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THE REAL ESTATE ECONOMICS OF WALKABILITY COMPONENTS: THE
INFLUENCE OF BUILT ENVIRONMENT ON HOUSING VALUE IN LINCOLN,

NEBRASKA

by

Dohee Kim

A THESIS

Presented to the Faculty of

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THE REAL ESTATE ECONOMICS OF WALKABILITY COMPONENTS: THE
INFLUENCE OF BUILT ENVIRONMENT ON HOUSING VALUE IN LINCOLN,
NEBRASKA

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University of Nebraska, 2013

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This study analyzes the association between walkability and housing value in neighborhoods of Lincoln, Nebraska in order to observe the impact of walkability as one of prominent smart growth principles in creating economic value. The study estimates walkability through walkability components in each neighborhood of Lincoln based on the Lawrence Frank walkability index model. For the housing value assessment, a hedonic regression model was created to estimate median housing value in Lincoln based on the census block group dataset. The result of the model shows that walkability components have weaker influence on estimated housing value compared to other physical, demographic, and socioeconomic attributes. Only two of the four components of walkability were statistically significant in this study: street intersection connectivity and retail floor to area ratio. Consequently, the relationship of these components of walkability, as well as other statistically significant attributes, and housing value was analyzed. It is also noted in the study that the current planning strategies of Lincoln's comprehensive development plan, LPlan 2040, have struggled with inefficiency in their organizational framework in implementing practical smart growth. It indicates that there are still places for improving the sustainable community development plan through

enhancement of local based planning indices. At this point, increasing the public awareness and getting them engaged in practical smart growth principle implementation is a key aspect of efficient policy. Application of appropriate public policy using smart growth principles is projected to attain added value and improve the overall quality of life in neighborhoods.

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DEDICATION

I dedicate this thesis to my beloved family: my parents, my brother, and my maternal grandmother, who always stood by me.

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Chapter 1

INTRODUCTION

1.1 Introduction

Sustainably developed communities that have applied smart growth principles have been shown to yield positive socioeconomic benefits. Smart growth is a concept in urban planning which emphasizes mixed-land use, transit-oriented development, walkability, and green infrastructure. Smart growth can lead to communities that are healthier and safer, for both the residents and the environment. There has been a rapid increase of sustainably developed communities in the United States during the past few decades because of its benefits to public health, efficient development, and improved sense of community (Jackson 2003, 1383). In the year 2000 for instance, there were about 410,000 housing units produced through 380 sustainable community development plans in 38 states (Song and Quercia 2008, 298). Smart growth principles are as relevant as ever now within the U. S. due to growing environmental concerns and the desire for sustainable, healthy neighborhoods.

Fewer urban sprawls are expected as community plans trend toward compact, mixed-land use development, long-term sustainability, economic growth, and greater social interaction (Talen 2003, 196-197). However, there has been little agreement as to what truly defines the association between the principles and the potential benefit to economic growth. At this point, one of the critical questions is whether the principles can be capitalized into economic benefits; in other words, creating positive economic outcomes in practice.

Economists have confirmed that benefits associated with smart growth principles can result in increases in property values (Cortright 2009, 8). This fact suggests that benefits of the smart growth are likely to materialize into increases in housing values, “as a proxy measure for economic value” (Song and Knaap 2004, 675-676; Sohn, Moudon and Lee 2012, 115). The association between the principles of smart growth and housing values must be assessed to determine whether economic value is added by smart growth.

Among the many smart growth principles, walkability has been distinguished for its role in sustainable development, especially in advancing socioeconomic conditions in communities. Many prior studies have identified the significance and value of walkability in creating urban land use efficiency by assessing the built environment attributes that influence walkability. Built environment attributes of walkability broadly affect urban land use efficiency because of its propensity to substantially impact land values. It is believed that this is because walkability encourages socioeconomic progress, which boosts property values (Sohn, Moudon and Lee 2012, 116).

This study is aimed at making an assessment of the association between various walkability components and housing values because it is important in contributing to sustainable community development and socioeconomic improvement. The expectation is that smart growth will provide socioeconomic benefits, as evaluated by whether walkability components have a positive association with housing values. Analyzing the components of walkability for their relationship with economic growth will contribute to more efficient future community development plans.

1.2 Significance of Research

Sustainable community development based on smart growth principles has been emphasized recently in urban planning and this has significantly influenced urban landscapes, as well as socioeconomic factors (Song and Quercia 2008, 297). In general, sustainably developed communities provide urban qualities that encourage economic growth by providing features that people find desirable. Hence, the neighborhood built environment attributes and urban design conditions are reflected into a comprehensive set of neighborhood value determinants (Frank and Pivo 1994, 51-52; Fisher and Pivo 2010, 3-5; Cortright 2009, 10).

Walkability has notably been identified for fostering environmental and socioeconomic progress in communities. Fisher and Pivo (2010) defined walkability as “a multi-dimensional construct composed of different factors, which together comprise a single theoretical concept” (Fisher and Pivo 2010, 2). In regards to the role of walkability in sustainable community development, the propagation of walkability suggests there is positive relationship that translates into a tangible benefit: increased housing values. As such, a prior study from Fisher and Pivo (2010) demonstrated that the value of residential and commercial real estate values have a significant relationship with walkability. The study noted that built environment attributes of walkability increased the property values. Walkability encouraged healthier physical behavior, improved socioeconomic conditions, and greater urban vitality, all of which were positively associated with residential preferences, resulting in increasing property values. Walkability also provided a variety of benefits to communities by “lowering the cost of transportation to food, and offering

better recreational, financial, and retail opportunities” than before (Fisher and Pivo 2010, 4).

In sum, walkability provided significant economic progress in communities by improving tangible and intangible benefits. This was generally reflected economically by increased housing values. However, some other studies have argued that walkability does not increase housing values in areas with a long history of automobile-oriented community development plans (Sohn, Moudon and Lee 2012, 115). In addition, housing values were also dependent on a variety of other characteristics besides walkability; the evidence that economic growth in communities can be attributed walkability is still weak and its influence and association must be studied further to be verified (Boyle et al. 2012, 15-16).

The association between walkability, as a salient sustainable development mechanism, and housing values, as an economic product of sustainable development, is becoming more crucial as recent developments trend toward plans using smart growth principles (Fisher and Pivo 2010, 2-3). In addition, walkability has not been examined closely in the context of housing values.

The city of Lincoln, Nebraska has a comprehensive sustainable community development plan that is designated LPlan 2040. LPlan 2040 proposes implementing smart growth principles in order to meet the long-term sustainable growth goals of the city. The plan aims to increase the quality of life using smart growth principles to create a healthier, more sustainable community. The plan has acknowledged that smart growth principles can create a more vibrant and interactive community and that value can be added by efficient land use along with increased transportation options since “mobility

plays a large role in the standard of living for residents in the community” (Lincoln Metropolitan Planning Organization 2011, 1).

One approach Lincoln could take to achieve the strategic goals in the plan, to become environmentally sustainable and attain economic growth, is to increase mobility by making neighborhoods more walkable. Mobility could be improved with “complete street;” transportation planning that provides greater attention to various transit alternatives besides the traditional automobile-focused approach. Particular consideration is given to land use plans, physical infrastructure improvements on sidewalks, bike lanes, trails, transit infrastructure, accessible pedestrian signals, and safe crossings. Some of the potential benefits of building “complete streets” are improved safety, increased walking and bicycling, decreased noise, and reduced carbon emissions. These outcomes accommodate sustainable growth and facilitate socioeconomic progress in communities.

In analysis of the sustainability goals of LPlan 2040, this study supposes that walkability in Lincoln is significantly associated in economic growth, as reflected by increases in the value of housing. The goal of this study is to empirically test the association between walkability and housing values. The analysis will examine the role of macro-level walkability attributes in this relationship to determine if they are significant. The outcome of this study has the potential to assist community-planning decisions as walkability is assumed to increase the desirability of communities.

1.3 Hypothesis

The hypothesis for this study is: conditions of walkability are significantly and positively associated with housing value in Lincoln, Nebraska.

Walkability, as a positive economic consequence, contributes to the quality of urban amenities, neighborhood design, and sustainability. Thus, walkability promotes sustainable community development by contributing to neighborhood qualities that are beneficial socioeconomically, which substantially influence neighborhood choices (Rauterkus and Miller 2011, 23). The preference of neighborhoods that are conveniently accessible, socioeconomically stable, and environmentally sustainable because of walkability is expected to create economic value in Lincoln: as seen by increased housing value.

Housing location, price, and supply levels are subject to be “maintained pattern of amenity supplies” (Smith 1996, 290). It is assumed that housing values follow the path of growth that reflects the real economic potential of communities (Lashgari 2010, 98). Therefore, rising housing values will be perceived as “a key leading indicator of neighborhood revitalization” (Weissbourd et al. 2009, 12; Cortright 2009, 8). This study is a project to observe the contribution of walkability to housing value creation: the real estate economics of walkability.

Chapter 2

LITERATURE REVIEW

2.1 New Urbanism Theory

2.1.1 Applied New Urbanism Theory in a Sustainable Community Growth Perspective

The ultimate vision of urban planning dates back to the 1920s in the United States. Low automobile dependence, small-scale transportation systems, and easily accessible neighborhood developments were the basic principles in urban development. After the end of World War II, the average household income level growth generated explosive suburbanization, characterized by heavy automobile dependence that produced urban sprawls throughout the country. This expansion-oriented urban development trend ruled the overall urban planning philosophies in the U.S. for more than half of the century. Between the 1950s and the 1990s, the urbanized land in the U.S. increased by 245 percent while the urban population increased by only 92 percent (O’Sullivan 2012, 6-7). As a result, expansion-oriented urbanism ideas have been controversial throughout the country because of the inefficiencies of land-use, environmental concerns, social segregation, and degradation in quality of life scale because of urban sprawls. Many urban theorists started to produce new ideas to renovate expansion-oriented urbanism; attempting to set out new urban planning guidelines to limit the amount of sprawls, environmental sustainability and higher density were prioritized in sustainable community development plans (Heikkila and Peiser 1992, 128).

Based on historic consciousness of urbanism trends, Talen (2005) pointed out that the essential urbanism principles practiced in the U.S. have been recognized as “recurrent

and embedded” (Talen 2005, 2). The urban theorists started to acknowledge the historic background of urbanism principles which brought them back into touch with their past. As a result, theorists started to produce different urban planning theories. This suggests that the best possible human settlement theory should be based on multiple historical concepts, viewpoints, and different approaches. Therefore, the human settlement trend would be able to link to the current on-going urbanism theories (Talen 2005, 2-6).

Jane Jacobs defined urbanism as “human settlement that is guided by principles of diversity, connectivity, mix, equity, and the importance of public space” (Talen 2005, 37). Since her urbanism definition in 1960s, urban planning strategies have emphasized its importance in promoting successful urbanization and it is widely acknowledged for the actual application practices. In sum, the principle of urbanism from Jacob’s theory expressed that urban planning should feature urban cultural differences and diversity. Jane Jacobs (1961) noted in her book, *The Death and Life of Great American Cities*, that fostering diversity is the most significant thing in shaping a healthy urban place. Jacobs argued that diversity is not only related to social conditions but also influential to physical land formation and the pattern of urban transaction that effects human interactions (Jacobs 1961, 187-197). In this approach, the notions of human behavior, scale, context, urban form, treatment of space, and circulation elements of urbanism started to come together in fundamentally different ways under modernist urbanism ideas. It is now known as “new urbanism”. Urbanists now recognize new urbanism as a reformation movement from the historic evidence of urbanism ideas (Talen 2005, 10-12).

However, urban planning in the U.S. until the late 1970s has dismissed the proposed ideals of new urbanism principles and concepts. Continuous conventional

suburban development created an absence of the application of the appropriate technology and the public participation to promote the proper vision of new urbanism. The failure of the implementation of new urbanism in urban development plans resulted in the formation of unsuccessful physical environments, the lack of the motivation for social-activity engagement, and the squandered public and commercial opportunities within communities. Urban problems, such as continuous urban sprawl, environmental pollution, and un-equal socioeconomic distribution, were followed by: broad single-house projects, heavy automotive dependence, (Glaeser and Kahn 2004, 4-7) and environmental distress that have continued to cause even more urban problems (Talen 2005, 8-10).

Consequently, a trend of the practical application of new urbanism among new urbanism theorists to resurrect the dismissed ideals of new urbanism theories evolved in the U.S. from early 1980s. The major aim of new urbanism is to attempt to combine multiple traditional urbanism ideas, providing urban diversity within a system of order. In order to do so, Talen (2005) insists to promote “control that does not impinge freedom and appreciation of smallness and fine-grained complexity can coexist with civic prominence, a comprehensive perspective that does not ignore detail” (Talen 2005, 1). Therefore, the primary purpose of new urbanism theory is promoting overall human settlement qualities by applying aesthetic, physical characteristics, land use efficiency, open space management, and pro-environmental efforts while co-existing with traditional urbanism ideas. Therefore, urban planners attempted long-term engagement in urban development plans and multi-faceted urban cultural practices, both theoretically and practically. The urban cultural practice in new urbanism theory is now to engage in the

forms of smart growth, sustainable development, and eco-friendly human settlement plans to meet the innovative new urbanism practices and ideas (Farr 2012, 5). The impact of these innovative ideas of new urbanism may possibly be measured on how they continue to inspire, affect future planning context, and remain relevant in contemporary urban contexts (Talen 2005, 55-57).

Jackson and Sinclair (2012) stated ideal principles of new urbanism in 10 categories:

Principles of New Urbanism

1. Environmental protection and enhancement
 2. A healthier lifestyle
 3. A sense of place
 4. A sense of community
 5. Economic and racial diversity
 6. Convenient and efficient transportation
 7. Energy conservation
 8. Lifelong learning and education
 9. Aesthetic design and high-quality construction
 10. Economic viability
- (Jackson and Sinclair 2012, 69).

In new urbanism theory, the regulatory aspects of regional planning are to move forward from old urbanism ideas in a way that promotes new urbanism principles; it endorses urban diversity, rather than arousing anti-urbanism, and prevents community segregation (Hirschhorn 2004). The new urbanists argue on the correct method of applying new urbanism principles. Constant urban development disorder, in various forms, should be well monitored based on the community level in order to achieve efficacy in implementation. In this approach, the willingness of the public to accept new urbanism theory oriented community development plans is emphasized. A strong normative proposal is suggested because it integrates with the administrative and

legalistic response on misconstruing ideals in an urban development plan (Talen 2005, 279).

2.1.2 Smart Growth: Promoting Smart Growth Principles

Jane Jacobs (1970) stated that vibrant urban cities promote active conditions of radical socioeconomic activities and interactions among residents. She argued in her book, *The Economy of Cities*, that these features are the primary deriving factors of city formation and economic development: urban vitality the idea that a city grows by a process of gradual diversification and differentiation of its economy, starting from little or nothing more than its initial export work and suppliers to that work (Jacobs 1970, 122-129). Considering the significance of urban vitality coordination and historic evidence of socially and environmentally irresponsible decisions in urbanization, new urbanism theory now practices in coordination with “smart growth,” especially when it is applied at the local development level (Litman 2009, 27-29). Smart growth is increasing the density level “while saving open space, improving opportunities for mass transit, and reinvigorating urban cores” by promoting mixed-land use plans (Lang et al. 2005, 7).

The practical smart growth movement was started extensively in Maryland from 1997 “to limit the sprawling patterns of low-density residential development and arterial strip commercial development, spilling outside of existing cities and villages” (Daniels 2001, 274). It was able to coordinate comprehensive community revitalization projects through systemic procedure and guidelines by emphasizing the obligations of state and local governments. The main goals of smart growth promotion were to coordinate mixed-land use and pedestrian oriented developments that promote land use efficiency and reduce sprawls (Daniels 2001, 273).

Previous study from Steuteville (2000) found “successful new urbanism theory performs a difficult balancing act by maintaining the integrity” of smart growth principles (Steuteville 2000, 2). Smart growth principles materialize in the form of growing preferences for dense, mixed-land use development, transit-oriented development, open spaces, walkable neighborhoods, social interaction, and more accessibility. The aim is to achieve the equitable distribution of various resources to foster sustainability for the efficient urbanization. The principles are known to be actual mechanisms of new urbanism theory in regional planning that work on compatible macro- and micro-scales.

According to Talen (2005), smart growth principles work in the macro-scale of physical urban structure and the micro-scale of intangible cultural diversity. Thus, this presents the importance of “maintaining flexibility and the ability to change grow and evolve” along with innovative community development ideas (Talen 2005, 279).

However, the opposition to smart growth argues that the principles are not beneficial because of economic inefficiencies. Since residents prefer suburban housing and automobile transportation, smart growth principles are regarded as a set of restriction on housing and transportation options. Moreover, in order to implement smart growth principles practically, “it requires adopting a whole set of additional policies that are appealing to most of the local or regional constituents” (Downs 2005, 369-370).

Despite the critics of smart growth, there have been increasing acknowledgments on the significance of smart growth among urban planners. Along with the recent cultural, demographic trend changes, there are consistent growing demands for the smart growth principle implementation in community development plans to allow for improved quality

of life and flourishing environmental, and socioeconomic benefits (Litman 2003, 13; Fisher and Pivo 2010, 2-3).

Table 2.1: Smart Growth Benefits & Costs (Litman 2009, 28)

	Internal (Users)	External (Other people)
Benefits	<ol style="list-style-type: none"> 1. Improved housing options (reduced restrictions on multi-family housing) 2. Increased housing affordability (e.g. reduced land and parking requirements). 3. Improved accessibility options 4. Transportation cost savings 5. Reduced crash risk 6. Improved public fitness and health 7. More attractive, livable community 8. Reduced chauffeuring responsibilities 	<ol style="list-style-type: none"> 1. Public service cost savings (lower costs for roads, utilities, emergency services, etc.) 2. Reduced road and parking costs/subsidies 3. Reduced congestion (if people drive less) 4. Reduced crash risk to other road users 5. Increased community cohesion 6. Improved accessibility for non-drivers 7. Energy conservation 8. Reduced pollution emissions 9. Open space preservation (farms and wild lands)
Costs	<ol style="list-style-type: none"> 1. Smaller lot size 2. Less privacy 3. Lower local traffic speeds 4. More road and parking fees 5. More exposure to some local pollutants 	<ol style="list-style-type: none"> 1. Some additional infrastructure costs (curbs, sidewalks and public transit) 2. Increased local traffic congestion 3. Higher impervious surface coverage in some areas

The implementation of smart growth principles, given its major focus on the environment, efficient economic expansion, and social equity, have been shown to eliminate the negative effects from urban sprawls (Speirs 2010, 18-19; Gatrell and Jensen 2002, 332). While the theoretical and practical application of interactive and transformative community development has been sought in many cases, there are still many suburban areas that remain opposed to such changes in development plans due to anticipated inefficiency (Katz 2002, 10-13).

In order to overcome these issues, Talen (2005) suggests in her book, *New Urbanism and American Planning: The Conflict of Cultures*, that it is necessary to work towards social and cultural diversity goals while maintaining flexibility on physical infrastructure planning. Talen (2005) insists that smart growth should be applied to community development plans this way: tracking the incremental progresses and

socioeconomic impacts of sustainable development projects upon the composite theoretical work frame (Talen 2005, 7-10).

Table 2.2: Smart Growth Principles & Examples of Variables Extracted from Included Studies (Durand et al. 2011, 12-13)

(1) Create a range of housing opportunities and choices	<ul style="list-style-type: none"> • Provide for a wide range of housing types • Meet housing needs for all income groups • Example variables: mix of apartments, townhouses and single family homes in same neighborhood; mix of rental and owner-occupied housing
(2) Create walkable neighborhoods	<ul style="list-style-type: none"> • Allow for reduction of street widths to promote walkability and bike friendliness • Require sidewalks on both sides of the street • Example variables: presence of sidewalks, controlled street crossings, traffic control devices (speed bumps) in the neighborhood
(3) Encourage community and stakeholder collaboration	<ul style="list-style-type: none"> • Strengthen state, metro and regional institutions to facilitate multi-jurisdictional decision-making and problem solving. • Provide a process for public participation in drafting and adopting the General Plan and supporting ordinances. • No example variables available
(4) Foster distinctive, attractive communities with a strong sense of place	<ul style="list-style-type: none"> • Public and private development should improve the character of existing neighborhoods, avoiding or removing factors that cause instability or create barriers and enhancing the sense of neighborhood identity • Neighborhoods should include places for interaction among residents, such as parks, community centers, schools, commercial areas, churches and other gathering places. • Example variables: presence of parks, gyms, or playgrounds nearby
(5) Make development decisions predictable, fair and cost effective	<ul style="list-style-type: none"> • Consistency between local government regulations, local actions and the comprehensive plan. • No example variables available
(6) Mixed-land uses	<ul style="list-style-type: none"> • Encourage mixing of uses at building, site and neighborhood levels • Encourage residential uses in the downtown districts • Example variables: quantification of land use mixture; perceptions of accessibility to commercial areas from home
(7) Preserve open space, farmland, natural beauty and critical environmental areas	<ul style="list-style-type: none"> • Establish guidelines to regulate development in critical areas such as wetlands, fish and wildlife conservation areas, frequently flooded areas and geologically hazardous areas • Establish open space and farmland protection programs • Example variables: presence of undeveloped, natural spaces; proximity to beach or lake
(8) Provide a variety of transportation choices	<ul style="list-style-type: none"> • Encourage transit-oriented and transit friendly developments • Encourage public transit use by integrating multimodal use and connectivity (Park and Ride lots, transit centers, etc.) • Example variables: availability or proximity of transit (bus, subway, light rail) stops
(9) Strengthen and direct development towards existing communities	<ul style="list-style-type: none"> • Discourage sprawl generating subsidies (such as funds for suburban highway and road construction, water and sewer facilities and service) in place of structured incentives for urban infill or transit oriented development • Encourage infill development with specific zoning ordinances. • Example variable: population density for a given land area
(10) Take advantage of compact building design	<ul style="list-style-type: none"> • Establish minimum densities for higher density development • Promote reduced lot guidelines to encourage higher density • Example variables: density of housing or commercial units

2.2 Walkability Improvements and Community Value Creation

2.2.1 The Importance of Land Use Efficiency

As mentioned in the previous chapter, smart growth principles provide an efficient framework for urban planning decisions because of their role in promoting public health, socioeconomic development, and efficient pragmatic infrastructure. Among many smart growth principles, walkability has been prominent in many sustainable community development plans because it has an explicit connection to the standard of sustainable development by generating consequential community benefits of public health improvement, less environmental pollution, and various socioeconomic opportunities. Therefore, promoting better walkable condition in neighborhoods has been emphasized as a method of satisfying demands for socioeconomic prosperity and quality of living conditions.

Walking is known as “the most effective, convenient way” to engage people in various activities (Pentella 2009, 2). Favorable walking conditions support the creation of healthy neighborhoods by reducing dependence on automobiles and encouraging people to pursue various outdoor activities on foot (Clear 2011, 3-4). Leinberger and Alfonzo (2012) defined walkability as a “mechanism” which bears triple bottom lines of “profit (economics), people (equity), and planet (environment)” (Leinberger and Alfonzo 2012, 2). They noted that the value of walkability is created by dense walkable neighborhoods. Walkability is a compatible and supportive strategy in fostering sustainable community development because it puts land use efficiency in a regional context, encourages urban diversity, and accessibility (Talen 2005, 251-253). Walkability is inextricably related to efficient mixed-land use and compact development.

Efficient land use, a key factor in walkability, benefits the community economically and provides environmental sustainability. Geoghegan et al. (1997) noted a case of efficient land use in central Maryland in which diversity and changes in land uses had a resulted in an improvement in walkability and public infrastructure (Geoghegan et al. 1997, 263). Van Cao and Cory (1982) argued that the positive effects of mixed-land uses on commercial, residential, and industrial property resulted in higher property values from better accessibility and additional pedestrian activities (Van Cao and Cory 1982, 15-16). A case study in the city of Lancaster, California, in which mixed-land use was applied in the redevelopment plan, presented evidence for the potential value of walkability and efficient land use in economic growth and improving environmental quality. During the redevelopment, the city of Lancaster extensively instituted pedestrian-friendly sidewalks, single-travel lanes, enhanced crosswalks, and increased micro-urban amenities to improve mobility. As a result of the redevelopment project, the median residential property sale prices in Lancaster rose about 10 percent in the downtown area; 49 new businesses were created along the main boulevard which almost doubled their tax revenues by attracting more pedestrian activities and increased overall road safety level (Benfield 2013). This walkability implementation case clearly identifies the potential benefits of walkability to communities. The benefits included increasing residential units, more compact commercial districts, safer walkable infrastructure, and quality pedestrian amenities such as sidewalks and street trees (Forsyth, Oakes, Schmitz and Hearst 2009, 43-49). Other benefits for the community were affordability and resource use efficiency (Litman 2003, 11).

Handy (2005) stated that a significant proportion of smart growth development projects were implementing land use and design strategies. These can have an effect on reducing automobile uses and creating more livable communities. (Handy 2005, 162-164). Handy et al. (2008) also noted that land development patterns are influenced by land use policies and that there should be strong public support for mixed-land uses in order to meet the increasing demand for more walkable neighborhoods (Handy et al. 2008, 215-220). Proving the contributions of walkability to public institutions and the private sector is vital to developing the necessary support for efficient land use. The planning decisions of policymakers and private developers are critical to the adoption of walkability in efficient land use plans. However, inefficient municipal zoning code practices and conflicts of interests between the public and the private sectors have made difficult such efficient land uses under “regulatory bias”. It resulted in walkability being labeled as “a less-viable option” for a few decades and is still challenging to promote walkability (Smart Growth Network; Leinberger and Alfonzo 2012, 12-13). It is proven that efficient land use and urban design plays “a pivotal role in encouraging pedestrian environments” and creating the socioeconomic benefits of “lower transportation costs, greater social interaction, improved personal and environmental health, and expanded consumer choice” (Smart Growth Network).

Implementing regulations through directed planning and proficient land use policy is essential to coordinate future sustainable community development plans and to successfully meet emerging market demands of walkability (Schmitz and Scully 2006, 53-54; Dannenberg et al. 2003, 1507). Progressive public policy changes that promote mixed-land uses and flexible zoning ordinances are expected to encourage the

revitalization of existing neighborhoods and walkability (Leyden 2003, 1448). In order to make this procedure practical, a better understanding of public support from mutual parties (public officials, planners, and private developers) is required to increase political and fundamental support (Handy et al. 2008, 220).

Considering the importance of the participation of the public in land use and walkability policies, Schmitz and Scully (2006) listed the role of the public to generate sustainable community development at the municipality level:

1. Add mixed-use and other flexible and pedestrian-friendly categories to the zoning code.
2. Establish design guidelines that facilitate and encourage walking.
3. Modify and streamline the approval process for pedestrian-oriented projects, thus reducing the risk to developers.
4. Use public meetings and *charrettes* to build a vision and consensus for new walkable places in areas where they would be appropriate (Schmitz and Scully 2006, 92).

2.2.2 Social Capital Aspects of Walkability

Built environment attributes of walkability, such as safety devices for pedestrians and cyclists, street connectivity, and mixed-land use generates not only physical activity levels, but also has broad influence in characterizing social capital in communities (Leyden 2003, 1446). Several studies have identified the importance built environment attributes of walkability in the context of public health, social capital, and economic benefits. These studies confirmed that built environment attributes of walkability and its efficiencies are regarded as key components in providing the quality of social traits in communities.

Rogers et al. (2011) noted that neighborhoods providing the ability to walk to destinations with efficient physical infrastructures have high value of social capital that increases the quality of life (Rogers et al. 2011, 203-204). Clear (2011) proved the value

of built environment attributes in coordinating healthy community. There was a 46 to 54 percent increase in physical activities and socioeconomic behaviors from lower density neighborhoods compared to compact, mixed-land use neighborhoods with sufficient built environment attributes (Clear 2011, 14). The study concluded that the general physical and socioeconomic behaviors of the residents were mainly dependent on surrounding built environment attributes. Therefore, better walkable conditions in neighborhoods contributed to significant social capital improvement than in other communities.

Koohsari et al. (2012) argued that the quality of built environment attributes is important to promote safety features, traffic relief, and aesthetic values, all of which impact the level of walking in the community, thus, social capital (Koohsari et al. 2012, 17-18).

Frank et al. (2006) developed the “walkability index” by examining these built environment attributes of walkability: residential density, retail floor ratio, street connectivity, and mixed land use (Frank et al. 2006, 77). The walkability index has been applied to identify the association between walkability and the presence of particular social capital in communities, in many previous walkability studies. For instance, Saelens, Sallis, Black and Chen (2003) found different physical and social activity levels in each different neighborhood by applying the walkability index model. The study outcome showed that walkable neighborhoods were actively engaged in interactive physical, social activities while less walkable neighborhoods had more over-weighted residents and lower social capital level (Saelens, Sallis, Black and Chen 2003, 1555-1557). In studies by McNeill et al. (2006) and Leyden (2003), the different social capital levels between walkable and more automobile-oriented neighborhoods were shown. Neighborhoods with better walkability had positive social activity outcomes; such as high societal morality

level and a shared sense of community because it enabled residents to interact frequently. One the other hand, neighborhoods with inefficient built environment attributes of walkability, or heavy automobile-dependencies, resulted in less mutual interaction chances and lower social cohesion levels, all of which are potentially connected to social conflicts and safety issues (McNeill et al. 2006, 1016-1019; Leyden 2003, 1447). The empirical evidence of the studies on built environment attributes and walking behavior provides the view that improvements to the physical environment encourages more walkability and more walkability various formations of social interactions among residents (Lund 2003, 426-428).

Consistent findings from previous studies indicate that the built environment attributes of street connectivity, residential density, retail floor to area ratio, and greater mixed-land uses lead to positive impacts on social capital promotion. The theory is that built environment attributes of walkability play a significant role in conveying the safety of surrounding areas causing social capital improvements to physical and mental health among residents and the social wellness of the community (Leyden 2003, 1446-1448). The studies suggest that improving built environment attributes are subject to balance out overall socioeconomic inequalities and reduce its associated negative effects. Negative socioeconomic qualities in communities, such as social inequity, high obesity, crime, racial segregation, and less mutual interaction are associated with inefficient built environment attributes. Promoting walkable conditions could reduce a multitude negative environmental facilitator in communities (Norman et al. 2010, 417-419; Rogers et al. 2011, 209-212).

There are differentiated community preferences for the urban design features among community residents. Nonetheless, the interesting fact is that the demand for more walkable neighborhoods is increasing along with the expansion of the trend of sustainable community development throughout the country (Rogers et al. 2011, 212; Fisher and Pivo 2010, 2-3). The recent demographic and cultural trends show a preference for walkable neighborhoods in housing choices. According to *In the Option of Urbanism* by Christopher Leinberger, the demand for more walkable neighborhood shifts upward among various demographic groups of residents because of the convenient accessibility, better public transit options, more economic opportunities, and more social interactions offered by higher density residential areas (Bliesner, Bouton and Schultz 2010, 10). It suggests that walkable neighborhoods are better generators of overall socioeconomic benefits that lead to preference changes toward a comprehensive quality of living (Leslie et al. 2005, 227-228). A combination of conceptual and applied features of walkability and its socioeconomic prosperity create substantial community value.

2.2.3 Relationship between Walkability and Housing Value

Walkability accommodates the demand for an integrated solution to significant urban issues by enhancing existing facilities, internal connectivity, pedestrian accessibility, transit access, and the quality of living. Given the fact that walkability has the potential to bear significant environmental and socioeconomic impacts to communities, the preference for more walkable neighborhoods should be capitalized into the purchase of rental prices and housing values (Bartholomew and Ewing 2011, 26-30). The value of walkability can be estimated by assessing its impact on housing values; this

would allow for the verification of the contribution of walkability to economic value created by community developments.

Regarding the potential role of walkability in the determination of real estate values, a number of studies have confirmed that both residential and commercial properties with greater walkability measures command higher real estate values. The studies from Li and Brown (1980), Eppli and Tu (1999), Matthews and Turnbull (2007), and Cortright (2009) found a significant association between existing walkable conditions and residential housing values.

Li and Brown (1980) observed the impacts of micro-neighborhood variables such as aesthetics, pollution levels, and proximity to non-residential land uses on housing sales prices. They found that the higher on-site visual quality and accessibility were significant in increased the housing values, while greater air pollution and older units decreased the housing values (Li and Brown 1980, 137-140). Eppli and Tu (1999) examined housing values in Kentlands, a community of the city of Gaithersburg, Maryland, where new urbanism theory was implemented through community revitalization. They found that pedestrian-oriented designs exhibited noticeable housing market value differences compared to other neighborhoods; a 12 percent premium for properties in this community. Moreover, residents were willing to pay to live in the communities where pedestrian-oriented strategy was applied in redevelopment plans. However, their study did not specifically featured insights of new urbanism characteristics such as diversity, walkability, and mixed-land use, just pedestrian-oriented designs (Eppli and Tu 1999, 449). The study from Matthews and Turnbull (2007) in King County, Washington proved that built environment attributes of walkability, especially distance-proximity dimensions

such as street connectivity and street patterns are likely to increase housing values while the opposite was true. They noted that the functional aspects of street layout and its accessibility level interplay together in the determination of housing values. In this study, they confirmed that neighborhoods and retail locations with better accessibility had higher housing values and that the qualities of street connectivity and patterns significantly produced net benefits to housing values (Matthews and Turnbull 2007, 137-140). Cortright (2009) found that walkability is positively associated with higher housing values for its proximity dimension. In his study, 13 out of 15 metropolitan areas had direct positive associations between housing values and walkability. The study presented that the ideal walkable proximity-distance that increased housing value is between one-quarter mile and one mile from the properties (Cortright 2009, 10-11; Bliesner, Bouton and Schultz 2010, 6). The study concluded that efficient built environment attributes in walkable neighborhoods were reflected in real estate values. Therefore, the demands for residential housing in more walkable neighborhoods were high enough to attract more residents to them. Based on the study outcome, Cortright insisted that walkability should be regarded as a key measure for community vitality in terms of walkability's ultimate role in increasing a community's socioeconomic values. Cortright proposed the potential beneficiaries of walkability improvements were local governments since walkability promotes higher housing values and, thus, higher tax revenues. He also suggested that local governments implement walkability features to generate balanced community growth at the municipality level (Cortright 2009, 25).

Not only does the value of residential housing have an association with walkability, but also the value of commercial properties, such as business offices and

retail locations. Fisher and Pivo (2010) identified this association in commercial properties with higher premiums; properties with higher walkable environments receive capitalized from them with higher property values. The study showed that the price premium was related to walkability: “a 1 unit increase in Walk Score produced a 0.9%, 0.9% and 0.1% value premium for office, retail and apartment properties, respectively” (Fisher and Pivo 2010, 13). The study from Leinberger and Alfonzo (2012) in the Washington, D.C. metro area also confirmed that the real estate values in places with better walkability were higher than the values of its counterparts. The study outcome sought to determine the economic performance of walkability by commercial property type: “a one-level (or approximately 20 pt.) increase in walkability (out of a range of 94 points) translates into a \$ 8.88 value premium in office rents, a \$ 6.92 premium in retail rents, an 80 percent increase in retail sales” (Leinberger and Alfonzo 2012, 9).

Bliesner, Bouton and Schultz (2010) summarized the walkability and real estate value association as the result of the high demand for socioeconomic good creation. They confirmed that potential homebuyers are interested in further benefits of walkable neighborhoods for its potential for more robust socioeconomic conditions: “the convenience of shopping services within a short walking distance and resistance to economic slowdowns and changes” (Bliesner, Bouton and Schultz 2010, 20). These observations were based on the study conducted in San Diego, California. They found that housing values increased in highly walkable neighborhoods by 83 percent of the variance between walkable areas and non-walkable areas. Housing values were also related to the number of types of destination businesses, such as restaurants, grocery stores, clothing, and miscellaneous retailers that attract high levels of commerce (Bliesner,

Bouton and Schultz 2010, 16). The study noted that the positive impact of walkability on overall property value creation is associated with public and private “community revitalization efforts” (Bliesner, Bouton and Schultz 2010, 10). The fact that both the public and private sectors were involved in walkability projects shows that they recognize the potential economic values through walkability development; as demonstrated by the effort from these two sectors to create financial growth from their investments in development plans. Further plans for financial investment are expected to increase the value of these communities by contributing economic growth (Bliesner, Bouton and Schultz 2010, 22-23).

Skeptical arguments regarding the association between walkability and housing value have recently surfaced in several studies. These studies reported that the association between walkability and housing value is inconsequential because other determinant factors affected housing values more drastically than walkability. For instance, Boyle et al. (2012) observed the association in several different neighborhoods in Florida. They found that housing value was no longer associated with walkability, but rather with “controlling unobserved heterogeneity” in neighborhoods. Based on this result, they argued that the existing “fixed effects” in every neighborhood, such as housing types, ethnic diversity, and different forms of public transit. Thus, housing values were impacted by these variables. This study concluded that housing values are differentiated by predominant controlling factors in neighborhoods, not by walkability. Housing values in high walkability areas can be lower than values in low walkability areas due to other fixed effects (Boyle et al. 2012, 14-15).

Although this argument may be true in some respect, the benefits walkability's benefits should still be considered as an important aspect in housing value creation. As found in several studies, walkability was identified as embodying local socioeconomic value improvements. In addition, spatial planning now relies more on sustainable economic growth potential considering the significance of "the spatial consequences of economic growth" (Smith, Poulos and Kim 2002, 108). Thus, walkability needs to be regarded as the influential factor in strategic economic development for financial valuations (Leinberger and Alfonzo 2012, 12-13) and neighborhood choices which affect the level of built environment attributes that are interwoven with housing values.

Consequently, the theoretical and empirical approach to walkability's impact on housing value creation should be emphasized. This approach is expected to provide smart growth application opportunities for assorted planning situations such as land availability, diversity of land use plans, retraining sustainable growth programs, and regeneration strategies that are congruent with community values for long-term sustainability (Barton 2009, 119-121).

Criteria for Walkable Cities

1. Connectivity of path network, both locally and in the larger urban setting.
2. Linkage with other modes: bus, streetcar, subway, train.
3. Fine grained and varied land use patterns, especially for local serving uses.
4. Safety, both from traffic and social crime.
5. Quality of path, including width, paving, landscaping, signing, and lighting.
6. Path context, including street design, visual interest of the built environment, transparency, spatial definition, landscape, and overall explorability (Southworth 2005, 249).

Economic Benefits of Walkable Community

1. Housing values are higher where walkable.
2. Walkable communities attract new economy workers.

3. Walkable communities are becoming a business relocation alternative.
4. Walkable communities reduce commuting costs.
5. Walkable communities cost the taxpayer less.
6. Walkability attracts tourists.
7. Walkable communities can capture an emerging lifestyle retail market (Ryan 2003).

2.2.4 The Benefits of Existing Open Space on Property Value and the Relationship to Walkability

Researchers assume that the convenience of accessibility to open green-spaces is favorable in the real estate market because of the substantial benefits in promoting property values that have emerged in the economic portion of community development plans (Poudyal, Hodges and Merrett 2009, 982). Another way, the presence of open green-spaces in communities has been linked to a “variety of economic benefits” that attract new residents; desirable foliage, recreational parks, and outdoor activities that could be reflected by economic value creation (Nicholls and Crompton 2005, 88).

Previous research in environmental dimensions of open green-spaces revealed that property values tended to rise along with closer proximity to urban parks (Tyrväinen and Miettinen 2000, 206-207; Thorsnes 2002, 426-428) and the size of these urban parks (Lutzenhiser and Netusil 2001, 297-298). Also, Geoghegan et al. (1997) found that the diversity of the natural environment had a marginal contribution on a property’s market value in different urban areas (Geoghegan et al. 1997, 258-263). These studies concluded that specific “environmental dimensions” of open green-spaces, such as the proximity, size, fragmented landscape, and various kinds of open-green spaces had significant effects on property value association (Kestens, Thériault and Des Rosiers 2002, 10; Nicholls 2004, 1).

Crompton (2001) has been investigating various cases of contributions to property values from environmental assets by applying the hedonic price model. He stated the estimation of economic benefits that were associated with the presence and the use of green amenities from properties as “proximate principle” (Crompton 2001, 2). Many studies of the proximate principle demonstrated the influence of green amenities benefit on property values based on distance proximity and its related scale. Geoghegan (2002) concluded that households preferred existing open green spaces within their range of residential areas for accessibility and large tracts of diverse land uses are preferred for its long-term economic potential (Geoghegan 2002, 92-93). Walsh (2004) calculated from his study result that households within “a half-mile from open green-spaces were willing to pay a one-time amount of \$4,104 to reduce its distance from open space by a quarter-mile” (Walsh 2004, 22; Henderson 2006, 12). Based on numerous studies on the proximity dimension of open green-spaces and its connection to property values, the effective distance proximity is defined as a quarter mile. Within a quarter mile, there is a positive association between open green spaces and property values (Acharya and Bennett 2001, 224; Geoghegan, Lynch and Bucholtz 2003, 34-35; Irwin 2002, 477-480)

Some studies emphasize the importance of diversity and the size of open green-spaces. Lutzenhiser and Netusil (2001) conducted a study of premium value for single-family houses association to different open green space types, “natural area parks, urban parks, specialty parks, golf courses, cemeteries” as well as the required sizes to attain maximized property values in Portland, Oregon. There they found a substantial positive impact on property values for the ones with open green-spaces nearby. “The largest effect on a housing price is estimated to occur for homes within 1,500 feet of an open green

space” (Lutzenhiser and Netusil 2001, 296). Results were shown with each different open green-space. “Natural area parks on average have the highest significant effect (maximized value) of \$10,648 (258 acres) on a housing price, golf courses \$8,849 (169 acres), facility/specialty parks \$5,657 (112 acres), and urban parks \$1,214 (148 acres), all at the 1 percent level in 1990 dollar value” (Lutzenehiser and Netusil 2001, 296). Overall, this study result estimated an average of \$ 2,262 property values increased (Nicholls and Crompton 2005, 328).

Crompton (2001) insists on the importance of diversity of open green-spaces and land preservations considering their economic potential (Crompton 2001, 28-29). The study from Cho et al. (2006) in Knox County, Tennessee found a significant association between property value and the proximity dimension of open green-spaces, as well as the importance of preserving existing open green spaces in community. These included residential homes and open green-spaces such as parks, trails, and watershed. They found “the marginal implicit price of proximity to local parks (1,000 feet closer) was estimated to have the value of \$172 in the global model, but ranged from \$662 to \$840 locally at an individual park level” (Cho et al. 2006, 504). Based on study results, they insisted public officials should participate in public green-space preservation for their potential economic value. This study showed that “it can be used for budget decisions regarding land management or in prioritizing specific parks to be protected” (Cho et al. 2006, 504) and that there was a benefit to establishing conservation regulation for green amenities. These regulations are expected to promote demand for housing and to increase property sales prices. Geoghegan, Lynch and Bucholtz (2003) argue that public officials should be able to apply specific financial and theoretical mechanisms to manage land preservation

more efficiently. Public officials also need to focus on the ability of green-spaces to create value (Geoghegan, Lynch and Bucholtz 2003, 44).

To that end, these research outcomes suggest that in order to make a positive impact on property values, as well as to maximize the value created, open green spaces should have diversified environmental dimensions since these assets generate maximum property values. To this extent, the economic value creation from environmental attributes should be recognized in open green-space regulation (Nicholls and Crompton 2005, 103-105). In addition, some scholars suggested that open green-space values should be viewed differently based on their specific urban settings. It provides a different value in metro areas as compared to suburban areas due to different population density levels and different amenities that influence economic levels (Acharya and Bennett 2001, 233-235).

Chapter 3

METHODOLOGY

3.1 Study Area

The city of Lincoln, Nebraska was chosen for this study (Figure 3.1). Lincoln is the capital of the state of Nebraska has a population of 258,381 as of 2010 (U.S Census Bureau 2010). Lincoln is the second biggest city in Nebraska and it has both urban and suburban areas. It has stable social and economic conditions that are favorable for growth and development (Cauchon 2011). In addition, Lincoln has a long-term sustainable community development plan: LPlan 2040. The plan aims to control and direct “future land use and phasing of growth” using sustainable growth strategies of smart growth principles (City of Lincoln & Lancaster County Planning Department: Summary Document 2011, 3).

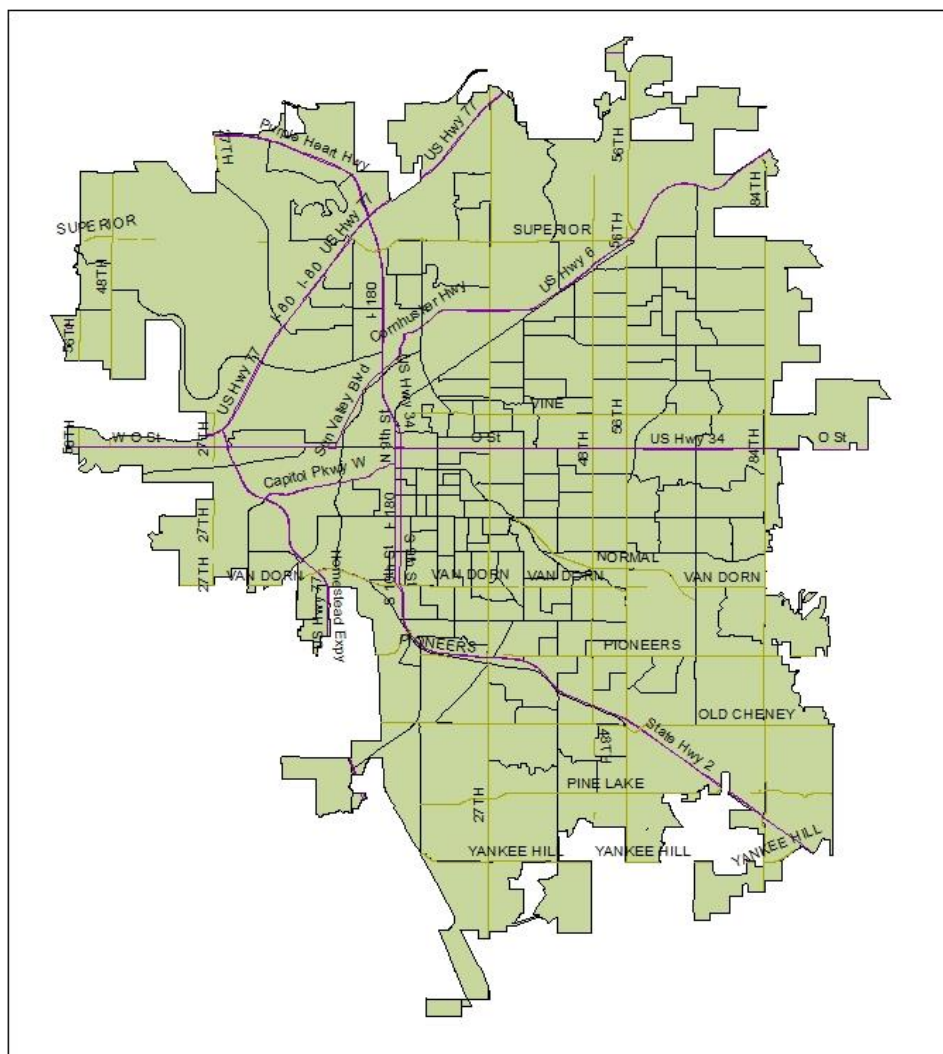
3.2 Unit of Analysis

The units of analysis for this study are census block groups. Census block groups are defined as the subdivisions of census tracts, and are the smallest geographic units that Census data is publically available for privacy reasons (U.S Census Bureau 2010). Each census block group consists of a collection of parcels (Figure 3.2). Thus, census block groups are the primary units in applying statistical divisions of neighborhood assessments. This allows for efficient data collection and analysis.

The boundary of Lincoln in this study is defined as census block groups within Lancaster County based on the 2010 Census Tract. Lancaster County consists of 201 census block groups. Therefore, the study will examine not only the city of Lincoln but

also the surrounding communities in Lancaster County are included in the units of analysis. However, since the study area is limited to Lincoln, a comprehensive model outcome based on census block groups is presented within the city limits only.

Figure 3.1: Projected Study Area



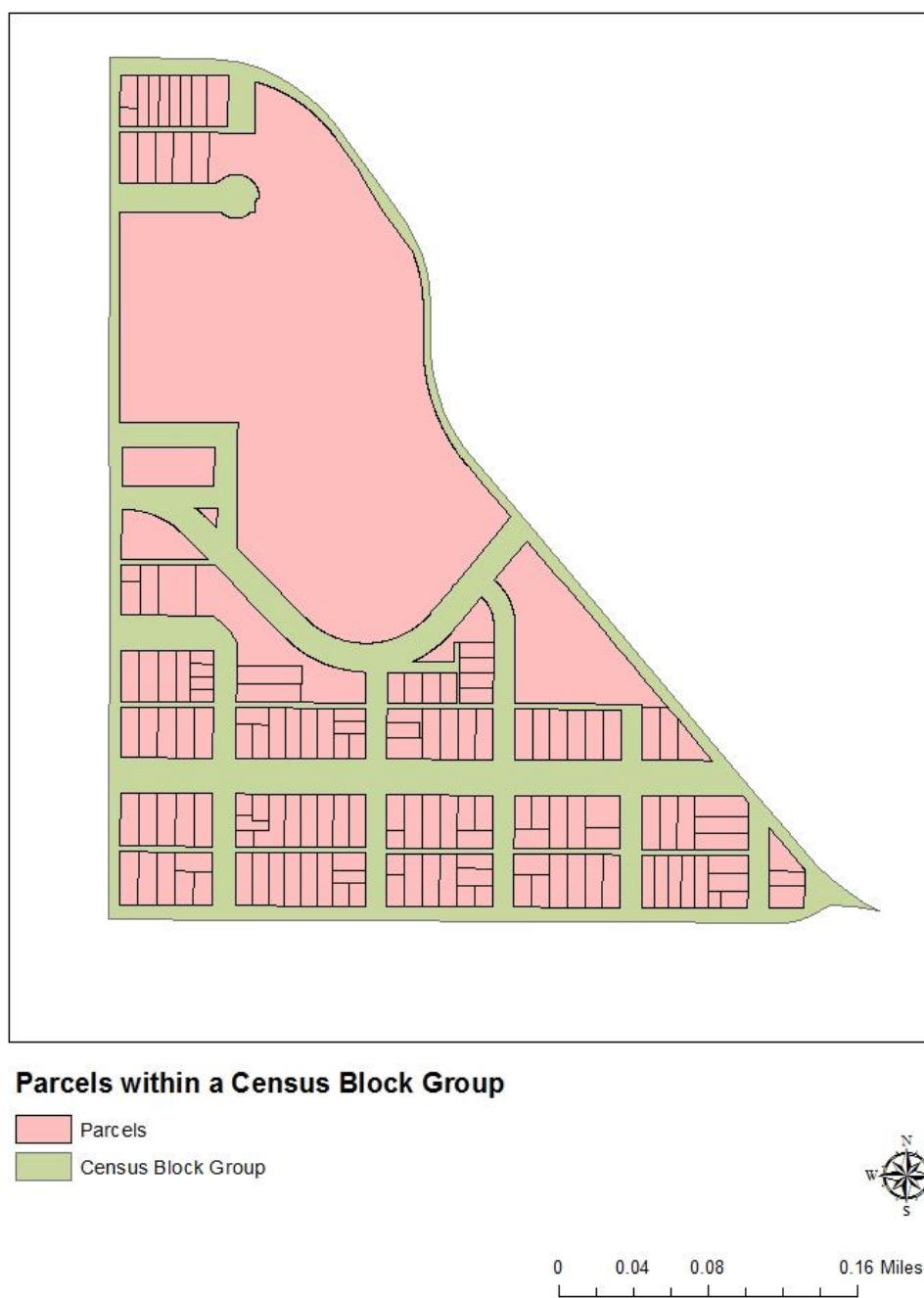
Projected Study Area

- Lancaster County Census Block Group 2010
- City Limits
- Major Road



0 1 2 4 Miles

Figure 3.2: A Collection of Parcels within a Census Block Group



3.3 The Measure of Walkability Components

The “walkability index”, developed by Frank et al. (2006), is a principal method of measuring walkability. A number of researchers in community planning and transportation have been using the walkability index in neighborhood walkability assessments. In addition, this method of estimating walkability has been used at various geographical levels, including census tracts and network buffers around specific households or commercial centers (Leslie et al. 2007, 114-115). There are four components in the index: 1) street intersection connectivity, 2) residential density, 3) land use mix index, and 4) retail floor to area ratio (Frank et al. 2006, 77). They are identified as the key aspects in estimating walkability (Frank and Pivo 1994, 51-52; Leslie et al. 2005, 232). The formula of the walkability index is:

$$\text{Walkability Index} = (2 \times \text{z-street intersection connectivity}) + (\text{z-residential density}) + (\text{z-retail floor to area ratio}) + (\text{z-land use mix index}) \text{ (Frank et al. 2006, 77)}$$

Street intersection density is weighted by a factor of 2 since street intersection density is regarded as the most influential of the walkability components (Frank et al. 2006). However instead of calculating a walkability index, this study will retain all four walkability components separately to attempt to observe each of the walkability component’s relationship to housing value in Lincoln at the block group level.

3.4 The Summary of Walkability Components

3.4.1 Street Intersection Connectivity

Three-way intersections are an indication of “moderate” walkability and four-way intersections are an indicator of “good” walkability (Ackerson 2005, 30). As

demonstrated in previous studies in the literature review, three-way (or greater) intersections indicate high street intersection connectivity. Therefore, street intersection connectivity for this study will be measured by calculating the number of three-way (or more) intersections per square mile.

3.4.2 Residential Density

Residential density for this study will be calculated by the number of residential units divided by the land area used for residential purpose.

3.4.3 Retail Floor to Area Ratio

Retail floor to area ratio indicates the ratio of retail area to the entire commercial areas. Retail floor to area ratio for this study will be calculated by the retail building floor area in acre divided by retail land area in acre.

3.4.4 Land Use Mix Index

Mixed land use is when there is a combination of two or more land uses (public, residential, retail, and office) in an area. Mixed land use areas are generally conducive to walking. The land use mix index formula is given by

$$\text{Land Use Mix Index} = \frac{A}{\ln N}$$

$$A = \left(\frac{b_1}{a}\right) \times \ln\left(\frac{b_1}{a}\right) + \left(\frac{b_2}{a}\right) \times \ln\left(\frac{b_2}{a}\right) + \left(\frac{b_3}{a}\right) \times \ln\left(\frac{b_3}{a}\right) + \left(\frac{b_4}{a}\right) \times \ln\left(\frac{b_4}{a}\right)$$

a = total acres of land for all four land uses present

b₁ = total acres of land in public uses

b₂ = total acres of land in single-family and multi-family residential uses

b₃ = total acres of land in retail uses

b₄ = total acres of land in office uses

N = number of four land uses with FAR >0

Finally, the measurement of each walkability component will be normalized by converting them into Z-score.

$$Z\text{-score} = \frac{(x_i - \bar{x})}{\sigma}$$

x_i = component data point

\bar{x} = component mean

σ = component standard deviation

3.5 Housing Value & Walkability Assessment: Hedonic Regression Model

For the association of housing value and walkability assessment, a hedonic regression model will be applied. The hedonic regression model is used to identify the marginal effects on housing prices and “statistically unbundle different attributes and estimates in separate value” (Cortright 2009, 9). It is a specific economic technique that “identifies and quantifies the various influences on property prices, thereby enabling estimation of the values of residential location adjacent” (Nicholls 2004, 1).

Walkability’s influence on housing value generation is projected to be confounded by other factors (Sohn, Moudon and Lee 2012, 122). Therefore, in order to determine housing value association with walkability upon hedonic regression model, locational and structural attributes will be considered as independent variables along with four walkability components. Such attributes are physical attributes of housing (number of rooms, household size), neighborhood conditions & design features (travel time to work, number of businesses), urban service (bus services), amenities (golf courses, public parks), and socioeconomic characteristics (age of householder, educational attainment level, crime rate, ratio of non-white population). The scope of housing value type will be generated for single-family, owner-occupied residential units.

“Since the hedonic regression model deals with the implicit prices of quantities of attributes of a product, the problem of misspecification of variables is inevitable” (Chau and Chin 2003, 148-150). In order to prevent such empirical issues upon misspecification; inefficient, inconsistent estimates, and bias in the estimated coefficients, proper functional form needs to be chosen. Therefore, it is significant to generate homogeneity on the data set by applying appropriate functional form. “There are several functional forms such as linear, semi-log, and log-log forms that can be applied in hedonic regression model” (Chau and Chin 2003, 147). Among these functional forms, semi-log function (logarithmic transformations) is chosen to be applied on several independent variables (number of rooms, household size, public parks, age of householder, educational attainment level, crime rate) in this study model to be justified for the accurate data composition.

Housing Value Type: Single-family, owner-occupied residential units

Hedonic Regression Model

$$V = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \dots \dots + \varepsilon$$

Dependent Variable: Median housing value of single-family, owner-occupied residential units

Independent Variables: (1) Physical Attributes of Housing, (2) Walkability, (3) Neighborhood Conditions & Neighborhood Design Features (4) Urban Service, (5) Amenities, (6) Socioeconomic Characteristics

$$V = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \dots \dots + \varepsilon$$

V is total estimated median housing value where **α** is the constant, **$\beta_1 \dots$** are coefficients, **$x_1 \dots$** are independent variables, and **ε** is an error term.

Table 3.1 summarizes the description of all variables for the hedonic regression model.

Table 3.1: Summary of Variables for Hedonic Regression Model

Variable		Name	Description	Unit of Measure
<i>Dependent Variable</i>		Housing Value	Median Housing Value (land value + improvement value) of single-family, owner-occupied residential housing units	\$ (Dollars)
<i>Independent Variables</i>	Physical Attributes of Housing	Number of Rooms	Median number of rooms (logged)	ln (# of rooms)
		Household Size	Average household size of occupied housing unit (logged)	ln (# of average household size)
	Walkability	Street Intersection Connectivity	Number of street intersections divided by square mile	Z-Score (square mile)
		Residential Density	Number of residential units divided by the land area used for residential purpose	Z-Score (acre)
		Retail Floor to Area Ratio	Retail building floor area divided by retail land area	Z-Score (acre)
		Land Use Mix Index	Index of types of land use	Z-Score (acre)
	Neighborhood Conditions & Neighborhood Design Features	Travel Time to Work	Median travel time to work	Minutes
		Number of Businesses	Geo-coded total business units	# of businesses
	Urban Service	Bus Services	Bus stop density	% (Percentage)
	Amenities	Golf Courses	Median distance to the nearest golf course	Acre
		Public Parks	Median distance to the nearest public park (logged)	ln (acre)
	Socioeconomic Characteristics	Age of Householder	Median age of householder in occupied housing units (logged)	ln (age)
		Educational Attainment Level	Ratio of higher educational attainment (Bachelor's degree and above) among the population of 25 year-old and over, divided by total population of 25 year-old and over (logged)	ln (%)
		Crime Rate	Average rate of crime from the total crime density level of years between 2008 and 2010 (logged)	ln (%)
		Ratio of Non-White Population	Total number of non-white population divided by total number of white-only population	% (Percentage)

3.6 Spatial Analysis with GIS

Spatial analysis with Geographic Information System (GIS) will be applied to the census block group based dataset for walkability components and median housing value. In many studies, measuring walkability components is done by applying GIS spatial analysis to define the targeted geographic areas' walkable distance proximity and measures walkability components (built environment attributes in specific geographic scales) (Chin et al. 2008, 43-45).

For this study, the spatial analysis will identify walkability conditions in each block group. Therefore, each walkability component will be individually identified on each block group through GIS mapping to show the overall walkability conditions. Other variables will be identified at each census block group through GIS mapping, in the same way as the walkability components. The Lancaster County dataset will be processed by the GIS procedure according to the given census block group number.

In order to construct the GIS process, ArcGIS 10.1 version will be used. By applying spatial join to the Excel spreadsheet based datasets, the collected variable data of each block group will be displayed on the map. Other necessary GIS functions and tools also will be applied in accordance with the appropriate GIS mapping procedure.

3.7 Data

The datasets for this study will be gathered from the American Community Survey (ACS) and various data sources from the City of Lincoln. The period of the data from ACS is collected over 5 years, between 2006 and 2010. All data from the City of Lincoln are within the same range, of 2006 and 2010. Data was limited to these years in

order to measure the recent (5-year terms) housing value in reasonable proxy from the base year of this study, 2010.

3.7.1 Walkability Components

The data set of four built environment attributes for walkability measurement is collected from various data sets that provided by The City of Lincoln. The list of walkability components' data sources is stated on the following table (Table 3.2).

Table 3.2: Criteria of Walkability Components & Data Sources

Walkability Components	Street Intersection Connectivity	Residential Density	Retail Floor to Area Ratio (FAR)	Land Use Mix Index
Criteria	3 to 6 intersections per square mile	The number of residential dwelling units to land area used for the residential	The retail floor space to land area used for the buildings	The different land uses based on zoning ordinances
Feature Class	Line	Polygon	Polygon	Parcel
Data Source	The Lancaster County Street Centerline dataset from the City of Lincoln	The dataset of residential dwelling units and residential use area map/data from the City of Lincoln	The dataset of retail floor and area of building layers from the City of Lincoln	The land use classification data/map from the City of Lincoln

3.7.2 Housing Value & Variables

The scope of residential housing for this study only includes single-family, owner-occupied residential units due to data availability on the ACS. Therefore, the median value of single-family, owner-occupied residential units will be used as the dependent variable.

As mentioned previously, for the housing value assessment, several independent variables were selected. The criteria of selecting independent variables are based on the significance of its influence on housing values in previous studies, as documented in the

literature review, and data availability. The dataset of independent variables is gathered from the American Community Survey (ACS) and various data sources from The City of Lincoln. Table 3.3 summarizes data sources of variables.

Table 3.3: Hedonic Regression Model Data Sources

Variable	Name	Data Source
<i>Dependent Variable</i>		
Housing value	Housing Value	Median value (B25077, ACS 2006-2010, 5 year estimates)
<i>Independent Variables</i>		
Physical Attributes of Housing	Number of Rooms	Median number of rooms (B25018, ACS 2006-2010, 5 year estimates)
	Household Size	Average household size of occupied housing units (B25010, ACS 2006-2010, 5 year estimates)
Walkability	Street Intersection Connectivity	The City of Lincoln: The dataset of street centerline
	Residential Density	The City of Lincoln: The dataset of residential dwelling units and residential use area
	Retail Floor to Area Ratio	The City of Lincoln: The dataset of retail floor and area of building layers
	Land Use Mix Index	The City of Lincoln: The dataset of land use classification
Neighborhood Conditions & Neighborhood Design Features	Travel Time to Work	Travel time to work (B08303, ACS 2006-2010, 5 year estimates)
	Number of Businesses	Geocoded-business units based on the business directory in Lincoln, Nebraska as of 2009 from The City of Lincoln
Urban Service	Bus Services	Total StarTran bus line stops in Lincoln, Nebraska as of 2009 from The City of Lincoln
Amenities	Golf Courses	Golf course polygons from The City of Lincoln
	Public Parks	Public park polygons from The City of Lincoln
Socioeconomic Characteristics	Age of Householder	Tenure by age of householder (B25007, ACS 2006-2010, 5 year estimates)
	Educational Attainment Level	Sex by educational attainment for the population 25 years and over (B15002, ACS 2006-2010, 5 year estimates)
	Crime Rate	The crime report database from Lincoln Police Department 2008-2010
	Ratio of Non-White Population	Race (B02001, ACS 2006-2010, 5 year estimates)

Chapter 4

RESULT INTERPRETATION

4.1 The Hedonic Regression Model

The result of the hedonic regression model is presented in Tables 4.1-3. The hedonic regression model was performed using the multiple linear regression analysis from SPSS Statistics Version 21. The model has one dependent variable and fifteen independent variables. During the final data sorting for the hedonic regression model, census block groups that did not contain housing values due to missing data were not included. As a result, of the total 201 census block groups, 193 census block groups were used for the analysis.

R squared, the coefficient of determination, was 0.669 and adjusted R squared was 0.641. R square explains how well the regression line fits the data. Since R square is above 0.5, it gives the explanatory power of the model that there is a significant relationship between the variables. The Durbin-Watson value is 2.010. A value of approximately 2 indicates no autocorrelation; the errors are uncorrelated in the model. The Variance Inflation Factor (VIF) values in the model, a collinearity diagnostic, is less than 10, indicating that no multi-collinearity exists among variables (Mela and Kopalle 2002, 667; Hair et al. 2009, 197- 202).

A significance level of p-value less than 0.05, ($p < 0.05$), means the null hypothesis can be rejected at a confidence level of 95%. The null hypothesis in this study is that the dependent and independent variables are not related. It means as long as the

variable's p-value is lower than 0.05, there is a statistically significant relationship between dependent variable and independent variables.

Table 4.1: Hedonic Regression Model: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.818 ^a	.669	.641	32662.938	2.010

a. Predictors: (Constant), HH_AGE_LOG, SID_Z_SCOREMSD, RESI_DENS_Z_SCOREMSD, EDUCATION_LOG, MIXED_Z_SCOREMSD, Bus_Dens, NON_WHITE, TRAVEL_T, HH_SIZE_LOG, PARK_DIST_LOG, BUSINESS, FAR_Z_SCOREMSD, ROOMN_LOG, GOLFC_DIST, CRIME_LOG

b. Dependent Variable: H_VALUE

Table 4.2: Hedonic Regression Model: ANOVA^a

Model 1	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.824E+11	15	25490824603	23.893	.000 ^b
Residual	1.888E+11	177	1066867541		
Total	5.712E+11	192			

a. Dependent Variable: H_VALUE

b. Predictors: (Constant), HH_AGE_LOG, SID_Z_SCOREMSD, RESI_DENS_Z_SCOREMSD, EDUCATION_LOG, MIXED_Z_SCOREMSD, Bus_Dens, NON_WHITE, TRAVEL_T, HH_SIZE_LOG, PARK_DIST_LOG, BUSINESS, FAR_Z_SCOREMSD, ROOMN_LOG, GOLFC_DIST, CRIME_LOG

Table 4.3: Hedonic Regression Model: Coefficients^a of the Hedonic Regression Model

Model 1	Unstandardized Coefficients		Standardized Coefficients	T	Sig	Collinearity Statistics		Correlations		
	B	Std. Error	Beta			Tolerance	VIF	Zero- order	Partial	Part
(Constant)	-289250.875	108679.618		-2.662	.008					
ROOMN_LOG	69366.898	16877.827	.299	4.110	.000	.352	2.839	.634	.295	.178
HH_SIZE_LOG	44736.260	15117.209	.156	2.959	.004	.672	1.488	.358	.217	.128
SID_Z_SCOREMSD	-7470.235	3499.793	-.136	-2.134	.034	.461	2.171	-.454	-.158	-.092
RESI_DENS_Z_SCOREMSD	802.370	4065.160	.011	.197	.844	.567	1.764	.022	.015	.009
FAR_Z_SCOREMSD	7175.268	3199.616	.133	2.243	.026	.529	1.890	.033	.166	.097
MIXED_Z_SCOREMSD	2803.032	2715.412	.052	1.032	.303	.748	1.336	.033	.077	.045
TRAVEL	39.053	836.190	.003	.047	.963	.628	1.592	.175	.004	.002
BUSINESS	13.349	28.083	.030	.475	.635	.461	2.167	.030	.036	.021
Bus_Dens	1.984	2.352	.046	.844	.400	.630	1.588	-.281	.063	.036
GOLFC_DIST	-1.004	.479	-.176	-2.096	.037	.264	3.786	.112	-.156	-.091
PARK_DIST_LOG	9484.985	4244.165	.150	2.235	.027	.414	2.416	.393	.166	.097
NON_WHITE	-7679.967	11639.756	-.034	-.660	.510	.718	1.394	-.347	-.050	-.029
CRIME_LOG	-3424.328	1727.564	-.199	-1.982	.049	.185	5.402	-.490	-.147	-.086
EDUCATION_LOG	30441.449	4985.396	.334	6.106	.000	.624	1.603	.614	.417	.264
HH_AGE_LOG	68556.140	22503.826	.142	3.046	.003	.860	1.162	.100	.223	.132

a. Dependent Variable: H_VALUE

Table 4.4: Description of the Variables in the Hedonic Regression Model

Variable	Variable Name	Description
x_1	ROOMN_LOG	Number of Rooms Natural Log Value
x_2	HH_SIZE_LOG	Household Size Natural Log Value
x_3	SID_Z_SCOREMSD	Street Intersection Connectivity times Z-score
x_4	RESI_DENS_Z_SCOREMSD	Residential Density times Z-score
x_5	FAR_Z_SCOREMSD	Retail Floor to Area Ratio times Z-score
x_6	MIXED_Z_SCOREMSD	Land Use Mix Index times Z-score
x_7	TRAVEL_T	Proximity to Employment Opportunities
x_8	BUSINESS	Number of Total Businesses
x_9	Bus_Dens	Bus Services
x_{10}	GOLFC_DIST	The Median Distance to the Nearest Golf Course
x_{11}	PARK_DIST_LOG	The Median Distance to the Nearest Public Park Natural Log Value
x_{12}	NON_WHITE	Ratio of Non-White Population
x_{13}	CRIME_LOG	Crime Rate Natural Log Value
x_{14}	EDUCATION_LOG	Educational Attainment Natural Log Value
x_{15}	HH_AGE_LOG	Household Age Natural Log Value

The p-value of several independent variables, number of rooms (0.000), average size of household (0.004), street intersection connectivity (0.034), retail floor to area ratio (0.026), golf course (0.037), public park (0.027), age of householder (0.003), educational attainment level (0.000), and crime rate (0.049) are less than 0.05 ($p < 0.05$). This indicates that these independent variables are statistically significant, and an association exists with the dependent variable of housing value.

However, the p-value of other independent variables, residential density (0.844), land use mix index (0.303), proximity to employment opportunities (0.963), number of businesses (0.635), bus services (0.400), and ratio of non-white population (0.510) are not statistically significant, meaning the null hypothesis cannot be rejected with a high

level of confidence. These independent variables may or may not be associated to the dependent variable, housing value.

The hedonic regression model (computed coefficient values) is created below.

$$V = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{14} x_{14} + \beta_{15} x_{15} + \epsilon$$

$$V = -289250.875 + 69366.898x_1 + 44736.260x_2 - 7470.235x_3 + 802.370x_4 + 7175.268x_5 + 2803.032x_6 + 39.053x_7 + 13.349x_8 + 1.984x_9 - 1.004x_{10} + 9484.985x_{11} - 7679.967x_{12} - 3424.328x_{13} + 30441.449x_{14} + 68556.140x_{15} + \epsilon$$

Chapter 5

DISCUSSION

5.1 Key Findings & Analysis

The most influential independent variables on median housing value, in the hedonic regression model, were physical, socioeconomic, and demographical attributes. The independent variables coefficient, represented by β (coefficient), indicates the relationship with the dependent variable. If the coefficient is a positive number, then as its independent variable increases, the model's predicted dependent variable does too, assuming all other inputs are fixed. If the coefficient is a negative number, then as its independent variable decreases, the model's predicted dependent variable does too. By comparing standardized betas, the weight of influence of variables can be determined (Hair et al. 2009, 196-197). The greater the absolute value of standardized beta, the more influence the variables have in the model. On Table 4.3, walkability components have moderate association compared to physical, demographical, socioeconomic variables. The major observation in this study is that those other attributes have the strongest association with housing value in Lincoln; they are dominantly reflected in neighborhood preferences.

The physical, socioeconomic, and demographical attributes with a positive coefficient were number of rooms, age of householder, household size, and educational attainment level. Crime rate had a negative coefficient in the model.

According to the "broken window theory", regarding visible signs of the affects of crime, a higher crime rate indicates "greater withdrawal of residency and diminution of the sense of community" (Schweitzer, Kim and Mackin 1999, 2). Signs of neglect

increase the crime rate, consequently, neighborhoods in Lincoln with a perceived higher crime rate may tend to have a negative impact on housing values by decreasing the attractiveness of the neighborhood for the fear of crime (Figure 5.1 and Figure 5.2).

Other socioeconomic, and neighborhood feature attributes of the ratio of non-white population, the number of businesses, and the travel time to work variables were not statistically significant in the model.

The public park and golf course independent variables, both common neighborhood green amenities, were statistically significant. Surprisingly, the sign of their coefficient values were opposites despite the fact they are both green spaces. The coefficient of median distance to the nearest public park was positive, while the coefficient of median distance to the nearest golf course was negative. At this point, it is important to note that a positive coefficient indicates that as the distance increases, the estimated value is increasing. Therefore, the outcome of the green amenities variables should be explained that median housing value increases as the median distance to golf courses decreases while the median housing value increases as the median distance to public parks increases. This result suggests that there are preferences for different distances to green amenities depending on the type of amenity, golf courses versus public parks, which are related to housing values.

The hedonic regression model analysis shows the relationship between walkability and housing value varies by the different walkability components. Retail floor to area ratio (FAR) had a positive coefficient and was statistically significant. Street intersection connectivity was statistically significant but unlike FAR, it had a negative coefficient. Residential density and land use mix index were statistically insignificant.

A relationship between walkability and housing value could not be concluded in this study because all four of the components were not statistically significant. However, since two individual components of walkability were statistically significant, an association with housing value was found between street intersection connectivity and FAR in the study.

When the data is analyzed using GIS mapping the results show some interesting patterns. The spatial analysis with GIS showed that individual components of walkability, when examined separately, were located in the same areas in some cases. For example, some areas of the city with high FAR (Figure 5.3) coincide with the areas of moderate to high housing values (Figure 5.1) toward the suburban areas along 27th Street and U.S. Highway 6. However, near the downtown and the O Street corridor, housing values are lower despite high FAR. Interestingly, this same central area of more densely developed commercial districts has high FAR and high street intersection connectivity (Figure 5.4). This area also corresponds with the older housing units (Figure 5.6). When examining the spatial distribution of walkability components in Lincoln, it is clear that the traditional old neighborhoods of downtown near the UNL city-campus and the major commercial districts along major transit corridors of the city have higher walkability when compared to the newly developed suburbs.

This relationship between walkability components and housing value has many possible explanations. The most likely explanation is that single-family residents in Lincoln prefer living “in low-density environments with large single-family lots” (Song and Knaap 2004, 676) in suburbs. The minimum lot area required by the Lincoln zoning ordinances for single-family housing maybe related to preferences to live in low-density

suburbs. The minimum single-family lot size allowances vary by zone: R-1 (lot area sq. ft. 9,000), R-2 (lot area sq. ft. 6,000), R-3 (lot area sq. ft. 6,000), etc. (Table 5.1). The majority of the suburban residential areas in Lincoln are zoned R-1, R-2, and R-3. (Figure 5.7) and are also associated with higher housing values (Figure 5.1). Conversely, the urban central areas have higher walkability (Figure 5.5) and are associated with lower housing values; these areas are generally zoned R-4 to R-8 (Figure 5.7).

In general, residential zoning ordinances in Lincoln require separation of residential and other land uses, as well as undiversified housing types under a constrained minimum lot size requirement (City of Lincoln & Lancaster County Planning Department: Chapter 27). The restriction of efficient land use plans discourages walkability. Thus, it is assumed that the current residential zoning ordinances substantially limit the effect of walkability improvements, particularly in residentially designated suburb areas in Lincoln. As a matter of fact, overall values of residential, single-family occupied housing units in Lincoln are not intimately associated with walkability while it is rather influenced by various attributes of physical, socioeconomic, and demographical features.

Another possible explanation is there are micro-environmental factors, such as sidewalk condition, pedestrian safety feature, tree density, etc., that affect walkability. The scope of this study is limited to certain macro-environmental factors of walkability. Combining the micro- and macro-environmental walkability components may provide further clarity to this subject.

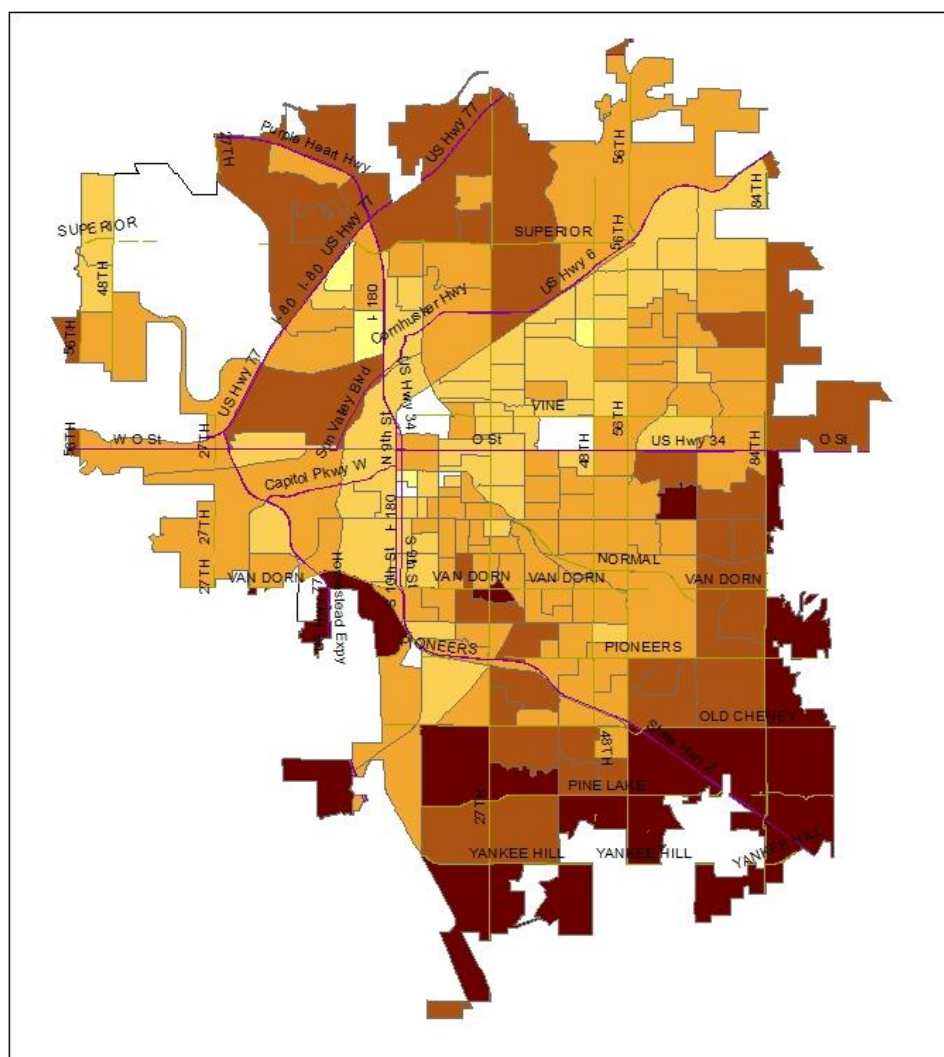
The bus services independent variable was statistically insignificant in the hedonic regression model; however, the spatial distribution of bus services (Figure 5.8 and Figure 5.9) and the composite score of statistically significant walkability

components of street intersection connectivity and FAR (Figure 5.5) in Lincoln are similar. The major stops and routes are prominently concentrated in the downtown areas and along the O Street corridor. The high public transit accessibility level in these areas suggests a positive relationship between walkability and public transit services exists.

Table 5.1: Single-family Maximum Height and Minimum Lot Requirements for the R-1 through R-8 Districts (Lincoln & Lancaster County Planning Department: Chapter 27.72 Height and Lot Regulations. Table 27.72.020(b))

Zoning	Lot Area (sq. ft.)	Avg. Lot Width	Front Yard	Side Yard	Rear Yard	Height
R-1	9,000	60'	30'	10'	Smaller of 30' or 20% of the lot depth	35'
R-2	6,000	50'	25'	5'		35'
R-3	6,000	50'	20'	5'		35'
R-4	5,000	50'	25'	5'		35'
R-5	5,000	50'	20'	5'	Smaller of 30' or 20% of the lot depth	35'
R-6	4,000	50'	20'	5'		35'
R-7	4,000	50'	20'	5'		35'
R-8	4,000	50'	10'	10'	20'	35'

Figure 5.1: Median Housing Value



Median Housing Value

Lancaster County Census Block Group 2010

Median Housing Value in Dollars

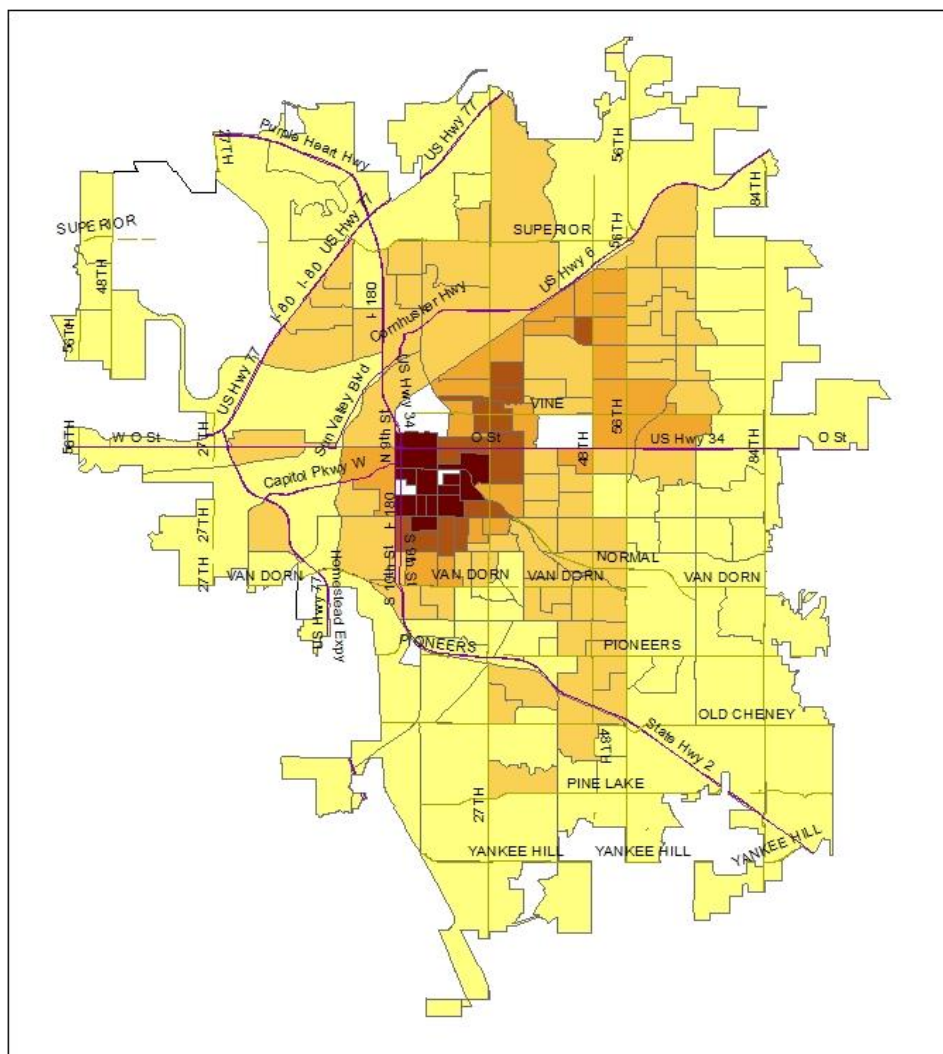
- \$9,999.00 - \$29,900.00
- \$29,900.01 - \$111,900.00
- \$111,900.01 - \$155,900.00
- \$155,900.01 - \$223,500.00
- \$223,500.01 - \$360,900.00

City Limits
Major Road



0 1 2 4 Miles

Figure 5.2: Crime Rate



Crime Rate

Lancaster County Census Block Group 2010

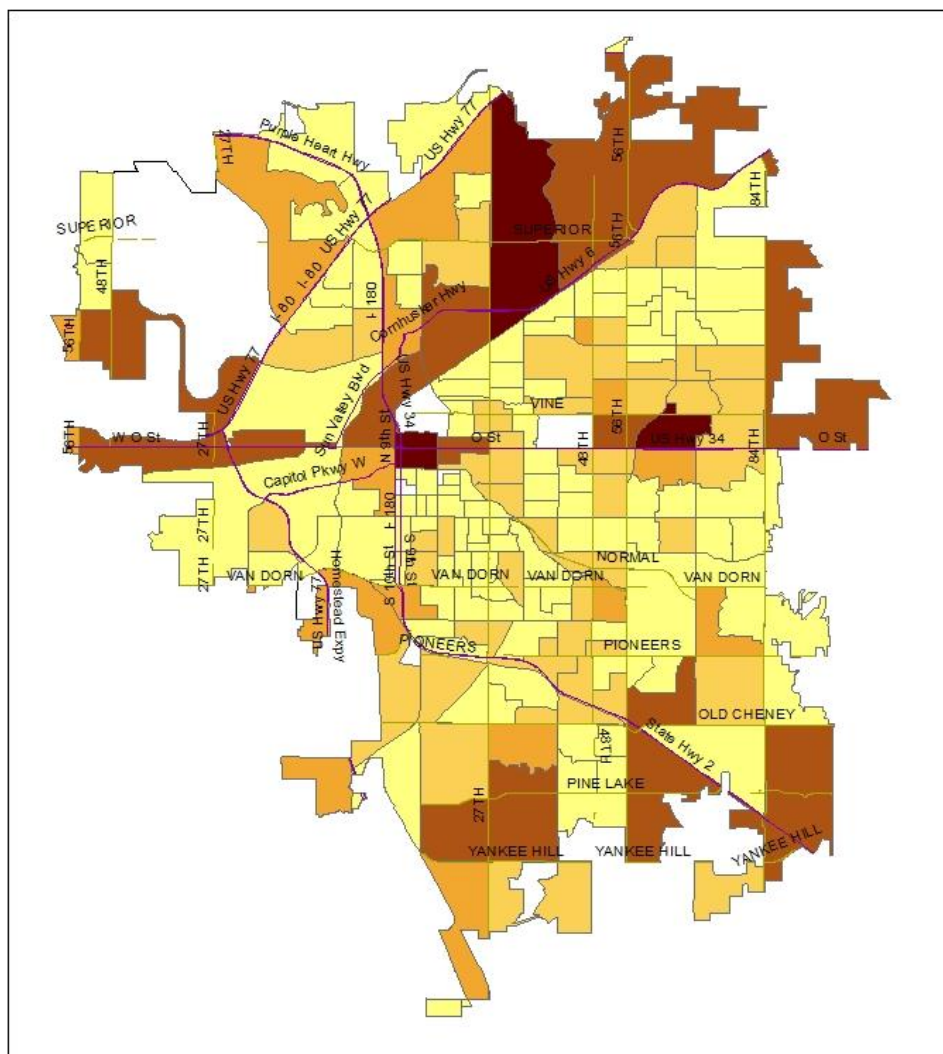
Number of Crime Incidents / Block Area in acre

- 0 - 11.2
- 11.3 - 24.7
- 24.8 - 47.1
- 47.2 - 83.3
- 83.4 - 146.6
- City Limits
- Major Road



0 1 2 4 Miles

Figure 5.3: Retail Floor to Area Ratio (FAR)



Retail Floor to Area Ratio (FAR)

Lancaster County Census Block Group 2010

Retail Building Floor in acre / Retail Land Area in acre

0 - 0.15

0.16 - 0.45

0.46 - 1.13

1.14 - 2.8

2.81 - 6.44

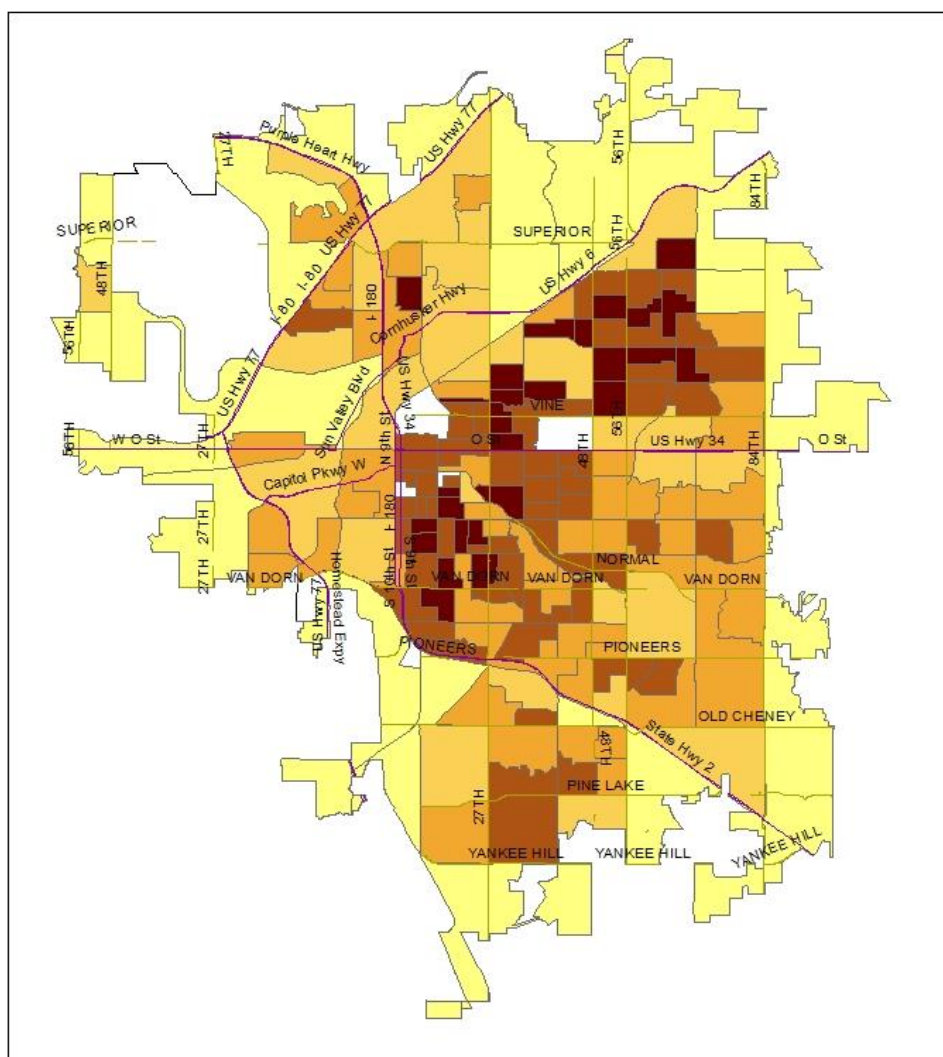
City Limits

Major Road



0 1 2 4 Miles

Figure 5.4: Street Intersection Connectivity



Street Intersection Connectivity

Lancaster County Census Block Group 2010

Street Intersections divided by Square Mile

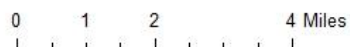
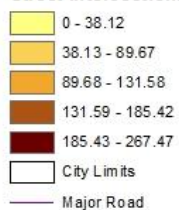
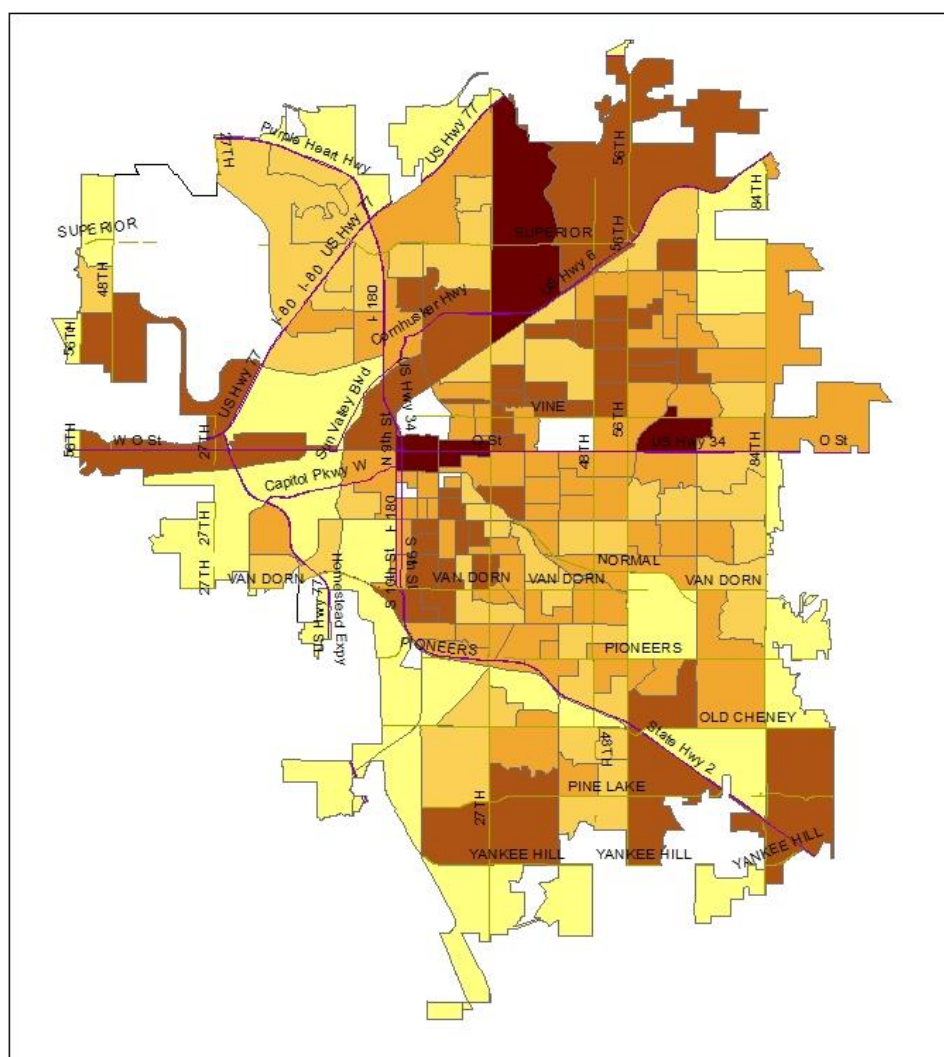


Figure 5.5: Composite Score of Street Intersection Connectivity and FAR



Composite Index of Street Intersection Connectivity & FAR

Lancaster County Census Block Group 2010

Street Intersection Connectivity + FAR

0.0 - 72.6

72.7 - 133.8

133.9 - 194.8

194.9 - 295.1

295.2 - 802.4

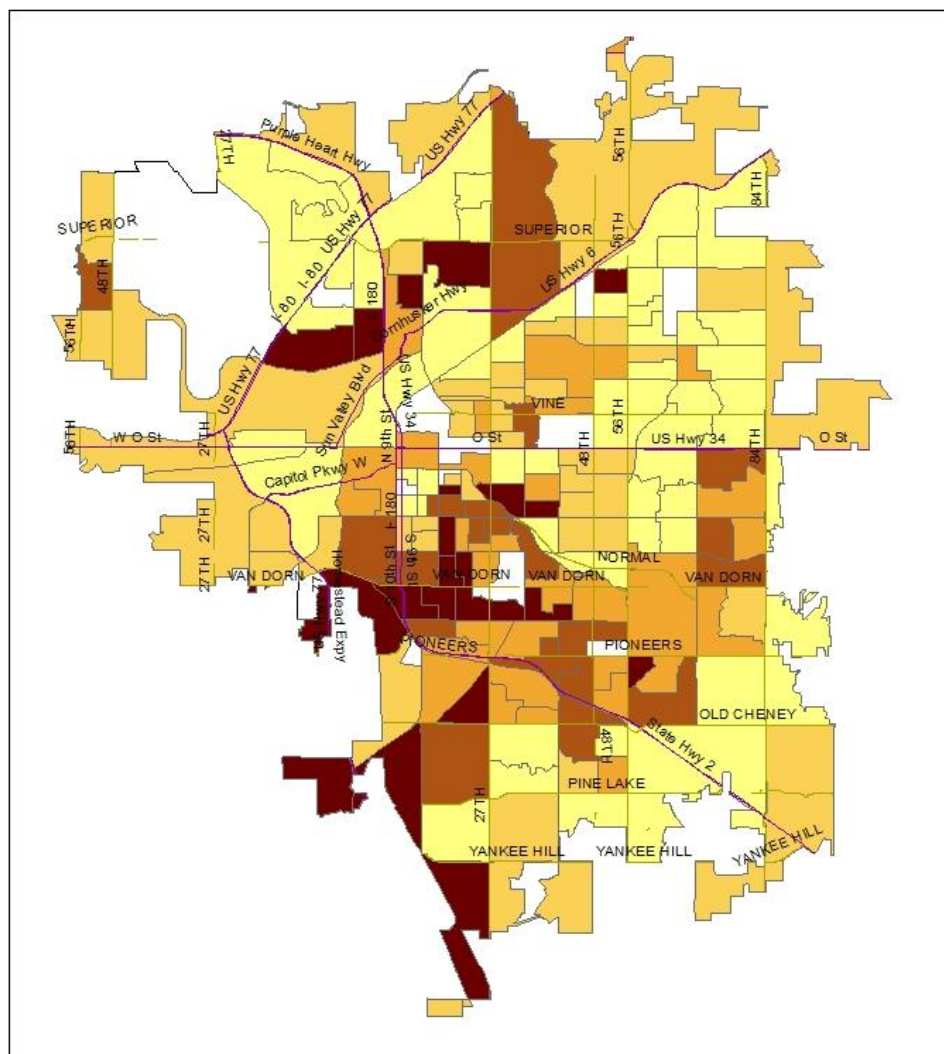
City Limits

Major Road



0 1 2 4 Miles

Figure 5.6: Median Built Year of Housing



Median Built Year of Housing

Lancaster County Census Block Group 2010

Median Built YR _

1939 - 1952

1953 - 1966

1967 - 1980

1981 - 1994

1995 - 2005

City Limits

Major Road



0 1 2 4 Miles

Figure 5.7: Residential Zoning Jurisdictions in Lincoln (Lincoln & Lancaster County Planning Department)

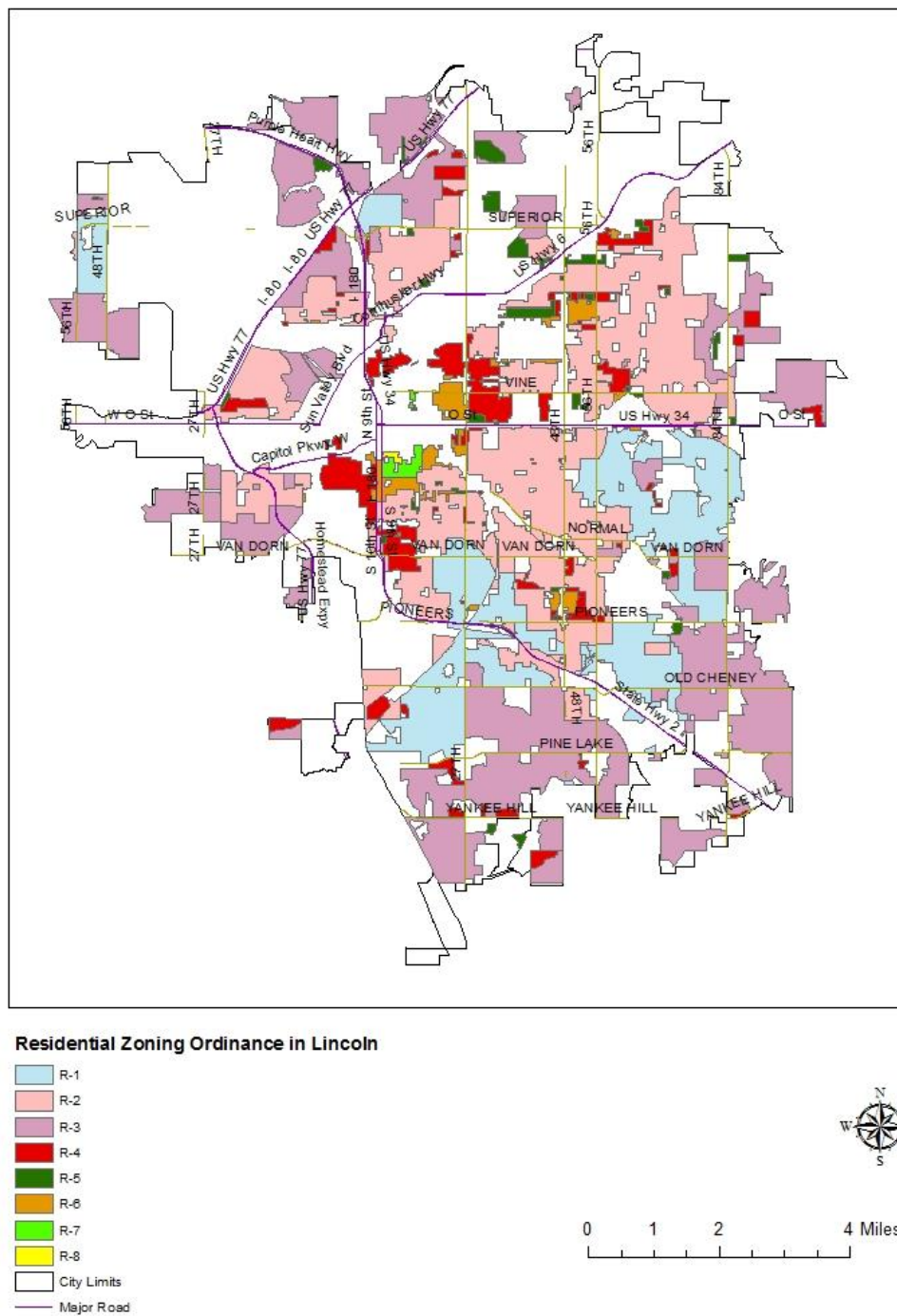
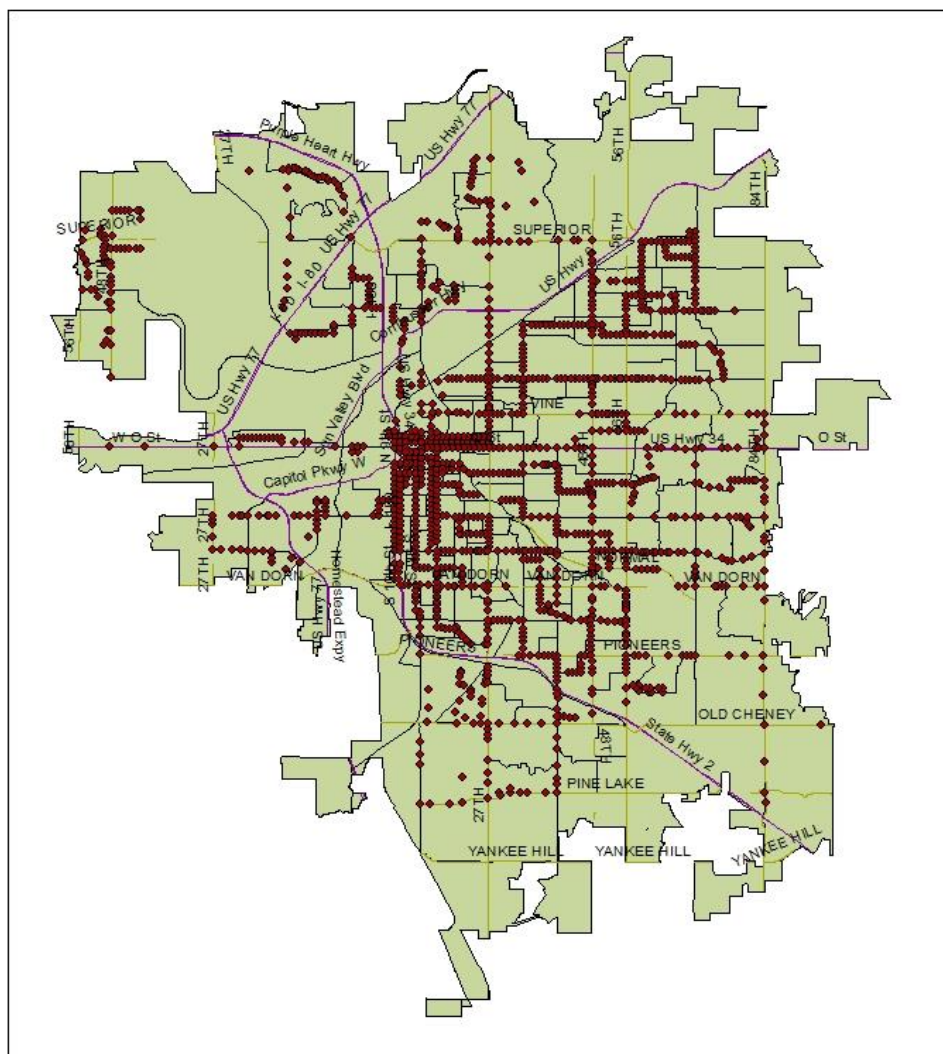


Figure 5.8: Total StarTran Bus Stops in Lincoln



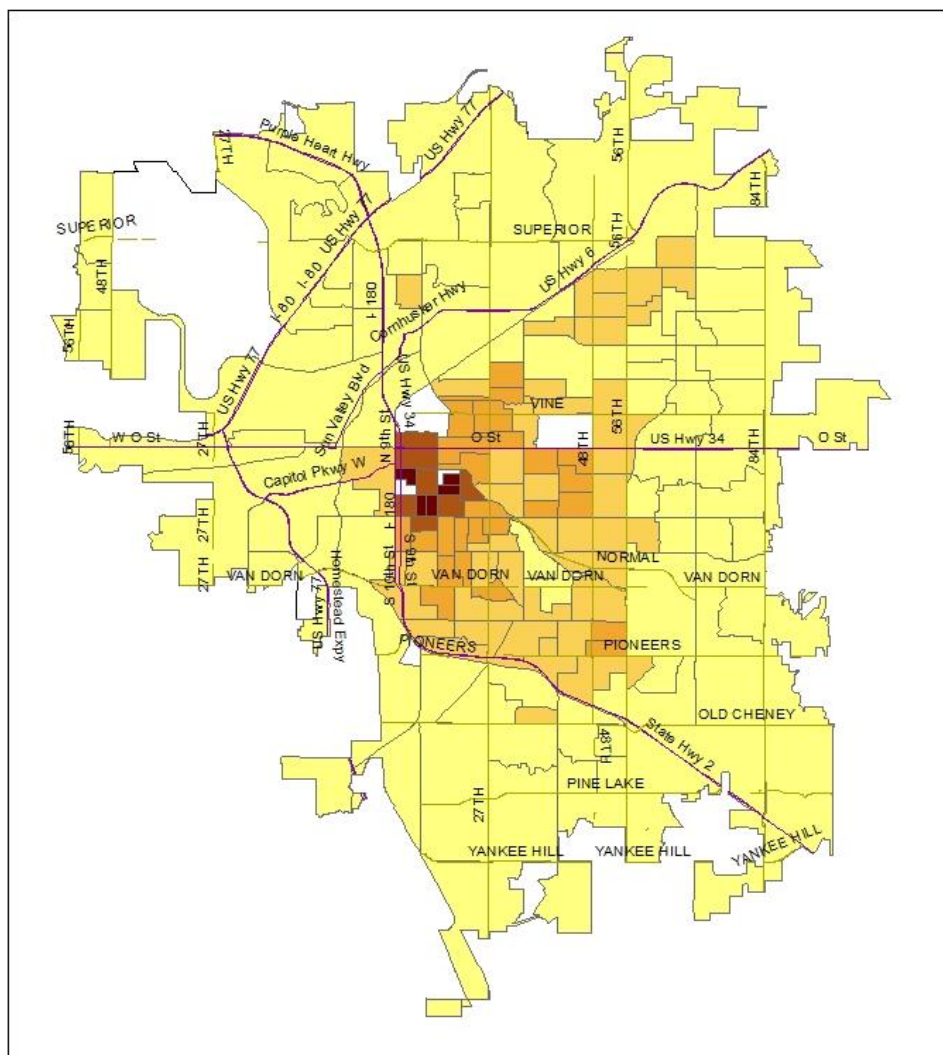
Bus Stops in Lincoln

- Lancaster County Census Block Group 2010
- Bus Stops
- City Limits
- Major Road



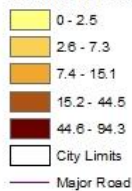
0 1 2 4 Miles

Figure 5.9: Density of Bus Services

**Bus Services**

Lancaster County Census Block Group 2010

Number of Bus Stops / Block Area in acre



0 1 2 4 Miles

5.2 LPlan 2040 & Walkability Promotion

The LPlan 2040 is the strategic sustainable development plan for Lincoln. It presents potential redevelopment practices as well as other planning policies. The LPlan 2040 aims for smart growth, however, the model outcome from this study indicates the city's practical application of smart growth in improving overall neighborhood value may still be lacking.

Walkability is one of the prominent smart growth principles in LPlan 2040 considering its importance in efficient land use plans and transportation plans. Despite the significant promotion of walkability throughout the LPlan 2040, Walkability turned out to be equivocally influential in neighborhood value generation, as reflected by residential housing value in Lincoln in the model. The study found neighborhood preferences of the socioeconomic conditions and the quality of urban amenities to be the major generators in housing value determination in Lincoln. In sum, the LPlan 2040 may not have sufficiently achieved success in creating tangible community value as it had planned.

In regards to a residential units' value and its geographic dispersion (geographic dimensional allocation) in Lincoln; the highest values of residential units are located around the suburbs. Most of the areas with the highest values are new development and, as the model outcome shows, these areas are less walkable compared to other parts of the city. In this respect, it is assumed that newly developed neighborhoods in Lincoln were planned with priority placed on other attributes beside walkability. It is also possible that the suburban developments are more profitable than sustainable developments to the developers. If this is the case perhaps, the maximum benefit to the community can be

achieved by offering incentives to encourage sustainable mixed-use developments.

According to the new urbanism theory, mixed-land use plans improve walkability as a result of creating multi-functional intrinsic value creation through a diverse use of land.

LPlan 2040 declares that coordination of mixed-land use is necessary to develop methods to meet the smart growth principles.

Although there is a steady expansion of smart growth awareness at the local level, it seems to struggle to apply walkability in practical planning projects. According to the report from the LPlan 2040 as of 2011, organizational strategy procedures for various public departments in the city have not functioned well. Thus, despite that the plan calls for promoting walkability, strategies were not implemented adequately to create walkability (City of Lincoln & Lancaster County Planning Department LPlan 2040 Comprehensive Plan 2011, 129-140).

For instance, the limitation on residential zoning ordinances in Lincoln appears to be a barrier in promoting mixed-land use plans (Appendix C). Development has been entirely under solid zoning ordinances and reform of the residential zoning restrictions is challenging. The existing peculiar conditions and its occasional barriers in promoting mixed-land use plans should be corrected by improving practical planning strategies in the LPlan 2040.

Therefore, an alternative residential zoning process, the path forward from the current zoning system to potential smart growth strategies, is needed to allow the necessary developments in the LPlan 2040. The continuing analysis of zoning issues, land-use indices, local transit networks, and interventional public policy adjustments are recommended. The local community development policy and conceptual strategic

framework need to be changed to achieve the sustainable development goals. This would also encourage public and private participation and enhance redevelopment investment at the local level. Public initiatives have been responsible for land use regulation, zoning ordinance, and public policy in general. In sum, comprehensive and gradual smart growth implementation, along with proper strategy and policy monitoring, need to be performed to achieve the goals of sustainable city development.

Based on the outcome of the study, walkability tends to be high where street intersection connectivity and retail floor to area ratio (FAR) are high in Lincoln also have a high crime rate. The features of better walkability may attract more crime because of convenient access and density of retail. However, walkability tends to reduce neighborhood segregation by increasing accessibility and increasing social cohesion by providing abundant urban activities. These positive features of walkability prevent crime-related occurrences by development of urban vitality (Litman 2009, 5-6). Therefore, the benefits of walkability in improving urban vitality should not be ignored in this respect.

5.3 Contribution

The study provides an analysis of current walkability and its overall association with housing value in Lincoln. The study identifies how built environment attributes of walkability and existing neighborhood conditions affect community value, as reflected by housing value. Regarding the model outcomes of walkability and housing value association in Lincoln, residents prefer certain amenities and neighborhood conditions that were more influential to housing values compared with walkability. Thus, it is assumed that residential choices in Lincoln are dependent on overall neighborhood conditions, not necessarily by the level of smart growth principles implemented.

It was found that residential zoning ordinances in Lincoln often require separation of residential and other land uses, as well as undiversified housing types under a constrained minimum lot size requirement. As previously mentioned, it discouraged walkability and efficient mixed-land use. This empirical evidence presents suggestions for revisions of the ongoing sustainable redevelopment plan of the city; LPlan 2040 should allow compatible land use plans and to change residential zoning ordinances to allow diversified residential zoning options.

Further studies on walkability with respect to community value, and the different roles of walkability on health-related issues, physical activity level, transportation usage association, transit or congestion cost analysis, travel patterns, and environmental assessment are desirable. Measuring other neighborhood effects of walkability would be feasible in constructing potential sustainable community development plans and encouraging its practical implementation.

5.4 Research Limitations & Suggestions for Future Research

This study is solely concentrated on the value of owner-occupied, single-family housing units. For this reason, further data confirmation of other scope of housing units is worthwhile; such as multi-family and mobile homes for a more comprehensive understanding. In addition, other variables that might be influential to housing value should be studied. Other socio-demographic characteristics, shifts of new constructions, and unique regional, environmental features could be evaluated based on their influence on housing value.

It is significant to note that housing values tend to be dependent on changes in demographics, economic circumstances and trend preferences. In this regard, appropriate

data modification and data sufficiency is required. This scope of data analysis is 5 years (2006-2010). A periodic evaluation of the analysis needs to be developed for more accurate observation of the changes.

Based on the result of this study, further analysis to advance understanding of walkability is recommended. Because some of the walkability components were not statistically significant, applying different empirical tests, such as cross-sectional analysis, could show results that prove a cause-and-effect relationship.

While this study was able to measure the contributions to walkability made by macro-level built environment attributes, micro-level attributes of walkability such as sidewalks, tree densities, health-related consequences, and safety conditions were not able to be included. For a comprehensive walkability evaluation, micro-level built environment assessment and residential survey-based walkability analysis (formative qualitative survey) is suggested to examine its possible association with the walkability. The research warrants a detailed examination of aspects of walkability. Relevant information may be obtained on intangible factors by conducting essential qualitative surveys with residents. Additional study may provide insight on walkability by measuring contribution of micro-level attributes and the actual value created in neighborhoods.

The probable inconsistency and limitation of statistical measurement were found during this study. Other independent variables, which were statistically insignificant in the model, should be reviewed by alternative empirical methods. Independent variables containing data from both housing types; single-family and multi-family units may have different outcomes. In addition, some variables were either presented as logged values or un-logged values. The difference between logged and un-logged values may have created

inconsistent statistical results. In this respect, specified and unified data sorting procedures and implementing an alternate methodology may clarify the results in future studies.

Chapter 6

CONCLUSION

This study examined the association between walkability components and housing value in Lincoln, Nebraska in order to determine whether walkability improvements corresponded to higher housing value. Based on the hypothesis, the result of empirical analysis confirmed the importance of urban amenities in determining housing value in this model. However, the model outcome shows that compared to other attributes of physical, demographic, and socioeconomic characteristics of neighborhoods, walkability components had less influence on housing value generation.

The evaluation from model analysis indicates the traditional downtown areas and districts along the city's major transit corridors have better walkability conditions based on the key aspects of walkability. However, they had lower housing values when compared to other newly developed suburbs of the city. To the extent that walkability, as a major smart growth principle, is known for promoting efficient land use, the benefits of walkability were expected to be reflected into overall neighborhood values. Demographic, socioeconomic, and physical residential unit characteristics, all of which are known to be prominent aspects of neighborhood preference, were obvious determinants on housing values. Some of the built environment attributes related to walkability were significantly associated with housing values; however, they did not substantially increase housing values in the study. This overall outcome indicates that Lincoln's general neighborhood preference is not strongly associated with the smart growth principle implementation. Consequently, the benefits of smart growth principles are not yet reflected in neighborhood values.

Lincoln's comprehensive community development plan, LPlan 2040, attempts to promote smart growth principles in order to achieve sustainable community development for the long-term. Throughout this plan, walkability is expected to increase mixed-land use, improve transit options, and increase accessibility; all of which are considerations involved in neighborhood choice. However, as shown in the study outcome, walkability improvements at the city level seem ineffective, perhaps due to the fact that the plan still struggles with the absence of practical strategies and organizational networks to perform adequate walkability developments. To this end, walkability is not likely to be recognized as a preferred attribute in neighborhood choice despite its benefits. As a result, this may be the reason that the walkability components were not more influential on housing in the model.

The benefits of walkability are stated as "a correlation between the desire for walkability and the desire for neighborhood change" (Fisher and Pivo 2010, 3). In this regard, increasing the public's awareness of the significance of walkability may require a sufficient effort toward the sustainable community development goals in Lincoln. Walkability's various socioeconomic benefits, such as health impact, public transit system improvement, and efficient urban facility management need to be presented for its comprehensive benefits in community. In order to make this happen, the public needs to be informed to the significance of smart growth principles by being involved in their neighborhood improvements plans. Thus, systemic approaches of consistent urban planning frameworks are encouraged.

Making the environment more walkable, by studying and implementing efficient land use plans, could deliver positive benefits to the community, including increased

housing values (Song and Knaap 2004, 665-667; Kuethe 2012, 16-18). Therefore, changing policies and developing local-level oriented plans may satisfy smart growth demands and create the potential to maximize the net benefit to the community. Practices, such as mixed-land use, node modification, and flexible zoning ordinances, must be implemented in order to overcome development barriers. A comprehensive benefit analysis and an appropriate economic framework of walkability improvements need to be completed in accordance with smart growth policy alternatives. Litman (2009) argues that this approach attempts to improve smart growth principle implementation by appropriate policy framework, therefore, practical sustainable community development benefits could be produced by a legitimate process. The following statement from Litman asserts and summarizes the justification of smart growth policies and its enforcement in promoting sustainable community development.

1. Smart growth policies respond to consumer demands for additional compact, accessible, multi-modal, affordable locations.
2. Smart growth can help reduce external costs associated with providing public services parking subsidies, accidents, land consumption, petroleum dependency and pollution.
3. Many smart growth policy reforms reflect good planning practices and market principles (integrated land use and transport planning, least-cost investments, cost based pricing, more efficient modes and higher value trips) (Litman 2009, 29).

These justifications for smart growth policies are subject to take market forces into consideration to support fragmental development alternatives (Levine and Inam 2004, 411; Lang et al. 2005, 3-5). Upon adequate smart growth principle implementation progress, an economic assessment on community development, such as a cost-effective analysis of neighborhood improvements would be able to focus on the incremental costs and benefits of a change. As a result, it would tend to increase public resources devoted

to promoting walkability as well as other necessary smart growth principles (Litman 2003, 11-13). In addition, it is expected to lead to overall community value improvement through proper land use regulations, additional investment in community development plans, and allowing market forces to create the demand for efficient urban development (Levine and Inam 2004, 421-422).

It is important to recognize that smart growth policy alternatives depend on actual participation from local residents because the land use policies and the preferences in the community are linked. By encouraging local participation in community planning decisions, public objections to improving built environment attributes can be addressed and resolved. Thus, LPlan 2040's long-term sustainable strategies need to focus on increasing public participation with urban redevelopment plans.

By improving the quality of life in the current urban planning climate, smart growth principles evolves to become "a serious niche investment" for the real estate market (Lang et al. 2005, 21-22) as provided its potential throughout this study. To the extent that walkability contributes to sustainable growth, it can foster a stable economy in Lincoln by creating fundamental economic benefits and environmental returns to the community. In order to accomplish overall sustainable growth, smart growth goals, along with supportable strategies, must continue to be an integral part of the development plan.

REFERENCES

- Abley, Stephen. "Walkability scoping paper." *Charted Traffic and Transportation Engineering, Christchurch, New Zealand* (2005).
- Acharya, Gayatri, and Lynne Lewis Bennett. "Valuing open space and land-use patterns in urban watersheds." *The Journal of Real Estate Finance and Economics* 22, no. 2-3 (2001): 221-237.
- Ackerson, Kristopher Joseph. "A GIS Approach to Evaluating Streetscape and Neighborhood Walkability." PhD diss., University of Oregon, 2005.
- Anderson, Larz T. *Planning the built Environment*. Planners Press, 2000.
- Bartholomew, Keith, and Reid Ewing. "Hedonic price effects of pedestrian-and transit-oriented development." *Journal of Planning Literature* 26, no. 1 (2011): 18-34.
- Barton, Hugh. "Land use planning and health and well-being." *Land Use Policy* 26 (2009): S115-S123.
- Benfield, Kaid. "The Case for Walkability as an Economic Development Tool." *The Atlantic Cities*, January 4th, 2013, accessed April 22nd, 2013.
<http://www.theatlanticcities.com/design/2013/01/case-walkability-economic-development-tool/4317/>
- Bliesner, Jim, Steve Bouton, and Barry Schultz. "Walkable neighborhoods: An economic development strategy." *JB&F Consulting*, 2010. Accessed January 12th, 2013.
<http://www.aarp.org/content/dam/aarp/livable-communities/act/transportation/Walkable-Neighborhoods-An-Economic-Development-Strategy-AARP.pdf>
- Boyle, Austin, Charles Barrilleaux, and Daniel Scheller. "Does Walkability Influence Housing Prices? Evidence from Miami." *Evidence from Miami (September 10, 2012)* (2012).
- Cauchon, Dennis. "Nebraska's residents turn to urban living" *USA Today*, March, 2011, accessed June 3rd, 2013.
http://usatoday30.usatoday.com/news/nation/census/2011-03-01-nebraska-census_N.htm
- Cerin, Ester, and Eva Leslie. "How socio-economic status contributes to participation in leisure-time physical activity." *Social science & medicine* 66, no. 12 (2008): 2596-2609.
- Chau, K. W., and T. L. Chin. "A critical review of literature on the hedonic price model." *International Journal for Housing Science and Its Applications* 27, no. 2 (2003): 145-165.

- Chin, Gary KW, Kimberly P. Van Niel, Billie Giles-Corti, and Mathew Knuiman. "Accessibility and connectivity in physical activity studies: the impact of missing pedestrian data." *Preventive medicine* 46, no. 1 (2008): 41-45.
- Cho, Seong-Hoon, J.M Bowker, and William M. Park. "Measuring the Contribution of Water and Green Space Amenities to Housing Values: An Application and Comparison of Spatially Weighted Hedonic Models." *Journal of Agricultural and Resource Economics* 31 (3):485-507 (2006).
- City of Lincoln & Lancaster County Planning Department. "Lincoln/Lancaster County 2040 Comprehensive Plan and Long Range Transportation Plan." 2011. Accessed March 14th, 2013. <http://lincoln.ne.gov/city/plan/lplan2040/content/news4.pdf>
- City of Lincoln & Lancaster County Planning Department. "LPlan 2040 Comprehensive Plan." 2011. Accessed March 14th, 2013. <http://lincoln.ne.gov/city/plan/lplan2040/lrtp.htm>
- City of Lincoln & Lancaster County Planning Department. "LPlan 2040 Summary Document." 2011. Accessed March 15th, 2013. <http://lincoln.ne.gov/city/plan/lplan2040/committee/110601/summdoc.pdf>
- City of Lincoln & Lancaster County Planning Department. "Chapter 27.72 Height and Lot Regulations." Accessed September 28th, 2013. <http://lincoln.ne.gov/city/attorn/lmc/ti27/ch2772.pdf>
- Clear, Katie. "A Health Impact Assessment of Mixed Use Redevelopment Nodes and Corridors in Lincoln, Nebraska." Environmental Studies Undergraduate Student Theses., University of Nebraska, December 2011.
- Cortright, Joe. "Walking the walk: How walkability raises home values in US cities." (2009).
- Crompton, John L. "The impact of parks on property values: A review of the empirical evidence." *Journal of Leisure Research* 33, no. 1 (2001): 1-31.
- Daniels, Tom. "Smart growth: A new American approach to regional planning." *Planning Practice and Research* 16, no. 3-4 (2001): 271-279.
- Dannenberg, Andrew L., Richard J. Jackson, Howard Frumkin, Richard A. Schieber, Michael Pratt, Chris Kochtitzky, and Hugh H. Tilson. "The impact of community design and land-use choices on public health: a scientific research agenda." *American journal of public health* 93, no. 9 (2003): 1500-1508.
- Downs, Anthony. "Smart growth: why we discuss it more than we do it." *Journal of the American Planning Association* 71, no. 4 (2005): 367-378.

- Durand, Casey P., Mohammad Andalib, Genevieve F. Dunton, Jennifer Wolch, and Mary Ann Pentz. "A systematic review of built environment factors related to physical activity and obesity risk: implications for smart growth urban planning." *obesity reviews* 12, no. 5 (2011): e173-e182.
- Eppli, Mark J., and Charles C. Tu. *Valuing the new urbanism: The impact of the new urbanism on prices of single-family homes*. Washington, DC: Urban Land Institute, 1999.
- Farr, Douglas. *Sustainable urbanism: urban design with nature*. Wiley.com 2012.
- Fisher, Jeffrey, and Gary Pivo. "The walkability premium in commercial real estate investments." *Real Estate Economics, Forthcoming* (2010).
- Food and Agriculture Organization of the United Nations. "Human energy requirements: Principles and Definitions." 2004. Accessed March 5th, 2013.
<http://www.fao.org/docrep/007/y5686e/y5686e04.htm>
- Forsyth, Ann, J. Michael Oakes, Brian Lee, and Kathryn H. Schmitz. "The built environment, walking, and physical activity: Is the environment more important to some people than others?." *Transportation research part D: transport and environment* 14, no. 1 (2009): 42-49.
- Frank, Lawrence D., and Gary Pivo. "Impacts of mixed use and density on utilization of three modes of travel: single-occupant vehicle, transit, and walking." *Transportation research record* (1994): 44-52.
- Frank, Lawrence D., James F. Sallis, Terry L. Conway, James E. Chapman, Brian E. Saelens, and William Bachman. "Many pathways from land use to health: associations between neighborhood walkability and active transportation, body mass index, and air quality." *Journal of the American Planning Association* 72, no. 1 (2006): 75-87.
- Gatrell, J. D., and R. R. Jensen. "Growth through greening: developing and assessing alternative economic development programmes." *Applied Geography* 22, no. 4 (2002): 331-350.
- Geoghegan, Jacqueline, Lisa A. Wainger, and Nancy E. Bockstael. "Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS." *Ecological economics* 23, no. 3 (1997): 251-264.
- Geoghegan, Jacqueline. "The value of open spaces in residential land use." *Land Use Policy* 19, (2002): 91-98.
- Geoghegan, Jacqueline, Lori Lynch, and Shawn Bucholtz. "Capitalization of Open Spaces into Housing Values and the Residential Property Tax Revenue Impacts of Agricultural Easement Programs." *Agricultural and Resource Economics Review* 32/1 (April 2003): 33S45.

- Glaeser, Edward L., and Matthew E. Kahn. "Sprawl and urban growth." *Handbook of regional and urban economics* 4 (2004): 1-55.
- Hair, Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson, "Multivariate analysis." *Prentice Hall 7th edition* (2009).
- Handy, Susan. "Smart growth and the transportation-land use connection: What does the research tell us?." *International Regional Science Review* 28, no. 2 (2005): 146-167.
- Handy, Susan, James F. Sallis, Deanne Weber, Ed Maibach, and Marla Hollander. "Is support for traditionally designed communities growing? Evidence from two national surveys." *Journal of the American Planning Association* 74, no. 2 (2008): 209-221.
- Heikkila, Eric J., and Richard B. Peiser. "Urban sprawl, density, and accessibility." *Papers in Regional Science* 71, no. 2 (1992): 127-138.
- Henderson, Katherine K. "The effect of open space on residential property values in Wake County, North Carolina." Dissertation paper from the University of North Carolina at Chapel Hill, 2006.
- Hirschhorn, Joel S. "Why Smart Growth Needs New Urbanism and Vice-Versa." *Planetizen Urban Insight*, 2004. Accessed February 20th, 2013.
<http://www.planetizen.com/node/118>
- Irwin, Elena G. "The effect of open space on residential property values." *Land Economics* 78, (4), 465-480. (2002).
- Jackson, Richard J. "The impact of the built environment on health: an emerging field." *American Journal of Public Health* 93, no. 9 (2003): 1382-1384.
- Jackson, Richard J., and Stacey Sinclair. "Designing healthy communities." *Health Affairs* 31 (2012): 4.
- Jacobs, Jane. *The death and life of great American cities*. Random House Digital, Inc., 1961.
- Jacobs, Jane. *The economy of cities*. Random House Digital Inc., 1970.
- Katz, Bruce. "Smart Growth: The Future of the American Metropolis?." *LSE STICERD Research Paper No. CASE058* (2002).
- Kestens, Yan, Marius Thériault, and François Des Rosiers. "House prices and environmental quality: combining gis, image analysis and hedonic modeling." In *6th Annual Integrating gis & cama Conference Proceedings, Reno, nv*. 2002.

- Koohsari, Mohammad Javad, Justyna Anna Karakiewicz, and Andrew T. Kaczynski. "Public open space and walking: the role of proximity, perceptual qualities of the surrounding built environment, and street configuration." *Environment and Behavior* (2012): 1-31.
- Kueth, Todd H. "Spatial fragmentation and the value of residential housing." *Land Economics* 88, no. 1 (2012): 16-27.
- Landry, Charles. *The creative city: A toolkit for urban innovators*. Earthscan, 2008.
- Lang, Robert E., Jennifer LeFurgy, and Steven Hornburg. "From Wall Street to Your Street: New Solutions for Smart Growth Finance." *Funders' Network for Smart Growth and Livable Communities*, 2005. Accessed February 2nd, 2013. http://www.drcog.org/documents/from_wall_street.pdf
- Lashgari, Malek. "Urban Real Estate Prices and Fair Value: The Case for US Metropolitan Areas." *Journal of Applied Business and Economics* 11, no. 3 (2010): 97-105.
- Leinberger, Christopher, and Mariela Alfonzo. "Walk this way: The economic promise of walkable places in metropolitan Washington, DC." *Washington: Brookings* (2012).
- Leslie, Eva, Brian Saelens, Lawrence Frank, Neville Owen, Adrian Bauman, Neil Coffee, and Graeme Hugo. "Residents' perceptions of walkability attributes in objectively different neighbourhoods: a pilot study." *Health & place* 11, no. 3 (2005): 227-236.
- Leslie, Eva, Neil Coffee, Lawrence Frank, Neville Owen, Adrian Bauman, and Graeme Hugo. "Walkability of local communities: using geographic information systems to objectively assess relevant environmental attributes." *Health & place* 13, no. 1 (2007): 111-122.
- Levine, Jonathan, and Aseem Inam. "The market for transportation-land use integration: Do developers want smarter growth than regulations allow?." *Transportation* 31, no. 4 (2004): 409-427.
- Leyden, Kevin M. "Social capital and the built environment: the importance of walkable neighborhoods." *American journal of public health* 93, no. 9 (2003): 1446-1450.
- Li, Mingche M., and H. James Brown. "Micro-neighborhood externalities and hedonic housing prices." *Land economics* 56, no. 2 (1980): 125-141.
- Lincoln Metropolitan Planning Organization. "2040 Long Range Transportation Plan." 2011. Accessed August 9th, 2013. <http://lincoln.ne.gov/city/plan/lplan2040/plan/document/lrtp/111020/lrtp.pdf>
- Litman, Todd Alexander. "Economic Value of Walkability." (2003): 1-16.

- Litman, Todd. "Where We Want To Be." *Home location preferences and their implications for smart growth*. Victoria Transport Policy Institute, Victoria, BC (2009): 1-40.
- Lund, Hollie. "Testing the claims of new urbanism: Local access, pedestrian travel, and neighboring behaviors." *Journal of the American Planning Association* 69, no. 4 (2003): 414-429.
- Lutzenhiser, Margot, and Noelwah R. Netusil. "The effect of open spaces on a home's sale price." *Contemporary Economic Policy* 19, no. 3 (2001): 291-298.
- Matthews, John W., and Geoffrey K. Turnbull. "Neighborhood street layout and property value: the interaction of accessibility and land use mix." *The journal of real estate finance and economics* 35, no. 2 (2007): 111-141.
- McNeill, Lorna Haughton, Matthew W. Kreuter, and S. V. Subramanian. "Social environment and physical activity: a review of concepts and evidence." *Social science & medicine* 63, no. 4 (2006): 1011-1022.
- Mela, Carl F., and Praveen K. Kopalle. "The impact of collinearity on regression analysis: the asymmetric effect of negative and positive correlations." *Applied Economics* 34, no. 6 (2002): 667-677.
- Nechyba, Thomas J., and Randall P. Walsh. "Urban sprawl." *The Journal of Economic Perspectives* 18, no. 4 (2004): 177-200.
- Nicholls, Sarah. "Measuring the Impact of Parks on Property Values." 2004. Accessed February 4th, 2013.
<http://new.massland.org/files/MeasuringImpactParksonPropertyValues.pdf>
- Nicholls, Sarah, and John L. Crompton. "Impacts of regional parks on property values in Texas." *Journal of Park and Recreation Administration* 23, no. 2 (2005): 87-108.
- Nicholls, Sarah, and John L. Crompton. "The impact of greenways on property values: Evidence from Austin, Texas." *Journal of Leisure Research* 37, no. 3 (2005): 321.
- Norman, Gregory J., Marc A. Adams, Jacqueline Kerr, Sherry Ryan, Lawrence D. Frank, and Scott C. Roesch. "A latent profile analysis of neighborhood recreation environments in relation to adolescent physical activity, sedentary time, and obesity." *Journal of public health management and practice: Journal of Public Health Management and Practice* 16, no. 5 (2010): 411-419.
- Oakes, Michael. "Measuring Socioeconomic Status." 2012. Accessed June 2nd, 2013.
<http://www.esourceresearch.org/eSourceBook/MeasuringSocioeconomicStatus/10AuthorBiography/tabid/895/Default.aspx>
- O'Sullivan, Arthur. *Urban economics*. 8th edition McGraw-Hill/Irwin, 2012.

- Pentella, Ricky. "Walkability and the Built Environment: A Neighborhood-and Street-Scale Assessment of Diverse San Francisco Neighborhoods." *Walkability Assessment of San Francisco* May 11th 2009.
- Poudyal, Neelam C., Donald G. Hodges, and Christopher D. Merrett. "A hedonic analysis of the demand for and benefits of urban recreation parks." *Land Use Policy* 26, no. 4 (2009): 975-983.
- Putnam, Robert D., Robert Leonardi, and Raffaella Y. Nanetti. *Making democracy work: Civic traditions in modern Italy*. Princeton university press, 1994.
- Rauterkus, Stephanie Yates, and Norman G. Miller. "Residential land values and walkability." *The Journal of Sustainable Real Estate* 3, no. 1 (2011): 23-43.
- Rogers, Shannon H., John M. Halstead, Kevin H. Gardner, and Cynthia H. Carlson. "Examining walkability and social capital as indicators of quality of life at the municipal and neighborhood scales." *Applied Research in Quality of Life* 6, no. 2 (2011): 201-213.
- Ryan, Bill. "Economic Benefits of a Walkable Community." *Center for Community Economic Development, University of Wisconsin-Extension*, 2003. Accessed January 26th, 2013. http://www.gpred.org/siteadmin/images/files/file_59.pdf
- Saelens, Brian E., James F. Sallis, Jennifer B. Black, and Diana Chen. "Neighborhood-based differences in physical activity: an environment scale evaluation." *American journal of public health* 93, no. 9 (2003): 1552-1558.
- Schmitz, Adrienne, and Jason Scully. *Creating Walkable Places: Compact Mixed-Use Solutions*. 2006.
- Schweitzer, John H., June Woo Kim, and Juliette R. Mackin. "The impact of the built environment on crime and fear of crime in urban neighborhoods." *Journal of urban technology* 6, no. 3 (1999): 1-12.
- Smart Growth Network. "Smart Growth Principles: Create Walkable Neighborhoods." Accessed May 16th, 2013. <http://www.smartgrowth.org/principles/walkable.php>
- Smith, Vicent Kerry. *Estimating economic values for nature: methods for non-market evaluation*. Edward Elgar Publishing, 1996.
- Smith, V. Kerry, Christine Poulos, and Hyun Kim. "Treating open space as an urban amenity." *Resource and energy economics* 24, no. 1 (2002): 107-129.
- Sohn, Dong Wook, Anne Vernez Moudon, and Jeasun Lee. "The economic value of walkable neighborhoods." *Urban Design International* 17, no. 2 (2012): 115-128.
- Song, Yan, and Gerrit-Jan Knaap. "Measuring the effects of mixed land uses on housing values." *Regional Science and Urban Economics* 34, no. 6 (2004): 663-680.

- Song, Yan, and Roberto Quercia. "How are neighborhood design features valued across different neighborhood types?." *Journal of Housing and the Built Environment* (2008) 23:297–316.
- Southworth, Michael. "Designing the walkable city." *Journal of urban planning and development* 131, no. 4 (2005): 246-257.
- Speirs, Mark. "Land Value Taxation: An Underutilized Complement to Smart Growth Policies." Masters Dissertation., Temple University, Philadelphia, PA (2010).
- Steuteville, Robert. "The New Urbanism: An alternative to modern, automobile-oriented planning and development." *New Urban News* (2000): 1-6.
- Talen, Emily. "Measuring urbanism: Issues in smart growth research." *Journal of Urban Design* 8 (2003): 195-215.
- Talen, Emily. *New urbanism and American planning: the conflict of cultures*. Routledge, 2005.
- The Congress of New Urbanism. "Charter of the New Urbanism." Accessed March 4th, 2013. <http://www.cnu.org/charter>
- Thorsnes, Paul. "The value of a suburban forest preserve: Estimates from sales of vacant residential building lots." *Land Economics* 78, no. 3 (2002): 426-441.
- Thrall, Grant Ian. *Business geography and new real estate market analysis*. New York: Oxford University Press, 2002.
- Tyrväinen, Liisa, and Antti Miettinen. "Property prices and urban forest amenities." *Journal of environmental economics and management* 39, no. 2 (2000): 205-223.
- U.S Census Bureau. "State & County Quick Facts." 2010. Accessed December 12th, 2012. <http://quickfacts.census.gov/qfd/states/31/3128000.html>
- Van Cao, Than, and Dennis C. Cory. "Mixed land uses, land-use externalities, and residential property values: a reevaluation." *The Annals of Regional Science* 16, no. 1 (1982): 1-24.
- Walsh, Randall P. *Analyzing open space policies in a locational equilibrium model with endogenous landscape amenities*. Mimeo. Boulder, CO: University of Colorado, 2004.
- Weissbourd, Robert, Riccardo Bodini, and Michael He. "Dynamic Neighborhoods: New Tools for Community and Economic Development." *The National Community Development Initiative*, September 2009. Accessed January 9th, 2013. <http://www.rw-ventures.com/ftp/DNT%20Final%20Report.pdf>

World Commission on Environment and Development. "Our Common Future, Chapter 2: Towards Sustainable Development." 2011. Accessed January 14th, 2013.
<http://www.un-documents.net/ocf-02.htm>

APPENDIX A
Table A.1: Hedonic Regression Model: Descriptive Statistics

Variable	Mean	Std. Deviation	Number of Block Group
H_VALUE	139994.30	54543.461	193
ROOMN_LOG	1.727497793	.2353107080	193
HH_SIZE_LOG	.8702381275	.1901934260	193
SID_Z_SCOREMSD	.0291123680	.9923685048	193
RESI_DENS_Z_SCOREMSD	.0639645013	.7700792379	193
FAR_Z_SCOREMSD	.0031891024	1.012935498	193
MIXED_Z_SCOREMSD	.0024141041	1.003420641	193
TRAVEL_T	19.4548087	3.55665300	193
BUSINESS	53.19	123.564	193
Bus_Dens	559.9770219	1262.626728	193
GOLFC_DIST	8147.791566	9572.165640	193
PARK_DIST_LOG	7.100034613	.8633319035	193
NON_WHITE	.1732489	.23906758	193
CRIME_LOG	6.486274958	3.171233362	193
EDUCATION_LOG	-1.232534856	.5985966595	193
HH_AGE_LOG	3.937504592	.1129213777	193

APPENDIX B

Definition of Terms

Accessibility is the easiness of approach within spatial dimension or system in geographical term. Accessibility specifically provides the benefits of convenience in mobility function thus recent urban designs substantially consider high accessibility coordination in urban development plans.

Built Environment Attributes are physical infrastructural elements of human-made surrounding. It features material, spatial and cultural products that provide a unique combination of living settings. Built environment attributes broadly influential in physical and socioeconomic activities of residents.

CBD stands for Central Business District. In geographic terms, it often refers to the center of a city that provides core commercial activities and main transit flows.

LPlan 2040 is the comprehensive community plan of the city of Lincoln and Lancaster County in Nebraska. Overall goals of the plan are based on sustainable community development strategies in order to meet the long-term efficiency in community management. The Long Range Transportation Plan (LRTP) is one of the main components in coordination with LPlan 2040. The plan is to provide a complement of transportation components in Lincoln for efficient land uses and transit modes (City of Lincoln & Lancaster County Planning Department: LPlan 2040 Comprehensive Plan 2011).

New Urbanism Theory is an urban design movement that became widely influential in urban development plans around the 1980s in the U.S. New Urbanism Theory is about to aid long-suffering urban issues of heavy automobile dependence, environmental concerns, and continuous suburban sprawl. Since the 1980s, New Urbanism Theory extensively influenced urban design standards. Many aspects of real estate development, as well as land-use policies, have been changed to meet efficient urban development plans. In general, New Urbanism Theory promotes sustainability in community development plans based on its principles (The Congress of New Urbanism: Charter of the New Urbanism).

Neighborhood Residential Density is defined as the number of dwelling units per area of land devoted to residential building sites. The area specifically excludes land uses serving populations outside of the area being analyzed. The land area may or may not include vacant land (Anderson 2000, 167-168).

Mixed-Land Use is one of New Urbanism Theory's principles. It is the usage of land or building for more than one purpose. Mixed-land use includes any combination of residential, recreational, commercial, or industrial components within a land or building. Mixed-land use promotes dynamic communities by creating unique combinations of public spaces. By promoting mixed-land use in community development plans, there will be fewer urban sprawls and better accessibility (Thrall 2002, 216-217).

Physical Activity Level is the measure a person's daily physical activity as a numerical term. Physical activity level is expressed in formula by total energy expenditure divided by basal metabolic rate (Food and Agriculture Organization of the United Nations 2004).

Smart Growth is “a set of broad principles that provide a framework for making development decisions that result in vibrant, diverse, economically healthy communities which have a strong sense of place” (Durand et al. 2011, 2).

Smart Growth Principles were developed under New Urbanism Theory and comprise ranges of housing options, eco-friendly concepts, mixed-land use development, open-space management, aesthetic features, walkable conditions, and brownfield redevelopment. The principles promote diverse housing types, mixed-use development, housing density, compact development patterns, and levels of open space (Durand et al. 2011, 3-4).

Social Capital is “a measure of an individual’s or group’s networks, personal connections, and involvement” (Rogers et al. 2011, 201). It is defined as the “features of social organization, such as trust norms and networks that can improve the efficiency of society by facilitating coordinated actions” (Putnam 1994, 167).

Socioeconomic Status (SES) signifies various socio-demographic features such as household income, educational attainment, unemployment rate, age group and ethnicity. SES is a major measure of social inequality status (Oakes 2012, 8-10). SES is measured by using area level variables that may independently affect, and be differentiated by, different attributes (Cerin and Leslie 2008, 2596-2598).

Sustainable Development “is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development 2011). In urban development terms, it is a comprehensive urban development plan that ensures efficient resource uses to provide quality living conditions.

Urban Amenities are the necessary urban features that provide tangible and intangible values. Urban amenities could be expressed by various attributes such as physical urban facilities, clear air, and level of safety. In general, urban amenities are known to significantly influence community value creation (Smith 1996, 217-318).

Urban Sprawl is the expansion of a city that is associated with decentralization from the urban core towards the suburban areas. Advanced automated technology and increased income levels after World War II caused the segmentation of residential, commercial, and industrial land uses which led to lower density zoning and higher automobile dependency. Urban sprawl causes negative externalities such as environmental pollution, traffic congestion, and loss of sense of community (Nechyba and Walsh 2004, 186).

Urban Vitality is the promotion of creative urban activities that improve conditions and opportunities. The indicators of urban vitality could be measure by economic, social, and environmental conditions (Landry 2008, 12-18).

Walkability (Walkability index) is a measure of built environment attributes that are related with certain walkable condition in a neighborhood. Walkability is defined as “the extent to which the built environment is friendly to the presence of people living, shopping, visiting, enjoying or spending time in an area” (Abley 2005, 2). Walkability can be measured based on environmental attribute values that are standardized. Higher walkability index means a better walkable environment.

APPENDIX C

Table C.1: Classification of Residential Districts (City of Lincoln & Lancaster County Planning Department: Title 27 ZONING Chapters)

RESIDENTIAL DISTRICTS	DEFINITION	NOTE
R-1 RESIDENTIAL DISTRICT	3 to 5 dwelling units per acre, single- and two-family dwellings	It is intended that this district be limited to previously platted portions of the city already undergoing substantial development, thereby preserving existing low-density residential development
R-2 RESIDENTIAL DISTRICT	3 to 5 dwelling units per acre, single- and two-family dwellings	It is intended that this district be limited to previously platted portions of the city already undergoing substantial development, thereby preserving existing low-density residential development
R-3 RESIDENTIAL DISTRICT	3to 5 dwelling units per acre, single- and two-family dwellings	With strong encouragement for the general use of community unit plans to foster improved and innovative design, a mix of housing types and socioeconomic groups, and improved energy and resource
R-4 RESIDENTIAL DISTRICT	3 to 5 dwelling units per acre, single- and two-family dwellings	This district is intended to provide a stable area of residential use at a gross density in the range of three to five dwelling units per acre. It is anticipated that some redevelopment will occur in this district
R-5 RESIDENTIAL DISTRICT	6 and 10 dwelling units per acre, single-family, two-family, and multiple and townhouse residential uses	This district is intended to provide a redeveloping area of moderate residential density of between six and ten dwelling units per acre
R-6 RESIDENTIAL DISTRICT	11 and 14 dwelling units per acre, single-family, two-family, multiple and townhouse residential uses, private clubs, fraternities and sororities	This district is intended to provide a generally redeveloping area of moderately high residential density between eleven and fourteen dwelling units per acre
R-7 RESIDENTIAL DISTRICT	15 dwelling units, gross, per acre, single-family, two-family, multiple, and townhouse residential uses, apartment hotels, private clubs, fraternities and sororities	This district is intended to provide a redeveloping area of comparatively high density residential use in the range of fifteen dwelling units, gross, per acre
R-8 RESIDENTIAL DISTRICT	Apartment hotels; private clubs; civic, cultural, educational, labor, professional, trade and fraternal membership organizations; and such facilities as schools, parks, community buildings, and churches	Exclusively in that area designated as the E-1 multiple dwelling district which existed immediately prior to the effective date of this title