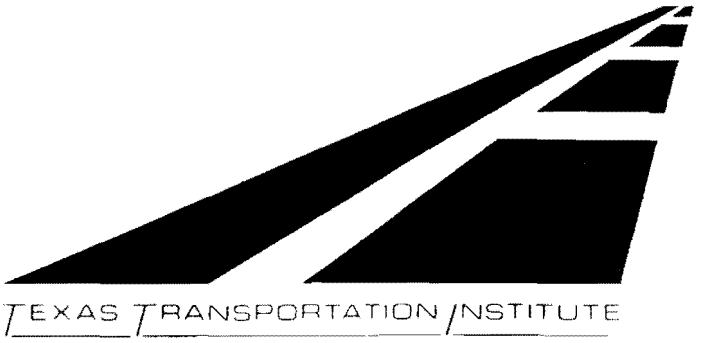
TTI 2-10D-89-968



ESTIMATED ECONOMIC IMPACT OF WIDENING U.S. HIGHWAY 80 (MARSHALL AVENUE) IN LONGVIEW, TEXAS

RESEARCH REPORT 968-1F

COOPERATIVE RESEARCH PROGRAM

TEXAS TRANSPORTATION INSTITUTE
THE TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS

TEXAS DEPARTMENT OF TRANSPORTATION

in cooperation with the
Texas Department of Transportation

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
TX-92/968-1F		

4. Title and Subtitle	5. Report Date
Estimated Economic Impact of Widening U.S. Highway 80 (Marshall Avenue) in Longview, Texas	November 30, 1992
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Jesse L. Buffington and Marie T. Wildenthal	Research Report 968-1F

9. Performing Organization Name and Address	10. Work Unit No.
Texas Transportation Institute Texas A&M University System College Station, Texas 77843-3135	11. Contract or Grant No. Study No. 2-10D-89-968

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Texas Department of Transportation; Transportation Planning Division P.O. Box 5051 Austin, Texas 78763	Final: September 1, 1988-August 31, 1992
	14. Sponsoring Agency Code

15. Supplementary Notes: Research performed in cooperation with the State of Texas
Research Study Title: Impact of Widening U.S. Highway 80 in Longview, Texas

16. Abstract

Since so many of the existing highways in Texas are being widened to expedite traffic more efficiently, the directly affected businesses and property owners are asking questions about the possible negative economic impacts of such highway improvements. This study is designed to determine the economic impact of widening a highway located in an urban area where the predominant abutting land use is strip commercial. A 6.7 mile section of U.S. Highway 80 in Longview, Texas, a city with a population of 70,311 in 1990, was selected for study. This of section the highway was formerly an undivided 4-lane highway, except for protected left-turn lanes at five major intersections, and had mountable paved shoulders which were used extensively for customer parking. The highway section was recently upgraded with a two-way continuous left-turn lane and curbs and gutters within the existing right of way. A new interconnecting signal system was also installed. The mountable paved shoulder had to be removed, and the original gutter openings had to be relocated further back on the right of way. The total cost of the project was 8.8 million dollars.

Prior to construction, a preliminary study was conducted to estimate the economic effects of the proposed widening on abutting businesses and the City of Longview. The study concentrated on businesses abutting the previously widened intersections to estimate the effects of widening the remainder of the highway section. The findings of that study were used by the Texas Department of Transportation as a supporting document for the environmental assessment (EA) submitted to the Federal Highway Administration for approval.

This study is a follow up study and was initiated prior to actual construction so that the construction period could be monitored and the economic impacts of the before and after construction periods could be estimated. The following impacts were studied: (1) impact on abutting businesses and properties, (2) impact on reduction of available parking, (3) impact on motorists using the highway, and (4) impact of construction expenditures on the local urban area or city. This study produced some very interesting and hopefully useful findings. These findings are also compared with those of the preliminary study and summarized in this report. Even though some negative impacts were found, especially during the construction period, widening this section of U.S. Highway 80 produced overall positive results on the abutting businesses and the City of Longview.

17. Key Words	18. Distribution Statement
Economic impact; highway widening; two way left-turn lane; curbing and gutter; sidewalks; abutting businesses; parking impact; gross sales impact; land value and land use impacts; employment impacts; highway user benefits-costs; highway and building construction expenditure impacts; city impact; mail and personal interview surveys.	No restrictions. This document is available to the public through the National Technical Information Service, 5285 Port Royal Road Springfield, Virginia 22191.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	136	

Form DOT F 1700.7 (8-69)

ESTIMATED IMPACT OF WIDENING U. S. HIGHWAY 80 (MARSHALL AVENUE) IN LONGVIEW, TEXAS

by

J.L. Buffington
M.T. Wildenthal

Research Report 968-1F
Research Study 2-10D-89-968

for

The Texas Department of Transportation

November 30, 1992

Texas Transportation Institute
Texas A&M University System
College Station, Texas

METRIC (SI*) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	0.3048	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	6.452	centimeters squared	cm^2
ft^2	square feet	0.0929	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
mi^2	square miles	2.59	kilometers squared	km^2
ac	acres	0.395	hectares	ha
		MASS (weight)		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.0328	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3

Note: Volumes greater than 1000 L shall be shown in m^3.

		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

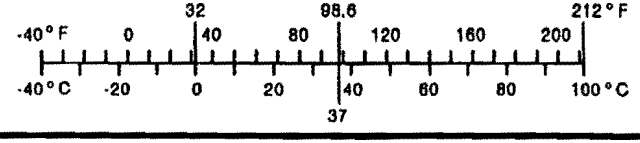
APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
yd	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
yd^2	kilometers squared	0.39	square miles	mi^2
ha	hectares (10,000 m^2)	2.53	acres	ac
		MASS (weight)		
g	grams	0.0353	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (1000 kg)	1.103	short tons	T
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3

		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

These factors conform to the requirement of FHWA Order 5190.1A

*SI is the symbol for the International System of Measurements



ABSTRACT

Since so many of the existing highways in Texas are being widened to expedite traffic, the directly affected businesses and property owners are asking questions about the possible negative economic impacts of such highway improvements. This study is designed to determine the economic impact of widening a highway located in an urban area where the predominant abutting land use is strip commercial. A 6.7 mile section of U.S. Highway 80 in Longview, Texas, a city with a population of 70,311 in 1990, was selected for study. This section of the highway was formerly an undivided 4-lane highway, except for protected left-turn lanes at five major intersections, and had mountable paved shoulders which were used extensively for customer parking. The highway section was recently upgraded with a two-way continuous left-turn lane and curbs and gutters within the existing right of way. A new interconnecting signal system was also installed. The mountable paved shoulder had to be removed, and the original gutter openings had to be relocated further back on the right of way. The total cost of the project was 8.8 million dollars.

Prior to construction, a preliminary study was conducted to estimate the economic effects of the proposed widening on abutting businesses and the City of Longview. The study concentrated on businesses abutting the previously widened intersections to estimate the effects of widening the remainder of the highway section. The findings of that study were used by the Texas Department of Transportation as a supporting document for the environmental assessment (EA) submitted to the Federal Highway Administration for approval.

This study is a follow up study and was initiated prior to actual construction so that the construction period could be monitored and the economic impacts of the before, during, and after construction periods could be estimated. The following impacts were studied: (1) impact on abutting businesses and properties, (2) impact on reduction of available parking, (3) impact on motorists using the highway, and (4) impact of construction expenditures on the local urban area or city. This study produced some very interesting and hopefully useful findings. These findings are also compared with those of the preliminary study and summarized in this report. Even though some negative impacts were found, especially during the construction period, widening this section of U.S. Highway 80 produced overall positive results on the abutting businesses and the City of Longview.

KEY WORDS

Economic impact; highway widening; two way left-turn lane; curbing and gutter; sidewalks; abutting business parking impact; gross sales impact; land value and land use impacts; employment impacts; highway user benefits-costs; highway and building construction expenditure impacts; city impact; mail and personal interviews.

ACKNOWLEDGEMENTS

The authors want to thank several officials of District 10 of the Texas Department of Transportation for their assistance in this study, as well as with the preliminary report. Special mention should be made of the following officials: Mr. James R. Evans, District Engineer and Mr. Harold C. Waggonner, Advance Planning Engineer for their support and guidance during this study. Also, thanks go to Mr. Robert E. Ward, Resident Engineer and Mr. J. Walter Lehmann, Project Engineer, for furnishing data and providing valuable assistance to this study.

The authors are indebted to Mr. Edlyn Vatthauer, City Planner, and Mr. John H. Russell, Superintendent of Traffic Engineering for the City of Longview for the data and valuable assistance given to the study.

Further, the authors want to express their sincere thanks to the officials of the Netherton Company, Inc., general contractor for the widening project, and the officials of the subcontractors for their help in determining the amount of the construction expenditures that were made in the Longview area and logging lane closure data for the study. Special thanks is due to Mr. L.C. Woods, Construction Superintendent, for keeping the log and helping obtaining the construction expenditure data.

Other members of the Texas Transportation Institute's Transportation Economics Program gave valuable assistance to the study. Drs. W.F. McFarland, Research Economist and Head of the Transportation Economics Program and J.L. Memmott, Associate Research Economist assisted with the highway user cost analysis. Ms. Katie N. Womack, Associate Research Sociologist, conducted the parking surveys. Also, Mr. Darrell Borchardt, Assistant Research Engineer, and Mr. Gerald Ullman, Assistant Research Engineer and their data collection staff collected the traffic data for the study. Mr. Nat Pinnoi, Research Associate, developed the before and after design illustrations. Mr. Craig Smith and Mr. George Rose helped to reduce the study data base. Finally, Ms. Linda Buzzingham helped with compiling and sorting the data base as well as with the report preparation.

DISCLAIMER

The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented within. The contents do not necessarily reflect the views or policies of the Texas Department of Transportation. This report does not constitute a standard, specification or regulation. It is not intended for construction, bidding or permit purposes. The report was prepared by Jesse L. Buffington, Research Economist and Marie T. Wildenthal, Assistant Research Economist.

SUMMARY OF FINDINGS

The Texas Department of Transportation (TxDOT) is continually faced with the responsibility of providing safe and congestion free highways. TxDOT is accomplishing this task by widening highways and adding a continuous left-hand turn lane in the median and curbs and gutters at the margins. Until this study of the highway widening construction on Marshall Avenue in Longview, Texas, there have been no studies reported in the literature which document the during and after construction effects of this specific type of widening construction. This section summarizes the findings of this report on these impacts.

Impacts on Business Activity

The business effects of the widening of Marshall Avenue are summarized in Table S-1. Between 61% and 89% of the businesses abutting Marshall Avenue which responded to a survey on the construction effects indicated that their number of usable parking spaces, customers per day, full-time employees, part-time employees, gross sales, and net profits did not change during the construction activity. Only 8% to 23% experienced a decrease in any of these business indicators, while 3% to 14% were not aware of how they were affected. In 1987, the businesses indicated that they were mainly unsure of what to expect, but those with expectations had negative expectations. The businesses at previously widened intersections were more positive than those at previously unwidened intersections. Therefore, the expectations about the impacts were more negative than the impacts themselves.

Once the construction was completed, an even greater percentage (75 to 94%) of the responding businesses experienced no change in the previously described business indicators. Also, an even lower percentage (3 to 22%) reported decreases in these indicators. Most businesses at or under parking capacity experienced no change in gross sales, while half of the businesses that were over capacity experienced a decrease in gross sales.

Impacts on Parking

The main impact of widening on Marshall Avenue business parking was the loss of shoulder parking. Some older businesses were located too close to the right-of-way and also lost front parking. In 1987, projected parking losses included 2% of all front parking spaces and a maximum of 9.7% of all available parking spaces of businesses that did not appear to have

Table S-1 Summary of Business Effects from Widening Marshall Avenue in Longview, Texas

During Construction				
Item Affected	Increase	No Change	Decrease	Don't Know
	(Percentage of Businesses)			
Usable Parking Spaces	0	74	23	3
Customers per Day	3	61	27	9
Full-Time Employees	0	89	8	3
Part-Time Employees	0	88	9	3
Gross Sales	3	67	17	13
Net Profit	3	62	21	14
After Construction				
Usable Parking Spaces	0	75	22	3
Customers per Day	9	76	9	6
Full-Time Employees	0	94	3	3
Part-Time Employees	0	94	3	3
Gross Sales	6	79	3	12
Net Profit	6	79	3	12

adequate front, side, and back parking. In 1992, 85 of these businesses had lost 20 or fewer parking spaces and 86 had 10 or less remaining parking spaces. However, of the latter, only 31 businesses require more parking spaces than they had, and not all of those requiring more parking than they had experienced a decrease in gross sales.

Impacts on Property Values and Uses

Recent trends in land values along Marshall Avenue are similar to those for Longview, which indicates that they are probably more affected by the general economic situation than the

highway widening. The decline in economic activity even before construction began on Marshall Avenue resulted in neglect of buildings, and recently there has been an increased number of building demolitions along Marshall Avenue. Building renovations have been routine maintenance improvements rather than those undertaken to remodel a building in response to right-of-way reclamation. However, permit values along Marshall Avenue began to increase in the latter part of 1990 and 1991.

Impacts on Motorists

The HEEM-III benefit-cost model was used to determine motorist benefits. Instrumented vehicle runs indicated that motorist delay was reduced. The delay reduction was due to optimal signal timing implemented during the widening construction and reduced stops as lanes were no longer blocked by left-turning vehicles. The accident rates fell steadily from the time that construction began. The total benefit cost-ratio for the whole project is 7.85, which means that motorists are receiving $7.85 for every dollar spent on the project.

Economic Impact on Longview Area

The general contractor on the U. S. Highway 80 widening project spent $5.59 million out of the total $9.54 million expenditures in the Longview area, and an additional $2.51 million in other areas of Texas. The estimated impact on Longview is the creation of 355 new jobs and $20.6 million additional output. This value is included in the estimated total impact of 514 new jobs and $29.9 million impact on the Texas economy.

Evaluation of Contractor's Performance

The performance of the contractor who widened U.S. Highway 80 (Marshall Avenue) was evaluated by the contractor's construction superintendent, TxDOT officials directly involved in the project, respondent Marshall businesses, and the TTI research and monitoring team.

The construction superintendent gave the contractor high marks for finishing the project a year ahead of schedule, having good communications with TxDOT officials and abutting property owners and businesses, and following closely the construction and lane closure requirements. TxDOT officials, the responding businesses, and the TTI team were essentially in agreement with the construction superintendent's evaluation.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

Section Page

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

INTRODUCTION

The Texas Department of Transportation (TxDOT) is continually faced with the responsibility of providing safe and congestion free highways. One of the principal ways that TxDOT is accomplishing these tasks 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. Additional right-of-way has to be acquired from abutting property owners to make these improvements on some highways.

Widening a highway to provide the above improvements always impacts the abutting property owners in a positive and/or negative manner. Such impacts either complement or partially offset the increased safety and reduced time and vehicle operating costs of motorists using the improved highway. Abutting businesses may gain more customers, particularly left-turning customers. On the other hand, abutting businesses may lose parking space and as a result lose customers. The negative impact on customer parking is greatest for highways passing through older strip commercial developments, especially where additional right-of-way is acquired or where mountable shoulders are removed.

The negative impact on abutting business is likely to be greatest during the construction phase of the highway improvement. The construction activities slow down the traffic on the highway and make businesses less accessible to their customers. At the same time, businesses may be experiencing a negative impact due to reduced parking space, which will continue after construction is completed. However, one of the offsetting positive impacts results from construction expenditures in the local area.

There are no studies reported in the literature which document the during and after construction effects of widening highways to install a continuous two-way left-turn lane with curbs and gutters. If such studies were made, the results could be used by TxDOT to estimate the positive and negative impacts of the same type of improvement on other highways across the state. Also, the results could be used as supporting data for the Environmental Assessment (EA) required for proposed projects before approval can be obtained from the Federal Highway Administration (FHWA). The need for such supporting data was dramatized recently with respect to the proposed widening of U.S. Highway 80 in Longview, Texas. As a result, TxDOT asked the Texas Transportation Institute to estimate the expected economic impact of the

proposed improvement. This initial study was completed in September, 1987. The findings were based on traffic counts, instrumented vehicle runs, parking surveys, and the opinions of businesses, especially those located along five short sections widened to install protected left-turn lanes at intersections. These findings were submitted as part of the EA to FHWA for approval, which was granted.

In the initial study, the before period parking space availability and use, travel times, speed changes, left-turning movements, lane volumes, and business volumes and employment levels were fully documented. The proposed improvement was approved and went to contract in the fall of 1989, and was completed in the fall of 1991. Then, a follow-up study was authorized by TxDOT, and similar data was collected during and after construction. Also, the construction activity and expenditures were monitored. Therefore, a complete before, during, and after construction impact analysis can be performed. This completed study is the first of several that need to be conducted on this type of highway improvement.

Background

Longview, a town with a population of approximately 70,000, is located in the northeast corner of Texas, close to the Arkansas and Louisiana borders. A major interstate highway, U.S. 80, runs through Longview, where it is known as Marshall Avenue. A map of the area is shown in Figure 1. People who view the road as U.S. 80 are interested in getting through Longview to their destination, while people viewing it as Marshall Avenue are trying to get to other locations in Longview. This conflict of interest can result in through traffic being backed up behind vehicles intent on making left turns off of Marshall Avenue, a situation which can lead to accidents.

To reduce traffic congestion, three major intersections were widened in 1974. Two additional major intersections were widened in 1986. In 1987, a continuous left-turn lane was proposed to create a continuous left-turn lane between Fisher and Eastman Roads along Marshall Avenue. The before and after construction designs of Marshall Avenue between intersections are shown in Figure 2, while the before and after construction designs for intersections are shown in Figure 3. A picture of a section that has been completed is shown in Figure C-1.

Preliminary Economic Study in 1987

There were no studies in the literature documenting the during and after construction

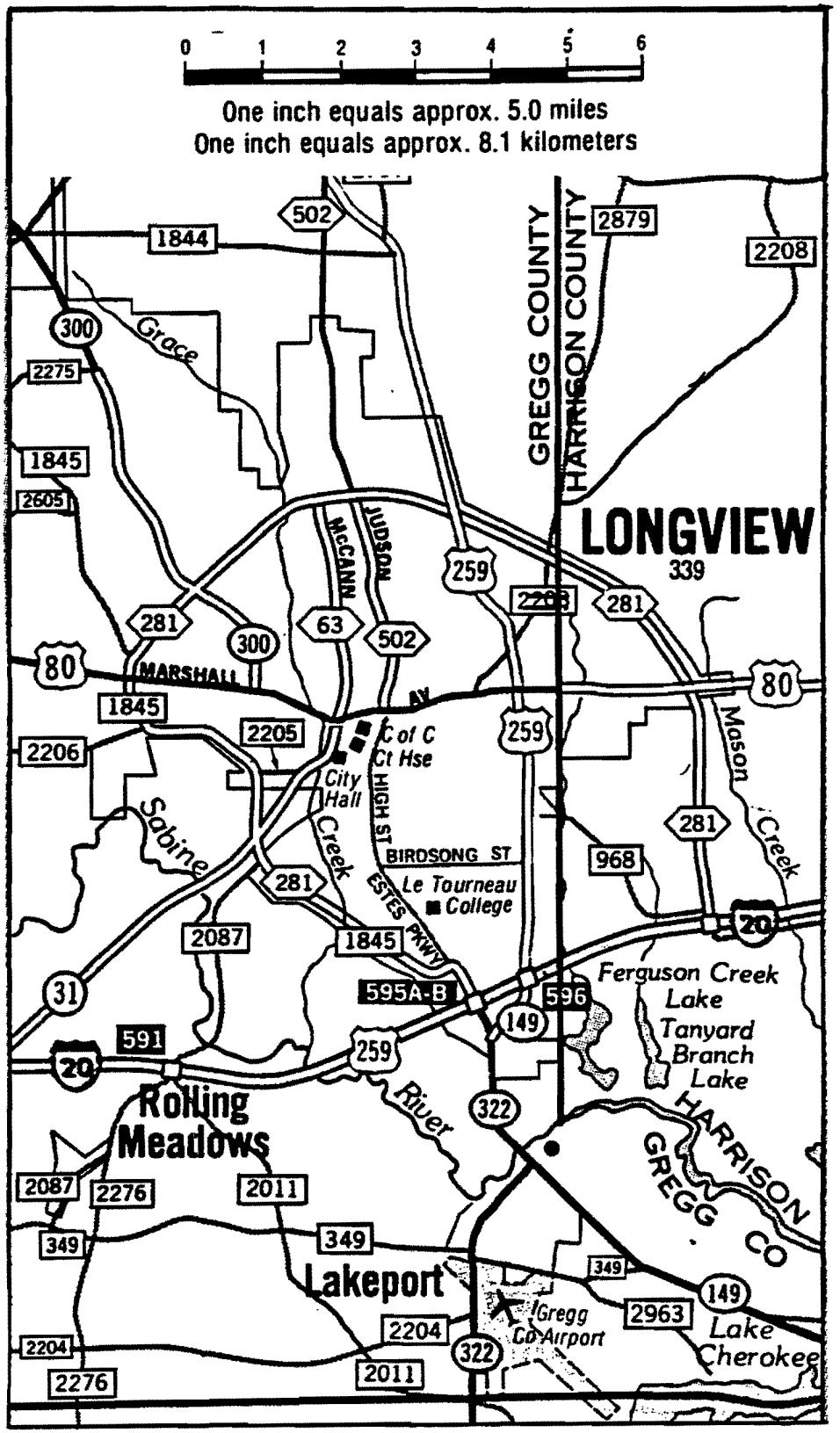


Figure 1 Map of Marshall Avenue and the Longview Area

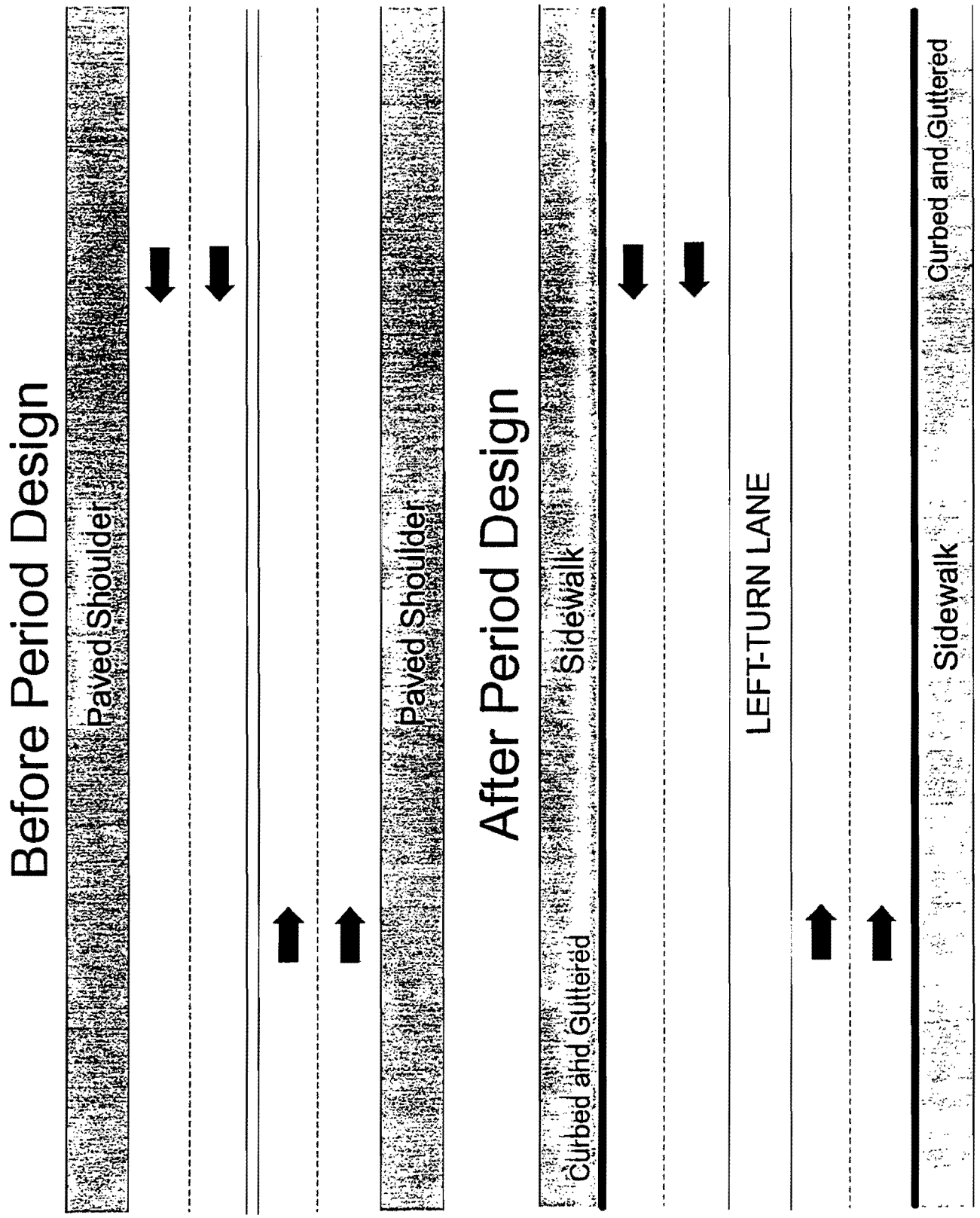


Figure 2 Before and After Construction Design of Marshall Avenue Between Intersections

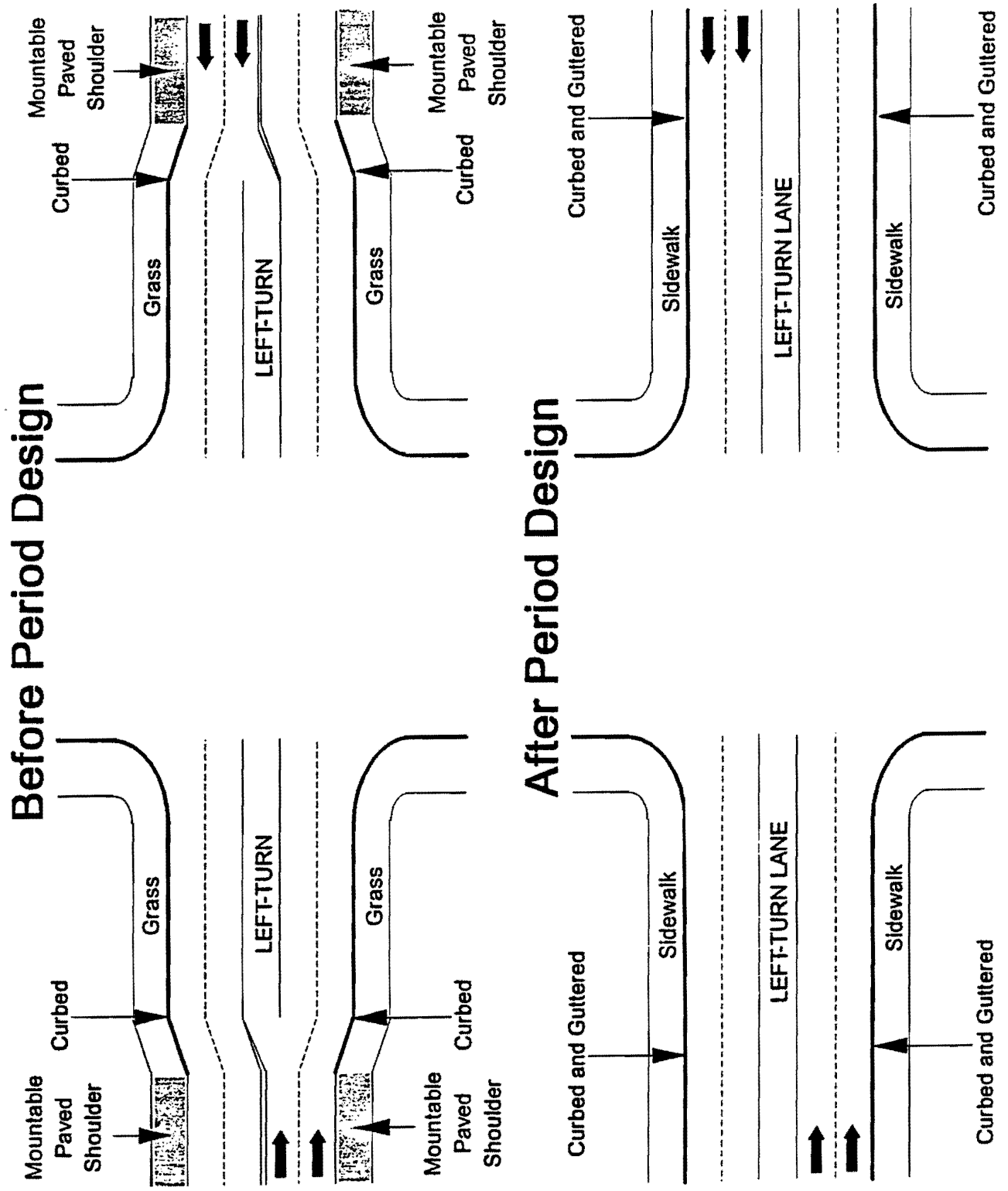


Figure 3 **Before and After Construction Designs at Major Marshall Avenue Intersections**

effects of installing a continuous left-turn lane with curbs and gutters. In 1987, a study was conducted to determine the benefits of creating a continuous left-turn lane on Marshall Avenue. This study showed that accidents would be reduced by approximately 26%, and that motorists would receive benefits that were 3.4 times greater than the cost to construct the project. As mentioned earlier, the results were presented as supporting documentation for the EA required for proposed projects before approval can be obtained from the FHWA. As a result, approval was granted.

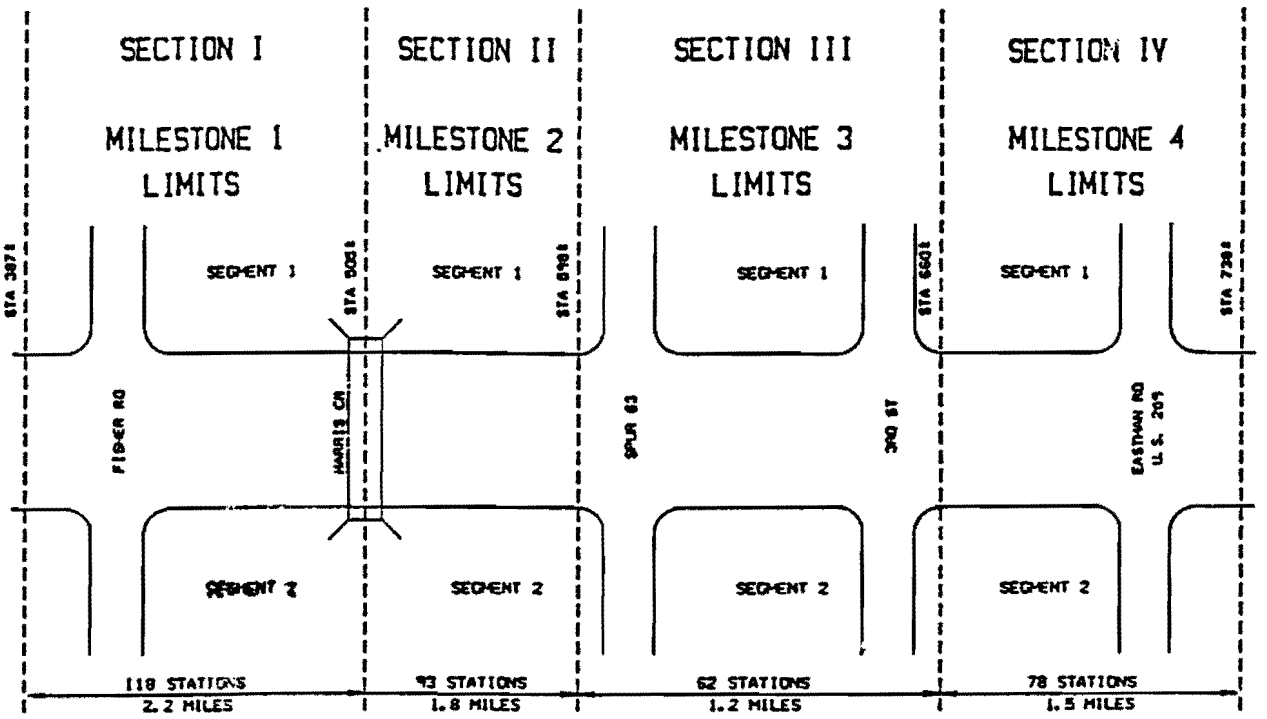
Construction Project to Widen U.S. Highway 80

The project was let out for bids, and the Netherton company was the low bidder with $8.8 million. Construction was to take place between October 15, 1989 and November 15, 1991. Construction guidelines are in Appendix A. The 6.7 mile construction area was divided into four sections, which are shown in Figure 4. Each section is further divided into two work segments, with segment 1 on the north side of the existing center line and segment 2 on the south side of the existing center line. The contractor had to construct Sections I through IV in consecutive order unless otherwise instructed by the engineer. To insure that the highway was kept open to the public at all times, no road work was to be performed on opposite sides of the road at the same time (see Table A-1). Storm drainage work was not permitted in segment 2 until the storm drainage work was completed and the curb and gutter work was started in segment 1. Curb and gutter work in segment 2 was not permitted until the subgrade widening work was under way in segment 1. Work in the next section was not allowed to begin until the subgrade widening work was under way in segment 2 of the preceding Section. The detailed construction sequence requirements are listed in Table A-2 and Table A-3.

Table 1 shows the length of construction time by section of the study project and the staging effect resulting from implementing the construction guidelines. The construction period was considerably shorter for Sections 3 and 4 than for Sections 1 and 2. However, not much construction activity was going on in Sections 1 and 2 during the last year of construction.

New Economic Study in 1988

The purpose of the present study is to monitor the construction period and measure impacts during and after the construction period. The study was completed August 31, 1992. The findings are summarized in this report.



US-80 - MARSHALL AVE.
In Longview

Figure 4 **Construction Segments of Marshall Avenue in Longview, Texas**

Table 1 Length of Construction Time by Section for the Study Project

Section of Project	Percent of Project Length	Construction Period		
		Starting Date	Finishing Date	Total Time (Months)
Section 1	32.8	10/15/89	11/15/91	26.0
Section 2	26.9	2/02/90	11/15/91	21.4
Section 3	17.9	7/16/90	11/15/91	16.0
Section 4	22.4	9/21/90	11/15/91	14.2
All Sections	100.0	10/15/89	11/15/91	26.0

ESTIMATED IMPACT ON BUSINESSES

The businesses abutting the previously and newly widened section of U.S. Highway 80 (Marshall Avenue) in Longview, Texas were surveyed to determine the impacts of the construction on their businesses. The completely widened section extends between Eastman and Fisher Roads, and 317 operating businesses were located on this section when the survey was administered in August, 1992, compared to the 313 in 1987. The distribution of these businesses by type of business is listed in Table 2. Forty-six businesses completed all or part of the survey. Results are reported only for those who answered the question, not those who left the question blank. The percentage of businesses that responded are listed in Table 3. Seven (16%) of these respondents were located along sections at the five major intersections that were widened prior to 1991.

Specific impacts of interest include changes in the number of usable parking spaces, gross sales, net income, the number of full-time and part-time employees, and the number of customers per day. Respondents were asked to indicate impacts both during and after construction.

By 1987, five intersections had already been widened to include a left-turn lane. Three intersections were widened in 1974, while the other two were widened in 1986. The impacts of these widenings were discussed in an unpublished report in 1987 [1]. The five widened intersections included 45 businesses, 39 of which were willing to respond to a 1987 survey on the impacts of widening the intersection. In the following discussion, the 1987 expectations and actual during and after construction impacts for these five intersections (hereafter referred to as previously widened sections of the highway) are compared with those impacts of widening construction for a continuous left turn lane for the unwidened sections.

The previously widened sections were minimally affected by the widening of the remaining portions of Marshall Avenue. Realignment of the curbs, new surface treatment, and new pavement markings were the principal improvements made in these sections during the latter construction. Also, the widening of the remaining sections was anticipated as portions most distant from the intersection were already being used to some extent to make left turns into parking spaces of businesses on the opposite side of Marshall Avenue.

Table 2 Distribution of Businesses by Type, 1987 and 1992

Type of Business	1987	1992
Gas and Food (Convenience Stores)	16	15
Eating (Restaurant and Fast Foods)	33	27
Lounges, Beer Parlors, and Clubs	20	17
Motels	11	8
Automobile Repairs	37	17
Automobile Dealers (New and Used)	38	45
Personal Services	13	4
Food and Liquor Stores	8	10
Other Retail and Repairs	90	139
Professional Services (including Real Estate)	16	22
Wholesale and Manufacturing	12	4
Public and Nonprofit Organizations	8	7
House Trailer Sales	8	3
Closed	18	53
Total	331	370

Table 3 Percentage of Respondents by Type of Business

Type of Business	Percent Response Rate
Gas and Food (Convenience Stores)	0
Eating (Restaurant and Fast Foods)	19
Lounges, Beer Parlors, and Clubs	29
Motels	0
Automobile Repairs	6
Automobile Dealers (New and Used)	16
Personal Services	0
Food and Liquor Stores	0
Other Retail and Repairs	11
Professional Services (including Real Estate)	9
Wholesale and Manufacturing	25
Public and Nonprofit Organizations	14
House Trailer Sales	0
Closed	4
Overall	12

During Construction

Usable Parking Spaces

In 1987, businesses abutting widened sections of Marshall Avenue were asked about the impacts of intersection widening construction activity on their number of usable parking spaces. Thirty-three percent indicated there was no change, and 23% said that their number of parking spaces decreased. Forty-four percent either said they did not know, or they did not answer the question (Table 4).

The 1992 businesses were asked about the impacts on their businesses during construction. The results, shown in Table 5, indicate that during the construction, 74% of the businesses said the number of usable parking spaces did not change, while 23% said they decreased, and 3% did not know. The 1987 businesses along the previously widened sections indicated about the same reduction in usable parking spaces during construction, while more respondents were unsure of the impact (Table 4).

Number of Customers per Day

When businesses abutting widened sections in 1987 were asked about the impacts of intersection widening on their number of daily customers, 16% said there was no change, and 41% indicated that their number of customers decreased. Forty-three percent did not know or did not answer the question (Table 4).

In 1992, 61% of the responding businesses along previously and newly widened sections indicated that during the construction the number of customers did not change, while 27% said the number decreased, and 9% did not know. These results are shown in Table 5.

Number of Full-Time Employees

Thirty-nine percent of the businesses at widened intersections said there was no change in the number of full-time employees during the construction in 1987, and 16% indicated that their number of full-time employees decreased. Forty-five percent did not know or did not answer the question (Table 4).

As indicated in Table 5, eighty-nine percent of the responding businesses along the study section in 1992 said that the number of full-time employees did not change during the construction, while 8% said the number decreased and 3% did not know.

Table 4 Effects of Construction Activity to Widen Intersections on Businesses, 1987

Item Affected	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know / No Answer
Usable Parking Spaces	0%	33%	23%	44%
Customers Per Day	0%	16%	41%	43%
Full-Time Employees	0%	39%	16%	45%
Part-Time Employees	0%	39%	13%	48%
Gross Sales	0%	18%	41%	41%
Net Profit	0%	18%	41%	41%

Table 5 Effects During Construction Activity to Create a Continuous Left-Hand Turn Lane on Businesses, 1992

Item Affected	Percentages of Businesses			
	Increased	No Change	Decreased	Don't Know
Usable Parking Spaces	0%	74%	23%	3%
Customers per Day	3%	61%	27%	9%
Full-Time Employees	0%	89%	8%	3%
Part-Time Employees	0%	88%	9%	3%
Gross Sales	3%	67%	17%	13%
Net Profit	3%	62%	21%	14%

Number of Part-Time Employees

The impacts on the number of part-time employees closely followed that of the impact on full-time employees. When businesses abutting widened sections were asked in 1987 about the construction impacts of intersection widening on their number of part-time employees, 39% said there was no change, and 13% indicated that the number of part-time employees decreased. Forty-eight percent did not know or did not answer the question (Table 4).

Eighty-eight percent of the responding businesses in 1992 indicated that during the construction, the number of customers did not change, while 9% said the number decreased and 3% did not know. These results are shown in Table 5.

Gross Sales

When businesses abutting widened sections in 1987 were asked about the construction period impacts of widening the intersection on their gross sales, 18% said there was no change, and 41% indicated that their gross sales decreased. Forty-one percent did not know or did not answer the question (Table 4). The eighteen businesses that estimated the amount of change in their gross sales experienced an average decline of 13% due to construction.

Sixty-seven percent of the responding businesses in 1992 indicated that during the construction, gross sales did not change, while 17% said they decreased and 13% did not know (Table 5). None of the responding businesses estimated the amount of change in their gross sales.

Net Profit

When businesses abutting widened sections were asked in 1987 about the construction period impacts of intersection widening on their net profit, 18% said there was no change, and 41% indicated that their net profit decreased (Table 4). Forty-one percent did not know or did not answer the question. The sixteen businesses that estimated the amount of change in their net profit experienced an average decline of 10.5% due to construction.

As seen in Table 5, 62% of the responding businesses in 1992 indicated that during the construction net profit did not change, while 21% said it decreased and 14% did not know. Again, none of the responding businesses estimated the amount of change in their net profit.

Parking Capacity Influences on Gross Sales Impacts

A major impact on businesses abutting the construction area is the loss of parking spaces. One way to measure this impact is to determine the capacity of the parking lot and compare it with the demand for its parking spaces. This is measured using capacity, where over capacity is defined as having more people wanting to park in the lot than there are spaces to accommodate them. In 1987, businesses, regardless of location, experiencing over capacity during an average week day were more positive about the construction impact on gross sales than those experiencing parking under capacity (Table 6). Therefore, having enough customers to have over capacity is important in determining businesses' attitudes toward parking impacts on gross sales. In addition, those abutting widened sections were more positive than those abutting non-widened sections.

During the 1987 construction, a smaller percentage of those businesses that usually had a surplus of parking spaces on their busiest days experienced a decrease in sales when compared to those who had no surplus parking spaces (Table 7). Therefore, those with limited parking spaces were more likely to have reduced sales than those with a parking surplus.

The construction impacts on sales by parking capacity for 1992 can be seen in Table 8. Only three percent of the businesses experienced an increase in gross sales, and these were businesses that were under parking capacity. Most businesses at or under parking capacity experienced no change in gross sales. Half of the businesses that were over capacity experienced a decrease in gross sales. These findings are similar to those for the 1987 construction period.

Overall Effects on Marshall Avenue Respondents

In 1987, the responding businesses abutting the widened intersections were asked about the construction impacts on their own businesses. Forty-four percent responded positively, twenty-six percent, negatively, and twenty-five percent reported no effect (Table 9). The businesses were more optimistic about the impacts on their own businesses than on the impacts of all Marshall Avenue businesses, as can be seen from the row corresponding to businesses on widened areas of Marshall Avenue as well as from all respondents shown in Table 10.

Similar effects for 1992 are shown in Table 11. Overall, 44% are positive to some degree, 12% experienced no effect, and 6% are negative to some degree. Thirty-eight percent

Table 6 **Expected Long-Term Effects on Gross Sales of Businesses by Parking Space Capacity Versus Use and Location, 1987**

Parking Space Capacity vs. Use	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know / No Answer
Under Capacity						
Widened Road	0%	15%	77%	8%	0%	0%
Unwidened Road	9%	0%	9%	9%	27%	46%
At Capacity						
Widened Road	0%	22%	39%	17%	16%	6%
Unwidened Road	0%	12%	18%	0%	29%	41%
Over Capacity						
Widened Road	0%	50%	38%	0%	0%	12%
Unwidened Road	4%	17%	17%	15%	22%	24%

Table 7 **Effects of Construction Activity to Widen Intersections on Gross Sales of Businesses by Parking Space Capacity Versus Use, 1987**

Parking Space Capacity Versus Use	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know / No Answer
Under Capacity	0%	33%	17%	50%
At Capacity	0%	11%	56%	33%
Over Capacity	0%	11%	44%	45%
All Uses Level	0%	18%	41%	41%

Table 8 **Effects of Construction Activity to Widen Intersections on Gross Sales of Businesses by Parking Space Capacity Versus Use, 1992**

Parking Space Capacity Versus Use	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know
Under Capacity	6%	72%	11%	11%
At Capacity	0%	76%	12%	12%
Over Capacity	0%	25%	50%	25%
All Uses Levels	3%	67%	17%	13%

Table 9 **Overall Expected Long-Term Effects on Own Business, 1987**

Location of Business	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know / No Answer
Widened Road	13%	31%	25%	13%	13%	5%
Unwidened Road	N/A	N/A	N/A	N/A	N/A	N/A
All Locations	N/A	N/A	N/A	N/A	N/A	N/A

Table 10 Overall Expected Long-Term Effects on Marshall Avenue Businesses, 1987

Location of Business	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know / No Answer
Widened Road	8%	26%	0%	31%	28%	15%
Unwidened Road	20%	4%	10%	7%	35%	24%
All Location	16%	12%	6%	15%	32%	19%

Table 11 Overall Effects of a Widened Marshall Avenue on 1992 Respondent Business

Location of Business	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know
Previously Widened	0%	40%	20%	0%	0%	40%
Newly Widened	31%	14%	10%	4%	4%	37%
All	26%	18%	12%	3%	3%	38%

do not know. Those on newly widened sections of the highway are slightly more negative than those along the previously widened sections of the highway.

After Construction

Usable Parking Spaces

In 1987, when asked about the impacts of construction once the work had been completed, 36% indicated there was no change, 16% said there was a decrease in available parking, and 3% indicated that their usable parking had increased. Forty-five percent either did not know or did not answer (Table 12).

The 1987 businesses were also asked about their expectations regarding the long-term effects on usable parking spaces after construction of a continuous left turn lane was completed. Forty-seven percent expected no effect, and 41% were negative to some degree. Businesses along widened sections were much more positive about parking impacts than those abutting unwidened sections of the highway (Table 13).

In 1992, Marshall Avenue businesses along both previously and newly widened sections were asked about the immediate after construction effects on their usable parking. According to results shown in Table 14, 22% experienced a decrease, 75% experienced no change, and 3% didn't know the impact on their usable parking. Therefore the 1987 businesses' expected long-run effects were more negative than were actually experienced by the 1992 businesses.

Number of Customers per Day

As for after construction effects, 28% of the 1987 businesses indicated there was no change, 16% indicated a decrease, and 5% indicated an increase in their number of customers per day. Fifty-one percent said they did not know or they did not answer (Table 12).

Regarding 1992 after construction effects, the results shown in Table 14 demonstrate that 76% indicated their number of customers did not change, while 9% indicated they had decreased and 6% did not know. Again, the 1992 businesses experienced a lower percentage decrease in the number of customers during and after construction than the 1987 businesses. At all locations, the 1987 businesses expected the long term effects on the number of customers were more negative than expected by the 1992 businesses.

Number of Full-Time Employees

When asked about the 1987 effects after construction, 41% of the respondents indicated

Table 12 Effects of Added Curb and Left-Turn Lane at Intersections on Abutting Businesses, 1987

Item Affected	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know / No Answer
Usable Parking Spaces	3%	36%	16%	45%
Customers Per Day	5%	28%	16%	51%
Full-Time Employees	0%	41%	10%	49%
Part-Time Employees	0%	41%	10%	49%
Gross Sales	3%	26%	18%	53%
Net Profit	3%	26%	18%	53%

Table 13 Expected Long-Term Effects on Number of Parking Spaces, 1987

Location of Business	No Effect	Negative	Very Negative	Don't Know / No Answer
Widened Road	72%	18%	10%	0%
Unwidened Road	34%	12%	35%	19%
All Locations	47%	14%	27%	12%

Table 14 Effects After Constructing a Continuous Left-Hand Turn Lane on Businesses, 1992

Item Affected	Percentages of Businesses			
	Increased	No Change	Decreased	Don't Know
Usable Parking Spaces	0%	75%	22%	3%
Customers per Day	9%	76%	9%	6%
Full-Time Employees	0%	94%	3%	3%
Part-Time Employees	0%	94%	3%	3%
Gross Sales	6%	79%	3%	12%
Net Profit	6%	79%	3%	12%

there was no change, and 10% indicated a decrease in the number of full-time employees. Forty-nine percent said they did not know or they did not answer (Table 12).

In 1992, ninety-four percent indicated that the number did not change after construction, while 3% indicated they had decreased and 3% did not know. These results are shown in Table 14. Again, the 1992 businesses experienced a more positive impact during and after construction than did the 1987 businesses. Also, the actual short term effect on employment was more positive than the expected long-term effect.

Number of Part-Time Employees

Regarding 1987 after construction effects, 41% indicated there was no change, and 10% indicated a decrease in the number of part-time employees. Forty-nine percent said they did not know or they did not answer (Table 12).

Regarding the 1992 after construction effects, the results in Table 14 show that 94% indicated that the number did not change, while 3% indicated they had decreased and 3% did not know. The 1992 respondents report more positive construction and after period impact on part time employment than the 1987 respondents (Table 4, Table 12).

Gross Sales

With respect to 1987 after construction effects, 26% indicated there was no change, 18% indicated a decrease, and 3% indicated an increase in gross sales. Fifty-three percent said they did not know or they did not answer (Table 12).

When all businesses existing in 1987 were asked about their expectations about the long-term effects after construction of the continuous left turn lane was completed, 28% expected no effect and 29% were negative to some degree. Twenty-two percent did not know or did not answer. Businesses along widened sections were much more positive than those abutting unwidened sections of the highway. Very few of the businesses indicated the actual amount of the gross sales impact on their business.

As for the 1992 after construction impacts, 79% indicated that their gross sales did not change, while 3% indicated that their sales had decreased and 12% did not know the after construction impact on their gross sales (Table 14). Again, the 1987 responding businesses anticipated a much more negative impact than that which was actually reported by those responding in 1992. Again, very few of the businesses indicated the actual gross sales impact.

Net Profit

After the 1987 construction, 26% indicated there was no change, 18% indicated a decrease, and 3% indicated an increase in net profit. Fifty-three percent said they did not know or they did not answer (Table 12).

After the 1992 construction, as seen in Table 14, 80% indicated that it did not change, while 3% indicated it had decreased and 11% did not know. Thus, the businesses responding in 1987 expected a more negative impact than the businesses responding in 1992 reported experiencing. Very few of the responding 1987 and 1992 businesses indicated the actual amount of net profit impact on their business.

Parking Capacity Influences on Gross Sales Impacts

Gross sales on the busiest days of responding 1987 businesses operating under parking capacity did not change after the intersection widening was completed. Similar to the situation during construction, those operating at or over parking capacity experienced sales declines (Table 15).

As seen in Table 16, most 1992 business respondents did not experience a change in sales after the construction was completed. Those with under capacity parking were the only types that experienced increased or decreased sales. Eleven percent of the businesses did not know if their sales had been affected by the construction.

Overall Effects on all Longview Businesses

The 1987 responding businesses along the widened sections expected that the overall long-term effects of widening on all Longview business would be more positive than those along the previously unwidened sections. Forty-nine percent of the businesses along widened sections expected a positive impact, while 19% on unwidened sections did so (Table 17). The 1992 respondents at all locations experienced a much less negative impact than what their 1987 counterparts expected, as shown in Table 18. Fifty-five percent of the responding businesses along newly widened sections did not know what the overall effects were on Longview business, while 32% indicated that Longview businesses were positively affected. Those on newly widened sections were slightly more negative than those on previously widened sections.

Summary of Estimated Business Effects

In summary, Marshall Avenue businesses were asked about the impacts of the widening

Table 15 **Effects of Added Curb and Left-Turn Lane at Intersections on Gross Sales of Businesses by Parking Space Capacity Versus Use, 1987**

Parking Space Capacity Versus Use	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know / No Answer
Under Capacity	0%	42%	0%	58%
At Capacity	0%	22%	28%	50%
Over Capacity	11%	11%	22%	56%
All Levels	3%	26%	18%	53%

Table 16 **Effects on Businesses After Construction Activity to Widen Intersections on Gross Sales of Businesses by Parking Space Capacity Versus Use, 1992**

Parking Space Capacity Versus Use	Percentage of Businesses			
	Increased	No Change	Decreased	Don't Know
Under Capacity	10%	75%	5%	10%
At Capacity	0%	88%	0%	12%
Over Capacity	0%	86%	0%	14%
All Uses Levels	6%	80%	3%	11%

Table 17 Overall Expected Long-Term Effects on Longview Businesses, 1987

Location of Business	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know / No Answer
Widened Road	10%	39%	17%	21%	5%	8%
Unwidened Road	12%	7%	23%	5%	21%	32%
All Locations	11%	18%	21%	11%	15%	24%

Table 18 Overall Effects of a Widened Marshall Avenue on All Longview Businesses, 1992

Location of Business	Very Positive	Positive	No Effect	Negative	Very Negative	Don't Know
Previously Widened	0%	40%	0%	0%	0%	60%
Newly Widened	16%	16%	8%	4%	4%	52%
All	13%	20%	7%	3%	3%	54%

of Marshall Avenue on various aspects of their businesses, including the number of parking spaces, customers, employees, sales, and profits, as well as overall effects on Marshall Avenue and Longview businesses. For the most part, the experience and expectations expressed by respondents to a previous survey in 1987 were more negative than the effects experienced by the 1992 respondents. A lower percentage of the 1992 respondents experienced a negative impact during and after construction on all aspects of their businesses except for usable parking spaces. Also a much lower percentage of the 1992 respondents experienced a negative impact on their business after construction than during construction. Had the construction period been a year longer and had there been less cooperation between all concerned, i.e. the business, contractor and TxDOT, the negative percentages, at least during construction, could have been higher.

ESTIMATED IMPACT ON PARKING

In 1987, Buffington *et al.* indicated that many of the businesses along Marshall Avenue in the 6.7 mile study area were concerned that widening the sections of the highway that hadn't been previously widened at intersections would have a negative impact on available customer parking [1]. Exacerbating the problem was the fact that many of the businesses were housed in older buildings located too close to the right-of-way. An example of this situation is shown in Figure C-2. In addition, many did not have the minimum number of available parking spaces as required in the city's zoning ordinance at that time. Some of the businesses depended on Marshall Avenue's sloped paved shoulders to provide much of their parking.

In the last section, the parking problem was addressed through the eyes of the businesses. The findings there indicate that businesses operating with their parking lots at or over capacity were more likely to experience a decrease in gross sales than those operating their parking lots under capacity. To further determine the magnitude of the parking problem, surveys on parking space availability and use were conducted. The parking space availability survey was done with the use of a 1986 aerial photograph, a detailed design schematic, and an on-the-ground inspection of the premises of each business. The estimated number of available parking spaces before and after construction was established. The parking space use survey of selected businesses was done by on-the-ground inspection.

The criteria used for estimating the number of parking spaces available before and after construction for each business are as follows:

1. Included the paved shoulder where parking was feasible.
2. Ignored the location of the right-of-way line.
3. Counted marked parking spaces and estimated the number of unmarked parking spaces by using the standard dimensions of 9 ft. by 20 ft. for each space and a 20 ft. lane to provide adequate access to each space in the parking lot.
4. Estimated spaces for straight-in, angular, or parallel parking in front of buildings. Spaces needing part of the paved shoulder were not counted. Also, shoulder parking was not considered feasible where there was not enough room to provide a 20 ft. lane to access straight-in or angular parking spaces in front of buildings.

A 10 ft. wide strip between the shoulder and buildings was required to count parallel spaces.

5. Counted automobile dealer parking spaces for customer use only.
6. Determined the availability of existing or potential side and/or back of building spaces but did not count the number of spaces, except for businesses with very few front, side, or back spaces available.

Before the highway widening construction, both the parking space availability and use included parking on the paved shoulder in front of the premises of each business. It should be understood that all of the paved shoulder is on the highway right-of-way, and parking on the shoulder is illegal. However, the standard dimension of 9 ft. by 20 ft. for each parking space was used to estimate the number of passenger vehicles that could park on the paved shoulder in front of each business.

Procedures used in the parking space use survey are as follows:

1. Included in the survey were businesses that would lose at least eight percent of their available parking spaces due to street widening.
2. The parking use was determined during peak and non-peak parking hours during three days (Thursday, Friday, and Saturday) of one week in April or July, 1987, 1989, 1990, 1991, and 1992. It was based on counts made starting at: 9 a.m., 12 p.m. 3 p.m., 5 p.m., and 8 p.m. each day for all businesses open these hours. Counting at businesses opening at 10 a.m. began at 10 a.m.
3. Parking space counts were by location as follows:
   a. number of vehicles parked on paved shoulder,
   b. number of vehicles parked elsewhere around the building.

Effects on Parking Space Availability

The results of the 1987 parking space availability survey are summarized below. The survey did not include the side and back spaces of businesses that have adequate front, side, and/or back parking. None of the shoulder spaces available to the businesses before construction would be available after the construction started on a particular section of the project. Projections in 1987 forecasted a two percent loss of the front parking spaces of all businesses, and a maximum loss of 9.7 percent of all available shoulder and front parking spaces. If all of

the side and back parking spaces had been included, the percentage reduction would have been much lower. Table 19 shows the 1987 projected parking space changes that would be experienced by all 356 Marshall Avenue businesses by status. Over half were expected to experience no change in their number of parking spaces, and only 4% would lose more than 8 parking spaces. A higher percentage of the open businesses would experience no more change in available parking spaces than would be the case for closed businesses.

Table 20 shows the before and after construction parking spaces available to 118 of the 1987 businesses (open and closed) which were expected to experience a parking space availability problem. A total of 300 or 22 percent of the parking spaces would be lost due to the construction. The average number of available parking spaces per business would drop from about 13 spaces to 10 spaces or a reduction of three spaces per business. Also, Table 20 shows the number of parking spaces that would be lost by businesses located in each section of the study project. Since the construction started in Section 1 and progressed as planned to Section 4, the businesses in Section 1 had to give up some of their available parking much sooner than those in Section 4. The total length of the construction period helped determine how soon businesses in the latter sections would experience a reduction in available parking, thus helping determine the magnitude of the construction period impact.

As shown in the business impact section, the loss of available parking spaces is more meaningful when interpreted in light of parking demanded, which is discussed next.

Effects on Parking Space Use

Since 1987, the parking demand for a selected group of businesses who were expected to have a parking availability problem has been studied. By 1992, the number of businesses or parking lots monitored for parking demand had been reduced partially because a small shopping center, structurally damaged from a nearby exploding rail car, had been demolished and because some went out of business. Table 21 shows parking space availability versus parking space use or demand for 84 businesses before and after construction of all existing and proposed widened sections of Marshall Avenue. (Parking capacity data was unavailable for one business.) About 24 of the 114 businesses surveyed in 1987 were already experiencing a shortage of available parking spaces, i.e. the use or demand for parking spaces was greater than the availability or supply of parking spaces. Since construction, this number has not changed, but some businesses

Table 19 **Effects of Road Improvement on Parking Space Availability to all Businesses by Status, 1987**

Change in Parking Space	Open Businesses		Closed Businesses		All Businesses	
	Number	Percent	Number	Percent	Number	Percent
No Change	187	57%	8	30%	195	55%
- 1	32	10%	7	27%	39	10%
- 2	46	14%	9	35%	59	17%
- 3	22	6%	1	4%	23	6%
- 4	24	7%	1	4%	25	7%
- 5	8	2%	0	0%	8	2%
- 6	3	1%	0	0%	3	1%
- 7	5	2%	0	0%	5	1%
- 8 through 20	4	1%	0	0%	4	1%
Total	330	100%	26	100%	356	100%

Table 20 **Number of Parking Places Before and After Construction for Selected Businesses with a Parking Shortage, 1987**

Measure	Section 1	Section 2	Section 3	Section 4	Total
Number of Observations	45	13	35	25	118
Total Parking Spaces Before Construction	416	317	315	307	1,355
Average Parking Spaces Before Construction	9.24	24.38	9.00	12.28	11.48
Total Parking Spaces After Construction	306	273	239	237	1,055
Average Parking Spaces After Construction	6.80	21.00	6.83	9.48	8.94
Total Parking Spaces Lost Due to Construction	110	44	76	70	300
Average Parking Spaces Lost Due to Construction	2.44	3.38	2.17	2.80	2.54

Table 21 Parking Space Availability Versus Demand Level for Selected Businesses Before and After Construction, 1987 versus 1992[A]

Space Availability Versus Demand Level[B]	Before Construction (1987)		After Construction (1992)	
	Number of Spaces	Number of Businesses	Number of Spaces	Number of Businesses
+ 20 or More	268	7	240	7
+ 15 to + 19	183	9	143	5
+ 10 to + 14	192	13	153	6
+ 5 to + 9	727	27	521	18
0 to + 4	213	34	144	24
-1 to - 4	22	7	10	7
-5 to - 9	73	8	55	8
- 10 to - 14	5	2	0	2
- 15 to - 19	13	2	7	2
- 20 or more	85	5	70	5
Total	1,781	114	1,343	84

A Businesses where peak hour parking space demand is established.

B Minus means a deficit in available spaces

now have a smaller parking surplus, and some businesses have gone out of business.

To analyze further the severity of the parking space availability versus use problem, all businesses having ten or less spaces left after construction were identified and classified in eleven parking loss levels for comparison according to levels of parking space use. The 53 affected businesses for 1987 are listed in Table 22. A total of 86 businesses surveyed fall into this group for 1992, as shown in Table 23. A comparison of the findings in Table 22 and Table 23 reveals the same percentage of businesses were under capacity, a higher percentage were overcapacity, and a lower percentage than in 1987 were closed, or didn't know in 1992. Overall, a higher percentage of the businesses lost all of their available spaces in 1992 than in 1987. However, a lower percentage of the businesses in the overcapacity category lost all of their available parking space in 1992 than in 1987. Even so, more of these businesses experienced a deterioration in their parking use versus availability situation during and after construction.

Summary of Parking Impacts

In 1987, over half of the businesses abutting the widened section of Marshall Avenue were expected to experience no change in their number of parking spaces. Firms that were expected to have inadequate front, side, and/or shoulder parking were selected for a follow-up study through 1992. The number of businesses expected to have a serious parking problem increased during and after construction. However, a higher percentage of these businesses had adequate parking after the construction than was anticipated.

Table 22 **Present Peak Parking Space Use Compared to Parking Space Loss Level for Selected Businesses, 1987**

Parking Space Loss Level	Present Peak Parking Use			
	Over Capacity	Under Capacity	Closed / Don't Know	Total
	Number of Businesses			
All Spaces	6	0	2	8
All But 1	1	1	1	3
All But 2	0	1	1	2
All But 3	0	4	6	10
All But 4	1	1	4	6
All But 5	2	2	1	5
All But 6	0	2	2	4
All But 7	0	0	1	1
All But 8	0	1	0	1
All But 9	0	6	5	11
All But 10	1	0	1	2
All Levels	11	18	24	53

Table 23 **Present Peak Parking Space Use Compared to Parking Space Loss Level for Selected Businesses, 1992**

Parking Space Loss Level	Present Peak Parking Use			
	Over Capacity	Under Capacity	Closed/Don't Know	Total
	Number of Businesses			
All Spaces	14	2	5	21
All But 1	3	0	0	3
All But 2	1	2	1	4
All But 3	2	4	3	9
All But 4	3	1	7	11
All But 5	4	4	3	11
All But 6	2	2	0	4
All But 7	2	9	0	11
All But 8	0	0	1	1
All But 9	0	4	6	10
All But 10	0	1	0	1
All Levels	31	29	26	86

ESTIMATED IMPACT ON PROPERTY VALUES AND USES

Although estimating the impacts on Marshall Avenue property values and uses was not required under the study, a limited amount of data was collected to provide some indication of the extent of such impacts. Data were collected from the Gregg County Appraisal District, local real estate appraisers, and the City of Longview to estimate abutting property value and land use impacts of the widening project. Property values, property uses, and building permits were the three types of data collected.

An attempt was made to estimate during construction and after construction impacts. The findings on these two types of impacts are presented separately below.

During Construction

Property Values

During the years before the widening of U. S. Highway 80, specifically between 1985 and 1989, Longview property value fell. This trend can be observed in Table 24. This decline, which was observed in both land and building values, was partly due to the oil recession. One appraiser also noted that Longview property values peaked in 1985 due to overbuilding. Land and building values on Marshall Avenue fell similar to the Longview property values. This trend was exacerbated by the continuation of a late 1960's - early 1970's trend to build north of U. S. Highway 80.

By the time that widening construction of U. S. Highway 80 began, Longview land and building values had leveled off and were beginning to rise. Land values on U. S. Highway 80 were behaving similarly. One appraiser noted that the construction slowed down the traffic on U. S. Highway 80, thus making it a more desirable location. He indicated that property values were related to the condition of the property, but were generally falling due to the earlier neglect of buildings.

Building Permit Data

Part of the earlier neglect of buildings can be traced through building demolition data available from the City of Longview, which can be seen in Table 25. Between 1984 and 1989, there were only a few building demolitions each year. During the construction period, there were more demolitions. As indicated earlier, some of the commercial demolitions were due to

Table 24 Value of Longview Property Between 1985 and 1991

Year	Value of Longview Land and Buildings
1985	$2,922,266,592
1986	$2,875,116,299
1987	$2,744,997,463
1988	$2,660,308,402
1989	$2,684,586,095
1990	$2,684,586,095
1991	$2,823,017,237
1992	$2,860,804,012

Source: Gregg County Appraisal Office

Table 25 Building Demolitions Along U. S. Highway 80, Longview, by Type

Year	Commercial	Residential	Other	All
	Number of Permits			
9/84 - 8/85	4	0	0	4
9/85 - 8/86	2	0	1	3
9/86 - 8/87	0	0	0	0
9/87 - 8/88	1	0	0	1
9/88 - 8/89	1	3	0	4
9/89 - 8/90	8	2	0	10
9/90 - 8/91	5	2	0	7
9/91 - 8/92	10	0	0	10

Source: City of Longview

a nearby rail car explosion. It is important to note that many kinds of work, including petroleum tank removal, are also classified as building demolition. An abandoned building is shown in Figure C-3, while a vacant lot resulting from a demolition is displayed in Figure C-4.

The distribution of building permits for new construction along U. S. Highway 80 is displayed in Table 26. The highest value of construction occurred between September 1984 and August 1985. Sixteen permits were issued between 1984 and when the construction started, while three permits were issued during the construction period. This decline supports the appraisers' view that Longview is overbuilt or that businesses are building north of Highway 80. Note that the permits filed are for installation of signs, offices, and electrical plugs, and are not necessarily due to the highway construction. An example of an expanded business is exhibited in Figure C-5, and one of the newly constructed buildings is displayed in Figure C-6.

Property Uses

Very few properties changed use during the study period. The property use changes that did occur include the addition of new retail outlets built on previously vacant land. These new retail outlets were built near the end of the construction period. Therefore, the new highway improvement may have influenced these use changes.

After Construction

Property Values

As seen in Table 24, only one year of after construction property value is available. The trends evident during construction are still present. The increase in value between 1991 and 1992 is not as great as the increase between 1990 and 1991, however. Obviously, more time is needed to assess even the short-run after construction impacts.

Building Permit Data

Only one year of building permit data is available for the after construction period. Demolition permit information is found in Table 25. There were more commercial demolition permits issued the first year after construction than in any previous year recorded in the table. This increase supports the contention that Marshall Avenue property had been previously neglected, requiring demolition of existing buildings to take advantage of the renewed interest in building in this location.

However, the building permits for new construction neither support or refute the

Table 26 **Building Permit Values for New Construction Along U. S. Highway 80 in Longview by Type**

Year	Commercial		Office		Residential		All	
	No.	Value ($)	No.	Value ($)	No.	Value ($)	No.	Value ($)
9/84 - 8/85	4	279,000	2	3,515,000	0	0	6	3,794,000
9/85 - 8/86	4	432,000	2	25,000	0	0	5	407,000
9/86 - 8/87	0	0	0	0	0	0	0	0
9/87 - 8/88	5	515,000	0	0	0	0	5	515,000
9/88 - 8/89	0	0	0	0	0	0	0	0
9/89 - 8/90	0	0	0	0	0	0	0	0
9/90 - 8/91	3	1,640,000	0	0	0	0	3	1,640,000
9/91 - 8/92	6	12,300	0	0	0	0	6	12,300

contention that there is renewed interest in building on Marshall Avenue (see Table 26). While $1.64 million in new construction permits were issued in the last year of construction, only $12,300 worth of permits were issued after the construction was completed.

One fear of city residents when faced with the possibility of highway widening was the possible loss of part of their property for highway right-of-way. For this reason, permits for remodeling purposes were investigated. The permits applied for after the construction was completed are listed in Table 27. These permits were related mainly to routine improvements such as installing electrical outlets, signs, lavatories, air conditioning, heating furnaces, roofing, and sprinkler systems. Property owners in cities faced with similar construction will be glad to learn that Longview residents did not have to do extensive remodeling in the aftermath of U. S. Highway 80 widening.

Property Uses

In 1991, over 40 percent of the properties abutting Marshall Avenue (U.S. Highway 80) were being used as sites for retail businesses, as shown in Table 28. Included in the table are vacant buildings representing the particular use for which they were designed. Another 14 percent were being used for other commercial, office and industrial purposes. About 25 percent of the properties were still vacant land. The remainder of the properties were used to house public activities, religious activities, or single and multiple family dwellings.

Figure 5, Figure 7 and Figure 6 show the 1992 land uses abutting Marshall Avenue. Figure 5, Figure 7 shows the property uses along Sections 1 and 2, or the western 4 miles of the study facility and Figure 6 shows the property uses of Sections 3 and 4, or the eastern 2.7 miles of the study facility. The retail and other types of business properties are concentrated near the Loop 281 intersection, as shown in Figure 5, Figure 7, or the first 15 blocks to the east of Spur 63, as shown in Figure 6. The latter section was a part of the old commercial area of Longview.

Summary of Property Value and Use Impacts

Longview land values peaked in 1986, and fell until Marshall Avenue construction began. The land values began to rise at that time, but they still haven't reached their 1985 and 1986 levels. The property along Marshall Avenue was affected by this trend, as well as the trend for building north of Marshall Avenue. Property was neglected, and building demolitions increased

Table 27 Permit Values for Remodeling Along U. S. Highway 80 in Longview from June 1991 - August 1992 by Type

Type of Permit	Commercial		Residential		Other		All	
	No.	Value ($)	No.	Value ($)	No.	Value ($)	No.	Value ($)
Building	36	520,952	5	5,000	3	900	44	526,852
Plumbing	10	0	1	0	0	0	11	0
Electric	28	0	5	0	0	0	33	0
Mechanical	12	33,842	1	1,200	0	0	14	35,042
Signs	12	18,685	0	0	0	0	12	18,685
Miscellaneous	1	0	0	0	0	0	1	0

Source: City of Longview

Table 28 Land Use Along Marshall Avenue in Mid-1991

PROPERTY USE	LINEAR FOOTAGE ON U.S. HIGHWAY 80	PERCENTAGE OF TOTAL
Single Family	7,797	8.8
Two-Family	0.0	0.0
Multi-Family	993	1.1
Retail	35,833	40.3
Commercial	10,409	11.7
Industrial	1,853	2.1
Oil/Gas	264	0.3
Railroad/Public Utility	50	0.1
Medical	488	0.5
Government	514	0.6
Quasi-Public	261	0.3
Religious	865	1.0
Education	180	0.2
Vacant Land	22,464	25.2
Office	4,756	5.3
Mobile Home	298	0.3
Cemetery	1,740	2.0
Parks	235	0.3
Total	89,000	100.0%

Source:City of Longview

US 80 LAND USE

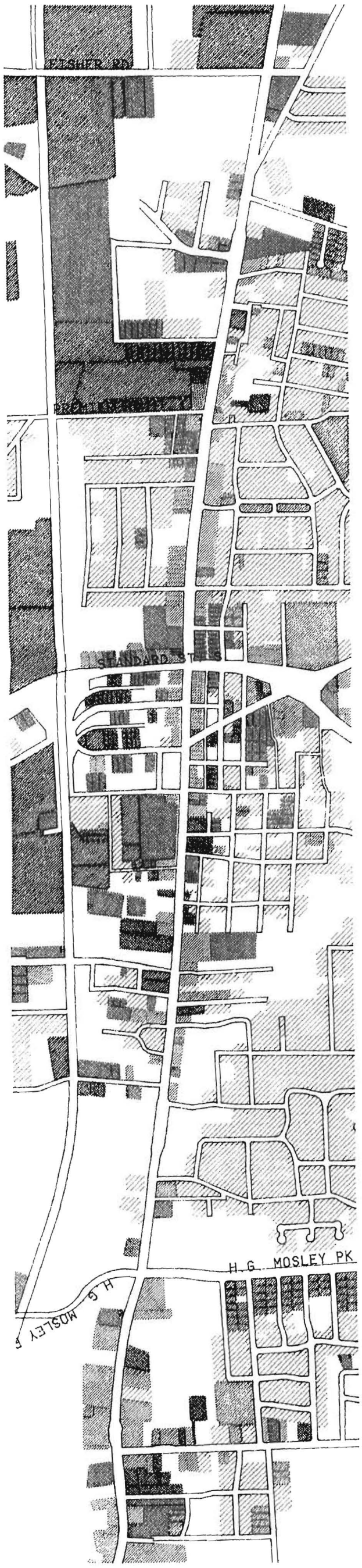
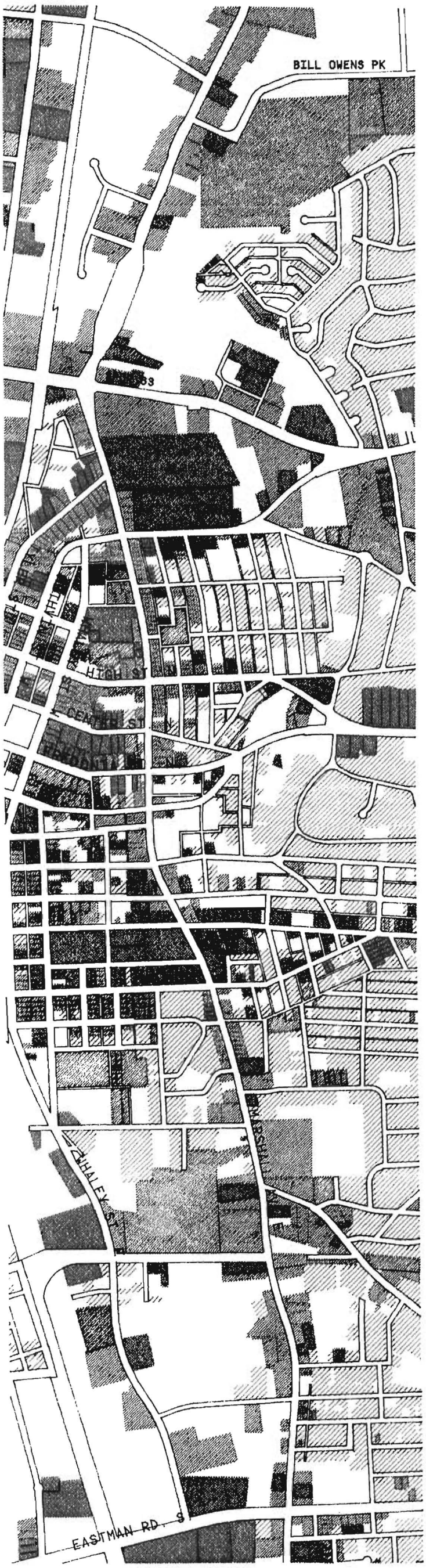


Figure 5 Land Use Along Marshall Avenue Between Fisher Road and Spur 63, 1992



US 80 LAND USE

SINGLE FAMILY RESIDENTIAL

TWO-FAMILY RESIDENTIAL

MULTI-FAMILY RESIDENTIAL

OFFICE

RETAIL

COMMERCIAL

INDUSTRIAL

PUBLIC, QUASI-PUBLIC

PARKS

CEMETERIES

PROPOSED THOROUGHFARE

PRESENT CITY LIMITS

SCALE: 1 inch = ≈ 2100 feet

Figure 6 Land Use Along Marshall Avenue Between Spur 63 and Eastman, 1992

during and after the construction period. Building permits for new construction were issued more frequently in the last year of construction and after construction, but not as frequently as before construction began. Property owners did not have to do extensive remodeling after the construction was completed, and few property changes occurred during the study period.

IMPACT ON MOTORISTS

The benefits to motorists of an improved highway can be classified into three general categories: delay savings, vehicle operating cost savings, and accident reductions. Many methods and techniques are available to calculate these benefits, but, in general, calculations are based on some change in the before versus after situation the motorists face, putting a dollar value on those changes, and calculating those dollar values over the life of the improvement. These benefits are then discounted to the present and compared to the construction cost. If the user benefits are greater than the costs, then it is a beneficial project.

In addition to the before versus after analysis, this study also conducted a during construction analysis to capture construction period impacts, such as length of construction period impacts and construction activity impacts. Table 29 shows the lane closure lengths and time requirements by type of construction activity. The major steps in the calculation of user benefits are described below.

Calculation of Traffic Volumes and Average Speed

Detailed average daily traffic (ADT) for 1986 was collected from Texas Department of Transportation (TxDOT) maps along the section of U. S. Highway 80 that was widened. Also, the Texas Transportation Institute collected ADT data annually before, during, and after construction for calculating construction period impacts. In addition, TxDOT provided a projected 2006 ADT for this section of highway. The difference between the 1986 and 2006 values was divided by 20 to obtain an annual increase in ADT. Various multiples of this value were added to the 1986 figure to obtain an estimated ADT for more recent years.

The estimated ADT is slightly higher than that established by the TTI counters, which show the ADT remaining nearly flat during the construction period. The construction period benefits may be slightly overstated, but TxDOT projections for the long-term seem reasonable.

For the major route, which is Marshall Avenue, the ADT for the segment with the least volume was used as the current ADT, and the difference between the actual segment volume and the current ADT were entered as local ADT. The ADT calculated for the minor routes, or cross streets, was put in directly as estimated. In addition to the current ADT, a projected ADT is required for calculating future benefits.

Table 29 Lane Closure Lengths and Time Requirements by Type of Work

Type of Work	Average Number of Days	Average Length of Lane Closure	Number of Observa -tions
1 Preparation of Right-of-Way	1.25	0.42	4
3 Storm Drainage Work and Bridge Widening Work Where Applicable	2.50	0.64	54
4 Curb & Gutter Work	2.44	0.65	61
5 Underground Signal Work	1.00	0.20	1
6 Concrete Driveways	2.73	0.73	41
7 Subgrade Widening and ACP (Ty A) Base	2.86	0.60	62
8 Sidewalks, Landscape Pavers, & Work Behind Curb & Gutter Including Block Sod	2.17	0.70	108
10 Seal Coat	3.50	0.42	4
11 1 1/2" ACP Base Course	2.84	0.65	30
12 Construction Pavement Markings	3.00	1.65	1
13 Install Detector Loops & Complete Signal Work	8.00	0.16	3
14 1 1/2" ACP Surf	4.30	0.72	3
15 Final Pavement Markings & Clean-Up	3.34	0.56	59

The ADT was further broken down into hourly volumes by lane using traffic counters placed in several locations along the highway. These counters counted the number of vehicles passing each location over a 24 hour period. These were accumulated into hourly totals and applied to the overall average ADT along the section to give average hourly traffic volumes by lane.

The before, during, and after construction speeds were determined by instrumented vehicle runs through the study section of U. S. Highway 80. For the before versus after construction analysis, these speeds were compared with the default speeds of the HEEM-III model, which is a benefit-cost computer program developed by a TTI researcher [2]. Where different, the default speeds were changed to represent the actual measured speeds. Then, the HEEM-III model was used to calculate vehicle operating costs/savings. For the during construction analysis, the speeds used in the model reflect the effects of construction activities including increased congestion caused by the lane closures.

Calculation of Delay Savings

Delay savings are calculated as the dollar value of motorist time savings resulting from the highway improvement, and calculated using the following formula,

$$\text{Savings} = \text{Length} \times \text{Volume} \times (\text{Speed}_{\text{No Median}} - \text{Speed}_{\text{With Median}}) \times \text{Value of Time}$$

where Savings = hourly delay savings,
Length = section length,
Volume = hourly traffic volume by lane,
$\text{Speed}_{\text{No Median}}$ = speed under previous conditions, no median,
$\text{Speed}_{\text{With Median}}$ = speed under current conditions, with median, and
Value of Time = the value of a motorist's time.

Based on a TTI study, the model assumes that the car value of time is $9.52 per hour per person and the truck value of time is $22.63 per hour per person [3]. Intersection or interchange delay is calculated using the delay equations for selected highway situations, which are displayed in Table 30.

The HEEM-III model calculates the delay on an hourly basis for each direction on both

Table 30 Delay Equations used in HEEM-III for Given Highway Conditions

Condition	Delay Equation
4 x 4 Intersection	1.1778 * exp (0.00072452 * vph)
4 x 6 Intersection	1.1855 * exp (0.00065674 * vph)
6 x 6 Intersection	1.2662 * exp (0.00056726 * vph)
4-Way Controlled Intersection	0.3993 * exp (0.00511955 * vph)
2-Way Stop	0.2629 * exp (0.00209176 * vph)

Note: exp = exponential and vph = vehicle per hour.

the major and minor routes for each route segment. These calculations are repeated for a 24-hour period for both the before and widened situations. The costs for each period are added, and the difference between the before and after calculations is the motorist benefit. This series of calculations is repeated for each year of the analysis. The actual delay used in the calculations modifies the lower and upper parts of the curve so that unreasonable delays are not used. Delay equations are based on optimal signal timing and phasing, so the calculated delay can be modified for less than ideal conditions using an intersection delay adjustment factor. These factors are modified based on vehicle travel time and number of stops recorded by instrumented vehicles, and summarized in Table 31.

While the previous discussion is concerned with delays due to changes in speed associated with intersections, additional vehicle operating costs can be incurred when motorists slow down and stop at intersections. These costs include running costs and idling costs incurred by vehicles while waiting for the signal to turn and the queue to dissipate. Average running speed is the most important variable in the vehicle running cost calculation, and HEEM-III's calculation for it is based on the 1985 Highway Capacity Manual, while the speed calculations for volume/capacity above capacity are taken from a TTI study on delay [4,5]. The equations are given below.

If the volume/capacity (VC) ratio is $\leq$ 1, then

$$\text{Speed} = (\text{FFSPD} - \text{CSPD}) * (1 - \text{VC}^2)^{0.5} + \text{CSPD}$$

where

Speed = average running speed over segment, excluding intersections,

FFSPD = free flow speed, from input data,

MSPD = minimum speed at LOS F assumed to be 10 in urban, 15 in rural,

VC = volume to capacity ratio, capacity taken from input data, and

CSPD = capacity speed at LOS E, assumed to be 30 in urban, 45 in rural.

If the VC ratio is $>$ 1 and $\leq$ 2, then

$$\text{Speed} = \text{CSPD} - \text{CSPD} * [1 - (2 - \text{VC})^2]^{0.5}.$$

If the VC ratio is $>$ 2, then

Table 31 Instrumented Vehicle Travel Time, Speed and Stops on Runs Through Study Project[1]

Year of Run	Number of Runs	Number of Stops at Lights per Run	Number of Mid-Block Stops per Run	Travel Time per Run (Minutes)	Travel Speed per Run (Miles per Hour)	Approach Speed per Run (Miles per Hour)
1987	99	10	3	14.91	26.98	36.38
1990	93	16	1	15.30	26.27	32.35
1991	76	19	1	14.60	27.53	35.71
1992	90	4	0	12.30	32.68	41.83

[1] An average of 33 runs per day on Thursday, Friday, and Saturday Between 6:00 a.m. and 10:00 p.m. each day of each year studied.

[2] Stops per run rounded off to appropriate whole number.

Speed = MSPD.

Finally, if the route is an urban arterial, then

Speed = FFSPD*(1 - 0.01875 * VC).

The delay is then calculated as the distance divided by the speed.

The operating cost equations were estimated from Zaniewski, updated to July 1990, and are given below [6]:

Idling Costs, Passenger Car = \$1.04/hour,

Idling Costs, Truck = \$1.08/hour,

$PCYC = 1.3549 + 0.16592 * Speed + 0.01141 * Speed^2$

where PCYC = passenger car cycling cost from Speed to 0 (\$/1000 cycles),

$TCYC = -10.9718 + 3.7359 * Speed + 0.10429 * Speed^2$

where TCYC = truck cycling cost from Speed to 0 (\$/1000 cycles),

$\log(PCYC1) = 1.0913 + 0.0324 * Speed - 0.0001 * Speed^2$

where PCYC1 = passenger car cycling cost for a 10-mph speed change (\$/1000 cycles),

$\log(TCYC1) = 3.1828 + 0.0562 * Speed - 0.0004 * Speed^2$

where TCYC1 = truck cycling cost for a 10-mph speed change (\$/1000 cycles),

$\log(PVOC) = 5.7414 - 0.02750 * Speed + 0.00033 * Speed^2$

where PVOC = passenger car running costs per 1000 vehicle miles, and

$\log(TVOC) = 6.8948 - 0.03464 * Speed + 0.00041 * Speed^2$

where TVOC = truck running costs per 1000 vehicle miles.

Additional delay can be caused by vehicles that are queued behind a vehicle waiting to make a left turn from the median lane. Without a median, vehicles attempting to make left turns at midblock driveways or intersections without a left-turn bay will have to wait for a gap in the oncoming traffic to make the turn. Vehicles may have to wait behind the turning vehicle if there are not sufficient spaces in the shoulder lane to pass the vehicle. These could be eliminated with a continuous left-turn median.

The reduction in delay stops due to queued vehicles was estimated using several runs with an instrumented vehicle through the length of the study highway section. The number of stops made by an instrumented vehicle did decrease with the addition of a continuous left-turn lane, as can be seen by the information in Table 31. The runs were not sufficient to estimate the

effects on an hourly basis, so daily traffic using the median lanes were used to estimate the savings. It was assumed that all of this delay would be eliminated with continuous left-turn medians, since the vehicle making the left turn could wait in the median.

The vehicle operating costs are summed and then adjusted for the pavement condition using the following formula, taken from the Highway Performance Monitoring System Analytical Package [7]. A pavement condition of 4.5 is used as the base for the adjustment.

$$VOC_a = VOC * (0.9818182 + (5.0 - PSI)/(20.0 + (5.0 * (PSI - 3.0))))$$

where VOC = calculated vehicle operating costs,

VOC_a = adjusted vehicle operating costs, and

PSI = Present Serviceability Index.

Accident Reduction Savings

In 1987, the projected reduction in accident costs was calculated by determining the current number and type of accidents on Marshall Avenue, shown in Table 32, and the average costs per accident, shown in Table 33. The total number of accidents along the study area is shown in Table 34. The number of accidents between 1989 and 1992 between Center to Fisher along Marshall Avenue is shown in Table 35, while the number between Center and Eastman is shown in Table 36. The total number of accidents for the study area, by type of accident damage, is shown in Table 37. From the tables it is clear that there were fewer accidents between 1989 and 1992 than there were between 1984 and 1986.

The present research assumes that the continuous left-turn lane will reduce the number of accidents involving turning vehicles. Table 38 displays the number of accidents involving turns during the construction period and almost a year after the construction period. The post-construction period data resembles that for 1990, and it is not clear that turning accidents were affected by the construction.

There is also a question of whether the construction caused additional accidents. In Table 39, accidents in the construction zone are divided into those that were construction related and those that were not. Only a small percentage of the construction zone accidents are construction-related.

With the HEEM-III model, accident costs are calculated by multiplying the accident rate times the cost per accident. The accident rate is then adjusted by the accident adjustment factor.

Table 32 Number of Accidents per Year, Study Area, 1984 - 1986

Year	Fatal	Injury	Property Damage Only	Total
1984	2	165	300	467
1985	2	171	251	424
1986	2	157	271	430
Average	2	164	274	440
Percent	0.45	37.27	62.27	99.99

Table 33 Calculation of Average Cost per Accident, Study Area, 1987

Accident Severity	Proportion by Severity	Cost per Accident	Proportion x Cost
Fatal	0.0045	835,700	3,761
Injury	0.3727	12,800	4,771
Property Damage Only	0.6227	1,150	716

Average Cost per Accident: $9,248

Table 34 Number of Accidents Along the Study Area on Marshall Avenue, 1989 - 1992

Year	Failure to Control Speed	Followed Too Close	Failure to Yield, Left Turn	Disregard Stop and Go	Failure to Yield, Private Drive	Other	Total
1989	76	29	18	19	0	41	183
1990	73	16	15	19	12	50	185
1991	56	16	23	0	15	52	162
1992	37	8	21	8	4	52	130

Source: City of Longview, Texas

Table 35 Number of Accidents Between Center Street and Fisher Road Between 1989 and 1992

Year	Failure to Control Speed	Followed Too Close	Failure to Yield, Left Turn	Disregard Stop and Go	Failure to Yield, Private Drive	Other	Total
1989	54	16	5	8	0	27	110
1990	46	8	0	6	8	36	104
1991	28	10	7	0	7	44	96
1992	27	5	13	6	0	35	86

Source: City of Longview

Table 36 Number of Accidents Between Center Street and Eastman, 1989 - 1992

Year	Failure to Control Speed	Followed Too Close	Failure to Yield, Left Turn	Disregard Stop and Go	Failure to Yield, Private Drive	Other	Total
1989	22	13	13	11	0	14	73
1990	27	8	15	13	4	14	81
1991	28	6	16	0	8	8	66
1992	10	3	8	2	4	17	44

Source: City of Longview

Table 37 Number of Accidents per Year, Study Area, 1989 - 1992

Year	Fatal Accidents	Injury Accidents	Property Damage Only Accidents	Total
1989	1	88	122	211
1990	1	109	132	242
1991	0	93	107	200
1992 (Jan-Aug)	1	50	63	114
1992 (Annualized)	1	75	95	171
Average	1	91	114	206
Percent	0.49	44.17	55.34	100.00

Table 38 Number of Accidents on Marshall Avenue Involving Turning Vehicles

Year	Left-Turn	Right-Turn
1989	19	14
1990	34	16
1991	18	21
1992 (Jan - Aug)	20	10
1992 (Annualized)	30	15

Source: TxDOT

Table 39 Distribution of Accidents in Construction and Maintenance Areas

Year	Construction Zone		Maintenance Zone	
	Non-Construction Related Accident	Construction Related Accident	Non-Maintenance Related Accident	Maintenance Related Accident
1989	2	0	0	0
1990	94	3	1	0
1991	55	2	0	0

Source: TxDOT

The accident adjustment factor was based on the total accident rate of the study area over various time periods, with the pre-construction period (1984 - 1988) representing the base rate of 1.0. Accident rates for highway segments are taken from the Highway Performance Monitoring System Analytical Package [7]. Accident rates for intersections, interchanges, and railroad grade crossings were estimated from Texas accident rate tapes from 1981 to 1986. Costs per accident were taken from a TTI study on accident costs by Rollins and McFarland [8]. All operating and accident costs are updated to July 1990 and are presented in Table 40. The model estimates that accident costs will be reduced by $236,790 over a twenty year period between 1993 and 2012.

Calculation of Motorist Benefits Over the Analysis Period

The benefits to widening Marshall Avenue that were projected in 1987 are presented in Table 41. The calculation of actual benefits is slightly more complicated, however. Three types of benefits are analyzed. The first type are the (dis)benefits associated with the construction. Benefits due to the early completion of the project (in two years instead of the estimated three years) are the second type of benefits. The last type are related to the benefits received after construction compared with those received before construction. Benefits calculated following project completion are presented in Table 42.

Highway Improvement Cost

In 1987, the expected cost of adding the continuous left-turn lane was estimated at $8,800,000 by the Texas SDHPT/TxDOT. Future costs were listed as overlays, striping, and routine maintenance. The 1987 worth of all costs are summarized in Table 43. The actual cost of the construction was $9,544,420.

Summary of Benefits and Costs

The benefit-cost ratio for the continuous left-turn lane is the total discounted user benefits divided by the costs. In 1987, the projected benefit-cost ratio was estimated as:

$$\text{B/C Ratio} = 30{,}727{,}079 / 9{,}025{,}105 = 3.40.$$

The benefit-cost ratio estimated in 1992 is

$$\text{B/C Ratio} = 74{,}963{,}400 / 9{,}544{,}420 = 7.85.$$

A benefit-cost ratio of 7.85 means that the motorists are receiving 7.85 dollars of benefit for every dollar spent on the project. This is a beneficial project from the standpoint of the motorist since the benefits are greater than the costs by a substantial margin, even greater than the margin

Table 40 Accident Rates and Costs in Texas

Accident Rates per Intersection per 1000 vehicle lane miles	PDO Accidents	Injury Accidents	Fatal Accidents
Urban			
RR Grade Crossing	0.0257	0.0156	0.0005728
At Grade Stop	0.9393	0.5165	0.0102303
At Grade Signal	0.4648	0.2145	0.0020001
Interchange	0.0879	0.0518	0.0014806
Rural			
RR Grade Crossing	0.0063	0.0036	0.0004956
At Grade Stop	0.8374	0.5484	0.0306748
At Grade Signal	0.8655	0.3598	0.0075463
Interchange	0.0694	0.0406	0.0046282
Cost per Accident			
Urban			
RR Grade Crossing	2,230	24,890	997,940
Intersection	1,380	14,410	984,310
Interchange	1,310	13,620	950,520
Rural			
RR Grade Crossing	3,140	20,430	956,020
Intersection	1,900	24,490	1,099,450
Interchange	2,030	22,790	1,185,630
Accident Rates per 100 Million Vehicle Miles	Freeway	Divided	Undivided
Urban Highway	244	565	616
Rural Highway	93	261	248
Cost per Accident			
Urban Highway	13,360	12,570	9,170
Rural Highway	29,630	37,070	36,670

Source: HEEM-III: Revised Highway Economic Evaluation Model Version 1.0

Table 41 Summary of Motorist Benefits, 1987

Motorist Benefits	Year 1	Year 20
Delay Savings	325,932	4,457,484
Running Cost Reduction	24,098	429,619
Speed Change Reduction	198,490	259,168
Stop Delay Reduction	61,565	81,810
Accident Reduction	1,057,971	1,406,044
Total	1,668,056	6,634,125

Table 42 Summary of Discounted Benefits, 1992

Motorist Benefits	Construction Period	Early Completion	Before vs. After	Total
Delay Savings	- 3,969.43	6,695.95	61,563.10	64,289.62
Reduced Vehicle Operating Cost	191.85	193.22	5,532.95	5,918.02
Accident Reduction	317.35	162.04	4,276.42	4,755.81
Total	- 3,460.23	7,051.21	71,372.47	74,963.45

Table 43 Summary of Increased Highway Costs for Adding Center Continuous Left-Turn Lane, 1987 Projections

Type of Cost	Present Worth of 20-Year Cost
Initial cost	$ 8,800,000
Overlays	206,182
Striping	7,830
Routine Maintenance	11,093
Subtotal	$ 9,025,125
Less: Present Worth of Salvage Value	(0)
Present Worth of Total Cost	$ 9,025,125

predicted in 1987. The 1992 benefits are higher due, in part, to the ability to make more detailed adjustments on the HEEM-III model than the model used in 1987. As shown in Table 42, finishing the construction a year earlier more than compensated for the negative user cost impacts incurred during the two years of construction.

Summary

The addition of a continuous left-hand turn lane can result in three types of motorist benefits: delay savings, vehicle operating cost savings, and accident reductions. This section has estimated the motorist benefits due to the widening of Marshall Avenue in Longview. Delay savings were estimated using the reduced number of stops along the study section as recorded by instrumented vehicle runs. Vehicle operating savings were calculated using the HEEM-III Benefit-Cost Model. The number of accidents along the study section fell as the construction started, and this trend continued during and after construction. Overall, the findings show considerable user benefits over the cost of highway improvement, even after subtracting the negative user impacts of construction.

ESTIMATED ECONOMIC IMPACT ON THE LONGVIEW AREA

The estimated general economic impact of the proposed change in U. S. Highway 80 (Marshall Avenue) on Longview and the surrounding area is presented in this section of the report. This evaluation is based on the following:

1. Impact on businesses along the facility.
2. Impacts of property values and land use.
3. Effects of the center lane on user costs and accidents.
4. Multiplier effects of the project expenditure on the Longview area.

Economic Trends (City and County)

Population

Between 1985 and 1992, the population of Longview has been between 62,000 and 73,000. The population trends are depicted in Figure 7.

Employment

Gregg County employment has fluctuated between 45,000 and 50,000 between 1985 and 1992, as can be seen in Figure 7.

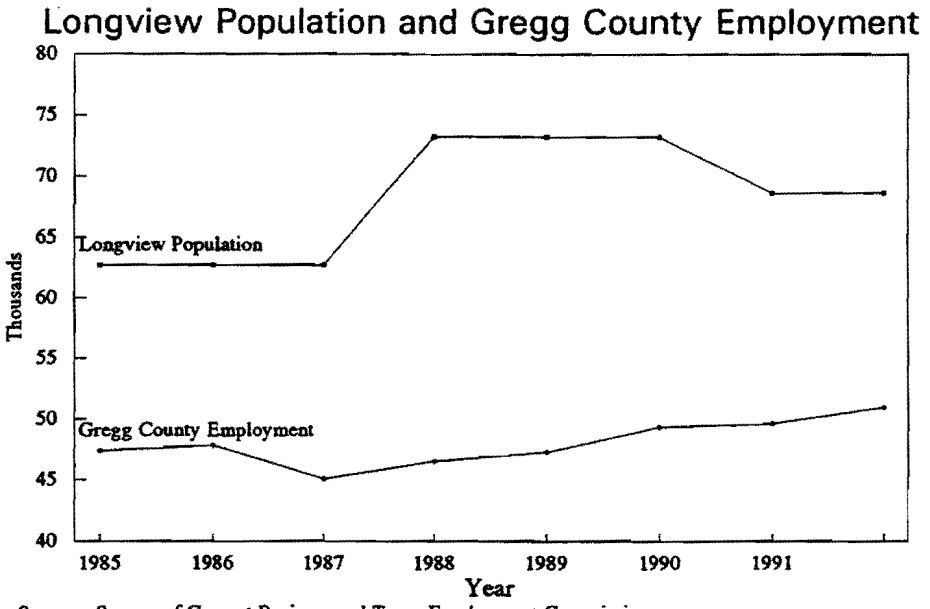
Reported Gross Sales

Longview gross sales for all major divisions ranged between $1.9 and 2.2 billion dollars. The trend can be observed in Figure 8.

Related to the topic of property uses is the topic of sales generated from those uses. Figure 8 shows the trend in reported gross and taxable sales from all major divisions of the Longview economy. The mainstay of the economy is retail sales, which remained between $750 and $875 million between 1984 and 1991. Manufacturing was also an important constant component of the economy as it remained around $375 million during the same time period. Services fluctuated between $125 and $300 million, while transportation ranged from $90 to 150 million. Wholesale trade revenue ranged from $56 to $76, million and construction sales amounted to $30 to $75 million. Agriculture and finance, insurance, and real estate ranged from $1 to $4 million, while mining fluctuated between $1 and $2.6 million.

Taxable Sales

Longview taxable sales for all major divisions ranged between $596 and $725 million



Source: Survey of Current Business and Texas Employment Commission

Figure 7 Longview Population and Gregg County Employment

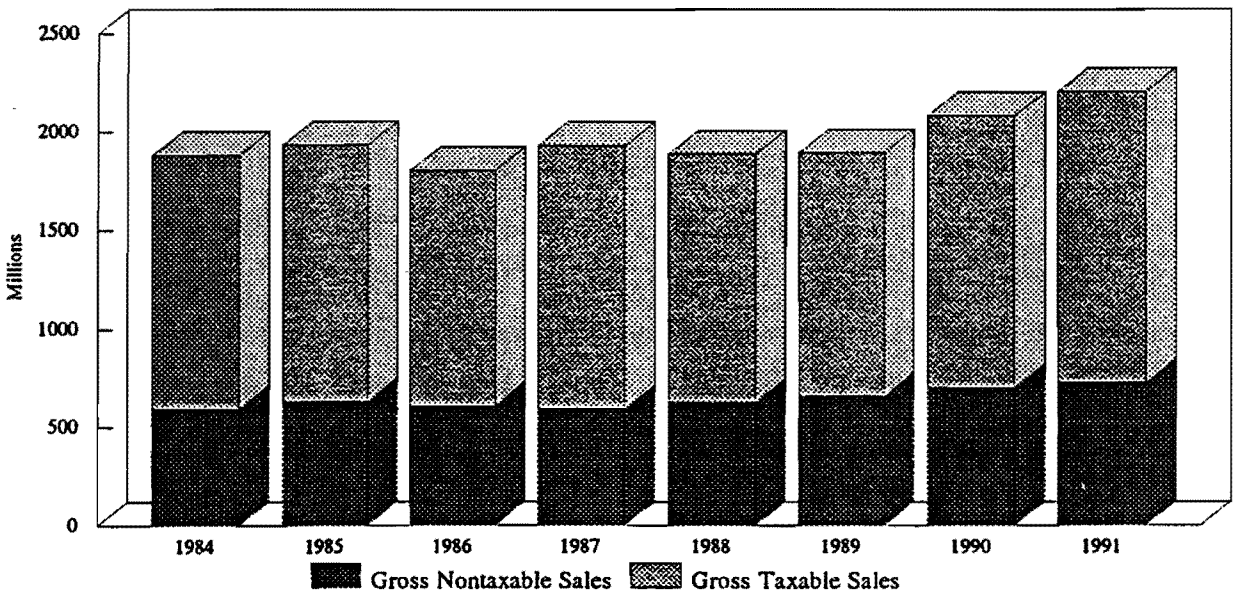


Figure 8 **Gross Sales and Taxable Sales for All Major Divisions, Longview, Texas**

dollars.

The main components that were potentially affected by the construction were the wholesale and retail trade, service, and construction sectors.

Number of Operating Businesses

Between 1985 and 1991, the number of operating businesses in Longview varied between 2,125 and 2,254. Between 1987 and 1992, the number of operating businesses abutting U. S. Highway 80 in the project area increased slightly from 313 to 317.

Value of Oil and Gas Production

The value of gas and oil production for Harrison County is shown in Figure 10, while similar information for Gregg County is displayed in Figure 11.

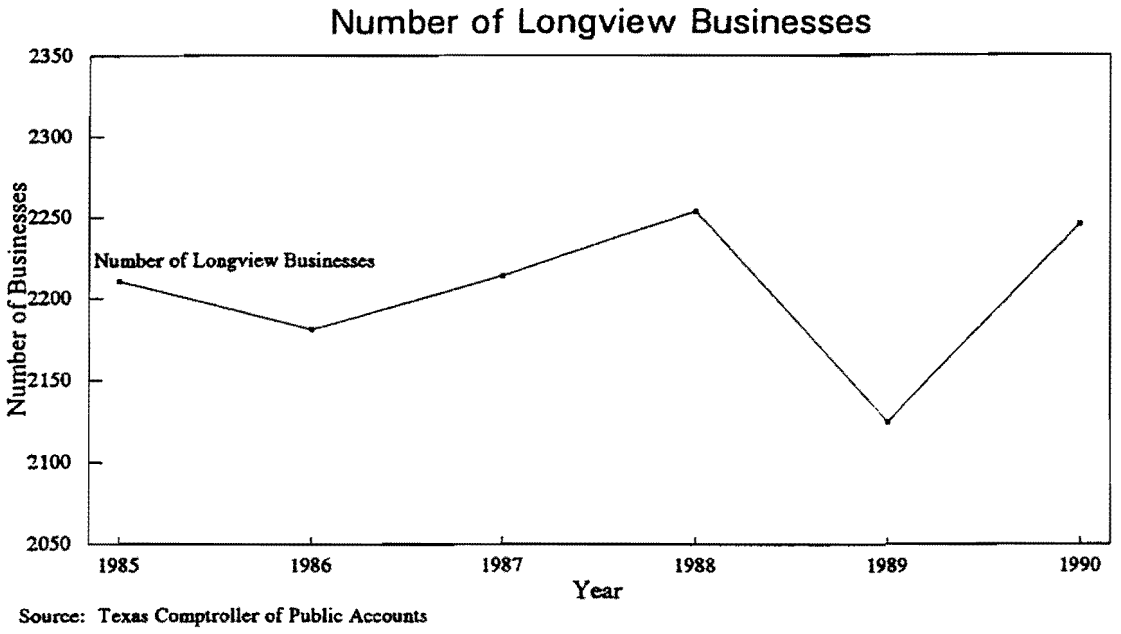
Impact on Business

In 1987, a few small businesses were predicted to go out of business due to loss of parking and the negative effects of construction. Less than a third of the responding businesses thought that the long-term business effects would be negative, and businesses along previously widened sections expected that fewer jobs would be lost than those on newly widened sections. The temporary effects on the number of employees, gross sales, and net profits were expected to be negative.

Even fewer businesses had negative expectations in 1992 than the number in 1987. Most businesses experienced no change in the number of usable parking spaces, the number of customers per day, and the number of full-time and part-time employees. Gross sales and net profit received a less negative response, with 3% of the respondents noting a decline and 79% indicating no change. Regarding the effect on smaller businesses, some did go out of business, but that is normal on Marshall Avenue and cannot be directly attributed to the widening construction.

Impact of Project Expenditure

U. S. Highway 80 construction costs totalled $9,554,420.00, over half of which was spent in the Longview area. $2,616,400.48 was spent on Longview area construction materials, $1,448,503.77 went to Longview area laborers, and $1,526,559.31 worth of overhead expenditures were paid to Longview area businesses. Longview area businesses appeared to receive the most patronage for each type of expenditure since $2,331,028 worth of materials,



Source: Texas Comptroller of Public Accounts

Figure 9 Number of Businesses, Longview, Texas

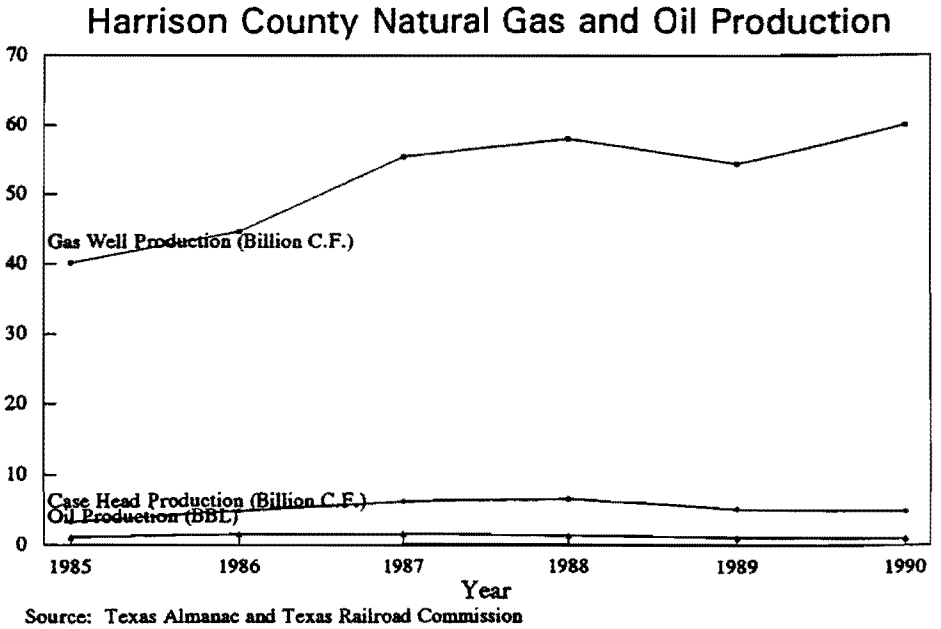


Figure 10 Harrison County Natural Gas and Oil Production

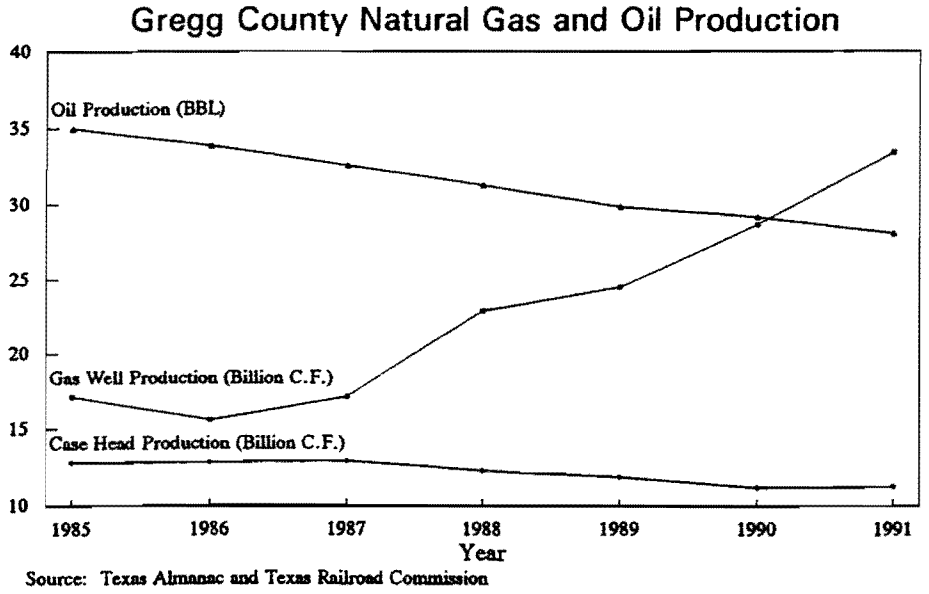


Figure 11 Gregg County Natural Gas and Oil Production

$783,837.65 worth of labor, and overhead expenditures of $517,908.72 were purchased from businesses located in other parts of Texas. These expenditures are summarized in Table 44.

Employment and output multipliers were developed from the 1986 Texas Input-Output Model to produce statewide estimates of impacts from U. S. Highway 80 widening expenditures. Impact estimates are made using the most applicable expenditure category in the input-output model, which is Category 20, New Road/Highway Construction. The estimated employment multiplier for New Road/Highway Construction is 53.7601 people 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 risen since 1986, the multiplier can be adjusted using the TxDOT construction cost index, which gives an adjustment factor of 1.1191 for 1991. An adjusted employment multiplier of 63.5 is generated by dividing the 1986 employment multiplier by the 1991 construction cost index. Applying this multiplier to the $8.1 million construction costs spent in Texas indicates that widening U. S. Highway 80 generated about 514 new jobs for the statewide economy. It is unknown how much employment was generated in the Longview area.

The total output multiplier is 3.69 dollars of output per dollar of expenditures. Applying this multiplier to the $8.1 million of construction expenditure in Texas construction expenditure indicates that widening U. S. Highway 80 generated about $29.9 million in additional output. Again it is unknown how much of this increase benefited the Longview area.

Local impacts of construction expenditures are difficult to determine because the Texas Input-Output Model is designed to average the economic relationships for all communities in Texas. Therefore, it is not truly representative of any specific city. Estimates of the economic benefits from the Longview area expenditures can be made, but extreme caution should be exercised in the use of the estimates provided in this report. Referring to Table 44, the total amount of expenditures made to Longview area vendors was $5.59 million dollars. Applying the Texas Input-Output multipliers to this value yields an estimated impact on Longview employment of 355 new jobs and $20.6 million of additional output.

Effects on User Costs and Accidents

In 1987, the biggest benefit in the first year after construction was expected to be the reduction in accident costs. At the end of the analysis period, when the route becomes more

Table 44 Distribution of the Contractor's Expenditures for Widening Marshall Avenue

Type of Cost	Location of Suppliers			TOTAL COST BY TYPE OF MATERIAL ($)
	Longview ($)	Elsewhere in Texas ($)	Outside Texas ($)	
Materials	2,616,400.48	1,632,187.64	698,841.20	4,947,429.32
Labor	1,448,503.77	713,494.93	70,342.72	2,232,341.42
Overhead	1,526,559.31	160,767.57	677,322.39	2,364,649.27
TOTAL COST BY LOCATION	5,591,463.56	2,506,450.14	1,446,506.31	9,544,420.01

Note: Overhead outside of Texas includes Netherton's profit because Netherton is headquartered in Louisiana.

Source: Netherton Company, Inc.

congested, delay savings were anticipated as becoming more important. The total discounted benefits to the users over the twenty year period was expected to be $30.7 million.

The 1992 results show that delay savings are the most important savings throughout the twenty year period. The total discounted benefits to the users are $95.91 million. A substantial part of these savings should be captured by the local economy, local residents using the improved facility, additional revenue to businesses along the route, and possibly increased property values.

Summary of Economic Impact

The City of Longview and motorists using the study section of U. S. Highway 80 have already benefitted from the improvements made on the facility. Business sales and property values along the highway are increasing. Also, the effects of construction expenditures of $5.59 million in the local area are still being felt. The construction period's negative impacts were held to a minimum by the early completion of the project.

CONCLUSIONS AND RECOMMENDATIONS

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

Conclusions

1. The widening of U.S. Highway 80 (Marshall Avenue) was accomplished almost in record time and minimally inconvenienced the motorists and abutting businesses and residents. Requiring the contractor to follow a well thought out construction and lane closure plan, along with maintaining good communication with all involved, seemed to be the keys to this success story.
2. Although the abutting businesses lost the mountable paved shoulder for customer parking and some front of business parking, very few were left with not enough parking to handle customer demand. Some of those businesses have built new parking areas to the side or back of the building.
3. The during construction period affected more businesses negatively than the after construction period. Less than a year after completion of the facility, most businesses were not experiencing negative effects on their gross sales or profit.
4. It is perhaps too early to assess the true effect that widening Marshall Avenue has had on property values and uses. The early signs reflected by the increased number of old building demolitions and the increased expenditures for remodeling and new buildings indicate that increased property values and higher uses are in the near future.
5. Motorists using the widened facility will benefit greatly. Travel time and the accident rate have declined significantly since construction was completed. The negative user costs generated during construction were more than offset by completion of the project a year earlier than scheduled.
6. The construction period produced a negative impact on some businesses, but these negative effects were offset by construction expenditures in the Longview area. Business customers and motorists will greatly benefit from the widened facility

in the years to come. Therefore, it has and will continue to produce a positive effect on the economy of the Longview area.

Recommendations

The following recommendations seem to be in order at this time:

1. The Longview construction and lane closure requirements should serve as a model for similar highway widening projects.
2. The economic impact findings of this study should be used by TxDOT planning officials to write and support environmental statements.
3. Since the after construction period was less that one year old, an updating follow-up study should occur five years from the completion of this study.

CITED REFERENCES

1. Buffington, J.L., W.F. McFarland, J.L. Memmott, and K.N. Womack, Estimated Impact of Widening U.S. Highway 80 (Marshall Avenue) in Longview, Texas, Research Report 01990, Texas Transportation Institute, Texas A&M University, College Station, Texas, September, 1987.

2. Memmott, J.L., The HEEM-III Benefit-Cost Computer Program, Research Report 01128, Texas Transportation Institute, Texas A&M University, College Station, Texas, November 1990.

3. McFarland, W.F. and M.K. Chui. The Value of Travel Time: New Estimates Using a Speed-Choice Model. Research Report 396-2F, Texas Transportation Institute, Texas A&M University, College Station, Texas, May 1986.

4. Transportation Research Board, Highway Capacity Manual, Special Report 209, Washington, D.C., 1985.

5. Memmott, J.L. and J.L. Buffington, A Model to Calculate Delay Savings for Highway Improvement Projects, Research Report 327-1, Texas Transportation Institute, Texas A&M University, College Station, Texas, October 1983.

6. Zaniewski, J.P. et al. Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Factors, Report No. FHWA/PL/82/001, Federal Highway Administration, Washington, D.C., March 1982.

7. Federal Highway Administration, Highway Performance Monitoring System Analytical Process, Vol. 2, Office of Highway Planning, Washington, D.C., January 1986.

8. Rollins, J.B. and W.F. McFarland, Costs of Motor Vehicle Accidents in Texas, Research

Report 396-1, Texas Transportation Institute, Texas A&M University, College Station, Texas, May 1985.

APPENDIX A CONSTRUCTION GUIDELINES

General:

The Contractor's particular attention is directed to the requirements of Item 7, "Legal Relations and Responsibilities to the Public", of the standard specifications. In addition to these requirements, the following provisions shall govern on this contract.

Traffic Control Plan:

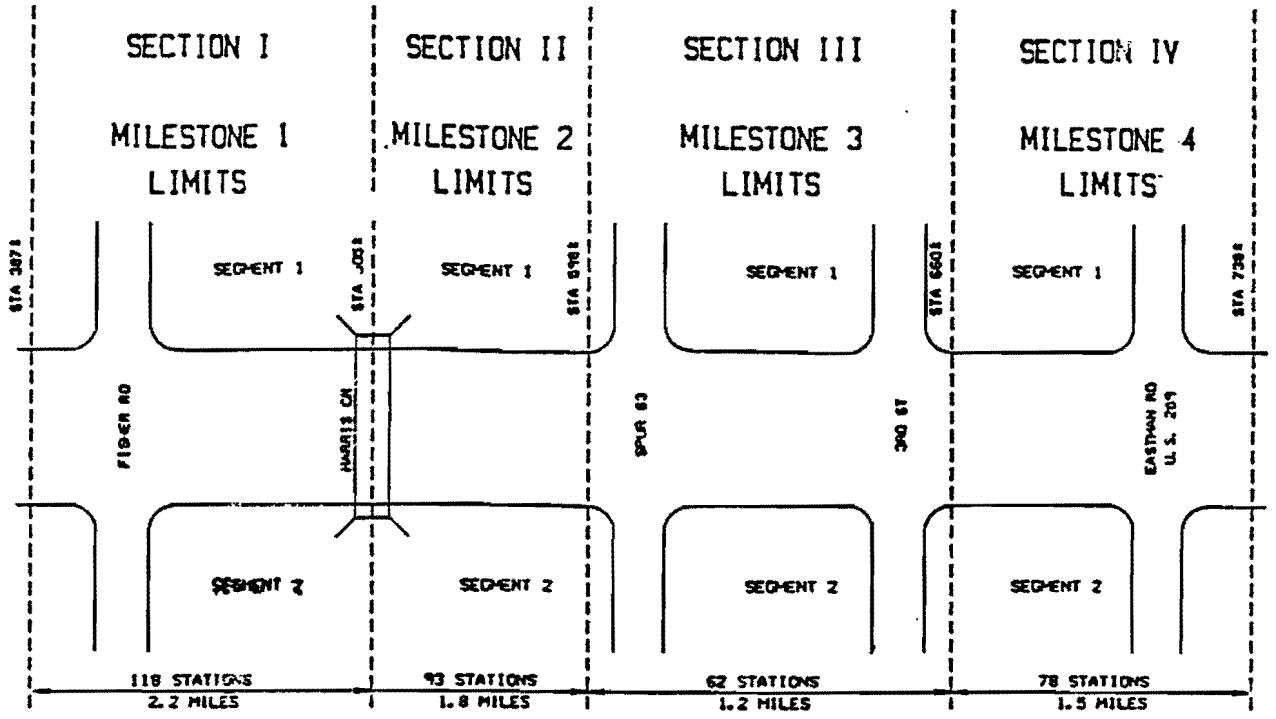
For this project, the traffic control plan consists of the installation and maintenance of barricades and warning signs, this special provision, applicable provisions of the Texas M.U.T.C.D., specification data which may pertain in the general notes, traffic control provisions included in the plans, and specification item 502.

Barricades and Warning Signs:

The present highway shall at all times be kept open to traffic. The Contractor shall maintain standard warning signs on the highway were hazards to traffic exist due to construction operations or on sections of highway on which the public cannot travel safely or comfortably at reduced speeds. In sections where there is excavation adjacent to the pavement edge, the contractor shall provide adequate warning signs, vertical panels, barricades and lights at the pavement edge, as directed by the engineer. The contractor shall place and maintain signs and barricades and/or flaggers to direct and/or route traffic at such points for such periods of time as may be required or directed by the engineer. For operations requiring a lane closure, the contractor shall use drums, vertical panels, signs, flaggers and arrow panels as necessary to route traffic around the closed lane as directed by the engineer. Lane closures will not be permitted between the hours of 7:00-8:30 A.M> and 4:30 -6:00 P.M., unless otherwise directed by the engineer. All construction traffic shall be regulated so as to cause a minimum of inconvience to traffic. At points where it is necessary for trucks to stop and unload, warning signs and floggers shall be provided to adequately protect the traveling public. The pavement shall be entirely open to traffic each night. No equipment shall be left in a position over night that will endanger traffic.

The contractor shall have at least one employee on call at night and on weekends (or any other time that work is not in progress) for maintenance of signs and barricades. This employee shall have an address and telephone number in the vicinity of the project, as approved by the engineer. The contractor shall notify the engineer in writing of the name, address, and telephone number of this employee, or these employees. The engineers will furnish this information to local law enforcement officials.

Figure A-1 Special Provisions for the Contractor to Operate Under During Construction



US-80 - MARSHALL AVENUE

In Longview

CONSTRUCTION MILESTONES

This contract has been divided into four work sections (Sections 1 thru IV) as shown above. Each of the four sections have been further divided into two work segments. Segments 1 being work on the North side of the existing centerline and Segment 2 being work on the south side of the existing centerline.

A milestone of work has been established for each of the four sections. Each milestone of work consists of completing Steps 1-8 in the construction Work Sequence as shown to the right. The contractor shall sequence his construction operations to complete the four milestones in consecutive order in accordance with the Special Provision, "Detours, Barricades, Sequence of Work, Traffic Control Plan, Etc."

Figure A-2 Map of Construction Sections and Construction Milestones

CONSTRUCTION WORK SEQUENCE

The Contractor is to construct sections I thru Iv in consecutive order unless otherwise directed by the Engineer. This construction sequence is intended to insure that the work will progress in an orderly manner with the least amount of inconvenience to the public and the adjoining property owners. At no time shall work be performed on opposite sides of the roadway at the same time as prescribed in the Special Provision, "Detours, Barricades, Warning Signs, Sequence of Work, Traffic Control Plan, Etc."

The following is the sequence of work within each segment that must be considered in the progress of work:

1. Preparation of Right of Way
2. Signal foundation & temporary signal installation
3. Storm drainage work and bridge widening work where applicable
4. Curb & Gutter work
5. Underground signal work
6. Concrete driveways
7. Subgrade widening and ACP (Ty A) Base
8. Sidewalks, landscape pavers & work behind curb & gutter including block sod, much sod, concrete work & ACP work
9. Planing work where needed
10. Seal Coat
11. 1 1/2" ACP Base Course
12. Construction pavement markings
13. Install detector loops & complete signal work
14. 1 1/2" ACP Surf
15. Final pavement markings & clean-up

Within each section work may begin with Prep ROW & Signal Work in both segments at the same time. The following restrictions shall also apply unless otherwise authorized by the Engineer in writing:

A. Storm Drainage Work will not be permitted in segment 2 until the Storm Drainage Work is completed & the Curb & Gutter Work is started in segment 1.

B. Curb & Gutter Work in segment 2 will not be permitted until the Subgrade Widening Work is under way in segment 1.

C. Work in the next Section will not be allowed to begin until the Subgrade Widening Work is under way in segment 2 of the preceding Section.

D. Work on Steps 9 thru 15 in a Work Section will not be permitted until the Milestone of Work (Steps 1-8) is complete in both segments within that Section.

When Sections I and II are complete, partial acceptance of the work will be allowed in accordance with Article 7.12, with the exception of the proposed traffic signal system.

Figure A-3 Construction Work Sequence

APPENDIX B MAIL QUESTIONNAIRE INSTRUMENTS

Appendix B-1 Contractor's Expenditure Data Form and Explanation of Filling Out the Form

CONTRACTOR EXPENDITURE DATA FORM
for
Research Study 9680
Conducted by
Jesse L. Buffington
Research Economist

TEXAS TRANSPORTATION INSTITUTE
TEXAS A&M UNIVERSITY SYSTEM
COLLEGE STATION, TEXAS 77843

Name of Project: U.S. Highway 80 Widening in Longview, Texas

Project Limits: A 6.7 mile section from Fisher Rd. to Eastman Rd.

General Contractor: Netherton Company, Inc.

Name of Contractor Furnishing Data: _____

Type of Work Performed: _____

Date Work Started: _____ Date Work Completed: _____

LOCATION AND TYPE OF EXPENDITURES	DOLLARS EXPENDED
Expenditures in Longview Area:	
Material costs:	_____
Labor costs:	_____
Overhead costs:	_____
Expenditures Elsewhere in Texas:	
Material costs:	_____
Labor costs:	_____
Overhead costs:	_____
Expenditures out of Texas:	
Material costs:	_____
Labor costs:	_____
Overhead costs:	_____
TOTAL EXPENDITURES	_____

EXPLANATIONS FOR FILLING OUT FORM

Expenditures in Longview Area:

Construction Materials:
Purchases of project materials from local suppliers located in Longview, in Gregg County or in the western part of Harrison County.

Labor:
Construction workers hired in the local area and who commute to work from their homes. They do the actual construction work on the project and are not salaried supervisors.

Overhead:
Local administrative expenses chargeable to the project. They include salaries of administrators, supervisors, and office help; expenses for office supplies, furniture, and equipment; office rent and utilities; and vehicle rental.

Warehouse, shop, and yard space cost or rental chargeable to the project.

Equipment cost or rental and fuel cost chargeable to the project.

Insurance, bonding fees, and property taxes chargeable to the project.

Expenditures Elsewhere in Texas

All materials, labor, and overhead expenses, as described above, that are chargeable to this Longview project.

Expenditures out of Texas

All materials, labor, and overhead expenses, as described above, that are chargeable to this Longview project.

Appendix B-2 Lane Closure Data Form

LONGVIEW US HIGHWAY 80 PROJECT LANE CLOSURE DATA

NO.	SECT NO.	SGMT NO.	DATE START	DATE END	LANE CLOSURE FROM	LANE CLOSURE TO	TYPE OF WORK
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							

Appendix B-3 Parking Use Survey Form

MARSHALL AVE. PARKING USE SURVEY

TABLE NO._____

DATE_____ HOUR_____ HOUR_____ Weather_____

Start Mileage_____ End Mileage_____ Temp_____

Code Number	Street Number	Name of Business	Shldr Veh	Oth Veh	Shldr Veh	Oth Veh

Appendix B-4 Business Mail Survey Form, 1987

Texas Transportation Institute
Texas A&M University System
College Station, Texas 77843

CONFIDENTIAL
Code No.____

MAIL SURVEY OF MARSHALL AVENUE BUSINESSES

Basic Information

1. Name of business _____

   Street address _____ Phone No._____

2. Operator of business_____

3. Owner of business _____

4. Owner of lot and building_____

5. Person interviewed: Owner_____Operator _____

6. Age of business _____ Years_____months

7. Building floor space (sq.ft.)_____number of occupants_____

8. Floor space occupied by this business (sq.ft.) _____

9. Number of parking slots provided on lot:

   For this business_____ Other businesses_____

10. Number of parking slots occupied by customers on lot:

    During busiest hour of average day _____busiest hour of year_____

11. Number of customers of this business during 1986:

    On average day of week _____busiest day of week_____

    busiest day of year_____

12. Number of hours of operation of business during 1986:

    Average week day hours_____ Average week-end hours_____

13. Number of employees of this business (including owner employed) during 1986:

    Full-time (average)_____ Part-time (average)_____

14. Total gross sales of this business for 1986 ($) _____

Expected Long-Term Effects of Widening Marshall Avenue
(after construction is completed)

1. How will a widened Marshall Avenue with a continuous two-way left-turn lane and curbs affect this business? (Please ask about each of the following effects:)

Items Affected	Effects (check one per line)					
	Very Positive	Positive	None	Negative	Very Negative	Don't Know
a. Left-turning customers	___	___	___	___	___	___
b. Right-turning customers	___	___	___	___	___	___
c. Number of parking slots			___	___	___	___
d. Number of employees	___	___	___	___	___	___
e. Gross sales	___	___	___	___	___	___

2. How will a widened Marshall Avenue with a continuous two-way left-turn lane and curbs affect <u>other businesses</u>? (Please ask about each of the following effects:)

Items Affected	Effects (check one per line)					
	Very Positive	Positive	None	Negative	Very Negative	Don't Know
a. Marshall Ave. businesses	___	___	___	___	___	___
b. Longview businesses	___	___	___	___	___	___

3. Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix B-5 Business Personal Interview Form, 1987

Texas Transportation Institute
Texas A&M University System
College Station, Texas 77843

CONFIDENTIAL
Code No.____

DETAILED SURVEY OF MARSHALL AVENUE BUSINESSES

Basic Information

Interviewer _____ Date _____

1. Name of business _____

   Street address _____ Phone No._____

2. Operator of business_____

3. Owner of business _____

4. Owner of lot and building_____

5. Person interviewed: Owner_____Operator _____

6. Age of business _____ Years_____months

7. Building floor space (sq.ft.)_____number of occupants_____

8. Floor space occupied by this business (sq.ft.) _____

9. Number of parking slots provided on lot:

   For this business_____ Other businesses_____

10. Number of parking slots occupied by customers on lot:

    During busiest hour of average day _____busiest hour of year_____

11. Number of customers of this business during 1986:

    On average day of week _____busiest day of week_____

    busiest day of year_____

12. Number of hours of operation of business during 1986:

    Average week day hours_____ Average week-end hours_____

13. Number of employees of this business (including owner employed) during 1986:

    Full-time (average)_____ Part-time (average)_____

14. Total gross sales of this business for 1986 ($) _____

Expected Long-Term Effects of Widening Marshall Avenue
(after construction is completed)

1. How will a widened Marshall Avenue with a continuous two-way left-turn lane and curbs affect this business? (Please ask about each of the following effects:)

Items Affected	Effects (check one per line) Very Positive	Positive	None	Negative	Very Negative	Don't Know
a. Left-turning customers	___	___	___	___	___	___
b. Right-turning customers	___	___	___	___	___	___
c. Number of parking slots			___	___	___	___
d. Number of employees	___	___	___	___	___	___
e. Gross sales	___	___	___	___	___	___

2. How will a widened Marshall Avenue with a continuous two-way left-turn lane and curbs affect <u>other businesses</u>? (Please ask about each of the following effects:)

Items Affected	Effects (check one per line) Very Positive	Positive	None	Negative	Very Negative	Don't Know
a. Marshall Ave. businesses	___	___	___	___	___	___
b. Longview businesses	___	___	___	___	___	___

3. Comments: _____

2. How did the added curb and left-turn lane affect this business? (Please ask about each of the following effects:)

	Amount			
	Increased	No Change	Decreased	Don't Know
a. Number of usable parking slots?	_____	_____	_____	_____
b. Number of customers per day?	_____	_____	_____	_____
c. Number of full-time employees?	_____	_____	_____	_____
d. Number of part-time employees?	_____	_____	_____	_____
e. Percent of gross sales?	_____	_____	_____	_____
f. Percent of net profit?	_____	_____	_____	_____
g. Others (state)_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

3. Comments: _____

_____

_____

_____

_____

_____

_____

_____

_____

Appendix B-6 Business Mail Survey Form, 1992

Date_____

Texas Transportation Institute
Texas A&M University System
College Station, Texas 77843-3135

CONFIDENTIAL
Code No.____

U.S. HIGHWAY 80 WIDENING ECONOMIC IMPACT SURVEY

Longview, Texas

Basic Information

1. Name of business_____

   Street address_____

2. Operator of business_____

3. Owner of business_____

4. Owner of lot and building_____

5. Age of business ___Yrs ___Months Floor space occupied by business _____Sq.Ft.

6. Parking spaces built for business _____ Spaces lost due to widening highway _____

7. Parking spaces occupied by customers of this business in past year:

   During busiest hour of average day _____ During busiest day of year _____

8. Please furnish the following information on your business for each year:

   NOTE: Such information will Be held extremely CONFIDENTIAL

	1988	1989	1990	1991	1992 (1st Half)
Number of employees (average #)					
• Full-time (incl working owner)	_____	_____	_____	_____	_____
Part-time	_____	_____	_____	_____	_____
Gross sales	_____	_____	_____	_____	_____
Net income before taxes	_____	_____	_____	_____	_____

Highway Widening Impact

1. How did the construction activity itself affect this business?

	Amount of Change During Construction			
	Increased	No Change	Decreased	Don't Know
Number of usable parking spaces?	____	____	____	____
Number of customers per day?	____	____	____	____
Number of full-time employees?	____	____	____	____
Number of part-time employees?	____	____	____	____
Percent of gross sales?	____	____	____	____
Percent of net income?	____	____	____	____
Other effects (state)? _____	____	____	____	____

2. How has the added curbs, gutters and two way left-turn lane affected this business?

	Amount of Change After Construction			
	Increased	No Change	Decreased	Don't Know
Number of usable parking spaces?	____	____	____	____
Number of customers per day?	____	____	____	____
Number of full-time employees?	____	____	____	____
Number of part-time employees?	____	____	____	____
Percent of gross sales?	____	____	____	____
Percent of net income?	____	____	____	____
Other effects (state)?_____	____	____	____	____

3. How has a widened Marshall Avenue (U.S. Highway 80) with a continuous two-way left-turn lane, curbs and gutters affected other businesses?

	Effects (check one per line)					
	Very Positive	Positive	None	Negative	Very Negative	Don't Know
Marshall Avenue businesses?	___	___	___	___	___	___
Longview businesses?	___	___	___	___	___	___

4. Comments:_____

_____

_____

APPENDIX C PHOTOGRAPHS SHOWING CHANGES IN FACILITY AND ABUTTING PROPERTY

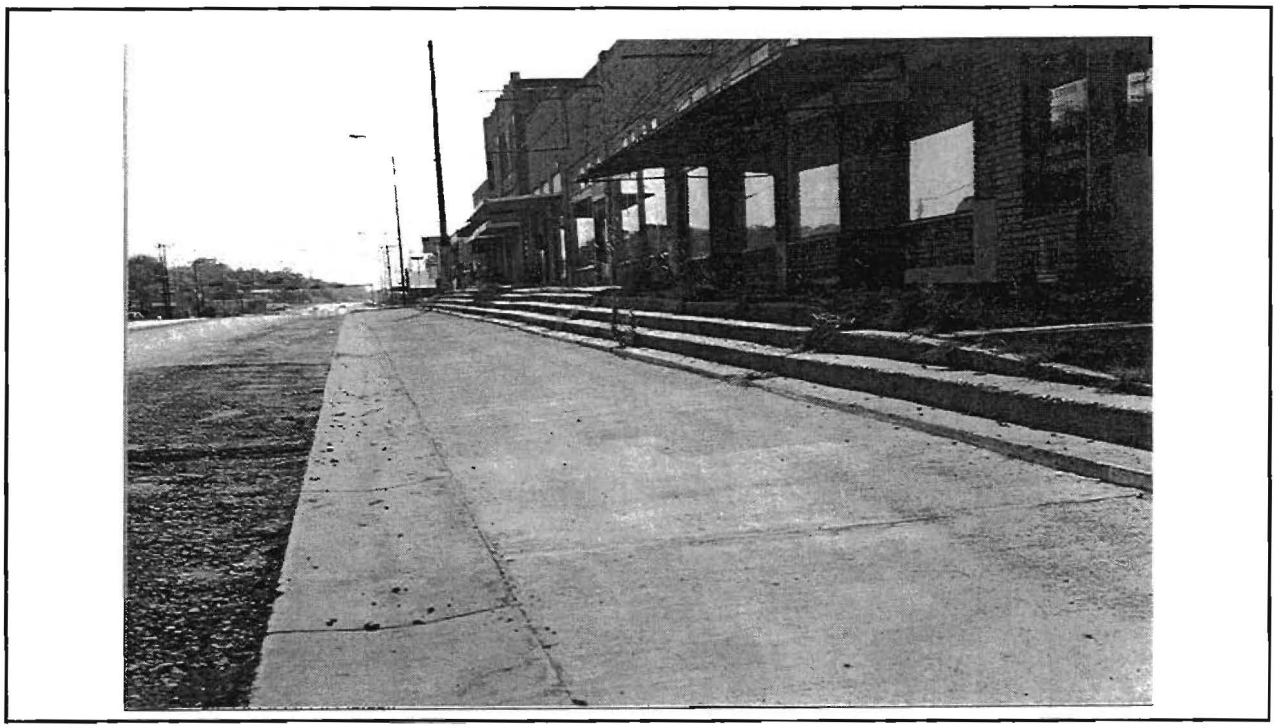


Figure C-1 Reduced Parking from Head-In Angle to Parallel Parking in Front of Old Businesses in Old Building

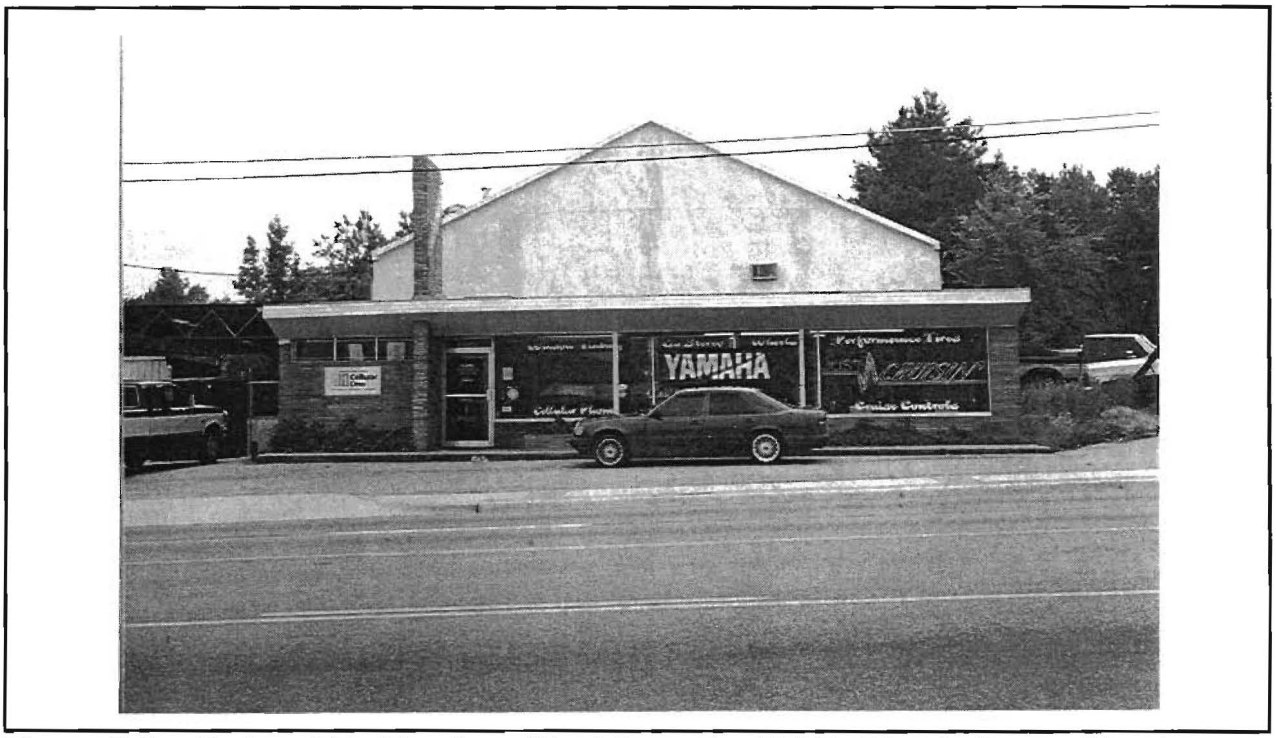


Figure C-2 Reduced Parking from Head-In to Parallel Parking in Front of Business

Figure C-3 Curb Breaks of Widened Facility that Allow Head-In Parking for Business

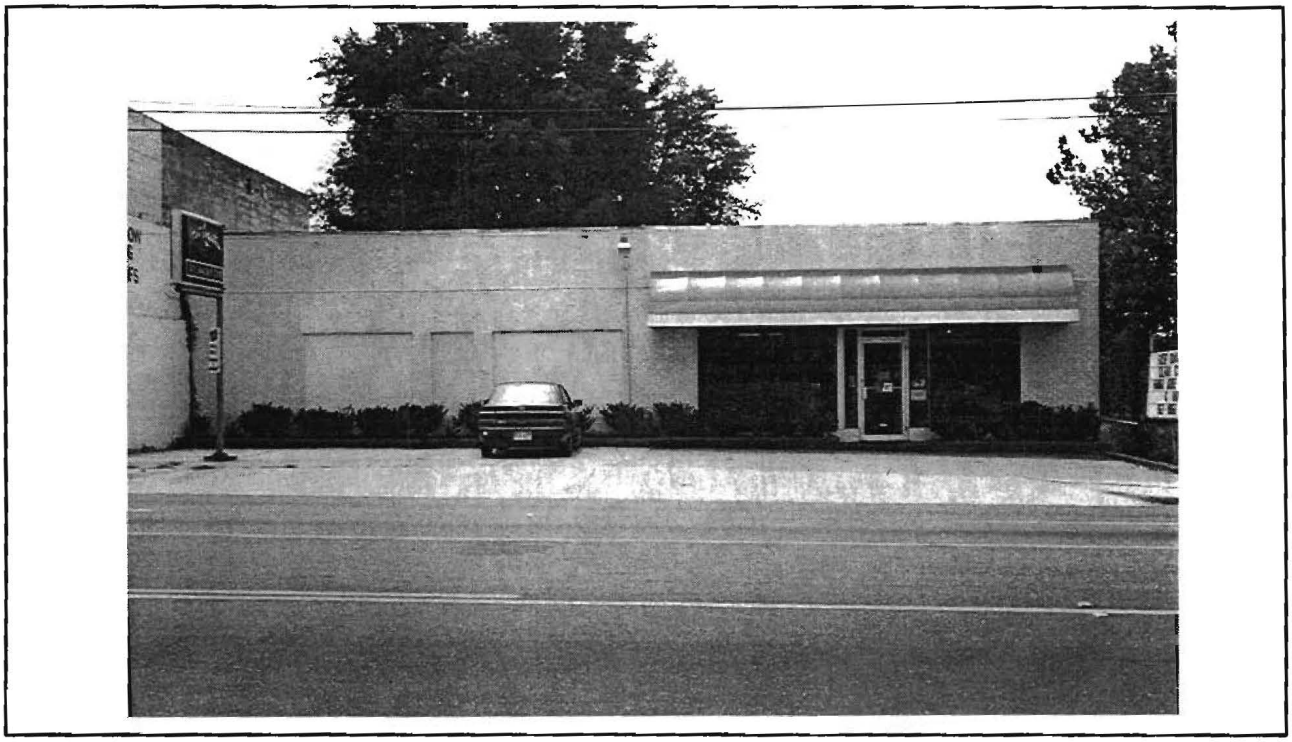


Figure C-4 Curb Breaks of Widened Facility that Allow Head-In Parking for Business

Figure C-5 Newly Widened Section is Tied into a Previously Widened Intersection in the Foreground

Figure C-6 Curbing at Previously Widened Intersection is Reworked

Figure C-7 Reworking Storm Sewer Openings at Previously Widened Intersections

Figure C-8 New Ornamental Sidewalks Built on Each Side of the Widened Facility

Figure C-9 Almost Finished Facility Showing Continuous Two-Way Left-Turn Lane, Curbs, and Ornamental Sidewalks

Figure C-10 Finished Facility Showing Curbing, Driveways, Sidewalks, and Continuous Two-Way Left-Turn Lane

Figure C-11 Finished Facility in Front of One of the Existing Businesses

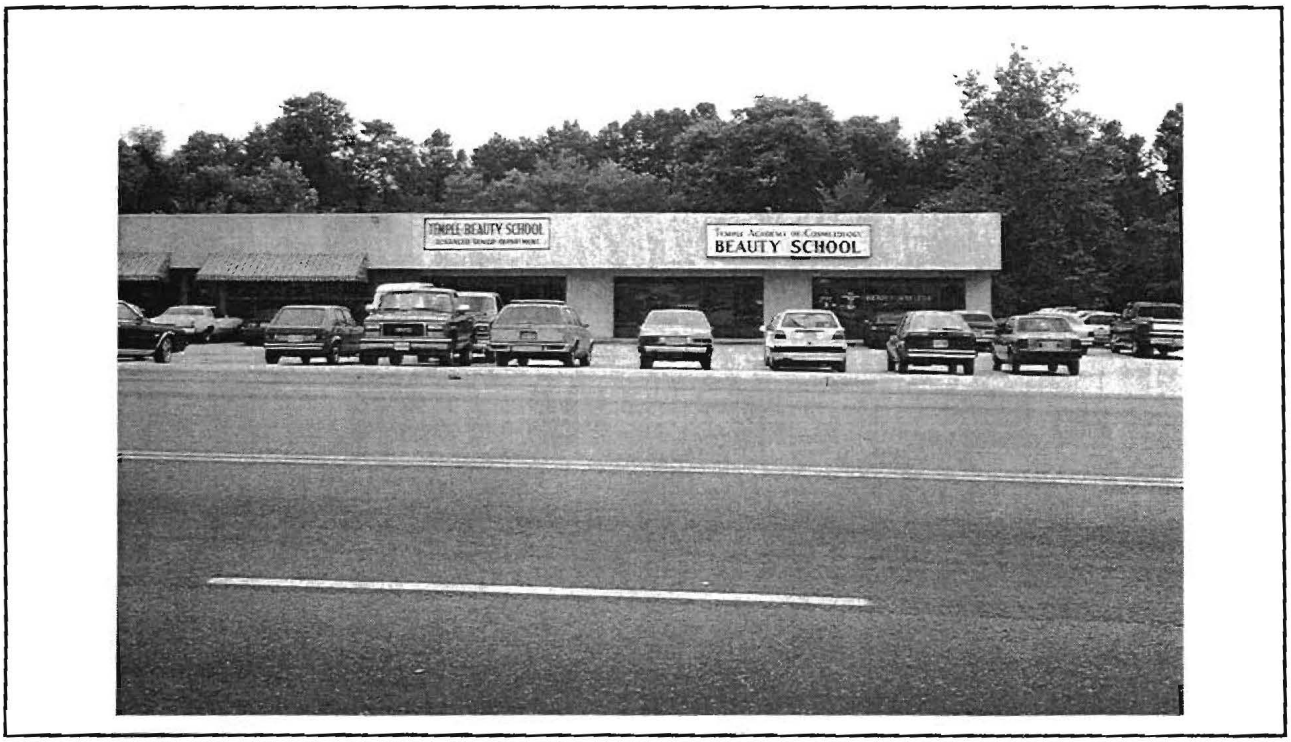


Figure C-12 Finished Facility in Front of Expanded Business

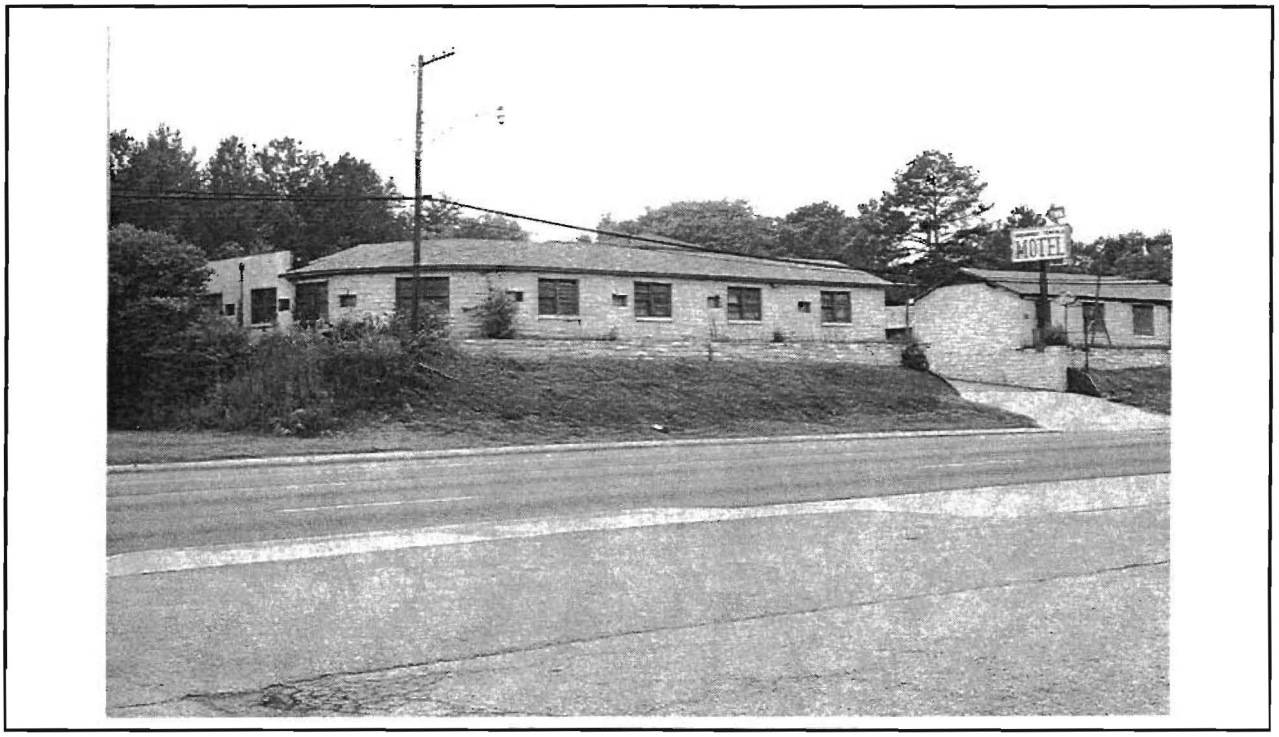


Figure C-13 Finished Facility in Front of a Closed Business

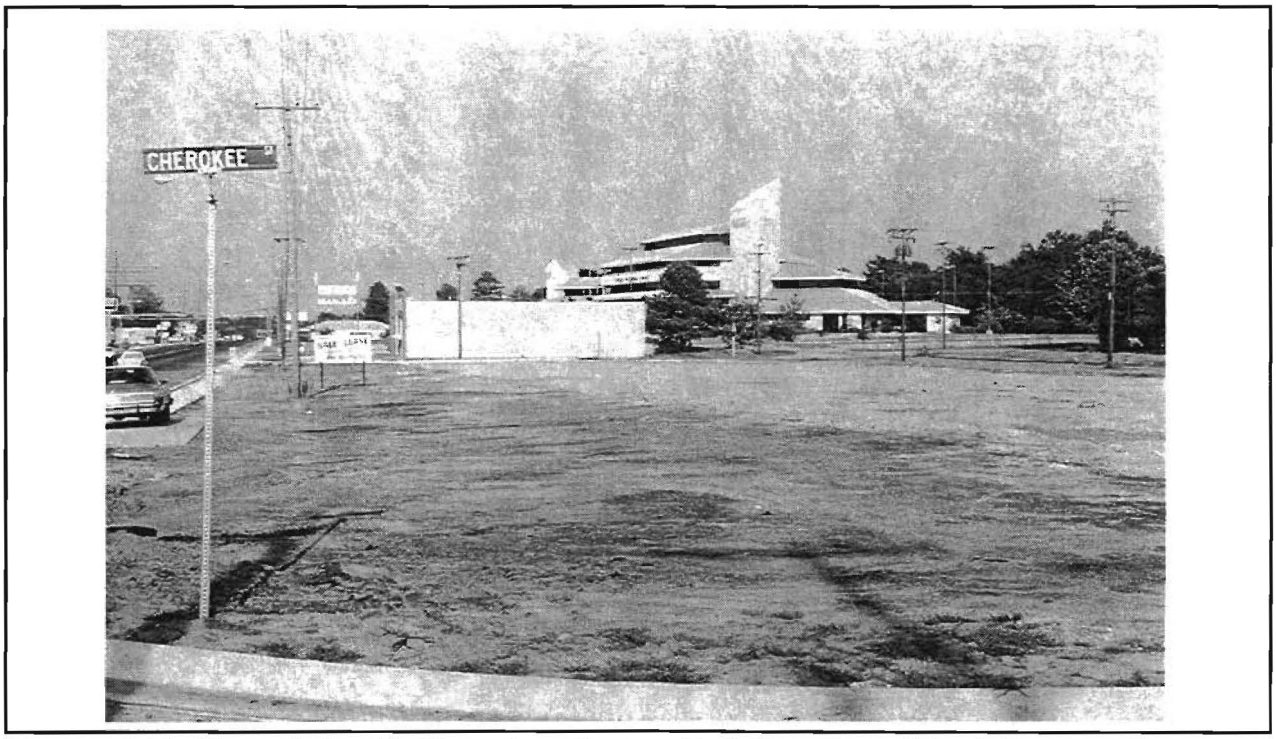


Figure C-14 Site of Small Shopping Center Building Demolished Due to Structural Damage from a Nearby Rail Car Blast

APPENDIX D SUPPLEMENTARY USER COST INFORMATION

Table D-1 Lane Closure Length and Time Requirements by Section and Type of Work

Type of Work	Average Length of Lane Closure			
	Section 1	Section 2	Section 3	Section 4
1 Preparation of Right-of-Way	--	0.30 (2)	0.50 (3)	--
3 Storm Drainage Work and Bridge Widening Work Where Applicable	0.56 (1)	--	0.33 (4)	0.29 (84)
4 Curb & Gutter Work	0.54 (3)	0.25 (2)	0.38 (46)	0.80 (93)
5 Underground Signal Work	--	--	--	0.20 (1)
6 Concrete Driveways	0.56 (1)	--	0.36 (25)	0.86 (84)
7 Subgrade Widening and ACP (Ty A) Base	0.57 (19)	0.70 (28)	0.42 (59)	1.14 (69)
8 Sidewalks, Landscape Pavers, & Work Behind Curb & Gutter Including Block Sod	0.72 (22)	0.43 (14)	0.41 (40)	0.79 (152)
10 Seal Coat	--	0.25 (8)	0.50 (3)	1.03 (3)
11 1 1/2" ACP Base Course	0.91 (13)	0.77 (9)	0.54 (18)	0.64 (47)
12 Construction Pavement Markings	--	1.56 (1)	1.88 (1)	1.50 (1)
13 Install Detector Loops & Complete SIgnal Work	0.16 (1)	0.12 (15)	0.44 (12)	--
14 1 1/2" ACP Surf	0.90 (8)	0.38 (3)	--	0.50 (2)
15 Final Pavement Markings & Clean-Up	0.72 (43)	0.48 (13)	0.38 (46)	0.63 (76)
Average Lane Closure Length per Section	0.72 (111)	0.49 (95)	0.41 (257)	0.74 (612)