

1. Report No. FHWA/TX-79/17+225-10		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Land Use Impact of Improving Antoine Drive in a Developed Residential Area in Houston, Texas				5. Report Date March, 1979	
				6. Performing Organization Code	
7. Author(s) Cary W. Herndon, Jr., Jesse L. Buffington				8. Performing Organization Report No. Research Report 225-10	
9. Performing Organization Name and Address Texas Transportation Institute Texas A&M University College Station, Texas 77843				10. Work Unit No.	
				11. Contract or Grant No. Research Study 2-8-77-225	
12. Sponsoring Agency Name and Address State Department of Highways and Public Transportation 11th and Brazos Austin, Texas 78701				13. Type of Report and Period Covered Interim - September, 1976 March, 1979	
				14. Sponsoring Agency Code	
15. Supplementary Notes Research performed in cooperation with DOT, FHWA, and SDHPT. Research Study Title: Economics of Highway Design Alternatives					
16. Abstract Previous studies on effects of highway construction upon land use have focused mainly upon the effects of the construction of new highways. In view of a new emphasis upon upgrading and expanding existing facilities rather than building new ones, the need arises for information concerning the effects of such improvements upon land use. This report relates the findings of research done in an area of Houston, Texas, where Antoine Drive was upgraded from a two-lane to a four-lane divided street. The improvement took place in a developed urban area where the predominant land use was residential. Land use changes were analyzed for both abutting and nonabutting properties that might have been affected by the street improvement. Data were collected for a 15-year period, which includes five years before construction began. Total acres in each type of land use were determined for two "before construction" years, 1964 and 1968, and for two "after construction" years, 1972 and 1978. Comparisons were made of the types and rates of development before and after upgrading occurred. The data are reported in narrative, graphic, and tabular form. Causes of development in the area other than the street improvement were also researched and are reported. Highway planners should be able to use this report and subsequent reports of this study to make more accurate predictions of land use changes due to specific highway improvements.					
17. Key Words Highways, impact, land use, abutting and nonabutting property			18. Distribution Statement No Restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 61	22. Price

LAND USE IMPACT OF IMPROVING ANTOINE DRIVE IN A  
DEVELOPED RESIDENTIAL AREA IN HOUSTON, TEXAS

by

Cary W. Herndon, Jr.  
Research Associate

and

Jesse L. Buffington  
Associate Research Economist

Research Report 225-10  
Research Study Number 2-8-77-225  
Economics of Highway Design Alternatives

Sponsored by  
State Department of Highways  
and Public Transportation

in Cooperation with the  
Federal Highway Administration  
U.S. Department of Transportation

March 1979

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

## 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.

Officials of the City of Houston supplied valuable land use and traffic information and were very cooperative in providing background data for the study. Mr. Joe C. Chow and Mr. David Waller of the City Planning Department were very patient and provided invaluable assistance in the collection and evaluation of the available data. Several business people and residents of Houston provided additional information.

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 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

Previous studies on the effects of highway construction upon land use have focused mainly upon the effects of the construction of new highways. In view of a new emphasis upon upgrading and expanding existing facilities rather than building new ones, the need arises for information concerning the effects of such improvements upon land use. This report relates the findings of research done in an area of Houston, Texas, where Antoine Drive was upgraded from a two-lane to a four-lane divided street. The improvement took place in a developed urban area where the predominant land use was residential. Land use changes were analyzed for both abutting and nonabutting properties that might have been affected by the street improvement. Data were collected for a 15-year period, which includes five years before construction began. Total acres in each type of land use were determined for two "before construction" years, 1964 and 1968, and for two "after construction" years, 1972 and 1978. Comparisons were made of the types and rates of development before and after the upgrading occurred. The data are reported in narrative, graphic, and tabular form. Causes of development in the area other than the street improvement were also researched and are reported. Highway planners should be able to use this report and subsequent reports of this study to make more accurate predictions of land use changes due to specific highway improvements.

## SUMMARY OF FINDINGS

Land use inventory data were collected for the Antoine Drive Study Area, located in Houston, Texas, to determine the impact on the amount and rate of land use change in this developed residential area due to improving Antoine Drive from a two-lane, undivided rural-type road with open drainage to a four-lane, raised median street with curbs and gutters. The data were reviewed during a 15-year study period which includes: five years before construction, four years during construction, and six years after construction was completed.

Summarizing the findings:

1. The total Study Area has progressed from being 81% developed in 1964 to 98% developed in 1978.
  - (a) The stage of development has remained "developed throughout the study period.
  - (b) The predominant type of land use continued to be single-family residential between 1964 and 1978, although several land use categories have undergone extensive changes.
  - (c) Multi-family residential experienced the highest percentage and acreage increase of 373% and 58.24 acres, respectively. Commercial development ranked second with an increase of 82% while streets and roads increased only slightly. Unimproved acreage decreased dramatically by 85.68 acres or 91.5%, and a slight decrease was recorded in the single-family residential category.
2. Properties abutting Antoine Drive remained virtually unchanged during the 15-year study period.
  - (a) Single-family residential remained the predominant land use throughout the period.
  - (b) Commercial acreage grew from 0 acres in 1964 to 0.98 acres in 1978. The redevelopment of 0.75 acres of single-family residential and the development of 0.23 acres of unimproved land constituted the growth of commercial property.
  - (c) No other land use changes occurred which means only two percent of the abutting properties experienced land use change during the project's analysis period.
3. Nonabutting properties along Antoine Drive changed use at a faster rate than abutting properties. For the 15-year study period, the annual

rate of change was 1.40% for nonabutting properties and only 0.14% for abutting properties.

- (a) The nonabutting predominant land use category has remained single-family residential throughout the period, but some new development and redevelopment has been recorded.
  - (b) Multi-family residential development has had the largest percentage (+373%) and absolute (+58.24 acres) increase. New apartment complexes were constructed on previously unimproved land located in the eastern portion of the Study Area.
  - (c) Commercial development has also experienced an overall increase in acreage, most of which was the result of opening a new section of a regional cemetery. Streets and roads acreage increased slightly to provide access to new apartments built during the study period.
  - (d) While some redevelopment of single-family residences has occurred, most of the increases resulted from the development of previously unimproved property. Unimproved acreage has decreased by -93%, or -84.5 acres between 1964 and 1978.
4. Approximately 52% of the total Study Area land use change occurred in the "before" period (1964-1968), 43% during the "construction" period (1968-1972), and only 5% changed use in the "after" period (1972-1978).
- (a) The annual rate of change for the Study Area was 1.97% in the "before" period, 2.08% in the "construction" period, and 0.15% in the "after" period. The overall average annual rate of change was 1.28% for the 15-year time period.
  - (b) Most of the land use changes were from unimproved to either multi-family residential or commercial development, although some redevelopment of single-family residential use to commercial use did occur.
5. Several factors influenced land use change and development relative to the improvement of Antoine Drive.
- (a) Abutting properties underwent minimal amounts of land use change because virtually all of the land had already been platted and developed as single-family residential prior to 1964. Very little unimproved land remained available for development during the study period.
  - (b) Nonabutting properties did experience a moderate amount of land development, but the improvement of Antoine Drive alone did not influence the land use change. Greater accessibility to the general area accomplished through the improvement of several major thoroughfares in the area, including Antoine Drive, has influenced the development of unimproved 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.

## TABLE OF CONTENTS

PREFACE . . . . .	i
ABSTRACT. . . . .	ii
SUMMARY OF FINDINGS . . . . .	iii
IMPLEMENTATION STATEMENT. . . . .	v
TABLE OF CONTENTS . . . . .	vi
LIST OF TABLES. . . . .	viii
LIST OF FIGURES . . . . .	ix
INTRODUCTION. . . . .	1
Purpose and Objectives of Study. . . . .	1
Method of Study. . . . .	2
Location of Street Improvement . . . . .	4
Key Characteristics of Street Improvement. . . . .	8
Sources of Data. . . . .	9
Definitions. . . . .	10
CHARACTERISTICS OF AREA STREETS BEFORE AND AFTER IMPROVEMENT OF ANTOINE DRIVE . . . . .	12
Antoine Drive. . . . .	12
Parallel Streets . . . . .	17
Intersecting Streets . . . . .	18
CHARACTERISTICS OF THE STUDY AREA BEFORE AND AFTER THE IMPROVEMENT OF ANTOINE DRIVE . . . . .	21
Size and Boundaries of Study Area. . . . .	21
Land Use Characteristics . . . . .	21
Land Use Changes . . . . .	26
Overall Study Area. . . . .	27
Proximity to West 43rd Avenue . . . . .	29
Abutting Properties. . . . .	29
Nonabutting Properties . . . . .	33
Land Use Impediments . . . . .	38
Land Use Plans and Controls . . . . .	38
Other Factors Influencing Land Use Changes. . . . .	39
Socio-economic Characteristics . . . . .	40



IMPACT OF THE STREET IMPROVEMENT ON LAND USE IN  
THE STUDY AREA . . . . . 43  
    Actual Land Use Changes. . . . . 43  
    Opinions of Knowledgeable People . . . . . 47  
CONCLUSIONS . . . . . 49

## LIST OF TABLES

Table		Page
1	Population and Percent Changes of Area Population for the Houston SMSA, Harris County, City of Houston, and Census Tract 442, 1950-1978. . . . .	5
2	Twenty-Four Hour Traffic Counts on Antoine Drive and Other Associated Parallel and Intersecting Streets . . . . .	16
3	Total Land Uses and Land-Use Changes by Time Period and Selected Years . . . . .	28
4	Abutting Land Uses and Land Use Changes by Time Periods and Selected Years. . . . .	32
5	Nonabutting Land Uses and Land Use Changes by Time Periods and Selected Years . . . . .	35
6	Comparison of 1960 and 1970 Socio-Economic Characteristics of Houston and Census Tract 442. . . . .	41
7	Percentage Change in Abutting and Nonabutting Acres by Time Period and Type of Land Use. . . . .	44
8	Types of Land Use Changes in the Study Area by Property Location and Time Period. . . . .	45

## LIST OF FIGURES

Figure		Page
1	Map of the Northwest Houston Area Showing the Location of Antoine Drive Study Area . . . . .	7
2	Map of the Antoine Drive Study Area and the Surrounding Region . . . . .	13
3	Design of Antoine Drive Before and After Improvement. . . . .	14
4	Map of Land Use in the Antoine Drive Study Area in 1964 . . . . .	22
5	Map of Land Use in the Antoine Drive Study Area in 1968 . . . . .	23
6	Map of Land Use in the Antoine Drive Study Area in 1972 . . . . .	24
7	Map of Land Use in the Antoine Drive Study Area in 1978 . . . . .	25
8	Change in Total Land Uses in the Antoine Drive Study Area . . . . .	30
9	Changes in Abutting Land Uses in the Antoine Drive Study Area . . . . .	34
10	Changes in Nonabutting Land Use in the Antoine Drive Study Area . . . . .	37

## 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 report is to provide data to state highway agencies concerning the impact of improving the existing highways on land use and land development.

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. In conjunction, 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 land use 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 conducted in an area located in Houston, Texas, where a portion of Antoine Drive had been widened and repaved through a developed residential section of the city. The Antoine Drive Study Area is one of eighteen sites located in different Texas cities with various types of existing highway improvements and various stages of land development and predominant land uses prior to the facility's design change which have been or are now under investigation. 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 the Antoine 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 the years since planning for the specific project began and construction through to the present (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. 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 land and nonabutting properties to permit further analysis. Abutting properties are identified as those with frontage along Antoine Drive, and for larger undeveloped tracts with frontage, an arbitrarily determined section of land 300 feet back from the facility is designated as abutting property. The remaining properties in the Study Area are defined as nonabutting tracts (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 Antoine Drive 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 Improvement

The improved portion of Antoine Drive being studied is 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 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 the international and national business market. 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

Table 1. Population and Percent Changes of Area Population for the Houston SMSA, Harris County, City of Houston, and Census Tract 442, 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 <sup>a</sup>	% Change Overall & Average Annual 1975-1978	1978 <sup>a</sup>
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 442 (Includes Entire Study Area)	NA <sup>c</sup>		8,626 <sup>b</sup>	+50.6% +5.1%	12,995	+13.9% +2.8%	14,802	+0.7% +0.2%	14,900

(a) Houston Chamber of Commerce Population Estimates.

(b) Census Tract 66-A in 1960 is identical to Census Tract 422 in 1970.

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

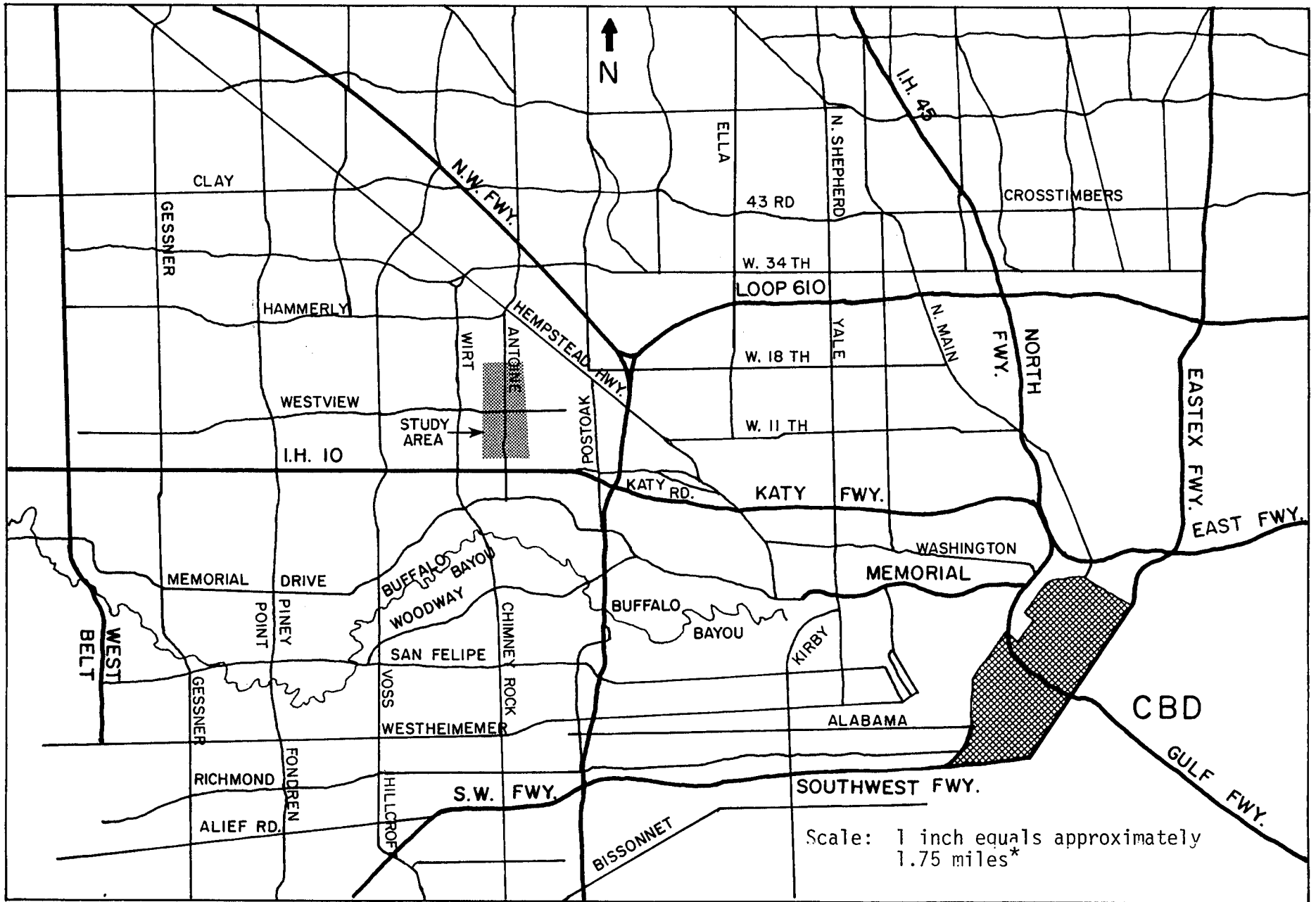


international market, air passenger and freight service is provided through two large airport terminals in the Houston area. The national business market is served well through a variety of transport modes. Low-cost barge transportation is available via the Intracoastal Waterway which connects Houston 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 the 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 Antoine Drive was accomplished to meet the traffic needs of an area (Census Tract 442) which experienced population increases of 51% between 1960 and 1970, and 15% between 1970 and 1978, as shown in Table 1.

The Study Area, as shown in Figure 1, is situated about 6.2 miles from Houston's central business district (CBD) and is approximately 600 feet north of IH 10 (Katy Freeway), the closest freeway and major traffic carrier. The Study Area is located in a section of Houston described as low density residential,



\*One mile equals 0.62137 kilometers

Figure 1. Map of the Northwest Houston Area Showing the Location of Antoine Drive Study Area

i.e. composed of primarily single-family residential. Most of the residences are 20 to 30 years old and are of brick or brick-veneer construction. The housing is in good condition.

### Key Characteristics of Street Improvement

The Antoine Drive 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 before the street improvement,
- (2) Type of street design change,
- (3) The predominant land use before the street improvement, and,
- (4) The type of setting (urban or suburban).

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 Antoine Drive area during the "before" period was determined to be a developed area and the predominant land use was classified as single-family residential. The "before" street design was two-lane, undivided without curb and gutter. Little change in land use was expected to occur as a result of the street improvement due to the limited amounts of unimproved land and due to the type of developments existing in the study area.

## Sources of Data

The major source of planning information concerning the Antoine Drive 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 reports and Houston-Harris County Metropolitan Transportation Study 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 Antoine Drive; and for large unimproved tracts, a section of land 300 feet back from the facility.

Nonabutting Properties - all tracts within the Study Area not defined as abutting Antoine Drive; i.e. improved tracts without frontage along Antoine Drive and unimproved tracts over 300 feet from the upgraded street.

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 Antoine Drive, the "before" period includes the years 1964 to 1968.

Construction Period - the time period in which final planning, funding and construction processes occur. In the report, the years 1968 through 1971 make up the "construction" period.

After Period - the time period which includes the first full year after the improvement is complete up to the present, or specifically 1972 to 1978.

CHARACTERISTICS OF AREA STREETS BEFORE AND  
AFTER THE IMPROVEMENT OF ANTOINE DRIVE

Antoine Drive

Antoine Drive is a major north-south thoroughfare which extends from Memorial Drive north approximately seven miles to Gulf Bank Road. Existing thoroughfare plans recommend that Antoine Drive be extended north beyond Gulf Bank Road an additional 5.5 miles to Stuebner-Airline Road. The section of Antoine Drive that this report focuses upon is located between Shavelson Street and Long Point Road, just north of IH 10 (Figure 2).

A review of past Major Street and Freeway Plans published by the City Planning Department of Houston gives the following history of Antoine Drive. The initial Major Street Plan published in 1942 listed the study section of Antoine Drive as "scheduled to be opened" but was not listed as a "major street." Antoine Drive was described as "adequate width" between 1946 and 1966. In the Recommended Thoroughfare Improvement Program 1966-1970, the study facility was "scheduled to be widened" and was described as a "major arterial" for the first time.

The 1.2 mile analysis section of Antoine Drive was contracted as a single improvement project and funded under the City of Houston's 1969 Capital Improvement Program. The contract was awarded in July of 1970 and the project was completed in September of 1971 and then accepted by the city in November of 1971. The facility, prior to the improvement, was described as a two-lane undivided rural road without curbs and gutters; today, Antoine Drive is a four-lane, raised median street with curbs and gutters, as illustrated in Figure 3.

The section of Antoine Drive from Long Point Road north to U.S. 290, which is just north of the study area, has remained a two-lane undivided rural road

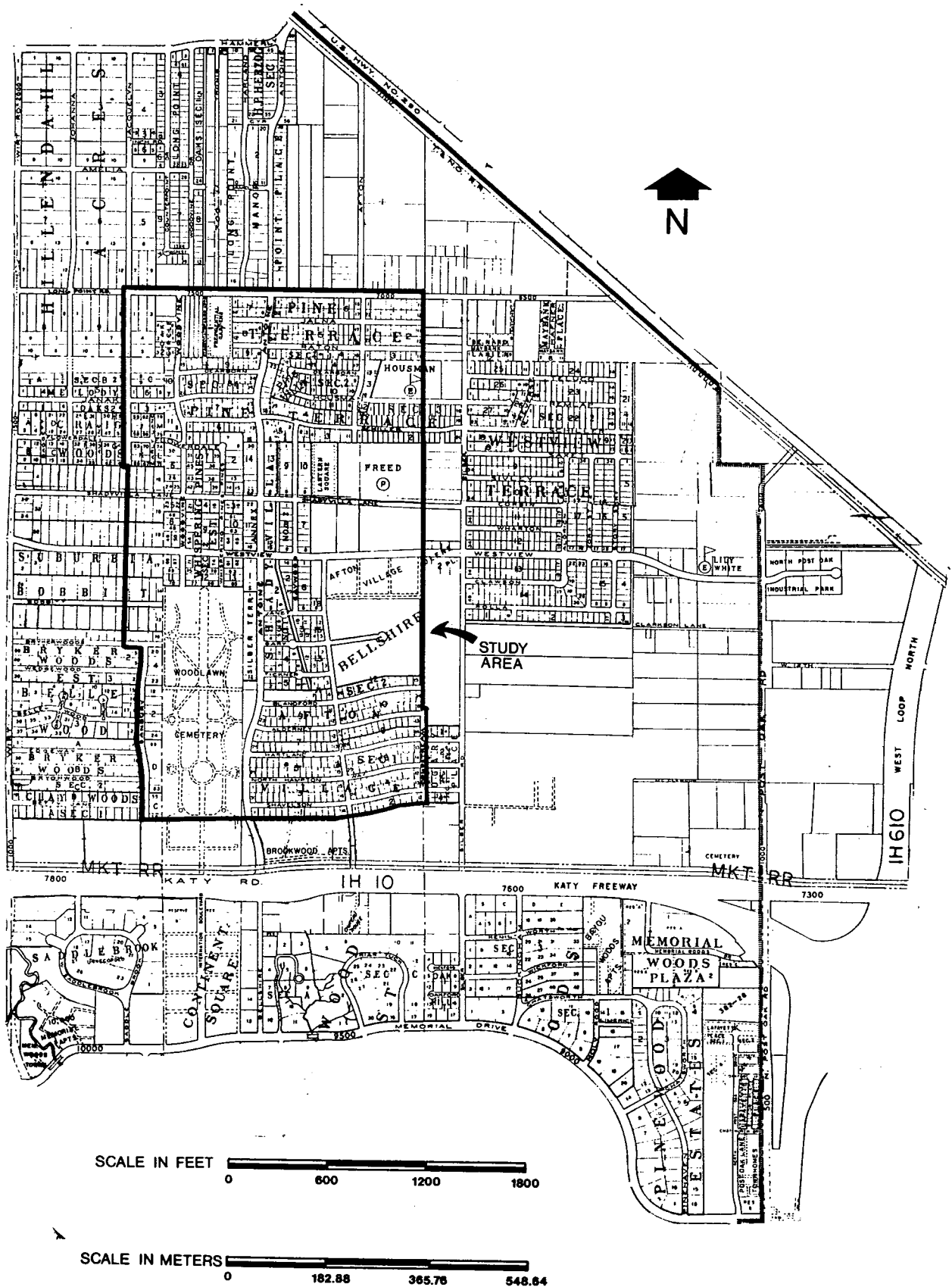
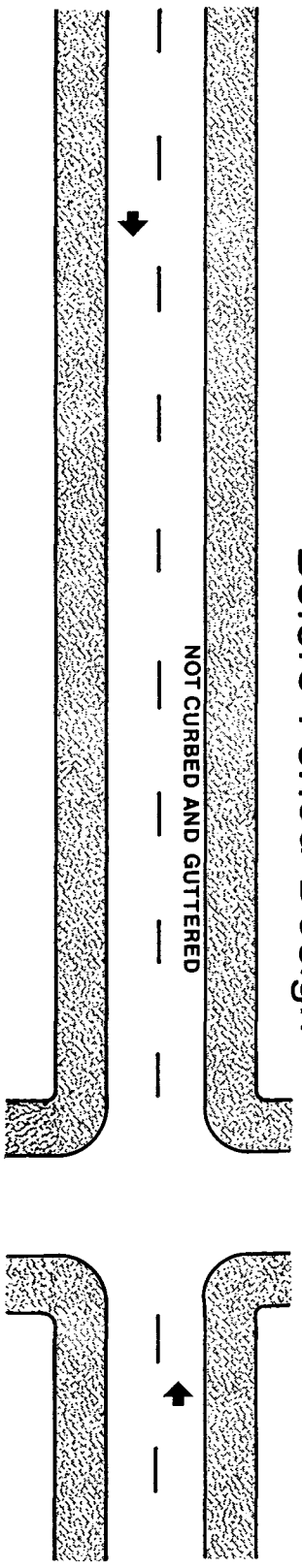


Figure 2. Map of the Antoine Drive Study Area and the Surrounding Region



# Before Period Design



# After Period Design

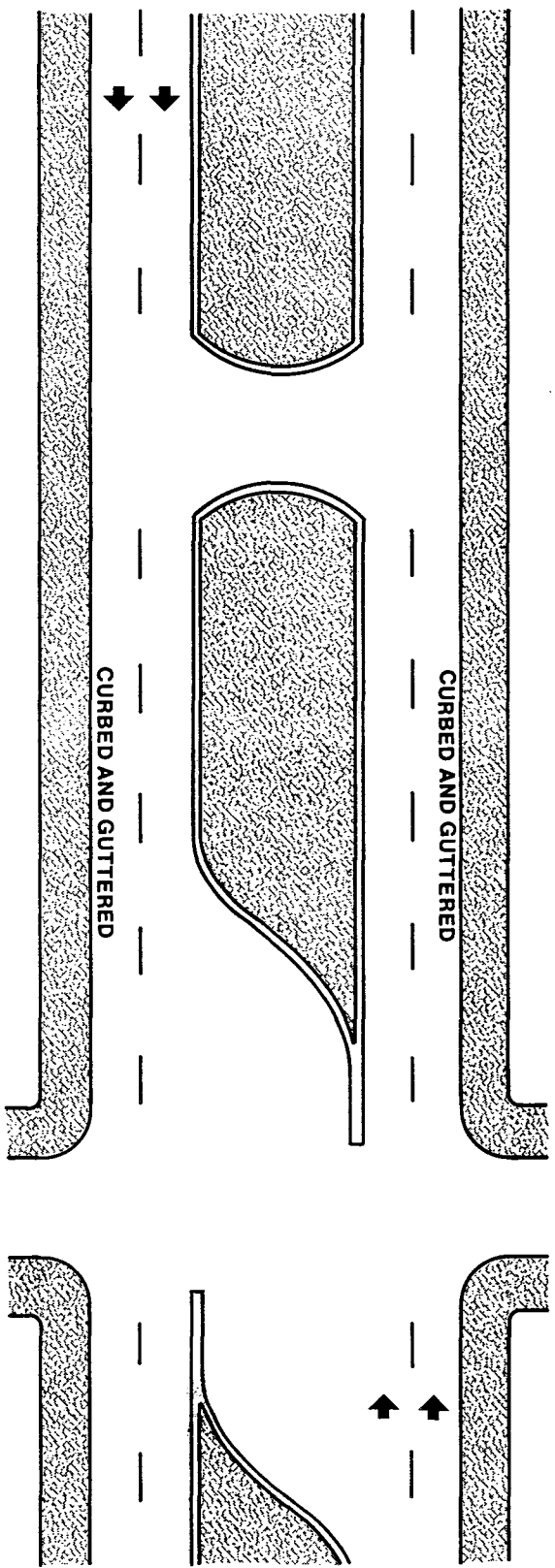


Figure 3. Design of Antoine Drive Before and After Improvement

with open drainage. In the Recommended Thoroughfare Improvement Program 1971-1975, plans were made for upgrading this portion to the same design as the study section. During 1961-62, Antoine Drive was improved from IH 10 to Shavelson (just south of the study section) as a four-lane, raised median facility with curbs and gutters.

Traffic count data indicate an overall increase in volume on Antoine Drive during the study period (see Table 2). For example, the 24-hour traffic count at the intersection of Antoine and Katy Freeway increased 103% (an average of 7.9% per year) between 1963 and 1976. A point on Antoine at Long Point had an increase in traffic of 327% (an average of 25.2% per year) between 1963 and 1976, and Antoine at Westview had an increase of 101% (an average of 7.8% per year) for the same time period.

At a point just north of Katy Freeway on Antoine, traffic volume fluctuated dramatically during the three time periods studied. Between 1963 and 1966, which represents the "before" period, traffic count decreased -35% (-11.8% per year). Then in the "construction" period, 1971 to 1976, traffic increased 29% (5.8% per year), and from 1971 to 1976, which approximate the after period, the traffic count increased by approximately 143% (28.7% per year). The remaining count data indicate that at a point just north of Long Point Road traffic volume has increased 97% (12.1% per year) between 1963 and 1971 and 116% (23.1% per year) between 1971 and 1976. Also, at the intersection of Antoine and Westview a 140% (10% per year) increase in the 24-hour traffic was recorded between 1963 and 1977.

Table 2. Twenty-four Hour Traffic Counts

Location	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
<u>Antoine Drive</u>															
(a) Long Point	1,054								2,081		4,491	4,630	5,067	4,503	
(a) Westview	4,475												10,735	9,017	10,742
(a) Katy Freeway	4,880			3,152					4,068		10,982	11,592	12,009	9,899	
<u>INTERSECTING STREETS</u>															
<u>Long Point Road</u>															
(a) Wirt	15,245		14,889	16,580	19,353		20,293		21,635		22,629	26,849	27,879		26,621
(a) Silber													17,264	15,797	
<u>Westview</u>															
(a) Wirt		5,034		6,399					7,390		9,471	9,112	10,602		11,312
(a) N. Post Oak									6,874		9,176	10,308	10,806	9,726	
<u>PARALLEL STREETS</u>															
<u>Silber Road</u>															
(a) Katy Freeway			8,802		7,766		11,661		12,981						
(a) Westview												9,923	9,270		10,148
(a) Shavelson												14,543	16,688	16,862	
<u>Wirt Road</u>															
(a) Katy Freeway	8,568	12,388		11,221				15,100		16,195		16,961	17,075	18,092	
(a) Long Point							13,160	13,329		15,593			16,304	17,282	
(a) Westview								13,936		15,015			17,172		18,947

## Parallel Streets

The two major thoroughfares immediately adjacent and parallel to Antoine Drive are Silber Road and Wirt Road. Silber Road is located about 0.45 miles, or three blocks, to the east of Antoine (Figure 2). The abutting land uses along Silber Road are very diverse and range from industrial to unimproved. Wirt Road, which is located approximately 0.6 miles to the west of Antoine, has predominantly single and multi-family residential uses abutting the facility. Both thoroughfares were improved during the study period and both are alternate routes for Antoine Drive traffic.

In late 1966, Silber Road was improved from a two-lane, undivided road with open drainage to a four-lane, undivided facility with curbs and gutters. The portion improved extends from Katy Freeway north some 0.4 miles while the northern section (which extends to U.S. 290) was not upgraded and has remained a two-lane, undivided road with open drainage.

Twenty-four hour traffic counts taken at a point just north of the intersection of Silber Road and Katy Freeway indicate that during the "before" period, 1965-1969, traffic volume on Silber increased 32.5% (8.1% per year), and during the period 1969-1971, or "construction" period, volume increased about 11.3% (5.7% per year) (Table 2). The remaining traffic volume information is difficult to interpret because too few years of data are available for the analysis, although the data collected at the intersections of Silber and Westview and Silber and Shavelson seem to indicate that vehicular traffic has increased slightly along Silber Road during the "after" period.

Wirt Road, an alternate parallel route of Antoine Drive, was upgraded in 1974 from a two-lane, undivided road with open drainage to a four-lane, undivided facility with a median and curbs and gutters. Only the portion from Westview Drive north to Long Point Road was improved in 1974; the remaining

sections both north and south of the improvement have remained the original design. The section of Wirt Road between Katy Freeway and Westview has been recommended to be widened and repaved, but as of August 1978 no construction had been initiated.

Analysis of 24-hour traffic counts indicates that Wirt Road has experienced a considerable increase in vehicular traffic over the Antoine Drive study period. As shown in Table 2, the traffic data taken at the intersection of Wirt and Katy Freeway indicated that in the "before" period, 1963-1966, traffic volume increased 31% (10.3% per year); vehicular traffic increased 35% (8.8% per year) in the "construction" period, 1966-1970; and during the "after" period, 1970-1976 traffic count increased 20% (3.3% per year). Also during the "after" period, an increase of 31% (4.4% per year) at the intersection of Wirt and Westview Drive was recorded between 1969 and 1976, and at the intersection of Wirt and Long Point Road traffic grew 36% (5.1% per year) between 1970 and 1977.

#### Intersecting Streets

The major streets intersecting Antoine Drive within the Study Area are Westview Drive and Long Point Road (Figure 2). Westview Drive, which bisects the Study Area, has predominantly single and multi-family residential developments abutting its right-of-way. The land uses which characterize Long Point Road, which forms the northern boundary of the Study Area, are strip commercial and single-family residential. Wirt and Long Point were both upgraded during the analysis period and both facilities affect traffic to and from Antoine Drive.

Westview Drive, from North Post Oak Road west to Wirt Road, was upgraded under two improvement projects from the existing two-lane, undivided road with open drainage design to a four-lane, divided design with raised median and curbs and gutters. In 1967, the portion of Westview from Wirt Road to Antoine was completed, and in 1969, the section from Antoine to North Post Oak Road was completed.

The City of Houston collected 24-hour traffic count data during selected years of the study period (Table 2). It was found that at the intersection of Westview and Wirt Road the traffic volume had increased 125% (9.6% per year) between 1964 and 1977. Also from 1964 to 1966, the "before" period, volume increased 27% (13.6% per year), and during the periods 1966-1971 and 1971-1977 traffic volume increased 15% (3.1% per year) and 53% (8.8% per year), respectively. Another location along Westview, just west of North Post Oak, had an increase of 41% (8.3% per year) between 1971 and 1976.

Long Point Road was improved from a two-lane, undivided road with open drainage to a four-lane, undivided facility with curbs and gutters between Wirt Road and U.S. 290 under two separate city contracts, both of which were completed in 1969. Traffic count data for Long Point Road near its intersection with Wirt Road show that traffic volume experienced a growth of 27% (6.7% per year) between 1963 and 1967, the "before" period. During the years 1967 to 1971, vehicular count increased 12% (2.9% per year) and between 1971 and 1977, an increase of 23% (3.8% per year) was recorded (which represents the "construction" and "after" periods, respectively).

Other important thoroughfares and freeways in the vicinity of the Study Area include: Katy Freeway (IH 10), West Loop (IH 610), U.S. 290, Hammerly Drive, North Post Oak Road, and Memorial Drive (see Figure 2). The phenomenal growth of metropolitan Houston, especially to the north and west, has caused a dramatic increase in traffic volumes recorded on these facilities.

## CHARACTERISTICS OF THE STUDY AREA BEFORE AND AFTER THE IMPROVEMENT OF ANTOINE DRIVE

### Size and Boundaries of Study Area

The area selected for land use analysis is approximately 3,500 feet wide and 6,200 feet long and is bisected by Antoine Drive. The 485 acre Study Area was delineated to include an equivalent of three blocks of developed land on either side of the improved facility. With Antoine Drive bisecting the area, the eastern section is about 1,900 feet wide and the area's eastern boundary is formed by Coldstream Street and a set of property lines. The western portion extends about 1,600 feet from Antoine to Danbury Street (southern part) and Jacquelyn Street (northern part). Long Point Road forms the northern boundary and the southern boundary is formed by a line approximately 600 feet north and parallel to IH 10. The Study Area is situated close to three of Houston's major freeways: (1) IH 10 (Katy Freeway) to the south, (2) U.S. 290 (Northwest Freeway) to the north, and (3) IH 610 (West Loop) to the east.

### Land Use Characteristics

An analysis of Study Area land use developments indicated that the predominant land use throughout the study period was single-family residential. A detailed account of area land uses was calculated for four selected years: 1964, 1968, 1972 and 1978. Figures 3 and 4 illustrate the "before period" or 1964 and 1968 land use, respectively. The "after" years land use configurations are shown in Figure 5 for 1972 and Figure 6 for August 1978. Total acres and percentage of total devoted to each land use in the selected years are listed in Table 3.



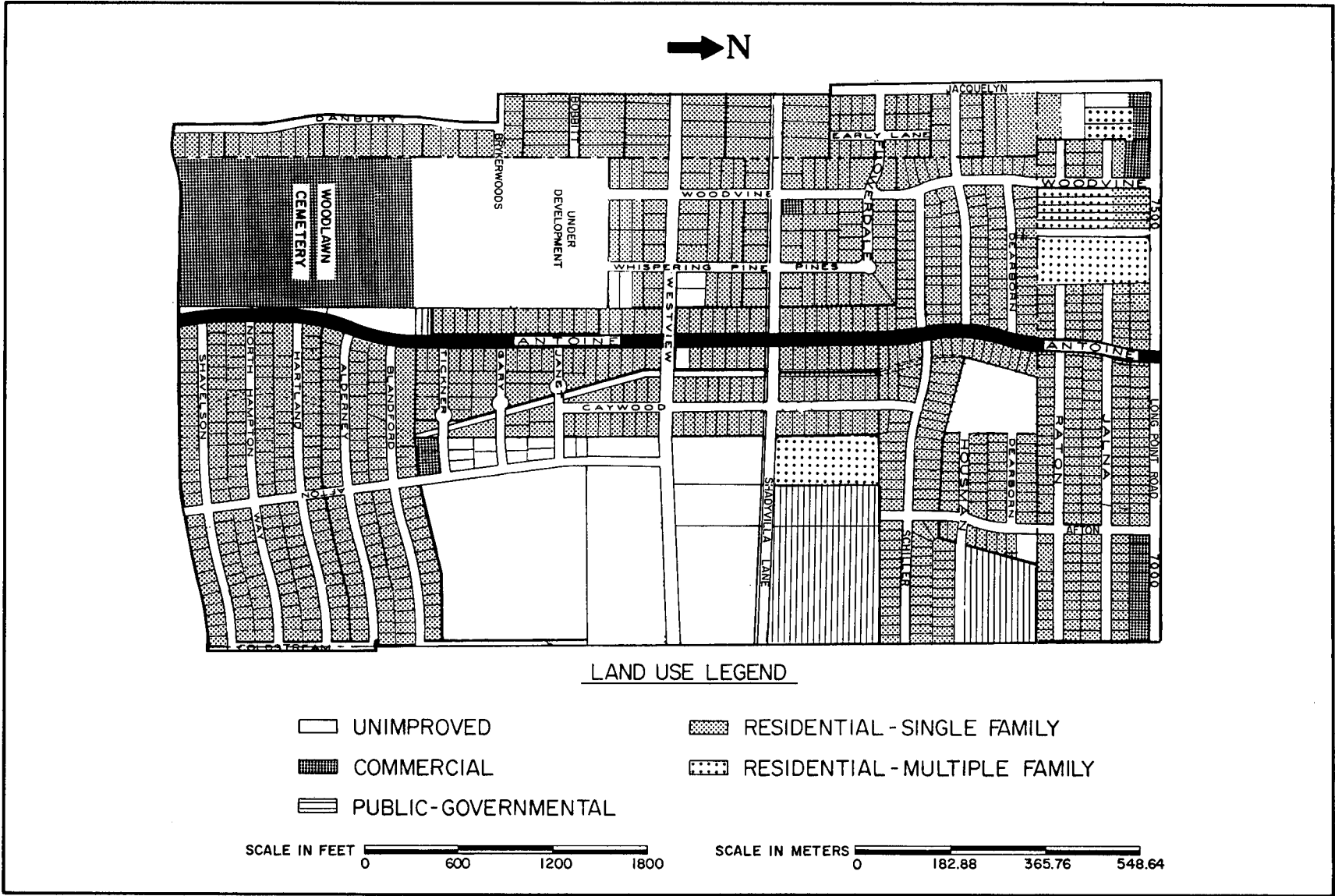
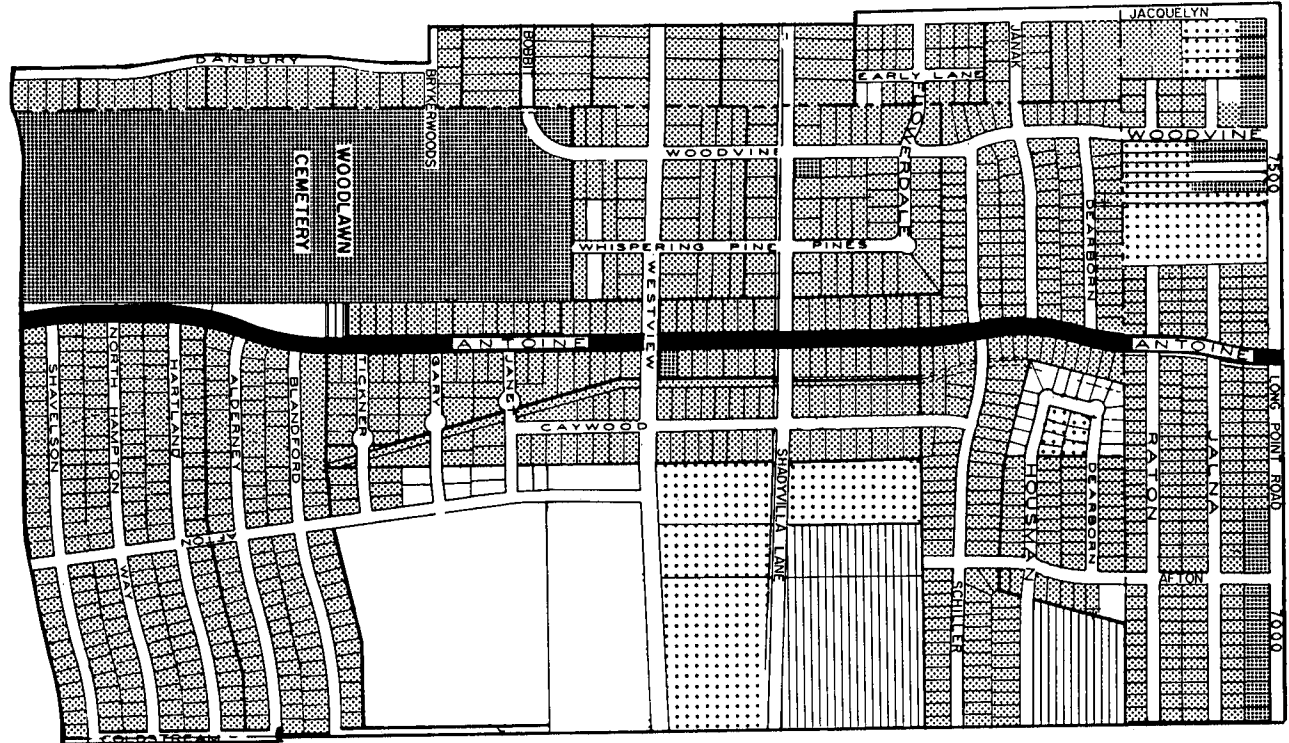


Figure 4. Map of Land Use in the Antoine Drive Study Area in 1964



LAND USE LEGEND

- |   |   |
|---|---|
|  UNIMPROVED            |  RESIDENTIAL - SINGLE FAMILY   |
|  COMMERCIAL            |  RESIDENTIAL - MULTIPLE FAMILY |
|  PUBLIC - GOVERNMENTAL |   |

SCALE IN FEET 0 600 1200 1800

SCALE IN METERS 0 182.88 365.76 548.64

Figure 5. Map of Land Use in the Antoine Drive Study Area in 1968

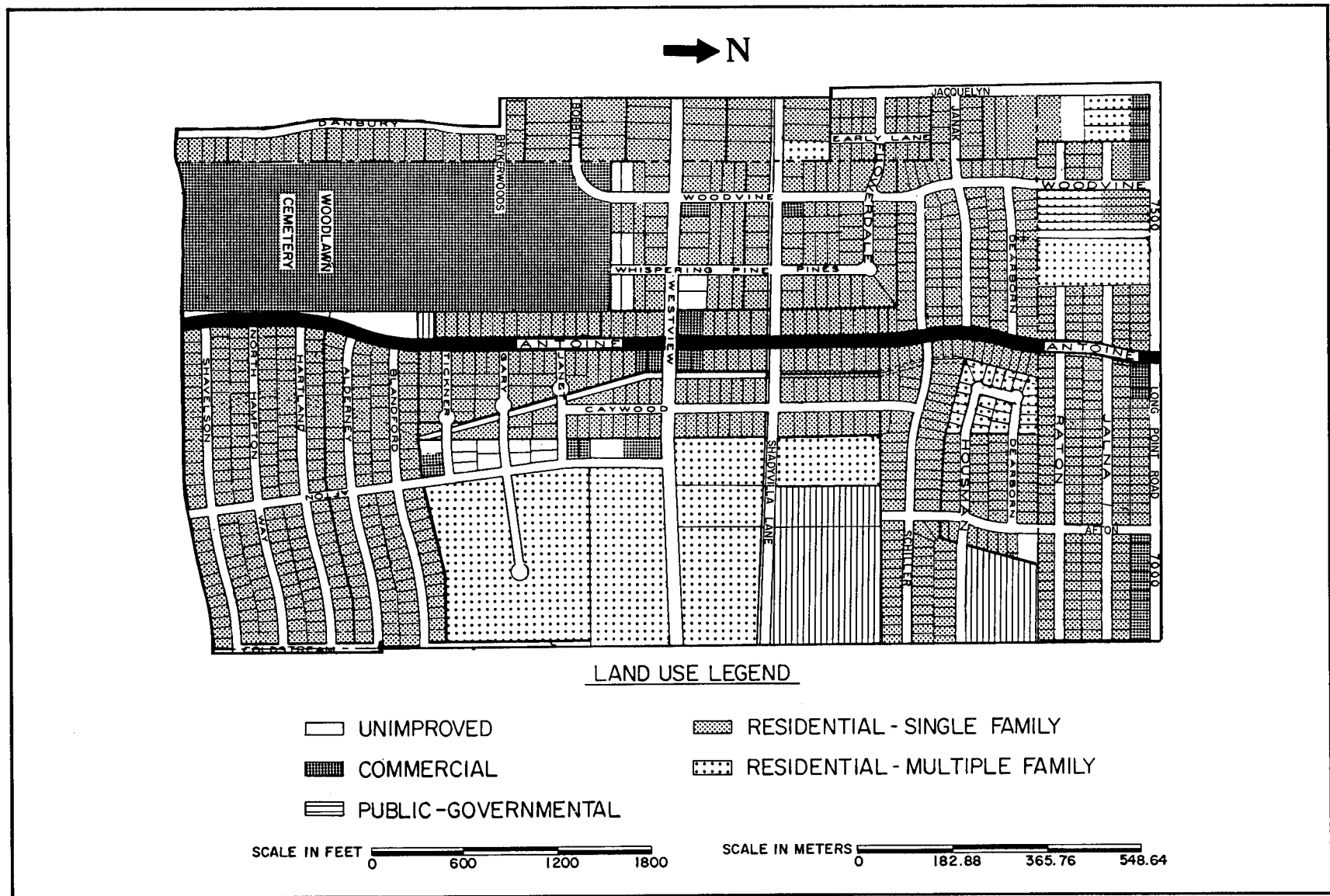


Figure 6. Map of Land Use in the Antoine Drive Study Area in 1972

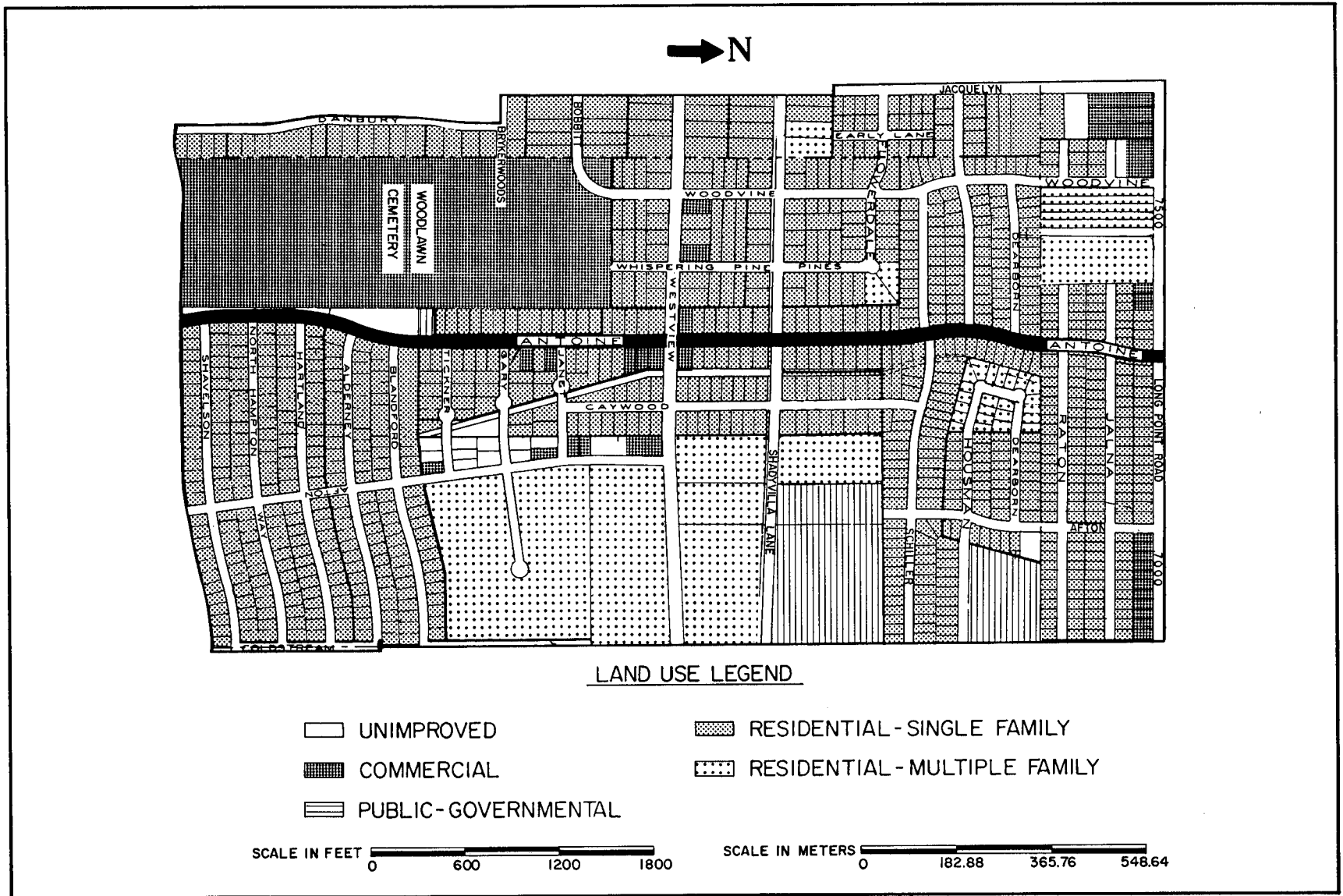


Figure 7. Map of Land Use in the Antoine Drive Study Area in 1978

In 1964 (the first year of the study period), the Study Area was described as a developed area with the predominant land use being single-family residential (see Figure 4). Of the 485.3 total area acres (196.4 hectares), approximately 80.7%, or 391.61 acres (158.5 hectares), were developed as of 1964 and only 93.69 acres (37.9 hectares), or 19.3% remained unimproved at the beginning of the analysis period. The percentage breakdown of the total Study Area by each land use category in 1964 is as follows: single-family residential, 49.2%; multi-family residential, 3.2%; commercial, 7.7%; public-governmental, 3.3%; public-educational, 1.1%; streets and roads, 16.2%; and unimproved, 19.3%. As illustrated in Figure 4, the majority of the unimproved acreage was located along or near Westview Drive and no unplatted and unimproved property abutted Antoine Drive.

In the last year of the study period, 1978, the predominant land use remained single-family residential but commercial and multi-family residential growth had been experienced during the 15-year period (see Figure 7). The amount of developed acreage increased to 477.29 acres (193.2 hectares), or 98.3% of the total area acreage, while only 8.01 acres (3.2 hectares) remained unimproved in 1978. The percentage breakdown by land use categories is as follows: single-family residential, 48.3%; multi-family residential, 15.2%; commercial, 14.0%; public-governmental, 3.3%; public-educational, 1.1%; streets and roads, 16.4%; and unimproved, 1.7%.

#### Land Use Changes

While the Antoine Drive Study Area has not changed dramatically during the 15-year study period, many land use changes have occurred. The analyses of land use changes are discussed first on an overall basis and second in terms of the proximity of property to Antoine Drive.

## Overall Study Area

As indicated in Table 3, single-family residential has remained the predominant land use in the 485.3 acre (196.4 hectares) Study Area. While commercial and multi-family residential land uses have experienced acreage increases, the unimproved and single-family residential categories realized decreases in acreage development during the overall study period. Street and road acreage also increased slightly during the analysis period.

Multi-family residential development experienced both the greatest absolute and percentage increase (58.24 acres and 373.1% respectively) in development of all land use categories. Multi-family residential development increased 111.85% between 1964 and 1968, 119.17% between 1968 and 1972, and 1.89% between 1972 and 1978. Commercial development has also realized notable growth. For example, overall period commercial acreage increased by 30.57 acres or approximately 81.9%. Further analysis revealed that commercial acreage increased by 78.17% during the "before" period, slightly decreased by 2.23% during the "construction" period, and increased by 4.41% during the "after" period. Acreage in streets and roads has remained almost constant throughout the study period with the only change being a 1.18% increase between 1968 and 1972 which provides access to a new multi-family apartment complex in the Study Area.

Single-family residential acreage underwent a decline of slightly over 4 acres, or 1.70%, during the 15-year study period. Percentage changes for each of the three study periods were +0.56% during the "before" period, -1.64% for the "construction" period, and -0.62% during the "after" period. Unimproved land, which recorded the greatest absolute change, decreased over 91.45%, or

Table 3. Total Area Land Use Changes

Land Use Change By Time Period	Before		After				Overall Change	
	1964		1968		1972		1978	1964 - 1968
Residential-Single Family Total Acres Absolute Change Percent Change	238.48	+1.34 +0.56	239.82	-3.94 -1.64	235.88	-1.46 -0.62	234.42	-4.06 -1.70
Residential-Multiple Family Total Acres Absolute Change Percent Change	15.61	+17.46 +111.85	33.07	+39.41 +119.17	72.48	+1.37 +1.89	73.85	+58.24 +373.09
Commercial Total Acres Absolute Change Percent Change	37.33	+29.18 +78.17	66.51	-1.48 -2.23	65.03	+2.87 +4.41	67.90	+30.57 +81.89
Public-Educational Total Acres Absolute Change Percent Change	5.62	0 0	5.62	0 0	5.62	0 0	5.62	0 0
Public-Governmental Total Acres Absolute Change Percent Change	15.93	0 0	15.93	0 0	15.93	0 0	15.93	0 0
Streets and Roads Total Acres Absolute Change Percent Change	78.64	0 0	78.64	+0.93 +1.18	79.57	0 0	79.57	+0.93 +1.18
Unimproved Total Acres Absolute Change Percent Change	93.69	-47.98 -51.21	45.71	-34.92 -76.39	10.79	-2.78 -25.76	8.01	-85.68 -91.45
Total Acres	485.3		485.3		485.3		485.3	

85.68 acres, during the entire study period. Examining each individual period illustrates that unimproved acreage decreased in each period; or, 51.21% between 1964 and 1968, 76.39% between 1968 and 1972, and 25.76% between 1972 and 1978. The two public land use categories did not experience any acreage change between 1964 and 1978. Total changes in land use by category are illustrated in Figure 8.

### Proximity to Antoine Drive

The Study Area properties have been segregated into two separate categories according to their location relative to Antoine Drive in order to facilitate a comparative analysis. Dividing the properties into either the abutting or non-abutting land category allows a study approach to be implemented to determine the influence of the street improvement on the location of land use changes. A priori, 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 area tracts with frontage along the subject facility, which is Antoine Drive. 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 larger 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. The 300-foot distance was arbitrarily chosen but is consistent with the other case studies of this project (see Definitions). One exception to the



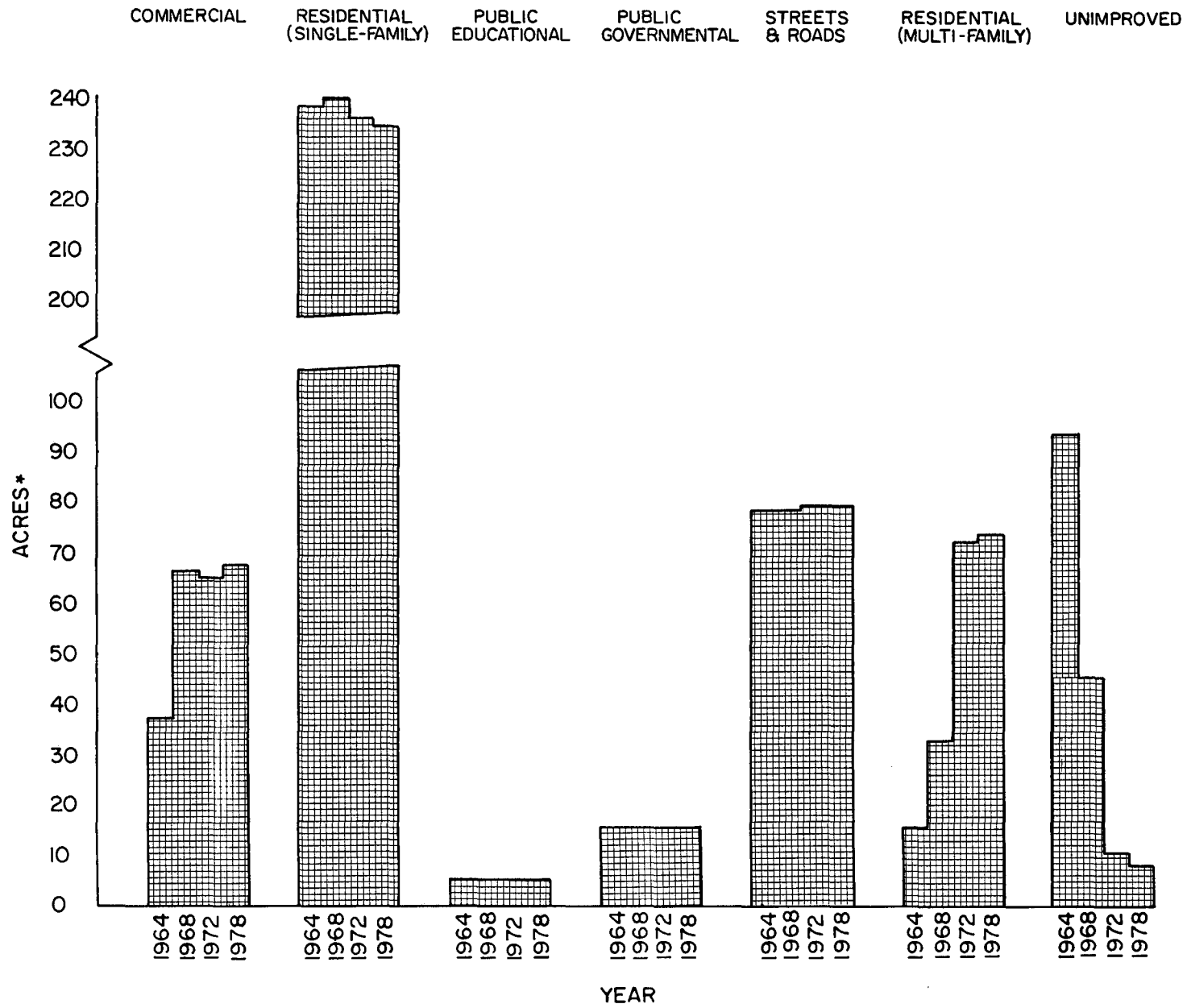


Figure 8. Change in Total Land Uses in the Antoine Drive Study Area

\* One Acre Equals 0.4046856 Hectare

above description was taken in the Antoine Drive Study Area in that although the Woodlawn Cemetery did have a small amount of frontage along the study facility, IH 10 or Katy Freeway influenced the cemetery's development relatively more than Antoine Drive. As a result, property in the Woodlawn Cemetery was not classified as abutting property.

All of the 47.35 abutting acres (19.16 hectares) with the exception of 2.11 acres between Woodlawn Cemetery and Antoine Drive, were platted and subdivided for single-family residences prior to 1964 (see Figure 3); therefore, single-family residential land constituted the dominant abutting land use, or about 56.4% of the 1964 total (Table 4). Of the other abutting land uses, streets and roads represented 38.6%; public-governmental land accounted for 0.9%; and unimproved land constituted only 4.1% of the total abutting acres. The percentage breakdown of abutting land in 1964 among developed land, streets and roads, and unimproved land was 57.3, 38.6, and 4.1, respectively.

There was only a slight change in the abutting land use configuration recorded between 1964 and 1968; specifically, only one change between uses occurred. Unimproved acreage decreased by 11.9%, or 0.23 acres, and was developed as commercial property. All other land use remained constant during the "before" period; therefore, the 1968 abutting land characteristics remained basically the same as described for 1964.

As was experienced in the "before" period, only one land use change occurred in both the "construction" (1968-1972) and "after" (1972-1978) periods. Although commercial acreage increased in each of the three specified time periods, the change was from single-family residential to commercial use in the "construction" and "after" periods rather than from unimproved to commercial as in the "before" period. These redevelopments of single-family residential

Table 4. Abutting Area Land Use Changes

Land Use Change By Time Period	Before				After			Overall Change
	1964		1968		1972		1978	1964 - 1968
Residential-Single Family Total Acres Absolute Change Percent Change	26.72	0 0	26.72	-0.52 -1.95	26.20	-0.23 -0.88	25.97	-0.75 -2.81
Commercial Total Acres Absolute Change Percent Change	0	+0.23 -	0.23	+0.52 +22.61	0.75	+0.23 +30.67	0.98	+0.98 -
Public Total Acres Absolute Change Percent Change	0.41	0 0	0.41	0 0	0.41	0 0	0.41	0 0
Streets and Roads Total Acres Absolute Change Percent Change	18.29	0 0	18.29	0 0	18.29	0 0	18.29	0 0
Unimproved Total Acres Absolute Change Percent Change	1.93	-0.23 -11.92	1.70	0 0	1.70	0 0	1.70	-0.23 -11.92
Total Abutting Acres	47.35		47.35		47.35		47.35	

properties represented only a small negative change of -0.52 and -0.23 acres between 1968 and 1972 and between 1972 and 1978, respectively. Although the acreage amounts were relatively small, percentage increases in commercial development were quite dramatic. During the "construction" period, commercial acreage increased over 226% and for the "after" period, almost 31%.

Reviewing the overall change in land use from 1964 to 1978, less than one acre of the 47.35 acres experienced development or redevelopment. Commercial development underwent the greatest amount of percentage and acreage change. Single-family residential development had the highest absolute acreage decrease (0.75 acres), while unimproved land had the highest percentage decrease (-11.92%) in acreage. Figure 9 illustrates the amount of acreage devoted to each abutting land use for each of the selected years.

Nonabutting Properties. Nonabutting properties are defined simply as those Study Area tracts not classified as abutting properties (see Definitions). As was the case in the abutting land, single-family residences constituted the dominant nonabutting land use (48.4%) in 1964. Table 5 indicates that of the total 437.95 acres (177.23 hectares), 65.3% were improved; 20.9% were unimproved; and 13.8% were devoted to street and road use in 1964. Breaking down the 285.85 acres (115.68 hectares) of improved nonabutting land, single-family residences composed 74.1%; multi-family residences, 5.5%; commercial, 13.1%; and public use, 7.4%.

By 1968, improved acreage had increased from 65.3% to 76.2% of the total mainly as a result of large increases in multi-family residential and commercial developments. While single-family residential acreage increased slightly (0.6%), multi-family use underwent the highest percentage increase (+111.85%) and commercial use experienced the highest absolute increase (+28.95 acres).

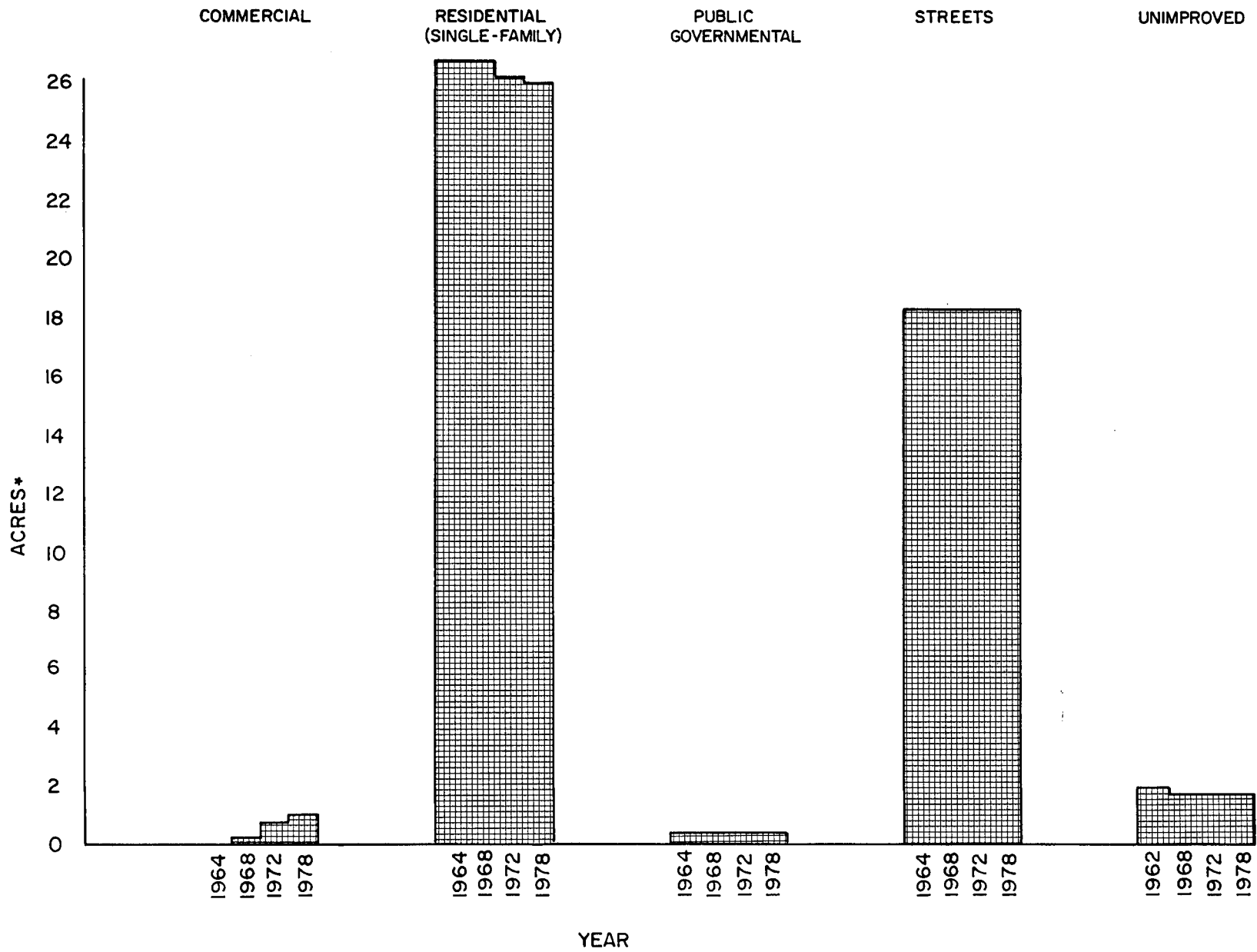


Figure 9. Changes in Abutting Land Uses in the Antoine Drive Study Area

\* One Acre Equals  
0.4046856 Hectare

Table 5. Nonabutting Area Land Use Changes

Land Use Change By Time Period	Before				After				Overall Change
	1964		1968		1972		1978	1964 - 1968	
Residential-Single Family Total Acres Absolute Change Percent Change	211.76	+1.34 +0.63	213.10	-3.68 -1.73	209.42	-0.97 -0.46	208.45	-3.31 -1.56	
Residential-Multiple Family Total Acres Absolute Change Percent Change	15.61	+17.46 +111.85	33.07	+39.41 +119.17	72.48	+1.37 +1.89	73.85	+58.24 +373.09	
Commercial Total Acres Absolute Change Percent Change	37.33	+28.95 +78.17	66.28	-2.00 -3.02	64.28	+2.64 +4.11	66.92	+29.59 +79.27	
Public Total Acres Absolute Change Percent Change	21.15	0 0	21.15	0 0	21.15	0 0	21.15	0 0	
Streets and Roads Total Acres Absolute Change Percent Change	60.35	0 0	60.35	+0.93 +1.54	61.28	0 0	61.28	+0.93 +1.54	
Unimproved Total Acres Absolute Change Percent Change	91.75	-47.75 -52.04	44.00	-34.66 -78.77	9.34	-3.04 -32.55	6.30	-84.52 -93.06	
Total Nonabutting Acres	437.95		437.95		437.95		437.95		

The multi-family development occurred in the eastern portion of the Study Area along Westview Drive and most of the increase in commercial acreage was a result of a new section of Woodlawn Cemetery being opened between 1964 and 1968. Unimproved acreage decreased by 52.0% (-47.75 acres) to 10.0% of the total nonabutting acres. Public and street right-of-way acreage did not change during the "before" period.

Unimproved acreage continued to show the highest percentage and absolute decrease of the nonabutting land uses between 1968 and 1972. Unimproved acreage decreased -78.77% (-34.66 acres) while commercial and single-family residential development decreased by -3.02% and -1.73, respectively. Multi-family residential, correspondingly, increased +119.17% (+39.41 acres) and street and road acreage increased by +1.54% (0.93 acres). In 1972, improved land constituted 83.9% of the total nonabutting acres, streets and roads 14%, and unimproved land has dropped to only 2.1%.

By 1978, 98.6% of nonabutting land was improved (including streets and roads) and 1.4% was unimproved. During the "after" period, multi-family residential (+1.89%) and commercial (+4.11%) acreage increased slightly while single-family residential (-0.46%) and unimproved (-32.55%) acreage decreased. The other land use categories, public and streets and roads, did not undergo any changes between 1972 and 1978.

Analyzing land use changes for the overall study period from 1964 to 1978, multi-family residential development experienced the highest absolute and percent increase and unimproved land underwent the highest absolute and percentage decrease. Acreages for each nonabutting land use category for each project year are charted in Figure 10.

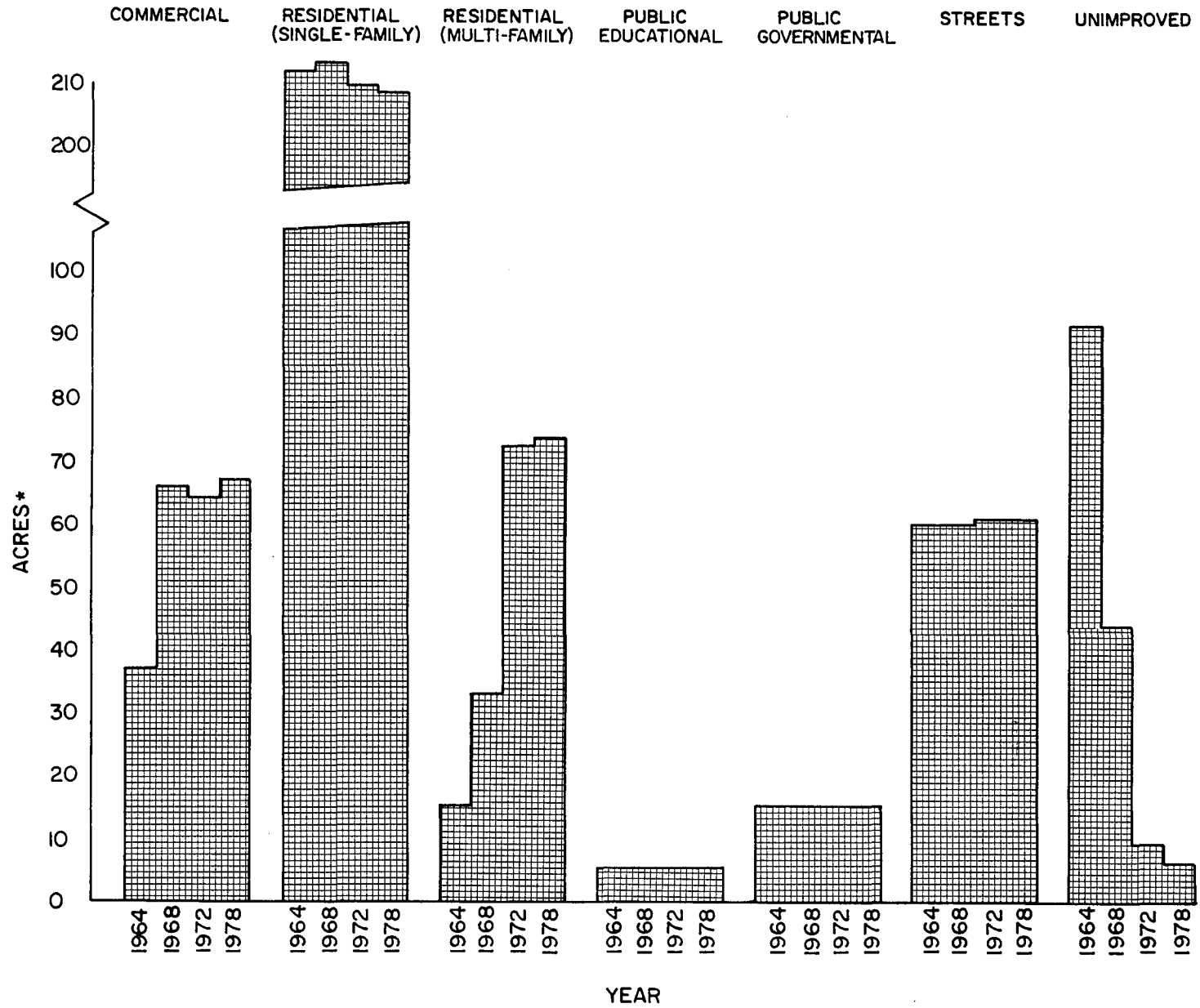


Figure 10. Changes in Nonabutting Land Uses in the Antoine Drive Study Area

\* One Acre Equals 0.4046856 Hectare



## Land Use Impediments

Many factors can affect the rate and type of land use change and development in an area besides the improvement of a single thoroughfare. Zoning laws, subdivision (deed) restrictions, area accessibility, property ownership, regional land developments, and comprehensive land uses can dictate how development and land use change occurs in the impacted area. These factors were investigated to determine their influence on the Study Area.

## 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 Transportation Study published a 1980 land use plan for Harris County that forecasted that the Antoine Drive Study Area would remain predominantly single-family residential. The 1980 comprehensive plan also predicted that the unimproved land abutting IH 10 frontage road would develop into industrial uses while the unimproved

land in the eastern portion of the Study Area would become multi-family residential. Another land use plan published in 1972 by the Houston City Planning Commission projected in the Houston General Study Plan for 1990 that the Study Area would be entirely low-density residential except for the southern portion which was expected to be industrial. Other land use plans were basically in agreement with the above plans in that the area would remain single-family residential.

These general land use plans are based on existing land use, land development trends, age of existing improvements, street condition and design, planned street improvements, and amenities offered for the various types of developments. The land use in the Antoine Drive Study Area has basically conformed with the various land use plans, especially the 1980 Houston Metropolitan Area plan. The only exception, although most of which is just south of the Study Area, is that the land abutting IH 10 has developed into commercial or multi-family residential uses rather than the predicted industrial use. The 1980 plan correctly forecasted the multi-family residential developments located in the undeveloped portion of the Study Area. Although the land use plans are too general to account for block by block land uses, land use development trends in Houston-Harris County have been effectively forecast by the comprehensive land use plans.

#### Other Factors Influencing Land Use Change

Commercial and industrial development in the Antoine Drive Study Area may have been influenced by the restricted accessibility to IH 10 (Katy Freeway). Antoine Drive does not have a separate exit ramp from Katy Freeway; instead, the easterly direction exit is a joint Silber Road-Antoine Drive ramp which is about one-half mile east of Antoine Drive. Although the Study Area is bracketted by three major traffic carriers (IH 10, IH 610, and U.S. 290), the accessibility to

and from the Study Area is inhibited by the incompleteness of the major thoroughfare network in the region.

Subdivision deed restrictions have not been strictly enforced by property owners in the Study Area during recent years, and therefore, have not been a major impediment to land use change. On the other hand, abutting land use change has been influenced by the fact that almost all of the abutting property along Antoine Drive has been platted for single-family residential use since the early 1950's. As a result, the impact of the Antoine Drive improvement on abutting land use change has been reduced.

### Socio-Economic Characteristics

The socio-economic characteristics of an area may have an important influence on the region's general land use development. Factors such as population, median family income, educational level, and labor force characteristics were investigated to determine their possible significance to land use development trends in the Antoine Drive area.

The 1960 and 1970 Bureau of the Census data were analyzed to determine whether any significant differences existed between the above characteristics of Houston and those of Census Tracts 66-A (1960 census) and 442 (1970 census). Since Census Tract 66-A/442 encompasses the entire 485 acre Study Area, a comparative analysis may be implemented.

According to Table 6, the population in Census Tract 66A/442 increased 50.6% between 1960 and 1970 as opposed to 31.4% in Houston as a whole. Also, the 1960 census found that Census Tract 66-A's percent of high school graduates and median school years completed were somewhat higher than those in Houston. The 1960 median family income of the census tract was 25.1% higher than the city-wide income and the median value of owner occupied residences was 7.3% higher than the comparable Houston figure. Analyzing the 1970 data revealed

that although Census Tract 442's percent of high school graduates and median school years completed remained higher than Houston's, the difference between the two areas was considerably less than in 1960. The difference between median family income had also dropped from 25.1% to 11.5% in 1970 while the median value of owner occupied residences were identical (\$14,400) in 1970. The difference between the median rent paid by tenants had narrowed, although still higher in the Census Tract than the city-wide figure. The percent of families below the poverty level in 1970 was only 4.3% in Census Tract 442 while Houston's total was 10.7%.

The data for labor force characteristics indicate that generally the census tract contained a higher percentage of high paying occupations in 1960; but by 1970, this advantage had disappeared. However, Census Tract 66-A/442 had a relatively higher proportion of salespersons, craftsmen and foremen, clerical workers and a smaller proportion of operatives, laborers, service, and private household workers in 1960 and 1970. These differences in the labor force's occupational breakdown suggest that the higher educational and family income level along with the lower percent of families below the poverty level in the census tract might be correlated to (explained by) the higher proportion of workers in higher paying jobs in 1960 and 1970. The above data suggest that the Study Area census tract had an economic base more conducive to continued land development than perhaps Houston as a whole.

Table 6. Comparison of 1960 and 1970 Socio-Economic Characteristics of Houston and Census Tracts 66-A and 442. (Source: U.S. Bureau of the Census)

Socio-Economic Characteristics	1960		1970	
	Houston	Tract 66-A	Houston	Tract 442
<u>Population</u>	938,219	8,626	1,232,793	12,995
Median School Years Completed	11.3	12.2	12.1	12.2
Percent High School Graduates	45.2	56.3	51.8	57.9
Median Family Income	\$5,902	\$7,384	\$9,876	\$11,014
Median Income of Families and Unrelated Individuals	\$5,093	\$7,160	\$8,055	\$10,160
Median Value of Owner Occupied Residences	\$10,900	\$11,700	\$14,400	\$14,400
Median Rent Paid by Tenants	\$67	\$101	\$96	\$135
Percent Families Below Poverty Level	NA <sup>(a)</sup>	NA <sup>(a)</sup>	10.7	4.3
<u>Occupation</u>				
Total Employed, 16 Years and Over	363,636 <sup>(b)</sup>	3,344 <sup>(b)</sup>	515,619	6,006
Percent Professional, Technical, and Kindred Workers	12.49	13.88	16.53	15.77
Percent Managers and Administrators, Except Farm	9.97 <sup>(c)</sup>	12.47 <sup>(c)</sup>	8.78	8.26
Percent Sales Workers	8.03	11.03	8.97	10.31
Percent Clerical and Kindred Workers	16.56	21.23	20.09	26.17
Percent Craftsmen, Foremen, and Kindred Workers	12.71	17.67	13.10	15.58
Percent Operatives, Except Transport	13.79 <sup>(d)</sup>	10.62 <sup>(d)</sup>	9.29	9.61
Percent Transport Equipment Operatives	NA <sup>(d)</sup>	NA <sup>(d)</sup>	4.24	2.95
Percent Laborers, Except Farm	5.74	2.18	5.19	2.05
Percent Farm Workers	NA <sup>(c)</sup>	NA <sup>(c)</sup>	0.24	0.25
Percent Service Workers	9.44	5.16	11.14	8.59
Percent Private Household Workers	4.21	0.66	2.09	0.46

(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.

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

Two approaches were implemented to estimate the impact of the Antoine Drive improvement on land use change and development in the Study Area. The two approaches utilized two different types of data to indicate probable impact of the improvement were: (1) actual land use change by type and location, and (2) the opinions of knowledgeable people.

### Actual Land Use Changes

During the 15-year study period, the percentage of developed land (including streets and roads) in the Study Area increased from 80.7% in 1964 to 98.3% in 1978 while the percent of unimproved land dropped from 19.3% to 1.7% for the same period. Approximately 85.68 acres (34.7 hectares) of previously unimproved land were developed and 6.88 acres (2.8 hectares) of previously improved land were redeveloped between 1964 and 1978.

Of the 485.3 acre (196.4 hectares) Antoine Drive Study Area, 47.35 acres (19.2 hectares) are classified as abutting property and the remaining 437.95 acres (177.2 hectares) are defined as nonabutting property. Only 2.1% of the abutting property and 21.0% of the nonabutting property changed land use during the overall study period.

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

Table 7. Absolute Changes in Land Use of Abutting and Nonabutting  
Acreage by Time Period and Type of Land Use Change<sup>a</sup>

Type of Land Use Change	Before Period		Short-Run After Period		Long-Run After Period		Total After Period	
	1964-1968		1968-1972		1972-1978		1964-1978	
	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting
	----- <sup>a</sup> Acres -----							
Single Family to Multiple Family	0	0	0	3.63	0	0	0	3.63
Single Family to Commercial	0	0	0.52	0	0.23	0.97	0.75	0.97
Commercial to Multiple Family	0	0	0	2.00	0	0	0	2.00
Unimproved to Single Family	0	1.34	0	0	0	0	0	1.34
Unimproved to Commercial	0.23	28.95	0	0	0	1.67	0.23	30.62
Unimproved to Multiple Family	0	17.46	0	34.66	0	1.37	0	53.49
Unimproved to Streets and Roads	0	0	0	0.93	0	0	0	0.93
Total Land Changing Use	0.23	47.75	0.52	41.22	0.23	4.01	0.98	92.98
Improved	0	0	0.52	5.63	0.23	0.97	0.75	6.60
Unimproved	0.23	47.75	0	35.59	0	3.04	0.23	86.38
Total Land Not Changing Use	47.12	390.20	46.83	396.73	47.12	433.94	46.37	344.97
Total Land	47.35	437.95	47.35	437.95	47.35	437.95	47.35	437.95
Unimproved to Industrial	0	7.62	0	0	0	0	0	0

\*One acre equals .4046856 hectares.

Table 8. Average Annual Changes in Abutting and Nonabutting Acreage by Time Period and Type of Land Use Change<sup>a</sup>

Type of Land Use Change	Before Period		Short-Run After Period		Long-Run After Period		Total After Period	
	1964-1968		1968-1972		1972-1978		1964-1978	
	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting	Abutting	Nonabutting
	-----Percent <sup>a</sup> -----							
Single Family to Multiple Family	0	0	0	0.21	0	0	0	0.06
Single Family to Commercial	0	0	0.27	0	0.08	0.04	0.11	0.02
Commercial to Multiple Family	0	0	0	0.11	0	0	0	0.03
Unimproved to Single Family	0	0.08	0	0	0	0	0	0.02
Unimproved to Commercial	0.12	1.65	0	0	0	0.06	0.04	0.50
Unimproved to Multiple Family	0	1.00	0	1.98	0	0.05	0	0.87
Unimproved to Streets and Roads	0	0	0	0.05	0	0	0	0.02
Total Land Changing Use	0.12	2.73	0.27	2.35	0.08	0.15	0.15	1.52
Improved	0	0	0.27	0.32	0.08	0.04	0.11	0.11
Unimproved	0.12	2.73	0	2.03	0	0.11	0.04	1.41

<sup>a</sup>Derived 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.



periods. Both tables also indicate the previous and new use categories for each change recorded.

The minimal impact of the street improvement project on land use change is revealed through the fact that only 0.98 acres of the total 47.35 abutting acres changed land uses during the overall study period (Table 7). Of the abutting land use changes, 0.23 acres of previously unimproved property were developed for commercial uses between 1964 and 1968, and 0.75 acres of previously improved property (single-family residential) were redeveloped for commercial uses during the last two study periods, 1968 to 1972 and 1972 to 1978.

Table 8 shows that the overall average annual percentage change in abutting land use was only 0.15%. This indicates that very little land use change has occurred on properties with frontage along Antoine Drive, especially unimproved tracts. However, the average annual percentage change for properties changing from single-family residential to commercial was higher for abutting properties than for nonabutting properties. Also influencing the small amount of change was that very little unimproved acreage was available for development along Antoine Drive when compared to the amount of undeveloped land not defined as abutting the facility. But in reviewing average annual percentage change for improved properties, the overall period rate of change is the same (0.11%) for both the abutting and nonabutting properties.

Table 7 does illustrate that large quantities of unimproved nonabutting acreage were developed during the "before" and "construction" time period. The improvement of several nearby thoroughfares, i.e. Silber and Wirt Road which run parallel to Antoine Drive and Westview Drive and Long Point Road which intersect Antoine in the Study Area, could have had some influence on the rate of land use change, especially nonabutting land. The highest rate of change on undeveloped nonabutting properties occurred during the "before" and "construction" periods,

and it was during these two periods that Silber, Westview, and Long Point were improved (Table 8).

The above evidence seems to indicate that the improvement of Antoine Drive and the other thoroughfares, especially Westview Drive, encouraged the development of previously unimproved nonabutting properties 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 into the impact of the Antoine Drive improvement project on area land use change and development. Generally speaking, the persons interviewed felt that the improvement of Antoine Drive had little effect on the existing single-family residences but has had some impact on the development of the unimproved properties into multi-family residential uses.

Real estate personnel and property owners indicated that the new apartment complexes constructed in the Study Area were the result of a much improved access to the general area. The improvement of Antoine Drive into a 4-lane, raised median facility with curbs and gutters coupled with the improvement of other area streets (i.e. Silber Road, Wirt Road, Westview Drive, and Long Point Road) attracted developers. Other factors cited that facilitated multi-family residential development were the existence of other apartment complexes, the availability of unplatted tracts of property, and the closeness of the area to downtown Houston. Commercial development (except for Woodlawn Cemetery) was

inhibited in the Study Area because of the strip commercial developments along Long Point and Silber Roads, and due to the lack of unplatted property tracts abutting Antoine Drive.

City government officials felt that the improvement of Antoine Drive alone has not affected the area's land development. City officials agree with the real estate people and property owners in that the greater accessibility to the Study Area accomplished through the improvements of Long Point, Westview, Silber, and Antoine collectively has impacted study area land development. Officials stated that planning for the improvement of Antoine Drive was a result of traffic demand pressures relative to increased population in the area and city, and that Antoine Drive was part of the major thoroughfare system in Houston.

The opinions of real estate personnel, property owners, and city officials agree that the Antoine Drive improvement did have an effect on area land use change and development. Basically, these opinions coincide with the findings of the land use analysis.

## CONCLUSIONS

The Antoine Drive Study Area has experienced a moderate amount of land use change during the 15-year study period. The improvement of Antoine Drive from a point just south of Shavelson Street to Long Point Road from a two-lane, open ditch rural-type road to a four-lane, divided (raised median) thoroughfare with curbs and gutters has been a factor in the development of unimproved land for commercial or residential uses. The Study Area's predominant type of land use has remained single-family residential but commercial and multi-family residential uses have increased their prominence in area development.

Abutting properties were virtually unchanged between 1964 and 1978. Only 2.1% of the abutting acreage underwent some type of land use change. The predominant abutting land use remained single-family residential and the overriding reason for the lack of change is that all of the abutting property was platted for single-family residential use in the late 1940's and early 1950's. Another factor that inhibited land use change is that only 4.1% of the abutting acres were unimproved in 1964. Some redevelopment of single-family residences into commercial uses were recorded during the "construction" and "after" periods.

Nonabutting properties experienced a moderate degree of change in land use composition over the study period. Approximately 21.0% of the nonabutting acreage changed land use type; most of which changed from unimproved to either multi-family residential or commercial use. The percent of improved nonabutting property grew from 79.1% in 1964 to 98.6% in 1978. Although the predominant land use type remained single-family residential, the combined commercial and multi-family residential acreage increased from 12.1% to 32.1% between 1964 and 1978. Most of the development occurred during the "before" period (1964 to 1968) and the "construction" period (1968 to 1972).

New land development in the Study Area has been attributed to the increased accessibility accomplished through the improvement of several area thoroughfares. The type of land development that has occurred in the Study Area generally conforms with the published comprehensive land use plans for the region and the improvement of Antoine Drive has not altered any land development trends in the region. In summary, the Antoine Drive improvement project has facilitated the development of nonabutting unimproved properties into multi-family residential and commercial establishments and the redevelopment of a limited number of improved abutting properties from single-family residential to commercial use.