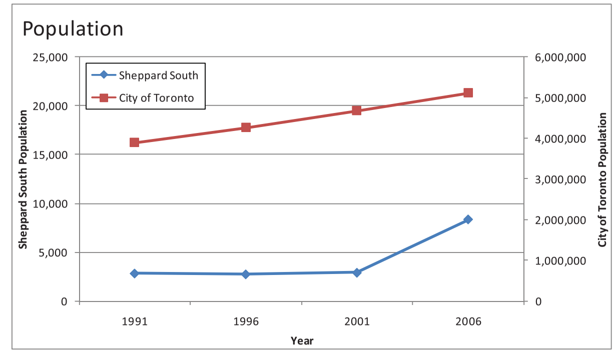


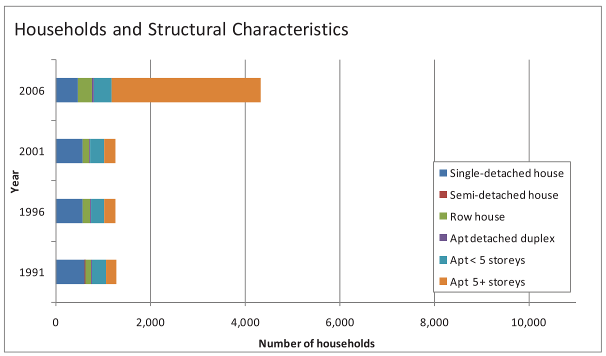


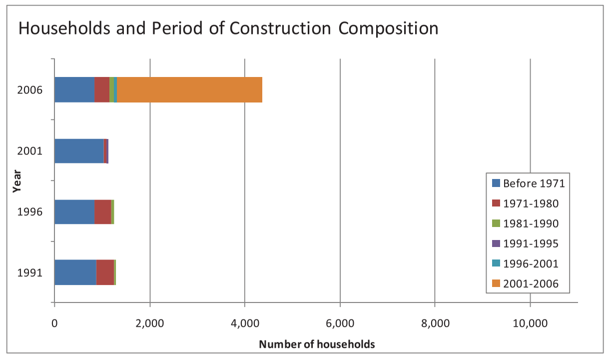


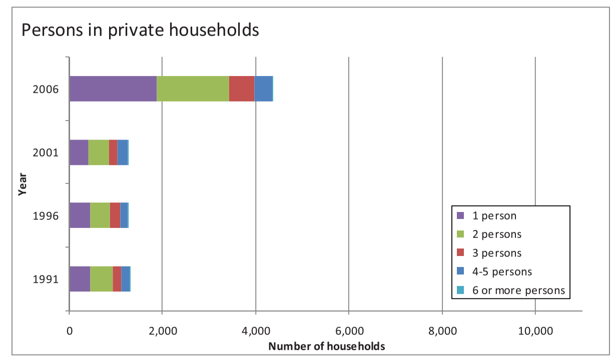
Census Data Analysis

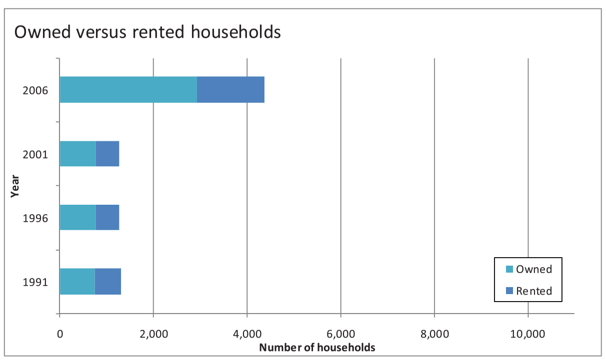
South Sheppard

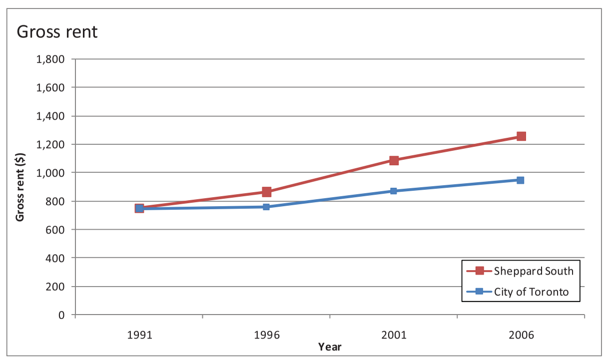


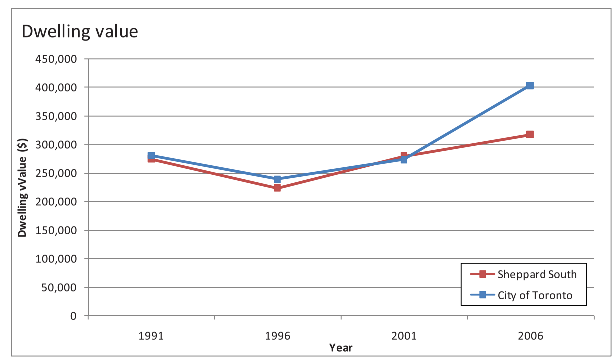






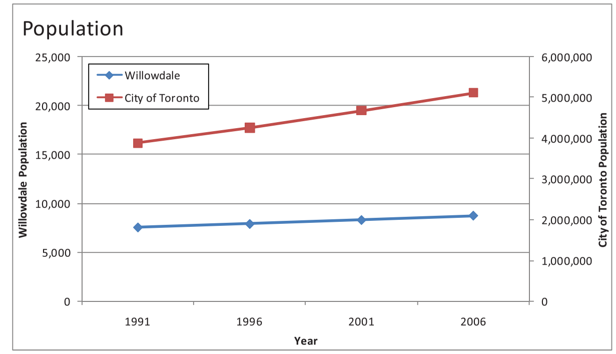


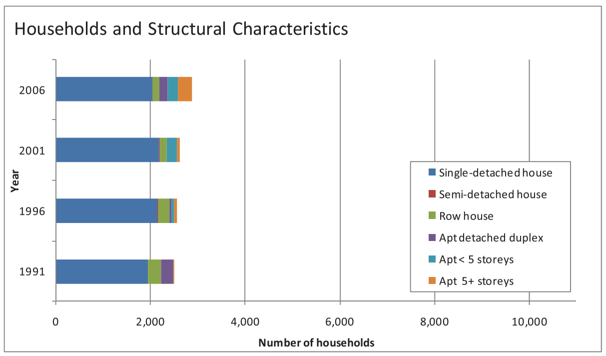


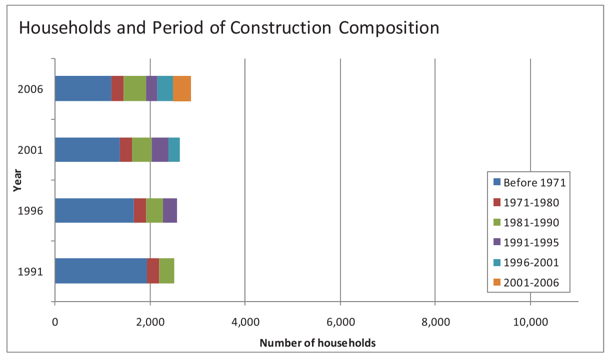


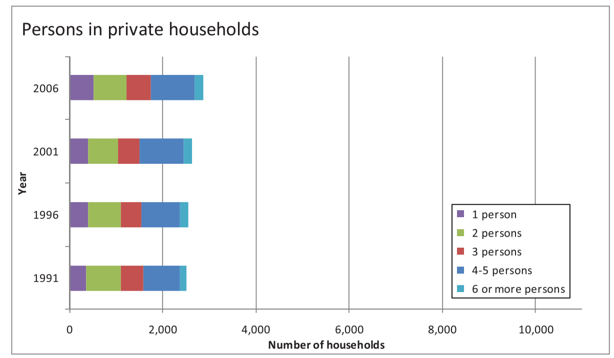
Census Data Analysis

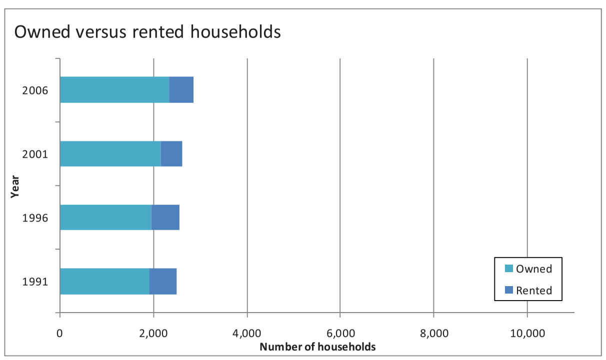
Willowdale

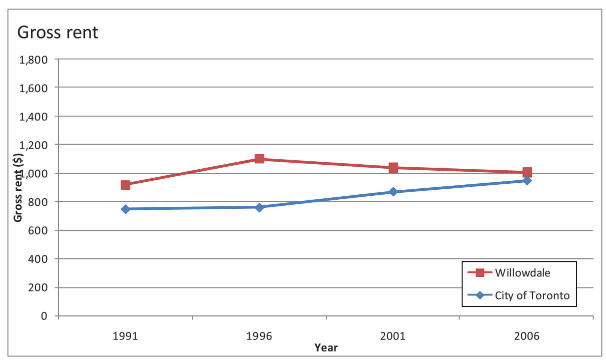


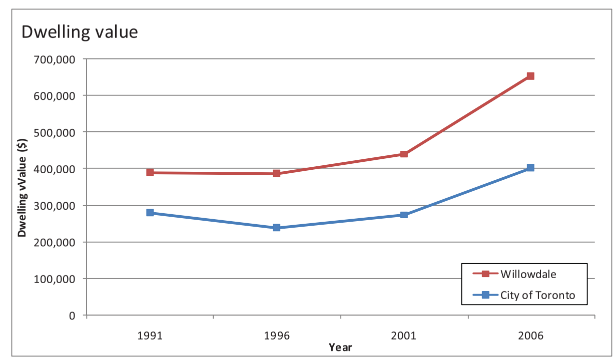








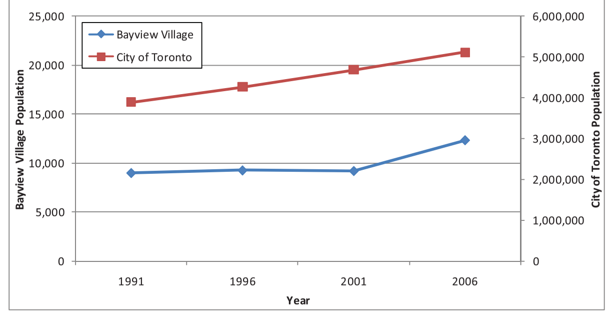




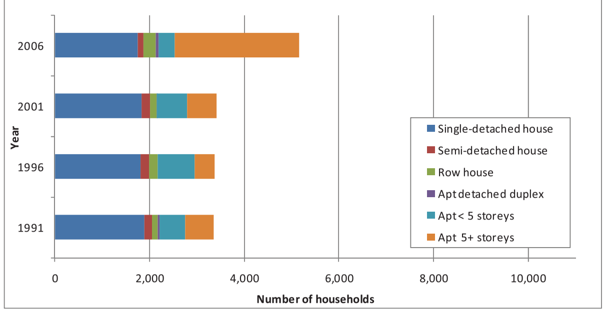
Census Data Analysis

Bayview Village

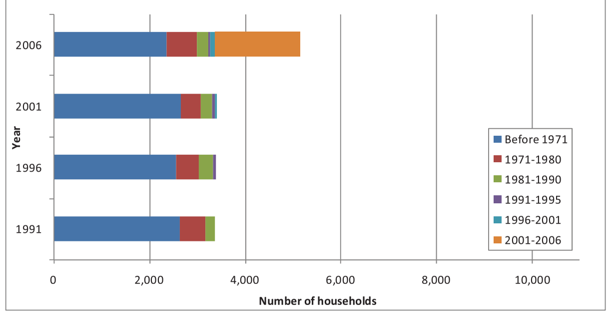
Population



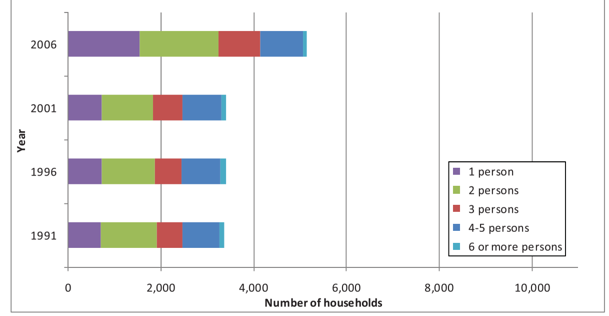
Households and Structural Characteristics



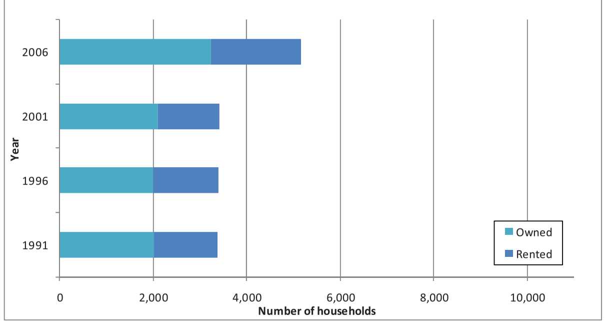
Households and Period of Construction Composition



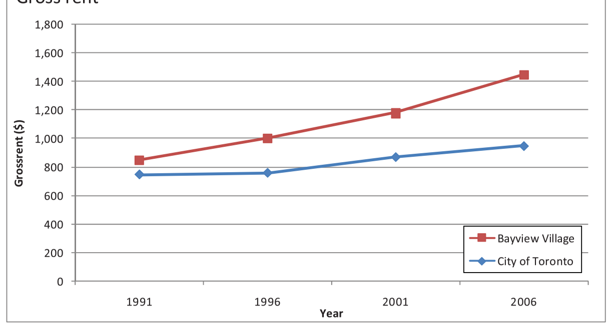
Persons in private households



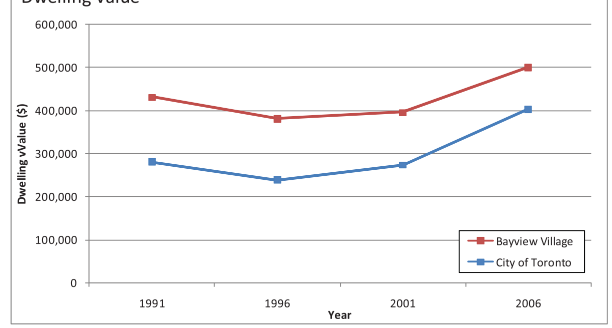
Owned versus rented households



Gross rent

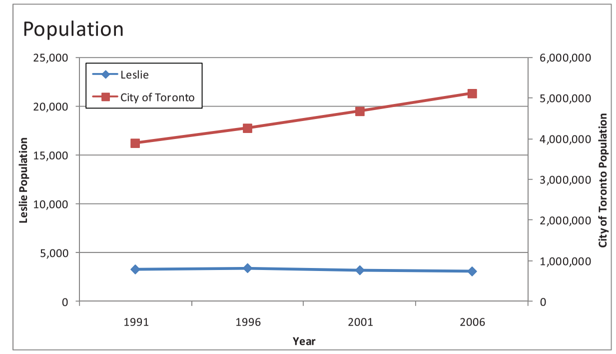


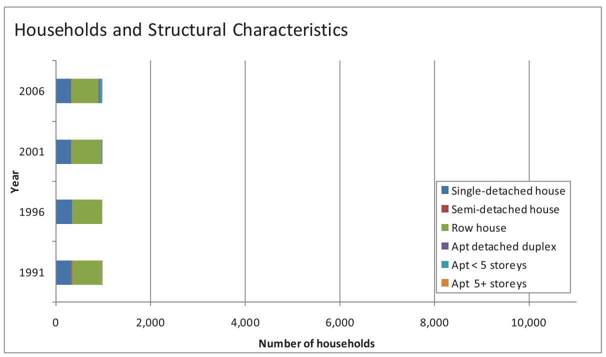
Dwelling value

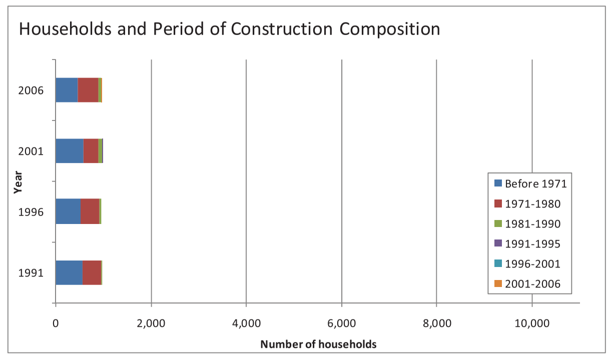


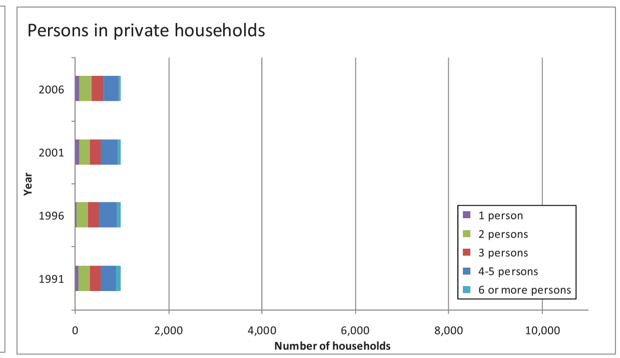
Census Data Analysis

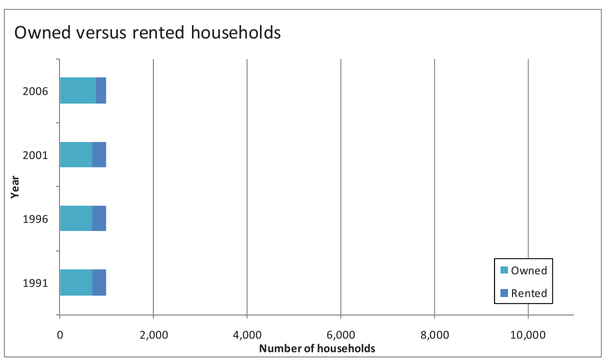
Leslie

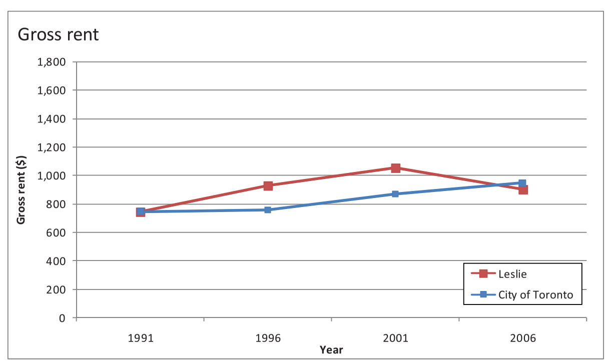


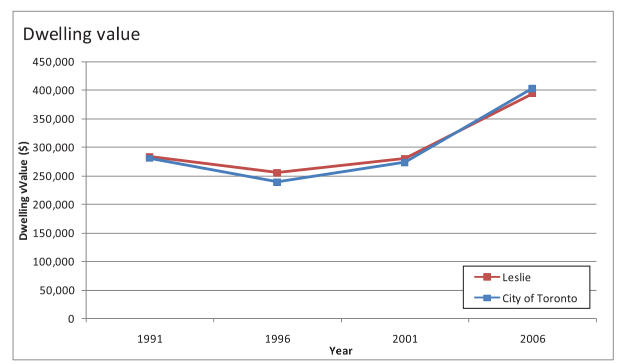








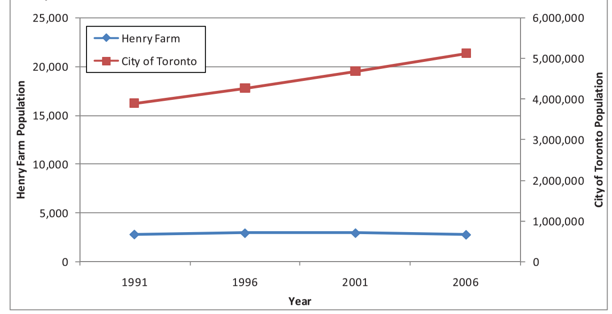




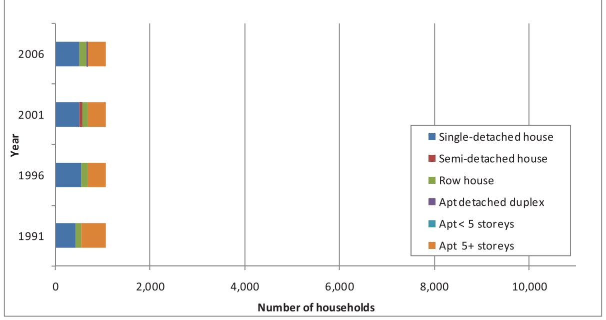
Census Data Analysis

Henry Farm

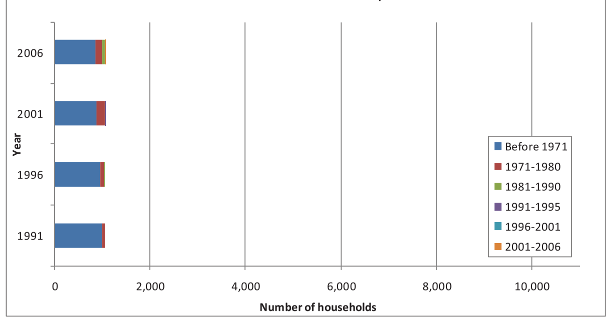
Population



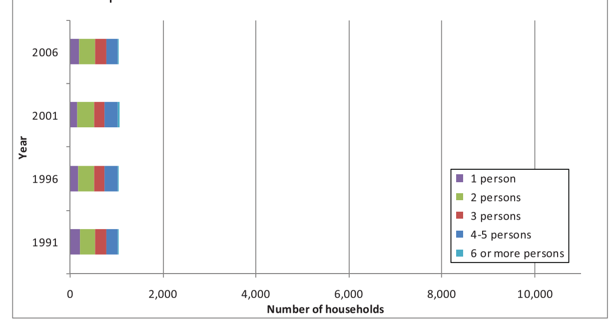
Households and Structural Characteristics



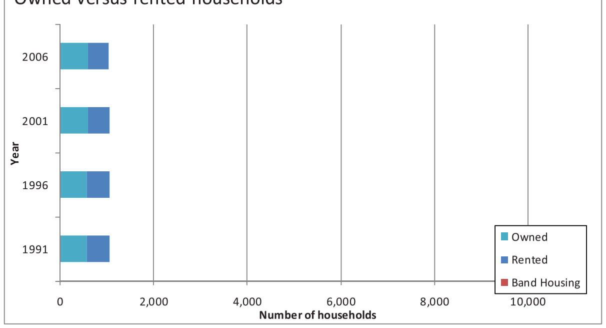
Households and Period of Construction Composition



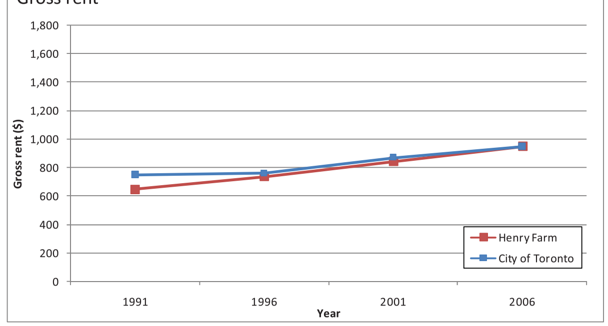
Persons in private households



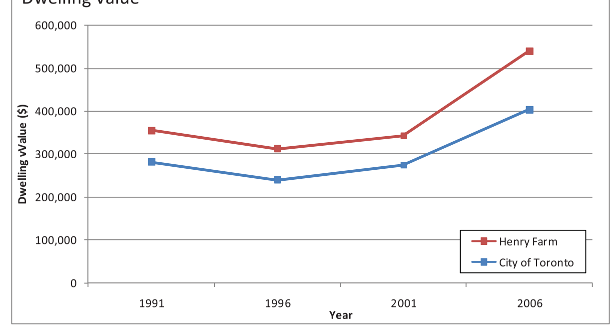
Owned versus rented households



Gross rent

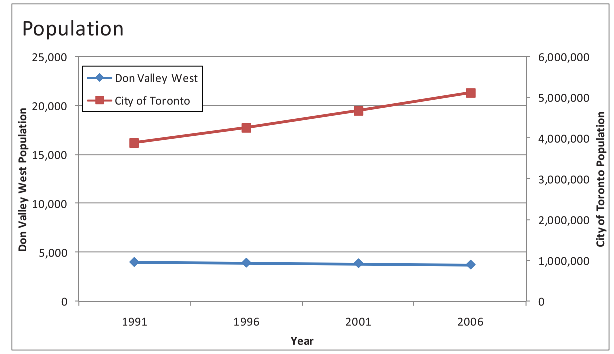


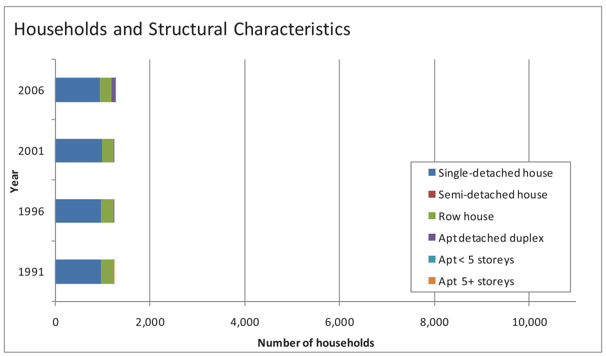
Dwelling value

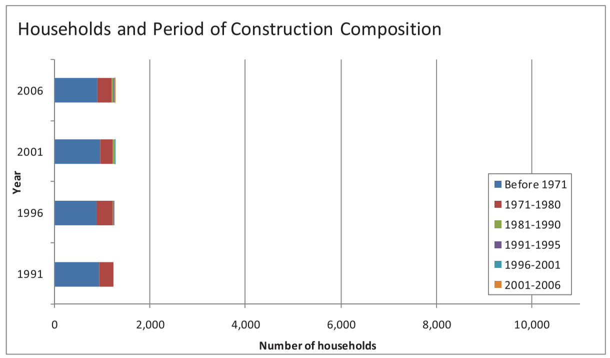


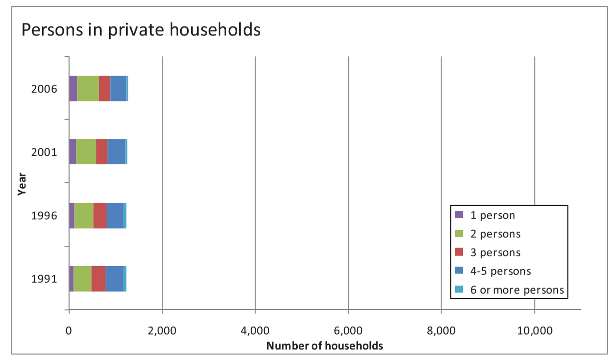
Census Data Analysis

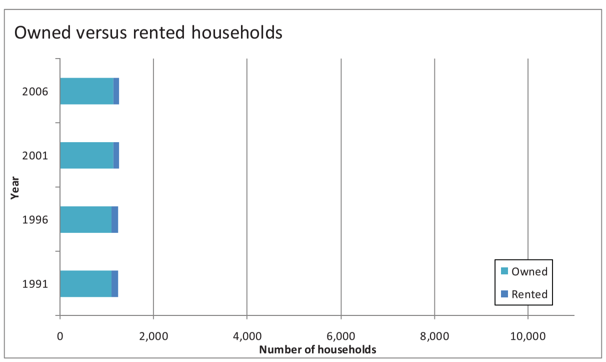
Don Valley West

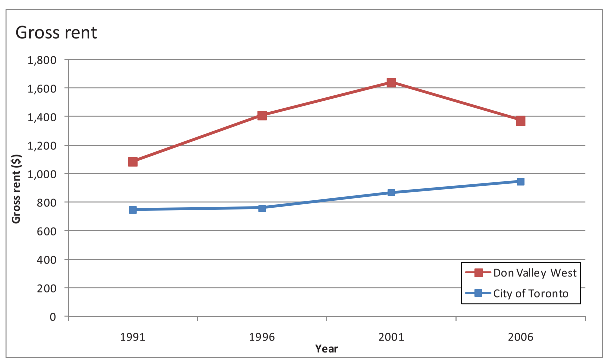


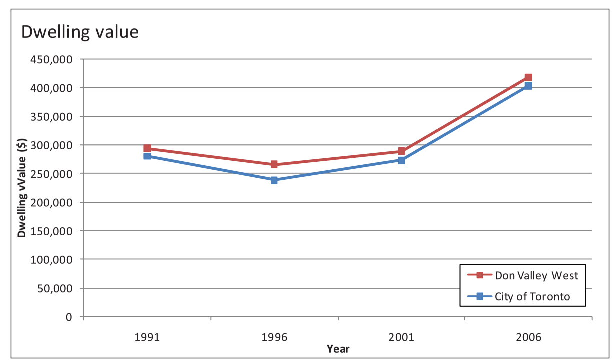








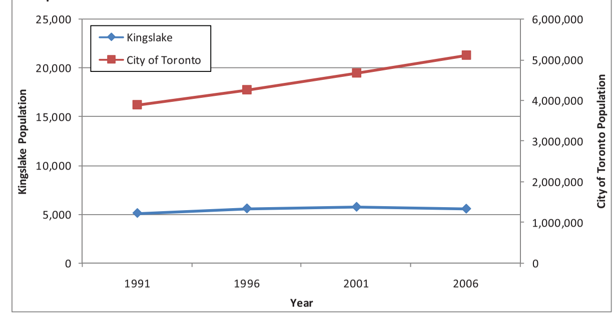




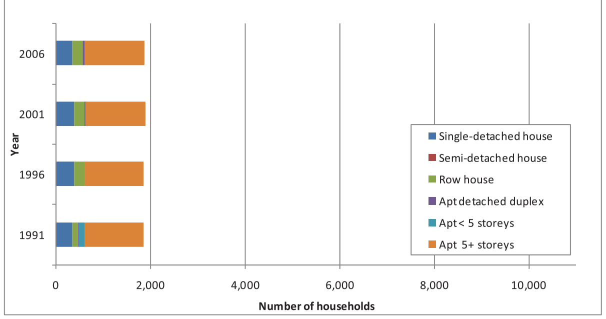
Census Data Analysis

Kingslake

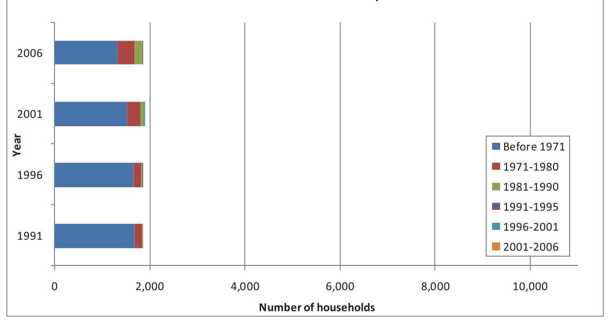
Population



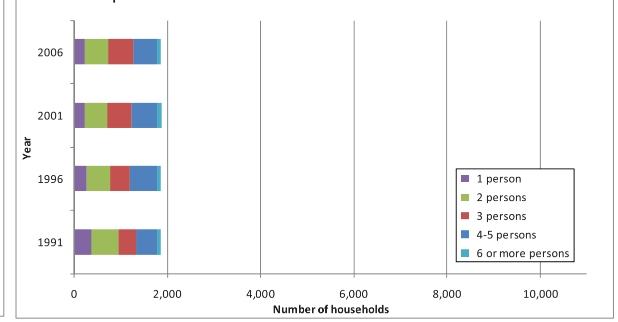
Households and Structural Characteristics



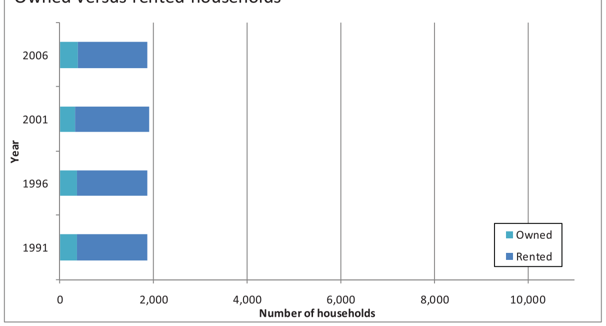
Households and Period of Construction Composition



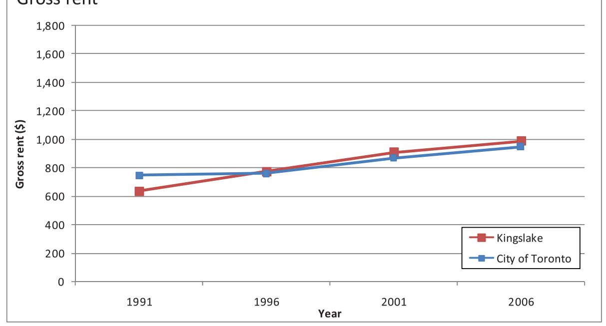
Persons in private households



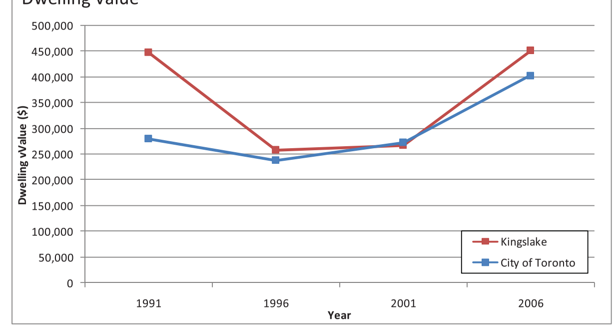
Owned versus rented households



Gross rent

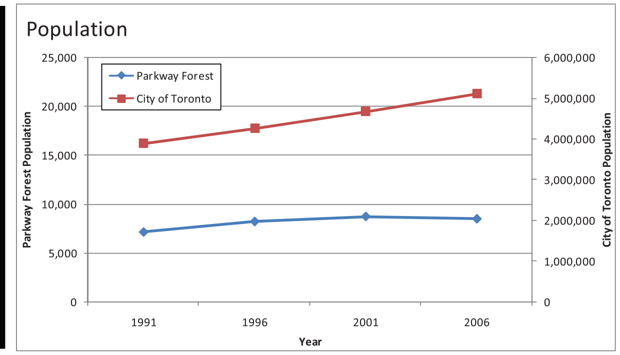


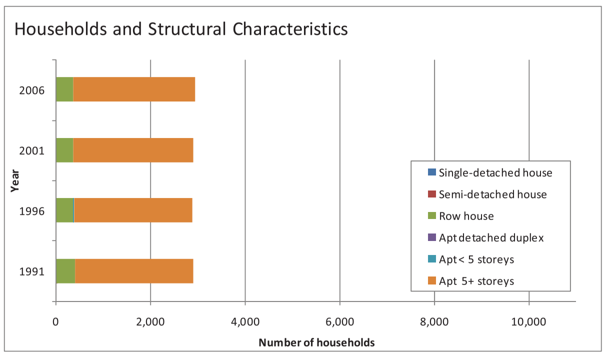
Dwelling value

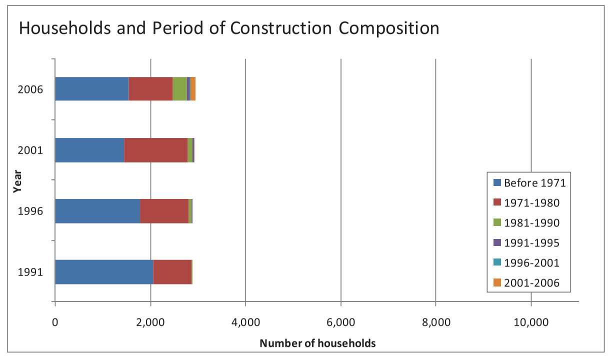


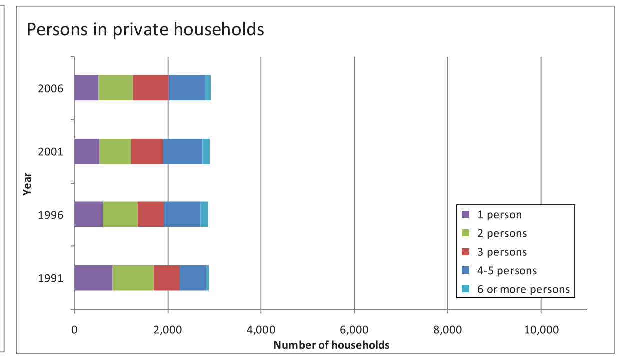
Census Data Analysis

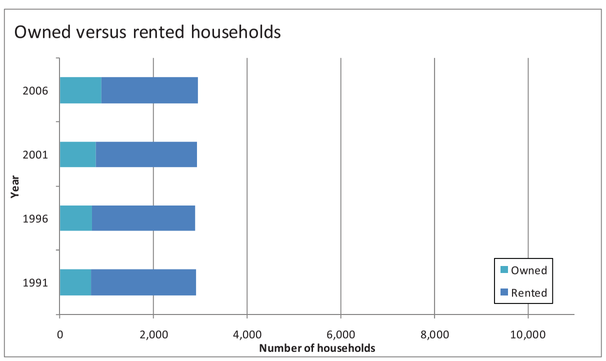
Parkway Forest

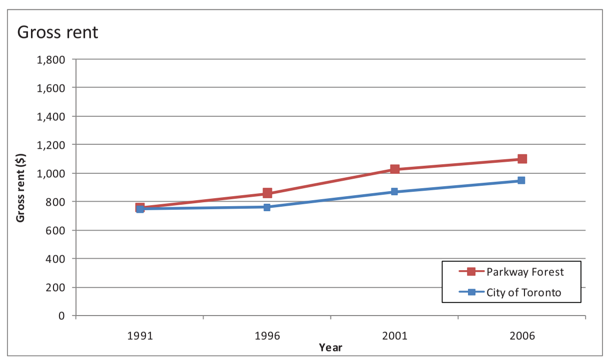


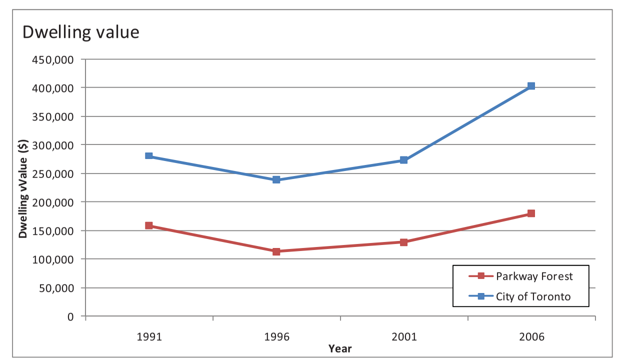






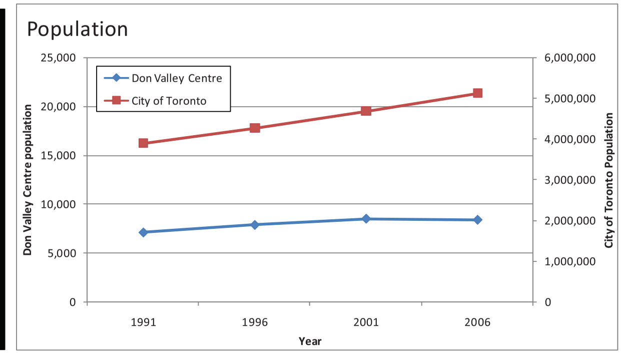


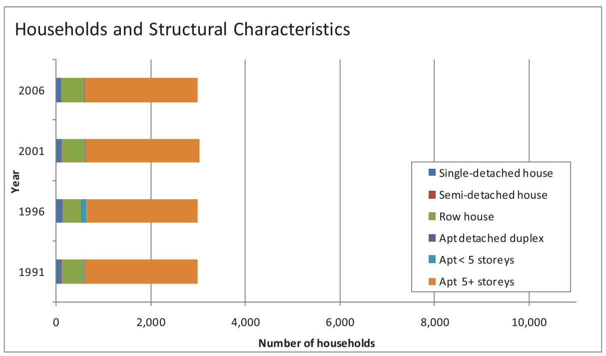


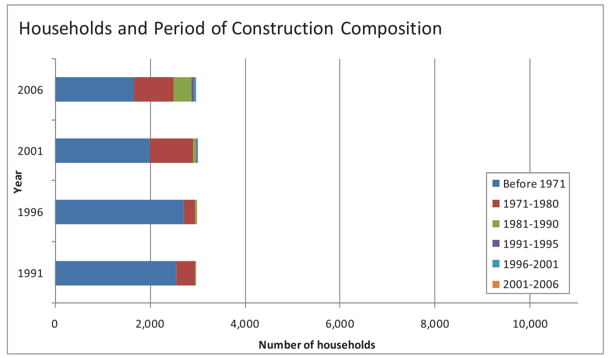


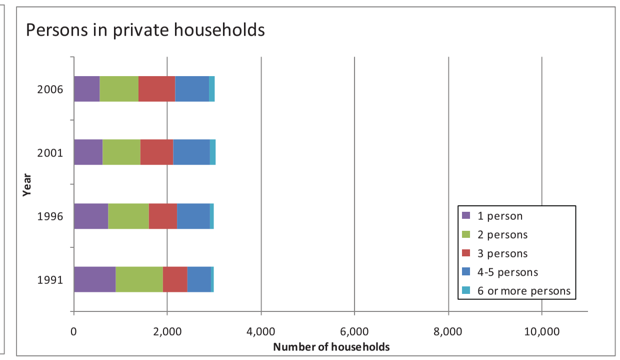
Census Data Analysis

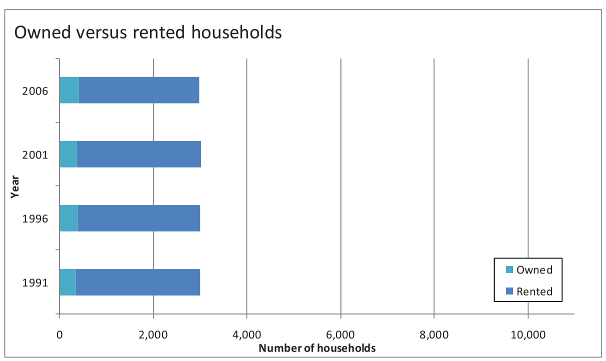
Don Valley Centre

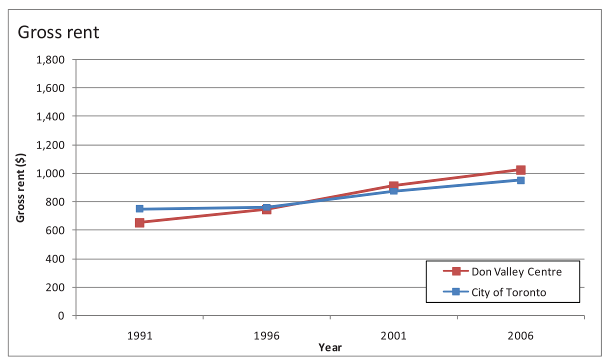


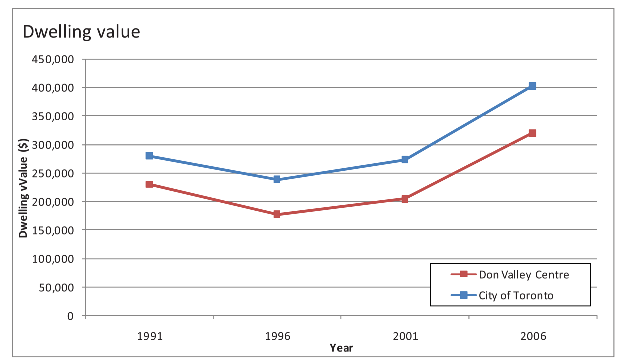












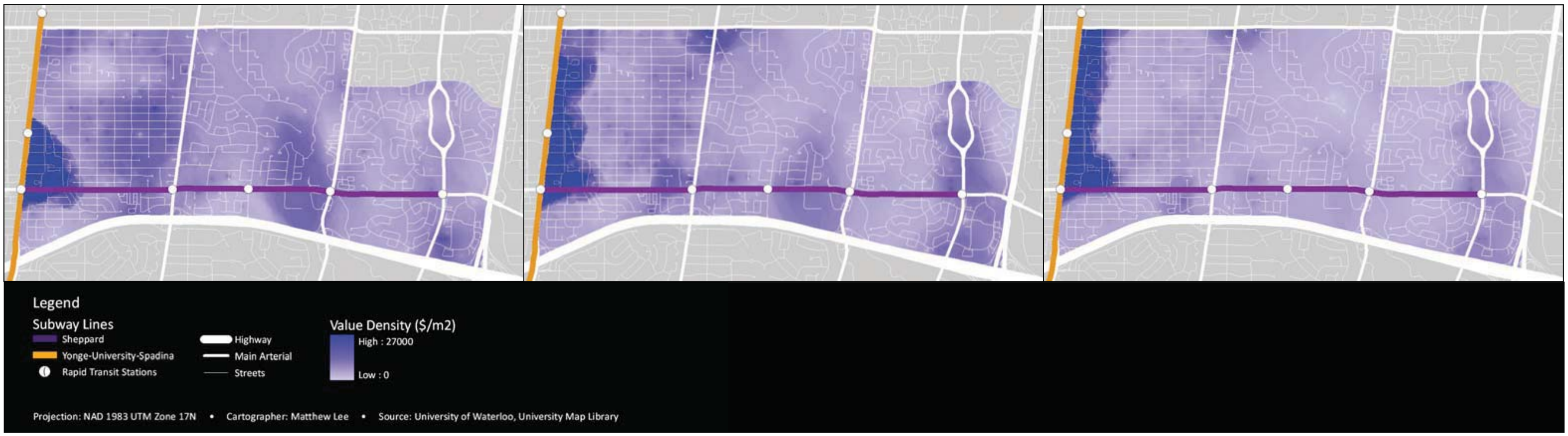
Appendix J:

Value and Dwelling Density Interpolated Raster Surfaces

Value and Dwelling Density Surfaces

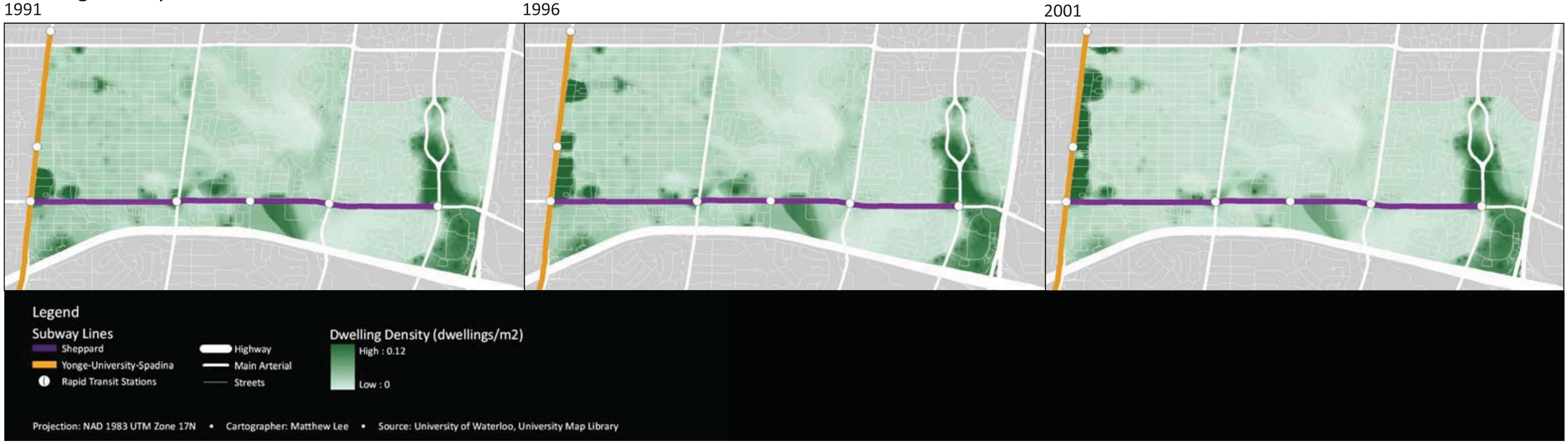
Value Density

1991 1996 2001



Dwelling Density

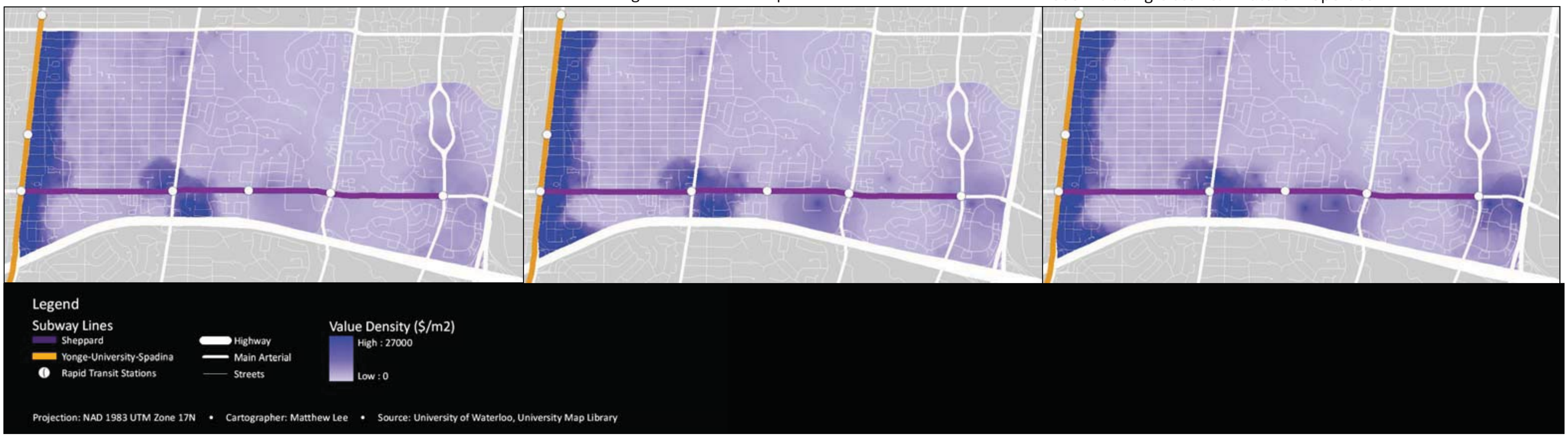
1991 1996 2001



Value and Dwelling Density Surfaces

Value Density

2006 | 2006 including Class I Future Properties | 2006 including Class I & II Future Properties



Dwelling Density

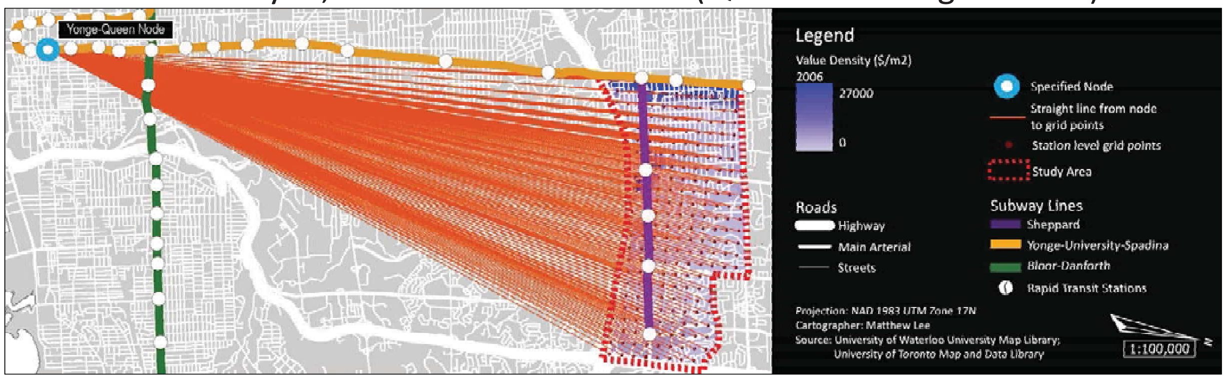
2006 | 2006 including Class I Future Properties | 2006 including Class I & II Future Properties

Appendix K:

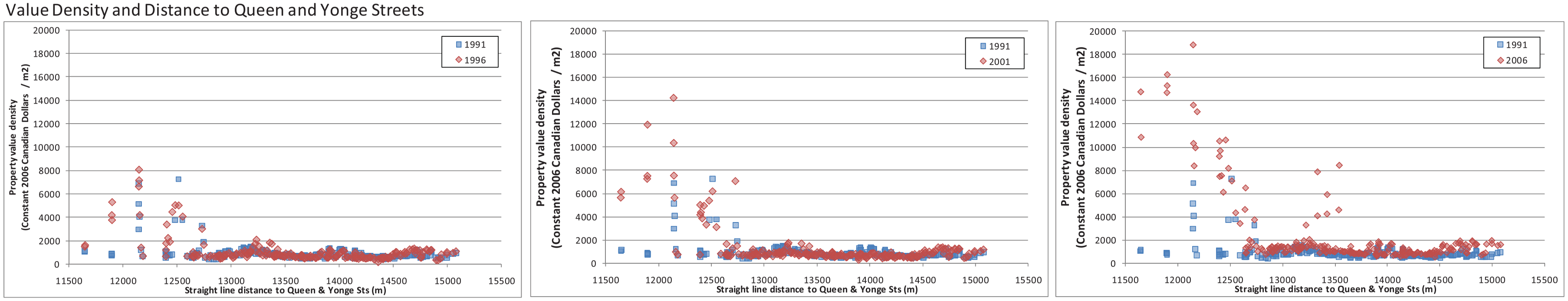
Macro-level Scatterplots (Based on Interpolated Values)

Scatterplots based on interpolated values

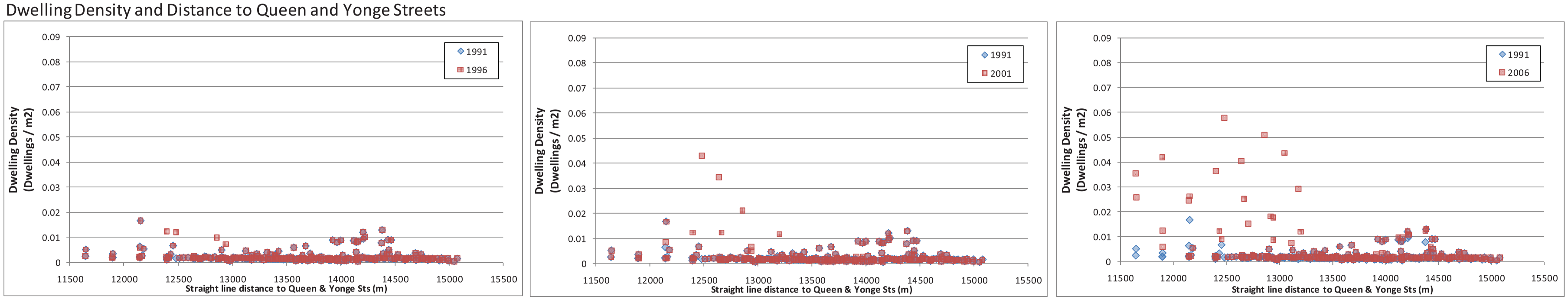
Macro-Level Analysis, Distance to Downtown (Queen and Yonge Streets)



Value Density and Distance to Queen and Yonge Streets

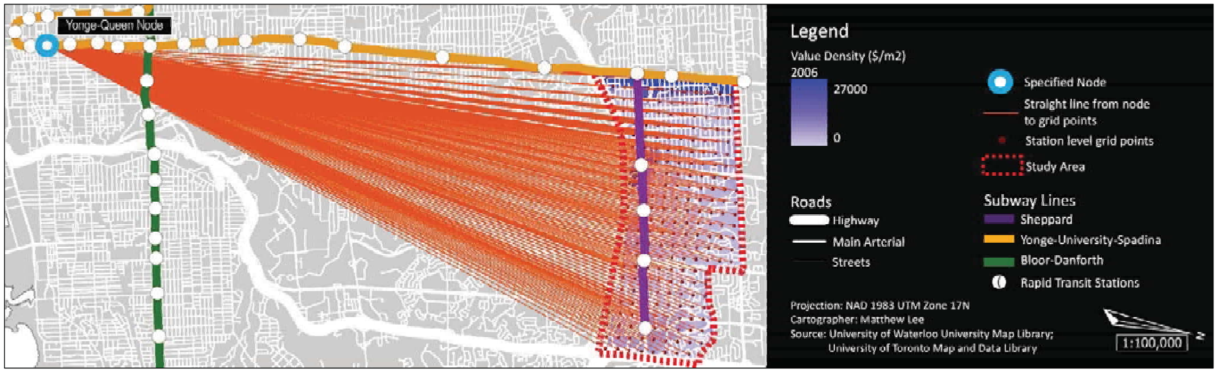


Dwelling Density and Distance to Queen and Yonge Streets

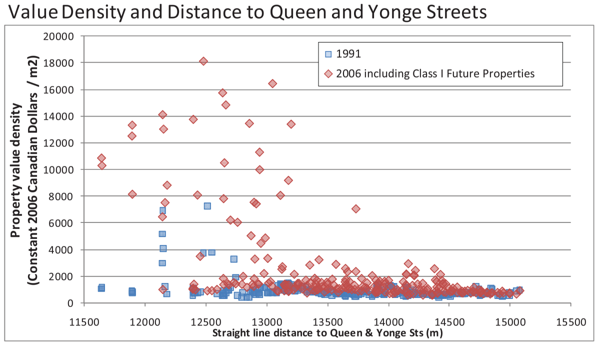


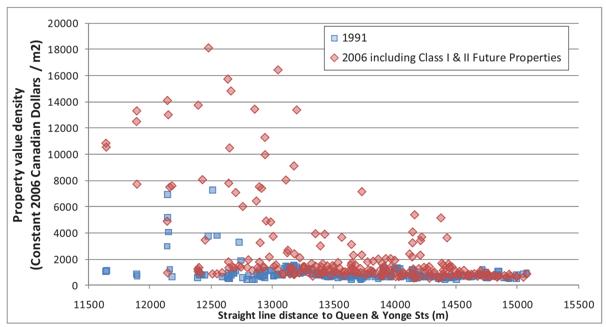
Scatterplots based on interpolated values

Macro-Level Analysis, Distance to Downtown (Queen and Yonge Streets)

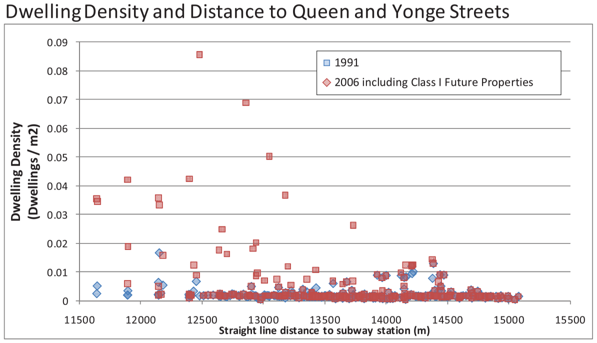


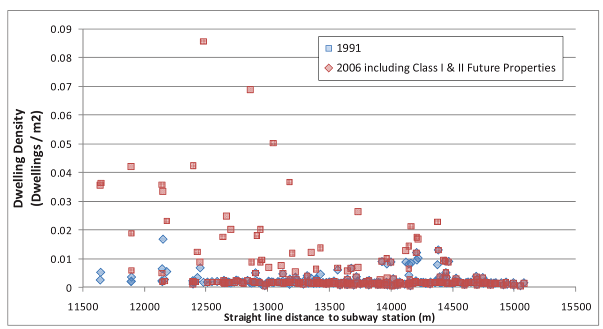
Value Density and Distance to Queen and Yonge Streets





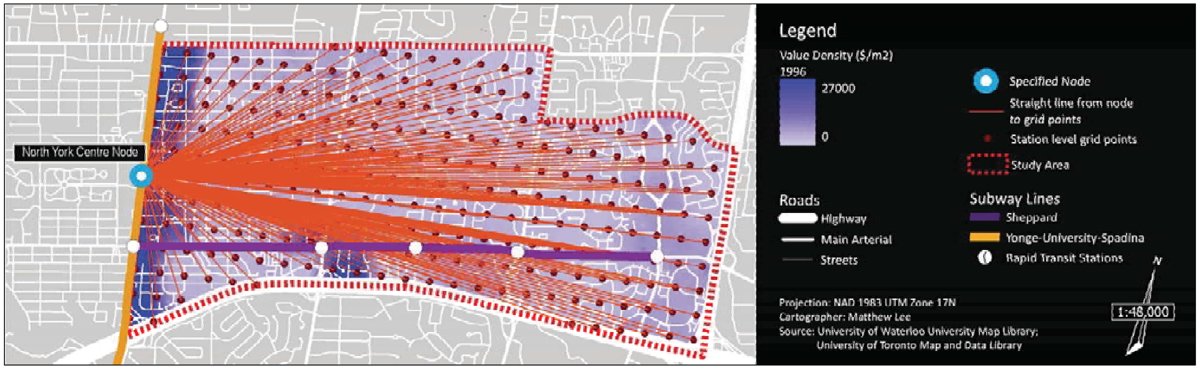
Dwelling Density and Distance to Queen and Yonge Streets



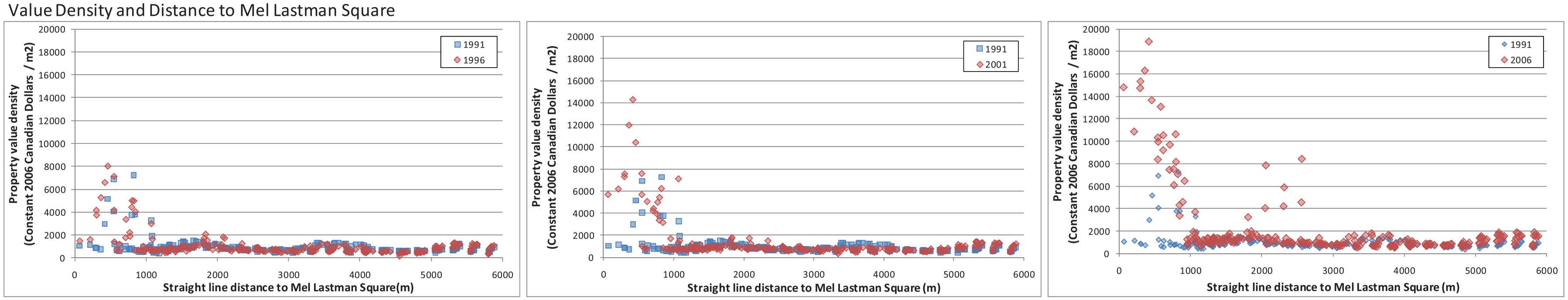


Scatterplots based on interpolated values

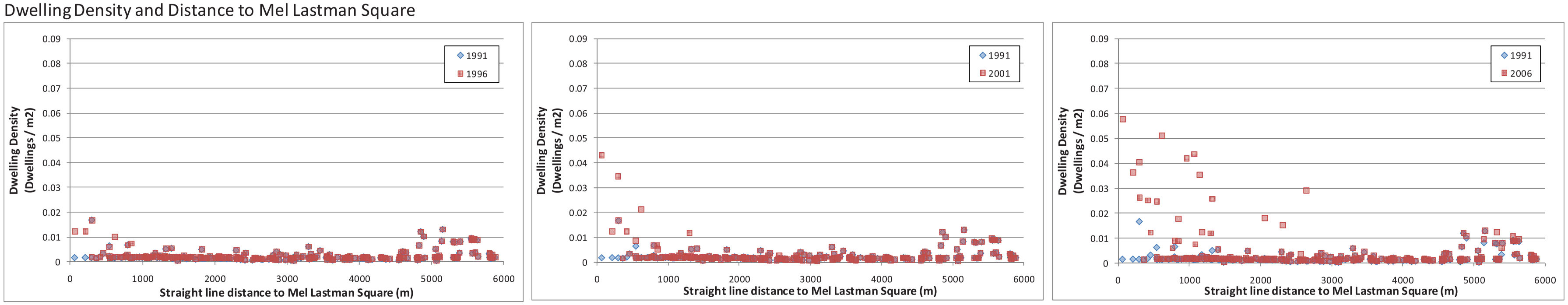
Macro-Level Analysis, Distance to North York Centre (Mel Lastman Square)



Value Density and Distance to Mel Lastman Square

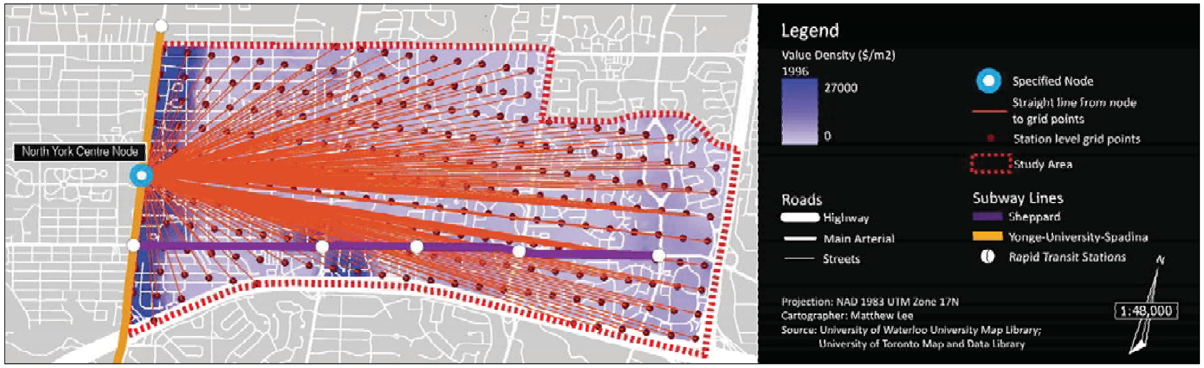


Dwelling Density and Distance to Mel Lastman Square

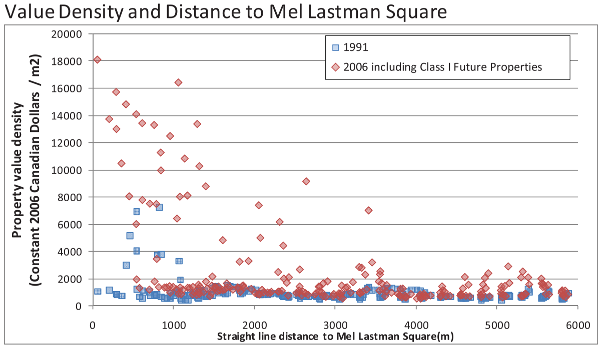


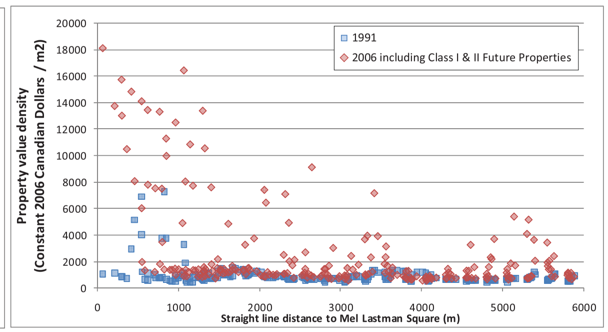
Scatterplots based on interpolated values

Macro-Level Analysis, Distance to North York Centre (Mel Lastman Square)

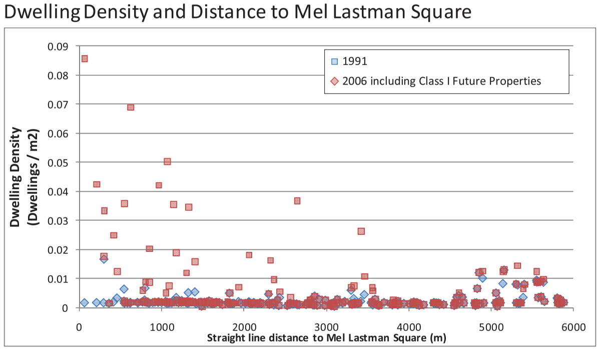


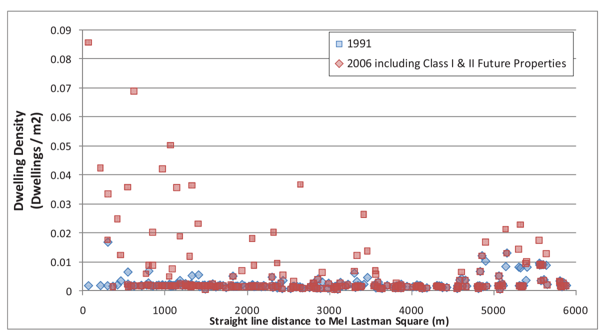
Value Density and Distance to Mel Lastman Square





Dwelling Density and Distance to Mel Lastman Square





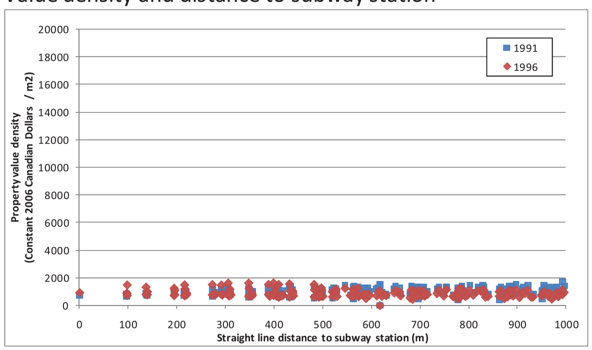
Appendix L:

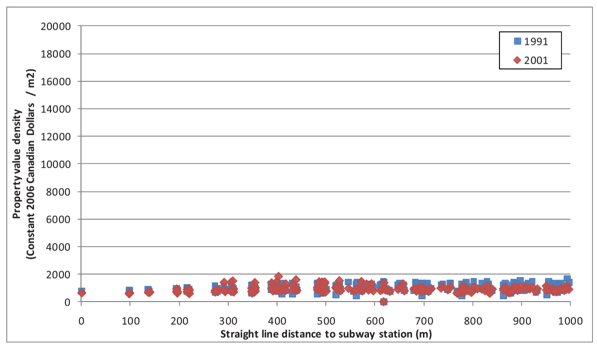
Station-level Scatterplots (Based on Interpolated Values)

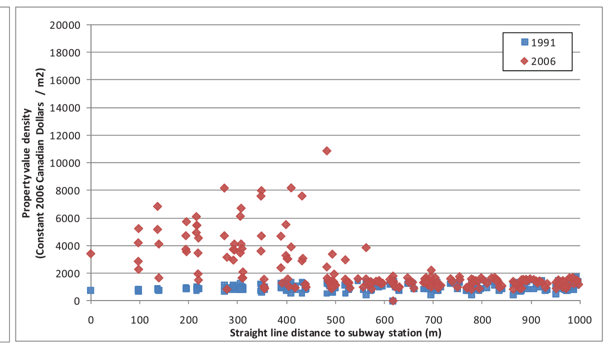
Scatterplots based on interpolated values

Bayview

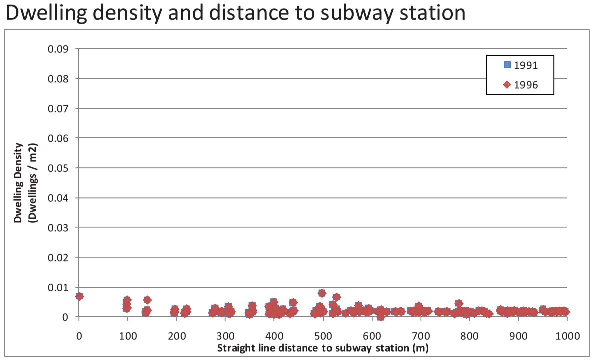
Value density and distance to subway station

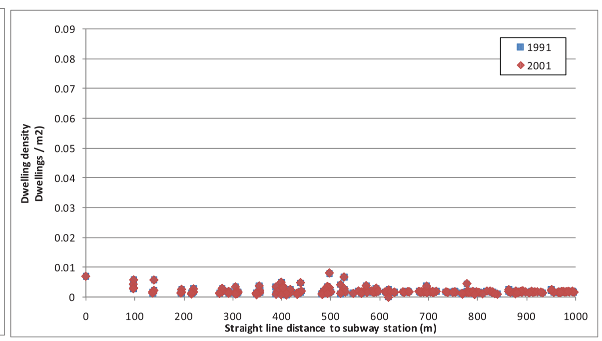


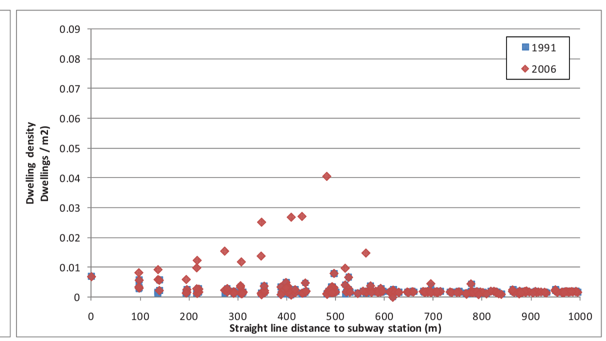




Dwelling density and distance to subway station



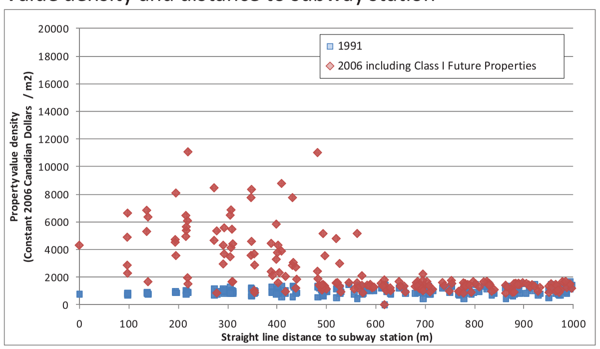


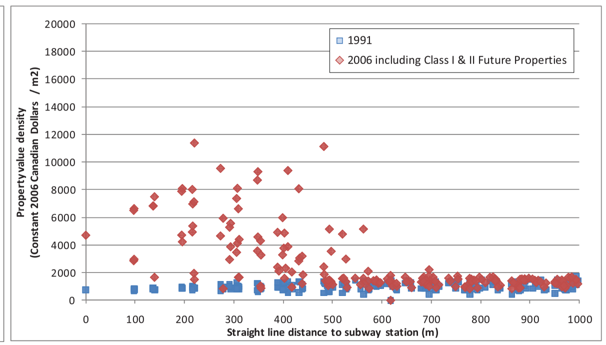


Scatterplots based on interpolated values

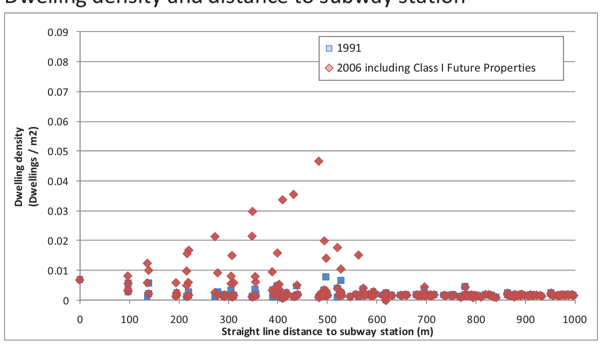
Bayview

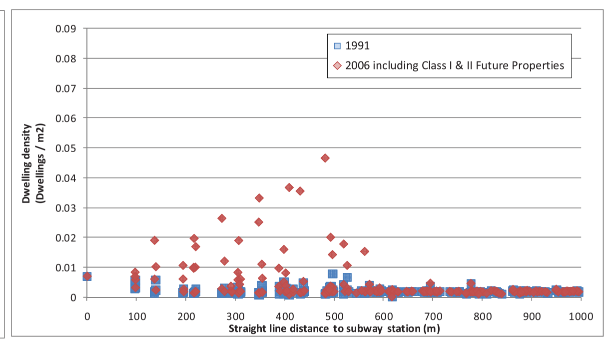
Value density and distance to subway station





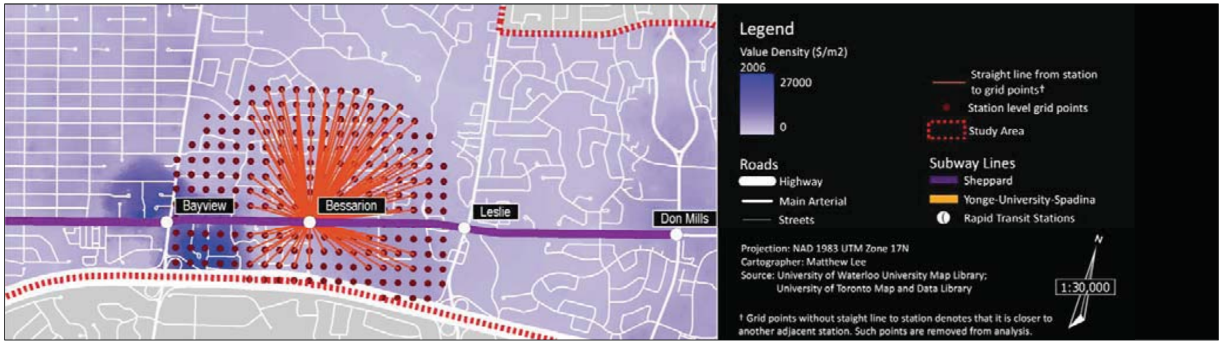
Dwelling density and distance to subway station



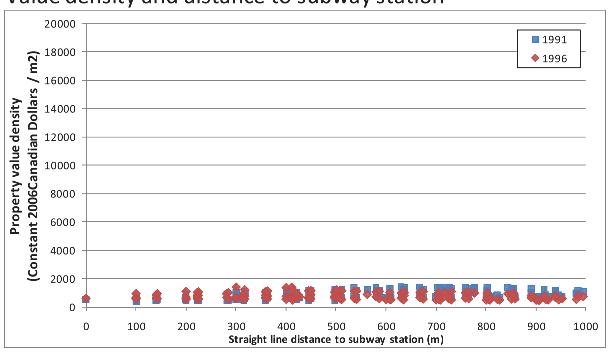


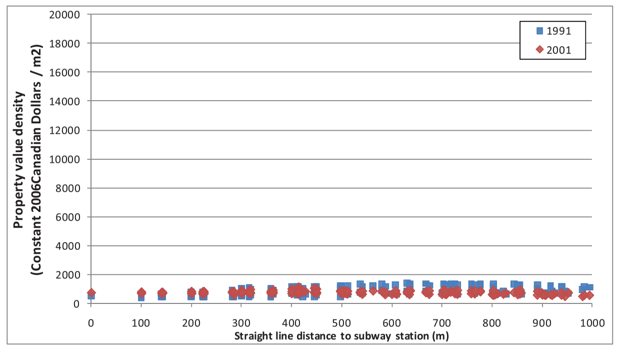
Scatterplots based on interpolated values

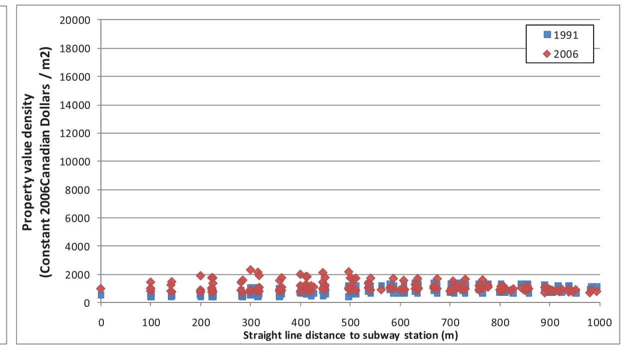
Bessarion



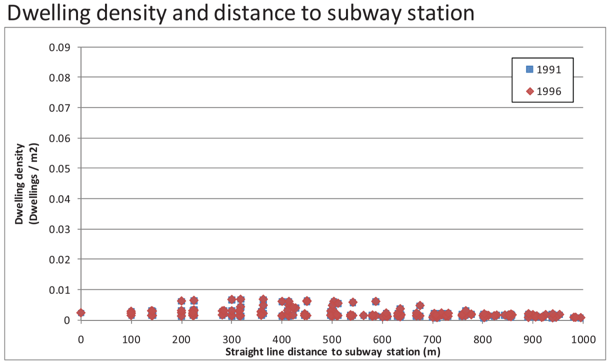
Value density and distance to subway station

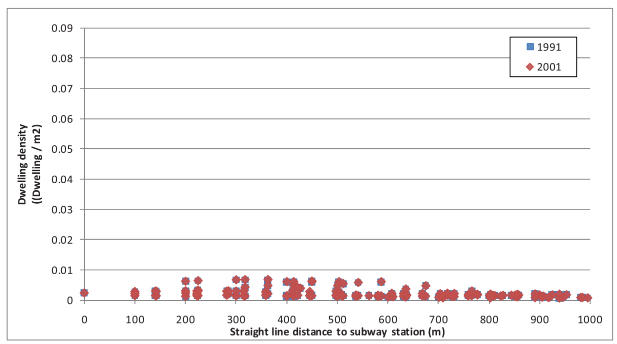


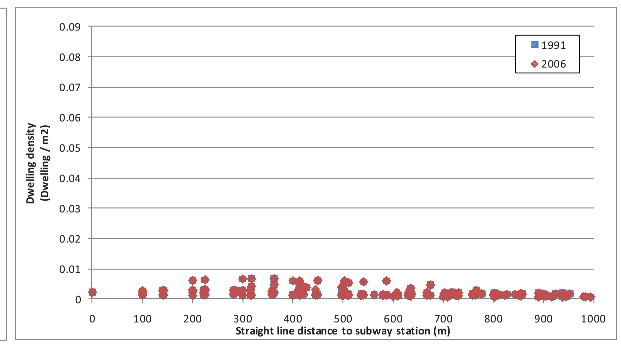




Dwelling density and distance to subway station

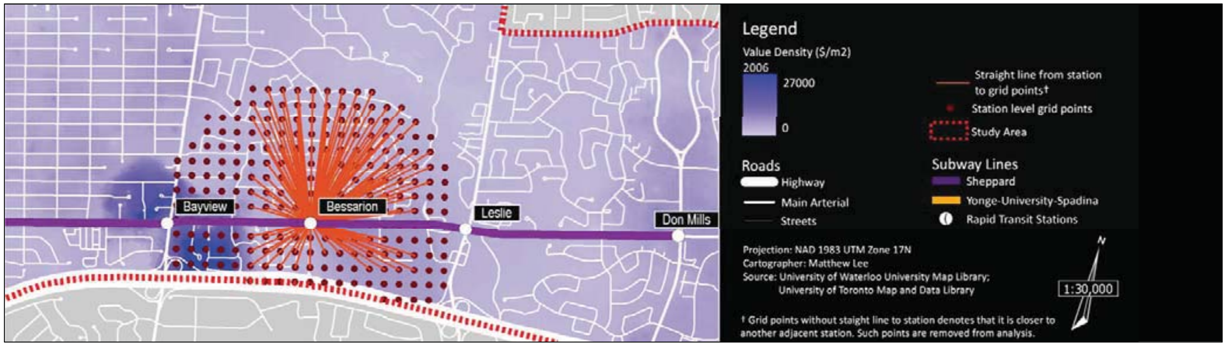




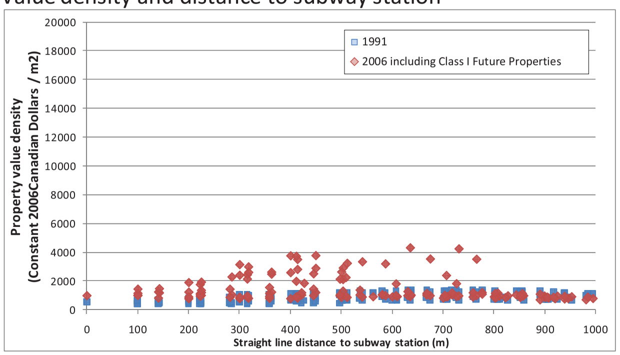


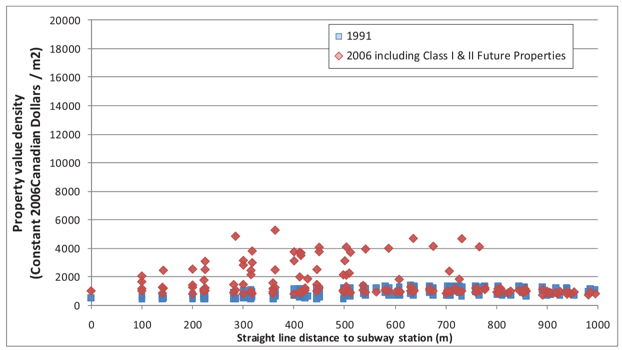
Scatterplots based on interpolated values

Bessarion

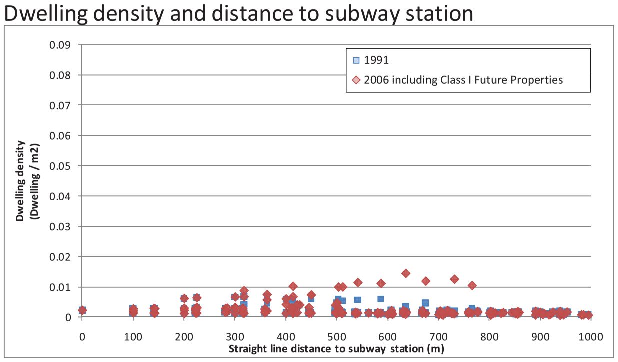


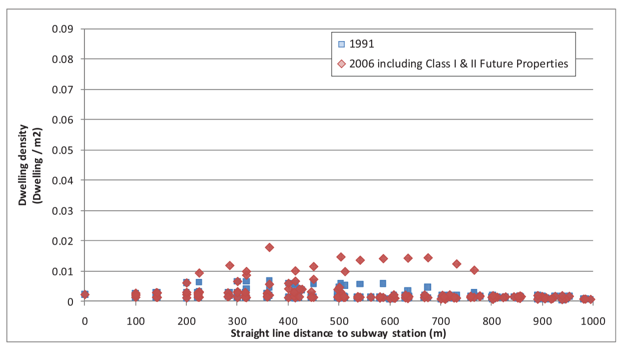
Value density and distance to subway station





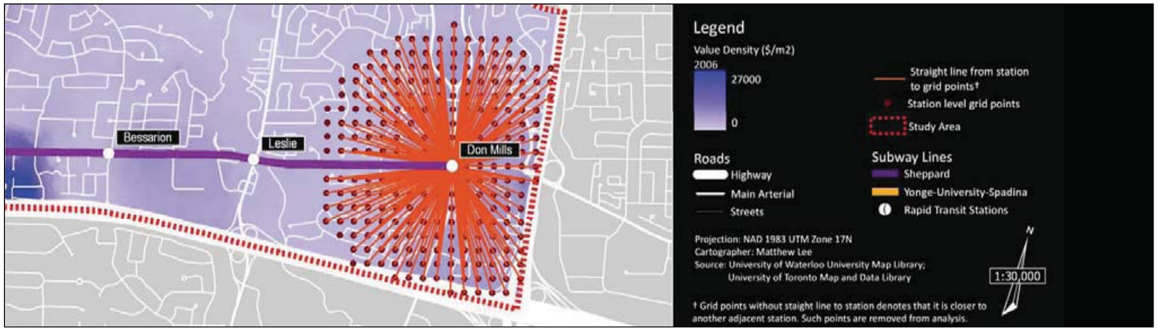
Dwelling density and distance to subway station



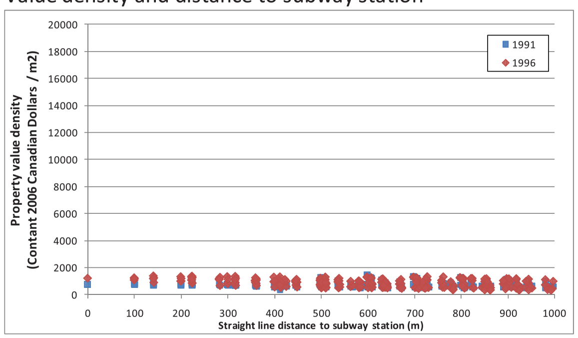


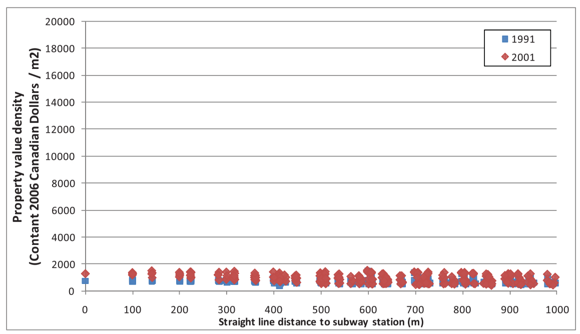
Scatterplots based on interpolated values

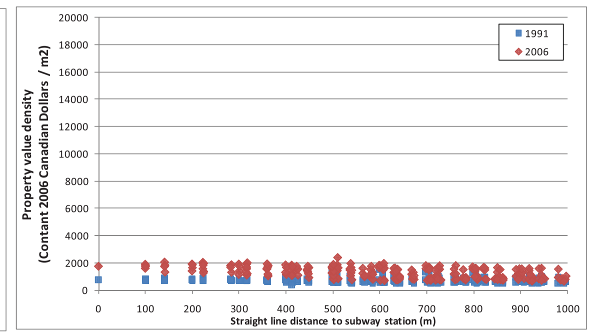
Don Mills



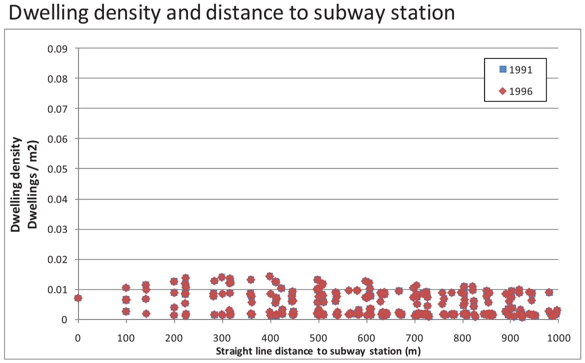
Value density and distance to subway station

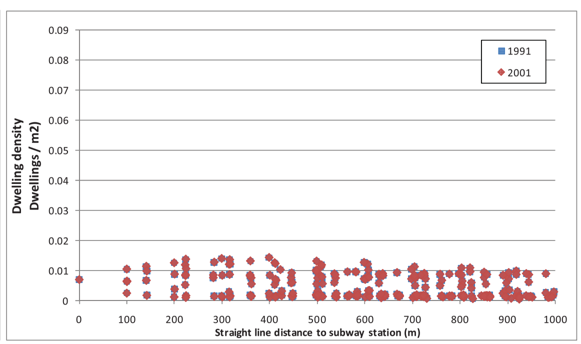


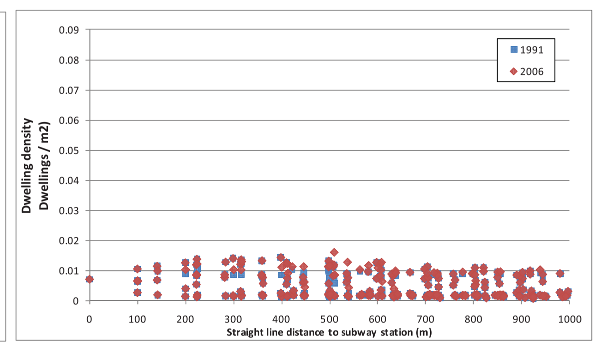




Dwelling density and distance to subway station

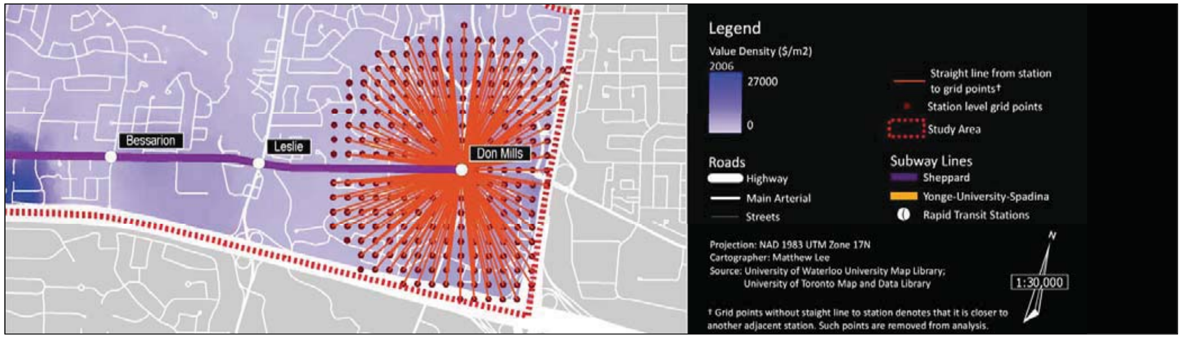




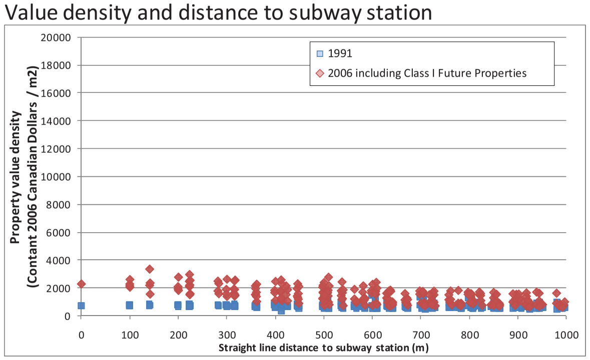


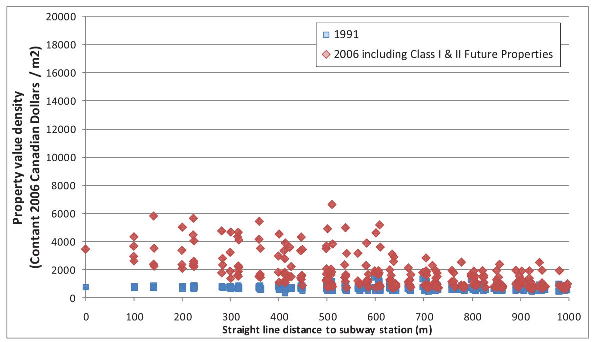
Scatterplots based on interpolated values

Don Mills

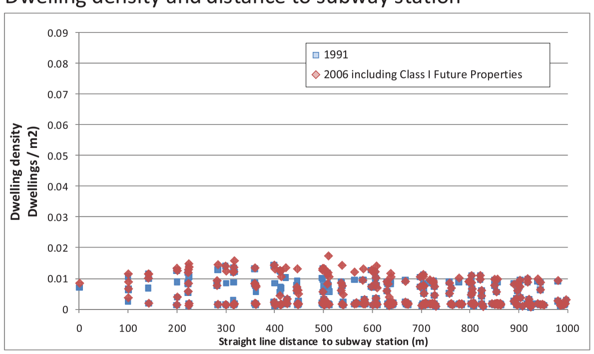


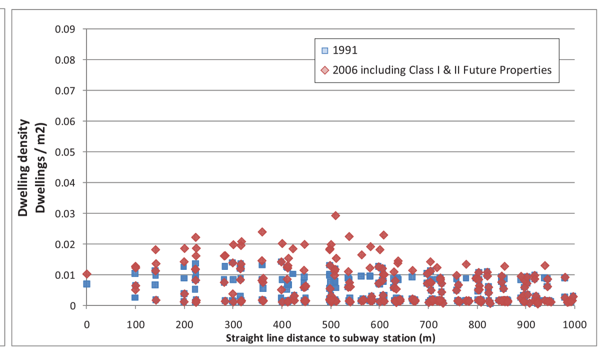
Value density and distance to subway station





Dwelling density and distance to subway station

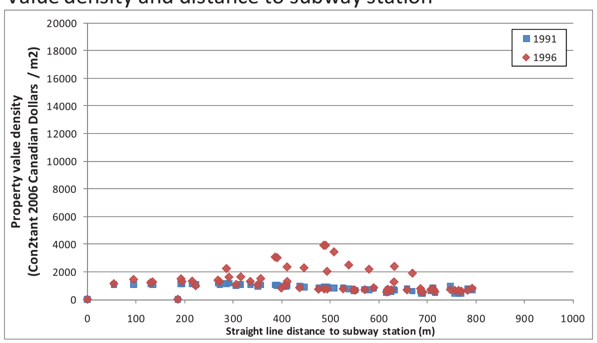


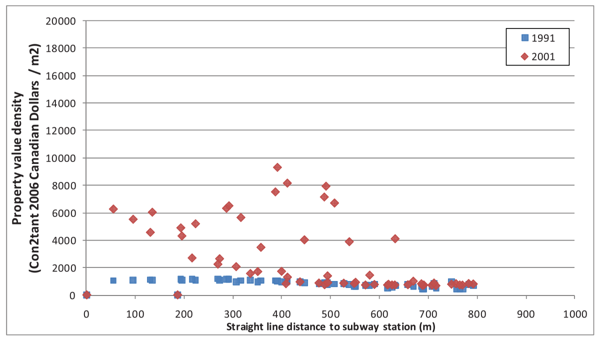


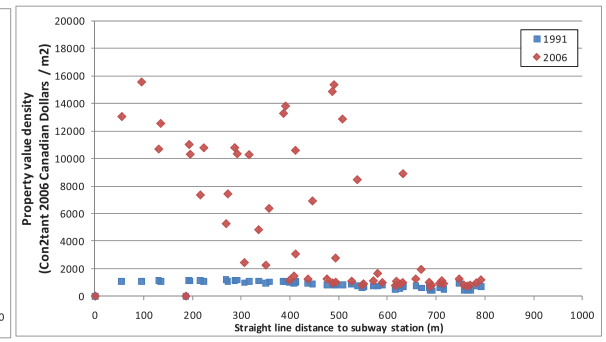
Scatterplots based on interpolated values

Finch

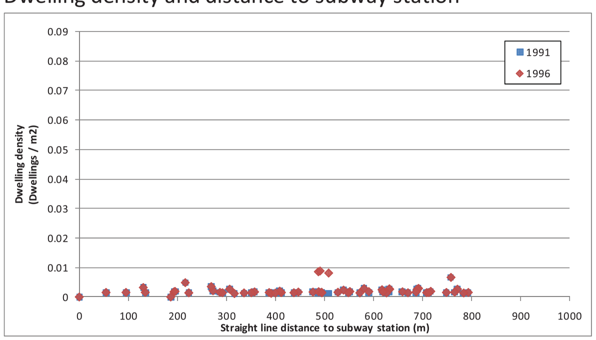
Value density and distance to subway station

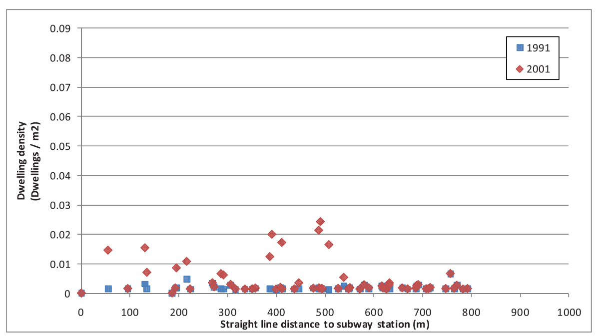


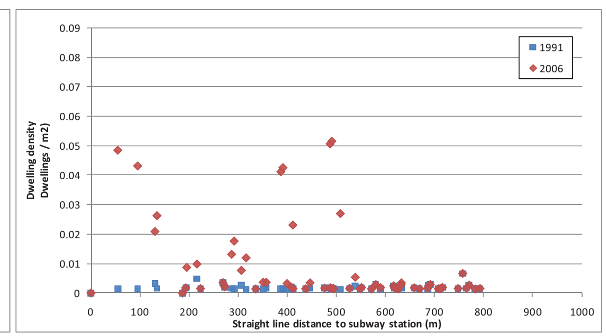




Dwelling density and distance to subway station

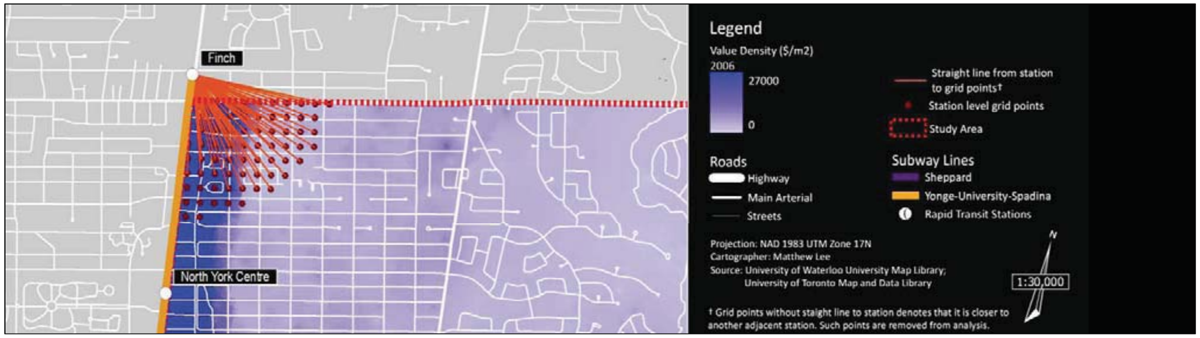




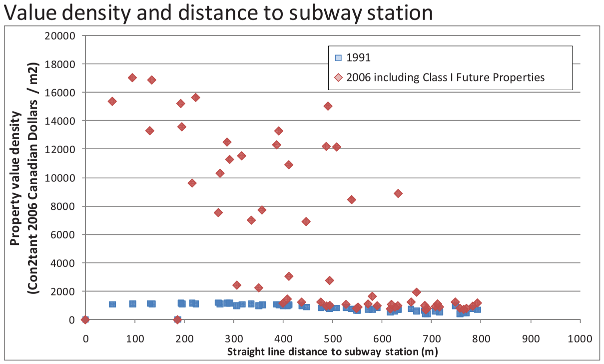


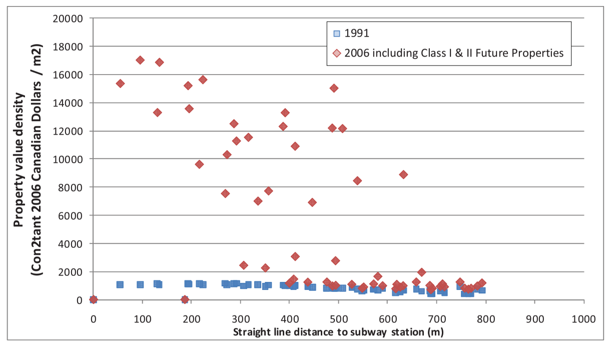
Scatterplots based on interpolated values

Finch

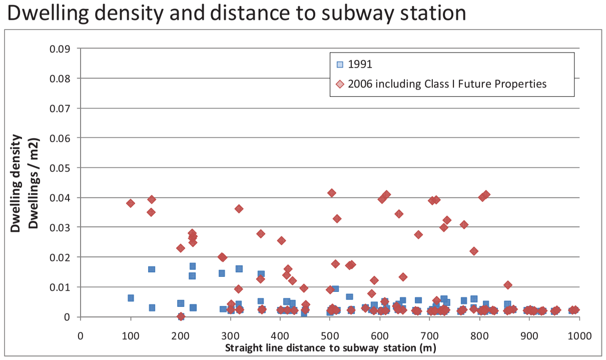


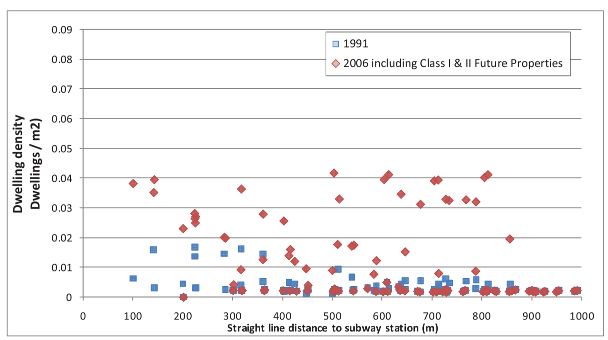
Value density and distance to subway station





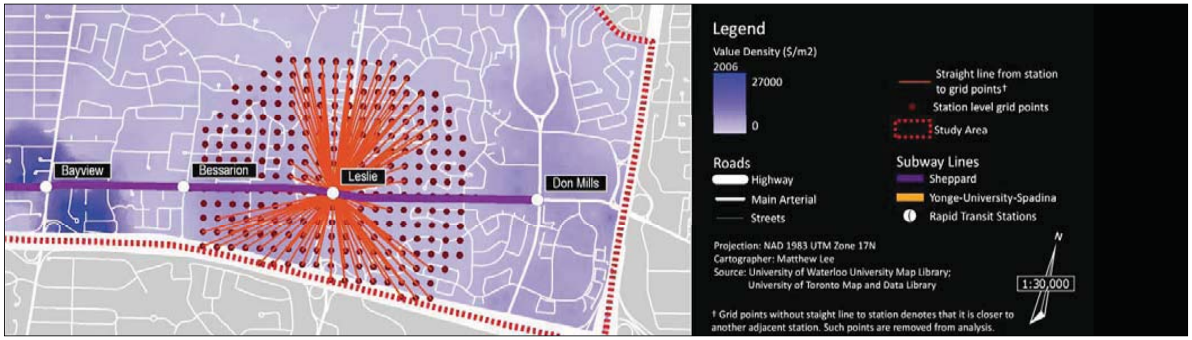
Dwelling density and distance to subway station



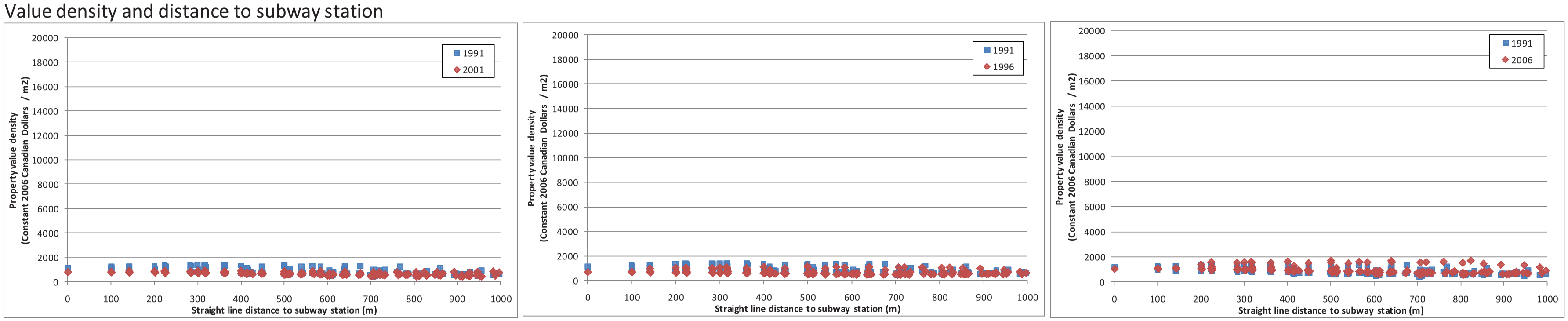


Scatterplots based on interpolated values

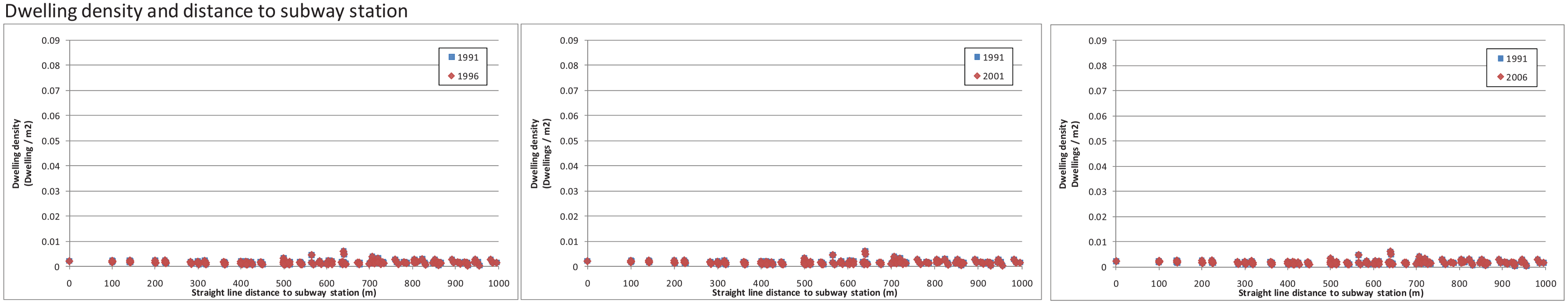
Leslie



Value density and distance to subway station

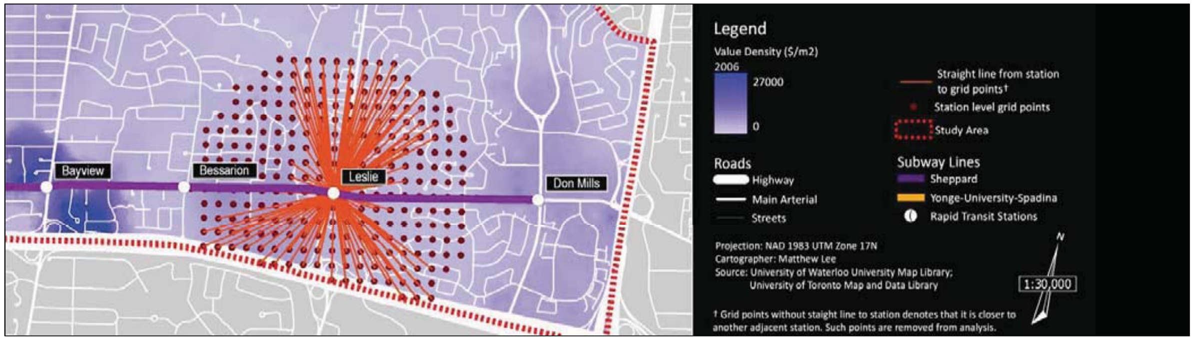


Dwelling density and distance to subway station

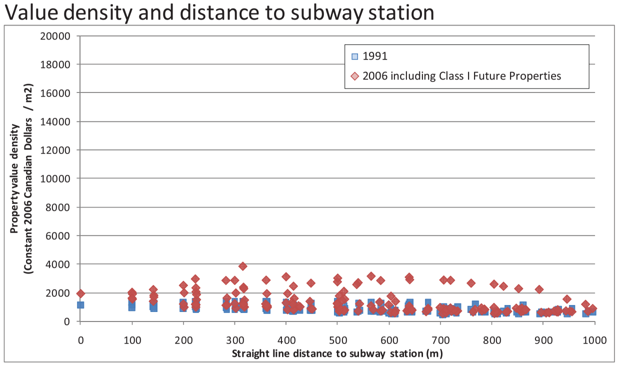


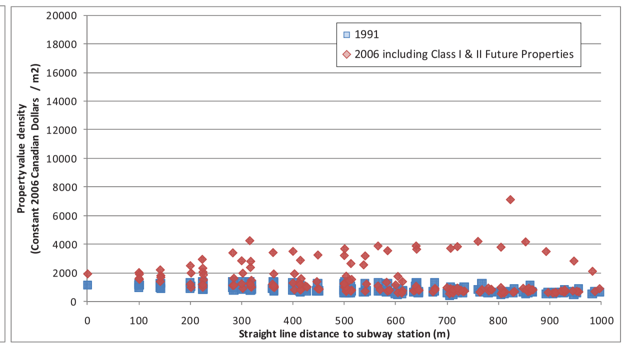
Scatterplots based on interpolated values

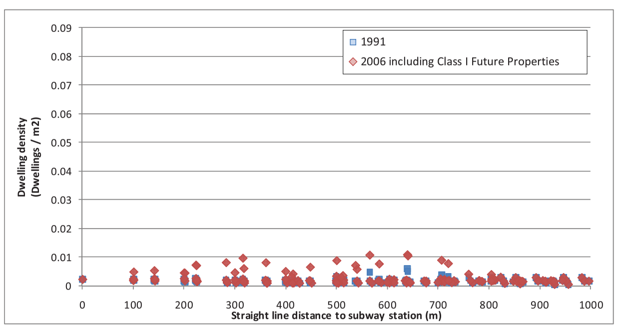
Leslie

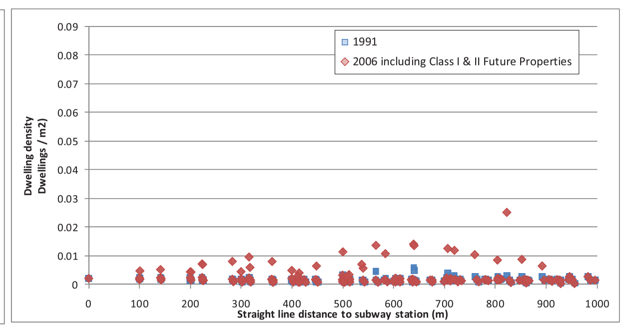


Value density and distance to subway station





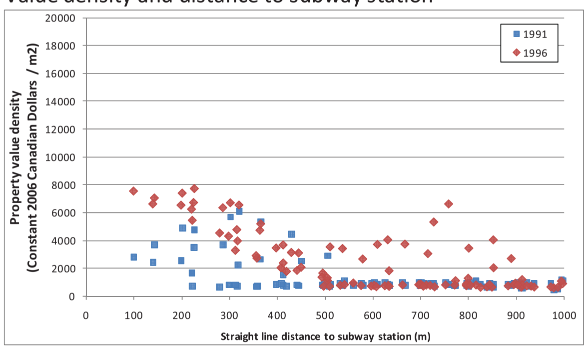


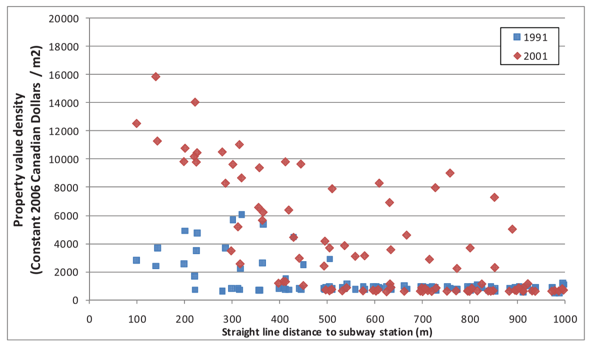


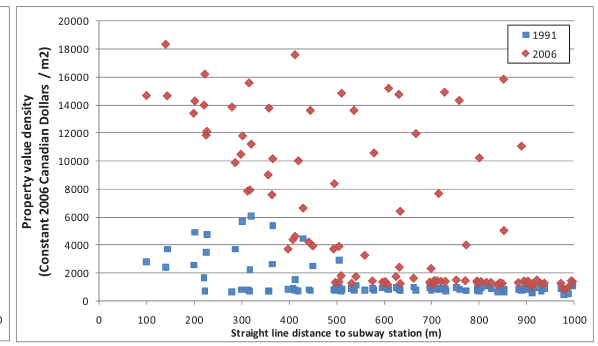
Scatterplots based on interpolated values

North York Centre

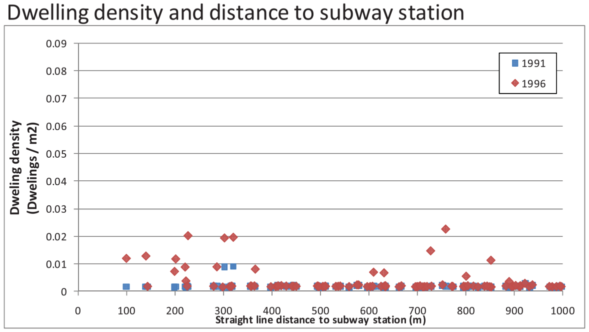
Value density and distance to subway station

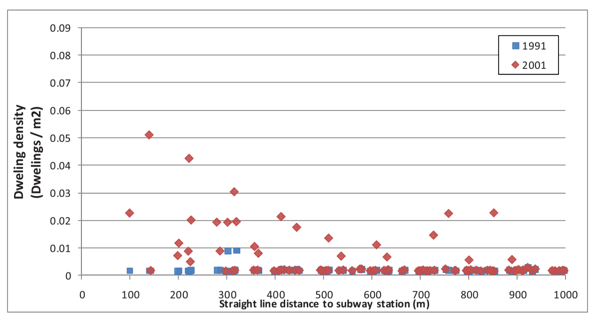


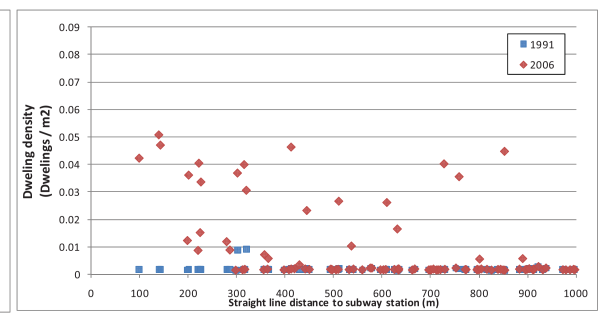




Dwelling density and distance to subway station

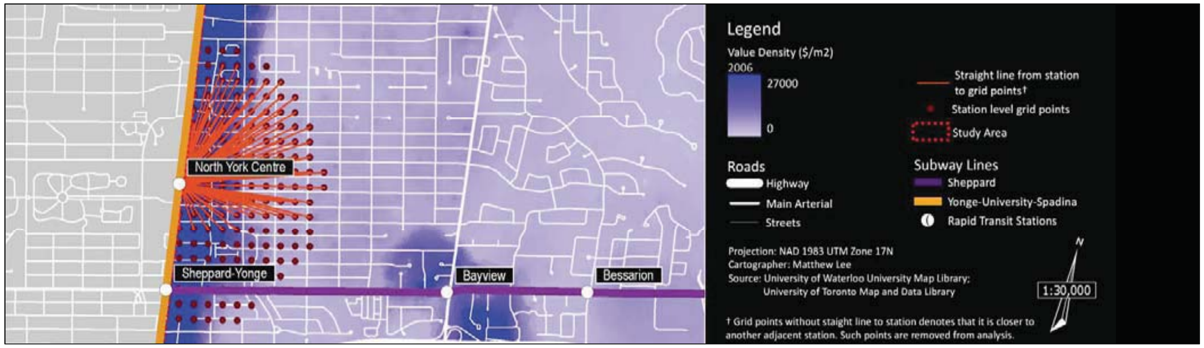




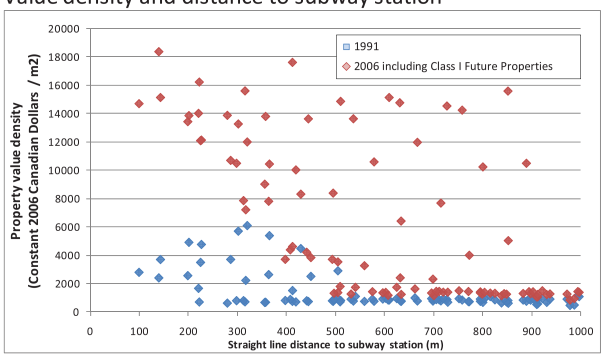


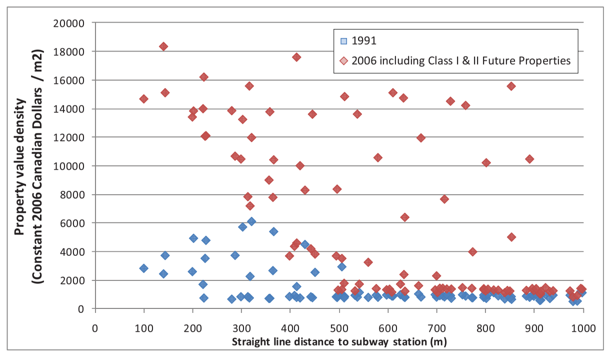
Scatterplots based on interpolated values

North York Centre

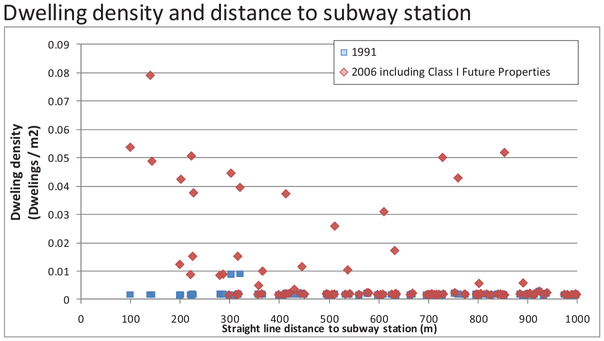


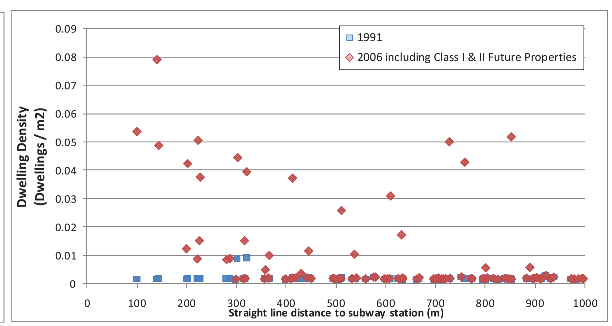
Value density and distance to subway station





Dwelling density and distance to subway station

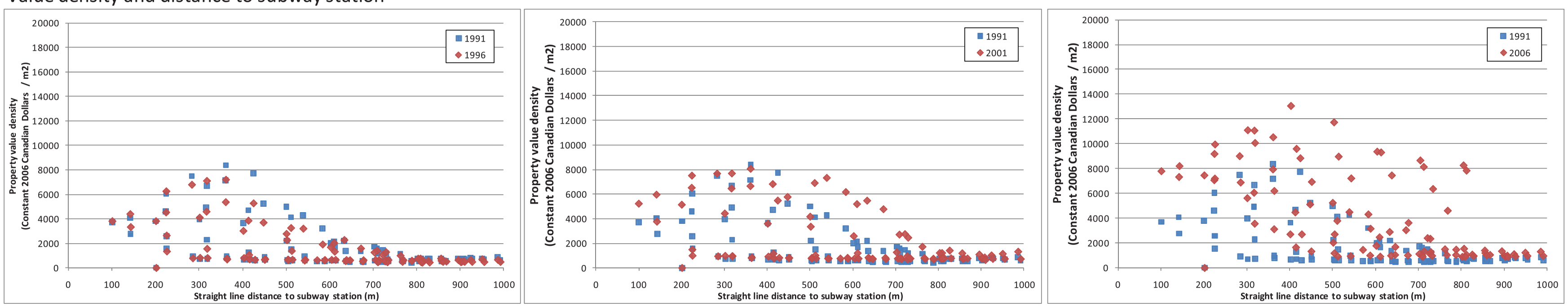




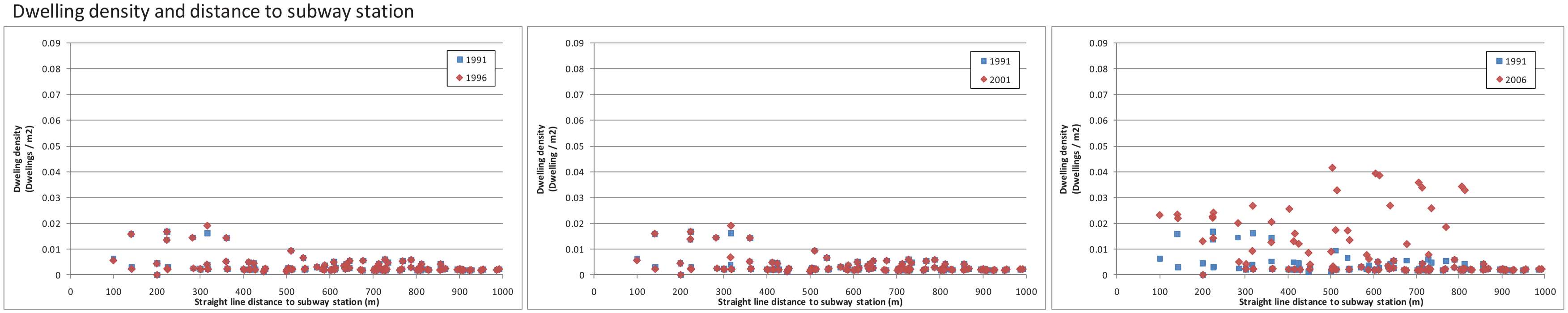
Scatterplots based on interpolated values

Sheppard-Yonge

Value density and distance to subway station



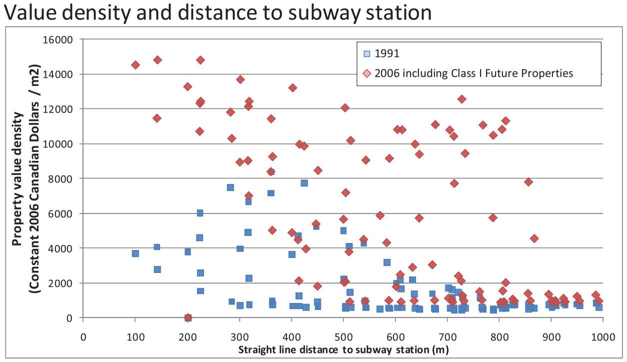
Dwelling density and distance to subway station

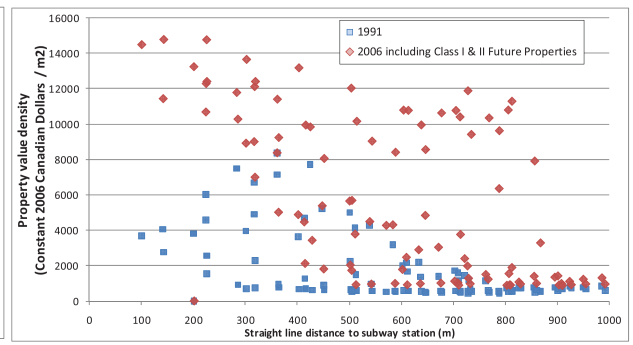


Scatterplots based on interpolated values

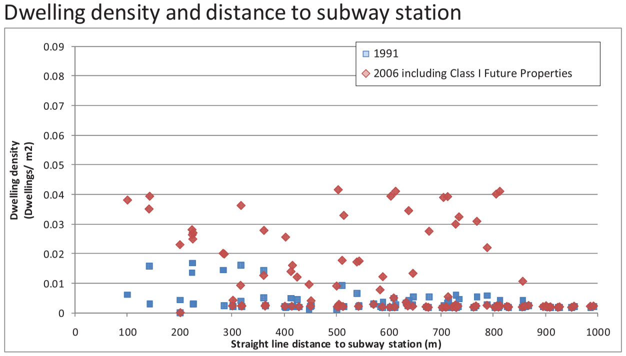
Sheppard-Yonge

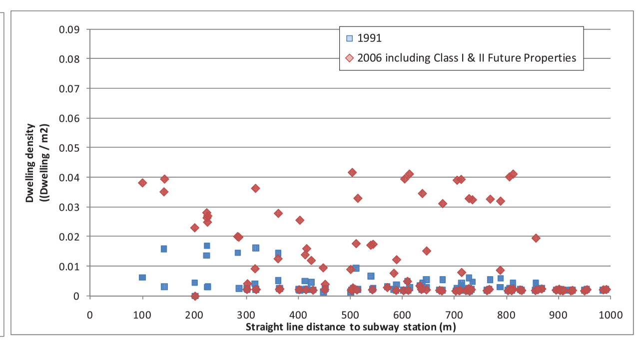
Value density and distance to subway station





Dwelling density and distance to subway station



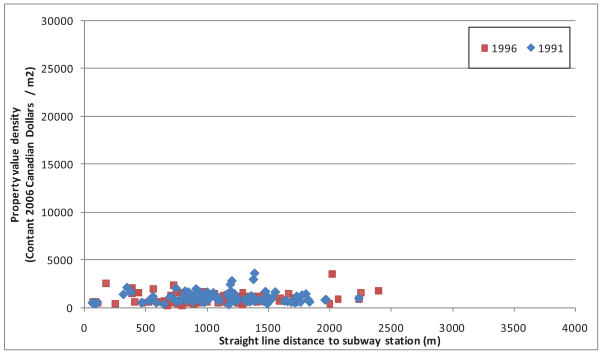


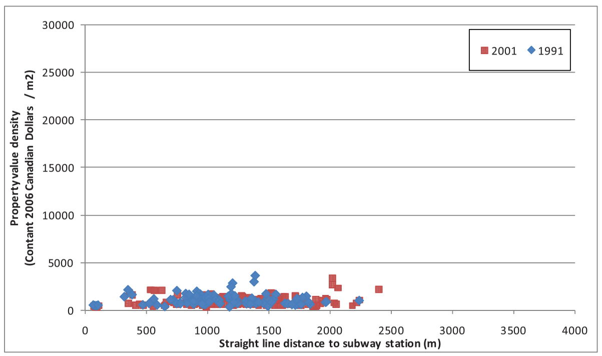
Appendix M:

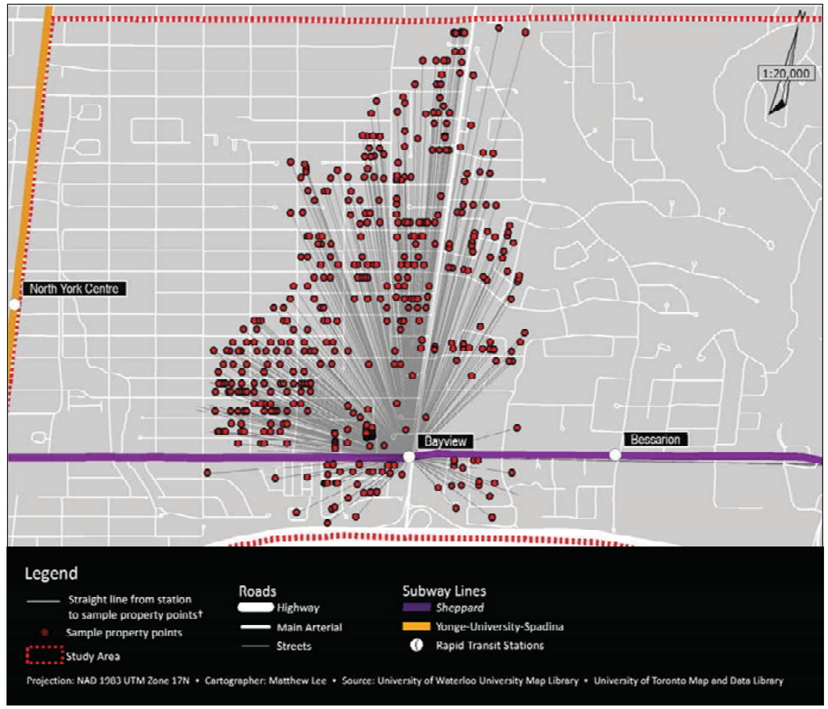
Station-level Scatterplots (Based on Actual Sales Values)

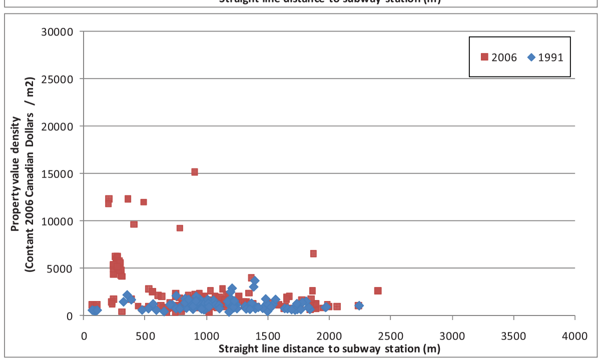
Scatterplots based on actual values

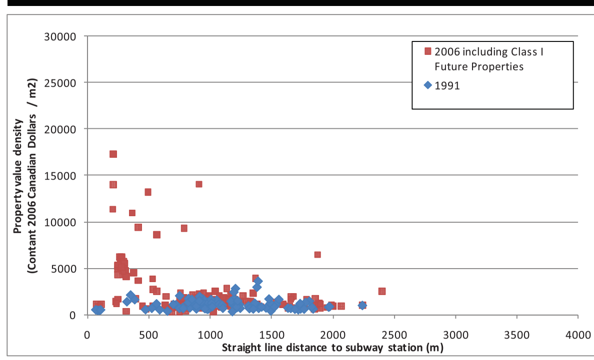
Bayview

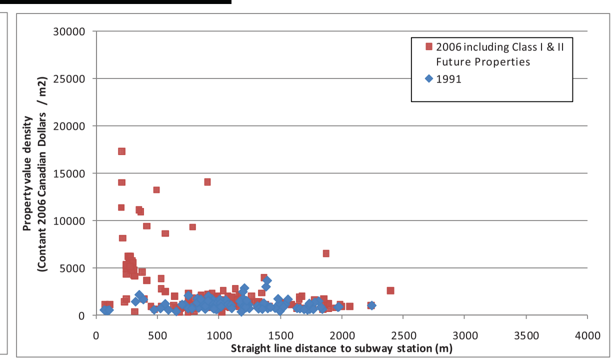






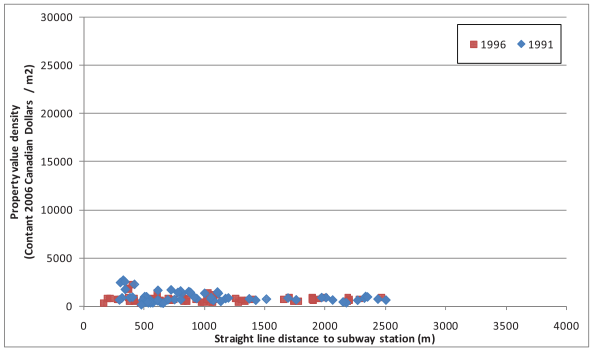


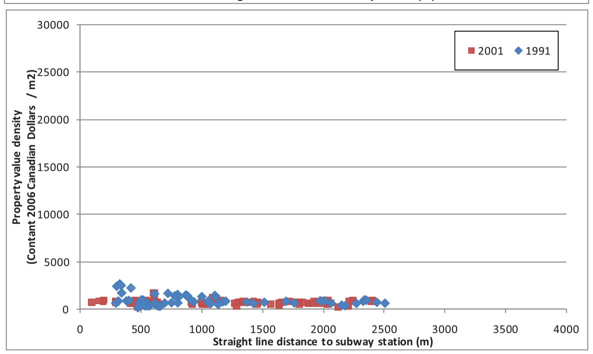


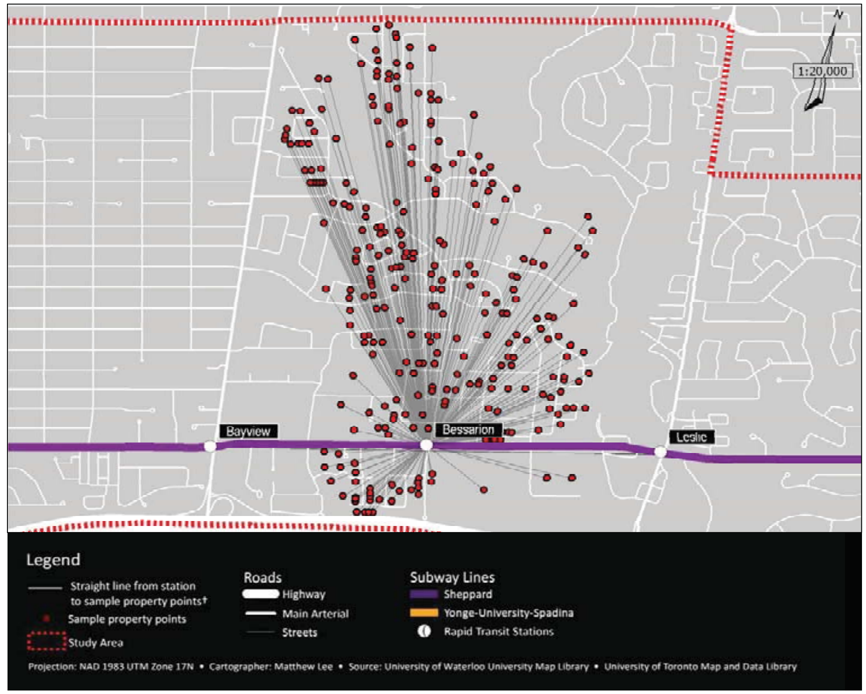


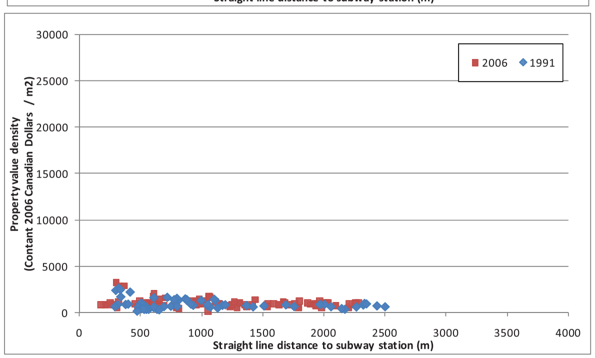
Scatterplots based on actual values

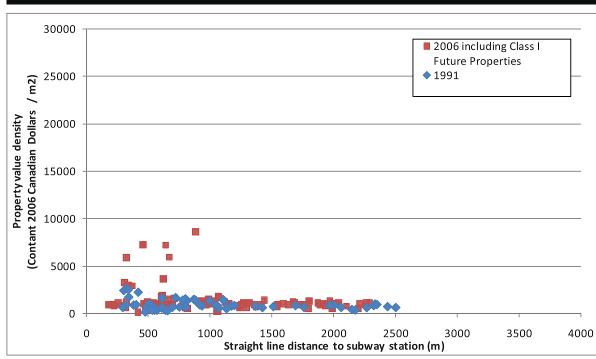
Bessarion

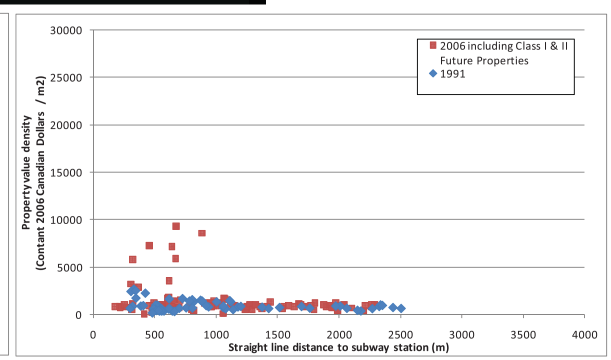






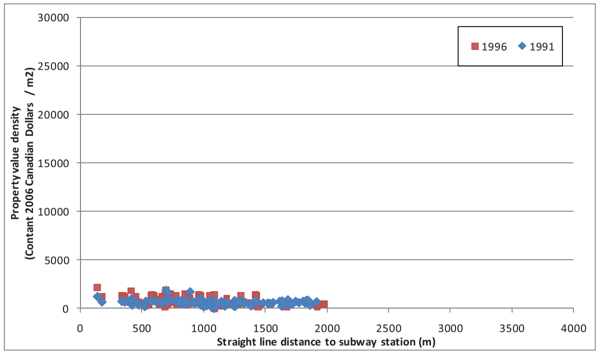


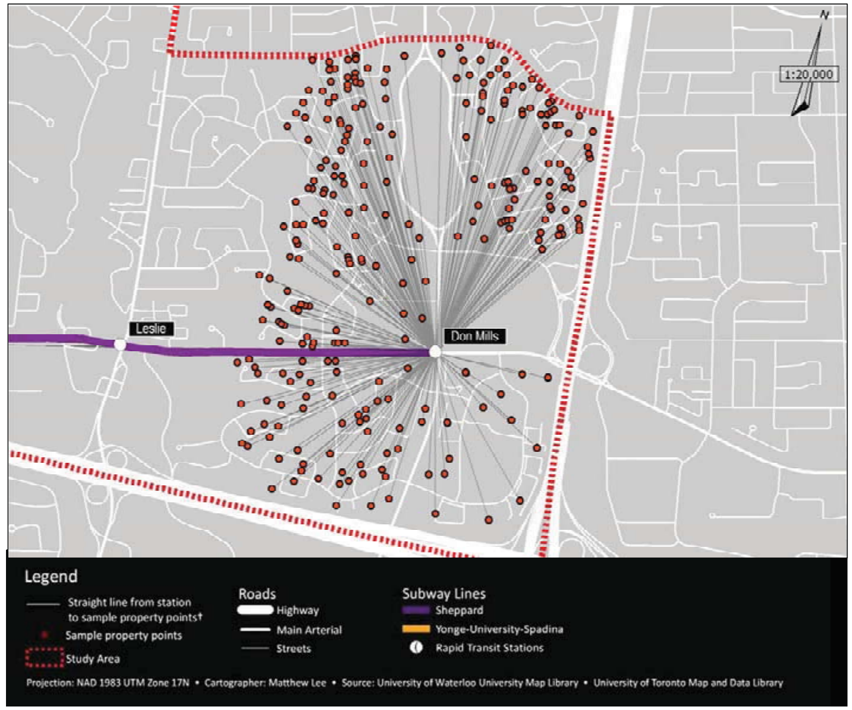


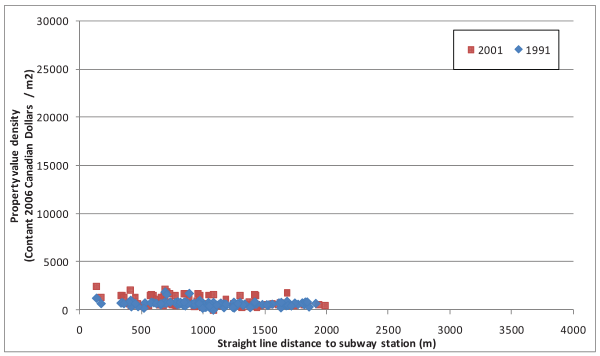


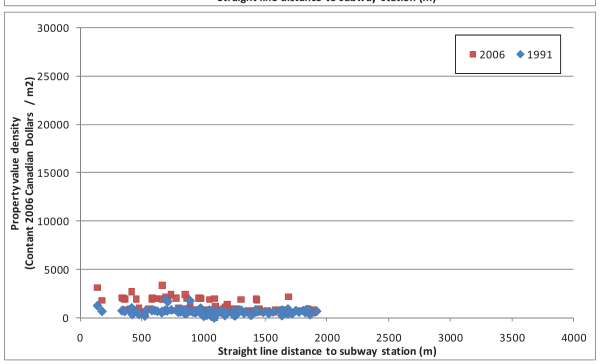
Scatterplots based on interpolated values

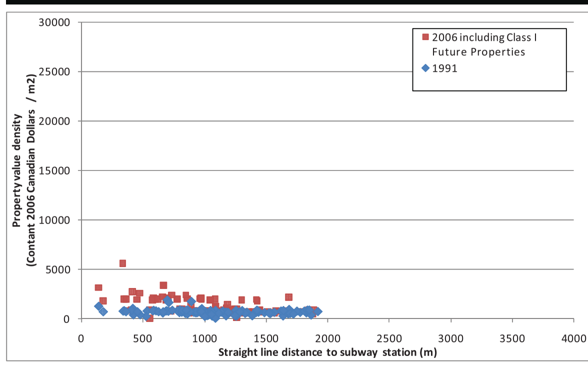
Don Mills

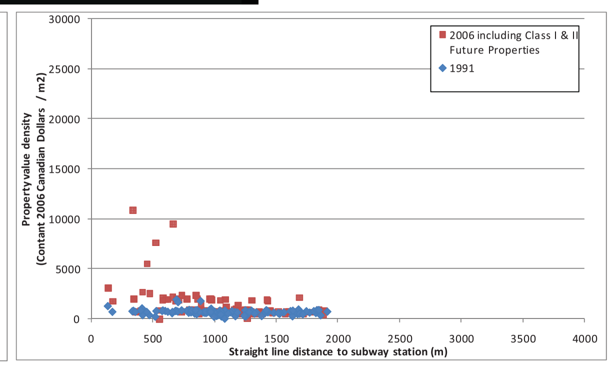






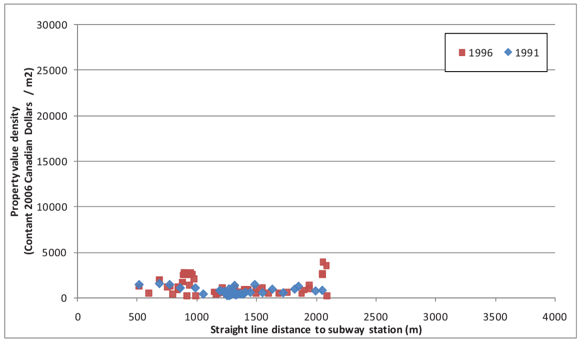


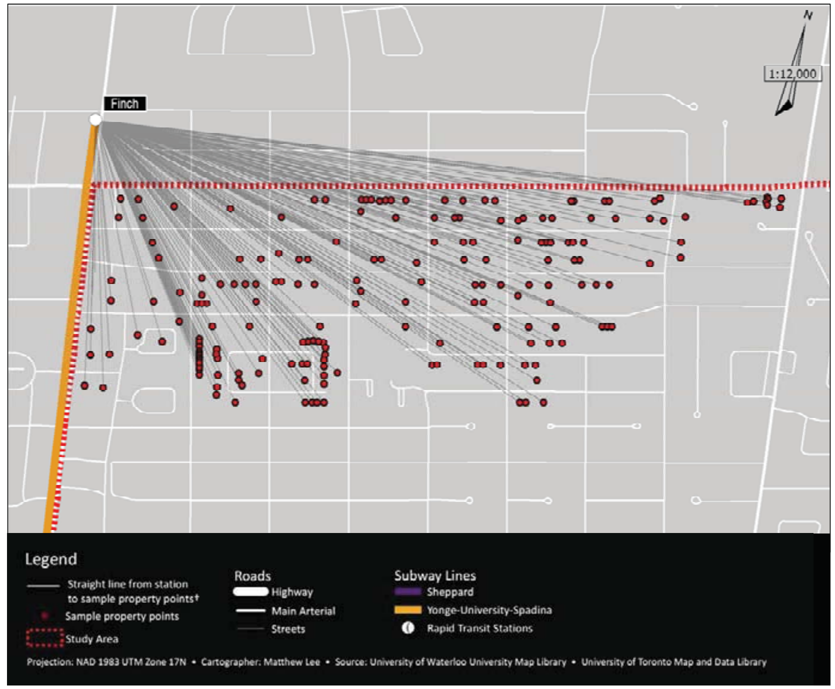


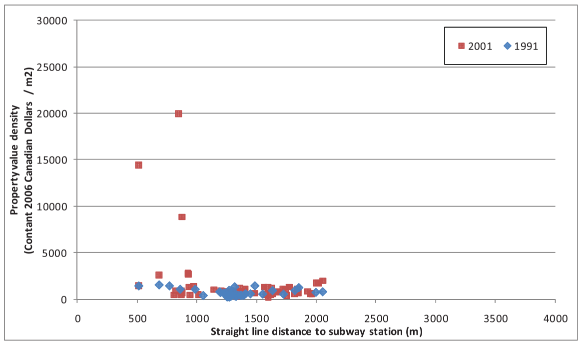


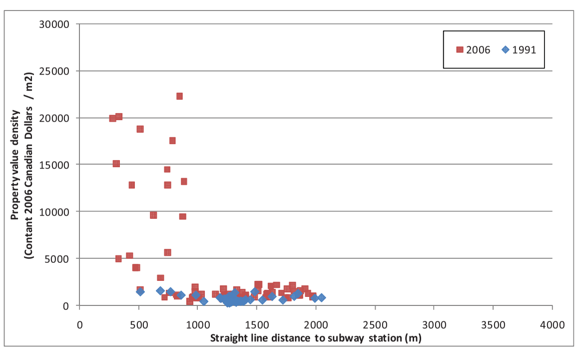
Scatterplots based on interpolated values

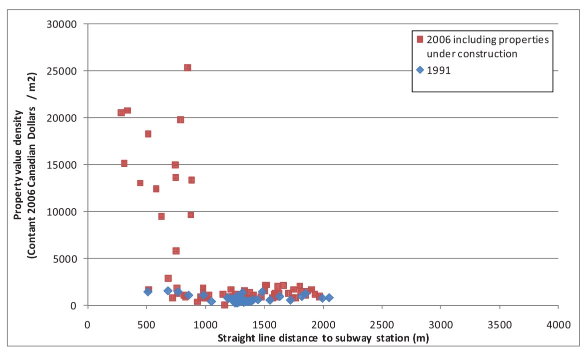
Finch

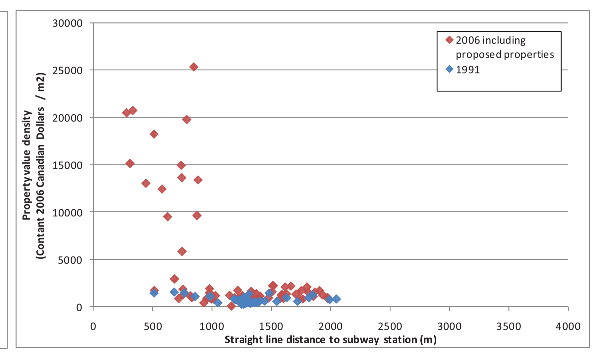






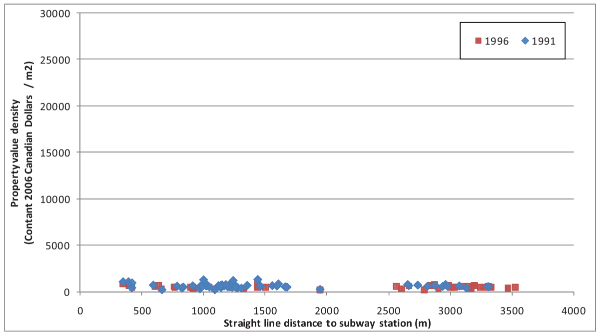


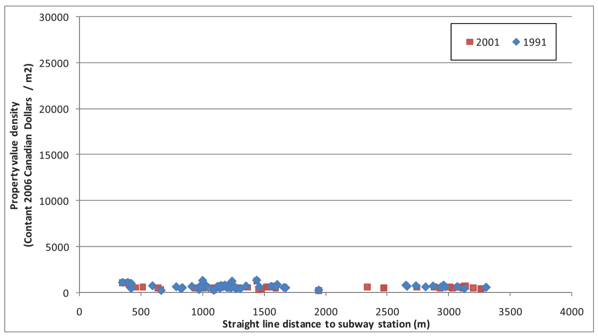


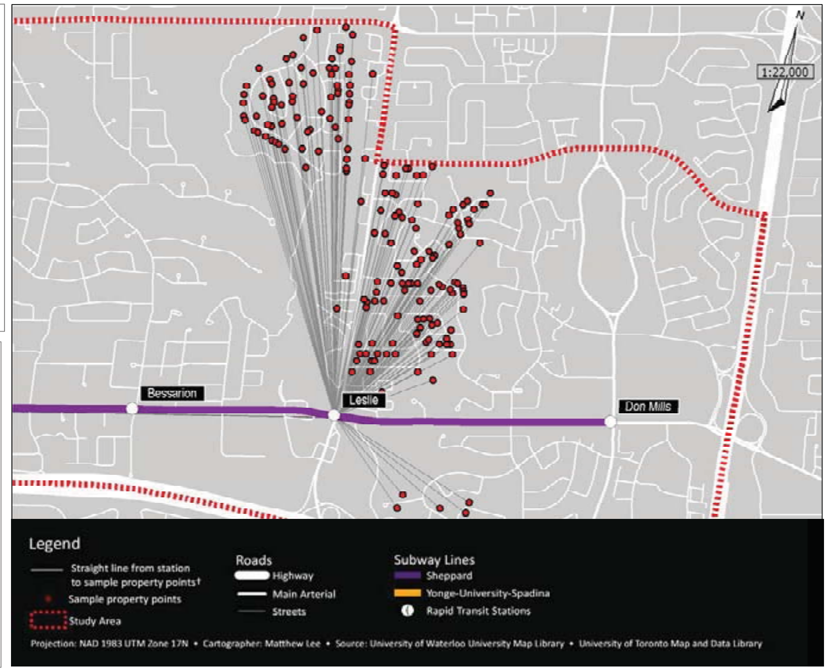


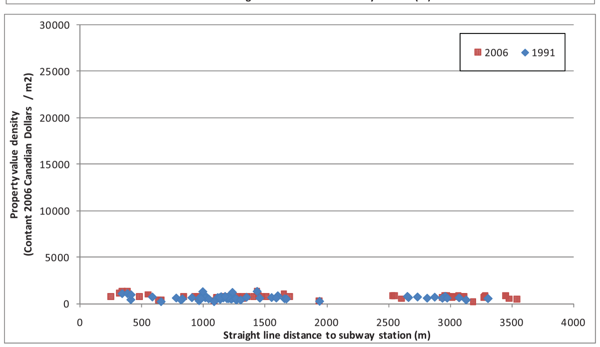
Scatterplots based on interpolated values

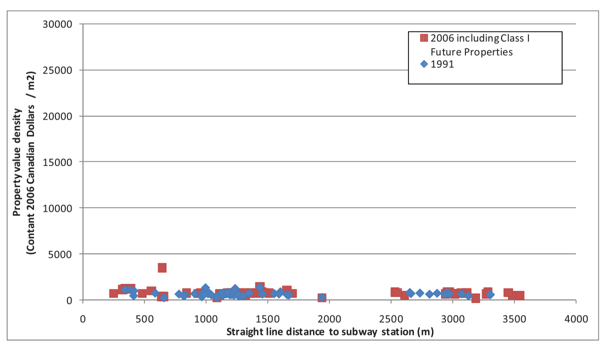
Leslie

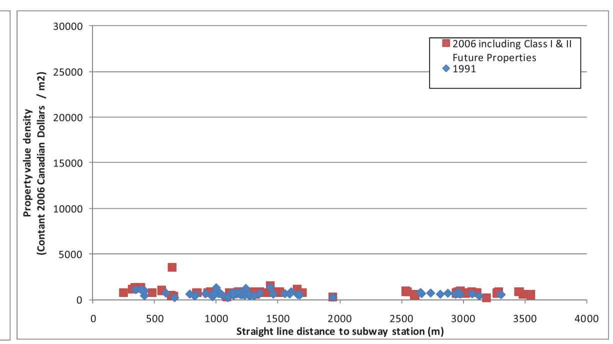






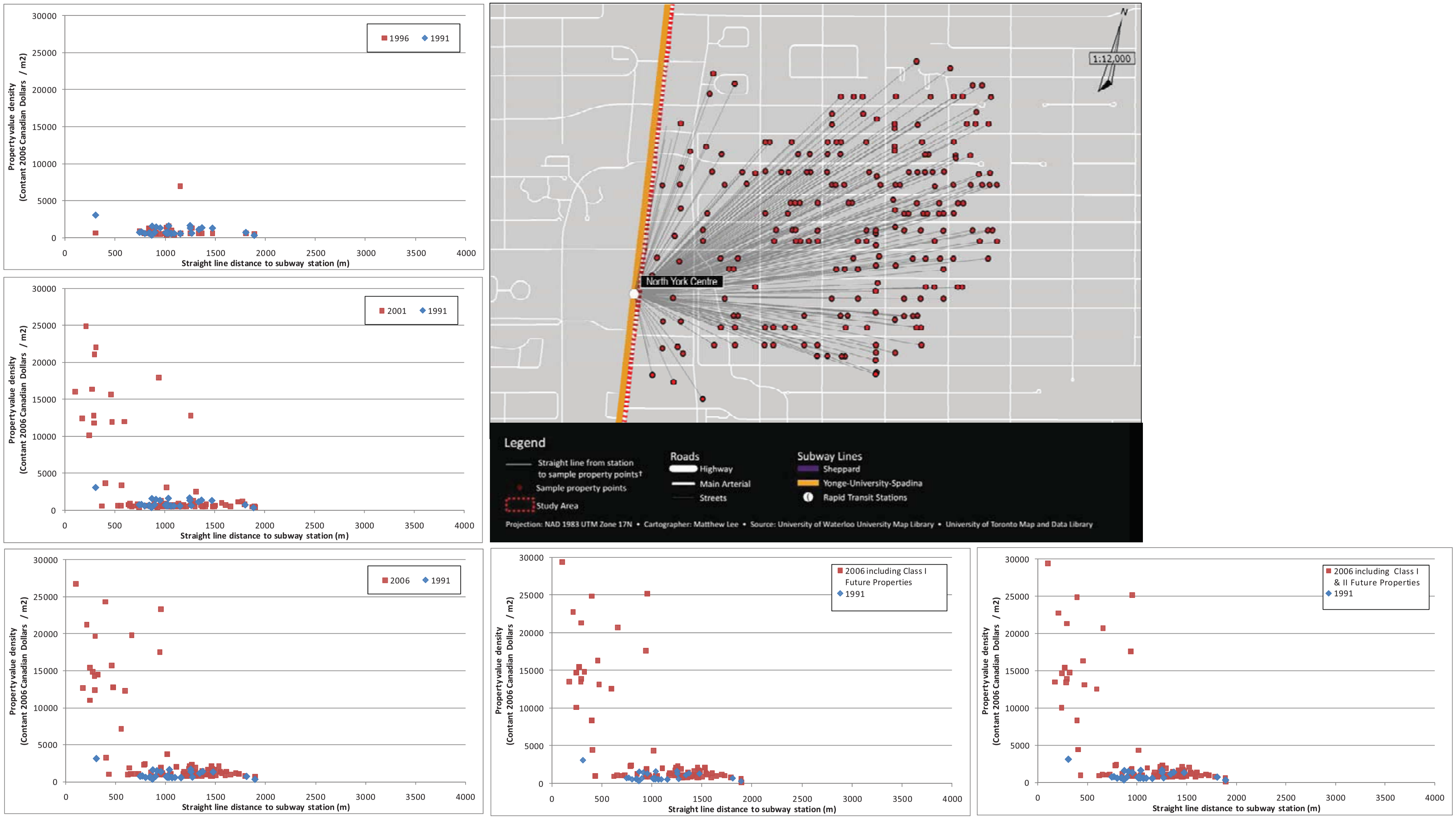






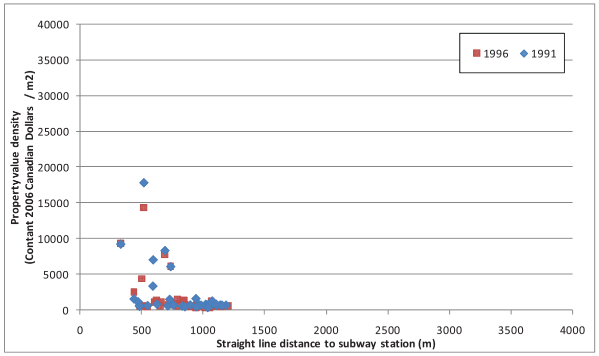
Scatterplots based on interpolated values

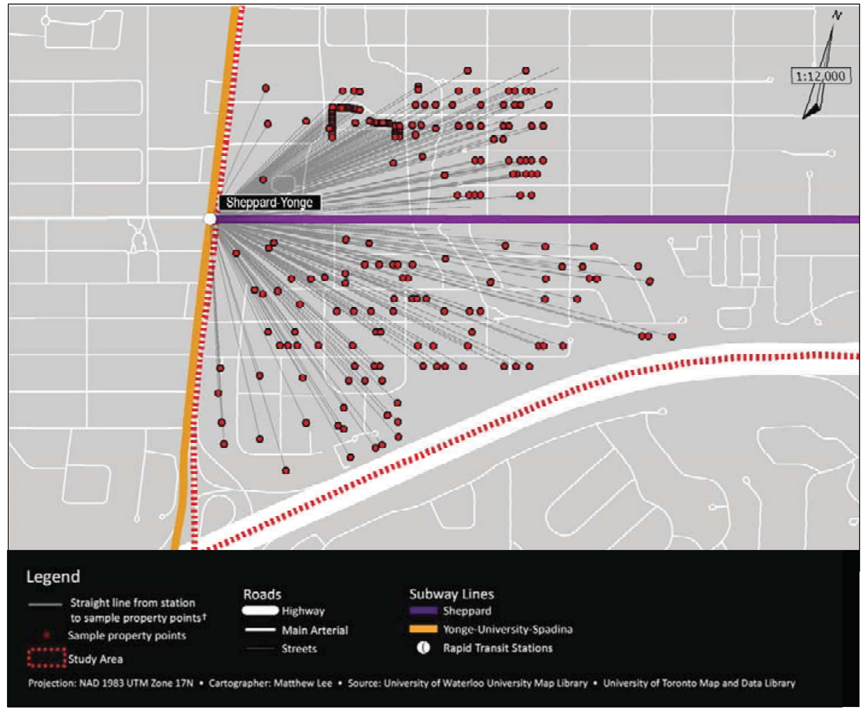
North York Centre

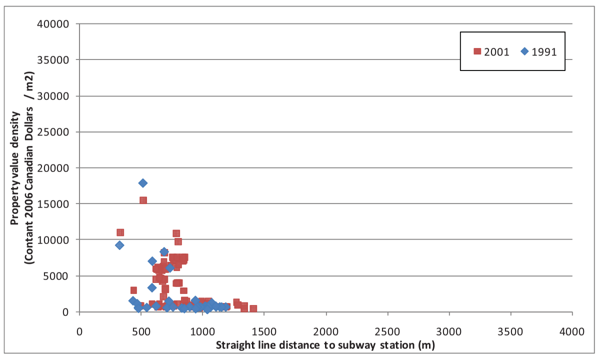


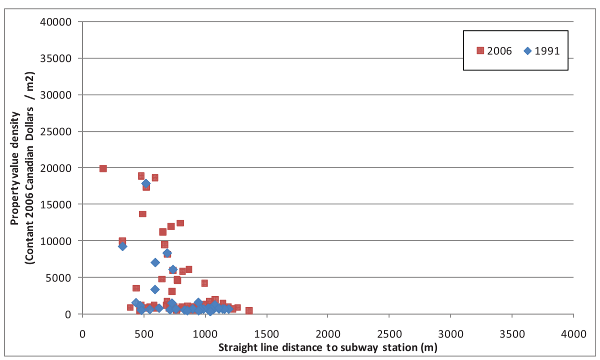
Scatterplots based on interpolated values

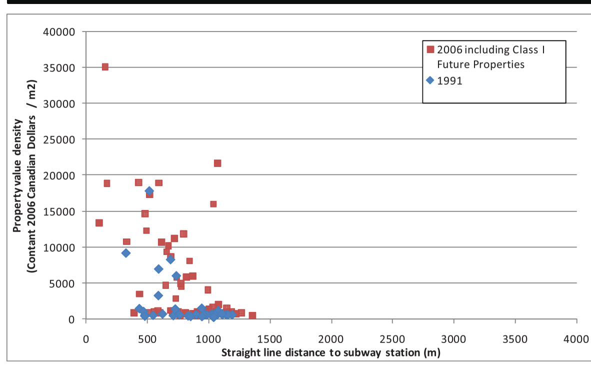
Sheppard-Yonge

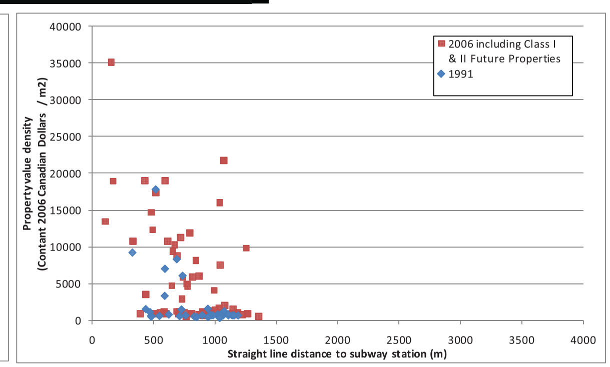








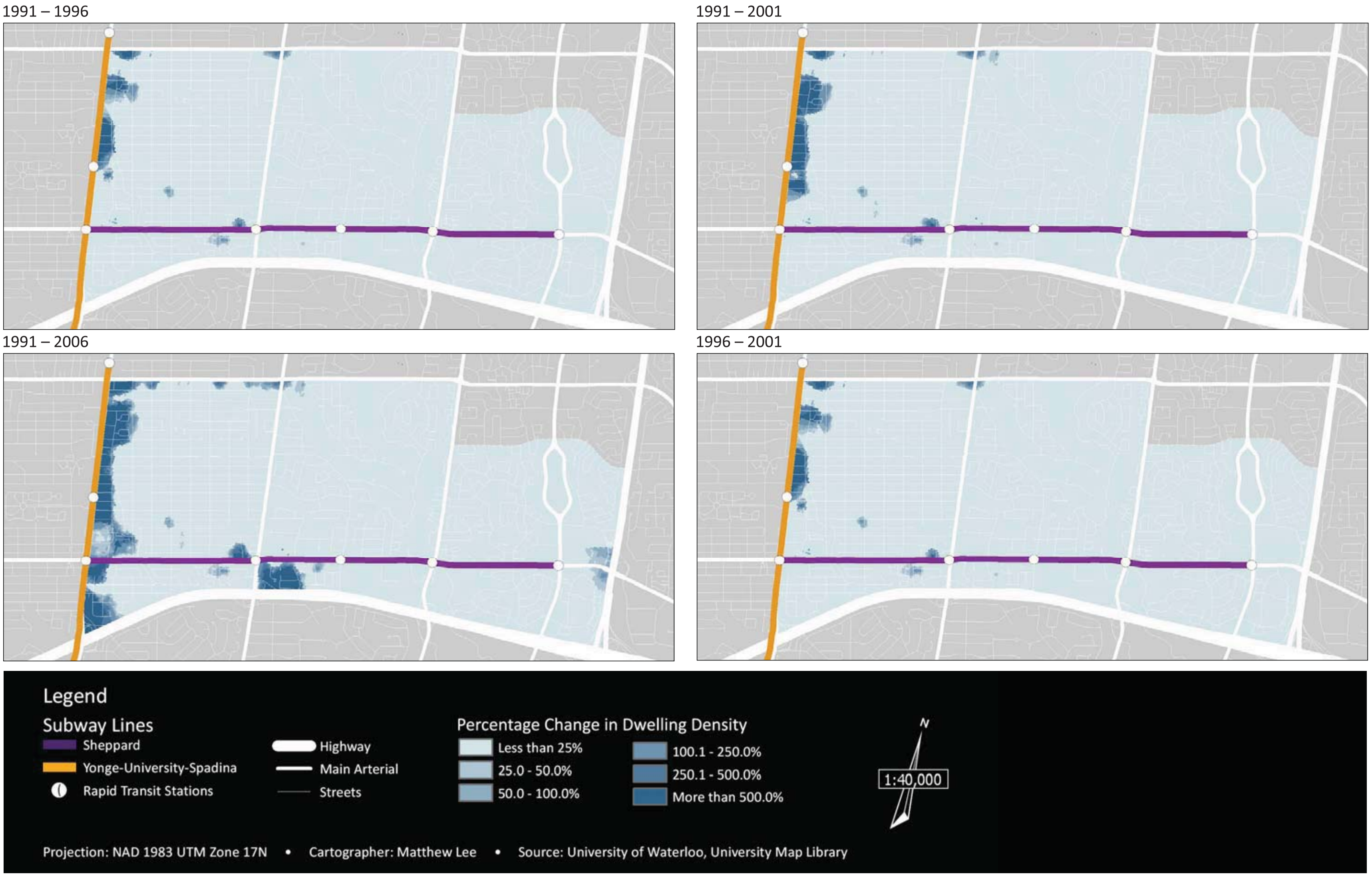




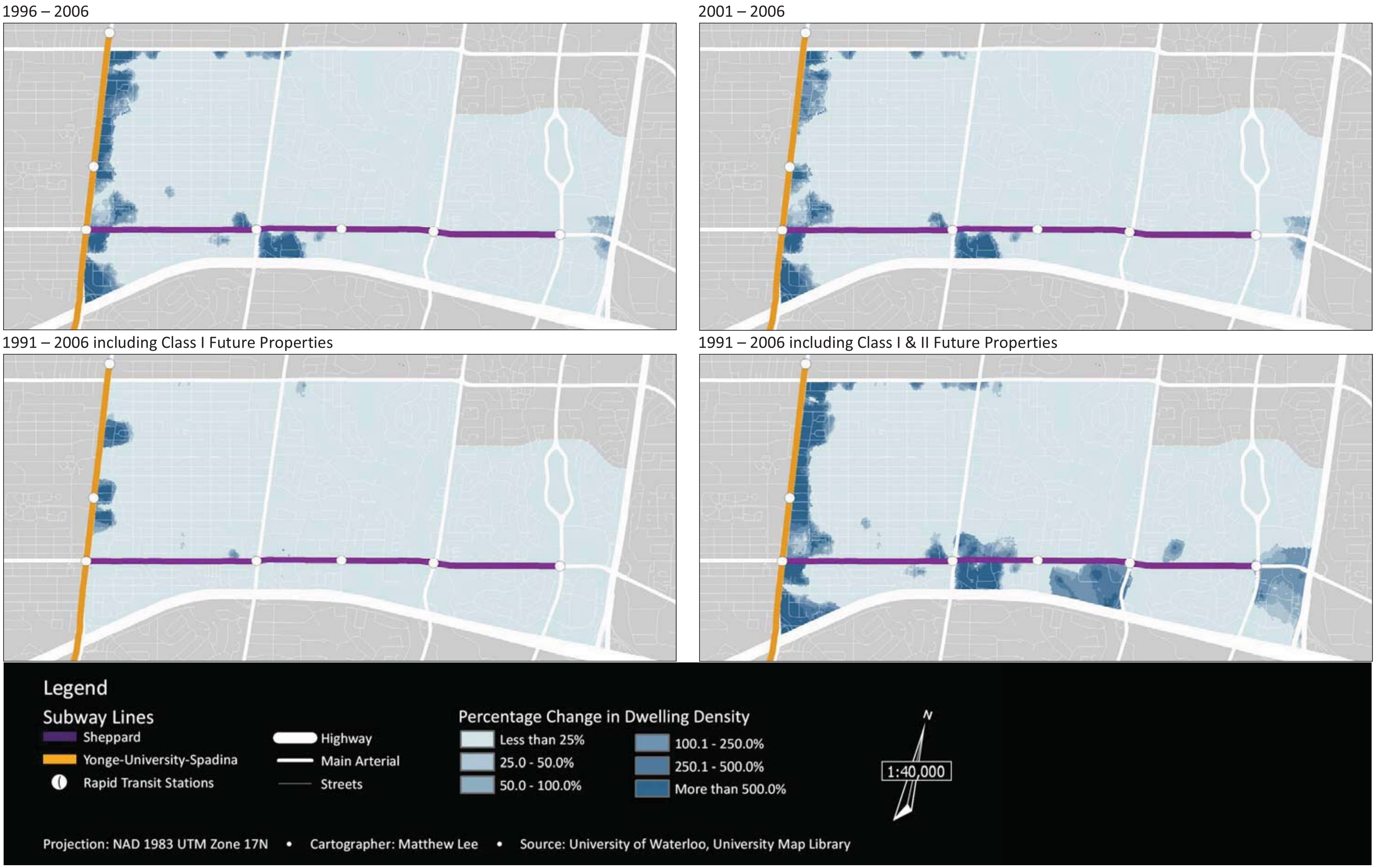
Appendix N:

Raster Method Visualization Outputs

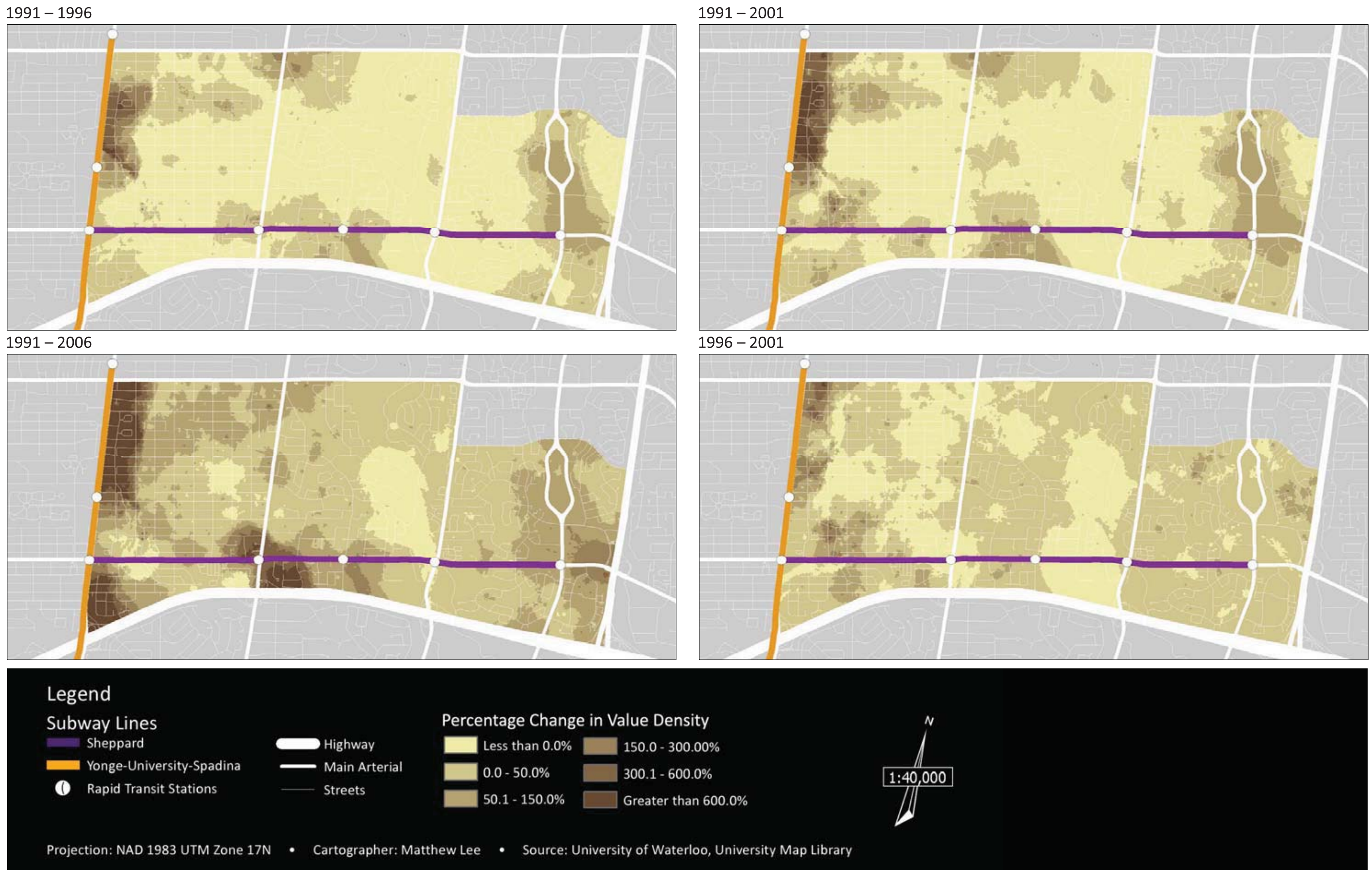
Raster Method Visualization – Percentage Change in Dwelling Density



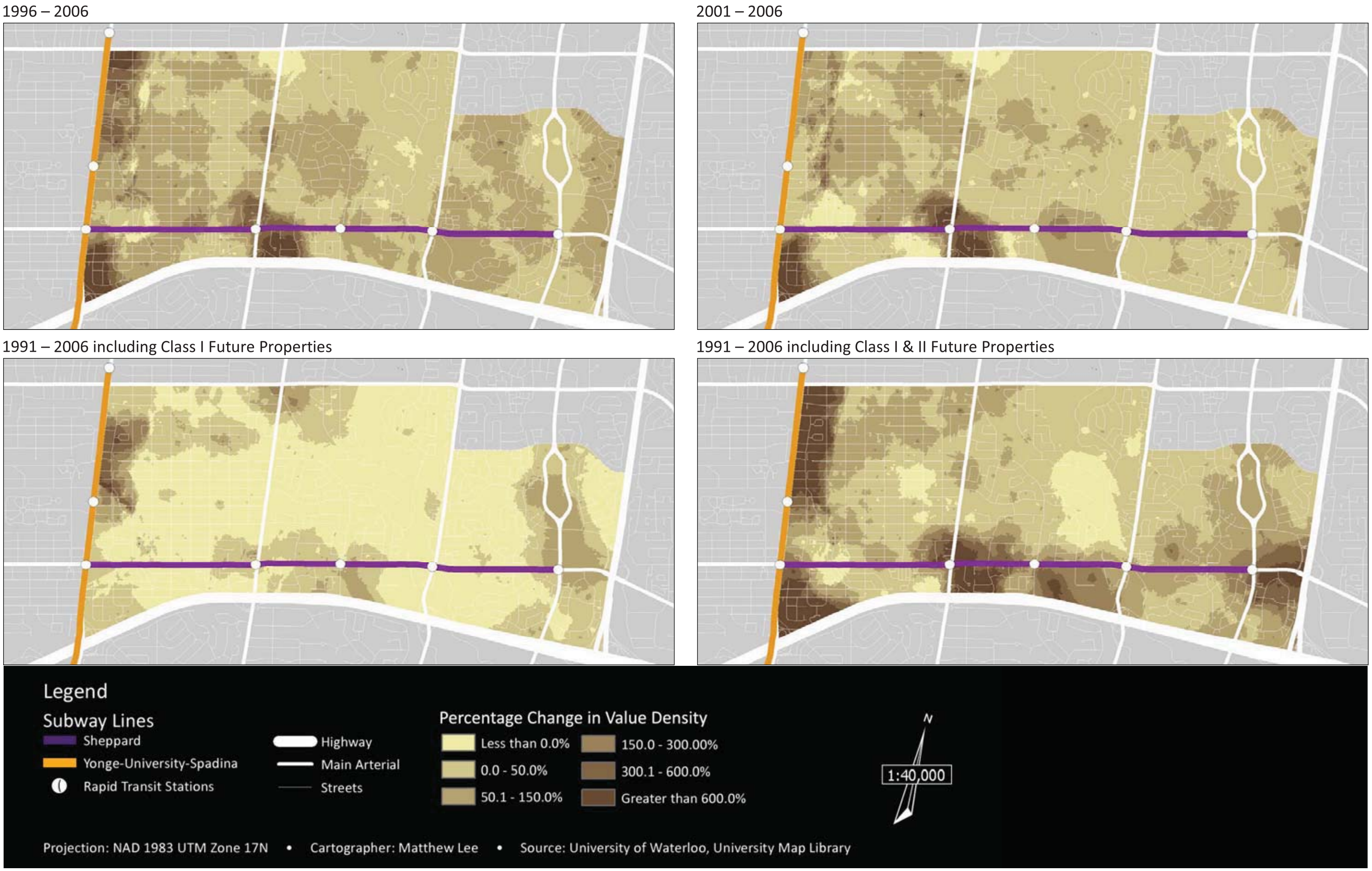
ArcScene Method Visualization - Percentage Change in Dwelling Density



Raster Method Visualization - Percentage Change in Value Density



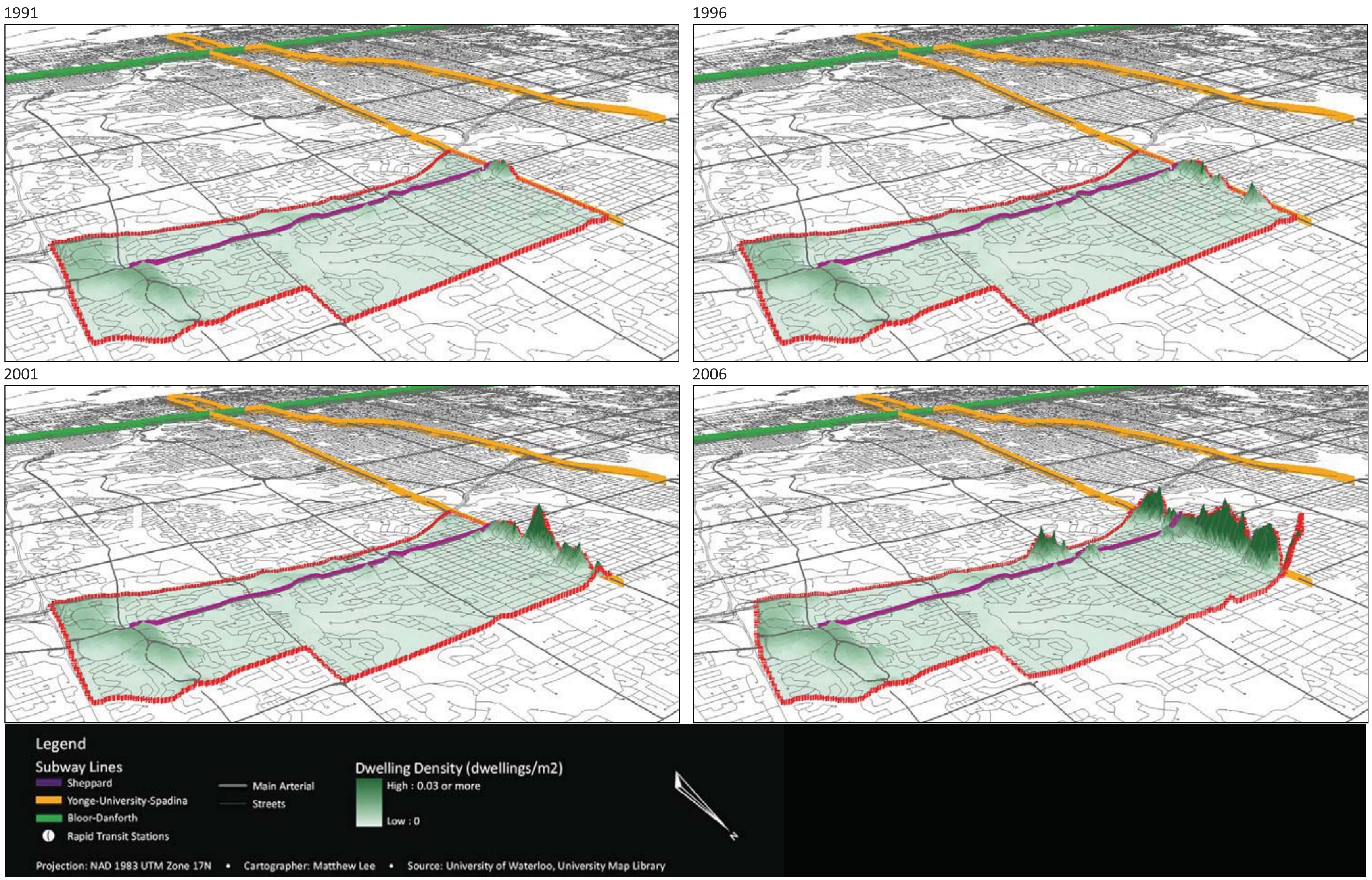
Raster Method Visualization - Percentage Change in Value Density



Appendix O:

ArcScene Method Visualization Outputs

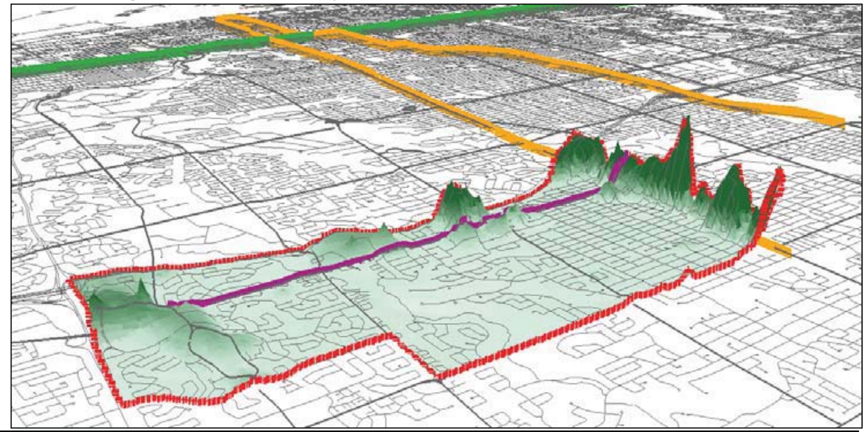
ArcScene Method Visualization - Dwelling Density

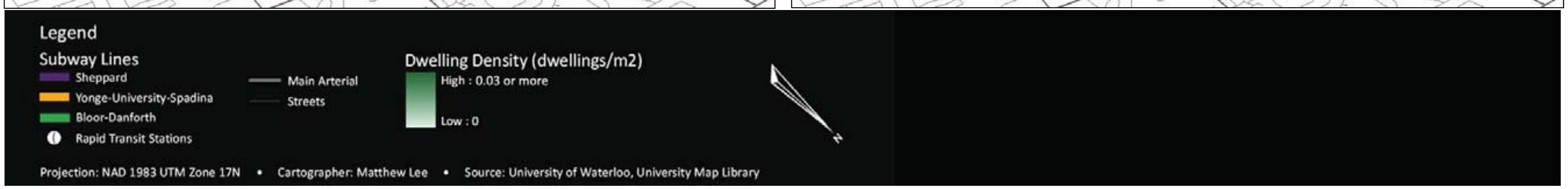


ArcScene Method Visualization - Dwelling Density

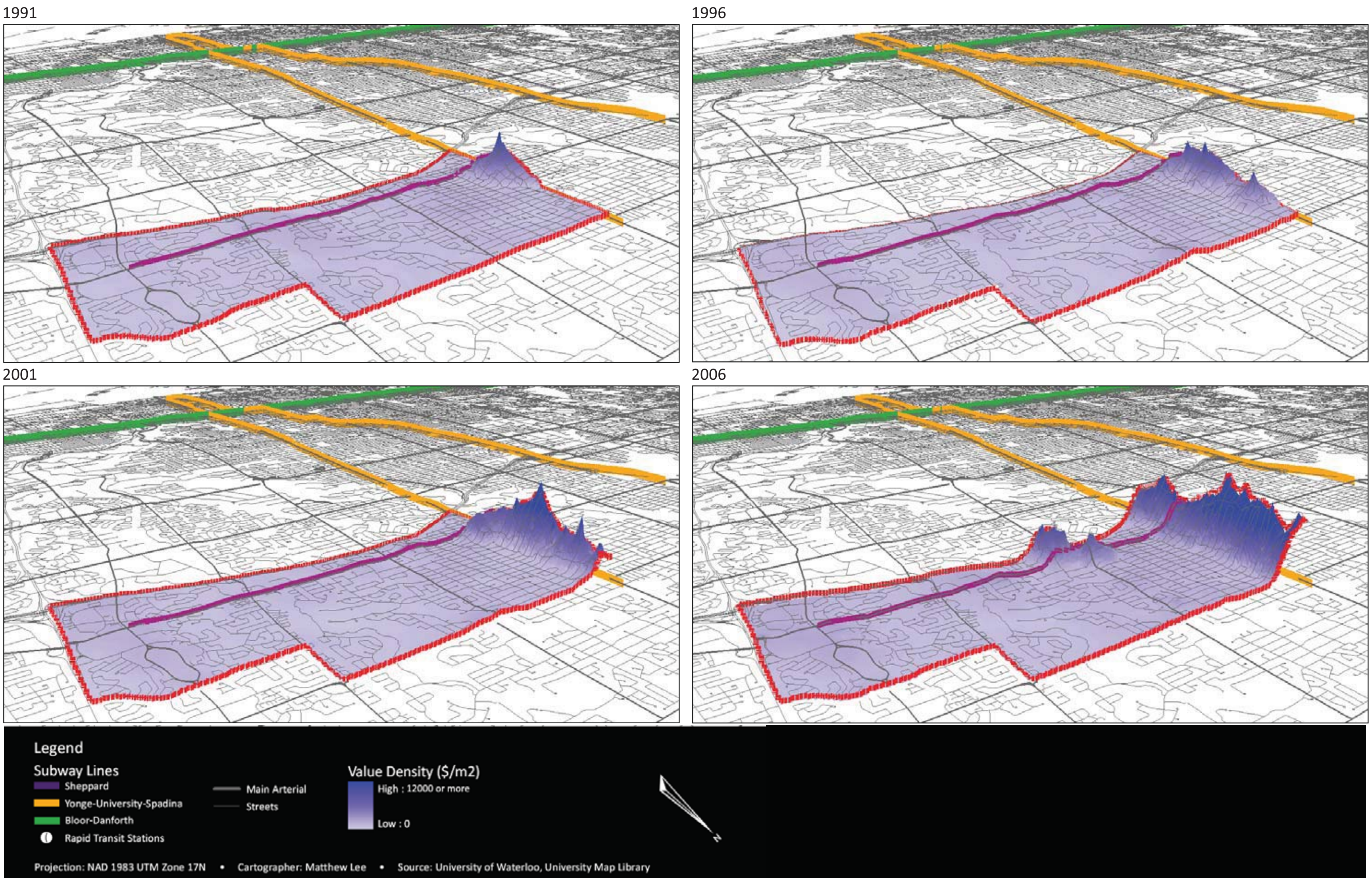
Forecast:
2006 including Class I Future Properties

Forecast:
2006 including Class I & II Future Properties





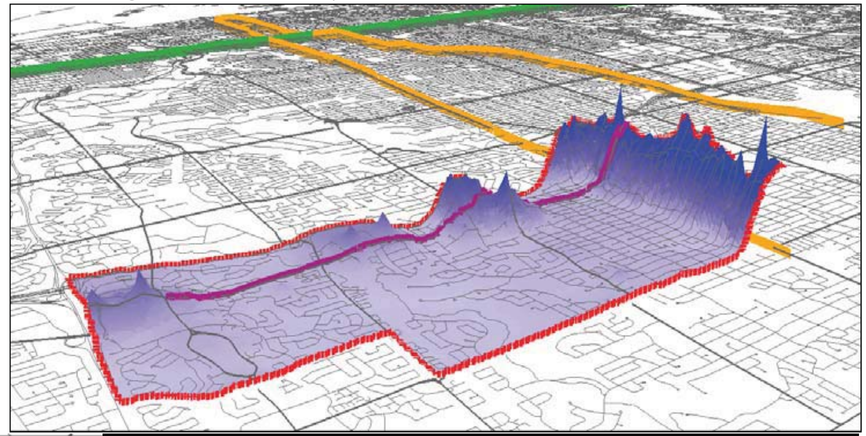
ArcScene Method Visualization - Value Density

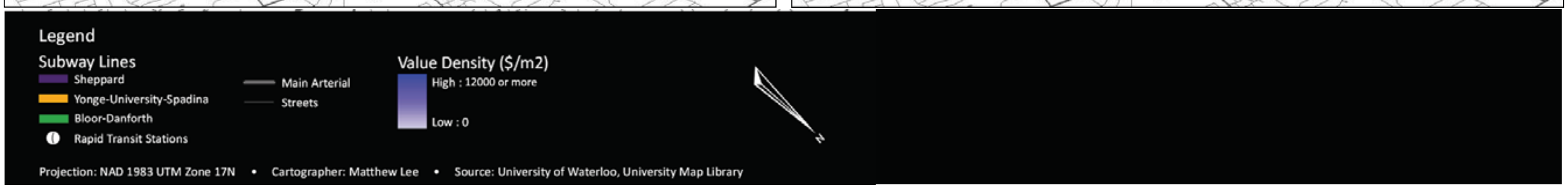


ArcScene Method Visualization - Value Density

Forecast:
2006 including Class I Future Properties

Forecast:
2006 including Class I & II Future Properties





Appendix P:
Census Summary

This appendix section is a supplement to Section 5.1. The table illustrates the criteria applied to determine the degree of residential land use change in the Study Area Census Tracts.

Census Tract	Percent Increase in number of dwellings	Percent increase in multi-storey residential structures	Index change in average gross rent relative to city-wide average	Index change in average dwelling value relative to city-wide average		Overall Ranking
Sheppard South	284%	1296%	High (0.3)	High (0.5)		High (6.8)
Bayview Village	51%	327%	High (0.4)	Medium (0.2)		High (6)
North York Centre	58%	295%	Medium (0.1)	High (0.3)		High (5.5)
Don Valley Centre	-1%	1%	High (0.2)	Medium (0.1)		Medium (4.3)
Don Valley West	0%	4%	Low (0)	High (0.3)		Medium (4.3)
Kingslake	-1%	0%	Medium (0.1)	Medium (0.2)		Medium (3.8)
Willowdale	1%	0%	Low (0.1)	Medium (0.1)		Medium (3.5)
Henry Farm	-2%	1350%	Medium (0.2)	Low (0)		Low (3)
Leslie	9%	-27%	Medium (0.2)	Low (0)		Low (3)
Parkway Forest	-1%	0%	Low (0)	Low (0)		Low (3)