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16. Abstract

The objective of this research effort was to develop and test a recommended methodology to estimate the economic impact of median design. This report summarizes the results, conclusions, and recommendations for the first year of this four year study. The first test of the methodology was conducted within the Bryan District of TxDOT on Texas Avenue in College Station. Texas Avenue is being widened from four to six lanes including the addition of a raised median. Subsequent years of this study will further test the recommended methodology at additional locations where a raised median is being installed. Data will be collected after the installation of the raised median is completed along Texas Avenue as part of further years of the study.

Conclusions are drawn about the Texas Avenue corridor with respect to quantitative aspects such as gross sales, employee hiring trends, accessibility, and qualitative comments and concerns expressed during the personal interviewing of business owners. Suggestions and recommendations are made about survey development and administration for future studies investigating economic impacts as well.

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A METHODOLOGY FOR DETERMINING ECONOMIC IMPACTS OF RAISED MEDIANS: INITIAL DEVELOPMENT

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TEXAS TRANSPORTATION INSTITUTE
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IMPLEMENTATION RECOMMENDATIONS

The Texas Department of Transportation (TxDOT) will be able to implement the results of this project in two ways—additional research studies and in the public planning process. The Texas Transportation Institute (TTI) will perform additional research and studies in the next three years through this research effort. TxDOT can immediately begin to use some of the results of the first year of this research project at public meetings and hearings. At the end of this project, TxDOT will have a thoroughly tested methodology which it can use to collect data relevant to estimating the economic impact of raised medians on adjacent businesses.

TxDOT will be able to implement findings of this research in the near future through communication with concerned parties at public meetings and hearings. These findings stem from the perceptions related by business managers and owners through survey questions and comments. These questions revealed many perceptions of business owners concerning economic indicators such as property values, gross sales, changes in available parking spaces or employees, and accessibility. Further, many affected individuals express some, but not necessarily all, of their concerns at public meetings and hearings early in the construction process. This methodology revealed many of the concerns that business owners and managers have, but had not communicated through previous channels made available by TxDOT. With this information, TxDOT will be able to address these concerns early in the project planning, design, and construction phases of the project.

Further implementation of the methodology will continue in the next fiscal year as TTI uses the methodology on additional case studies. During this process, the research team will continue to refine the methodology as deemed necessary by the team and the TxDOT advisory panel. By using the methodology to perform additional case studies, the research team will create a larger set of data from various locations. The research team and TxDOT will use these data to determine the general patterns of which types and locations (relative to median openings) of businesses are more likely to be impacted by the construction of raised medians. In addition, after the completion of the raised median along Texas Avenue, "after" data along this corridor will be collected for comparison to "before" construction data to estimate economic impacts along this

corridor as well. Ultimately, TxDOT can use the findings of these completed case studies in their planning and design of raised medians.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation.

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SUMMARY

In recent years, transportation agencies have increased construction of raised medians on urban and suburban arterials. In addition to their use for access control, raised medians provide improved traffic operations and safety for a facility by separating opposing traffic flows and removing left-turning vehicles from the through lanes. With respect to access control, raised medians restrict left turns to mid-block and intersection median openings. While improving the operations and arterial signal coordination, the economic impacts of restricting these left turns may be felt by owners of businesses and properties adjacent to the arterial. Extensive research has investigated and quantified the costs and benefits of constructing raised medians with respect to initial costs and benefits to motorists in terms of reduced delay and increased safety. Prior to this project, however, limited research has been conducted to aid in estimating the economic impacts of raised medians on sales and property values for adjacent business and land owners.

Many state and local transportation agencies, including the Texas Department of Transportation (TxDOT), have recognized the need to provide answers to the public regarding the before-, during-, and after-construction impacts of installing raised medians. The use of raised medians is increasing in urban areas. While currently unaware of the overall economic impacts, transportation agencies and the public are interested in learning more about these impacts. The TxDOT districts need a methodology to determine if such concerns are warranted. With such a methodology, TxDOT and local businesses will be better informed of the economic impact that a raised median may have on adjacent businesses and properties. After estimating the impacts, if any, that may be expected, TxDOT can provide this information to the public to keep them informed and aware of anticipated changes.

The objective of this research effort was to develop and test a recommended methodology to estimate the economic impact of median design. The researchers performed the following steps: 1) conducted a state-of-the-practice literature review; 2) identified existing methodologies for estimating economic impacts; 3) developed a sample survey instrument; 4) administered the survey; and 5) finalized and developed a recommended methodology for estimating economic impacts.

This report summarizes the results, conclusions, and recommendations for the first year of this four-year study. The first test of the methodology was conducted within the Bryan District of TxDOT on Texas Avenue in College Station, Texas. At the time of this research study, TxDOT was widening Texas Avenue from four to six lanes and installing a raised median.

The research team decided that the best approach to obtain the necessary data and information would be to develop and administer a survey to business establishments along the corridor. The research team, through several iterations, designed a survey to obtain relevant quantitative data as well as valuable business owner comments. The survey was administered as part of the methodology by personal, face-to-face interviews.

CONCLUSIONS

Much insight into the perceived economic impacts of raised median design surfaced as a result of this study. Not only are conclusions drawn about the Texas Avenue corridor, but insight for future studies investigating the economic impacts of median design, including survey development and administration, was also found.

Quantitative Survey Results

Survey Response

The response rate obtained in the study was relatively high overall. A total of 73 percent of the businesses that were contacted participated in the study. The high response rate can be attributed to the method used to schedule the personal interviews. Based upon prior experience, the researchers would expect only a 15 to 20 percent response rate if the survey was mailed out.

Although sample sizes were often low for specific questions for analysis (e.g., gross sales), useful trends, perceptions, and summary statistics were obtained for the variables discussed below.

Gross Sales

A majority of the responding business owners (67 percent) north of Dominik Drive believe that their gross sales will decrease due to the construction along Texas Avenue. This perception demonstrates that there is considerable concern for gross sales during the construction phase. After the median is installed, a majority of the business owners (65 percent) believe that gross sales will either increase or remain the same as prior to the construction. During the time period of this study when businesses were being selected for interviews, 21 businesses either closed or moved. The construction phase is seen as the most financially difficult stage for the businesses.

Number of Employees

A majority of the business owners indicated that they would not alter their number of staff during the construction phase of the project. Therefore, businesses appear to be loyal to their employees during the financially constrained time period of roadway construction.

Accessibility to Business

The results of a ranking of important items to customers as indicated by business owners indicated that the accessibility to the store generally ranked about third or fourth. This indicates that the most important elements used by customers (according to business owners) to determine what businesses they will endorse are factors that may be controlled by the business owners themselves (e.g., customer service, product quality, product price).

Personal Interview Comments

The personal interviews also provided valuable comments from business owners. These include the following:

- Business owners generally understand the usefulness of access restrictions, but many business owners wished they could have been more involved in the public planning process.
- Many business owners expressed their concern that the restricted access would lead to a diversion of traffic to side streets for access to the business.
- Many individuals asked questions and/or expressed concerns over issues that could be addressed with more information about the project initially and project progress reports throughout construction. Although the public involvement process attempts to raise and address many of these concerns, as a practical matter many business owners do not react to plans and instead wait until the median is being installed to voice concern. Many business owners knew this information due to efforts along the Texas Avenue corridor.

Survey Development and Administration

The survey development and administration used in the study was considered successful by the research team and sponsors. One key element in making the process successful was conducting the surveys in person. Further, gaining the support of the Bryan/College Station Chamber of Commerce proved to be useful in getting business owners and managers to participate in the survey. Setting up the personal interviews with an identified contact person was also beneficial. Confirmation calls a few days prior to the interviews also aided in ensuring that the interview would be completed.

RECOMMENDATIONS

This research project yielded a methodology that can be used to estimate what, if any, economic impacts on businesses result from the installation of raised medians on arterial streets. Based on the results and conclusions of this project, the research team recommends that the proposed

methodology for estimating economic impacts of raised medians be further tested. This methodology contains several elements, all of which are important to its success. The recommended methodology includes the following steps:

1. Identify a site for evaluating economic impacts;
2. Identify corridor characteristics including, but not limited to, abutting land uses, street cross section, and corridor length;
3. Make contact and develop good working relationships with the local Chamber of Commerce and Appraisal District Office;
4. Inventory businesses and establishments along the subject corridor;
5. Obtain information about businesses including, contact information (e.g., name, address, phone number), property values, and additional relevant information;
6. Prioritize businesses to be surveyed;
7. Collect data from personal interviews set by appointment; and
8. Analyze and summarize data.

1.0 INTRODUCTION

1.1 BACKGROUND

In recent years, transportation agencies have increased construction of raised medians on urban and suburban arterials. In addition to their use for access control, raised medians provide improved traffic operations and safety for a facility by separating opposing traffic flows and removing left-turning vehicles from the through lanes. With respect to access control, raised medians restrict left turns to mid-block and intersection median openings. While improving the operations and arterial signal coordination, the economic impacts of restricting these left-turns may be felt by owners of businesses and properties adjacent to the arterial. Extensive research has investigated and quantified the costs and benefits of constructing raised medians with respect to initial costs and benefits to motorists in terms of reduced delay and increased safety. Prior to this project, however, limited research has been conducted to aid estimating the economic impacts of raised medians on sales and property values for adjacent business and land owners.

Many state and local transportation agencies, including the Texas Department of Transportation (TxDOT), have recognized the need to provide answers to the public regarding the before-, during-, and after-construction impacts of installing raised medians. The use of raised medians is increasing in urban areas. While currently unaware of the overall economic impacts, transportation agencies and the public are interested in learning more about these impacts. TxDOT requires a methodology with which to determine if such concerns are warranted. With such a methodology, TxDOT will be better informed of the overall economic impact that a raised median may have on adjacent businesses and properties. After estimating what, if any, impacts may be expected, TxDOT can provide this information to the public to keep them informed and aware of anticipated changes.

1.2 PROJECT OBJECTIVES

The objective of this study was to develop and test a recommended methodology to estimate the economic impact of median design. This was performed by: 1) identifying prior evaluations and practices in the literature related to the effects of median design, as well as identifying other relevant issues and concerns; 2) developing a methodology for evaluating the economic impacts of median design; and 3) evaluating current economic impacts of the construction widening project by surveying local business owners with the techniques outlined in the developed methodology.

Currently, TxDOT does not have a method of estimating the economic impacts that result from the construction of a raised median. Developing such a methodology will allow TxDOT engineers and planners to estimate the potential impacts so that the information can be provided to the public, specifically to business owners. Several TxDOT roadway construction projects currently underway, or in the planning stages, would benefit from such a methodology.

1.3 RESEARCH METHODOLOGY

During the first year of this project, researchers completed five major tasks to meet the project objectives. An extensive literature review was conducted to provide information on issues related to the effects of constructing different types of medians. Based upon the literature and by working with the Project Director (PD), a survey instrument was developed and administered to local businesses and property owners who own or lease land adjacent to an on-going roadway widening project where a raised median is currently being installed. The intent of the survey was to assess the effects before, during, and after construction of the widening project. The survey was only one portion of the methodology developed to estimate the economic impacts of the raised median design. It is anticipated that this methodology can be used by TxDOT to evaluate similar impacts. This research report documents the completed tasks. The following sections of this chapter further explain each of the work tasks. Figure 1-1 below illustrates the project methodology.

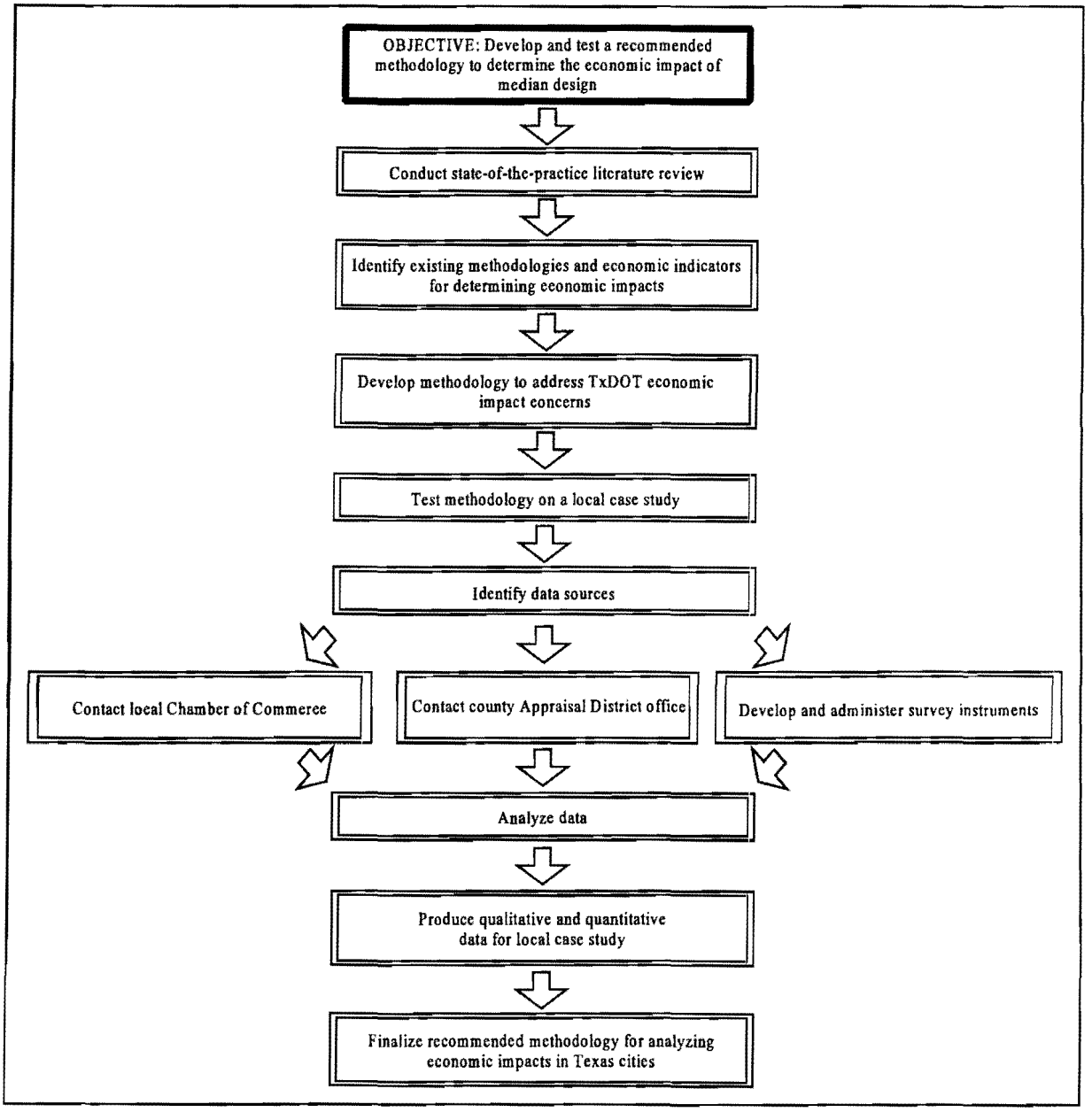

Figure 1-1. Work Plan for Research Project To Estimate the Economic Impacts of Median Design

1.3.1 Conduct State-of-the-Practice Literature Review

Numerous research and case studies have evaluated the impacts of different median installations. Many of these studies have addressed the traffic-related impacts, such as the operational and safety issues, related to installing or removing different median types. From an economic impact perspective, there have been several case studies that have evaluated the impacts on businesses of installing raised medians. Some of the main factors that these evaluations considered were business sales (if available), sales tax information, property values, land use, employment patterns, and parking availability.

Most of the case studies that have addressed economic impacts of median design have been site-specific, with the researchers unable to apply results to all situations. Some factors that appear to restrict findings to site-specific locations include local traffic conditions, the history of the local economy, and land use characteristics that may change over time. Chapter Two will address in more detail these issues, which, at times, can be difficult to predict or quantify but can impact the sustainability of businesses.

1.3.2 Identify Existing Methodologies for Estimating Economic Impacts

Two generally accepted practices for estimating the economic impacts of a raised median installation are a before-and-after evaluation and a post-facto evaluation. In the case of a median installation, the before-and-after technique simply involves collecting the same type of site data before and after the median is installed, with a time allowance to account for the initial effects of pre- and post-construction activity. The post-facto technique is used when the median has already been installed and an economic analysis is desired. The "before" data is obtained or reconstructed with available data and by surveying persons knowledgeable with the "before" period (e.g., business owners, county appraisal offices, and real estate representatives). The "after" data is collected in the same manner for the post-facto technique as the before-and-after technique. Again, as previously mentioned, there are common economic indicator data available for analyses, and occasionally, attempts are made to first model this data to predict future economic impacts and then to validate the model with actual field data.

The analysis procedure for both techniques are generally similar, with the only major difference being the data collection process. With the post-facto technique, all available before-, during-, and after-construction data is collected at one time ("after" period), while the data for the before-and-after technique is collected at two different times, before and after the construction period.

1.3.3 Develop Sample Survey Instruments

It was anticipated that from the task outlined in Section 1.3.2 that existing methodologies from past case studies would include the development of a survey(s) to facilitate the gathering of information from business and land owners affected by a median installation. Researchers identified several surveying techniques. Three types of surveys were identified from past studies for possible use in this work task. The first survey was developed to assess the economic impact on businesses adjacent to the median project. The survey questions focused on the real impacts *during* construction (as compared to "before" conditions) and perceived impacts *after* construction. In addition, the survey ascertained such factors as the number of customers, parking spaces, gross sales, employment patterns, and property values.

The second survey was developed for assessing the economic impact on vacant land adjacent to streets in which a raised median will be installed. The survey included several of the same perception-type questions as the one oriented toward business owners. Similar economic indicators also evaluated included parking spaces, gross sales, employment patterns, and property values. The third survey identified was a survey of customers to determine their perceptions of how the median installation will influence their endorsement of businesses along the corridor after installation of the raised median.

Chapter Three discusses two of the three of these survey instruments (business survey and vacant land survey) in detail and in the context of the recommended methodology. Appendix A and Appendix B present, respectively, these two survey instruments.

1.3.4 Administer Suggested Surveying Techniques

Participants in the survey included approximately 100 businesses and property owners adjacent to a local construction project in which a major arterial is being widened and a raised median is being installed. The research team first conducted a "windshield" survey to determine which businesses and land uses were present along the corridor in which the survey was to be administered. Business information (e.g., address and contact name) for each location was then obtained from the local Chamber of Commerce, Brazos County Appraisal District office, and telephone directories. The researchers then contacted all businesses by telephone to determine their interest in participating and arranged interviews at each of the locations to administer the survey. The Chamber of Commerce sent a letter to corridor businesses endorsing the project and encouraging them to participate in the survey.

1.3.5 Analyze Survey Results

The research team analyzed the property value data obtained from the Brazos County Appraisal District. Trends over time were developed. The business survey results were analyzed to determine initial perceptions and indications of economic impacts of the raised median installation. With this survey, the researchers evaluated business owners' perceptions of changes due to the median installation as well as preliminary estimates of impacts of the construction phase on sales and services.

1.3.6 Develop Methodology for Estimating Economic Impacts

After the data analysis, the researchers developed a methodology for estimating the economic impacts of a median design project. This recommended methodology incorporates the experiences of the research team in administering the methodology on one study location.

1.3.7 Organization of Report

This report is organized into five chapters, as described below:

- Chapter One–Introduction: Provides an introduction to the research topic and presents the research objectives and scope.

- Chapter Two–Background: Provides a summary of prior research and case studies related to the assessment of impacts of installing roadway medians. The background section provides a basis for many of the decisions made in the study methodology, including the selection of surveying techniques and the primary economic indicators of interest.

- Chapter Three–Study Methodology: Provides an explanation of the development and testing of a methodology to assess the economic impacts of a raised median design. This chapter describes the study site selected for the methodology (a local case study), the survey instruments that were administered, the businesses and local officials that participated in the study, and the type of data that were collected. This chapter also provides a brief explanation of the data analysis procedure, which Chapter Four explains in more detail.

- Chapter Four–Study Results: Provides a detailed summary of the data that researchers collected, the analysis procedures that were conducted, and the findings of these analyses.

- Chapter Five–Conclusions and Recommendations: Presents the research recommendations based upon the findings of the data analyses. The recommendations are in the form of a methodological approach for TxDOT to estimate the economic impacts of a raised median design.

2.0 BACKGROUND

2.1 INTRODUCTION

For a transportation agency, the decision to install an arterial median is typically based on providing improved traffic operations and safety on that arterial. Depending upon the approach taken, the goals of the median design may conflict with the interests of adjacent business and property owners, who desire full access with unrestricted left turns and curb cuts to their properties. A desirable solution for the agency, business owner, motorist, and customer is to improve the mobility and safety of the arterial while not adversely affecting business sales and property values adjacent to that arterial.

This chapter provides an overview of medians, including the geometric design elements of medians, types of medians, their purpose, and the advantages/disadvantages of each. In addition, this chapter provides an overview of relevant literature related to the study of medians. For the purposes of this project, the discussion of medians will primarily relate to urban and suburban arterial designs, with reference to medians in rural areas or on freeway facilities only as a point of comparison.

2.2 OVERVIEW OF MEDIAN DESIGN

According to *A Policy on Geometric Design of Highways and Streets*, commonly known as the *Green Book*, published by the American Association of State Highway and Transportation Officials (AASHTO), medians are used on urban arterials to "separate traffic in opposing directions" and are "highly desirable on arterials carrying four or more lanes" of traffic (*1*). Most arterials that are divided with a median will usually operate more efficiently and safely than undivided roadways, since the median increases the separation distance between opposing traffic streams. Functionally, other than separating opposing traffic, the medians can provide a refuge area for pedestrians (by providing a stopping area for roadway crossing and a recovery area for out-of-control vehicles, allow space for speed changes and storage of left-turning and U-turning

vehicles, minimize headlight glare at night, and/or provide width for future roadway widening projects) (*1*).

2.2.1 Types of Medians

Medians can technically be defined as the dimension between the left edges of opposing through-lanes, and can include left shoulders, if any exist (*1*). The two basic median designs that are available for urban arterials are traversable and non-traversable medians. A traversable median, typically a one-lane, continuous two-way left-turn lane (TWLTL), allows the movement of traffic across the median and unlimited access to and from driveways. The traffic control devices typically used on a TWLTL include pavement marking delineation and traffic signs, indicating to motorists that the intended use of the median is for making left turns in either direction. A non-traversable median, either depressed or raised from the roadway surface, restricts vehicle cross movements to designated median openings and is primarily delineated by mountable or barrier curbs.

Different median types are designed to achieve different levels of control over left-turn access to adjacent properties. Consequently, this affects the mobility and capacity on the roadway, as well as the behavior of drivers as they desire to enter/exit adjacent properties. Non-traversable medians, such as raised medians, provide the highest level of left-turn control. Raised medians provide a barrier to separate opposing traffic. Left-turn access is provided through the careful placement of median openings at mid-block and at-grade intersection locations. Traversable medians, on the other hand, can provide an unlimited amount of access to adjacent properties. The continuous TWLTL, the most common traversable median, is intended to be used for left-turning vehicles in either direction. Drivers use TWLTLs for storage, while waiting for an appropriate gap in the opposing traffic stream prior to making a left turn. Since the vehicle is physically removed from the main through lanes, the capacity of the facility is effectively increased.

Non-Traversable Medians

The two basic types of non-traversable medians include raised or depressed medians. Raised medians have application on arterials where it is desirable to regulate left-turning vehicles. They may also be used for landscaping purposes. Depressed medians have general applications on freeways, with the primary purpose of efficient drainage and snow removal.

Traversable Medians

Painted (delineated) flush medians and TWLTLs have become widely accepted by transportation agencies. AASHTO recommends TWLTLs only in urban/suburban areas where operating speeds are low, between 40 to 70 kilometers per hour (25 to 45 miles per hour), and where there are no heavy concentrations of left-turning traffic. Curbed, traversable medians are also a generally accepted practice. These types of medians provide a curbed barrier, and are primarily used to separate left-turning traffic from the through-traffic at high concentration, left-turn areas.

Transportation engineers and planners responsible for designing or upgrading two- and four-lane arterials with either a traversable or non-traversable median treatment must consider the existing and/or anticipated operational, safety, and economic factors of the facility, with respect to the proposed median type. Operational characteristics (e.g., traffic volumes, speeds, motorist delay, pedestrian movements) and safety characteristics (e.g., vehicle and pedestrian accidents) are design and engineering factors that should be considered in proposed roadway improvements. Numerous studies have investigated these factors with respect to the various median designs on arterials in urban areas, and researchers have suggested guidelines to minimize the costs and improve the safety for the motorists. Previous research studies also have documented operational and safety advantages and disadvantages of these median treatments. Economic factors that are more difficult to quantify but are equally important to consider include before-, during-, and after-construction impacts on factors such as sales and property values for adjacent businesses and land owners. Limited documentation of quantifiable economic impacts supports the notion that these factors are often subjective and perceived, and depending upon the perspective (e.g., transportation agency, business/land owner, motorist), may vary greatly.

2.2.2 Geometric Design Elements

Although the AASHTO *Green Book* (*1*) does not present a comparative analysis of different median types, it does address specific design elements of a roadway cross-section, including design elements for non-traversable medians and TWLTLs. These median design policies and related issues are located throughout the *Green Book* in various chapters dealing with roadway functional classification, roadway design features, and cross-sectional elements. The AASHTO policy (*1*) addresses median issues, such as the recommended usage on certain roadway classifications, cross-section design elements (median widths and median openings at mid-block and at-grade intersections), and recommended access provisions.

Roadway Classification

The three major functional classifications for streets and highways are arterials, collectors, and local streets. Arterials and collectors are further subdivided by principal/major and secondary/minor classifications. For planning purposes, the two major factors in classifying highways and streets into these categories are access and mobility. The degree and extent of access control and mobility plays a major role in determining the functional classification of a street or highway. Figure 2-1 illustrates the relationship between a roadway functional classification and its provision of access and mobility (*1*).

As previously stated, medians are "desirable on arterials carrying four or more lanes" of traffic, typically in urban/suburban areas (*1*). For mobility purposes, the recommendations state, in general, that transportation agencies should construct a median, or "divided roadway," on facilities that are at or above a "collector" functional classification having two or more lanes of traffic in each direction. Major collectors will typically fall into this category, but the desired access control and geometric design (design speed and cross-section) would be the primary factors in the decision to construct a median. The Texas *Highway Design Division Operations and Procedures Manual* recommends that curbed or flush (TWLTL) medians are desirable on urban facilities with four or more lanes primarily to provide storage space for left-turning vehicles (*2*). The separation of opposing traffic is also desirable, and can be accomplished with these median types.

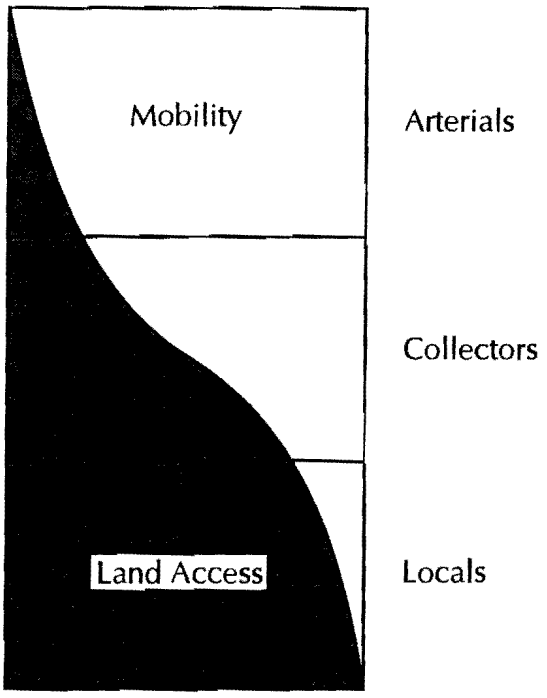

Figure 2-1. Relationship of Functional Classification, Access, and Mobility (*1*)

Median Widths

For design purposes, the AASHTO *Green Book* recommends that medians should be as wide as practical, indicating substantial safety benefits to incremental width increases. For narrow, raised sections, a median width of 0.6 to 1.8 meters is recommended on urban collectors with two or more lanes in each direction. In suburban areas, this width can be even greater, if the right-of-way permits. For TWLTLs, the TxDOT *Operations and Procedures Manual* (*2*) recommends the median widths presented in table 2-1, along with a comparison of the AASHTO width recommendation for urban collectors. The minimum values are provided for design projects where restrictive right-of-way/improvement projects to attain the "usual" width would require excessive costs of removing and replacing exterior curbing to gain only a few "additional feet of roadway width" (*2*).

Table 2-1. Median Lane Widths for Two-Way Left-Turn Lanes (*2*)

Maximum Legal Speed (Kilometers Per Hour)	Width of TWLTL (Meters)	
	Usual	Minimum
0 - 48	3.7 - 4.3	3.4
56 - 64	3.7 - 4.3	3.4
72 - 80	4.3	3.7
over 80	4.9	4.3
AASHTO - Collector	3.1 - 4.9	

2.3 EVALUATING SAFETY AND OPERATIONAL IMPACTS OF MEDIANS

Since the 1950s, engineers have been concerned with evaluating the operational and safety benefits (or disbenefits) of median designs (*3*). The concerns stem directly from the perspective of satisfying the goals of any roadway facility: to provide a balance between mobility and access for the motorists.

2.3.1 Advantages and Disadvantages of Median Types

With respect to different median types, there exist numerous factors that relate to the balance between the provision of mobility and access on a roadway. Several research and case studies have addressed this "balance" in terms of advantages and disadvantages of raised and TWLTL medians. Two studies in particular provide a comprehensive list of the advantages and disadvantages of each (*4*, *5*), and tables 2-2 and 2-3 provide the lists.

Table 2-2. Primary Advantages and Disadvantages of Raised Medians (*4, 5*)

Advantages	Provide a separation between opposing traffic flows Reduce number of conflicting vehicle movements at driveways Safer on major arterials with high (>40 per kilometer) driveway density Allows greater speed limits Reduce number of possible median conflict points Reduce mid-block accidents Provide pedestrian refuge
Disadvantages	Reduce operational flexibility for emergency vehicles Increase left-turn volumes at major intersections Reduce capacity at signalized intersections Restrict direct access to adjoining property Require more advance preparation for motorists in terms of destination Higher installation costs

Table 2-3. Primary Advantages and Disadvantages of Two-Way Left-Turn Lanes (*4, 5*)

Advantages	Left-turning vehicles are removed from through traffic Left-turn delay is reduced Operational flexibility Detours are easy to implement during roadway construction Permit direct access to adjoining properties Lower installation costs
Disadvantages	Conflicting vehicle maneuvers at driveways and intersections Poor operation if sight distance is less than AASHTO minimums No pedestrian refuge areas

2.3.2 Safety and Operational Impacts

The literature hypothesizes that the installation of a raised or TWLTL median will improve traffic operations (i.e., reduce delay) and reduce the accident occurrence along an arterial. Several studies have attempted to develop a methodology for quantitatively analyzing the costs of installing and maintaining a median versus the benefits derived from improved operations and safety.

A study by Parker developed a methodology for estimating left-turn delay and accidents for arterials with raised and TWLTL medians (*6*). Included in the methodology were such factors as accident types and frequency, construction and maintenance costs, and delay costs and benefits.

Squires, et al. and Harwood conducted similar studies to estimate accident frequencies on different roadway classifications, including ones with raised and TWLTL medians (*7*, *8*). Squires, et al. considered the safety perspective by only reviewing prior accident histories, but Harwood used a simulation model to estimate delay. Finally, a study by McCoy, et al. attempted to compare the costs of installing and maintaining TWLTLs to the benefits provided by improved safety and operations (*9*). The methodology for evaluating the cost-effectiveness of this median type included studying numerous cost factors, including the initial construction costs, travel time costs, stop and delay costs, and the benefit costs of the reduction in different accident types.

To specifically address arterial safety with respect to median designs, Bonneson and McCoy developed an accident-prediction model to predict the safety of an urban arterial with a specified median treatment (*10*). Several factors were found to contribute to the safety of arterials, including traffic volumes, driveway density, and unsignalized street intersection density. Median type (undivided, TWLTL, or raised) and land use (business, office, residential, or industrial), were found to contribute the most to accident rates. Several study sites (roadways) were selected and segmented, and the accident rates were computed for each of these roadway segments. A model was then developed and calibrated with available site data, which included traffic volumes, segment lengths, driveway/intersection densities, property damage accidents, and median type (undivided, TWLTL, and raised). Table 2-4 provides a summary of accident rates on selected arterials.

Table 2-4. Accident Rates on Selected Arterials (*10*)

Land Use or Roadway Type		Accident Rates (per million vehicle kilometers)		
		Undivided Roadway	TWLTL	Raised Median
Land Use -	Business	3.3	2.5	1.5
	Office	6.2	2.0	1.5
	Residential	1.4	1.7	0.9
	Industrial	—	0.7	0.5
Arterial -	Two-Lane	0.9	—	—
	Four-Lane	2.6	2.3	1.4
	Six-Lane	—	1.1	1.1

These data demonstrate the safety benefits of a median design, with a raised median showing the lower accident rate of the three different median alternatives. Furthermore, the undivided roadway showed a significantly higher accident rate than the two alternatives with medians. In general, though, the raised median treatment appeared to be the safest median treatment in most situations, with respect to different land use types and the number of through lanes on the arterials. Figure 2-2 provides the predicted regression accident rates for the three different median treatments (*10*).

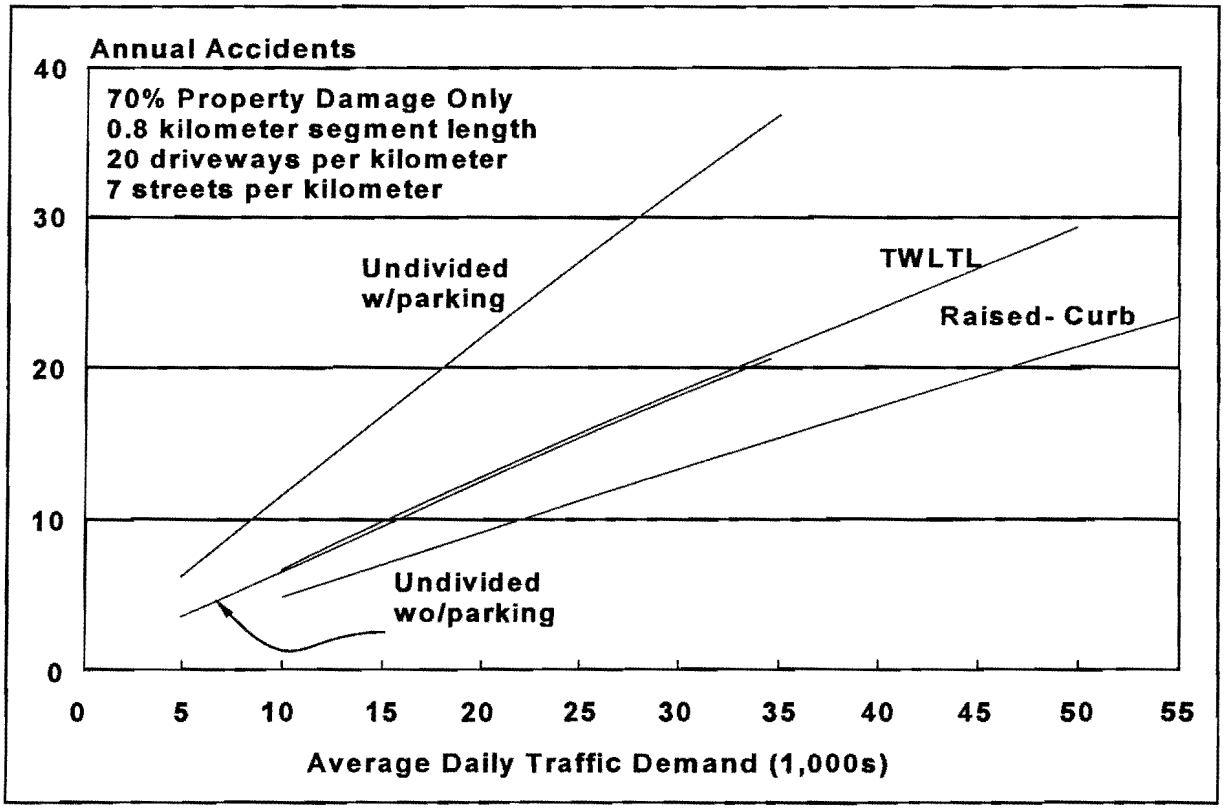

Figure 2-2. The Effect of Traffic Demand on Accident Frequency in Business and Office Areas (*10*)

Long, et al. for the Florida Department of Transportation (*11*) and Bowman, et al. (*14*) presented similar numbers. Accident rates were generally higher for undivided roadways versus ones with a median (raised or TWLTL). In the Florida study, over 650 kilometers of urban arterials were evaluated, and the authors found a statistical correlation with accident rates and driveway densities. In Bowman's study, 15 different arterial sites were selected in California,

Georgia, and Arizona. Table 2-5 summarizes certain accident rates for different roadway and median types from these two studies (*5, 11*).

Table 2-5. Accident Rates for Selected Four/Six-Lane Arterials (*5, 11*)

Roadway Type	Accident Rates (Total Crashes per Exposure)			Reference
	Undivided Roadway	TWLTL	Raised Median	
Urban - Four Lane	4.4	2.9	2.4	*11*
Urban - Six Lane	n/a	3.8	3.3	*11*
Suburban - All	4.1	6.8	3.7	*5*

In applying their methodologies to case study evaluations, the general findings for these studies are that TWLTLs reduce delay to left-turning vehicles and enhance operational flexibility, but should not be used if stopping sight distance is less than AASHTO standards. For raised medians, the studies generally find that these treatments are desirable for major arterials to accommodate large pedestrian and traffic volumes (for refuge and maximum through-put, respectively), but can reduce operational flexibility and increase travel time for drivers wishing to make left-turn movements (*6, 7, 8, 9*)

Other studies have presented comparative analyses of "before"/ "after" operational data and accident data on roadways that have received median treatments. In a report by the Federal Highway Administration (FHWA), Azzeh, et al. (*12*) found that raised medians were safer than TWLTLs when driveway densities exceeded 40 per kilometer (60 per mile) in urban areas; however, TWLTLs were found to have a lower accident frequency on roadways with low driveway densities of less than 40 per kilometer (60 per mile) in suburban areas. The results were statistically consistent for the two median types for all levels of average daily traffic (ADT) studied. Similar comparative studies conducted by the Georgia Department of Transportation, the City of Arlington, Texas, the New York State Department of Transportation, and FHWA reported a reduction in accidents when raised medians and TWLTLs were installed on four-lane, undivided roadways (*13, 14, 15, 16*).

General guidelines have been proposed by Modur, et al. and others concerning the design of medians on urban arterials. These guidelines, listed below, are based solely on operational and safety issues (*2*, *3*).

- TWLTLs are recommended on arterials where the speed is less than 70 kilometers per hour;
- Raised medians are recommended on high-speed, high volume arterials;
- If driveway density exceeds 12 per kilometer (20 per mile) and no median currently exists, a TWLTL should be used;
- If driveway density exceeds 40 per kilometer (60 per mile), raised medians should be used; and
- If a roadway is experiencing high accidents, TWLTLs are recommended, even though they may not meet operational warrants.

While these studies were comprehensive in nature and considered many of the engineering factors of installing medians, a limitation is common to much of the available literature. While analyzing the impacts of installing raised and TWLTL medians, the short- and long-term economic impacts on the abutting property values and businesses were not considered. A complete economic analysis considering all economic implications of installing raised or TWLTL medians, including operations, safety, and property values, would be useful.

2.4 ECONOMIC IMPACTS OF LEFT-TURN RESTRICTIONS

Even though roadway widening projects and median installations on arterial roadways may improve the safety and operations of that road, the construction will almost always economically affect abutting businesses and property owners, in either a positive or negative manner. As a result of the median installation, businesses may see an increase in customers and sales volumes if the roadway itself experiences higher traffic volumes. Due to a new median design, however, a business may lose customers regardless of increased traffic typically because of in-bound left-turn restrictions. Motorists (i.e., potential customers) may feel inconvenienced if a non-

traversable median restricts left turns to only mid-block or intersection locations. Due to the inconvenience of having to make U-turns and adding significant time to their travel, drivers may avoid these "less accessible" businesses and find other suitable locations.

2.4.1 Evaluating Economic Impacts

To estimate the economic impacts of an occurrence such as a median installation, there are two generally accepted practices of analyzing the economic effects: a before-and-after evaluation and a post-facto evaluation. As explained earlier, these methods differentiate with respect to the "before" type data that is collected and when that data is collected. Both methods, however, have advantages and disadvantages.

Before-And-After Evaluation

The before-and-after evaluation approach is useful when the researcher knows in advance the anticipated impacts of a construction project (*17*, *18*). The researchers can focus the study on these impacts in the evaluation process and collect quantifiable data during both "before" and "after" periods. The during-construction data is also an option that is available to the researcher to assess the impacts during this time period. The primary disadvantage of this evaluation approach, though, is the uncertainty of when the "after" data can be collected, especially for construction projects that are delayed due to contractual issues (i.e., funding and labor), weather, public opposition, and other related reasons. Related to the uncertainty of when to collect the "after" data is the immediate effect of a construction project on operational and economic factors such as traffic volumes, gross sales, and property values. A period of time may exist from the end of final construction to a point in time where operational and economic conditions are not truly representative of either the construction period or the after period.

Post-Facto Evaluation

The primary advantage of the post-facto method is that no waiting period is required to collect the "before" data because the construction project is already complete. On the other hand, the

primary disadvantage is the difficulty for researchers to ensure the quality and reliability of the "before" data because it is collected after the impacts resulting from the construction (i.e., two to three years after the project is complete) (*17*, *18*).

Economic Variables of Interest

Several economic variables are of interest for studying the impacts of left-turn restrictions. The primary variable is the characteristics and mix of business types and land use that will be affected by the left-turn restrictions (*18*). Because substantial variations can exist in the trip generation characteristics for different business and land use types, it is important to refer to standard business classifications, such as the Standard Industrial Classifications (SIC), to categorize similar business types. Businesses can also be classified by trip generation characteristics, such as the number of passer-by traffic or primary destination traffic. The *Institute of Transportation Engineers (ITE) Trip Generation Manual* (*19*) is a recognized reference for determining trip generation characteristics for the many business classifications.

Other key variables for assessing economic impacts include gross sales figures and appraised property values for each business, on-site parking availability, and full- and part-time employment trends. General local economy conditions, which may be, in part, a function of state or federally reported/established unemployment figures, interest rates, or other economic indicators, are also important to consider when assessing economic impacts. Many of these variables have been addressed in numerous case studies, some of which are summarized below.

2.4.2 Evaluating Economic Impacts (Case Studies)

Numerous site specific, case studies have assessed the economic impacts of a median installation or other highway improvement project, but a limited number of these studies have been applicable on a general, widespread basis. This section presents a brief summary of several of the more relevant case studies.

Wootan, et al.–1963-1964

In three different studies by Wootan, et al. the researchers examined the economic impacts of medians on businesses in three Texas cities--Baytown, San Antonio, and Pleasonton (*20, 21, 22*). In each of the studies, the researchers interviewed business owners and managers in the study area and businesses in a control area to obtain sales information, parking availability, and building conditions before, during, and after construction of a raised median. In both the San Antonio study (*21*) and the Pleasonton study (*22*), control and study-site businesses were stratified by different classifications, such as automotive stores, food service establishments, personal service establishments, and gas service stations.

The researchers found similar results between the three case studies. In Baytown, the results of the research indicated a decrease in sales during construction, with the study area decreasing more than the control area (*20*). The results also concluded that there was not an advantage being located near a median opening. In general, businesses away from a median opening showed more of an increase in sales during the "after" period. In San Antonio (*21*), of the businesses that were in operation during any of the study periods, the automotive-type and general retail-type businesses were the only groups of the study area businesses experiencing an increase in sales. All other groups had a decrease in sales. Furthermore, in general, the sales of study area businesses continued to decline after construction while the control businesses experienced a gain. In the Pleasonton study (*22*), during a three-year study period, the total sales of the study businesses declined during the construction period and in the after period, while the control businesses had a gain in the construction and after periods. Similar to the Baytown study, however, the results of the research concluded that no advantages were gained for businesses located near a median opening.

Transportation Research Center at the University of Florida, 1993

Researchers at the University of Florida assessed the impacts of a median reconstruction project in Ft. Lauderdale, Florida (*23*). The median at the study site, Oakland Park Boulevard, was being re-constructed from a TWLTL to a raised median, while a control site, Sunrise Boulevard, was used as a comparison site. To obtain attitudes prior to and after the median changes, the

researchers administered surveys on each roadway. Survey participants included through-motorists, delivery-truck drivers, nearby residents, business owners, and customers. Postcard questionnaires were given to through-motorists at intersections, while the other groups were personally interviewed. Also, some traffic and economic characteristics of Oakland Park Boulevard were assessed before and after construction and compared to Sunrise Boulevard characteristics.

Prior to the construction of the raised median, 58 percent of those surveyed favored the left-turn restrictions if the restrictions would improve travel times (i.e., increased speeds). Through-motorists, delivery-truck drivers, and customers approved the change, but the majority of residents and business owners were not supportive. Results of the attitude surveys indicated that a substantial proportion of each group saw the roadway as safer after the reconstruction of the median, although a safety analysis showed little improvements. After construction, most residents and customers favored the revised median. However, 68 percent of the 87 residents and customers that made U-turns on Oakland Park Boulevard indicated that they were inconvenienced, and 36 percent reported that U-turns affected the business they chose to endorse.

Cambridge Systematics, 1995

In a comprehensive evaluation, researchers with Cambridge Systematics and JHK & Associates evaluated the economic impacts of left-turn restrictions on abutting businesses (*17*). The researchers' data collection method consisted of both the before-and-after approach and the post-facto approach. Data for before and after business starts, failures, sales, and employment patterns were gathered for areas affected by left-turn restrictions and for control group areas, similar to Wootan, et al (*21*, *22*). Researchers conducted surveys and interviews to determine the views of business owners, planning officials, real-estate professionals, and customers with regards to the turn restrictions' impacts on businesses, commercial property values, and travel performance. Researches used multiple regression models to analyze the data.

The data analyses produced little evidence that certain types of businesses were negatively affected and that the impacts on businesses varied by business type. Some businesses indicated that increased travel speeds after construction allowed customers traveling from further distances to access their establishment, which essentially increased their market base. In

contrast to Wootan's findings, businesses located at intersections where left turns were allowed reported an increase in business (sales, customers) after construction. Business surveys also revealed that over 75 percent of the customers visited the establishments with the same frequency both before and after construction. Furthermore, of the customers surveyed, over 50 percent reported that the average travel times to each business were the same before and after construction. Those that visited less frequently after construction, however, did so because of inconvenient access to certain businesses, longer travel times, or another establishment was easier or more convenient to access.

Harvey, 1996

The scope of the research study was to examine the effects of highway widening in urban and suburban areas (*24*). Harvey divided the effects into eight general categories: land use, business impacts, location and relocation of utilities, employment, property values, tax base, parking, and safety. To measure the economic and social impacts, Harvey suggested that the following general type of data be collected: the number, size, and types of businesses within the affected area be identified, if the business is new, already established, and/or is deteriorating, if the business is highly dependent upon highway access and location for profit, and a description of the clientele served by each of the businesses. With respect to short-term land use and business impacts, Harvey determined that businesses that depend upon passer-by traffic, such as service stations, fast-food restaurants, and convenience stores, can be more adversely affected by highway widening projects for a short time period after roadway construction. Long range impacts, however, do not appear to constitute a concern. Mitigating measures include identifying impacts, meeting with business owners to present issues and design alternatives, traffic management during construction, installing signs to guide customers to the businesses, and temporary access or parking facilities.

2.4.3 User Impacts

Changes in roadway design and/or land use as it relates to access and mobility requires a strategy by the many groups involved to maintain the integrity of traffic and economic conditions. Three

general groups should be involved with the coordination of this strategy: 1) the transportation agency and its contract representatives; 2) the business owners and their representatives (Chamber of Commerce, Small Business Administration, etc.); and 3) the motorists/customers. If all three groups are not adequately represented, certain impacts will affect each group. Businesses can suffer economic impacts of lost revenue and decreased property values due to motorists that are unwilling to accept poor planning, design, and construction techniques. Increased delays and inconvenient left-turn provisions are the two primary impacts felt by motorists which result in the loss of business endorsements. Transportation agencies should make concerted efforts to provide timely and accurate information to all groups so that businesses do not feel this "boycott."

A study by Stover, et al. (*25*) assessed attitudes of various interest groups with respect to frontage road operational issues. Similar to the effects that a raised median can have on an arterial roadway, the conversion of a two-way frontage road to a one-way road has safety and economic implications which can affect businesses and motorists alike. Interviews were conducted with individuals from small and medium-sized cities in Texas. These individuals included city staff, city council members, real estate appraisers, real estate and development interests, and owners and managers of abutting businesses. Survey questionnaires were developed using a combination of semantic scaling techniques and open-ended questions.

The results of the study emphasized the importance of transportation agencies being aware of the needs of all parties involved. Coordinated efforts should be made with city and state engineering staffs to facilitate roadway construction projects. The development of guidelines is recommended so that businesses and motorists are aware of all potential impacts of a construction project. Finally, transportation agencies should address the fears and objections of the businesses and motorists in a timely manner. Not doing so only increases the opposition to the construction project (*25*).

As mentioned previously, in a study at the University of Florida (*23*), motorists' attitudes were obtained through postcard questionnaires provided to the motorists at intersections, while other groups (business owners and delivery-truck drivers) were interviewed personally. Researchers administered these questionnaires both before and after the construction project and found that it was an effective tool in assessing attitudes towards the project.

2.5 METHODOLOGY FOR ESTIMATING ECONOMIC IMPACTS

Many of the case studies that were reviewed for this project contained "site-specific" findings that would be difficult to apply on a widespread basis. What was learned from this review, however, was the practicality of the evaluation methods, variables of interest for this project, and methods of obtaining the data of interest.

2.5.1 Evaluation Methodologies

Based on many of the case studies reviewed, the post-facto evaluation technique appears to be the most practical due to simplifications in the data collection procedures. In many of the before-and-after studies, several years of data (before and after a construction project) were evaluated, and at times, inconclusive results were obtained from the analyses. The before-and-after technique is, however, a more reliable means of evaluation but requires extensive time and planning to be successful. Limited resources may prevent many agencies from conducting a thorough before-and-after evaluation, which makes the post-facto technique a more practical solution.

2.5.2 Economic Indicators

The literature review revealed numerous traffic, safety, and economic variables that relate to the effects of either a roadway widening project or a median installation project. Such variables as traffic/pedestrian volumes, delay, accidents, land use, gross sales, sales tax, property values, customer visits, employment trends, and location with respect to left-turn access are some of the more common variables researched with respect to roadway widening or median installations.

2.5.3 Obtaining Economic Data

Based on the literature and many of the case studies, business interviews were the most prevalent means of obtaining economic data before, during, and/or after a roadway construction project. Interviewers usually conducted interviews at the business site where sales, customer, and

employment records were easily accessible. General perceptions of convenience, access, and other conditions were also obtained through interviews or questionnaires of motorists and customers.

3.0 STUDY METHODOLOGY

3.1 INTRODUCTION

The goals of this study were to develop and test a methodology which TxDOT can use to estimate the economic impacts on adjacent businesses when raised medians are installed on arterial streets. TxDOT desires the methodology to be of a nature that can eventually be used in-house by TxDOT staff. The research team has developed a methodology that can be used to collect the data necessary to make economic impact estimations. This methodology has been tested on one corridor to collect data from businesses where a median project is under construction. In subsequent years of the study, the recommended methodology will be tested on corridors where a median has been previously installed to collect both before- and after-construction data. It should be noted that this overall project is not simply a case study of one corridor, but the development of a methodology to be applied at several locations over several years.

A significant amount of time during the first year of this project was spent developing the proposed methodology. The research team considered many options regarding what type of information they wanted and what type of data they should collect. In addition, the team also evaluated various techniques for obtaining the data. There are several aspects to the proposed methodology, including corridor identification, business/establishment identification, data collection, and data analysis, and this chapter discusses them in detail.

3.2 RESEARCH APPROACH

The sponsor of this project was the Bryan District of TxDOT. Therefore, the first test of the methodology was conducted within that district on Texas Avenue in the City of College Station. At the time of this research project, TxDOT was widening Texas Avenue from four to six lanes as well as installing a raised median. The overall approach to the methodology has six elements:

- Identify the Site/Corridor;
- Study the Corridor Characteristics;

- Obtain Information about the Establishments;
- Select the Businesses to be Studied;
- Collect Data; and
- Analyze Data.

The research team decided that the best approach to obtain the necessary data and information would be to develop and administer a survey to business establishments along the corridor. The research team, through several iterations, designed a survey to obtain quantitative data that is relevant to economic impacts, as well as data that may provide additional useful information. The survey was administered, in person, to more than half of the businesses along the Texas Avenue corridor. Through this process, the research team collected data from an array of businesses. By administering the surveys in person, in an interview-type format, the research team was able to obtain a much higher response rate than what might be achieved through a mail-out survey.

3.3 STUDY SITE

3.3.1 Site/Corridor Identification

The research team performed the initial test of the methodology in the Bryan/College Station, Texas area, which is located in the Bryan District of TxDOT. Specifically, the methodology was tested on a segment of State Highway (S.H.) Business 6 (Texas Avenue) bounded by Texas Farm-to-Market (F.M.) 60 (University Drive) on the north and F.M. 2818 on the south (figure 3-1) in College Station, Texas. The first phase of construction occurred on the northern portion of Texas Avenue, from University Drive to Dominik Drive. The contract for the construction of the remainder of the corridor (from Dominik Drive to F.M. 2818) is scheduled for bidding near the year 2001. Even though only the northern section of the corridor is currently under construction, data were collected along the entire corridor to aid in testing the methodology.

3.3.2 Corridor Characteristics

Texas Avenue is a four-lane arterial divided by a two-way left-turn lane (TWLTL) north of Dominik Drive (figure 3-2). Some portions of the southern segment of Texas Avenue have six lanes and are also divided by a TWLTL. All intersections with cross streets are at-grade. The construction project will provide Texas Avenue with six lanes from University Drive to Dominik Drive and a non-traversable median that will create left-turn bays at specified openings (figure 3-3).

The development along the corridor is primarily commercial, with some churches, municipal buildings, and vacant parcels. Most of the commercial development is concentrated within shopping centers, but there are several free-standing businesses with individual curb-cuts and driveways. The northern most segment of Texas Avenue, approximately 2.4 kilometers, has commercial development on only the east side of the street. The Texas A&M University campus is located on the west side. This part of the campus is comprised of a golf course and other undeveloped land. There is one main entrance to the campus within this segment of Texas Avenue.

3.3.3 Obtain Business Information

Windshield Survey

After identifying the corridor, the research team conducted a windshield survey of business establishments along the corridor. Team members drove the corridor, recording the names and locations of establishments. For the most part, the team members recorded only establishments that fronted on Texas Avenue or were located in shopping centers with direct access to Texas Avenue. The most notable exceptions were businesses located on Dominik Drive, which intersects with Texas Avenue as a "T" intersection. While those businesses do not have direct frontage on Texas Avenue, they do depend on access from Texas Avenue for their customers. In addition, the research team knew that the intersection of Texas Avenue and Dominik Drive would be directly affected by the installation of the raised median on Texas Avenue; left turns to and from Dominik Drive would be prohibited by the raised median. There are also some

businesses located in shopping centers with direct access to Texas Avenue that have direct access to side streets and are located a considerable distance from Texas Avenue. In those cases the side streets would retain their left-turn access to and from Texas Avenue at major intersections. Only a few of these businesses were identified in the windshield survey for potential interview surveying. Once the research team identified all of the establishments along the corridor, the team created maps and tables of the establishments. This effort facilitated the process of prioritizing establishments to be interviewed.

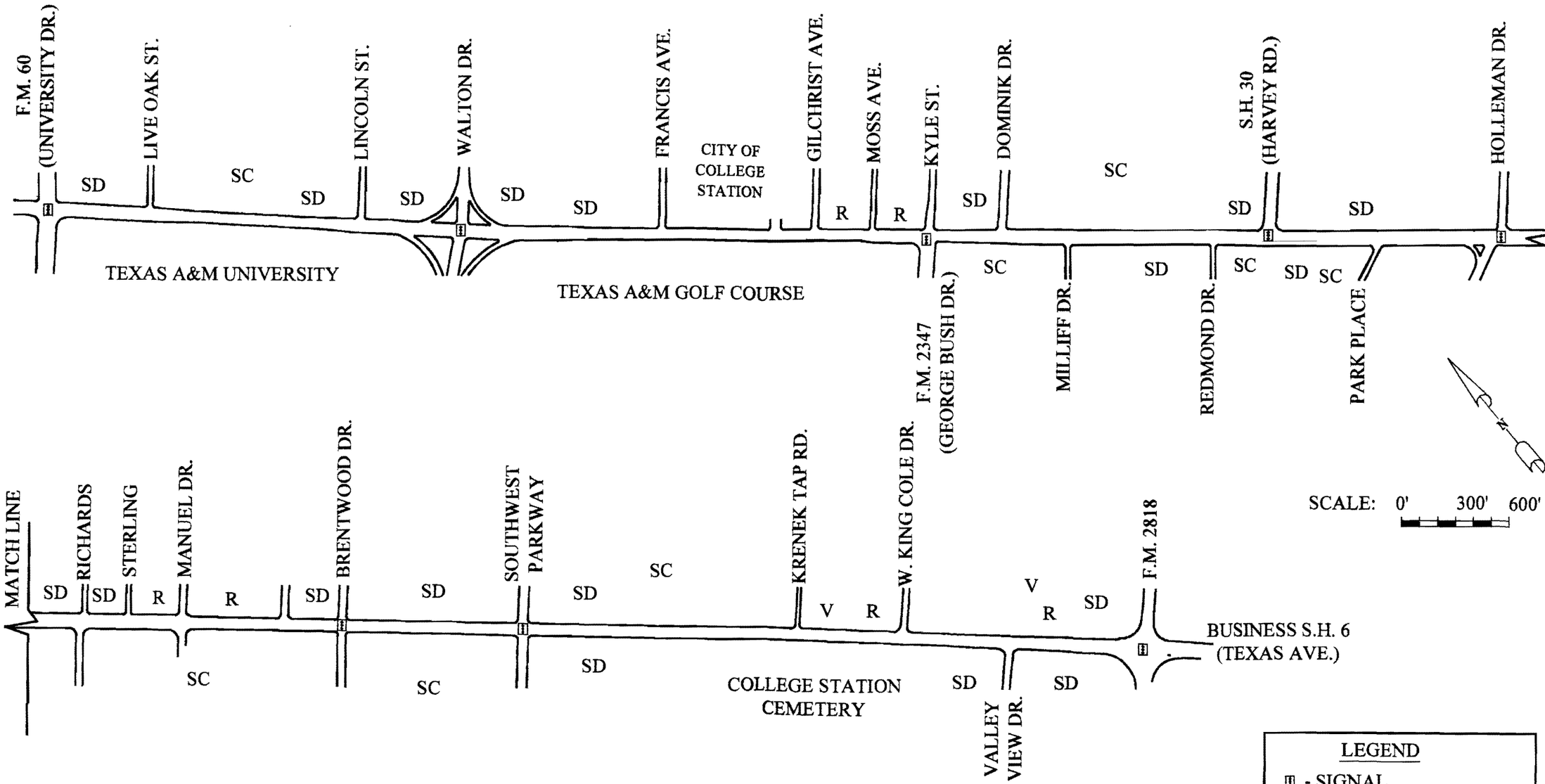

Figure 3-1. Texas Avenue Study Corridor From F.M. 60 to F.M. 2818

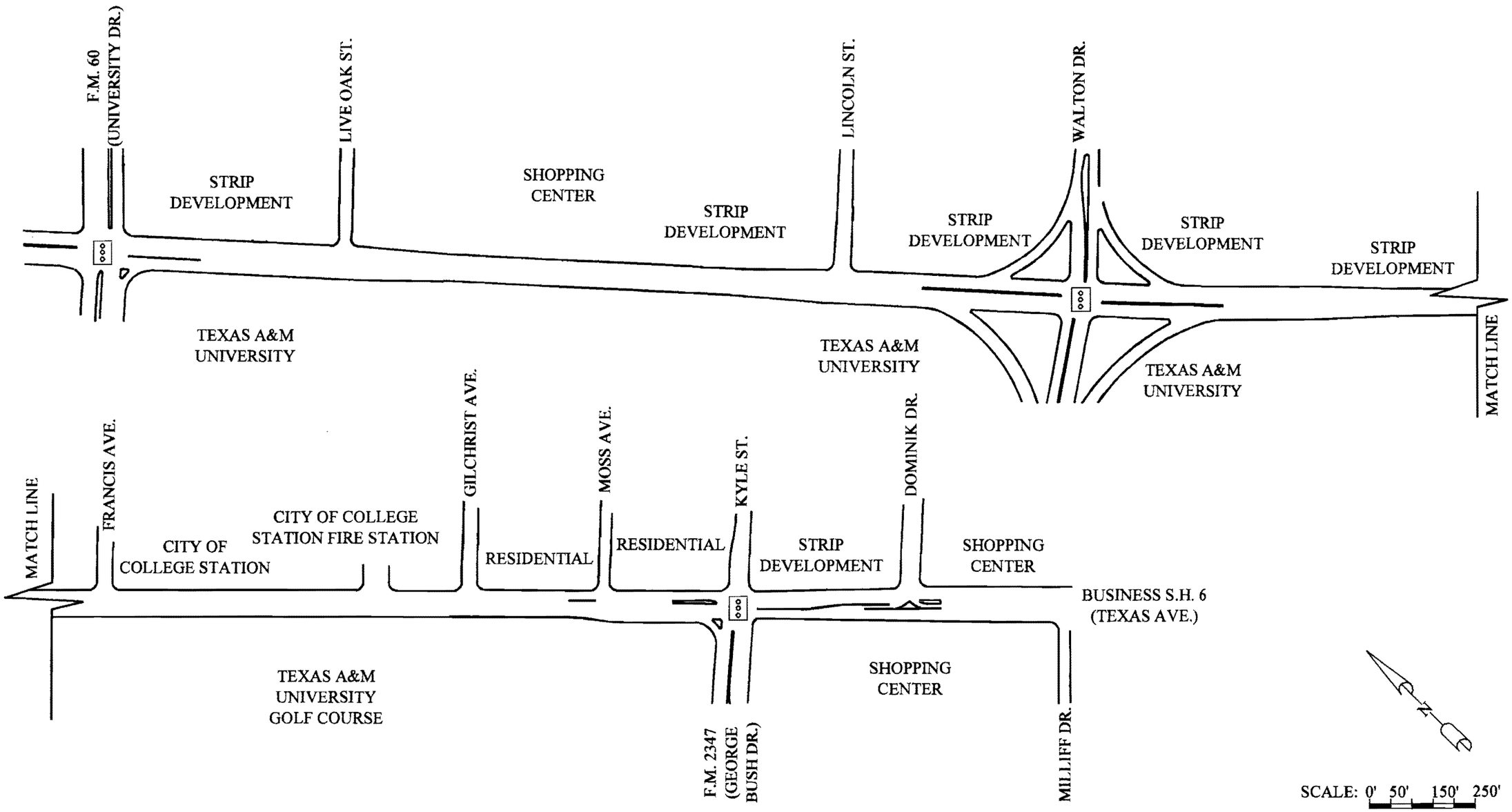

Figure 3-2. Texas Avenue Corridor North of Dominik Drive Before Construction

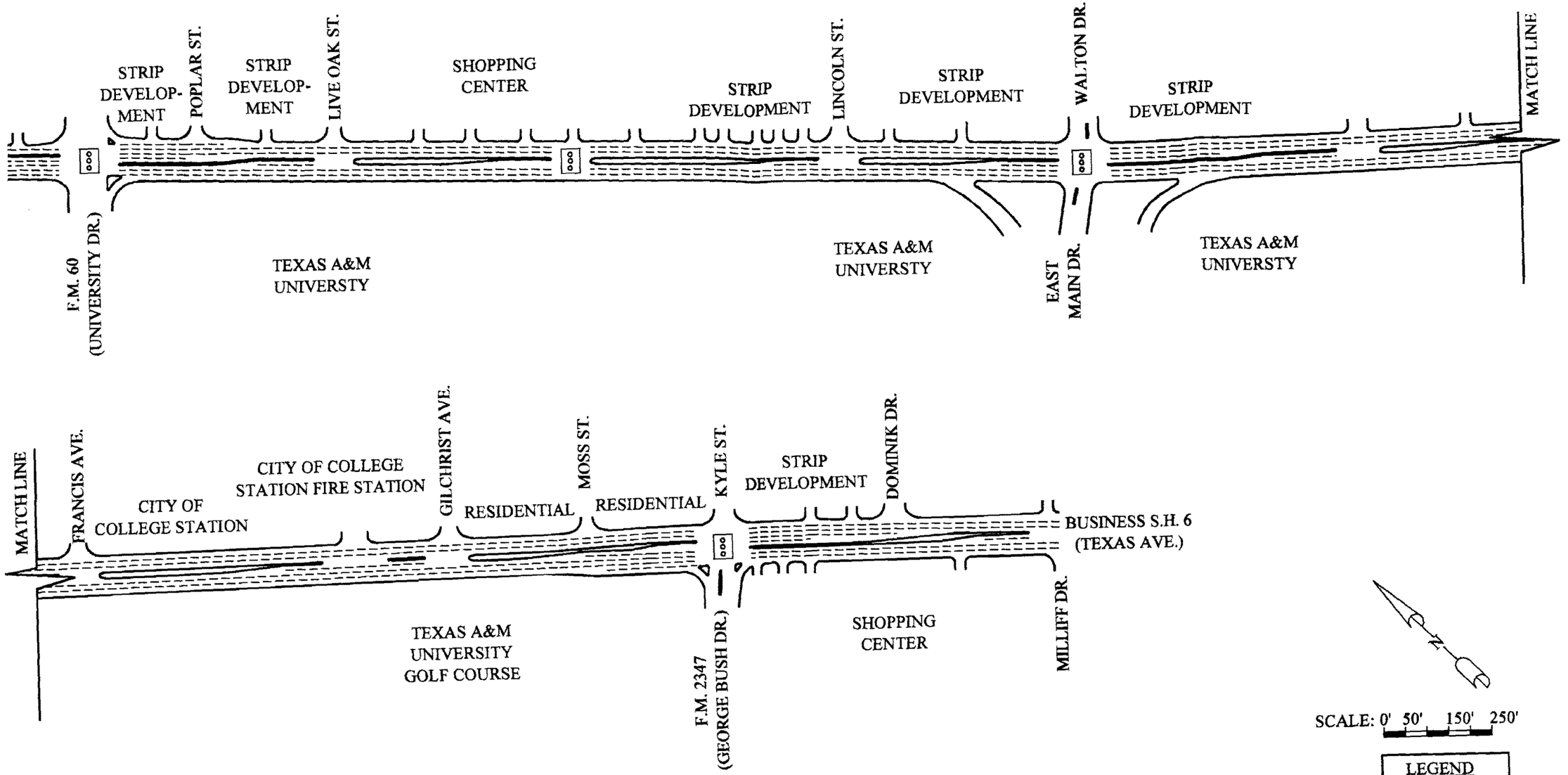

Figure 3-3. Texas Avenue Corridor North of Dominik Drive After Construction

Assistance from Other Agencies

In an effort to gain participation from as many businesses as possible, the research team solicited assistance from the Bryan/College Station Chamber of Commerce. The team contacted a Chamber of Commerce representative who agreed to send a letter from the Chamber to businesses in support of this project and encouraging them to participate in the interview surveys. While no statistics related to the Chamber's assistance and business participation were recorded, that assistance proved to be beneficial. That supposition was made from comments from some of the survey participants.

The Brazos County Appraisal District provided valuable assistance in the effort of determining property values for businesses and properties along the Texas Avenue corridor. The research team developed important working relationships with Appraisal District Office staff members. These staff members assisted the research team by making available District resources and instructing them on how to use the resources. The Appraisal District Office staff members also took an interest in the project.

The research team also contacted the Texas State Comptroller's Office, seeking information related to business sales tax. Although the sales tax information desired by the research team was not available due to state law, the Comptroller's staff was extremely helpful in determining this fact and investigating alternative sources of information.

3.3.4 Selection of Businesses to Survey

The research team realized early in the project that, for a variety of reasons, it would not be possible to survey every establishment within the corridor. Therefore, a process was developed to select business establishments to be surveyed. The first step in identifying establishments was to conduct a windshield survey and record the names of every establishment along the corridor. The research team then categorized the establishments by type (e.g., various retail businesses, corporate offices, medical offices, churches, and municipal buildings). The researchers studied the types of businesses and establishments and prioritized them as to their perceived relative importance of being included in the survey process. Several factors were used to determine the perceived relative importance, including:

- Dependence upon access to the arterial for economic vitality;
- If the establishment was actually a business or other type of establishment; and
- Proximity to Texas Avenue.

The establishments were divided into three groups of prioritization: 1 (highest), 2 (medium), and 3 (lowest). Priorities were assigned to establishments based on their apparent relevant dependencies on adjacent traffic for economic vitality as well as geographic distribution. Examples of priority 1 establishments are gasoline stations, restaurants, and retail stores. Priority 2 establishments are generally stores that sell higher-priced, durable items, such as furniture, or establishments that depend somewhat on appointments, such as medical offices and clinics. In considering geographic distribution of survey participants, some stores were assigned a priority 2 ranking because they are located in a shopping center that already had as many as, or more, priority 1 ranked establishments of similar nature as similar shopping centers. Establishments such as churches, educational facilities, corporate offices, and municipal buildings were identified as priority 3 and were not immediately targeted for surveying.

The research team then attempted to contact all of the priority 1 businesses and to survey as many of them as possible. The researchers made this decision based on the fact that priority 1 establishments are most likely to be impacted by the installation of a raised median; therefore, it was determined that the responses from priority 1 establishments would possibly be more valuable than those of priority 2 and 3 establishments. The team decided to contact as many of

the priority 2 establishments as necessary to provide good geographic coverage as well as a wider variety of businesses. It was decided to contact priority 3 establishments in cases where they would help provide better geographic coverage or it was determined that the responses would be useful.

3.3.5 Data Collection

One of the primary means of collecting data for this project was the use of surveys. Two types of surveys were developed for this study: a business survey and a vacant land survey. The purpose of the business survey was to obtain information from businesses operating along the corridor, while the vacant land survey was developed to get information about undeveloped parcels. Furthermore, the research team considered various survey methods to utilize, including telephone, mail-back, and interview surveys. The format of the survey instrument is dependent on the type of survey process utilized. Telephone surveys require either an appointment being made ahead of time or a "cold call." The success of mail-back surveys relies on survey recipients taking time to complete the surveys and return them in the mail. To maximize the response rate, the researchers decided to conduct the surveys in person using an interview process.

Business Survey

The business survey asked a variety of questions of business owners and/or managers along the Texas Avenue corridor. The survey used for this study is shown in Appendix A. There are basically two types of questions in the survey: quantitative and qualitative. The quantitative questions are designed to obtain numerical or other data that can be used to achieve findings and conclusions directly tied to economic impacts. The qualitative questions are included to acquire the merchants' comments regarding issues related to the installation of the raised medians.

Some of the questions which yield quantitative results relate to retail sales, numbers of employees, and distances to the nearest proposed median opening. The quantitative results are data that can be analyzed and, in many cases, produce trend lines of historical information. The historical information will be imperative to ultimately estimate what, if any, economic impacts businesses realize as a result of the construction of the raised medians.

In the process of developing the business survey, the research team considered several types of data that may be useful for estimating the economic impacts of raised medians on businesses. Obviously, the most important data came from issues related to economic success, such as retail sales and numbers of employees.

Types of Questions in the Survey The following discussion details the questions that were included in the business survey used in testing the methodology. This discussion provides some background information of why the questions were included and the types of information the research team anticipated receiving from each question. Chapter Four presents an explanation of the survey responses and analytical results.

There are four general types of questions in the survey: historical/geographical, perceptive, quantitative, and categorical. The first three questions of the survey are historical/geographical in nature, asking if the building is owned or leased, when the business began operating at the current and previous locations, and if the business had to relocate due to right-of-way acquisition. The questions were designed to provide basic background information as well as possibly to be used to stratify data during analyses of other responses.

The perception questions asked the respondents to give their perceptions of a variety of topics related to the potential impacts of medians. The purpose in asking perception questions is two-fold: their responses provide insight into the mind-set of business owners regarding the installation of medians as well as that those results can ultimately be compared to quantitative data. That comparison will provide information that can be used to determine if business owners'/managers' perceptions match quantitative results. The first of these questions asked the respondent to estimate what percent of the business' customers are passer-by traffic and what percent planned to stop at that business prior to leaving their home, business, school, etc. The next perception question asked the respondents if they believe regular customers will be less likely, more likely, or remain about the same to return to that business after a median is installed. Another question asks the respondents to rank six factors that consumers likely consider when selecting a business to patronize. The respondents were asked to put themselves in the position of the consumer when ranking those factors, which include accessibility to the store, customer service, product price, and others. The business survey also included two multi-part questions about the respondents' perceptions of how the new medians would affect specific aspects of their

businesses as well as the corridor overall. The final perception question asked if the respondent believed that the new median would increase, decrease, or not affect the travel time for consumers to the business.

The six quantitative questions in the business survey were designed to obtain quantitative data that could be analyzed statistically. Some of these data ultimately provided the information that most directly led to the estimation of economic impacts of raised medians on businesses. These data will be most useful when the same questions are asked again at a time after the median construction is complete and the two sets of data can be compiled. Two of the quantitative questions requested annual gross sales, offering the respondent with an option of providing either specific amounts or ranges. Respondents answered one of these two questions. Another quantitative question asked how many full- and part-time employees the business has had since 1995, before construction began. This question was included because the employment at a business can provide secondary information regarding the economic condition of a business. In cases where businesses did not provide gross sales information, employment may likely be the most important economic indicator. Other quantitative questions asked if, and by what percentage, rent has increased for businesses that operate in leased spaces, the number of parking spaces that businesses had before and during construction, and the estimated peak hours of operation for the businesses.

The categorical questions recorded the demeanor of the person surveyed, construction progress in front of the business, and location of and approximate distance to the nearest median opening. The demeanor of the respondent related to his or her attitude during the survey, not whether or not he or she was for or against the median project. These questions were not asked of the respondent during the interview, but were answered by the researcher immediately before or after the interview. The responses to these questions can be used in the data analysis process to stratify the data from other responses.

Questions Not Included in the Survey The research team considered several potential questions for the survey that were not included in the final version. One type of data that was considered and investigated for potential use in this study was sales tax information from the State Comptroller's Office. The research team determined that if sales tax information was known, then retail sales amounts could be calculated. However, after several meetings with the

Comptroller's staff, the research team learned that such information is not made available to the public. In addition, other related information would either not be available or would not be beneficial to the study.

Another type of question that was considered, but not included in the final version of the survey, pertained to the performance of the construction contractor and TxDOT personnel. While this information may have been interesting or useful to TxDOT, the research team determined that it would possibly detract from the data needed for estimating economic impacts. That detraction could occur by having negative or positive feelings about the contractors and/or TxDOT carry over into other questions. The research team decided to maintain the integrity of the results by including only questions that related to potential economic impacts of medians.

The research team considered inquiring about moving costs resulting from having to relocate as a result of TxDOT's purchase of right-of-way. However, no establishments had to move as a result of right-of-way purchases. In addition, the researchers determined such information would not be useful since moving costs are included in right-of-way acquisition packages and would not be indicative of economic impacts of medians.

This research project did not include the collection of shopping center occupancy rates, although the research team considered that data. While occupancy rates may eventually prove useful, the researchers decided not to collect those data since they would not provide results leading directly to economic impacts on businesses. Shopping center occupancy rates may be considered for inclusion in the methodology if it is determined that that type of data are useful.

During the process of conducting the surveys, the research team considered requesting the number of gallons of gasoline that gasoline stations sold, in addition to monetary sales data. The main advantage of collecting gasoline volume data over monetary sales would be that the gasoline volume would account for variances in the price of gasoline. However, in recent years there have not been significant gasoline price differentials. In addition, this idea did not evolve until later in the project, and it was also not clear how easily that type of data would be to collect.

Similarly, the research team considered collecting hotel/motel occupancy rates. The advantage of collecting lodging occupancy rates, like the gasoline volume, is that it would allow for changes in lodging rates over time. While it was not clear how freely innkeepers would share that data, similar data is available through the State Comptroller's Office. Further consideration will be given to lodging occupancy rates in future methodology tests.

The documentation of the reasoning behind these economic indicator uses is valuable because they are anticipated to be useful in future evaluations of economic impacts as part of this project and efforts elsewhere.

Vacant Land Survey

Background/Purpose The vacant land survey (see Appendix B) was designed in a similar fashion as the business survey. However, different or modified questions were needed to obtain relevant information. The vacant land survey contains fewer questions than the business survey since the only information available relates to the use of the property and not a business enterprise. The purpose of the vacant land survey was to find out from the property owners what types of plans they may have for developing the property and how the median installation may affect those plans, if at all.

Survey Administration The Texas Avenue corridor in this project is being constructed in two phases. The north phase, from University Drive to Dominik Drive, is receiving the median installation first. Construction was underway at the time of this project. The south phase, from Dominik Street to F.M. 2818, is scheduled for contract bidding near the year 2001, with actual construction beginning in approximately 2002. The north phase contains no vacant land; therefore, the vacant land survey was not administered in that portion of the project. In addition, due to the fact that construction on the south phase is not scheduled to begin for at least four years, the vacant land survey was not performed in the south section either. However, the research team anticipates using the vacant land survey on new study corridors in the next year of the study, provided these corridors contain vacant land.

3.3.6 Analyze Survey Data

This section will describe the analyses performed and summarized in Chapter Four of this report. Both quantitative and qualitative data and observations were included for analysis. Summary statistics and analysis were performed to describe the data collected in the survey and property value trends are introduced. In addition, qualitative comments and observations are included that

describe the experiences utilizing the recommended methodology and comments from business owners during survey administration.

As mentioned previously, both quantitative and qualitative analyses and observations were evaluated. The quantitative analyses were the first to be performed and are described in the following chapter. The first portion of the quantitative analyses included the identification of variables that were utilized to stratify the data for analyses. After the stratifiers are identified, survey participation rates are presented. One important aspect of the survey administration was to determine the success of performing data collection with the use of a business survey along Texas Avenue. Survey results are then described for many economic indicators and questions contained on the business survey. These results include summaries of key economic indicators including gross sales, employment trends, and parking space availability. Analyses are also performed on additional elements of interest, including customer accessibility, passer-by and planned trips, and the raised median installation effect on regular customers. Perception questions related to customer rates, property values, accidents, and traffic volumes are also summarized. Furthermore, trend analyses are provided for property values along the Texas Avenue corridor.

After the discussion of quantitative data results, the following chapter describes qualitative summaries of information obtained in the study. The first comments described in the results are comments provided by business owners during the personal interviews. Observations are also presented that describe the usefulness of survey questions whose responses were not an integral part of the analysis at this stage of the project. These observations are expected to be of interest to those individuals who may require developing a survey for similar analyses. Finally, Chapter Four describes observations about the survey application experiences.

4.0 STUDY RESULTS

This chapter describes the results obtained in this study. Summary statistics and analyses are provided to describe the data collected from the survey. Following the summary statistics of the survey results, figures illustrating trends of property values over time are described. Finally, this chapter describes experiences with the developed methodology. In addition, comments of particular interest from business owners along the Texas Avenue corridor are presented.

4.1 DATA STRATIFICATION

The objective of this research project was to develop and test a methodology that can be used to estimate the economic impact of median design. As described in detail in Chapter Three, a methodology was developed to address this objective. The most significant portion of the methodology is the business survey used to collect information to measure the economic impact of the median installation. These surveys provide both quantitative and qualitative data from business owners. Since property values over time also provided an indication of the economic impact of the median design, obtaining this information was also an important step in the methodology.

As described in the previous chapter, researchers administered the survey by scheduling interviews with the business owners or managers. When scheduling the interviews, research team members discussed with the owners the type of information and questions that would be asked (e.g., sales information, number of employees). This effort aided in making the business owners more comfortable by knowing what to expect during the interview process.

Figure 3-1 illustrates the Texas Avenue corridor. Since the economic impacts of median design on businesses were the major interest in this study, the few residential areas along the corridor were not interviewed. Business owners for the vacant lot locations were not interviewed since there was a limited number of vacant parcels along the corridor. Further, since they were located to the south of Dominik Drive, according to the original scope of the project "after" data would not be collected. Prior to analysis of the data, researchers stratified business locations into

different groups based upon their location and type of business. Clearly, these situations will alter the extent of the economic impact upon a particular business. The first stratifier was that of the physical location of the business along the corridor relative to the project limits. The division between the north and south segments of project phasing along Texas Avenue is Dominik Drive. Since the businesses along Dominik Drive are not provided left-in and left-out access during the construction and after the median is installed, they were included with the businesses north of Dominik Drive during analysis. These two groups (north of Dominik and on Dominik) comprise of businesses that are affected by the median installation in the first phase. In addition, businesses to the south of Dominik provide a control group comparison to those businesses that are north of Dominik since the businesses to the south are along the same corridor in a similar environment without construction activity. Therefore, the control group provides a comparison of a similar corridor where one location is under construction and the other is not.

The next stratifier identified whether the business is located in a shopping center or is a strip development. Businesses in shopping centers are defined as those that 1) are set back from the street a relatively long distance, 2) share parking with adjacent businesses, and 3) share access. Strip development includes businesses that either stand alone or do not satisfy the above criteria for a shopping center. Finally, the type of business was used as a stratifier in the analyses. Depending upon the sample size of the analysis being performed, aggregation of like businesses was performed. Some analyses were kept disaggregate to provide information about economic impacts on specific types of businesses. Later sections will discuss this in further detail.

4.2 SURVEY PARTICIPATION RATES

A particular interest in this study was the response rate of survey participants. A significant portion of the methodology being developed to aid in the estimation of economic impacts depended upon the accuracy and quantity of data obtained in these surveys. The following discussion explains the success rates in obtaining survey data from business owners and managers.

Table 4-1 shows a breakdown of the 202 businesses adjacent to the Texas Avenue corridor at the beginning of the project, and their participation status. Several businesses (30) stated that they were not interested in participating in the survey or that their "parent" organization would not allow them to participate in the study. An additional five businesses noted that they were not interested in the study, and they didn't feel they would be affected by the raised median installation. A total of 21 businesses either closed or moved operations during the course of the study interviews, and 28 businesses were not applicable to the study. The lots that are not applicable to the study included municipal buildings, businesses identified on side streets, or businesses in which the raised median installation would likely not have an effect since they provide a specific service.

Table 4-1. Business Survey Participation of Businesses and Establishments Along Texas Avenue

Business Participation Status	Number of Businesses and Establishments
Not Interested	30
Not Interested--And Didn't Feel They Would be Affected	5
Closed or Moved	21
Not Applicable to the Study	28
Waiting for Next Set of Surveys	23
Surveyed	95
Total	202

It was originally desired to obtain "during" and "before" data for all businesses along Texas Avenue. "After" data was also expected to be collected along the entire corridor after the installation of the raised median. With the originally proposed construction project time frame, it was anticipated that the "before" data would be recollected south of Dominik Drive immediately before construction. This was necessary since it was not known exactly where median openings in the south segment would be when the interviews were originally performed. However, since the current research project contract does not allow for new data collection of

the "before" data in the south section of Texas Avenue, this data will not be recollected. The 23 businesses labeled "Waiting for Next Set of Surveys" in table 4-1 are those that would have originally been included in this second survey of the "before" data on the south segment of Texas Avenue. Although businesses south of Dominik Drive are not currently scheduled for follow-up surveys, those results are still vital to the success of testing this methodology.

Finally, table 4-1 indicates that 95 businesses were surveyed in the study. It should be noted that although there are 202 businesses along Texas Avenue, the actual number of businesses that could be possibly surveyed was 130. This is the result when businesses that were closed or moved (21), not applicable (28), or were being saved for the next set of scheduled surveys (23) are subtracted from the 202 original businesses and establishments. One can generally expect a return rate of approximately 15 to 20 percent with a mailout survey requesting the information on the business survey. The response rate with the scheduled interviews in this study was 73 percent (95 out of 130).

Table 4-2 contains the number of businesses surveyed by their location relative to Dominik Drive. As shown in the table, there were 25 businesses surveyed north of Dominik and 70 businesses surveyed south of Dominik. Percentages based upon 95 completed business surveys are also shown. These percentages indicate that a larger percentage of the businesses are located south of Dominik (74 percent). Table 4-3 shows the number of businesses that were surveyed that are in shopping centers or were part of a strip development. Table 4-4 illustrates the breakdown of surveyed businesses by their location relative to Dominik and whether they are in a shopping center or strip development. Percentages of the total number of businesses surveyed (95) are also shown.

Table 4-2. Location of Surveyed Businesses and Establishments Along Texas Avenue

Location Relative to Dominik Drive	Number and Percentage of Surveys[1]
Businesses North of Dominik Drive	25 (26%)
Businesses South of Dominik Drive	70 (74%)
Total Surveyed	95

[1]Percentages are calculated compared to the 95 surveys performed.

Table 4-3. Breakdown of Businesses and Establishments in Shopping Centers and Strip Development

Location	Number and Percentage of Surveys[1]
Shopping Center	59 (62%)
Strip Development	36 (38%)
Total Surveyed	95

[1]Percentages are calculated compared to the 95 surveys performed.

Table 4-4. Breakdown of Participant Surveys by Location Relative to Dominik Drive

Location	Shopping Center	Strip Development
North of Dominik	11 (11%)	14 (15%)
South of Dominik	48 (51%)	22 (23%)

Note: Percentages are calculated compared to the 95 surveys performed.

After the data stratifications were determined and the number of completed surveys was determined, it was necessary to investigate the number of surveys that were obtained by different businesses based upon their location along the corridor. As previously described, the location of the business was important for research purposes as well as whether the business was located in a shopping center or in a strip development. When evaluating the economic impacts of median design, the effects upon a particular type of business (e.g., gas station, fast food restaurant) are of interest. To ensure the confidentiality of the survey participants, survey results are not reported when it is possible to recognize which businesses and establishments along the corridor may have responded.

Table 4-5 shows the sample size for each of these business categories for the completed interviews. The table also indicates the total number available of each business type. The table shows that the largest sample sizes were for specialty retail (e.g., clothing stores, hobby-related stores, book stores, etc.), sit-down restaurants, and other services (e.g., hair salons, beauty shops, copy stores, travel agencies, shipping stores, etc.). The sample sizes for other business types were relatively small. Namely, gas stations were much less likely to provide information about

sales, often because they were not allowed to by the parent organization. However, specialty retail shops and fast-food restaurants were often willing to provide data for the study.

Table 4-5. Sample Sizes for Specific Business Types

Business Type	Total Number of Potential Survey Participants	Number and Percentage of Survey Participants[1]	Survey Participants North of Dominik Drive	Survey Participants South of Dominik Drive
Specialty Retail	42	33 (35%)	6	27
Durables Retail	1	1 (1%)	0	1
Grocery	3	3 (3%)	0	3
Gas Station	4	2 (2%)	1	1
Convenience and Gas Station Combined	2	1 (1%)	1	0
Sit-down Restaurant	22	16 (17%)	4	12
Fast-food Restaurant	8	6 (6%)	0	6
Tavern	1	1 (1%)	1	0
Other Services	37	27 (28%)	11	16
Hotel	5	3 (3%)	0	3
Medical	5	2 (2%)	1	1
Total	130	95	25	70

[1]Percentages are calculated compared to the 95 surveys performed.

Researchers performed analyses at this disaggregate level to the extent possible and when sample sizes were high enough to report confidential results. They also performed analyses at a more aggregate level by groups of economically-similar business types. Table 4-6 shows these groups along with the sample size of each business type. This aggregation level was chosen to provide a larger sample size in each group and to group similar business types. A final analysis was performed that evaluated the results of all businesses north of Dominik with those south of Dominik.

Table 4-6. Business Groups by Economic Similarity Used in the Study Including Sample Sizes

Business Groups		
Group 1	*Group 2*	*Group 3*
Specialty retail (33)	Sit-down restaurant (16)	Other services (27)
Durables retail (1)	Fast-food restaurant (6)	Hotel (3)
Grocery (3)	Tavern (1)	Medical (2)
Gas station (2)	—	—
Convenience and gas station combined (1)	—	—
40 (42%)	23 (24%)	32 (34%)

Percentages are calculated compared to the 95 surveys performed.

4.3 STATISTICAL SIGNIFICANCE OF ANALYSES AND RESPONSE BIAS

The target population for the survey was the 130 businesses and establishments adjacent to sections of Texas Avenue that are being widened or will be widened and include a median. Random sampling of such a small population may require mathematically-involved statistics. In this case, however, it was possible to contact the entire population. In spite of this, complete information for the whole population was not obtained because some business managers chose not to answer some or all of the questions. Whether the information obtained from those who chose to respond is representative of the whole population is open to speculation. Respondents themselves selected whether or not to respond to the survey and thus were not chosen at random. Therefore, statistical tests based on random sampling do not answer the question of whether the number of respondents was appropriate for inferences about the whole population. Furthermore, there is an inherent response bias in the collected data since not all businesses completed a survey. Even though the information may not fully represent the whole population, this was the most complete information that was available.

4.4 ANALYSES OF SURVEY RESULTS

The previous section described the survey participation rates that were realized for this study. Since a significant portion of the methodology includes the use of the survey for data collection, survey participation was critical. In addition, the success of such a survey instrument was of interest.

The following sections describe analyses that were performed to investigate the influence of the median installation along Texas Avenue. These sections include analysis of measures of key indicators such as gross sales, employment trends, parking space availability, and other descriptive statistics (e.g., ease of access, business owner perceptions).

4.4.1 Gross Sales

Gross sales information is of particular interest when estimating the economic impact of median design. Table 4-7 presents the total number of businesses in each category along with the number of businesses that provided gross sales information in either question 13 (actual amount by year) or 14 (provided a range). Reviewing table 4-7 reveals that specialty retail, sit-down restaurants, and other services have a relatively higher number of samples than the other categories. The sample sizes for durables retail, grocery stores, gas stations, fast-food restaurants, hotels, taverns, and medical are not large enough to be used in disaggregate analyses.

Table 4-7. Number of Survey Participants Answering Questions Referring to Gross Sales Information

Business Type	Total Number of Businesses Surveyed	Participants Answering Question 13 (Actual Sales Data)	Participants Answering Question 14 (Sales Ranges)
Durables Retail	1	1	0
Specialty Retail	33	13	4
Grocery	3	0	1
Gas Station	2	0	0
Convenience and Gas Station Combined	1	0	1
Fast-food Restaurant	6	1	2
Sit-down Restaurant	16	4	6
Tavern	1	0	0
Hotel	3	1	0
Medical	2	2	0
Other Services	27	8	6
Totals	95	30	20

Analyses of gross sales data were performed at the most disaggregate level (i.e., by business type when appropriate), by group as shown in table 4-6, and at the most aggregate level (i.e., analyzing all businesses north and south of Dominik Drive). These analyses included using the results of questions 13 and 14 of the survey that provide actual sales and sales ranges for the years of interest in the study. These analyses also evaluated responses to the questions listed in figure 4-1. It should be noted that the Consumer Price Index (CPI) was applied to the actual sales figures provided in question 13 for analysis. The past sales data were converted to 1996 dollars—the year of during-construction data. The CPI values were obtained from the U.S. Bureau of the Census and the Internet (*26*, *27*).

Business Survey

8E. What will be the effect of the construction on gross sales?

8E. What will be the effect of the median installation on gross sales?

9D. What will be the effect on the gross sales volumes for all businesses on Texas Avenue due to the construction?

9D. What will be the effect on the gross sales volumes for all businesses on Texas Avenue after the median is installed?

9E. What will be the effect on the gross sales volumes for all other businesses in College Station due to the construction?

9E. What will be the effect on the gross sales volumes for all other businesses in College Station due to the median installation?

Figure 4-1. Survey Questions Related to the Effects on Gross Sales

As shown in the survey in Appendix A, the six questions listed in figure 4-1 allow the responder to answer each question with the following ranges: down more than 25 percent, down less than (or equal to) 25 percent, no change, up one percent to 25 percent (inclusive), up more than 25 percent, or unsure. Therefore, perceptions from the business owners were obtained for comparison to the actual sales information provided.

Analyses were first performed by evaluating the sales information reported by business type. Table 4-7 indicates that the specialty retail, sit-down restaurant, and other services are the three categories that have a relatively higher sample size than the other categories. Since the collected data are rather limited for the other groups, results are not reported for these categories. For each business type, responses for both questions 13 (actual sales) and 14 (ranges) were obtained. When the analyses were performed, it was found that the data obtained in the form of ranges could not be aggregated with the sales data obtained from question 13 (actual amount). The range data tended to influence the standard deviation, especially when the range of over one million was included. It was noted that those businesses and establishments that reported a range generally had a relatively higher income as a group. These businesses often indicated that they were experiencing growth every year as well.

Table 4-8 presents the average and standard deviations of percent change in sales reported in question 13 of the survey for each business type. The table includes the location of the business types relative to Dominik and the sample size upon which the summary statistics are based. It is important to note that the sample size values in table 4-8 are lower in some cases than those reported in table 4-7 because businesses did not always report sales information for all years of interest (e.g., both before- and during-construction data). This was due to the fact that some businesses were open only one of the years. Further, the stratifying variable of whether a business is located in a shopping center or is a stand-alone business could not be used in the analysis. It caused sample sizes in particular analyses to become too small to obtain results of interest.

Table 4-8. Average and Standard Deviation of Percent Change in Gross Sales Comparing Before and During Construction

Business Type	Sample Size (n)		Average Percent Change[1]		Standard Deviation of Percent Change	
	North	South	North	South	North	South
Specialty Retail	—	10	—	11.7	—	32.8
Sit-down Restaurant	—	3	—	8.9	—	19.2
Other Services	4	3	-4.4	11.5	8.2	25.3

[1]The difference in gross sales before and during construction is not statistically significant at the α=0.05 level of significance.

Table 4-8 indicates that the sales data obtained for businesses north of Dominik Drive are very limited. The category of other services provided the largest sample north of Dominik Drive for a given business type. Although the sample size is very small, the data suggest that sales were decreasing during the construction phase of the section north of Dominik Drive. Sales appeared to increase in the section south of Dominik Drive while the construction continued north of Dominik.

Since the largest samples were obtained with specialty retail, sit-down restaurants, and other services, these business types were studied further. The responses to the six questions shown in figure 4-1 were analyzed. These six questions originated from questions 8E, 9D, and

9E on the business survey shown in Appendix A. Table 4-9 presents the total number of businesses responding to each range along with the percentage for specialty retail businesses. The construction phase column contains either "during" or "after." When "during" is indicated, the responses pertain to the business owners' perception of the construction impacts during the construction relative to what was being experienced prior to the construction. When "after" is indicated in this column, the responses are considering the perceived change that will result after the median is installed relative to what was being experienced prior to construction. The questions provided previously in figure 4-1 are referred to in the following table.

Table 4-9. Responses to Questions in Figure 4-1 Related to Gross Sales for Specialty Retail Stores South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	2 8%	10 37%	11 41%	3 11%	0	1 4%
8E	After	1 4%	2 7%	14 52%	8 30%	0	2 7%
9D	During	4 15%	18 67%	3 11%	1 4%	0	1 4%
9D	After	0	2 7%	10 37%	14 52%	1 4%	0
9E	During	0	4 15%	11 41%	10 37%	1 4%	1 4%
9E	After	0	1 4%	16 59%	7 26%	1 4%	2 7%

Many observations can be made from the results presented in table 4-9. In response to question 8E, 46 percent of the respondents believed that the construction period would cause gross sales to go down. Further, as indicated for question 8E, 82 percent of business owners thought that gross sales would increase or not change after the median installation. In response to question 9D, 82 percent of the respondents felt that the gross sales volumes for all businesses

on Texas Avenue would decline due to the construction. Conversely, 93 percent of the respondents felt that the presence of the median would cause sales to increase or not change along Texas Avenue. Finally, 81 percent of specialty retail owners felt that the construction along Texas Avenue would increase the gross sales volumes in other parts of College Station implying a transfer of consumer patronage. After the median installation, 89 percent of the business owners felt that the gross sales volumes would either increase or not change. It is important to note that these are the results provided by businesses south of Dominik Drive. There were very few respondents to the sales information for specialty retail north of Dominik Drive.

A similar analysis was also performed for sit-down restaurants. Table 4-10 presents the summary statistics for these establishments. The data in table 4-10 indicate that the construction period is anticipated to cause a decrease in sales. This is shown by the responses to questions 8D and 9D. Further, after the median is installed, there is generally a perception among sit-down restaurant owners that sales will increase. The response to question 8D ("after") demonstrates that 67 percent of business owners believe that the median installation will either result in no change or an increase in sales. A perceived growth in sales or no change is also indicated for Texas Avenue (83 percent) and for College Station (83 percent).

The results shown in table 4-11 for other services were similar to those of other business types. Namely, 63 percent of the respondents felt that during the construction the gross sales would decrease (question 8E). Sixty-three percent of the business owners feel that the gross sales will increase or not change (question 8E). During the construction phase, 75 percent of the respondents felt that Texas Avenue would experience a decrease in gross sales (question 9D), and after the median installation 75 percent of the respondents thought that there will either be no change or an increase in gross sales (question 9D). In response to question 9E, 75 percent of business owners perceived that there will either be no change or that gross sales would increase for College Station. After the installation of the median, 81 percent of the respondents for other services believe that there will be either no change or an increase in gross sales.

Table 4-10. Responses to Questions in Figure 4-1 Related to Gross Sales for Sit-Down Restaurants South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8D	During	4 33%	4 33%	2 17%	1 8%	0	1 8%
8D	After	0	1 8%	3 25%	5 42%	0	3 25%
9D	During	2 17%	8 67%	1 8%	0	0	1 8%
9D	After	0	0	2 17%	8 67%	0	2 17%
9E	During	0	0	5 42%	6 50%	1 8%	0
9E	After	1 8%	0	10 83%	0	0	1 8%

Table 4-11. Responses to Questions in Figure 4-1 Related to Gross Sales for Other Services South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8D	During	4 25%	6 38%	4 25%	0	0	2 13%
8D	After	1 6%	2 13%	7 44%	3 19%	0	3 19%
9D	During	3 19%	9 56%	3 19%	0	0	1 6%
9D	After	1 6%	2 13%	6 38%	6 38%	0	1 6%
9E	During	0	2 13%	4 25%	7 44%	1 6%	2 13%
9E	After	0	0	8 50%	5 31%	0	3 19%

Table 4-12 contains summary data for other services that are north of Dominik Drive. At the disaggregate level (i.e., by business type), these data are the only data presented for north of Dominik since it was the only one that yielded a reasonable amount of data. The results are consistent with those found for north of Dominik Drive. The perception of the effect of construction on gross sales was that they would decrease according to 64 percent of the business owners (question 8E). Further, after the median is installed, 73 percent of the business owners believe that the gross sales will increase or not change (question 8E). There was also a general impression that during the installation of the median, gross sales would be down along Texas Avenue as stated by 82 percent of the respondents (question 9D). Fifty-five percent of business owners felt that after the completion of the median installation, gross sales would either not change or be up along Texas Avenue. Seventy-three percent of the survey participants claimed that the construction would cause gross sales throughout College Station to increase or stay the same while the same percentage stated that this would also be the case after the median was installed.

Table 4-12. Responses to Questions in Figure 4-1 Related to Gross Sales for Other Services North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	3 27%	4 36%	3 27%	1 9%	0	0
8E	After	1 9%	1 9%	4 36%	2 18%	2 18%	1 9%
9D	During	1 9%	8 73%	0	0	0	2 18%
9D	After	2 18%	0	1 9%	3 27%	2 18%	3 27%
9E	During	0	1 9%	2 18%	5 46%	1 9%	2 18%
9E	After	1 9%	0	5 46%	2 18%	1 9%	2 18%

Due to the relatively small sample sizes, after the summary statistics presented above were analyzed, groups of similar businesses were studied. Groups of similar businesses were defined as shown in table 4-6 and analyses similar to the above were conducted. Finally, the sales information for all the businesses north of Dominik Drive and south of Dominik Drive were aggregated and compared. The results of these analyses are discussed below.

Table 4-13 presents the average and standard deviation of percent change in sales values for before and during the construction along Texas Avenue. Although the businesses are grouped with similar businesses, the sample sizes are still rather small. Although the sample sizes are rather small, the data suggest that there is smaller growth north of Dominik Drive (i.e., during construction) than there is along the southern segment of Texas Avenue.

Table 4-13. Average and Standard Deviation of Percent Change in Gross Sales Comparing Before and During Construction

Business Type	Sample Size (n)		Average Percent Change[1]		Standard Deviation of Percent Change	
	North	South	North	South	North	South
Group 1	1	11	12.5	8.7	—	32.7
Group 2	—	3	—	8.9	—	19.2
Group 3	5	5	4.0	14.7	20.1	18.5
All	6	19	5.4	10.3	18.3	26.8

[1] The difference in gross sales before and during construction is not statistically significant at the α=0.05 level of significance.

Table 4-14 presents the data for the questions in figure 4-1 for the group 1 businesses north of Dominik Drive. The sample sizes for this group, as well as all groups north of Dominik Drive, are relatively small. It appears, however, that half of the respondents believed that during construction, sales were down. After the installation of the median, a larger percentage (43 percent) of the business owners felt that the median would be beneficial. Approximately 88 percent of the respondents felt that the median installation would also result in decreased sales along Texas Avenue during the construction phase. A majority of the business owners felt that sales would increase for the last four questions in figure 4-1.

Table 4-14. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 1 Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	2 25%	2 25%	2 25%	2 25%	0	0
8E	After	0	2 29%	0	2 29%	1 14%	2 29%
9D	During	2 25%	5 63%	0	1 13%	0	0
9D	After	0	1 14%	1 14%	3 43%	1 14%	1 14%
9E	During	1 13%	1 13%	3 38%	1 13%	1 13%	1 13%
9E	After	0	1 14%	2 29%	1 14%	1 14%	2 29%

Table 4-15 presents the results of the group 1 (specialty retail, grocery, gas stations) businesses south of Dominik Drive. The results are consistent with those obtained for businesses north of Dominik Drive. Table 4-16 presents the results of the group 2 businesses (sit-down and fast-food restaurants) located to the north of Dominik Drive. There is also a low sample size for these businesses north of Dominik Drive. These results are similar to those obtained with the group 1 businesses. Table 4-17 contains the responses to questions in figure 4-1 for gross sales for group 2 businesses south of Dominik Drive. Once again, the results are consistent with what was found for the group 1 businesses. A total of 72 percent of the respondents believed that during construction the sales would decrease while 72 percent of the business owners felt that after the median installation gross sales would either not change or would increase. A majority of business owners (83 percent) felt that during the construction of a raised median along Texas Avenue there would be a decrease in gross sales. A majority of the business owners responded that the gross sales would either not change or would increase after the median was installed.

Table 4-15. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 1 Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	5 16%	11 34%	12 38%	3 9%	0	1 3%
8E	After	2 6%	4 13%	15 47%	9 28%	0	2 6%
9D	During	7 22%	20 63%	3 9%	1 3%	0	1 3%
9D	After	0	3 9%	11 34%	17 53%	1 3%	0
9E	During	1 3%	4 13%	11 34%	13 41%	2 6%	1 3%
9E	After	1 3%	0	18 56%	9 28%	1 3%	3 9%

Table 4-16. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 2 Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	1 25%	3 75%	0	0	0	0
8E	After	0	0	3 75%	1 25%	0	0
9D	During	2 50%	2 50%	0	0	0	0
9D	After	0	0	1 25%	3 75%	0	0
9E	During	0	0	0	3 75%	1 25%	0
9E	After	0	0	1 33%	2 67%	0	0

Table 4-17. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 2 Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	5 28%	8 44%	2 11%	2 11%	0	1 6%
8E	After	0	2 11%	6 33%	7 39%	0	3 17%
9D	During	3 17%	12 67%	2 11%	0	0	1 6%
9D	After	0	1 6%	5 28%	10 56%	0	2 11%
9E	During	0	0	6 33%	10 56%	2 11%	0
9E	After	2 11%	0	14 78%	1 6%	0	1 6%

Table 4-18 presents the responses to questions in figure 4-1 for gross sales for group 3 businesses (other services, hotel, medical) north of Dominik Drive. The sample sizes for this group north of Dominik Drive are relatively higher than those for group 1 and group 2 businesses. The results are similar to those found for previous business groups. Most of the respondents (67 percent) believe that during construction the gross sales will be down and that after the raised median is installed that sales will not change or increase. A total of 75 percent of the business owners believe that during the construction phase, gross sales were down for the entire Texas Avenue corridor. Half of the business owners felt that after the installation of the raised median there would either be no change or sales would increase. A total of 67 percent of respondents felt that during the construction on Texas Avenue gross sales would be unchanged or increase for the entire City of College Station. This same percentage also thought that sales would be unchanged or up for the entire city after the installation of the raised median. The results presented in table 4-19 for group 3 businesses south of Dominik Drive are similar to the results found for north of Dominik Drive.

Table 4-18. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 3 Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	3 25%	5 42%	3 25%	1 8%	0	0
8E	After	1 8%	2 17%	4 33%	2 17%	2 17%	1 8%
9D	During	1 8%	8 67%	0	0	0	3 25%
9D	After	2 17%	0	1 8%	3 25%	2 17%	4 33%
9E	During	0	1 8%	2 17%	5 42%	1 8%	3 25%
9E	After	1 8%	0	5 42%	2 17%	1 8%	3 25%

Table 4-19. Responses to Questions in Figure 4-1 Related to Gross Sales for Group 3 Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	4 21%	9 47%	4 21%	0	0	2 11%
8E	After	1 5%	2 11%	9 47%	4 21%	0	3 16%
9D	During	3 16%	11 58%	3 16%	1 5%	0	1 5%
9D	After	1 5%	2 11%	7 37%	8 42%	0	1 5%
9E	During	0	3 16%	4 21%	8 42%	1 5%	3 16%
9E	After	0	0	9 47%	7 37%	0	3 16%

Similar summary statistics were produced for all the businesses to the north and south of Dominik Drive. Table 4-20 shows the responses to questions in figure 4-1 for all businesses north of Dominik Drive. These results are consistent with what was found with each business type. For example, a majority (67 percent) of the business owners felt that during the construction phase gross sales would be down. After the median is installed, a majority of the business owners (65 percent) believed that gross sales would increase or not change. During the construction, a majority (83 percent) of the business owners felt that gross sales would be down along the entire Texas Avenue corridor, while after the median installation, 65 percent of respondents felt that there would be either no change or an increase in gross sales. Both during (71 percent) and after (68 percent) installation of the raised median, business owners felt there would be no change or an increase in gross sales throughout the City of College Station. Table 4-22 shows the responses to the questions in figure 4-1 for all businesses south of Dominik Drive. The results are consistent with those found for businesses north of Dominik Drive.

Table 4-20. Responses to Questions in Figure 4-1 Related to Gross Sales for All Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	6 25%	10 42%	5 21%	3 13%	0	0
8E	After	1 4%	4 17%	7 30%	5 22%	3 13%	3 13%
9D	During	5 21%	15 63%	0	1 4%	0	3 13%
9D	After	3 13%	0	3 13%	9 39%	3 13%	5 22%
9E	During	1 4%	2 8%	5 21%	9 38%	3 13%	4 17%
9E	After	2 9%	0	8 36%	5 23%	2 9%	5 23%

Table 4-21. Responses to Questions in Figure 4-1 Related to Gross Sales for All Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8E	During	14 20%	28 41%	18 26%	5 7%	0	4 6%
8E	After	3 4%	8 12%	30 44%	20 29%	0	8 12%
9D	During	13 19%	43 62%	8 12%	2 3%	0	3 4%
9D	After	1 2%	6 9%	23 33%	35 51%	1 2%	3 4%
9E	During	1 2%	7 10%	21 30%	31 45%	5 7%	4 6%
9E	After	3 4%	0	41 59%	17 25%	1 2%	7 10%

4.4.2 Employment Trends

Another important indicator of the economic impact of roadway construction and the installation of a raised median is the number of full- and part-time employees that a business employs. If employment rates appear to stay relatively constant throughout the construction phase, then business sales have not been affected to the extent that businesses must consider altering their number of staff. This study investigated employment trends for both the "before" and "after" periods, north and south of Dominik Drive. Table 4-22 presents the different business types along with their location relative to Dominik Drive, sample size, and average and standard deviation in the percent change of the number of part-time employees. The percent change is between the before (1995) and during (1996) construction periods. Table 4-23 presents similar statistics for full-time employees.

Table 4-22. Average and Standard Deviation of Percent Change in Part-Time Employees Before and During Construction

Business Type	Sample Size (n)		Average Percent Change[1]		Standard Deviation of Percent Change	
	North	South	North	South	North	South
Group 1	5	29	-5.0	14.1	11.2	32.8
Group 2	4	14	4.5	-3.6	8.9	19.0
Group 3	7	9	8.9	-6.4	32.8	8.6
All	16	52	3.5	5.8	22.8	28.0

[1] The difference in part-time employees before and during construction is not statistically significant at the α=0.05 level of significance.

Table 4-23. Average and Standard Deviation of Percent Change in Full-Time Employees Before and During Construction

Business Type	Sample Size (n)		Average Percent Change[1]		Standard Deviation of Percent Change	
	North	South	North	South	North	South
Group 1	6	28	13.9	5.1	22.2	29.8
Group 2	3	14	0	8.0	0	17.5
Group 3	11	14	19.2	-1.5	41.0	20.4
All	20	56	14.7	4.2	32.5	24.9

[1] The difference in full-time employees before and during construction is not statistically significant at the α=0.05 level of significance.

The data in table 4-22 and table 4-23 suggest that generally the number of part- or full-time employees did not decrease. It did decrease during the construction phase for the group 2 businesses (restaurants) for part-time employees. This makes intuitive sense during the construction phase. It is unknown why there may be decreases in the number of employees in the southern segment of Texas Avenue since it was not under construction, and the gross sales analysis showed that sales were generally on the increase in the southern segment. It is likely that the decrease in employees may be attributable to other effects than the construction along Texas Avenue. For example, for the group 3 businesses (services, hotels, medical) it could be a natural attrition of employees.

With percent changes of employees, it is possible to have several data points that do not have a change in employees and a small number of data points that do have a change. When these data points are aggregated, it displays an overall change that may not really express the fact that many businesses had the same number of employees before and during construction. To investigate this occurrence, table 4-24 and table 4-25 were created for part- and full-time employees, respectively. These tables illustrate the number of businesses that did not change, increased, and decreased in the number of employees that went into the calculations in tables 4-22 and 4-23. A majority of the businesses did not have a change in employees or experienced an increase in the number of employees.

Table 4-24. Number of Businesses Experiencing A Decrease, Increase, or No Change in the Number of Part-Time Employees Comparing Before and During Construction

Business Type	No Change		Increase		Decrease	
	North	South	North	South	North	South
Group 1	4	15	0	10	1	4
Group 2	3	9	1	2	0	3
Group 3	3	5	3	0	1	4
All	10	29	4	12	2	11

Table 4-25. Number of Businesses Experiencing A Decrease, Increase, or No Change in the Number of Full-Time Employees Comparing Before and During Construction

Business Type	No Change		Increase		Decrease	
	North	South	North	South	North	South
Group 1	4	15	2	8	0	5
Group 2	3	7	0	5	0	2
Group 3	6	8	4	3	1	3
All	13	30	6	16	1	10

Business owner perceptions of the changes in the number of part- and full-time employees were also studied in a similar manner as performed in the gross sales analysis. Figure 4-2 shows the questions used for these comparisons. Respondents had the option of providing the following responses for these questions: down more than 25 percent, down less than (or equal to) 25 percent, no change, up one percent to 25 percent (inclusive), up more than 25 percent, and unsure.

Tables 4-26 and 4-27 present the results of these perceptions of business owners for all businesses to the north and south of Dominik Drive, respectively. Generally, most of the respondents feel that there will not be a change in the number of employees. In both tables a majority of the survey participant responses indicate that there will either be no change in the number of employees or a small number indicate that there may be some decrease in the number of employees for the first five questions in figure 4-2. For question 9C, several respondents felt as though the median installation would cause an increase in the number of employees for Texas Avenue as a whole. While interviewing business owners of the effect of construction and after the installation of the raised median, generally there was a feeling that the number of employees would not be changed. Although some businesses indicated that a reduction in sales may require a reduction in staff, most businesses indicated that they would not alter their staff numbers during the construction phase.

Business Survey
8C. What will be the effect of the construction on the number of full-time employees?
8C. What will be the effect of the median installation on the number of full-time employees?
8D. What will be the effect of the construction on the number of part-time employees?
8D. What will be the effect of the median installation on the number of part-time employees?
9C. What will be the effect of the construction on the number of employees along Texas Avenue?
9C. What will be the effect of the median installation on the number of employees along Texas Avenue?

Figure 4-2. Questions to Investigate the Perceptions of Business Owners Concerning Employment Trends

Table 4-26. Responses to Questions in Figure 4-2 Related to Employment for All Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8C	During	1 4%	1 4%	22 92%	0	0	0
8C	After	0	2 9%	21 91%	0	0	0
8D	During	1 4%	2 9%	19 83%	1 4%	0	0
8D	After	0	1 5%	19 86%	2 9%	0	0
9C	During	2 8%	8 33%	10 42	1 4%	0	3 13%
9C	After	0	1 4%	9 39%	7 30%	3 13%	3 13%

Table 4-27. Responses to Questions in Figure 4-2 Related to Employment for All Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8C	During	1 1%	5 7%	62 90%	0	0	1 1%
8C	After	1 1%	4 6%	58 84%	3 4%	0	3 4%
8D	During	3 4%	10 15%	55 80%	0	0	1 1%
8D	After	2 3%	4 6%	56 81%	4 6%	0	3 4%
9C	During	5 7%	30 44%	32 46%	1 1%	0	1 1%
9C	After	2 3%	2 3%	40 58%	21 30%	1 1%	3 4%

4.4.3 Parking Space Availability

The next economic indicator of interest was the loss of parking spaces due to the construction of the raised median along Texas Avenue. For construction activities that include the widening of roadways, this is often an important factor. Survey participants were asked about the actual number of parking spaces that they had before the construction and how many they believed they would have during and after the installation of the raised median. From this information, a percent change in the number of parking spaces was calculated. Since many of the businesses along this corridor are located in shopping centers, there was often not a loss in parking spaces that could be directly attributed to a particular business since many businesses were often sharing parking spaces.

Table 4-28 contains the perceptions of all business owners north and south of Dominik Drive along Texas Avenue. Business owners were asked to respond to the following two questions related to useable parking spaces:

Question 8A ("during"): What will be the effect of the construction on the number of useable parking spaces? and

Question 8A ("after"): What will be the effect of the median installation on the number of useable parking spaces?

The possible responses were down more than 25 percent, down less than (or equal to) 25 percent, no change, up one percent to 25 percent (inclusive), up more than 25 percent, and unsure. A cursory review of table 4-28 indicates that a large majority of business owners did not perceive a loss of parking spaces either north or south of Dominik Drive.

Table 4-28. Responses to Question 8A Related to Parking Space Availability for Businesses North and South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
North							
8A	During	4 16%	2 8%	19 76%	0	0	0
8A	After	1 4%	0	21 88%	2 8%	0	0
South							
8A	During	4 6%	3 4%	57 83%	0	0	5 7%
8A	After	3 4%	1 1%	56 81%	1 1%	0	8 12%

4.4.4 Customer Accessibility

There were several additional economic indicators and perceptions that were evaluated based upon the responses from business owners. One was the business owner's perception of the importance of access as compared to other factors that customers use when selecting a business to patronize. Business owners were asked to rank order the following items in order of importance that a consumer would use when selecting a business of their type: distance to travel, hours of operation, customer service, product quality, product price, and accessibility to the business. Table 4-29 displays the order of importance of these items for all businesses north and south of Dominik Drive.

Table 4-29. Rank Order of Items of Importance to Customers as Indicated by Business Owners

Businesses North of Dominik Drive (n = 25)	Businesses South of Dominik Drive (n = 70)
1. Customer Service	1. Customer Service
2. Product Quality	2. Product Quality
3. Accessibility to Store	3. Product Price
4. Product Price	4. Accessibility to Store
5. Hours of Operation	5. Distance to Travel
6. Distance to Travel	6. Hours of Operation

It is interesting to note that for businesses to the north and south of Dominik Drive, the accessibility to the store was ranked third and fourth, respectively, in importance by business owners. The categories appearing before accessibility (customer service, product quality, and product price) for each of the business locations are all elements that can be controlled by the business owner. This indicates that the most important elements used by customers to determine what businesses they will patronize are factors that may be controlled by the management of the business themselves. Similar results were obtained for different business types.

4.4.5 Passer-by and Planned Trips

Question 4 of the business survey in Appendix A asks business owners what they believe is the percentage of their customers who are passer-by customers and those who had intended on stopping at their businesses. Passer-by customers are those customers that had originally begun their trip with a destination other than the establishment they patronized. Business owners then responded to the question of what percentage of passer-by trips and planned trips they believe are made to their business. Table 4-30 shows the results of this question for the different business groups and for all the businesses to the north and south of Dominik Drive. Passer-by trips, or "impulse" customers, are more likely to occur when accessibility is relatively easy. Review of the results shown in table 4-30 indicates that approximately 17 to 30 percent of the

trips for a given business type are passer-by trips. The installation of the raised median would likely impact this market share for a particular business the most.

Table 4-30. Responses to Survey Question Inquiring About Business Owner Perceptions About the Percentage of Trips That Are Passer-by and Planned Stops

Business Type	Location Relative to Dominik Drive	Sample Size (n)	Average Passer-by Traffic Percentage	Average Planned Stop Percentage
Group 1	North	8	30	70
Group 1	South	32	26.1	73.9
Group 2	North	5	25	75
Group 2	South	18	20.3	80.8
Group 3	North	12	20.7	81.2
Group 3	South	20	17	83.9
All	North	25	24.4	76.8
All	South	70	22.1	78.5

4.4.6 Raised Median Installation Effect on Regular Customers

The results in table 4-31 indicate that a majority of the business owners perceive that the installation of the raised median will not affect the likeliness of regular customers to endorse their businesses. It is clear from the data in the table that the businesses to the north of Dominik Drive have a slightly higher percentage of respondents in each business group that felt the regular customers will be less likely to continue to endorse their businesses. This makes intuitive sense because these were the businesses that were surveyed during the current construction. This percentage is about 30 percent for each business group, and it is highest for group 3 (other services, hotels, medical).

Table 4-31. Responses to Question Inquiring About the Likeliness of Regular Customers to Continue to Visit the Business Owner's Establishment After Raised Median Installation

Business Type	Location Relative to Dominik Drive	Less Likely	More Likely	Stay About the Same
Group 1	North	2 29%	1 14%	4 57%
Group 1	South	5 17%	4 13%	21 70%
Group 2	North	1 20%	0	4 80%
Group 2	South	3 19%	1 6%	12 75%
Group 3	North	4 33%	2 17%	6 50%
Group 3	South	4 21%	4 21%	11 58%
All	North	7 29%	3 13%	14 58%
All	South	12 19%	9 14%	44 67%

4.4.7 Perception Questions Related to Customer Rates and Property Values

Additional questions were asked in the business survey that related to business owner perceptions of effects on the number of customers per day and property values. Figure 4-3 shows these eight questions. Similar to previous questions of this sort, the possible responses to these questions are: down more than 25 percent, down less than (or equal to) 25 percent, no change, up one percent to 25 percent (inclusive), up more than 25 percent, and unsure. Table 4-32 presents the results of these questions for all businesses and establishments north of Dominik Drive. During the construction phase, 71 percent of business owners believed the number of customers was down. However, a majority indicated that after the construction phase there would be no change, and an equal percentage (26 percent) indicated that there would be an increase or a decrease in the number of customers. For question 8F, a majority of the survey participants felt that their property values would not change during the construction phase.

Additional comments from respondents indicated that they believed that the limited time period of the construction would not have an effect on property values.

Business Survey
8B. What will be the effect of the construction on the number of customers per day?
8B. What will be the effect of the median installation on the number of customers per day?
8F. What will be the effect of the construction on the business' property value?
8F. What will be the effect of the median installation on the property value?
9F. What will be the effect of the construction on property values along Texas Avenue?
9F. What will be the effect of the median installation on the property values along Texas Avenue?
9G. What will be the effect of the construction on property values of all properties in College Station?
9G. What will be the effect of the median installation on property values of all properties in College Station?

Figure 4-3. Questions to Investigate the Perceptions of Business Owners Concerning Customers Per Day and Property Values

Table 4-32. Responses to Questions in Figure 4-3 Related to Customers Per Day and Property Values for All Businesses North of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8B	During	7 29%	10 42%	6 25%	1 4%	0	0
8B	After	1 4%	5 22%	8 35%	5 22%	1 4%	3 13%
8F	During	3 13%	3 13%	7 29%	3 13%	0	8 33%
8F	After	1 5%	2 9%	1 5%	7 32%	2 9%	9 41%
9F	During	1 4%	10 42%	3 13%	3 13%	0	7 29%
9F	After	0	0	3 13%	10 44%	2 9%	8 35%
9G	During	0	2 8%	9 38%	2 8%	1 4%	10 42%
9G	After	0	0	11 48%	4 17%	0	8 35%

A high rate of respondents answering "unsure" to these questions was common since many business owners lease their business location because they are located in a shopping center, and, therefore, they are unfamiliar with the property values of the businesses. After the construction period (question 8F), 41 percent of the respondents indicated that they believed the property values would increase. A majority of respondents felt that during the construction, property values along the Texas Avenue corridor would be down (46 percent) and that after the raised median installation values would be up (52 percent). Finally, 38 percent of respondents felt that during the construction, property values would be unchanged throughout College Station. Forty-eight percent of business owners believed that property values would not change in College Station after the median installation. Table 4-33 presents the survey results to the eight questions presented in figure 4-3 for all the businesses to the south of Dominik Drive. The results

for south of Dominik Drive display similar trends as those in table 4-32 for businesses to the north of Dominik Drive.

Table 4-33. Responses to Questions in Figure 4-3 Related to Customers Per Day and Property Values for All Businesses South of Dominik Drive

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
8B	During	15 22%	30 44%	18 26%	3 4%	0	3 4%
8B	After	1 1%	11 16%	25 36%	21 30%	1 1%	10 15%
8F	During	6 9%	18 26%	27 39%	5 7%	0	13 19%
8F	After	1 1%	3 4%	25 36%	22 32%	3 4%	15 22%
9F	During	3 4%	23 33%	30 44%	4 6%	1 1%	8 12%
9F	After	1 1%	3 4%	25 36%	28 41%	3 4%	9 13%
9G	During	0	6 9%	43 63%	12 18%	0	7 10%
9G	After	0	0	41 60%	16 24%	0	11 16%

4.4.8 Perception Questions for Accidents and Traffic Volumes

Perceptions were also recorded from business owners for questions referring to the number of accidents and traffic volumes along the corridor. Figure 4-4 shows these questions from the Texas Avenue Business Impact Survey in Appendix A. Table 4-34 summarizes the data obtained from these questions for all businesses located north and south of Dominik Drive.

The results displayed in table 4-34 indicate that half of the respondents believe that the number of accidents on Texas Avenue increased during the construction. A total of 57 percent of the business owners felt that after the construction, the number of accidents along the corridor would decrease. Over half (54 percent) of the respondents to the survey believe that traffic

volumes are either down or have not changed during the construction, and 61 percent feel that the traffic volumes will be up after the installation of the raised median. The results in the lower portion of table 4-34 for businesses south of Dominik Drive illustrate similar perceptions.

4.4.9 Business Owner Comments

Scheduling and performing the business survey interviews provided not only the quantitative data obtained and discussed above, but many important comments from business owners. This qualitative information and business owner comment may be very valuable to TxDOT and other transportation agencies in realizing some of the major concerns that business owners may have during a construction project involving the installation of a raised median. The public involvement process attempts to raise and address many of these concerns, but as a practical matter many owners do not react to plans and instead wait until the median is being installed to voice concern. Many business owners took advantage of the personal interviews to provide their comments about the median installation. To the extent possible, it is recommended that TxDOT conduct personal interviews with meetings targeted to business owners to obtain their comments and concerns about median installation projects. This section describes the major points that business owners expressed to the interviewers while performing the business surveys.

Business Survey

9A. What will be the effect of the construction on the number of accidents on Texas Avenue?

9A. What will be the effect of the median installation on the number of accidents on Texas Avenue?

9B. What will be the effect of the construction on traffic volumes along Texas Avenue?

9B. What will be the effect of the median installation on the traffic volumes along Texas Avenue?

Figure 4-4. Questions to Investigate the Perceptions of Business Owners Concerning Accident Rates and Traffic Volumes

Table 4-34. Responses to Questions in Figure 4-4 Related to Accident Rates and Traffic Volumes

Question No.	Construction Phase	Response Range					
		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1 to 25%	Up More Than 25%	Unsure
North							
9A	During	1 4%	0	6 25%	9 38%	3 13%	5 21%
9A	After	1 4%	12 52%	7 30%	1 4%	0	2 9%
9B	During	0	13 54%	5 21%	4 17%	0	2 8%
9B	After	0	1 4%	7 30%	13 57%	1 4%	1 4%
South							
9A	During	1 1%	2 3%	6 9%	37 54%	14 20%	9 13%
9A	After	5 7%	39 57%	10 15%	5 7%	0	9 13%
9B	During	4 6%	32 47%	23 34%	4 6%	3 4%	2 3%
9B	After	0	2 3%	27 40%	31 46%	6 9%	2 3%

Usefulness of Access Restrictions

Although there were many business owners that expressed their dissatisfaction with the use of access restrictions (i.e., the raised median), many business owners also understand the reasons for installing raised medians. They understand that traffic movement and safety along the corridor are often improved with the median installation. However, many business owners desired a greater role in the public involvement process.

Diverted Traffic Concern

Several business owners expressed their concern that the restricted access would lead to a diversion of traffic to side streets for access to the business. The concern is that this diverted traffic may become a very large volume of traffic as motorists search for alternative methods of accessing businesses and may not come to their business establishment.

Development Impact on Community

Many of the business owners along the Texas Avenue corridor in College Station recognize the fact that the large concentration of development and trip generators along a central corridor in the city causes many of the challenges to meeting transportation needs.

More Information "Up Front"

Many individuals asked questions and/or expressed concerns over issues that could be addressed by providing more information about the project initially and project progress reports throughout construction. Questions and concerns such as, "when will the construction be completed?," "what is the construction schedule?," "what is the project phasing?," and "why are certain elements of a project performed at different times?," can be addressed in the public hearing phases of the project and through media efforts throughout the project. Many business owners knew this information due to efforts along the Texas Avenue corridor. Of course, obtaining and considering public comment throughout the public involvement process also facilitates the understanding of

these concerns. Public involvement increased as construction impacts became more apparent, but receptiveness to and pursuit of public comment was significant throughout the Texas Avenue corridor project.

4.5 TREND ANALYSES

Another valuable indicator to estimate the economic impact of median design is the use of trend analyses that investigate changes in property values of businesses along the corridor under construction. Such trend analysis generally includes obtaining property sales information from before, during, and after the construction and installation of the raised median and/or highway widening. While many of the questions used in the business survey provided quantitative data of interest prior to final installation of the raised median, trend analyses are most beneficial after the data has been obtained for all phases of the project (e.g., before, during, and after construction).

A trend analysis investigating property values is also being performed as part of this study. The "before" data have been collected as well as a portion of the "during" data (1996) for north of Dominik Drive. However, the "after" data have not been collected since the raised median has not yet been completed. The trend analyses can be completed after these data have been fully collected--two or three years after median installation. Appendix C contains the graphs that have been prepared for the trend analysis with the data that are currently available. The reader is encouraged to review Appendix C and the text therein for further discussion of these figures.

4.6 ADDITIONAL SURVEY DISCUSSION AND FINDINGS

Since a significant component of the recommended methodology developed in this project includes the business survey and the specific questions included on the survey, additional discussion is provided here about the usefulness of several of the questions in the survey. Many of the questions on the survey have already been discussed and the results summarized previously in this chapter.

The first three questions in the survey ask business owners if they own or lease the building in which they are conducting their business, how long they had been at this location, and whether they had to move their business as a result of the construction along Texas Avenue. These questions were originally placed in the survey as potential analysis stratifiers. It was expected that it would make intuitive sense to break down analyses on different considerations based upon how long businesses may have been in operation and/or whether they are owned or leased. However, due to the limitations in the sample sizes of data obtained in the study, these questions were not used to further stratify the data. Although this analysis was not done at this stage of the analysis, it is still possible that they will be useful for analysis when the "after" data have been collected.

Question 7 of the survey asks what the peak period is for business operations before and during the construction phase. It was hypothesized that there may have been a change in the hours of peak operation due to the construction, but this was not generally the case according to analyses performed. Again, this question may be more valuable for comparisons of operating hours before and after construction.

Question 10 referred to whether it was believed that the installation of the raised median would cause the time it takes customers to get to businesses to increase, decrease, or stay the same. It further asked for what percentage of customers for each of these three possibilities, and it asked for the number of minutes that would be added if the response was "increase" and subtracted from the trip time if the response was "decrease." Although some of the data collected in this question is useful, it was often difficult for business owners to provide reasonable estimates of the amount of traffic that would experience an increase, decrease, or not change. Further, the number of minutes of travel time increase or decrease was also difficult to estimate by many of the business owners and several did not. Analysis of this question also proved somewhat difficult since the categories were not mutually exclusive, making aggregation difficult. Question 5, which inquired about the likelihood of regular customers patronizing the business to remain about the same, increase, or decrease due to the raised median installation provided very similar data that is much more conducive to aggregate analyses.

As discussed in the section of this chapter addressing parking space availability, question 11, referring to the number of usable parking spaces, was not useful for this study. Although the number of usable parking spaces is generally a good indicator of economic impact on businesses, many of the businesses along Texas Avenue are located in shopping centers with shared parking, and, therefore, this question had limited value.

Question 15 asked if historically rent for leased space had gone up, gone down, or stayed about the same since 1993 and by what percent each year. For this study, analysis of this question found that many of the businesses were locked into long-term leases that often covered a period of time from 1993 to the present or next year. Therefore, this question did not provide valuable information in analysis at this stage. It is possible that more useful results may be obtained when the "after" data is collected along the corridor since some of the businesses may have re-signed new leasing agreements by that time.

Question 16 of the survey asked about the demeanor of the business owner being surveyed. The researchers recorded this information because it is thought that such a question would be very useful in the survey as a stratifier for analyses. It would likely be interesting to investigate changes in responses to specific questions based upon whether the demeanor of an individual was relatively negative or positive. Since sample sizes were relatively low, this variable was not used as a stratifier to avoid increasing the number of categories of analysis and reducing sample sizes for a given category even further. Further, it was found that only approximately 16 percent of business owners north of Dominik Drive had a relatively negative demeanor, 12 percent were neutral, and 72 percent were relatively positive. South of Dominik Drive, 6 percent of business owners were relatively negative, 26 percent were relatively neutral, and 68 percent were relatively positive. This question may also be useful for further analyses when the "after" data is obtained.

Question 18 was added to the survey to identify whether a business was located mid-block or at a street intersection. This question also has a place for recording the distance from the business to the nearest median opening. This question was also intended to be used as a stratifier for analyses when appropriate. Again, due to sample size limitations, it was not used for this purpose. However, this question still provides valuable information that should be recorded for studies of this sort. When the "after" data are collected, this question may prove

more useful for stratification of analysis. This information was unavailable for most businesses south of Dominik Drive since plans are not finalized.

4.7 SURVEY ADMINISTRATION EXPERIENCES

The research team considered the survey process used in this methodology to have been successful. One of the key elements in making the process successful was conducting the surveys in person. By arranging appointments and meeting with the respondents in person, the research team attained the highest possible participation rate. Gaining the support of the Bryan/College Station Chamber of Commerce proved to be quite useful in getting business owners and managers to participate in the survey. Although it was not part of a survey question, several of the respondents mentioned that the letter from the Chamber of Commerce did encourage them to participate. Another important part of this process was having members of the research team call the businesses to identify the appropriate contact persons and schedule appointments with them. Research team members would again call the business to confirm the appointments a few days before the interviews were to happen. By employing this process, the respondents had already been contacted at least three times before the researcher arrived to conduct the interview. That amount of contact and briefing about the project helped make the survey interview process work very smoothly.

The vast majority of the people being surveyed were extremely cooperative. Some of the respondents desired to discuss the construction project and/or the research project in addition to simply answering the survey questions. Even though most of the respondents did not particularly favor the median project, they were amenable to participating in the survey. Almost every respondent answered all of the questions, except for the annual gross sales questions. Approximately 38 percent of the respondents did provide annual gross sales information in one of the two formats requested. Other respondents cited corporate policies against sharing such data. A few of the respondents who were not sure about their companies' policies actually contacted the appropriate person within the company and then let the research team know if they would be able to provide any gross sales data.

A few surveys had to be canceled due to business owners/managers not being able to keep scheduled appointments and then not being able to reschedule the appointments. A very small percentage of potential surveys were lost due to these occurrences.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Much insight into the perceived economic impacts of raised median design surfaced as a result of this study. Not only can conclusions be drawn about the Texas Avenue corridor, but insight for future studies investigating the economic impacts of median design, including survey development and administration, were also found. This chapter discusses these conclusions and related recommendations.

5.1 CONCLUSIONS

5.1.1 Quantitative Survey Results

Survey Response

The response rate obtained in the study overall was relatively high. A total of 73 percent of the businesses that were contacted participated in the study. This can be attributed to the method used to schedule the personal interviews. Mailout surveys of a similar form would likely result in a response rate of 15 to 20 percent.

Although sample sizes were often low for specific questions for analysis (e.g., gross sales), useful trends, perceptions, and summary statistics such as the following were obtained.

Gross Sales

A majority of the responding business owners north of Dominik Drive (67 percent) believe that their gross sales will go down due to the construction along Texas Avenue. This demonstrates that there is considerable concern for gross sales during the construction phase. After the median is installed, a majority of the business owners (65 percent) believe that gross sales will either increase or remain the same as prior to the construction. Therefore, the construction phase is the most financially difficult stage for the businesses. During the time period of this study when businesses were being selected for interviews, 21 businesses either closed or moved.

Number of Employees

A majority of business owners indicated that they would not alter their number of staff during the construction phase of the project. Only one business north of Dominik Drive out of 16 responding to this question indicated they would be decreasing their number of part-time employees. Similarly, only one business north of Dominik Drive out of 20 responding to this question for full-time employees indicated they would decrease the full-time work force. Therefore, businesses tend to desire to be loyal to their employees during the financially constrained time period during construction.

Accessibility to Business

The results of a ranking of important items to customers as indicated by business owners indicated that the accessibility to the store generally ranked about third or fourth (see table 4-30). This indicates that the most important elements used by customers according to business owners to determine what businesses they will endorse are factors that may be controlled by the business owners themselves (e.g., customer service, product quality, product price).

5.1.2 Personal Interview Comments

The personal interviews also provided valuable comments from business owners. These include the following:

- Business owners generally understand the usefulness of access restrictions, but many business owners wished they could have been more involved in the public involvement process.
- Many business owners expressed their concern that the restricted access would lead to a diversion of traffic to side streets for access to the business.
- Many individuals asked questions and/or expressed concerns over issues that could be addressed with more information about the project initially and project progress reports throughout construction. Questions and concerns such as, "when will the construction be completed?," "what is the construction schedule?," "what is the

project phasing?," and "why are certain elements of a project performed at different times?," can be addressed in the public hearing phases of the project and through media efforts throughout the project. Many business owners knew this information due to efforts along the Texas Avenue corridor.

- The public involvement process attempts to raise and address many of the concerns listed above but as a practical matter many business owners do not react to plans and instead wait until the median is being installed to voice concern.

5.1.3 Survey Development and Administration

The research team considered the survey development and administration used in the study quite successful. One key element in making the process successful was conducting the surveys in person. Further, gaining the support of the Bryan/College Station Chamber of Commerce proved to be quite useful in getting business owners and mangers to participate in the survey. Setting up the personal interviews with an identified contact person was also beneficial. Confirmation calls a few days prior to the interviews also aided in ensuring that the interview would be completed.

5.2 RECOMMENDATIONS FOR METHODOLOGY

This research project has entailed developing and testing a methodology that can be used to estimate what, if any, economic impacts on businesses result from the installation of raised medians on arterial streets. Based on the results and conclusions of this project, the research team recommends the following methodology for estimating economic impacts of raised medians be further tested. This methodology contains several elements, all of which are important to its success.

1–Identify Sites (Cities) with Potential Corridors

The first step in continuing to test this methodology is to identify cities or areas that have corridors that have had a raised median installed in the last three to five years. The median should have been installed during that time period so that enough data since installation will be available to develop historical trends before and after installation. Ideally, such corridors will be discovered in small to medium size urban areas in Texas similar to Texas Avenue in College Station. However, the search should not be exclusive to only small to medium size areas, or to cities in Texas.

2–Identify Corridor Characteristics

The research team will need to identify the characteristics of the subject corridors. These characteristics include, but are not limited to, abutting land uses, street cross section, and corridor length. This part of the methodology testing can be performed through discussions with local officials and by reviewing land use maps.

3–Make Contact with the Chamber of Commerce and Appraisal District Office

Once a satisfactory corridor has been identified, the research team should make contact with the local chamber(s) of commerce. The purpose of that contact is to explain the research project to chamber officials to gain their support of the project. The goal of this contact is to request the chamber to write a letter supporting the project, specifically the survey process, to businesses along the corridor.

The research team should also contact the local appraisal districts to establish working relationships with their staffs. Researchers will need to obtain property value and other information from the appraisal districts. It is quite likely that different appraisal offices will have various information systems that the researchers may need to learn to use. Developing good working relationships with the appraisal district staffs is an important step in this methodology.

4–Inventory the Establishments (& Identify Businesses)

This step of the methodology provides a means of identifying all of the establishments along the subject corridor. The first part of this step is to perform a windshield survey of the corridor, in

which research team members drive the corridor and record the names of operating businesses. The business names should be recorded on a list as well as on a map of the corridor to record their locations. It is important to also note multiple locations of businesses within the corridor to avoid confusion later in the research effort. It is at this point in the process that businesses can be classified by their type of primary operations, such as gasoline stations, hotels, specialty retail, and durable goods.

5–Obtain Information About Businesses (property values, names, addresses, phone numbers, and additional relevant information)

The research team needs to obtain basic information about each of the businesses along the corridor. In addition to the official names of the businesses, the researchers should also acquire addresses and phone numbers for them. Property value data can be collected through the local appraisal district office.

6–Prioritize Businesses to be Surveyed

After the basic information is gathered for each business along the corridor, the businesses can be prioritized for inclusion in the survey process. This step is accomplished by analyzing the types and numbers of businesses and determining which ones are the best candidates for being surveyed. Three priority levels should be assigned: priority 1 (highest), priority 2 (medium), and priority 3 (lowest). Priority 1 businesses are those that should definitely be contacted for inclusion in the survey. Priority 2 businesses should be surveyed in the case that not enough priority 1 businesses cooperate in the survey process. Priority 2 businesses can also be those that should be surveyed to help provide an even geographic distribution of surveyed businesses. Priority 3 establishments are those that do not appear to be economically impacted by raised medians. Those types of establishments include municipal facilities, corporate offices, and medical facilities.

7–Collect Data

The data collection process begins with the research team contacting businesses along the corridor that are to be surveyed. Those contacts are made with the goal of identifying the person at each business who is appropriate to participate in the survey process. If an appointment can

be scheduled during that contact, it should be. Otherwise, another call needs to be made to set the appointment with the person to be surveyed. It is best to try to schedule appointments to begin every hour and as close to each other geographically as possible. One or two days before each scheduled appointment, the prospective respondent should be contacted to confirm the appointment. Finally, a project team member will go to the business and conduct the survey interview.

Appendices A and B present the Texas Avenue Business Survey used in this study and a general vacant land survey, respectively. These instruments are recommended for others performing studies of economic impacts based upon the results and experiences in this study.

8–Analyze Data

The final step of the methodology is to analyze the data collected through the survey and other means. Quantitative survey responses should be summarized and statistically analyzed. Qualitative data, including business owner comments, should also be considered in estimation of the economic impacts. It is necessary to obtain data for the before-, during-, and after-construction phases of the project to estimate economic impacts. The analysis steps below can be used to aid in estimating the economic impact of median design.

1. Stratify data by appropriate variables for further analysis (e.g., business type, whether a business is in a shopping center or is strip development, whether a business is adjacent to a median opening).

2. Investigate sample sizes for different analyses of interest (e.g., gross sales, change in parking spaces, change in employees) to determine possible levels of disaggregation of the analyses.

3. Calculate percent change values for gross sales, parking spaces, employees, or property values between construction phases of interest (i.e., during- or after-construction with before-construction). Investigate mean and standard deviations of these values.

4. Investigate perceptions of individual business owners or managers compared to actual values computed in step 3.

5. Investigate perceptions of individual business owners based upon responses to questions evaluating the estimated percentage of passer-by trips and likeliness of regular customers to return after installation of the raised median.

6. Determine perceived importance to customers of items such as customer service, product quality, product price, distance to travel, hours of operation, and accessibility.

7. Consider business owner comments. Valuable information can be obtained from business owners about their concerns. These comments should be considered on a business-by-business basis for consideration of estimated economic impacts.

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APPENDIX A–TEXAS AVENUE BUSINESS IMPACT SURVEY

Date_____ **Texas Transportation Institute** **CONFIDENTIAL**
Texas A & M University System Code No._____
College Station, Texas 77843-3135

ECONOMIC IMPACT OF MEDIAN DESIGN ALONG TEXAS AVENUE
(BUSINESS IMPACT SURVEY)
College Station, Texas

Purpose of Survey

The Texas Transportation Institute (TTI) is studying the economic impact of raised median installation along Texas Avenue (Business Route 6) in College Station, Texas for the Texas Department of Transportation (TxDOT). TxDOT requires the findings of an impartial study to aid in planning median design projects that maximize positive impacts and minimize negative impacts during and after construction, especially on abutting businesses. ALL ANSWERS TO THE FOLLOWING QUESTIONS WILL BE HELD CONFIDENTIAL. Your name or the name of your business will not be used in any way that would identify you.

1. Do you own or lease this building (office space)?

   Own__ Lease___ Owned by parent corporation___

2. When did this business begin operations?

	Month	Year
....at this location	____	____
....at other location (if applicable)	____	____

3. Did you, or will you, have to move your business due to the State obtaining right-of-way to widen Texas Avenue?

   Yes____ No____

   If "Yes," where was the original location?

   On this lot, closer to the roadway?__ Other location?__

   If other location, where? _____

4. What do you believe is the percentage of your customers who are passer-by customers and those who had intended on stopping at your business?

Percent passer-by traffic____ Percent planned stop____

5. Do you believe your regular customers will remain about the same, be more likely, or be less likely to visit your business due to the raised median?

Less likely____ More likely____ Stay about the same_____

6. Please rank the following considerations that consumers use when selecting a business of your type:

Distance to Travel	Hours of Operation	Customer Service	Product Quality	Product Price	Accessibility to Store
___	___	___	___	___	___

7. What is the peak period?

Peak Before Construction _____ Peak During Construction _____

8. There are several ways that the roadway widening and installation of a raised median along Texas Avenue could affect *your business* DURING the construction period and AFTER the construction period. (Please give your best estimate of the percentage impact, up or down, on your business relative to before construction.)

Possible Effects		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1% to 25% (Inclusive)	Up More Than 25%	Unsure
A. Number of usable parking spaces?	D						
	A						
B. Number of customers per day?	D						
	A						
C. Number of full-time employees?	D						
	A						
D. Number of part-time employees?	D						
	A						
E. Gross sales?	D						
	A						
F. Property values?	D						
	A						

9. There are several ways that widening Texas Avenue and installing a raised median could affect the *people, businesses, and travelers in the City of College Station* DURING the construction period and AFTER the construction period. (Please give your best estimate of the percentage impact, up or down, on the city of College Station relative to before construction.)

Possible Effects		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1% to 25% (Inclusive)	Up More Than 25%	Unsure
A. Number of accidents on Texas Avenue?	D						
	A						
B. Traffic volumes on Texas Avenue?	D						
	A						
C. Employment along Texas Avenue?	D						
	A						
D. Gross sales volumes for all businesses on Texas Avenue?	D						
	A						
E. Gross sales volumes for all other business in College Station?	D						
	A						
F. Property values on Texas Avenue?	D						
	A						
G. Property values for all properties in CS?	D						
	A						

10. Do you believe that the installation of a raised median will cause the time it takes your customers to get to your establishment to:

Increase___ (minutes___) Decrease___ (minutes___) Not Change__
Percentage_____ Percentage_____ Percentage___

11. How many parking spaces did you have for your customers in 1995 before widening Texas Avenue, and during the roadway widening (e.g., 1996, 1997)?

1995 number before_____ 1996 number during_____1997 number during___

12. How many people were employed by your business in 1995 before roadway widening and from 1996-1997 during the roadway widening? (Please give the average annual number, including working owner and/or manager.)

	1995	1996	1997
Full-time	____	_____	_____
Part-time	____	_____	_____

13. What was the annual gross sales volume of this business before the roadway widening and during the widening?

Before widening volume ($)? 1993 $_____ 1994 $_____ 1995 $_____
During widening volumes ($)? 1996 $_____ 1997 $_____

14. AND/OR check proper annual gross sales category as follows:

	1993	1994	1995	1996	1997
Less than $25,000	____	____	____	____	____
$25,000 to $50,000	____	____	____	____	____
$50,000 to $100,000	____	____	____	____	____
$100,000 to $250,000	____	____	____	____	____
$250,000 to $500,000	____	____	____	____	____
$500,000 to $1,000,000	____	____	____	____	____
More than $1,000,000	____	____	____	____	____

15. If this is a rented location, has your rent gone up, gone down or stayed the same since 1993, and by what percentage per year?

'94_____ '95_____ '96_____ '97_____

16. Demeanor of person surveyed:

___ 1 Extremely Positive
___ 2 Positive
___ 3 Neutral
___ 4 Negative
___ 5 Extremely Negative

17. Construction progress in front of establishment:

___ 1 Road excavation
___ 2 Signs, barrels, etc. up, but road not disturbed
___ 3 No evidence of construction

18. Location and distance of nearest median opening:

Mid-Block____ Street Intersection____

Distance_____

19. What is the primary type of business?

Durables Retail___ Specialty Retail___ Grocery ___ Convenience___

Gas Station___ Conv/Gas Station___ Rest (Fast)___ Rest. (Sit Down)___

Bar___ Tavern___ Hotel___ Other Services___ Medical___ Vacant Lot___

Other____ describe:

If both retail sales and service, please provide:
percent sales ___ percent service ___

APPENDIX B–GENERAL VACANT LAND SURVEY

Date_____

CONFIDENTIAL
Code No._____

ECONOMIC IMPACT OF MEDIAN DESIGN (VACANT LAND SURVEY)

College Station, Texas

Purpose of Survey

The economic impact of raised median installation is being studied along this route for the *<Performing Agency>*. The *<Performing Agency>* requires the findings of an impartial study to aid in planning median design projects that maximize positive impacts and minimize negative impacts during and after construction, especially on abutting businesses. ALL ANSWERS TO THE FOLLOWING QUESTIONS WILL BE HELD CONFIDENTIAL. Your name or the name of your business will not be used in any way that would identify you.

1. How long have you owned this property?

   Number of years_____

   When did you purchase this property?

   Month_____ Year_____

2. What is the area (square footage) of the property you own?

   _____ Sq. Ft.

3. How much frontage along this roadway does the property have?

   _____ Ft.

4. Will you lose some of your property due to the widening of this roadway?

   Yes _____ No _____

5. Do you believe that the installation of a raised median will cause the time it takes to access your property to:

Increase___ (minutes___) Decrease___ (minutes___) Not Change___
Percentage_____ Percentage_____ Percentage___

6. Do you believe that your property will be more attractive or less attractive to potential buyers after the raised median is installed?

More Attractive _____ Less Attractive _____

7. Do you believe that the addition of a raised median on Texas Avenue will affect the type of development on your property? If yes, please explain.

Yes ___ No ___

If yes, please explain._____
_____
_____

8. Has the announcement of the raised median already affected your plans for development on your property?

Yes ___ No ___

If yes, please explain._____
_____
_____

9. Do you believe your property's value will be affected by the installation of a raised median?

Yes ___ No ___

If yes, Up ___ Down ___ Percent _____

10. Do you believe your property value will be affected by subsequent roadway widening or loss of property?

Yes ___ No ___

If yes, Up ___ Down ___ Percent _____

11. There are several ways that widening this roadway and installing a raised median could affect the *property, people, businesses, and travelers in this city* DURING the construction period and AFTER the construction period. (Please give your best estimate of the percentage impact, up or down, in this city, relative to before construction.)

Possible Effects		Down More Than 25%	Down Less Than (or Equal to) 25%	No Change	Up 1% to 25% (Inclusive)	Up More Than 25%	Unsure
A. Number of accidents on this roadway?	D						
	A						
B. Traffic volumes on this roadway?	D						
	A						
C. Employment along this roadway?	D						
	A						
D. Gross sales volumes for all businesses on this roadway?	D						
	A						
E. Gross sales volumes for all other business in this city?	D						
	A						
F. Property value of your business?	D						
	A						
G. Property values on this roadway?	D						
	A						
H. Property values for all properties in this city?	D						
	A						

12. Demeanor of person surveyed:

___ 1 Extremely Positive
___ 2 Positive
___ 3 Neutral
___ 4 Negative
___ 5 Extremely Negative

13. Construction progress in front of establishment:

___ 1 Road excavation
___ 2 Signs, barrels, etc. up, but road not disturbed
___ 3 No evidence of construction

14. Location and distance of nearest median opening:

Mid-Block____ Street Intersection____

Distance_____

APPENDIX C–APPRAISAL VALUES

This appendix contains several trend analyses graphs of property values for the Texas Avenue corridor. Section 4.5 in Chapter Four discusses the use of these graphs for identifying changes in property values along Texas Avenue before and after the installation of the raised median. Figures C-1 and C-2 show the total appraised vacant property value trends from 1983 to 1996 for Bryan, College Station, and Brazos County. Figures C-3 and C-4 illustrate the trend in appraised commercial property values from 1984 to 1996 for Bryan, College Station, and Brazos County.

Figures C-5 and C-6 present the trend in total appraised value for all businesses and complexes along the Texas Avenue corridor in which appraisal information could be obtained. Figure C-5 shows the trend as a total appraised value, and figure C-6 shows the total appraised value per square meter. Figures C-7 and C-8 show similar relationships for all the businesses and complexes that completed a business survey. Two figures are again shown to present the relationship as a total appraised value and an appraised value per square meter. Figures C-9 through C-12 present the same four graphs as C-5 through C-8 except they are for appraised land values. Land values are useful in property value analysis since they do not consider the type of improvements (e.g., building, asphalt parking lot) placed on the land. Therefore, studying only the land value allows for comparisons between different plots that may have very different improvements added to the land.

After the collection of the "after" data along the section of Texas Avenue north of Dominik Drive is completed, analyses utilizing these trends will be possible. These trends will be used to estimate the change in property values before and after the median installation north and south of Dominik Drive. Comparisons between the Cities of Bryan, College Station, and Brazos Valley will also be possible with such analyses.

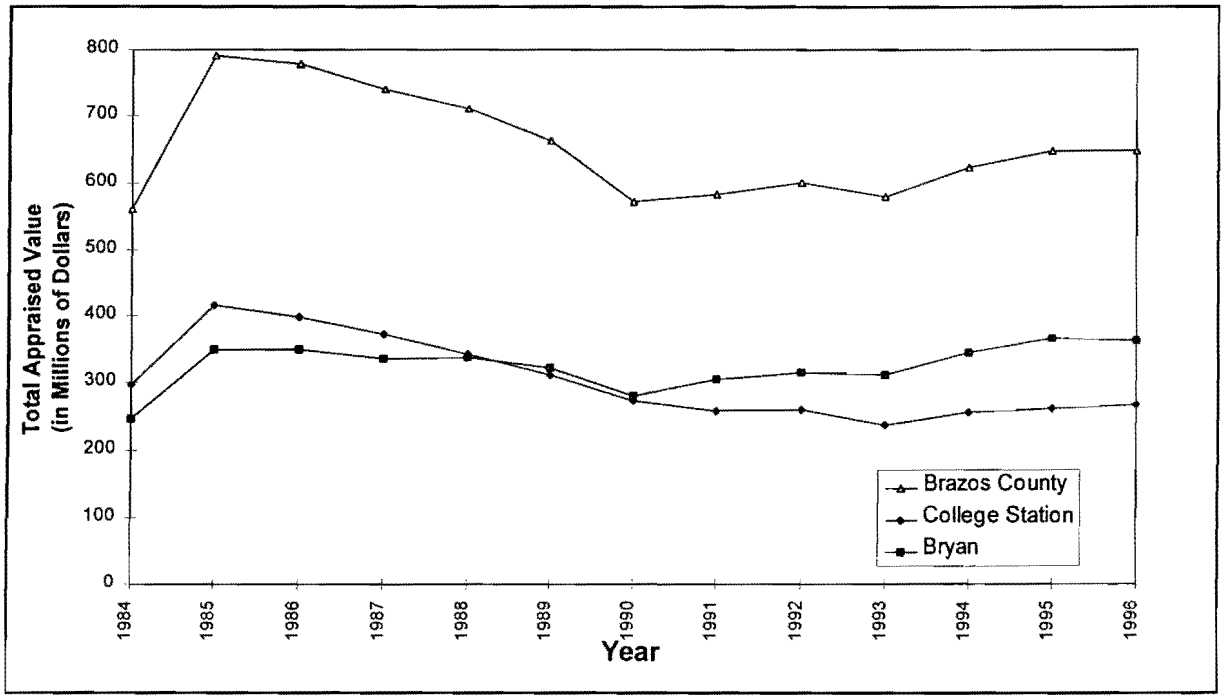

Figure C-1. Appraised County and Local Vacant Land Property Values

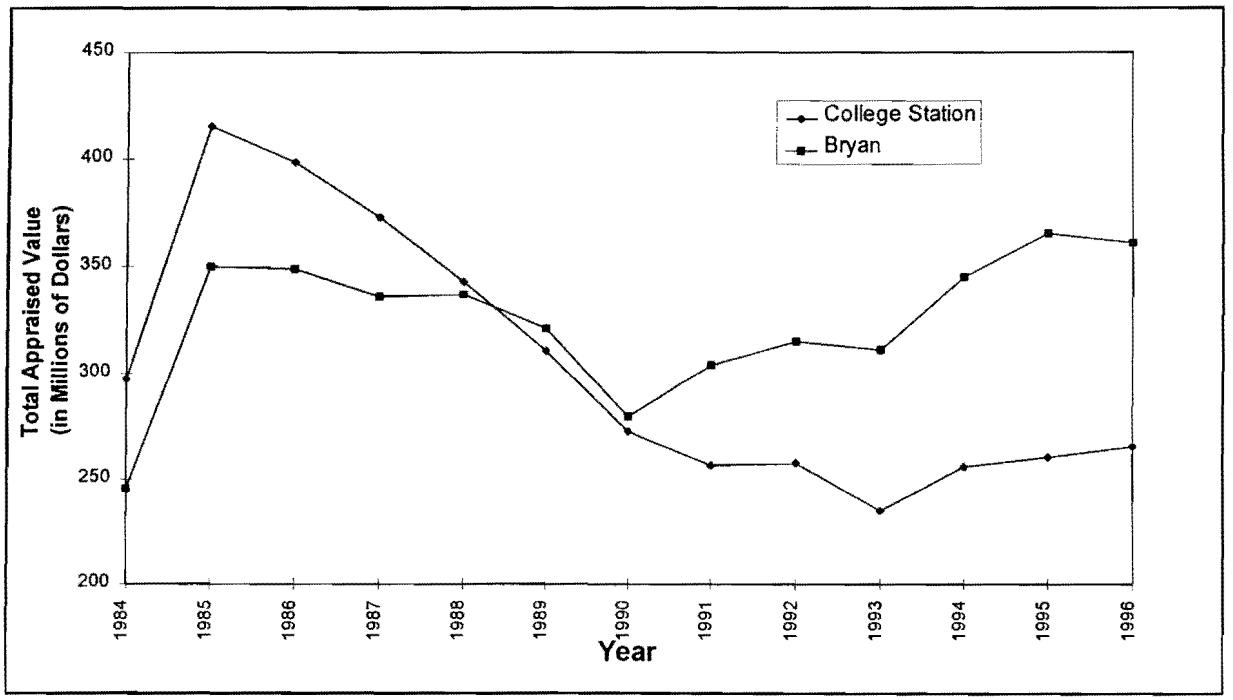

Figure C-2. Appraised Local Vacant Land Property Values

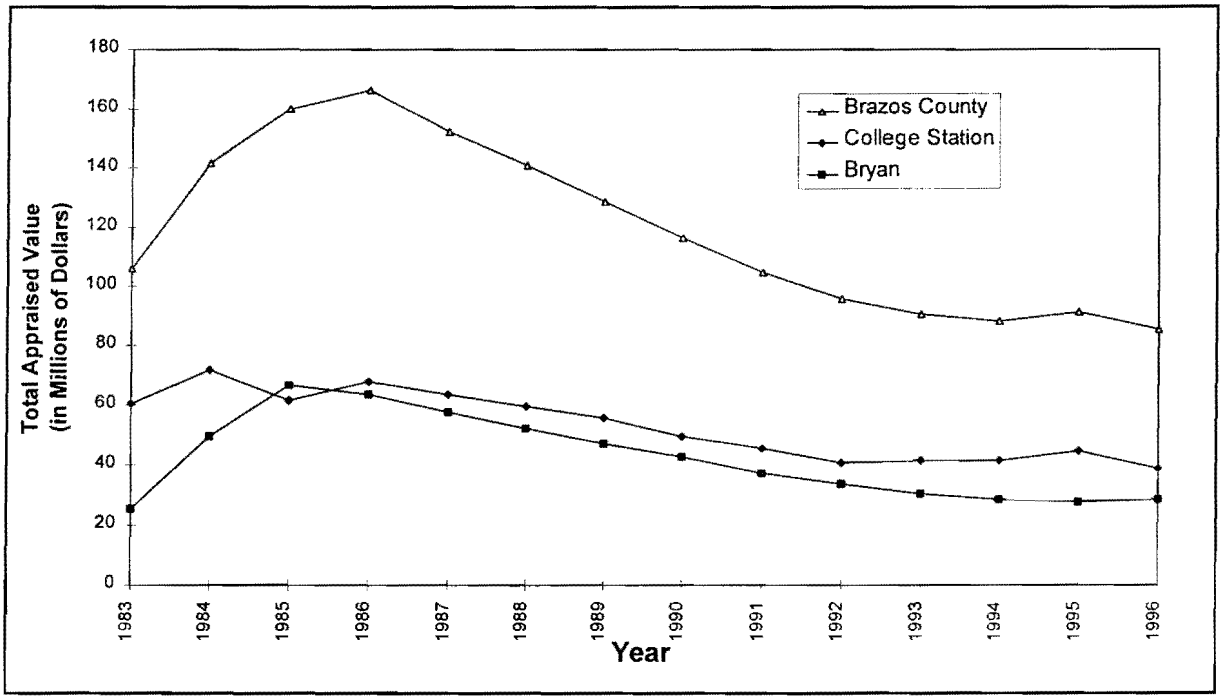

Figure C-3. Appraised County and Local Commercial Property Values

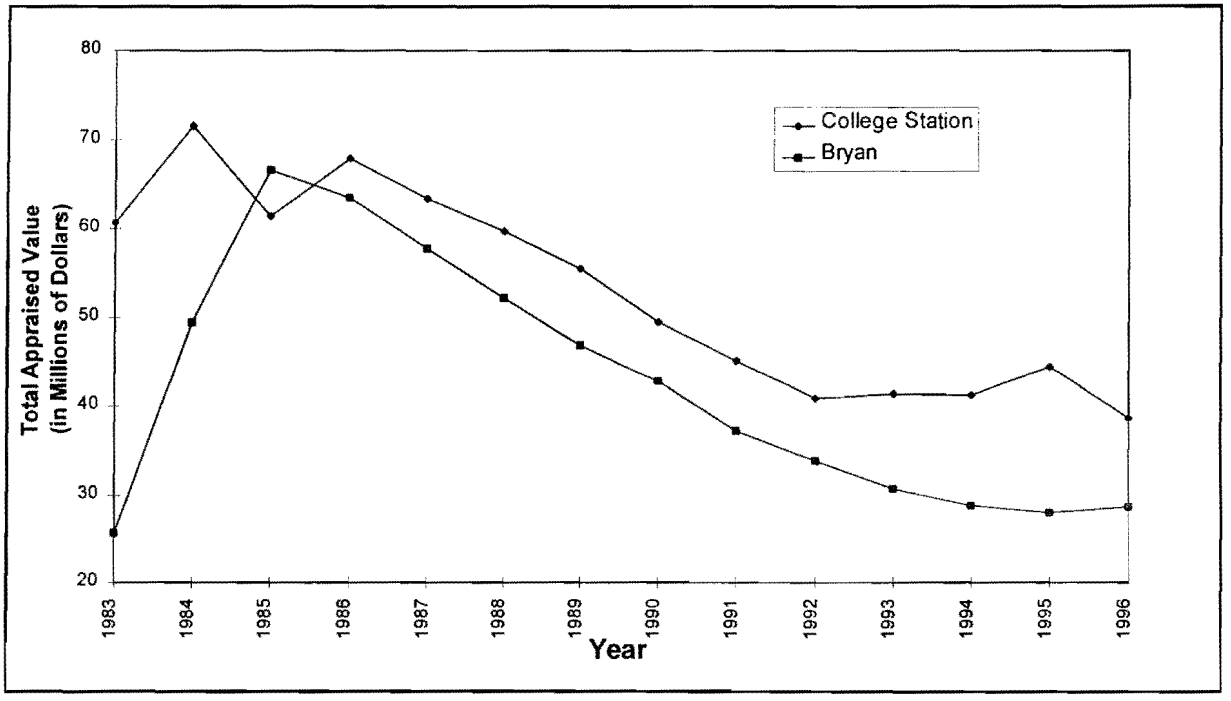

Figure C-4. Appraised Local Commercial Property Values

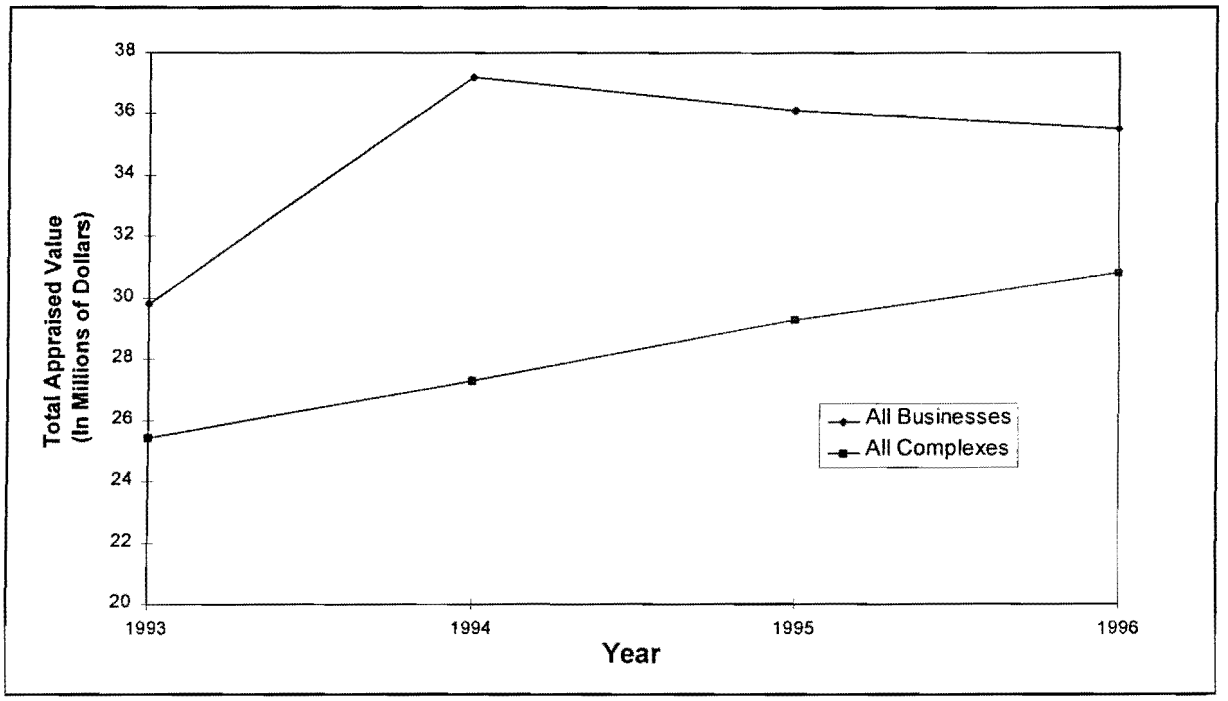

Figure C-5. Total Appraised Value of All Businesses and Complexes Along Texas Avenue With Available Appraisal Information

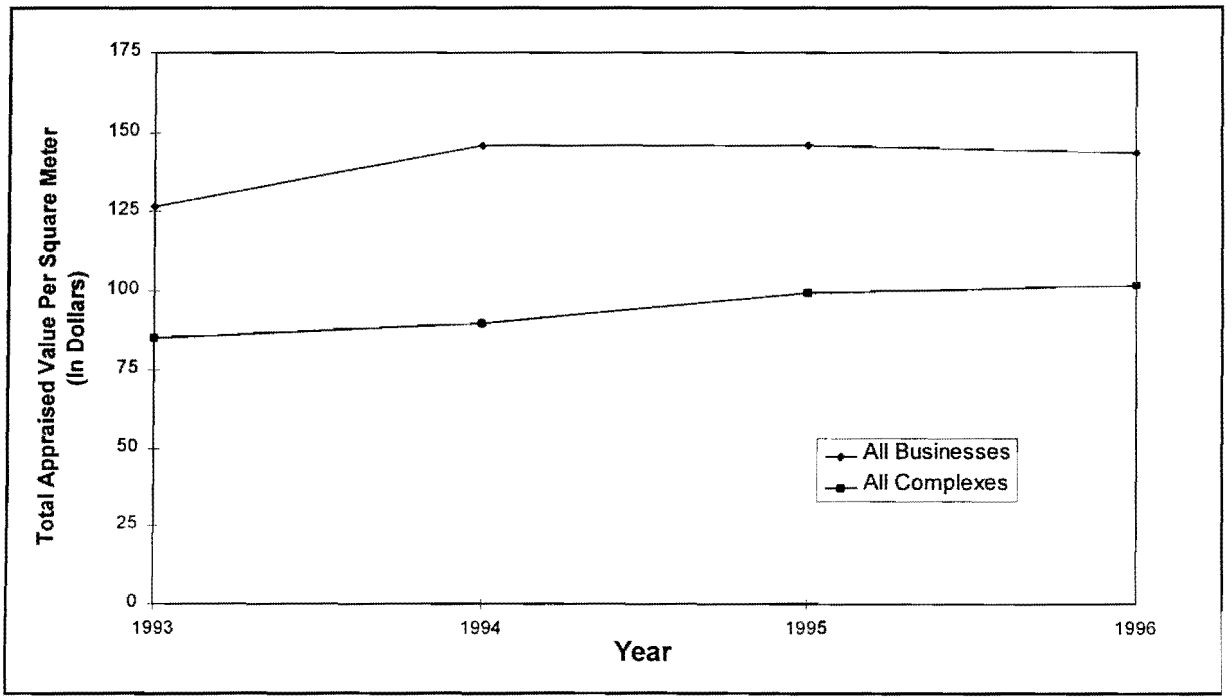

Figure C-6. Total Appraised Value (Per Square Meter) of All Businesses and Complexes Along Texas Avenue With Available Appraisal Information

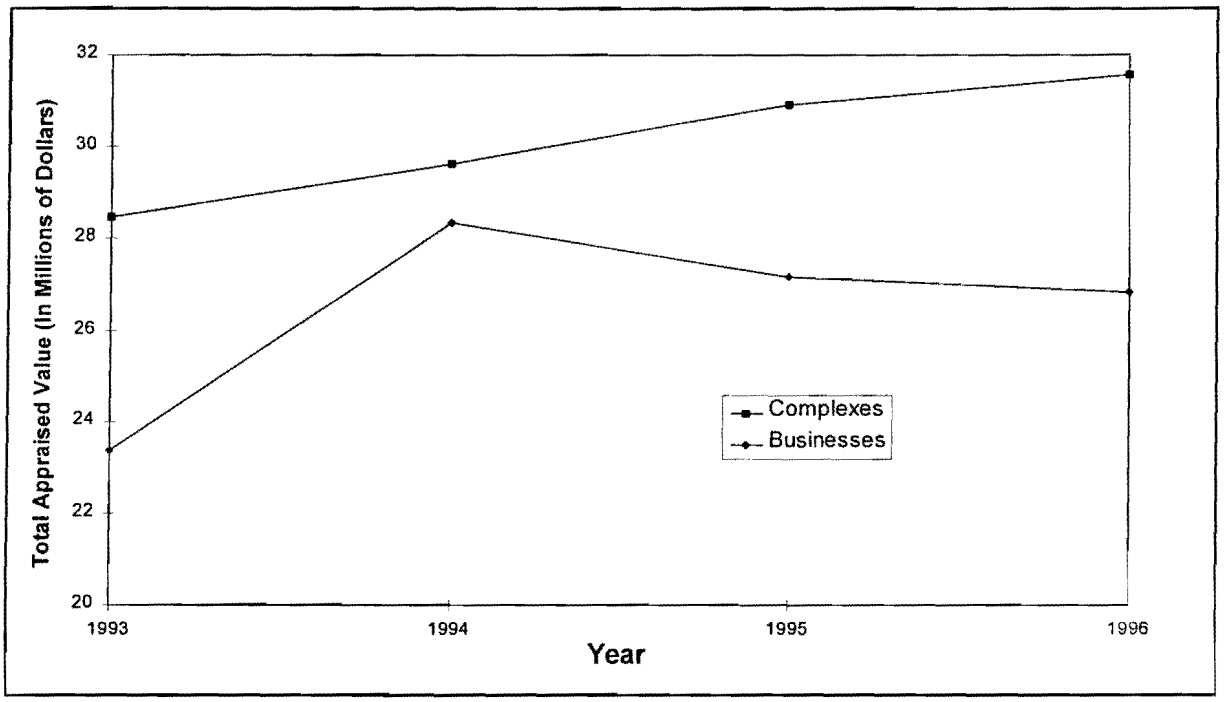

Figure C-7. Total Appraised Value of Businesses and Complexes Along Texas Avenue Surveyed in Study

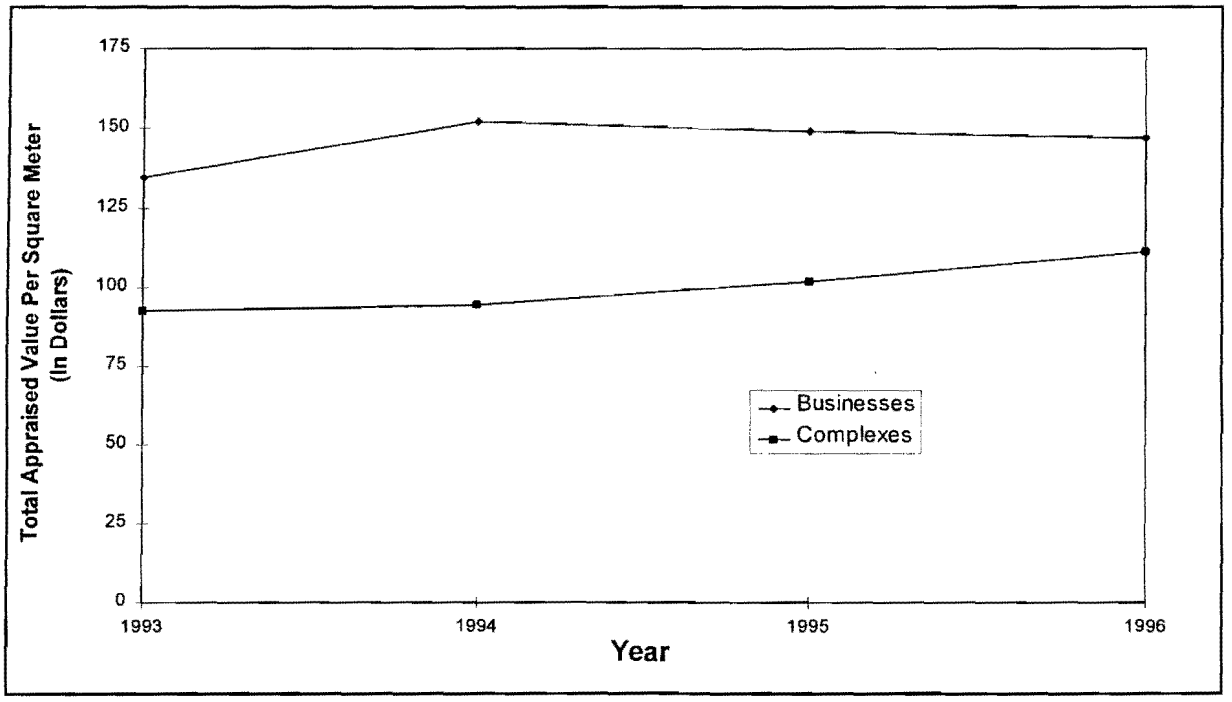

Figure C-8. Total Appraised Value (Per Square Meter) of All Businesses and Complexes Along Texas Avenue Surveyed in Study

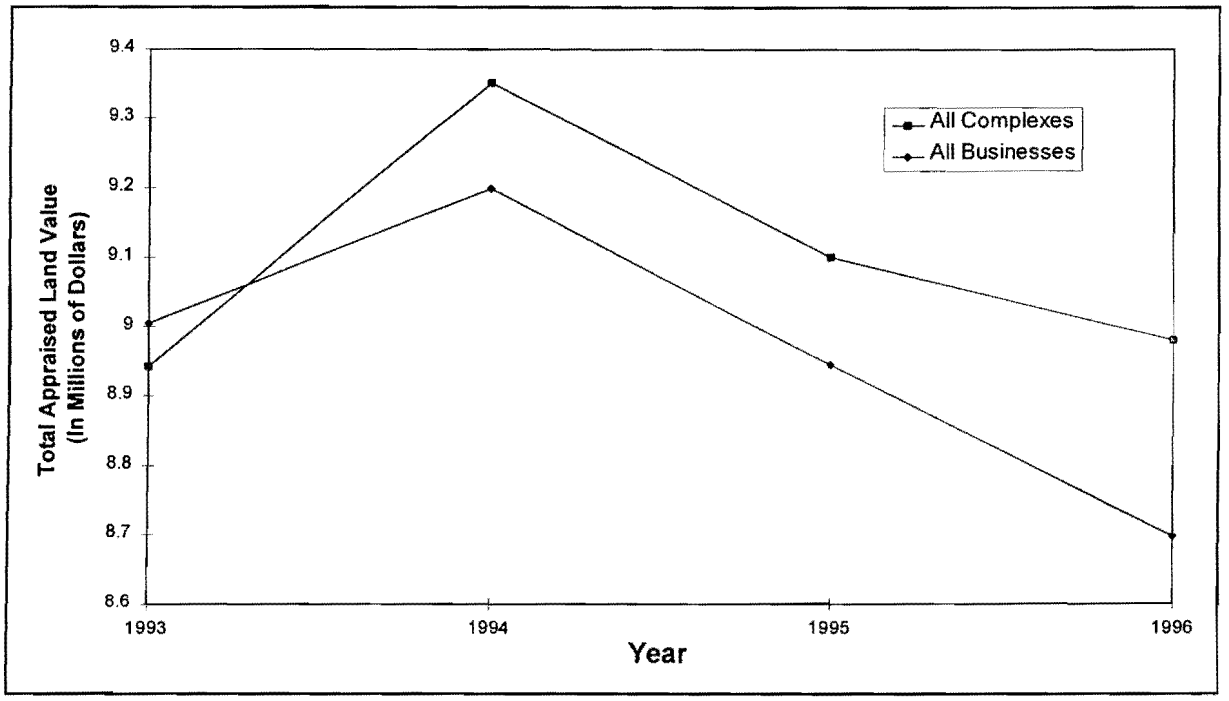

Figure C-9. Total Appraised Land Value of All Businesses and Complexes Along Texas Avenue With Available Appraisal Information

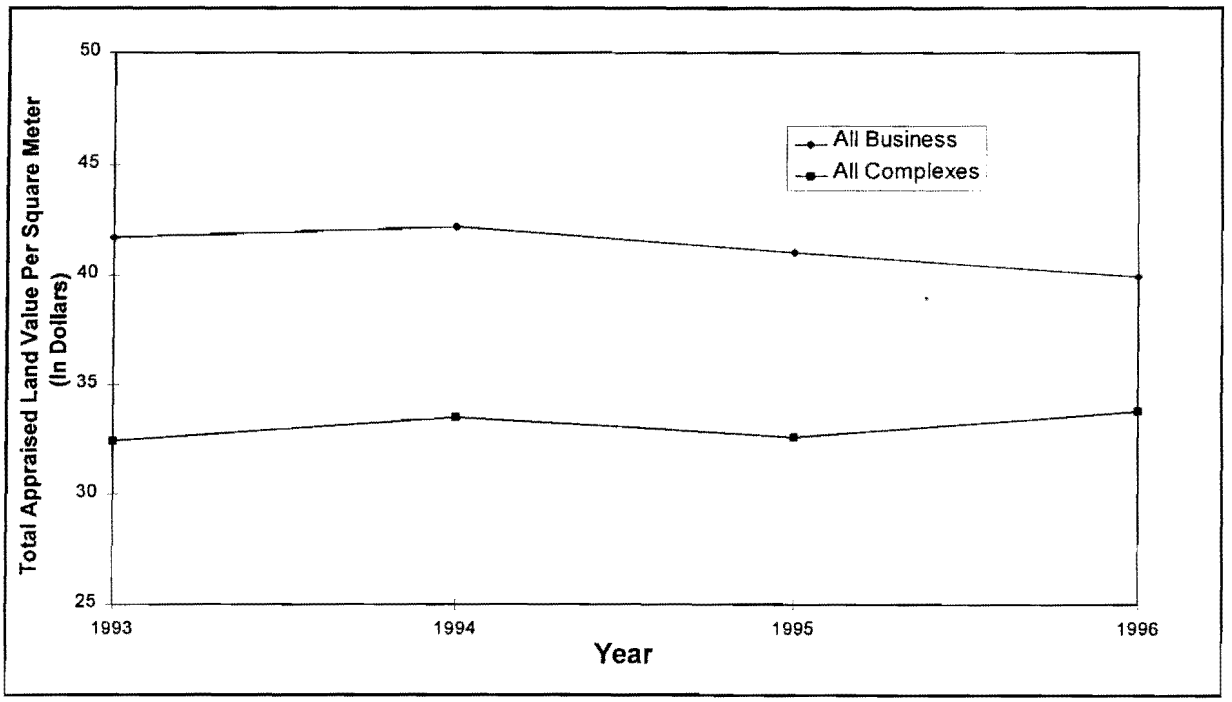

Figure C-10. Total Appraised Land Value (Per Square Meter) of All Businesses and Complexes Along Texas Avenue With Available Appraisal Information

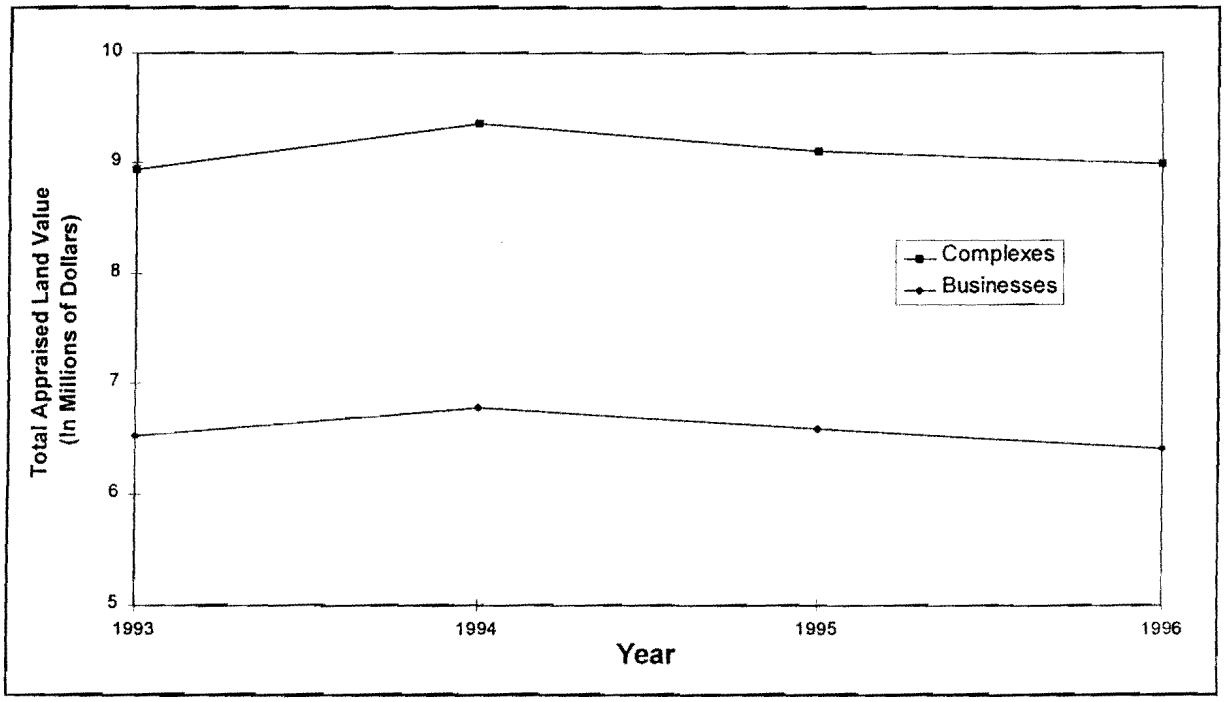

Figure C-11. Total Appraised Land Value of All Businesses and Complexes Along Texas Avenue Surveyed in Study

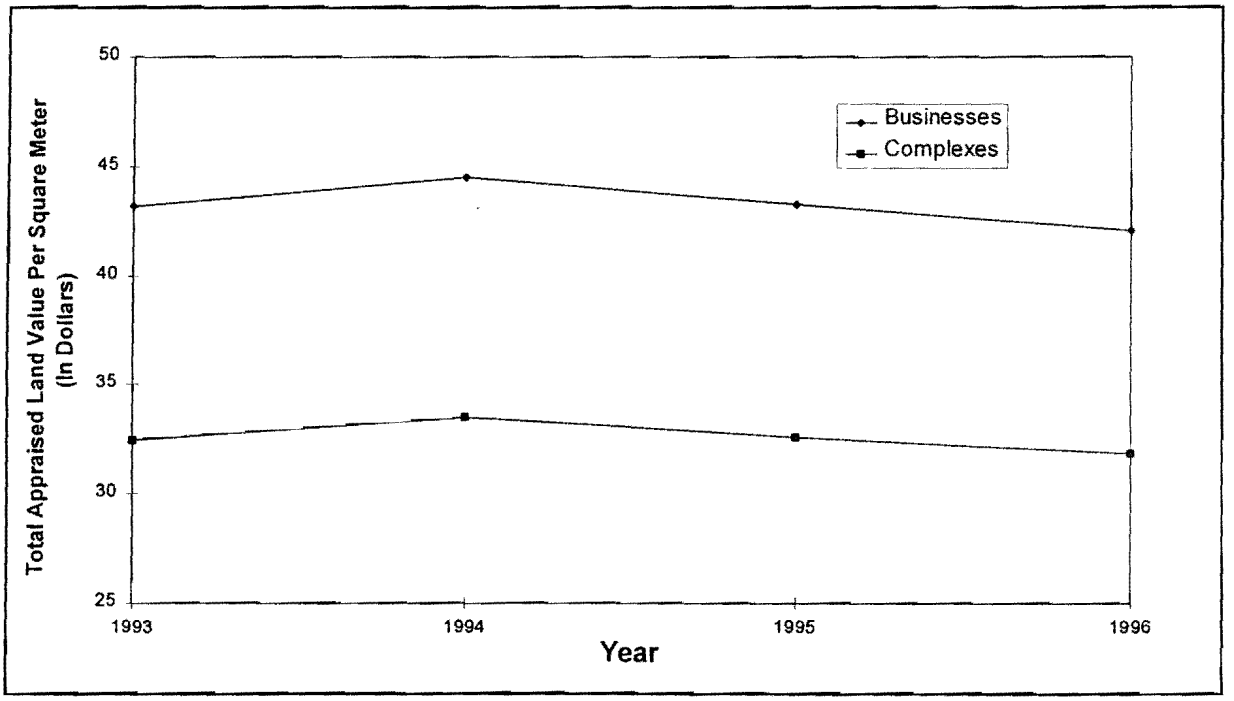

Figure C-12. Total Appraised Land Value (Per Square Meter) of All Businesses and Complexes Along Texas Avenue Surveyed in Study