Technical Report Documentation Page

| 1. Report No. FHWA/TX-98/1327-1 | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| 4. Title and Subtitle SOCIAL AND ECONOMIC EFFECTS OF ELEVATED, DEPRESSED, AND AT-GRADE LEVEL FREEWAYS IN TEXAS | | 5. Report Date November 1997 |
| | | 6. Performing Organization Code |
| 7. Author(s) Jesse L. Buffington, Katie N. Womack, and Carol A. Lewis | | 8. Performing Organization Report No. Research Report 1327-1 |
| 9. Performing Organization Name and Address Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135 | | 10. Work Unit No. (TRAIS) |
| | | 11. Contract or Grant No. Study No. 0-1327 |
| 12. Sponsoring Agency Name and Address Texas Department of Transportation Research and Technology Transfer Office P.O. Box 5080 Austin, Texas 78763-5080 | | 13. Type of Report and Period Covered Interim: September 1992 - August 1996 |
| | | 14. Sponsoring Agency Code |

15. Supplementary Notes
Research performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration.
Research Study Title: Social, Economic, and Environmental Effects of Elevated and Depressed Freeways

16. Abstract
To answer questions being raised by abutting residents and businesses about proposed elevated and/or depressed freeway improvements in the urban and suburban areas of Texas, a four-year study has been conducted to estimate the social, economic, and environmental effects of such freeway designs. Eight existing, two under construction, and one approved-for construction freeway sections have been studied on a before-, during-, and after-construction basis. The sections selected for study range from being in predominately residential suburban areas to predominately commercial-industrial downtown areas. The specific effects of the three types estimated for each study section include: (1) social impacts: population changes, neighborhood accessibility, neighborhood cohesion; (2) economic impacts: relocation and mitigation costs, business sales, property uses and values, tax revenues, employment, and income and user costs; and (3) environmental impacts: aesthetics, drainage and erosion, noise and air pollution, vibration, and hazardous spills. The literature review and a survey of highway agencies in other states were used to determine the appropriate procedures or models and mitigation measures to implement in estimating the social, economic, and environmental impacts of elevated and depressed freeways.

The results of the study, presented in six separate reports according to types of effect, can be used by highway planning and designing engineers to prepare environmental statements and documents of the expected social, economic, and environmental impacts of proposed elevated and depressed freeway projects. Also, the results can be disseminated at the public hearings for a proposed project. This report presents the findings of the social and economic effects of elevated, depressed, and at-grade level freeways. The findings from prior studies indicate that freeway grade level differences in selected measures of social and economic activity are statistically significant. However, these differences are negative or positive, depending upon various locational factors. The results of this study tend to confirm those findings.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Traffic, Grade Level, Elevated, Depressed, At-Grade, Combination or Double-Deck, Social, Economic, Environmental, Impacts, Effects, Distance, Abutting and Non-Abutting, "Before and After," Literature Review, Surveys, Questionnaires, Freeways, Study Sections, Mitigation, Walls and Barriers, Businesses, Gross Sales, Residents, Opinions, Construction Costs, Right-of-Way Costs, Aesthetics, Land Values, Land Uses, Zoning and Ordinances, Noise and Air Pollution, City, Urban, Suburban | No restrictions. This document is available to the public through NTIS: National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161 |

| 19. Security Classif.(of this report) | 20. Security Classif.(of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| Unclassified | Unclassified | 450 | |

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

# SOCIAL AND ECONOMIC EFFECTS OF ELEVATED, DEPRESSED, AND AT-GRADE LEVEL FREEWAYS IN TEXAS

by


Jesse L. Buffington
Research Economist
Texas Transportation Institute

Katie N. Womack
Research Sociologist
Texas Transportation Institute

and

Carol A. Lewis
Director of Transportation Research
Texas Southern University



Research Report 1327-1
Research Study Number 0-1327
Research Study Title: Social, Economic, and Environmental Effects of Elevated and Depressed Freeways

Sponsored by the
Texas Department of Transportation
In Cooperation with
U.S. Department of Transportation
Federal Highway Administration

November 1997

TEXAS TRANSPORTATION INSTITUTE
The Texas A & M University System
College Station, Texas 77843-3135

# IMPLEMENTATION STATEMENT

The findings of this study can be used by TxDOT to improve its procedures for estimating various social, economic, and environmental effects from proposed elevated, depressed, and at-grade freeways. The findings indicate that the grade level differences in various measures of social, economic, and environmental activities or effects are statistically significant. The specific grade level designs of the study freeway sections do affect business gross sales, land values and uses, social services, degree of access, etc. enough for transportation planners and designing engineers to carefully consider which freeway grade level is most feasible for the dominant abutting land use being encountered. The findings of this study can be implemented immediately to be presented at public hearings and prepare environmental impact statements.

## DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented within. The contents do not necessarily reflect the views or policies of the Texas Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation. It is not intended for construction, bidding, or permit purposes.

# ACKNOWLEDGMENT

The authors want to thank Mr. Jon Underwood, Director, Research and Technology Transfer Office, and staff members Lana Ashley and Klaus Alkier for assistance in handling TxDOT administrative matters pertaining to the study. Special thanks are given to the TxDOT technical panel members, Joe B. Thompson, Project Director, Melissa Neeley, Peggy D. Thurin, and John P. Kelly, Origin Project Director, for providing oversight and direction to the study. The research team is especially appreciative of the many TxDOT district personnel for their help in the selection of study sections and responding to various data requests during the life of this study. These personnel are named by their respective districts or organizations as follows:

Dallas District:

Richard H. Rawles, Jr., Former Director of Construction; Gary W. Taylor, Project Manager of North Central Project Office; and Terry L. May, District Right-of-Way Engineer.

Houston District:

Hans C. Olavson, Director of District Transportation Planning; Dennis W. Warren, Director of Construction; and Thomas N. Lou, Assistant to Director of Transportation and Planning.

Harris County Toll Road Authority:

Wesley E. Freise, Executive Director.

Lubbock District:

Carl R. Utley, District Engineer; V.G. Chetty, Former Deputy District Engineer; John E. Rantz, Director of Operations and Construction; Steven P. Warren, Director of Transportation Planning and Development; Ted Copeland, Traffic Engineer; Mike Craig, Assistant District Design Engineer; Davis Melton, Environmental Coordinator; and Claude C. Kneisley, Right-of-way Supervisor.

San Antonio District:

John P. Kelly, District Engineer; Julie Brown, Director of Transportation Planning and Development; Mary T. Richards, Environmental Coordinator; Gilbert G. Gavia, District Design Engineer; Felix A. Lemra, District Design Section; and Herbie L. Belvin, District Right-of-Way Administrator.

The authors also wish to acknowledge the Federal Highway Administration for providing funding and technical support for the study.

Other members of the Texas Transportation Institute gave valuable assistance to the study. Dr. W. F. McFarland, Research Economist and Head of the Transportation Economics Program, gave administrative support. Thanks are due to Dr. Sharada R. Vadali, Assistant Research Scientist, for her help in data analysis and in the preparation of this report. Thanks are due Mr. Alan G. Nelson, Student Worker, for his hard work in data entry and reduction and Mrs. Cheryl Kruse, Secretary for the Transportation Economics Program, who took care of much of the paperwork for the study and also assisted with the data entry. Thanks are due Diana G. Wallace, Assistant Research Specialist; Stephen E. Ranft, Research Associate; Darrell W. Borchardt, Associate Research Engineer; and Paul A. Hawkins, Assistant Research Scientist, for their help in collecting all of the traffic data needed for this study.

Thanks are due Ms. Linda Pedro and Mr. Mack Lindsey of the Research Division of the Texas State Comptroller's Office for their help in furnishing business gross sales and state sales tax data needed for this study. Thanks are due the officials of the Dallas, Harris, Bexar, and Lubbock County Appraisal Districts for furnishing appraised values of abutting properties for the study sections in their respective counties.

Last, thanks are due all of the cooperating businesses and residents who furnished survey data.

# TABLE OF CONTENTS

## TABLE OF CONTENTS, continued

**Chapter** **Page**

# TABLE OF CONTENTS, continued

## TABLE OF CONTENTS, continued

# TABLE OF CONTENTS, continued

# LIST OF FIGURES

## LIST OF FIGURES, continued

**Figure** **Page**

# LIST OF TABLES

## LIST OF TABLES, continued

## LIST OF TABLES, continued

## LIST OF TABLES, continued

## LIST OF TABLES, continued

# LIST OF TABLES, continued

# INTRODUCTION

## STUDY PROBLEM STATEMENT

The Texas Department of Transportation (TxDOT) is continually upgrading the existing highway system in the state, especially in urban and suburban areas. This upgrading involves improving existing highways or freeways on the existing route or on a new route paralleling the old route or bypassing the central city. Such freeway improvements are made at varying grade levels, i.e., at-grade, elevated grade and depressed grade, depending on the terrain, land use, and other factors. The choice of grade level at a particular point may be an attempt to mitigate negative noise and aesthetics impacts on a residential neighborhood. The current trend in design is toward elevated and depressed sections to gain additional lanes. The elevated sections may be either earthen or bridge in form. Many sections of each type of grade level have been built over the years since the late 1950s. Many are over 20 years old. However, quite a few sections have been built during last 5 to 10 years, and some sections are either under construction or in the planning stages.

Even though many sections of elevated and depressed freeways have been built over the years in the state, more and more questions are being raised by abutting or nearby residents and businesses about the possible negative impacts of such freeways. In recent years, stiff resistance has been given to the proposed elevated section of the Dallas North Central Expressway and more recently to the proposed elevated or depressed section of U.S. Highway 287 in Wichita Falls. Also, the elevated sections of U.S. Highway 183 now under construction in Austin have caused similar concerns.

Any highway improvement, regardless of grade level, not only impacts users but also impacts abutting and nearby property owners, businesses, and residents in some manner. Even the whole city or community is impacted in some way during and after construction. Elevated and depressed freeway designs raise particular questions concerning noise and air quality impacts, but vibration in moving vehicles and in structures adjacent to the freeway and flooding of depressed freeways are additional concerns. The recent flooding of a depressed section of I-10 in Houston dramatized the latter problem. Soil erosion, at the point of drainage discharge, can cause a problem. Last, aesthetic qualities of elevated and depressed sections are matters of concern.

Impacts that result from elevated and depressed freeway improvements can be classified into three major types: (1) social, (2) economic, and (3) environmental. A partial list of the specific impacts of each of the major types is given below. The social impacts are: population changes, neighborhood accessibility, neighborhood cohesion, and community services. The economic impacts are: relocation and mitigation costs, business sales, land uses and property values, tax revenues, employment and income, and user costs. The environmental impacts are: aesthetics, drainage and erosion, air quality, noise and vibration, and hazardous spills.

A preliminary search of the literature reveals very few case studies that have measured many of the social, economic, and environmental impacts of depressed and elevated freeways, especially those in Texas. Therefore, the highway decision-makers have very little relevant impact data to write and support the environmental assessment statements and to present at public hearings for proposed elevated and depressed sections of existing or proposed freeway.

## STUDY OBJECTIVES

The general objective of the study is to determine the social, economic, and environmental effects of elevated and depressed freeways in urban and suburban areas. The more specific objectives of the study are as follows:

1. Determine the appropriate estimating procedures or models and mitigation measures to be used in this study to estimate the social, economic, and environmental effects of elevated and depressed freeways.
2. Estimate the social, economic, and environmental effects of several existing, contracted, and proposed elevated and depressed freeway sections situated in urban areas in Texas and recommend a final set of impact estimating procedures for use by TxDOT.

## SELECTION OF FREEWAY STUDY SECTIONS

At the beginning of this study, a survey was conducted of all of TxDOT's districts to locate all elevated and depressed freeway sections at least 0.805 kilometers (one-half mile) long that were planned, under construction, or recently constructed during the last 10 years. (Copies of the survey forms appear in Appendix A.) Also, the survey asks for TxDOT to indicate the location (downtown or suburban), abutting land use, and age (less than five years or more than five years) of each qualifying freeway section. Later, a determination was made whether each freeway section was on an existing highway route or a new location. These were considered primary characteristics to be used in selecting the freeway study sections.

A total of 30 freeways (11 elevated and 19 depressed) was identified and reported by the TxDOT districts. A total of 12 (six elevated and six depressed) was planned; three (one elevated and two depressed) were under construction; and 15 (four elevated and 11 depressed) were recently constructed. Each of the 30 candidate study sections was personally inspected by TTI researchers accompanied by a TxDOT district official.

With the help of TxDOT's study panel members, a total of 11 freeway section sections was selected for study. Of those selected, two (one elevated and one depressed) were planned; two (one elevated and one depressed) were under construction; and seven (three elevated and four depressed) were built. Of the seven already built, three (two elevated and one depressed) were less than four years old, and four (one elevated and three depressed) were over four years old.

## LOCATION AND CHARACTERISTICS OF STUDY FREEWAY SECTIONS

Table 1 shows the selected study sections, type of grade level, location, abutting land use, and age. As can be seen, an attempt was made to have a fairly good mix of study sections representing different types of locations, stages of construction, and ages and land uses for each of the study grade levels.

The 11 study sections are located in four Texas cities: one depressed section on U.S. Highway 75 in Dallas; one depressed section on the Sam Houston Tollway in Houston; and four sections in Lubbock. Two of these were located on I-27 (one elevated and one depressed), and two are located on the planned East-West Freeway (U.S. 62/82), one elevated and one depressed. Figures 1-4 show the location of the study sections within Dallas, Houston, San Antonio, and Lubbock, respectively. Tables 2 and 3 show other important characteristics of each study section by study grade level. Some of these characteristics are used in evaluating the different impacts considered under this study.

**Table 1. Freeway Sections Selected for Study by Type of Grade Level Design and Key Characteristics**

| TYPE OF DESIGN/Number/ STATUS | CITY & HIGHWAY Type/Number | ROUTE LOCATION | SECTION LOCATION | ABUTTING LAND USE |
|---|---|---|---|---|
| **Elevated Sections** | | | | |
| No. 11-Planned | Lubbock-U.S. 62/82 | Existing | Suburban | Res/Com |
| No. 8-Built Under 4 Years | Lubbock-I-27 | New | Downtown | Com/Ind |
| **Depressed Sections** | | | | |
| No. 10-Planned | Lubbock-U.S. 82 | Existing | Downtown | Com/Pub/Re s |
| No. 7-Under Construction | Dallas-U.S. 75 | Existing | Downtown & Suburban | Com/Res |
| No. 9-Built Under 4 Years | Lubbock-I-27 | New | Suburban | Res/Com |
| No. 5-Built Under 4 Years | San Antonio-U.S. 281 | Existing | Suburban | Vacant/ Res/Com |
| No. 1-Built Over 4 Years[1] | San Antonio-I-35 | Existing | Downtown | Res/Com |
| No. 6-Built Over 4 Years | Houston-Beltway 8 | New | Suburban | Res/Com |
| **Combination Elevated & Depressed Sections** | | | | |
| No. 2-Built Under 4 Years | San Antonio-I-35 | Existing | Downtown | Res/Com |
| No. 3-Built Under 4 Years | San Antonio-I-10 | Existing | Downtown | Res/Com |
| No. 4-Built Over 4 Years | San Antonio-I-10/35 | Existing | Downtown | Com/Ind |

[1]No basic grade level change in this section, but adjacent to a new elevated/depressed section having feeder ramps extending into this section.

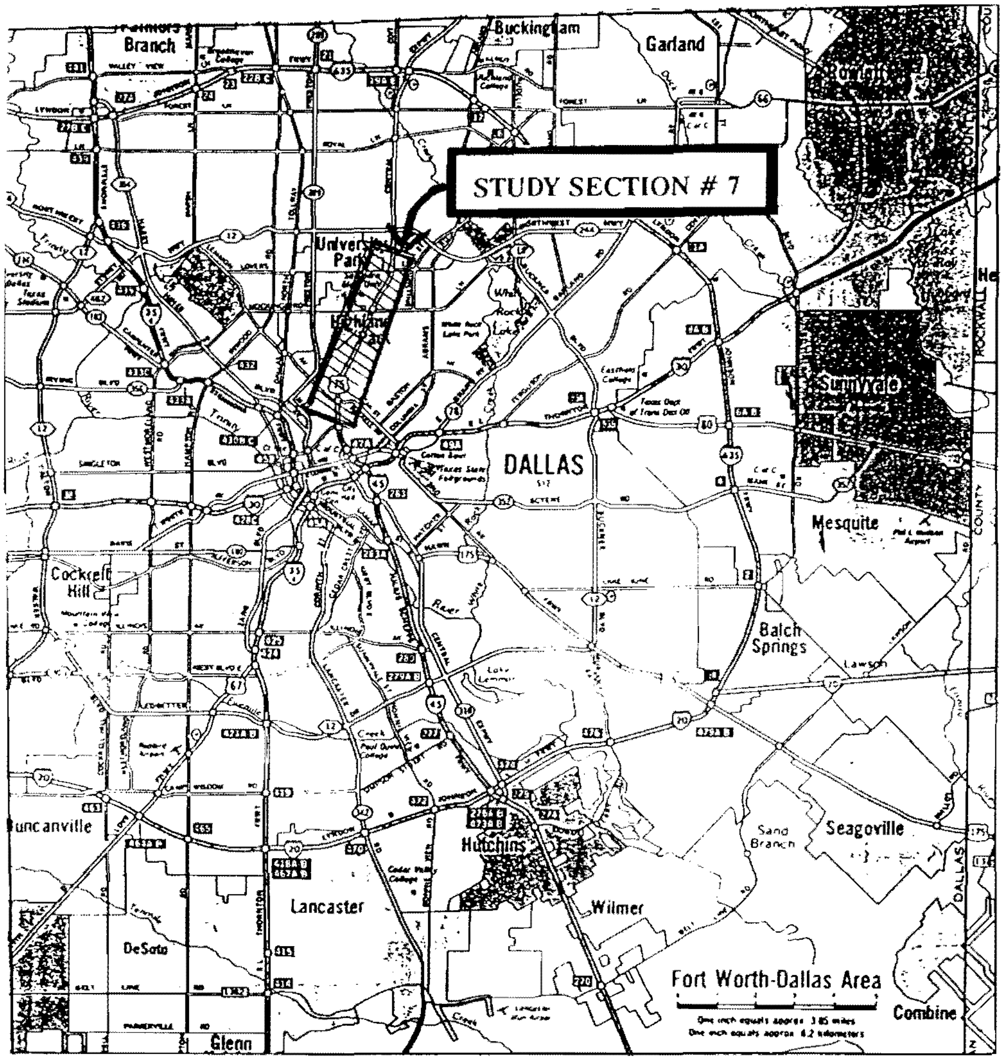



**Figure 1. Location of the Study Section 7 on U.S. 75 (Central Expressway) near Downtown Dallas**

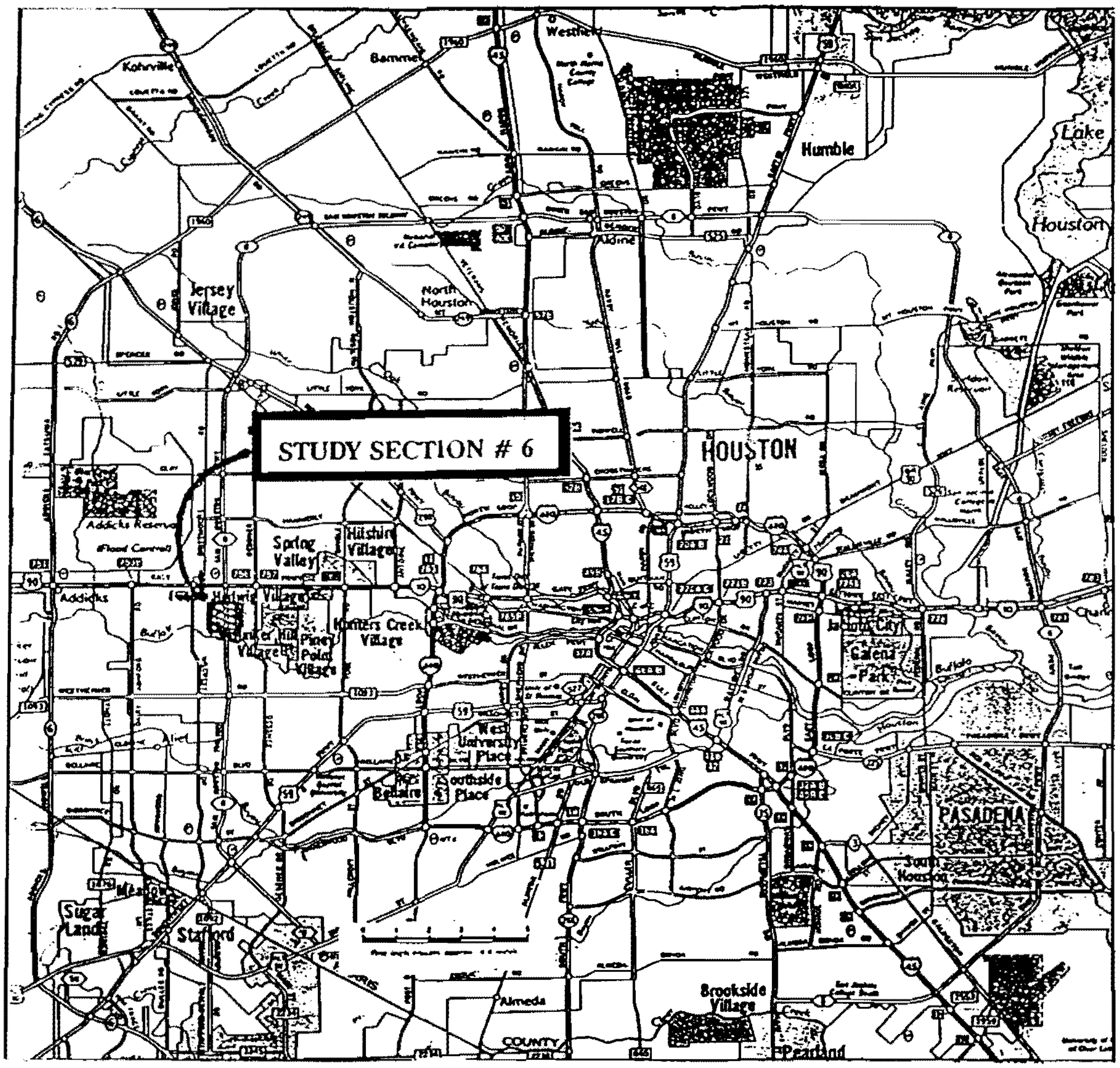



**Figure 2. Location of Study Section 6 on the Sam Houston Tollway in Southwestern Part of Houston**

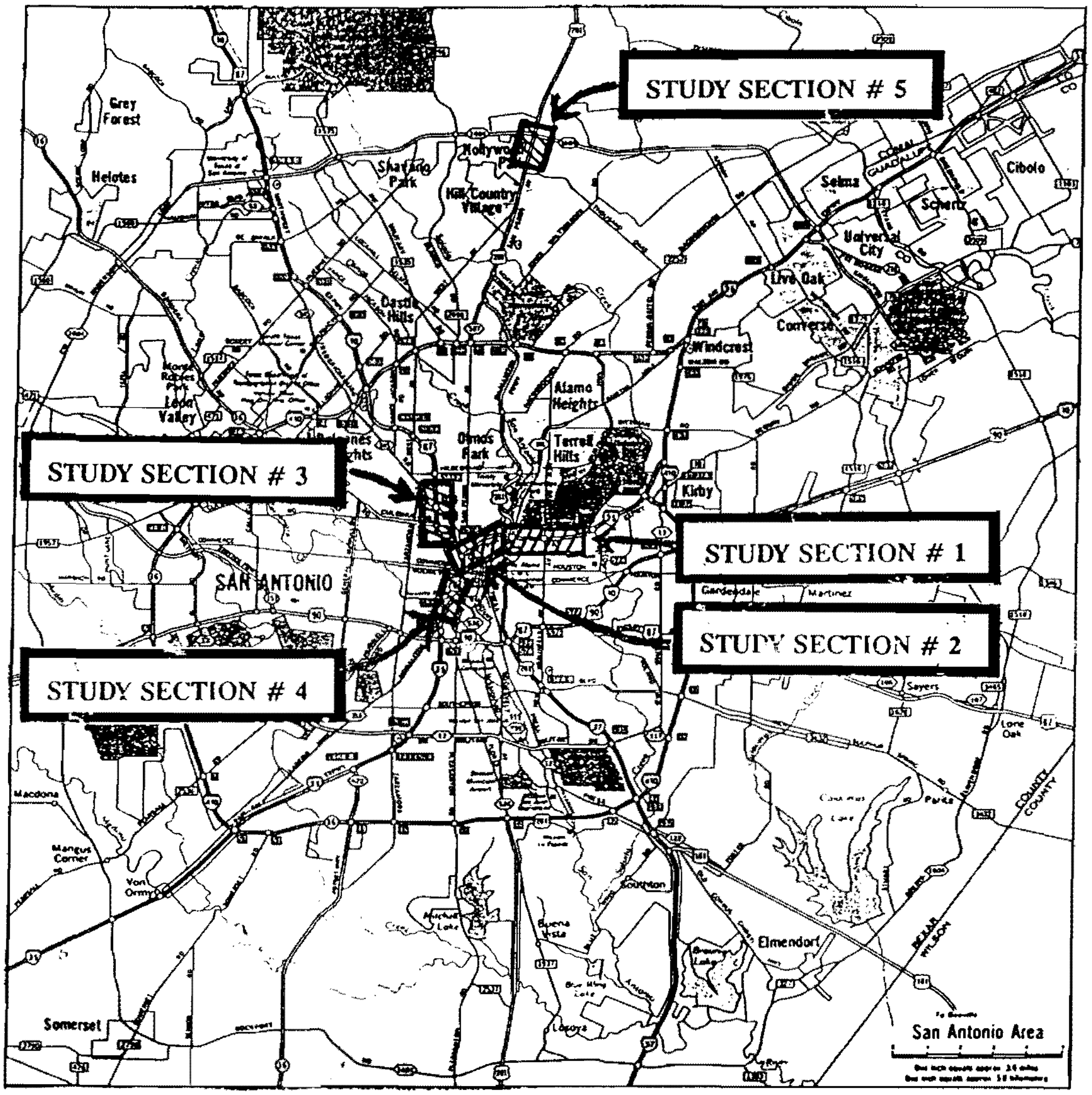



**Figure 3. Location of Study Sections 1-5 on I-10, I-10/35, I-35, and U.S. 281 in San Antonio**

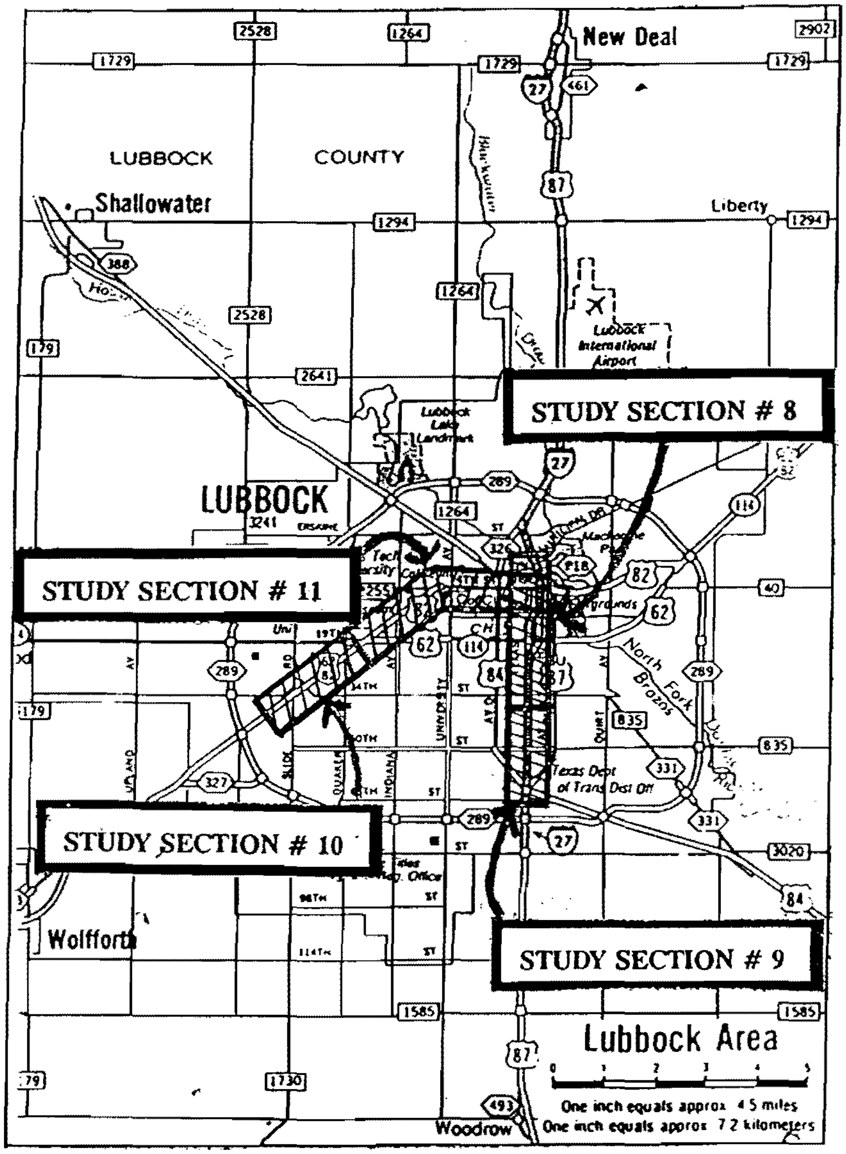



**Figure 4. Location of Study Sections 8-11 on I-27 and U.S. 62/82 (Proposed East-West Freeway) in Lubbock**

**Table 2. Study Freeway Sections by Age, Grade Level Before, Length, Grade Level Depth, Right-of-Way Width, Type of Mainlane Access, and ADT**

| STUDY NO./ TYPE OF GRADE LEVEL AFTER CONSTRUCTION | AGE AFTER (yrs) | GRADE LEVEL BEFORE | LENGTH AFTER km(mi) | GRADE LEVEL HEIGHT/DEPTH m(ft) | | RIGHT-OF-WAY WIDTH m(ft) | | TYPE OF ACCESS TO MAINLANES | | ADT | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | BEFORE | AFTER | BEFORE | AFTER | BEFORE | AFTER | BEFORE | AFTER |
| **Elevated/Combination Elevated & Depressed** | | | | | | | | | | | |
| No. 2 I-35-San Antonio | 1 | depressed | 2.01(1.25) | -4.6(-15) | +6.1(+20) | 64.0(210) | 70.7(232) | full | limited | 75,600 | 188,300 |
| No. 3 I-10- San Antonio | 3 | depressed | 2.96(1.84) | 0(0) | +6.1(+20) | 65.5(215) | 74.7(245) | limited | limited | 94,100 | 198,500 |
| No. 4 I-10/35- San Antonio | 6 | elevated/ depressed | 2.28(1.42) | +6.1(+20) | +6.1(+20) | 61.0(200) | 76.2(250) | limited | limited | 79,800 | 186,500 |
| No. 8 I-27- Lubbock | 3 | at-grade | 3.02(1.88) | 0(0) | 5.5(+18) | 38.1(125) | 121.9(400) | full | limited | 42,352 | 77,350 |
| No. 10 U.S. 62/82-Lubbock | 0 | at-grade | 2.32(1.44) | 0(0) | +6.4(+21) | 53.6(176) | 97.5(320) | full | limited | 22,493 | 52,533 |
| **Depressed** | | | | | | | | | | | |
| No. 6 Sam Houston Beltway-Houston | 6 | at-grade | 2.09(1.30) | 0(0) | -5.2(-17) | 91.4(300) | 91.4(300) | full | limited | 84,000 | 168,000 |
| No. 7 U.S. 75-Dallas | 0 | at-grade | 6.47(4.02) | 0(0) | -6.7(-22) | 67.1(220) | 85.3(280) | limited | limited | 155,000 | 217,700 |
| No. 9 I-27- Lubbock | 3 | at-grade | 4.84(3.01) | 0(0) | -5.2(-17) | 38.1(125) | 121.9(400) | full | limited | 42,356 | 77,350 |
| No. 11 .U.S. 62/82-Lubbock | 0 | at-grade | 2.56(4.12) | 0(0) | -6.7(-22) | 53.7(176) | 102.1(335) | full | limited | 22,656 | 34,483 |
| No. 1 I-35- San Antonio | 10 | depressed | 2.22(1.38) | -4.6(-15) | -4.6(-15) | 91.4(300) | 91.4(300) | limited | limited | 50,000 | 150,000 |
| No. 5 U.S. 281- San Antonio | 5 | at-grade | 2.85(1.77) | 0(0) | -6.4(-21) | 91.4(300) | 91.4(300) | full | limited | 12,700 | 94,000 |

Table 3. Study Freeway Sections by Number of Structures, Crossing Streets, Mainlanes, On Ramps, and Off Ramps

| STUDY NO./ TYPE OF GRADE LEVEL AFTER CONSTRUCTION | STRUCTURES (NUMBER) | | CROSSING STREETS (NUMBER) | | MAINLANES (NUMBER) | | ON RAMPS (NUMBER) | | OFF RAMPS (NUMBER) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | BEFORE | AFTER | BEFORE | AFTER | BEFORE | AFTER | BEFORE | AFTER | BEFORE | AFTER |
| **Elevated/Combination Elevated & Depressed** | | | | | | | | | | |
| No. 2 I- 35-San Antonio | 11 | 12 | 11 | 11 | 4 | 10 | 4 | 8 | 6 | 8 |
| No. 3 I-10-San Antonio | 9 | 11 | 6 | 6 | 4 | 10 | 3 | 6 | 5 | 6 |
| No. 4 I-10/35-San Antonio | 6 | 8 | 8 | 8 | 6 | 10 | 4 | 6 | 4 | 3 |
| No. 8 I-27-Lubbock | 2 | 6 | 21 | 6 | 4 | 6 | 0 | 4 | 0 | 3 |
| No. 10 U.S. 62/82-Lubbock | 2 | 4 | 5 | 3 | 4 | 6 | 0 | 3 | 0 | 3 |
| **Depressed** | | | | | | | | | | |
| No. 6 Sam Houston Beltway-Houston | 0 | 3 | 7 | 3 | 4 | 6 | 0 | 2 | 0 | 2 |
| No. 7 U.S. 75-Dallas | 13 | 14 | 13 | 13 | 4 | 8 | 16 | 5 | 16 | 5 |
| No. 9 I-27-Lubbock | 0 | 7 | 11 | 4 | 4 | 6 | 0 | 2 | 0 | 2 |
| No. 11 U.S. 62/82-Lubbock | 4 | 21 | 22 | 15 | 4 | 6 | 0 | 8 | 0 | 8 |
| No. 1 I-35-San Antonio | 9 | 9 | 7 | 7 | 6 | 6 | 3 | 3 | 3 | 3 |
| No. 5 U.S. 281-San Antonio | 1 | 2 | 2 | 2 | 4 | 6 | 0 | 3 | 0 | 3 |

## TYPICAL CROSS-SECTIONAL DESIGN OF STUDY FREEWAY SECTIONS

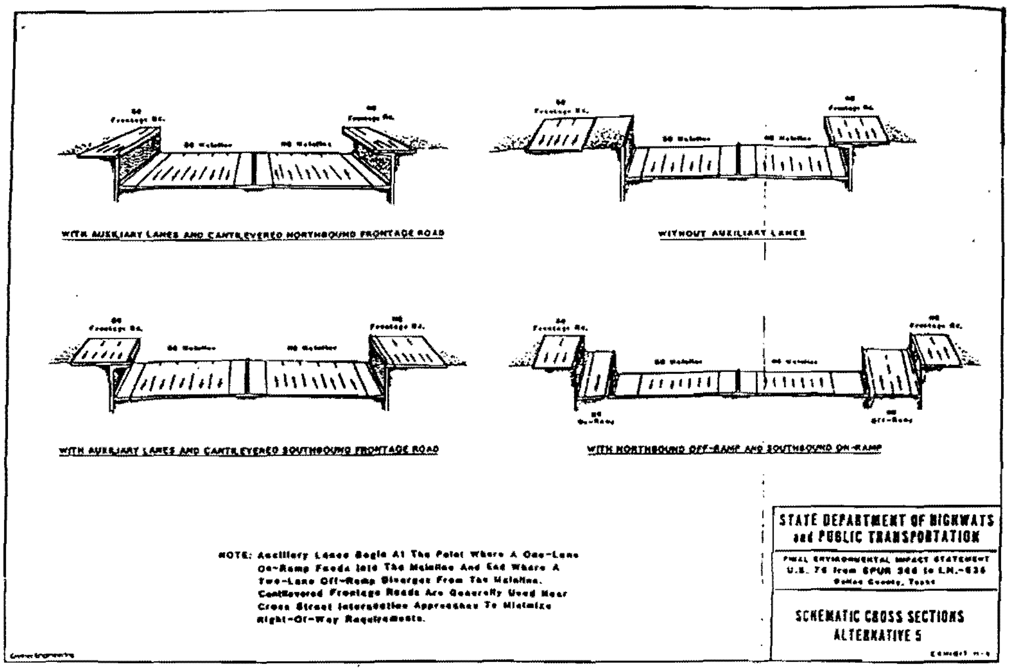
Figures 5-12 show the typical cross-sectional designs of the study freeway sections and photographs of the same. There are some variations in cross-sectional design through each study section, depending on the specific location. For instance, only one of the cross-sections shows the on and off ramp designs or the variation in the number of mainlanes or frontage road lanes throughout the study section.

## GENERAL METHODOLOGY AND DATA SOURCES

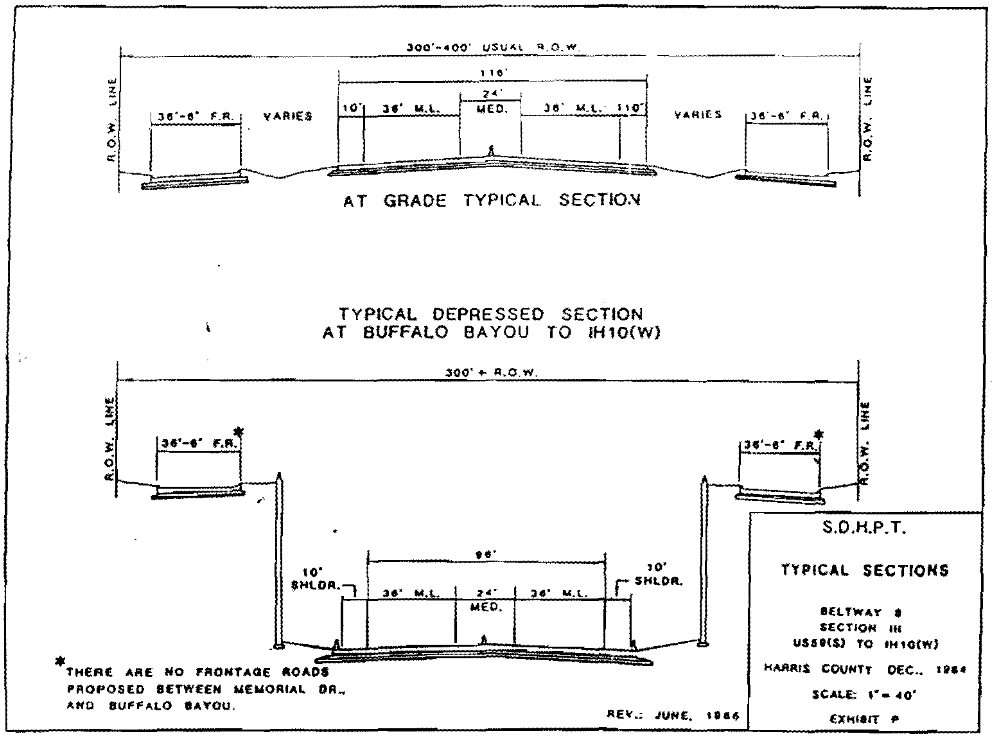
The general methodology planned for this study was to conduct a "before and after" construction period comparative analysis across time supplemented with a cross-sectional analysis at one point-in-time. The eight completed freeway study sections lend themselves easily to both analyses. The three others can be used to provide current before and/or during construction period data to supplement these analyses. For instance, the two study sections still under construction, at time of selection, can be used to study some of the construction effects of each grade level. The two planned study sections can be used to estimate anticipatory effects by grade level.

The before and after analysis can compare the elevated freeway sections with depressed freeway sections to ascertain any significant differences in various types of impact elements, i.e., air pollution, noise pollution, business activity, neighborhood cohesion, etc. The one point-in-time analysis can compare current level unit values of each impact element to determine significant differences between elevated and depressed freeway grade levels. For either of these analytical approaches, you can compare elevated study sections with depressed study sections and also compare these two grade levels with adjacent or nearby at-grade level sections. The at-grade sections, when available, can serve as a control or base section.

Sources of data used in the study ranged from a review of the literature to "on-site" data collection. The prior studies found in the literature, as well as data obtained from a national survey of state transportation agencies, helped to determine the different methodologies used in the study.

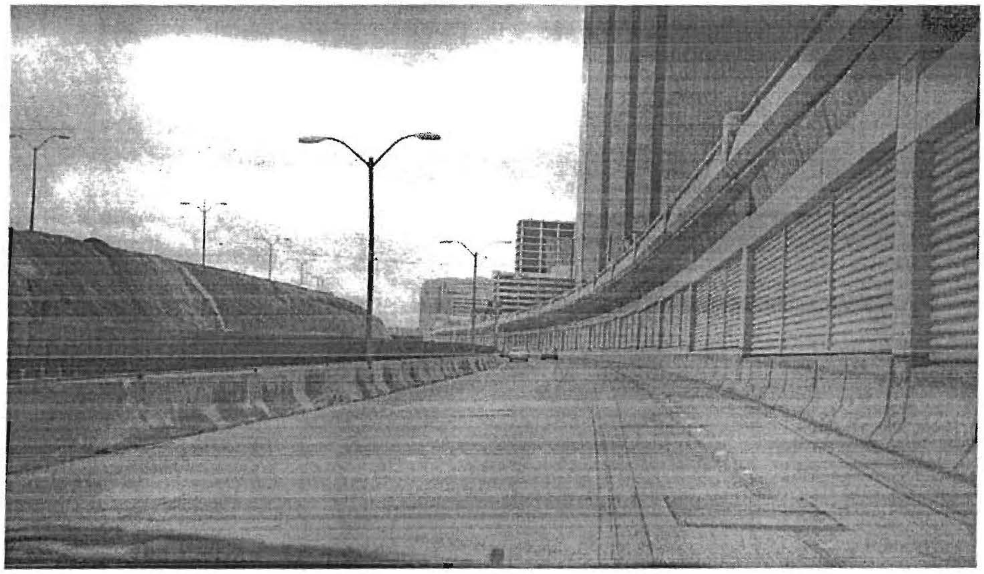



U.S. 75 Section # 7, Dallas

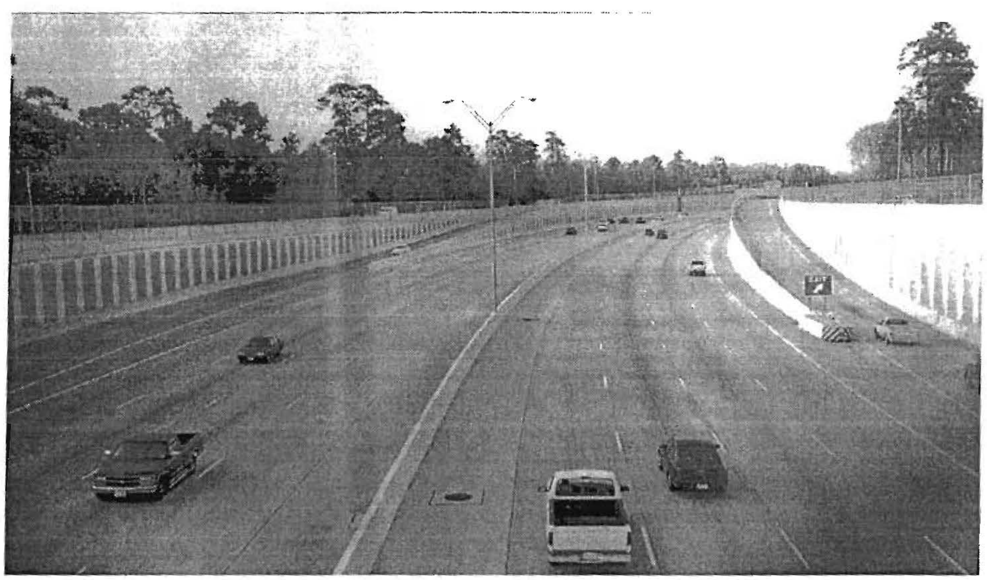



Sam Houston Tollway Section # 6, Houston

**Figure 5. Typical Cross-sectional Design of Depressed Study Sections on U.S. 75 in Dallas, Texas, and Sam Houston Tollway in Houston, Texas**

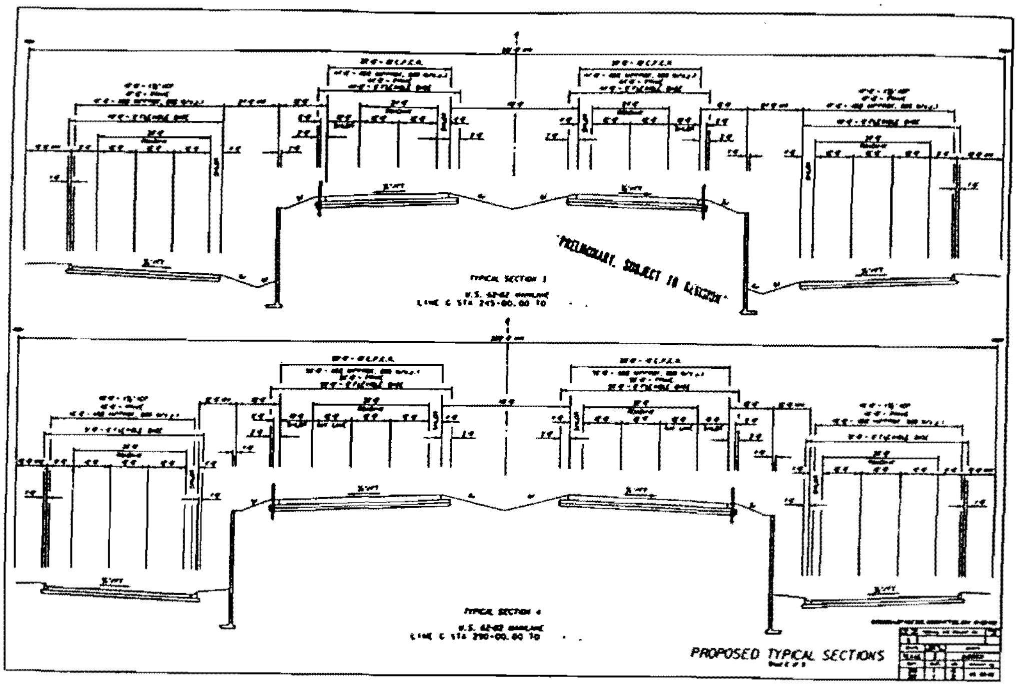


U.S. 75 Section # 7, Dallas

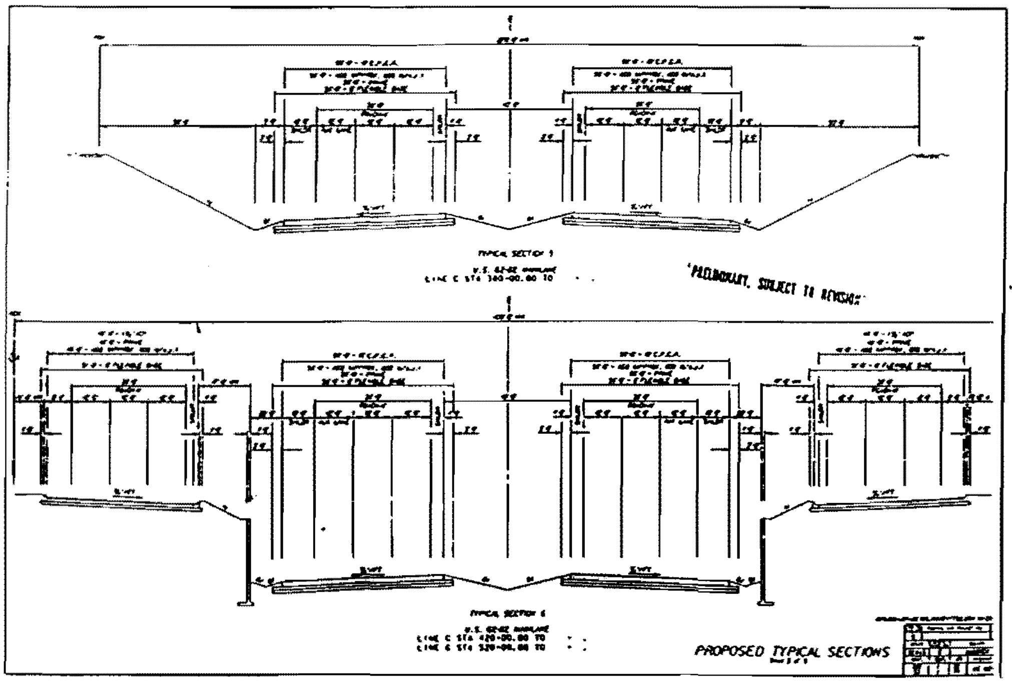


Sam Houston Tollway Section # 6

**Figure 6. Photograph of Typical Cross-sectional Design of Depressed Study Sections on U.S. 75 in Dallas, Texas, and Sam Houston Tollway in Houston, Texas**

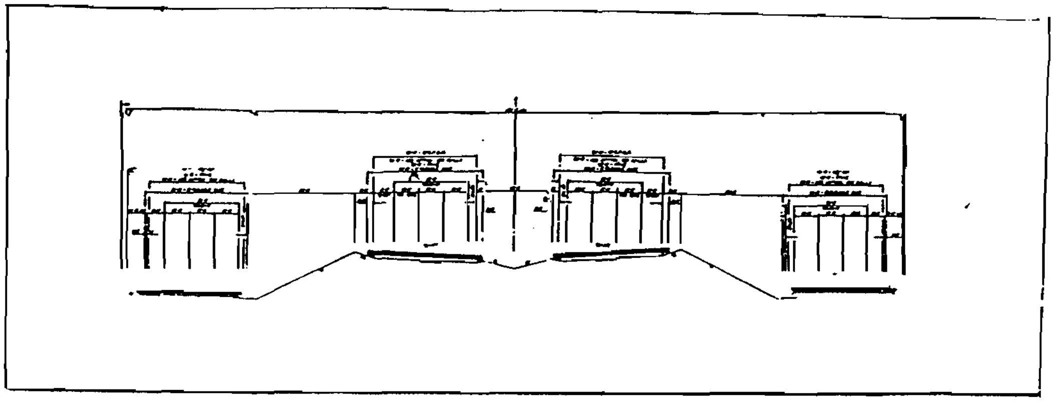



Elevated Section # 10

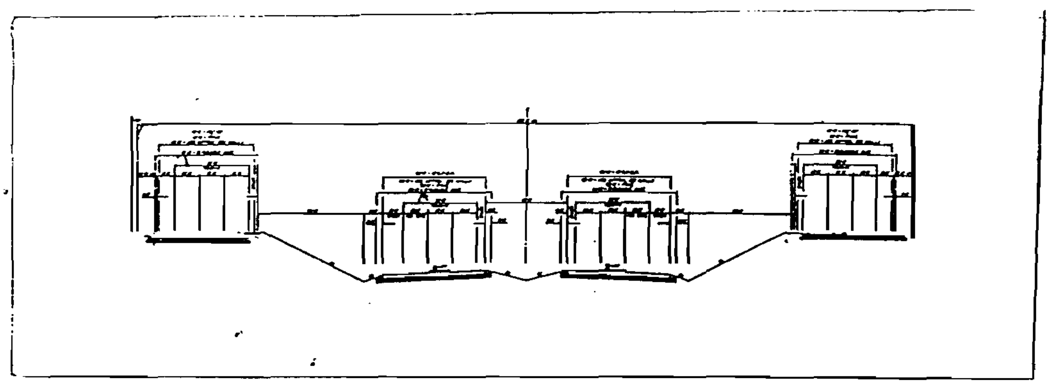



Depressed Section # 11

**Figure 7. Typical Cross-sectional Design of the Depressed and Elevated Study Sections on the Planned East-West Freeway in Lubbock, Texas**



Elevated Section # 8

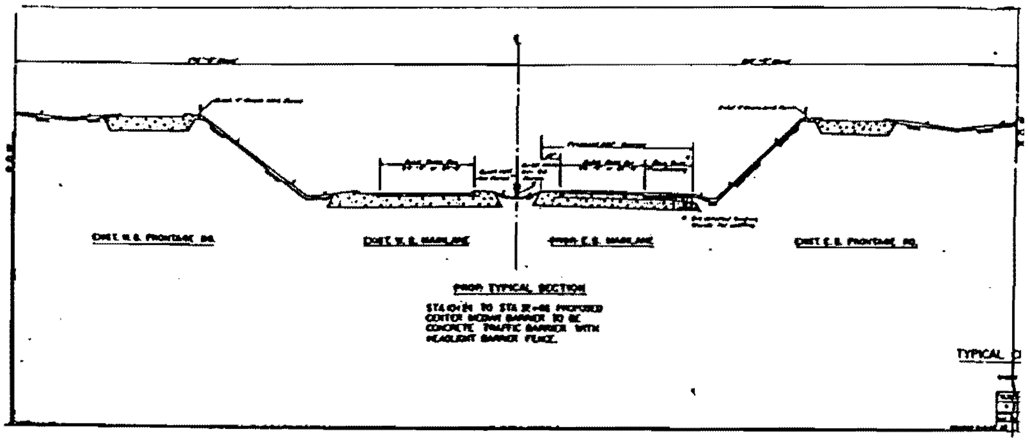


Depressed Section # 9

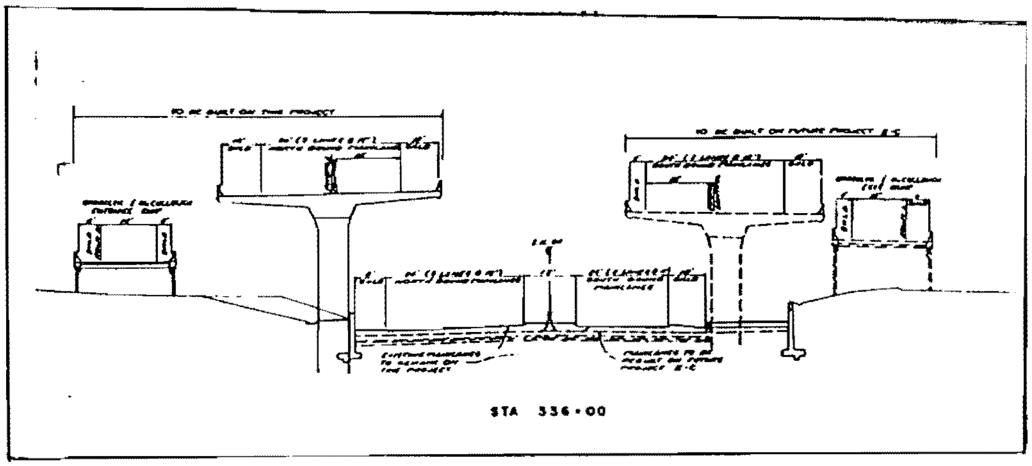
**Figure 8. Typical Cross-sectional Design of the Elevated and Depressed Study Sections on I-27 in Lubbock, Texas**

Depressed Section # 9

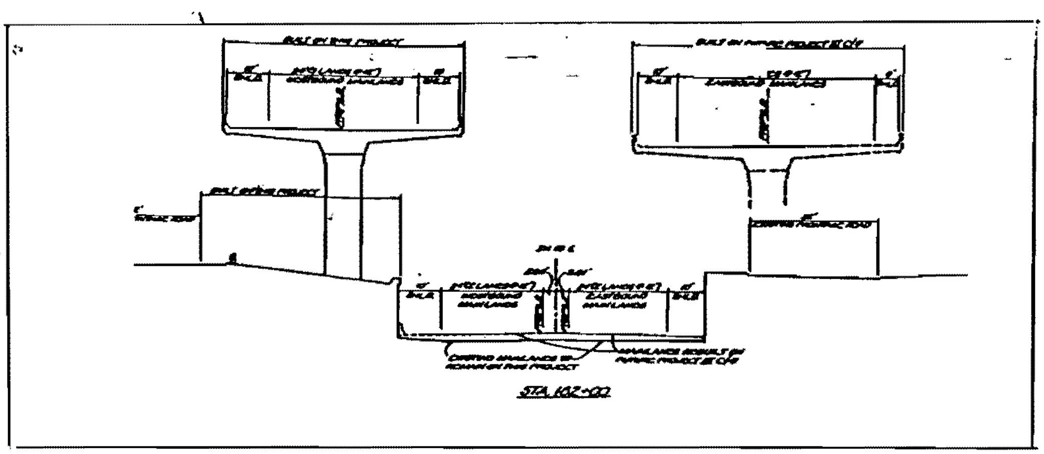
**Figure 9. Photograph of Typical Cross-sectional Design of the Elevated and Depressed Study Sections on I-27 in Lubbock, Texas**




I-35 Section # 1

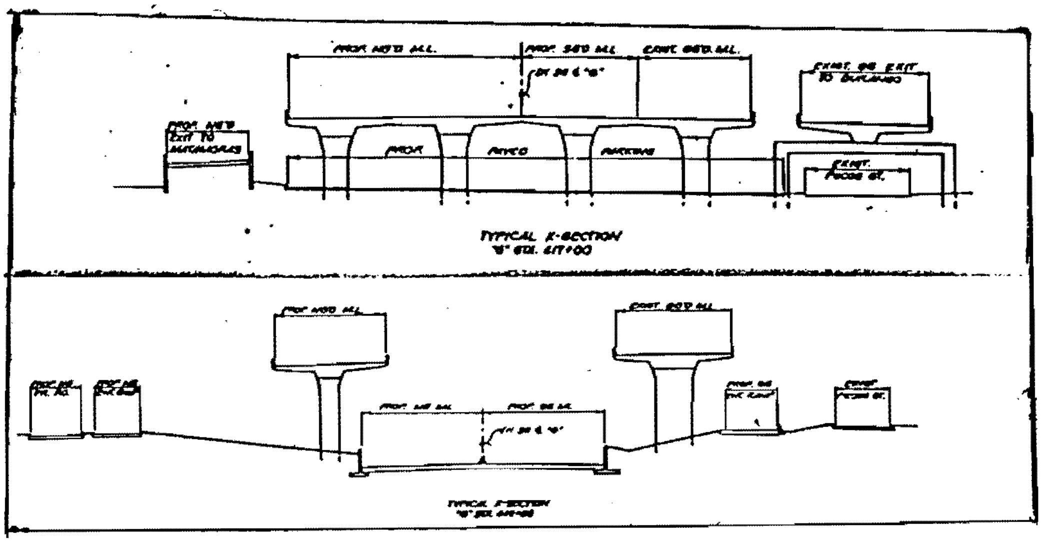



I-35 Section # 2

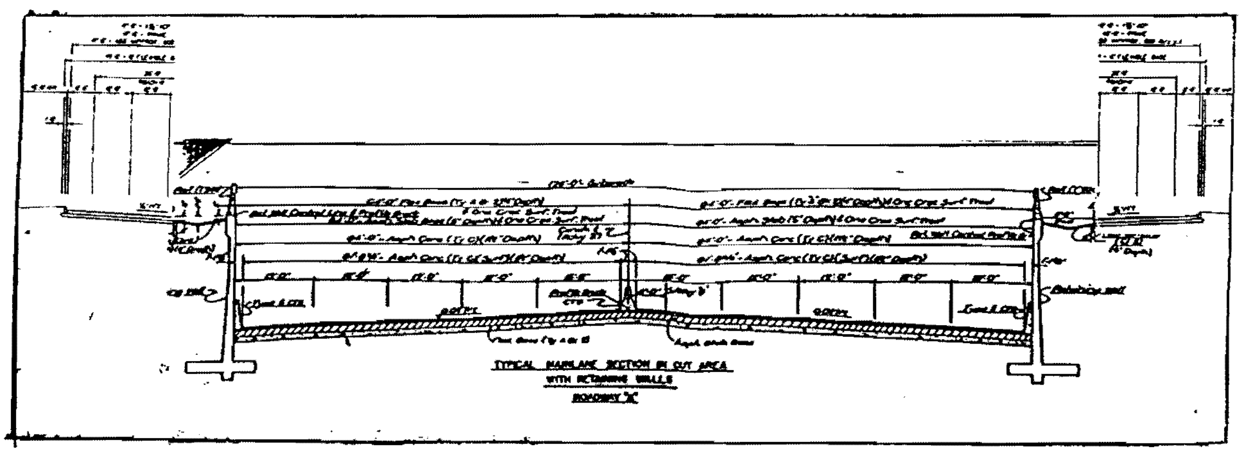


I-10 Section # 3

**Figure 10. Typical Cross-sectional Design of the Combination Elevated/Depressed Study Sections on I-10 and I-35 in San Antonio, Texas**

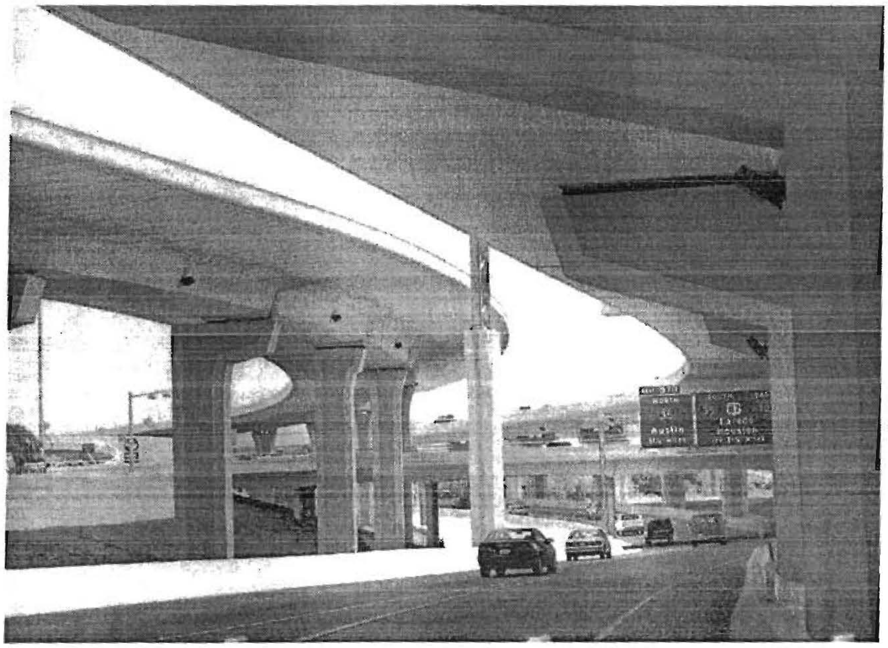


I-35 Section # 4



U.S. 281 Section # 5

**Figure 11. Typical Cross-sectional Design of the Elevated and Depressed Study Sections on U.S. 281 and I-35 in San Antonio, Texas**



I-35 Sections #2, 3, and 4

U.S. 281 Section #5

**Figure 12. Photograph of Typical Cross-sectional Design of the Combination Elevated/Depressed Study Sections on I-10 and I-35 and Depressed Section on U.S. 281 in San Antonio, Texas**

The data obtained to estimate the effects of the different impact elements came from the literature, national survey, United States Census Bureau, Texas State Comptroller and Employment Commission, TxDOT, Environmental Impact Statements (EIS) of each of the study sections, city criss-cross directories, site surveys of businesses and residents, traffic volumes and composition, air and noise levels, and drainage, erosion, and other environmental conditions.

## REPORTS OF FINDINGS

Since this study involves the study of many different impact elements, the findings are presented in several reports by type of impact. The reports are as follows:

- Research Report 1327-1:
  Social and Economic Effects of Elevated and Depressed Freeways in Texas
- Research Report 1327-2:
  Land Value and Use Effects of Elevated and Depressed Freeways in Texas
- Research Report 1327-3:
  Noise Pollution Effects of Elevated and Depressed Freeways in Texas
- Research Report 1327-4:
  Air Pollution Effects of Elevated and Depressed Freeways in Texas
- Research Report 1327-5:
  Drainage, Erosion, Hazardous Spill, Vibration and Aesthetic Effects of Elevated and Depressed Freeways in Texas
- Research Report 1327-6F:
  Social, Economic, and Environmental Effects of Elevated and Depressed Freeways in Texas

This report (Research Report 1327-1) contains a summary of the findings from an extensive literature survey and a national survey of state transportation agencies. Also, this report contains the findings on the effects of elevated and depressed freeways on abutting or nearby businesses and residents, local tax revenues, employment and income, relocation of businesses and residents, and freeway user costs.

## DESCRIPTION OF STUDY CITIES, FREEWAY SECTIONS, AND ADJACENT AREAS

The areas adjacent to or near the study and control sections of the study freeways in each city, as referred to in Table 1 and also shown in Figures 1-4, form what are called study areas and are shown in Figures 13-17. The limits of the study and control section grade levels are also shown.

A socio-economic assessment of each study area and the city within which it is located is presented below and is based on U.S. Census Bureau Data. Also presented is the description of land use in each study area, primarily of the properties abutting the study freeway.

### Houston Study Area

Figure 13 shows the study area encompassing Study Section 2, a depressed section of the Sam Houston Tollway Study and its control sections. Also shown are the limits of each freeway grade level represented by the study and control sections.

#### *Description of Study and Control Freeway Sections*

The tollway in the study area is elevated from I-10 to approximately Kimberly Lane where the structure becomes fully depressed sections and continues to Traviata Avenue and then again becomes an elevated structure rising to cross Rumel Creek and Buffalo Bayou. After crossing the creek and bayou, the freeway becomes at-grade to the study terminus at Westheimer. The study section is the depressed portion, and the control sections are the at-grade and elevated portions.

#### *Socio-Economic Assessment*

The city of Houston has one of the largest ports in the world and is considered the world's "Energy Capital." Houston has developed as a center for the oil and petrochemical industries due to its central location and proximity to the country's oil and natural gas fields. Houston is also known as "Space City" for the three decades of space and lunar expeditions from Johnson Space Center.

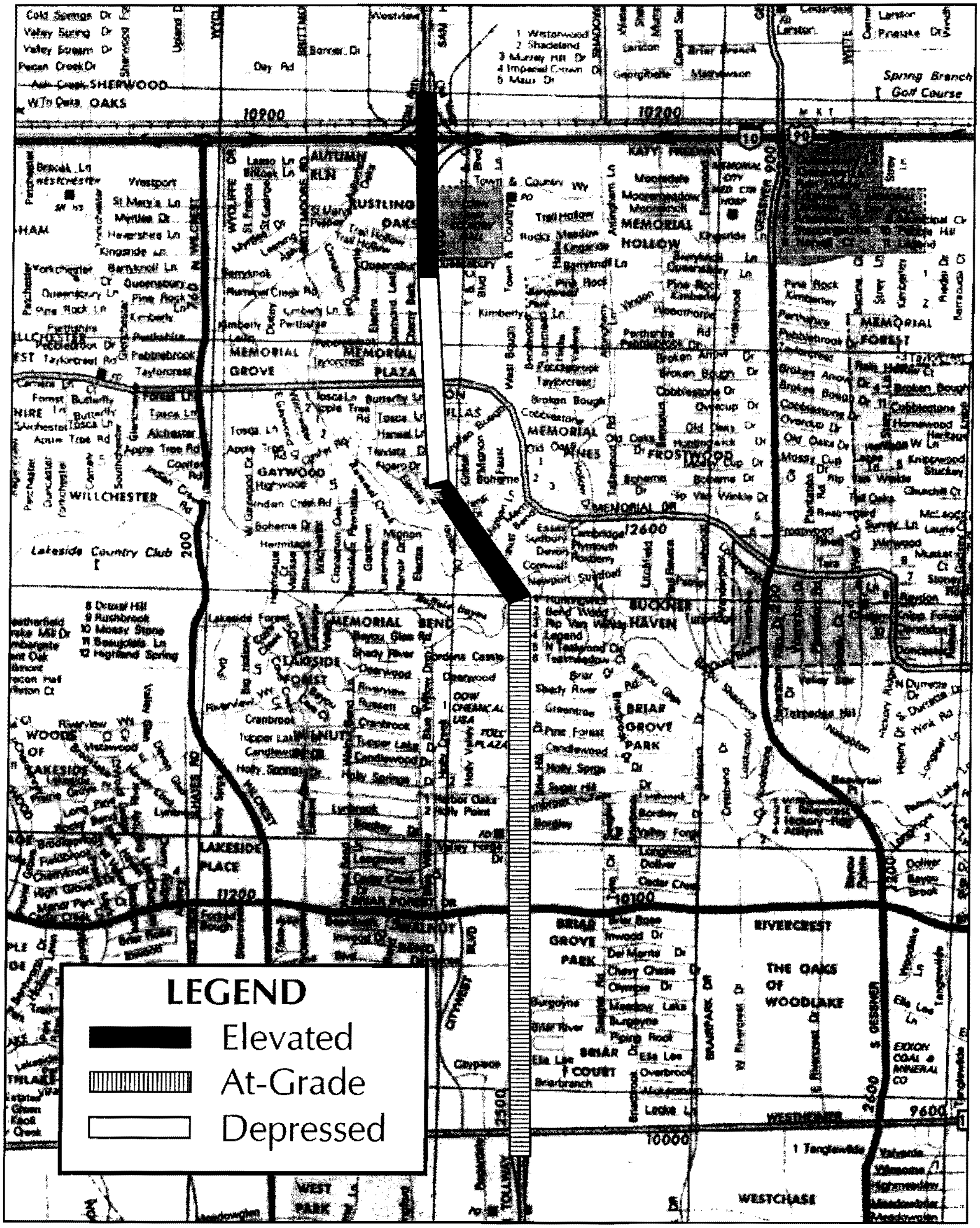



Figure 13. Map of Sam Houston Tollway Study Area

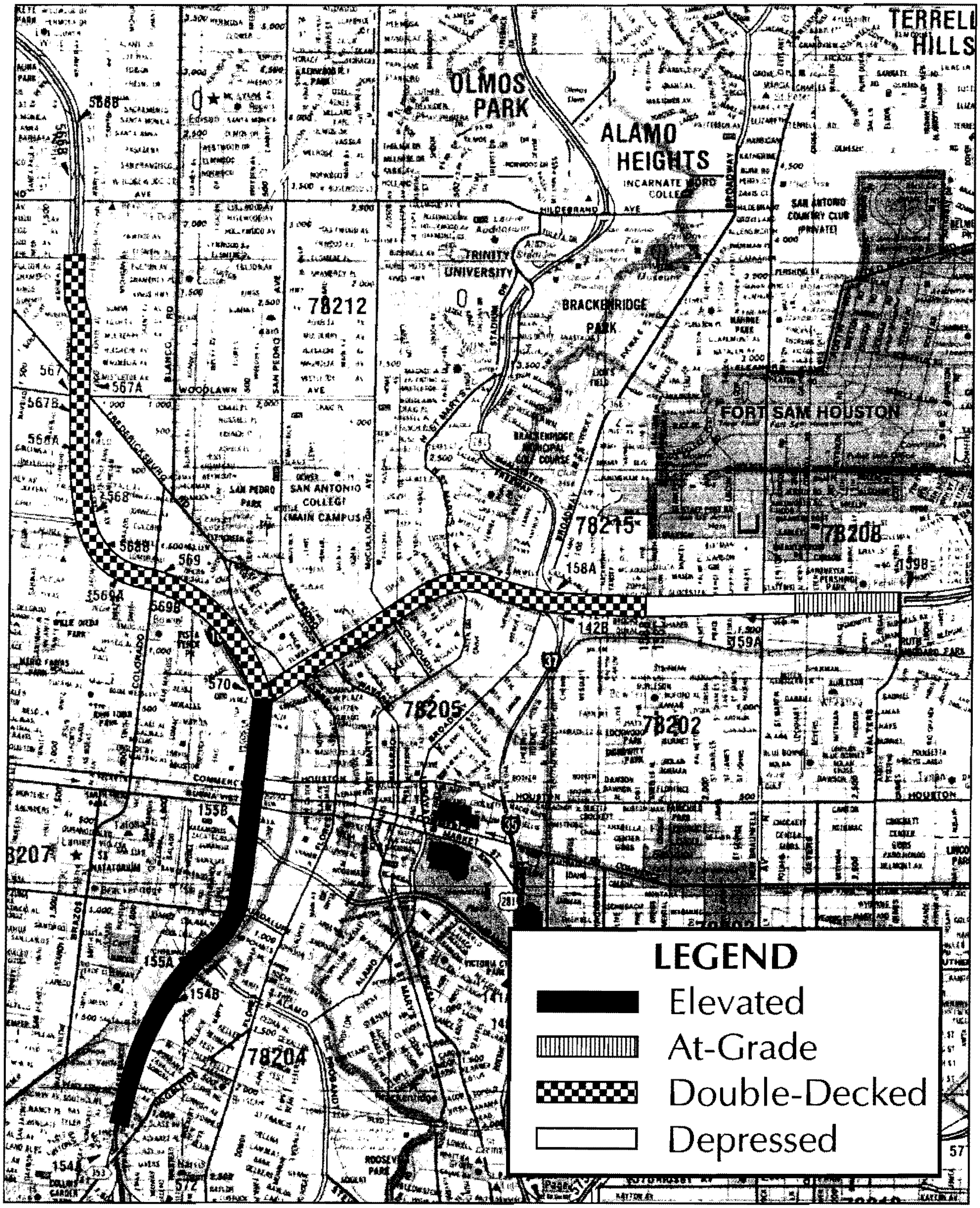



Figure 14. Map of the I-10/I-35 "Y" Study Area in San Antonio

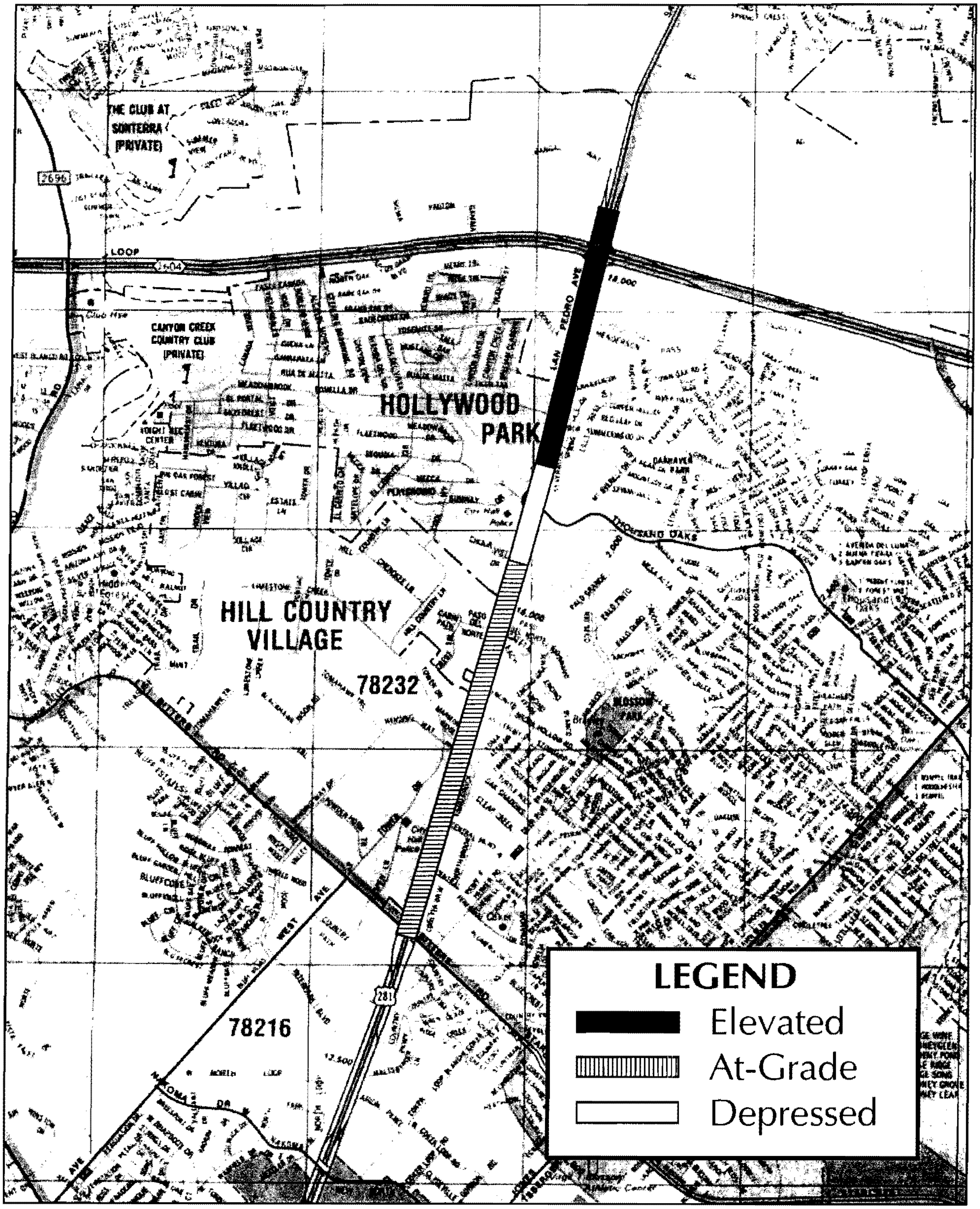



Figure 15. Map of the U.S. 281 Study Area in San Antonio Depressed Section

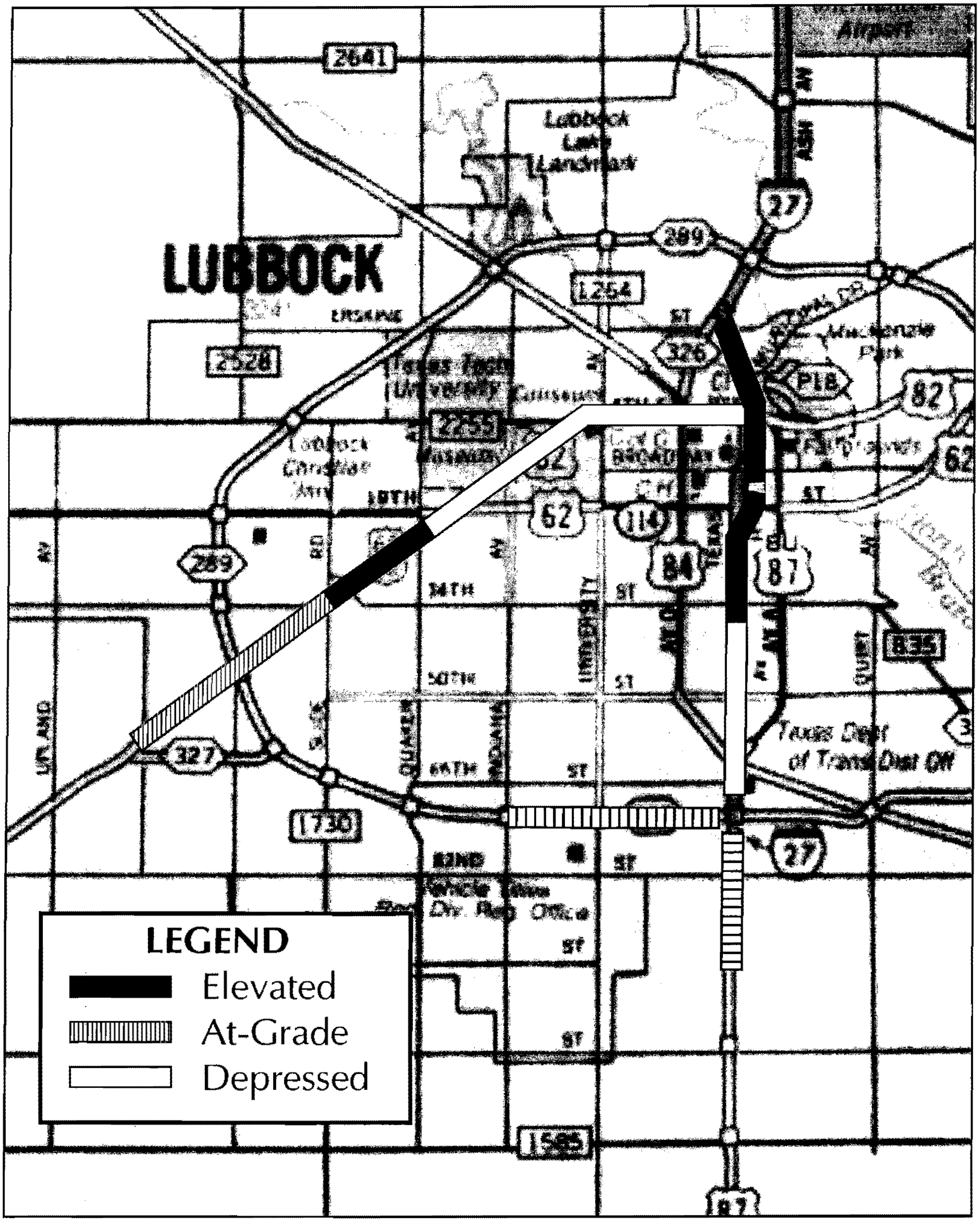



Figure 16. Map of I-27 and Proposed U.S. 62/82 (East-West)
Freeway Study Areas in Lubbock

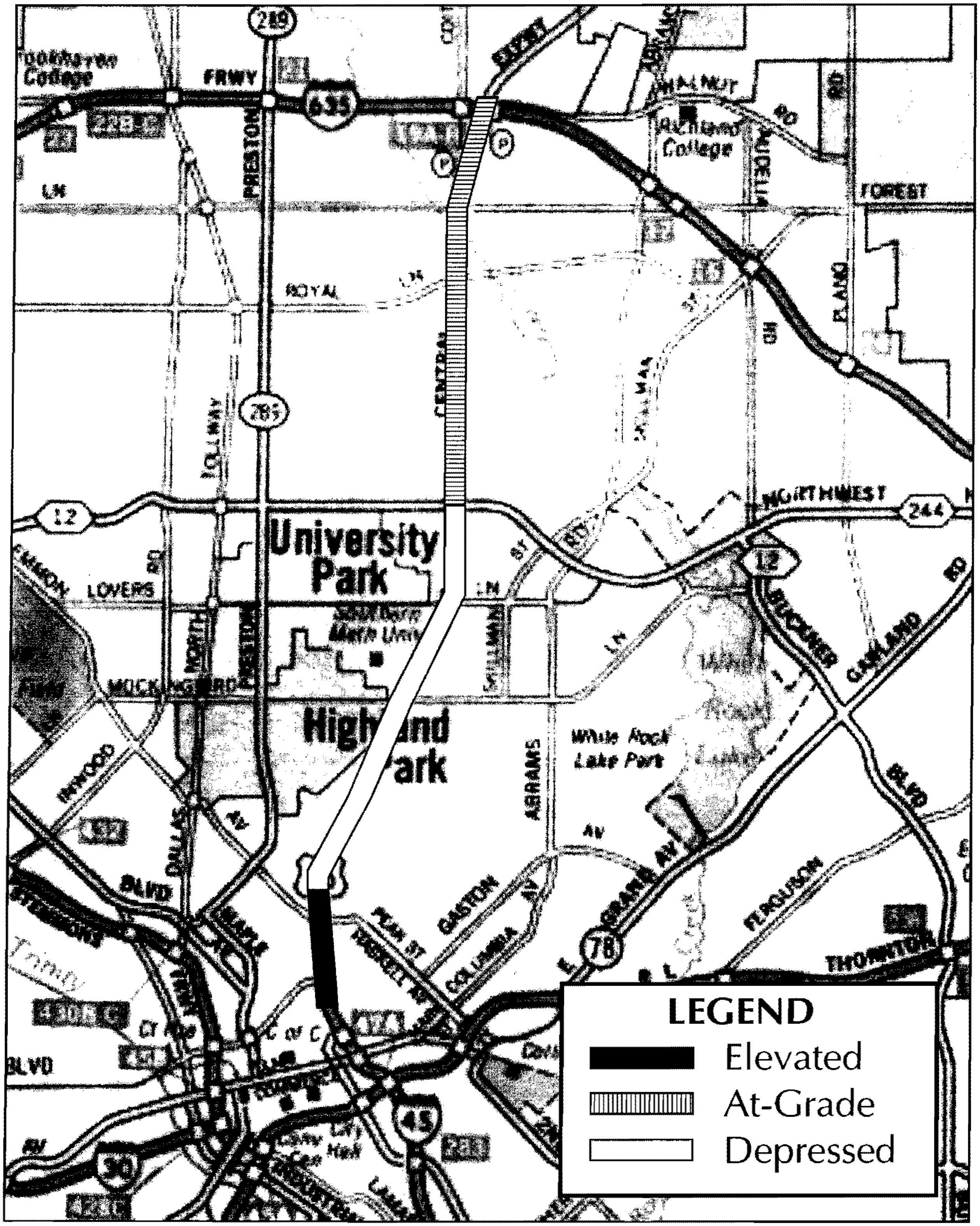



Figure 17. Map of the U.S. 75 (Central Expressway)
Freeway Study Area in Dallas

The population of Houston has increased by 2.2% between 1980 and 1990 and now has approximately 1.5 million people, increasing 15% since 1986. It is a diverse city, composed of 41% White, 27% Black, 28% Hispanic, and 4% Asian and American Indian. Hispanics represent well over one-fourth (32.0%) of the city's total population. Houston has attracted people from all over the world and is represented by more than 50 ethnic and heritage organizations. Ancestral diversity is exemplified by the 60+ foreign languages and over 100 countries of origin identified among students in the Houston Independent School District. The population for the city of Houston experienced a 2.2% increase from 1980 to 1990. During the same period, the study area recorded an increase in population of 16%, and a 6% increase in population density. There were no significant increases in the city's or the study area's average persons per household. The racial composition of the study area recorded substantial population increases in both the African-American and Hispanic groups of 75% and 63%, respectively. However, city-wide numbers reflect a less than 1% change in the population of African-Americans, and only an increase of 36% in Hispanics. However, the study area experienced a dramatic decrease of 47% in the group White/Other, compared to a smaller 22% decrease citywide.

In 1980, the city had a vacancy rate of 11%, and by 1990 that figure had grown to 15%, an increase of 27% over the 10-year period. The study area also had a vacancy rate of 11% for 1980 but only increased 21% to a vacancy rate of 14% by 1990.

*Land Use*

A total of 7.3 million square feet of leasable office space was built outside downtown Houston's Central Business District during the 1960s. This constituted almost 75% of total office space constructed during that decade. Industrial uses are generally located along the ship channel, spreading eastward adjacent to rail lines that radiated from the Port of Houston. During the 1970s, there was rapid residential construction activity followed by annexation in the north, west, and far southwest that accounted for a large increase in single-family land use acreage during the boom. The largest land use in the city is single-family residential and accounts for 20.5% of Houston's area. Multifamily replacement of older single-family housing took place inside Loop 610. Many multifamily complexes were built on outlying areas of lower land costs but with convenient access to a freeway. Development in the 1990s has been targeted for higher income tenants and is threestory rather than two-story construction. Density ranges from 20 to 35 units per acre with common areas offering recreation. High-rise condominiums are generally located on the periphery of affluent residential areas such as the Medical Center, Galleria, and Memorial areas. Despite the trend toward decentralization of the city's population, the areas with the highest employment concentrations tend to have intense development.

Today, Houston's land use pattern reveals a Central Business District encircled by freeways that also radiate from this downtown loop. Two highway loops (I-610 and Beltway 8) as well as a proposed third loop (Grand Parkway) encircle the Houston area. Outside the downtown loop, the Inner Loop (Loop 610) surrounds the oldest most intensively developed area, Houston's inner-city. New development and revitalization are occurring in many areas inside the Inner Loop. The Outer Loop (Beltway 8) and even larger loop of the proposed Grand Parkway are opening up undeveloped land in the outer regions of the city. Throughout Houston, intersecting thoroughfares and freeways have provided strategic locations for other commercial establishments, shopping malls, and business centers.

The study area is primarily a mix of single-family and multifamily residential and commercial land uses. Buffalo Bayou runs through the study area, and the property north and south of the bayou are in flood plains and not developed. This property is owned by public agencies and is not included as taxable. Of note also is that the northern boundary of the study area is a major interchange unlike any other in the overall study. The meeting of I-10 and the Sam Houston Tollway (Beltway 8) is comprised of a multilevel interchange with on-off and toll ramps of four levels. Nearest the interchange of Sam Houston Tollway and I-10, a large shopping mall, a chain hotel, and other commercial uses occupy the southeast quadrant. The southwest quadrant has townhouses extending approximately 1.6 km (1 mile). Thereafter, both sides of the tollway are a mix of single-family, multifamily, and commercial land uses. Roughly one-half of the abutting properties in the study area are abutting the depressed section, one-fourth abutting the elevated section, and one-fourth abutting the at-grade section. Residential land uses account for 80% of the properties, and approximately 19% are commercial properties. The vacant, industrial, and institutional uses combined make up roughly 1% of the total properties.

**San Antonio Study Areas**

As shown in Figures 14 and 15, two study areas encompass the freeway study and control areas in San Antonio. One is composed of Study Sections 1-4 located on I-10 and/or I-35 in the downtown area and is called the "Y" area (Figure 11). The other study area is composed of Study Section 5 located on U.S. 281 at the intersection of Loop 1604 in a suburban area of northern San Antonio (Figure 12). The specific location of the different grade levels of the study and control sections are shown in each of the study areas.

*Description of Study and Control Freeway Sections*

In the downtown "Y" study area, the northeastern stem beginning at the intersection of I-10 and I-35, the freeway is double-decked until it reaches Broadway Blvd. and then becomes primarily depressed until it reaches Walters Street. The double-decked portion is Study Section 2, and the depressed section is Section 1. The northwestern stem of the "Y" is I-10 where Study Section 3 is located. Beginning at the intersection of I-10 and I-35 and continuing to Frio Street is primarily at-grade. From Frio Street to Kings Highway, the freeway is principally elevated or double-decked, although a small segment is at-grade. The south stem of the "Y," which is I-10 and I-35 combined, contains Study Section 4. Starting at the intersection of the two freeways and continuing to Laredo Street, the segment is primarily elevated or double-decked.

In the other study area (U.S. 281), the study freeway is primarily at-grade between Bitters Road and Thousand Oaks. The freeway is elevated at Thousand Oaks and then becomes depressed to just beyond the intersection of Loop 1604. The depressed section is Study Section 5.

*Socio-Economic Assessment*

San Antonio is located in the southern portion of the state, roughly 240 km (150 miles) from the Mexican border; the influence of Hispanic culture is a strong contributor to the city's character. Of the city's total population, more than half possess Spanish surnames or are Spanish speaking. The city is known for its abundance of military bases, including Kelly, Randolph, Lackland, Brooks, Ft. Sam Houston, and Camp Bullis, which are major contributors to the local economy. In the last two decades, the city's population has increased 37.5% to 800,000 compared to the county's increase of 3.2%. The growth is consistent with the national trend that indicates population increases in the south and western United States. The state of Texas is noted as one of the five fastest growing states in the Union. These increases have intensified the number of automobiles on the road. The San Antonio area is served by several radial freeways and two circumferential loops.

In 1980, the suburban study area was so sparsely populated it had a population density of less than one person per square mile. By 1990, the population density in the suburban study area had grown to 745 persons per square mile, and city officials estimate this figure has continued to increase dramatically since the 1990 data were reported. The population increased by 76% in the suburban study area while the increases in the urban study area and city baseline were 16% each. The city experienced a decrease from 3 to 2.8 in the average persons per household category, while the urban study area remained constant at roughly 2.4 persons per household in 1980 and 1990. The 1990 suburban study area persons per household figure was also lower than the city's at 2.5 persons per household.

San Antonio experienced decreases in two of the three racial categories. From 1980 to 1990, the categories *African-Americans* and *White/Other* decreased as a percentage of the entire population by almost 7% and 4%, respectively, while the Hispanic racial group experienced an increase in their proportion of the population of 3%. Despite the decreases noted in percentage terms, the number in each ethnic group increased in the urban study area. For instance, 1980 census tracts of the urban study area show that the groups *White/Other* and *African-Americans* had less than 400 people, but by 1990 the African-American population had grown to over 5,000 individuals, and those classified as *White/Other* had increased to nearly 7,000. The Hispanic racial group registered the greatest increase from roughly 11,000 in the urban area in 1980 to over 50,000 by 1990. In the suburban U.S. 281 study area, no ethnic groups were identified in the 1980 census; however, by 1990, the group *White/Other* had a population of over 27,500; *Hispanics* numbered 6,310, and *African-Americans* equaled 507.

The vacancy rates for the city were 7% in 1980 but increased to over 10% by 1990. The urban study area experienced a similar increase from 11% to 14%, while the suburban study area experienced a dramatic decrease of 40% to approximately 7% in 1990. This decrease can most likely be attributed to the building of new housing in the suburban study area.

*Land Use*

The downtown "Y" or I-10/I-35 study area, as shown in Figure 14, contains an established commercial, industrial, and residential core area. Included in the area are breweries, multistory banks, a medical complex, churches, a large apartment complex, and commercial offices. Recreation in the area is focused on the city parks and other public spaces. Columbus Park has been renovated and is well used by many of the adjacent neighborhood residents. There are also some recently landscaped areas along San Pedro Creek. Major streets in the area from east to west are the north-south arterials of Broadway, McCullough, Main, San Pedro, Flores, and Zarzamora. The major east-west arterials are Houston, Commerce, Buena Vista, Martin, and Fredericksburg Road running in a northwesterly-southeasterly direction. The streets and freeways reflect aged construction. They tend to be narrower and lack a grid system that is considered more desirable in an urban area. Recreation in the area of the transportation corridor is limited mainly to city parks. Columbus Park is centered around Boccie Courts housing complex and St. Francisco Di Paola Church. This church was the religious and social center of San Antonio's Italian community. The park has been rebuilt and enhanced and is well used by many of the adjacent neighborhood residents. There are also some areas along San Pedro Creek that have been recently landscaped.

The study section is characterized by a mix of land uses. The southernmost land on the west side of the freeway, in the vicinity of South Laredo, is somewhat under-developed compared to other portions of the study area. The east side is a mix of stockyards, small retail, and light manufacturing. Moving north, the development on the west side intensifies with motels, multifamily and single-family housing, commercial, and institutional uses. Although many structures show signs of age and are not well maintained, the west side of I-35/I-10 has an area of newly constructed single-family housing. From I-10 and Fredericksburg Road to the I-10 / I-35 interchange, there are mainly machinery manufacturers and wholesale distribution centers. Although a large area has been cleared for future development, the section of I-35 between its interchanges with I-10 on the west and Broadway on the east is primarily residential.

The housing in the areas adjacent to these transportation corridors is varied. Along I-35, between its interchange with I-37 and U.S. 281 and the I-10 connection to the south, are older homes that at one time were spacious single-family dwellings. Many of these have now been subdivided into multifamily units and rented out as apartments. Along I-10, north of its jointly designated section with I-35, some of the single-family residences have been well maintained.

The U.S. 281 freeway area (Figure 15) was sparsely developed prior to the construction of the freeway. Previously, the four-lane divided urban highway had at-grade crossings and was known as the McAllister Freeway. The area had pockets of typical suburban single-family homes. Several churches were within one or two blocks of the freeway. The area began to undergo rapid change as this research neared its conclusion. Vacant parcels began to be developed into commercial tracts. The principal arteries around U.S. 281 are Blanco, Bitters, Heimer, Redland Road, and Bulverde Avenue. On the west side of U.S. 281 from Bitters Road to Loop 1604 through the towns of Hill Country Village and Hollywood Park are several commercial and residential dwellings.

**Lubbock Study Areas**

Figure 16 shows the study areas of I-27 and the proposed East-West (U.S. 62/82) Freeway in Lubbock. Also shown are limits of the different grade levels of each freeway's study and control sections.

*Description of Study and Control Freeway Sections*

As shown in Figure 16, the review of the I-27 freeway begins at Loop 289 North and extends south to 114th Street. From the northern limit at Loop 289, the structure is elevated to 38th Street. From 38th Street to slightly south of 66th Street, the freeway is depressed. After crossing over Loop 289 South, the structure comes to grade and is at-grade to 114th Street. A short section of Loop 289 west was included to strengthen the assessment of at-grade parcels.

Because the right-of-way for U.S. 62/82 is currently being purchased, the route of the future freeway will be described (Figure 16). The southwestern extent of the study area is defined by the Lubbock city limit, which is roughly at Milwaukee Avenue. The freeway will continue in a northeasterly direction paralleling U.S. 62/82, alternately named Brownfield Road. The freeway will cross the downtown area along 4th Street; the research for this study ends at the western edge of MacKenzie State Park. The freeway will be at-grade between Milwaukee Avenue and Delmont Avenue. Between Delmont Avenue and Oxford Avenue, the freeway will be primarily elevated. Between Oxford Avenue and I-27, the freeway will be depressed.

*Socio-Economic Assessment*

Lubbock is located in the center of a semi-arid geographic region known as the Southern High Plains of the Texas Panhandle. Lubbock's terrain is relatively flat with very little natural slope. The only exception is the Yellowhouse Canyon, which contains a tributary of the Brazos River. A number of dry lakes dot the land surface, serving as natural drainage and storage areas.

Lubbock has been known for many years as the Hub City of the South Plains since it is the major distribution center for the region. The city is surrounded by vast amounts of rich agricultural land. Agricultural products and related industries contribute a large portion of the city's economic base.

The existing traffic distribution system within Lubbock consists of primarily a north-south, east-west grid pattern with major thoroughfares located at one-mile intervals. Three major U.S. highways serve the city: U.S. 62 and U.S. 82, running east and west; U.S. 84 traveling northwest to southeast; and I-27, with a north-south alignment. The Central Business District in Lubbock has been slowly changing from a retail district to a center for financial institutions, governmental offices, and professional office space. There are currently no high-speed, large-volume transportation facilities serving the Central Business District from the east or west. City officials considered the absence of such a facility as a deterrent for downtown redevelopment, since safe and efficient access to and from the Central Business District is essential to continuing vitality and growth. The reconstruction and upgrading of U.S. 62/82 into a major freeway is planned to address this deficiency. Approximately 12% of the Lubbock work force is employed in the Central Business District, while present commercial and residential growth trends are to the south and southwest. As these suburban areas continue to grow, I-27 will become increasingly important for travel to and from the core urban area. I-27 has reduced travel time for trips between the Central Business District and outlying areas of the city.

Two freeway sections are included in this study for Lubbock, I-27 and the proposed U.S. 62/82. The I-27 corridor became operational in 1992, but the planned East-West Freeway (U.S. 62/82) will not become operational until 2003 or later. Right-of-way acquisition purchase is currently underway. When this study was initiated, it was anticipated that the U.S. 62 / 82 (East-West) freeway would be in construction by the end of this study. However, the construction has not proceeded as rapidly as expected. The data presented in this section regarding Lubbock should be viewed from that perspective.

Many of the census tracts for the two Lubbock study areas have much in common. Thus, the study area reference is for both freeways. In Lubbock, the city population increased by 6.5%, while the average persons per household decreased from 2.7 to 2.6 persons per household. In contrast, the study area, experienced a 9% decrease in population and a decrease in average persons per household of 3.3 in 1980 to 3.1 in 1990. The study area also experienced an increase of 11% in vacancy rates during the period 1980 to 1990, compared to the nearly 18% increase for the city as a whole. Lubbock as a whole experienced increases in two of the three racial categories: Hispanics (16 %) and African-Americans (3%). The group *White/Other* increased in raw numbers by almost 1,700, but as a percentage of the entire city population, this group decreased by almost 6%. However, the racial mix in the study area did not follow the city pattern: African-Americans decreased by 75%, Hispanics increased (26%) as did White/Other (9.5%).

*Land Use*

Land use within the I-27 corridor is now urban in character. Statistics indicate a continual overall decrease in residential habitation and a transition to commercial development within the corridor. This corridor also includes industrial uses. In fact, most motor freight terminals in Lubbock are located within .8 km (one-half mile) of the proposed corridor. These freight terminals along with other industrial uses parallel both sides of I-27 near its northern termus with Loop 289 North. Continuing south, public use and park areas border the freeway to slightly south of Parkway Drive. A small single-family residential neighborhood is contiguous to the west side of the freeway and adjacent to the Parkway; while public space is designated south of the Parkway on the east. Continuing south, industrial and commercial properties border both sides of the freeway to approximately 46th Street, although a small residential area interrupts that flow on the east side at approximately 35th Street. From that point to U.S. 84 and U.S. 87, the predominant land use is residential. Commercial and industrial uses begin and continue to south of Loop 289 South. Residential and commercial properties make up the study corridor to 114th Street.

Property adjacent to the U.S. 62/82 East-West Freeway corridor is primarily commercial and industrial, with single-family residential neighborhoods behind the commercial and industrial frontage, from its southern boundary to 18th Street. The corridor passes through Texas Tech University, crossing downtown at 4th Street, and ending at Parkway Drive.

### Dallas Study Area

Figure 13 shows the study area encompassing the U.S. 75 (Central Expressway) freeway Study Section 7 and adjacent control sections. Also shown are the limits of each freeway grade level represented by the study and control sections.

#### *Description of Study and Control Freeway Sections*

The study area is bounded on the south by the intersection of U.S. 75 and Spur 366; from this point to just prior to Haskell, the structure is elevated. The freeway will descend under Haskell Street and remain depressed to Southwestern Blvd. From Southwestern Blvd. to the northern terminus at I-635, the structure is principally at-grade but rises on approach to major streets and is elevated over cross-streets.

#### *Socio-Economic Assessment*

This study examines the area adjacent to the reconstruction of U.S. 75 (North Central Expressway) from downtown to I-635 (Lyndon B. Johnson Freeway) in Dallas, Texas. The project corridor is approximately 14.7 km (9.2 miles) long and extends from just north of the Dallas Central Business District (CBD) through Highland Park and University Park to just south of Richardson. This corridor varies from those previously examined in that it is in the midst of reconstruction. Completion is anticipated in the year 2000.

The existing North Central Expressway project corridor is in a period of emerging trends and economic activity. During the last several years, the Expressway's residential areas have been under transitional pressures. Redevelopment pressure from high-rise offices, retail centers, and large scale regional activity centers has caused some significant changes along the corridor.

The population growth within the Expressway Corridor is not expected to keep pace with the city of Dallas. The cities of Richardson and Plano have been the fastest growing areas in the study area with respect to population. In summary, population trends within the project area are expected to remain stabilized with low nominal annual increases. It should also be noted that the cities of

Dallas, Highland Park, University Park, Richardson, and Plano represent over 35% of the population in the urban area which includes all of Dallas and Tarrant counties as well as portions of Denton, Collin, Rockwell, Kaufman, Ellis, Johnson, and Parker counties.

Between 1980 and 1990, the population for the city of Dallas increased by 10% and the average persons per household remained constant at a ratio of 2.5. The population and average persons per household for the North Central Expressway study area increased by 18% and 3%, respectively, which is more than the city as a whole. Further, there was a significant increase of 32% in the study area's population density. Dallas experienced a 34% increase in vacancy rates from 7% in 1980 to 11% in 1990. Conversely, the vacancy rates in the study area decreased 15 %, from 13% to 11% during the same period. Unlike Houston, the city of Dallas and its study area experienced little change in the population of African-Americans. In actuality, the city baseline remained essentially stable, decreasing by 1%. The Hispanic population increased in the city by 41% and in the study area by 38%, while the White/Other racial category decreased by 17% and 14% for the city and study area, respectively.

The average range of median household annual income along the North Central Expressway Corridor is between $10,000 and $50,000. In the southern project area around Roseland Homes, the median household income is less than $10,000 a year, while in the Park Cities and "M Streets," the annual income ranges between $30,000 and $50,000+. North of Northwest Highway, annual median household income ranges from $10,000 to $50,000+, with the higher income household typically on the west side of the Expressway.

*Land Use*

Land use along the project corridor varies from light industrial in the northern end to residential, retail/commercial, and park facilities spread along the length of the corridor. The industrial sites along the corridor are found at the northern end of the corridor by Forest Lane and the Lyndon B. Johnson Freeway. Although the corridor lies within a highly developed retail, commercial, and residential area of Dallas County, adjacent areas also include significant recreational and institutional use.

The commercial sites include auto-oriented retail, shopping centers, single office buildings and office parks, and several hotels/motels. The frontage of the North Central Expressway has almost 12 million square feet of office space existing or under construction and 2.5 million square feet of existing retail space. The project area north of Mockingbird Lane has the most recently developed portions of the corridor, and this area reflects a decidedly different land use mix than the southern area. The primary structures along the expressway in this area are high-rise office towers and large commercial and retail structures such as the Northpark Mall at the intersection of Northwest Highway and North Central Expressway. Set back from the fronting structures are large multifamily apartments and condominiums.

Dense residential areas, both single-family and multifamily, are directly adjacent to the right-of-way near downtown and University Park. Also north of Northwest Highway, there are pockets of multifamily housing along the right-of-way. The corridor passes through neighborhoods of townhouses and apartments in East Dallas and Vickery, reaching densities of over 7,500 people per square mile. Highland Park and University Park are known as "Park Cities." They are predominantly residential with relatively small populations. The Park Cities are located predominantly on the west side of the North Central Expressway between Knox Street and Northwest Highway. The smaller cities of Highland Park and University Park are considered to be "prestigious" neighborhoods. University Park includes Southern Methodist University and the surrounding residential area.

The areas to the west of North Central Expressway from Fitzhugh to Northwest Highway contain some of the most sought after residential areas in Dallas.

# LITERATURE REVIEW AND NATIONAL SURVEY FINDINGS

## LITERATURE REVIEW FINDINGS

Many sections of elevated and depressed freeways have been built for many years now, and we would expect that the economic and social changes that might be expected during and after construction have been well studied. However, an interesting issue is the evidence of the potential economic effects of these freeway sections on the nearby/abutting residents, businesses, properties is very limited. An exhaustive literature review revealed only few studies [1,2,3,4,5,6,7,8,9,14]. Some of these studies were conducted almost three decades ago with respect to freeway effects. Further, a few studies study the effects of elevated heavy rail transit stations [10,11,12]. However, most of these earlier studies share a common factor in that they examine only one economic aspect—the effect of elevated/depressed freeways on property values and/or land use. Some of the references cited include environmental impact statements which also evaluate some other socioeconomic effects of alignment variations of the freeway.

Thiel (1962) discussed some of the effects on relocation of residents and businesses, employment conditions, effect on public services among other factors, and presented cogent reasons as to why we may expect to observe some of these effects [13]. Residents' attitudes and opinions towards the highway facility were suggested as an important indication of the social impact that the highway has on the community. This is also discussed by Buffington et al. [14]. While it may suggest that some of these changes are the direct result of the highway, these effects have multiple causes and can be traced to the highway itself only in part. This is an important factor to keep in mind during the analysis of such impacts. Some studies address the socioeconomic impacts of highway alternatives which include elevated or depressed configurations as has been mentioned above. Since the available literature on the differing effects of elevated versus depressed freeways is very sparse, the following strategy will be adopted. First, the results of the earlier studies and impact statements will be summarized, to the extent that those results have a bearing on the choice of elevated, depressed, and/or at-grade highway configuration from a socioeconomic standpoint. Second, an attempt will be made to trace out the criteria from other highway improvement/widening studies as well as the anticipated effects and the methodologies used to assess the same.

**Summary of Findings on Economic Impacts from Previous Studies**

The environmental impact statements are ambiguous as regards to the economic impacts of alternative highway configurations and abstract from methodological details. An example will substantiate the comment made above. For example, some of these environmental impact statements furnish the readers with residential, business displacement, and land use information due to the highway facility. In terms of costs, some note that the elevated concept would be more expensive than the depressed alternative. These studies are aware of the differing effects of alternative highway configurations; however, only overall economic impacts of the construction of the highway facility are presented. It is further noted that the results would vary depending on the alignment configuration. The only economic aspect for which the differing impacts of elevated/depressed freeways are discussed is joint use development of land. However, Buffington's study provides some concrete evidence on economic effects of elevated versus depressed alternatives [9]. The results of his study are summarized briefly below (excluding land use and property value effects[2]) in Table 4. These results used in conjunction with the results of the highway widening studies will provide guidance in the analyses of the impacts in this report. The depressed alternative was found to be inferior to all elevated alternatives on all counts mentioned in Table 4. Social effects were not addressed in this report.

[2]This aspect receives a thorough treatment in another report.

**Table 4. Depressed Versus Elevated Highway Alternatives: Summary of Findings on Economic Impacts**

| Impact Category | Effect |
|---|---|
| Business Impacts | 1. Abutting businesses' gross sales for depressed alternative were negatively impacted during construction compared to elevated and other highway alternatives, and especially large effects on traffic serving businesses.<br>2. A negative gross sales impact on abutting businesses after construction for traffic serving and other businesses for the depressed alternative.<br>3. Individual highway configuration effects for impact on wholesale and manufacturing firms are not presented. |
| Tax Revenue Impacts | 1. Both depressed and elevated configurations have a negative impact on taxable sales during the construction period, but depressed configuration had a more negative impact than the elevated. |
| User Costs | 1. Depressed alternative had lower benefit-cost ratios compared to all elevated alternatives. |
| Relocation Costs | 1. Do not clearly separate out individual highway configuration effects on relocation costs. |
| Employment and Income | 1. The depressed alternative would generate the lowest amount of business employment in comparison to elevated and other alternatives.<br>2. Depressed alternative would generate the lowest employment impact resulting from commercial/industrial building construction expenditures. |

### Summary of Findings on Social Impacts From Previous Studies

The references here consist of environmental impact statements and results from opinion - based surveys. It is noted that a depressed or at-grade configuration of the highway would affect neighborhood accessibility conditions to the extent that certain local streets would be terminated at the freeway. This would minimize through traffic and provide an opportunity for neighborhood preservation. An elevated configuration would essentially retain existing access patterns [5]. Considerable research has been done over the last few decades on economic and social impacts of highway projects in general. These impacts could be adapted to assess the effects of elevated versus depressed freeways, but very little guidance is available in that form at the present time as is evident from the discussion so far. Economic effects discussed in this review fall into the following categories:

- impact on businesses,
- impact on relocation,
- impact on tax revenues,
- impact on employment and income, and
- impact on user costs.

Social effects discussed in this review include population changes, neighborhood accessibility, neighborhood cohesion, community services, and residents' attitudes and opinions. For each of these categories, the following will be addressed: its relationship to highway infrastructure, nature of the effect, general character of the criteria and the techniques, and methodological aspects used to analyze the effect. Two types of impacts have been identified in the literature, short and long range. Short range impacts, such as business displacements, have been and will continue to be a key issue for highway officials and planners in comparison to long range impacts [15]. More specifically, two types of impacts need to be examined: 1) those which occurred *during* the construction, and 2) those which occurred after the construction was completed.

**Economic Effects**

*Impact on Businesses*

The impacts of highway improvement projects on businesses can be substantial. They can result in manifold increases in volume or in decreases so severe that they cause firms to fail. The general consensus from the literature review is that firms that are susceptible to passing traffic, called traffic-serving businesses, are particularly vulnerable, such as service stations, fast food outlets, and convenience stores. The effects can be considered to be short range or long range. The former refers to those set of effects which occur due to the actual construction process itself. The latter are those effects which affect the accessibility of affected locations.

The methodology typically used in the literature in order to measure these effects is the "before versus after" approach. Most often, wherever available, in order to mitigate the effect of factors external to the highway construction, a control area is also used as a benchmark. To be more specific, the procedure analyzes an area under an original set of conditions, constructs the highway improvement, and then reanalyzes the area to determine the impact of the highway construction.

Generally, the before period includes information for a period of 2-7 years prior to the construction of the highway. Buffington et al. provide a range of impacts put together from studies done on various Texas cities [9,16]. Other methodological details and steps involved in the analysis can also be readily obtained from [16].

*Impact on Relocation Costs*

Relocations of residences, businesses, and public facilities occur when additional right-of-way is needed to accommodate the highway construction. These relocation costs and effects on those businesses and residents displaced by the right-of-way takings of any highway project are a major concern and need to be considered by the highway officials in the decision-making process. Some studies mentioned earlier [4,5,6,7,8] are environmental impact statements which show that a significant number of businesses and residents will be displaced and therefore outline mitigation measures for businesses and residents based on the findings. Estimated relocation effects have been conducted for many highway projects in the state of Texas. The results of these studies, as well as findings outlined in Table 4, are important guidelines for analyzing the impact of elevated versus depressed freeways in Texas [9,16,17,18,19,20].

*Impact on Employment and Income*

The impacts of highway construction on employment could be either positive or negative. This is very closely related to business impacts outlined above. Two different methodological approaches to analyzing employment effects of highway construction or construction alternatives have been encountered in the literature. The first approach is that by Buffington et al. [9,16], and it is based on a before versus after construction analysis of employment of industrial and commercial firms. The average number of employees per firm is taken from each category of firms, for each route. This is computed from the Bureau of Census data. These figures are then added to obtain the number of industrial and commercial workers. The next step is to estimate the employment impact for each route by obtaining the following:

a) total construction cost for each route and total construction cost of commercial/industrial buildings and single-family residences for each route, and

b) estimate the number of employees that might be generated because of each type of construction.

In order to calculate the impact, the employment multipliers are obtained from the Texas Input-Output model published by the Texas Comptroller of Public Accounts [21]. The multipliers have to be adjusted to the year in concern using price indices. The adjusted multiplier is then multiplied by the corresponding construction expenditures to obtain the number of employees.

A concomitant effect of construction expenditures is a total demand effect or an output effect. This effect is assessed by obtaining the output multipliers. The appropriate multipliers are then multiplied by the amount of each expenditure type to yield the final output estimates.

The second approach encountered in the literature is that followed by Zografos and Stephandes [22]. This approach assesses the employment effects on regional basis or an areawide basis rather than on the local area of interest. Their approach suggests that prioritization of highway construction expenditures should be based on the potential expected impact of a proposed investment on the regional economy. Their analysis is based on highway construction expenditures and county employment data in conjunction with vector autoregression structural plots and causality tests. Another approach which has been used to study the employment generating potential of alternative roadway configurations is based on computer simulations.

In the context of the analysis of the effects of elevated versus depressed freeways on employment, a local measure seems to be more appropriate rather than studying regional impacts.

*Impact on Tax Revenues*

Highway improvements, in general, affect the communities in terms of land values as well as gross business sales. When this happens, an indirect impact ensues on the tax base and tax revenue, which could be both of a short-term and a long-term nature. The literature suggests that the normal procedure for computing these impacts makes use of 1) taxable retail sales data to obtain tax revenues, 2) sales tax revenues, and 3) property tax revenues. The details of this methodology can be obtained in [16].

*Impact on Highway Users Costs and Benefits*

Benefits of transportation improvement projects represent the difference between the new and the existing facility in terms of 1) time or delay costs, 2) vehicle operating costs, 3) accident costs, 4) routine maintenance costs, and 5) discomfort costs savings and pollution reduction. Therefore, any change that can reduce any, some, or all of the these costs receives benefits from such changes. Attempts are made to measure the first three cost savings components using computer algorithms such as HEEM-III [23]. References to works which measure such user costs savings can be found in Buffington et al. [9,16]. Recent work by McFarland, Memmott, and Chui [24] has led to the development of an algorithm called MicroBENCOST which accounts for all of the above four cost/benefit components to produce benefit-cost ratios which could potentially be important tools in aiding project selection. MicroBENCOST is an improvement over the currently used HEEM-III version of computing user benefits/costs.

**Social Effects**

*Population Changes*

The national survey findings substantiate the use of population changes due to highway construction as an important social impact.

*Neighborhood Accessibility*

Changes in access to residential areas and to public facilities such as local schools, universities, etc., often constitute an important social issue. The short-term social impact includes those stemming from the nature of the provisions for temporary access to residences and public facilities and those involving detours which bypass the construction site. The long-term impacts arise due to a long term change in the access to retail businesses. Access related impacts, particularly temporary access restrictions, have been mentioned in the national surveys and in environmental impact statements as being of concern to highway officials.

*Neighborhood Cohesion*

The types of communities impacted by highway projects can be defined by what the members of the given communities have in common. Common attributes include a similar ethnic background, a common culture and/or language, residing in the same school district, and being served by the same recreational or community center. The more of these attributes that a given group of people have in common, the stronger is the sense of community and its value to the members.

The cohesion of the community could be affected by a highway project to the extent that the project weakens or strengthens these attributes and the ability of the community to communicate and interact. Assessing such an effect requires determining the particular communities and attributes that are affected and the degree to which contacts are likely to be decreased. The literature indicates that the method for evaluating community cohesion and neighborhood quality could include a variety of measures including opinions, right-of-way impacts, noise levels, pollution levels, crime levels, relocations, and disruptions.

*Community Services*

The community impacts are routinely discussed in highway project reports and have also been discussed in environmental impact statements which address the effects of highway alignment [5,6,7,8].

*Residents' Attitudes and Opinions*

Residents' attitudes and opinions have been identified as critical variables to assess the social impact of such projects [13,14]. The national survey findings also reveal that opinions are an important variable. The following national survey comment is representative: "The public strongly desires depressed profiles. Future freeway planning must include depressed concepts to obtain public support."

To conclude, this review has outlined the key social and economic variables which need to be considered in order to evaluate the effect of freeway alignment. Wherever possible, methodological details have also been provided for the analysis.

## NATIONAL SURVEY FINDINGS

The Texas Transportation Institute canvassed all of the State or Provincial Transportation Agencies in the United States and Canada regarding the social, economic, and environmental effects of elevated and depressed freeways in urban and suburban areas. An initial literature review revealed a limited amount of study focusing on these two freeway types in terms of their relative impact. The objective of the survey of the states and Canadian Provinces was to determine, to the extent possible, the "state-of-the-art" with regard to data collection and procedures used to measure such impacts, recognizing that while published studies may be limited, much information may have been acquired through experience and data collection across the United States and Canada.

**Survey Response**

As was indicated above, the survey questionnaire was sent to all 50 states and the 10 Canadian Provinces. No responses were received from the Canadian Provinces, but 31 states did provide a response. (See a copy of the survey questionnaire with cover letter in Appendix B.) Four of the responses were by telephone, and the remainder were by returned questionnaire. Sixteen of the responding states reported having (during the past 10 year period) current or planned construction of elevated or depressed freeways. Six of these states reported that they have collected data and/or developed procedures to measure some of the effects of such freeways, and several furnished information concerning the issues of social, economic, or environmental effects. The remaining respondents reported no previous experience nor collected data or developed procedures to measure the effects of them. Last, two of the responding states expressed interest in TTI study findings.

The states listed below provided a response to the questionnaire:

| | | |
|---|---|---|
| Alaska | Michigan | Pennsylvania |
| Arizona | Montana | South Dakota |
| Arkansas | Nebraska | Tennessee |
| California | Nevada | Texas |
| Georgia | New Hampshire | Virginia |
| Hawaii | New Jersey | Washington |
| Idaho | New York | West Virginia |
| Illinois | North Carolina | Wisconsin |
| Kansas | North Dakota | Wyoming |
| Kentucky | Oklahoma | |
| Louisiana | Oregon | |

Also, the scatter of the responding states can be seen in Figure 18 which shows a map of the United States.

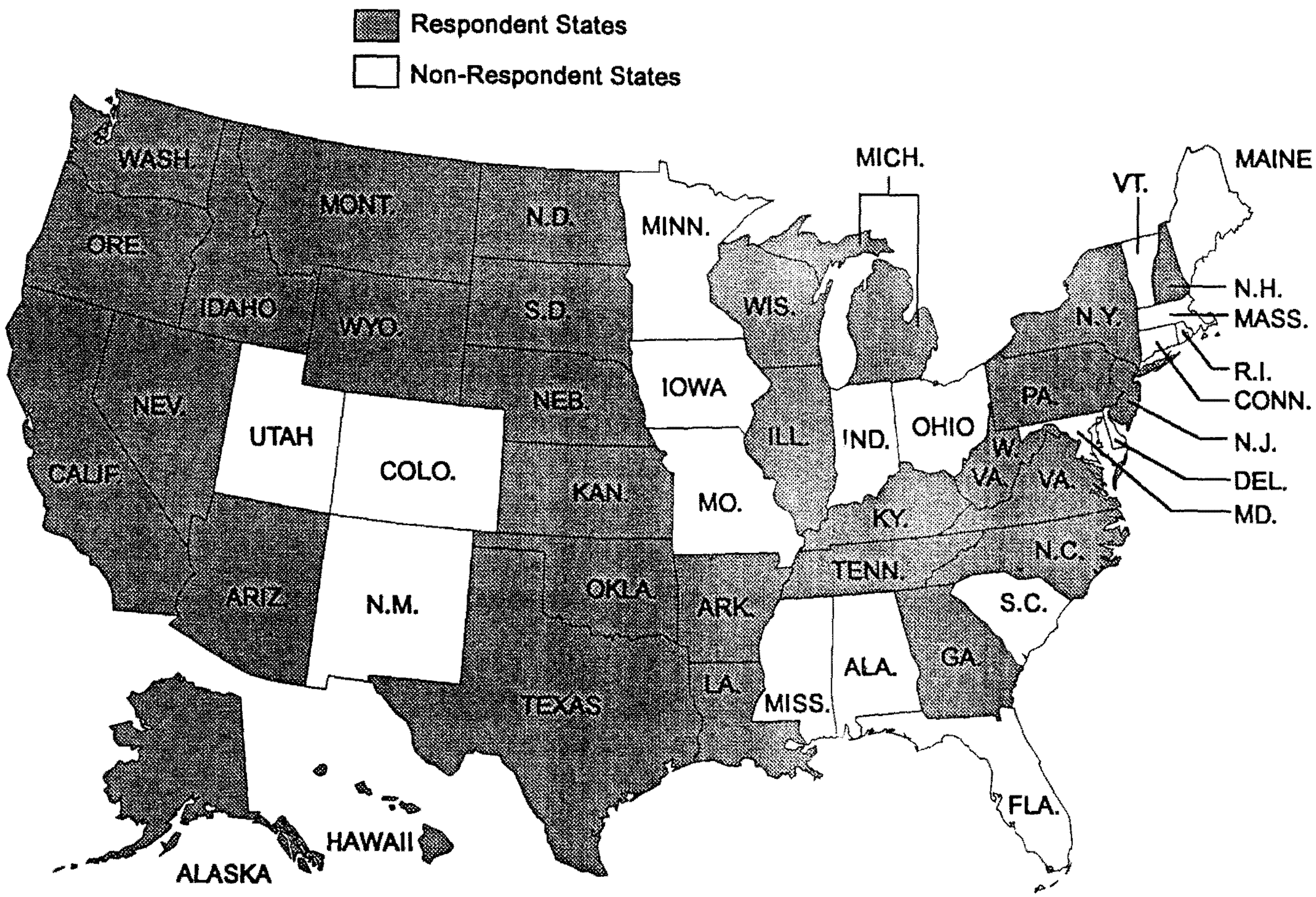



**Figure 18. Map of the United States Showing the Location of the 31 Respondent States**

### Elevated and Depressed Freeway Construction Activity

As indicated above,16 states reported previous or planned elevated or depressed freeway construction activity within the last 10 years. Of course we do not know how much of such activity exists in the non-responding states. Table 5 shows the number of elevated and depressed freeways that have been built during the last 10 years, under construction, and planned in the 16 states reporting such activity. A total of 64 (60.4%) of the 106 freeways reported as having been built in prior 10 years, under construction, or planned, were of the elevated type. Of the 25 planned freeways, 20 (80%) are of the elevated type.

### Experiences and Preferences by Grade Level

As indicated above, at least 16 of the responding state agencies had some experience with either or both elevated and depressed freeways, but only three expressed a definite preference for one grade level over the other. Only one of these states, Louisiana, preferred the elevated freeways. The basis of that preference was the "high water table in the southern part of the state prevents the use of depressed freeways." The other two states, Arizona and Oklahoma, preferred depressed freeways because they are less intrusive visually, act as a noise barrier, or are most desired by the public. In some cases, a depressed design is necessary to gain public support for a freeway project.

**Table 5. Number of Elevated and Depressed Freeways Built During 10 Prior Years, Under Construction, or Planned as of Early 1993**

| Question | Elevated | Depressed |
|---|---|---|
| Estimate the number of recently completed (within the past 10 years) elevated and depressed freeway sections in your state. | 28 | 16 |
| How many elevated and depressed freeway sections are currently under construction in your state? | 16 | 7 |
| How many elevated and depressed freeway sections are currently planned in your state? | 20 | 5 |
| Total number of freeways reported | 64 | 42 |

Note: Elevated and depressed freeway sections refer to sections that involve at least two over/underpasses, or are at least 1/2 mile in length.

Three states, Michigan, California, and New York, preferred the at-grade freeway design. They gave no reason for their preference for this grade level over either the elevated or depressed grade level. Last, no grade level preference was given by the following 11 states: Hawaii, Idaho, Illinois, Kansas, Nebraska, Nevada, North Dakota, Pennsylvania, Texas, Virginia, and Washington.

**Collection of Data and Development of Procedures to Measure Effects**

Only six (19.4%) of the 31 responding states had collected data and/or developed procedures to measure one or more of the following types of effects: social, economic, and environmental. When asked how many of each type of freeway reported had been studied in detail to estimate their social, economic, and environmental impacts, only 37 (34.9%) of the 106 freeways had been studied in detail. Such levels of response tend to indicate the degree of importance placed on the consideration of social, economic, and environmental impacts in planning new or reconstructed elevated, depressed, or at-grade freeways.

*Social Effects*

Several of the six state agencies indicating that they collected data and/or developed procedures to measure social, economic, or environmental effects of different grade level of freeways listed the following types of data used to measure the social effects:

- Demographic and housing data based on census tract data that reflected changes in the affected neighborhoods,
- Employment data,
- Opinion survey data,
- Traffic data, and
- Noise levels.

These data were used to prepare environmental impact statements (EIS). The demographic data includes the number and type of displacements, population distribution, and the effect of the freeway on neighborhood cohesion. Employment data use was mentioned by only one state. The opinion survey data includes the perceptions of residents or affected citizens, collected usually by personal interview. The traffic data included vehicular and pedestrian circulation patterns. Last, the noise levels are used, at least in one state, to gauge the need for noise walls or other noise control measures.

*Economic Effects*

The survey respondents were asked to specify the types of data that have been collected to measure economic effects of elevated or depressed freeways. Again, several of the six states responded to this question and indicated they used the following types of data to measure the economic effects:

— Number of business and residences displaced,
— Employment,
— Property values,
— Retail sales,
— Parking analysis, and
— Accessibility analysis.

These respondents indicated that they used these data to prepare the EISs. However, no further details as to the methodology or format used to measure economic effects nor actual effects of these types of freeway designs were available.

*Environmental Effects*

Last, the survey respondents were asked to specify the types of data used to measure environmental effects of elevated or depressed freeways. Once again, several of the six respondents mentioned one or more of the following types of data used to measure such effects:

— Air quality data,
— Noise impact data,
— Habitat information,
— Hazardous waste data,
— Flooding/runoff effects (hydro logic data),
— Archaeological impacts,
— Aesthetic impacts,
— Roadkill reports, and
— Salt spray impact data.

With regard to noise data, the model mentioned as having been used was STAMINA. The hydro logic data that had been used includes groundwater recharge/discharge, flood storage and desyncronization, sediment and shoreline stabilization, nutrient retention/transformation/ export, effects on streams and waterways, and ecology of wetlands. Salt spray impact actually references an impact study done in Illinois and would be of greater importance in areas where de-icing with salt is prevalent.

The respondents indicated that they used the above data to prepare Environmental Impact Statements on these types of freeway designs.

# EFFECTS OF STUDY FREEWAYS ON BUSINESSES SURVEYED

Businesses both non-abutting and abutting the freeway study sections in Houston, Lubbock, Dallas, and San Antonio were surveyed. The survey was designed to elicit responses regarding the possible effects of grade level variations in the freeway on businesses. Businesses along elevated, depressed, and at-grade sections of the freeways were asked to describe the area where they were located, their opinions on freeway elevation, as well as their preferences. Businesses were asked a number of questions pertaining to their characteristics like age, type of business, estimated dollar value of property, and gross sales levels at different time periods prior to, during, and after the highway construction. Further, the respondents were also asked what changes they had experienced since construction in terms of variations in noise levels, pollution levels, travel safety, crime, etc. They were also questioned on their opinions on the number of ramps, over and underpasses, parking spaces, the changes in the employment levels before, during, and after constructions periods. The actual questionnaire is included for reference in Appendix D. The main objectives of the survey can be briefly summarized below:

1) To identify characteristics of businesses near the highway by grade level, and
2) To examine the opinions and perceptions of businesses abutting the freeway, by grade level with respect to the following:

- degree of satisfaction with the freeway location, and
- effects of different freeway design characteristics. Among the effects, the most salient factors include the assessment on property values, gross sales, employment, noise, and pollution.

The first set of results that will be discussed pertain to characteristics of businesses abutting the freeway. Information on type, age of abutting businesses, length of stay at the present location, ownership of building, estimated property value of the building, number of parking spaces, number of people employed, and range of gross sales will be discussed. The results are presented for abutting businesses mostly since the study focuses on grade level differences of highway projects, and these effects can reasonably be expected to be magnified in the proximity of the highway. However, the results for non-abutting businesses are also presented as a comparison wherever appropriate.

Percentage distributions are presented by design sub-area in order to highlight the differences between elevated versus depressed versus at-grade freeway sections. The percentages reported are based on the actual number of respondents. The results of both the business surveys and residential surveys are presented by grade level. Sometimes the grade indicated individual sections, as in Lubbock (sections #8 and #9), and otherwise indicated more than one section as in the case of San Antonio (elevated includes sections #2, #3, and #4; depressed includes sections #1 and #5; at-grade includes control sections). The results were combined for the San Antonio sections in order to obtain a better direction in terms of effects of differences in grade levels of projects. In the case of Houston and Dallas, the elevated, depressed, and at-grade design sub-areas indicate the corresponding segments of Beltway 8 and North Central Expressway, respectively.

## CHARACTERISTICS OF ABUTTING SURVEYED BUSINESSES

### Number and Type of Study Area Businesses

Table 6 below summarizes the type and number of businesses surveyed in all the study areas; Lubbock, Houston, Dallas, and San Antonio. The largest number of the businesses surveyed belonged to the retail trade group. For the combined sample as a whole, 50% of those surveyed belong to this group. Thirty-nine percent of businesses belonging to the services category (this includes all groups of services) were surveyed. However, a very small percentage of those surveyed belonged to the manufacturing and wholesale category. In Houston, all of the businesses surveyed belonged to either the retail trade or services group.

**Table 6. Number and Type of Surveyed Businesses by Study Area**[3]

| | Lubbock | Houston | San Antonio | Dallas | All Study Areas Combined |
|---|---|---|---|---|---|
| **Business Type** | | | | | |
| Services | 31 (30.0) | 10 (31.0) | 110 (39.3) | 49 (50.5) | 200 (38.9) |
| Manufacturing | 12 (12.0) | 0 (0.0) | 16 (5.7) | 3 (3.1) | 31 (6.0) |
| Wholesale | 11 (11.0) | 0 (0.0) | 16 (5.7) | 0 (0.0) | 27 (5.3) |
| Retail | 47(45.0) | 17 (53.0) | 124 (44.3) | 40 (41.2) | 228 (44.4) |
| Gas Stations | 3 (3.0) | 5 (16.0) | 14 (5.0) | 5 (5.2) | 27 (5.3) |
| Retail (total) | 50 (48.0) | 22 (69.0) | 138 (49.3) | 45 (46.4) | 255 (49.7) |
| Total Number | 104 | 32 | 280 | 97 | 513 |

### Age of Abutting Businesses

Table 7 presents the age distribution of the abutting surveyed businesses in all study areas by design sub-area. In study area 1 (Lubbock), approximately 63% of the surveyed businesses on all design sub-areas combined were older than 11 years. This implies that less than 63% of the surveyed abutting businesses were around both prior to and after the highway construction in Lubbock.

[3] Figures in parentheses represent percentages.

## Table 7. Age of Abutting Businesses

| Years | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | **Number** | **%** | **Number** | **%** | **Number** | **%** | **Number** | **%** |
| **Study Area 1: Lubbock** | | | | | | | | |
| < 1 | 2 | 4.8 | 1 | 5.9 | 1 | 5.9 | 4 | 5.3 |
| 1 - 5 | 13 | 30.9 | 1 | 5.9 | 1 | 5.9 | 15 | 19.7 |
| 6 - 10 | 3 | 7.1 | 2 | 11.8 | 5 | 29.4 | 10 | 13.2 |
| 11 - 20 | 6 | 14.3 | 5 | 29.4 | 5 | 29.4 | 16 | 21.1 |
| > 20 | 18 | 42.9 | 8 | 47.1 | 5 | 29.4 | 31 | 40.8 |
| Mean age (years) | 9 years | | 12 years | | 9.5 years | | 10.2 years | |
| No Response | 0 | | 0 | | 0 | | 0 | |
| Total Responses | 42 | | 17 | | 17 | | 76 | |
| **Study Area 2: Houston** | | | | | | | | |
| < 1 | 1 | 7.1 | 1 | 20.0 | 0 | 0.0 | 2 | 7.4 |
| 1 - 5 | 3 | 21.4 | 1 | 20.0 | 3 | 37.5 | 7 | 25.9 |
| 6 - 10 | 1 | 7.1 | 0 | 0.0 | 1 | 12.5 | 2 | 7.4 |
| 11 - 20 | 6 | 42.9 | 1 | 20.0 | 1 | 12.5 | 8 | 29.6 |
| > 20 | 3 | 21.4 | 2 | 40.0 | 3 | 37.5 | 8 | 29.6 |
| Mean age (years) | 8.5 years | | 8 years | | 8.5 years | | 8.3 years | |
| No Response | 0 | 0 | | 0 | | 0 | | |
| Total Responses | 14 | | 5 | | 8 | | 27 | |

**Table 7. Age of Abutting Businesses (continued)**

| Years | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % | Number | % |
| **Study Area 3: San Antonio** | | | | | | | | |
| < 1 | 6 | 5.2 | 3 | 8.6 | 3 | 5.7 | 12 | 5.9 |
| 1 - 5 | 17 | 14.7 | 7 | 20.0 | 14 | 26.4 | 38 | 18.6 |
| 6 - 10 | 22 | 19.0 | 6 | 17.1 | 13 | 24.5 | 41 | 20.1 |
| 11 - 20 | 27 | 23.2 | 13 | 37.1 | 11 | 20.8 | 51 | 25.0 |
| > 20 | 44 | 37.9 | 6 | 17.1 | 12 | 22.6 | 62 | 30.4 |
| Mean age (years) | 9.5 years | | 7.5 years | | 7.5 years | | 8.2 years | |
| No Response | 3 | | 0 | | 0 | | 3 | |
| Total Responses | 116 | | 35 | | 53 | | 204 | |
| **Study Area 4: Dallas** | | | | | | | | |
| < 1 | 0 | 0.0 | 1 | 2.9 | 0 | 0.0 | 1 | 1.7 |
| 1 - 5 | 5 | 29.4 | 3 | 8.8 | 2 | 25.0 | 10 | 16.9 |
| 6 - 10 | 5 | 29.4 | 8 | 23.5 | 2 | 25.0 | 15 | 25.4 |
| 11 - 20 | 4 | 23.5 | 8 | 23.5 | 2 | 25.0 | 14 | 23.7 |
| > 20 | 3 | 17.7 | 14 | 41.2 | 2 | 25.0 | 19 | 32.2 |
| Mean age (years) | 7.5 years | | 10.0 years | | 8.5 years | | 8.6 years | |
| No Response | 0 | | 0 | | 0 | | 0 | |
| Total Responses | 17 | | 34 | | 8 | | 59 | |

**Table 7. Age of Abutting Businesses (continued)**

| Years | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **Number** | **%** | **Number** | **%** | **Number** | **%** | **Number** | **%** |
| < 1 | 9 | 4.8 | 6 | 6.6 | 4 | 4.7 | 19 | 5.2 |
| 1 - 5 | 38 | 20 | 12 | 13.2 | 20 | 23.3 | 70 | 19.1 |
| 6 - 10 | 31 | 16.4 | 16 | 17.6 | 21 | 24.4 | 68 | 18.6 |
| 11 - 20 | 43 | 22.8 | 27 | 29.7 | 19 | 22.1 | 89 | 24.3 |
| > 20 | 68 | 35.9 | 30 | 32.9 | 22 | 25.6 | 120 | 32.8 |
| Mean age (years) | 8.6 years | | 9.4 years | | 8.5 years | | 8.8 years | |
| No Response | 3 | | 0 | | 0 | | 3 | |
| Total Responses | 189 | | 91 | | 86 | | 366 | |

Twenty five percent of the businesses were 5 years old or less at the time the surveys were administered. The mean age of businesses located adjacent to depressed section # 9 is 12 years. For businesses located adjacent to section #8 (elevated section) and the at-grade control section, the mean ages are 9 and 9.5 years, respectively. The mean age of all surveyed abutting businesses on I-27 is 10.2 years. In study area 2 (Houston), about 59% of all businesses were 11 years or older, and 32% were 5 years old or less. The mean age of all surveyed abutting businesses on Beltway 8 is 8.3 years. In the case of study areas 3 and 4 (San Antonio and Dallas), approximately 55% of the businesses were aged 11 years or older, while only 24% and 19% of the businesses were aged 5 years or less, respectively. The mean age of all surveyed abutting businesses in San Antonio and Dallas study areas was 8.2 years and 8.6 years, respectively. Grade level differences in mean age are not as apparent in the San Antonio and Houston study areas. In the case of Dallas, however, the mean age of businesses located adjacent the depressed sections of the Central Expressway was greater than the mean age of businesses located adjacent the elevated and control segments of the same. For all study areas combined, 56% of the total abutting businesses surveyed were aged 11 years or older, and 24% were 5 years old or less at the time the surveys were administered. Furthermore, while the age distribution seems fairly similar for both elevated and depressed sections, the pattern is somewhat different on the at-grade sections, with a roughly even proportion of businesses in age groups 1-5, 6-10, 11-20, and >20. The overall mean age of all businesses is 9 years, and businesses located adjacent depressed segments have the highest mean age.

**Length of Time at Present Location**

Businesses were asked to indicate how long they were located at the present location. Table 8 shows the mean lengths of stay for all study areas and by design sub-area. Lubbock businesses are among those who had stayed the longest at the present location, with a mean length of stay of 15.1 years, while Dallas businesses had been around for the shortest period of time, with a mean length of stay of 8.9 years. Furthermore, all study areas are stable with respect to the movement of businesses. In these study areas, businesses tend to show a strong tendency to remain at the same location for extended periods of time. The mean length of stay is 11.8 years for all survey respondents. In addition, there seems to be substantial differences in the lengths of stay across different grade levels. The lengths of stay for the surveyed businesses are the longest for depressed sections (13 years) of the freeway in all study areas, suggesting that businesses in this type of design sub-area had been around in the neighborhood for the longest period of time. Furthermore, even within each design sub-area, Lubbock businesses had the longest lengths of stay while Dallas had the shortest.

**Ownership of Buildings**

Table 9 clearly reveals that a majority (59%) of the surveyed abutting businesses are renters in all study areas combined. Furthermore, the pattern is the same for all grade levels. Lubbock is the exception, however, with a majority of those surveyed in the depressed segment of the highway being owners rather than renters.

**Table 8. Percentage Distribution of Abutting Business Respondents by Length of Residency in Neighborhood and by Design Sub-Area**

| Years | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Study Area 3 | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas |
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | |
| < 1 | 7.3 | 8.3 | 6.3 | 6.3 | 6.7 | 6.3 | 0.0 | 6.1 | 3.3 | 4.8 | 5.9 | 14.3 | 4.0 | 12.5 | 6.1 | 6.8 | 8.7 | 5.7 | 5.6 | 6.1 |
| 1 | 19.5 | 16.7 | 2.7 | 0.0 | 7.2 | 0.0 | 25.0 | 6.1 | 16.7 | 9.6 | 0.0 | 0.0 | 8.0 | 0.0 | 4.9 | 10.8 | 13.0 | 4.6 | 9.3 | 7.2 |
| 2 | 9.8 | 8.3 | 1.8 | 31.3 | 6.7 | 6.3 | 0.0 | 6.1 | 10.0 | 7.2 | 0.0 | 14.3 | 16.0 | 25.0 | 13.4 | 6.8 | 8.7 | 6.2 | 18.5 | 8.4 |
| 3 | 9.8 | 0.0 | 4.5 | 25.0 | 7.2 | 0.0 | 0.0 | 9.1 | 10.0 | 7.2 | 5.9 | 0.0 | 8.0 | 25.0 | 8.5 | 6.8 | 0.0 | 6.2 | 16.7 | 7.5 |
| 4 | 7.3 | 0.0 | 7.2 | 0.0 | 6.1 | 0.0 | 0.0 | 3.0 | 6.7 | 3.6 | 0.0 | 0.0 | 6.0 | 12.5 | 4.9 | 4.1 | 0.0 | 6.2 | 5.6 | 5.2 |
| 5 | 7.3 | 8.3 | 6.3 | 0.0 | 6.1 | 12.5 | 0.0 | 6.1 | 3.3 | 6.0 | 0.0 | 0.0 | 6.0 | 0.0 | 3.7 | 6.8 | 4.4 | 6.2 | 1.9 | 5.5 |
| 6-9 | 4.9 | 25.0 | 18.9 | 12.5 | 1.6 | 0.0 | 0.0 | 18.2 | 10.0 | 10.8 | 23.5 | 14.3 | 20.0 | 0.0 | 19.5 | 8.1 | 17.4 | 19.1 | 9.3 | 15.4 |
| 10-14 | 2.4 | 8.3 | 23.4 | 6.3 | 1.6 | 12.5 | 0.0 | 9.1 | 10.0 | 9.6 | 29.4 | 28.6 | 14.0 | 0.0 | 17.1 | 10.8 | 13.0 | 18.6 | 7.4 | 14.8 |
| 15-19 | 4.9 | 16.7 | 6.3 | 6.3 | 6.7 | 6.3 | 0.0 | 9.1 | 10.0 | 8.4 | 11.8 | 28.6 | 12.0 | 12.5 | 13.4 | 6.8 | 17.4 | 8.3 | 9.3 | 8.7 |
| >20 | 26.8 | 8.3 | 22.5 | 12.5 | 2.2 | 56.3 | 75.0 | 27.3 | 20.0 | 3.3 | 23.5 | 0.0 | 6.0 | 12.5 | 9.8 | 32.4 | 17.4 | 19.1 | 16.7 | 21.4 |
| Mean Length (years) | 14.2 | 8.3 | 13 | 7.09 | 10.5 | 19.8 | 15.4 | 11.5 | 10.6 | 13.0 | 12.9 | [illegible]2 | 7.6 | 6.7 | 8.8 | 15.1 | 9.8 | 11.6 | 8.9 | 11.8 |
| No Response (N) | 1 | 2 | 8 | 1 | 12 | 1 | 1 | 2 | 4 | 8 | 0 | 1 | 2 | 0 | 3 | 2 | 4 | 12 | 5 | 23 |
| Total Responses (N) | 41 | 12 | 111 | 16 | 180 | 16 | 4 | 33 | 30 | 83 | 17 | 7 | 50 | 8 | 82 | 74 | 23 | 194 | 54 | 345 |

3. There are four study areas:
   1 refers to Study Area 1: Lubbock  2 refers to Study Area 3: Houston
   3 refers to Study Area 2: San Antonio  4 refers to Study Area 4: Dallas

**Table 9. Percentage Distribution of Abutting Business Respondents by Type of Tenure and by Design Sub-Area**

| Type of Tenure | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Owned | 40.5 | 64.7 | 47.1 | 47.4 |
| Rented | 59.5 | 35.3 | 52.9 | 52.6 |
| No Response | 0 | 0 | 0 | 0 |
| Total Responses | N=42 | N=17 | N=17 | N=76 |
| **Study Area 2: Houston** | | | | |
| Owned | 33.3 | 40.0 | 12.5 | 28.0 |
| Rented | 66.7 | 60.0 | 87.5 | 72.0 |
| No Response | 2 | 0 | 0 | 2 |
| Total Responses | N=12 | N=5 | N=8 | N=25 |
| **Study Area 3: San Antonio** | | | | |
| Owned | 44.4 | 48.6 | 39.6 | 43.9 |
| Rented | 55.6 | 51.4 | 60.4 | 56.1 |
| No Response | 2 | 0 | 0 | 2 |
| Total Responses | N=117 | N=35 | N=53 | N=205 |

**Table 9. Percentage Distribution of Abutting Business Respondents by Type of Tenure and by Design Sub-Area (continued)**

| Type of Tenure | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 4: Dallas** | | | | |
| Owned | 11.8 | 32.4 | 25.0 | 25.4 |
| Rented | 88.2 | 67.7 | 75.0 | 74.6 |
| No Response | 0 | 0 | 0 | 0 |
| Total Responses | N=17 | N=34 | N=8 | N=59 |
| **All Study Areas Combined** | | | | |
| Owned | 39.9 | 45.1 | 37.2 | 40.5 |
| Rented | 60.1 | 53.9 | 61.6 | 58.9 |
| No Response | 4 | 0 | 0 | 4 |
| Total Responses | N=188 | N=91 | N=86 | N=365 |

## Condition of Building

Most of the buildings were observed to be in the very good to fair categories, and less than 3% were ranked as either in poor or very poor condition as shown in Table 10.

**Table 10. Condition of Building by Study Area and by Design Sub-Area**

| Condition | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 2[4]: Houston** | | | | |
| Very Good | 92.9 | 80.0 | 50.0 | 77.8 |
| Good | 7.1 | 20.0 | 37.5 | 18.5 |
| Fair | 0.0 | 0.0 | 12.5 | 3.7 |
| Poor | 0.0 | 0.0 | 0.0 | 0.0 |
| Very Poor | 0.0 | 0.0 | 0.0 | 0.0 |
| No Response | 0 | 0 | 0 | 0 |
| Total Responses | N=14 | N=5 | N=8 | N=27 |
| **Study Area 3: San Antonio** | | | | |
| Very Good | 25.4 | 20.0 | 30.8 | 25.9 |
| Good | 41.2 | 48.9 | 46.2 | 43.8 |
| Fair | 30.0 | 22.9 | 21.2 | 25.9 |
| Poor | 3.5 | 8.6 | 1.9 | 4.0 |
| Very poor | .9 | 0.0 | 0.0 | .5 |
| No Response | 5 | 0 | 1 | 6 |
| Total Responses | N=114 | N=35 | N=52 | N=201 |

[4] This question was not asked for Study Area 1: Lubbock

## Table 10. Condition of Building by Study Area and by Design Sub-Area (continued)

| Condition | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 4: Dallas** | | | | |
| Very Good | 35.3 | 51.5 | 75.0 | 50.0 |
| Good | 58.8 | 15.2 | 12.5 | 27.6 |
| Fair | 5.9 | 33.3 | 12.5 | 22.4 |
| Poor | 0.0 | 0.0 | 0.0 | 0.0 |
| Very Poor | 0.0 | 0.0 | 0.0 | 0.0 |
| No Response | 0 | 1 | 0 | 1 |
| Total Responses | 17 | 33 | 8 | 58 |
| **All Study Areas Combined** | | | | |
| Very Good | 33.1 | 38.4 | 38.2 | 35.7 |
| Good | 40.0 | 31.5 | 41.2 | 38.1 |
| Fair | 23.4 | 26.0 | 19.1 | 23.1 |
| Poor | 2.8 | 4.1 | 1.5 | 2.8 |
| Very Poor | 0.7 | 0.0 | 0.0 | 0.4 |
| No Response | 5 | 1 | 1 | 7 |
| Total Responses | N=145 | N=73 | N=68 | N=286 |

**Estimated Value of Property**

The percentage distribution of respondents in the various property value categories is presented in Table 11. Substantial differences are apparent in the distribution of responses within each study area, both across design sub-areas and between abutting versus non-abutting businesses. Approximately 13% of the abutting businesses in study area 1 (Lubbock) stated that their properties were valued at less than $50,000, and 2% stated that their properties were worth over one million dollars. In contrast, none of the non-abutting businesses stated that their properties were valued at less than $50,000, and 12% owned/rented properties valued at one million dollars or more. Combining all design sub-areas, the largest percentage of the abutting and non-abutting business respondents belonged to the $50,000-$100,000 range of property values. The mean value of commercial properties on abutting sections was $146,667 and $155,833 on non-abutting sections. The average value of business properties adjacent section #9 (depressed section) was the lowest at $70,000. On the other hand, the average property value for parcels adjacent the at-grade control section was the highest. In addition, the average property value for non-abutting properties was higher than that for abutting properties.

In the case of study area 2 (Houston), 38% of the abutting businesses surveyed owned/rented properties valued at over a million dollars; 50% of the properties were valued between $300,000 to $750,000, and the remaining were all valued at less than $50,000. Parcels on elevated segments of Beltway 8 had the highest property values, on average.

In San Antonio, the range of abutting businesses with properties worth more than a million dollars ranged from 33% on elevated sections to 15% on depressed sections. The largest percentage of respondents (30%) on the abutting sections belonged to the million dollar range, and 25% belonged to the $100,000 to $300,000 range. On the contrary, the largest percentage (63%) of non-abutting respondents belonged to the $100,000 to $300,000 range. Within abutting sections, businesses located adjacent depressed segments had the lowest average property value.

## Table 11. Estimated Property Value of Abutting and Non-Abutting Business Properties by Design Sub-Area

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1:Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting & Non-Abut.** |
| < $50,000 | 11.1 | 0.0 | 33.3 | 0.0 | 0.0 | -[5] | 12.8 | 0.0 | 9.4 |
| $50,000-$100,000 | 29.6 | 44.4 | 22.2 | 25.0 | 18.2 | - | 25.5 | 35.3 | 28.1 |
| $100,001-$200,000 | 14.8 | 11.1 | 33.3 | 37.5 | 9.1 | - | 17.0 | 23.5 | 18.8 |
| $200,001-$300,000 | 29.6 | 11.1 | 0.0 | 25.0 | 18.2 | - | 21.3 | 17.6 | 20.3 |
| $300,001-$500,000 | 3.7 | 22.2 | 11.1 | 0.0 | 36 4 | - | 12.8 | 11.8 | 12.5 |
| $500,001-$750,000 | 0.0 | 0.0 | 0.0 | 0.0 | 9.1 | - | 2.1 | 0.0 | 1.6 |
| $750,001-$1,000,000 | 7.4 | 0.0 | 0.0 | 0.0 | 9.1 | - | 6.4 | 0.0 | 4.7 |
| > $1,000,000 | 3.7 | 11.1 | 0.0 | 12.5 | 0.0 | - | 2.1 | 11.8 | 4.7 |
| Mean property value ($) | 130,000 | 170,000 | 70,000 | 160,000 | 240,000 | - | 146,667 | 165,000 | 155,833 |
| Total Responses | N=27 | N=9 | N=9 | N=8 | N=11 | - | N=47 | N=17 | N=64 |
| **Study Area 2:Houston** | | | | | | | | | |
| < $50,000 | 0.0 | - | 0.0 | - | 25.0 | - | 12.5 | - | 12.5 |
| $50,000-$100,000 | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 |
| $100,001-$200,000 | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 |
| $200,001-$300,000 | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 |
| $300,001-$500,000 | 33.3 | - | 0.0 | - | 25.0 | - | 25.0 | - | 25.0 |
| $500,001-$750,000 | 0.0 | - | 100.0 | - | 25.0 | - | 25.0 | - | 25.0 |
| $750,001-$1,000,000 | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 | - | 0.0 |
| > $ 1,000,000 | 66.7 | - | 0.0 | - | 25.0 | - | 37.5 | - | 37.5 |
| Mean property value ($) | 750,000 | - | 500,000 | - | 300.000 | - | 516,700 | - | 516,700 |
| Total Responses | N=3 | - | N=1 | - | N=4 | - | N=8 | - | N=8 |

[5] Implies that none in that category were interviewed.

Table 11. Estimated Property Value of Abutting and Non-Abutting Business Properties by Design Sub-Area (continued)

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3:San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting & Non-Abut.** |
| < $50,000 | 5.6 | 11.8 | 23.1 | 0.0 | 10.5 | - | 8.9 | 11.1 | 9.8 |
| $50,000-$100,000 | 16.7 | 8.8 | 0.0 | 0.0 | 0.0 | - | 13.4 | 8.3 | 9.8 |
| $100,001-$200,000 | 14.8 | 26.5 | 7.7 | 0.0 | 10.5 | - | 13.4 | 25.0 | 16.4 |
| $200,001-$300,000 | 7.4 | 23.5 | 30.8 | 100.0 | 10.5 | - | 11.9 | 27.7 | 16.4 |
| $300,001-$500,000 | 9.3 | 8.8 | 7.7 | 0.0 | 10.5 | - | 8.9 | 8.3 | 9.0 |
| $500,001-$750,000 | 3.7 | 5.9 | 15.4 | 0.0 | 5.3 | - | 5.9 | 5.6 | 5.7 |
| $750,001-$1,000,000 | 9.3 | 5.9 | 0.0 | 0.0 | 10.5 | - | 7.5 | 5.6 | 7.4 |
| > $1,000,000 | 33.3 | 8.8 | 15.4 | 0.0 | 42.1 | - | 29.9 | 8.3 | 25.4 |
| Mean property value ($) | 320,000 | 190,000 | 220,000 | 200,000 | 460,000 | - | 333,333 | 195,000 | 264,150 |
| Total Responses | N=54 | N=34 | N=13 | N=2 | N=19 | - | N=86 | N=36 | N=122 |
| **Study Area 4: Dallas** | | | | | | | | | |
| < $50,000 | 0.0 | 0.0 | 7.7 | 0.0 | 0.0 | - | 4.3 | 0.0 | 2.6 |
| $50,000-$100,000 | 0.0 | 0.0 | 7.7 | 20.0 | 33.3 | - | 8.7 | 13.3 | 10.5 |
| $100,001-$200,000 | 14.3 | 0.0 | 7.7 | 0.0 | 0.0 | - | 8.7 | 0.0 | 5.3 |
| $200,001-$300,000 | 0.0 | 0.0 | 23.1 | 10.0 | 0.0 | - | 13.0 | 6.7 | 10.5 |
| $300,001-$500,000 | 0.0 | 0.0 | 30.8 | 10.0 | 0.0 | - | 17.4 | 6.7 | 13.2 |
| $500,001-$750,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $750,001-$1,000,000 | 28.6 | 20.0 | 0.0 | 20.0 | 0.0 | - | 8.7 | 20.0 | 13.2 |
| > $ 1,000,000 | 57.1 | 80.0 | 23.1 | 40.0 | 66.7 | - | 39.1 | 53.3 | 44.7 |
| Mean property value ($) | 750,000 | 980,000 | 280,000 | 480,000 | 500,000 | - | 510,000 | 730,000 | 620,000 |
| Total Responses | N=7 | N=5 | N=13 | N=10 | N=3 | - | N=23 | N=15 | N=38 |

**Table 11. Estimated Property Value of Abutting and Non-Abutting Business Properties by Design Sub-Area (continued)**

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| Study Area 1: All Study Areas Combined | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting & Non-Abut. |
| < $50,000 | 6.6 | 8.3 | 19.4 | 0.0 | 8.1 | - | 9.8 | 5.9 | 8.6 |
| $50,000-$100,000 | 18.7 | 14.6 | 8.3 | 20.0 | 8.1 | - | 14.0 | 16.2 | 14.7 |
| $100,001-$200,000 | 14.3 | 20.8 | 13.9 | 15.0 | 8.1 | - | 12.8 | 19.1 | 14.7 |
| $200,001-$300,000 | 13.2 | 18.8 | 19.4 | 25.0 | 10.8 | - | 14.0 | 20.6 | 15.9 |
| $300,001-$500,000 | 7.7 | 10.4 | 16.7 | 5.0 | 18.9 | - | 12.2 | 8.8 | 11.2 |
| $500,001-$750,000 | 2.2 | 4.2 | 8.3 | 0.0 | 8.1 | - | 4.9 | 2.9 | 4.3 |
| $750,001-$1,000,000 | 9.9 | 6.3 | 0.0 | 10.0 | 8.1 | - | 7.3 | 7.4 | 7.3 |
| > $1,000,000 | 27.5 | 16.7 | 13.9 | 25.0 | 29.7 | - | 25.0 | 19.1 | 23.3 |
| Mean property value ($) | 487,500 | 446,670 | 267,500 | 280,000 | 375,000 | - | 376,670 | 363,333 | 370,000 |
| Total Responses | N=91 | N=48 | N=36 | N=20 | N=37 | - | N=164 | N=68 | N=232 |

5. - implies that none in that category were interviewed.

In study area 4 (Dallas), for both abutting and non-abutting businesses, the largest percentage of those surveyed belonged to the million dollar range on all design sub-areas. As in Lubbock, the average value for properties on non-abutting sections was higher than for those on abutting sections. Further, the mean property value for businesses located adjacent depressed segments was the lowest.

Combining all study areas (abutting sections), the mean property value for properties adjacent depressed, elevated, and at-grade control segments is \$267,500, \$487,500 and \$375,000, respectively. This shows that in general, properties adjacent depressed segments have the lowest average property values. This was not found to be the case in the Houston study area.

**Number of People Employed**

Table 12 reveals that there are differences in the employment patterns within design sub-areas and between abutting and non-abutting businesses surveyed. Abutting businesses clearly had a larger number of both part-time and full-time employees, with the exception of the Dallas study area. Businesses on elevated sections were observed to have a larger number of employees than businesses on at-grade or depressed sections, again with the exception of Dallas. The number of full-time employees for abutting businesses ranged from 2,078 on elevated sections to 638 on the at-grade sections; the number of part-time employees ranged from 311 on elevated sections to 75 on at-grade sections. In the case of non-abutting businesses, the number of full-time employees ranged from 1,230 on elevated sections to 322 on depressed sections; the number of part-time employees ranged from 97 on elevated sections to 27 on the at-grade sections. The total number of full-time and part-time employees for businesses surveyed on abutting sections was reported to be 3,171 and 481, respectively. The average full-time employment for study areas 1 and 4 non-abutting businesses exceeded the average employment of abutting businesses. The reverse pattern is observed for study areas 2 and 3. Abutting businesses in all study areas had average employment levels as high as non-abutting businesses and also higher in the case of the Houston and San Antonio study areas. However, for all study areas combined, the average employment levels of non-abutting businesses exceeded that of abutting businesses on all design sub-areas.

## Table 12. Number of Full-Time Versus Part-Time Employees for Abutting and Non-Abutting Businesses

| Employee Type | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. |
| **Study Area 1: Lubbock** | | | | | | | | |
| Full-Time | 274 | 111 | 67 | 88 | 221 | - | 562 | 199 |
| Part-Time | 56 | 9 | 8 | 5 | 9 | - | 73 | 14 |
| Total | 330 | 120 | 75 | 93 | 230 | - | 635 | 213 |
| No Response | 10 | 6 | 3 | 2 | 2 | - | 15 | 8 |
| Total Responses | 32 | 12 | 14 | 8 | 15 | - | 61 | 20 |
| Average Number of Full-Time Employees | 9 | 9 | 5 | 11 | 15 | - | 9 | 10 |
| Average Number of Part-Time Employees | 2 | 1 | 1 | 1 | 1 | - | 1 | 1 |
| Average Number of Employees Per Firm | 10 | 10 | 5 | 12 | 15 | - | 10 | 11 |
| **Study Area 2: Houston** | | | | | | | | |
| Full-Time | 135 | 8 | 10 | 2 | 4 | - | 149 | 10 |
| Part-Time | 15 | 0 | 2 | 6 | 5 | - | 22 | 6 |
| Total | 150 | 8 | 12 | 8 | 9 | - | 171 | 16 |
| No Response | 9 | 2 | 3 | 0 | 3 | - | 15 | 2 |
| Total Responses | 5 | 1 | 2 | 2 | 5 | - | 12 | 3 |
| Average Number of Full-Time Employee | 27 | 8 | 5 | 1 | 1 | - | 12 | 3 |
| Average Number of Part-Time Employees | 3 | 9 | 1 | 3 | 1 | - | 2 | 2 |
| Average Number of Employees Per Firm | 30 | 8 | 6 | 4 | 2 | - | 14 | 5 |

## Table 12. Number of Full Time Versus Part Time Employees for Abutting and Non-Abutting Businesses (continued)

| Employee Type | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. |
| **Study Area 3: San Antonio** | | | | | | | | |
| Full-Time | 1481 | 491 | 100 | 32 | 335 | - | 1916 | 523 |
| Part-Time | 143 | 73 | 60 | 0 | 55 | - | 258 | 73 |
| Total | 1624 | 564 | 160 | 32 | 390 | - | 2432 | 596 |
| No Response | 30 | 24 | 14 | 3 | 22 | - | 66 | 27 |
| Total Responses | 89 | 44 | 21 | 4 | 31 | - | 141 | 48 |
| Average Number of Full-Time Employees | 17 | 11 | 5 | 8 | 11 | - | 14 | 11 |
| Average Number of Part-Time Employees | 2 | 2 | 3 | 0 | 2 | - | 2 | 2 |
| Average Number of Employees Per Firm | 18 | 13 | 8 | 8 | 13 | - | 17 | 12 |
| **Study Area 4: Dallas** | | | | | | | | |
| Full-Time | 195 | 620 | 278 | 200 | 78 | - | 551 | 820 |
| Part-Time | 127 | 15 | 25 | 16 | 6 | - | 158 | 31 |
| Total | 327 | 635 | 303 | 216 | 84 | - | 709 | 851 |
| No Response | 5 | 1 | 10 | 8 | 2 | - | 17 | 9 |
| Total Responses | 12 | 8 | 24 | 21 | 6 | - | 42 | 29 |
| Average Number of Full-Time Employee | 16 | 76 | 12 | 10 | 13 | - | 13 | 28 |
| Average Number of Part-Time Employees | 11 | 2 | 1 | 1 | 1 | - | 4 | 1 |
| Average Number of Employees Per Firm | 27 | 79 | 13 | 10 | 14 | - | 17 | 17 |

## Table 12. Number of Full Time Versus Part Time Employees for Abutting and Non-Abutting Businesses (continued)

| Employee Type | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. |
| **All Study Areas Combined** | | | | | | | | |
| Full-Time | 2085 | 1230 | 455 | 322 | 638 | - | 3178 | 1552 |
| Part-Time | 341 | 97 | 95 | 27 | 75 | - | 511 | 124 |
| Total | 2389 | 1327 | 550 | 349 | 713 | - | 3689 | 1676 |
| No Response | 54 | 33 | 30 | 13 | 29 | | 113 | 46 |
| Total Responses | 138 | 65 | 61 | 35 | 57 | - | 256 | 100 |
| Average Number of Full- Time Employee | 15 | 19 | 7 | 9 | 11 | - | 12 | 16 |
| Average Number of Part-Time Employees | 3 | 2 | 2 | 1 | 1 | - | 2 | 1 |
| Average Number of Employees Per Firm | 18 | 20 | 9 | 10 | 13 | - | 14 | 17 |

Businesses located immediately adjacent the elevated sections of the study freeways had the highest average employment levels in three out of four study areas, the exception being the I-27 Lubbock study area where the at-grade segments had the highest average total employment levels at the time the surveys were administered. Even in the Lubbock study area, businesses located adjacent the elevated section (#8) had higher average employment levels than those located adjacent section #9.

**Parking Spaces Available**

Respondents on abutting and non-abutting sections were asked to provide information on the number of parking spaces available to them, and the distribution on responses is presented in Table 13. For all study sections combined, there is a clear-cut pattern—the average number of parking spaces for abutting businesses exceeded that of non-abutting businesses when all design sub-areas were combined. The same pattern was observed when all study areas were combined; the average number of parking spaces available for businesses adjacent to the highway exceeded the number available for non-abutting businesses by 12%. As in the case of average employment levels, abutting and non-abutting elevated sections had the highest number of parking spaces in three out of the four study areas (Dallas, Houston, and San Antonio). In the case of Lubbock, abutting at-grade sections had the highest number of parking spaces; however, businesses located adjacent the elevated section had a greater average number of parking spaces than those adjacent the depressed section.

## Table 13. Number of Parking Spaces Available for Abutting and Non-Abutting Businesses

| Number of Parking Spaces | Elevated | | | | | Depressed | | | | | At-Grade | | | | | All Design Sub-Areas | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Study Area | | | | | Study Area | | | | | Study Area | | | | | Study Area | | | | |
| | 1 | 2 | 3 | 4 | All Areas | 1 | 2 | 3 | 4 | All Areas | 1 | 2 | 3 | 4 | All Areas | 1 | 2 | 3 | 4 | All Areas |
| Abutting | 410 | 360 | 1815 | 1418 | 4003 | 125 | 50 | 509 | 308 | 992 | 347 | 23 | 724 | 113 | 1102 | 882 | 433 | 3048 | 1839 | 6135 |
| Total Responses | 22 | 3 | 57 | 9 | 91 | 9 | 2 | 18 | 20 | 49 | 8 | 5 | 26 | 3 | 41 | 39 | 10 | 101 | 32 | 182 |
| No Response | 20 | 11 | 62 | 8 | 101 | 8 | 3 | 17 | 14 | 42 | 9 | 3 | 27 | 6 | 45 | 37 | 17 | 106 | 28 | 188 |
| Average Per Firm | 18.6 | 120 | 31.8 | 157.6 | 43.9 | 13.9 | 25 | 28.3 | 15.4 | 20.2 | 43.4 | 4.6 | 27.9 | 37.7 | 26.9 | 22.6 | 43.3 | 30.2 | 57.5 | 33.7 |
| Non-Abutting | 210 | - | 965 | 171 | 1346 | 116 | 10 | 22 | 176 | 324 | - | - | - | - | - | 326 | 10 | 987 | 347 | 1670 |
| Total Responses | 8 | - | 40 | 4 | 52 | 7 | 1 | 3 | 14 | 25 | - | - | - | - | - | 15 | 1 | 43 | 18 | 77 |
| No Response | 10 | - | 28 | 5 | 46 | 3 | 1 | 4 | 15 | 23 | - | - | - | - | - | 13 | 4 | 32 | 20 | 69 |
| Average Per Firm | 26.3 | - | 24.1 | 42.8 | 25.9 | 16.6 | 10 | 7.3 | 12.6 | 12.9 | - | - | - | - | - | 21.7 | 10 | 22.9 | 19.3 | 21.7 |

**Estimated Range of Gross Sales**

Abutting and non-abutting businesses were asked to provide information on the range of their gross sales; the distribution of coded responses is presented in Table 9 by study area and by design sub-area. Table 14 clearly reveals that the distribution is varied across grade levels, across distance zones (as indicated by abutting and non-abutting properties), and across study areas.

In the Lubbock study area, almost 39% of those surveyed on abutting elevated sections reported sales in the million dollar range; on depressed segments, the bulk of the respondents reported sales levels of less than $50,000 average per year, and on at-grade segments almost 67% reported sales in the $750,000 to million dollar range. For both abutting and non-abutting sections combined, almost 50% earned over $750,000 average per year. The mean gross sales level for non-abutting businesses was higher than that for abutting businesses. Further, within abutting sections, businesses within control segments at-grade had the highest average gross sales levels of $740,000 in comparison to $350,000 and $400,000 for businesses adjacent depressed and elevated sections, respectively.

Almost 67% of abutting businesses surveyed in study area 2 (Houston) earned over a million dollars per year on elevated sections, and the remaining averaged between $200,000 to $300,000; on the depressed segments, all respondents belonged to the $100,000-$200,000 range. The average gross sales for all businesses in the Houston study area was $395,000.

In the case of San Antonio, the number of abutting respondents in the million dollar range varied from 51% on elevated sections to 29% on depressed segments; the number of non-abutting business respondents in the million dollar range varied from 20% on elevated sections to 67% on depressed segments. The situation here is very similar to the Lubbock study area. Businesses on non-abutting sections had higher mean gross sales than those on abutting sections. Also, businesses on depressed segments had lower gross sales ($279,000) than businesses located adjacent elevated segments ($495,000), while businesses located on control segments had the highest average gross sales levels ($740,000).

## Table 14. Range of Gross Sales of Abutting and Non-Abutting Businesses by Study Area and by Design Sub-Area

| Range of Gross Sales | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1:Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting & Non-Abut.** |
| < $50,000 | 15.4 | 0.0 | 50.0 | 0.0 | 0.0 | - | 20.0 | 0.0 | 11.8 |
| $50,000-$100,000 | 7.7 | 0.0 | 25.0 | 0.0 | 0.0 | - | 10.0 | 0.0 | 5.9 |
| $100,001-$200,000 | 23.1 | 12.5 | 0.0 | 33.3 | 0.0 | - | 15.0 | 21.4 | 12.6 |
| $200,001-$300,000 | 7.7 | 0.0 | 0.0 | 0.0 | 33.3 | - | 10.0 | 0.0 | 5.9 |
| $300,001-$500,000 | 0.0 | 25.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 14.3 | 5.9 |
| $500,001-$750,000 | 7.7 | 0.0 | 0.0 | 0.0 | 0.0 | - | 5.0 | 0.0 | 2.9 |
| $750,001-$1,000,000 | 0.0 | 25.0 | 0.0 | 0.0 | 66.7 | - | 10.0 | 14.3 | 11.8 |
| > $1,000,000 | 38.5 | 37.5 | 25.0 | 66.7 | 0.0 | - | 30.0 | 50.0 | 38.2 |
| Mean gross sales level | 400,000 | 620,000 | 350,000 | 500,000 | 740,000 | - | 496,667 | 560,000 | 528,310 |
| Total Responses | N=13 | N=8 | N=4 | N=6 | N=3 | - | N=20 | N=14 | N=34 |
| **Study Area 2:Houston** | | | | | | | | | |
| < $50,000 | 0.0 | - | - | - | 0.0 | - | 0.0 | - | 0.0 |
| $50,000-$100,000 | 0.0 | - | - | - | 0.0 | - | 0.0 | - | 0.0 |
| $100,001-$200,000 | 0.0 | - | - | - | 100.0 | - | 40.0 | - | 40.0 |
| $200,001-$300,000 | 33.3 | - | - | - | 0.0 | - | 20.0 | - | 20.0 |
| $300,001-$500,000 | 0.0 | - | - | - | 0.0 | - | 0.0 | - | 0.0 |
| $500,001-$750,000 | 0.0 | - | - | - | 0.0 | - | 0.0 | - | 0.0 |
| $750,001-$1,000,000 | 0.0 | - | - | - | 0.0 | - | 0.0 | - | 0.0 |
| > $ 1,000,000 | 66.7 | - | - | - | 0.0 | - | 40.0 | - | 40.0 |
| Mean gross sales level | 690,000 | - | - | - | 100,000 | - | 395,000 | - | 395,000 |
| Total Responses | N=3 | - | - | - | N=2 | - | N=5 | - | N=5 |

## Table 14. Range of Gross Sales of Abutting and Non-Abutting Businesses by Study Area and by Design Sub-Area (continued)

| Range of Gross Sales | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting & Non-Abut.** |
| < $50,000 | 4.4 | 24.0 | 14.3 | 0.0 | 0.0 | - | 6.8 | 21.4 | 11.5 |
| $50,000-$100,000 | 11.1 | 16.0 | 7.1 | 0.0 | 0.0 | - | 10.2 | 14.3 | 11.5 |
| $100,001-$200,000 | 11.1 | 8.0 | 14.3 | 0.0 | 8.3 | - | 13.6 | 7.1 | 11.5 |
| $200,001-$300,000 | 2.2 | 0.0 | 14.3 | 0.0 | 16.7 | - | 8.5 | 0.0 | 5.7 |
| $300,001-$500,000 | 6.7 | 12.0 | 14.3 | 0.0 | 8.3 | - | 10.2 | 10.7 | 15.8 |
| $500,001-$750,000 | 8.9 | 12.0 | 0.0 | 33.3 | 8.3 | - | 8.5 | 14.3 | 15.8 |
| $750,001-$1,000,000 | 4.4 | 8.0 | 7.1 | 0.0 | 8.3 | - | 6.8 | 7.1 | 6.9 |
| > $1,000,000 | 51.1 | 20.0 | 28.6 | 66.7 | 50.0 | - | 55.9 | 25.0 | 45.9 |
| Mean gross sales level | 495,000 | 228,000 | 279,000 | 865,000 | 670,000 | - | 481,333 | 546,500 | 513, 900 |
| Total Responses | N=45 | N=25 | N=14 | N=3 | N=12 | - | N=59 | N=28 | N=87 |
| **Study Area 4: Dallas** | | | | | | | | | |
| < $50,000 | 0.0 | 0.0 | 8.3 | 0.0 | 0.0 | - | 5.9 | 0.0 | 3.3 |
| $50,000-$100,000 | 0.0 | 0.0 | 8.3 | 11.1 | 100.0 | - | 11.8 | 7.7 | 10.0 |
| $100,001-$200,000 | 0.0 | 0.0 | 8.3 | 11.1 | 0.0 | - | 5.9 | 7.7 | 6.7 |
| $200,001-$300,000 | 25.0 | 0.0 | 8.3 | 11.1 | 0.0 | - | 11.8 | 7.7 | 10.0 |
| $300,001-$500,000 | 0.0 | 25.0 | 0.0 | 11.1 | 0.0 | - | 0.0 | 15.4 | 6.7 |
| $500,001-$750,000 | 0.0 | 25.0 | 8.3 | 22.2 | 0.0 | - | 5.9 | 23.1 | 13.3 |
| $750,001-$1,000,000 | 0.0 | 25.0 | 16.7 | 11.1 | 0.0 | - | 11.8 | 15.4 | 13.3 |
| > $ 1,000,000 | 75.0 | 25.0 | 41.7 | 22.2 | 0.0 | - | 47.1 | 23.1 | 36.7 |
| Mean gross sales level | 750,000 | 680,000 | 560,000 | 380,000 | 50,000 | - | 453,333 | 530,000 | 491,650 |
| Total Responses | N=4 | N=4 | N=12 | N=9 | N=1 | - | N=17 | N=13 | N=30 |

**Table 14. Range of Gross Sales of Abutting and Non-Abutting Businesses by Study Area and by Design Sub-Area (continued)**

| Range of Gross Sales | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting & Non-Abut.** |
| < $50,000 | 6.2 | 21.6 | 17.7 | 0.0 | 0.0 | - | 8.0 | 14.5 | 10.2 |
| $50,000-$100,000 | 9.2 | 8.1 | 10.3 | 5.6 | 5.6 | - | 8.9 | 7.3 | 8.4 |
| $100,001-$200,000 | 12.3 | 5.4 | 10.3 | 16.7 | 16.7 | - | 12.5 | 9.1 | 11.4 |
| $200,001-$300,000 | 6.2 | 5.4 | 10.3 | 5.6 | 16.7 | - | 8.9 | 5.5 | 7.8 |
| $300,001-$500,000 | 4.6 | 10.8 | 6.4 | 5.6 | 5.6 | - | 5.4 | 9.1 | 6.6 |
| $500,001-$750,000 | 7.7 | 16.2 | 3.4 | 16.7 | 5.6 | - | 6.3 | 16.4 | 9.6 |
| $750,001-$1,000,000 | 3.1 | 8.1 | 10.3 | 5.6 | 16.7 | - | 7.1 | 7.3 | 7.2 |
| > $1,000,000 | 50.8 | 24.3 | 31.0 | 44.4 | 33.3 | - | 42.9 | 30.9 | 38.9 |
| Mean gross sales value | 583,750 | 509,300 | 396,330 | 581,670 | 390,000 | - | 456,583 | 545,500 | 501,040 |
| Total Responses | N=65 | N=37 | N=29 | N=18 | N=18 | - | N=112 | N=55 | N=167 |

Seventy-five percent of the abutting businesses located adjacent to elevated sections in the Dallas study area reported sales in the million dollar range, and 25% were in the $200,000-$300,000 range. The distribution is more spread out in the depressed segments in the case of both abutting and non-abutting businesses. All respondents located adjacent to the at-grade sections belonged to the $50,000-$100,000 range. Businesses on at-grade segments had the lowest average gross sales ($50,000), while businesses located adjacent elevated segments had the highest average gross sales.

In all the study areas, in general, the average gross sales of businesses on non-abutting sections exceeds that of businesses on abutting sections. For all study areas combined, businesses with sales levels of over a million dollars represent the largest single category of respondents to the survey on all design sub-areas combined for both types of firms, those abutting the study freeways, and those located on non-abutting sections. Thirty-nine percent of the entire sample belong to this category, suggesting that this group of businesses is very well represented in the sample. On the other end of the scale, 10% of the total sample surveyed reported sales levels of less than $50,000, the next largest single category of respondents.

The tables show that all categories of firms are well represented in the surveys overall. This is true for all study areas individually, with the exception of the Houston study area.

## OPINIONS OF BUSINESSES CONCERNING LOCATION

One of the main objectives of the study was to determine the opinion of businesses located near the freeway concerning the preferred location of businesses with respect to the freeway.

The degree to which a business has a favorable attitude to the presence of the freeway can be assumed to be a function of the amount of satisfaction it feels towards its location relative to the freeway, and whether it views the freeway as enhancing this utility or detracting from it.

This section examines the responses of businesses to a series of questions asked to determine the following: 1) description of the present location, 2) the reasons for locating at their present location, 3) the main advantages and disadvantages of being at present location, and 4) the extent to which the businesses perceive that the area has changed since the time they have been in business and since the construction of the freeway.

The main focus of the analysis in this section of the report was to relate the opinions of abutting businesses towards the freeway to some variable that could be controlled in the design and construction of future freeways. In this regard, one of the major concerns in this report was whether opinions varied significantly by type of freeway design (grade level). Just as the characteristics of surveyed businesses were grouped by design sub-area within study areas, opinions of the same businesses are also grouped likewise in order to arrive at some general conclusions about the study area businesses on the one hand and their perceptions on the other.

Hypotheses of significant differences in respondent opinions by design sub-area are subjected to statistical tests whenever appropriate with the aid of contingency tables. These tests are designed to detect whether responses of businesses and grade level differences are independent or correlated. The most popular tests are the chi-square tests. However, there are situations when these tests are of questionable value. This occurs when 1) sample sizes are small and 2) individual cells in contingency tables have observed frequencies equal or very close to zero, that is, individual cell counts are very small. It is well established in the statistical literature on chi-squared testing that the presence of empty cells and sparse tables cause poor chi-squared approximations for goodness-of-fit statistics. This problem was often encountered in the analysis of the surveys administered in the four study areas. Some possible solutions to this problem include:

—Combine categories of variables/responses to obtain larger cell counts. This should only be done when there is a natural way to combine the responses and there is little information loss in defining the variable more crudely.

—Use of exact small-sample methods. One example of an exact test is the Fisher's Exact Test Statistic for general ($i \times j$) tables. This test estimates a p-value which is the null probability that the chi-square is at least as large as the observed value, the calculation being done using the exact distribution rather than the large-sample chi-squared distribution.

In most situations in this report, the latter method has been adopted, and wherever appropriate, Fisher's test statistic is also reported along with standard chi-square tests. When only the chi-square statistic is reported with the original p-value, statistical significance is assessed by the size of the p-value or by comparing the computed chi-square statistic to the critical value. When the sample size is small, the original p-value is replaced by the Fisher's statistic. The Fisher's statistic represents the modified probability (p-value) of the observed chi-square. A p-value equal to or greater than .05 indicates the presence of a statistically significant correlation between the variables in concern with 95% confidence level or more. Both the original probability (p-value) as well as the Fisher's statistic p-value are reported. This is done because there were situations, albeit very few, where the original chi-square probability indicated the presence of a relation (no-relation) which was contradicted by the Fisher's statistic. This can occur when the original p-value is of the magnitude of .05 or less (suggesting a correlation between two variables with 95% confidence or more) and the Fisher's statistic is greater than .05, contradicting the presence of the relation. When response categories were large in number and fairly similar, a combination of grouping response categories and exact methods were used. Furthermore, open-ended questions such as "What are the main advantages/disadvantages of being in business at this location?" were not subjected to such statistical tests. The reason for this was that a large variety of responses were elicited, and there was no way to group responses without losing information.

In studying the effect of an explanatory variable 'X' on a response variable 'Y', one should try to control for factors that could potentially influence that relationship through another control variable 'Z'. Therefore, instead of using two-way contingency table analysis, another technique that is made use of in this report is called *meta analysis*. Meta analysis is the process of combining the statistical results from different studies to arrive at a general conclusion about the question in concern. Meta analysis controls for differences in study areas ('Z' variable), while assessing the strength of the relationship between the 'X' variable (grade level) and the 'Y' variable (opinion/perceptions). This is essentially a three-way contingency analysis instead of a two-way analysis. Since study areas differ from each other in many respects, this approach is justifiable. Instead of individual chi-square statistics, the test is based on Cochran-Mantel-Haenszel type (CMH) statistics. This technique is used wherever appropriate in the sense that it was conducted only if there was information to gain in the combined analysis of relevant questions.

**Description of Present Location**

Each business was asked to describe the present location, and these opinions are described in Table 15 below. The table is organized in a way such that the "% Yes" column indicates the percentage of total respondents who thought the location had that attribute, while the "% No" column indicates the percentage of total respondents who believed the location did not have the attribute. Again, percentages are based on total number of respondents, and the percentages do not add up because of multiple responses; this is typical of questions which target attribute(s).

## Table 15. Abutting Businesses: Description of Present Location

| Description of Location | Elevated % Yes | Elevated % No | Depressed %Yes | Depressed % No | At-Grade % Yes | At-Grade %No | All Design Sub-Areas % Yes | All Design Sub-Areas % No |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **N=38** | | **N=16** | | **N=17** | | **N=71** | |
| Nice | 18.4 | 18.4 | 18.8 | 12.5 | 11.8 | 17.7 | 16.9 | 16.9 |
| So-so | 15.8 | 26.3 | 25.0 | 18.8 | 29.4 | 11.8 | 21.1 | 21.1 |
| Accessible | 60.5 | 18.4 | 37.5 | 37.5 | 88.2 | 5.9 | 61.9 | 19.7 |
| Active | 23.7 | 7.9 | 31.3 | 0.0 | 82.4 | 0.0 | 39.4 | 4.2 |
| Safe | 23.7 | 23.7 | 25.0 | 43.8 | 52.9 | 17.7 | 30.9 | 26.8 |
| Convenient | 57.9 | 7.9 | 12.5 | 50.0 | 58.8 | 5.9 | 47.9 | 16.9 |
| Stable | 26.3 | 10.5 | 18.8 | 0.0 | 70.6 | 0.0 | 35.2 | 5.6 |
| Well-kept | 26.3 | 21.1 | 25.0 | 31.3 | 41.2 | 11.8 | 29.6 | 21.1 |
| Spacious | 39.5 | 7.9 | 25.0 | 6.3 | 52.9 | 11.8 | 39.4 | 8.5 |
| **Study Area 2: Houston** | **N=14** | | **N=5** | | **N=8** | | **N=27** | |
| Nice | 50.0 | 0.0 | 60.0 | 20.0 | 25.0 | 25.0 | 44.4 | 11.1 |
| So-so | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | 12.5 | 3.7 | 3.7 |
| Accessible | 28.6 | 35.7 | 20.0 | 20.0 | 37.5 | 12.5 | 29.6 | 25.9 |
| Active | 21.4 | 14.3 | 40.0 | 20.0 | 0.0 | 12.5 | 18.5 | 14.8 |
| Safe | 14.3 | 7.1 | 60.0 | 0.0 | 25.0 | 25.0 | 25.9 | 11.1 |
| Convenient | 42.9 | 21.4 | 20.0 | 20.0 | 37.5 | 25.0 | 37.0 | 22.2 |
| Stable | 21.4 | 0.0 | 20.0 | 0.0 | 37.5 | 0.0 | 25.9 | 0.0 |
| Well-kept | 42.9 | 7.1 | 60.0 | 0.0 | 37.5 | 12.5 | 44.4 | 7.4 |
| Spacious | 28.6 | 0.0 | 0.0 | 0.0 | 25.0 | 0.0 | 22.2 | 0.0 |

## Table 15. Abutting Businesses: Description of Present Location (continued)

| Description of Location | Elevated % Yes | Elevated % No | Depressed %Yes | Depressed % No | At-Grade % Yes | At-Grade %No | All Design Sub-Areas % Yes | All Design Sub-Areas % No |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | N=117 | | N=33 | | N=53 | | N=203 | |
| Nice | 29.1 | 11.1 | 42.4 | 12.1 | 39.6 | 7.6 | 34.0 | 10.3 |
| So-so | 14.5 | 13.7 | 6.1 | 9.1 | 15.1 | 5.7 | 13.3 | 10.8 |
| Accessible | 63.3 | 16.2 | 48.5 | 15.2 | 56.6 | 18.9 | 59.1 | 16.8 |
| Active | 47.0 | 4.3 | 48.5 | 12.1 | 37.7 | 1.9 | 44.8 | 4.9 |
| Safe | 31.6 | 17.1 | 42.4 | 15.2 | 24.5 | 17.0 | 31.5 | 16.8 |
| Convenient | 56.4 | 5.1 | 57.6 | 18.2 | 49.1 | 7.6 | 54.7 | 7.9 |
| Stable | 31.6 | 0.9 | 33.3 | 3.0 | 28.3 | 0.0 | 31.0 | 1.0 |
| Well-kept | 42.8 | 5.1 | 60.6 | 6.1 | 45.3 | 0.0 | 46.3 | 3.9 |
| Spacious | 30.8 | 10.3 | 33.3 | 6.1 | 33.9 | 5.7 | 32.0 | 8.4 |
| **Study Area 4: Dallas** | N=17 | | N=34 | | N=8 | | N=59 | |
| Nice | 41.2 | 5.9 | 29.4 | 20.6 | 12.5 | 25.0 | 30.5 | 17.0 |
| So-so | 17.7 | 11.8 | 11.8 | 2.9 | 12.5 | 50.0 | 13.6 | 11.9 |
| Accessible | 47.1 | 17.7 | 58.8 | 14.7 | 62.5 | 12.5 | 55.9 | 15.3 |
| Active | 23.5 | 23.5 | 50.0 | 5.9 | 62.5 | 0.0 | 44.1 | 10.2 |
| Safe | 0.0 | 23.5 | 35.3 | 11.8 | 12.5 | 12.5 | 22.0 | 15.3 |
| Convenient | 29.4 | 11.8 | 55.9 | 8.8 | 75.0 | 0.0 | 50.9 | 8.5 |
| Stable | 41.2 | 0.0 | 44.1 | 0.0 | 12.5 | 0.0 | 38.9 | 0.0 |
| Well-kept | 29.4 | 11.8 | 41.2 | 2.9 | 0.0 | 37.5 | 32.2 | 10.2 |
| Spacious | 47.1 | 17.7 | 17.7 | 14.7 | 0.0 | 0.0 | 23.7 | 13.6 |

**Table 15. Abutting Businesses: Description of Present Location (continued)**

| Description of Location | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | % Yes | % No | %Yes | % No | % Yes | %No | % Yes | % No |
| **All Study Areas Combined** | N=186 | | N=88 | | N=86 | | N=360 | |
| Nice | 30.0 | 11.0 | 34.0 | 16.0 | 30.0 | 13.0 | 31.0 | 13.0 |
| So-so | 15.0 | 15.0 | 11.0 | 8.0 | 16.0 | 12.0 | 14.0 | 13.0 |
| Accessible | 59.0 | 18.0 | 49.0 | 19.0 | 62.0 | 15.0 | 57.0 | 18.0 |
| Active | 38.0 | 8.0 | 45.0 | 8.0 | 45.0 | 2.0 | 42.0 | 6.0 |
| Safe | 26.0 | 18.0 | 38.0 | 18.0 | 29.0 | 17.0 | 29.0 | 18.0 |
| Convenient | 53.0 | 8.0 | 47.0 | 20.0 | 52.0 | 8.0 | 51.0 | 11.0 |
| Stable | 31.0 | 3.0 | 34.0 | 1.0 | 36.0 | 0.0 | 33.0 | 2.0 |
| Well-kept | 38.0 | 9.0 | 47.0 | 9.0 | 40.0 | 7.0 | 41.0 | 9.0 |
| Spacious | 34.0 | 10.0 | 24.0 | 9.0 | 34.0 | 6.0 | 31.0 | 9.0 |

Accessibility of the present location is one of the most frequently cited attributes for all study areas, and it was cited 57% for all study areas combined. This response is closely followed by convenience, which was mentioned 51% of the time. A very small percentage of the responses, only 2%, believed that the location is unstable, for all study areas combined.

The evaluation of these responses presents a perception of the neighborhood from the perspective of businesses abutting the study freeways as well as the accessibility of the location.

Lubbock: Almost 62% of the businesses who responded to the survey mentioned that the study sections were very accessible. Forty-eight percent mentioned convenience. However, accessibility and convenience were cited most frequently (88% and 59% of the time, respectively) on at-grade (control) sections and more frequently on elevated sections than on depressed sections. On depressed sections, only 13% said the location was convenient, while almost 50% of the businesses felt otherwise, and businesses' responses to accessibility were ambiguous. Furthermore, positive neighborhood attributes such as safe, stable, well-kept, and spacious were all cited most often on at-grade sections and also more frequently on elevated sections than on depressed sections. Negative attributes such as unsafe and ill-kept neighborhoods were cited most frequently on depressed sections. Active neighborhoods were cited most frequently on at-grade sections and more frequently on depressed than elevated sections, indicating traffic levels.

Houston: Sixty percent of businesses located adjacent to depressed sections of the freeway responded that the area was nice, safe, and well-kept. These responses were cited most frequently on depressed sections in comparison to elevated and at-grade sections. Accessibility was cited most often on at-grade sections (38%); on elevated segments, a greater percentage thought the area was inaccessible in comparison to those who thought it was accessible. Convenience was cited most frequently by businesses located adjacent to elevated sections (43%) and was cited by 37% of businesses overall. Forty-four percent of the abutting businesses mentioned the area was nice, while less than 4% thought it was so-so. None of the businesses believed that the area was unstable or not spacious.

San Antonio: Accessibility and convenience were cited 59% and 55% of the time, on all design sub-areas combined, and these were the most frequently cited attributes of the area. Forty-six percent of the abutting businesses thought the area was well-kept, and 34% responded that the area was nice. Again, positive neighborhood type attributes such as safe, stable, well-kept, nice, convenient, and spacious were all cited most frequently on depressed sections of the study area. However, accessibility and convenience were cited most frequently on elevated sections (63% and 56% of the time, respectively).

Dallas: Accessibility and convenience were cited 56% and 51% of the time, respectively, on all design sub-areas combined. These two responses were again cited most frequently on the at-grade sections and more often on depressed segments than on elevated segments. Sixty-three percent of the respondents also thought that the activity level was highest on the at-grade sections. Attributes like safe, stable, and well-kept were all cited most frequently on depressed segments (35%, 44%, and 41% of the time respectively). Other neighborhood qualities such as nice and spacious were cited most frequently on elevated segments (41%

and 47% of the time, respectively). 'Active neighborhood' was cited most frequently on the at-grade segment, and again more frequently on the depressed segment of North Central Expressway than on the elevated segment.

### Reasons for Locating at Present Address

Respondents were asked to list the major reasons for selecting the present location. The distribution of coded responses is included in Table 16. The most frequent response that was given by businesses (for all study areas combined) was "convenience" followed by "customer market" and "price of real estate." Abutting businesses in all study areas did not consider "landscape" as an important reason at all, and less than 6% of the respondents mentioned it as one of the factors for locating at the present address.

In the Lubbock I-27 area, price and convenience were cited most often. Price was cited approximately 41% of the time, and convenience was cited 51% of the time. The frequency of responses mentioning convenience ranged from 33% on the depressed section to 57% on the at-grade section.

In the Houston study area, customer market, convenience, and type of area were cited most often. Substantial differences are observed in the responses by freeway grade level. For example, 75% of the businesses adjacent the at-grade segments mentioned convenience while 40% cited it on elevated segments, and only 25% cited it on depressed segments. Overall, convenience was cited by 50% of the 22 respondents. Customer market was cited by 55% of the respondents overall, with almost 90% of the respondents on elevated segments citing it as an important factor. Type of area was cited by 40% of the respondents overall; traffic patterns were cited by 32% and 'took over existing business' by another 23%.

Responses from the San Antonio study sections did not show a great variation by design sub-area. Convenience was cited by 58% of the respondents; 41% of the respondents mentioned customer market; 27% mentioned price, type of area, and 'took over existing business' individually; 28% mentioned traffic patterns as deciding factors, and another 2% mentioned landscape.

**Table 16. Percentage Distribution of Abutting Businesses' Responses to the Question "What Are the Main Reasons You Decided to Locate at This Address" by Design Sub-Area**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Price | 46.0 | 46.7 | 23.5 | 40.6 |
| Convenience | 56.8 | 33.3 | 52.9 | 50.7 |
| Type of area | 21.6 | 20.0 | 5.9 | 17.4 |
| Customer market | 18.9 | 20.0 | 23.5 | 20.3 |
| Traffic patterns | 24.3 | 40.0 | 41.2 | 31.9 |
| Took over existing business | 13.5 | 13.3 | 29.4 | 17.4 |
| Landscape | 2.7 | 0.0 | 0.0 | 1.5 |
| Other responses (building type) | 8.1 | 0.0 | 5.9 | 5.8 |
| Total number of responses | N=37 | N=15 | N=17 | N=69 |
| **Study Areas 2: Houston** | | | | |
| Price | 20.0 | 25.0 | 25.0 | 22.7 |
| Convenience | 40.0 | 25.0 | 75.0 | 50.0 |
| Type of area | 40.0 | 50.0 | 37.5 | 40.9 |
| Customer market | 90.0 | 50.0 | 12.5 | 54.6 |
| Traffic patterns | 40.0 | 50.0 | 12.5 | 31.8 |
| Took over existing business | 10.0 | 50.0 | 25.0 | 22.7 |
| Landscape | 0.0 | 0.0 | 0.0 | 0.0 |
| Other responses (building type) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total number of responses | N=10 | N=4 | N=8 | N=22 |

**Table 16. Percentage Distribution of Abutting Businesses' Responses to the Question "What Are the Main Reasons You Decided to Locate at This Address" by Design Sub-Area (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | | | | |
| Price | 27.9 | 25.8 | 25.0 | 26.7 |
| Convenience | 57.7 | 58.1 | 57.7 | 57.8 |
| Type of area | 21.2 | 41.9 | 30.8 | 27.3 |
| Customer market | 39.4 | 41.9 | 42.3 | 40.6 |
| Traffic patterns | 25.0 | 32.3 | 30.8 | 27.8 |
| Took over existing business | 29.8 | 25.8 | 21.2 | 26.7 |
| Landscape | 1.9 | 3.2 | 0.0 | 1.6 |
| Other responses (building type) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total number of responses | N=104 | N=31 | N=52 | N=187 |
| **Study Area 4: Dallas** | | | | |
| Price | 30.8 | 41.9 | 75.0 | 44.2 |
| Convenience | 46.2 | 67.7 | 75.0 | 63.5 |
| Type of area | 23.1 | 22.6 | 0.0 | 19.2 |
| Customer market | 53.9 | 51.6 | 12.5 | 46.2 |
| Traffic patterns | 30.8 | 25.8 | 12.5 | 25.0 |
| Took over existing business | 23.1 | 16.1 | 25.0 | 19.2 |
| Landscape | 0.0 | 9.7 | 0.0 | 5.8 |
| Other responses (building type) | 0.0 | 0.0 | 0.0 | 0.0 |
| Total number of responses | N=13 | N=31 | N=8 | N=52 |

**Table 16. Percentage Distribution of Abutting Businesses' Responses to the Question "What Are the Main Reasons You Decided to Locate at This Address" by Design Sub-Area (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All study Areas Combined** | | | | |
| Price | 32.0 | 36.0 | 29.0 | 32.0 |
| Convenience | 55.0 | 56.0 | 60.0 | 57.0 |
| Type of area | 23.0 | 31.0 | 24.0 | 25.0 |
| Customer market | 39.0 | 42.0 | 33.0 | 38.0 |
| Traffic patterns | 26.0 | 32.0 | 29.0 | 28.0 |
| Took over existing business | 24.0 | 21.0 | 24.0 | 23.0 |
| Landscape | 2.0 | 5.0 | 0.0 | 2.0 |
| Other responses (building type) | 2.0 | 0.0 | 1.0 | 1.0 |
| Total number of responses | N= 164 | N= 81 | N=85 | N=330 |

Sixty-four percent of the respondents in the Dallas study section mentioned convenience as a reason for locating at the present address; 46% mentioned customer market; 44% mentioned price. Only 19% of the respondents cited each of the factors 'type of area' and 'took over existing business' as reasons for selecting the present location. Landscape was mentioned by only 6% of the respondents; all of them were located adjacent depressed segments of the study section.

## Main Advantages of Being at Present Location

Respondents were asked open-ended questions on the advantages of being at the present location, and the distribution of responses is presented in Table 17. The responses are found to vary significantly both by study area and by design sub-area. The percentages do not add up in Tables 17 and 18 because of multiple responses. In Study Area 1 (Lubbock), accessibility was cited 35% of the time on all design sub-areas combined as an important advantage. This was followed by price/rent and convenience cited 17% and 15% of the time, respectively.

**Table 17. Distribution of Responses to the Question "What Are the Main Advantages of Being in Business at This Location?" by Design Sub-Area**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Accessibility | 42.9 | 16.7 | 25.0 | 34.8 |
| Convenience | 25.0 | 0.0 | 0.0 | 15.2 |
| Customer market | 3.6 | 0.0 | 25.0 | 8.7 |
| Price/rent | 25.0 | 16.7 | 0.0 | 17.4 |
| Parking | 10.7 | 0.0 | 0.0 | 6.5 |
| Visibility | 7.1 | 0.0 | 8.3 | 6.5 |
| Total number of responses | N=28 | N=6 | N=12 | N=46 |
| **Study Areas 2: Houston** | | | | |
| Accessibility | 18.2 | 0.0 | 20.0 | 15.0 |
| Convenience | 9.1 | 0.0 | 60.0 | 20.0 |
| Customer market | 45.4 | 25.0 | 20.0 | 35.0 |
| Price/rent | 0.0 | 0.0 | 20.0 | 5.0 |
| Neighborhood | 18.2 | 50.0 | 0.0 | 20.0 |
| Visibility | 9.1 | 0.0 | 0.0 | 5.0 |
| Total number of responses | N=11 | N=4 | N=5 | N=20 |

**Table 17. Distribution of Responses to the Question "What Are the Main Advantages of Being in Business at This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | | | | |
| Accessibility | 31.0 | 28.6 | 36.8 | 32.1 |
| Convenience | 18.0 | 14.3 | 15.8 | 16.9 |
| Customer market | 38.0 | 47.6 | 39.5 | 39.6 |
| Price/rent | 5.0 | 9.5 | 7.9 | 6.3 |
| Neighborhood | 23.0 | 23.8 | 26.3 | 23.9 |
| Parking | 1.0 | 0.0 | 0.0 | 0.6 |
| Central | 18.0 | 0.0 | 10.5 | 13.8 |
| Visibility | 6.0 | 9.5 | 28.9 | 11.9 |
| Total number of responses | N=100 | N=60 | N=61 | N=275 |
| **Study Areas 4: Dallas** | | | | |
| Accessibility | 46.7 | 20.7 | 50.0 | 32.0 |
| Convenience | 6.7 | 27.6 | 33.3 | 22.0 |
| Customer market | 6.7 | 13.8 | 16.7 | 12.0 |
| Price/rent | 6.7 | 3.5 | 33.3 | 8.0 |
| Neighborhood | 0.0 | 6.9 | 0.0 | 4.0 |
| Parking | 6.7 | 3.5 | 0.0 | 4.0 |
| Visibility | 6.7 | 13.8 | 0.0 | 10.0 |
| Total number of responses | N=15 | N=29 | N=6 | N= 50 |

**Table 17. Distribution of Responses to the Question "What Are the Main Advantages of Being in Business at This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All Study Areas Combined** | | | | |
| Accessibility | 33.8 | 21.7 | 34.4 | 31.3 |
| Convenience | 17.5 | 18.3 | 18.0 | 17.8 |
| Customer market | 29.2 | 25.0 | 32.8 | 29.1 |
| Price/rent | 8.4 | 6.7 | 9.8 | 8.4 |
| Neighborhood | 16.2 | 15.0 | 16.4 | 16.0 |
| Parking | 3.3 | 1.7 | 0.0 | 2.2 |
| Central | 11.7 | 0.0 | 6.6 | 8.0 |
| Visibility | 6.5 | 10.0 | 19.7 | 10.2 |
| Total number of responses | N=154 | N=60 | N=61 | N=275 |

**Table 18. Distribution of Responses to the Question "What Are the Main Disadvantages of Being in Business at This Location?" by Design Sub-Area**

| Lack of | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Accessibility | 23.1 | 33.3 | 12.5 | 23.9 |
| Convenience | 0.0 | 0.0 | 25.0 | 4.4 |
| Customer market | 7.7 | 0.0 | 0.0 | 4.4 |
| Price/rent | 0.0 | 0.0 | 0.0 | 0.0 |
| Neighborhood | 30.8 | 25.0 | 12.5 | 26.1 |
| Parking | 7.7 | 8.3 | 12.5 | 8.7 |
| Visibility | 15.4 | 25.0 | 12.5 | 17.4 |
| Total number of responses | N=26 | N=12 | N=8 | N=46 |
| **Study Areas 2: Houston** | | | | |
| Accessibility | 44.4 | 75.0 | 20.0 | 44.4 |
| Convenience | 11.1 | 0.0 | 0.0 | 5.6 |
| Visibility | 22.2 | 0.0 | 20.0 | 16.7 |
| Total number of responses | N=9 | N=4 | N=5 | N=18 |

**Table 18. Distribution of Responses to the Question "What Are the Main Disadvantages of Being in Business at This Location?" by Design Sub-Area (continued)**

| Lack of | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | | | | |
| Accessibility | 22.7 | 47.4 | 60.6 | 36.2 |
| Convenience | 4.0 | 0.0 | 18.2 | 7.1 |
| Customer market | 4.0 | 10.5 | 6.1 | 5.5 |
| Price/rent | 4.0 | 0.0 | 3.0 | 3.2 |
| Neighborhood | 38.7 | 21.1 | 27.3 | 33.1 |
| Parking | 6.7 | 0.0 | 0.0 | 3.9 |
| Visibility | 21.3 | 21.1 | 3.0 | 16.5 |
| Total number of responses | N=75 | N=19 | N=33 | N=127 |
| **Study Areas 4: Dallas** | | | | |
| Accessibility | 14.3 | 35.7 | 33.3 | 29.2 |
| Convenience | 21.4 | 0.0 | 16.7 | 8.3 |
| Customer market | 0.0 | 0.0 | 0.0 | 0.0 |
| Price/rent | 0.0 | 7.1 | 0.0 | 4.2 |
| Neighborhood | 14.3 | 10.7 | 0.0 | 10.4 |
| Parking | 0.0 | 0.0 | 0.0 | 0.0 |
| Visibility | 7.1 | 0.0 | 16.7 | 4.2 |
| Total number of responses | N=14 | N=28 | N=6 | N=48 |

**Table 18. Distribution of Responses to the Question "What Are the Main Disadvantages of Being in Business at This Location?" by Design Sub-Area (continued)**

| Lack of | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All Study Areas Combined** | | | | |
| Accessibility | 23.4 | 41.3 | 46.2 | 33.1 |
| Convenience | 5.7 | 0.0 | 17.3 | 6.7 |
| Customer market | 4.0 | 3.2 | 3.9 | 3.8 |
| Price/rent | 2.4 | 3.2 | 1.9 | 2.5 |
| Neighborhood | 31.5 | 15.9 | 19.2 | 24.7 |
| Parking | 5.7 | 1.6 | 1.9 | 3.8 |
| Visibility | 18.6 | 11.1 | 7.7 | 14.2 |
| Total number of responses | N=124 | N=63 | N=52 | N=239 |

Furthermore, not surprisingly, visibility was cited only on the at-grade and elevated sections. Parking was also mentioned only on the elevated section. Overall, only two advantages were cited on depressed section of I-27 (#9). These were accessibility and price, each cited only about 17% of the time. Accessibility, customer market, and visibility were the only advantages cited on the at-grade segment. In contrast, businesses adjacent the elevated segment cited many more advantages. In Study Area 2 (Houston), customer market was cited 35% of the time as an important attribute of the location, followed by convenience and neighborhood. Visibility and rent were the least important attributes, cited by only about 5% of the respondents. In Study Area 3 (San Antonio), customer market was cited by 40% of the respondents as an important attribute of the location, followed by accessibility (32% of the time). Neighborhood was cited by almost 24% of the businesses as an advantage; central location was cited by 14%, and visibility was cited by another 12%. Interestingly, the visibility was cited most frequently on the at-grade sections. Parking was the least important attribute, cited less than 1% of the time. In Study Area 4 (Dallas), accessibility was cited 32% of the time on all design sub-areas combined, as an advantage of being in business at the present location. This was followed by convenience (22% of the time) and customer market

(12% of the time). Visibility was cited by 10% of the businesses. Neighborhood and parking were the least important attributes, each being cited 4% of the time. The surveys for all study areas combined indicate that accessibility was the most often cited advantage (31% of the time), followed by customer market (29% of the time). Parking was cited the least number of times as an advantage of the location (2% of the time).

**Main Disadvantages of Being at Present Location**

Businesses were once again asked open-ended questions on the disadvantages of being in business at the present location. The distribution of coded responses is presented in Table 18. In Lubbock, lack of accessibility and poor neighborhood were cited most often, 24% and 26% of the time, respectively. Lack of visibility was cited by 17% of the respondents overall; within design sub-areas lack of visibility was cited most frequently on the depressed sections. Less than 5% of the respondents on all design sub-areas combined believed that the location was inconvenient or that there was a lack of customer market. In the Houston study area, lack of accessibility was cited 44% of the time, followed by lack of visibility (17%) as disadvantages of being in business at the present location. In San Antonio and Dallas, lack of accessibility was the most often cited response, 36% and 29%, respectively. This response was followed by poor neighborhood, cited 33% and 10% of the time, respectively. Lack of accessibility was the most cited response in all study areas, both individually as well as combined (33% of the time). Bad neighborhood was the next most cited response (25% of the time) followed by visibility (14% of the time).

**Extent Area Has Changed While at Present Location**

Abutting businesses in all study areas were asked to indicate the extent to which the area had changed while being in business, and their responses are summarized in Table 19. In the analysis, non-responses were not included. Substantial differences were found in the opinions across study areas. As mentioned earlier, chi-square tests from the contingency tables were conducted for each study area individually and for all study sections combined to assess whether the differences in the frequency distribution of responses for the different design sub-areas are statistically significant. For all study areas combined, the value of the chi-square statistic with 12 degrees of freedom equals 14.65 which has a probability p-value equal to .261 which is much greater than .05. Therefore, the chi-square statistic for this contingency table is not significant. This suggests that statistically, the responses by design sub-area are not significant, or in other words, freeway elevation does not affect their responses. Responses were also studied by individual study areas to assess if there was any association between grade level differences and opinions. However, the test statistics were found to be statistically insignificant for all study areas, suggesting that there does not exist any correlation between grade level and opinions.

Figure 19 clearly shows the differences in the response patterns across study areas. Clearly, only in the case of Lubbock and San Antonio did a greater percentage feel that the area has improved since the time they located there. In the case of Houston, the percent of respondents who thought the area had improved was as large as the percent who believed there was no change in the area. A greater percentage of the Dallas study section abutting businesses felt the area had declined rather than improved.

**Table 19. Percentage Distribution of Responses to the Question "Extent Area Has Changed While Being in Business at the Present Location"**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Improved greatly | 23.1 | 6.3 | 52.9 | 26.4 |
| Improved a good bit | 20.5 | 25.0 | 11.8 | 19.4 |
| Improved little | 17.9 | 6.3 | 11.8 | 13.9 |
| No change | 15.4 | 6.3 | 17.7 | 13.9 |
| Declined little | 7.7 | 12.5 | 0.0 | 6.9 |
| Declined a good bit | 10.3 | 18.8 | 5.9 | 11.1 |
| Declined greatly | 5.1 | 25.0 | 0.0 | 8.3 |
| No response | N=3 | N=1 | N=0 | N=4 |
| Total number of responses | N=39 | N=16 | N=17 | N=72 |
| Chi-square Statistic $\chi^2(12)^6 = 20.5$ p =.058, Fisher's exact test (2-tail) p = .082 Not Significant; | | | | |
| **Study Areas 2: Houston** | | | | |
| Improved greatly | 7.7 | 20.0 | 0.0 | 7.7 |
| Improved a good bit | 15.4 | 0.0 | 0.0 | 7.7 |
| Improved little | 7.7 | 40.0 | 37.5 | 23.1 |
| No change | 38.5 | 40.0 | 37.5 | 38.5 |
| Declined little | 15.4 | 0.0 | 12.5 | 11.5 |
| Declined a good bit | 15.5 | 0.0 | 0.0 | 7.7 |
| Declined greatly | 0.0 | 0.0 | 12.5 | 3.9 |
| No response | N=1 | N=0 | N=0 | N=1 |
| Total number of responses | N=13 | N=5 | N=8 | N=26 |
| Chi-square Statistic $\chi^2(12) = 11.28$ p=.505, Fisher's Exact Test (2-tail) p =.671 Not Significant; | | | | |

[6] The figures in parentheses are degrees of freedom.

**Table 19. Percentage Distribution of Responses to the Question "Extent Area Has Changed While Being in Business at the Present Location" (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | | | | |
| Improved greatly | 14.6 | 21.4 | 17.7 | 16.4 |
| Improved a good bit | 18.2 | 10.7 | 15.7 | 16.4 |
| Improved little | 21.8 | 25.0 | 23.5 | 22.8 |
| No change | 28.2 | 28.6 | 31.4 | 29.1 |
| Declined little | 10.0 | 3.6 | 11.8 | 9.5 |
| Declined a good bit | 3.6 | 7.1 | 0.0 | 3.2 |
| Declined greatly | 3.6 | 3.6 | 0.0 | 2.7 |
| No response | N=9 | N=7 | N=2 | N=18 |
| Total number of responses | N=110 | N=28 | N=51 | N=189 |
| Chi-square Statistic $\chi^2$ (12) = 8.00 p=.785<br>Fisher's Exact Test (2-tail) p=.8 Not Significant; | | | | |
| **Study Area 4: Dallas** | | | | |
| Improved greatly | 5.9 | 6.1 | 0.0 | 5.2 |
| Improved a good bit | 11.8 | 12.1 | 37.5 | 15.5 |
| Improved little | 17.7 | 18.2 | 12.5 | 17.2 |
| No change | 17.7 | 21.2 | 12.3 | 18.9 |
| Declined little | 29.4 | 24.2 | 12.5 | 24.1 |
| Declined a good bit | 17.7 | 12.1 | 25.0 | 15.5 |
| Declined greatly | 0.0 | 6.1 | 0.0 | 3.5 |
| No response | N=0 | N=1 | N=0 | N=1 |
| Total number of responses | N=17 | N=33 | N=8 | N=58 |
| Chi-square Statistic $\chi^2$ (12) = 6.69 p=.877<br>Fisher's Exact Test (2 tail) =.959 Not Significant; | | | | |

**Table 19. Percentage Distribution of Responses to the Question "Extent Area Has Changed While Being in Business at the Present Location" (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All Study Areas Combined** | | | | |
| Improved greatly | 13.4 | 12.2 | 14.3 | 13.3 |
| Improved a good bit | 17.3 | 9.8 | 15.5 | 15.1 |
| Improved little | 20.1 | 23.2 | 21.4 | 21.1 |
| No change | 26.8 | 21.9 | 34.5 | 27.5 |
| Declined little | 11.7 | 13.4 | 9.5 | 11.6 |
| Declined a good bit | 7.3 | 10.9 | 3.6 | 7.3 |
| Declined greatly | 3.4 | 8.5 | 1.2 | 4.1 |
| No response | 13 | 9 | 2 | 24 |
| Total number of responses | N=179 | N=82 | N=84 | N=345 |
| Chi-square Statistic $\chi^2(12) = 14.65$ p=.261, Critical $\chi^2(12)(.05)=21.03$ Not Significant; | | | | |

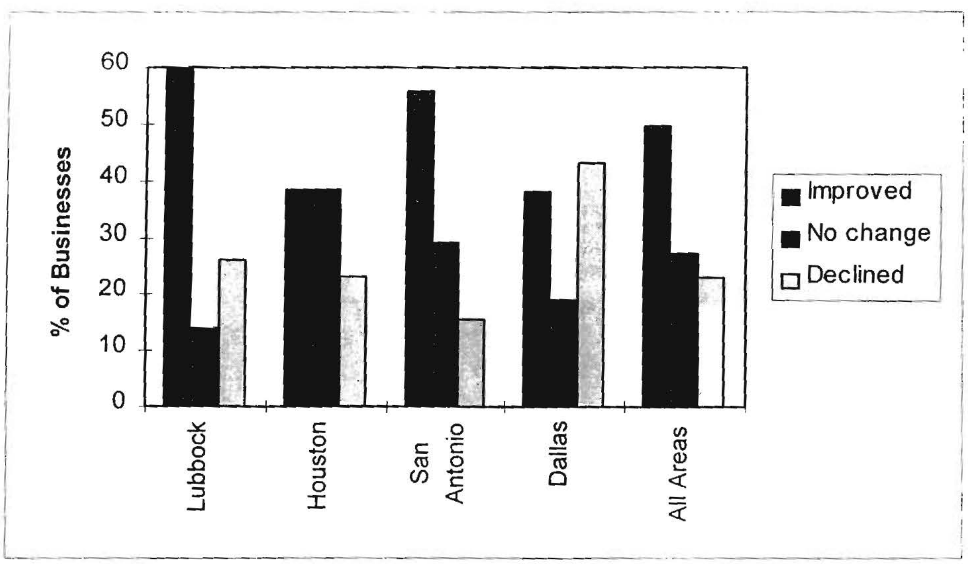



**Figure 19. Extent of Change in the Location Since Being in Business at the Location**

**Extent Area Has Changed Since Completion of Study Freeway**

The businesses were once again asked to respond to the question "How do you think the area has changed since completion of the freeway?" The percentage distribution of the responses is shown in Table 20. The value of the chi-square statistic (for all study areas combined) with 12 degrees of freedom equals 19.9 with a probability of .10. Therefore, once again the chi-square statistic for this contingency table is not significant. This suggests that statistically, the responses by design sub-area are not significant or, in other words, freeway elevation does not affect their responses. The individual study area statistics were significant for the Lubbock area alone, where 47% on depressed section #9 of I-27 believed the area had declined since construction in comparison to only 15% on elevated sections and 20% on at-grade sections. Similarly, 67% on elevated section #8 of I-27 said there was an improvement in the area since construction in comparison to 47% on depressed sections and 87% on at-grade sections. The percentage who said there was no change in the area after construction ranged from 7% on the depressed section to 18% on the elevated segment.

Figure 20 reflects the opinions of the abutting businesses in terms of change in the area since completion of the study freeways. A majority of the abutting businesses in the Lubbock, San Antonio, and Dallas areas unambiguously felt that their areas had improved since completion of the study freeways. In the Houston area, 39% believed that their neighborhood had improved since construction; an equally large number believed otherwise, and another 13% felt there was no change.

**Table 20. Percentage Distribution of Responses of Abutting Businesses to the Question "Extent Area Has Changed Since Completion of Study Freeway"**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Improved greatly | 25.6 | 0.0 | 47.1 | 25.4 |
| Improved a good bit | 17.9 | 40.0 | 23.9 | 23.9 |
| Improved little | 23.1 | 6.7 | 15.5 | 15.5 |
| No change | 17.9 | 6.7 | 15.5 | 15.5 |
| Declined little | 7.7 | 0.0 | 5.6 | 5.6 |
| Declined a good bit | 7.7 | 20.0 | 8.5 | 8.5 |
| Declined greatly | 0.0 | 26.7 | 5.6 | 5.6 |
| No response | N=3 | N=2 | N=5 | N=5 |
| Total number of responses | N=39 | N=15 | N=17 | N=71 |
| Chi-square Statistic $\chi^2$ (12 degrees of freedom) = 33.2 p = .001<br>Fisher's Exact Test (2 tail) p = .001 Significant; | | | | |
| **Study Areas 2: Houston** | | | | |
| Improved greatly | 0.0 | 0.0 | 0.0 | 0.0 |
| Improved a good bit | 27.3 | 0.0 | 37.5 | 26.1 |
| Improved little | 0.0 | 25.0 | 25.0 | 13.0 |
| No change | 18.2 | 50.0 | 12.5 | 21.7 |
| Declined little | 27.3 | 0.0 | 0.0 | 13.0 |
| Declined a good bit | 18.2 | 0.0 | 0.0 | 8.7 |
| Declined greatly | 9.1 | 25.0 | 25.0 | 17.4 |
| No response | N=3 | N=1 | N=0 | N=4 |
| Total number of responses | N=11 | N=4 | N=8 | N=23 |
| Chi-square Statistic $\chi^2$ (10 degrees of freedom) = 12.34 p = .263<br>Fisher's Exact Test (2 tail) p = .300 Not significant; | | | | |

**Table 20. Percentage Distribution of Responses of Abutting Businesses to the Question "Extent Area Has Changed Since Completion of Study Freeway" (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | | | | |
| Improved greatly | 15.7 | 20.0 | 11.1 | 15.1 |
| Improved a good bit | 14.7 | 4.0 | 13.3 | 12.8 |
| Improved little | 31.4 | 28.0 | 26.7 | 29.7 |
| No change | 31.4 | 36.0 | 46.7 | 36.1 |
| Declined little | 3.9 | 4.0 | 2.2 | 3.5 |
| Declined a good bit | 0.0 | 0.0 | 0.0 | 0.0 |
| Declined greatly | 2.9 | 8.0 | 0.0 | 2.9 |
| No response | 17 | 10 | 8 | 35 |
| Total number of responses | N=102 | N=25 | N=45 | N=172 |
| Chi-square Statistic $\chi^2$ (10 degrees of freedom) = 8.81 p = .550<br>Fisher's Exact Test (2 tail) p =.6 Not significant; | | | | |
| **Study Areas 4: Dallas** | | | | |
| Improved greatly | 17.7 | 32.4 | 12.5 | 25.4 |
| Improved a good bit | 35.3 | 26.5 | 50.0 | 32.2 |
| Improved little | 17.7 | 20.6 | 25.0 | 20.3 |
| No change | 23.5 | 11.8 | 0.0 | 13.6 |
| Declined little | 5.9 | 5.9 | 12.5 | 6.8 |
| Declined a good bit | 0.0 | 2.9 | 0.0 | 1.7 |
| Declined greatly | 0.0 | 0.0 | 0.0 | 0.0 |
| No response | 0 | 0 | 0 | 0 |
| Total number of responses | N=17 | N=34 | N=8 | N=59 |
| Chi-square Statistic $\chi^2$ (10 degrees of freedom) = 6.49 p = .772<br>Fisher's Exact Test (2 tail) p = .778 Not significant; | | | | |

**Table 20. Percentage Distribution of Responses of Abutting Businesses to the Question "Extent Area Has Changed Since Completion of Study Freeway" (continued)**

| Response | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All Study Areas Combined** | | | | |
| Improved greatly | 15.4 | 21.7 | 11.5 | 16.0 |
| Improved a good bit | 19.5 | 14.1 | 17.9 | 17.9 |
| Improved little | 24.9 | 26.9 | 25.6 | 25.5 |
| No change | 28.4 | 19.2 | 38.5 | 28.6 |
| Declined little | 6.5 | 3.8 | 3.9 | 5.2 |
| Declined a good bit | 2.9 | 5.1 | 0.0 | 2.8 |
| Declined greatly | 2.4 | 8.9 | 2.6 | 4.0 |
| No response | 23 | 13 | 8 | 44 |
| Total number of responses | N=169 | N=78 | N=78 | N=325 |
| Chi-square Statistic $\chi^2$ (12 degrees of freedom) = 19.87 p = .07<br>Fisher's Exact Test (2 tail) p = .10 | | | | |

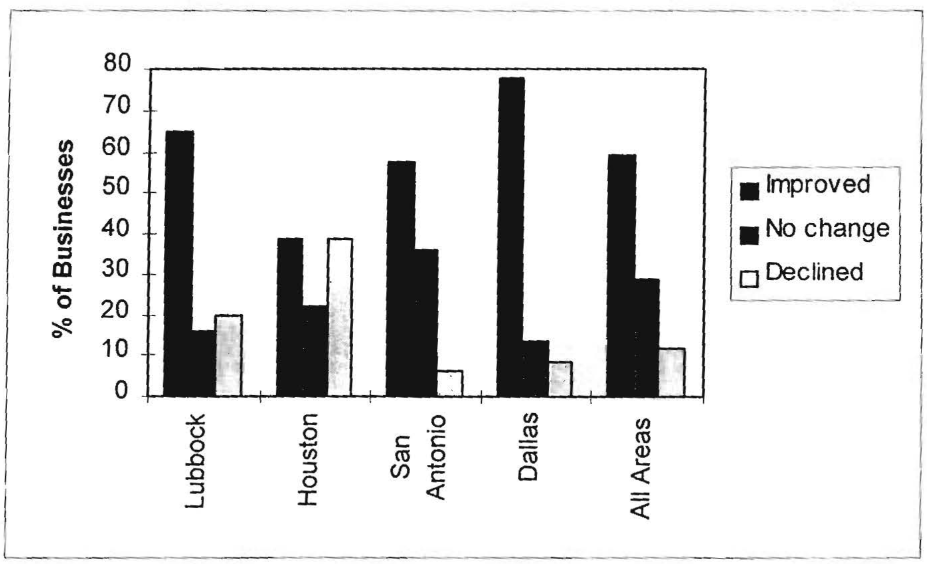



**Figure 20. Extent Area Has Changed Since Completion of Study Freeway**

## EFFECTS ON SURVEYED BUSINESSES

In this section, the goal is to assess the impacts of the grade level differences in freeway construction on abutting businesses. Respondents in all study sections were asked a series of questions on some aspects of freeway design and the construction of the freeway itself. They were also asked information pertaining to the following: 1) Changes experienced since the construction of the freeway, 2) Information on property values at different points in time (before, during, and after) to assess possible property value effects, 3) Information on the number of people employed at different points in time (before, during, and after) in order to assess changes in employment, 4) Information on the gross sales levels at different points in time (before, during, and after) in order to assess changes in gross sales levels, 5) Information on the actual gross sales at different points in time (before, during, and after) in order to assess changes in gross sales, and 6) Number of parking spaces available at different points in time (before, during, and after).

All the data presented in this section pertain to abutting businesses. However, wherever appropriate, information on non-abutting businesses is also provided for comparison purposes. As in the previous section, statistical tests based on contingency tables are conducted whenever appropriate.

### Necessity of Construction of Study Freeway

Respondents were asked their opinions on the necessity of highway construction, and the results are tabulated in Tables 21 and 22 for abutting and non-abutting businesses, respectively. Regardless of design sub-area, there appears to be a general consensus in the responses. Approximately 81% of all abutting businesses in all design sub-areas, agreed that construction of the freeway was necessary. Only about 10% were unsure, and less than 5% thought it was not necessary. Similarly, about 85% of non-abutting businesses agreed that construction was necessary, while less than 3% disagreed. The statistical tests of independence between opinions and grade using standard chi-square and exact tests from two-way contingency tables cannot be rejected for any study area. Furthermore, the results for all the four study areas were combined into a three-way contingency table to assess whether grade level differences in the opinions of respondents across study areas were significant. This type of approach of combining responses across study areas is called *meta analysis,* as mentioned before.

## Table 21. Percentage Distribution of Responses of Abutting Businesses to the Question "Was Construction Necessary?"

| Response | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** |
| Yes | 63.2 | 85.7 | 84.6 | 88.2 | 80.7 | 70.6 | 80.0 | 80.7 | 88.2 | 81.6 | 76.5 | 87.5 | 80.8 | 87.5 | 81.1 | 68.1 | 85.2 | 83.1 | 88.1 | 81.1 |
| No | 7.9 | 0.0 | 1.7 | 0.0 | 2.7 | 11.8 | 0.0 | 0.0 | 2.9 | 3.4 | 11.8 | 12.5 | 0.0 | 12.5 | 4.7 | 9.7 | 3.7 | 1.0 | 3.4 | 3.3 |
| Maybe | 10.5 | 0.0 | 5.1 | 5.9 | 5.9 | 5.9 | 0.0 | 6.5 | 5.9 | 5.7 | 5.9 | 0.0 | 3.9 | 0.0 | 3.5 | 8.3 | 0.0 | 4.9 | 5.1 | 5.3 |
| Not sure | 18.4 | 14.3 | 8.5 | 5.9 | 10.7 | 11.8 | 20.0 | 12.9 | 2.9 | 9.2 | 5.9 | 0.0 | 15.4 | 0.0 | 10.6 | 13.9 | 11.1 | 10.9 | 3.4 | 10.3 |
| No response | N=4 | N=0 | N=1 | N=0 | N=6 | N=0 | N=0 | N=4 | N=0 | N=4 | N=0 | N=0 | N=1 | N=0 | N=1 | N=4 | N=0 | N=6 | N=0 | N=11 |
| Total responses | N=38 | N=14 | N=118 | N=17 | N=187 | N=17 | N=5 | N=31 | N=34 | N=87 | N=17 | N=8 | N=52 | N=8 | N=85 | N=72 | N=27 | N=201 | N=59 | N=359 |

Study Area 1 (Lubbock): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 2.47 p = .872 Fisher's Exact Test (2 tail) = .917 Not significant;

Study Area 2 (Houston): $\chi^2$ Chi-square Statistic (4 degrees of freedom) = 3.77 p = .438 , Fisher's Exact Test (2 tail) = .437 Not significant;

Study Area 3 (San Antonio): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 3.48 p = .747, Fisher's Exact Test (2 tail) = .783 Not significant;

Study Area 4 (Dallas): $\chi^2$ Chi-square Statistic (4 degrees of freedom) = 3.77 p = .727 , Fisher's Exact Test (2 tail) = .817 Not significant;
Cochran-Mantel-Haenszel Statistic (6 degrees of freedom) = 1.427 p = .964 (Hypothesis of general association) Not significant;

## Table 22. Percentage Distribution of Responses of Non-Abutting Businesses to the Question "Was Construction Necessary?"

| **Response** | **Elevated %** | | | | | **Depressed %** | | | | | **At-Grade %** | | | | | **All Design Sub-Areas %** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** |
| Yes | 88.9 | 66.7 | 82.0 | 100.0 | 84.5 | 88.9 | 50.0 | 71.4 | 89.3 | 86.7 | - | - | - | - | - | 88.9 | 60.0 | 81.3 | 91.7 | 85.2 |
| No | 0.0 | 0.0 | 1.5 | 0.0 | 1.0 | 11.1 | 0.0 | 14.3 | 3.6 | 6.7 | - | - | - | - | - | 3.7 | 0.0 | 2.7 | 2.8 | 2.8 |
| Maybe | 5.6 | 0.0 | 4.4 | 0.0 | 4.1 | 0.0 | 0.0 | 0.0 | 3.6 | 0.0 | - | - | - | - | - | 3.7 | 0.0 | 4.0 | 2.8 | 2.8 |
| Not sure | 5.6 | 33.3 | 11.8 | 0.0 | 10.3 | 0.0 | 50.0 | 14.3 | 3.6 | 6.7 | - | - | - | - | - | 3.7 | 40.0 | 12.0 | 2.8 | 9.2 |
| No response | N=0 | N=0 | N=0 | N=1 | N=1 | N=1 | N=0 | N=0 | N=1 | N=3 | - | - | - | - | - | N=1 | N=0 | N=0 | N=2 | N=4 |
| Total responses | N=18 | N=3 | N=68 | N=8 | N=97 | N=9 | N=2 | N=7 | N=28 | N=45 | - | - | - | - | - | N=27 | N=5 | N=75 | N=36 | N=142 |

Study Area 1 (Lubbock): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 3.0 p = .392, Fisher's Exact Test (2 tail) = .200 Not significant;
Study Area 2 (Houston): $\chi^2$ Chi-square Statistic (1 degrees of freedom) = 2.68 p = .101, Fisher's Exact Test (2 tail) = .257 Not significant;
Study Area 3 (San Antonio): $\chi^2$ Chi-square Statistic (3 degrees of freedom) = 4.34 p = .747, Fisher's Exact Test (2 tail) = .200 Not significant;
Study Area 4 (Dallas): $\chi^2$ Chi-square Statistic (3 degrees of freedom) = .935 p = .817, Fisher's Exact Test (2 tail) = 1.00 Not significant;
Cochran-Mantel-Haenszel Statistic (3 degress of freedom) = 5.904 p = .116 (Hypothesis of general association) Not significant.

The CMH statistic of general association with six degrees of freedom is equal to 1.427 with a probability p = .964 for abutting businesses. For non-abutting businesses, the CMH statistic is equal to 5.904 (three degrees of freedom) with probability p = .116. This implies that the null hypothesis of independence of responses from the different grade levels cannot be rejected for abutting as well as non-abutting businesses. This confirms the idea that while respondents in all study areas believed that construction was required, no statistically significant relationship was found between the responses from the different design sub-areas.

**Opinion of the Grade Level of Freeway Adjacent to Businesses**

This section is concerned with the responses to the question "What is your opinion of this type of freeway?" "This type" refers to the grade level of the freeway adjacent to the business. Hence, responses to this question are also categorized by design sub-area. No chi-square tests are conducted because the nature of the question is different for each design sub-area.

Almost 44% of respondents surveyed on elevated sections and 33% on depressed freeway sections commented that they liked the respective grade sections they were located on very much. A very small percentage said that they disliked the grade level of the adjacent freeway, and a yet smaller percentage was unsure. The pattern of responses on elevated sections is similar for all study areas, with a large percentage of respondents responding that they liked the elevated freeway very much. On depressed freeway sections, however, the pattern is quite different. A large percentage of abutting businesses in study areas 1 (Lubbock) and 2 (Houston) commented that they disliked the depressed freeway in varying degrees. Businesses in study areas 3 (San Antonio) and 4 (Dallas) said that they liked the depressed freeway. Businesses abutting at-grade sections of the freeway were also asked to express their opinion on the freeway grade type immediately adjacent to the at-grade section. The responses of these businesses are separated and also presented in Table 23.

**Table 23. Percentage Distribution of Responses of Abutting Businesses to the Question "Your Opinion of this Type of Freeway"**

| Response | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study Area | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 NE[7] | 2 ND | 3 NE | 3 ND | 4 NE | 4 ND | All Study Areas NE | All Study Areas ND |
| Like it very much | 41.0 | 38.5 | 46.8 | 37.5 | 44.1 | 11.8 | 20.0 | 35.3 | 43.8 | 32.9 | - | 14.3 | - | 34.4 | 36.4 | - | 25.0 | 30.8 | 31.6 |
| Like it some | 25.6 | 23.1 | 21.1 | 18.8 | 22.0 | 17.7 | 20.0 | 11.8 | 21.9 | 17.1 | - | 42.9 | - | 31.3 | 36.4 | - | 37.5 | 33.3 | 17.9 |
| Dislike it some | 5.1 | 0.0 | 10.1 | 18.8 | 9.0 | 11.8 | 40.0 | 5.9 | 3.1 | 7.9 | - | 14.3 | - | 6.3 | 18.2 | - | 0.0 | 7.9 | 5.1 |
| Dislike it very much | 7.7 | 23.1 | 5.5 | 18.8 | 8.5 | 35.3 | 0.0 | 23.5 | 6.3 | 18.2 | - | 14.3 | - | 3.1 | 0.0 | - | 0.0 | 5.1 | 0.0 |
| No opinion | 20.5 | 15.4 | 14.7 | 6.3 | 15.3 | 17.7 | 20.0 | 17.7 | 25.0 | 20.5 | - | 14.3 | - | 21.9 | 9.1 | - | 37.5 | 20.5 | 21.1 |
| Not sure | 0.0 | 0.0 | 1.8 | 0.0 | 1.1 | 5.9 | 0.0 | 5.9 | 0.0 | 3.4 | - | 0.0 | - | 3.1 | 0.0 | - | 0.0 | 2.6 | 0.0 |
| No response | N=3 | N=1 | N=10 | N=1 | N=15 | N=0 | N=0 | N=1 | N=2 | N=3 | - | N=1 | - | N=10 | N=0 | - | N=0 | N=10 | N=1 |
| Total responses | N=39 | N=13 | N=109 | N=16 | N=177 | N=17 | N=5 | N=34 | N=32 | N=88 | - | N=7 | - | N=32 | N=11 | - | N=8 | N=39 | N=19 |

[7]NE: stands for near elevated freeway.
ND: stands for near depressed freeway.

**Grade Level of Freeway Preferred**

All respondents were asked what type of freeway design they preferred, elevated or depressed. The results for abutting businesses are presented in Table 24, and those for non-abutting businesses are presented in Table 25. Since the study areas differ substantially in terms of their characteristics, a three-way analysis was also performed. For the three-way contingency analysis of preferences and grade level, controlling for the study area, the CMH test statistic of association between preferences and grade level for abutting businesses is 22.67 with degrees of freedom equal to six. This statistic exceeds the critical value of the chi-square with six degrees of freedom and level of significance of .05. This suggests that for the overall sample, there is an association between preferences and grade level. Interestingly, the pattern of responses of non-abutting businesses is similar to the response pattern of abutting businesses. The CMH statistic of general association for non-abutting businesses is 18.9 with three degrees of freedom and probability $p = .001$ which is lower .05, affirming the presence of a strong correlation. When responses are analyzed by design sub-area, there is a tendency for respondents to prefer either the grade type that they are currently located on or gravitate towards the 'no-preference' response category.

Design sub-area differences were apparent only in the case of the responses from abutting businesses abutting the I-27 study sections in Lubbock and the San Antonio sections . A majority of the businesses on both I-27 sections (elevated, depressed) prefer elevated freeway types, and 10% or less preferred depressed types. Twelve percent of the respondents from the at-grade I-27 control section said they preferred elevated freeway types; none preferred the depressed type of freeway, and a large majority, 84%, had no preference or were not sure. In the case of San Antonio, the largest percentage of respondents had either no preference or were unsure. However, among those who did exhibit a preference in the San Antonio sections, there are considerable design sub-area differences. On the elevated sections, there is a tendency to show preference for the elevated freeway type; on depressed sections there is a preference for depressed type of freeways; on the at-grade sections, the percentage preferring either types of designs are approximately similar.

There were design sub-area differences in the responses from non-abutting sections of the study freeways, and this is not surprising.

**Table 24. Percentage Distribution of Responses of Abutting Businesses to the Question "Do You Prefer Elevated or Depressed Freeways?"**

| Opinion | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Elevated | 52.4 | 41.2 | 11.8 | 40.8 |
| Depressed | 9.5 | 5.9 | 0.0 | 6.6 |
| No preference | 19.1 | 17.7 | 58.8 | 27.6 |
| Not sure | 2.4 | 17.7 | 23.5 | 10.5 |
| No response | N=7 | N=3 | N=1 | N=11 |
| Total number of responses | N=42 | N=17 | N=17 | N=76 |
| Chi-square Statistic $\chi^2(6) = 19.3$ $p = .40$; Fisher's Exact Test (2 tail) $p = .001$ Significant | | | | |
| **Study Areas 2: Houston** | | | | |
| Elevated | 57.1 | 0.0 | 57.1 | 46.2 |
| Depressed | 14.3 | 40.0 | 14.3 | 19.2 |
| No preference | 21.4 | 40.0 | 14.3 | 23.1 |
| Not sure | 7.1 | 20.0 | 14.3 | 11.5 |
| No response | N=0 | N=0 | N=0 | N=0 |
| Total number of responses | N=14 | N=5 | N=7 | N=26 |
| Chi-square Statistic $\chi^2(6) = 5.71$ $p = .457$; Fisher's Exact Test (2 tail) $p = .306$; Not significant; | | | | |
| **Study Area 3: San Antonio** | | | | |
| Elevated | 37.6 | 24.2 | 28.8 | 32.4 |
| Depressed | 8.5 | 33.3 | 26.9 | 16.9 |
| No preference | 40.2 | 36.4 | 42.3 | 39.1 |
| Not sure | 13.7 | 6.1 | 1.9 | 9.2 |
| No response | N=2 | N=2 | N=1 | N=5 |
| Total number of responses | N=119 | N=35 | N=53 | N=207 |
| Chi-square Statistic $\chi^2(6) = 20.56$ $p = .002$; Significant; | | | | |

**Table 24. Percentage Distribution of Responses of Abutting Businesses to the Question "Do You Prefer Elevated or Depressed Freeways?" (continued)**

| Opinion | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 4:Dallas** | | | | |
| Elevated | 23.5 | 6.1 | 12.5 | 12.1 |
| Depressed | 11.8 | 45.5 | 50.0 | 36.2 |
| No preference | 47.1 | 39.4 | 25.0 | 39.7 |
| Not sure | 17.7 | 9.1 | 12.5 | 12.1 |
| No response | N=0 | N=1 | N=0 | N=1 |
| Total number of responses | N=17 | N=33 | N=8 | N=58 |
| Chi-square Statistic $\chi^2(6) = 8.19$ $p = .224$; Fisher's Exact Test $p = .456$; Not significant | | | | |
| **All Study Areas Combined** | | | | |
| Elevated | 42.6 | 20.0 | 26.5 | 33.3 |
| Depressed | 9.8 | 34.1 | 22.9 | 18.8 |
| No preference | 36.1 | 35.3 | 42.2 | 37.3 |
| Not sure | 11.5 | 10.6 | 8.4 | 10.5 |
| No response | N=9 | N=6 | N=2 | N=17 |
| Total number of responses | N=183 | N=85 | N=83 | N=351 |
| Chi-square Statistic $\chi^2(6) = 30.79$ $p = .001$; Significant | | | | |

Cochran-Mantel-Haenszel Statistic (6 degrees of freedom) (general association) = 22.64 $p = .001$
Significant

**Table 25. Percentage Distribution of Responses of Non-Abutting Businesses to the Question "Do You Prefer Elevated or Depressed Freeways?"**

| Opinion | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | | | | |
| Elevated | 44.4 | 22.2 | - | 37.0 |
| Depressed | 0.0 | 11.1 | - | 3.7 |
| No preference | 38.9 | 44.4 | - | 40.7 |
| Not sure | 16.7 | 22.2 | - | 18.5 |
| No response | N=0 | N=1 | - | N=1 |
| Total number of responses | N=18 | N=9 | - | N=27 |
| Chi-square Statistic $\chi^2(3) = 2.95$ $p = .400$; Fisher's Exact Test (2 tail) $p = .456$; Not significant<br>Abutting vs. Non-abutting: $\chi^2(3) = 1.86$ $p = .602$; Fishers Test=.7; Not significant | | | | |
| **Study Areas 2: Houston** | | | | |
| Elevated | 66.7 | 0.0 | - | 40.0 |
| Depressed | 0.0 | 50.0 | - | 20.0 |
| No preference | 33.3 | 50.0 | - | 40.0 |
| Not sure | 0.0 | 0.0 | - | 0.0 |
| No response | N=0 | N=0 | - | N=0 |
| Total number of responses | N=3 | N=2 | - | N=5 |
| Chi-square Statistic $\chi^2(2) = 2.92$ $p = .233$; Fisher's Exact Test (2 tail) $p = .600$; Not significant<br>Abutting vs. Non-abutting: $\chi^2(3) = 1.08$ $p = .78$; Fishers Test=.8; Not significant | | | | |
| **Study Area 3: San Antonio** | | | | |
| Elevated | 35.3 | 28.6 | - | 34.5 |
| Depressed | 13.2 | 57.1 | - | 17.3 |
| No preference | 42.7 | 14.3 | - | 40.0 |
| Not sure | 8.8 | 0.0 | - | 8.0 |
| No response | N=0 | N=0 | - | N=0 |
| Total number of responses | N=68 | N=7 | - | N=75 |
| Chi-square Statistic $\chi^2(3) = 9.04$ $p = .029$; Fisher's Exact Test (2 tail) $p = .058$; Not significant<br>Abutting vs. Non-abutting: $\chi^2(3) = 1.86$ $p = .602$; Fishers Test=.7; Not significant | | | | |

**Table 25. Percentage Distribution of Responses to Non-Abutting Businesses to the Question "Do You Prefer Elevated or Depressed Freeways?" (continued)**

| Opinion | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 4:Dallas** | | | | |
| Elevated | 55.6 | 13.8 | - | 23.7 |
| Depressed | 0.0 | 41.4 | - | 31.6 |
| No preference | 22.2 | 34.5 | - | 31.6 |
| Not sure | 22.2 | 6.9 | - | 10.5 |
| No response | N=0 | N=1 | - | N=1 |
| Total number of responses | N=9 | N=29 | - | N=38 |
| Chi-square Statistic $\chi^2$ (3) =10.44 p = .015; Fisher's Exact Test (2 tail) p =.008; Significant<br>Abutting vs. Non-abutting: $\chi^2$ (4) = 2.95 p = .567; Fishers Test=.7; Not significant | | | | |
| **All Study Areas Combined** | | | | |
| Elevated | 39.8 | 17.4 | - | 32.6 |
| Depressed | 9.2 | 39.1 | - | 18.8 |
| No preference | 39.8 | 34.8 | - | 38.2 |
| Not sure | 11.2 | 8.7 | - | 10.4 |
| No response | N=0 | N=2 | - | N=2 |
| Total number of responses | N=98 | N=46 | - | N=144 |
| Chi-square Statistic $\chi^2$ (3) =20.19 p = .001; Significant<br>Abutting vs. Non-abutting: $\chi^2$ (4) = 2.95 p = .567; Fishers Test=.7; Not significant | | | | |

Cochran-Mantel-Haenszel Statistic (6 degrees of freedom) (general association) = 18.9 p = .001 Significant

Figures 21 and 22 are a pictorial representation of the results of this section for abutting and non-abutting sections in all study areas individually as well as for all study areas combined.

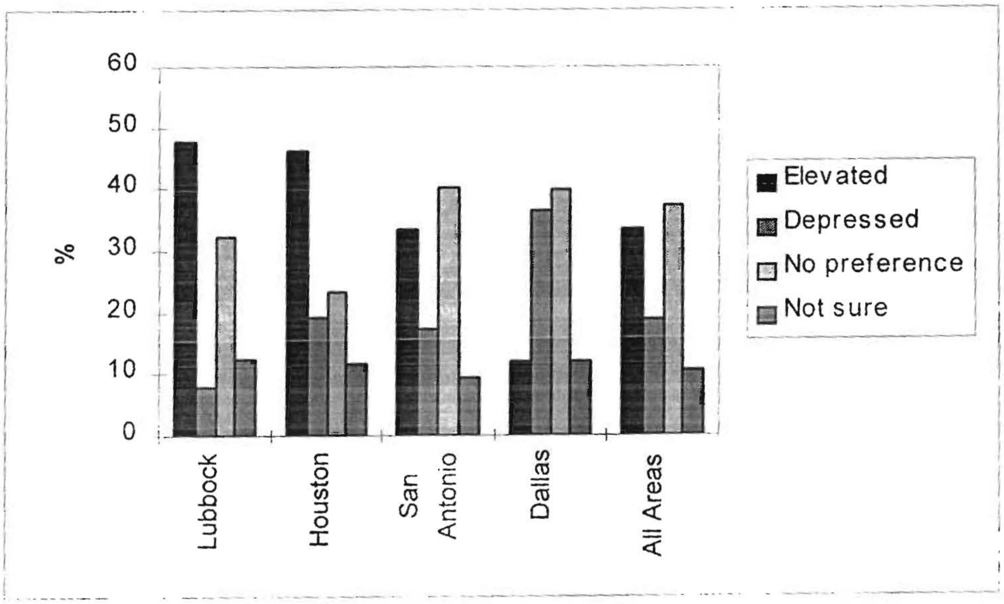



**Figure 21. Grade Level of Freeways Preferred: Opinions of Abutting Businesses**

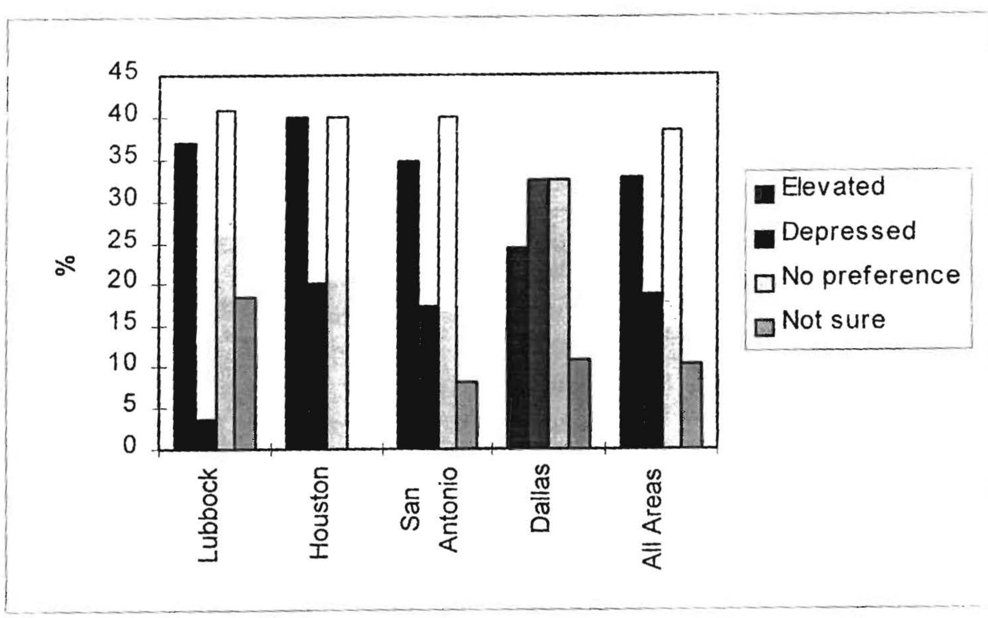



**Figure 22. Grade Level of Freeways Preferred: Opinions of Non-Abutting Businesses**

Individual study area tests were also conducted to assess whether there were any differences in the responses of businesses abutting and non-abutting the highway. However, no significant differences were found in the preferences of abutting and non-abutting businesses. Figures 21 and 22 clearly show that elevated types of freeways are preferred to depressed types in most study areas, Dallas being the exception. In the case of Dallas, the reverse is observed. Overall, elevated freeway types are preferred to depressed types. As expected, 'no preference' type of responses are most frequent on non-abutting sections. Further, when comparing across study areas, 'no preference' type of responses were most frequently observed in the Dallas and San Antonio study areas.

This shows that by and large, abutting businesses prefer the elevated type of freeway to the depressed type. While the same is true for the non-abutting businesses, the percentage of respondents with no-preference and no opinion is much larger than those who exhibit a preference. The only exception is Dallas, where a greater percentage of the abutting and non-abutting businesses preferred the depressed type to the elevated type of freeway, but a large percentage had no preference or were not sure (52% on abutting sections and 42% on non-abutting sections).

**Changes Experienced Since Construction of Freeway**

Respondents in all study areas were asked their opinions, perceptions, and experiences concerning the impacts of the freeway construction. They were asked whether they had experienced any increases or decreases in noise, pollution levels, travel safety, crime, travel time, property values, business volumes, travel convenience, or any other specific change they had observed. The percentages reported in the table are based on the number of respondents (N) and do not add up because of multiple responses. The responses are presented separately by study area because each study area's experiences are considered to be unique. Furthermore, in the case of Dallas (study area: 4), these experiences will be a reflection of construction period effects since construction was underway at the time the surveys were administered. Table 26 presents a summary of the survey responses for abutting businesses.

**Table 26. Percentage Distribution of Responses of Abutting Businesses to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area**

| Experiences | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 1: Lubbock** | N=36 | N=17 | N=14 | N=67 |
| **No response** | 16.7 | 0.0 | 21.4 | 13.4 |
| **Noise** | | | | |
| Increase | 36.1 | 35.3 | 7.1 | 29.9 |
| Decrease | 13.9 | 5.9 | 0.0 | 8.9 |
| **Pollution** | | | | |
| Increase | 19.4 | 5.9 | 0.0 | 11.9 |
| Decrease | 2.8 | 0.0 | 0.0 | 1.5 |
| **Travel Time** | | | | |
| Increase | 27.8 | 23.5 | 14.3 | 23.9 |
| Decrease | 27.8 | 35.3 | 35.7 | 31.3 |
| **Crime** | | | | |
| Increase | 11.1 | 29.4 | 14.3 | 16.4 |
| Decrease | 16.7 | 5.9 | 0.0 | 10.5 |
| **Property Values** | | | | |
| Increase | 30.6 | 23.5 | 0.0 | 22.4 |
| Decrease | 5.6 | 17.7 | 7.1 | 8.9 |
| **Business Volume** | | | | |
| Increase | 33.3 | 17.7 | 21.4 | 26.9 |
| Decrease | 5.6 | 47.1 | 14.30 | 17.9 |
| **Travel Convenience** | | | | |
| Increase | 93.0 | 64.0 | 100.0 | 89.0 |
| Decrease | 7.0 | 36.0 | 0.0 | 11.0 |
| **Travel Safety** | | | | |
| Increase | 88.0 | 50.0 | 67.0 | 74.0 |
| Decrease | 12.0 | 50.0 | 33.0 | 26.0 |

**Table 26. Percentage Distribution of Responses of Abutting Businesses to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 2: Houston** | N=12 | N=5 | N=8 | N=25 |
| **No Response** | 16.7 | 0.0 | 0.0 | 8.0 |
| **Noise** | | | | |
| Increase | 50.0 | 0.0 | 12.5 | 28.0 |
| Decrease | 0.0 | 0.0 | 12.5 | 4.0 |
| **Pollution** | | | | |
| Increase | 50.0 | 20.0 | 0.0 | 28.0 |
| Decrease | 0.0 | 0.0 | 12.5 | 4.0 |
| **Travel Time** | | | | |
| Increase | 0.0 | 0.0 | 12.5 | 4.0 |
| Decrease | 16.7 | 20.0 | 75.0 | 36.0 |
| **Crime** | | | | |
| Increase | 8.3 | 0.0 | 12.5 | 8.0 |
| Decrease | 8.3 | 0.0 | 0.0 | 4.0 |
| **Property Values** | | | | |
| Increase | 8.3 | 0.0 | 12.5 | 8.0 |
| Decrease | 25.0 | 0.0 | 12.5 | 16.0 |
| **Business Volume** | | | | |
| Increase | 16.7 | 0.0 | 12.5 | 12.0 |
| Decrease | 58.3 | 20.0 | 25.0 | 40.0 |
| **Travel Convenience** | | | | |
| Increase | 33.3 | 80.0 | 62.5 | 52.0 |
| Decrease | 16.7 | 0.0 | 0.0 | 8.0 |
| **Travel Safety** | | | | |
| Increase | 8.3 | 0.0 | 50.0 | 20.0 |
| Decrease | 16.7 | 0.0 | 12.5 | 12.0 |

**Table 26. Percentage Distribution of Responses of Abutting Businesses to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 3: San Antonio** | N=107 | N=28 | N=48 | N=183 |
| **No Response** | 11.2 | 25.0 | 10.4 | 13.1 |
| **Noise** | | | | |
| Increase | 26.2 | 39.3 | 27.1 | 28.4 |
| Decrease | 8.4 | 7.1 | 8.3 | 8.2 |
| **Pollution** | | | | |
| Increase | 25.2 | 28.6 | 22.9 | 25.1 |
| Decrease | 3.7 | 3.6 | 2.1 | 3.3 |
| **Tr..vel Time** | | | | |
| Increase | 32.7 | 28.6 | 18.8 | 28.4 |
| Decrease | 35.5 | 28.6 | 31.3 | 33.3 |
| **Crime** | | | | |
| Increase | 6.5 | 10.7 | 6.3 | 7.1 |
| Decrease | 2.8 | 3.6 | 4.2 | 3.3 |
| **Property Values** | | | | |
| Increase | 13.1 | 17.9 | 16.7 | 14.8 |
| Decrease | 5.6 | 10.7 | 0.0 | 4.9 |
| **Business Volume** | | | | |
| Increase | 12.2 | 7.1 | 22.9 | 14.2 |
| Decrease | 15.9 | 28.6 | 12.5 | 16.9 |
| **Travel Convenience** | | | | |
| Increase | 50.5 | 46.4 | 56.3 | 51.4 |
| Decrease | 15.9 | 28.6 | 6.3 | 15.3 |
| **Travel Safety** | | | | |
| Increase | 35.5 | 21.4 | 29.2 | 31.7 |
| Decrease | 15.9 | 17.9 | 16.7 | 16.4 |

**Table 26. Percentage Distribution of Responses of Abutting Businesses to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **Study Area 4: Dallas** | N=17 | N=34 | N=8 | N=59 |
| **No Response** | 0.0 | 0.0 | 0.0 | 0.0 |
| **Noise** | | | | |
| Increase | 29.4 | 70.6 | 75.0 | 59.3 |
| Decrease | 5.9 | 5.9 | 0.0 | 5.1 |
| **Pollution** | | | | |
| Increase | 29.4 | 50.0 | 25.0 | 40.7 |
| Decrease | 0.0 | 0.0 | 0.0 | 0.0 |
| **Travel Time** | | | | |
| Increase | 64.7 | 82.4 | 75.0 | 76.3 |
| Decrease | 11.8 | 14.7 | 12.5 | 13.6 |
| **Crime** | | | | |
| Increase | 17.7 | 11.7 | 0.0 | 11.8 |
| Decrease | 0.0 | 0.0 | 0.0 | 0.0 |
| **Property Values** | | | | |
| Increase | 0.0 | 5.9 | 0.0 | 3.4 |
| Decrease | 17.7 | 32.4 | 12.5 | 25.4 |
| **Business Volume** | | | | |
| Increase | 17.7 | 2.9 | 0.0 | 6.8 |
| Decrease | 58.8 | 47.1 | 50.0 | 50.9 |
| **Travel Convenience** | | | | |
| Increase | 11.8 | 2.9 | 0.0 | 5.1 |
| Decrease | 58.8 | 67.7 | 62.5 | 64.4 |
| **Travel Safety** | | | | |
| Increase | 17.7 | 23.5 | 0.0 | 18.6 |
| Decrease | 29.4 | 41.2 | 25.0 | 35.6 |

**Table 26. Percentage Distribution of Responses of Abutting Businesses to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | Depressed % | At-Grade % | All Design Sub-Areas % |
|---|---|---|---|---|
| **All Study Areas Combined** | N=172 | N=84 | N=78 | N=334 |
| **No Response** | 11.6 | 8.3 | 10.3 | 10.5 |
| **Noise** | | | | |
| Increase | 30.2 | 48.8 | 26.9 | 34.1 |
| Decrease | 8.7 | 5.9 | 6.4 | 7.5 |
| **Pollution** | | | | |
| Increase | 26.2 | 32.1 | 16.7 | 25.5 |
| Decrease | 2.9 | 1.2 | 2.6 | 2.4 |
| **Travel Time** | | | | |
| Increase | 32.6 | 47.6 | 23.1 | 34.1 |
| Decrease | 30.2 | 23.8 | 34.6 | 29.6 |
| **Crime** | | | | |
| Increase | 8.7 | 14.3 | 7.7 | 9.9 |
| Decrease | 5.8 | 2.4 | 2.6 | 4.2 |
| **Property Values** | | | | |
| Increase | 15.1 | 13.1 | 11.5 | 13.8 |
| Decrease | 8.1 | 20.2 | 3.9 | 10.2 |
| **Business Volume** | | | | |
| Increase | 17.4 | 7.1 | 19.2 | 15.2 |
| Decrease | 20.9 | 39.3 | 17.9 | 24.9 |
| **Travel Convenience** | | | | |
| Increase | 51.2 | 29.8 | 57.7 | 47.3 |
| Decrease | 18.0 | 41.7 | 10.3 | 22.2 |
| **Travel Safety** | | | | |
| Increase | 33.1 | 21.4 | 28.2 | 29.0 |
| Decrease | 15.1 | 27.4 | 16.7 | 18.6 |

*Negative Effects of the Freeway Construction*

In all study areas, a large percentage of the abutting surveyed businesses believed that noise and pollution levels had increased rather than decreased since highway construction, regardless of the grade level. Thirty-four percent and 26% of the total number of respondents in all study areas combined responded that noise and pollution levels had increased, respectively. A greater percentage of respondents also believed that crime had also increased rather than decreased in all study areas following construction. In most study areas, with the exception of Dallas, businesses located on the elevated freeway sections responded more frequently than businesses located on depressed and at-grade sections on the increase in noise and pollution levels.

Sixteen percent of all respondents (all design sub-areas combined) in Houston and 25% in Dallas believed that property values had declined since construction. Forty percent of all respondents (all design sub-areas combined) in Houston, 17% in San Antonio, and 51% in Dallas believed that business volumes had gone down since construction. Furthermore, 36% of respondents from the Dallas study area reported that travel safety had declined, while 64% felt that travel convenience had decreased. Seventy-six percent of the respondents in Dallas also felt that travel time had increased. One factor to note—of the four study areas where surveys were administered, Dallas was the only study area where construction was underway. Therefore, the results from the abutting business surveys conducted in Dallas are not surprising.

*Positive Effects of the Freeway Construction*

Thirty-one percent of the respondents in Lubbock, 36% in Houston, and 33% in San Antonio reported that travel time had decreased since the construction of the freeway. Eighty-nine percent of the respondents from the Lubbock study area reported that travel convenience had increased, while 74% responded that travel safety had increased. Fifty-two percent of the respondents from the Houston study area reported that travel convenience had increased, while 20% reported that travel safety had increased. Further, 51% from the San Antonio study areas reported that travel convenience had increased, while 32% of the respondents reported that travel safety had increased.

Combining all design sub-areas, 22% of all respondents in Lubbock believed that property values increased, and 27% believed that business volumes had increased since the construction. Similarly, 15% of the respondents in San Antonio believed that the property values had increased.

Differences in responses by design sub-area are observed in the following response categories—property values and business volumes—particularly in the case of Lubbock and San Antonio. In Lubbock, 31% and 24% respondents surveyed on elevated and depressed portions, respectively, felt that property values had increased. On the contrary, none of the respondents on the at-grade portions of the freeway in Lubbock felt that property values had increased. Thirty-three percent of the respondents on elevated freeway sections and 21% on the at-grade segments in Lubbock reported that business volumes had increased while 47% of the respondents on depressed sections in Lubbock responded that business volumes had decreased. Sixteen percent and 29% of the respondents on elevated and depressed sections in San Antonio reported that business volumes had decreased, respectively, while 23% of the respondents on the at-grade portions reported that business volumes had increased.

In summary, the following conclusions can be reached about the perceived effects of the highway construction.

Lubbock: A greater number of respondents thought that noise, pollution, and crime levels increased rather than decreased following construction. Increases in noise and pollution were reported by a greater percentage of respondents on the elevated sections than on the depressed or at-grade sections. On the positive side, a greater percentage of the respondents believed that property values, business volumes, travel time, travel safety, and convenience had increased rather than decreased. Businesses located adjacent to depressed sections responded more frequently that business volumes had decreased, while more of the other businesses reported increases in volumes. Two possible reasons could be the visibility of firms located adjacent to the depressed sections and the lack of accessibility, both cited by a majority of the respondents as disadvantages of the depressed study section in Table 18.

Houston and San Antonio: Noise, pollution, and crime levels were perceived by a greater number of respondents to have increased rather than decreased. Noise and pollution were perceived to have increased much more on elevated segments of Beltway 8 than on depressed sections and more on depressed sections in San Antonio than elevated sections. On the other hand, the reverse can be said about property values and business volumes in Houston and business volumes only in San Antonio. Travel safety and travel convenience were perceived to have increased more often than decreased. Furthermore, travel time was perceived to have decreased by a greater percentage of respondents.

Dallas: The ongoing construction activity in the Dallas study area appears to have had a negative effect on the perceptions on the abutting businesses on all counts. All respondents unanimously felt that crime levels and pollution levels had increased during the construction period. A greater percentage of respondents on depressed segments of Central Expressway perceived an increase in noise levels than on elevated segments. However, the at-grade segments elicited the largest response, indicating increases in noise levels. In comparison to the other segments, businesses located adjacent the depressed segment felt the most that pollution levels had increased.

**Changes in Value of Property**

Respondents in all design sub-areas were asked to indicate the approximate range of the value of their properties before, during, and after construction of the study freeways. The goal was to assess if there were any significant effects of freeway elevation on adjacent business property values based on the analysis of survey data. One way of approaching this problem was to assess (within a design sub-area) what happened to property values before, during, and after construction. An effort was made to restrict the analysis only to those who reported the property value range for all the periods under consideration. Property values were said to have increased (decreased) in the during- and after-construction periods if the range indicated was higher (lower) than in the before period. The property value ranges are indicated in Table 11 as well as the survey included in Appendix D. The results are presented in Table 27. Houston's non-abutting businesses are not shown because there were no responses from non-abutting businesses. Statistical tests are presented in Table 28. Although exact tests are more appropriate here, both standard chi-square tests and Fisher's exact test are reported for two categories: a) before- versus during-construction and b) before- versus after-construction. There does not appear to be any compelling statistically significant evidence of differences in the perceptions and responses of the businesses by grade level both in the before-during and before-after situation other than for the Lubbock I-27 study area and Dallas study area abutting businesses. In other words, no pattern could be detected in the responses pertaining to property value changes in the San Antonio and Houston study areas; however, this was not the case with the Dallas and Lubbock study areas.

## Table 27. Opinion of Businesses on Construction Effects on Property Values by Study Area and by Design Sub-Area

| | Before Versus During Change in Property Values | | | | Before Versus After Change in Property Values | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 1: Lubbock** | | | | | | | | |
| Abutting Elevated | 7.1 | 17.9 | 75.0 | 28 | 28.6 | 3.6 | 67.9 | 28 |
| Abutting Depressed | 0.0 | 55.6 | 44.4 | 9 | 44.4 | 33.3 | 22.2 | 9 |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 11 | 9.1 | 0.0 | 90.9 | 11 |
| All Design Sub-Areas (Abutting) | 4.2 | 20.8 | 75.0 | 48 | 27.1 | 8.3 | 64.6 | 48 |
| Non-Abutting Elevated | 10.0 | 10.0 | 80.0 | 10 | 10.0 | 0.0 | 90.0 | 10 |
| Non-Abutting Depressed | 0.0 | 12.5 | 87.5 | 8 | 12.5 | 0.0 | 87.5 | 8 |
| All Design Sub-Areas (Non-Abutting) | 5.6 | 11.1 | 83.3 | 18 | 11.1 | 0.0 | 88.9 | 18 |
| **Study Area 2: Houston** | | | | | | | | |
| Abutting Elevated | 0.0 | 66.7 | 33.3 | 3 | 0.0 | 0.0 | 100.0 | 3 |
| Abutting Depressed | 0.0 | 0.0 | 100.0 | 1 | 0.0 | 100.0 | 0.0 | 1 |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 4 | 50.0 | 25.0 | 25.0 | 4 |
| All Design Sub-Areas (Abutting ) | 0.0 | 25.0 | 75.0 | 8 | 25.0 | 25.0 | 50.0 | 8 |
| **Study Area 3: San Antonio** | | | | | | | | |
| Abutting Elevated | 0.0 | 9.3 | 90.7 | 54 | 14.8 | 3.7 | 81.5 | 54 |
| Abutting Depressed | 15.4 | 7.7 | 76.9 | 13 | 23.1 | 0.0 | 76.9 | 13 |
| Abutting At-Grade | 0.0 | 5.3 | 94.7 | 19 | 26.3 | 0.0 | 73.6 | 19 |
| All Design Sub-Areas (Abutting ) | 2.3 | 8.1 | 89.5 | 86 | 18.6 | 2.3 | 79.1 | 86 |
| Non-Abutting Elevated | 2.9 | 5.9 | 91.1 | 34 | 17.6 | 2.9 | 79.4 | 34 |
| Non-Abutting Depressed | 0.0 | 0.0 | 91.1 | 2 | 50.0 | 0.0 | 50.0 | 2 |
| All Design Sub-Areas (Non-Abutting ) | 2.8 | 5.6 | 94.4 | 36 | 19.4 | 2.8 | 77.8 | 36 |

**Table 27. Opinion of Businesses of Construction Effects on Property Values by Study Area and by Design Sub-Area (continued)**

| | Before Versus During Change in Property Values | | | | Before Versus After Change in Property Values | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total ( N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 4: Dallas** | | | | | | | | |
| Abutting Elevated | 0.0 | 0.0 | 100.0 | 7 | - | - | - | - |
| Abutting Depressed | 0.0 | 69.2 | 30.8 | 13 | - | - | - | - |
| Abutting At-Grade | 0.0 | 33.3 | 66.7 | 3 | - | - | - | - |
| All Design sub-Areas (Abutting) | 0.0 | 43.5 | 56.5 | 23 | - | - | - | - |
| Non-Abutting Elevated | 0.0 | 0.0 | 100.0 | 5 | - | - | - | - |
| Non-Abutting Depressed | 0.0 | 30.0 | 70.0 | 10 | - | - | - | - |
| All Design sub-Areas (Non-Abutting) | 0.0 | 20.0 | 80.0 | 15 | - | - | - | - |
| **All Study Areas Combined** | | | | | | | | |
| Abutting Elevated | 2.2 | 13.0 | 84.8 | 92 | 21.2 | 3.5 | 75.3 | 85 |
| Abutting Depressed | 5.6 | 41.7 | 52.8 | 36 | 39.1 | 8.7 | 52.2 | 23 |
| Abutting At-Grade | 0.0 | 5.4 | 94.6 | 37 | 23.5 | 2.9 | 73.5 | 34 |
| All Design sub-Areas (Abutting) | 2.4 | 17.6 | 80.0 | 165 | 24.6 | 4.2 | 57.0 | 142 |
| Non-Abutting Elevated | 4.1 | 6.1 | 89.8 | 49 | 15.9 | 2.3 | 81.8 | 44 |
| Non-Abutting Depressed | 0.0 | 20.0 | 80.0 | 20 | 30.0 | 0.0 | 70.0 | 10 |
| All Design sub-Areas (Non-Abutting) | 2.9 | 10.1 | 86.9 | 69 | 15.6 | 1.6 | 67.2 | 64 |

**Table 28. Opinions on Changes in Property Values: Statistical Tests of Independence**

| Study Area | Before Versus During | Before Versus After |
|---|---|---|
| | **Abutting Businesses** | |
| **Lubbock** | $\chi^2$(4 degrees of freedom) = 11.09; p=.026<br>Significant | $\chi^2$(4 degrees of freedom) = 14.49; p=.006<br>Significant |
| | Fisher's Exact Test p=.024; | Fisher's Exact Test p=.008; |
| *** Houston** | $\chi^2$(4 degrees of freedom) = 9.04; p=.060<br>Not Significant | $\chi^2$(4 degrees of freedom) = 7.50; p=.112<br>Not Significant |
| | Fisher's Exact Test p=.130 | Fisher's Exact Test p=.200 |
| **San Antonio** | $\chi^2$(4 degrees of freedom) = 11.81; p=.019<br>Not significant based on Fisher's test | $\chi^2$(4 degrees of freedom) = 2.47; p=.651<br>Not Significant |
| | Fisher's Exact Test p=.077 | Fisher's Exact Test p=.706 |
| **Dallas** | $\chi^2$(2 degrees of freedom) = 9.02; p=.011<br>Significant | - |
| | Fisher's Exact Test p=.001 | - |
| **All Areas** | $\chi^2$(4 degrees of freedom) = 23.04; p=.001<br>Significant | $\chi^2$(4 degrees of freedom) = 5.11; p=.277<br>Not Significant |
| | Fisher's Exact Test p=.0001 | Fisher's Exact Test p=.3 |
| | CMH $\chi^2$ statistic = 16.33 (4 degrees of freedom) p=.003; Significant | CMH $\chi^2$ statistic = 9.3 (4 degrees of freedom) p=.06; Not Significant |
| | **Non-Abutting Businesses** | |
| **Lubbock** | $\chi^2$(2 degrees of freedom) = 0.86; p=.65<br>Not Significant | $\chi^2$(1 degree of freedom) = 0.028; p=.867<br>Not Significant |
| | Fisher's Exact Test p=1.000 | Fisher's Exact Test p=1.000 |
| **San Antonio** | $\chi^2$(2 degrees of freedom) = 0.19; p=.908<br>Not Significant | $\chi^2$(2 degrees of freedom) = 1.29; p=.526<br>Not Significant |
| | Fisher's Exact Test p=1.000 | Fisher's Exact Test p=.40 |
| **Dallas** | $\chi^2$(1 degree of freedom) = 1.88; p=.171<br>Not Significant | - |
| | Fisher's Exact Test p=.505 | - |
| **All Areas** | $\chi^2$(2 degree of freedom) = 3.44; p=.179<br>Not Significant | $\chi^2$(2 degree of freedom) = 1.24; p=.537<br>Not Significant |
| | Fisher's Exact Test p=.141 | Fisher's Exact Test p=.492 |

Comparing the before-during construction scenarios in the Lubbock study sections, 4.2% of the 48 abutting businesses on all design sub-areas combined felt that property values had increased (all businesses located were on the elevated section of I-27). Another 21% believed that property values had declined, while 75% indicated that there had been no change. Similarly, in the before-after situation, 27% indicated there had been an increase; 8% indicated there had been a decrease, and the remaining 65% indicated no change. Interestingly, the responses were not statistically significant for non-abutting businesses.

The preponderance of evidence, however, suggests that majority of the businesses perceive that the highway construction had no impact on the property values. This result is probably because of the large property value ranges specified in the surveys itself, hence a substantial part of the impact could go undetected.

For all study areas combined, the statistical tests are significant beyond 99% confidence only for abutting businesses when comparing the before-during construction period scenarios, thus showing a relation between grade type and responses as indicated by the Fisher's and CMH statistics. Two percent and 25%, respectively, of abutting businesses in all study areas and design sub-areas combined responded that property values had increased in the before-during and before-after situations. Eighteen percent responded that property values had decreased in the before-during situation, and 4% believed that property values had decreased in the before-after situation. Eighty percent and 57% responded that there was no change. In the case of non-abutting businesses, the pattern of responses is similar, with 3% and 16% reporting increased property values in the before-during and before-after situations, respectively. Another 10% and 2% reported a decrease in property values, respectively. Another 87% and 67% responded that there was no change, respectively.

The second approach analyzes the mean gross property values before, during and after construction. Like the first approach, this analysis was also restricted only to those who reported during all periods, so N, the sample size, is the same in all periods. The mean property values are presented in Table 29 in actual and real dollars for the before- and after-construction periods. The before periods were assumed to be 1983 for Lubbock and San Antonio, 1982 for Houston, and 1986 for Dallas. The following conclusions can be reached from the means presented in Table 29:

**Table 29. Average Property Values Before, During, and After Construction by Design Sub-Area and by Study Area**

| Study Area | Grade | Before-Construction ($000) | | During Construction ($000) | | After-Construction ($000) | | % Change (real) Before-After | |
|---|---|---|---|---|---|---|---|---|---|
| **1. Lubbock** | | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| | Elevated | 110(173) | 160(252) | 100 | 170 | 130 | 170 | -25 | -33 |
| | Depressed | 95(150) | 150(236) | 30 | 140 | 70 | 160 | -53 | -32 |
| | At-grade | 230(362) | - | 230 | - | 240 | - | -34 | - |
| **2. Houston** | Elevated | 750(1219) | - | 500 | - | 750 | - | -38 | - |
| | Depressed | 750(1219) | - | 750 | - | 500 | - | -59 | - |
| | At-grade | 280(455) | - | 280 | - | 300 | - | -34 | - |
| **3. San Antonio** | Elevated | 290(457) | 160(252) | 280 | 150 | 320 | 190 | -30 | -24 |
| | Depressed | 190(299) | 150(236) | 190 | 150 | 220 | 200 | -26 | -15 |
| | At-grade | 385(606) | - | 380 | - | 460 | - | -24 | - |
| **4. Dallas** | Elevated | 750(1074) | 980(1403) | 750 | 980 | 750 | - | -30 | - |
| | Depressed | 250(358) | 435(623) | 170 | 340 | 170 | - | -52 | - |
| | At-grade | 500(716) | - | 440 | - | 440 | - | -39 | - |

* Figures in parentheses are real dollars obtained by adjusting the actual dollars by the CPI.

1) During-construction effects:

Lubbock: Depressed sections were hurt to a greater extent than elevated sections of I-27 or at-grade sections during construction in real and actual terms. In actual dollars, average property values increased on non-abutting elevated segments and decreased slightly on non-abutting depressed segments, but in real terms, this would imply that all property values declined.

Houston: Average property values fell only for properties abutting elevated segments while they remained the same for depressed and at-grade segments in actual dollars and therefore declined for all segments in real terms.

San Antonio: The abutting and non-abutting elevated sections (2, 3, and 4) were negatively impacted during construction as the average property value fell by 3% and 6% in actual dollars. Since non-abutting average property values fell by a greater extent, it suggests that the cause for the decline lies not in the construction itself but elsewhere.

Dallas: Average property values fell on abutting and non-abutting depressed segments and abutting at-grade segments by 32%, 22%, and 28%, respectively, in actual and therefore also real dollars. There was no change in property values in abutting and non-abutting elevated segments in actual dollars; however, this implies a decline in real terms.

2) After-construction effects:

In real dollars, all sections, both abutting and non-abutting, were negatively impacted.

Lubbock: While perceptions of the businesses indicated that property values on both abutting and non-abutting elevated segments had increased in actual terms, this was not the case for abutting depressed segments. Properties adjacent depressed segments were observed to be lower in value than those adjacent elevated and at-grade segments and more susceptible to influences such as construction projects.

Houston: Property values for parcels abutting the depressed segment declined the most in real terms. In the absence of the responses from true controls, it is impossible to say that these impacts can be directly attributed to the construction activity itself.

San Antonio: Average property values increased on both abutting and non-abutting sections only in actual dollars. The average increase in all properties in actual dollars was 15% on abutting sections (10%—elevated; 15.8%—depressed; 19.5%—at-grade) and 26% on non-abutting sections (18.8—elevated; 33.3—depressed). All properties, both abutting and non-abutting, declined in real terms in value, and the maximum decrease was observed on abutting elevated sections.

This analysis indicates that abutting property values in the study section are following a trend similar to non-abutting properties. Therefore, highway construction cannot directly be considered responsible for the decline in property values. However, construction may have contributed to the decline offset by other economic factors. However, this analysis is based only on survey responses and only for those businesses who reported property values in all the periods under construction. A detailed analysis of all property values could indicate otherwise.

**Changes in People Employed**

All businesses were asked to provide information on their employment levels before, during, and after construction of the study freeways. The information on full-time employment provided by all businesses in all three stages only was used to track changes in employment levels. As can be seen from the results presented in Table 30, the general response of businesses suggests no change in full-time employment levels with the exception of the Houston study area businesses and San Antonio businesses (in the before-after situation). Fifty-eight percent and 67%, respectively, of all abutting and non-abutting business respondents in Houston on all design sub-areas combined, report that actual full-time employment levels had decreased in the before-during construction phase. Further, 67% of the respondents in Houston reported that employment had decreased in the before-after period.

## Table 30. Opinion of Businesses on Effects of Construction on Employment by Study Area and by Design Sub-Area

| | Before Versus During Change in Employment | | | | Before Versus After Change in Employment | | | |
|---|---|---|---|---|---|---|---|---|
| | **Increase (%)** | **Decrease (%)** | **No Change (%)** | **Total (N)** | **Increase (%)** | **Decrease (%)** | **No Change (%)** | **Total (N)** |
| **Study Area 1: Lubbock** | | | | | | | | |
| Abutting Elevated | 6.5 | 16.1 | 77.4 | 31 | 12.9 | 19.4 | 67.7 | 31 |
| Abutting Depressed | 0.0 | 21.4 | 78.6 | 14 | 7.1 | 28.9 | 64.3 | 14 |
| Abutting At-Grade | 6.7 | 6.7 | 86.7 | 15 | 13.3 | 6.7 | 80.0 | 15 |
| All Design Sub-areas (Abutting) | 5.0 | 15.0 | 80.0 | 60 | 11.7 | 18.3 | 70.0 | 60 |
| Non-Abutting Elevated | 0.0 | 0.0 | 100.0 | 12 | 8.3 | 8.3 | 83.3 | 12 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 8 | 10.0 | 0.0 | 90.0 | 8 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 0.0 | 100.0 | 20 | 10.0 | 5.0 | 85.0 | 20 |
| **Study Area 2: Houston** | | | | | | | | |
| Abutting Elevated | 0.0 | 60.0 | 40.0 | 5 | 0.0 | 40.0 | 60.0 | 5 |
| Abutting Depressed | 0.0 | 100.0 | 0 | 2 | 0.0 | 50.0 | 50.0 | 2 |
| Abutting At-Grade | 0.0 | 40.0 | 60.0 | 5 | 60.0 | 20.0 | 20.0 | 5 |
| All Design Sub-areas (Abutting) | 0.0 | 58.3 | 41.7 | 12 | 25.0 | 33.3 | 41.7 | 12 |
| Non-Abutting Elevated | 0.0 | 0.0 | 100.0 | 1 | 0.0 | 0.0 | 100.0 | 1 |
| Non-Abutting Depressed | 0.0 | 100.0 | 0.0 | 2 | 0.0 | 100.0 | 0.0 | 2 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 66.7 | 33.3 | 3 | 0.0 | 66.7 | 33.3 | 3 |
| **Study Area 3: San Antonio** | | | | | | | | |
| Abutting Elevated | 8.9 | 21.4 | 69.7 | 89 | 17.9 | 19.1 | 62.9 | 89 |
| Abutting Depressed | 14.3 | 28.6 | 57.1 | 21 | 14.3 | 14.3 | 71.4 | 21 |
| Abutting At-Grade | 6.5 | 16.1 | 77.4 | 31 | 22.6 | 9.7 | 67.7 | 31 |
| All Design Sub-areas (Abutting) | 9.2 | 21.3 | 69.5 | 141 | 18.4 | 16.3 | 65.3 | 141 |

**Table 30. Opinion of Businesses on Effects of Construction on Employment by Study Area and by Design Sub-Area (continued)**

| | Before Versus During Change in Employment | | | | Before Versus After Change in Employment | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease(%) | No Change (%) | Total (N) |
| **Study Area 3: Contd..** | | | | | | | | |
| Non-Abutting Elevated | 9.1 | 15.9 | 75.0 | 44 | 20.5 | 18.2 | 61.4 | 44 |
| Non-Abutting Depressed | 25.0 | 0.0 | 75.0 | 4 | 25.0 | 0.0 | 75.0 | 4 |
| All Design Sub-areas (Non-Abutting) | 10.4 | 14.6 | 75.0 | 48 | 51.3 | 10.3 | 38.5 | 48 |
| **Study Area 4: Dallas** | | | | | | | | |
| Abutting Elevated | 0.0 | 25.0 | 75.0 | 12 | - | - | - | - |
| Abutting Depressed | 8.3 | 33.3 | 58.3 | 24 | - | - | - | - |
| Abutting At-Grade | 16.7 | 0.0 | 83.3 | 6 | - | - | - | - |
| All Design Sub-area(Abutting) | 7.1 | 26.2 | 66.7 | 42 | - | - | - | - |
| Non-Abutting Elevated | 25.0 | 0.0 | 75.0 | 8 | - | - | - | - |
| Non-Abutting Depressed | 0.09 | 23.8 | 66.7 | 21 | - | - | - | - |
| All Design Sub-areas (Non-Abutting) | 13.8 | 17.2 | 68.9 | 29 | - | - | - | - |
| **All Study Areas Combined** | | | | | | | | |
| Abutting Elevated | 7.3 | 21.9 | 70.8 | 137 | 17.6 | 19.2 | 63.2 | 125 |
| Abutting Depressed | 8.2 | 31.2 | 60.7 | 61 | 10.8 | 18.9 | 70.3 | 37 |
| Abutting At-Grade | 7.0 | 14.0 | 78.9 | 57 | 20.0 | 10.0 | 70.0 | 50 |
| All Design Sub-areas (Abutting) | 7.5 | 22.4 | 70.2 | 255 | 16.9 | 16.9 | 66.0 | 212 |
| Non-Abutting Elevated | 9.2 | 10.8 | 80.0 | 65 | 17.5 | 15.8 | 66.7 | 57 |
| Non-Abutting Depressed | 8.6 | 20.0 | 71.4 | 35 | 14.3 | 14.3 | 71.4 | 14 |
| All Design Sub-areas (Non-Abutting) | 9.0 | 14.0 | 77.0 | 100 | 16.9 | 15.5 | 67.6 | 71 |

In general, the statistical tests of significance failed to reveal any pattern in the responses of either abutting and non-abutting businesses by grade level as can be seen from the results presented in Table 31. The test statistic is, however, significant in the case of non-abutting businesses in San Antonio. The extremely small p-values as indicated by the Fisher's statistic in the before-after situation show that there is clearly a connection between the responses of the non-abutting businesses in the San Antonio study areas and grade level, and the relation is also significant beyond the 99% confidence level. Fifty-one percent of all non-abutting businesses on all design sub-areas reported that employment levels were up in the before-after comparison, while 10% reported that employment levels had decreased. Another 39% reported no change. Ninety-one percent of the non-abutting businesses located near depressed sections mentioned that employment levels had increased. None mentioned that there was a decrease.

For all study areas, 9% reported an increase in employment levels in the before-during situation, while 19% reported an increase in the before-after situation. Fourteen percent and 16% reported decreases in employment levels in the before-during and before-after situation, respectively. Further, 77% and 68% reported no change in employment levels in the before-during and before-after situation. No evidence of any correlation is found for all study areas combined between responses and grade type.

Table 32 presents the average total employment levels before, during, and after construction for all study areas and design sub-areas. Business employment levels generally stayed the same in the non-abutting control sections of the I-27 study sections. However, employment went down during construction and then increased for businesses immediately adjacent the elevated section of I-27 (section #8). For businesses located adjacent the depressed section (section #9), employment levels were continuously decreasing. Businesses located on the at-grade segment had the highest employment levels among all design sub-areas, and their employment levels increased in all periods. Part of the explanation for the employment pattern can be traced to the level of sales of these businesses, as will be seen.

## Table 31. Opinions on Changes in Employment: Statistical Tests of Independence

| Study Area | Before Versus During | Before Versus After |
|---|---|---|
| | **Abutting Businesses** | |
| **Lubbock** | $\chi^2$(4 degrees of freedom) = 2.13; p=.711<br>Not Significant | $\chi^2$(4 degrees of freedom) = 2.56; p=.635<br>Not Significant |
| | Fisher's Exact Test p=.792 | Fisher's Exact Test p=.660; |
| **Houston** | $\chi^2$(2 degrees of freedom) = 2.13; p=.345<br>Not Significant | $\chi^2$(4 degrees of freedom) = 5.70; p=.223<br>Not Significant |
| | Fisher's Exact Test p=.747 | Fisher's Exact Test p=.293 |
| **San Antonio** | $\chi^2$(4 degrees of freedom) = 2.50; p=.645<br>Not Significant | $\chi^2$(4 degrees of freedom) = 2.04; p=.729<br>Not Significant |
| | Fisher's Exact Test p=.630 | Fisher's Exact Test p=.769 |
| **Dallas** | $\chi^2$(2 degrees of freedom) =4.34; p=.362<br>Not Significant | - |
| | Fisher's Exact Test p=.343 | |
| **All Areas** | $\chi^2$(4 degrees of freedom) =5.37; p=.251<br>Not Significant | $\chi^2$(4 degrees of freedom) =3.38; p=.497<br>Not Significant |
| | Fisher's Exact Test p=.23 | Fisher's Exact Test p=.43 |
| | CMH $\chi^2$(4 degrees of freedom) = 6.22<br>p=.183<br>Not significant | CMH $\chi^2$(4 degrees of freedom) = 4.92<br>p=.29<br>Not significant |
| | **Non-Abutting Businesses** | |
| **Lubbock** | - | $\chi^2$(2 degrees of freedom) =.76; p=.684<br>Not Significant |
| | - | Fisher's Exact Test p=1.000 |
| **San Antonio** | $\chi^2$(2 degrees of freedom) =1.53; p=.466<br>Not Significant | $\chi^2$(2 degrees of freedom) =38.65; p=.001<br>Significant |
| | Fisher's Exact Test p=.440 | Fisher's Exact Test p=3.95*10$^{-10}$ |
| **Dallas** | $\chi^2$(2 degrees of freedom) =2.97; p=.227<br>Not Significant | - |
| | Fisher's Exact Test p=.246 | - |
| **All Areas** | $\chi^2$(2 degrees of freedom) =1.61; p=.446<br>Not Significant | $\chi^2$(2 degrees of freedom) =.125; p=.94<br>Not Significant |
| | Fisher's Exact Test p=.467 | Fisher's Exact Test p=1.000 |

**Table 32. Average Total Employment Levels Before, During, and After Construction by Design Sub-Area and by Study Area**

| Study Area | Grade | Before Construction | | During Construction | | After Construction | |
|---|---|---|---|---|---|---|---|
| **1. Lubbock** | | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| | Elevated | 8.9 | 10 | 8.7 | 10 | 10.3 | 10 |
| | Depressed | 6.9 | 11.5 | 5.6 | 11.5 | 5.4 | 11.6 |
| | At-grade | 13.27 | - | 14.47 | - | 15.33 | - |
| **2. Houston** | Elevated | 33.2 | - | 26.4 | - | 30.0 | - |
| | Depressed | 11.5 | - | 6.5 | - | 6.0 | - |
| | At-grade | 2.2 | - | 1.8 | - | 1.8 | - |
| **3. San Antonio** | Elevated | 18.5 | 13.1 | 17.9 | 12.9 | 18.3 | 12.8 |
| | Depressed | 7.3 | 7.3 | 6.9 | 8.0 | 7.6 | 8.0 |
| | At-grade | 10.3 | - | 10.7 | - | 12.6 | - |
| **4. Dallas** | Elevated | 27.3 | 76 | 26.3 | 76.3 | - | - |
| | Depressed | 13.3 | 9.9 | 11.6 | 9.5 | - | - |
| | At-grade | 13.7 | - | 14.0 | - | - | - |

In the case of the Beltway 8 study area in Houston, a general reduction in employment levels is observed for all segments and, therefore, for the overall study area. In the San Antonio area, the elevated sections with the highest employment levels registered a small decline in employment in comparison to the depressed and at-grade sections. Last, in the Dallas study area, employment levels for businesses adjacent the elevated and depressed segments of Central Expressway registered a small decline in the during construction period in comparison to the before period. Employment levels for non-abutting businesses in the Central Expressway study section did not change much.

### Changes in the Level of Business Sales

In regards to changes in business sales, businesses both abutting and non-abutting were asked the range of their business sales volume. The analysis here is similar to that in the property value changes section. The analysis was limited to only those reporting sales volume before, during, and after the construction period. Sales levels were assumed to have increased (decreased) in the during and after periods if the range indicated was higher (lower) than in the before period.

In the Lubbock study area, approximately 4% of all abutting and 22% of all non-abutting businesses on all design sub-areas combined reported that business sales had increased in the before-during period (Table 33). Comparing the before-after scenarios, 14% of abutting and 26% of non-abutting businesses reported an increase in the sales volume. Twenty-one percent of abutting businesses reported sales had decreased in the before-during period, while 14% reported sales had decreased in the before-after period. None of the non-abutting businesses reported any decrease in sales. Another 75% of abutting businesses and 78% of non-abutting businesses reported no change in the sales level in the before-during situation. In the before-after situation, 71% of abutting businesses and 74% of non-abutting businesses reported no change in sales. Statistical tests further revealed strong evidence of a pattern between the responses regarding changes in sales levels and grade level for abutting business in the Lubbock study area, whereas no pattern was evident for non-abutting businesses (Table 34). The percentage of businesses who reported a decrease in the sales levels was clearly much greater on depressed sections in comparison to the elevated sections of the freeway. Further, businesses located on at-grade sections of the freeway either reported an increase or no change in the range of gross sales. These factors suggest that abutting businesses were significantly impacted in the Lubbock area; of the non-abutting businesses surveyed, none were negatively impacted. Abutting businesses located adjacent to the depressed section of I-27 were affected to a greater extent than businesses located adjacent to the elevated section if I-27; of the businesses surveyed on the at-grade section, none were adversely impacted. When this evidence is considered in conjunction with the main advantages/disadvantages of the location as reported by these businesses, then lack of visibility and inadequate parking could potentially be some of the important reasons for the adverse impact on abutting businesses on depressed sections of the I-27 study area. Another factor that has a bearing on these results is that almost 50% of the abutting businesses surveyed in the Lubbock study area were retail types of businesses. The evidence presented here is fortified by the conclusions drawn from Table 26.

## Table 33. Opinion of Businesses on the Effects of Construction on Business Sales by Study Area and by Design Sub-Area

| | Before Versus During Change in Business Sales | | | | Before Versus After Change in Business Sales | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 1: Lubbock** | | | | | | | | |
| Abutting Elevated | 5.9 | 11.8 | 82.4 | 17 | 11.8 | 0.0 | 88.2 | 17 |
| Abutting Depressed | 0.0 | 66.7 | 33.3 | 6 | 16.7 | 66.7 | 16.7 | 6 |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 5 | 20.0 | 0.0 | 80.0 | 5 |
| All Design Sub-Areas (Abutting) | 3.6 | 21.4 | 75.0 | 28 | 14.3 | 14.3 | 71.4 | 28 |
| Non-Abutting Elevated | 2 | 0.0 | 9 | 11 | 3 | 0.0 | 8 | 11 |
| Non-Abutting Depressed | 2 | 0.0 | 5 | 7 | 2 | 0.0 | 6 | 8 |
| All Design Sub-Areas (Non-Abutting) | 22.2 | 0.0 | 77.8 | 18 | 26.3 | 0.0 | 73.7 | 19 |
| **Study Area 2: Houston** | | | | | | | | |
| Abutting Elevated | 0.0 | 0.0 | 100.0 | 3 | 0.0 | 0.0 | 100.0 | 3 |
| Abutting Depressed | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 |
| Abutting At-Grade | 50.0 | 0.0 | 50.0 | 2 | 100.0 | 0.0 | 0 | 2 |
| All Design Sub-Areas (Abutting) | 20.0 | 0.0 | 80.0 | 5 | 40.0 | 0.0 | 60.0 | 5 |
| **Study Area 3: San Antonio** | | | | | | | | |
| Abutting Elevated | 6.7 | 11.1 | 82.2 | 45 | 20.0 | 4.4 | 75.6 | 45 |
| Abutting Depressed | 7.1 | 21.4 | 71.4 | 14 | 35.7 | 7.1 | 57.1 | 14 |
| Abutting At-Grade | 16.7 | 8.3 | 75.0 | 12 | 25.0 | 8.3 | 66.7 | 12 |
| All Design Sub-Areas (Non-Abutting) | 8.5 | 12.7 | 78.9 | 71 | 23.9 | 5.6 | 70.4 | 71 |

Table 33. Opinion of Businesses on the Effects of Construction on Business Sales by Study Area and by Design Sub-Area (continued)

| | Before Versus During Change in Business Sales | | | | Before Versus After Change in Business Sales | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 4: Contd.** | | | | | | | | |
| Non-Abutting Elevated | 8.0 | 8.0 | 84.0 | 25 | 16.0 | 4.0 | 80.0 | 25 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 3 | 33.3 | 0.0 | 66.7 | 3 |
| All Design Sub-Areas (Non-Abutting) | 7.1 | 7.1 | 85.7 | 28 | 17.9 | 3.6 | 78.6 | 28 |
| **Study Area 4: Dallas** | | | | | | | | |
| Abutting Elevated | 0.0 | 25.0 | 75.0 | 4 | - | - | - | - |
| Abutting Depressed | 16.7 | 25.0 | 58.3 | 12 | - | - | - | - |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 1 | - | - | - | - |
| All Design Sub-Areas (Abutting) | 11.8 | 23.5 | 64.7 | 17 | - | - | - | - |
| Non-Abutting Elevated | 1 | 1 | 2 | 4 | - | - | - | - |
| Non-Abutting Depressed | 3 | 2 | 4 | 9 | - | - | - | - |
| All Design Sub-Areas (Non-Abutting) | 30.8 | 23.1 | 46.2 | 13 | - | - | - | - |
| All Study Areas Combined | | | | | | | | |
| Abutting Elevated | 5.8 | 11.6 | 82.6 | 69 | 16.9 | 3.1 | 80.0 | 65 |
| Abutting Depressed | 9.4 | 31.3 | 59.4 | 32 | 30.0 | 25.0 | 45.0 | 20 |
| Abutting At-Grade | 15.0 | 5.0 | 80.0 | 20 | 31.6 | 5.3 | 63.2 | 19 |
| All Design Sub-Areas (Abutting) | 8.3 | 15.7 | 76.0 | 121 | 22.1 | 7.7 | 70.2 | 104 |
| Non-Abutting Elevated | 12.5 | 7.5 | 80.0 | 40 | 19.4 | 2.8 | 77.9 | 36 |
| Non-Abutting Depressed | 25.0 | 10.0 | 65.0 | 20 | 27.3 | 0.0 | 72.7 | 11 |
| All Design Sub-Areas (Non-Abutting) | 16.7 | 8.3 | 75.0 | 60 | 21.3 | 2.1 | 76.6 | 47 |

**Table 34. Opinions on Changes in Business Sales: Statistical Tests of Independence**

| Study Area | Before Versus During | Before Versus After |
|---|---|---|
| | **Abutting Businesses** | |
| **Lubbock** | $\chi^2$(4 degrees of freedom) = 10.12; p=.038<br>Significant | $\chi^2$(4 degrees of freedom) = 18.12; p=.001<br>Significant |
| | Fisher's Exact Test p=.021 | Fisher's Exact Test p=.0003 |
| **Houston** | $\chi^2$(1 degrees of freedom) = 1.9; p=.17<br>Not Significant | $\chi^2$(4 degrees of freedom) = 5.0; p=.023<br>Not Significant. |
| | Fisher's Exact Test p=.40 | Fisher's Exact Test p=.10 |
| **San Antonio** | $\chi^2$(4 degrees of freedom) = 2.45; p=.653<br>Not Significant | $\chi^2$(4 degrees of freedom) = 1.98; p=.740<br>Not Significant |
| | Fisher's Exact Test p=.622 | Fisher's Exact Test p=.552 |
| **Dallas** | $\chi^2$(4 degrees of freedom) =1.42; p=.841<br>Not Significant | - |
| | Fisher's Exact Test p=1.000 | |
| **All Areas** | $\chi^2$(4 degrees of freedom) =10.38; p=.034<br>Significant | $\chi^2$(4 degrees of freedom) =14.69; p=.005<br>Significant |
| | Fisher's Exact Test p=.02 | Fisher's Exact Test p=.0001 |
| | CMH $\chi^2$(4 degrees of freedom) =9.6; p=.05<br>Significant | CMH $\chi^2$(4 degrees of freedom) =13.51;<br>p=.009 Significant |
| | **Non-Abutting Businesses** | |
| **Lubbock** | $\chi^2$(1 degrees of freedom) =.27; p=.605<br>Not Significant | $\chi^2$(4 degrees of freedom) =.012; p=.912<br>Not Significant |
| | Fisher's Exact Test p=1.000 | Fisher's Exact Test p=1.000 |
| **San Antonio** | $\chi^2$(2 degrees of freedom) =.56; p=.756<br>Not Significant | $\chi^2$(2 degrees of freedom) =.631; p=.729<br>Not Significant |
| | Fisher's Exact Test p=1.000 | Fisher's Exact Test =.530 |
| **Dallas** | $\chi^2$(2 degrees of freedom) =.09; p=.956<br>Not Significant | - |
| | Fisher's Exact Test p=1.000 | - |
| **All Areas** | $\chi^2$(2 degrees of freedom) =1.75; p=.417<br>Not Significant | $\chi^2$(2 degrees of freedom) =.58; p=.75<br>Not Significant |
| | Fisher's Exact Test p=.412 | Fisher's Exact Test =.757 |

drop in the employment levels along the depressed section since, in general, employment and sales tend to move together. Sales for businesses abutting Central Expressway depressed and elevated segments also declined much more in comparison to those located on the at-grade segment and those on non-abutting sections. In the San Antonio and Houston areas, sales declined the most in real dollars for businesses located adjacent elevated sections. In the case of Houston, sales increased for businesses on at-grade segments in real terms by 25%.

**Table 35. Average Gross Business Sales Before, During, and After Construction by Design Sub-Area and by Study Area**

| Study Area | Grade | Before Construction ($000) | | During Construction ($000) | | After Construction ($000) | | % Change real before-after | |
|---|---|---|---|---|---|---|---|---|---|
| 1. Lubbock | | A | NA | A | NA | A | NA | A | NA |
| | Elevated | 375(591)* | 450(709) | 350 | 500 | 400 | 620 | -32 | -13 |
| | Depressed | 170(268) | 450(709) | 100 | 500 | 120 | 640 | -55 | -10 |
| | At-Grade | 700(1102) | - | 700 | - | 740 | - | -33 | - |
| 2. Houston | Elevated | 690(1121) | - | 690 | - | 690 | - | -39 | |
| | Depressed | - | - | - | - | - | - | - | |
| | At-Grade | 49(80) | - | 50 | - | 100 | - | +26 | |
| 3. San Antonio | Elevated | 460(724) | 228(359) | 440 | 208 | 495 | 228 | -32 | -37 |
| | Depressed | 250(393) | 690(1087) | 236 | 690 | 279 | 865 | -29 | -20 |
| | At-Grade | 610(961) | - | 670 | - | 670 | - | -31 | - |
| 4. Dallas | Elevated | 860(1231) | 680 | 750 | 680 | - | - | -39 | -30 |
| | Depressed | 610(873) | 320 | 560 | 380 | - | - | -36 | -17 |
| | At-Grade | 50(72) | - | 50 | - | - | - | -30 | - |

* Figures in parentheses are real dollars. % change reflects before-during affect in the case of Dallas.

## Changes in Parking Spaces

Businesses were asked to indicate changes in the actual number of parking spaces before, during, and after construction in all study areas. The responses were classified according to whether parking spaces increased, decreased, or did not change during and after construction, and the results are shown in Table 36. Table 37 summarizes all the statistical tests for the before-during and before-after construction scenarios, and Table 38 summarizes the average number of parking spaces by study area as well as design sub-area. No statistical evidence showing any pattern between responses by grade level was found for any study area individually or for all study areas combined as indicated by the test statistics. The combined CMH statistic of general association also provides no evidence for all study areas.

Lubbock: In the before-during construction scenarios, all the businesses surveyed responded that the number of parking spaces had either stayed the same or decreased. In the before-after situation, 18% of abutting businesses said that parking spaces had increased, and 10% reported a decrease on all design sub-areas combined. Another 72% reported no change in the level of parking spaces. Seven percent of the non-abutting businesses reported a decrease, while the remaining said there was no change. Table 38 also verifies these conclusions. Other than the at-grade segment, there was a considerable decline in the number of parking spaces during construction for businesses adjacent the elevated section #8 and depressed section #9. The average number of parking spaces increased in the after period for both these sections; however, for the depressed section, the increase did not offset the initial decline.

**Table 36. Opinion of Businesses on Effects of Construction on Parking Spaces by Study Area and by Design Sub-Area**

| | Before Versus During Change in Parking Spaces | | | | Before Versus After Change in parking Spaces | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 1: Lubbock** | | | | | | | | |
| Abutting Elevated | 0.0 | 27.3 | 72.3 | 22 | 18.2 | 18.2 | 63.6 | 22 |
| Abutting Depressed | 0.0 | 44.4 | 55.6 | 9 | 33.3 | 0.0 | 66.7 | 9 |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 8 | 0.0 | 0.0 | 100.0 | 8 |
| All Design Sub-areas (Abutting) | 0.0 | 25.6 | 74.4 | 39 | 17.9 | 10.3 | 71.8 | 39 |
| Non-Abutting Elevated | 0.0 | 25.0 | 75.0 | 8 | 0.0 | 12.5 | 87.5 | 8 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 7 | 0.0 | 0.0 | 100.0 | 7 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 13.3 | 86.7 | 15 | 0.0 | 6.7 | 93.3 | 15 |
| **Study Area 2: Houston** | | | | | | | | |
| Abutting Elevated | 0.0 | 33.3 | 66.7 | 3 | 0.0 | 0.0 | 100.0 | 3 |
| Abutting Depressed | 0.0 | 0.0 | 100.0 | 2 | 0.0 | 0.0 | 100.0 | 2 |
| Abutting At-Grade | 0.0 | 0.0 | 100.0 | 5 | 20.0 | 20.0 | 60.0 | 5 |
| All Design Sub-areas (Abutting) | 0.0 | 10.0 | 90.0 | 10 | 10.0 | 10.0 | 80.0 | 10 |
| Non-Abutting Elevated | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 1 | 0.0 | 0.0 | 100.0 | 1 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 0.0 | 100.0 | 1 | 0.0 | 0.0 | 100.0 | 1 |
| **Study Area 3: San Antonio** | | | | | | | | |
| Abutting Elevated | 1.8 | 7.0 | 91.2 | 57 | 5.3 | 7.0 | 87.7 | 57 |
| Abutting Depressed | 0.0 | 0.0 | 100.0 | 18 | 0.0 | 0.0 | 100.0 | 18 |
| Abutting At-Grade | 0.0 | 3.9 | 96.2 | 26 | 7.7 | 0.0 | 92.3 | 26 |
| All Design Sub-areas (Abutting) | .9 | 4.9 | 94.1 | 101 | 4.9 | 3.9 | 91.1 | 101 |

**Table 36. Opinion of Businesses on Effects of Construction on Parking Spaces by Study Area and by Design Sub-Area (continued)**

| | Before Versus During Change in Parking Spaces | | | | Before Versus After Change in Parking Spaces | | | |
|---|---|---|---|---|---|---|---|---|
| | Increase (%) | Decrease (%) | No Change (%) | Total (N) | Increase (%) | Decrease (%) | No Change (%) | Total (N) |
| **Study Area 3: Contd..** | | | | | | | | |
| Non-Abutting Elevated | 0.0 | 0.0 | 100.0 | 40 | 5.0 | 0.0 | 95.0 | 40 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 3 | 0.0 | 0.0 | 100.0 | 3 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 0.0 | 100.0 | 43 | 4.7 | 0.0 | 95.4 | 43 |
| **Study Area 4:Dallas** | | | | | | | | |
| Abutting Elevated | 0.0 | 0.0 | 100.0 | 9 | - | - | - | - |
| Abutting Depressed | 0.0 | 25.0 | 75.0 | 20 | - | - | - | - |
| Abutting At-Grade | 0.0 | 33.3 | 66.7 | 3 | - | - | - | - |
| All Design Sub-areas (Abutting) | 0.0 | 18.8 | 81.3 | 32 | - | - | - | - |
| Non-Abutting Elevated | 0.0 | 0.0 | 100.0 | 4 | - | - | - | - |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 14 | - | - | - | - |
| All Design Sub-areas (Non-Abutting) | 0.0 | 0.0 | 100.0 | 18 | - | - | - | - |
| **All Study Areas Combined** | | | | | | | | |
| Abutting Elevated | 1.1 | 12.1 | 86.8 | 91 | 8.5 | 4.9 | 86.6 | 82 |
| Abutting Depressed | 0.0 | 18.4 | 81.6 | 49 | 10.3 | 0.0 | 89.7 | 29 |
| Abutting At-Grade | 0.0 | 4.8 | 95.2 | 42 | 25.0 | 8.3 | 66.7 | 39 |
| All Design Sub-areas (Abutting) | 0.6 | 12.1 | 87.4 | 182 | 10.6 | 4.1 | 85.4 | 123 |
| Non-Abutting Elevated | 0.0 | 3.9 | 96.1 | 52 | 4.2 | 0.0 | 95.8 | 48 |
| Non-Abutting Depressed | 0.0 | 0.0 | 100.0 | 25 | 0.0 | 0.0 | 100.0 | 11 |
| All Design Sub-areas (Non-Abutting) | 0.0 | 2.6 | 97.4 | 77 | 3.4 | 0.0 | 96.6 | 59 |

**Table 37. Opinions on Changes in Parking Spaces: Statistical Tests of Independence**

| Study Area | Before Versus During | Before Versus After |
|---|---|---|
| | **Abutting Businesses** | |
| **Lubbock** | $\chi^2$(4 degrees of freedom) = 4.46; p=.108 Not Significant | $\chi^2$(4 degrees of freedom) = 6.84; p=.145 Not Significant |
| | Fisher's Exact Test p=.117 | Fisher's Exact Test p=.202 |
| **Houston** | $\chi^2$(2 degrees of freedom) = 2.59; p=.27 Not Significant | $\chi^2$(4 degrees of freedom) = 2.50; p=.645 Not Significant |
| | Fisher's Exact Test p=.50 | Fisher's Exact Test p=1.000 |
| **San Antonio** | $\chi^2$(4 degrees of freedom) = 2.34; p=.672 Not Significant | $\chi^2$(4 degrees of freedom) = 4.62; p=.329 Not Significant |
| | Fisher's Exact Test p=.903 | Fisher's Exact Test p=.546 |
| **Dallas** | $\chi^2$(2 degrees of freedom) =3.01; p=.222 Not Significant | - |
| | Fisher's Exact Test p=.309 | - |
| **All Areas** | $\chi^2$(4 degrees of freedom) =4.95; p=.293 Not Significant | $\chi^2$(4 degrees of freedom) =5.11; p=.277 Not Significant |
| | Fisher's Exact Test p=.309 | Fisher's Exact Test p=.31 |
| | CMH $\chi^2$ statistic (4 degrees of freedom) =3.16 p=.53; Not Significant | CMH $\chi^2$ statistic (4 degrees of freedom) =5.14; p=.27; Not Significant |
| | **Non-Abutting Businesses** | |
| **Lubbock** | $\chi^2$(1 degree of freedom) =2.02; p=.155 Not Significant | $\chi^2$(1 degree of freedom) =.938; p=.333 Not Significant |
| | Fisher's Exact Test p=.467 | Fisher's Exact Test p=1.000 |
| **San Antonio** | - | $\chi^2$(1 degree of freedom) =.157; p=.692 Not Significant |
| | - | Fisher's Exact Test p=1.000 |
| **Houston** | $\chi^2$(1 degree of freedom) =3.00; p=.083 Not Significant | $\chi^2$(4 degree of freedom) =2.50; p=.645 Not Significant |
| | Fisher's Exact Test p=.333 | Fisher's Exact Test p=1.000 |
| **All Areas** | $\chi^2$(1 degree of freedom) =.99; p=.320 Not Significant | $\chi^2$(1 degree of freedom) =.47; p=.491 Not Significant |
| | Fisher's Exact Test p=1.000 | Fisher's Exact Test p=1.000 |

**Table 38. Average Number of Parking Spaces Before, During, and After Construction by Design Sub-Area and by Study Area**

| Study Area | Grade | Before Construction ($000) | | During Construction ($000) | | After Construction ($000) | |
|---|---|---|---|---|---|---|---|
| 1. Lubbock | | A | NA | A | NA | A | NA |
| | Elevated | 13.8 | 27.5 | 11.8 | 20.0 | 18.6 | 26.3 |
| | Depressed | 16.2 | 16.6 | 11.1 | 16.6 | 13.9 | 16.6 |
| | At-Grade | 43.4 | - | 43.4 | - | 43.4 | - |
| 2. Houston | Elevated | 120.0 | - | 100.0 | - | 120.0 | - |
| | Depressed | 50.0 | 10.0 | 50.0 | 10.0 | 50.0 | 10.0 |
| | At-Grade | 25.0 | - | 25.0 | - | 25.0 | - |
| 3. San Antonio | Elevated | 32.1 | 23.9 | 30.8 | 23.9 | 31.8 | 24.1 |
| | Depressed | 28.3 | 7.3 | 28.3 | 7.3 | 28.3 | 7.3 |
| | At-Grade | 26.5 | - | 26.1 | - | 27.9 | - |
| 4. Dallas | Elevated | 157.6 | 42.8 | 157.6 | 42.8 | | - |
| | Depressed | 16.2 | 12.6 | 13.7 | 12.6 | - | - |
| | At-Grade | 45.0 | - | 37.7 | - | - | - |

Houston: In the before-after construction situation, 10% of the abutting businesses said that parking spaces had increased; another 10% said that parking spaces had decreased ,and 80% reported no change. All non-abutting businesses reported no change in the number of parking spaces. The average number of parking spaces declined during construction for businesses located adjacent the elevated segment of Beltway 8. Businesses on this section also had the highest average number of parking spaces in all periods. Overall, there was a small decline in the average number of parking spaces from 43.5 to 37.5 during construction. In the after-construction period, businesses had the same number of average parking spaces as before. Since no effect is observed for reporting non-abutting businesses, the decline during construction may be attributed to the construction activity itself.

San Antonio: Many businesses reported no change in the number of parking spaces. A very small percentage, less than 5%, reported an increase or decrease. The average number of parking spaces declined slightly for elevated sections during construction and improved again after construction. At-grade segments also showed a small improvement in the after period. No change is observed on the depressed and non-abutting sections.

Dallas: Nineteen percent of the Dallas abutting businesses reported a decrease, while 81% reported no change. All of the non-abutting businesses reported no change in the number of parking spaces. Businesses located adjacent both the depressed segment and at-grade segment reported a small decline in the average number of parking spaces. Overall, comparing the before-during construction period scenarios, there was approximately a decline of only two parking spaces in the average number of parking spaces per business; comparing the before-after scenarios, there was only a one parking space decline in the after period.

Table 38 shows the average number of parking spaces before, during, and after construction. Since the number of relocations due to right-of-way acquisitions were highest in the Lubbock I-27 study sections, the impact on parking spaces would also be most greatly felt on these sections.

## OPINION OF SURVEYED BUSINESSES ON STUDY FREEWAY DESIGN

### Number of Over and Underpasses

Table 39 presents the responses of abutting and non-abutting businesses, respectively, to the question "What is your opinion on the number of over and underpasses?" The responses indicate clearly that businesses either had no opinion or thought that there were plenty of over and underpasses. A very small percentage believed that there were too many over/underpasses. The preponderance of a large number of 'no opinion' type responses indicates that perhaps this is a design feature that is more difficult for non-technical people to evaluate.

**Table 39. Percentage Distribution of Abutting and Non-Abutting Businesses' Opinions on the Number of Overpasses and Underpasses**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A[8]** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Not enough overpasses | 5.6 | 0.0 | 4.8 | 0.0 | 0.0 | - | 4.3 | 0.0 |
| Not enough underpasses | 0.0 | 0.0 | 4.8 | 0.0 | 0.0 | - | 1.1 | 0.0 |
| Plenty of overpasses | 37.0 | 36.4 | 14.3 | 40.0 | 21.1 | - | 28.7 | 37.8 |
| Plenty of underpasses | 27.8 | 27.3 | 19.1 | 33.3 | 21.1 | - | 24.5 | 29.7 |
| Too many overpasses | 0.0 | 0.0 | 0.0 | 6.7 | 0.0 | - | 0.0 | 2.7 |
| Too many underpasses | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| No opinion | 39.6 | 36.4 | 57.1 | 20.0 | 57.9 | - | 41.5 | 2[illegible].7 |
| Total responses | N=54 | N=22 | N=21 | N=15 | N=19 | - | N=94 | N=37 |

Abutting Businesses: Chi-square Statistic $\chi^2$ (8)= 12.61 p=.126; Fisher's Exact Test p=.118
Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (3) = 2.41 p=.492; Fisher's Exact Test p=.595
Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (5) = 6.46 p=.264; Fisher's Exact Test p=.297

| Response | Elevated A | Elevated NA | Depressed A | Depressed NA | At-Grade A | At-Grade NA | All A | All NA |
|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston** | | | | | | | | |
| Not enough overpasses | 0.0 | 25.0 | 0.0 | 0.0 | 8.3 | - | 2.9 | 16.7 |
| Not enough underpasses | 5.9 | 25.0 | 0.0 | 0.0 | 0.0 | - | 2.9 | 16.7 |
| Plenty of overpasses | 23.5 | 0.0 | 0.0 | 50.0 | 41.7 | - | 26.5 | 16.7 |
| Plenty of underpasses | 11.8 | 0.0 | 0.0 | 0.0 | 33.3 | - | 17.7 | 0.0 |
| Too many overpasses | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.9 | 0.0 |
| Too many underpasses | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.9 | 0.0 |
| No opinion | 47.1 | 50.0 | 100.0 | 50.0 | 16.7 | - | 44.1 | 50.0 |
| Total responses | N=17 | N=4 | N=5 | N=2 | N=12 | - | N=34 | N=6 |

Abutting Businesses: Chi-square Statistic $\chi^2$ (12) = 15.77 p=.202; Fisher's Exact Test p=.113
Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (3) =3.73 p=.292; Fisher's Exact Test p=.643
Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6) =5.49 p=.483; Fisher's Exact Test p=.396

[8] A stands for Abutting Businesses and NA stands for Non-Abutting Businesses.

**Table 39. Percentage Distribution of Abutting and Non-Abutting Businesses' Opinions on the Number of Overpasses and Underpasses (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Not enough overpasses | 8.5 | 2.2 | 15.8 | 0.0 | 6.9 | - | 9.1 | 1.9 |
| Not enough underpasses | 4.9 | 2.2 | 2.6 | 0.0 | 5.6 | - | 4.8 | 1.9 |
| Plenty of overpasses | 18.3 | 29.4 | 15.8 | 40.0 | 31.9 | - | 21.8 | 30.4 |
| Plenty of underpasses | 18.3 | 26.1 | 15.8 | 30.0 | 26.4 | - | 20.2 | 26.5 |
| Too many overpasses | 2.1 | 1.1 | 5.3 | 0.0 | 2.8 | - | 2.8 | 1.0 |
| Too many underpasses | 0.0 | 1.1 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.0 |
| No opinion | 47.9 | 38.0 | 44.7 | 30.0 | 26.4 | - | 41.3 | 37.3 |
| Total responses | N=142 | N=92 | N=38 | N=10 | N=72 | - | N=252 | N=102 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =92.22 p=.001; Fisher's Exact Test p=.001<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (6) = 1.19 p=.977; Fisher's Exact Test p=.879<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6) =13.99 p=.03; Fisher's Exact Test p=.025 | | | | | | | | |
| **Study Area 4: Dallas** | | | | | | | | |
| Not enough overpasses | 0.0 | 9.1 | 9.8 | 13.2 | 27.3 | - | 9.7 | 12.2 |
| Not enough underpasses | 0.0 | 0.0 | 4.9 | 10.5 | 18.2 | - | 5.6 | 8.2 |
| Plenty of overpasses | 25.0 | 18.2 | 34.2 | 31.6 | 9.1 | - | 27.8 | 28.6 |
| Plenty of underpasses | 25.0 | 18.2 | 14.6 | 23.7 | 9.1 | - | 16.7 | 22.5 |
| Too many overpasses | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Too many underpasses | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| No opinion | 50.0 | 54.6 | 36.6 | 21.1 | 36.4 | - | 40.3 | 28.6 |
| Total responses | N=20 | N=11 | N=41 | N=38 | N=11 | - | N=72 | N=49 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =13.73 p =.089; Fisher's Exact Test p =.110<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (4) = 5.27 p =.260; Fisher's Exact Test p =.348<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =2.12 p =.714; Fisher's Exact Test p=.699 | | | | | | | | |

**Table 39. Percentage Distribution of Abutting and Non-Abutting Businesses' Opinions on the Number of Overpasses and Underpasses (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Not enough overpasses | 6.4 | 3.1 | 10.5 | 7.7 | 7.9 | - | 7.7 | 4.6 |
| Not enough underpasses | 3.4 | 2.3 | 3.8 | 6.2 | 5.3 | - | 3.9 | 3.6 |
| Plenty of overpasses | 23.6 | 28.7 | 21.9 | 3.5 | 2.9 | - | 24.6 | 30.9 |
| Plenty of underpasses | 20.6 | 24.8 | 15.2 | 26.2 | 2.5 | - | 20.4 | 25.3 |
| Too many overpasses | 1.7 | 1.0 | 1.9 | 1.5 | 1.8 | - | 1.8 | 1.0 |
| Too many underpasses | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 1.0 |
| No opinion | 43.8 | 39.5 | 46.7 | 23.1 | 31.6 | - | 41.4 | 34.0 |
| Total responses | N=233 | N=129 | N=105 | N=65 | N=114 | - | N=452 | N=194 |

Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =10.45 p=.577; Fisher's Exact Test p=.60
Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (6) =8.57 p=.199; Fisher's Exact Test p= .20
Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6)= 8.3 p=.218; Fisher's Exact Test p= .20

The individual study area statistical tests for abutting businesses are mostly insignificant, with the exception of San Antonio for which the test statistic is significant beyond the 99% confidence level (Fisher's exact test statistic = .001). This indicates that for three out of the four study areas statistical independence of responses from the different grade levels could not be rejected and the general response pattern indicates that people either have no opinion or believe that there are plenty of overpasses and underpasses. In the case of San Antonio, while the majority of the abutting businesses surveyed on elevated and depressed sections have no opinion, respondents on the at-grade sections believe that there are plenty of overpasses and underpasses. In the case of non-abutting businesses, the individual test statistics could not be rejected for all study areas.

Statistical tests were conducted to assess whether there were any differences between the responses of abutting versus non-abutting businesses. Once again, the responses across grade levels were significant only for San Antonio beyond the 95% confidence level since the Fisher's statistic = .03.

**Number of Ramps**

Opinions on the number of on and off ramps for abutting and non-abutting businesses are shown in Table 40. Once again, a large number of 'no opinion' types of responses are observed. The individual test statistics could not be rejected for Lubbock, Houston, and Dallas implying that grade level differences in responses are not statistically significant in these study areas. In the case of San Antonio, however, the tests were rejected for non-abutting sections as well as for abutting versus non-abutting sections. The results are summarized below.

Lubbock: About 17% of the 105 abutting businesses and 18% of the 40 non-abutting businesses responding to the survey believed that there were plenty of on and off ramps; about 56% of responding abutting businesses and 63% of responding non-abutting businesses felt that there were plenty of on and off ramps; 27% of responding abutting businesses and 20% of responding non-abutting businesses had no opinion, and none thought that there were too many on and off ramps.

Houston: About 46% of the 37 abutting businesses and none of the 5 non-abutting businesses responding to the survey believed that there were plenty of on and off ramps; about 32% of responding abutting businesses and 20% of responding non-abutting businesses felt that there were plenty of on and off ramps; 16% of responding abutting businesses and 60% of non-abutting businesses had no opinion; 5% of abutting businesses and 20% of non-abutting businesses thought that there were too many on and off ramps.

**Table 40. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on the Number of Ramps**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| Study Area 1: Lubbock | A | NA | A | NA | A | NA | A | NA |
| Not enough on ramps | 6.5 | 12.5 | 13.0 | 6.3 | 10.0 | - | 8.6 | 10.0 |
| Not enough off ramps | 4.8 | 4.2 | 13.0 | 12.5 | 15.0 | - | 8.6 | 7.5 |
| Plenty of on ramps | 33.9 | 37.5 | 17.4 | 37.5 | 25.0 | - | 28.6 | 37.5 |
| Plenty of off ramps | 35.5 | 20.8 | 17.4 | 31.3 | 15.0 | - | 27.6 | 25.0 |
| Too many on ramps | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Too many off ramps | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| No opinion | 19.4 | 25.0 | 39.1 | 12.5 | 35.0 | - | 26.7 | 20.0 |
| Total responses | N=62 | N=24 | N=23 | N=16 | N=20 | - | N=105 | N=40 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =2.43 p=.168; Fisher's Exact Test p=.118<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (4) = 2.43 p=.657; Fisher's Exact Test p=.719<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =1.44 p=.837; Fisher's Exact Test p=.841 | | | | | | | | |
| **Study Area 2: Houston** | | | | | | | | |
| Not enough on ramps | 23.8 | 0.0 | 33.3 | 0.0 | 10.0 | - | 21.6 | 0.0 |
| Not enough off ramps | 28.6 | 0.0 | 16.7 | 0.0 | 20.0 | - | 24.3 | 0.0 |
| Plenty of on ramps | 9.5 | 33.3 | 16.7 | 0.0 | 30.0 | - | 16.2 | 20.0 |
| Plenty of off ramps | 9.5 | 0.0 | 16.7 | 0.0 | 30.0 | - | 16.2 | 0.0 |
| Too many on ramps | 4.8 | 33.3 | 0.0 | 0.0 | 0.0 | - | 2.7 | 20.0 |
| Too many off ramps | 4.8 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.7 | 0.0 |
| No opinion | 19.1 | 33.3 | 16.7 | 100.0 | 10.0 | - | 16.2 | 60.0 |
| Total responses | N=21 | N=3 | N=6 | N=2 | N=10 | - | N=37 | N=5 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =6.80 p=.871; Fisher's Exact Test p=.907<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (2) = 2.22 p=.329; Fisher's Exact Test p=1.000<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6) =9.99 p=.125; Fisher's Exact Test p=.102 | | | | | | | | |

**Table 40. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on the Number of Ramps (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Not enough on ramps | 13.9 | 10.1 | 21.6 | 0.0 | 17.5 | - | 16.3 | 9.4 |
| Not enough off ramps | 13.3 | 5.1 | 17.7 | 0.0 | 13.8 | - | 14.2 | 4.7 |
| Plenty of on ramps | 23.4 | 34.3 | 19.6 | 12.5 | 26.3 | - | 23.5 | 32.7 |
| Plenty of off ramps | 21.5 | 29.3 | 21.6 | 12.5 | 22.5 | - | 21.8 | 28.0 |
| Too many on ramps | 1.9 | 1.0 | 1.9 | 12.5 | 3.8 | - | 2.4 | 1.9 |
| Too many off ramps | 1.3 | 1.0 | 0.0 | 12.5 | 3.8 | - | 1.7 | 1.9 |
| No opinion | 24.7 | 19.2 | 17.7 | 50.0 | 12.5 | - | 20.1 | 21.5 |
| Total responses | N=158 | N=99 | N=51 | N=8 | N=80 | - | N=289 | N=107 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =10.51 p=.571; Fisher's Exact Test p=.875<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (6) =16.76 p=.01; Fisher's Exact Test p=.026<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6) =12.70 p=.048; Fisher's Exact Test p=.05; | | | | | | | | |
| **Study Area 4: Dallas** | | | | | | | | |
| Not enough on ramps | 13.6 | 15.4 | 17.0 | 19.1 | 30.8 | - | 18.3 | 18.2 |
| Not enough off ramps | 18.2 | 15.4 | 17.0 | 11.9 | 23.1 | - | 18.3 | 12.7 |
| Plenty of on ramps | 22.7 | 23.1 | 27.7 | 28.6 | 15.4 | - | 24.4 | 27.3 |
| Plenty of off ramps | 22.7 | 15.4 | 17.0 | 21.4 | 15.4 | - | 18.3 | 20.0 |
| Too many on ramps | 0.0 | 7.7 | 4.3 | 2.4 | 0.0 | - | 2.4 | 3.6 |
| Too many off ramps | 0.0 | 7.7 | 2.1 | 2.4 | 0.0 | - | 1.2 | 3.6 |
| No opinion | 22.7 | 15.4 | 14.9 | 14.3 | 15.4 | - | 17.1 | 14.6 |
| Total responses | N=22 | N=13 | N=47 | N=42 | N=13 | - | N=82 | N=55 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =5.41 p=.943; Fisher's Exact Test p=1.000<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (6) =2.01 p=.919; Fisher's Exact Test p=.865<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6) =1.96 p=.923; Fisher's Exact Test p=.9; | | | | | | | | |

**Table 40. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on the Number of Ramps (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | A | NA | A | NA | A | NA | A | NA |
| Not enough on ramps | 12.9 | 10.8 | 18.9 | 13.2 | 17.1 | - | 15.4 | 11.6 |
| Not enough off ramps | 12.9 | 5.8 | 16.5 | 10.3 | 15.4 | - | 14.4 | 7.2 |
| Plenty of on ramps | 24.7 | 33.8 | 22.0 | 27.9 | 25.2 | - | 24.2 | 31.9 |
| Plenty of off ramps | 23.9 | 25.9 | 18.9 | 22.1 | 21.1 | - | 22.0 | 24.6 |
| Too many on ramps | 1.5 | 2.2 | 2.4 | 2.9 | 2.4 | - | 1.9 | 2.4 |
| Too many off ramps | 1.1 | 1.4 | 1.0 | 2.9 | 2.4 | - | 1.4 | 1.9 |
| No opinion | 22.8 | 20.1 | 20.5 | 20.6 | 16.3 | - | 20.7 | 20.3 |
| Total responses | N=263 | N=139 | N=127 | N=68 | N=513 | - | N=513 | N=207 |

Abutting Businesses: Chi-square Statistic $\chi^2$ (12) =8.24 p=.766; Fisher's Exact Test p=.8
Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (6) =2.95 p=.815; Fisher's Exact Test p=.78
Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (6)= 11.9 p=.065; Fisher's Exact Test=.05

San Antonio: Thirty percent of the 289 abutting businesses and 14% of the 107 non-abutting businesses responding to the survey believed that there were plenty of on and off ramps; about 45% of responding abutting businesses and 68% of responding non-abutting businesses felt that there were plenty of on and off ramps; 20% of responding abutting businesses and 22% of responding non-abutting businesses had no opinion; 4% of responding abutting businesses and non-abutting businesses thought that there were too many on and off ramps.

Dallas: Thirty-six percent of the 82 abutting businesses and 31% of the 55 non-abutting businesses responding to the survey believed that there were plenty of on and off ramps; about 43% of responding abutting businesses and 47% of responding non-abutting businesses felt that there were plenty of on and off ramps; 17% of responding abutting businesses and

15% of responding non-abutting businesses had no opinion; 4% of responding abutting businesses and 7% of responding non-abutting businesses thought that there were too many on and off ramps.

For the combined sample, 30% out of a total of 513 abutting businesses and 19% of 207 non-abutting businesses who responded to this question on the survey thought that there were plenty of on and off ramps; 46% of responding abutting businesses and 56% of responding non-abutting businesses felt that there were plenty of on and off ramps; 21% of responding abutting businesses and 20% of responding non-abutting businesses had no opinion; 3% of responding abutting businesses and 4% of responding non-abutting businesses thought that there were too many on and off ramps.

**Appearance of the Freeway Design**

When asked their opinions on the general appearance of the freeway design, a majority of the respondents on all design sub-areas clearly revealed that they liked it. For all the study areas combined, about 15% of the 358 abutting businesses and 15% of the 144 non-abutting businesses had no clear-cut opinion. A very small percentage said they disliked the appearance of the freeway design. Seventy nine percent of abutting business respondents and 81% of non-abutting business respondents said they liked the freeway design. The responses of abutting and non-abutting businesses are shown in Table 41 by study area and by design sub-area. Again statistical tests were conducted on the two distributions for each study area individually to ascertain if there are significant differences in opinions 1) across design sub-areas for both abutting and non-abutting businesses, and 2) between businesses abutting the freeway and non-abutting the freeway. The individual statistical tests were not significant and could not be rejected for Lubbock, Dallas, and Houston as indicated by the high values of the Fisher's statistics (exceeding .05), suggesting that no clear-cut differences were observed in the responses either by grade level or by distance from the freeway (i.e., abutting or non-abutting). In the case of San Antonio, however, the statistical tests were rejected with 99% confidence level for abutting businesses but could not be rejected for non-abutting businesses. Even the distance test could not be rejected for San Antonio, suggesting no statistically significant differences in the responses between abutting and non-abutting businesses.

**Table 41. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on the Appearance of Freeway Design**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Like it very much | 30.8 | 44.4 | 18.8 | 20.0 | 35.3 | - | 29.2 | 35.7 |
| Like it OK | 43.6 | 44.4 | 50.0 | 60.0 | 47.1 | - | 45.8 | 50.0 |
| Dislike it some | 10.3 | 5.6 | 12.5 | 10.0 | 0.0 | - | 8.3 | 7.1 |
| Dislike it very much | 2.6 | 5.6 | 6.3 | 0.0 | 0.0 | - | 2.8 | 3.6 |
| No opinion | 12.8 | 0.0 | 12.5 | 10.0 | 17.7 | - | 13.9 | 3.6 |
| No answer | N=3 | N=0 | N=1 | N=0 | N=0 | - | N=4 | N=0 |
| Total responses | N=39 | N=18 | N=16 | N=10 | N=17 | - | N=72 | N=72 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =4.28 p=.831; Fisher's Exact Test p=.838<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (4) =2.32 p=.678; Fisher's Exact Test p=.723<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =2.38 p=.666; Fisher's Exact Test p= .7 | | | | | | | | |
| **Study Area 2: Houston** | | | | | | | | |
| Like it very much | 14.3 | 33.3 | 0.0 | 0.0 | 37.5 | - | 18.5 | 20.0 |
| Like it Ok | 35.7 | 0.0 | 80.0 | 50.0 | 50.0 | - | 48.2 | 20.0 |
| Dislike it some | 14.3 | 0.0 | 0.0 | 0.0 | 0.0 | - | 7.4 | 0.0 |
| Dislike it very much | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 3.7 | 0.0 |
| No opinion | 28.6 | 66.7 | 20.0 | 50.0 | 12.5 | - | 22.2 | 60.0 |
| No answer | N=0 | N=0 | N=0 | N=0 | N=0 | - | N=0 | N=0 |
| Total responses | N=14 | N=3 | N=5 | N=2 | N=8 | - | N=27 | N=5 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =7.52 p=.482; Fisher's Exact Test p=.657<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (2) =2.22 p=.329; Fisher's Exact Test p=1.000<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =3.47 p=.483; Fisher's Exact Test p=.5 | | | | | | | | |

**Table 41. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on Appearance of Freeway Design (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Like it very much | 35.7 | 29.9 | 28.6 | 42.9 | 26.9 | - | 32.2 | 31.1 |
| Like it OK | 50.4 | 52.2 | 45.7 | 42.9 | 55.8 | - | 50.9 | 51.4 |
| Dislike it some | 1.7 | 1.5 | 5.7 | 0.0 | 1.9 | - | 2.5 | 1.4 |
| Dislike it very much | 1.0 | 0.0 | 0.0 | 0.0 | 1.9 | - | 1.0 | 0.0 |
| No opinion | 11.3 | 16.4 | 20.0 | 14.3 | 13.5 | - | 13.4 | 16.2 |
| No answer | N=4 | N=1 | N=0 | N=0 | N=1 | - | N=5 | N=1 |
| Total responses | N=115 | N=67 | N=35 | N=7 | N=52 | - | N=202 | N=74 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =26.05 p=.001; Fisher's Exact Test p=.01<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (3) =.576 p=.902; Fisher's Exact Test p= .875<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =1.38 p=.848; Fisher's Exact Test p=.963 | | | | | | | | |
| **Study Area 4: Dallas** | | | | | | | | |
| Like it very much | 47.1 | 44.4 | 37.5 | 60.7 | 37.5 | - | 40.4 | 56.8 |
| Like it Ok | 17.7 | 44.4 | 43.8 | 17.9 | 37.5 | - | 35.1 | 24.3 |
| Dislike it some | 0.0 | 0.0 | 3.1 | 3.6 | 12.5 | - | 3.5 | 2.7 |
| Dislike it very much | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | - | 1.8 | 0.0 |
| No opinion | 29.4 | 11.1 | 15.6 | 17.9 | 12.5 | - | 19.3 | 16.2 |
| No answer | N=0 | N=0 | N=2 | N=1 | N=0 | - | N=2 | N=1 |
| Total responses | N=17 | N=9 | N=32 | N=28 | N=8 | - | N=57 | N=37 |
| Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =8.56 p=.38; Fisher's Exact Test p=.341<br>Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (3) =2.81 p=.422; Fisher's Exact Test p=.528<br>Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =2.95 p=.567; Fisher's Exact Test p=.57 | | | | | | | | |

**Table 41. Percentage Distribution of Opinions of Abutting and Non-Abutting Businesses on Appearance of Freeway Design (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Like it very much | 34.1 | 34.0 | 28.4 | 46.8 | 30.6 | - | 31.8 | 38.2 |
| Like it OK | 44.9 | 48.5 | 47.7 | 31.9 | 51.8 | - | 47.2 | 43.1 |
| Dislike it some | 4.3 | 2.1 | 5.7 | 4.3 | 2.4 | - | 4.2 | 2.8 |
| Dislike it very much | 2.2 | 1.0 | 1.1 | 0.0 | 1.2 | - | 1.7 | 1.0 |
| No opinion | 14.6 | 14.4 | 17.0 | 17.0 | 14.1 | - | 15.1 | 15.3 |
| No answer | N=8 | N=1 | N=3 | N=1 | N=1 | - | N=12 | N=2 |
| Total responses | N=185 | N=97 | N=88 | N=47 | N=85 | - | N=358 | N=144 |

Abutting Businesses: Chi-square Statistic $\chi^2$ (8) =3.25 p=.918; Fisher's Exact Test p=1.00
Non-Abutting Businesses: Chi-square Statistic $\chi^2$ (4) =4.54 p=.338; Fisher's Exact Test p=.4
Abutting vs. Non-Abutting: Chi-square Statistic $\chi^2$ (4) =2.87 p=.58; Fisher's Exact Test p=.57

Figures 23 and 24 show the similarity of responses for the abutting and non-abutting businesses for the combined sample as well as for individual study areas. The 'like it very much' and 'like it OK' type responses were grouped together into one category in Figures 23 and 24. Similarly, 'dislike it some' and 'dislike it very much' were grouped together. Clearly, the 'like it' type of responses dominate other responses followed by 'no opinion' type responses.

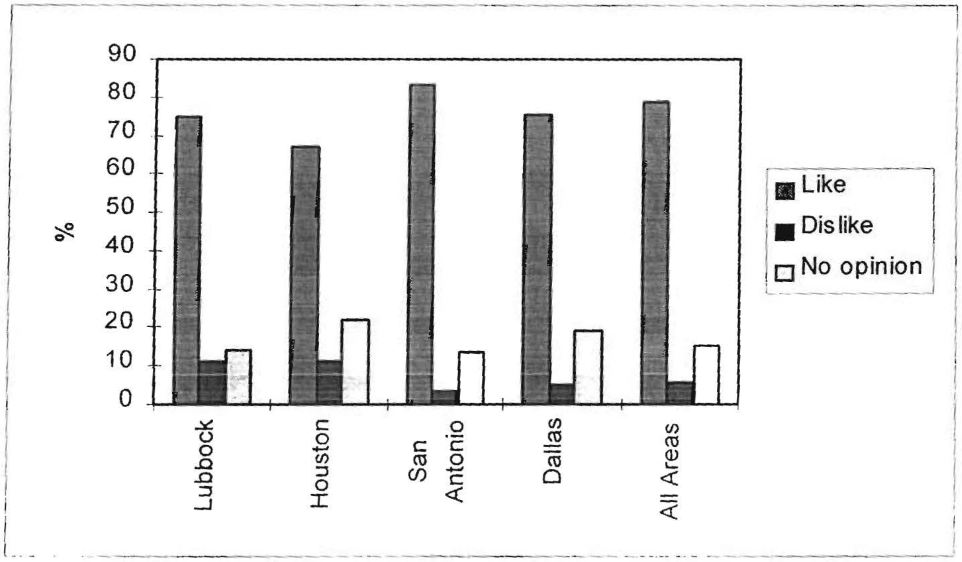



**Figure 23. General Appearance of Freeway Design: Opinions of Abutting Businesses**

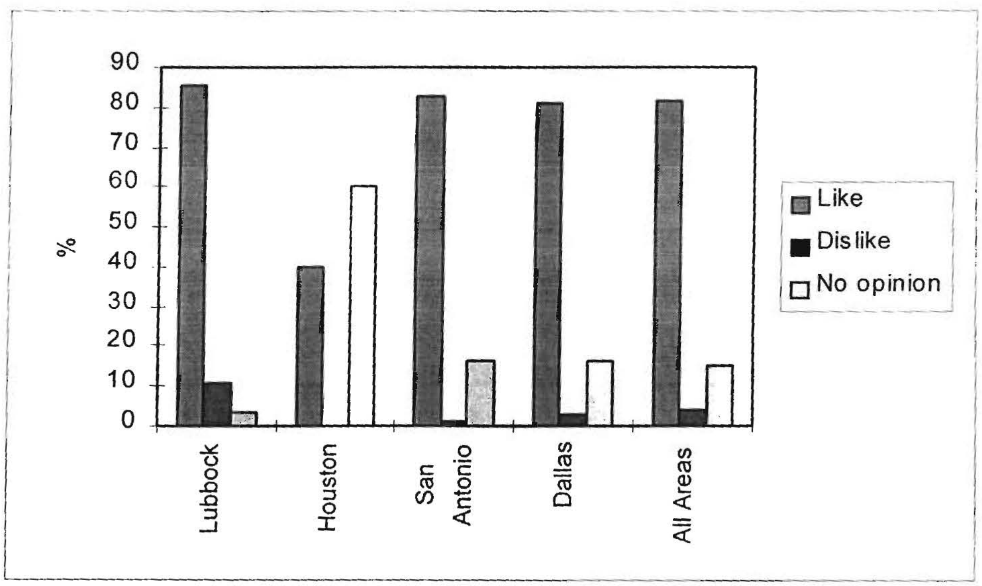



**Figure 24. General Appearance of Freeway Design: Opinions of Non-Abutting Businesses**

# EFFECTS OF STUDY FREEWAYS ON RESIDENTS SURVEYED

This section of the report presents the findings (by grade level) of the surveys of residents conducted to identify some social, economic, and environmental effects of the freeways constructed in Lubbock, Dallas, Houston, and San Antonio. Residents were asked information pertaining to their 1) households, 2) opinions concerning the location of their present location, 3) opinions regarding the effect of the freeway construction on the home, neighborhood, and general preferences on the design of the freeway grade level, and 4) travel experience on the freeway in concern. Respondents were asked open ended as well as questions requiring "yes," "no," or "maybe" type responses.

Percentage distributions are presented by design sub-area to highlight differences between the different grade levels. The percentages reported are based on the actual number of respondents. Just as in the analysis of business surveys, responses are categorized by grade level. In the case of Lubbock, the different design sub-areas correspond to the sections #8, #9, and control at-grade sections; in the case of San Antonio, the elevated sections include sections #2, #3, and #4, while depressed sections include sections #1 and #5. Again, in the case of Dallas and Houston the elevated, depressed, and at-grade design sub-areas reflect the corresponding segments of Beltway 8 and North Central Expressway.

## CHARACTERISTICS OF RESIDENCES IN THE SURVEY

### Number and Type of Dwellings in the Survey

Table 42 summarizes the information on the type and number of abutting and non-butting residential dwellings in all the study areas: Lubbock, Houston, Dallas, and San Antonio. The largest number of the residents surveyed lived in single-family detached buildings. For the combined sample as a whole, 77 % of those surveyed on abutting sections and 80% of those surveyed on non-abutting sections belonged to this group. Thirteen percent of abutting residents and 1% of non-abutting residents surveyed lived in single-family attached type housing. However, a very small percentage, less than 2% of those surveyed, lived in triplexes and quadriplexes. In Lubbock, all of the residents surveyed on abutting sections lived in single-family detached buildings.

**Table 42. Number and Type of Surveyed Dwellings by Study Area[9]**

| | Lubbock % | | Houston % | | San Antonio % | | Dallas % | | All Study Areas Combined % | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Type of Dwelling** | A[10] | NA | A | NA | A | NA | A | NA | A | NA |
| Single-Family Detached | 100.0 | 92.6 | 64.0 | 70.0 | 80.3 | 78.5 | 69.4 | 73.7 | 76.9 | 79.6 |
| Duplex | 0.0 | 3.7 | 0.0 | 0.0 | 9.8 | 8.7 | 0.0 | 22.8 | 3.1 | 9.9 |
| Triplex/Quadriplex | 0.0 | 1.9 | 0.0 | 0.0 | 0.0 | 2.1 | 0.0 | 0.0 | 0.0 | 1.7 |
| Single-Family Attached | 0.0 | 0.0 | 36.0 | 20.0 | 0.0 | 0.4 | 8.3 | 3.5 | 12.8 | 1.4 |
| Multifamily | 0.0 | 1.9 | 0.0 | 10.0 | 9.8 | 10.3 | 22.2 | 0.0 | 7.2 | 7.4 |
| No Response (N) | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 1 |
| Total Responses (N) | 37 | 54 | 61 | 10 | 61 | 242 | 36 | 57 | 195 | 363 |

## Age of Dwellings

Table 43 presents the age distribution of the dwellings occupied by the surveyed residents in the abutting and non-abutting zones. Clearly, the majority of abutting and non-abutting residents in all study areas lived in dwellings which were over 20 years old; the percentage for abutting residents was approximately 86% and for non-abutting residents was 73%. For the combined sample, about 78% out of a total of 551 residents lived in dwellings which were 20 years or older. Another 11.3% of the 551 lived in dwellings aged between 11 and 20 years. Less than 5% of the entire sample lived in dwellings which were less than 10 years in age.

[9] Figures in parentheses represent percentages.

[10] 'A' stands for abutting and 'NA' stands for non-abutting.

**Table 43. Age of Dwelling by Study Area and by Design Sub-Area**

| Years | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 1: Lubbock** | | | | | | | | |
| < 1 | 0.0 | 4.8 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.9 |
| 1- 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 6 - 10 | 0.0 | 0.0 | 2.9 | 3.1 | 0.0 | - | 2.3 | 1.9 |
| 11 - 20 | 0.0 | 23.8 | 5.9 | 18.8 | 0.0 | - | 4.5 | 20.8 |
| > 20 | 100.0 | 71.4 | 91.2 | 78.1 | 100.0 | - | 93.2 | 75.5 |
| Mean age (years) | 25.5 | 16.5 | 25.5 | 19 | 20 | - | 23.6 | 17.8 |
| Total Responses (N) | 4 | 21 | 34 | 32 | 6 | - | 44 | 53 |
| **Study Area 2: Houston** | | | | | | | | |
| < 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 1 - 5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 6 - 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 11 - 20 | 24.0 | 0.0 | 0.0 | 0.0 | 19.0 | - | 13.0 | 0.0 |
| > 20 | 76.0 | 100.0 | 100.0 | 100.0 | 81.0 | - | 87.0 | 100.0 |
| Mean age (years) | 18.5 | 25.5 | 18.5 | 25.5 | 25.5 | - | 20.8 | 25.5 |
| Total Responses (N) | 17 | 2 | 24 | 8 | 21 | - | 62 | 10 |

**Table 43. Age of Dwelling by Study Area and by Design Sub-Area (continued)**

| Years | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 3: San Antonio** | | | | | | | | |
| < 1 | 0.0 | 4.9 | 0.0 | 0.0 | 0.0 | - | 0.0 | 3.1 |
| 1- 5 | 0.0 | 13.3 | 2.3 | 4.6 | 0.0 | - | 1.6 | 10.0 |
| 6 - 10 | 12.5 | 3.5 | 4.6 | 8.1 | 0.0 | - | 6.6 | 5.2 |
| 11 - 20 | 12.5 | 18.2 | 6.8 | 6.9 | 0.0 | - | 8.2 | 13.9 |
| > 20 | 75.0 | 60.1 | 86.4 | 80.5 | 100.0 | - | 83.6 | 67.8 |
| Mean age (years) | 16.5 | 11.5 | 25 | 16.5 | 18.5 | - | 20 | 14 |
| Total Responses | 16 | 143 | 44 | 87 | 1 | - | 61 | 230 |
| **Study Area 4: Dallas** | | | | | | | | |
| < 1 | 0.0 | 0.0 | 3.2 | 1.9 | 0.0 | - | 2.8 | 1.8 |
| 1 - 5 | 0.0 | 0.0 | 6.5 | 1.9 | 0.0 | - | 5.6 | 1.8 |
| 6 - 10 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| 11 - 20 | 0.0 | 0.0 | 9.7 | 7.7 | 100.0 | - | 11.1 | 7.3 |
| > 20 | 100.0 | 100.0 | 80.6 | 88.5 | 0.0 | - | 80.6 | 89.1 |
| Mean age (years) | 25.5 | 25.5 | 25 | 18.5 | 17.5 | - | 22.7 | 22 |
| Total Responses | 4 | 3 | 31 | 52 | 1 | - | 36 | 55 |

**Table 43. Age of Dwelling by Study Area and by Design Sub-Area (continued)**

| Years | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| < 1 | 0.0 | 4.7 | 0.8 | 0.6 | 0.0 | - | 0.5 | 2.6 |
| 1 - 5 | 0.0 | 11.2 | 2.3 | 2.8 | 0.0 | - | 1.5 | 6.9 |
| 6 - 10 | 4.9 | 2.9 | 2.3 | 4.5 | 0.0 | - | 2.5 | 3.7 |
| 11 - 20 | 14.6 | 18.3 | 6.0 | 8.9 | 17.2 | - | 9.4 | 13.5 |
| > 20 | 80.5 | 62.7 | 88.7 | 83.2 | 82.8 | - | 86.2 | 73.3 |
| Mean age (years) | 21.5 | 19.8 | 23.5 | 19.8 | 20.4 | - | 21.8 | 19.8 |
| Total Responses | 41 | 169 | 133 | 179 | 29 | - | 203 | 348 |

The mean age of dwellings abutting I-27 study sections ranged from 25.5 years on elevated section #8 to 20.0 on the at-grade section. On average, dwellings on abutting sections were observed to be older than dwellings on non-abutting sections by approximately four years. Within abutting sections, dwellings located adjacent elevated and depressed sections were older than those adjacent at-grade sections. The reverse situation was observed in the case of the Houston study area. No clear-cut differences within design sub-areas and distance zones were observed in the case of the Dallas study area. In the case of the San Antonio study area, the depressed sections (#1 and #5) had the highest mean age within both abutting and non-abutting sections.

**Number of Rooms in the Dwelling**

A majority of the surveyed residents lived in houses with the number of rooms ranging between five and nine, with the exception of residents surveyed in Houston's Beltway 8 abutting study sections. A very small percentage, less than 4%, lived in houses where the number of rooms exceeded 15. The pattern is again similar across study areas as can be seen from the results presented in Table 44.

Table 44. Number of Rooms in the Dwelling by Study Area

| Number of Rooms | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 1: Lubbock** | | | | | | | | |
| 1- 4 | 20.0 | 31.8 | 14.7 | 12.5 | 0.0 | - | 13.3 | 20.4 |
| 5-9 | 80.0 | 63.6 | 85.3 | 87.5 | 83.3 | - | 84.4 | 77.8 |
| 10-14 | 0.0 | 4.5 | 0.0 | 0.0 | 16.7 | - | 2.2 | 1.9 |
| >15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Total Responses (N) | 5 | 22 | 34 | 32 | 6 | - | 45 | 54 |
| **Study Area 2: Houston** | | | | | | | | |
| 1 - 4 | 12.0 | 0.0 | 5.0 | 14.0 | 0.0 | - | 5.0 | 11.0 |
| 5 - 9 | 71.0 | 50.0 | 36.0 | 71.0 | 21.0 | - | 41.0 | 67.0 |
| 10 - 14 | 18.0 | 50.0 | 55.0 | 14.0 | 79.0 | - | 52.0 | 22.0 |
| >15 | 0.0 | 0.0 | 5.0 | 0.0 | 0.0 | - | 2.0 | 0.0 |
| Total Responses (N) | 17 | 2 | 22 | 7 | 19 | - | 58 | 9 |
| **Study Area 2: San Antonio** | | | | | | | | |
| 1 - 4 | 31.3 | 14.3 | 22.7 | 21.8 | 0.0 | - | 24.6 | 17.1 |
| 5 - 9 | 68.8 | 51.7 | 70.5 | 73.6 | 100.0 | - | 70.5 | 59.8 |
| 10 - 14 | 0.0 | 31.3 | 6.8 | 3.5 | 0.0 | - | 4.9 | 20.9 |
| >15 | 0.0 | 2.7 | 0.0 | 1.2 | 0.0 | - | 0.0 | 2.1 |
| Total Responses (N) | 16 | 147 | 44 | 87 | 1 | - | 61 | 234 |

Table 44. Number of Rooms in the Dwelling by Study Area (continued)

| Number of Rooms | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 4: Dallas** | | | | | | | | |
| 1- 4 | 0.0 | 0.0 | 20.7 | 7.7 | 0.0 | - | 17.6 | 7.3 |
| 5-9 | 100.0 | 0.0 | 72.4 | 80.8 | 100.0 | - | 76.5 | 76.4 |
| 10-14 | 0.0 | 66.7 | 3.4 | 9.6 | 0.0 | - | 2.9 | 12.7 |
| >15 | 0.0 | 33.3 | 3.4 | 1.9 | 0.0 | - | 2.9 | 3.6 |
| Total Responses (N) | 4 | 3 | 29 | 52 | 1 | - | 34 | 55 |
| **All Study Areas Combined** | | | | | | | | |
| 1 - 4 | 19.1 | 16.1 | 17.1 | 15.7 | 0.0 | - | 15.2 | 15.9 |
| 5 - 9 | 73.8 | 52.3 | 68.9 | 78.1 | 40.7 | - | 66.2 | 65.3 |
| 10 - 14 | 7.1 | 28.7 | 12.4 | 5.1 | 59.3 | - | 17.7 | 16.8 |
| >15 | 0.0 | 2.9 | 1.6 | 1.1 | 0.0 | - | 1.0 | 1.9 |
| Total Responses (N) | 42 | 174 | 129 | 178 | 27 | - | 198 | 352 |

### Condition of the Dwelling

The condition of the houses of the residents surveyed is presented in Table 45. The condition of most of the surveyed residents' houses in the Lubbock I-27 study area ranged from good to very poor. Less than 3% of the houses were found to be in very good condition. In the Houston study area, almost all of the houses were found to be in very good or good condition, and 3% of the houses on the abutting sections of the freeway were found in fair condition. None of the houses in the Houston study area were found in either poor or very poor condition. Like the Houston study area, residents' houses in the Dallas study area were found to be in very good to fair condition. A very small percentage of the houses, approximately 3% on the abutting sections and 6% on the non-abutting sections, were found in poor condition, and none were found in very poor condition. In the San Antonio study area, most of the houses were found in conditions ranging from very good to poor. Approximately 9% of the houses in the San Antonio study areas abutting the freeways and 5% of the houses non-abutting the study freeways were found to be in very poor condition.

## CHARACTERISTICS OF RESIDENCES SURVEYED

### Ownership of Property

Table 46 presents the type of tenure of the respondent, i.e., whether he/she was an owner of the house or a renter. The pattern is similar across study areas, with the largest percentages of those surveyed being owners as opposed to renters. The gap between the percentages of owners and renters is much wider in Houston, whereas in San Antonio, Dallas, and Lubbock there is evidence to show that there are a large number of renters as well. In San Antonio, about 39% of the combined 301 residents were found to be renters. Thirty-nine percent of the total 88 residents in Dallas and 41% of 101 residents in Lubbock were found to be renters in comparison to only 15% in Houston.

Table 45. Condition of Dwelling by Study Area and by Design Sub-Area

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 1: Lubbock** | | | | | | | | |
| Very good | 0.0 | 0.0 | 3.6 | 2.9 | 0.0 | - | 2.7 | 1.8 |
| Good | 0.0 | 0.0 | 28.6 | 35.3 | 75.0 | - | 29.7 | 21.4 |
| Fair | 0.0 | 9.1 | 32.1 | 35.3 | 25.0 | - | 27.0 | 25.0 |
| Poor | 20.0 | 77.3 | 32.1 | 23.5 | 0.0 | - | 27.0 | 44.6 |
| Very poor | 80.0 | 13.6 | 3.6 | 2.9 | 0.0 | - | 13.5 | 7.1 |
| Total Responses (N) | 5 | 22 | 28 | 34 | 4 | - | 37 | 56 |
| **Study Area 2: Houston** | | | | | | | | |
| Very good | 47.0 | 50.0 | 43.0 | 63.0 | 86.0 | - | 59.0 | 60.0 |
| Good | 53.0 | 50.0 | 48.0 | 38.0 | 14.0 | - | 38.0 | 40.0 |
| Fair | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 | - | 3.0 | 0.0 |
| Poor | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Very poor | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Total Responses (N) | 17 | 2 | 23 | 8 | 21 | - | 61 | 10 |
| **Study Area 2: San Antonio** | | | | | | | | |
| Very good | 6.3 | 47.0 | 20.5 | 3.3 | 0.0 | - | 16.4 | 30.6 |
| Good | 31.3 | 20.5 | 25.0 | 27.5 | 100.0 | - | 27.9 | 23.1 |
| Fair | 31.3 | 15.9 | 31.8 | 38.5 | 0.0 | - | 31.2 | 24.4 |
| Poor | 18.8 | 11.9 | 15.9 | 26.4 | 0.0 | - | 16.4 | 17.4 |
| Very Poor | 12.5 | 4.6 | 6.8 | 4.4 | 0.0 | - | 8.2 | 4.6 |
| Total Responses (N) | 16 | 151 | 44 | 91 | 1 | - | 61 | 242 |

**Table 45. Condition of Dwelling by Study Area and by Design Sub-Area (continued)**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 4: Dallas** | | | | | | | | |
| Very good | 0.0 | 100.0 | 45.2 | 44.2 | 0.0 | - | 38.9 | 47.3 |
| Good | 50.0 | 0.0 | 9.7 | 30.8 | 0.0 | - | 13.9 | 29.1 |
| Fair | 50.0 | 0.0 | 41.9 | 19.2 | 100.0 | - | 44.4 | 18.2 |
| Poor | 0.0 | 0.0 | 3.2 | 5.8 | 0.0 | - | 2.8 | 5.5 |
| Very poor | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Total Responses (N) | 4 | 3 | 31 | 52 | 1 | - | 36 | 55 |
| **All Study Areas Combined** | | | | | | | | |
| Very good | 21.4 | 42.1 | 26.9 | 17.3 | 66.7 | - | 31.3 | 29.5 |
| Good | 38.1 | 17.9 | 26.2 | 30.3 | 25.9 | - | 28.7 | 24.2 |
| Fair | 16.7 | 14.6 | 30.2 | 30.8 | 7.4 | - | 24.1 | 22.9 |
| Poor | 9.5 | 19.7 | 13.5 | 18.9 | 0.0 | - | 10.8 | 19.3 |
| Very poor | 14.3 | 5.6 | 3.2 | 2.7 | 0.0 | - | 5.1 | 4.1 |
| Total Responses (N) | 42 | 178 | 126 | 185 | 27 | - | 195 | 363 |

**Table 46. Percentage Distribution of Residential Respondents by Type of Tenure and by Design Sub-Area**

| Type of Tenure | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA |
| **Study Area 1: Lubbock** | | | | | | | | |
| Owned | 60.0 | 36.4 | 70.6 | 53.1 | 100.0 | - | 73.3 | 46.3 |
| Rented | 40.0 | 63.6 | 29.4 | 46.9 | 0.0 | - | 26.7 | 53.7 |
| Total Responses (N) | 5 | 22 | 34 | 32 | 6 | - | 45 | 54 |
| **Study Area 2: Houston** | | | | | | | | |
| Owned | 59.0 | 50.0 | 96.0 | 88.0 | 95.0 | - | 85.0 | 80.0 |
| Rented | 41.0 | 50.0 | 4.0 | 13.0 | 5.0 | - | 15.0 | 20.0 |
| Total Responses (N) | 17 | 2 | 23 | 8 | 21 | - | 61 | 10 |
| **Study Area 3: San Antonio** | | | | | | | | |
| Owned | 50.0 | 69.1 | 52.3 | 54.9 | 100.0 | - | 52.5 | 63.8 |
| Rented | 50.0 | 30.9 | 47.7 | 45.1 | 0.0 | - | 47.5 | 36.3 |
| Total Responses (N) | 16 | 149 | 44 | 91 | 1 | - | 61 | 240 |
| **Study Area 4: Dallas** | | | | | | | | |
| Owned | 100.0 | 100.0 | 51.6 | 57.7 | 0.0 | - | 55.6 | 60.0 |
| Rented | 0.0 | 0.0 | 38.7 | 42.3 | 100.0 | - | 36.1 | 40.0 |
| Total Responses (N) | 4 | 3 | 28 | 52 | 1 | - | 33 | 55 |
| **All Study Areas** | | | | | | | | |
| Owned | 59.5 | 65.3 | 65.9 | 56.8 | 93.1 | - | 68.5 | 61.0 |
| Rented | 40.5 | 34.6 | 34.1 | 43.2 | 6.9 | - | 31.5 | 39.0 |
| Total Responses (N) | 42 | 176 | 129 | 183 | 29 | - | 200 | 359 |

**Length of Time at Present Location**

All residents on abutting and non-abutting sections were asked to indicate how long they were located at the present location. Tables 47 and 48 present the percentage distributions of abutting and non-abutting residents by length of stay in the neighborhood and by design sub-area.

Lubbock: The mean lengths of stay for abutting residents in the at-grade and depressed portions of the freeway are much higher than on elevated sections, with the overall average length of stay being equal to 19.7 years. For non-abutting residents, the mean length of stay was 8.9 years.

Houston: Residents living on properties abutting the depressed sections of the freeway had the longest average length of stay of 20.2 years, while those living on elevated sections had a mean length of stay of only 8.8 years. Again, the mean length of stay for non-abutting residents also was higher on depressed sections. The mean length of stay for abutting residents was 14.7 years and 11.8 years for non-abutting residents.

San Antonio: For residents abutting the freeway, those living near at-grade portions had the highest length of stay of 30 years, while those living near depressed sections had been in the neighborhood for the shortest time. However, for non-abutting residents, those living near depressed segments had longer lengths of stay than those living near elevated segments. The average length of stay for abutting residents was 16.2 years and 12.8 years for non-abutting residents.

Dallas: The mean length of stay for abutting and non-abutting residents was highest for those residing near elevated portions of the freeway. The overall mean length for abutting residents was 10.9 years and 13.5 years for non-abutting residents.

**Table 47. Percentage Distribution of Abutting Res'dential Respondents by Length of Residency in Neighborhood and by Design Sub-Area**

| Years | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas |
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | |
| 1 | 20.0 | 24.0 | 6.7 | 25.0 | 17.1 | 26.5 | 0.0 | 19.5 | 35.7 | 21.4 | 0.0 | 15.0 | 0.0 | 0.0 | 10.7 | 22.2 | 12.0 | 15.8 | 33.3 | 18.9 |
| 2 | 0.0 | 0.0 | 20.0 | 0.0 | 7.3 | 8.8 | 4.0 | 2.4 | 7.1 | 5.6 | 16.7 | 0.0 | 0.0 | 0.0 | 3.6 | 8.9 | 2.0 | 7.0 | 6.1 | 5.6 |
| 3 | 20.0 | 18.0 | 6.7 | 0.0 | 12.2 | 0.0 | 4.0 | 7.3 | 10.7 | 5.6 | 0.0 | 5.0 | 0.0 | 0.0 | 3.6 | 2.2 | 8.0 | 7.0 | 9.1 | 6.7 |
| 4 | 0.0 | 0.0 | 13.3 | 0.0 | 4.9 | 2.9 | 4.0 | 0.0 | 7.1 | 3.2 | 0.0 | 15.0 | 0.0 | 0.0 | 10.7 | 2.2 | 7.0 | 3.5 | 6.1 | 4.6 |
| 5 | 0.0 | 12.0 | 6.7 | 0.0 | 7.3 | 5.9 | 9.0 | 4.9 | 7.1 | 6.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.4 | 7.0 | 5.3 | 6.1 | 5.6 |
| 6-9 | 0.0 | 6.0 | 6.7 | 0.0 | 4.9 | 5.9 | 9.0 | 9.8 | 3.6 | 7.1 | 0.0 | 20.0 | 0.0 | 100.0 | 17.9 | 4.4 | 12.0 | 8.8 | 6.1 | 8.2 |
| 10-14 | 0.0 | 18.0 | 13.3 | 0.0 | 12.2 | 5.9 | 0.0 | 14.6 | 7.1 | 7.9 | 33.3 | 5.0 | 0.0 | 0.0 | 10.7 | 8.9 | 7.0 | 14.0 | 6.1 | 9.2 |
| 15-19 | 0.0 | 12.0 | 6.7 | 0.0 | 7.3 | 17.6 | 22.0 | 9.8 | 3.6 | 12.7 | 0.0 | 5.0 | 0.0 | 0.0 | 3.6 | 13.3 | 13.0 | 8.8 | 3.0 | 10.3 |
| >20 | 60.0 | 12.0 | 20.0 | 75.0 | 26.8 | 26.5 | 48.0 | 31.7 | 17.9 | 30.2 | 50.0 | 35.0 | 100.0 | 0.0 | 39.3 | 33.3 | 33.0 | 29.8 | 24.2 | 30.8 |
| Mean Length (years) | 22.4 | 8.8 | 10.7 | 17.6 | 11.9 | 13.5 | 20.2 | 17.9 | 9.2 | 15.2 | 23.3 | 13.3 | 30.0 | 5.8 | 15.8 | 19.7 | 14.7 | 16.2 | 10.9 | 14.6 |
| Total Responses (N) | 5 | 17 | 15 | 4 | 41 | 34 | 23 | 41 | 28 | 126 | 6 | 20 | 1 | 1 | 28 | 45 | 60 | 57 | 33 | 195 |

# Table 48. Percentage Distribution of Non-Abutting Residential Respondents by Length of Residency in Neighborhood and by Design Sub-Area

| Years | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Study Area[1] | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas | Study Area | | | | All Study Areas |
| | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | 4 | |
| 1 | 9.1 | 50.0 | 17.8 | 0.0 | 16.8 | 25.0 | 13.0 | 23.8 | 22.6 | 23.1 | - | - | - | - | - | 18.0 | 20.0 | 20.0 | 14.8 | 19.9 |
| 2 | 22.7 | 0.0 | 10.3 | 0.0 | 11.6 | 7.1 | 0.0 | 10.7 | 20.8 | 12.7 | - | - | - | - | - | 14.0 | 0.0 | 10.4 | 13.6 | 12.1 |
| 3 | 18.2 | 0.0 | 13.0 | 33.3 | 13.9 | 3.6 | 13.0 | 1.2 | 1.9 | 2.3 | - | - | - | - | - | 10.0 | 10.0 | 8.7 | 2.5 | 8.1 |
| 4 | 4.5 | 50.0 | 2.7 | 0.0 | 3.5 | 3.6 | 0.0 | 4.8 | 7.5 | 5.2 | - | - | - | - | - | 4.0 | 10.0 | 3.5 | 4.9 | 4.3 |
| 5 | 18.2 | 0.0 | 6.2 | 0.0 | 7.5 | 7.1 | 0.0 | 5.9 | 1.9 | 4.6 | - | - | - | - | - | 12.0 | 0.0 | 6.1 | 1.2 | 6.1 |
| 6-9 | 9.1 | 0.0 | 10.3 | 0.0 | 9.8 | 10.7 | 13.0 | 2.4 | 15.1 | 8.1 | - | - | - | - | - | 10.0 | 10.0 | 7.4 | 9.9 | 8.9 |
| 10-14 | 4.5 | 0.0 | 8.2 | 0.0 | 7.5 | 14.3 | 13.0 | 9.5 | 0.0 | 7.5 | - | - | - | - | - | 10.0 | 10.0 | 8.7 | 0.0 | 7.5 |
| 15-19 | 4.5 | 0.0 | 7.5 | 0.0 | 6.9 | 3.6 | 0.0 | 4.8 | 5.7 | 4.6 | - | - | - | - | - | 4.0 | 0.0 | 6.5 | 3.7 | 5.8 |
| >20 | 9.1 | 0.0 | 23.9 | 66.7 | 22.5 | 25.0 | 50.0 | 36.9 | 24.5 | 31.8 | - | - | - | - | - | 18.0 | 40.0 | 28.7 | 18.5 | 27.2 |
| Mean Length (years) | 6.8 | 2.5 | 11.3 | 15.0 | 10.7 | 11.0 | 14.1 | 15.5 | 10.0 | 13.1 | - | - | - | - | - | 8.9 | 11.8 | 12.8 | 13.5 | 11.9 |
| Total Responses (N) | 22 | 2 | 146 | 3 | 173 | 28 | 8 | 84 | 53 | 173 | - | - | - | - | - | 50 | 10 | 230 | 81 | 346 |

For the combined sample, the mean length of stay was 14.6 years for abutting residents and 11.9 years for non-abutting residents. Also, the mean length was highest at 15.8 years for abutting residents living near at-grade segments followed by residents living near depressed segments. For non-abutting sections, residents living near depressed segments had means lengths of stay greater than those living near elevated portions. In the abutting sections, Lubbock study area residents had the longest mean length of stay of 19.7 years and Dallas had the lowest with 10.9 years. In the non-abutting segments, the pattern was exactly reverse with San Antonio and Houston retaining the same ranking. To conclude, there are substantial differences in the lengths of stay within each study area, across design sub-areas, and also by distance zone (i.e., abutting versus non-abutting). However, it appears from the combined study area analysis, that people living near depressed segments on average have higher mean lengths of stay than those residing near elevated segments.

In order to assess whether there were any significant differences in lengths of residency between owners and renters, respondents were cross classified by tenure type and length of stay. The percentage distribution of respondents by tenure type and length of stay is shown in Table 49. Clearly, there are substantial differences between owners and renters with respect to length of stay. The mean length of stay for owners is always much higher than that for renters in all study areas. For all study areas combined, approximately 31% of the owners had resided in the neighborhood for five years or less, while 61% had lived in the area for ten years or more. For renters, the pattern is reverse, with 68% living in the neighborhood for five years or less and only 12% living in the neighborhood for ten years or more. This pattern is common to all study areas individually.

**Estimated Value of Property**

The percentage distribution of respondents in the various property value categories is presented in Table 50. Substantial differences are apparent in the distribution of responses within each of the study areas, both across design sub-areas and between abutting versus non-abutting residents.

**Table 49. Percentage Distribution of Residential Respondents by Type of Tenure and by Length of Stay in the Neighborhood**

| Length of Residency (years) | Tenure by Study Area Owner (%) | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | All Study Areas |
| 1 | 11.7 | 5.0 | 11.1 | 13.2 | 10.5 |
| 2 | 5.0 | 0.0 | 5.3 | 7.5 | 4.7 |
| 3 | 3.3 | 8.3 | 7.4 | 7.5 | 6.9 |
| 4 | 1.7 | 8.3 | 3.2 | 7.5 | 4.4 |
| 5 | 6.7 | 3.3 | 4.2 | 1.9 | 4.1 |
| 6 - 9 | 6.7 | 13.3 | 6.3 | 11.3 | 8.3 |
| 10 - 14 | 11.7 | 8.3 | 12.7 | 3.8 | 10.5 |
| 15 - 19 | 13.3 | 13.3 | 9.5 | 5.7 | 10.2 |
| > 20 | 40 | 40.0 | 40.2 | 41.5 | 40.3 |
| Mean Length of Stay (years) | 17.5 | 16.3 | 17.7 | 14.7 | 16.9 |
| Total Responses (N) | N=60 | N=60 | N=189 | N=53 | N=362 |
| **Length of Residency (years)** | **Tenure by Study Area (Renter) (%)** | | | | |
| | 1 | 2 | 3 | 4 | All Study Areas |
| 1 | 30.8 | 54.5 | 35.4 | 45.7 | 37.4 |
| 2 | 23.1 | 9.1 | 15.0 | 25.7 | 18.2 |
| 3 | 12./8 | 9.1 | 9.7 | 2.9 | 9.1 |
| 4 | 5.1 | 0.0 | 3.5 | 5.7 | 4.0 |
| 5 | 10.3 | 18.2 | 8.8 | 5.7 | 9.1 |
| 6 - 9 | 7.7 | 9.1 | 12.4 | 8.6 | 10.6 |
| 10 - 14 | 5.1 | 0.0 | 7.1 | 0.0 | 5.1 |
| 15 - 19 | 0.0 | 0.0 | 1.8 | 2.9 | 1.5 |
| > 20 | 5.1 | 0.0 | 6.2 | 2.9 | 5.1 |
| Mean Length of Stay | 4.7 | 2.7 | 5.4 | 3.9 | 4.9 |
| Total Responses (N) | N=39 | N=11 | N=113 | N=35 | N=198 |

**Table 49. Percentage Distribution of Residential Respondents by Type of Tenure and by Length of Stay in the Neighborhood (continued)**

| Length of Residency (years) | Tenure by Study Area Total (%) | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | All Study Areas |
| 1 | 19.2 | 12.7 | 20.2 | 26.1 | 20.0 |
| 2 | 12.1 | 1.4 | 8.9 | 14.8 | 9.5 |
| 3 | 7.1 | 8.5 | 8.3 | 5.7 | 7.7 |
| 4 | 3.0 | 7.0 | 3.3 | 6.8 | 4.3 |
| 5 | 8.1 | 5.6 | 5.9 | 3.4 | 5.9 |
| 6 - 9 | 7.1 | 12.7 | 8.6 | 10.2 | 9.1 |
| 10 - 14 | 9.1 | 7.0 | 10.6 | 2.3 | 8.6 |
| 15 - 19 | 8.1 | 11.3 | 6.6 | 4.5 | 7.1 |
| > 20 | 26.3 | 33.8 | 27.5 | 26.1 | 27.9 |
| Total Responses (N) | N=99 | N=71 | N=302 | N=88 | N=560 |
| Study Area 1: Chi-square statistic (8 degrees of freedom) =32.5 p=.001 Significant | | | | | |
| Study Area 2: Chi-square statistic (8 degrees of freedom) =30.5 p=.001 Significant | | | | | |
| Study Area 3: Chi-square statistic (8 degrees of freedom) = 72.5 p=.001 Significant | | | | | |
| Study Area 4: Chi-square statistic (8 degrees of freedom) = 11.4 p=.18 Not Significant | | | | | |

## Table 50. Estimated Property Value Range of Abutting and Non-Abutting Residents by Design Sub-Area

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area: Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| < $10,000 | 33.3 | 15.0 | 0.0 | 3.4 | 0.0 | - | 2.6 | 8.2 | 5.7 |
| $10,001-$25,000 | 66.7 | 40.0 | 41.9 | 34.5 | 0.0 | - | 38.5 | 36.7 | 37.5 |
| $25,001-$50,000 | 0.0 | 35.0 | 45.2 | 55.2 | 20.0 | | 38.5 | 46.9 | 43.2 |
| $50,001-$75,000 | 0.0 | 10.0 | 9.7 | 6.9 | 0.0 | - | 7.7 | 8.2 | 7.9 |
| $75,001-$100,000 | 0.0 | 0.0 | 3.2 | 0.0 | 80.0 | - | 12.8 | 0.0 | 6.8 |
| $100,001-$200,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $200,001-$500,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| > $500,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Mean property value ($) | 10,000 | 16,000 | 65,000 | 22,000 | 22,000 | - | 32,333 | 19,000 | 25,667 |
| Total Responses | 3 | 20 | 31 | 29 | 5 | - | 39 | 49 | 88 |
| **Study Area Houston** | | | | | | | | | |
| < $10,000 | 0.0 | 0.0 | 0.0 | 13.0 | 0.0 | - | 0.0 | 10.0 | 1.0 |
| $10,001-$25,000 | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.0 | 0.0 | 1.0 |
| $25,001-$50,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $50,001-$75,000 | 29.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 9.0 | 0.0 | 7.0 |
| $75,001-$100,000 | 53.0 | 100.0 | 10.0 | 0.0 | 0.0 | - | 19.0 | 20.0 | 19.0 |
| $100,001-$200,000 | 12.0 | 0.0 | 76.0 | 75.0 | 0.0 | - | 55.0 | 60.0 | 56.0 |
| $200,001-$500,000 | 0.0 | 0.0 | 14.0 | 13.0 | 70.0 | - | 16.0 | 10.0 | 15.0 |
| > $ 500,000 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | - | 0.0 | 0.0 | 0.0 |
| Mean property value ($) | 65,000 | 75,000 | 30,000 | 90,000 | 100,000 | - | 65,000 | 82,500 | 73,750 |
| Total Responses | 17 | 2 | 21 | 8 | 20 | - | 58 | 10 | 68 |

**Table 50. Estimated Property Value Range of Abutting and Non-Abutting Residents by Design Sub-Area (continued)**

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| < $10,000 | 0.0 | 2.4 | 2.6 | 9.1 | 0.0 | - | 1.9 | 4.9 | 4.3 |
| $10,001-$25,000 | 26.7 | 7.1 | 26.3 | 31.2 | 0.0 | - | 25.9 | 16.3 | 18.3 |
| $25,001-$50,000 | 53.3 | 14.3 | 28.9 | 36.4 | 100.0 | - | 37.0 | 22.7 | 25.7 |
| $50,001-$75,000 | 6.7 | 8.7 | 28.9 | 16.9 | 0.0 | - | 22.2 | 11.8 | 14.0 |
| $75,001-$100,000 | 6.7 | 11.9 | 13.2 | 3.9 | 0.0 | - | 11.1 | 8.9 | 9.3 |
| $100,001-$200,000 | 6.7 | 44.4 | 0.0 | 0.0 | 0.0 | - | 1.9 | 27.6 | 22.2 |
| $200,001-$500,000 | 0.0 | 7.9 | 0.0 | 1.3 | 0.0 | - | 0.0 | 5.4 | 4.3 |
| >$500,000 | 0.0 | 3.2 | 0.0 | 1.3 | 0.0 | - | 0.0 | 2.5 | 1.9 |
| Mean property value ($) | 30,000 | 75,000 | 25,000 | 24,000 | 38,000 | - | 38,000 | 49,500 | 40,250 |
| Total Responses | 15 | 126 | 38 | 77 | 1 | - | 54 | 203 | 257 |
| **Study Area 4: Dallas** | | | | | | | | | |
| < $10,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $10,000-$25,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $25,001-$50,000 | 33.3 | 0.0 | 3.8 | 0.0 | 0.0 | - | 6.7 | 0.0 | 2.5 |
| $50,001-$75,000 | 33.3 | 0.0 | 19.2 | 19.6 | 0.0 | - | 20.0 | 18.4 | 19.0 |
| $75,001-$100,000 | 0.0 | 0.0 | 15.4 | 28.3 | 0.0 | - | 13.3 | 26.5 | 21.5 |
| $100,001-$200,000 | 33.3 | 33.3 | 53.8 | 41.3 | 0.0 | - | 50.0 | 40.8 | 44.3 |
| $200,001-$500,000 | 0.0 | 66.7 | 7.7 | 6.5 | 100.0 | - | 10.0 | 10.2 | 10.1 |
| > $500,000 | 0.0 | 0.0 | 0.0 | 4.3 | 0.0 | - | 0.0 | 4.1 | 2.5 |
| Mean property value ($) | 57,500 | 170,000 | 200,000 | 90,000 | 88,000 | - | 115,167 | 130,000 | 122,583 |
| Total Responses | 3 | 3 | 26 | 46 | 1 | - | 30 | 49 | 79 |

**Table 50. Estimated Property Value Range of Abutting and Non-Abutting Residents by Design Sub-Area (continued)**

| Dollar Value of Property | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas Combined** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| < $10,000 | 2.6 | 3.9 | 0.9 | 5.6 | 0.0 | - | 1.1 | 4.8 | 3.5 |
| $10,000-$25000 | 18.4 | 11.3 | 19.8 | 21.3 | 0.0 | - | 16.6 | 16.4 | 16.5 |
| $25,001-$50,000 | 23.7 | 16.6 | 22.4 | 27.5 | 7.4 | - | 20.4 | 22.2 | 21.5 |
| $50,001-$75,000 | 18.4 | 8.6 | 16.4 | 15.0 | 0.0 | - | 14.4 | 11.9 | 12.8 |
| $75,001-$100,000 | 26.3 | 11.3 | 10.3 | 10.0 | 14.8 | - | 14.4 | 10.6 | 11.9 |
| $100,001-$200,000 | 10.5 | 37.8 | 25.9 | 15.6 | 51.9 | - | 26.5 | 26.4 | 26.4 |
| $200,001-$500,000 | 0.0 | 7.9 | 4.3 | 3.1 | 25.9 | - | 6.6 | 5.5 | 5.9 |
| > $500,000 | 0.0 | 2.7 | 0.0 | 1.9 | 0.0 | - | 0.0 | 2.3 | 1.4 |
| Mean property value ($) | 40,625 | 84,000 | 80,000 | 56,500 | 62,000 | - | 60,875 | 70,250 | 65,563 |
| Total Responses | 38 | 151 | 116 | 160 | 27 | - | 181 | 311 | 492 |

Lubbock: Almost 80% of the residents on abutting segments and 92% on non-abutting segments reported property values ranging from less than $10,000 to $50,000. Of these, a very small percentage, approximately 3%, in abutting sections and 8% in non-abutting sections, owned/rented properties whose value was less than $10,000. There were no properties whose values exceeded $100,000 in value. Depressed sections had the highest mean property values. Further, the mean property value for properties on abutting sections was $32,333, and this exceeded the mean value for properties on non-abutting sections.

Houston: Approximately 19% of the surveyed residents declared that their properties were worth anywhere between $75,000 to $100,000. Another 56% reported property values ranging from $100,000 to $200,000 and yet another 15% reported property values ranging from $200,000 to $500,000. Only 9% reported values less than $75,000. No property was declared as having a value in excess of $500,000. The average property value on non-abutting sections exceeded the average property value on abutting sections. Within abutting sections, the average property value was highest for properties adjacent the at-grade segment of Beltway 8.

San Antonio: Forty-three percent of the total number of residents surveyed reported property values ranging from $10,000 to $50,000. Twenty-three percent reported property values in the range of $50,000 to $100,000. Another 22% responded that their properties were valued in the $100,000 to $200,000 range. Six percent reported values in excess of $200,000 and all of these residents resided on non-abutting segments of the study freeways. Less than 4% of the total number surveyed in San Antonio lived in buildings which were worth less than $10,000 in value. The average property value on non-abutting sections exceeded the average property value on abutting sections. Within abutting sections, the mean property value was the highest on the at-grade portions.

Dallas: Forty-one percent of the residents surveyed declared that their properties were valued between $50,000 an $100,000. Fifty-four percent reported property values in the $100,000 to $500,000 range. Two and one-half percent reported values between $25,000 and

$50,000,all of which were located in abutting segments of the study freeways. Yet another 2.5% reported values in excess of $500,000, all of which were located in non-abutting segments. The average property value on non-abutting sections exceeded the average property value on abutting sections. Within abutting sections, the average property value was the highest on the depressed segment of Central Expressway. Within non-abutting sections, the average property value was the highest on the elevated segment.

For the combined sample of all the four study areas, about 4% of the total number surveyed reported values less than $10,000. Thirty-eight percent reported values ranging from $10,000 to $50,000. Twenty-five percent declared that their properties were valued in the $50,000 to $100,000 range. Another 26% reported values in the $100,000 to $200,000 range. Only about 6% reported values in $200,000 to $500,000 range, and about 1.4% reported values in excess of $500,000 (all of which were located in non-abutting segments). Overall, depressed segments had the highest average property values on abutting sections, and elevated segments had the highest average property values on non-abutting sections.

**Ethnicity, Size of the Household, and Number of Occupants Related**

Table 51 presents information pertaining to some personal characteristics of the residents surveyed as well as household size and composition.

## Table 51. Percentage Distribution of Respondents By Ethnicity, Household Size, and Composition

| Household Information | Elevated % | | Depressed % | | A -Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| Study Area: Lubbock | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Total |
| Ethnicity: Anglo | 40.0 | 18.2 | 39.3 | 36.4 | 75.0 | - | 43.2 | 29.1 | 34.8 |
| Black | 20.0 | 9.1 | 10.7 | 15.2 | 0.0 | - | 10.8 | 12.7 | 11.9 |
| Hispanic | 40.0 | 72.7 | 50.0 | 48.5 | 25.0 | - | 45.9 | 58.2 | 53.3 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| No response (N) | 0 | 0 | 6 | 0 | 2 | - | 8 | 0 | 8 |
| Total Responses (N) | 5 | 22 | 28 | 33 | 4 | - | 37 | 55 | 92 |
| **Size:** 1 - 2 | 80.0 | 27.3 | 36.4 | 21.9 | 66.7 | - | 45.5 | 24.1 | 33.7 |
| 3 - 5 | 20.0 | 50.0 | 48.5 | 59.4 | 33.3 | - | 43.2 | 55.6 | 50.0 |
| ≥6 | 0.0 | 22.7 | 15.2 | 18.8 | 0.0 | - | 11.4 | 20.4 | 16.3 |
| No response (N) | 0 | 0 | 1 | 1 | 0 | - | 1 | 1 | 2 |
| Total Responses (N) | 5 | 22 | 33 | 32 | 6 | - | 44 | 54 | 98 |
| **Composition**: Couple | 50.0 | 5.9 | 17.2 | 11.5 | 50.0 | - | 25.6 | 9.3 | 17.1 |
| Couple + children | 0.0 | 58.8 | 48.3 | 65.4 | 33.3 | - | 41.0 | 62.8 | 52.4 |
| Family + Relatives | 25.0 | 17.6 | 17.2 | 3.8 | 0.0 | - | 15.4 | 9.3 | 12.2 |
| Family + Non-Relatives | 0.0 | 5.9 | 0.0 | 0.0 | 0.0 | - | 0.0 | 2.3 | 1.2 |
| Roommates Only | 0.0 | 5.9 | 3.4 | 0.0 | 0.0 | - | 2.6 | 2.3 | 2.4 |
| Alone | 0.0 | 0.0 | 3.4 | 0.0 | 0.0 | - | 2.6 | 0.0 | 1.2 |
| Other (single mother) | 25.0 | 5.9 | 10.3 | 19.2 | 16.7 | - | 12.8 | 14.0 | 13.4 |
| No Response (N) | 1 | 5 | 5 | 7 | 0 | - | 6 | 12 | 18 |
| Total Responses (N) | 4 | 17 | 29 | 26 | 6 | - | 39 | 43 | 82 |

## Table 51. Percentage Distribution of Respondents By Ethnicity, Household Size, and Composition (continued)

| Household Information | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| Study Area: Houston | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Total |
| Ethnicity: Anglo | 76.0 | 50.0 | 100.0 | 87.5 | 95.0 | - | 92.0 | 80.0 | 90.0 |
| Black | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Hispanic | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Other | 24.0 | 50.0 | 0.0 | 12.5 | 5.0 | - | 8.0 | 20.0 | 10.0 |
| No response (N) | 0 | 0 | 1 | 0 | 0 | - | 1 | 0 | 1 |
| Total Responses (N) | 17 | 2 | 23 | 8 | 21 | - | 61 | 10 | 71 |
| Size: 1 - 2 | 53.0 | 0.0 | 64.0 | 25.0 | 53.0 | - | 57.0 | 20.0 | 51.0 |
| 3 - 5 | 47.0 | 100.0 | 36.0 | 75.0 | 47.0 | - | 43.0 | 80.0 | 49.0 |
| ≥6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| No response (N) | 0 | 0 | 2 | 0 | 2 | - | 4 | 0 | 4 |
| Total Responses (N) | 17 | 2 | 22 | 8 | 19 | - | 58 | 10 | 68 |
| Composition: Couple | 35.0 | 0.0 | 32.0 | 25.0 | 19.0 | - | 30.0 | 20.0 | 28.0 |
| Couple + children | 35.0 | 100.0 | 47.0 | 75.0 | 33.0 | - | 41.0 | 80.0 | 47.0 |
| Family + Relatives | 0.0 | 0.0 | 5.0 | 0.0 | 5.0 | - | 4.0 | 0.0 | 3.0 |
| Family + Non-Relatives | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.0 | 0.0 | 2.0 |
| Roommates Only | 0.0 | 0.0 | 11.0 | 0.0 | 5.0 | - | 6.0 | 0.0 | 5.0 |
| Alone | 12.0 | 0.0 | 5.0 | 0.0 | 33.0 | - | 19.0 | 0.0 | 16.0 |
| Other (single mother) | 12.0 | 0.0 | 0.0 | 0.0 | 5.0 | - | 0.0 | 0.0 | 0.0 |
| No Response (N) | 0 | 0 | 2 | 0 | 3 | - | 8 | 0 | 8 |
| Total Responses (N) | 17 | 2 | 19 | 8 | 21 | - | 54 | 10 | 64 |

**Table 51. Percentage Distribution of Respondents by Ethnicity, Household Size, and Composition (continued)**

| Household Information | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Ethnicity**: Anglo | 18.8 | 63.5 | 20.5 | 8.8 | 0.0 | - | 19.7 | 42.7 | 38.0 |
| Black | 6.3 | 0.7 | 2.3 | 18./7 | 0.0 | - | 3.3 | 7.5 | 6.7 |
| Hispanic | 75.0 | 35.1 | 77.3 | 72.5 | 100.0 | - | 77.1 | 49.4 | 55.0 |
| Other | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.4 | 0.3 |
| No response (N) | 0 | 3 | 0 | 0 | 0 | - | 0 | 3 | 3 |
| Total Responses (N) | 16 | 148 | 44 | 91 | 1 | - | 61 | 239 | 300 |
| **Size:** 1 - 2 | 40.0 | 38.5 | 0.0 | 29.9 | 46.5 | - | 44.1 | 35.2 | 37.0 |
| 3 - 5 | 33.3 | 51.1 | 100.0 | 48.3 | 41.9 | - | 40.7 | 50.0 | 48.1 |
| ≥6 | 26.7 | 10.5 | 0.0 | 21.8 | 11.6 | - | 15.3 | 14.8 | 14.9 |
| No response (N) | 1 | 8 | 0 | 4 | 1 | - | 2 | 12 | 4 |
| Total Responses (N) | 15 | 143 | 1 | 87 | 43 | - | 59 | 230 | 289 |
| **Composition**: Couple | 11.1 | 23.3 | 100.0 | 15.1 | 25.7 | - | 26.2 | 20.3 | 21.3 |
| Couple + children | 22.2 | 48.1 | 0.0 | 46.6 | 37.1 | - | 35.7 | 47.5 | 45.5 |
| Family + Relatives | 44.4 | 13.1 | 0.0 | 21.9 | 17.1 | - | 23.8 | 16.3 | 17.6 |
| Family + Non-Relatives | 11.1 | 3.1 | 0.0 | 2.7 | 2.9 | - | 4.8 | 2.9 | 3.3 |
| Roommates Only | 11.1 | 4.7 | 0.0 | 5.5 | 8.6 | - | 9.5 | 4.9 | 5.7 |
| Alone | 0.0 | 4.7 | 0.0 | 0.0 | 0.0 | - | 0.0 | 2.9 | 2.5 |
| Other (single mother) | 0.0 | 3.1 | 0.0 | 8.2 | 8.6 | - | 0.0 | 4.9 | 41.7 |
| No Response (N) | 7 | 22 | 0 | 18 | 9 | - | 19 | 40 | 59 |
| Total Responses (N) | 9 | 129 | 1 | 73 | 35 | - | 42 | 202 | 244 |

## Table 51. Percentage Distribution of Respondents by Ethnicity, Household Size and Composition (continued)

| Household Information | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Ethnicity**: Anglo | 100.0 | 100.0 | 80.6 | 77.8 | 100.0 | - | 83.3 | 78.9 | 80.6 |
| Black | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Hispanic | 0.0 | 0.0 | 9.7 | 18.5 | 0.0 | - | 8.3 | 17.5 | 14.0 |
| Other | 0.0 | 0.0 | 9.7 | 3.7 | 0.0 | - | 8.3 | 3.5 | 5.4 |
| No response (N) | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 |
| Total Responses (N) | 4 | 3 | 31 | 54 | 1 | - | 36 | 57 | 93 |
| **Size:** 1 - 2 | 100.0 | 66.7 | 60.0 | 64.6 | 100.0 | - | 66.7 | 64.7 | 65.1 |
| 3 - 5 | 0.0 | 33.3 | 40.0 | 31.3 | 0.0 | - | 33.3 | 31.4 | 32.6 |
| ≥6 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | - | 0.0 | 3.9 | 2.3 |
| No response (N) | 0 | 0 | 1 | 4 | 0 | - | 1 | 6 | 7 |
| Total Responses (N) | 4 | 3 | 30 | 48 | 1 | - | 3 | 51 | 86 |
| **Composition**: Couple | 75.0 | 66.7 | 22.2 | 24.0 | 0.0 | - | 28.1 | 26.4 | 27.1 |
| Couple + children | 0.0 | 33.3 | 37.0 | 24.0 | 0.0 | - | 31.3 | 24.5 | 27.1 |
| Family + Relatives | 0.0 | 0.0 | 7.4 | 8.0 | 0.0 | - | 6.3 | 7.5 | 7.1 |
| Family + Non-Relatives | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Roommates Only | 0.0 | 0.0 | 18.5 | 14.0 | 0.0 | | 15.6 | 13.21 | 14.1 |
| Alone | 25.0 | 0.0 | 14.8 | 30.0 | 100.0 | - | 18.8 | 28.3 | 24.7 |
| Other (single mother) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| No Response (N) | 0 | 0 | 4 | 7 | 0 | - | 4 | 4 | 8 |
| Total Responses (N) | 4 | 3 | 27 | 50 | 1 | - | 32 | 53 | 85 |

## Table 51. Percentage Distribution of Respondents by Ethnicity, Household Size, and Composition (continued)

| Household Information | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Ethnicity: Anglo | 52.4 | 58.3 | 53.9 | 37.1 | 88.9 | - | 58.5 | 47.4 | 51.3 |
| Black | 4.8 | 1.7 | 3.2 | 11.8 | 0.0 | - | 3.1 | 6.9 | 5.6 |
| Hispanic | 33.3 | 38.9 | 40.5 | 49.5 | 7.4 | - | 34.4 | 44.3 | 40.8 |
| Other | 9.5 | 1.1 | 2.4 | 1.6 | 3.7 | - | 4.1 | 1.4 | 2.3 |
| No response (N) | 0 | 3 | 7 | 0 | 2 | - | 9 | 3 | 12 |
| Total Responses (N) | 42 | 175 | 126 | 186 | 27 | - | 195 | 361 | 556 |
| **Size:** 1 - 2 | 56.1 | 37.1 | 50.0 | 37.7 | 55.6 | - | 52.0 | 37.4 | 42.7 |
| 3 - 5 | 34.2 | 51.2 | 42.2 | 46.9 | 44 4 | - | 40.8 | 48.9 | 46.0 |
| ≥6 | 9.8 | 11.8 | 7.8 | 15.4 | 0 0 | - | 7.1 | 13.6 | 11.3 |
| No response (N) | 1 | 8 | 5 | 11 | 2 | - | 8 | 19 | 27 |
| Total Responses (N) | 41 | 170 | 128 | 176 | 27 | - | 196 | 345 | 541 |
| **Composition**: Couple | 35.3 | 21.9 | 21.4 | 17.8 | 37.0 | - | 26.6 | 19.8 | 22.3 |
| Couple + children | 23.5 | 49.7 | 39.3 | 43.9 | 40 7 | - | 36.4 | 46.8 | 43.0 |
| Family + Relatives | 14.7 | 13.3 | 12.5 | 13.4 | 3.7 | - | 11.6 | 13.3 | 12.7 |
| Family + Non-Relatives | 5.9 | 3.3 | 0.9 | 1.3 | 0.0 | - | 1.7 | 2.3 | 2.1 |
| Roommates Only | 2.9 | 4.6 | 8.9 | 7.0 | 7.4 | - | 7.5 | 5.8 | 6.4 |
| Alone | 8.8 | 3.9 | 10.7 | 9.6 | 7.4 | - | 9.8 | 6.8 | 7.9 |
| Other (single mother) | 8.8 | 3.3 | 6.3 | 7.0 | 3.7 | - | 6.4 | 5.2 | 5.6 |
| No Response (N) | 8 | 27 | 21 | 29 | 2 | - | 31 | 56 | 87 |
| Total Responses (N) | 34 | 151 | 112 | 157 | 27 | - | 173 | 308 | 481 |

**Table 51. Percentage Distribution of Respondents by Ethnicity, Household Size, and Composition (continued)**

| Chi-square Tests of Independence | | | |
|---|---|---|---|
| **Differences in Ethnicity** | | | |
| **Study Area** | **Abutting** | **Non-abutting** | **Abutting vs. Non-abutting** |
| Lubbock | $\chi^2$ (4) = 2.39 p=.664 Fishers' p=.663; Not significant | $\chi^2$ (2) = 3.21 p=.200 Fishers' p=.22; Not significant | $\chi^2$ (2) = 1.96 p=.375 Fishers' p=.405; Not significant |
| Houston | $\chi^2$ (2) = 7.69 p=.02 Fishers' p=.01; Significant | $\chi^2$ (1) = 1.41 p=.24 Fishers' p=.378; Not significant | $\chi^2$ (1) = 1.35 p=.246 Fishers' p=.254; Not significant |
| San Antonio | $\chi^2$ (4) = .894 p=.925 Fishers' p=.786; Not significant | $\chi^2$ (3) = 80.4 p=.001 Fishers' p=.663; Not significant | $\chi^2$ (3) = 15.1 p=.002 Fishers' p=.009; Significant |
| Dallas | $\chi^2$ (2) = 1.16 p=.656 Fishers' p=1.00; Not significant | $\chi^2$ (2) = .84 p=.656 Fishers' p=1.00; Not significant | $\chi^2$ (1) = 2.35 p=.309 Fishers' p=.336; Not significant |
| All Areas Combined | $\chi^2$ (6) = 17.22 p=.009 Fishers' p=.001; Significant | $\chi^2$ (3) = 24.3 p=.009 Fishers' p=.001; Significant | $\chi^2$ (3) =13.4 p=.004 Fishers' p=.003; Significant |

Lubbock: Almost 35% of the total number of residents surveyed in Lubbock were Anglo. Another 53% were of Hispanic origin, and yet another 12% were Black. Within design sub-areas, there is considerable variation in the ethnicity of the households. The percentage of Anglo respondents on abutting sections varied from 75% on at-grade segments to 39% on depressed segments. On non-abutting sections, this percentage varied from 18% on elevated segments to 36% on depressed segments. The percentage of Hispanic respondents on abutting sections ranged from 25% on at-grade segments to 50% on depressed segments; for non-abutting sections the percentage varied from 49% on depressed segments to 73% on elevated segments. Blacks constituted the smallest percentage of the residential respondents, with percentages ranging from 20% and below and only about 12% for the entire study area. In regard to household size, 50% of all the households surveyed consisted of three to five members. For 34%, the household size ranges from one to two members only, and for yet another 16%, the number of family members exceeded six. Almost 52% of all the households in the sample consisted of married couples living with their children. Another 17% were couples living alone. About 13% were families living with relatives and/or non-relatives. There is substantial difference within design sub-areas on abutting sections. Fifty percent of all households on elevated and at-grade segments were couples living alone, while the majority of households on depressed segments were couples living with their children (48%).

Houston: On abutting and non-abutting sections, 90% of all responding residents were Anglo, and a very small percentage of the residents had ethnic backgrounds other than Anglo, Black, or Hispanic (10% of the entire sample). On abutting sections, the majority of the households surveyed had a typical household size of one to two members and three to five members on non-abutting sections. There were no households with sizes larger than six. Overall, about 47% of the households in the sample consist of couples living with their children, and 28% of the households consist of couples living alone. There is again considerable variation both within design sub-areas and across distance zones (abutting versus non-abutting). Couples living with their children constitute almost 80% of the households surveyed on non-abutting sections, while the couples living alone constitute the remaining 20%. On abutting sections, the respective percentages are only 41% and 30%, while individuals living alone constitute another 19%.

San Antonio: Households of Hispanic origin constitute the majority, overall (about 55%). The pattern is fairly similar across design sub-areas on abutting sections, with Hispanics being the majority. However, on non-abutting sections, only 49% of the households are of Hispanic origin and an equally large number (43%) are Anglo. A very small percentage of the households are Black (less than 7% overall). About 44% of the households on abutting sections have between one and two members; 41% have members between three and five, and 15% have more than six members. On the non-abutting sections, almost 50% of the households have between three and five members, and only 35% have one to two members. On both abutting and non-abutting sections couples living with their children constitute the majority; however, there is a lot of variation across design sub-areas. For example, on abutting elevated sections, about 44% of the households surveyed were couples living with relatives. On abutting depressed sections, all the households were couples living alone , and on at-grade segments the majority were couples living with their children.

Dallas: The largest percentage of residents surveyed are Anglo. The pattern is similar within design sub-areas, across distance zones, and therefore overall. A very small percentage are of Hispanic origin (14% overall). The majority of households surveyed had between one and two members (65% overall), and again the pattern is similar within design sub-areas. About 33% of the households had between three and five members. On abutting sections, about 28% of the households constitute couples living alone, and another 31% constitute couples living with their children. On non-abutting sections, 26% of the households constitute couples living alone, and couples living with their children constitute another 25%. Almost 19% of the households on abutting sections and 28% on non-abutting sections are individuals living alone.

For the combined sample, Anglos constitute the majority of the residents surveyed (51% of the entire sample) followed by Hispanics (41%). Blacks constitute another 6%, and people of other ethnic backgrounds constitute less than 3%. On abutting sections, about 52% of the households have between one and two members, 41% have between three and five members, and 7% have greater than six members. On non-abutting sections, about 49% of the households have between three and five members, only 37% have one to two members, and 14% have more than six members. About 43% of the households constitute couples living with their children, and 22% constitute couples living alone.

### Household Income Level and Number of Vehicles Owned

Some of the financial characteristics of the residents in all four study areas are shown in Table 52 as is reflected in the number of automobiles owned and the income level of the household.

Lubbock: Overall, about 76% of the residents owned 1 or 2 cars, with the percentage owning one car and the percentage owning two cars being exactly equal at 38%. About 14% owned three or more cars, and 9% had none. Looking at the individual zones, 49% on abutting sections owned two cars; 31% had one car; 11% had three or more cars, and 9% had none. On non-abutting sections, 44% had one car; 30% had two cars; 17% had three or more cars, and 9% had none. This difference is due to differences in the responses within design sub-areas for each distance zone. In regards to income level, almost 35% of the residents overall earned less than $10,000 per year; 28% earned between $10,000 and $20,000; 21% earned between $20,000 and $30,000. On abutting elevated sections, 67% of the residents earned less than $10,000 per year, and the remaining residents earned between $10,001 and $20,000. The mean income level on the elevated section of I-27 was only $3,000. On depressed and at-grade segments, the disparity is quite great. Twenty-nine percent and 17% earned less than $10,000 on abutting depressed and at-grade segments, respectively. Eleven percent earned between $40,000 and $80,000 on abutting depressed sections. The corresponding figure for at-grade sections is almost 50%, and another 17% earned over $100,000. This suggests that there is considerable variation within design sub-areas in the income levels, with the largest percentage of at-grade respondents belonging to the high income bracket. The mean income level is the highest on abutting depressed sections.

**Table 52. Percentage Distribution of Residential Respondents by Income Level and Number of Vehicles Owned by Design Sub-Area**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Number of Vehicles Owned | | | | | | | | | |
| 0 | 20.0 | 18.2 | 8.8 | 3.1 | 0.0 | - | 8.9 | 9.3 | 9.1 |
| 1 | 60.0 | 36.4 | 29.4 | 50.0 | 16.7 | - | 31.1 | 44.4 | 38.4 |
| 2 | 20.0 | 45.5 | 52.9 | 18.8 | 50.0 | - | 48.9 | 29.6 | 38.4 |
| 3 | 0.0 | 0.0 | 2.9 | 21.9 | 16.7 | - | 4.4 | 13.0 | 9.1 |
| 4 | 0.0 | 0.0 | 2.9 | 6.3 | 16.7 | - | 4.4 | 3.7 | 4.0 |
| 5 or more | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | - | 2.2 | 0.0 | 1.0 |
| No response (N) | 0 | 0 | 0 | 1 | 0 | - | 0 | 1 | 1 |
| Total Responses (N) | 5 | 22 | 34 | 32 | 6 | - | 45 | 54 | 99 |
| **Income Level of Household** | | | | | | | | | |
| < $10,000 | 66.7 | 50.0 | 28.6 | 32.1 | 16.7 | - | 29.7 | 39.6 | 35.3 |
| $10,001- $20,000 | 33.3 | 20.0 | 28.6 | 35.7 | 16.7 | - | 27.0 | 29.2 | 28.2 |
| $20,001- $30,000 | 0.0 | 25.0 | 21.4 | 25.0 | 0.0 | - | 16.2 | 25.0 | 21.1 |
| $30,001- $40,000 | 0.0 | 5.0 | 10.7 | 0.0 | 0.0 | - | 8.1 | 2.1 | 4.7 |
| $40,001-$60,000 | 0.0 | 0.0 | 7.1 | 7.1 | 16.7 | - | 8.1 | 4.2 | 8.2 |
| $60,001- $80,000 | 0.0 | 0.0 | 3.6 | 0.0 | 33.3 | - | 8.1 | 0.0 | 3.5 |
| $80,001- $100,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| >$100,000 | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 | - | 2.7 | 0.0 | 1.2 |
| Mean income level ($) | 3000 | 9000 | 37,000 | 11,000 | 15,000 | - | 18,333 | 10,000 | 14,167 |
| Total Responses (N) | 3 | 20 | 28 | 28 | 6 | - | 37 | 48 | 85 |

Table 52. Percentage Distribution of Residential Respondents by Income Level and Number of Vehicles Owned by Design Sub-Area (continued)

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Number of Vehicles Owned | | | | | | | | | |
| 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| 1 | 76.0 | 0.0 | 36.0 | 0.0 | 20 0 | - | 42 0 | 0.0 | 36.0 |
| 2 | 12.0 | 100.0 | 36.0 | 75.0 | 65.0 | - | 39.0 | 80.0 | 45.0 |
| 3 | 12.0 | 0.0 | 14.0 | 25.0 | 10.0 | - | 12.0 | 20.0 | 13.0 |
| 4 | 0.0 | 0.0 | 5.0 | 0.0 | 5.0 | - | 3.0 | 0.0 | 3.0 |
| 5 or more | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 | - | 3.0 | 0.0 | 3.0 |
| No response (N) | 0 | 0 | 2 | 0 | 1 | - | 3 | 0 | 3 |
| Total Responses (N) | 17 | 2 | 22 | 8 | 20 | - | 59 | 10 | 69 |
| **Income Level of Household** | | | | | | | | | |
| < $10,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $10,001- $20,000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| $20,001- $30,000 | 7.0 | 0.0 | 0.0 | 0.0 | 7.0 | - | 4.0 | 0.0 | 4.0 |
| $30,001- $40,000 | 7.0 | 0.0 | 6.0 | 29.0 | 0.0 | - | 4.0 | 22.0 | 7.0 |
| $40,001-$60,000 | 20.0 | 0.0 | 18.0 | 29.0 | 33.0 | - | 23.0 | 22.0 | 23.0 |
| $60,001- $80,000 | 40.0 | 50.0 | 6.0 | 29.0 | 13.0 | - | 19.0 | 33.0 | 21.0 |
| $80,001- $100,000 | 13.0 | 50.0 | 18.0 | 0.0 | 27.0 | - | 19.0 | 11.0 | 18.0 |
| >$100,000 | 13.0 | 0.0 | 53.0 | 14.0 | 20.0 | - | 30.0 | 11.0 | 27.0 |
| Mean income level ($) | 59,000 | 70,000 | 79,000 | 48,000 | 62,000 | - | 66,667 | 59,000 | 62,833 |
| Total Responses (N) | 15 | 2 | 17 | 7 | 15 | - | 47 | 9 | 56 |

**Table 52. Percentage Distribution of Residential Respondents by Income Level and Number of Vehicles Owned by Design Sub-Area (continued)**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Number of Vehicles Owned** | | | | | | | | | |
| 0 | 25.0 | 7.0 | 21.4 | 11.4 | 0.0 | - | 22.0 | 8.7 | 11.4 |
| 1 | 25.0 | 20.4 | 26.2 | 32.9 | 100.0 | - | 27.1 | 25.2 | 25.6 |
| 2 | 25.0 | 40.1 | 35.7 | 34.1 | 0.0 | - | 32.2 | 37.8 | 36.7 |
| 3 | 12.5 | 25.4 | 14.3 | 11.4 | 0.0 | - | 13.6 | 20.0 | 18.7 |
| 4 | 6.3 | 4.9 | 2.4 | 5.7 | 0.0 | - | 3.4 | 5.2 | 4.8 |
| 5 or more | 6.3 | 2.1 | 0.0 | 4.6 | 0.0 | - | 1.7 | 3.0 | 2.8 |
| No response (N) | 0 | 9 | 2 | 3 | 0 | - | 2 | 12 | 14 |
| Total Responses (N) | 16 | 142 | 42 | 88 | 1 | - | 59 | 230 | 289 |
| **Income Level of Household** | | | | | | | | | |
| < $10,000 | 42.9 | 13.9 | 35.9 | 33.8 | 0.0 | - | 37.0 | 21.5 | 24.7 |
| $10,001- $20,000 | 42.9 | 8.5 | 30.8 | 23.8 | 100.0 | - | 35.2 | 14.4 | 18.6 |
| $20,001- $30,000 | 14.3 | 13.2 | 15.4 | 21.3 | 0.0 | - | 14.8 | 16.3 | 15.9 |
| $30,001- $40,000 | 0.0 | 13.9 | 17.9 | 13.8 | 0.0 | - | 12.9 | 13.9 | 13.7 |
| $40,001-$60,000 | 0.0 | 11.6 | 0.0 | 5.0 | 0.0 | - | 0.0 | 9.1 | 7.2 |
| $60,001- $80,000 | 0.0 | 15.5 | 0.0 | 0.0 | 0.0 | - | 0.0 | 9.6 | 7..6 |
| $80,001- $100,000 | 0.0 | 7.8 | 0.0 | 1.3 | 0.0 | - | 0.0 | 5.3 | 4.2 |
| >$100,000 | 0.0 | 15.5 | 0.0 | 1.3 | 0.0 | - | 0.0 | 10.1 | 7.9 |
| Mean income level ($) | 8000 | 36,000 | 10,000 | 14,000 | 12,000 | - | 10,000 | 25,000 | 17,500 |
| Total Responses (N) | 14 | 129 | 54 | 80 | 1 | - | 54 | 209 | 263 |

Table 52. Percentage Distribution of Residential Respondents by Income Level and Number of Vehicles Owned by Design Sub-Area (continued)

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Number of Vehicles Owned** | | | | | | | | | |
| 0 | 0.0 | 0.0 | 3.3 | 2.0 | 0.0 | - | 2.9 | 1.9 | 2.2 |
| 1 | 50.0 | 0.0 | 30.0 | 31.4 | 100.0 | - | 34.3 | 29.6 | 31.5 |
| 2 | 50.0 | 33.3 | 53.3 | 39.2 | 0.0 | - | 51.4 | 38.9 | 43.8 |
| 3 | 0.0 | 66.7 | 3.3 | 17.6 | 0.0 | - | 2.9 | 20.4 | 13.5 |
| 4 | 0.0 | 0.0 | 10.0 | 3.9 | 0.0 | - | 8.6 | 3.7 | 5.6 |
| 5 or more | 0.0 | 0.0 | 0.0 | 5.9 | 0.0 | - | 0.0 | 5.6 | 3.4 |
| No response (N) | 0 | 0 | 0 | 3 | 0 | - | 1 | 3 | 4 |
| Total Responses (N) | 4 | 3 | 30 | 51 | 1 | - | 35 | 54 | 89 |
| **Income Level of Household** | | | | | | | | | |
| < $10,000 | 0.0 | 0.0 | 0.0 | 4.3 | 0.0 | - | 0.0 | 4.0 | 2.5 |
| $10,001- $20,000 | 0.0 | 0.0 | 12.0 | 4.3 | 0.0 | - | 10.3 | 4.0 | 6.3 |
| $20,001- $30,000 | 0.0 | 0.0 | 4.0 | 10.6 | 0.0 | - | 3.4 | 10.0 | 7.6 |
| $30,001- $40,000 | 0.0 | 33.3 | 12.0 | 19.1 | 0.0 | - | 10.3 | 20.0 | 16.5 |
| $40,001-$60,000 | 33.3 | 0.0 | 24.0 | 14.9 | 100.0 | - | 27.6 | 14.0 | 19.0 |
| $60,001- $80,000 | 33.3 | 0.0 | 24.0 | 17.0 | 0.0 | - | 24.1 | 16.0 | 19.0 |
| $80,001- $100,000 | 33.3 | 33.3 | 20.0 | 14.9 | 0.0 | - | 20.7 | 16.0 | 17.7 |
| >$100,000 | 0.0 | 33.3 | 4.0 | 14.9 | 0.0 | - | 3.4 | 16.0 | 11.4 |
| Mean income level ($) | 60,000 | 66,000 | 40,000 | 44,000 | 44,000 | - | 48,000 | 55,000 | 51,500 |
| Total Responses (N) | 3 | 3 | 25 | 47 | 1 | - | 29 | 50 | 79 |

Table 52. Percentage Distribution of Residential Respondents by Income Level and Number of Vehicles Owned by Design Sub-Area (continued)

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Number of Vehicles Owned | | | | | | | | | |
| 0 | 11.9 | 8.3 | 10.2 | 6.7 | 0.0 | - | 9.1 | 7.5 | 8.1 |
| 1 | 52.4 | 21.9 | 29.7 | 34.1 | 25.0 | - | 33.8 | 28.2 | 30.2 |
| 2 | 21.4 | 41.4 | 44.5 | 34.6 | 57.1 | - | 41.4 | 37.9 | 39.2 |
| 3 | 9.5 | 22.5 | 8.6 | 15.6 | 10.7 | - | 9.1 | 18.9 | 15.4 |
| 4 | 2.4 | 4.1 | 4.7 | 5.0 | 7.1 | - | 4.6 | 4.6 | 4.6 |
| 5 or more | 2.4 | 1.8 | 2.3 | 3.9 | 0.0 | - | 2.0 | 2.9 | 2.6 |
| No response (N) | 0 | 9 | 5 | 7 | 1 | - | 6 | 16 | 22 |
| Total Responses (N) | 42 | 169 | 128 | 179 | 28 | - | 198 | 348 | 546 |
| **Income Level of Household** | | | | | | | | | |
| < $10,000 | 22.9 | 18.2 | 20.6 | 23.5 | 4.0 | - | 18.6 | 20.9 | 20.1 |
| $10,001- $20,000 | 20.0 | 9.7 | 21.5 | 19.1 | 8.0 | - | 19.2 | 14.6 | 16.2 |
| $20,001- $30,000 | 8.6 | 14.3 | 13.1 | 17.9 | 0.0 | - | 10.2 | 16.1 | 14.1 |
| $30,001- $40,000 | 2.9 | 12.9 | 12.2 | 13.6 | 4.0 | - | 8.9 | 13.3 | 11.8 |
| $40,001-$60,000 | 11.4 | 9.7 | 12.2 | 9.3 | 20.0 | - | 13.2 | 9.5 | 10.8 |
| $60,001- $80,000 | 20.0 | 13.6 | 8.4 | 6.2 | 12.0 | - | 11.4 | 9.8 | 10.4 |
| $80,001- $100,000 | 8.6 | 7.8 | 8.4 | 4.9 | 12.0 | - | 8.9 | 6.3 | 7.3 |
| >$100,000 | 5.7 | 13.6 | 3.7 | 5.6 | 40.0 | - | 9.6 | 9.5 | 9.5 |
| No Response (N) | 32,500 | 45,250 | 41,500 | 29,250 | 33,250 | - | 35,750 | 37,250 | 36,500 |
| Total Responses (N) | 35 | 154 | 107 | 162 | 25 | - | 167 | 316 | 483 |

Houston: Thirty-six percent of the respondents overall possessed one car; 45% possessed two cars, and 19% possessed three or more cars. On abutting sections, 42% owned one car; 39% owned two; 12% owned three, and 9% owned four or more. On non-abutting sections, 80% owned two cars, and 20% owned three. Respondents who earned more than $100,000 constitute 27% of the overall number of respondents, with the majority of these respondents living on depressed segments. None of the respondents earned less than $20,000. About 11% overall reported earnings between $20,000 and $40,000; 23% reported earnings between $40,000 and $60,000 per year; 21% reported earnings between $60,000 and $80,000 and yet another 18% reported income between $80,000 and $100,000. These statistics suggest that the respondents in this study area are financially well off, as indicated by the fairly high income levels as well as number of cars owned, and are also much better off in comparison to Lubbock study area residents. Further, the range in the mean income levels (abutting sections) is from $59,000 for residents abutting the elevated segment of Beltway 8 to $79,000 for those abutting the depressed segment.

San Antonio: Overall, 11% of the respondents owned no cars at all; 26% owned one car;37% owned two cars; 19% owned three, and about 8% owned four or more cars. There is also substantial income disparity across the respondents. Almost 25% of the total number of respondents in San Antonio study areas reported earnings of less than $10,000 per year. On the other extreme, about 8% reported earnings of more than $100,000 or more. Thirty-five percent reported incomes between $10,000 and $30,000, 14% between $30,000 and $40,000; 7% reported earnings between $40,000 and $60,000, and about 12% between $60,000 and $100,000. The statistics for San Antonio suggest a diverse mix of respondents, with a substantial number of respondents from both the high and low income brackets as defined in Table 52. The mean income levels are very low in all sections in the San Antonio study area. However, average income levels are higher on non-abutting sections than on abutting sections.

Dallas: Dallas study area residential financial characteristics, like San Antonio, reveal a mix from all categories. However, there is one major difference. While the San Antonio sample tends to be skewed towards a lower income and fewer number of automobiles owned, the situation is reverse in the Dallas study area. In the case of the Dallas study area respondents, only about 2% owned no automobiles; 32% possessed only one automobile; 44% owned two, and 23% owned three or more automobiles. In the context of income levels of respondents, only 3% earned less than $10,000, while 11% earned more than $100,000. Fourteen percent earned between $10,000 and $30,000; 17% reported an income level of $30,000 and $40,000; 38% reported incomes between $40,000 and $80,000, and another 18% reported earnings between $80,000 and $100,000. There is also substantial variation between abutting and non-abutting sections and between the different design sub-areas as indicated by the mean income levels, the highest mean income being reported for residents adjacent the elevated segment of Central Expressway.

The survey results for the combined sample suggest that almost 8% possessed no automobiles; 30% possessed only one; 39% owned two, 15% owned three, and 9% owned four or more vehicles. Overall, about 20% of the total number of respondents reported annual income levels of less than $10,000; 30% reported incomes between $10,000 and $30,000; 12% reported incomes between $30,000 and $40,000; 21% earned between $40,000 and $80,000; 7% earned between $80,000 and $100,000, and almost 10% reported incomes exceeding $100,000. These statistics reflect the high levels of physical mobility and also the medium economic status of the respondents. The results are also consistent with the hypothesis that the automobile constitutes a major means of transportation for the study area residents and with the assumption that the study freeways have impacted upon the study areas by enhancing accessibility.

**Educational Level of the Head of the Household**

Table 53 presents the distribution of responses by educational background of the respondents.

Table 53. Percentage Distribution of Residential Respondents by Educational Level and by Study Area and Design Sub-Area

| Education Level of household head | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Less than High School | 75.0 | 31.8 | 26.3 | 37.5 | 0.0 | - | 27.9 | 35.2 | 31.9 |
| High School or GED | 25.0 | 18.2 | 48.5 | 31.3 | 50.0 | - | 46.5 | 25.9 | 35.1 |
| Trade or Technical | 0.0 | 4.5 | 9.1 | 3.1 | 33.3 | - | 11.6 | 3.7 | 7.2 |
| Some College | 0.0 | 36.4 | 9.1 | 12.5 | 16.7 | - | 9.3 | 22.2 | 16.5 |
| College Graduate | 0.0 | 9.1 | 3.0 | 9.4 | 0.0 | - | 2.3 | 9.3 | 6.2 |
| Graduate | 0.0 | 0.0 | 3.0 | 6.3 | 0.0 | - | 2.3 | 3.7 | 3.1 |
| No response (N) | 1 | 0 | 1 | 1 | 0 | - | 2 | 1 | 3 |
| Total Responses (N) | 4 | 22 | 33 | 32 | 6 | - | 43 | 54 | 97 |
| **Study Area 2: Houston** | | | | | | | | | |
| Less than High School | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| High School or GED | 6.0 | 0.0 | 4.0 | 0.0 | 5.0 | - | 5.0 | 0.0 | 4.0 |
| Trade or Technical | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | - | 2.0 | 0.0 | 1.0 |
| Some College | 29.0 | 0.0 | 13.0 | 38.0 | 16.0 | - | 19.0 | 30.0 | 20.0 |
| College Graduate | 41.0 | 0.0 | 43.0 | 25.0 | 26.0 | - | 37.0 | 20.0 | 35.0 |
| Graduate | 24.0 | 100.0 | 35.0 | 38.0 | 53.0 | - | 37.0 | 50.0 | 39.0 |
| No Response (N) | 0 | 0 | 1 | 0 | 2 | - | 3 | 0 | 3 |
| Total Responses (N) | 17 | 2 | 23 | 8 | 19 | - | 59 | 10 | 69 |

Table 53. Percentage Distribution of Residential Respondents by Educational Level and by Study Area and Design Sub-Area (continued)

| Education Level of household head | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Less than High School | 15.4 | 11.5 | 31.7 | 26.2 | 0.0 | - | 27.3 | 17.0 | 19.1 |
| High School or GED | 53.9 | 20.1 | 19.5 | 36.9 | 0.0 | - | 27.3 | 26.5 | 26.6 |
| Trade or Technical | 7.7 | 5.0 | 17.1 | 7.1 | 100.0 | - | 16.4 | 5.8 | 7.9 |
| Some College | 23.1 | 23.0 | 29.7 | 20.2 | 0.0 | - | 27.3 | 21.9 | 23.0 |
| College Graduate | 0.0 | 20.1 | 0.0 | 4.8 | 0.0 | - | 0.0 | 14.4 | 11.5 |
| Graduate | 0.0 | 20.1 | 2.4 | 4.8 | 0.0 | - | 1.8 | 14.4 | 11.9 |
| No response (N) | 3 | 12 | 3 | 7 | 0 | - | 6 | 19 | 25 |
| Total Responses (N) | 13 | 139 | 41 | 84 | 1 | - | 55 | 223 | 278 |
| **Study Area 4: Dallas** | | | | | | | | | |
| Less than High School | 0.0 | 0.0 | 0.0 | 7.7 | 0.0 | - | 0.0 | 7.3 | 4.4 |
| High School or GED | 0.0 | 0.0 | 3.2 | 9.6 | 0.0 | - | 2.9 | 9.1 | 6.7 |
| Trade or Technical | 0.0 | 0.0 | 3.2 | 0.0 | 0.0 | - | 2.9 | 0.0 | 1.1 |
| Some College | 0.0 | 0.0 | 9.7 | 21.2 | 0.0 | - | 8.6 | 20.0 | 15.6 |
| College Graduate | 0.0 | 33.3 | 45.2 | 40.4 | 100.0 | - | 42.9 | 40.0 | 41.1 |
| Graduate | 100.0 | 66.7 | 38.7 | 21.2 | 0.0 | - | 42.9 | 23.6 | 31.1 |
| No Response (N) | 1 | 0 | 0 | 2 | 0 | - | 1 | 2 | 3 |
| Total Responses (N) | 3 | 3 | 31 | 52 | 1 | - | 35 | 55 | 90 |

Table 53. Percentage Distribution of Residential Respondents by Educational Level and by Study Area and Design Sub-Area (continued)

| Education Level of household head | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Less than High School | 15.4 | 11.5 | 31.7 | 26.2 | 0.0 | - | 27.3 | 17.0 | 19.1 |
| High School or GED | 53.9 | 20.1 | 19.5 | 36.9 | 0.0 | - | 27.3 | 26.5 | 26.6 |
| Trade or Technical | 7.7 | 5.0 | 17.1 | 7.1 | 100.0 | - | 16.4 | 5.8 | 7.9 |
| Some College | 23.1 | 23.0 | 29.7 | 20.2 | 0.0 | - | 27.3 | 21.9 | 23.0 |
| College Graduate | 0.0 | 20.1 | 0.0 | 4.8 | 0.0 | - | 0.0 | 14.4 | 11.5 |
| Graduate | 0.0 | 20.1 | 2.4 | 4.8 | 0.0 | - | 1.8 | 14.4 | 11.9 |
| No response (N) | 3 | 12 | 3 | 7 | 0 | - | 6 | 19 | 25 |
| Total Responses (N) | 13 | 139 | 41 | 84 | 1 | - | 55 | 223 | 278 |
| **Study Area 4: Dallas** | | | | | | | | | |
| Less than High School | 0.0 | 0.0 | 0.0 | 7.7 | 0.0 | - | 0.0 | 7.3 | 4.4 |
| High School or GED | 0.0 | 0.0 | 3.2 | 9.6 | 0.0 | - | 2.9 | 9.1 | 6.7 |
| Trade or Technical | 0.0 | 0.0 | 3.2 | 0.0 | 0.0 | - | 2.9 | 0.0 | 1.1 |
| Some College | 0.0 | 0.0 | 9.7 | 21.2 | 0.0 | - | 8.6 | 20.0 | 15.6 |
| College Graduate | 0.0 | 33.3 | 45.2 | 40.4 | 100.0 | - | 42.9 | 40.0 | 41.1 |
| Graduate | 100.0 | 66.7 | 38.7 | 21.2 | 0.0 | - | 42.9 | 23.6 | 31.1 |
| No Response (N) | 1 | 0 | 0 | 2 | 0 | - | 1 | 2 | 3 |
| Total Responses (N) | 3 | 3 | 31 | 52 | 1 | - | 35 | 55 | 90 |

Table 53. Percentage Distribution of Residential Respondents by Educational Level and by Study Area and Design Sub-Area (continued)

| Education Level of household head | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Less than High School | 13.5 | 13.9 | 17.2 | 21.6 | 0.0 | - | 14.1 | 17.8 | 16.5 |
| High School or GED | 24.3 | 19.3 | 20.3 | 26.1 | 14.8 | - | 20.3 | 22.8 | 21.9 |
| Trade or Technical | 2.7 | 4.8 | 9.4 | 3.9 | 11.1 | - | 8.3 | 4.4 | 5.8 |
| Some College | 21.6 | 24.1 | 16.4 | 19.9 | 14.8 | - | 17.2 | 21.9 | 20.2 |
| College Graduate | 18.9 | 18.7 | 19.5 | 17.1 | 22.2 | - | 19.8 | 17.8 | 18.5 |
| Graduate | 18.9 | 19.3 | 17.2 | 11.4 | 37.0 | - | 20.3 | 15.2 | 17.0 |
| No response (N) | 5 | 12 | 5 | 10 | 2 | - | 12 | 22 | 34 |
| Total Responses (N) | 37 | 166 | 128 | 176 | 27 | - | 192 | 342 | 534 |

Lubbock: The distribution of responses shows that almost 32% of the respondents overall had not completed high school. Thirty-five percent of the respondents had attended high school or had undergone GED. Seven percent had attended a trade or technical school, and another 17% had some college experience. Only 6% were college graduates, and furthermore, only 3% had a graduate degree. The response pattern shows that a majority of respondents (almost 74%) are not highly educated, the pattern being common across design sub-areas and distance zones.

Houston: Only 4% of the respondents overall had attended high school or had undergone GED, and 1% had attended a trade or technical school. Approximately 55% of the respondents had either spent some years in college or had a college degree. In contrast to the Lubbock responses, almost 39% of the residents had a graduate degree. These statistics suggest that a large number of the respondents from the Houston study are well educated, and some (39%) are highly educated.

San Antonio: Almost 54% of all the respondents in the San Antonio study areas had no college experience at all. Twenty-three percent of the respondents had some college experience; 12% had a college degree, and another 12% had attended graduate school. The educational background of the respondents is quite varied, with a large percentage of the respondents being either not very educated or well educated.

Dallas: In the case of Dallas, almost 72% are either college graduates or have a graduate degree. Sixteen percent of the respondents had some years in college, and only 12% had no college experience at all. These responses are again indicative of a sample that is well educated.

The results for the combined sample show that almost 44% had no college experience; 20% had some college experience; 19% possessed a college degree, and 17% had attended graduate school.

## CHARACTERISTICS OF TRAVEL EXPERIENCE OF RESIDENTS

### Travel Frequency and Distance Traveled on Study Freeway

All study area residents were asked how frequently they used the concerned study freeway. They were also asked information pertaining to the distance traveled on the study freeway. The distribution of responses is presented in Table 54.

In the Lubbock study area, 44% of the respondents overall said that they used the freeway several times a day. Only 8% of the respondents said they used the freeway once or twice a day and only 10% of the respondents reported using the freeway once or twice a week. Forty-eight percent of the respondents said that they traveled a distance of more than five miles (8 km) and another 45% reported traveling a distance of one to five miles (1.6-8 km). A very small percentage, only 6%, reported traveling less than one mile (1.6 km) on the concerned freeway.

In study area 2 (Houston), 24% of the residents reported using the study freeway on a daily basis. Of these, 13% reported using the freeway several times a day. Thirty-one percent reported using the freeway on a weekly basis; 33% said that they used the freeway on a monthly basis, 10% said they used the freeway on a yearly basis, and 6% said they almost or never used the freeway. The bulk of the respondents, 68% of the total number surveyed in the study area, said that they traveled a distance of over five miles (8 km) on the study freeway. This response pattern is similar both within design sub-areas and across distance zones.

**Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Travel Frequency** | | | | | | | | | |
| Daily: Several times a day | 0.0 | 31.8 | 55.9 | 46.7 | 50.0 | - | 48.9 | 40.4 | 44.3 |
| Once or twice a day | 0.0 | 0.0 | 5.9 | 20.0 | 0.0 | - | 4.4 | 11.5 | 8.2 |
| Weekly: Several times a week | 20.0 | 13.6 | 11.8 | 20.0 | 0.0 | - | 11.1 | 17.3 | 6.9 |
| Once or twice a week | 20.0 | 22.7 | 2.9 | 6.7 | 16.7 | - | 6.7 | 13.5 | 10.3 |
| Monthly: Several times a month | 20.0 | 9.1 | 5.9 | 3.3 | 16.7 | - | 8.9 | 5.8 | 7.2 |
| Once or twice a month | 20.0 | 13.6 | 5.9 | 0.0 | 16.7 | - | 8.9 | 5.8 | 7.2 |
| Yearly: Several times a year | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Once or twice a year | 0.0 | 4.5 | 5.9 | 0.0 | 0.0 | - | 4.4 | 1.9 | 3.1 |
| Never or almost never | 20.0 | 4.5 | 5.9 | 3.3 | 0.0 | - | 6.7 | 3.8 | 5.2 |
| No Response (N) | 0 | 0 | 0 | 3 | 0 | - | 0 | 3 | 3 |
| Total Responses (N) | 5 | 22 | 34 | 30 | 6 | - | 45 | 52 | 97 |
| **Distance Traveled** | | | | | | | | | |
| Less than one mile | 0.0 | 0.0 | 9.4 | 9.7 | 0.0 | - | 7.1 | 5.9 | 5.8 |
| 1 - 5 miles | 25.0 | 35.0 | 46.9 | 45.2 | 83.3 | - | 50.0 | 41.2 | 45.2 |
| More than 5 miles | 75.0 | 65.0 | 43.8 | 45.2 | 16.7 | - | 42.9 | 52.9 | 48.4 |
| No Response (N) | 1 | 2 | 2 | 2 | 0 | - | 3 | 4 | 7 |
| Total Responses (N) | 4 | 20 | 32 | 31 | 6 | - | 42 | 51 | 93 |

## Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area (continued)

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Travel Frequency** | | | | | | | | | |
| Daily: Several times a day | 0.0 | 50.0 | 13.0 | 13.0 | 20.0 | - | 11.0 | 20.0 | 13.0 |
| Once or twice a day | 12.0 | 0.0 | 4.0 | 25.0 | 5.0 | - | 7.0 | 20.0 | 8.0 |
| Weekly: Several times a week | 24.0 | 0.0 | 21.0 | 0.0 | 25.0 | - | 23.0 | 0.0 | 20.0 |
| Once or twice a week | 18.0 | 0.0 | 13.0 | 13.0 | 5.0 | - | 11.0 | 10.0 | 11.0 |
| Monthly: Several times a month | 29.0 | 0.0 | 17.0 | 25.0 | 25.0 | - | 23.0 | 20.0 | 23.0 |
| Once or twice a month | 6.0 | 0.0 | 17.0 | 0.0 | 10.0 | - | 11.0 | 0.0 | 10.0 |
| Yearly: Several times a year | 6.0 | 0.0 | 8.0 | 13.0 | 5.0 | - | 7.0 | 10.0 | 7.0 |
| Once or twice a year | 0.0 | 0.0 | 4.0 | 13.0 | 0.0 | - | 2.0 | 10.0 | 3.0 |
| Never or almost never | 6.0 | 50.0 | 4.0 | 0.0 | 5.0 | - | 5.0 | 10.0 | 6.0 |
| No response (N) | 0 | 0 | 0 | 0 | 1 | - | 1 | 0 | 1 |
| Total Responses (N) | 17 | 2 | 24 | 8 | 20 | - | 61 | 10 | 71 |
| **Distance Traveled** | | | | | | | | | |
| Less than one mile (< 1.6 km) | 0.0 | 0.0 | 11.0 | 0.0 | 4.0 | - | 5.0 | 0.0 | 4.0 |
| 1 - 5 miles (< 1.6-8 kmkm) | 29.0 | 0.0 | 21.0 | 50.0 | 25.0 | - | 25.0 | 44.0 | 28.0 |
| More than 5 miles (> 8 km) | 71.0 | 100.0 | 68.0 | 50.0 | 71.0 | - | 70.0 | 56.0 | 68.0 |
| No Response (N) | 0 | 1 | 2 | 0.0 | 0 | - | 2 | 1 | 3 |
| Total Responses (N) | 17 | 1 | 19 | 8 | 24 | - | 60 | 9 | 69 |

**Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area (continued)**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Travel Frequency** | | | | | | | | | |
| Daily: Several times a day | 20.0 | 45.9 | 41.9 | 46.1 | 0.0 | - | 35.6 | 45.9 | 43.9 |
| Once or twice a day | 0.0 | 19.2 | 2.3 | 13.5 | 0.0 | - | 1.7 | 17.0 | 13.9 |
| Weekly: Several times a week | 20.0 | 22.6 | 25.6 | 20.2 | 0.0 | - | 23.7 | 21.7 | 22.1 |
| Once or twice a week | 20.0 | 3.4 | 9.3 | 5.6 | 0.0 | - | 11.9 | 4.3 | 5.8 |
| Monthly: Several times a month | 6.7 | 0.7 | 9.3 | 2.3 | 100.0 | - | 10.2 | 1.3 | 3.1 |
| Once or twice a month | 6.7 | 3.4 | 2.3 | 3.4 | 0.0 | - | 3.4 | 3.4 | 3.4 |
| Yearly: Several times a year | 0.0 | 0.0 | 2.3 | 1.1 | 0.0 | - | 1.7 | 0.4 | 0.7 |
| Once or twice a year | 6.7 | 0.0 | 0.0 | 1.1 | 0.0 | - | 1.7 | 0.4 | 0.7 |
| Never or almost never | 20.0 | 4.8 | 6.9 | 6.7 | 0.0 | - | 10.2 | 5.5 | 6.5 |
| No Response (N) | 1 | 5 | 1 | 2 | 0 | - | 2 | 7 | 9 |
| Total Responses (N) | 15 | 146 | 43 | 89 | 1 | - | 59 | 235 | 294 |
| **Distance Traveled** | | | | | | | | | |
| Less than one mile (< 1.6 km) | 0.0 | 2.9 | 2.6 | 4.7 | 0.0 | - | 1.9 | 3.6 | 3.3 |
| 1 - 5 miles (1.6-8 km) | 69.2 | 49.6 | 56.4 | 25.9 | 100.0 | - | 60.4 | 40.6 | 44.4 |
| More than 5 miles (> 8 km) | 30.8 | 47.5 | 41.0 | 69.4 | 0.0 | - | 37.7 | 55.8 | 52.4 |
| No Response (N) | 3 | 12 | 5 | 6 | 0 | - | 8 | 18 | 26 |
| Total Responses (N) | 13 | 139 | 39 | 85 | 1 | - | 53 | 224 | 277 |

**Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area (continued)**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Travel Frequency** | | | | | | | | | |
| Daily: Several times a day | 25.0 | 0.0 | 0.0 | 24.5 | 32.3 | - | 30.6 | 23.2 | 26.1 |
| Once or twice a day | 0.0 | 33.3 | 0.0 | 26.4 | 12.9 | - | 11.1 | 26.8 | 20.7 |
| Weekly: Several times a week | 25.0 | 33.3 | 0.0 | 22.6 | 22.6 | - | 22.2 | 23.2 | 22.8 |
| Once or twice a week | 0.0 | 33.3 | 100.0 | 15.1 | 6.5 | - | 8.3 | 16.1 | 13.0 |
| Monthly: Several times a month | 0.0 | 0.0 | 0.0 | 1.9 | 6.5 | - | 5.6 | 1.8 | 3.3 |
| Once or twice a month | 0.0 | 0.0 | 0.0 | 0.0 | 3.2 | - | 2.8 | 0.0 | 1.1 |
| Yearly: Several times a year | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | - | 0.0 | 1.8 | 1.1 |
| Once or twice a year | 25.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 2.8 | 0.0 | 1.1 |
| Never or almost never | 25.0 | 0.0 | 0.0 | 7.5 | 16.1 | - | 16.7 | 7.1 | 10.9 |
| No Response (N) | 0 | 0 | 0 | 1 | 0 | - | 0 | 1 | 1 |
| Total Responses (N) | 4 | 3 | 1 | 53 | 31 | - | 36 | 56 | 92 |
| **Distance Traveled** | | | | | | | | | |
| Less than one mile (< 1.6 km) | 0.0 | 0.0 | 3.4 | 2.0 | 0.0 | - | 3.0 | 1.9 | 2.3 |
| 1 - 5 miles (1.6-8 km) | 66.7 | 66.7 | 48.3 | 56.0 | 100.0 | - | 51.5 | 56.6 | 54.7 |
| More than 5 miles (> 8 km) | 33.3 | 33.3 | 48.3 | 42.0 | 0.0 | - | 45.5 | 41.5 | 43.0 |
| No Response (N) | 1 | 0 | 2 | 4 | 0 | - | 3 | 4 | 7 |
| Total Responses(N) | 3 | 3 | 39 | 50 | 1 | - | 33 | 53 | 86 |

# Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area (continued)

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| **Travel Frequency** | | | | | | | | | |
| Daily: Several times a day | 9.8 | 43.4 | 37.9 | 38.3 | 25.0 | - | 30.4 | 40.8 | 37.0 |
| Once or twice a day | 4.9 | 16.8 | 6.1 | 18.9 | 3.6 | - | 5.5 | 17.9 | 13.4 |
| Weekly: Several times a week | 21.9 | 21.4 | 20.5 | 20.0 | 17.9 | - | 20.4 | 20.7 | 20.6 |
| Once or twice a week | 17.1 | 6.4 | 7.6 | 8.9 | 10.7 | - | 9.9 | 7.7 | 8.5 |
| Monthly: Several times a month | 17.1 | 1.7 | 9.1 | 3.3 | 25.0 | - | 12.9 | 2.6 | 6.3 |
| Once or twice a month | 7.3 | 4.6 | 6.1 | 1.7 | 10.7 | - | 6.9 | 3.1 | 4.5 |
| Yearly: Several times a year | 2.4 | 0.0 | 2.3 | 1.7 | 3.6 | - | 2.5 | 0.9 | 1.4 |
| Once or twice a year | 4.9 | 0.6 | 2.3 | 1.1 | 0.0 | - | 2.5 | 0.9 | 1.4 |
| Never or almost never | 14.6 | 5.2 | 8.3 | 6.1 | 3.6 | - | 8.9 | 5.7 | 6.9 |
| No Response (N) | 1 | 5 | 1 | 6 | 1 | - | 3 | 11 | 14 |
| Total Responses (N) | 41 | 173 | 132 | 180 | 28 | - | 201 | 353 | 554 |
| **Distance Traveled** | | | | | | | | | |
| Less than one mile (< 1.6 km) | 0.0 | 2.5 | 7.4 | 4.6 | 4.8 | - | 4.3 | 3.6 | 3.8 |
| 1 - 5 miles (1.6-8 km) | 45.9 | 47.9 | 40.7 | 39.1 | 45.9 | - | 45.2 | 43.3 | 44.0 |
| More than 5 miles (> 8 km) | 54.1 | 49.7 | 51.9 | 56.3 | 49.2 | - | 50.5 | 53.1 | 52.2 |
| No Response (N) | 5 | 15 | 2 | 12 | 9 | - | 16 | 27 | 43 |
| Total Responses (N) | 37 | 163 | 27 | 174 | 124 | - | 188 | 337 | 525 |

## Table 54. Percentage Distribution of Residential Responses Regarding Frequency of Use and Distance Traveled on the Study Freeway by Design Sub-Area and by Study Area (continued)

| Chi-square Tests of Independence | | | |
|---|---|---|---|
| | **Abutting** | **Non-Abutting** | **Abutting versus. Non-Abutting** |
| **1: Travel Frequency** | | | |
| Study Area 1: Lubbock | $\chi^2$ (4degrees) = 2.39 p=.664 Fisher's p=.663; Not significant | $\chi^2$ (4) = 8.9 p=.06 Fisher's p=.027; Significant | $\chi^2$ (4) = 3.17 p=.529 Fisher's p=.527; Not significant |
| Study Area 2: Houston | $\chi^2$ (8 degrees) = 2.26 p=.972 Fisher's p=.984 Not significant | $\chi^2$ (4) = 5.31 p=.257 Fisher's p=.51; Not significant | $\chi^2$ (4) = 5.78 p=.216 Fisher's p=.125; Not significant |
| Study Area 3: San Antonio | $\chi^2$ (8 degrees)=10.81 p=.213 Fisher's p=.183; Not significant | $\chi^2$ (4) = 4.19 p=.38 Fisher's p=.42; Not significant | $\chi^2$ (4) =16.5 p=.002 Fisher's p=.001;Significant |
| Study Area 4: Dallas | $\chi^2$ (8 degrees) = 11.24 p=.189 Fisher's p=.255; Not significant | $\chi^2$ (4) =1.12 p=.891 Fisher's p=.70; Not significant | $\chi^2$ (4) = 4.88 p=.3 Fisher's p=.267; Not significant |
| All Study Areas Combined | $\chi^2$ (8 degrees) = 17.7 p=.023; Significant | $\chi^2$ (4) = 3.09 p=.542 Fisher's p=.579; Not significant | $\chi^2$ (4) = 44.2 p=.001 Fisher's p=.0001; Significant |
| **2: Distance Traveled** | | | |
| Study Area 1: Lubbock: | $\chi^2$ (4 degrees) = 4.76 p=.312 Fisher's p=.402 ; Not significant | $\chi^2$ (2) = 3.14 p=.208 Fisher's p=.208; Not significant | $\chi^2$ (2) = .938 p=.626 Fisher's p=.638;Not significant |
| Study Area 2: Houston | $\chi^2$ (4 degrees) = 2.31 p=.68 Fisher's p=.826 ; Not significant | $\chi^2$ (1) = .9 p=.34 Fisher's p=1.00; Not significant | $\chi^2$ (2) = 1.76 p=.41 Fisher's p=.52; Not significant |
| Study Area 3: San Antonio | $\chi^2$ (4 degrees) = 1.55 p=.818 Fisher's p=.787 ; Not significant | $\chi^2$ (2) = 12.37 p=.002 Fisher's p=1.3*($10^{-3}$) Significant | $\chi^2$ (2) = 6.81 p=.03 Fisher's p=.04; Significant |
| Study Area 4: Dallas | $\chi^2$ (4 degrees) = 16.22 p=.003 Fisher's p=9.6*($10^{-4}$); Significant beyond 99%. | $\chi^2$ (2) = .168 p=.910 Fisher's p=1.00; Not significant | $\chi^2$ (2) = .284 p=.867 Fisher's p=.915; Not significant |
| All Study Areas Combined | $\chi^2$ (4 degrees) = 18.9 p=.001 Fisher's p=1.00*($10^{-4}$); Significant beyond 99% | $\chi^2$ (2) = 3.28 p=.19 Fisher's p=.198; Not significant | $\chi^2$ (2) = .405 p=.817 Fisher's p=.9; Not significant |

Almost 58% of the total number of respondents in study area 3 (San Antonio) reported using the study freeway on a daily basis. Of these, 44% reported using the freeway several times a day. Twenty-eight percent reported using the freeway on a weekly basis, and only 7% said that they used the freeway on a monthly basis. Only 1% said they used the freeway on a yearly basis, and about 7% said they almost or never used the freeway. Overall, 52% said that they traveled a distance of more than five miles (8 km), and 44% reported traveling a distance between one and five miles (1.6-8 km), and only 3% reported traveling less than one mile (1.6 km). A greater percentage of respondents on abutting sections were observed to have reported traveling a distance of one to five miles (1.6-8 km) (60% overall) in comparison to those on non-abutting sections. On non-abutting sections, a greater percentage (56%) reported traveling a distance of more than five miles (8 km).

In study area 4 (Dallas), 47% of the respondents said that they traveled on the freeway on a daily basis, with almost 26% reporting using the freeway several times a day. Thirty-six percent of the residents reported traveling on the freeway on a weekly basis; 4% reported using the freeway on a monthly basis; 2% reported using the freeway on a yearly basis, and interestingly, 11% reported almost or never using the freeway. Of those residents who said that they used the freeway, almost 55% said they traveled a distance of one to five miles (1.6-8 km), and another 43% said they traveled a distance greater than five miles (8 km). Only 2% said that they traveled less than one mile (1.6 km) on the Central Expressway. Statistical tests of independence reveal that responses from abutting sections as regards distance traveled are significantly different across grade levels. The chi-square test statistic with four degrees of freedom for abutting sections is equal to 16.22 with a Fisher's p value = $9.6*(10^{-4})$ which implies that this test statistic is significant beyond the 99% confidence level.

The results in Table 54 once again point to the high levels of physical mobility of the individuals in all study areas and reliance on the freeway as a means to getting to the concerned destinations. The combined study area analysis shows that the majority of the respondents travel longer as opposed to shorter distances. There is also evidence that the frequency of freeway use is very high in all study areas individually as well as in the combined study area analysis. Almost 52% traveled distances of over five miles (8 km), and 44% traveled between one and five miles (1.6-8 km). A very small percentage, less than 4%, traveled less than one mile (1.6 km). Furthermore, 47% of the residents report traveling on the study freeways on a daily basis. Thirty percent said that they used the freeway on a weekly basis; 11% reported using the freeway on a monthly basis; 3% reported using the freeway on a yearly basis, and 7% reported never or almost never using the freeway. Although the tests statistics for differences in frequency by grade level and distance traveled are mostly insignificant for each of the study areas individually (with the exception of Dallas), the combined study area analysis, however, does reveal statistically significant differences across design sub-areas.

**Type of Trips Made on Study Freeway**

Table 55 presents the responses to the question relating to the use of the freeway as indicated by the nature of trips made on the study freeways. The percentages are based on the number of responses elicited and do not add up because of the multitude of responses.

> Lubbock: Looking at the combined abutting and non-abutting results, shopping was the most frequently cited response (62% of the time). This response was followed by running personal errands (55% of the time). Visiting friends and traveling through town were cited 44% and 41% of the time, respectively. Medical trips were cited 37% of the time, and trips to school were cited only 27% of the time. Church-related trips were cited the least often (23% of the time). Personal errands, shopping, and work-related trips were cited more often on depressed and at-grade segments than on elevated segments, while traveling through town was cited most frequently on at-grade portions.

> Houston: The most cited responses include trips to run personal errands, commuting to work, and visiting friends (44%, 40%, and 35% of the time, respectively). Medical trips, school trips, and church-related trips were cited the fewest number of times (13%, 8%, and 7% of the time, respectively). Traveling through town, trips made to the airport, and shopping trips were also cited quite a large number of times (28%, 26%, and 25% of the time, respectively). There is again substantial variation in the responses by grade level, with airport-related trips being cited most frequently on depressed and at-grade segments (33% and 43% of the time, respectively) and shopping trips being cited 65% of the time on elevated portions.

**Table 55. Percentage Distribution of Responses of Residents Regarding Type of Trips Made on Study Freeway by Design Sub-Area and by Study Area**

| Trip type | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Work | 0.0 | 26.5 | 50.0 | 60.6 | 33.3 | - | 42.2 | 54.4 | 49.0 |
| School | 20.0 | 2.9 | 41.2 | 24.2 | 33.3 | - | 37.8 | 17.5 | 26.5 |
| Shopping | 20.0 | 50.0 | 55.9 | 63.6 | 66.7 | - | 53.3 | 68.4 | 61.8 |
| Medical | 0.0 | 14.7 | 47.1 | 36.4 | 66.7 | - | 44.4 | 31.6 | 37.3 |
| Personal Errands | 40.0 | 29.4 | 52.9 | 60.6 | 83.3 | - | 55.6 | 54.4 | 54.9 |
| Church | 0.0 | 8.8 | 32.4 | 21.2 | 16.7 | - | 26.7 | 19.3 | 22.5 |
| Visit Friends | 20.0 | 35.3 | 44.1 | 48.5 | 16.7 | - | 37.8 | 49.1 | 44.1 |
| Traveling through town | 20.0 | 17.6 | 35.3 | 54.5 | 83.3 | - | 40.0 | 42.1 | 41.2 |
| Other (airport) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total Responses (N) | 5 | 22 | 6 | 33 | 34 | - | 45 | 57 | 102 |

Table 55. Percentage Distribution of Responses of Residents Regarding Type of Trips Made on Study Freeway by Design Sub-Area and by Study Area (continued)

| Trip type | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| Study Area 2: Houston | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Abutting | Non-Abut. | Total |
| Work | 24.0 | 50.0 | 38.0 | 50.0 | 52.0 | - | 39.0 | 50.0 | 40.0 |
| School | 12.0 | 0.0 | 0.0 | 25.0 | 10.0 | - | 6.0 | 20.0 | 8.0 |
| Shopping | 18.0 | 50.0 | 17.0 | 38.0 | 33.0 | - | 23.0 | 40.0 | 25.0 |
| Medical | 6.0 | 0.0 | 17.0 | 13.0 | 14.0 | - | 13.0 | 10.0 | 13.0 |
| Personal Errands | 65.0 | 0.0 | 42.0 | 38.0 | 38.0 | - | 47.0 | 30.0 | 44.0 |
| Church | 6.0 | 0.0 | 8.0 | 13.0 | 5.0 | - | 6.0 | 10.0 | 7.0 |
| Visit Friends | 29.0 | 0.0 | 54.0 | 13.0 | 29.0 | - | 39.0 | 10.0 | 35.0 |
| Traveling through town | 29.0 | 50.0 | 13.0 | 38.0 | 38.0 | - | 26.0 | 40.0 | 28.0 |
| Other (airport) | 6.0 | 0.0 | 33.0 | 13.0 | 43.0 | - | 29.0 | 10.0 | 26.0 |
| Total Responses (N) | 17 | 2 | 24 | 8 | 21 | - | 62 | 10 | 72 |

**Table 55. Percentage Distribution of Responses of Residents Regarding Type of Trips Made on Study Freeway by Design Sub-Area and by Study Area (continued)**

| Trip type | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Work | 37.5 | 56.9 | 50.0 | 54.9 | 0.0 | - | 45.9 | 56.2 | 54.1 |
| School | 6.3 | 17.2 | 20.5 | 18.7 | 0.0 | - | 16.4 | 17.8 | 17.5 |
| Shopping | 56.3 | 76.8 | 75.0 | 59.3 | 100.0 | - | 70.5 | 70.3 | 70.3 |
| Medical | 31.3 | 38.4 | 63.6 | 47.3 | 100.0 | - | 55.7 | 41.7 | 44.6 |
| Personal Errands | 50.0 | 74.8 | 72.7 | 53.9 | 100.0 | - | 67.2 | 66.9 | 67.0 |
| Church | 12.5 | 29.8 | 29.6 | 25.3 | 0.0 | - | 24.6 | 28.1 | 27.4 |
| Visit Friends | 43.8 | 48.3 | 63.6 | 53.9 | 100.0 | - | 59.0 | 50.4 | 52.2 |
| Traveling through town | 25.0 | 41.7 | 52.3 | 47.3 | 0.0 | - | 44.3 | 43.8 | 43.9 |
| Other (airport) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total Responses (N) | 16 | 151 | 44 | 91 | 1 | - | 61 | 242 | 303 |

**Table 55. Percentage Distribution of Responses of Residents Regarding Type of Trips Made on Study Freeway by Design Sub-Area and by Study Area (continued)**

| Trip type | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Work | 50.0 | 66.7 | 58.1 | 63.0 | 0.0 | - | 55.6 | 63.2 | 60.2 |
| School | 0.0 | 33.3 | 6.5 | 13.0 | 0.0 | - | 5.6 | 14.0 | 10.8 |
| Shopping | 50.0 | 66.7 | 67.7 | 72.2 | 100.0 | - | 66.7 | 71.9 | 69.9 |
| Medical | 0.0 | 0.0 | 45.2 | 22.2 | 0.0 | - | 38.9 | 21.1 | 28.0 |
| Personal Errands | 50.0 | 66.7 | 74.2 | 64.8 | 100.0 | - | 72.2 | 64.9 | 67.7 |
| Church | 0.0 | 0.0 | 12.9 | 14.8 | 0.0 | - | 11.1 | 14.0 | 12.9 |
| Visit Friends | 25.0 | 33.3 | 54.8 | 50.0 | 100.0 | - | 52.8 | 49.1 | 50.5 |
| Traveling through town | 25.0 | 100.0 | 35.5 | 38.9 | 0.0 | - | 33.3 | 42.1 | 38.7 |
| Other (airport) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total Responses (N) | 4 | 3 | 31 | 57 | 1 | - | 36 | 57 | 93 |

Table 55. Percentage Distribution of Responses of Residents Regarding Type of Trips Made on Study Freeway by Design Sub-Area and by Study Area (continued)

| Trip type | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Abutting** | **Non-Abut.** | **Total** |
| Work | 28.6 | 55.1 | 49.6 | 58.1 | 44.8 | - | 44.6 | 56.6 | 52.3 |
| School | 9.5 | 15.7 | 18.8 | 18.3 | 13.8 | - | 16.2 | 17.0 | 16.7 |
| Shopping | 35.7 | 76.4 | 57.9 | 62.9 | 44.8 | - | 51.5 | 69.5 | 63.0 |
| Medical | 14.3 | 35.4 | 46.6 | 36.6 | 27.6 | - | 37.3 | 35.9 | 336.4 |
| Personal Errands | 54.8 | 70.2 | 62.4 | 57.5 | 51.7 | - | 59.3 | 63.7 | 62.2 |
| Church | 7.1 | 26.9 | 22.6 | 20.9 | 6.9 | - | 17.2 | 23.9 | 21.5 |
| Visit Friends | 33.3 | 48.3 | 54.9 | 50.0 | 31.0 | - | 47.1 | 49.2 | 48.4 |
| Traveling through town | 26.2 | 41.0 | 36.8 | 45.7 | 44.8 | - | 35.8 | 43.4 | 40.7 |
| Other (airport) | 2.4 | 0.0 | 6.0 | 0.5 | 31.0 | - | 8.8 | 0.3 | 3.4 |
| Total Responses (N) | 42 | 178 | 133 | 186 | 29 | - | 204 | 364 | 568 |

San Antonio: Overall, shopping trips were cited approximately 70% of the time followed closely by trips to run personal errands. Work-related trips and trips to visit friends were cited 54% and 52% of the time, respectively. Medical trips and traveling through town were cited 45% and 44% of the time, respectively, while church and school-related trips were cited only about 27% and 17% of the time, respectively.

Dallas: The overall response pattern is similar to responses from the San Antonio study areas, with shopping trips and personal errand trips being cited most frequently (70% and 68% of the time, respectively). Church and school-related trips were cited the fewest number of times (13% and 11% of the time, respectively).

The combined study area responses suggest that shopping and personal errand trips are the most frequently cited trip types made on the concerned study freeways (63% and 62% of the time, respectively). Church and school-related trips are the cited only 22% and 17% of the time, respectively. In general, this leads us to believe that respondents used the freeway to travel longer distances than shorter ones.

**Changes in Travel After Construction of the Freeway**

Respondents were asked how their travel changed on the concerned freeways; the distribution of responses is presented in Table 56. The responses to this question provide important information on how the freeways may have altered accessibility within the study areas to the destinations mentioned in Table 55, by affecting route circuitry.

Lubbock: Almost 18% of the overall 93 respondents in the Lubbock study area responded that they were making fewer trips after the construction of I-27 than before. Thirty-one percent reported an increase in the number of trips. Twenty-two percent responded that their trips were shorter. Only 1% reported that their trips were longer. Lastly, 28% reported no change in the trip length.

**Table 56. Percentage Distribution of Responses of Residents to the Question Regarding Changes in Travel After Construction of the Freeway**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA | Total |
| **Study Area 1: Lubbock** | | | | | | | | | |
| Fewer trips | 25.0 | 18.2 | 16.7 | 23.3 | 0.0 | - | 14.6 | 21.2 | 18.3 |
| More trips | 25.0 | 22.7 | 23.3 | 40.0 | 57.1 | - | 29.3 | 32.7 | 31.2 |
| Shorter trips | 25.0 | 27.3 | 20.0 | 23.3 | 0.0 | - | 17.1 | 25.0 | 21.5 |
| Longer trips | 0.0 | 0.0 | 0.0 | 0.0 | 14.3 | - | 2.4 | 0.0 | 1.1 |
| No change | 25.0 | 31.8 | 40.0 | 13.3 | 28.6 | - | 36.6 | 21.2 | 27.9 |
| Total responses (N) | 4 | 22 | 30 | 30 | 7 | - | 41 | 52 | 93 |
| **Study Area 2: Houston** | | | | | | | | | |
| Fewer trips | 29.0 | 50.0 | 5.0 | 11.0 | 19.0 | - | 16.0 | 18.0 | 16.0 |
| More trips | 7.0 | 0.0 | 23.0 | 22.0 | 29.0 | - | 21.0 | 18.0 | 21.0 |
| Shorter trips | 21.0 | 50.0 | 5.0 | 33.0 | 24.0 | - | 16.0 | 36.0 | 19.0 |
| Longer trips | 0.0 | 0.0 | 9.0 | 11.0 | 0.0 | - | 4.0 | 9.0 | 4.0 |
| No change | 43.0 | 0.0 | 59.0 | 22.0 | 29.0 | - | 44.0 | 18.0 | 40.0 |
| Total responses (N) | 14 | 2 | 22 | 9 | 21 | - | 57 | 11 | 68 |
| **Study Area 2: San Antonio** | | | | | | | | | |
| Fewer trips | 6.3 | 2.9 | 0.0 | 9.1 | 0.0 | - | 1.6 | 5.3 | 4.5 |
| More trips | 37.5 | 42.1 | 40.9 | 30.7 | 0.0 | - | 39.3 | 37.7 | 38.1 |
| Shorter trips | 6.3 | 16.4 | 11.4 | 22.7 | 100.0 | - | 11.5 | 18.9 | 17.3 |
| Longer trips | 12.5 | 7.1 | 15.9 | 6.8 | 0.0 | - | 14.8 | 7.0 | 8.7 |
| No change | 37.5 | 31.4 | 31.8 | 30.7 | 0.0 | - | 32.8 | 31.1 | 31.5 |
| Total responses (N) | 16 | 140 | 44 | 88 | 1 | - | 61 | 228 | 289 |

**Table 56. Percentage Distribution of Responses of Residents to the Question Regarding Changes in Travel After Construction of the Freeway (continued)**

| | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | NA | A | NA | A | NA | A | NA | Total |
| **Study Area 4: Dallas** | | | | | | | | | |
| Fewer trips | 50.0 | 50.0 | 48.5 | 50.7 | 0.0 | - | 47.5 | 67.3 | 49.6 |
| More trips | 0.0 | 0.0 | 3.0 | 4.3 | 100.0 | - | 5.0 | 5.8 | 4.4 |
| Shorter trips | 16.7 | 50.0 | 15.2 | 23.2 | 0.0 | - | 15.0 | 30.8 | 21.2 |
| Longer trips | 16.7 | 0.0 | 6.1 | 7.2 | 0.0 | - | 7.5 | 9.6 | 7.1 |
| No change | 16.7 | 0.0 | 27.3 | 14.5 | 0.0 | - | 25.0 | 19.2 | 17.7 |
| Total responses (N) | 6 | 4 | 33 | 69 | 1 | - | 40 | 73 | 113 |
| **All Study Areas** | | | | | | | | | |
| Fewer trips | 22.5 | 6.5 | 17.1 | 26.0 | 13.3 | - | 17.6 | 17.0 | 17.2 |
| More trips | 20.0 | 38.1 | 24.0 | 22.4 | 36.7 | - | 25.1 | 29.7 | 28.1 |
| Shorter trips | 15.0 | 19.0 | 13.2 | 23.5 | 20.0 | - | 14.6 | 21.4 | 19.0 |
| Longer trips | 7.5 | 5.9 | 8.5 | 6.1 | 3.3 | - | 7.5 | 6.0 | 6.6 |
| No change | 35.0 | 30.4 | 37.2 | 21.9 | 26.7 | - | 35.2 | 25.8 | 29.1 |
| Total responses (N) | 40 | 168 | 129 | 196 | 30 | - | 199 | 364 | 563 |

Lubbock: (A): $\chi^2$ (8)= 10.36 p=.241, Fisher's Statistic p=.271; Not significant
(NA) $\chi^2$ (4) = 4.27 p=.234, Fisher's Statistic p=.223; Not significant;
(A versus NA) $\chi^2$ (4)=4.77 p=.311, Fisher' s Statistic p=.311; Not significant;

Houston: (A): $\chi^2$ (8)= 13.59 p= .093, Fisher's Statistic p=.077; Not significant
(NA) $\chi^2$ (4) = 2.59 p=.627, Fisher's Statistic p=1.00; Not significant;
(A versus NA) $\chi^2$ (4)= 4.29 p=.368, Fisher's Statistic p=.27; Not significant

San Antonio: (A): $\chi^2$ (8)= 11.15 p=.193; Not significant; (NA): $\chi^2$ (4) = 7.03 p=.135; Not significant
(A versus NA) $\chi^2$ (4)=6.33 p=.176; Not significant

Dallas: (A): $\chi^2$ (8)= 20.58 p=.008, Fisher's Statistic p=.274; Not significant;
(NA) $\chi^2$ (4) = 4.27 p=.234, Fisher' s Statistic p=.223; Not significant;
(A versus NA) $\chi^2$ (4)=4.77 p=.311, Fisher' s Statistic p=.311; Not significant

All Study Areas: (A): $\chi^2$ (8)=5.37 p=.717; Not significant; (NA): $\chi^2$ (4)=32.1 p=.001; Significant;
(A versus NA) $\chi^2$ (4)= 8.45 p=.076; Not significant

Houston: Forty percent of the respondents in the Houston area reported no change at all. Only 4% said that their trip lengths had increased. Nineteen percent commented that their trips were shorter, while 21% reported that trip lengths had actually increased. Another 16% said that they were making fewer trips than before.

San Antonio: Thirty-eight percent of the San Antonio study area residents surveyed reported that the number of trips had increased after construction. Another 32% reported no change. About 5% reported fewer trips, and 17% reported shorter trips than usual. Only 9% said that their trips were longer.

Dallas: A very large percentage, almost 50% of the residents surveyed in Dallas study area, commented that their trips were fewer. This could imply that these residents were moving away from using the freeway itself by using other access roads, possibly due to the construction activity. This result is not surprising when we consider the timing at which these surveys were administered. Most surveys along Central Expressway were administered at a time when construction was underway. Another 21% answered that their trips were shorter. Eighteen percent indicated no change. Seven percent mentioned that their trips were longer, and yet another 4% reported that the number of their trips had increased.

All study areas reveal an interesting pattern. While the percentage of respondents who indicate no change in the number of trips is quite large in most study areas, those who comment that trips are longer in length are very few in all study areas, less than 9% individually and less than 7% overall. On the other hand, the percentage of respondents who comment that their trips are shorter in length ranges from 22% in Lubbock to 17% in San Antonio. Overall, 19% of the respondents reported a decrease in their trip lengths to the destinations mentioned in Table 55. These results provide some evidence of enhanced accessibility resulting from the construction of the study freeways.

## EFFECTS ON NEIGHBORHOOD WHERE SURVEYED RESIDENTS ARE LOCATED

### Description of Present Location

Each resident was asked to describe the present location, and these opinions are described in Table 57. The information provided presents a perception of neighborhood quality as well as neighborhood cohesion. The table is organized in a way such that "% Yes" column indicates the percentage of total respondents who thought the location had that attribute, while the "% No" column indicates the percentage of total respondents who believed the location did not have the attribute. Again, percentages are based on total number of respondents, and the percentages do not add up because of multiple responses.

> Lubbock: Thirty-three percent of the abutting section respondents reported that the study area was quiet and peaceful. Thirty-one percent believed that the study area was also family oriented indicative of strong cohesion in the neighborhood. However, there were also a very large number of respondents (40%) who believed that the area was noisy. Another 31% thought that the neighborhood was not as nice as most. Thirty-six percent thought that there was a lot of traffic, and another 31% believed that the neighborhood was not well kept. A very small percentage, approximately 7%, thought that the neighborhood conveyed a sense of permanence. The attributes that were cited most frequently on non-abutting sections include peaceful neighborhood and less traffic on the streets (32% of the time), friendly (39% of the time), and stable (37% of the time). On the other hand, unfriendly and crowded were cited only 7% of the time. Overall, 33% of the combined 102 respondents in Lubbock believed that the neighborhood was noisy. Another 32% of the combined 102 respondents believed that the neighborhood was peaceful, friendly, and stable. Thirty percent believed that the neighborhood was family oriented. The responses cited the fewest number of times are unfriendly, unstable, and crowded (6%, 7%, and 5% of the time, respectively).

## Table 57. Descriptions of Abutting and Non-Abutting Residents Regarding Present Location

| Description of Location | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | % Yes | % No | %Yes | % No | % Yes | % No | % Yes | % No |
| **Study Area 1: Lubbock (Abutting)** | N=5 | | N=34 | | N=6 | | N=45 | |
| Nice | 20.0 | 0.0 | 8.8 | 17.6 | 16.7 | 83.3 | 11.1 | 24.4 |
| So-so | 0.0 | 80.0 | 20.6 | 29.4 | 50.0 | 0.0 | 22.2 | 31.1 |
| Quiet | 20.0 | 80.0 | 32.4 | 38.2 | 50.0 | 16.7 | 33.3 | 40.0 |
| Peaceful | 20.0 | 0.0 | 29.4 | 11.8 | 66.7 | 0.0 | 33.3 | 8.9 |
| Safe | 40.0 | 20.0 | 20.6 | 23.5 | 66.7 | 0.0 | 28.9 | 20.0 |
| Friendly | 20.0 | 20.0 | 20.6 | 2.9 | 50.0 | 0.0 | 24.4 | 4.4 |
| Stable | 20.0 | 0.0 | 20.6 | 11.8 | 66.7 | 0.0 | 26.7 | 8.9 |
| Permanent | 0.0 | 20.0 | 2.9 | 14.7 | 33.3 | 0.0 | 6.7 | 13.3 |
| Well kept | 0.0 | 80.0 | 8.8 | 32.4 | 33.3 | 0.0 | 11.1 | 33.3 |
| Spacious | 40.0 | 0.0 | 14.7 | 2.9 | 66.7 | 0.0 | 24.4 | 2.2 |
| Family oriented | 40.0 | 40.0 | 23.5 | 11.8 | 66.7 | 16.7 | 31.1 | 15.6 |
| Little traffic | 40.0 | 40.0 | 14.7 | 32.4 | 33.3 | 50.0 | 20.0 | 35.6 |
| **Study Area 1: Lubbock (Non-Abutting)** | N=22 | | N=35 | | | | N=57 | |
| Nice | 22.7 | 0.0 | 25.7 | 17.1 | - | - | 24.6 | 10.5 |
| So-so | 31.8 | 27.3 | 17.1 | 31.4 | - | - | 22.8 | 29.8 |
| Quiet | 13.6 | 45.5 | 34.3 | 17.1 | - | - | 26.3 | 28.1 |
| Peaceful | 31.8 | 31.8 | 31.4 | 5.7 | - | - | 31.6 | 15.8 |
| Safe | 27.3 | 18.2 | 28.6 | 22.9 | - | - | 28.1 | 21.1 |
| Friendly | 36.4 | 13.6 | 40.0 | 2.9 | - | - | 38.6 | 7.0 |
| Stable | 36.4 | 9.1 | 37.1 | 2.9 | - | - | 36.8 | 5.3 |
| Permanent | 18.2 | 13.6 | 17.1 | 11.4 | - | - | 17.5 | 12.3 |
| Well kept | 13.6 | 27.3 | 25.7 | 17.1 | - | - | 21.1 | 21.1 |
| Spacious | 18.2 | 13.6 | 31.4 | 2.9 | - | - | 26.3 | 7.0 |
| Family oriented | 27.3 | 22.7 | 31.4 | 2.9 | - | - | 29.8 | 10.5 |
| Little traffic | 22.7 | 45.5 | 37.1 | 17.1 | - | - | 31.6 | 28.1 |

## Table 57. Descriptions of Abutting and Non-Abutting Residents Regarding Present Location (continued)

| Description of Location | Elevated % Yes | Elevated % No | Depressed %Yes | Depressed % No | At-Grade % Yes | At-Grade % No | All Design Sub-Areas % Yes | All Design Sub-Areas % No |
|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston (Abutting)** | N=17 | | N=24 | | N=21 | | N=62 | |
| Nice | 76.0 | 29.0 | 79.0 | 17.0 | 100.0 | 0.0 | 85.0 | 15.0 |
| So-so | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Quiet | 65.0 | 18.0 | 54.0 | 33.0 | 71.0 | 0.0 | 63.0 | 18.0 |
| Peaceful | 71.0 | 0.0 | 58.0 | 0.0 | 71.0 | 0.0 | 66.0 | 0.0 |
| Safe | 59.0 | 6.0 | 63.0 | 13.0 | 57.0 | 5.0 | 60.0 | 8.0 |
| Friendly | 47.0 | 6.0 | 67.0 | 0.0 | 57.0 | 0.0 | 58.0 | 2.0 |
| Stable | 65.0 | 0.0 | 75.0 | 0.0 | 67.0 | 0.0 | 69.0 | 0.0 |
| Permanent | 65.0 | 0.0 | 58.0 | 0.0 | 62.0 | 0.0 | 61.0 | 0.0 |
| Well kept | 76.0 | 0.0 | 92.0 | 0.0 | 95.0 | 0.0 | 89.0 | 0.0 |
| Spacious | 41.0 | 6.0 | 54.0 | 0.0 | 43.0 | 10.0 | 47.0 | 5.0 |
| Family oriented | 53.0 | 0.0 | 79.0 | 4.0 | 71.0 | 0.0 | 69.0 | 2.0 |
| Little traffic | 41.0 | 24.0 | 46.0 | 33.0 | 48.0 | 10.0 | 45.0 | 23.0 |
| **Study Area 2: Houston (Non-Abutting)** | N=2 | | N=8 | | | | N=10 | |
| Nice | 50.0 | 50.0 | 75.0 | 13.0 | - | - | 83.0 | 15.0 |
| So-so | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Quiet | 50.0 | 0.0 | 88.0 | 0.0 | - | - | 65.0 | 15.0 |
| Peaceful | 100.0 | 0.0 | 75.0 | 0.0 | - | - | 68.0 | 0.0 |
| Safe | 100.0 | 0.0 | 75.0 | 0.0 | - | - | 63.0 | 7.0 |
| Friendly | 50.0 | 0.0 | 88.0 | 0.0 | - | - | 61.0 | 1.0 |
| Stable | 100.0 | 0.0 | 63.0 | 0.0 | - | - | 69.0 | 0.0 |
| Permanent | 50.0 | 0.0 | 50.0 | 0.0 | - | - | 60.0 | 0.0 |
| Well kept | 100.0 | 0.0 | 75.0 | 0.0 | - | - | 88.0 | 0.0 |
| Spacious | 50.0 | 0.0 | 38.0 | 13.0 | - | - | 46.0 | 6.0 |
| Family oriented | 100.0 | 0.0 | 75.0 | 0.0 | - | - | 71.0 | 1.0 |
| Little traffic | 0.0 | 100.0 | 50.0 | 50.0 | - | - | 44.0 | 28.0 |

## Table 57. Descriptions of Abutting and Non-Abutting Residents Regarding Present Location (continued)

| Description of Location | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | % Yes | % No | %Yes | % No | % Yes | % No | % Yes | % No |
| **Study Area 3: San Antonio (Abutting)** | N=16 | | N=44 | | N=1 | | N=61 | |
| Nice | 6.3 | 25.0 | 15.9 | 22.7 | 0.0 | 100.0 | 13.1 | 22.9 |
| So-so | 43.8 | 25.0 | 31.8 | 36.4 | 100.0 | 0.0 | 36.1 | 34.4 |
| Quiet | 37.5 | 50.0 | 36.4 | 36.4 | 0.0 | 0.0 | 36.1 | 39.3 |
| Peaceful | 37.5 | 12.5 | 36.4 | 9.1 | 0.0 | 0.0 | 36.1 | 9.8 |
| Safe | 31.3 | 56.3 | 22.7 | 40.9 | 100.0 | 0.0 | 26.2 | 44.3 |
| Friendly | 50.0 | 6.3 | 43.2 | 15.9 | 100.0 | 0.0 | 45.9 | 13.1 |
| Stable | 25.0 | 12.5 | 31.8 | 18.2 | 100.0 | 0.0 | 31.2 | 16.4 |
| Permanent | 18.8 | 37.5 | 20.5 | 15.9 | 100.0 | 0.0 | 21.3 | 21.3 |
| Well kept | 25.0 | 31.3 | 25.0 | 31.8 | 0.0 | 0.0 | 24.6 | 31.2 |
| Spacious | 31.3 | 12.5 | 20.5 | 6.8 | 0.0 | 0.0 | 22.9 | 8.2 |
| Family oriented | 25.0 | 12.5 | 34.1 | 18.2 | 100.0 | 0.0 | 32.8 | 16.4 |
| Little traffic | 25.0 | 62.5 | 15.9 | 56.8 | 0.0 | 100.0 | 18.0 | 59.0 |
| **Study Area 3: San Antonio (Non-Abutting)** | N=151 | | N=91 | | | | N=242 | |
| Nice | 57.6 | 17.2 | 27.5 | 17.6 | - | - | 46.3 | 17.4 |
| So-so | 13.3 | 7.9 | 37.4 | 21.9 | - | - | 22.3 | 13.2 |
| Quiet | 64.9 | 7.3 | 37.4 | 17.6 | - | - | 54.6 | 11.2 |
| Peaceful | 60.9 | 3.3 | 39.6 | 8.8 | - | - | 52.9 | 5.4 |
| Safe | 57.6 | 9.3 | 18.7 | 30.8 | - | - | 42.9 | 17.4 |
| Friendly | 64.2 | 1.9 | 47.3 | 9.9 | - | - | 57.9 | 4.9 |
| Stable | 47.0 | 5.3 | 30.8 | 8.8 | - | - | 40.9 | 6.6 |
| Permanent | 39.1 | 8.6 | 14.3 | 9.9 | - | - | 29.8 | 9.1 |
| Well kept | 56.9 | 9.3 | 16.5 | 25.3 | - | - | 41.7 | 15.3 |
| Spacious | 43.7 | 5.3 | 18.7 | 5.5 | - | - | 34.3 | 5.4 |
| Family oriented | 50.9 | 6.6 | 32.9 | 10.9 | - | - | 44.2 | 8.3 |
| Little traffic | 50.9 | 21.2 | 32.9 | 31.9 | - | - | 44.2 | 25.2 |

## Table 57. Descriptions of Abutting and Non-Abutting Residents Regarding Present Location (continued)

| Description of Location | Elevated % Yes | Elevated % No | Depressed %Yes | Depressed % No | At-Grade % Yes | At-Grade % No | All Design Sub-Areas % Yes | All Design Sub-Areas % No |
|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas (Abutting)** | N=4 | | N=31 | | N=1 | | N=36 | |
| Nice | 75.0 | 0.0 | 61.3 | 12.9 | 100.0 | 0.0 | 63.9 | 11.1 |
| So-so | 0.0 | 0.0 | 3.2 | 3.2 | 0.0 | 0.0 | 2.8 | 2.8 |
| Quiet | 50.0 | 0.0 | 38.7 | 22.6 | 100.0 | 0.0 | 41.7 | 19.4 |
| Peaceful | 25.0 | 0.0 | 35.5 | 3.2 | 100.0 | 0.0 | 36.1 | 2.8 |
| Safe | 25.0 | 50.0 | 51.6 | 9.7 | 0.0 | 0.0 | 47.2 | 13.9 |
| Friendly | 50.0 | 25.0 | 61.3 | 3.2 | 0.0 | 0.0 | 58.3 | 5.6 |
| Stable | 25.0 | 0.0 | 54.8 | 3.2 | 100.0 | 0 .0 | 52.8 | 2.8 |
| Permanent | 100.0 | 0.0 | 38.7 | 3.2 | 0.0 | 0.0 | 44.4 | 2.8 |
| Well kept | 75.0 | 0.0 | 54.8 | 3.2 | 0.0 | 0.0 | 55.6 | 2.8 |
| Spacious | 0.0 | 0.0 | 12.9 | 6.5 | 0.0 | 0.0 | 11.1 | 5.6 |
| Family oriented | 25.0 | 25.0 | 45.2 | 3.2 | 0.0 | 0.0 | 41.7 | 5.6 |
| Little traffic | 25.0 | 50.0 | 38.7 | 35.5 | 0.0 | 0.0 | 36.1 | 36.1 |
| **Study Area 2: Dallas (Non-Abutting)** | N=3 | | N=54 | | | | N=57 | |
| Nice | 66.7 | 0.0 | 42.6 | 25.9 | - | - | 43.9 | 24.6 |
| So-so | 0.0 | 0.0 | 11.1 | 11.1 | - | - | 10.5 | 10.5 |
| Quiet | 0.0 | 33.3 | 44.4 | 16.7 | - | - | 42.1 | 17.5 |
| Peaceful | 0.0 | 0.0 | 40.7 | 9.3 | - | - | 38.6 | 8.8 |
| Safe | 33.3 | 0.0 | 38.9 | 14.8 | - | - | 38.6 | 14.0 |
| Friendly | 33.3 | 0.0 | 48.1 | 3.7 | - | - | 47.4 | 3.5 |
| Stable | 66.7 | 0.0 | 44.4 | 1.9 | - | - | 45.6 | 1.8 |
| Permanent | 66.7 | 0.0 | 25.9 | 7.4 | - | - | 28.1 | 7.0 |
| Well kept | 66.7 | 0.0 | 40.7 | 7.4 | - | - | 42.1 | 7.0 |
| Spacious | 66.7 | 0.0 | 13.0 | 5.6 | - | - | 15.8 | 5.3 |
| Family oriented | 0.0 | 0.0 | 31.5 | 11.1 | - | - | 29.8 | 10.5 |
| Little traffic | 0.0 | 100.0 | 20.4 | 38.9 | - | - | 19.3 | 42.1 |

## Table 57. Descriptions of Abutting and Non-Abutting Residents Regarding Present Location (continued)

| Description of Location | Elevated | | Depressed | | At-Grade | | All Design Sub-Areas | |
|---|---|---|---|---|---|---|---|---|
| | % Yes | % No | %Yes | % No | % Yes | % No | % Yes | % No |
| **All Study Areas (Abutting)** | N=42 | | N=133 | | N=29 | | N=204 | |
| Nice | 42.9 | 21.4 | 36.1 | 18.1 | 79.3 | 17.2 | 43.6 | 18.6 |
| So-so | 16.7 | 19.1 | 16.5 | 20.3 | 13.8 | 3.5 | 16.2 | 17.7 |
| Quiet | 47.6 | 35.7 | 39.1 | 33.1 | 65.5 | 3.5 | 44.6 | 29.4 |
| Peaceful | 47.6 | 4.8 | 38.4 | 6.8 | 68.9 | 0.0 | 44.6 | 5.4 |
| Safe | 42.9 | 30.9 | 36.1 | 24.1 | 58.6 | 3.5 | 40.7 | 22.6 |
| Friendly | 45.2 | 9.5 | 45.9 | 6.8 | 55.2 | 0.0 | 47.1 | 6.4 |
| Stable | 40.5 | 4.8 | 42.1 | 9.8 | 68.9 | 0.0 | 45.6 | 7.4 |
| Permanent | 42.9 | 16.7 | 27.1 | 9.8 | 55.2 | 0.0 | 34.3 | 9.8 |
| Well kept | 47.6 | 21.4 | 39.9 | 19.6 | 75.9 | 0.0 | 46.6 | 17.2 |
| Spacious | 33.3 | 7.1 | 23.3 | 4.5 | 44.8 | 6.9 | 28.4 | 5.4 |
| Family oriented | 38.1 | 11.9 | 42.1 | 10.5 | 68.9 | 3.5 | 45.1 | 9.8 |
| Little traffic | 33.3 | 42.9 | 26.3 | 41.4 | 41.4 | 20.7 | 29.9 | 38.7 |
| **All Study Areas (Non-Abutting)** | N=178 | | N=186 | | | | N=364 | |
| Nice | 53.4 | 15.2 | 33.9 | 19.4 | - | - | 43.4 | 17.3 |
| So-so | 15.2 | 10.1 | 24.7 | 19.9 | - | - | 20.1 | 15.1 |
| Quiet | 57.3 | 12.4 | 40.9 | 16.1 | - | - | 48.9 | 14.3 |
| Peaceful | 56.7 | 6.7 | 39.8 | 8.1 | - | - | 48.1 | 7.4 |
| Safe | 53.9 | 10.1 | 28.5 | 23.7 | - | - | 40.9 | 17.0 |
| Friendly | 60.1 | 3.4 | 47.9 | 6.5 | - | - | 53.9 | 4.9 |
| Stable | 46.6 | 5.6 | 37.6 | 5.4 | - | - | 42.0 | 5.5 |
| Permanent | 37.1 | 8.9 | 19.9 | 9.1 | - | - | 28.3 | 9.1 |
| Well kept | 52.3 | 11.2 | 27.9 | 17.7 | - | - | 39.8 | 14.6 |
| Spacious | 41.0 | 6.2 | 19.9 | 5.4 | - | - | 30.2 | 5.8 |
| Family oriented | 47.8 | 8.4 | 34.4 | 9.1 | - | - | 40.9 | 8.8 |
| Little traffic | 46.1 | 26.4 | 30.7 | 31.7 | - | - | 38.2 | 29.1 |

Houston: On both abutting and non-abutting sections, a very large percentage of the respondents (85% and 89% respectively on abutting sections; 83% and 88% respectively on non-abutting sections) believed that the neighborhood was nice and well kept. Overall, of the 72 total respondents, 83% believed that the neighborhood was nice and 88% thought it was well kept also. Seventy-one percent overall reported that the neighborhood was family oriented. The percentage of responses for the other positive attributes like quiet, peaceful, safe, friendly, and permanent are also very high and range from 61% to 68%. On the other hand, negative attributes such as not a nice neighborhood, noisy, unstable, transient, and not well kept are not even cited. Twenty-eight percent of the total 72 respondents do believe that there is busy traffic in the neighborhood, and another 15% believe that the neighborhood is middle type and 'rowdy.'

San Antonio: The percentage of responses on abutting sections range from 8% to 59% and from 5% to 58% on non-abutting sections. Overall, for the combined sample of 303 residents the percentages range from 6% to 56%. Fifty-nine percent of the respondents on abutting sections believed that there was a lot of busy traffic on the streets, and 39% thought that it was a noisy area. Thirty-six percent of them believed that the neighborhood was peaceful. Forty -four percent thought the area was unsafe. Negative attributes such as noise, lack of safety, and not well kept were cited more frequently on abutting than on non-abutting sections. In contrast, almost 58% of the respondents on non-abutting sections believed that the neighborhood was friendly. Fifty-five percent and 53%, respectively, believed that the area was also quiet and peaceful. In general, respondents residing near the freeway had more unfavorable opinions than those residing further away from the freeway.

Dallas: Sixty-four percent of the respondents on abutting sections responded that the neighborhood was nice. Fifty-eight percent, 53%, and 56% of the respondents, respectively, believed that the neighborhood was also friendly, stable, and well kept, and fewer than 6% thought otherwise. Among the negative attributes, traffic was cited the most often on both abutting and non-abutting sections (36% and 42% of the time, respectively). The positive attributes cited most frequently on non-abutting sections include friendly, stable, quiet, and well kept neighborhood. These were cited 47%, 46%, and 42% of the time, respectively. Fifty-two percent of the combined sample believed that the neighborhood was nicer than most and friendly.

Each individual study area, as noted above, is uniquely described by its residents. Out of all four study areas, positive attributes of the neighborhood such as variables related to neighborhood cohesion (friendly, permanence, stable) and neighborhood quality (variables such as well kept areas, friendly, safe, spacious, quiet) are cited more often in the case of the Houston and Dallas study areas. The single negative attribute that is cited most frequently in these two study areas is the presence of busy traffic on the streets.

If neighborhood cohesion and quality could be ranked on a three point scale—poor, fair, and good—the Lubbock study area could be rated as having fair cohesion (family oriented, stable, friendly) and poor neighborhood quality (not as nice as most, high traffic leveis, noisy, not well kept, middle type neighborhood being cited as often or more times than their opposites). The Houston study area responses lead us to believe that neighborhood cohesion is good and quality is fair. Positive cohesion attributes are cited more frequently than their negative counterparts in the Houston study area, and the differences in the responses are very wide. It is often noticed that many negative attributes of the neighborhood are not even cited in the Houston study area. Further, quality variables such as friendly, nice neighborhood, peaceful, spacious, safe, well kept, quiet, and nice are also reported more frequently than their opposites. However, as mentioned before, traffic levels are found to be high by the Houston study area residents. In the case of San Antonio, both abutting and non-abutting residential properties have good cohesion; however, they vary dramatically in terms of neighborhood quality. Not surprisingly, abutting residents cite negative attributes such as noise, traffic levels, lack of safety, and ill-kept neighborhoods more often than the positive attributes and also more frequently than non-abutting residents. The Dallas study area can also be considered as possessing good neighborhood cohesion and fair neighborhood quality. Like the Houston study area, high traffic level is often cited. However, unlike the Houston study area, negative neighborhood attributes are cited quite frequently, although not more frequently than the positive attributes. Although this analysis is somewhat crude, it does help to provide a broad indication of the overall neighborhood quality and cohesion in the different study areas.

The frequency of responses pertaining to cohesion-related attributes on abutting sections is the highest on the at-grade segments in the Lubbock and San Antonio study areas. No clear cut pattern is apparent within the elevated and depressed sections of Lubbock and San Antonio. Also, no pattern was clear between the three segments in the Dallas and Houston study areas. Interestingly, on all non-abutting sections, the frequency of cohesion-related attributes is higher on elevated than on depressed sections/segments.

**Reasons for Locating at Present Address**

Respondents were asked to list the major reasons for selecting the present location. The distribution of coded responses is included in Table 58. In all study areas, price and convenience are some of the factors that are cited most frequently. Once again, the information provided in Table 58 provides a good perception of cohesion in the neighborhood quality as well as accessibility.

> Lubbock: Both in abutting and non-abutting sections, price and convenience are the most frequently cited reasons. Price was cited 53.3% of the time on abutting sections and 57.9% of the time on non-abutting sections. All accessibility measures such as convenience and distance to work were cited quite frequently. Convenience was cited 40% and 32% of the time, respectively, on abutting and non-abutting sections. Distance to work was cited 31% and 21% of the time on abutting and non-abutting sections, respectively. Landscape, choices of homes in the neighborhood, and safe traffic were the factors that were cited the fewest number of times. Some indicators of neighborhood quality and cohesion such as neighborhood type and similar people were cited 40% and 20% of the time on abutting sections, respectively, and 32% and 14% on non-abutting sections, respectively. This amounts to 23% and 17% of the overall sample of 102 residents in Lubbock who cite neighborhood type and similar people, respectively, as reasons to locate at the present address.

## Table 58. Percentage Distribution of Responses of Residents to the Question "What Are the Main Reasons You Decided to Live in This Location?" by Design Sub-Area

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | A | NA | A | NA | A | NA | A | NA |
| Price | 20.0 | 59.1 | 52.9 | 57.1 | 83.3 | - | 53.3 | 57.9 |
| Convenience | 60.0 | 22.7 | 32.4 | 37.1 | 66.7 | - | 40.0 | 31.6 |
| Type of neighborhood | 40.0 | 18.2 | 17.6 | 25.7 | 33.3 | - | 22.2 | 22.9 |
| Safety | 40.0 | 13.6 | 8.8 | 25.7 | 16.7 | - | 13.3 | 21.1 |
| Choices of homes in the area | 0.0 | 0.0 | 0.0 | 2.9 | 0.0 | - | 0.0 | 1.8 |
| Distance to work | 40.0 | 22.7 | 35.3 | 20.0 | 0.0 | - | 31.1 | 21.1 |
| Schools | 40.0 | 27.3 | 29.4 | 22.9 | 16.7 | - | 28.9 | 24.6 |
| Similar people | 40.0 | 9.1 | 14.7 | 17.1 | 33.3 | - | 20.0 | 14.0 |
| Safe traffic | 0.0 | 9.1 | 5.9 | 20.0 | 16.7 | - | 6.7 | 15.8 |
| Landscape | 40.0 | 0.0 | 2.9 | 11.4 | 16.7 | - | 8.9 | 7.0 |
| Always lived here | 40.0 | 9.1 | 8.8 | 17.1 | 0.0 | - | 11.1 | 14.0 |
| Total number of responses | N=5 | N=22 | N=34 | N=35 | N=6 | - | N=45 | N=57 |
| **Study Areas 2: Houston** | | | | | | | | |
| Price | 53.0 | 50.0 | 92.0 | 63.0 | 52.0 | - | 68.0 | 60.0 |
| Convenience | 59.0 | 100.0 | 71.0 | 38.0 | 62.0 | - | 65.0 | 50.0 |
| Type of neighborhood | 65.0 | 100.0 | 83.0 | 63.0 | 81.0 | - | 77.0 | 70.0 |
| Safety | 59.0 | 50.0 | 75.0 | 38.0 | 43.0 | - | 60.0 | 40.0 |
| Choices of homes in the area | 24.0 | 50.0 | 21.0 | 13.0 | 29.0 | - | 24.0 | 20.0 |
| Distance to work | 29.0 | 100.0 | 33.0 | 25.0 | 43.0 | - | 35.0 | 40.0 |
| Schools | 59.0 | 100.0 | 79.0 | 100.0 | 0.0 | - | 47.0 | 100.0 |
| Similar people | 6.0 | 50.0 | 33.0 | 25.0 | 29.0 | - | 24.0 | 30.0 |
| Safe traffic | 12.0 | 50.0 | 38.0 | 13.0 | 10.0 | - | 21.0 | 20.0 |
| Landscape | 29.0 | 100.0 | 79.0 | 50.0 | 52.0 | - | 56.0 | 60.0 |
| Other responses | 18.0 | 0.0 | 33.0 | 0.0 | 14.0 | - | 23.0 | 0.0 |
| Total number of responses | N=17 | N=2 | N=24 | N=8 | N=21 | - | N=62 | N=10 |

**Table 58. Percentage Distribution of Responses of Residents to the Question "What Are the Main Reasons You Decided to Live in This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | A | NA | A | NA | A | NA | A | NA |
| Price | 68.8 | 57.6 | 52.3 | 49.5 | 100.0 | - | 57.4 | 54.6 |
| Convenience | 37.5 | 64.2 | 50.0 | 38.5 | 100.0 | - | 47.5 | 54.6 |
| Type of neighborhood | 6.3 | 53.6 | 18.2 | 18.7 | 0.0 | - | 14.8 | 40.5 |
| Safety | 6.3 | 50.9 | 20.5 | 19.8 | 0.0 | - | 16.4 | 39.3 |
| Choices of homes in the area | 50.0 | 17.2 | 47.7 | 37.4 | 0.0 | - | 47.5 | 24.8 |
| Distance to work | 37.5 | 37.8 | 36.4 | 37.4 | 100.0 | - | 37.7 | 37.6 |
| Schools | 25.0 | 45.7 | 25.0 | 30.8 | 100.0 | - | 26.2 | 40.1 |
| Similar people | 12.5 | 19.9 | 13.6 | 14.3 | 100.0 | - | 14.8 | 17.8 |
| Safe traffic | 0.0 | 25.8 | 9.1 | 16.5 | 100.0 | - | 8.2 | 22.3 |
| Landscape | 6.3 | 35.8 | 4.6 | 6.6 | 100.0 | - | 6.6 | 24.8 |
| Always lived here | 31.3 | 14.6 | 22.7 | 31.9 | 0.0 | - | 26.2 | 21.1 |
| Total number of responses | N=16 | N=151 | N=44 | N=91 | N=1 | - | N=61 | N=242 |
| **Study Areas 4: Dallas** | | | | | | | | |
| Price | 50.0 | 100.0 | 51.6 | 42.6 | 0.0 | - | 50.0 | 45.6 |
| Convenience | 100.0 | 100.0 | 71.0 | 70.4 | 100.0 | - | 75.0 | 71.9 |
| Type of neighborhood | 25.0 | 33.3 | 54.8 | 44.4 | 0.0 | - | 50.0 | 43.9 |
| Safety | 25.0 | 33.3 | 38.7 | 22.2 | 100.0 | - | 38.9 | 22.8 |
| Choices of homes in the area | 50.0 | 66.7 | 16.1 | 13.0 | 0.0 | - | 19.4 | 15.8 |
| Distance to work | 75.0 | 66.7 | 35.5 | 44.4 | 0.0 | - | 38.9 | 45.6 |
| Schools | 25.0 | 0.0 | 51.6 | 22.2 | 0.0 | - | 47.2 | 21.1 |
| Similar people | 0.0 | 33.3 | 25.8 | 16.7 | 0.0 | - | 22.2 | 17.5 |
| Safe traffic | 0.0 | 0.0 | 16.1 | 11.1 | 0.0 | - | 13.9 | 10.5 |
| Landscape | 50.0 | 66.7 | 25.8 | 24.1 | 0.0 | - | 27.8 | 26.3 |
| Other responses | 0.0 | 33.3 | 16.1 | 20.4 | 0.0 | - | 13.9 | 21.1 |
| Total number of responses | N=4 | N=3 | N=31 | N=54 | N=1 | - | N=36 | N=57 |

**Table 58. Percentage Distribution of Responses of Residents to the Question "What Are the Main Reasons You Decided to Live in This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Price | 54.5 | 58.4 | 59.4 | 49.5 | 58.6 | - | 58.3 | 53.9 |
| Convenience | 54.8 | 60.1 | 54.1 | 47.3 | 65.5 | - | 55.9 | 53.6 |
| Type of neighborhood | 35.7 | 49.4 | 38.4 | 29.0 | 65.5 | - | 41.7 | 39.0 |
| Safety | 33.3 | 46.1 | 31.6 | 22.0 | 37.9 | - | 32.8 | 33.8 |
| Choices of homes in the area | 33.3 | 16.3 | 23.3 | 22.6 | 20.7 | - | 25.0 | 19.5 |
| Distance to work | 38.1 | 37.1 | 35.3 | 36.0 | 34.5 | - | 35.8 | 36.5 |
| Schools | 40.5 | 43.3 | 42.1 | 30.1 | 6.9 | - | 36.8 | 36.5 |
| Similar people | 11.9 | 19.1 | 20.3 | 16.1 | 31.0 | - | 20.1 | 17.6 |
| Safe traffic | 4.8 | 23.6 | 15.0 | 15.6 | 13.8 | - | 12.8 | 19.5 |
| Landscape | 23.8 | 32.6 | 22.6 | 14.5 | 44.8 | - | 25.9 | 23.4 |
| Always lived here | 23.8 | 14.0 | 19.6 | 24.2 | 13.8 | - | 19.6 | 19.2 |
| Total number of responses | N=42 | N=178 | N=133 | N=186 | N=29 | - | N=204 | N=364 |

Houston: Price, convenience, and neighborhood type were the most frequently cited reasons followed by safety and landscape in the Houston study area. Out of the total number of 72 responses on abutting and non-abutting sections, 67% cited price as an important factor; 63% cited convenience (an accessibility measure), and 76% cited neighborhood type. Fifty-seven percent of the respondents thought that safety and landscape were important reasons, and 54% selected schools as deciding factors. Distance to work was cited 36% of the time by the total sample of 72 respondents. Similar people as an indicator of cohesion was cited 25% of the time by the 72 respondents.

San Antonio: Again, price and convenience were the most frequently cited responses. Price was cited 55% of the time, and convenience was cited 53% of the time. Similar people in the neighborhood and safe traffic were cited only 17% and 20% of the time, respectively, by the 303 respondents. Distance to work was cited 38% of the time in both abutting and non-abutting sections individually.

Dallas: Convenience was cited the maximum number of times, 73% of the time out of total of 93 respondents. Price range and neighborhood type were cited 47% and 46% of the time, respectively. Choices of homes in the area was cited 17% of the time, and safe traffic was cited only 12% of the time. Distance to work was cited 43% of the time overall. Similar people was cited 19% of the time overall.

Cohesion-related attributes were cited more frequently on abutting elevated sections of Lubbock, I-27 study area as reasons for locating at the address and more frequently on non-abutting depressed sections than non-abutting elevated sections. The reverse situation was observed in the Houston and Dallas study areas. No clear-cut pattern was evident from the San Antonio resident responses.

On a combined study area basis, price was cited 55% of the time followed by convenience cited 54% of the time. Neighborhood type was cited 40% of the time overall; safe traffic was cited 17% of the time; distance to work—36%; similar people—18%; schools—37%.

**Main Advantages of Being at Present Location**

Respondents were asked open-ended questions on the advantages of being at the present location, and the distribution of responses is presented in Table 59. The responses are found to vary significantly both by study area and by design sub-area. The percentages do not add up in Table 59 because of multiple responses.

## Table 59. Percentage Distribution of Residents' Responses to the Question "What Are the Main Advantages of Living in This Location?"

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | A | NA | A | NA | A | NA | A | NA | Total |
| Freeway Access | 20.0 | 13.6 | 11.8 | 20.0 | 0.0 | - | 11.1 | 17.4 | 55.9 |
| Proximity to work | 20.0 | 13.6 | 17.6 | 17.1 | 0.0 | - | 15.6 | 15.8 | 14.7 |
| Proximity to shopping | 20.0 | 13.6 | 2.9 | 0.0 | 33.3 | - | 8.9 | 5.3 | 6.9 |
| Proximity to schools | 0.0 | 22.7 | 20.6 | 11.4 | 0.0 | - | 15.6 | 15.8 | 15.7 |
| Neighborhood | 0.0 | 22.7 | 2.9 | 2.9 | 0.0 | - | 2.2 | 10.5 | 6.9 |
| Price | 0.0 | 13.6 | 2.9 | 14.3 | 16.7 | - | 4.4 | 14.0 | 9.8 |
| Near downtown | 20.0 | 9.1 | 2.9 | 0.0 | 0.0 | - | 4.4 | 3.5 | 3.9 |
| Convenient /central location | 0.0 | 0.0 | 2.9 | 14.3 | 50.0 | - | 8.9 | 8.8 | 8.8 |
| Dining | 0.0 | 0.0 | 2.9 | 5.8 | 0.0 | - | 2.2 | 3.5 | 2.9 |
| Safety | 0.0 | 4.5 | 5.9 | 5.8 | 0.0 | - | 4.4 | 5.3 | 4.9 |
| Prestige/beauty | 0.0 | 0.0 | 5.9 | 5.8 | 50.0 | - | 11.1 | 3.5 | 6.9 |
| Quiet/little traffic | 20.0 | 4.5 | 8.8 | 5.8 | 16.7 | - | 11.1 | 5.3 | 7.8 |
| Total number of responses | N=5 | N=22 | N=34 | N=33 | N=6 | - | N=45 | N=57 | N=102 |
| Study Areas 2: Houston | | | | | | | | | |
| Freeway access | 29.0 | 0.0 | 13.0 | 0.0 | 24.0 | - | 21.0 | 0.0 | 18.0 |
| Proximity to work | 12.0 | 50.0 | 8.0 | 0.0 | 19.0 | - | 13.0 | 10.0 | 13.0 |
| Proximity to shopping | 6.0 | 50.0 | 29.0 | 13.0 | 14.0 | - | 18.0 | 20.0 | 18.0 |
| Proximity to schools | 6.0 | 0.0 | 8.0 | 0.0 | 5.0 | - | 6.0 | 0.0 | 6.0 |
| Property value | 0.0 | 0.0 | 0.0 | 13.0 | 10.0 | - | 3.0 | 10.0 | 4.0 |
| Convenient | 24.0 | 0.0 | 21.0 | 38.0 | 33.0 | - | 26.0 | 30.0 | 26.0 |
| Neighborhood | 12.0 | 0.0 | 33.0 | 25.0 | 19.0 | - | 23.0 | 20.0 | 22.0 |
| People | 0.0 | 0.0 | 0.0 | 0.0 | 5.0 | - | 2.0 | 0.0 | 1.0 |
| Price | 0.0 | 0.0 | 4.0 | 13.0 | 5.0 | - | 3.0 | 10.0 | 4.0 |
| Safety | 6.0 | 50.0 | 4.0 | 13.0 | 5.0 | - | 5.0 | 20.0 | 7.0 |
| Trees/landscape | 6.0 | 50.0 | 4.0 | 38.0 | 14.0 | - | 8.0 | 40.0 | 13.0 |
| Quiet/little traffic | 12.0 | 0.0 | 4.0 | 13.0 | 0.0 | - | 5.0 | 10.0 | 6.0 |
| Good schools | 41.0 | 50.0 | 4.0 | 63.0 | 0.0 | - | 21.0 | 60.0 | 26.0 |
| Total number of responses | N=17 | N=2 | N=24 | N=8 | N=21 | - | N=62 | N=10 | N=72 |

## Table 59. Percentage Distribution of Residents' Responses to the Question "What Are the Main Advantages of Living in This Location?" (continued)

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Freeway Access | 21.4 | 18.7 | 24.2 | 23.3 | 0.0 | - | 22.9 | 20.3 | 20.8 |
| Proximity to work | 21.4 | 13.4 | 15.2 | 15.1 | 0.0 | - | 16.7 | 14.0 | 14.5 |
| Proximity to shopping | 14.3 | 14.9 | 15.2 | 6.9 | 0.0 | - | 14.6 | 12.1 | 12.6 |
| Proximity to schools | 28.6 | 23.1 | 6.1 | 19.2 | 0.0 | - | 12.5 | 21.7 | 20.0 |
| Proximity to hospital/doctors | 42.9 | 5.9 | 0.0 | 2.7 | 0.0 | - | 12.5 | 4.8 | 6.3 |
| Convenient/ Central | 42.9 | 35.1 | 27.3 | 27.4 | 0.0 | - | 31.3 | 32.4 | 32.2 |
| Neighborhood | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| People | 7.1 | 10.5 | 15.2 | 10.9 | 0.0 | - | 12.5 | 10.6 | 10.9 |
| Price | 7.1 | 3.7 | 12.1 | 6.9 | 0.0 | - | 10.4 | 4.8 | 5.9 |
| Safety | 7.1 | 10.5 | 3.0 | 12.3 | 0.0 | - | 4.2 | 11.1 | 9.8 |
| Trees/landscape | 0.0 | 10.5 | 0.0 | 0.0 | 0.0 | - | 0.0 | 6.8 | 5.5 |
| Space | 7.1 | 8.2 | 0.0 | 4.1 | 0.0 | - | 2.1 | 6.8 | 5.9 |
| Quiet/little traffic | 7.1 | 11.9 | 6.1 | 8.2 | 0.0 | - | 6.3 | 10.6 | 9.8 |
| Bus line | 21.4 | 8.9 | 15.2 | 13.7 | 0.0 | - | 16.7 | 10.6 | 11.8 |
| Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total number of responses | N=14 | N=134 | N=33 | N=73 | N=1 | - | N=48 | N=207 | N=255 |

**Table 59. Percentage Distribution of Residents' Responses to the Question "What Are the Main Advantages of Living in This Location?" (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Freeway Access | 25.0 | 33.3 | 12.9 | 3.7 | 0.0 | - | 13.9 | 5.3 | 8.6 |
| Proximity to work | 0.0 | 0.0 | 16.1 | 18.5 | 0.0 | - | 13.9 | 17.5 | 16.1 |
| Proximity to shopping | 25.0 | 33.3 | 9.7 | 11.1 | 0.0 | - | 11.1 | 12.3 | 11.8 |
| Proximity to schools | 25.0 | 33.3 | 38.7 | 11.1 | 0.0 | - | 36.1 | 12.3 | 21.5 |
| Neighborhood | 0.0 | 33.3 | 29.0 | 20.4 | 0.0 | - | 27.8 | 21.1 | 23.7 |
| Price | 0.0 | 0.0 | 16.1 | 9.3 | 0.0 | - | 13.9 | 8.8 | 10.8 |
| Near downtown | 0.0 | 0.0 | 16.1 | 16.7 | 100.0 | - | 16.7 | 15.8 | 16.1 |
| Convenient/central location | 25.0 | 66.7 | 19.4 | 18.5 | 0.0 | - | 19.4 | 21.1 | 20.4 |
| Dining | 0.0 | 0.0 | 6.5 | 9.3 | 0.0 | - | 5.6 | 8.8 | 7.5 |
| Safety | 25.0 | 0.0 | 19.4 | 16.7 | 0.0 | - | 19.4 | 15.8 | 17.2 |
| Prestige/beauty | 0.0 | 0.0 | 22.6 | 29.6 | 100.0 | - | 22.2 | 28.1 | 25.8 |
| Quiet/little traffic | 0.0 | 0.0 | 19.4 | 3.7 | 100.0 | - | 19.4 | 3.5 | 9.7 |
| Total number of responses | N=4 | N=3 | N=31 | N=54 | N=1 | - | N=36 | N=57 | N=93 |

**Table 59. Percentage Distribution of Residents' Responses to the Question "What Are the Main Advantages of Living in This Location?" (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | A | NA | A | NA | A | NA | A | NA | Total |
| Freeway Access | 25.0 | 18.0 | 15.6 | 14.9 | 17.2 | - | 17.8 | 16.4 | 16.9 |
| Proximity to work | 15.0 | 13.7 | 14.8 | 16.1 | 13.8 | - | 14.7 | 14.9 | 14.8 |
| Proximity to shopping | 12.5 | 15.5 | 13.1 | 7.1 | 17.2 | - | 13.6 | 11.3 | 12.1 |
| Proximity to schools | 15.0 | 22.9 | 18.9 | 14.3 | 3.5 | - | 15.7 | 18.5 | 17.5 |
| Proximity to hospital/doctors | 15.0 | 4.9 | 0.0 | 1.2 | 0.0 | - | 3.1 | 3.0 | 3.1 |
| Convenient/ Central | 27.5 | 31.7 | 22.1 | 27.9 | 37.9 | - | 25.7 | 29.8 | 28.3 |
| Neighborhood | 5.0 | 0.0 | 6.6 | 1.2 | 13.8 | - | 7.3 | 0.6 | 3.1 |
| People | 5.0 | 12.4 | 12.3 | 11.9 | 3.5 | - | 9.4 | 12.2 | 11.2 |
| Price | 2.5 | 4.9 | 9.0 | 9.5 | 6.9 | - | 7.3 | 7.3 | 7.3 |
| Safety | 7.5 | 9.9 | 8.2 | 12.5 | 3.5 | - | 7.3 | 11.3 | 9.8 |
| Trees/landscape | 2.5 | 9.3 | 8.2 | 12.5 | 24.1 | - | 9.4 | 10.9 | 10.4 |
| Space | 2.5 | 6.8 | 0.0 | 1.8 | 0.0 | - | 0.5 | 4.3 | 2.9 |
| Quiet/little traffic | 10.0 | 9.9 | 7.4 | 5.4 | 3.5 | - | 7.3 | 7.6 | 7.5 |
| Bus line | 7.5 | 7.5 | 4.1 | 5.9 | 0.0 | - | 4.2 | 6.7 | 5.8 |
| Other | 17.5 | 0.6 | 4.9 | 2.9 | 0.0 | - | 6.8 | 1.8 | 3.7 |
| Total number of responses | N=40 | N=161 | N=122 | N=168 | N=29 | - | N=191 | N=329 | N=520 |

In Study Area 1 (Lubbock), proximity to work and schools were cited 16% of the time out of the combined 102 responses on all design sub-areas combined. This was followed by freeway access cited 15% of the time. In Study Area 2 (Houston), convenience and good schools were cited most often as advantages of the location (26% of the time out of the 72 respondents overall). Neighborhood type was cited 22% of the time as an advantage of the location. Similar people, property values, price, proximity to schools, and safety were cited the least number of times (less than 7% of the time). In Study Area 3 (San Antonio), 32% of the overall sample of 255 respondents cited convenience/central location as an important attribute of the location, and 21% cited freeway access. In Study Area 4 (Dallas), prestige/beauty of the neighborhood was cited as an advantage of the study area by 26% of 93 respondents. Neighborhood was also cited by 24% of the respondents on all design sub-areas combined. This was followed by proximity to schools (22% of the time) and convenient location (20% of the time). Less than 10% of the respondents cited safety and freeway access as advantages of the location. The surveys for all study areas combined indicate that convenience was the most often cited advantage (28% of the time). Neighborhood, proximity to hospitals, and spaciousness were cited the least number of times as an attribute of the location (less than 4% of the time).

**Main Disadvantages of Being at Present Location**

Residents were once again asked open-ended questions on the disadvantages of residing in the present location, and the distribution of coded responses is presented in Table 60.

Lubbock: Out of a total of 102 respondents, 20% responded that neighborhood/upkeep was a disadvantage of the location. Sixteen percent of the respondents selected traffic level as a negative attribute of the area, and 12% selected noise levels. Less than 5% of the respondents thought that proximity to the freeway, pollution, distance to work/schools, and lack of safety were the main disadvantages.

Houston: Some of the negative attributes cited most frequently in the Houston study area include noise levels and traffic/speed levels followed by proximity to the freeway. Noise levels were cited 28% of the time overall, while traffic was cited 24% of the time. The next most frequently cited disadvantage was proximity to the freeway, reported 13% of the time.

San Antonio: Twenty-four percent of the overall number of respondents in San Antonio cited the amount of traffic as a disadvantage of the study area. Sixteen percent mentioned noise levels and type of people in the neighborhood as other disadvantages. Pollution, upkeep, decrease in the property values, and price were mentioned less than 3% of the time.

**Table 60. Percentage Distribution of Residents' Responses to the Question "What Are the Main Disadvantages of Living in This Location?" by Design Sub-Area**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Noise | 20.0 | 9.1 | 17.6 | 6.1 | 16.7 | - | 17.8 | 7.0 | 11.8 |
| Pollution | 20.0 | 0.0 | 2.9 | 0.0 | 33.3 | - | 8.9 | 0.0 | 3.9 |
| Lack of stores | 20.0 | 13.6 | 8.8 | 3.0 | 0.0 | - | 8.9 | 7.0 | 7.8 |
| Amount of traffic | 0.0 | 13.6 | 17.6 | 9.1 | 50.0 | - | 20.0 | 10.5 | 15.7 |
| Unsafe | 0.0 | 4.5 | 2.9 | 3.0 | 0.0 | - | 2.2 | 3.5 | 2.9 |
| Proximity to freeway | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | - | 2.2 | 0.0 | 1.0 |
| Neighborhood/Upkeep | 80.0 | 9.1 | 23.5 | 18.2 | 0.0 | - | 26.7 | 14.0 | 19.6 |
| Distance to work/education | 0.0 | 9.1 | 0.0 | 3.0 | 0.0 | - | 0.0 | 5.3 | 2.9 |
| Customer influence | 0.0 | 4.5 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.8 | 1.0 |
| Crime | 0.0 | 13.6 | 5.9 | 15.2 | 0.0 | - | 4.4 | 14.0 | 9.8 |
| Total number of responses | N=5 | N=22 | N=34 | N=35 | N=6 | - | N=45 | N=57 | N=102 |
| **Study Area 2: Houston** | | | | | | | | | |
| Noise | 29.0 | 0.0 | 42.0 | 38.0 | 10.0 | - | 27.0 | 30.0 | 28.0 |
| Pollution | 12.0 | 0.0 | 8.0 | 13.0 | 5.0 | - | 8.0 | 10.0 | 8.0 |
| Speed/traffic | 12.0 | 0.0 | 33.0 | 63.0 | 10.0 | - | 19.0 | 50.0 | 24.0 |
| Unsafe | 6.0 | 0.0 | 8.0 | 0.0 | 5.0 | - | 6.0 | 0.0 | 6.0 |
| Proximity to freeway | 6.0 | 0.0 | 21.0 | 13.0 | 10.0 | - | 13.0 | 10.0 | 13.0 |
| People | 12.0 | 0.0 | 4.0 | 0.0 | 0.0 | - | 5.0 | 0.0 | 4.0 |
| Upkeep | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Price | 6.0 | 0.0 | 0.0 | 0.0 | 5.0 | - | 3.0 | 0.0 | 3.0 |
| Taxes | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | - | 3.0 | 0.0 | 3.0 |
| Decreased property value | 6.0 | 0.0 | 4.0 | 0.0 | 14.0 | - | 8.0 | 0.0 | 7.0 |
| Poor schools | 0.0 | 0.0 | 0.0 | 0.0 | 14.0 | - | 5.0 | 0.0 | 4.0 |
| Total number of responses | N=17 | N=2 | N=24 | N=8 | N=21 | - | N=62 | N=10 | N=72 |

**Table 60. Percentage Distribution of Residents' Responses to the Question "What Are the Main Disadvantages of Living in This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Noise | 15.4 | 8.3 | 34.5 | 21.2 | 100.0 | - | 30.2 | 12.4 | 16.2 |
| Pollution | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Lack of stores | 15.4 | 11.0 | 3.5 | 17.3 | 0.0 | - | 6.9 | 13.0 | 11.8 |
| Amount of traffic | 7.7 | 26.6 | 17.2 | 26.9 | 0.0 | - | 13.9 | 26.0 | 24.0 |
| Unsafe | 30.8 | 7.3 | 10.3 | 5.8 | 0.0 | - | 16.3 | 6.8 | 8.8 |
| Proximity to freeway | 15.4 | 1.8 | 10.3 | 0.0 | 0.0 | - | 11.6 | 1.2 | 3.4 |
| People | 30.8 | 12.8 | 6.9 | 23.1 | 0.0 | - | 13.9 | 16.2 | 15.7 |
| Upkeep | 0.0 | 0.9 | 10.3 | 3.9 | 0.0 | - | 6.9 | 1.9 | 2.9 |
| Price | 0.0 | 2.8 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.9 | 1.5 |
| Crime | 15.4 | 2.8 | 10.3 | 9.6 | 0.0 | - | 11.6 | 4.9 | 6.4 |
| Decreased property value | 0.0 | 1.8 | 0.0 | 3.9 | 0.0 | - | 0.0 | 2.5 | 1.9 |
| Total number of responses | N=13 | N=109 | N=29 | N=52 | N=1 | - | N=43 | N=161 | N=204 |
| **Study Area 4: Dallas** | | | | | | | | | |
| Noise | 25.0 | 33.3 | 38.7 | 13.0 | 0.0 | - | 36.1 | 14.0 | 22.6 |
| Pollution | 25.0 | 0.0 | 16.1 | 7.4 | 0.0 | - | 16.7 | 7.0 | 10.8 |
| Speed | 50.0 | 33.3 | 6.5 | 5.6 | 0.0 | - | 11.1 | 7.0 | 8.6 |
| Amount of traffic | 75.0 | 100.0 | 35.5 | 37.0 | 0.0 | - | 38.9 | 40.4 | 39.8 |
| Unsafe | 25.0 | 33.3 | 9.7 | 7.4 | 100.0 | - | 13.9 | 8.8 | 10.8 |
| Proximity to freeway | 25.0 | 0.0 | 16.1 | 14.8 | 0.0 | - | 16.7 | 14.0 | 15.1 |
| Neighborhood/Upkeep | 0.0 | 0.0 | 3.2 | 16.7 | 0.0 | - | 2.8 | 15.8 | 10.8 |
| Taxes | 0.0 | 0.0 | 9.7 | 7.4 | 0.0 | - | 8.3 | 7.0 | 7.5 |
| Commercial influence | 0.0 | 0.0 | 3.2 | 14.8 | 0.0 | - | 2.8 | 14.0 | 9.7 |
| Crime | 0.0 | 0.0 | 6.5 | 5.6 | 0.0 | - | 5.6 | 5.3 | 5.4 |
| Total number of responses | N=4 | N=3 | N=31 | N=54 | N=1 | - | N=36 | N=57 | N=93 |

**Table 60. Percentage Distribution of Residents' Responses to the Question "What Are the Main Disadvantages of Living in This Location?" by Design Sub-Area (continued)**

| Response | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Noise | 23.1 | 8.8 | 32.2 | 15.7 | 13.8 | - | 27.4 | 12.4 | 18.3 |
| Pollution | 10.3 | 0.0 | 6.8 | 3.4 | 10.3 | - | 8.1 | 1.8 | 4.3 |
| Lack of stores | 7.7 | 11.0 | 3.4 | 6.8 | 0.0 | - | 3.8 | 8.8 | 6.8 |
| Speed/ traffic | 20.5 | 26.5 | 27.1 | 30.6 | 17.2 | - | 24.2 | 28.6 | 26.9 |
| Unsafe | 15.4 | 7.4 | 7.6 | 5.4 | 6.9 | - | 9.1 | 6.4 | 7.5 |
| Proximity to freeway | 10.3 | 1.5 | 11.9 | 6.1 | 6.9 | - | 10.8 | 3.9 | 6.6 |
| People | 25.6 | 11.8 | 10.2 | 18.4 | 0.0 | - | 11.8 | 15.2 | 13.9 |
| Neighborhood/Upkeep | 0.0 | 0.7 | 2.5 | 1.4 | 0.0 | - | 1.6 | 1.1 | 1.3 |
| Price | 2.6 | 2.2 | 2.5 | 2.7 | 10.3 | - | 3.8 | 2.5 | 2.9 |
| Crime | 5.1 | 4.4 | 5.9 | 8.8 | 0.0 | - | 4.8 | 6.7 | 5.9 |
| Decreased property value | 2.6 | 1.5 | 0.9 | 1.4 | 10.3 | - | 2.7 | 1.4 | 1.9 |
| Total number of responses | N=39 | N=136 | N=118 | N=147 | N=29 | - | N=186 | N=283 | N=469 |

Dallas: In the Dallas study area, the most frequently mentioned disadvantage was amount of traffic which was cited by approximately 40% of the total number of respondents. Noise levels were mentioned by 23% and proximity to the freeway by 15% of the respondents. Neighborhood upkeep, lack of safety, and pollution levels were each cited by 11% of the respondents.

The survey results for the combined study area show that the most frequently cited disadvantages were amount of traffic followed by noise levels. 'Type of people' was only cited as a disadvantage in the Houston and San Antonio study areas.

**Extent Area has Changed While at Present Location**

Abutting and non-abutting residents in all study areas were asked to indicate the extent to which the area had changed while living in the location. The information presented in Table 61, if related back to the description of the location and reasons for locating at present address given by the respondents, can also provide an indication of the impact of changes in the neighborhood quality and cohesion.

Substantial differences are found in the opinions across study areas. As mentioned earlier, chi-square tests from the contingency tables are conducted for each study area separately and for all study sections combined to assess whether the differences in the frequency distribution of responses for the different design sub-areas are statistically significant, i.e., to assess if there is any association between grade level differences and opinions. There is no evidence of any correlation between the responses and grade type for any study area, and the pattern of responses is the same regardless of grade level as suggested by chi-square statistics and Fisher's test statistics. This suggests that there is no statistically significant relation between opinions of the respondents and the grade level near which they reside; and these variables are therefore independent. Furthermore, on both abutting and non-abutting sections, the single response category that was most frequently checked was 'no-change,' suggesting that a large number of respondents on all study areas believed that there was no change in the area. The difference in the responses were also tested by distance zone, i.e., abutting versus non-abutting. Evidence of a statistically significant relation is found between distance zone and opinions of respondents in the case of the Houston and San Antonio study areas as well as for all study areas combined.

Lubbock: Thirty-nine percent of all the respondents believed that there had been no change in the area. Twenty percent were of the opinion that the area had improved some and 1% believed that it had improved greatly. On the other hand, 17% thought that there had been a decline in the neighborhood, and another 24% thought that the area had declined greatly.

**Table 61. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed While Living at the Present Location"**

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 0.0 | 4.3 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.8 | 1.0 |
| Improved a good bit | 0.0 | 4.3 | 8.8 | 3.0 | 0.0 | - | 6.7 | 3.8 | 5.0 |
| Improved little | 0.0 | 13.0 | 14.7 | 15.2 | 33.3 | - | 15.6 | 14.3 | 14.9 |
| No change | 40.0 | 43.5 | 32.4 | 42.4 | 33.3 | - | 33.3 | 42.9 | 38.6 |
| Declined little | 20.0 | 13.0 | 0.0 | 12.1 | 0.0 | - | 2.2 | 12.5 | 7.9 |
| Declined a good bit | 0.0 | 8.7 | 5.9 | 9.1 | 33.3 | - | 8.9 | 8.9 | 8.9 |
| Declined greatly | 40.0 | 13.0 | 38.2 | 18.2 | 0.0 | - | 33.3 | 16.1 | 23.8 |
| No response | N=0 | N=0 | N=0 | N=0 | N=0 | - | N=0 | N=0 | N=0 |
| Total number of responses | N=5 | N=23 | N=34 | N=33 | N=6 | - | N=45 | N=56 | N=101 |
| (Abutting) Chi-square Statistic $\chi^2(10)$[11] = 18.2 p =.05; Fisher's Exact test (2-tail) p =.106 Not significant ; (Non-Abutting) Chi-square $\chi^2(6)$ =1.78 p=.939; Fisher's Exact test p =.99 Not significant; (Abutting vs. Non-Abutting) $\chi^2(6)$= 8.36 p=.21 Fisher's statistic=.19 Not significant | | | | | | | | | |
| **Study Area 2: Houston** | | | | | | | | | |
| Improved greatly | 6.0 | 0.0 | 4.0 | 0.0 | 0.0 | - | 3.0 | 0.0 | 3.0 |
| Improved a good bit | 6.0 | 0.0 | 0.0 | 0.0 | 20.0 | - | 8.0 | 0.0 | 7.0 |
| Improved little | 6.0 | 50.0 | 17.0 | 63.0 | 15.0 | - | 13.0 | 60.0 | 20.0 |
| No change | 53.0 | 50.0 | 43.0 | 25.0 | 60.0 | - | 52.0 | 30.0 | 49.0 |
| Declined little | 29.0 | 0.0 | 22.0 | 0.0 | 5.0 | - | 18.0 | 0.0 | 16.0 |
| Declined a good bit | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | - | 2.0 | 10.0 | 3.0 |
| Declined greatly | 0.0 | 0.0 | 9.0 | 0.0 | 0.0 | - | 3.0 | 0.0 | 3.0 |
| No response | N=0 | N=0 | N=1 | N=0 | N=1 | - | N=2 | N=0 | N=2 |
| Total number of responses | N=17 | N=2 | N=23 | N=8 | N=20 | - | N=60 | N=10 | N=70 |
| (Abutting) Chi-square Statistic $\chi^2(12)$ =16.03 p=.19; Fisher's Exact Test (2-tail) p =.15 Not significant; (Non-abutting) Chi-square $\chi^2(2)$ =.63 p=.732; Fisher's Exact Test p=1.00 Not significant; (Abutting vs. Non-Abutting) $\chi^2(6)$= 15.58 p=.016 Fisher's statistic=.02 Significant | | | | | | | | | |

[11] The figures in parentheses are degrees of freedom.

### Table 61. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed While Living at the Present Location" (continued)

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Ant.** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 6.3 | 9.4 | 11.9 | 6.7 | 0.0 | - | 10.2 | 8.9 | 8.7 |
| Improved a good bit | 12.5 | 7.9 | 4.8 | 7.9 | 0.0 | - | 6.8 | 7.9 | 7.7 |
| Improved little | 25.0 | 19.6 | 11.9 | 23.6 | 100.0 | - | 16.9 | 21.2 | 20.3 |
| No change | 18.8 | 43.5 | 33.3 | 37.1 | 0.0 | - | 28.8 | 40.9 | 38.5 |
| Declined little | 6.3 | 12.3 | 11.9 | 6.7 | 0.0 | - | 10.2 | 10.1 | 10.1 |
| Declined a good bit | 12.5 | 2.9 | 11.9 | 10.1 | 0.0 | - | 11.9 | 5.7 | 6.9 |
| Declined greatly | 18.8 | 4.4 | 14.3 | 7.9 | 0.0 | - | 15.3 | 5.7 | 7.7 |
| No response | N=0 | N=13 | N=2 | N=2 | N=0 | - | N=2 | N=15 | N=17 |
| Total number of responses | N=16 | N=138 | N=42 | N=89 | N=1 | - | N=59 | N=227 | N=286 |
| (Abutting) Chi-square Statistic $\chi^2$ (12)[12] = 8.92 p= .71; Fisher's Exact Test (2-tail) p =.705 Not significant; (Non-Abutting) Chi-square $\chi^2$ (6) = 9.17 p=.164; Not significant; (Abutting vs. Non-Abutting) $\chi^2$ (6)= 35.36 p=.001 Fisher's statistic=.001 Significant | | | | | | | | | |
| **Study Area 4: Dallas** | | | | | | | | | |
| Improved greatly | 0.0 | 0.0 | 10.7 | 7.8 | 0.0 | - | 9.1 | 7.5 | 8.1 |
| Improved a good bit | 25.0 | 0.0 | 14.3 | 13.7 | 0.0 | - | 15.2 | 13.2 | 14.0 |
| Improved little | 0.0 | 0.0 | 25.0 | 35.3 | 0.0 | - | 21.2 | 34.0 | 29.1 |
| No change | 25.0 | 50.0 | 32.1 | 27.5 | 100.0 | - | 33.3 | 28.3 | 30.2 |
| Declined little | 25.0 | 0.0 | 14.3 | 3.9 | 0.0 | - | 15.2 | 3.8 | 8.1 |
| Declined a good bit | 25.0 | 50.0 | 3.6 | 5.9 | 0.0 | - | 6.1 | 7.5 | 7.0 |
| Declined greatly | 0.0 | 0.0 | 0.0 | 5.9 | 0.0 | - | 0.0 | 5.7 | 3.5 |
| No response | N=0 | N=1 | N=3 | N=3 | N=0 | - | N=3 | N=4 | N=7 |
| Total number of responses | N=4 | N=2 | N=28 | N=51 | N=1 | - | N=33 | N=53 | N=86 |
| (Abutting) Chi-square Statistic $\chi^2$ (10)=6.8 p=.75 ; Fisher's Exact Test (2-tail) p =.59 Not significant; (Non-abutting) Chi-square $\chi^2$ (6) =6.64 p=.36; Fisher's Exact Test p=.35 Not significant; (Abutting vs. Non-Abutting) $\chi^2$ (6)= 11.4 p=.076 Fisher's statistic=.08 Not significant | | | | | | | | | |

[12] The figures in parentheses are degrees of freedom.

**Table 61. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed While Living at the Present Location" (continued)**

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 4.8 | 8.5 | 7.1 | 5.6 | 0.0 | - | 5.6 | 6.9 | 6.5 |
| Improved a good bit | 9.5 | 7.3 | 7.1 | 8.4 | 14.3 | - | 8.6 | 7.9 | 8.1 |
| Improved little | 11.9 | 18.8 | 16.5 | 27.4 | 21.4 | - | 16.2 | 23.3 | 20.7 |
| No change | 35.7 | 43.6 | 34.7 | 34.6 | 53.6 | - | 37.6 | 38.9 | 38.5 |
| Declined little | 19.1 | 12.1 | 11.0 | 6.7 | 3.6 | - | 11.7 | 9.3 | 10.2 |
| Declined a good bit | 7.1 | 4.2 | 7.1 | 8.9 | 7.1 | - | 7.1 | 6.7 | 6.8 |
| Declined greatly | 11.9 | 5.5 | 16.5 | 8.4 | 0.0 | - | 13.2 | 6.9 | 9.2 |
| No response | N=0 | N=13 | N=6 | N=7 | N=1 | - | N=7 | N=20 | N=27 |
| Total number of responses | N=42 | N=165 | N=127 | N=179 | N=28 | - | N=19 7 | N=344 | N=541 |
| (Abutting) Chi-square Statistic $\chi^2(12)=15.2$ $p=.234$; Fisher's Exact Test (2-tail) $p=.22$ Not significant; (Non-Abutting) Chi-square $\chi^2(6)=12.3$ $p=.056$ Not significant; (Abutting vs. Non-Abutting) $\chi^2(6)=60.14$ $p=.001$ Significant | | | | | | | | | |

Houston: The percentage who thought that there was no change in the study area ranged from 52% on abutting sections to 30% on non-abutting sections. Twenty-four percent on abutting sections and 60% on non-abutting sections believed that there had some improvement in the study area. While 3% of the abutting respondents felt that there had been a great improvement, another 3% felt that there had been a great decline in the neighborhood. No one on non-abutting sections believed this to be the case. Furthermore, 20% on abutting sections and 10% on non-abutting sections thought that there had been some decline in the study area.

San Antonio: Twenty-nine percent on abutting sections and 41% on non-abutting sections felt that there was no change in the study area. Almost 10% on abutting sections and 9% on non-abutting sections thought that there had been a great improvement in the study area. The percentage who thought there had been some improvement ranged from 24% on abutting sections to 29% on non-abutting sections. The percentage who thought there had been some decline in their neighborhood ranged from 22% on abutting sections to 17% on non-abutting sections. Another 15% on abutting sections and 6% on non-abutting sections thought that there had been a great decline. Overall, approximately 37% believed that there was an improvement in the area; 25% thought there had been some decline, while the remaining 39% thought there had been no change at all.

Dallas: Overall, about 51% believed that there had been some improvement in the Dallas study area. Of these, almost 8% thought that there had been a great improvement. Nineteen percent were of the opinion that there had been some decline in the area, and another 30% thought there had been no change.

It is only in the case of the Dallas study area that we find the largest percentage of respondents who felt that there had been some improvement in the study area as opposed to those who felt there had been a decline and those who felt there had been no change. Relating this to the information provided in Table 57, it could be perceived as evidence of an improvement in neighborhood quality and cohesion in the case of the Dallas study area. In the case of Lubbock, there is evidence that a greater percentage felt there had been a decline. This suggests a decline in neighborhood quality in the case of the Lubbock study area. Further, in the case of San Antonio and Houston, the percentage who felt there had been no change is the largest. For all study areas combined, almost 39% felt there had been no change; 35% believed there had been some improvement, and 26% thought there had been some decline.

**Extent Area has Changed Since Completion of Study Freeway**

The residents were once again asked to respond to the question "How do you think the area has changed since completion of the freeway?" This question is designed to measure the effect of construction activity on the variables that might refer to neighborhood quality, cohesion, and accessibility (as indicated in Tables 57 and 58).

For all study areas, chi-square tests are reported along with their modified probabilities as indicated by the Fisher's statistics (wherever appropriate). These help to assess the strength of the relationship between grade level and opinions. Once again, the tests were rejected for all abutting sections in all study areas as well as for the combined study area category. This suggests that statistically, the responses by design sub-area are not significant. This result fortifies the evidence obtained from Table 61 and reinforces the conclusions that freeway elevation does not affect the response pattern. Some evidence of a correlation was found for non-abutting sections in the Lubbock and San Antonio study areas. Furthermore, tests conducted for differences in responses from abutting and non-abutting sections showed that there was no correlation between distance zone and opinions in most situations (San Antonio is the exception as can be seen from the results presented in Table 62).

In the Lubbock study area, approximately 48% report no change in the area since completion of the I-27 construction. Twenty-two percent thought there was an improvement, of which 3% believed there was a great improvement. Another 30% believed there was some decline in the area, out of which almost 14% thought there was a great decline. This suggests that the construction activity may have impacted neighborhood quality negatively by contributing to increased traffic and noise levels. While we may be led to believe that accessibility may also have been impacted, the results from Table 56 suggest that the impact is positive.

Almost 33% of the total number of respondents in the Houston study area report no change, while only 13% felt there was some improvement. Another 53% felt that there was a decline in the neighborhood since construction of Beltway 8. A number of respondents were observed to have reported high traffic levels as a negative attribute and disadvantage of the Houston study area in Table 57 and Table 60. Construction activity may have contributed to increased traffic within the residential areas of the study section and, therefore, led to some decline in neighborhood quality.

**Table 62. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed Since Completion of Study Freeway"**

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 0.0 | 9.5 | 2.9 | 0.0 | 0.0 | - | 2.2 | 3.8 | 3.0 |
| Improved a good bit | 0.0 | 9.5 | 8.8 | 2.9 | 0.0 | - | 6.7 | 5.7 | 6.1 |
| Improved little | 0.0 | 14.3 | 14.7 | 11.8 | 16.7 | - | 13.3 | 13.2 | 13.3 |
| No change | 40.0 | 47.6 | 26.5 | 67.6 | 66.7 | - | 33.3 | 60.3 | 47.9 |
| Declined little | 0.0 | 0.0 | 11.8 | 8.8 | 16.7 | - | 11.1 | 5.7 | 8.2 |
| Declined a good bit | 20.0 | 14.3 | 8.8 | 0.0 | 0.0 | - | 8.9 | 5.7 | 7.1 |
| Declined greatly | 40.0 | 4.8 | 26.5 | 8.8 | 0.0 | - | 24.4 | 5.7 | 14.3 |
| No response | N=0 | N=1 | N=0 | N=1 | 0.0 | - | N=0 | N=2 | N=2 |
| Total number of responses | N=5 | N=21 | N=34 | N=34 | N=6 | - | N=45 | N=53 | N=98 |
| (Abutting) Chi-square Statistic $\chi^2$ (12) =8.6 p=.738 (Non-Abutting) Chi-square $\chi^2$ (6) =12.2 p=.058<br>Fisher's Exact Test (2-tail) p =.76 Not significant Fisher's Exact Test p =.046 Significant (95% confidence)<br>(Abutting vs. Non-abutting) $\chi^2$ (6)=10.2 p=.118 Fisher' s Exact Test =.094 Not significant | | | | | | | | | |
| **Study Area 2: Houston** | | | | | | | | | |
| Improved greatly | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Improved a good bit | 0.0 | 0.0 | 5.0 | 13.0 | 0.0 | - | 4.0 | 11.0 | 4.7 |
| Improved little | 8.0 | 0.0 | 9.0 | 13.0 | 5.0 | - | 7.0 | 11.0 | 7.9 |
| No change | 38.0 | 100.0 | 27.0 | 13.0 | 42.0 | - | 35.0 | 22.0 | 33.3 |
| Declined little | 46.0 | 0.0 | 36.0 | 50.0 | 42.0 | - | 41.0 | 44.0 | 41.0 |
| Declined a good bit | 8.0 | 0.0 | 9.0 | 13.0 | 0.0 | - | 6.0 | 11.0 | 6.3 |
| Declined greatly | 0.0 | 0.0 | 14.0 | 0.0 | 5.0 | - | 7.0 | 0.0 | 6.3 |
| No response | N=4 | N=1 | N=2 | N=0 | N=2 | - | N=8 | N=1 | N=9 |
| Total number of responses | N=13 | N=1 | N=22 | N=8 | N=19 | - | N=54 | N=9 | N=63 |
| (Abutting) Chi-square Statistic $\chi^2$ (10)=5.64 p=.845 (Non-abutting) Chi-square $\chi^2$ (4) =3.95 p =.415<br>Fisher's Exact Test (2-tail) p =. 914 Not significant Fisher's Exact Test=.556 Not significant<br>(Abutting vs. No-abutting) $\chi^2$ (5)= 2.48 p=.78 Fisher's Exact Test=.566 Not significant | | | | | | | | | |

**Table 62. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed Since Completion of Study Freeway" (continued)**

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 6.3 | 18.1 | 17.1 | 7.2 | 100.0 | - | 15.4 | 13.8 | 14.1 |
| Improved a good bit | 6.3 | 14.9 | 11.4 | 13.3 | 0.0 | - | 9.6 | 14.3 | 13.4 |
| Improved little | 25.0 | 14.2 | 8.6 | 25.3 | 0.0 | - | 13.5 | 18.6 | 17.6 |
| No change | 12.5 | 36.2 | 34.3 | 49.4 | 0.0 | - | 26.9 | 41.4 | 38.6 |
| Declined little | 18.8 | 8.7 | 2.9 | 2.4 | 0.0 | - | 7.7 | 6.2 | 6.5 |
| Declined a good bit | 18.8 | 4.7 | 5.7 | 0.0 | 0.0 | - | 9.6 | 2.9 | 4.2 |
| Declined greatly | 12.5 | 3.2 | 20.0 | 2.4 | 0.0 | - | 17.3 | 2.9 | 5.7 |
| No response | N=0 | N=24 | N=9 | N=8 | N=0 | - | N=9 | N=32 | N=41 |
| Total number of responses | N=16 | N=127 | N=35 | N=83 | N=1 | - | N=52 | N=210 | N=262 |
| (Abutting) Chi-square Statistic $\chi^2$ (12) =16.8 p=.157 (Non-Abutting) Chi-square $\chi^2$ (6) =17.04 p=.009<br>Fisher's Exact Test (2-tail) p =.088 Not significant Fisher's Exact Test p =.001 Significant<br>(Abutting vs. Non-abutting) $\chi^2$ (6)=23.53 p=.001 Fishers' Exact Test=.0001 Significant | | | | | | | | | |
| **Study Area 4: Dallas** | | | | | | | | | |
| Improved greatly | 0.0 | 0.0 | 6.7 | 4.4 | 0.0 | - | 5.9 | 4.2 | 4.9 |
| Improved a good bit | 33.3 | 0.0 | 6.7 | 11.1 | 0.0 | - | 8.8 | 10.4 | 9.8 |
| Improved little | 0.0 | 0.0 | 20.0 | 11.1 | 0.0 | - | 17.6 | 10.4 | 13.4 |
| No change | 0.0 | 66.7 | 26.7 | 35.6 | 100.0 | - | 26.5 | 37.5 | 32.9 |
| Declined little | 33.3 | 0.0 | 20.0 | 22.2 | 0.0 | - | 20.6 | 20.8 | 20.7 |
| Declined a good bit | 33.3 | 33.3 | 13.3 | 6.7 | 0.0 | - | 14.7 | 8.3 | 11.0 |
| Declined greatly | 0.0 | 0.0 | 6.7 | 8.9 | 0.0 | - | 5.9 | 8.3 | 7.3 |
| No response | N=1 | N=0 | N=1 | N=9 | N=0 | - | N=2 | N=9 | N=11 |
| Total number of responses | N=3 | N=3 | N=30 | N=45 | N=1 | - | N=34 | N=48 | N=82 |
| (Abutting) Chi-square Statistic $\chi^2$ (12)=7.8 p=.80 (Non-abutting) Chi-square $\chi^2$ (6) =4.86 p=.56<br>Fisher's Exact Test (2-tail) p =.68 Not significant Fisher's Exact Test =.54 Not significant<br>(Abutting vs. Non-abutting) $\chi^2$(6) =2.58 p=.859; Fisher's Exact Test=.857 Not significant | | | | | | | | | |

**Table 62. Percentage Distribution of Residents' Responses to the Question "Extent Area Has Changed Since Completion of Study Freeway"( continued)**

| Response | Elevated (%) | | Depressed (%) | | At-Grade (%) | | All Design Sub-Areas (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **Total** |
| Improved greatly | 2.7 | 16.5 | 7.4 | 4.8 | 3.7 | - | 5.9 | 10.3 | 8.7 |
| Improved a good bit | 5.4 | 13.8 | 8.3 | 10.7 | 3.7 | - | 7.0 | 12.2 | 10.3 |
| Improved little | 13.5 | 13.8 | 13.2 | 18.5 | 7.4 | - | 12.4 | 16.3 | 14.9 |
| No change | 24.3 | 38.8 | 28.9 | 47.6 | 48.2 | - | 30.8 | 43.4 | 38.8 |
| Declined little | 27.0 | 7.2 | 15.7 | 11.3 | 33.3 | - | 20.5 | 9.4 | 13.5 |
| Declined a good bit | 16.2 | 6.6 | 9.1 | 2.4 | 0.0 | - | 9.2 | 4.4 | 6.1 |
| Declined greatly | 10.8 | 3.3 | 17.4 | 4.8 | 3.7 | - | 14.1 | 4.1 | 7.7 |
| No response | N=5 | N=26 | N=12 | N=18 | N=2 | - | N=19 | N=44 | N=63 |
| Total number of responses | N=37 | N=152 | N=121 | N=168 | N=27 | - | N=185 | N=320 | N=505 |

(Abutting) Chi-square Statistic $\chi^2$ (12) =18.12 p=.112 ; (Non-Abutting) Chi-square $\chi^2$ (6) =.005 Significant
Fisher's Exact test= .13 Not significant;
(Abutting vs. Non-abutting) $\chi^2$ (6)= 41.99 p=.001 Significant

In the case of San Antonio, 39% of the 262 respondents report no change. Forty-five percent believed there had been some improvement, and 16% believed that there had been a decline. Almost 14% of the 45% believed that there had been great improvement in their neighborhoods due to the construction activity.

Thirty-three percent of the 82 respondents overall in the Dallas Central Expressway study area believed that there was no change. Almost 28% felt there had been some improvement, and 39% felt there was a decline in the neighborhood. As in the case of Houston, construction on Central Expressway may have forced a lot of traffic into the residential areas, leading to the increased traffic and noise within the residential areas as indicated in Tables 58 and 60.

The combined results show that a large majority, almost 39% overall, believe there was no change on their neighborhoods since completion of the study freeways. Thirty-four percent believed there was an improvement, and 27% believed that there was a decline in their areas. Of the 27%, almost 8% felt that there was great decline in the neighborhood. Out of the 34%, approximately 9% felt that there was a great improvement. Figures 25-29 present the overall results for all study areas individually as well for all study areas combined.

## EFFECTS ON SURVEYED RESIDENTS

In this section, the goal is to assess the impacts of the grade level differences in freeway construction on residents. Respondents in all study sections were asked a series of questions on some aspects of freeway design and the construction of the freeway itself. More specifically, the residents in all study areas were asked whether they thought the construction of the freeway was necessary, opinions on the grade level of the freeway immediately adjacent to their residence, what grade level of freeway they preferred, and changes experienced since the construction of the freeway. As in the previous sections, statistical tests based on contingency tables are conducted whenever appropriate.

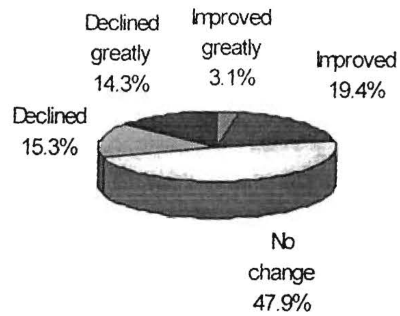



Figure 25. Impact of I-27 Construction on the Neighborhood: Lubbock

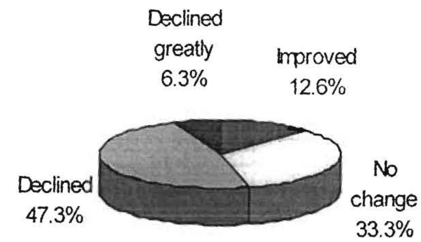



Figure 26. Impact of Beltway 8 Construction on the Neighborhood: Houston

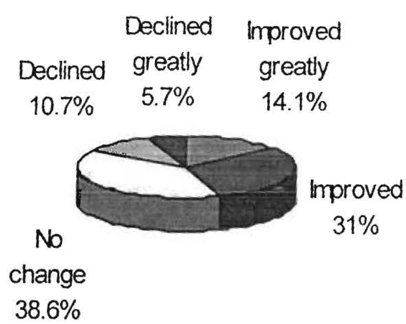



Figure 27. Impact of Y-project and U.S. 281 Construction on the Neighborhood: San Antonio

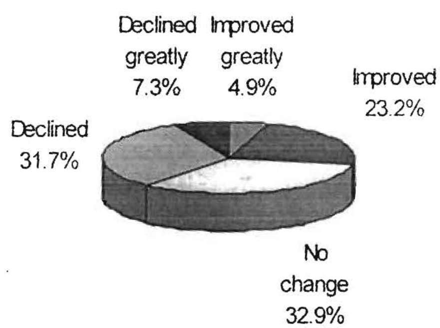



Figure 28. Impact of Central Expressway Construction on the Neighborhood: Dallas

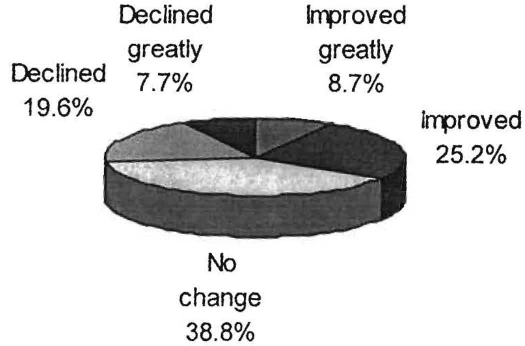



Figure 29. Impact of Freeway Construction on All Study Areas Combined

**Necessity of Construction of Study Freeway**

Respondents were asked their opinions on the necessity of highway construction, and the results are shown in Tables 63 and 64 for abutting and non-abutting residents, respectively. As in the case of the business surveys, regardless of design sub-area there appears to be a general consensus in the responses from residents from all study areas. Increased traffic levels occurring due to growth in the cities was often cited as the main reason why residents though that construction of the study freeways was required. Many residents in the Houston study area also agreed that construction was necessary; however, many commented that construction should have been undertaken further out on Beltway 8 or on Highway 6. Respondents also mentioned that improved highways implied better traffic flow, less congestion, improved access, and safety.

The statistical tests of independence between opinions and grade level using standard chi-square and exact tests from two-way contingency tables could be rejected for any study area (except for non-abutting sections in the San Antonio study area). Furthermore, the results from a meta analysis of all the four study areas using the CMH statistic showed no evidence of any correlation between grade level differences in opinion. The CMH statistic of general association with six degrees of freedom is equal to 4.12 with a probability $p = .661$ for abutting residents. This implies that the null hypothesis of independence of responses from the different grade levels cannot be rejected for abutting residents. This also confirms the idea that while respondents in all study areas believed that construction was required, no statistically significant differences were found between the responses of abutting residents from the different design sub-areas.

## Table 63. Percentage Distribution of Responses of Abutting Residents to the Question "Was Construction Necessary?"

| Response | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** |
| Yes | 80.0 | 65.0 | 57.1 | 75.0 | 65.0 | 43.8 | 78.0 | 57.1 | 93.3 | 66.1 | 100.0 | 76.0 | 100.0 | 100.0 | 82.8 | 55.8 | 74.0 | 57.9 | 91.4 | 68.5 |
| No | 20.0 | 12.0 | 6.3 | 0.0 | 10.0 | 31.3 | 17.0 | 4.8 | 3.3 | 13.4 | 0.0 | 14.0 | 0.0 | 0.0 | 10.3 | 25.6 | 15.0 | 5.3 | 2.9 | 12.2 |
| Maybe | 0.0 | 18.0 | 0.0 | 25.0 | 10.0 | 12.5 | 4.0 | 14.3 | 3. 3 | 9.5 | 0.0 | 5.0 | 0.0 | 0.0 | 3.5 | 9.3 | 8.0 | 10.5 | 5.7 | 8.7 |
| Not sure | 0.0 | 6.0 | 31.3 | 0.0 | 15.0 | 12.5 | 0.0 | 23.8 | 0.0 | 11.0 | 0.0 | 5.0 | 0.0 | 0.0 | 3.5 | 9.3 | 3.0 | 26.3 | 0.0 | 10.7 |
| No response (N) | 0 | 0 | 2 | 0 | 2 | 2 | 1 | 2 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 4 | 1 | 8 |
| Total responses (N) | 5 | 17 | 14 | 4 | 40 | 32 | 23 | 42 | 30 | 127 | 6 | 21 | 1 | 8 | 29 | 43 | 61 | 57 | 35 | 196 |

Study Area 1 (Lubbock): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 8.21 p= .223, Fisher's Exact Test (2 tail) =.341 Not significant;
Study Area 2 (Houston): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 4.3 p = .636, Fisher's Exact Test (2 tail) = .64 Not significant;
Study Area 3 (San Antonio): $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 3.46 p = .750, Fisher's Exact Test (2 tail) = .64 Not significant;
Study Area 4 (Dallas): $\chi^2$ Chi-square Statistic (4 degrees of freedom) = 3.26 p = .515, Fisher's Exact Test (2 tail) =.380 Not significant;
All Study Areas: $\chi^2$ Chi-square Statistic (6 degrees of freedom) = 4.63 p = .592, Fisher's Exact Test (2 tail) =.680 Not significant;
Cochran-Mantel-Haenszel Statistic (6 degrees of freedom) = 4.12 p = .661 (Hypothesis of general association) Not significant.

## Table 64. Percentage Distribution of Responses of Non-Abutting Residents to the Question "Was Construction Necessary?"

| Response | Elevated % | | | | | Depressed % | | | | | All Design Sub-Areas (Non-abutting) % | | | | | All Design Sub-Areas (Abutting and Non-abutting Total) % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Study Area** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** | **1** | **2** | **3** | **4** | **All Study Areas** |
| Yes | 68.2 | 50.0 | 82.2 | 100.0 | 80.4 | 64.5 | 50.0 | 65.2 | 96.2 | 73.3 | 65.5 | 50.0 | 75.7 | 96.4 | 76.8 | 61.4 | 70.4 | 72.3 | 94.4 | 73.4 |
| No | 9.1 | 0.0 | 2.1 | 0.0 | 2.9 | 9.7 | 12.5 | 4.5 | 1.9 | 5.0 | 9.1 | 10.0 | 2.9 | 1.8 | 3.9 | 16.7 | 14.1 | 3.4 | 2.2 | 6.9 |
| Maybe | 9.1 | 0.0 | 2.7 | 0.0 | 3.5 | 9.7 | 12.5 | 13.5 | 0.0 | 8.9 | 9.1 | 10.0 | 6.8 | 0.0 | 6.2 | 9.4 | 8.5 | 7.5 | 2.2 | 7.1 |
| Not sure | 13.6 | 50.0 | 13.0 | 0.0 | 13.3 | 16.1 | 25.0 | 16.9 | 1.9 | 12.8 | 16.4 | 30.0 | 14.5 | 1.8 | 13.0 | 12.5 | 7.0 | 16.8 | 1.1 | 12.2 |
| No response (N) | 0 | 0 | 5 | 0 | 5 | 2 | 0 | 2 | 2 | 6 | 2 | 0 | 7 | 2 | 11 | 4 | 1 | 11 | 3 | 19 |
| Total responses (N) | 22 | 2 | 146 | 3 | 173 | 31 | 8 | 89 | 52 | 180 | 55 | 10 | 235 | 235 | 355 | 96 | 71 | 292 | 90 | 548 |

Study Area 1 (Lubbock): $\chi^2$ Chi-square Statistic (3 degrees of freedom) = .089 p= .993, Fisher's Exact Test (2 tail) = .963 Not significant;
Study Area 2 (Houston) : $\chi^2$ Chi-square Statistic (3 degrees of freedom) = .833 p = .841, Fisher's Exact Test (2 tail) = 1.00 Not significant;
Study Area 3 (San Antonio): $\chi^2$ Chi-square Statistic (3 degrees of freedom) = 13.16 p = .004, Fisher's Exact Test (2 tail) = .001 Significant;
Study Area 4 (Dallas) : $\chi^2$ Chi-square Statistic (2 degrees of freedom) = .12 p = .942, Fisher's Exact Test (2 tail) = 1.00 Not significant;
All Study Areas: $\chi^2$ Chi-square Statistic (3 degrees of freedom) = 5.73 Not significant;
Cochran-Mantel-Haenszel Statistic (3 degrees of freedom) =10.78 p = .013 (Hypothesis of general association) Significant.

The percentage of respondents who believed that the construction was necessary was very high and ranged from 61% in the Lubbock study area to almost 94% in the Dallas study area. Seventy percent of the 96 respondents from the Houston study area and 72% of the 292 respondents from the San Antonio study areas thought that construction was necessary. On the other hand, the percentage of respondents who clearly thought that construction was not required ranged from 17% in Lubbock to only 2% in Dallas. Further, the percentage of respondents who were unsure (including response categories "maybe" and "not sure") ranged from 24% in San Antonio to 3% in Dallas. Combining all study areas, approximately 73% of the respondents said that construction was required; 7% said that construction was not necessary; 7%, said maybe, and another 12% were not sure.

**Opinion of Grade Level of the Freeway Adjacent to Residents**

This section is concerned with the responses to the question "What is your opinion of this type of freeway?" Tables 65 and 66 present evidence to show that in general, all residents by and large like the grade level of the freeway that they are adjacent to, with a few exceptions which will be discussed below. This result is not surprising since residents have the most experience with the grade type of freeway that they are immediately adjacent to. However, a deeper examination shows that people on depressed sections tend to prefer the depressed grade type of freeway more often than residents on elevated sections prefer the elevated grade type. Further, respondents from abutting sections living adjacent to the elevated type of freeway were observed to have said they disliked the elevated grade type more frequently than those living immediately adjacent to depressed or at-grade sections.

Table 65. Percentage Distribution of Responses of Abutting Residents to the Question "Your Opinion of This Type of Freeway"

| Response | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study Area | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas |
| Like it very much | 60.0 | 12.0 | 15.4 | 50.0 | 23.1 | 33.3 | 48.0 | 50.0 | 53.3 | 45.6 | 83.3 | 0.0 | 0.0 | 100.0 | 23.1 | 43.2 | 21.0 | 38.6 | 54.3 | 37.4 |
| Like it some | 0.0 | 29.0 | 38.5 | 25.0 | 28.2 | 30.3 | 24.0 | 33.3 | 26.7 | 28.9 | 0.0 | 17.0 | 100.0 | 0.0 | 15.4 | 22.7 | 23.0 | 36.4 | 25.7 | 26.8 |
| Dislike it some | 0.0 | 18.0 | 15.4 | 25.0 | 15.4 | 12.1 | 10.0 | 0.0 | 0.0 | 5.3 | 0.0 | 17.0 | 0.0 | 0.0 | 11.5 | 9.1 | 14.0 | 4.6 | 2.9 | 8.4 |
| Dislike it very much | 40.0 | 6.0 | 30.8 | 0.0 | 17.9 | 12.1 | 14.0 | 6.7 | 3.3 | 8.8 | 0.0 | 28.0 | 0.0 | 0.0 | 19.2 | 13.6 | 16.0 | 13.6 | 2.9 | 12.3 |
| No opinion | 0.0 | 29.0 | 0.0 | 0.0 | 12.8 | 9.1 | 5.0 | 3.3 | 13.3 | 7.9 | 16.7 | 33.0 | 0.0 | 0.0 | 26.9 | 9.1 | 21.0 | 2.3 | 11.4 | 11.7 |
| Not sure | 0.0 | 6.0 | 0.0 | 0.0 | 2.6 | 3.0 | 0.0 | 6.7 | 3.3 | 3.5 | 0.0 | 6.0 | 0.0 | 0.0 | 3.9 | 2.3 | 4.0 | 4.6 | 2.9 | 3.4 |
| No response | N=0 | N=0 | N=3 | N=0 | N=3 | N=1 | N=3 | N=14 | N=1 | N=19 | N=0 | N=3 | N=0 | N=0 | N=3 | N=1 | N=6 | N=17 | N=1 | N=25 |
| Total responses | N=5 | N=17 | N=13 | N=4 | N=39 | N=33 | N=21 | N=30 | N=30 | N=114 | N=6 | N=18 | N=1 | N=1 | N=26 | N=44 | N=56 | N=44 | N=35 | N=179 |

Table 66. Percentage Distribution of Responses of Non-Abutting Residents to the Question "Your Opinion of This Type of Freeway"

| Response | Elevated % | | | | | Depressed % | | | | | At-Grade % | | | | | All Design Sub-Areas % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study Area | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas | 1 | 2 | 3 | 4 | All Study Areas |
| Like it very much | 50.0 | 50.0 | 42.5 | 0.0 | 43.0 | 30.3 | 83.0 | 36.2 | 53.2 | 42.5 | - | - | - | - | - | 38.2 | 75.0 | 40.4 | 51.0 | 42.8 |
| Like it some | 36.4 | 0.0 | 19.4 | 100.0 | 22.4 | 36.4 | 0.0 | 47.8 | 14.9 | 33.9 | - | - | - | - | - | 36.4 | 0.0 | 28.9 | 18.4 | 27.9 |
| Dislike it some | 4.5 | 50.0 | 7.9 | 0.0 | 7.9 | 6.1 | 17.0 | 5.8 | 4.3 | 5.9 | - | - | - | - | - | 5.5 | 25.0 | 7.2 | 4.1 | 6.9 |
| Dislike it very much | 0.0 | 0.0 | 1.4 | 0.0 | 1.2 | 9.1 | 0.0 | 0.0 | 2.1 | 1.9 | - | - | - | - | - | 5.5 | 0.0 | 0.9 | 2.0 | 1.6 |
| No opinion | 9.1 | 0.0 | 27.3 | 0.0 | 24.2 | 15.2 | 0.0 | 10.1 | 25.5 | 15.0 | - | - | - | - | - | 12.7 | 0.0 | 21.6 | 24.5 | 19.8 |
| Not sure | 0.0 | 0.0 | 1.4 | 0.0 | 1.2 | 3.0 | 0.0 | 0.0 | 0.0 | 0.7 | - | - | - | - | - | 1.8 | 0.0 | 0.9 | 0.0 | 0.9 |
| No response | N=0 | N=0 | N=12 | N=1 | N=13 | N=2 | N=2 | N=22 | N=7 | N=33 | - | - | - | - | - | N=2 | N=1 | N=34 | N=8 | N=46 |
| Total responses | N=22 | N=2 | N=139 | N=2 | N=165 | N=33 | N=6 | N=69 | N=47 | N=153 | - | - | - | - | - | N=55 | N=61 | N=208 | N=49 | N=318 |

Lubbock: Tables 65 and 66 show that approximately 66% of the residents on abutting sections and 75% of the residents on non-abutting sections like the grade level of the freeway immediately adjacent to their residential area. The percentage of respondents on individual design sub-areas on abutting sections who said they like the grade type of freeway adjacent to them ranges from 63% on elevated sections to 83% on at-grade sections. On non-abutting sections this percentage ranges from 66.7% on depressed sections to 86.4% on elevated sections. Twenty-three percent of the respondents on abutting sections and 11% on non-abutting sections said they disliked the grade level of the freeway. Another 11% on abutting sections and 15% on non-abutting sections had no opinion or were not sure.

Houston: The largest percentage of the respondents who said they liked the grade level of freeway were located adjacent depressed sections of the freeway (72% on abutting sections and 83% on non-abutting sections). For those living near elevated sections, this percentage is slightly smaller, ranging from 41% on abutting sections to 50% on non-abutting sections. For those living near at-grade sections, this percentage is very small, approximately 17% with a greater percentage saying they dislike this type of freeway (45%). Forty-four percent of respondents on abutting sections and 75% on non-abutting sections said they liked the grade level of freeway. Thirty percent of respondents on abutting sections said they disliked the grade type, and another 25% were unsure or had no opinion. On non-abutting sections, 25% said they disliked the grade level of freeway and none were unsure.

San Antonio: Almost 75% of the respondents on abutting sections and 69% on non-abutting sections said that they liked the grade type of highway that they were adjacent to. Eighteen percent on abutting sections and 8% on non-abutting sections said they disliked the grade type. Further, only 7% on abutting sections were unsure or had no opinion. The percentage of non-abutting section respondents who disliked the grade level of freeway is 22%.

Dallas: Eighty percent of respondents on abutting sections said that they liked the grade level of freeway adjacent to them; 6% disliked it, and another 14% had no opinion or were not sure. On non-abutting sections, these percentages were 70%, 8%, and 25%, respectively.

**Grade Level of Freeway Preferred**

While Tables 65 and 66 show the opinions of residents on the grade level of freeway that they are immediately adjacent to, the information presented in Table 67 shows the general preferences of residents for any specific grade type of freeway by individual study area, by design sub-area, as well by distance zone. Figures 30-32 present the overall grade level preferences for all study areas individually.

An examination of the test statistics for abutting residents using two-way contingency tables for the four study areas separately, reveals that preferences and grade levels are correlated for some study areas. Since the study areas differ substantially in terms of their characteristics, a three-way analysis was also performed. For the three-way contingency analysis of preferences and grade level, controlling for the study area, the CMH test statistic of association between preferences and grade level for abutting residents is 29.14 with degrees of freedom equal to six and probability $p = .001$. This p-value indicates that the test statistic is significant beyond the 99% confidence level. This suggests that for the overall sample, there is an association between preferences and grade level. Interestingly, the pattern of responses of non-abutting residents is similar to the response pattern of abutting residents. There is a tendency for respondents to prefer either the grade type that they are currently located on or gravitate towards the 'no-preference' response category. Individual study area tests were also conducted to assess whether there were any differences in the responses of residents abutting and non-abutting the highway. However, no significant differences were found in the preferences (with the exception of Lubbock and San Antonio). While the respondents from both abutting and non-abutting sections showed a greater preference for depressed types of freeways both in Houston and Dallas, the pattern is not as clear in Lubbock and San Antonio. In both Lubbock and San Antonio, the preference is towards depressed grade levels on abutting sections. On non-abutting sections, the largest percentage of respondents have no preference, and the remaining tend to show a preference for elevated grade levels in comparison to depressed grade type. Figures 30-32 show the overall (abutting, non-abutting sections, and combined) results for all study areas individually as well as for all study areas combined.

## Table 67. Percentage Distribution of Responses of Residents to the Question "Do You Prefer Elevated or Depressed Freeways?"

| Opinion | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | A | NA | A | NA | A | NA | A | NA |
| Elevated | 60.0 | 45.5 | 10.0 | 13.8 | 0.0 | - | 14.6 | 26.4 |
| Depressed | 20.0 | 0.0 | 43.3 | 24.1 | 50.0 | - | 41.5 | 13.2 |
| No preference | 20.0 | 36.4 | 20.0 | 37.9 | 50.0 | - | 24.4 | 39.6 |
| Not sure | 0.0 | 18.2 | 26.7 | 24.1 | 0.0 | - | 19.5 | 20.8 |
| No response | N=0 | N=0 | N=4 | N=4 | N=0 | - | N=4 | N=4 |
| Total number of responses | N=5 | N=22 | N=30 | N=31 | N=6 | - | N=41 | N=53 |
| (Abutting) Chi-square Statistic $\chi^2$ (6) = 13.9 p = .031 ; Fisher's Exact Test p=.062 Not Significant ; (Non-abutting) $\chi^2$ (3)= 10.09 p=.018 Fisher's Exact Test p=.014 Significant; (Abutting vs. Non-abutting) $\chi^2$ (3)= 10.38 p=.016 Significant; | | | | | | | | |
| **Study Area 2: Houston** | | | | | | | | |
| Elevated | 29.0 | 0.0 | 0.0 | 0.0 | 19.0 | - | 15.0 | 0.0 |
| Depressed | 24.0 | 0.0 | 91.0 | 100.0 | 38.0 | - | 54.0 | 80.0 |
| No preference | 41.0 | 50.0 | 9.0 | 0.0 | 43.0 | - | 30.0 | 10.0 |
| Not sure | 6.0 | 50.0 | 0.0 | 0.0 | 0.0 | - | 2.0 | 10.0 |
| No response | N=0 | N=0 | N=1 | N=0 | N=0 | - | N=1 | N=0 |
| Total number of responses | N=17 | N=2 | N=23 | N=8 | N=21 | - | N=61 | N=10 |
| (Abutting) Chi-square Statistic $\chi^2$ (6) = 23.96 p=.001; Fisher's Exact Test p =4.7*($10^{-8}$) Significant; (Non-abutting) $\chi^2$ (2)=10.0 p=.007 Fisher's Exact Test =.022 Significant; (Abutting vs. Non-abutting) $\chi^2$ (3)= 5.83 p=.120 Fisher's Exact Test=.138 Not significant; | | | | | | | | |
| **Study Area 3: San Antonio** | | | | | | | | |
| Elevated | 28.6 | 36.4 | 5.4 | 29.4 | 0.0 | - | 11.5 | 34.0 |
| Depressed | 7.1 | 16.3 | 21.6 | 17.7 | 0.0 | - | 17.3 | 16.8 |
| No preference | 28.6 | 37.9 | 56.8 | 42.7 | 0.0 | - | 48.1 | 39.6 |
| Not sure | 35.7 | 9.3 | 16.2 | 10.3 | 100.0 | - | 23.1 | 9.6 |
| No response | N=2 | N=22 | N=7 | N=23 | N=0 | - | N=9 | N=45 |
| Total number of responses | N=14 | N=129 | N=37 | N=68 | N=1 | - | N=52 | N=197 |
| (Abutting) Chi-square Statistic $\chi^2$ (6) = 12.71 p = .048; Fisher's Exact Test p=.024 Significant; (Non-abutting) $\chi^2$ (3)=.985 p=.805; Fisher's Exact Test =.377 Not significant; (Abutting vs. Non-abutting) $\chi^2$ (3)= 13.77 p=.003 Significant; | | | | | | | | |

## Table 67. Percentage Distribution of Responses of Residents to the Question "Do You Prefer Elevated or Depressed Freeways?" (continued)

| Opinion | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | A | NA | A | NA | A | NA | A | NA |
| Elevated | 25.0 | 0.0 | 13.3 | 13.7 | 100.0 | - | 17.1 | 13.0 |
| Depressed | 50.0 | 66.7 | 76.7 | 49.0 | 0.0 | - | 71.4 | 50.0 |
| No preference | 25.0 | 0.0 | 3.3 | 23.5 | 0.0 | - | 5.7 | 22.2 |
| Not sure | 0.0 | 33.3 | 6.7 | 13.7 | 0.0 | - | 5.7 | 14.8 |
| No response | N=0 | N=0 | N=1 | N=3 | N=0 | - | N=1 | N=3 |
| Total number of responses | N=4 | N=22 | N=30 | N=51 | N=1 | - | N=35 | N=54 |
| (Abutting) Chi-square Statistic $\chi^2(6) = 8.78$ p=.186 ; (Non-abutting) $\chi^2(3)=2.03$ p=.566; Fisher's Exact Test p=.153 Not Significant; Fisher's Exact Test=.712 Not significant (Abutting vs. Non-abutting) $\chi^2(3)= 7.17$ p=.067 Fisher's Exact Test =.065 Not significant; | | | | | | | | |
| **All Study Areas** | | | | | | | | |
| Elevated | 32.5 | 36.5 | 7.5 | 19.9 | 17.2 | - | 14.3 | 28.2 |
| Depressed | 20.0 | 14.7 | 54.2 | 33.3 | 37.9 | - | 44.4 | 24.0 |
| No preference | 32.5 | 37.2 | 25.0 | 33.3 | 41.4 | - | 29.1 | 35.3 |
| Not sure | 15.0 | 11.5 | 13.3 | 13.5 | 3.5 | - | 12.2 | 12.5 |
| No response | N=2 | N=22 | N=13 | N=30 | N=0 | - | N=15 | N=52 |
| Total number of responses | N=40 | N=156 | N=120 | N=156 | N=29 | - | N=189 | N=312 |
| (Abutting) Chi-square Statistic $\chi^2(6) = 26.11$ p=.001; (Non-abutting) $\chi^2(3)=19.45$ p=.001 Significant; Fisher's Exact Test p = .002 Significant; (Abutting vs. Non-abutting) $\chi^2(6)=26.74$ p=.001 Significant; | | | | | | | | |

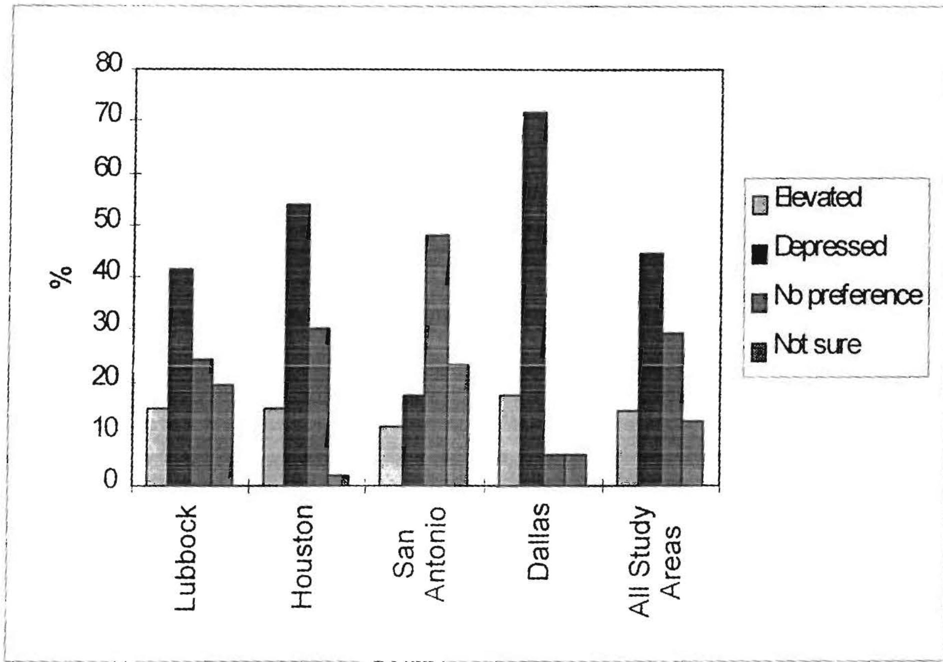



Figure 30. Grade Level of Freeway Preferred by Residents: Abutting Sections

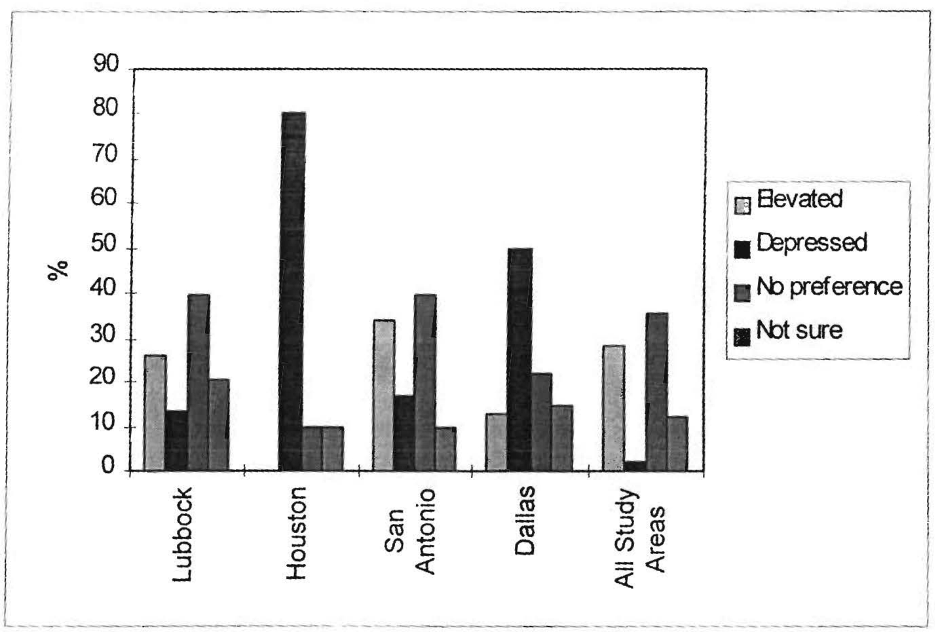



Figure 31. Grade Level of Freeway Preferred by Residents: Non-Abutting Sections

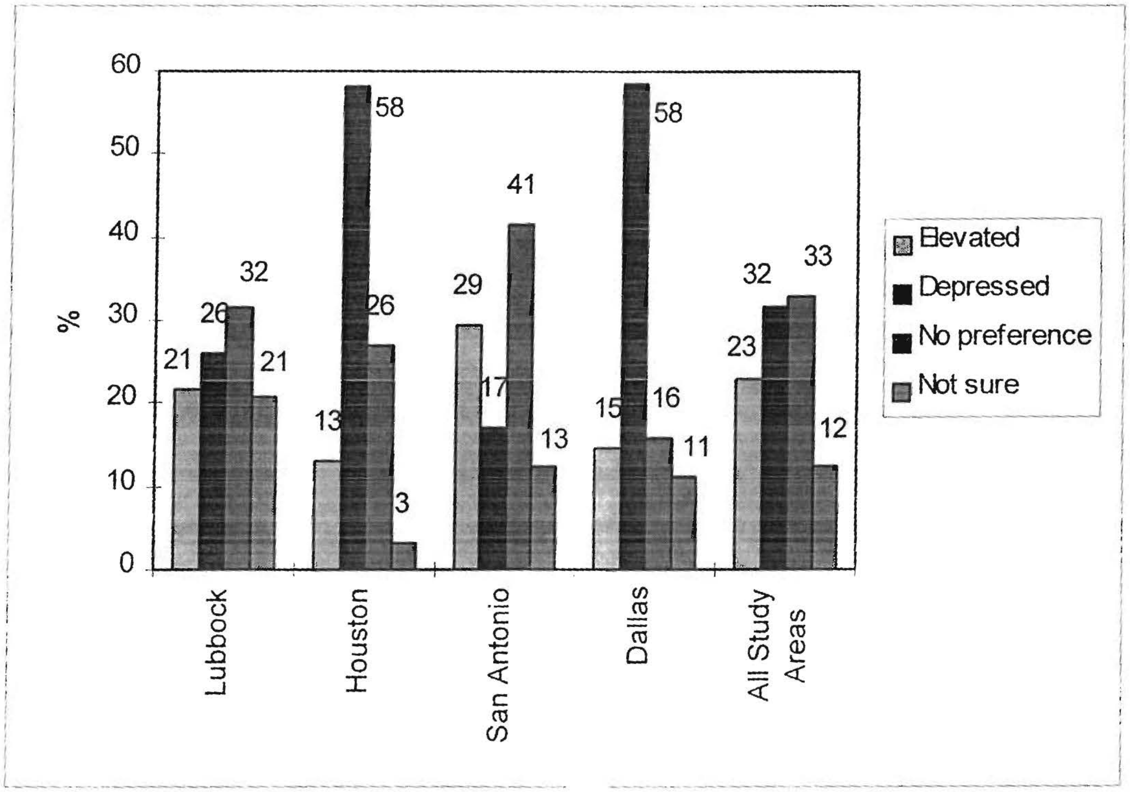



**Figure 32. Grade Level of Freeway Preferred by Residents: Overall Results**

When all study areas are combined, the majority of respondents have no preference. Respondents from abutting sections prefer depressed grade type to elevated grade type of freeways. Respondents from non-abutting sections in Houston and Dallas also reveal a similar preference. However, this is not the case for respondents from San Antonio and Lubbock non-abutting sections. Figure 32 shows that when abutting and non-abutting sections are combined, there is greater evidence of preference for depressed types of freeways—San Antonio, being the exception to this case.

Considering the results from Tables 65 and 66 in conjunction with the results from Figures 30-32, there is substantial evidence showing that the depressed grade type of freeway is the preferred choice for most residential respondents.

## Opinion of the Noise Barriers

Respondents in the Houston and Dallas study areas were questioned on the effectiveness of the noise barrier walls in their respective study areas. The results of the survey pertaining to this aspect are presented in Table 68 and Figures 33-35.

First of all, the results from Table 68 show no statistically significant relation between grade level differences and opinion of residents from abutting sections in either Houston or Dallas. This is also the case for non-abutting sections of the Houston study area. The majority of the respondents in these cases believe that noise barriers are either very effective or somewhat effective. A very small percentage believe that noise barriers are ineffective or have no opinion. However, in the case of non-abutting sections of the Dallas study area, a significant difference in the pattern of responses from the elevated and depressed segments of the freeway is observed. In this case, almost 33% of respondents on depressed segments tend to have no opinion in comparison to those on elevated segments.

Second, differences in responses from abutting and non-abutting sections were also tested for both the study areas and for the two study areas combined. All the chi-square statistics and their modified probabilities show strong evidence of a relation between opinion type and distance zone, in all cases. Both the tests (chi-square tests across design sub-areas and across distance zones), show that while opinions are not significant across grade levels, they are certainly significant across distance zones. This is not surprising—people living in the vicinity of the highway (abutting sections) would have a stronger impact of the noise barriers than those living far away (non-abutting sections). The findings show that a large percentage of respondents from abutting sections believe that noise barriers are effective, and a very small percentage think they are ineffective or have no opinion. The only difference in the case of respondents from non-abutting sections is that the percentage who believe that the noise barrier is ineffective or have no opinion is very large (60% in the case of Houston, 36% in the case of Dallas, and 39% overall). Figures 33-35 are a pictorial representation of the results of this section for abutting, non-abutting sections, and for all study areas combined.

**Table 68. Percentage Distribution of Responses of Residents to the Question "What Is Your Opinion of the Barrier Walls?"**

| Opinion | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston** | A | NA | A | NA | A | NA | A | NA |
| Very effective | 23.5 | 0.0 | 27.8 | 25.0 | 47.6 | - | 33.9 | 20.0 |
| Somewhat effective | 64.7 | 100.0 | 55.6 | 12.5 | 52.4 | - | 57.1 | 30.0 |
| Not very effective | 11.7 | 0.0 | 0.0 | 25.0 | 0.0 | - | 3.6 | 20.0 |
| No opinion | 0.0 | 0.0 | 16.7 | 37.5 | 0.0 | - | 5.4 | 30.0 |
| No response | N=0 | N=0 | N=6 | N=0 | N=0 | - | N=6 | N=0 |
| Total number of responses | N=17 | N=2 | N=18 | N=8 | N=21 | - | N=56 | N=10 |
| (Abutting) Chi-square Statistic $\chi^2(6)=13.04$ $p=.04$; Fisher's Exact Test $p=.074$ Not Significant; (Non-abutting) $\chi^2(3)=5.83$ $p=.12$; Fisher's Exact Test=.178 Not significant; (Abutting vs. Non-abutting) $\chi^2(3)=19.5$ $p=.001$ Fisher's Exact Test $=2.17*(10^{-3})$ Significant; | | | | | | | | |
| **Study Areas 4: Dallas** | | | | | | | | |
| Very effective | 50.0 | 0.0 | 50.0 | 4.4 | 100.0 | - | 51.5 | 38.2 |
| Somewhat effective | 50.0 | 100.0 | 35.7 | 21.2 | 0.0 | - | 36.4 | 25.5 |
| Not very effective | 0.0 | 0.0 | 14.3 | 5.8 | 0.0 | - | 12.1 | 5.5 |
| No opinion | 0.0 | 0.0 | 0.0 | 32.7 | 0.0 | - | 0.0 | 30.9 |
| No response | N=0 | N=0 | N=3 | N=2 | N=0 | - | N=3 | N=2 |
| Total number of responses | N=4 | N=3 | N=28 | N=52 | N=21 | - | N=33 | N=55 |
| (Abutting) Chi-square Statistic $\chi^2(6)=1.76$ $p=.78$; Fisher's Exact Test $p=1.00$ Not significant; (Non-abutting) $\chi^2(3)=9.29$ $p=.026$; Fisher's Exact Test $p=.03$ Significant; (Abutting vs. Non-abutting) $\chi^2(3)=13.03$ $p=.005$ Fisher's Exact Test $=8.9*(10^{-4})$ Significant; | | | | | | | | |
| **Study Areas 3 & 4 Combined** | | | | | | | | |
| Very effective | 28.6 | 0.0 | 41.3 | 38.3 | 50.0 | - | 40.5 | 35.4 |
| Somewhat effective | 61.9 | 100.0 | 43.5 | 20.0 | 50.0 | - | 49.4 | 26.2 |
| Not very effective | 9.5 | 0.0 | 8.7 | 8.3 | 0.0 | - | 6.7 | 7.7 |
| No opinion | 0.0 | 0.0 | 6.5 | 33.3 | 0.0 | - | 3.4 | 30.8 |
| No response | N=0 | N=0 | N=9 | N=2 | N=0 | - | N=9 | N=2 |
| Total number of responses | N=21 | N=5 | N=46 | N=60 | N=22 | - | N=89 | N=65 |
| Chi-square Statistic $\chi^2(6)=7.02$ $p=.319$; Fisher's Exact Test $p=.404$ Not significant; (Non-abutting) $\chi^2(3)=15.29$ $p=.002$; Fishers'Exact Test $p=2.9*(10^{-3})$ Significant; (Abutting vs. Non-abutting) $\chi^2(3)=24.32$ $p=.001$ Fisher's Exact Test $p=1.1*(10^{-5})$ Significant; | | | | | | | | |

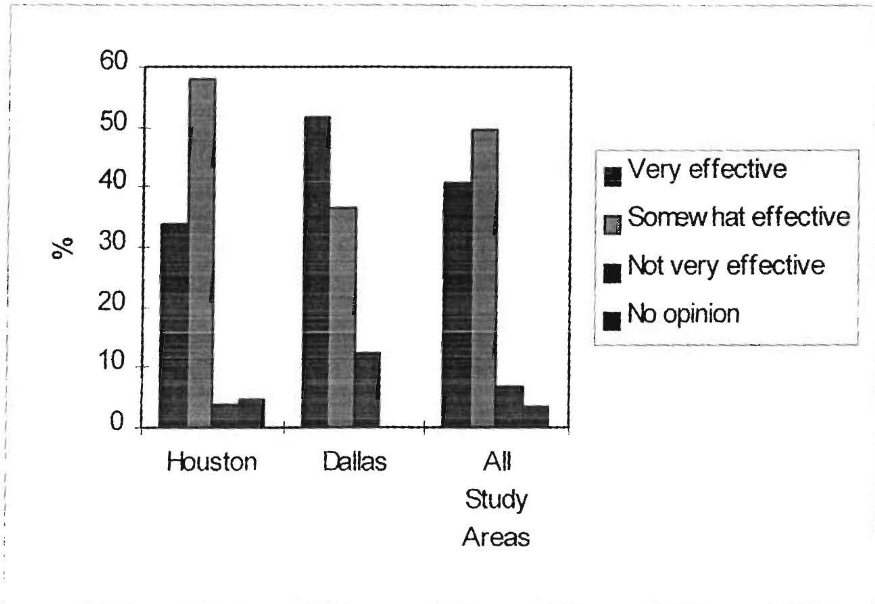



**Figure 33. Effectiveness of Noise Barrier Walls: Abutting Sections**

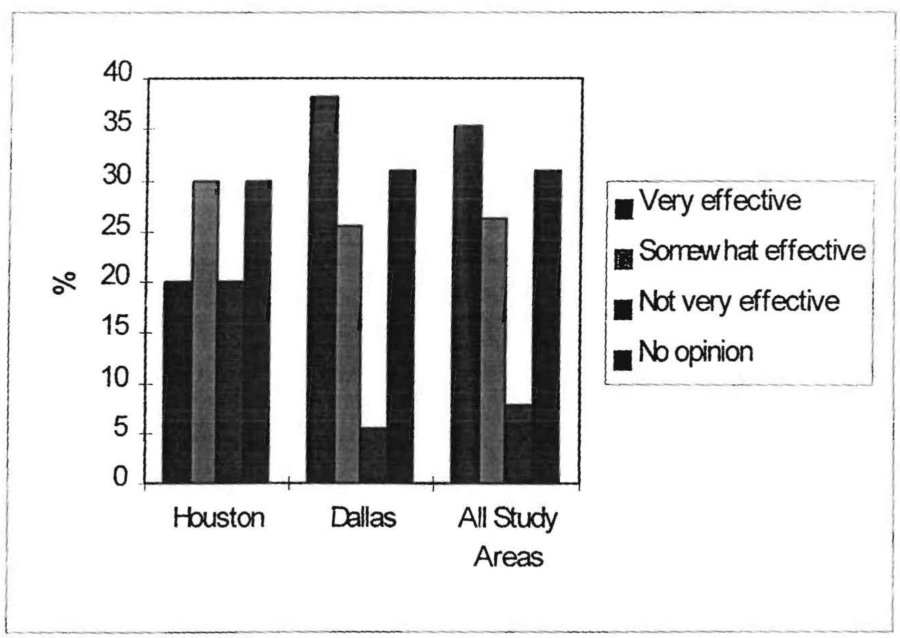



**Figure 34. Effectiveness of Noise Barrier Walls: Non-Abutting Sections**

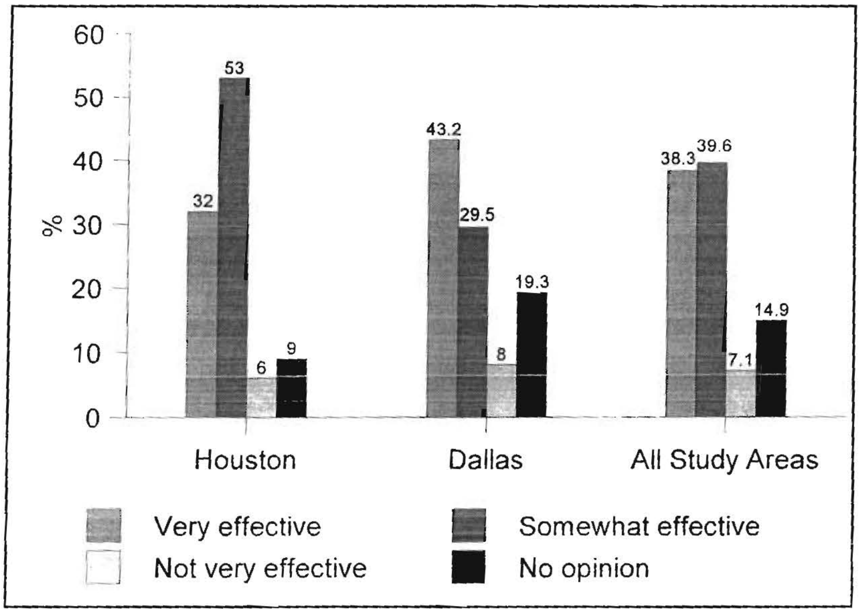



**Figure 35. Effectiveness of Noise Barrier Walls: Overall Results**

Figure 35 shows that about 78% of the respondents from study areas (all sections) believed that the noise barriers were effective. Of these, approximately 38% thought that the barriers were very effective in reducing noise, and the remaining 40% thought that they were only somewhat effective. Only 7% were of the opinion that noise walls were ineffective, and another 15% had no opinion. When asked the comments on noise walls, some respondents commented that noise walls absorbed a lot of heat and increased utility bills drastically, and some others commented on the ugly appearance.

### Changes Experienced Since Construction of Freeway

Respondents in all study areas were asked their opinions, perceptions, and experiences concerning the impacts of the freeway construction. They were asked whether they had experienced any increases or decreases in noise, pollution levels, travel safety, crime, travel time, property values, neighborhood quality, travel convenience, or any other specific change they had observed. The percentages reported in the table are based on the number of respondents (N) and do not add up because of multiple responses. The responses are presented separately by study area because each study area's experiences are considered to be unique. Furthermore, as has been mentioned before, in the case of Dallas (Study area 4) these experiences will be a reflection of construction period effects since construction was underway at the time the surveys were administered. Table 69 presents a summary of the survey responses for abutting and non-abutting residents.

*Negative Effects of the Highway Construction*

Direct ways in which construction could negatively impact residents and businesses alike include increases in noise and pollution levels. Sometimes travel convenience is decreased, especially if the construction is underway. Indirect effects include a reduction in neighborhood quality and reduction in property values. In all study areas, a majority of the abutting and non-abutting surveyed residents believed that noise and pollution levels had gone up since highway construction regardless of the grade level. A large number of the respondents also believed that crime levels had increased in all study areas. Sixty-five percent and 43% of the total number of abutting section respondents in all study areas combined responded that noise and pollution levels had increased, respectively. Fifteen percent of abutting section respondents thought that crime had also increased. For non-abutting sections, these figures were 32%, 26%, and 8% for noise, pollution levels, and crime levels, respectively. Travel convenience was reported to have declined by 42% of the residents abutting Central Expressway and by 53% non-abutting the freeway.

Furthermore, a greater percentage of respondents, especially those residing on sections adjacent to the freeway, thought that neighborhood quality had decreased rather than increased due to the construction activity. The overall percentage on abutting sections who felt that neighborhood quality had deteriorated was approximately 22%.

**Table 69. Percentage Distribution of Responses of Residents to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area**

| Experiences | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 1: Lubbock** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Number of respondents | N=5 | N=22 | N=34 | N=35 | N=6 | - | N=45 | N=57 |
| Noise | | | | | | | | |
| Increase | 60.0 | 20.6 | 52.9 | 42.9 | 13.6 | - | 53.3 | 38.6 |
| Decrease | 0.0 | 8.8 | 11.8 | 2.9 | 0.0 | - | 8.9 | 7.0 |
| Pollution | | | | | | | | |
| Increase | 60.0 | 11.8 | 41.2 | 22.9 | 0.0 | - | 37.8 | 21.1 |
| Decrease | 0.0 | 2.9 | 2.9 | 5.7 | 0.0 | - | 2.2 | 5.3 |
| Travel Time | | | | | | | | |
| Increase | 20.0 | 17.6 | 35.3 | 3.4 | 18.2 | - | 37.8 | 29.8 |
| Decrease | 0.0 | 14.7 | 8.8 | 22.9 | 4.5 | - | 8.9 | 22.9 |
| Crime | | | | | | | | |
| Increase | 0.0 | 8.8 | 14.7 | 14.3 | 0.0 | - | 11.1 | 14.0 |
| Decrease | 20.0 | 5.9 | 0.0 | 8.6 | 0.0 | - | 2.2 | 8.8 |
| Property Values | | | | | | | | |
| Increase | 20.0 | 11.8 | 8.8 | 17.1 | 4.5 | - | 11.1 | 17.5 |
| Decrease | 20.0 | 5.9 | 38.2 | 20.0 | 4.5 | - | 33.3 | 12.3 |
| Neighborhood Quality | | | | | | | | |
| Increase | 0.0 | 11.8 | 2.9 | 14.3 | 0.0 | - | 2.2 | 15.8 |
| Decrease | 20.0 | 5.9 | 32.4 | 5.7 | 0.0 | - | 26.7 | 7.0 |
| Travel Convenience | | | | | | | | |
| Increase | 40.0 | 38.2 | 35.3 | 60.0 | 22.7 | - | 42.2 | 59.6 |
| Decrease | 0.0 | 2.9 | 20.6 | 0.0 | 0.0 | - | 15.6 | 8.8 |
| Travel Safety | | | | | | | | |
| Increase | 40.0 | 23.5 | 29.4 | 28.6 | 13.6 | - | 33.3 | 31.6 |
| Decrease | 0.0 | 2.9 | 17.6 | 8.6 | 0.0 | - | 13.3 | 7.0 |

**Table 69. Percentage Distribution of Responses of Residents to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 2: Houston** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Number of respondents | N=17 | N=2 | N=24 | N=8 | N=21 | - | N=62 | N=10 |
| Noise | | | | | | | | |
| Increase | 53.0 | 0.0 | 88.0 | 50.0 | 90.0 | - | 79.0 | 40.0 |
| Decrease | 0.0 | 0.0 | 4.0 | 13.0 | 0.0 | - | 2.0 | 10.0 |
| Pollution | | | | | | | | |
| Increase | 18.0 | 100.0 | 63.0 | 75.0 | 24.0 | - | 37.0 | 80.0 |
| Decrease | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Travel Time | | | | | | | | |
| Increase | 12.0 | 0.0 | 25.0 | 13.0 | 10.0 | - | 16.0 | 10.0 |
| Decrease | 41.0 | 50.0 | 25.0 | 25.0 | 48.0 | - | 37.0 | 30.0 |
| Crime | | | | | | | | |
| Increase | 6.0 | 0.0 | 21.0 | 0.0 | 10.0 | - | 13.0 | 0.0 |
| Decrease | 0.0 | 0.0 | 0.0 | 0.0 | 14.0 | - | 5.0 | 0.0 |
| Property Values | | | | | | | | |
| Increase | 12.0 | 0.0 | 0.0 | 25.0 | 0.0 | - | 3.0 | 20.0 |
| Decrease | 18.0 | 0.0 | 63.0 | 50.0 | 43.0 | - | 44.0 | 40.0 |
| Neighborhood Quality | | | | | | | | |
| Increase | 0.0 | 0.0 | 4.0 | 25.0 | 0.0 | - | 2.0 | 20.0 |
| Decrease | 12.0 | 0.0 | 38.0 | 25.0 | 19.0 | - | 24.0 | 20.0 |
| Travel Convenience | | | | | | | | |
| Increase | 53.0 | 50.0 | 42.0 | 50.0 | 62.0 | - | 52.0 | 50.0 |
| Decrease | 6.0 | 0.0 | 4.0 | 13.0 | 0.0 | - | 3.0 | 10.0 |
| Travel Safety | | | | | | | | |
| Increase | 24.0 | 50.0 | 33.0 | 0.0 | 19.0 | - | 26.0 | 10.0 |
| Decrease | 6.0 | 0.0 | 29.0 | 50.0 | 0.0 | - | 13.0 | 40.0 |

**Table 69. Percentage Distribution of Responses of Residents to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 3: San Antonio** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Number of respondents | N=16 | N=151 | N=44 | N=91 | N=1 | - | N=61 | N=242 |
| Noise | | | | | | | | |
| Increase | 62.5 | 24.5 | 54.6 | 30.8 | 100.0 | - | 57.4 | 26.9 |
| Decrease | 6.3 | 5.9 | 0.0 | 12.1 | 0.0 | - | 1.6 | 8.3 |
| Pollution | | | | | | | | |
| Increase | 62.5 | 18.5 | 38.6 | 20.9 | 100.0 | - | 45.9 | 19.4 |
| Decrease | 0.0 | 3.9 | 2.3 | 4.4 | 0.0 | - | 1.6 | 4.1 |
| Travel Time | | | | | | | | |
| Increase | 31.3 | 17.9 | 25.0 | 31.9 | 0.0 | - | 26.2 | 23.1 |
| Decrease | 6.3 | 31.8 | 11.4 | 19.8 | 0.0 | - | 9.8 | 27.3 |
| Crime | | | | | | | | |
| Increase | 37.5 | 6.6 | 18.2 | 8.8 | 0.0 | - | 22.9 | 7.4 |
| Decrease | 6.3 | 3.9 | 4.6 | 7.7 | 0.0 | - | 4.9 | 5.4 |
| Property Values | | | | | | | | |
| Increase | 12.5 | 17.2 | 15.9 | 9.9 | 100.0 | - | 16.4 | 14.5 |
| Decrease | 25.0 | 5.3 | 11.4 | 13.2 | 0.0 | - | 14.8 | 8.3 |
| Neighborhood Quality | | | | | | | | |
| Increase | 12.5 | 13.3 | 9.1 | 17.6 | 0.0 | - | 9.8 | 14.9 |
| Decrease | 31.3 | 5.9 | 11.4 | 10.9 | 0.0 | - | 16.4 | 7.9 |
| Travel Convenience | | | | | | | | |
| Increase | 37.5 | 62.9 | 68.2 | 65.9 | 100.0 | - | 60.7 | 64.1 |
| Decrease | 0.0 | 1.3 | 0.0 | 2.2 | 0.0 | - | 0.0 | 1.7 |
| Travel Safety | | | | | | | | |
| Increase | 31.3 | 29.1 | 20.5 | 39.6 | 100.0 | - | 24.6 | 33.1 |
| Decrease | 6.3 | 8.6 | 6.8 | 7.7 | 0.0 | - | 6.6 | 8.3 |

**Table 69. Percentage Distribution of Responses of Residents to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **Study Area 4: Dallas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Number of respondents | N=4 | N=3 | N=31 | N=54 | N=1 | - | N=36 | N=57 |
| Noise | | | | | | | | |
| Increase | 75.0 | 33.3 | 67.7 | 50.0 | 100.0 | - | 69.4 | 49.1 |
| Decrease | 0.0 | 0.0 | 16.1 | 1.9 | 0.0 | - | 13.9 | 6.5 |
| Pollution | | | | | | | | |
| Increase | 75.0 | 66.7 | 54.8 | 50.0 | 0.0 | - | 55.6 | 50.9 |
| Decrease | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | - | 0.0 | 1.8 |
| Travel Time | | | | | | | | |
| Increase | 25.0 | 100.0 | 61.3 | 64.8 | 100.0 | - | 58.3 | 66.7 |
| Decrease | 0.0 | 0.0 | 2.8 | 3.7 | 0.0 | - | 2.8 | 3.5 |
| Crime | | | | | | | | |
| Increase | 50.0 | 0.0 | 6.5 | 7.4 | 0.0 | - | 11.1 | 7.0 |
| Decrease | 0.0 | 0.0 | 6.5 | 0.0 | 0.0 | - | 5.6 | 0.0 |
| Property Values | | | | | | | | |
| Increase | 0.0 | 0.0 | 12.9 | 9.3 | 0.0 | - | 11.1 | 8.8 |
| Decrease | 25.0 | 33.3 | 25.8 | 11.1 | 0.0 | - | 25.0 | 12.3 |
| Neighborhood Quality | | | | | | | | |
| Increase | 0.0 | 0.0 | 9.7 | 7.4 | 0.0 | - | 8.3 | 7.0 |
| Decrease | 50.0 | 33.3 | 16.1 | 16.7 | 0.0 | - | 19.4 | 17.5 |
| Travel Convenience | | | | | | | | |
| Increase | 0.0 | 0.0 | 3.2 | 3.7 | 0.0 | - | 2.8 | 3.5 |
| Decrease | 0.0 | 66.7 | 48.4 | 51.9 | 0.0 | - | 41.7 | 52.6 |
| Travel Safety | | | | | | | | |
| Increase | 25.0 | 33.3 | 22.6 | 16.7 | 0.0 | - | 22.2 | 17.5 |
| Decrease | 25.0 | 33.3 | 32.3 | 25.9 | 0.0 | - | 30.6 | 26.3 |

**Table 69. Percentage Distribution of Responses of Residents to the Question on Changes Experienced Since Highway Construction by Study Area and by Design Sub-Area (continued)**

| Experiences | Elevated % | | Depressed % | | At-Grade % | | All Design Sub-Areas % | |
|---|---|---|---|---|---|---|---|---|
| **All Study Areas** | **A** | **NA** | **A** | **NA** | **A** | **NA** | **A** | **NA** |
| Number of respondents | N=42 | N=178 | N=133 | N=29 | N=29 | - | N=204 | N=364 |
| Noise | | | | | | | | |
| Increase | 59.5 | 25.3 | 63.2 | 39.3 | 82.8 | - | 65.2 | 32.4 |
| Decrease | 2.4 | 6.7 | 7.5 | 7.5 | 0.0 | - | 5.4 | 7.1 |
| Pollution | | | | | | | | |
| Increase | 45.2 | 20.2 | 47.4 | 31.7 | 20.7 | - | 43.1 | 26.1 |
| Decrease | 0.0 | 3.9 | 1.5 | 3.8 | 0.0 | - | 0.9 | 3.9 |
| Travel Time | | | | | | | | |
| Increase | 21.4 | 20.2 | 36.1 | 40.9 | 24.1 | | 31.4 | 30.8 |
| Decrease | 19.1 | 30.3 | 11.3 | 15.6 | 37.9 | - | 16.7 | 22.8 |
| Crime | | | | | | | | |
| Increase | 1.4 | 7.3 | 15.0 | 9.1 | 6.9 | - | 15.2 | 8.2 |
| Decrease | 4.8 | 4.5 | 3.0 | 4.8 | 10.3 | - | 4.4 | 4.7 |
| Property Values | | | | | | | | |
| Increase | 11.9 | 16.9 | 10.5 | 11.8 | 6.9 | - | 10.3 | 14.3 |
| Decrease | 21.4 | 6.2 | 30.8 | 13.9 | 34.5 | - | 29.4 | 10.2 |
| Neighborhood Quality | | | | | | | | |
| Increase | 4.8 | 13.5 | 6.8 | 14.5 | 0.0 | - | 5.4 | 14.0 |
| Decrease | 23.8 | 6.7 | 22.6 | 12.4 | 13.8 | - | 21.6 | 9.6 |
| Travel Convenience | | | | | | | | |
| Increase | 40.5 | 61.2 | 39.9 | 46.2 | 65.5 | - | 43.6 | 53.6 |
| Decrease | 2.4 | 2.8 | 17.3 | 18.8 | 0.0 | - | 11.8 | 10.9 |
| Travel Safety | | | | | | | | |
| Increase | 28.6 | 30.3 | 25.6 | 29.0 | 27.6 | - | 26.5 | 29.7 |
| Decrease | 7.1 | 8.4 | 19.6 | 15.1 | 0.0 | - | 14.2 | 11.8 |

In regards to the findings within each study area (abutting sections only), the percentage who responded that noise had increased ranged from 53% in the Lubbock study area to 79% in the Houston study area. For pollution, these figures ranged from 37% in the Lubbock study area to 56% in the Dallas study area. Considering non-abutting sections, the range of percentage is from 27%-49% for noise levels and 19%-80% for pollution levels. When considering crime levels, the individual study area abutting section findings range from 11%-23%, and the corresponding results for non-abutting sections vary from 0% in the Houston case (no one reported it as a problem) to 14% in the Lubbock area. Neighborhood quality was believed to have declined, as reported by 27% of the respondents abutting I-27 in Lubbock, 24% of the respondents abutting Beltway 8 in Houston, 16% of respondents abutting the Y-project and U.S. 281, 19% of the respondents abutting Central Expressway, and 18% of the respondents living on non-abutting sections of Central Expressway.

Surprisingly, respondents from Lubbock, San Antonio, and Dallas study areas report that travel times had increased, and the percentages range from 26% in the San Antonio abutting areas to 58% in the Dallas abutting areas. For non-abutting sections, these figures range from 23%-67%. One possible reason for this increase in travel times may be increased route circuitry. Only Houston area respondents reported reductions in travel times.

The majority of the residents from Lubbock, Houston, and Dallas study areas believed that property values decreased since construction of the freeways. The percentage of respondents who thought property values had decreased ranged from 25% in Dallas (abutting sections) to as high as 44% in Houston (abutting sections). On non-abutting sections, these percentages vary from 12% in Dallas to 40% in Houston.

*Positive Effects of the Highway Construction*

Positive effects of the freeway could be felt in a number of ways. Some of the ways include a reduction in travel time and an increase in travel convenience and safety. These may be thought to be direct effects of the construction activity. Some effects are, however, indirect and could be manifested in the property values, but the results of the survey show that in no study area do residents believe that property values actually increased since construction.

Only respondents from the Houston study areas report a reduction in travel times. This percentage ranged from 37% on abutting sections to 30% on non-abutting sections. Respondents in all study areas report that travel safety has increased rather than decreased, with the exception of Dallas. The results for Dallas are not surprising because construction activity could have forced travelers to resort to inner roads and expose themselves to greater risks. The percentage of respondents who thought travel safety had increased ranged from 25% on San Antonio abutting sections to 33% in the Lubbock abutting sections.

The results of the survey clearly show that the majority of respondents in all study areas unambiguously felt that noise, pollution, and crime had increased and that neighborhood quality had decreased. Noise and pollution were reported to have increased by respondents on the elevated section of I-27 more frequently than on the depressed section. This was also the case for the San Antonio study sections. Noise and pollution were also reported to have increased by residents more frequently on the elevated segment of North Central Expressway and the depressed segment of Beltway 8. Travel safety and convenience were reported by many individuals to have increased in the Lubbock, San Antonio, and Houston study areas. Property values were also thought to have declined by residents in the Lubbock, Dallas, and Houston areas.

# IMPACT ON RELOCATION, EMPLOYMENT, AND INCOME

This section covers two aspects. First, the impact of alternative freeway elevations (in terms of grade level variations) of a highway on relocation of abutting businesses and residents is considered. More specifically, the differing impacts of elevated and depressed freeway sections on the number of relocatees, both residential and business, are examined here. The discussion of relocation effects is limited to the Lubbock, I-27 study sections because these sections had by far the most relocatees of all the sections. The number of relocatees were very few in the Houston, San Antonio, and Dallas study sections. Second, the differing effects of elevated and depressed freeways on employment and income are addressed. The methodological issues regarding the estimation of these effects have been discussed in the literature review chapter.

## RELOCATION IMPACTS

Figure 36 shows the total number of residential, commercial, and other parcels that would be relocated. According to Table 70 and Figure 36, it is clear that elevated freeway sections in Lubbock lead to the greatest displacement in all three categories studied. Business relocatees are, however, most affected in all cases, but much more so on elevated freeway sections. One factor that needs to be mentioned here is the proximity of Section #8 (elevated section) to the central business district where most of the businesses would be expected to be relocated.

## EMPLOYMENT AND INCOME IMPACTS

Each of the individual study areas considered would have fairly significant employment and income impacts. Typically, the gross employment effect would be a composite of three individual components. The first component would include a portion due to the net change (existing businesses before construction less displaced businesses plus new businesses after construction) in employment by businesses locating abutting the existing and proposed routes. The second component would be from construction expenditures by the highway contractor to build the facility. The third component would be from construction expenditures by building contractors to build new businesses and residences or renovate old businesses or residences abutting the route.

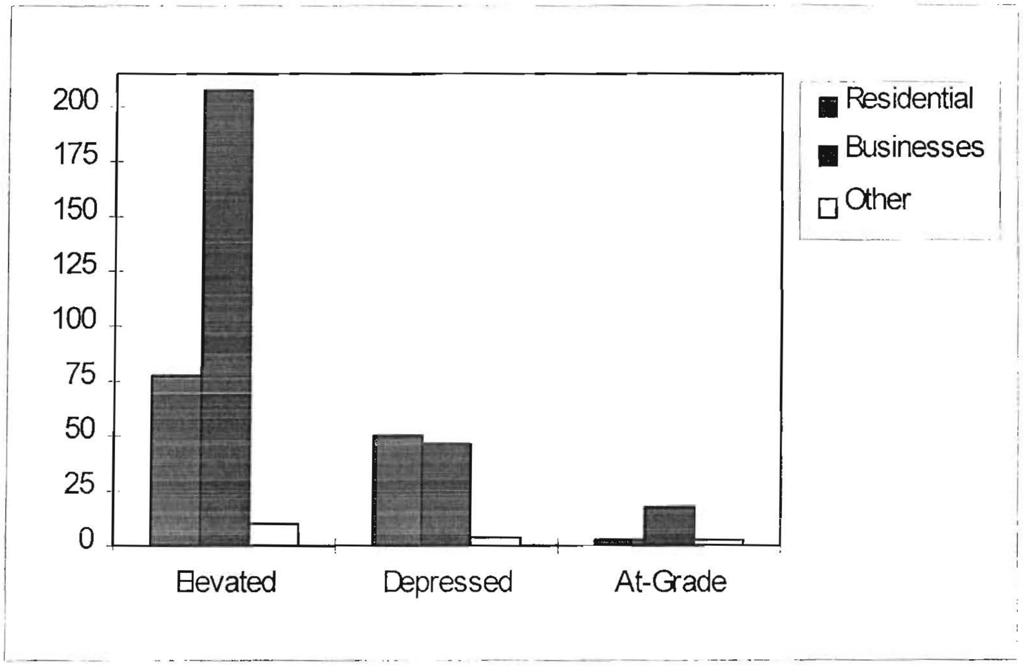



**Figure 36. Estimated Relocation Impact on Businesses and Residents of Elevated and Depressed Freeway Sections of I-27 in Lubbock**

**Table 70. Relocation Impacts of Elevated and Depressed Freeways in Lubbock (I-27)**

| HIGHWAY ELEVATION | TYPE OF RELOCATEE | NUMBER OF RELOCATEES | % OF TOTAL |
|---|---|---|---|
| **Elevated** (Section #8) | Residential | 77 | 26.2 |
| | Businesses | 207 | 70.4 |
| | Other[13] | 10 | 3.4 |
| | Total | 294 (61 relocatees per km) | |
| **Depressed** (Section #9) | Residential | 50 | 50 |
| | Businesses | 46 | 46 |
| | Other | 4 | 4 |
| | Total | 100 (33 relocatees per km) | |
| **At-Grade** (Control) | Residential | 3 | 13.6 |
| | Businesses | 17 | 77.3 |
| | Other | 2 | 9.1 |
| | Total | 22 (14 relocatees per km) | |

[13]This category includes schools, churches, and health clinics.

Out of all the four cities studied in this report, Lubbock (I-27) was the only study area for which relocation information was available in order to address relocation employment effects. Moreover, virtually no information was available on total construction cost of commercial/industrial buildings and single-family residences for any study section. This precludes an estimate of the third component mentioned above. Therefore, our analysis of employment and income effects will be limited to include the following on an individual study section basis:

1) Employment effects from highway contractor's construction expenditures in:

—Houston (Beltway 8 Study Section #6),

—Lubbock (I-27 and U.S. 62/82 Study Sections # 8, 9, 10, and 11),

—Dallas (U.S. 75 Study Section # 7), and

—San Antonio (Y-Project Study Sections # 1, 2, 3, 4; U.S. 281 Study Section # 5).

**Construction Employment and Output Effects**

In order to estimate the employment impact, the 1986 Texas Input-Output employment and output multipliers available from the report published by the Texas Comptroller of Public Accounts in 1986 are utilized. However, since costs have gone down since 1986, these multipliers have to be adjusted using information on Composite Price Indices for the State of Texas available from the Annual Price Trends for Federal-Aid Highway Construction. The estimated employment multiplier for the year 1986 for New Road/Highway Construction is 53.7601 jobs per million dollars of expenditures. The Composite Price Indices for Texas in 1986 and 1995 are 114.6 and 109.98, respectively. The adjusted employment multiplier of 56.02 is obtained by dividing the 1986 employment multiplier by the ratio of the 1995 composite price index to the 1986 composite price index. The total output multiplier is 3.69 dollars of output per dollar of construction expenditure. These adjusted employment multipliers and output multipliers are then multiplied to the construction expenditures for the different projects to obtain the corresponding employment and output effects.

Table 71 below shows the construction costs and the estimated construction employment and output impacts per kilometer for each of the study sections in Lubbock, Dallas, San Antonio, and Houston. This table presents information on increases in employment and output resulting from expenditures on highway construction expenditures. For example, the construction costs incurred on elevated Section #8 of I-27 were in the order of 11.37 million per kilometer. Applying the adjusted employment multiplier of 56.02 to this figure, the estimated increase in jobs in the Lubbock area was 637 per kilometer. Similarly, applying the output multiplier of 3.69 to the construction expenditures of 11.37 million, approximately $41.9 million in output was generated per kilometer. Since construction is still underway in Dallas and the U.S. 62/82 project in Lubbock has yet to be constructed, these estimates are the anticipated employment effects of the highway project.

It is important to highlight some of the problems and caveats in this analysis. First of all, there was one problem in the estimates of construction costs. These costs were reported for certain overlapping segments of the study sections under consideration which sometimes included elevated, depressed, and/or at-grade sections of the freeway. Therefore, there was no easy way to separate out the costs incurred on elevated, depressed, and at-grade freeway sections. Approximations of construction costs were determined by considering the total section cost, the segment length, and the proportion of the elevated to the depressed section length in the overall segment. This factor should be remembered when interpreting the effects on output and employment.

To obtain a clearer picture, the construction costs for the different projects were segregated into three broad groups: costs incurred on elevated freeway sections, costs incurred on depressed freeway sections, and costs incurred on the at-grade control sections. The only problem in adopting this approach is that the costs were reported in different years, and to make meaningful comparisons, all should have a common base year. Therefore, all construction costs were adjusted to arrive at cost (per kilometer) figures in 1995 dollars. In the next step, the multiplier was applied to costs for the three different groups. Table 71 presents the unadjusted cost figures and the corresponding output and employment effects, while Table 72 presents the adjusted (1995 dollars) cost figures and the aggregate effect on employment and output.

## Table 71. Construction Expenditures (Unadjusted) and Estimated Employment and Output Effects

| Study No. (Grade type) | Section Length in Kilometers (km) | Construction Costs (millions per km) | Estimated Employment Effect (number per km) | Estimated Output Effect (million per km) |
|---|---|---|---|---|
| **Elevated/Elevated-Depressed Combination** | | | | |
| #8 Lubbock (I-27) | | | | |
| Elevated segment | 4.84 | 11.37* | 637 | 41.96 |
| #2 San Antonio (I-35) | | | | |
| Elevated segment | 2.01 | 18.16 | 1017 | 67.01 |
| #3 San Antonio (I-10) | | | | |
| Elevated segment | 2.96 | 27.17 | 1522 | 100.25 |
| #4 San Antonio (I-10/35) | | | | |
| Elevated segment | 2.28 | 35.35 | 1980 | 130.44 |
| #10 Lubbock (U.S. 62/82) | | | | |
| Elevated segment | 2.32 | 22.83* | 1279 | 84.25 |
| **Depressed** | | | | |
| #6 Houston Beltway 8 | | | | |
| Depressed segment | 2.09 | 22.37 | 1253 | 82.55 |
| # 7 Dallas (U.S. 75) | | | | |
| Depressed segment | 6.47 | 33.03 | 1850 | 121.88 |
| #9 Lubbock (I-27) | | | | |
| Depressed segment | 3.02 | 12.33* | 691 | 45.51 |
| #11 Lubbock (U.S. 62/82) | | | | |
| Depressed segment | 4.12 | 22.46* | 1258 | 82.87 |
| # 1 San Antonio (I-35) | | | | |
| Depressed segment | 2.22 | 1.86 | 104 | 6.87 |
| #5 San Antonio U.S. 281 | | | | |
| Depressed segment | 2.58 | 6.78 | 380 | 25.02 |

* Indicates that these figures were arrived at by approximation.

## Table 71. Construction Expenditures (Unadjusted) and Estimated Employment and Output Effects (continued)

| Study No. (Grade type) | Section Length in Kilometers (km) | Construction Costs (millions per km) | Estimated Employment Effect (number per km) | Estimated Output Effect (millions per km) |
|---|---|---|---|---|
| **Control (At-grade) sections** | | | | |
| #6 Houston Beltway 8 | | | | |
| At-grade segment | 2.22 | 4.09 | 229 | 15.11 |
| # 7 Dallas (U.S. 75) | | | | |
| At-grade segment | 7.28 | 11.3 | 634 | 41.73 |
| #9 Lubbock (I-27) | | | | |
| At-grade segment | 1.6 | 16.31* | 914 | 60.19 |
| #11 Lubbock (U.S. 62/82) | | | | |
| At-grade segment | 1.7 | 16.41* | 919 | 60.56 |
| #5 San Antonio (U.S. 281) | | | | |
| At-grade segment | 3.42 | 6.68 | 374 | 24.63 |

## Table 72. Construction Expenditures (Adjusted) and Estimated Employment and Output Effects

| Study # (Grade type) | Construction Costs (millions per km) (1995 dollars) | Estimated Employment Effect (number per km) | Estimated Output Effect (millions per km) |
|---|---|---|---|
| **Elevated/Elevated-Depressed Combination** | | | |
| #8 Lubbock (I-27) | | | |
| Elevated segment | 13.97 | 783 | 51.57 |
| #2 San Antonio (I-35) | | | |
| Elevated segment | 25.72 | 1441 | 94.91 |
| #3 San Antonio (I-10) | | | |
| Elevated segment | 37.78 | 2116 | 139.40 |
| #4 San Antonio (I-10/35) | | | |
| Elevated segment | 51.85 | 2905 | 191.3 |
| #10 Lubbock (U.S. 62/82) | | | |
| Elevated segment | 22.83 | 1279 | 84.24 |
| **Total** | 152.16 | 8524 | 561.46 |
| **Depressed** | | | |
| #6 Houston Beltway 8 | | | |
| Depressed segment | 31.11 | 1743 | 114.78 |
| #7 Dallas (U.S. 75) | | | |
| Depressed segment | 34.84 | 1952 | 128.54 |
| #9 Lubbock (I-27) | | | |
| Depressed segment | 16.55 | 927 | 61.06 |
| #11 Lubbock (U.S. 62/82) | | | |
| Depressed segment | 22.46 | 1258 | 82.87 |
| #1 San Antonio (I-35) | | | |
| Depressed segment | 2.85 | 160 | 10.52 |
| #5 San Antonio U.S. 281 | | | |
| Depressed segment | 9.09 | 510 | 33.56 |
| **Total** | 116.89 | 6548 | 431.33 |

**Table 72. Construction Expenditures (Adjusted) and Estimated Employment and Output Effects (continued)**

| Study # (Grade type) | Construction Costs (millions per km) (1995 dollars) | Estimated Employment Effect (number per km) | Estimated Output Effect (millions per km) |
|---|---|---|---|
| **Control (At-grade) Segments** | | | |
| #6 Houston Beltway | | | |
| At-grade segment | 5.69 | 319 | 21.01 |
| #7 Dallas (U.S. 75) | | | |
| At-grade segment | 11.93 | 668 | 44.01 |
| #9 Lubbock (I-27) | | | |
| At-grade segment | 21.88 | 1226 | 80.75 |
| #11 Lubbock (U.S. 62/82) | | | |
| At-grade segment | 16.41 | 919 | 60.56 |
| #5 San Antonio U.S. 281 | | | |
| At-grade segment | 8.96 | 502 | 33.05 |
| **Total** | 64.87 | 3634 | 239.38 |

From Table 72, the following conclusions emerge:

1) Construction costs incurred on elevated freeways were much greater than those incurred on other types of freeways in the San Antonio study area. Consequently, the estimated employment and output effects generated from elevated freeway segments exceed those from other types of freeways. In the case of Lubbock, depressed sections seem to have generated the largest increases in employment and output effects. This is because the I-27 depressed section #9 cost more than the elevated section #8. Further, the depressed section #11 of U.S. 62/82 cost as much as section #10. However, the cost figures for the Lubbock study sections were approximations.

2) On the whole, elevated freeway sections appear to have generated the largest estimated increases in employment and output effects both in comparison to depressed sections and at-grade (control) sections.

One important factor needs to be kept in mind when interpreting these results. The employment and income impacts rely on the estimate of construction costs incurred on each freeway segment. As mentioned earlier, in the case of Lubbock study sections, the construction cost figures were provided for overlapping elevated and depressed sections, and the results were based on the approximate costs incurred on each individual section. Hence, to the extent that there exists a discrepancy between the actual freeway section construction cost and the costs reported in this chapter, these impacts can be considered only as approximate figures.

# IMPACT ON TAX REVENUES

Highway improvements are associated with substantial tax revenue impacts, and the evidence to support this notion is well documented in the literature. However, as noted in the review, not much exists in terms of the differing impacts of alternative freeway elevations or grade levels on the tax base. This section of the report discusses the methodology and presents the results for the property value tax base and sales tax base for all the study sections.

## PROPERTY TAX IMPACT

The value of the abutting property was used to estimate the proposed impact on property tax receipts from property abutting the different freeway sections. The following procedure was used to estimate the existing/remaining abutting property tax impacts in Lubbock, Houston, San Antonio, and Dallas.

The property tax rates are presented in Table 73 for all the cities. The sources of this data are the respective county tax offices and appraisal district offices. These rates are multiplied by the respective property values.

The analysis of property tax impacts in this report does not consider any exemptions. Furthermore, improvement values were not available for three of the four study areas in the scope of the study. In addition, for the city for which the breakdown between land and improvement values was available, it was not available consistently for all account numbers in the study section. Hence, the analysis of property tax impacts is based on land values alone. Land value normally appreciates when compared to the property value itself, the latter of which may be subject to some obsolescence and depreciation. Therefore, it is justifiable to use land values as an appropriate matrix for tax revenue impact analysis. Tables 74-77 summarize the tax impacts for the cities of Houston, San Antonio, Dallas, and Lubbock, respectively.

**Table 73. Property Tax Rates per $100 for Houston, Dallas, Lubbock, and San Antonio: Selected Years**

| Year | City | County Tax | City Tax | School District | Overall Rate for ISD |
|---|---|---|---|---|---|
| | Houston | | | | |
| 1982 | | .6524 | .495 | .609 | 1.7564 |
| 1986 | | .47793 | .53 | .7045 | 1.7124 |
| 1993 | | .60044 | .63 | 1.384 | 2.6144 |
| 1994 | | .62665 | .665 | 1.384 | 2.6756 |
| | Dallas | | | | |
| 1985-6 | | .3002 | .4918 | .6523 | 1.4443 |
| 1993-4 | | .46785 | .6744 | .4183 | 1.56055 |
| | San Antonio | | | | |
| 1983 | | .43388 | - | .80871 | 1.2425 |
| 1994 | | .75543 | .58797 | - | 1.55245 |
| | Lubbock | | | | |
| 1983 | | .18 | .6100 | 1.0000 | 1.7900 |
| 1994 | | .28456 | .6400 | 1.47500 | 2.39956 |

Source: County Tax Offices and Appraisal District Offices

**Table 74. Estimated Abutting Property Tax Revenue Impacts Before, During, and After Construction for Study Section #6 (Beltway 8)**

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues | | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|---|
| | | | Before | During | After | |
| **Houston** | Elevated | Commercial | 11932.63 | 164621.4 | 120784.15 | +912 |
| Section 6 | | Residential | 4870.67 | 24709.93 | 38254.8 | +685 |
| | | Vacant | 363.93 | 1491.5 | 3975.45 | +992 |
| | | Total | 17167.23 | 190822.83 | 163014.39 | +849 |
| | | Total per km | 35765.06 | 397547.6 | 339613.3 | +849 |
| Section 6 | Depressed | Commercial | 6754.41 | 25556.37 | 18565.24 | +175 |
| | | Residential | 179688.43 | 791524.26 | 964526.11 | +437 |
| | | Total | 186442.84 | 817080.63 | 983091.35 | +427 |
| | | Total per km | 105753.2 | 463460.4 | 557624.1 | +427 |
| Control | At-grade | Commercial | 1362.62 | 7508.87 | 10491.59 | +786 |
| | | Residential | 7541.28 | 64941.06 | 267884.77 | +3452 |
| | | Industrial | 119.61 | 1078.81 | 1592.17 | +1231 |
| | | Institutional | 151.58 | 0 | 1295.96 | +755 |
| | | Vacant | 116.98 | 979.49 | 1490.21 | +1173 |
| | | Total | 11274.07 | 76494.23 | 284334.62 | +2422 |
| | | Total per km | 5078.4 | 34456.9 | 128078.7 | +2422 |
| | | Overall | 214884.1 | 1084397.7 | 1430440.4 | +566 |
| | | Overall per km | 146596.6 | 895464.8 | 1025316.1 | +599 |

**Table 74. Estimated Abutting Property Tax Revenue Impacts Before, During and After Construction for Study Section #6 (Beltway 8) (continued)**

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues (1995=100) | | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|---|
| | | | Before | During | After | |
| **Houston** | Elevated | Commercial | 18844.9 | 241465.85 | 126166.96 | +569 |
| Section 6 | | Residential | 7692.13 | 36244.40 | 39799.83 | +417 |
| | | Vacant | 574.75 | 2187.73 | 4144.43 | +621 |
| | | Total | 27111.77 | 279897.97 | 170111.22 | +527 |
| | | Total per km | 56482.9 | 583120.8 | 354398.4 | +527 |
| Section 6 | Depressed | Commercial | 10667.07 | 37485.96 | 19340.75 | +81 |
| | | Residential | 283777.38 | 1161003.8 | 1004551.8 | +254 |
| | | Total | 294444.44 | 1198489.8 | 1023892.6 | +248 |
| | | Total per km | 167013.3 | 679801.3 | 580767.2 | +248 |
| Control | At-grade | Commercial | 2151.95 | 11013.97 | 11065.18 | +483 |
| | | Residential | 11909.75 | 95255.22 | 280782.45 | +2258 |
| | | Industrial | 188.89 | 1582.39 | 839.61 | +345 |
| | | Institutional | 239.39 | 0 | 1343.67 | +461 |
| | | Vacant | 184.75 | 1436.71 | 785.84 | +325 |
| | | Total | 16656.73 | 111274.29 | 296303.31 | +1679 |
| | | Total per km | 7503.03 | 50123.6 | 133469.9 | +1679 |
| | | Overall | 338212.9 | 1589662.1 | 1490307.1 | +341 |
| | | Overall per km | 230999.2 | 1313045.7 | 1068635.5 | +363 |

## Table 75. Estimated Abutting Property Tax Revenue Impacts Before and After Construction for Study Sections 1, 2, 3, 4, and 5 (I-10/35 and U.S. 281)

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|
| | | | Before | After | |
| **San Antonio** | Elevated | Commercial | 7886 | 39,773 | +404 |
| Section 4 | | Residential | 3443 | 17,527 | +409 |
| | | Industrial | 1940 | 6240 | +222 |
| | | Institutional | 4251 | 10,338 | +143 |
| | | Vacant | 1137 | 657 | -42 |
| | | Total | 18,656 | 74,534 | +300 |
| | | Total per km | 8219 | 32,835 | +300 |
| Sections 1,5 | Depressed | Commercial | 14,298 | 75,749 | +430 |
| | | Residential | 5096 | 8919 | +75 |
| | | Industrial | 0 | 6542 | - |
| | | Institutional | 144 | 0 | -100 |
| | | Vacant | 0 | 217 | - |
| | | Total | 19,537 | 91,428 | +368 |
| | | Total per km | 4045 | 18,929 | +368 |
| Control section | At-grade | Commercial | 3296 | 384,505 | +11565 |
| | | Residential | 2159 | 35,295 | +1535 |
| | | Institutional | 0 | 13,759 | - |
| | | Vacant | 0 | 2492 | - |
| | | Total | 5455 | 436,051 | +7894 |
| | | Total per km | 747 | 59733 | +7894 |
| Sections 2,3 | Double-Decker | Commercial | 15,090 | 51,668 | +242 |
| | | Residential | 14,314 | 34,592 | +142 |
| | | Industrial | 19,364 | 27,083 | +40 |
| | | Institutional | 3744 | 2147 | -43 |
| | | Vacant | 2802 | 11,640 | +315 |
| | | Total | 55,313 | 127,130 | +130 |
| | | Total per km | 9053 | 20,807 | +130 |
| | | Overall | 98,962 | 729,144 | +637 |
| | | Overall per km | 22,064 | 132,304 | +500 |

## Table 75. Estimated Abutting Property Tax Revenue Impacts Before and After Construction for Study Sections 1, 2, 3, 4, and 5 (I-10/35 and U.S. 281) (continued)

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues (1995=100) | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|
| | | | Before | After | |
| **San Antonio** | Elevated | Commercial | 12,067 | 40,900 | +239 |
| Section 4 | | Residential | 5268 | 18,023 | +242 |
| | | Industrial | 2968 | 6416 | +116 |
| | | Institutional | 6504 | 10,631 | +116 |
| | | Vacant | 1740 | 676 | -61 |
| | | Total | 28,547 | 76,647 | +168 |
| | | Total per km | 12,576 | 33,765 | +168 |
| Sections 1,5 | Depressed | Commercial | 21,877 | 93,212 | +326 |
| | | Residential | 7797 | 9712 | +18 |
| | | Industrial | 0 | 6727 | - |
| | | Institutional | 220 | 0 | -100 |
| | | Vacant | 0 | 217 | - |
| | | Total | 29,894 | 109,329 | +266 |
| | | Total per km | 6189 | 22,635 | +266 |
| Control section | At-grade | Commercial | 5043 | 395,402 | +7740 |
| | | Residential | 3303 | 36,925 | +999 |
| | | Institutional | 0 | 14,419 | - |
| | | Vacant | 0 | 2563 | - |
| | | Total | 8346 | 448,409 | +5273 |
| | | Total per km | 1143 | 61,426 | +5273 |
| Section s 2,3 | Double-Decker | Commercial | 23,089 | 53,132 | +130 |
| | | Residential | 21,902 | 35,573 | +62 |
| | | Industrial | 29,629 | 27,850 | -6 |
| | | Institutional | 5729 | 2208 | -61 |
| | | Vacant | 4288 | 11,970 | -179 |
| | | Total | 144,195 | 350,269 | +53 |
| | | Total per km | 84,636 | 130,733 | +53 |
| | | Overall | 211,211 | 983,775 | +405 |
| | | Overall per km | 33,760 | 139,223 | +312 |

**Table 76. Estimated Abutting Property Tax Revenue Impacts**
**Before and During Construction for Study Section #7 (Central Expressway)**

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues | | Percent Change (Before vs. During) |
|---|---|---|---|---|---|
| | | | Before | During | |
| **Dallas** | Elevated | Commercial | 3347 | 70,537 | +2007 |
| Section 7 | | Vacant | 0 | 5527 | - |
| | | Total | 3347 | 76,064 | +2173 |
| | | Total per km | 1992 | 45,276 | +2173 |
| Section 7 | Depressed | Commercial | 1,121,752 | 895,123 | -20 |
| | | Residential | 9043 | 11,223 | +24 |
| | | Industrial | 4978 | 2758 | -45 |
| | | Vacant | 143,716 | 143,424 | -.2 |
| | | Total | 1,279,489 | 1,052,528 | -18 |
| | | Total per km | 197,757 | 162,678 | -18 |
| Control | At-grade | Commercial | 1,046,709 | 1,698,029 | +62 |
| | | Residential | 263,850 | 173,963 | -34 |
| | | Industrial | 32,256 | 52,741 | +63 |
| | | Vacant | 494,611 | 629,042 | +27 |
| | | Total | 1,837,426 | 2,553,505 | +39 |
| | | Total per km | 252,394 | 350,756 | +39 |
| | | Overall | 3,120,262 | 2,966,018 | -5 |
| | | Overall per km | 452,143 | 460,348 | +2 |

Table 76. Estimated Abutting Property Tax Revenue Impacts Before and During Construction for Study Section #7 (Central Expressway) (continued)

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues(1995=100) | | Percent Change (Before vs. During) |
|---|---|---|---|---|---|
| | | | Before | During | |
| **Dallas** | Elevated | Commercial | 4741 | 74,393 | +1469 |
| Section 7 | | Vacant | 0 | 5829 | - |
| | | Total | 4741 | 80,223 | +1592 |
| | | Total per km | 2822 | 47,751 | +1592 |
| Section 7 | Depressed | Commercial | 1,588,801 | 944,061 | -41 |
| | | Industrial | 7051 | 2909 | -59 |
| | | Residential | 12,808 | 11,837 | -8 |
| | | Vacant | 203,553 | 151,265 | -26 |
| | | Total | 1,812,213 | 1,110,071 | -39 |
| | | Total per km | 280,095 | 171,572 | -39 |
| Control | At-grade | Commercial | 1,482,513 | 1,790,862 | +21 |
| | | Residential | 373,706 | 183,474 | -51 |
| | | Industrial | 45,686 | 55,340 | +21 |
| | | Vacant | 700,546 | 663,433 | -5 |
| | | Total | 2,602,451 | 2,693,108 | +3 |
| | | Total per km | 357,480 | 369,932 | +3 |
| | | Overall | 4,419,405 | 3,883,402 | -12 |
| | | Overall per km | 640,396 | 485,516 | -24 |

**Table 77. Estimated Abutting Property Tax Revenue Impacts Before and After Construction for Study Sections 8 and 9 (I-27)**

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|
| | | | Before | After | |
| **Lubbock** | Elevated | Commercial | 18,936 | 29,340 | +55 |
| Section 8 | | Residential | 2712 | 5576 | +106 |
| | | Industrial | 5139 | 8811 | +71 |
| | | Total | 26,787 | 43727 | +63 |
| | | Total per km | 8870 | 14,479 | +63 |
| Section 9 | Depressed | Commercial | 17,428 | 25,154 | +44 |
| | | Residential | 2778 | 1234 | -56 |
| | | Institutional | 0 | 234 | - |
| | | Total | 20,207 | 26,623 | +32 |
| | | Total per km | 4175 | 5501 | +32 |
| Control | At-grade | Commercial | 1167 | 4110 | +252 |
| | | Residential | 5248 | 8474 | +62 |
| | | Institutional | 75 | 98 | +32 |
| | | Vacant | 103 | 125 | +21 |
| | | Total | 6591 | 12,807 | +94 |
| | | Total per km | 4112 | 8004 | +94 |
| | | Overall | 53,584 | 83,156 | +55 |
| | | Overall per km | 17,164 | 27,984 | +63 |

**Table 77. Estimated Abutting Property Tax Revenue Impacts Before and After Construction for Study Sections 8 and 9 (I-27) (continued)**

| City and Section | Freeway Elevation | Property Type | Property Tax Revenues (1995=100) | | Percent Change (Before vs. After) |
|---|---|---|---|---|---|
| | | | Before | After | |
| **Lubbock** | Elevated | Commercial | 28,974 | 30,171 | +4 |
| Section 8 | | Residential | 4149 | 5734 | +38 |
| | | Industrial | 7864 | 9060 | +15 |
| | | Total | 40,987 | 44,966 | +10 |
| | | Total per km | 13,572 | 14,889 | +10 |
| Section 9 | Depressed | Commercial | 26,667 | 25,867 | -3 |
| | | Residential | 4251 | 1269 | -70 |
| | | Institutional | 0 | 240 | - |
| | | Total | 30,918 | 27,337 | -12 |
| | | Total per km | 6388 | 5656 | -12 |
| Control | At-grade | Commercial | 1785 | 4227 | +137 |
| | | Residential | 8030 | 8714 | +9 |
| | | Institutional | 114 | 101 | -12 |
| | | Vacant | 157 | 128 | -18 |
| | | Total | 10,086 | 13,170 | +31 |
| | | Total per km | 6304 | 8231 | +31 |
| | | Overall | 81,991 | 85,513 | +4 |
| | | Overall per km | 26,264 | 28,777 | +10 |

**Houston**

Houston at-grade sections in the 'after' period or post-construction period show a 1679% appreciation in property tax revenues (1995 dollars) when compared to the before period. Elevated segments of Beltway 8 showed an increase of 527%, and depressed sections show the lowest increase at 248%. Overall, the entire Houston study section #6 showed a 341% increase in tax revenues (1995 dollars) in the post-construction period when compared to the pre-construction period.

**San Antonio**

At-grade segments of the I-35/I-10 and U.S. 281 study sections showed the greatest increase in property tax revenues, as shown in Table 75. Tax revenues increased overall (312%, 1995 dollars) as well as within segments abutting at-grade, depressed, elevated, and double-decker types of freeways.

**Dallas**

Property tax revenues from properties abutting elevated sections of Central Expressway showed the maximum increase. Overall, however, tax revenues per kilometer of freeway length showed a decline of -24% (1995 dollars) in the during-construction period. Since tax rates did not decline and relocations were minimal, this reduction in tax revenues could only have been due to a reduction in land values, especially along the depressed section. Tax revenues from residential properties also declined on both at-grade and depressed segments of North Central Expressway. This factor also implies a decline in residential land values.

**Lubbock**

At-grade control sections show the maximum increase in tax revenues. Tax revenues declined by 12% (1995 dollars) on the depressed section of I-27, whereas tax revenues per kilometer increased on the elevated and at-grade control sections of I-27 by 10% and 31%, respectively. Overall, tax revenues (per kilometer of construction) from properties abutting I-27 study sections increased 10% (1995 dollars).

The evidence shows that, in general, at-grade control sections have shown the best performance in terms of tax revenues, excluding the Dallas study section. Property tax revenues from depressed sections have generally tended to lag behind elevated sections in all study areas. Further, depressed sections did not show a positive increase in revenues in the Lubbock and Dallas areas. Since tax rates did not decline over the period, this suggests that land values in these areas must have declined substantially during the period under consideration.

**Summary of Property Tax Revenue Impacts**

When all study areas were considered on an individual basis, the evidence suggests that, in general, the control sections showed the maximum appreciation in terms of tax revenues. For study sections in the San Antonio area. depressed sections (1, 5) showed a stronger increase than both elevated and double-decker sections (4, 2, and 3). At-grade sections, however, showed the maximum increase at 5273% (1995 dollars). In the case of the I-27 study sections, the elevated section (8) outperformed the depressed section, (9) but again, both sections tended to lag behind the control at-grade section. In the case of Central Expressway and Beltway 8 study sections, elevated segments of the study freeways tended to outperform depressed segments. At-grade segments of Beltway 8, however, outperformed all other segments. At-grade segments did not perform nearly as well as elevated segments of the Central Expressway study section but outperformed depressed segments. However, in terms of the relative performance of elevated and depressed types of freeways within a study area, in most situations, depressed sections have tended to lag behind elevated sections for both residential and commercial land uses as well as overall. The depressed sections outperform elevated sections in the case of the San Antonio study sections.

In order to obtain further insight, the percent increases in tax revenues (1995 dollars) were reclassified using the original study section classifications in Table 78 below. The Dallas study section was excluded because construction is still underway. Table 78 clearly shows that: 1) control at-grade segments outperform other sections, and 2) depressed sections with an average increase of 167.3% outperform elevated and double-decker sections in terms of property tax revenues.

**Table 78. Before and After Percent Change in Property Tax Revenues by Freeway Section**

| Study Section Number | City | % Increase or Decrease | % Increase or Decrease on At-Grade Control Segments |
|---|---|---|---|
| Depressed | | | |
| 6 | Houston | 248 | 1679 |
| 1, 5 | San Antonio | 266 | 5273 |
| 9 | Lubbock | -12 | 31 |
| | Average | 167.3 | 2327.7 |
| Elevated | | | |
| 4 | San Antonio | 168 | 5273 |
| 8 | Lubbock | 10 | 31 |
| | Average | 89 | 2652 |
| Double-Decker | | | |
| 2, 3 | San Antonio | 53 | 5273 |

## BUSINESS SALES IMPACT

The gross sales impact is discussed in this section of the report because of the implications it has on sales tax revenues. The assessment of the sales tax revenue impacts on businesses abutting the study freeways is discussed in the following section. In the most ideal scenario, the responses of businesses to survey questions pertaining to the sales level before, during, and after construction are the most appropriate sources of data for this type of analysis. However, most businesses consider this information confidential and are reluctant to impart any information on actual gross sales levels. In regard to this project, out of all the surveys administered to highway businesses in Lubbock, San Antonio, Houston, and Dallas, only 17 businesses disclosed their actual sales level information. Businesses were also asked information on their actual gross sales category or range of gross sales in addition to their levels. The majority of the business respondents responded to sales related questions by selecting the appropriate sales category before and after the highway construction. The analysis of the survey-type questions on sales is included in the previous section of this report.

The goal of this section is to use publicly available information in order to arrive at an approximate effect on broad groups of highway businesses, in the absence of firsthand information on actual sales. The major sources of data used in this section of the report are the State Comptroller's Office and the City Directories. The problem with the State Comptroller data is that the sales information is highly aggregative; this is once again due to disclosure problems. The State Comptroller's Office provides information on the total number of reporting outlets and gross sales of businesses grouped in the following categories:

1. A-Agriculture, Forestry, and Fishing
2. B-Mining
3. C-Construction
4. D-Manufacturing
5. E-Transportation, Communications, Electric, Gas, and Sanitary Services
6. F-Wholesale Trade
7. G-Retail Trade
8. H-Finance, Insurance, and Real Estate (F.I.R.E)
9. I-Services
10. J-Public Administration
11. K-Nonclassifiable Establishments

The following steps are involved in the estimation of the impacts on gross sales of highway abutting businesses:

Step 1. The first step was to classify businesses in the study section from the City Directory according to business type, where type refers to the 11 categories mentioned above. An interesting hypothesis is what happens to sales of traffic-serving businesses. However, this level of detail is precluded due to the aggregative nature of data available, and the analysis is restricted to the 11 major groups mentioned above.

Step 2. The second step was to estimate the average gross sales per business in each of the 11 categories before and after construction (or during construction for projects under construction). The State Comptroller's gross sales data and number of reporting outlets were used in order to estimate this figure for each city.

Step 3. The number of highway businesses in the study section by type, was multiplied by the average gross sales per business of the corresponding type, as determined in Step 2, to determine the total gross sales of all businesses of that type for the before and after period (or during period for projects under construction).

This procedure is repeated for all projects in each of the four cities.

Table 79 summarizes the number of reporting outlets for the relevant zip codes on I-27 in Lubbock before and after highway construction as well as in the study section. I-27 was actually Avenue H prior to construction between U.S. 87 on the North end to 64th Street on the South. A segment between U.S. 87 and 26th Street was bypassed completely by the elevated segment of I-27, and this portion of Avenue H was also included in the before period. Two factors need to kept in mind:

1) This segment of Avenue H has a before period but not an after period because I-27 bypassed this segment. 2) Furthermore, the new I-27 has no comparable before period to be used in the analysis for this segment, and there were no new businesses alongside this segment of I-27. For these reasons, it was decided to evaluate the effects two ways. The first approach limits the analysis to the overlapping segment between 26th Street and 80th Street, and the second approach includes the bypassed segment of Avenue H. The results of the first approach are included in column 1 of Tables 79-81, and those of the second approach are included in column 2.

## Table 79. Number and Percentage of Businesses Abutting I-27 Before and After Construction: Lubbock

| Industry | Year | Number of Outlets in the Zip Code | | % of Total | | Number of Outlets on I-27 By Grade Level | | % of Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | Col. 1[14] | Col. 2 | Col. 1 | Col. 2 | Col. 1 | Col. 2 | Col. 1 | Col. 2 |
| Construction | 1984 | 28 | 21 | 5.52 | 3.65 | 2 (1 #9; 1 A) | 5 (3#8; 1#9; 1 A) | 1.36 | 2.08 |
| | 1994 | 26 | 26 | 6.89 | 5.54 | 0 | 0 | 0.00 | 0.00 |
| Manufacturing | 1984 | 46 | 44 | 9.07 | 7.64 | 5 (1#8, 2#9; 2 A) | 8 (4#8; 2#9; 2 A) | 3.40 | 3.33 |
| | 1994 | 30 | 30 | 7.96 | 6.39 | 3 (A) | 3 (A) | 5.17 | 5.17 |
| Agriculture | 1984 | 0 | 2 | 0.00 | 0.35 | 0 | 0 | 0.00 | 0.00 |
| | 1994 | 9 | 9 | 2.39 | 1.92 | 0 | 0 | 0.00 | 0.00 |
| Transportation and Energy Services | 1984 | 3 | 9 | 0.59 | 1.56 | 0 | 1 | 0.00 | 0.42 |
| | 1994 | 5 | 8 | 1.33 | 1.71 | 0 | 0 | 0.00 | 0.00 |
| Retail Trade | 1984 | 229 | 288 | 45.2 | 50.0 | 91(45#8; 45#9; 1 A) | 141 (95#8; 45#9; 1 A) | 61.9 | 58.8 |
| | 1994 | 158 | 211 | 41.9 | 44.9 | 34(15#8, 18#9, 1 A) | 34(15#8, 18#9, 1 A) | 53.4 | 58.6 |
| Services | 1984 | 78 | 109 | 15.4 | 18.9 | 47 (13#8; 34#9) | 72 (38#8; 34#9) | 31.9 | 30.0 |
| | 1994 | 74 | 102 | 19.6 | 21.7 | 21 (4#8; 16#9, 1 A) | 21 (4#8; 16#9, 1 A) | 36.2 | 36.2 |
| Wholesale Trade | 1984 | 123 | 92 | 24.3 | 15.9 | 2 (#9) | 11 (9#8; 2#9) | 1.36 | 4.58 |
| | 1994 | 73 | 67 | 19.4 | 14.2 | 0 | 0 | 0.00 | 0.00 |
| F.I.R.E | 1984 | 0 | 9 | 0.0 | 1.56 | 0 | 2 (#8) | 0.00 | 0.83 |
| | 1994 | 0 | 13 | 0.0 | 2.77 | 0 | 0 | 0.00 | 0.00 |
| Public Administration | 1994 | 0 | 1 | 0.0 | 0.21 | 0 | 0 | 0.00 | 0.00 |
| All Major Divisions | 1984 | 507 | 576 | 100 | 100 | 147 (59#8; 84#9; 4 A) | 240 (152#8;84#9;4 A) | 100 | 100 |
| | 1994 | 377 | 469 | 100 | 100 | 58 (19#8; 34#9; 5 A) | 58 (19#8; 34#9; 5 A) | 100 | 100 |

[14]Col 1 excludes the bypassed segment of Avenue H, whereas Col. 2 includes this segment. The after period (1994) is the same for both, however, primarily because there were no new businesses along the corresponding elevated segment of I-27. 'A' stands for At-grade control section.

**Table 80. Gross Sales, Average Gross Sales, and the Overall Number of Reporting Outlets in the Zip Code (s): Lubbock**

| Industry | Year | Number of Outlets in the Zip Code | | Gross Sales (dollars) | | Average Gross Sales | |
|---|---|---|---|---|---|---|---|
| | | Col. 1 | Col. 2 | Col. 1 | Col. 2 | Col.1 | Col. 2 |
| Construction | 1984 | 28 | 21 | 33,239,1'6 | 41,580,704 | 1,187,111 | 1,980,034 |
| | 1994 | 26 | 26 | 72,825,229 | 85.285,716 | 2,800,970 | 3,280,220 |
| Manufacturing | 1984 | 46 | 44 | 179,000,000 | 215.844.628 | 3,891,304 | 4,905,560 |
| | 1994 | 30 | 30 | 321,000,000 | 414.621.321 | 10,700,000 | 13,820,711 |
| Agriculture | 1984 | 0 | 2 | 0 | NA | 0 | NA |
| | 1994 | 9 | 9 | 1,876,152 | 5,124,730 | 208,461.3 | 569,414 |
| Transportation and Energy Services | 1984 | 3 | 9 | NA | 52,959,342 | NA | 5,884,371 |
| | 1994 | 5 | 8 | 23,700,000 | 152,896.255 | 4,733,268 | 19,112,032 |
| Retail Trade | 1984 | 229 | 288 | 137,000,000 | 284.206.465 | 598.253.3 | 986,828 |
| | 1994 | 158 | 211 | 216,000,000 | 384,644,587 | 1,367,089 | 1,822,960 |
| Services | 1984 | 78 | 109 | 21,269,386 | 51,642,361 | 272,684.4 | 473,783 |
| | 1994 | 74 | 102 | 41,018,605 | 77,228,518 | 554,305.5 | 757,142 |
| Wholesale Trade | 1984 | 123 | 92 | 1140,000,000 | 1220,000,000 | 9,268,293 | 13,260,870 |
| | 1994 | 73 | 67 | 1570,000,000 | 1667.198.447 | 21,506,849 | 24,883,559 |
| F.I.R.E | 1984 | 0 | 9 | 0 | 760,571 | 0 | 84,508 |
| | 1994 | 0 | 13 | 0 | 3,024,398 | 0 | 232,646 |
| Mining | 1984 | 0 | 2 | 0 | 0 | 0 | 0 |
| | 1994 | 2 | 2 | NA | 5,124,730 | NA | 569,414 |
| All Major Divisions | 1984 | 507 | 576 | 1510,000,000 | 1866.994,071 | 2,979,307 | 3,241,309 |
| | 1994 | 377 | 469 | 2250,000,000 | 2790,023,972 | 5,958,571 | 5,948,878 |

**Table 81. Estimated Gross Sales of Abutting Businesses on I-27 (Lubbock) Before and After Construction**

| Industry | Year | Number of Outlets on I-27 | | Estimated Gross Sales (actual dollars)[15] | | Estimated Gross Sales (1995=100) | | % Change Real (Before vs. After) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Col.1 | Col. 2 | Col.1 | Col. 2 | Col.1 | Col. 2 | Col. 1 | Col. 2 |
| Construction | 1984 | 2 | 5 | 2,374,223 | 9,[illegible]00,168 | 3.482,498 | 14,521,516 | -100 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Manufacturing | 1984 | 5 | 8 | 19,456,522 | 39,244,478 | 28,538,729 | 57,563,604 | +65 | -26 |
| | 1994 | 3 | 3 | 32,100,000 | 41.462,132 | 47,084,119 | 42,637,172 | | |
| Retail Trade | 1984 | 91 | 141 | 54,441,048 | 139,142,748 | 79,853,857 | 213,960,748 | -14.6 | -67 |
| | 1994 | 34 | 34 | 46,481,013 | 61,980.644 | 68,178,117 | 63,737,181 | | |
| Services | 1984 | 47 | 72 | 12,816,168 | 34,112,385 | 18,798.692 | 50,035,876 | -9.2 | -69 |
| | 1994 | 21 | 21 | 11,640,415 | 15.899,989 | 17,074,102 | 16,350,596 | | |
| F.I.R.E | 1984 | 0 | 2 | 0 | 169,016 | 0 | 247.912 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Telecommunications and Energy Services | 1984 | 0 | 1 | 0 | 5,884,371 | 0 | 8,631,166 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Wholesale Trade | 1984 | 2 | 11 | 18,536,585 | 145,869,565 | 27,189,371 | 213,960,748 | -100 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Total Estimated Sales | 1984 | 147 | 240 | 107.624.546 | 374,322.732 | 157.863,146 | 549,054.709 | -41 | -78 |
| | 1994 | 58 | 58 | 90,221,421 | 119,342.765 | 92,778,310 | 122.724,949 | | |

[15]This column is the product of Column 5 (Table 9) and "number of outlets" column (Table 10). while the total sales is just the sum of sales within the study section.

Table 79 presents the number of businesses in the relevant zip codes and in the I-27 study sections for the before- and after-construction periods. One aspect is very clear. There is considerable reduction in the number of businesses, both in the area as a whole as well as along I-27, especially in the retail trade and wholesale trade categories. Table 79 also shows the number of businesses of each type in each of two study sections (#8 and #9) as well as the at-grade control section (A). There were a total of 240 businesses in the before period using the first approach (including bypassed segment of Avenue H). Of these, 152 businesses (63.3%) were located in Section #8; 84 (35%) were located in Section #9, and the remaining 4 (1.7%) were located on the at-grade control segment. Using the second approach, the total number of businesses is 147 with 40.1%, 57.1%, and 2.7% located in Sections #8, #9, and control, respectively. In the after construction period, the number of businesses decreased to 58 with 32.8% located on Section #8, 58.6% located on Section #9, and 8.6% located on the at-grade segment. The reduction in the number of businesses is noticeable, particularly within Section #8.

Table 80 shows that while there has been a decrease in the number of businesses in the area as a whole, sales actually increased in real terms (adjusting the gross sales figures in column 4 of Table 80 using the U.S. Consumer Price Index the percentage change is 4% (Column 1) and 5% (Column 2)). On the contrary, Table 81 shows that sales declined (in real terms) for the Lubbock study section. Table 81 also summarizes the overall impact on the gross sales of all businesses abutting I-27 in Lubbock. With the exception of manufacturing firms, all other categories seem to have registered losses in the after-construction period. All firms as a whole also appear to have shown a decrease in the gross sales in the after period. One important reason for this factor is a reduction in the number of businesses due to right-of-way acquisitions and non-entry of new firms. For example, the number of businesses in the retail-trade category went down drastically from 91 in 1984 to 34 in 1994 using the first approach and from 141 to 34 using the second approach. The same can be said of services. Furthermore, the overall number of businesses in the relevant zip codes also decreased by 26% using the first approach and by 19% using the second approach.

Tables 81-84 summarize the impact on sales by section. The individual section results, however, indicate that both the elevated Section #8 and the depressed Section #9 show large decreases in the real sales levels, while the at-grade sections show a 149% increase in sales. Furthermore, sales for the area as a whole also increased even though there was a decline in the number of businesses. Within the study section, therefore, this negative impact may be attributed to construction-related activity, such as right-of-way acquisitions. The performance of Section #9 (depressed), though negative, was still better than Section #8 (elevated).

The estimated sales impact on the San Antonio U.S. 281 businesses is shown in Tables 85-89. Table 85 shows the total number of businesses in the relevant zip codes as well as those abutting the U.S. 281 study section. Table 86 presents the gross sales and average gross sales obtained from the information provided by the State Comptroller. It also indicates that gross sales in real terms increased by 268% for the area as a whole. Table 87 presents the overall section results and Tables 88-89 present the depressed segment and at-grade (control) segment results, respectively. The study section as a whole did not perform as well as the area as a whole in this situation; however, the depressed section outperformed the whole area performance. Table 87 indicates that in the U.S. 281 study section, business sales increased both in real and actual terms in the after period for all categories, with the exception of F.I.R.E. The largest increases were noted for retail trade firms and firms in the services category. The evidence suggests that sales increased for the overall study section by 214%. The depressed section sales increase surpassed that of the control at-grade segment. One interesting aspect is the number of businesses on the depressed segment in the retail sector increased from 9 to 26 and in the services sector from 5 to 50. The overall number of businesses located adjacent the depressed segment increased from 18 to 89, while the increase was not as large in the number adjacent the at-grade segment.

## Table 82. Estimated Sales Impact by Type of Business: Lubbock Section #8

| Industry | Year | Number of Reporting Outlets in Section #8 | | Estimated Gross Sales[16] (1995=100) | | % Change Real | |
|---|---|---|---|---|---|---|---|
| | | Col. 1 | Col. 2 | Col. 1 | Col. 2 | Col. 1 | Col. 2 |
| Construction | 1984 | 0 | 3 | 0 | 8,712,910 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | | |
| Manufacturing | 1984 | 1 | 4 | 5,707,745 | 28,781,802 | -100 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | | |
| Transportation and Energy Services | 1984 | 0 | 1 | 0 | 8.631,166 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | | |
| Retail Trade | 1984 | 45 | 95 | 39,488,173 | 137,510,066 | -47 | -80 |
| | 1994 | 15 | 15 | 21,087,486 | 28,119,344 | | |
| Services | 1984 | 13 | 38 | 5,199,637 | 26,407,823 | -56 | -88 |
| | 1994 | 4 | 4 | 2,280,058 | 3,114,399 | | |
| Wholesale Trade | 1984 | 0 | 9 | 0 | 175,058,794 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | | |
| F.I.R.E | 1984 | 0 | 2 | 0 | 247,911 | 0 | -100 |
| | 1994 | 0 | 0 | 0 | 0 | | |
| Total Estimated Sales | 1984 | 59 | 152 | 50,395,555 | 385,350,473 | -54 | -92 |
| | 1994 | 19 | 19 | 23,367,544 | 31,233,744 | | |
| Total Estimated Sales per km | 1984 | 59 | 152 | 16,687,270 | 12,759,949 | | |
| | 1994 | 19 | 19 | 7,737,597 | 10,342,299 | | |

[16]These numbers have been derived by using the average gross sales figures reported in Table 9 (Column 5).

## Table 83. Estimated Sales Impact by Type of Business: Lubbock Section #9

| Industry | Year | Number of Reporting Outlets in Section #8 | Estimated Gross Sales (1995=100) | % Change Real |
|---|---|---|---|---|
| Construction | 1984 | 1 | 1,741,249 | -100 |
| | 1994 | 0 | 0 | |
| Manufacturing | 1984 | 2 | 11,415,492 | -100 |
| | 1994 | 0 | 0 | |
| Retail Trade | 1984 | 45 | 39,488,171 | -36 |
| | 1994 | 18 | 25,304,976 | |
| Services | 1984 | 34 | 13,599,054 | -33 |
| | 1994 | 16 | 9,120,233 | |
| Wholesale Trade | 1984 | 2 | 27,189,371 | -100 |
| | 1994 | 0 | 0 | |
| Total Estimated Sales | 1984 | 84 | 93,433,336 | -63 |
| | 1994 | 34 | 34,425,209 | |
| Total Estimated Sales per km | 1984 | 84 | 19,304,408 | |
| | 1994 | 34 | 7,112,647 | |

**Table 84. Estimated Sales Impact by Type of Business: Lubbock I-27 Control Section**

| Industry | Year | Number of Reporting Outlets in Section #8 | Estimated Gross Sales (1995=100) | % Change Real |
|---|---|---|---|---|
| Construction | 1984 | 1 | 1,741,249 | -100 |
| | 1994 | 0 | 0 | |
| Manufacturing | 1984 | 2 | 11,415,492 | +189 |
| | 1994 | 3 | 33,009,717 | |
| Retail Trade | 1984 | 1 | 877,515 | +60 |
| | 1994 | 1 | 1,405,832 | |
| Services | 1984 | 0 | 0 | +100 |
| | 1994 | 1 | 570,015 | |
| Total Estimated Sales | 1984 | 4 | 14,034,255 | +149 |
| | 1994 | 5 | 34,985,563 | |
| Total Estimated sales per km | 1984 | 4 | 8,771,409 | |
| | 1994 | 5 | 21,865,977 | |

**Table 85. Number and Percentage of Businesses Abutting U.S. 281 Before and After Construction: San Antonio**

| Industry | Year | Number of Reporting Outlets in the Zip Code(s) | % of Total | Number of Outlets on U.S. 281 | % of Total |
|---|---|---|---|---|---|
| Construction | 1984 | 10 | 2.3 | 4 (A[17]) | 2.4 |
| | 1993 | 41 | 5.7 | 1 (D) | 0.4 |
| Manufacturing | 1984 | 20 | 4.6 | 4 (A) | 2.4 |
| | 1993 | 24 | 3.3 | 10 (5D, 5A) | 4.0 |
| Agriculture | 1984 | 2 | 0.5 | 2 (1D, 1A) | 1.2 |
| | 1993 | 24 | 3.3 | 1 (1D) | 0.0 |
| Transportation and Energy Services | 1984 | 0 | 0 | 0 | 0.0 |
| | 1993 | 6 | 0.8 | 5 (3D, 2A) | 2.0 |
| Retail Trade | 1984 | 279 | 64.1 | 87 (9D, 78A) | 51.8 |
| | 1993 | 384 | 53.3 | 100 (26D, 74A) | 40.0 |
| Services | 1984 | 88 | 20.2 | 66 (5D, 61A) | 39.3 |
| | 1993 | 200 | 27.7 | 128 (50D, 78A) | 51.2 |
| Wholesale Trade | 1984 | 32 | 7.4 | - | - |
| | 1993 | 36 | 4.9 | - | - |
| F.I.R.E | 1984 | 4 | 0.9 | 4 (3D, 1A) | 2.4 |
| | 1993 | 6 | 0.8 | 5 (3D, 2A) | 2.0 |
| All Major Divisions | 1984 | 435 | 100 | 167 (18D, 149A) | 100 |
| | 1993 | 721 | 100 | 250 (89D, 161A) | 100 |

[17] 'A' stands for at-grade section and 'D' stands for depressed segments. The figures in parentheses in Column 5 tell us how many firms of a particular type are on the at-grade segment and depressed segments.

**Table 86. Gross Sales, Average Gross Sales, and the Overall Number of Reporting Outlets in the Zip Code (s): U.S. 281 (San Antonio)**

| Industry | Year | Number of Reporting Outlets in the Zip Code (s) | Gross Sales (dollars) | Average Gross Sales |
|---|---|---|---|---|
| Construction | 1984 | 10 | 2,694,555 | 269,455.5 |
| | 1993 | 41 | 64,512,205 | 1,573,468 |
| Manufacturing | 1984 | 20 | 8,800,580 | 440,029 |
| | 1993 | 24 | 7,718,947 | 321,622.8 |
| Agriculture | 1984 | 2 | NA | NA |
| | 1993 | 24 | 2,509,846 | 104,576.9 |
| Transportation and Energy Services | 1984 | 0 | - | - |
| | 1993 | 6 | 7,84,441 | 130,740.2 |
| Retail Trade | 1984 | 279 | 54,666,747 | 195,938.2 |
| | 1993 | 384 | 268,250,261 | 698,568.4 |
| Services | 1984 | 88 | 8,495,118 | 96,535.4 |
| | 1993 | 200 | 61,135,268 | 305,676.3 |
| Wholesale Trade | 1984 | 32 | 7,253,807 | 961,662 |
| | 1993 | 36 | 34,619,832 | 226,681.5 |
| F.I.R.E | 1984 | 4 | 11,811 | 2952.8 |
| | 1993 | 6 | 7356 | 1226 |
| All Major Divisions | 1984 | 435 | 76,906,654 | 176,796.91 |
| | 1993 | 721 | 439,538,156 | 609,623.00 |

**Table 87. Estimated Gross Sales of Abutting Businesses on U.S. 281 (San Antonio) Before and After Construction (Overall)**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Construction | 1984 | 4 | 1,077,822 | 1,580,943 | +5 |
| | 1993 | 1 | 1,573,468 | 1,659,491 | |
| Manufacturing | 1984 | 4 | 1,760,116 | 2,581,729 | +31 |
| | 1993 | 10 | 3,216,228 | 3,392,063 | |
| Agriculture | 1984 | 2 | NA | NA | - |
| | 1993 | 1 | 104,576.9 | 110,294.3 | |
| Transportation and Energy services | 1984 | 0 | NA | NA | - |
| | 1993 | 5 | 653,701 | 689,439.7 | |
| Retail Trade | 1984 | 87 | 16,850,685 | 24,716,500 | +198 |
| | 1993 | 100 | 69,856,840 | 73,676,003 | |
| Services | 1984 | 66 | 6,371,336 | 9,345,444 | +342 |
| | 1993 | 128 | 39,126,566 | 41,265,666 | |
| Wholesale Trade | 1984 | 0 | - | - | - |
| | 1993 | 0 | - | - | |
| F.I.R.E | 1984 | 4 | 11,811.2 | 17,324.6 | -63 |
| | 1993 | 5 | 6130 | 6465 | |
| Total Estimated Effect | 1984 | 167 | 26,267,709 | 38,529,344 | +214 |
| | 1993 | 250 | 114,537,510 | 120,799,423 | |

**Table 88. Estimated Gross Sales of Abutting Businesses on U.S. 281 (San Antonio) Before and After Construction (Depressed Section)**

| Industry | Year | Number of Outlets | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|
| Construction | 1984 | 0 | 0 | - |
| | 1993 | 1 | 1,659,492 | |
| Manufacturing | 1984 | 0 | 0 | - |
| | 1993 | 5 | 1,696032 | |
| Agriculture | 1984 | 1 | NA | - |
| | 1993 | 1 | 110,294 | |
| Transportation and Energy services | 1984 | 0 | 0 | - |
| | 1993 | 3 | 413,664 | |
| Retail Trade | 1984 | 9 | 2,586,611 | +641 |
| | 1993 | 26 | 19,155,761 | |
| Services | 1984 | 5 | 707,988 | +2177 |
| | 1993 | 50 | 116,119,401 | |
| F.I.R.E | 1984 | 3 | 12,994 | -70 |
| | 1993 | 3 | 3879 | |
| Total Estimated Effect | 1984 | 18 | 3,307,592 | +1084 |
| | 1993 | 89 | 39,158,522 | |
| Total Estimated Effect per km | 1984 | | 1,768,766 | |
| | 1993 | | 20,940,386 | |

**Table 89. Estimated Gross Sales of Abutting Businesses on U.S. 281 (San Antonio) Before and After Construction (At-Grade Section)**

| Industry | Year | Number of Outlets | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|
| Construction | 1984 | 4 | 1,580,944 | -100 |
| | 1993 | 0 | 0 | |
| Manufacturing | 1984 | 4 | 2,581,729 | |
| | 1993 | 5 | 1,696032 | |
| Agriculture | 1984 | 1 | NA | - |
| | 1993 | 0 | 0 | |
| Transportation and Energy services | 1984 | 0 | 0 | - |
| | 1993 | 2 | 275,776 | |
| Retail Trade | 1984 | 78 | 22,417,292 | +143 |
| | 1993 | 74 | 54,520,242 | |
| Services | 1984 | 61 | 8,637,456 | +191 |
| | 1993 | 78 | 25,146,265 | |
| F.I.R.E | 1984 | 1 | 4331 | -40 |
| | 1993 | 2 | 2586 | |
| Total Estimated Effect | 1984 | 149 | 35,221,752 | +132 |
| | 1993 | 161 | 81,640,901 | |
| Total Estimated Effect per km | 1984 | | 18,835,161 | |
| | 1993 | | 43,658,236 | |

Tables 90-95 show the impact on businesses abutting Central Expressway study and control sections. Table 90 presents the total number of businesses abutting Central Expressway. The overall study area sales increased in real terms by 5% (obtained by adjusting the gross sales figures in Table 91 column 4 by the CPI. Gross sales were $9.75 billion in 1986 (1995 dollars) and $10.2 billion in 1991 (1995 dollars). The percent difference is +5%. The actual overall study section gross sales, however, decreased in real terms by about 5%. (This can be obtained by estimating gross sales for the overall study sections as done in Table 92). In the case of the Central Expressway depressed segment, sales increased in real terms for all major divisions combined by 43%. This is shown in Table 93. Among the individual industry groups, construction, manufacturing, and F.I.R.E saw a marked decrease in the during-construction period, both in real and actual terms. Retail trade also registered a small decrease in sales in real terms, although the sales actually increased in actual terms. Very few firms were located adjacent the elevated segment: three in 1986 and only one in 1991. Sales declined by 89% on the elevated segment as shown in Table 94. Table 95 shows the impact on businesses adjacent the control section of Central Expressway. Sales decreased by 39% on the at-grade segment during the construction period. Comparing the three segments, businesses abutting the depressed segment show an improvement in sales in comparison to those adjacent to the elevated and at-grade segments.

Tables 96-101 show the number of reporting outlets as well as average and estimated gross sales figures for the Houston study and control section. Retail trade types of firms constitute the majority along the Beltway 8 study sections. Overall, in real terms, sales increased by 333% along the Beltway 8 study section while they increased by only 78% for the area as a whole (obtained by adjusting the figures in column 4, Table 97 by the CPI). In this case, there is evidence that the study section may have outperformed the area as a whole.

The results can be summarized as follows:

1) At-grade control sections in the Lubbock study area showed a positive performance in comparison to the elevated and depressed sections (#8 and #9, respectively) which showed a decline in terms of sales. The actual study section showed negative performance in comparison to the area as a whole.

**Table 90. Number and Percentage of Businesses Abutting Central Expressway Study and Control Section Before and During Construction, Dallas**

| Industry | Year | Number of Reporting Outlets in the Zip Code(s) | % of Total | Number of Outlets on Central Exp. | % of Total |
|---|---|---|---|---|---|
| Construction | 1986 | 73 | 1.3 | 21 | 1.3 |
| | 1991 | 169 | 2.6 | 15 | 1.1 |
| Manufacturing | 1986 | 193 | 3.3 | 37 | 2.3 |
| | 1991 | 244 | 3.8 | 29 | 2.1 |
| Agriculture | 1986 | 22 | 0.4 | 3 | 0.2 |
| | 1991 | 103 | 1.6 | 7 | 0.5 |
| Transportation and Energy Services | 1986 | 22 | 0.4 | 20 | 1.2 |
| | 1991 | 47 | 0.7 | 35 | 2.5 |
| Retail Trade | 1986 | 3338 | 57.9 | 357 | 22.1 |
| | 1991 | 3240 | 50.2 | 294 | 20.8 |
| Services | 1986 | 1670 | 28.9 | 1115 | 69.1 |
| | 1991 | 2135 | 33.1 | 917 | 64.9 |
| Wholesale Trade | 1986 | 395 | 6.9 | 24 | 1.5 |
| | 1991 | 397 | 6.1 | 44 | 3.1 |
| Mining | 1986 | 9 | 0.2 | 5 | 0.3 |
| | 1991 | 15 | 0.2 | 6 | 0.4 |
| Public Administration | 1986 | 4 | 0.07 | 4 | 0.2 |
| | 1991 | 6 | 0.09 | 5 | 0.4 |
| F.I.R.E | 1986 | 36 | 0.6 | 25 | 1.5 |
| | 1991 | 96 | 1.5 | 54 | 3.8 |
| Nonclassifiable Firms | 1986 | 3 | 0.05 | 3 | 0.2 |
| | 1991 | 5 | 0.08 | 5 | 0.4 |
| All Major Divisions | 1986 | 5765 | 100 | 1614 | 100 |
| | 1991 | 6457 | 100 | 1411 | 100 |

**Table 91. Gross Sales, Average Gross Sales, and the Overall Number of Reporting Outlets in the Zip Code(s): Central Expressway (Dallas)**

| Industry | Year | Number of Outlets in the Zip Code (s) | Gross Sales (dollars) | Average Gross Sales |
|---|---|---|---|---|
| Construction | 1986 | 73 | 81,427,831 | 1,115,450 |
| | 1991 | 169 | 120,635,555 | 713,819.9 |
| Manufacturing | 1986 | 193 | 878,214,855 | 4,550,336.0 |
| | 1991 | 244 | 825,094,213 | 3,381,534.0 |
| Agriculture | 1986 | 22 | 1,847,430 | 83,974.09 |
| | 1991 | 103 | 16,642,788 | 161,580.5 |
| Transportation and Energy Services | 1986 | 22 | 7,502,054 | 341,002.5 |
| | 1991 | 47 | 68,715,942 | 1,462,041.0 |
| Retail Trade | 1986 | 3338 | 2060,923,639 | 617.412.7 |
| | 1991 | 3240 | 2576,490,904 | 795213.2 |
| Services | 1986 | 1670 | 1443,808,870 | 864,556.2 |
| | 1991 | 2135 | 1209,839,857 | 566,669.7 |
| Wholesale Trade | 1986 | 395 | 2511,638,585 | 6,358,579 |
| | 1991 | 397 | 2898,852,752 | 7,301896 |
| Mining | 1986 | 9 | 281,711 | 31,301.2 |
| | 1991 | 15 | 1409,063,349 | 93,937,557 |
| Public Administration | 1986 | 4 | NA | NA |
| | 1991 | 6 | 1035 | 172.5 |
| F.I.R.E | 1986 | 36 | 28,145,456 | 781,818.2 |
| | 1991 | 96 | 31,616,996 | 566,669.7 |
| Nonclassifiable Firms | 1986 | 3 | NA | NA |
| | 1991 | 5 | NA | NA |
| All Major Divisions | 1986 | 5765 | 7013,790,431 | 1,216,616 |
| | 1991 | 6457 | 9156,953,391 | 1,418,583 |

**Table 92. Estimated Gross Sales of Abutting Businesses on Central Expressway (Dallas) Before and During Construction: (Overall)**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Construction | 1986 | 21 | 23,424,450 | 32,571,954 | -63 |
| | 1991 | 15 | 10,707,299 | 11,980,854 | |
| Manufacturing | 1986 | 37 | 168,362,432 | 234,109,805 | -53 |
| | 1991 | 29 | 98,064,486 | 109,728,544 | |
| Transportation and Energy Services | 1986 | 20 | 6,820,050 | 9,483,354 | +504 |
| | 1991 | 35 | 51,171,435 | 57.257,905 | |
| Agriculture | 1986 | 3 | 251,922 | 350.301 | +261 |
| | 1991 | 7 | 1,131,064 | 1,265,595 | |
| Retail Trade | 1986 | 357 | 220,416,334 | 306,491,326 | -15 |
| | 1991 | 294 | 233,792,681 | 261,600,621 | |
| Services | 1986 | 1115 | 963,980,163 | 1,340,424,971 | -57 |
| | 1991 | 917 | 519,636,115 | 581,443,054 | |
| Wholesale Trade | 1986 | 24 | 152,605,896 | 212,200,169 | +69 |
| | 1991 | 44 | 321,283,424 | 359,497,752 | |
| Mining | 1986 | 5 | 156,506 | 217,623 | +289696 |
| | 1991 | 6 | 563,625,342 | 630,664,480 | |
| Public Administration | 1986 | 4 | NA | NA | - |
| | 1991 | 5 | 863 | 965 | |
| F.I.R.E | 1986 | 25 | 19,545,455 | 27,178,169 | +26 |
| | 1991 | 54 | 30,600,164 | 34,239,831 | |
| Nonclassifiable Firms | 1986 | 3 | NA | NA | - |
| | 1991 | 5 | NA | NA | |
| Total Estimated Effect | 1986 | 1614 | 1,555,563,208 | 2,163,027,673 | -5.3 |
| | 1991 | 1411 | 1,830,012,871 | 2,047,679,600 | |
| Total Estimated Effect per km | 1986 | 1614 | 240,427,080 | 334,316,487 | |
| | 1991 | 1411 | 282,845,884 | 316,488,346 | |

**Table 95. Estimated Gross Sales of Abutting Businesses on Central Expressway (Dallas) Before and During Construction: At-Grade Segment**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Construction | 1986 | 8 | 8,923,600 | 12,408,364 | -94 |
| | 1991 | 1 | 713,820 | 798,724 | |
| Manufacturing | 1986 | 22 | 100,107,392 | 139,200,425 | -62 |
| | 1991 | 14 | 47,341,476 | 52,972,401 | |
| Transportation and Energy Services | 1986 | 15 | 5,115,038 | 7,112,516 | +452 |
| | 1991 | 24 | 35,088,984 | 39,262,564 | |
| Agriculture | 1986 | 1 | 83,974 | 116,767 | +365 |
| | 1991 | 3 | 484,742 | 542,398 | |
| Retail Trade | 1986 | 260 | 160,527,302 | 223,214,971 | -20 |
| | 1991 | 201 | 159,837,853 | 178,849,404 | |
| Services | 1986 | 645 | 557,638,749 | 775,402,786 | -59 |
| | 1991 | 505 | 286,168,199 | 320,205,826 | |
| Wholesale Trade | 1986 | 10 | 63,585,790 | 88,416,737 | +76 |
| | 1991 | 19 | 138,736,024 | 155,237,666 | |
| Public Administration | 1986 | 2 | NA | NA | - |
| | 1991 | 3 | NA | NA | |
| F.I.R.E | 1986 | 15 | 11,727,273 | 16,306,902 | -3 |
| | 1991 | 25 | 14,166,743 | 15,851,774 | |
| Nonclassifiable Firms | 1986 | 2 | NA | NA | - |
| | 1991 | 3 | NA | NA | |
| Total Estimated Effect | 1986 | 980 | 907,709,118 | 1262,179,466 | -39 |
| | 1991 | 798 | 682,538,357 | 763,721,334 | |
| Total Estimated Effect per km | 1986 | 980 | 124,685,318 | 173,376,300 | |
| | 1991 | 798 | 93,755,269 | 104,906,777 | |

**Table 96. Number and Percentage of Businesses Abutting Beltway 8 Before and After Construction, Houston**

| Industry | Year | Number of Reporting Outlets in the Zip Code(s) | % of Total | Number of Outlets on Beltway 8 | % of Total |
|---|---|---|---|---|---|
| Construction | 1984 | 88 | 1.8 | 0 | 0 |
| | 1995 | 183 | 2.9 | 4 | 2.5 |
| Manufacturing | 1984 | 199 | 4.2 | 1 | 2.4 |
| | 1995 | 247 | 3.9 | 3 | 1.9 |
| Agriculture | 1984 | 66 | 1.4 | 0 | 0 |
| | 1995 | 94 | 1.5 | 0 | 0 |
| Transportation and Energy Services | 1984 | 20 | 0.4 | 0 | 0 |
| | 1995 | 73 | 1.2 | 1 | 0.6 |
| Retail Trade | 1984 | 2962 | 61.9 | 37 | 88.1 |
| | 1995 | 3199 | 51.2 | 117 | 73.6 |
| Services | 1984 | 951 | 19.9 | 3 | 7.1 |
| | 1995 | 1881 | 30.2 | 31 | 19.4 |
| Wholesale Trade | 1984 | 431 | 9.0 | 0 | 0 |
| | 1995 | 423 | 6.8 | 0 | 0 |
| Mining | 1984 | 30 | 0.6 | 0 | 0 |
| | 1995 | 32 | 0.5 | 0 | 0 |
| Public Administration | 1984 | 0 | 0.0 | 0 | 0 |
| | 1995 | 1 | 0.02 | 1 | 0.6 |
| F.I.R.E | 1984 | 27 | 0.6 | 1 | 2.4 |
| | 1995 | 103 | 1.7 | 2 | 1.3 |
| Nonclassifiable Firms | 1984 | 4 | 0.08 | 0 | 0 |
| | 1995 | 5 | 0.08 | 0 | 0 |
| All Major Divisions | 1984 | 4778 | 100 | 42 | 100 |
| | 1995 | 6236 | 100 | 159 | 100 |

**Table 97. Gross Sales, Average Gross Sales, and the Overall Number of Reporting Outlets in the Zip Code(s): Beltway 8 (Houston)**

| Industry | Year | Number of Outlets in the Zip Code (s) | Gross Sales (dollars) | Average Gross Sales |
|---|---|---|---|---|
| Construction | 1984 | 88 | 75,127,302 | 853,719.3 |
| | 1995 | 183 | 288,256,302 | 1,575,171 |
| Manufacturing | 1984 | 199 | 404,000,000 | 2,030,150 |
| | 1995 | 247 | 545,105,902 | 2,206,906.5 |
| Agriculture | 1984 | 66 | 10,522,254 | 159,428.09 |
| | 1995 | 94 | 23,936,925 | 254,648.1 |
| Transportation and Energy Services | 1984 | 20 | 2,352,066 | 117,603.3 |
| | 1995 | 73 | 169,902,199 | 2,327,427 |
| Retail Trade | 1984 | 2962 | 1950,000,000 | 653,338.9 |
| | 1995 | 3199 | 3463,828,262 | 1,082,784.7 |
| Services | 1984 | 951 | 295,021,840 | 310,222.8 |
| | 1995 | 1881 | 1097,808,597 | 583,630.3 |
| Wholesale Trade | 1984 | 431 | 1510,000,000 | 3,503,480 |
| | 1995 | 423 | 1787,529,058 | 4,225,837 |
| Mining | 1984 | 30 | 1,363,683 | 45,456.1 |
| | 1995 | 32 | 150,361,385 | 4,698,793.3 |
| Public Administration | 1984 | 0 | 0 | 0 |
| | 1995 | 1 | NA | NA |
| F.I.R.E | 1984 | 27 | 886,749 | 32842.6 |
| | 1995 | 103 | 51,045,226 | 495,584.7 |
| Nonclassifiable Firms | 1984 | 4 | NA | NA |
| | 1995 | 5 | NA | NA |
| All Major Divisions | 1984 | 4778 | 4249,273,894 | 889,341.5 |
| | 1995 | 6236 | 7577,773,856 | 1,215,165.8 |

**Table 98. Estimated Gross Sales of Abutting Businesses on Beltway 8 (Houston) Before and After Construction (Overall)**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Transportation and Energy Services | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 1 | 2,327,427 | 2,327,427 | |
| Construction | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 4 | 6,300,684 | 6,300,684 | |
| Manufacturing | 1984 | 1 | 203,150 | 297,979 | +2122 |
| | 1995-6 | 3 | 6,620,720 | 6,602,720 | |
| Retail Trade | 1984 | 37 | 24,173,539 | 35,457,627 | +257 |
| | 1995-6 | 117 | 126,685,810 | 126,685,810 | |
| Services | 1984 | 3 | 930,668 | 1,365,099 | +1225 |
| | 1995-6 | 31 | 18,092,539 | 18,092,539 | |
| Public Administration | 1985 | 0 | NA | NA | - |
| | 1995-6 | 1 | NA | NA | |
| F.I.R.E | 1984 | 1 | 32843 | 48,173 | +1958 |
| | 1995-6 | 2 | 991,169 | 991,169 | |
| Nonclassifiable Firms | 1984 | 0 | NA | NA | - |
| | 1995-6 | 0 | NA | NA | |
| Total Estimated Effect | 1984 | 42 | 25,340,200 | 37,168,879 | +333 |
| | 1995-6 | 159 | 161,018,349 | 161,018,349 | |

**Table 99. Estimated Gross Sales of Abutting Businesses on Beltway 8 (Houston) Before and After Construction: Depressed Section**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Retail Trade | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 7 | 7,579,493 | 7,579,493 | |
| Construction | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 1 | 1,575,171 | 1,575,171 | |
| Manufacturing | 1984 | 1 | 203,150 | 297,979 | +641 |
| | 1995-6 | 1 | 2,206,907 | 2,206,907 | |
| Services | 1984 | 2 | 620,446 | 910,066 | +349 |
| | 1995-6 | 7 | 4,085,412 | 4,085,412 | |
| Total Estimated Effect | 1984 | 3 | 823,596 | 1,208,046 | +1179 |
| | 1995-6 | 16 | 15,446,983 | 15,446,983 | |
| Total Estimated Effect per Km | 1984 | 3 | 467,156 | 685,222 | |
| | 1995-6 | 16 | 8,761,760 | 8,761,760 | |

**Table 100. Estimated Gross Sales of Abutting Businesses on Beltway 8 (Houston) Before and After Construction: Elevated Section**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Transportation and Energy Services | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 1 | 2,327,427 | 2,327,427 | |
| Services | 1984 | 1 | 310,223 | 455,033 | +1695 |
| | 1995-6 | 14 | 8,170,824 | 8,170,824 | |
| F.I.R.E | 1984 | 1 | 32,843 | 48,173 | +1958 |
| | 1995-6 | 2 | 991,169 | 991,169 | |
| Retail Trade | 1984 | 34 | 22,213,523 | 32,582,684 | +186 |
| | 1995-6 | 86 | 93,119,484 | 93,119,484 | |
| Total Estimated Effect | 1984 | 1 | 22,556,588 | 33,085,890 | +216 |
| | 1995-6 | 7 | 104,608,905 | 104,608,905 | |
| Total Estimated Effect per km | 1984 | 1 | 46,992,892 | 68,928,938 | |
| | 1995-6 | 7 | 217,935,218 | 217,935,218 | |

**Table 101. Estimated Gross Sales of Abutting Businesses on Beltway 8 (Houston) Before and After Construction: At-Grade Section**

| Industry | Year | Number of Outlets | Estimated Gross Sales (dollars) | Estimated Gross Sales (1995=100) | % Change Real (Before vs. After) |
|---|---|---|---|---|---|
| Retail Trade | 1984 | 3 | 1,960,017 | 2,874,942 | +804 |
| | 1995-6 | 24 | 25,986,833 | 25,986,833 | |
| Services | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 10 | 5,836,303 | 5,836,303 | |
| Construction | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 3 | 4,725,513 | 4,725,513 | |
| Manufacturing | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 2 | 4,413,813 | 4,413,813 | |
| Pub. Admin. | 1984 | 0 | 0 | 0 | - |
| | 1995-6 | 1 | NA | NA | |
| Total Estimated Effect | 1984 | 3 | 1,960,017 | 2,874,943 | +1325 |
| | 1995-6 | 40 | 40,962,462 | 40,962,462 | |
| Total Estimated Effect per km | 1984 | 3 | 882,891 | 1,295,019 | |
| | 1995-6 | 40 | 18,451,559 | 18,451,559 | |

2) Both study and control sections (at-grade as well as whole area) in Houston and San Antonio ( U.S. 281), respectively, showed an increase in sales levels (1995 dollars). However, some study sections outperformed the overall area performance in both situations. In the case of section #5 (San Antonio), the depressed section outperformed the at-grade section. In the case of section #6, the at-grade segment outperformed all other segments of Beltway 8. However, the elevated and depressed sections of Beltway 8 also showed a marked increase in sales levels. The study section overall did not perform as well as the study area as a whole in the case of San Antonio. In the case of Houston, the study section outperformed the study area performance.

3) In the case of Dallas, the depressed segment outperformed the elevated and at-grade segments of Central Expressway. The study section did not perform as well as the overall area.

The researchers conclude that in most scenarios, the effect of the freeway construction has been negative; the sections where construction occurred showed a smaller improvement in sales levels in comparison to the study area overall. Lubbock sections #8 and #9 showed a negative performance. This is probably due to the extensive relocation effects discussed in an earlier section of this report. The only exception is the Houston study section where the study section outperformed the study area.

**Summary of Gross Sales Impacts**

The percentage changes in the sales levels were grouped by segment type in order to arrive at an overall impact. This is shown in Table 102. Once again, Dallas was excluded because it was under construction. The results show that depressed segments have outperformed both the at-grade control and elevated segments.

**Table 102. Before and After Percent Change in Gross Sales Levels by Freeway Section**

| Study Section | City | % Increase or Decrease | % Increase or Decrease (Overall Study Section) | % Increase or Decrease on At-Grade Segments | % Increase or Decrease for Study Area Overall |
|---|---|---|---|---|---|
| Depressed | | | | | |
| 6 | Houston | 1179 | 333 | 1325 | 78 |
| 5 | San Antonio (U.S.281) | 1084 | 214 | 132 | 268 |
| 9 | Lubbock | -63 | -78 | 149 | 5 |
| | Average | 733 | 156 | 535 | 117 |
| Elevated | | | | | |
| 6 | Houston | 216 | 333 | 1325 | 78 |
| 8 | Lubbock | -92 | 214 | 149 | 5 |
| | Average | 62 | 274 | 737 | 42 |

The analysis in this section of the report is only an approximate effect on sales of abutting businesses and involves a number of restrictive assumptions. The most questionable assumption is the use of averages to approximate the gross sales of businesses abutting the study freeways. In an effort to obtain more meaningful conclusions, the analysis was limited to study sections with similar preexisting conditions by way of grade type. Therefore, in all the cases analyzed above, the grade level in the pre-construction period was at-grade, facilitating comparisons both across and within study sections. This was not the case for the San Antonio Y-project. As Table 2 shows, study sections #1, #2, #3, and #4 were predominantly depressed types of freeways prior to construction, but some sections (such as #4) did have a combination elevated/depressed grade type as well. The post-construction grade was elevated for sections 2, 3, and 4; some segments of section #1 are depressed. These differences made the comparison within and across the Y-project study sections infeasible, and therefore, they have been excluded from the analysis.

The above analysis is only an approximation in light of the fact that a) more disaggregative data was unavailable from the State Comptroller due to disclosure problems, and b) the businesses refused to disclose most sales-related information in the personal surveys.

## SALES TAX REVENUE IMPACT

This section assesses the indirect benefit/loss to the community from the increase/decrease in sales tax revenues that accrue due to the changes in gross sales that could be affected by highway construction and the amount that is subject to tax. The results are presented by study area and by design sub-area in order to facilitate comparisons both within and across design sub-areas. The results are also presented by the same broad groups as in the sales impact section. Since more disaggregative data were not available, this section makes use of the same State Comptroller database as in the sales impact section. However, in doing so, the same caveats that hold for the sales tax impacts analysis hold for this section—namely, problems stemming from the use of highly aggregative data that are used to extrapolate information.

The procedure that is usually implemented to estimate the sales tax revenues relies on the estimate of the amount of taxable sales and gross sales provided by the State Comptroller. The amount of taxable sales are divided by the gross sales to obtain the percentage that is taxable by broad business type in the before- and after-construction periods. This percentage is then applied to the estimated gross sales for the businesses in the study section to obtain their estimated amount of taxable sales for all periods under consideration. This amount of taxable retail sales can then be multiplied by the city tax rates to estimate the dollar amount of tax revenues for the city as a whole. Similarly, the county or Metropolitan Transit Authority (MTA) rates, if applicable, may be applied to the same to obtain the estimated amount of tax revenues for the county or MTA. The city rates were constant at 1% for all four study areas and for all periods under consideration. Therefore, the percentage change in the estimated amount subject to tax is the percentage change in estimated tax revenues for the city. The city tax rates and MTA rates were also provided by the State Comptroller.

The results for the Lubbock study area are presented in Tables 103-105, and these together with the 1% city tax rate indicate that for the area as a whole, city tax revenue impact is negative with ranges from -1% to -13%. Local or immediate study section impacts to city tax revenues are also negative overall (-48% to -74%) as well as in elevated (+14% to -59%) and depressed sections (-49%). However, the effect is positive (+57%) on the control at-grade section. The depressed sections' contribution to city tax revenues declined the most, as is apparent.

Table 103. **Amount Subject to Tax, Percentage of Taxable Sales for I-27 (Lubbock) Study Area Businesses as a Whole**

| Industry | Year | Amount Subject to Tax (AST) # | | Amount Subject to Tax (1995=100) | | Percentage Change (real) | | Percentage Taxable* | |
|---|---|---|---|---|---|---|---|---|---|
| | | Col. 1 | Col. 2 | Col. 1 | Col.2 | Col.1 | Col. 2 | Col.1 | Col. 2 |
| Construction | 1984 | 6,850,753 | 8,706,362 | 10,048,650 | 12,770,448 | -16 | -17 | 20.6 | 20.9 |
| | 1994 | 8,239,615 | 10,318,132 | 8,473,126 | 10,610,549 | | | 11.3 | 12.1 |
| Manufacturing | 1984 | 11,782,364 | 23,991,845 | 17,282,313 | 35,191,118 | +22 | -9 | 6.58 | 11.1 |
| | 1994 | 20,545,460 | 31,024,395 | 21,127,720 | 31,903,629 | | | 6.40 | 7.48 |
| Agriculture | 1984 | 0 | - | 0 | - | +100 | - | - | - |
| | 1994 | 487,497 | 662,347 | 501,313 | 681,118 | | | 25.9 | 12.9 |
| Retail Trade | 1984 | 68,822,035 | 154,785,029 | 100,947,817 | 227,037,906 | -13 | -27 | 50.24 | 54.5 |
| | 1994 | 85,070,486 | 161,589,516 | 85,070,486 | 166,168,976 | | | 39.4 | 42.01 |
| Services | 1984 | 8,007,257 | 23,979,285 | 11,745,004 | 35,172,695 | +69 | +13 | 37.6 | 46.4 |
| | 1994 | 19,288,754 | 38,492,501 | 19,288,754 | 39,583,382 | | | 47.02 | 49.8 |
| F.I.R.E. | 1984 | NA | 802,275 | NA | 1,176,773 | - | +4 | - | ** |
| | 1994 | NA | 1,192,990 | NA | 1,226,799 | | | - | 39.5 |
| Transportation, Communications & Energy Services | 1984 | NA | 9,149,226 | NA | 13,420,039 | - | +149 | - | 17.3 |
| | 1994 | 3,550,566 | 32,560,076 | 3,651,189 | 33,482,831 | | | 15.0 | 21.3 |
| Wholesale Trade | 1984 | 49,472,757 | 65,797,509 | 72,566,392 | 96,511,457 | -5 | -13 | 4.34 | 5.39 |
| | 1994 | 66,814,114 | 81,603,975 | 68,707,631 | 83,916,638 | | | 4.26 | 4.89 |
| All Divisions | 1984 | 144,935,166 | 287,211,531 | 212,590,176 | 421,280,436 | -1 | -13 | 9.59 | 15.38 |
| | 1994 | 192,714,995 | 357,443,932 | 209,777,769 | 367,573,922 | | | 9.08 | 12.81 |

\# Source: State Comptroller. No information was available for the 'Mining' category in both the periods.
* The percentage taxable is obtained by dividing the Amount Subject to Tax reported in this table by gross sales figures reported in Table 80 (Column 4).
**The percentage taxable exceeds 100% because gross sales reported for the group is lower than the reported amount subject to tax, and the results for such groups are not reported.

**Table 104. Estimated Amount Subject to Sales Tax for I-27 (Lubbock) Abutting Businesses##**

| Industry | Year | Estimated Amount Subject to Sales Tax (I-27 Overall) (1995=100) | | Estimated Amount Subject to Sales Tax (Section 8) (1995=100) | | Estimated Amount Subject to Sales Tax (Section 9) (1995=100) | Estimated Amount Subject to Sales Tax (At-grade Section) (1995=100) |
|---|---|---|---|---|---|---|---|
| | | Col.1 | Col. 2 | Col.1 | Col. 2 | | |
| Construction | 1984 | 717,761 | 3.040,583 | 0 | 1,824,483 | 358,872 | 358,871 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 |
| Manufacturing | 1984 | 1,878,512 | 6,398,385 | 375,570 | 3,200,536 | 751,139 | 751,139 |
| | 1994 | 2,112,772 | 3.190,363 | 0 | 0 | 0 | 2,112,622 |
| Retail Trade | 1984 | 40,114,635 | 111,153,975 | 19,838,858 | 74,887,982 | 19,838,857 | 440,863 |
| | 1994 | 18,825,109 | 26,776,044 | 8,304,252 | 11.812,937 | 9,965.099 | 553,616 |
| Services | 1984 | 7,077,118 | 23,233,340 | 1,957,664 | 12,261,152 | 5,120,044 | 0 |
| | 1994 | 5,628,965 | 8,149,520 | 1,072,083 | 1.552,217 | 1,780,269 | 111,267 |
| F.I.R.E. | 1984 | 0 | 261,505 | 0 | 261,497 | 0 | 0 |
| | 1994 | - | - | 0 | 0 | 0 | 0 |
| Transportation, Communications & Energy Services | 1984 | - | 1,491,115 | 0 | 1,491,466 | 0 | 0 |
| | 1994 | - | - | 0 | 0 | 0 | 0 |
| Wholesale Trade | 1984 | 1,179,941 | 11,539,413 | 0 | 9,435,669 | 1,179,747 | 0 |
| | 1994 | 0 | 0 | 0 | 0 | 0 | 0 |
| All Divisions | 1984 | 61,638,572 | 175.533.515 | 61,605.661 | 111.144.966 | 35.203.231 | 1,676,344 |
| | 1994 | 32,273,503 | 45,451,579 | 70,190,772 | 45,451,579 | 17,874,961 | 2,628,671 |

## These numbers are obtained by multiplying the real gross sales reported in Tables 81-84 by the percent taxable reported in Table 103.

**Table 105. Percentage Change in Estimated Real Amount Subject to Sales Tax for I-27 (Lubbock) Abutting Businesses**

| Industry | Year | Percentage Change in real AST (Overall) | | Percentage Change in real AST (Section 8) | | Percentage Change in real AST (Section 9) | Percentage Change in real AST (At-grade Section) |
|---|---|---|---|---|---|---|---|
| | | Col.1 | Col.2 | Col.1 | Col.2 | | |
| Construction | 1984 | -100 | -100 | - | -100 | -100 | -100 |
| | 1994 | | | | | | |
| Manufacturing | 1984 | +12 | -50 | -100 | -100 | -100 | +181 |
| | 1994 | | | | | | |
| Retail Trade | 1984 | -53 | -76 | -58 | -84 | -50 | +26 |
| | 1994 | | | | | | |
| Services | 1984 | -21 | -65 | -45 | -87 | -65 | +100 |
| | 1994 | | | | | | |
| F.I.R.E. | 1984 | - | -100 | - | -100 | - | - |
| | 1994 | | | | | | |
| Transportation, Communications & Energy Services | 1984 | - | -100 | - | -100 | - | - |
| | 1994 | | | | | | |
| Wholesale Trade | 1984 | -100 | -100 | - | -100 | -100 | - |
| | 1994 | | | | | | |
| All Divisions | 1984 | -48 | -74 | +14 | -59 | -49 | +57 |
| | 1994 | | | | | | |

Tables 106-107 show the city tax revenue impacts to be positive for the San Antonio U.S. 281 study area as a whole, for the overall study section, as well as for the depressed and at-grade sections individually. In this situation, the depressed section showed a 607% increase in city tax revenues and outperformed both the study section as a whole and the study area businesses (i.e., businesses in the relevant zip codes). However, the city tax revenues increased by 114% for the study section overall in comparison to the study area as a whole (139% increase).

Furthermore, in the case of the San Antonio, Dallas, and Houston areas, a Metropolitan Transit Authority (MTA) rate is also a component of the overall sales tax rate, in addition to the city tax rates. For the San Antonio area, these rates were 4.5% in 1984 and 7.25% in 1993. Applying these rates to the Amount Subject to Sales Tax (AST) for the study area as a whole, provided by the State Comptroller, we can obtain an estimate of the impact on MTA tax revenues. Using the estimated AST for the study section overall and for the individual sections, an estimate of the local or project-specific impact on MTA tax revenues can be obtained. MTA tax revenue impact for the study area as a whole is 284% [(.045*$77,923,066 = $3,506,538) and (.0725*$185,848,648 = $13,477,652) and the percentage change is 284%]. In comparison, the local area overall impact is 245%: 1039% for the depressed section and 123% for the at-grade section. These percentages are obtained by applying the same MTA rates to the estimated real AST for the respective sections.

Tables 108-109 present the amount subject to tax, percentage of taxable sales, and estimated real AST for the Dallas Central Expressway study area. The city tax revenue impact for the study area as a whole is indicated by the percentage change in real AST which shows an increase of 9%. The local area overall city tax revenues increased by 10%; increased by 50% on the depressed segment of North Central Expressway; decreased by 89% on the elevated segment and by 37% on the at-grade segment. Similarly, applying the MTA rates of 5.125% in 1986 and 7.25% in 1991 to the real AST, the suggested MTA tax revenue impact on the study area as a whole is an increase of 55%. Again, applying the MTA rates to the estimated real AST by section, the following results for the local area are obtained: 1) Overall: + 55%, 2) Depressed segment: +112%, 3) Elevated segment: -85%, and 4) At-grade segment: -11%. The results suggest that from the tax revenue impact perspective, the study section did as well as the study area as a whole. Furthermore, the depressed segment within the study section outperformed the study area in terms of tax revenues as well as gross sales impact (overall gross sales impact was 5% in real terms for the area as a whole).

## Table 106. Amount Subject to Tax and Percentage of Taxable Sales for U.S. 281 (San Antonio) Study Area

| Industry | Year | AST (Study Area) | Percentage of Taxable Sales# |
|---|---|---|---|
| | | | |
| Construction | 1984 | 3,184,272 | ** |
| | 1993 | 10,079,008 | 15.62 |
| Manufacturing | 1984 | 4,374,272 | 33.89 |
| | 1993 | 2,769,439 | 34.02 |
| Agriculture | 1984 | NA | NA |
| | 1993 | 1,425,233 | 56.79 |
| Retail Trade | 1984 | 43,342,713 | 79.28 |
| | 1993 | 131,271,306 | 48.94 |
| Services | 1984 | 4,204,548 | 49.49 |
| | 1993 | 26,398,186 | 43.18 |
| F.I.R.E. | 1984 | 63,739 | ** |
| | 1993 | 7906 | ** |
| Transportation, Communications & Energy Services | 1984 | NA | NA |
| | 1993 | 361,106 | 46.03 |
| Wholesale Trade | 1984 | 4,093,546 | 11.82 |
| | 1993 | 63,739 | ** |
| All Divisions | 1984 | 53,124,715 | 69.08 |
| | 1993 | 176,262,170 | 40.10 |

# The percentage of taxable sales is obtained by dividing actual Amount Subject to Tax by the actual gross sales reported in Table 86 (Column 4).
** The percent taxable exceeds 100%.

Table 107. Amount Subject to Tax and Percentage Change in Real Taxable Sales for U.S. 281 Study Area as a Whole and Abutting Businesses

| Industry | Year | AST (1995=100) (Study Area) | AST(1995=100) (Study Section Overall) | AST(1995=100) (Depressed Section) | AST(1995=100) (At-grade Section) | % Change (Study Area) (1995=100) | % Change (Study Section Overall) | % Change (Depressed Section) | % Change (At-Grade Section) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Construction | 1984 | 4,670,674 | 1,868,270 | 0 | 1,868.677 | +128 | -86 | +100 | -100 |
| | 1993 | 10,630,040 | 259,269 | 259,213 | 0 | | | | |
| Manufacturing | 1984 | 4,374,272 | 874,854 | 0 | 874,948 | -37 | +32 | +100 | -34 |
| | 1993 | 2,769,439 | 1,153,933 | 576,990 | 576,990 | | | | |
| Agriculture | 1984 | NA | NA | NA | NA | - | - | - | - |
| | 1993 | 1,503,152 | 62,631 | 62,636 | 0 | | | | |
| Retail Trade | 1984 | 63,574,875 | 19,824,427 | 2,050.665 | 17.772.429 | +118 | +82 | +357 | +50 |
| | 1993 | 185,848,648 | 36,054,187 | 9.374,829 | 26,682,206 | | | | |
| Services | 1984 | 6,167,210 | 4,625,406 | 350,384 | 4,274.677 | +351 | +285 | +1886 | +154 |
| | 1993 | 27,841,409 | 17,818,499 | 6,960,357 | 10,858,157 | | | | |
| F.I.R.E. | 1984 | 93,492 | 93,493 | 70,126 | 23.375 | -91 | -93 | -94 | -88 |
| | 1993 | 8338 | 6948 | 4170 | 2780 | | | | |
| Transportation, Communications & Energy Services | 1984 | 0 | 0 | 0 | 0 | +100 | +100 | +100 | +100 |
| | 1993 | 380,848 | 317374 | 190,409 | 126.940 | | | | |
| Wholesale Trade | 1984 | 1,821,500 | 0 | 0 | 0 | +137 | 0 | 0 | 0 |
| | 1993 | 4,317,345 | 0 | 0 | 0 | | | | |
| All Divisions | 1984 | 77,923,066 | 30,904,426 | 2,221.379 | | +139 | +114 | +607 | +38 |
| | 1993 | 185.848,648 | 64,458,620 | 15,702,567 | | | | | |

**Table 108. Amount Subject to Tax and Percentage of Taxable Sales for Central Expressway (Dallas) Study Area**

| Industry | Year | AST (Study Area) | AST (1995=100) (Study Area) | Percentage Taxable | % Change Real AST (Study Area) |
|---|---|---|---|---|---|
| Construction | 1986 | 9,667,114 | 13,442,228 | 11.87 | +127 |
| | 1991 | 3,577,409 | 30,513,798 | 22.61 | |
| Manufacturing | 1986 | 396,195,337 | 550,913,954 | 45.11 | +38 |
| | 1991 | 677,932,313 | 758,567,434 | 82.16 | |
| Agriculture | 1986 | 1,211,113 | 1,684,066 | 65.67 | +577 |
| | 1991 | 10,195,744 | 11,408,454 | 61.26 | |
| Retail Trade | 1986 | 1,382,817,713 | 1,922,823,170 | 67.09 | -9 |
| | 1991 | 1,556,343,058 | 1,741,458,752 | 60.41 | |
| Services | 1986 | 215,579,421 | 299,765,545 | 14.93 | +88 |
| | 1991 | 503,992,716 | 563,938,986 | 41.66 | |
| F.I.R.E. | 1986 | 5,115,037 | 7,112,515 | 18.17 | +82 |
| | 1991 | 11,564,281 | 12,939,769 | 36.58 | |
| Mining | 1986 | 249,567 | 347,026 | 88.59 | +1053 |
| | 1991 | 3,577,409 | 4,002,916 | 0.25 | |
| Transportation, Communications & Energy Services | 1986 | 3,443,233 | 4,787,853 | 45.89 | +251 |
| | 1991 | 15,031,939 | 16,819,879 | 21.88 | |
| Public Administration | 1986 | NA | NA | NA | - |
| | 1991 | 5054 | 5655 | ** | |
| Wholesale Trade | 1986 | 127,679,957 | 177,540,378 | 5.08 | -35 |
| | 1991 | 103,031,946 | 115,286,847 | 3.55 | |
| All Divisions | 1986 | 2,141,958,492 | 2,978,416,735 | 30.54 | +9 |
| | 1991 | 2,908,944,665 | 3.254,942,489 | 31.77 | |

Table 109. Amount Subject to Tax and Percentage Change in Real Taxable Sales for the Central Expressway (Dallas) Study Section Abutting Businesses

| Industry | Year | Estimated AST (Study Section Overall) (1995=100) | Estimated AST (1995=100) (Depressed Segment) | Estimated AST (1995=100) (Elevated Segment) | Estimated AST(1995=100) (At-grade Segment) | % Change (Overall) | % Change (Depressed Segment) | % Change (Elevated Segment) | % Change (At-Grade Segment) |
|---|---|---|---|---|---|---|---|---|---|
| Construction | 1986 | 13,439,964 | 2,209,309 | 184,109 | 1,472,873 | +127 | +14 | -100 | -88 |
| | 1991 | 30,519,947 | 2,528,280 | 0 | 180,591 | | | | |
| Manufacturing | 1986 | 550,868,597 | 39,959,380 | 2,854,241 | 62,793,312 | +127 | +18 | -100 | -31 |
| | 1991 | 758,528,451 | 46,630,847 | 0 | 43,522,124 | | | | |
| Agriculture | 1986 | 1,686,978 | 153,362 | - | 76,681 | +576 | +188 | - | +333 |
| | 1991 | 11,408,040 | 443,031 | - | 332,273 | | | | |
| Mining | 1986 | 347,026 | 192,792 | - | - | +1054 | +731 | - | - |
| | 1991 | 4,004,719 | 1,601,888 | - | - | | | | |
| Retail Trade | 1986 | 1,922,622,833 | 55,294,126 | 575,981 | 149,754,924 | -9 | -11 | -7 | -28 |
| | 1991 | 1,741,587,447 | 49,452,483 | 537,527 | 108,042,925 | | | | |
| Services | 1986 | 299,739,461 | 84,357,812 | - | 115,767,636 | +88 | +29 | - | +15 |
| | 1991 | 563,968,693 | 1,08,831,429 | - | 133,397,747 | | | | |
| F.I.R.E. | 1986 | 7,111,114 | 1,975,309 | - | 2,962,964 | +213 | +241 | - | +96 |
| | 1991 | 22,266,543 | 6,726,351 | - | 5,798,579 | | | | |
| Transportation, Comm. & Energy Services | 1986 | 4,787,102 | 1,087,978 | - | 3,263,933 | +251 | +262 | - | +163 |
| | 1991 | 16,823,354 | 3,937,381 | - | 8.590,649 | | | | |
| Public Administration | 1986 | NA | NA | - | - | - | - | - | - |
| | 1991 | 5655 | 1885 | - | - | | | | |
| Wholesale Trade | 1986 | 177,417,025 | 6,288,198 | - | 4,491,570 | -35 | +15 | - | +23 |
| | 1991 | 115,149,581 | 7,251,233 | - | 5,510,937 | | | | |
| All Divisions | 1986 | 2,978,490,923 | 272,450,806 | 2,668,236 | 385,469,609 | +9 | +50 | -89 | -38 |
| | 1991 | 3,256,196,549 | 407,630,852 | 282,688 | 242,634,268 | | | | |

The results of the Houston study area are presented in Tables 110-111. While city tax revenues increased only by 24% for the study area as a whole, for the study section, tax revenues increased by 342%. The highest increase was observed for the at-grade segment (1351%), and the depressed segment (+1202%) outperformed the elevated segment (+222%). The MTA rates for the Houston area were 5% in 1984 and 7.25% in 1995. Applying these rates to the AST we have the following results in terms of MTA tax revenues: 1) Study area as a whole (+798%), 2) Study section overall (+541%), 3) Depressed segment (+1788%), 4) Elevated segment (+367%), and 5) At-grade segment (+2003%).

**Summary of Sales Tax Revenue Impacts**

Limiting the analysis to mature freeways and excluding Dallas, the evidence from Table 112 indicates that depressed sections have shown better performance than elevated sections in terms of city tax revenues. Other than the U.S. 281 study section, at-grade sections have shown better performance than either depressed or elevated sections or the overall area in consideration.

**Table 110. Amount Subject to Tax and Percentage of Taxable Sales for Sam Houston Tollway (Beltway 8) (Houston) Study Area**

| Industry | Year | AST (Study Area) | AST (1995=100) (Study Area) | Percentage Taxable | % Change Real AST (Study Area) |
|---|---|---|---|---|---|
| Construction | 1984 | 60,944,270 | 89,392,750 | 81.12 | -22 |
| | 1995 | 69,297,704 | 69,297,704 | 24.04 | |
| Manufacturing | 1984 | 64,521,811 | 94,640,270 | 15.97 | +5 |
| | 1995 | 99,460,917 | 99,460,917 | 18.25 | |
| Agriculture | 1984 | 2,945,113 | 4,319,877 | 27.99 | +165 |
| | 1995 | 11,466,235 | 11,466,235 | 47.9 | |
| Retail Trade | 1984 | 1,030,000,000 | 1,510,798,845 | 52.82 | +12 |
| | 1995 | 1,693,093,156 | 1,693,093,156 | 48.88 | |
| Services | 1984 | 94,149,876 | 138,098,567 | 31.91 | +132 |
| | 1995 | 320,692,191 | 320,692,191 | 29.21 | |
| F.I.R.E. | 1984 | 885,367 | 1,298,652 | 99.8 | +1471 |
| | 1995 | 20,406,036 | 20,406,036 | 39.9 | |
| Mining | 1984 | 46,526,441 | 68,244,751 | ** | +119 |
| | 1995 | 149,989,754 | 149,989,754 | 99.8 | |
| Transportation, Communications & Energy Services | 1984 | 3,687,692 | 5,409,088 | ** | - |
| | 1995 | 47,511,352 | 47,511,352 | 27.96 | |
| Public Administration | 1984 | NA | NA | - | - |
| | 1994 | NA | NA | - | |
| Wholesale Trade | 1984 | 102,000,000 | 149,613,090 | 6.75 | -3 |
| | 1995 | 145,015,721 | 145,015,721 | 8.11 | |
| All Divisions | 1984 | 1,405,660,570 | 2,061,815,889 | 33.08 | +24 |
| | 1995 | 2,556,933,066 | 2,556,933,066 | 33.74 | |

**Table 111. Amount Subject to Tax and Percentage Change in Real Taxable Sales for the Sam Houston Tollway (Houston) Study Section Abutting Businesses**

| Industry | Year | Estimated AST (Study Section Overall) (1995=100) | Estimated AST (1995=100) (Depressed Segment) | Estimated AST (1995=100) (Elevated Segment) | Estimated AST(1995=100) (At-grade Segment) | % Change (Overall) | % Change (Depressed Segment) | % Change (Elevated Segment) | % Change (At-Grade Segment) |
|---|---|---|---|---|---|---|---|---|---|
| Construction | 1984 | 0 | 0 | - | 0 | +100 | +100 | - | +100 |
| | 1995 | 1,514,704 | 378,041 | - | 1,134,123 | | | | |
| Manufacturing | 1984 | 47,590 | 47,379 | - | 0 | +2438 | +748 | - | +100 |
| | 1995 | 1,208,027 | 401,657 | - | 803,314 | | | | |
| Retail Trade | 1984 | 18,728,900 | 0 | 17,203,657 | 1,517,970 | +231 | +100 | +165 | +737 |
| | 1995 | 61,923,069 | 3,706,372 | 45,535,428 | 12,707,561 | | | | |
| Services | 1984 | 435,642 | 290,311 | 145,156 | 0 | +1113 | +311 | +1544 | +100 |
| | 1995 | 5,285,198 | 1,192,940 | 2,385,881 | 1,704,200 | | | | |
| F.I.R.E. | 1984 | 48,098 | - | 48,077 | - | +724 | - | +723 | - |
| | 1995 | 396,234 | - | 395,477 | - | | | | |
| Transportation, Commn. & Energy Services | 1984 | 0 | - | 0 | - | +100 | - | +100 | - |
| | 1995 | 650,840 | - | 649,352 | - | | | | |
| Public Administration | 1984 | 0 | - | - | - | +100 | - | - | - |
| | 1995 | 48,098 | - | - | - | | | | |
| All Divisions | 1984 | 12,295,472 | 399,863 | 10,951,430 | 951,606 | +342 | +1202 | +222 | +1351 |
| | 1995 | 54,331,674 | 5,205,633 | 35,253,201 | 1[illegible],804,350 | | | | |

**Table 112. Percentage Change in City Tax Revenues Before and After Construction by Study Section #**

| Study Section | City | % Increase or Decrease | % Increase or Decrease on At-Grade Control Segments | % Increase or Decrease for Overall Study Section | % Increase or Decrease for Study Area As a Whole* |
|---|---|---|---|---|---|
| Depressed | | | | | |
| 6 | Houston | 1202 | 1351 | 342 | 24 |
| 5 | San Antonio (U.S. 281) | 607 | 38 | 114 | 139 |
| 9 | Lubbock | -49 | 57 | -74 | -13** |
| | Average | 587 | 482 | 127 | 50 |
| Elevated | | | | | |
| 6 | Houston | 222 | 1351 | 342 | 24 |
| 8 | Lubbock | -59 | 57 | -74 | -13 |
| | Average | 82 | 704 | 134 | 6 |

# The results for Dallas are excluded since construction is not complete.
* This column represents the true control, comprised of all the relevant zip codes in the vicinity of the project in consideration.
** Including all the firms in the analysis and therefore using the results of Column 2 from Tables 102-104.

# USER BENEFIT-COST EFFECTS

An estimate of the user benefit-cost effects of any freeway improvement or design change is very desirable to help transportation agencies decide whether such an improvement is economically feasible. Therefore, an attempt was made to estimate the effects of grade level changes of the elevated and depressed freeway study sections. Such an analysis involves building a fairly extensive database. While building the database, researchers found that such a database would be incomplete and could not be reduced properly to yield unbiased estimates. The database and some of the problems related to it are briefly described below.

## DATABASE

As mentioned in earlier chapter, the benefits of transportation improvement projects represent the difference between the new or improved facility and the existing facility in terms of 1) time or delay costs, 2) vehicle operating costs, 3) accident costs, 4) routine maintenance costs, 5) discomfort cost savings, and 6) pollution reduction. The net benefits or disbenefits calculated from all these components combined are then divided by the construction and right-of-way costs to improve the transportation facility to yield the benefit-cost ratio. The recently developed MicroBENCOST computer algorithm or model developed by McFarland, et al., was going to be used to perform these calculations.

The use of default values in the above mentioned computer model reduces the amount of data needed to obtain an estimate of the net benefits or disbenefits of each before and after freeway design type. However, an attempt was made to collect the following before-, during- and after- construction data on each freeway study section: mainlane and service road average daily traffic volume, vehicle distribution, vehicle occupancy, average speed of traffic, and air pollution (CO) rates. Also, an attempt was made to collect the construction, right-of-way, and relocation cost data for each freeway study section. A part of the reduced data from this database is presented in Tables 113 and 114.

**Table 113. Recent Traffic Volumes, Percentage of Trucks, and Travel Speed by Freeway Study Section and Grade Level**

| STUDY NO./ TYPE OF GRADE LEVEL AFTER CONSTRUCTION | RECENT ADT (BOTH DIRECTIONS) | | | PERCENT OF TRUCKS | AVERAGE SPEED km/hr (mi/hr) |
|---|---|---|---|---|---|
| | MAINLANES | SERVICE ROADS | TOTAL | | |
| **Elevated/Combination Elevated & Depressed** | | | | | |
| #2 I-35-San Antonio | 233,375 | 17,675 | 250,843 | 5.3 | 84.6 (52.6) |
| #3 I-10- San Antonio | 291,110 | 29,151 | 320,261 | 4.4 | 89.4 (55.5) |
| #4 I-10/35- San Antonio | 281,367 | 14,233 | 295,600 | 4.7 | 86.7 (53.9) |
| #8 I-27- Lubbock | 40,050 | 14,259 | 54,309 | 5.5 | 90.1 (56.0) |
| #10 U.S. 62/82-Lubbock | 26,064 | NA* | 26,605 | - | - |
| **Depressed** | | | | | |
| #6 Sam Houston Beltway-Houston | 111,077 | 46,156 | 157,233 | 0.5 | 97.3 (60.5) |
| #7 U.S. 75-Dallas | -** | - | 421,270 | 5.8 | 70.3 (43.7) |
| #9 I-27- Lubbock | 41,136 | 14,185 | 55,322 | 5.5 | 91.7 (57.0) |
| #11 U.S. 62/82-Lubbock | 35,696 | NA** | 35,656 | - | - |
| #1 I-35- San Antonio | 223,486 | 34,935 | 258,421 | 5.3 | 93.7 (58.3) |
| #5 U.S. 281- San Antonio | 48,562 | 24,233 | 72,795 | 7.1 | 94.4 (58.7) |

* NA implies Not Applicable.
** A dash (-) implies that the data was not available, not obtained, or not complete enough to present.

**Table 114. Right-of-Way and Construction Costs and Other Information by Freeway Study Section and Grade Level**

| STUDY NO./ TYPE OF GRADE LEVEL AFTER CONSTRUCTION | RIGHT-OF-WAY ACQUISITION DATA | | | | | CONSTRUCTION DATA | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | YEAR(S) OF ACQUISITION | NUMBER OF PARCELS | NUMBER OF ACRES | COST PER ACRE | TOTAL COST ($) | LETTING DATE | LENGTH OF CONSTRUCTION (yrs) | COST PER MILE ($) | COST PER STRUCTURE ($) | TOTAL COST ($) |
| **Elevated/Combination Elevated & Depressed** | | | | | | | | | | |
| #2 I-35-San Antonio | 82-91 | 72 | -* | - | 6,227 | 4-85 | 9.0 | 28,497 | 2,968 | 35,621 |
| #3 I-10-San Antonio | 82-91 | 52 | 3.5 | 1,351 | 4,730 | 3-86 | 6.2 | 52,125 | 8,719 | 95,911 |
| #4 I-10/35-San Antonio | 83-91 | 87 | 13.0 | 370 | 4,815 | 10-84 | 4.8 | 44,934 | 7,976 | 65,807 |
| #8 I-27-Lubbock | 85-86 | - | - | - | - | 4-89 | 3.4 | 18,283 | 6,879 | 55,032 |
| #10 U.S. 62/82-Lubbock | 95-99 | - | - | - | 16,000** | -00 | NA | 18,923 | 4,542 | 27,249 |
| **Depressed** | | | | | | | | | | |
| #6 Sam Houston Beltway-Houston | 83-85 | 11 | 6.44 | 243 | 1,564** | 3-86 | 1.8 | 31,170 | 15,585 | 46,754 |
| #7 U.S. 75-Dallas | 87-91 | 251 | - | - | 15,976 | 9-93 | 6.3 | 51,886 | 14,871 | 208,200 |
| #9 I-27-Lubbock | 85-86 | - | - | - | - | 10-87 | 4.9 | 17,119 | 6,208 | 37,248 |
| #11 U.S. 62/82-Lubbock | 95-99 | - | - | - | 37,500** | -00 | NA | 22,459 | 13,219 | 95,530 |
| #1 I-35-San Antonio | NA | NA | NA | NA | NA | 8-83 | 2.1 | 2,996 | 0 | 4,135 |
| #5 U.S. 281-San Antonio | 86-88 | 21 | 1.90 | 2,453 | 4,660 | 11-87 | 3.5 | 10,865 | 9,615 | 19,231 |

* A dash (-) implies that the data was not available, not obtained, or not complete enough to present.
** Estimated.

## DATABASE PROBLEMS

Some of the database problems which made it unwise to try to estimate the benefit-cost effects of the study freeway grade level changes stem from the differing characteristics of freeway sections selected for study. For example, the completed freeway sections have differing before-construction period grade levels to compare with the differing after-construction period grade levels. Such a mix made it difficult to compare elevated sections with depressed sections as groups. Two study sections, one in each group, did not change grade levels. Varying numbers of before- versus after-construction period structures, crossing streets, and on and off ramps complicated making grade level comparisons.

Another major problem that would prevent true grade level comparisons of benefit/cost ratios was caused by having overlapping construction contracts covering more than one type of grade level because the beginning and ending points of the construction projects differed from those of the study section. Also, the study researchers were unable to obtain detailed before period traffic volume data on some study sections and obtain right-of-way and relocation cost data on certain study sections. Therefore, the construction cost side of the benefit/cost equation was biased.

# SUMMARY OF FINDINGS FROM BUSINESS SURVEYS, BUSINESS DATA ANALYSIS, RELOCATION, CONSTRUCTION EMPLOYMENT, AND TAX REVENUE EFFECTS

The majority of the businesses surveyed were retail types of businesses. The second largest category of surveyed businesses belonged to the services category. Most of the businesses were located in rented buildings and were observed to be in good condition. A very small percentage of businesses surveyed belonged to other categories, such as manufacturing or construction. The mean age of surveyed businesses ranges from 10.2 years in the Lubbock study area to 8.2 years in the San Antonio area. The mean length of stay for businesses was also the highest in the Lubbock I-27 study area, while Dallas Central Expressway businesses had the smallest length of stay.

In all study areas, the mean commercial property values, parking spaces, employment, and sales were sometimes found to be higher on sections adjacent to at-grade segments and sometimes on sections adjacent to elevated segments of the study freeways than on sections adjacent depressed segments. The pattern was found to be fairly similar, even in the non-abutting sections.

When asked to describe their locations, businesses cited accessibility and convenience most frequently. Other attributes cited in the Houston, San Antonio, and Dallas study areas include well-kept and nice areas. Differences were found in the response pattern by design sub-area, particularly in the Lubbock study area. Business respondents from this study area cited more positive neighborhood attributes on at-grade and elevated sections of I-27 in comparison to the depressed sections of the freeway. The most frequently cited reasons for locating at the area included convenience, in most study areas. Customer market was cited in all areas other than the Lubbock study area. Price was cited in both the Lubbock and Dallas study areas. Traffic patterns were also cited as important reasons in the Lubbock and Houston areas.

Businesses cited these advantages of the area most frequently:

Lubbock: Accessibility, price, convenience, parking, and visibility (all of these were cited most often on elevated and at-grade segments and very infrequently or not at all on depressed segments).

Houston: Customer market, convenience, neighborhood, and accessibility.

San Antonio: Customer market, accessibility, neighborhood, and convenience.

Dallas: Accessibility, customer market, and convenience.

Accessibility, convenience and visibility were often cited most frequently on elevated and at-grade segments. The most frequently cited disadvantages include:

Lubbock: Lack of accessibility, lack of visibility, poor neighborhood, lack of parking space.

Houston: Lack of accessibility, inconvenient, and lack of visibility.

San Antonio: Lack of accessibility, poor neighborhood, lack of parking, and lack of visibility.

Dallas: Lack of accessibility, lack of convenience, and poor neighborhood.

Lack of accessibility was the most frequently cited disadvantage on depressed segments, and lack of convenience was often cited on elevated segments, sometimes on at-grade segments, and never on depressed segments. Furthermore, all the problems cited by Lubbock businesses were cited most frequently by those located adjacent the depressed section #9.

No significant differences were observed by design sub-area in the opinions of businesses regarding extent of change in the area since they located there. Businesses in all study areas by and large agreed that there was an improvement in the area since they had located there. The responses of Houston businesses did not provide a clear-cut direction of change. Furthermore, no grade level differences were observed when businesses were asked about change in the area since construction of the study freeways, except in the Lubbock study area. Again, the direction of change was felt to be in the positive direction in all study areas. Overall, the opinion of businesses in the Lubbock area suggested a change in the positive direction, however, 47% businesses located adjacent the depressed section believed there had been a decline in comparison to only 15% and 20% on the elevated and at-grade control sections, respectively. Therefore, the construction of the study freeways had a positive impact on the neighborhood from the perspective of businesses. Negative impacts were largely limited to the Lubbock area depressed section.

The majority of businesses on all freeway sections in all study areas also agreed that construction was necessary. The preferred grade level of freeways in three of the four study areas was elevated. Businesses in the Dallas study area preferred the depressed type more frequently than they preferred the elevated type; however, the overall direction was unclear because the largest percentage of respondents indicated no preference over one or the other design.

Some of the negative effects reported most frequently in all study areas as having increased since construction include increase in noise, pollution, and crime levels. Responses of businesses indicate that commercial property values and business sales volumes were positively affected in some areas and negatively in others. Property values and business volumes were believed to have decreased in the Houston and Dallas (mostly in the depressed segment) areas. Business volumes were also believed to have decreased more frequently in the depressed section of the I-27 study area and San Antonio study area.

Positive effects of the freeways include increased travel safety, travel convenience, and travel time—all factors which would lead to an enhancement of direct user benefits. Commercial property values and business volumes improved since construction in some situations, particularly in the San Antonio and Lubbock area (mostly on elevated sections). Dallas presents a unique situation, essentially because most of the changes experienced by businesses and residents are a reflection of pure construction period effects. All negative changes were experienced in the Dallas area which include increased travel time, noise, pollution, and crime levels. They also include decreased travel safety, travel convenience, business volumes, and property values.

Businesses indicated that they liked the appearance of the freeways in all study areas, and a very small percentage, less than 5% overall, said that they disliked the appearance, while 15% had no opinion. When asked about some design type aspects pertaining to the number of underpasses and overpasses and number of on and off ramps, businesses by and large had no opinion or said that there were plenty of on/off ramps or overpasses/underpasses. Furthermore, in most study areas, no design sub-area differences nor distance effects in the responses were observed.

A more detailed analysis of changes in property values, average total employment, parking spaces, and sales volumes was also conducted using changes in ranges, changes in means. Further, a detailed analysis of changes in land values of all types based on actual data obtained from appraisal offices can be found in another related report entitled "Land Value and Land Use Effects of Elevated, Depressed and At-Grade Freeways in Texas," Report No. 1327-2. Actual sales are also analyzed in a more detailed fashion using the State Comptroller's data in this report. These analyses were conducted in order to assess whether there were any systematic differences or similarities in the opinions of the businesses and reality, both by design sub-area and overall. Wherever appropriate, we will draw on the results of the actual analysis and compare them to the survey type information by study area.

**Changes in Employment**

Negative during-construction period effects are observed in all study areas, as expected. When considered by design sub-area, the results show that sometimes the change is in the positive direction, indicating an improvement in the after-construction period, and sometimes in the negative direction. The change was observed to be in the positive direction for the at-grade control sections, in most cases, both during and after construction, and either minimal negative change, no change, or a change in the positive direction for the non-abutting sections—the true controls. However, the changes were not found to be statistically significant across grade levels for either abutting or non-abutting sections in any study area. Changes in means and an assessment of the number of businesses reporting increases/decreases/no change indicate that the Lubbock elevated section #8 and at-grade control section, and San Antonio depressed and at-grade sections were positively impacted in the after-construction period. Further, Lubbock I-27 depressed section #9, Dallas study area (elevated and depressed segments), San Antonio (elevated sections), and Houston (all sections) were negatively impacted both during and after construction. These changes were found to be related to the construction of the freeway in all study areas since, in all cases, the observed change in the non-abutting sections was minimal.

**Changes in Parking Spaces**

Again, negative during-construction period effects in all study areas were observed, and the extent of impact varied by design sub-area from no impact in some design areas to negative impact in some. Again, design sub-area differences in the changes were not statistically significant for all study areas. The largest impact was observed in the Lubbock study area; this is probably due to extensive right-of-way acquisitions in the Lubbock study area, as reported in another section of this report. (The number of relocations on the at-grade sections was the lowest in comparison to the elevated and depressed sections of I-27, as also shown in this report. There were only 14 relocatees per km on at-grade segments in comparison to 61 and 33 relocatees per km in the elevated and depressed sections, respectively. The impact was found to be minimal in all other study sections.) In the after-construction period, almost all study areas either regained their original number of parking spaces or improved. Only the depressed I-27 section #9 in Lubbock continued to be negatively impacted even in the after period.

**Changes in Property Values**

The means based on property value ranges indicate that during construction, some decline was observed in many sections. Some other sections were unaffected during construction. In the after-construction period, there seems to be no systematic pattern in the property value changes observed within each design sub-area for all study areas. Grade level differences in property value changes were observed only in the case of Lubbock and Dallas abutting businesses.

All sections, both abutting and non-abutting, were negatively impacted in real terms in the during- and after-construction periods. This suggests that the construction of the highways itself did not cause this decline in property values. However, the construction may have contributed to this decline on abutting sections, although property values would be more vulnerable to economy-wide changes. This contention is also supported when the change in property values in the county as a whole is considered in addition to a change in the non-abutting sections. For example, total market values of properties in the Bexar County area increased by 6.3% from 33.8 billion dollars (1994 dollars) to 36.1 billion in 1994. Since no responses were available from non-abutting sections of Beltway 8, it was not possible to infer anything about the impact of the construction of Beltway 8 on Houston study area commercial property values. However, considering the decrease by 14.7% in total assessed market values of properties from 203 billion in 1982 (1994 dollars) to 173 billion in 1994, we are led to believe that the construction of Beltway 8 in itself did not reduce the growth in the value of adjacent commercial properties in real terms. The total market values declined over the 1988-1994 period in Lubbock (total property values were 6.0 billion dollars (1994 dollars) in 1988 and only 5.3 billion in 1994). Similarly, Dallas County reports a decline of approximately 28% in total market values of properties over the 1985-1994 period (total market values were 37 billion

(1994 dollars) in 1985 and 29 billion in 1994). It is interesting that grade level effects in the responses of businesses were also observed for Dallas and Lubbock, reinforcing the notion that the construction activity could have indirectly contributed to the observed decline, particularly in these two areas.

The results of the means analysis in actual dollars closely followed the opinions expressed by businesses within each design sub-area, as shown in Table 26, in many cases. There were situations when discrepancies were observed and they include:

—Lubbock (at-grade and depressed sections). The means analysis indicated an increase in the mean property values on at-grade sections and a decline on depressed sections. Opinions indicate the reverse direction of change for each design sub-area.

—Houston (elevated and at-grade segments). The means analysis indicated no change in mean property values after construction for properties adjacent the elevated segment and an increase in mean property values for properties adjacent the at-grade segment. Opinions, however, indicate no change on at-grade segments and a decrease on elevated segments of Beltway 8.

**Changes in Gross Sales of Businesses**

Negative during-construction period effects are once again indicated for all study areas, as indicated by means derived from ranges of gross sales reported by businesses. The results for the Dallas study area are pure construction period effects. Further, grade level differences in opinions on changes in sales were statistically significant only for the Lubbock study area.

In the after period, most sections were affected negatively, and only one section was positively impacted in real terms. Among those that were negatively impacted were:

—Lubbock (all sections, including the at-grade control section),

—Houston (depressed and elevated segments), and

—San Antonio (all sections, including at-grade control sections)

The Houston at-grade segment was the only one that was positively impacted.

The opinions of businesses, as shown in Table 26, concur with the results from the means analysis by design sub-area for the Lubbock and Dallas study areas in actual terms. The opinions and results of means analysis are not in agreement for the following study areas:

—Houston (all segments). A greater percentage of respondents indicated a decline in sales on all segments of Beltway 8. However, the means analysis indicated an improvement in the mean level of sales for businesses located adjacent the at-grade segment and no change in mean gross sales for businesses located adjacent the elevated segment of Beltway 8.

—San Antonio (elevated and depressed sections). Opinion of businesses suggest decline in gross sales for businesses abutting elevated and depressed sections, but these opinions are contradicted in the means analysis.

The analysis of actual sales data from the State Comptroller confirmed the findings of the means analysis only in the case of the following study sections:

—Lubbock (all sections),

—Dallas (elevated and at-grade segments), and

—Houston (at-grade segment)

The means analysis indicated a decline in gross sales on depressed segments of Central Expressway; however, the analysis of actual sales indicated an increase for the depressed segment. In the case of Houston (elevated and depressed segments), the means analysis indicated a decline in sales (real dollars) of businesses adjacent the elevated segments, and no information was available for businesses on the depressed segment. The actual sales data analysis for Houston indicated an increase on all segments. In the case of San Antonio, the means analysis indicated a decline in sales for all sections, while the analysis of U.S. 281 data from State Comptroller indicated an increase in sales. Again, the discrepancies in the two results are primarily because 1) the means analysis uses means which are derived from broad gross sales ranges, and 2) the means analysis is based on a sample of firms reporting sales in all periods while the other approach is based on all businesses abutting the highway. It is also observed that changes in employment levels closely match the changes in gross sales levels; this is to be expected to a certain degree.

Overall, pooling in the results of the studies, there is evidence that depressed sections, as defined in the introductory chapter, have outperformed elevated sections in terms of changes in gross sales levels. Analysis of sales based on State Comptroller data of relevant zip codes surrounding the study areas and non-abutting sections showed a positive increase in sales for all study sections in real terms (except Lubbock I-27 sections). The net impact on the Lubbock, San Antonio, and Dallas abutting study sections was in the negative direction (since the study section showed a smaller positive percentage change in comparison to the study area as a whole), and the impact was estimated to be positive in the case of the Houston study section. These impacts can be attributed to the construction of study freeways, and in the case of Lubbock, grade level differences were also a contributing factor. In general, the abutting businesses in the depressed section (#9) in Lubbock were the worst affected on all counts: property values, gross sales levels, parking spaces, and employment declined. Dallas study area businesses were also negatively impacted on many counts; however, these are purely during-construction period effects. San Antonio study area businesses were, in general, positively affected in terms of parking spaces and employment. Houston study area businesses were also positively impacted, in some cases (sales and parking spaces), and negatively affected in others cases ( property values and employment). Lubbock elevated sections were positively impacted in the after-period only in terms of employment and parking spaces and negatively impacted in terms of property value and sales; at-grade sections were positively impacted in terms of employment only.

**Construction Employment Effects**

The analysis of employment and income effects of contractors' expenditures on construction of the study freeways leads us to believe that elevated/elevated-depressed sections have led to the largest increases in employment and related output effects. This is primarily because construction costs for elevated types of freeways are typically much higher than for either the depressed or at-grade types.

**Tax Revenue Impacts**

The combined property and sales tax revenue impact analysis indicated that overall, depressed sections have outperformed elevated sections. On an individual section basis, in most cases and excluding Dallas, the at-grade control sections have shown the maximum positive appreciation in property and sales tax revenues than other segments within the same study section.

## SUMMARY OF FINDINGS FROM RESIDENTIAL SURVEYS

Most of the residential respondents lived in single-family detached housing and lived in houses sometimes as old as 26 years, with approximately 5-9 rooms in the house. Most of the respondents in all study areas were homeowners and had lived in the neighborhood for longer than 15 years on abutting sections and 12 years on non-abutting sections. The average length of stay of residential respondents was, in general, higher on abutting sections than other non-abutting sections, except in the Dallas study area. Property values were observed to be highest on non-abutting sections rather than abutting sections, in general. There did not appear to be any consistent pattern by design sub-area. In the case of the I-27 study area in Lubbock, however, the abutting properties had higher mean property values than non-abutting properties, and further, properties both abutting and non-abutting the depressed section of I-27 had the highest mean property values in comparison to other grade levels.

In both Lubbock and San Antonio study areas, the majority of respondents were Hispanic, while the majority of respondents were Anglo in the Houston and Dallas study areas. Household size ranged between three to five members in most study areas, members typically being couples living with their children. In the Dallas study area, however, the household size consisted of either one or two members and the typical composition being married couples. A very high percentage of respondents from the Lubbock I-27 study area (74%) and San Antonio study areas (54%) were not highly educated and had either a high school degree, trade, or technical degree or less. On the contrary, the educational background of respondents from the Houston Beltway 8 study area and Dallas Central Expressway study areas was much stronger, with a large majority of respondents possessing at least a college degree.

Two aspects were considered as indicators of financial characteristics of the respondents. The first variable was the number of cars owned, and the second variable was the annual income range. A majority of the responding households possessed at least two cars in most study areas. Mean income ranges within abutting sections of the study areas were the highest on depressed sections or segments of the concerned freeways. This was not the case in the Dallas study area, where mean income was highest on the elevated segment of Central Expressway. In the non-abutting sections, elevated sections had higher mean incomes than depressed sections, the exception to this case being Lubbock non-abutting sections where the reverse was observed. Furthermore, mean incomes were higher for respondents on abutting sections in the Lubbock and San Antonio study areas; mean incomes were higher on non-abutting sections in the Dallas and Houston study areas.

As regarding the travel habits of the respondents, most of the respondents in the Lubbock and Houston study areas usually traveled a distance exceeding five miles (3.01 km) for shopping, running personal errands, or commuting to work. Most respondents in the Dallas and San Antonio study areas traveled between one and five miles (1.61 and 3.01 km) for purposes of shopping and running personal errands.

All of the study area neighborhoods were found to be cohesive; however in terms of quality, there were found to be wide differences, with the Houston and Dallas study areas at the upper end of the scale and Lubbock at the lower end of the scale. An inverse relation was observed between distance from the freeway and the incidence of reported problems. Price and convenience were found to be the leading reasons for locating in the neighborhood in all study areas. Neighborhood type was another critical deciding variable in the case of the Houston and Dallas study areas. The most frequently reported advantages of the study areas include:

Lubbock: Proximity to work and schools, freeways access,

Houston: Convenient, neighborhood type, good schools,

San Antonio: Convenient and central location, freeway access, and

Dallas: Prestige and beauty, neighborhood type, proximity to schools, convenient, and central location.

The most frequently cited disadvantages of the study areas typically include:

Lubbock: Neighborhood upkeep, traffic level, noise,

Houston: Traffic level, noise, proximity to the freeway,

San Antonio: Traffic level, noise, neighborhood people, and

Dallas: Traffic level, noise.

Although there was a large percentage of respondents who believed that the study freeways had not changed the travel pattern, there is some evidence that the construction of the study freeways improved accessibility in all study areas. No grade level differences were observed either in the change in travel patterns after construction of study freeways or opinions on extent of change in the area while at location or since completion of study freeways. However, there is some evidence to show that the distance from the freeway may be an important determinant of these perceptions. The incidence of opinions suggesting decline increased on some abutting zones. Opinions of change in the study areas since at location and since completion of study freeways differed considerably in two of the four study areas, Dallas and Houston. In the case of Lubbock, the responses to both of the questions indicated a change in the negative direction rather than positive; the reverse was observed in the case of San Antonio. While a greater percentage of respondents from the Houston and Dallas study areas felt the areas had improved rather than deteriorated since at location, when asked about extent of change since completion of study freeways, these opinions were completely reversed. These factors lead us to believe that the construction of the study freeways may have had some negative impact on the perceptions and opinions of residents regarding area effects in Lubbock, Dallas, and Houston study areas and a positive impact in the San Antonio study area. However, in the case of Dallas, the responses are a reflection of construction period effects.

All study area respondents believed that construction of the study freeways was necessary. No grade level effects were detected in the responses, and the responses were not different even by distance zone. Some of the reasons for construction provided by respondents include increased traffic due to growth in the respective cities and increasing congestion levels. Respondents in most study areas indicated a strong preference for the depressed type of freeway over the elevated type, particularly as distance to the freeway decreased. The incidence of no preference type of responses increased as distance the freeway increased, i.e., on non-abutting zones. In the Houston and Dallas study areas, depressed types of freeways were the preferred choice regardless of distance from the freeway or the current location of the respondents.

Regarding the effectiveness of noise barrier walls in the Houston and Dallas study areas, the evidence suggests that a greater percentage of respondents believed that they are effective rather than ineffective in mitigating noise problems. In the Houston study area, these percentages are 91% and 50% on abutting and non-abutting sections, respectively. In the Dallas study area, these percentages are 89% and 64%, respectively. Again, no grade level differences were found in the opinions of residents. However, distance from the freeway was found to be an important variable in determining opinions. As expected, an inverse relation was observed between the degree of effectiveness as reported by the respondents and distance from the freeway. Nevertheless, even on non-abutting sections, more respondents felt the noise barriers were effective rather than ineffective.

Some positive effects of the freeway were reported by respondents from all study areas. The effects were found to be different based on distance from freeway. In addition, some benefits were reported in some areas and others in other areas. The positive effect that was cited in all study areas (abutting sections) as having improved after construction was an improvement in travel times. An increase in travel convenience and travel safety was also observed from responses in all study areas, with the exception of Dallas. Again, this is because of the ongoing construction activity on Central Expressway. Other benefits, such as an improvement in property values were observed only in the San Antonio study area. On non-abutting sections, travel times were reported to have improved in Lubbock and Dallas only. Travel convenience was reported to have increased in all areas except Dallas. Travel safety was observed to have increased in Lubbock and San Antonio areas only. Property values were observed to have improved in the San Antonio study area and non-abutting sections of the Lubbock I-27 study area.

Among the negative effects most frequently cited on both abutting and non-abutting sections were increased noise, pollution, and crime levels. Neighborhood quality was reported more frequently to have declined on all abutting sections. In the non-abutting sections, the responses suggest an improvement in the Lubbock and San Antonio study areas, no change in the Houston area, and a deterioration in the Dallas area. Property values were reported more often to have decreased rather than increased in the Lubbock (abutting sections), Houston, and Dallas study areas.

# CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations can be made based on the findings of this study.

## CONCLUSIONS

- Negative during-construction period effects are observed on both businesses and residents. Furthermore, the Dallas study area survey responses clearly show the negative construction period impacts since Central Expressway construction was underway at the time this study was undertaken.

- Grade level differences in responses to business surveys were observed mostly in the Lubbock study area with regard to preferred grade level, extent of change in the area since construction, changes in property values, and changes in actual sales. Grade level impacts were observed in the responses of businesses in the Dallas study area only with regard to the effect of construction of Central Expressway on the locality. As far as residential surveys are concerned, no grade level differences were observed in the responses. However, residents' opinions changed as distance from the freeway increased. An inverse relation was observed between distance from the freeway and the incidence of reported negative responses.

- Neighborhoods effects were found to be both positive and negative. The positive effects stem mostly from increased accessibility for both businesses and residents, while negative effects arise due to increased noise, pollution, and crime levels. Business survey responses indicate mostly positive area effects overall, and negative area effects were limited to Lubbock I-27 section #9. Responses from resident surveys indicate negative area effects due to construction in the Lubbock, Houston, and Dallas study areas and mostly positive effects in the San Antonio study areas. Both business and resident survey responses also indicate a deterioration in neighborhood quality in all study areas due to increases in noise, pollution, and crime levels among other factors after construction; however, this reduction seems to be due to construction itself rather than due to grade level differences.

- Community cohesion declined the most on the I-27 elevated section #8 and I-27 depressed section #9 in Lubbock, where extensive relocations were undertaken. The residential survey responses also indicated a greater decline of cohesion on the depressed segments of the Sam Houston Tollway and Central Expressway than elevated or at-grade segments, confirming the findings of the literature review.

- Negative effects of the freeways, which include increased noise, pollution, and crime, were observed in all study areas indicating, once again, a deterioration in neighborhood quality. However, the construction of the freeways brings with it a host of benefits to businesses and residents, especially in areas where the freeways have been operative for a while. These direct benefits include increased travel safety, a reduction in travel time, and an increase in travel convenience. All these factors would tend to enhance user benefits. Property value effects were mostly negative, and sales effects were sometimes positive and sometimes negative. Further, both business and residential survey responses also indicate an improvement in accessibility since construction of study freeways.

- The depressed section #9 was the most negatively impacted on all counts, which includes a decline in neighborhood quality, community cohesion, property values, gross sales, employment, and parking spaces.

- Impacts on sales of abutting businesses, parking spaces, and employment can all be linked to the construction of study freeways. Negative impacts on parking spaces of businesses were limited to the during-construction period only, and the after-construction period effects were either small positive changes or no change. Overall, sales impacts on the study sections in the after-construction period were mostly negative, as in the case of the San Antonio, Lubbock, and Dallas study areas. Sales impact on the Houston study section were largely positive. Further, depressed sections outperformed elevated sections in terms of sales impacts. Employment effects follow a pattern similar to sales in all cases, except in Houston. It is interesting to note that while sales effects in the after construction period were found to be positive in the Houston study area, employment effects were found to be negative. Under some assumptions, one would expect that sales and employment would generally follow similar patterns; however, the case of Houston raises some interesting questions. For example: 1) What is the validity of using gross sales averages from the State Comptroller data to arrive at estimated effects? 2) If we assume that the use of averages is justified, then what other factors (like those which improve labor productivity) could be responsible for this observed decline? 3) Would the results have been different had the response rates been higher?

- Interestingly, commercial property value effects were found to be negative in all study sections but could not always be attributed to the construction of the study freeways itself. In three out of four situations (exception being San Antonio), there was a concomitant decline in the total market values of properties over roughly the same period, suggesting that local economy trends could have been responsible for the observed decline. Further, grade level effects were observed only for the Dallas and Lubbock study areas in the responses of businesses indicating actual range of property values rather than pure perceptions of change. This suggests that the construction could have magnified a problem which was originally brought about by factors other than the highway construction in these two areas. This also suggests that in a vulnerable economy, even grade level differences of freeway construction could make a difference to abutting property values of commercial properties adjacent to depressed sections. On the other hand, Houston actual commercial property value trends did not change in the before- and after-construction period, but would imply a reduction in real terms.

- The majority of the residents in both the Houston and Dallas study areas unanimously felt that noise barriers were effective in reducing noise. No grade level differences were observed in the responses.

- Business and resident survey responses from all study sections indicated the need for construction in all study areas. One of the reasons most frequently cited includes increased congestion levels due to increased traffic and growth in the cites.

- Construction employment effects due to highway contractor expenditures were found to be the highest for the elevated sections. Before- and after-construction tax revenue effects were found to be highest for the at-grade sections but higher on depressed sections than elevated sections. Relocation employment impacts were found to be minimal for at-grade sections and highest for elevated sections of I-27.

- Interestingly, this study found large differences in the after-construction period effects but similar results for all cases during-construction. The overall socio-economic impacts on the I-27 study sections were largely negative (section #9, in particular), ambiguous in the case of Houston and San Antonio (some effects were positive and some negative), and mostly negative in the case of Dallas. This leads us to ask why the effects are so different across study sections. Besides local economy-related differences, there are also differences in the location/type of construction undertaken. The I-27 study section, the Central Expressway study section, and the San Antonio Y-project study sections are examples of construction activity in and around the downtown areas. This is not the case for the U.S. 281 study section in San Antonio and the Houston Beltway 8 study section.

## RECOMMENDATIONS

- TxDOT should continue to construct freeways at-grade, and decisions to build elevated or depressed type of designs should be based on predominant land use, public opinion, cost, and socio-economic considerations addressed in this report. The research indicated that the preferred choice for businesses is the elevated type of design in Lubbock, Houston, and San Antonio. Dallas businesses preferred the depressed design more than the elevated design. The preferred choice for residents is the depressed design. The research indicates that depressed sections tend to outperform elevated sections with regard to business sales effects, property, and sales tax revenue effects. Elevated sections outperform depressed sections in construction employment-related effects because they are more expensive to construct; however, the evidence in this report indicates that they may have somewhat less intrusive effects on neighborhood cohesion. Quality-related variables are found to be a function of construction of the freeway itself rather than grade level of freeway constructed.

- On the whole, some effects will be positive and others negative, and decisions should be based taking all factors into consideration. When undertaking a construction project in an area which is going through an economic slowdown, even more caution should be exercised because even grade level variations could further hurt the area in terms of property values and business sales.

- The negative during-construction period effects observed in all study areas and Dallas specifically suggest that TxDOT should continue to adopt mitigation measures in planned future undertakings, such as maintaining access and visibility of businesses.

- Considering the residents' opinions regarding the effectiveness of noise barriers in lowering noise levels, mitigation efforts should continue to consider the use of noise barriers as tools to lower noise levels both due to highway construction and highway- induced traffic after construction.

- Findings from this study and similar case studies conducted in the future should be used to develop a database of findings on different socio-economic impacts considered in this report and could be used to develop a methodology to be used for predictive purposes in the construction of future elevated/depressed highways. This pooled database of findings could also be categorized by location of project construction to ascertain the differential effects of different types of projects. For example, it may not be reasonable to expect that construction projects undertaken near the Central Business District will have the same overall effects as construction on a loop around the city or other projects which aim at the enhancement of connectivity.

- Additional research could be undertaken at a later date when construction work on currently planned freeway Lubbock U.S. 62/82 and Central Expressway is completed to assess whether the effects are any different from the Lubbock I-27 study area results for reasons mentioned above.

# REFERENCES


1. Ashley, Roger H., and William F. Berard. *Proximity Study No.203. A Comparison of Economic Effects of an Above Grade Freeway on a Residential Subdivision Versus Alternate Land Uses: City of Farmington.* U.S. Department of Commerce, Bureau of Public Roads. March 1965.

2. Dude, R. *The Effects of a Depressed Expressway- A Detroit Case Study.* The Appraisal Journal, October 1958. pp: 487-507.

3. Brinton, J. H., and J. N. Bloom. *Effect of Highway Landscape Development on Nearby Property Values.* Highway Research Board Bulletin, NCHRP Report, No. 75, 1969.

4. Draft Environmental Assessment, Hohokam Freeway (State Route 143), Arizona Department of Transportation, Environmental Planning Services, January 1987.

5. Final Environmental Impact Statement and Section 4(f) Statement, Interstate 10, 91st Avenue to Junction I-10, Maricopa County. Federal Highway Administration, Report No: FHWA-AZ-EIS-76-1-F, 1977.

6. Final Environmental Impact Statement, U.S. 75 from Spur 366 to IH- 635, Dallas County, Texas, State Control No. 47-7-122. Texas State Department of Highways and Public Transportation, District 18, July 1986.

7. Draft Environmental Impact Statement, Squaw Peak Extension, State Route 510, Glendale Avenue-Outer Loop. Arizona Department of Transportation, Highways Division, Gruen Associates, 1987.

8. Final Environmental Impact Statement, Paradise Parkway-SR 50, RAM 600-600-4-202, Squaw Peak (SR 51) to Outer Loop Freeway (SR-101L), Arizona Department of Transportation, Phoenix, Arizona, 1989.

9. Buffington, Jesse L., Lawrence M. Crane, Katie N. Womack, and Rohani Salleh. *Economic Assessment of the Proposed Improvement of U.S. Highway 287 in Wichita Falls, Texas.* Texas Transportation Institute, TTI Research Report 1915-1F, June 1991.

10. Nelson, Arthur C. *Effects of Elevated Heavy-Rail Transit Stations on House Prices with Respect to Neighborhood Income.* Transportation Research Record, No. 1359, 1992.

11. Nelson, Arthur C., and S. McClesky. *Influence of Elevated Transit Stations on Neighborhood House Values.* Transportation Research Record, No. 1266, 1990.

12. S. McClesky. *Investigating the Effects of Elevated Heavy-Rail Transit Station Planning and Design on Single Family House Prices.* M.S. Thesis. City Planning Program, Georgia Institute of Technology, Atlanta, 1988.

13. Thiel, Floyd I. *Social Effects of Modern Highway Transportation.* Highway Research Board Bulletin, No. 327, 1962.

14. Buffington, Jesse L., D. Burke., W. G. Adkins., and H. G. Meuth. *Experiences and Opinions of Residents Along Elevated, Depressed, and On-Grade Freeway Sections in Houston, Texas.* Texas Transportation Institute, TTI Research Report, No. 148-1, 1971.

15. Harvey, Thomas N. *Assessing the Effects of Highway-Widening Improvements on Urban and Suburban Areas: A Synthesis of Highway Practice.* National Cooperative Highway Research Program, Transportation Research Board, No. 221. Washington D.C., 1996.

16. Buffington, Jesse L., Lawrence M. Crane, Burton Clifton, and John Speed. *Methodology for Estimating Economic Impacts of Highway Improvements: Two Case Studies in Texas.* Transportation Research Record, No.1359, 1992.

17. Buffington, Jesse L., C. W. Herndon, and M. E. Weiss. *Non User Impacts of Different Highway Designs as Measured by Land Use and Land Value Changes.* Texas Transportation Institute, TTI Research Report, No. 225-2, 1978.

18. Buffington, Jesse L., H. G. Meuth, D. L. Schafer, R. Pledger, and C. Bullion. *Attitudes, Opinions, and Experiences of Residents Displaced by Highways Under the 1970 Relocation Assistance Program.* Texas Transportation Institute, TTI Research Report, No. 159-1, 1974.

19. Buffington, Jesse L., D. L. Schafer, and C. Bullion. *Attitudes, Opinions, and Experiences of Business and Institutional Relocates Displaced by Highways Under the 1970 Relocation Assistance Program.* Texas Transportation Institute, TTI Research Report, No. 159-2, 1974.

20. Buffington, Jesse L. *Consequences of Freeway Displacement to Urban Residents in Low-Valued Housing.* Texas Transportation Institute, TTI Research Report, No. 148-3, 1973.

21. Texas Comptroller of Public Accounts. The Texas Input-Output Model, 1986 Update. December 1989.

22. Zografos, Kostas G., and Yorgos J. Stephanedes. *Impact of State Highway Investment on Employment Along Major Highway Corridors.* Transportation Research Record, No.1359, 1992. pp: 151-155.

23. Memmott, Jeffery L. *The HEEM-III Benefit-Cost Computer Program.* Texas Transportation Institute, TTI Research Report, No. 1128-1F, November 1990.

24. McFarland, William F., Jeffery L. Memmott, and Margaret K. Chui. *Microcomputer Evaluation of Highway User Benefits*. National Cooperative Highway Research Program, Final Report, No. 7-12, 1993.

25. Buffington, Jesse L., Margaret K. Chui, Katie N. Womack, and Lawrence M. Crane. *Integrated Approach to Appraisal: Economic, Social, and Environmental Impacts of Highway Improvement Alternatives*. Proceedings of the 20th Summer Annual Meeting, Seminar H of the Planning and Transport Research and Computation International Association, pp: 33-45.

# APPENDIX A

# SURVEY OF STATEWIDE TxDOT DISTRICT ENGINEERS FOR FREEWAY SECTIONS FOR INCLUSION IN THE STUDY

Date

Name
Title
Organization
Address
City, State, Zip

Dear [TxDOT personnel]:

The Texas Transportation Institute is conducting a study to determine the social, economic and environmental effects of elevated and depressed freeways in urban and suburban areas. We would like to estimate these effects by studying several existing, contracted and proposed elevated and depressed freeway sections situated in urban areas in Texas. We are writing to request your assistance in locating candidate sites for the study.

The following types of elevated and depressed sections are of interest to us:

1. Existing sections completed within the last 10 years,
2. Sections under construction, and
3. Sections being planned.

In this study, data will be collected for sections that are currently being planned that will establish baseline information. For study sections already completed or under construction, as much data will be collected as possible to estimate conditions before and during construction. The effects of construction will be measured in follow-up studies.

The results of this study will be used by TxDOT planning and design engineers in the preparation of environmental statements and documentation of the expected social, economic, and environmental impacts of a proposed elevated or depressed freeway project. It is hoped that the findings of this study will assist TxDOT in objectively selecting an urban freeway design, and help to maintain good public relations with those directly and indirectly affected by the construction of elevated and depressed freeway improvements.

We ask that you furnish a list of projects that meet any of the criteria above. Additionally, we would appreciate any maps or drawings that would help locate the projects and/or describe the construction. If possible, please indicate the predominant abutting land use for each section. Also, we need the dates of the planned or completed projects.

A form is attached to facilitate the collection of this information. If you have any questions, need additional information, or would find it easier to relay any of this information by phone, we can be contacted at (409)845-9939. We look forward to your response.

Sincerely,

Jesse Buffington
Study Supervisor

**Recent Construction**

Estimate the number of **recently constructed** (within the past 10 years) elevated and depressed freeway sections in your District [City].

☐ Number of elevated sections.

Note: Please list only sections that would be viable for study, that is, sections that involve at least two over/underpasses, or are at least 1/4 mile long.

☐ Number of depressed sections.

Give the location and check the descriptive characteristics for each section.

| Section Location (Hwy/Frwy Name or Number)* | Elevated | Depressed | Downtown | Suburban | Residential | Commercial | Age of Facility | | Facility Length (Miles) | Land Use Map Available | Aerial Map Available |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | <5yrs | 6-10yrs | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

*Please attach map with section identified.

**Under Construction**

Estimate the number of elevated and depressed freeway sections in your District [City] that are currently **under construction**.

☐ Number of elevated sections.

☐ Number of depressed sections.

Note: Please list only sections that would be viable for study, that is, sections that involve at least two over/underpasses, or are at least 1/4 mile long.

Give the location and check the descriptive characteristics for each section.

| Section Location (Hwy/Frwy Name or Number)* | Elevated | Depressed | Downtown | Suburban | Residential | Commercial | Construction Start Date | Facility Length (Miles) | Land Use Map Available | Aerial Map Available |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

*Please attach map with section identified.

**Planned Construction**

Estimate the number of **planned** elevated and depressed freeway sections in your District [City].

☐ Number of elevated sections.

Note: Please list only sections that would be viable for study, that is, sections that involve at least two over/underpasses, or are at least 1/4 mile long.

☐ Number of depressed sections.

Give the location and check the descriptive characteristics for each section.

| Section Location (Hwy/Frwy Name or Number)* | Elevated | Depressed | Downtown | Suburban | Residential | Commercial | Construction Start Date | Facility Length (Miles) | Land Use Map Available | Aerial Map Available |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

*Please attach map with section identified.

# APPENDIX B

# NATIONAL SURVEY

Date

Name
Title
Organization
Address
City, State, Zip

Dear [State Agency Personnel]:

The Texas Transportation Institute is conducting a study for the Texas Department of Transportation to determine the social, economic, and environmental effects of elevated and depressed freeways in urban and suburban areas. We have found that only a few studies exist in the literature where measures of social, economic and environmental impacts of depressed and elevated freeways were used. We would like to know if any work has been done in your State on this topic.

We would greatly appreciate your response to the attached questionnaire. Our objective is to determine, to the extent possible, the state of the art with regard to data and procedures used to measure the above mentioned impacts, recognizing that much has not been published, but in fact may have been learned and put into practice in other States.

If you have any questions, need additional information, or would find it easier to relay any of this information by phone, we can be contacted at (409)845-9939. We look forward to your response.

Sincerely,

Dr. Jesse Buffington
Research Economist

Note: Elevated and depressed freeway sections refer to sections that involve at least two over/underpasses, or are at least 1/4 mile in length.

| | | Elevated | Depressed |
|---|---|---|---|
| 1. | Estimate the number of recently completed (within the past 10 years) elevated and depressed freeway sections in your state. | | |
| 2. | How many elevated and depressed freeway sections are currently under construction in your state? | | |
| 3. | How many elevated and depressed freeway sections are currently planned in your state? | | |
| 4. | How many of each type freeway have been studied in detail to estimate their social, economic, and/or environmental impacts? | | |

5. What specific types of data have been collected to measure **social effects** of elevated or depressed freeways?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

6. What specific types of data have been collected to measure **economic effects** of elevated or depressed freeways?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

7. What specific types of data have been collected to measure **environmental effects** of elevated or depressed freeways?

______________________________________________

______________________________________________

______________________________________________

______________________________________________

______________________________________________

8. Have predictive models or procedures using the data listed above been developed for use in your State?

If so, are published reports available that document their use?

If so, please provide a reference list.

If predictive models or procedures using the data listed above have been developed but have not been published, is written documentation available?

If yes, we would greatly appreciate a copy.

9. Is there a preference for elevated, depressed or neither type of freeway in your State?

If so, what is the basis for the preference?

10. If possible, summarize your State's experience with elevated and/or depressed freeways.

# APPENDIX C

# SURVEY PROTOCOL

# PROTOCOL FOR 1327 DROP-OFF SURVEY

## BACKGROUND AND PURPOSE

The purpose of this survey is, as stated on the questionnaires, to determine the effects of construction on area businesses, residents, and institutions. The study is designed to compare the effects of elevated versus depressed freeway types on the adjacent and surrounding properties. We will be surveying in a variety of settings in an attempt to collect as much data as possible. For each study site, we will also collect data for a control site. This study is a multi-year effort and is currently in its fourth year.

The survey is designed to be a drop-off and pick-up survey, meaning a questionnaire will be left with potential respondents to complete when convenient, and picked up at a later time. This method has been chosen to 1) give respondents ample time to think through their responses or acquire data if necessary, and 2) to maximize the number of questionnaires that can be distributed and collected during the limited survey periods. Additionally, this method was chosen over a mail questionnaire so that a personal contact could be made and so that responses could be reviewed and clarified with the respondent, if necessary. This approach is intended to provide a higher response rate with more complete data than would be acquired using a mail questionnaire.

The following paragraphs describe how you should approach respondents, sampling procedures, troubleshooting, and general instructions. Careful adherence to this protocol is required to assure a non-biased, valid, and successful survey.

### Initial Contact

Carry a logo type folder whenever you make a contact to deliver a questionnaire, and have business cards with you to back up your introduction. If you are surveying a business, you should ask for the owner or manager. If the owner or manager is "permanently" unavailable, ask for the manager or assistant manager on duty (i.e., someone who is familiar with overall day-to-day operations). If you are surveying a residence and the person who answers does not appear to be a head of household (i.e., a child, an employee of the household), ask for a parent or the "man or woman" of the house. You may leave the questionnaire with either the male or female head of household.

Once you have identified the appropriate respondent, ask for their cooperation in the following way:

> **Hello, my name is ____________. I'm with Texas Southern University. We're doing a study for the Highway Department about the construction of Beltway 8 and the effects it may have had on you [your business]. I would like to leave this questionnaire with you, if you would be so kind as to fill it out at your convenience. I can come back tomorrow and pick it up.**

Respond to questions completely, but succinctly and in a straightforward manner. Do not elaborate unnecessarily.

**Sampling Procedures**

Our goal is to survey every business and residence adjacent to the construction facility in each study site, and to survey a sample of 20% of the businesses and residences within a band of proximity to the study facility. However, this goal may be unreasonable in some cases. Therefore, the following sampling protocol should be followed.

- If a study area has fewer than 150 businesses or fewer than 150 residences adjacent to the study facility, then every business and every residence should be included in the survey.

- If a study area has more than a total of 150 business properties or residences adjacent to the study facility, then every other business and residence should be surveyed.

To determine which abutting businesses/residences to survey, flip a coin to decide to begin with the first or second business/residence at one of the boundaries of the study site. From that point on, you must methodically select **every other** business/residence throughout the abutting area for the survey.

For multi-level offices, the following sampling procedure should be used:

- If there are two floors, survey on one floor. Flip a coin to decide which one.
- If there are three floors, survey on one floor. Draw a number out of a container to decide which one.
- If there are four or five floors, survey on two floors. Draw numbers to decide which ones.
- If there are six or more floors, survey on three floors. Draw numbers to decide which ones.
- Use the same proportion within the building you are using for other businesses. That is, if you are surveying every abutting business, then survey every business on the selected floor(s). If you are surveying every other business, then survey every other business on the selected floor(s).

For apartment complexes, the following sampling procedure should be used:

- If there are three residences to a building, survey one of them. Draw a number to decide which one.
- If there are four to a building, survey two. Flip a coin to decide whether to survey even or odd numbered apartments.
- If there are numerous buildings, randomly select two buildings and survey half the occupant households in each building.

For both business and apartment sample selection, flip a coin or draw a number each time you need to select a sample. In other words, don't flip or draw and use the same number throughout the day or throughout the survey period.

For sampling non-abutting businesses and residences, the following procedures should be used:

- Every 5th business and every 5th residence throughout the non-abutting study area should be surveyed.

- As you start in the survey area, randomly choose an outside boundary to begin with, and select every 5th home and every 5th business throughout the area.

- Make sure your selections are made methodically. Do not select for convenience or desirability, but follow a rigid pattern of selecting every 5th home and every 5th business.

**Troubleshooting**

If you believe a residence or place of business would be dangerous to approach, then do not approach it. This does not mean that you avoid unpleasant places. The key word is **dangerous**. Do not approach residences (or businesses) that have *No Trespassing* or *No Soliciting* signs on them. You are not required to approach residences or businesses that have unchained or unfenced dogs or other threatening animals. In very run-down areas, or when clusters of people pose a potential threat, conduct the survey with a partner. It is best not to go inside residences, regardless of "the neighborhood." Our business can easily be conducted in the doorway. However, you are not prohibited from going inside, if invited, and if you are comfortable with the situation. Never ask if you can come inside.

If you determine that a house or business is too dangerous to approach, you should skip it and continue to sample as if it was not there. In other words, select the next house or business to survey and begin or continue the count there. Keep a record of any residences or businesses you skip, explaining your reasons for taking them out of the sample.

Try to have your survey partner within eyesight or earshot as much as possible. You do not need to survey together, unless conditions mentioned above warrant it. However, stay close enough so that if you don't see your survey partner after approximately 15 minutes inside a business or residence, go in and check on them.

**Questionnaire Collection**

At the agreed upon time, you will need to pick up completed questionnaires. As you pick them up, quickly review them to make sure all the questions have been answered **before you leave the business or residence**. If there are any incomplete responses, ask the respondent for their answer(s) to the question(s). If they do not know or refuse to give an answer, then write "don't know" or "refused" by the question. Initial anything you write on a questionnaire. If you are quoting the respondent, put quotes around responses and initial.

If the respondent has not done the questionnaire at pick up time, ask if they have time to complete it within the hour, and say you will come back within the hour. Try to avoid having to wait while they fill out the questionnaire completely. However, if they only lack a question or two, it would be best to wait. If it is near the end of the survey period and the only way you will get the completed questionnaire is to wait for it, then wait for it. Otherwise, try to keep moving as much as possible.

**Miscellaneous**

Keep records of refusals and reasons for refusals. Note the demographics for refusals—approximate age, gender, and ethnicity. For business refusals, include the type of business in addition to the demographics. Write comments on the questionnaires, with your initials.

When in doubt, ask. Don't assume. Let's make sure we all do these the same way.

Things NOT to say:

It is just a little survey that won't take long to do. [Do not minimize the importance of the survey as a way to entice a response.] Better to say—"the survey is not difficult, and everyone's input is very valuable to the study."

Rebuttals:

Sometimes people will say they do not want to answer the questionnaire because "I really don't have any opinions about that," or "My opinion doesn't matter that much," or "I have not been affected by the Interstate." Counter these arguments with the notion that we do not want to hear only from those with strong opinions or from those who have been greatly affected. We need to get responses that represent everyone in the study section to accurately determine how the construction has affected everyone.

TIDBITS:

Remember, we do not represent or speak for TxDOT in any way.

We do not know anything about the construction job.

If someone wants study results, take their business card or name and address and make a note of the request. Explain that this is a multi-year project, that we are doing similar surveys in other cities, and that results are not expected to be published for at least a year.

Never discuss anyone else's responses or opinions, or give your impressions of specific study results.

Be polite and cordial, and business-like. Act like a professional at all times.

# APPENDIX D

# TYPICAL BUSINESS AND RESIDENT SURVEY INSTRUMENTS

*Dear Business Operator:*

*The Texas Transportation Institute at Texas A&M University is doing a study of the effects of highway construction on people doing business near United States 281 (U.S. 281) in San Antonio. This study is being done for the Texas Department of Transportation to see how the construction of different types of freeways affects nearby businesses. We hope you will find the questions interesting and easy to answer. It is important that we hear from as many business operators in the area as possible so that an accurate measure of the effects can be made. The results will be studied as a group, and your business will never be identified individually. Thank you for your help.*

**The first eight questions are about the construction on U.S. 281 and its effect on this business.**

1. **Do you think construction on US 281 was necessary?**

_____ yes why yes________________________________

________________________________

_____ no why no________________________________

________________________________

_____ maybe
_____ not sure

2. **The freeway section near your business is an elevated freeway (above the ground surface). What is your opinion of this type of freeway?**

_____ like it very much
_____ like it some
**Why do you like it?**________________________________
_____ dislike it some
_____ dislike it very much
**Why do you dislike it?**________________________________
_____ no opinion one way or the other
_____ not sure

3. **Do you prefer elevated or depressed freeways?**

_____ elevated
_____ depressed
_____ no preference
_____ not sure

4. **What changes, if any, have you experienced during the construction on U.S. 281? (Check all that apply.)**

_____ increase in noise
_____ increase in pollution
_____ increase in travel safety
_____ increase in travel time
_____ increase in crime
_____ increase in property value
_____ increase in business volume
_____ more convenient for travel
_____ decrease in noise
_____ decrease in pollution
_____ decrease in travel safety
_____ decrease in travel time
_____ decrease in crime
_____ decrease in property value
_____ decrease in business volume
_____ less convenient for travel
_____ other (please list)______________________________________________
_____ no changes

5. **What is your opinion of the appearance of the freeway design?**

_____ like it very much
_____ like it OK
_____ dislike it some
_____ dislike it very much
_____ no opinion one way or the other

6. **Do you have any suggestions for improvements to the appearance of U.S. 281?**

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

7. **What is your opinion of the number of ramps to the Freeway?**

_____ not enough on ramps
_____ not enough off ramps
_____ plenty of on ramps
_____ plenty of off ramps
_____ more on ramps than needed
_____ more off ramps than needed
_____ no opinion on the number of ramps

**8. What is your opinion of the number of over and underpasses of the Freeway?**

_____ not enough overpasses
_____ not enough underpasses
_____ plenty of overpasses
_____ plenty of underpasses
_____ more overpasses than needed
_____ more underpasses than needed
_____ no opinion on the number of over and underpasses

**In the next set of questions, we would like your opinion regarding the location of this business.**

**9. How would you describe this location? (Check all that apply.)**

_____ nicer area than most
_____ area is only so-so
_____ accessible location
_____ active
_____ safe
_____ convenient
_____ stable
_____ well kept
_____ plenty of space
_____ middle type area
_____ not as nice as most
_____ not very accessible
_____ quiet
_____ not so safe
_____ inconvenient
_____ unstable
_____ not well kept
_____ crowded
_____ other (please describe) ______________________________

**10. What are the main reasons you decided to locate at this address? (Check all that apply.)**

_____ price of real estate
_____ convenience of location
_____ type of area
_____ customer market
_____ traffic patterns
_____ took over existing business
_____ landscape
_____ other (please describe) ______________________________

**11. What are the main advantages of being in business at this location?**

1. ____________________________________________
2. ____________________________________________

**12. What are the main disadvantages of being in business at this location?**

1. ____________________________________________
2. ____________________________________________

**13. How has this area changed in the time that you have been in business here?**

_____ has not changed
_____ has improved a little
_____ has improved a good bit
_____ has improved greatly
_____ has declined a little
_____ has declined a good bit
_____ has declined greatly

**14. How do you think this area will change after completion of the construction on U.S. 281?**

_____ will not change
_____ will improve a little
_____ will improve a good bit
_____ will improve greatly
_____ will decline a little
_____ will decline a good bit
_____ will decline greatly

**The last 7 questions are about the history and the future of this business.**

**15. How old is this business?**

_____ Less than one year old
_____ 1 - 5 years old
_____ 6 - 10 years old
_____ 11 - 20 years old
_____ over 20 years old

**16. How long has this business been at this address?**

_____years, or _____months

17. **Is your building owned or rented by this business?**

_____ Owned _____ Rented

18. **How many people are employed by this business at this location? (average per year)**

**Before U.S. 281 construction (if applicable)**
_____ full time employees
_____ part time employees

**During U.S. 281 construction (if applicable)**
_____ full time employees
_____ part time employees

**After U.S. 281 construction (if applicable)**
_____ full time employees
_____ part time employees

19. **How many parking spaces are available for this business?**

**Before U.S. 281 construction (if applicable)**

_____ number of spaces

**During U.S. 281 construction (if applicable)**

_____ number of spaces

**After U.S. 281 construction (if applicable)**

_____ number of spaces

20. **What is your estimate of the dollar value of this property, before, during and after U.S. 281 construction? (Including the land and the building)**

**Before construction**
_____ less than $50,000
_____ $50,001 - $100,000
_____ $100,001 - $200,000
_____ $200,001 - $300,000
_____ $300,001 - $500,000
_____ $500,001 - $750,000
_____ $750,001 - $1,000,000
_____ over $1,000,000

**During construction**

_____ less than $50,000
_____ $50,001 - $100,000
_____ $100,001 - $200,000
_____ $200,001 - $300,000
_____ $300,001 - $500,000
_____ $500,001 - $750,000
_____ $750,001 - $1,000,000
_____ over $1,000,000

**After construction**

_____ less than $50,000
_____ $50,001 - $100,000
_____ $100,001 - $200,000
_____ $200,001 - $300,000
_____ $300,001 - $500,000
_____ $500,001 - $750,000
_____ $750,001 - $1,000,000
_____ over $1,000,000

**21a. What is your estimate of the gross sales of this business before, during, and after U.S. 281 construction?**

Please note—this information is confidential. We would greatly appreciate knowing actual gross sales volumes by year so that dollar impacts of the construction can be more accurately measured. If you are not able to provide yearly estimates of actual sales, would you please check an estimate of the range in sales given in 21b.

**Before construction**

1986 total gross sales $______________

**During construction**

1987 total gross sales $______________
1988 total gross sales $______________
1989 total gross sales $______________
1990 total gross sales $______________

**After construction**

1991 total gross sales $______________
1992 total gross sales $______________
1993 total gross sales $______________
1994 total gross sales $______________

**21b. If actual dollar amounts are not available for 21a, then what is your estimate of the range in gross sales of this business before, during, and after U.S. 281 construction? (average per year)**

**Before construction**

_____ less than $50,000
_____ $50,001 - $100,000
_____ $100,001 - $200,000
_____ $200,001 - $300,000
_____ $300,001 - $500,000
_____ $500,001 - $750,000
_____ $750,001 - $1,000,000
_____ over $1,000,000

**During construction**

| | |
|---|---|
| _____ less than $50,000 | _____ $300,001 - $500,000 |
| _____ $50,001 - $100,000 | _____ $500,001 - $750,000 |
| _____ $100,001 - $200,000 | _____ $750,001 - $1,000,000 |
| _____ $200,001 - $300,000 | _____ over $1,000,000 |

**After construction**

| | |
|---|---|
| _____ less than $50,000 | _____ $300,001 - $500,000 |
| _____ $50,001 - $100,000 | _____ $500,001 - $750,000 |
| _____ $100,001 - $200,000 | _____ $750,001 - $1,000,000 |
| _____ $200,001 - $300,000 | _____ over $1,000,000 |

**22. Do you have any other comments?**_________________________________________

______________________________________________________________

______________________________________________________________

**THANK YOU FOR TAKING TIME TO ANSWER THESE QUESTIONS.
WE GREATLY APPRECIATE YOUR HELP.**

FOR OFFICE USE ONLY

**23. Name of business:**______________________________________

**24. Type of business:**__________________________________________

**25. Condition of dwelling:**

_____ very good condition (no signs of disrepair)
_____ good condition (structure in good shape with little sign of disrepair)
_____ fair condition (some sign of disrepair)
_____ poor condition (structure in bad shape with many signs of disrepair)
_____ very poor condition (structure in dilapidated condition)

**26. Abutting** _____
**Non-abutting** _____

**27. Elevated** _____
**Depressed** _____

**28. Study section #** _____
**Control section #** _____

**DROP-OFF INFORMATION:**

**Day/Date of Drop-off:**______________ **Scheduled Day/Date of Pick-Up:**______________
**Time of Drop-Off:**______________ **Scheduled Time of Pick-Up:**______________

**ADDRESS:**__________________________________________

*Dear Houston Resident:*

*The Texas Transportation Institute at Texas A&M University is doing a study of the effects of highway construction on people living near Beltway 8 in Houston. This study is being done for the Texas Department of Transportation to see how the construction of different types of highways affects people who live nearby. We hope you will find the questions interesting and easy to answer. It is important that we hear from as many people in the area as possible so that an accurate measure of the effects can be made. The results will be studied as a group, and you will never be identified personally. Thank you for your help.*

**In the first set of questions, we would like your opinion regarding the location of this home.**

1. **How would you describe this neighborhood? (Check all that apply.)**

| | |
|---|---|
| _____ nicer neighborhood than most | _____ middle type neighborhood |
| _____ neighborhood is only so-so | _____ not as nice as most |
| _____ quiet | _____ noisy |
| _____ peaceful | _____ rowdy |
| _____ safe | _____ not so safe |
| _____ friendly | _____ unfriendly |
| _____ stable | _____ unstable |
| _____ sense of permanence | _____ transient |
| _____ well kept | _____ not well kept |
| _____ plenty of space | _____ crowded |
| _____ family oriented | _____ not family oriented |
| _____ little traffic on streets | _____ busy street traffic |

_____ other (please describe)________________________________________________

2. **What are the main reasons you decided to locate at this address? (Check all that apply.)**

| | |
|---|---|
| _____ price range of home | _____ distance to work |
| _____ convenience of location | _____ schools |
| _____ type of neighborhood | _____ similar people |
| _____ safe neighborhood | _____ safe traffic |
| _____ home choice just | _____ trees/landscape |
| _____ happened to be in this location | _____ always lived here |

_____ other (please describe)________________________________________________

**3. What are the main advantages of living at this location?**

1. ______________________________
2. ______________________________
3. ______________________________

**4. What are the main disadvantages of living at this location?**

1. ______________________________
2. ______________________________
3. ______________________________

**5. How has this neighborhood changed in the time that you have been living here?**

_____ has not changed
_____ has improved a little          _____ has declined a little
_____ has improved a good bit          _____ has declined a good bit
_____ has improved greatly          _____ has declined greatly

**6. How do you think this neighborhood has changed since the construction of Beltway 8?**

_____ has not changed
_____ has improved a little          _____ has declined a little
_____ has improved a good bit          _____ has declined a good bit
_____ has improved greatly          _____ has declined greatly

**The next few questions are about Beltway 8 and its effect on this home.**

**7. Do you think construction on Beltway 8 was necessary?**

_____ yes          why yes ______________________________
______________________________
_____ no          why no ______________________________
______________________________
_____ maybe
_____ not sure

**8. Do you prefer elevated (like an overpass) or depressed (like an underpass) freeways?**

_____ elevated
_____ depressed
_____ no preference
_____ not sure

9. **The freeway section closest to your home is elevated (like an overpass). What is your opinion of this type of freeway?**

_____ like it very much
_____ like it some
**Why do you like it?**

______________________________________________________________________
______________________________________________________________________

_____ dislike it some
_____ dislike it very much
**Why do you dislike it?**

______________________________________________________________________
______________________________________________________________________

_____ no opinion one way or the other
_____ not sure

10. **What changes have you experienced since the construction of Beltway 8? (Check all that apply.)**

| | |
|---|---|
| _____ increase in noise | _____ decrease in noise |
| _____ increase in pollution | _____ decrease in pollution |
| _____ increase in travel safety | _____ decrease in travel safety |
| _____ increase in travel time | _____ decrease in travel time |
| _____ increase in crime | _____ decrease in crime |
| _____ increase in property value | _____ decrease in property value |
| _____ increase in neighborhood quality | _____ decrease in neighborhood quality |
| _____ more convenient for travel | _____ less convenient for travel |

_____ other (please list)______________________________________________

11. **What is your opinion of the barrier walls that have been built along the sides of Beltway 8?**

_____ very effective in reducing noise
_____ somewhat effective in reducing noise
_____ not very effective in reducing noise
_____ no opinion one way or another

**Do you have any other comments about the barrier walls?**

____________________________________________________________
____________________________________________________________
____________________________________________________________

**The next 4 questions are about your travel experience on Beltway 8.**

**12. How often do you travel by car on Beltway 8?**

_____ several times a day
_____ once or twice a day
_____ several times a week
_____ once or twice a week
_____ several times a month
_____ once or twice a month
_____ several times a year
_____ once or twice a year
_____ never or almost never

**13. How far do you usually travel per trip (one-way) on Beltway 8?**

_____ less than 1 mile
_____ 1 to 5 miles
_____ more than 5 miles

**14. What types of trips do you make on Beltway 8? (Check all that apply.)**

_____ work
_____ school
_____ shopping
_____ medical
_____ personal errands
_____ church
_____ visit friends
_____ traveling through town
_____ other (please list) ___________
________________________________

**15. How has your travel changed after construction of Beltway 8?**

_____ fewer trips on the freeway
_____ more trips on the freeway
_____ shorter trips on the freeway
_____ shorter trips on the freeway
_____ longer trips on the freeway
_____ no change in freeway use

**The last 10 questions are about your home and the people who live in it.**

**16. How long have you lived at this address?**

_____years, or _____months

17. **What is the age of this home?**

_____ Less than one year old
_____ 1 - 5 years old
_____ 6 - 10 years old
_____ 11 - 20 years old
_____ over 20 years old

18. **Do you own or rent this home?**

_____ Own _____ Rent

19. **How many rooms are in this home? (Including bathrooms)**

_____ rooms

20. **What is your estimate of the dollar value of this property? (Including the land and home)**

_____ less than $10,000
_____ $10,001 - $25,000
_____ $25,001 - $50,000
_____ $50,001 - $75,000
_____ $75,001 - $100,000
_____ $100,001 - $200,000
_____ $200,001 - $500,000
_____ over $500,000

21. **How many people live in this home at this time?**

_____ people

22. **How are the people living in this home related to each other?**

_____ couple only
_____ couple plus children
_____ family plus relative(s)
_____ family plus non-relative(s)
_____ roommates only (not related)
_____ other, please describe_______________________________

23. **How many vehicles are owned by people living in this home?**

_____ 0
_____ 1
_____ 2
_____ 3
_____ 4
_____ 5 or more

**24. What is the education level of the head(s) of this household?**

| **Head of household #1:** | **Head of household #2:** |
|---|---|
| _____ less than high school | _____ less than high school |
| _____ high school or G.E.D. | _____ high school or G.E.D. |
| _____ trade or technical school | _____ trade or technical school |
| _____ some college | _____ some college |
| _____ college graduate | _____ college graduate |
| _____ graduate degree(s) | _____ graduate degree(s) |

**25. What is the total income per year (before taxes) for this household?**

| | |
|---|---|
| _____ less than \$10,000 | _____ \$40,001 - \$60,000 |
| _____ \$10,001 - \$20,000 | _____ \$60,001 - \$80,000 |
| _____ \$20,001 - \$30,000 | _____ \$80,001 - \$100,000 |
| _____ \$30,001 - \$40,000 | _____ over \$100,000 |

**THANK YOU FOR TAKING TIME TO ANSWER THESE QUESTIONS.
WE GREATLY APPRECIATE YOUR HELP.**

FOR OFFICE USE ONLY

26. **Ethnicity of household occupants: (If several, code number of each by category. Put a check mark by ethnicity of respondent.)**

_____ Anglo
_____ Black
_____ Hispanic
_____ Other

27. **Type of dwelling:**

_____ single-family detached
_____ duplex
_____ triplex or quadraplex
_____ single-family attached (town home, patio home, condominium with attached walls)
_____ multifamily (apartment complex)

28. **Condition of dwelling:**

_____ very good condition (no signs of disrepair)
_____ good condition (structure in good shape with little sign of disrepair)
_____ fair condition (some sign of disrepair)
_____ poor condition (structure in bad shape with many signs of disrepair)
_____ very poor condition (structure in dilapidated condition)

29. **Abutting** _____
**Non-abutting** _____

30. **Elevated** _____
**Depressed** _____

31. **Study section** _____
**Control section** _____

32. **Behind barrier wall** _____ (Yes or No)

**DROP-OFF INFORMATION:**

**Day/Date of Drop-off:**_______________ **Day/Date of Pick-Up:**_______________
**Time of Drop-Off:** _______________ **Time of Pick-Up:** _______________

**ADDRESS:**_______________________________________________

# APPENDIX E

# IMPLEMENTATION METHODOLOGY

# RECOMMENDED ESTIMATING PROCEDURES

The following procedures can be used by TxDOT advance planning and designing engineers in estimating the grade effects of the various types of social and economic impact elements covered in the report and deciding which grade level is the most feasible to build on freeways in the state. This procedure is based on two recent papers prepared by the senior author of this report [16,25].

## INTRODUCTION

Highway improvements, whether they are for new highways or only improvements in old existing routes, create changes in the local economy and how it functions. Some of these changes are temporary, lasting only during the relatively short construction period, whereas, some of these functional changes are long-term because they result from the characteristics of the new facility itself. These changes can be either beneficial, adverse, or both beneficial and adverse. Rarely is an economic impact clearly all positive or all negative within a community.

The social and economic impacts from highway changes and construction improvements, such as grade level changes, are not easily measured. Of those that are measurable, some are easier to quantify. For example, the decrease in operating cost and travel time resulting from traveling a shorter new route is easier to quantify than the resulting impact on the abutting business and property values. Furthermore, because there are so many interacting relationships between different aspects of a highway improvement and the local and the general economies of the surrounding areas, it is not feasible to measure precisely the partial or total effects of any highway improvement. However, reasonable estimates can be obtained by looking at comparable improvements at other locations and the effects they had on their economies.

Before doing the literature search and review, "key" descriptive data should be collected on the study area, including the existing and proposed routes. The descriptive data includes the design of existing and proposed routes, average daily traffic (ADT) of existing and proposed routes, number and types of existing route businesses, dominant abutting land use along existing and proposed routes, distance to the central business district (CBD), and the current population.

The above descriptive data should be used in the literature search and review to select comparable case studies for use in estimating the various impacts described in this study. It was originally desired that enough comparable case studies could be found to reflect the varying lengths of time lapse between the date of construction and the date of study, in order that short-term and long-term estimates could be made more directly. However, most of the relevant studies reflect 5-10 years of after-construction impact.

Percentage changes in the number of businesses, amount of gross sales, employment, property uses, and values, etc. compiled from the comparable literature can be used to estimate the various impacts. In the case of business impacts, separate estimates are made, if possible, to indicate the impact on traffic-serving businesses and other nontraffic-serving retail/service businesses, and also on business relocation.

The literature also contains general studies that estimate the relationship between highway construction expenditures and employment. Findings from the general studies supplement and further support the case study findings. Separate estimates are made to indicate the employment impact resulting from highway construction expenditures, replacement building expenditures, and loss or gain of existing businesses' clientele.

The business and property impact estimates are used as the basis for estimating the impact on municipal tax revenues. Separate estimates are made for each of the alternative grade levels, routes, etc., and the current tax rate is applied directly to these estimates to calculate the revenue.

The traffic data obtained from TxDOT and TTI's personnel, can be used as input data to the MicroBENCOST computer model to estimate the highway user costs projections of each alternative route, provided the construction costs for the different grade levels are not overlapping. Then, the differentials between the alternative grade levels are used to estimate the user cost impact of choosing one grade or route over another. Also, the user cost impact of choosing the no-build option is calculated. More specific details of the data base and estimating methodology are presented in the respective impact sections.

## METHOD OF MEASURING EACH IMPACT

There are various methods of measuring each type impact included in this methodology. However, the methods chosen seem to be necessary and practical from the viewpoint of both highway researchers and highway agency practitioners. Two of the recent studies, upon which these procedures are based, had a TxDOT advanced planning engineer and designing engineer at the district level working closely with the researchers to develop procedures and generate data needed for estimating each of the economic impacts estimated in those studies.

The process of estimating the magnitude of each impact can be divided into three parts, namely: (1) collection of accurate "before" construction period data, (2) developing accurate impact multipliers applicable to each type of route and/or design alternative, and (3) proper application of multipliers to the "before" data to estimate before-construction period and/or after-construction period impacts. To collect accurate before-construction data, it is extremely important to collect the appropriate data from the state highway agency records, city records, and field study surveys. The development of accurate impact multipliers are heavily dependent on the findings of previous before versus after impact studies, input-output models, and/or other prediction models based on data from previous impact studies and surveying local real estate experts, study area businesses, residents, public officials, and non-profit organizations. Adjustments to the initial multipliers generated from the literature or estimating models should be made by local public and private professional persons knowledgeable of the area affected by the proposed route/design alternatives. Finally, the proper application of the impact multipliers is extremely important to produce accurate estimates of impacts. The multipliers should be applicable to impacts measured in dollars or the most appropriate physical units.

**Business Sales**

The impact of business activity should be measured in gross sales volumes. A review of the literature reveals several before- versus after-construction case studies, including this study, of highway grade level, bypass and existing route widening improvements are available which can be used to estimate business impacts. It is especially important to be able to establish the range of business impacts with prior study data, such as changes in the number of businesses and the percentage change in sales volumes by type of business. Also, an attempt should be made to select the most "comparable" prior studies to decide on the actual percentage multipliers to use in estimating the business sales impact. All types of businesses from retail to manufacturing should be studied. Establishing a good estimate of the number of businesses by type can help produce good estimates for the other economic impacts, i.e., land use/new development, employment/income, and tax revenues. Most of the impact studies have dealt mainly with measuring impacts on abutting businesses. The same is true for most of the other economic impacts. It is very difficult to accurately measure non-abutting impacts, especially business impacts.

The level of before period business numbers and sales can be established fairly easily and accurately with data collected by field surveys, business surveys, and government sales tax data. Then, the impact multiplier for each highway improvement alternative, such as grade level, can be used to estimate the actual amount of impact in dollars. Essentially the same approach can be taken to estimate the dollar amounts of the other impacts, especially economic impacts.

When the number of businesses changes due to the highway/freeway improvement, the number of business employees is also likely to change. An estimate of such an impact can be made based on prior studies and can be included the employment/income impact category.

**Relocation**

New or widening highway/freeway improvements can and do cause some relocation impact, especially if right-of-way is taken that has residents or businesses. Prior studies can be used to estimate total relocation impacts to residents and businesses that would be forced to relocate for each type of highway improvement alternative. The highway agency must estimate the amount of relocation cost for each alternative that would be due right-of-way relocation, but this estimate may not be enough to cover all of the relocation costs incurred by relocatees. Therefore, the "overage," if any, could be considered as the relocation impact in this procedure.

**Employment/Income**

Highway improvements produce some employment/income impacts on the local area that they serve. The construction of new building improvements, local expenditures to construct the highway improvement, and net changes in business employment generated by the highway improvement cause employment/income impacts. Data from prior impact studies, including this study, and data estimates made in the process of estimating the business sales, land use/development, relocation impacts, and local contractor expenditure estimates can be used with appropriate input-output multipliers to estimate the dollar employment/income impact.

**Municipal Tax Revenues**

The municipal tax revenue impact of a highway/freeway improvement, such as grade level change, can be a considerable amount. Many cities obtain much of their revenues from business sales or value added taxes and even more from property tax assessments. Business closings and new businesses opening along an improved highway/freeway will affect the amount of sales available for generating tax revenues. The amount of right-of-way taken (including land and improvements), new building improvements, and changes in land values caused by a highway improvement will significantly affect the size of the real property value base that can be taxed. Again, data from prior studies and data collected to measure the business sales, land value, and land use/new development impacts can be used to estimate the impact on municipal revenues.

**Highway Users**

Users of highways experience what is called highway user costs. These costs are classified into three types: (1) time or delay costs, (2) vehicle operating costs, (3) accident costs, and (4) discomfort and inconvenience costs. One way to economically justify improving a segment of an existing highway/freeway segment is to show that the right-of-way, relocation, construction, and maintenance costs will produce an even greater dollar amount of user cost savings. Before period traffic data and future traffic projections can be used in an appropriate user cost computer model, such as MicroBENCOST, to estimate the user cost impact of each highway improvement or grade level alternative.

**Neighborhood Cohesion**

Neighborhood cohesion is defined as the degree to which those in a particular neighborhood move around. If a new highway is built through the middle of the neighborhood, it can cause a deterioration in the neighborhood cohesion, resulting in greater mobility or more moving around. Thus, it could cause some of the people to incur costs to relocate elsewhere. Prior studies have established neighborhood mobility and stability indexes for use in estimating neighborhood cohesion impacts. These indexes could be applied to the neighborhood census block data to estimate the number of people who might voluntarily relocate. The unit of relocation costs developed in estimating the involuntary relocation impacts could be applied to estimate the voluntary relocation or neighborhood cohesion impact.

**Accessibility to Work Place/Community Services**

Prior studies reveal that various highway/freeway improvements do affect nearby residents' accessibility to their work place and community services. These studies provide some data needed to estimate the dollar value of this impact. The amount of reduced or additional time, vehicle operating and accident costs incurred to continue working at the same work-place and to continue using the same community services is a legitimate benefit or cost to those living in the area. Even the design of the highway improvement can cause circuitous travel to and from work and/or community services and represents an additional cost to those living in the affected area.

**Air Pollution**

High air pollution levels generated by motor vehicles is one of the primary concerns of people living in urban areas near major traffic arteries. Consequently, when a highway/freeway improvement is recommended, such as a grade level change, the people directly affected will be concerned about the magnitude of the air pollution impact that might result from each grade level or design alternative being considered. Prior studies, including this study, have developed fairly accurate procedures and models to estimate this impact in physical units, i.e., grams or tons of carbon monoxide (CO), hydrocarbon (HC), and nitrogen oxides ($NC_x$). Also, the user can convert the estimated quantity of CO into monetary terms, or \$300 per ton, being the vehicle operating cost of producing that quantity of CO. Other efforts are being made to place a dollar value on air pollution impacts in urban areas.