Title
Livability and LEED-ND: The Challenges and Successes of Sustainable Neighborhood Rating Systems

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Publication Date
2015

Peer reviewed|Thesis/dissertation

Livability and LEED-ND: The Challenges and Successes of Sustainable Neighborhood Rating Systems

by

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A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

City and Regional Planning

in the

Graduate Division

of the

University of California, Berkeley

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Spring 2015

Abstract

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A rating system known as Leadership in Energy and Environmental Design for Neighborhood Development, LEED-ND, (USGBC 2011) was developed in 2007 to assess sustainability at the neighborhood scale. Although at this time LEED for buildings is a well-known and well-established program in the United States, LEED for Neighborhood Development is less widely recognized since it was developed in 2007 as compared to LEED for buildings. LEED-ND requires that certified developments meet credit areas in three main categories: a) smart location and linkage (SLL), b) neighborhood pattern and design (NPD), and c) green infrastructure and buildings (GIB). LEED-ND goes above and beyond singularly requiring sustainable mobility, traditional neighborhood design, or green building; rather, it incorporates the above three categories into a single rating system. To date, prior LEED rating systems (New Construction and Existing Buildings) have focused on the building scale, as have most critiques of such metrics (Del Percio 2004; Dermisi 2009; Humbert et al. 2007; Hodapp 2008). Few authors have ventured to analyze the neighborhood rating system with the exception of Garde (2009) and Ewing et al. (2013) and Sharifi and Murayama (2013b), who have only used only secondary scorecard data and other aggregated data to assess the success or predict outcomes of LEED-ND neighborhoods. No post-occupancy studies have been conducted to date that take into consideration the resident's perception and stated preferences. Additionally, no studies have examined in detail the provision of affordable housing within LEED-ND developments.

LEED-ND has been rapidly adopted as the *de-facto* green neighborhood standard and is now used to measure the sustainability of neighborhood design around the world. Like the previous LEED green building rating systems, LEED-ND is heavily reliant on physical & environmental design criteria (measures such as compact urban form and transit accessibility), and is based on an expert-generated point system. LEED-ND thus excels in measuring 'environmental sustainability' through its stringent environmental performance criteria. However, it fails to critically address important livability factors—namely social and economic factors—and there has not been a critical examination of how to properly weigh the various factors in response to user preferences. Scholars have emphasized that the major weakness of sustainable development agendas, emphasizing that although assessment of *environmental* sustainability is quite thorough, often sustainable development projects fail to adequately address or operationalize *social* and *economic* sustainability (White and Lee 2009; Lehtonen 2004). Ultimately, creating metrics for social and

economic sustainability is more complicated than developing metrics for environmental sustainability, which can be reduced to direct built environment performance measures. At the neighborhood scale, socio-cultural and socio-economic concerns—such as affordable housing—become magnified for residents. Accordingly, this dissertation argues that socio-cultural and socio-economic factors and user preferences require a more significant foothold in neighborhood scale rating systems, if such systems purport to fully support all three tiers of sustainability: social, economic and environmental (Wheeler 2004). Specifically, this study examines affordable housing as a proxy for social equity and social sustainability in LEED-ND neighborhoods, and determines the extent to which principles of social sustainability are being upheld.

This dissertation advances the emerging field of sustainable neighborhood rating systems, by illustrating and evaluating a significant gap in current sustainable neighborhood evaluation systems. Cutting across planning, landscape architecture, architecture, psychology and sociology in both Canada and the US, the study critically questions the LEED-ND rating system as the epitome of sustainable development. This dissertation illustrates that in order to be truly sustainable, developments must consider social-cultural and socio-economic livability factors alongside environmental factors, including post-occupancy evaluation. This dissertation also asks the question if social equity and affordability issues can be singularly addressed by a voluntary, market-based rating system, or if a broader range of strategies is needed to ensure the provision of affordable housing in new sustainable developments. Ultimately, this study provides recommendations to improve the rating system, with a specific focus on affordable housing.

This dissertation uses a mixed-methods approach to answer the above questions about sustainability, livability and affordable housing. The methodology behind the research approach is outlined at length in Chapter 3. This Chapter includes an overview of a post-occupancy survey of livability factors that was conducted in four neighborhoods in Metro Vancouver, British Columbia and in Portland, Oregon. The four neighborhoods—two urban LEED-ND platinum, and two suburban Traditional Neighborhood Design (TND) neighborhoods—are described in detail in Chapter 4. The two urban LEED-ND neighborhoods are Southeast False Creek in Vancouver, British Columbia and Hoyt Street Yards in Portland, Oregon. The two suburban Traditional Neighborhood Design (TND) neighborhoods are East Clayton in Surrey, British Columbia, and Fairview Village in Fairview, Oregon. This chapter also explains why they are comparable cases. In addition, in order to address the questions about affordable housing and equity in LEED-ND, this chapter recounts the methodology used, including credit-level statistical scorecard data aggregation, an online survey of LEED-ND Accredited Professionals, interviews with LEED-ND Accredited Professionals, and policy analysis of affordable housing provision.

This dissertation, based on post-occupancy survey evidence, finds that there are several livability qualities that are important to residents living in both urban LEED-ND and Traditional Neighborhood Design (TND) suburban neighborhoods in the Pacific Northwest—namely safety and security and walkability. Additionally, there are several criteria that are important to suburban TND respondents, privacy within the interior of the unit, views to trees and natural landscapes, and a sense of community. Surprisingly, most respondents believe that vehicle ownership is important in all neighborhoods, and most respondents still own at least one car. Additionally, driving is still the number one mode choice in all four neighborhoods except one (Hoyt Street Yards, Portland, Oregon) challenging the assumption that LEED-ND development currently has the power to drastically reduce VMT in new sustainable developments. Hoyt Street Yards in the Pearl District in

Portland, Oregon provides a good example of where walking is the number one mode choice, which is most likely due to the small size of the blocks (200' x 200') and its frequent and well-maintained light rail MAX transit system. However, further research could be done on this particular assumption.

This dissertation also finds through survey and statistical evidence presented in Chapter 6 that although LEED-ND espouses income-mixing and social equity as part of its mission, that affordable housing remains a largely neglected element within LEED-ND neighborhoods. Currently only 40% of LEED-ND neighborhoods (v2009) provide affordable housing. Because affordable housing is a critical component of social equity, and the optional credit allows developers to bypass the provision of affordable housing, the credit needs to be changed. It does not necessarily need to be a mandatory credit or pre-requisite, but the credit, which is currently worth less than 3% of the overall rating system, needs to be better incentivized. Until the credit is weighted more heavily in LEED-ND, city planners will have to rely upon a much broader portfolio of both 'carrots' (density bonuses, faster approval processes) and 'sticks' (inclusionary zoning) to ensure that there is affordable housing in new sustainable development. In addition, cities and states must take advantage of current federal and state funding specifically earmarked for affordable housing, including the National Housing Trust Fund (NHTF) and the Affordable Housing and Sustainable Communities (AHSC) fund.

There are also other elements of LEED-ND certification that could improve upon, according to interviews with LEED-ND Accredited Professionals. These further recommendations are examined in Chapter 8. First, there is a call for increased peer review in the LEED-ND certification process, given the high costs of certification and primary oversight from the USGBC. Second, the cost of registering and certifying a LEED-ND development is unfortunately prohibitive for smaller developers. The costs of paying $20,000 (plus $30,000 in LEED-ND AP consultant fees) to certify a neighborhood development may absorbed by a developer with a larger project that is over 200 units, but if a project is 30 units, it is very unlikely that it will 'pencil' out. Thus, certifying a smaller, infill development is ultimately more challenging than certifying a large development. Additionally, the use of ArcGIS to assess linkage, location and distance factors seem to be prohibitive and costly for certain firms. If cities could utilize the criteria and incorporate it into ArcGIS, and create an index of parcels that fit the pre-requisites in terms of smart location and linkage (SLL), then they could apply a zoning overlay system to incentivize development. Because alignment between LEED-ND and city request-for-proposals is already occurring (even the US Department of Housing and Urban Development (HUD) has made LEED-ND a requirement for receipt of funding for Choice Neighborhoods projects) this would be a natural step forward.

Chapter 7 and 8 also focus on spatial income mixing by examining the concept through the lens of both housing policy and design. Traditionally, the income mixing debate has been situated between the mobility model (dispersing people of different incomes throughout new neighborhoods increases diversity), and the community development model (investing *in situ* in local existing neighborhoods enhances place attachment, community and identity). Interviews with LEED-ND Accredited Professionals and developers illustrate that income mixing—when it does take place in new sustainable neighborhoods—mainly occurs in a horizontal fashion (the affordable housing units are distributed throughout a new neighborhood), and this is due to the current financing mechanisms. While the incorporation of affordable housing through horizontal mixing is a step forward, it does not guarantee that the affordable housing will be spatially dispersed throughout a

neighborhood. Developers are ultimately reluctant to engage in the construction of vertically mixed income buildings, given that there is a general stigma that mixed-income units would not appeal to higher income clients. In a few particular instance that are examined in this dissertation, vertical income mixing has occurred in both Vancouver and New York, but these examples are not without controversy. The 'poor door' problem of segregated entrances within the same building or complex has arisen, sparking recent debate about discrimination and access to amenities. With an eye to the future, this dissertation ends in Chapter 9 by highlighting three new forms of affordable housing that have great potential to provide equitable, livable housing: vertical income mixing, accessory dwelling units, and microunits. These forms of affordable housing and the benefits they offer need to be further scrutinized, including the challenges and barriers.

To Troy, a fellow planner & designer

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ACKNOWLEDGMENTS

I would first of all like to acknowledge my funding sources. The Dean's Normative Time Fellowship (DNTF), as well as the Edward Hildebrand Graduate Fellowship from the Canadian Studies program at the University of California, Berkeley, in addition to the Social Sciences and Humanities Research Council of Canada (SSHRC) Graduate Fellowship all have directly supported this dissertation research. I would especially like to thank the Canadian Studies Program for their continued support of Canadian studies related research, and for supporting young scholars interested in comparative Canada-US related research. In particular, I would like to thank Dr. Irene Bloemraad and Dr. Rita Ross who manage a successful Canadian Studies Program at UC Berkeley, and contribute to the community of scholars and academics interested in Canadian Studies.

My deepest gratitude goes to my committee members, who made my time at UC Berkeley more Academically enriching than I ever could have experienced. I would like to thank my dissertation advisor, Professor Elizabeth Macdonald, for providing an incredible amount of intellectual support and advice throughout the PhD program at UC Berkeley. I would also like to thank her for her close reads of my work, and for keeping me on track and focused. I would also like to thank Professor Elizabeth Deakin, for her close reads of my dissertation, her continued support of women in planning, and for always encouraging me to think critically, and her close reads of my work. I would also like to thank Professor Peter Bosselmann for his excellent guidance in environmental design research methods, and for his advice on housing design and urban theory. I would also like to thank Professor Harrison Fraker for inspiring me to investigate the complexity of sustainable neighborhoods and sustainability principles, and for challenging me to make a difference by asking tough, critical questions. Finally, I would like to thank Professor Carolina Reid for her specific advice on affordable housing policy, and her close reads of my dissertation.

I am also extremely grateful to the Department of City and Regional Planning for their financial and administrative support throughout my time at UC Berkeley. Specifically I would like to thank Clayton Hall, Malla Hadley, Leslie Huang, Kathleen Pera, Yeri Caesar- Kaptoech, Pat Ramirez, for always being on hand for program and administrative advice.

In solidarity I would like to thank my PhD candidate peers, who are all brilliant and wonderful colleagues. We had an extremely large cohort and thus were able to rely on each other for both intellectual and emotional support. I would like to thank Jesus Barajas, my fellow Managing Co-Editor of Berkeley Planning Journal Volume 26. I am proud to have served as a joint editor with you for the longest running student planning journal in North America. I would like to thank Michael Mendez, Pedro Peterson, Andrea Broaddus, Lizzy Mattiuzzi, Cheryl Young, Yizhen Gu, Julie Gamble, Matthew Wade, Geoff Boeing, Hyungkyoo Kim, Jake Wegmann Fletcher Foti, Heather Arata, Sophie Gonick, Jennifer Tucker, Monica Villalobos, Allie Thomas and Aaron Young for all their program-related support. I would also like to thank fellow colleagues who I have taught at UC Berkeley with, including Ian Carlton, Fernando Burga, Ayrin Zayner, Nicole Horn, Jennifer Hughes and Leah Stockstrom.

I would also like to thank my mother, Catharine Szibbo, for encouraging me to do a PhD. As a female completing a PhD in the 1980s when it was tough slogging for women, you have been an inspiration to me—providing me with advice and mentorship along the way. I would like to thank my father, Alec Szibbo, for encouraging me to be a 'go getter', despite my introverted personality, and for never giving up. They say completing a PhD is an endurance test, and that is no joke. You are in for the long haul, but it is worth it. And to my sister, Dyana Szibbo, who always makes me smile, who inspires me as a woman in engineering, and who knows all about livability from living in another great city down under: Melbourne, Australia.

Most of all, I would like to thank my husband Troy Reinhalter, whom I met in graduate school in the Master of City Planning (MCP) program in 2008 at UC Berkeley. You have provided me with all the support I could have ever asked for, and on so many different levels: intellectual, emotional, spiritual and physical. I know there were many late nights spent arguing about planning principles, chapter revisions, and research methods. Thank you for being guest speaker in my classes, and a supportive fellow conference-goer. Your constant intellectual banter has both persuaded me and motivated me to be a better academic.

INTRODUCTION

This introduction provides a 'road map' of the dissertation, summarizing the issues addressed in each chapter. The dissertation uses a mixed-methods approach to examine the LEED-ND rating system, and critically questions how livability could be evaluated and incorporated into the rating system. Additionally, the research addresses if the sustainability pillar of social equity, through the provision affordable housing, can be improved and strengthened within the rating system.

Chapter One: 'LEED-ND—Problematizing a Rating System'
This chapter introduces LEED-ND as an aspirational, yet problematic and self-serving sustainable neighborhood rating system. It describes the rating system in relation to sustainability goals, and describes the current gap in the literature on LEED-ND. It lays out the major research questions on sustainability, livability and affordability, and proposes a research approach and several hypotheses for answering the research questions.

Chapter Two: 'Livability—What Does it Mean?'
Chapter Two looks at livability as a concept and definition. It looks at the key schools of thought that have contributed to livability studies, focusing on The Berkeley School of Planning and Urban Design. This Chapter also differentiates sustainability from livability, and discusses sustainability as a concept. This chapter also highlights specific design issues related to livability, including open space, compactness, density, mixed-use development, walkability, territory and affordability.

Chapter Three: 'Research Methods'
Chapter Three introduces the main research methods used in the dissertation. It describes the post-occupancy evaluation (POE) methods used to answer questions about neighborhood livability. It also outlines the case selection process, highlights the research controls, the data collection and the survey design methods used. In addition to the POE methods, this chapter also focuses on the methods used to answer the research questions pertaining to affordability, including LEED-ND data aggregation, online LEED-ND survey methods, and the policy analysis case studies of spatial income mixing.

Chapter Four: 'Background on Post-Occupancy Case Studies'
Chapter Four introduces the four neighborhoods in the post-occupancy analysis: Southeast False Creek in Vancouver, British Columbia; East Clayton in Surrey, British Columbia; Hoyt Yards in Portland, OR; and Fairview Village in Fairview, OR. The chapter presents statistical information for each of the four developments, and focuses on LEED-ND data, land use and development statistics, in addition to density and unit type statistics. The chapter also provides a concise history of the vision and goals for each neighborhood, and major events and issues experienced during the development process.

Chapter Five: 'Livability in Four Neighborhoods'
This chapter addresses the findings from the mail-out mail back Post-Occupancy Evaluation (POE), which focused on evaluating 19 livability factors in four neighborhoods. Descriptive statistic survey results are described and analyzed. Demographics, travel modes and findings on livability and affordability are presented. This chapter also focuses on findings from the suburban TND sites and specifically their livability needs. If planners want to increase the density of current

neighborhoods rather than support suburban development on the fringe, then it is necessary to know what livability factors could potentially entice suburban fringe dwellers to live in urban contexts.

Chapter Six: 'LEED-ND and Affordable Housing'
Chapter Six draws upon 1) statistical LEED-ND credit-level evidence 2) survey evidence from 114 LEED-ND Accredited Professionals and 3) twenty interviews with LEED-ND accredited professionals, to illuminate the role of the rating system in affordable housing provision. This research illustrates that only 40% of LEED-ND projects currently include affordable housing. Furthermore, survey, interview and case study evidence reveals that LEED-ND professionals are not satisfied with the current affordability criteria in the LEED-ND rating system, and that the LEED-ND rating system itself has very little impact in the provision of affordable housing. Given that it is easy for for-profit developers to opt out of the affordable housing credit, planners will have to rely on a broader portfolio of strategies—namely a combination of both developer incentives ('carrots') and inclusionary zoning regulation ('sticks') to reinforce the provision of affordable housing in new sustainable development. In addition, planners and government officials must capitalize on recent subsidies directed toward the provision of affordable housing, as illustrated by examples from California.

Chapter Seven: 'Affordable Housing and Spatial Income Mixing in New Sustainable Neighborhoods'
Chapter Seven introduces three innovative models in spatial income mixing. Income mixing is primarily a housing policy endeavor, however this chapter uses a spatial approach to illustrate how various urban form typologies can differently influence income mixing. If new sustainable developments provide affordable housing, then income-mixing policies must consider urban design strategies and building types that could potentially be incorporated into rating systems or guidelines. Firstly, this chapter investigates the two main theoretical housing policy camps that attempted to support income mixing (the mobility model and the community development model). This Chapter also draws on interview evidence from LEED-ND AP professionals to illustrate current challenges and successes with income-mixing policies, and reveals specific bias and stigmatism surrounding income mixing. Finally, three innovative models are presented for spatial income mixing in the Pacific Northwest: 1) Cooperative Vertical Income Mixing in Southeast False Creek, Vancouver, BC, 2) Horizontal Mixing in Hoyt Street Yards in Portland, OR and 3) Vertical Income Mixing in The Woodwards Building in Vancouver, BC.

Chapter Eight: 'Recommendations for LEED-ND
This chapter presents a series of recommendations garnered during the 20 interviews with LEED-ND Accredited Professionals. The findings and recommendations reflect upon the overall feasibility and utility of LEED-ND as a rating system for planners, sustainability consultants, architects, landscape architects, engineers and developers. Key recommendations include reducing the cost of LEED-ND certification so that it is based, increased peer review, and streamlining the ArcGIS. These recommendations will ultimately help reform and improve the rating system for future use by practitioners and developers.

Chapter Nine: 'Conclusions'
The major conclusions of the dissertation are presented and summarized in chapter nine. This chapter also outlines the contributions of the dissertation to the field of urban design, and in

particular focuses on the contributions to the planning literature. This chapter also contains a description of potential areas for future research, with a focus on vertical income mixing, accessory dwelling units (ADUs) and microunits. This chapter closes with the major issues addressed in the dissertation, the individual policy implications of the research findings for planning practice, and provides specific recommendations for improvement in the public, private and academic spheres.

CHAPTER ONE: LEED-ND—PROBLEMATIZING A RATING SYSTEM

HISTORY & GOALS

One of the recent planning tools for analyzing and promoting higher density and mixed-use development is the LEED-ND rating system. LEED-ND is a sustainable neighborhood rating system developed by the US Green Building Council (USGBC) in 2007, in concert with the Congress for New Urbanism and the Natural Resources Defense Council. It is a rating system that integrates the principles of smart growth, new urbanism and green building into a national rating system for neighborhood design. Its aim is to use design standards to promote sustainable urban design in the construction and building industry. Today, LEED-ND is known as the 'gold standard' in sustainable neighborhood development in North America, and has gained significant popularity among planning professionals, developers and sustainability consultants.

LEED-ND & The Universe of Sustainable Neighborhood Rating Systems

The formal LEED-ND standard was released in 2009, in the context of a pilot rating system (Hidalgo and Hernandez 2001:277). Several critiques (Newsham, Mancini, and Birt 2009; Zimmerman and Kibert 2007; Retzlaff 2008) and valuation studies (Dermisi 2009) have been conducted to date on LEED for New Construction (NC)—a rating system for individual commercial buildings, considered a precursor to LEED-ND. Studies have also been done that assess LEED for Homes (residential buildings)(Reposa 2009) and LEED for Existing Buildings (Hodapp 2008). However, Garde (2009) Ewing et al. (2013), and Sharifi and Murayama (2013b) have completed the only comprehensive studies on LEED-ND development thus far. However, none of these studies surveyed residents in situ, rather they have analyzed and compared secondary LEED-ND scorecard data. Around the world, other rating systems have been developed to assess sustainable communities, but LEED-ND is by far the most well known rating system in North America (Sharifi and Murayama 2013a). The larger universe of sustainable neighborhood rating systems around the world is shown in Table 1.

Table 1: Sustainable Neighborhood Rating Systems Around the World (adapted from Sharifi & Murayama (2013b)

Name of Tool	Developer(s)	Country/Region
BREEAM Communities	BRE Global	United Kingdom
CASBEE for Urban Development	Japan Sustainable Building Consortium (JSBC), and Japan Green Building Council (JaGBC)	Japan
DGNB for Urban Districts	German Sustainable Building Council	Germany
Green Star Communities	Green Building Council of Australia	Australia
GSAS/QSAS Neighborhoods	Gulf Organization for Research & Development	Qatar
Green Mark for Districts	Building and Construction Authority	Singapore
Neighborhood Sustainability Framework	Beacon Pathway Ltd	New Zealand
LEED-ND	USGBC, Congress for the New Urbanism, Natural Resources Defense Council	USA
Star Community Index	International Council for Local Environmental Initiatives (ICLEI), USGBC, National League of Cities, Center for American Progress	USA
Ecodistricts	Public-Private Partnership in Portland, OR	USA
SEED®	Design Corps	USA

LEED-ND Certification

Projects seeking LEED-ND certification must be evaluated by a LEED-ND Accredited Professional, who assesses three major development categories: Smart Location and Linkage (SLL), Neighborhood Pattern and Design (NPD), and Green Infrastructure and Buildings (GIB) (see Figure 1). There are two additional optional categories for innovation and regional priority credits. Each major category has several prerequisites that must be achieved, in addition to flexible 'credits.' The credits are made up of a range of optional points (See Figure 2) below. There are defined certification thresholds based on the total points obtained: certified (40-49), silver (50-59), gold (60-79) and platinum (80+). As of 2014, 216 projects have been registered for LEED-ND evaluation, but only approximately 18% (38) of those projects are fully certified (Studhalter 2014)

Figure 1: The LEED-ND Rating System Total Possible Points (USGBC®)

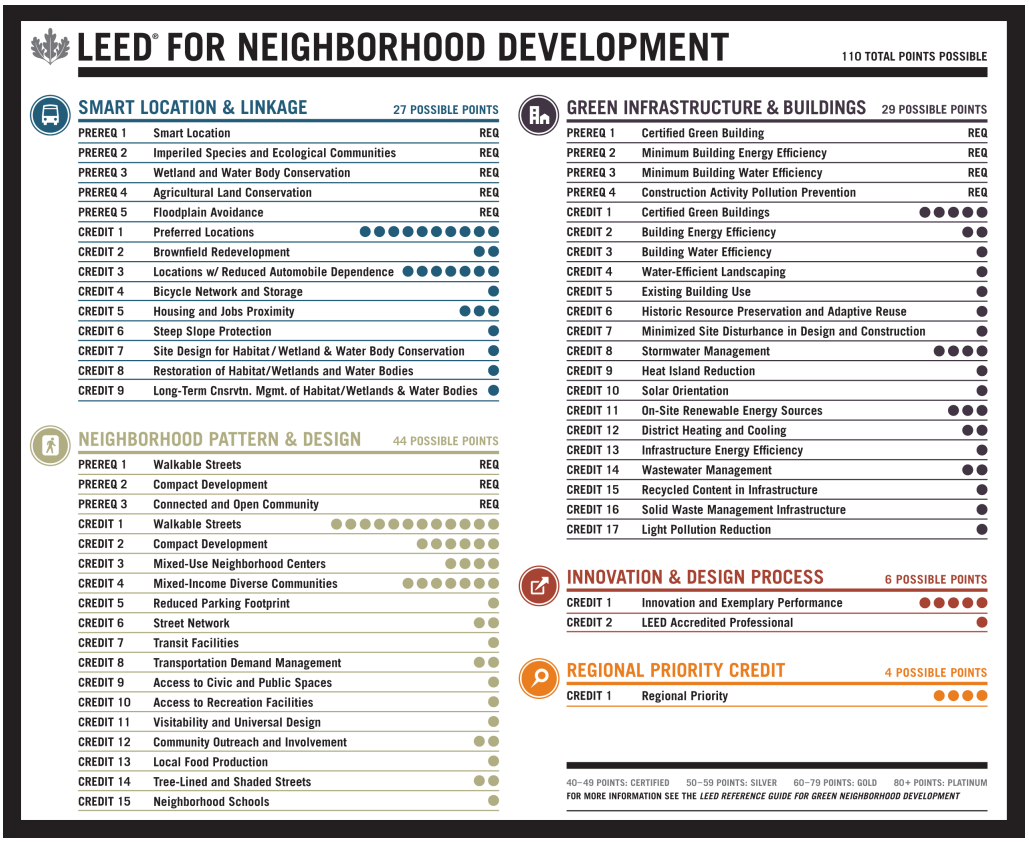


Figure 2: The LEED-ND Rating System for v3 2009, illustrating the credits and points possible for each credit. The credits are listed to the left, and the dots represent the number of points possible (USGBC ®). A graphic for LEED-ND v4 does not yet exist.

LEED-ND has gone through several iterations, including a LEED-ND pilot, LEED-ND v3, and LEED-ND v4. LEED-ND v3, which was introduced in 2009, possessed three project stages:

- *Stage 1-Conditionally Approved Plan*: Projects that have not completed public review, or entitlements (land use approvals), can earn this designation, envisioned to help gain support from the local government or community.

- *Stage 2-Pre-Certified Plan*: Fully entitled projects and/or projects under construction may earn this designation, which can help to expedite permitting, secure financing, and attract tenants.

- *Stage 3-Certified Neighborhood Development:* Constructed projects can certify that the final built project meets all attempted pre-requisites and credits.

LEED-ND v4 was introduced in 2013, and the new designations of LEED-ND Plan and LEED-ND Built Project replaced the Stage 1, 2 and 3 structure of LEED-ND v3 2009. This new framework alleges to " provide project teams with more flexibility and support as you certify projects at all phases of development, from conceptual planning, through design and development to completed construction." (Maynard 2014). Stage 1 is now characterized by LEED-ND Plan, and Stage 3 is characterized by Built Project (Melton 2013). In most cases, developers will usually approach a LEED-ND Accredited Professional (AP) firm once they have a project that is entitled, financed and mostly designed and planned. Given that this is currently the norm, 'LEED-ND Built projects' are far more common at the moment, specifically because LEED-ND is often added afterward for marketing caché, and after the major financing and entitlement hurdles have been dealt with (Reinhalter 2015).

Certification costs vary depending if the developer wants the evaluation to be expedited or not, but generally costs hover around $20,000 US (including project registration)(GBCI 2014). A project can register for a few thousand dollars, but obtaining the actual LEED-ND certification is a definite investment. The $20,000 US does not include the fees required to hire a LEED-ND Accredited Professional (AP) i.e. an accredited sustainability consultant or an urban planning firm or architecture firm to complete the assessment. This usually costs another $30,000-$60,000 US, depending on the size (# of units) of the project (Reinhalter 2015). There is no minimum or maximum size for LEED-ND development. LEED-ND recommends that projects consist of at least two habitable buildings and not be larger than 320 acres. As a result, projects typically range in scale from 1+ acres to 30+ acres. Very large projects are encouraged to subdivide their applications into smaller neighborhood submissions (Lambert 2010).

Certification takes about 6 months to a year, and is conducted by a LEED-ND Accredited Professional (AP), who liaises with the developer and the Green Building Certification Institute (GBCI). The consultant may offer to look at the pre-requisites for new LEED-ND projects before a contract has been signed, in order to see if the project even qualifies as LEED-ND. That way a new client has some idea of the certification feasibility of project location and site. Due to the strict and narrow requirements of the pre-requisites, is virtually impossible to have a greenfield LEED-ND site, as infill and brownfield development is heavily incentivized. The LEED-ND AP will then analyze the developer-provided plans and documents, going through the LEED-ND checklist and criteria (see Figure 2). The LEED-ND Accredited Professionals use GIS, AutoCAD, Google Earth and Adobe Illustrator to analyze the 1) site plans, 2) landscape plans and 3) detailed construction documents (Reinhalter 2015) and assign points and credits. The LEED-ND AP will then submit a fillable pdf scorecard through the USGBC website. The GBCI then reviews the work done by the LEED-ND AP, and then awards a level of certification (Reinhalter 2015).

Current Issues with LEED-ND

Unlike either Smart Growth or New Urbanism/Traditional Neighborhood Design (TND) frameworks, LEED-ND incorporates both green building principles and landscape/site-level concerns in an attempt to curb climate change and the Urban Heat Island (UHI) effect. Freilich et al (2010) note that LEED-ND as a rating system addressed the concern that principles of new urbanism are divorced from sustainability and growth management issues, as the rating system integrates: smart growth principles, new urbanism principles and green building. LEED-ND is a voluntary and market-driven approach that seeks to push developers to go beyond satisfying the bare minimum development regulatory requirements.

Fraker (2013) tested the LEED-ND rating system criteria using performance data from four neighborhoods in Germany (Vauban in Freiburg and Kronsberg) and Sweden (B001 in Malmo and Hammarby Sjostad in Stockholm). He found that the majority of the points in the rating system awarded were to items that do not reduce CO_2 emissions in a significant way, such as having the neighborhood evaluated by a LEED-ND Accredited Professional (AP). All of the buildings studied in all four European neighborhoods performed more efficiently than most LEED 'green' buildings in North America, yet because they did not complete the official certification process, they lost quite a few points. In addition, he also found that the percentage of points awarded to meaningful categories such as renewable energy sources and energy efficiency was relatively low. Fraker concludes that the focus on possessing a trademarked 'LEED' certification is ultimately self-serving, and it could be argued that to some extent a market-based rating system becomes self-fulfilling prophecy, since the priorities lie with perpetuating the brand rather than creating quality neighborhoods.

In addition to Fraker's recent work, several student studies guided by Peter Bosselmann have tested the rating system criteria on older, well-designed neighborhoods throughout the Bay Area that would appear to be considered livable, but are not LEED-ND certified (Clark et al. 2013; Boeing et al. 2014), including the Duboce Triangle neighborhood of San Francisco, Hercules Bayfront in the East Bay, and Temescal in Oakland. Measurement results indicated that none of the neighborhoods would qualify as a certified LEED-ND neighborhoods, because they did not meet the technical criteria (ex. connectivity as measured by intersections per square mile), however, residents ranked their neighborhoods as highly livable places. These studies illustrate that LEED-ND in its current form may not be able to reflect the desired amenities and values of

many communities.

Garde (2009) critically evaluated the rating system and found that participation in the LEED-ND rating system does not necessarily guarantee sustainable neighborhood development. Garde surveyed a variety of LEED-ND developments, assessed their point achievements, and interviewed developers and LEED-ND consultants regarding the process. One problem Garde (2009:428) notes is that the LEED-ND rating system provides very little credit for the sufficient provision of affordable housing. The three pillars of sustainability are touted as environment, equity and economy, but equity is largely ignored in LEED-ND. Garde (2009) also found that those projects seeking LEED-ND Gold or higher went after points in the Green Infrastructure and Buildings (GIB category, in addition to addressing affordable rental housing, but those that sought silver and mere certification did not. LEED-ND, although it has been revised since its inception in 2007, it has never incorporated post-occupancy evaluation (POE) as part of its criteria. Although Mapes and Wolch (2010:115) argue that LEED-ND is a constructive step forward in that it pressures developers to move beyond 'greenwashing' to incorporate features that have a greater impact on long-term sustainability, LEED-ND clearly falls short in terms of social sustainability—particularly in its failure to require post-occupancy evaluation and assessment of resident perceptions of the built environment, and lack of attention to affordable housing.

Other recent studies of LEED-ND have looked at its potential impact on mode share and vehicle miles traveled (VMT). Ewing et al (2013) predict that VMT (vehicle miles traveled) per person in LEED-ND developments will be reduced by 24 to 60 percent from the respective regional average. However, this study is merely a projection, using comparative data from LEED-ND scorecards/project data and the 2009 National Household Travel Survey (NHTS).

As of 2013, LEED-ND underwent changes to become LEED-ND v.4 (USGBC 2013), which aligns itself with the reference standards for current industry norms as well as with the LEED Building Design and Construction (LEED-BD&C) rating systems. A variety of credits have undergone name changes, in order to better reflect their intent in the BD&C rating systems. In addition, a few credits now more closely reflect the requirements and underlying standards in LEED for New Construction and other BD&C rating systems. However, aside from name changes and a few changes (or 'clarification') in the credits, no substantive changes have been made that truly affect 'social sustainability.' The credit 'Housing Types and Affordability' (formerly known as the Mixed Income Communities credit) has been left untouched by the USGBC, despite non-profit groups championing an increased weighting of the credit (Wells 2014).

Post Occupancy Evaluation (POE) and Livability

One of the challenges of LEED-ND rating systems has been developing a performance-based system of indicators, whereby the development is constantly evaluated on what it claims to have achieved with regard to sustainability, especially social sustainability. Although the other LEED programs have moved toward post-occupancy evaluation, this criterion has never been specifically incorporated in to LEED-ND.

Within the field of architecture, post-occupancy evaluations (POEs) have matured and evolved over time as a useful tool for evaluating the performance of both single and multi-residential buildings (Garde 2009). Post-occupancy evaluations involve a survey of building performance and/or resident satisfaction after residents have moved into a development or neighborhood. POEs attempt to assess whether the building has been successful in meeting its projected benchmarks. Private consulting firms or academic institutes normally carry out POEs, as they are interested in quantifying building performance for either marketing purposes or scholastic studies (Rabinowitz 1989). More recently, POEs have received a lot of attention as a popular tool for evaluating 'green buildings', since the combined set of survey data can validate sustainability goals. However, while energy use and sustainability issues have been thoroughly examined, the social experience of residents has largely been ignored or marginalized, and this presents serious limitations within the discipline. More often than not, the measurement of end-use energy becomes the sole end goal (Newsham, Mancini, and Birt 2009), with the possible inclusion of occupant comfort and/or productivity (Paumgartten 2003; Paul and Taylor 2008). Occupant comfort studies are usually conducted for commercial buildings, with the goal of increasing 'worker productivity'—rather than worker quality of life or livability—and are often financed by large corporations. There are scarce financial incentives and support to study residential buildings, and resident satisfaction is often overlooked unless it is a high-profile pilot project. Some recent examples of neighborhood-scale POEs include the Mustel group's (2010) analysis of SFU UniverCity in Burnaby, Metro Vancouver, and Lancaster's (2008) POE of False Creek North, in Vancouver, BC. The frequency of such post-occupancy evaluations is recommended at 3-6 months (an immediate operational review), 9-18 months (after transfer of development has been completed and residents are familiar with the building), and strategic reviews every 3-5 years(University of Westminster 2006).

The Dilemma of Sustainability

Since the late 1990s, sustainability has typically defined by the 'triple-bottom line' or 'three-legged stool' model: Equity/People, Economy/Profit, and Environment/Planet (Campbell 1996; Wheeler 2004). Each of these three categories encompasses a wide range of factors or variables that contribute to the concept of sustainability, and the 'triple-bottom line' has become the dominant and most popular model for illustrating sustainability as a concept.

In the early to mid-2000s, the constraints of each of these categories were defined, and the tensions between the categories noted (Berke and Conroy 2000; Godschalk 2004). Environment/planet sustainability variables are generally easier to measure, since they relate more directly to the built environment. Meta-factors, for example, that contribute to the energy efficiency of the built environment with regard to the transportation and land use connection have been assessed in studies by Cervero and Ewing (2010a). Many of these variables have surfaced in the LEED-ND rating system in both the Smart Location and Linkage (SLL) category and the Neighborhood Pattern and Design (NPD) category. The economy/profit variables are also relatively easy measure—but less easier to measure than environmental variables—since 'the real cost' of

carbon or 'the real cost' of health impacts needs to be translated from an environmental variable into a particular dollar amount through contingent valuation. Equity, however, is empirically the most problematic 'leg' of the 'three-legged stool' to measure. Due to the fact that political, cultural and social factors contribute to this category, its emphasis on context and relative cultural value make it the most difficult category to directly measure. However, the complexity does not lead to the conclusion that such investigations are lost causes. As Davidson (2009) notes, new studies in sustainability have a "potential for politics", where we should be critically asking "what type of society do we want to sustain", and demanding that social ethics be placed at the forefront of the sustainability agenda. Questions of where social equity, environmental and social factors fit within the sustainability model, and their import, have risen to the forefront in academic studies, illustrating the topical and important nature of such inquiries (Magis 2010; Turcu 2013; Pearsall and Pierce 2010; Agyeman 2005a).

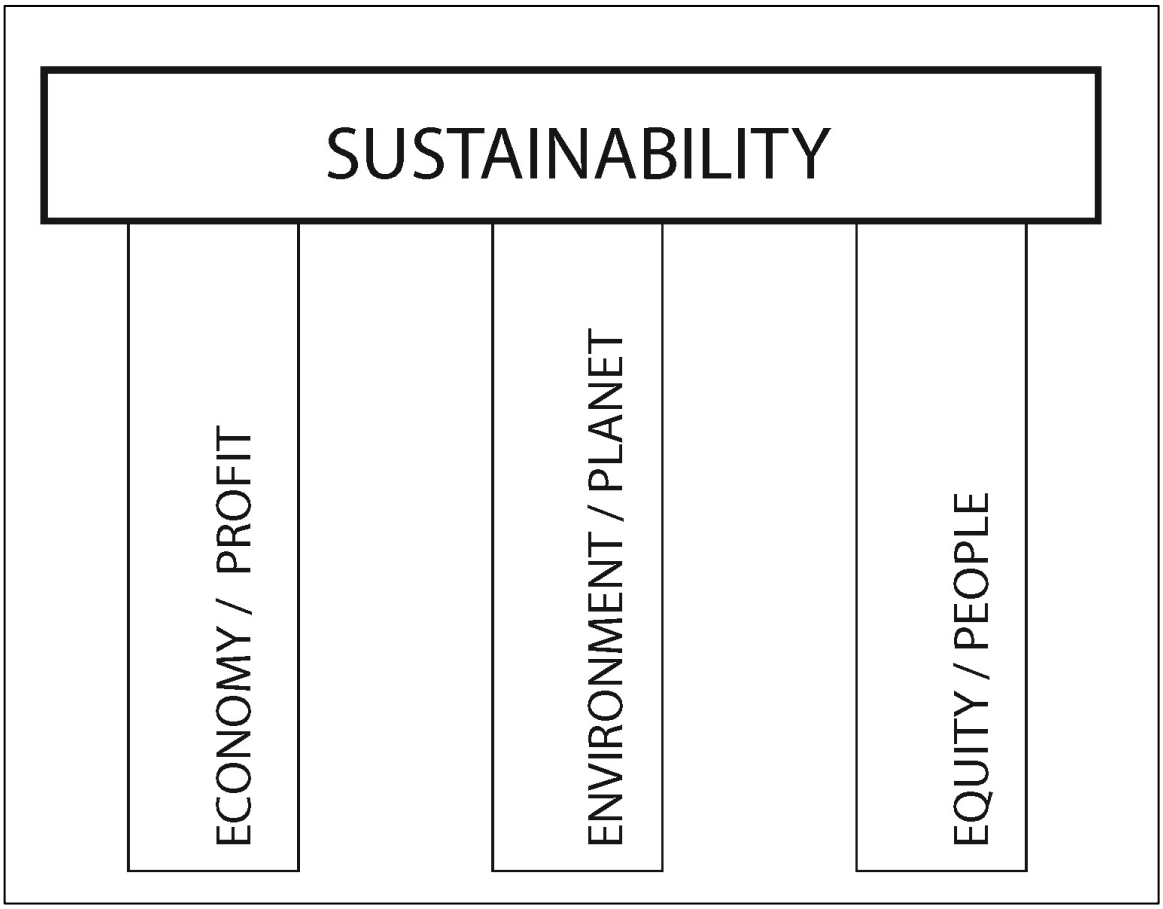


Figure 3: The Three-Legged Stool of Sustainability

Because the tri-pillar concept of sustainability has been critiqued by some as static, and too bounded in its conceptual framework, new sustainability models have recently emerged, that are based on a rotating 'wheel' format, which incorporates a host of other practice-oriented factors, such as management, governance and engagement. These models are more hesitant to divide and compartmentalize the various contributing factors to one particular sustainability category such as equity, environment or economy An example of this is the SPeAR® sustainability decision-

making tool, created by the global engineering firm ARUP, which instead appraises projects based on key themes such as transport, biodiversity, culture, employment and skills.

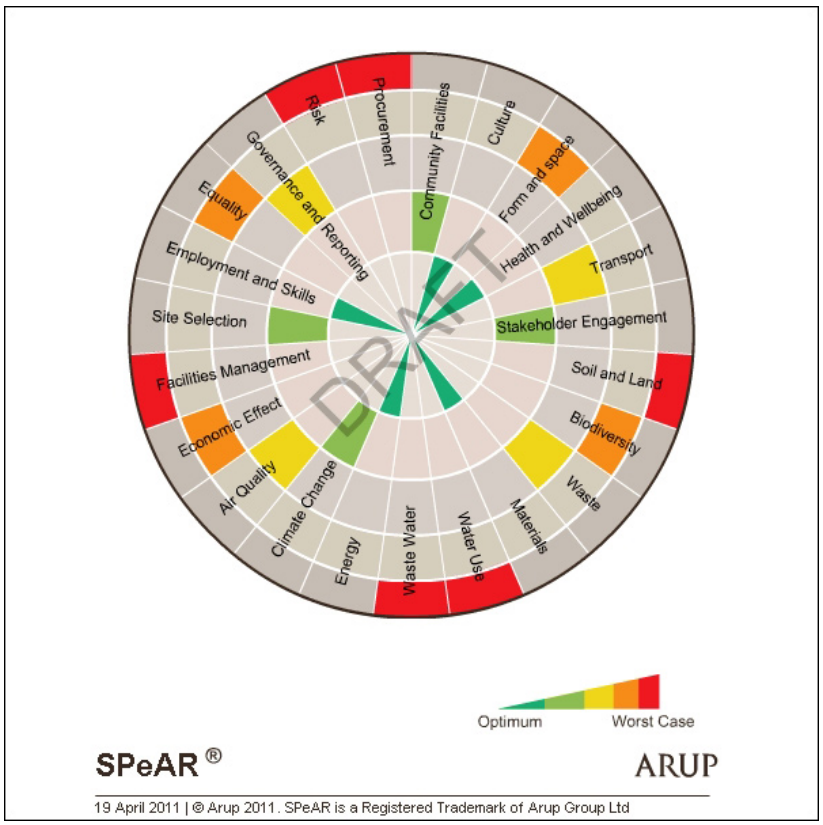


Figure 4: SPeAR (R) is a global sustainability tool, intended to assess a wide variety of sustainability factors.

Overall, LEED-ND as a rating system claims to reduce VMT (and indirectly GHG emissions), and thus it contributes to environmental leg of sustainability. In addition, LEED-ND seeks to "*build communities where people of a variety of income levels can coexist and where jobs and services are accessible by foot or transit*" (USGBC 2006). As such, it also claims to attend to the equity and economy pillars. However, this dissertation asks if LEED-ND is really a useful and successful tool that adequately addresses social equity and social sustainability. Ideally, LEED-ND has the potential to evolve as a checklist and act as a predictor of performance. This dissertation posits that LEED-ND currently as it currently exists is a well-meaning but flawed system, and that there is much room for improvement.

GAP IN THE LITERATURE/ FUTURE RESEARCH NEEDS

Little study has been done to date for LEED-ND neighborhoods, although the popularity of such rating systems are presently surging. This study acknowledges the gap in the urban design research field regarding 'green' or 'sustainable' neighborhood rating systems, and critically questions if LEED-ND upholds the pillar of social equity.

LEED-ND and other rating systems look solely at physical indicators to evaluate sustainable neighborhood form—they do not take into account human satisfaction with the built environment, or attempt to qualitatively evaluate how 'livable' a place is for the people who reside within. It is apparent that human and social factors and social sustainability elements—particularly the

provision of affordable housing—require a more significant foothold in such rating systems, if they purport to fully support all three tiers of sustainability: social, economic and environmental (Wheeler 2004).

RESEARCH QUESTIONS

The main research questions addressed in this dissertation are related broadly to concepts of sustainability and livability, and to affordable housing more specifically:

Sustainability

- Does LEED-ND attend to all three legs of the 'sustainability stool' equally? Is the rating system successful in ensuring the 'equity pillar' in new sustainable neighborhoods?

Livability

- How do residents of LEED-ND neighborhoods rank and weight LEED-ND criteria? Do rankings and weightings differ from those established by LEED-ND?

- Do residents of LEED-ND neighborhoods rank and weight livability criteria differently than residents of Traditional Neighborhood Design (TND) suburban neighborhoods? How do the rankings and weightings differ in these two neighborhood types?

- Are there any criteria missing from LEED-ND that residents believe contribute to neighborhood livability?

- What additional criteria could be incorporated into sustainable neighborhood evaluation systems such as LEED-ND?

Affordability

- To what extent are new LEED-ND neighborhoods incorporating affordable housing?

- How does LEED-ND as a rating system incorporate affordable housing criteria? Does LEED-ND uphold the principles of social sustainability and social equity, if affordable housing is bypassed?

- What recommendations can be made to improve the LEED-ND rating system in terms of the affordable housing element?

- How would LEED-ND Accredited Professionals (AP) improve the rating system in terms of general feasibility and use-value? What are their specific suggestions and recommendations?

- What are some new urban form models for spatial income mixing that LEED-ND and other sustainable neighborhood rating systems could consider?

PURPOSE STATEMENT

This mixed-methods, multi-case dissertation determines if LEED-ND attends to all three legs of the sustainability model equally. It also determines if the fulfillment of LEED-ND criteria results in a 'livable' neighborhood as measured through residents ranking and weighting of current LEED-ND criteria. Furthermore, this dissertation also determines if additional socio-cultural and socio-economic indicators for livability, which are not currently part of the LEED-ND rating system (affordability, safety and security, privacy, neighborhood territory etc.), are deemed equally important by residents.

Research Approach

In order to answer the above questions pertaining to sustainability, overall livability, and in a more detailed fashion, social equity and affordable housing, this research utilizes a mixed methods approach. The research questions initially focused on more broad questions regarding sustainability and livability, but findings from the post-occupancy analysis in 2013 suggested that issues related to affordable housing and social were important, and thus follow-up surveys specifically on the topic of affordability were carried out the subsequent year.

Livability:

1) March-August 2013: Post-Occupancy Analysis of four sustainable neighborhoods through a mail-out mail back survey—two LEED-ND neighborhoods (Southeast False Creek, Vancouver, BC and Hoyt Yards, Portland, OR) and two TND suburban neighborhoods (East Clayton, Surrey, BC and Fairview Village, Fairview, OR)

Affordability

2) March 2014: Online survey of LEED-ND Accredited Professionals
3) September-October 2014: Interviews with LEED-ND Accredited Professionals
4) February-March 2015: Policy Analysis of Spatial Income-Mixing Strategies in three neighborhoods

Hypothesis

It is predicted that certain factors will be more important to residents living in suburban versus urban neighborhoods. It is also predicted that LEED-ND neighborhoods are currently not perceived to be affordable by 1) the residents themselves and 2) LEED-ND AP professionals.

The first specific hypothesis is that residents of both urban LEED-ND and non-LEED-ND suburban neighborhoods will value qualities not captured by the LEED-ND rating system.

Hypothesis #1

- *LEED-ND does not attend to all three elements of the sustainability model equally. LEED-ND is not entirely successful in its attempt to incorporate a wide range of livability factors into its green neighborhood rating system. There are important social factors that require further consideration and incorporation in the rating system*

The specific range and exact prioritization of livability qualities will vary somewhat between the case studies, but the overall premise is that LEED-ND does not adequately address certain social

factors. Overall this study will identify the range of "missing" criteria from LEED-ND and devise ways to incorporate them into neighborhood evaluation methods.

Hypothesis #2

- *LEED-ND does not uphold its commitment to social sustainability and social equity within the sustainability model, as there are very few points in the rating system awarded for affordable housing. Although there are some considerations in the rating system for social equity, because affordable housing is a critical and key element in terms of ensuring social equity, the rating system could improve in terms of its commitment to affordable housing*

- *A multi-pronged strategy of utilizing both developer incentives, increased subsidy and regulation will continue to be necessary to ensure that affordable housing gets built in new sustainable developments, given the weakness of the affordable housing element in the LEED-ND rating system*

- *There are new models of spatial income-mixing that could be considered in new sustainable development, such as vertical income mixing*

Specifically, this dissertation focuses on social equity, and asks the question if LEED-ND as a sustainable neighborhood rating system is a key driver of affordability. This dissertation will also provide more general recommendations for improving the rating system, based on the opinion of LEED-ND Accredited Professionals (AP).

CHAPTER 2: LIVABILITY—WHAT DOES IT MEAN?

INTRODUCTION

Donald Appleyard was the first scholar to coin the term 'livability' in the 1970s and 1980s, and specifically referenced the term with regard to the quality of neighborhood streets. Appleyard (1980; 1982) stipulated that livable neighborhood streets should be places of sanctuary and comfort, places that were healthy and protected from noise, places that were free from pollution and traffic intrusions, and places with a defined neighborhood territory, sense of community and neighborhood identity. While there is some truth to this universal prescription of livability, there is much more to creating a livable place than merely checking items off a list. Meeting a set of generalized physical criteria does not necessarily result in a successful and sustainable urban environment. Livable places and neighborhoods are deeply contextualized environments, which have particular historic, political, economic and socio-cultural dimensions embedded within. Often, these qualitative dimensions vary according to place and time. Importantly, the people who ultimately live in such developments have a measurable impact on the success of the new developments, and how such developments are received by the greater public-at-large. Jacqueline Vischer (2008) points out that design struggles between social constructivism and environmental determinism, and that a person, or user-focused approach needs to be considered that takes both forces into account equally, negotiating between these two extremes. Urban design research can play an active role by contributing to the design of new sustainable, urban neighborhoods and ensuring that such positionality on the spectrum is maintained. People living in a neighborhood ultimately contextualize and created nuanced versions of what livability means to them on individual and social levels.

Over the past five years, a new rating system known as LEED-ND has been developed to assess sustainability at the neighborhood scale, rather than at the individual building. The rapid adoption of this sustainable rating system has promoted the implementation of sustainable neighborhood design around the world. Yet despite its success, a rating system such as LEED-ND is still overly reliant on physical design criteria (measures of compact urban form, transit accessibility), lacking a critical examination into how qualitative and social factors impact daily and resident perception in such sustainable neighborhoods. A key question remains as to whether or not LEED-ND neighborhoods are livable and equitable places. This chapter aims to highlight the key literature and the schools of thought that have conceptualized livability, specifically from an urban design and planning perspective.

LIVABILITY AS A CONCEPT

'Livability' versus 'Sustainability'

In the literature, the concepts of 'livability' and 'sustainability' have often been used to situate academic research in the field of city planning and urban design. A major difference between 'livability' studies and 'sustainability' studies is that livability studies put more of an emphasis on human and social factors than do sustainability studies. Livability, as a concept, is also not an independent variable; to some extent it is dependent on the 'triple-bottom line' sustainability model.

Sustainability studies are based on variables that are ultimately easier to measure, variables that usually relate directly to the measurement of the built environment and performance standards. A sustainability study example by Evans et al. (2009), illustrates that such efforts may primarily limited to physical measurements of the built environment. Although scholars have articulated that sustainability is based on 'three pillars'—economy, equity and environment (Wheeler 2004; Campbell 1996; Godschalk 2004)—the environment pillar has come to dominate many sustainability-related studies. For example, in their study, Evans et al (2009) comparatively assess the amount of greenhouse gas emissions generated, water consumption, the price of electricity, and land area required for a variety of renewable energy systems, without examining residential satisfaction. Such end-use energy metering and primarily quantitative studies are also not necessarily place-based or concerned with livability, as they fail to examine the presence and effects of social and cultural feedback in housing and neighborhood design. Livability studies are unique in that they recognize that social factors are equally important as economic and environmental factors in terms informing planning policy and the built environment. This dissertation conceives of livability as a critical component of sustainability—a specific section of the 'triple-bottom line' model that prioritizes the human, social factors 'lens' over the economy pillar and the equity pillar.

In essence, 'livability' studies are inherently tied to people, place and social equity (see Figure 5). Livability studies attempt to simultaneously measure built form, observe and record community behavior, and determine satisfaction with a specific urban environment. There exists a large body of research on 'livability' studies, mostly regarding the design of streets and public interaction in plazas. Livability studies were originally inspired by the writings of Kevin Lynch (1960), who theorized that resident perceptions of the city should inform future design processes. Appleyard, Lynch and Meyer (1965) and Appleyard and Lintell (1972b) also pioneered methods for early livability studies. Although the definition of livability varies widely in the literature, the definition used here for the purposes of this dissertation is based on the one created by Appleyard and Lintell (1972b) for neighborhood streets, as mentioned above. According to the authors, a livable place (or in their case, a livable street) has a balance of renters and owners, and accommodates a variety of household sizes. Many people know their neighbors because they spend time outdoors, on their front porches or yards. In this sense, Jacobs' (1961) "eyes on the street" surveillance theory is important to understanding dimensions of neighborhood and its livability. As Macdonald (2005) notes, Jacobs's neighborhood was comprised of medium-density traditional building types: low-scale, apartment buildings, and one- and two-family row houses. What one learns from Jacob's study is that housing density and mix influences social interaction. In addition, Macdonald's study (2005) demonstrates that a livable place is where residents not only know each other, but where they also act as stewards and identify with the physical territory of the community.

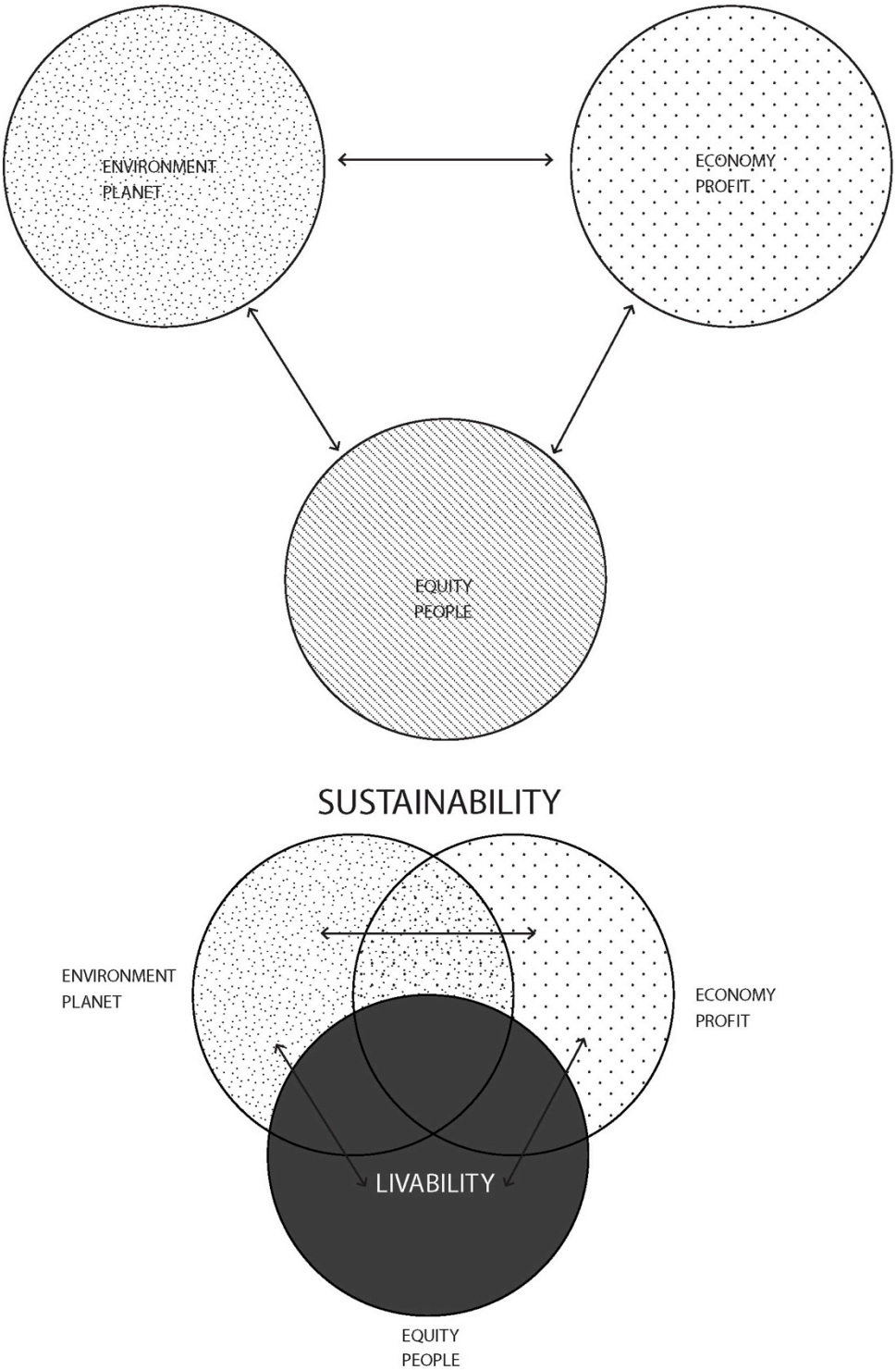


Figure 5: Livability--an integral part of sustainability. People and social equity are prioritized over the other pillars. (Szibbo 2015).

The Berkeley School of Planning & Livability

The Berkeley School of Planning has been a strong proponent of livability studies since Donald Appleyard's initial studies. Continuing in Appleyard's (1980; 1982) tradition, Allan Jacobs (1995), Bosselmann (2008b) and Bosselmann, Macdonald & Kronemeyer (1999) further examine street and public realm studies with respect to user experience. Bosselmann (2008b:142) has highlighted that "the original meaning of livability described conditions in neighborhoods where residents live relatively free from intrusions", but that the term has been progressively broadened to include safety, sustainability, comfort, available services, walkability, and transit. He explicitly differentiates the term from vitality (the presence of other people within close proximity and how this influences the functionality and desirability of public places) and sense of belonging (the psychological or emotional dimensions obtained from living in a particular place such as a neighborhood, on a street or in a building).

With regard to housing, Marcus and & Sarkissian (1988) were the first to survey tenants and develop guidelines in order to improve livability in high-density buildings. Macdonald's (2005) work studying the effects of high-density residential development on social interaction and street life is an important recent contribution that extends its scope beyond the limited realm of street design to include the semi-private spaces between building facade and street. She concludes that half-grade raised entries for units are critical for increasing residential privacy, and strong ground-floor unit articulation adds to visual interest and 'eyes on the street.' A strong component of livability and resident satisfaction in North America is the preserving the underlying element of urban privacy, as also confirmed by Day (2000).

Clare Cooper Marcus is also known for her work on livability and the form that affordable housing takes. In her book entitled *Housing As if People Mattered: Site Design Guidelines for Medium-Density Family Housing (1986)*, Marcus posits that post-occupancy research on people-housing relations is key to understanding livability and generating successful future design guidelines and recommendations. Marcus (1974) also emphasized the need to a return to community-oriented housing design, and completed a comparative study on livability in two affordable housing developments. She touts St. Francis Square in San Francisco as an example of moderate-income housing created under Section 221(d)3 of the Housing Act, and managed by the International Longshore and Warehouse Union (ILWU). St. Francis Square was designed as three-storey walk up units at 37 units per acre. The Square, comprised of 300 units, was designed with interior courtyards in mind, which ultimately enhanced the spaces for local children to play in and created a neighborhood and community with more vitality. Thus, she argues that it is successful example of affordable housing design as compared to the Geneva Towers high-rise development, two towers 19 storey towers set at right angles to each other on one city block (125 dwelling units per acre), as the Square allowed for more social interaction between residents and their children. The site also represents a co-operative affordable housing project supported by a union, which is now more the exception than the rule.

Studies have also been conducted that illustrate that non-visual sensations in the urban environment also influence the quality of city life (Southworth 1969). Ultimately, the "sonic environment" will affect residential perceptions of how 'livable' a place is. Studies done by Appleyard & Lintell (1972b), and Bosselmann et al (1999) cite 65 decibels as the commonly accepted auditory minimum baseline threshold above which noise becomes extremely bothersome for residents. Automobiles—and specifically motorcycles and freight trucks—contribute more noise pollution in cities than any other form, and one way to help mitigate this in cities is by introducing speed controls (Holmes and van Hemert 2008). Ultimately, street design (width of street to building ratio, building height, pavement choice) can have an effect on whether noise pollution is prominent or not.

Quality of Life versus Livability Studies

In addition to interdisciplinary research, there also exist quality of life studies. Quality of life studies comprise a field of scholarship that attempts to capture national, regional or metropolitan variation in the quality of life. Pacione (2003) notes that there are problems to framing such quality-of-life studies, as they lead to conundrums of measuring, composition, scale of analysis and indicatory specificity problems. Ultimately, it is important to differentiate between quality of life studies and livability studies. Although Myers (1987:110) states that they have essentially become conflated, I argue that quality of life studies mainly use physical indicators and can be conducted at the larger national or state scale, whereas livability studies, incorporate qualitative modes of measurement into their investigation, and conduct such studies at smaller city, neighborhood or block scales. In fact, it is clear that Quality of Life studies use quantitative indicators to create indices for the sake of making national indexed comparisons for use primarily in public policy contexts (Hagerty et al. 2001).

Human Needs and Livability

Maslow's (1954) hierarchy of human needs provides a useful framework for assessing the success of urban buildings and spaces, and their general livability [see Figure 6]. His sociological framework has been adopted by multiple academics in the urban planning and design field researching topics on satisfaction (Zavei and Jusan 2012; Alfonzo 2005; Waliczek, Zajicek, and Lineberger 2005). While the precise ranking of needs has been criticized on empirical and theoretical grounds, and psychologists and sociologists have moved passed the static hierarchy in their own work, the general framework provides a useful framing device in other applied disciplines, such as urban planning. How do people expect to—and actually—fulfill their needs and wants in the urban context? How do we differentiate between a truly human "need" versus luxuries we "want"? These are the key questions that livability studies attempt to address.

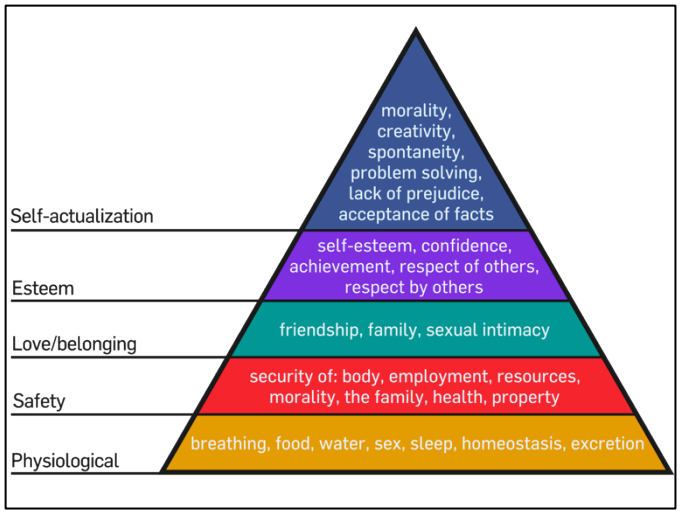


Figure 6: Abraham Maslow's Hierarchy of Human Needs (Creative Commons)

Other Disciplines and Intersects with Livability

Other academics in interdisciplinary fields have also contributed to the field of livability research, including the intersection of public health, urban design and transportation. Smith et al (1997) in the field of landscape architecture, provide a more utilitarian definition of livability, which consists of survival, personal health, environmental health, comfort, and safety and security. Character, connection, mobility, personal freedom and diversity are perceived of as separate categories outside of the realm of livability. However, these studies are limited to and define livability on the basis of health, safety and welfare considerations, whereas livability studies are concerned more broadly with the sense of place, comfort, quality of community, and belonging.

SPECIFIC DESIGN ISSUES RELATED TO LIVABILITY

In this section, various elements of urban form that have been associated with livability are explained through a review of the literature. Emerging as a discipline in the1960s, urban design as a field has been increasingly recognized as positively affecting the way a community appears and feels. Canonical texts devoted to the ways in which design relates to livability have attempted to broadly cover sub-fields (Larice and Macdonald 2007; Carmona and Tiesdell 2007). This section addresses the specific sub-fields that address livability in urban design research.

Open Space & Livability

There is some consensus in the literature that open green space fulfills certain universal human needs. Jay Appleton was the first to hypothesize that humans have certain sociobiological and evolutionary desires that play out in landscapes. In his view, humans have an evolutionarily derived preference for spaces that provide “prospects,” an unimpeded opportunity to see, and “refuges,” the opportunity to hide. Appleton’s (1975) prospect-refuge theory postulates that the ability to see without being seen is critical for meeting the innate human desire for survival. A landscape that is both protective, yet inculcates a sense of one’s omniscience and provides views and vistas, will be experienced as the most comfortable and beneficial at universal level. Even if we do not wish to trace back an evolutionary heritage for our relationship to open spaces, Appleton’s theoretical

contributions underscore the deep-seated and often unconscious needs we feel are fulfilled—or go unfulfilled—when we are in open spaces.

In addition, the social and psychological benefits of open space (e.g. mitigation of sedentary lifestyles, improved mental health, access to quality food through community gardens, increase in property values, mitigation of incivility) are well documented in the literature (Berman, Jonides, and Kaplan 2008; Bodin and Hartig 2003; Chiesura 2004; Fuller et al. 2007; Kim and Kaplan 2004; Waliczek, Zajicek, and Lineberger 2005). The integration of natural landscapes and trees in particular has shown to significantly affect livability. Faber Taylor, et al. (2002) found that children living in buildings with merely a *view* of trees and green space exhibited superior attention capacities and impulse control than did similar children without those views. In addition, Kaplan (2001) has discovered that the presence of natural settings in the view from the window contributes substantially to residents' satisfaction with their neighborhood, and also with diverse aspects of their sense of well-being. In contrast, views of built elements, affected satisfaction but not well-being.

This does not imply, however, that cities bereft of trees—such as many well-designed European cities e.g. Siena, and Rome—are not designed for livability and well-being. In such cities, views to plazas and visually interesting meandering pathways may provide a serial visual escape, equally as attractive for the resident (Bosselmann 2008a). Such scholars as Camillo Sitte have articulated that a livable city was one that was of human scale and was endowed with great civic culture and pedestrian-grain features—plazas, public buildings, fountains and cathedrals. Most famously, Sitte used successive images of a person walking through a city to illustrate his theory. In his text City Planning According to Artistic Principles(1889), Sitte pictured the ideal street as an enclosed unit, and argued that streets and squares needed to be considered as volumetric and three-dimensional spaces—in the same way that architecture was concerned with spatial correlations. Sitte disdained bilateral symmetry and right angles and intervals, prioritizing human experience over form, as he was primarily concerned with the quality of the contained space and a sense of human enclosure.

In addition to natural spaces, common social spaces are also vital to health. In his influential book, *The Great Good Place* (1997), Ray Oldenburg cites plazas, coffee shops and other open spaces as potential "third spaces": spaces where people can gather easily, inexpensively, regularly, and pleasurably. Depending upon the available features, urban open spaces can serve human needs for comfort, relaxation, discovery, active recreation (e.g. walking, playing sports, riding bicycles, etc.) and passive recreation (e.g. sunbathing, picnicking, reading, people-watching, etc.) (Carr 1992).

How do planners and urban designers create spaces that are livable? Research on creating vibrant public spaces for the general public can be traced back to William Whyte's (1980) original publication "The Social Life of Small Urban Spaces" and Jan Gehl's (2010; 1987; 1996) work. Gehl (1987) and Whyte (1980) were among the first to document and observe how people actively use public open spaces, and they were carefully attuned to the correspondence between use and human needs. In "Cities for People," Gehl (2010) discusses how quality open space provides an informal, relaxed means of maintaining social ties and a sense of community in an urban environment. Through careful observation, Whyte (1980) was able to conclude that, in public parks in New York, the volume of seating space, and the flexibility and comfort of these spaces, proved to be the most valuable assets for open spaces. Whyte suggests some factors such as the legibility

of spaces, seats, trees, and water encourage people to stay in public outdoor spaces. Furthermore, these activities are 'generative': such activities can propagate more activities occurring in the public realm (Gehl 1987; Jacobs 1961). Gehl (1987:13) defines social activities are "all activities that depend on the presence of others in public spaces." Ultimately, when a person stays in outdoor space watching passing pedestrians, he/she enhances the opportunity for social interaction (Gehl 1987). Aside from the provision of amenities and the compounding effects of human presence, Zhang and Lawson (1975) also note that the quality of space and community design in the public realm present in high-density developments greatly affects whether a space will be successful or not, and retain people engaged in activity. Lists of qualitative factors are hard to concretize, but design ideas and improvement can be gauged by soliciting comment through community design strategies (Hester 2006; Hester 1989; Francis 1983).

Compact Urban Form & Density

One of the places where the range of types and ages of people inhabiting cities collides forcefully with the desire to create livable, sustainable urban spaces is in the concept of "density." It is a term freely used in a neutral fashion by planners and architects, yet is subject to a variety of interpretations and preconceptions by the public and their elected officials.

Encouraging growth in pre-existing urban areas is considered to be the principal antidote to mounting Vehicle Miles Traveled (VMT), a phenomenon precipitated by increased suburban sprawl (Ewing et al. 2008). Growing compactly is now equated with growing sustainably. Measures of how compact—how dense—a specific area is, is central to the discussion. Density, within the planning language, is mainly perceived as the number of housing dwelling units within a prescribed land area. In the United States, it is defined as the number of units per acre (upa) or dwelling units per acre (dua). In the United Kingdom and other commonwealth countries, building density is referred to as the number of units per hectare (uph). Pont and Per Haupt (2010:12) note that the concept of density initially grew out of late nineteenth century concerns in England and Germany for the spread of "fires, disease and social disorder." These concerns within industrializing cities resulted in land use controls that prescribed maximum allowable densities.

Virtually all urban planning terms carry both quantitative and qualitative meanings. The term "density" is perhaps at the forefront of this reality. In contrast to the development of density as a concept in industrializing Europe, the concept has since been utilized in contemporary contexts, and especially in North America, to regulate post-war suburban sprawl. Ultimately, it has been transformed into a call for planning controls that prescribe minimum allowable densities for redevelopment (Pont and Per Haupt 2010). This concept is also integral to discussions of how the built environment can reduce the GHG emissions by enabling the creation of compact urban areas. Compact, urban neighborhoods can not only reduce of greenhouse gas emissions by minimizing the number and length of trips by modes of transport harmful to the environment, but they can reduce energy consumption by providing building densities capable of supporting district heating or combined heat and power systems (Jabareen 2006:40).

Density and Livability

Although the planning and development field refers to density primarily in the context of buildings, density can also be defined according to population: the population by land area or population per housing unit. Population density is critical in demonstrating the reality of density and is linked to affective density and overcrowding (Southern California Association of NonProfit Housing 2012).

Rappoport (1975) has differentiated between quantitative population density or "evaluation of density" (number of people per unit area) and the preferential result of this evaluation, which he terms "affective density." Affective density (otherwise known as 'evaluative'/'perceived' or 'subjective' density) is much more than a simple measurement of people per unit area. Density is not only physical, but it is also a social and mental construct. Affective density encompasses both the social and physical dimensions, as it is the perception of density itself. For example, a feeling of crowding may be elicited when there is an inadequate relationship between perceived density and desired density. As such, the feeling of crowding may arise—a subjective experience of psychological stress. Edward Hall (1996:30) notes that such feelings of crowding and stress have biochemical and biological origins. This subjective element is important, and may influence individuals differently when matched against varying norms and desires. For one to say "the room is crowded" is much different than saying "I feel crowded" since the latter is based upon personal preferences, whereas the former is based on a quantitative count.

Not only is density a psychological construct, it is also influenced by culture and ethnicity. Gillis et al. (1986) acknowledge that there are human thresholds for population density in residential areas, and there exists a tipping point for social pathologies, i.e. there are densities at which incidents of conflict and crime increase. They note that density is cultural, however. For example, Asian cities with the highest levels of population density, such as Tokyo and Hong Kong, have relatively low levels of social pathology, in comparison to other high-density North American cities such as New York. The authors conducted a study in Metro Toronto, where they examined the power of room density (persons per room) and dwelling type to predict psychological stress for three different ethnic categories: British, Asian and Southern European, controlling for gender and socio-economic status. For the British population studied, room density and dwelling type were significant predictors of psychological strain. For the Asian population analyzed, room density and dwelling type were not significant predictors of psychological stress. Southern Europeans were found to be unaffected by room density, but affected by dwelling type. As a result, the authors conclude that Asians are the most tolerant of high-density room and different dwelling types, with the British least tolerant, and the Southern Europeans somewhere in between.

Such studies cannot be generalized to North America, but instead offer hints at the complex make-up regarding how different cultures and ethnicities perceive, interact and negotiate their livelihoods within space. Firley and Stahl (2009) have also noted how different building typologies of different densities have arisen in different cultures, due to diverse socio-historical and development processes.

Unfortunately, there is a lack of recent studies in the United States which look at the effects of density on socio-demographic groups, and how such populations fashion and shape their daily lives in dense urban building types. Such intersectional patterning studies are of high value in North America, considering the increasing rates of immigration in an increasingly globalizing world. More and more attention is being paid in the literature to the rapidly urbanizing cities in the Global South where overcrowding and quality of life are more imminent problems, or in Asian cities where densities have become extreme (Jenks and Burgess 2000).

With regard to density studies conducted in the United States, Marans and Rodgers (1973) were among the earliest to innovate within the field of planning. The authors conducted a study of 1300 individuals nation-wide. They found that people living at the lowest densities in the U.S. were the most satisfied with their neighborhoods, while those at the highest densities were the least satisfied. Baldassare (1979) points out that most Americans reside at rather low densities by historical and cross-cultural standards. However, in a more recent study, Myers and Gearin (2001) illustrate that the tide for density preferences might be turning. The authors analyzed future demand for denser, walkable environments as a whole in the United States. They found that heads of households older than 45 years old showed a distinct interest in densely configured, central neighborhoods—an indication that as the baby boomers age, they are beginning to desire a more livable and compact urban form. They note that homeowners 45 years and older would account for 31 percent of housing growth during the 2000-2010 period.

It is evident that the tide for the “suburban dream” may finally be turning. Interestingly, the current supply of conventional-lot single-family detached homes in California exceeds the projected demand for these homes in 2035, as households without children are on the rise (Nelson 2011). Ultimately, rental demand will be on the rise in California’s current metropolitan areas, and thus higher-density apartments, condominiums, unit conversions, accessory dwelling types and non-traditional housing types will become more in demand. Transit-accessible land uses will become an increasingly important factor, given consumer preference for locations served by public transit (Nelson 2011).

Nelson (2011) explains that people are largely inconsistent when reporting their preferences. Everyone wants their “own castle,” but many respondents also reported wanting to live in a mix of housing types, in a walkable neighborhood. They want privacy—but they also want access to transit and safe access to schools. Even among families with children, one-third of families with children surveyed are willing to trade lot size and “ideal” suburban homes for walkable, diverse communities. The next few decades to come may witness increasing demand for more high-density living in California. Such long-term market trends represent a confluence between the real estate preferences expressed by consumers and the greenhouse gas reduction objectives expressed by the state of California in the form of Senate Bills AB 32 and SB 375. While AB 32 required state government to set goals for the reduction of California’s greenhouse gas emissions to 1990 levels by 2020, SB 375 provides key support to achieve the goals of AB 32 through the implementation of metropolitan "Sustainable Community Strategy" (SCS) that integrates transportation, land-use and housing policies for achievement of regional emissions targets (Deakin 2011; Altmaier et al. 2009; Barbour and Deakin 2012). While the above issues could be categorized as sustainability issues given their focus on reducing VMT and GHG (greenhouse gas) emissions, they are also livability issues because individual, social and cultural preferences have the potential to impact land use patterns and travel choice.

Mixed-Use Development & Livability

"Mixed-use" is a key metric for the LEED-ND rating system. The term "mixed-use" remains ill-defined in the planning literature, as it can relate to a vertical mix of uses within a single building or a city block (Roberts and Lloyd-Hughes 1997:162), a horizontal mixing of land use types over a certain area (Van and Senior 2000), or functional, 'time-of-day' mixing within a building or public space (Gurian 2001). The idea of incorporating 'mixed-use' communities became popular during the late 1980s and 1990s, when New Urbanists incorporated the concept into their platform (Talen 2002:181). The current literature that focuses specifically on mixed-use building types and social implications in the United States is relatively thin. There is a richer body of city-scale literature that addresses overall diversity within cities and socially mixed neighborhoods (Talen 2006; Fainstein 2005). In *Sustainable Urbanism* (Farr 2008), the concept of "neighborhood completeness," which incorporates mixed-use, is defined as the product of the number of pedestrian destinations and the proportional area balance of all pedestrian destinations in the quarter-mile pedestrian walking shed. In addition to neighborhood completeness, the optimum residential mix of buildings is outlined for a) new traditional neighborhoods (suburban context) and for b) downtown and in-town neighborhoods (urban context). With respect to the concept of neighborhood retail, metrics are given for the amount of dwellings necessary to support retail. For example, 2000 dwellings are needed to support corner stores or convenience centers, which are 10,000-30,000 square feet. The authors mention that these numbers can be significantly reduced if the store is located along a major road with at least 15 cars per day, or near a gas station.

Aside from its use in New Urbanism and LEED-ND, over the years the term "mixed-use" has come to represent a myriad of different meanings to planning practitioners. Francis (2011) prefers to refer to 'mixed-life' places, rather than 'mixed-use' places, as he notes that the term 'mixed-use' been used to invoke community life and diversity agendas by planners and designers, without a robust community actually existing in practice. Rowley (1996) discusses the problem that the definition is ambiguous, multi-faceted and used in a cursory, prescriptive fashion. He states that generally, "places containing a mix of uses tend to have varied buildings and varied architecture and the legibility of districts and of smaller scale environments is promoted" (Rowley 1996:88). However, he warns that many mixed-use developments in the USA have failed to deliver visual quality, either in isolation or in relation to the surrounding urban fabric. In particular, he argues that many mixed-use developments in North America are master planned on a monolithic and monumental scale. These forced, superficial environments are actually a far cry form traditional European cities—where Jan Gehl's (1987) notion of "life between buildings" freely and naturally transpires.

Rowley (1996) also argues that prospective tenants are more likely to accept mixed-use housing conditions and higher densities if the developments are located on inner city brownfield sites rather than on suburban greenfield locations—because of increasing diversity and vitality at the center of the city versus the edge of the metropolis. He states that until mixed-use development can be built in such a way that it is more attractive and affordable with quality construction, suburban single-family counterparts preference for suburban lifestyles will likely remain the dominant force in the housing market. Although the tide is turning in terms of a propensity for high-density living, design aesthetics and construction issues will still be a counterargument for NIMBYs and Tea Party activists who rally against "stack and pack housing" (Trapenberg Frick 2013; Frick, Weinzimmer, and Waddell 2015).

Angotti and Hanhardt similarly note the variability in the term "mixed-use." They question whether it refers to vertical mixing in building types or to the mixing of land uses and stress the discrepancy in the definition. The authors enter the debate from an environmental justice and social equity perspective, stating that in order for mixed-use communities to truly exist in New York City, the public health threats of industrial zoning and hazardous waste siting must be more fairly distributed across the landscape. Land-use planning must incorporate the effects of environmental hazards into zoning. They also argue for more parks and open spaces, which also improve healthy, complete communities. With regard to real estate and development, mixed-use places, and in particular the presence of retail, have been shown to increase nearby residential property values (Grether and Mieszkowski 1980; Song and Knaap 2003; Matthews and Turnbull 2007). Countless studies have been also done on the public health benefits associated with walking, as a result of mixed-use development (Frank et al. 2005a; Handy et al. 2002; Jackson 2003; Mumford et al. 2011; Saelens, Sallis, and Frank 2003). Ewing and Cervero (2010b), in their comprehensive meta-analysis of 54 studies focusing on the relationship between travel and the built environment, have found that walking is most strongly correlated to measures of land use diversity, intersection density, and the number of destinations within walking distance.

Walkability & Livability

It would thus seemingly appear that 'walkability' is a positive spillover effect that occurs when you successfully mix a wide range of land uses over a relatively dense area. However, none of these quantitative studies considered the significance of qualitative design factors, completely ignoring sensorial and social settings. Indeed, Mehta (2008) notes that research in walkability lacks qualitative studies that analyze the environment at the micro scale, The character and qualities of a walkable, 'livable' environment have been tested empirically, but more testing is needed in this arena since landscape factors are often left out of pedestrian level-of-service (LOS) models and accessibility models.

Accessibility models measure how easily pedestrians can access a particular place. Riggs (2011), in his dissertation, differentiates specifically between *accessibility models* and *suitability studies/* urban design models. Accessibility models provide quantifiable measures of neighborhood accessibility, whereas suitability models include more subjective, qualitative measures. Those authors who have put forward accessibility models or who have written with an emphasis on accessibility include Handy and Niemeier (1997), Krizek (2003), Frank (2005a), Leslie (2007), Ewing & Cervero (2010a), and Walkscore (2013). In the majority of these models, the primary limitation is that they over-emphasize *3 main environmental design variables/inputs*: residential density, street connectivity (# of intersections, % of 4-way intersections and/or block geometry), and land use mix (# of employees and/or type of land use per aerial container). In addition, up-to-date parcel, traffic analysis zone (TAZ), and census data remain critical to accuracy of the model. The spatial unit or scale at which these analyses are conducted is not standardized, but ¼ mile appears to be prevalent, given that this is the standard people are willing to walk for daily trips (Barber 1995). However, the particular spatial unit also depends on the type of data available. Cervero's work has become well known for conceptualizing the 3 'D's that comprise travel demand and pedestrian accessibility: density, design, and diversity (Cervero and Kockelman 1997). More recently, Ewing and Cervero (2010a) conducted a meta-analysis and discovered intersection density to be the most salient variable in predicting walking trips. The authors expanded upon the original three travel demand categories to include additional factors such as distance to transit, destination, and demographics.

The notion of "connectivity" within accessibility studies usually refers to intersection density (Schlossberg and Brown 2004; Frank et al. 2005b; Ewing and Cervero 2010a; Bradley, Bowman, and Griesenbeck 2010). However, other scholars have expanded the definition to include various measures of block length/size/geometry/density, (Cervero and Kockelman 1997; Handy, Paterson, and Butler 2003; Hess et al. 1999), street density (Matley, Goldman, and Fineman 2000; Handy 1996) links & nodes (Berrigan, Pickle, and Dill 2010; Dill and Voros 2007; Dill and Carr 2003; Ewing et al. 1996; Song 2003; Handy, Paterson, and Butler 2003), 4-way intersections (Cervero and Gorham 1995; Boarnet and Crane 2001; Boarnet and Sarmiento 1998; Cervero and Kockelman 1997), parcel connectivity (Criterion Planners Engineers 2001), and pedestrian route directness (Aultman-Hall, Roorda, and Baetz 1997; Hess 1997; Randall and Baetz 2001). Accessibility models are most closely related to walkability models, such as Walkscore®, Walkonomics, and Ratemystreet™ in that they both assess the same design variables: residential density, land use mix and connectivity. However, most walkability models are proprietary or patent-pending systems and their exact algorithms remain unknown to the public. Ultimately, these models do not include aggregate measures of the built environment, and the models are not fully comprehensive, as they focus only on a narrow range of locations such as coffee shops, groceries, and parks (Foti, Waddell, and Luxen 2012). Such models also do not account for how the 'street' or 'intersection' fits within a larger 'place type' context.

Although these three variables are proxies for design, they do not really capture the pleasantness or unpleasantness of a streetscape. Most accessibility models do not emphasize design elements. Approximately 90% of the Walkscore metric is distance to destinations, and design aspects are thrown in as an afterthought (Frontlane 2008). They also fail to include important factors such as aesthetics and crime/safety (Guhathakurta et al. 2013).

Mehta (2008) notes that research in walkability lacks qualitative studies that analyze the environment at the micro-scale. Sensorial studies have shown that pedestrians prefer a moderate level of culturally acceptable sensory-stimuli that are defined by but not limited to: the street and the sidewalk (vehicles, street furniture), natural features (landscape elements and trees), the edges of the buildings (fenestration, canopies, awnings, signage, windows and the goods within), and the people and their activities including behavior, movements and sounds (Kaplan and Kaplan 1989; Nasar 1990; Rapoport 1990; Porteous 1996; Zacharias 2001). Alfonzo (2005) has created a 5-tiered hierarchy of walking 'needs', which considers 1) feasibility (mobility, time, tradeoffs), 2) accessibility (sidewalk connectivity and pattern), 3) safety (CPTED features, people present), 4) comfort (level of amenities), and 5) pleasurability (complexity, liveliness, architectural coherence, aesthetic and sensory appeal). Although the qualitative factors of safety, comfort and pleasurability are ranked as less important, they nonetheless contribute strongly to the user experience when considered as a whole. There is no question that walkability is not comprised solely of accessibility dimensions—even Cervero and Duncan (2003:1483) concede that statistical analyses and quantitative studies ''should be supplemented by micro-level analyses, including qualitative case studies and quasi-experimental comparisons, that account for possible influences of street-scale design elements."

Recent attempts have been made to 'unpack' walkability, to broaden its contextual scope and include it within the more context-sensitive arena of suitability studies, including human perception of urban design qualities (Schlossberg et al. 2007; Adkins et al. 2012; Ewing and Handy 2009). The question remains as to precisely which parameters contribute to walkability (Forsyth and Southworth 2008), how these factors can be validated, and whether designers and planners can actually "measure the immeasurable" (Ewing and Handy 2009).

Although pure accessibility models appear limited with their narrow range of inputs, one benefit of accessibility models is that the algorithms can now be computed spatially through GIS-integrated programs, no longer requiring in-field calculations. In addition, there are fewer variables required in calculation than suitability models or LOS equations, and final scores are summed and normalized for effective comparison. One practical use of accessibility models has been to contribute to the development of urban network analysis tools. Work by Foti et al (2012) has led to the creation of a software infrastructure that provides an interface between parcel-level land use models. This software offers shortest path computations from parcels to activities, increasing the opportunity for future activity-based travel demand models (see below) to assess walkability at a finer-grained scale than TAZ activity-based models.[i]

Progress has also been made at MIT's City Form Lab, where Sevtsuk & Mekonnen (2012) have created an Urban Network Analysis tool box that unlike previous network centrality tools (which have operated with only two network elements, nodes and edges) include a third network element: specific, individual buildings, that can be used as the smallest spatial unit of analysis. The degree of analysis becomes more detailed with this added element, as two neighboring buildings on the same street segment can therefore obtain different accessibility results for pedestrians. The underlying logic of network centrality derives from the school of space syntax (Hillier 1984), which suggests that spaces are constructed from components, and can be analyzed as networks of choices. Subsequently, they are represented as maps and graphs that describe the relative connectivity and integration of those spaces. It has also been recently adapted for GIS modeling (Jiang and Claramunt 2002; Raford and Ragland 2004). However, Ratti (2004) has critiqued this method by arguing that contradictions can arise under certain geometric configurations. Such tools can also conduct barrier analyses for regions and indicate within larger geographical context where funding should be prioritized for pedestrian planning. Studies completed by Matley, Goldman and Fineman (2000) and Swords et al (2004) in the state of New Jersey led to the creation of a Pedestrian Priority Index, based on the analysis of census tract data and utilizing four key indicators.

Schools of engineering have dominated pedestrian street design from early periods in history (Southworth and Ben-Joseph 1995; Hebbert 2005; Macdonald 2011). In the middle of the 20th century, engineers developed interrupted & uninterrupted flow models[ii], which contributed to a widespread acceptance of the level of service (LOS) concept. Although the first edition of the Highway Capacity Manual was published in 1950, the LOS concept for highways was not formally introduced until the 1965 second version was released (National Research Council, 1965). While originally developed to measure vehicle flow, the model had a pedestrian component. There are six designated LOS for each type of facility, from 'A' to 'F'—with LOS 'A' representing the best operating conditions and LOS 'F' the worst. Between 1965 and 2010 the 'A' to 'F' rating system for pedestrian LOS has remained completely unchanged (Bhuyan and Nayak 2013:220).

Continuing in the original LOS tradition are studies completed by Fruin (1971), whose model incorporated sidewalk capacity and pedestrian volume factors. These early PLOS models prioritized time, flow and space variables in planning for pedestrians. Essentially, the Highway Capacity Manual (HCM) LOS models created by the Transportation Research Board and the National Research Council (2000) provide a "go-to" golden standard for quantifying pedestrianism and are well-accepted models in engineering. Other recent variations on this model and other improvements in this arena have been conducted by Dixon (1996), Huang and Chiun (2007), Jensen (2007), Landis et al (2001), Miller, Bigelow and Garber (2000) and Petrisch et al (2006). However, the standard HCM LOS model has recently been critiqued, as pedestrians are "treated like cars", and the assessment emphasis has remained singularly focused on speed, volume and capacity (Asadi-Shekari, Moeinaddini, and Zaly Shah 2013a). Asadi-Shekari et al (2013b:168) note that "*factors related to the quality of the walking environment, such as qualitative dimensions, facilities and street furniture are not investigated thoroughly in these types of models*." Importantly, there are other, more nuanced and sophisticated ways to evaluate streets beyond simple capacity inputs. This includes analyzing from a roadway perspective, and focusing on broader *suitability* characteristics. Studies beginning in the 1970s and continuing into the 2000s tried to re-frame traditional LOS models by introducing increased attention to safety, security, comfort, convenience, continuity and attractiveness (Henson 2000; Khisty 1994; Lautso and Murole 1974; Sarkar 1993). Another major shortcoming of such models is that on site assessment is always required—assessment that can only be completed by transportation engineers. This is because PLOS assessment methods tend to use calculations, algorithms and volume-to-capacity ratios that do not fall under the normal training of general land use planners. In addition, there is an acute focus on time, space and other purely quantitative factors that overshadow the potential for qualitative input. Measures of automobile delay, primarily through LOS, have been widely used in many jurisdictions to assess potential traffic impacts during a project's environmental review, which is mandated by the California Environmental Quality Act (CEQA). The Governor's Office of Planning and Research (2013:3–5) has recently illuminated key problems using traditional LOS. These include:

- *LOS is difficult and expensive to calculate*
- *LOS is biased against "last in" development*
- *LOS scale of analysis is too small*
- *LOS mitigation itself is problematic*
- *LOS mischaracterizes transit, bicycle, and pedestrian improvements as detrimental to transportation*
- *Use of LOS thresholds implies false precision*
- *As a measurement of delay, LOS measures motorist convenience, but not a physical impact to the environment*

Critical to this discussion is the problem that *"LOS mischaracterizes transit, bicycle and pedestrian improvements*." Since LOS prioritizes automobile delay, any improvement for other modes (walking, cycling, transit) that might inconvenience motorists is characterized as an impediment to transportation. Little focus is given to alternative, or 'sustainable' modes. In addition, due to the small scale of analysis in LOS—limited to intersection and roadway analysis—there is little thought given to congestion in the overall network or neighborhood as a whole. As a result, alternatives to LOS must now be considered, mandated by SB743. Notably, pedestrian LOS is always calculated separately from vehicular LOS. However, the new MMLOS (Multi-Modal Level-of-Service) models attempt to address the historical separation of these two spheres.

Multimodal LOS models illustrate a marked improvement over interrupted and uninterrupted flow models. The MMLOS model is a new method to assist engineers and planners in splitting the available street right-of-way between the four primary modes that use urban streets: pedestrians, transit, bicycles and vehicles. In fact, in the new HCM (National Research Council (U.S.) 2010), there are no longer any stand-alone chapters for pedestrian, bus or bicycle. The major data requirements of the MMLOS method include signal timing, the posted speed limit, geometric street cross-section, headways for buses, transit patronage, vehicular traffic volumes and pedestrian volumes (Bhuyan and Nayak 2013:221). Dowling et al. (2008) initiated the first work towards creating a multi-modal model. In 2010, the Transportation Research Board and the National Research Council released its MMLOS handbook (National Research Council (U.S.) 2010). Several transportation firms have also released their own versions of MMLOS models, such as those completed by Fehr & Peers (2013), Kittelson & Associates (2013), and McTrans (2013). MMLOS are a well-accepted model in the hard sciences, but this type of model is relatively new and many improvements are still forthcoming. In particular, some studies have found MMLOS models to be relatively insensitive to pedestrian quality, in particular their comfort-based indices (Carter et al. 2012). Although somewhat narrow in their range of testing qualitative inputs, these studies have indicated what factors may be significant in incorporating in a pedestrian quality of service model (Carter et al. 2012; Elias 2010).

In general, although MMLOS has attempted to integrate level of service modes, it has not been largely successful in evaluating and prioritizing pedestrian quality. As mentioned above, MMLOS has incorporated pedestrian factors mentioned above such as signal timing, the posted speed limit, geometric street cross-section, headways for buses, transit patronage, vehicular traffic volumes and pedestrian volumes, there is little attention paid to more qualitative factors that reflect an enjoyable pedestrian experience and comfort. Admittedly, microscale landscape design factors are largely missing from MMLOS models, reflecting a lack of comfort-based indices that Carter et al (2012) reference above.

As Riggs (2011) notes, *suitability* models go above and beyond basic *accessibility* and *LOS* measures to include more subjective, qualitative measures of walkability, such that they emphasize the suitability of a place for walking. Such factors include physical elements of the urban environment like street width, number of lanes, safe speeds, bulb outs, crossing improvements, presence of trees, and other measurable elements. However, such models may also attempt to include human perception of walking quality, such as perception of safety and crime, path quality, and most recently 'green street' design (Adkins et al. 2012). Weinstein et al (2008) argue that safety factors, after accessibility and distance, are the single most important determinant in pedestrian route choice. In fact, they go so far as to argue that aesthetics are not significant at all. Traditionally, these more subjective models have emerged out of the discipline of urban design. Authors that have developed suitability models or consider qualitative factors relevant to evaluations of pedestrianism include Gallin (2001), Handy & Clifton (2001), Schlossberg & Brown (2004), Ewing et al (2005), Abley (2006), Day et al (2006), Maternini & Pezzagno (2007), Park (2008), Ewing & Handy (2009), Millington's (2009) SWAT model and the San Francisco Department of Public Health's Pedestrian Environmental Quality Index (PEQI) (2013). Some authors, such as Alfonzo, have taken previous comprehensive indexes, such as the Irvine-Minnesota Inventory (Day et al. 2006) and correlated the above factors to potential economic vitality and promise within neighborhoods (Leinberger and Alfonzo 2012). Alfonzo's (2012) State of Place™ model is one such example.

Suitability models often actively attempt to demonstrate the subjective qualities of a place, and often attention is given to human perception and “walking needs” (Alfonzo 2005). These studies are typically conducted at the level of the neighborhood or street segment, and factors that contribute to suitability are often determined using ‘environmental audits’ (Moudon and Lee 2003). With regard to the limitations of such studies, on-site assessment is required, and furthermore, such assessment often requires trained observers or researchers due to the detailed list of assessed factors. Suitability models, with their large universe of urban design factors, also make scoring systems increasingly complex, especially with regard to indices and weighting. Due to lack of agreement on which factors to include and the inconsistent weighing of these factors, there is little standardization among suitability models, and thus they are not readily accepted or used in the engineering field.

Other studies have attempted to distill the multitude of variables to a few essential walkability factors. In Ewing et al (2005), the authors point to 6 variables as having potential for operationalizing ‘walkability’: imageability, enclosure, human scale, transparency, complexity and tidiness . However, the variables that influence walkability are, in fact, each composites of quite a few physical variables, some of which are not particularly easy to measure and observe en masse. The development of this instrument is based on assessment of 32 video clips by a panel of experts. These experts' ratings are the entire basis of the statistical analysis and subsequent conclusions. Whether experts value the same things that ordinary pedestrians do is a fair question in this context, in addition the validity of a sample size of only 32 video clips. In addition, the authors (Ewing et al. 2005:31) state that they encountered a lot of difficulty operationalizing these factors consistently in the final assessment instrument.

Sensorial studies have shown that pedestrians prefer a moderate level of culturally acceptable sensory-stimuli that are defined by but not limited to: the street and the sidewalk (vehicles, street furniture), natural features (landscape elements and trees), the edges of the buildings (fenestration, canopies, awnings, signage, windows and the goods within), and the people and their activities including behavior, movements and sounds (Kaplan and Kaplan 1989; Nasar 1990; Rapoport 1990; Porteous 1996; Zacharias 2001). Alfonzo (2005) has created a 5-tiered hierarchy of walking ‘needs’ (based on Maslow’s hierarchy of human needs), which considers 1) feasibility (mobility, time, tradeoffs), 2) accessibility (sidewalk connectivity and pattern), 3) safety (CPTED features, people present), 4) comfort (level of amenities), and 5) pleasurability (complexity, liveliness, architectural coherence, aesthetic and sensory appeal). Although the qualitative factors of safety, comfort and pleasurability are ranked as less important, they nonetheless contribute strongly to the user experience when considered as a whole. There is no question that walkability is not comprised solely of practical dimensions—even Cervero and Duncan (Cervero and Duncan 2003:1483) concede that statistical analyses and quantitative studies ‘‘should be supplemented by micro-level analyses, including qualitative case studies and quasi-experimental comparisons, that account for possible influences of street-scale design elements.” Ultimately, it is the qualitative factors and comfort-based factors that need to be taken into consideration when assessing the livability and walkability of a place.

Neighborhood, Territory & Livability

The definition of a 'neighborhood' is subjective and varies widely, notes Wheeler (2004:181). For some, it can be a square mile or miles, containing many blocks and people. In contrast, for others, a neighborhood may include merely a few blocks. However, Wheeler states that typically, the term has been applied to an area that a resident can easily traverse on foot—a radius of one mile or less. Critical to Wheeler's definition is that the area should also possess some *unifying* architectural, social, economic, historical and physical characteristics, so as to distinguish it from proximate neighborhoods. (Neighbor-)"hoods" can also refer to a specific cultural or social group of people living in close proximity to each other. It is hard to say whether people or the physical environment define a neighborhood. Edward Hall in *The Hidden Dimension* (1966) asserts that propinquity does not necessarily define the term neighbor. He provides the comparative international example of England vs. United States, whereby in the US, residential proximity means borrowing things, socializing and being 'neighborly.' However, in the UK, proximity to another family does not entitle you to socialize. Rather, the ability to socialize and be neighborly is based upon social class status. Although Hall's study clearly generalizes, he does make the important point that one's 'neighborhood' can be a socio-economic construct, in addition to a physically constrained one.

Lewis Mumford wrote about the significance of neighborhoods for urban planning in *The Neighborhood and the Neighborhood Unit* (1954). He argued that neighborhoods had been in existence long before the industrial age. Most of the earliest cities around the world, as excavated by archaeologists, possess evidence for the presence of social neighborhoods. Historical documents shed light on neighborhood life in numerous preindustrial or nonwestern cities, such as in ancient Chinese cities and Aztec *barrios*, in addition to planned neighborhoods and *fauborgs* in European cities. Morris (1996) notes that historically the grid has been used by a variety different cultures: from the Greeks to the Romans, new towns in medieval cities and within the US notably in Philadelphia, Manhattan, San Francisco, Savannah to compartmentalize and segregate social, economic and religious factions. Colonization in the 'New World' often followed the Laws of the Indies, whereby Cartesian grids were built on top of previous Amerindian neighborhoods.

The compartmentalization of neighborhoods and the prospect of their self-sufficiency was further encouraged by Ebenezer Howard's vision for Garden Cities, which eventually spread to North America in the 1920s. Wheeler (2004) specifically alludes to Clarence Perry (1872-1944), an American planner, who believed that the 'neighborhood unit' could be a self-contained entity. A key element of Perry's residential unit design was "self-sufficiency" (Southworth and Ben-Joseph 2003:76). Six principles comprised the formal layout of the neighborhood unit: 1) the incorporation of one elementary school, 2) the bounding of the development by arterial right-of-ways, 3) a hierarchical street system, 4) systematic open spaces, 5) the grouping of neighborhood institutions and 6) the inclusion of one or more shopping districts at the edges of the unit. Additionally, no residence was to be located more than .5 mile from the school, introducing the basic geometric concept what would come to be known as 'walkability.' Banerjee and Baer (1984) have critically questioned Perry's neighborhood unit concept, condemning it as a static design paradigm, evocative of specific values in the US during the 1920s. However, the diagram has recently re-surfaced in topical texts such as Douglas Farr's *Sustainable Urbansim* (2008), the LEED-ND manual and Andres Duany's SmartCode, and it continues to surface as an important metric for proximity: the walking radius.

The definition of a 'sense of community' would appear to be ambiguous (Talen 1999), but like any other concept it can be operationalized and tested. Generally, sense of community within a neighborhood refers to an individual's feelings about belonging to a group. Mel Webber (1964) was one of the first scholars to allude to this concept in his essay on *Urban Place and the Non-Place Urban Realm*. Webber believed that 'community could exist without propinquity'—that essentially cities that were clusters of settlements with the urban realm of its occupants being determined by social links and economic networks. Ultimately, community was based on social and economic factors, versus pure physical proximity. Lyon(1987) later noted that individuals have a sense of community in relation to a physical neighborhood, or in a relation to an aspatial community such as a professional group. The concept of community within a neighborhood has also been broached by Nasar & Julian (1995) in their study. The authors used an 11-item scale to assess psychological sense of community at the neighborhood scale. The authors note this is an improvement upon the 15-point Glynn scale (1981). Both Nasar and Julian (1995) and Glynn (1981) found that a "sense of community" was more prominent in neighborhoods that facilitated face-to-face interaction - those where a car was not necessary for transportation. In a similar vein, other studies have found a correlation between Traditional Neighborhood Development (TND)/pedestrian-friendly public realm/decreased automobile use and community/social ties (Lund 2002; Freeman 2001). In contrast, Nasar (2003) in his later work has also shown that a sense of community can be strong in the suburbs, and is not necessarily strongly correlated to compact development or TND.

Herbert Gans, a sociologist, had a huge impact on the way scholars of urban theory think about community. Gan's initial work on community is recounted in his book, *The Urban Villagers(1982)*. Here, he intricately describes Boston's diverse West End Neighborhood, where he analyzed the underlying the strong cultural ties between the Italian-American working class communities. Gans emphasized the concept of *symbolic ethnicity*—whereby one's ethnic identity is solely associated with iconic elements of the culture, and the strong association between ethnic identity and neighborhood territory. Gans also later went on to address suburban community ties in his 1967 publication *The Levittowners*. Relying on participant observation as his primary method, Gans examined how formal and informal organizations establish a sense of community in suburban neighborhoods. He also illustrated how diversity existed within suburban neighborhoods with varied political and class structures, despite widespread assumptions at the time that they were homogenous places.

In addition to sense of community, neighborhood territory is an important element that contributes to livability. Appleyard and Lintell (1972b) explored this concept by collecting cognitive maps from participants and asking them to delineate their "home territory." The main takeaway from this effort was that residents living on a high traffic street refrained from including the street as part of their home territory. Bosselmann et al (1999) in a later study suggest similar findings—those homes on the streets with the lightest traffic possessed the largest "home territories." The same visual survey technique can be used at the scale of the neighborhood, to delineate neighborhood boundaries.

There are countless studies that suggest that neighborhood safety & security is an important factor in neighborhood livability. Oscar Newman's book entitled *Defensible Space* (1972) signaled the creation of a new environmental design discipline called Crime Prevention Through Environmental Design (CPTED). Overall, Newman confirms Jane Jacob's (1961) notions on surveillance theory: that maintaining a constant set of 'eyes on the street' reduces the need for formal policing and increases neighborhood territoriality. Since then, studies have been spawned in the realm of environmental psychology to examine the connection between 'defensible' neighborhoods/buildings and crime rates (Perkins et al. 1993; Perkins, Meeks, and Taylor 1992; Taylor, Kuo, and Sullivan 2002; Brown and Altman 1983). These studies showed that neighborhoods that had less surveillance were more vulnerable to burglaries and break-ins.

Neighborhood identity can be influenced by architecture and urban design, but ultimately the definition is heavily reliant upon resident perception. For Lynch, in *The Image of the City (1960)* a city as a 'place' had to be imageable, and contain distinct paths, edges, districts, nodes and landmarks. Logically, a neighborhood must also contain some or all of these ingredients to become a memorable place in the mind of its residents. Cognitive mapping can reveal how residents in a particular city or neighborhood perceive important landmarks or places (Lynch 1990). Place attachment is loosely related to identity, and the two concepts inform each other. However, place attachment is more closely based on the notion that certain spaces can trigger emotional responses and become symbolically embedded in one's dwelling identity (Brown, Perkins, and Brown 2003; Cuba and Hummon 1993; Lewicka 2010). In a sense, place attachment creates positive psychological bonds that support one's sense of identity and memory.

Affordability, Livability and Social Equity

Housing that is affordable is a human need. It has always been viewed as a critical element of the "food, clothing and shelter triumvirate." Not only is housing a basic physical need necessary for existence—but at a psychological level it is also an emotional need that retains symbolic importance for people. As an extension of Maslow's (1954) hierarchy of human needs, housing functions at multiple physiological and cognitive levels to provide a higher quality of life for people. In this way, affordable housing plays an important role in strengthening the sustainability 'axis' (Campbell 1996; Wheeler 2004) of social equity in neighborhoods, and therefore aids in improving the overall livability of communities. Ultimately, affordability and livability are inherently interdependent, and a mix of income groups makes for a more economically successful and vibrant place.

This human need for affordable housing has generally been underserved in North America. For too long, has affordable housing suffered from delayed and lapsed investment, with its residents experiencing segregating effects and poor construction and design. To compound the problem of distressed public housing, many inner city and downtown neighborhoods have experienced gentrification during the last 30 years. Dale and Newman (2009) have also noted that the relationship between new sustainable development and gentrification is more complex than originally suggested. The dilemma of exactly how to provide new housing that is not only affordable, but is also well-designed in the eyes of residents and provides access to reasonable amenities, can be described within the discipline of urban planning as a "*wicked problem*" (Rittel and Webber 1973).

Ultimately, the question of affordable housing, and what affordability *really* means, is often a difficult one to answer, and varies widely from nation to nation, and city to city around the world. The phrase is a broad umbrella term that is typically comprised of complex subcategories, and can be confusing to disentangle. In the literature, the actual definition in North America, and in particular the US, has been problematized and carefully weighed (Hulchanski 1995; Kutty 2005; Bratt, Stone, and Hartman 2006; Stone 2006; Glaeser 2008). The meanings of 'affordable housing' in the US, and the more politically-infused welfare state term of 'social housing' in Canada, are shaped by drastically different legacies and trajectories. Yet the goal for both countries is similar: to provide decent housing options to low-income residents. The general term is intrinsically tied to the concept of a) contextual & regionally determined cost of living in addition to b) area median income (AMI)/median family income (MFI).

Affordable housing is generally defined in the United States as "*housing for which the occupant(s) is/are paying no more than 30 percent of his or her income for gross housing costs, including utilities.*" (US Department of Housing and Urban Development 2014). In Canada, affordable housing is defined as "*housing costs less than 30% of before-tax household income. Shelter costs include for renters the rent and any payments for electricity, fuel, water and other municipal services. For owners, affordable housing includes mortgage payments (principal and interest), property taxes, and any condominium fees, along with payments for electricity, fuel, water and other municipal services*." (CMHC 2014). In this sense, both Canada and the US have very similar definitions of housing, although typically Area Median Income (AMI) is used in the United States, whereas in Canada, the term 'regional income profile' is generally referenced instead.

One critical question remains in terms of affordable housing—does affordable housing need to occur in every neighborhood for a place to be livable? This is a difficult question. A place can surely be livable without affordable housing, but the next question is then for whom is it specifically livable? Is it livable for only a specific tier of high-income residents? Considering that the market favors the production of market-rate housing over subsidized and affordable housing, it is reasonable to assume that market-rate housing will tend to dominate the urban landscape, and secondly that affordable housing requires championing from planners and designers alike. Thus, this dissertation situates itself within a specifically within an 'advocacy' role (Davidoff 1965; Checkoway 1994; Peattie 1968; Hayden 1994) in the planning theory literature.

Summary

The concept of livability is a complex and multi-faceted term, which encompasses a wide range of criteria. Livability is ultimately a relative versus an absolute concept, and will vary on an individual basis, and an acknowledgement that it is somewhat of a 'fuzzy' concept that quantitative scholars may not be comfortable with. It is inherently individually formed and perceived. However, it cannot be denied that above the scale of the individual, there is some social and cultural consensus about what livability means in North America. This dissertation aligns itself with the use of the term 'livability' as traditionally used in the Berkeley School of Planning and Urban Design. It builds on Appleyard and Lintell's (1972) definition and Bosselmann's (2008) definition as a general measure of comfortableness, 'neediness' and suitability, including freedom from intrusion. It specifically outlines 'livability*'* as the *'suitability of a place for comfortably meeting all of one's daily and long-term needs and desires*.' The next chapter focuses on the specific research methods used in the dissertation, and outlines the mixed-methods research design and approach.

CHAPTER 3: RESEARCH METHODS

RESEARCH DESIGN

This dissertation uses a mixed-methods approach to answer the aforementioned research questions (see CHAPTER ONE: LEED-ND—PROBLEMATIZING A RATING SYSTEM) pertaining to both livability and affordable housing. Both quantitative approaches (survey design, descriptive statistics) and qualitative approaches (interviews) were used to tackle multiple research questions. Specifically, five main research approaches were used in this dissertation:

Livability:

1) Post-Occupancy Evaluation (POE) using Mail-Out Mail-Back Survey of Residents in four case study sites in Metro Vancouver, BC and Metro Portland

To assess livability, four cases were included in a mail-out mail-back survey, with paired comparison format. Two LEED-ND platinum urban neighborhood cases are compared, in a quasi-experimental form to ensure generalizable findings for urban neighborhoods in the Pacific Northwest. In addition to two similar sites, each of these LEED-ND sites required a 'business-as-usual' suburban counterpoint or 'control' neighborhood, in order to illustrate that suburbanites also value qualities outside the realm of LEED-ND.

Social Equity and Affordable Housing:

2) Statistical Aggregation of LEED-ND Score Card Data
3) On-Line Survey of LEED-ND AP Professionals
4) Interviews with LEED-ND AP Professionals
5) In-Depth Case Studies of Affordable Housing Policy

Assessing the question of whether social equity in the form of affordable housing is upheld in LEED-ND required a combination of methods. Statistical aggregation of scorecards would quantitatively prove whether or not affordable housing is being incorporated into LEED-ND projects. An online survey of LEED-ND AP professionals would quantitatively determine in the eyes of experts if the affordable housing credits in LEED-ND were successful or not. Structured interviews with LEED-ND AP professionals would further reveal the reasons behind whether or not the credit is successful. And finally, an in-depth case study of a premier LEED-ND platinum neighborhood was chosen to reveal the intricate tensions and complexities in implementing affordable housing policy in new sustainable neighborhoods.

LIVABILITY: POST-OCCUPANCY EVALUATION (POE) FOR FOUR CASE STUDIES

Case Selection and Approach

In the spring and summer of 2012, scoping of potential project sites was conducted. Due to the North American birthplace of the USGBC and LEED-ND as a rating system, cases were limited to both the United States and Canada. Both the City and region of Greater Vancouver (Berelowitz 2005; Beasley 2000; Holden 2012; Macdonald 2008; Punter 2003; Fernandez 2011; Harcourt 2007; Macdonald 2005) and the City of Portland (Abbott 2011; Podobnik 2011; Ozawa 2004) are world renowned for their sustainability and neighborhood planning. Given the aggressiveness of

both cities to develop as 'green cities', a comparison between both metropolitan areas has generalizability for the Pacific Northwest region.

The scoping included neighborhood site visits to 5 potential sites in both British Columbia and Oregon. All of the neighborhoods were photo-documented, and notes about the neighborhoods were taken in the field. Only LEED-ND Platinum rated sites were considered, in addition to those in Stage II development (necessary approvals and entitlements to be built to plan) or those developments attempting Stage III (see Table 2). By selecting only Platinum rated neighborhoods, the most stringent LEED-ND AP requirements would be tested.

Table 2: Summary of LEED-ND Platinum Sites, adapted from LEED-ND Project Database

Development Name	Certification date	City/State	Country	Version	Certification level	Stage
9th and Berks Street TOD	12-Oct-13	Philadelphia, PA	USA	v2009	Platinum	II
Shanghai EXPO UBPA Development	5-Apr-13	-	China	v2009	Platinum	I
Ever Vail	30-Sep-08	Vail, CO	USA	v1.0 pilot	Platinum	I
Southeast False Creek Neighborhood	*3-Feb-10*	*Vancouver, BC*	*Canada*	*v1.0 pilot*	*Platinum*	*II*
Hoyt Yards	*1-Apr-10*	*Portland, OR*	*USA*	*v1.0 pilot*	*Platinum*	*II*
Dockside Green	19-Nov-09	Victoria, BC	Canada	v1.0 pilot	Platinum	II
The Brewery, the former Pabst Brewery	9-Apr-12	Milwaukee, WI	USA	v1.0 pilot	Platinum	II
Emeryville Marketplace	22-May-08	Emeryville, CA	USA	v1.0 pilot	Platinum	I
360 State Street	25-Jun-12	New Haven, CT	USA	v1.0 pilot	Platinum	III

The Dockside Green development in Victoria, BC initially looked like a good candidate site. However, ground truthing (in-field analysis) in the form of photo-analysis and pre-dissertation site visits illustrated that the development was not fully built out at the time. This potential study site was thus dropped from the case study framework. Southeast False Creek, located in Vancouver, BC, CANADA and Hoyt Street Yards, in the Pearl District in Portland, Oregon confirmed as comparable LEED-ND study sites. These sites are both LEED-ND Platinum rated, Stage II, brownfield sites. Southeast False Creek currently has approximately 1102 units, and Hoyt Street Yards has 1800. Ideally the number of units would have been within close range of each other, but given the small universe of LEED-ND sites that fit the platinum rating requirement, it was not possible to find a better match. In addition, it would have been helpful to test LEED-ND suburban sites, but such sites do not exist as the LEED-ND pre-requisites and Smart Location and Linkage (SLL) credit requirements make it impossible for a LEED-ND site to be located in a suburban greenfield site. The two contextually paired non-LEED-ND control, business-as-usual (BAU) cases to be assessed were: East Clayton in Surrey, BC (1,700 units) and Fairview Village in Multnomah County Oregon, OR (600 units). These two sites are less well known than Southeast False Creek and Hoyt Street Yards, but the development of both East Clayton (Condon 2008; Grant 2009) and Fairview Village (Hock 2000; Dill 2006) have been documented in the literature as well. All of the study sites are master planned developments, created with the intent of either ensuring walkability or sustainability for residents.

Controls

It was determined that master planned neighborhoods that were built less than 20 years ago, located in the geographic region of the Pacific Northwest were good candidates for comparison. The two LEED-ND sites had to be LEED Platinum, Stage II projects. The control cases had to be located in a suburb within the same metropolitan area. These developments also had to be influenced by principles of New Urbanism or Traditional Neighborhood Design. These suburban cases were intended to reveal the preferences particular to suburban residents living in walkable, yet isolated neighborhoods.

LEED-ND Platinum Sites

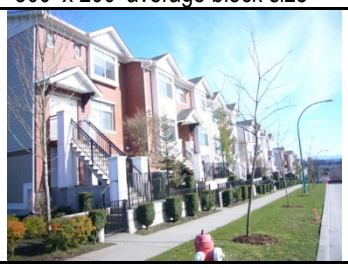
Southeast False Creek, Vancouver, BC	Hoyt Yards, Portland, OR
East Clayton, Surrey, BC	Fairview Village, Fairview, OR

Traditional Neighborhood Design (TND) Suburban Sites

Figure 7: The four study sites--two in Metro Vancouver, BC and two in Metro Portland, Or.

Figure 8: Oregon Study Sites: LEED-ND Hoyt Street Yards in the Pearl District in Portland, OR and TND Suburban Site Fairview Village in Fairview, OR

Figure 9: Metro Vancouver Study Sites: LEED-ND site in Southeast False Creek in Vancouver, and Suburban TND East Clayton site in Surrey, BC

	CANADIAN	USA
LEED-ND Sites	**Southeast False Creek, Vancouver, BC** -Urban context -Master planned neighborhood -Primarily 8-10 Storeys -Vertical Mixed Use -Cartesian grid -300' x 200' average block size	**Hoyt Yards, Pearl District, Portland, OR** -Urban context -Master planned neighborhood -Primarily 5-6 storeys -Vertical Mixed Used -Cartesian grid -200' x 200' average block size
		
TND Sites	**East Clayton, Surrey, BC** -Suburban context -Master planned neighborhood -Primarily single family, some townhomes and apartments, some 5 he mid-rise apartments -Cartesian & curvilinear grid -500' x 200' average block size	**Fairview Village, Portland, OR** -Suburban context -Master planned neighborhood -Primarily single family and townhouses, some mid-rise apartments, some live-work -Curvilinear grid -500' x 200' average block size
		

Address & Geospatial Data Collection

A mail-out mail-back survey design was chosen as the survey method of choice over an online survey for the resident's survey. Emailing the surveys through an online survey program proved to not be feasible, given the tight neighborhood boundary constraints and privacy laws in Canada. In addition, the survey was intended to capture a wide age range of respondents, and younger generations tend to answer such online surveys more readily and accurately than older generations, especially those over age 50 (Gosling et al. 2004:99). Thus, it was decided that a mail-out, mail-back survey was most appropriate for this type of study.

In January and February 2013, address data was collected for the four case study sites. For all four sites, the address data was collected using a combination of groundtruthing (site visits) and purchased or publicly available geospatial data from online platforms or downloadable files. Groundtruthing was specifically used for entering multi-unit apartment and condominium buildings to obtain unit numbers and confirm MLS acquired web data.

During the months of January and February, photo data was also collected for the selected four neighborhoods. These photos were intended to supplement photo data taken during pre-dissertation research conducted in the summer of 2012.

Case Study Site	Data Source	Type of Data Obtained
Hoyt Yards, Portland, OR	• Metro RLIS (Regional Land Information System)	• Name data • Address data
	• Experian Consumer Reports/Accudata	• Name data • Address data
	• Groundtruthing	• Address data • Unit numbers
Fairview Village, OR	• Metro RLIS	• Name data • Address data
	• Experian Consumer Reports/Accudata	• Name data • Address data
	• Groundtruthing	• Address Data • Unit numbers
Southeast False Creek, BC:	• City of Vancouver VanMap	• Address data
	• MLS webscraping	• Address Data • Unit numbers
	• Groundtruthing	• Address data • Unit numbers
East Clayton, Surrey, BC:	• City of Surrey COSMO GIS Platform	• Address data
	• MLS webscraping	• Address data • Unit numbers
	• Groundtruthing	• Address data • Unit numbers

Data Collection Limitations

Given the stringent neighborhood boundaries (which do not follow other spatial administrative units such as census blocks, tracts, or zip codes), a combination of the above methods was used to acquire the address data, in order to ensure that surveys were only sent to houses within the neighborhood boundaries.

Ultimately, it would have been helpful to compare the results of the post-occupancy evaluation with official census data. Unfortunately, comparative census data in Canada is not available for the specific neighborhood boundaries for Southeast False Creek or East Clayton, due to the fact that at the smallest units of geographic analysis that comprises the neighborhoods—the Dissemination

Block (DB) and the Dissemination Area (DA)—only population and dwelling are disseminated. In addition, the conservative government of Canada under Steven Harper discontinued to the long form census in 2011 for privacy reasons. Thus, the only detailed data at this point can be traced back to 2006, the last time the long form census was conducted.

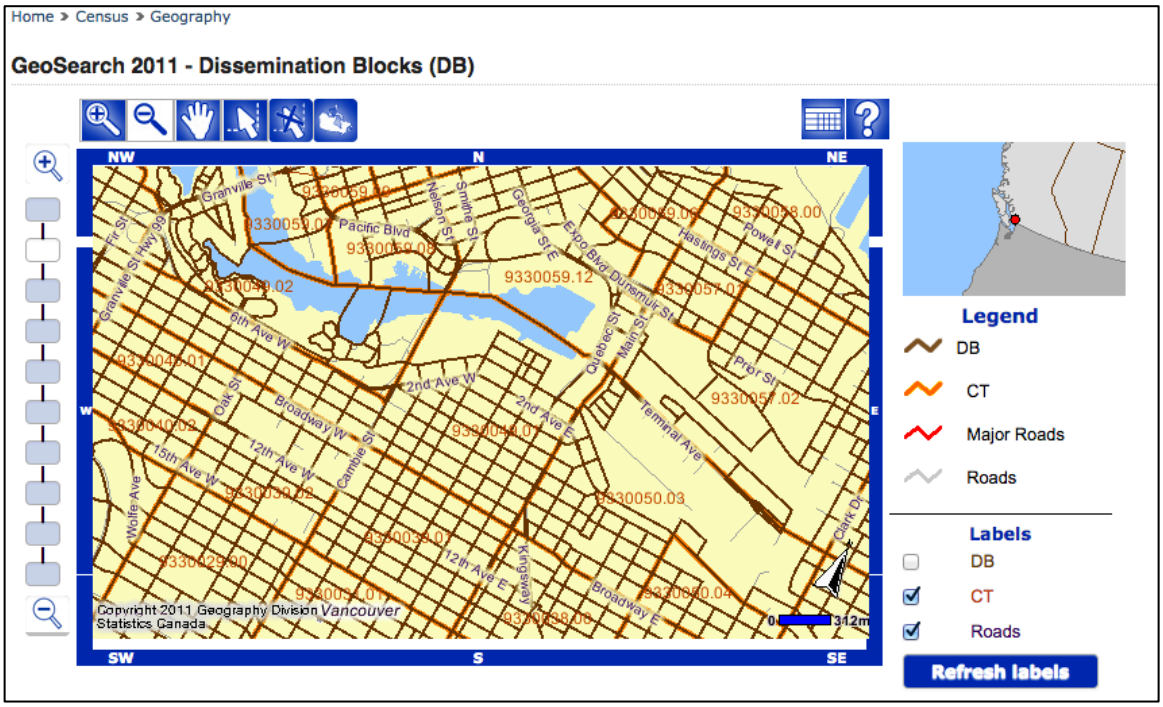


Figure 10: Map illustrating the scale of Dissemination Blocks (DB) in brown, in relation to the larger Census Tract areas from Statistics Canada. Comprehensive demographic data is only available at the scale of the Census tract, which is not representative of the SEFC neighborhood. Only population data is available at the scale of the Dissemination Block (DB).

Privacy laws in Canada are also different than in the US, and thus acquiring data (such as names, addresses, & email addresses) from private companies such as Experian was not an option. In cases where GIS data for addresses was thin, or specific rental unit numbers were not given for buildings, groundtruthing (site visits, including entering apartment buildings to retrieve unit numbers) was deemed necessary and used as a last resort.

Mail-Out Mail-Back Survey Design

The mail-out, mail-back survey included a cover letter, explaining the purpose of the study and its CPHS protocol number (See APPENDIX A: MAIL OUT MAIL BACK SURVEY COVER LETTER). A definition of livability was given and defined as "*the suitability of a place for comfortably meeting all your daily and long-term needs and desires*." The objectives stated in the cover letter were "*to learn what environmental design qualities you feel are most important to the character and quality of your neighborhood*." It was explained to respondents that as a researcher I hope to understand how to improve new neighborhood developments and rating systems such as LEED-ND.

The person in the household over the age of 18 whose birthday month was closest to May or June 2013 was asked to complete the enclosed questionnaire. A return envelope was enclosed with pre-paid postage.

The survey itself (See APPENDIX B: MAIL-OUT MAIL-BACK SURVEY) was comprised of six pages (3 pages double-sided). The majority of the questions were multiple-choice tri-level Likert-scale questions. The survey was implicitly divided into five main categories, organized as follows: dwelling type information, livability, housing, travel and demographics. A basic series of questions on building and unit type were asked, in addition to length of residence. The following livability section comprised the majority of the survey, and led respondents through a series of 19 tri-level Likert scale questions regarding factors and characteristics both in LEED-ND and not included in LEED-ND. These questions were developed from a proxy sheet that related LEED-ND credits to survey questions (See APPENDIX C: PROXY SURVEY QUESTION KEY**).** The LEED-ND proxy factors and non-LEED-ND factors were mixed randomly together, creating a "mixed-bag" blind survey design.

After introducing respondents to these 19 factors in independent Likert scale questions, respondents were then asked to rank the top three characteristics related to livability (in order of importance). Following this, residents were then asked to rank the three neighborhood characteristics that were the least important to them, in terms of livability. This method is based upon the Q-sort methodology more commonly used in psychology, whereby the participants are initially introduced to a range of factors, and afterward are asked to rank the factors relative to one another.

Questions regarding housing precluded the livability questions. A focus on cost and the impact of housing cost on livability remained an important focus, given that affordable housing had been severely reduced in the Southeast False Creek neighborhood. Travel questions regarding vehicle ownership and travel mode choice followed, in order to get a sense of the impact LEED-ND development has on mode share. Demographic information was collected last as this often the most sensitive information.

Survey Mailing

A survey pre-test was mailed to all four sites in February and March 2013. Twenty addresses were randomly selected at each site for the pre-test, using the RAND feature in Microsoft Excel. The survey pre-tests were returned with an overall 29% survey return response rate. Only one returned survey was not completed fully, demonstrating that 'survey fatigue' was not an issue. The results from all four neighborhoods were analyzed collectively, given that splitting and analyzing the four neighborhoods individually using a relatively small pre-test sample size would be statistically insignificant. Based on the limited pre-test results, I was encouraged by that the hypothesis (that there are other factors that are equally important to neighborhood livability as LEED-ND factors) would be supported by the final survey results. Residents on the survey pre-test indicated that other livability factors were important to them. For example, safety/security and privacy, both of which are not currently factors measured by LEED-ND, were shown in the pre-test results to be particularly important to residents.

The decision was made to mail out 500 surveys to each of the study sites, with 2,000 surveys mailed out in total. 500 surveys were deemed as the absolute survey minimum, given that there

were only 550 units in Fairview Village at the time with known addresses. Therefore, the lowest common denominator was the determining number. There was no incentive offered to respondents, given the project's limited budget.

The surveys were mailed to the following buildings, which fall within the LEED-ND development boundaries:

Southeast False Creek (1102 units)	**Hoyt Street Yards, Pearl District (1675 units)**
Shoreline	Bridgeport Condos
Sails	Johnson Street Townhomes
Kayak	Kearney Plaza Apartments
Compass	Lexis on the Park
Canada House	Metropolitan Condos
Brook	Park Place Condos
Bridge	Riverstone Condos
	Streetcar Lofts Condos
	Tanner Place
	The Encore Condominiums
	The Pinnacle

Figure 11: Hoyt Street Yards Development, Pearl District, Portland, Oregon. Hoyt building addresses were retrieved for the majority of residents living within the Hoyt Street Properties Development (Szibbo 2015)

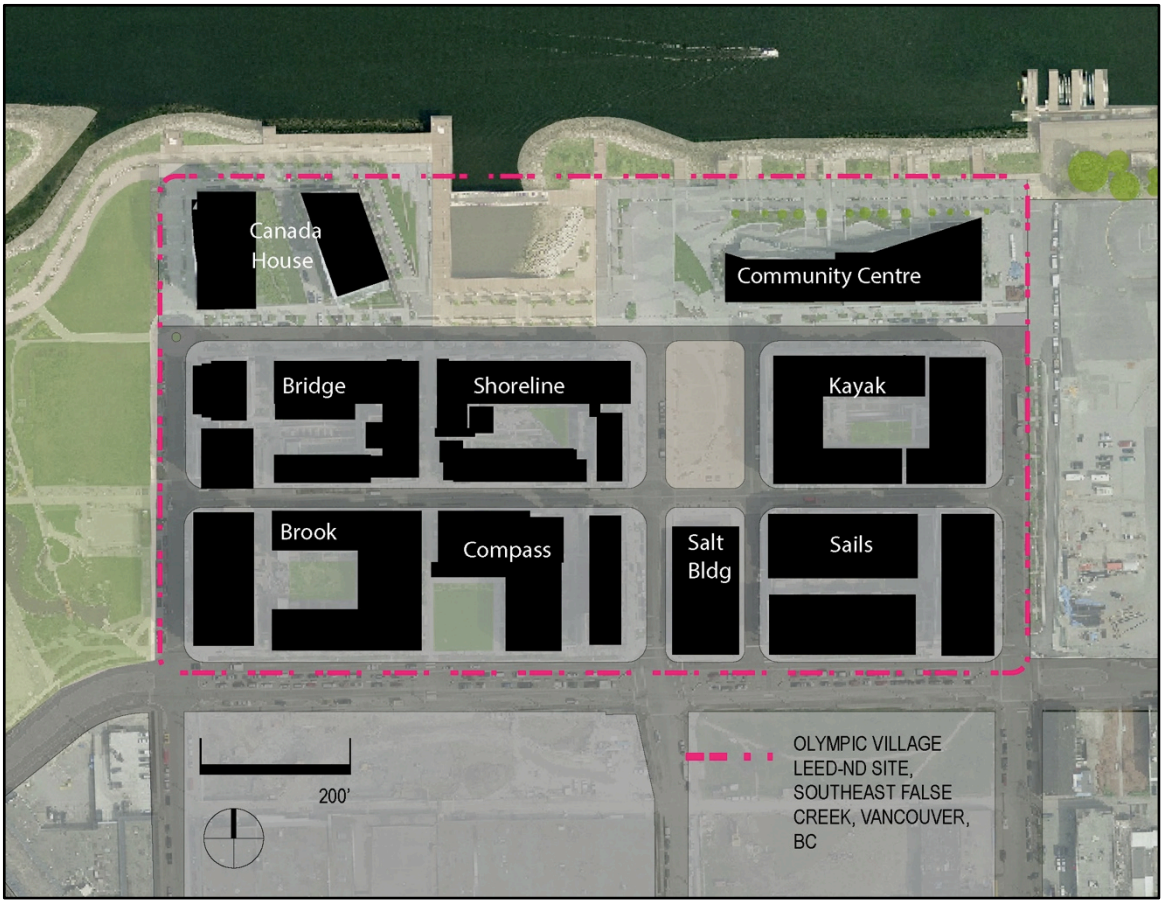


Figure 12: Southeast False Creek Olympic Village Building Map (Szibbo 2015)

Survey Return Rate

The final survey was mailed to all for sites in May and June 2013. Survey collection took place between June 2013-September 2013. The survey return results are displayed below in Table X:

Table 3: Survey Return Rate

	Approx. Number of Units at Time of Survey	# of Surveys Mailed	# of Valid Surveys Returned	Survey Return Rate	# of Unclaimed /Returned Surveys	# of Mailed Valid Surveys	Discounted Survey Return Rate
Canadian Sites							
Southeast False Creek (SEFC), Vancouver, BC	1102	500	**69**	**13.8%**	23	477	**14.5%**
East Clayton, Surrey, BC	3,800	500	**29**	**5.8%**	13	472	**6.1%**
US Sites							
Hoyt Yards, Portland, OR	1675	500	**112**	**22.4%**	49	451	**24.8%**
Fairview Village, Portland, OR	550	500	**55**	**11%**	121	379	**14.5%**

Limitations

A number of surveys were unclaimed or returned. Hoyt Yards, in the Pearl District in Portland, OR, had the overall best survey return rate, at 22.4%, and 24.8% discounting the invalid addresses. Both suburban, non-LEED-ND sites (East Clayton and Fairview Village) had the lowest survey return rates. Fairview Village also had the overall most unclaimed and unreturned surveys, which could be explained through a naming or address error. One of the limitations of a mail-out mail-back survey study such as this one is that survey results are often lower than email surveys, which on average have a return rate of about 30%. The survey is also representative of only the respondents, given that there is survey bias in terms of those willing to return a survey.

AFFORDABLE HOUSING: LEED-ND STATISTICAL DATA AGGREGATION

In order to investigate the percentage of LEED-ND neighborhoods that were including the affordable housing credit, summary statistics were collected and aggregated from LEED-ND scorecards in Fall 2014. This credit-level scorecard data was then cross-referenced with current internal USGBC data (Studhalter and Szibbo 2014). A USGBC staff member assisted in cross-checking the data, due to inconsistencies and lack of clarity in what is currently publicly available data on the USGBC website.

Limitations

Credit-level data for the 'Housing Types and Affordability Credit' is publicly available on the USGBC website. However, the scorecards are only made available for certain developments. From an analytical perspective, the way in which the current LEED-ND scorecards are published is that they provide a combined, conflated score for the 7 points—combining the 1) diversity of housing types points option (NPDc4 option 1) with the 2) score for affordable housing points (NPDc4 Option 2). This ultimately makes it difficult to really distinguish whether or not a project has provided certain percentage of affordable housing or certain percentage of diverse housing types. It is also impossible to distinguish the breakdown between for-sale affordable and affordable rental achieved by a project.

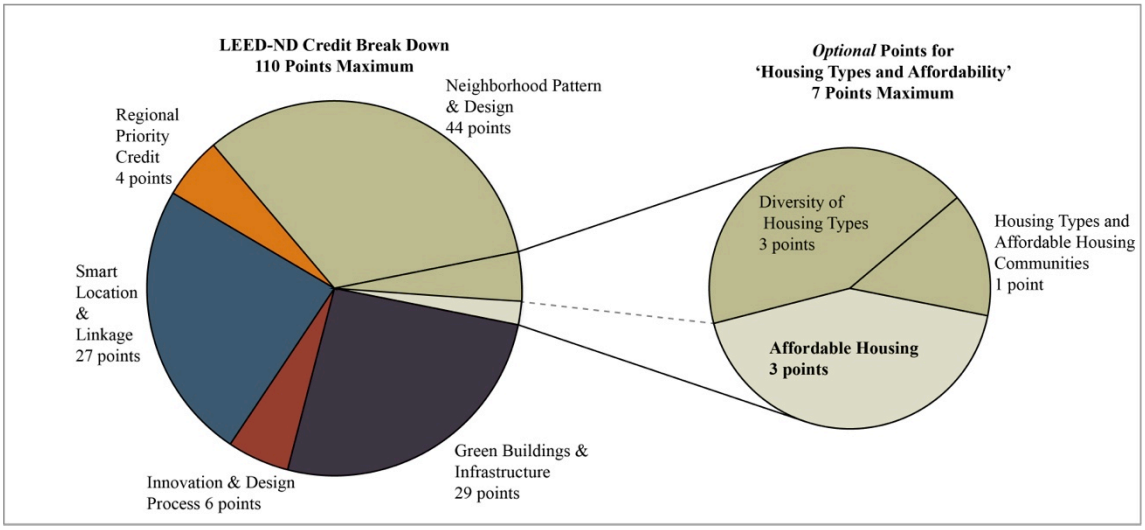


Figure 13: The Conflated 'Housing Types and Affordability' Credit. NPDc4 is the Diversity of Housing Types (3 points), NPDc4 Option 2 is Affordable Housing (3 points), and NPDc4 is the extra point allocated if you attempt to provide both a Diversity of Housing and Affordable Housing

AFFORDABLE HOUSING: ONLINE SURVEY WITH LEED-ND ACCREDITED PROFESSIONALS

A preliminary weeklong online survey of LEED-ND AP experts was also conducted in March 2014 using the online survey distributor Qualtrics. The cover letter (see APPENDIX D: ONLINE SURVEY COVER LETTER) and survey (see APPENDIX E: ONLINE SURVEY OF LEED-ND AP) were sent to 314 LEED-ND AP professionals listed on the USGBC LEED-ND contact webpage, 114 of who replied (n=114), for a 39% discounted[iii] return rate. A breakdown of the occupation of the respondents is listed in Table 4: LEED-ND Accredited Professional Respondents by Occupation, and by private or public employment in Table 5.

Table 4: LEED-ND Accredited Professional Respondents by Occupation

LEED-ND AP Respondents by Occupation, N-114	
Occupation	**%**
Planners	30%
Engineers	16%
Urban Designers	12%
Architect	12%
Landscape Architects/Landscape Designers	4%
Developers	4%
Analysts	4%
Other (sustainability consultants & project managers)	15%
Prefer not to answer	3%
Total	**100%**

Table 5: LEED-ND Accredited Professional Respondents by Private and Public Employment

LEED-ND AP Professionals by Private or Public Employment, N=114	
Occupation	**%**
Private firm	61%
Independent consultants	20%
Municipal Government	7%
Other (MPOs, State Government, Non-Profits)	10%
Total	**100%**

Limitations

While the overall percentage of developers (4%) in the survey sample (see Table 4) is relatively small (4%), this small percentage could be attributed to multiple factors including a) the assumption that there exists a smaller universe of LEED-ND accredited developers, and/or b) survey fatigue and/or c) lack of interest. A series of structured interviews were thus conducted with 20 LEED-ND professionals to better comprehend the financial feasibility of the accreditation process, gaining insight into the development perspective. The developers comprised seven of the 20 interviewees (approximately 35%). It also became clear in the interview process that most developers directly rely on the advice of LEED-ND accredited professionals, frequently planners and consultants, to guide them through both the accreditation and the feasibility process.

AFFORDABLE HOUSING: INTERVIEWS WITH LEED-ND PROFESSIONALS

The interview request was sent to all 314 surveyed LEED-ND AP professionals. In addition, chain referrals were used for three interviews. Interviews were conducted in October and November 2014. These 20 interviewees were carefully selected based on their specific project experience, including familiarity with affordable housing and financial feasibility of the certification process.[iv] Their combined LEED-ND experience included over 40 projects, which ranged geographically from Hawaii, California, Nevada, Colorado, Utah, Indiana, Quebec, Louisiana, Florida, Pennsylvania, New Jersey and New York. The interviews lasted 30 minutes to an hour depending on the professional's project experience. All interviewees were asked similar questions that focused on LEED-ND's affordable housing component and accreditation process (see attached interview guide, APPENDIX F: LEED-ND AP INTERVIEW GUIDE).[v]

Limitations

As mentioned above, it would have been ideal in the study to interview LEED-ND Accredited Professionals who were all developers. However, this is unrealistic as developers are notoriously difficult to interview in comparison to planners, public officials and consultants who are more than willing to devote their time to interviews. Developers typically have complicated contractual confidentiality obligations and assume financial risk for projects, and thus are more concerned with the provision of information as it relates to potential liability.

AFFORDABLE HOUSING: IN-DEPTH POLICY CASE STUDIES

Finally, Southeast False Creek (SEFC) was reviewed as a case (see CHAPTER 6: LEED-ND & AFFORDABLE HOUSING) since it is perceived as a premier case in city-initiated sustainable

development. Long before the LEED-ND pilot system had been implemented, local design professionals lobbied the city to set high place-making and sustainability standards—working from the platform that "form follows context" (the creation of place), versus "form follows finance" (the creation of value) (Bayley 2010:13). In 2005, the City Council acted to define specific social, environmental, and economic sustainability goals for SEFC development. By the time of its inauguration during the Winter 2010 Olympics, it was awarded LEED-ND Platinum certification with the highest score achieved in North America. Despite these high ratings, the city's affordable housing goals in in the development were continually re-adjusted downward. This case thus illustrates the difficulty of implementing affordable housing in large-scale sustainable developments, despite inclusionary zoning, a density bonus developer agreement and platinum LEED-ND certification. Ultimately, Southeast False Creek tells a story of the failures of inclusionary housing policy in the face of a weak housing market, and the addition of LEED-ND did not enhance the affordable housing element.

Limitations

There are definite limitations associated with presenting single case studies, including issues surrounding the 'generalizability' of the findings from a single case study. However, single case studies are helpful in this case when they are illustrated as "embedded" (Yin 2009:46) case designs—when multiple units of analysis are used (detailed policy analysis in addition to post-occupancy analysis).

Two other case studies were also utilized to illustrate the possibilities in new sustainable neighborhood development with regard to income mixing (see Chapter 7). Southeast False Creek and Hoyt Street Yards were chosen as they were LEED-ND cases which both chose to integrate income mixing differently. The Woodward's building in Vancouver was chosen as it exemplifies an extreme and innovative case in vertical income mixing rarely seen in the United States or Canada.

SUMMARY

This mixed-methods approach was useful in assessing topics related to both livability and affordability. Mail-out mail-back survey design lends itself well to post-occupancy analysis in specific neighborhood territories—such as LEED-ND neighborhoods—that do not follow traditional census blocks or zip codes. Data aggregation was useful for determining what percentage of LEED-ND neighborhoods currently choose to include affordable housing. Online survey design was also used for surveying LEED-ND Accredited Professionals within the wide geographic net of Canada and the United States. The online survey address data collection also allowed the author contact the same group of professionals to request interviews with those who had specific project experience related to the LEED-ND certification process. Close case study analysis of different types spatial income mixing in new sustainable neighborhoods simultaneously reveals both successes and failures in the spatial organization of affordable housing. The next Chapter introduces the four case studies used in the post-occupancy livability evaluation study, and provides some development and visioning context and background.

CHAPTER 4: BACKGROUND ON POST-OCCUPANCY CASE STUDIES

COMPARATIVE OVERVIEW OF NEIGHBORHOODS

This chapter provides background information on the four neighborhoods selected for post-occupancy analysis of livability factors. The following tables provide an overview of statistical information related to LEED-ND, land use and development, and density for the four case studies: Southeast False Creek (LEED-ND), Hoyt Street Yards (LEED-ND), East Clayton (Suburban Traditional Neighborhood Design (TND)) and Fairview Village (Suburban TND). This information was collected as part of the case selection process, in order to ensure that neighborhood comparisons were similar.

Ultimately, it would have been ideal to rate the TND sites with the LEED-ND rating system, but given time constraints and lack of access to the official 1) site plans, 2) landscape plans and 3) detailed construction documents, it was not possible to do this for either East Clayton or Fairview Village. The official plans are required to evaluate LEED-ND, and this ensures a high degree of accuracy in the rating process. If the plans were available to rate both the sites, it is likely that the TND sites would not score well in smart location and linkage (SLL) due to their lack of frequent transit service and greenfield nature. The category they would likely score the most points in is Neighborhood Pattern and Design (NPD), however, the grids are not cartesian and the required intersection density (90 intersections per square mile) would likely not be met. Since some of the buildings would be energy efficient but not up to the latest green building standards, it is likely that they would not score particularly well in the Green Infrastructure and Buildings (GIB) category either. In addition, since both sites are essentially greenfield sites, and without local access to light rail or frequent transit, it is also unlikely they would meet the Smart Location and Linkage (SLL) requirements and LEED-ND location pre-requisites.

Table 6: LEED-ND Points Comparison

	LEED-ND Sites		TND Sites	
Context	**Urban**		**Suburban**	
Regional Location	**Urban Center Ex-Industrial Lands**	**Downtown Core Ex-Industrial Lands**	**Agricultural Land Reserve (ALR) Suburb**	**Outer Ring Greenfield Suburb**
Site	**SE FALSE CREEK, VANCOUVER**	**HOYT YARDS, PORTLAND**	**EAST CLAYTON, SURREY**	**FAIRVIEW VILLAGE, FAIRVIEW**
LEED-ND Current Rating	Platinum	Platinum	-	-
LEED-ND Stage	II	II	-	-
LEED-ND Total Points (106 max)	83	84	-	-
Smart Location & Linkage (30 Points Possible)	27	22	-	-
Neighborhood Pattern & Design Points (39 Points Possible)	28	33	-	-
Green Construction & Technology (31 Points Possible)	22	24	-	-
Innovation & Design Process (6 Points Possible)	6	5	-	-

Table 7: Land Use and Development Comparison

	LEED-ND Sites		TND Suburban Sites	
	SE FALSE CREEK, VANCOUVER	**HOYT YARDS, PORTLAND**	**EAST CLAYTON, SURREY**	**FAIRVIEW VILLAGE, FAIRVIEW**
# of Projected Units	1102	1800	3,379-5,843	600
Total Development Site Size (area)	80 (17) acres	34 acres	560 acres	95 acres
Ownership	City owns 50 acres, 30 acres private, 17 acres Millenium Water	Hoyt Properties	Aloha Estates	Holt & Haugh
Architects	Merrick Architects Arthur Erickson gBL Architects	Boora Architects	Multiple	Sienna Architecture, Lennertz Coyle & Associates, Group Mackenzie
Landscape Architects/Landscape	PWL Partnership	Durante Kreuk	James Taylor Chair in Landscape and Livable Environments, UBC	Army Corps of Engineers
Type of Site	Brownfield	Brownfield	Greenfield	Greenfield
Land Use Prior to Development	Industry	Former Railyard	Upland of Agricultural Land Reserve	Wetlands and farmland belonging to the Tektronix Corporation
Cost of Environmental Remediation	$30 million CAD	$45 million USD	N/A	N/A
Cost of Development	$1.075 billion CAD	$600 million USD	--	$140 million USD

Table 8: Density & Units Comparison

	LEED-ND Sites		Suburban TND Sites	
	SE FALSE CREEK, VANCOUVER	HOYT YARDS, PORTLAND	EAST CLAYTON, SURREY	FAIRVIEW VILLAGE, FAIRVIEW
Year Built	2008-2013	2007-2013	2002-2013	1996-2002
# of units projected at development phase build-out	1102	1800	3,379-5,843	600
# of units currently built	1102	1675	4,000 (approx.)	550
Projected Retail Sq. footage	68,000	100,000	831,125	300,000
Gross Density at build-out	65 upa	138 upa	15 upa (net density)	5-30 upa (11.4 net density)
Density at build-out (FAR)	3-3.5 FSR	3-4 FSR	.5-2.5 FSR	-
% Goal Affordable Housing	30%	35%	Units projected to cost 20-30% less than a standard home in the same area	Not specified
Initial Unit Cost	$3,000,000 CDN (for 1,600 square foot unit)	-	$139,089 CDN for 1,661 square foot unit (land, building and infrastructure, does not include Developer Cost Charges (DCCs), Developer profit, permit fees, carrying costs, realtor fees, $450,0000 for single-family)	$140,000-$360,000 US for single family, $140,000-$296,000 US for townhouses & rowhouses

Southeast False Creek, Vancouver, BC (LEED-ND)

As a unique Canadian charter city, Vancouver possesses a strong history of public consultation and citizen engagement, streamlined permitting, intensive design review and a commitment to community development (Macdonald 2008). The basic formula combines zoning with a discretionary review system for urban design, mandatory community amenity contributions from developers, all the while engaging the community in the process. This pro-active system, with an emphasis on livability, a charter city government and a site largely owned by the City, has supported and made it possible to implement such large-scale pilot sustainable development projects like LEED-ND neighborhoods to be built and supported by the City which would likely be impossible elsewhere (Clark 2001). Vancouver undoubtedly remains a world leader on the city planning and sustainability front.

Figure 14: Southeast False Creek Master Plan © 2015 City of Vancouver
http://vancouver.ca/your-government/terms-of-use.aspx#Bylaws

In 2011, Southeast False Creek became the second neighborhood in the world to receive a LEED-ND platinum rating (City of Vancouver 2012). The development sits along the False Creek Inlet on former industrial land that once housed a variety of industrial uses including sawmills, foundries, shipbuilding, metalworking, salt distribution, warehousing, and the city's public works yard. Beginning in the 1970s, the area around False Creek was re-zoned for residential development and parks, and with Expo 86 (a World's Fair on Transportation and Communication) this process was expedited. The last industrial use vacated the area in 1990, at which time most of the older industrial buildings were torn down.

In 2003, the City launched an official development plan to determine parks, rows, public amenities, overall density and massing for the area, which included both publicly-owned lands near the water, and privately-owned lands farther inland. In 2006, a Public Realm guide was passed for the area (PWL Partnership and City of Vancouver 2009), and in 2008 a green building strategy was approved that would foster the attainment LEED-ND status. By this time, Vancouver had been selected as the host city for the 2010 Olympics, and it was determined that the heart or 'core' of the development would be the Olympic Village, defined as Area 2A within the overall development plan. The Olympic Village was planned with buildings that would initially house the Olympic athletes, which would later be transition into strata/condominium properties and rental units. Initially, development was to be done by a private developer, but with the economic downturn in 2008, the developer ran into financial difficulty, and the city had to step in. However, the City was very successful in terms of creating a series of plans that provided design guidelines for the public realm and green building strategies.

The intent was to promote the following sustainable principles within the development:

Ecosystem health

- The Southeast False Creek plan should improve the health of the False Creek Basin and encourage resource conservation and waste reduction.

Economic viability and vitality

- Development should ensure viability without subsidy and encourage a vibrant and vital community.

Social and community health

- Southeast False Creek should be a livable, complete community supporting social networks and enhancing quality of life.

Green building strategy

A green building strategy was adopted, requiring all buildings on City lands to be built to a minimum LEED silver standard, with the objective of the gold standard. Some of Southeast False Creek's green features include:

- Urban agriculture
- Green roofs
- Island and inter-tidal fish habitat
- Seaside greenways and bikeways
- Rainwater management systems with a 50% reduction in water consumption through the re-use of rainwater
- The Neighborhood Energy Utility (NEU) system, an environmentally friendly community energy system that will provide space heating and domestic hot water to all buildings in the area

The neighborhood energy utility system (NEU) is the first of its kind for residential development in Canada. The system is unique and operates on a base-load system utilizing sewer heat recovery pump along with a boiler back-up. The two original contenders for the energy source were biomass and sewer heat, but the sewer heat recovery heat pump system was selected because of the public concerns over local air quality, emissions and traffic inconvenience that may arise from biomass utilization (Pa, Bi, and Sokhansanj 2011).

Figure 15: Aerial of SE False Creek, courtesy of Scot Hein, City of Vancouver (2011)

In addition to this, a goal was set to accommodate 30% of units as affordable housing within the original Olympic Village area. However, because of fiscal missteps and cost overruns (Charlie Smith 2010), the goal for affordable housing changed from 30% to about 20% (Hiebert 2014). Given the change in affordable housing goals, some have chosen to critique the development, identifying the process as indicative of the "*semantic plasticity of sustainability*" used in the discourse of planning (Kear 2007). For Kear, Southeast False Creek represents an accumulation of wealth and capital under the guise of the sustainability pillars.

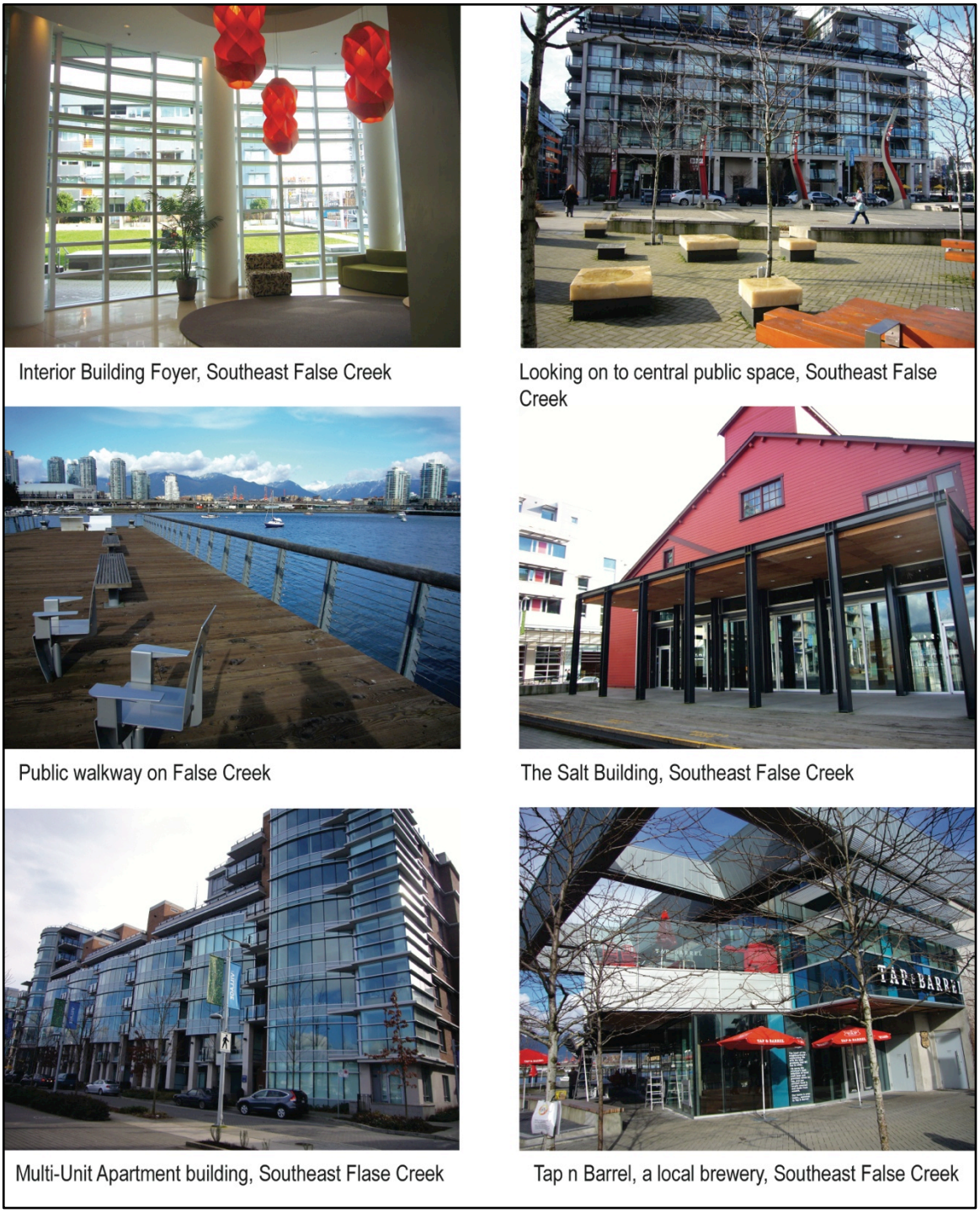


Figure 16: Images of Southeast False Creek (Szibbo 2013)

Southeast False Creek Development Financing

This section chronicles the development agreements and the troubled financing of Southeast False Creek's Olympic Village, as described by Official City of Vancouver (2014) documents. In November 2002, the City of Vancouver signed a Multi-Party Agreement (MPS) for the 2010 Olympic games. The MPA detailed the City's commitment to build the Olympic Village, subject to a $30 million contribution by VANOC. In June of 2003, the Olympic bid was won by the City of Vancouver. In July 2005, the Vancouver City council enacts the Official Development Plan (ODP)—similar to a general plan—for Southeast False Creek, establishing urban design and sustainability principles for a mixed-use urban neighborhood. A year later in April 2006, the Vancouver City Council selected Millennium Properties Ltd. to be the developer of the Olympic Village. Millennium Properties agree to a final purchase price of the land for $200 million CAD. The City of Vancouver was to retain the title to the land until after the Olympic games had occurred, as the Athletes were to be initially housed in the village for the games.

From June to September 2007, the Vancouver City Council approved a $190 million financial guarantee and a Completion Guarantee as part of the financing agreement with Fortress Credit Corp. Through the Completion Guarantee, the City of Vancouver was exposed to the entire financial risk of the project—roughly at the time $750 million CAD. However, between May to August 2008, Fortress Credit Corp claimed that the Milliennium Properties Ltd. loan was "out of balance"—the project experienced major cost overruns. Then, in September of 2008, Fortress Credit Corp. advised that no further funding would be advanced to Millennium for the project. The City of Vancouver, as guarantor, had to step in during October 2008, in order to keep the project moving for the tight timeline of February 2010 for the Olympic games. The City had to use protective advances (cash advances) in order to pay for construction. The new Mayor, Gregor Robertson, in December 2008, asked for an audit of the entire Olympic Village project, and subsequently created a special advisory group for the Olympic Village project. In January 2009, the details of the financing agreement between the City of Vancouver, Millennium, and Fortress became public. The Charter for the City of Vancouver was amended by the Province of British Columbia to allow the City to borrow and lend money to finish the development of the Olympic Games (City of Vancouver 2014).

In February 2009, the City of Vancouver purchased the loan from Fortress (an outstanding amount of $319 million) and became the official lender to Millennium. Millennium was anticipated to repay the City through its sales of market-rate condominium and rental units. The City of Vancouver arranged this special financing through a syndicate of Canadian Chartered Banks, they issued a debenture, and commenced a commercial paper program. The lower interest rates on the financing through the syndicate saved the taxpayers an estimated $110 million (City of Vancouver 2014).

In November 2009, the City handed over the Olympic Village to VANOC (the Vancouver Organizing Committee of the 2010 Olympic Games). The village became home to approximately 2,800 Olympic athletes. During this time, the Olympic Village received a LEED-ND platinum rating. After the games, VANOC returned the Olympic Village to the City of Vancouver in April 2010. However, in August 2010, Millennium defaulted on the City's loan, and by November of that same year, the City had announced that they had placed the project in receivership with Ernst and Young. The City of Vancouver successfully transferred over 32 properties that were part of the loan guarantees to the City. During this time, Rennie Marketing Systems continued to be the

marketing agent for the developer, and re-launched a re-branded sales effort for the 'The Village on False Creek' in February 2011. By August 2012, the majority of commercial spaces had opened, and between 2011-2013 market-rate condominiums continued to be sold. Finally, in April 2014, the City sold the remaining interest in the project for $91 million CAD. The City officially retired the $630 million external debt, and repaid $60 million dollars of City working capital, and in addition to recovering an additional $70 million CAD (City of Vancouver 2014).

East Clayton, Surrey, BC (Suburban TND)

Smart Growth Principles that became popular in the early 2000s originally inspired East Clayton in Surrey, BC—the control site for Southeast False Creek— . The East Clayton Neighborhood Concept Plan was as created by a design charrette process led by the 'James Taylor Chair in Landscape and Livable Environments' directed by Patrick Condon, at the University of British Columbia. The public and the appropriate private, city and regional institutions designed the land-use plan in a four-day charrette.

Figure 17: East Clayton Neighborhood Concept Plan developed from the 1999 Charrette process http://www.jtc.sala.ubc.ca/newsroom/surrey/ecfinal%20plan.html

The vision for East Clayton was simple: a walkable, compact community that was high density, contained a mix of housing types and a natural drainage system. The neighborhood was originally intended to cover 560 acres of land, with housing for a population of 13,000. Interestingly, the plan rested on the three tiers of sustainability: ecology, economy and equity. A set of specific performance measures were formed for the development, created by Condon (SmartGrowthBC 2008). Most of the predicted reductions were based on a comparison between estimations done for land use, infrastructure and building costs in East Clayton as compared to a similar-sized business-as-usual (BAU) suburban site in South Newton, Surrey, British Columbia (James Taylor Chair in Landscape and Livable Environments 2000).

1) Ecology

To improve air quality by reducing auto use:

- ensure that commercial and transit services are to be within a 400-metre walkable radius of all residents
- ensure a 25% reduction in travel-related CO2 emissions generated per capita and corresponding increase in air quality

With respect to achieving the above goals, the transit that was originally promised never materialized in the East Clayton neighborhood, which has actually resulted in traffic congestion in a community meant to be 'walkable.' Translink, the regional transportation entity, has agreed to provide transit only after density amassed, thus making it necessary for residents to use their cars (Matas 2012). Ten years later, the City is re-considering placing a rapid transit facility adjacent to the East Clayton neighborhood along Fraser Highway (Zinn 2013).

To maintain stream health and to enhance habitat:

- maintain or enhance ecological performance of native aquatic habitats
- ensure that 60% of parks, riparian areas and greenways have significant habitat value
- maintain existing base flow level in all on-site and off-site stream channels
- maintain stream temperature
- eliminate storm surge
- eliminate water pollution

With respect to the plan for Limited Impact Development (LID) and sustainable stormwater management, the City of Surrey backed away from the original plan which pushed for a non-conventional storm drain system—curbless, gutterless roads with swales and soft shoulders—which would have promoted natural infiltration and is effective at absorbing the rain (Boei 2003). However, the plan for natural drainage was considered "unmarketable" and the City did not want to be liable, and thus the above strategy replaced with 'infiltration streets' that have curbs with multiple slots cut through them that channel the runoff water into grassy areas on both sides of the street. Despite the hesitation to go completely with a natural drainage system, the City did build an on-site detention system to be used the majority of the time. The conventional stormwater system is used for overflow during long-term and heavy rain events in the spring. In addition to this, many of the originals second growth trees in the development had to be clear cut in order to save the permeable topsoil in the area (the soil in the development is heavy clay, which is impervious)(Boei 2003). Thus, the zero impact on the ecological system has not really been achieved in comparison to the original above goals.

2) Equity

- Provide one job per 2.8 community residents
- Provide a variety of unit types appropriate to citizens of all ages and family types.
- Provide at least 20% of affordable rental housing relative to income distribution and family size of the surrounding communities — with an emphasis on affordable family housing — throughout the community.

According to the Federation of Canadian Municipalities (2013), in terms of achieving the above specific goals, housing diversity has been achieved. The current housing options fall between 2690 square feet to 3444 square feet. These single-family properties allow the option to add secondary suites/accessory dwelling units and coach houses, thus offering more options for affordable housing and an increase in density over time. While other areas in Surrey have densities of approximately 6 to 8 units per acre or less, the net density East Clayton is approximately 16 units per acre.

3) Economy

- Orient all residential units so that they maximize passive solar heating.
- Reduce cost of infrastructure by 20%.
- Increase efficiency of land by 30%.
- Incorporate imaginative financing devices (i.e., mortgage helpers in the form of secondary suites and live/work).
- Reduce base cost of housing by 25% per square foot

According to Boei (2003), although the homes in East Clayton were intended to sell for $90,000-$100,000 less than a typical suburban single-family home, the cost of added infrastructure—mainly the storm sewers—during the final design stages resulted in the homes costing no less than homes elsewhere in suburban Surrey. In addition, according to the developers, the cost of adding in laneways with back-loaded lots were $10,000-$15,000 more expensive to produce than a normal front-loaded lot. Although some of the costs were recouped through green infrastructure grants from the provincial and federal governments, it was ultimately not enough to reduce the cost of the development to the norm or lower (Boei 2003).

Although admirable in its goals, the reality of achieving such high standards overall was perhaps optimistic. Grant (2009) writes about the institutional, political, economic and socio-cultural barriers that have prevented the successful implementation of new urbanist, smart-growth and sustainable developments in Canada. Using the example of East Clayton, Grant (2009) notes that new 'walkable' suburbs continue to reveal the influence of conventional development practice, due to weak political commitment and market pressures. Surrey is described as "*a bit of a free-for-all in development*" where the City Council promotes growth of any kind, including sustainable development, and fails to follow-through on its commitments.

Figure 18: A Streetscape Free from the Faces of Garages
http://www.jtc.sala.ubc.ca/newsroom/surrey/principles4.html

On government-side failures, current Surrey Mayor Diane Watts has noted that the need for schools, hospitals, transportation and other infrastructure, has not been met, and the City is also concerned with housing affordability (Matas 2012). Only one of the two schools anticipated in the plan was built, due to provincial government cutbacks. Areas zoned for home-based businesses—which would have promoted live-work lifestyles—were changed to single-family homes. Ultimately, East Clayton represents a "compromise in sustainability"(Boei 2003).

Figure : East Clayton Single Family Homes. Many of the single-family homes front parks or detention ponds, or possess back alleyways.

Another issue with implementing new Smart Growth or sustainable communities is that local governments are not yet firmly committed to requiring — or even allowing — the departures from conventional planning that sustainable development currently demands (Boei 2003). Other recent problems include the conversion of more than one secondary unit for houses that have coach homes, which the City does not allow. Currently, the City allows for either a secondary coach house unit or a basement suite, but not both on the same property.

While some developers complained that the Surrey City Council did not follow-through on the community benefits that planning staff promised in promoting the plan, other developers continually fought the city on various requirements (such as white picket fences) as they are purely focused on 'profit' versus planning and design 'principle'. As such, the East Clayton development provides a good example of new urbanist-suburban "growing pains"—a neighborhood that was heralded as the next visionary development, but failed to truly carry out sustainability principles. This illustrates the importance and the power of marketing and promotional power early on in the design process. While Condon's development was originally heralded as the gold standard of sustainable development at the time of the charrette, ultimately it came down to liability concerns for the City and other cost tradeoffs that situate the development as an incremental step forward in achieving sustainability principles, rather than a visionary one.

Figure 19: Images of East Clayton, Surrey, British Columbia (Szibbo 2013)

East Clayton Development Financing

In contrast to the role that the City of Vancouver took as a joint developer and financier in Southeast False Creek's Olympic Village, the role of the City of Surrey financing East Clayton was much more removed. The implementation of the Neighborhood Concept Plan (NCP)(City of Surrey 2003) depends on the ability of individual developers to finance the required infrastructure (roadway, water supply, sanitary and stormwater) to service their particular area through Development Cost Charges (DCCs). At the time of development, an overall surplus in DCCs of $13 million CAD was projected for the development at full build out. In addition, a Development Phasing Strategy was also implemented to ensure that DCC funds were available for each phase, to cover infrastructure-financing costs for that specific phase, and was adopted as part of the official plan.

In addition, in order to address the amenity needs of new development in East Clayton, at the time of rezoning, development proposals were required to make a monetary contribution toward the provision of new police, fire protection, library services and toward the development of parks, open space and pathways (City of Surrey 2003). This model is similar to other Community Amenity Contribution (CAC) models that are applied elsewhere in Canada, where the Developer pays the full cost of amenities and infrastructure up front. Due to the fact that the City took less of a direct development role in this project, the financing was ultimately less controversial for the project than Southeast False Creek, as hundreds of millions of taxpayer dollars were not on the line.

Hoyt Street Yards, Portland, OR (LEED-ND)

Hoyt Street Yards is set in the Pearl District, in Northeast Portland. The Pearl District is has a very similar historical background to Vancouver's Southeast False Creek. Both districts were important rail yard sites at the turn of the 20th century. By the 1890s, the Pearl District area was fairly urbanized and had acquired the platting of 200' by 200' walkable blocks known as Couch's Addition. Plans for the platting were formulated in the 1860s & 1850s, designed by John Couch, sea captain & settler (Gorsek 2012).

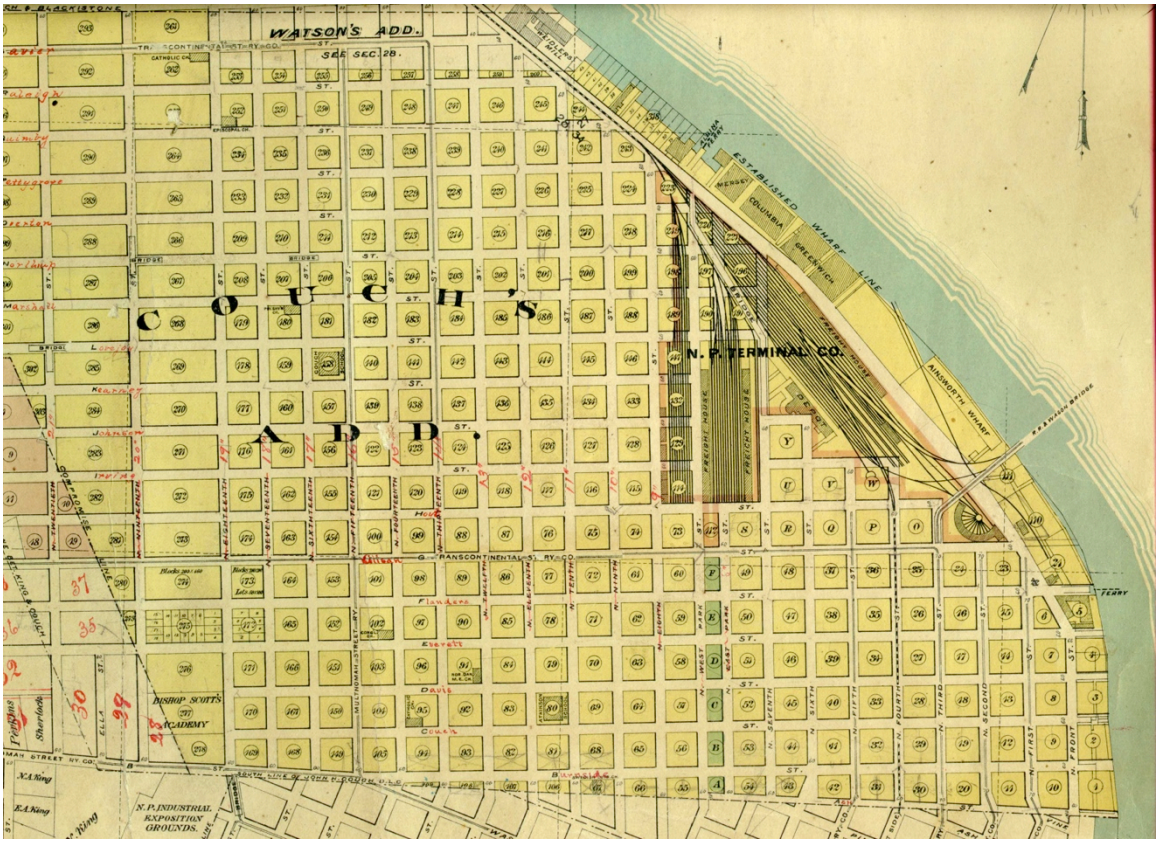


Figure 20: Couch's Addition, illustrating the platting of the city grid in the Pearl District (City of Portland)

In the early 1900s, Pearl District was home to Asian Americans and African Americans, many of who came to work on the railroad (Gorsek 2012). Economic decline hit the area in the 1950s-1970s, as warehouses relocated to farther flung suburban locations which were better suited to new single-story, truck-oriented operations. Although the railroads and Union Station remained active until the late 1970s, in the 1980s the Union Station Yard and the Hoyt Street Yard became largely defunct—a place for storing aging railroad cars and engines. Eventually these disappeared, and small-scale gentrification occurred thereafter in abandoned warehouses until the mid-1990s (Gorsek 2012).

Figure 21: Johnson Street Townhomes in Pearl District, designed by Mithun Architects (Szibbo 2013)

Upper-income housing projects soon followed. Beginning in 1994, Hoyt Street properties purchased the former 34-acre railyard. Hoyt Properties then began to collaborate with the City of Portland to transform the Pearl District into a gentrified neighborhood in 1997. In 2001, a comprehensive urban design framework study and plan was created (Portland Parks and Recreation, Peter Walker and Partners Landscape Architects, and Opsis Architecture 2001). The riverbank north of Broadway Bridge was to be transformed into green space, and Tanner Creek was 'daylighted.' In 2008, Portland City Council approved the North Pearl District Plan (City of Portland Bureau of Planning 2008). The plan was developed over an 18-month period and comprised an extensive public outreach process. The purpose was to engage a group of stakeholders in the evaluation of what began as the request by developers for additional floor area and height allowances within the plan area.

In addition to new development (mainly high-density condo buildings), there exist two new city parks: Tanner Creek Park, which commemorates the former lakes and wetlands native to the landscape, and Jameson Square, a waterpark for children.

Figure 22: Images of Hoyt Street Properties (Szibbo 2013)

Figure 23: Tanner Creek Park mimics the natural processes and wetlands that once flooded the Pearl District area. (Szibbo 2013)

Although the neighborhood has received much praise for its resounding transformation, there have been recent critiques of the Hoyt Yards development. Like Southeast False Creek, Hoyt Yards has failed to meet its goals for affordable housing development. In 1994, the Portland City Council set a "target" that at least 35% to 55% of the new units would be affordable for individuals or families earning up to 80 percent of the median income. In 1997, Hoyt Street Properties signed on to develop the lands. Despite claims from that Hoyt Street Properties that “we develop housing for blue collar workers”, when it came to negotiate the affordable housing goals for Hoyt Street Yards, the development agreement went with the bare minimum—35%. As of 2014, only 28 percent of all new housing is considered affordable—much less than the desired 35%-55% (Schmidt 2014a; Schmidt 2014b). Hoyt Street Properties is currently under pressure to contribute another 258 units to meet the original production goals of the contract. The City has the right to buy back parcels if Hoyt Street Properties does not meet the production goals, in order to ensure that affordable housing gets built in the Pearl District neighborhood.

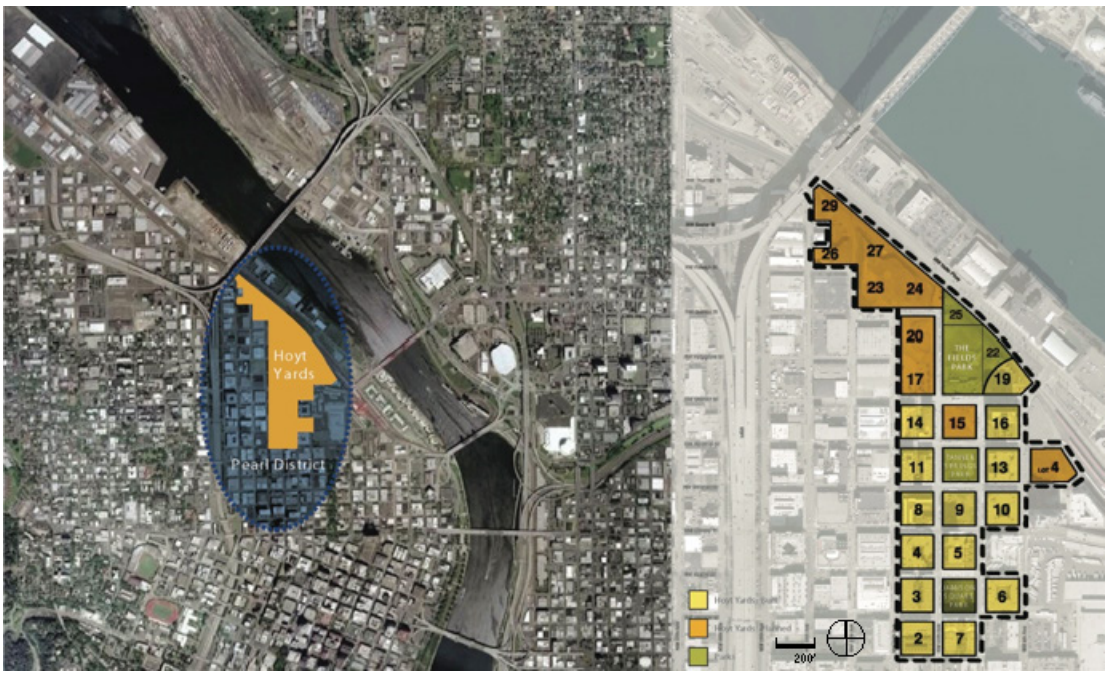


Figure 24: Hoyt Street Yards Masterplan, courtesy of Boora Architects

Hoyt Street Yards Development Financing

The Hoyt Street Yards development provides an excellent example of a public-private partnership built on Tax Increment Financing (TIF). As mentioned, in 1994 Hoyt Properties acquired the property from Burlington Railroad. The cost of developing the area was estimated to be about $600 million at the time. Due to the fact the initial development site was hampered by the Lovejoy Street ramp that approached the Broadway Bridge, Hoyt Street Yards and the Portland Development Commission (PDC) negotiated to relocate the ramp, opening up a once bisected property to increased walkability and higher densities. The PDC deposed the ramp, and Hoyt Properties agreed to turn the area into a mixed-use, livable community. The Pearl District (The River District Urban Renewal Area) and Hoyt Street Properties were good candidates for Tax Increment Financing, due to the fact that was as a previously underutilized warehouse area, it demonstrated great potential for improvement and upzoning. Under the Tax Increment Financing (TIF) agreement, the PDC agreed to remove the Lovejoy ramp, implement the Streetcar, give loans to affordable housing developers. In exchange, Hoyt Street properties agreed to increase housing densities and give property to the PDC for park space. Hoyt Street Properties agreed to build at densities of 60 units per acre, and as many as 90 units per acre, contingent o the city opening a modern public street car connecting the Pearl District to the rest of downtown (Lefcoe 2009). In essence, the TIF pays for the design and maintenance of the three Hoyt Street Yard parks. In absence of Tax Increment Financing, private developers would not have been able to finance affordable housing projects on inner city real estate. In addition, certain protections are in place to ensure long term financial gain for the city. If Hoyt Street Properties defaults on the developer agreement (i.e. ensuring densities and percent of affordable units), the city can recover damages through the court. In addition, if the tax increment revenue surpasses what is needed to meet the Portland Development Commission debt obligations, then that money goes into the City's general fund. The use of TIF in Portland's Pearl District has been quoted as "buying the type of urban form you want."(Lefcoe 2009:436)

Fairview Village, Fairview, OR (Suburban TND)

Fairview Village—the control neighborhood for Hoyt Street Yards—is a New Urbanist development within Portland's Urban Growth boundary, located 13 miles east of the City of Portland proper. At the time of development, it was one of the last greenfield sites of its size within the metropolitan Portland Growth boundary (Hock 2000). It is one of the original examples of New Urbanism in the Pacific Northwest and the community was the recipient of the 2001 National Association of Home Builders "Best Smart Growth Community in the U.S." Gold Award. The project was supported by architects Bill Lennertz and William Denis—former apprentices of the New Urbanist power couple team, Andres Duany and Elizabeth Plater-Zyberk. Formulated with a return to early twentieth century small town design or Traditional Neighborhood Design (TND) in mind, a focus on community, and pedestrian access to shopping, jobs, schools, and civic activities, Fairview Village is:

"not quite a city, yet decidedly not a suburb, Fairview is a town in the classic sense -- a cohesive network of individual neighborhoods built around community shopping, anchored by civic buildings and public parks, and scaled to people rather than to their cars. We wanted Fairview to be a community with the warmth and security of a small town and the energy and convenience of an urban area -- a good place to live and work. A place to call home (The Everhart Company, Inc n.d.)."

In 1993, developers Holt & Haugh bought the industrial-zoned greenfield land from a high tech company that had once planned an expansion in the area. Following the acquisition, a three-day charrette engaged 75 stakeholders. The outcome was a regulating plan, a new mixed-use development zoning code, and architectural guidelines (Hock 2000). Multi-use zoning was utilized in the plan instead of single-use zoning. This allowed for a mix of retail, business, and residential activity, with the goal that people could walk or bike to local shops, amenities instead of driving.

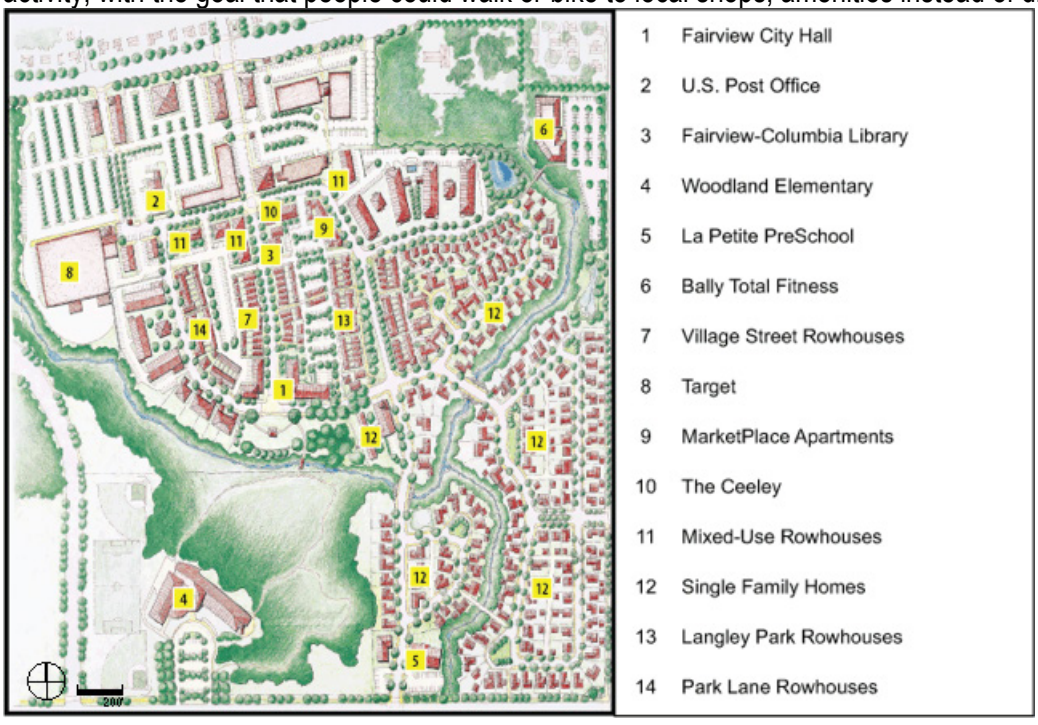


Figure 25: Fairview Village Master Plan http://www.fairviewvillage.com/main.html

Fairview Village contains a mix of housing types including attached townhomes, rowhouses, duplexes, apartments and single-family homes. Most units include front porches, balconies and/or setbacks. Higher density housing, in particular 'live-work' housing is located along the "main street", which is home to several local businesses. In addition to the amenities of the "main street" there is a Fairview Post Office, a library, a community park and Fairview City Hall, which also houses the Fairview Police Station. Within about ¼ mile radius of the community is a large retail anchor variety store (Target), a fitness center, and a combined grocery and variety store (Fred Meyer).

Figure 26: Fairview Village Post Office channeling Old Town Main Street feel (Szibbo 2013)

The average street width is 32 feet wide on most streets. Residents and visitors are allowed to park on both sides of the street. The street network in Fairview Village is not a grid, as one would expect from a New Urbanist development. However, the streets are well connected for pedestrians, and many pedestrian paths are in place to provide connections where a street is not available. Mews and back alleys exist behind the multi-unit apartments and townhouses. Garages are still present for most single-family homes, and many townhouses have garage entrances in the alleyways. Driving through the neighborhood, however, is a meandering process, and is not very efficient for vehicle access. As witnessed with other New Urbanist neighborhoods (And and Ahn 2003; Southworth 1997), the development is cut-off and isolated from neighboring communities giving the development a feeling of segregation. Ultimately, this disconnect is not the fault of the designers, but rather a locational land use development problem.

Figure 27: Porches, Verandas and White Picket Fences are indicative of the New Urbanist Influence in Fairview Village (Szibbo 2013)

Both Dill (2006) and Hock (2000) have conducted studies of Fairview Village. Dill found that as Fairview Village encouraged walking to amenities, a direct objective of the Congress of New Urbanism. She attributes this in part to the proximity of stores, a post-office, parks, cafes, the library and other services. Residents of this neighborhood also appeared to drive less, but without a longitudinal study identifying their driving behavior prior moving to the neighborhood, Dill noted it would be impossible to definitively state that driving has been reduced in the neighborhood due to neighborhood design. She found that the neighborhood attracted smaller households, particularly households without children, and seniors. These factors reduce vehicle travel, and thus would impact any study of vehicular travel. Dill also confirmed that the residents of this neighborhood were not significantly more diverse that the other conventional suburban neighborhoods she surveyed, although the neighborhood showed greater income diversity. Hock (2000), in a similar critique of the diversity of the neighborhood, revealed that just because Fairview Village contains a wider mix of housing types, it may not guarantee a socioeconomically diverse neighborhood. Dill's findings also revealed that residents in Fairview Village did not have a greater sense of community, neighborliness, or residential satisfaction as compared to the residents in conventional suburban neighborhoods.

Figure 28: Images of Fairview Village, OR (Szibbo 2013)

Fairview Village Development Financing

In the 1990s, Tektonics, an electronics company, sold a large parcel of land in Fairview, OR because of the changing conditions of the electronics industry. The 80 acres were sold as 'the new town center' of Fairview, and Holt & Haugh began redeveloping the area—the first neo-traditional development in Oregon. The city entered into a partnership with Holt & Haugh in 1999 to develop and market Fairview Village to prospective retailers. The project's financial partners included Centennial Bank, Washington Mutual, Key Bank of Oregon and US Bank.

In January 2001, US Bank filed papers that lead to foreclosure proceedings, that would have resulted in the sale of a 124 unit Chinook Way apartment complex, had Holt and Haugh not come up with $8 million in principal and interest it owned the bank from past due construction loans. Although Holt and Haugh originally wanted to sell the units as condos, the market went flat for them, and they reverted back to an all-apartment complex and began leasing the units(Miller 2001a; Miller 2001c). Finally, in April of 2001, financial assistance came in the form from Bellevue, WA-based Robertson Capital Corp. Holt and Haugh closed on a refinance loan from Heller Financial that allowed it to pay off construction lender U.S. Bank, and while simultaneously buying out their Jersey-based equity partner (Miller 2001b). Aside from some trouble selling the condominium units planned for Fairview Village, little has plagued the development financing of the Fairview Village project, since it is much smaller in scale.

SUMMARY

This chapter introduces the four main case studies included in the post-occupancy livability analysis. The four main cases, Southeast False Creek (Vancouver, BC), East Clayton (Surrey, BC) Hoyt Street Yards (Portland, OR) and Fairview Village (Fairview, OR) were selected based on a few control factors (namely the fact that they are all geographically located in the Pacific Northwest, and they were all built less than 20 years ago). Specifically, the LEED-ND cases—Southeast False Creek and Hoyt Yards—are platinum-rated sustainable neighborhoods, meaning that they represent the 'best of the best' of LEED-ND certified neighborhood developments. They are relatively new, as they were built in the mid-to-later 2000s. They are comparable as they are both urban sites, located in the core of the city, close to the city center. The control cases—East Clayton and Fairview Village—are suburban counter sites, where much planning and design thought has gone into making them walkable communities with traditional architectural styles, however they exist far from the urban core on the periphery. They are also comparable as they were built earlier on in the 1990s and early 2000s, at a time when New Urbanist and 'Smart Growth' principles had reached an apex of popularity. One key difference is that while the LEED-ND communities possess 'green buildings', the TND suburban neighborhoods do not have any. Ultimately, the goal of the case study comparison is to illustrate similarities and differences in opinion in terms of livability within each neighborhood, and look specifically at the similarities and differences in resident perception between the urban, LEED-ND neighborhoods and the suburban, TND neighborhoods. The next Chapter reveals the results of the post-occupancy livability evaluation in the four neighborhoods, and explains the importance of these findings for urban planning and urban design research.

CHAPTER 5: POST-OCCUPANCY LIVABILITY IN FOUR NEIGHBORHOODS

This chapter describes the findings from a post-occupancy analysis of two LEED-ND neighborhoods (Southeast False Creek and Hoyt Street Yards) and two suburban Traditional Neighborhood Design (TND) neighborhoods (East Clayton and Fairview Village). Basic demographics are presented, including findings on travel behavior. Specific findings on both affordability and livability are then presented and discussed within the context of urban planning policy and urban design guidelines.

DEMOGRAPHIC PROFILE

Demographic information was collected from all respondents who completed the Post-Occupancy Evaluation (POE) Mail-Out Mail Back survey in the four neighborhoods: Southeast False Creek (SEFC), Hoyt Street Yards, East Clayton and Fairview Village. These descriptive statistics are presented below in chart format, in addition to findings related to livability that pertain to the dissertation research questions.[vi]

Age & Gender

Approximately the same number of men and women respondents completed the survey in all neighborhoods, with the exception of Fairview Village. In this neighborhood, significantly more female (72.4%) than male (27.6%) respondents completed the survey. In terms of household size, the majority of the respondents in the neighborhoods are comprised of 1 or 2 person households, with few people under the age 18 living in them with the exception of East Clayton, which contained the highest number of children. With regard to the age of the respondents, in both the US sites the mode was older, 66 years in Hoyt Yards and 60 years in Fairview Village, reflecting an older generation living in these neighborhoods versus a significantly younger age group living in both the Canadian sites, where the mode age is 32 in Southeast False Creek and 46 in East Clayton. This could possibly be explained by the fact that there is more senior housing located in Fairview Village, and some of the buildings in the Pearl District (for example The Sitka building) do not allow student tenants.

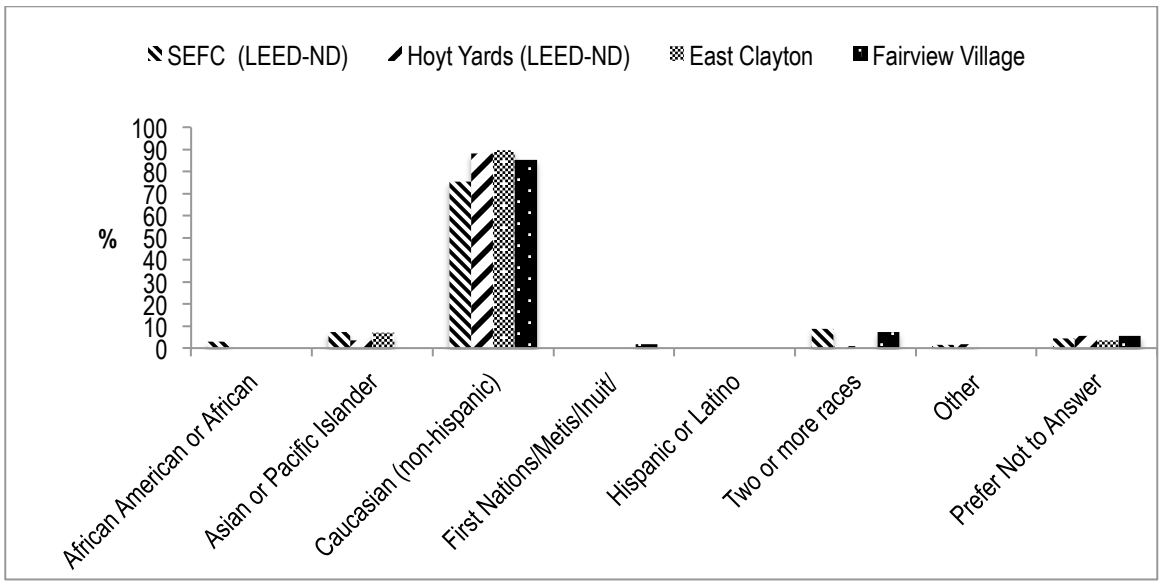


Figure 29: Race by Neighborhood

Race

75.4% of respondents in Southeast False Creek identify themselves as Caucasian, as do 88.2% of residents in Hoyt Yards, 89.7% in East Clayton, and 85.2% in Fairview Village (see Figure 29: Race by Neighborhood**).** Out of all of the neighborhoods, Southeast False Creek displays the highest level of racial diversity, with 8.4% respondents identifying as two or more races, 7.2% identifying as Asian or Pacific Islander, and 2.9% identifying as African Canadian. There is the limitation and possibility that some groups were more willing than others to fill in the survey. However, given the high percentage of homogeneity, the overall the conclusion could be made that both the LEED-ND developments and the conventional, suburban neighborhoods with traditional neighborhood design do not possess high levels of racial diversity.

Income & Education

In terms of income, Fairview Village respondents possess the most distributed income groups, with an even 25.9% of the population generating 20-50K US, 50-80K US and also 80k-150K US. For Southeast False Creek (43.5%) and East Clayton (58.6%), income peaks at 80K CDN-150K CND, and the Pearl District (38%) income peaks at 150K+ US.[vii] The majority of respondents in each neighborhood have obtained a bachelor's degree level of education or higher. Hoyt Yards contained the highest percentage of respondents who have obtained a graduate degree or higher (58.9%). In contrast, the suburban sites like Fairview Village possess the highest percentage of respondents who have only obtained a high school degree (13%), and East Clayton also possess the highest percentage of respondents who have only obtained some college (30%). In all neighborhoods, no survey respondents answered that they had obtained only 'some high school' education, signifying that only those respondents with a high school degree filled out the survey.

Housing

Interestingly, in three neighborhoods—Hoyt Yards, East Clayton, and Fairview Village—the proportion of owner to renter respondents was higher (see Figure 30: Tenure Type). Southeast

False Creek contains the highest percentage of renter respondents out of all the neighborhoods at 46.6%. Southeast False Creek also possess the highest percentage of respondents living in co-operative rental housing (10.1%) and social/public housing (5.8%).

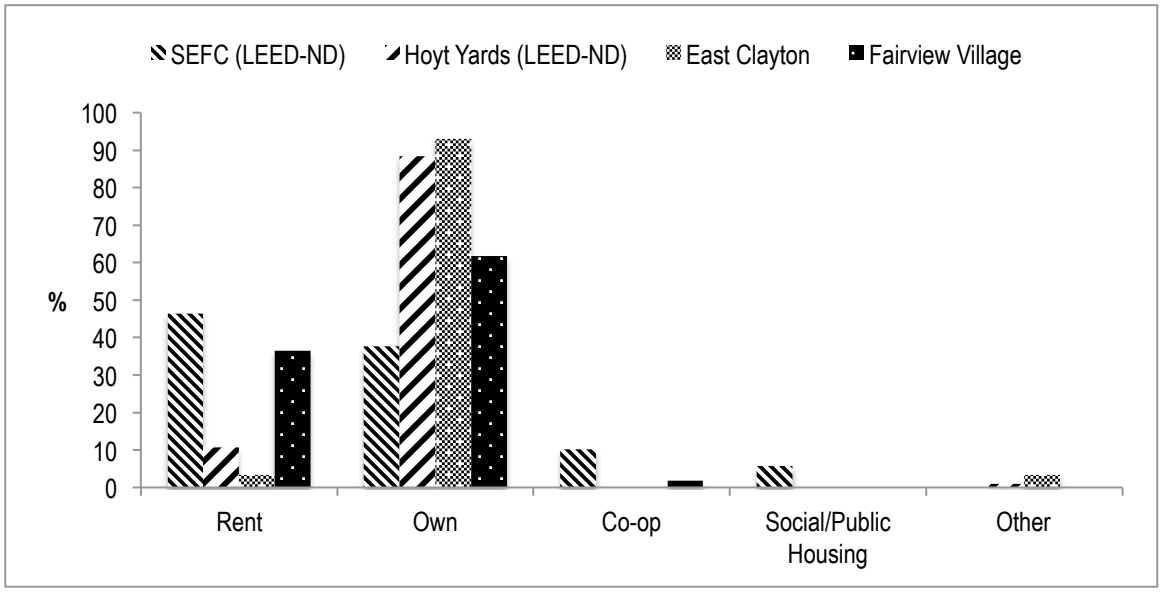


Figure 30: Tenure Type

With respect to building type, it is not surprising that both LEED-ND developments have the highest percentage of respondents that live in condominium buildings (SEFC at 62.3% and Hoyt Yards at 92%). The suburban, traditional neighborhood development respondents in contrast live mostly in single-family detached housing (East Clayton at 96.6% and Fairview Village at 43.6%). Fairview Village also has the highest number of respondents who lived in townhouses (27.3%). Given that Southeast False Creek and Fairview Village also had the highest and second highest proportion of respondents in rental housing, it is logical that these neighborhoods also possess the greatest amount of rental buildings (SEFC at 33.3% and Fairview Village at 20%).

In both the LEED-ND developments, most respondents live in 1 or 2 bedroom units (SEFC at 82.6% and Hoyt Yards at 82.1%). Conversely, in the suburban neighborhoods, most respondents live in 3 bedroom units. 100% of respondents from the East Clayton neighborhood identified their units as 3 bedrooms or more, as do 56.4% from Fairview Village. In terms of tenure, in Southeast False Creek 0% of respondents identify themselves as living in the development longer than five years, and the majority of respondents (68.1%) have only lived in the development between one and 3 years. In the other three neighborhoods, a significant proportion of respondents in each neighborhood had lived there for more than 5 years—Hoyt Yards (40.2%), East Clayton (51.1%) and Fairview Village (54.5%). In all neighborhoods, the majority of respondents stated that their unit in the surveyed neighborhoods is their primary residence (SEFC at 97.1%, Hoyt Yards at 89.2%, East Clayton at 96.6% and Fairview Village at 96.4%). Hoyt Yards contained the highest number of respondents who stated that this was not their primary unit (10.8%). The majority of residents in all neighborhoods live above the ground floor or higher, and for most residents in the suburban neighborhoods this question was not applicable, given the high proportion living in single-family homes.

Travel

In terms of vehicle ownership, respondents in all neighborhoods felt owning or leasing a vehicle was still 'somewhat important' or 'very important', although those in suburban traditional neighborhood developments felt even more strongly that it was very important (see Figure 31: How Important is Vehicle Ownership to You?).

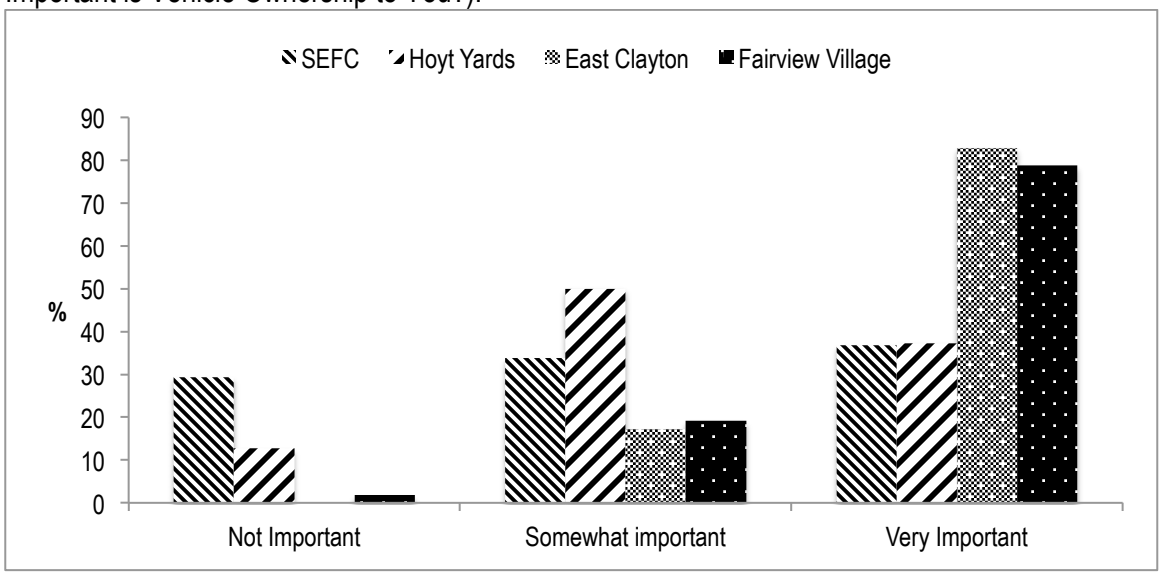


Figure 31: How Important is Vehicle Ownership to You?

36.8% of respondents in Southeast False Creek felt owning or leasing a vehicle was 'very important', as did 37.3% of respondents in Hoyt Yards. Respondents in East Clayton and Fairview Village felt much more strongly about ownership, with 82.8% of respondents in East Clayton stating that owning/leasing a vehicles was 'very important', and 78.8% of respondents in Fairview Village agreeing that it was 'very important. Approximately 30% of respondents in Southeast False Creek thought it was 'not important', the highest percentage, with 13% of respondents in Hoyt Yards stating that owning a vehicle was also 'not important' to them.

Ironically, although respondents in the LEED-ND neighborhoods believe owning a vehicle is somewhat less important than those who are living in the suburban neighborhoods, the majority of residents in all neighborhoods still owned one or two vehicles (see Figure 32: Number of Vehicles Owned or Leased Per Household). In Southeast False Creek, 65.2% of respondents owned 1 vehicle, as did 71.7% in Hoyt Yards, 13.8% in East Clayton, and 33.3% in Fairview Village. Those respondents living in suburban neighborhoods were more likely to own two or more vehicles. 86% of respondents in East Clayton possess two or more vehicles, and 66.7% in Fairview Village. Only 20.3% of respondents in Southeast False Creek possess two or more vehicles, as do only 24.6% of respondents in Hoyt Yards. Southeast False Creek contained the highest percentage of respondents who own or lease zero vehicles, at 14.5%.

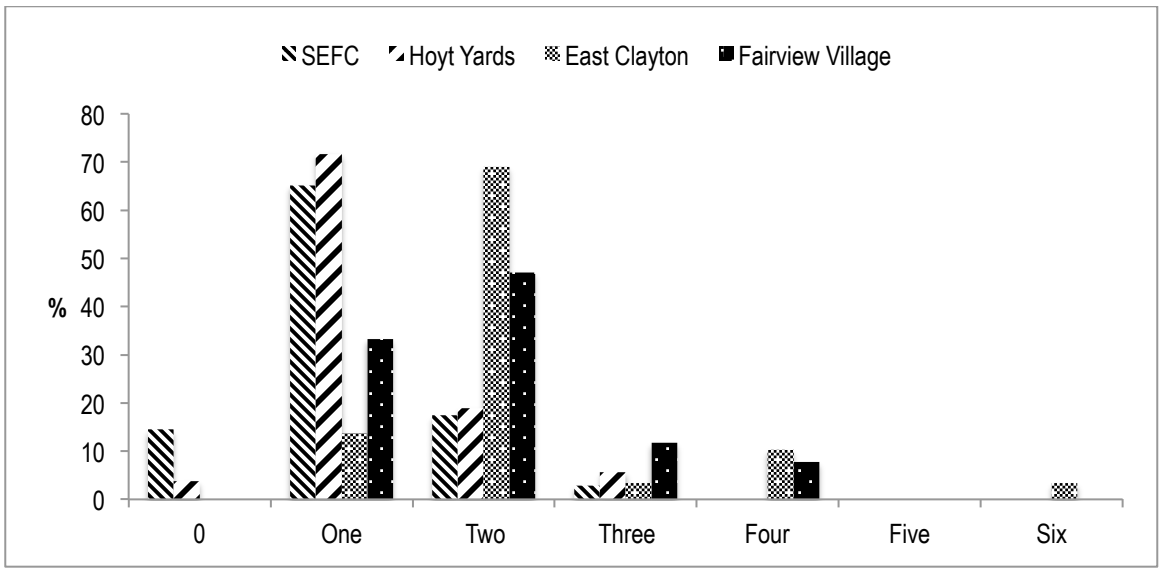


Figure 32: Number of Vehicles Owned or Leased Per Household

In all neighborhoods except one, driving remains the #1 most frequent mode of travel in a typical week (see Figure 33: #1 Most Frequent Mode of Travel in A Typical Week). Although the percentage was significantly more in the two suburban neighborhoods, it is surprising that driving remains the dominant mode choice, and this supports the strong affinity for vehicle ownership. With Hoyt Yards, walking was the #1 most frequent mode of travel, and this most likely due to 1) the high degree of pedestrian connectivity downtown Portland (200' x 200' blocks) and a well-integrated and frequent light rail system.

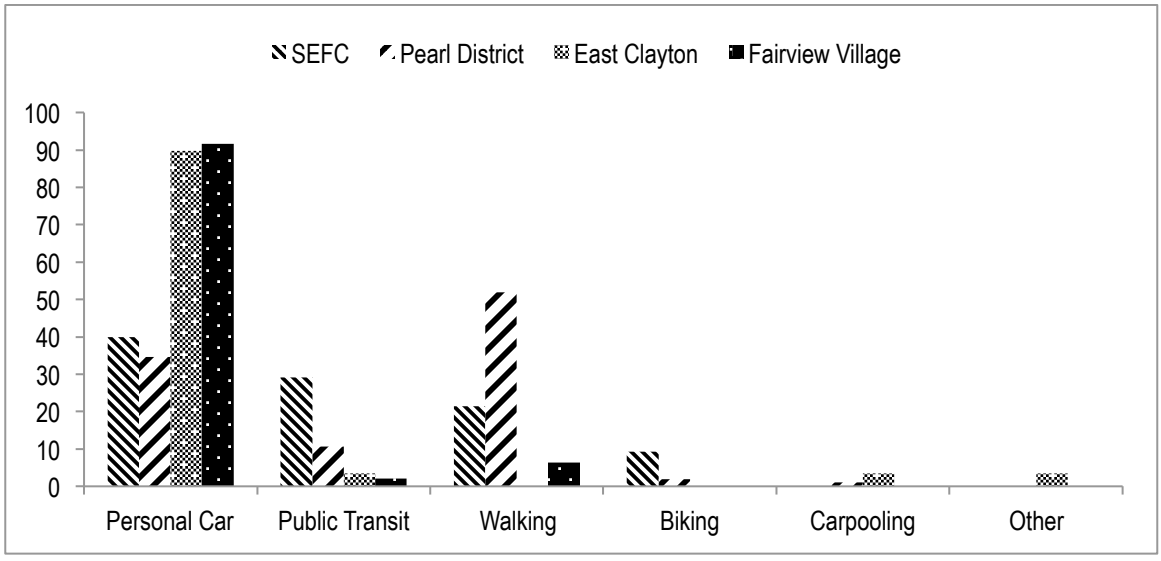


Figure 33: #1 Most Frequent Mode of Travel in A Typical Week

The second most frequent model of travel in a typical week for all neighborhoods is walking (Figure 34: #2 Most Frequent Mode of Travel in A Typical Week). For Southeast False Creek Residents, the 47.5% choose walking as their second mode of travel, as do 33.7% of residents in Hoyt Yards, 52.2% of residents in East Clayton, and 55% of residents in Fairview Village. Surprisingly, a high percentage of residents in the suburban traditional neighborhood design developments choose

walking as their second mode of travel, but this is likely because the neighborhoods are designed specifically for the purpose of walking within them.

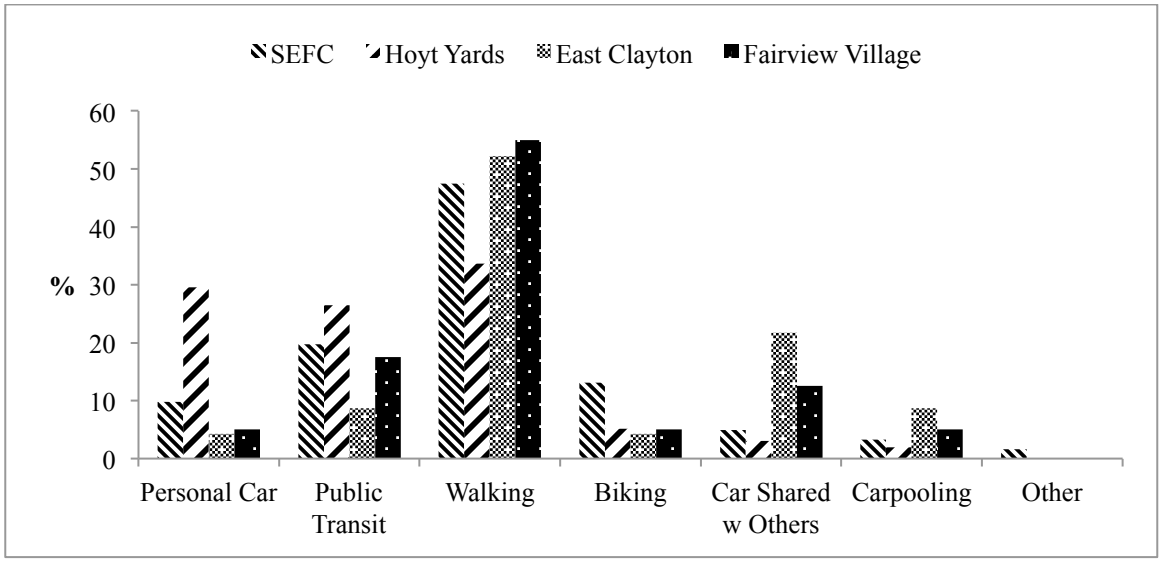


Figure 34: #2 Most Frequent Mode of Travel in A Typical Week

For the two LEED-ND developments, public transit is the third most frequent mode of travel in a typical week, with 30.4% taking it from SEFC and 34% choosing it from Hoyt Yards. Walking is the third most frequent mode of travel for the two suburban neighborhoods.

Evidence on the importance of vehicle ownership, and current ownership statistics reveals that in LEED-ND neighborhoods, car ownership is still high. This questions whether the LEED-ND credits 'transportation demand management' and 'reduced parking footprint' are effective. While in some LEED-ND neighborhoods, like Hoyt Yards, walking has become the main mode of travel, in other LEED-ND neighborhoods like Southeast False Creek, driving is the still the number one mode choice. The answer to this discrepancy may perhaps lie in the difference of connectedness between the two neighborhoods, as Portland possesses an incredibly accessible and pedestrian-friendly grid with short blocks of 200' by 200'. In comparison the block lengths in Southeast False Creek are larger at 400'-600 by 200', and the development feels more physically segregated. Portland's excellent light rail system may also be a driver for walking (to transit), in comparison to Southeast False Creek where the intended light rail was only tested temporarily (Bailey 2010), has not yet been implemented.

Affordability

The survey results illustrated that affordability affects livability in all four neighborhoods, and that affordability is more of an issue in LEED-ND neighborhoods (and in particular Southeast False Creek) than the suburban base-case TND neighborhoods. The majority of respondents in all neighborhoods (Southeast False Creek, Hoyt Yards, Fairview Village and East Clayton) stated that the cost of housing in their neighborhoods impacts the livability of their neighborhood. However, Southeast False Creek residents believed this the most, with 79.7% agreeing that the cost of housing impacts livability. 60.2% of residents in Hoyt Yards believed this, as did 64.3% of residents in East Clayton, and 63.6% of residents in Fairview Village (see Figure 5). Importantly, affordability

was also the number one answer to the survey question "*what one element or characteristic would make your neighborhood more livable?*" in Southeast False Creek.

Overall Livability

When asked how satisfied they were with their neighborhood, the majority of respondents in all neighborhoods were either very satisfied or extremely satisfied (SEFC=85.2%, Hoyt Yards=98.3%, & Fairview Village=83.6%), with the exception of East Clayton. In East Clayton, the majority of respondents were instead either somewhat satisfied or very satisfied (93.1%). The Hoyt Yards Pearl District neighborhood had the highest proportion of respondents where were 'extremely satisfied' (51.8%) with the overall livability with their neighborhood.

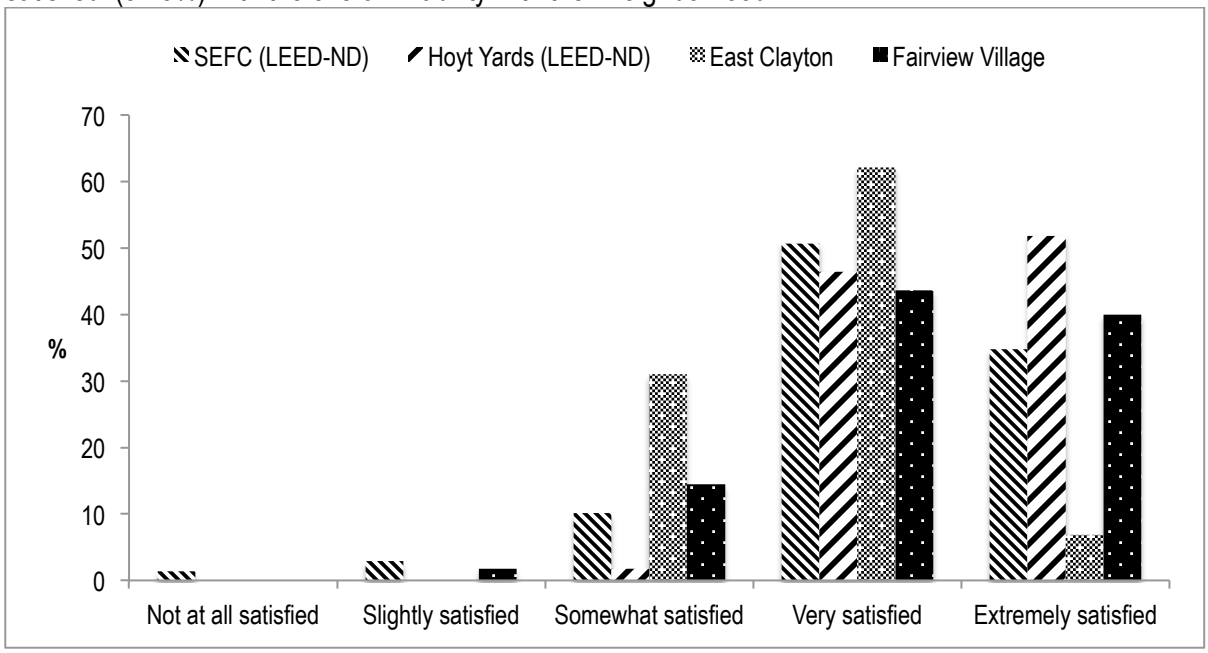


Figure 35: Satisfaction with Neighborhood In Terms of Overall Livability

Southeast False Creek contained the highest proportion of respondents out of all of the neighborhoods who were either 'not at all satisfied' or 'slightly satisfied' with the livability of their neighborhood (4.3%). However, this proportion is negligible relative to the proportion of SEFC residents who are satisfied.

It should be noted as a limitation that both SEFC (2008) and Hoyt Street Yards (2008) are more recent developments than East Clayton (2002) and Fairview Village (1996), and thus there are issues of self-selection and "newness" factor. It is typical for new residents to feel satisfied with the neighborhood they have just moved into, especially if that neighborhood is a brand new development.

Security & Safety: Crime Prevention Through Environmental Design (CPTED)

With regard to the #1 most important livability factor out of 19 factors, the majority of respondents in three of the four neighborhoods ranked '*safety from crime*' as their first choice (see Table 9: #1 Most Important Livability Factor). 20% of respondents in Southeast False Creek ranked it as the number one factor, as did East Clayton residents (51.7%) and Fairview Village residents (43.8%). It is interesting to note that safety from crime was most important to a much larger percentage of

suburban survey respondents. The number one livability factor in the Hoyt Yards is '*Daily Needs within a 15 Minute Walk*'—an important principle in LEED-ND (34%). However, the #2 ranked choice in Hoyt Yards after this was Safety from Crime (27.1%).

Table 9: #1 Most Important Livability Factor

Neighborhood	Factor
SEFC	*Safety from Crime* (20%)
Hoyt Yards	Daily Needs within a 15 Minute Walk (34%)
East Clayton	*Safety from Crime* (51.7%)
Fairview Village	*Safety from Crime* (43.8%)

These findings indicate that '*safety from crime*' is important to residents in both LEED-ND neighborhoods and non-LEED-ND neighborhoods, and this has important implications for the LEED-ND rating system. Currently, LEED-ND does not attempt to integrate CPTED (Crime Prevention Through Environmental Design) Principles into its credit rating system. Further attention and study of how to integrate CPTED principles in to new sustainable neighborhoods is necessary.

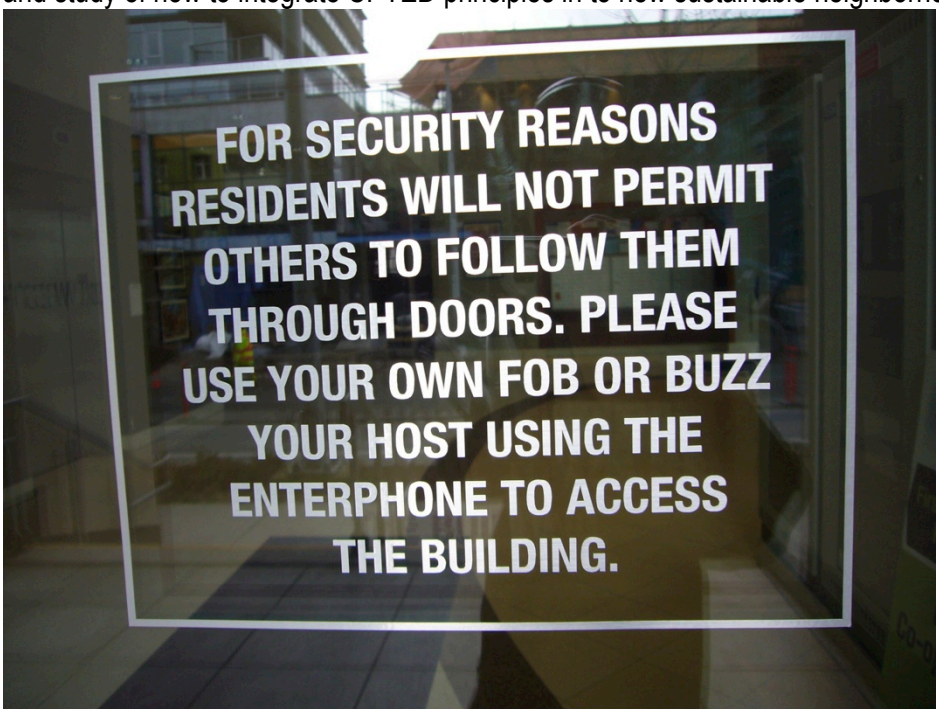


Figure 36: Public security notice at Southeast False Creek. In most of the neighborhoods surveyed, safety from crime was the #1 most important livability factor. (Szibbo 2013)

Suburban Needs

While the above factors illustrate that '*safety from crime'* is a general concern in the majority of neighborhoods, it is helpful to specifically examine those factors that are important to suburban communities. If future sustainable development intends to attract residents to existing communities in urban areas, then it is crucial to think about what neighborhood elements are critical to potential suburbanites. The below tables illustrate several factors which have the potential to be significant from a housing re-location perspective.

Table 10: Second Most Important Livability Factor

Neighborhood	Factor
SEFC	Daily Needs within a 15 Minute Walk (17.2%)
Pearl District	Daily Needs within a 15 Minute Walk (23.6%)
East Clayton	*Safety from Fast Traffic* (24.1%)
Fairview Village	*Privacy within interior of unit* (18.8%)

For East Clayton, the second most important livability factor is '*Safety from Fast Traffic'*, and for Fairview Village, the second most important livability factor is '*Privacy within the Interior of the Unit*.' While Safety from Fast Traffic is already incorporated into LEED-ND[viii], a design element ensuring privacy within interior units much less so, with the exception of the LEED-ND v.4 Walkable Streets Credit, which states that "if the project has ground floor dwelling units, the principal level of at least 50% of those units has an elevated finished floor at least 24 inches (60 centimeters) above the sidewalk grade." Macdonald (2005:36) in her work has noted the importance of treating ground floor units so that they are raised at least four to six steps off of the sidewalk grade to increase privacy for residents. For ground floor dwelling units, if each riser height is 6"-8", then instead of the recommended LEED-ND 24 inches, this minimum requirement would change to 24"-48", with 48" being the preferred height. Ideally, an even greater improvement for the rating system would be the inclusion of a ground level entryway 6 feet (72") above grade (a 'half-grade' raised entryway), so that people passing by cannot see to far into the individual unit.

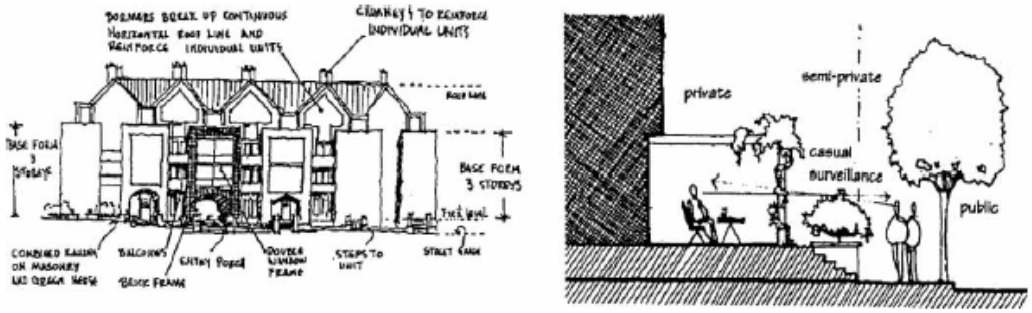


Figure 9. Typical sketch drawings from the Arbutus Neighbourhood guidelines. *Source:* City of Vancouver (1994).

Figure 37: 'Privacy within the Interior of the Unit ' is an important concept for suburban residents. © 2015 City of Vancouver http://vancouver.ca/your-government/terms-of-use.aspx#Bylaws

In suburban East Clayton, '*Sense of Community with Neighbors*' is the third most important livability factor, illustrating that for even suburban neighborhoods, ties with local residents are important. This is supported by findings from Nasar (2003), who has shown that a sense of community can be strong in the suburbs, and is not necessarily correlated only to compact development. Although the definition of a 'sense of community' would appear to be ambiguous (Talen 1999), but like any other concept it has been operationalized and tested. Generally, sense of community within a neighborhood refers to an individual's feelings about belonging to a group. According to Lyon (1987), individuals have a sense of community in relation to a physical neighborhood, or in a relation to an aspatial community such as a professional group. The concept of community within a neighborhood has also been broached by Nasar & Julian (1995) in their study. The authors used an 11-item scale to assess psychological sense of community at the neighborhood scale. The authors note this is an improvement upon the 15-point Glynn scale (1981). Both Nasar and Julian (1995) and Glynn (1981) found that a "sense of community" was more prominent in neighborhoods that facilitated face-to-face interaction - those where a car was not necessary for transportation. In a similar vein, other studies have found a correlation between Traditional Neighborhood Development (TND)/pedestrian-friendly public realm/decreased automobile use and community/social ties (Lund 2002; Freeman 2001). For this survey, a 'sense of community with neighbors was defined specifically as '*a sense of social ties and social network within your neighborhood.*' The exact measure that can be taken to ensure this within new sustainable developments is beyond the scope of this dissertation, but requires further investigation.

In Fairview Village, the #3 most important factor livability factor for respondents is '*A View to Trees or Natural Landscapes*. The integration of natural landscapes and trees by way of view sheds has shown to significantly affect livability.

Table 11: #3 Most Important Livability Factor

Neighborhood	Factor
SEFC	Daily Needs within a 15 Minute Walk (16.9%)
Hoyt Yards	Well-used Sidewalks, Plazas & Parks (15.2%)
East Clayton	*Sense of Community with Neighbors* (24.1%)
Fairview Village	*View to Trees or Natural Landscapes* (18.4%)

Faber Taylor, et al. (2002) found that children living in buildings with merely a view of trees and green space exhibited superior attention capacities and impulse control than did similar children without those views. In addition, Kaplan (2001) has discovered that the presence of natural settings in the view from the window contributes substantially to residents' satisfaction with their neighborhood, and also with diverse aspects of their sense of well-being. In contrast, views of built elements, affected satisfaction but not well-being.' Interestingly, LEED-ND includes credits for tree-lined streets and tree canopy %, but there are no credits awarded for stipulating that units should be oriented to natural landscapes or trees when possible.

Figure 38: East Clayton, Surrey, British Columbia. A view to trees and natural landscapes are important for residents living in suburban neighborhoods (Szibbo 2013)

Figure 39: Fairview Village, OR. Single-family homes look out onto a harmonious stream setting (Szibbo 2013).

DISCUSSION & RECOMMENDATIONS

Findings reveal that the majority of respondents in both the LEED-ND and non-LEED case studies believe that owning a vehicle is important, and the majority of respondents in all four neighborhoods also own one or more vehicles. The number one most frequent mode of travel for all neighborhood respondents is still the personal car, with the exception of Hoyt Yards, where walking is the most popular travel mode. This has implications for Ewing et al.'s (2013) projections that LEED-ND developments have the potential to drastically reduce VMT. There is the possibility that unless a neighborhood is highly connected, and consists of high-density development with a robust transit system in place (such as Portland's light rail), residents will continue to own a car and drive, and such neighborhoods will see no reduction in VMT.

Findings also reveal that affordability is a major concern for current residents. The survey results illustrate that the majority of respondents in all case study neighborhoods believe that the cost of housing in their neighborhoods impacts the livability of their neighborhood. These beliefs were strongest in Southeast False Creek, hinting at issues with the provision of affordable housing. This concern with affordable housing in new sustainable neighborhoods is further addressed in Chapter Six.

With regard to livability, it could be argued that there are important social aspects that have been omitted from the rating system. While all respondents were generally either very satisfied or extremely satisfied with the livability of their neighborhoods, there were outstanding elements that LEED-ND does not concern itself with. For example, '*safety from crime*' was the overall most important factor in three out of four neighborhoods, and more important in suburban neighborhoods than in LEED-ND neighborhoods. This is interesting as LEED-ND currently does not include or integrate CPTED (Crime Prevention Through Environmental Design) principles into its rating system. Suburban respondents also ranked other non-LEED-ND factors important, such as '*privacy within the interior of the unit*', '*a view to trees and natural landscapes'*, and *'a sense of community with neighbors'*. The latter two, a view to trees and natural landscapes, and sense of community with neighbors are particular to the suburban sites, and may thus potentially indicate what features, both social and environmental, could be studied more in order to entice people to back to higher density development in more urban environments.

This chapter has endeavored to analyze LEED-ND rating system, evaluated through the eyes of its residents. It has illustrated that there is much room for improvement within the rating system, to incorporate post-occupancy evaluation (POE), and changes to how affordable housing is integrated. Additionally, the rating system needs to assess how the presence of transit or lack of transit, and if the current transportation demand management and parking footprint credits are effective. Other factors which suburban residents consider to be important should also be considered and introduced into the rating system criteria, such as views to trees and natural landscapes, privacy, a sense of community and safety from fast traffic. The next section, Chapter 6 of the dissertation, examines the LEED-ND rating system specifically in terms of social equity and affordable housing, given that the majority respondents in all neighborhoods noted that the cost of housing impacts the livability of their neighborhoods. Statistical analysis, survey data and interview data from experts are presented and discussed with regard to the provision of affordable housing in LEED-ND neighborhoods.

CHAPTER 6: LEED-ND & AFFORDABLE HOUSING

This chapter examines the specific element of affordable housing in the LEED-ND rating system. A combination of statistical analysis, survey evidence from LEED-ND Accredited Professionals, interviews with LEED-ND Accredited Professionals, and policy analysis reveals how the affordable housing credit within LEED-ND is currently being bypassed.

QUESTIONING THE GOLD STANDARD IN SUSTAINABLE DEVELOPMENT

Cities and developers today look to LEED-ND (Leadership in Energy and Environmental Design for Neighborhood Development) as the North American gold standard for sustainable neighborhood development. LEED-ND as a rating system is different from previous smart growth and New Urbanist initiatives, as it incorporates "green building" (Kibert 2013) principles into its criteria. LEED-ND rewards high density, compact development containing a variety of unit sizes and building types, as well as access to a diverse mix of land uses. Scholars have recently touted the rating system's potential to reduce VMT per person per trip by 24-60% based on the regional average, especially for centrally located, urban neighborhoods (Ewing et al. 2013).

In addition to reducing VMT emissions, LEED-ND also purports to "*build communities where people of a variety of income levels can coexist and where jobs and services are accessible by foot or transit*" (USGBC 2006). Yet despite this championing of income integration, it is difficult to see how social equity (and social sustainability) is supported. While there are credits available for developers who set aside specified amounts of for-sale or affordable[ix] rental housing for residents earning certain AMI (Area Median Income), these credits are an optional element within the rating system. Accredited LEED-ND developers, planners and consultants may thus completely bypass the affordable housing element when completing the LEED-ND checklist for certification, without major consequence for their overall LEED-ND rating.

Utilizing this limitation as a starting point, this chapter critically questions whether LEED-ND upholds the pillar of social equity due to the potential to bypass and undervalue the affordable housing credits. It examines the tensions that arise in implementing affordable housing in new sustainable neighborhoods, and asks how the provision of affordable housing may be improved and incentivized. Through a combination of statistical analysis, survey research, structured interviews, and policy review this chapter 1) draws attention to the percentage of LEED-ND projects that omit affordable housing, 2) highlights current professional opinions from planners, architects and developers on the affordable housing gap in the rating system, 3) emphasizes affordable housing feasibility from the perspective of experienced LEED-ND AP professionals, and 4) illustrates how aggressive affordable housing targets for new neighborhoods can easily be undermined due to budgetary and fiscal constraints. This chapter argues that affordable housing policy for new sustainable development needs to reconsider incorporating both "carrots" (for-profit market rate housing developer incentives such as density bonuses, faster entitlement approvals, tax breaks) and "sticks" (city-mandated inclusionary zoning regulation and zoning overlay strategies) given the limited integration of affordable housing. City planners ultimately need to have a better understanding of the incentives that they can entice developers to increase the provision of affordable housing. Additionally, the LEED-ND credit for affordable housing can be strengthened within the rating system itself.

LEED-ND & AFFORDABLE HOUSING: A MISSED OPPORTUNITY

As a sustainable neighborhood rating system, LEED-ND evaluates three major development categories: smart location and linkage, neighborhood pattern and design, and green infrastructure and buildings. There are two additional optional categories for innovation and regional priority credits. Each major category has several prerequisites that must be achieved, in addition to flexible 'credits.' There are defined certification thresholds based on the points/credits obtained: certified (40-49), silver (50-59), gold (60-79) and platinum (80+). As of 2014, 216 projects are registered, and 38 of those projects are fully certified (Studhalter 2014).

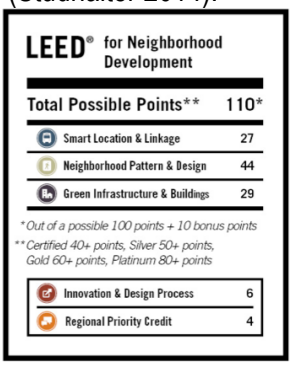


Figure 40: The LEED-ND Rating System Total Possible Points (USGBC®)

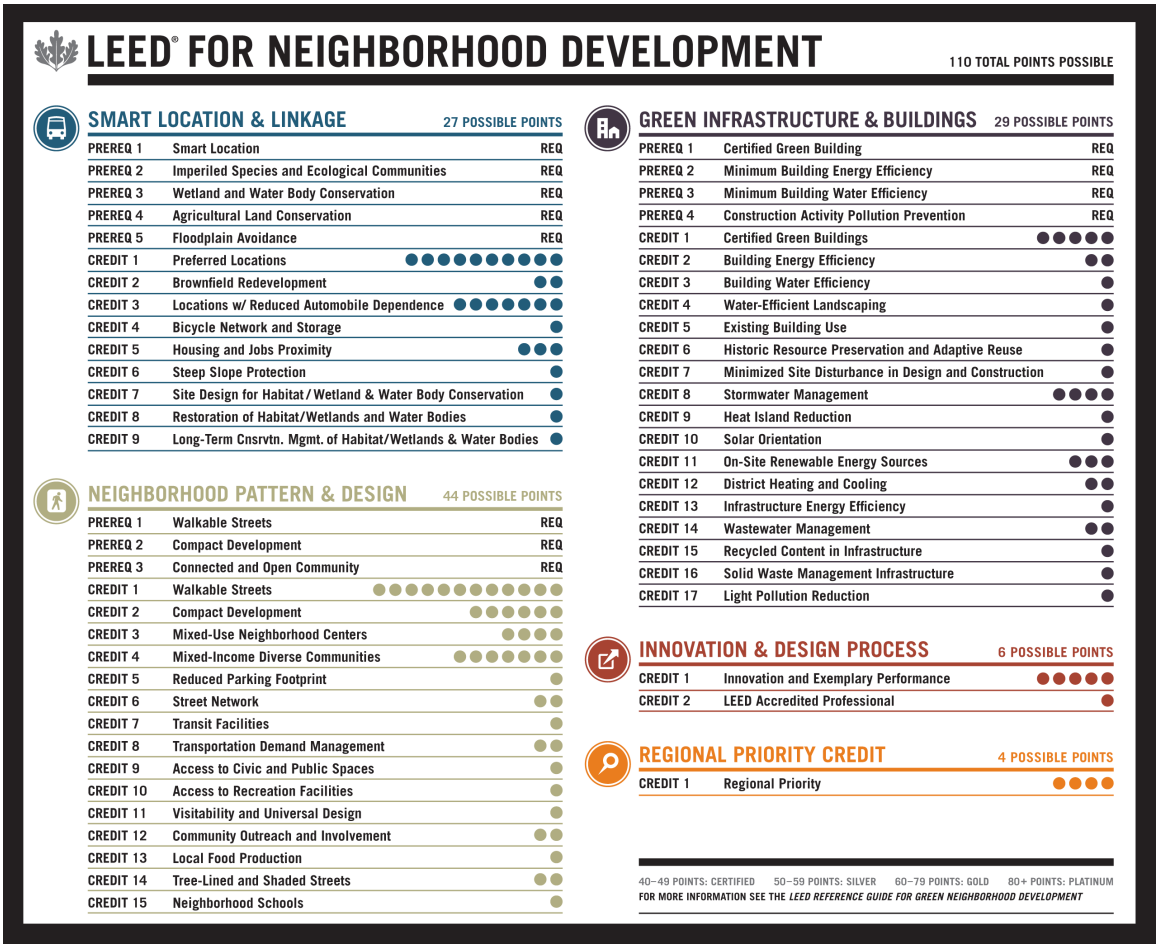


Figure 41: The LEED-ND Rating System v3 2009, illustrating the credits and points possible for each credit. The credits are listed to the left, and the dots represent the number of points possible (USGBC ®).

Since its inception in 2007 (including a pilot), there have been "no substantive changes" (USGBC 2013) or improvements made to the affordable housing credit in LEED-ND. In the current iteration (v4), there is one solitary credit entitled 'Housing Types and Affordability' under the Neighborhood Pattern & Design category (in v3 it was named the Mixed Income Diverse Communities Credit).[x] The intended purpose of this credit is "*to promote socially equitable and engaging communities by enabling residents from a wide range of economic levels, household sizes, and age groups to live in a community*" (USGBC 2014a). There are up to 7 allowable points under this credit.[xi]

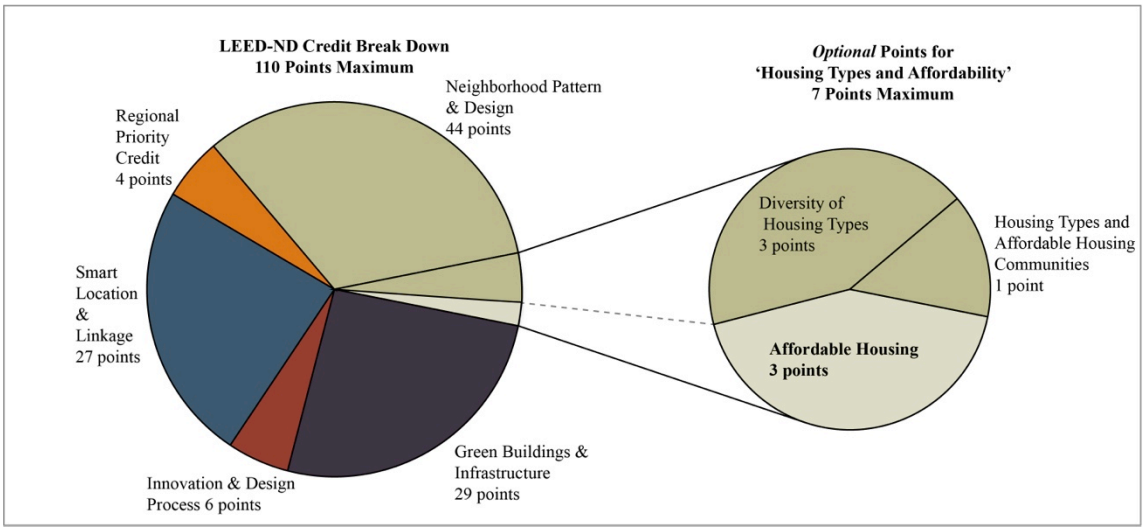


Figure 42: LEED-ND Affordable Housing Credit Breakdown (Szibbo 2015)

Affordable housing is worth a maximum of 3 points, out of a total possible score of 110.[xii] The other 3 points relate to diversity of housing types, and one final point is earned for achieving the other six points. In other words, the affordable housing credit is worth less than three percent of the overall sustainable neighborhood rating system.[xiii] Moreover, this credit is optional, allowing certified neighborhoods to bypass affordable housing completely should the developer choose to do so. The developer is also free to choose between providing rental *or* for-sale units – there is no credit incentive to provide *both*.[xiv] The rating system awards points for a specific proportion of units priced to be affordable by households that earn a percentage of AMI. Points may be accumulated for rental dwelling units priced up to 60% AMI or 80% AMI, and for for-sale dwelling units priced up to 100% AMI or 120%. This means there is very little encouragement to develop rental or for-sale housing priced between 80%-100% of AMI. The Department of Housing and Urban Development (HUD) defines as the 'middle income' bracket as between 80%-120% of AMI, and this range of affordability is especially important, because it often serves as 'workforce housing'[xv] (Haughey 2002; Moore 2011; Sacks 2005).

When the pilot LEED-ND rating system was developed, early academic studies demonstrated the weakness of the affordable housing component. Garde (2009), in his study of LEED-ND pilot projects, states that the LEED-ND rating system provides very little credit for the provision of affordable housing. Furthermore, Garde (2009:28) found that only 68.5% of the surveyed projects expected to include some percentage of affordable housing and suggests that "*not including affordable housing in projects that are likely to be certified is of great concern.*" A retrospective analysis is useful in determining if Garde's (2009) forecast was accurate with regard to the

prospect of projects neglecting affordable housing, and if so, what can be done to remedy this omission.

Re-Thinking Affordable Housing in New Sustainable Neighborhoods

This research builds on previous findings by Dale & Newman (2009) that suggest that the discourse on sustainable development needs to be broadened to include equity as an important component of sustainability. Since the World Commission on Environment and Development (1987) defined sustainable development as one of 'intergenerational equity,' the concept has been partitioned as an heuristic consisting of the 'three e's': economy, environment and equity (Berke and Conroy 2000; Campbell 1996; Wheeler 2004). Scholars have specifically focused on the tensions that have arisen from this triumvirate (Godschalk 2004), or the equity deficit (Agyeman and Evans 2003; Agyeman 2005b; Agyeman 2013), which is timely given the concentration of income and wealth within a small minority in the United States and Canada. An increasingly constrained housing market combined with rising income inequality (Schwartz 2010:36) means that a sustainable neighborhood rating system which lacks strong requirements for affordable housing is of great concern from an equity perspective. In short, fostering a built environment that accommodates all income groups is a key part of creating a socially equitable development.[xvi]

Studies of New Urbanist developments have concluded that only a small percentage of housing is affordable to households making the area median income (AMI) for the surrounding metro area, and that developers charge a premium for these homes (Talen 2010; Tu and Eppli 2001). In order for sustainable, green neighborhoods to follow a more progressive trajectory, planners and designers need to think carefully how they can successfully house low-income residents. Dale and Newman's (2009) case study of Dockside Green in Victoria, BC describes a LEED-ND Platinum neighborhood that has already become a symbol of gentrification. More and more often, cities are beginning to ask developers in Requests-For-Proposals (RFPs) for LEED-ND certification. Yet such efforts must consider the lax attention to affordable housing requirements in LEED-ND, and the potential willingness of developers to ignore the credit.

Ensuring that affordable housing is built in new sustainable neighborhood-scale developments, such as those receiving LEED-ND certification, will undoubtedly be a challenge, requiring a variety of different responses, some of which have already surfaced in the literature. Johnson and Talen (2008:602), note that approximately half of developers believe that a combination of local financial incentives and regulatory changes could encourage them to include affordable units in future projects. In terms of incentives, Godschalk (2013:56–57) states that while the cash-on-cash return to developers and investors is generally less for projects that leverage a density bonus for including affordable housing compared to a base case market scenario, there are significant benefits such as faster land use approval processes. Another possible solution for cities is to leverage LEED-ND as a suitability analysis tool (Talen et al. 2013). Planners could analyze and rank properties based on the Smart Location and Linkage criteria (i.e. transit access, existing density, slope, and intersection density). Developers would then be incentivized or otherwise encouraged to acquire and build on the highly ranked and most suitable locations. LEED-ND criteria could be used strategically by cross-matching citywide affordable housing needs with prospective LEED-ND eligible sites.

Quantifying Affordable Housing in LEED-ND Projects

This section discusses the statistical data aggregation from the USGBC LEED-ND scorecards. This aggregation contributed to a points-based analysis of the affordable housing credit in all LEED v3 2009 projects, and allowed the researcher to see if LEED-ND projects were pursuing the affordable housing credit.

As of November 2014, 60%, or 23 of the 38 projects certified under LEED v2009 had chosen not to pursue the affordable housing credit (NPDc4 option 2). In addition, 10 out of 38 certified projects—26.3%—had chosen to ignore the entire credit, receiving 0/7 for excluding both a diversity of housing types and affordable housing percentages (USGBC 2014e).[xvii] This data was 'webscraped' from the USGBC website, aggregated and then sent to a USGBC staff member for confirmation of its validity, given that there are some inconsistencies with the publicly available scorecards on the website.

The Professional Opinion on LEED-ND & Affordable Housing

This section discusses the results of the online LEED-ND Accredited Professionals survey on the topic of affordable housing. The survey was sent to 314 LEED-ND AP professionals listed on the USGBC LEED-ND contact webpage, 114 of who replied (n=114), for a 39% discounted[xviii] return rate. The 114 LEED-ND AP respondents were divided on whether LEED-ND sufficiently supports the pillar of 'social sustainability' or 'social equity.' 47% believed that it did support social equity and social sustainability, but 41 % believed that it did not. Significantly, 63% of respondents believed that the LEED-ND affordable housing requirement could be improved, with only 19% suggesting that no change was necessary. When asked how they would improve the rating system, 23% would designate more points for affordable housing, with another 13.5% stating they would make the affordable housing credit mandatory (see Table 12**).**

Table 12: How Would You Improve the LEED-ND Rating System with Respect to Affordable Housing?

How Would You Improve the LEED-ND Rating System with Respect to Affordable Housing?, N=52	
Long Answer Response	**%**
More points for affordable housing	23%
Make the credit mandatory	13.5%
Don't know/not sure	9.6%
Make affordable housing a pre-requisite	7.7%
Create more incentives	7.7%
% AMI needs to be contextualized to local area	5.8%
Affordable housing doesn't belong in LEED-ND	5.8%
New financial models needed	5.8%
Look at other tools/standards	5.8%
Developers need more incentives	3.7%
Different scoring based on how affordable housing is distributed or clustered throughout development	1.9%
Require long-term affordability (rent control)	1.9%
Require an affordable housing representative on integrated planning team	1.9%
Need for performance-based evaluation	1.9%
Encourage synergy between affordable housing credits and other credits	1.9%
Greater points for more housing types that are affordable	1.9%
Total	**100%**

Interestingly, 59% of respondents believed developers are reluctant to include affordable housing in LEED-ND projects. When asked why in a long answer question, 64% of professionals stated that this is due to a lower profit and lower return-on-investment, and 15% responding that it was due to social stigma of low-income residents (see Table 13).

Table 13: Why Are Developers Reluctant to Include Affordable Housing in LEED-ND?

Why Are Developers Are Reluctant to Include Affordable Housing in LEED-ND?, N=54	
Long Answer Response	**%**
Lower cost/profit/lower Return-On-Investment (ROI)	63%
Social Stigma and/or property value decrease	14.8%
Affordable housing is best served through other mechanisms	7.4%
Cost of certification is high already	5.6%
Developers need incentives	3.7%
Low ROI, Social stigma and difficulties with maintenance (multiple answer response)	1.9%
Increased Risk	1.9%
Dependent upon AMI Percentages (very low income vs. low income vs. middle)	1.9%
Total	**100%**

When asked, "*what tends to happen in your experience with affordable housing in LEED-ND projects?*," 18.5% stated that local regulation was most effective at requiring it, 12.5% stated that cost overruns were symptomatic of it's inclusion, and another 12.5% stated that a lack of housing for middle income residents occurs (see Table 14). Ultimately, the LEED-ND Accredited Professionals believed that strong arm regulatory measures like inclusionary zoning are the most successful strategy for ensuring affordable housing gets built, yet it is evident that barriers still exist in terms of effective financing mechanisms and the provision of affordable housing for middle income residents.

Table 14: What Tends to Happen in Your Experience with Affordable Housing in LEED-ND Projects?

What Tends to Happen in Your Experience with Affordable Housing in LEED-ND Projects, N=32	
Long Answer Response	**%**
Local regulation and requirements end up being more effective	18.5%
Cost complications	12.5%
"All or Nothing Phenomenon"—no housing for middle-income	12.5%
Incentives are more effective	9.4%
Affordable Housing Credit is ignored	9.4%
NIMBY's Don't Want Affordable Housing	9.4%
HUD Choice Neighborhoods Have Been More Successful	9.4%
Affordable Housing Should Not be Part of LEED-ND	9.4%
Other	9.4%
Total	**100%**

The survey also raised the question '*Do you think of the idea of having city zoning overlays that mandate and incentivize affordable housing in LEED-ND neighborhoods is a good one*? 64% responded affirmatively. When asked to rank four different solutions for improving affordable housing in sustainable neighborhood developments from 1 (most popular) to 4 (least popular), the mean response was: 1) citywide inclusionary zoning mandates for affordable housing (2.05), 2) direct government subsidies or non-profit assistance (2.19), 3) zoning overlays that incentivize or mandate affordable housing[xix] (2.33) and 4) voluntary certification through LEED-ND (3.43). These

answers suggest that professionals are skeptical that LEED-ND alone will result in desirable levels of affordable housing. Rather, some combination of the top ranked strategies—inclusionary zoning, direct subsidies, and zoning overlays— would be essential.[xx]

LEED-ND, Financial Feasibility, & Affordable Housing:
In the fall of 2014, 20 interviewees throughout the United States (a combination of LEED-ND Accredited developers, planners, architects, engineers and sustainability consultants) were interviewed on the topic of LEED-ND, financial feasibility and affordable housing. The interview request was sent to all 314 previously contacted respondents from the above March 2014 survey. In addition, chain referrals were used for three interviews. Interviews were conducted in October and November 2014. These 20 interviewees were carefully selected based on their specific project experience, including familiarity with affordable housing and financial feasibility of the certification process. Their combined LEED-ND experience included over 40 projects, which ranged geographically from Hawaii, California, Nevada, Colorado, Utah, Indiana, Quebec, Louisiana, Florida, Pennsylvania, New Jersey and New York. The interviews lasted 30 minutes to an hour depending on the professional's project experience. All interviewees were asked similar questions that focused on LEED-ND's affordable housing component and accreditation process (see attached interview guide, APPENDIX F: LEED-ND AP INTERVIEW GUIDE).[xxi]

From the 20 interviews with LEED-ND Accredited Professionals, one clear theme that emerged was that the different types of development models influenced whether or not the affordable housing credit would be pursued, as well as why a developer would pursue LEED-ND certification in the first place. For most projects, LEED-ND was an afterthought, or a convenient alignment that leveraged previous work in either a) affordable housing and/or mixed-income projects or b) large-scale green building. One affordable housing developer mentioned that LEED-ND "is not a key driver for affordable housing," and the "nature of the project" is determined well beforehand. It was suggested that affordable housing developers are already mandated to supply a certain percentage, and they have to go above and beyond the LEED-ND affordable housing requirements to qualify for the Low Income Housing Tax Credit (LIHTC).

In contrast, for-profit market rate housing developers revealed they were generally less likely to pursue the affordable housing credit, unless they had a specific history of partnering with housing authorities. For-profit market rate housing developers were not as willing to take on the risk of losing profitability for affordable units, and more likely to develop luxury condo units or resort properties. LEED-ND was perceived as a stamp of approval on their already flourishing practice of building "green" at a larger scale. Ultimately, affordability according to for-profit market-rate developers, is not best promoted through LEED-ND, and is ultimately a larger planning policy issue.

Different types of developers also have varying motives for choosing LEED-ND certification. For example, from the interviews, the majority indicated the case for-profit market rate housing developers who build and sell the units off are generally interested in LEED-ND for purposes of corporate recognition or as a marketing tool.

In contrast, professionals felt that when a housing authority develops projects, it is much more likely to be interested in the long-term energy use reduction and utility costs savings generated from sustainable infrastructure, as these benefits are passed on to their residents. In the case of

Northwest Gardens in Fort Lauderdale, Florida, the housing authority and developer noted that utility bills for residents were reduced more than half, which was very impactful for low-income residents. Another reason mentioned was location efficiencies and adjacencies that are achieved, and which thus reduces the overall cost of living for affordable housing residents. Additionally, affordable housing developers (including housing authorities) may pursue LEED-ND to secure financing and/or build technical assistance partnerships, i.e. through the Affordable Green Neighborhoods Grant program[xxii] (USGBC 2014f), the Enterprise Green Neighborhoods Program (Enterprise Community Partners Inc 2014), or the Choice Neighborhoods program[xxiii]. LEED-ND Accredited Professionals provided other reasons why developers might choose LEED-ND, including faster entitlements, and a smoother public approval process. Professionals felt like this was a realistic option, since fast-tracking project entitlements and approvals has the potential to incentivize developers because it is more cost efficient on their end if a project timeline is shorter.

The Affordable Green Neighborhoods Grant Program awards funding and educational resources to developers of affordable housing developers who are pursuing LEED-ND certification. The program is supported by the Bank of America Foundation, and intends to build capacity among affordable housing developers and enable them to integrate the LEED-ND requirements and obtain LEED-ND certification(USGBC 2014f). A current USGBC staff member commented on the program:

> *It's a great program and we are so lucky to do it. It is supported by Bank of America Foundation funds. We have awarded 31 projects over 3 rounds, you know—three 2 year cycles beginning in 2010, to support projects that are pursuing LEED-ND certification that are including an affordable housing component. They are all US based projects…Of those grant recipients, I hold monthly phone calls with them, at our conference that was just last week. We had a convening of the most recent recipients to provide additional technical assistance to help them pursue certification. One part of the award package for 5 of the 11 that I just awarded, we will fly staff to their project site for a 2 day intensive work session to leave them much closer to achieving certification than they were before(Studhalter 2014).*

In the Affordable Green Neighborhoods Project recipients receive a $31,000 USD cash award, to be used to pursue LEED-ND certification, in addition to other certification support. In addition to the Affordable Green Neighborhoods Program, HUD has required that all Choice Neighborhoods Planning Grant recipients must secure Stage 1 Conditional Approval of their Transformation Plan for LEED for Neighborhood Development. Tying LEED-ND certification to funding ensures that federally funded affordable housing projects are meeting sustainable neighborhood development standards. Another program, Enterprise Green Communities, has developed similar criteria to the LEED-ND rating system, but with the specific goal of "achieving health, economic and environmental benefits to low-income families"(Enterprise Community Partners Inc 2015). One interviewee noted that Enterprise Green Communities—as a competing rating system—"more predictably delivers affordable housing outcomes."

Additionally, interviewees confirmed that a balance of both incentives and regulation is necessary given that affordable housing in LEED-ND is optional. Most felt that affordable housing mandates such as inclusionary zoning are ultimately the most effective measure.[xxiv] A LEED staff member at USGBC concurred with the idea of setting a regulatory floor and adding targeted incentives:

> *I think that to have the largest impact on the creation and preservation of affordable housing, there needs to be both a pushing and pulling of the market simultaneously. Mandates create a minimum floor of compliance, pushing the market forward. Dangling a carrot out there with incentives can help to pull the market along, going further and deeper. As common practice evolves and the market moves, the mandates need to keep pace and the incentives need to be ratcheted up. We hope that LEED can be a central part of that incentive package. To have the largest impact on affordable housing, I think that both efforts need to be coordinated and complementary.*

Similarly, one developer stated that a combination of both carrots and sticks was important, noting the local government's critical role in guiding these efforts, which ultimately shape new sustainable development in a collaborative way:

> *You could get the collaboration of ALL developers with* the two measures *that you mention* [regulation & incentives]*…. For a developer, you can't develop without the collaboration of the city…Great places are made through collaboration between the developer and the city. However, what can bring it to the level of the sustainable or 'green' is that the city should get even more involved."* For-profit developer, Quebec)

Professionals also agreed that density bonuses for incorporating more affordable housing are a viable trade-off. One developer mentioned that it is a useful tool with the caveat of density bonuses being suitable only for larger developments. The scale of the project and the type of developer involved appeared key in determining the success of the incentive. Another developer stated that a density bonus would depend on the developer's clientele. They stated that if it is a "high-end" development there is no chance affordable housing will materialize—but if it is a "middle class" development, there are more possibilities for going "bigger or taller."

When asked about recommendations for improving the rating system with regard to affordable housing, one planner in a private firm in California mentioned increased collaboration between the GBCI and local government:

> *I think the GBCI*[xxv] [Green Building Certification Institute] *needs to reach out more to governments to help them integrate LEED-ND guidelines into their zoning codes…. A rating system only has as much power as they choose to use it, since it is voluntary. Putting some teeth into it wouldn't be a bad thing. And encouraging the city to give both incentives and punishments for not doing LEED-ND. For example, density bonuses for incentives, and by punishments so that you don't get your entitlements…*

Although opinions were mixed on whether or not the credit should be a pre-requisite, some suggested it could be worth more points. A gap in the rating system was pointed out for projects with affordable rental housing between 80-100% AMI described by interviewees as "workforce housing" (Goetz 2008:223). In addition to the credit-level suggestions, professionals agreed that reducing the cost of LEED-ND certification would not by itself make the affordable housing credits more attainable. However, many professionals felt that the high registration cost ($1,500) and initial stage certification costs ($18,000) (GBCI 2014) had generally deterred clients with smaller projects

from committing to the process.[xxvi] One interviewee suggested that the cost of certification be scaled per residential unit, so that the fees would not be a disproportionate burden for smaller developments.

Shifting Policy to Reality: A Case Study on Affordable Housing 'Revisionism'

The story of Southeast False Creek, a LEED-ND Platinum development, demonstrates how initial affordable housing goals were marginalized throughout the planning and development process. This case study also highlights how LEED-ND, as an accredited rating system, did not provide the extra incentive required at the time to overcome the challenges of a weak real estate market during a period of economic recession.

British Columbia is often lauded for its attempts to maintain social housing (Canada's term for affordable housing) throughout the whole province, which remain an integral part of equity planning (Calavita and Mallach 2010a:86). The City of Vancouver is often cited as a model for social housing implementation, as it upholds a longstanding citywide mandate of 20% affordable housing in new developments of over 200 units (CMHC 1996). In other words, the City requires 20% of all new units be non-market housing. With the help of provincial funding, the City purchases part of the site from the developer for 60% of market value, and leases this site to a non-profit housing provider, such as a co-op agency. The for-profit developer then constructs the subsidized housing and turns it over to the non-profit group to administer, in the case of Southeast False Creek this materialized as mixed market rate and affordable rental housing.

The Southeast False Creek development area originally included both privately owned and City owned lands[xxvii] (see Figure 43). Part of Southeast False Creek was initially built as the Olympic Village for the 2010 Vancouver Olympic Winter Games. Built on publicly owned land at the time of this study, it was the only completed residential area (sub-area 2A). The City of Vancouver initially prescribed a high percentage of affordable housing—approximately 1/3—to be located in this Olympic Village. However, the final product fell well short of this ambitious goal. The original goal, according to the 2005 Adopted SEFC Official Development Plan (ODP), was to have a household income mix of one-third affordable[xxviii], one-third modest market[xxix], and one-third market-rate for the City-owned lands (subareas 1A, 2A & 3A), with the thirds defined by the regional income profile. A similar objective for affordable housing provision was established for the private surrounding lands (Subareas 1B, 2B, 3B, and 3C).[xxx]

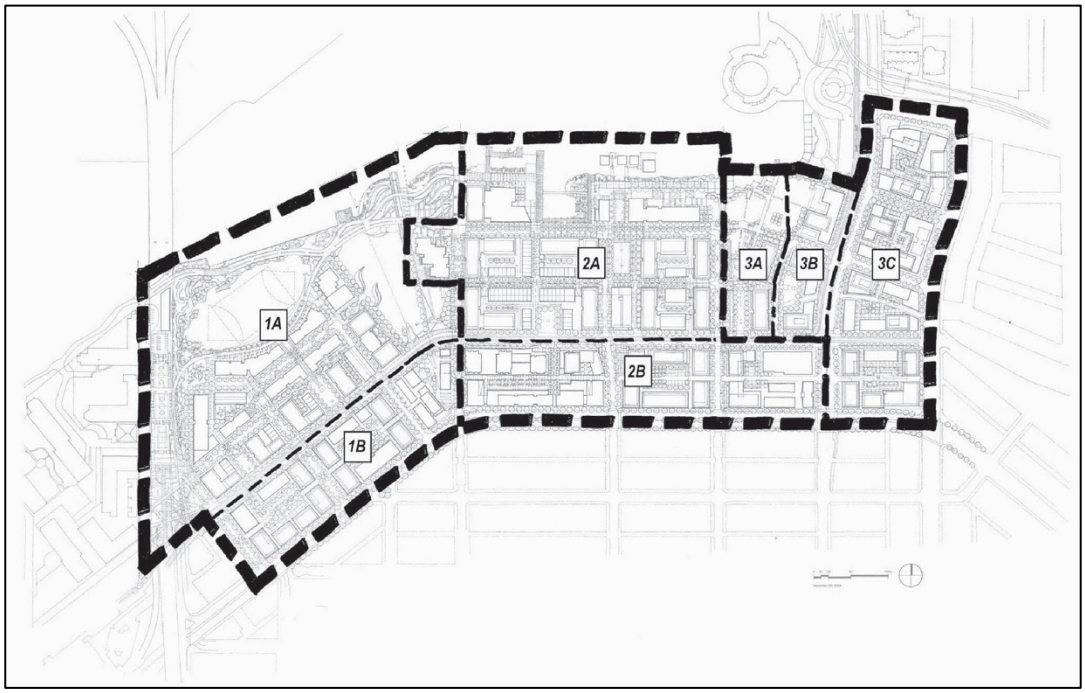


Figure 43: Southeast False Creek Official Development Plan (ODP) Subareas. The Olympic Village Proper is Subarea 2A. (City of Vancouver 2007:36).

In the 2006 SEFC Development Plan Amendments, affordable housing was reduced from 33% to 20% within the City-owned lands (French and Hiebert 2006). The 33% 'modest market housing' requirement was removed from sub-area 2A (Olympic Village) by City Council in 2006, but retained for sub-areas 1A and 3A. A City of Vancouver policy report released in 2010 stated that the 2005 Official Development Plan included only a 20% affordable housing requirement for the 50-acre parcel—which was the minimum percentage listed, despite the fact that 33% had been recommended if financially possible in 2006. The 2010 policy report recommended that of the 252 affordable units in SEFC, there would be a "50:50 ratio of core need[xxxi] residents and residents paying market rental" due to severe cost overruns in the City's construction budget in consultation with the developer Millennium Water (City of Vancouver 2010:2). Fifty percent would be truly affordable (non-market rental), and the other fifty percent would be market rental with the aim of serving essential service works (workforce housing market rental). This severe cut to affordable housing due to budget constraints received tremendous negative attention in the local Vancouver media (CBC News 2009a; CBC News 2009b), given that the original intent had been to create a development that was affordable for a range of incomes and household sizes. Many (including the municipal planners themselves) felt the impact on the City's overall affordable housing initiative was of significant concern, as the viability of the business model for affordable housing had been compromised. Although the design-development and policy documents were completed just before the economic downturn, the actual construction coincided with the bursting of the real estate housing bubble, making the City's cost overruns seem more ominous. The City of Vancouver took over project development in 2009 when Millennium, the developer for the project, got hit by the 2008 economic crisis—as they had overbid on the project. The city took on a gargantuan debt to finish the project and Millennium went into voluntary receivership (Gold 2015). Receiver Ernst &

Young and Rennie Marketing Systems took over and recovered costs, ending the city's precarious part (Gold 2015). As of 2014, the City of Vancouver was still trying to recoup a $50 million construction cost loss on the project, specifically incurred by the social housing units (Lee 2014). In April 2014, Mayor Gregor Robertson announced the City had finally paid of its $630 million debt. The Aquilini Group bought the project's remaining 67 condo units for $91 million, and they continue to sell and rent the units the approximately 30 remaining units.

Ultimately, 252 affordable housing units[xxxii] were built in the first phase of the development, as well as 110 units of modest market rental housing aimed at middle-income singles and families, for a total of just over 350 units (City of Vancouver 2010). Of the 252 affordable units, half are non-market rental and half are market rental units intended to be "workforce housing" (City of Vancouver 2010). Preferential access to the latter is given to health care workers (doctors, nurses, hospital staff) and public safety workers (police, fire, or ambulance) – thus ensuring housing for essential service workers is present in the neighborhood.
In Southeast False Creek, the planners chose to mix affordable housing at the building scale – in both co-op and rental buildings (See Figure 44).

	Non Market Rental Units	%	Market Rental Units	%	Total # Units by Building
Cooperative Housing (151 W 1st)	23	27%	61	73%	84
Rental Building 1 (122 Walter H)	55	54.5%	46	45.5%	101
Rental Building 2 (80 Walter H)	38	56.7%	29	43.3%	67
Total Non Market vs. Market #	**116**	**46%**	**136**	**54%**	**252**

Figure 44: Affordable Housing Unit Breakdown at Southeast False Creek

Today, there is one co-op building managed by the Cooperative Housing Federation of BC (CHF BC), and two rental housing buildings run by S.U.C.C.E.S.S, a non-profit. In addition to the two rental buildings, there is another rental building that the City sold to Bentall (a private business) in 2013. The developer voluntarily included 110 market rental units in the rezoning in exchange for a density bonus, and negotiated a 20-year term for these units to be kept rental (Hiebert 2014).

The case of Southeast False Creek suggests that incentives for affordable housing, such as density bonuses, are possible trade-offs developers are willing to accept for constructing affordable rental housing, but only if the market supports profitable development at higher densities. However, the deterioration of affordable housing policy suggests that affordable housing goals are susceptible to a 'slippery slope' within the planning and sustainable development process, and are highly contingent upon budgetary and fiscal constraints, and the flux of the larger economy. Those units most at risk of being cut are the affordable rental units. Francis and Hiebert (2014) state that in the City of Vancouver, losses from rental inventory tend to be at the bottom end of the spectrum, making for a shortage of affordable rental housing—leaving the poorest tenants with little choice or few options.

When SEFC underwent the certification process in 2010, the development was evaluated based on the LEED-ND pilot version.[xxxiii] At the time, SEFC only received 1 out of 2 credits for affordable rental housing, and did not receive any credits for affordable for-sale housing.[xxxiv] In sum, the development did not score particularly highly for affordable rental housing, and failed to provide

any affordable for-sale housing at all. LEED-ND ultimately provided little 'value-added' with regard to incentivizing affordable housing, and the offer of a density bonus was a far more effective measure.

DISCUSSION & RECOMMENDATIONS

This chapter explores the hypothesis that the LEED-ND rating system does not adequately promote social equity, primarily due to the insufficient incentives for affordable housing. Statistical scorecard evidence, survey results, structured interviews and policy review suggest that affordable housing is not being integrated in the majority of LEED-ND projects, that the affordable housing credits do not incentivize the provision of affordable housing, and that improvements could be made to the rating system, with increased collaboration between the private and public sectors. Below are recommendations for improving the rating system relative to affordable housing, as well as proposed methods for the public sector to take better advantage of the rating system.

Current statistics show that only 40% of certified LEED-ND projects opted to include affordable housing, significantly less than the amount projected in the original study (68.5%) (Garde 2009). In addition, 26% are choosing to completely ignore housing type diversity and affordable housing. The survey results of current LEED-ND professionals further suggests that the affordable housing credit needs to be strengthened or critically reconsidered. Interviews with professionals highlight that a combination of both carrots and sticks are necessary while the affordable housing credit remains optional. Although affordable housing developers will tend to go above and beyond the credit, for-profit market-rate housing developers in this survey noted that they are not likely to include any affordable housing unless they have a history of partnering with housing authorities.

The case study of Southeast False Creek in Vancouver, BC serves as a cautionary tale that even with ambitious affordable housing policy goals and regulation at the city level, the reality of developers' financial constraints and the flux of the real estate market may hinder progressive percentages of affordable housing in LEED-ND projects. However, the element of density bonuses as a tradeoff for including affordable rental units highlights a targeted strategy that may be utilized by planners, in addition to providing an example of workforce housing provision.

In addition, cities can implement complementary policies and regulations that support affordable housing in new sustainable development. While non-profit housing developers, intermediaries, and for profit affordable housing developers in the United States have various resources from Community Reinvestment Act (CRA) financing to financing from federal programs, many for-profit market-rate housing developers have little reason to integrate affordable housing. While density bonuses could potentially 'pencil-out' for large-scale projects, developers in the interviews also cited regulation as an important tool that would effectively target smaller developers, who may not see the benefit of density bonuses. In addition, according to the survey results, LEED-ND professionals in the private sector still perceive inclusionary zoning mandates as the most effective policy for producing new affordable housing. Essentially, inclusionary zoning policies are one of the only ways to mandate a base level of affordability for all new development.

At the neighborhood scale, cities have the option to independently leverage LEED-ND credits; for example, Talen et al (2013) have noted it could be used by planners as a suitability analysis tool. Cities could institute geographically targeted zoning overlays that directly mandate particular

LEED-ND criteria (such as affordable housing) in order to create tailored development standards. In doing so, cities can ensure that new affordable housing development takes place in specific neighborhoods. Furthermore, the zoning overlays can be tied to development incentives, such as FAR or density bonuses, property tax breaks, or expedited permitting processes.

At a minimum, increasing the points allocated towards the credit could internally strengthen the LEED-ND affordable housing requirement. Another internal option would be to add a credit for building "workforce housing" (rental units) between 80-100% of AMI. Additionally, points could be awarded for providing both a mix of for-sale and rental units, as a greater mix of tenure types provides greater income diversity. Certification costs could be reduced or subsidized for projects that include a significant portion of affordable housing, and USGBC could continue to build upon and strengthen the Affordable Green Neighborhoods Program. Another option would be to add a credit[xxxv] for affordable projects that significantly reduce utility costs for low-income residents. Research shows that energy efficiency upgrades in multifamily buildings could save building owners and residents up to $3.4 billion annually (McKibbin et al. 2012), thus the same logic could be applied to new sustainable developments such as LEED-ND neighborhoods which have the potential to possess affordable housing.

Scaling up, subsidies at the federal, state and regional levels are also key to ensuring that affordable housing is implemented in new sustainable neighborhoods—in addition to maintaining and preserving what affordable housing stock already exists. Planners and government officials can capitalize on subsidies that offer support for very low-income households. Several recent initiatives at the federal level appear to be very promising—the National Housing Trust Fund and the Capital Magnet Fund. The National Housing Trust Fund (NHTF) was established as a provision in the Housing and Economic Recovery Act, and signed into law in 2008. The fund seeks to "provide communities with funds to build, preserve, and rehabilitate rental homes that are affordable for extremely and very low income households" (National Low Income Housing Coalition 2015). The fund provides a permanent, dedicated source of funding not dependent on federal appropriation bills (legislative motions), and 90% of the funds are targeted toward rental housing. Seventy-five percent of the 90% of funds targeted toward rental housing must target extremely low-income households(National Low Income Housing Coalition 2015). The Capital Magnet Fund falls under the Community Development Financial Institutions Fund (CDFI), and is managed by the United States Department of the Treasury. Through the Capital Magnet fund, the CDFI Fund provides grants to CDFIs and qualified nonprofit housing organizations. The grants are not only used to finance affordable housing activities, but in addition they are intended to more broadly fund community service facilities and related economic development activities (United States Department of the Treasury 2015).

At the state level, California has led the way in passing legislation related to linking climate action funding to affordable housing. Assembly Bill (AB) 32 requires California to reduce its GHG emissions to 1990 levels by 2020. While Senate Bill (SB) 375 theoretically aligns transportation and land use state and regional policy, SB 535 and the Greenhouse Gas Reduction Fund (GGRF) provide the actual legislation to put the reductions into practice. The GGRF is account established to receive Cap-and-Trade auction proceeds. While the majority of funds from the cap and trade are set aside for high speed rail and low carbon transportation, approximately 15% of the total fund is set aside for the Affordable Housing and Sustainable Communities (AHSC) program.

While the AHSC essentially supports the implementation of sustainable communities strategies required by SB 375, it is not technically subject to SB 375 requirements. The Strategic Growth Council coordinates the program, and projects that benefit disadvantaged communities are given priority. Fifty percent of the AHSC funds are set aside for Affordable Housing Developments, and the other fifty percent of the funds are set aside for projects benefitting Disadvantaged Communities. A single project can address both, they are not mutually exclusive set asides (California Department of Housing and Community Development 2015). The AHSC projects will reduce GHG emissions by increasing active transportation, transit ridership, affordable housing near transit stations, the preservation of agricultural land, and local planning that promotes infill development vehicle miles traveled (VMT) reduction. There are two types of projects that fall under the AHSC. The first are infill-focused projects—Transit Oriented Development (TOD) Project Areas, which must illustrate VMT reduction through fewer or shorter vehicle trips, or mode shifting to walking, bicycling or transit use by integrating key destinations and high quality transit systems. There is $15 million maximum available for each project, and 40% of the AHSC funds are dedicated toward this project type. The second project type is the Integrated Connectivity Project (ICP), which has a more rural focus, and these projects must demonstrate VMT reduction through shorter or fewer vehicle trips or through a mode shift to walking, bicycling and transit use within areas lacking qualifying high quality transit. There is an $8 million maximum available for each project, and 30% of AHSC funds are available. At the moment, the AHSC is still relatively new and reviewing and receiving applications, so there is no data yet to evaluate its effectiveness.

An Assembly Bill currently up for ratification in California is AB 1335 (Atkins 2015b), which is called the Building Homes and Jobs Act. This Bill would basically impose a $75 fee for every real estate transaction that is recorded, which would be sent to the Department of Housing and Community development to be deposited in the Building Homes and Jobs Fund, which would be created within the State Treasury. Funds may be expended for supporting affordable housing, home ownership opportunities, and other housing-related programs.

In tandem with AB 1335, Atkins (2015a) also put forward Assembly Bill 90, which designates the California Department of Housing and Community Development (HCD) as the state agency responsible for administering federal National Housing Trust Fund (NHTF) allocations. The Bill requires HCD to post their plans for use of NHTF resources within 30 days of receipt of funding, creating a framework for how the Housing Trust Funds would trickle down to the state level by 2016.

Other recent State of California action has attempted to maintain the affordable housing stock that already exists in neighborhoods. Assembly Bill 35, brought to the table by Chiu (2014), aims to preserve and rehabilitate the existing affordable housing stock initially created through public investment in this State. The Bill aims to address the affordable housing crisis by preserving older SRO and other buildings with deep income-targeted rents. The Bill authorizes a new State of California tax credit of $40 million dollars for the annual rehabilitation and report of qualifying older buildings that serve Very Low and Extremely Low Income tenants, given that the deeply-targeted SROs that need to capitalize are not privy to this opportunity because that have agreed to deep income-targeting which excludes them from acquisition credits.

State legislation also can be quite powerful in the development of density bonus incentives. In 2005, for example, the State of California has instituted legislation, such as SB 1818 (Hollingsworth

2005), which states that developers are eligible for a range of density bonuses up to 35%, based on the percentage of affordable units in a development. Applicants are also eligible for an innovative new land donation density bonus. Local governments are also required to offer at least 1-3 incentives (reductions in parking, for example) rather than one, based on the percentage of affordable units in a development. SB 1818 also limits parking requirements that localities may impose.

Ultimately, federal and state subsidies are critical to the preservation of existing and development of new affordable housing units, and there is increasing movement toward aligning these subsidies with neighborhood development sustainability criteria. Currently, acquiring LEED-ND Stage 1 criteria is a requirement at the federal level for receiving funding for the Choice Neighborhoods programs, and also at the local government level where cities are issuing request for proposals for LEED-ND projects. Overall, planners and decision makers at the various levels of government may believe that LEED-ND standards will adequately cover the three pillars of sustainability. However, this chapter demonstrates that in fact the equity pillar is not satisfied by LEED-ND in its present form. However, as individual cities implement a combination of additional carrots (such as density bonuses or development review facilitation) and sticks (required percentages of affordable housing in the form of inclusionary zoning or mandating LEED-ND standards) affordable housing can be better supported. Finally, this chapter raises the question as to whether a voluntary, developer-driven rating system can ever be sufficient to overcome the market bias toward higher end housing development without major systemic reforms and accompanying affordable housing mandates. Until LEED-ND can provide better incentives for the provision of affordable housing—and capture a larger share of private development—a multi-pronged strategy of city-negotiated developer incentives, inclusionary zoning regulation, and leveraging government subsidies will continue to be necessary in order to assure the provision of affordable housing in new sustainable development. The next chapter discusses affordable housing and spatial income mixing, and illustrates the tensions and biases toward spatial income mixing in neighborhoods.

CHAPTER 7: AFFORDABLE HOUSING & SPATIAL INCOME MIXING IN NEW SUSTAINBLE DEVELOPMENTS

This chapter investigates the recent history of income mixing and affordable housing development in sustainable communities in the United States and Canada, and potential new models of urban form that can be drawn upon for best practices. Financing mixed-income development in the United States and Canada is difficult because 1) the existing financing tools rarely align for mixed income development, especially vertical income mixing in the same building, and 2) there are strong resident and developer concerns about mixed income individuals living in the same building or the same neighborhood. In Chapter 5, post-occupancy survey results revealed that the majority of respondents living in two urban LEED-ND neighborhoods and two suburban Traditional Neighborhood Design (TND) developments in the Pacific Northwest are a) Caucasian, b) highly educated and c) primarily high-income earners. Assuming the respondents' demographic characteristics are representative of household demographics, if new sustainable neighborhoods intend to uphold the principle of social sustainability and social equity, then some consideration needs to be given to planning for spatial income mixing, ensuring that low-to-middle income residents have a place in new developments. Again, the LEED-ND credit for affordable housing and a diversity of housing types is optional in LEED-ND, so it is likely that any income mixing will be bypassed unless stronger incentives, regulation and internal rating system changes are achieved, or the project is specifically an affordable housing project.

This chapter also examines the current attitudes of LEED-ND Accredited Professionals with regard to spatial income mixing in new sustainable neighborhoods. Finding from LEED-ND Accredited Professionals reveal that negative perceptions of low-income residents and stigmatism is a major barrier for developers. Substantial prior research has been done on affordable housing policy, but much less on the way people of varying incomes are spatially 'mixed' throughout a neighborhood. This chapter also examines three urban form examples of spatial income mixing through the case studies of 1) Southeast False Creek in Vancouver, BC, 2) The Woodwards' Building in Vancouver, BC and 3) Hoyt Street Yards in Portland, OR.

Shifting Paradigms

In the US, affordable housing provision can be divided into two main categories: supply side strategies and demand side strategies. Since the mid 1900s, there have been two major shifts in housing finance. First, funding has shifted from direct government funding of public housing provision to a devolved funding model, based on tax expenditures and other programs like HOME and Community Development Block Grants (CDBG). A whole host of agents now participate in affordable housing provision and supply, including non-profits, intermediaries, for-profit market-rate housing developers and for-profit affordable housing developers. Second, there has been a shift to demand-side housing strategies, for example the Section 8 voucher program. Overall, Graddy and Bostic (2010:82) explain that "*what has emerged in the United States is the use of multiple policy instruments to encourage private developers—both for-profit and nonprofit—to produce affordable housing*." Davis (1994) refers to this approach as "third sector housing" when a variety of different federal, state, and local government sources, and private sources put together packages of funding.

Two main theoretical paradigms frame current strategies of affordable housing provision—the 'community development' model, and the 'mobility' or 'fair housing' model. The 'community development' model encourages building and investing in current low-income communities *in situ*, and asks the question why investing in a place should be contingent on low-income communities mixing with high-income communities. The second model helps low-income families move into high opportunity neighborhoods. It focuses on building integrated, mixed income communities, reducing concentrated poverty and factors in the literature on neighborhood effects. William Julius Wilson (2011; 2012) first addressed the topic of neighborhood effects when he discussed a "spatial mismatch" between increasingly suburban job opportunities and the primarily minority residents of poor urban neighborhoods. This mismatch in turn has spatial implications in some minority neighborhoods—magnified crime, the movement of middle-class residents to better neighborhoods, increased barriers to access and limited other resources (US Department of Housing and Urban Development 2011). According the Wilson combination of barriers creates communities with serious crime, health, and education problems that, in turn, further restrict the opportunities of those growing up and living in them. Strategies such as the section 8 housing vouchers fall under the mobility paradigm, as does inclusionary zoning, as they seek to rectify the income and racial imbalance through spatial integration in neighborhoods. The Hope VI HUD program rested on a combination of both paradigms, and the new Choice Neighborhoods Program focuses specifically on the community development paradigm.

Other nations, such as Sweden and the Netherlands, have similarly encouraged an increased integration through mobility by directly financing an increased choice of housing options. This is not done through a voucher program, but even more directly through a "housing allowance" program (*bostadsbidrag*) whereby families with children and people under the age of 29 are eligible for extra income 'to level the housing playing field', depending on the size of the household and number of dependents (Chen 2006; Chen and Enström Öst 2005). This program is available for both renters and owners, and has also been put into practice in Finland, Norway and the Netherlands (Loikkanen 1988; Nordvik and \AAHRéN 2005; Åhrén 1987). While these policies were meant to encourage housing mobility within classes, they have thus historically dealt with income integration rather than racial integration. However, this is changing with the creation of the European Union and increased in-migration to Northern Europe, which ultimately negatively affects public opinion on welfare state spending (Eger 2009).

The mobility paradigm in the United States also goes by another name—the 'fair housing' model (Goetz 2015). This model tends to focus on the eradication of discrimination in housing market interactions and the achievement of racially and ethnically integrated communities. Goetz (2015) argues that the community development and mobility/fair housing paradigms are constantly in conflict one another. He notes that the spatial integration objective of the fair housing model is problematic, because it forces people out of their homes in the name of segregation and de-concentration. In contrast, the community development paradigm acknowledges the existing strengths of community in place. Goetz (2015: 20) calls for a return to an emphasis on housing choices, and on improving housing conditions for people of color: "reaffirming choice and nondiscrimination as the guiding principles of fair housing advocacy, furthermore, has the potential to bring fair housing and community development into an alignment in which the efforts of one movement support those of the other." The choice to remain in place, as suggested by Imbroscio (2008) is an important one. However, increased choice in terms of integrated communities is also

important, and this chapter examines some successes and challenges through interview evidence and recent examples of spatial income mixing.

Hope VI

Since the 1990s, no new public housing has been constructed in the United States except as part of the HOPE VI Program, which allows for the demolition and re-construction of older, troubled public housing projects by private developers with the assistance of federal financing (Calavita and Mallach 2010b:16). Affordable housing programs through the United States Department of Housing and Urban Development (HUD) sought to replace public housing units that were distressed at a one-for-one basis, rather than add to the current public housing stock (Goetz 2014). One of the main goals of the Hope VI projects was to ensure new development supported mixed finance, mixed-income housing, under the assumption that "economic integration was the only way to sustain a successful projects and neighborhoods"(Katz 2009:23). Prominent urban designers and planners alike, especially those working in the New Urbanism framework, jumped on the Hope VI platform, since they saw potential to leverage new sources funding, given that New Urbanism's principles were "a perfect fit" with HUD's intent to engage in income-mixing strategies (Calthorpe 2009). Mixed income, mixed-use communities were, according to Calthorpe (2009), perceived as dependent on not only new policy paradigms, but on New Urbanist design paradigms as well.

Since its introduction, the mixed-income platform has been widely critiqued as the 'quick fix' antidote to improving the stock of affordable housing (Vale 2006; Joseph 2006). However, case studies, have illustrated, that when the supportive services and community services aspects of Hope VI are taken seriously, there are significant benefits that can accrue for residents (Katz 2009). Studies such as this one illustrated potential successes that can be garnered from partnering with social services, which is the framework that Hope VI moved toward with Choice Neighborhoods. According to Pendall and Hendey (2013), there are three important contributions from the Hope VI program that informed the design of Hope VI's successor, Choice Neighborhoods:

1) Hope VI resulted in the development of hundreds of mixed income housing projects. New relationships were formed between housing authorities, city and county governments, and private-developers, property managers an investors.
2) Hope VI diversified the nation's portfolio of housing assistance by replacing public housing units with a mix of new housing units, tenant-based assistance, HIHTC units, and other types of diverse subsidies. The diversity of subsidy encouraged and reinforced income-mixing
3) Hope VI provided examples of how to engage and protect vulnerable tenants during and after redevelopment processes, this included the development of supportive services—especially in deep case management and relocation

However, overall, Hope VI was ultimately less successful in helping families improve their economic services, and the most vulnerable households did not benefit from the program, as they required the most intensive support (Popkin, Levy, and Buron 2009). A whole slew of urban geographers and academics in the 2000s critiqued the 'neoliberal' and mobility-focused Hope VI agenda, which they claimed had a singular focus of displacement, and too easily succumbed to New Urbanist spatial dispersion principles (Bohl 2000; Deitrick and Ellis 2004; Elliott, Gotham, and Milligan 2004; Hanlon 2010; Pyatok 2000; Sohmer and Lang 2000). Given the backlash, the

Choice Neighborhoods was created as the successor to Hope VI, with the intent of providing services and support with the hope that it will address "the many complex challenges that many of these families face in moving toward self-sufficiency" (Popkin 2012:2).

From Hope VI to Choice Neighborhoods

Choice Neighborhoods differs from the Hope VI in that it focuses on providing funding for neighborhood investment and partnering with social services. While the emphasis remains on public-private partnerships and mixed financing to replace and/or rehabilitate affordable housing, the major sea change is to "*create synergy between the renovation of the target development and efforts within the neighborhood surrounding the target development*" (The Urban Institute 2013). Choice Neighborhoods focuses on local neighborhood improvement projects, and attends to social services, the care and education of children and youth, public safety issues, and the revitalization of a neighborhood's commercial opportunities and infrastructure. In short, Choice Neighborhoods has a tri-partite focus: housing, people and neighborhood, with the aim of catalyzing synergies between these three elements. It recognizes the synergies created between housing and local nearby social services as critical to the success of a neighborhood.

In order to achieve comprehensive neighborhood revitalization under the program, Choice Neighborhood applicants (public housing authorities (PHAs), local governments, nonprofits, tribal entities and for-profit developers that apply jointly with a public entity) must create a Transformation Plan, which serves as the guiding document for the revitalization of the public and/or assisted housing units. To successfully implement the Transformation Plan, the Choice Neighborhood applicants are required to work with private and public agencies, organizations, and individuals to gather and leverage resources needed to support the financial viability of the plan (US Department of Housing and Urban Development 2015). In this sense, because Choice Neighborhoods focuses on leveraging and creating synergies between local asset groups already in-situ, it better represents the community development affordable housing provision paradigm. While some initial work has been done in terms of methods for evaluating and monitoring the success of the program (Robin E. Smith 2010; Smith 2011), because Choice Neighborhoods is still a relatively new program, it remains to be seen if it is successful in accomplishing its holistic and synergistic goals for affordable housing provision.

In February 2012, the US Department of Housing and Urban Development created the requirement that all Choice Neighborhood Planning Grant recipients must secure LEED-ND Stage 1 Conditional Approval. Because government agencies are increasingly aligning their RFPs and making funding contingent on LEED-ND requirements, and further alignment at the federal level is expected (Galante 2015), it is worth analyzing 1) current issues in the field of urban development with respect to spatial income mixing in LEED-ND projects as elicited by experts and 2) current examples of how income mixing has and has not been successful in new sustainable developments. The next section addresses how current LEED-ND Accredited Professionals conceive of and spatial income mixing in new sustainable developments.

Income Mixing in New Sustainable Development

In order to assess the role of spatial income mixing in new sustainable development, twenty LEED-ND Accredited Professionals were interviewed on the topic of spatial income mixing (see CHAPTER 6: LEED-ND & AFFORDABLE HOUSING). Interviewees were asked what type of spatial income mixing worked best at the neighborhood scale. Most LEED-ND Accredited

Professionals were familiar with income mixing that took place at the scale of the neighborhood, i.e. where affordable housing was incorporated throughout a neighborhood, and mixed 'horizontally' in separate buildings, as one interviewee recounted:

> *"Yeah it is almost always horizontal. I'm trying to think of where I have actually seen it mixed in a development. The reason for this is it is much more easy to finance a stand-alone building, as the affordable building. And this all how you are able to credibly calculate the cost basis for the project. You know, say that is used for the Low-Income Housing Tax Credit, and it's mostly for LIHTC, and it does have a bearing on the other sources of funding. But otherwise you are trying to say "well it is a 100 unit building and 20 units are affordable, and the whole building cost 10 million dollars, and so the affordable part cost two. They are all going to use the same elevator, the same parking structure and the same landscaping, so maybe it cost 2 and a half. And then they are like, we don't even want to deal with this, they just want to stick them side-by-side." I bet if you looked at some of the examples in the Bay Area, like Tassafaronga, there is the Habitat piece, the low-income housing piece, there's the 9% tax credit deal.*
>
> *There is no low-income housing tax credit in Canada. So it is all based on local effectively development agreements or inclusionary ordinances. When Greenbuild was in Toronto, we had some Toronto Housing Developers on a panel that I put together, and they said this is how we do affordable housing in Canada is one project at time." (*Sustainability consultant, Southern California)

One planner was positive about the Hope VI approach toward horizontal mixing within a neighborhood, which encourages indistinguishable market rate and affordable units. He noted the problem with the financial model for purely affordable projects, noting that Section 8 can cause a lack of income mixing:

> *"Absolutely I am a huge fan of the Hope VI approach of different income groups and different units. And making sure they are indistinguishable from the exterior. The same basic features and amenities…. Fully mixed. The people who say it doesn't work are wrong. There is a mix, and there is a right way to do it, and a wrong way to do it. It's a delicate act. I absolutely am a firm believer that completely segregated affordable housing is a bad idea. It just is. It leads to ghettoization. Even in really nice buildings, you need some mix of at least income ranges. A lot of affordable housing projects in America are dedicated to everything under 40% AMI, the nice thing about LEED-ND and you don't see this in practice as much. I work with affordable housing section 8 projects and they are all under 40% and 30%. I see projects that go up all the time that are entirely under 40% and 30% and I cringe."*

Interestingly, one LEED-ND AP developer noted that in projects he/she had worked on, they were able to effectively mix households with different income-levels:

> *'All of our projects* [have mixed income units]*….. All of our projects have market rate and affordable side-by-side in the exact same buildings and with the exact same floor plans, and the exact same finishes. The difference is what people pay for them. Then we manage them to market rate levels. So, what the market expects is how we manage our properties.*

Effectively you don't know what your next-door neighbor makes. They could be in a public housing unit, they could be in a tax credit unit, or they could be paying full rent."

Vertical mixing (i.e. mixing affordable housing units and market rate units in one building) seemed less common. Most had experience only working with horizontal mixing. One architect in Portland noted that vertical mixing (i.e. within the building) does not work for reasons of safety and security, and referenced separate entrances as the solution to the problem:

"It doesn't work for high-income people…just imagine the highest-end woman you can imagine, an old lady with a poodle under her arm, getting into an elevator with low-income housing guy, that wouldn't feel safe to me. Part of that security, I think it would only work if there are separate elevators or separate lobbies. I think it is not very nice. That is the thing you fight against, in that scenario in trying to combine it. I think you could have it combined if they have separate entrances. But combining them and having them use the same elevators is not feasible for higher-end projects."

One architect concurred with the theme of lack of safety and security within vertically income-mixed buildings, and introduced the fear of vertical income mixing as more of a social stigma:

"You know I talk to a lot of people who look at that and say…say, if I am in a building, I don't want to get off my floor, where my condo is a half a million dollars and have someone whose house is subsidized for 100,000 dollars. It is just a stigma that is ingrained in Americans, at the very least. And that is the piece that is harder to overcome. If you are the developer of the residential tower and you are including affordable homes in that tower, people don't see that as a benefit, they say 'oh god, those people are going to be so close to my home, my kids!' And they are horrible things to say, but that's the reality and developers don't do it."

Another developer working in Montreal noted the difficulties associated with developing vertical income mixing from a financial feasibility perspective:

"From a market point of view, it doesn't work. You can't mix, just like it is hard to mix rental with owners. To mix low-cost units with expensive condominiums it doesn't work…. I've seen projects where they have actually built two buildings, but they have separate entrances, separate elevators, they are totally separate and not within the same project. Developers are too scared understandably and stressed out, when you consider the investment being made, especially for a large project. It will take 3-4 years from start to finish and the market could change. Anything could happen. The risk is extremely high. No developer in their right mind would get into it."

However, another architect thought that in theory, vertical income mixing is important for building community, especially the interactions that occur between residents of different income groups:

"My purely theoretical self thinks that the vertical mixing is more important. Cause I think it is…I think anytime you say well "THAT building is the affordable building" there is an immediate stigma, and anyone that lives in THAT building feels it everyday. Every day that they try and go get a job, every day that they go to their job that isn't paying enough, or

their 2nd job or their 3rd job or however many have to undertake to afford that. There is an additional stigma that feels bad.

So, having a mixed-income building provides them opportunity to see what they can achieve and encourage them, and its not an address that somebody says "Oh god, you're one of those." I also think it is good for people who are of higher means to know their neighbors and to know what people struggle with daily. And to be able to see like, when I pay my taxes it is x% for affordable housing or you know programs for lower income folks. That's Susie who lives down the street, and that's little Billy and our kids play together. And you know, that's ok. Those types of interactions are what are important, and that is what builds community. I think the vertical mixing is important".

In terms of solutions, one consultant noted (incorrectly) that a diversity of unit sizes could potentially fulfill the affordability needs:

"I have seen in Sweden—the way that they have this affordability question is that they have different unit sizes in the same development. So it won't be all luxury 3 and 4 bedroom condominiums. There will be studios, 1 bedrooms, and 2 bedrooms and family size apartments all in one buildings or elevator or stairway. That is how they say there are housing options. But in Sweden they actually don't have income-restricted housing or social housing. They try and build to the market needs and provide a diversity of unit sizes. I think that works because then you have the young student in the same development with the family and three kids. I think that maybe gets you to maybe some of the diversity, the economic diversity and social diversity.

I am not sure it makes sense to shove in 15% affordable units in to the luxury tower SOMA. You have probably seen some of this—I read somewhere where there was a building in New York, you know half of it was affordable and half of it was market rate. At the same time there is a real aversion, and again we are talking about California-style five storey buildings… You know you are in Europe, and there was in Glasgow the summer before last. And there you know the 20 storey social housing towers around the city. That is not good. If it is going to be segregated like that, it would be way better to mix it in. But, I'm not sure if this 50-100 unit you know fully affordable four storey building in Hayward or San Leandro is really creating a social problem."

CASE STUDIES IN SPATIAL INCOME MIXING

Vertical Mixing in Southeast False Creek: A Co-operative Model

The Southeast False Creek case study demonstrates how affordable units can be mixed successfully within the same building as market rate units. Although this example represents a model that is more commonly used in in Canada than in the United States, it illustrates that vertical income mixing is possible within new sustainable developments.

In Southeast False Creek Olympic Village, the affordable housing units consist of approximately 252 units, and about 110 units of modest market rental housing aimed at middle-income singles and families, for a total of just over 350 units. Of the 252 units that are designated as affordable, approximately 125 (50%) units are non-market rental and the remaining 125 are market rental units "*with the tenants of the market rent units to be limited to households with a monthly income less*

than or equal to five times the market rent; with the operators focusing as much as possible on renting to tenants whose work is in Vancouver with an emphasis on those serving citizens of Vancouver in the areas of health care and public safety" (City of Vancouver 2010). Thus, preferential treatment is given to people who work in health care (doctors, nurses, hospital staff) and public safety (police, fire or ambulance workers). This is an interesting way to ensure that a mix of both blue-collar, pink-collar and white-collar workers work in the neighborhood, including those who work in essential services.

Figure 45: Co-op Housing, West 1st Avenue, in Southeast False Creek managed by CHF BC (Szibbo 2013)

The affordable housing is located in one co-operative building and two rental buildings (see Figure 4). The one co-op housing building is managed by CHF BC (West 1st Avenue), and two buildings of rental housing run by S.U.C.C.E.S.S, a non-profit (122 & 80 Walter Hardwick). The co-op housing consists of 84 units, and the other two rental buildings are 101 units and 67 units. The co-op housing breakdown is 75% market rental and 25% non-market rental, whereas the two rental buildings are each 25% market rental and 75% non-market rental. This breakdown was done in order to ensure an overall 50%/50% mix of affordable and market rental units.

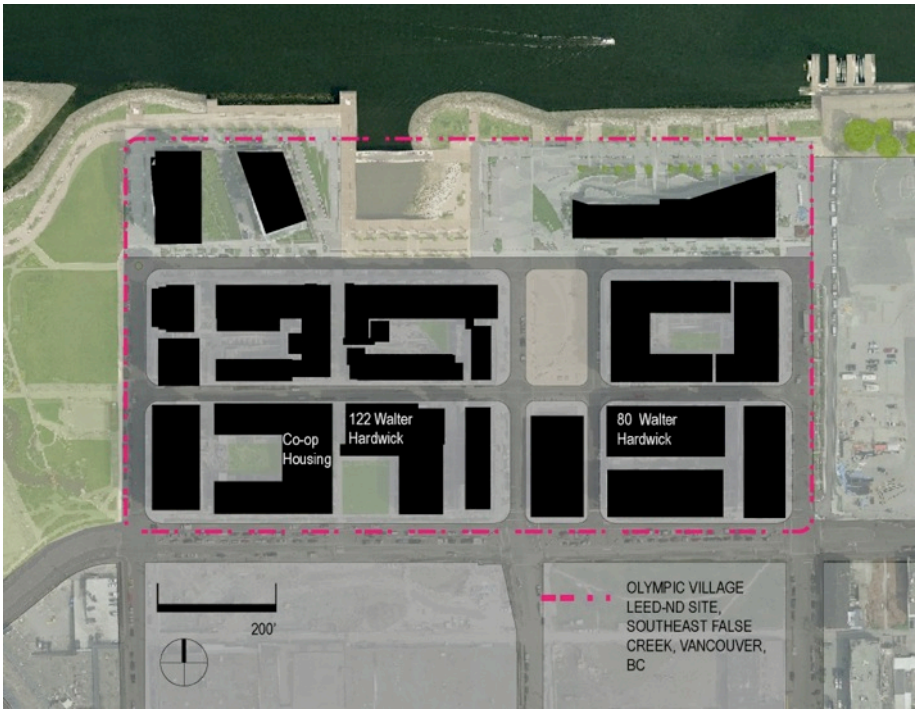


Figure 46: Southeast False Creek Olympic Village LEED-ND Development Area. The main blocks range in length between 400-600' by 200' wide (Szibbo 2014).

Historically, non-profit co-op housing has been a part of Canada's rich tradition of social democratic housing since the 1930s.[1] Over the years, both the provincial and federal governments have funded various programs to help Canadians create non-profit housing co-ops. The co-ops developed under these programs provide good quality, affordable housing. Today, there exists more than 261 non-profit housing co-ops comprising over 14,500 units in British Columbia alone (CHFBC 2010). In general, the housing co-op model has been successful—whether or not this is due to a unique Canadian conscience and identity that values collectivity and/or European or British policy transfer remains to be answered. Undoubtedly, political parties such as the socially progressive NDP (New Democratic Party)—both federal and provincial—have kept social housing alive and well on the Canadian agenda. Perhaps that is why Dreier and Hulchanski's (1994) chapter is cheekily titled "Social Housing: US Prospect, Canadian Reality."

In the policy literature, co-op housing has also been specifically emphasized in the Canadian arena more frequently and positively versus than in the United States (David Ley 2013; Sousa 2013; Werkle 2011; Dreier and Hulchanski 1994). Sousa's (2013) in-depth account of the conversion of Alexandra Park public housing in Toronto to the Atkinson Housing Co-operative provides one example of recent work focusing on the pursuit of the Canadian cooperative housing dream. In the United States, the financing and development of co-ops is much more manifold. Many cooperatives have been set up as limited equity partnerships with permanent affordability clauses, in some cases necessitating the creation of community land trusts, with relaxed zoning regulations and land

[1] The people who live in the housing are the co-op's members. Amongst themselves, they elect a board of directors to manage the business of

subsidies by locality (Sazama 2000; Abromowitz 1991; Saegert and Benítez 2005). In contrast in Canada, housing cooperatives tend to have deeper subsidies and mixed income provisions (Afredi 1995:11). In addition, most tend to be non-equity cooperatives, based on a proprietary lease or rental occupancy agreement.

In the case of SEFC co-op housing, the co-op units are only affordable because of substantial investment by the City of Vancouver. CHF BC currently runs the housing coop program, and they have a 60-year lease with the City (Hiebert 2014). Issues with renewing leases are on the minds of current residents in nearby False Creek South—another high-density development built in the 1970s. In the False Creek South neighborhood, 5,500 residents live on land leased by the City that is expiring soon. The first set of leases expires in seven years, while the majority of the leases are up on 2036 (Bramham, 22, and 2014 2014). However, overall, the case study of Southeast False Creek illustrates that mixing non-market rental and market rental in the same building is possible—with a 75% to 25% mix.

Hoyt Street Yards, Portland, OR: Horizontal Mixing

The Hoyt Street Yards case study illustrates that horizontal spatial income mixing for affordable housing in new sustainable developments is much more vulnerable in terms of fulfilling production requirements during implementation and phasing. The effectiveness of a horizontal strategy, as compared to vertical mixing strategies, as exemplified below, is that it is less easy to meet a goal when the affordable housing is constructed in a piecemeal manner, as compared to a single development project by a single developer (such as a tower development).

Unfortunately, as of Fall 2014, Hoyt Street Properties had missed its long-term contractual goals for developing affordable housing in the Pearl District, and the Portland Housing Bureau announced that it will force Hoyt Street Properties to sell land to the city (Schmidt 2014a). According to Brad Schmidt (2014b) in *The Oregonian*, of the nearly 2,000 units built under the agreement, only 30 percent are affordable. When another 500 market rate units are constructed to meet build out, that share is expected to drop even lower, to 28 percent. This case demonstrates that if affordable housing is mixed vertically within the same building, it is easier to ensure that it will get built, versus a horizontal phasing strategy. Figure 47 on the next page illustrates how the affordable housing in Hoyt Properties is currently spatially dispersed throughout the development (four current buildings plus the proposed Abigail building, with 126 units, which has not yet been constructed).

The original housing goals for the Hoyt Street Properties were much higher than 28 percent affordable. In 1997, the City ceded development control of the NE Pearl District to Hoyt Street Properties. Under the development agreement, Hoyt Street Properties agreed to a goal of 35% of new condos and apartments built on its 34 acres would be 'affordable' to individuals and families of modest means. These goals were even more aggressive than the 30% social housing goals in Southeast False Creek, as originally the City had preferred a 35%-50% affordable housing mix. As mentioned in Chapter 4, the affordable housing strategy was negotiated in part by the City and the Portland Development Commission through a tax increment financing (TIF) strategy. In return for infrastructure and parks amenities, the development agreement with Hoyt Street Properties included requirements that addressed housing affordability, including that 15% of the housing units must be affordable to households earning 0-15% of the Portland region's Median Family Income

(MF), and 20% of housing units must be affordable to households earning 51%-80% of Portland MFI—for a total of 35% affordable housing ratio for the area.

Figure 47: Affordable Housing units in Hoyt Street Yards in white. The developer, Hoyt Street Properties, did not fulfill the production requirements of 30% affordable housing as of 2014.

Currently, Hoyt Street Properties holds approximately 5.75 acres of vacant land left in its 34 acres hold, county property records show. This land is north of Pettygrove Street, which has a value of $26.7 million. They will need about 258 new affordable units to meet the City's goals. As of April

2015, Portland officials have planned to buy quarter-block parcel from Hoyt Street Properties for $1.3 million, in order to supplement the existing affordable housing and attempt to meet the goals.

The "POOR DOOR" Problem: The Woodwards Building, Vancouver, BC

Although the vertical income mixing within a single building does work, as illustrated by the case of Southeast False Creek, it is critical to note that are exclusionary issues that can come with the design of vertically mixed buildings. Whereas in Southeast False Creek, the non-market rate housing and market rate housing were integrated and managed by a housing cooperative. Another Vancouver project, the Woodwards building's vertical mixing was achieved through an integrated yet permeable campus design strategy. A study of this project reveals the tensions and contested redevelopment process of the project located in the Downtown Eastside (DTES) in Vancouver, British Columbia. The Woodwards building is also an example of vertical income mixing, but this particular model focuses on complete separation between the market rate units and the non-market rate units.

In 1903 Woodwards was a centrally located department store. Famous for its iconic rooftop 'W', and its vibrant Christmas window displays, the store was similar to New York's Macy's in that it featured heavily in Downtown Vancouver's social life. The building also contained a popular cafeteria floor where rich and poor alike congregated. However, with the rise of post-war suburban shopping malls and de-industrialization in the city, urban department stores in Vancouver's central core such as Woodward's suffered dramatic losses in terms of their clientele. In 1993, the store closed and its vacant presence contributed to neighborhood change and deterioration in the DTES. The DTES neighborhood became known for a wide variety of social problems, including drug abuse, homelessness, mental illness and unemployment, some of which still persist today. In 2001, the City of Vancouver acquired the property from the Province of British Columbia, which had previously acquired it, with the intention of redeveloping the property. In 2002, protesters occupied the building and reclaimed it in hopes that attention would be brought to the issue of much needed affordable housing in the neighborhood. This protest, also known as 'Woodsquat', provided the impetus for the city to re-design the building as a mixed-use project with both non-market rate and market rate units, in addition to retail and office space.

In its final form, the Woodward's development has 125 apartments reserved for low-income singles or "the hard to house" (SRO units), and 75 spacious units reserved for families. Eighty percent the family apartments are rented at below-market rates. However, the low-income units are must utilize separate entrances to access units in the same building. Thus, this example brings up the '*poor door'* phenomenon—whereby affordable units are integrated into a building, but there remains some level of segregation and exclusion between residents.

New York City has recently been debating the appropriateness of "poor door" approaches. In 2009, Mayor de Blasio voted for changes to the zoning code in New York that would allow for developers to put affordable apartments in an attached segment of the building (Navarro 2014). The overall goal of this at the time was to increase the number of housing units in the city, but the outcome for many buildings has been completely segregated entrances, as developers mention that the configuration of one building with an attached affordable segment works better when the market-rate units are for sale, as in the case of condos. While New York has always been a city of both 'haves' and 'have-nots', this type of segregation has tapped into the anxiety of many residents, who feel that the city is becoming a livable place only for the wealthy. In most cases, residents are

prevented from using the amenities of the higher-income building, which include gym/recreational and pool spaces, and thus they feel discriminated again(Navarro 2014; Babin 2014). Ultimately, the main issue in New York is whether building more affordable housing units at the risk of discrimination is a worthwhile decision. De Blasio is now in favor of banning the practice going forward, vowing to reverse the trend of segregated development.

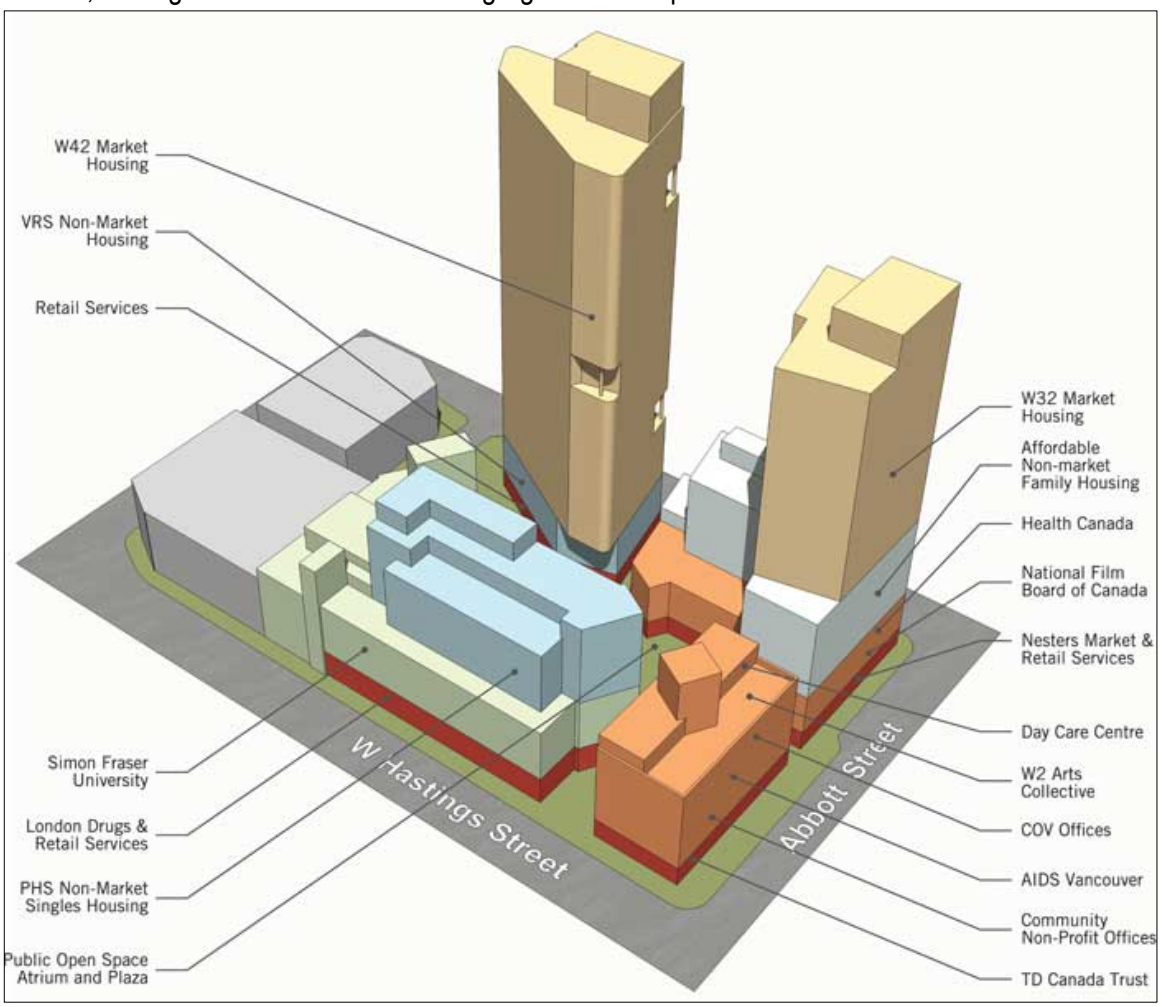


Figure 48: Axonometric illustrating the location of Non-Market versus Market Housing and other multiple uses in the new Woodward's development (Courtesy of Henriquez Partners Architects).

While the Woodward's building does reflect the segregated entrance configuration that is currently occurring in New York (see Figure 47 where non-market housing and market housing are assigned separate building floors), as a redevelopment project, the project architect, Henriquez Partners, utilized the principles of good urban design to allow for social interaction and accessibility outside of the segregated condominium floors (condo residents have special access to recreational facilities and lounge facilities on certain floors and rooftops). One of the major goals was to create attractive public spaces and ensure a level of pedestrian permeability within the complex. People and visitors can move through the Woodwards complex, rather than having to go around it. There is a central street level atrium and courtyard that can be accessed from pathways from all directions, including access from the three streets that border the complex. The courtyard has a glass-covered roof that provides shelter in severe weather and rain (especially for the homeless), but can be retracted in warmer weather(Schwanke 2014).

In addition to permeability and accessible public open space, the complex also contains several other retail services that all residents can access. This includes a pharmacy, a bank, and a grocery store, several restaurants and a flower shop. Importantly, other community facilities are also easily accessible to the Woodwards residents, including a day care center with a rooftop open play area, and dental offices. In addition, several offices are located in the complex, and the Simon Fraser University School (SFU) for the Contemporary Arts also chose to locate its campus here. SFU offers free regular event and coordinates cultural activities that appeal to a wide demographic. Ultimately, it was the addition of SFU as a campus 'anchor tenant' and cultural center that made the project a viable for marketing purposes for the market rate units. In terms of employment, there are also good synergies occurring between the residential and commercial/office spaces. Some of the residents are employed within the retail services and office spaces, including the Single Resident Occupancy (SRO) residents who serve as ushers for events in the SFU school (Schwanke 2014).

This vertical mixing 'campus' model is ultimately less common than horizontal income mixing or 100% affordable housing models given the traditional methods of financing affordable and social housing in the United States and Canada. Because Vancouver is a Charter City, questions regarding increasing the density is at the discretion of the design review board. In addition, when Simon Fraser University agreed to locate their downtown campus at the Woodward's complex, this made it financially feasible for the developer and architect to increase the number of housing units (both market rate and affordable), thus effectively increasing the density of the complex. This particular case study also provides a successful example of a public-private partnership, based on the collaboration between the city, the provincial government, the university, two private sector developers, drugstore and grocery anchors, a number of social housing groups and community groups. As one of the first examples in Canada of mixed income vertical integration, the project is an in important landmark and demonstrates that such income integration can work—but not without conflict or tension or segregation of classes.

DISCUSSION & RECOMMENDATIONS

This chapter has illustrated the complexities involved in spatial income mixing, including the recent policy histories of Hope VI and Choice Neighborhoods. This chapter also highlights the opinions of LEED-ND Accredited Professionals (planners, sustainability consultants, developers and engineers etc.) with respect to spatial income mixing within new LEED-ND development, and finds that many are heavily biased against vertical income mixing (mixing residents of different incomes within the same building). Three case studies are also presented in the chapter; each case represents a different model of spatial income mixing. A vertical mixing model in Southeast False Creek, in Vancouver, BC illustrates that a cooperative-based lease strategy allows for 75%-25% market to non-market or non-market to market mix to occur. The case from Hoyt Street Yards in Portland, Oregon, demonstrates that with horizontal mixing, piecemeal development is likely to occur, and those units that are most vulnerable are the affordable units. The developer in this instance was non-compliant, with little consequence. Finally, the case study of vertical income mixing in the Woodwards building in Downtown Vancouver is presented, and highlights some of the controversial issues with equal access to amenities and discrimination in vertically mixed buildings. The next Chapter proposes further recommendations for the LEED-ND rating system, based on in-depth structured interviews with LEED-ND Accredited Professionals.

CHAPTER 8: FURTHER RECOMMENDATIONS FOR LEED-ND

This chapter expands upon the recommendations briefly mentioned in the previous chapter, presenting more evidence and other further detailed suggestions from in-depth structured interviews with LEED-ND Accredited Professionals (AP). Due to the fact that the interviews were held with LEED-ND accredited experts, their detailed insights into improving the rating system are key findings as their suggestions have the potential to help guide any future LEED-ND rating system reforms. These recommendations do not specifically focus on social equity issues, but instead relate more generally to issues brought up by LEED-ND accredited experts, including criteria related to a diversity of building types, reducing the cost of certification, increasing the flexibility of the system, and increased peer review.

Diversity of Building Types

According to statistical scorecard data aggregation obtained from the USGBC, approximately 68% (26 out of 38) certified LEED-ND v3 2009 projects had acquired the diversity of housing types option for the Housing Types and Affordability Credit—acquiring between 1-3 points for this option.

The LEED-ND v4 Housing Types and Affordability Option 1 credit (USGBC 2014a) states that developments can "*include a sufficient variety of housing sizes and types in the project such that the total variety of planned and existing housing within the project achieves a Simpson Diversity Index score greater than 0.5, using the housing categories below. Projects of less than 125 acres (50.5 hectares) may calculate the Simpson Diversity Index for the area within ¼ mile (400 meters) of the project's geographic center. The Simpson Diversity Index calculates the probability that any two randomly selected dwelling units in a project will be of a different type.*

Equation 1: LEED-ND NPDC4 Option 1: Simpson Diversity Index

$$\textbf{Score} = 1 - \sum (n/N)^2$$

Where
n = the total number of dwelling units in a single category, and
N = the total number of dwelling units in all categories.

Table 15: LEED-ND NPDC4 Option 1: Points for Housing Diversity

Simpson Diversity Index score	Points
> 0.5 to < 0.6	1
≥ 0.6 to < 0.7	2
≥ 0.7	3

Housing categories are defined by the dwelling unit's net floor area.

Table 16: LEED-ND NPDC4 Option 1: Housing Categories

Type	Square feet	Square meters
Detached residential, large	> 1,250	> 116
Detached residential, small	≤ 1,250	≤ 116
Duplex or townhouse, large	> 1,250	> 116
Duplex or townhouse, small	≤ 1,250	≤ 116
Dwelling unit in multiunit building with no elevator, large	> 1,250	> 116
Dwelling unit in multiunit building with no elevator, medium	> 750 to ≤ 1,250	> 70 to ≤ 116
Dwelling unit in multiunit building with no elevator, small	≤ 750	≤ 70
Dwelling unit in multiunit building with elevator, 4 stories or fewer, large	> 1,250	> 116
Dwelling unit in multiunit building with elevator, 4 stories or fewer, medium	> 750 to ≤ 1,250	> 70 to ≤ 116
Dwelling unit in multiunit building with elevator, 4 stories or fewer, small	≤ 750	≤ 70
Dwelling unit in multiunit building with elevator, 5 to 8 stories, large	> 1,250	> 116
Dwelling unit in multiunit building with elevator, 5 to 8 stories, medium	> 750 to ≤ 1,250	> 70 to ≤ 116
Dwelling unit in multiunit building with elevator, 5 to 8 stories, small	≤ 750	≤ 70
Dwelling unit in multiunit building with elevator, 9 stories or more, large	> 1,250	> 116
Dwelling unit in multiunit building with elevator, 9 stories or more, medium	> 750 to ≤ 1,250	> 70 to ≤ 116
Dwelling unit in multiunit building with elevator, 9 stories or more, small	≤ 750	≤ 70
Live-work space, large	> 1,250	> 116
Live-work space, small	≤ 1,250	≤ 116
Accessory dwelling unit, large	> 1,250	> 116
Accessory dwelling unit, small	≤ 1,250	≤ 116

For the purposes of this credit, townhouse and live-work units may have individual ground-level entrances or be within a multiunit or mixed-use building. Double counting is prohibited; each dwelling may be classified in only one category. The number of stories in a building is inclusive of the ground floor regardless of its use.

Given that that Option 1 (Diversity of Housing Types) seems easier to achieve than Option 2 (Affordable Housing), it could potentially be strengthened and improved within the LEED-ND rating system. One LEED-ND AP developer from Quebec cited an increased diversity of housing types as a key recommendation for LEED-ND.

> *"Now coming to the typology of diversity. I think that is key, and there aren't enough credits for that. It is the essence of the LEED-ND and sustainable communities in my mind. Diversity of typologies, diversity of uses, diversity of your rents. So that is what really it makes it more interesting. We have some diversity built into our project—a diversity of typology and a diversity of uses, so a mixture of commercial and residential. Otherwise it would be a...how do you call it…a 'dormitory community'* [bedroom community], *and that is not what we want—we want an active community.*
>
> *I want a typology where we have townhouses, mid-rises and high-rises and in high rises we have different sizes, big units and small units, 3 bedrooms in the high rises, which goes contrary to what you think, but that is where the demand is for larger spaces and the mid-rises have smaller units—more studio, 1 bedrooms and 2 bedrooms where the younger clientele are. So you have the more mature clientele in the high rises, which actually have a bit of both, where they will have the older kids that are about to leave the nest that are still there—or boomerang kids—you know the ones that never leave. They leave and they figure out that I was doing really well at home, and I am here to go back, I had my meals, my laundry at home, a 5 star hotel. So we have the young families that are settling into condominiums now, we have the medium-aged families that are buying the townhouses. Then we have the more mature families which are in the high rises mixed with single people, couples without kids and all sorts of different people. The diversity typology is very important and very desirable."*

Ultimately, increasing the diversity of housing types within a neighborhood is important, as it allows for multiple building types, unit sizes and configurations. For people of different incomes, an increased variation in building types, unit types and their configuration allows for more housing choice.

Reducing the Certification Cost

Most firms consisting of LEED-ND Accredited Professionals, developers and engineers noted the cost prohibitive nature of LEED-ND. Certification is generally expensive, and the fees are significant, generally hovering around $20,000 US in total including registration. The certification cost is currently as follows: registration ($1500/project), Smart Location and Linkage (SLL) Prerequisite Review (optional, $2,250), Expedited review for SLL (reduce from 20-25 business days to 10-12, available based on GBCI review capacity). Once passed the optional pre-requisite review, there is the cost of the Initial Stage Review ($18,000). The Initial Stage Review may be expedited for $25,000. Subsequent Stages of review are $10,000, unless you want an expedited review, which is $15,000. If the project is over 20 acres for the Initial Stage or any Subsequent

Stage, then it costs an additional $350/acre. If you are interested in appealing a credit it is $500/credit, and again you may expedite the credit appeal process by paying extra $500 on top of the $500 credit appeal fee. The fees cover the GBCI cost of paying their employees, review certification and appeals, and for updating the LEED-ND rating system. The GBCI also occasionally does credit interpretation requests.

The above does not include the fees required to hire a LEED-ND Accredited Professional (AP) e.g. a sustainability consultant or an urban planning firm or architecture firm, which are another $30,000-$60,000 US, depending on the size (# of units) of the project. The LEED-ND Accredited Professionals use GIS and AutoCAD to analyze the 1) site plans, 2) landscape plans and 3) detailed construction documents, which the developer usually provides. So the total costs of certification, if you do not have an accredited LEED-ND professional in-house, can be between $50,000-$80,000.

On LEED-ND consultant mentioned that for LEED-ND projects that are smaller than 2 or 3 buildings or less than 200 units, it is not worth to do LEED-ND. One engineer in Sacramento illustrated an example of the financial barriers of the certification fees for his firm:

> *"So one of the projects we were working on was a 30 unit affordable housing project. So they were looking at LEED-ND and certified for homes. And other more like energy efficiency and net zero energy approach. And so the registration and certification fees did end up being quite substantial. It kind of panned out that it made more sense to go with another route. I think they might have ended up going to LEED for homes, and some energy efficiency measures. LEED-ND ended up being too much.*
>
> *We looked into the affordable housing grant from the Bank of America. Yeah the Affordable Green Neighborhoods Grants. Had we pursued and got the grant that would have tilted the decision-making process. I can't remember why they didn't pursue that. But that was one of the reasons why they chose not to do it, because of the certification and registration fees. I was talking to the USGBC about this issue, and talking to them about it trying to make the case re these smaller projects like these 30 units or less, it kind of was a bigger amount to absorb versus a larger affordable housing complex with a few hundreds. Where per unit if you split that up on a similar site or acreage of land to develop on, if you average the cost out, then it becomes much more manageable. Although USGBC understood that at the time, their pricing structure was kind of the way it was. So I was saying it could be based on a per unit measure.*

Another sustainability consultant in Sacramento also mentioned the initial cost hurdle of LEED-ND accreditation:

> *"I would say still one of the biggest factors is the initial cost hurdle. You know, 19,000 bucks is a big number for smaller projects to swallow, in addition to my consulting fee. So, I mean that is why that grant [affordable green neighborhoods] is especially effective. That cost item is the single biggest one. The registration is 1500, and then the certification cost is 18 grand for under 20 acres. That is a heartfelt flaw. It makes it hard for us to charge the value of our services, without a really big client that has deep pockets. The affordable guys especially are run on really tight margins—that makes it tough."*

One international sustainability consultant mentioned that her clients were turned off by the overall cost once the accreditation costs were brought to their attention:

> *"Yeah, well I think that reducing the cost of certification overall—affordable housing or not—would make quite a big difference. Generally speaking, I am finding that clients are interested in neighborhood development, when we try to sell it to them, and they get kind of excited. And then when we actually go through the first phase of work and figure out how much money they would have to spend in order to make certification…*
>
> *Broadly speaking we are losing opportunities because it is too expensive. The fee itself is high, but the, you know, you have to do energy modeling for 50 buildings. That one is just crazy. Try and sell that to somebody in Brazil, that's not happening they simply can't afford it. But then that is one part of your question."*

One LEED-ND architect from Philadelphia stated that the high cost of fees (approximately $20,000 for the certification process) was an impediment from developers:

> *I think they are high enough that they discourage a lot of people from even considering. Especially LEED-ND, as it is probably the most expensive. I think there are many developers that look at that fee and can't see anything about the LEED certification that is going to make that worth their while. Unless there is some a major piece of funding that requires it that is bigger than the fee is going to be.*
>
> *And I think to a certain extent that is true with all the versions of LEED. With the others the I think a lot of the times a big chunk of the expense is in the changes you are actually making for the project, that make the project more expensive, or increased design fees and consultant fees in order to capture all the data you need for the application itself. Between those two things, that is what makes it a tough decision for developers under the other categories. But I think the difference in the magnitude of fees for LEED-ND—the fee itself often stops people before they even start looking into what the consultant fees are going to be, or what the difference is going to be in the cost for their project.*

The high cost of LEED-ND seemed obvious to one consultant, who suggested that a total cost of $5,000 or $2500 would be more appropriate, versus a $20,000:

> *The LEED-ND certification is too expensive, and everyone knows it. And so….but the better answer is there isn't an affordable entry level for LEED-ND. You pay $1500 to sign up, and then you have to pay at least 20 grand to get certified. Whether that is big or little relative to the size of your project, kind of doesn't matter, it is still 20 grand. People know that they can do something else with 20,000.*
>
> *There needs to be some other way to enable people to get the value out of LEED-ND. You know like a third party verification of adopting best practices, that doesn't require the whole you know thorough credit-by-credit that comes with certification. You know they do something like this with the SLO credits. But that is like they do the pre-requisite review and SLO. But that is just background conditions. I mean that basically says, "You are not*

doing this wrong. Your assumptions about these things are not wrong." But it doesn't say anything about your project. It just says, we agree that you are not close enough to a bike path. There has to be some other high-level scan that says, yeah, this is credible.

You know, that, an affordable housing developer could then use as leverage when they go into the City, you know when they are dealing with the NIMBYs and and say, you know, we are building more affordable housing here for low-income families, and we have a great property manager and great architect. But also, this national entity has validated that this is sustainable and is consistent with your general plan, SB375, you know the Climate Protection Act and the Sustainable Communities Strategies. You know this thing you are supposed to be making, this is it, and you have verified it. I mean if it was something that cost $5,000 or $2500 on that level. Then I think LEED-ND would become much more accessible. They are kind of shooting themselves in the foot by being, you know, so thorough. It is all-or-nothing. There is no way to start in and say, yeah, you are on the right track, and what you are doing is consistent.

One architect proposed a specific solution for reducing the cost of certification, specifically at Stage III of the certification process, to ensure that development agreements and entitlements were in place before discounts were given:

"Reducing the cost of LEED certification is interesting….I think that would probably have to be on the Stage III certification because you want to make sure it was actually built. If you did it on the upfront you could SAY it was coming, um, and maybe by Phase II there was enough to say we will give you a 5% discount but before you get your final Phase II certification level we need to see that the regulatory development agreement or development is in place. It starts getting muddied…

So maybe the reduced cost is on the Stage III certification when you know it is built. And you could say you get 10% here or whatever. That would be interesting. LEED certification the actual amount you pay to USGBC is not that much…actually I take that back…to do a building is not that expensive. I mean clients always like it when we give them money back. It's at least an incentive…but is it going to cover the cost of building affordable housing? No. Even if it is $20,000 and you knock of 10%, you get 2 grand back, which is still money, it is still good stuff but it is not going to pay for affordable housing. 2 grand isn't make somebody say "oh now I am going to put it in my project."

Another architect from Portland mentioned that due to the high cost of certification, they often use LEED-ND as a guideline but do not go after the certification:

You know you have to, what everyone weighs it against. Right now, the cost is outweighing the benefits. That is based on the economics right now. I am not just talking about developers, I am also seeing that with higher-ed. The highest end high tech companies that we do work for. If we use that as a guideline as an equivalent but we don't have to go after the actual certification—the paperwork and the fees.

One suggestion came from a larger developer that LEED-ND should create some web-based tools that would decrease the cost of LEED-ND certification for smaller developers:

"Ummm, yeah the certification process is highly GIS-based. And I think if USGBC can develop. And then it is fine for someone like us…We have 4 or 5 staff members who are GIS savvy. I think if USGBC wants to encourage smaller developers to apply for LEED-ND or to think of their project as LEED-ND. Developing some tools that don't involve having to spend the money and training to find somebody who can do ARC, will have a bigger impact more so than reducing the fees.

Right now it's not the fees inclusive of the cost, it is the person you are paying to run all that GIS. If they can create some web-based tools, or some kind of program to accommodate the submittal preparation, I think that would help significantly. That is where the technical expertise is lacking. For again, for a smaller developer, for a small affordable housing developer or even for a small market rate developer who would otherwise be interested in using it as a marketing tool and a planning tool."

Complexity & Rigidity of the Rating System

Despite general consensus that the rating system was one of the most aspirational of the LEED rating systems, consultants also noted that the rating system as the most difficult and complex of the rating systems to navigate, in addition to having a *longue durée*. One architect stated that because of the complexity of the system, it was difficult to guide a client through the entire process, and see the development built in its entirety:

I will also say it is one of the most detailed, and intricate and difficult of the rating systems. Because, yes it is still 110 points. There is one credit that has 18 different paths. There are a lot of credits with a lot of different paths you can take. It is difficult to encourage a client and say I can take you through this process. I understand why, it is the most obtuse of the rating systems. Even the rating guide is 100 more pages than the BD&C guide. There's good stuff, but it is challenging….

And the projects take so long to do. Project teams may or may not stay together for five years. I mean, that I see is the other challenge. Is that you may start off with a team that gets it, but the time the project is in Phase I or Phase II that could be 10 years out and Phase III could be a 20 year build out. And when the developer may be invested for that long, you hope and assume, they may sell off pieces of it. There are all sorts of things. It almost seems like the campus approach is…maybe little easier some times. Because it is individual building certification but you have common site credits. So if you do a good job on the site, then all of those buildings get to count those credits. We will see. Its an area to watch, and I think it is a good thing. It is a difficult thing to use. In theory its awesome, but in practice it is daunting."

One consultant from Colorado suggested that another common hurdle within LEED-ND was the rigidity and specificity of the credits:

The other barrier that is common to most LEED rating systems is just, um, the rigidity of some of the credits. That you can just get kicked out…. I just recently lost one of the affordable housing grants because of the silly part of the walkable streets, and I ended up getting conflicting information on from the USGBC. I love the guys there, but they were still

developing it as it is a nuanced question. At the end of the day though there weren't enough buildings facing the street because there was a corner condition with townhomes where the side faced. Anyway. So some of the ticky tacky pieces that can totally disqualify a project are beyond annoying and need some revision.

Um, I'm kind of embarrassed now because don't think many of my comments were incorporated to the USGBC, but USGBC did ask me to review their Version 4.0 of LEED-ND, as I made a number of comments but they kind of went into a black hole, so, which is a bit unfortunate. Overall it is a good system, but when you get caught by those it is rough. That one was a pre-requisite. Some of the pre-requisites, especially the walkable streets one can really…. They had some problems with the pilot, the proximity to water issues that they fixed back in 2009. That also ended up knocking another project out of commission back in the day. It would be great if…. There are only so many people who are deep into the weeds with these projects. So a little bit more reaching out and how to tweak it would make the system better. There are very few elements it doesn't include from a comprehensive overall neighborhood planning and design perspective. I continue to proselytize and in general I love it is a few minor tweaks would be nice to get resolved.

Thus, some inherent flexibility in the system would add to the utility of the rating system. If professionals are losing grants to develop affordable housing due to conflicting information, increased peer review and oversight may ameliorate the issue of having a single third party veto project certification.

Increased Peer Review

One elegant suggestion that was made by a developer was to incorporate peer review into the LEED-ND accreditation process. Given the fact that a for-profit corporation manages LEED-ND, peer-review would help balance competing market interests and to a certain extent help keep projects honest:

"I think a way to cut-down on the bureaucracy, would be to have it more so peer-reviewed, than reviewed by than the GBCI. It just seems that…I've been doing this a long time, comparatively for the LEED system, for 14 years, so right around when it started. So it just seems somewhat subjective, and if we are going to have subjectivity we should have review by our peers, than our off-governing bodies so-to-speak. It would also potentially cut down on lag times, and the burden on the GBCI, so. That's just my opinion. We do peer review for all sorts of things, why not do it for sustainability."

As aforementioned above, the bureaucratic nature of the current USGBC review process slows the certification process down. Increased peer review would be a helpful and time saving addition for LEED-ND review.

Where LEED-ND Excels

Despite the above suggestions, the LEED-ND rating system was generally regarded as a positive contribution to world of sustainable urban planning. In one example, a consultant proposed that LEED-ND has a lot of clout with NIMBYs, as it forces them to challenge a nationally recognized standard, which is hard to do:

I mean this is this distinction, when Mercy is going forward to the San Francisco Planning Commission and Bridge is going forward with Potrero, you know, in saying, not only are we preserving units and adding units, we are also certified with this green standard, this helped. They were able to say, in additional to all the other stuff, "we are pursuing this national standard for sustainability." And for those planning commissioners who were interested in that they were like "awesome, this is fantastic." You know it helps in that regard, but you know they want to approve those projects because they want to move the redevelopment of the housing along.

I haven't seen it really work in the market rate, infill development, that you know has seen some resistance because it is slightly higher density that what is around there as a tool to battle opposition to change. I do know that being a LEED certified neighborhood does help sort of combat the NIMBY argument. Because you can say well, this is helping poor families and it is sustainable in protecting the environment. So what exactly is your problem—is it just self-interest…?

Besides the added benefit of combatting NIMBYs, it was lauded as having a widespread positive impact in urban planning by one architect:

I think it is the most aspirational of the rating systems. I think it can cause the most good. If you have good planning, then you have good buildings. I mean, having people get out of their cars and walk, is one of the easiest ways to increase public health and increase community ties. There are so many things that come out of good planning that are sustainable strategies that reduce energy and water consumption. It is encouraging good planning principles. If you are an urban planner these are the things you learn in school, but these are not necessarily what happen in practice and reality.

DISCUSSION & RECOMMENDATIONS

Overall, this chapter has examined further recommendations for improving LEED-ND, based upon the opinion of LEED-ND Accredited Professionals. The recommendations include reducing the LEED-ND certification and fees, so that it is possible for smaller developers and firms to become involved in the certification process and maintain their clients. A fee per developable unit is proposed to remedy this problem, so that larger developments with a higher number of units would be charged a larger certification fee compared to smaller developments with fewer units. In addition, increased peer review of the rating system requirements has also been proposed, to provide more oversight and reduce the overall certification costs, and to reduce the system's bureaucracy. There has also been a call for LEED-ND to introduce more GIS-web based tools, a new type of platform that could be easily accessed, versus relying on ArcGIS to (the cost of ArcGIS licenses are often prohibitive for small firms, and developers or consultants may not have the technological capability). The next chapter of the dissertation provides an overall summary and conclusions from the research findings. It also situates the contribution of the dissertation within the literature, and examines new areas of future research that can have an impact for affordable housing provision from both a design and policy perspective. Key findings are presented, the specific policy implications, and recommendations are made for the rating system itself, developers, the public sector and future academic research.

CHAPTER 9: CONCLUSIONS

OVERVIEW

This dissertation has focused on livability as specific lens within the greater topic of sustainability. This research examines the LEED-ND rating system as a neighborhood scale rating system for sustainable design that has the potential to fulfill resident's livability needs, but finds the rating system sorely lacking in addressing the social equity aspects of sustainability, as illuminated through a post-occupancy evaluation of residents in two LEED-ND neighborhoods in the Pacific Northwest. Scholars have focused on affordable housing specifically as a "sustainability strategy"(Gurstein 2012), arguing that a failure to provide affordable housing will mean increased transportation costs, GHG emissions, as families seek affordable housing further away from the central city. There are several general improvements that could be made to the rating system in this respect, which are discussed below. In addition, in order to sway potential urbanites away from suburbia, there are several specific recommendations that are made so that new sustainable developments in urban areas can better address the livability needs of current and potential suburbanites.

This dissertation has also focused specifically on the affordable housing gap in LEED-ND. Statistical scorecard evidence from the "Housing Types and Affordability" credit under the Neighborhood Pattern and Design category illustrates that only 40% of LEED-ND projects are currently incorporating affordable housing into their developments. In addition, only 29% of LEED-ND projects are incorporating both a diversity of housing types and affordable housing into their projects. However, 68% are incorporating a greater diversity of housing types into their neighborhoods, illustrating that is easier to capture a greater range of variation in building type rather than price.

In addition to affordable housing, this study has examined recent trends in income mixing policy as it relates to the spatial design of neighborhoods. The two are often conceived of as separate—income mixing as a broad public policy endeavor, while design occupies a narrow space entrusted architects and designers. In truth, there needs to be more discussion about how the two interact and overlap, given that geographic mobility had until recently become an important praxis in federal policy. Although it is difficult to define 'which comes first: policy or design?', it is clear that they mutually affect one another. While the relationship hasn't always been a positive one, more dialogue is needed that bridges both fields.

This chapter focuses on how this dissertation has made a significant contribution to the literature, and where it positions itself within the different disciplines of architecture and urban planning. This chapter also provides a summary of key findings from the research, and offers policy implications complete with recommendations for future improvement—both internal feedback for the rating system, and external recommendations.

CONTRIBUTIONS TO THE LITERATURE

This research contributes to the body of livability research in urban planning and urban design. It offers findings from the first ever post-occupancy evaluation (POE) of a LEED-ND neighborhood. It

thus contributes to the body of scholarly research that focuses on why POE is critical for rating systems in terms of human comfort and livability (Fraker 2013; de Dear and Brager 1998).

Specifically, in terms of urban design theory, this literature had contributed to the Berkeley School body of livability theory in urban design, including those works by Whyte (1980), Appleyard & Lintell (1972a), Bosselmann, Macdonald & Kronemeyer (1999), Macdonald (2005), Bosselmann (2008a), and Gehl (2010), and Fraker (2013). In addition, this work falls in line with other studies that focus mainly on LEED as a sustainable neighborhood rating system, including the work by Garde (2009), Ewing (2013), Sharifi & Muryama (2013b), Clark et al (2013) and Boeing et al(2014).This research also contributes to the body of research that focuses more generally on sustainable neighborhoods and rating systems. This research arena includes works by Beatley (2000), Girling and Kellet (2005), Erickson (2006), Farr (2008), and Mapes & Wolch (2010), and Godschalk (2013).

Since this dissertation also falls within the geographic constraints of the Pacific Northwest (Metropolitan Vancouver, British Columbia and Metropolitan Portland, Oregon) this research falls under Canadian urban design policy & process authors including Punter (2003; 1999; 2002) and Macdonald (2008). It is similar to cross-case comparison studies such as those done by Podobnik (2002; 2011). Additionally, it offers a critique of LEED-ND and social equity, in a similar tradition in which other scholars have critiqued New Urbanism Talen (2002; 2006; 1999), Johnson and Talen (2008), Ellis (2002), Day (2003), and Trudeau and Malloy (2011).

SUMMARY OF KEY FINDINGS & POLICY RECOMMENDATIONS

Findings & Recommendation on Livability

This section summarizes the findings from the dissertation, examines the policy implications of these findings, and provides recommendations. Some of the recommendations are particular to the LEED-ND rating system, while others are meant for the public, private and academic sectors.

- *1) **Finding**: Little to no post-occupancy evaluation is conducted for LEED-ND projects.*
    - **Policy Implication:** LEED-ND has received a lot of 'hype' recently as it is a well-marketed product, but few studies have tested the success of such neighborhoods by measuring resident satisfaction. Planners need to be aware of the potential pitfalls of the rating system, given that it lacks tools for evaluating the social equity aspects of sustainable neighborhoods
        - **Rating System Recommendation:** It is recommended that LEED-ND incorporate a post-occupancy evaluation, so that the rating system can evaluate resident satisfaction and evolve from a prescriptive-based system into a performance-based system. This should be done a least a year out from build-out, and then every three to five years (University of Westminster 2006).

- *2) **Finding:** Demographic analysis from this study suggests that new sustainable neighborhoods in the Pacific Northwest are not very diverse in terms of race, educational attainment and income*.

    - **Policy Implications:** Current means of encouraging the development of sustainable neighborhoods may not result in diverse communities that include people of color, lower income people, or less educated people. New mechanisms need to be created to address this inequity problem.

        - **Rating System Recommendation:** There is no easy solution to this dilemma. However, one step in ensuring a diverse mix of residents in new developments is by encouraging or requiring the provision of affordable housing within the neighborhood, and supporting a diverse mix of housing types.

- *3) **Finding**: The majority of respondents in both LEED-ND and non-LEED neighborhoods believe that owning a vehicle is important, and the majority own at least one vehicle. In addition, the majority of residents in each neighborhood (except Hoyt Yards, in the Pearl District in Portland, OR), drives as their primary mode of transportation.*

    - **Policy Implications:** VMT (and by correlation GHG emissions) in developments marketed as sustainable neighborhoods may not decrease unless a) vehicle ownership is discouraged or b) other forms of sustainable transportation are encouraged.

        - **Rating System Recommendation:** Create a credit related to parking ratios and the overall number of vehicle parking spaces in new development. For example, require a minimum parking ratio (0.5) in LEED-ND neighborhoods so that the neighborhood is virtually car-free. Cities in Europe have been known to do this (ex. Vauban in Freiberg, Germany).

        - **Public Sector Recommendation:** Strengthen existing transit facilities and create shorter blocks so that people can walk to transit. The Hoyt Street Yards LEED-ND development was the only case study where walking is the #1 mode choice.

- 4) ***Finding:** The majority of respondents in all neighborhoods stated that safety from crime was their number one livability concern*.

    - **Policy Implications:** Residents want to live in neighborhoods that feel safe and secure. People will be reluctant to live in new developments if they don't have the perception that the neighborhood is safe.

        - **Rating System Recommendation**: Extensively incorporate more Crime Prevention Through Environmental Design (CPTED) principles into the

Walkable Streets credit. Encourage LEED consultants and architects to provide design guidelines for new sustainable development, especially in urban areas.

- 5) ***Finding****: Respondents of suburban neighborhoods value interior privacy within their units, views of trees and natural landscapes, and a sense of community.*

    - **Policy Implications:** In order to prevent continuing urban sprawl, developers, planners and designers need to attract suburban residents back to core urban areas and corridors. Credits or design guidelines can be created to lure would-be suburbanites back to the city by promoting greater privacy, internal open areas, and other common spaces.

        - **Rating System Recommendation:** Add a credit to NPD c1 for "views to nature," for example 'Provide direct views from windows to trees and natural landscapes when possible, and orient buildings towards key vistas and natural landscapes.'

        - **Rating System Recommendation**: Ensure that all ground floor units are raised 48-72 inches above street level, by incorporating this into the credits

        - **Rating System Recommendation**: Add a credit related to the provision of private and semi-private space (i.e. provide 75 square feet of private outdoor open space per unit). Encourage balconies and rooftop patios.

        - **Rating System Recommendation:** Support the provision of community amenities through mandatory Community Amenity Contributions (CACs in Canada) and Community Benefit Agreements (CBAs), by including this in the credits

Findings on Affordable Housing

- *1) **Finding:** Only 40% of LEED-ND projects have incorporated affordable housing in to the development.*

    - **Policy implications:** LEED-ND does not adequately support income integration as it claims to do so. LEED-ND developments and new sustainable developments will not promote social, cultural and economic diversity if the affordable housing credit is so easily ignored and marginalized by developers.

        - **Rating System Recommendation:** Make the LEED-ND affordable housing credit mandatory or a pre-requisite for certification.

        - **Rating System Recommendation**: Incentivize the LEED-ND affordable housing credit by making it worth more points.

        - **Rating System Recommendation:** Create extra credits and points for deep discounting for low-income households, ex. reducing energy use in affordable housing units, and locating the affordable housing close to the transit.

        - **Public Sector Recommendation:** Integrate LEED-ND Smart Location and Linkage (SLL) and other location effiency pre-requisites into citywide ArcGIS. Utilize the parameters to select parcels and create a parcel inventory of sites that can be pre-selected and streamlined for new LEED-ND development.

        - **Public sector recommendation:** Create zoning overlays for new development based on the LEED-ND SLL parcel inventory.

        - **Public sector recommendation:** While LEED-ND remains a weak tool for the provision of affordable housing, rely on citywide inclusionary zoning mandates and density bonuses to increase the supply of affordable housing.

- *2) **Finding**: While 26% of LEED-ND projects are choosing to ignore both the mix of housing types and the affordable housing credit, 68% of projects have earned the diversity of housing types credit.*

    - **Policy Implications:** While the affordable housing points are currently not attractive for many developers, a mix of housing types is ultimately more obtainable. An increased range of housing types and units leads to a greater mix of residents.

        - **Rating system recommendation**: Include points for buildings that fully integrate income levels in the same building—'vertical mixing', rather than horizontal mixing, which has the potential to isolate and segregate units

        - **Rating system recommendation:** Support co-operative housing models that often have an emphasis on income-mixing, by creating a credit oriented towards cooperative activities. Such models often have supportive services and an active community-based group that runs social programs.

        - **Academic sector recommendation**: Further international research in the livability of small units, including accessory dwelling units (ADUs) and microunits

        - **Academic sector recommendation**: Further research into vertical mixing of low-income and high-income residents in the same building

        - **Academic sector recommendation**: Further research into the tensions and inequities caused by the 'poor door' problem. How can equal access to amenities be ensured?

- *3) **Finding**: While registering a LEED-ND project costs only a few thousand dollars, certifying a project is a large financial commitment ($20,000 to certify through the USGBC, not including LEED-ND AP consulting fees, which can run an additional $30,000-$60,000, depending on the project size).*

    - **Policy Implications:** With such high certification and consulting fees, and anecdotal evidence from many interviewees noting that the significant fees have scared off clients, it is likely that smaller projects (under 200 units), will not seek certification due to high costs. In some cases, developers will cherry-pick buildings for LEED-BD&C (Building Design and Construction) instead of seeking out the full LEED-ND certification.

        - **Rating system recommendation:** Instead of charging a flat certification fee, the fee should be based on the number of units in the proposed development.

- *4) **Finding:** The rigidity and specificity of the credits often discourages developers from continuing certification of a project. The lengthy timeframe involved in certification due to tacking back and forth with the USGBC also potentially slows the projects down.*

    - **Policy implications**: Consultants and developers become discouraged when the USGBC has complete control over the certification process and the final say in project disqualification.

        - **Rating system recommendation:** Greater peer review has been proposed to provide third party oversight on the certification process. In fact, the USGBC currently draws on planning practitioners and developers to inform its latest checklist (version 4) for the rating system. A blind peer review could be incorporated into the process, either to reduce costs, and/or create more objectivity in the rating system.

In sum, LEED-ND as a rating system has become the gold standard for sustainable neighborhood development across North America. The introduction of LEED-ND into the housing and development market has overall positive ramifications for sustainability, as the rating system has pushed the market toward 'green' development at a larger scale.

Despite the mainly positive reception of LEED-ND by planning professionals and LEED-ND's well-intentioned goals, it does not mean that there is no room for improvement in the rating system. LEED-ND certainly is not the ultimate guide to ensuring a livable or socially sustainable neighborhood. This dissertation has examined the successes, the weaknesses and challenges that the LEED-ND rating system currently faces, focusing on livability and

social equity factors currently missing from the rating system. Findings reveal that there are improvements that can be both internally within the rating system, and additional recommendations are made for the public sector, private sector and within academia. Ultimately, a broader range of strategies is needed to address current inequities in affordable housing provision in new sustainable development, and a range of livability factors can be better incorporated into the rating system itself.

FUTURE RESEARCH

New Affordable Housing Types

In the end, this dissertation research points toward directions for future research to address gaps in affordable housing provision. Further research needs to be done on vertical income mixing, laneway housing, and microunits as potential models that have the potential to be put to greater use in urban planning practice

Vertical Income Mixing

As illustrated in Chapter 7, vertical income mixing is a recent form affordable housing development that seeks to integrate units into the same building, or an attached building. While this has increased the overall amount of affordable housing units being built in cities such as New York, there are ethical design issues that have not yet been completely resolved. Many of these new podium and tower-type buildings have configured their plans so that the lower-income residents must use a separate entrance (usually renters), while those who own luxury or higher-end condominiums have a different, upscale lobby and access to a greater range of amenities. It remains to be seen if this model will continue, given that it has received negative attention in the media recently (Babin 2014; Navarro 2014). Despite discrimination issues with vertical income mixing, Southeast False Creek's cooperative housing model, whereby there is a mix of both market rate renters and low-income renters, illustrates increased building integration. In addition, the Woodwards building in Vancouver highlights how vertical income mixing is financially feasible, given its campus anchor configuration. There are opportunities for new research in this area, which can be explored.

Future Research Questions:

- Does the "poor door" problem have a negative influence on resident satisfaction among low-income residents? Do low-income residents feel discriminated against?
- What types of regulation are needed to ensure that the "poor door" problem does not become standard practice?
- Does a central location, access to open spaces, amenities and services provide a trade-off for living in a building with segregated entrances?
- How can amenities and services be clustered around vertical income-mixing typologies, so that residents of all income groups have access to meet their daily needs?

Accessory Dwelling Units (ADUs)

Accessory dwelling units (ADUs) are an interesting housing typology, and they have historic origins that date back several centuries. Coach houses, or carriage houses, are named after a popular form of housing in the United Kingdom, and originate from multi-purpose stables in the 17th century (McManus 2004). Often these houses existed off a cobbled mew, in which the first storey of the secondary building housed the horses, complete with stalls and storage for hay. Above, existed the living quarters for the groom, the stable hands and the coachman (McManus 2004). Various iterations developed over time, and more recent terms have come into use including 'in-law units', 'granny flats' or 'laneway housing.' Whereas laneway houses and coach houses refers to a specific type of unit backing on to an alleyway usually above or adjacent to a garage, secondary dwelling units and accessory dwelling units refer to a more general type of unit where no alleyway is present. Accessory dwelling units are usually smaller, subordinate units to the main house on the property, they also have a separate exterior entrance and they are equipped with their own bathroom and kitchen(Wegmann and Nemirow 2011). They can also exist within the envelope of the main house, or they can be a separate structure, either detached or attached from the primary house on the property (Wegmann and Nemirow 2011).

Figure 49: Photograph of a small Accessory Dwelling Unit (ADU). Courtesy of New Avenue Homes.

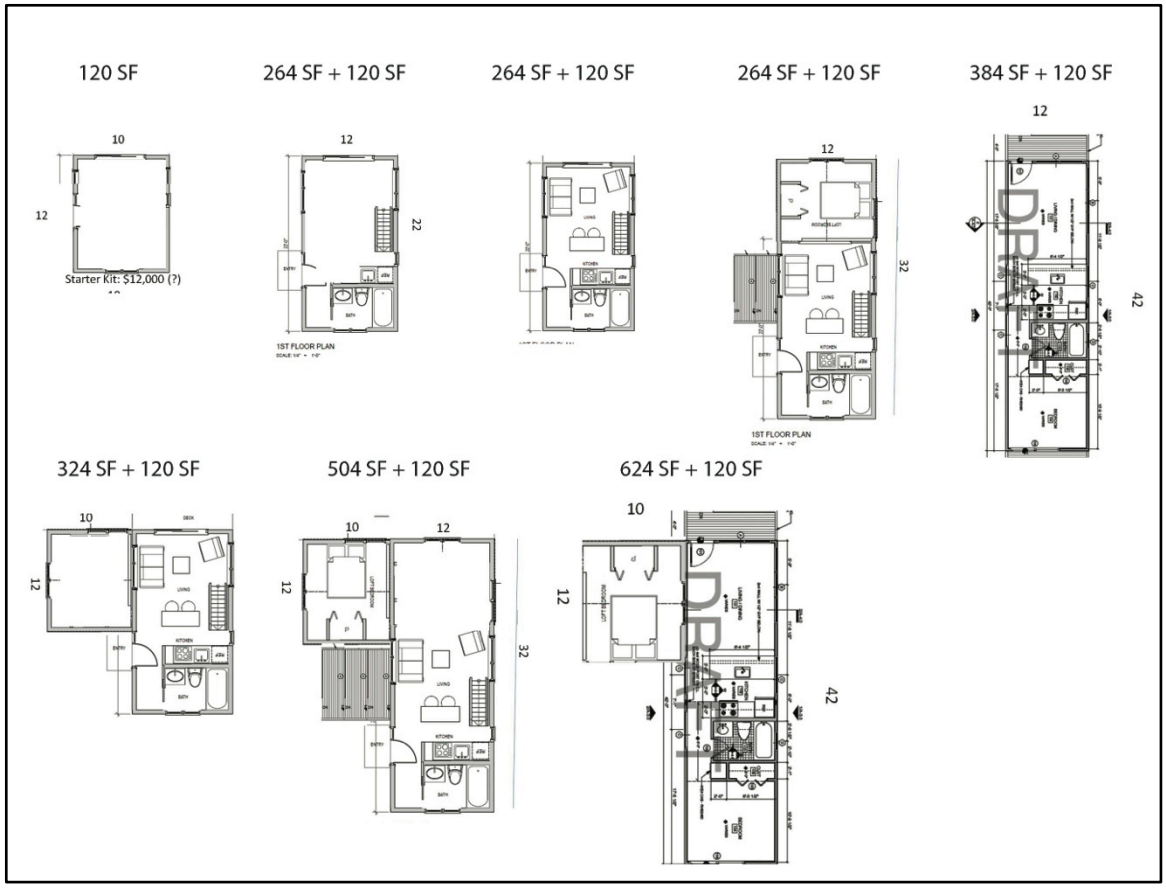


Figure 50: Range of architectural drawings for ADUs done by a firm in Berkeley. Most floor plans have an extra 120 square foot sleeping space above in a loft. Courtesy of New Avenue Homes, Inc

In some cities, secondary dwelling units has been a thriving business, where owners have turned their garages into accessory dwelling units and have rented them out. One of the major benefits of Accessory Dwelling Units is that they provide a source of revenue for homeowners. In addition, they often small and modest, and thus provide a more affordable option for renting—at often one-third of the price of a comparable unit in a multi-family unit (Chapple 2011). Because they are technically 'infill development', they make efficient use of existing infrastructure and help increase neighborhood densities to levels at which transit becomes feasible (Chapple 2011). In the City of Berkeley, this practice has been occurring for a long time, but it was not until March 2015 that this process was streamlined for homeowners who wanted to add secondary units to their properties. Prior to March 2015, homeowners were required to have an administrative use permit pre-construction, which could take months, and public hearings and neighborhood feedback were required. Now, only the plans need to be reviewed by city staff (shadow studies, blueprints etc), reducing the permitting timeline (Raguso 2015). The streamlining process will ultimately make it both easier and faster for homeowners to convert their units through legal means.

In many growing cities, the provision of secondary suites to boost the housing stock is crucial for incoming immigrants and refugees (Teixeira 2011). Mukhija (2014) has examined in the City of Los Angeles how the great need for secondary conversions has bypassed the formal permitting process and has lead to a "stealth through informality", whereby extralegal conversions are taking place, often with sub-par infrastructure. In contrast, cities such as the City of Vancouver have actively supported and formalized such conversions, by introducing legislation to legalize these units. Mukhija (2014) argues that the City of Vancouver's success with laneway housing is largely due to three elements: 1) the formal legalization of such units, 2) the financing of such units through VanCity bank, and 3) a strong tenancy branch which deals with tenant's rights. I would also add that 4) the City of Vancouver's thorough design guidelines and regulation for scale, massing and landscape have played an important role in public acceptance of laneway housing, in addition to 5) the urban form of Vancouver blocks (600' by 200' with bisecting laneways the length of the block) and 6) the 'Ecodensity'(Rosol 2013) campaign that occurred simultaneously with the laneway housing legalization. The recent successes in Vancouver and other Canadian cities have as spurred a great number of policy-oriented studies on the subject of laneway housing in Canada, as a way of increasing densities in cities (Schatz 2013; Duffus 2012; Janikowski 2011; Cubitt 2008). In contrast,

One of the benefits of accessory dwelling units is that there is some evidence that this housing type allow for 'ageing in place' for older family members, allowing extended families to live together or more options for empty nesters after their children leave a home (Chapman and Howe 2001). In other instances, a caregiver or childcare worker may occupy the secondary unit, for ease of access to a patient in the main house. Overall, accessory dwelling units should not be overlooked as a key way of increasing density in currently zoned R1 and R2 single-family areas. Chapple and Wegmann (2014) have projected that accessory dwelling units have the potential to act as a smart growth strategy, by injecting density and increasing housing affordability highlighting a case study in the Flatlands of Berkeley, Albany and El Cerrito. They recommend a loosening of obstructive land-use regulations at the municipal level, further education of the public on secondary units, assistance guiding homeowners through the permitting and construction process, and the provision of low-cost financing for such units. In addition, further examination of how permitting processes

can be streamlined or 'fastracked', and how urban design guidelines can best support the livable design of such units is needed.

Future Research Questions:

- What architectural and interior design elements contribute to 'livable' Accessory Dwelling Unit?
- How can the regulation and permitting of Accessory Dwelling Units (ADUs) become streamlined and fastracked?
- What type of public education on Accessory Dwelling Units has proven to be particularly effective?
- How can urban design guidelines support the design of Accessory Dwelling Units? What are good examples of these?
- Who currently lives in Accessory Dwelling Units, and are they satisfied with the design of their unit?

Micro-units

Micro-units, often also named "effiency units" or "micro-flats" have gained increasing attention in the media in the past few years. There is less academic literature on micro-units at the moment than accessory dwelling units, primarily because it is a more recent phenomenon and the housing typology is generally associated with the generation known as the "millennials" (Wright 2014), although it has been proposed as an option for seniors as well. Wright (2014), notes that the North American pre-cursor to the micro-unit was likely the 'bungalow court' which appeared in the 1920s in California, the Pacific Northwest and the Midwest. These were small-scale apartment buildings around a central courtyard. These were one-bedroom or 'efficiency studio' units, that possessed small kitchenettes. Today, the definition of micro-units implies a small unit, usually a few hundred square feet in size (usually around 200-300 square feet), where eating, living and sleeping spaces overlap or function as multi-purpose spaces, with a reduced range of appliances and amenities that occur in a single family home (i.e. a kitchenette versus a full kitchen) (Bates 2015). In some instances, kitchens and bathrooms can be shared, and the micro-unit is primarily for sitting and sleeping, although usually these units with common amenities are termed single-resident occupancy (SRO) units. Micro-units are often more affordable than traditional size apartments, and similar to accessory dwelling units are often less than one-third the cost of a normal studio unit. When the price of a 1 bedroom unit have topped $3,000 in cities such as San Francisco, the price for living in core urban locations seems like a good deal.

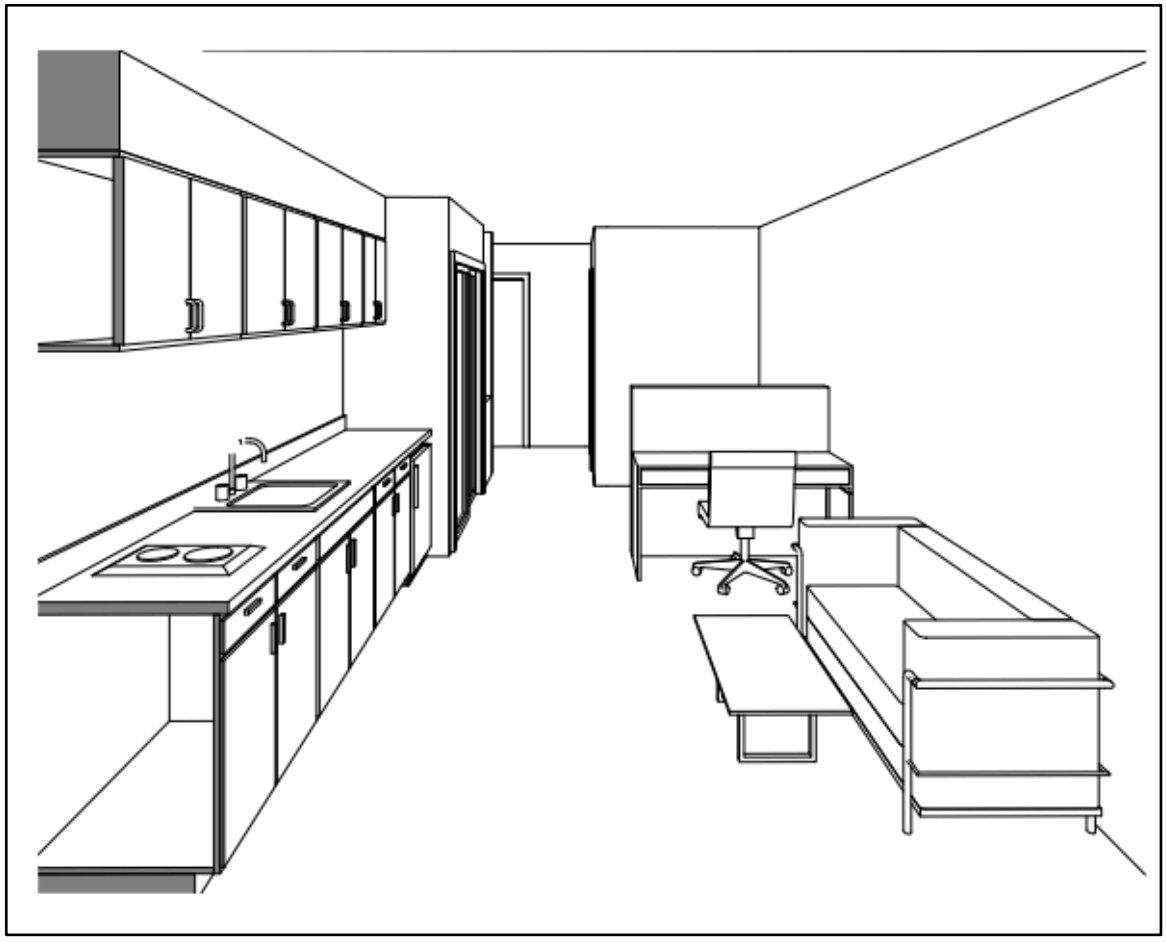


Figure 51: Perspective of Microunit in Berkeley, California proposed for 2701 Shattuck (Shattuck and Derby), courtesy of Lowney Architects.

To date, micro-units have gained prominence in New York, the Bay Area, Seattle and Vancouver and Tokyo (Wright 2014; Bates 2015). As younger people are moving back into the urban core and searching for creative professional jobs, and household sizes are shrinking, there is a desire to find housing that accommodates single-occupancy and reduced footprint living (Infranca 2013). In popular media, Sunset and Dwell Magazine has often feature 'inspiring small homes' and 'small space style, that illustrates the minimum amount of space required for couples and families to live—comfortably. While many millennials choose to share buildings and apartments by subletting rooms, this is often done without the knowledge of the landlord, and does not accommodate couples or singles that desire more privacy. If housing can be provided for singles and couples where space where the footprint is minimized, but other types of amenities provided important to millennials—such as wireless access—then this may be a viable tradeoff. Interior design adjustments for micro-units illustrated by Patrick Kennedy's 178 square foot prototype in Berkeley illustrate that further research needs to be done in terms of what people are willing to accept in terms of amenities (murphy beds versus regular beds, showers that comprise the whole bathroom etc.) (Anderson 2015).

The danger of micro-units is that the micro-unit strategy is vulnerable to the modernist "one-size-fits-all" set of standardized dimensions. Further research needs to be conducted on the social and cultural constraints of modular and micro-living. While Le Corbusier (1933) recommended the universally applicable modulor metric of 14 square meters (roughly 150 square feet) per person, it is likely that such an absolute unit of measurement is not appropriate for all household types or cultures. International research comparing micro-units in Japan versus in San Francisco, or New York versus Vancouver would be useful for determining a range of normative values in these countries, and resident's comfort levels with different types of spaces. Extremely small units, 150 square feet or smaller, have recently become popular in cities such as Paris, Rome and Tokyo (Buczynski 2013; Day 2012; Jaffe 2012). Some cities in California, such as San Jose and Santa Barbara, already permit 150 square foot units (Jaffe 2012). In some instances, in Japan, units called '*geki-sema*' have been built which are more or less 'coffins', and possess no windows or doors. They lie stacked upon one another, with room for few possessions. This begs the question in terms of what is a livable space truly is. Without room to entertain, relax and be comfortable with natural light and air, such a space can hardly be ideal. Similar conditions in the industrial age led to the development of building codes that prevented insalubrious housing development, and thus environmental health concerns are still relevant and critical today.

Again, as with Accessory Dwelling Units (ADUs), micro-units tend to face opposition from existing neighbors (Raguso 2013). Noise, parking, and shadowing effects comprise the main concerns, as with any higher density development (Raguso 2013). Some have also disagreed with the strategy of micro-units, as they state that the provision of "Twitter" apartments will only exacerbate the lack of housing affordability in cities by catering only to the tech employees, and thus they call for more affordable family housing (Wollan 2012). Chapple (2015) has noted that the impact of the tech workers on the housing affordability crisis is actually insignificant, and the main problem is increasing housing supply. Additionally, Infranca (2013) also argues that if micro-units increase housing supply in a city they should reduce or maintain current rent levels. Higher-than-average rents for micro-units may simply reflect demand for new construction, particular locations within a city, or the attractiveness of a new housing option. In addition, micro-units may reduce the demand among singles for shared two-to-four bedroom housing units (often shared sublets), which could make those units more affordable to families. Overall, micro-units are an underutilized type of

affordable housing, but further research and testing is needed in terms of user experience, comfort and design regulation.

Future Research Questions:

- What is a 'livable' microunit? How do different cultures, ethnicities and races define a minimum area of livable space for a microunit? Is there a normative range of square feet or 'modular 'that is also contextually or culturally acceptable?
- Are residents currently living in microunits satisfied with the design and layout with their units? What could be improved?
- Can the environmental health of residents in these smaller units be measured? What metrics could be used to do so?
- How can the regulation and permitting of microunits become more streamlined?

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APPENDIX A: MAIL OUT MAIL BACK SURVEY COVER LETTER

University of California
Berkeley

University of California, Berkeley
Nicola Szibbo, PhD Candidate
Return Address: 1307 Channing Way
Berkeley, CA 94702
(301) 538-8540 Phone
http://dcrp.ced.berkeley.edu/

Department of City and Regional Planning

May 2013

Dear Survey Participant,

My name is Nicola Szibbo and I am a PhD Candidate in the Department of City and Regional Planning at UC Berkeley. I am studying resident perceptions of the livability of recently built neighborhoods. **Livability in this study is broadly defined as the '<u>suitability of a place for comfortably meeting all your daily and long-term needs and desire</u>.'** My objectives are to learn what environmental design qualities you feel are most important to the character and quality of your neighborhood. Through your participation, I hope to understand how to improve new neighborhood developments and neighborhood rating systems (such as LEED-ND: Leadership in Energy and Environmental Design for Neighborhood Development).

<u>I would be very grateful if the person in the household over the age of 18 whose birthday month is closest to the date above (for random selection purposes) would complete the enclosed questionnaire and send it back to me in the return enclosed postage-paid envelope.</u> Without the help of people like you, research on neighborhoods and improvements in livability could not take place.

The survey data will be handled as confidentially as possible. If results of this study are published or presented, individual names and other personally identifiable information will not be used.
If you are able to or interested in participating in a one-hour follow-up focus group between January–March 2014, please email me at nszibbo@berkeley.edu, or fill in your email address or contact information at the bottom of the survey. Participants will be awarded with a $50 gift certificate for one hour of their time.

If you have any questions or concerns about the questionnaire or about participating in this study, you may contact me at (301) 538-8540 or at nszibbo@berkeley.edu

Sincerely,

Nicola Szibbo
PhD Candidate
Master of City Planning 2010
University of California, Berkeley
nszibbo@berkeley.edu

Note: This study was approved by the IRB on May 1st, 2013. The assigned Committee for the Protection of Human Subjects Protocol (CPHS) number is *2012-12-4874*. If you have any questions about your rights as a research subject, you may contact the UC Berkeley Office for the Protection of Human Subjects at: 2150 Shattuck Avenue, Suite 300, University of California at Berkeley, Berkeley, CA 94704-5940 Telephone: (510) 642-7461/General Email: ophs@berkeley.edu

APPENDIX B: MAIL-OUT MAIL-BACK SURVEY

University of California
Berkeley

University of California, Berkeley
Nicola Szibbo, PhD Candidate
Return Address: 1307 Channing Way
Berkeley, CA 94702
(301) 538-8540 Phone
Department of City and Regional Planning
http://dcrp.ced.berkeley.edu/

Please ask the person in your household over the age of 18 whose birthday month is closest to May to fill out this survey. Please complete and return to Nicola Szibbo in the return postage-paid envelope (Addressed to Nicola Szibbo, 1307 Channing Way, Berkeley, CA 94702). Contact Nicola Szibbo by email or phone (nszibbo@berkeley.edu, Ph: 1-301-538-8540) with questions. **You may skip questions you do not wish to answer or if you have no opinion.** Thank you for your participation!

1. Do you rent or own your dwelling in this neighborhood? (circle all that apply)
a. Rent
b. Own
e. Co-op
f. Social/Public housing
g. Other_____

2. Of the following, which best describes the building you live in?
a. Rental building
b. Condominium building
c. Townhouse
d. Duplex (attached house)
e. Single-family detached house

3. Of the following, which best describes your unit?
a. Studio
b. 1 bedroom
c. 2 bedroom
d. 3 bedroom or more

4. How long have you lived in your current unit?
a. Less than a year
b. 1 year to 3 years
c. 3 years to 5 years
d. 5 years or more

5. Is this your primary residence?
a. Yes
b. No

6. If you live in a condo/apartment building, do you live on the ground floor?

a. Yes
b. No
c. N/A

7. You would classify your neighborhood as a good place to live for the following types of people (check all that apply):
___Single people or young couples
___Families with children
___Empty nesters & seniors

LIVABILITY

8. How satisfied are you with your current neighborhood in terms of its overall "livability"? Livability is defined as the 'suitability of a place for comfortably meeting all your daily and long-term needs and desires':

a. Not at all satisfied
b. Slightly satisfied
c. Somewhat satisfied
d. Very satisfied
e. Extremely satisfied

For the following questions #9-28 please indicate how important the following characteristics are to the LIVABILITY OF YOUR NEIGHBORHOOD. Livability is defined as: *the suitability of a place for comfortably meeting all your daily and long-term needs and desires*.

9. Energy efficient buildings?
a. Not important
b. Somewhat important
c. Very important

10. Privacy within the interior of your home from neighbors or people walking by on the street?
a. Not Important
b. Somewhat important
c. Very Important

11. Intermediate spaces (ie porches, stoops, verandahs etc.) between ground floor units and the sidewalk?
a. Not important
b. Somewhat important
c. Very important

12. Safety from fast-moving traffic?
a. Not Important
b. Somewhat important
c. Very important

13. Safety from crime?
a. Not important

b. Somewhat important
c. Very important

14. A strong sense of community with your neighbors? (defined as a sense of social ties and social network within your neighborhood)
a. Not important
b. Somewhat important
c. Very Important

15. A distinct neighborhood identity?
a. Not important
b. Somewhat important
c. Very Important

16. Actively-used sidewalks, plazas and parks in your neighborhood?
a. Not important
b. Somewhat important
c. Very Important

17. A diverse mix of ethnicities and races in your neighborhood?
a. Not important
b. Somewhat important
c. Very important

18. Families with children in your neighborhood?
a. Not important
b. Somewhat important
c. Very Important

19. A view of trees or natural landscapes from your home?
a. Not Important
b. Somewhat important
c. Very important

20. A spacious back yard or front yard?
a. Not important
b. Somewhat important
c. Very important

21. Housing for a range of income-levels integrated into your neighborhood?
a. Not Important
b. Somewhat important
c. Very important

22. Being able to easily satisfy most of your daily needs within a 15 minute walk from your home?
a. Not important
b. Somewhat important
c. Very Important

23. Streets and sidewalks in your neighborhood that are pleasant to walk along?
a. Not important

b. Somewhat important
c. Very important

24. Green landscaping within your neighborhood?
a. Not important
b. Somewhat important
c. Very Important

25. Well-maintained buildings, streets, and landscapes in your neighborhood?
a. Not important
b. Somewhat important
c. Very Important

26. Being able to easily access public transit from your neighborhood?
a. Not important
b. Somewhat important
c. Very important

27. Bicycle paths, bicycle lanes and other bicycle facilities/amenities within your neighborhood?
a. Not Important
b. Somewhat important
c. Very important

28. Most of your neighbors possess similar lifestyles to you?
a. Not Important
b. Somewhat important
c. Very important

29. Of the neighborhood characteristics mentioned in questions 9-28, which three are the MOST important to you and why?
Please rank from #1-3 in order of importance, with #1 being the most important.

___Energy efficient buildings
___Privacy within interior of unit
___Porches, stoops & verandahs
___Safety from fast traffic
___Safety from crime
___Sense of community w neighbor
___Distinct neighborhood identity
___Well-used sidewalks, plazas, parks
___Mix of ethnicities and races
___Families with children
___View to trees or natural landscapes
___A spacious front yard/back yard
___Housing for a range of income levels
___Daily needs within a 15 minute walk
___Sidewalks pleasant to walk along
___Property maintenance
___Easily accessible public transit

___Bicycle paths, lanes & amenities
___ Neighbors with similar lifestyles
___Green landscaping

Why?:

#1:

#2:

#3:

30. Of the neighborhood characteristic mentioned in questions 9-28, which three are the LEAST important to you?
Please rank from #1-3 in order of unimportance, with #1 being the least important.

___Energy efficient buildings
___Privacy within interior of unit
___Porches, stoops & verandahs
___Safety from fast traffic
___Safety from crime
___Sense of community w neighbor
___Distinct neighborhood identity
___Well-used sidewalks, plazas, parks
___Mix of ethnicities and races
___Families with children
___View to trees or natural landscapes
___A spacious front yard/back yard
___Housing for a range of income levels
___Daily needs within a 15 minute walk
___Sidewalks pleasant to walk along
___Property maintenance
___Easily accessible public transit
___Bicycle paths, lanes & amenities
___ Neighbors with similar lifestyles
___Green landscaping

Why?:

#1:

#2:

#3:
31. What one element or characteristic would make your neighborhood more livable and why?

HOUSING

32. Does the cost of housing for you and others in your neighborhood significantly impact the livability of your neighborhood?
a. Yes
b. No

Why or why not?:

33. Is public, social, non-market, or co-op housing present in your neighborhood?
a. Yes
b. No

34. If public, social, non-market, or co-op housing is present in your neighborhood, does it blend in well with the architectural style of the neighborhood?
a. Yes
b. No

35. Suppose you could afford to live wherever you wanted within your metropolitan region. Would you:
a. Stay where you are
b. Move to a single-family detached house in the suburbs
c. Move to a single-family detached house downtown
d. Move to a luxury condo, townhouse or apartment in the suburbs
e. Move to a luxury condo, townhouse or apartment downtown
f. None of the above.

TRAVEL

36. How important is vehicle ownership to you?
a. Not important
b. Somewhat important
c. Very Important

37. How many vehicles does your household own or lease? _____

38. What are your main modes of travel over the course of a typical week? Please rank from most frequent to least frequent (1=most frequent, 6=least frequent)
___Public transit (buses, light rail, train)
___Carpooling
___My personal car
___Car shared with others
___Walking
___Biking
___Other: _____

DEMOGRAPHICS

39. What is your gender?

a. Male
b. Female

40. What is your age?

41. How many people under the age of 18 live in your household?

42. How many people 18 and older live in your household?

43. Which race do you self-identify with?
a. African American
b. Asian or Pacific Islander
c. Caucasian (non-hispanic)
d. First Nations/Metis/Inuit/American Indian or Alaska Native
e. Hispanic or Latino
g. Two or more races
h. Other: _____
i. Prefer not to answer

44. What is your household income?
a. Less than 20k
b. 20k-50k
c. 50k-80k
d. 80k-150k
e. 150k or more
f. Prefer not to answer

45. What is your education level?
a. Some high school
b. High school diploma/professional certificate program
d. Associate (2 yr) degree
e. Some college
f. Bachelor's (4 yr) degree
g. Graduate degree or higher
h. Prefer not to answer

Are you interested in participating in a follow-up focus group in Spring 2014 in your neighborhood? Participants will be awarded a $50 gift certificate for a one-hour focus group, to take place at your local community center.

Please fill out your email address: _____

Or please fill out your phone #: _____

You may also contact me at nszibbo@berkeley.edu if you are interested in participating!

Thank you again for your participation!
xxx

APPENDIX C: PROXY SURVEY QUESTION KEY

Question Number	Survey Language Used	LEED-ND Category?	Livability Category?	Livability Precedent in Literature
7	"Energy efficient & environmentally friendly buildings"	Green Infrastructure & Buildings	Green infrastructure and buildings	-
8	"Privacy with your unit"	N/A	Privacy	Day 2000; Macdonald 2005
9	"Safety and Security"	N/A	Safety and security	Newman 1973; Jacobs 1961
10	"Sense of community"	N/A	Sense of community	Nasar & Julian 1995; Nasar 2003
11	"Well-bounded, neighborhood, and a sense of ownership over this neighborhood area"	N/A	Neighborhood Territory	Appleyard & Lintell 1972;
12	"Vibrant public realm"	N/A	Vibrant Public Realm	Whyte 1980; Gehl 1987; Oldenburg 1997
13	"Diverse mix of ethnicities and races"	N/A	Ethnic & Racial Diversity	Talen 2002, Talen 2006
14	"Diverse range of household sizes"	N/A	Household diversity	Talen 2002; Talen 2006
15	"View (unobstructed by buildings) from your unit "	N/A	View corridors	Zacharias 1999
16	"Affordable housing"	N/A	Affordable housing	Dale and L.L Newman 2009
17	"Clearly defined public spaces and private housing realms, and spaces dedicated to the transition between these (ie porches, verandahs etc.)"	N/A	Transition Zones	Jacobs 1961, Macdonald 2005
18	"Ability to easily walk to work, school or other locations in your neighborhood?"	Neighborhood Pattern & Design (Pre-req 1, Pre-req 3, Credit 1, Credit 6, Credit 9, Credit 10 &	Accessibility	-

		Credit 15)		
19	"Streets that are pleasant to walk on"	Neighborhood Pattern & Design (Credit 11 & Credit 14)	Pedestrian-friendly design	-
20	"Easily accessible public transit (buses, light rail, trains) in your neighborhood?"	Smart Location and Linkage (Smart Location Pre-requisite)	Transit accessibility	
21	"Bicycle paths, bike lanes and other	Smart Location and Linkage (Credit 4)	Bicycle accessibility	
22	"overall combination of 1) energy efficient and context-sensitive buildings, 2) being able to walk to nearby locations 3) easily accessible public transit 4) bicycle paths and bicycle lanes and 5) pleasant streets for walking"	LEED-ND Overall	LEED-ND Overall	

APPENDIX D: ONLINE SURVEY COVER LETTER

University of California
Berkeley

University of California, Berkeley
Nicola Szibbo, PhD Candidate
Return Address: 1307 Channing Way
Berkeley, CA 94702
(301) 538-8540 Phone
Department of City and Regional Planning
http://dcrp.ced.berkeley.edu/

Dear Survey Participant,

My name is Nicola Szibbo and I am a PhD Candidate in the Department of City and Regional Planning (DCRP) at UC Berkeley. Through my dissertation research I hope to understand how to improve new neighborhood developments and neighborhood rating systems (such as LEED-ND: Leadership in Energy and Environmental Design for Neighborhood Development).

I would be very grateful if you could complete the following questionnaire on LEED-ND and affordability:

Follow this link to the Survey:
${l://SurveyLink?d=Take the Survey}
Or copy and paste the URL below into your internet browser:
${l://SurveyURL}

This link is uniquely tied to this survey and your email address. Please do not forward this message. You will have one week to complete the survey.

Without the help of people like you, research on neighborhoods and improvements in livability could not take place. The survey data will be handled as confidentially as possible, and is completely anonymous, although it should be noted that confidentiality cannot be guaranteed. This survey is only being sent to planners and developers like you, the email addresses of which were obtained from the USGBC website project list and contact list for LEED-ND. Participation is voluntary.

If you have any questions or concerns about the questionnaire or about participating in this study, you may contact me at (301) 538-8540 or at nszibbo@berkeley.edu

Thank you for your participation!

Sincerely,

Nicola Szibbo

PhD Candidate
Master of City Planning 2010
University of California, Berkeley

nszibbo@berkeley.edu
301-538-8540

Note: This study was approved by the IRB on May 1st, 2013 and amended on March 26th, 2014. The assigned Committee for the Protection of Human Subjects Protocol (CPHS) number is 2012-12-4874. If you have any questions about your rights as a research subject, you may contact the UC Berkeley Office for the Protection of Human Subjects at: 2150 Shattuck Avenue, Suite 300, University of California at Berkeley, Berkeley, CA 94704-5940 Telephone: (510) 642-7461/General Email: ophs@berkeley.edu

Follow the link to opt out of future emails:
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APPENDIX E: ONLINE SURVEY OF LEED-ND AP

University of California
Berkeley

University of California, Berkeley
Nicola Szibbo, PhD Candidate
Return Address: 1307 Channing Way
Berkeley, CA 94702
(301) 538-8540 Phone
Department of City and Regional Planning
http://dcrp.ced.berkeley.edu/

1. Given that within LEED-ND incorporating a % of affordable housing is optional, do you agree that LEED-ND sufficiently supports 'social sustainability' or 'social equity.'

2. Do you think that residents living in LEED-ND neighborhoods are satisfied with the affordability of their neighborhoods?

3. Do you think that a potential lack of affordable housing in a LEED-ND neighborhood would contribute to residents' perceiving their neighborhoods as less livable?

4. Do you believe the LEED-ND rating system could be improved in terms of its affordable housing credit?

5. If yes, then how can the LEED-ND rating system be improved?

6. Do you believe developers are reluctant to include affordable housing in LEED-ND projects?

7. If yes, then why are they reluctant to include affordable housing in LEED-ND projects?

8. Do you think of the idea of having city zoning overlays that mandate and incentivize affordable housing in LEED-ND neighborhoods is a good one?

9. What strategies best support the development of affordable housing for new sustainable neighborhoods? Please rank in terms of importance, 1 being most important, and 4 being least important.

10. I am a(n)_____.

a) urban planner
b) urban designer
c) architect
d) landscape architect or designer
e) engineer
f) developer
g) analyst

h) student
i) other
j) prefer not to answer

11. I work _____.

a) for a city government
b) in a private firm
c) as an independent consultant
d) prefer not to answer

12. If relevant, please comment on your experience with affordable housing in LEED-ND projects (ie what tends to happen with affordable housing)?

13. Open comment:

APPENDIX F: LEED-ND AP INTERVIEW GUIDE

1. What LEED-ND projects have you worked on or have experience with?

2. In what role/capacity have you worked on these projects?

3. Why would a developer, consultant or planner want to pursue LEED-ND certification?

4. Have you worked on any projects that have obtained the 'Housing Types and Affordability' affordability credit? If so, have there been any challenges in meeting the criteria? If not, what other project challenges have you come across in the accreditation process?

5. In LEED-ND, the affordable housing credit is optional, and worth approximately 3% of the overall score (this does not include the diversity of housing types credit, which is worth another 3%). Do you think the fact that it is optional, and worth 3% would enable people from a variety of income levels to live in a neighborhood? Is this credit worth enough to incentivize developers to go after it?

6. Earlier this year I conducted a study of 114 LEED-AP professionals that revealed that 59% of LEED-ND AP professionals believe developers are reluctant to include affordable housing in LEED-ND projects. Do you agree with this survey result? Why or why not?

7. In the survey, one LEED-ND AP professional suggested that the affordable housing criteria provides 5%-20% of housing as affordable for low income earners (60% AMI, 80% AMI etc), but leaves the remaining 80%-90% of the project for high-income buyers, with nothing in the middle for middle-income earners. Do you agree with this statement? Why or why not?

8. In a survey I conducted earlier this year on affordability and LEED-ND, LEED-ND AP professionals suggested the following regulatory measures and incentives to improve the affordable housing component in LEED-ND. They are listed here in order of importance: 1) inclusionary zoning mandates for affordable housing, 2) direct government subsidies or non-profit assistance (3) zoning overlays that incentivize or mandate affordable housing and finally 4) voluntary certification through LEED-ND. Do you agree with this ranking? Why or why not?

9. Do you think a balance of both regulation and incentives is needed currently for affordable housing in new sustainable development, given that the affordable housing credits in LEED-ND are optional?

10. What, if anything can you comment on the financial feasibility or viability of incorporating affordable housing into LEED-ND? Do you have any recommendations or suggestions other than those mentioned in Question #6, specifically from a developer's perspective (ie reducing the cost of LEED-ND certification? Density bonuses? Other suggestions?).

11. Open comment:

[i] Traditional Activity-Based Travel Demand Models use the Traffic Analysis Zone (TAZ) comprised of a few blocks long. These zones are

[ii] Uninterrupted flow models refer specifically to freeways and rural highways, whereas interrupted flow models refer specifically to urban arterials, intersections, roundabouts, signals in interchanges, and bicycle/Pedestrian Paths.

[iii] Discounted return rate refers to the rate of return minus the bounced emails. 19 of the 314 original emails bounced.

[iv] One interview out of a total 21 interviews was discounted due to lack of direct project experience.

[v] Basic meta-themes emerged in the first 8 interviews, with saturation occurring around 12-13 interviews.

[vi] Ideally, it would be beneficial to compare the survey results against other census data. However, in 2011, the Conservative Government of Canada under Steven Harper announced that the long form of the Statistics Canada census was no longer mandatory, city privacy reasons. Thus, there is no recent census data at the same level of detail for which this survey can be compared against. The long form of the Canadian Census needs to be brought back.

[vii] At the time the post-occupancy study was conducted, the exchange rate was virtually at par (the Canadian Dollar was worth 96 cents on the US dollar).

[viii] According to the walkable streets credit in LEED-ND v4 (USGBC 2014), 5% of the length of new residential-only motorized parts of the circulation network within the project is designed for a target speed of no more than 20 mph (30 km/h). 70% of the length of new nonresidential or mixed-use motorized parts of the circulation network within the project is designed for a target speed of no more than 25 mph (40km/h). A multiway boulevard, with travel lanes separated from access lanes by medians, may apply this requirement to its outer access lanes only (through-lanes are exempt), provided pedestrian crosswalks are installed across the boulevard at intervals no greater than 800 feet (245 meters).

[ix] Affordable housing is generally defined in the United States as "*housing for which the occupant(s) is/are paying no more than 30 percent of his or her income for gross housing costs, including utilities.*" (US Department of Housing and Urban Development 2014). In Canada, affordable housing is defined as "*housing costs less than 30% of before-tax household income. Shelter costs include for renters the rent and any payments for electricity, fuel, water and other municipal services. For owners, affordable housing includes mortgage payments (principal and interest), property taxes, and any condominium fees, along with payments for electricity, fuel, water and other municipal services.*" (CMHC 2014). In this sense, both Canada and the US have very similar definitions of housing, although typically Area Median Income (AMI) is used in the United States, whereas in Canada regional income profile is generally referenced instead.

[x] This credit was formerly named the "Mixed-Income and Diverse Communities Credit" under Built Project v.3 LEED 2009.

[xi] Other ways of obtaining the maximum 7 points under this credit include incorporating a diversity of housing typologies using the Simpson Diversity Index scoring system. The typology includes detached residential, duplexes/townhouses, multi-unit buildings, live-work spaces and accessory dwelling units.

[xii] LEED-ND credit states that to get the credit, the developer can "*include a proportion of rental and/or for-sale dwelling units priced for households earning below area median income (AMI). Rental units must be maintained at affordable levels for a minimum of 15 years. Existing dwelling units are exempt from requirement calculations. A maximum of three points may be earned by meeting any combination of thresholds in the following table (table of AMI thresholds follows).*"

[xiii] The credit is potentially worth more than 3% if a development is aiming for a lower LEED-ND rating, such as gold.

[xiv] From an analytic perspective, the way in which the current LEED-ND scorecards are published is that they provide a combined, conflated score for the 7 points—combining the diversity of housing types score with the score for affordable housing percentages. This ultimately makes it difficult to really see whether or not a project has provided certain percentage of affordable housing. It is impossible to distinguish the breakdown between for-sale affordable and affordable rental achieved by a project, unless one requests internal data.

[xv] The term 'workforce housing' is intended to apply to households in the middle income range that are priced out of market rate housing, but perhaps earn too much to qualify for low and moderate housing subsidies. At this time there is no definition of workforce housing present in the HUD glossary, and the definition remains heavily debated. According to a series of three reports by the Urban Land Institute's Terwilliger Center for Workforce Housing, the Center uses varying definitions: 60%-100% of AMI for Boston and Washington DC metropolitan areas, and 60%-120% of AMI for the San Francisco (Sandra Robles 2009a; Sandra Robles 2009b; Sandra Robles 2010).

[xvi] In 2014 LEED introduced 'social equity' pilot credits into its BD&C: New Construction. None of the three credits—1) social equity within the project team (USGBC 2014b), 2) social equity within the community (USGBC 2014c), and 3) social equity within the supply chain (USGBC 2014d)—solely focuses on or requires affordable housing. These credits have not been yet added to LEED-ND.

[xvii] A lack of scorecard data on the USGBC website for projects earlier than v.3 does not allow for an in-depth analysis of the credit prior to this version.

[xviii] Discounted return rate refers to the rate of return minus the bounced emails. 19 of the 314 original emails bounced.

[xix] A small-scale LEED-ND zoning update is a hybrid technique that melds the voluntary nature of LEED with the challenging and often heavy-handed requirements of citywide inclusionary zoning.

[xx] Although in the US housing choice vouchers are by far the most important type of rental housing subsidy for very low-income households, this paper focuses primarily on citywide or development-scale strategies that can be realized at the municipal level by planners or developers.

[xxi] Basic meta-themes emerged in the first 8 interviews, with saturation occurring around 12-13 interviews.

[xxiv] One interviewee qualified this with recommendation that in-lieu fees should not be part of such an inclusionary zoning measure, as they offer opportunities for for-profit developers to 'opt-out' and leave geographic disparities.

[xxv] The Green Building Certification Institute (GBCI) was established in 2008, and is the third-party organization that provides independent oversight of professional credentialing and project certification programs related to green building.

[xxvi] The certification cost is currently as follows: registration ($1500/project), Smart Location and Linkage (SLL) Prerequisite Review (optional, $2,250), Expedited review for SLL (reduce from 20-25 business days to 10-12, available based on GBCI review capacity). Once passed the optional pre-requisite review, there is the cost of the Initial Stage Review ($18,000). The Initial Stage Review may be expedited for $25,000. Subsequent Stages of review are $10,000, unless you want an expedited review, which is $15,000. If the project is over 20 acres for the Initial Stage or any Subsequent Stage, then it costs an additional $350/acre. If you are interested in appealing a credit it is $500/credit, and again you may expedite the credit appeal process by paying extra $500 on top of the $500 credit appeal fee.

[xxvii] The Southeast False Creek Development plan is comprised of both public land and private land development. The city-owned lands are areas 1A, 2A and 3A. The privately owned lands are sections 1B, 2B, 3A and 3C.

[xxviii] Affordable is defined as defined as dwelling units designed to be affordable to persons who make up a core need household where such persons pay more than 30% of their combined gross annual income to rent an adequate and suitable rental unit, including utilities, to meet the basic housing needs of the household at an average market rent. Core need households are defined as such households paying more than 30% of their combined gross annual income to rent an adequate and suitable rental unit, including utilities, to meet the basic housing needs of the household at an average market rent.

[xxix] Modest market is defined as dwelling units designed to be affordable to persons who make a household and whose combined gross annual income falls within the middle third of income distribution. The thirds are defined by the regional income profile.

[xxx] Subarea 2A is the Olympic Village proper.

[xxxi] Core need households are defined as such households paying more than 30% of their combined gross annual income to rent an adequate and suitable rental unit, including utilities, to meet the basic housing needs of the household at an average market rent.

[xxxii] Out of the 1,100 total units in the Olympic village were built, this would make the affordable housing percentage in the Olympic village proper at roughly 22.9%.

[xxxiii] LEED-ND has undergone two revisions since this point in time—the 2010 version and LEED-ND v.4 released in 2013. In 2010, the 'affordable rental' and 'affordable for sale' credits in the pilot version were merged into a category entitled 'Mixed-Income Diverse Communities', which also includes the old credit pilot credit 'Diversity of Housing Types.' In LEED-ND v.4, there are no significant changes made to this credit, but the title has changed to a more explicit one: 'Housing Types and Affordability.'

[xxxiv] Though it did earn the maximum points possible for the diversity of housing types credit.

[xxxv] It was suggested by professionals that this credit fall under the Green Infrastructure and Buildings category of LEED-ND.