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LAND USE IMPACT OF IMPROVING SECTION TWO
OF WESTHEIMER ROAD IN A DEVELOPING AREA
IN HOUSTON, TEXAS

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PREFACE

The authors wish to acknowledge the assistance that others have given in conducting this study. Special thanks are due Mr. James W. Barr and Mr. James R. Farrar of the Texas State Department of Highways and Public Transportation. Also, Mr. Robert Todd, Mr. Merwyn Hirsh, and Mr. Chris Olavson of the Houston-Galveston Regional Transportation Study were helpful in providing materials and data sources.

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Members of the Texas Transportation Institute staff have rendered valuable assistance. Mrs. Pamela J. Cosby provided guidance in the collection of data and in the writing and reviewing of the manuscript. Special assistance was given by Ms. Karen Spohr in typing and reviewing this manuscript.

The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented within. The contents do not necessarily reflect the official views or policies of the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

ABSTRACT

The majority of previous land use impact studies have been devoted to investigating the effects that new highway construction has on land use change and development. In view of the new emphasis placed upon upgrading and redesigning existing facilities rather than building new ones, highway planners need information relative to the influence that existing facility improvement has on area land uses. This report relates the findings of such an improvement which occurred in Houston, Texas when Section Two of Westheimer Road (F.M. 1093), between Hillcroft-Voss Road and Fondren Road, was upgraded from a two-lane rural type road to a six-lane divided thoroughfare. Prior to the improvement, the study area was described as a developing area in which the predominant land use was unimproved. Abutting and nonabutting properties were analyzed to determine the impact that the Westheimer Road improvement had on land development relative to location of property within the Study Area. Land use inventory data were collected for four study period years: 1962, the first "before" year; 1964, the last "before" year and first "construction" year; 1970, the last "construction" year and first "after" year; and 1978, the last "after" year. The 16-year study period includes two "before" years, six "construction" years, and eight "after" years. Comparisons of the type and rate of land use change were made between each of the three analysis periods to determine the impact of the improvement on area development. The results are reported in narrative, graphic and tabular form.

Other factors affecting land development were also investigated and included in this report. Highway planners should be able to implement this and subsequent reports of this study to make more accurate predictions of land use change relative to specific highway improvement projects.

SUMMARY OF FINDINGS

Land use data were collected for the Westheimer Road, Section Two Study Area (located in Houston, Texas) to determine the probable impact of upgrading Westheimer Road (F.M. 1093), between Hillcroft-Voss Road and Fondren Road, from a two-lane, undivided road with open drainage to a six-lane, divided street with raised median and curbs and gutters. The effects on the amount, rate, and type of land use change in this developing urban-fringe area were studied. An inventory of land uses was collected for four selected years during a 16-year study period, 1962-78, which includes: two years prior to construction, six years in which construction took place, and eight years after construction was completed.

Summarizing the findings:

- (1) The 517-acre Study Area has undergone many changes in land use. The percentage of developed acreage in the area has increased considerably during the overall period, from 14.6% in 1962 to 62.3% in 1978.
 - (a) The Study Area has remained in the developing stage through the study period.
 - (b) The predominant type of land use has remained unimproved. However, multi-family residential use has become the next most plentiful land use category.
 - (c) Multi-family residential use recorded the highest absolute increase (127.96 acres) while commercial use experienced the greatest percentage increase (478.63%) between 1962 and 1978. Acreage increases were also found in single-family residential (32.82 acres) and streets and roads (28.02 acres) categories during the same time span.

- (d) Unimproved acreage underwent the greatest absolute decrease (246.88 acres) and the greatest percentage decrease (100%) was experienced in the industrial use category.
- (2) Properties defined as abutting Westheimer Road, 190.29 acres, experienced many changes in land use between 1962 and 1978, during which the percentage of developed acreage has grown from 24.1% to 81.7%.
- (a) The predominant abutting land use changed from unimproved to commercial during the 16-year period.
- (b) Commercial acreage increased from 12.82 acres in 1962 to 65.34 acres in 1978, or by 58.49 acres, which was the greatest absolute increase in development recorded by land use category. Multi-family residential use also experienced an increase from 0 to 58.49 acres over the total study period.
- (c) Unimproved acreage was being developed steadily throughout the analysis period. A total of 109.33 acres of unimproved land were developed during the 16-year span, which was the greatest absolute decrease recorded for the Study Area. Redevelopment of single-family residences into commercial uses occurred during each of the three periods until all of the single-family residential tracts (4.86 acres) had become commercial acreage.
- (d) Over 69% of the abutting acreage recorded a change in land use of which 91% was the development of previously unimproved land.
- (3) The remaining 326.82 acres in the Study Area were defined as nonabutting property. Considerable amounts of land use change and development were recorded on nonabutting acreage, and the percentage of developed land increased from 9.0% in 1962 to 51% in 1978.

- (a) The predominant nonabutting land use remained unimproved throughout the study period.
 - (b) Multi-family residential acreage increased from 0 acres in 1962 to 69.47 acres in 1978. Also, single-family residential acreage increased from 14.13 acres in 1962 to 51.81 acres in 1978. Supporting streets and roads acreage increased from 12.47 acres in 1962 to 36.63 acres in 1978.
 - (c) Very little commercial development occurred during the study period. No commercial acreage was reported in 1962 and only 8.84 acres in commercial use were reported in 1978.
 - (d) Unimproved acreage experienced the greatest absolute decrease (137.35 acres) while industrial land experienced the greatest percentage decrease (100%).
- (4) The percentage of the Study Area acreage experiencing a change in land use fluctuated during the three time periods. In the "before" period (1962-64), 16.7% underwent a change; in the "construction" period (1964-70), 15.7% changed land uses; and in the "after" period (1970-78), 24.3% of the area recorded a land use change.
- (a) The average annual percentage of total Study Area land use change was 3.54% during the 16-year overall period. The average annual rate of change was 8.35% for the "before" period, 2.62% for the "construction" period, and 3.04% for the "after" period. The annual rate of change was expected to be as high or higher in the "construction" and "after" periods than for the "before" period. However, this does not mean that the street improvement failed to influence land development in the area. If the facility had not been improved, it is quite probable that land development in the area would have been even slower in the last two periods.

- (b) The average annual rate of land use change during the overall period was greater for abutting (4.32%) than for nonabutting (3.09%) properties. As expected, abutting properties experienced a higher rate of change than nonabutting properties. Also, between the "before" and "construction" or "after" periods, the annual rate of change dropped less for abutting than for nonabutting properties.
 - (c) As expected, the average annual rate of change for the entire analysis period was much higher for the previously unimproved acreage (3.18%) than for previously improved property (0.36%).
- (5) Several factors have facilitated land use change and development in the Westheimer Road, Section Two Study Area.
- (a) The growth of Houston toward the west, the availability of large tracts of undeveloped land, and the fact that Westheimer Road is the major traffic artery providing access to the developing area has made property in the Study Area some of the most attractive land in the state for commercial and multi-family residential development.
 - (b) Greater accessibility to the general region provided by the completion and improvement of the area's thoroughfare network, including Westheimer Road, has influenced Study Area land development. Generally, the improvement of Westheimer Road Section Two has encouraged the continued development of unimproved properties and has influenced the redevelopment of improved properties in the Study Area.

IMPLEMENTATION STATEMENT

This report relates the findings of a case study on land use changes that have occurred after an existing street was improved. The findings can be implemented immediately by highway agencies in predicting what might happen as a result of a similar street improvement in a comparable area elsewhere.

This case study is one of several being done in Texas cities. The predictive capabilities will be increased after analysis and comparison of data from all areas is accomplished. Those findings will be described in other reports.

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INTRODUCTION

Purpose and Objectives of Study

The near completion of the Interstate Highway System, the completion of many urban freeways, and the increasing shortage of funds for future highway construction have caused state highway agencies to turn to upgrading and expanding the vehicular capacity of existing streets and highways as a means of improving the transportation network. Much of the land use impact research conducted in the past investigated the effect of new location highway construction, while very little research was devoted to studying the impact of upgrading an existing facility in an urban area. In order to optimize public benefits, highway agencies need information concerning the effect of existing facility improvements to assist in making decisions on highway funding alternatives. The overall purpose of this study is to provide data to state highway agencies concerning the impact of improving the existing highways.

One important factor in determining the impact of any highway construction is the changes that occur in adjacent land use. The specific task of this analysis is to investigate land use changes in areas where an existing street or highway has been upgraded. Land use changes in the specified areas are compared to general land use plans and/or zoning maps to determine their importance to the evolution of area development. Traffic volume changes are also reviewed to ascertain the effects of various types of existing facility improvements. Many other economic and social factors are included in the study to assist in measuring the impact of existing street or highway improvement on urban land use.

Specifically, this report relates the findings of an investigation of land use change and development conducted in an area of Houston, Texas, where a

portion of Westheimer Road (FM 1093) was widened and repaved through a developing section of the city. The Westheimer Road, Section Two, Study Area, as shown in Figure 1, is one of three contiguous areas along Westheimer Road chosen for land use analysis relative to thoroughfare improvement. The area is also one of eighteen sites which have been or are now under investigation which are located in different Texas cities with various types of existing highway designs, various stages of land development, and various predominant land uses prior to the facility's design change and improvement. Reports of findings in those areas are available or will be forthcoming.

Objectives of this study are as follows:

- (1) To determine the initial and long-range land use impacts of different highway design changes on existing highways with a minimum of data collection.
- (2) To determine traffic volume changes resulting from various types of improvements.

Method of Study

A "before and after" study approach was employed in this analysis to identify land use changes in Westheimer Road, Section Two Study Area. Since land use changes may have been affected by the public's anticipation of a better roadway, data were collected for a time before formal planning for the specific project began as well as for subsequent years through 1978 (the applicable time periods are described in the Definitions section).

The amount of land (acres) in various uses was determined for the selected "before and after" years, and then average annual rates of land use change were calculated for each of the time periods. In addition, changes in improved and unimproved properties' land use were established separately for each period.

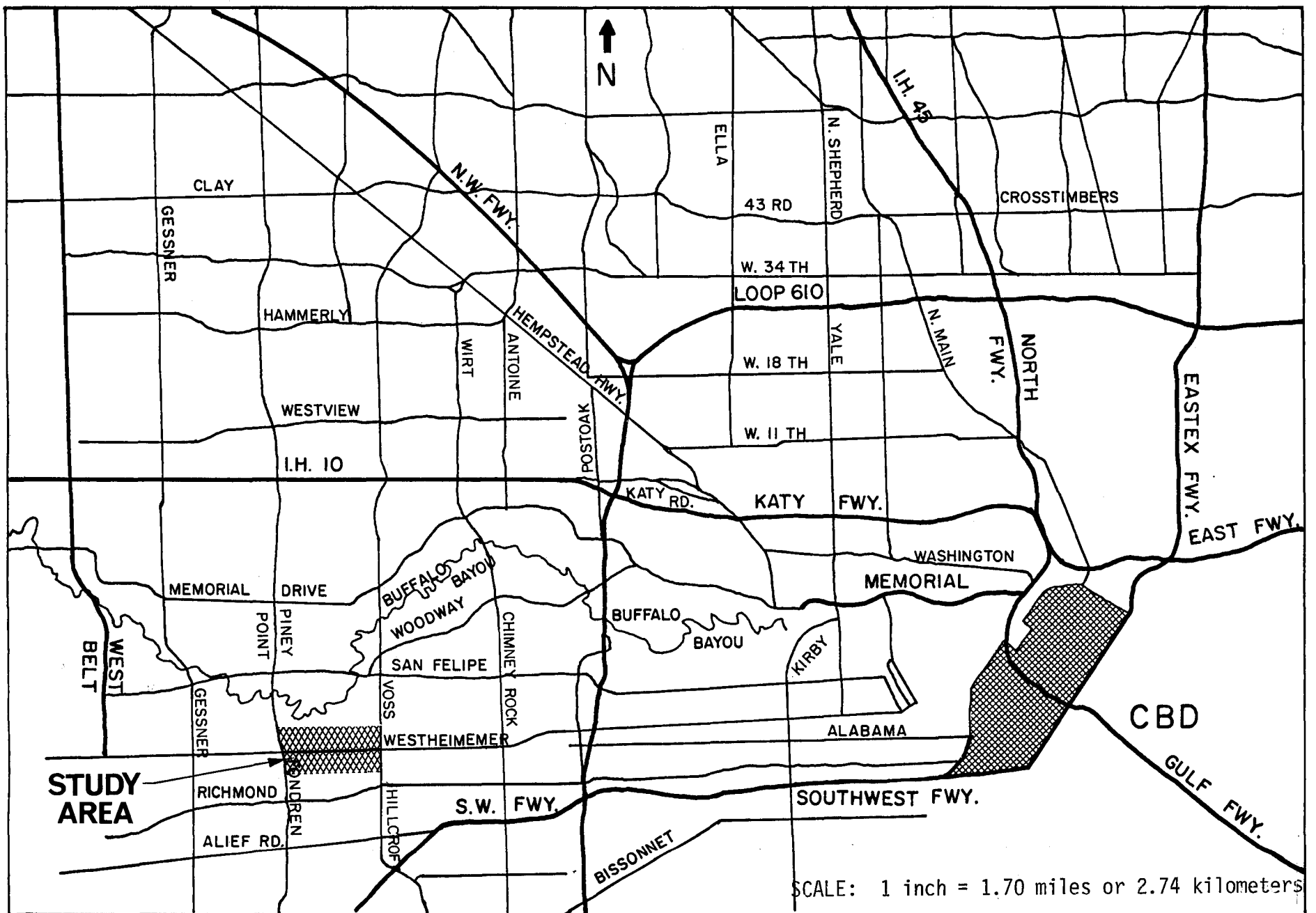


Figure 1. Map of the Northwest Houston Area Showing the Location of Westheimer Road Study Area, Section Two.

Finally, the differences in the annual rates of change between periods were analyzed to indicate the effect of the improvement on land use change and development.

The land in the Study Area was divided into abutting and nonabutting properties to permit further analysis. Abutting improved properties were identified as being on land having frontage along Westheimer Road not divided by a street and part of one development. Undeveloped properties with frontage were identified to be land extending 300 feet back from the facility. The remaining properties in the Study Area were defined as nonabutting properties (see Definition Section). These two categories of properties were studied separately to determine the differences in land uses and rates of development brought about by the improvement project.

In order to obtain background information about land use changes and development, several knowledgeable people were interviewed concerning the impact of the Westheimer Road project. Real estate people and area residents who were familiar with the area provided information on land sales and developments and about past and present land use. These individuals also provided insight into considerations given to the street improvement in making land development decisions in the Study Area.

Various factors which might have influenced land use changes were also investigated to provide additional background data about the social, economic, and environmental make-up of the area studied. The factors are: traffic volume, population characteristics, area land use plans, and area growth statistics.

Location of Street Improvements

The improved portions of Westheimer Road (F.M. 1093) being studied are now located within the incorporated city limits of Houston. Houston, the nation's fifth largest city and largest city in the South and Southwest, is the business and population center of a dynamic metropolitan area situated on the upper Gulf Coast of Texas, located approximately 50 miles from the Gulf of Mexico. The growth of Houston, Harris County, and the Houston SMSA has been phenomenal in recent decades, as is illustrated in Table 1. The 1978 Houston population has been estimated at 1,623,000 by the Houston Chamber of Commerce, and when compared to the 1970 census figure of 1,232,000 represents an increase of 31.7%.

Several industries have contributed to the extraordinary growth of the Houston-Gulf Coast region, but the chemical and petrochemical industries have played an extremely important part in the city's growth. The discovery of oil and gas in Southeast Texas and the opening of the Houston Ship Channel in the early 1900's stimulated development of the petroleum refining in the area to the extent that today over 50% of the nation's major petrochemical manufacturing capacity is located in the region. The Houston SMSA has long been the nation's leading producer of refined petroleum and petrochemicals, and, as a result, various allied industries have also located in the metroplex.

The Houston-Gulf Coast region possesses an excellent transportation network to both international and national business markets. The Port of Houston is the third largest seaport in the United States in total tonnage and ranks second in total dollars of foreign trade. The major import products are steel, petroleum, and passenger cars, while the port's leading export commodities are agricultural products, petroleum equipment, and chemicals. Also serving the international

Table 1. Population and Percent Changes of Area Population for the Houston SMSA, Harris County, City of Houston, and Census Tract 422 and 423, 1950-1978.

Area	1950	% Change Overall & Average Annual 1950-1960	1960	% Change Overall & Average Annual 1960-1970	1970	% Change Overall & Average Annual 1970-1975	Dec. 31, 1975 ^a	% Change Overall & Average Annual 1975-1978	1978 ^a
Houston SMSA	947,500	+51.0% +5.1%	1,430,394	+39.8% +4.0%	1,999,316	+25.8% +5.2%	2,516,000	+5.8% +1.9%	2,661,000
Harris County	806,701	+54.1% +5.4%	1,243,158	+40.1% +4.0%	1,741,912	+24.3% +4.9%	2,165,301	+6.4% +2.1%	2,304,000
City of Houston	596,163	+57.4% +5.7%	938,219	+31.4% +3.1%	1,232,793	+19.8% +4.0%	1,477,022	+9.9% +3.3%	1,623,000
Census Tract 422 (Includes Northern Portion of Study Area)	NA ^c		5,622 ^b	+193.2% +19.3%	16,486	+51.5% +10.3%	24,977	+12.3% +4.1%	28,039
Census Tract 423 (Includes Southern Portion of Study Area)	NA ^c		7,875 ^d	+124.0% +12.4%	17,616	+42.9% +8.6%	25,173	+33.6% +11.2%	33,633

(a) Houston Chamber of Commerce Population Estimates.

(b) Census Tract 91-E in 1960 is identical to Census Tract 422 in 1970.

(c) Census Tract Information in 1950 was not applicable for comparative analysis.

(d) Census Tract 91-F in 1960 is similar to Census Tract 423 in 1970.

market, air passenger and freight service is provided through two large airport terminals in the Houston area. The national business market is served well through a variety of transport modes. Low-cost barge transportation is available via the Intracoastal Waterway which connects Houston to the midcontinent regions of the Mississippi River and its tributary systems. Rail and motor freight operations are provided by six major railroad companies and a large number of common-carrier, specialty-carrier, and local delivery trucking firms. Houston is also a major center of oil and gas transmission for pipeline companies which operate 13 crude oil and products pipelines and 21 gas pipelines which serve almost every section of the nation.

The favorable industrial, transportation, and energy environment of the Houston-Gulf Coast area has led to an increasingly diversified economic structure during the past 20 years. During the 1960's, Houston's growth as a corporate center expanded tremendously. Since 1970, over 200 major companies have moved their headquarters, divisions, or subsidiaries to Houston making the city an important center of international economic activity.

The substantial business activity and population growth and subsequent growth of Houston as a marketing center has generated increasing amounts of traffic and has made greater demands on the street and highway system to provide adequate access to developed and developing urban areas. The improvement of Westheimer Road was accomplished to meet the traffic needs of an area (Census Tract 422 and 423) which has experienced population increases that are greater percentagewise than experienced by the Houston SMSA, Harris County, and City of Houston during the study period shown in Table 1.

The Study Area, as shown in Figure 1, is located approximately seven miles west of Houston's central business district and is situated between IH 10 (to the north) and the Southwest Freeway (to the south), two of the city's major

traffic carriers. The location of Westheimer Road relative to the city's free-ways has placed great pressure on this facility to provide access to and from the large amount of developing acreage in western Houston.

Reviewing general land use maps, the Study Area is described as "medium density residential," i.e. composed of primarily single-family residential developments. Most of the single-family residences are about 20 years old and are of brick or brick-veneer construction while the multi-family apartment complexes range from five to 15 years old. The housing is described as being in good condition.

Key Characteristics of Street Improvement

Westheimer Road, Section Two Study Area is one of six Houston study sites chosen for analysis of land use changes relative to street improvements. The study areas were chosen according to the following characteristics:

- (1) The stage of area development,
- (2) Type of highway or street,
- (3) The predominant land use, and
- (4) The type of setting (suburban or urban).

These factors were determined during the period of time prior to the beginning of the street improvement project. Using these characteristics, different types of study sites have been selected that will permit analyses of various design changes and the resulting impact on land use changes.

The characteristics of the second section of Westheimer Road during the "before" period were determined to be as follows:

- (1) The stage of area development--developing;
- (2) Type of highway--two-lane, undivided road with open ditches;
- (3) Predominant land use--unimproved; and

(4) Type of setting--urban-fringe (suburban).

Due to the availability of unimproved land and the general growth of Houston toward the west, large amounts of land use change and development was expected to occur during the study period. These changes in land use were expected to be accelerated by the Westheimer Road improvement, but the trend and type of land developments were not expected to be affected by the design change.

Sources of Data

The major source of planning information concerning the Westheimer Road improvement was obtained from the Houston City Planning Department, while construction and street design data were collected from the Houston Public Works Department, Paving Division.

Land use data were available through several sources, but the most applicable information was provided by the City Planning Department (CPD). Other sources of valuable land use data were the District Office of the State Department of Highways and Public Transportation (SDHPT), Harris County Agricultural Stabilization and Conservation Service Office, and Houston-Galveston Regional Transportation Study (H-GRTS). Most of the land use data were collected from colored (Lambert) maps, aerial photographs, and on-site inspections of the area.

Background land use information was collected from city directories of Houston, from Sanborn (fire insurance) maps, from subdivision platting records maintained by Harris County, and from personal interviews with real estate developers and brokers, city planners and officials, and property owners and area residents. Information about city-wide and regional land use plans was obtained from CPD and H-GRTS publications.

Traffic volume data were provided by the Houston Traffic and Transportation Department for city streets and relevant state and federal highways. H-GRTS was also a source of traffic volume information. The Houston Chamber of Commerce provided historical U.S. census and population projections along with housing information for Houston and its metropolitan area. Socio-economic data were collected from U.S. Bureau of the Census publications found in the City of Houston's Public Library.

Definitions

The following land use categories and time periods were used to identify properties within the arbitrarily defined study area:

Abutting Properties - improved tracts with frontage along Westheimer Road, not separated by streets, and a part of the same development. Unimproved tracts, with Westheimer Road frontage extending 300 feet back from the facility.

Nonabutting Properties - all tracts within the Study Area not defined as abutting Westheimer Road.

Single-Family Residential - tract improved with occupiable house for one family.

Multiple-Family Residential - tract improved with duplex or apartment complexes designed to house two or more families.

Commercial - tract improved with a commercial business.

Educational - tract improved with an elementary, middle or high school, or property owned by a school district.

Public-Governmental - tract improved with a governmental office, park, public owned utility, etc.

Semi-Public-Nonprofit - tract with improvements such as churches, non-profit clubs, or other non-profit organizations.

Industrial - tract improved for manufacturing, product storage, etc.

Streets and Roads - land improved with a street or road; includes land dedicated as right-of-way.

Unimproved - land which has not been developed for any particular use; also includes previously developed land that is presently vacant or unused and land used for agricultural purposes.

Before Period - the time period which ends the year prior to the initiation of formal planning and construction. For Westheimer Road, the "before" period includes the years 1962 to 1964.

Construction Period - the years in which final planning, funding, and construction processes occur. In this report, the construction period includes two years after the improvement was completed due to availability of reliable data. The years 1964 through 1970 constitute the "construction" period.

After Period - the period which includes those years after the "construction" period to the present, or specifically, 1970 to 1978.

CHARACTERISTICS OF AREA STREETS
BEFORE AND AFTER THE IMPROVEMENT
OF WESTHEIMER ROAD

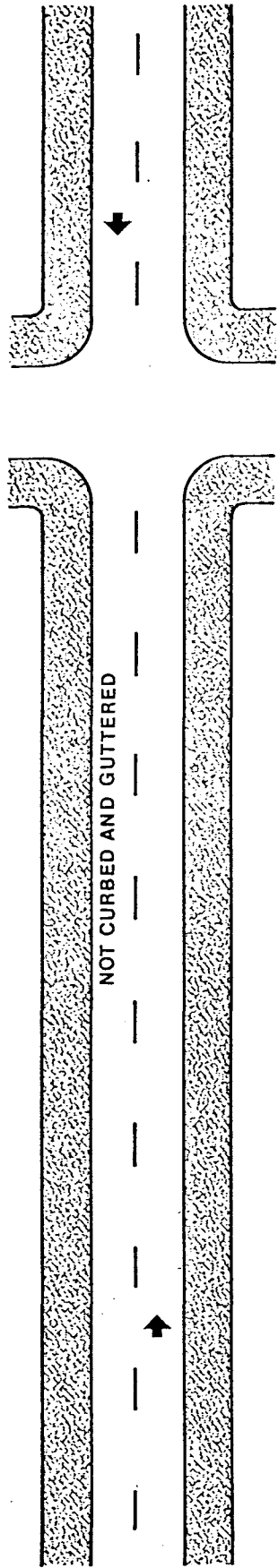
Westheimer Road

Westheimer Road is a major east-west thoroughfare which extends west from the central business district (CBD) of Houston approximately 20 miles to the Harris-Fort Bend county line. Westheimer Road, or FM 1093 (a state maintained facility), extends beyond the county line an additional 43 miles west to Eagle Lake, Texas. This report focuses on a section of Westheimer Road (Figure 1) located between Hillcroft-Voss Road and Fondren Road that was improved during 1966-67. FM 1093 carries the highest traffic volume of any farm-to-market road in Texas.

The 1.25-mile portion of Westheimer under investigation in this report was part of a 1.33-mile section of Westheimer Road improvement funded by the State of Texas. The funds for the planned design change were provided through the 1967-68 Consolidated Program. Work began on the improvement project in September 1966 and construction was completed and accepted in January 1968. The "before" design of the analysis section was a 24-foot wide, two-lane, undivided asphalt roadway with six-foot wide shoulders and open drainage (Figure 2) which was upgraded to a six-lane divided thoroughfare with two 36 foot road surfaces, raised median, and curbs and gutters. The "before" and "after" right-of-way was 120 feet; no additional right-of-way was acquired for the improvement.

The portions of Westheimer Road contiguous to the 1.25 mile study section were also improved between 1966 and 1972. The portion just east of the section under investigation, from Hillcroft-Voss east to South Post Oak, was upgraded to the same "after" design as the study section during 1966-67. Just west of Fondren Road, Westheimer was a two-lane, undivided road with open ditches prior to 1970, but during 1970-71, a portion of Westheimer Road, from Fondren to

Before Period Design



After Period Design

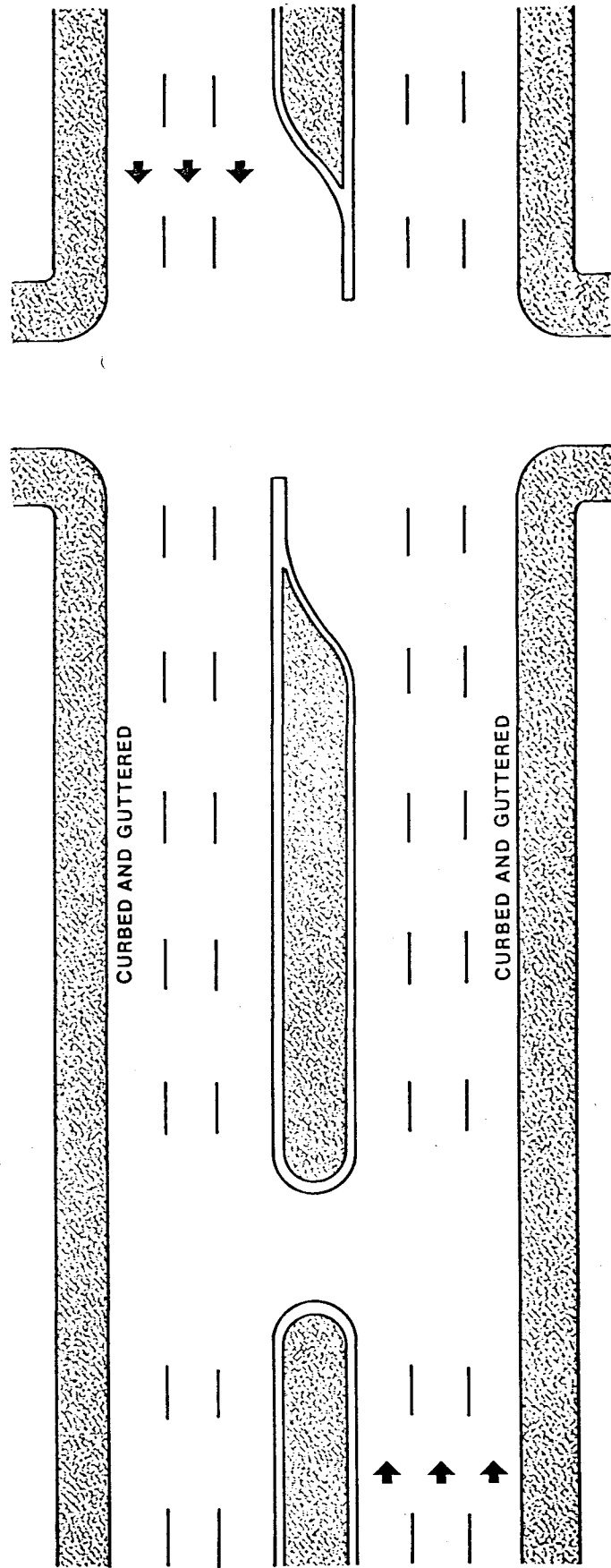


Figure 2. Street Design

Gessner, was improved to the same "after" design as the study section (Figure 2).

As shown in Table 2, Traffic count data collected by the City of Houston and the SDHPT indicate a dramatic increase in vehicular traffic on Westheimer Road during the overall study period; i.e. Westheimer at Hillcroft-Voss, 186% (12.4% average per year); Westheimer at Briargrove, 266% (16.6% average per year); and Westheimer at Gessner, 524% (32.7% average per year). Reviewing the traffic data by the three time periods reveals that at the intersection of Westheimer and Hillcroft-Voss, traffic volume increased 44.4% (14.8% per year) during the "before" period, 1961-64; 7.0% (1.7% per year) during the "construction" period, 1964-68; and 85.2% (10.6% per year) during the "after" period, 1968-76.

At the intersection of Westheimer and Briargrove, located approximately three-tenths of a mile east of Hillcroft-Voss, similar increases in traffic volumes were recorded but, at Westheimer and Gessner traffic volume increased faster than the other two collection sites. Between 1961 and 1963, traffic volume grew much slower than the two other sites, or only 15.9% (8.0% per year). During the latter two periods, an increase of 66.8% (16.7% per year) was recorded from 1963-67 and, for the period 1967-77, an increase of 222.6% (22.3% per year) was experienced at a point over one mile to the west of Fondren Road. Traffic volumes along Westheimer Road were still growing rapidly as the completion of the area thoroughfare network neared and as area land development progressed.

Intersecting Streets

The two major thoroughfares intersecting Westheimer Road within the Study Area are Hillcroft-Voss Road, which forms the eastern border, and Fondren Road,

Table 2. Twenty-Four Hour Traffic Counts of Study Area Streets

Location	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
<u>Westhelmer Road</u> at Hillcroft-Voss at Briargrove* at Gessner	14,190	15,314 14,090 6,976	16,208 20,460	24,319 20,500 8,088	22,113 20,880	22,046 19,540 11,251	15,000 15,450	19,427 16,490 13,489	23,654 24,700	31,120 16,078	32,600	33,980	42,280 26,277	41,439 40,460 34,482	45,094 39,540 34,870	41,250 35,832	43,800 41,190	43,522	
INTERSECTING STREETS																			
<u>Hillcroft-Voss</u> at Westhelmer at Richmond Ave. at Buffalo Bayou	11,420	5,634	13,577	17,601	12,998	17,807	15,396	13,059	14,056	22,669	17,516	26,459	20,917	27,629 32,345	31,389 33,024 18,340	31,513 33,586	27,197 34,590 20,665	36,092	
<u>Fondren</u> at Westhelmer at Bellair Blvd. at Buffalo Bayou	4,705	4,761	6,607	7,518	7,502	10,040	11,948	10,081 9,299	10,730	11,585 18,633		19,752 21,955	9,909	26,220 22,834	21,367 24,520 9,545	20,686 25,414 10,641	20,892 26,719	27,237 11,851	
PARALLEL STREETS																			
<u>Richmond</u> at Fondren at Chimney Rock at Gessner												11,734		13,727 22,044 3,138	16,763 24,052 9,218	19,830 25,199 12,405	24,078	29,542 12,172	
<u>San Felipe</u> at Voss at Sage									11,049				20,754	20,043 23,856	20,519 27,233	31,088	23,008		

*Average annual 24-hour traffic counts maintained by SDHPT.

which makes up the western boundary (Figure 1). Hillcroft Avenue intersects Southwest Freeway to the south, while Voss Road intersects Katy Freeway to the north. Fondren Road intersects Southwest Freeway to the South and connects with Piney Point Road which intersects Katy Freeway to the north.

Hillcroft-Voss Road is a four-lane, divided, curbed and guttered thoroughfare with raised median within the Study Area. Hillcroft Avenue, from Westheimer south to Westpark, was improved to its present design during 1962-63. Voss Road was improved from Westheimer north to San Felipe during 1966-67, the same time that Westheimer Road Section Two was improved.

Traffic volume on Hillcroft-Voss has increased during the study period, as illustrated by the 383% (25.5% per year) increase in traffic count recorded at its intersection with Westheimer Road between 1961 and 1976 (Table 2). Reviewing the data by time periods for the intersection described above, "before" period traffic volume increased by 216% (54.0% per year); "construction" period traffic volume increased 27% (6.8% per year); and "after" period traffic volume increased 20% (2.9% per year). Traffic counts collected along Hillcroft-Voss at locations north and south of Westheimer also indicate that 24-hour traffic volume has increased over the study period (Table 2).

Fondren Road has two street designs within the Study Area. During 1965-66, Fondren was upgraded by the City of Houston to a four-lane, divided (raised median) thoroughfare with curbs and gutters from 770 feet north of Westheimer south to West Park Drive. From 770 feet north of Westheimer to Buffalo Bayou, Fondren has remained a two-lane, undivided asphalt road with open ditches. In the Recommended Thoroughfare Improvement Program 1971-75, plans for widening and paving Fondren Road from Westheimer north of Memorial Drive as a four-lane, divided facility were published but, as of 1978, no construction on the project has been initiated. Traffic data collected at three locations along Fondren

have indicated that vehicular volume has grown considerably during the study period. For instance, traffic counts at the intersection of Fondren and Westheimer have increased 339% (22.6% per year) between 1961 and 1976. The "before" period traffic experienced a 57.9% (29.0% per year) increase; the "construction" period traffic experienced an increase of 54.1% (9.0% per year); and the "after" period traffic experienced an increase of 80.3% (11.5% per year). The two other locations along Fondren Road where traffic count data were collected also indicated that traffic volumes grew dramatically during the analysis period (Table 2).

Other important area freeways and streets which intersect Westheimer Road include: IH 610 (West Loop), South Post Oak Road, Chimney Rock Road, and Gessner Road (see Figure 1). Many of these facilities were upgraded during the analysis period and as a result have influenced traffic volume and land use changes and development within the Study Area and the general vicinity.

Parallel Streets

The major thoroughfares immediately adjacent and parallel to Westheimer Road are San Felipe Road and Richmond Avenue (Figure 1). Located over eight-tenths of a mile north of Westheimer and outside the Study Area, San Felipe is about six miles in length and is situated between Shephard Drive (to the east) and merges with Memorial Drive just west of Voss Road. Also situated outside the Study Area, Richmond Avenue is located four-tenths of a mile south of Westheimer and extends from near downtown Houston east approximately 11 miles to Beltway 8 (West Belt). Both facilities are alternate routes for traffic in the Westheimer Road area.

San Felipe Road, between Chimney Rock and Voss, was improved as a four-lane, divided median street with curbs and gutters under two projects contracted

by the city and both improvements were completed during 1962-63. Although the street width does vary between Chimney Rock and Fountain View (Figure 1), the street design has not changed since 1963. Traffic count data for San Felipe were available for only the "after" period. The available traffic data does indicate an increase of 181% (22.7% per year) at San Felipe and Sage, just east of the Study Area, between 1968 and 1976 and an increase of 15% (4.9% per year) from 1974 to 1977 at the intersection of San Felipe and Voss Road.

The section of Richmond Avenue located between Hillcroft and Fondren was improved as a four-lane, divided (raised median) facility with curbs and gutters under two separate improvement projects. The first portion upgraded, involving the section from Chimney Rock west to Ann Arbor, was accomplished during 1968-69; while the portion from Ann Arbor to Gessner was improved between 1971 and 1973. Traffic data for Richmond Avenue indicate that the volume of traffic has increased over the period in which traffic counts are available. At the intersection of Richmond and Fondren, an increase of 115% (28.8% per year) in traffic volume was recorded during the 1973-77 period. While at Richmond and Chimney Rock and at Richmond and Gessner, the increases in volume were 105% (17.5% per year) from 1971 to 1977 and 288% (72.0% per year) between 1973 and 1977, respectively.

Other parallel streets which can be utilized as alternate routes for Westheimer are Woodway Drive, Memorial Drive, West Park Drive, Gulfton Drive, and Bellaire Boulevard.

CHARACTERISTICS OF THE STUDY AREA BEFORE AND AFTER THE IMPROVEMENT OF WESTHEIMER ROAD, SECTION TWO

Size and Boundaries of Study Area

The dimensions of the Westheimer Road, Section Two Study Area are approximately 3,400 feet wide and 6,600 feet long. The 517 acre Study Area was delineated to include an equivalent of three blocks of developed land on either side of the improved facility. The eastern boundary is formed by Hillcroft-Voss Road, while the western border of the Study Area is formed by Fondren Road. With Westheimer Road bisecting the identified area, the northern section extends about 1,200-1,800 feet from the improved facility and its boundary is formed by Burgoyne Road (in the eastern portion) and Woodway Drive (in the western portion). The southern section ranges from 1,500 to 1,700 feet in width and the southern border of the Study Area is formed by Meadowglen Drive and a set of property lines which is in alignment with Meadowglen. The Study Area is located in a section of the Houston metropolitan area which has experienced rapid growth and development during the 1960's and 1970's.

Land Use Characteristics

A review of the land use characteristics of the Westheimer Road, Section Two Study Area indicates that a large amount of land use change and development has occurred during the analysis period. Although the predominant land use has remained unimproved throughout the study period, the percentage of the total area acreage remaining unimproved has decreased considerably. A detailed account of area land uses was collected for four selected years of the study period: 1962, 1964, 1970 and 1978. Each of these years corresponds to important dates for the planning, funding, construction, and completion of the

Westheimer Road improvement project. Figures 3 and 4 illustrate the land uses identified for 1962 and 1964, the first and last year of the "before" period, respectively. Figures 5 and 6 illustrate the land uses identified for 1970 and 1978, the year after "construction" period and the last year of the "after" period, respectively. Total acreage devoted to each of the identified land use categories in each of the four selected years is listed in Table 3. Also found in Table 3 are the absolute acreage and percentage change in each use category recorded during each of the three time periods (i.e. before, construction, and after) and the overall 16-year period.

In 1962 (the first year of the analysis period), the Study Area was described as an undeveloped area with the predominant land use being unimproved (some of which was agricultural land). Of the over 517 total area acres (209 hectares), over 85.4%, of 441.83 acres (178.8 hectares) was unimproved while the remaining 14.6%, or 75.28 acres (30.5 hectares), was improved as of 1962. The percentage breakdown by land use category during the first year of this analysis is as follows: single-family residential, 3.7%; commercial, 2.5%; industrial, 0.6%; streets and roads, 7.8%; and unimproved, 85.4%. As shown in Figure 3, very few land developments existed in the Study Area and unimproved land was plentiful in 1962.

The land use configuration during the last year of the study period, 1978, as shown in Figure 6, was quite different from the 1962 configuration. Although the predominant land use had remained unimproved, the percentage of unimproved land had dropped to only 37.7% while the improved properties made up 62.3% of the total Study Area. Figure 6 illustrates that multi-family residential, commercial, and single-family residential developments now exist where unimproved land was before. The percentage breakdown by land use category as of 1978 is as

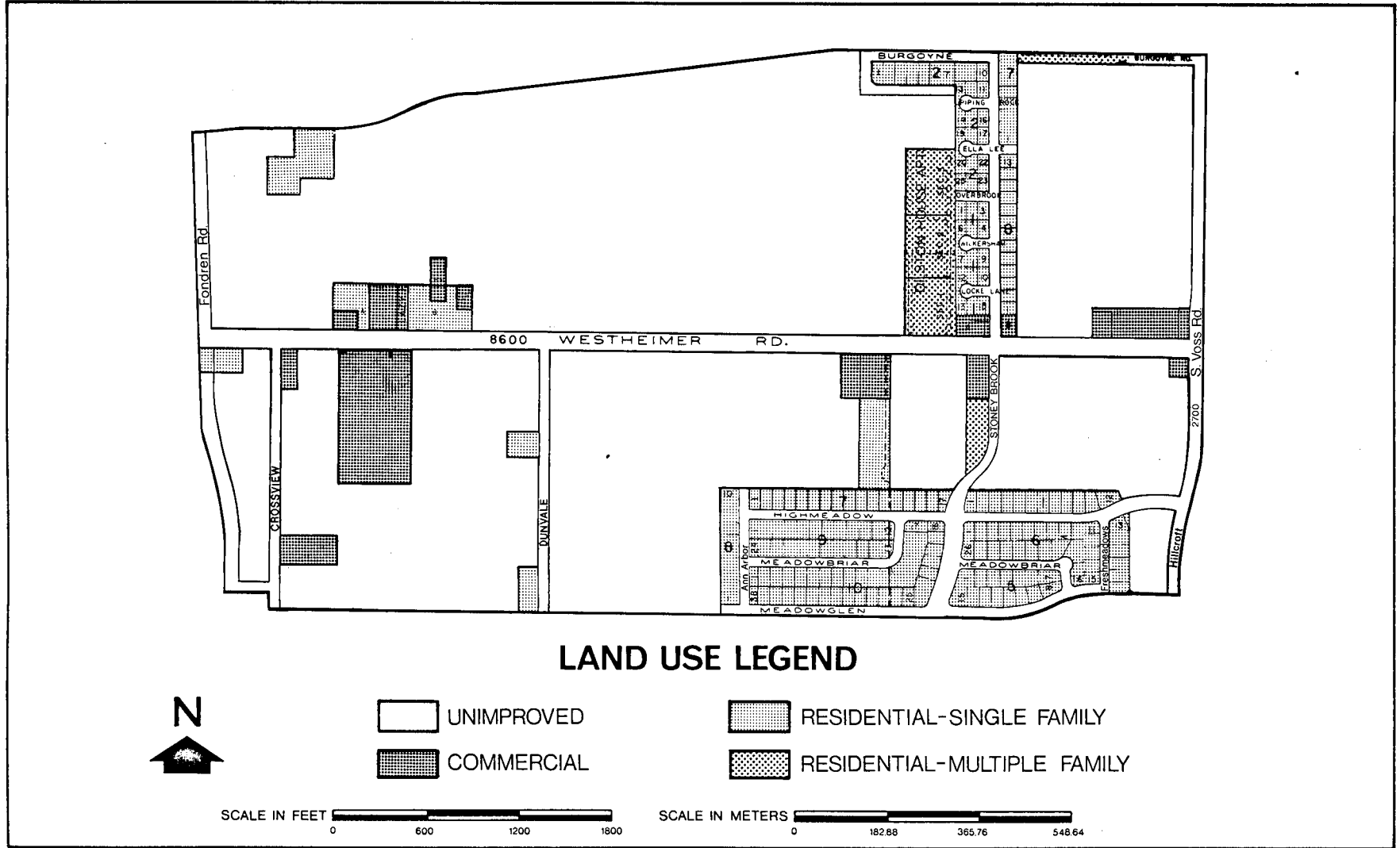


Figure 4. Map of Land Use in the Westheimer Road Study Area in 1964

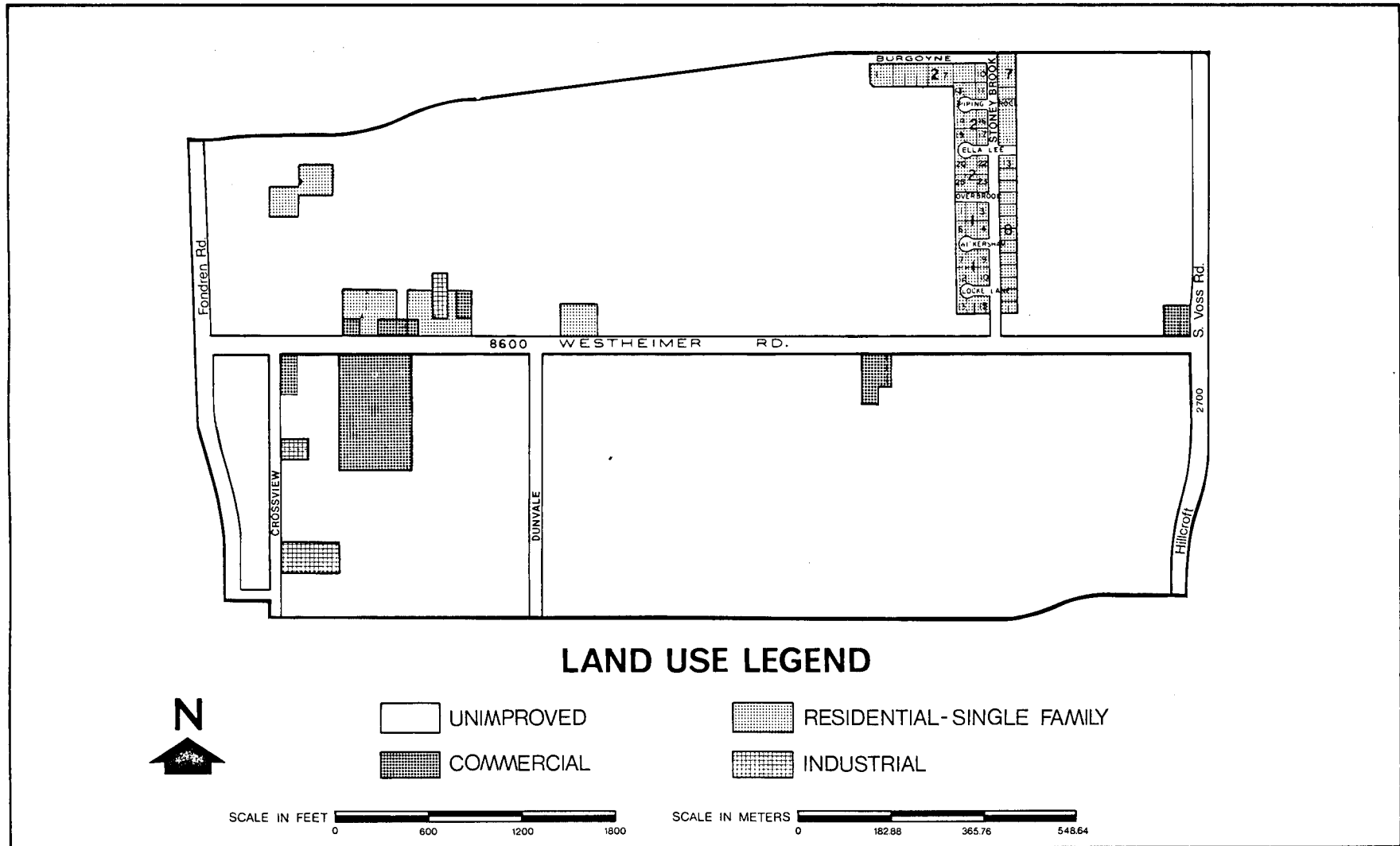


Figure 3. Map of Land Use in the Westheimer Road Study Area in 1962

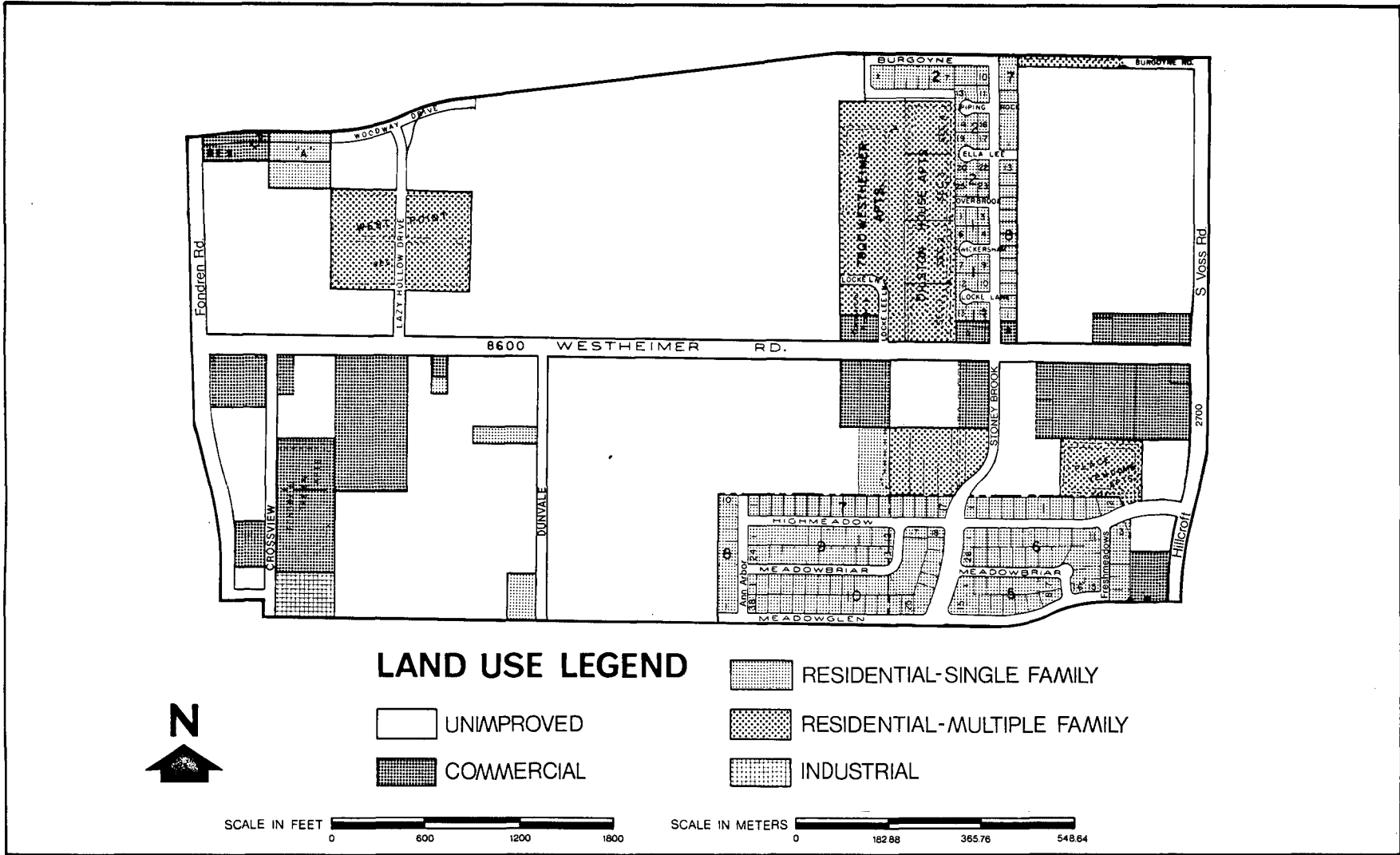


Figure 5. Map of Land Use in the Westheimer Road Study Area in 1970

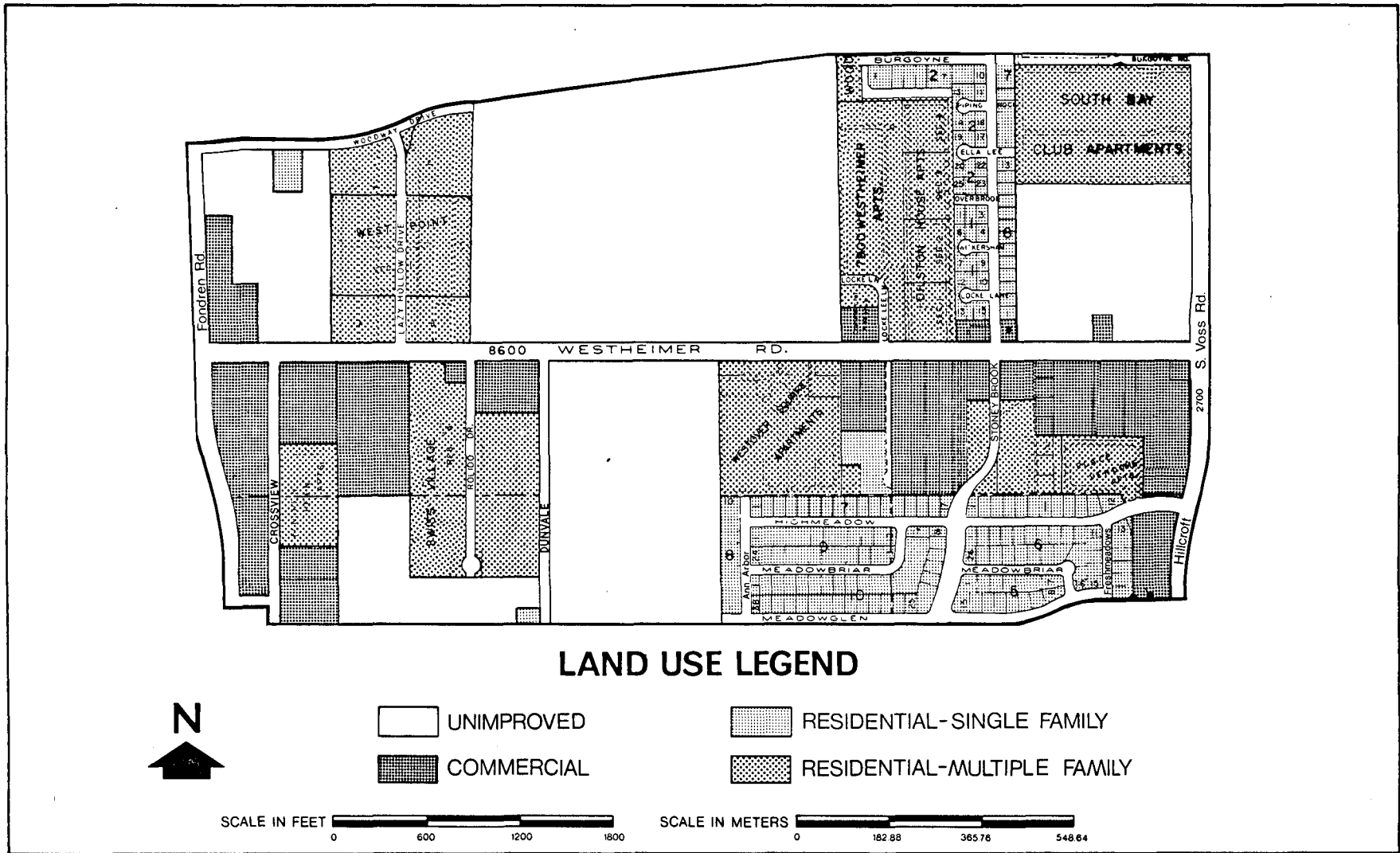


Figure 6. Map of Land Use in the Westheimer Road Study Area in 1978

Table 3. Total Study Area Land Use Acreage Change by Year and Land Use Category^a

Land Use Change By Time Period	Before		Construction		After		Overall Period	
	1962		1964		1970		1978	1962 - 1978
Single-Family Residential Total Acres Absolute Change Percent Change	18.99	+41.18 +216.85%	60.17	-4.29 -7.13%	55.88	-4.07 -7.28%	51.81	+32.82 +172.83%
Multi-Family Residential Total Acres Absolute Change Percent Change	0	+11.75 -	11.75	+36.61 +311.57%	48.36	+79.60 +164.60%	127.96	+127.96 -
Commercial Total Acres Absolute Change Percent Change	12.82	+10.70 +83.46	23.52	+25.60 +108.84	49.12	+25.06 +51.02	74.18	+61.36 +478.63%
Industrial Total Acres Absolute Change Percent Change	3.28	-3.28 -100%	0	+2.58 -	2.58	-2.58 -100%	0	-3.28 -100.00%
Semi-Public Total Acres Absolute Change Percent Change	0	- -	0	- -	0	- -	0	- -
Public Total Acres Absolute Change Percent Change	0	- -	0	- -	0	- -	0	- -
Streets & Roads Total Acres Absolute Change Percent Change	40.19	+19.35 +48.15%	59.54	+4.23 +7.10%	63.77	+4.44 +6.96%	68.21	+28.02 +69.72%
Unimproved Total Acres Absolute Change Percent Change	441.83	-79.70 -18.04	362.13	-64.73 -17.87	297.40	-102.45 -34.45	194.95	-246.88 -55.88%
Total Study Area Acres	517.11		517.11		517.11		517.11	

^aOne acre equals 0.4047 hectares.

follows: single-family residential, 10.0%; multi-family residential, 24.8%; commercial, 14.3%; streets and roads, 13.2%; and unimproved, 37.7%.

Land Use Changes

The land use configuration of the Westheimer Road Study Area has changed somewhat during the 16-year study period. The land use changes that occurred in the Study Area are analyzed first on an overall area basis and second, in terms of the proximity of property to Westheimer Road.

Overall Study Area

The predominant land use has remained unimproved throughout the entire study period, but unimproved acreage has decreased considerably from 85.4% in 1962 to 37.7% in 1978 of the total area acreage. Multi-family residential, commercial and single-family residential use categories have experienced acreage increases primarily at the expense of unimproved property. Table 3 indicates the amount of acres devoted to each use category in each of the four years in which data were collected and the acreage and percentage change by category between the selected years.

Reviewing specific land use changes for the overall period, multi-family residential development recorded the greatest absolute increase (127.96 acres) and commercial development recorded the greatest percentage increase (478.63%) between 1962 and 1978. Notable growth was also realized in the single-family residential (32.82 acres or 172.83%) category. The unimproved and industrial land use categories had the greatest absolute (246.88 acres) and percentage (100.0%) decreases in acreage. As the above description suggests, the majority of the land use changes were the result of the development of previously unimproved land (see Table 3).

Analyzing land use change by each of the three identified study periods indicates that during the "before" period, 1962-64, single-family residential development had the greatest absolute (41.18 acres) and percentage (216.85%) increase, while unimproved acreage recorded the greatest absolute decrease (79.70 acres) and industrial use experienced the greatest percentage decrease (100.0%). Increases in acreage were also recorded for streets and roads (19.35 acres), multi-family residential (11.75 acres), and commercial (10.70 acres) categories during the "before" period. The percentage of unimproved land in the overall area decreased from 85.4% to 70.0% between 1962 and 1964.

During the "construction" period, 1964-70, the land use changes and developments that occurred were similar to those that occurred in the "before" period. The greatest absolute (64.73 acres) and percentage (17.87%) decrease in acreage was recorded in the unimproved land use category, while multi-family residential acreage experienced both the greatest absolute (36.61 acres) and percentage (311.57%) increase between 1964 and 1970. Other categories experiencing acreage change were commercial, increased 25.60 acres; industrial, increased 2.58 acres; streets and roads, increased 4.23 acres; and single-family residential, decreased 4.29 acres. As in the previous period, most of the acreage recording change in use was the development of previously unimproved property and correspondingly, the percentage of unimproved acreage decreased from 70.0% to 57.5% between 1964 and 1970.

Between 1970 and 1978, the "after" period, the land development trend toward multi-family residential and commercial uses continued. Unimproved acreage again realized the greatest absolute decrease (102.45 acres) and industrial land experienced the greatest percentage decrease (100.0%) during the eight-year period. Multi-family residential acreage underwent the greatest absolute (79.60 acres) and percentage (164.60%) increase with commercial development also

recording a notable jump in acreage (25.06 acres). Slight changes were also experienced in the single-family residential (decreased 4.07 acres) and streets and roads (increased 4.44 acres) categories. Unimproved land had the largest acreage decline (102.45 acres) from 1970 to 1978 and, as a result, the percent of unimproved property dropped from 57.5% to 37.7% over those years. Total Study Area acreage devoted to each land use category by selected year is illustrated in Figure 7.

Proximity to Westheimer Road

The Study Area properties were segregated into two separate categories according to their location relative to Westheimer Road in order to facilitate a comparative analysis. Dividing the properties into either the abutting or nonabutting land category allows a study approach to be implemented to determine the influence of the street improvement on the location of land use changes. Abutting properties normally are expected to undergo relatively more land use changes than nonabutting properties as a result of the street improvement; however, several factors may exist that could alter the anticipated results (i.e. availability of developable land, predominant land use, etc.). Therefore, an analysis of the land use changes occurring in each location category is reviewed to confirm or reject the above hypothesis.

Abutting Properties. Abutting properties are defined as those tracts with frontage along the subject facility, which is Westheimer Road. For developed properties, if an abutting tract was improved as a single development, all of the land development was included to avoid arbitrary division of the tract. For unimproved tracts with frontage on the subject facility, a section of land 300 feet (91.44 meters) deep from the right-of-way was defined as abutting properties. Abutting property in the Study Area was defined according to land use

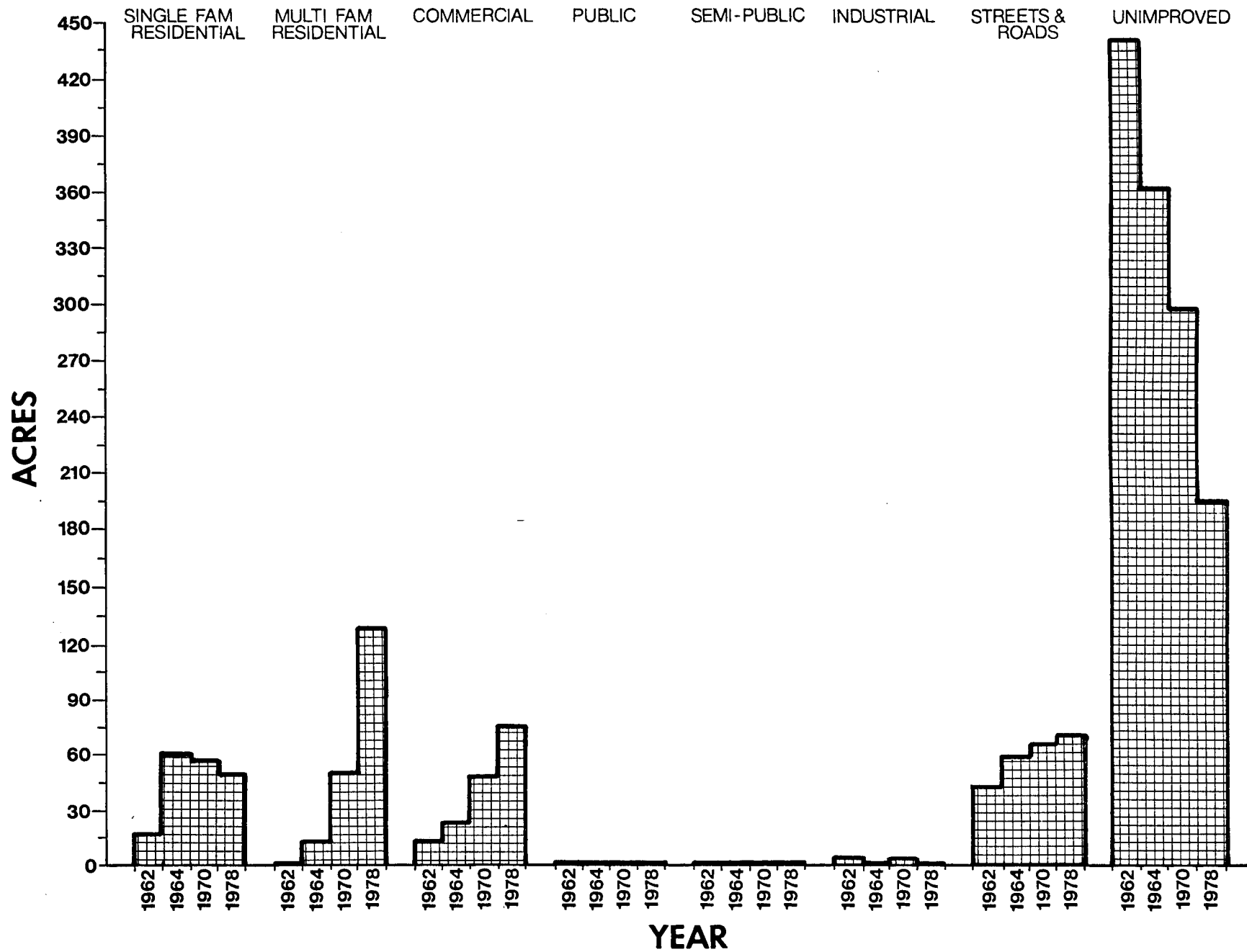


Figure 7. Changes in Total Land Use in the Westheimer Road Study Area by Category and Selected Years

configuration in 1978, the last year of the analysis period, and remained consistent for the preceding years of the 16-year time period.

According to the above description, 190.29 acres (77.0 hectares) were defined as abutting the improved facility. In the first year of analysis, 1962, unimproved land was the predominant land use category. Approximately 75.9% (144.41 acres) of the total abutting acreage was undeveloped (see Table 4). Of the developed acreage, streets and roads constituted 60.4% of the total 1962 development. The percentage breakdown by land use category as of 1962 is as follows: single-family residential, 2.6%; commercial, 6.7%; industrial, 0.2%; streets and roads, 14.6%; and unimproved, 75.9%. Figure 3 shows that very little of the abutting acreage had been developed prior to 1962.

Only 9.5% (18.02 acres) of the total abutting property underwent a change in land use during the "before" period. Commercial development recorded the greatest percentage increase (65.21%) and multi-family residential acreage was determined to have experienced the greatest absolute increase (9.30 acres) of the land use categories identified. Industrial use underwent the greatest percentage decline (100.0%) while unimproved acreage dropped 17.37 acres, the greatest absolute decrease found between 1962 and 1964. Single-family residential and streets and roads recorded slight changes in acreage between the first and last years of the "before" period. By 1964, unimproved acreage constituted 66.8% of the abutting property compared to 75.9% in 1962.

Between 1964 and 1970, the "construction" period, approximately 19.7% (37.41 acres) of the total abutting acreage changed land uses. Multi-family residential acreage experienced the greatest absolute (20.40 acres) and percentage (219.35%) growth. Also undergoing increases in development were the commercial (15.57 acres) and streets and roads (1.44 acres) use categories. Conversely, the land uses experiencing the greatest absolute and percentage

Table 4. Abutting Property Land Use Acreage Change by Year and Land Use Category^a

Land Use Change By Time Period	Before		Construction		After		Overall Period	
	1962		1964		1970		1978	1962 - 1978
Single-Family Residential Total Acres Absolute Change Percent Change	4.86	-0.17 -3.49%	4.69	-4.30 -91.68%	0.39	-0.39 -100%	0	-4.86 -100%
Multi-Family Residential Total Acres Absolute Change Percent Change	0	+9.30 -	9.30	+20.40 +219.35%	29.70	+28.79 +96.94%	58.49	+58.49 -
Commercial Total Acres Absolute Change Percent Change	12.82	+8.36 +65.21%	21.18	+15.57 +73.51%	36.75	+28.79 +77.80	65.34	+58.49 +409.67%
Industrial Total Acres Absolute Change Percent Change	0.48	-0.48 -100%	0	- -	0	- -	0	-0.48 -100%
Semi-Public Total Acres Absolute Change Percent Change								
Public Total Acres Absolute Change Percent Change								
Streets & Roads Total Acres Absolute Change Percent Change	27.72	+0.36 +1.30%	28.08	+1.44 +5.13%	29.52	+2.06 +6.98%	31.58	+3.86 +13.92%
Unimproved Total Acres Absolute Change Percent Change	144.41	-17.37 -12.03%	127.04	-33.11 -26.06%	93.93	-59.05 -62.87%	34.88	-109.53 -75.85%
Total Abutting Acres	190.29		190.29		190.29		190.29	

^aOne acre equals 0.4047 hectares.

decreases were the unimproved (33.11 acres) and single-family residential (91.68%) categories. Most of the new developments were built on previously unimproved land and correspondingly, the percentage of unimproved property dropped from 66.8% to 49.4% between 1964 and 1970 (see Figures 4 and 5).

During the "after" period, 1970-78, multi-family residential development again experienced both the greatest absolute (28.79) and percentage (96.94%) increases in acreage, while unimproved land again exhibited the greatest absolute decrease (59.05 acres). Single-family residential use was found to have had the greatest percentage decrease (100.0%) during the "after" period. Other changes in acreage recorded were increases in both the commercial (28.59 acres) and streets and roads (2.06 acres) categories. The land use trend in the Study Area of the development of unimproved land as primarily multi-family residential or commercial establishments continued throughout the 16-year period (Figure 6). Following this trend, the percentage of unimproved property has declined from 49.4% to 18.3% during the "after" period and for the overall period, from 75.9% in 1962 to 18.3% in 1978. Figure 8 shows the amount of abutting acreage in each land use category in each of the four selected years.

A review of the abutting land use change during the overall period indicates that by 1978 the abutting portion of the Study Area had developed into a combination commercial/multi-family residential area. Approximately 69.2% of the abutting acreage changed use, and commercial and multi-family residential development constituted 88.7% of the acreage that changed use. Multi-family residential and commercial acreage recorded the greatest absolute (58.49 acres) and percentage (409.67%) increases. On the other hand, unimproved land had the greatest absolute decline (109.53 acres) while single-family residential and industrial acreage both experienced the greatest percentage decrease (100%) of the eight land use categories. Streets and roads development also recorded an

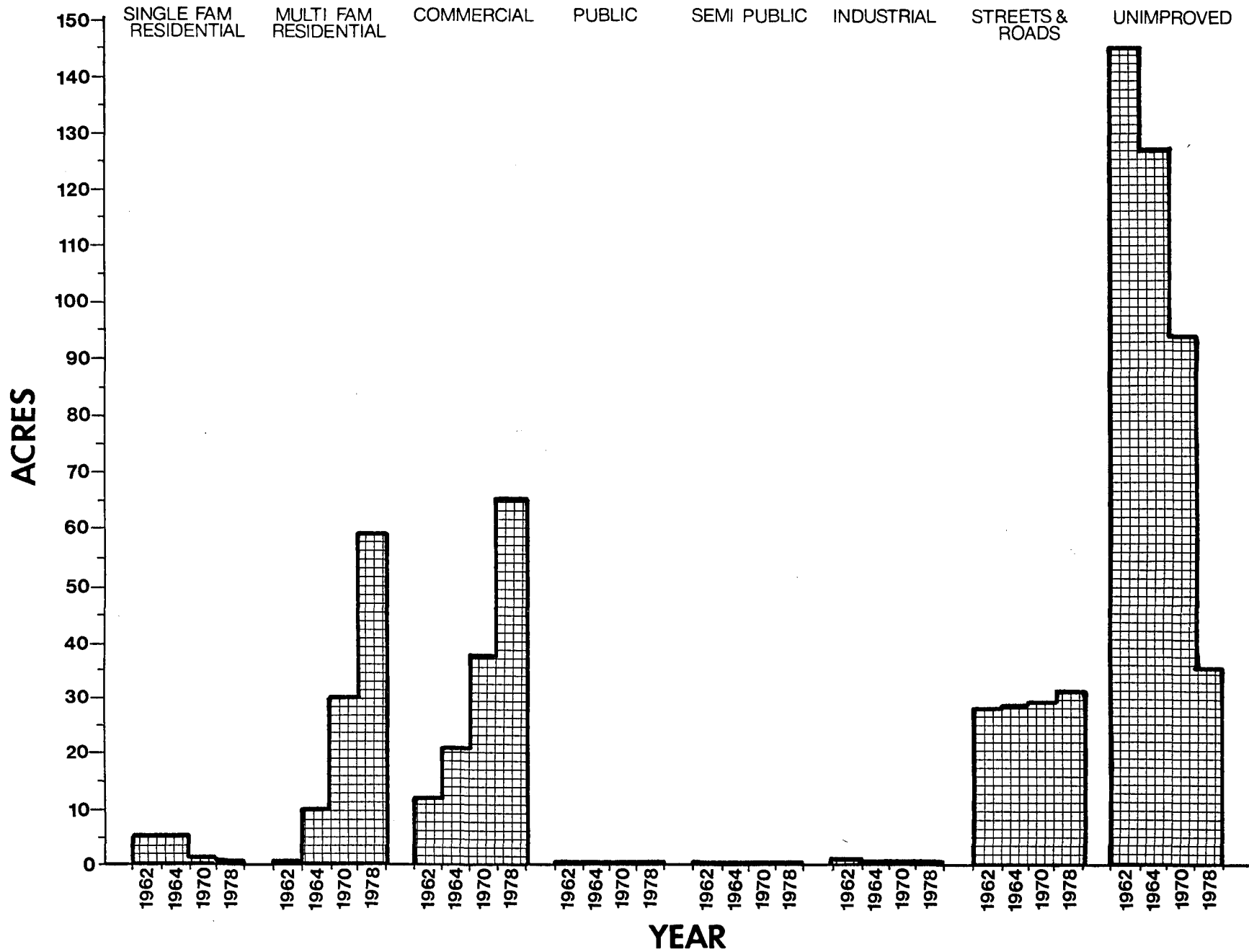


Figure 8. Changes in Abutting Land Uses in the Westheimer Road Study Area by Category and Selected Years

increase in acreage (3.68 acres) between 1962 and 1978. About 60.3% of the abutting portion of Study Area experienced a change in land use during the overall period.

Nonabutting Properties. Nonabutting property in the Study Area has been defined simply as those tracts not classified as abutting the improved facility (see Definitions). Using this criteria, 326.82 acres (132.3 hectares) were defined as nonabutting property and Table 5 indicates the acreage and amounts of land use change for each use category and selected time period. As was the case in the abutting tracts, the predominant land use in 1962 was found to be unimproved acreage; in fact, 91.0% (297.42 acres) of the total nonabutting acres was undeveloped during the first analysis year. Only 9.0% (29.40 acres) was developed and single-family residential constituted almost half of that total. The percentage breakdown by land use category in 1962 was single-family residential 4.3%, industrial 0.9%, streets and roads 3.8%, and unimproved 91.0% (see Figure 3). The nonabutting portion of the Study Area was described as an undeveloped area in 1962.

During the first analysis period, 1962-64, 19.9% (65.13 acres) of the nonabutting acreage underwent a change in land use. Unimproved land suffered the greatest absolute decrease (62.33 acres) and industrial acreage realized the greatest percentage decrease (100.0%). Single-family residential development had both the greatest absolute (41.35 acres) and percentage (292.64%) increase of the eight land uses. Categories also recording increases in acreage were streets and roads (18.99 acres), and multi-family residential (2.45 acres), and commercial (2.34 acres). About 95.7% of the acreage changing use was previously unimproved land and, as a result, the percentage of undeveloped property fell to 71.9% in 1964 from 91.0% in 1962.

Table 5. Nonabutting Property Land Use Acreage Change by Year and Land Use Category^a

Land Use Change By Time Period	Before		Construction		After		Overall Period	
	1962		1964		1970		1978	1962 - 1978
Single-Family Residential Total Acres Absolute Change Percent Change	14.13	+41.35 +292.64%	55.48	+0.01 +0.01%	55.49	-3.68 -6.63%	51.81	+37.68 +266.67%
Multi-Family Residential Total Acres Absolute Change Percent Change	0	+2.45 -	2.45	+16.21 +661.63%	18.66	+50.81 +272.29%	69.47	+69.47 -
Commercial Total Acres Absolute Change Percent Change	0	+2.34 -	2.34	+10.03 +428.63%	12.37	-3.53 -28.54%	8.84	+8.84 -
Industrial Total Acres Absolute Change Percent Change	2.80	-2.80 -100%	0	+2.58 -	2.58	-2.58 -100%	0	-2.80 -100%
Semi-Public Total Acres Absolute Change Percent Change	0	- -	0	- -	0	- -	0	- -
Public Total Acres Absolute Change Percent Change	0	- -	0	- -	0	- -	0	- -
Streets & Roads Total Acres Absolute Change Percent Change	12.47	+18.99 +152.29%	31.46	+2.79 +8.87%	34.25	+2.38 +6.95%	36.63	+24.16 +193.74%
Unimproved Total Acres Absolute Change Percent Change	297.42	-62.33 -20.96%	235.09	-31.62 -13.45%	203.47	-43.40 -21.33%	160.07	-137.35 -46.18%
Total Nonabutting Acres	326.82		326.82		326.82		326.82	

^aOne acre equals 0.4047 hectares.

Between 1964 and 1970, the "construction" period, only 9.7% (31.62 acres) of nonabutting experienced a change in land use and all of that acreage was previously unimproved. Correspondingly, the unimproved use category recorded the greatest absolute (31.62 acres) and percentage (13.45%) decline in acreage. Multi-family residential development was determined to have increased the most in absolute (16.21 acres) and percentage (661.63%) terms. Acreage growth was found to have occurred in the commercial (10.03 acres), streets and roads (2.79), industrial (2.58 acres), and single-family residential (0.01 acres) categories.

As in the previous periods, unimproved acreage underwent the greatest absolute decrease (43.40 acres) during the "after" period, 1970-78. Industrial development recorded the greatest percentage decrease (100.0%), while the greatest absolute (50.81 acres) and percentage (272.29%) increase was found in multi-family residential acreage. Other acreage changes recorded between 1970 and 1978 were decreases in the single-family residential (3.68 acres) and commercial (3.53 acres) uses and an increase in the streets and roads (2.38 acres) category. Following the overall period trend, the percentage of nonabutting unimproved land declined from 62.3% in 1970 to 49.1% in 1978.

Analyzing nonabutting land use change for the overall 16-year study period, multi-family residential development experienced the greatest absolute increase (69.47 acres) and single-family residential acreage recorded the greatest percentage increase (266.67%). Conversely, unimproved and industrial acreage underwent the greatest absolute (137.35 acres) and percentage (100%) decrease during the same period. Increase in development was also found in the streets and roads (24.16 acres) and commercial (8.84 acres) use categories. By 1978, approximately 51.0% of the nonabutting property was developed and of that total,

over 72.7% was improved as either multi-family or single-family residential use and can be described as a developing residential area (see Figure 7). Figure 9 illustrates the nonabutting acreage in each land use category by the selected analysis years.

Land Use Impediments

Many factors can alter the rate and type of land use development in an area besides the improvement of a single thoroughfare. Zoning laws, subdivision (deed) restrictions, and comprehensive land use plans could have dictated how development and change occurred in the impacted area. Other factors also investigated to determine their influence on area land use were regional land developments, area accessibility, and property ownership.

Land Use Plans and Controls

The City of Houston does not have zoning laws and, therefore, has no legal means of enforcing or controlling land use. The process through which the city may influence land use development is by approving or rejecting plats submitted by land developers. When approving plats, the city has the authority to impose certain restrictions, e.g. location and number of access points to major thoroughfares, type and width of local streets, and set-back distance of buildings from street; but the city cannot dictate the type of land development. Deed restrictions are the only legal method of controlling land use in Houston, but area property owners, not the city government, must instigate the action to prevent a nonconforming land use.

Although land use planners in Houston have no power to enforce land use controls, comprehensive land use plans have been developed to reflect general trends in land development. In 1960, the Houston Metropolitan Area

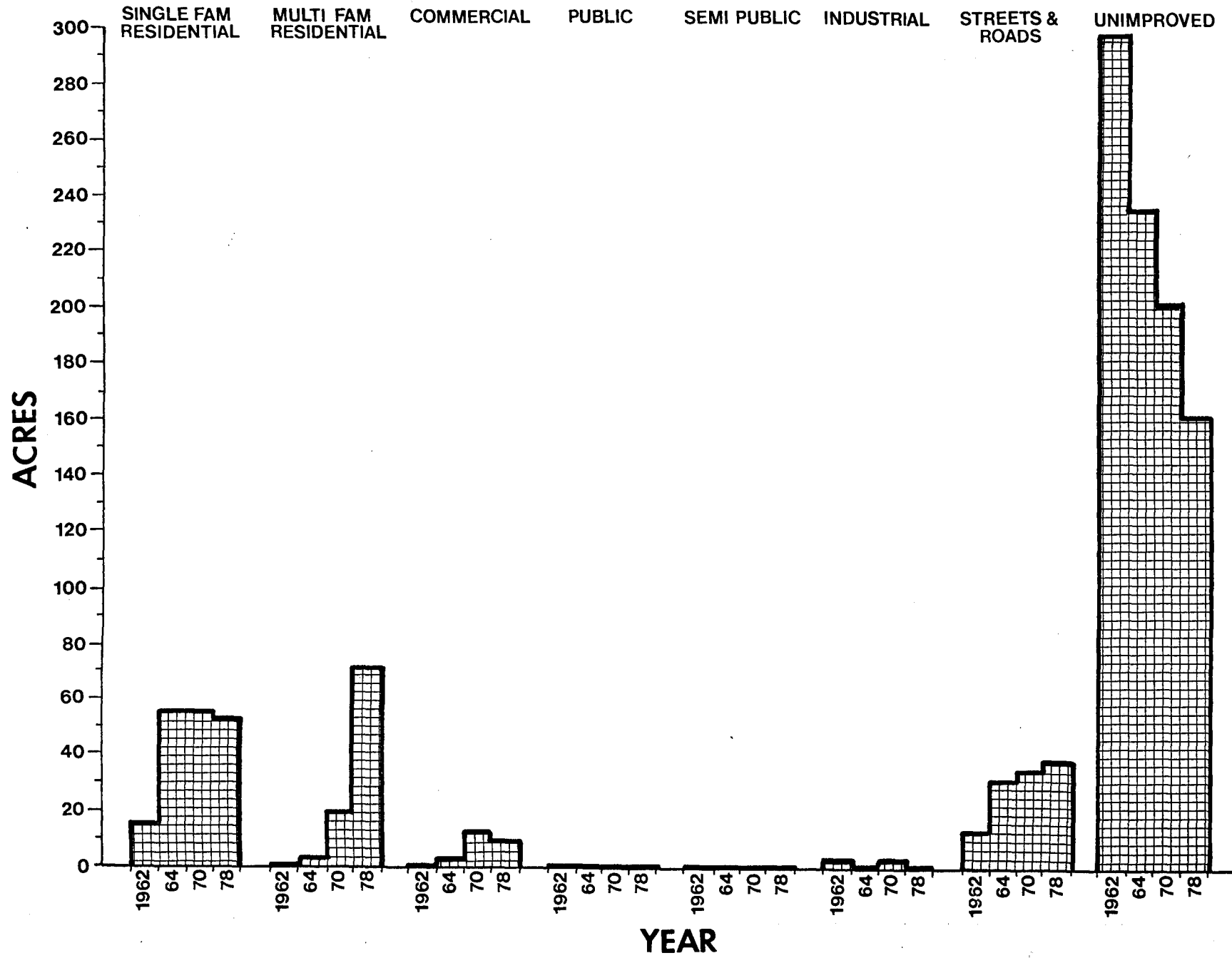


Figure 9. Changes in Nonabutting Land Uses in the Westheimer Road Study Area by Category and Selected Years

Transportation Study published a 1980 land use plan for Harris County that forecast that the Westheimer Road Section Two Study Area would evolve into a predominantly single-family residential area with strip commercial establishments concentrating along Westheimer Road and Hillcroft-Voss Road. The 1980 general plan projected that multi-family residential developments would locate near the intersection of Westheimer and Hillcroft-Voss Roads. In the 1990 general land use plan, published by the Houston City Planning Commission in 1972, the entire Study Area was described as medium density residential (i.e. primarily single and multi-family residential uses). The 1990 plan did not address, or account for strip commercial developments like the ones located in the Study Area; only regional and neighborhood shopping centers and large business establishments were identified in the general land use plan.

These land use plans were based on existing land use, age of existing improvements, amenities offered for the various types of developments, land use development plans, and area growth trends. The 1978 land use configuration found in the Westheimer Road, Section Two Study Area is not entirely consistent with the Houston Metropolitan Area plan. The differences between the actual and forecast land use are the large tracts of land which have remained unimproved as of 1978, the widespread multi-family residential development throughout the area, and the strip commercial establishments abutting Fondren Road. Although the 1980 plan correctly forecast the regional land use trend of strip-commercial and single-family residential development, the Study Area's land use development has not followed the regional single-family residential trend because of the importance of multi-family residences locating near Westheimer and the problem of property owners not selling or improving several large tracts of land within the area. The analysis revealed that the Study Area has evolved into primarily

a multi-family residential and commercial, or medium-density residential area (as described in the 1990 general land use plan).

The land use plans published for the Houston-Harris County and Westheimer Road area have been effective in forecasting general regional land development trends. Although the general land use plans do not account for block by block land uses, trends in land uses have been correctly predicted by city and county planners.

Other Factors Influencing Land Use Change

Due to the availability of unimproved land and the lack of land use controls (i.e. zoning laws and deed restrictions), land development in the Study Area has not encountered many impediments. The only type of impediment encountered was the resistance of several owners of large tracts of property to develop or sell to developers. It is difficult to ascertain the impact of these large unimproved tracts on Study Area development. Certainly, if these tracts were made available, additional land development in the form of commercial, multi-family and single-family residential use would occur in the area. In all probability, the resistance of property owners has caused developments that would have been located in the Study Area to locate elsewhere along Westheimer Road.

Factors which might have encouraged commercial and multi-family residential development were: the growth trend of Houston toward the west, the fact that Westheimer Road is the only east-west traffic artery that serves the Study Area, availability of large tracts of unimproved land, and the completion and improvement of the area's thoroughfare network (i.e. San Felipe, Richmond, Hillcroft-Voss, and Fondren).

Socio-Economic Characteristics

The socio-economic characteristics of an area may have an important influence on the regional land use development. Factors such as population growth, median family income, educational level, and labor force characteristics were investigated to determine their possible significance to land use development trends in Section Two of the Westheimer Road area.

Table 6 enumerates the 1960 and 1970 Bureau of the Census population and labor force data for Census Tracts 91-E/422 and 91-F/423 and the City of Houston. These data were analyzed to detect if any significant differences existed in the above characteristics between the City of Houston and the census tracts during the two years of interest. Since Census Tracts 91-E/422 and 91-F/423 encompass the entire 517 acre Study Area, a comparative analysis between the two sets of data may be implemented. (Census Tracts 91-E and 91-F were the 1960 census identification codes for Census Tracts 422 and 423 in the 1970 census.)

Table 6 indicates that the population in Census Tracts 91-E/422 and 91-F/423 increased by 152.7% from 1960 to 1970, while the City of Houston increased 31.4% during the same time frame. Also, the median school years completed and the percent of high school graduates in both the 1960 and 1970 censuses were noticeably higher for the census tracts, when compared to the city-wide data. Correspondingly, the median family income was higher in Census Tracts 91-E/422 (132.9% in 1960 and 75.7% in 1970) and 91-F/423 (16.0% in 1960 and 27.1% in 1970) than the Houston income figure. In addition, the median value of owner-occupied residences of the two census tracts was higher than the comparable Houston median value in both the 1960 and 1970 censuses. Further analysis of the above differences indicate that generally the gap between the

Table 6. Comparison of 1960 and 1970 Socio-Economic Characteristics of Houston and Census Tracts 91-E/422 and 91-F/423

Socio-Economic Characteristics	1960			1970		
	Houston	Tract 91-E	Tract 91-F	Houston	Tract 422	Tract 423
<u>Population</u>	938,219	5,622	7,875	1,232,793	16,486	17,616
Median School Years Completed	11.3	14.6	12.4	12.1	15.5	13.2
Percent High School Graduates	45.2	84.6	60.2	51.8	88.5	75.3
Median Family Income	\$5,902	\$13,744	\$6,848	\$9,876	\$17,354	\$12,551
Median Income of Families and Unrelated Individuals	\$5,093	\$13,197	\$6,606	\$8,055	\$16,877	\$10,221
Median Value of Owner Occupied Residences	\$10,900	\$25,000+	\$13,800	\$14,400	\$41,400	\$22,100
Median Rent Paid by Tenants	\$67	\$--	\$93	\$96	\$178	\$158
Percent Families Below Poverty Level	NA ^(a)	NA ^(a)	NA ^(a)	10.7	3.0	6.3
<u>Occupation</u>						
Total Employed, 16 Years and Over	363,636 ^(b)	1,894 ^(b)	2,929 ^(b)	515,619	9,288	8,657
Percent Professional, Technical, and Kindred Workers	12.49	28.62	18.13	16.53	35.61	27.11
Percent Managers and Administrators, Except Farm	9.97 ^(c)	28.88 ^(c)	13.21 ^(c)	8.78	18.14	10.80
Percent Sales Workers	8.08	14.15	11.67	8.97	15.83	15.46
Percent Clerical and Kindred Workers	16.56	12.88	14.44	20.09	20.53	22.89
Percent Craftsmen, Foremen, and Kindred Workers	12.72	3.75	6.79	13.10	3.60	6.88
Percent Operatives, Except Transport	13.79 ^(d)	2.06 ^(d)	9.15 ^(d)	9.29	1.18	4.13
Percent Transport Equipment Operatives	NA ^(d)	NA ^(d)	NA ^(d)	4.24	0.34	1.13
Percent Laborers, Except Farm	5.74	1.64	9.53	5.19	0.61	3.26
Percent Farm Workers	NA ^(c)	NA ^(c)	NA ^(c)	0.24	0.08	0.10
Percent Service Workers	9.44	2.22	4.92	11.14	3.38	6.58
Percent Private Household Workers	4.21	2.27	6.76	2.09	0.61	1.64

(a) Percent Families Below Poverty Level was not calculated by the Bureau of the Census in the 1960 census.

(b) In the 1960 census, Total Employed included all employed persons 14 years old and over.

(c) In the 1960 census, the percent total for managers and administrators included farm workers; therefore, a separate percent total for Farm Workers was Not Available.

(d) In the 1960 census, the percent total for Operatives include transport equipment operatives; therefore, a separate percent total for Transport Equipment operatives was Not Available.

city-wide data and the data for Census Tract 91-E/422 has remained the same (in absolute and percentage terms) between the 1960 census and 1970 census (i.e., percent high school graduates, median family income, median value of owner-occupied residences, and median rent paid by tenants).

An analysis of the labor force characteristics indicated that the persons living in the two census tracts were employed in higher paying occupations than those in Houston in 1960 and 1970. For example, Census Tracts 91-E/422 and 91-F/423 contained a relatively higher proportion of people employed as professional and technical workers, managers and administrators, and sales workers and a smaller proportion of craftsmen and foremen, laborers, service workers, and private household workers than Houston, city-wide. As was the case above, Census Tract 91-F/423 has widened the gap in the occupational characteristics between 1960 and 1970.

The socio-economic data found in Table 6 indicates that the Study Area and the surrounding region has experienced marked changes in population and that the characteristics of the Census Tracts are somewhat different than Houston as a whole. The differences in the above data suggest that the Study Area's census tracts have had an economic base more conducive to continued land development than perhaps Houston in general.

IMPACT OF THE STREET IMPROVEMENT ON LAND USE IN THE STUDY AREA

Two approaches were employed to indicate whether the Westheimer Road, Section Two improvement impacted land use in the Study Area. The first approach is based on actual land use data. This approach generates the "before" and "after" average annual percentage changes in land use or land development. The second approach utilizes the opinions of knowledgeable people to ascertain the land use impact of the improvement.

Actual Land Use Changes

During the analysis period, the percentage of developed land (including streets and roads) increased from 14.6% in 1962 to 62.3% in 1978, while the corresponding percent of unimproved land in the 517.11 acre Study Area dropped from 85.4% to 37.7% of the total acreage. Between 1962 and 1978, 262.82 acres (106.4 hectares) of previously unimproved land underwent some manner of development and 30.17 acres (12.2 hectares) of previously improved land experienced some type of redevelopment (Table 7).

Tables 7 and 8 were prepared to illustrate the extent of land use change that was recorded in the study area according to property location (abutting vs. nonabutting). Table 7 indicates the period by period acreage changing land use. Table 8 shows the period by period average annual percentage change in land use calculated to adjust for the difference in the number of years between time periods. Both tables also indicate the previous and new use categories for each change recorded. This approach will permit a comparative analysis to be done between abutting and nonabutting property changes and, therefore, determine the land use impact of the Westheimer Road improvement relative to property location.

Table 7. Absolute Changes in Land Use of Abutting and Nonabutting Acreage by Time Period and Type of Land Use Change

Type of Land Use Change	Before Period		Construction Period		After Period		Overall Period	
	1962-1964		1964-1970		1970-1978		1962-1978	
	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting
	* ----- Acres -----							
Commercial to Multi-Family	0	0	0	0	0	5.65	0	5.65
Industrial to Commercial	0.48	2.80	0	0	0	2.58	0.48	5.38
Single-Family to Commercial	0.21	0	1.15	0	0	0	1.36	0
Single-Family to Multi-Family	0	0	0	0	0.39	0.97	0.39	0.97
Commercial to Unimproved	0	0.46	3.54	0	2.21	1.94	5.75	2.40
Single-Family to Unimproved	1.03	0	3.15	0.90	0	2.71	4.18	3.61
Unimproved to Commercial	7.67	0	17.96	10.03	30.80	1.48	56.43	11.51
Unimproved to Multi-Family	9.30	2.45	20.40	16.21	28.40	44.19	58.10	62.85
Unimproved to Single-Family	1.07	41.35	0	0.91	0	0	1.07	42.26
Unimproved to Industrial	0	0	0	2.58	0	0	0	2.58
Unimproved to Streets	0.36	18.99	1.44	2.79	2.06	2.38	3.86	24.16
Total Acreage Changing Use	20.12	66.05	47.64	33.42	63.86	61.90	131.62	161.37
Improved Acreage	1.72	3.26	7.84	0.90	2.60	13.85	12.16	18.01
Unimproved Acreage	18.40	62.79	39.80	32.52	61.26	48.05	119.46	143.36
Total Acreage Not Changing Use	170.17	260.77	142.65	293.40	126.43	264.92	58.67	165.45
Total Acreage	190.29	326.82	190.29	326.82	190.29	326.82	190.29	326.82

*One acre equals 0.4046856 hectares.

Table 8. Average Annual Percentage Changes in Abutting and Nonabutting Acreage by Time Period and Type of Land Use Change.

Type of Land Use Change	Before Period		Construction Period		After Period		Overall Period	
	1962-1964		1964-1970		1970-1978		1962-1978	
	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting
	-----Percent ^a -----							
Commercial to Multi-Family	0	0	0	0	0	0.22	0	0.11
Industrial to Commercial	0.13	0.43	0	0	0	0.10	0.02	0.10
Single-Family to Commercial	0.06	0	0.10	0	0	0	0.04	0
Single-Family to Multi-Family	0	0	0	0	0.03	0.04	0.01	0.02
Commercial to Unimproved	0	0.07	0.31	0	0.15	0.07	0.19	0.05
Single-Family to Unimproved	0.27	0	0.28	0.05	0	0.10	0.14	0.07
Unimproved to Commercial	2.02	0	1.57	0.51	2.02	0.06	1.85	0.22
Unimproved to Multi-Family	2.44	1.37	1.79	0.83	1.87	1.69	1.91	1.20
Unimproved to Single-Family	0.28	6.33	0	0.05	0	0	0.04	0.81
Unimproved to Industrial	0	0	0	0.13	0	0	0	0.05
Unimproved to Streets	0.09	2.91	0.13	0.14	0.14	0.09	0.13	0.46
Total Acreage Changing Use	5.29	10.10	4.17	1.71	4.19	2.37	4.32	3.09
Improved Acreage	0.46	0.49	0.69	0.05	0.17	0.53	0.40	0.34
Unimproved Acreage	4.83	9.61	3.48	1.66	4.02	1.84	3.92	2.75

^aDerived from the absolute acreages in Table 7. For example, the individual acreages changing use during the "before" period are divided by the total abutting or nonabutting acreage at bottom of Table 7 to obtain the corresponding percentages for that period. Then each percentage figure is divided by the number of years represented by the "before" period. This procedure is repeated for each period.

Table 8 shows that the average annual percentage change in abutting properties was 4.32% for the overall period. This figure represents that on the average over the 16-year period, 8.22 acres (432%) of the 190.29 abutting acres underwent a change in land use in each year of the analysis. Previously unimproved acreage constituted 3.92% of the total average annual percentage change, of which multi-family residential and commercial development made up 1.91% and 1.85%, respectively. The redevelopment of previously improved land amounted to only 0.40% of the total 4.32% average annual land use change. Reviewing the percentage change by time period indicates that during each of the three periods the highest average annual percentages were recorded in the unimproved to multi-family residential and unimproved to commercial types of land use change.

Reviewing Table 8, it is readily apparent that the average annual percentage change in nonabutting land use (3.09%) is lower than the corresponding abutting figure (4.32%). Basically, this conforms with the hypothesis that abutting property would be influenced more than nonabutting property by the improvement of the study facility. The highest average annual percentage land use change by type during the overall period was recorded in the unimproved to multi-family residential change (1.20%), followed by the unimproved to single-family residential (0.81%) and the unimproved to streets and roads(0.46%) types of change.

The "before" period experienced the highest average annual percentage change (10.10%) of the three time periods, and during that period, unimproved to single-family residential (6.33%) and unimproved to streets and roads (2.91%) types of changes were highest average annual percentages recorded during the entire period. Primarily, this was the result of the difference in the length of the three periods; two "before" period years compared to six and eight "construction" and "after" period years, respectively. The highest annual rate of

change on previously improved property was recorded in the "after" period (0.53%).

The data illustrated in Tables 7 and 8 seems to suggest that the improvement of Westheimer Road has facilitated the development of previously unimproved property in the Study Area. The abutting land use analysis, especially, indicates that new commercial and multi-family residential development was influenced by the improvement project. Nonabutting land use analysis points out that trends in use may have been altered from single-family to multi-family use, although the fact that several large tracts of unimproved land were held off the market may have inhibited single-family residential development. Generally, the improvement of Westheimer Road has encouraged the continued development of unimproved property and has influenced the redevelopment of certain properties (primarily suburban residences) in the Study Area.

Opinions of Knowledgeable People

Interviews were conducted with local real estate personnel, area property owners, and city government officials in an effort to obtain relevant background information that would provide additional insight as to the land use impact of the Westheimer Road, Section Two improvement. These persons felt that in general the widening and paving of Westheimer Road had facilitated and accelerated land development in the Study Area but did not alter the land use trends that existed prior to the improvement.

Real estate personnel pointed out that Westheimer Road was the only major east-west traffic arterial, prior to the extension of Richmond Road, that provided access to large amounts of acreage being developed between the Southwest Freeway (U.S. 59) and Katy Freeway (IH 10) during the 1960's and 1970's (Figure 1). As a result, Westheimer Road became one of the most traveled thoroughfares

in Houston and the abutting and adjacent properties became some of the most attractive commercial and multi-family residential land in Harris County. The improvement of Westheimer Road as a six-lane, raised median facility improved access to the developing area and, coupled with the growth trend of Houston toward the west and north, accelerated the existing land use development trends. Real estate developers indicated that strip-commercial developments which sprang up along Westheimer were probably influenced most by the widening and paving project, while multi-family residential complexes which located along and near Westheimer were influenced by the completion of the area's thoroughfare network and the increasing population. The concensus among real estate people was that the Study Area's property was prime strip-commercial and multi-family residential land.

City government officials were in agreement with real estate people in that the improvement of Westheimer Road has encouraged land development in the area. In fact, one official felt that pressures placed on Westheimer as a traffic artery by increased population and new land developments in the area resulted in the improvement of the facility. Officials also said that the combination of Westheimer Road being one of Houston's most traveled streets and Houston's phenomenal growth has influenced the types of land uses that have been developed in the Study Area. Government officials felt that the Westheimer Road improvement project accelerated the land use development trends which existed in the area.

The opinions of real estate developers and brokers, property owners, and government officials agree that the improvement of Westheimer Road, Section Two, accelerated and facilitated land use change and development. Basically, these opinions coincide with the findings of the land use analysis of the Study Area.

CONCLUSIONS

Land use data collected during the 16-year study period indicate that the Westheimer Road, Section Two Study Area has experienced a considerable amount of land use change and development. The Westheimer Road improvement is situated between Hillcroft-Voss and Fondren Roads. The design change from a two-lane, undivided asphalt rural-type road with open ditches to a six-lane, divided (raised median), concrete thoroughfare with curbs and gutters has influenced the development of area properties into primarily multi-family residential and commercial uses. Between 1962 and 1978, 56.7% of the Study Area's property underwent a change in land use. Although unimproved land has remained the predominant land use category throughout the period, multi-family residential and commercial acreage have increased significantly.

The percentage of unimproved abutting property in the Study Area has declined from 75.9% to 18.3% during the overall (1962-1968) study period. Approximately 69.2% of the 190.29 acres of abutting land experienced a change in use; and correspondingly, the predominant land use has changed from unimproved to commercial. The majority of the land use change involved commercial and multi-family residential developments. Some redevelopment on abutting tracts was recorded during each of the time periods, with the redevelopment of rural single-family residences being the most important type. Each of the time periods experienced a decrease in unimproved acreage and an increase in multi-family residential and commercial acreage. The largest amount of acreage changed use during the "after" period, but the annual rate of change was highest in the "before" period.

Nonabutting properties underwent similar types of land use changes and developments as the abutting properties, but only 49.4% of the 326.82

nonabutting acres experienced a change in land use compared to 69.2% of the abutting tracts. Although the percentage of unimproved land had dropped from 91.0% to 49.0% between 1962 and 1978, the predominant nonabutting land use has remained unimproved throughout the analysis period. Due to the availability of large unimproved tracts, the most important types of nonabutting land use change were the unimproved to multi-family and unimproved to single-family residential developments. The only land use categories recording an increase or decrease during each of the time periods were the multi-family residential and unimproved categories, respectively. Oddly, the greatest amount of acreage changed use during the "before" period. Also, the annual rate of change in use was highest in the "before" period.

The extensive land use changes and developments experienced along Westheimer Road and in the Study Area have been attributed to the phenomenal population growth of the region and the characteristics of Westheimer Road. Westheimer Road (FM 1093), being one of the most heavily traveled thoroughfares in Harris County and coupled with the westerly growth of Houston, has made property fronting and adjacent to the study facility some of the most attractive for commercial and multi-family residential development in the Gulf Coast region. The types of land developments occurring during the study period has generally conformed with the projected land uses published by area governments in comprehensive land use plans. Failure to develop several large tracts of land in the Study Area by property owners has confused the land use analysis but, it is reasonable to conclude that the improvement of Westheimer Road, Section Two has not altered the general land use trends of the Study Area.

In summary, the improvement of Westheimer Road between Hillcroft-Voss and Fondren Roads has facilitated and perhaps accelerated the development of previously unimproved property as either multi-family residential or commercial.

This was found to be especially true for the abutting property, where all of the single-family residential acreage was redeveloped in some manner. The analysis of nonabutting properties is more difficult because of the large tract of land held back, but basically the development of multi-family and single-family residences on previously unimproved land has characterized the nonabutting acreage. Although the predominant land use in the Study Area remained unimproved acreage in 1978, it is clear that continued multi-family residential and commercial development will soon alter this characteristic.