

Estimated Construction Period Impact of Widening State Highway 21 in Caldwell, Texas

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Documented are the during- and after-construction effects of widening a highway. Between 1991 and 1993, a 3.75 km (2.33 mi) section of State Highway (TX-21) in Caldwell, Texas, a town of 3,000, was widened for a continuous two-way left-turn lane with curbs and gutters. Data collected during and after construction include information about the abutting businesses' estimation of the impact of construction on their businesses profits and property values and on the traffic volumes, travel times, and accident rates of the highway. The number of most businesses' usable parking spaces, customers per day, and full-time and part-time employees decreased slightly during construction. Most business managers thought that sales decreased. Reported sales figures showed a 5 percent decrease, which was less severe than the business managers had estimated. Appraised abutting property values fell between 1990 and 1992, while land values increased. Construction expenditures in Texas totaled \$6.095 million. The Texas input-output model estimates the impact of these expenditures to be \$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. The benefit-cost ratio was 1.71—that is, the motorists are receiving \$1.71 in benefits for every dollar spent on the project.

Departments of transportation have the responsibility to provide safe and congestion-free highways. One way this can be accomplished is by widening and adding travel lanes to existing highways. In many cases, these highways are widened enough to install a continuous two-way left-turn lane in the median and curbs and gutters at the margins. In some cases, additional right-of-way has to be acquired from owners of abutting property.

Many business and property owners who may be affected by such construction are worried about potential negative economic impacts. A list of business concerns includes loss of shoulder and private parking space for customers, the inability of customers to safely turn into parking lots, and the impact on land value and business sales during construction. Unfortunately, most of the literature dealing with the impacts of highway-widening projects that add a continuous two-way left-turn lane discusses only the benefit-cost and land use impacts.

In 1993, the economic impact of widening US-80 in Longview, Texas, was studied (1). However, to establish a minimal data base for estimating related economic impacts of widening projects on the businesses directly affected, as well as on the city as a whole, several more case studies of different types of projects are needed. The results of such studies could fulfill the environmental assessment required for approval by FHWA. The need for supporting data for environmental assessments was dramatized in the case of the pro-

posed widening of US-80 in Longview. As a result, the Texas Department of Transportation (TXDOT) asked the Texas Transportation Institute (TTI) to estimate the proposed economic impact of the improvement. The findings were submitted as part of the environmental assessment to FHWA for approval, which was granted.

The current study includes three widening projects: TX-21 in Caldwell, Texas; TX-199 near Fort Worth, Texas; and US-59 in Houston, Texas. In this paper, the construction period effects of widening TX-21 in Caldwell, Texas, are described.

The construction site of interest is a 3.75-km (2.33 mi) segment of TX-21 from Davidson Creek to 1.61 km (1 mi) west of FM-975 in Caldwell, Texas, in addition to the area on TX-36 adjoining the intersection of TX-21 and TX-36. Caldwell is a rural town of approximately 3,000 people. Bryan/College Station, a community of approximately 100,000, is approximately 40.23 km (25 mi) away. The next closest city with a population over 25,000 is Austin, approximately 128.75 km (80 mi) away.

The construction transformed a two- to four-lane undivided highway with an open ditch into a four-lane divided highway with a two-way left-turn lane, curbs, and gutters. A new railroad overpass bridge was constructed to allow for four lanes of traffic. Construction occurred between January 1991 and July 1993. No right-of-way was taken.

METHODS

Construction impacts were evaluated by surveying business managers, analyzing property values, and evaluating user costs and construction expenditure impacts. This method of data collection and evaluation allows the analyst to compare opinions expressed with actual changes shown by hard data. In other words, psychological responses can be interpreted with factual data.

Business Survey

Impacts were evaluated through personal interviews of business managers along the widened section of TX-21. The list of businesses was compiled during a windshield survey of the study area. The list was cross-referenced with a list of Caldwell businesses obtained from the state comptroller's office.

Survey questions were designed to address issues raised by people who had asked TTI about potential construction impacts. Many of the questions asked managers of abutting businesses about changes in sales, number of employees, and number of parking spaces. Other questions dealt with impacts on the whole construc-

tion area, such as the change in traffic volume, number of accidents, and travel time. Managers were also asked to provide their number of parking spaces, actual sales, and employment figures before and during construction.

During a previous study, the surveys had been administered by mail. The response rate was low, and some of the returned surveys were incomplete. Therefore, the surveys for this study were administered in person, mainly by three TTI researchers during the week of July 26, 1993. The few remaining surveys were administered over the following 2 weeks. One manager refused to answer the questionnaire, and two went out of business during the interview period. Fifty-four responses were received.

Personal interviews worked out better than anticipated. Not only did the response and completion rate improve, but the quality of response improved as well. Managers related anecdotes about the construction that they probably would not have taken the time to write about.

Property Data

The property data were obtained from the Burlison County Appraisal District. The appraiser provided the appraisal records for each property abutting construction. He also provided property values for the city of Caldwell.

Traffic Data

Traffic data was collected by TTI's Transportation Analysis and Design Division. The engineers set up equipment to count the number of cars passing through each intersection for each hour of the day for 3 consecutive days each year. They also counted turning movements at intersections for several 15-min intervals during the day. They classified the vehicles as cars, trucks, buses, and so on. Most importantly, they drove up and down the study area in instrumented vehicles so they could record events, such as stopping at a stop sign or for a construction worker, and times of the events. All of these data are useful in benefit-cost analysis, which was conducted using the MicroBENCOST model for this analysis.

Impact of Construction Expenditures

The contractors of the TX-21 widening project in Caldwell were asked to break down their expenditures in the Caldwell area versus elsewhere so construction expenditure impact estimates could be made. These numbers were used in the Texas Input-Output model to estimate the impact of the construction expenditures on output and employment for both the Caldwell area and Texas.

BUSINESS IMPACT

The business managers were asked to estimate the extent to which highway construction activities affected different aspects of their businesses, all abutting businesses, and all Caldwell businesses. These opinions were compared to actual changes experienced by their businesses and also Caldwell businesses when the data were available. The gross sales for all Caldwell businesses combined were obtained from the state comptroller's office.

Individual Business Impacts

Business managers were asked to indicate the number parking spaces they had available, the number of occupied parking spaces, percentage of customers from out-of-town, and the number of full-time and part-time employees before and during construction. These data are reported in this section along with a comparison of actual data with business managers' opinions on sales and profits.

Customer Parking

Sixty percent (32) of the business managers thought that the number of their parking spaces did not change during construction. Available parking decreased for most (21) of the rest of the businesses. Nine managers (16.67 percent) thought they lost more than half of their parking spaces, while 12 (22.22 percent) thought they lost fewer than half of their parking spaces.

Responding managers had a total of 745 parking spaces before construction and 695 during construction. Note that no right-of-way was purchased, so the 50 lost parking spaces (7 percent) were either located on the existing right-of-way or were lost in the creation of curbs and gutters.

Responding managers reported a total of 575 occupied parking spaces during the busiest hour of an average day before construction, and 438 occupied parking spaces during construction. The 24 percent decrease may have been due to the appearance of reduced accessibility to the businesses.

Number of Customers per Day

The impact on the number of customers per day was stronger than on parking spaces. Only 13 managers (24.07 percent) thought number of customers they had per day did not change. Twenty-one managers (38.89 percent) thought they lost up to 50 percent of their customers during construction, while 15 (27.78 percent) thought they lost more than 50 percent of their daily customers. Two managers (3.70 percent) thought they had more customers per day during construction. These were places where the construction workers would stop or places that were relatively more accessible during construction.

Some businesses were able to conduct business even though they were less accessible to customers. One business owner took phone orders during construction but lost drop-in customers. Another business owner sent agents out to do business to compensate for his inaccessibility.

Number of Full-Time Employees

Forty-four of the responding business managers (81.49 percent) thought that the number of their full-time employees did not change during the construction, while eight business managers (14.81 percent) thought that the number of their full-time employees decreased during construction. Only one business manager (1.85 percent) thought that the number of his full-time employees increased during construction. Responding business managers employed a total of 327 full-time workers before construction and 311 during construction. Therefore, there was a net loss of 16 full-time employees, while eight businesses lost full-time employees and one business gained full-time employees.

Number of Part-Time Employees

The responses about part-time employees are similar to those about full-time employees. Forty-three of the responding business managers (79.64 percent) thought that the number of their part-time employees did not change during the construction, while eight business managers (14.81 percent) thought that the number of their part-time employees decreased during construction. Only one business manager (1.85 percent) thought that the number of his part-time employees increased during construction. There were a total of 121 part-time employees for the responding businesses before construction and 115 during construction. Therefore, eight business lost part-time employees, one business gained part-time employees, and there was a net loss of six part-time employees. Apparently, the businesses that reduced the number of their full-time employees did not replace them with part-time help.

Gross Sales

Fourteen of the business managers thought their gross revenue did not change during the highway widening. Thirty-four (62.96 percent) thought their sales declined. Twenty (37.03 percent) of those businesses thought they lost 25 percent or more of their gross sales. Three businesses thought their gross sales increased for many of the same reasons that they had more customers.

Twenty-three businesses reported their sales volumes for 1990 and 1991. The combined sales of responding businesses decreased 5 percent during construction, from \$15,738,258 to \$14,882,738.

The decrease in abutting businesses' sales is supported by the opinions of abutting businesses. However, while three businesses thought their sales increased, five reported increases in sales averaging \$159,046. Furthermore, while 34 (approximately 60 percent of those providing their opinion) thought that their sales decreased, 11 (approximately 50 percent of those reporting their actual gross sales) reported decreases averaging \$137,562. The net change in actual reported sales by 23 businesses was $-\$855,520$. If the businesses reporting their actual gross sales are assumed to be representative of all abutting businesses, gross sales did decrease, but not by as much as the businesses' opinions would indicate.

More business managers were willing to provide their sales volume levels than their actual sales volumes. A slightly higher percentage of businesses were in lower sales categories during construction than before construction. No individual businesses moved to higher sales categories during construction than they were in before construction. Six businesses moved to lower categories.

Most business managers commenting on their gross sales had a decline in sales. One business owner thought about closing during construction, and another actually closed for three months. Businesses relying on drop-in traffic were considerably hurt. Businesses selling unique products generally were not affected as drastically as others.

Net Profit

Changes in net profit were similar to changes in gross sales. Fifteen (27.78 percent) managers thought their net profit did not change, while 31 (57.41 percent) thought their net profit declined. Only two business managers (3.70 percent) thought their net profit increased.

Impact on All Highway and Other City Businesses

Individual business owners or managers were asked their opinions about the gross sales impact of construction activities on all highway businesses and also on other city businesses. These opinions are presented below.

All Abutting Businesses

Most business managers (70.37 percent) on TX-21 thought that total sales for all businesses on TX-21 decreased during construction. Assuming that the 23 businesses that reported their actual sales are representative of all abutting businesses, this expectation was true. Twenty-eight percent of the managers did not respond when asked what the impact was.

Other City Businesses

The numbers and percentages of all businesses abutting the construction and in Caldwell are presented in Table 1. Abutting businesses constituted approximately one-third of the businesses in 1990 and almost one-half in 1991, so nonabutting businesses made up two-thirds of Caldwell businesses in 1990 and one-half in 1991. The number of Caldwell service establishments declined, while the number of retail establishments increased during construction. The number of service and retail businesses abutting the highway increased between 1990 and 1991. Approximately three-fourths of the businesses abutting the highway were retail establishments; slightly more than half of all Caldwell businesses were engaged in retail trade. A small percentage of the highway businesses were involved in finance, insurance, and real estate (F.I.R.E.), and a few were involved in wholesale trade.

Gross Sales Business managers located on TX-21 were asked their opinion of the construction's impact on gross sales of Caldwell business managers not located on TX-21. Thirty percent of the businesses did not think that other Caldwell businesses' sales changed because of the construction. Twenty-five percent thought that non-TX-21 businesses sales decreased, while 15 percent thought they increased. Thirty percent did not have an opinion about the change in nonabutting businesses' sales. The total gross sales for all Caldwell businesses increased 5 percent, from \$84,511,505 to \$90,140,024. Assuming that the 23 businesses that provided their gross sales figures are representative of all abutting businesses, abutting businesses' gross sales decreased 5 percent. Nonabutting sales must have increased for Caldwell total sales to have increased 5 percent. Therefore, approximately 15 percent of the managers recognized the increase in Caldwell gross sales.

Employment Twenty-two business managers (40.74 percent) did not have an opinion when asked how employment changed for Caldwell businesses not located along TX-21. Seventeen business managers (31.48 percent) did not think that employment for non-TX-21 businesses changed, while 11 business managers (20.38 percent) thought that it decreased. Four business managers (7.40 percent) thought it might have increased.

TABLE 1 Change, Before or After Construction, in Number and Percentage of Businesses Abutting Construction and in Caldwell, Texas

Industry	Year	Number of Outlets on S.H. 21 ^a	Percent of S.H. 21 Outlets per Industry per Year	Number of Outlets in Caldwell ^b	Percent of Caldwell Outlets per Industry per Year
F.I.R.E	1990	2	6.06	2	1.82
	1991	2	4.08	2	1.82
Manufacturing	1990	0	0.00	8	7.27
	1991	0	0.00	8	7.27
Mining	1990	0	0.00	3	2.73
	1991	0	0.00	3	2.73
Retail Trade	1990	27	81.82	62	56.36
	1991	36	73.47	65	59.09
Services	1990	3	9.09	23	20.91
	1991	10	20.41	20	18.18
Wholesale Trade	1990	1	3.03	8	7.27
	1991	1	2.04	7	6.36
Transportation	1990	0	0.00	1	0.91
	1991	0	0.00	1	0.91
Other	1990	0	0.00	3	2.73
	1991	0	0.00	4	3.64
All Major Divisions	1990	33	100.00	110	100.00
	1991	49	100.00	110	100.00

Source: State Comptroller's Office and windshield survey

Source: State Comptroller's Office

PROPERTY VALUE IMPACT

It is important to look at changes in property values abutting construction sites in light of changes in nonabutting property values in the vicinity of the construction. Therefore, Caldwell property value trends have been investigated to determine if abutting property value changes were similar.

Property Value Trends

Property value effects were considered from three different perspectives: each business manager's opinion of how his own business property value was affected by the widening construction, how TX-21 property value changed as a result of construction, and also how all Caldwell property value changed.

Individual TX-21 Properties

Twenty-eight business managers (51.86 percent) did not think that the business property value changed during the construction. Twelve business managers (22.22 percent) did not respond when asked if their property values changed during the construction. Eleven business managers (20.37 percent) thought their property value decreased, while three business managers (5.55 percent) thought their property value increased.

Evaluating the actual direction of change showed that approximately three-fourths of the property values did not change during construction. Of the remaining property values, more than twice as many decreased as increased. Therefore, a greater percentage of property values remained unchanged than was anticipated by the business managers.

All Highway 21 Properties

Twenty business managers (37.05 percent) thought that property values along TX-21 decreased during the construction, while 17 business managers (31.48 percent) did not respond when asked if their property value had changed. Fifteen (27.77 percent) business managers thought that these property values did not change, while two business managers (3.70 percent) thought that TX-21 property values increased during construction. Actual highway property values, presented in Table 2, decreased between 1990 and 1992. Therefore, 37 percent of the managers recognized the property value decline. Note that appraised land values increased in 1992, during construction. Therefore, most if not all of the decrease in TX-21 property values is due to a decrease in improvement values. Probably most of the decrease in improvement values is due to physical depreciation of existing structures.

All Caldwell Properties

Twenty-six business managers (48.17 percent) did not think that Caldwell property values changed during the construction, while 17 business managers (31.48 percent) did not respond when asked if Caldwell property values changed during the construction. Eight business managers (14.80 percent) thought that Caldwell property values decreased during the construction, while three (5.55 percent) business managers thought they had increased. As shown in Table 3, Caldwell real property value has been decreasing since 1986 and decreased 10.6 percent between 1990 and 1992. However, most managers did not notice the decline. Land values are not available for improved Caldwell properties. However, the real unit value of vacant land in Caldwell decreased 6.75 percent between 1990 and 1992.

USER COST IMPACTS

The business managers were asked to estimate the extent to which highway construction activities affected traffic volume, travel time, and accident numbers in the construction area. The opinions and actual numbers are compared in this section. The benefit-cost ratio was also estimated.

Traffic Volume

Twenty-four business managers (44.44 percent) indicated that there was no change in the traffic volume on TX-21 during construction, while 11 business managers (20.37 percent) indicated that the traffic volume increased. Thirteen business managers (24.08 percent) thought that the traffic volume decreased, while six (11.11 percent) did not have an opinion about the change in traffic volume. Automatic traffic counter data, averaged over 3 consecutive days each year at several locations on TX-21, recorded 6,960 vehicles in 1991, 5,583 vehicles in 1992, and 5,947 vehicles for 1993. Therefore, TX-21 traffic volume dropped by 5 percent between 1991 and 1992 and rose by 6 percent between 1992 and 1993. It was still lower in 1993 than in 1991, so 24 percent of the managers recognized the decrease in traffic volume.

Travel Time

Forty-two business managers (77.78 percent) thought that the time it took to travel through Caldwell on TX-21 increased during the construction. Three business managers (5.56 percent) thought that it did not change, while seven (12.96 percent) thought that it decreased. Two business managers (3.70 percent) did not respond to the question. The average travel time for instrumented vehicle runs in 1991 was 4 min 21 sec, while the average travel time in 1992 was 4 min 43 sec, so travel time increased by 8.4 percent during the first year of construction. Therefore, 78 percent of the managers recognized that travel time increased.

Accidents

Twenty-eight of the business managers (51.85 percent) thought that the number of accidents on TX-21 increased during the construction, while 11 (20.37 percent) did not think that the number of accidents changed. Two business managers (3.70 percent) thought that the number of accidents went down, while 13 (24.08 percent) did not have an opinion about the change in the number of accidents.

The total number of accidents on TX-21 and TX-36 in Caldwell for 1984 to 1993 is shown in Table 4. There was a slight increase in accidents during construction. The increase was detected by 52 percent of the managers. Only a few of the construction zone accidents were construction related.

TABLE 2 Appraisal Values for Properties Abutting Construction Area on TX-21 and TX-36 for Various Years

Year	Land Value (\$)	Number of Properties	Total Appraisal Market Value (\$)	Real Appraisal Value (\$) (1994 = 100)
1980	1,405,520	137	5,550,400	9,982,637
1985	1,903,507	137	8,715,740	12,004,393
1990	1,593,705	137	8,755,280	9,927,563
1992	1,882,545	137	8,114,118	8,571,007

Source: Burleson County Appraisal District

TABLE 3 Value of Caldwell Property Between 1983 and 1993

Year	Total Net Appraisal Value (\$)	Real Total Net Appraisal Value (\$) (1994 = 100)
1983	68,160,862	101,420,077.79
1984	69,043,477	98,481,648.62
1985	82,035,182	112,988,977.43
1986	84,476,240	114,227,908.46
1987	78,369,587	102,239,197.13
1988	80,467,764	100,805,770.28
1989	78,438,896	93,747,132.15
1990	76,333,575	86,554,214.34
1991	76,211,080	82,925,712.60
1992	73,231,058	77,354,545.94
1993	72,411,558	74,265,694.77

Source: Burleson County Appraisal District

Benefit-Cost Ratio

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 \$54,630, but the net benefits discounted over 20 years totaled \$7,399,610.

The cost figures are summarized in Table 5. The benefit-cost ratio was 1.71, which means that the motorists are receiving \$1.71 in benefits for every dollar spent on the project.

IMPACT OF CONTRACTOR'S EXPENDITURES

The impact of the contractor's expenditures was estimated with multiplier analysis. Employment and output multipliers were developed from the 1986 Texas Input-Output Model to produce statewide estimates of impacts from TX-21 and TX-36 widening expenditures. Impact estimates were made using the most applicable expenditure category in the input-output model, which is Category 20, New Road/Highway Construction. The estimated employment mul-

tiplier in 1986 for New Road/Highway Construction is 53.7601 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. Because costs have fallen since 1986, the multiplier can be adjusted using the Annual Price Trends for Federal-Aid Highway Construction, which gives a composite index for Texas of 114.6 for 1986 and 102.82 for 1993. An adjusted employment multiplier of 59.73 is generated by dividing the 1993 composite index by the 1986 composite index, and dividing the 1986 employment multiplier for New Road/Highway Construction by the ratio of the indexes. Applying this multiplier to the \$6.095 million of construction expenditures indicates that widening TX-21 and TX-36 generated about 364 new jobs for the Texas economy. It is unknown how much employment was generated in the Caldwell area. However, applying the multiplier to the \$2.032 million expenditures in Caldwell gives an estimated increase in Caldwell employment of 121 new jobs.

The total output multiplier is 3.69 dollars of output per dollar of expenditures. Applying this multiplier to the \$6.095 million dollars of expenditures indicates that widening TX-21 and TX-36 generated

TABLE 4 Number of Accidents per Year, TX-21 and TX-36 in Caldwell, 1985-1993

Year	Total Number of Accidents	Number of Construction Zone Accidents	
		Non-Construction Related	Construction Related
1985	74	2	0
1986	54	0	0
1987	52	0	0
1988	64	3	0
1989	49	1	0
1990	90	1	0
1991	72	29	7
1992	75	58	5
1993 (Jan-Oct)	53	15	0

Source: Texas Accident Database

TABLE 5 Discounted Benefits, Costs, and Benefit-Cost Ratio, 1994

Motorist Benefits	Benefit Value (\$)
Delay Savings	7,895,680
Reduced Vehicle Operating Cost	-1,629,480
Accident Reduction	1,133,750
Total Discounted User Benefits	7,399,940
Discounted Construction Costs	5,805,000
Discounted Maintenance Costs	203,000
Salvage Value	1,672,000
Total Discounted Costs Less Salvage Value	4,336,000
Gross Benefit-Cost Ratio: 1.71	

about \$22.5 million in additional output. Again, it is unknown how much of this increase benefited the Caldwell area, but an estimate using the multipliers and the \$2.032 million expenditure in Caldwell is \$7.5 million.

IMPACT ON ENVIRONMENT AND GENERAL APPEARANCE

Impacts on the environment were assessed using the answers to opinion questions on the survey described in the Business Impact section. The impacts are divided into two categories: those on the individual abutting businesses and those on all abutting businesses. The general impacts are those on noise level, air pollution level, and the general appearance of TX-21 and TX-36.

Individual Businesses

Noise Level

Business managers were first asked about the construction impact on the noise level at their own business during construction. Thirty-four business managers (62.97 percent) thought that the noise level went up, while one business manager (1.85 percent) thought the noise level decreased. Eighteen business managers (33.33 percent) did not think the noise level changed, and one business manager (1.85 percent) did not have an opinion about the change in noise level at his business.

Air Pollution Level

Business managers were asked a similar question about the construction impact on the air pollution level at their own businesses during construction. Twenty-four business managers (44.45 percent) experienced an increase in the air pollution level, while 22 (40.74 percent) did not think that the air pollution level changed. Two business managers (3.70 percent) thought that the air pollution level decreased during construction, and six business managers (11.11 percent) did not have an opinion about the change in air pollution level at their businesses.

All TX-21 Businesses

Noise Level

The business managers were also asked about the change in noise level on TX-21. Thirty-five business managers (64.82 percent) thought that the general noise level on TX-21 went up, while 10 business managers (18.52 percent) thought that there was no change. Two business managers (3.70 percent) thought that the noise level went down, and seven (12.96 percent) did not have an opinion on the change in abutting businesses' noise level.

Air Pollution Level

Twenty-seven (50 percent) of the business managers thought that the air pollution level on TX-21 went up during construction, while 19 (35.19 percent) thought there was no change in the air pollution level. Three business managers (5.55 percent) thought it went down, while five business managers (9.26 percent) did not have an opinion on air pollution level at abutting businesses.

General Appearance of TX-21

Thirty-eight business managers (70.38 percent) thought that the general appearance of TX-21 deteriorated during the construction. Three business managers (5.55 percent) thought that the appearance improved during construction, while six business managers (11.11 percent) thought that the general appearance did not change. Seven business managers (12.96 percent) did not have an opinion about whether the general appearance had changed.

SUMMARY

Highway widening construction impacts abutting businesses, property owners, and residents. Many are concerned about potential changes in the number of their parking spaces, the ability to turn safely into businesses and residences, land value, and business sales. These issues were studied during the widening of TX-21 in Caldwell, a small, rural town of 3,000 people in Texas. Residents were surveyed, but this paper concentrates on the impact on businesses.

Information about the businesses abutting the construction was obtained from a survey of those businesses. Even though no right-

of-way was taken, there were 7 percent fewer parking spaces during construction. The number of occupied parking spaces decreased slightly for a few businesses. This may have occurred because the businesses were less accessible rather than because they had fewer parking spaces.

The number of customers was more dramatically affected as two-thirds of the managers thought that the number decreased. Even though there were fewer customers, most businesses tried to retain their employees. Eighty percent of the businesses did not change the number of their employees during construction.

Annual gross sales for 23 abutting businesses that reported their actual gross sales decreased 5 percent during construction. Fifty-two percent of the businesses experienced a decline. A slightly higher percentage of all surveyed managers thought their sales declined. Businesses that were patronized by construction workers or were relatively more accessible had increased sales during construction.

Half of the business managers believed there was no change in the value of their business properties, while 71 percent of the actual property values did not change.

The traffic volume decreased between 1990 and 1992, but only one-fourth of the business managers recognized this fact. Almost half thought that it did not change. Most managers realized that the average travel time increased. Slightly more than half recognized that the number of accidents increased. Note that construction zone accidents were generally not construction related.

This was a beneficial project from a user benefit-cost aspect. The benefit-cost ratio was 1.71, which means that motorists are receiving \$1.71 in benefits for every dollar spent on the project.

The project also benefited the Texas economy. The \$6.095 million dollars of expenditures for widening TX-21 and TX-36 generated about 364 new jobs for the Texas economy. Using multiplier analysis, the estimated increase in Caldwell employment was 121 new jobs. The construction generated approximately \$22.5 million in additional output, \$7.5 million of which was spent in the Caldwell area.

More than half of the business managers thought that the noise level increased at their own business and for all TX-21 businesses during construction. Twenty-four percent of the business managers thought that the air pollution level at their business increased during construction and 27 percent thought the air pollution level at all abutting businesses increased during construction. Forty-one percent thought the air pollution level did not change at their business, while 35 percent thought it did not change for all abutting businesses. Seventy percent of the business managers thought the general appearance of the construction area worsened during construction.

In conclusion, not all of the above changes experienced by abutting businesses and properties were due to the highway construction impact. Other economic factors affected businesses and properties along TX-21 and the whole city of Caldwell. However, businesses generally thought that the construction impacts were worse than they actually were.

SUGGESTIONS FOR AGENCIES CONDUCTING SIMILAR ANALYSES

Experiences in two major parts of the analysis may help other researchers.

1. During a previous study, the surveys had been administered by mail. The response rate was low and some of the returned surveys were incomplete. Personal interviews worked out better than anticipated. Not only did the response and completion rate improve, but the response quality improved as well.

2. Caldwell is a small town and the appraisal office provided the needed appraisal data. With larger areas, appraisal data acquisition may require more work. Obtaining property value data for the Parker County and Houston projects involved several trips to the appraisal offices. First, maps of the construction area were obtained from the Texas Department of Transportation. Then appraisal maps were obtained and compared with the TXDOT maps. Those maps were annotated with the numbers of smaller maps that listed the information used to identify the appraisal numbers of each property on the map. The smaller maps and the instructions on how to construct the appraisal numbers from them were obtained from the appraisal office. After the list of numbers was created, the appraisal officers provided instructions on how to access the appraisal data.

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