

CRIME IN TRANSIT ORIENTED DISTRICTS:

LEARNING FROM DALLAS, TEXAS

by

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Presented to the Faculty of the Graduate School of
The University of Texas at Arlington in Partial Fulfillment
of the Requirements
for the Degree of

MASTER OF LANDSCAPE ARCHITECTURE

THE UNVIERSITY OF TEXAS AT ARLINGTON

May 2013

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ACKNOWLEDGEMENTS

I am sincerely appreciative to Dr. Taner R. Ozdil, my thesis chair, for his guidance and encouragement through this entire thesis process. I would like to express my appreciation for Dr. Pat D. Taylor and Professor Jim Richards for their time and valuable contributions to this thesis. I am grateful to all the faculty members and adjunct professors in the Program of Landscape Architecture, who have augmented my acquaintance with landscape architecture through knowledge-imparting coursework. Special thanks to Mrs. Steward for her editorial contributions to my thesis. I would also like to thank Joshua Been for his countless hours of tutorials and GIS consultations.

I am extremely grateful to my close friends and classmates for their invaluable suggestions and support. My deepest gratitude is extended to my parents, my sisters, future in laws, and extended family. I would like to specially thank my fiancée who has always encouraged me to excel and pursue my dreams, and has helped and supported me throughout the master's program.

April 17, 2013

ABSTRACT

CRIME IN TRANSIT ORIENTED DISTRICTS:

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The University of Texas at Arlington, 2013

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Recognizing that the components of the built environment may effect crime in urban areas, emerging transit station areas and Transit Oriented Developments (TOD) and districts (TODT) present new challenges for designers and planners. Transit oriented developments, especially within the past decade, are seen as desirable choices for developing metropolitan areas to accommodate the concerns surrounding population growth (Ozdil et. al, 2012), but very little is known about how the spatial environment impacts delinquency around station areas. More specifically, it is not clear how design and planning might address such issues, and influence future TOD and TODT strategic plans.

This research assesses the location and the level of criminal activity surrounding transit stations within Transit Oriented Districts in the city of Dallas in order to understand the spatial environmental contributors to crime. Transit Oriented Districts in this study are defined as ½

radius area surrounding the station. The research specifically concentrates on the spatial commonalities (exterior elements) of the locations where majority of crime occurs within Transit Oriented Districts to inform future planning and design decisions.

This research focuses on the various criminal statistics and their relations to the built environment using quantitative methods. The research primarily uses secondary 2010 through 2012 crime data from the city of Dallas (DPD, 2013) and passive site observations (Marcus and Francis, 1998) in Transit Oriented Districts in the city of Dallas to assess the commonalities among the built-environments. The study utilizes Geographic Information Systems (GIS) for crime identification, land use, frequency, and location to pinpoint the exact criminal events in Transit Oriented Districts. Analyzes inventory is followed by online-site inspection using (Google Earth) to: (1) assess the exterior environment elements, and (2) to clarify ambiguities that may occur due to GIS interpretation. The research is validated through this process of comparison of observed data from the findings and the online web base observations on selected set of crime hotspots.

Findings illustrates that crime in Transit Oriented Districts frequently occur near public land uses and street right-of-ways with heavy pedestrian traffic but surprisingly not within the immediate vicinity of station areas in the case of Dallas. Observations also illustrate that areas that are prone to criminal activity require a more detailed look as to how to design when considering the surrounding environmental elements. Strategic planning and design combined with considerations of these findings by officers in contributing positions can help improve the spatial organization at Transit Oriented Districts. With further research, this study can be a valuable instrument for landscape architects in the preparation and strategic phase of constructing Transit Oriented Districts.

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CHAPTER 1

INTRODUCTION

1.1 Background

Transit Oriented Developments (TOD) are contributing to walkable, sustainable communities for people of all ages and incomes and providing more transportation and housing choices (including townhomes, apartments, live-work spaces, and lofts (Reconnecting America, 2007). TOD has seen rapid acceptance, increase, and creditability across the United States. The population increase projected for the urbanized areas along with the concerns about urban sprawl encourage development strategies such as TOD due to their unique integration of multi modal transportation and densification methods in urbanizing regions (Ozdil, et. al, 2011).

Transit Oriented Developments (TOD) or districts (TODT) are typically mixed-use residential or commercial areas designed to maximize access to public transport, and often incorporate features to encourage transit ridership. TOD's are higher density developments located along the transit corridors next to a station in urbanized areas with the intention of maximizing access to public transportation (Ozdil, et. al, 2012). TODs or TODTs commonly have one centralized transit stop and their land uses are shaped by the station. The built environment typically include, transit infrastructure, mixed-use (residential, commercial, office, and etc.), parking, parks, and streets all of which benefit from the station and its amenities.

Transit Oriented Districts refer to an area within ½ mile of the station. The district is composed of three key segments; station area, transit core, and the transit district. The area within one eighth of a mile radius from the station is considered the transit station area, one quarter of a mile which is the transit core, followed by one half of a mile which forms the

district. This is a scale that is appropriate for pedestrian accessibility, transit stops are desired to be within a walkable distance for maximum usage (Ozdil, et. al, 2012).

Although the pedestrian friendly design of these developments and districts presents the opportunity to promote sustainable lifestyles and increases human interactions, it also believed to contribute to unintended consequences such as delinquency within urban areas. Due to TOD's and TODTs respective location within the larger city and their accessibility by various modes of transportation these developments and districts are believed to be subject to higher criminal activity.

The Dallas-Fort Worth metropolitan area added 67 stations and 85 miles of new light and passenger rail within the past decade (DART, 2013). The expansion of rail-based transit brings a renewed interest and look at the Transit Oriented Development concept, and crime is one of the key factors that determine the assessment of such developments in urban environments. Crime prevention methods are also a topic open for discussion. Examples of published articles such as Oscar Newman's "Defensible Space" can relate to some of the environmental commonalities recognized in this literature (Newman, 1972). Crime prevention topics such as factors influencing crime and instability and corridor studies can be used for categorization.

Creation of Transit Oriented Districts as a design and planning strategy is seen as a noteworthy prospect for municipalities in the North Texas region to expand its usage of public transportation for its economics and sustainability. Those who design, plan, and approve of these TODT's need a comprehensive evaluation of the statistics and present concerns.

1.2 Purpose Statement

The purpose of this research is to study the location of crime and assess criminal activity taking place surrounding the transit station within Transit Oriented Districts in the City of Dallas in order to understand and improve the spatial environment contributing to crime. The research specifically concentrates on the spatial commonalities of (exterior elements) in the locations where most crime occurs within Transit Oriented Districts to inform future planning and design decisions.

Transit Oriented Districts in this study is defined as ½ radius area surrounding the station. The research specifically concentrates on the spatial commonalities (exterior elements) of the locations where most crime occurs within Transit Oriented Districts to inform future planning and design decisions. Dallas Police Department (DPD) provided crime data ranging from 2010-2012 was used for this study (Dallas Police Department, 2013).

The primary tool used to perform this study is Geographic Information Systems (GIS). The GIS tool not only allowed the researcher to geocode crime events within a designated radius of the TODT but also allowed the researcher to understand the spatial commonalities through digital imagery and map analysis.

1.3 Research Questions

The primary research questions addressed by this study are:

1. What are the spatial commonalities (exterior elements) of the locations where crime occurs in Transit Oriented Districts in Dallas, Texas?
2. What types of crimes occur at Transit Oriented Districts?
3. Where are the hotspots /crime clusters located in Transit Oriented Districts and how do they relate to the physical environment?

1.4 Research Methods

This research document analyzes various criminal statistics and their relations to the built environment using quantitative methods. The research primarily exploits secondary crime data (DPD, 2013) and site observations (Marcus and Francis, 1998) on selected Transit Oriented Districts within the city of Dallas to assess the relationship between the spatial elements and crime. The study utilizes Geographic Information Systems (GIS) for crime identification, frequency, and location to pinpoint the exact criminal events in TODT. GIS analyzes is followed by a virtual-site inspection of crime clusters to: (1) assess the spatial element and (2) to clarify ambiguities that may occur due to GIS interpretation. The research methods are further cross checked through the process of comparison of GIS findings and virtual-site observation. The data collection and analysis methods in this research can be summarized in four steps:

1. Secondary data acquisition (Annual crime statistics data from DPD between 2010 and 2012 are collected, prepared and geocoded)
2. District inventory, analysis, and mapping
3. Site observations and documentation through aerial maps and site visits

4. Reporting of findings

A range of necessary supporting data is required for GIS; this secondary data is obtained from a combination of descriptive statistic resources. The secondary data is geocoded and analyzed in relation to spatial elements for proximity to green space / parks, infrastructures, and adjacent land use. Inventory and analysis formed from the GIS tool determine the criminal activities using description, address, and the coordinates. Site observations associated with criminal activity follow the preliminary inventory and analysis to (1) identify and compare crime proximity and (2) provide photographic data to better understand spatial commonalities among crime clusters.

Once the initial research methods steps are complete, the GIS tools are used to configure the secondary data, the combination of primary data allows the research to identify types of crime and evaluate environmental elements that contribute to delinquency. The results are exhibited with descriptive statistics, graphs, charts, and visual illustration.

1.5 Definition of Terms

Accessibility: A site, building, facility, or portion thereof that complies with the guidelines set by United States Access Board (United States Access Board, 2004). Accessibility refers to the ability to reach the desired goods, services and activities (Litman, 2003). Walking is an important form of access, both by itself and in conjunction with other modes.

Central Business District: The term Central Business District (CBD) is interchangeable with the term downtown. Commercially, it is the heart of the city where high levels of commercial, retail, and governmental offices reside within an identified boundary (U.S. Census Bureau, 2006). Dallas's CBD historically refers to the area bounded by Woodall Rodgers Freeway to the North, Central Expressway to the East, R. L. Thornton Freeway to the South, and Stemmons Freeway to the west.

Commuter Rail (Transit): Urban passenger train service for short-distance travel between a central city and adjacent suburb. This does not include rapid rail transit or light rail service (National Transportation Statistics, 2010).

Crime: breaking a rules or laws for which some governing authority can ultimately prescribe a conviction (National Institute of Justice, 1996).

Crime Clusters: a sector where an exceeding number of criminal incidents take place (Braga, 2008).

Crime Prevention Through Environmental Design (CPTED): an approach to problem-solving that considers environmental conditions and opportunities they offer for crime or other unintended and undesirable behaviors. CPTED attempts to reduce or eliminate those opportunities by using elements of the environment to (1) control access; (2) provide

opportunities to see and be seen; and (3) define ownership and encourage the maintenance of territory. (U.S. Department of Justice. Office of Community Oriented Policing Services, 2007).

Dallas Area Rapid Transit (DART): Created on August 13, 1983, DART is the primary transit agency for the Dallas region. DART currently operates DART Rail, a portion of the Trinity Railway Express (TRE), bus services and a system of high occupancy vehicle (HOV) in 13 cities in North Texas. The network of DART Rail, TRE and bus services currently moves more than 220,000 passengers per day across our 700-square-mile service area (DART, 2010).

Geographic Information Systems (GIS): Geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information (ESRI, 2013).

Geocoding: the primary purpose of geocoding is to convert an address or other identifier (such as postal code) to an X, Y coordinate and save results to an existing recording a database (ESRI, 2013).

Hot Spots: (AKA Crime Cluster) a sector where an exceeding number of criminal incidents take place. In this research a 350' feet by 350' feet cells are used within the designated radius to illustrate crime clusters.

Light Rail: Streetcar-type vehicles operated on city streets, semi-exclusive rights-of-way, or exclusive rights-of-way. Service may be provided by step-entry vehicles or by level boarding (National Transportation Statistics, 2010).

Mixed-Use Developments (MXD): Development that has three or more significant revenue generating uses that have significant functional and physical integration of project components; a

relatively close-knit and intensive use of land; uninterrupted pedestrian connections; and development in conformance with a coherent plan that frequently stipulates the type and scale of uses, permitted densities, and related items (Ozdil et. al, 2012).

North Central Texas Council of Government (NCTCOG): Voluntary association of, by and for local governments, and was established to assist local governments in planning for needs, cooperating for mutual benefit, and coordinating for sound regional development (NCTCOG, 2009).

Smart Growth: Refers to urban planning and transportation methodologies that concentrate growth in developed areas to avoid urban sprawl and its negative consequences. (Ozdil et. al, 2012).

Station Area Plan: Development/regulatory plan used to guide the type, intensity and density of development in a transit oriented district or station area (DART, 2008, DART Policy, and DART TOD guideline, 2008). Strategic Transit Oriented District Plan: Also refer to as Transit-Oriented District. (Ozdil et. al, 2012).

Strategic Transit Oriented District Plan: Also refer to as Transit-Oriented District Strategic Plan or Strategic TOD Plan. A guide for prioritizing the planning and implementation activities of cities, transit authorities, counties, etc., related to transit planning and transit-oriented development stations and the areas around them. These plans may be small area plans specific to a particular area or may be general guidelines for all areas adjacent to transit stations in an entire transit system. These planning efforts typically involve public participation and significant amounts of input from other public departments, such as transportation or economic development departments of city, county, or even state departments. The goal here is to develop

physical guidelines pursuant to TOD principles and goals for the station area. These plans may or may not have regulatory authority and are typically used to guide development of an area with multiple ownerships where a master plan by a single owner/ developer is not viable. In this research this term typically refers to 1/2 a mile radius area surrounding the station (City of Denver, 2006, August).

Transit Core: Area defined as ¼ mile from a transit station. (Ozdil et. al, 2012).

Transit Oriented Design: Transit Oriented Design is defined as a relatively higher density development within walking distance of a transit station that contains a diverse mix of uses such as housing, employment, shops, restaurants and entertainment. The term is typically used to describe individual new development projects but can also refer to a mix of uses in a transit station area typically defined as the area within ½ mile of a transit station (Center for TOD, 2010).

Transit Oriented Developments (TOD): Defined as a high density development within walking distance of a transit station that contains a diverse mix of uses such as housing, employment, shops, restaurants and entertainment and is used to describe individual new development projects (Ozdil et. al, 2012).

Transit Oriented District: Area typically defined as ½ mile from a transit station providing high density mixed-use development (Ozdil et. al, 2012). ¼ of a mile is considered the transit core and the 1/8 mile is the designated transit station area.

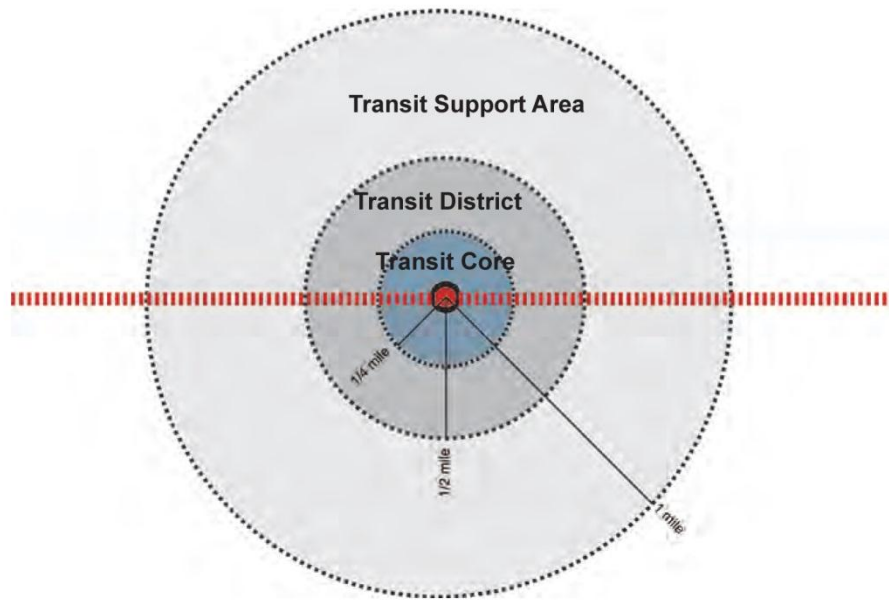


Figure 1.1 Transit Area Zones Map (Ozdil et. al, 2012).

Transit Stops: Stop made by a vehicle such as an aircraft, train, bus on the way to its final destination (DART, 2009).

Walkability: Walkability is a measure of how conducive and friendly an area is to walking (Ozdil et. al, 2012).

Urban Environment: a construction of space or spaces, including the physical and contextual elements, found within a city (Alexander, 1964; Eckbo, 1964; Simonds, 1998).

1.6 Significance and Limitations

This research provides systematic understanding of crime in relation to design and planning practices. The research informs landscape architecture professional about the spatial commonalities among criminal occurrence in higher density urban areas around transit station. This study also equips the city of Dallas with a greater understanding of TODT. This research provides examples on how to identify criminal hotspots at the district level.

This study assessment for criminal incidents at TODT's has limitations, including:

(1) Some stations in the orange and green rail lines within the DART system have recently opened and crime data is not reflective of the station or the district.

(2) The district concept of TODT is adopted for this research does not manifest itself as physical plan on the ground. Each TODTs has unique environmental conditions, no two TODT's have identical site layouts nor common design features.

(3) Although the researcher reviewed and cleaned the data for optimum quality the secondary data acquired from the city of Dallas website potentially may have human or computer errors while formatting the statistics; this may create unforeseen discrepancies.

(4) Criminal behavior may not be a result of the spatial setting.

1.7 Study Overview

The format of this thesis is organized into five sections: (1) introduction, (2) literature review, (3) research methods, (4) analyzes the data and outline findings, (5) results and conclusions. The chronological sequence of the following chapters establishes a strategic approach for this research topic.

The first sections, Chapters 1-2 focus on the introduction of TOD's and TODT's, the importance of criminal assessments, and the primary objectives for the research. The next section of this research, Chapter 3-4 focus on identification, preparation and analysis of the relevant data for the research questions sets forth in this research. This section also summarizes the preliminary findings of the research. Finally, Chapter 5 summarizes research findings, clarifies the significance of the study, and discusses how it relates to the profession of landscape architecture, and the potential explorations for the future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the design and planning literature focusing on the relationship of crime and physical environment. The literature review specifically focuses on the presence and the location of criminal activity within the context of Transit Oriented Developments (TOD)/ Districts (TODT) that advances urban development adjacent to public transportation. Portions of this chapter describe the spatial environment and how it contributes to crime occurrences. This literature suggests that the combination of urban spaces, physical elements and contextual environments combine to create designed urban environments (Simonds, 1998). Extensive review of crime categories and the particular land use within TODT boundaries are explored in this chapter. Concluding the chapter is a discussion of Geographic Information Systems (GIS) tool, the value of the program and the capabilities and limitations that are associated with GIS.

2.2 Crime

Crime is defined as breaking a rules or laws for which some governing authority can ultimately prescribe a conviction (National Institute of Justice, 1996). The French sociologist Emile Durkheim ([1893] 1984), discusses that crime is not only normal but is also necessary to hold society together. First, crime serves to establish and clarify the moral boundaries of society, by identifying those behaviors deemed unacceptable, the members of society reaffirm and refine what is acceptable (Lanier and Henry, 2011).

There are categorized methods that identify to the severity of the criminal event. A path analysis is provided to determine the influence of other factors, including socioeconomic

characteristics, management effectiveness, quality of city police and security services, and form of ownership (Newman, 1996). The classifications of present crime are essential to understand. The classifications are listed into three categories based on the seriousness of the crime: (1) public offense (2) crimes against people (3) serious crime. The differences between the three categories are the severity of the punishment which results as misdemeanors and felonies. The perception of crime to a user changes their take on the safety of a transit stops (Newman, 1996). Understanding the classification of crime is essential to gauge the implication for future strategic planning.

2.3 Hot Spots/Crime Clusters

Hot spots also known as the term crime clusters are a location where an exceeding number of criminal incidents take place (Braga, 2008). Hot spots policing has become a very popular way for police departments to prevent crime. A police foundation report found that 7 out of 10 departments with more than 100 police officers reported using crime mapping to identify hot spots (Weisburd et al., 2001). Recognizing the importance of place is essential for crime prevention or inventory. The emergence of hot spots policing can be traced to the development of computerized mapping and database technologies and the growing academic interest in the importance of specific places in the understanding crime problems (Weisburd and Braga, 2006). Given the growing popularity of this approach to crime prevention, a review of existing evaluations of hot spots policing programs can help police executives and policymakers understand what works in preventing crime in hot spot areas (Braga, 2008). A number of police policymakers and researchers have suggested that many crime problems can be reduced more efficiently if police officers focused their attention to these deviant places (Sherman and Weisburd, 1995; Weisburd and Green, 1995). The appeal of focusing limited resources on a

small number of high-activity crime places is straightforward. If the crime can be prevented in hot spot locations, then we might be able to reduce total crime.

2.4 Crime in Dallas

The city of Dallas is the fourth largest metropolitan areas in the Unites States. The north Texas region currently houses 6.3 million residents and projected to reach a population of 9.1 million by the year 2030 (NCTCOG, 2013). With substantial growth, and increasing density in transit stations areas crime becomes a topic of concern. According to City of Dallas crime statistics there are over seventy thousands recorded criminal events within the past three years (DPD, 2013) but very little is known about the criminal activity surrounding transit stations.

The city has seen crime reduce over the past decade but is still in need of exploration (DPD, 2013). In Dallas it is found that the deterring effects of crime for potential movers is greater for families with children than without and for more affluent families, white and black (Katzman, 1980). The perception that the inner city is unsafe is demonstrated from the continuation of sprawl. The concentration of outdoor crime is studied in this research to provide the city of Dallas with current results.

2.4.1 Data on Crime in Dallas

Crime statistics are recorded and stored by the city of Dallas Police Department. The datasets are published through the city of Dallas websites annually in the form of simple text files with various categorizes of information.

In 2010, the overall crime went down 10.2 percent from the previous year. This is the seventh consecutive year of overall crime reduction with in the city of Dallas (DPD, 2013). Non-recorded incidents contribute to the perception that data statistics are misleading. The reduction

in crime rate per 1 to 1000 concludes that the city of Dallas is moving towards a decrease criminal activities.

2.4.2 Land Use and Crime

The type of land uses in urban areas has been found to contribute criminal behavior (Loukaitou-Sideris et. al., 2000). Transit Oriented Districts incorporate a variety of land uses to accommodate various types of needs of urban dwellers. Transit oriented developments and districts typically provide a mix of major uses, jobs/housing balance, essential uses and services, diversity of uses, and a range of housing types including mixed income housing and mixed life-stage housing (Ozdil et. al, 2012). Criminal assessment in this kind of environments becomes critical given that future metropolitan areas are likely to integrate such developments to respond to population growth. From an analysis and inventory understanding, land use in relation to crime becomes an essential part of research. Analysis of relationships between land uses identifies commercial and transitional areas as more attractive targets for criminals, followed by industrial areas, with residential areas considers the least attractive (Loukaitou-Sideris et. al., 2000). Multi-family housing areas were more susceptible to crime than single-family housing (Rhodes and Conly, 1981). The consideration of land use for strategic planning in regards to this valuation can alter site layout.

2.4.3 Design, Planning, and Crime

The preliminary steps in the design of Transit Oriented Districts include intensive planning and design organization. Design professionals rely on these methods to create a sustainable development. The initial procedure is to plan for the district. This participatory phase of the planning efforts extends through all stages of the process and is essential; environmental design frequently involves making choices between the needs and values of different groups.

These choices are especially pronounced in open space design where the values of different user groups are frequently in direct conflict (Francis, 1988 p. 67). Designing pedestrian-oriented places means embracing the human scale over vehicular convenience, while still accommodating vehicular traffic and parking. According to Walkable Communities, Inc.'s Dam Burden, a number of elements must be included to encourage and facilitate pedestrian activity (Burden, 2009). Recognizing the importance of the both techniques creates sustainability within the district in regards to crime.

2.5 Crime Prevention Through Environmental Design (CPTED)

Crime prevention through environmental design (CPTED) is an approach to problem-solving that considers environmental conditions and the opportunities they offer for crime or other unintended and undesirable behaviors (Braga, 2008). CPTED is an approach to eliminate those opportunities of crime by using elements of the environment to (1) control accessibility; (2) provide opportunities to be visible; and (3) define ownership and encourage the maintenance of territory (Zahn, 2007). CPTED is a relatively new term, but use of design for safety and security is not. Caves and cliff dwellings, and castles and moats are good historical examples.

Requirements for street lighting grew out of a need to distinguish legitimate travelers from outlaws and thieves (Zahn, 2007). Contemporary approaches, including CPTED, emerged out of research on the relationship between crime and place, theories known variously as environmental criminology, situational prevention, rational choice theory, or routine activities theory, among others. Each theoretical approach focuses on the crime event and how a criminal offender understands and uses the environment to commit a crime. An example of CPTED is Oscar Newman's "defensible space" ideas, representing a brilliant attempt to use architectural form to rescue public housing in the United States from the depredations of crime (Loukaitou-Sideris et.

al., 2000). CPTED, defensible space, and problem oriented policing are all emerging problem solving related to Transit Oriented Districts.

2.6 Pedestrian Environment

The pedestrian environment is often considered the exterior space of a site. It includes the form of the circulation, structures, and physical environment features of districts. The TODTs are areas that promote multi-modal transportation activities such as walking, biking, public transportation, and etc. Spatial environment contains factors that seem to correlate with the criminal statistics (Harrell and Taylor, 1996). These elements include the landscape, open space, structures, and infrastructure. Assessment of criminal activity is necessary for TODT to identify characteristics such as pedestrian buffers with proximity to the transit station. Greater pedestrian connectivity has the potential for varies types of criminal occurrences.

Specific emphasis was given to address issues surrounding the creation of physical environment under the framework of urban design that include architecture, open space / landscape, parking, streets, walkability and sense of place in order to create people places in Transit Oriented Districts. Open spaces is needed for prosperous and safe transit stops. It is stated that an urban transit stop can be considered safer with the abundant flattering light, day and night, feeling of openness, “Eyes on Street” – can see out and see in, transparent, and “Make Sense”- Clean (Lusk, 2001). Architecture and identity around TOD’s are influencing factors for considerations related to crime. These buildings create environments for people to live, work, shop, and entertain. Built structures are just one contributing element of a TODT. The type of land use that the structure embodies plays a critical role in the occurrence of delinquency in the spatial environment of a TODT. The spatial environment directly influences the performance of TODT’s and assist in this criminology study.

2.7 Transit Oriented Developments and Districts

Transit Oriented Developments or (TOD) is typically defined as more compact development within easy walking distance to transit stations. TODs typically contains a mix of uses such as housing, jobs, shops, restaurants, and entertainment (Reconnecting America, 2007). The term Transit Oriented District (TODT) specifies the pedestrian radius considered walking distance. The district is typically defined as ½ mile from a transit station providing high density mixed-use development (Ozdil et. al, 2012). *The Transit Oriented Developments Report* describes TOD's as desirable choices in growing metropolitan areas. These areas accommodate various needs of the urbanizing population with higher development densities, a diverse mix of land uses, and opportunities they present with multi-modal transportation connections to serve their immediate locale (Ozdil et. al, 2012). As it can be exemplified with the pioneering project in DFW, Mockingbird Station TOD completed in 2001. The architecture of these developments includes structures with several stories and a combination of uses such as commercial, office, and residential. TOD's create activity centers, nodes, and landmarks in the urban setting.

For these developments to become desirable choices for growing cities and municipalities' criminal activity in relation to physical environment must be studied locally. The number of projected rail lines and population is likely to double over the next twenty years, (North Central Texas Council of Government (NCTCOG), 2012).

It's also stated that real or perceived problems such as crime deter investment for TOD; either investment will simply not occur, or the quality of the development will be compromised (Belzer and Autler, 2002). There's a strong urgency to understand the spatial environment of transit oriented developments and districts related to crime.

2.7.1 Dallas Transit Stations

The Dallas Area Rapid Transit (DART) light rail line system includes over 67 stations and 85 miles of new light and passenger rail throughout North Texas (DART, 2013) 41 of the light rail transit stations are within the city of Dallas' boundaries serving over 220,000 passengers weekly. As it can be visualized in figure 2 .1 DART's rail system map. The system is one of the fastest growing public transportation systems in the United States and expects to expand to more cities in the upcoming decade. With the added number of miles and stations, the rail system also encourages scores of new transit oriented developments throughout North Texas which requires closer look at it impact to the quality of life.

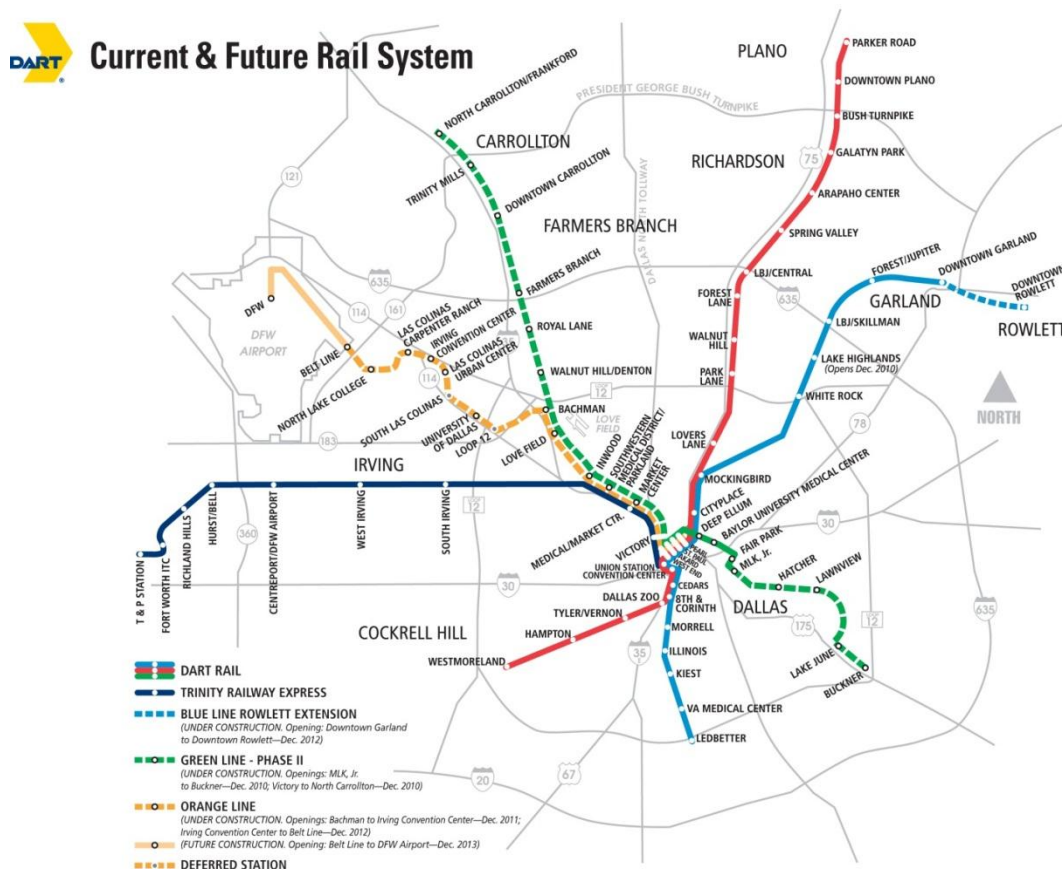


Figure 2.1 DART Rail Line System (Source: DART, 2013)

2.8 GIS

Geographic Information Systems (GIS) lets us visualize, question, analyze, interpret, and understand data to reveal relationships, patterns, and trends (ESRI, 2013). GIS gives the public sector manager and the business leader the power to understand complex relationship, the power to plan for tomorrow, the power to present data in a clear compelling way, the power to make informed decisions, and the power to save time money, and lives (Office of State Budget and Management, 2008). Local governments use GIS technology to manage land records, manage their infrastructure, perform addressing and routing as part of emergency operations, and for many other purposes. State government agencies use it for school bus routing, management and monitoring of natural resources, emergency response, and tracking of sex offenders, among many other daily uses. The GIS tool functionality output is dependent on the data input and the researcher parameters on the calculated procedures.

This research uses GIS tools and technology to understand the criminal activity in its physical context. Although crime and its setting are studied with GIS in various locations (see such as (Chainey and Ratcliffe, 2005) there is limited number of research in the literature concerning the location of the crime in relation to its spatial context within the TODT. As to the present there's no other crime related literature located concerning the city of Dallas and its transit oriented developments and districts. This research specifically concentrates on the calculation of following categories of information:

- Categorized Crime
- Vicinity
- Specified Radius

- Land Use

GIS is a dynamic tool capable of pinpointing the precise location of events, but it's essential that the correct data is inserted into the calculations. By following proper data collection and analysis procedures GIS is found to be the appropriate tool for this study.

2.9 Summary

This chapter provides an overview of the literature that explores the relationship between physical environment and crime. The chapter explains the significance of TOD and TODT's in the urban environment and clarifies contributing factors associated with crime. Throughout each major subtopic literature is provided to demonstrate the current status of the subject. Finally, the literature puts emphasis on (GIS) as a tool and technology to geospatially locate the data so that environmental factors can be studied. The criminal assessment with the combined data, inventory, and further studies can be a useful resource and guideline tool. The following chapters explain the methodology in detail in order to further iterate the topic under investigation.

CHAPTER 3

RESEARCH METHODS

3.1 Introduction

This chapter focuses on the research methods used in this thesis. The research assesses the location and the level of criminal activity taking place in the Transit Oriented Districts (TODT) of the City of Dallas by using empirical methods and GIS tools. It specifically concentrates on the spatial elements where crime occurs as a means of order informing future planning and design decisions. The following sections includes details of the study location and its relevance, data acquisition methods, analysis procedures to understand crime in TODT, along with significance and limitations of the procedures followed in this research. Geospatial data and Geographic Information Systems (GIS) tools are utilized to better understand crime and its spatial characteristics in Transit Oriented Districts.

3.2 Study Location

Site selection was one of the first critical steps in this research. The city of Dallas and its' transit station districts are selected to study spatial commonalities of criminal activities. The growth, population increase, increasing development activities especially inside the city boundaries, as well as the expansion of the light-rail system made Dallas a good case to study in this type of research.

Transit Oriented Districts (TODT) with a ½ mile radius from the stations were identified from the city of Dallas to examine the characteristics of crime. The half mile distance from the station is commonly regarded as a pedestrian shed for the station, and it is typically referred to as transit area or district in the transit oriented development literature (Transit Oriented

Development Strategic Plan for the City of Denver, 2006). The concept of TODT is adopted in this research, it is found to be the appropriate approach given that it is commonly referred as pedestrian shed. Each TODT has unique environmental conditions, no two TODT's have identical site layouts nor common design features. Figure 3.1 Downtown Dallas' TODT provides a visual of the TODTs in the central business district. Each TODT in this region is uniquely formed.

Light rail and public transportation in the city of Dallas are managed by the Dallas Area Rapid Transit (DART). Large portions of the transit stations are located in the Central Business District (CBD) of downtown Dallas where the DART's transit-way mall is located. The image above illustrates the transit-way mall in the CBD. This investigation takes into considerations all the DART rail stops and districts surrounding them within the city of Dallas with the exceptions of station areas which opened recently and crime statistics for these locations may not associated with the transit activity along the blue line.

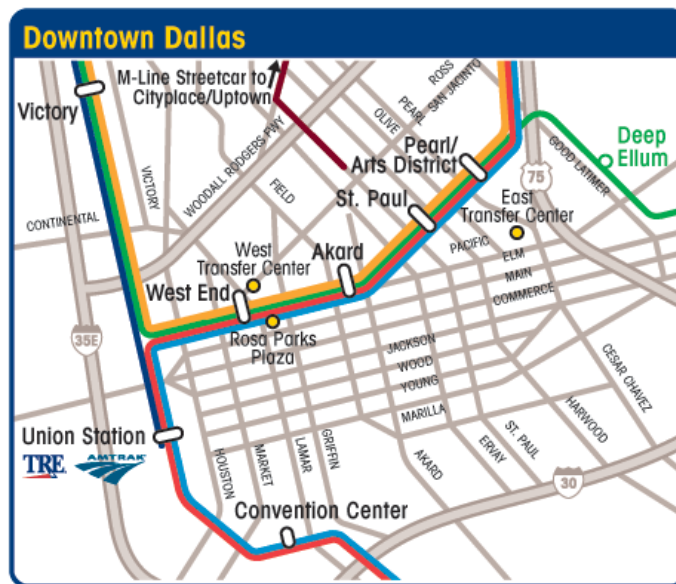


Figure 3.1. Downtown Dallas TODT (Source: DART, 2013)

The transit oriented districts are divided in to zones in this literature in order to develop design and plan strategies for each zone. The proximity from the transit station is commonly used as a measure in this conceptual construct. TODT's encompasses a range of designated radiuses. The radiuses are determined by a pedestrian scale centered by the rail station. For this thesis each TODT was given a specified radiuses to (1) understand pedestrian realm (2) evaluate the criminal events based on its vicinity to the rail station. The center of TODT is a transit station surrounded by a transit core area which is typically $\frac{1}{4}$ mile radius from the station. $\frac{1}{2}$ mile radius area from the station is considered as the transit oriented district where as the areas beyond this distance up to 3 mile commonly considered as the transit support area. This study uses transit oriented district ($\frac{1}{2}$ radius area from the station) as a framework to assess criminal activity and study its spatial commonalities.

The study of TODT's in Dallas provides evidence of commonalities of elements and environments that influence criminal activity in such area. By utilizing GIS technologies this research assesses the location, the type of crime, and hot spots in all 41 TODTs in the city of Dallas. It also documents some spatial commonalities of criminal activities in all stations. Finally, it concentrates on observations on three hotspots in three different TODTs to study design details of those specific sites to have a more clear understanding of crime in its context.

The observation shows a link in the site selection and the preliminary steps regarding the hot spots at the TODT's. Three locations are chosen to provide examples of the correlation of hotspots / crime clusters to the spatial environment. The selection processes for the three specific locations are listed below:

1. All three were to be positioned on the identical DART line.

2. The largest quantity of recorded crime occurrences on the particular rail line.
3. One location is to be located in the Central Business District (CBD) of Dallas.
4. Sufficient establishment for the TODT to generate as a district that primary mode of transportation is the centralized rail station.
5. Similar characteristics of spatial design and uses.

The combination of all the requirements listed above pinpointed three TODT's to be explored and documented. The investigation provides an in-depth perspective of exterior elements within the spatial environment that show patterns of occurrences. Site imagery is displayed in the latter chapters of this study.

3.3 Data Acquisition

This study benefited from two sets of data. First is the crime statistics, secondary data collected from public sources of the city of Dallas. The majority of the data set was used for the inventory and analysis section using GIS. Second is the geospatial data set which examines spatial characteristics of crime concerning Transit Oriented Districts. The statistics were obtained from the website of Dallas Police Department (DPD, 2013) whereas geospatial data for location characteristics obtained from North Central Texas Council of Governments (NCTCOG, 2013). Both data sets are used as the primary resources for the GIS analysis. In addition to these datasets Google Street view and ESRI online aerial maps are utilized throughout the research to study the specifics of these locations (See Appendix A for the various examples of street view images from Google).

The crime statistics acquired for this research are from the city of Dallas Police Department (DPD) website. The DPD online web site allows users to filter and select criminal

events dating back ten years. The criminal statistics provide users with descriptive information regarding the type of event, the name of the violator, the time of the day, the address of where event occurred, and whether the event is indoor or outdoor. To have a better understanding of recent crime this research only focused on crime statistics between the years of 2010 and 2012. For each year the data sets time frame started from January 1 through December 31 (365 calendar days). This procedure gave 11,994 for all three years. The following are the datasets acquired and used for this research:

1. Dallas Police Department Crime statistics for the year 2010 (DPD, 2013).
2. Dallas Police Department Crime statistics for the year 2011 (DPD, 2013).
3. Dallas Police Department Crime statistics for the year 2012 (DPD, 2013).

The North Central Texas Council of Governments (NCTCOG) data center provides various geospatial data such as aerial images, streets, parcels, city boundaries, land use, environmental elements, and transportation data. These data sets are examined in relation to crime statistics to not only to pinpoint crime clusters and hotspots but also the document and observe the commonalities among the locations of the crimes to better inform design and planning processes. The following are the list of data used in this research:

1. Public Transportation Data
2. County and City Data
3. 2010 Land Use
4. Hydrology Data
5. Aerial Imagery Data

3.4 Data Analysis Procedures

The preliminary steps regarding the data collected from the DPD to export the descriptive criminal statistic into the Excel spreadsheet and clean minor structural errors such as spacing and duplicated events. The spreadsheet was modified and reviewed for accuracy. Each criminal year was separated, so the process was done three times and then merged for total occurrences. Criminal events are listed by the individual locations. For example, one criminal occurrence may include four violators; the listed description would include four separate occurrences based on the format of the DPD. Understanding the methods used by the DPD are imperative for outcome of identify hot spots.

The collected data from DPD was geocoded in order to study and analyze this information in relation to other spatial data in Geographic Information System (GIS). The object was to record and associate the spatial environment features, contextual land use, and crime data. GIS provided methods to geocode the addresses of each crime. The city, state, and address were the elements used to pinpoint the criminal events within the radius of each TODT's in the city of Dallas. Spatial joining of the crime and specified location allow for the area to be examined.

Specified base elements are incorporated into the TODT. These elements stated from literature review are classified as contributors to the criminal activity. They are listed as (1) the rail station, (2) the rail line and setback region, (3) major public roads, (4) parks, (5) commercial land use, (6) multi-family land use, (7) water bodies; and (8) flow lines also known as rivers, streams, and creeks. These elements were merged within each TODT for analysis of the spatial relationship to the criminal occurrences.

Each TODT represents a study area in this research. The ArcGIS software is used to create a square polygon fishnet with the dimensions of 350' feet by 350' feet formed for the evaluation of the hot spots at each TODT. A spatial join of the criminal occurrences, fishnet, and radius buffer formulated the identification of hot spots. With the analysis tool clip GIS was able to accurately account for the amount of criminal incidents took place for each TODT. The incident total for each TODT differ this represented a range of different hot spots within the fishnet based from the quantity of criminal events. Each TODT has its own range of crime based from the amount recorded. The highlighted areas in the investigation of the fishnet were deemed as crime clusters. Figure 3.2 demonstrates examples of the fishnet results.

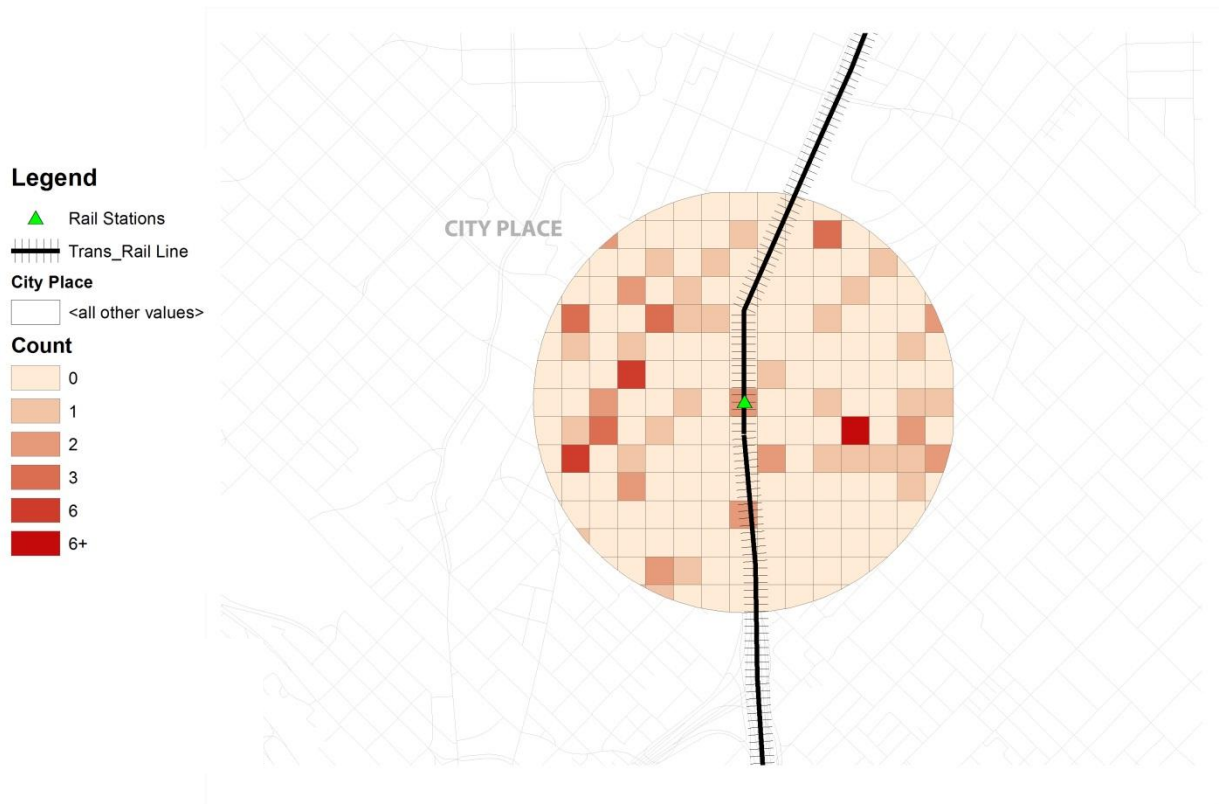


Figure 3.2 City Place Hotspot Example

The polygon fishnet areas and the associated crime spreadsheet were compiled forming the study areas for this research. Each TODT was formed into a shape-file with the contributing factors clipped within the district boundaries for facilitating the analysis. The imagery was organized into folders corresponding to the commonalities. Due to the large amount of images the photographs were not associated with the corresponding shape-files in the GIS environment.

The recorded hot spots are documented and formulated in conjunction to contributing environmental factors. For example parks and the hot spots layer are merged creating a spatial join for the proximity of the parks to each hot spots is generated into an excel spreadsheet. This process is done as a whole with all the TODT allowing results such as average distance to parks to be conveyed. Each contributing factors was recorded the same. The results provided conclusions that identify the relevance of what spatial element is contributing to the criminal events taking place at that particular hot spot.

For additional evidence, visual observations were explored to illustrate the element in the human perspective. This process was performed using Google Earth software and street view functions. The hot spots identified with the criteria mention in the earlier portion of this research explored for analysis purposes. The aerial imagery as well as street view panoramic photographs provides the researcher with a quick look and documentation of spatial issues that may contribute to the criminal activity. Madden suggest “that when you observe a space, you learn how it is used rather than how you think it is used; observation enables you to quantify what would otherwise be regarded as intuition or opinion” (Madden, 2000). The integration of observations and the photographs analysis allows the researcher to collectively evaluate the patterns of the environment and their contextual relationship to crime. This step of the research displays a closer look at the hotspots and their spatial context. The street view images are found to be an effective

tool to study space configuration and how the element areas may be susceptible to criminal incidents.

3.5 GIS Component

The Geographic Information Systems (GIS) component primary function is to calculate the positioned hotspots from the spatial elements. A statistical quantitative approach using varies elements listed above. The formats in which the files are obtained from the Dallas Police Department (DPD) database are shape files. The inventory data when calculated illustrates a number of coordinates on a site map that has an embodied description with all the specifics. Due to the scope of this study the particular land use categories are described as commercial, multi-family, and parks. The GIS component allows for precise identified events. GIS is used for the site inventory and analysis; the inventory is based from the address, time, and type of crimes from the Dallas Police Department (DPD, 2013). The information is gathered and formatted into a digital graphic for interpretation. This information is integrated to identify hotspot areas at the TODT's.

The general procedure used in the GIS software is as follows:

1. Crime and geospatial data acquisition
2. District inventory, analysis, and mapping
3. Examine and assess the relationship of crime data points with various land use and environmental elements
4. Aerial observations and documentation through aerial maps on selected crime clusters/hot spots

3.6 Research Design

Providing design and planning professionals with the performance of built environment is essential part of design and planning research. The research is designed to study the location and the level of criminal activity taking place in the Transit Oriented Districts (TODT) of the City of Dallas by using empirical methods and GIS tools. This research specifically concentrates on the identification and evaluation of spatial elements where crime occurs in order to inform future planning and design decisions.

This research provides a unique in depth review as well as set of examples regarding the spatial assessment of crime at TODT's in Dallas. The location, the type of crime, and the hot spots in all 41 TODT's are examined in the city of Dallas. It also documents some spatial commonalities of criminal activities in all stations. Finally, research focuses on observations on three hotspots in three different TODTs to study design details of those specific sites to have a more clear understanding of crime in its context.

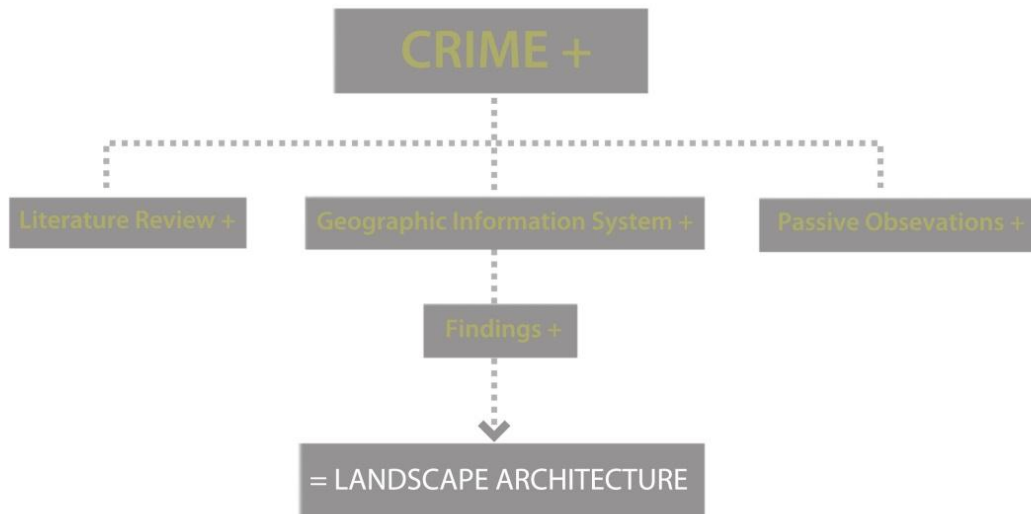


Figure 3.3 Research Design

This research examines all the TODT's in the boundaries of Dallas, the research compares and contrast some of the commonalties that are frequency observed. In this research, the multiple locations are used to format data, using basic department statistics and site location. By following the procedures highlighted above the research attempts to answer three questions: (1) what are the environmental commonalties (exterior elements) of the locations where crime occurs in Transit Oriented Districts (2) What type of crime and how much crime is occurring at Transit Oriented District (3) Where are the hot spots (crime clusters) located in TODT and how do they related to the physical environment? In the following chapter the results from the systematic procedures are revealed.

3.7 Delimitations

The City of Dallas, Texas was selected as the boundaries of this research due to data availability and site proximity for the researcher. Given that the crime data was attainable from the city of Dallas the DART light rail lines, station areas, and TODT's within the city boundaries were the focus of the research. The TODT's are depicted of ½ of a mile radius for study areas as individual cells. The radius is based on supporting literature that states that the ½ mile region is considered the furthest distance the typical pedestrian is willing to travel to a transit station. Although pedestrian shed function of the GIS software attempted to be used to define an area this tool found to be limited in further analysis and ½ radius is adopted as the framework to study crime and it spatial commonalties. Figure 3.4 below demonstrates the pedestrian shed which had complications in comparisons to the adopted ½ mile radius used in this research.

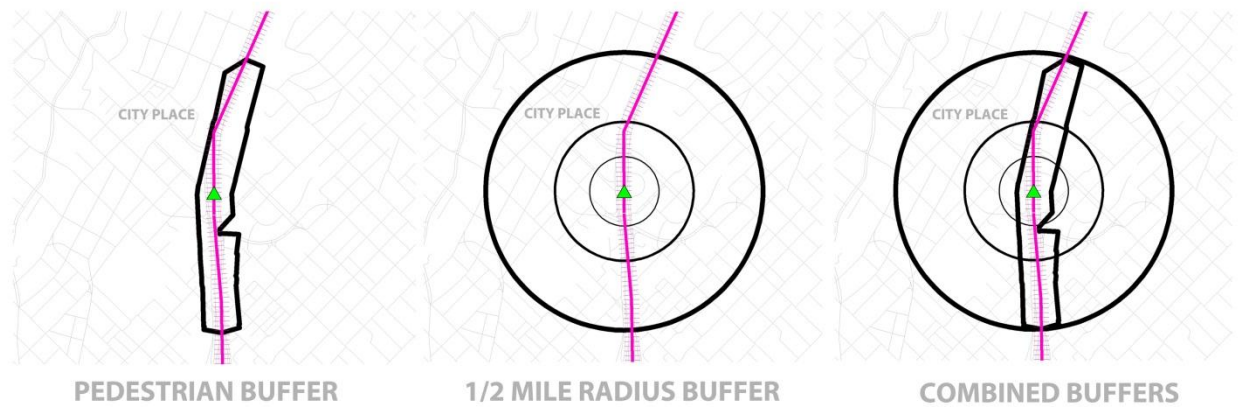


Figure 3.4 Pedestrian vs. 1/2 Radius Buffer

Only the criminal statistics within the buffer radius are assessed for each TODT in the city of Dallas. The City of Dallas crime statistics were collected between 2010-2012 and studied as a whole. The restrictions placed on this research are provided to obtain specific information and to help target the criminal patterns from the environmental elements.

3.8 Limitations

The assessment of TODT's has limitations, including: (1) the density of the North Texas region varies from other TOD's located in urban settings, (2) no two TOD's have identical site layouts, (3) site observation from online resources may be outdated, and (4) the statistics are created by organizations that potentially may have human or computer errors while formatting statistics providing an opportunity for discrepancy. However, in this study there's not enough

allocated time for secondary data to be reviewed. This research acknowledges these limitations for the inventory, site observations, and report findings.

3.9 Summary of Research Methods

The comprehensive and deductive nature of this research is set to systematically assess criminal activity and its spatial context within the city of Dallas TODT's. The research is design to identify hotspots/ crime clusters in order to effectively determine spatial commonalities for the intended design related users. Methodology is imperative in the process of evaluating criteria at this level of professional services. The chapter separates the major items contributed to the formulation of the overall objective.

This study identifies the spatial elements and patterns of the urban environment of TODT's that seem to impact criminal activity crime. The research is an attempt to identify spatial elements as contributor in some form. This research pinpoints which component is a leading factor related to the hot spots on the illustrated diagram. Landscape architecture is influential in forming methods that demonstrate techniques that can further enhance the welfare of society. The investigation of this thesis provides identification of crime types and hotspots. The next chapter explores the findings from this vantage point in greater detail.

CHAPTER 4

RESEARCH ANALYSIS AND FINDINGS

4.1 Overview of Research Methods

This chapter begins with an overview of the research methods used in this study. Then, findings from the of collection data procedures are provided. The analysis of crime data is demonstrated in the form of coordinate points to allow the user to have a clear visual of the incidents that take place within the Transit Oriented District (TODT). An overview of the findings from each contributing element is given within this chapter and the chapter concludes with a brief summary of the findings in relationship to urban environment.

4.2 Overview of the Findings for all Transit Oriented Districts

As it is explained in detail in the previous chapter data sets are primarily utilized; the systematic review of archival crime data for the city of Dallas, and the geospatial data accumulated from various sources (such as NCTCOG) to determine spatial commonalities of where crime occurs within TODT. Both data sets are prepared and inserted into Geographic information Systems (GIS) platform in order to study crime in relation to its spatial context. The analysis results are displayed in descriptive statistics and frequencies along with a series of maps and associated images to summarize the findings from the research. Additional observations are conducted through street view images as well as site visits on selected sites in order to better understand the specifics of the hotspots. An example of the spreadsheets that encompasses the crime data is seen in the latter parts of the findings, the spreadsheets breaks down the information into segments for comprehension. The site observations which are generated from online resources were made during the daylight hours of the recorded dates.

4.2.1 Crime Profile in TODTs

Crime counts examine the number of crime occurrences in each TODT and the combined TODT's for the city of Dallas. The statistical count provides comparison with the City of Dallas and surrounding municipalities that encompasses TODT's. The total number of crime is obtain from the DPD as an excel spreadsheet. The data was then modified, merged, and clipped within the TODT's radius for identifying the hotspots of within the district. Each TODT was studied separately and then all were studied as a whole. Understanding the amount of criminal occurrences is important for identifying targeted areas to focus crime prevention and for the overall process of this research. 11,994 criminal activities were able to be retrieved from the city of Dallas' Police Department online records between the years 2010 through 2012. 2,010 of these criminal activities occurred within ½ mile distance from the 41 stations in this research.

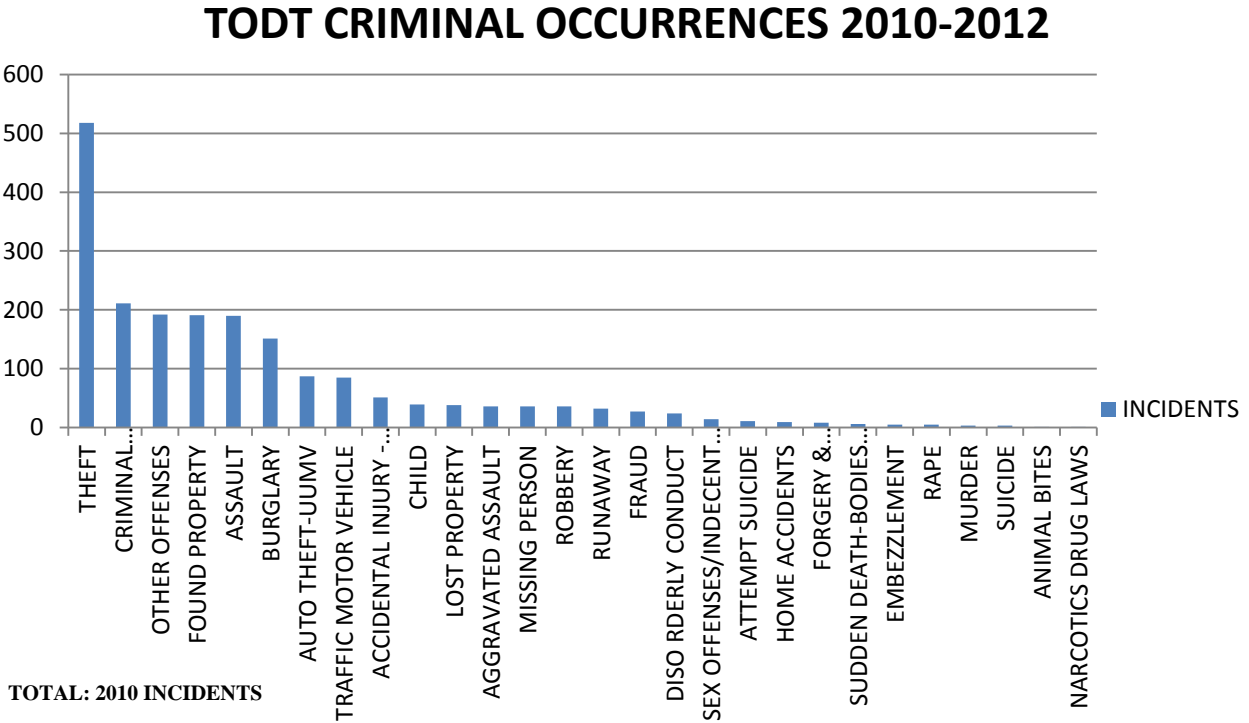


Table 4.1 Total TODT Criminal Occurrences

As it can be seen in table 4.1 above the two major criminal activities within the TODT's are (1) theft totaling 518 reported incidents and (2) criminal mischief / vandalism totaling in 211 reported incidents. One in four incidents is classified as a theft at TODT. In regards to this study, theft is the one of importance due to the focus of spatial environmental element contributing to criminal incidents. The image above displays the individual count of each categorized crime, a total of events, and a percentage formed from the total. 2,010 recorded incidents were obtained at the TODT from the calendar years of 2010 to 2012. The percentage break down range is close for the other crimes due to the short variances in the each category.

4.3 Overview of the Findings Regarding Land Uses and Spatial Features in all TODTs

First, the criminal activity in all forty transit oriented districts within the city boundaries of Dallas are identified and assessed (see figure 4.1 for City of Dallas TODTs). Each of the districts is assembled with land uses. This research primarily concentrated on the examination of; the parks, commercial uses, and multi-family uses, as well as specific uses such as rail lines, major street corridors, and water bodies and stream corridors to examine their relation to criminal activity in TODTs. These categories were determined by reviewing the previous literature in this type of research.

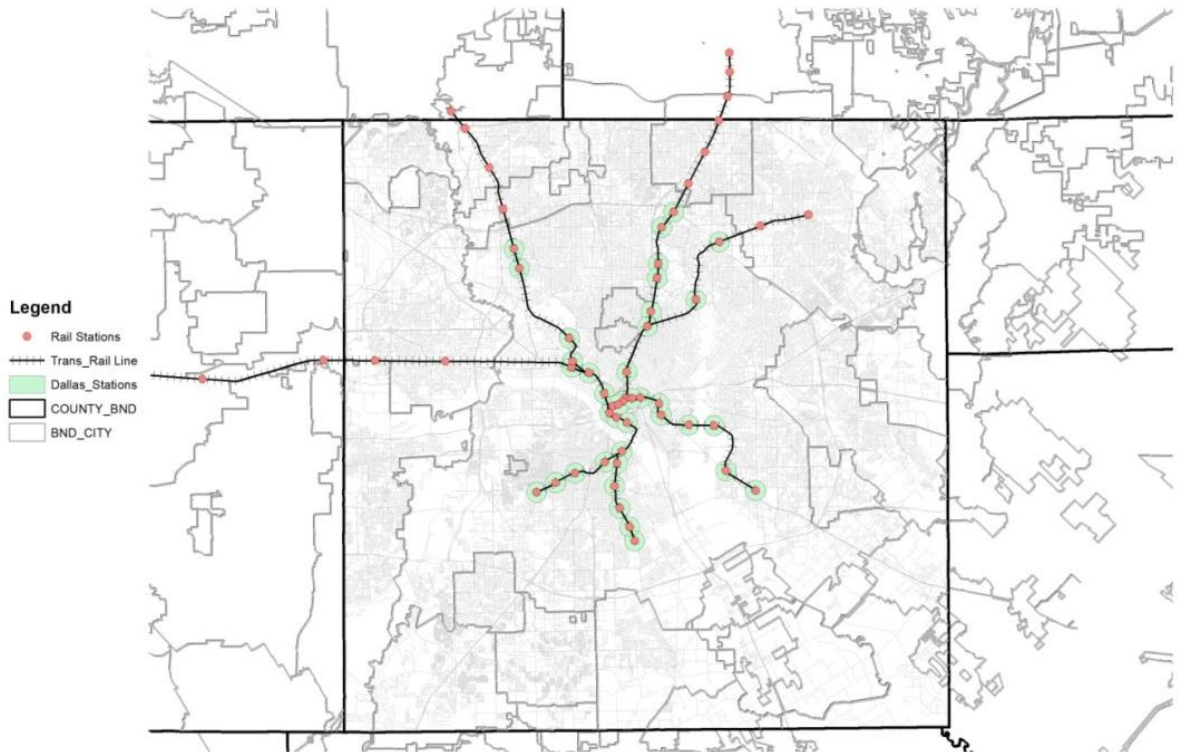


Figure 4.1 City of Dallas TODT

Findings of this research illustrates that commercial use was the primary land use where the location and the quantity of crime typically associated with followed by the multi-family uses, and the parks as the smallest in terms of location and quantity. An example of the randomly chosen study area with the incorporated elements is displayed in figure 4.1 for demonstration of the analysis process. The following section briefly explains each selected land uses as well as spatial features examined in the research.

4.3.1 Proximity to Parks

The parks reports the relationship found between the measured environmental element parks and the identified hotspots (crime clusters). Parks are considered a third place, a place where people go to relax, exercise, and enjoy gatherings. These areas are subject to criminal

events due to the spatial form. Each TODT either has a close relation to environmental parks or they are located in the same proximity of the hotspots. From the investigated data the average distance to park from hotspots in TODT is 697.97 feet. Figure 4.2 below provides an example of a TODT station (Mockingbird and Lovers Lane) that has a hotspot in close proximity to a park.



Figure 4.2 Mockingbird Lane Hotspots

4.3.2 Proximity to Flow Line

The flow line reports the relationship found between the measured environmental element flow line and the identified hotspots (crime clusters). Flow lines include rivers, streams, and creeks. The flow line consists of region that typically may have a setback area of floodplain. These regions have large vegetation and limited visibility. Flow line is located in every TODT; the flow of water is a natural process whether controlled by infrastructure or remaining in its pre-existing form. Ironically flow line typically has a relationship to parks and trails. These areas are also subject to criminal events due to the vegetation in native form. From the investigated data

the area average distance to flow lines from hotspots in TODT is 3202.84 feet ranking this element last among the selected studied components. The findings state that the average flow line is more than ½ a mile away from the identified hotspots in the TODT’s study area. The image below is an example of a selected TODT that has the close proximity of a crime cluster and a flow line. The example displayed is the Forest Lane rail station, the hotspot is directly on top of a flow line. This spatial element has some influence on the crime events taking place.

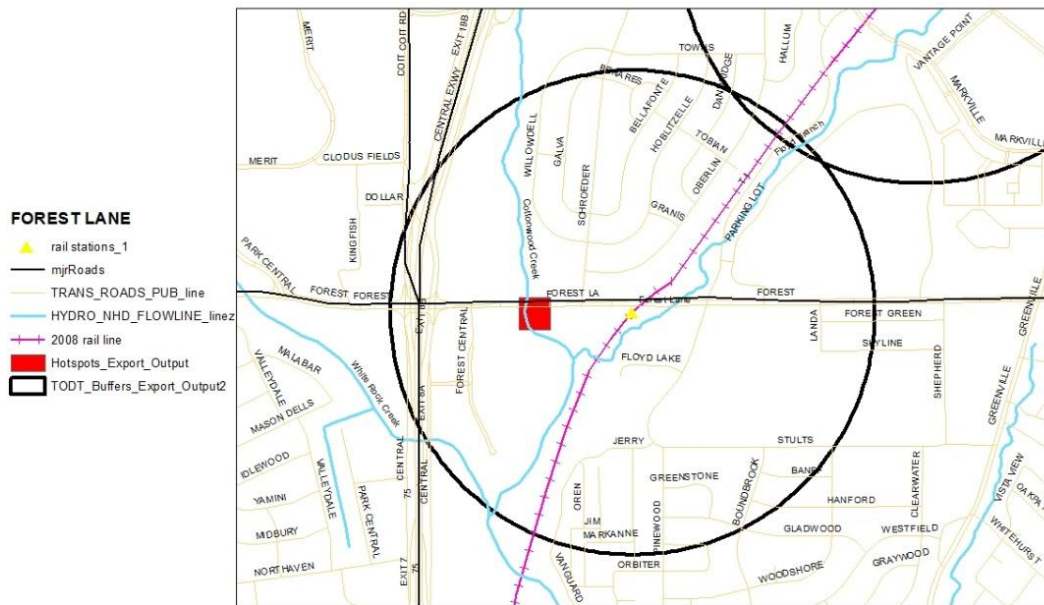


Figure 4.3 Forest Lane Hotspot Proximity to Flow Line

4.3.3 Proximity to Water Body

The water body reports the relationship found between the measured water body and the identified hotspots (crime clusters). The term water body is not the same thing as flow line; it does have similar characteristics due to hydrology. Water bodies are classified as lakes, ponds, and reservoirs. Like flow lines, water bodies contain floodplain regions and have sector that

contain mass of vegetation areas. Water bodies are subject to criminal activity. These areas are also subject to criminal events due to the spatial elements. From the investigated data the area average distance to water bodies from hotspots in TODT is 2,836.90 feet ranking this element seventh out of the eight selected factors. Figure 4.4 below is an example of a selected TODT that has the closest proximity to a hotspot/ crime cluster.

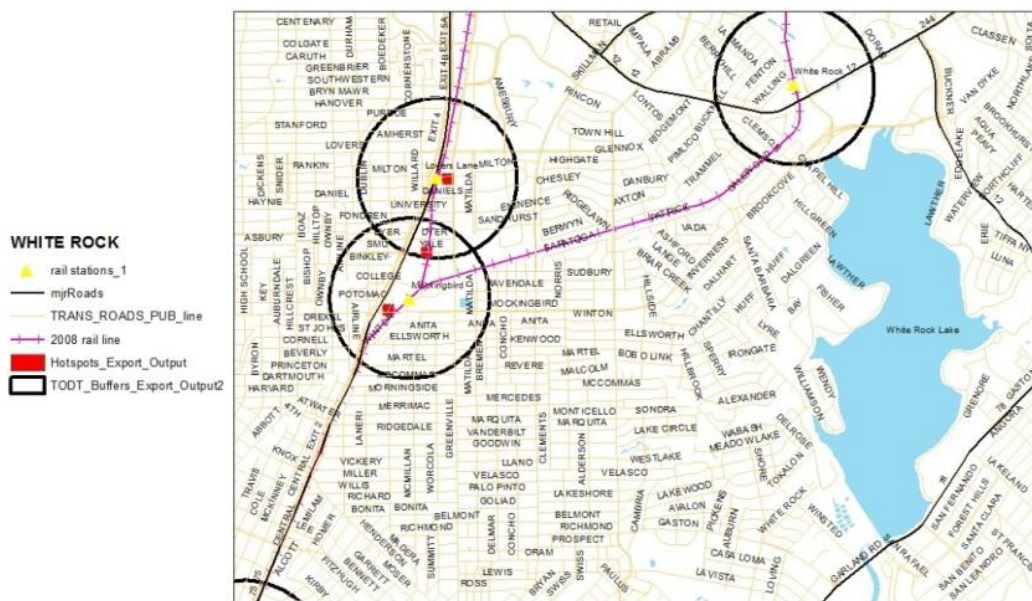


Figure 4.4 White Rock Hotspots Proximity to Water Bodies

4.3.4 Proximity to Rail Stations

The rail stations reports the relationship found between the measured environmental element, the centralized rail station and the identified hotspots (crime clusters). The term rail station for this thesis refers to DART light rail stops. These stations have formed districts that facilitate public transportation. The transit core is a topic of high interest when discussing TODT's. It is a place where users gather and either arrive or depart for a specific destination. There are many people and interactions can contribute to crime occurrences. The transit core and

its radius are defined as 1/8 of a mile. From the investigated data the area average distance to rail stations from hotspots in TODT is 1,109.49 feet ranking this element sixth out of the eight selected factors. Based from the collected data much of the recorded criminal is outside of the transit core. Figure 4.5 below is an example of a selected TODT that has close hotspot proximity to a rail station.

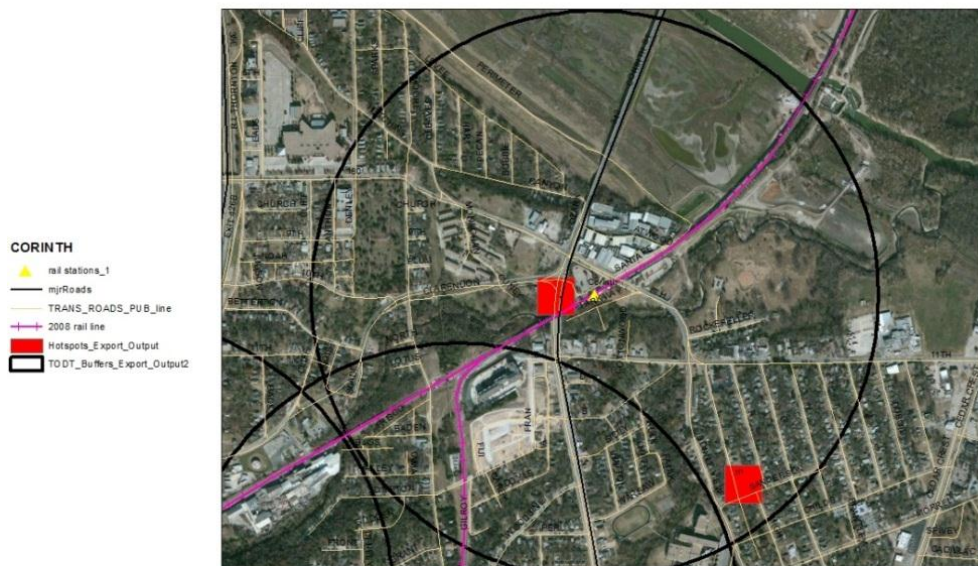


Figure 4.5 Corinth Hotspots

4.3.5 Proximity to Rail Line

The rail line section reports the relationship found between the rail line and the identified hotspots (crime clusters). The rail line is different than the rail station, the rail line consist of the tracks and the setback along the tracks. The rail lines analysis in this study are from the DART rail system. The rail line is similar to a public road; the difference is that typically rail lines are buffered to provide a sound wall and for aesthetic purposes. Due to these design factors rail lines also can be subject to criminal events. From the investigated data the average distance to rail

lines from hotspots in TODT is 817.78 feet ranking this element fourth out of the eight selected factors. Surprisingly the rail line has more occurrences of crime then the actual rail station.

Figure 4.6 below is an example of a selected TODT that has a hotspot in close proximity to the rail line.

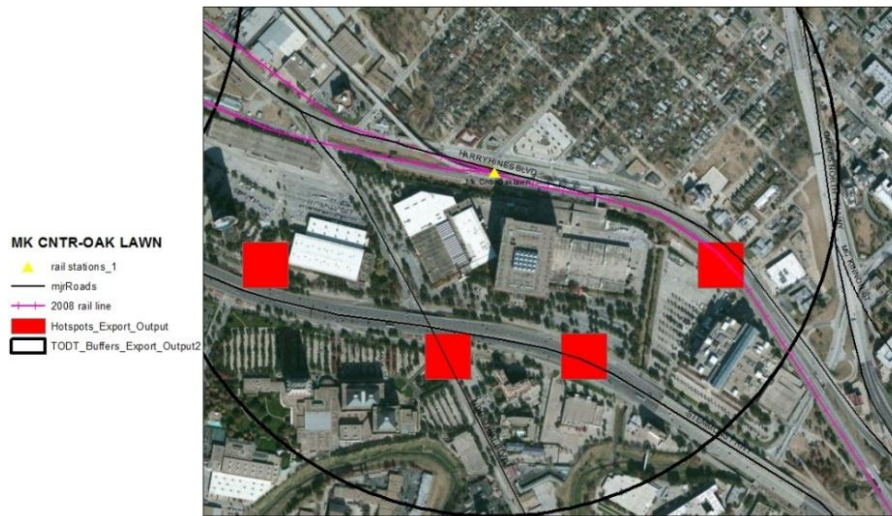


Figure 4.6 Market Center- Oak Lawn Hotspots

4.3.6 Proximity to Major Roads

The major roads reports the relationship found the major roads and the identified hotspots (crime clusters). The major roads are high traffic corridors that consist of great number of users at all times of the day. Major roads have a direct relationship to land uses such as commercial and multi-family. These roads are also subject to pedestrians walking and cycling to destinations. The major roads were provided from the NTCOG database. The selected hotspots that were identified along major roads were use in this research. Major roads encompass elements such as shopping, dining, and leisure. All these factors play part in crime occurrences. Major roads are similar to rail lines. From the investigated data the average distance to major roads from hotspots

in TODT is 984.07 feet ranking this element fifth out of the eight selected factors. Figure 4.7 below is an example of a selected TODT that has hotspots in close proximity to the major road located within the district.



Figure 4.7 Kiest Veterans Hospital Hotspots

4.3.7 Proximity to Commercial Land Use

The commercial land use section reports the relationship found between commercial land use and the identified hotspots (crime clusters). Commercial land use includes several types of entities, activities example (shops, offices, theaters, restaurants, and etc.). It is recorded that on average a city's make-up consists of about 5% commercial land use. Even though these commercial regions only amount to a small portion of the designated land types, commercial land use typically contain the most occurrences of criminal activity. This is related to the type of business associated with the land use. These businesses have goods and bring large amounts of

money in and out of the sector. This provides opportunities for criminal to take advantage of users. Land designated as a commercial area is usually located on a major public road, this provides similar results as the major road element due to the direct connection. These areas are subject to criminal events due not so much the spatial elements by the designated spatial land use. Each TODT either has a close relation to commercial land use or it's located in the same proximity of the hotspots. From the investigated data the average distance from commercial land use to the hotspots in TODT is 68.65 feet, this ranks first among the selected elements in regards to proximity to the associated crime hotspots. Figure 4.8 below provides an example of a TODT's station that has hotspots in close proximity to a commercial land use. Each of the three hotspot region are directly surrounded by commercial land use, this example provides the user with an understanding of how criminal occurrences are portrayed in regards to commercial land use. There are many TODT's with similar commonalities as City Place.

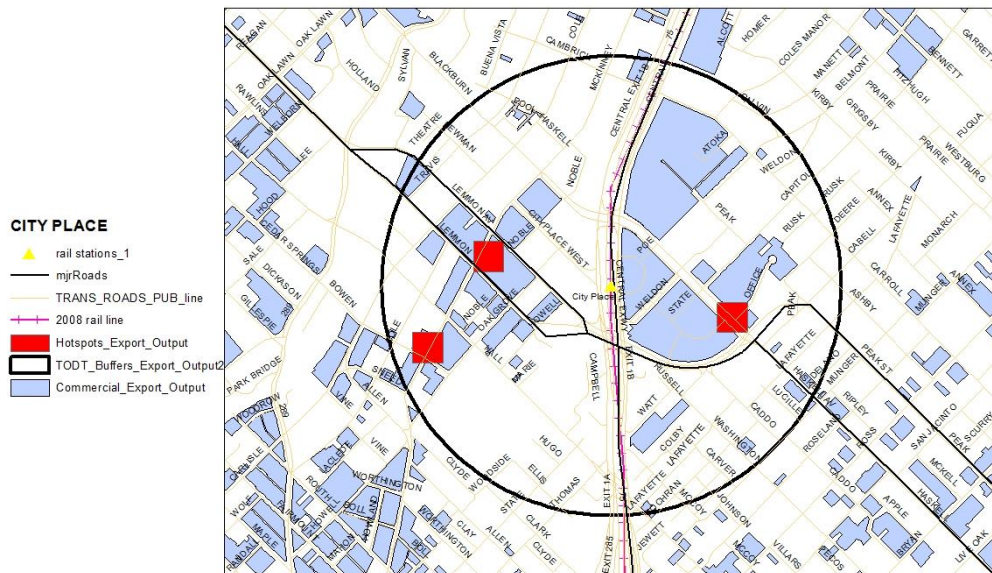


Figure 4.8 City Place Commercial Land Use Proximity to Hotspots

4.3.8 Proximity to Multi-Family Land Use

The multi-family land use section reports the relationship found between the measures the multi-family land use and the identified hotspots (crime clusters). Multi-family land use includes several types of residential forms such as duplex, townhouse, apartment building, and mixed-use buildings. Multi-family sector consist of higher density due to the number of units in such a small proximity of each other. The most common is an apartment building. This land use element consists of intentional communities a termed defined as a high degree of social cohesion and teamwork. These members consist of a diverse make up of social, political, religious, and lifestyle. Some of designated multi-family land use contains of a combination of commercial land use, this is defined as the mixed-use. Multi-family land use has similarities as commercial due to the high population, location, and the mixed-use combination. The similarities also result in criminal occurrences, the major differences is the fact that humans reside in multi-family land use where commercial land use is subject to business hours. The formation of the spatial make-up of the multi-family is an important factor to recognize and the environmental elements associated to the location. These areas are subject to criminal events due not so much the spatial elements by the designated spatial land use. From the investigated data the average distance from multi-family land use to hotspots in TODT is 332.59 feet, this ranks second among the selected elements in regards to vicinity of the associated crime hotspots. Figure 4.9 below provides an example of a TODT's station that has hotspots in close proximity to a multi-family land use. Each of the four hotspots or crime cluster regions are in close vicinity of multi-family land use, this example provides the user with an understanding of how criminal occurrences are portrayed in regards to multi-family land use. The great concentration of multi-family located east of the

centralized rail station indicates that the factors associated with this particular land use correlate to the occurrences of criminal events. The spatial examination is imperative in first recognizing the targeted areas. This is example of Park Lane, a mixed-use area that provides users with recognition of the identified crime sectors.

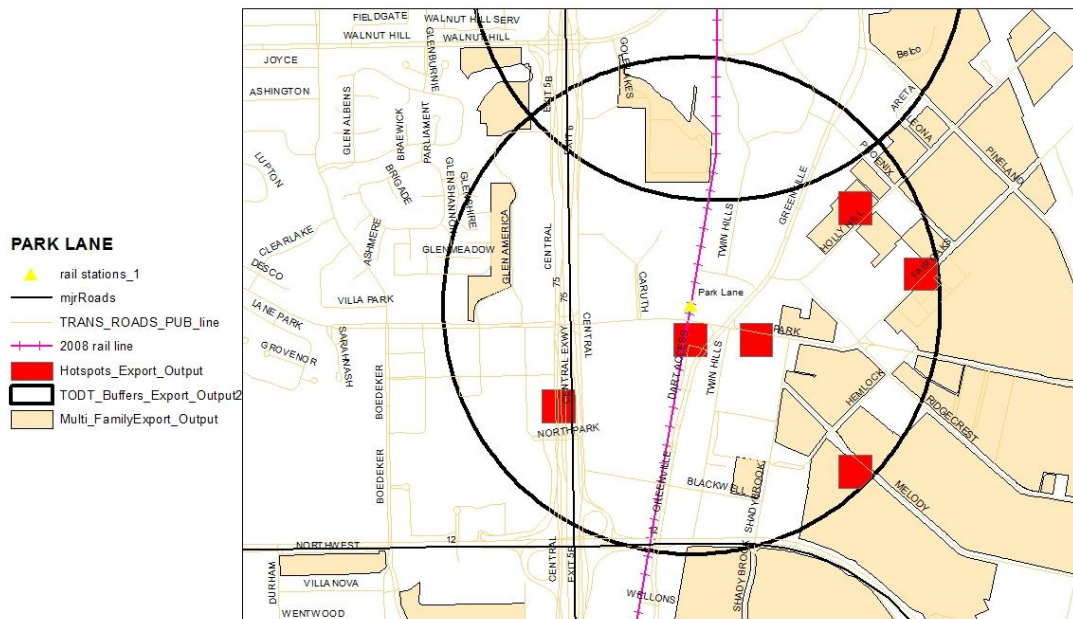


Figure 4.9 Park Lane Multi-Family Land Use Proximity to Hotspots

4.4 Summary of the Findings from Land Uses and Spatial Features

The integration of each variable resulted in unique findings. Each variable has micro spatial elements or actual physical elements that contribute to the occurrences of crime in the hotspots of TODT's. This research provides the overall spatial assessment of the environmental commonalities taking place with a designated buffer zone. The information taken from the process is that the particular land use is the predominantly influential factors of the identified hotspots. Occurrences surrounding natural elements such as creek, ponds, and floodplain regions

are on the lower end of recorded data. The process also leads to the determination of similar characteristics from element to element; for example commercial, multi-family and major roads are typically intertwined resulting in closer comparison in the findings. The major separation from the variable when measured was the consistency, for example there were hotspots that had a direct relation to a flow line or water body the difference is that there wasn't a high number of occurrences as a whole resulting in a greater gap of average distances. In contrast the investigated variable (commercial land use) was more apparent in a close vicinity of the identified hotspots resulting in shorter average distance. Pinpointing the distance provides the users with a vicinity of where associated crime is susceptible to occur. If one knows that theft occurs more frequency in the ¼ radius range, alterations can be made. Table 4.2 portrayed below is the breakdown of each variable in a chart format.

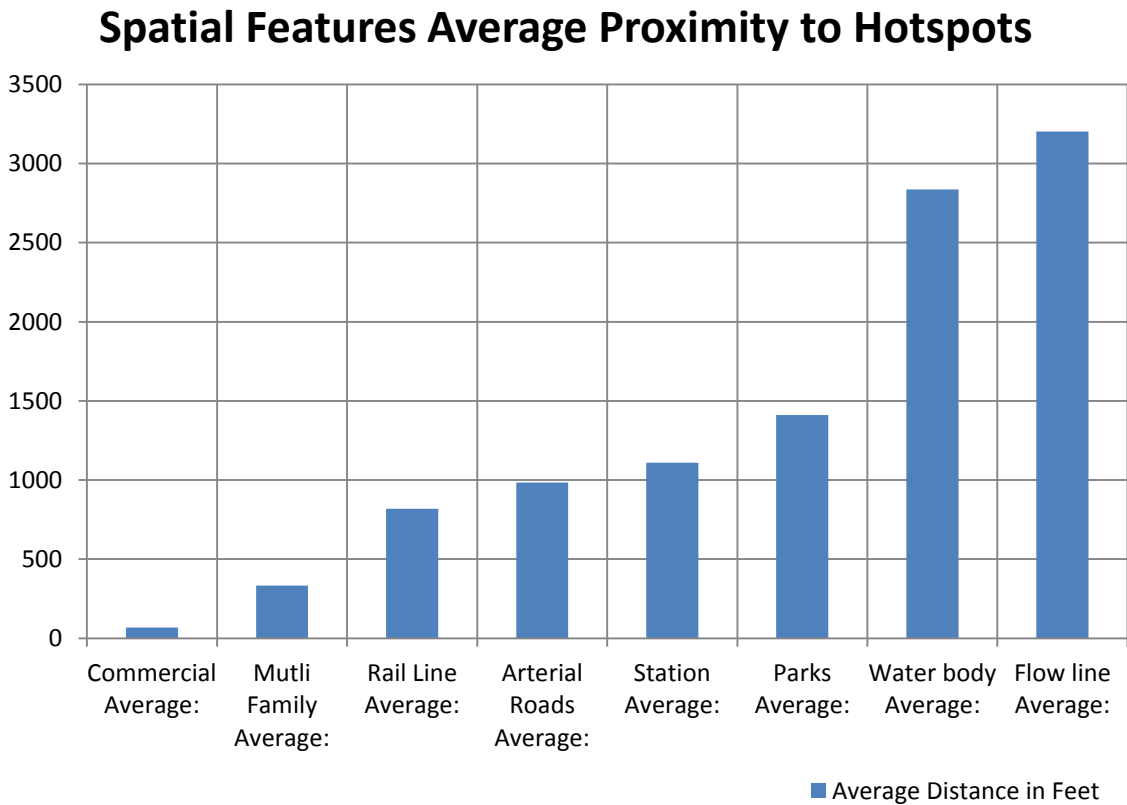


Table 4.2 Proximity to Hotspots

4.5 Selected TODT's for Detailed Observations

The following section investigates the three selected TODT for detailed site review. They are located in Mockingbird Station, City Place, and West End and their transit oriented districts (see figure 4.10 to view them in the city context). They are selected based on the frequency of the criminal activity as well as their urban context as major pedestrian environment within the city of Dallas. The purpose of this examination was not for comparison but for identifying spatial elements and patterns from the hotspots / crime clusters. Statistical information is provided for evidence of criminal incidents that have taken place at the TODT within the three years span (2010- 2012 crime data). Site imagery is exhibited for illustration spatial makeup and to show occurrences in the pedestrian environment. The procedures of post-occupancy evaluation from (Marcus and Francis, 1998) are demonstrated for passive observations. Magnified aerial photographs from GIS and site observations resulting in panoramic photographs contribute to the findings for this study, pinpointing patterns, and identifying character at hotspots.



Figure 4.10 Selected TODT

4.6 City Place

City Place is located in the uptown area in the city of Dallas. At all times of the day there are large number of users in this districts, this is due its vicinity to the CBD and a mixtures of hundreds of amenities that accommodate multiple age groups. This provides opportunity for criminal activity. Table 4.3 below illustrates the criminal events recorded in the past three years.

CRIME TYPE	OCCURRENCES	PERCENTAGE
THEFT	39	48.15
CRIMINAL MISCHIEF/VANDALISM	6	7.41
OTHER OFFENSES	6	7.41
FORGERY & COUNTERFEITING	1	1.23
LOST PROPERTY	1	1.23
TRAFFIC MOTOR VEHICLE	5	6.17
MISSING PERSON	1	1.23
ASSAULT	5	6.17
BURGLARY	4	4.94
AUTO THEFT-UUMV	2	2.47
CHILD	1	1.23
ROBBERY	1	1.23
ATTEMPT SUICIDE	1	1.23
ACCIDENTAL INJURY - PUBLIC PROPERTY	1	1.23
FOUND PROPERTY	4	4.94
RAPE	1	1.23
RUNAWAY	1	1.23
DISORDERLY CONDUCT	1	1.23
TOTAL:	81	100.00

Table 4.3 City Place Criminal Statistics

As seen in figure 4.11 below provides an overview of the criminal events, hotspots, and radius zones. The aerial image portrays multiple clusters of buildings resembling multi-family. Examining the positioned hotspots and lead to findings about the spatial environment.

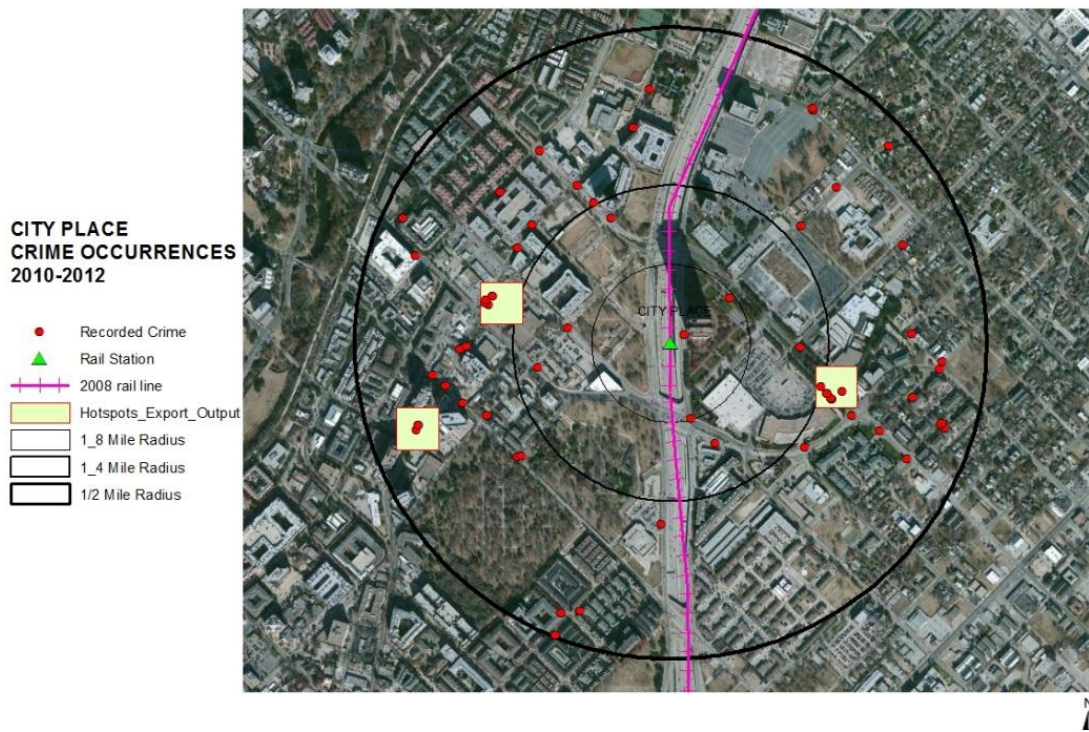


Figure 4.11 City Place Crime Occurrences

Enlarged aerial images of the identified hotspots are depicted in both figures 4.12 and 4.14 below. The hotspots are both along major arterial roads. Based from the aerial examination the Haskell Avenue, the hotspot has large vegetation that could potentially create shaded and hidden spaces in the spatial surroundings. Noted the hotspot in this district is also next to a large parking lot near a Target store, which is a national commercial merchandiser.

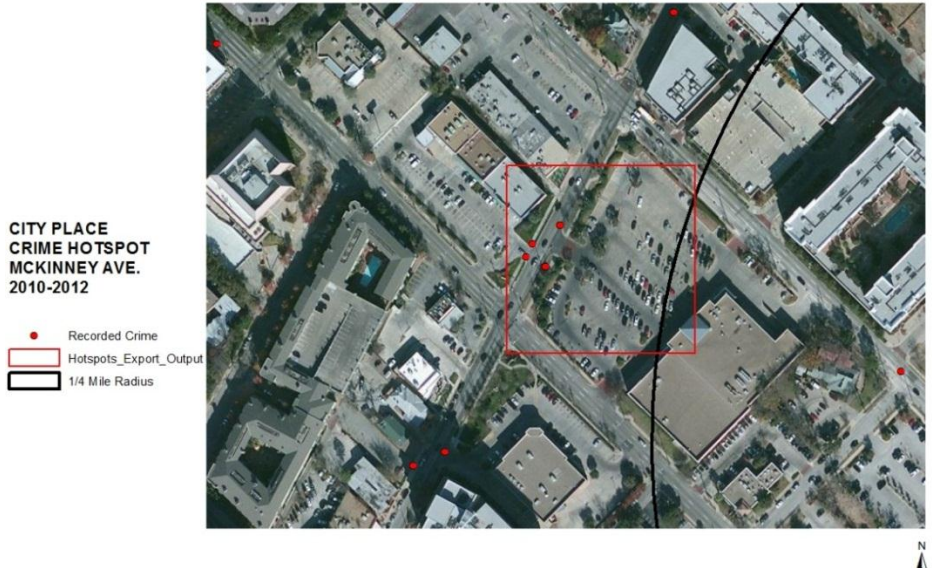


Figure 4.12 City Place Enlarged Hotspots (McKinney Ave.)



Figure 4.13 City Place Enlarged Hotspots (McKinney Ave. #2)

McKinney Avenue is known for its mixed-use, incorporating elements of retail, office, and multi-family living. The hotspot is located near the intersection, with crossing street

Lemmon Avenue. The hotspot is surrounded by a major grocery store and restaurants, the onsite observation provide evidence of physical feature that contribute to the influence of criminal occurrences. Further exploration of the site through the figure 4.14 predominantly unveils the amount of open space and the vegetated street corridor in the area.

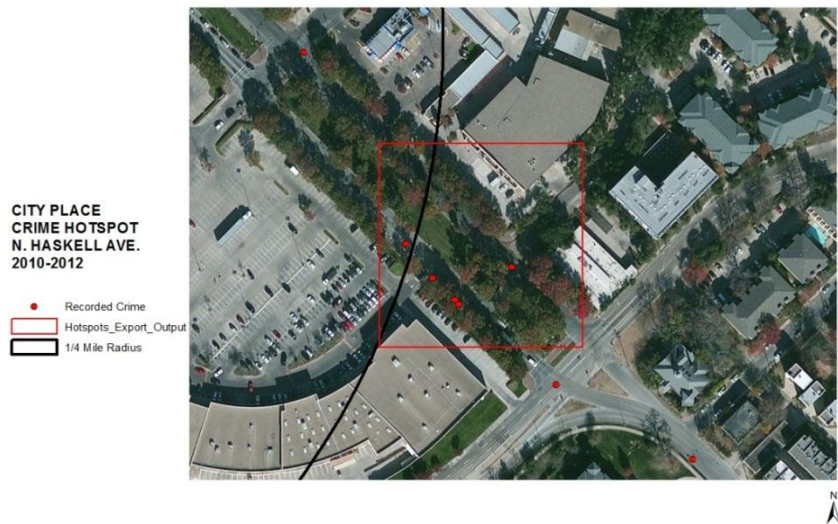


Figure 4.14 City Place Enlarged Hotspots (N. Haskell Ave.)

The land use provided from NCTCOG shows a wide range of designated spaces. Figure 4.15 consists of the overall land use for the City Place. The image is displayed to pinpoint the connection of the hotspots and the land use. The three hotspots are surrounded by commercial and multi-family land use.

**CITY PLACE
CRIME HOTSPOTS / LAND-USE
2010-2012**

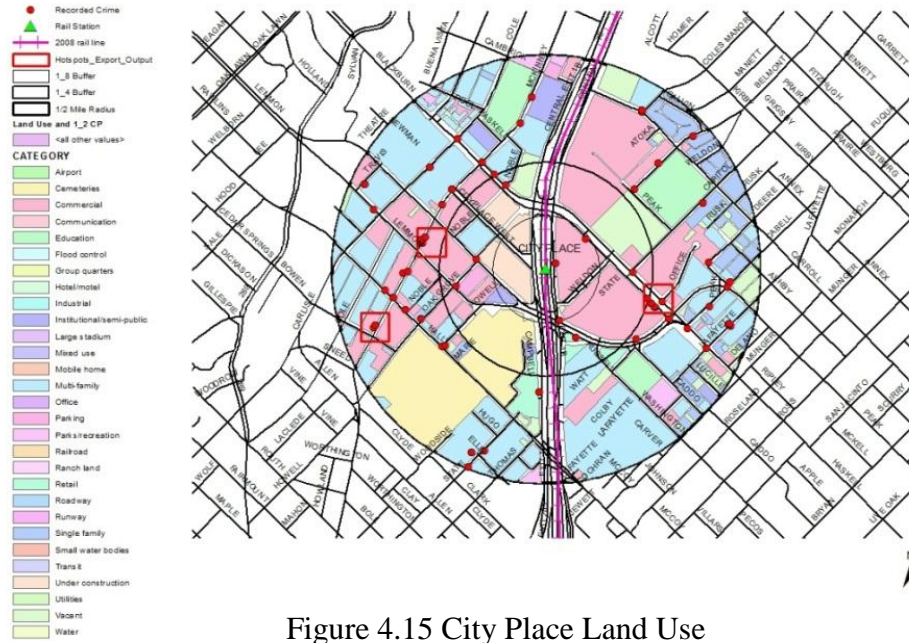


Figure 4.15 City Place Land Use

Examination of the location of the criminal activities reveals that ninety percent of the occurrences take place near commercial land use. The remaining ten percent of occurrences are near multi-family or parks. Figure 4.16, 4.17, and 4.18 below further illustrate the proximity of hotspots and land use at City Place.

**CITY PLACE
COMMERCIAL LAND-USE**



Figure 4.16 City Place Commercial Land Use

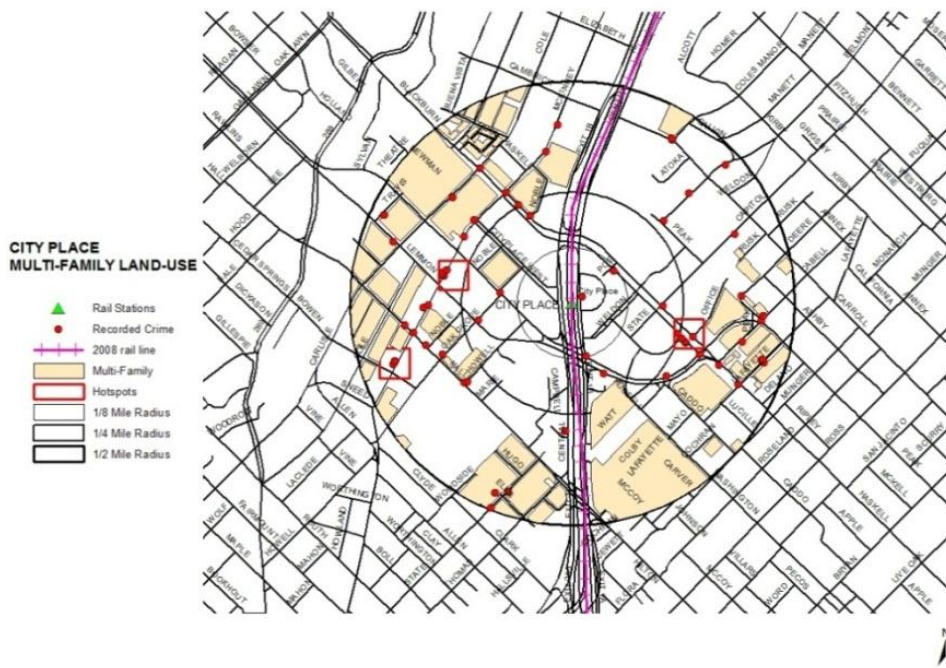


Figure 4.17 City Place Multi- Family Land Use

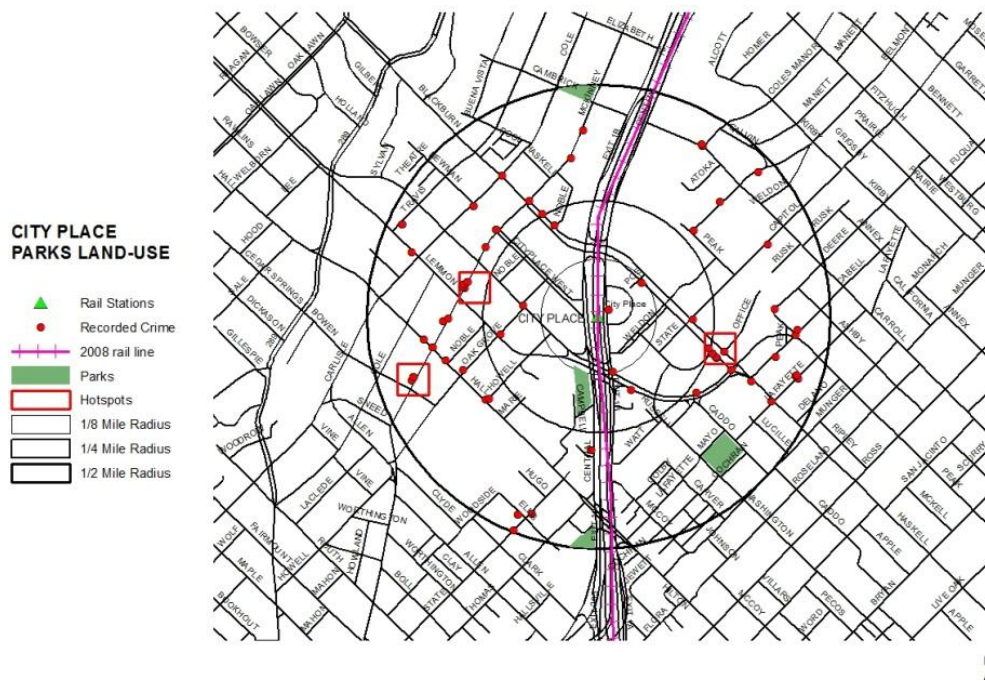


Figure 4.18 City Place Parks Land Use

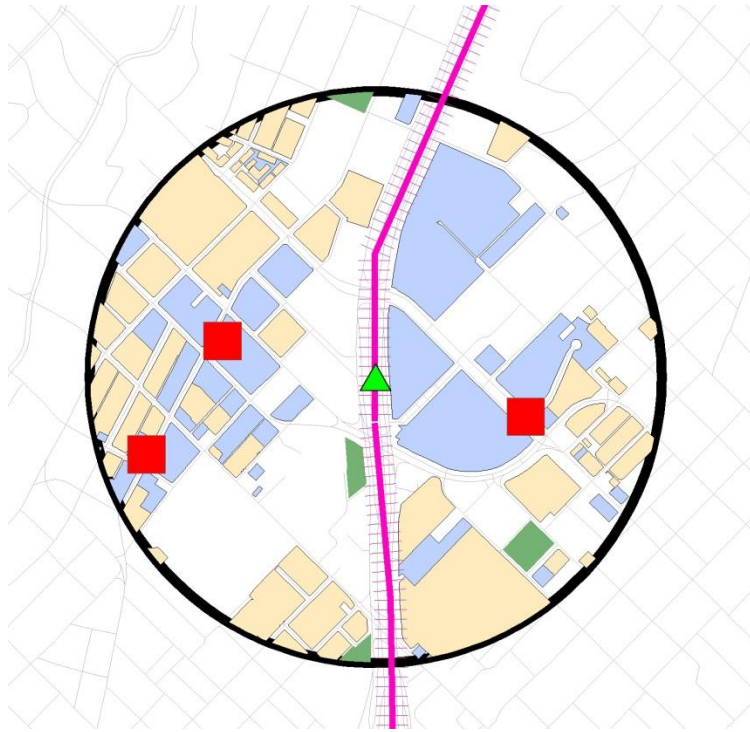


Figure 4.19 City Place Combined Selected Land Uses

Site observations provide true spatial evidence of the patterns. The city of Dallas Police Department data reveals that City Place is dominated by criminal theft as oppose to other criminal activities. The specific observations suggest that theft usually seems to take place near commercial land use. The review of the data further illustrates that the hotspots in this district are surrounded in all directions by commercial-land use and each is located on a major corridor suggesting that such area may be prone to more criminal activity.

4.6.1 Mockingbird Station

Mockingbird Station is the first transit oriented development established in the sunbelt cities (Ozdil, et. al., 2012). It's comprised of various mixed of use and has been recognized in the literature as one of the successful TOD in North Texas. Although the development is referred positively the Mockingbird transit oriented district is prone to criminal activities as well. One of the hotspots for this TODT is located in the intersection of the vibrant shopping sector. The analyzed statistical crime data and the exploration of the districts provide the research with evidence of similarities from the district layout in relation to criminal incidents. The table 4.4 below illustrates the criminal events recorded in the past three years.

CRIME TYPE	OCCURRENCES	PERCENTAGE
THEFT	17	38.64
BURGLARY	7	15.91
CRIMINAL MISCHIEF/VANDALISM	4	9.09
OTHER OFFENSES	3	6.82
TRAFFIC MOTOR VEHICLE	2	4.55
NARCOTICS DRUG LAWS	2	4.55
AUTO THEFT-UUMV	2	4.55
LOST PROPERTY	2	4.55
ASSAULT	1	2.27
FOUND PROPERTY	1	2.27
FRAUD	1	2.27
RAPE	1	2.27
DISORDERLY CONDUCT	1	2.27
TOTAL:	44	100.00

Table 4.4 Mockingbird Station Criminal Statistics

The GIS tool generated two hotspots for Mockingbird TODT. The explored hotspot is located at the intersection of Mockingbird and North Central Expressway 75. The hotspot is located in an area with many variables. The area is surrounded by a shopping development, a major intersection that feeds into North Central Expressway 75 and has close proximity to the rail line.

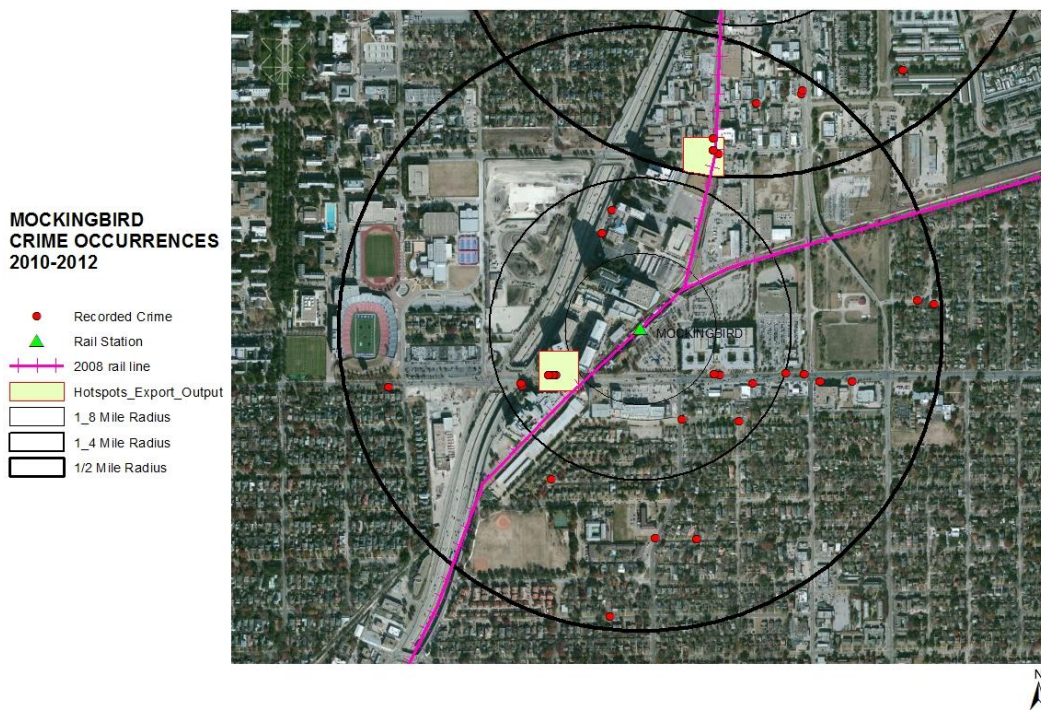


Figure 4.20 Mockingbird Crime Occurrences

An enlargement of the hotspot is provided in figure 4.21 for visibility of the surrounding elements. The hotspot aligns on a major shopping development entrance.

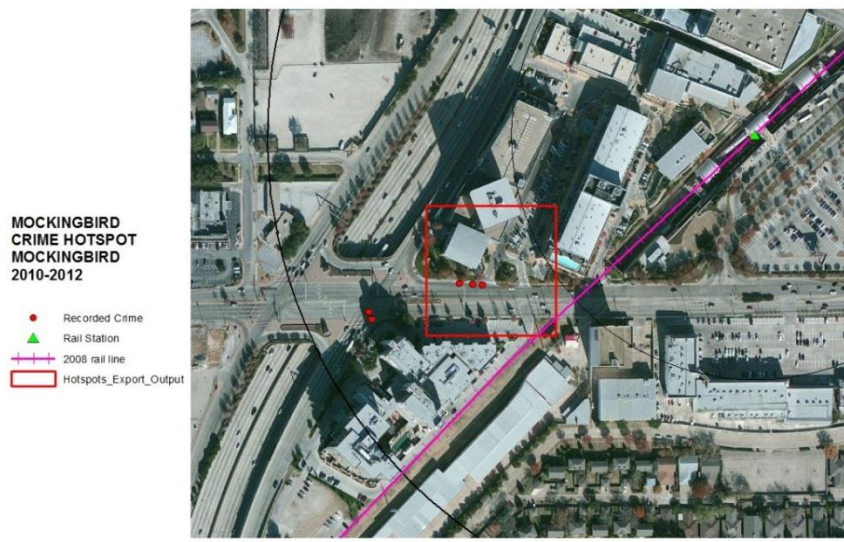


Figure 4.21 Mockingbird Enlarged Hotspot (Mockingbird Lane)

The second identified hotspot is located on the rail line and Yale Blvd. this hotspot yields for exploration due to the rail line in the vicinity. Figure 4.22 validates the commonalities.

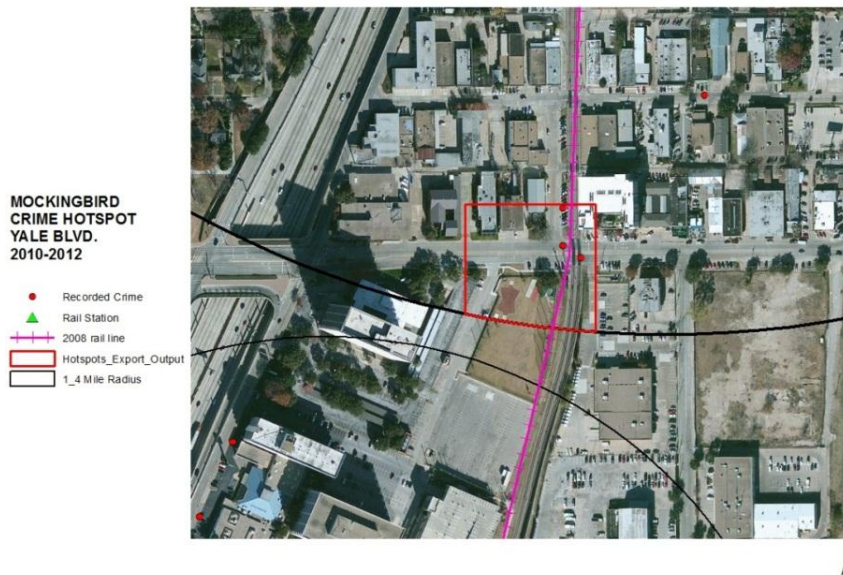


Figure 4.22 Mockingbird Enlarged Hotspot (Yale Blvd)

Mockingbird TODT like other TODT's located in the urban environment comprise of several land uses. The two hotspots displayed are located in multi-family and commercial. The

unique variable is that both are located in close range of the rail line. It is noted that the rail line doesn't reach ground level until it reaches the Mockingbird station.

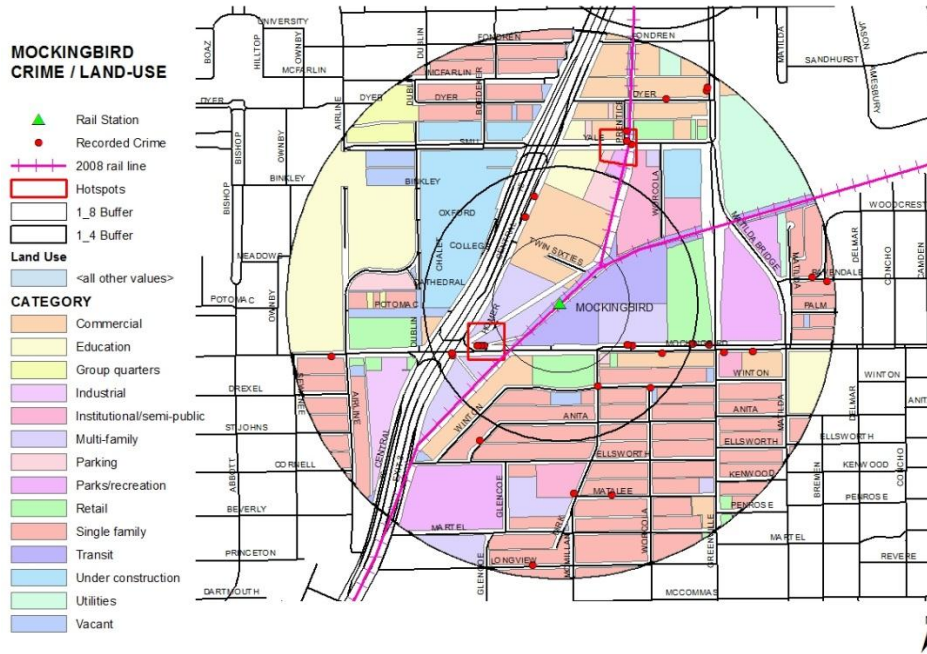


Figure 4.23 Mockingbird Land Use

This figure 4.23 is showing how the land use is arranged within the Mockingbird district. The transit station region is labeled as multi-family and transit. The crime that occurred in the specified time frame is allocated outside the 1/8 radius zone also called the transit core.

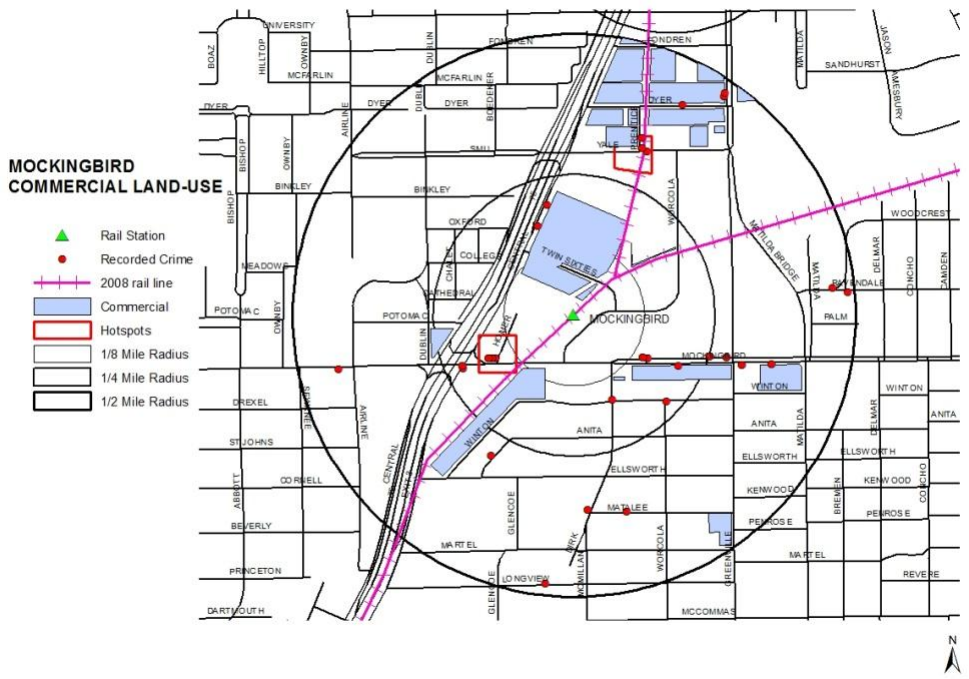


Figure 4.24 Mockingbird Commercial Land Use

Demonstrated is the land use separated to provide a visual of the predominantly contributing factor.

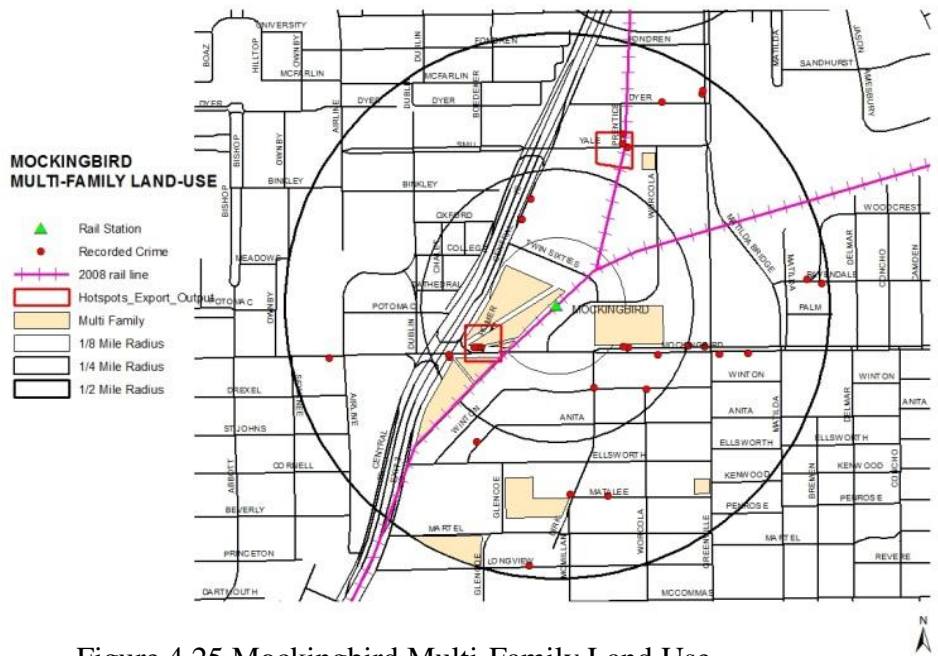


Figure 4.25 Mockingbird Multi-Family Land Use

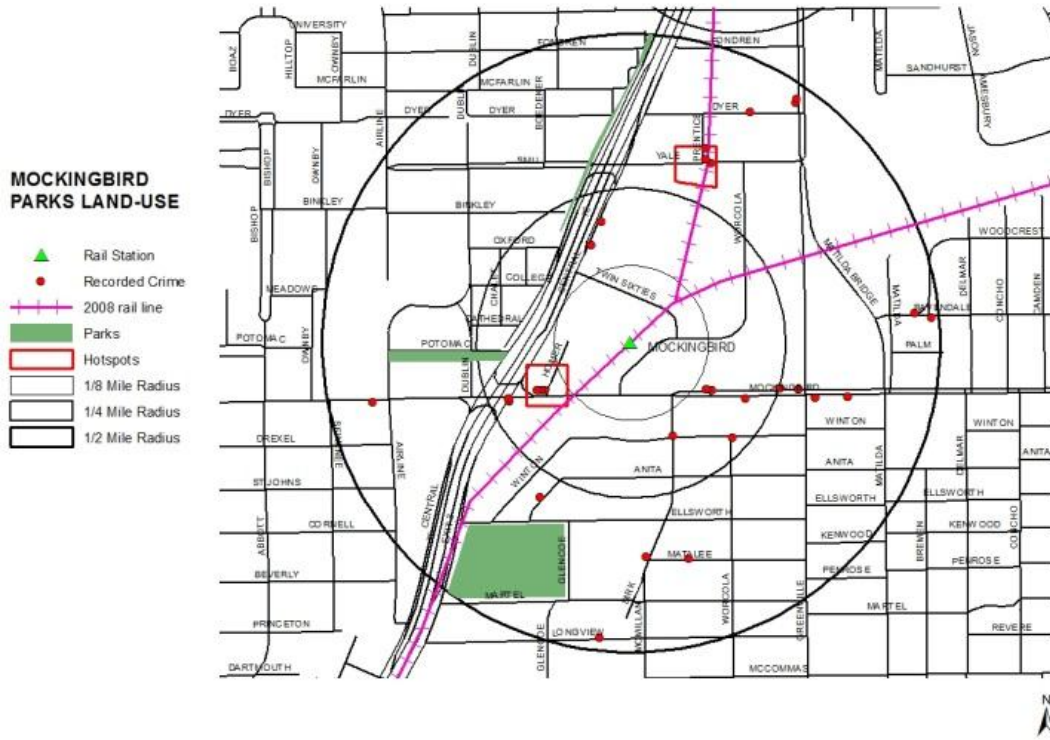


Figure 4.26 Mockingbird Parks Land Use

4.6.2 West End

The West End portion of the central business district is one of the vibrant areas in the city of Dallas. Due to its critical location in downtown and mixtures of amenities it provides the area is not only an employment center for the city but also destination for visitors. There are large numbers of pedestrian activity within this district. These qualities also seem to be one of the reasons for high number of criminal activities. The table below illustrates the criminal events recorded in the past three years.

CRIME TYPE	OCCURRENCES	PERCENTAGE
THEFT	58	34.32
FOUND PROPERTY	21	12.43
CRIMINAL MISCHIEF/VANDALISM	19	11.24
OTHER OFFENSES	13	7.69
ASSAULT	10	5.92
AUTO THEFT-UUMV	7	4.14
ACCIDENTAL INJURY – PUBLIC PROPERTY	7	4.14
TRAFFIC MOTOR VEHICLE	5	2.96
BURGLARY	5	2.96
MISSING PERSON	5	2.96
LOST PROPERTY	3	1.78
SEX OFFENSES/INDECENT CONDUCT	3	1.78
CHILD	3	1.78
AGGRAVATED ASSAULT	2	1.18
EMBEZZLEMENT	1	0.59
RUNAWAY	1	0.59
ROBBERY	1	0.59
HOME ACCIDENTS	1	0.59
FRAUD	1	0.59
SUICIDE	1	0.59
DISORDERLY CONDUCT	1	0.59
FORGERY & COUNTERFEITING	1	0.59
TOTAL:	169	100.00

Table 4.5 West End Criminal Statistics

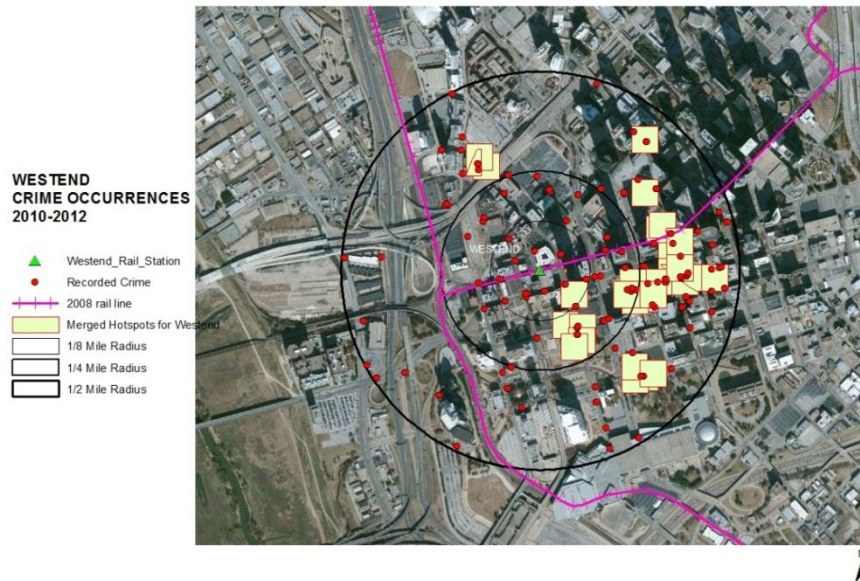


Figure 4.27 West End Crime Occurrences

Aerial imagery is provided above illustrates the frequency of the criminal activities taking place in this district. The West End district is surrounded by skyscrapers also associated with building height in regards to this study. The structures height potentially provides opportunities for criminal activities, but this research excludes the height and focuses on the pedestrian realm of the downtown transit district.



Figure 4.28 West End Enlarged Hotspots

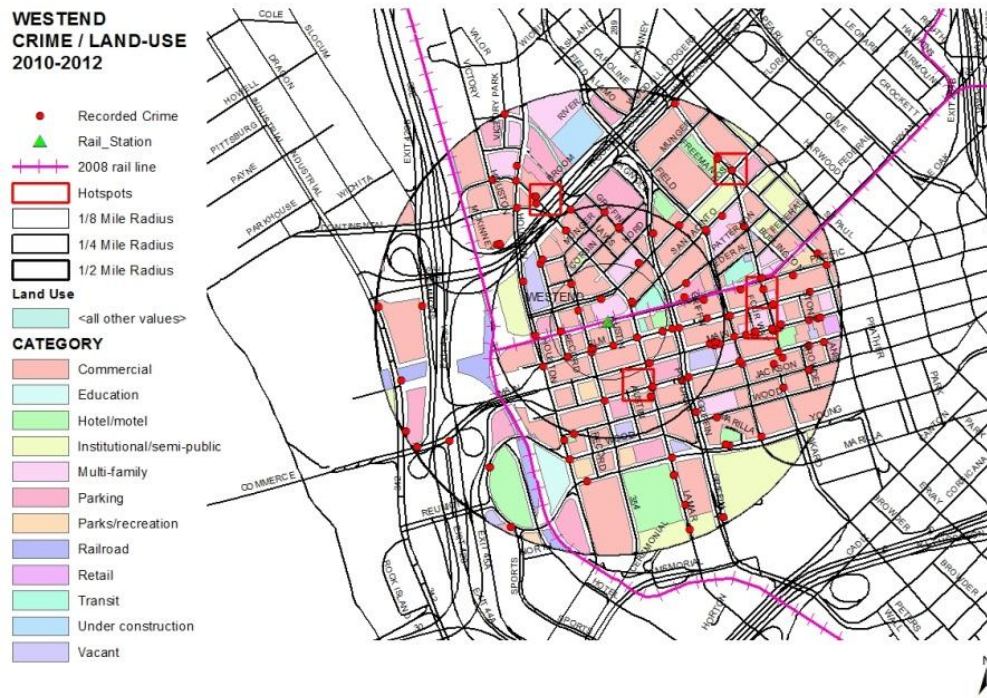


Figure 4.29 West End Land Use

The West End is impacted by high population that can result into criminal mischief. One of the identified hotspots is at Akard and Main Street. The aerial images and observation in this particular case seem to suggest that the plaza to the southwest is one of contributing spatial element in crime occurrences. The plaza is an open space with mature vegetation all characteristics that provide opportunity for crime. Appendix A (Akard St. and Main St.) provides panoramic imagery used to study the spatial attributes of this hotspot.

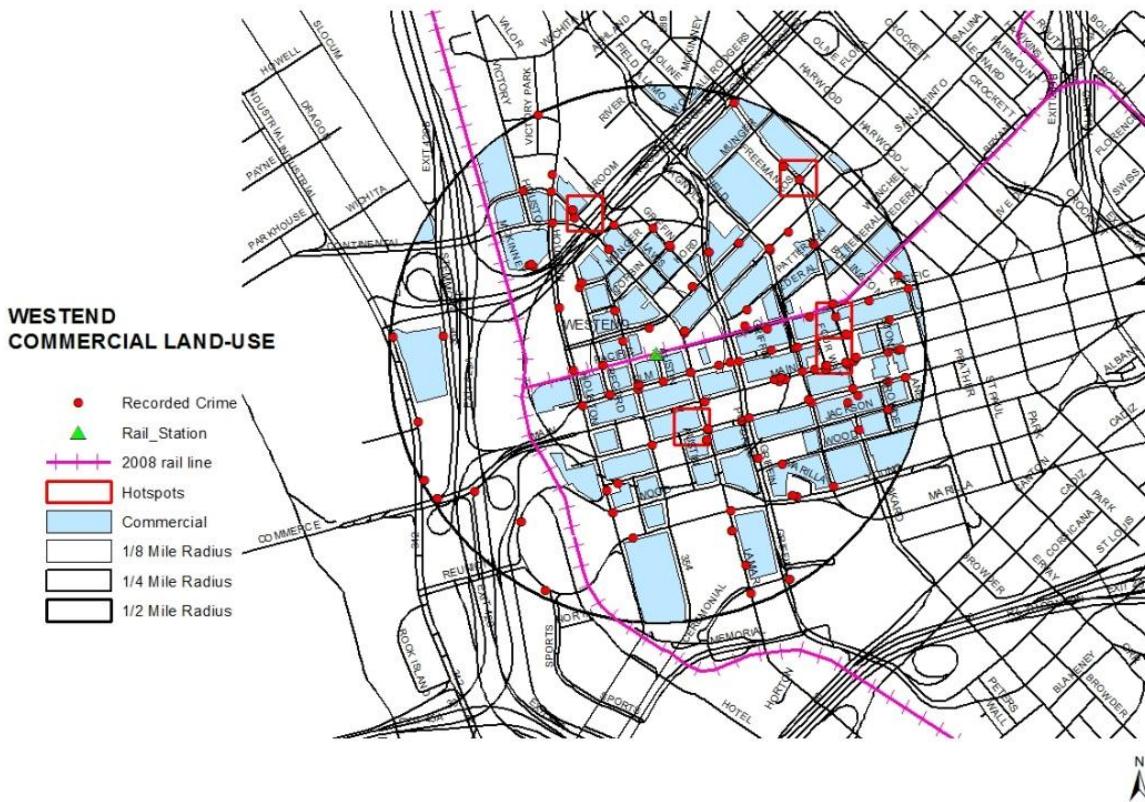


Figure 4.30 West End Commercial Land Use



Figure 4.31 West End Multi-Family Land Use

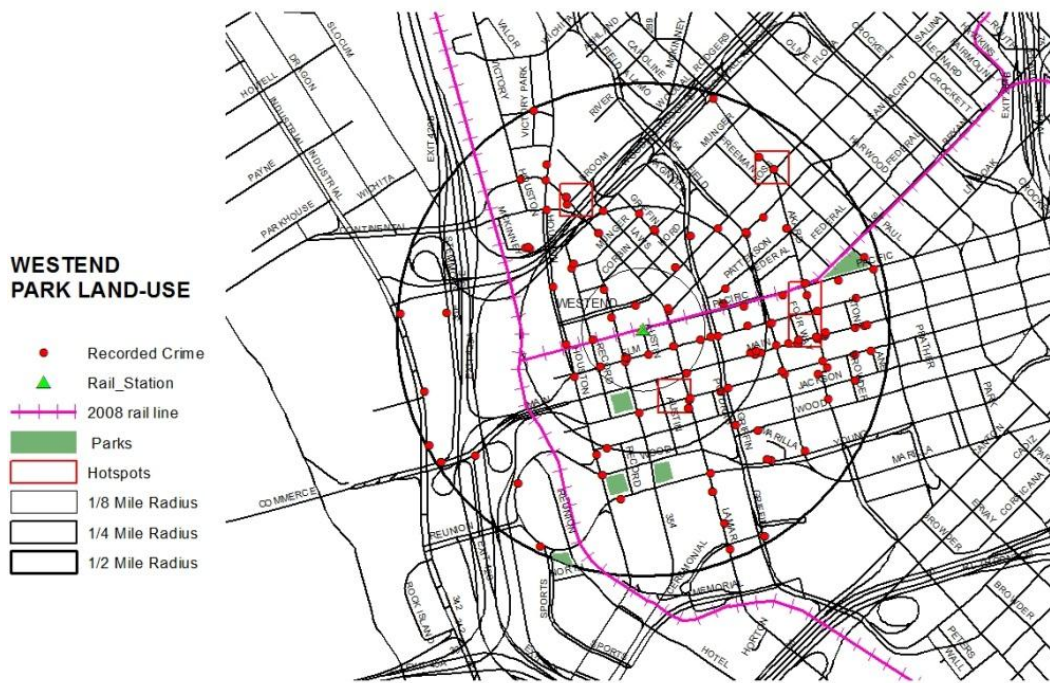


Figure 4.32 West End Parks Land Use

Although the previous four figures displayed above provide substance in regards to the average proximity of selected land use it reveals very little details land use context. This is in part due to complexities of downtown how various uses are overlaid in this part of downtown. Therefore the average distance to particular land use in this context seems to be limited measure for this particular district. However, street view photos as well as the site visits reveal that the area is a hub for public transportation activities not only light-rail but in and out of city bus systems. These images also illustrate the presence of alleys, surface parking lots, and unattained public realm which seem to impact the delinquency in this district.

4.7 Summary

This study illustrates that nearly one third of the 2,010 criminal activities recorded by the Dallas Police Department that is taking place within the 41 TODT are theft, and criminal mischief and vandalism. The findings also illustrates that lesser number of crime occur within the transit core area (1/4 radius from the station) then one might assume given that station is always located in the transit core area.

This study finding suggests that majority of the criminal activity that took place within the TODT's of the city of Dallas between 2010-2012 occurred near commercial and multi-family land uses as oppose to other uses and spatial features studied in this research (DPD, 2013).

Although it was not the primary goal of this research the detailed look at the selected hotspots reveals that as much as the proximity to various land-uses and spatial features may be determinant of delinquency in these districts. There seem to be spatial commonalities in design elements and details in specific sites that may be contributing to the criminal activity. Those

spatial features may include but not limited to heavily vegetated areas, unattained open space, parking lots, transitional spaces, alleys, as well as destination quality of the environment. The final chapter in this research draws conclusions, discusses the relevance of the topic to design and planning professionals and suggests future research directions.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS OF THE STUDY

This research is conducted to study the location of crime and assess the level of criminal activity taking place surrounding the transit station within Transit Oriented Districts (TODT) in the City of Dallas in order to understand and improve the spatial environment contributing to crime. The research specifically concentrated on the spatial commonalities of the locations where most crime occurs within TODT's to understand patterns and to inform future planning and design decisions.

As it is highlighted with the location image below crime is complex and the criminal activities are sporadic due to uncontrollable motives of human nature, but patterns can be studied as it is displayed in this research to inform future professional activities (Figure 5.1). This research is an attempt to understand criminal activity within ½ radius area surrounding transit stations within the city of Dallas. This research identifies the major contributing elements that influence criminal events at TODT's. The research questions expressed in the earlier chapters are reiterated below provide assurance of a completed objective. This chapter summarizes the key components and explains the importance of this research to the practice of landscape architecture. To conclude this chapter, topics regarding future research are articulated for continued inquiry.

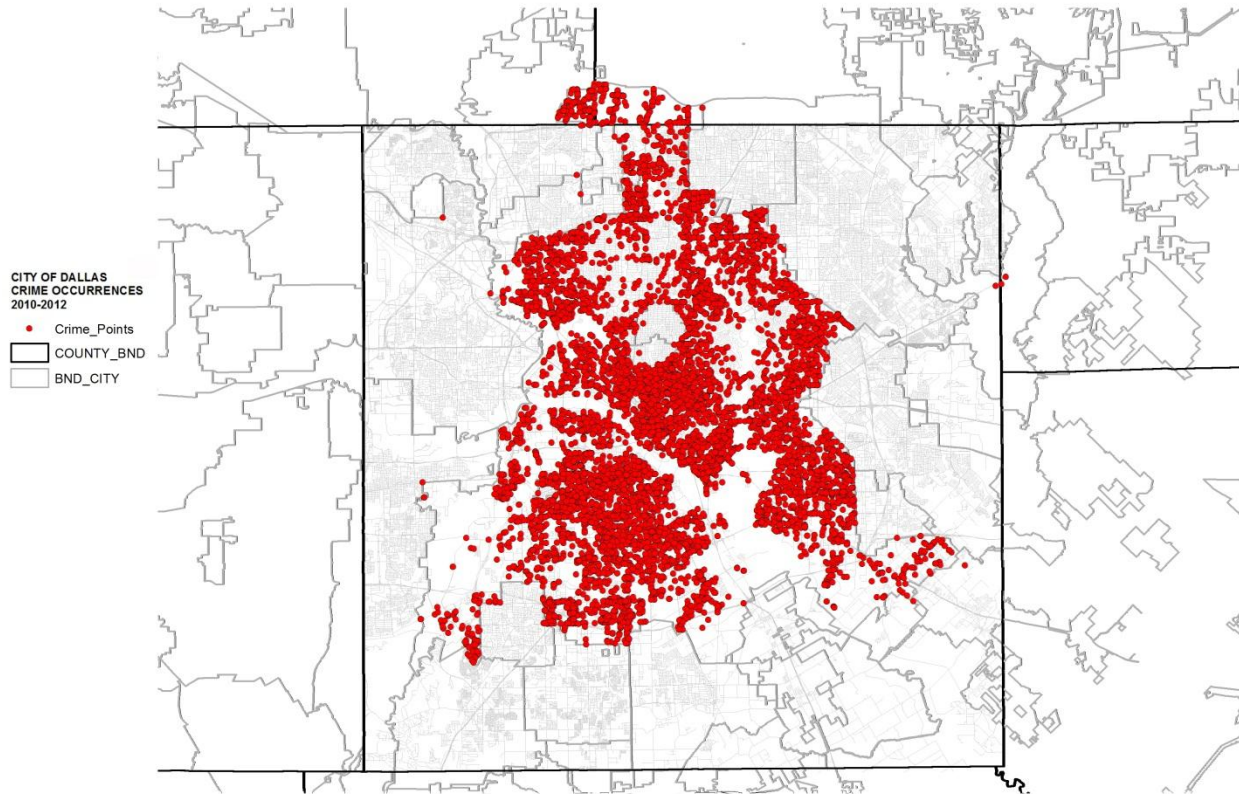


Figure 5.1 City of Dallas Crime Occurrences 2010-2012

5.1 Conclusions

The purpose of the study was to assess the criminal activity for the City of Dallas' TODT's. The research questions were listed for hierarchy of importance and to provide a sequence or process for the analysis. From the research questions objectives were set.

The objectives of this study were to:

1. Determine the contributing spatial elements that influence the occurrences of crime.
2. Determine the quantity and percentage of crime taking place at Transit Oriented Districts.

3. Categorize the crimes at Transit Oriented Districts and to identify what types of crimes are occurring at Transit Oriented Districts.
4. Identify where hotspots / crime cluster are located with the radius buffer of Transit Oriented Districts.
5. Determine which designated radius the crime occurrences are taking place.
6. Provide human perspectives visuals of the hotspots and the spatial surroundings.

To accomplish these research objectives, systematic research procedures were developed. The process is further explained in greater detail in the previous chapter of methodology. Listed below are the methods used to achieve the above objectives, they are corresponding with the listed number.

1. The exploration of each transit oriented district was examined to identify common patterns based from inserted data. Observations were also made to validate the GIS results.
2. Gathered statistics were obtained from Dallas Police Department (DPD) and exported into Excel spreadsheet. The data was then filtered and modified for geocoding. The data was inserted into the transit oriented district s and excess crime points were clipped. The final step includes the query count tool. Percentage was determined by the breakdown of each individual crime category.
3. The Geographic Information System (GIS) selected crime by using the attributes tool. The Transit Oriented Districts were merged using a spatial join tool. The attributes tables were exported into excel where the find and search tablet was use to count and categorized each crime.

4. A fishnet was created using the Data Management Tools in GIS. The fishnet was then spatial joined to the crime data points. GIS automatically calculated the occurrence for each cell, creating a range based on the total amount of incident in the districts radius.
5. A count of incidents were made within each radius, a percentage was formulated from the total calculation of the combine Transit Oriented Districts.
6. The located hotspots were examined from Google Earth software to provide to panoramic image of the space. The literature from (Marcus and Francis, 1998) was also used to determine the particular element to photograph.

5.2 Summary Findings

Three research questions are identified and reviewed throughout this research. These are:

- What are the spatial commonalities (exterior elements) of the locations where crime occurs in Transit Oriented Districts in Dallas, Texas?
- What types of crimes occur at Transit Oriented Districts?
- Where are the hotspots /crime clusters located in Transit Oriented Districts and how do they relate to the physical environment?

In summary, 11,994 criminal activities were retrieved from the city of Dallas' Police Department online records between the years 2010 through 2012. 2,010 criminal activities occurred within ½ mile distance from the 41 stations documented in this research. Nearly one third of these criminal activities in Transit Oriented Districts were classified as theft and criminal vandalism.

This research illustrates that there's lesser number of criminal activity taking place within the transit core area (1/4 radius area from the station) then from the remainder of the district (the area 1/4 mile radius to 1/2 mile radius area). The findings also illustrate that land use type is one of the factors that influenced criminal activity in the city of Dallas between the years 2010 and 2012.

In regards to the spatial commonalities at the studied TODT's in the city of Dallas the influence in crime was commonly related to the designated land use type studied in this research. This research studied distance of hotspots to selected land use types. This research assess distance to commercial, multi-family, rail line, flow line, parks, transit stations, and water bodies to understand the spatial context of criminal activity.

Findings suggest that majority of the criminal activities take place in the TODT's in the city of Dallas occur near commercial and multi-family land use as opposed to others land uses and spatial uses studied in this research. Distance to transit rail lines and arterials seem to have an impact in the emergence of hotspots. As one might assume distance to parks, flow lines, and water bodies were not major factors in the emergence of hotspots for the dataset under investigation.

This research concentrated on three specific TODT's (City Place, Mockingbird, and West End) hotspots/ crime clusters in order to have a better understanding of the physical environment. Review of aerial images, Google street view, and onsite observations reveals that in addition to land use types, factors such as accessibility, vegetation, street furniture, visibility, pedestrian circulation, and lighting are elements that influenced criminal activity. A detailed look at these areas further illustrates that big box stores with large parking lots, as well as places with

heavy pedestrian activity seem to elevate the presence of criminal activity in selected Dallas TODT's.

5.3 Lessons Learned From TODT's

The research targeted spatial patterns of locations where crime occurs. Three major components were identified from the findings, with analysis and the observations acting as the contributors to the three components. The findings are (1) commercial land use is the most prominent element related to crime at TODT, (2) theft is the top categorized crime within the TODT's, and (3) there are 106 identified hotspots / crime clusters within the TODT buffers. Studying hotspots may give clues about designing and planning future TODT's.

In the case of Transit Oriented Districts, in the city of Dallas the distance to certain land use seems to correlate with the number of incidents. The high occurrences of events lead the user to think about the spatial makeup of the environment, the contributing factors, and the designated land use. The answer is that both assist in the pattern of the hotspots, the designated land use does provide business vendors and high numbers of people, but the form and makeup of the building, associated infrastructure, and parking all add to the criminal events. Commercial land use provides a unique character of structures and open space.

Theft is defined as a non-violence incident of stealing some type of object. The occurrence happens and the victim doesn't have an idea of the incident until the criminal is out of site and mind. The categorized crime would make users aware of the most apparent criminal activity within the identified hotspots. Theft is identified greatly in Transit Oriented Districts around commercial land use and major arterial roads. Awareness of high theft occurrences at TODT needs to be address.

The locations of the hotspots are somewhat sporadic, but after studying each TODT's in Dallas it's apparent that most hotspots had some common spatial features impacting the pedestrian environment. The study of hotspots allowed this researcher to study concentrated criminal occurrences in a confined area to influence design and planning decisions. This study suggests that studying and addressing crime in hotspots may impact the quality of pedestrian environment in TODTs.

As it is highlighted earlier in the case of Dallas' TODT's majority of criminal activity in the districts are located outside the ¼ mile radius (transit core). The transit core and station (less than ¼ mile distance) results in less than half the incidents that are located in the ¼ to ½ mile radius (district zone). This research proposes that studying greater spatial configuration and urban morphology may be a critical component of crime related studies in TODT's.

5.4 Value to Landscape Architecture

The performance of the spatial environment is a topic that design and planning fields encounter daily. Landscape architecture tends to encounter interaction with the environment at a greater rate than other allied professions. Although the larger contextual environments are often organized and influenced by planners, social sciences, and other stakeholders (Nelson, 2008). Landscape architecture has an important role to address some of the society's issues through design.

Landscape Architecture is a profession largely responsible on creating the resulting environments that is experienced by all. For landscape architects to truly provide stewardship and welfare for the well-being of society crime prevention through design must be included in every design and planning practices. This research especially becomes instrumental for

landscape architects since transit related professional design services is emerging as a results of the growth expected in urbanized regions.

The objective of the research was to identify the environmental commonalities contributing to crime in TODT's for the city of Dallas. The components that can be taken from the previous statement are to recognize the similarities of pre-existing elements or proposal elements included in TODT's, should be considered for the investigation of future delinquency.

This study provides the profession with a step-by-step process of identifying hotspots or crime clusters to be analyzed. The process allows landscape architects to pinpoint targeted areas so that suggestions can be made in regards to crime prevention through design and planning for new developments.

Familiarity with spatial configuration and definitions of terms relating to TODT provide landscape architecture with terminology that can help establish conversations that involve public transportation realms. This research provides the profession with tools and procedures to locate, categorize, and assess criminal activity in TODT's in the city of Dallas. Such research informs and better equips future practitioners and researcher to address crime through design and planning.

5.5 Opportunities for Future Research

Although crime prevention through design and planning has been an emerging area in architectural fields within the past decades the research in crime is not deeply rooted in the design fields. It becomes especially critical for design professionals who are shaping the built environment in their daily practice to have a greater understanding of the topic and responsibility to address such concerns. Therefore crime and crime prevention associated with the spatial

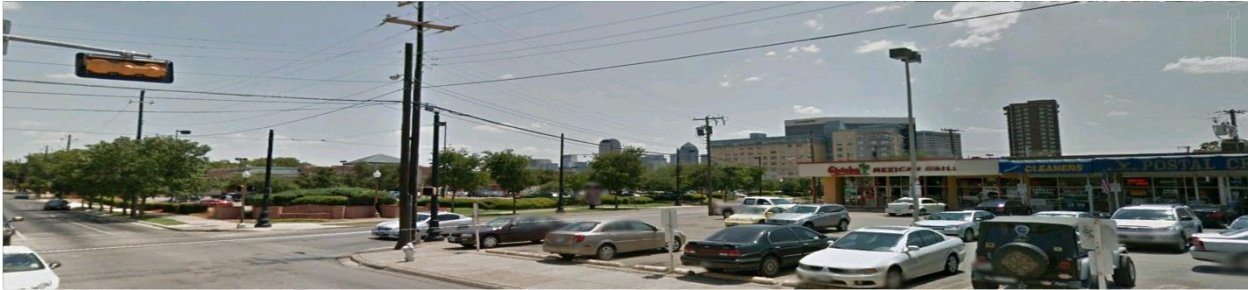
environment demonstrates opportunities for further research for design professional. Even though this study addresses several of the objectives especially in regard to TODT's in the city of Dallas, there are other issues that haven't been in the scope of this thesis which may set the ground for other research topics. With the constant growth and acceptance of TODT's in the North Texas region the opportunities for in-depth investigation of criminal occurrences can be explored. Some broad opportunities for future research include:

1. What are the users' perceptions of crime in transit oriented districts?
2. How are the criminal activities in other municipalities compared to the City of Dallas TODT's?
3. What are some of the other factors that may influence crime incidents within the transit oriented districts? For example does the time of day influence crime incidents at TODT's?
4. What are the factors, besides the design elements and how do they impact the occurrences of crime?
5. Do the environmental elements outside the designated radius influence crime within the TODT's?
6. Does density, income, ethnic diversity contribute to the identified hotspots / crime clusters in TODT?
7. How do these TODT's perform in crime in comparison to other major cities in the U.S.?

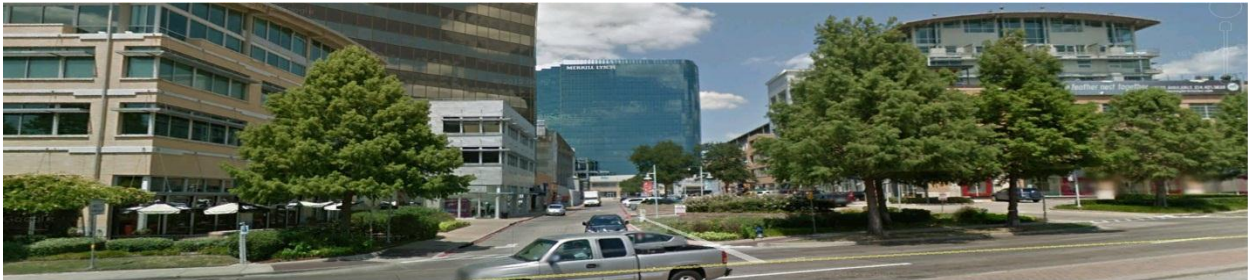
APPENDIX A

STREET VIEW IMAGES FOR SELECTED SITES GOOGLE STREETVIEW IMAGE SETS
FOR DOCUMENTING SPATIAL COMMONALITIES ON SELECTED HOTSPOT SITES

City Place TODT (McKinney Ave & Lemmon Ave) Hotspot Images:



Mockingbird TODT (Mockingbird Lane & North Central Expressway) Hotspot Images:



West End TODT (Akard St. & Main. St) Hotspot Images:



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BIOGRAPHICAL INFORMATION

Devin Durrell Guinn was born in Tyler, Texas. He completed his Bachelor of Science degree in Horticulture Landscape Management from Tarleton State University in Stephenville, Texas. Devin has worked in the landscaping industry in and out his entire life; position titles ranging from foreman, to project manager. Currently, he is self-employed working as a landscape designer / contractor in the Dallas/ Fort Worth area. He has developed a passion for urban design and transit oriented developments and looks forward to working with these components in the future.