ASSESSING THE ECONOMIC VALUE OF LINEAR LANDSCAPES: LEARNING FROM THE KATY AND SANTA FE TRAILS IN DALLAS, TEXAS

by

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Abstract

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IN DALLAS, TEXAS

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The University of Texas at Arlington, 2014

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This research is an economic value study for linear landscapes. Additionally, the research builds upon relevant landscape architecture literature in concern to the economic value of landscape. Specifically, the focus occurs upon a landscape typology that is relevant to today's design practice (Crompton, 2001; Brander et al., 2011; Sherer, 2006). The research's relevancy stems from the landscape architect's ability to analyze and understand dynamic, linear landscapes as they stimulate economic activity beyond their direct footprint (see such as Vandermeulen et al., 2011; Ozdil, 2008; Tzoulas et al., 2007; de Groot et al., 2002; Quayle, 1995).

The purpose of this research is to assess the economic value of linear landscapes in the urban setting through the study of Katy and Santa Fe Trails in Dallas, Texas. Linear landscape, as a term, derives from relevant literature in concern to parks and open spaces with linear qualities. Specifically, the term builds upon the typologies of urban trails, linkages, greenways and green infrastructure (see such as Tzoulas, 2007; Walmsley, 2001; Wright; 2013 and so on). This research derives from the landscape architect's ability to understand unique landscape typologies, utilize research to

understand relevant precedents and to implement a research method strategy to understand the economic value of linear landscapes through geo-spatial analysis.

The research follows quantitative methods to assess the economic value of linear landscapes. For the research methods, first, the literature review informs the collection and distillation of economic value indicators through the study of land development and landscape architecture case studies (Francis, 1999; LAF, 2014; ULI, 2014). Second, the data collection process utilizes open record requests and/or government data sharing sources (for example, US Census, 2014). This procedure promotes a replicable data collection format. Third and finally, the geo-spatial data analysis occurs in Geographic Information Systems (GIS) (Esri, 2014) to understand the economic value on-site, along the adjacencies and within the urban fabric.

In conclusion, the data analysis outlines different growth patterns for adjacent development and the urban context within 0.25 mile radius from the Katy and Santa Fe Trails in Dallas Texas. Of note, the linear landscapes display immediate impact (within first five years of inception) in economic value. Specifically the impact is through the indicators of property values, sales tax generated, and number of jobs and establishment. The research illustrates that the utilization of replicable research methods and accessible data sources helps to understand the unique impact of linear landscapes. This topic is relevant due direct and indirect impact urban landscapes, especially linear landscapes, stimulate within their urban context.

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Chapter 1

Introduction

1.1 Introduction

During the 19th century's evolution of urban form, the landscape architect acted in the role of city planner to address the increasing demand for accessible, urban green space as a public amenity. One of the first to address this phenomenon, Frederick Law Olmsted invented two basic greenway components; the stream valley park and 'pleasure drive' for carriages (Walmsley, 1995). Olmsted's design concepts propose the landscape as more than a static space. It retains the potential to connect and integrate disparate physical, geographic or even socio-economic areas.

> "The idea was promoted less by aesthetics than for social and economic reasons-people would benefit from having parks and parkways part of their everyday experience, and promoters would find investment opportunities and homeowners enhanced property values around the parks or along the parkways (Walmsley, 1995, pg. 84)."

The idea of how landscape architecture projects impacts economic value engages the discussion on the value of landscape architecture. Jon Lang, in his book, *Urban Design: A Typology of Procedures and Products*, discusses the roles of the major design, planning and engineering practices in the realm of urban design. The landscape architect is the prime conduit to connect the work of these fields of practice. The landscape architect understands the strengths of their allied design practices. Additionally, the landscape architect connects these strengths through landscape design (Lang, 2005). With today's prevalence of high expertise, technology and access to data, design as an aesthetic objective is too limited of a design rationale. Various institutions

like the Landscape Architecture Foundation (LAF) and the Urban Land Institute (ULI) research the value of design and the impact of landscape at various levels.

Case studies provide designers or stakeholders (investor, developer, public representative and so on) with a method to select to understand innovative, landscape projects (Francis, 1999). For example, ULI offers research findings on the economic impact of development projects. In comparison, LAF focuses mainly on the environmental and social performance of innovative landscape architecture projects. Chapter 2 expands on the two institution's methods and findings. A topical research understands how to expand on the work of these case studies to further explore the value of landscape.

The value of landscape architecture responds to the increase in demand for public, urban amenities (Florida, 2013). A question that leads into the interest of this research starts with the landscape architect's unique approach to problem solving as well as the toolset. The ability to both analyze and visualize data impacts the realization of the development of urban landscapes. The research simply formulates that the symbiosis of data analysis and design visualization promotes the value of landscape architecture. This is relevant because landscape architecture utilizes both aesthetic taste and scientific measures to produce tangible, public goods (Miccoli, 2012).

In summary, this introduction details the value of landscape architecture, utilization of case study findings and the questions on the potential of a landscape architect's directed skill-set towards geo-spatial analysis of economic indicators. This research understands the value of both urban landscapes and the profession of landscape architecture in concern to urban design. As a forecast for this document, the research explores value, value in application on a landscape typology and the influence of geospatial visualization and analysis to further expand the role of landscape architecture in the design of the urban form.

1.2 Problem Statement

Linear landscapes within the urban context stimulate place, introduce social and environmental permeability and catalyze economic development. Linear landscapes intertwine with complex social, environmental, geographic and political situations. Various stakeholders, developers, planners, urbanists, landscape architects, community representatives, city official and so on, all desire different outcomes from design implementation. These desires coincide with the densification in urban areas and the demand for accessible, green open space (US Census, 2013).

The identification of a comprehensive set of economic variables informs future design endeavors on the value of urban landscapes and promotes the cooperation to create investment initiatives. The further application of this research design on select cases continues the discussion on the value of landscape architecture. More specifically this application recognizes the benefits of understanding long-term value versus the short-term gain through research on the indirect economic value of landscape architecture projects.

1.3 Purpose of Research

The purpose of this research is to assess the economic value of linear landscapes in the urban setting through the study of Katy and Santa Fe Trails in Dallas, Texas. The direct and indirect effect of the linear landscapes in concern to surrounding development is explored following replicable research methods. Additionally, the user-friendly approach of the research promotes a landscape architect's assessment of economic value on linear landscapes.

To study this core query, the thesis informs itself on the concept of value, especially economic value, through landscape architecture and urban design literature. The relevance of the topic coincides with the deeper research into the responsive

development of existing urban landscapes. For example, the research into landscape performance is a relevant topic (LAF, 2014).

Research on the economic value of landscape projects is present in literature. The research literature on economic value is limited though in comparison to environmental and social value. Still though, economic value is as strong an outcome as the two aforementioned qualities.

The study of linear landscapes parallels the broader economic value discussion in design fields yet it brings up a new dimension which has to do with its form and geo-spatial influences. Linear landscapes require greater understanding due in part to their connective quality through both disparate physical and socio-economic geographies. Especially with the intense edge conditions around grey infrastructure, linear landscapes are responsive design solutions for connectivity, place creation and permeability in the urban fabric. As an example, SWA Group's design of the Buffalo Bayou Promenade installed a pedestrian-centric connection point. This connection occurs through an edge condition perceived as impenetrable (LAF, 2014; Ozdil et al., 2013).

The assessment of linear landscapes yields data at both the macro and micro level. At the macro level, the entirety of the linear landscapes offers a viewpoint of general district by district growth. At the micro level, an identification of key nodes stimulates an analysis of design patterns. A concept to build upon, in concern to linear landscapes, is how this typology's unique dynamic influences design at various scales.

Ultimately, this thesis underlines how the landscape architect understands, assesses and visualizes the economic value of linear landscapes. A landscape architect implicitly understands the catalytic properties of design typologies like linear landscapes. Additionally, the ability to collect, analyze and visualize secondary data is part of the landscape architect's toolbox. With the use of software technology, such as Geographic

Information Systems (GIS), the graphic analysis of this secondary data is a further form of visualization and knowledge-based design.

1.4 Research Questions

The research questions explored, within the confines of Katy and Santa Fe Trails in Dallas, Texas are:

1) What is the economic value of linear landscapes?
2) What are the economic value indicators in literature relevant to linear landscapes?
3) How can Geographic Information System (GIS) organize, analyze and assess the economic value of linear landscapes through the use of secondary data?

While the above three research questions provide the back-bone for the research, the questions below inform the researcher's thought process to build up towards this study. The subsequent chapters detail this subset of questions to various degrees.

- What is a linear landscape?
- What is a linear landscape in the context of greenways?
- What is meant by economic value in landscape architecture?
- Is the graphic analysis of secondary data, such as economic value indicators, a viable mode of communication for the landscape architecture practice?

1.5 Definition of Key Terms

Consultant: a person who is trying to have some influence over a group or organization but has not direct power to make changes or implement programs (Block, 1999).

Economic Viability: development that is economically feasible and which remains economically viable over the long term. Concepts include: character, continuity and enclosure, ease of movement, legibility, adaptability and diversity (Carmona et al., 2001).

Geospatial Technology: a set of technological approaches, such as GIS, photogrammetry, and remote sensing, for acquiring and manipulating geographic data (Wade and Sommer, 2006, pg. 89).

Green Infrastructure: green infrastructure is "…an interconnected network of natural areas and other open spaces that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife" (Benedict and McMahon, 2006, p.1).

Greenway: Greenways are networks of linear elements that are planned, designed and managed for multiple purposes, including ecological, recreational, cultural, aesthetic or other purposes compatible with the concept of sustainable land use (Ahern, 1995).

- Generation 1 greenways (pre- 1700s-circa 1960): These are the axes, boulevards and parkways that first linked urban spaces-the 'ancestral' greenways (Searns, 1995, pg. 67).
- Generation 2 greenways (circa 1960-circa 1985): These are trail-oriented, primarily recreational, greenways and linear parks that provide access to rivers, streams, ridgelines, rail-beds and other corridors within the urban fabric. An important emphasis of most of these greenways is non-motorized travel (Searns, 1995, pg. 69).
- Generation 3 greenways (circa 1985 onward): These are the emerging 'multi-objective' greenways that address needs of wildlife, flood damage reduction, water quality, education and other infrastructure needs in addition to urban beautification and recreation (Searns, 1995, pg. 72).

Linear landscape (researcher's definition): The term linear landscape, for the purpose of this research, is a construct of various parks and open spaces linear in character. Landscape typologies include, but are not limited to, urban trails, linkages, greenway or other green infrastructure (with linear dynamics) are potential linear landscapes.

Perception: The objective of perception is to present our brain with a coherent and meaningful picture of the outside world and to give each object its place in an organized whole (Coeterier, 1996, pg. 28).

Public Goods: Landscape is an integral part of public goods and, as such, fulfils a subsidiary function by meeting needs and preferences based on qualitative values. From the economic viewpoint, the neoclassic theory defines public goods as aggregate assets characterized by: a) the ability to avoid excluding all individuals from the possibility to benefit from them free of cost, ad libitum and simultaneously with others; b) the prevention of the insurgence of competition among consumers, since the consumption of any good by anyone does not lead to a significant decrease in the consumption of others; c) a marginal cost of their use amounting to nil. (Miccoli, 2012, pg. 117-132).

Stakeholder: a person affected by the particular issue being addressed by the consultant (Block, 1999).

Urban Design: the many strands of place-making, environmental responsibility, social equity and economic viability (drawn together) (Llewellyn-Davies, 2000) and the complex relationships between the elements of the built and unbuilt space (DoE, 1997).

Value: (literal definition) a measure of the worth of something to its owner or any other person who derives benefit from it, this being the amount at which it can be exchanged (Carmona et al, 2001).

(in urban design) the potential to generate benefits for the built environment stakeholders (Parfect & Power, 1997; Worpole, 1999, Carmona et al., 2001) or the wider ‘value in use’ benefits that accrue to society as a whole (Eccles, 1996).

1.6 Research Methods

The research employs quantitative methods to assess the economic value of linear landscapes. The application of the research methods occurs at the Katy and Santa

Fe Trails in Dallas, Texas (Francis, 1999; LAF, 2014; McIntyre, 2005; ULI, 2014 and so on). The research design utilizes three major components. First, the literature review drives the collection and distillation of economic value indicators through the study of land development and landscape architecture case studies (Francis, 1999; LAF, 2014; ULI, 2014). Second, the collection of secondary data occurs with the selection of economic value indicators (property value, tax revenue and so on) in context to the two, aforementioned, linear landscapes. Third and finally, the data analysis and visualization occurs in the software technology of Geographic Information Systems (GIS) (Esri, 2014).

The review of archival and literary sources informs the value in landscape architecture and urban design. The definition for linear landscape derives from the research and literature of greenways and the concept of linkages. Additionally, the precedent study of economic value indicators influences this research design. The data informs a combination of past, present and future trends in concern to economic value indicators. The literature review essentially drives the 'how to' approach of the research design.

Data for the Katy and Santa Fe Trails derive from various public sources only. This user-friendly approach stimulates a replicable means and methods of assessment. Subscription based software, such as *LoopNet* and *SimplyMap*, provide quick outlets for economic data retrieval (LoopNet, 2014 and SimplyMap, 2014). The research excludes these information sources due to limited clarity about data cleaning and processing undertaken these third party information providers. Private/public ownership stakeholders, city, county, state, national and so on are all potential data sources for secondary economic data. The data analysis is with the use of Geographic Information System (GIS) (Esri, 2014).

The use of the previously stated software of GIS outlines a landscape architect's contribution to the urban design practice. The landscape architect is spatially aware, through graphic analysis, of how the linear landscape fits into the urban fabric, stimulates development and catalyzes connectivity. For the purpose of this research, the study area focuses on economic changes on the trail's adjacencies and within a 0.25 mile buffer around the two trails. Before and after data ascertain any instances of economic change and economic value creation.

In summation, the research design first utilizes a literature driven study to define the linear landscape, second, to derive a comprehensive set of economic value indicators and third, to analyze secondary economic data through GIS software. A further explanation of the research design is found in Chapter 3: Research Methods.

1.7 Limits, Limitations and Significance

This section highlights the limits, limitations and significance of the study. For the purpose of this research limits are defined as what you know (or not know) before the research process versus limitations which are the limits that arise during the research process.

There is not an accepted comprehensive definition in landscape architecture literature in concern to 'linear landscape'. The concept of linear landscape derives from the literature review of green infrastructure and greenways. For the purpose of this study, a linear landscape is a construct of different typologies. The linear dynamics of the Katy and Santa Fe Trail fall under the purview of this concept.

As with any quantitative approach, the availability or attainability of desirable data is a research design limitation. More specifically, data collection time frames, communication with data sources and existence of appropriate geographies (as data) are all research design limitations. Secondary data, in simple terms data collected by others,

contains inherent errors as well. For example, the research primarily focuses on two sites within the Dallas Metropolitan area. As an example, to access historic parcel data, there is an approximate two week time lag for the open record request. Additionally, the researcher needs historic parcel data for the year 2000, but earliest data available is 2004. This data collection process continues in Chapter 4: Analysis and Findings in more detail.

The significance of this research is how the landscape architect understands and communicates the economic value of linear landscapes. Even without an economics background, a landscape architect typically understands suitable economic value indicators in concern to a linear landscape, how to access economic data and how to analyze and visualize economic value indicators through geo-spatial analysis. Overall, this study focuses on how the landscape architect's scope of work in urban design evolves with the understanding of the economic value landscape typologies such as linear landscapes add to their urban context.

In concern to linear landscapes, it is important to understand the differences in economic value in comparison to traditional, 'square' parks. A linear landscape with an equitable square footage to a 'square' park yields thousands of more linear feet for adjacent development to occur. Additionally, the linear landscape stimulates various design patterns and land use morphologies to evolve along its edges. This research does not concern so much the applicability of the term linear landscape. Instead the focus is on the qualities of a linear landscape as it contributes to economic value within its adjacencies as well as walkable distance. Whether it is a 'rail to trail' design or streetscape enhancement project, the linear dynamic of these typologies influence economic value at a greater scale than traditional green space or park designs.

1.8 Assumptions

For the research, the assumption is that the literature contains viable economic value indicators appropriate to the study of linear landscapes. Additionally, the data collection process yields both comprehensive and geographically relevant (for example, census tract data are more pertinent to the study than county level data) secondary economic data for analysis. The final assumption concerns the use of GIS and the software's ability to graphically organize the secondary economic data for the researcher to visually analyze.

This research assumes the need to understand the economic value of linear landscapes. Specifically, linear landscapes interact with various land use, geographies, and socio-economic complexities along its adjacencies. Geospatial visualization stimulates the perception of the linear landscape as a viable urban development typology for investment.

Also, this research assumes the practice of landscape architects continued growth in the sphere of urban design. As the main proponents of the urban landscape, it is the practice's role to overcome perceptual constraints to continue to inform the environmental and social benefits of the urban landscape and above all the potential economic value added by its implementation. It is typically argued in the profession that the implementation of design ultimately comes down to dollars and cents.

Finally, the assumption is that GIS will continue as the pre-eminent geo-spatial analysis software for the foreseeable future. GIS's platform clearly (and graphically) interprets complex data asserts it role as the prime software engine to undertake this research process.

1.9 Summary

This chapter outlines the introduction and the background for the research. The next chapter focuses on the literature review to provide the foundation for this research's applicability and relevance. The chapters to follow focus on literature review, research methods, analysis and findings, conclusions, relevance to landscape architecture and future research. These chapters develop the theory of the economic value of urban landscapes and the landscape architects future role in urban design to understand the economic value of linear landscapes and overall, urban landscapes by studying Katy and Santa Fe Trails in Dallas, Texas.

Chapter 2

Literature Review

2.1 Introduction

This chapter covers the literature review portion of the thesis. There are three major areas covered in this review. First, the literature review understands the concept of linear landscapes. The concept of linkages and the typologies of greenways and green infrastructure have merit in this discussion.

Second, the chapter discusses the concept of economic value in the fields of urban design, landscape architecture (traditional practice) and landscape architecture (with a lens toward urban design.) The study of economic value in these relevant fields highlight the concepts that apply to this thesis research and the limitations present in each topic.

Finally, the select, economic value indicators derive from the review of select and/or relevant Urban Land Institute (ULI) and Landscape Architecture Foundation (LAF) case studies. The final set of economic value indicators in the research design all trace back to the case study review in this chapter.

2.2 Linear Landscape

The following paragraphs touch upon the concept of linear landscapes. The term is a construct of various landscape typologies that display linear dynamics in an urban context. In Amalie Wright's 2013 publication, *Future Park: Imagining Tomorrow's Urban Parks*, the literature concisely details relevant linear landscapes as 'linkages'. They are as follows:

- Single, overall linkage park (at city or regional scale)
- Transit-led regeneration corridor

- Unlocked river corridor
- Unlocked road corridor
- Unlocked rail corridor
- Transformed political boundaries (between cultural landscapes) (Wright, 2013, pg. 32-111)

For the purpose of this study, the 'unlocked rail corridor' is the relevant concept. In the United States, the equivalent term is 'rails to trails' under the purview of the Rails to Trails Conservancy (Kidambi, 2011). With over 130,000 miles of abandoned rail lines in the United States, the city of Dallas has shown an innovative vision in re-appropriating their own abandoned rail lines within the city limits (Harnik, 2010). Specifically for this research, the linear landscapes the research utilizes the Katy and Santa Fe Trails in Dallas, Texas as the study sample sites.

The concept of linear landscape derives from the 'greenway' landscape typology. As a form of green infrastructure, it offers various benefits to the urban form. It upgrades urban green space systems, introduces natural, semi natural and artificial networks of ecological systems to the urban fabric, emphasizes the quantity of urban and peri-urban green spaces, provide framework for economic growth and nature conservation and provide opportunity for integration between urban development, nature conservation and public health promotion (Tzoulas et al., 2007).

The greenways, to follow the framework of the linear landscape concept, are at a "macro-scale" (Walmsley, 1995). For example, at the macro-scale linear landscape forms that provide edge conditions for "formless 'edge cities'" consist of boulevards/parkways, linear parks (of continuous trail systems through stream valleys, flood plains, hillsides, ridge-lines, historic and public properties), working landscapes, aquifer recharge areas,

regional reservations, ‘rail to trails’ networks, historic landscapes and scenic byways maintained for the public good (Walmsley, 1995).

The key quality of the linear landscape resides in its elongated edge condition. In comparison to a square or rectilinear park, a linear landscape of equitable surface area has a substantially greater perimeter. This creates greater opportunity for adjacent development to occur along its proximity. As a consequence, this exponentially increases the indirect impact on economic value. This concept derives from Andrew Miller’s master’s thesis: *Valuing Open Space: Land Economics and Neighborhood Parks*.

> “Elongated parks increase park perimeter, all else equal, thereby boosting the net proximity premium provided by that park. A double square park with the same area as a square park will have a 6% longer perimeter. A triple square park, in turn, has a 15% longer perimeter…(Miller, 1995, pg. 143).”

The researcher applies this concept to understand the difference between a one mile long linear landscape and a park with an approximate 400 foot square dimension. Both landscapes have an approximate surface area of 132,000 square feet. In contrast, the linear landscape has a net proximity (or perimeter) of 10,610 linear feet versus 1,592 linear feet of net proximity for the square park. In summation, the linear landscape has an approximate 566% greater net proximity impact than the square park (Miller, 2001). Figure 2-1 below provides a graphic comparison between a (1) mile linear landscape versus a square park with an equal square footage.

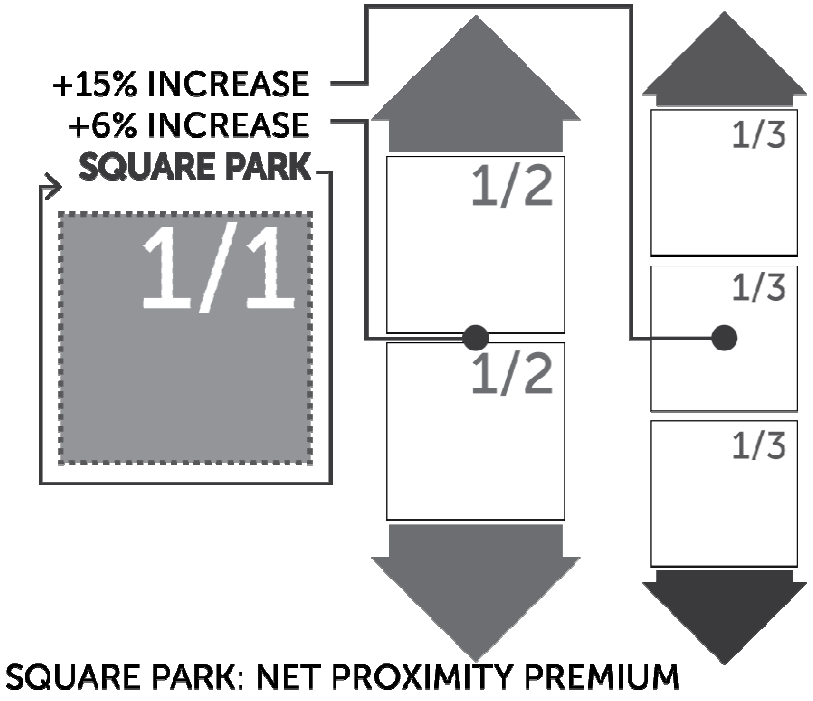

Figure 2-1: Net Proximity Premium (Miller, 2001)

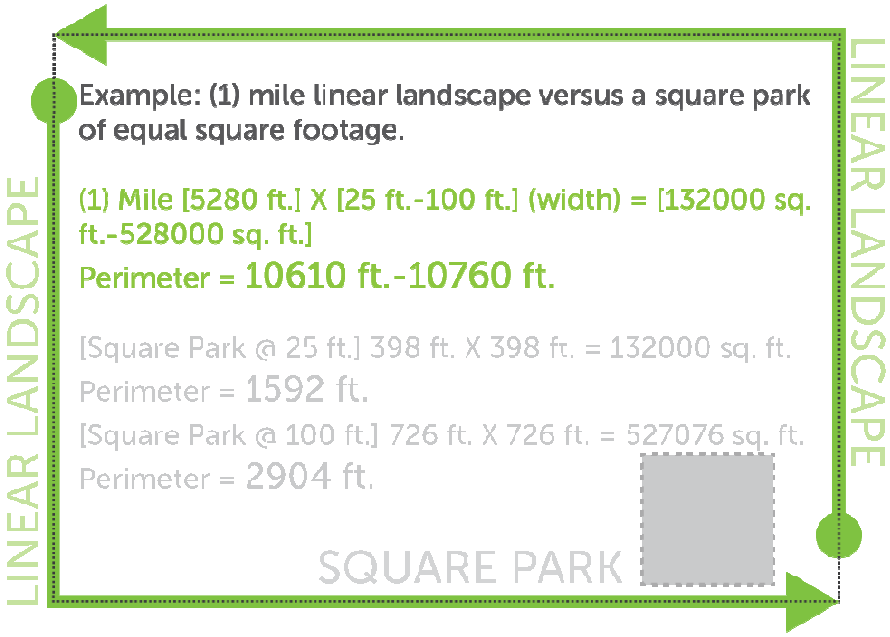

Figure 2-2: Net Proximity Premium; Linear Landscape versus Square Park

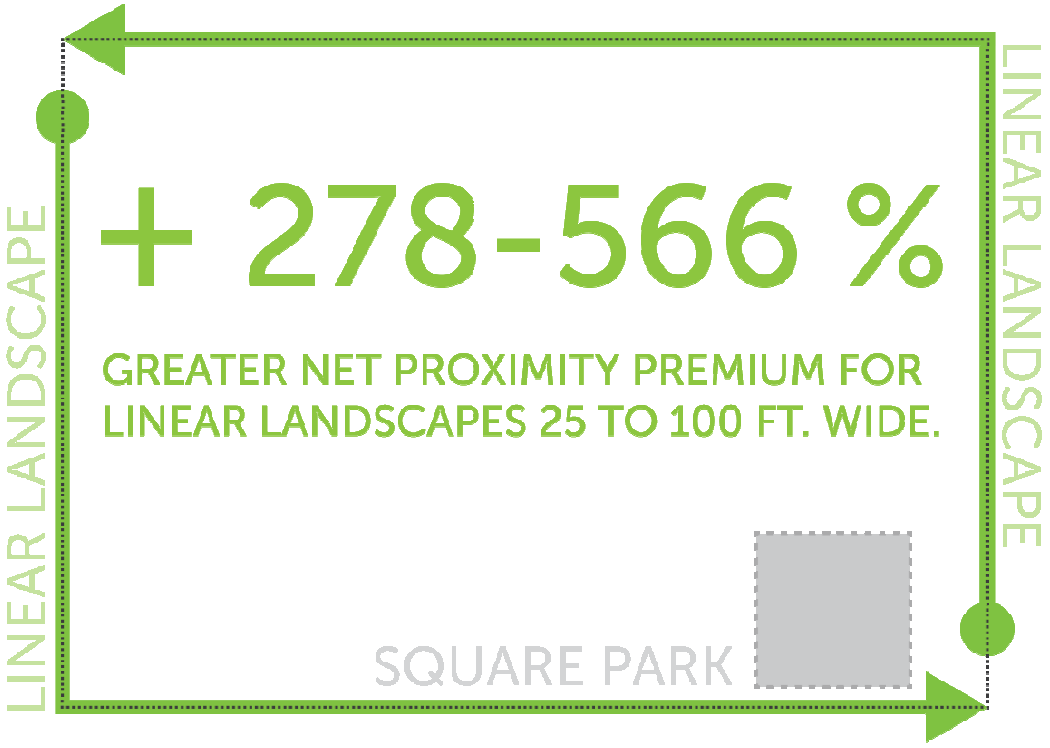

Figure 2-3: Net Proximity Premium; Linear Landscape versus Square Park

2.3 Economic Value of Landscape

For most landscape architecture projects, the provision of value creation is a requirement for their inception to become a reality. The assumed role of the landscape architect is to bring an environmental value to the design. An assumed secondary result, but a primary goal, is the creation of social value to the users of the designed space. Presently, the trend in landscape architecture research is to quantify the performance or metrics of landscape architecture projects (LAF, 2014).

Organizational bodies like the Urban Land Institute (ULI) and the Landscape Architecture Foundation (LAF) utilize a case study approach to identify the specific examples of development (ULI) and landscape (LAF) metrics and/or performance. In concern to economic value, ULI, as a planning/land development organization, places an

emphasis on real estate value, tax revenue, etc. while the LAF explores the value of green infrastructure and its long-term cost saving potential.

Before the discussion on the LAF and ULI case studies take place, it is important to understand the relevant literature in concern to the economic value of landscape. A linear landscape, as an urban landscape, derives it merit from multiple practices. This literature details three categories to understand economic value. The categories of economic value research fall under traditional landscape architecture inquiry, urban design inquiry and landscape architecture inquiry that relates to an urban design scale.

2.3.1 Traditional Economic Value of Landscape Architecture

To provide a comparison to the value of urban design (as applied to urban landscape design) is a review of traditional economic value added to parks and recreation projects. Crompton, in his economic value study of urban parks, highlights four main categories that outline economic value added by parks to an urban, suburban or exurban contexts. Listed below are the four 'economic development "public" benefits that may accrue from park and recreation services':

1) "Attracting tourists: the major factor considered by tourists when they make a decision about which communities to visit on a pleasure trip is the attractions that are available. In most cities, those attractions are dominated by facilities and services operated by park and recreation agencies and their non-profit partners (parks, beaches, events, festivals, athletic tournaments, museums, historical sites, cultural performances, etc.). Without such attractions, there is no tourism (Crompton, 2001, pg.2)."
2) "Enhancing real estate values: people are prepared to pay more to live close to natural park areas. The enhanced value of these properties results in their owners paying higher property taxes to governments. If the incremental

amount of taxes paid by each property that is attributable to the park is aggregated, it is often sufficient to pay the annual debt charges required to retire the bonds used to acquire and develop the park (Crompton, 2001, pg.2)."

3) "Attracting businesses: in many cases, the viability of businesses in the highly recruited high-technology, research and development, company headquarters, and services sectors is dependent on their ability to attract and retain highly educated professional employees. The deciding factor of where these individuals choose to live is often the quality of life in the geographic vicinity of the business. No matter how quality of life is defined, park and recreation opportunities are likely to be a major component of it (Crompton, 2001, pg.2)."
4) "Attracting retirees: a new clean growth industry in American today is the increasing number of relatively affluent, active retirees. Their decision as to where to locate with their substantial retirement incomes is primarily governed by two factors: climate and recreational opportunities (Crompton, 2001, pg.2)."

Crompton's research provides a broad, but insightful starting point to understand the relationship between landscape and its effect on economic value. It is important to this research to discuss economic value in terms of direct or indirect effect.

2.3.2 Direct and Indirect Economic Value Added

The economic valuation methods for landscape architecture fall into four basic types: direct market valuation, indirect market valuation, contingent valuation and group valuation (de Groot et al., 2002). The definitions of the four variables are below:

- “Direct market valuation: This is the exchange value that ecosystem services have in trade, mainly applicable to the ‘goods’ (i.e. production functions) but also some information functions (e.g. recreation) and regulation function (de Groot et al., 2002, pg. 403)”.
- “Indirect market valuation: When there are no explicit markets for services, we must resort to more indirect means of assessing values. A variety of valuation techniques can be used to establish the (revealed) Willingness To Pay (WTP) or Willingness To Accept compensation (WTA) for the availability or loss of these services. Avoided Cost (AC): services allow society to avoid costs that would have been incurred in the absence of those services (de Groot et al., 2002, pg. 403).”
- “Contingent valuation (CV): Service demand may be elicited by posing hypothetical scenarios that involve the description of alternatives in a social survey questionnaire (de Groot et al., 2002, pg. 404).”
- “Group valuation (GV): Another approach to ecosystem service valuation that has gained increasing attention recently involves group deliberation. Derived from social and political theory, this valuation approach is based on principles of deliberative democracy and the assumption that public decision making should result, not from the aggregation of separately measured individual preferences, but from open public debate (de Groot et al., 2002, pg. 404).”

To relate to linear landscapes, the investment in this landscape typology not only contributes to the environment but also creates direct and indirect (positive) impact for a region (Vandermeulen et al., 2011). The lesson in this section of the literature review is the application of direct and indirect (and its sub-categories) in application to a research design for landscape architecture economic valuation. For the purpose of this research, the assumption is that direct economic value is a result of the landscape itself. In

comparison, indirect economic value is a result of proximity, or nearness, to a landscape architecture project. Specifically, this research tests the thesis that linear landscapes impact the economic value of nearby developments through indirect means.

2.3.3 Traditional Economic Value of Urban Design

> A comprehensive definition for urban design is as follows:
>
> "…urban design should be taken to mean the relationship between different buildings; the relationship between buildings and the streets, squares, parks and waterways and other spaces which make up the public domain; the nature and quality of the public domain itself; the relationship of one part of a village, town or city with other parts; and the patterns of movement and activity which are thereby established: in short, the complex relationships between all the elements of built and unbuilt space…(DoE, 1997, para. 14)"

This definition outlines many aspects of what urban design covers. Urban design concerns itself with the entire physical, built environment that is accessible to the public. It recognizes how the built environment spaces connect together dynamically, their function, and above all their social value.

Past research details the difference of perception of good design by planners, politicians, the general public and designers (Jeffrey and Reynolds, 1999). Perception of good urban landscape design ultimately boils down to depend on the user's perception versus the exact nature of the development (Carmona et al., 2001). Carmona found though, in his 2001 case study, the perceptual disconnect of what stakeholders considered as constraints for good urban design and what they actually gained. Basically, their perceptions still overruled the outcome. Their perceived anticipated costs include (Carmona et al., 2001):

1. Increased construction and development costs

2. Increased time to obtain planning approvals
3. Increased management once built
4. Increased risk of development not happening at all because developers could not, or refused to, meet the local authorities design standards.

Good urban design leads to significant benefits (both short and long term) to investors, developers and designers with long term benefits to occupiers, public interests and the community. To overcome the default need for short term gain, it is imperative for stakeholders to understand the opportunities for tangible long term gains (Carmona et al., 2001). 'Financial Tangibles' that relate to this research include:

1. Potential for higher land values
2. Higher sales values
3. Funding potential through public/private partnerships
4. Higher rental returns
5. Increased asset value
6. Better re-sale values
7. Increased economic viability for neighborhood
8. Increased local tax revenue (Carmona et al., 2001)

2.3.4 Economic Value In Urban Design Literature

To call back on Crompton's research covered earlier, he discusses the traditional lens of the landscape architect towards the economic value study of parks. This model bases its merit within the realm of parks and recreation design and planning for neighborhood developments. Recent literature concerns the landscape architect's knowledge of the economic value of urban landscapes. This research addresses the practice's growth in the study of the urban design. The two literature precedents under

review relate to landscape architecture at a macro scale (district and city analysis) and at a micro scale (block analysis).

The literature, in concern to a macro scale analysis, looks to Taner Ozdil's book, published in 2008, the *Economic Value of Urban Design*. Ozdil's includes an assessment on the Texas Main Street Program (TMSP) and its 'Four-point Approach' for main street revitalization. Ozdil outlines three research objectives to study urban design improvements in up to 76 cities in Texas: an assessment of the 'Four-point Approach', the economic impact within the district and the economic impact within the city. For this research's purpose, Ozdil's approach to the third research objective is relevant. First, to understand economic value creation, before and after data (specifically, 1997 to 2001) ascertains the increase or decrease in direct economic value creation. This study supports the program's economic impact within the city and the region. Second, TMSP's and Ozdil's list of economic value indicator data is of relevance to this research's specific approach. Ozdil benefits from two sets of indicators. The first set is specific to the study districts within their direct boundaries. The second set is the list of other indicators from secondary data that covers the study district's adjacencies. Data for the adjacent geographies haves scales of report at block group, census track, zip codes and/or city level. The list of indicators for urban design district is as follows:

- Number of building rehabilitation projects
- Total expenditure on rehabilitation projects
- Number of newly constructed buildings
- Total expenditures on new construction
- Number of buildings sold
- Total expenditures of buildings sold
- Net business start-ups, relocations and expansions

- Net gain in jobs created
- Total reinvestment (Ozdil, 2008)

The list, as follows, includes examples of indicators that apply the study district's adjacent proximities:

- Population (household), Place
- Employment – Jobs (employer), Zip Code
- Establishment (employer), Zip Code
- Employment (household), City
- New Sales Tax Permit, City
- City Retail Trade (taxable), City
- Commercial Property Values, City (Ozdil, 2008)

The limitations of the data, in concern to this research, are the availability and attainability of secondary data. Additionally, the appropriate data may be available, but its geography scale limits its use in concern to the economic value of linear landscapes.

Next, the literature in concern to the micro scale analysis derives from Miller's master's thesis (2001) on land economics with neighborhood parks in Dallas, Texas. The thesis objective is a hedonic regression analysis to quantify market value for neighborhoods near Dallas, Texas (Miller, 2001). What is relevant to the purpose of this research is the study of urban forms (at a parcel and block scale) in relation to market value. Different design attributes of urban parks, for example rectilinear forms versus square forms, impact the market valuation of properties adjacent to the park and from varied proximal distances away from the park. Overall, the major take-away from this literature is how the form of a park/urban landscapes increases market values with increased recti-linearity (Miller, 2001). In summation, a technique on how linear

landscapes add economic value is through the increase in frontage property for development derives from this research.

2.4 Urban Land Institute Development Case Studies

Since 1971, the Urban Land Institute (ULI) has published case studies to detail the development process of projects that are both innovative in their markets and financially successful (ULI, 2014). The precedent study of the ULI case studies promotes a complimentary study to the landscape architecture economic value indicators. The ULI case studies understand that indirect benefits stimulate direct value as well. In general, the development typologies ULI covers include:

- Mixed-use
- Office/Industrial/Hotel
- Planned/Resort Communities
- Residential
- Special/Other

The publication of the case studies covers financially successful projects, background data on costs, rents, etc., identifies innovative features and strategies, how the development came to be and lessons learned and finally, include photos, site plans, floor plans and etc. (ULI, 2014). The literature review covers the ten most recent published case studies which seem to have a relevance to the economic value of urban landscapes. The ULI case studies are accessible through their online, ULI Development portal. From here, interested parties have access to the full publication of each case study.

2.4.1 Bayshore Town Center

The Bayshore Town Center project is a 1950's era enclosed shopping mall redeveloped into a mixed-use, pedestrian friendly town center. Introduced land uses

include retail, office and residential developments. Below are key economic value indicators the case study details (Newberg and Thoerig, 2009 in ULI, 2014).

- Increase in property taxes
- Increase in sale tax revenues
- 30 to 40% annual increase in adjacent property value (5 to 6% is prior observed annual increase.
- Introduction of new land uses promotes new urbanism
- Strong public and private partnership between city and developer (Tax Increment Financing (TIF) offset acquisition and remediation costs)

2.4.2 Al Kout-Fahaheel Waterfront

The Al Kout-Fahaheel Waterfront is an international project that falls under the build, operate and transfer (BOT) model. The BOT stimulates a public/private partnership in which a private developer receives a concession from a public entity to finance, design, construct, and operate a development (usually on public land). The project introduces to prominent pedestrian piers (flanking an inner harbor), over 180,000 square feet of rentable retail space, two marinas for recreation and fishing purposes (one for each) and a beachfront promenade that extends over one mile. Below are key economic value indicators the case study details (Sabah and Thoerig, 2009 in ULI, 2014).

- Stimulates economic activity through connections of residential and commercial districts
- Regional shopping, entertainment and recreation destination
- Bolsters fishing industry with marina construction and promotes direct economic activity with on-site fish market
- Design standards accommodate elderly and disabled (non-typical international example) to promote retirement destination

2.4.3 The Christman Building

The Christman Building is a 64,190 square foot Class A office building that was remodeled for modern amenities. The success of this project is the final outcome of a sustainably conscious, financially competitive historic office renovation that follows the design aesthetic of the surrounding urban context. Below are key economic value indicators the case study details (Mayers et al. and Thoerig, 2009 in ULI, 2014).

- Financially successful historic renovation project
- Financing incentive from state and federal programs (complex public and private partnership)
- Indirect effect of marketing potential based on projects success

2.4.4 National Park Seminary

The National Park Seminary is a residential project that features both new construction use of dilapidated resort hotel and educational institution. Overall, 86 townhouses, 66 apartments, and 18 condominiums have housing occupants. As a green space amenity, a historic interpretive trail that abstracts the seminary ties together the project's master plan. Below are key economic value indicators the case study details (Rother and Thoerig, 2009 in ULI, 2014).

- Educated community eased the project's development (especially with prior poor perception of the site by public)
- Successful integration of wide range of housing opportunities for different economic status levels

2.4.5 Gateway Quarter

The Gateway Quarter is a 25 square block historic neighborhood redevelopment project. The first three phases of development in the Gateway Quarter include 192 for-sale residential units, 32 rental units, and nearly 55,000 square feet of ground floor

commercial space (data current as of 2009). The total development planned for the area includes 400 residential units and over 72,000 square feet of commercial space. Below are key economic value indicators the case study details (Newberg and Thoerig, 2009 in ULI, 2014).

- Over ¾ of new housing unit buyers in 24 to 32 age range
- Attracted 10 retail businesses to cater to residential district
- Attraction of walkable and urban housing units

2.4.6 The Walk at Jumeirah Beach Residence

The international The Walk at Jumeirah Beach Residence (JBR) is a 1.1 mile stretch of outdoor and indoor retail destination. This linear retail development generates a variety of pedestrian traffic levels throughout the day. Pedestrian traffic includes jogging/biking, lunch/shopping and dining/entertainment in their respective time slots. The Walk receives about 60,000 visitors on weekends, and every day visitors spend an average of three to four hours at the walk. Below are key economic value indicators the case study details (Khayat and Thoerig, 2010 in ULI, 2014).

- Economic value of accessibility (both pedestrian and vehicular)
- Importance of sensitive and knowledge driven design can overcome perceived bias of what is acceptable design standards
- Precedent study of how outdoor and economic activity can be stimulated in hot, summer climates

2.4.7 Southborough

Southborough is a mixed-use project consisting of for-sale townhouses and flats, and commercial building located on an infill site in Charlotte. This unconventional development wraps a 172,000 square foot ‘big-box’ retail store. Southborough buffers an existing neighborhood (from the existing retail) with 2.8 acres that includes 69 residential

units and a 30,280 square foot commercial structure. Below are key economic value indicators the case study details (Newberg and Thoerig, 2010 in ULI, 2014).

- Significant, physical constraints can be economically viable developments
- 'Good' design drives community acceptance
- Relative demand of mixed-use development during recession

2.4.8 Morgan Woods

Morgan Woods, in the heart of Martha's Vineyard, provides 60 affordable rental homes for residents that are employed to support the summer resort through a variety of occupations. This development is a prime example of how to economically viable housing units for resort workers while tying into the upscale aesthetic of the resort. Below are key economic indicators the case study details (Pontius and Thoerig, 2010 in ULI, 2014).

- Development success between low, mid and high income earning levels
- Complex public/private partnership promotes sustainable design
- Innovative design technologies reduced freight/transportation costs
- Clear design vision

2.4.9 Middleton Hills

Middleton Hills is a master planned community designed with new urbanism principles. It contains 428 residential units and 102,800 square feet of commercial space. The design aesthetic is clearly regional which features craftsman, bungalow and prairie style architecture. Below are key economic indicators the case study details (Newberg and Thoerig, 2010 in ULI, 2014).

- Internationally marketed master planned community
- Promotes civic sites to anchor mainly residential development
- Overall attraction of walkable housing opportunities

- Relatively successful example of new urbanism

2.4.10 Anthem Park at Uptown Village

Anthem Park at Uptown Village is a mixed use, mixed income development that occupies one city block. Included is an affordable apartment building, for-sale townhomes, retail space, underground parking, and public park on a 5.2 acre urban site. Below are key economic indicators the case study details (Schmitz and Thoerig, 2010 in ULI, 2014).

- Economic viability of development cluster of diverse land uses
- Understanding the desires of community wants promotes the approval process and increases marketability
- Integration of green and open public spaces with development improves visibility, accessibility and overall project longevity

The section as follows provides a summary of the economic value findings from the ULI case studies. From left to right, Table 2-1 lists the title of the case study, the economic value indicator category each finding corresponds to and whether the finding is a direct or indirect impact of the development. This concise format informs the analysis of the literature in Chapter 3: Methodology.

2.4.11 Summary of ULI Development Case Studies

The ten Urban Land Institute case studies reviewed here both summarize the type of development as well as economic indicators undertaken within. Table 2-1 offers a concise summary of the ULI Development case study review. The table is set-up to distill the specific (economic) findings in each case study to a consistent variable or construct. For the purpose of this research, economic variables are of higher importance. Second, the researcher applies a proximity designation to each variable. Multiple proximity designations may apply to each variable. The proximities include direct (on-site), indirect

1 (immediate adjacencies), indirect 2 (within a 0.5 mile area) and indirect 3 (within a district boundary).

This comprehensive list stimulates the first step towards the research design. The identification of the appropriate variable with a proximity designation that aligns with the study of the economic value in concern to landscape begins to inform the final indicator selection for the research.

In summary for the ULI Development case studies, the majority of the variables occur at proximities outside the limits of the site. This is partially due to the type of case studies ULI publishes. The larger developments retain a greater sphere of influence within their urban context. The researcher assumes that these development case studies parallel the linear landscape's sphere of influence. For example, the linear frontage of an example from the ULI case studies with a linear landscape, the total linear feet of each edge condition may be comparable.

Table 2-1: ULI Development Case Study Indicator Table

Performance Indicator Table Derived from Literature Review			
CASE STUDY CATEGORY			
Urban Land Institute Development Case Studies	***Economic Indicators Analyzed/ Major Themes Observed***	***Research Design Category**** ***AS APPLIES TO THESIS RESEARCH**** ***DIRECT = ON-SITE VALUE CREATION*** ***INDIRECT 1 = VALUE TO ADJACENCIES*** ***INDIRECT 2 = VALUE WITHIN 0.5 MILE RADIUS*** ***INDIRECT 3 = VALUE AT DISTRICT LEVEL***	***Primary/Secondary Data***
Bayshore Town Center	Property Taxes	Indirect 1,2	Primary
	Sales Tax Revenue	Indirect 1,2,3	Primary
	Adjacent Property	Indirect 1	Primary
	Land Use	Indirect 2,3	Both
	Public/Private Partnership	Indirect 3	Both
Al Kout-Fahaheel Waterfront	District Connectivity	Indirect 3	Secondary
	Sales Tax Revenue	Indirect 1,2,3	Primary
	Retail Opportunities	Indirect 2,3	Both
	Commercial Opportunities	Indirect 2,3	Both
	Quality of Life	Direct	Secondary
	Retirement	Direct; Indirect 1,2	Both
The Christman Building	Historic Context	Direct	Secondary
	Public/Private Partnership	Direct	Both
	Mixed-use infill	Indirect 1,2,3	Primary
	Marketing Potential	Direct; Indirect 3	Secondary
National Park Seminary	Public/Private Partnership	Direct	Both
	Community Context	Indirect 1,2	Secondary
	Socio-economic Factors	Indirect 1,2,3	Secondary

Table 2-1: ULI Development Case Study Indicator Table (Cont.)

Performance Indicator Table Derived from Literature Review			
CASE STUDY CATEGORY			
Gateway Quarter	Living Opportunities	Indirect 1,2	Primary
	Socio-economic Factors	Indirect 1,2,3	Secondary
	Retail Opportunities	Indirect 2,3	Both
	Mixed-use infill	Indirect 1,2,3	Primary
	District Connectivity	Indirect 2,3	Secondary
The Walk at Jumeirah Beach Residence	District Connectivity	Indirect 2,3	Secondary
	Retail Opportunities	Indirect 2,3	Both
	Commercial Opportunities	Indirect 2,3	Both
	Quality of Life	Direct	Secondary
	Community Context	Indirect 1,2	Secondary
	Quality of Life	Direct	Secondary
Southborough	Land Use	Indirect 2,3	Both
	Public/Private Partnership	Direct	Both
	Mixed-use infill	Indirect 1,2,3	Primary
	Community Context	Indirect 1,2	Secondary
Morgan Woods	Socio-economic Factors	Indirect 1,2,3	Secondary
	Living Opportunities	Indirect 1,2	Primary
	Public/Private Partnership	Direct	Both
	Quality of Life	Direct	Secondary
Middleton Hills	District Connectivity	Indirect 2,3	Secondary
	Mixed-use infill	Indirect 1,2,3	Primary
	Community Context	Indirect 1,2	Secondary
	Quality of Life	Direct	Secondary
Anthem Park at Uptown Village	Land Use	Indirect 2,3	Both
	Community Context	Indirect 1,2	Secondary
	Public/Private Partnership	Direct	Both
	Mixed-use infill	Indirect 1,2,3	Primary
	District Connectivity	Indirect 2,3	Secondary
	Retail Opportunities	Indirect 2,3	Both
	Living Opportunities	Indirect 1,2	Primary

2.5 Landscape Architecture Foundation Case Study Investigation Series

This section details selected group of case study publications from the Landscape Architecture Foundation Case Study Investigation Series (LAF CSI) . These case studies selected based on their coverage on economic issues. The mission of the LAF CSI is to promote the concept of landscape performance (LAF, 2014). Like the study of building performance, the study of landscape performance highlights the importance of sustainable design and the education of knowledge based design to development stakeholders.

The ten case studies selected from the LAF CSI catalog is due to their deeper understanding of economic impacts. The select case studies display diverse set of economic value indicators relevant to this research. From the 47 projects available on the LAF CSI website that contain economic variables, the ten outlined below display an array of direct (typical landscape architecture performance benefit indicator) and indirect economic value indicators. Ultimately, it is the researcher's bias in the case study selection. Since urban design economic value indicators derive from the ULI literature review, the LAF CSI study complements and balances this review from the traditional, landscape architecture perspective (LAF, 2014).

2.5.1 Beijing Olympic Forest Park

The 1,680 acre Beijing Olympic Forest Park is the largest green space ever constructed in this historic city. This public green space amenity supports a surrounding high density urban fabric. The design blends cultural aesthetics with ecological green infrastructure to create a recreation, educational and environmental city destination. Below are the economic value indicators this case study details (Li et al., 2012 in LAF, 2014).

Economic value added:

- Pollution reduction
- Sustainable energy creation on-site
- On-site job creation for ongoing park maintenance and operations

2.5.2 Cheonggyecheon Stream Restoration Project

The Cheonggyecheon Stream Restoration Project is the result of the removal of an elevated freeway to uncover a historic stream-bed. This ecological revival is a catalyst for economic development in a previously poor area in the city. Below are the economic value indicators this case study details (Robinson et al., 2011 in LAF, 2014).

- Increase in public transportation ridership
- Impacts adjacent property market value
- Catalyst for business creation
- Tourist attraction

2.5.3 Dutch Kills Green

Dutch Kills Green is an introduced green space that covers over eight blocks of a previously pedestrian hostile realm. The increase in permeability enhances both the pedestrian and environmental setting to increase the overall livability in the area. This project follows the trend of green infrastructure as an indirect catalyst for real estate resurgence. Below are the economic value indicators this case study details (Thoren et al., 2013 in LAF, 2014).

- Sustainable stormwater infrastructure
- Net annual benefits to city
- Sustainable plant palette
- Impacts adjacent property values
- Reduction in pedestrian and cyclist fatalities
- Tourist attraction

2.5.4 Cherry Creek North Improvements and Fillmore Plaza

Cherry Creek North is a 16-block retail district and outdoor shopping promenade. This streetscape enhancement project retains the historical aesthetic of the area with the introduction of a modern and vibrant pedestrian street life. Below are the economic value indicators this case study details (Yang et al., 2012 in LAF, 2014).

- Increase district sales tax revenue
- Decrease in retail vacancy
- Reduction in crime statistics
- Reduction in energy consumption
- Reuse of recycled material

2.5.5 Klyde Warren Park

Klyde Warren Park turns an impenetrable edge condition into a design opportunity to connect a residential district (Uptown) to a cultural and downtown district (Arts and Main Street). This relatively small 5.2 acre park is a major regional destination for the DFW Metroplex. A complex public/private stakeholder partnership facilitates the ongoing success of this urban park. Below are the economic value indicators this case study details (Ozdil et al., 2013 in LAF, 2014).

- Tourist attractor
- Impacts public transportation ridership and infrastructure investment
- Stimulates city economic development
- Construction job creation
- Employment for ongoing maintenance and operations of park
- Impacts adjacent property market values
- Impacts urban residential housing opportunities

2.5.6 Millennium Park

Millennium Park is an award winning example of how complex urban situations accommodate innovative green infrastructure design challenges. Now an international tourist destination, this green space is a catalyst for this part of Chicago. Like most of the recognized urban landscapes, Millennium Park is a result of effective leadership and a strong public/private partnership between stakeholders. Below are the economic value indicators this case study details (Jerke et al., 2011 in LAF, 2014).

- Tourist attractor
- Impacts urban residential housing opportunities
- Impacts adjacent property market values
- Impacts rental rates in existing apartments
- Sustainable energy creation on-site

2.5.7 Napa Flood Protection Project

With the use of ecological engineering, the Napa Flood Protection Project is a visionary, regional flood protection plan. Along with the flood reduction benefits, the ecologically-oriented approach is a catalyst for the City of Napa's reinvention. Below are the economic value indicators this case study details (Kondolf et al., 2013 in LAF, 2014).

- Temporary construction job creation
- Permanent retail job creation

2.4.8 Port of Los Angeles Wilmington Waterfront Park

This community park is a design alternative to standard engineering solution of 20 foot tall noise buffer wall for the Port of Los Angeles. The park introduces a sustainable landscape while still mitigating the port noise. This landscape is a community catalyst. Below are the economic value indicators the case study details (Robinson et al., 2011 in LAF, 2014).

- Economic value of newly planted trees
- Energy savings from stormwater retention
- Reuse of material reduces hauling costs
- Temporary construction job creation

2.5.9 Richmond Canal Walk

The Richmond Canal Walk unifies fragmented urban areas with an open space pedestrian system, canal restoration and district development. The adaptive reuse of the existing industrial infrastructure impacts significant private development. Below are the economic value indicators the case study details (Hill et al., 2011 in LAF, 2014).

- District economic development
- Catalysis for retail/restaurant/entertainment new construction
- Impacts housing market (even through recession)
- Reuse of recycled materials during construction
- Impacts public transportation ridership

2.5.10 William G. Milliken State Park, Phase II

W. G. Milliken is a riverfront brownfield redevelopment and Michigan's first state park in an urban setting. By connecting Detroit's downtown to this area of the riverfront landscape, it follows a part in the city's long-term economic strategy to catalyze capital investment in mixed use development on the surrounding properties. Below are the economic value indicators the case study details (Deming et al., 2013 in LAF, 2014).

- Tourist attractor
- Impacts economic development in adjacent property
- Links downtown to riverfront amenity

The section as follows provides a summary of the economic value findings from the LAF case studies. From left to right, Table 2-2 lists the title of the case study, the

economic value indicator category each finding corresponds to and whether the finding is a direct or indirect impact of the development. This concise format informs the analysis of the literature in chapter 3.

2.5.11 Summary of LAF CSI Case Studies

The ten LAF case studies reviewed here both summarize the type of landscape architectural work as well as the economic performance indicators reviewed within. Table 2-2 offers a concise summary of the LAF CSI case study review. The table is set-up to distill the specific (economic) findings in each case study to a consistent variable or construct. For the purpose of this research, economic variables are of higher importance. Second, the researcher applies a proximity designation to each variable. Multiple proximity designations may apply to each variable. The proximities include direct (on-site), indirect 1 (immediate adjacencies), indirect 2 (within a 0.5 mile area) and indirect 3 (within a district boundary).

This comprehensive list stimulates the first step towards the research design. The identification of the appropriate variable with a proximity designation that aligns with the study of the economic value in concern to landscape begins to inform the final indicator selection for the research.

In concern to the LAF case studies, the majority of the economic variables have a direct proximity designation. This is in contrast the ULI's case studies. This finding is due to the report of economic value in LAF case studies in comparison to the environmental and social 'benefits' that comprise the majority of the research findings. In general, the economic 'benefits' create the highest degree of difficulty in concern to quantification. Recently though, research teams explore the indirect impact of landscapes such as Millennium and Klyde Warren Park in concern to economic value (Jerke et al., 2012; Ozdil et al., 2013 in LAF, 2014). This assumes a trend for landscape architecture to

understand the greater sphere of influence an urban landscape creates in concern to economic impact. This concept is not too dissimilar from the ULI Development case study findings.

Table 2-2: LAF Case Study Indicator Table

Performance Indicator Table Derived from Literature Review			
Landscape Architecture Foundation CSI Series	***Economic Indicators Analyzed/ Major Themes Observed***	***Research Design Category**** ***AS APPLIES TO THESIS RESEARCH**** ***DIRECT = ON-SITE VALUE CREATION*** ***INDIRECT 1 = VALUE TO ADJACENCIES*** ***INDIRECT 2 = VALUE WITHIN 0.5 MILE RADIUS*** ***INDIRECT 3 = VALUE AT DISTRICT LEVEL***	***Primary/Secondary Data***
Beijing Olympic Forest Park	Pollution Reduction	Direct	Primary
	Energy Creation	Direct	Primary
	Direct Job Creation	Direct	Primary
Cheonggyecheon Stream Restoration Project	District Connectivity	Indirect 2,3	Secondary
	Adjacent Property	Indirect 1	Primary
	Commercial Opportunities	Indirect 2,3	Both
	Tourism	Direct; Indirect 2,3	Both
	Retail Opportunities	Indirect 2,3	Both
Dutch Kills Green	Environmental Context (Ecological)	Direct	Primary
	Property Taxes	Indirect 2,3	Primary
	Adjacent Property	Indirect 1	Primary
	District Connectivity	Indirect 2,3	Secondary
	Tourism	Direct; Indirect 2,3	Both
Cherry Creek North Improvements and Fillmore Plaza	Sales Tax Revenue	Indirect 1,2,3	Primary
	Retail Opportunities	Indirect 2,3	Both
	Quality of Life	Direct	Secondary
	Energy Creation	Direct	Primary
	Environmental Context (Ecological)	Direct	Primary

Table 2-2: LAF Case Study Indicator Table (Cont.)

Performance Indicator Table Derived from Literature Review			
CASE STUDY CATEGORY			
Klyde Warren Park	Tourism	Direct; Indirect 2,3	Both
	District Connectivity	Indirect 2,3	Secondary
	Commercial Opportunities	Indirect 2,3	Both
	Property Taxes	Indirect 2,3	Primary
	Adjacent Property	Indirect 1	Primary
	Direct Job Creation	Direct	Primary
	Indirect Job Creation	Direct; Indirect 2	Both
	Living Opportunities	Indirect 1,2	Primary
	Sales Tax Revenue	Indirect 1,2,3	Primary
Millennium Park	Tourism	Direct; Indirect 2,3	Both
	Living Opportunities	Indirect 1,2	Primary
	Adjacent Property	Indirect 1	Primary
	Property Taxes	Indirect 2,3	Primary
	Energy Creation	Direct	Primary
Napa Flood Protection Project	Indirect Job Creation	Direct; Indirect 2	Both
	Retail Opportunities	Indirect 2,3	Both
	Sales Tax Revenue	Indirect 1,2,3	Primary
Port of Los Angeles Wilmington Waterfront Park	Environmental Context (Ecological)	Direct	Primary
	Energy Creation	Direct	Primary
	Indirect Job Creation	Direct; Indirect 2	Both
	Quality of Life	Direct	Secondary
Richmond Canal Walk	District Connectivity	Indirect 2,3	Secondary
	Property Taxes	Indirect 2,3	Primary
	Retail Opportunities	Indirect 2,3	Both
	Sales Tax Revenue	Indirect 1,2,3	Primary
	Energy Creation	Direct	Primary
William G Milliken State Park and Harbor	Tourism	Direct; Indirect 2,3	Both
	Adjacent Property	Indirect 1	Primary
	District Connectivity	Indirect 2,3	Secondary
	Environmental Context (Ecological)	Direct	Primary

2.6 Summary

The next step is to select the economic value indicators for the research design. In Chapter 3: Methodology, an analysis covers the indicators in Table 2-1 and Table 2-2. The selection of economic value indicators relate directly to urban landscapes and more specifically, linear landscapes.

This section's objective is to review literature on landscape architecture and urban design (as precedent), value, economic value of urban design, economic value of parks and recreation, and background on greenways and linkages as an abstract to linear landscape. The literature review provides the foundation for the research design through the review of the Urban Land Institute Development Case Studies and the Landscape Architecture Foundation Case Study Investigation series. A synthesis of urban design, parks and recreation and other methods create a platform for urban landscape design economic value. The following chapter details the methodology of the research.

Chapter 3

Methodology

3.1 Introduction

This chapter focuses on the research design methods. The study employs an quantitative approach to study and assess economic value of linear landscapes (Deming and Swaffield, 2011; Ozdil et al., 2013; Ozdil, 2008; Murphy, 2005). Chapter 3: Methodology reviews the quantitative approach, research design, and basic procedures followed in this research. Specifically it discusses the literature review as the form of analysis for the economic value indicators, the collection of secondary data, the use of Geographic Information Systems (GIS) and the final research design execution. The chapter concludes with the basic coverage regarding limitations, bias, errors, and or significance of the research.

3.2 Quantitative Approach

The purpose of adopting a quantitative approach is both to assess the economic value of linear landscapes with empirical methods while providing procedures and findings (primarily through descriptive statistics) that communicate numerical means to a broader audience. In this research the quantitative methods are also assumed to create replicable and generalizable methods. Such procedures inform comprehensive research opportunities in future research through secondary data. The empirical approach utilizes systematic documentation of design project(s) is to further understand the economic value of linear landscapes through pre and post data analysis (Francis, 1999). This approach is important to understand if the linear landscapes of the Katy and Santa Fe Trails add economic value to their urban proximities (Crompton, 2001; Ozdil, 2006 and 2008).

Relevant methods from urban design and landscape architecture practice inform the final research design on how the linear landscapes impact economic value (Carmona et al., 2001; Crompton, 2001; LAF, 2014; Miller, 1995; Ozdil, 2006 and 2008; ULI, 2014). Specifically, this research utilizes various degrees of parametric analysis (through GIS), secondary description (economic data) and descriptive case study analysis to assess the economic value of linear landscapes (Deming and Swaffield, 2011).

3.3 Research Design

This research assesses the economic value of linear landscape elements in the urban setting.The literature review drives the makeup of economic indicators present in this research. The review, organization and analysis of precedent economic value indicator methodologies lead to this point of the research. Before the collection of data, what and how to use GIS is necessary to undertake this process. Knowledge of this tool pushes the extent of the research design and the extent of the data analysis.

This section underlines what the actual research design is, what are the variables of study and how the analysis is introduced. As previously stated, the research design identifies the economic value of two linear landscapes. The landscapes in question are the Katy and Santa Fe Trail in Dallas, Texas. These trails retain on-site accessibility for the researcher, available secondary data for analysis and a linear, dynamic edge condition along the urban proximities (Lynch, 1960). The Katy and Santa Fe Trails exemplify the characteristics of the linear landscape that the application of this methodology requires.

This research employs a quantitative approach to assess the economic value of linear landscapes. The research designates the Katy and Santa Fe Trails for the analysis. These trails retain qualities that fall under the researcher's expectation of linear landscape conditions that require in-depth exploration of economic value. Specifically, as

rails to trails applications, they offer new modes of connectivity to their proximal urban contexts, innovative green infrastructure design solutions and finally, promote the landscape architecture practice in the scope of urban design through the creation of an urban, public amenity and good.

The steps to test this application on the Katy and Santa Fe Trails are as follows:

1. Literature review drives final selection of economic value indicators.
2. Secondary data source from open record requests or through '.gov or .org' open access downloads.
3. Indicators (data clean preparation by researcher) understand where the best proximity of analysis occurs (on-site, adjacencies and urban context).
4. Analysis of cleaned, secondary data occurs in Geographic Information Systems (GIS) with the use of geographic specific shapefiles such as parcels, census tracts or zip codes.

This approach not only applies to this research, but in theory, is applicable for any landscape architect in pursuit of similar research endeavors. From the literature review of ULI Development and LAF case studies through the data collection process, the replicable research methods is key in this thesis research. The research methods inform both the economic value of linear landscapes and the economic value discussion for landscape architecture research.

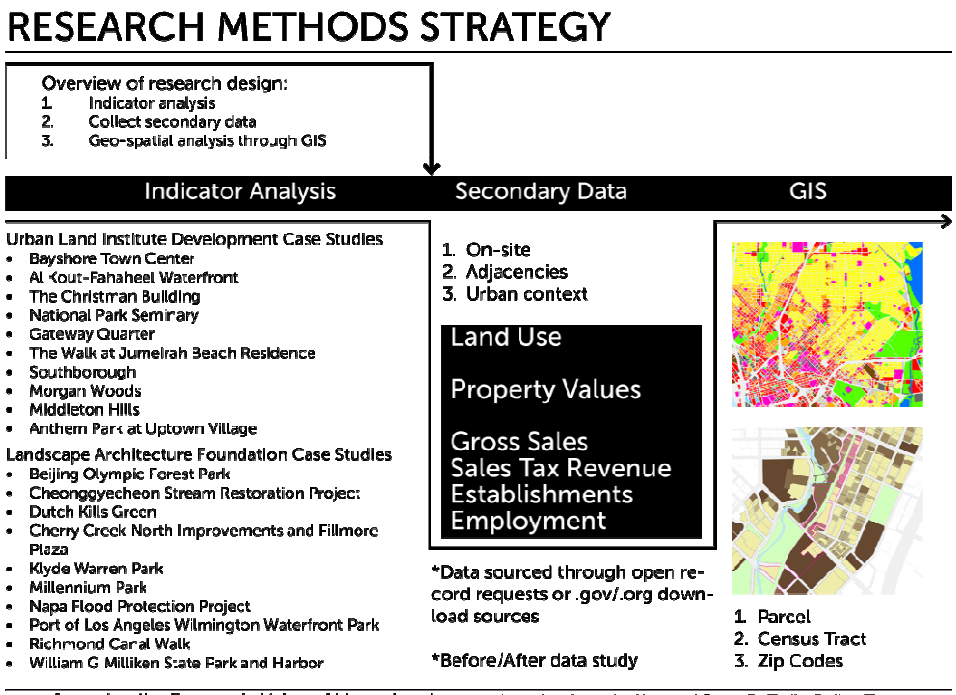

Figure 3-1: Graphic Summary of Research Methods

3.4 Identification of Economic Indicators

The first step of the research design identifies economic indicators that pertain are relevant to linear landscapes. Analysis of relevant literature informs the selection of appropriate indicators. Specifically, the literature review, informs the relevant economic value indicators in landscape architecture research and the secondary data that corresponds with said indicators. The second part of the literature review, the analysis of the ULI and LAF case studies, is shown below in Table 3-1 (Francis, 1999; LAF, 2014; ULI, 2014).

First, Table 3-1 delineates economic value indicators as variables or constructs. For example, in Section 2.4.1, the finding of “introduction of new land uses promotes new urbanism” distills to ‘land use’ as a variable. The report constructs, a concept that multiple

variables comprises, like ‘district connectivity’ are shown in the Table 3-1. The study omits the use of constructs as they are outside the scope of the research design.

Second, the economic value indicators have a designation of direct or indirect impact. For example, ‘retail sales’ is a direct economic value impact in the case of linear landscapes. This variable has primary data backing. Indirect economic value impact, such as ‘retirement destination’, informs economic value, but it may have only secondary data to back its merit. The concept of direct and indirect economic value creation derives from de Groots’ research on direct and indirect market value (de Groot et al., 2002).

Third and finally, Table 3-1 assigns a proximity designation to the economic value indicators. The three categories of proximity are on-site, adjacencies and urban context. On-site occurs from the economic value that the landscape creates itself. A majority of the LAF findings support this proximity study. Adjacencies include any geography, development or land use that shares an edge with the landscape of note. Finally, the urban context includes proximity from 0.25 mile pedestrian walking distance to a district proximity that may stretch to a zip code level. Refer to Figure 3-1 for a visual comparison of data geographies. This field is of high importance because of the current argument of how much an urban landscape plays in economic value creation (Jerke et al., 2008; Miller, 1995).

For the purpose of this research, it is import to note the differences of direct and indirect effect. Direct effect, for example, occurs directly within the boundaries of a landscape. Specifically, Klyde Warren Park stimulates economy through an on-site restaurant, snack kiosk and a food truck parking area (Ozdil et al., 2013; LAF, 2013). Indirect effect, in contrast, occurs outside the confines of the landscape and confounding variables play into the economic value impact. For example, Klyde Warren Park impacts adjacent real estate total market value, rental/vacancy rates and office leases (Ozdil et

al., 2013; LAF, 2013). The aforementioned examples provide the basis for the proximity designations in Table 3-1.

Table 3-1: Economic Indicator Analysis Based On Literature Review

Economic Value Indicators Retrieved from Literature	Direct or Indirect Value Created	Proximity of Study
Property Taxes	Direct	2,3
Sales Tax Revenue	Direct	3
Property Value	Direct	2,3
Land Use Morphology	Direct	3
Public/Partnership	Indirect	1
*Connectivity**	Indirect	3
Retail Sales	Direct	3
Business Creation	Direct	3
Retirement Destination	Indirect	1,2,3
*Quality of Life Indexes**	Indirect	3
Historic Preservation	Indirect	2
Mixed-use Development	Direct	3
Transit-oriented Development	Direct	3
*Community Perception**	Indirect	2,3
Housing Unit Creation	Direct	2,3
Rental Prices	Direct	2,3
Rental Vacancies	Direct	2,3
*Socio-Economic Indicators**	Indirect	2,3
Business Indexes	Indirect	3
Carbon Sequestration	Direct	1
Renewable Energy	Direct	1
New Tree Plantings	Direct	1
Direct Job Creation	Direct	1
Indirect Job Creation	Direct	1,2,3
Tourism Destination	Direct	1,3
BMP Value	Direct	1
Economic Impact	Indirect	3
*CONSTRUCT**		1=ON-SITE 2=ADJACENCIES 3=URBAN CONTEXT
HIGHLIGHTED CELLS = PRIMARY INDICATORS OF FOCUS		

In summary, the indicators below provide the variables to assess the economic value of linear landscapes. As per Table 3-1, linear landscapes indirectly affect these economic value indicators.

- Land use
- Property value
- Retail sales
- Sales tax revenue
- Business creation

As direct value creators, these indicators understand the economic value of the linear landscapes this study applies to. The sections to follow in this chapter detail the secondary data equivalent to each indicator for study and how GIS analyzes this data.

3.5 Data Collection Methods

The thesis research represents a replicable strategy for any landscape architect to explore the economic value of urban landscapes, or more specifically, urban linear landscapes (trails, linear parks, greenways and so on). How to access the secondary data is important for the overall research design strategy. Local, regional, state and national organizations/governments collect and distribute data on various economic indicators that is relevant to this research. As the aforementioned agencies collected and organized this data, the researcher utilizes it a secondary level. The thesis refers to this data as ‘secondary data’ throughout the document.

This section details what secondary data corresponds with each economic value indicator, the geographic scale of data reports (for example, census block versus state level) and accessible data sources. For Section 3.4, this description bases off the researchers’ assumption from past research and design applications with a focus on geo-

spatial analysis. Chapter 4: Analysis and Findings discusses in more detail the limitations the researcher encounters in the data collection phase.

The secondary data that corresponds with 'land use morphology' is 'land use'. For the study, the researcher accesses 'land use' data through the North Central Texas Council of Governments (NCTCOG) GIS Clearinghouse. The accessibility is through download off of the NCTCOG website. Additionally, the data are available through the National Resources Conservation Services (NRCS) data-share portal (through download request). The geography of report bases on parcel level data. A parcel is a single lot of land with a commercial market value. Years available for 'land use' data include 1990, 1995, 2000, 2005 and 2010 (NCTCOG, 2014).

The secondary data that corresponds with 'property value' is 'total market value'. 'Total market value', as a term, is generalized as property value. 'Total market value' is the summation of base property value plus the improved market value (value of any development found on parcel). For the study, the researcher accesses 'property value' data through the Dallas Central Appraisal District (DCAD) (DCAD, 2014). Property value organization is a county level application. This is universal through the United States. 'Property value', like 'land use', data are parcel level geographies. DCAD includes 2009 through 2013 full level data sets. The researcher assumes 2000 data sets are available through an open record request.

The secondary data that corresponds with 'retail sales' and 'sales tax revenue' correspond with 'gross sales' and 'sales tax revenue'. For the study, the researcher accesses 'gross sales' and 'sales tax revenue' data through the Texas State Comptroller Office (TSCO, 2014). The state comptroller office is universal for state agencies. This data requires an open record request. The researcher assumes the data are available at census tract level geographies. Census tracts are relatively homogeneous units with

respect to population characteristics, economic status, and living conditions, census tracts average about 4,000 inhabitants (US Census, 2014). The data timeframe is on quarterly reports for each year.

The secondary data that corresponds with ‘business creation’ corresponds with ‘establishments’. For the study, the researcher accesses ‘establishments’ data through the US Census’ American Factfinder portal. American Factfinder is a national data service and free download source (US Census, 2014). The researcher assumes the data geography are at the census tract level. The timeframes include 2002, 2007 and 2012 (to parallel the economic census data reports).

Schedule for research design execution:

1. Pre, February 1, 2014: Develop scope of research, literature review and overall thesis proposal. (Approximate 4 month time frame)
2. February 1 through February 21, 2014: Locate, contact and/or download, request and organize secondary data and corresponding geographic shapefiles.
3. February 21 through March 14, 2014: Continue data collection as secondary objective. Begin data analysis and data cleaning preparation through Microsoft EXCEL and GIS. This includes joining primary data tables with geographic shapefiles. (Data cleaning is the process of organizing the raw, secondary data for use in this research).
4. March 14 through April 1, 2014*: Continue any outstanding data analysis. Edit all final graphic maps, tables and charts for presentation level quality.

In summary, the secondary data are accessible through open record requests or .gov and/or .org website downloads. The replication of this study is of higher importance than the specific data itself. A landscape architect, to research the economic value of urban landscapes, has access to this data without the need for a subscription (i.e.

SimplyMap) or knowledge of how to access private real estate data collectors portals (i.e. LoopNet). Third-parties organize these data engines. Further scrutiny is required to assess their validity and/or relevance. The report of limitations the researcher encounters through the data collection process are found in the chapter that follows.

3.6 Data Analysis Methods

This section discusses data analysis methods used in this research. Research typically uses descriptive statistics and frequencies (such as averages, mean or median amounts, or total numbers of sales figures) in order to communicate findings. Research significantly benefits from GIS technologies and following section explains this in more detail.

The research utilizes the GIS software to organize and analyze the secondary data. The geo-spatial analysis attempts to understand the empirical data through the visualization of the graphic output/maps. Overall, this software technology contributes to the landscape architects knowledge of economic value added through linear landscapes. The use of GIS, as an assumption, projects a role the landscape architect plays in future urban design practice.

Geographic Information System (GIS) is an integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships and model spatial processes (Esri, 2014; Wade and Sommer, 2006). Two components of ArcGIS are ArcMap and ArcCatalog (Esri, 2014). ArcMap is an application for displaying maps and investigating them, for analyzing maps to answer geographic questions and producing maps that make analysis persuasive (Ormsby et al., 2010). ArcCatalog is an application for managing geographic data (Ormsby et al., 2010). The combination of these two applications undertakes the majority

of the data organization. The data is geo-processed to display an array of variable combinations (Wade and Sommer, 2006).

Figure 3-2, shown below, displays a geography comparison between parcel (black polygons), census tract (dark gray polygons) and zip code (light gray polygons) shapefiles. “Shapefiles are vector data storage format for storing location, shape and attributes of geographic features (Wade and Sommer, 2006, pg. 191)”. For the purposes of this research, a geography level of parcels is more desirable for analysis than zip code. The parcel data creates a higher detail of study, especially in context to trail adjacencies. For the purpose of this research, the proximity analysis includes that of adjacencies and within a 0.25 mile buffer/radius. These proximities correspond to the linear landscapes indirect impact on economic value.

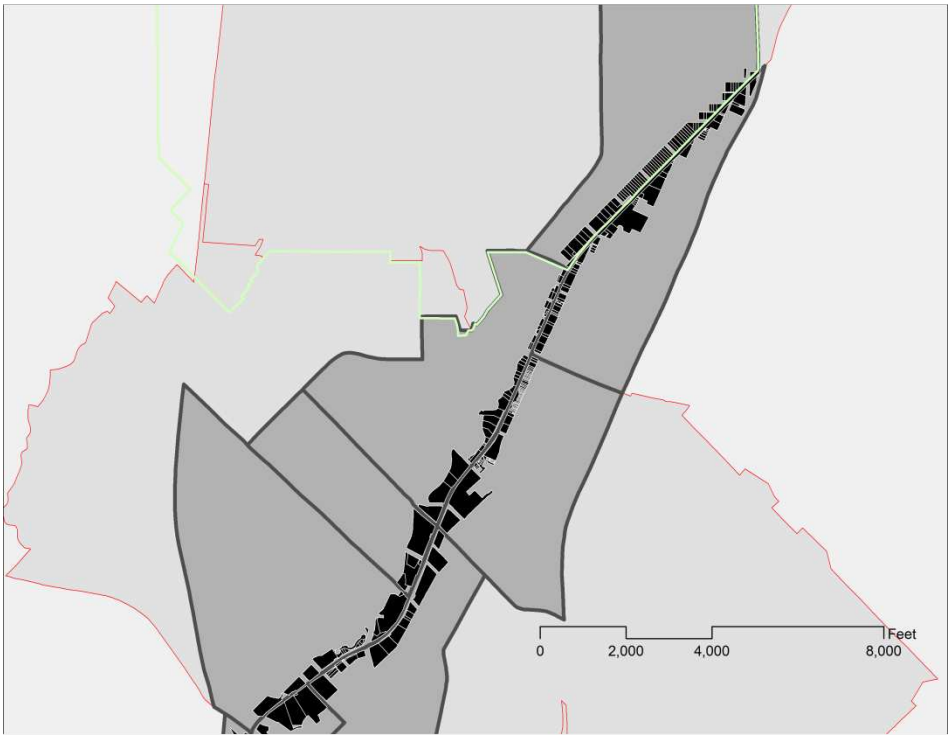

Figure 3-2: Parcel, Census Tract and Zip Code Comparison

In summary, Geographic Information Systems (GIS) is the prime tool for both attribute and spatial data analysis. The ease of use and depth of study shows how GIS in collaboration with the landscape architect's unique skill-set offers a didactic visualization method to discuss the economic value of linear landscapes. The graphic representation of secondary data opens dialogue on how direct or indirect the economic value added by the linear landscape actually is present.

3.7 Study Location: Katy and Santa Fe Trails Overview

The Katy Trail is an urban trail that stretches from the Victory Promenade (at the American Airlines Arena) towards Dallas Highland Park. While planning for the trail began in the 1980's, the SWA Group design, opened for use approximately in the year 2000. The Rails to Trails Conservancy project, the current manifestation overlays an abandoned Texas to Missouri right-of-way.

In 1997, the establishment of the Friends of the Katy Trail stimulates funding for the proposed $23 million dollar masterplan. A prime example of the success a public/private partnership can achieve with the right vision and the right organization, the Katy Trail is a key amenity for both the Uptown District in Dallas and for the city as a whole. Serving approximately 300,000 potential users within a 1 mile radius of the trail, the Katy Trail promotes connectivity with dual bike and pedestrian trails, sustainability through native plant design and economic stimulus with a noted increase in development along the trail (Lockwood, 2007).

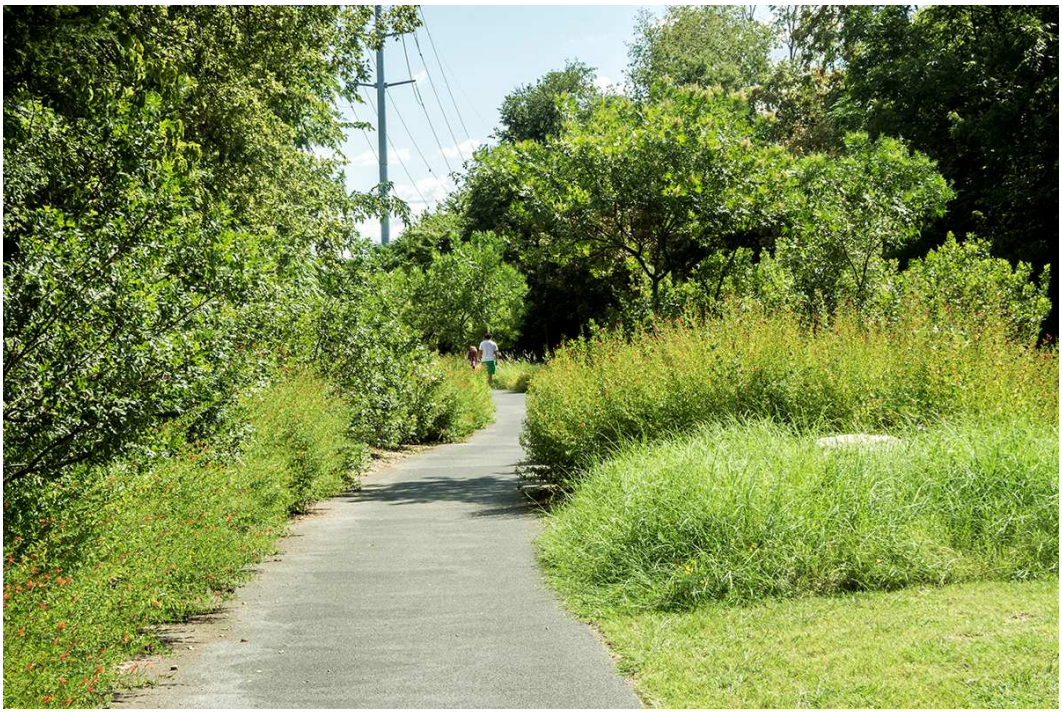

Figure 3-3: Katy Trail

In comparison to the Katy Trail, the Santa Fe Trail does not retain the same recognition. From 2008, the trail connects the eastern portion of downtown Dallas with the White Rock Lake trail loop. As with the Katy Trail, the Santa Fe Trail repurposes the abandoned Santa Fe rail line. The viability of this linear landscape derives from the private/public partnership between the City of Dallas, ONCOR, DART and the advocacy of the local community. As a linear landscape, the Santa Fe Trail engages various cultural districts and development typologies.

Figure 3-4: Santa Fe Trail (Source: Friends of the Santa Fe Trail)

In summary, this section details a brief outline on the Katy and Santa Fe Trails. The Katy Trail, open to public since 2000, has a reputation in the City of Dallas as a successful urban, public amenity. The Santa Fe Trail, open to public since 2008, is a popular urban, public amenity within its neighborhood context. There is potential though for growth with a proposal to connect the Katy Extension and Santa Fe Trails with an additional trail design. For the purpose of this study, both trails retain qualities that fall under that of linear landscapes. Select qualities include: rails to trails designation, overall connectivity enhancement, interaction with various districts and adjacency to various development typologies. The researcher has access to both the linear landscapes and to local data sources. The discussion on the linear landscape's ability to add economic value to their adjacency and within a 0.25 mile area continues in the next chapter.

3.8 Bias and Error

The primary bias of this research is the researcher's use of secondary data and the acceptance of all the errors that may be inherent to such data sets. Although the researcher made every attempt to clean and update the data, to note, comparable data sets contain inherent issues. On another note, confounding variables are not fully accounted for in this research. It is known in such complex urban settings that other variables may influence the economic value of linear landscapes. The research does not account for confounding variables within the research. This research is also the result of a six month research timeframe. The researcher utilizes a specific amount of case studies and economic value indicators. The merit of this research increases with a wider scope of use for said variables. Additionally, the definition of linear landscape derives from the researcher's analysis of literature. There is potential for the term's validity in landscape architecture literature with further exploration.

3.9 Summary

This research uses quantitative methods to quantify the economic value of linear landscapes. The procedure followed includes; uses a systematic review of archival, literature and secondary sources to derive a standard set of research methods to inform economic value indicators. This approach applies to the Katy and Santa Fe Trails in Dallas, Texas. The dynamic element of the linear landscape form offers a new precedent of research in concern to the urban landscape, its future importance, and the potential economic value added to the urban fabric/city. Chapter 4: Analysis and Findings discusses the analysis and findings from the research methods application upon the Katy and Santa Fe Trails.

Chapter 4

Analysis and Findings

4.1 Introduction

The purpose of Chapter 4: Analysis and Findings is to review the analysis and findings for this research. More specifically, the examination concerns the research methods in application towards the linear landscapes of the Katy and Santa Fe Trails in Dallas, Texas. The chapter includes a brief introduction of the sample sites and the analysis and findings of the theses select economic value indicators. To recap, the select economic value indicators are land use, property values, and the combination of gross sales/sales tax revenue/establishments/employment. Finally, an overall summary of analysis and findings covers the researcher's observations of the secondary data, the analysis of data, and the use of Geographic Information Systems (GIS).

4.2 Study Sites

Section 3.8 briefly outlined a background for the Katy and Santa Fe Trails. This section concisely displays further information on the linear landscapes. Additionally, through the lens of the researcher, the discussion of why these trails are relevant as sample sites and linear landscapes occurs as well.

4.2.1 The Katy Trail

The Katy Trail is an urban, pedestrian trail that stretches from the Victory Promenade northeast into the municipality of Dallas Highland Park. The initial phase of the trail has a 2000 opening. The trail contains additional extensions across Interstate 35 into the Design District (and into the Trinity River flood plain). Additional extensions occur to the north east to engage the trail loop around White Rock Lake.

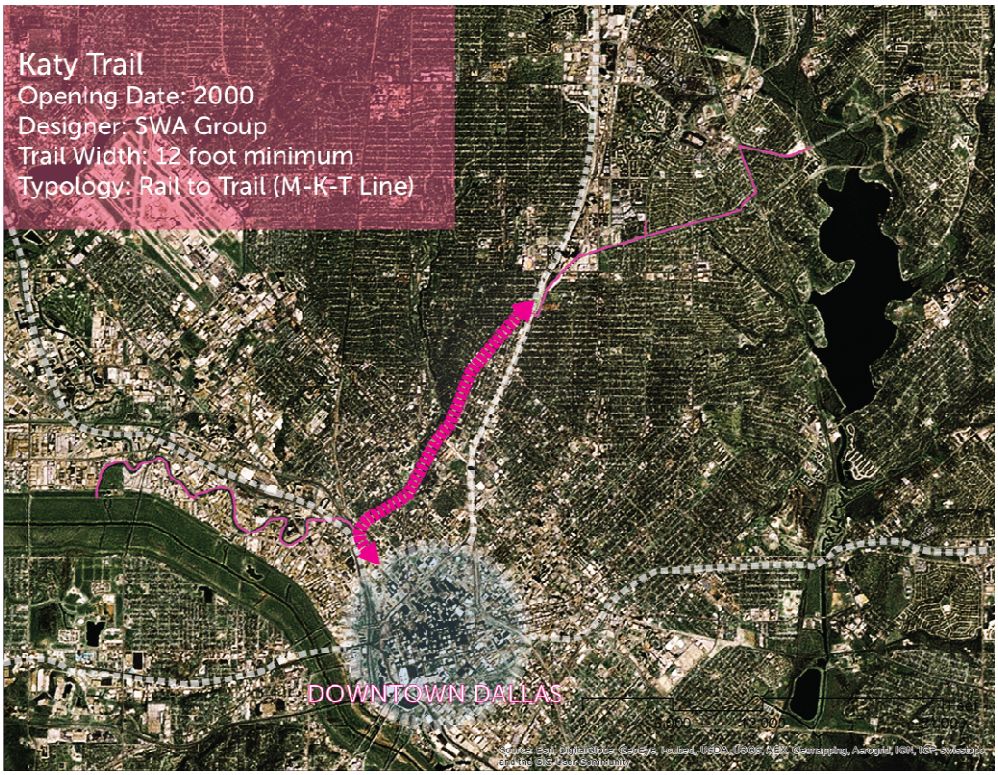

Figure 4-1: Katy Trail Aerial Image (Source: Esri, 2014)

The aerial above shows the sample portion of the Katy Trail in green. This portion is approximately 3.5 miles in length. The additional planned trail extensions are shown in pink. The trailhead at the south interacts at the Downtown and Uptown District confluence. As the trail moves northeast there is an interaction with mixed development (commercial and multi-family) and finally single-family developments at the trailhead towards the northeast exit.

The following is additional quantitative data from the City of Dallas Parks and Recreation Department (October 2008). The study sample is approximately 50% of the total trail network proposal. The trail itself is a combination of a concrete (12 foot wide) trail for cyclists and so on and a rubberized surface appropriate for pedestrians. As a rail to trails project, the Katy Trail is a result of a public/private partnership. The partnership is

between the City of Dallas, Dallas Area Rapid Transit (DART), and ONCOR which is the regional electricity provider. Additional advocacy results from the Friends of the Katy Trail and the Texas Department of Transportation STEP grant program. The Friends of the Katy Trail, a not-for-profit organization, continues to advocate for additional funding to realize the trails design vision. Again, the study sample area of the trail is a SWA Group design (Dallas studio).

4.2.2 The Santa Fe Trail

The Santa Fe Trail is an urban to semi-urban trail that stretches from the east Dallas Deep Ellum District northeast towards White Rock Lake. The trail became accessible to the public in 2008.

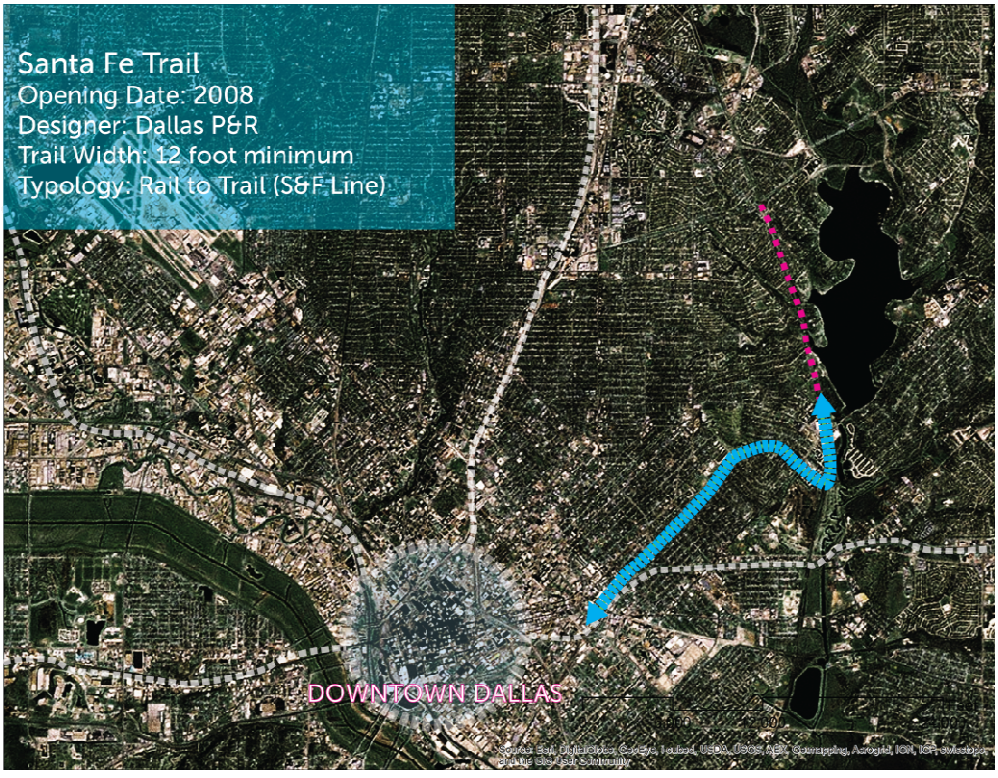

Figure 4-2: Santa Fe Trail Aerial Image (Source: Esri, 2014)

The aerial above shows the sample portion of the Santa Fe Trail in green. This portion of the trail is approximately 4.2 miles in length. The trailhead to the southeast is at the eastern part of downtown Dallas. The remainder of the trail, as it moves northeast, interacts with a mostly single-family development context.

The following is additional quantitative data from the City of Dallas Parks and Recreation Department (October 2008). This portion of the trail is 100% complete with a single, concrete trail (12 foot wide). The trail derives from a public/private partnership between the City of Dallas and DART. Additional advocacy occurs through the Friends of the Santa Fe Trail and the Texas Department of Transportation STEP grant program. Future design vision considerations for activity nodes and trailheads are through the Good, Fulton and Farrell architecture firm.

4.2.3 Trails As Linear Landscapes

Both the Katy and Santa Fe Trails are rail to trails incarnations. Mary Theilgaard Watts' advocacy led to the inception of the Illinois Prairie Path. This begins the rails to trails movement (Harnik, 2010). The rail to trails typology itself exemplifies the concept of the linear landscape. For example, they lie within urban centers, interact with various physical, geo-political and socio-economic edges. The linear dynamic of both the Katy and Santa Fe Trails promote connectivity at both the pedestrian scale and the neighborhood scale. Pockets of development that are adjacent to the trail connect through the linkage quality the trails provide. In summary, the outline of the linear dynamic quality provides the appropriate sample to test the thesis of economic value added by the linear landscape.

4.3 Land Use Analysis and Findings

4.3.1 Introduction

This section discusses land use as one of the economic value indicator. For the purpose of this research the definition of land use is: “the classification of land according to what activities take place on it or how humans occupy it; for example, agricultural, industrial, residential, urban, rural or commercial (Wade and Sommer, 2006, pg. 120). The secondary data derives from the North Central Texas Council of Governments (NCTCOG) data clearinghouse. The researcher utilizes the Dallas County data sets for the years of 1990, 1995, 2000, 2005 and 2010 (NCTCOG, 2014). NCTCOG is a regional cooperation between cities in the north central region of Texas. To promote the model of research replication, this data has a universal source of the NRCS. The NRCS is a national government organization accessible to the general public.

For the purpose of the research, the data study occurs for the land uses adjacent and within a 0.25 mile radius of the sample sites. The shapefiles (see section 3.4 for definition) in use for this specific approach include the sample sites (as polylines) selected from the 2013 Regional VeloWeb shapefile and the land use (as polygons) shapefiles for the years of 1990, 1995, 2000, 2005 and 2010 (NCTCOG, 2014; NRCS, 2014).

The paragraph discusses the general data cleaning process in GIS. Refer to this paragraph for Section 4.4 and 4.5. To study adjacencies, the command prompt of select by location in GIS is necessary. With the select sample site trail, set the selection radius to 250 feet and extract the land use polygons from the various 5-year shapefiles. To study the 0.25 mile radius, employ the same procedure with a buffer polygon shapefile that derives from the sample site. To create a buffer, insert the sample site polygon into the buffer command prompt (under spatial analyst) and assign the buffer radius of 1320

feet (or 0.25 mile). These new shapefiles are part of the data cleaning process. This allows for a faster analysis without the time lag that occurs with the use of the original shape file (at county level). Finally, the researcher assigns standard land use color designations to promote replicable analysis. This occurs through the properties and symbol function of GIS.

4.3.2 Land Use Analysis

Descriptive statistics and frequencies allow for the comparison of land use from 1990 to 2010 (at 5-year increments). Within both the adjacent and 0.25 mile shapefiles, the researcher is able to extract the square footage totals of select land use categories. For the purpose of this research the land use categories include single-family, multi-family, commercial, mixed-use*, parks and recreation and vacancy. A study limitation the researcher encounters in the process is that the mixed-use field occurs only in the 2005 and 2010 data sets.

At this point, data normalization occurs. Data normalization occurs in the cleaning process to promote a general comparison between data sets of different years. To achieve normalization, the researcher divides each, select land use variable by the total square footage of either the adjacent or 0.25 mile shapefile. For example, at the Katy Trail within the 2010 data set, the adjacent commercial land use retains a square footage of (X) sq. ft. The total square footage of the 2010 adjacent land use shapefile is (A) sq. ft. Divide (X)/ (A) (multiply by 100) to calculate the commercial land use percentage of the total adjacent land uses. From here, the researcher calculates the percent change between the 5-year data sets.

Table 4-1: Katy Trail Land Use Analysis

Adjacent						
Katy Trail		**1990**	**1995**	**2000**	**2005**	**2010**
	Land Use Type	*5 Year Change (sq. ft.)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*
	Single-family	12234804	0%	-17%	12%	-2%
	Multi-family	10158496	1%	-6%	15%	-2%
	Commercial	11165449	-6%	-11%	8%	-1%
	Mixed-use	0	0%	0%	0%	1%
	Parks & recreation	5337463	1%	-2%	8%	4%
	Vacancy	584295	7%	-7%	6%	1%
0.25 Mile						
Katy Trail		**1990**	**1995**	**2000**	**2005**	**2010**
	Land Use Type	*5 Year Change (sq. ft.)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*
	Single-family	14255067	-1%	-6%	-2%	0%
	Multi-family	11424605	0%	-2%	1%	2%
	Commercial	13389365	-3%	-4%	-4%	1%
	Mixed-use	0	0%	0%	0%	0%
	Parks & recreation	5633175	1%	-1%	-2%	1%
	Vacancy	1297231	7%	-6%	2%	0%

Table 4-2: Santa Fe Trail Land Use Analysis

Adjacent						
Santa Fe Trail		**1990**	**1995**	**2000**	**2005**	**2010**
	Land Use Type	*5 Year Change (sq. ft.)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*
	Single-family	2583717	0%	12%	5%	-5%
	Multi-family	5680103	1%	2%	0%	-2%
	Commercial	4531250	6%	-8%	1%	1%
	Mixed-use	0	0%	0%	0%	0%
	Parks & recreation	10130514	3%	3%	15%	-3%
	Vacancy	578988	1%	-2%	8%	1%
0.25 Mile						
Santa Fe Trail		**1990**	**1995**	**2000**	**2005**	**2010**
	Land Use Type	*5 Year Change (sq. ft.)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*	*5 Year Change (%)*
	Single-family	26955988	-2%	-11%	-3%	-1%
	Multi-family	6420881	1%	0%	-3%	1%
	Commercial	7617216	3%	-4%	-4%	3%
	Mixed-use	0	0%	0%	0%	0%
	Parks & recreation	10852174	2%	-2%	-4%	4%
	Vacancy	629190	2%	-3%	6%	-1%

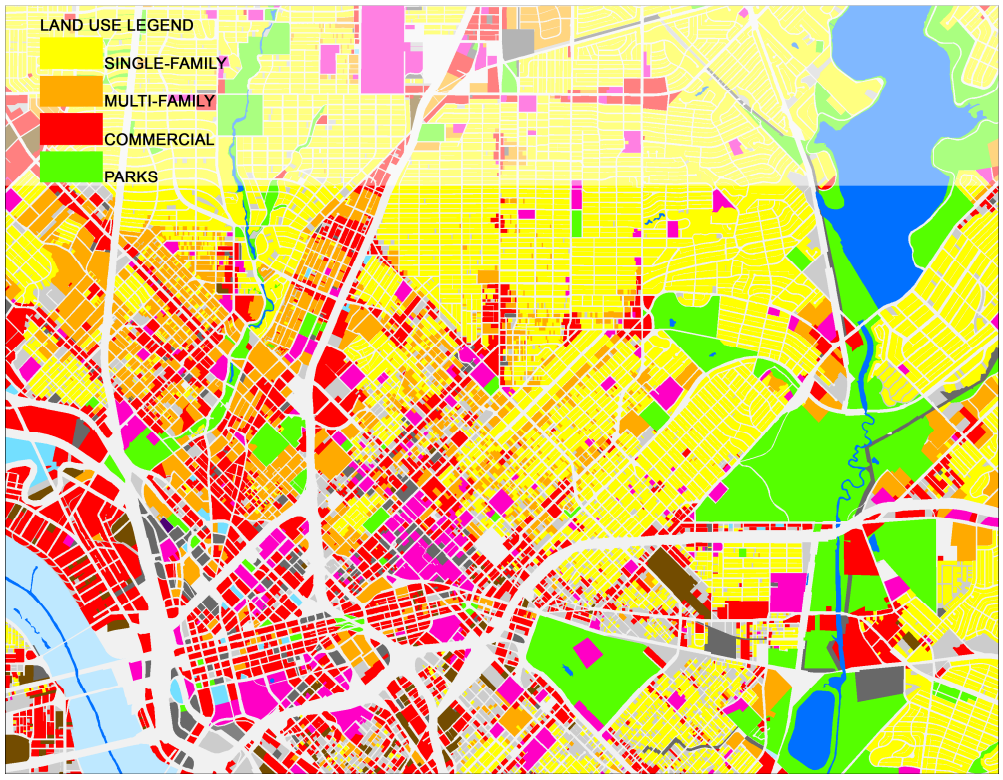

Figure 4-3: 2010 Land Use Map

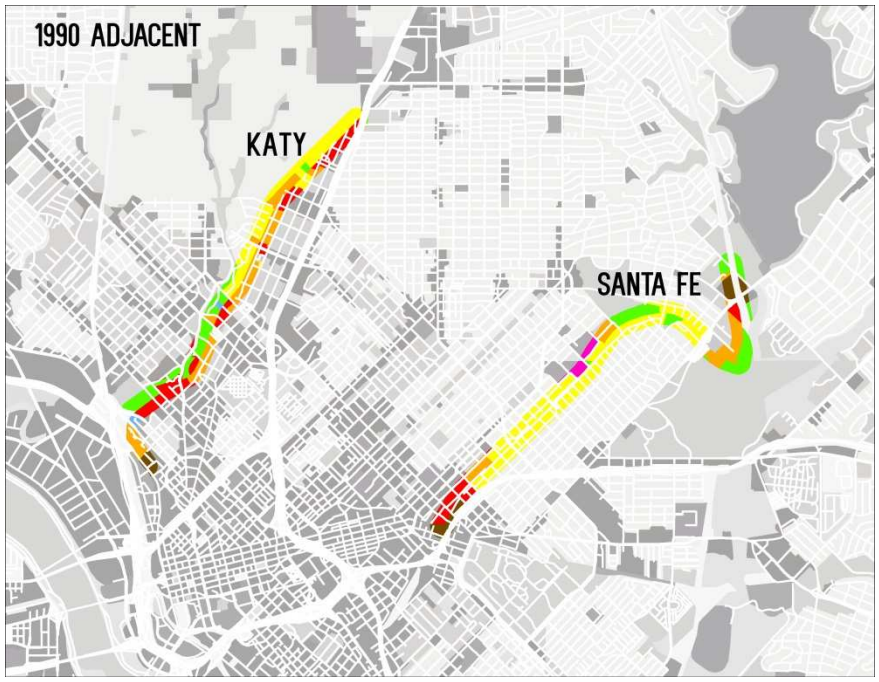

Figure 4-4: Land Use Comparison; 1990 Adjacent

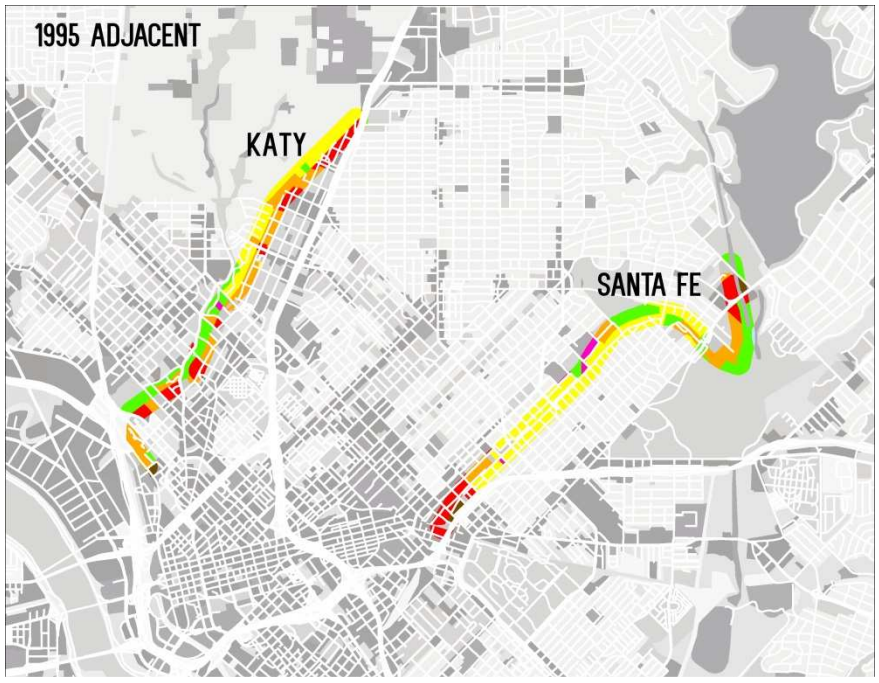

Figure 4-5: Land Use Comparison; 1995 Adjacent

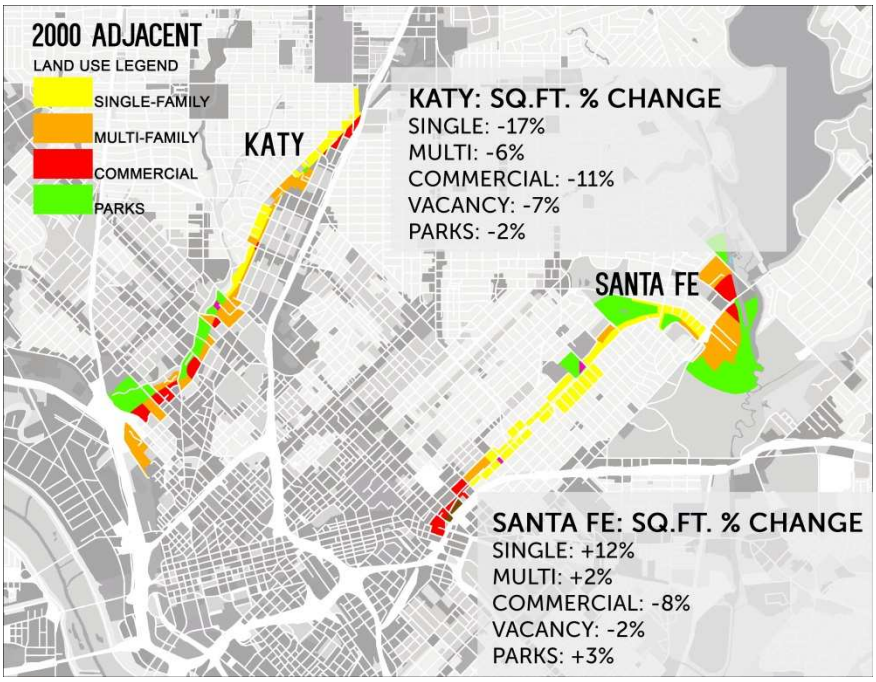

Figure 4-6: Land Use Comparison; 2000 Adjacent

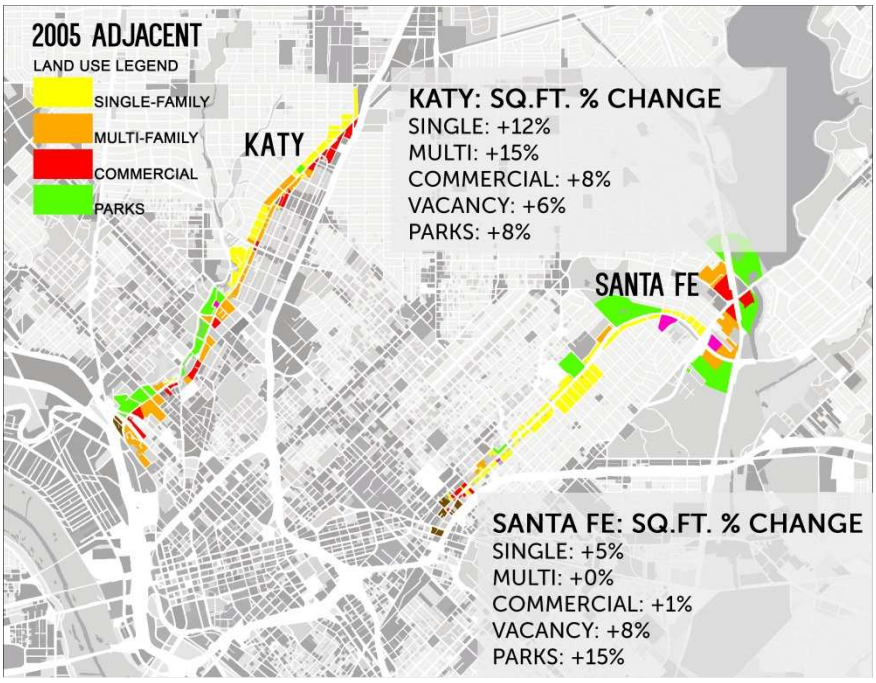

Figure 4-7: Land Use Comparison; 2005 Adjacent

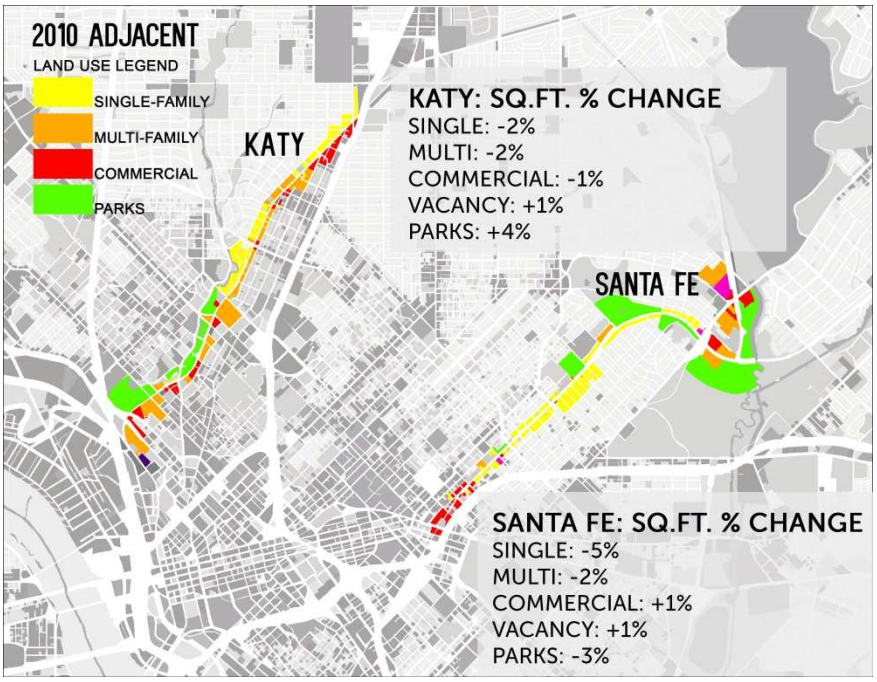

Figure 4-8: Land Use Comparison; 2010 Adjacent

Figure 4-9: Land Use Comparison; 1990 0.25 Mile Area

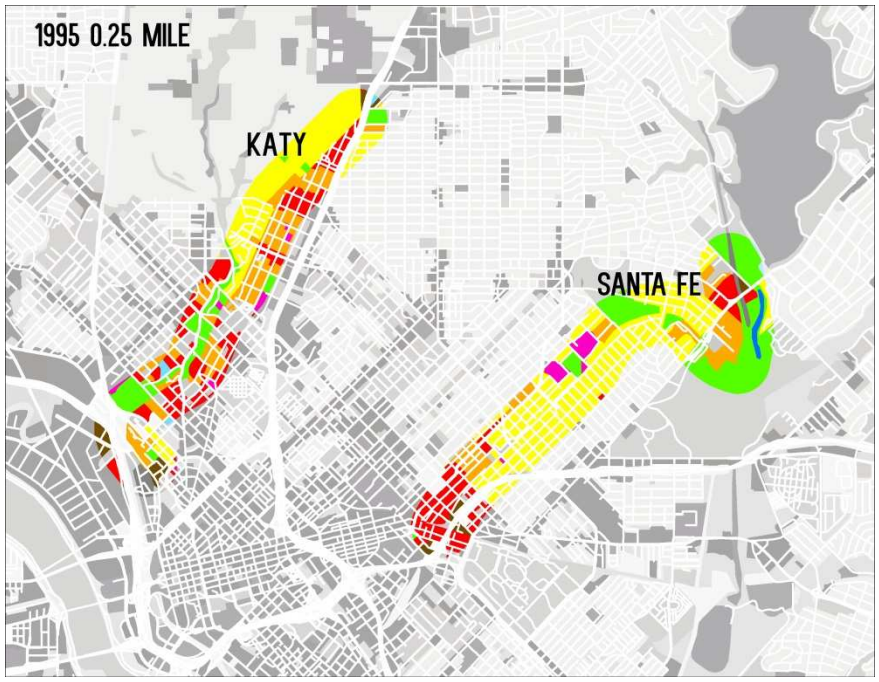

Figure 4-10: Land Use Comparison; 1995 0.25 Mile Area

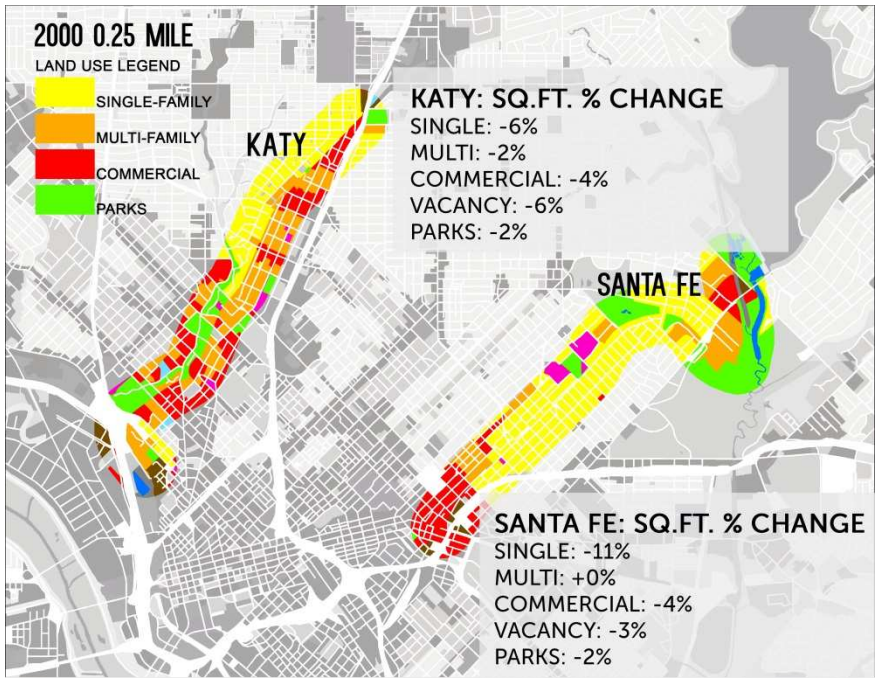

Figure 4-11: Land Use Comparison; 2000 0.25 Mile Area

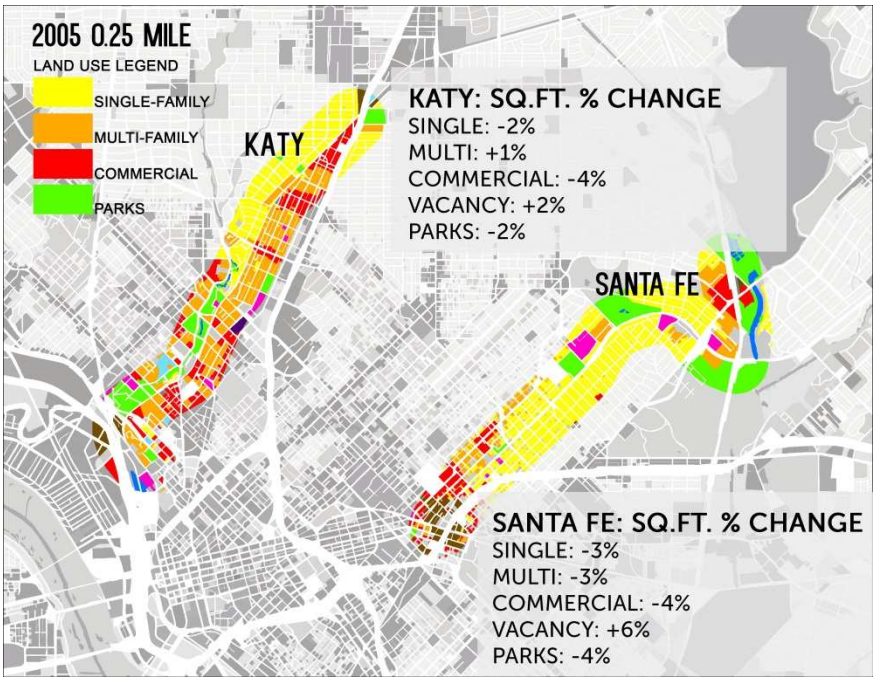

Figure 4-12: Land Use Comparison; 2005 0.25 Mile Area

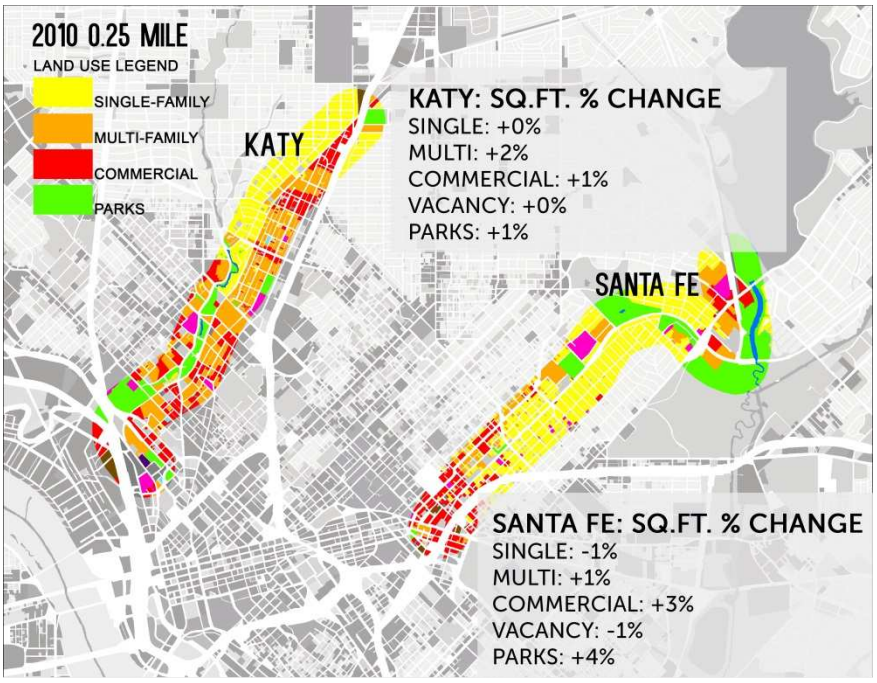

Figure 4-13: Land Use Comparison; 2010 0.25 Mile Area

4.3.3 Land Use Findings

This section discusses the researcher's analysis of the land use findings. To note, a purpose of this research is not to compare the Katy and Santa Fe Trails to each other. The comparison occurs between the trails select, adjacent and 0.25 mile area land use data.

The merit of land use as an economic value indicator derives from the case study analysis of the ULI Development case studies. These case studies argue that, through land use, specific changes that occur after the development's opening promote economic value added. More specifically, this research analyzes increase in commercial land use, re-appropriation of single-family to multi-family land uses and decrease in vacant land uses. Additionally, the researcher set mixed-use and parks and recreation land uses as study fields. Appropriate changes in land use between 1990, 1995, 2000, 2005 and 2010 data set years promote the thesis that linear landscapes impact land use change to indirectly stimulate economic activity. Any land use effect this analysis uncovers is ultimately an indirect effect of the linear landscape itself. Despite this indirect effect, the researcher considers land use as a direct economic value indicator. This means that future analysis shows growth towards monetary value with the select land use fields. Section 4.4 discusses this idea in general.

For this section of land use findings, refer to Figures 4-4 through 4-13. The Katy Trail, along its adjacencies, experiences a strong spike in economic value between the 2000 and 2005 data sets. This is relevant due to the Katy Trail's inception in 2000. Single-family increases by 12%, multi-family increases by 15%, commercial increases by 8% and parks and recreation increases by 8%. In contrast, vacancy increases by 6% and there is no observable mixed-use development in the same time frame. Despite this jump in economic value in the select land use categories, the 0.25 mile area shows small

decreases except for the 2005 to 2010 time period. For example, in 2005 to 2010 time period, multi-family increases by 2% and commercial increases by 1%. To compare the previous time period of 2000 to 2005 time period, the 0.25 mile area shows single-family decreases by 2%, multi-family decreases by 2%, commercial decreases by 4%, parks and recreation decreases by 2% and vacancy increases by 2%. The full percent change in value is in Table 4-3.

The researcher concludes from this analysis that the linear landscape stimulates land use change. This suggests favorable growth in economic activity and conditions to enhance value within the linear landscapes immediate and 0.25 mile area adjacencies. This strong stimulus is not a long-term phenomenon though. Within the 0.25 mile area, the linear landscape does show a strong impact in land-use impact on economic value. While is positive observations in economic value, the researcher assumes outstanding variables dilute the strength of the indirect stimulus of the linear landscape.

The Santa Fe Trail does not experience significant land-use changes along its adjacencies. The researcher concludes this especially from the analysis of 2005 to 2010 time period. The Santa Fe Trail opened in 2008. For example, single-family decreases by 5% and multi-family decreases by 2%. In contrast though, the researcher observes commercial increases by 1% from 2000 to 2005 and 2005 to 2010 time periods. Within the 0.25 mile area, there are decreases in land uses (and increases in vacancy). Of note, commercial increases by 3% in the 2005 to 2010 time period corresponds with similar growth in the adjacencies. The full percent change in value is in Table 4-3.

The researcher concludes from this analysis that ultimately, the Santa Fe Trail requires future study. The newness of the linear landscape limits the appropriate before and after analysis. The researcher assumes that initial increases in commercial land use show an indirect impact from the linear landscapes. An additional assumption is that the

decreases in single-family land use may yield increases in multi-family land use in future studies.

Figure 4-4 through 4-13 display findings over the entirety of the linear landscape. The next step for analysis refers to the findings in Figure 4-14 through 4-19. The findings show the complexities of linear landscapes and the need for both the macro and micro level analysis. Overall, in reference to the Katy and Santa Fe Trails, the land use morphology displays a general decrease in the single-family footprint. In contrast, while single-family decreases, either multi-family or commercial land uses increase their footprint. The findings show a general pattern of evolution from single-family to multi-family/commercial land uses. This furthers the discussions on how linear landscapes positively impact economic value in concern to the Katy and Santa Fe Trails. The Figures of 4-14 through 4-19 show positive land use square footage change between the 2005 and 2010 data sets.

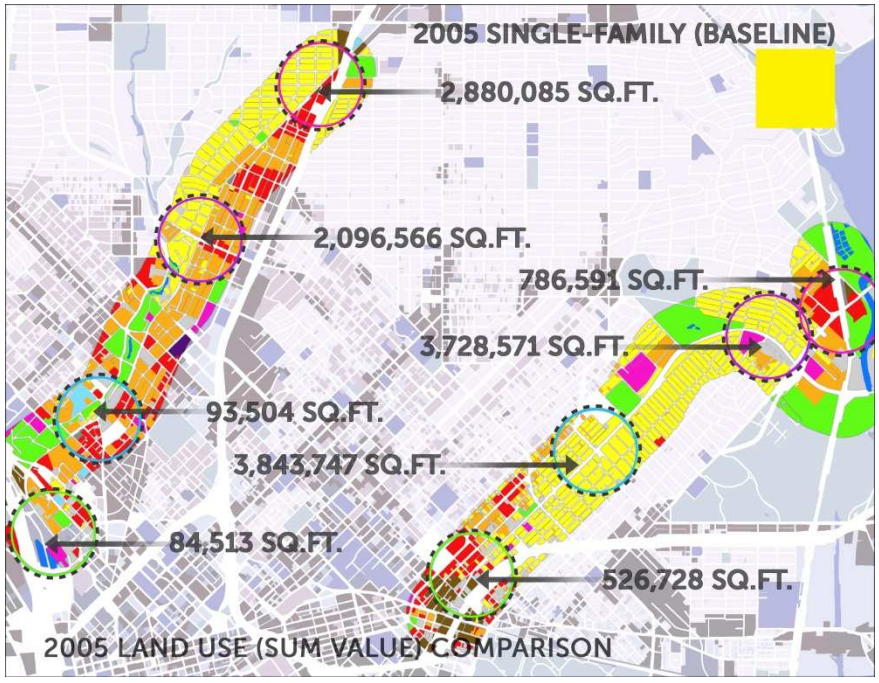

Figure 4-14: Single Family 2005-2010; Square Footage Baseline

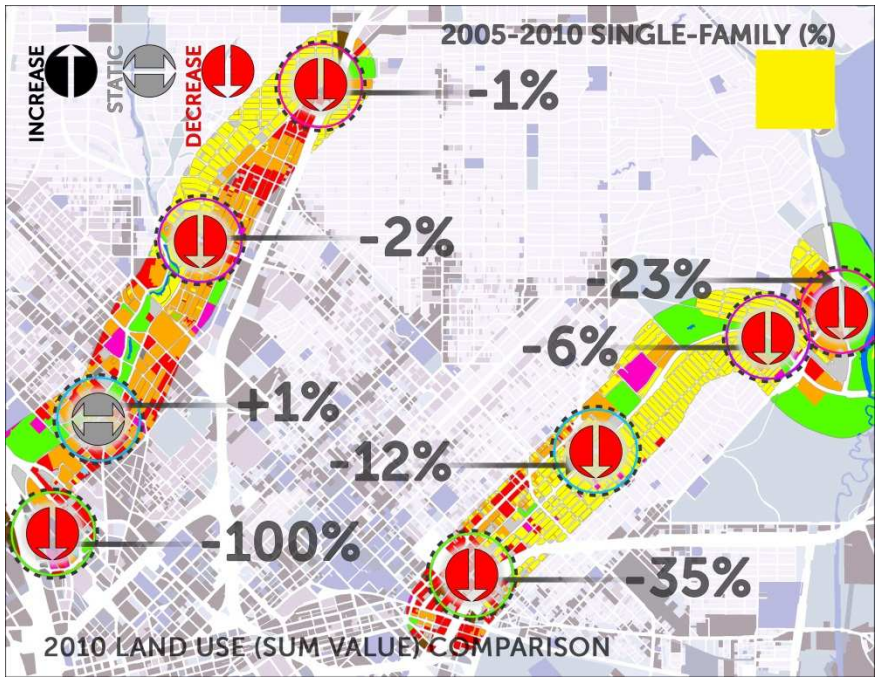

Figure 4-15: Single Family 2005-2010; Percent Land Use Change

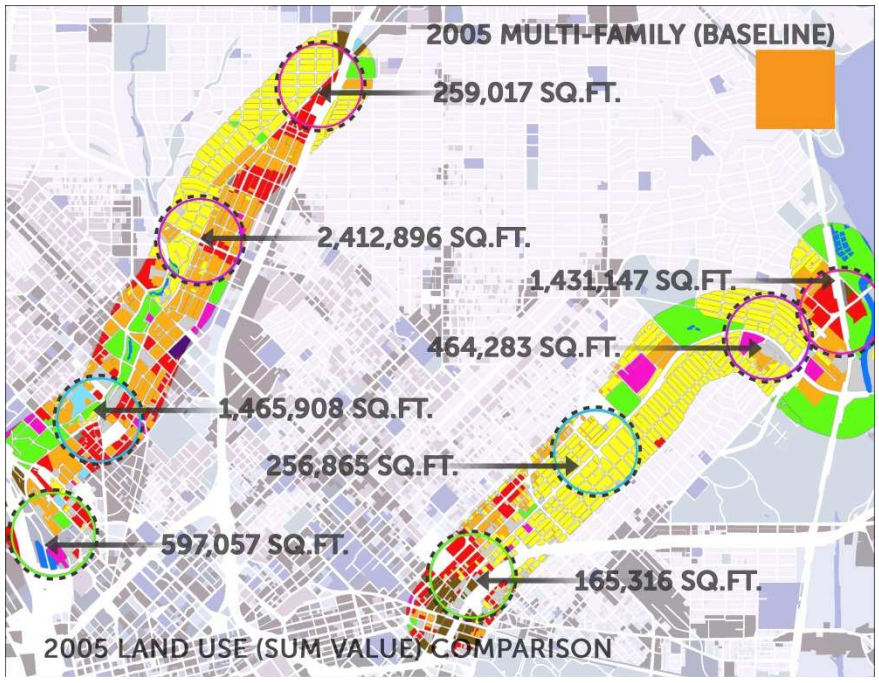

Figure 4-16: Multi-Family 2005-2010; Square Footage Baseline

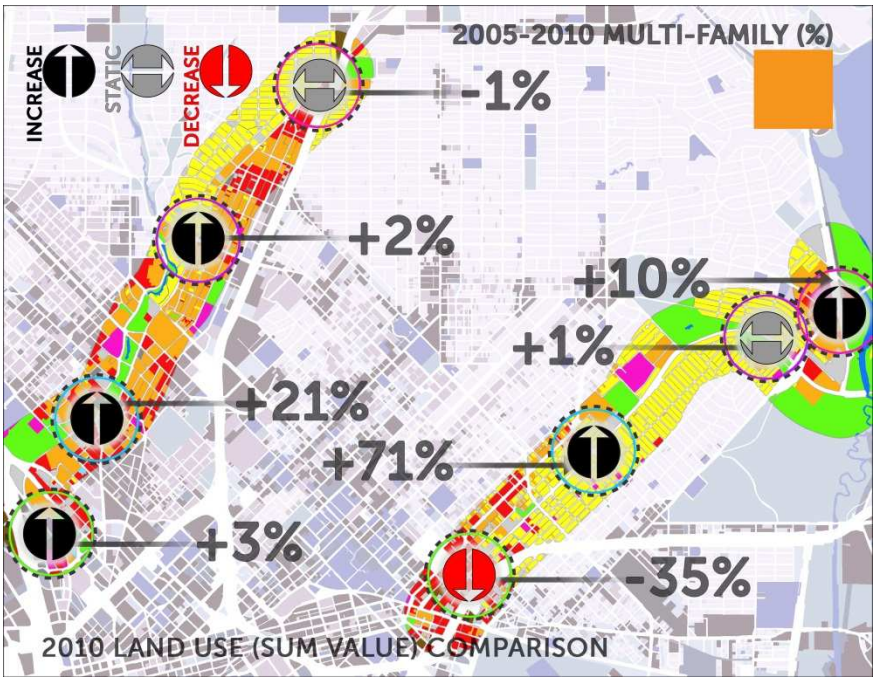

Figure 4-17: Multi-Family 2005-2010; Percent Land Use Change

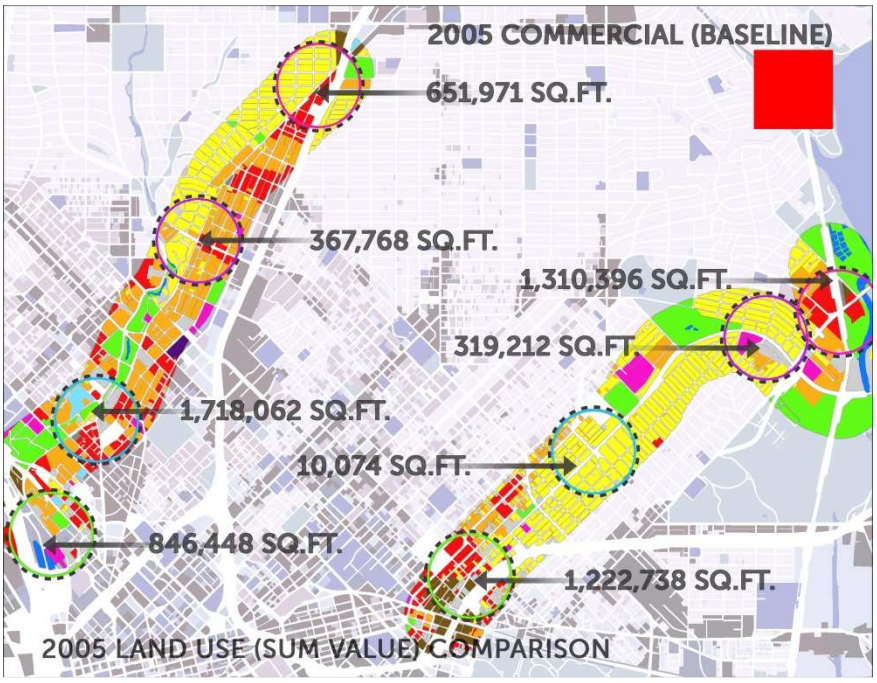

Figure 4-18: Commercial 2005-2010; Square Footage Baseline

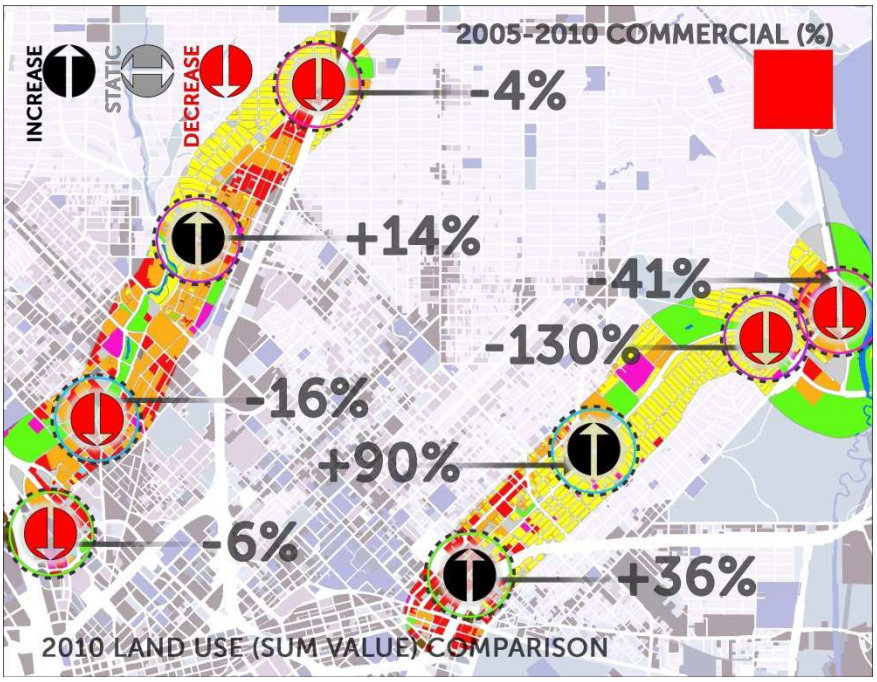

Figure 4-19: Commercial 2005-2010; Percent Land Use Change

4.4 Property Value Analysis and Findings

4.4.1 Introduction

This section discusses the property values as economic value indicator. The physical geography of property value is in parcel delineations. The definition of parcel is "a piece of land, defined by a series of measured straight or curved lines that connect to form a polygon (Wade and Sommer, 2006, pg. 158). This data derives from the Dallas Central Appraisal District (DCAD). DCAD is the Dallas county agency that appraises property values (DCAD, 2014). County administrations, such as DCAD, have similar data sets available for public use which assures data availability and attainability in most instances for replicable methods.

An assumption of the researcher before the data collection process centers on the availability of specific years for parcel data. For example, available historic parcel

data for the 2000, appropriate for this research, is a researcher assumption. The earliest available data, that contains separate secondary data with parcel shapefile, is for the year 2004. Additionally, at the time of data collection, 2013 is the latest concurrent parcel data set. In summary, the researcher utilizes historic parcel data for the years 2004, 2009 and 2013. The 2004 for data derives from an open record request, while the 2009 and 2013 data is available for download through DCAD's data share portal.

The secondary data within the parcel file is expansive. For future study, a thesis is applicable through this secondary data alone. For the purpose of this research, the property value analysis occurs through the total market value and property class fields identified in DCAD tabular data sets. Total market value is the summation of land value (value of land alone) and improved land value (value of any built element within parcel). Property class is DCAD's designation for property classifications.

The secondary data sets require time-intensive data cleaning. Data cleaning is the process to format data to allow for target analysis of specific variables. Most of the data cleaning occurs in GIS. First, the researcher joins the parcel shapefile with the comma delineated spreadsheet that contains all fields of various property value indicators. DCAD modifies the parcel shapefile and spreadsheet to allow for a seamless join application. From here, the same procedure as the land use analysis occurs to select the adjacent and 0.25 mile area parcels from the master shapefile. Refer to Section 4.3.1 for procedure details on the data cleaning process.

4.4.2 Property Value Analysis

Descriptive statistics and frequencies allow for the comparison of property values between 2004, 2009 and 2013. For total market value, to visually understand the economic value of each selection, a value range assignment applies a gradient to each parcel. For example, parcel with a lighter color value has a smaller monetary value.

Specifically, the range of monetary values the researcher assigns are $100,000, $500,000, $1,000,000, $5,000,000 and greater than $5,000,000. At this point, the researcher runs the statistics command to ascertain the parcel count, minimum value, maximum value, sum value, mean value and median value for each adjacent and 0.25 mile area yearly data set. From here, a percent change calculation understands the economic value the linear landscape adds between 2004, 2009 and 2013. Of note, the researcher observes economic value changes for Dallas County in 2004, 2009 and 2013. This allows for a base comparison of overall economic change.

To visually understand the property class field, the researcher utilizes the variables of single-family (A11), multi-family (B11), vacant (C11/C12) and commercial (F10). The name convention is a DCAD specific property class designation. The researcher assigns the colors of yellow for single-family (A11), orange for multi-family (B11), brown for vacancy (C11/C12) and red for commercial (F10). This refers back to the land use discussion in Section 4.3.1. While the property class values do not correspond directly with the land use changes, it does present the research with an additional analysis outlet. For example, now with the commercial property class designation, there is available aggregate, monetary data. Through the statistics command in GIS, the researcher collects specific monetary data for parcel count, sum value and mean value. From here, a percent change calculation understands the economic value between 2004, 2009 and 2013. Refer to Section 4.3.1 for procedure details on how to select adjacent and 0.25 mile radius parcels from the master parcel shapefile.

Table 4-3: Total Property Market Value Analysis

Percent Change in Total Market Value Between 2004, 2009, 2013						
Data Set (Year)	*Parcel Count*	*Min. Value*	*Max. Value*	*Sum Value*	***Mean Value***	*Median Value*
Katy Trail, Adjacent (2004)	n/a	n/a	n/a	n/a	**n/a**	n/a
Katy Trail, Adjacent (2009)	-2.60%	0.00%	26.36%	33.15%	**34.84%**	38.64%
Katy Trail, Adjacent (2013)	0.00%	0.00%	-7.35%	3.19%	**3.19%**	-7.88%
Katy Trail, 0.25 mi (2004)	n/a	n/a	n/a	n/a	**n/a**	n/a
Katy Trail, 0.25 mi (2009)	1.39%	0.00%	23.19%	35.07%	**34.15%**	27.28%
Katy Trail, 0.25 mi (2013)	0.42%	0.00%	11.78%	9.75%	**9.37%**	-0.61%
Santa Fe Trail, Adjacent (2004)	n/a	n/a	n/a	n/a	**n/a**	n/a
Santa Fe Trail, Adjacent (2009)	0.32%	0.00%	-61.02%	12.82%	**12.55%**	35.03%
Santa Fe Trail, Adjacent (2013)	1.86%	0.00%	65.23%	31.69%	**30.39%**	0.00%
Santa Fe Trail, 0.25 mi (2004)	n/a	n/a	n/a	n/a	**n/a**	n/a
Santa Fe Trail, 0.25 mi (2009)	0.36%	0.00%	1.58%	22.30%	**22.02%**	34.33%
Santa Fe Trail, 0.25 mi (2013)	-0.24%	0.00%	0.00%	6.91%	**7.05%**	-4.37%
Dallas County (2004)	n/a	n/a	n/a	n/a	**n/a**	n/a
Dallas County (2009)	-2.26%	0.00%	0.00%	15.29%	**17.16%**	2.12%
Dallas County (2013)	0.46%	0.00%	0.00%	1.29%	**0.84%**	-9.92%

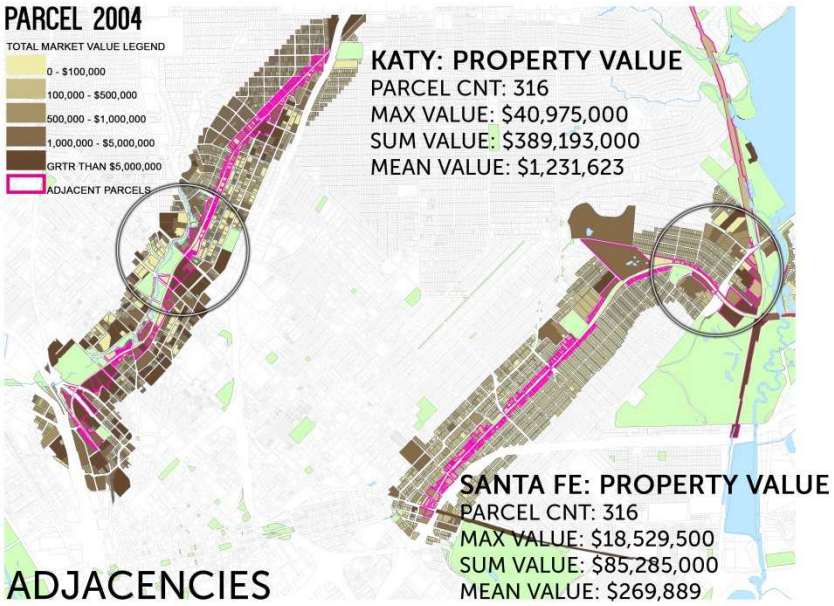

Figure 4-20: Total Market Value Comparison (Adjacencies)

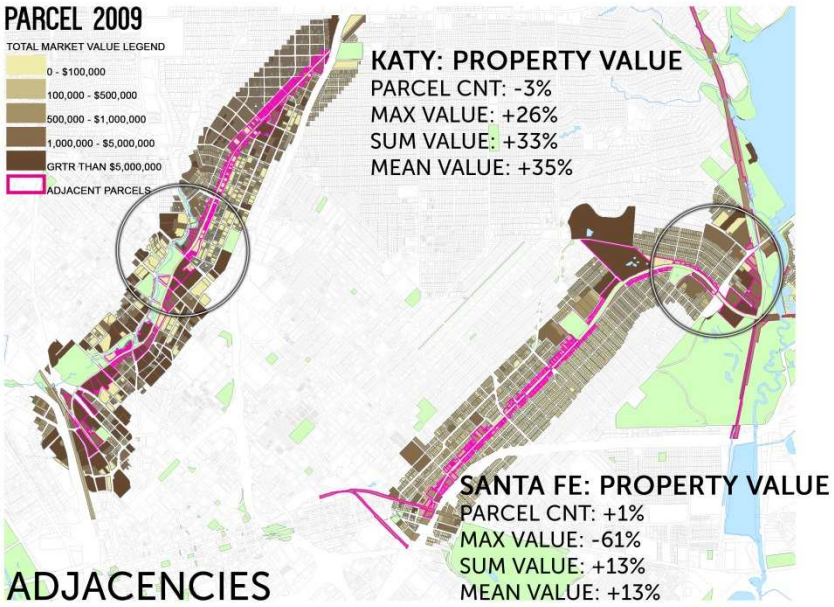

Figure 4-21: Total Market Value Comparison (Adjacencies)

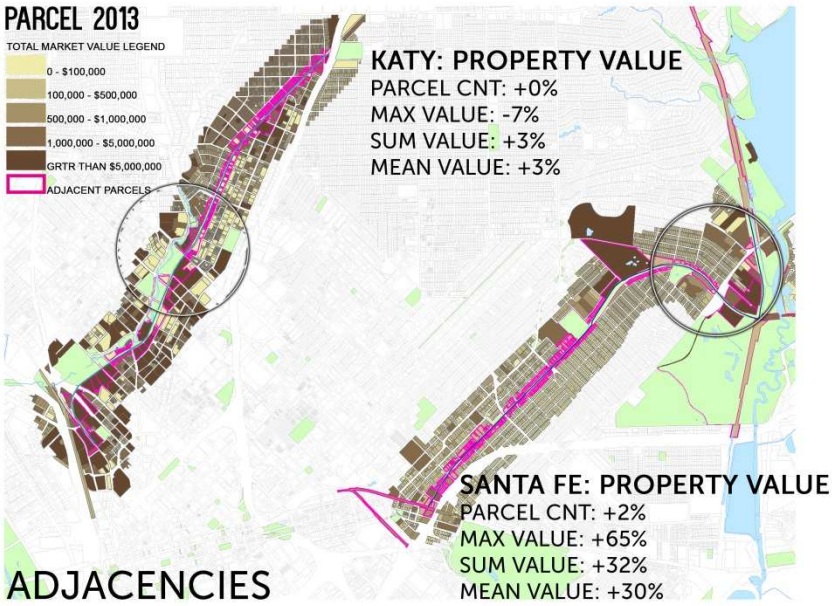

Figure 4-22: Total Market Value Comparison (Adjacencies)

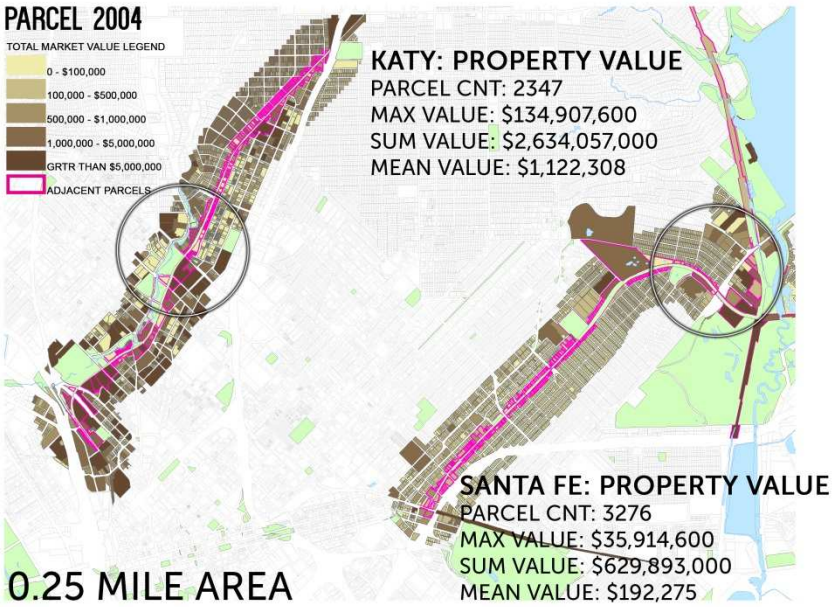

Figure 4-23: Total Market Value Comparison (0.25 Mile Area)

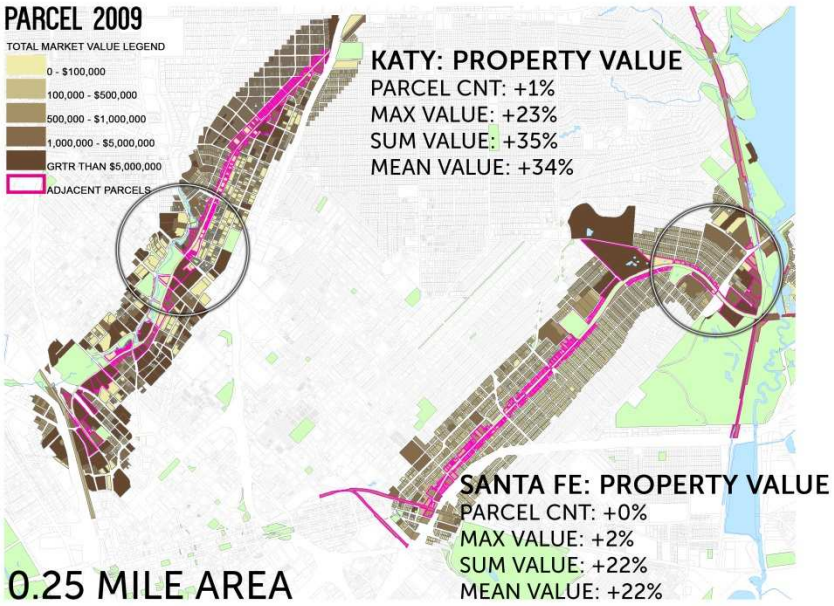

Figure 4-24: Total Market Value Comparison (0.25 Mile Area)

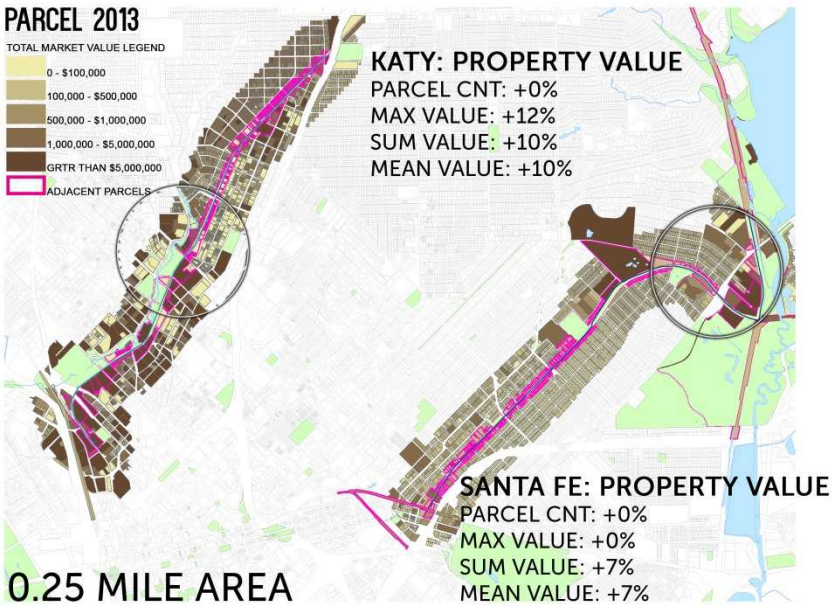

Figure 4-25: Total Market Value Comparison (0.25 Mile Area)

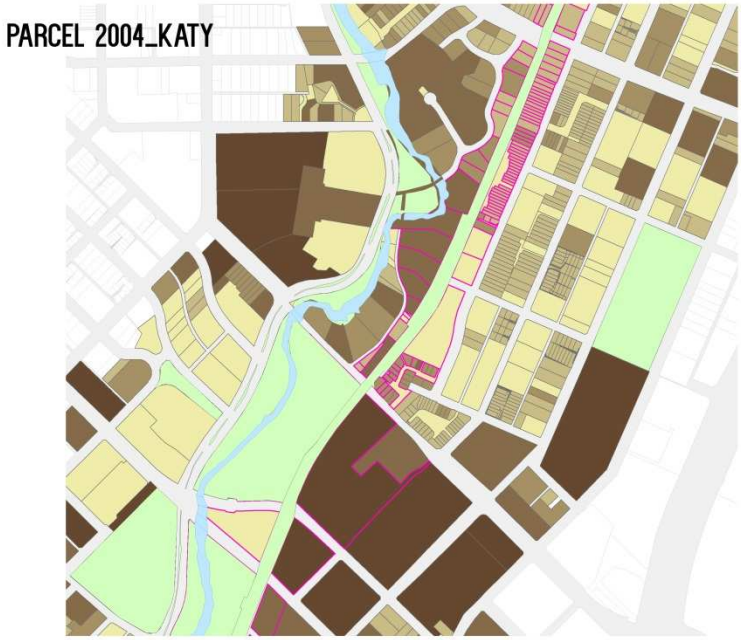

Figure 4-26: Total Market Value Analysis; Katy Trail (2004)

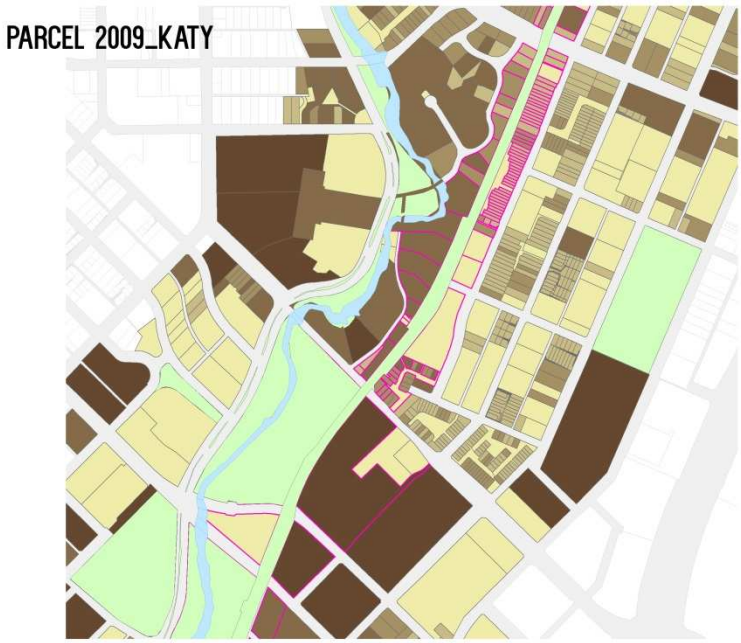

Figure 4-27: Total Market Value Analysis; Katy Trail (2009)

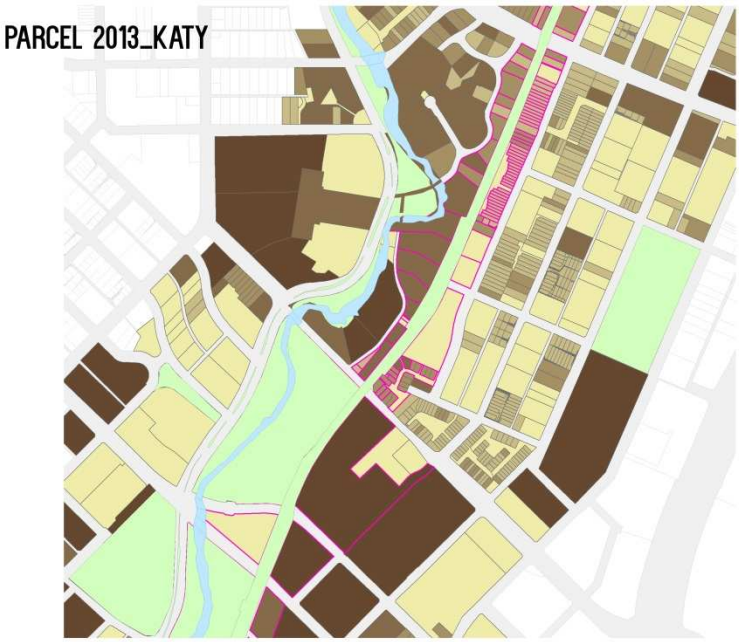

Figure 4-28: Total Market Value Analysis; Katy Trail (2013)

Figure 4-29: Total Market Value Analysis; Santa Fe Trail (2004)

Figure 4-30: Total Market Value Analysis; Santa Fe Trail (2009)

Figure 4-31: Total Market Value Analysis; Santa Fe Trail (2013)

Table 4-4: Property Class Analysis (Colors Match Graphics)

Percent Change in Total Market Value Between 2004, 2009, 2013

Data Set (Year)	**A11 = Single Family**			**B11 = Multi Family**			**C11 + C12 = Vacant**			**F10 = Commercial**		
	Parcel Count	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*
Katy Trail, Adjacent (2004)	88	$62,260,060	$707,501	28	$170,685,610	$6,095,915	60	$39,279,820	$654,664	37	$86,909,260	$2,348,899
Katy Trail, Adjacent (2009)	2.22%	29.15%	27.76%	-16.67%	21.15%	32.41%	-15.38%	57.78%	63.41%	-2.78%	41.31%	42.89%
Katy Trail, Adjacent (2013)	-5.88%	3.82%	8.88%	-14.29%	7.32%	18.90%	11.86%	5.98%	-6.67%	5.26%	-4.58%	-10.40%
Katy Trail, 0.25 mi (2004)	856	$686,204,500	$807,299	107	$509,819,290	$4,764,666	320	$184,579,400	$595,417	390	$1,021,301,440	$2,618,722
Katy Trail, 0.25 mi (2009)	-0.23%	37.29%	37.00%	-21.59%	29.08%	41.68%	-7.74%	51.84%	53.86%	-13.04%	33.43%	41.11%
Katy Trail, 0.25 mi (2013)	-0.95%	-3.15%	-2.18%	6.38%	31.07%	26.37%	0.34%	-3.24%	-3.59%	-5.18%	10.96%	15.35%
Santa Fe Trail, Adjacent (2004)	160	$13,156,420	$82,228	12	$31,314,850	$2,609,571	79	$6,262,020	$79,266	33	$11,446,730	$346,871
Santa Fe Trail, Adjacent (2009)	0.00%	30.24%	30.24%	-100.00%	0.71%	50.36%	2.47%	61.60%	60.63%	21.43%	48.96%	35.03%
Santa Fe Trail, Adjacent (2013)	1.23%	-1.62%	-2.89%	14.29%	51.13%	42.99%	6.90%	-48.41%	-59.40%	-7.69%	42.66%	46.76%
Santa Fe Trail, 0.25 mi (2004)	2093	$275,624,430	$131,689	127	$95,680,740	$753,392	457	$94,453,860	$206,682	298	$98,092,300	$329,169
Santa Fe Trail, 0.25 mi (2009)	0.71%	26.86%	26.34%	-11.40%	12.59%	21.53%	-8.04%	-80.90%	-67.44%	3.87%	55.22%	53.42%
Santa Fe Trail, 0.25 mi (2013)	-0.09%	1.44%	1.54%	1.72%	30.07%	28.85%	-1.20%	-39.24%	-37.59%	0.00%	8.54%	8.54%

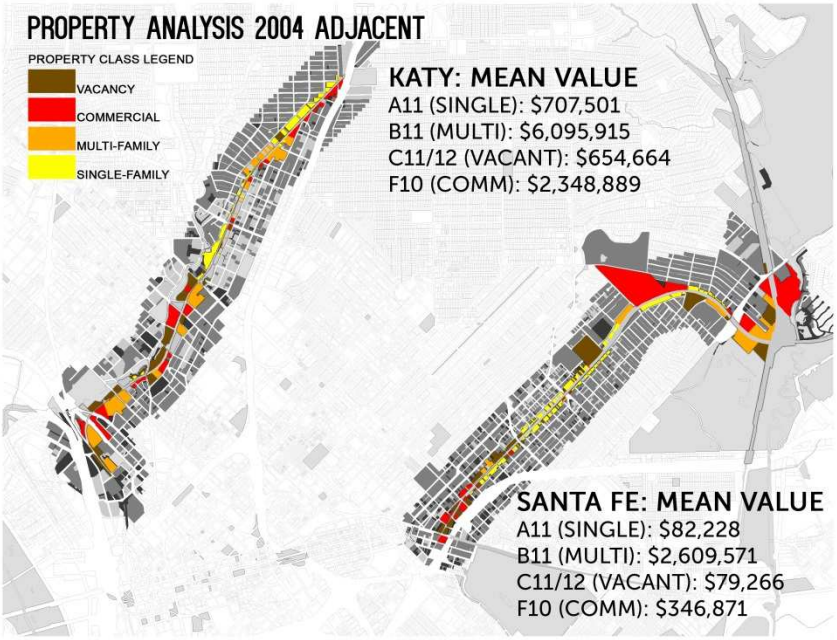

Figure 4-32: Property Class Analysis; Adjacent (2004)

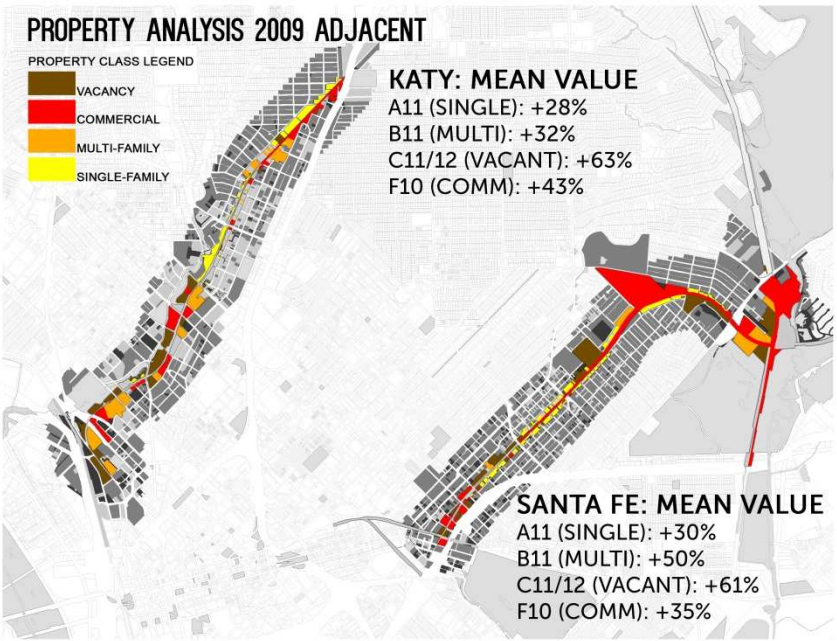

Figure 4-33: Property Class Analysis; Adjacent (2009)

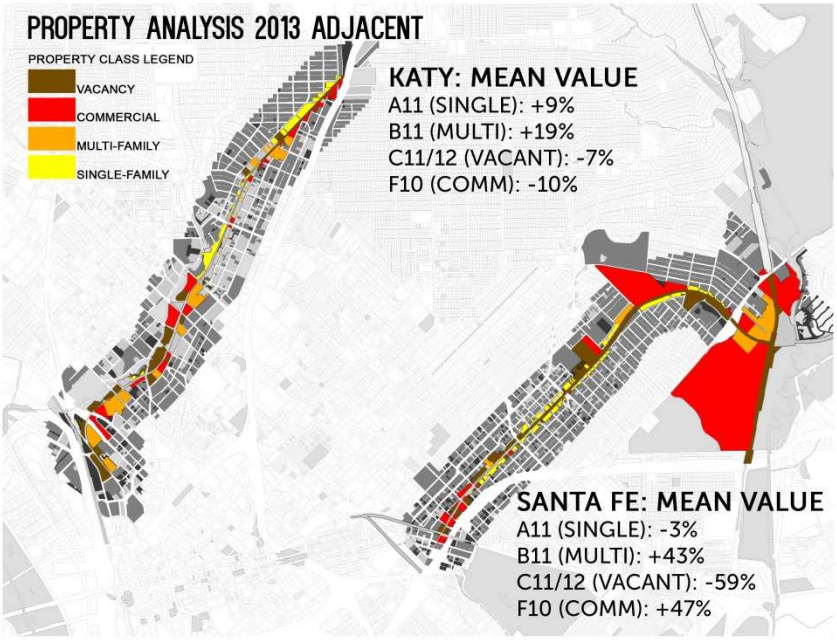

Figure 4-34: Property Class Analysis; Adjacent (2013)

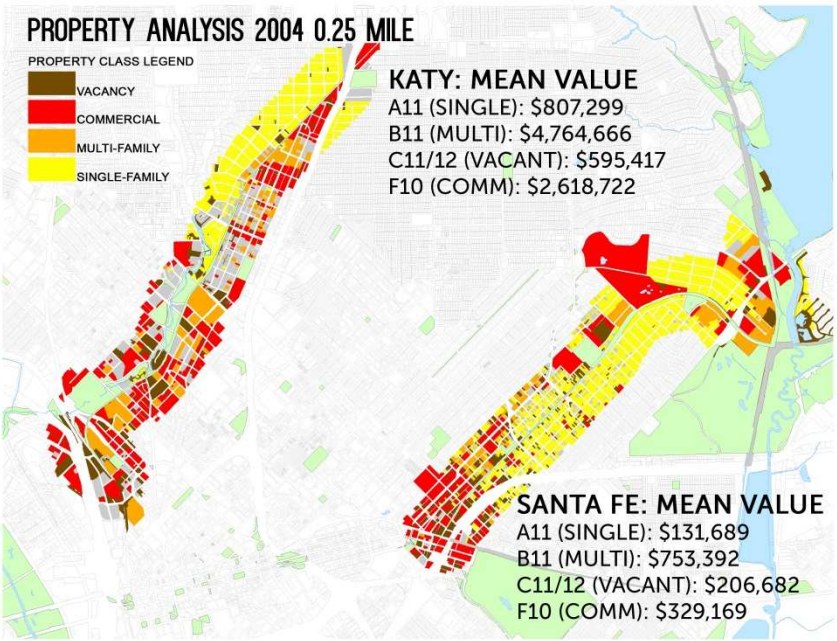

Figure 4-35: Property Class Analysis; 0.25 Mile Area (2004)

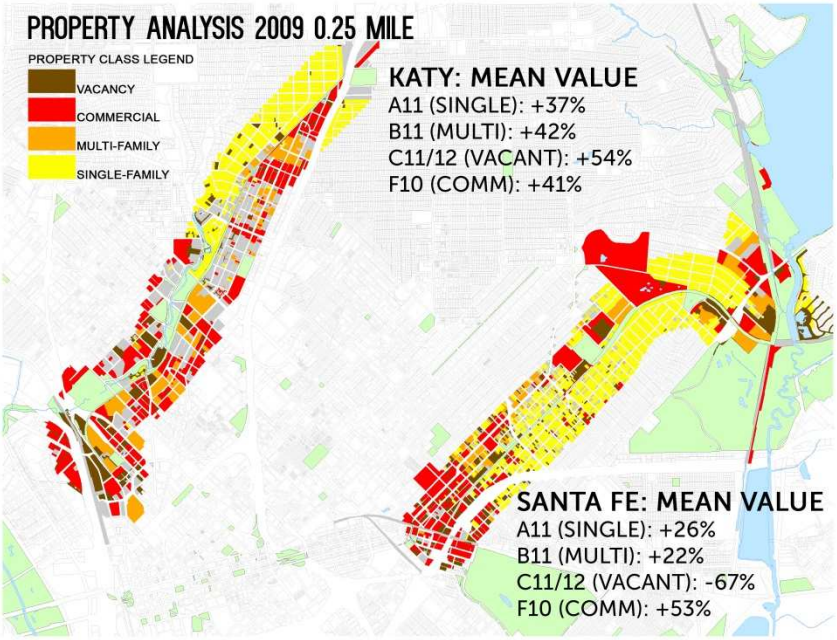

Figure 4-36: Property Class Analysis; 0.25 Mile Area (2009)

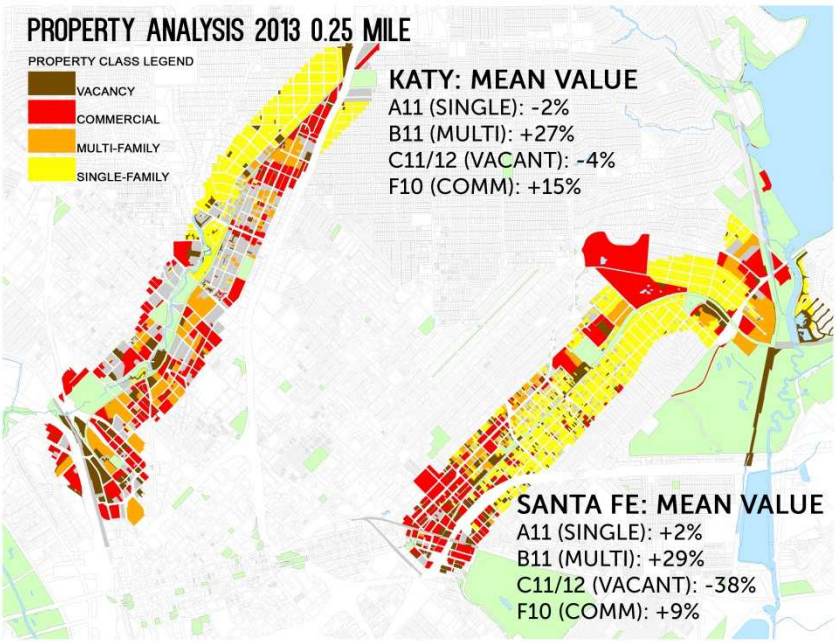

Figure 4-37: Property Class Analysis; 0.25 Mile Area (2013)

This section discusses the researcher's analysis of the findings for the property values as the economic value indicator. The purpose of this research is not to cross compare the Katy and Santa Fe Trails but rather highlight the relevant economic impact of the linear landscapes adjacencies and 0.25 mile area development. The analysis occurs first at the adjacent parcels to the trails and then with the 0.25 mile area for additional comparison. The analysis covers the total market value and property class variables of property value. To note, the mean average inflation rate from 2000 to 2013 is 2.4% (CPI Inflation Calculator, 2014). The findings in this chapter are not adjusted for inflation.

For the following findings refer to Figures 4-20 through 4-25. Overall, the data notes substantial increases in total market value for the adjacent parcels to the Katy Trail. For example, for the 2004 to 2009 time period, the mean value shows a 34.84% along the adjacent parcels. Additionally, for the 0.25 mile area, the mean value shows an increase of 34.15%. In comparison, the county shows a mean value increase of 17.16%. The researcher assumes that the strong increase in total market value at the county scale is partially due to the impact of the Katy Trail's adjacencies and within the 0.25 mile area. Even from the time between 2009 and 2013, there is a 3.19% along the adjacent parcels and a 9.37% increase in the 0.25 mile area.

For the Santa Fe Trail, the data notes increases in total market value for the adjacent parcels. For example, from 2009 to 2013 the increase in mean value for adjacent parcels is 30.39% versus an increase of 7.05% for the parcels in the 0.25 area. Overall, through the 2009 to 2013 time period, the county shows a total market increase of 0.84%. There is an approximate 30% difference between the Santa Fe Trail's adjacent parcels and the mean value of the county's parcels as a whole.

In concern to total market value, the researcher concludes a significant indirect effect upon adjacent parcels and parcels within a 0.25 mile radius by the linear landscape. As with the land use, rapid increases occur within a 5-year time period of the linear landscape opening for public use. Additionally, the researcher observes strong growth within a 10-year period. It is not at the impact of the 5-year period, but it is still significantly higher than the Dallas county total market values as a whole.

For the following findings refer to Figures 4-32 through 4-37. To build upon both the land use and total market value analysis, the study of the property class field yields significant results. For example, for parcels adjacent to the Katy Trail during the 2004 to 2009 time period, the mean value increases by 27.76% in single-family (A11), by 32.41% in multi-family (B11), by 63.41% in vacancies (C11/C12) and by 42.89% in commercial (F10). These are significant increases among key property class categories. In comparison, the mean values increases for parcels within a 0.25 mile radius are 37.00% in single-family, 41.68% in multi-family, 53.86% in vacancies and 41.11% in commercial property classes. As with total market value, there are additional increases in the 2009 to 2013 time period, there is a lower percentage of increase in the property class mean value.

The Santa Fe Trail displays significant increases as well in key property class categories. While the 2009 to 2013 time period displays a 2.89% decrease in single-family mean value, multi-family increases by 42.39% and commercial increases by 46.76%. The researcher assumes there is a shift from single-family property class dominance towards a mixed development typology. Additionally, the parcel count for vacancies decreases by 8.04% from 2004 to 2009 and by 1.20% from 2009 to 2013. An additional assumption is that with the decrease in vacancies coincides with the Santa Fe Trail's adjacent and 0.25 mile radius parcels as viable development investments.

The researcher concludes that the property class analysis displays the greatest impact in economic value by the linear landscape. Both the Katy and Santa Fe Trail showcase remarkable increases in sum and mean value. Mean value increases are especially relevant in concern to the multi-family property class in comparison to the single-family property class. The researcher assumes this displays an overall densification in population along the adjacencies and within the 0.25 radius of both sample linear landscapes. The data shows densification increases parallel increases in economic activity in select areas.

Refer to Figure 4-38, 4-39, 4-40 and 4-41 to observe the property value findings along four nodes of both the Katy and Santa Fe Trails. As with the land use findings, the next step for property value analysis occurs at key nodes. Overall, with both total market value and property class fields, the Katy and Santa Fe Trails display marked growth. Between 2004 and 2013, the study linear landscapes display total market value increases from 23% to 59% for the Katy Trail and 34% to 38% for the Santa Fe Trail. Additionally for property class findings, the Katy Trail displays value increases of 0% to 30% (single-family), 14% to 100% (multi-family) and 35% to 53% (commercial). For the Santa Fe Trail, the increases are 7% to 37% (single-family), 39% to 77% (multi-family) and 33% to 70% (commercial). This micro level analysis understands how the adjacent developments respond to the linear landscapes over an approximate 10-year period.

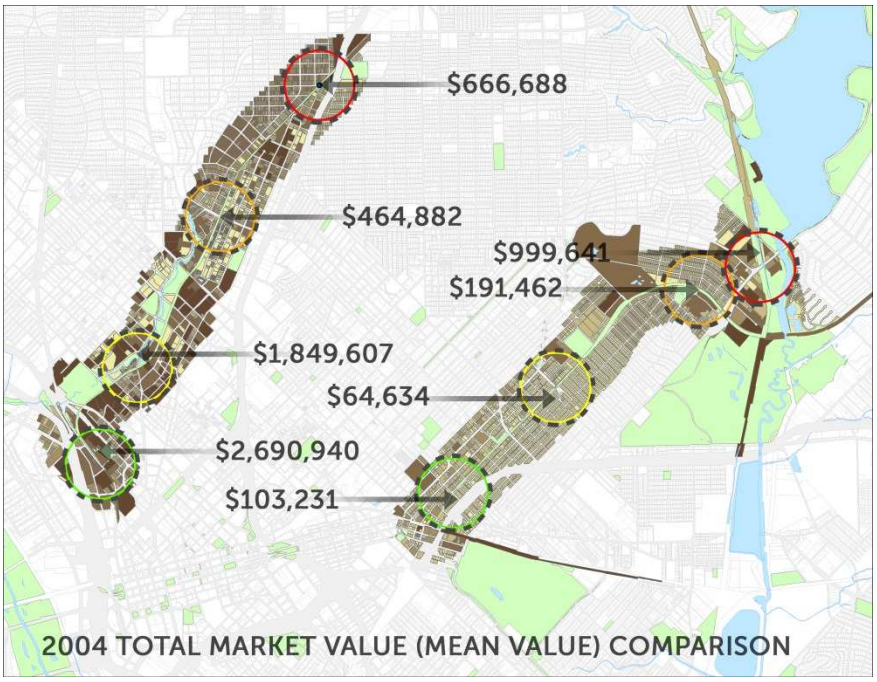

Figure 4-38: Total Market Value Area Baseline Findings; 2004

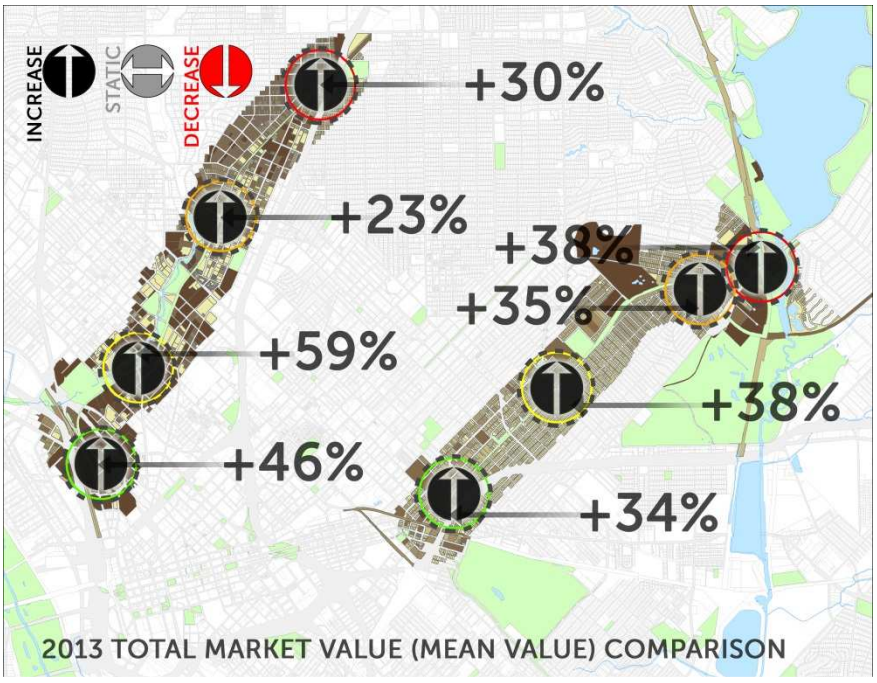

Figure 4-39: Total Market Value % Change; From 2004-2013

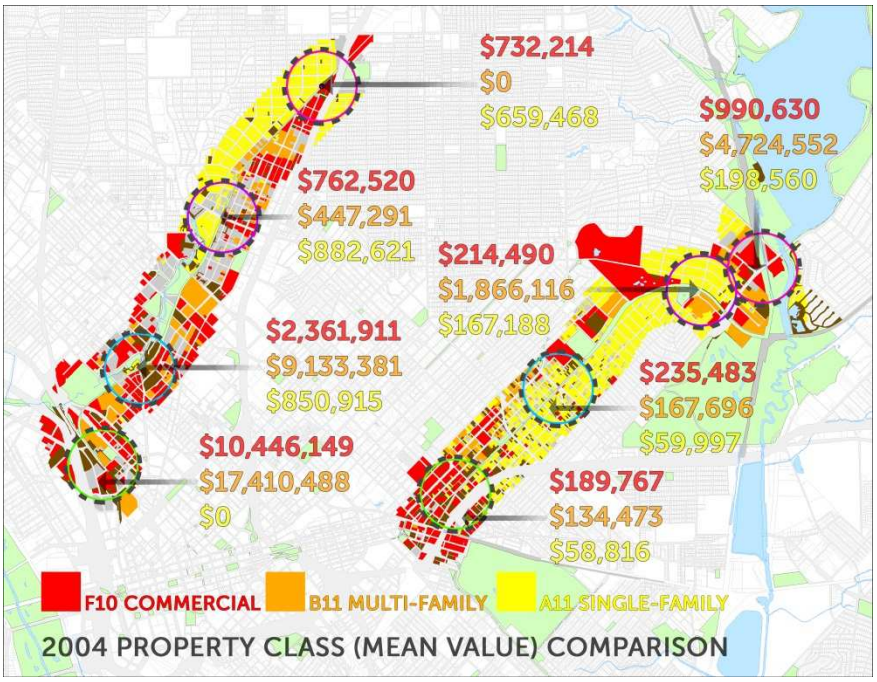

Figure 4-40: Property Class Baseline Findings; 2004

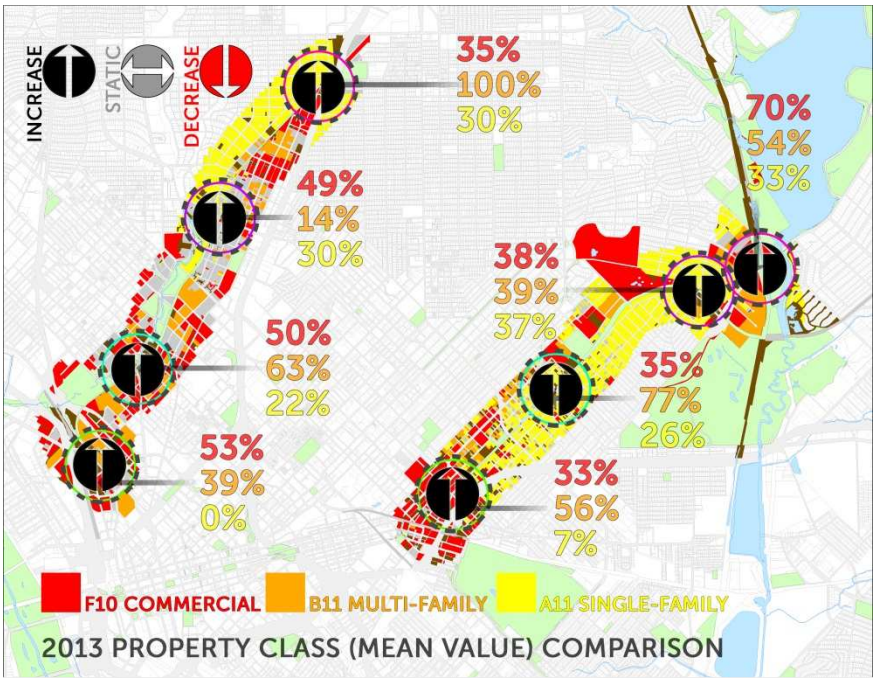

Figure 4-41: Property Class % Change; From 2004-2013

4.5 Gross Sales/Sales Tax Revenue/Employment/Establishments Analysis and Findings

4.5.1 Introduction

This section covers the economic value indicators of gross sales/sales tax revenue/employment/establishments. The data geographies are in zip code and census tracts. A zip code, or zone improvement plan code, is “a five-digit code, developed by the U.S. Postal Service that identifies the geographic delivery area served by an individual post office or metropolitan area delivery station (Wade and Sommer, 2006, pg. 240)”. The definition for census tract is “designed to encompass a population with relatively uniform economic status, living conditions, and some demographic characteristics…Tract boundaries normally follow physical features, but may also follow administrative boundaries or other nonphysical features (Wade and Sommer, 2006, pg. 28)”. The secondary data for gross sales/sales tax revenue and establishments are in zip code geographies. Employment data are in census tract geographies.

This data, in comparison to the land use and property value economic value indicators, differ the most from the researcher’s initial assumptions. The assumption is that the data is available at geographies lower than census tract. Appropriate geographies at this scale include address, block or block group formats. At the zip code and census tract level, the secondary data an increase in variables that contribute to the economic value discussion. Specifically, increases in external variables diminish the thesis of the linear landscapes impact on economic value in adjacent development. For example, adjacent census tracts extend approximately 0.5 miles from the linear landscape. Zip code geographies extend approximately 1.0 miles from the linear landscape. These geographies increase for linear landscapes that are further away from urban centers. For example, higher densities, as rule of thumb, contribute to smaller

census tract and zip code geographies. For the purpose of this research there is merit though in the report of these economic value indicators.

4.5.2 Gross Sales/Sales Tax Revenue/Establishments/Employment Analysis

The secondary data for gross sales and sales tax revenue derives from the Texas Comptroller Office (TSCO, 2014). The submission of an open record request is necessary to obtain the data. In total, the request process takes approximately two weeks and data delivery takes approximately three days. The researcher requests data for the years 2005 through 2013. The data arrives in a spreadsheet and contains economic values for the NAICS industry codes. NAICS is an acronym for North American Industry Classification System. The definition is a "system for classifying individual business locations by their types of economic activities (Wade and Sommer, 2006, pg. 141)". The researcher accesses zip code and census tract shapefiles through the US Census Tiger/line download portal.

For the purpose of this research, the researcher utilizes the industry categories of construction, retail and trade, real estate and arts/entertainment/recreation. The bases for these categories use are their relationship with landscape architecture. For example, these industry categories are indirect results of landscape architecture projects. To ascertain the economic value the linear landscapes add, the researcher calculates the percent value change from 2005 to 2012 for both gross sales and sales tax revenue. The secondary data requires cleaning to target the four specific categories.

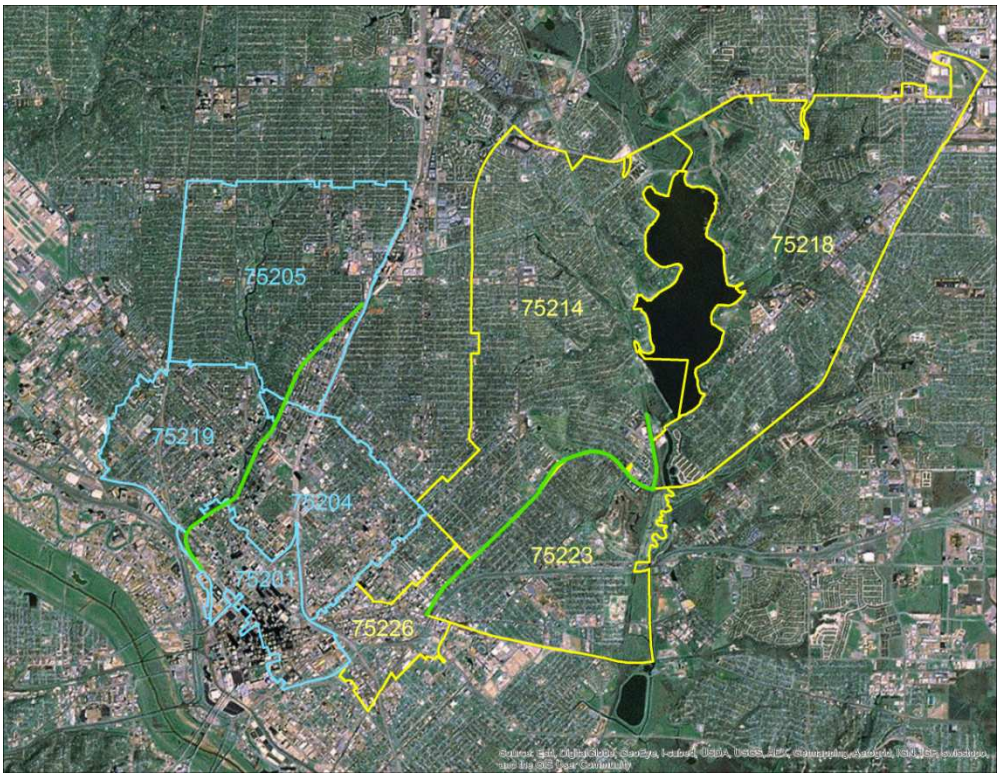

Figure 4-42: Zip Code Reference (Source: US Census, 2014)

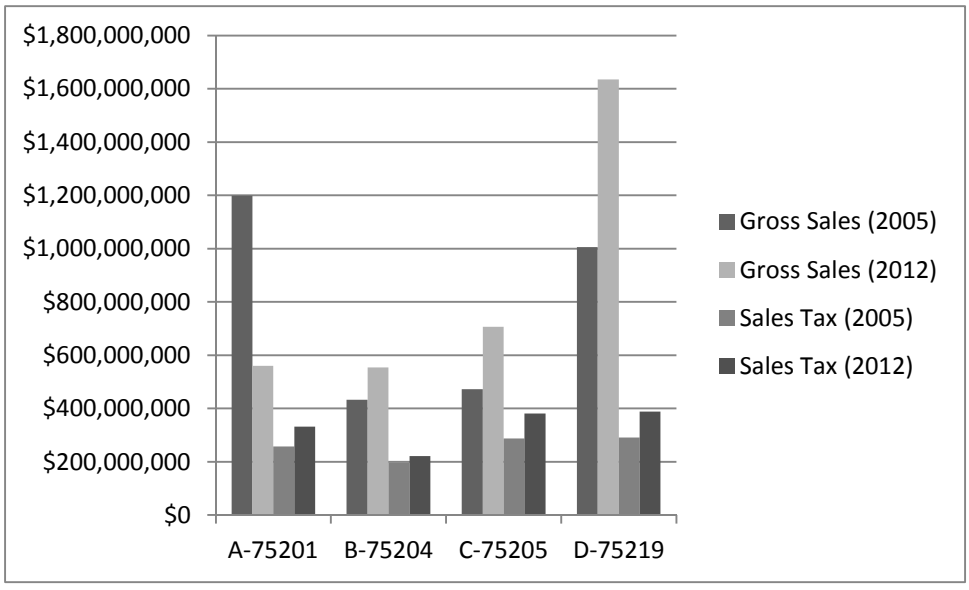

Figure 4-43: Katy Trail, Gross Sales and Sales Tax Revenue (2005 & 2012)

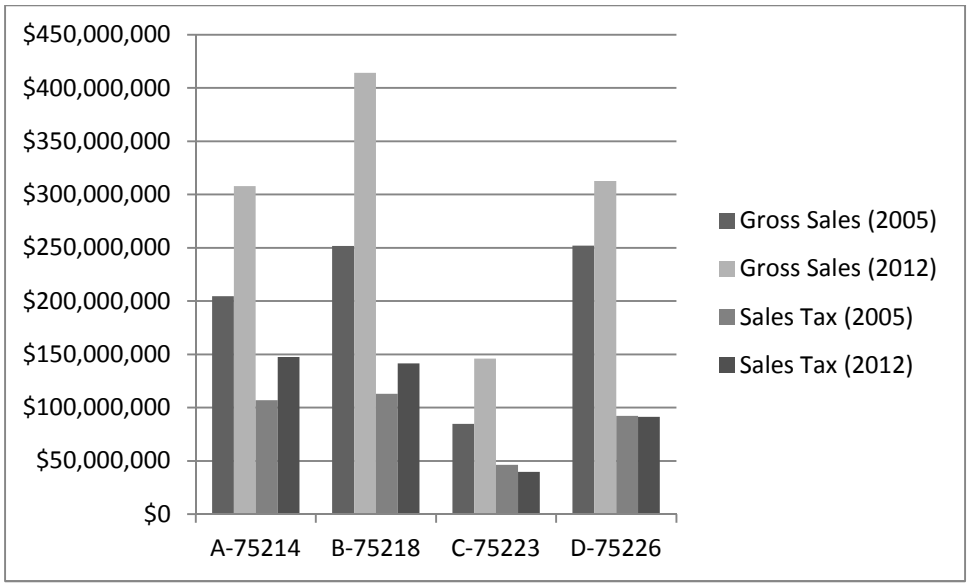

Figure 4-44: Santa Fe Trail, Gross Sales and Sales Tax Revenue (2005 & 2012)

The secondary data for establishments derives from the US Census County Business Patterns (CBP). With a specific year and zip code, the researcher has access to the total number of establishments for each NAICS category. Again, the researcher utilizes categories of construction, retail and trade, real estate and arts/entertainment/recreation. Refer to Figure 4-42 for zip code geographies adjacent to the Katy and Santa Fe Trails. The graphic for the zip code boundaries display the large extents within each geographic area. Zip code data inherently contains more confounding variables in concern to the Katy and Santa Fe Trails. There is no time lag in data retrieval as it is available directly from this national government data share service.

The data contains the years 2005, 2008 and 2011. To ascertain the economic value the researcher calculates the percent value change in establishments in each category between the three data set years. Descriptive frequencies and statistics is the method of analysis.

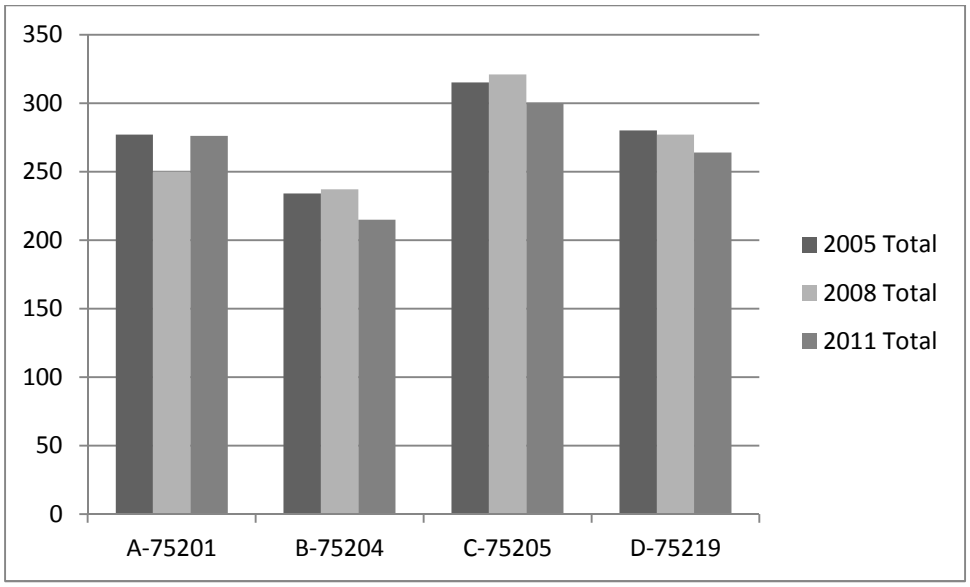

Figure 4-45: Katy Trail, Establishment Totals (#)

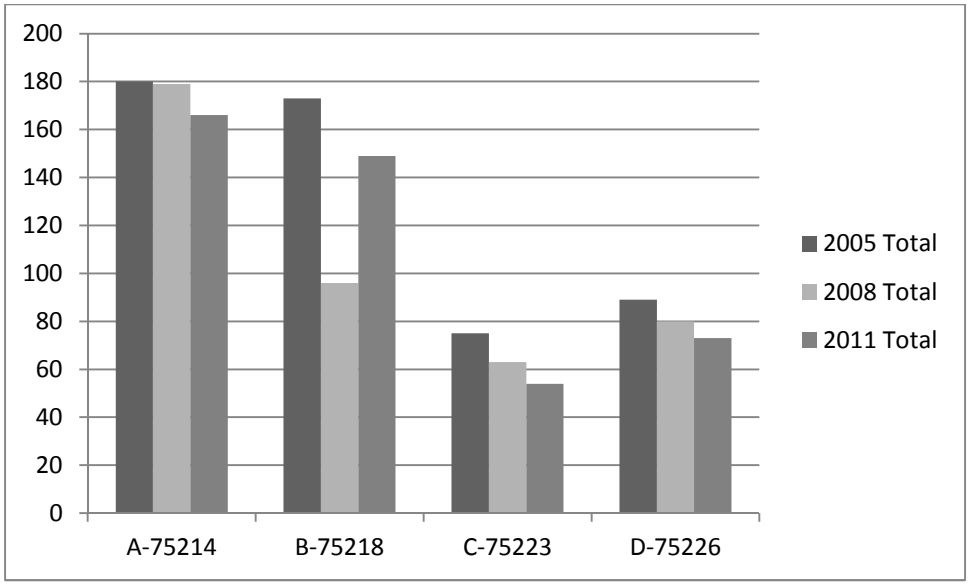

Figure 4-46: Santa Fe Trail, Establishment Totals (#)

The secondary data for employment derives from the US Census American Factfinder data share portal (US Census, 2014). Through American Factfinder, employment data is available at the census tract geography. The census tract geography

is approximately twice as small as the zip code geography. Refer to Figure 4-47 for census tract geographies adjacent to the Katy and Santa Fe Trails. In effect, this increases the validity of the secondary data for this thesis research. American Factfinder has no time lag for data retrieval. All that is necessary for data download is the input of the census tract id designation and the employment by industry data set. Data cleaning allows for the extraction of the industry categories of construction, retail and trade, real estate and arts/entertainment/recreation. This data comes in a spread sheet so join command prompt is necessary in GIS. Again, the census tract shapefiles are available through the US Census Tiger/line shapefile data share portal.

A major research limitation is the years available for study. Through American Factfinder, the only years available for employment by industry are 2010 and 2012. There is value in this data but it has low validity. Basically, this data does not have before comparison for reference. Due to time constraints, the researcher does not utilize the bulk data download that is accessible through Data Ferret. Data Ferret is the US Census ftp site for historic census data. Through this portal, one has access to the appropriate employment by industry data set.

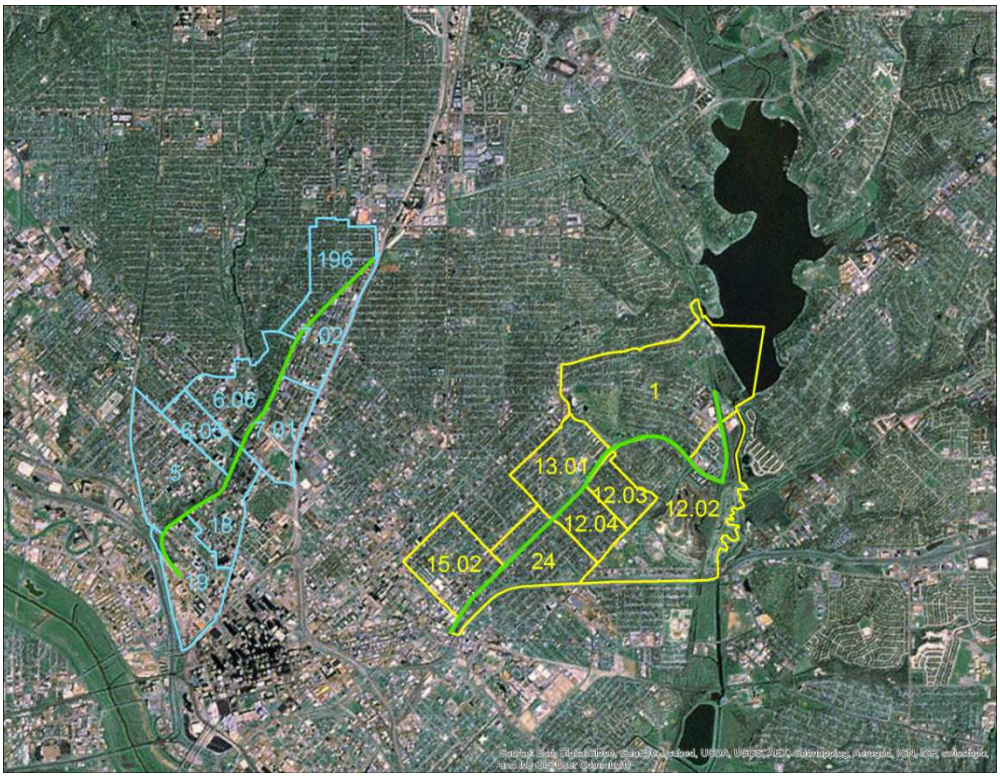

Figure 4-47: Census Tract Reference (Source: US Census, 2014)

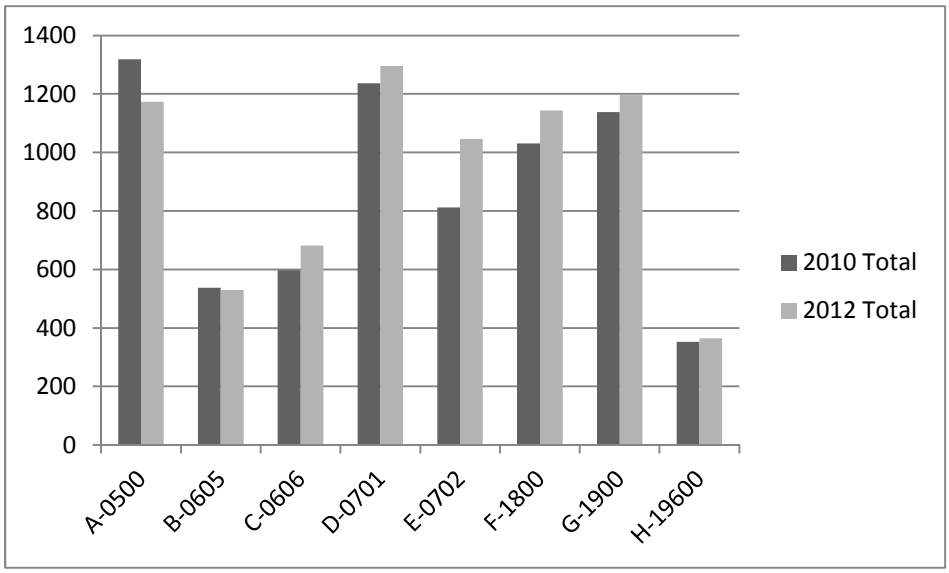

Figure 4-48: Katy Trail, Employment Totals (#)

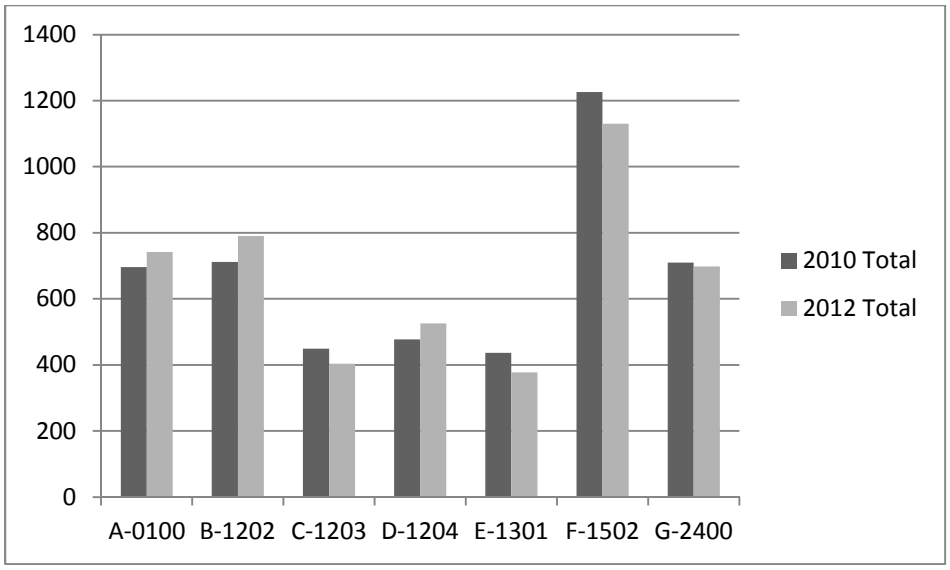

Figure 4-49: Santa Fe Trail, Employment Totals (#)

4.5.3 Gross Sales/Sales Tax Revenue/Establishments/Employment Findings

The purpose of this section is to display the researcher's analysis for the gross sales, sales tax revenue, number of establishments and number of employment economic value indicators. The analysis visuals are charts from Excel. GIS maps for the gross sales/sales tax revenue economic value indicators are accessible in Appendix C. The cleaned data is found in Appendix C as well. For analysis purposes, the researcher normalizes the data by using the sum total of the construction, retail and trade, real estate and arts/entertainment/recreation variables.

Overall, the researcher observes general growth among the study zip codes for gross sales and sales tax revenue. Refer to Figure 4-43 and 4-44 for the gross sales and sales tax revenue findings. The major exception occurs for the 75201 zip code (Katy Trail). The gross sales dip dramatically from 2005 to 2012 by 114%. This zip code is an outlier though as it contains a large scale of geography of downtown Dallas. For the gross sales and sales tax economic value indicators, the researcher assumes there is a

slight, indirect impact from the linear landscapes. To what extent is uncertain though. Confounding variables like the downtown core and additional cultural districts mitigate the indirect economic impact of the linear landscapes. In summary, the relative increases from 2005 to 2012 show a healthy city growth. This growth occurs through the 2008/2009 recession as well.

For the number of establishments, the researcher observes a gradual decrease in value. Refer to Figure 4-45 and 4-46 for the number of establishments findings. There is growth from 2008 to 2011 in the 75201 zip code (Katy Trail) and the 75218 zip code (Santa Fe Trail). From the cleaned, secondary data the reduction in construction, and in effect real estate establishments, is responsible for this gradual decline. The researcher assumes that the recession of 2008/2009 impacts growth more so than either linear landscape. With the zip code geographies, the confounding variables mitigate the validity of the linear landscapes as indirect economic value creators.

Finally, the employment data is in census tract geography. The smaller geographies impact the discussion of economic value positively. Both the Katy and Santa Fe Trails display a mix of increase and regression within the census tracts. Overall there is higher growth than regression in general. Refer to figure 4-48 and 4-49 for number of employment findings. The researcher assumes that employment data corresponds with establishment data in that they work off each other. For example, a decrease in construction establishments contributes to an overall decrease in employment for the construction industry. In contrast, the researcher notes that the industries of retail/trade and arts/entertainment/recreation increase between 2010 and 2012.

The researcher concludes that between the four industry variables, their increases and decreases in value depend on one another's life cycle. For example, high construction employment suggests concurrent development. In effect, new development

stimulates the real estate industry. New property owners create retail and trade opportunities. Finally, arts/entertainment/recreation destinations arise to further stimulate economic value. The life cycle of development continues until stagnation and further redevelopment. In theory, the linear landscape, as a self-renewing resource, has a longer permanence than the industry variables. Thus, the linear landscape retains a greater indirect economic value impact for new development to occur.

4.6 Summary of Analysis and Findings

The data collected in this research, to various degrees, assesses the economic value of linear landscapes. The assessment occurs over an approximate time frame of ten years for both land use and property value indicators. Additionally, the indicators of gross sales, sales tax revenue, number of establishments and number of employees display positive and negative economic value increases over a specific time period. For all analysis, descriptive frequencies and statistics assess the economic value of linear landscapes in concern to the Katy and Santa Fe Trails.

The findings of the research illustrate that the data and methods adopted here seem to be suitable for replications in other linear settings. There are factors that have debatable success, to some extent, in this research process. For example, the large geographies of zip codes contain too many confounding variables. Especially with the analysis of urban landscapes, the major factor is the influence of the downtown economic structure. Specifically, the large amounts of variables in relatively dense areas construe the overall data analysis in concern to the linear landscapes adjacencies. Additionally, at the zip code level, whereas with parcel and land use data a delineation between adjacent and 0.25 mile is achievable, the data geographies includes a range of adjacency to over 2 mile extents. There is merit in this economic data, but the discussion of the indirect economic value added by the linear landscape diminishes. At this scale, the linear

landscape transfers from an economic actor to an additional variable within a complex, urban fabric.

Despite the limitations of the aforementioned data, the data analysis has merit for present and future research. First, the availability and analysis of parcel level data (land use geography is at a similar level) displays a geographic scale prime for dual adjacent and 0.25 mile area research. This shows parcel level data as the prime geography for in-depth analysis of adjacent and 0.25 mile area proximities. In concern to this research, the data clearly argues that the indirect effect of the linear landscape adds economic value to both adjacencies and within a 0.25 mile area. For example, the Katy and Santa Fe Trails display land use changes that parallel to economic activity and positive increases in property values in the immediate and 0.25 mile area adjacencies. Additionally their positive value of change strongly outpaces that of similar urban areas, within Dallas, as a whole.

In summary, chapter 4 discusses the methods of analysis and findings to assess the economic value of linear landscapes in Katy and Santa Fe Trail cases. Overall, the data indicates overall positive growth as an indirect effect of the linear landscape. This is evident from the analysis of adjacent and 0.25 mile area proximities. Through descriptive frequencies and statistics, this analysis assesses available pre and post data. The researcher utilizes the economic value indicators of land use, property value (total market value and property class designations), gross sales, sales tax revenue, number of establishments, and number of employees to defend the research questions posed earlier in this study. Chapter 5: Conclusion discusses the researcher's conclusion as a whole. Additionally, a discussion on this theses relevance in the landscape architecture practice and future research applications takes place.

Chapter 5

Conclusion

5.1 Introduction

The purpose of this chapter is to review the research findings and reflect on its meaning for the landscape architecture scholarship and profession. First, the discussion centers on the three, primary research questions. Specifically, the researcher recaps how the analysis and findings engage these queries. This reflection discusses both the success and shortcomings of the research. Overall, this informs the present relevance to the practice and future research opportunities.

Second, the discussion ties the thesis research within the context of landscape architecture practice and scholarship. More specifically, this section understands the relevance of this research in concern to its present and future applications.

Finally, the chapter concludes on future research topics. This section includes both initial research objectives determined outside the scope of the final research design. Additionally, the discussion centers on ideas that arose during the research process. The importance of the future topics discussion is to stimulate further research beyond this thesis. Overall, the value of landscape architecture is a relevant research agenda. This is especially true for the economic value of linear landscapes because of the need for landscape architects to understand the metrics, benefits, value and so on of design.

5.2 Research Questions Revisited

In Chapter 1: Introduction, the researcher outlines three research questions. These questions guide the scope of the research. The section as follows summarizes the research questions, and how the final research analysis fits within their scope.

The primary research question that guides this thesis research is if there is economic value in linear landscapes? From the analysis of land use, property value, and

gross sales, sales revenue tax, establishments, employments is that linear landscapes do add economic value in the two examples studied in this research. More specifically, the linear landscapes of the Katy and Santa Fe Trails, in Dallas, Texas, impact the economic value in their adjacencies (the parcels and uses next to the linear landscape) as well as within a 0.25 mile radius from the trail centerlines. This is evident in the increases in total market value and property class value along the adjacencies and within the 0.25 mile area of the two study locations. Additionally, data also support a positive economic change that took place up to two miles (based on census tract, zip code, and/or county level data) away from the centerline of the sample sites.

Again, it is important to assert that this economic value impact is an indirect effect of the linear landscapes. The hypothesis of the researcher is that the closer a unit of geography is to a linear landscape, the higher its economic value rises, in the two examples studies in this research, due to a result of proximity. For example, parcel level data geographies promote an economic analysis within a directly adjacent proximity. The impact of linear landscapes is understood through the study of pre and post conditions. An assumption is that the vacant and derelict qualities, before the inception of a linear landscape development, provide a prime setting for development to occur. For example, the analysis of property values displays a strong increase in value within an approximate five year time period after the linear landscapes opening. After this time period, the strong increase is not a sustainable growth pattern. Of note though is the still present increase in economic value (in concern to property values). A revisit to this data in ten years' time is necessary to ascertain the extent of this economic value increase.

The major limitation of the procedure adopted in this research is the availability, accessibility and quality of secondary data. Limits include time frame for data collection, data available in geographies that out-scale the scope of the research, non-existence of

desired data all together, data available through private sources and high fees and so on. An aim of this research on economic value is for the researcher to utilize data from public sources. These include, but are not limited to, local, state, national government data share portals, regional commissions and county appraisal districts. Specifically for the researcher, potential data is accessible through a subscription only data engine. This source goes against the user-friendly methods process.

For example, with the number of establishment and employment set of economic value indicators, the researcher utilizes the County Business Patterns and US Census American Factfinder datasets. This data is in zip code and census tracts geographies respectively. In comparison, SimplyMap offers concurrent data at a block group level. “A block group is the smallest unit for which the US Census Bureau reports a full range of demographic statistics (Wade and Sommer, 2006, pg. 20)”. As an approximate comparison, a block group is roughly four times smaller than a census tract and eight times smaller than zip code areas. In concern to this research on adjacencies and within a 0.25 mile area, a block group set is more desirable geography of data.

A positive note is the rate of change in how government agencies collect and organize their primary data. A researcher observation through the data collection process notes the relative short time frame in which agencies began to organize their primary, economic data for seamless integration with geo-spatial analysis technologies like GIS. An assumption of the researcher is that, excluding privacy laws, data will be available in more appropriate geographies for proximity analyses. This coincides with GIS as the prominent geo-spatial technology and its increasingly more user-friendly interface. This observation transitions to the next research question.

The next research question is in concern to how the technology of Geographic Information System (GIS) organizes and analyzes secondary data to understand the

economic value of linear landscapes? To note, the researcher has a prior years' experience with this software technology in Esri platform. This experience centers on more landscape planning procedure like environmental inventory and suitability analysis. With GIS, these procedures for analysis apply to this thesis research means and methods. A limitation to this research question is the underlying procedure of the researcher to adhere to a fully replicable format. Specifically, the limitation is in the assumption that all landscape architects have access to GIS. This argument is minor though with landscape architecture firms' investment in the latest software technologies as standard, operating protocol.

For this research, GIS (by Esri) mitigates the researcher's minimal background in economics. For example, most if not all of the secondary data in this research is in a spreadsheet format. It is an overwhelming task to clean, analyze and understand this data through Microsoft EXCEL or ACCESS alone. With the geo-spatial visual analysis capability of GIS, the researcher understands where the linear landscapes are in concern to the overall urban context and how the data geographies compare in scale to the aforementioned landscapes. For example, the researcher understands clearly what constitutes parcel geography and its scale in comparison to the adjacent linear landscape. Additionally, at the 0.25 mile area, GIS visualizes the overall impact of this proximity relationship in concern to the actual degree of the indirect effect of the linear landscape itself in concern to economic value.

The geo-spatial visualization capabilities of GIS refine the analysis of secondary, economic data. With GIS, the researcher combines the cleaned, secondary data (in spreadsheet format) with shapefiles that include only geographic designations. Within the software, the researcher links the shapefile with the spreadsheet to create graphic, secondary data. For example, post join, the researcher adjusts the properties of the total

market value field (property value indicator) to display in a gradation of a single color value. Now one can visualize the patterns of higher value parcels versus lower value parcels in concern to their proximity to the linear landscape. Specifically, the researcher assigns darker tonal values to the parcels with higher market values.

Additionally, GIS provides the ability to compare separate adjacent data geographies from the 0.25 mile radius data geographies. This excludes the secondary data in zip code and census tracts geographies as their boundaries stretch beyond the 0.25 mile buffer. In concern to the parcels and land use data, this comparison is achievable. The comparison of adjacencies with concurrent data in the 0.25 mile radius enhances the value discussion through the standard comparison method. An important method of this research is to concisely compare pre and post data. Graphic outputs, or maps, overlay within GIS to quickly ascertain the change in economic value over time.

In conclusion, to tie-back to the research question, GIS is an essential tool for this research to organize, analyze and ultimately understand the economic value of linear landscapes. Most importantly, it offers a landscape architect the opportunity to understand, at a basic level, how the economic value changes over a specific time period. Additionally, through graphic means, the ability to communicate economic value promotes these innovative projects as a whole and the landscape architect's role in value creation within the urban design realm.

The final research question this section covers is what are the economic value indicators in literature relevant to linear landscapes? The approach to this research question began in the earlier portion of the research process. The literature component, more specifically the case study analysis, is essential to the scope of this research. The selection of appropriate economic value indicators dictates both data collection and data analysis portions of this thesis research. To reengage the initial statement of research

focus, this research question has the strongest affect. For example, prior to the final selection of the economic value indicators the researcher veered from the scope of the research on numerous occasions. In contrast, once the economic value indicators became final in concern to this research, the path for data collection and data analysis is relatively straight forward.

Specifically, the economic value indicators derive from the ULI and LAF case studies (LAF, 2014 and ULI, 2014). In summary, ULI case studies focus primarily on the indirect effect of development on adjacencies and the urban context. In contrast, the LAF case studies focus primarily on the direct effect of economic value a landscape creates internally or to some extent, along its adjacencies. Recently, select LAF case studies discuss the indirect economic value of landscape. Refer to Chapter 2: Literature Review and Chapter 3: Methodology for more details on the case study analysis.

The research method of this component concerns the importance to understand the indirect effect of linear landscapes on economic value. Specifically, ULI case studies discuss the indirect effect and LAF case studies discuss the economic value of landscape. It is clear that this research requires an analytical synthesis of these case studies to yield the most appropriate economic value indicators. To summarize, the researcher utilizes land use, property value and gross sales/sales tax revenue/establishments/employment for this research. These variables are direct economic value indicators. To various extents, direct economic value indicators default to a monetary data expression. With reference to Table 3-1, the additional economic value indicators yield a wealth of future research applications on their own merit.

In summary, the literature creates the foundation for this thesis research. The economic value indicators within case studies like the ULI or LAF show there is, to various extents, merit in their analysis and potential, available secondary data to drive the

value on discussion. Additionally, more so than environmental or social value, economic value indicators, such as property value, bridge multiple professions. From landscape architects to city governments to developers, the discussion of monetary value is a strong connector and enabler for these cross-discipline relationships.

5.3 Implications For Design & Planning

Linear landscapes, as with economic value, have the potential to affect the physical form of development. This is the linear landscape's impact on design. The implications for design and planning occur at both large and small scales. The assumption is that within the expansive geometry a linear landscape lies within, the larger impact is how design responds to this typology.

A deeper analysis at intersections through the linear landscapes (in the cases of the Katy and Santa Fe Trail) denote nodes of development patterns. In reference to Figure 4-26 through 4-31, the select areas display various patterns of growth. Overall, the linear landscapes positively impact linear landscapes. To explore deeper into this pattern, refer back to Figure 4-14 through 4-19. While property value is increasing, the land use morphology displays a more complex pattern. The square footage of single-family land use generally decreases versus multi-family and commercial land use increases. In concern to design, the researcher assumes the evolution of single-family to vacancy to multi-family/commercial occur at faster pace along the linear landscape. Larger clusters displace older, disparate single-family parcels to promote density and economic activity. Overall, this directly affects the design standards along the linear landscape.

At smaller scales, the parcels directly adjacent begin to orientate towards the linear landscape. This is reference to the parcels with direct view/access to the linear landscape have a higher economic value. For this research, the Katy and Santa Fe Trails provide a clean, greenway setting and access to a dynamic, recreation space. The

researcher assumes that these qualities influence the economic value of parcels through the need to have direct access to the linear landscape. Additionally, especially on the Katy Trail, the linear landscape offers direct, connectivity to retail spaces. As a consequence, the retail spaces need to respond in turn with direct access to the linear landscape.

Future research on the Katy and Santa Fe Trails offers the opportunity to understand how development responds to linear landscapes at different levels. Specifically, there is potential for design to directly respond to the linear landscapes. The design begins with how the development connects/responds to the linear landscape and works back from this point.

5.4 Relevance to Landscape Architecture

This thesis research is directly relevant to the landscape architecture profession and scholarship since it concentrates on its economic value. The discussion on the value of landscape is an extremely relevant topic. This relevance is evident in the growth of understanding and measuring landscape performance within the years (CELA, 2014; LAF, 2014 and so on). A major impetus for this research is from relative lack of research on the topic of the economic value of landscape by landscape architects who are more equipped with the components and typologies of landscapes. Additionally, there is a lack of research on the economic value of prominent and present landscape typologies such as linear landscapes. Still, there are strong advertisements of the equal symbiosis of environmental, social and economic value. This notion may be a result of the landscape architect's strong skill-set towards environmental and social factors but relatively weak exposure to economics.

Specifically, the relevance of this thesis research is to enhance the landscape architect's exposure the economic value of linear landscapes. This exposure understands

economic value as a compliment to respective environmental and social value indicators. This initial exposure opens avenues for dialogue with economists, developers and so on to enhance collaboration and cross-discipline education.

The replicable format of the research methodology offers the opportunity, potentially, for any landscape architect to collect, organize, analyze and ultimately understand the economic value of linear landscapes. In theory, this applies to various other urban, landscape typologies as well. This approach requires no economics background, but the researcher assumes a greater knowledge on the subject after participation in the process their selves.

In summary, the thesis research is relevant to the landscape architecture process on two fronts. First, it enhances the overall value discussion in concern to landscape. It elevates the research of economic value, in an attempt, to parallel the research of environmental and social value of landscape architecture. Second, through the replicable methodology, the thesis research engages any landscape architect on the topic of economic value. The mitigation of (lack of) experience in economics promotes the landscape architect's role in this discussion. Additionally, through visual, geo-spatial analysis, a landscape architect clearly enhances the overall value of the discussion.

To close, ultimately, to promote the continuation of these innovative linear landscapes within the urban context, the landscape architect offers an additional avenue for their future promotion. Specifically, this promotion centers on how the landscape architect understands how linear landscapes add economic value towards adjacent and within a 0.25 mile area.

5.5 Future Research Opportunities

Essentially, this master level thesis scratches the surface on the discussion of the economic value of linear landscapes especially in urbanized settings. The section that

follows elaborates on future of avenues of research in concern to this topic. Specifically, future research opportunities include ideas that derive directly from unused or under-utilized economic value indicators or even to more expansive research topics.

Throughout the literature review and data analysis of this research, many different economic value indicators present themselves. As stated prior, refer to Table 3-1 for a list of relevant economic value indicators. Additionally, future research applications have the opportunity to pursue either direct or indirect economic value indicators.

Multiple avenues of future research are present within the economic value indicators of land use, property value, gross sales, sales tax revenue, number of establishments and number of employees. Specifically, there is opportunity to expand this research beyond linear landscapes in Dallas to provide an additional comparison. Within the data sets themselves, such as property value, there is a wealth of opportunities present. Specifically the parcel data sets (property value) contain dozens of columns of data in concern to direct economic value indicators. This thesis research utilizes just two of these columns which pertains upmost relevance to this particular study. Whereas, this thesis research utilizes zip code level data for gross sales/sales tax revenue, there is opportunity to either locate agencies with this data at smaller geographies or attempt to produce primary data for this economic value indicator through collaboration with agencies like the Texas State Comptroller.

In the same line of thought, this research also realizes that linear landscapes, unlike more refined parks and open spaces, retain a linear dynamic that interacts with various socio-economic conditions. Additionally, the linear dynamic presents the opportunity to understand economic value in different segments of the landscape. The availability of more specific data may ascertain such variations in different segments of

the same landscape. This promotes a further understanding of the confounding variables that parallel the linear landscape.

An initial vision for this research concerns the utilization of additional visualization software like CityEngine and Business Analyst (Esri, 2014). Through CityEngine, this research elevates the visualization of geo-spatial data to a 3D plane. On the assumption that select, historic data is available (for example, historic structure shapefiles), an avenue of research is to combine historic land use data with the structure foot print data to further visualize the growth of development in proximity to a linear landscape. Business Analyst pushes the envelope of economic analysis. Again, on the assumption of data availability, an avenue for future research is to implement a walkability index to enhance the merit of 0.25 mile radius designation.

The future research topics this section presents, to this point, are of a quantitative nature. A straight forward concept for a qualitative assessment is to push the linear landscape discussion. Through interview or even observation methods, a future research opportunity is to assess the viability of the linear landscape as a viable landscape typology. For the purpose of this research, the researcher assigns a definition for linear landscape. Basically, any landscape typology that displays a linear dynamic has merit as a linear landscape. A qualitative or primary data assessment has the potential to assign more direct environmental, social and economic parameters to validate the term and integrate it as a standard practice in both the landscape architecture practice and urban design realm.

In conclusion, this section briefly outlays possible avenues of future research in concern to the economic value of linear landscapes. Whether it is through avenue of the data, technology or even the concept of linear landscapes, all of these opportunities have relevance to the landscape architecture practice. As a final thought, this research boils

down to a discussion on value. The relevance of this research promotes the practice as both a generator of value through art of science of design and planning.

Appendix A

Land Use Data

Cleaned Land Use Data: Santa Fe Trail (NCTCOG, 2014)

Santa Fe Trail Buffer Area (sq. ft.)	61463160			
Katy Trail Buffer Area (sq. ft.)	54624240			
Land Use (1990)				
Santa Fe Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	26955988	44%	n/a
	Multi-family	6420881	10%	n/a
	Commercial	7617216	12%	n/a
	Mixed-use	0	0%	n/a
	Parks & recreation	10852174	18%	n/a
	Vacancy	629190	1%	n/a
Land Use (1995)				
Santa Fe Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	25783651	42%	-2%
	Multi-family	6798838	11%	1%
	Commercial	9754032	16%	3%
	Mixed-use	0	0%	0%
	Parks & recreation	12292751	20%	2%
	Vacancy	1767191	3%	2%
Land Use (2000)				
Santa Fe Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	19272646	31%	-11%
	Multi-family	6497944	11%	0%
	Commercial	7587100	12%	-4%
	Mixed-use	0	0%	0%
	Parks & recreation	10809120	18%	-2%
	Vacancy	208858	0%	-3%

Cleaned Land Use Data: Santa Fe Trail (NCTCOG, 2014) (Cont.)

Land Use (2005)				
Santa Fe Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	17489883	28%	-3%
	Multi-family	4775294	8%	-3%
	Commercial	4946641	8%	-4%
	Mixed-use	0	0%	0%
	Parks & recreation	8588166	14%	-4%
	Vacancy	4042084	7%	6%
Land Use (2010)				
Santa Fe Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	16705344	27%	-1%
	Multi-family	5223270	8%	1%
	Commercial	6621994	11%	3%
	Mixed-use	0	0%	0%
	Parks & recreation	11025800	18%	4%
	Vacancy	3174972	5%	-1%
Land Use (1990)				
Santa Fe Trail				
57596300	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	2583717	4%	n/a
	Multi-family	5680103	10%	n/a
	Commercial	4531250	8%	n/a
	Mixed-use	0	0%	n/a
	Parks & recreation	10130514	18%	n/a
	Vacancy	578988	1%	n/a

Cleaned Land Use Data: Santa Fe Trail (NCTCOG, 2014) (Cont.)

Land Use (1995)				
Santa Fe Trail				
58377674	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	2467307	4%	0%
	Multi-family	6058051	10%	1%
	Commercial	7950755	14%	6%
	Mixed-use	0	0%	0%
	Parks & recreation	12253369	21%	3%
	Vacancy	1410202	2%	1%
Land Use (2000)				
Santa Fe Trail				
34024380	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	5366045	16%	12%
	Multi-family	4319621	13%	2%
	Commercial	1751129	5%	-8%
	Mixed-use	0	0%	0%
	Parks & recreation	7994422	23%	3%
	Vacancy	77359	0%	-2%
Land Use (2005)				
Santa Fe Trail				
17771597	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	3717503	21%	5%
	Multi-family	2282621	13%	0%
	Commercial	1106487	6%	1%
	Mixed-use	0	0%	0%
	Parks & recreation	6846603	39%	15%
	Vacancy	1537648	9%	8%

Cleaned Land Use Data: Santa Fe Trail (NCTCOG, 2014) (Cont.)

Land Use (2010)				
Santa Fe Trail				
20702403	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	3330108	16%	-5%
	Multi-family	2293726	11%	-2%
	Commercial	1448890	7%	1%
	Mixed-use	0	0%	0%
	Parks & recreation	7419327	36%	-3%
	Vacancy	1930034	9%	1%

Cleaned Land Use Data: Katy Trail (NCTCOG, 2014)

Santa Fe Trail Buffer Area (sq. ft.)	61463160			
Katy Trail Buffer Area (sq. ft.)	54624240			
Land Use (1990)				
Katy Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	14255067	26%	n/a
	Multi-family	11424605	21%	n/a
	Commercial	13389365	25%	n/a
	Mixed-use	0	0%	n/a
	Parks & recreation	5633175	10%	n/a
	Vacancy	1297231	2%	n/a
Land Use (1995)				
Katy Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	13690290	25%	-1%
	Multi-family	11632521	21%	0%
	Commercial	11853930	22%	-3%
	Mixed-use	0	0%	0%
	Parks & recreation	5919794	11%	1%
	Vacancy	4853576	9%	7%

Cleaned Land Use Data: Katy Trail (NCTCOG, 2014) (Cont.)

Land Use (2000)				
Katy Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	10369368	19%	-6%
	Multi-family	10522338	19%	-2%
	Commercial	9463712	17%	-4%
	Mixed-use	0	0%	0%
	Parks & recreation	5236069	10%	-1%
	Vacancy	1315014	2%	-6%
Land Use (2005)				
Katy Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	9259365	17%	-2%
	Multi-family	10887726	20%	1%
	Commercial	7176091	13%	-4%
	Mixed-use	252883	0%	0%
	Parks & recreation	3961972	7%	-2%
	Vacancy	2558937	5%	2%
Land Use (2010)				
Katy Trail				
	Land Use Type	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	9081013	17%	0%
	Multi-family	11779361	22%	2%
	Commercial	7610491	14%	1%
	Mixed-use	144345	0%	0%
	Parks & recreation	4546389	8%	1%
	Vacancy	2294069	4%	0%

Cleaned Land Use Data: Katy Trail (NCTCOG, 2014) (Cont.)

Land Use (1990)				
Katy Trail				
46995827	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	12234804	26%	n/a
	Multi-family	10158496	22%	n/a
	Commercial	11165449	24%	n/a
	Mixed-use	0	0%	n/a
	Parks & recreation	5337463	11%	n/a
	Vacancy	584295	1%	n/a
Land Use (1995)				
Katy Trail				
44726049	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	11669947	26%	0%
	Multi-family	10235316	23%	1%
	Commercial	7758816	17%	-6%
	Mixed-use	0	0%	0%
	Parks & recreation	5611264	13%	1%
	Vacancy	3650313	8%	7%
Land Use (2000)				
Katy Trail				
26249492	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	2343176	9%	-17%
	Multi-family	4358267	17%	-6%
	Commercial	1538743	6%	-11%
	Mixed-use	0	0%	0%
	Parks & recreation	2812845	11%	-2%
	Vacancy	264126	1%	-7%

Cleaned Land Use Data: Katy Trail (NCTCOG, 2014) (Cont.)

Land Use (2005)				
Katy Trail				
10491816	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	2242617	21%	12%
	Multi-family	3306423	32%	15%
	Commercial	1408250	13%	8%
	Mixed-use	0	0%	0%
	Parks & recreation	1966641	19%	8%
	Vacancy	728448	7%	6%
Land Use (2010)				
Katy Trail				
12713771	*Land Use Type*	*Surface Area Covered (sq. ft.)*	*Percent of Total Area (%)*	*5 Year Change (%)*
	Single-family	2401659	19%	-2%
	Multi-family	3789616	30%	-2%
	Commercial	1544052	12%	-1%
	Mixed-use	144345	1%	1%
	Parks & recreation	2873136	23%	4%
	Vacancy	1053112	8%	1%

Appendix B

Property Value Data

Cleaned Total Market Value Data: Property Value (DCAD, 2014)

Parcel Data Comparison Chart for the Katy and Santa Fe Trails (Dallas County: 2004, 2009, 2013)						
Data Set (Year)	*Parcel Count*	*Min. Value*	*Max. Value (00)*	*Sum Value (000)*	***Mean Value***	*Median Value*
Katy Trail, Adjacent (2004)	316	$0	$409,750	$389,193	**$1,231,623**	$413,820
Katy Trail, Adjacent (2009)	308	$0	$556,434	$582,189	**$1,890,225**	$674,415
Katy Trail, Adjacent (2013)	308	$0	$518,343	$601,377	**$1,952,523**	$625,150
Data Set (Year)	*Parcel Count*	*Min. Value*	*Max. Value (00)*	*Sum Value (000)*	***Mean Value***	*Median Value*
Katy Trail, 0.25 mi (2004)	2347	$0	$1,349,076	$2,634,057	**$1,122,308**	$420,680
Katy Trail, 0.25 mi (2009)	2380	$0	$1,756,321	$4,056,524	**$1,704,422**	$578,530
Katy Trail, 0.25 mi (2013)	2390	$0	$1,990,843	$4,494,901	**$1,880,712**	$575,000
Data Set (Year)	*Parcel Count*	*Min. Value*	*Max. Value (00)*	*Sum Value (000)*	***Mean Value***	*Median Value*
Santa Fe Trail, Adjacent (2004)	316	$0	$185,295	$85,285	**$269,889**	$55,000
Santa Fe Trail, Adjacent (2009)	317	$0	$115,073	$97,828	**$308,607**	$84,650
Santa Fe Trail, Adjacent (2013)	323	$0	$330,964	$143,205	**$443,360**	$84,650
Data Set (Year)	*Parcel Count*	*Min. Value*	*Max. Value (00)*	*Sum Value (000)*	***Mean Value***	*Median Value*
Santa Fe Trail, 0.25 mi (2004)	3276	$0	$359,146	$629,893	**$192,275**	$82,450
Santa Fe Trail, 0.25 mi (2009)	3288	$0	$364,906	$810,687	**$246,559**	$125,560
Santa Fe Trail, 0.25 mi (2013)	3280	$0	$364,906	$870,895	**$265,274**	$120,300
Dallas County (2004)	831758	$0	$1,000,000	$188,979,000	**$227,204**	$97,240
Dallas County (2009)	813408	$0	$1,000,000	$223,084,000	**$274,259**	$99,350
Dallas County (2013)	817127	$0	$1,000,000	$225,998,000	**$276,577**	$90,380

Cleaned Property Class Data: Property Value (DCAD, 2014)

Parcel Data Comparison Chart for the Katy and Santa Fe Trails (Dallas County: 2004, 2009, 2013)

Data Set (Year)	**A11 = Single Family**			**B11 = Multi Family**			**C11 + C12 = Vacant**			**F10 = Commercial**		
	Parcel Count	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*	*Parcel Count*	*Sum Value*	*Mean Value*
Katy Trail, Adjacent (2004)	88	$62,260,060	$707,501	28	$170,685,610	$6,095,915	60	$39,279,820	$654,664	37	$86,909,260	$2,348,899
Katy Trail, Adjacent (2009)	90	$87,870,590	$979,340	24	$216,456,780	$9,019,033	52	$93,037,350	$1,789,180	36	$148,073,020	$4,113,139
Katy Trail, Adjacent (2013)	85	$91,361,150	$1,074,837	21	$233,542,990	$11,121,095	59	$98,959,160	$1,677,274	38	$141,581,720	$3,725,835
Katy Trail, 0.25 mi (2004)	856	$686,204,500	$807,299	107	$509,819,290	$4,764,666	320	$184,579,400	$595,417	390	$1,021,301,440	$2,618,722
Katy Trail, 0.25 mi (2009)	854	$1,094,296,810	$1,281,328	88	$718,909,620	$8,169,428	297	$383,298,640	$1,290,568	345	$1,534,173,090	$4,446,879
Katy Trail, 0.25 mi (2013)	846	$1,060,859,300	$1,253,971	94	$1,042,954,760	$11,095,263	298	$371,271,060	$1,245,876	328	$1,723,014,070	$5,253,092
Santa Fe Trail, Adjacent (2004)	160	$13,156,420	$82,228	12	$31,314,850	$2,609,571	79	$6,262,020	$79,266	33	$11,446,730	$346,871
Santa Fe Trail, Adjacent (2009)	160	$18,858,600	$117,866	6	$31,539,450	$5,256,575	81	$16,308,480	$201,339	42	$22,428,600	$533,925
Santa Fe Trail, Adjacent (2013)	162	$18,557,790	$114,554	7	$64,542,230	$9,220,319	87	$10,989,100	$126,311	39	$39,113,630	$1,002,914
Santa Fe Trail, 0.25 mi (2004)	2093	$275,624,430	$131,689	127	$95,680,740	$753,392	457	$94,453,860	$206,682	298	$98,092,300	$329,169
Santa Fe Trail, 0.25 mi (2009)	2108	$376,842,920	$178,768	114	$109,455,970	$960,140	423	$52,213,360	$123,436	310	$219,052,900	$706,622
Santa Fe Trail, 0.25 mi (2013)	2106	$382,361,060	$181,558	116	$156,529,560	$1,349,393	418	$37,499,230	$89,711	310	$239,513,470	$772,624

Appendix C

Gross Sales/Sales Tax Revenue/Establishments/Employment Data

Cleaned Gross Sales/Sales Tax Revenue Data (TSCO, 2014)

Katy Trail

Zip_Code	Ind_Desc	Gross_Sal_05	Gross_Sal_12	Tx_Rev05	Tx_Rev12
75201	CONSTR	$572,962,806	$244,280,649	$125,844,268	$171,537,061
75201	RETAIL_TRADE	$11,330,654,000	$5,175,843,000	$114,595,000	$125,248,000
75201	REAL_ESTATE	$59,441,429	$130,948,476	$11,718,613	$26,835,270
75201	ARTS_ENT_RE	$25,318,704	$47,212,821	$5,064,589	$8,010,190
75204	CONSTR	$88,114,966	$192,760,949	$38,914,615	$47,289,840
75204	RETAIL_TRADE	$314,931,534	$353,329,372	$152,732,825	$168,694,413
75204	REAL_ESTATE	$23,453,129	$3,706,211	$1,858,952	$2,760,778
75204	ARTS_ENT_RE	$6,354,350	$4,144,232	$4,264,268	$2,866,053
75205	CONSTR	$13,591,359	$55,343,913	$1,024,026	$6,195,307
75205	RETAIL_TRADE	$433,319,290	$621,067,732	$266,084,024	$347,538,120
75205	REAL_ESTATE	$6,049,548	$6,253,396	$2,467,397	$2,201,365
75205	ARTS_ENT_RE	$19,230,805	$23,576,531	$17,300,283	$24,628,776
75219	CONSTR	$304,875,650	$375,470,524	$84,320,983	$126,291,420
75219	RETAIL_TRADE	$616,783,854	$1,139,248,374	$122,924,657	$157,323,134
75219	REAL_ESTATE	$6,000,562	$19,888,884	$4,558,880	$6,665,728
75219	ARTS_ENT_RE	$78,209,688	$100,790,993	$78,558,481	$98,251,422

Santa Fe Trail

Zip_Code	Ind_Desc	Gross_Sal_05	Gross_Sal_12	Tx_Rev05	Tx_Rev12
75214	CONSTR	$17,149,021	$41,787,898	$2,272,535	$12,588,907
75214	RETAIL_TRADE	$176,987,669	$249,695,148	$95,262,848	$121,339,008
75214	REAL_ESTATE	$2,019,316	$2,390,155	$1,592,251	$1,953,397
75214	ARTS_ENT_RE	$8,310,208	$13,886,940	$7,829,115	$11,597,451
75218	CONSTR	$15,189,240	$25,474,177	$2,619,913	$4,603,745
75218	RETAIL_TRADE	$228,703,440	$378,182,340	$104,045,370	$130,499,150
75218	REAL_ESTATE	$2,994,765	$2,942,954	$2,740,627	$2,392,730
75218	ARTS_ENT_RE	$4,707,836	$7,477,402	$3,479,441	$4,049,570
75223	CONSTR	$4,960,984	$78,260,668	$301,631	$1,137,962
75223	RETAIL_TRADE	$79,680,441	$65,260,590	$45,937,352	$38,634,515
75223	REAL_ESTATE	$0	$0	$0	$0
75223	ARTS_ENT_RE	$21,322	$2,344,176	$277	$45,439
75226	CONSTR	$119,072,704	$144,247,190	$8,054,851	$11,768,363
75226	RETAIL_TRADE	$123,580,418	$107,496,057	$81,804,005	$26,518,393
75226	REAL_ESTATE	$7,433,604	$7,399,392	$1,154,127	$678,277
75226	ARTS_ENT_RE	$2,019,790	$53,354,655	$1,226,010	$52,480,225

Gross Sales/Sales Tax Revenue Table (TSCO, 2014)

Zip_Code	Gross_Sal_05	Gross_Sal_12	Sal_Tx_Rev_05	Sal_Tx_Rev_12
A-75201	$1,198,837,700	$559,828,500	$257,222,470	$331,630,521
B-75204	$432,853,979	$553,940,764	$197,770,660	$221,611,084
C-75205	$472,191,002	$706,241,572	$286,875,730	$380,563,568
D-75219	$1,005,869,754	$1,635,398,775	$290,363,001	$388,531,704
Zip_Code	Gross_Sal_05	Gross_Sal_12	Sal_Tx_Rev_05	Sal_Tx_Rev_12
A-75214	$204,466,214	$307,760,141	$106,956,749	$147,478,763
B-75218	$251,595,281	$414,076,873	$112,885,351	$141,545,195
C-75223	$84,662,747	$145,865,434	$46,239,260	$39,817,916
D-75226	$252,106,516	$312,497,294	$92,238,993	$91,445,258

Cleaned Establishments Data (CBP, 2014)

Katy Trail						
Zip codes	Years	Construction	Retail	Real Estate	Arts, Ent, Rec	Total
75201	2005	26	68	156	27	277
75201	2008	31	64	132	23	250
75201	2011	27	69	155	25	276
75204	2005	32	107	68	27	234
75204	2008	25	101	81	30	237
75204	2011	22	88	82	23	215
75205	2005	46	136	117	16	315
75205	2008	52	144	109	16	321
75205	2011	47	137	101	15	300
75219	2005	28	123	111	18	280
75219	2008	38	106	112	21	277
75219	2011	28	96	115	25	264
Santa Fe Trail						
Zip codes	Years	Construction	Retail	Real Estate	Arts, Ent, Rec	Total
75214	2005	40	77	53	10	180
75214	2008	38	76	55	10	179
75214	2011	36	62	49	19	166
75218	2005	44	87	28	14	173
75218	2008	40	20	25	11	96
75218	2011	34	80	24	11	149
75223	2005	14	51	9	1	75
75223	2008	13	41	8	1	63
75223	2011	11	35	8	0	54
75226	2005	10	44	20	15	89
75226	2008	14	38	18	10	80
75226	2011	14	32	16	11	73

Establishments Table (CBP, 2014)

Katy Trail			
	Years		
Zip code	2005 Total	2008 Total	2011 Total
A-75201	277	250	276
B-75204	234	237	215
C-75205	315	321	300
D-75219	280	277	264
Santa Fe Trail			
	Years		
Zip code	2005 Total	2008 Total	2011 Total
A-75214	180	179	166
B-75218	173	96	149
C-75223	75	63	54
D-75226	89	80	73

Cleaned Employment Data (US Census, 2014)

2010 Employment by Industry								
Census Tract (Adjacent to Trail)	Adjacent Trail	Total (All Industry)	Construction	Retail	Real Estate	Arts, Ent, Recr	Total	
48113000500	Katy	2722	192	135	453	539	1319	
48113000605	Katy	1794	43	58	335	101	537	
48113000606	Katy	1982	41	233	203	120	597	
48113000701	Katy	3195	99	259	665	214	1237	
48113000702	Katy	2322	69	211	242	290	812	
48113001800	Katy	2891	31	204	467	329	1031	
48113001900	Katy	2717	63	252	498	325	1138	
48113019600	Katy	1116	7	59	223	63	352	
2012 Employment by Industry								
Census Tract (Adjacent to Trail)	Adjacent Trail	Total (All Industry)	Construction	Retail	Real Estate	Arts, Ent, Recr		
48113000500	Katy	3109	45	211	547	370	1173	
48113000605	Katy	1638	30	117	283	100	530	
48113000606	Katy	1870	29	194	195	264	682	
48113000701	Katy	3267	49	339	664	243	1295	
48113000702	Katy	2334	27	288	267	464	1046	
48113001800	Katy	3086	27	197	620	300	1144	
48113001900	Katy	3576	35	316	504	341	1196	
48113019600	Katy	1044	52	55	198	60	365	
2010 Employment by Industry								
Census Tract (Adjacent to Trail)	Adjacent Trail	Total (All Industry)	Construction	Retail	Real Estate	Arts, Ent, Recr		
48113000100	Santa Fe	2279	115	99	286	196	696	
48113001202	Santa Fe	1708	116	135	220	241	712	
48113001203	Santa Fe	806	183	34	87	145	449	
48113001204	Santa Fe	974	184	56	47	190	477	
48113001301	Santa Fe	1237	39	155	64	178	436	
48113001502	Santa Fe	1988	610	199	205	212	1226	
48113002400	Santa Fe	1263	287	137	94	192	710	
2012 Employment by Industry								
Census Tract (Adjacent to Trail)	Adjacent Trail	Total (All Industry)	Construction	Retail	Real Estate	Arts, Ent, Recr		
48113000100	Santa Fe	2269	160	112	253	217	742	
48113001202	Santa Fe	1939	72	178	278	262	790	
48113001203	Santa Fe	846	174	42	65	123	404	
48113001204	Santa Fe	1048	146	108	90	182	526	
48113001301	Santa Fe	1223	21	129	74	153	377	
48113001502	Santa Fe	1919	576	130	195	229	1130	
48113002400	Santa Fe	1382	262	120	101	215	698	

Employment Table (US Census, 2014)

Census Tract (Adjacent to Trail)	2010 Total	2012 Total
A-0500	1319	1173
B-0605	537	530
C-0606	597	682
D-0701	1237	1295
E-0702	812	1046
F-1800	1031	1144
G-1900	1138	1196
H-19600	352	365

Census Tract (Adjacent to Trail)	2010 Total	2012 Total
A-0100	696	742
B-1202	712	790
C-1203	449	404
D-1204	477	526
E-1301	436	377
F-1502	1226	1130
G-2400	710	698

References

Abrahams, P. (2010). *Stakeholder's Perceptions of Pedestrian Accessibility to Green Infrastructure: Fort Worth's Urban Villages.* Arlington: The University of Texas at Arlington.

Admiraal, J. F., Wossink, A., de Groot, W. T., & de Snoo, G. R. (2003). More than total economic value: How to combine economic valuation of biodiversity with ecological resilience. *Ecological Economics*, 115-123.

Bengochea Morancho, A. (2003). A hedonic valuation of urban green areas. *Landscape and Urban Planning*, 35-42.

Block, P. (2001). *The Flawless Consulting Fieldbook & Companion.* San Francisco: Jossey-Bass/Pfeiffer.

Carmona, M., Maghalhaes, C. d., Edwards, M., Awour, B., & Aminossehe, S. (2001). *The Value of Urban Design.* London: Commission for Architecture and the Built Environment.

Carmona, M., Punter, J., & Chapman, D. (2002). *From Design Policy to Design Quality: The treatment of design in community strategies, local development framework and action plans.* Cardiff City: RTPI.

CELA. (2014). Retrieved from Council of Educators in Landscape Architecture: www.thecela.org

Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and Urban Planning*, 129-139.

Coeterier, J. (1995, June 7). *Dominant Attributes in the Perception and Evaluation of the Dutch Landscape.* Retrieved November 2013, from Landscape and Urban Planning: http://libproxy.uta.edu:2128/science?_ob=ArticleURL&_udi=B6V91-3VWF8BD-

Crompton, J. (2001). *The Impact of Parks on Property Value: A Review of the Empirical Evidence.* Urbana: Sagamore Publishing.

Crompton, J. L. (2001, November). American Planning Association. *Parks and Economic Development*.

Dallas Central Appraisal District. (2014). Retrieved from DCAD: http://www.dallascad.org

Dallas Parks and Recreation Department. (2008). *Dallas Trail Network Plan.* Dallas: City of Dallas.

de Groot, R. (2006). Function analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multi-functional landscapes. *Landscape and Urban Planning*, 175-187.

de Groot, R. S., Wilson, M. A., & Boumans, R. M. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecological Economies*, 393-409.

Deming, E., & Swaffield, S. (2011). *Landscape Architecture Research.* Hoboken: John Wiley & Sons, Inc.

DETR & CABE. (2000). *By Design, Urban Design in the Planning System: Towards Better Practice.* London: Thomas Telford.

DoE. (1997). *Planning Policy Guidance Note 1: General Policy and Principles.* London: The Stationery Office.

Eccles, T. (1996). The professional concept of value within the built environment: a conceptual critique. *Environment by Design*, Vol. 1, No. 1, pp39-52.

Esri. (2014). Retrieved from Esri: http://www.esri.com

Florida, R. (2002). *The Rise of the Creative Class.* New York: Basic Books.

Francis, M. (1999). *A Case Study Method for Landscape Architecture.* Washington D.C.: Landscape Architecture Foundation.

Friends of the Santa Fe Trail. (2013). Retrieved 2013, from Friends of the Santa Fe Trail: http://friendsofsantafetrail.org/

Gurrutxaga, M., Lozano, P. J., & del Barrio, G. (2010). GIS-based approach for incorporating the connectivity of ecological networks into regional planning. *Journal for Nature Conservation*, 318-327.

Harnik, P. (2010). Urban Green: Innovative Parks for Resurgent Cities. Washington D.C.: Island Press.

Hein, L., van Koppen, K., de Groot, R. S., & van Ierland, E. S. (2006). Spatial scales, stakeholders and the valuation of ecosystem services. *Ecological Economies*, 209-219.

Heo, J., Jeong, S., Park, H.-K., Jung, J., Han, S., Hong, S., & Sohn, H.-G. (2013). Productive high-complexity 3D city modeling with point clouds collected from terrestial LiDAR. *Computers, Environment and Urban Systems*, 26-39.

Jeffrey, D., & Reynolds, G. (1999). Planners, architects, the public, and aesthetics factor analysis or preferences for infill development. *Journal of Architecture and Planning*, 271-288.

Jerke, D., Porter, D., & Lassar, T. (2008). *Urban design and the bottom line: Optimizing the return on perception.* Washington D.C.: The Urban Land Institute.

Kapper, T., & Chenoweth, R. (2000). Landscape Architecture and Societal Values: Evidence from Literature. *Landscape Journal*, 149-155.

Kirkland, S. (2013). *Paris Reborn*. New York: St. Martins Press.

Kidambi, B. (2011). *Assessing the Impacts of Converted Rail-Trails in North Texas: Learning from Stakeholder's Perspectives.* Arlington: The University of Texas at Arlington.

Kong, F., Yin, H., & Nakagoshi, N. (2007). Using GIS and landscape metrics in the hedonic price modeling of the amenity value of urban green space: A case study in Jinan City, China. *Landscape and Urban Planning*, 240-253.

Landscape Architecture Foundation. (2013). *Landscape Performance Series*. Retrieved 2013, from Landscape Architecture Foundation: http://www.lafoundation.org/research/landscape-performance-series/

Lang, J. (2005). *Urban Design.* New York: Architectural Press.

Llewelyn-Davies. (2000). *Urban Design Compendium.* London: English Partnerships and the Housing Corporation.

Lockwood, C. (2007). *From Tracks to Trails.* Urban Land, 186-197.

LoopNet. (2014). Retrieved from LoopNet: www.loopnet.com

Lopez-Mosquera, N., & Sanchez, M. (2011). The influence of personal values in the economic-use valuation of peri-urban green spaces: An application of means-end chain theory. *Tourism Management*, 875-890.

Lynch, K. (1960). *The Image of the City.* Cambridge: MIT Press.

Marcus, C. C., & Francis, C. (1998). *People Places.* New York: John Wiley & Sons, Inc.

Miccoli, S. (2012). Evaluation principles in Landscape Projects. *Firenze University Press*, 117-133.

Miller, A. R. (1995). *Valuing Open Space: Land Economics and Neighborhood Parks.* Cambridge: Massachusetts Institute of Technology.

North Central Texas Council of Governments. (2014). *GIS Clearinghouse*. Retrieved from NCTCOG: http://www.nctcog.org

Nijkamp, P., & Vindigni, G., & Nunes ALD, P. (2008). Economic valuation of biodiversity: A comparitive study. *Ecological Economics*, 217-232.

Olin, L. (1988). Form, Meaning and Expression in Landscape Architecture. *Landscape Journal*, 149-168.

Ormsby, Napoleon, Burke, Groessi, & Bowden. (2010). *Getting to Know ArcGIS Desktop.* Redlands: Esri Press.

Ozdil, T. R., & Modi, S., & Stewart, D. (December, 2013). “Case Study Investigation 2013: Klyde Warren Park”. OJB. *Landscape Performance Series.* Landscape Architecture Foundation, Washington D.C. Retrieved from http://www.lafoundation.org/research/landscape-performance-series/case studies/case-study/612/

Ozdil, T. R. (2008). *The Economic Value of Urban Design.* Saarbrücken: VDM Publishing.

Ozdil, T. R. (2006). *Assessing the Economic Revitalization Impact of Urban Design Improvements: The Texas Main Street Program.* College Station: Office of Graduate Studies Texas A&M University.

Ozdil, T. R., & Taylor, P. & , & Li, J., Mattingly, S., & Bell, B. (2008). *Transit Oriented Development Report.* Arlington: NCTCOG.

Plottu, E., & Plottu, B. (2012). Total landscape values: a multi-dimensional approach. *Journal of Environmental Planning and Management*, 797-811.

Pogodzinski, J., & Kos, R. M. (2013). *Economic Development & GIS.* Redlands: Esri Press.

Prekosovich, M., & Martinez, H., & Sierra, A., & Bian, C., & Noh, Y. R. (2011). *Woodall Rodgers Park, "The Park" Dallas, TX.* College Station: Texas A&M University .

Quayle, M. (1995). Urban greenways and public ways: realizing public ideas in a fragmented world. *Landscape and Urban Planning*, 461-476.

Searns, R. M. (1995). The evolution of greenways as an adaptive urban landscape form. *Landscape and Urban Planning*, 65-81.

Shafer, C. S., Koo Lee, B., & Turner, S. (2000). A tale of three greenway trails: user perceptions related to quality of life. *Landscape and Urban Planning*, 163-179.

Sherer, P. (2006). *The Benefits of Parks: Why America Needs More City Parks and Open Space.* San Francisco: The Trust for Public Land.

SimplyMap. (2014). Retrieved from Geographic Research, Inc.: http://geographicresearch.com/simplymap/

State of Texas. (2014). *Texas Comptroller of Public Accounts*. Retrieved from Window on State Government: http://www.window.state.tx.us

SWA Group. (2013). *Katy Trail*. Retrieved 2013, from SWA: http://www.swagroup.com/project/katy-trail.html

Taylor, S., & Bogdan, R. (1998). *Introduction to Qualitative Research Methods.* New York: John Wiley & Sons, Inc.

Thompson, C. W. (2002). Urban open space in the 21st century. *Landscape and Urban Planning*, 59-73.

Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kazmierczak, A., Niemela, J., & James, P. (2007). Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review. *Landscape and Urban Planning*, 167-179.

Urban Land Institute. (2013). *ULI Development Case Studies*. Retrieved from ULI: casestudies.uli.org

US Census Bureau. (2013). Retrieved July 2013, from United States Census Bureau: http://www.census.gov/

US Department of Agriculture. (2014). Retrieved from Natural Resources Conservation Service: http://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/

US Department of Commerce. (2014). *County Business Patterns*. Retrieved from US Census Bureau: http://www.census.gov/econ/cbp

US Department of Commerce. (2014). *US Census Bureau*. Retrieved from American FactFinder: http://factfinder2.census.gov

US Department of Labor. (2014). *CPI Inflation Calculator*. Retrieved from Bureau of Labor Statistics: http://www.bls.gov/data/inflation_calculator.htm

Vandermeulen, V., Verspecht, A., Vermeire, B., Van Huylenbroeck, G., & Gellynck, X. (2011). The use of economic valuation to create public support for green infrastructure investments in urban areas. *Landscape and Urban Planning*, 198-207.

Wade, T., & Sommer, S. (2006). *A to Z GIS.* Redlands: Esri Press.

Walmsley, A. (1995). Greenways and the making of urban form. *Landscape and Urban Planning*, 81-128.

Walmsley, A. (2006). Greenways: multiplying and diversifying in the 21st century. *Landscape and Urban Planning*, 252-291.

Wright, A. (2013). Future Park: Imagining Tomorrow's Urban Parks. Collingwood: CSIRO.

Whyte, W. H. (1980). *The Social Life of Small Urban Spaces.* New York: Project for Public Spaces.

Worpole, K. (1999). *The Value of Architecture-Design, Economy and the Architectural Imagination.* London: RIBA.

Biographical Information

Dylan Stewart holds a Bachelor's Degree in Environmental Design (BED) from Texas A&M University at the College of Architecture and now Master's Degree in Landscape Architecture from The University of Texas at Arlington. Professionally, Stewart worked for various construction, landscape construction, architecture and landscape architecture offices. These experiences shape Stewart's interests in the built form that follows scientific or knowledge-based merit. Still, Stewart's passion for the profession stems from the artistic visioning of design at all project scales.

Stewart participated with the UTA research team on the 2013 & 2014 Landscape Architecture Foundation's Case Study Investigation Series. External recognition includes a 2013 University Olmsted Scholar nomination, 2013 DFW Chapter Merit Scholarship and various student design awards at the state and national level. These awards include a juror award for the 2014 Edmund Bacon Student Design Competition and two honor awards from the Texas ASLA for student design submissions.

For future endeavors, Stewart plans to continue the research in concern to economic value in linear landscapes (and urban landscapes) with his professional endeavors. Furthermore, Stewart will continue to promote the landscape architecture program at UTA as it grows with continued success.