The Influence of Housing Suitability on Commuting Patterns in Montreal, Toronto and Vancouver

by

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Authors 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 revisions, as accepted by my examiners.

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Abstract

This thesis explores the impact of housing suitability on the commute to work link for the metropolitan areas of Montreal, Toronto and Vancouver. Housing suitability, operationalized in this thesis using variables for number of bedrooms and dwelling type, has not been studied extensively in the literature. The research goal is to build upon the current knowledge of the factors shaping the distance between home and work by investigating the role of housing suitability using a large data set permitting statistical analysis. This requires access to household level data including geographic identifiers for the workers' home and work location rarely available in public data to protect confidentiality of respondents. Accessibility to the confidential micro-level census data from 2006 provided by Statistics Canada was secured to enable such a unique quantitative examination. Two different approaches are used to measure the influence of housing suitability on the home-work link. First, a series of regression models estimate the importance of housing suitability on proximity to the workplace holding several other factors constant. Second using a descriptive, comparative analysis the housing in the employment centres of each CMA is compared to (a) the current housing occupied by workers and (b) the housing that would be required, based on suitability criteria, to accommodate the workforce currently working in specific employment centres. The results speak to the role housing suitability plays in countering Smart Growth planning principles as workers are forced to live further away from work due to the inability to find suitable housing near their place of work. For planners the results indicate that an examination of housing suitability at the metropolitan scale, in relation to the home-work link, is required before attempts are made to implement Smart Growth policy.

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1. Introduction

*"Housing is a crucial component of area economic competitiveness. The economic health of a region is dependent on the presence of a competitive workforce, which in turn is strongly related to the availability of suitable and affordable housing. The lack of housing opportunities near jobs creates costs for employers, as the local labor pool contracts, and as turnover, training and placement costs increase. "(*Pill, 2000 p.22-23)

Pill's (2000) quote presents a rationale for exploring housing suitability, a multi-dimensional phenomenon, in relation to the home-work link. Pill makes the case from an economic standpoint but, as current planning strategies indicate and advocate, the bringing together in closer proximity of employees with their workplaces is beneficial for not only the economy but for the environment and health of cities in general by reducing vehicle travel.

In recent decades, major Canadian cities have experienced dramatic increase in their downtown housing stock through intensification. In Montreal, Toronto and Vancouver, for example, the number of new condominium apartments built annually for the years 2000 and 2013 increased from 3,539 units to 8,805 units, 11,454 to 18,070 units and 3,421 to 11,707, respectively (CMHC, 2014). This has raised several key planning issues relating to housing. The literature has commonly considered the housing affordability implications of the trend but fewer have considered the impact of intensification on housing suitability (Rosen & Walks, 2014). Moos (2012) suggests that housing size is a key determinant of commuting distance after controlling for other factors, and Willcocks (2011) considers the necessity of building larger apartments in downtown Toronto to accommodate households with children, but none have considered the explicit role of housing suitability in determining the commute, the home-work link, in a large-sample size quantitative analysis.

The home-work link is a cornerstone of urban studies that delineates how urban space, structure and processes are understood and envisioned (Cropper & Gordon, 1991; Giuliano & Small, 1993). Early conceptualizations of the model date back to the work of Alonso (1964), Mills (1967) and Muth (1969) and identified trade-offs between housing and

transportation costs as decision making factors for residential location. City structure and demographics have shifted significantly from those upon which these early economic models were based. Polycentricism, dispersion and the rise of edge cities (Shearmur et al., 2007) have altered the location of employment centres. Residential location decisions are also driven by demographics (Salomon, Waddell, and Wegener, 2002) and the increase of dual-income households, single-person households, lone-parent families and females in the workplace have altered residential and workplace location decisions (Hanson & Pratt, 1988). These new urban realities have increased scholarly interest of the home-work link and have resulted in the need for re-conceptualization of the concept (Hanson & Pratt, 1988).

The complexity of the home-work link is evident by the range of scholarly perspectives and the interdependence of the factors influencing the commute. Urban models of the concept often fall under the camp of economic-geography (typically studies of workplace location, labour structure or land economics) or social-geography (centred on topics concerning the residential location) (Hanson & Pratt, 1988). Other dimensions found in the literature include a growing body of research from the feminist perspective (Pratt & Hanson, 1991; Turner & Niemeier, 1997; MacDonald, 1999; Kwan, 1999; Kwan, 2000) and a large body of work exploring dimensions of land-use and transportation issues specific to the journey-to-work. Within these broad perspectives are a number of inter-related issues including; job-housing balance, spatial mismatch and excessive commuting. These topics highlight an important aspect of home-work link research, the "interdependence of job and residence location decisions" (Hanson & Pratt, 1988, p.304). Despite the growing scholarly interest in the home-work link, and the number of individual topics that appear in recent research, there are still topics absent from the discussion. Housing suitability, the focus of this thesis is one such topic currently underrepresented in home-work link research.

This thesis is concerned with the spatial relationship of housing between the home and workplace locations of the employed workforce. Interest in the connections between

workforce housing, commuting patterns and the environment has increased in recent decades. Documented impacts of moving closer to work include both benefits to the employee through transportation savings, reduced commute distance and time, and quality of life improvements; benefits to the environment including less greenhouse gas (GHG) emissions and other air pollutants; and benefits to firms with respect to training costs, turnover and replacement (Rohe et al., 2010).

The inclusion of housing suitability within the home-work link discussion is important for several reasons. First, housing suitability is important for the direction of housing-related policy. Housing suitability, along with affordability and adequacy, is used to identify those Canadian households in core housing need (CMHC, 2014a). Second, under the lens of social inclusion, access to suitable housing is considered a basic societal necessity (Westfall, 2010). In an analysis conducted for the Australian Housing and Urban Research Institute, Stone et al. (2013) identified housing suitability as one of six housing indicators to measure housing wellbeing. A third reason to explore housing suitability is its connection to current planning strategies attempting to depart from the traditional development patterns supporting low-density and car dependency. These development strategies include pedestrian-oriented development, complete communities, infill, intensification and the planning doctrines of New Urbanism and Smart Growth. Smart Growth in particular aims to create more compact cities that offer a range of housing choices to satisfy the needs and wants of a broader demographic (Tomalty et al., 2005). Achieving these goals requires consideration of the physical characteristics of housing including housing-suitability particularly since higher density areas do not currently house many larger households such as families with children (Moos, 2012). Finally as Hanson & Pratt (1988) point out, understanding the home-work link requires an understanding of the inter-related parts. Pill's (2000) opening quote attests to the inter-relational aspects of housing suitability with the home-work link. The literature review will further support the case of housing suitability as a crucial component of the home-work link.

1.1 Defining Housing Suitability

Housing suitability as a planning subject opens itself to personal interpretation and may vary for individuals or groups, based on culture and personal preference (Rapoport, 1980). The opening quote offered by Pill (2000) sets the context under which housing suitability is explored in this thesis. As an individual topic and as part of the broader concept of home-work link, housing suitability is viewed through the lens of the workforce. Through this lens two measures of housing suitability are selected for analysis; number of bedrooms and dwelling type. Both measures are physical attributes of housing that are available in the 2006 Canadian census and both enable quantitative analysis.

The first measure, using number of bedrooms, analyses housing suitability in accordance with the Canadian Mortgage and Housing Corporation (CMHC) definition. Housing suitability, as defined by CMHC is one of three housing indicators (which also include affordable and adequate housing) used to determine those households that are in core housing need. CMHC's formal definition for suitable housing is as follows:

> "Suitable housing has enough bedrooms for the size and make-up of resident households, according to National Occupancy Standard (NOS) requirements. Enough bedrooms based on NOS requirements means one bedroom for:
>
> - each cohabiting adult couple;
> - unattached household member 18 years of age and over;
> - same-sex pair of children under age 18;
> - and additional boy or girl in the family, unless there are two opposite sex children under 5 years of age, in which case they are expected to share a bedroom.
>
> A household of one individual can occupy a bachelor unit (i.e., a unit with no bedroom)" (CMHC, 2014b).

Adherence to this definition eliminates the potential for misinterpretation of the term "suitable" with respect to housing and allows for empirical analysis that can be replicated for other CMAs. It allows us to consider whether a household could reasonably move closer to their workplace in terms of the number of bedrooms required to accommodate the specific household composition under the CMHC definition.

The second measure of housing suitability in this thesis is based on the dwelling type. In their 2004 Australian study Wulff et al. argue "The preference for a free-standing dwelling is closely intertwined with the nearly universal goal of homeownership" (p. 61). This preference for single-detached homeownership remains the popular ideal despite emerging financial realities that are making this dwelling type unattainable for many households (Grant & Scott, 2011). This sentiment identifies a strong connection between tenure decisions and dwelling type. Residential satisfaction has been found to vary by dwelling type (Parkes & Kearnes, 2003) and studies have concluded a general preference for single detached housing (Myers & Gearin, 2001; van Ham & Feijten, 2008). Dwelling type is featured prominently in current planning growth strategies. Achievement of sustainable and compact development patterns like those advocated by the Smart Growth planning agenda requires a broad choice of housing to accommodate a diversity of household types at various stage of life-cycle (Alexander & Tomalty, 2002). In this thesis the composition of dwelling types is compared between the home and workplace, while acknowledging that it may not be possible in practice to actually provide a full range of housing types in employment centers due to the higher densities, and thus higher prices, found in these areas. Nonetheless, studying housing type is useful as it permits insight into how housing preferences contribute towards shaping commuting patterns.

1.2 Research Strategy and Questions

This thesis builds upon the current knowledge of the home-work link by investigating the role of housing suitability for the Canadian metropolitan regions of Montreal, Toronto and Vancouver. The questions that guide this research are:

(1) In what ways does housing suitability impact proximity to the work place; and what is the importance of suitability compared to other known explanatory factors influencing the commute?
(2) Is the housing stock currently located in employment centres congruent with the housing suitability requirements of the workforce currently employed in these centres?
(3) How can housing suitability be given due consideration in the process of attempting to achieve the principles of Smart Growth for the major employment centres of Montreal, Toronto and Vancouver?

The ability to address and explore these questions quantitatively is made possible through the granting of access to confidential micro-level census data. The use of master census files for this type of research is not common in the literature and having access to all census variables opened the door to a unique analysis.

Two quantitative methods are used to address the research questions. The first method is a multivariate regression model (OLS) to determine the significance (and magnitude) of housing suitability in explaining commuting distance for all those working in the metropolitan areas of Montreal, Toronto or Vancouver. The regression is then repeated for a sub-set of the population- those working in one of the identified major employment centres. The second research method compares the housing suitability of the employment centres with that of workforce employed at these locations.

1.3 Study Area

The three largest Canadian census metropolitan areas (CMAs) –Montreal, Toronto and Vancouver – were selected for inclusion in this project. Their selection serves three purposes. First these CMAs have been studied extensively from a spatial and economic perspective which provides a wealth of contextual information to draw upon. Second, there are a number of economic, social, and spatial similarities between the metropolitan areas that allow for inter-metropolitan comparison with respect to housing suitability. Third, compared to many smaller Canadian metropolitan regions, Toronto, Montreal and to a lesser extent Vancouver each have several employment centres which provides the opportunity to make intra-metropolitan comparisons within each region (for example between the downtown and suburban employment centres).

As previously mentioned, the CMAs have economic, social and spatial commonalities. In addition to being immigrant and population growth centres for the country (Bourne & Simmons, 2003), they all exhibit evidence of post-Fordist economic restructuring (Walks, 2001) as characterized by their declines in manufacturing and increases in service sector jobs (Coffey and Shearmur, 2006).Their strongest employment centres continue to be the central business districts (CBD) which are the locations of their financial districts. Consumer services tend to be located outside of their CBDs (Shearmur & Coffey, 2002). Polycentrism and the dispersion of employment centres have occurred in all three CMAs. Compared to smaller Canadian metropolitan regions the CBDs for Toronto, Montreal and Vancouver have remained fairly intact (Shearmur & Coffey, 2002). Economic redistribution is evident however by the polycentric nature the employment centres (Shearmur et al., 2007). Decentralization of employment continues and the greatest growth for each city is in the suburbs (Heisz and LaRochelle-Cote, 2005).

There are important differences between the regions that have spatial implications for the home-work link. Toronto is the main business and finance centre of the three

metropolitan areas. It shows the greatest increase in suburban development (Skaburskis & Moos, 2008) and its suburban employment centres are located farther away from the CBD than is the case for the other CMAs. The CBD is strong but it is not the only centre for employment. In fact there is little growth of consumer services in this area and more jobs in the outer rings of the city (Shearmur & Coffey, 2002). Toronto has a number of suburban employment centres that are located a greater distance from the CBD than is the case for Montreal and Vancouver. Montreal remains Canada's manufacturing centre. It has a strong CBD and economic activity tends to revolve around the CBD (Shearmur & Coffey, 2002). It is known for having a strong residential concentration in the inner city. Montreal exhibits a "monotonic distance decay pattern" (Shearmur & Coffey, 2002, p. 577) in that there are a high number of jobs in the CBD and jobs decrease with distance from the CBD. Vancouver is the most dispersed with respect to employment with many isolated employment centres (Shearmur & Coffey, 2002). It is considered a centre of high-order services and transport (Shearmur & Coffey, 2002; Shearmur et al., 2007).

The statistics in Table 1.1 present a number of housing characteristics relevant to this thesis topic. In each CMA the percentage of owned dwellings exceeds those that are rented. This thesis only studies homeowners to keep the analysis straightforward. Housing career literature confirms a usual sequence of housing tenure which begins with renting and peaks with homeownership (Kendig, 1990; Mulder & Wagner, 2001). As pointed out by Clark et al. (2003) each move on the housing ladder is "one step closer to the house that best meets the needs and aspirations of the household" (p. 145). The parity between Clark et al.'s (2003) household "need" and this thesis's definition for "housing suitability" justifies the study's sample consisting only of homeowners. Further research is required to better understand these dynamics in the rental market. With the exception of Montreal there are more single detached houses than any other dwelling type, and in all three CMAs, moveable dwellings exist in very small percentages. Interestingly, of the three CMAs, Montreal has the lowest average number of persons in private households, average rooms per dwelling and average number of bedrooms.

Table 1.1 Summary of housing characteristics for the study CMAs

Census metropolitan area	Montreal	Toronto	Vancouver
Population	3,635,571	5,113,149	2,116,581
% Owned dwellings	53.37%	67.57%	65.06%
Dwelling Type			
% Single-detached house	32.10%	41.66%	35.28%
% Attached-house[1]	17.58%	20.43%	24.65%
% Apartment in building that has 5 or more storeys	8.44%	26.57%	12.76%
% Apartment in building that fewer than 5 storeys	41.66%	11.31%	26.65%
% Movable dwelling	0.22%	0.03%	0.66%
Average number of persons in private households	2.3	2.8	2.6
Average number of rooms per dwelling	5.6	6.3	6.1
Average number of bedrooms per dwelling	2.4	2.7	2.6

Notes:
All data from Statistics Canada, 2006
[1] Attached house includes semi-detached house, row house, other single attached house and apartment in a duplex

1.4 Thesis Overview

This introductory chapter has outlined the basic concepts, definitions, objectives, and research questions that the thesis will explore. Chapter two presents a comprehensive literature review of the topics associated with housing suitability within the context of the home-work link. Chapter three outlines the data and methods used for the two quantitative research approaches. Chapter four to seven present and discuss the results of the analysis, and planning implications. Chapter eight summarizes the thesis and outlines areas for additional research.

2. Literature Review

"Contemporary cities are the product of the interaction of large-scale processes with local urban forms, mediated through a variety of institutions". (England & Mercer, 2006, p. 24)

This opening quote by England and Mercer (2006) speaks to the complexity of urban-based research in general and provides the rationale to explore housing suitability from multiple inter-related realms. In order to ground the logic for this study, the existing literature on housing suitability is presented and expanded to include other relevant research areas that are connected to the dimension of housing suitability being explored in this thesis. Figure 2.1 presents the research areas and individual topics included in the literature review. The topics are grouped by realm but illustrated without defined lines or connections between them. This was intentional so as to reflect the interdependencies of the topics and to emphasize the significance of Pratt and Hansen's (1988) statement with regard to home-work link conceptualizations, "the futility of trying to study one in isolation from the other" (Hanson & Pratt, 1988 p.299). The framework of Figure 2.1 presents more of a continuum approach in order to depict the dynamic and multiple associations between topics.

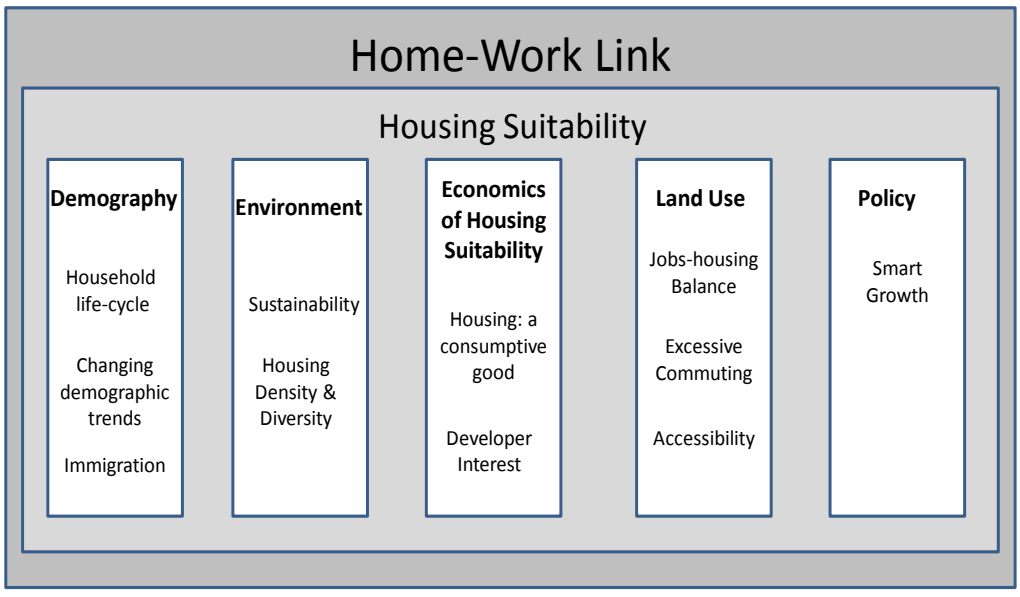


Figure 2.1 Literature review topics

2.1 Demography

Demography plays an important role in housing suitability and in the broader context of the home-work link. Projected population growth is the key driver of estimated future housing need (Myers et al., 2002) and as stated by Mulder (2006) the number of households not only determines demand for housing but the availability of suitable housing can attract certain demographic groups. Demography also drives spatial behaviour (Salomon et al., 2002) by influencing residential decisions and mobility. The demographic concepts explained in this section for their connection to housing suitability include household life-cycle, changing demographic trends and immigration.

2.1.1 Household Life-Cycle

Households can go through a number of stages from the time of their initial formation to that of their inevitable dissolution, and the household's space requirements change through each of these stages. Examples of these events include; marriage, the birth of a child, dissolution of a marriage, children moving out of the family home, changing jobs, retirement, or the death of a spouse (Gilly & Enis, 1982). There are multiple household-life-cycle models defined in the literature (See: Wells & Guber, 1966; Duvall, 1971; Murphy and Staples, 1979; Gilly and Ennis, 1982). These models base the stages of the household life-cycle on different variables. For example Wells and Guber (1966) frame the household life-cycle on the age of the youngest child whereas Duvall (1971) frames the stages based on the school age of the oldest child. What may have been suitable housing in one life-cycle stage, such as a bachelor apartment occupied by a single-earner, may no longer be suitable at a different stage, such as moving in with a spouse and having two children.

Household life-cycle stages are not homogeneous for all households nor are the requirements for housing and mobility based solely on household life-cycle stage (Brown & Moore, 1970) however, these stages are associated with systematic patterns of housing

consumption need and behaviour. Generalized observations include that of Rossi (1955) who concluded that housing dissatisfaction arises due to changes in the household life-cycle, and Michelson (1980) who found that in order to achieve housing satisfaction incremental changes are made to housing choice. Both observations suggest a dynamic system where demography factors into housing stock choice. Of particular interest to this thesis is the fact that the empirical measurement of housing consumption for household studies typically consists of the number of rooms or bedrooms which is used in this research to define housing suitability.

Three household life-cycle stages; the formation of a two person household, the addition of children and the transition to that of the empty nester nicely demonstrate the changing needs with respect to housing consumption and suitability. The formation of a two person household either through marriage or common-law living arrangement often combines two incomes providing a greater financial ability to save for and pay a mortgage. The formation of two person households can also result in a need to increase the number of rooms of a dwelling (McLeod & Ellis, 1982). Newly formed dual income households also face important considerations regarding commuting time and distance to the workplace (Green, 1997; Jarvis 1999) which impacts residential location decisions. Conventional studies of housing preference have also shown that the addition of children into a household alters housing suitability and residential location requirements. Young people prior to having children tend to prefer more urban lifestyles (Glasgow, 2000; Moos, 2014). Upon having a first child young couples residing in an urban dwelling location may wish to make the transition to a single detached home in a suburban location. This is still the revealed preference for most families. The addition of children also adds to the number of bedrooms required (McLeod & Ellis 1982). For some households having children before establishing home ownership can make it difficult to enter the housing market if the number of earners is reduced due to child care obligations. The departure of grown children once again changes the needs and requirements of households. Many empty nest households are relocating to the city in search of a more urban lifestyle. Those wishing to downsize and

remain in their same neighbourhood may have a more difficult time doing so in conventional suburbs where the housing choice (suitability) is limited.

2.1.2 Changing Demographic Trends

Changing demographic trends, lifestyles and population profiles have emerged in aggregate terms across Canadian metropolitan areas that have implications for housing requirements (Champion, 2001). One clear demographic shift is an increase in non-traditional households. These include one-person households, lone parent families, non-couple households (roommates) and couples without children; and the fact that households may not follow a 'textbook' trajectory of the lifestyle stages depicted in the section above. Young people in particular are spending more time in what was previously perceived to be an early stage household formation (Lesthaeghe & Moors 1996). This can be the result of a number of factors including; a longer time spent seeking higher education, getting married later, and having children later. All of these shifts represent the "growing fluidity of household formation and fission" (Champion, 2001 p. 662). The housing preferences and lifestyles of these households, particularly those without children are typically more urban and focused on quality of life features placing greater importance on walk-ability, proximity to the workplace, and amenities. There are of course exceptions, one being non-traditional households with children in urban settings. But overall, a trade-off between access to the natural environment and accessibility to the workplace (commuting distance) remains (Kim et al., 2005) and there are still fewer households with children in urban settings. There is also a growing segment of divorced households with children. Divorced parents searching for housing post marriage dissolution may opt to remain close to their children's residence but encounter difficulty finding suitable housing due to housing market availability and new financial realities resulting from the marriage dissolution (Gram-Hanssen & Bech-Danielsen 2008). The pull of the suburbs may also be felt by non-traditional households aspiring for the household life-cycle events of marriage and children and who make current housing choices based on these future aspirations (Champion, 2001).

2.1.3 Immigration

"Successful integration of immigrants into a new society is based on their attainment of several basic needs, including access to adequate, suitable and affordable housing" (Teixeira, 2009, p. 323).

The residential settling patterns of immigrants is an important component of home-work link based research and has been a subject of much study (See: Fong and Wilkes 2003, Myles and Hou 2004). Immigrants are vital to the sustainability of housing markets; as a segment of the employed workforce; and for school enrollment levels in metropolitan areas (Musnick, 2010). Home ownership is considered an important part of financial security for immigrants (Alba & Logan 1992). The attainment of suitable housing by immigrants has been linked to their ability to access social amenities and it represents a commitment to community (Alba & Logan 1992). Both of these are social indicators of integration, yet, in 2006, 44% of recent immigrant households experienced core housing need (Francis & Hiebert, 2011).

The attainment of suitable housing is more difficult for immigrants because of ethnic discrimination, and a lack in supply of suitable housing. Ethnicity remains a barrier to Canada's housing market. Visible minorities face more discrimination in terms of access to housing and affordability (Francis 2009, Carter & Osborne, 2009). A dichotomy of immigrants exists in Canada which presents itself in the ability to attain suitable housing. As opposed to highly skilled immigrants for whom home ownership is a priority (Bauder et al., 2001) and more easily attained from an affordability perspective, refugees who are more likely to be low income earners face greater challenges with respect to finding suitable housing. A study by Francis and Hiebert (2011) of Vancouver Refugees found that Sponsored Refugees had the largest households and the smallest dwellings. In their research household size was reported as the greatest barrier to accessing housing. As a result of this many refugees must resort to living in crowded unsuitable housing conditions. Smaller households can also be overcrowded as a result of multiple one-person households

sharing small apartments in order to cut costs (Hiebert 2009). These conditions lead to an increasing risk of homelessness and hidden homelessness with many immigrants living in crowded conditions with extended family. New immigrants also tend to move more frequently in search of suitable housing (Owusu, 1999). Compounding the problem as Hulchanski (2006) points out, is the state of Canada's housing market which is highly privatized and lacking in public housing development which prevents many immigrants from finding suitable housing.

2.2 Environment

As a society, Canadians are huge consumers of housing space. The average size for a newly constructed single detached home in 2013 was 2000 square feet. These homes are more than double the size of homes constructed between 1946 and 1960 (CommSec 2009). As shown by the prevailing demographic trends, while house size has and continues to increase, household size is decreasing. The average living space per person in 2013 was 800 square feet. This figure greatly surpasses the living space consumption of other countries. For comparison in Germany, France and Italy, the average living space per person is 587, 464 and 335 square feet respectively (CommSec, 2009). These statistics raise the question of whether we are building the appropriate housing for the demographic reality of the day and, while the argument above has been one of shifting demographics, the following section presents the environmental reality of constructing large, sprawling homes.

The prevailing pattern of urban form is associated with a number of environmental problems (Beatley & Manning, 1997; Rees, 1999; Haughton, 1999). Low-density development takes up much space, affects habitats and eco-systems, water quality, and endangers species through vast amounts of land consumption (Norman et al., 2006). Automobile commuting requires the use of fossil fuels which causes air pollution and contributes to global climate change. The connections between home-work link and the

environment are extensive but the topic most relevant to the discussion of housing suitability is sustainability.

Sustainable development has emerged as the popular counter to conventional development patterns and the models of sustainable built form include a number of housing characteristics related to housing suitability. Jabareen's (2006) work on sustainable urban form identifies themes that represent sustainability and are relevant to this discussion of housing suitability; diversity, density, compactness, sustainable transport, and mixed land use. The author goes further to identify four urban forms that present these characteristics. They include Neo-traditional development, urban containment, compact city and Eco City. Each theme and the associated urban forms create a composite of spatial, transportation, and land-use elements that are relatable to the home-work link and can be elaborated on for their relevance to housing suitability. Most noteworthy to this thesis are the themes of diversity and density. Both themes include the housing attributes which are being used to explore housing suitability.

2.2.1 Housing Density and Diversity

"Sustainable Cities" are arguably cities of high density (Carl, 2000, p. 343). Compared to low-density development, which typically consists of single detached dwellings, the construction of high-density developments require less resources in terms of land area, urban infrastructure, and building materials (Rees, 1999). Housing type is an important factor for density. High-rise apartments in contrast to single-detached housing use less energy and materials to construct (Walker & Rees, 1997). Higher density development is also more conducive to public transportation. In a study comparing the life-cycle energy use and greenhouse gas emissions for both high and low density development, Norman et al. (2006) found that the operational energy costs and costs associated with transit use (in terms of GHG emissions) are higher for low density development. Interestingly, however their research revealed that when the unit of measurement is shifted

to unit of living space (per m^2) the energy and GHG emissions factor decreases, making dwelling size an important consideration in determining urban density impacts. The growing emphasis on decreasing dwelling size, and increasing density, to address environmental concerns raises new questions regarding housing suitability.

Diversity is considered a multi-dimensional concept that can pertain to transportation, land use, activity levels and dwelling type, the focus of this research. One of the six principles used to define sustainable development in a study conducted by Berke and Conroy (2000) illustrates the connection between home-work link and the offering of a diverse housing stock. Included in their sustainability principle for a place-based economy is the following:

"The local economy should also produce built environments that meet locally defined needs and aspirations. It should create diverse housing, and infrastructure that enhances community livability and the efficiency of local economic activities." (Berke & Conroy, 2000 p.23).

Here the connection between suitable housing for different stages of ages, income and life-cycle stage as offered through a diverse housing stock is tied to the job location.

Another example illustrating the connection between housing suitability and sustainability can be drawn from the CMHC (2012) study that compared neighbourhoods in five Canadian Cities for sustainability. In each city the following sustainability indicators were defined and measured:

- "How close are the homes to schools, jobs and other daily destinations, so people can choose how to get there (for example by walking, biking or using public transit)?
- Do people get by with fewer cars or do they drive less, which can save money?
- Monthly costs to rent or own a home.

- How many rooms are there in the homes?
- Do people reduce greenhouse gas emissions by driving less?
- Is there a range of housing choices available, so people can remain in the neighbourhood as their needs change?" (CMHC 2014b)"

Again, the themes of diversity and density of housing stock are implied to meet the suitability requirements for households. Two of the sustainable indicators above from CMHC directly reference housing suitability as it is measured in this study; by the number of rooms, and dwelling type.

2.3 The Economics of Housing Suitability

The housing market is composed of and differentiated by a number of characteristics including housing suitability. The analysis of these housing characteristics is important because it provides information on the trade-offs between location and housing that people are willing to make (Follain & Jumenez, 1985). Housing affordability, one of the three indicators of core housing need, is featured most prominently in housing studies. Chambers et al., (2007) point to mortgage innovations (an income factor) as the key to explaining home-ownerships rates. The authors indicate a less clear distinction between housing consumption and housing stock. However, Whitehead (1991) argues that housing suitability in addition to affordability is required to achieve suitable housing for all. This sentiment is shared by Sgro (2002) who concludes that competition for suitable housing stock applies pressure on the market which can lead to less choice and create overcrowded conditions. To explore housing suitability from an economic perspective two frames of reference have been selected. The first is that of housing as a good, and the second is that of the producer of housing, the developer.

2.3.1 Housing: A Consumptive Good

Housing differs from many other consumptive goods due to its spatial fixity and durability (Ball & Kirwan, 1977). Unlike other goods that allocate units based on demand and supply, housing provision is considered a necessity to be provided irrespective of the costs required. Housing suitability becomes relevant when the private market (which dominates in Canadian housing provision), "fails to achieve the minimum housing requirements" (Whitehead, 1991, p. 872). From a supply perspective households are formed and dissolve at a much faster rate than the housing inventory. The supply adjusts but not necessarily in accordance to demographic realities which may result in suitability deficits. According to Myers et al., (2002), most of the current housing is built for married couples with children but as demographic trends suggest, this is no longer the typical Canadian household. A large share of housing being built as part of intensification and Smart Growth strategies is intended for one or two person households—also not making it suitable for larger households. The spatial immobility of housing can result in longer commutes if suitable housing is not available near work. It can also result in the postponement of moves if suitable housing is unavailable (Kendig, 1984).

2.3.2 Developer Interest

Land development is synonymous with economic development where developers take on the role of the producer and a number of factors contribute to where and what type of housing they produce. Developers are in the profit-generating business and maximizing profits requires sales of new dwelling units. From a supply perspective new housing construction is influenced by land availability, cost of land, location of job-growth, infrastructure costs and construction costs. As stated by Skaburski & Tomalty (2000), development charges influence the type and location of housing. Developers tend to build in the same areas they have previously built in. This is referred to as "state dependency" (Haider & Miller, 2004 p.148) and makes the development process easier for developers

who have already established relationships with municipal authorities and know the ins and outs of the local planning approval process. Developers also tend to specialize in building types which are influenced by land prices. For example, condo development is concentrated in densely concentrated areas which are typically accessible by public transit. For the City of Toronto, Haider and Miller (2004) reported a phenomenon they referred to as "spatial inertia" whereby the development of housing of a certain type attracted similar housing of that same type. Developer interest provides an example of what Murdie (1974) describes as a market force existing outside of the household that impacts residential location decisions. Developer interest impacts housing suitability when the type of development (for example condo development) impedes larger households from locating closer to work.

2.4 Land Use

The connection between land-use and commuting is an important issue that has not been studied within the context of housing suitability. While increased mobility has allowed for more opportunity in terms of the ability to match job opportunities with housing location preferences one adverse effect is inefficient land-use development. In his 2004 study of the spatial dimensions of urban commuting, Horner outlines three themes connecting commuting and land-use; jobs-housing balance, excess commuting and accessibility. Commuting as the representation of the daily interaction between the home and the workplace presents both social costs in terms of traffic congestion, environmental costs as a source of environmental and noise pollution and individual costs for transportation that are incurred by households. In this section Horner's three themes are defined and then discussed through the lens of housing suitability.

2.4.1 Jobs-Housing Balance

The concept of job-housing balance is featured prominently in home-work link research (See: Cervero, 1989, 1996; Downs, 1992; Guiliano and Small, 1993; Wang, 2000). The idea is intuitive, by bringing residents and their jobs within closer proximity, commuting distance is reduced along with the associated environmental problems. The concept dates back to Ebenezer Howard's (1965) Garden City, whose utopian vision was the ultimate live-work-play environment. While a simple proposition, the effectiveness and likelihood of achieving jobs-housing balance remains a subject of debate (Cervero, 1996).

There are a number of studies on both sides of the job-housing balance debate. Those advocating the concept as a means to reduce commuting distances include the work of: Ewing 1995; Cervero, 1989; Peng, 1997; and Sarzynski et al., 2006. One example relevant to this study is the work of Nowlan and Stewart (1991) for the City of Toronto. They concluded that the jobs created by the office building construction boom in the 1970s and 1980s were filled by employees living in the downtown. These employees could walk or take public transit to work which reduced traffic congestion and commuting challenges. This study, however, is cited an exception by those who argue against the effectiveness of jobs-housing balance. Among the reasons cited for the ineffectiveness of jobs-housing balance are the rise in two-worker households who work in different locations, job mobility, race, the fluidity of job creation and loss, and the pull of non-job related residential location decisions like school quality (Giuliano 1991; Downs, 1992; Levine, 1998; Downs, 2004), and neighbourhood amenities. The general argument made by these researchers is that residential location decisions are complex and it's this complexity that results in the ineffectiveness of jobs-housing balance (Giulinano, 1991; Giuliano and Small, 1993; Downs, 1992; Wachs et al., 1993; Peng, 1997). Another related argument pointed out by Levine

(1998) is the assumption that large numbers of workers would be willing to choose sites close to their workplace.

Scale and market influence are two other considerations for jobs-housing based research. As Guiliano (1991) states, the measure of jobs-housing balance is conducted at an arbitrary geographic scale. At a large enough geographic scale, balance will be presented (Cervero, 1996). A third perspective that is presented in the literature finds jobs-housing balance to be effective but that the planning interventions to achieve it are ineffective. This perspective argues that left to its own devices the market will adjust to achieve more balance (Shen, 2000).

Whether for or against job-housing balance as an effective measure to reduce commuting distance and encourage sustainability, the concept of housing suitability within the discussion is noticeably limited. Typically measures of jobs-housing balance present housing as the number of dwelling units without stratifying by dwelling type. Given the diversity of households, and the different preferences for housing achieving balance must take into consideration both housing and household composition. Cervero's (1996) work in San Fransico supports this. He found that cities with a diverse housing stock were more balanced with respect to jobs-housing balance than cities offering only suburban, single detached housing. His argument is that jobs-housing imbalance is a result of "barriers to the production of suitable housing in job-rich cities and sub regions" (Cervero, 1996, p.508). This is in accordance with the work of Levine (1998) who found in his research that people want to live in more diverse ways than what is afforded them in the post-war homogeneous subdivisions.

This thesis moves beyond the typical jobs-housing balance discussion in two ways. First while it compares the jobs and housing composition of the employment centres it does so at a specific scale (at the census tract level) and by stratifying dwelling type. Again reiterating the work of Guiliano (1991), at a large enough geographic scale, jobs-housing balance will be present. Measures of jobs-housing balance are often done at the census

subdivision scale (CSD) scale. While advantageous from a land use policy perspective, commuting distance is "artificially limited" (Levinson 1998, p.12). A smaller scale of study is necessary to identify imbalance. Jobs-housing balance is also only effective as a means of commuting reduction if the houses are occupied by the people working there and not by employees who commute out of the region for work. Second, this analysis touches upon the concept of "self-containment" (Cervero, 1989) by identifying the composition of households who live and work within the same census tract.

2.4.2 Excess Commuting

Excess commuting is the wasteful or "non-optimal" commuting distance spent as a result of the spatial arrangement of the home-work link (White, 1988). It relates commuting and land use by determining the minimum commute for a city and comparing actual commuting distances to this theoretical minimum (Horner, 2004). The theoretical minimum is calculated by relocating the residential locations of workers to the job locations that achieve minimum regional commute (Horner 2002). The closer the actual commute to the theorized minimum commute the lower the aggregate regional commuting costs and the greater the jobs-housing balance achieved. Excess commuting occurs as a result of urban form, specifically the nature and relationships between different residential and workplace locations (Small & Song 1992).

Housing suitability was not found in the review of excess-commuting literature but it has been suggested that incorporating housing attributes into models of excess commuting are warranted to better reflect locational decisions (Hamilton, 1982). The studies of Thursten & Yezer (1991); Kim (1995); and Spense (1999) have built in household, gender, or social class variables to account for the heterogeneity among households in their calculations of excess commuting. The work of Cropper and Gordon (1991) for the city of Balitore, MD comes closest to considering housing suitability within the excess commuting construct by broadening their model to include housing utility. They define utility by a

number of housing and neighbourhood attributes. Their study, in addition to the number of dwelling units, included variables for the mean number of bathrooms, mean bedrooms, percentage of detached units as well as a number of household variables. Running the models separately for owners and renters, the authors concluded that expanding the definition of housing utility to include a number of housing attributes, which are also being used in this thesis to define housing suitability, increased the average commute distance.

2.4.3 Accessibility

Accessibility is the third commuting theme defined by Horner (2004) and described here through the lens of housing suitability. One definition of accessibility as defined by Levinson (1998) is:

"A continuous variable which is measured by counting the number of activities (e.g., jobs) available at a given distance from an origin (e.g. the home) and discounting that number by the intervening travel time)". (Levinson, 1998, p.12)

The notion is that the higher the accessibility the shorter the commuting distance (Mills, 1972). While this view has been countered by Guiliano (1991) who argues that the complexity of residential location decisions makes accessibility to the job location less important than other considerations, other studies of accessibility have shown that higher accessibility translates into shorter commutes (Ong & Blumenberg, 1998).Once again in studies of accessibility, housing suitability is missing from the discussion. Accessibility studies include the number of dwelling units as a model variable but without differentiating by dwelling type or number of rooms.

2.5 Policy

Intervention in the form of planning policy influences the home-work link and physical form of cities. Maintaining a balance between jobs and housing has become an important part of municipal planning (Cervero, 1996) and as Levinson (1998) points out

there are many types of policies, including; tax, growth management, and zoning that impact the home-work link. From a supply side, estimates of housing need are used to direct public policy (Myers et al., 2002). This section explores one planning intervention, Smart Growth, which was conceived as a reaction against contemporary development patterns (Downs, 2001). It has gained in popularity and generated a number of policies at both municipal and regional levels that impact the home-work link and housing suitability.

There is no single widely accepted definition of Smart Growth and specific policies differ by organization and municipality. However, they all share the same prime objective as a planning and policy tool. Smart Growth is premised on the acknowledgement that contemporary development patterns consisting primarily of low density, single detached dwellings, leap-frog development and segregated land uses are unsustainable (Downs, 2001). To minimize the environmental impacts associated with development, Smart Growth policies promote sustainable development. This type of development is often characterized as high-density, compact, and pedestrian-friendly.

Housing, is an essential component of Smart growth (Danielson et al., 1999). In their article examining how housing can support the implementation and effectiveness of Smart Growth policies, Danielson et al., (1999) define Smart Growth principles as land patterns that:

> "1. Reuse existing infrastructure and land resources to the greatest extent possible
> 2. Encourage and make possible alternative transit modes
> 3. Reduce the number of vehicle miles traveled
> 4. Improve an area's jobs/housing balance
> 5. Mix land uses to the finest grain the market will bear and include civic uses in the mix
> 6. Concentrate commercial development in compact centers or districts
> 7. Reduce community opposition to growth." (p. 517)

These principles are in line with those of other organizations and include the sustainability themes of Jabareen (1997). Danielson et al. then define Smart Growth principles specific to housing. These include:

1. "Promote denser subdivisions in suburbia
2. Encourage urban infill housing
3. Place higher density housing near commercial centers and transit lines
4. Phase convenience shopping and recreational opportunities to keep pace with housing
5. Transform subdivisions into neighborhoods with well-defined centers and edges
6. Maintain housing affordability through mixed-income and mixed-tenure development
7. Offer diverse housing options, including "life-cycle" housing." (p.517)

Again, these housing specific principles speak to the important relationships between housing and the workplace and express Jarbareen's (2006) themes of sustainability including diversity and density.

The principles of Smart Growth have been promoted across Canada's cities, yet the implementation of Smart Growth principles through policy is difficult. In his study of Smart Growth policy, Downs (2005) highlights several obstacles that Smart Growth policies encounter including; a requirement to redistribute the costs and benefits of development, resistance to change, conflicting views regarding increasing residential density, the potential to increase housing prices, a failure to effectively reduce traffic, more bureaucracy in the development process, restrictions of profits for land owners in outlying areas, and shifting power from the local to the regional level.

The obstacle of shifting the power from the local to regional level is significant to this study and revisited in the results section. Part of this study assesses housing suitability at

the employment centre. In this thesis the employment centres are defined by the census subdivision they are located within. In some cases the employment centres span multiple boundaries. The failure to coordinate strategies between planning agencies has been the source of problems in other efforts to achieve Smart Growth principles at the metropolitan level (Filion, 2009).

3. Methodology

Figure 3.1 (and the supporting figures, Figure 3.2 and 3.3) outline the conceptual framework of the methodology followed in this thesis. Two quantitative methods address the research questions posed in the introductory chapter.

The first research question; "In what ways does housing suitability impact proximity to the work place; and what is the importance of suitability compared to other known explanatory factors influencing the commute?" is explored using multivariate regression models. Using four variables to represent housing suitability, each variable is run in a separate regression that tests whether housing suitability enters the model significantly for commute distance. A number of control variables are included in each model. The regressions are repeated for two samples. The first sample considers all commuters who work in census tracts within each of the three study census metropolitan areas (CMAs) (Montreal, Toronto and Vancouver). This sample accounts for the great variability in workplace location within each CMA. The second sample considers only those who work in one of the designated employment centres which will be defined in the text. These employment centres are concentrated areas of economic activity and represent active commuter destinations.

The second research question; "Is the housing stock currently located in employment centres congruent with the housing suitability requirements of the workforce currently employed in these centres?" is explored through a comparative analysis of housing attributes (dwelling type and number of bedrooms) at two locations, (1) the employment centre, and (2) the residential location of its respective workforce.

The final research question "How can housing suitability be given due consideration in the process of attempting to achieve the principles of Smart Growth for the major employment centres of Montreal, Toronto and Vancouver?" draws on the results of the first two research questions

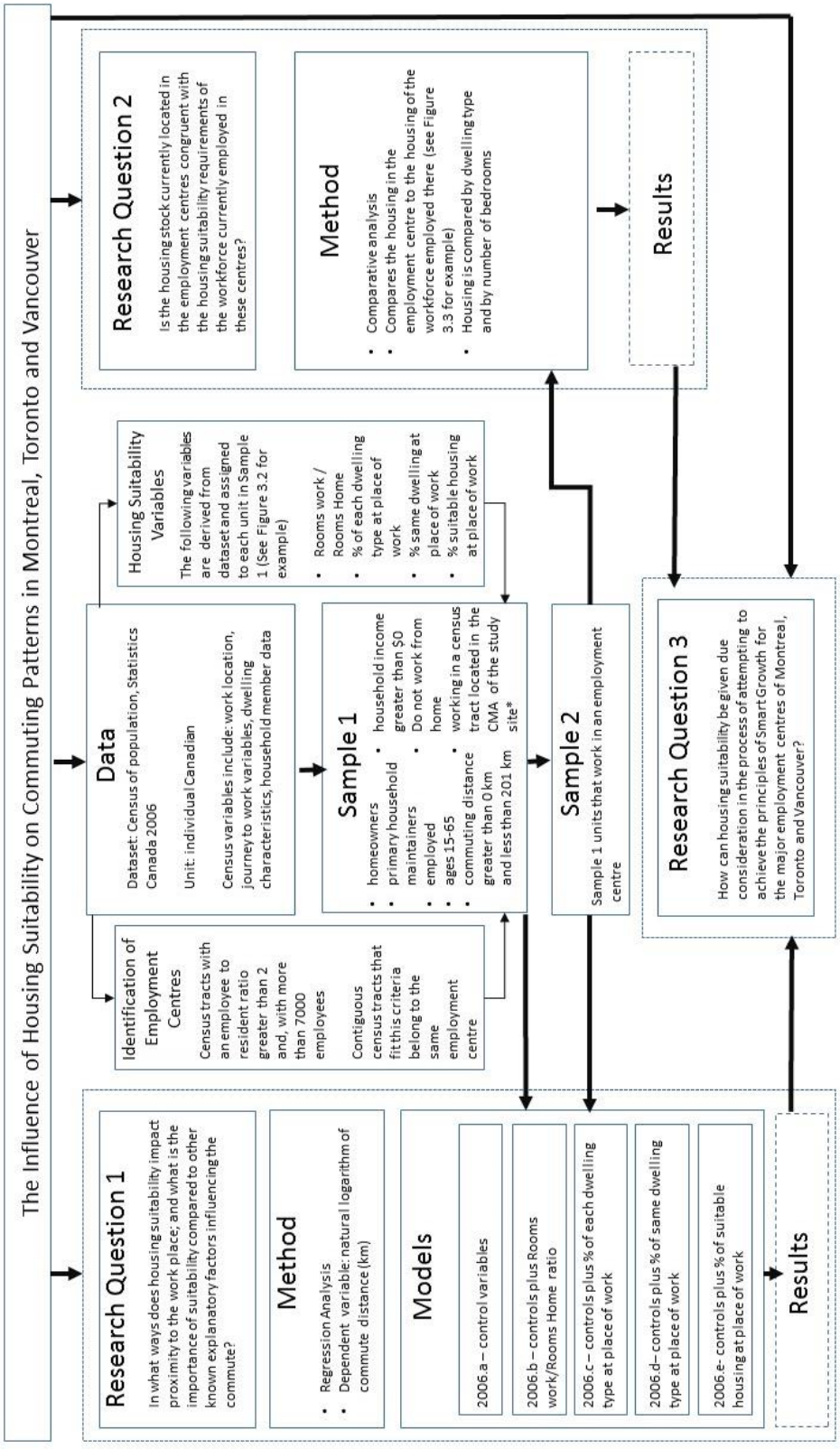


Figure 3.1 Concept map of thesis methodology

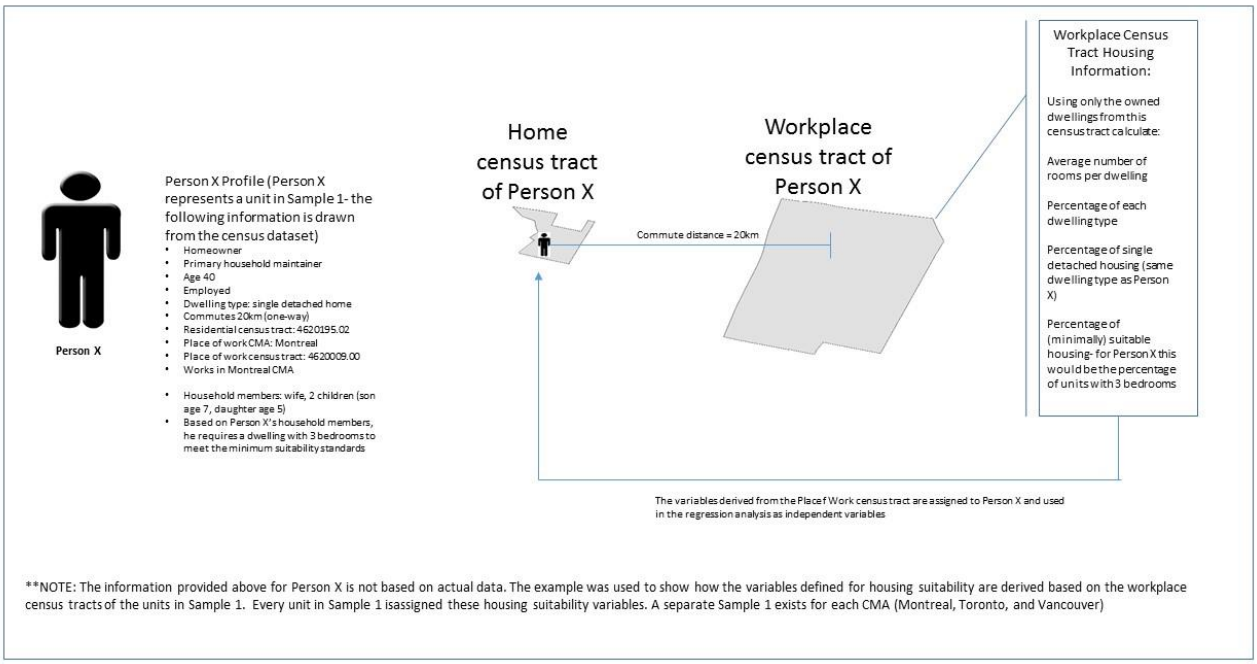


Figure 3.2 Method to assign housing suitability variables based on the workplace census tract

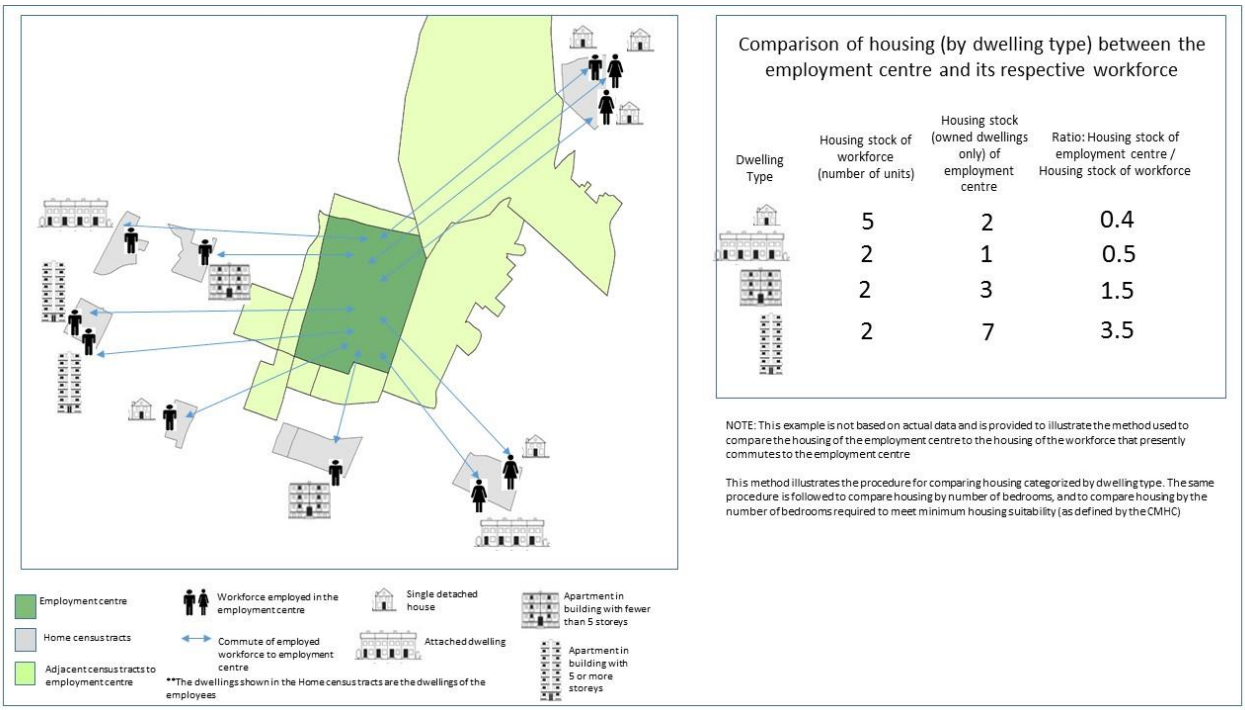


Figure 3.3 Method to compare housing at the employment centre to the respective workforce

The data used in this study consists of micro-level census data from 2006. This was the most recent census data available at the time of study. Census data was selected because it contained the place of work, journey to work, household, residential location, and demographic variables at the geographic scale of the census tract which were required to answer the research questions. While there are more detailed transportation surveys, the same census data is consistently available across different metropolitan areas. Approximately 20% of the Canadian population was surveyed for the long-form census (1 in 5 households). Weights are then assigned to the data so that it can be expanded to represent the whole country. The unit of analyses is the individual Canadian.

3.1 South Western Ontario Research Data Centre (SWORDC)

Micro-level census data access was granted through a proposal process which required joint approval from the Social Sciences and Humanities Research Council (SHHRC) and Statistics Canada. The confidential nature of the data required that all analysis be conducted on site at the SWORDC lab (located at the University of Waterloo) and all results underwent a vetting process by the Statistics Canada analyst on site prior to release. Descriptive frequencies had to meet a minimum cell count of 4 for unweighted results and 10 for weighted results. All frequencies were rounded to base 5, and only weighted frequencies were released. The one exception is the "number of observations" values shown in the regression output. These numbers represent the number of observations (unweighted but rounded to base 5) that make up the regression model.

3.2 Census Geography

The lowest geographic level provided in the micro-level dataset is the census tract. Census tracts consist of areas with populations between 2,500 and 8,000 people and are located in census metropolitan areas that have a population of at least 50,000. These areas are selected to be as homogeneous as possible in terms of socio-economic characteristics and represent areas that are small and relatively stable (Statistics Canada, 2011).

Census tracts were used as the geographic unit of analysis as follows:

- To identify the place of work location of each individual in the sample
- To identify the place of residence of each individual in the sample
- To identify the employment centres in each city
- As a boundary in which to aggregate the number of dwelling units by dwelling type and number of bedrooms which are variables used in both the regression models and in the comparative analysis section

The three study sites are the census metropolitan areas (CMAs) of Montreal, Toronto and Vancouver. CMAs consist of one or more municipalities that are centred on a defined core. They have a population of at least 100,000 and at least 50,000 people must live in the core. The municipalities located in a CMA have a high degree of integration with the core (population centre) as represented by commuting flows. (Statistics Canada, 2011b).

3.3 Employment Centres

The second quantitative method of analysis focuses on the employment centres of each CMA. The decentralization of employment is an urban process present in each of the three metropolitan areas in this study. While the central business district (CBD) for the three study sites has remained fairly intact compared to smaller Canadian cities (Filion et al, 2004), suburban employment centres are on the rise. These suburban employment centres (Cervero 1989), or edge cities (Garreau, 1991) continue to increase in importance often in direct competition with the economic functions of the CBD. The impact they have both physically, and economically for their respective CMAs make them an important area for study.

There are a number of proposed identification methods for employment centres found in the literature. Some studies use employment thresholds (Fujii & Hartshorn, 1995), while others use employment density gradients (McDonald & Prather, 1994) or ratios of total

employees to residents (McDonald, 1987). Other studies have used a combination of employment density and total employees (Guiliano & Small, 1991). This study uses the method of Shearmur and Coffey (2001) which combines an employee to resident ratio with a total employee threshold.

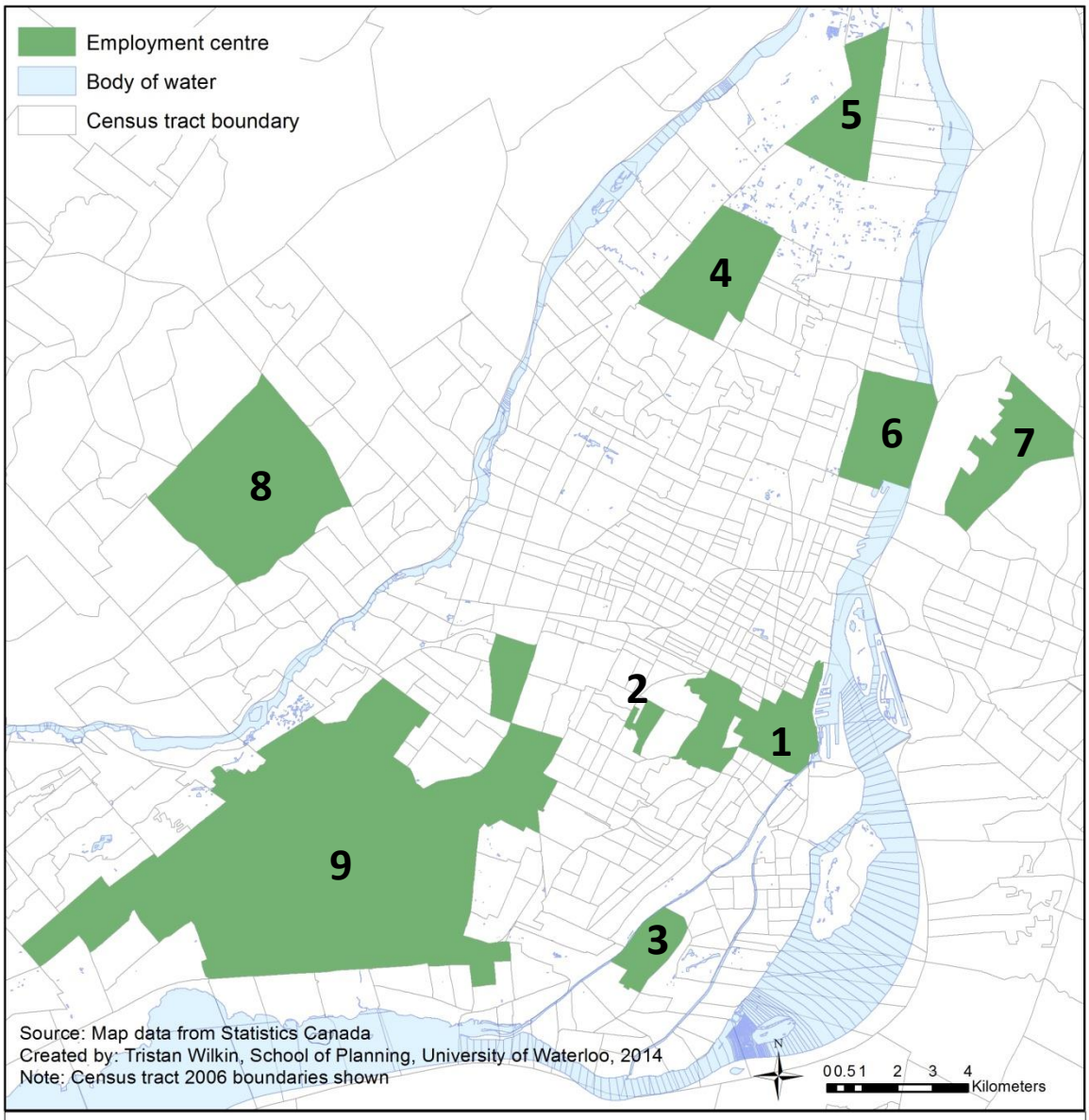
Specifically, the employment centres in this thesis are characterised as:

A set of contiguous census tracts (the spatial unit used in the identification) that meet both of the following criteria:

Employee (E) to resident ratio (R) is greater than or equal to 2: (E/R) >=2.0

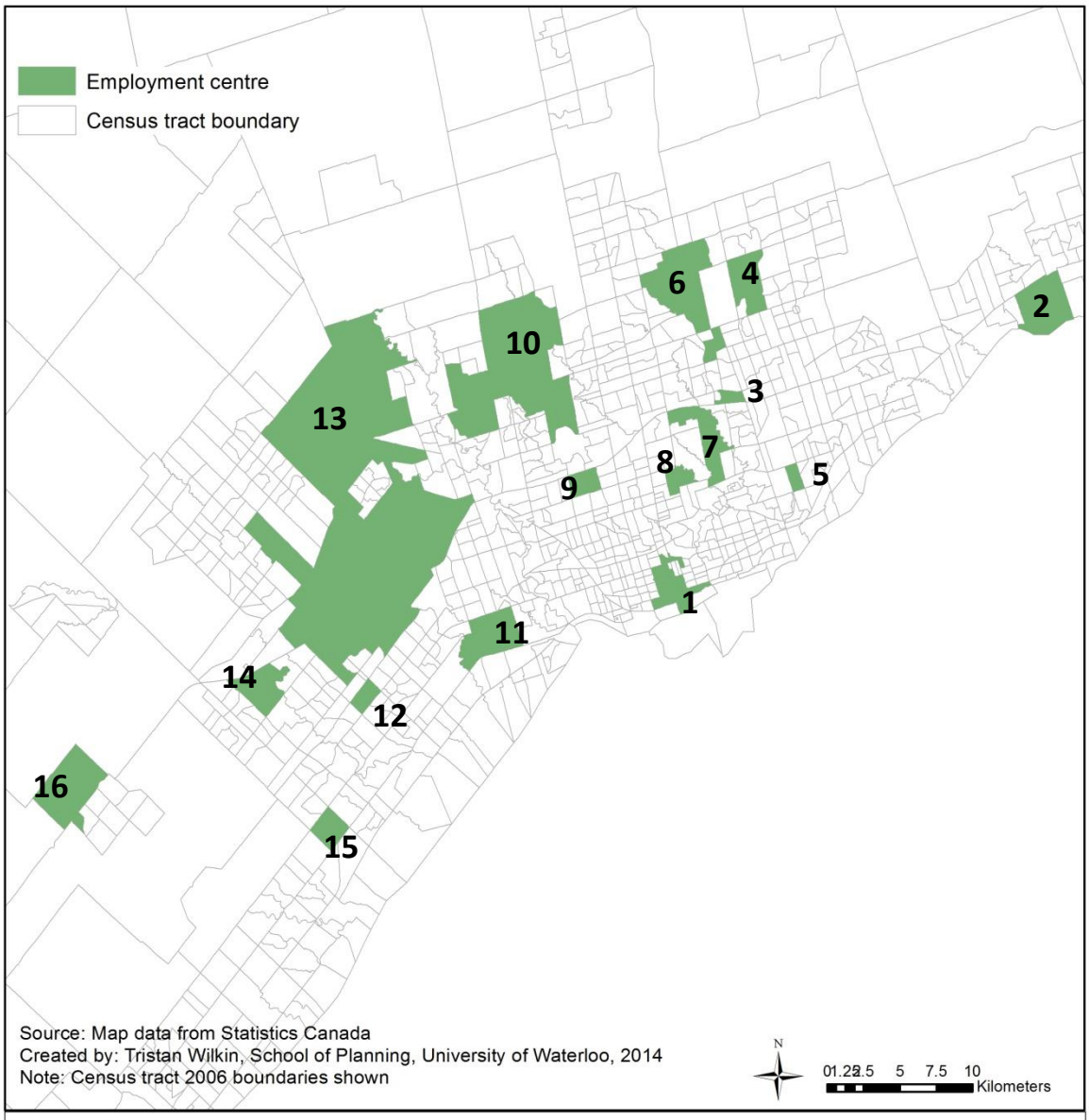
Number of employees (E) is greater than or equal to 7000: (E) >= 7000

In their study for the City of Montreal, Shearmur and Coffey (2001) concluded that this specific combination of employee to resident ratio and employee threshold best identified Montreal's employment centres based on their knowledge of the metropolitan area. Their method was applied to all three study sites in this analysis. The employment centres were named using the census sub-division (CSD) labels. In some cases where multiple employment centres fell within the same CSD an additional descriptor was sought, one which reflected a major junction, or relatively well-known point of interest to uniquely identify the employment centre. In the event that the employment centre crossed multiple CSD boundaries, all CSDs were included in the naming convention in order of decreasing area coverage. Figures 3.4-3.6 show the identified employment centres for each CMA.



1 Montreal (CBD)
2 Montreal (University of Montreal)
3 Montreal
4 Montreal (Anjou)
5 Montreal (Pointe-aux-Trembles)
6 Montreal (Longue Pointe)
7 Longueuil
8 Laval
9 Montreal/Dorval/Pointe-Claire/Mont-Royal

Figure 3.4 Geographic locations of Montreal CMA employment centres



1 Toronto (CBD)
2 Pickering
3 Toronto (North York- 401 meets 404)
4 Markham (City Centre)
5 Toronto (Scarborough Junction)
6 Markham/Richmond Hill/Toronto
7 Toronto (York Mills/Don Mills)
8 Toronto (Lawrence Park-Sunnyside)
9 Toronto (Yorkdale)
10 Vaughan/Toronto
11 Toronto (Highway 427)
12 Mississauga (City Centre)
13 Mississauga/Brampton/Vaughan/Toronto (includes Airport)
14 Mississauga (Meadowvale)
15 Oakville
16 Milton

Figure 3.5 Geographic locations of Toronto CMA employment centres

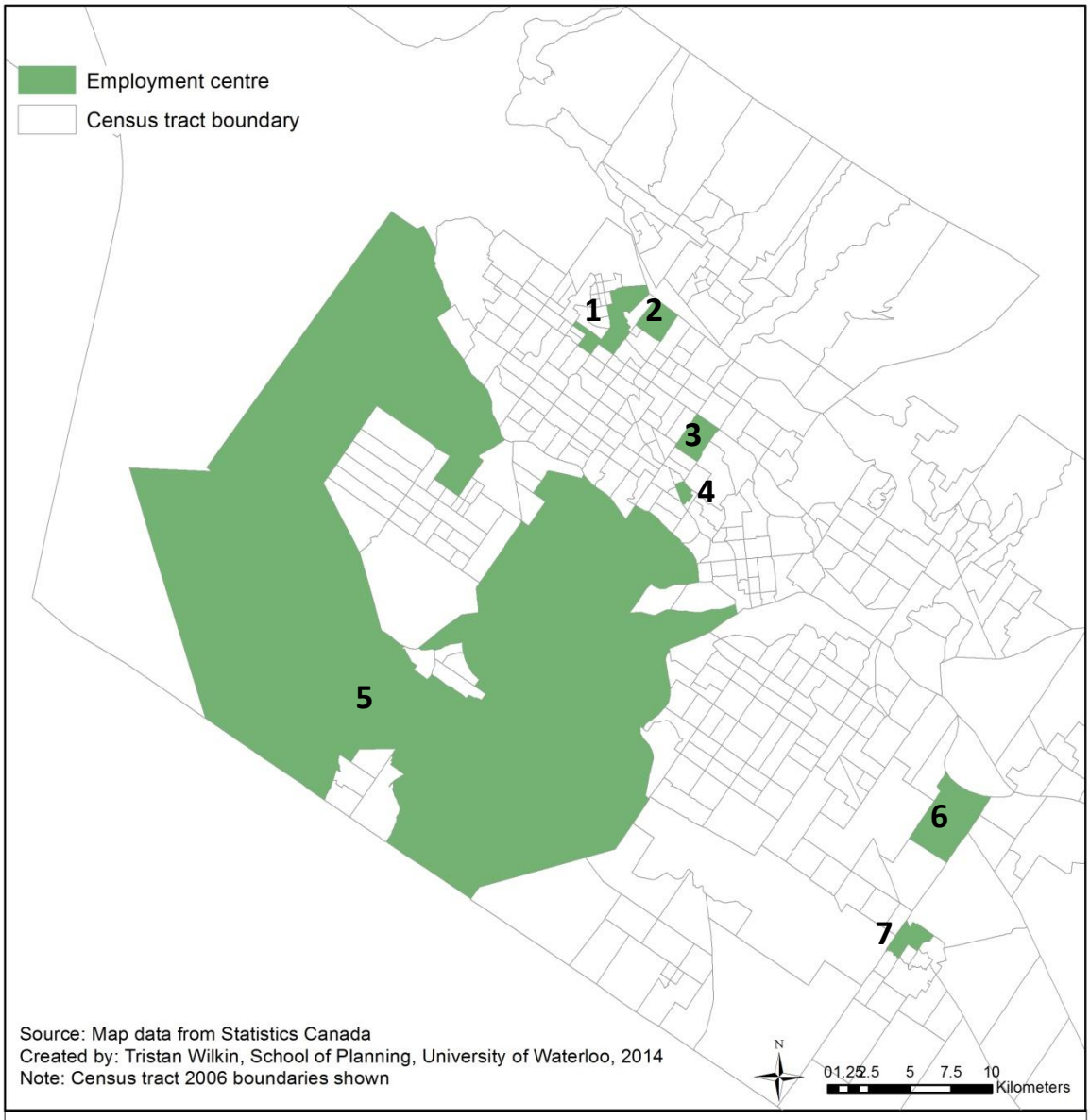


Figure 3.6 Geographic locations of Vancouver CMA employment centres

3.4.1 A closer examination of Vancouver Employment Centre 5- Delta/Richmond/Burnaby

Vancouver employment centre 5- Delta/Richmond/Burnaby has census geography that requires explanation. At first glance this employment centre appears to surpass all others in land area. In actuality the land area covered by this employment centre is much less. Census tract boundaries can extend into water bodies which impacts the Delta/Richmond/Burnaby area due to its proximity to the water. The original census tract boundaries are kept in the map to maintain consistency with the other employment centre representations but Figure 3.7 is provided below to show the actual land mass covered by the census tract boundaries comprising the employment centre.

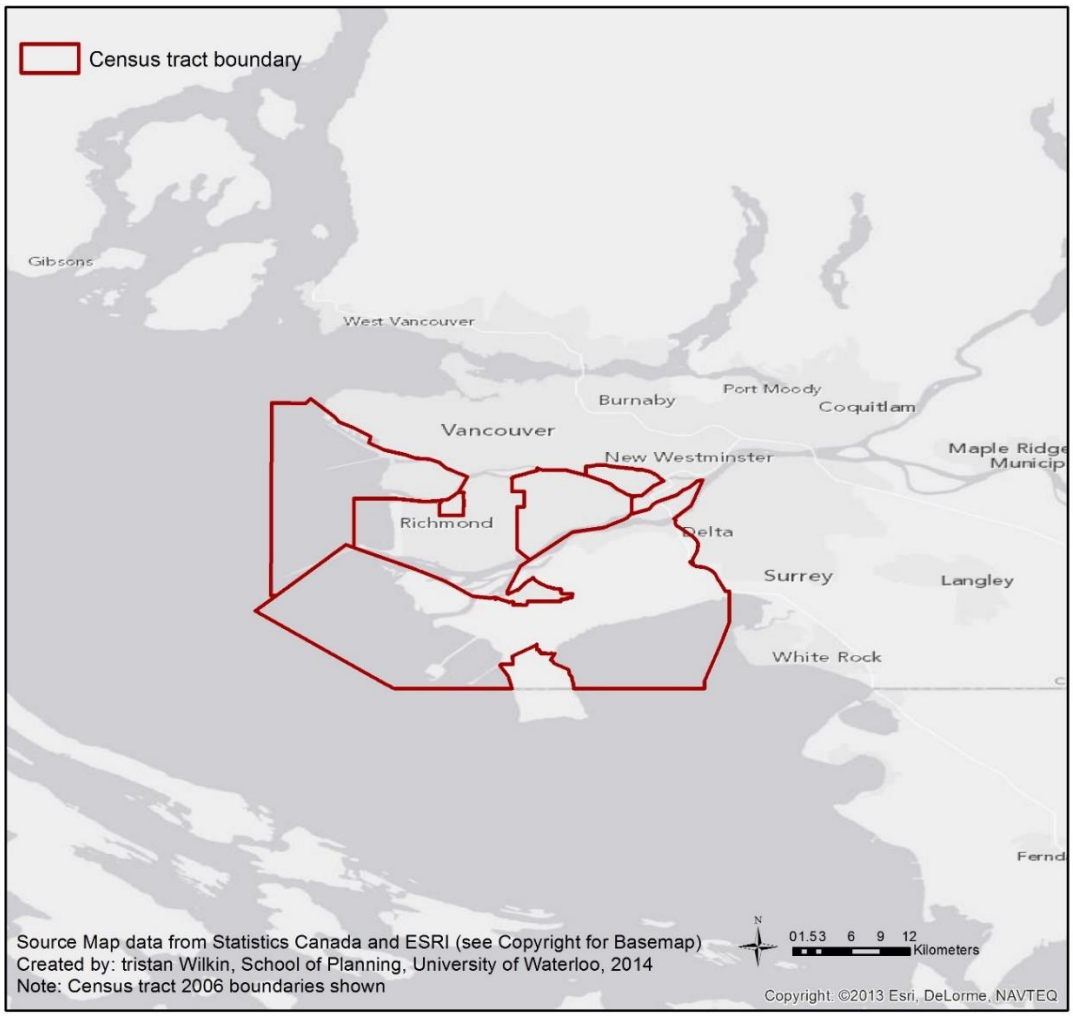


Figure 3.7 Vancouver employment centre 5- land mass and census tract boundaries

3.4 Samples

Two samples were constructed for each CMA (Toronto, Montreal and Vancouver) from the original census data-set. They will be referred to in this thesis as Sample1: All commuting employees, and Sample 2: Commuting employees working in an employment centre. Sample 2 is a sub-sample of Sample 1. The samples are described below:

Sample 1: All commuting employees

This sample is created for each census metropolitan area (CMA) of Montreal, Toronto and Vancouver (3 samples in total) and includes respondents who meet the following criteria:

- homeowners
- primary household maintainers
- employed
- ages 15-65
- do not work from home
- have a commuting distance greater than 0 km and less than 201 km
- have a household income greater than $0 (excludes those who reported net investment losses or zero income)
- working in a census tract located in the census metropolitan area of the study site

Sample 2: Commuting employees working in an employment centre

This is a sub-sample of Sample 1, and includes only those from the larger sample that work in one of the designated employment centres. Again, there is a separate Sample 2 for each CMA.

Based on the sampling conditions the sample sizes for each CMA are shown below in Table 3.1. These frequencies represent the number of observations in each regression

model (frequencies are unweighted and rounded to base 5), however the coefficients of the models are based on the weighted frequencies.

Table 3.1 Number of observations in each sample (unweighted and rounded to base 5)

CMA	Sample 1: All Commuting employees	Sample 2: Commuting employees working in an employment centre
Montreal	100,475	34,840
Toronto	156,590	75,940
Vancouver	57,370	19,345

3.5 Study Limitations

This is an exploratory study, and a number of limitations are recognized:

(1) For purposes of this study renters were excluded from the sample. Homeowners and renters are often distinguished from one another in commuting studies (Kim, 1994; Plaut, 2006). This study focuses on owners as renters would require additional consideration in terms of the geography of rental units that were beyond the scope of this research. Owned units are generally available in all areas of the three CMAs, although rental stock is more dominant in Montreal, particularly in its downtown. By focusing on homeowners it is recognized that one dimension of housing suitability is absent. Renters are typically lower income earners than home-owners and the actual prevalence of those encountering housing suitability problems may have been higher had this group been included. Homeowners also tend to live farther from the CBD and commute greater distances (Blackley & Follain, 1987), therefore the exclusion of renters may overstate average commuting distances.

(2) The sample consists of primary household maintainers. A primary household maintainer is the first person identified on the census survey and is normally the person who contributes the greatest amount to shelter expenses (Statistics Canada, 2009). The decision to use only primary household maintainers was made to avoid the double counting of dwelling units in the analysis as a result of multiple earners within the household. There is a large body of research on dual-income earners. These households must make identical housing decisions based on two different employment locations. The research has shown that for these households men tend to travel greater distances then women (Chapple & Weinberger, 2000). This is often explained as a reflection of the greater household responsibilities typically held by women. Future research has to consider the place of work of both earners in dual earner household in the context of housing suitability.

(3) Those residing in mobile homes or moveable dwellings were also excluded from the sample. This represented a very small segment of the overall population.

(4) Those respondents with a commuting distance of zero were excluded from the sample. The first quantitative method uses commuting distance as the dependent variable. As noted by Shearmur's work on commuting distance (2006), the analysis of home-based workers would require a separate study (see for example Moos and Skaburskis, 2007).

(5) This is a purely quantitative study that defines housing suitability by the housing type and required number of bedrooms to appropriately shelter the household occupants. As such it does not explore the value judgements that are inherent in

residential location decisions. Norman et al. (2006) describes these value judgements as the individual's "right to space" verses the "right to comfortable shelter". This study leans towards the latter by comparing the current housing of the workforce to that of their respective workplace to see if the "right to comfortable shelter" (expressed as meeting the minimum number of bedrooms requirement) is available at the workplace.

(6) As a quantitative study this analysis can identify a mismatch between where people live and work and housing imbalances based on the suitability definitions however it does not assess the willingness to move, which would require additional research.

3.6 Commuting Distance

The commuting distance variable in the micro-level census data is the Euclidean (straight line) distance between the residence and the place of work measured in kilometers (km). While the distance does not take into account travel network, straight line distance has been found to approximate network distances and time (Shearmur, 2007). The fact that commuting distance as opposed to time is being analysed should be noted (Shearmur, 2007). As Shearmur points out in his commuting study for the City of Montreal, there are thresholds regarding commuting time that people are more sensitive to than distance. In this case data on travel time was not available and therefore distance is used. Distances greater than 201 km as obtained in the census survey questionnaire are aggregated to 201 km in the data. Therefore because of the potential misrepresentation of distances greater than 201km, any household in the sample reporting a commuting distance equal to 201km has been excluded from the analysis. All commuting modes are included in the analysis. Modal choice is often associated with income which is already used as a variable in the regression models. As Shearmur (2007) points out the differentiation by transit mode can

lead to problems of multicollinearity and for this reason he excludes mode from his Montreal study. This thesis follows suit and does not differentiate by transit mode because of potential multicollinearity issues.

3.7 Regression Analysis of Commuting Distance

The relationship between commuting and land use pattern is the subject of a large body of literature (Cervero 1989; Guilano and Small, 1993; Scott et al., 1997; Miller & Ibrahim 1998; Handy et al., 2005). Commuting data is often combined with housing and other urban form data to understand travel behaviour (Jun, 2004) and to investigate the sustainability of transportation systems (Black, 1996). As Shearmur (2006) points out, other non-work trips and stops are often made based on the commute. As the daily interaction between the home and the workplace commuting distance is an appropriate variable of interest for this thesis. Commuting distance was modelled through multivariate regression models.

3.8.1 Dependent variable: Commuting distance

The dependent variable used in this study is the square root of commute distance. This transformation of commute distance (km) normalized the distribution of the variable, thereby reducing the variance and skewness of the original variable. The transformation of the variable commute distance has been done in other commuting studies (Handy et al., 2005; Maoh & Tang 2012; Axisa et al., 2012). The regression equation is as follows:

$$\sqrt{(d)} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \epsilon \qquad (3.1)$$

where,

$\sqrt{\ }$ = square root function

d = commute distance in km

β_0 = intercept term

$\beta's$ = model coefficients

X = independent variables

ϵ = error term

3.8.2 Independent Control Variables

A number of control variables are specified for the model. These variables were selected based on their presence in and impact on previous commuting studies and are described below.

Occupation

Like the work of Cervero & Duncan (2006), Axixa et al. (2012) and Shearmur (2006), occupation has been included as an independent variable in many commuting regression studies. As suggested by Shearmur (2006) higher level occupations are associated with longer commutes.

Income

Income is associated with commuting distance differences. Higher incomes allow people to afford the costs of commuting greater distances. In this way income becomes a direct measure of the capacity to pay for transportation costs (Rouwendal & Nijkamp, 2004).

In this study in order to normalize the variable, the natural logarithm transformation of income was used. Other studies that have transformed income include the work of Axisa (2012) who also used the natural logarithm, and Gordon et al., 1989 who used a quadratic term. In the preliminary analysis of this study, the natural logarithin transformation of the income variable best resembled a normal distribution for the data and therefore it was selected to represent the income variable. It is expected that income will have a positive effect on commute distance in accordance to the research found in other commuting regression studies (Shearmur, 2006, Axisa, 2012).

Education

High levels of education have been associated with longer commutes (Dieleman et al., 2002; Watts, 2009). It has been suggested in these studies that high levels of education are associated with high income which allows these people to cover the costs of transportation and the costs associated with suburban lifestyles.

Gender

Gender is a commonly used variable in commuting related literature. The work of; Clark et al., (2003), Hanson & Pratt (1995) and Giuilano & Narayan (2003) find that females travel shorter distances then men.

Presence of young child (*less than 15 years old)*

The presence of young children has been shown to increase commute distance (Axisa, 2012). A possible explanation is the preference for suburban lifestyles that are typical of households with children, and the association of this lifestyle with single-family dwellings which are typically located in areas further from employment centers.

Residential Density

To include a spatial dimension, the residential density at the census tract level was included as a control variable. It is expected that commute distance increases with sprawl, and sprawl is conceptualized as a spatial pattern consisting of low population densities. While not a definitive indicator of sprawl residential density has been used in a number of studies (See: Galster et al., 2001; Ewing et al., 2004). Residential density was calculated using publicly accessible data from the Geographic Attribute File 2006, published by Statistics Canada (Statistics Canada, 2006). This file included the number of dwellings and area (m^2) at the dissemination block which was aggregated to the census tract level.

Place of Work Residential Density

The residential density at the place of work census tract was also calculated for each unit in Sample 1. Applying the same logic, a commute destination (workplace census tract) with a low residential density suggests a suburban workplace location which is associated with greater commuting distances. Place of work residential density is included in all models with the exception of the model testing the dwelling type classifications. A preliminary analysis showed a strong degree of multicollinearity between the dwelling type variables and the place of work residential density. In this model only, place of work residential density is excluded.

Immigration and Number of Earners- Excluded as Control Variables

In a preliminary analysis of the control variables, both immigration and the number of earners were tested as potential control variables but ultimately excluded from the analysis.

Immigration

Studies of migration and commuting are less prevalent in the research. However given the importance of immigration to the CMAs in this study, immigration was initially included as a control variable. It was expected that immigrants would commute greater

distances than non-immigrants (Axisa, 2012). However, the preliminary results were not robust. Adding immigration to the model resulted in a change in sign of multiple coefficients which led to the decision to exclude immigration from the set of control variables.

Number of Earners

As previously mentioned there is a large body of research that looks at the commuting and residential decision making of dual-income earners. The result of adding this variable to the other control variables was a high degree of multicollinearity. Thus, the variable was excluded. A possible explanation is a close association with the already included gender variable.

3.8.3 Housing Composition at the Workplace

A significant part of this thesis is the comparison of the current housing of the sample (employed workforce) to the housing that is available at the place of work. Housing composition at the workplace (differentiated by dwelling type and separately by the number of bedrooms) was calculated using the full census dataset (the original dataset provided by Statistics Canada). Renters and those other than primary household maintainers were eliminated from this dataset so that the remaining units consisted of all primary maintainers who are homeowners living in the CMA. The total number of units in this sample represents the number of owned dwellings in the CMA which could then be broken down into subsets representing the number of dwelling units by dwelling type and by number of bedrooms. Averages for each census tract were then calculated for each housing attribute. Each respondent in Sample 1 and Sample 2 was then assigned the variables corresponding to the housing stock located at their place of work.

3.8.4 Housing Suitability Independent Variables

To the knowledge of the author, no regression models testing commuting distance using housing suitability variables exist. As a result and due to the exploratory nature of this analysis, four different variables, or set of variables (as in the case of dwelling type) were derived from the data to represent and test the significance of housing suitability with respect to commuting distance. Each variable (or set of variables) was tested individually along with the control variables as distinct models. This prevented any issues of multicollinearity due to the related nature of the variables. The calculation of the derived housing suitability variables which were assigned to each record in Sample 1 (and Sample 2) are described below.

Rooms work/Rooms Home Ratio $\left(\frac{R_w}{R_h}\right)$

The first variable is a ratio comparing the number of rooms between the two spatial locations of the home and the workplace. The number of rooms has been used as a variable in housing studies to measure housing quality and size (Borsch-Supan, 1986; Parsons 1986). It was selected as a measure of housing suitability as it allowed for a comparison of approximate housing size between the home and work location. It is calculated as a ratio of the average number of rooms per dwelling at the workplace census tract to the actual number of rooms at the place of residence for the employee of that workplace census tract. The calculation of this ratio (for employee X who works in census tract Y) is as follows:

(3.2)

$$\left(\frac{\mathrm{R_w}}{\mathrm{R_h}}\right)=\frac{\frac{\sum_{i=1}^{n} number\ of\ rooms\ in\ dwelling\ i, located\ in\ workplace\ census\ tract\ Y}{number\ of\ dwellings\ in\ workplace\ census\ tract\ Y}}{number\ of\ rooms\ in\ current\ dwelling\ of\ employee\ X}$$

where:

i= a dwelling unit (not specified by type), owned by a primary maintainer and located in the workplace census tract of respondent

n= total number of dwellings in the workplace census tract of employee X

This ratio was calculated and assigned to each respondent in Sample 1 and Sample 2 (based on their place of work census tract).

Percentage of each dwelling type

Statistics Canada has eight classifications for the Structural Type of Dwelling (see Appendix A for Statistics Canada classifications of Structural Type of Dwelling). For ease of analysis these variables have been reclassified into four categories; single detached house, attached house, apartment in building that has 5 or more storeys (also referred to a high-rise in this thesis), apartment in building that has fewer than 5 storeys (also referred to as low-rise in this thesis). Table 3.2 shows the original Statistics Canada classifications as well as the reclassified categories used in this analysis. Each employee in Sample 1 was assigned four variables representing the percentage of each dwelling type at their place of work census tract.

Table 3.2 Original Statistics Canada dwelling type classifications and the new classifications

Dwelling Type (from Statistics Canada's classification of "Structural Type of Dwelling"	New Dwelling Type Classification
Single detached house	Single detached house
Semi-detached house	Attached house
Row house	Attached House
Apartment or flat in a duplex	Attached house
Other single attached house	Attached house
Apartment in a building that has 5 or more storeys	Apartment in building that has 5 or more stoeys
Apartment in a building that has fewer than 5 storeys	Apartment in a building that has fewer than 5 storeys
Mobile home	Excluded from the analysis
Other movable dwelling	Excluded from the analysis

Percentage of same dwelling type

Whereas the previous variables identify the compositional arrangement of housing at the workplace by including variables for all dwelling types, the percentage of same dwelling

type variable identifies the percentage of housing at the workplace that matches the current dwelling type of the resident.

Percentage of suitable housing at the workplace

This variable was calculated using CMHC's definition of housing suitability. First the number of bedrooms required to suitably house the occupants of each household in Sample 1 and Sample 2 was calculated. The full census master-file contained variables for the age, sex, and relationship to the primary household maintainer for each household member. Using these three variables the required number of bedrooms was calculated according to the housing suitability requirements of CMHC.

The next step was to tabulate the owned (not rented) dwellings by number of bedrooms for each census tract in the three metropolitan areas. These tabulations were converted to percentages representing the composition of owned housing (by number of bedrooms) for each census tract.

The third step was to assign each record in Sample 1 with the percentage of housing in their place of work census tract that had the number of bedrooms they required in order to meet their household's minimum suitability requirement. Here it must be noted that only the percentage of housing with the same number of rooms as that required under CHMC's guidelines was used. By using this definition the potential to understate the availability of suitable housing at the workplace location must be recognized. For example a household requiring 4 bedrooms could live in a house with more than 4 bedrooms, 4 is simply the minimum required. However, due to price gradients typically associated with increasing the number of bedrooms in a residence, only the minimum required number of bedrooms was included in the analysis.

Table 3.3 summarizes the control variables and the housing suitability variables that were derived for each record in Sample 1 and Sample 2.

Table 3.3 The control and housing suitability variables used in the regression analysis

Variable	Definition
Controls	
ln income	Natural logarithm of total household income
Sex	1 if respondent is female; 0 otherwise
Presence of young child	1 if respondent has a child under the age of 15; 0 otherwise
Residential density / 100	Residential density divided by a factor of 100
Place of work residential density/100	Place of work residential density divided by a factor of 100
Occupation type (processing, manufacturing and utilities = 0)	
Management	1 if respondent works in management occupation; 0 otherwise
Business/finance/administration	1 if respondent works in business, finance or administration occupation; 0 otherwise
Sciences	1 if respondent works in natural sciences, applied sciences or related occupations; 0 otherwise
Health	1 if respondent works in health occupation; 0 otherwise
Social sciences/government/education	1 if respondent works in social science, education, government service or religious occupation; 0 otherwise
Arts/recreation	1 if respondent works in art, culture, recreation or sport occupation; 0 otherwise
Sales/services	1 if respondent works in sales or service occupation; 0 otherwise
Education (less than highschool=0)	
Highschool	1 if respondent has a highschool certificate or eqiuvalent; 0 otherwise
Apprentice/trade	1 if respondent has an apprenticeship certificate or diploma, other trades certificate or diploma; 0 otherwise
College	1 if respondent has a College, CEGEP or other non-university certificate or diploma; 0 otherwise
University	1 if respondent has a university certificate or diploma below bachelor level, Bachelor's degree, University certificate or diploma above bachelor level; 0 otherwise
Professional degree	1 if respondent has a degree in medicine, dentistry, veterinary medicine or optometry; 0 otherwise
Graduate degree	1 if respondent has a Master's degree, Earned doctorate; 0 otherwise
Housing Suitability variables	
Rooms work-Rooms home Ratio	Ratio of the number of rooms at the respondents current (2006) residence to the average number of rooms per dwelling at their workplace census tract
Dwelling type (apartments or flats in building with less than 5 storeys =0)	
% of single family housing units	percentage of single family housing units at the place of work census tract
% of attached housing units	percentage of attached housing units (includes semi-detached, row houses, apartments or flats in a duplex, and other attached housing) at the place of work census tract
% apartments or flats in building: 5 or more storeys	percentage of apartments or flats in buildings with 5 or more storeys
% same dwelling type	percentage of dwellings at the workplace census tract that are the same dwelling type as the current residence of the respondent
% suitable housing	% of housing at the workplace census tract that meets the minimum suitability requirement based on CMHC definition of suitable housing (based on number of rooms)

Each housing suitability variable is tested along with the control variables as a separate model. This is repeated for both Sample 1 and Sample 2.

3.8.5 Standardizing Coefficients

Standardized (beta) coefficients were used in order to compare the relative strength of the independent variables in the models.

3.8.6 Regression Diagnostics

A number of diagnostics were performed to ensure that the data met the assumptions of OLS Regression models. First the control variables were added one by one and checked for linearity and normality of residuals. Checking the normality of the residuals led to the transformations of the variables for commuting distance and income. All models were checked for linearity, normality, and multicollinearity which was tested for using a variance inflation factor of 10. This is the rule-of-thumb factor recommended by Stata to check the degree of collinearity (UCLA, 2014).

3.8 Comparative Analysis- Comparing Housing Using the Home-Work Link

The second quantitative method explores the second research question "Is the housing stock currently located in employment centres congruent with the housing suitability requirements of the workforce?" The focus here is on the employment centres which are the areas representing the centres of economic activity in terms of the number of jobs. As centres of economic activity and with large numbers of commuting employees they pose the greatest challenges in terms of traffic congestion and other environmental concerns.

3.9.1 Using Ratios to Measure Housing Congruence between the Home and Workplace

To compare housing according to the spatial arrangement of the home-work link and to identify areas of housing congruence and incongruence based on the housing attributes of dwelling type and number of bedrooms three different ratios were developed. The first ratio is based on dwelling type and defined as follows:

(3.3)

$$\left(\frac{Housing\ stock\ of\ employment\ centre\ Y}{Current\ Housing\ stock\ of\ workforce\ of\ employment\ centre\ Y}\right)_X =$$

$$\frac{number\ of\ dwellings\ of\ type\ X\ at\ the\ place\ of\ work\ employment\ centre\ Y}{number\ of\ dwellings\ of\ type\ X\ currently\ occupied\ by\ the\ Sample\ 2, who\ work\ in\ employment\ centre\ Y}$$

where:

X= dwelling type (single detached house, attached dwelling, apartment in a building with 5 or more storeys, apartment in a building with fewer than 5 storeys).

Y = the employment centre

Four ratios are created for each employment centre of each CMA, one for each dwelling type.

The second ratio scale is based on number of bedrooms and defined as follows:

(3.4)

$$\left(\frac{Number\ of\ bedrooms_{work}}{Number\ of\ bedrooms_{home}}\right)_X =$$

$$\frac{number\ of\ dwellings\ with\ X\ bedrooms\ at\ the\ place\ of\ work\ employment\ centre\ Y}{number\ of\ dwellings\ with\ X\ bedrooms\ \ currently\ occupied\ by\ the\ Sample\ 2\ who\ work\ in\ employment\ centre\ Y}$$

where:

X = number of bedrooms (values equal: 0 or 1, 2,3,4,5,>5)

Y = the employment centre

Due to the unweighted and weighted frequency minimum requirements set by the SWORDC and Statistics Canada for micro-level data release, dwellings with 0 or 1 bedroom were combined into one category to ensure that this data could be included. Residences with greater than 5 bedrooms were also combined into one category to meet the frequency requirements. In other cases where the frequencies were too low other categories were combined.

The third ratio also compares housing between the home-work link by number of bedrooms but whereas equation 3.4 compares dwellings based on the number of bedrooms currently occupied by the workforce, the final ratio compares the housing stock of the employment centres by number of bedrooms to the housing stock required to meet the minimum suitability needs of the workforce (See equation 3.5).

(3.5)

$$\left(\frac{Minimum\ suitability\text{: }Number\ of\ bedrooms_{work}}{Minimum\ suitability\text{: }Number\ of\ bedrooms_{home}}\right)_X =$$

$$\frac{number\ of\ dwellings\ with\ X\ bedrooms\ at\ the\ place\ of\ work\ employment\ centre\ Y}{number\ of\ workers\ of\ employment\ centre\ Y\ who\ require\ X\ bedrooms\ to\ meet\ minimum\ suitability\ \ requirements}$$

where:

X = number of bedrooms (values equal: 0 or 1, 2,3,4,5,>5)

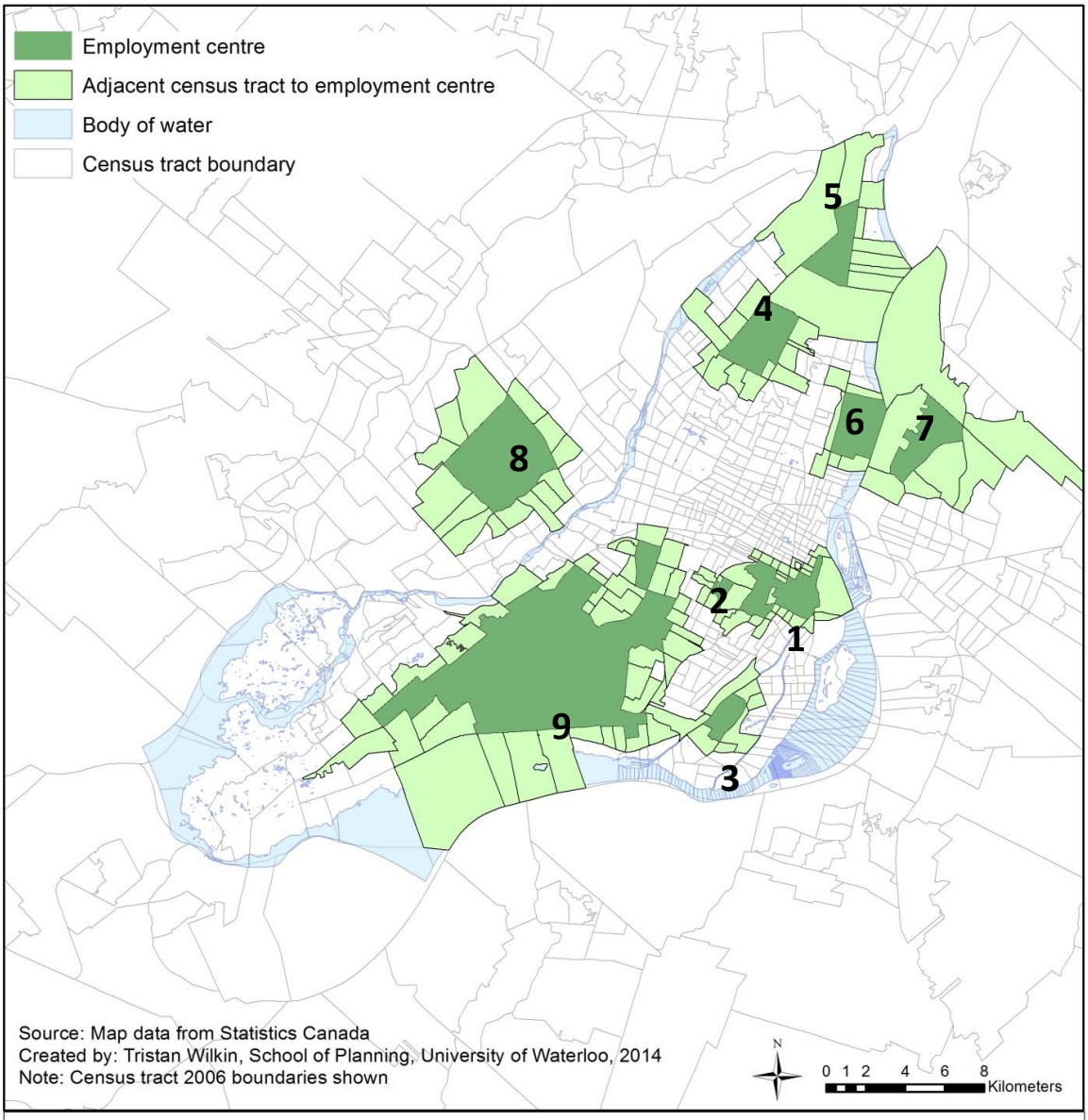
Y = the employment centre

Using ratios for both dwelling type and number of bedrooms will allow for the identification of housing suitability congruence and incongruence between the home and workplace for the samples of interest. Absolute congruence would be represented by a ratio equal to 1.0. This would represent an employment centre where the housing stock (based on the dwelling type or the number of bedrooms) is suitable to effectively house the employed workforce of that employment centre (based on the specific housing attribute). Ratio values greater than 1.0 represent employment centres where the housing stock exceeds the minimum suitability requirements of the respective workforce. Values less than 1.0 represent employment centres that are unable to house their respective workforce based on the current housing stock.

The comparative ratio analysis is repeated a second time using a larger geographic area that encompasses the original employment centre plus all census tracts adjacent to the employment centres. Expanding the geographical area to include the adjacent census tracts addresses two issues. First, as excessive commuting literature points out, there are many reasons for excess commuting including; the heterogeneity of households, housing and labour markets; residential location decisions based on neighbourhood amenities; moving costs; and tenure

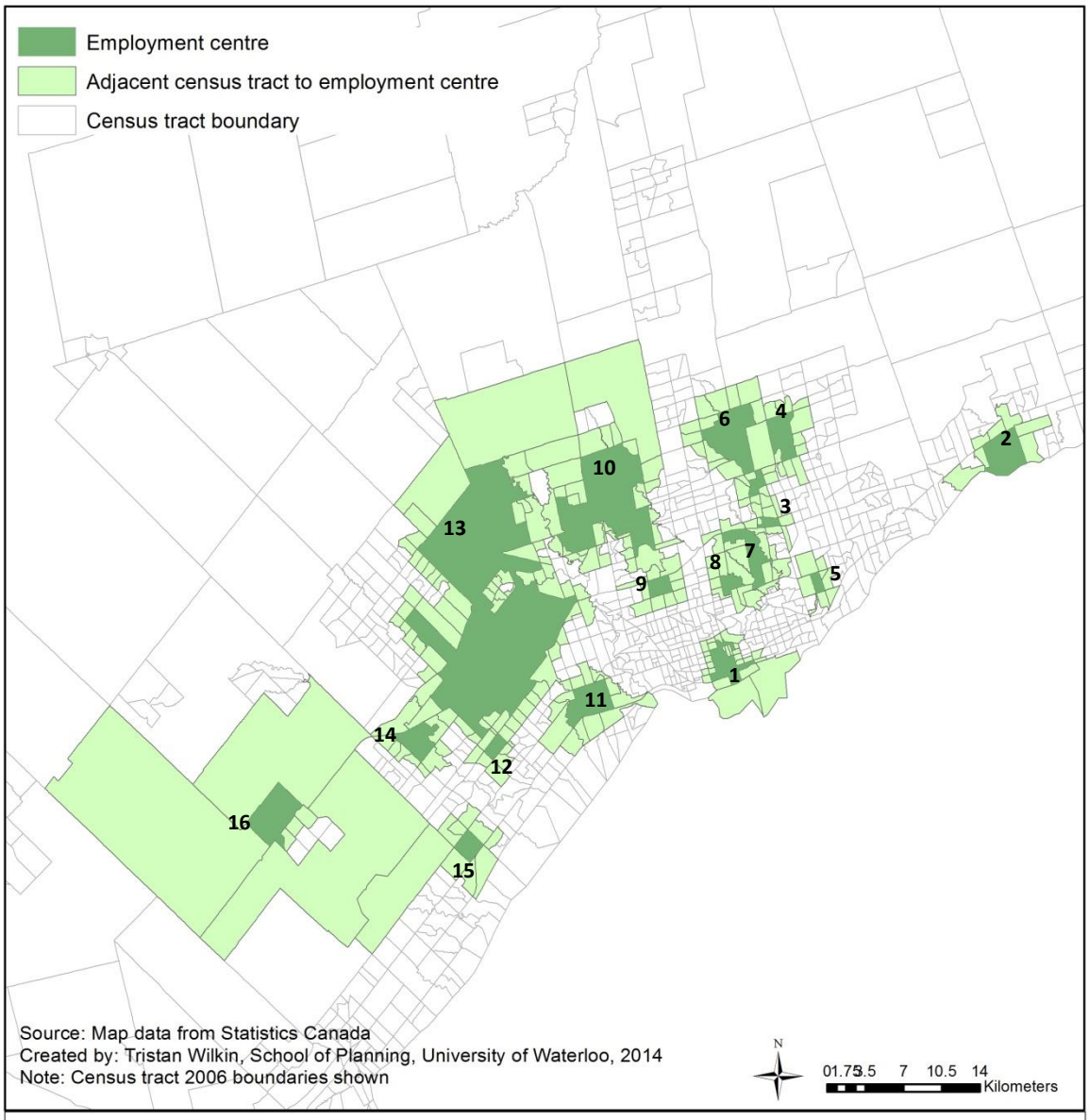
choice (Ma & Banister, 2006). Other studies have shown that for some, commuting can provide a personal positive utility and therefore a willingness to commute is a valid consideration (Ory et al., 2004). Increasing the potential geographical commuting catchment area by including the adjacent census tracts to the employment centres addresses these realities.

The second reason to expand the commuting catchment area is based on the geographic scale of measurement used to identify the employment centres. While the census tract reasonably identifies the location of the employment centres, the actual concentration of the employment within the census tracts remains unknown at this scale. The inclusion of the adjacent census tracts to the employment centres, while arguably rudimentary, was the only means available in the data to account for these important commuting realities. Figures 3.4 -3.6 show the employment centres and the adjacent census tracts for each employment centre.



1 Montreal (CBD)
2 Montreal (University of Montreal)
3 Montreal
4 Montreal (Anjou)
5 Montreal (Pointe-aux-Trembles)
6 Montreal (Longue Pointe)
7 Longueuil
8 Laval
9 Montreal/Dorval/Pointe-Claire/Mont-Royal

Figure 3.8 Montreal CMA employment centres and their adjacent census tracts



1 Toronto (CBD)
2 Pickering
3 Toronto (North York- 401 meets 404)
4 Markham (City Centre)
5 Toronto (Scarborough Junction)
6 Markham/Richmond Hill/Toronto
7 Toronto (York Mills/Don Mills)
8 Toronto (Lawrence Park-Sunnyside)
9 Toronto (Yorkdale)
10 Vaughan/Toronto
11 Toronto (Highway 427)
12 Mississauga (City Centre)
13 Mississauga/Brampton/Vaughan/Toronto (includes Airport)
14 Mississauga (Meadowvale)
15 Oakville
16 Milton

Figure 3.9 Toronto CMA employment centres and their adjacent census tracts

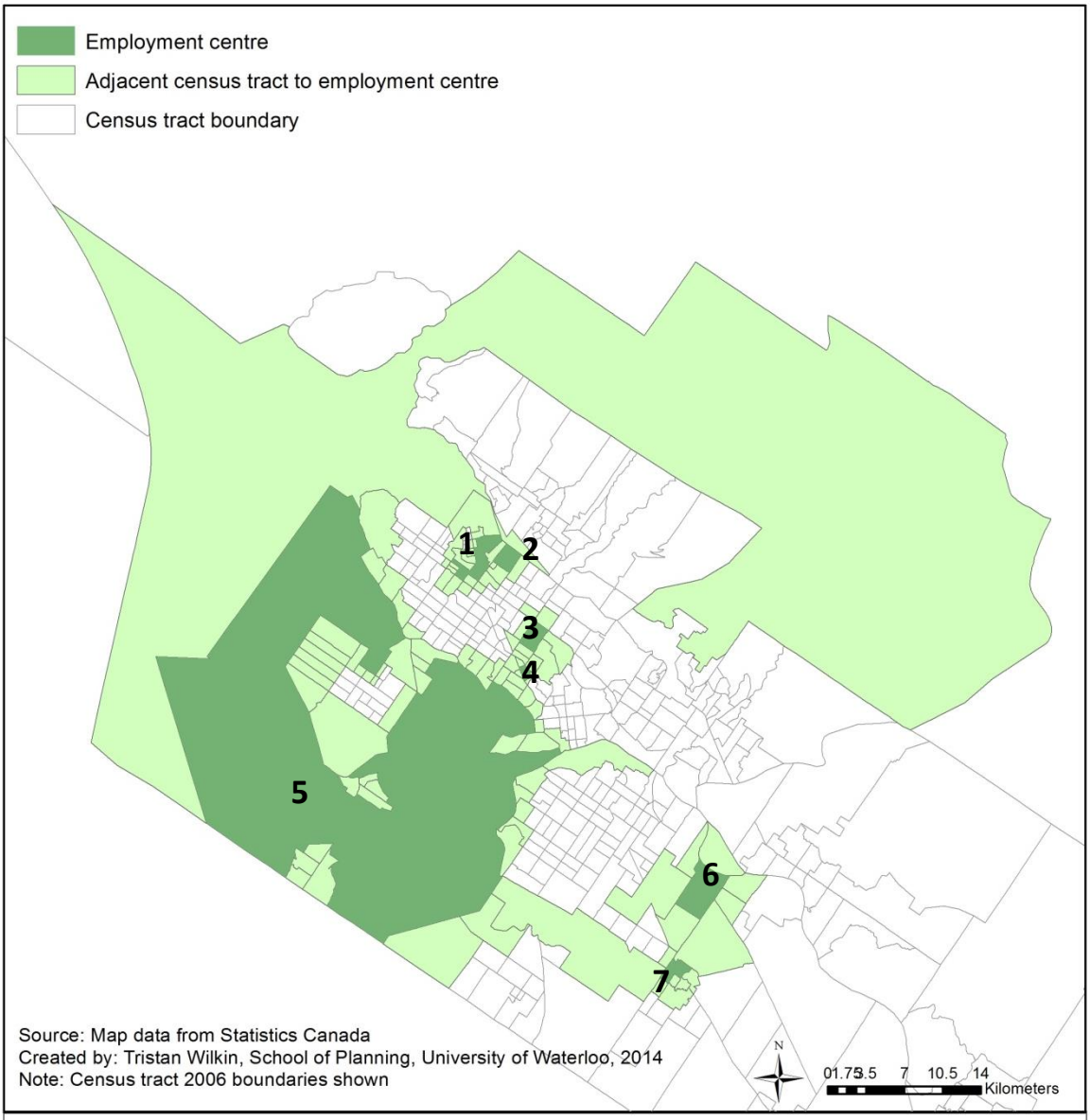


Figure 3.510 Vancouver employment centres and their adjacent census tracts

Again, the employment centre 5- Delta/Richmond/Burnaby presents a much larger area coverage due to the inclusion of census tracts that extend into the water bodies. While included in the map above, the interpretation of the results for this employment centre will be taken bearing the course census tract boundaries produced as a result.

4. Providing Context: Current Housing and Commuting Observations of Sample 1 and Sample 2

This chapter presents a number of descriptive univariate statistics for both Sample 1 and 2. These observations provide additional information of the current housing composition, housing suitability and commuting distances of both samples. While this thesis is primarily concerned with the study of housing suitability within the spatial arrangement of the home-work link, a preliminary look at the housing composition of the home (residential) location sheds light on the situational characteristics of the samples of interest. This can provide context and lend credence for the subsequent analysis and discussion of the two quantitative methods that explore housing suitability from within the home-work link.

4.1 Mean Commute Distance

The average one-way commute distance for the CMAs vary by CMA and sample (See Table 4.1). Toronto has the greatest (in terms of distance) average one-way commute of the three CMAs. Vancouver has the lowest average commute distance of 13.28 km for Sample 1. This echoes the Statistics Canada 2001 census analysis conducted by Turcotte (2006) who found Toronto to have the greatest median distance followed by Montreal and then Vancouver. The majority of Turcotte's work was focused on travel time which is outside the scope of this thesis, however it is interesting to note that the median commute travel time corresponded to commute distance with Toronto having the longest median commute time followed by Montreal and then Vancouver.

Sample 2 for each CMA presented greater mean commute distances. Toronto again had the longest average one-way commute (21.01 km). Once again it is Vancouver that boasts the shortest average commute at 14.84 km. It is possible that this observation is a result of deliberate action on behalf of the workforce to locate away from these employment centres, or as this thesis will explore in the comparative analysis section, one contributing

factor may be the lack of suitable housing at the workplace (employment centre) which requires the workforce to travel greater distances to these centres.

Table 4.1 Average one-way commute distances by CMA and Sample

	Mean (1-way) Commute Distance (km)	
CMA	Sample 1	Sample 2
Montreal	15.87	17.67
Toronto	19.4	21.01
Vancouver	13.28	14.84

4.2 Dwelling Composition of Sample 1 and Sample 2

Consistent with the Statistics Canada data presented in the introductory chapter (which included dwelling statistics for all Canadians regardless of tenure) single-detached housing is the largest dwelling type for all samples (See Table 4.2). The numbers for single detached homes do not fluctuate greatly between Sample 1 and Sample 2. Vancouver stands out with the lowest percentage of single detached homes (only 49.17% for Sample 1 compared to 62.92 % for Montreal and 60.98% for Toronto). The composition of attached housing does not fluctuate greatly between CMAs, ranging from a low of 20.4% in Montreal to a high of 26.84% in Vancouver. The percentage of apartments in buildings with 5 or more storeys exhibit interesting interurban differences. Montreal has a much lower percentage of these high-rises (2.03% for Sample 1) compared to Toronto (9.29%). The large percentage of high-rises in Toronto is not unexpected and continues to be a trend. In 2011, the construction of high rise buildings in Toronto was the highest of all North American Cities (Toronto City Council Economic Development Committee, 2011).

Table 4.2 Dwelling composition for each CMA and Sample

Dwelling Type	CMA & Percentage (%) of Total Dwellings for Sample 1 and 2					
	Montreal		Toronto		Vancouver	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
Single Deatched House	62.92	60.67	60.98	59.08	49.17	47.86
Attached House	20.40	21.17	25.21	25.94	26.84	25.92
Apartment in building that has 5 or more storeys	2.03	2.74	9.29	10.36	7.26	8.80
Apartment in building that has fewer than 5 storeys	14.65	15.42	4.52	4.62	16.73	17.42

4.3 **Percentage of Sample 1 Currently Residing in a Live & Work Environment**

A very low percentage of the employed workforce (Sample 1) currently reside and work in the same census tract (See Table 4.3). This makes sense given the average commute distances. The fact that few people live and work in the same place could be a result of a number of factors which extend beyond the scope of this analysis but suffice it to say that the objective of this analysis and its findings will be to show if housing suitability is indeed a contributing factor.

Table 4.3 Percentages by CMA and Sample of respondents who live and work in the same census tract

	Percentage of Sample 1 & Sample 2 Living and Working in the Same Census Tract	
CMA	Sample 1	Sample 2
Montreal	3.19	0.54
Toronto	2.20	0.56
Vancouver	3.06	1.14

4.4 **Current Housing Suitability Status of Sample 1**

A final univariate observation provided for Sample 1 which is pertinent to the discussion of this thesis is the current housing suitability status of the sample using

CMHC's definition of housing suitability. Tables 4.4 to 4.6 show the current housing suitability status of Sample 1. Households with more bedrooms than are required to accommodate their household members (based on their household compositions) are classified as living in a dwelling that exceeds their minimum suitability requirement. This is the case for the majority of households in each CMA (71%–74%). Montreal has the lowest percentage of households (based on Sample 1) currently living in unsuitable dwellings (3% compared to 7% for Vancouver and 8% for Toronto.

Table 4.4 Montreal CMA suitability classifications for Sample 1 households

Suitability classification	Frequency	Percentage
Dwelling exceeds minimum suitability requirements	374,475	73%
Dwelling meets minimum suitability requirements	124,465	24%
Dwelling is unsuitable (does not meet minimum requirement)	17,825	3%
Total	**516,765**	**100%**

Table 4.5 Toronto CMA suitability classifications for Sample 1 households

Suitability classification	Frequency	Percentage
Dwelling exceeds minimum suitability requirements	575,375	71%
Dwelling meets minimum suitability requirements	169,613	21%
Dwelling is unsuitable (does not meet minimum requirement)	61,445	8%
Total	**806,433**	**100%**

Table 4.6 Vancouver CMA suitability classifications for Sample 1 households

Suitability classification	Frequency	Percentage
Dwelling exceeds minimum suitability requirements	218,920	74%
Dwelling meets minimum suitability requirements	56,620	19%
Dwelling is unsuitable (does not meet minimum requirement)	21,095	7%
Total	**296,635**	**100%**

5. Housing Suitability Impacts Proximity to the Workplace

The first quantitative method was designed to explore the ways in which housing suitability impacts proximity to the work place. This chapter discusses the results of the regression analysis, the significance of the results for the variables and interurban and intraurban differences that were presented in the results.

5.1 The Regression models and their statistical significance

To test the significance of the housing suitability variables for commuting distance, five regression models were run (the same models were run for Sample 1 and Sample 2). Each model other than the control variable model (2006.a) tested a variable representing housing suitability. Table 5.1 describes each model.

Table 5.1 Regression model descriptions

Regression model	Description
2006.a	The model includes only the control variables.
2006.b	The model includes control variables and the Rooms Work/Rooms Home Ratio.
2006.c	The model includes the control variables, with the exception of the Place of Work residential density variable, and the dwelling type percentages at the place of work (one variable for each dwelling type). Place of work residential density was excluded because of multicollinearity issues with the dwelling type variables.
2006.d	The model includes the control variables plus the variable for the percentage of same type of dwelling at the place of work census tract.
2006.e	This model includes the control variables plus the variable for the percentage of suitable housing at the workplace census tract (based on the required number of rooms of the respondent).

The results of the models are shown in Appendix 1 Tables 1 to 6 with the standardized coefficients.

All of the regression models presented for each CMA were statistically significant (based on the F-statistic with an alpha of 0.05) and accounted for a reasonable amount of explanatory power. The r^2 values ranged from a low of 8.52% (Vancouver model 2006.a) to a high of 15.52% (Montreal model 2006.d) for Sample 1. Sample 2 models accounted for higher amounts of explanatory power ranging from 13.44% (Toronto 2006.a) to 20.30% (Montreal 2006.d). All models testing the significance of the housing suitability variables for Sample 1added to the explained variance value (r^2) for each CMA. This was not the case for Sample 2 models. For both Montreal (models 2006.b and 2006.e) and Vancouver (models 2006.d and 2006.e) no increase in explanatory power was reported despite producing statistically significant models. The r^2 values were measured to 4 decimal places so an increase in (r^2 may have occurred for these models but at a very low value (less than 0.0001). Sample 1coefficient signs for the significant variables (to at least a 95% level) remained consistent across all models for each CMA, but not across CMAs which suggests interurban differences with respect to the impact of housing suitability on commute distance at the metropolitan area level. More variables in Sample 2 were insignificant compared to the larger Sample 1, and as a result the discussion that follows will focus primarily on the results from Sample 1.The r^2 values for Sample 1, while lower than some commuting studies (Guiliano & Narayan, 2003; Shearmur, 2006; Weber & Sultana, 2007) are in the range of a number of studies in the literature (see Table 5.2).

Table 5.2 r^2 values for commuting studies using distance as the dependent variable

Study	r^2 Values
Buliung & Kanaroglou (2002)	0.121 to 0.123
Handy & Mokhtarian (2005)	0.160
Axisa et al. (2012)	0.104
Maoh & Tang (2012)	0.080 to 0.410

5.2 Known Factors Impacting Proximity to the Workplace (The Control Variables)

The effect of income on commute distance for the CMAs of Toronto and Vancouver met with expectations and conformed to the results of previous commuting studies (Guiliano & Narayan, 2003; Axisa, 2012) that show longer commute distances with higher household incomes. All models for the three CMAs show this positive effect on commute distance for the control model. For Montreal, household income was only positive and significant in the model of control variables and for model 2006.e. that tests the percentage of suitable housing at the workplace. Of the control model coefficients, household income was also lower for Montreal compared to the other variables. For example, in model 2006.e that tests the impact of the percentage of suitable housing at the workplace on commute distance, for every standard deviation of increase in household income, scores on the square root of commute distance $(\sqrt{d})$ increase by 0.014 standard deviations, controlling for the other control variables. This is very low compared to other control variables. For example in the same model, a standard deviation increase in residential density resulted in score of commute distance decreasing by 0.326.

The control variable for gender performed as expected for all models and CMAs. Females commuted shorter distances than males. This is consistent with the findings of other commuting studies that attribute this result to the greater domestic and child care roles assumed by female workers which places constraint on job mobility (Hansen & Pratt, 1995).

Differences were observed between CMAs for the presence of a young child variable (presence of child less than 15 years old in household). The coefficients for all models in Montreal were significant and negative suggesting that primary maintainers with young children travel shorter distances to work. This contradicts the work of (Shearmur, 2006) who found increases in distance when a young child was present in a household in

Montreal. Shearmur's study however included all people living and working in Montreal whereas this study only includes primary maintainers who are homeowners. These sample differences may account for the difference. The coefficient for Toronto was significant at the 95% level for the control model but presented as insignificant in the subsequent models and Vancouver was insignificant at the 95% level for all models. It is possible that the insignificance of the variable for Toronto and Vancouver is partially a result of the chosen sample. The sample selection criteria of using only primary maintainers resulted in an uneven distribution of males and females. There were more male primary maintainers of households than females. The percentage of females in each Sample 1 ranged from a low of 31% (Toronto) to a high of 37% (Montreal). The percentages for Sample 2 ranged from a low of 29% (Toronto) to a high of 31% (Montreal). Had the distribution been more even perhaps the associations between gender and commuting that are discussed above would have presented themselves.

The results for the urban form variable "residential density" presented the most interesting results with respect to the magnitude of the control coefficients. The coefficients for residential density were consistently negative and significant for all models and CMAs. This is evidence of decreasing commute distances with higher residential densities. This predictor variable also presented consistently with the greatest (in magnitude) coefficient among the control variables for all models. A possible explanation for these results is that residential density serves as a good proxy for urban form with low residential density (housing density) equating to sprawl, and compared to more urban and dense environments, sprawled development result in longer commuting distances. The results also raise the question of whether or not higher densities are a reality that needs acceptance in order to be closer to one's work.

The influence of workplace residential density was positive with commute distance for all three CMAs, but the magnitude of the coefficient was lower than for residential density. Given the strong influence that the location of the workplace has on commute

time (Crane, 2007) it was expected that this would also translate to commute distance, however this was not the case. Upon further reflection the inclusion of a third urban form variable that classified the density relationship of the home-work commute as a change in density between the two locations (a type of density gradient) may have yielded a more accurate representation of home-work link urban form. Following this thinking the home-work link density would be classified as low to low (low density residential to high density workplace), high to high, low to high or high to low.

Education and occupation did not perform as expected. Higher status occupations (those requiring a higher level of education) have been associated with high wages and result in longer commute distances (Gordon et al., 1989). However, with the exception of science occupations all occupation classes in Vancouver and Montreal had a negative influence on commute distance. Toronto presented different results for the education variables. Management, business, financial, administrative and science occupations were positive for Toronto. Sales and service occupations presented consistently for all models and CMAs which is echoed in the literature (Villenueve & Rose 1988). The influence of these occupations was negative for commute distance. For Montreal and Vancouver the magnitude of this coefficient was the second largest of the control variables (after residential density). The sign of this variable was expected. These occupations are typically associated with lower incomes and shorter commute distances. Education levels were consistently significant and positive for the categories high school, apprentice/trade and college. This was the case for all CMAs. Professional degrees were associated with negative coefficients.

The control variables for Sample 2 presented more variability and insignificance than Sample 1 (See Appendix 1Tables 4-6). The gender coefficients were as expected and consistent with Sample 1 but income for Toronto and Vancouver was insignificant at the 95% level for all but one model in Vancouver and three for Toronto. A high school education level was also insignificant for all models for Montreal which was not the case

for the larger Sample 1 models. Again, because of the variability in these models and the issues of multiple insignificant variables, the focus of the discussion below is on the results of the regression models for Sample 1.

5.3 Housing Suitability Impacts Commuting Distance

The regression models show that housing suitability is associated with commute distance for Sample 1 of each CMA. All housing suitability variables tested for Sample 1were significant at the 95% level and, with the exception of the dwelling type variables (models 2006.c), were consistently signed across the three CMAs. In this section the individual variables are discussed separately and interurban and intraurban observations based on the models are presented. Again where Sample 2 results show consistent results, they will be noted separately in the results.

5.3.1 Rooms Work/Rooms Home Ratio $\left(\frac{R_w}{R_h}\right)$

As the average number of rooms per dwelling at the workplace census tract increases relative to the number of rooms at the home (thereby increasing the ratio) the commuting distance ($\sqrt{d}$) decreases. This was the case for each CMA. With respect to the magnitude of coefficients, $\left(\frac{R_w}{R_h}\right)$ was most significant for Toronto (the ratio was the 4th largest of the variable coefficients for Toronto). For Montreal and Vancouver the magnitude of the ratio coefficient in relation to the other coefficients was much lower (11th place out of 19 variables for both CMAs).

The results for Sample 2 were consistent with those of Sample 1. The ratio negatively impacted commute distance for all CMAs. Interestingly the magnitude of the coefficients revealed differences when considering only those who work in employment centres. Vancouver's $\left(\frac{R_w}{R_h}\right)$ ratio coefficient was the second largest in magnitude of all model coefficients at -0.061. Toronto presented similarly with the third largest

magnitude of all coefficients for that CMA (-0.072). Montreal however presented a much lower relative magnitude ranking 12th (-0.026).

As indicated earlier Toronto has the greatest number of condo buildings and the continuing trend for this development type are small units with few bedrooms. When the results of the $\left(\frac{R_w}{R_h}\right)$ ratio for the employment centres are taken in consideration with both the current condo development trend of smaller units and the current suitability status that show the majority of people live in dwellings that exceed their suitability needs the case of housing size (as defined by number of rooms) as a contributor for explaining home-work link (commute distance) is strengthened.

5.3.2 Percentage of Dwelling Types at the Place of Work

The second housing suitability variable tested for its impact on commuting distance was the suite of variables representing the percentages of different types of dwellings present at the workplace. As previously mentioned each unit in Sample 1 (and thereby Sample 2) was assigned variables representing the percentage of each dwelling type located at their workplace census tract. The regression results for Sample 1 show that dwelling type at the workplace is associated with commuting distance (all coefficients were significant at the 95% level) and the results also present some interesting interurban differences.

Commuting distance increased with an increase in apartments or flats in buildings with 5 or more storeys (high-rises). This result was consistent for all Sample 1CMAs. For Toronto and Vancouver the magnitude of the coefficient was the second largest of all the model coefficients whereas Montreal's coefficient was the lowest in magnitude of all significant coefficients signalling the first observed interurban difference between the metropolitan regions. This effect may be a result of the continuing trend for both Toronto and Vancouver that are seeing much more condo development than Montreal and it's possible that people are avoiding high rises to some extent. Another difference

between the CMAs were the coefficients for single detached housing. Montreal's coefficient was negative and had the coefficient with the second greatest magnitude (other than residential density). Vancouver and Toronto were both positive, indicating for these two CMAs an increase in commute distance with increasing percentage of this dwelling type at the place of work. Given the general preference for single detached housing, particularly in the case of home-ownership, this result was surprising.

5.3.3 Percentage of Same dwelling Type

As the percentage of the same dwelling type increases at the place of work, commuting distance decreases. Each unit in Sample 1 was assigned a variable representing the percentage of the same dwelling type (percentage of equivalent dwelling type that they currently occupy) at their place of work census tract. The results for Sample 1 were consistently negative across all CMAs, and the magnitude of the coefficients were strong (second highest coefficient for Montreal, 4th for Toronto and 3rd for Vancouver). One possible explanation is that the result represents an affinity on behalf of the Sample to occupy the current dwelling type they reside in and as a result when that dwelling type is underrepresented at their place of work, they accept the trade-off of commuting further distances in order to obtain that form of housing. The univariate analysis showed that single-detached housing makes up the largest proportion of housing for each Sample (in each CMA) and single-detached housing remains today the most desired dwelling type for Canadians (CMHC- Observer 2013).

These results, common across CMAs, may also reflect a broader phenomenon which is the desire for a homogeneous neighbourhood housing composition. The lower the percentage of the same type of dwelling, the less homogeneous the housing stock, which for those who desire neighbourhood homogeneity may result in the acceptance of a longer commute in order to obtain it. The work of Morrow-Jones et al.,(2004) shows not only an affinity on behalf of homeowners for single detached housing but for

neighbourhoods that present this type of housing, and Rybczynsji (1998) concluded that homogeneity of housing is a desirable neighbourhood characteristic. However the question remains whether or not this is personal preference or a result of the market (Shlay (1985). Conventional suburbs are typically created in environments with the same type of dwelling and as Shlay points out "housing choice behavior may not reflect overall housing desires because these choices come in predictable packages with little flexibility" (Shlay, 1985 pg. 622).

5.3.4 Percentage of Suitable Housing

The lower the percentage of suitable housing at the workplace (based on minimum suitability requirements), the greater the commute distance. This was the resounding theme of the last model testing the impact of housing suitability at the workplace on commute distance. This variable, defined according to CMHCs definition of housing suitability was consistently negative for its impact on commuting distance for all CMAs and with the exception of Vancouver Sample 2, the coefficients were significant at the 99.99% level.

These results were not unexpected. Obtaining a home that accommodates (by number of bedrooms) the household members is a realistic goal and as expected if the housing at the workplace does not accommodate the household, the household would locate elsewhere and accept the commute. This is supported by the samples that showed a very small percentage of households resided in homes that did not meet these suitability needs. What was surprising was the relatively low magnitude of the coefficients. In relation to the control variables the coefficient for the percentage of suitable housing at the workplace was quite low (second lowest coefficient for Montreal, and third lowest for Vancouver). In Toronto the coefficient had the 8th highest value (out of 19 significant variables). This distinction for Toronto suggests that suitability is a greater determinant of commute distance than for the other CMAs.

6. Employment Centres are Incongruent for Suitable Workforce Housing Provision

The second quantitative method in this thesis explores housing suitability congruence between the employment centres of each CMA and their respective workforces. The current housing of the workforce for each employment centre (classified by both dwelling type and by number of bedrooms) is aggregated and compared to the owned housing stock at their place of work (in this case place of work is a designated employment centre).

6.1 Incongruent Dwelling Types

As a result of not meeting the minimum cell count frequencies required by the SWORDC five employment centres have been excluded in this section of the analysis which compares housing of the home-work link by dwelling type. The Toronto CMA employment centres; Toronto (Lawrence Park/Sunneyside), Toronto (Scarborough Junction) and Milton, and the Montreal employment centres; Montreal and Montreal (Pointes-aux-Trembles) had one or more dwelling type frequencies that did not meet the minimum requirements of the SWORDC. The normal course of action is to combine categories to meet the minimum frequency requirements, however the combining of categories (dwelling types) in these specific cases were not meaningful from an analytic standpoint so these employment centres have been omitted from the analysis. The comparative analysis of the remaining employment centres is discussed in the following sections and reveals a number of commonalities and differences between CMAs.

6.2 **Incongruence of Single Detached Housing Present in the Central Business Districts**

Not surprisingly the ratio for single detached homes in the CBDs of each CMA was the lowest of all the employment centres (See Figures 6.1 to 6.3). As the single most occupied dwelling type by the workforce of each CBD this result re-affirms that there are challenges in using planning strategies focused on reducing commuting distances by increasing densities. Higher-density dwellings are not typically in the form of single detached housing.

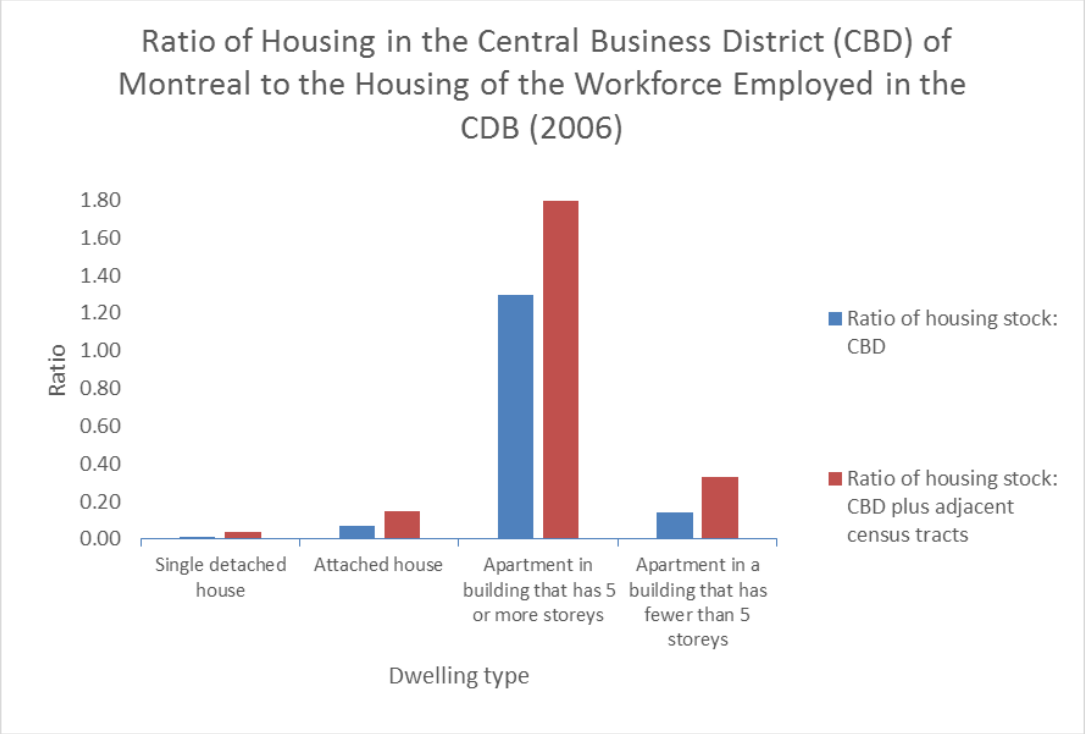


Figure 6.1 Ratio of housing in the CBD of Montreal to that of its workforce (by dwelling type)

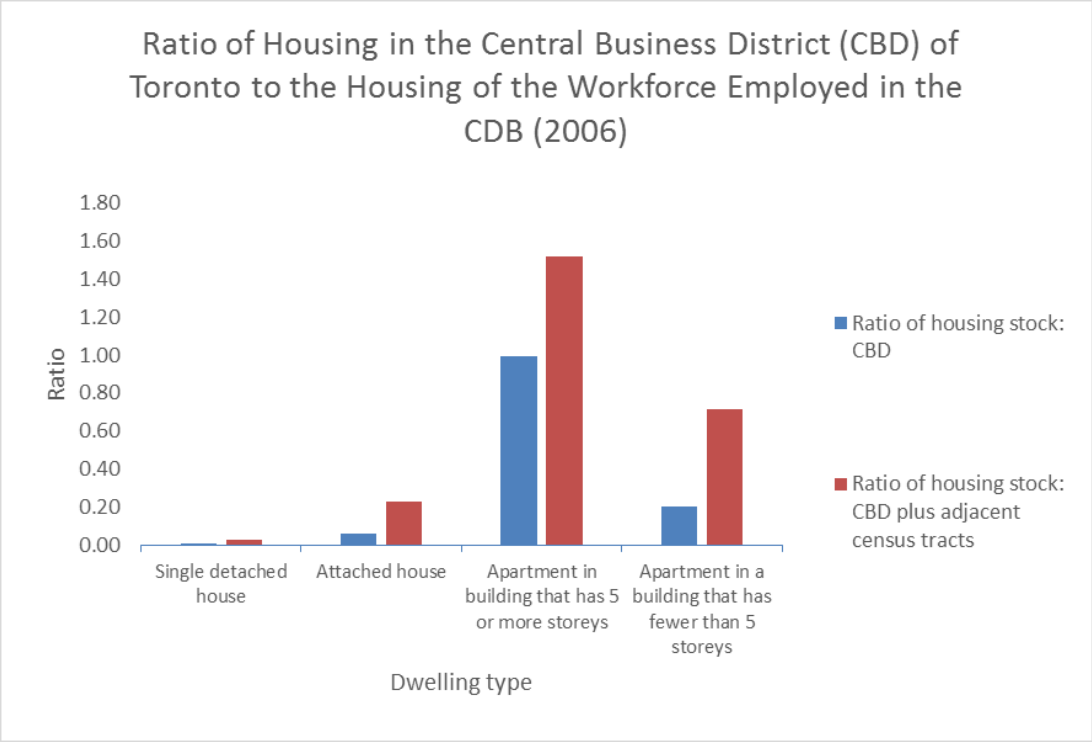


Figure 6.2 Ratio of housing in the CBD of Toronto to that of its workforce (by dwelling type)

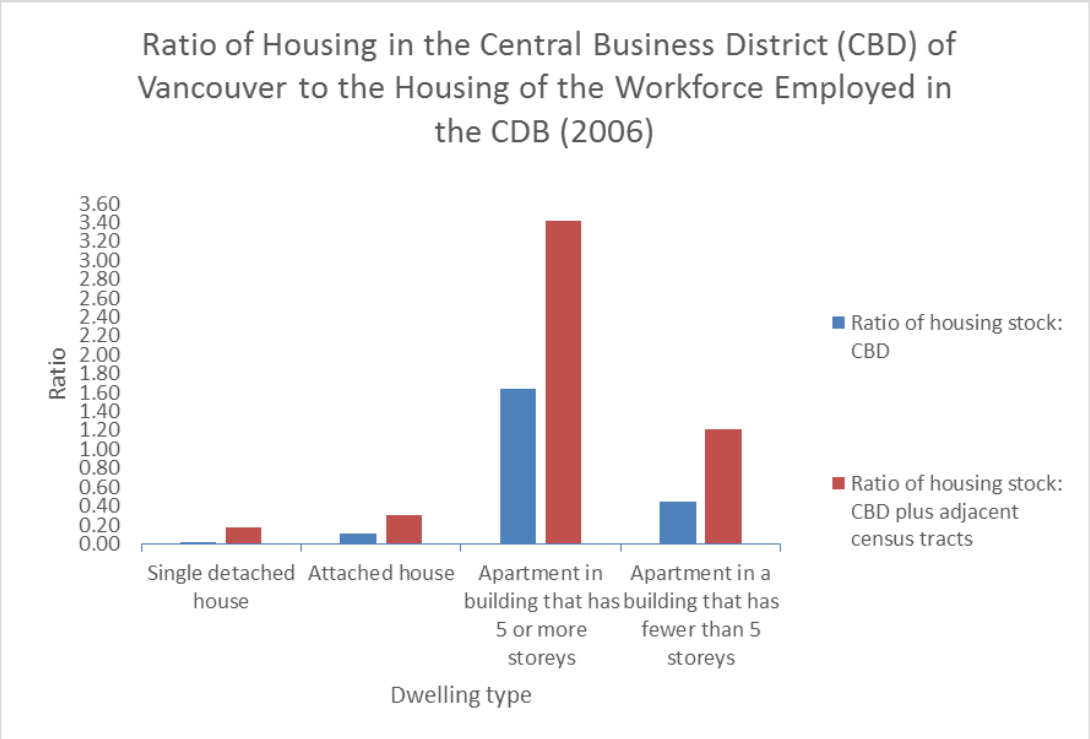


Figure 6.3 Ratio of housing in the CBD of Vancouver to that of its workforce (by dwelling type)

Even with the inclusion of the adjacent census tracts this ratio increases only slightly (to a high of 0.18 for Vancouver CMA). The adjacent census tracts were included in the analysis to account for the fact that a certain amount of commuting is generally accepted by people travelling to work. The low ratios for single detached housing when the adjacent census tracts are included are signals of the requirement of CBD employees to commute greater distances in order to obtain single detached housing, and these resulting distances may generate a negative utility with respect to commuting. However, CBDs are the employment centres most likely to be serviced by public transit so whether or not the acceptable commute boundary for the CBD can be extended beyond the point defined here (using adjacent census tracts) is also a consideration. All three study CBDs have public transit systems that extend in multiple directions from their CBD.

One expectation with respect to housing in the CBDs was a greater proportion of high-rises than any other dwelling type, based on the prevailing development trend of high-density condo development in downtown cores. Defined in the thesis as an "Apartment in building that has 5 or more storeys", the results were aligned with expectations. In each CMA this dwelling type surpassed the others in terms of units and presented with the highest ratios (See Figures 6.1 to 6.3). Both Montreal and Vancouver had ratios above one indicating that the housing stock compared to that of its respective workforce exceeded in number of units what would be required to house its respective workforce. Toronto presented absolute congruence with a value of 1.00. When the adjacent census tracts were included the ratios rose higher. Vancouver stood out with the highest ratio of 3.42 when including the housing in the adjacent census tracts. This suggests that in the Vancouver CBD an excess of high-rise development is present compared to the stated preference (defined by comparable dwelling type) of the workforce. These results for the CMA are however unique to this dwelling type. The other dwelling types (single detached house, attached house and low-rise apartments) presented incongruence with ratios below 1.00 even with the inclusion of housing in the adjacent census tracts.

6.3 **Low Provisions of Single-Detached Housing Across CMA Employment Centres**

The incongruence presented in the ratios for single-detached houses were not isolated to the CBDs. The employment centres in all three CMAs with the exception of three in Toronto had low ratios (less than 1.00) for single detached houses (see Figures 6.4 to 6.6). This was the dwelling type most occupied by the workforce of every employment centre in terms of number of units. Only Markham City Centre, Toronto (York Mills/Don Mills), and Vaughan/Toronto presented ratios greater than 1.00. These employment centres are considered more suburban which may account for the high ratios.

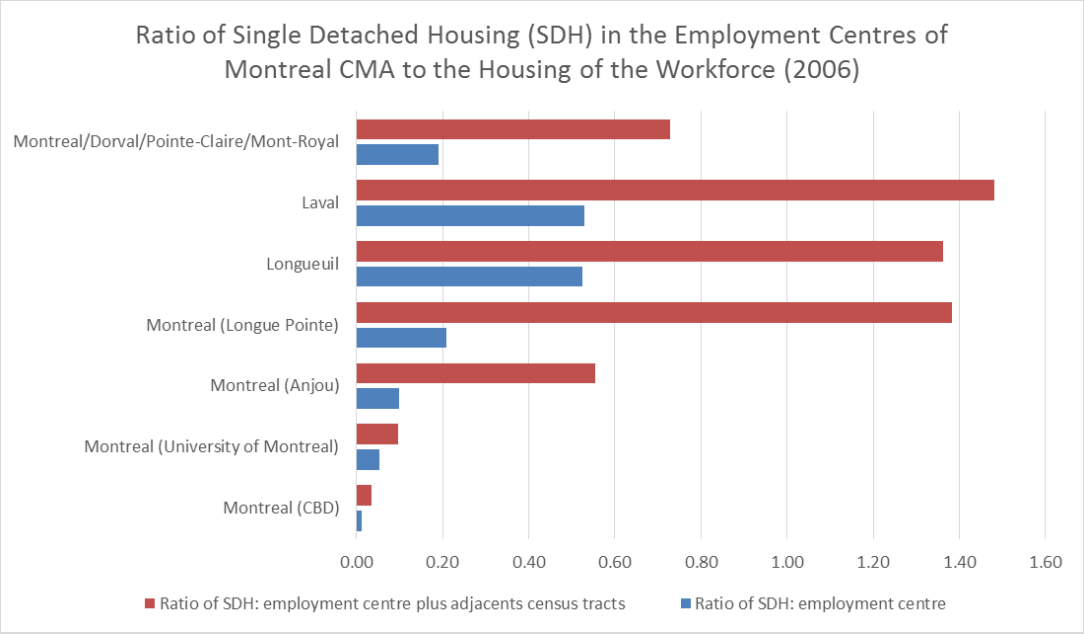


Figure 6.4 Ratio of single detached housing in the employment centres of Montreal to that of their workforce

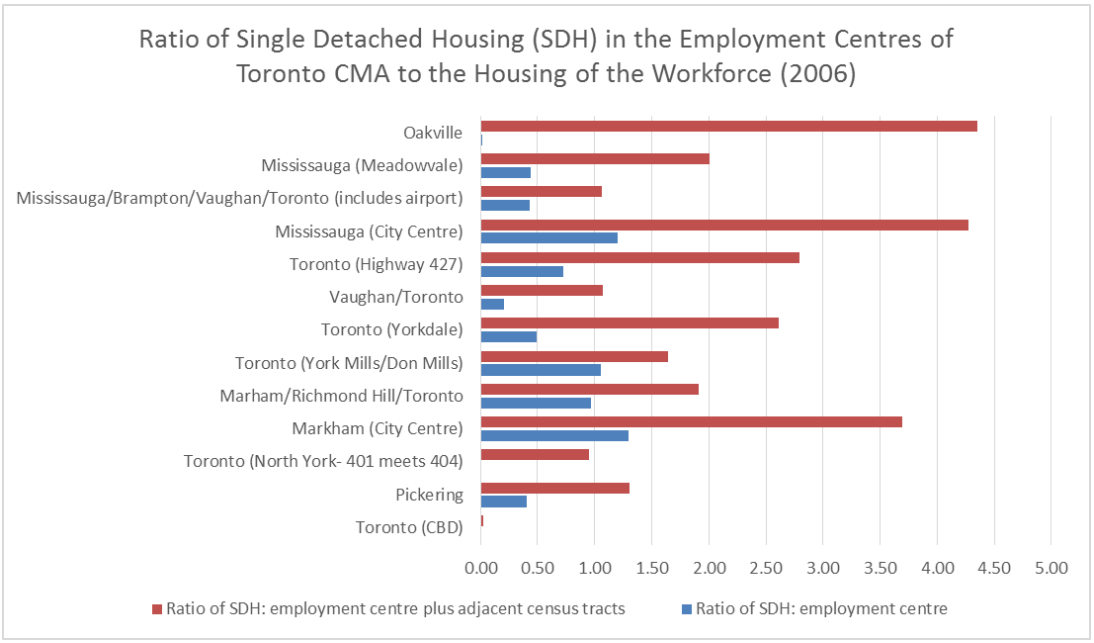


Figure 6.5 Ratio of single detached housing in the employment centres of Toronto to that of their workforce

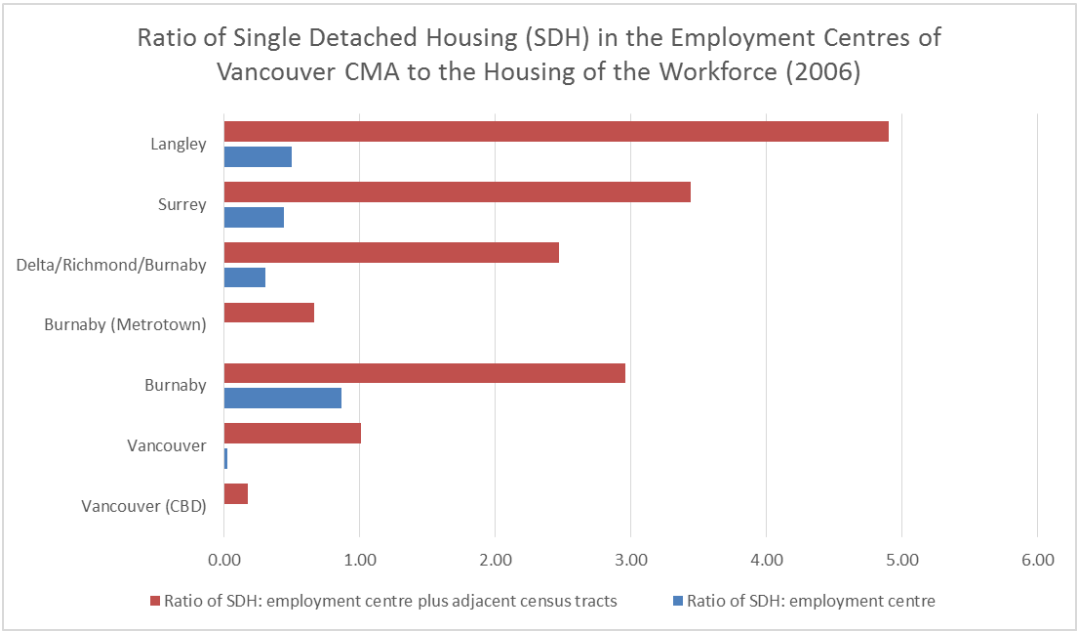


Figure 6.6 Ratio of single detached housing in the employment centres of Vancouver to that of their workforce

Taking into consideration the single detached housing stock of the employment centre plus the adjacent census tracts greatly improves the ratio for stated preference based on dwelling type. Excluding the CBDs from the analysis (it has already been shown that aside from high-rise development all other dwelling type ratios fall short of housing suitability requirements in the CBDs) only one Toronto employment centre (Toronto (North York- 401 meets 404) remains below 1.0 and it comes close at 0.95. This means that the housing provision required to meet the apparent housing preferences of the workforce is located within a reasonable commuting distance. Again, a reasonable commuting distance was defined as the geographic area represented by the employment centre plus the adjacent census tracts.

Montreal and Vancouver employment centres see their ratios improve as well. In Montreal (aside from the CBD) only the employment centres Montreal (Anjou) and Montreal (University of Montreal) remain below 1.0. A possible explanation for the Montreal (University of Montreal) employment centre may be related to a concentration of student housing and less family or residentially owned housing within the centre. This brings up an important point in terms of housing suitability within the home-work link. There may exist employment centres whose primary use or nature of employment are not conducive to residential development, and therefore the workforce must accept a commute to their workplace. Certain light industrial, or commercial employment centres may not attract the residential development or may be zoned to prevent residential development within close proximity.

The other two dwelling types; attached housing and apartments in buildings with less than 5 storeys presented similar stories across CMAs. The ratio for both dwelling types were for the most part below 1.00 in the employment centres. The ratios also increased (with the exception of the CBDs, the Montreal (University of Montreal) and Vancouver employment centres) to values above one when the housing in the adjacent census tracts was included.

6.4 Employment Centre Differences with Respect to Housing Congruence by Dwelling Type

A number of employment centres presented interesting individual findings with respect to housing congruence. Both Montreal (Anjou) and Mississauga City Centre had three of their four dwelling types with ratios greater than 1.0 highlighting a close match between the housing of the employment centres and their workforce. When the adjacent census tracts were included the ratios for these two employment centres increased to values above 1.00 for the high-rise dwelling type. Montreal Anjou which already had a ratio of 16.4 increased to 48.3 with the inclusion of high-rises in the adjacent census tracts. Mississauga City Centre and Burnaby (Metrotown) also presented outliers for the high-rise ratio when including the housing stock in the adjacent census tracts (24.07 and 18.51 respectively). Burnaby (Metrotown) contains the largest shopping and entertainment district of the province and is on a SkyTrain route which may explain the strong results here. A final observation was the total absence of particular dwelling types from a number of employment centres (See Table 6.1).

Table 6.1 Employment centres with one or more dwelling types absent

CMA	Employment Centre Code	Employment Centre name	Dwelling Types with 0 Units of Housing Stock in the Employment Centre
Montreal	2	Montreal (University of Montreal)	Apartment in building that has 5 or more storeys*
Montreal	6	Montreal (Longue Pointe)	Apartment in building that has 5 or more storeys
Montreal	7	Longueuil	Apartment in building that has 5 or more storeys
Toronto	3	Toronto (North York- 401 meets 404)	Single detached house Apartment in a building that has fewer than 5 storeys
Toronto	9	Toronto (Yorkdale)	Apartment in building that has 5 or more storeys
Toronto	14	Mississauga (Meadowvale)	Apartment in building that has 5 or more storeys
Toronto	15	Oakville	Attached house Apartment in building that has 5 or more storeys Apartment in a building that has fewer than 5 storeys
Vancouver	2	Vancouver	Attached house
Vancouver	3	Burnaby	Apartment in building that has 5 or more storeys
Vancouver	4	Burnaby (Metrotown)	Single detached house Attached house
Vancouver	6	Surrey	Apartment in building that has 5 or more storeys*
Vancouver	7	Langley	Apartment in building that has 5 or more storeys*

Note: Dwelling types marked with "*" were not present in the housing stock when the adjacent census tracts were included

From a stated preference for dwelling type the absence of these dwelling types is relevant if the employed workforce of the employment centres live in this type of dwelling and are unable to find comparable housing within a comfortable commuting distance (again measured as the geographic area comprising the employment centre and the adjacent census tracts). This is the case for the employment centres of Montreal (University of Montreal), Surrey and Langley. The ratios when including the adjacent census tracts for the dwelling type "Apartment in building that has 5 or more storeys" remains at zero for all three employment centres. To find comparable dwelling types the workforce for these centres currently living in high-rises must endure further commutes. The immediate concern this presents is questionable. A closer examination of the data shows that the percentage of the overall workforce population living in high-rises are quite low compared to the other dwelling types for these employment centres. For Montreal (University of Montreal), Surrey and Langley the percentage of the workforce living in owned high-rise dwellings is only 4.0%, 1.7% and 1.2% respectively. This however could change with the demographic shifts that are moving towards a rise in non-traditional households who may be seeking this dwelling type.

6.5 Incongruent Dwellings by Number of Rooms

In the previous analysis the existing owned housing stock of the employment centres was compared to the currently owned housing of the respective workforce of those centres, based on the dwelling type. Using this same spatial arrangement the comparative analysis is repeated a second time but instead of differentiating by dwelling type the housing stock is differentiated by number of bedrooms. Ratios comparing the housing between the two locations are first calculated using the geographic boundaries of the employment centres and again for the area encompassed by the employment centres and their adjacent census tracts.

Differentiating housing by the number of bedrooms extends the discussion from the previous analysis which focused more on housing congurance based on housing type preference to one that strictly adheres to CMHC's definition of housing suitability. Using the CMHC's definition of housing suitability each unit in Sample 2 has been assigned a variable representing the number of bedrooms required by the household to meet the minimum suitability requirements. The results of this analysis are presented in Appendix 5 to 7 and discussed in the following section.

Differentiating housing by the number of bedrooms resulted in a need to combine some housing categories. The frequency requirements of the SWORDC require that unweighted frequencies meet a minimum of 4 cell count and weighted frequencies meet a cell count of at least 10. As a result 0 bedroom and 1 bedroom housing units have been combined into one category "0 and 1 bedrooms". This issue also presented itself with larger numbers of bedrooms. To maintain the integrity of the data, while still allowing for effective analysis the maximum category for number of bedrooms was set to "greater than or equal to 5 bedrooms". Some employment centres did not meet the requirements for this category and for these employment centres the maximum number of bedrooms is "greater than or equal to 4". The employment centres; Vancouver (CBD), Burnaby (Metrotown) and Surrey had to have their categories combined further because of their cell counts. Finally three employment centres for the Toronto CMA; employment centre 5- Scarborough Junction, 8-Lawrence Park/Sunnyside and 16-Milton) were not included the analysis. To include them would require the combining of multiple categories which would render the analysis based on the number of bedrooms meaningless.

6.6 The Significance of the Three Bedroom Home

The data revealed a number of reasons to discuss the three bedroom home with respect to housing suitability. The three bedroom home is the most occupied dwelling type for the workforces of all the employment centres. It is one of the two most prevalent dwelling types

in all employment centres (excluding the CBDs), and while not sufficient in numbers within the employment centres, it tends to be attainable within an acceptable commuting distance of them. The proportion of three bedroom housing currently occupied by Sample 2 (employed, primary maintainers, homeowners, commuting to and working in an employment centre) range from a low of 27.5% for Vancouver CBD to a high of 51% for Montreal. In the Montreal CMA the percentage is significantly higher for all employment centres with a low percentage of 43.6% for the CBD. No employment centre achieved congruence for three bedroom dwellings. However, the picture greatly improved when the adjacent census tract housing was included. With their inclusion only 3 employment centres (aside from the CBDs) remain below the congruence level of 1.0. They include; Montreal/Dorval/Pointe-Claire/Mont-Royal, Montreal (Longue Pointe), Mississauga/Brampton/Vaughan/Toronto (includes airport), and Burnaby (Metrotown).

6.7 Number of Bedrooms in the Central Business District (CBD)

The CBDs of each CMA share two commonalities. They are the employment centres with the largest workforce in each CMA and they each contain more "0 and 1 bedroom" dwellings than any other employment centre. The high quantities of "0 and 1 bedroom" dwellings make sense given the level of condo development in these centres which is characterized by a smaller number of bedrooms. Interestingly both Montreal and Vancouver CBDs have more dwellings with 2 bedrooms than 0 and 1 bedrooms. The Toronto CBD has more 0 and 1 bedroom dwellings than any other dwelling type. In Toronto "0 and 1 bedroom" units comprise 43% of all owned dwellings. In Montreal and Vancouver this percentage is lower 27.14% and 36% respectively.

The CBDs fall short with respect to housing congruence in every bedroom category when compared to the housing of the workforce employed there (see Figures 6.7-6.9). The ratios increase across all categories when the adjacent housing tracts are included but only

the “0 and 1 bedroom” unit category for Toronto and Vancouver and the 2 bedroom unit category for Toronto see ratios above 1.00. As the most concentrated employment centres, an acceptable commuting distance still results in added traffic congestion and environmental problems if the commute is done by car.

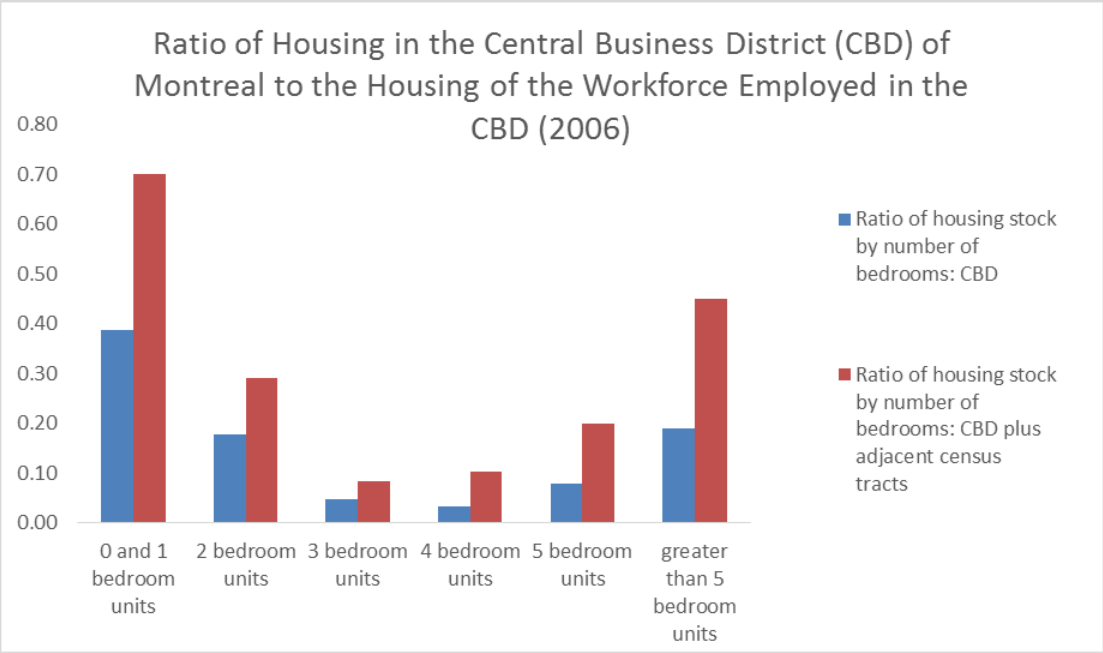


Figure 6.7 Ratio of housing in the Montreal CBD to that of its workforce (by number of bedrooms)

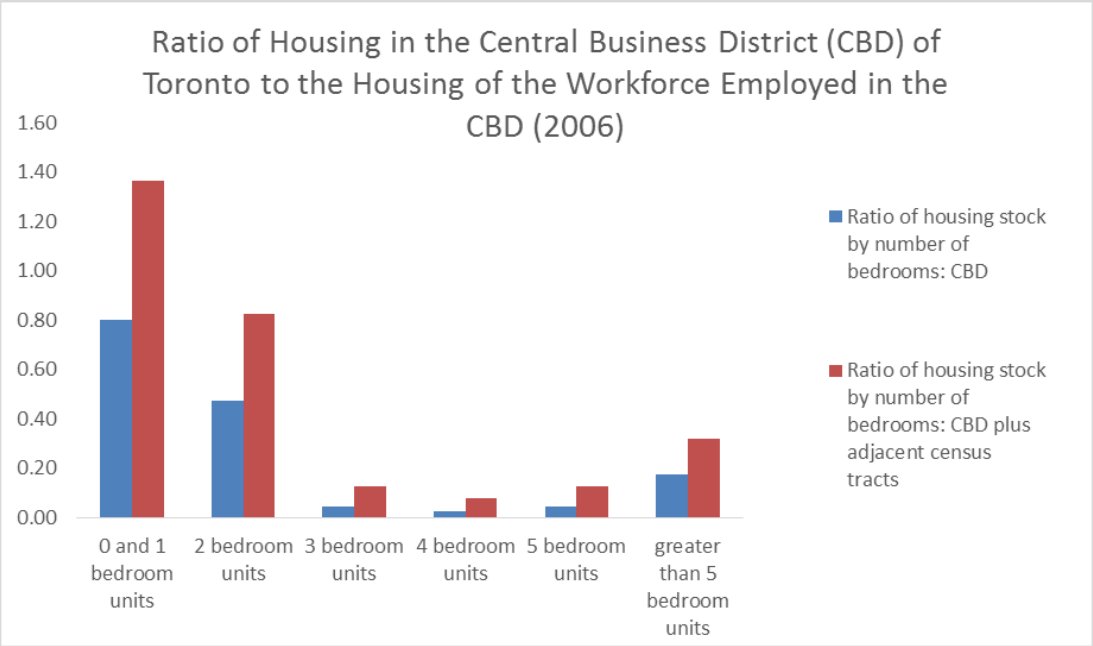


Figure 6.8 : Ratio of housing in the Toronto CBD to that of its workforce (by number of bedrooms)

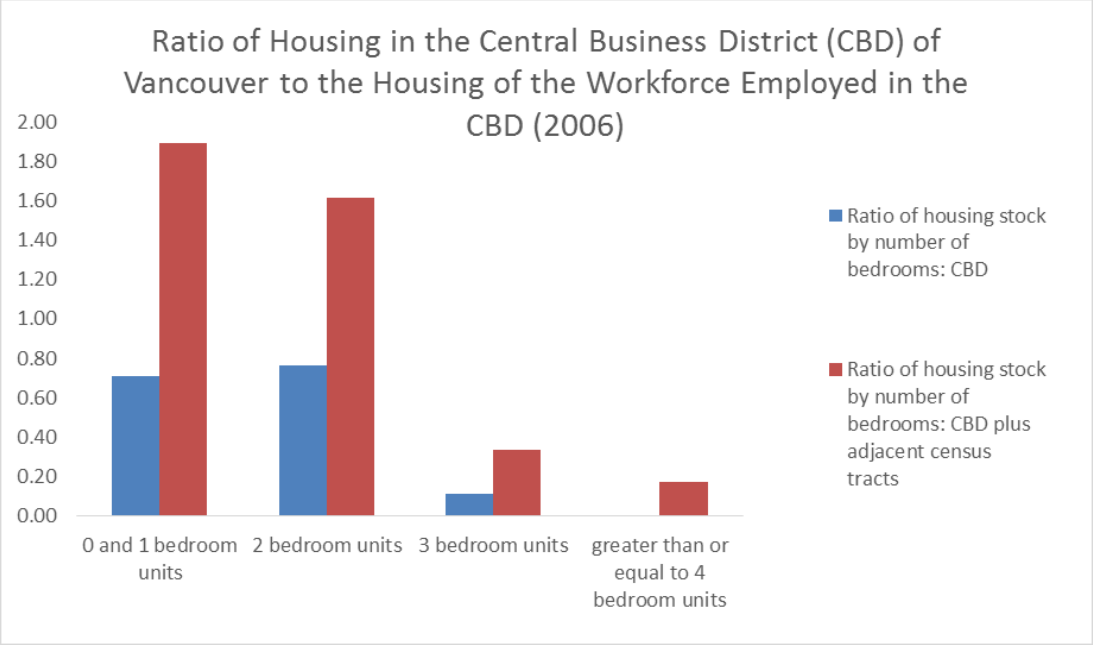


Figure 6.9 Ratio of housing in the Vancouver CBD to that of its workforce (by number of bedrooms)

6.8 **Congruence at an Acceptable Commuting Distance**

Excluding the CBDs, the inclusion of the adjacent census tracts reveals congruence for the majority of the other employment centres in most bedroom categories. This suggests that the workforce could find comparable housing based on dwellings with the same number of bedrooms close to their place of employment. There are a few exceptions. Once again suitable housing is not found near the Burnaby (Metrotown) employment centre. As a major employment centre for sales and services positions there remains little choice but to accept longer commutes to this employment centre.

6.9 Minimum Suitability Requirements Misaligned with Current Housing Stock

The ratios comparing the housing of the employment centres to what is needed to suitably house their respective workforces (based on the minimum suitability requirements) presents incongruence at both ends of the bedroom scale. The previous discussion showed that the greatest percentage of the workforce of each employment centre live in three bedroom dwellings, and yet the stock of the employment centres does not contain the matching provision of three bedroom dwellings. The analysis of the minimum housing suitability requirements reveals that the housing stock needed to meet the housing suitability requirements is not the three bedroom home that dominated the previous discussion. Aside from the CBDs and the Burnaby (Metrotown) employment centres there is a sufficient supply of three bedroom housing units to meet the suitability requirements of the workforce with the inclusion of the adjacent census tracts, and for many employment centres the supply of three bedroom housing exceeds what is actually needed to meet minimum suitability requirements. For example the ratio (with the inclusion of the adjacent census tracts) for Pointe-aux-Tremble in the Montreal CMA is 7.25 signalling an excess of three bedroom homes compared to households requiring this dwelling.

Housing incongruence is also prevalent for the lower bedroom categories, particularly the "0 and 1 bedroom" and 2 bedroom homes when measuring minimum suitability requirements. With the exception of one employment centre (Vaughan/Toronto), the greatest housing categories needed to suitability house the workforce and their households were 0 and 1 bedroom or 2 bedroom units. This aligns with the demographic shifts previously discussed for each of the study CMAs that are experiencing both an increase in single person households and declining household sizes. The CBDs that previously fared positively for congruence of the smaller bedroom categories, meaning that the stock of "0 and 1" and 2 bedroom housing was close to that of the workforce currently occupying these dwellings, now experiences significant incongruence under the minimum suitability criteria.

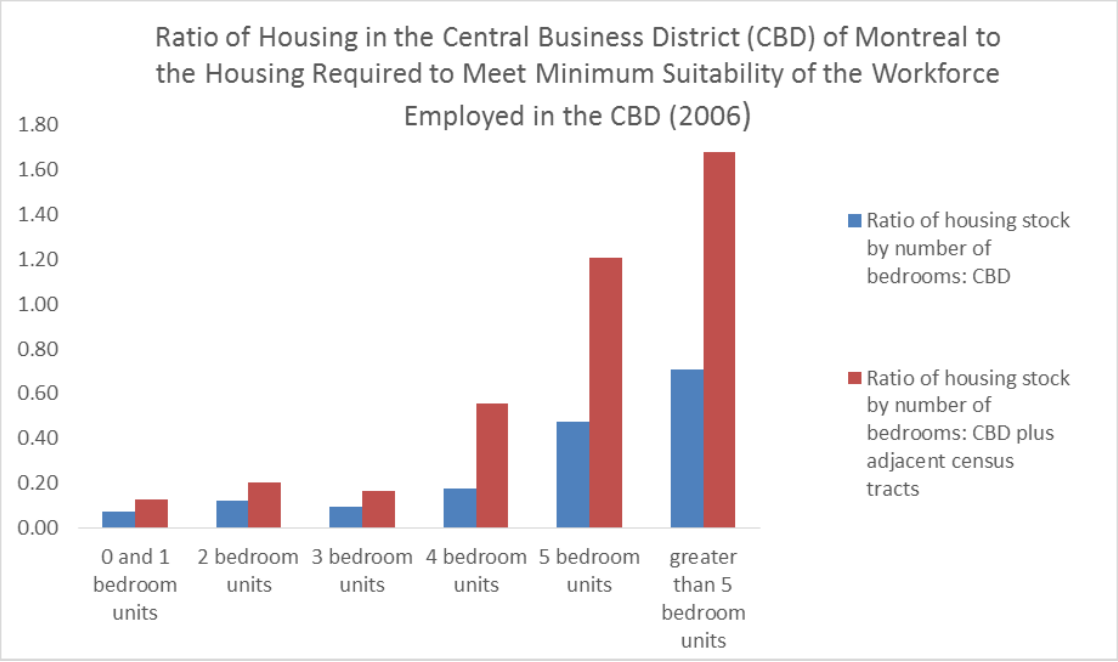


Figure 6.10 Ratio of housing in the CDB of Montreal to the housing required to meet minimum suitability of the workforce

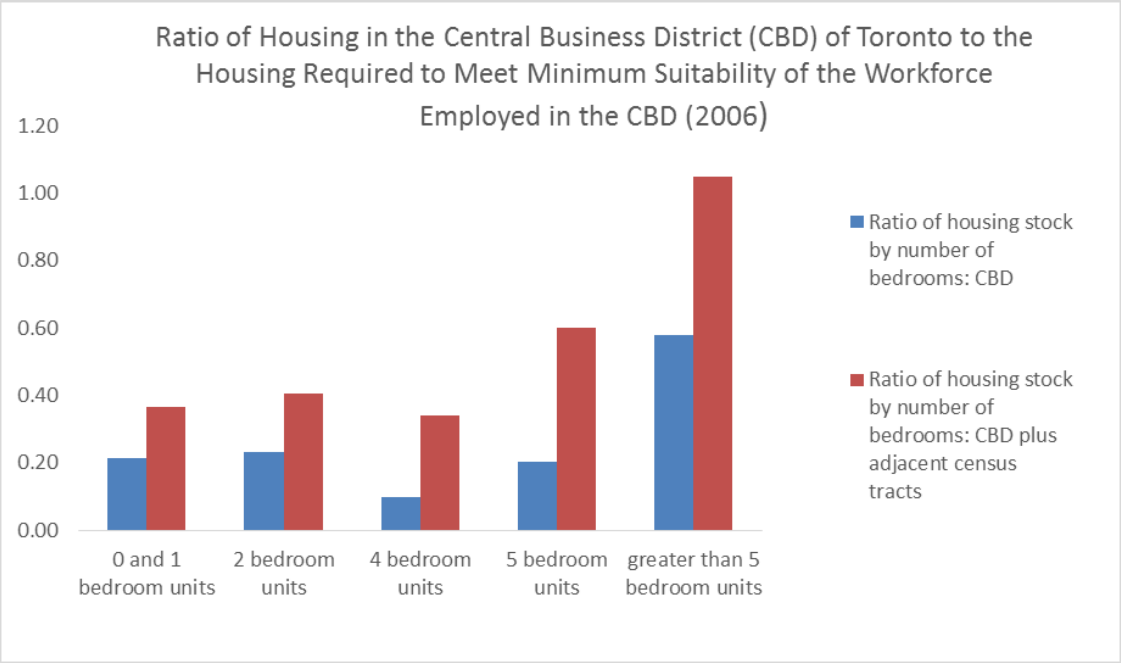


Figure 6.11 Ratio of housing in the CDB of Toronto to the housing required to meet minimum suitability of the workforce

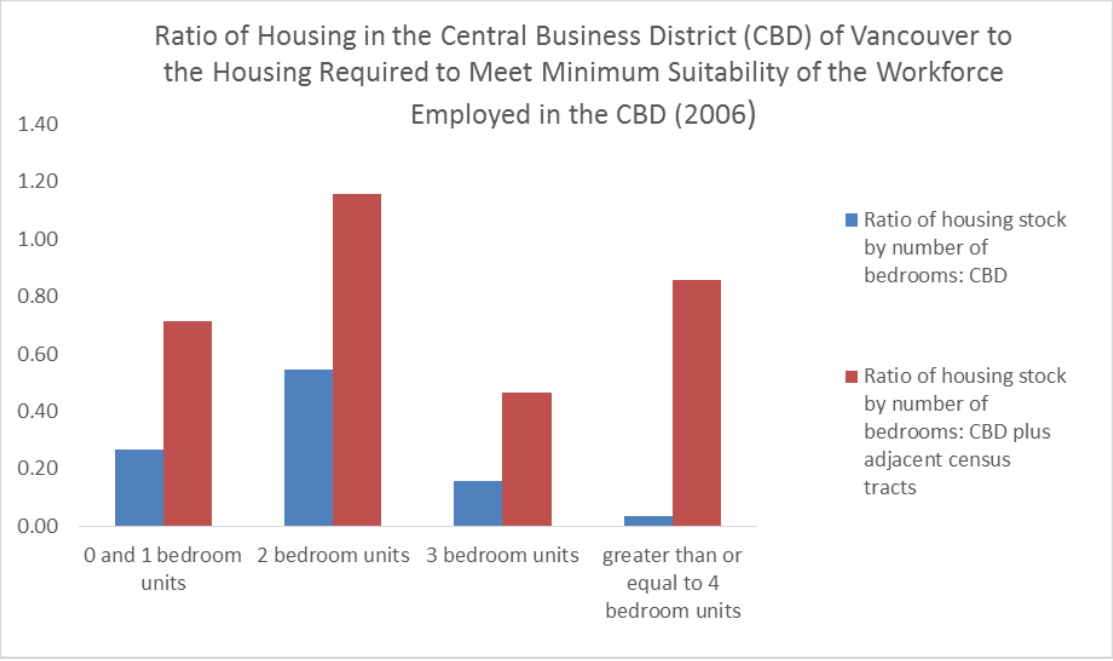


Figure 6.12 Ratio of housing in the CDB of Torontol to the housing required to meet minimum suitability of the workforce

6.10 Exceeding Suitability Requirements

Incongruence in terms of excess supply of dwellings with a higher number of bedrooms was a prevalent theme for the employment centres. This pattern is present to some extent in the employment centres where the ratios for most 3 or 4 bedroom categories begin to pass the absolute congruence level of 1.0 indicating for these employment centres the provision of 3 and 4 bedroom homes is in eccess of what is needed to house the employees and their families. The inclusion of the adjacent census tracts amplifies the effect. With their inclusion the ratio of housing available to what is needed to minimally house the workforce households exceeds 1.0 for every housing category equal to or greater than 3 bedrooms. This is the case for every employment centre in each CMA except for the CBDs and Burnaby (Metrotown). In a few distinct cases the ratios greatly surpass the minimum requirements. Examples include Pointe-aux-Trembles in Montreal CMA with ratio values reaching as high as 20.41 for 4 bedroom units and 35.75 for 5 bedroom units, and Burnaby in Vancouver CMA that sees ratio values of 51.3 and 34.86 for 5 bedroom and greater than 5 bedroom housing. These examples highlight the excess of larger homes compared to the needs of the respective workforce.

7. Giving Housing Suitability Due Consideration in the Process of Attempting to Achieve the Principles of Smart Growth

The prerequisite to a discussion of how to give housing suitability due consideration is a justification for considering it in the first place. What this research has revealed (based on the analysis of micro-level census data) is that housing suitability from the spatial arrangement of the home-work link, holds significance. The regression analysis concluded that it impacts the proximity to the workplace and the comparative housing analysis of the employment centres identifies areas of incongruence of the housing provision of the employment centres compared with their respective workforces. Having validated the need to consider housing suitability the question then is how these findings can be used in attempting to implement and achieve the principles of Smart Growth. In this section, based

on the analysis, three ideas are discussed; reinforcing the need for a metropolitan scope, how the demography- workforce housing mix is at odds with one another with respect to housing suitability and the challenge that is presented with society's present relationship with housing size and space.

7.1 Housing Suitability: Reinforcing the Need for a Metropolitan Wide Scope

One of the challenges referred to repeatedly in the literature and relevant to housing suitability that makes the implementation of Smart Growth policies difficult is the lack of metropolitan scope. The importance of a metropolitan scope with respect to Smart Growth implementation is not a new idea. In their 2007 study, Filion and McSpurren looked at the capacity of increasing residential density in order to increase public transit use (a pinnacle of the Smart Growth agenda). They concluded that without a concerted effort on behalf of the multiple jurisdictions and stakeholders involved, the efforts to increase public transit use falls short of goals. These findings are relevant and applicable to housing suitability for three reasons. First, as has been repeatedly demonstrated in this thesis both through the research and the literature, housing suitability is one of many inter-related components comprising the home-work link. With connections to transit, commuting distance and housing composition among other factors, it is reasonable to assume that like the case of Filion and McSpurren, without the buy-in of all relevant stakeholders any consideration of housing suitability within the home-work link will fail in implementation. One of the challenges that Filion and McSpurren identify in their study for fulfilling the Smart Growth principle of higher density residential development is public opposition to this type of development. If the increase of residential density is not balanced and distributed in a well thought out way across the metropolitan region, the goals of bringing people and jobs within closer proximity is upheaved by the mobility of the workforce. This is the second reason why housing suitability requires a metropolitan scope. The regression analysis shows that people commute father distances when the type of housing they live in is in low quantity. Progress in reducing commute distances will be hindered if the development of higher density is not taken into context of the metropolitan area. The analysis shows the potential to increase commute distances if certain areas choose not to increase densities. This is not to say that there is an easy solution and that increasing density should occur at the same rate and amount in all affected municipalities. However, it does suggest that a

broader examination of the distribution of said densities should be explored in relation to the known factors of housing suitability and commute distances. A final reason for adopting a broad metropolitan scope is that in each CMA there exist multiple employment centres and at least one employment centre that crosses multiple municipal boundaries. The polynucleation and dispersion of employment centres suggest that issues of employment, traffic, and housing as a result of these employee rich areas is already affecting multiple political areas.

7.2 Demographic Trends and Housing Stock are Out of Alignment

The results of the comparative analysis suggest that the current patterns of development are not aligned with the demography of the working population. This is a criticism common in housing related literature (Wulff et al., 2004). As the comparative analysis showed, in all three ratio measures (dwelling type, comparable number of bedrooms and minimum suitability requirements), incongruence between the housing of the workforce and that of the employment centre exists. The demographic realities which continue towards more non-traditional and smaller households are at odds with the existing housing stock. Part of the problem is the fixity of housing but the other issue is that new development continues to build for the traditional family which is declining in numbers.

7.3 A Need to Re-examination our Relationship with Housing Size

The third consideration for suitability within the Smart Growth discussion is one of the hardest to address as it requires a cultural shift in our relationship with housing size. Small households do not live in small dwellings. This is evident from the univariate analysis that shows the majority of people in each CMA living in dwellings that exceed their minimum housing suitability requirements. The regression analysis also revealed that as the house size increased at the work location, commute distance decreased. To achieve the

environmental, transportation and infrastructure benefits that Smart Growth offers requires a different mind-set and cultural shift different from the current one where the single detached, three bedroom house is the preferred choice.

8. Conclusions and Recommendations

This thesis has presented two quantitative methods to explore the role of housing suitability within the home-work link for the Canadian metropolitan areas of Montreal, Toronto and Vancouver. The first quantitative method was a series of multiple regression methods testing the impact of housing suitability on the proximity to the workplace. Four different variables representing housing suitability concluded that housing suitability does impact the proximity to the workplace. The second quantitative method which focused on the employment centres revealed that incongruence exists between the housing at the workplace and with that of its respective workforce. The results of the methods justify the inclusion of housing suitability within home-work link based discussion and identify a number of ways in which it is connected to the planning strategies of Smart Growth.

A recurring theme that was found throughout the analysis and one which resounds with current planning challenges of implementing the principles of Smart Growth in Canadian cities is a disconnect between housing suitability requirements, the existing housing stock and present demographic realities.

8.1 Recommendations & Future Research

This thesis has contributed to filling a gap in home-work link literature by exploring empirically the role of housing suitability within this spatial arrangement but there remain a number of avenues to further explore the concept. One of the challenges of having access to micro-level census master files are the seemingly endless number of questions which can be considered for analysis. This thesis focused only on home-owners but a similar analysis

studying those with a rent tenure may have revealed different findings regarding housing suitability. The possibilities from an empirical standpoint are extensive for both sample selection and variable composition. The employment centres themselves could also be analysed further from a spatial perspective to include their physical geographies.

While the empirical avenues with which to extend this thesis are extensive the nature of housing-suitability, the relationship society has with house space and the complexity of decision making that goes into choosing a residential location requires more than what can be found in a dataset and a qualitative component that addresses the willingness to move and housing preference with respect to dwelling size and type along with the empirical piece would further the understanding and role of housing suitability in the home-work link.

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APPENDIX 1: Regression Tables for Sample 1

Table 1: Regression results for the Montreal census metropolitan area for Sample 1

Model	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.125	0.126	0.1485	0.1552	0.1254
Controls					
ln income	0.014	0.005**	0.002**	0.006**	0.014
Sex	-0.067	-0.066	-0.065	-0.064	-0.067
Presence of young child	-0.010	-0.015	-0.010	-0.008	-0.008
Residential density / 100	-0.326	-0.322	-0.357	-0.332	-0.326
Workplace residential density / 100	0.051	0.045		0.009	0.051
Occupation type (processing, manufacturing and utilities = 0)					
Management	-0.052	-0.054	-0.058	-0.057	-0.052
Business/finance/administration	-0.025	-0.028	-0.044	-0.041	-0.025
Sciences	0.011	0.010	0.003**	0.002**	0.011
Health	-0.045	-0.045	-0.044	-0.044	-0.045
Social sciences/government/education	-0.063	-0.064	-0.059	-0.060	-0.063
Arts/recreation	-0.014	-0.015	-0.023	-0.018	-0.014
Sales/services	-0.073	-0.073	-0.075	-0.074	-0.073
Education (less than highschool=0)					
Highschool	0.036	0.036	0.032	0.031	0.036
Apprentice/trade	0.051	0.051	0.052	0.050	0.051
College	0.064	0.063	0.056	0.055	0.064
University	0.050	0.047	0.033	0.034	0.050
Professional degree	-0.015	-0.016	-0.016	-0.017	-0.015
Graduate degree	0.024	0.022	0.009**	0.010	0.024
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.035			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			-0.167		
% of attached housing units			-0.008*		
% apartments or flats in building: 5 or more storeys			0.008*		
% same dwelling type				-0.180	
% suitable housing					-0.009

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 100,475 (unweighted Sample 1 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (575,375). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

Table 2: Regression results for the Toronto census metropolitan area for Sample 1

Model	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.0996	0.1023	0.1070	0.1029	0.1009
Controls					
ln income	0.039	0.026	0.031	0.040	0.041
Sex	-0.083	-0.081	-0.085	-0.084	-0.083
Presence of young child	0.006*	0.001**	0.005**	0.005*	0.010
Residential density / 100	-0.253	-0.242	-0.262	-0.255	-0.250
Workplace residential density / 100	0.024	0.012		0.009	0.029
Occupation type (processing, manufacturing and utilities = 0)					
Management	0.029	0.025	0.022	0.029	0.029
Business/finance/administration	0.011	0.007*	-0.003**	0.008*	0.011
Sciences	0.053	0.052	0.045	0.052	0.052
Health	-0.017	-0.018	-0.018	-0.017	-0.018
Social sciences/government/education	-0.026	-0.028	-0.027	-0.025	-0.027
Arts/recreation	-0.009	-0.010	-0.013	-0.010	-0.009
Sales/services	-0.037	-0.039	-0.041	-0.037	-0.038
Education (less than highschool=0)					
Highschool	0.047	0.048	0.045	0.047	0.047
Apprentice/trade	0.040	0.040	0.040	0.041	0.040
College	0.089	0.089	0.086	0.089	0.088
University	0.012*	0.014	0.003**	0.010**	0.012*
Professional degree	-0.030	-0.029	-0.030	-0.029	-0.030
Graduate degree	-0.012	-0.012	-0.020	-0.015	-0.013
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.056			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			0.049		
% of attached housing units			0.068		
% apartments or flats in building: 5 or more storeys			0.162		
% same dwelling type				-0.060	
% suitable housing					-0.037

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 156,590 (unweighted Sample 1 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (806,433). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

Table 3: Regression results for the Vancouver census metropolitan area for Sample 1

Model	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.0852	0.0858	0.0927	0.0877	0.0855
Controls					
ln income	0.044	0.039	0.040	0.046	0.044
Sex	-0.075	-0.074	-0.073	-0.075	-0.074
Presence of young child	0.006**	0.003**	0.006**	0.006**	0.008**
Residential density / 100	-0.230	-0.224	-0.235	-0.227	-0.229
Workplace residential density / 100	0.017	0.010*		0.002**	0.021
Occupation type (processing, manufacturing and utilities = 0)					
Management	-0.044	-0.044	-0.044	-0.045	-0.043
Business/finance/administration	-0.030	-0.031	-0.034	-0.033	-0.030
Sciences	0.018	0.018	0.017	0.016	0.018
Health	-0.044	-0.044	-0.036	-0.044	-0.045
Social sciences/government/education	-0.042	-0.043	-0.040	-0.044	-0.043
Arts/recreation	-0.029	-0.029	-0.029	-0.030	-0.029
Sales/services	-0.083	-0.083	-0.083	-0.085	-0.083
Education (less than highschool=0)					
Highschool	0.025	0.025	0.023	0.025	0.025
Apprentice/trade	0.033	0.033	0.033	0.034	0.034
College	0.038	0.038	0.035	0.038	0.038
University	-0.016	-0.015**	-0.022*	-0.017**	-0.015**
Professional degree	-0.034	-0.034	-0.034	-0.034	-0.034
Graduate degree	-0.014*	-0.014*	-0.015*	-0.016*	-0.014*
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.026			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			0.067		
% of attached housing units			-0.040		
% apartments or flats in building: 5 or more storeys			0.079		
% same dwelling type				-0.053	
% suitable housing					-0.017

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 57,370 (unweighted Sample 1 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (296,635). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

Table 4: Regression results for the Montreal census metropolitan area for Sample 2

Model (Sample 2)	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.203	0.203	0.2048	0.2092	0.203
Controls					
ln income	-0.029	-0.035	-0.032	-0.033	-0.029
Sex	-0.028	-0.028	-0.032	-0.032	-0.028
Presence of young child	-0.001**	-0.004**	0.001**	-0.001**	0.001**
Residential density / 100	-0.417	-0.413	-0.422	-0.416	-0.416
Workplace residential density / 100	0.009**	0.004**		-0.010**	0.010**
Occupation type (processing, manufacturing and utilities = 0)					
Management	-0.045	-0.048	-0.052	-0.052	-0.045
Business/finance/administration	-0.033	-0.036	-0.043	-0.044	-0.032
Sciences	0.001**	-0.001**	-0.005**	-0.006**	0.002**
Health	-0.023	-0.022	-0.025	-0.025	-0.023
Social sciences/government/education	-0.040	-0.041	-0.046	-0.045	-0.040
Arts/recreation	-0.016	-0.017	-0.020	-0.019	-0.015
Sales/services	-0.039	-0.040	-0.043	-0.043	-0.039
Education (less than highschool=0)					
Highschool	0.007**	0.007**	0.007**	0.006**	0.007**
Apprentice/trade	0.049	0.049	0.050	0.049	0.049
College	0.020*	0.002*	0.020*	0.019*	0.020*
University	-0.027*	-0.028*	-0.032	-0.032	-0.026*
Professional degree	-0.028	-0.028	-0.028	-0.027	-0.028
Graduate degree	-0.039	-0.040	-0.043	-0.043	-0.039
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.026			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			-0.038		
% of attached housing units			0.004**		
% apartments or flats in building: 5 or more storeys			0.017**		
% same dwelling type				-0.084	
% suitable housing					-0.017

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 34,840 (unweighted Sample 2 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (178,955). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

Table 5: Regression results for the Toronto census metropolitan area for Sample 2

Model (Sample 2)	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.1344	0.1386	0.1376	0.1372	0.1366
Controls					
ln income	0.013	-0.004**	0.006**	0.012	0.014
Sex	-0.056	-0.055	-0.059	-0.057	-0.055
Presence of young child	0.004**	-0.001**	0.004**	0.003**	0.006**
Residential density / 100	-0.323	-0.309	-0.330	-0.319	-0.319
Workplace residential density / 100	0.046	0.026		0.029	0.054
Occupation type (processing, manufacturing and utilities = 0)					
Management	0.075	0.067	0.066	0.074	0.074
Business/finance/administration	0.042	0.036	0.028	0.039	0.042
Sciences	0.069	0.067	0.063	0.068	0.068
Health	0.016	0.016	0.015	0.017	0.015
Social sciences/government/education	0.007**	0.003**	-0.001**	0.005**	0.007**
Arts/recreation	0.003**	0.001**	-0.002**	0.002**	0.003**
Sales/services	0.021	0.018	0.015	0.020	0.019
Education (less than highschool=0)					
Highschool	0.053	0.053	0.051	0.053	0.052
Apprentice/trade	0.046	0.046	0.046	0.047	0.046
College	0.096	0.097	0.094	0.097	0.096
University	-0.001**	0.001**	-0.009**	-0.003**	-0.001*
Professional degree	-0.029	-0.029	-0.030	-0.029	-0.029
Graduate degree	-0.031	-0.029	-0.037	-0.033	-0.030
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.072			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			-0.028**		
% of attached housing units			-0.017**		
% apartments or flats in building: 5 or more storeys			0.044**		
% same dwelling type				-0.056	
% suitable housing					-0.048

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 75,940 (unweighted Sample 1 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (390825). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

Table 6: Regression results for the Vancouver census metropolitan area for Sample 2

Model (Sample 2)	2006.a	2006.b	2006.c	2006.d	2006.e
Model r^2	0.1727	0.1755	0.1817	0.1727	0.1727
Controls					
ln income	0.012**	-0.001**	0.0120**	0.013	0.012**
Sex	-0.050	-0.048	-0.045	-0.050	-0.049
Presence of young child	0.027	0.021	0.029	0.027	0.027
Residential density / 100	-0.361	-0.346	-0.361	-0.360	-0.360
Workplace residential density / 100	0.014**	-0.005**		0.011	0.017**
Occupation type (processing, manufacturing and utilities = 0)					
Management	-0.026*	-0.029	-0.013**	-0.026	-0.025*
Business/finance/administration	-0.027*	-0.029	-0.014**	-0.028	-0.027*
Sciences	0.022*	0.023*	0.032	0.021	0.022*
Health	-0.035	-0.036	-0.017*	-0.035	-0.035
Social sciences/government/education	-0.036	-0.039	-0.027	-0.037	-0.036
Arts/recreation	-0.039	-0.040	-0.031	-0.039	-0.039
Sales/services	-0.037	-0.038	-0.037	-0.037	-0.037
Education (less than highschool=0)					
Highschool	0.030*	0.030*	0.023**	0.030	0.030*
Apprentice/trade	0.036	0.036	0.030*	0.036	0.036
College	0.040*	0.041	0.032*	0.040	0.040
University	-0.055	-0.052	-0.060	-0.055	-0.054
Professional degree	-0.050	-0.051	-0.051	-0.050	-0.050
Graduate degree	-0.046	-0.044	-0.045	-0.046	-0.046
Housing Suitability variables					
Rooms work-Rooms home Ratio		-0.061			
Dwelling type (apartments or flats in building with less than 5 storeys =0)					
% of single family housing units			0.088		
% of attached housing units			-0.108		
% apartments or flats in building: 5 or more storeys			-0.001**		
% same dwelling type				-0.009	
% suitable housing					-0.009**

Notes: Dependent variable: journey to work distance (in kilometers). All regression coeffients are significant at the 99.99% level except those marked with "*" (significant between 95% and 99.99% levels) and those marked with "**" (not significant at the 95% level). The number of observations (individuals) in each model is 19,345 (unweighted Sample 1 frequency). A weighted regression was run, therefore the coeffiecients are based on the weighted frequency (100,125). Standardized coefficients are presented, therefore there is no intercept to report.

Model 2006.c excludes the variable "Workplace residential density/100". This variable produced multicollinearity issues with the Housing suitability variables for dwelling type.

APPENDIX 2: MONTREAL CMA EMPLOYMENT CENTRE HOUSING BY DWELLING TYPE

MONTREAL CMA

Housing Stock of the Employment Centre (Owned dwellings only)

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Montreal (CBD)	490	1200	4030	2145
2	Montreal (University of Montreal)	50	275	0	415
4	Montreal (Anjou)	375	1780	820	1845
6	Montreal (Longue Pointe)	440	650	0	435
7	Longueuil	2885	770	0	980
8	Laval	6000	860	450	2280
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	7840	7045	430	1940

MONTREAL CMA

Housing Stock of the Employment Centre PLUS the Adjacent Cenus Tracts (Owned dwellings only)

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Montreal (CBD)	1440	2625	5580	4995
2	Montreal (University of Montreal)	90	315	0	675
4	Montreal (Anjou)	2095	5355	2415	5980
6	Montreal (Longue Pointe)	2905	2090	30	2140
7	Longueuil	7505	2135	120	2400
8	Laval	16770	4515	625	5125
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	30030	18605	5375	6850

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

MONTREAL CMA

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Montreal (CBD)	40850	17770	3105	15240
2	Montreal (University of Montreal)	920	620	85	505
4	Montreal (Anjou)	3785	1320	50	965
6	Montreal (Longue Pointe)	2100	660	25	505
7	Longueuil	5505	1090	90	865
8	Laval	11320	2800	170	1560
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	41270	12550	1330	7445

Ratio:
Housing Stock at Employment Centre / Housing Stock Currently Occupied by the Workforce

MONTREAL CMA

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Montreal (CBD)	0.01	0.07	1.30	0.14
2	Montreal (University of Montreal)	0.05	0.44	0.00	0.82
4	Montreal (Anjou)	0.10	1.35	16.40	1.91
6	Montreal (Longue Pointe)	0.21	0.98	0.00	0.86
7	Longueuil	0.52	0.71	0.00	1.13
8	Laval	0.53	0.31	2.65	1.46
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	0.19	0.56	0.32	0.26

MONTREAL CMA

Ratio:
Housing Stock at Employment Centre PLUS Adjacent Census Tracts /
Housing Stock Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Montreal (CBD)	0.04	0.15	1.80	0.33
2	Montreal (University of Montreal)	0.10	0.51	0.00	1.34
4	Montreal (Anjou)	0.55	4.06	48.30	6.20
6	Montreal (Longue Pointe)	1.38	3.17	1.20	4.24
7	Longueuil	1.36	1.96	1.33	2.77
8	Laval	1.48	1.61	3.68	3.29
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	0.73	1.48	4.04	0.92

APPENDIX 3: TORONTO CMA EMPLOYMENT CENTRE HOUSING BY DWELLING TYPE

TORONTO CMA Employment Centre Code	Employment Centre Name	Housing Stock of the Employment Centre (Owned dwellings only) Single detached	Attached house	Apartment in building	Apartment in a
1	Toronto (CBD)	315	1835	19360	1675
2	Pickering	2380	1440	25	315
3	Toronto (North York- 401 meets	0	935	750	0
4	Markham (City Centre)	5315	1690	25	95
6	Marham/Richmond Hill/Toronto	15825	4420	4075	300
7	Toronto (York Mills/Don Mills)	6645	1825	1450	225
9	Toronto (Yorkdale)	1515	630	0	15
10	Vaughan/Toronto	6215	5000	50	110
11	Toronto (Highway 427)	4350	1010	1005	70
12	Mississauga (City Centre)	2220	490	835	80
13	Mississauga/Brampton/Vaughan /Toronto (includes airport)	30510	18540	620	875
14	Mississauga (Meadowvale)	2065	1955	0	40
15	Oakville	25	0	0	0

TORONTO CMA Employment Centre Code	Employment Centre Name	Housing Stock of the Employment Centre PLUS the Adjacent Cenus Tracts (Owned dwellings only) Single detached	Attached house	Apartment in building	Apartment in a
1	Toronto (CBD)	1975	6860	29530	5895
2	Pickering	7705	3640	1595	765
3	Toronto (North York- 401 meets	3670	2635	2300	195
4	Markham (City Centre)	15195	4340	885	490
6	Marham/Richmond Hill/Toronto	31200	12905	8190	1520
7	Toronto (York Mills/Don Mills)	10345	3160	4765	415
9	Toronto (Yorkdale)	7975	2115	2175	615
10	Vaughan/Toronto	32690	18115	2940	1030
11	Toronto (Highway 427)	16685	3280	5010	860
12	Mississauga (City Centre)	7890	3740	7220	715
13	Mississauga/Brampton/Vaughan /Toronto (includes airport)	75130	39970	6405	2690
14	Mississauga (Meadowvale)	9370	8240	555	195
15	Oakville	8530	3875	35	500

TORONTO CMA Employment Centre Code	Employment Centre Name	Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre: Single detached	Attached house	Apartment in building	Apartment in a
1	Toronto (CBD)	69570	30320	19445	8235
2	Pickering	5890	1155	215	145
3	Toronto (North York- 401 meets	3875	1370	615	210
4	Markham (City Centre)	4110	1730	600	190
6	Marham/Richmond Hill/Toronto	16340	6145	2280	805
7	Toronto (York Mills/Don Mills)	6305	2655	1205	395
9	Toronto (Yorkdale)	3055	1410	770	325
10	Vaughan/Toronto	30425	14160	4110	1995
11	Toronto (Highway 427)	5965	2595	985	490
12	Mississauga (City Centre)	1845	825	300	60
13	Mississauga/Brampton/Vaughan /Toronto (includes airport)	70695	33285	8600	4570
14	Mississauga (Meadowvale)	4675	2085	450	195
15	Oakville	1960	830	125	105

TORONTO CMA Employment Centre Code	Employment Centre Name	Housing Stock at Employment Centre / Housing Stock Currently Occupied by the Workforce: Single detached	Attached house	Apartment in building	Apartment in a
1	Toronto (CBD)	0.00	0.06	1.00	0.20
2	Pickering	0.40	1.25	0.12	2.17
3	Toronto (North York- 401 meets	0.00	0.68	1.22	0.00
4	Markham (City Centre)	1.29	0.98	0.04	0.50
6	Marham/Richmond Hill/Toronto	0.97	0.72	1.79	0.37
7	Toronto (York Mills/Don Mills)	1.05	0.69	1.20	0.57
9	Toronto (Yorkdale)	0.50	0.45	0.00	0.05
10	Vaughan/Toronto	0.20	0.35	0.01	0.06
11	Toronto (Highway 427)	0.73	0.39	1.02	0.14
12	Mississauga (City Centre)	1.20	0.59	2.78	1.33
13	Mississauga/Brampton/Vaughan /Toronto (includes airport)	0.43	0.56	0.07	0.19
14	Mississauga (Meadowvale)	0.44	0.94	0.00	0.21
15	Oakville	0.01	0.00	0.00	0.00

TORONTO CMA Employment Centre Code	Employment Centre Name	Housing Stock at Employment Centre PLUS Adjacent Census Tracts / Housing Stock Currently Occupied by the Single detached	Attached house	Apartment in building	Apartment in a
1	Toronto (CBD)	0.03	0.23	1.52	0.72
2	Pickering	1.31	3.15	7.42	5.28
3	Toronto (North York- 401 meets	0.95	1.92	3.74	0.93
4	Markham (City Centre)	3.70	2.51	1.48	2.58
6	Marham/Richmond Hill/Toronto	1.91	2.10	3.59	1.89
7	Toronto (York Mills/Don Mills)	1.64	1.19	3.95	1.05
9	Toronto (Yorkdale)	2.61	1.50	2.82	1.89
10	Vaughan/Toronto	1.07	1.28	0.72	0.52
11	Toronto (Highway 427)	2.80	1.26	5.09	1.76
12	Mississauga (City Centre)	4.28	4.53	24.07	11.92
13	Mississauga/Brampton/Vaughan /Toronto (includes airport)	1.06	1.20	0.74	0.59
14	Mississauga (Meadowvale)	2.00	3.95	1.23	1.00
15	Oakville	4.35	4.67	0.28	4.76

APPENDIX 4: VANCOUVER CMA EMPLOYMENT CENTRE HOUSING BY DWELLING TYPE

VANCOUVER CMA

Housing Stock of the Employment Centre
(Owned dwellings only)

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Vancouver (CBD)	65	1115	9165	3780
2	Vancouver	40	0	115	35
3	Burnaby	1980	1175	0	1225
4	Burnaby (Metrotown)	0	0	2940	320
5	Delta/Richmond/Burnaby	6120	1400	1505	415
6	Surrey	820	135	0	25
7	Langley	630	545	0	530

VANCOUVER CMA

Housing Stock of the Employment Centre PLUS
the Adjacent Cenus Tracts
(Owned dwellings only)

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Vancouver (CBD)	3580	3230	19075	10430
2	Vancouver	1370	435	575	470
3	Burnaby	6750	4970	1730	2290
4	Burnaby (Metrotown)	1010	1160	5275	1420
5	Delta/Richmond/Burnaby	48720	17455	5810	12365
6	Surrey	6370	3280	0	890
7	Langley	6130	3705	0	3240

VANCOUVER CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Vancouver (CBD)	19950	10670	5575	8560
2	Vancouver	1355	740	225	560
3	Burnaby	2280	1565	570	1095
4	Burnaby (Metrotown)	1520	960	285	550
5	Delta/Richmond/Burnaby	19715	10510	2090	6030
6	Surrey	1850	970	55	355
7	Langley	1250	540	25	285

VANCOUVER CMA

Ratio:
Housing Stock at Employment Centre /
Housing Stock Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Vancouver (CBD)	0.00	0.10	1.64	0.44
2	Vancouver	0.03	0.00	0.51	0.06
3	Burnaby	0.87	0.75	0.00	1.12
4	Burnaby (Metrotown)	0.00	0.00	10.32	0.58
5	Delta/Richmond/Burnaby	0.31	0.13	0.72	0.07
6	Surrey	0.44	0.14	0.00	0.07
7	Langley	0.50	1.01	0.00	1.86

VANCOUVER CMA

Ratio:
Housing Stock at Employment Centre PLUS Adjacent Census Tracts /
Housing Stock Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	Single detached house	Attached house	Apartment in building that has 5 or more storeys	Apartment in a building that has fewer than 5 storeys
1	Vancouver (CBD)	0.18	0.30	3.42	1.22
2	Vancouver	1.01	0.59	2.56	0.84
3	Burnaby	2.96	3.18	3.04	2.09
4	Burnaby (Metrotown)	0.66	1.21	18.51	2.58
5	Delta/Richmond/Burnaby	2.47	1.66	2.78	2.05
6	Surrey	3.44	3.38	0.00	2.51
7	Langley	4.90	6.86	0.00	11.37

APPENDIX 5: MONTREAL CMA EMPLOYMENT CENTRE HOUSING RATIOS BY NUMBER OF BEDROOMS

MONTREAL CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	2135	3260	1595	500	255	120
4	Montreal (Anjou)	455	1335	2565	365	100	0
8	Laval	400	2745	4740	1455	250	0
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	530	2685	8785	4160	790	310

MONTREAL CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	40	490	895	405	150
6	Montreal (Longue Pointe)	105	495	725	155	50
7	Longueuil	150	1125	2125	1085	150

MONTREAL CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	15	195	275	260
3	Montreal	25	80	670	360

MONTREAL CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	3875	5385	2820	1590	645	285
4	Montreal (Anjou)	1510	4255	8215	1540	265	40
8	Laval	1150	6520	13970	4575	750	55
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	2850	11425	26845	16075	3680	940

MONTREAL CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	440	3145	5110	2705	715
6	Montreal (Longue Pointe)	810	2405	2930	810	205
7	Longueuil	465	3080	5515	2625	460

MONTREAL CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	310	1060	1040	1030
3	Montreal	760	2090	3510	970

MONTREAL CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	5525	18495	33535	15475	3245	635
4	Montreal (Anjou)	255	1435	2940	1245	220	30
8	Laval	670	3525	7825	3175	560	100
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	2850	12445	29730	14335	2625	580

MONTREAL CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	175	920	1445	545	205
6	Montreal (Longue Pointe)	110	530	3635	2670	455
7	Longueuil	335	1385	3735	1610	480

MONTREAL CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	180	610	995	345
3	Montreal	90	320	745	300

MONTREAL CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	30140	26245	17010	2870	535	170
4	Montreal (Anjou)	1950	2180	1625	310	40	25
8	Laval	5545	5440	3995	735	115	25
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	21140	21580	16165	2990	505	215

MONTREAL CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	1035	1095	705	130	20
6	Montreal (Longue Pointe)	1395	1105	710	60	20
7	Longueuil	2705	2520	1940	315	70

MONTREAL CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	985	720	360	60
3	Montreal	515	585	310	40

MONTREAL CMA

Ratio:
Housing Stock (by number of bedrooms) at Employment Centre
/
Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	0.39	0.18	0.05	0.03	0.08	0.19
4	Montreal (Anjou)	1.78	0.93	0.87	0.29	0.45	0.00
8	Laval	0.60	0.78	0.61	0.46	0.45	0.00
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	0.19	0.22	0.30	0.29	0.30	0.53

MONTREAL CMA

Ratio:
Housing Stock (by number of bedrooms) at Employment Centre /
Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	0.23	0.53	0.62	0.74	0.73
6	Montreal (Longue Pointe)	0.95	0.93	0.20	0.06	0.11
7	Longueuil	0.45	0.81	0.57	0.67	0.31

MONTREAL CMA

Ratio:
Housing Stock (by number of bedrooms)
at Employment Centre /
Housing Stock (by number of bedrooms)
Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	0.08	0.32	0.28	0.75
3	Montreal	0.28	0.25	0.90	1.20

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	0.70	0.29	0.08	0.10	0.20	0.45
4	Montreal (Anjou)	5.92	2.97	2.79	1.24	1.20	1.33
8	Laval	1.72	1.85	1.79	1.44	1.34	0.55
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	1.00	0.92	0.90	1.12	1.40	1.62

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	2.51	3.42	3.54	4.96	3.49
6	Montreal (Longue Pointe)	7.36	4.54	0.81	0.30	0.45
7	Longueuil	1.39	2.22	1.48	1.63	0.96

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	1.72	1.74	1.05	2.99
3	Montreal	8.44	6.53	4.71	3.23

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	0.07	0.12	0.09	0.17	0.48	0.71
4	Montreal (Anjou)	0.23	0.61	1.58	1.18	2.50	0.00
8	Laval	0.07	0.50	1.19	1.98	2.17	0.00
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	0.03	0.12	0.54	1.39	1.56	1.44

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	0.04	0.45	1.27	3.12	7.50
6	Montreal (Longue Pointe)	0.08	0.45	1.02	2.58	2.50
7	Longueuil	0.06	0.45	1.10	3.44	2.14

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	0.02	0.27	0.76	4.33
3	Montreal	0.05	0.14	2.16	9.00

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Montreal (CBD)	0.13	0.21	0.17	0.55	1.21	1.68
4	Montreal (Anjou)	0.77	1.95	5.06	4.97	6.63	1.60
8	Laval	0.21	1.20	3.50	6.22	6.52	2.20
9	Montreal/Dorval/Pointe-Claire/Mont-Royal	0.13	0.53	1.66	5.38	7.29	4.37

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
5	Pointe-aux-Trembles	0.43	2.87	7.25	20.81	35.75
6	Montreal (Longue Pointe)	0.58	2.18	4.13	13.50	10.25
7	Longueuil	0.17	1.22	2.84	8.33	6.57

MONTREAL CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
2	Montreal (University of Montreal)	0.31	1.47	2.89	17.17
3	Montreal	1.48	3.57	11.32	24.25

APPENDIX 6: TORONTO CMA EMPLOYMENT CENTRE HOUSING RATIOS BY NUMBER OF BEDROOMS

TORONTO CMA		Housing Stock (number of owned units) of the Employment Centres -By Number of Bedrooms					
Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	10080	9505	2185	765	335	355
3	Toronto (North York- 401 meets 404)	40	265	1035	300	45	0
4	Markham (City Centre)	145	435	2570	2550	785	630
6	Markham/Richmond Hill/Toronto	1455	2755	5230	11485	2805	890
7	Toronto (York Mills/Don Mills)	495	1600	4025	2660	925	445
9	Toronto (Yorkdale)	110	555	1155	290	60	0
10	Vaughan/Toronto	105	375	4100	5840	695	255
11	Toronto (Highway 427)	495	1305	2875	1215	490	60
12	Mississauga (City Centre)	250	715	635	1445	350	235
13	Mississauga/Brampton/Vaughan/Toronto (inc	1565	3000	16655	25075	3990	1540
14	Mississauga (Meadowvale)	20	195	2370	1255	215	0

TORONTO CMA		Housing Stock (number of owned units) of the Employment Centres -By Number of Bedrooms				
Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	30	260	2220	1185	460
15	Oakville	0	0	0	25	0

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	17110	16550	6255	2645	995	645
3	Toronto (North York- 401 meets 404)	525	1830	4665	2305	440	105
4	Markham (City Centre)	785	1675	7180	8245	1815	1180
6	Markham/Richmond Hill/Toronto	3025	6145	14210	22310	6230	1915
7	Toronto (York Mills/Don Mills)	2395	3455	6200	4300	1700	615
9	Toronto (Yorkdale)	860	2775	5770	2480	690	295
10	Vaughan/Toronto	1405	3995	21715	23645	3140	860
11	Toronto (Highway 427)	2350	6620	11195	4595	935	120
12	Mississauga (City Centre)	2395	4935	5115	5635	935	535
13	Mississauga/Brampton/Vaughan/Toronto (in	3975	10615	47700	51180	8735	3180
14	Mississauga (Meadowvale)	285	1340	9365	6055	1010	280

TORONTO CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	705	1940	6325	3815	900
15	Oakville	110	600	4755	6305	1150

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	12550	20060	50360	34560	8000	2040
3	Toronto (North York- 401 meets 404)	305	655	2485	1990	450	180
4	Markham (City Centre)	370	710	2605	2375	395	165
6	Markham/Richmond Hill/Toronto	1295	2935	10460	8800	1590	495
7	Toronto (York Mills/Don Mills)	635	1490	4325	3165	725	220
9	Toronto (Yorkdale)	355	835	2300	1625	310	135
10	Vaughan/Toronto	2120	5515	21040	17595	3205	1215
11	Toronto (Highway 427)	525	1350	4315	3055	605	185
12	Mississauga (City Centre)	170	320	1190	1130	165	55
13	Mississauga/Brampton/Vaughan/Toronto (in	4780	11585	52325	39450	6825	2155
14	Mississauga (Meadowvale)	340	790	3330	2475	400	70

TORONTO CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units	
2	Pickering	110	530	3635	2670	455	7400.00
15	Oakville	90	210	1445	1020	260	3025.00

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	46860	40720	29975	7745	1660	615
3	Toronto (North York- 401 meets 404)	1645	2160	1645	465	125	25
4	Markham (City Centre)	1755	2075	1985	630	120	60
6	Markham/Richmond Hill/Toronto	6755	9195	6940	2060	410	210
7	Toronto (York Mills/Don Mills)	3085	3355	2985	840	235	65
9	Toronto (Yorkdale)	1630	1785	1480	460	150	55
10	Vaughan/Toronto	11485	15680	15930	5295	1485	815
11	Toronto (Highway 427)	2670	3285	2700	965	295	115
12	Mississauga (City Centre)	820	980	900	265	35	20
13	Mississauga/Brampton/Vaughan/Toronto (in	29465	37450	34470	11385	3005	1370
14	Mississauga (Meadowvale)	2095	2525	2000	620	105	60

TORONTO CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	2155	2400	2235	505	110
15	Oakville	725	1105	870	220	100

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Ratio:
Housing Stock (by number of bedrooms) at Employment Centre
/
Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	0.80	0.47	0.04	0.02	0.04	0.17
3	Toronto (North York- 401 meets 404)	0.13	0.40	0.42	0.15	0.10	0.00
4	Markham (City Centre)	0.39	0.61	0.99	1.07	1.99	3.82
6	Markham/Richmond Hill/Toronto	1.12	0.94	0.50	1.31	1.76	1.80
7	Toronto (York Mills/Don Mills)	0.78	1.07	0.93	0.84	1.28	2.02
9	Toronto (Yorkdale)	0.31	0.66	0.50	0.18	0.19	0.00
10	Vaughan/Toronto	0.05	0.07	0.19	0.33	0.22	0.21
11	Toronto (Highway 427)	0.94	0.97	0.67	0.40	0.81	0.32
12	Mississauga (City Centre)	1.47	2.23	0.53	1.28	2.12	4.27
13	Mississauga/Brampton/Vaughan/Toronto (in	0.33	0.26	0.32	0.64	0.58	0.71
14	Mississauga (Meadowvale)	0.06	0.25	0.71	0.51	0.54	0.00

TORONTO CMA

Ratio:
Housing Stock (by number of bedrooms) at Employment Centre /
Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	0.27	0.49	0.61	0.44	1.01
15	Oakville	0.00	0.00	0.00	0.02	0.00

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	1.36	0.83	0.12	0.08	0.12	0.32
3	Toronto (North York- 401 meets 404)	1.72	2.79	1.88	1.16	0.98	0.58
4	Markham (City Centre)	2.12	2.36	2.76	3.47	4.59	7.15
6	Markham/Richmond Hill/Toronto	2.34	2.09	1.36	2.54	3.92	3.87
7	Toronto (York Mills/Don Mills)	3.77	2.32	1.43	1.36	2.34	2.80
9	Toronto (Yorkdale)	2.42	3.32	2.51	1.53	2.23	2.19
10	Vaughan/Toronto	0.66	0.72	1.03	1.34	0.98	0.71
11	Toronto (Highway 427)	4.48	4.90	2.59	1.50	1.55	0.65
12	Mississauga (City Centre)	14.09	15.42	4.30	4.99	5.67	9.73
13	Mississauga/Brampton/Vaughan/Toronto (inc	0.83	0.92	0.91	1.30	1.28	1.48
14	Mississauga (Meadowvale)	0.84	1.70	2.81	2.45	2.53	4.00

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	6.41	3.66	1.74	1.43	1.98
15	Oakville	1.22	2.86	3.29	6.18	4.42

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	0.22	0.23	0.07	0.10	0.20	0.58
3	Toronto (North York- 401 meets 404)	0.02	0.12	0.63	0.65	0.36	0.00
4	Markham (City Centre)	0.08	0.21	1.29	4.05	6.54	10.50
6	Markham/Richmond Hill/Toronto	0.22	0.30	0.75	5.58	6.84	4.24
7	Toronto (York Mills/Don Mills)	0.16	0.48	1.35	3.17	3.94	6.85
9	Toronto (Yorkdale)	0.07	0.31	0.78	0.63	0.40	0.00
10	Vaughan/Toronto	0.01	0.02	0.26	1.10	0.47	0.31
11	Toronto (Highway 427)	0.19	0.40	1.06	1.26	1.66	0.52
12	Mississauga (City Centre)	0.30	0.73	0.71	5.45	10.00	11.75
13	Mississauga/Brampton/Vaughan/Toronto (in	0.05	0.08	0.48	2.20	1.33	1.12
14	Mississauga (Meadowvale)	0.01	0.08	1.19	2.02	2.05	0.00

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	0.01	0.11	0.99	2.35	4.18
15	Oakville	0.00	0.00	0.00	0.11	0.00

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
1	Toronto (CBD)	0.37	0.41	0.21	0.34	0.60	1.05
3	Toronto (North York- 401 meets 404)	0.32	0.85	2.84	4.96	3.52	4.20
4	Markham (City Centre)	0.45	0.81	3.62	13.09	15.13	19.67
6	Markham/Richmond Hill/Toronto	0.45	0.67	2.05	10.83	15.20	9.12
7	Toronto (York Mills/Don Mills)	0.78	1.03	2.08	5.12	7.23	9.46
9	Toronto (Yorkdale)	0.53	1.55	3.90	5.39	4.60	5.36
10	Vaughan/Toronto	0.12	0.25	1.36	4.47	2.11	1.06
11	Toronto (Highway 427)	0.88	2.02	4.15	4.76	3.17	1.04
12	Mississauga (City Centre)	2.92	5.04	5.68	21.26	26.71	26.75
13	Mississauga/Brampton/Vaughan/Toronto (in	0.13	0.28	1.38	4.50	2.91	2.32
14	Mississauga (Meadowvale)	0.14	0.53	4.68	9.77	9.62	4.67

TORONTO CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
2	Pickering	0.33	0.81	2.83	7.55	8.18
15	Oakville	0.15	0.54	5.47	28.66	11.50

Note: Employment centres 5- Scarborough Junction, 8- Lawrence Park/Sunnyside and 16-Milton could not be reported due to minimum frequency count restrictions for certain bedroom categories

APPENDIX 7: VANCOUVER CMA EMPLOYMENT CENTRE HOUSING RATIOS BY NUMBER OF BEDROOMS

VANCOUVER CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	490	805	880	900	835	475
5	Delta/Richmond/Burnaby	955	1685	2995	2270	1060	475
7	Langley	80	715	710	135	75	0

VANCOUVER CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	5110	7505	1400	110

VANCOUVER CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	1090	1680	490	0

VANCOUVER CMA — Housing Stock (number of owned units) of the Employment Centres –By Number of Bedrooms

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	195	300	370	120

VANCOUVER CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	1465	3285	4055	3130	2565	1220
5	Delta/Richmond/Burnaby	7685	17340	29385	18875	8050	2890
7	Langley	925	4130	4760	2160	855	230

VANCOUVER CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	**13560**	**15900**	**4125**	**2705**

VANCOUVER CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	2520	3735	1460	1135

VANCOUVER CMA

Housing Stock (number of owned units) of the Employment Centres PLUS the Adjacent Census Tracts -By Number of Bedrooms

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	605	2180	4100	3675

VANCOUVER CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	770	1205	1700	1185	450	195
5	Delta/Richmond/Burnaby	3645	6810	12550	8920	3980	2435
7	Langley	120	380	750	520	265	55

VANCOUVER CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	7170	9830	12300	15460

VANCOUVER CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	405	625	1655	630

VANCOUVER CMA

Housing Stock Currently Occupied by the Workforce Commuting to the Employment Centre

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	705	1245	770	155

VANCOUVER CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	2140	1885	1130	270	50	35
5	Delta/Richmond/Burnaby	12765	11490	9815	3030	900	335
7	Langley	690	655	500	200	35	15

VANCOUVER CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	19000	13720	8885	3150

VANCOUVER CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	1090	1105	1030	90

VANCOUVER CMA

Number of Dwelling Units Required in the Employment Centres to Meet the Minimum Suitability Requirements (number of bedrooms) of the Workforce

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	3290	790	255	65

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	0.64	0.67	0.52	0.76	1.86	2.44
5	Delta/Richmond/Burnaby	0.26	0.25	0.24	0.25	0.27	0.20
7	Langley	0.67	1.88	0.95	0.26	0.28	0.00

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	0.71	0.76	0.11	0.01

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	2.69	2.69	0.30	0.00

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	0.28	0.24	0.48	0.77

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	1.90	2.73	2.39	2.64	5.70	6.26
5	Delta/Richmond/Burnaby	2.11	2.55	2.34	2.12	2.02	1.19
7	Langley	7.71	10.87	6.35	4.15	3.23	4.18

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	1.89	1.62	0.34	0.17

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	0.43	0.30	0.71	0.08

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Currently Occupied by the Workforce

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	0.86	1.75	5.32	23.71

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	0.23	0.43	0.78	3.33	16.70	13.57
5	Delta/Richmond/Burnaby	0.07	0.15	0.31	0.75	1.18	1.42
7	Langley	0.12	1.09	1.42	0.68	2.14	0.00

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	0.27	0.55	0.16	0.03

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	1.00	1.52	0.48	0.00

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	0.06	0.38	1.45	1.85

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	4 bedroom units	5 bedroom units	greater than 5 bedroom units
3	Burnaby	0.68	1.74	3.59	11.59	51.30	34.86
5	Delta/Richmond/Burnaby	0.60	1.51	2.99	6.23	8.94	8.63
7	Langley	1.34	6.31	9.52	10.80	24.43	15.33

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 bedroom units	greater than or equal to 4 bedroom units
1	Vancouver (CBD)	0.71	1.16	0.46	0.86

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	0 and 1 bedroom units	2 bedroom units	3 and 4 bedroom units	greater than or equal to 5 bedroom units
4	Burnaby (Metrotown)	2.69	1.77	0.62	0.14

VANCOUVER CMA

Ratio: Housing Stock (by number of bedrooms) at Employment Centre PLUS Adjacent Census Tracts / Housing Stock (by number of bedrooms) Required to Meet Minimum Housing Suitability Requirements of the Workforce

Employment Centre Code	Employment Centre Name	less than or equal to 2 bedroom units	3 bedroom units	4 bedroom units	greater than or equal to 5 bedroom units
6	Surrey	0.18	2.76	16.08	56.54

APPENDIX 8 Statistics Canada: Structural Type of Dwelling Definitions

"Single-detached house – A single dwelling not attached to any other dwelling or structure (except its own garage or shed). A single-detached house has open space on all sides, and has no dwellings either above it or below it. A mobile home fixed permanently to a foundation is also classified as a single-detached house.

Semi-detached house – One of two dwellings attached side by side (or back to back) to each other, but not attached to any other dwelling or structure (except its own garage or shed). A semi-detached dwelling has no dwellings either above it or below it, and the two units together have open space on all sides.

Row house – One of three or more dwellings joined side by side (or occasionally side to back), such as a townhouse or garden home, but not having any other dwellings either above or below. Townhouses attached to a high-rise building are also classified as row houses.

Apartment or flat in a duplex – One of two dwellings, located one above the other, may or may not be attached to other dwellings or buildings.

Apartment in a building that has five or more storeys – A dwelling unit in a high-rise apartment building which has five or more storeys.

Apartment in a building that has fewer than five storeys – A dwelling unit attached to other dwelling units, commercial units, or other non-residential space in a building that has fewer than five storeys.

Other single-attached house – A single dwelling that is attached to another building and that does not fall into any of the other categories, such as a single dwelling attached to a non-residential structure (e.g., a store or a church) or occasionally to another residential structure (e.g., an apartment building).

Mobile home – A single dwelling, designed and constructed to be transported on its own chassis and capable of being moved to a new location on short notice. It may be placed temporarily on a foundation pad and may be covered by a skirt.

Other movable dwelling – A single dwelling, other than a mobile home, used as a place of residence, but capable of being moved on short notice, such as a tent, recreational vehicle, travel trailer, houseboat or floating home." (Statistics Canada, 2014, page #??)