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16. Abstract The upgrading and widening of highways across the state, especially in urban areas, are causing directly affected businesses and property owners to inquire about the possible negative economic impacts of such construction. A review of the literature reveals little data available to transportation agencies who would provide adequate answers to these inquiries. This study is designed to fill in part of that data gap by estimating the during and after construction period effects of three widening projects, each having different widening and locational characteristics. The data collected throughout the construction period and one to three years after construction represents conditions abutting or near the study facilities. The following construction and post construction period impacts were studied: (1) impacts on abutting businesses, residents, and properties, (2) impacts on motorists using these highways, and (3) impacts on the local urban areas or cities involved. The data collected on each of the study projects includes information on abutting business managers' estimation of the construction impact on their businesses and property values, and on the traffic volumes, travel times, and accident rates of the highway. Results indicate that, generally, highway widening projects, regardless of type, produce temporary negative effects on abutting businesses, residents, and property owners during the construction period. Businesses and tax revenues are the most negatively affected, especially for projects requiring considerable right-of-way. However, the local construction expenditures offset much of the negative effects. Also, motorists receive considerable longrun benefits in the form of reduced travel time, operating, and accident costs, regardless of the type of widening project. These benefits are reduced some during the construction period and reduced even more when the construction period is extended a considerable amount of time. These results can be used by transportation agencies to prepare environmental impact statements, which are disseminated at public hearings of similar future widening projects and help business owners assess their potential gains and losses resulting from the construction.					
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**ESTIMATED ECONOMIC IMPACT OF SELECTED HIGHWAY WIDENING
PROJECTS IN TEXAS**

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Research Study Number 0-1260
Research Study Title: Economic Impact of Highway Widening Projects

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IMPLEMENTATION STATEMENT

This study's results can immediately be implemented by TxDOT planning officials who write and support environmental impact statements (EIS). The results for each of the three case study projects represent most of the highway widening projects in Texas. The construction period results from all three study projects are applicable for implementation. In the case of "after period" findings, one of the study projects, U.S. 59 in Houston, was terminated before the "after period" started. Therefore, only the "after period" findings of S.H. 21 in Caldwell and S.H. 199 in Parker County study projects are applicable for implementation.

Since the U.S. 59 (Eastex Freeway) study project is the only freeway project studied, it is highly recommended to be reactivated in a couple of years to collect additional data and estimate the "after construction" period economic impacts. In fact, the other two projects in the reactivated study should be included to collect additional data and estimate the longer term "after period" impacts of those types of projects.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT) or the Federal Highway Administration (FHWA). This report does not constitute a standard, specification, or regulation. The report was prepared by Jesse L. Buffington and Marie T. Wildenthal.

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The authors are indebted to officials of the cities of Caldwell, Azle, Springtown, and Houston and to the officials of Burleson, Parker, and Harris Counties. These officials are acknowledged in the respective reports. Furthermore, the authors want to express their sincere thanks to the construction contractors of the case study projects for furnishing construction cost data. These contractors are acknowledged in the respective reports. Officials of the Texas State Comptroller's Office also furnished valuable information for the study.

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SUMMARY

STATE HIGHWAY 21 (CALDWELL)

Between 1991 and 1993, a rural, 3.75 kilometer (2.33 mile) section of State Highway (S.H.) 21, in Caldwell, Texas, was widened to include a continuous, two-way left-turn lane with curbs and gutters and an additional mainlane in both directions for about one-half of the section, including the railroad underpass. No right-of-way was taken for the project. The 'during and after' construction economic effects of the widening are summarized below.

Abutting businesses experienced a 4% decrease during construction compared to an increase of 7% and 14% for Caldwell and Burleson counties, respectively, but the decrease was less than most businesses estimated. After construction, sales increased 8%. The number of parking spaces decreased 7% during construction, but the number of occupied parking spaces decreased 60%. Businesses thought their number of customers per day and percentage of out-of-town customers decreased during construction, but they increased afterward. Eighty percent of the businesses' number of full-time and part-time employees were unaffected during construction.

Abutting property (land plus improvement) values have steadily declined since 1985, including the construction period, due primarily to the oil boom decline. However, land values only declined 1% during construction and increased 5% after construction. Property values decreased 8% and 25% for Caldwell and Burleson counties, respectively, during construction and 10% and 21% after construction.

Traffic volume increased only slightly during construction and accelerated after construction. After construction, some businesses said that the traffic volume increased, but it flowed more smoothly. Most responding businesses thought that the travel time increased during construction and decreased afterward, while most responding residents thought travel time did not change. The instrumented vehicle runs indicate that travel time increased 8.4% during construction and decreased 12% after construction.

The number of accidents increased slightly during construction and declined significantly two years after construction. Most businesses thought accidents increased during construction, and more than one-third thought accidents decreased after construction. Almost half of the responding residents thought that the number of accidents did not change during construction. Finally, the benefit-cost ratio for the project was estimated at \$1.54, indicating that motorists are receiving \$1.54 worth of benefits for every \$1 spent on construction.

Sales tax revenues of businesses reporting their gross sales decreased 4.5% during construction and 2% after construction. Real abutting property tax receipts decreased 9% during construction and 15% after construction.

The \$6.095 million of construction expenditures was estimated to generate \$22.5 million in additional output and 364 jobs for the statewide economy, including \$7.5 million in additional output and 121 jobs for the Caldwell economy.

Most of the responding businesses thought that the noise level, air pollution level, and number of accidents at their business or along S.H. 21 increased during construction and did not change after construction. More than half of the responding residents thought that the general appearance and desirability of living abutting construction increased due to the construction.

Less than half of the businesses had a good or very good opinion of the contractor's performance. Also, slightly less than half thought that TxDOT did a good or better job.

STATE HIGHWAY 199 (PARKER COUNTY)

Between 1990 and 1994, a 15.13 kilometer (9.4 mile) section of State Highway (S.H.) 199, in Parker County, Texas, was widened from two to four lanes divided by a ditch median or a continuous two-way left-turn lane within Azle and Springtown. A total of 179 properties, 193 owners, and tenants were affected. It cost \$5.8 million for extra right-of-way and \$0.8 million to relocate tenants and owners. A summary of the during and after-construction effects of the widening are given below.

Responding businesses on the Azle project lost 33% of their parking spaces compared to 16% for those on the Springtown project during construction; after construction, they were 3%

and 9% fewer, respectively. Also, there were 36% and 31% fewer spaces occupied during the busiest hour of the day during construction compared to 7% and 8%, respectively, after construction. The average percentage out-of-town customers decreased 3% for the Azle businesses and 4% for those of Springtown. Only a few businesses (3% and 5% of Azle and Springtown businesses, respectively) reduced the number of full-time employees during construction. After construction, 9% and 10%, respectively, increased the number of full-time employees. Part-time employment was affected in a similar way.

Lastly, nominal gross sales reported by abutting businesses increased 23% compared to 9% for the city of Azle during construction. Those abutting the Springtown project reporting gross sales showed nominal sales increasing 21% compared to 22% for the city of Springtown during construction. After construction, nominal sales more than doubled for the abutting Springtown businesses. Since no Azle abutting businesses reported after construction gross sales, no comparison could be made. The opinions of responding businesses for both projects were not as positive as the actual sales changes indicated during and after construction.

The nominal appraised value of land abutting the Azle project decreased about 4% during and after construction. For the Springtown project, nominal land values increased over 10% and 3% during and after construction. Overall, highway, Springtown, and Parker County nominal property values declined during and after construction. Since all area properties were similarly affected, the decline is not solely due to the construction. Abutting inhabitants were more optimistic about the impact, thinking mainly that their property values did not change during construction. Up to half thought that it increased afterward.

The traffic volume of S.H. 199 decreased 2% to 7% each year of construction and rose 2% to 23% each year after construction. Travel time increased during much of the construction period, but in 1996 it decreased 13% to 19% below 1991 values. Accidents increased in Springtown but decreased in Azle during construction. In 1995, the number of accidents in both cities was lower than in any year from 1991 to 1995. The benefit-cost ratio was \$2.95 for Azle (\$1.48 for Springtown), which means that motorists receive \$2.95 (\$1.48) in benefits for every dollar spent on the project.

Estimated sales tax receipts from abutting Azle businesses that reported their sales decreased 7% during construction, while they increased for Azle and Parker County. Sales tax receipts increased for responding abutting Springtown businesses before and during construction, so their sales tax receipts were not as affected as were the Azle firms. Abutting property tax receipts in Azle and Springtown increased by a greater percentage than Springtown and Parker Counties tax receipts during and after construction.

The estimated impact of the \$8 million of the Springtown construction expenditures spent in Texas is \$29.8 million in output and 453 jobs for the Texas economy. No estimate could be made as to how many jobs or how much output was generated locally. The estimated impact of the \$3.6 million in-Texas expenditures for the Azle project is \$13.4 million in output and 202 more jobs for the Texas economy. It is estimated that 10 new jobs and \$0.7 million in output was generated locally.

Over half of the responding businesses and residents of the Azle and Springtown projects thought that air and noise pollution increased by their property during construction. There was no consensus on the general appearance of the area during construction, but most residents thought that the appearance improved greatly after construction.

The Azle contractor was generally regarded more negatively than positively by the responding businesses and residents. On the other hand, the Springtown contractors were regarded more positively than negatively by almost half of the respondents. TxDOT was considered to have performed more positively than the contractors. However, some businesses disliked TxDOT's public relations, management, and certain aspects of the highway design for both projects.

U.S. HIGHWAY 59 (EASTEX FREEWAY)

Between 1991 and the present, a 3.5 kilometer (2.2 mile) section of U.S. 59 in Houston, Texas, was widened from a four-lane freeway with a four-lane service road to a ten-lane freeway with a six-lane service road. Construction is not complete on one of the three widened sections. A total of 281 properties was purchased for \$26 million for an extra right-of-way, and \$4.55

million were spent to relocate tenants and owners. The effects during construction of the widening are summarized below.

Fifteen percent of the responding abutting businesses' parking spaces were lost during construction. During the busiest hour of the day at the responding businesses, 17% more parking spaces were occupied during construction than before construction. There were fewer customers per day for 70% of the businesses, and the reported percentage of customers from out-of-town fell from 22% to 13%.

Most businesses realized the construction was temporary and tried to retain their employees during construction. Approximately 60% of the businesses thought that their number of full-time employees did not change, and approximately 30% thought that the number decreased, while the number of full-time employees increased 3%. Eighty-two percent of the businesses thought that their number of part-time employees did not change, while the number of part-time employees decreased 16%.

The sales reported by 13 businesses increased 13% nominally and decreased 2% in real terms during construction. However, the sales for 1988 and 1996 reported by 10 businesses responding near the end of the construction period decreased 34% nominally and 50% in real terms. The latter result is supported by over 60% of the 67 responding businesses expressing an opinion. Houston and Harris County sales increased 32% nominally and 5% in real terms, so the abutting firms' sales (and sales tax receipts) were negatively affected by the construction.

Real abutting commercial property values decreased less and residential property values decreased more than Houston property values decreased during construction. Nominal Houston property value only decreased 1% between 1989 and 1996. Vacant property value changes were similar for abutting and Houston properties. Twenty-eight percent of the businesses thought that the value of all properties abutting U.S. 59 decreased, and the value decreased 41%. The response as to whether property value decreased, increased, or stayed the same was similar to the distribution of individual property changes; however, a greater percentage increased than the businesses expected. Contrary to most businesses' expectations, commercial abutting property values increased 23% nominally. Nominal abutting residential property values decreased 57% between 1989 and 1996, and half of the relocated residents thought they would decrease. Lastly,

it is important to point out that changes in land values are the best indicators of highway construction impact on property values. It was found that nominal land values per square meter/foot decreased only 1.3%, but real land values decreased 25%.

Tax revenues from abutting business sales were negatively affected by the construction by as much as 40%. Average abutting property tax revenues from properties unaffected by right-of-way acquisition increased while Houston property tax revenues decreased. However, property tax revenues from all abutting property decreased one and one half times as much as Houston property tax, and Harris County's property tax revenues increased 7%.

The three main aspects of user costs include the traffic volume, travel time, and number of accidents. There was no consensus among the business managers, relocated residents, and non-relocated residents of the impact on most of these aspects. They thought the number of accidents and travel time increased or did not change. However, the actual number of accidents and travel time changed little between 1991 and 1995, but they were lowest in 1995 when some construction had been completed. The benefit-cost ratio was \$5.98, which means that the motorists will receive \$5.98 in benefits for every dollar spent on the project.

A majority of the abutting business and resident respondents thought that air and noise pollution increased and that the general appearance of the area declined during construction.

In general, the responding businesses were more pleased with TxDOT personnel than with the contractors. The opinions were fairly evenly distributed between very good and very poor, while about half of the businesses said TxDOT did a good or very good job during construction.

The conclusion and recommended implementation of the results are presented in the last two sections of this report.

INTRODUCTION AND BACKGROUND

STUDY PROBLEM

The State Department of Highways and Public Transportation (SDHPT) is continually upgrading existing highways. This includes straightening the horizontal and vertical alignment, adding capacity (more through lanes), adding continuous two-way left-turn lanes or raised medians with or without protected left-turn lanes (also with or without curb and guttering), adding railroad or intersecting highway grade separations, and widening expressways or freeways. There are still many miles of the state's highway system that need to be upgraded.

Upgrading and widening highways over the state, especially in urban areas, are causing the directly affected businesses and property owners to ask questions about the possible negative economic impacts. Some business groups and property owners are calling their congressmen or threatening lawsuits against the SDHPT. These businesses are concerned about losing shoulder and private parking space for their customers or having to relocate because of losing too much land to right-of-way. Property owners are concerned about the possible negative effects on the value of their property, and cities, school districts, and counties are concerned about the tax revenue effects. There are few studies reported in the literature which give complete economic impact documentation of the during and after construction effects of highway widening projects. If more of these types of studies were done, the results could be used by the SDHPT and other highway agencies over the country to estimate all of the positive and negative economic impacts of the same type of proposed highway widening projects as those studied. The types of during and after construction economic impacts that need investigating include the following:

1. business parking,
2. business sales and employment,
3. business relocation (where considerable right-of-way is taken),
4. property land values and uses,
5. city tax base and revenues,
6. local effects of highway construction expenditures, and
7. highway user benefits and costs.

STUDY OBJECTIVES

The study determines the economic impacts (during and after construction) of highway widening improvements along selected strip commercial areas in Texas. The specific objectives of the study are as follows:

1. Determine the impacts on abutting businesses and properties.
2. Determine the impacts on motorists using these highways.
3. Determine the impacts on the local urban areas or cities involved.

HIGHWAY WIDENING STUDY SECTIONS

The project director (PD) TxDOT assigned helped select highway widening projects to study. To aid in this selection, all proposed projects currently or soon to be let for construction were reviewed. Several projects were selected which represented the most frequent type to be improved. Table 1 shows the number and types of proposed projects that are candidates for construction during the next 10 years. The desired types of projects to be selected are:

1. Highway widened from a four-lane undivided facility, with or without curb and guttering, to a four-lane facility divided, with a fifth lane to be used as a two-way continuous left-turn lane which has curb and guttering and requires an additional strip of right-of-way,
2. Highway being widened from a four-lane undivided open ditch facility to a four-lane facility divided with a fifth lane to be used as a two-way continuous left-turn lane which has curb and guttering, and
3. Highway widened from a four-lane undivided or divided direct access facility to four-lane limited access freeway, with or without service roads, which requires additional right-of-way.

Table 1. Number of Proposed Projects to Widen Existing Highways in 1986

TYPE OF PROJECT	NUMBER OF PROJECTS	PERCENT OF TOTAL
Nonfreeway Projects		
2 to 4 lanes with continuous left-turn lane	62	15
2 to 4 lanes with two-way left-turn lane	1	.2
2 to 4 lanes with median or left-turn median	4	1
2 to 4 lanes with other median treatment	0	0
2 to 6 lanes with two-way left-turn lane	3	1
2 to 6 lanes with other median treatment	35	9
4 to 6 lanes with continuous left-turn lane	10	2
4 to 6 lanes with two-way left-turn lane	10	2
4 to 6 lanes with other median treatment	68	17
Total Nonfreeway Projects	193	47
Freeway Projects		
Two-lane road to 4 lane freeway with service roads	13	3
Two-lane road to 4 lane freeway without service roads	11	3
Four or more lane road to freeway	92	23
Two or more lanes to freeway	100	24
Total Freeway Projects	316	53
Total Projects	409	100

Source: TxDOT Design Division

A preliminary study of proposed projects identified 15 to 20 proposed projects where construction had just started or would begin soon. An on-site investigation was conducted to obtain more detailed information on each one. Finally, three projects were selected for study, including:

1. State Highway 21 in Caldwell, Texas
2. State Highway 199 in Parker County (between Azle and Springtown), and
3. U.S. Highway 59 (Eastex Freeway) in Houston.

These three projects fit most of the characteristics of the types described above. Details are described in Table 2. Also, Figures 1 through 3 show the location of these projects in their respective cities or counties.

REPORTS OF FINDINGS

A report of the detailed findings was prepared for each of the three study projects as well as for this final report, which summarizes the results as follows:

<u>Report Number</u>	<u>Title</u>
1260-1	Estimated Economic Impact of Widening State Highway 21 in Caldwell, Texas (1)
1260-2	Estimated Construction Period Impact of Widening State Highway 199 in Parker County, Texas (2)
1260-3	Estimated Construction Period Impact of Widening U.S. 59 in Houston, Texas (3)
1260-4	Estimated Economic Impact of Selected Highway Widening Projects in Texas

In addition, Patricia Ann Jackson, a TxDOT employee in the Employee Development Program and a Civil Engineering graduate student enrolled at Texas A & M University, wrote her Master's Thesis entitled, "The Economic Impacts of Highway Widening Projects," which is based on data she helped collect from this study.

Table 2. Selected Study Projects for Research Study 1260

CHARACTERISTICS	STUDY PROJECTS		
	SH 199	SH 21	US 59
District	2	17	12
County	Parker	Burleson	Harris
City	Azle & Springtown	Caldwell	Houston
Project CSJ number	0171-03-039, 0171-03-046	0116-03-044, 0116-03-044, 0116-03-047	0177-11-083, 177-11-084
Project Limits	From Azle to Springtown	From Davidson Crk. to FM 975	From .5 mi N of Crosstimbers to .1 mi N of Langley Rd.
Project Length (miles/kilometers)	9.4/15.13	2.33/3.75	2.2/3.5
Project Design (from-to)	From 2L undiv to 4L div with ditch/2 wtl	From 2L/4L undiv open ditch to 4L div, 2 wtl Curb & Gutter, RR underpass	From 6L Frwy with 4L Service Rd. to 10L Freeway with 6L Service Road
Present ADT	16,900	7,000	115,000
Projected ADT (20 yr)	32,500	16,700	188,000
Right of Way Taken (ft/meters)	140+/.43	None	30-200/9-61 m
Right of Way Cost (\$000)	5,544	None	21,314
Dominant Land Use	Mixed	Commercial	Commercial
Number of Businesses	64	40	100+
Number of Residences	63	20+	75+
Displaced Businesses	26	None	87
Displaced Residents	42	None	55
Construction Cost (\$000)	13,531	5,752	55,960
Begin Construction	Oct 90/Sept 92	Oct 90	Sept 91
Projected Completion	Apr 93/June 94	Jul 93	Oct 93-Jun 95

Source: TxDOT Districts 2, 17, and 12, respectively

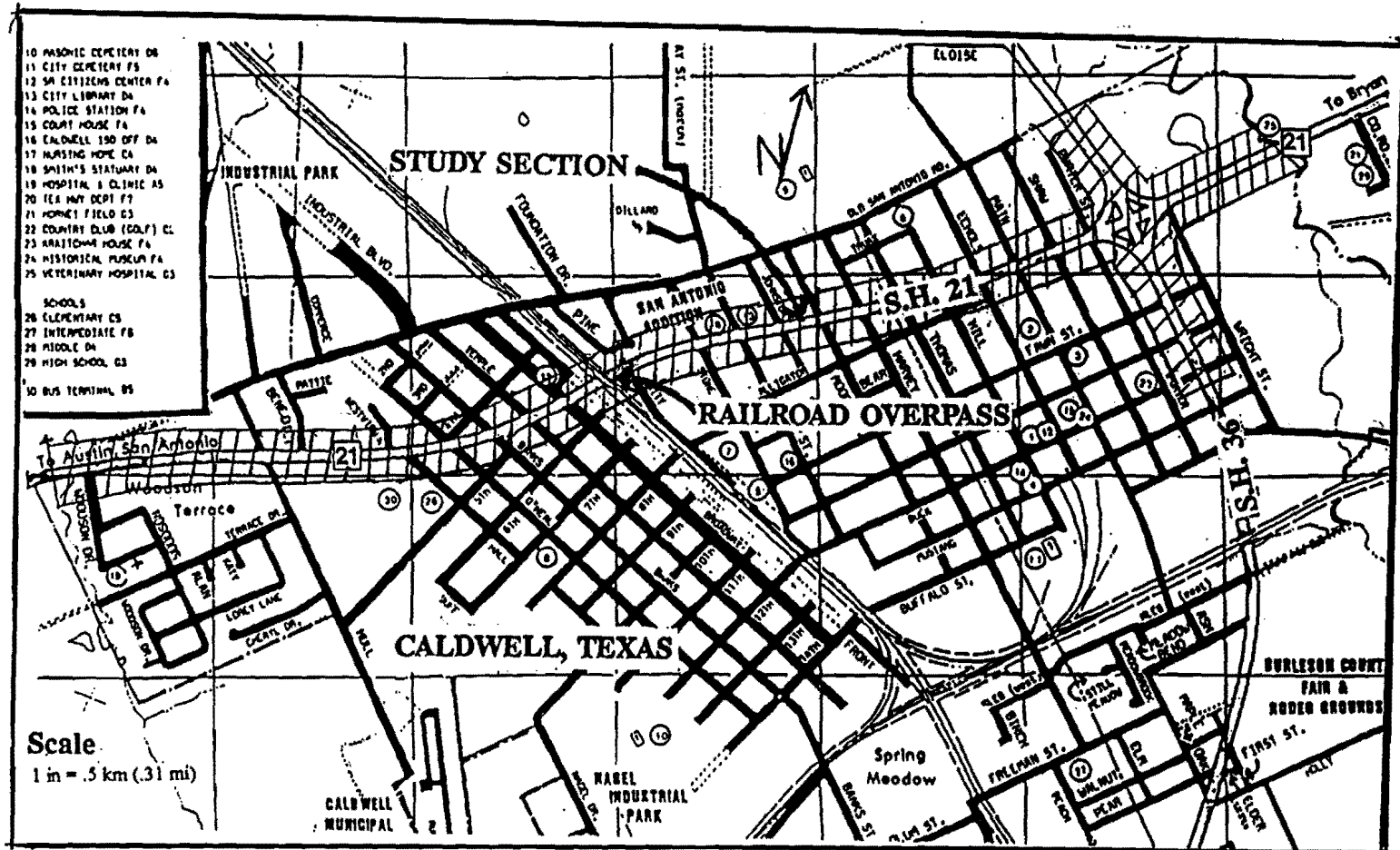


Figure 1. Location of the S.H. 21 Project Study Area in Caldwell, Texas

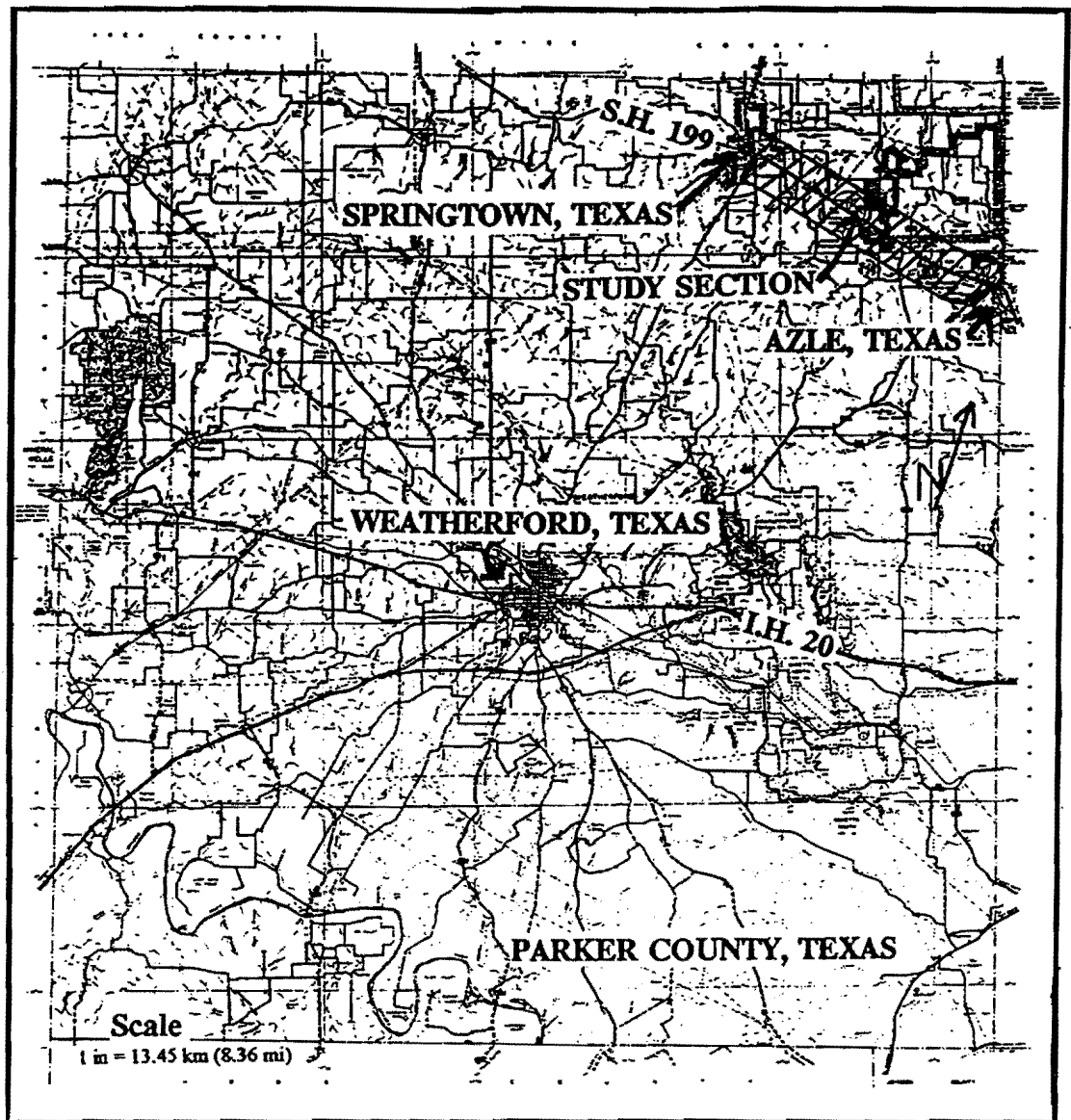


Figure 2. Location of the S.H. 199 Project Study Area in Parker County, Texas

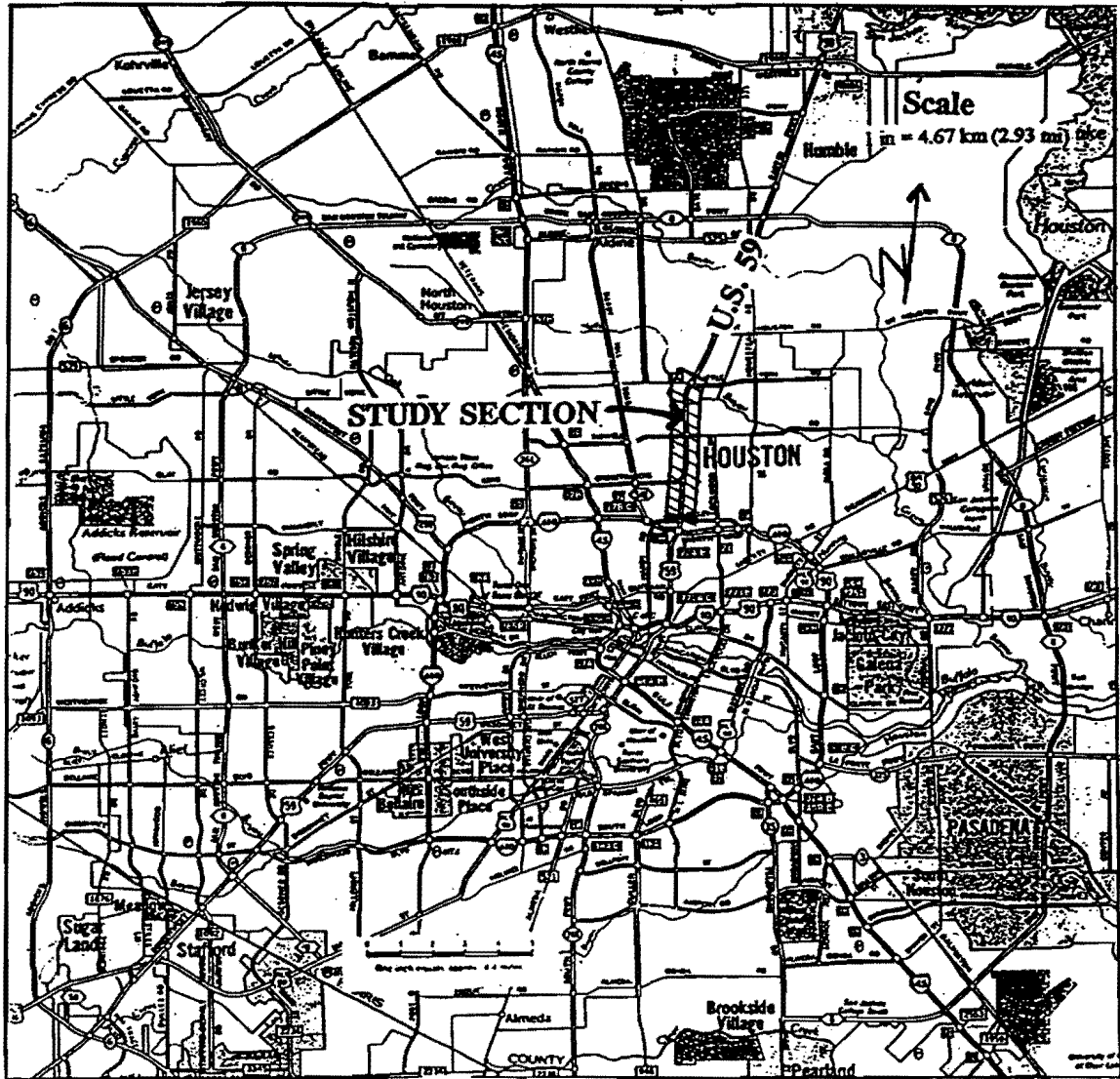


Figure 3. Location of the S.H. Highway 59 Project Study Area in Houston, Texas

REVIEW OF PREVIOUS WORK

TxDOT's recent experience in getting the U. S. Highway 80 widening project in Longview, Texas (population of about 100,000), approved is a good indicator of the need for such economic impact information. Buffington and McFarland, TTI research economists, conducted a preliminary study of a proposed project and were able to collect a small amount of 'before versus after' data on businesses involved at five major intersections which had been previously widened on U.S. Highway 80. The unpublished report of findings was used as documentation of the Environmental Assessment (EA), which was submitted for approval at the state and federal levels [4]. Even though the project was finally approved, TxDOT District 10 planners saw a need for a more complete study. Therefore, this district funded a three and a-half year, before, during, and after construction study of the U. S. Highway 80 widening project. This study was conducted by the same TTI researchers, and a research report was published in 1992 [5]. However, this experience by TxDOT emphasized the need for several more case studies of different types of highway widening projects to establish a minimal data base for estimating all types of economic impacts of such improvements on those directly affected and the city as a whole.

The only studies found in literature dealing with impacts of highway widening projects which add a two-way continuous left-turn lane are of the benefit/cost and land use impact types. The benefit/cost or cost-effectiveness studies focus on the effects on motorists, estimating the operational effects and accident effects or just the accident costs effects. Two studies conduct benefit/cost analysis of the operational and accident cost effects [6,7]. One accident cost-effectiveness study has been done [8]. Two 'before and after' studies of the operational effects have been done, but they are not put in the benefit/cost framework [9,10]. Three 'before and after' studies have been done which report accident rate and/or cost reductions [11,12,13]. The second Longview study performed a complete benefit/cost analysis of motorist's time, vehicle operating cost, and accident costs savings; the net benefits were then compared to the construction cost of the widening project [5]. Buffington conducted several 'before and after' land-use studies of different highway segments widened to include a two-way continuous left-

turn lane summarized [14]. He also studied other highway segments widened to include an additional through lane and/or a raised median [14].

In related studies, Buffington conducted a nine-area study which estimated the land value, land use, business activity, travel pattern, and general economic impacts of building new highway bypasses [15-23]. Buffington and/or McFarland conducted several benefit/cost analyses and developed or revised benefit/cost procedures [24-28]. Buffington conducted three separate studies evaluating the consequences of freeway displacement of businesses and residents [29-31]. Buffington studied the railroads' effects on the assessed land values in urban areas [29,30].

RESEARCH APPROACH/PROCEDURES

This research's planned approach was to conduct a 'before and during/after construction period' comparative analysis of different types of highway/freeway widening projects. Relevant data used to estimate the various impacts were collected while the selected research was under construction and lasted through an 'after construction' period for at least one year. Unfortunately, one of the three projects was not completed because it was terminated two years prematurely. Corresponding city-wide and county-wide data were collected and analyzed to compare with corresponding abutting study highway property data. Such data could be used somewhat as a control area to the highway study section data.

The primary data used to estimate the widening impacts were obtained through personal interviews, mail surveys, and county appraisal district, city, TxDOT district, State Comptroller, and Railroad Commission offices. The 'before construction' and 'after construction' period percentage changes in study and control area data were calculated from appropriate number totals or averages of individual observations, such as, businesses, gross sales, appraised property values, etc. All nominal dollar values were deflated in 1995 or 1996 values (real values) with the U.S. Consumer Price Index.

Below is a brief summary of the methodology used in establishing each type of impact.

BUSINESS IMPACTS

Business impacts were evaluated by studying trends in the State Comptroller's record of number and types of businesses since 1984. Business impacts were also evaluated through a business survey abutting the widened sections of each study highway section. Managers/owners of these businesses were asked about changes in their number of parking spaces, employees, and customers, as well as sales and profit levels and amounts.

PROPERTY VALUE IMPACTS

Property values were evaluated using County Appraisal District appraisals of property and land values of county, city and abutting highway study section properties. Percentage changes and trends in city and county property values were compared with the abutting property values to help establish the extent of highway widening impacts during and after construction. Business managers' and residents' opinions about the changes in property values during and after construction were also incorporated in the analysis.

CITY AND COUNTY TAX REVENUE IMPACTS

State Comptroller's data were used to calculate a city and county average percent of taxable sales per business by SIC code; the percentage was applied to the annual sales provided by business owners and managers in the study area. City and county tax rates, obtained from the county and city tax assessor-collectors, were applied to these sales volumes, as well as to the property values obtained from the county appraisal districts.

CONTRACTOR EXPENDITURE IMPACTS

TxDOT furnished the total construction costs of all of the projects involved in the three study sections. The contractors of each research section were asked to break down their construction expenditures by location of supplier and type of expenditure. Wherever possible, the total expenditures spent for the city or county researched were separated from those spent elsewhere.

Employment and output multipliers were developed from the 1986 Texas Input-Output Model to produce statewide estimates of impacts from widening expenditures of each of three study sections. Impact estimates were made using the New Road/Highway Construction expenditure category, Category 20 in the input-output model. The estimated employment multiplier in 1986 for this category is 53.76 jobs per million dollars of expenditures. This

includes the direct impact of the construction expenditures, the indirect impacts on the suppliers, and the induced effect of increased consumer spending. Since costs have fallen since 1986, the multiplier was adjusted using the Annual Price Trends for Federal-Aid Highway Construction. This gives a composite index for Texas for 1986 and the last year of construction activity. An adjusted employment multiplier is generated by dividing the last year of construction composite index by the 1986 composite index, and dividing the 1986 employment multiplier for New Road/Highway Construction by the ratio of the indices. Applying this multiplier (number of jobs per million of dollars of construction expenditures) to the total amount of construction expenditures estimates the number of new jobs generated per million dollars of expenditures for the Texas economy. It is unknown how much employment is actually generated in each local area, but the adjusted statewide multiplier is used on the local expenditures to give a rough estimate.

An adjusted total output multiplier (number of dollars of output generated per million dollars of construction expenditures) is multiplied by the total dollars of construction expenditures to calculate the amount of total statewide dollar output on each of the construction sections. Again, it is unknown how much of these expenditures benefit the local area, but an estimate is made by multiplying these expenditures by the amount of the construction expenditures made locally.

RELOCATION AND RIGHT-OF-WAY IMPACTS

Relocation and right-of-way impacts are minimal when little or no right-of-way is needed to widen a highway. In this study, two out of three sections required considerable right-of-way, which caused a considerable number of relocations of businesses and residents and reduced the tax base, at least temporarily. Depending on the type and amount of abutting property acquired, the right-of-way, moving, and relocation costs can require a considerable amount of funds, not to mention the extra amount of unrecoverable time and expenditures of those directly affected.

Right-of-way and relocation data were obtained from TxDOT to help evaluate the right-of-way and relocation impacts. The number of business and resident relocations were

determined, and the total right-of-way, moving and relocation costs were determined for each study project section. These data were also used to help assess the property value and tax revenue impacts of the study project section.

Relocated businesses and residents were mailed a survey form to obtain their opinions on having to be relocated and to determine how they had to spend on relocation, as well as the problems that relocation caused.

USER COST IMPACTS

The researchers estimated user-cost impacts by investigating instrumented vehicle, accident, construction costs, and ADT data as well as business managers' and residents' opinions on the changes in traffic volumes, travel time, and accidents on each study highway section. They were also analyzed using the MicroBENCOST benefit-cost model.

An attempt was made to calculate the construction period impact on user costs. Due to data deficiencies and early termination, these calculations could not be made on two of the three study projects.

ENVIRONMENTAL AND GENERAL APPEARANCE IMPACT

Abutting business managers' and residents' opinions on the change in noise level, air pollution level, and general appearance of the highway study sections were used to evaluate the impact of the widening construction on these aspects of each study project.

CONTRACTOR AND TxDOT PERFORMANCE EVALUATION

Abutting business owners' and managers' opinions on contractor and TxDOT performance were used to evaluate these aspects. The TxDOT area engineer's assessment of the contractor was also included in the contractor performance evaluation.

FINDINGS/DISCUSSION

The findings of this study are based on 'before versus during and after' construction changes in the various types of impacts measured. They reflect the construction record and length of the after construction period of each of the study sections, as shown in Table 3. Also, part of the findings are based on data obtained from the different surveys of abutting businesses and residents. Table 4 gives the number surveyed, response rate, and etc. by type and kind of survey.

The findings of this study are summarized below by project. The more detailed findings are found in the respective reports, i.e., Research Report 1260-1 (State Highway 21 in Caldwell), Research Report 1260-2 (State Highway 199 in Parker County), and Research Report 1260-3 (U.S. Highway 59 Eastex Freeway in Houston).

ECONOMIC IMPACTS

State Highway 21 (Caldwell)

Business Impacts

Highway Businesses—Business impacts were assessed using survey results supplemented with secondary data. For certain impacts, the business owners/managers were asked for their opinion on how the aspect changed, and later they were asked to provide numbers before, during, and after construction. This situation allowed for a comparison of perceptions to actual numbers. All but one of the 55 abutting businesses answered a survey on during-construction impacts. Few businesses were less than five years old, so most existed before and during construction. The after-construction survey focused on businesses that responded to the during-construction survey, and 39 businesses responded.

Table 3. Research Study 0-1260 Project Construction Record and Length of After Construction Period

LOCATION AND SECTION	PROJECT LETTING DATE	PROJECT COMPLETION DATE	CONSTRUCTION PERIOD LENGTH (YRS)	PERCENT TIME LAPSE	PERCENT COMPLETE AS OF 2/97	AFTER PERIOD LENGTH (YRS)
Caldwell (SH 21)						
Sections 1, 2 & 3	12/90	7/93	2.5	100	100	3.4
Parker County (SH 199)						
Section 1	3/90	4/93	3.1	110	100	3.7
Section 2	10/92	12/94	2.2	99	100	2.0
Houston (US 59 Eastex Freeway)						
Section 1	4/91	4/97 ¹	6.0 ¹	134	82	0.0
Section 2	4/91	4/97 ¹	6.0 ¹	116	50	0.0
Section 3	6/91	4/95	3.8	106	100	0.8

Source: TxDOT Districts 2, 17, and 12, respectively

¹Projected.

Table 4. Response Rates of Abutting Business and Residents Surveyed in the Three Project Areas

LOCATION AND TYPE OF SURVEY	TYPE OF SURVEY METHOD	TIME OF SURVEY	NUMBER OF SURVEYS ATTEMPTED	NUMBER OF RESPONSES	PERCENT OF RESPONSES
S.H. 21 (CALDWELL)					
Business	Interview	During	55	54	98%
Resident	Mail	During	59	17	29%
Business	Interview	After	59	39	66%
S.H. 199 (PARKER COUNTY)					
Business	Interview	During	145	107	74%
Business (Relocated)	Mail	During	37	6	16%
Resident	Mail	During	59	28	48%
Business	Interview	After	85	70	82%
U.S. 59 (HOUSTON)					
Business	Interview	During		67	92%
Business (Relocated)	Mail	During	134	13	10%
Resident (All)	Mail	During	298	46	15%
Business	Interview	During (At End)	68	64	94%

Over half of the businesses' buildings were over 20 years old. Therefore, land value may be a more accurate gauge of changes in property values due to the aging of the improvements. However, 70% of the buildings were owned by the businesses; therefore, they may be better maintained than average.

Almost half of the businesses were retail and were more dependent on customers coming to their location. Some of the service-oriented businesses were able to travel to their customers, and thus, were not impacted as negatively as retail stores during construction.

For certain impacts, businesses were asked for their opinions on how the aspect changed, and later they were asked to provide actual numbers before, during, and after construction. This situation allowed comparison of perceptions to the actual numbers.

No right-of-way was taken for this project, but 50 parking spaces (7%) were lost due to parking spaces located on the right-of-way or due to curbing and guttering. Of those reporting their number of parking spaces, 88% provided numbers that supported their opinion on whether their number of parking spaces changed during construction, and 77% provided numbers that supported their opinion after construction.

During the busiest hour of the day, 137 (24%) fewer parking spaces were occupied during construction than before construction, while the number increased by 34 (10%) after construction. The decrease during construction was attributed to reduced accessibility to businesses or the appearance of hazardous entry. One business noted that after construction the faster traffic didn't stop.

The decreased number of occupied parking places corresponded to fewer customers per day during construction for 67% of the businesses, although 24% did not think there was a change in their number of customers per day. The reported percentage of customers from out-of-town fell from 27% to 20% during construction because out-of-towners did not know back ways into the businesses or did not want to get off the highway amid all of the construction. After construction, 49% thought that there was no change in their number of customers per day, but 42% thought the number increased. The reported percentage of out-of-town customers increased from 30% to 34%.

Most businesses realized that the construction was only temporary and tried to retain their employees during construction. Approximately 80% reported no change in part-time and full-time

employees during and after construction. Of those reporting their number of employees, 70% to 80% provided numbers that supported their opinion on their change in number of employees during and after construction.

The 54 businesses operating during construction and responding to the first survey gave their opinions regarding 'before versus construction' period changes in their gross sales. Thirty-eight (70%) thought that their sales had declined, and 20 (37%) of these businesses thought that their sales declined over 25%. Only three (6%) and 14 (26%) thought that their sales had increased or remained the same, respectively. However, the 23 businesses that reported their actual sales 'before versus during' construction experienced a combined decrease of \$855,520 (5%). In real terms, the decrease was \$1,945,268 (an 11% decline).

The 39 businesses responding to the second survey after construction gave their opinions of the 'before versus after construction' period changes in their gross sales. Almost half (18 or 47%) thought that their sales increased, and 15 (38%) thought that their sales did not change. Only four (11%) thought their gross sales decreased. Thirteen of these businesses reported that their actual gross sales increased \$2,858,000 (24%). In real terms, the increase was \$434,849 (6%), indicating a significant recovery in sales after construction was completed.

Highway Versus City and County Businesses—'Before versus during' construction sales are compared for S.H. 21, Caldwell, and Burleson County based on data obtained from highway businesses and the State Comptroller's Office. These comparisons are made to determine the extent of the construction impact on the gross sales of the S.H. 21 businesses.

Nominal sales in Caldwell increased 7% during construction, while Burleson County sales increased 14%. In real terms, Caldwell sales increased 2%, and Burleson County sales increased 10%. These figures support the abutting businesses' opinions that their sales decreased during construction. After construction, Caldwell and Burleson County sales increased 42% to 45% nominally and 25% to 28% in real terms. Abutting sales did not increase this much, but this result may be due to response bias. When the sales of eight firms with reported sales for both surveys are compared, reported 1990 sales for the after construction survey are higher and result in a slower increase in sales after construction.

Property Value Impacts

Highway Businesses—Abutting property values slowly and steadily declined from 1985 through the end of construction. A realtor and the deputy chief appraiser agreed that the oil boom decline was the most significant factor which caused a decline in property values. Since the oil boom decline started in 1985, the values have decreased due mainly to the aging of the improvements. They indicated that property values decreased during construction because no one tried to sell their property during construction, and immediately after construction, properties sold for higher prices than before or during construction. Furthermore, people selling property now are asking for more than they did right after construction ended. They attribute this increase in activity to the constructed improvements.

The opinions of responding abutting business owners (managers) tended to confirm the above mentioned property value trends. Thirty-eight percent of those responding said their property values decreased during the construction period. Only 4% thought that their values had increased. In contrast, 23% thought that their property values increased between the ‘before and after construction’ period, while only 6% thought their values decreased.

The opinions of responding abutting resident owners differed from those of abutting business owners. About 50% of the residents thought that their property values increased due to construction, while only one resident thought that his values decreased.

The changes in the appraised value of abutting property value do not necessarily confirm the opinions of businesses or residents. About 75% of these properties did not change during the construction period, while 17% decreased and 8% increased. Therefore, business owners/managers slightly overestimated the negative impact of the construction period on their property values. A higher percentage of the property values did not change, and a lower percentage decreased.

The most important indicator of highway construction impact is a study of land values. Overall, abutting land values (nominal) decreased less than 1% during construction and increased 5% after construction. Therefore, the negative effects on abutting land values were not significant.

Highway Versus City and County Businesses—Comparing abutting property values to Caldwell and Burleson County property values is complicated due to the differing proportions of

property types and reassessment rates. Also, these are property values, not land values, so the age of the improvements could also greatly impact the property values.

Commercial property values in Caldwell decreased 20% during construction. Highway property values decreased only 13%, while non-abutting property values decreased 24%. This situation could be due to few abutting properties being sold during construction and, therefore, few property values were reassessed. After construction, Caldwell property values were still 20% below 1990 levels, but abutting property values dropped 28%. Nonabutting property values dropped 14% overall, and 17% on average.

Ranch properties during construction in Burleson County and Caldwell, abutting and non-abutting property, decreased 7%. After construction, Caldwell and Burleson County ranch property values decreased approximately 15% from their 1990 values, but abutting ranch property values decreased 30%.

During construction, Caldwell and Burleson County residential property values fell between 7% and 10%, while abutting property values fell 16%. After construction, Caldwell and Burleson County property values fell between 12% and 17% from their 1990 values, while abutting property values fell 36%.

City and county vacant property values decreased approximately 8% and 25%, respectively. Abutting property values decreased 13%. After construction, city and county property decreased 10% and to 34%, respectively, while abutting properties decreased 18%.

In general, abutting property values decrease more than city and county property values during and after construction, confirming some construction effects.

Tax Revenue Impacts

Sales Tax Revenue—‘Before and during construction’ sales figures were reported for 23 abutting businesses. Sales tax revenue from these firms decreased 4.5% between the end of construction and the year before construction. Caldwell sales tax revenue increased 14%, and Burleson County sales tax revenue decreased 45% during the same time.

Before and after construction sales figures were reported for 13 abutting businesses. Sales tax revenue from these firms increased 2% between the year after and the year before construction. Caldwell sales tax revenue increased 6%, and Burleson County sales tax revenue decreased 49% during this time. Therefore, sales tax revenue from abutting businesses may have decreased slightly during construction, but the revenue rebounded after construction. Burleson County sales tax revenue was probably affected more by other factors than the construction.

Property Tax Revenue—Real abutting property tax receipts decreased 9% between the end of construction and the year before construction, while Caldwell property tax revenue decreased 5% during the same time. Burleson County property tax revenue increased 14% during that time.

Real abutting property tax receipts decreased 15% between the year after construction ended and the year before construction. Caldwell property tax revenue increased 14%, and Burleson County property tax revenue increased 97% during the same time. Caldwell property taxes have increased since 1980; the deputy chief appraiser said that properties have been selling for more since the end of construction. Therefore, abutting property values, and thus, tax receipts, will probably increase in the future. However, tax revenue from abutting property has been negatively affected by the construction, at least temporarily.

Contractor Expenditure Impacts

Contractor expenditures are broken down by location of the supplier and type of expenditure. All expenditures were paid to Texas suppliers. Twice as much was paid to contractors outside Caldwell as was paid to Caldwell suppliers.

As indicated earlier in this report, adjusted employment and output multipliers were developed from the 1986 Texas Input-Output Model to produce statewide estimates of impacts from S.H. 21 widening expenditures. The adjusted employment multiplier used for this study is 59.9 jobs per million dollars of expenditures. The adjusted total output multiplier is 3.69 dollars of output per dollar of expenditures.

Employment Impact—Applying the employment multiplier to the \$6.095 million of construction expenditures indicates that widening S.H. 21 generated about 364 new jobs for the

Texas economy. It is unknown how much employment was generated in the Caldwell area. However, using the proportion of expenditures made in the local area, the estimated increase in Caldwell employment was 121 new jobs.

Output Impact—Applying the output multiplier to the \$6.095 million dollars of expenditures indicates that widening S.H. 21 generated about \$22.5 million in additional output. Again, it is unknown how much of this increase benefitted the Caldwell area, but using the amount of expenditures made locally, the output impact could have been as much as \$7.5 million.

Relocation Impacts

Since no right-of-way was acquired, there were no relocation impacts resulting from the S.H. 21 widening project.

User Cost Impacts

Traffic volume, travel time, and accidents are some of the elements affecting highway user costs. ‘Before versus during and after’ construction changes in the elements are summarized below. Also, the total benefits versus costs are summarized.

Traffic Volume—Most residents (81%) thought that the traffic volume on S.H. 21 increased due to construction, but there was no consensus among businesses on the change in traffic volume either during or after construction. Almost half thought it did not change during construction, but over half thought it increased after construction. During construction, travel was frustrating for everyone. The lights changed quickly, and traffic was backed up. People detoured around Caldwell during holidays and Texas A&M football games. After construction, some managers said that the traffic volume increased, but it flowed more smoothly.

The actual traffic volume, as measured by instrumented vehicle runs, decreased 5% in the first year of construction. Traffic volume rose 3% to 6% each year during construction and 20% after construction, and was 3% higher than the first year of construction.

Travel Time—Slightly over half of the responding residents thought that their travel time to work did not change due to construction, and 19% thought that it decreased. There was no consensus on the change in travel time to buy gas and food. Most responding business owner/managers (78%) thought that the travel time increased during construction, although 13% said it decreased. Reasons given for the increased travel time include construction workers leaving things in the road, construction of the railroad underpass, and short signal lights.

After construction, most business owners/managers (64%) said that travel time decreased, although 31% did not know if it had changed or not. One manager said that travel was faster and easier, but another said that people no longer wanted to pull over and buy things.

The instrumented vehicle runs indicate that travel time increased 8.4% during construction. After construction, it was 12% lower than it was in 1991 and 19% lower than it was in 1992.

Accidents—Forty-four percent of the responding residents thought that the number of accidents did not change due to construction, while 31% thought they decreased. No consensus among responding businesses during or after construction, was made about the change in the number of accidents. Slightly over half thought that they increased during construction. During construction, there was a problem with knowing which lane they were supposed to be traveling in. After construction, responding businesses did not agree on whether the two-way continuous left-turn lane helped customers get in and out of their businesses, or if drivers in the lane got confused about what they were supposed to do while they were there.

Total Estimated Benefits Versus Costs—The MicroBENCOST benefit-cost model was used to analyze the benefits and costs to motorists of the highway-widening construction. Construction period negative benefits totaled \$54,300, but benefits discounted over 20 years totaled \$7,399,950.

The benefit-cost ratio was 1.54, which means that the motorists are receiving \$1.54 in benefits for every dollar spent on the project.

State Highway 199 (Parker County)

There were two end-to-end S.H. 199 widening projects included in the Parker County study located between the cities of Azle on the east end and Springtown on the west end, respectively. The two projects joined each other at F.M. Road 2257, about halfway between Azle and Springtown. They were studied separately and are referred to as the Azle and Springtown projects.

Business Impacts

Highway Businesses—Business impacts were assessed using survey results supplemented with secondary data. Most business owners/managers answered a 1993 (Azle) or 1995 (Springtown) survey on during construction impacts and a 1996 survey on after construction impacts. The during construction survey yielded opinion and hard data from 46 businesses abutting the Azle project and 61 businesses abutting the Springtown project. The after construction survey yielded data from 24 Azle businesses and 46 Springtown businesses. Fifty percent (Azle) to 60% (Springtown) of the businesses were less than five years old. Therefore, questions about circumstances before construction started may have been answered by referring to circumstances before the construction reached their business. For certain impacts, the responding businesses were asked for their opinion on how the aspect changed, and later they were asked to provide numbers before, during, and after construction. This situation allowed for a comparison of perceptions to actual numbers.

Approximately half of the businesses' buildings were less than 10 years old in each city. Almost half of the businesses in each city owned their building during construction, and two-thirds owned it after construction.

In Azle, 197 (33%) of the responding abutting businesses' parking spaces were lost during the construction, while in Springtown, 136 spaces (16%) were lost. Part of the parking space lost is due to land being taken for right-of-way from approximately half of the abutting businesses. Of those reporting their number of parking spaces, 97% of Azle businesses and 86% of Springtown businesses provided numbers that agreed with their opinion on the change in their number of parking

spaces. After construction, 84% of Azle businesses and 89% of Springtown businesses provided numbers that agreed with their opinion on the change in their number of parking spaces.

During the busiest hour of the day at the responding businesses, 151 (36%) fewer Azle parking spaces and 191 (31%) fewer Springtown parking spaces were occupied during construction than before construction. After construction, the number further decreased by 10 (7%) in Azle and 38 (8%) in Springtown. Part of the decrease during construction was attributed to reduced accessibility of businesses. After construction, customers may have been used to patronizing different businesses and didn't return to the ones they had patronized before construction.

The decreased number of occupied parking spaces corresponded to fewer customers per day during construction for 58% of the Azle businesses and 70% of the Springtown businesses, although 28% of the Azle businesses and 26% of the Springtown businesses did not think there was a change in their number of customers per day. After construction, 63% of the Azle businesses and 28% of the Springtown businesses thought that there was no change in their number of customers per day, but 25% of the Azle businesses and 56% of the Springtown businesses thought the number increased.

The reported percentage of customers from out of town fell from 34% to 21% in Azle and from 30% to 26% in Springtown during construction. After construction, the reported percentage of out-of-town customers increased from 32% to 35% in Springtown but decreased from 38% to 37% in Azle.

Most businesses realized the construction was temporary and tried to retain their employees during construction. Between 74% and 89% of Azle and Springtown businesses thought that their number of part-time and full-time employees did not change during or after construction. The numbers provided by the businesses agreed with opinions they expressed 70% to 89% of the time. After construction, three Azle and six Springtown businesses increased the number of full-time employees.

In Azle, slightly over 50% of the responding businesses thought that their gross sales decreased during construction, while 24% said they experienced no change, and only 9% experienced an increase. After construction, 58% did not think that their sales changed, while 25% thought that their sales increased, and only 12% thought that their sales decreased.

In Springtown, 70% of the responding businesses thought that their sales decreased (48% said their sales declined more than 25%) during construction. Thirty percent said that their sales did not change, and only 2% thought that their sales increased. After construction, 58% of the responding businesses thought that their sales increased; 13% thought that their sales did not change, and only 6% thought that their sales decreased.

There were 16 abutting businesses of the Azle project that reported gross sales figures for the year before construction through the end of construction. Their sales increased 23% nominally from \$3.5 million to \$4.3 million. In real terms (deflated), this is an 8% increase.

Over 50% of these businesses reporting their actual sales thought that their sales had decreased during the construction period. Therefore, their perception of impact was more negative than the actual impact on their sales.

None of the responding Azle businesses reported their 'after construction' period annual sales, preventing a similar comparison between the 'before and after construction' period.

In Springtown, there were 18 businesses who reported annual gross sales figures before construction and through the end of construction. Their sales increased 21% nominally from \$9.1 million to \$11.0 million during construction. This amounts to 8% in real terms. A comparison of these businesses' opinions versus their reported sales shows 61% of them perceived that their sales changed in the same direction as their reported sales.

Only four responding businesses reported their before, during, and after construction annual sales. Their nominal sales doubled from \$1.8 million to \$3.6 million, a 45% increase in real dollars. Only half of these businesses perceived that their sales increased, but all of them experienced an increase in their actual sales.

Highway Versus City and County Businesses—The actual gross of the reporting abutting highway businesses are compared to the sales of the cities of Azle and Springtown and Parker County to determine the extent of the construction impact on the highway businesses.

Azle sales increased 6% nominally and decreased 9% in real terms compared to a 23% nominal increase or 9% real decrease in abutting businesses during construction of the Azle project. Therefore, if the businesses reporting their actual sales are representative of all abutting businesses, the abutting firms apparently performed better than the city of Azle's businesses. No comparison

could be made ‘after construction’ changes in sales, but it could be assumed that abutting businesses probably did as well as Azle businesses in the ‘after construction’ period.

During construction, abutting businesses’ nominal sales increased 21% (an 8% real increase), while Springtown’s businesses’ nominal sales increased 32% (a 14% real increase). Therefore, if the businesses reporting their actual sales are assumed to be representative of all abutting businesses, then the abutting businesses’ sales did not perform as well as those of Springtown during the construction period. After construction, the nominal sales doubled, and real sales increased 45% for abutting businesses, but Springtown sales are not available for comparison.

Parker County sales increased 32% nominally and 14% in real terms the during construction period. Therefore, the county sales increased equally or more than the abutting property sales of both the Azle and Springtown projects. This result is a further indication that the construction period did have some negative effects on abutting businesses’ sales.

Parker County sales are not available to compare with ‘after construction’ sales figures of abutting businesses of the two projects.

Property Value Impacts

Highway Properties—Approximately half of the businesses along both the Azle and Springtown highway projects did not think their property value changed during construction. Abutting non-relocated residents’ opinions were almost evenly divided between increase, decrease, no change, and no opinion on the change in their property value. There was no real consensus among the Azle project’s businesses as to how abutting property values were affected, but over half of the Springtown businesses thought it did not change, and one-third thought its value decreased.

After construction, 35% to 40% of the businesses thought that all abutting property values increased. Many of the remaining businesses did not know how it changed or thought it did not change. About half of the Azle project’s businesses thought their property values did not change, and 40% thought they increased. About half of the Springtown project’s businesses did not know how their property value changed, while one-third thought they increased.

The total nominal appraisal market value for all properties abutting construction on S.H. 199 in 1989 was \$14.2 million, while the real value was \$10 million. Nominally, abutting property values increased 5.6% during construction, but in real terms, property values decreased 6.7%. 'Before versus after construction' abutting property values decreased 1.4% nominally and 17.8% in real terms.

As indicated earlier, it is important to look at land values since property values may decrease due to aging of improvements. Also, the value per acre is a more accurate gauge of the change in land values. The nominal land value per acre for all 196 abutting properties with reported acreage increased about 2% during the construction period, while the real values per acre decreased 10%. 'Before versus after construction' nominal land value per acre decreased 1.6% and 20% in real terms.

For the Azle project, the nominal appraised land value per acre of 106 abutting properties decreased 4.4%, and the real value decreased 15.5%. 'Before versus after construction' nominal appraised land value per acre decreased a total of 4.2%, and the real value decreased 22%. In other words, the decrease in nominal value did not continue during the after period, but the real value experienced a continued decrease.

For the Springtown project, the nominal appraised land value of 90 abutting properties increased 10.8%, but the real value per acre decreased 2%. 'Before versus after construction' nominal land value per acre increased a total of 3.2%, and the real value decreased 16%.

Highway Versus City and County Properties—Property values for Springtown and Parker County are compared with those of highway properties. Since no highway properties were located within the city limits of Azle, no comparison was made between highway and Azle property values. Overall, the Springtown, Parker County, and highway property values generally decreased, where acreage information was available, on a per acre basis. Therefore, since all area properties are similarly affected, the decline is not solely due to the construction. Abutting inhabitants were more optimistic about the impact, thinking mainly that their property values did not change or increase.

During and after construction, abutting commercial property values did not decrease as much as Springtown commercial property values did. Abutting ranch values were also less than Springtown values, but abutting residential and vacant property values decreased more than the same types in Springtown.

In conclusion, the decline in abutting property values is not solely due to the construction.

Tax Revenue Impacts

Sales Tax Revenues—Real sales tax receipts from 16 abutting businesses, whose managers were willing to report their sales, decreased 7% for Azle businesses during construction. None of the Azle businesses reported their sales after construction. Azle sales tax receipts increased 13% (2% in real terms) during construction and 15% (7% in real terms) after construction, while Parker County sales tax receipts increased 16% nominally and 1% in real terms during construction. Assuming that the responding businesses are representative of all abutting Azle businesses, sales tax receipts were negatively impacted during construction.

Estimated real sales tax receipts from 18 abutting Springtown businesses increased by less than 1% during construction, but increased 31% after construction for four responding businesses. Springtown tax receipts increased 13% nominally but decreased 1% in real terms. Therefore, Springtown sales tax receipts were not as affected as Azle sales tax receipts during construction.

Property Tax Revenues—Abutting property tax receipts in Azle and Springtown increased by a greater percentage than Springtown and Parker County property tax receipts increased before, during, and after construction, both in real and nominal terms.

Contractor Expenditure Impacts

Adjusted employment and output multipliers developed from the 1986 Texas Input-Output Model were used to produce statewide estimates of impacts from S.H. 199 widening expenditures. These multipliers can be used to produce a rough estimate of local area impacts where the contractor broke down the expenditures to show how much was spent locally as opposed to other parts of the state or the nation. The contractor of the Springtown project did not break down these expenditures.

The adjusted employment multiplier is \$56.02 jobs per million dollars of expenditures, and the adjusted output multiplier is \$3.69 of output per dollar of expenditures.

Azle Highway Project—The contractor’s expenditures on the Azle highway project were broken down by location of the supplier and type of expenditure to estimate the employment and output impacts.

Employment Impacts—Applying the employment multiplier calculated above to the \$3.620 million of construction expenditures in Azle indicates that widening S.H. 199 generated approximately 202 new jobs for the Texas economy. It is unknown how much employment was generated in the Azle area. However, using the multipliers, the estimated increase in Azle employment was 10 new jobs.

Output Impacts—Applying the output multiplier to the \$3.620 million dollars of Azle expenditures indicates that widening S.H. 199 generated about \$13.4 million in additional output. Again, it is unknown how much of this increase benefitted the Azle area, but an estimate using the multipliers is \$680,000.

Springtown Highway Project—The Springtown contractor did not provide a location-breakdown of his expenditures, but TxDOT provided the total cost of the Springtown construction, \$8.082 million.

Employment Impacts—Applying the employment multiplier to the \$8.082 million of construction expenditures in Springtown indicates that widening S.H. 199 generated about 453 new jobs for the Texas economy.

Output Impacts—Applying the output multiplier to the Springtown construction expenditures indicates that widening S.H. 199 generated about \$29.82 million in additional output.

Relocation Impact

As indicated earlier right-of-way was required to widen S.H. 199 in Parker County. Therefore, an additional 23 meters (76 feet) was purchased on one side of the highway. A strip was purchased on the north side for the Azle project and on the south side for the Springtown project. A total of 179 properties were acquired, displacing 45 businesses and 75 residences, which affected 193 owners and tenants. Twenty-six businesses and 40 residences were displaced, but 20 businesses and 30 residences had enough remaining land to relocate on site.

Right-of-Way and Relocation Expenses—The right-of-way was purchased for \$5.8 million, and relocation expenses totaled over \$800,000. Title, court, witness, and appraisal fees added over \$375,000 to the purchase costs. The price per square foot for the right-of-way ranged from \$0.26 to \$2.10, while the price per acre ranges from \$2,000 to \$55,000.

Relocation Survey Results—A total of 39 businesses responded to the relocation survey.

Azle—Seven businesses moved because the state took right-of-way. The front of the property was the original location for four businesses, and three businesses started at other locations. Forty-six percent of the businesses were started before 1992 at the interview location, while 41% began business at the interview location during construction. Only three businesses had previously been located somewhere else.

Springtown—Eleven businesses moved because the state took right-of-way. The front of the property was the original location for nine businesses, and five businesses started at other locations. Fifty-six percent of the businesses were started before 1992 at the interview location, while 39% began business at the interview location during construction. Twelve businesses (20%) had previously been located somewhere else.

User Cost Impacts

The various elements used to determine user cost impacts were studied as follows:

Traffic Volume—Approximately half of the responding Azle and Springtown business managers thought that the traffic volume did not change, while the rest were divided between thinking that it increased or decreased. Fifty-eight percent of the non-relocated residents thought that traffic volume increased, while the rest were divided between decrease and no change. The traffic volume decreased 2% to 7% each year during construction.

After construction, approximately 80% of the Azle and Springtown business managers thought that traffic volume increased. Traffic counters corroborated their feelings as they indicated that traffic volume rose 2% to 23% each year after construction. Springtown traffic in 1996 was still 3% below the traffic volume in 1991.

Travel Time—Seventy-five percent to 86% of Azle and Springtown managers thought that the travel time increased, while there was no consensus among non-relocated residents about the impact on travel time. Travel time for both cities increased 3% to 5% during the first year of construction. However, Azle travel time decreased 10% during the second year of construction while Springtown travel time increased 11%.

After construction, 61% to 87% thought that travel time decreased. Travel time for both cities increased in 1994. In Azle, the travel time was still four seconds faster than in 1991. Travel time in both cities decreased in 1996 and was 13% to 19% lower than 1991 values.

Accidents—Most Azle and Springtown (68% to 76%) business managers thought that the number of accidents increased during construction, while there was no consensus among non-relocated residents. The average number of accidents during construction increased for Springtown but decreased for Azle.

After construction, there was no consensus among Azle business managers. Half of the Springtown managers thought that the number of accidents increased, and the rest were divided between “no change,” “decrease,” and “don’t know.” The number of accidents after construction was lower than any year reported in the Texas Accident Database.

Total Estimated Benefits Versus Costs—User benefits in Azle discounted over 20 years totaled \$9.5 million. Although not estimated, the construction period negative effects would have reduced the net benefits some. Also, it took longer than planned to finish this project. Therefore, the benefit-cost ratio would be smaller than shown here. The benefit-cost ratio was 2.95, which means that the motorists are receiving \$2.95 in benefits for every dollar spent on the project.

Springtown user benefits discounted over 20 years totaled \$9.4 million. The benefit-cost ratio was 1.48 which means that the motorists received \$1.48 in benefits for every dollar spent on the project.

U.S. Highway 59 (Eastex Freeway)

Business Impacts

Highway Businesses—Business impacts were assessed using survey results supplemented with secondary data. Most businesses (67) responded to an October 1994 survey on during construction impacts. Construction was not complete for two of the three segments in January 1997, but since the study was terminated, a survey on after construction impacts was administered at that time. In fact, construction was to be completed by June 1995. Remember, although construction was almost complete, it was still taking place on two of the three projects at the time of the last survey. A total of 64 businesses responded to the survey.

Fifteen percent of the businesses responding to the first survey were less than five years old. Therefore, questions about circumstances before construction started may have been answered by referring to circumstances before the construction reached their business. Approximately one-third of the businesses' buildings were less than 10 years old. Slightly over half of the businesses owned their building during and after construction.

Fifteen percent of the responding abutting businesses' parking spaces were lost during the construction. Since a strip of right-of-way had to be taken on one side of the freeway, part of the parking loss was due to land being acquired from the property owner. This action caused a permanent loss of some parking spaces, but the remaining loss was due to temporary construction activities. Of those reporting their number of parking spaces, 86% of the businesses agreed on the change in their number of parking spaces. After construction, 81% of the businesses agreed on the change in their number of parking spaces. Responding abutting businesses lost 5% of their parking spaces after construction.

During the busiest hour of the day at the responding businesses, 17% more parking spaces were occupied during construction than before construction. This outcome may have been due to some respondents with large parking lots which did not indicate how many parking spaces they had but reported the change in their number of occupied parking spaces. After construction, the number of occupied parking spaces decreased by 20%. The decrease was attributed to the closure or

relocation of entry and exit ramps close to businesses, lack of access, and people going around the construction.

The decreased number of occupied parking spaces corresponded to fewer customers per day during construction for 70% of the businesses during and after construction, although 23% of the businesses did not think there was a change in their number of customers per day. The reported percentage of customers from out of town fell from 22% to 13% during construction. After construction, the reported percentage of out of town customers decreased from 16% to 15%.

Most managers realized the construction was temporary and tried to retain their employees during construction. Approximately 60% of the managers thought their number of full-time employees did not change during or after construction, and approximately 30% thought the number decreased. The number of full-time employees increased 3% during construction but fell 13% afterwards. Eighty-two percent of the managers thought that their number of part-time employees did not change during construction, and 64% thought so afterwards. The number of part-time employees decreased 16% during construction but increased 53% afterward. The numbers provided by the managers agreed with opinions they expressed about 80% of the time.

There were 13 businesses who reported gross sales figures for the year before construction through the end of construction. Their sales increased 13% nominally and decreased 2% in real terms during construction. There were 10 managers who reported their sales for 1988 and 1996, and their sales decreased 34% nominally and 50% in real terms. Remember, construction was still going on when the last survey was taken. Therefore, the extra long construction period was taking its toll on abutting businesses' sales.

Highway Versus City and County Businesses—‘Before versus during’ and ‘after construction’ business sales are compared for U.S. 59, Houston, and Harris County based on data obtained from highway businesses and the State Comptroller’s Office. As explained earlier, these comparisons are made to determine the extent of the construction impact on the gross sales of the U.S. 59 businesses.

Thirteen abutting businesses reported their actual gross sales on the first survey taken during the mid-part of the construction period. Assuming these businesses are representative of the other abutting businesses, their nominal sales decreased 13% (a real decrease of 2%) during construction

The city of Houston' sales increased 31% (4% real) during the corresponding passage of time. Harris County's nominal sales increased 33% or a 2% real increase.

The 10 abutting businesses reporting their gross sales 'before and during construction' period sales later in the construction period showed a nominal sales decrease of 34% or a real sales decrease of 50%. Unfortunately, Houston's and Harris County's sales were not available for 1996.

Comparing the sales of the abutting businesses with those of the city of Houston and Harris County, it is obvious that the construction period of the freeway had a negative effect on abutting businesses' gross sales.

Property Value Impacts

Highway Properties—Businesses responding to the first survey were asked if their property value changed during the construction. Forty-six percent of the respondents thought that it did not change; 27% thought it had decreased, and 4% thought it had increased. Twenty percent were unsure or did not answer. Respondents of the second survey, sent out later in the construction period, mainly gave no opinion on the change in property value, and there was no consensus among those giving an opinion as to what the change might be. Twenty-three percent of abutting businesses estimated that it had not changed; 16% said it had decreased, and 11% said it had increased. Therefore, respondents of the second survey were a little more optimistic about their property values than those of the first survey.

Approximately half (48%) of the 46 abutting residents (of the 298 sent a survey) thought that their property value decreased due to construction. Nineteen percent of the respondents thought that their property value increased up to 50% due to the construction. Fourteen percent of the respondents did not think their property value changed due to the construction, and 19% did not know or did not answer. One resident said that the reason his property value hasn't changed is because he now has less land than before.

Slightly over half (52%) of the 21 relocated resident respondents thought that their property value increased due to construction. Twenty-four percent thought that it decreased, while 8% thought there was no change. Sixteen percent did not know or did not answer the question.

The total nominal appraisal market value for all properties abutting construction and having value for all years between 1984 and 1996 on U.S. 59 decreased from \$153 million in 1987 to \$104 million in 1996, a decrease of 32%, which represents the period of highway construction impact. Part of this decrease in value was due to the taking over \$25 million in right-of-way and damages to remainder property.

It is important to look at land values since property values may decrease due to aging of improvements. Also, the value per square meter (foot) is a more accurate gauge of the change in land values. Nominal values of all abutting land ranged from \$13.58 per square meter (\$1.26 per square foot) in 1984 to \$12.31 per square meter (\$1.14 per square foot) in 1996, representing only a minor decrease of 9.4% in value. Between 1984 and 1996, the real values per square meter decreased from \$20.51 per square meter (\$1.91 per square foot) to \$12.31 per square meter (\$1.14 per square foot), representing a 40% decrease in value. Therefore, abutting land value per square meter (square foot) did not decrease as much as abutting total property value during this period of time, which includes the construction period of 1989-1996. Also, the abutting land values appeared the same regardless of which side of the freeway the property was located.

During the 1989-1996 construction period, abutting land values per square meter/foot remained the same, but the real value per square meter/foot decreased 21%. Therefore, the construction impact on abutting land values appear to be minimal at most, and the after period impact remains to seen.

Highway Versus City and County Properties—A comparison is made between the value of highway, Houston, and Harris County properties to help determine the extent of the construction period impact on U.S. 59's abutting property. Note, as indicated above, these are property values, not land values, so the age of the improvements could greatly impact the property values. Only abutting properties where no right-of-way were taken are used in making value comparisons with the city and county properties.

Commercial property values in Houston and Harris County decreased 27% and 12%, respectively, in real terms during the 1989-1996 construction period. Highway property values decreased 1%. Therefore, abutting commercial property values appear to have decreased less than Houston and Harris County commercial property values during construction.

Residential property values in Houston and Harris County decreased only 1% and increased 9%, respectively, in real terms during construction, while abutting property values decreased an unusual 18%. Therefore, abutting residential property values appear to have decreased more than Houston and Harris County residential property values during construction.

Vacant property values in Houston and Harris County property values decreased approximately 33% and 29%, respectively, in real terms. Abutting vacant property values decreased 32% in real terms. Therefore, abutting vacant property values do not appear affected by the construction, similar to the conclusion reached above in the analysis of changes in abutting land values measured on a square meter/foot basis.

Tax Revenue Impacts

Based on 24 abutting businesses' sales reported on the first survey in 1994, sales tax revenues from businesses abutting U.S. 59 decreased 27.8% during construction, while Houston sales tax receipts only decreased 0.9%, and Harris County sales tax receipts increased 4%. Based on 10 abutting businesses' sales reported on the second survey in 1996, sales tax revenue from abutting businesses decreased 37.7% during construction, while Houston sales tax receipts increased 4.2%, and Harris County sales tax receipts increased 17%. Therefore, the sales tax receipts of abutting businesses were negatively affected by the construction. After construction sales figures are not available for comparison.

Average abutting property tax revenue from properties unaffected by right-of-way acquisition increased while Houston property tax revenue decreased. Property tax revenue from all abutting properties decreased one and one half times as much as Houston property tax revenue. Harris County property tax revenue increased 7%.

Contractor Expenditure Impacts

Adjusted output and employment multipliers were developed from the 1986 Texas Input-Output Model to produce statewide estimates of impacts from U.S. 59 widening expenditures.

Output Impacts—Applying the output multiplier of \$3.69 of output per dollar of expenditures to the \$114 million dollars of construction expenditures as of October 1997 indicates that widening U.S. 59 generated about \$6,386 million in additional output. It is unknown how much of this increase benefitted the Houston area. Since construction has not been completed, the amount of output generated by the construction is underestimated in this analysis.

Employment Impacts—Applying the employment multiplier 56.02 jobs per million dollars of expenditures to the \$114 million of construction expenditures in Houston indicates that widening U.S. 59 generated approximately 421 new jobs for the Texas economy. It is unknown how much employment was generated in the Houston area. Again, since construction has not been completed, the amount of employment generated by the construction is underestimated in this analysis.

Relocation Impacts

In order to have enough land to accommodate the widening of U.S. 59, 281 properties were purchased by TxDOT.

Right-of-Way and Relocation Expenses—Property purchase costs include \$10.7 million for land, \$10.1 million for improvements, and \$5.7 million for net damages or enhancements. Relocation costs were \$4.6 million. The price per hectare for 142 properties for which land area and values were available ranges from \$96,296 to \$1,420,000 per hectare (\$39,000 to \$575,100 per acre). The total value of the properties divided by the total land area yielded an average value per hectare of \$380,072 (\$153,929 per acre).

Relocation Survey Results—Twenty-three (34%) of the 67 businesses responding to the during construction survey moved because the state took right-of-way. The front of the property was the original location for 16 businesses, and five businesses started at other locations.

Sixteen (25%) of the businesses responding to the during construction survey moved because the state took right-of-way. The front of the property was the original location for 13 businesses, and two businesses started at other locations.

Relocation inconvenienced many of the 25 responding residents, but some were more affected than others. Many owners were not happy with the right-of-way payment amount and procedures used.

One displaced business closed because the owner lost his business and was not given enough money to buy a new place of business. Another owner was not given enough money to relocate and was too old to be hired. A third business closed because of shrinking margins and today's environmental expense of new locations. One abutting manager thought that businesses in the inbound area were lost and did not come back. Another thought that by the time the construction ended, people would be out of the habit of stopping at abutting businesses and wouldn't come back to them.

User Cost Impacts

Traffic volume, travel time, and accident rates on the U.S. 59 study sections were affected by changes in the highway during construction. The opinions of abutting businesses and residents are compared with actual changes in these user cost elements, and the benefit-cost ratio is estimated.

Between Kelley and Hopper roads, the number of lanes increased from 4 to 10 on U.S. 59, and the 4-lane service road was expanded to 6 lanes. The construction was divided into three sections, and a fourth project involved the construction of an HOV fly-over bridge. Construction on the bridge occurred between 1994 and 1996. The construction started between April and October 1991 on the three sections of the freeway. Construction on two sections is completed and is ongoing on the remaining section. Completion was originally scheduled to end between October 1993 and June 1995 for the various projects.

Traffic Volume—Forty-five percent of the businesses responding to the first survey thought that the traffic volume did not change during construction; 22% thought that it had decreased, and 23% thought that it had increased. A higher percentage (40%) of businesses responding to the second survey thought that traffic volumes increased later in the construction period, while a smaller percentage thought that it did not change (20%) or decreased (5%). On the other hand, only 24% of the responding non-relocated residents thought that traffic volume increased during construction,

and only 15% thought that it decreased or didn't change. Most of them (62%) didn't know or didn't give an answer. In contrast, 44% of the relocated residents thought that the traffic volume decreased due to the construction, and 32% thought that it increased. Another 16% thought that it did not change.

Main-lane traffic volume could not be measured by TTI researchers during construction. However, they were able to record frontage road volumes which trended upward during the construction period. Also, before construction, TxDOT projected an increase in volume over a 20-year period.

Travel Time—Most businesses (63%) from the first survey thought that the time it took to travel through Houston increased during construction, and 24% thought that it did not change. Only 22% percent of the businesses responding to the second survey thought that the travel time went up near the end of construction, and 25% thought it went down.

Twenty-nine percent of the non-relocated residents thought that the time it took to get to work increased due to construction. Only one resident thought that it decreased. In contrast, 68% of the relocated residents thought that their travel time to work increased due to construction, while 12% thought it decreased.

Thirty-nine percent of the non-relocated residents thought that it took more time to obtain gas and food during construction, and only 10% thought that it took less time. Over half (56%) of the relocated residents thought that their travel time to buy food and gas on U.S. 59 increased due to the construction, and only 12% thought that it decreased.

The average travel time for instrumented vehicle runs on U.S. 59 in 1991 was three minutes and 44 seconds, while the average travel time on the frontage road was six minutes and 44 seconds. The travel time on U.S. 59 alternately decreased and increased between 1% and 14% each year until 1996, while the travel time on the frontage road alternately decreased and increased 3% to 43% each year during that time. In 1996, the average travel time on U.S. 59 was three minutes and seven seconds, while the travel time on the frontage road was six minutes and eight seconds. Therefore, travel time decreased 16.6% on U.S. 59 and 8.8% on the frontage road during the first six years of construction.

Accidents—Most businesses responding to the first survey thought that the number of accidents on U.S. 59 either increased (36%) or did not change (43%) during construction. Twenty-seven percent of the businesses responding to the second survey thought that the number of accidents increased, while the others thought that the number of accidents “did not change,” “didn’t know,” or “didn’t answer.”

Thirty-four percent of the responding non-relocated residents thought that accidents on U.S. 59 had increased during construction, while 15% thought that the number decreased. The others thought that the number hadn’t changed or they did not answer the question. Thirty-six of the relocated residents thought that the number had increased, and 32% thought the number had decreased. The others thought that the number had not changed, didn’t know, or didn’t answer.

During construction (between 1991 and 1995), there was an average of 1.8 fatalities per year, with a range of 0 to 4 per year. Injury or possible injury accidents averaged 199 per year, with a range of 178 to 216 per year. There was an average of 163 non-injury accidents per year, with a range of 115 to 184 per year. Total accidents ranged from 317 to 390 per year, with an average of 363 per year. The fewest non-injury and total accidents occurred in 1995, when some of the construction had been completed.

Total Estimated Benefits Versus Costs—The MicroBENCOST computer program was used to analyze the benefits and costs to motorists of the highway widening construction. In general, the program compares the motorist costs before an improvement with those existing after an improvement has been made.

A 2.85 kilometer (1.77 mile) section of the project between Crosstimbers and Little York in Houston was studied. The construction costs for this segment were \$53.4 million as of October 1997, but the construction was not complete; therefore, costs are underestimated for this analysis. The ADT for Bennington and Tidwell from the Environmental Impact Assessment was used. Lane closures and the extra amount of construction time for this project were not logged, so this information was not included in the model, leading to further underestimation of the costs.

The benefit-cost ratio was \$5.98, which means that the motorists are receiving \$5.98 in benefits for every dollar spent on the project. As mentioned previously, costs are still accruing

because the project has not yet been completed, and lane closures were not included in the model. Therefore, this number overestimates the user benefit-cost ratio of this project.

ENVIRONMENTAL IMPACTS

State Highway 21 (Caldwell)

Noise Level

Over 60% of the responding businesses thought that the noise level at their business or along S.H. 21 increased during construction, while 20% to 30% did not think it changed. After construction, 60% to 70% of the businesses thought that the noise level at their business or along S.H. 21 did not change after construction, while 20% to 30% thought it increased. Ninety-four percent of the responding residents thought that the noise level increased due to construction.

Air Pollution Level

Forty to 50% of the responding businesses thought that the air pollution near their business or on S.H. 21 increased during construction, while 35% to 40% of them thought that it did not change. After construction, 67% to 72% thought that the air pollution level did not change near their business or on S.H. 21; 21% to 23% did not know. Sixty-nine percent of the responding residents thought that the air pollution level increased, and 25% thought it did not change.

General Appearance

Seventy percent of the responding businesses thought that the general appearance of S.H. 21 declined during construction, while 88% thought that it improved after or near the end of construction. Eighty percent of the responding residents thought that it improved due to construction.

Many businesses liked the appearance of the new highway. One thought that it looked like a park, and another thought it looked like it had more room. Others didn't like the grass, concrete, or increased trash due to the construction.

Desirability as a Place to Live

Fifty-five percent of the responding residents thought that the desirability of living abutting construction increased due to the construction, while 38% thought it did not change, and 12% thought it decreased. Improvements included better drainage, reduced flooding, improved appearance, wider underpass, curbs and gutters, reduced travel time, and the center left-turn lane. The major drawback was the increased traffic speed.

State Highway 199 (Parker County)

Over half of the responding businesses thought that noise and air pollution levels increased near their own business and on S.H. 199 during construction. Over half of the responding residents thought that the noise level near their residence increased during construction. Most of the remaining respondents thought that the levels did not change. There was no consensus on the general appearance of S.H. 199, the residents' opinions of the desirability of living abutting S.H. 199 or the change in air pollution during construction.

After construction, most business managers thought that the air pollution and noise level at their business did not change. Fifty percent to 60% thought that the noise and air pollution levels on S.H. 199 increased, and 30% to 50% thought that they did not change after construction. Sixty-seven percent to 84% of the respondents thought that general appearance of S.H. 199 improved after construction.

U.S. Highway 59 (Eastex Freeway)

Fifty to 60% of the responding businesses and non-relocated residents thought that noise and air pollution levels increased near their own business/residence and on U.S. 59 during construction. Most of the remaining respondents thought that the levels did not change. After construction or near the end of construction, 50% to 60% of the businesses thought that the noise and air pollution levels did not change near their own business/residence and on U.S. 59, while 20% to 30% thought they increased. Seventy-seven percent of the businesses and 53% of the non-relocated residents thought the general appearance of U.S. 59 deteriorated during construction. Fifty-six percent of the relocated residents thought it improved. Forty-two percent of the managers thought it improved after construction, but 42% did not answer the question.

CONTRACTOR AND TxDOT PERFORMANCE

State Highway 21 (Caldwell)

In general, the responding businesses were more pleased with TxDOT personnel than with the contractor. Opinions of the contractor were distributed between very good and very poor, while almost half of the businesses thought TxDOT did a very good or good job.

Major problems with the contractor related to construction delays, employee attitude, employee performance, and communication with businesses. Positive aspects included considerate relationship with business managers, steady work load, and good curbs and gutters from the concrete people.

Major problems with TxDOT included dislike of the construction plan, of the safety of the plan, and of communication with business managers. Positive aspects were that the personnel were nice and helpful, and they kept construction moving on schedule.

State Highway 199 (Parker County)

There were three contractors for the Azle construction, so it is hard to determine which contractor is referred to by a given respondent. The Azle contractor was generally regarded more negatively than positively by the respondents. Several respondents were unhappy with the quality of the work performed on the driveways or drains and with the way the contractor's workers performed their job. Major issues involved beginning and ending construction on holiday weekends, poorly marking changes in the direction and lanes of travel, poor public relations, and not working diligently.

There were two contractors for the Springtown segment. Almost half the respondents rated the contractor as good or very good, one-fourth fair, and one-fourth poor or very poor. Businesses said that the construction took longer than it should have due to poor time management. They were concerned about poor road quality because the road was being repaired shortly after it opened. Some did not like the workers' attitudes, either.

TxDOT was considered to have performed more positively than the contractors. However, some businesses disliked their public relations, management, and aspects of the highway design for both segments.

U.S. Highway 59 (Eastex Freeway)

During construction, half of the responding businesses rated the contractor and TxDOT personnel good or very good. Many businesses thought that the construction was necessary and that TxDOT and contractor personnel were polite and helpful. Many were unhappy about the signing, the sparsity of exit ramps, and the length of time it was taking to complete the construction.

CONCLUSIONS

The project specific and general conclusions are presented separately below.

PROJECT SPECIFIC CONCLUSIONS

The following conclusions are based on the findings of this study. They are not the only conclusions that might be supported by the findings but seem to be the most meaningfully supported.

The conclusions on the S.H. 21 and S.H. 199 study sections are based on 'before versus construction' and after period impacts, whereas, the conclusions on the U.S. Highway 59 study section are based on 'before versus construction' period impacts. In the latter case, an attempt was made to get the businesses surveyed in the last survey to answer some of the questions as if construction was completed.

State Highway 21 (Caldwell)

1. Although no right-of-way was purchased, the use of all of the existing right-of-way caused abutting businesses to lose parking spaces. Caldwell businesses lost 7% of their parking spaces.
2. Businesses were affected more negatively during construction than after construction. Reported business sales increased after construction, while they decreased during construction.
3. Businesses' opinions about changes in their number of parking spaces, full-time employees, and part-time employees were in agreement with the numbers they reported before, during, and after construction.

4. Abutting land values apparently have not experienced even a short-run negative effect from the widening of S.H. 21, even though the values of whole properties declined.
5. Motorists using the widened facility will benefit greatly. Travel time and accidents have declined significantly since the construction was completed. The negative user costs generated during construction were more than offset by the long-term benefits.
6. Residents and businesses are not pleased with the increased travel speed on S.H. 21 after construction. Some businesses think that the traffic flows too fast for people to consider stopping and shopping.
7. The construction period produced a negative impact on some businesses and tax revenue, but these negative effects were offset by construction expenditures in the Caldwell area. Therefore, the overall economic impact was positive on business activity. Property values after construction was completed and were expected to accelerate.

State Highway 199 (Parker County)

1. The purchase of a significant amount of right-of-way produced considerable negative affects on a large number of owners, businesses, and residents, displacing many and generating high right-of-way and relocation costs.
2. The number of parking spaces lost during construction was considerably greater during the construction period than after construction, especially for the Azle project, and most of the permanent parking loss was due to the right-of-way taken.
3. Businesses' opinions about changes in their number of parking spaces, full-time employees, and part-time employees were in agreement with the numbers they reported before, during, and after construction at least 70% of the time. This relationship between opinions and facts

supports our ability to rely on opinions, which are more readily available, when conclusions are made.

4. The overall economic impact of the S.H. 199 widening project in Azle and Springtown, Texas, has been positive on business activity after construction was completed and is expected to accelerate in the future.
5. Abutting property values for both the Azle and Springtown projects were affected negatively to a significant extent during construction and after widening S.H. 199.
6. The construction period produced a negative impact on some businesses and tax revenues, but these negative effects were offset by construction expenditures in the Azle and Springtown area.
7. Business customers and motorists will greatly benefit from the widened facility in the years to come and continue to produce a positive effect on the economy of the Azle and Springtown area.

U.S. Highway 59 (Eastex Freeway)

1. The purchase of a considerable amount of right-of-way negatively affected businesses, residents, and property owners significantly by displacing many of them and producing high right-of-way and relocation costs.
2. Abutting businesses lost more parking spaces during the main part of construction than near the end of construction due to taking land for right-of-way.

3. Once again, businesses' opinions about changes in their number of parking spaces, full-time employees, and part-time employees agreed with the numbers they reported before, during, and after construction at least 70% of the time.
4. The gross sales of abutting businesses declined significantly during construction, becoming less severe near the end of construction.
5. Abutting property values declined during construction, but abutting land values changed little, indicating very little if any negative impact from widening U.S. 59.
6. The construction expenditure effect on employment and net output in the Houston area is very positive and will help offset some of the negative effects of business sales.
7. Tax revenues from businesses sales and property taxes from abutting businesses and properties declined significantly during construction.
8. Although traffic volume, travel time, and accidents increased during construction, the significantly large benefit/cost ratio indicates that considerable net benefits will accrue to highway users over a 20-year after period.

GENERAL CONCLUSIONS

1. Generally, highway widening projects, regardless of type, produce temporary negative effects on abutting businesses, residents, and property owners during the construction period. Businesses and tax revenues are the most negatively affected, especially for projects requiring considerable right-of-way. However, the local construction expenditures offset much of the negative effects.

2. Motorists receive considerable long run benefits in the form of reduced travel time, operating, and accident costs, regardless of the type of widening project. However, such benefits are reduced some during the construction period, especially when the construction period is extended to a considerable amount of time.

RECOMMENDATIONS FOR IMPLEMENTATION

1. It is recommended that the amount of right-of-way taken and the length of the construction period should be held to an absolute minimum on all highway widening projects to reduce the negative economic effects.
2. It is recommended that further study be conducted on the U.S. Highway 59 project, since this study was terminated before construction was completed. Hence, valid 'before versus after construction' results were not obtained. It is further recommended that the other two projects, S.H. 21 in Caldwell and S.H. 199 in Parker County, be revisited to obtain longer after period results.
3. Finally, it is recommended that this study's research be implemented immediately, particularly those of the Caldwell and Parker Counties' projects, to assist in writing Environmental Impact Statements (EIS) and further valuable economic impact information at public hearings.

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