

The Economic Impact of Interstate Highway 10 On A Rural Area East of Houston, Texas

by

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on Selected Areas in Texas

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The opinions, findings, and conclusions expressed in this publication are those of the author and not necessarily those of the Bureau of Public Roads.

Foreword

In November of 1957, the U. S. Bureau of Public Roads and the Texas Highway Department authorized the Texas Transportation Institute to conduct an economic impact study along sections of the Interstate Highway System in Texas. This authorization called for joint financial support by the Bureau of Public Roads and the Texas Highway Department.

The study was to include an analysis of the economic impact of the Interstate Highway System on local areas. With the advice of the Project Advisory Committee, nine such sites were selected for initial study in or near the following Texas cities: Austin, Temple, Rockwall, Waxahachie, Merkel, Houston, Huntsville, Conroe, and Anahuac. At a later date, the Committee authorized a restudy of the Austin and Temple areas.

Preliminary reports were made to the sponsors on the following study sites: Austin, Temple, Rockwall, Waxahachie, Merkel, and Huntsville. Final reports have been prepared on the Austin, Temple, Rockwall, Waxahachie, Merkel and Houston areas. By September 1, 1966, final reports will have been prepared on the remaining study areas: Huntsville, Conroe, and Chambers County (Anahuac).

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Summary of Findings

The economic effects of IH 10 on the Houston study area were measured in terms of changes in land value, land use, and business activity.

The results of the findings, in brief, are as follows:

1. Land values increased significantly more in the study area than in the control area between the "before" and "after" construction periods.

2. The impact of the new highway on study area land values was evident, regardless of whether the tracts selling were abutting or not abutting the facility. Abutting tracts received a greater initial impact.

3. The eastern half of the study area (Section 2) received a much greater highway impact on land values than the more highly developed western half (Section 1).

4. The extent of changes in the quantity of study area land in various uses between 1954 and 1962 indicates a considerable highway influence on land use. There was approximately a 44 percent decrease in the acreage of agricultural land during this period and a corresponding increase in the commitment of land to higher uses.

5. Business activity, commercial and industrial, increased between 1958 and 1962 in the study area. The volume of gross sales of the cooperating retail businesses increased during that period. A major petrochemical plant which located along IH 10 in the study area is the most significant sign of industrial economic change which has occurred. It appears that the ripening period for this area is about over and that much new development will occur shortly.

Introduction

Purpose of Study

The purpose of the over-all study is to determine the economic changes caused by an Interstate Highway constructed in various types of local areas. The findings in each area may be used in anticipating the economic effects of the Interstate System upon comparable areas over the state.

For the over-all study, the principal objectives were as follows:

1. To determine land value changes in each area and to relate land value changes to the proximity of the new highway.
2. To determine land use changes in each area and relate them to the proximity of the new facility.
3. To determine the effects of the new highway on over-all business activity in each area.
4. To determine the effects of the new highway on general travel habits within each area.
5. To determine other economic changes which might affect the general development of each area.

The Houston area lends itself best to the fulfillment of the first two objectives, because the new highway is located a considerable distance from any other existing highway. Also, this area was purposely selected to find out if measurable effects could be obtained in an almost completely agricultural area, rice farms at that, where quick and positive land value and land use changes would be least anticipated.

New IH 10

Before the Highway Act of 1956 brought into existence the Interstate Highway System, the Texas Highway Department and the three counties involved had already initiated plans to build a more direct route connecting Houston with Beaumont and Port Arthur. In fact, this route had been under consideration for probably 15 years before 1956. It was not until 1947, the year right of way purchasing began, that any concrete action was taken toward actually building the road designated as State Highway 73.

By 1952 most of the 300 foot right of way in Harris County was purchased. Since the right of way was acquired by the county in sections, construction contracts were let by sections with some segments being opened to traffic as early as 1952. The section closest to Houston, stretching from downtown to Wayside Drive, was still under construction in late 1965.

When Highway 73 was designated Interstate Highway 10, additional right of way was required at interchanges to meet the higher design standards. These purchases were made by the state.

Study Area

A nine-mile section, beginning 21 miles from Houston's central business district, was selected as an economic

impact study area. (See Figure 1.) Construction was let for this section in 1955 and it was opened to traffic in May, 1959. Prior to this time, the study area did not have direct access to a state or federal highway.

The area is about six miles north of Baytown, the nearest incorporated town of any consequence. The study area has two natural boundaries, the San Jacinto River to the west and Cedar Bayou to the east. It is approximately two miles wide, one on either side of IH 10. About 13,000 acres make up the study area. Much of this land area is being used for rice production.

The area engulfs McNair, an unincorporated community of perhaps 1,000 inhabitants. (See Figure 2 for a 1964 aerial view.) Most of the homes in McNair are small and of frame construction. The community is built around the railroad on the west side of the study area.

To the west of McNair and near the San Jacinto River, several rural subdivisions are about one half built-up with homes, of primarily frame and asbestos siding construction. There are a few brick homes in this area. The other parts of the study area are sprinkled with rural residences and farm houses. As a whole, the study area is populated with low to medium income families.

Control Area

Another area was selected as a control for study area land values. This area is located about one mile directly north of the study area. In most respects, it is similar to the study area so far as land use is concerned. Both areas share two common hard top roads leading north and south. U. S. Highway 90, the alternate route from Houston to Beaumont, passes through the north western tip of the control area. Also a railroad is located near, but not in the control area.

Most of the unincorporated town of Barrett is located in the control area. (See Figure 3 for a 1964 aerial view.) The homes are primarily of frame or asbestos siding construction with a few brick homes scattered through the town. Many rural residences are scattered through the control area. As a whole, the homes in this area are better quality than those in the study area. However, the average family income of the control area occupants is not likely to be much greater than that of the study area.

The control area is very nearly the same size as that of the study area. Much of the rural area is in agricultural use—primarily rice production. A small portion is covered with pine forests.

Method of Study

The primary methodology employed throughout this study is the "before" and "after" comparative technique. The before and after periods are dictated by the construction schedule of the new Interstate Highway. The procedures, sources of information, and specific before and after years required for the different phases of the study are presented below.

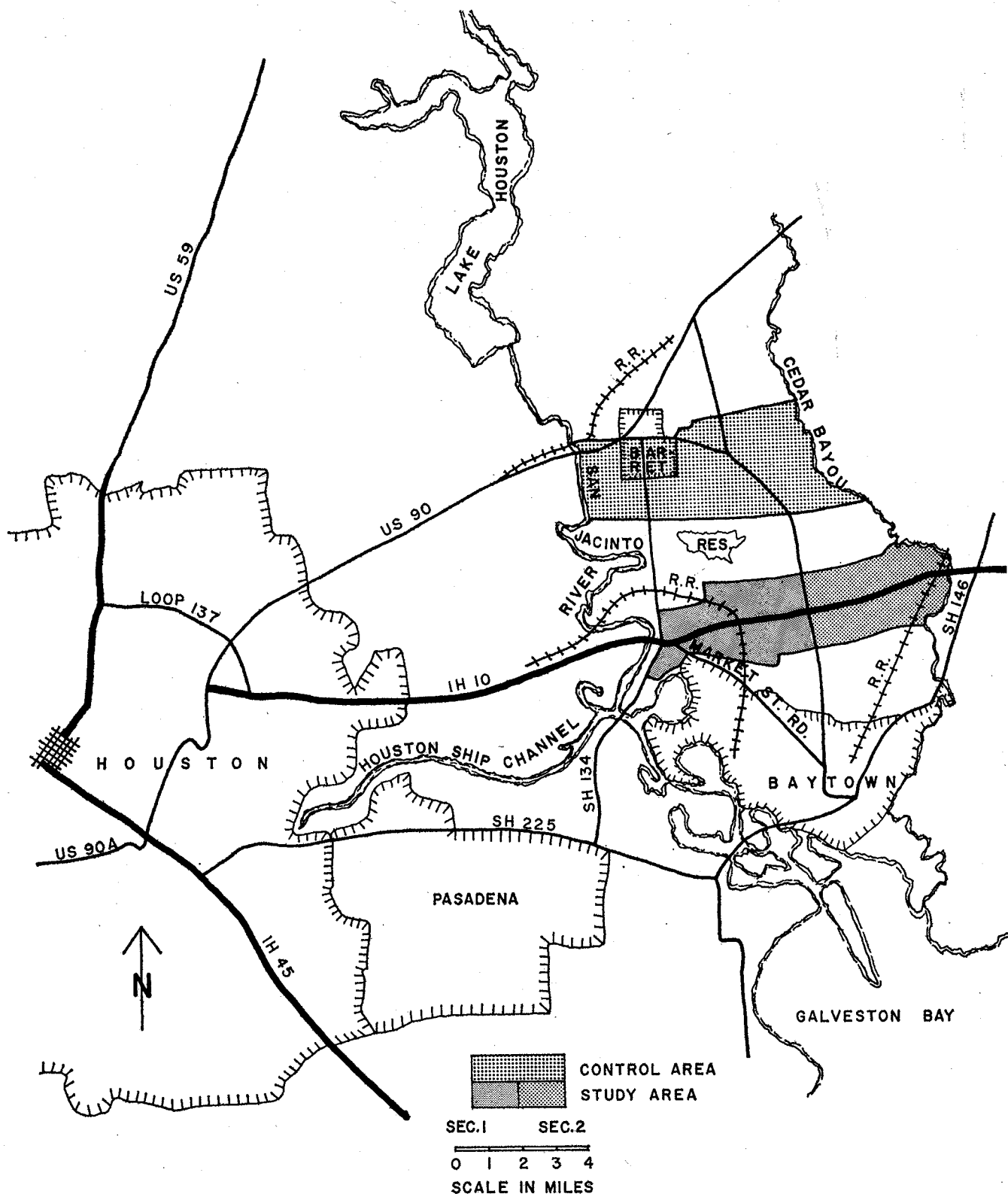


Figure 1. A map showing the location of the transportation system and municipalities connected with the Houston study and control areas.

Land Value. Considering that real estate sales prices, made in a competitive market, may be taken to be the best indication of land or property values, an effort was made to collect all bonafide sales in the study

and control areas from the county deed records for a 13-year period. This period includes a five-year before construction period, 1950-54; a four-year during construction period, 1955-58; and a four-year after con-



Figure 2. A 1964 Aerial View of the Houston Study Area.

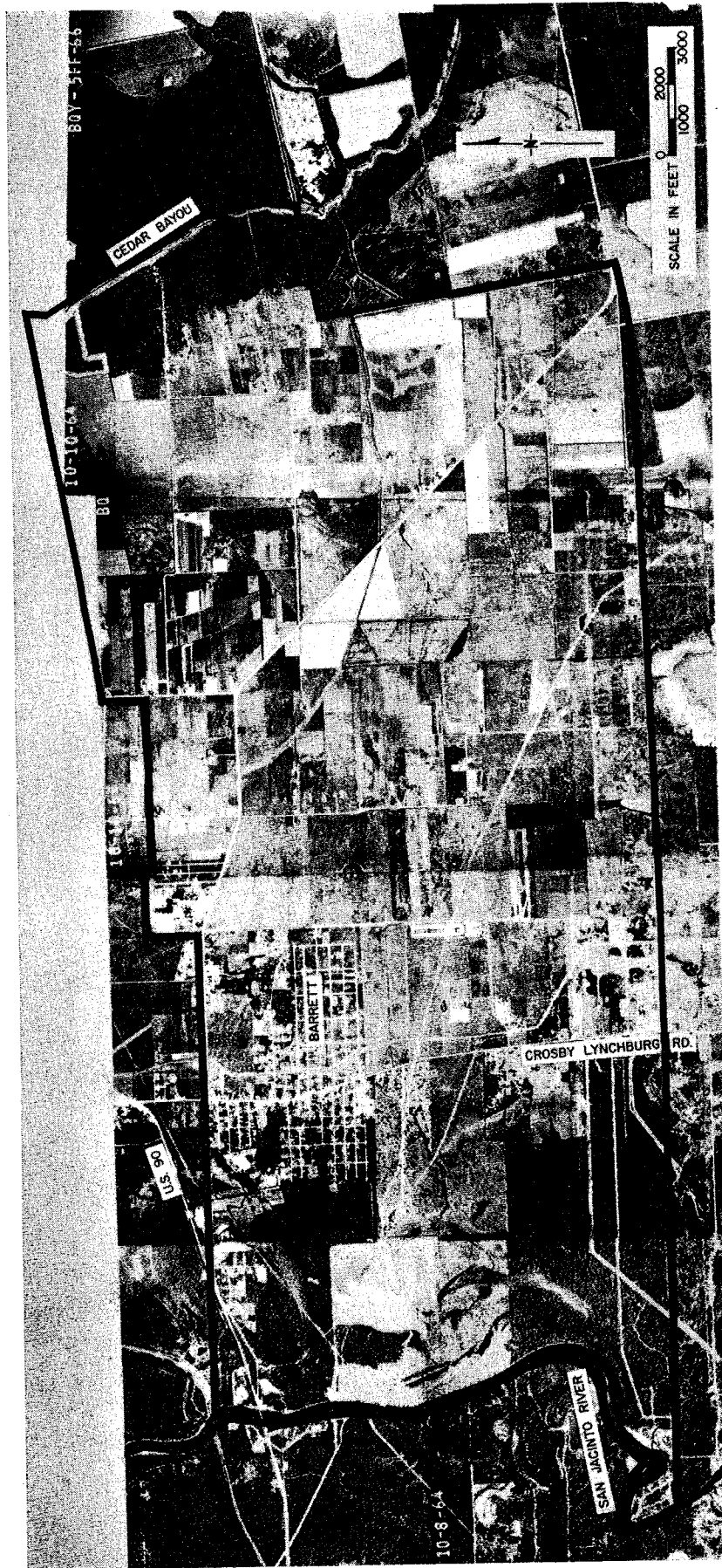


Figure 3. A 1964 Aerial View of the Houston Control Area.

struction period, 1959-62. In some segments of the overall research study, the construction period encompassed the period of time when the right of way was being purchased. But for the Houston area, the right of way was purchased so far back, 1947-52, that it was not included in this period.

If the purchase price of a bonafide sale in either the study or control area could be determined by reading the deed, the necessary information (such as date of sale, name of buyer and seller, and area purchased) was recorded directly on take off cards. This and other information was later punched on cards and analyzed through the use of the Texas A&M University Data Processing Center.

When the purchase price was determined by use of the United States Internal Revenue Stamps values, every \$.55 stamp was considered as \$500 of consideration, except for the last \$.55 which was valued at \$250 to reduce the bias introduced into the sales price. Also, to remove the influence of inflation on the value of dollar, the consideration of each sale was adjusted by the Consumer Price Index, computed by the Bureau of Labor Statistics of the United States Department of Commerce. (See schedule in the Appendix.)

The study area properties selling during the 1950-62 time period were identified in order to determine their location in relation to the new highway. This was necessary in order to analyze property value changes on an abutting and nonabutting basis. Also, to determine the influence (if any) of closeness of Houston on land values, the properties in the study area were divided on a sectional basis. The western half was coded Section 1, and the eastern half was coded Section 2.

Each property was inspected to determine its land use before and after sale. Improved properties were analyzed separately. Also, subdivision sales were separated from acreage sales. The burden of proof concerning the extent of highway benefit is placed upon the price changes of unimproved acreage properties.

The extent of highway influence on land values in the study area is determined by comparing the time period changes in study area property unit (per acre or per square foot) prices with those of the control area.

The variation in unit prices for each type of property is shown in some of the tables. Also, a measure of the degree of closeness between the study and control area before and after period unit prices were shown in the footnotes of the tables. This consisted of reporting the standard error of the difference, the *t* value, and the percent level of probability for the pair of means of each period. See the appendix for an explanation of these terms and the formulas used.

Land Use. Land use changes occurring between the before and after periods were recorded for all properties in the study area. This information was collected by the aid of personal interviews with property owners and realtors, aerial photographs, and by visual inspection. The basic land use was established for the year 1954, the last year before construction began on the study area segment. The last year of the study, 1962, became the after year, or the year in which to determine land use changes.

Each property was assigned one of eight land use designations for each of the above years. They are as follows:

1. Agricultural—tract used primarily for agricultural purposes by an owner who depends upon farming for a livelihood. The minimum size is 10 acres, except for intensive type farming.
2. Held for future use—tract generally considered to be held for future use rather than for its utility at present; however, it may be farmed or grazed or used for other purposes during the interim period.
3. Rural residential—tract having an occupiable house used primarily as a residence. The maximum size is 15 acres.
4. Urban residential—tract subdivided into lots improved with occupiable houses in most cases.
5. Commercial traffic serving—tract having a commercial business deriving more than 50 percent of its income from traffic.
6. Commercial nontraffic serving—tract having a commercial business deriving less than 50 percent of its income from traffic.
7. Industrial—tract used for manufacturing, product storage, and surface facilities or pipelines.
8. Institutional-Municipal—tract used for school, park, hospital, church, or other public function.

Business Activity. Business activity in the Houston area was studied by means of personal inspection and interviews with operators of each business. An inventory was made of all businesses operating in 1958 (the last year before the new highway was opened to traffic) and 1962 (the last year of study). The retail businesses were interviewed to obtain gross dollar sales and other pertinent information. Average daily traffic volume information was obtained from the Texas Highway Department to detect any influences that changes in traffic volumes may have had on business volumes in the area.

Changes in number, type, and gross sales of retail businesses are used to indicate the extent of highway influence on retail businesses in the study area.

Changes In Land Values

During the 13 years of study, some 717 bonafide real estate sales with determinable considerations occurred in the Houston study area. Of this number, 225 were acreage sales and 492 were subdivision sales. In the same period the control area had 471 sales, 79 acre-

age sales and 392 subdivision sales. Table 1 shows the number of improved and unimproved sales and the division of these sales between Sections 1 and 2. However, due to the limited number of Section 2 subdivisions sales, the sectional analysis was limited to acreage comparisons.

Table 1
NUMBER OF LAND SALES TRANSACTIONS OCCURRING IN THE HOUSTON STUDY AND CONTROL AREAS FOR THE 1950-62 PERIOD

Period	Number of Transactions				Grand Total
	Acreage		Subdivisions		
	Unimproved	Improved	Unimproved	Improved	
STUDY AREA					
Section 1					
Before Period (1950-54)	27	27	143	54	251
Construction Period (1955-58)	33	19	86	60	198
After Period (1959-62)	6	12	98	45	161
Section 2					
Before Period (1950-54)	34	8	5		47
Construction Period (1955-58)	29	4			33
After Period (1959-62)	21	5		1	27
Total All Periods for Study Area	150	75	332	160	717
CONTROL AREA					
Before Period (1950-54)	26	2	108	24	160
Construction Period (1955-58)	22	2	94	65	183
After Period (1959-62)	25	2	54	47	128
Total All Periods for Control Area	73	6	256	136	471

Table 2
CHANGES IN PRICES OF UNIMPROVED ACREAGE TRACTS LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS, IN CONSTANT DOLLARS (1947-49 = 100)

Period	Study			Control			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price Per Acre	Standard Deviation	Number of Sales	Price Per Acre	Standard Deviation		
Before Period (1950-54)	61	\$ 535	\$ 993	26	\$ 225	\$189	\$ 310 ¹	
Construction Period (1955-58)	62	733	673	22	228	162	505	
After Period (1959-62)	27	1137	1376	25	353	187	784 ²	
Increase Between Periods								
Before and Construction		\$ +198			\$ + 3		\$ +195	+36.4%
Dollars								
Percent		+ 37.0%			+ 1.3%		+ 35.7%	
Construction and After		\$ +404			\$ +125		\$ +279	
Dollars								
Percent		+ 55.1%			+ 54.8%		+ 0.3%	
Before and After		\$ +602			\$ +128		\$ +474	+88.6% ³
Dollars								
Percent		+112.5%			+ 56.9%		+ 55.6% ⁴	
Probable Highway Influence								
Percent ⁵		+ 72.1%						
Dollars ⁶		\$ +388						

¹The standard error of the difference between the means (S.D.) of the study and control area is \$197; T is equal to 1.57. This is significant beyond the 80% level.

²The S.D. is \$278; t is equal to 2.82. This is significant beyond the 99% level.

³Assuming that property prices in the control and study areas would have increased in value by the same dollar value in the absence of a new road improvement, the between period dollar difference between areas would have been zero. However, in most cases, the presence of a new road caused study area prices to increase by a greater dollar amount with the net difference shown above which is then stated as a percent of the study's before period price.

⁴Same assumption as Footnote 3, but based on percentage changes between areas instead of dollar changes.

⁵Average of Footnotes 3 and 4 percentages.

⁶Footnote 5 percentage multiplied by the study area's before period price.

The average prices used in this section of the report are in constant dollars, and they are not weighted by the area sold. Two other measures, the actual average prices (not area weighted) and the area weighted average prices in constant dollars, are presented in the Appendix, but are not included in the body of the report.

Acreage Land

The acreage land sales (both unimproved and improved) were scattered throughout the study area with some sales of acreage tracts abutting the new highway. The analysis of these sales is presented first on an overall basis; second, on an abutting and nonabutting basis; and third, on a sectional basis. The study area values are compared to those of the control area according to the above three groupings.

Over-all Analysis. Table 2 shows the study and control price changes of unimproved acreage property. The unit prices of study area tracts increased consistently between the three time periods. The same was true for the control area, but to a lesser extent. Both absolute dollar changes and percentage increases were substantially greater in the study area. The probable highway influence, explained in the footnotes under Table 2, was \$388 per acre or 72.1 percent of the study area before period price.

It is reasonable to assume that the above is a modest estimate of the over-all highway influence on land values. It apparently does not represent the total highway influence, since the before period used does not cover the period when the right of way was being purchased. Other studies have shown that substantial changes in nearby land values occur during this time of first right of way purchase. Also, since 1962 (the cut-off date for data collection) there are strong indications that the highway impact on land values has continued at an accelerated rate.

There were not enough improved acreage sales in the control area to permit a statistical comparison with these types of properties in the study area. Furthermore, the quality of improvements on properties selling in different time periods differed greatly in both study and control areas. These variations in quality of improvements over a limited number of sales, made a comparative analysis impractical.

Abutting Versus Nonabutting Analysis. The impact of the new highway throughout the study area was evident regardless of whether the tracts selling were abutting or not abutting the facility. Table 3 shows that the before to after period price changes of abutting and nonabutting properties were greater than those of the control area. However, the table also shows that most

Table 3
CHANGES IN PRICES OF ABUTTING AND NONABUTTING UNIMPROVED ACREAGE TRACTS IN THE STUDY AREA AS COMPARED TO THE CONTROL AREA, HOUSTON, TEXAS, IN CONSTANT DOLLARS (1947-49 = 100)

Period	Price Per Acre ¹			Difference Between Areas			Percent of Respective Parts of Study Area's Before Period Price	
	Study Area Abutting	Study Area Nonabutting	Control Area	Abutting vs. Non-abutting	Abutting vs. Control Area	Non-abutting vs. Control Area	Abutting	Non-abutting
Before Period (1950-54) ²	\$ 299(17)	\$ 627(44)	\$ 225(26)	\$ 328	\$ 74	\$ 402		
Construction Period (1955-58)	708(16)	742(46)	228(22)	34	480	514		
After Period (1959-62) ³	760 (7)	1,269(20)	353(25)	509	407	916		
Increase Between Periods								
Before and Construction Dollars	+\$409	+\$ 115	+\$ 3	+\$294	+\$406	+\$112	+135.8%	+17.9%
Percent	+136.8%	+ 18.3%	+ 1.3%	+118.5%	+135.5%	+ 17.0%		
Construction and After Dollars	+\$ 52	+\$ 527	+\$125	-\$475	-\$ 73	+\$402		
Percent	+ 7.3%	+ 71.0%	+ 54.8%	- 63.7%	- 47.5%	+ 16.2%		
Before and After Dollars	+\$461	+\$ 642	+\$128	-\$181	+\$333	+\$514	+111.4%	+82.0%
Percent	+154.2%	+ 102.4%	+ 56.9%	+ 51.8%	+ 97.3%	+ 45.5%		
Probable Highway Influence⁴								
Percent	+104.4%	+ 63.8%						
Dollars	\$+312	\$+ 400						

¹Number of transactions is shown in parentheses.

²The S.D. between the means of the study area (abutting) and the study area (nonabutting) is \$282; t is equal to 1.16. This is significant beyond the 70% level. The S.D. between the means of the study area (abutting) and the control area is \$92; t is equal to 0.80. This is significant beyond the 50% level. The S.D. between the means of the study area (nonabutting) and the control area is \$224; t is equal to 1.70. This is significant beyond the 90% level.

³The S.D. between the means of the study area (abutting) and the study area (nonabutting) is \$608; t is equal to 0.84. This is significant beyond the 50% level. The S.D. between the means of the study area (abutting) and the control area is \$87; t is equal to 4.68. This is significant beyond the 99% level. The S.D. between the means of the study area (nonabutting) and the control area is \$318; t is equal to 2.88. This is significant beyond the 99% level.

⁴See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 4

CHANGES IN THE PRICES OF UNIMPROVED ACREAGE TRACTS IN SECTIONS 1 AND 2 OF THE STUDY AREA AS COMPARED TO THE CONTROL AREA, HOUSTON, TEXAS, IN CONSTANT DOLLARS (1947-49 = 100)

Period	Price per Acre ¹			Differences Between Areas			Percent of Study Areas Section's Before Period Price	
	Study Area Section 1	Study Area Section 2	Control Area	Section 1 vs. Section 2	Section 1 vs. Control Area	Section 2 vs. Control Area	Section 1	Section 2
	Before Period (1950-54) ²	\$917(27)	\$ 232(34)	\$ 225(26)	\$ 685	\$ 692	\$ 7	
Construction Period (1955-58)	935(33)	504(29)	228(22)	431	707	276		
After Period (1959-62) ³	616 (6)	1,286(21)	353(25)	670	263	933		
Increase Between Periods								
Before and Construction Dollars	\$+ 18	\$+ 272	\$+ 3	\$- 254	\$+ 15	\$+269	+ 1.6%	+115.9%
Percent	+ 2.0%	+ 117.2%	+ 1.3%	- 115.2%	+ 0.7%	+115.9%		
Construction and After Dollars	\$-319	\$+ 782	\$+125	\$-1,101	\$-444	\$+657		
Percent	- 34.1%	+ 155.2%	+ 54.8%	- 189.3%	- 88.9%	+100.4%		
Before and After Dollars	\$-301	\$+1,054	\$ 128	\$-1,355	\$-429	\$+926	-46.8%	+399.1%
Percent	- 32.8%	+ 454.3%	+ 56.9%	- 487.1%	- 88.7%	+397.4%		
Probable Highway Influence⁴								
Percent	- 67.8%	+ 398.3%						
Dollars	\$-622	\$+ 924						

¹Number of transactions is shown in parenthesis.

²The Sd between the means of Sections 1 and 2 of the study area is \$242; t is equal to 2.83. This is significant at a beyond the 99% level. The Sd between the means of Section 1 of the study area and the control area is \$272; t is equal to 2.54. This is significant at a confidence level of 98%. The Sd between the means of Section 2 of the study area and the control area is \$67; t is equal to 0.10. This is significant beyond the 6% level.

³The Sd between the means of Section 1 and 2 of the study area is \$636; t is equal to 1.05. This is significant at a beyond the 60% level. The Sd between the means of Section 1 of the study area and the control area is \$79; t is equal to 3.33. This is significant at a confidence level of 99%. The Sd between the means of Section 2 of the study area and the control area is \$309; t is equal to 3.02. This is significant beyond the 99% level.

⁴See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

of the impact on the abutting land values came between the before and during construction periods, whereas the primary highway influence on nonabutting land values apparently occurred between the during and after construction periods. As was expected, those properties nearest, if not abutting, the facility received the most immediate impact.

Percentage-wise, abutting properties received a greater probable highway influence than nonabutting properties. This was not quite the case dollar-wise. Many of the nonabutting sales were located along roads intersecting IH 10. Perhaps sites just off the new highway were in greater demand for residential purposes than sites abutting the facility.

Sectional Analysis. The impact of the new highway was also evident on a sectional basis, as shown in Table 4. Section 1, the western half of the study area, was already built up with residential subdivisions before the new facility was constructed. These subdivisions were built on the few tracts having trees in the Section. As a result, tracts selling in the after period were less desirable for subdivision development than those selling in the before period. Consequently, this section failed to reflect as much benefit from the new facility as Section 2.

In the case of Section 2, the higher quality road service (IH 10) made many new tracts available for potential residential, commercial and industrial development. Consequently, the prices of the more desirable Section 2 sites increased more than fourfold.

The highway influence in Section 2 was much more pronounced on abutting properties than on nonabutting properties.

Subdivided Land

The subdivided land sales of the study area were located almost solely in Section 1. Very few sales were directly abutting the new highway. As indicated earlier, the control subdivisions are directly north of those in the study area.

Table 5 shows the price changes in the unimproved sales of the study and control areas. Fortunately, there were large numbers of sales for each period in each area. Also, the base period prices in each area were very nearly the same. Therefore, the difference between price changes in each area should closely approximate the true net highway influence on study area land values during the time period covered. So after deducting the increase in control area prices, the study area after period prices

Table 5

CHANGES IN PRICES OF UNIMPROVED SUBDIVIDED LAND LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS, IN CONSTANT DOLLARS (1947-49 = 100)

Period	Study			Control			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price Per Sq. Ft.	Standard Deviation	Number of Sales	Price Per Sq. Ft.	Standard Deviation		
Before Period (1950-54)	148	\$.0411	\$.0380	108	\$.0405	\$.0576	\$.0006 ¹	
Construction Period (1955-58)	86	.0538	.0493	94	.0374	.0449	.0164	
After Period (1959-62)	98	.0521	.0253	54	.0422	.0332	.0099 ²	
Increase Between Periods								
Before and Construction								
Dollars		\$+.0127			\$-.0031		\$+.0158	+38.4%
Percent		+ 30.9%			- 7.7%		+ 38.6%	
Construction and After								
Dollars		\$-.0017			\$+.0048		\$-.0065	-16.0%
Percent		- 3.2%			+ 12.8%		- 16.0%	
Before and After								
Dollars		\$+.0110			\$+.0017		\$+.0093	+22.6%
Percent		+ 26.8%			+ 4.2%		+ 22.6%	
Probable Highway Influence³								
Percent		+ 22.6%						
Dollars		\$+.0093						

¹The S.D. is \$.0059; T is equal to 0.10; this is significant beyond the 8% level.

²The S.D. is \$.0048; T is equal to 2.06; this is significant beyond the 95% level.

³See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

increased a net 23 percent over the before period prices. Although the unimproved lot sales occurred in a built-up area where some homes were fairly old, the new highway apparently caused an increase in demand for the remaining vacant lots.

The difference in the quality of improvements on lots selling within and between periods, as well as between areas, made it difficult to analyze improved sales in a manner to ascertain the extent of highway influence. The analysis used in Table 6 indicates that the new high-

way depressed improved lot values. However, in view of the performance of vacant lot values, the price changes of such properties in the study area do not seem to be attributable to the highway.

The over-all conclusion is that the construction of the Interstate Highway through this almost completely agricultural area has produced measurable effects on land values. Quick and positive price changes occurred in the most agriculturally oriented section of the study area where such changes would be least anticipated.

Table 6

CHANGES IN PRICES OF IMPROVED SUBDIVIDED LAND LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS, IN CONSTANT DOLLARS (1947-49 = 100)

Period	Study			Control			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price per Sq. Ft.	Standard Deviation	Number of Sales	Price per Sq. Ft.	Standard Deviation		
Before Period (1950-54)	54	\$.1944	\$.1313	24	\$.3903	\$.6663	\$.1959 ¹	
Construction Period (1955-58)	60	.2093	.1902	65	.5177	.4905	.3084	
After Period (1959-62)	46	.1851	.0998	47	.5243	.4770	.3392 ²	
Increase Between Periods								
Before and Construction								
Dollars		\$+.0149			\$+.1274		\$-.1125	-57.9%
Percent		+ 7.7%			+ 32.6%		- 24.9%	
Construction and After								
Dollars		\$-.0242			\$+.0066		\$-.0308	-12.9%
Percent		- 11.6%			+ 1.3%		- 12.9%	
Before and After								
Dollars		\$-.0093			\$+.1340		\$-.1433	-73.7%
Percent		- 4.8%			+ 34.3%		- 39.1%	
Probable Highway Influence³								
Percent		- 56.4%						
Dollars		\$-.1096						

¹The S.D. is \$.0935; t is equal to 2.10; this is significant beyond the 95% level.

²The S.D. is \$.0718; T is equal to 4.72; this is significant beyond the 99% level.

³See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Changes In Land Use

Changes in land use are presented to give an indication of the extent of highway influence on study area properties. These changes occurred over an eight year period and involved primarily agricultural land predominantly used for growing rice.

Prior to World War II, large sections of the study area were held by the United States Government. This land was divided into tracts of various sizes, ranging from five to 75 acres. It was first divided into the larger tracts and called the Elena Fruit and Cotton Farms. At a later date, most of the larger land holdings were broken up into smaller tracts and renamed the Highland Farms. All of this land came under private ownership before 1950.

As mentioned earlier, the area was not serviced by a state or federal highway connecting it with Houston prior to construction of IH 10. However, it had fairly good access to Baytown, a town of some 12,000 population, six miles to the south. The lack of direct and quick accessibility to the central business district of Houston has undoubtedly discouraged the area's development for both residential and commercial purposes.

Land Use as of 1954

Land use as of the last year (1954) before construction began on IH 10 is shown in Figure 4A, the base map. A study of this map will reveal that most of the residential development at this point in time was primarily concentrated in 10 subdivisions (low to middle class) in the western one-third of the study area. The majority of the houses constructed then were frame or asbestos siding type of construction. Located in this area are the unincorporated communities of Lynchburg, Four Corners, and McNair. As would be expected all of the commercial tracts were located in these communities, abutting the major roads traversing them.

In contrast, the majority of the agricultural land is located in the middle of the study area. In 1954, rice was grown in rotation with cattle raising on most of the

agricultural tracts. To a lesser extent, this was still practiced in 1962.

Since State Highway 73 (now designated as IH 10) had been in the planning stages as far back as the 1940's, land speculators had already purchased many tracts in the study area prior to 1954 and were holding them for future sale or use. Both large and small tracts held for future use were scattered throughout the study area. Several large tracts located in the eastern third of the area are covered with oak and pine trees and have some potential as forestry lands.

A pipeline pump station and a carbon black plant, occupying the two industrial tracts, were both located in the study area prior to 1954.

Table 7 shows the approximate number of acres of land in the various uses as of 1954. Of all the uses, agricultural land ranked first in land area and institutional (publicly owned) land ranked last.

Changes in Land Use Between 1954 and 1962

The changes in land use in the study area between 1954 and 1962 are shown in Figure 4B, an overlay to the base map. Table 7 shows the number of acres changing to or from the various uses.

The principal changes which have occurred during the construction of the highway and four years after have been primarily from agriculture to land held for future use. Although still farmed, many tracts formerly held by farmers have changed to nonfarm ownership. Several of these new owners freely admit that they are holding such land for investment or speculative purposes. Even as early as 1959, immediately after construction of the new highway, at least 20 of the land owners were known to be holding tracts of land for resale or conversion into other uses.

Nearly 500 acres changed from agricultural and land held for future use to higher uses. A large portion of this land area changed into a single industrial use—a site for an oil refining facility. Most of the remaining area changed to rural and urban residential use. These residential tracts were scattered throughout the area. Two have been developed into residential subdivisions, one abutting the new highway and the other approximately one mile from the facility.

One of the Baytown streets (Main Street Road) was extended into the study area and connected with IH 10 providing another direct access to the city proper. This new route to Baytown bisected several tracts which changed land use. It should influence residential development in the study area.

By and large, the story of land use change for this study area has been the continued shift of land out of agricultural use into the held for future use category. The distance to Houston's central business district and the fact that the new highway is not yet directly connected to the central core area of Houston have been primarily responsible for the lack of extensive residential, commercial and industrial development in the study area. Opening of the last section of IH 10 into down-

Table 7
QUANTITY OF STUDY AREA LAND IN VARIOUS USES AS OF 1954 AND 1962

Land Use	Number of Acres ¹		Changes Between 1954 and 1962	
	1954	1962	Acres	Percent
Agricultural	6,000	3,371	-2,629	- 43.8%
Held for Future Use	5,500	7,600	2,100	38.2
Rural Residential	500	657	157	31.4
Urban Residential	500	517	17	3.4
Commercial Traffic				
Serving	10	11	1	10.0
Commercial Nontraffic				
Serving	10	15	5	50.0
Industrial	50	360	310	620.0
Institutional	5	17	12	240.0
Other (Roads, Canals, and Gullies)	625	652	27	4.3
Total Area	13,200	13,200		

¹Approximate Acreages.

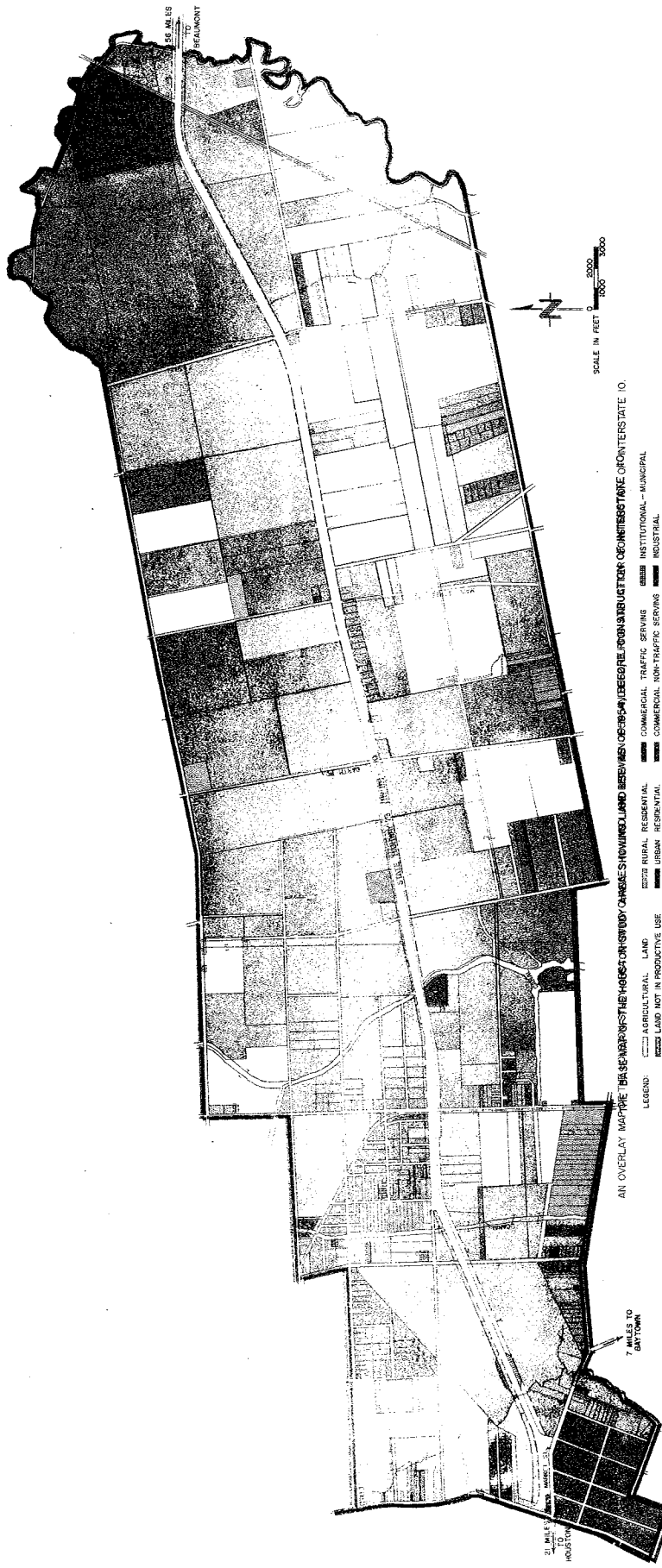


Figure 4A.

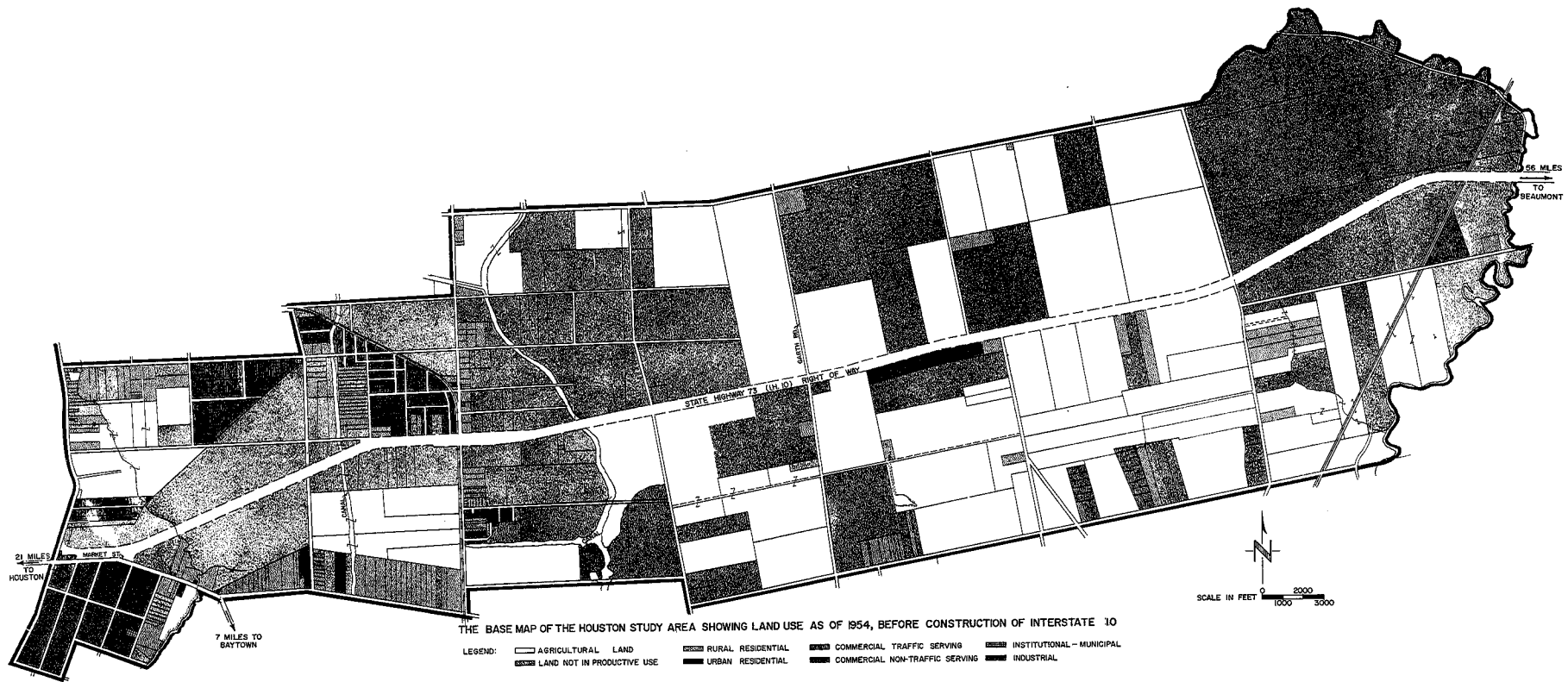
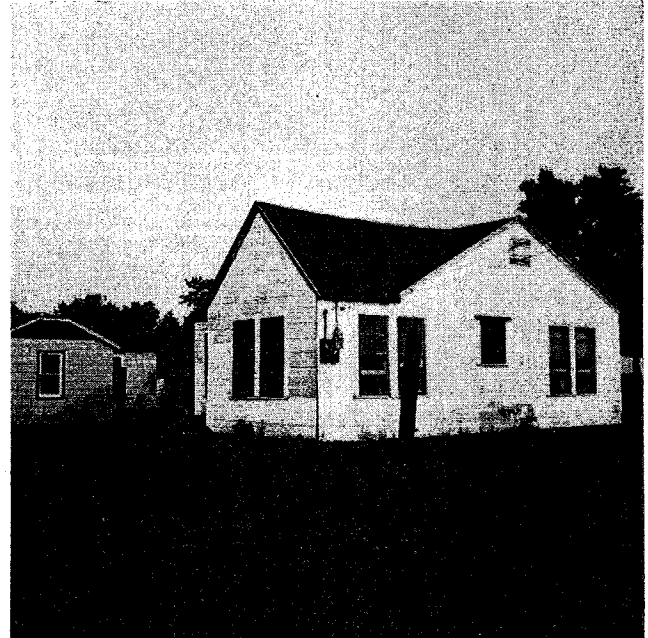
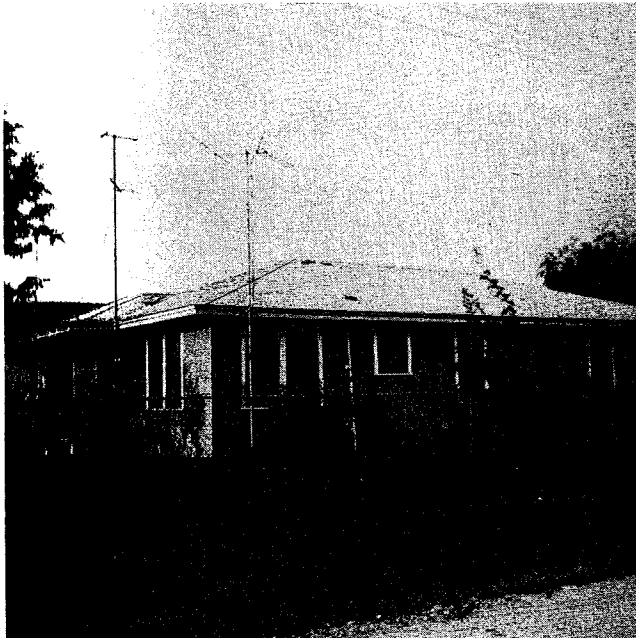


Figure 4A.

town Houston will reduce travel time considerably. With two railroads and the new highway serving the area, a more rapid development of both abutting and nonabutting lands should be encouraged. An extension of the Baytown water and sewage system into the area would also greatly encourage residential development.

As it stands, however, development has been limited primarily to residential use, scattered throughout the study area. Many other tracts have been taken out of productive use and stand ready to be developed into a higher use. A great portion of this idle land abuts IH 10.



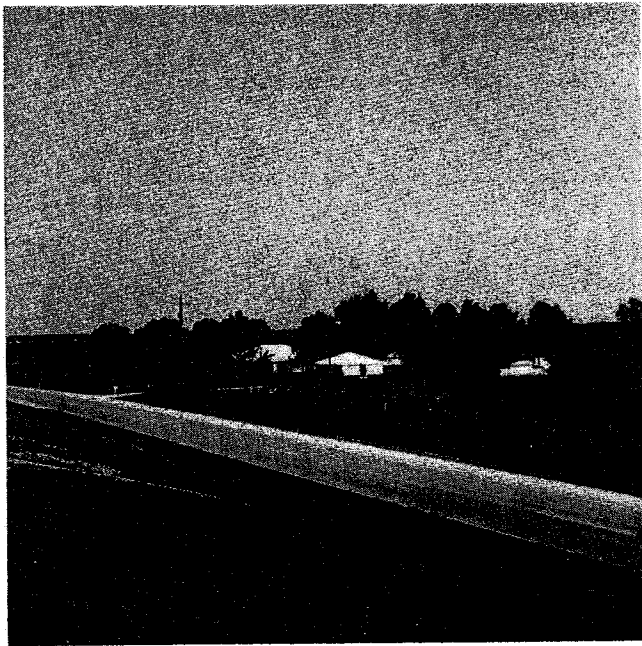
Typical homes located in the urban subdivision of the study area.



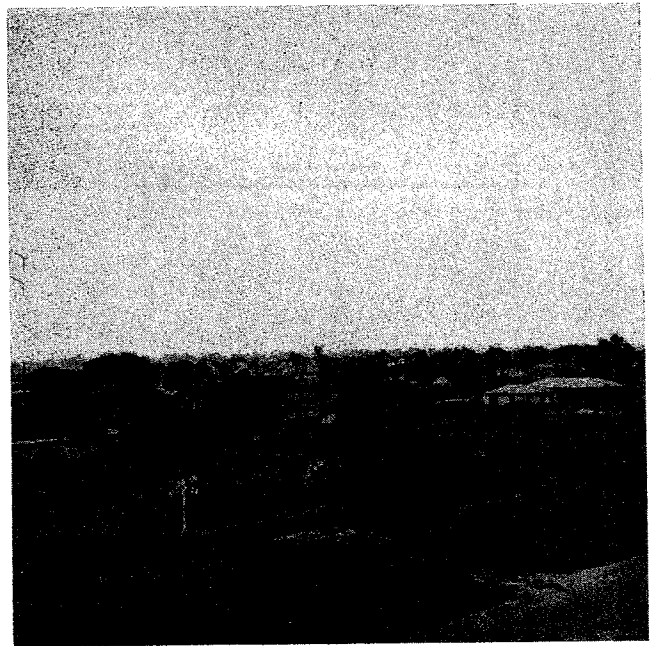
Agricultural



Held for Future Use



Rural Residential



Urban Residential

Land in different land uses along IH 10 in the study area.

Changes In Business Activity

The Houston study area was selected primarily to measure changes in land value and land use. Unlike other studies in this series, no primary highway was left close by, so that a full-fledged before and after business activity impact study was not contemplated. As Figure 1 shows, the IH 10 study area is located several miles from old U. S. Highway 90, which is the alternate route from Houston to Beaumont. However, existing business activity within the boundaries of the study was studied to determine if a measurable impact could be discerned.

Before the new route was completed in 1959, a survey of business activity revealed that forty-four businesses of all types existed in the study area. (See Table 8.) Most of these businesses were concentrated along Market Street Road which was one of the roundabout connecting links between Baytown and Houston. (See Figure 1.) Almost all the others were located in the unincorporated town of McNair.

Of the 44 businesses, the 31 that were considered to be legitimate commercial retail establishment were interviewed. No attempt was made to obtain data from the

remaining 13 firms which consisted of entertainment houses, auto junkyards, warehouses, and a manufacturing plant.

Of the 31 businesses, all considered retail in nature, 17 supplied before period gross sale information for the years 1957 and 1958. After the new highway had been opened to traffic for four years, another survey of business activity was made. At this time a total of 54 businesses were operating in the study area. This was a net increase of 10 businesses in the area, two of which were nonretail.

Only those businesses which furnished gross sales during the before period were interviewed in an attempt to obtain after period sales. Eleven were able to furnish such information.

Table 9 shows the before and after gross sale comparisons for the 11 businesses. Six of these businesses were located on Market Street Road which now serves as an access road to IH 10. A portion of this road is used as a service or frontage road of IH 10. The other five businesses are located in McNair which now abuts IH 10.

Two of the above Market Street Road firms are traffic serving, and four are nontraffic serving. Of the five McNair firms, two are traffic serving and three are nontraffic serving.

Seven of the 11 businesses were over 20 years of age and were housed in old buildings, some of which were in poor condition.

Over-all, it appears that the new highway has had little effect on the old businesses within the study area. The traffic serving businesses made modest gains in sales, whereas the nontraffic serving businesses experienced a mild decline. Actually, one business in the latter group caused most of the decline for the group. When the sales of this particular firm are removed, the group shows a 24.6 percent increase in sales.

As a group, the 11 businesses showed no appreciable change in sales between 1958 and 1962. However, if the dollar volume of the above-mentioned nontraffic serving business is removed from the totals, the remaining 10

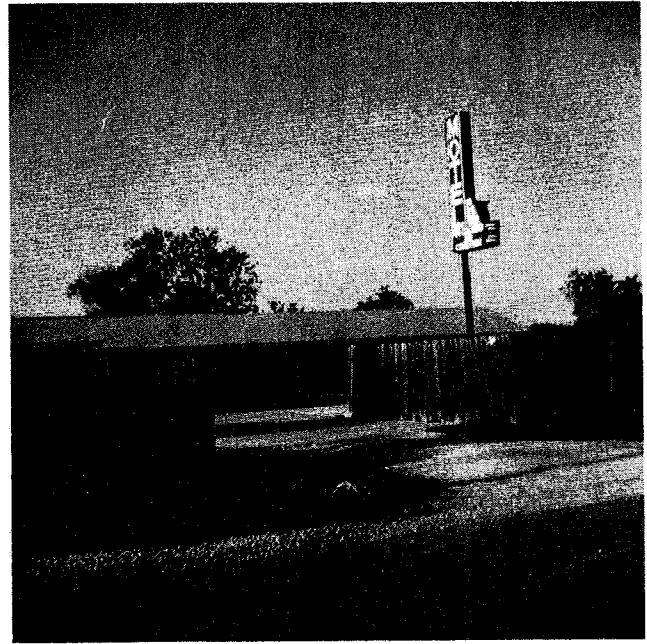
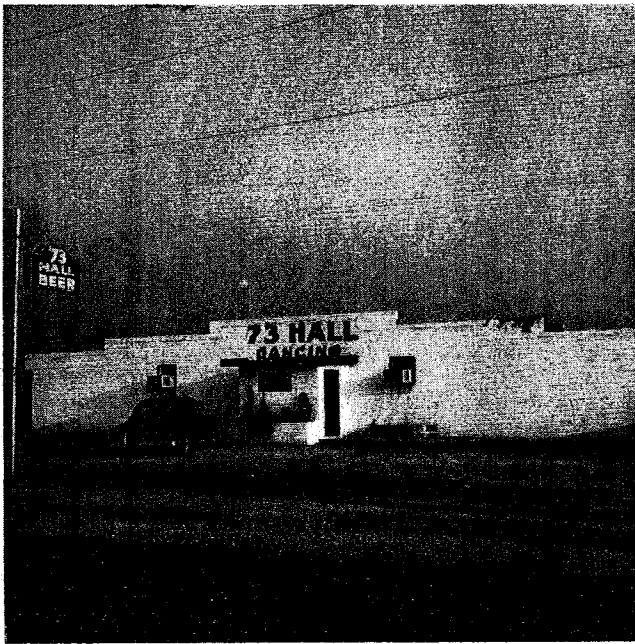
Table 8
NUMBER OF VARIOUS TYPES OF BUSINESSES OPERATING IN THE HOUSTON STUDY AREA

Type of Business	Number Operating in	
	1958	1962
Retail Traffic Serving		
Service Stations	5	6
Food Service	9	10
Motels	0	1
Retail Nontraffic Serving		
Grocery Markets	11	13
Lumber and Builders' Supply	2	2
Auto Wrecking Yards and Parts	3	4
Service	2	3
Other	11	12
Nonretail		
Wholesale	0	1
Manufacturing	1	2
Total Businesses	44	54

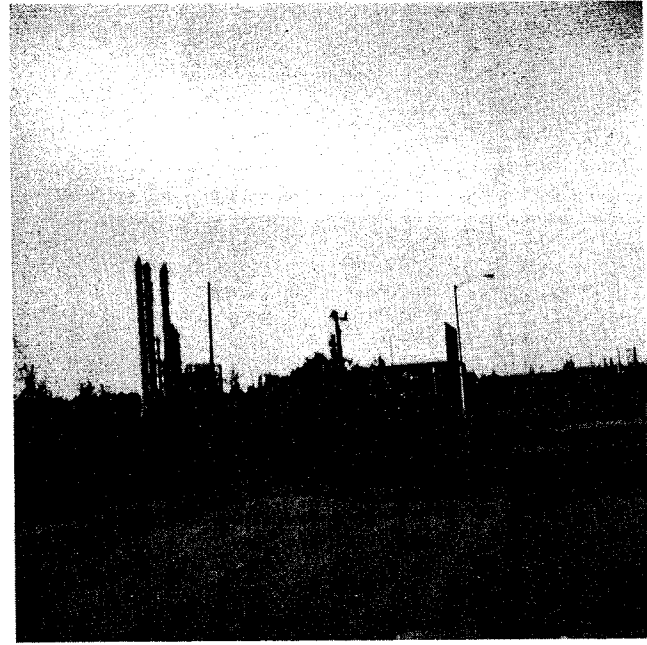
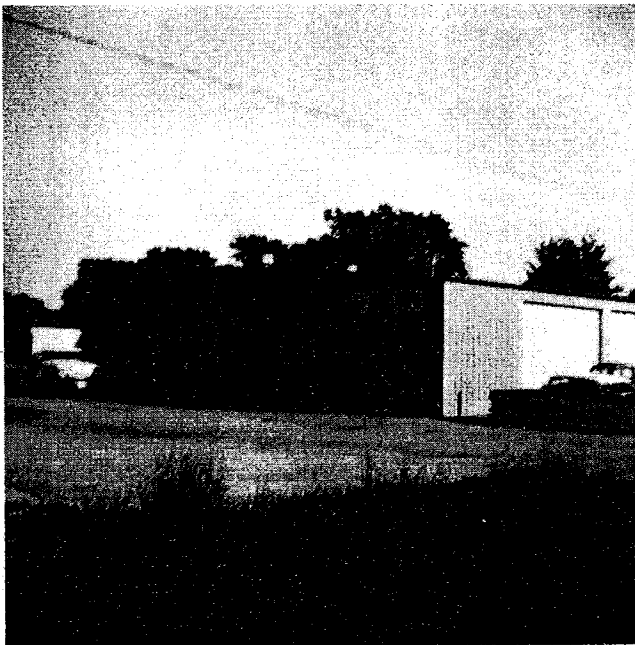
Table 9
CHANGE IN THE GROSS SALES OF 11 RETAIL BUSINESSES IN THE HOUSTON STUDY AREA

Type of Business	Number of Businesses	Gross Sales		Change Between 1958 and 1962	
		1958	1962	Dollar	Percent
Traffic Serving					
Service Stations	3	1	1		
Food Service	1	1	1		
Total Traffic Serving	4	\$182,735	\$195,013	\$ 12,278	6.7%
Nontraffic Serving					
Grocery Markets	3	\$645,874	\$599,676	\$-46,198	- 7.2%
Miscellaneous	4	\$104,468	\$142,801	\$ 38,333	36.7%
Total Nontraffic Serving	7	\$750,342	\$742,477	\$- 7,865	- 1.0%
Grand Total All Businesses	11	\$933,077	\$937,490	\$ 4,413	.5%

¹Data withheld to prevent disclosure of the volume of individual businesses.



Traffic serving businesses located along IH 10 in the study area.



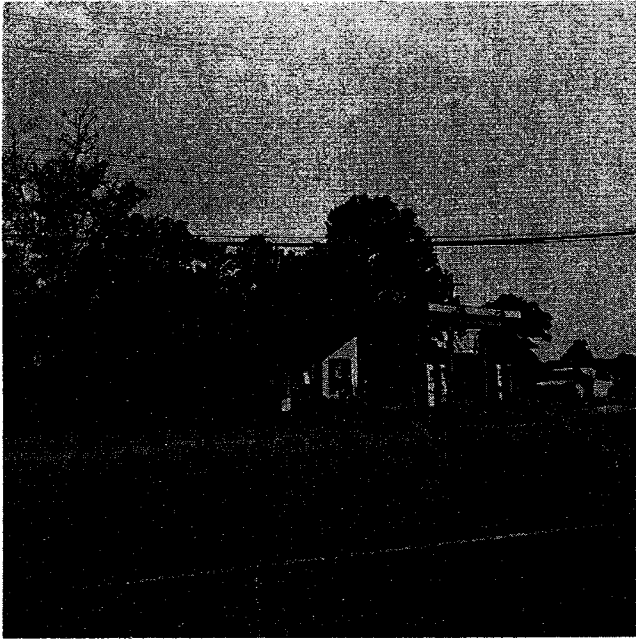
A warehouse and petrochemical plant located along or near IH 10 in the study area.

businesses show a 14 percent dollar volume increase between 1958 and 1962.

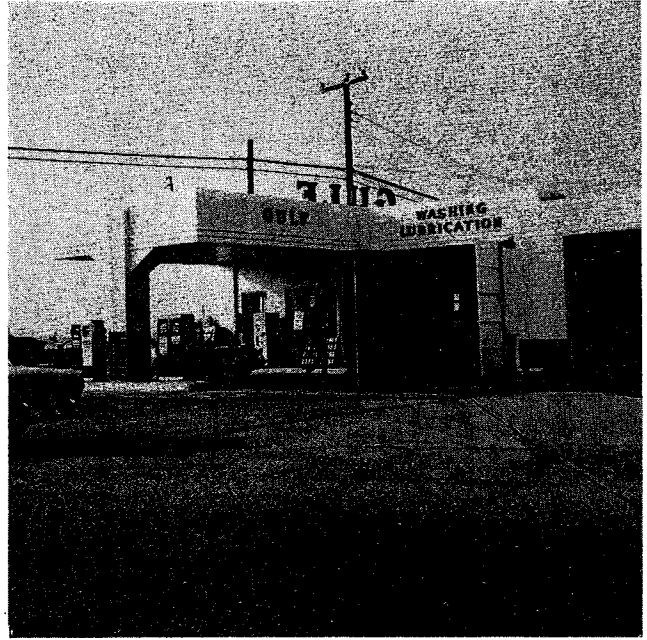
The condition of the business houses was probably largely responsible for their lack of more substantial sales gains. If the traffic serving business houses would have been new and attractive, they may have been able to capture more trade from the increased IH 10 and Market Street Road traffic. In 1958 the average daily traffic volume passing the Market Street Road businesses was 9,880 vehicles. By 1964, the count was 17,030 vehicles, an increase of 7,150 or 72 percent. This count reflects traffic generated from IH 10. After the new highway was completed throughout the study area, in

1959, the average daily volume of traffic on the extreme eastern end of the study area was 4,240. By 1964, the count at this point was up to 7,930, an increase of 3,690 or 87 percent. This growth in traffic volumes on IH 10 occurred in spite of the fact that its last section to downtown Houston was not yet completed.

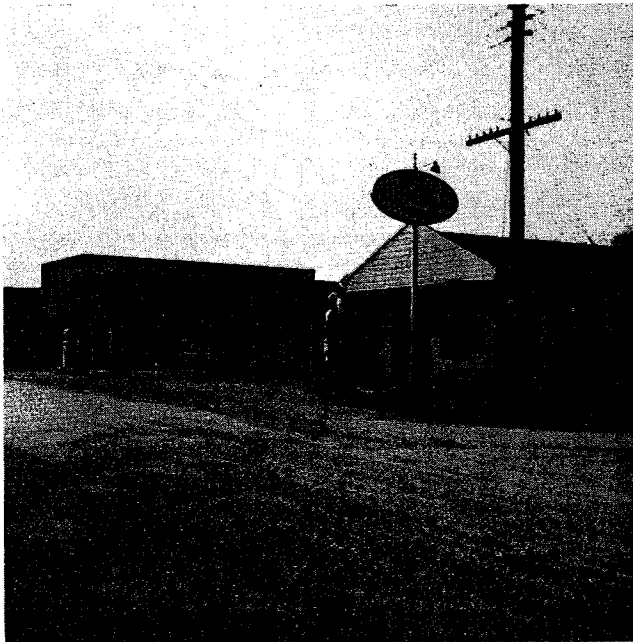
New businesses which located abutting the new highway consisted of a food service and entertainment hall combination, a motel, fish bait house, machine shop, and a petrochemical plant. Other businesses located in the study area were a service station, two grocery markets, an automobile parts yard, a television and radio repair service, and a wholesale warehouse.



Along Market Street Rd.

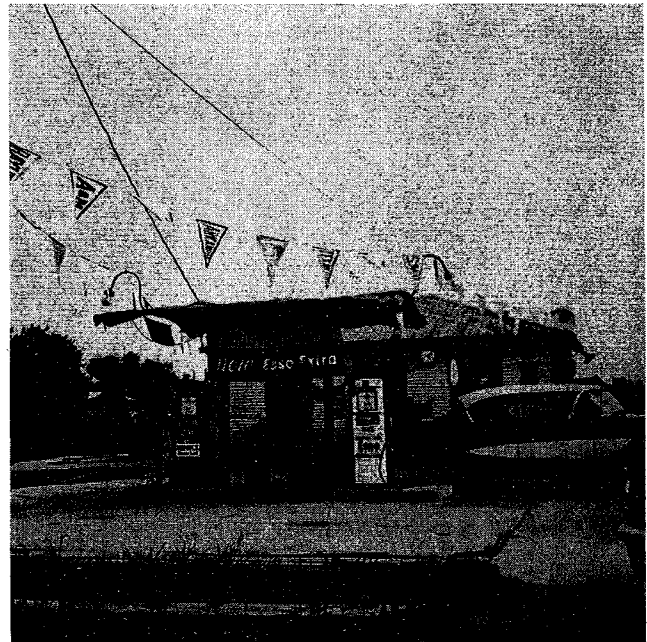


Along Market Street Rd.



In McNair

The principal service stations operating along or near IH 10 in the study area.



In McNair

The most important single old business operating in the study area during the before period is a carbon black and ink manufacturing plant which employs over 100 persons. During the after period, the most important single new business operating in the study is a refinery owned by a major oil company. It also employs over 100 persons. A 50-million-dollar planned expansion program for this facility is to be completed in 1966.

The above two study firms combined with manufacturing firms in nearby Baytown, Channelview, and Crosby serve as the main bulwark to the area's economy. According to the *Texas Directory of Manufacturers*, published by the Bureau of Business Research of the Uni-

versity of Texas, the 23 firms in the general area employed a minimum of 2,000 persons and a maximum of 7,000 persons in 1964. Four of these firms operate nationally and four internationally.

The new highway now serves as a connecting link between industries in this general area. The facility has made the study area even more competitive for new industry.

The primary economic impact of the new IH 10 is seen in making the study area land much more attractive for industrial development and to a lesser extent increasing its desirability for residential and commercial development. This area's accessibility to Houston has



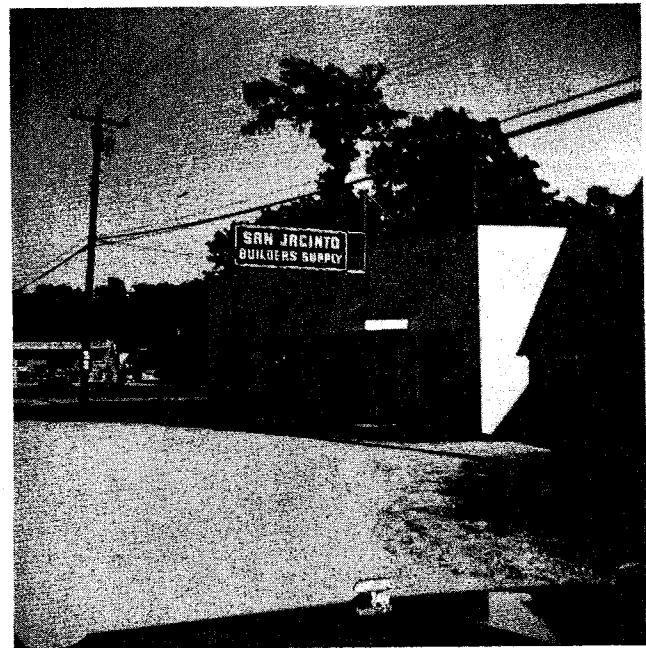
Feed and Hardware Store



Fishing Supply Store



Grocery Store



Builder's Supply Store

New and old nontraffic serving businesses are operating along Market Street Road which abuts IH 10 in the study area.

been greatly increased, and when the last connecting link between the study area and the central business district of Houston has been completed, the area should be even more attractive to industry.

One of the primary inhibitors of future residential development is the lack of a central water and sewage system servicing the study area. The new highway has made this area more attractive for a further expansion of Baytown in that direction. This undoubtedly will result in an extension of that city's water and sewage systems to the area. As these services are made avail-

able, higher quality commercial services will follow over time.

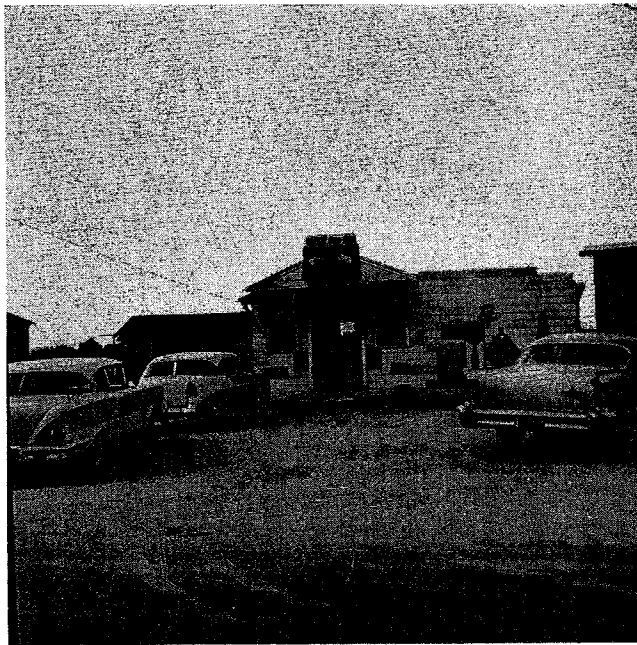
It seems logical to expect some of the same development in the study area as has occurred along IH 10 nearer to Houston. As each section of this highway has been completed, development has followed. Because of its relative remoteness, development has been slower in this area than in other areas more closely connected with an urban center. Yet measurable changes in land value, land use, business activity, and general community development have occurred in the Houston study area.



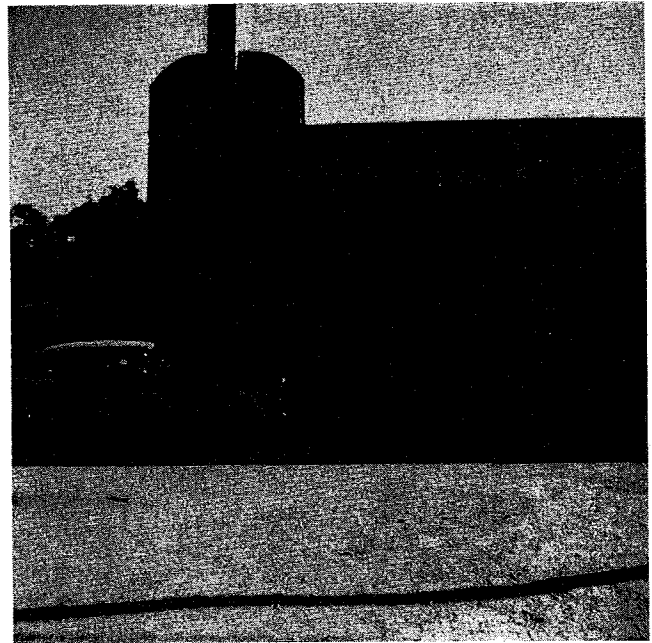
Along Market Street Road



Along Market Street Road



In McNair



In McNair

Eating and drinking businesses located along Market Street Road and in McNair in the study area.

Appendix

CONSUMER PRICE INDEX

As a means of measuring price changes, constant dollars were calculated and presented in the analysis of this report. The actual dollars were multiplied by the reciprocal of the Consumer Price Index for the United States, as published by the U. S. Department of Commerce, Bureau of Labor Statistics, to arrive at the constant dollar value.

Below is a listing of the consumer price index and its reciprocal for each year involved. The base was 1947-49 = 100.

Year	Index	Reciprocal
1944	75.2	1.330
1945	76.9	1.300
1946	83.4	1.200
1947	95.5	1.047
1948	102.8	0.973
1949	101.8	0.982
1950	102.8	0.973
1951	111.0	0.901
1952	113.5	0.881
1953	114.4	0.874
1954	114.8	0.871
1955	114.5	0.873
1956	116.2	0.861
1957	120.2	0.832
1958	123.5	0.810
1959	124.6	0.803
1960	126.5	0.791
1961	127.9	0.782
1962	129.3	0.773

Supporting Tables

Table 10

CHANGES IN ACTUAL PRICES OF UNIMPROVED ACREAGE TRACTS LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS

Period	Study			Control			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price Per Acre	Standard Deviation	Number of Sales	Price Per Acre	Standard Deviation		
Before Period (1950-54)	61	\$ 613	\$1147	26	\$ 259	\$222	\$ 354 ¹	
Construction Period (1955-58)	62	876	809	22	279	200	597	
After Period (1959-62)	27	1433	1720	25	447	236	986 ²	
Increase Between Periods								
Before and Construction								
Dollars		\$+ 263			\$+ 20		\$+243	+ 39.6%
Percent		+ 42.9%			+ 7.7%		+ 35.2%	
Construction and After								
Dollars		\$+ 557			\$+168		\$+389	
Percent		+ 63.6%			+ 60.2%		+ 3.4%	
Before and After								
Dollars		\$+ 820			\$+188		\$+632	+103.1%
Percent		+ 133.8%			+ 72.6%		+ 61.2%	
Probable Highway Influence³								
Percent		+ 82.2%						
Dollars		\$+ 504						

¹The S.D. is \$229; t is equal to 1.56; this is significant at beyond the 80% level.

²The S.D. is \$361; t is equal to 2.73; this is significant at beyond the 99% level.

³See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 11

CHANGES IN PRICES OF UNIMPROVED ACREAGE TRACTS IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS, WEIGHTED BY AREA SOLD IN CONSTANT DOLLARS (1947-49 = 100)

Period	Number of Sales	Number of Acres	Adjusted Price Per Acre	Price Changes Between Periods	
				Dollars	Percent
<u>Study</u>					
Before Period (1950-54)	61	1,958	\$111	\$ + 321	+ 289.2%
Construction Period (1955-58)	62	2,271	432	+ 224	+ 51.9
After Period (1959-62)	27	1,480	656	+ 545 ¹	+ 491.0 ¹
<u>Control</u>					
Before Period (1950-54)	26	734	\$157	\$ + 36	+ 22.9%
Construction Period (1955-58)	22	602	193	+ 106	+ 54.9
After Period (1959-62)	25	502	299	+ 142 ¹	+ 90.4 ¹

¹Changes between the before period and the after period in the study and control areas.

Table 12

CHANGES IN ACTUAL PRICES OF ABUTTING AND NONABUTTING UNIMPROVED ACREAGE TRACTS IN THE STUDY AREA AS COMPARED TO THE CONTROL AREA, HOUSTON, TEXAS

Period	Price per Acre ¹			Difference Between Areas			Percent of Respective Parts of Study Area's Before Period Price	
	Study Area Abutting	Study Area Nonabutting	Control Area	Abutting vs. Non-abutting	Abutting vs. Control Area	Non-abutting vs. Control Area	Abutting	Non-abutting
Before Period (1950-54) ²	\$ 342(17)	\$ 718(44)	\$ 259(26)	\$ 376	\$ 83	\$ 459		
Construction Period (1955-58)	844(16)	886(46)	279(22)	42	565	607		
After Period (1959-62) ³	968 (7)	1,595(20)	447(25)	627	521	1,148		
<u>Increase Between Periods</u>								
Before and Construction Dollars	\$ + 502	\$ + 168	\$ + 20	\$ + 334	\$ + 482	\$ + 148	+ 140.9%	+ 20.6%
Percent	146.8%	+ 23.4%	+ 7.7%	+ 123.4%	+ 139.1%	+ 15.7%		
Construction and After Dollars	\$ + 124	\$ + 709	\$ + 168	\$ - 585	\$ - 44	\$ + 541		
Percent	+ 14.7%	+ 80.0%	+ 60.2%	- 65.3%	- 45.5%	+ 19.8%		
Before and After Dollars	\$ + 626	\$ + 877	\$ + 188	\$ - 251	\$ + 438	\$ + 689	+ 128.1%	+ 96.0%
Percent	+ 183.0%	+ 122.1%	+ 72.6%	+ 60.9%	+ 110.4%	+ 49.5%		
<u>Probable Highway Influence⁴</u>								
Percent	+ 119.3%	+ 72.8%						
Dollars	\$ 408	\$ 523						

¹Number of transactions is shown in parentheses.

²The Sd between the means of the study area (abutting) and the study area (nonabutting) is \$326; t is equal to 1.15. This is significant beyond the 70% level. The Sd between the means of the study area (abutting) and the control area is \$107; t is equal to 0.78. This is significant beyond the 50% level. The Sd between the means of the study area (non-abutting) and the control area is \$259; t is equal to 1.77. This is significant beyond the 90% level.

³The Sd between the means of the study area (abutting) and the study area (nonabutting) is \$760; t is equal to 0.83. This is significant beyond the 50% level. The Sd between the means of the study area (abutting) and the control area is \$109; t is equal to 4.80. This is significant beyond the 99% level. The Sd between the means of the study area (non-abutting) and the control area is \$398; t is equal to 2.88. This is significant beyond the 99% level.

⁴See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 13

CHANGES IN THE ACTUAL PRICES OF UNIMPROVED ACREAGE TRACTS IN SECTIONS 1 AND 2 OF THE STUDY AREA AS COMPARED TO THE CONTROL AREA, HOUSTON, TEXAS

Period	Price per Acre ¹			Differences Between Areas			Percent of Study Area Section's Before Period Price	
	Study Area Section 1	Study Area Section 2	Control Area	Section 1 vs. Section 2	Section 1 vs. Control Area	Section 2 vs. Control Area		
	Before Period (1950-54) ²	\$ 1,052(27)	\$ 265(34)	\$ 259(26)	\$ 787	\$ 793	\$ 6	
Construction Period (1955-58)	1,116(33)	602(29)	279(22)	514	837	323		
After Period (1959-62) ³	776 (6)	1,620(21)	447(25)	844	329	1,173		
Increase Between Periods								
Before and Construction Dollars	\$+ 64	\$+ 337	\$+ 20	\$- 273	\$+ 44	\$+ 317	+ 4.2%	+119.6%
Percent	+ 6.1%	+ 127.2%	+ 7.7%	- 121.1%	- 1.6%	+ 119.5%		
Construction and After Dollars	\$- 340	\$+1,018	\$+168	\$-1,358	\$-508	\$+ 850		
Percent	- 30.5%	+ 169.1%	+ 60.2%	- 199.6%	- 90.7%	+ 108.9%		
Before and After Dollars	\$- 276	\$+1,355	\$+188	\$-1,631	\$-464	\$+1,167	-44.1%	+440.4%
Percent	- 26.2%	+ 511.3%	+ 72.6%	- 537.5%	- 98.8%	+ 438.7%		
Probable Highway Influence⁴								
Percent	- 71.5%	+ 439.6%						
Dollars	\$- 752	\$+1,165						

¹Number of transactions is shown in parentheses.

²The Sd between the means of Sections 1 and 2 of the study area is \$280; t is equal to 2.81. This is significant beyond the 99% level. The Sd between the means of Section 1 of the study area and the control area is \$315; t is equal to 2.52; this is significant beyond the 98% level. The Sd between the means of Section 2 of the study area and the control area is \$77; t is equal to 0.08. This is significant beyond the 6% level.

³The Sd between the means of Section 1 and 2 of the study area is \$794; t is equal to 1.06. This is significant beyond the 70% level. The Sd between the means of section 1 of the study area and the control area is \$100; t is equal to 3.29. This is significant beyond the 99% level. The Sd between the means of Section 2 of the study area and the control area is \$386; t is equal to 3.04. This is significant beyond the 99% level.

⁴See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 14

CHANGES IN ACTUAL PRICES OF UNIMPROVED SUBDIVIDED LAND LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS

Period	STUDY			CONTROL			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price Per Sq. Ft.	Standard Deviation	Number of Sales	Price Per Sq. Ft.	Standard Deviation		
Before Period (1950-54)	148	\$.0471	\$.0443	108	\$.0461	\$.0637	\$.0010 ¹	
Construction Period (1955-58)	86	.0642	.0584	94	.0447	.0523	.0195	
After Period (1959-62)	98	.0658	.0318	54	.0533	.0420	.0125 ²	
Increase Between Periods								
Before and Construction Dollars		\$+.0171			\$-.0014		\$+.0185	+39.3%
Percent		+ 36.3%			- 3.0%		-\$+ 39.3%	
Construction and After Dollars		\$+.0016			\$+.0086		\$-.0070	
Percent		+ 2.5%			+ 19.2%		- 16.7%	
Before and After Dollars		\$+.0187			\$+.0072		\$+.0115	+24.4%
Percent		+ 39.7%			+ 15.6%		+ 24.1%	
Probable Highway Influence³								
Percent		+ 24.3%						
Dollars		\$+.0114						

¹The Sd is \$.0068; t is equal to 0.15. This is significant beyond the 10% level.

²The Sd is \$.0061; t is equal to 2.05. This is significant beyond the 95% level.

³See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 15

CHANGES IN PRICES OF UNIMPROVED SUBDIVIDED LAND IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS, WEIGHTED BY AREA SOLD IN CONSTANT DOLLARS (1947-49 = 100)

Period	Number of Sales	Number of Square Feet	Adjusted Price Per Square Foot	Price Changes Between Periods	
				Dollars	Percent
<u>Study</u>					
Before Period (1950-54)	148	3,623,333	\$.0313	\$.0055	+17.6%
Construction Period (1955-58)	86	1,522,536	.0368	+.0094	+25.5
After Period (1959-62)	98	2,613,369	.0462	+.0149 ¹	+47.6 ¹
<u>Control</u>					
Before Period (1950-54)	108	1,524,410	\$.0263	\$-.0019	- 7.2%
Construction Period (1955-58)	94	1,513,744	.0244	+.0043	+17.6
After Period (1959-62)	54	715,907	.0287	+.0024 ¹	+ 9.1 ¹

¹Changes between the before period and the after period of the study and control areas.

Table 16

CHANGES IN ACTUAL PRICES OF IMPROVED SUBDIVIDED LAND LOCATED IN THE STUDY AND CONTROL AREAS, HOUSTON, TEXAS

Period	Study			Control			Difference Between Areas	Percent of Study Before Period Price
	Number of Sales	Price Per Sq. Ft.	Standard Deviation	Number of Sales	Price Per Sq. Ft.	Standard Deviation		
Before Period (1950-54)	54	\$.2198	\$.1521	24	\$.4440	\$.7618	\$.2242 ¹	
Construction Period (1955-58)	60	.2497	.2256	65	.6282	.5954	.3785	
After Period (1959-62)	46	.2339	.1256	47	.6584	.5981	.4245 ²	
<u>Increase Between Periods</u>								
Before and Construction								
Dollars		\$.0299			\$.1842		\$-.1543	-70.2%
Percent		+ 13.6%			+ 41.5%		- 27.9%	
Construction and After								
Dollars		\$-.0158			\$.0302		\$-.0460	
Percent		- 6.3%			+ 4.8%		- 11.1%	
Before and After								
Dollars		\$.0141			\$.2144		\$-.2003	-91.1%
Percent		+ 6.4%			+ 48.3%		- 41.9%	
<u>Probable Highway Influence³</u>								
Percent		- 66.5%						
Dollars		\$-.1462						

¹The S.D. is \$.1059; t is equal to 2.12; this is significant beyond the 95% level.

²The S.D. is \$.0900; t is equal to 4.75; this is significant beyond the 99% level.

³See Footnotes 3, 4, 5, and 6 of Table 2 for explanation.

Table 17

CHANGES IN PRICES OF IMPROVED SUBDIVIDED LAND IN THE STUDY AND CONTROL AREA, HOUSTON, TEXAS, WEIGHTED BY AREA SOLD IN CONSTANT DOLLARS (1947-49 = 100)

Period	Number of Sales	Number of Square Feet	Adjusted Price Per Square Foot	Price Changes Between Periods	
				Dollars	Percent
<u>Study</u>					
Before Period (1950-54)	54	1,250,862	\$.1588	\$-.0035	- 2.2%
Construction Period (1955-58)	60	1,327,408	.1553	+.0067	+ 4.3
After Period (1959-62)	46	1,248,248	.1620	+.0032 ¹	+ 2.0 ¹
<u>Control</u>					
Before Period (1950-54)	24	324,625	\$.2483	\$-.0051	- 2.1%
Construction Period (1955-58)	65	1,039,357	.2432	+.0481	+19.8
After Period (1959-62)	47	692,093	.2913	+.0430 ¹	+17.3 ¹

¹Changes between the before period and the after period of the study and control areas.

Formulas Used In Making Statistical Tests On Land Value Data

In the footnotes of the land value tables, certain statistical data are presented to aid the reader in further evaluating the land value information given in the tables. By using the appropriate large and small sample formulas, the standard errors of the difference between various pairs of means (study versus control areas, Section 1 versus Section 2, etc.) were computed and shown in the footnotes under each table. These standard errors were used in formulas deriving T and Student's t values. The quantity T, or Student's t, is the deviation of the difference between two sample means from the mean of the population, expressed in units of the standard error of the difference between the means. The only difference between T and Student's t is that the latter is used for a sample with small number of observations. These T or Student's t values are also shown. Finally, the approximate confidence level in which these T or t values are significant is shown. The larger the value of T or t, the less the chance that its value is due to chance only. For example, if the value of T is 1.96 (based on sample means with each having 30 or more observations) at a 95 percent probability level, the interpretation is that a value of T this large would occur only five times out of a hundred and cannot be due to chance alone.

An explanation of the formulas used in determining the standard error of difference between two means and the T or t values is presented below.

1. For pairs of samples, each of which is made up of 30 or more observations, the formula used for computing the standard error of the difference between the means of these two samples is given by

$$S_d = \sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}$$

where σ_1 and σ_2 are the standard deviations of the populations of means from which sample means 1 and 2

come respectively. With the two σ 's not known, the corresponding sample standard deviations were used. N_1 and N_2 are the number of observations that make up samples 1 and 2 respectively. In determining whether the differences between the means of samples 1 and 2 deviates significantly at a certain confidence level, a T value is computed by the formula $T = D/S_d$ where D is the difference between the means of samples 1 and 2, and S_d is the standard error given above. It is assumed that samples 1 and 2 come from normal populations with the same means.

2. For a pair of samples consisting of less than 30 observations, the standard error of the difference between the means of these two samples is given by

$$S_d = \sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2} - 2}$$

where σ_1 and σ_2 are the standard deviations of the populations of means from which sample means 1 and 2 come respectively. With the two σ 's not known, we substituted for them the σ 's of the corresponding samples. N_1 and N_2 are the number of observations that make up samples 1 and 2 respectively. In determining whether the difference between the means of samples 1 and 2 deviates significantly at a certain confidence level, a T value is computed by using Student's t and is given by

$$t = S_d \sqrt{\frac{D}{\frac{N_1 + N_2}{N_1 \times N_2}}}$$

where D is the difference between the means of samples 1 and 2, and S_d is the standard error given above. It is assumed that samples 1 and 2 come from normal populations with the means.