Summer 8-1-1970

A Vigo County Population and Land Use Forecast for 1990

Harry M. Raley
Indiana State University

A VIGO COUNTY POPULATION AND LAND USE FORECAST FOR 1990

A Master's Thesis

Presented to

the Faculty of the School of Graduate Studies

Indiana State University

Terre Haute, Indiana

In Partial Fulfillment

of the Requirements for the

Master of Arts Degree

---

by

Harry M. Raley

August, 1970

THESIS APPROVAL SHEET

The thesis of Harry M. Raley, Contribution of the School of Graduate Studies, Indiana State University, Series I, Number 999, under the title, "A Vigo County Population and Land Use Forecast For 1990," is approved as counting toward the completion of the Master of Arts Degree in the amount of six semester hours of graduate credit.

APPROVAL OF THESIS COMMITTEE:

Wm D. Brooks
(Signature of Committee Member)

Robert R. Drummond
(Signature of Committee Member)

J. L. Gluesing
(Signature of Committee Chairman) 8-12-70 (Date)

APPROVAL FOR SCHOOL OF GRADUATE STUDIES:

[signature]
(Dean, School of Graduate Studies) 8-21-70 (Date)

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the people who have assisted him in this study. Thanks in particular are due to Dr. Lee Guernsey, Chairman of the thesis committee, and committee members, Dr. Robert Drummond and Dr. William Brooks. Thanks is also expressed to Mr. John Hanley of the Area Planning Commission. Their comments, criticism, and guidance are greatly appreciated. A special word of thanks goes to Dr. Lois Coulson for the tedious task of proofreading the rough copy of this text. The author is especially grateful to his wife, Julia and his typist, Janann Bennett, for their patience and suggestions regarding this project.

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF ILLUSTRATIONS

Figures

Figures

INTRODUCTION

One of the current trends in American urban areas is the obvious shifting of population from the central city to suburbia. With the continuous population growth most observers think that the movement to suburban living will continue without interruption. The results of this movement must be anticipated in the planning process. Consequently, planners need to anticipate areas to which the population will move and the number of people that will exist in the different areas.

The purpose of this study was to examine probable population distribution and density for Vigo County in 1990 using the Density Saturation Gradient Method.[1] This procedure is concerned with the search for underlying regularities in the pattern of land use in the urban area and the development of an understanding of the factors, and the extent of their influence, which appear to significantly affect the direction and intensity of growth. The problem of this study was to determine the population of Vigo County in 1990 and where these people will be living within Vigo County.

The Density Saturation Gradient Method is one of a number of possible procedures to which the analyst might turn in an attempt to determine population numbers and locations. There are a number of

---

[1]Urban Planning Division, Sample Problem Illustrating Use of the Density Saturation Gradient Method for Land Use Analysis and Forecasting (Indianapolis, Indiana: Indiana Bureau of Public Roads, 1969), p. 2.

methods available, some simpler in nature and others more demanding in the use of analytic and mathematical talent, which can be used in the analysis and forecasting of urban land use patterns.[2] The decision to use the Density Saturation Gradient Method was made after consideration was given to the nature and adequacy of local data sources, the experience and ability of the researcher and the resources available.

The paper is divided into three chapters:

1. The initial chapter serves as a detailed analysis of the methodology in using the Density Saturation Gradient Method.
2. Chapter II contains the population projection for 1990 and an analysis of the study area by sector.
3. Chapter III presents the conclusions of the study. It is composed of summary comments and projections for future research using similar techniques.

---

[2] Ibid., p. 1.

CHAPTER I

DELINEATING THE SECTORS

For the purpose of gathering and evaluating data, Vigo County was divided into nine pie-shaped sectors. The lines dividing these sectors emanated from the center of the Central Traffic District and terminated at the County Line. The Central Traffic District was bounded by Poplar Street, the C. & E. I. Railroad, Tippecanoe Street, and the Wabash River. The geographic center of the Central Traffic District was arbitrarily established at a point at the center of the intersection of Fifth Street and Mulberry Street.

In order that the information from this study could be used in a future transportation study, the nine sectors were selected so as to "drain" the traffic areas that they delineate. That is, the major traffic arteries that carry the traffic "flow" of Vigo County were, when feasible, located near the center of the sector.[3]

The sector boundary lines were established so as to follow natural boundaries and conform to census tract boundaries whenever possible. Figures 1 and 2 illustrate the division of the study area. It should be noted here that the Dobbs Park, Rea Park, and Hulman Field areas of the corporate boundary were included in the county area because they were not a contiguous part of the city area. The western

---

[3]Terre Haute City Planning and Redevelopment Commission, Comprehensive Development Plan for the Terre Haute Planning Area: Part 2 (Mishawaka, Indiana: City Planning Associates Incorporated, 1961), pp. 78-80.

TERRE HAUTE STUDY AREA

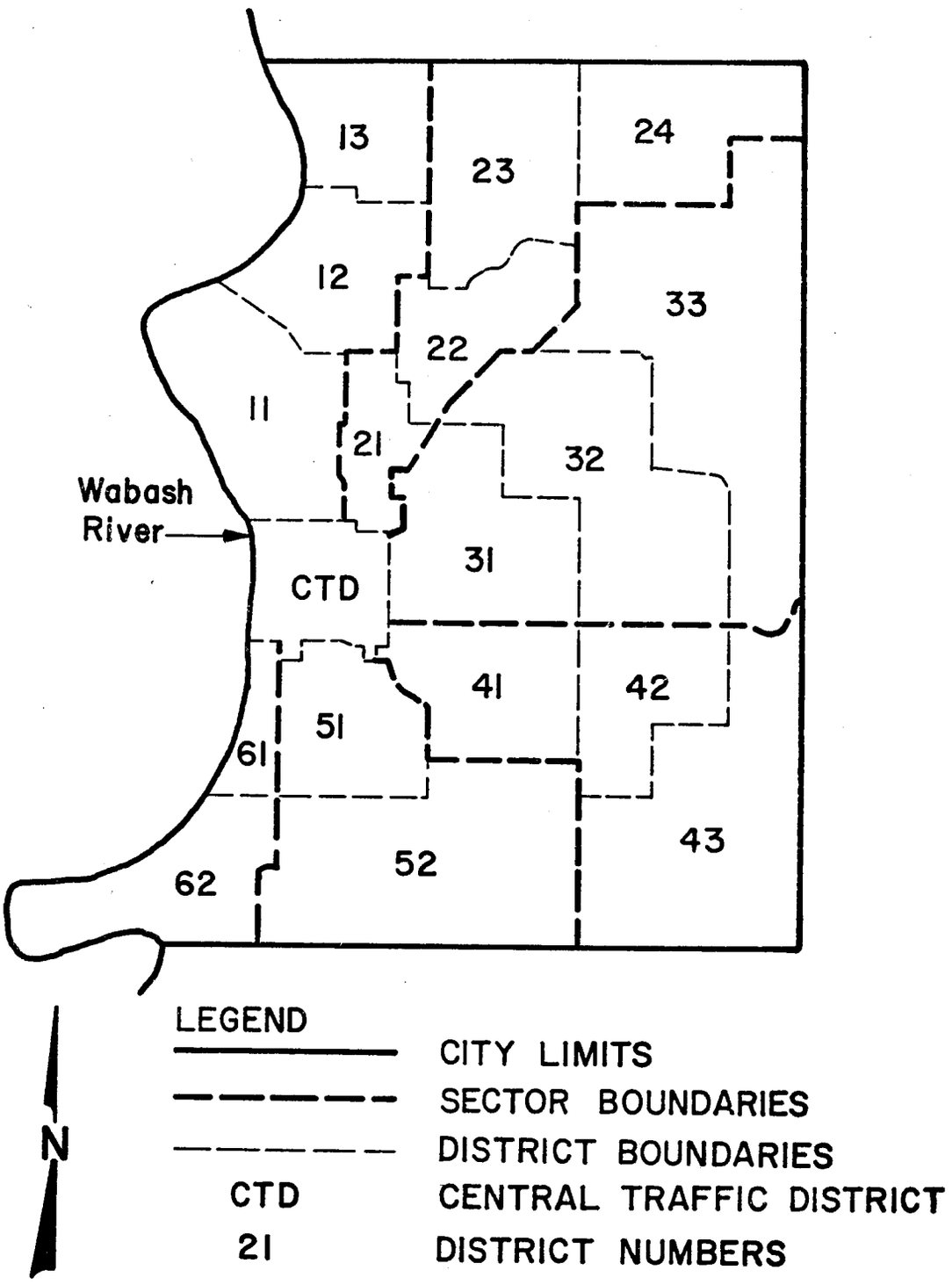


Fig. 1.--A map illustrating the Terre Haute study area divided into districts.

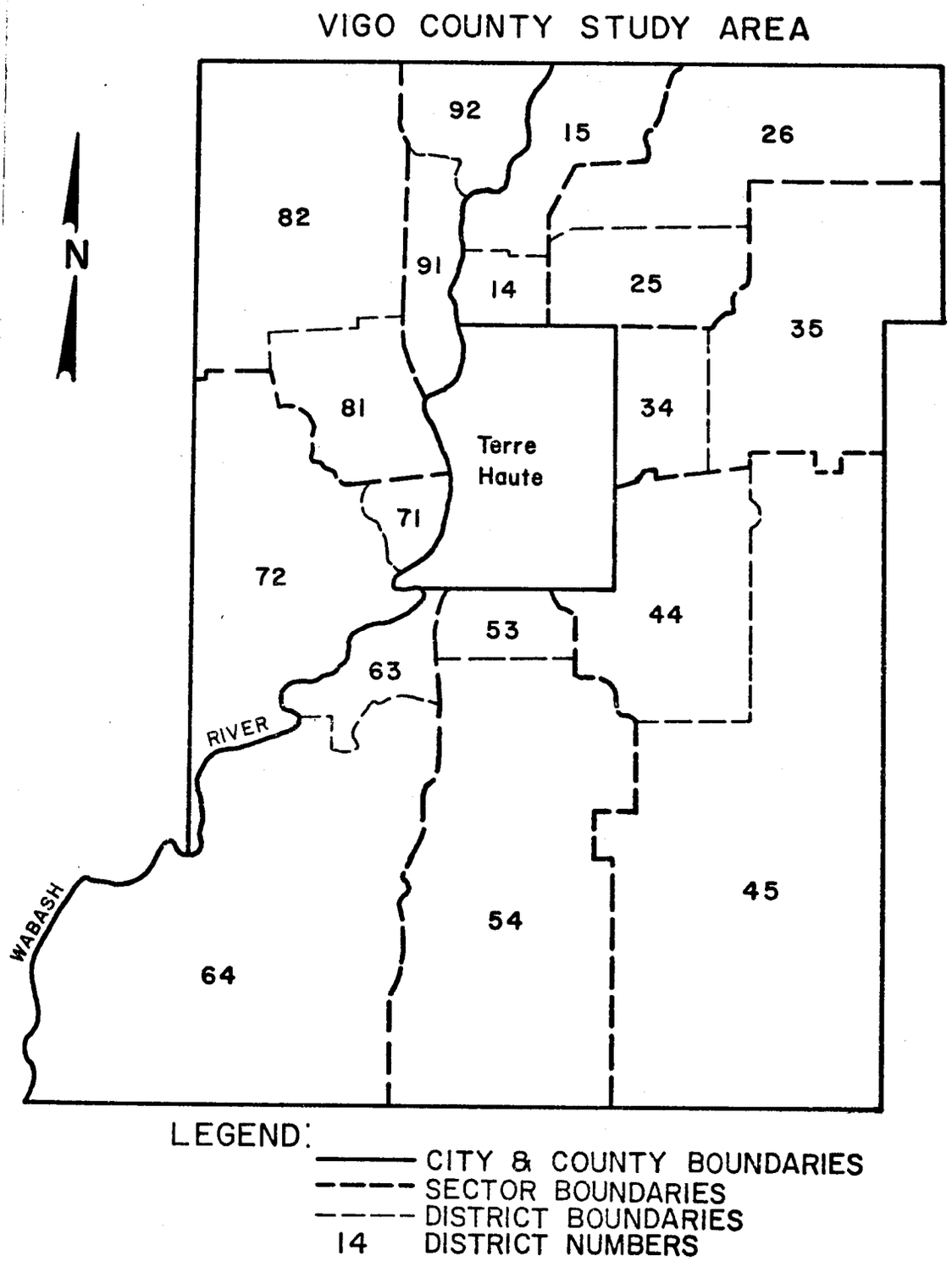


Fig. 2.--A map illustrating the Vigo County study area divided into districts.

boundary of Sector 1 was the middle of the Wabash River extending in a northward direction to the County Line. The dividing line between Sector 1 and Sector 2, which was the eastern boundary of Sector 1, was 6½ Street and Center Street north to Maple Avenue; Maple Avenue east to 11th Street; 11th Street north to Florida Avanue, Florida Avenue east to 13th Street; 13th Street north to Hawthorne Avenue; Hawthorne Avenue east until a point midway between old and new U.S. 41 was reached; north and northeast from that point to the intersection of Evans Lane and U.S. 41; east on Evans Lane to Creek Road; and Creek Road to the County Line. The transportation route at the center of Sector 1 was U.S. 41 North.

The dividing line between Sector 2 and Sector 3 followed Tippecanoe Street from the Central Traffic District Boundary to Eleventh Street; Eleventh Street north to Locust Street; Locust Street west to Tenth Street; Tenth Street north to Third Avenue; Third Avenue east to the center of the Penn-Central Railroad tracks; the Penn-Central tracks northeast to Maple Avenue; Maple Avenue east to Duane Avenue; Duane Avenue northeast to Twenty-fifth Street; Twenty-fifth Street north to Fort Harrison Road; Fort Harrison Road east to Fruitridge Avenue; Fruitridge Avenue north to Steelton Road; Steelton Road east to Westpark Drive; Westpark Drive north to Hawthorne Avenue; Hawthorne Avenue east to Coffee Road; Coffee Road east to Hunt Road; Hunt Road northeast to Roberson Road; Roberson Road north to Seth Engle Road; and Seth Engle Road east to the County Line. The main transportation routes of Sector 2 were Lafayette Avenue and Rosedale Road.

The dividing line between Sector 3 and Sector 4, which was the southern limit of Sector 3, was Ohio Boulevard east to Deming Park Drive; Deming Park Drive east to Park Lane; Park Lane extended east to the north boundary of Dobbs Park and north along the boundary of Dobbs Park to Route 46; east to Chamberlain Road; Chamberlain Road north to Milner Road; Milner Road east to Felling Road; and Felling Road east to the County Line. The transportation artery of Sector 3 was U.S. 40 East. The dividing line between Sector 4 and Sector 5 started at Ninth Street and the southern limits of the C. & E. I. Railroad yard and proceeded southeast along the rail yard to Thirteenth Street; Thirteenth Street south to Washington Avenue; Washington Avenue east to Twenty-fifth Street; Twenty-fifth Street south to Thompson Ditch; southeast along Thompson Ditch to the intersection of Davis Avenue and Fagin Road; Fagin Road south to Ferree Road; Ferree Road southeast to Metcalf-Hamilton Road; south along Metcalf-Hamilton Road to Price Road; Price Road west to Eaton Road; Eaton Road south to Cox Road; Cox Road east to Township Line Road; and the Township Line Road south to the County Line. The major roads in Sector 4 were Highway 46, S.R. 42, Fruitridge Avenue, and Poplar Street.

The dividing line between Sector 5 and Sector 6 started at the intersection of Poplar Street and First Street. It extended south on First Street to Voorhees; Voorhees west to Dillman Street; Dillman Street south to Margaret Avenue; from the intersection of Dillman and Margaret Avenue the boundary was southwest to the intersection of Cantrell Road and Rigney Road; then the boundary extended southward

on the Terre Haute-Sullivan Road to the County Line. The main transportation route of Sector 5 was U.S. 41 South.

The western boundary of Sector 6 was the middle of the Wabash River starting at Poplar Street and going south to the County Line. This was also the southern boundary of Sector 7. The main transportation route of Sector 6 was Highway 63 South. The boundary between Sector 7 and Sector 8 started at the middle of the Penn-Central Railroad bridge over the Wabash River. The boundary followed the Penn-Central Railroad tracks west to the intersection with the Cusick Road; north on the Cusick Road to the Gannon Road; Gannon Road northwest to Tiffin Road; and the Tiffin Road to the County Line. The main transportation route of Sector 7 was U.S. 40 West. The boundary line between Sector 8 and Sector 9 was a line approximately 0.5 mile west of Highway 63 starting at the bridge and running parallel to Highway 63 until the County Line was reached. The main transportation artery of Sector 8 was Highway U.S. 150. The other boundary of Sector 9 was the previously mentioned Sector 1, the middle of the Wabash River starting at Tippecanoe Street and extending north to the County Line. The main transportation route of Sector 9 was Highway 63 North.

Establishing the Districts

The Vigo County study area was further divided into districts (see Figure 3). From the center of the Central Traffic District at Fifth and Mulberry streets, circles were drawn. The first circle had a radius of 1.5 miles. This 1.5 mile radius was used to assure the first district would be about one mile wide. The first 0.5 mile of

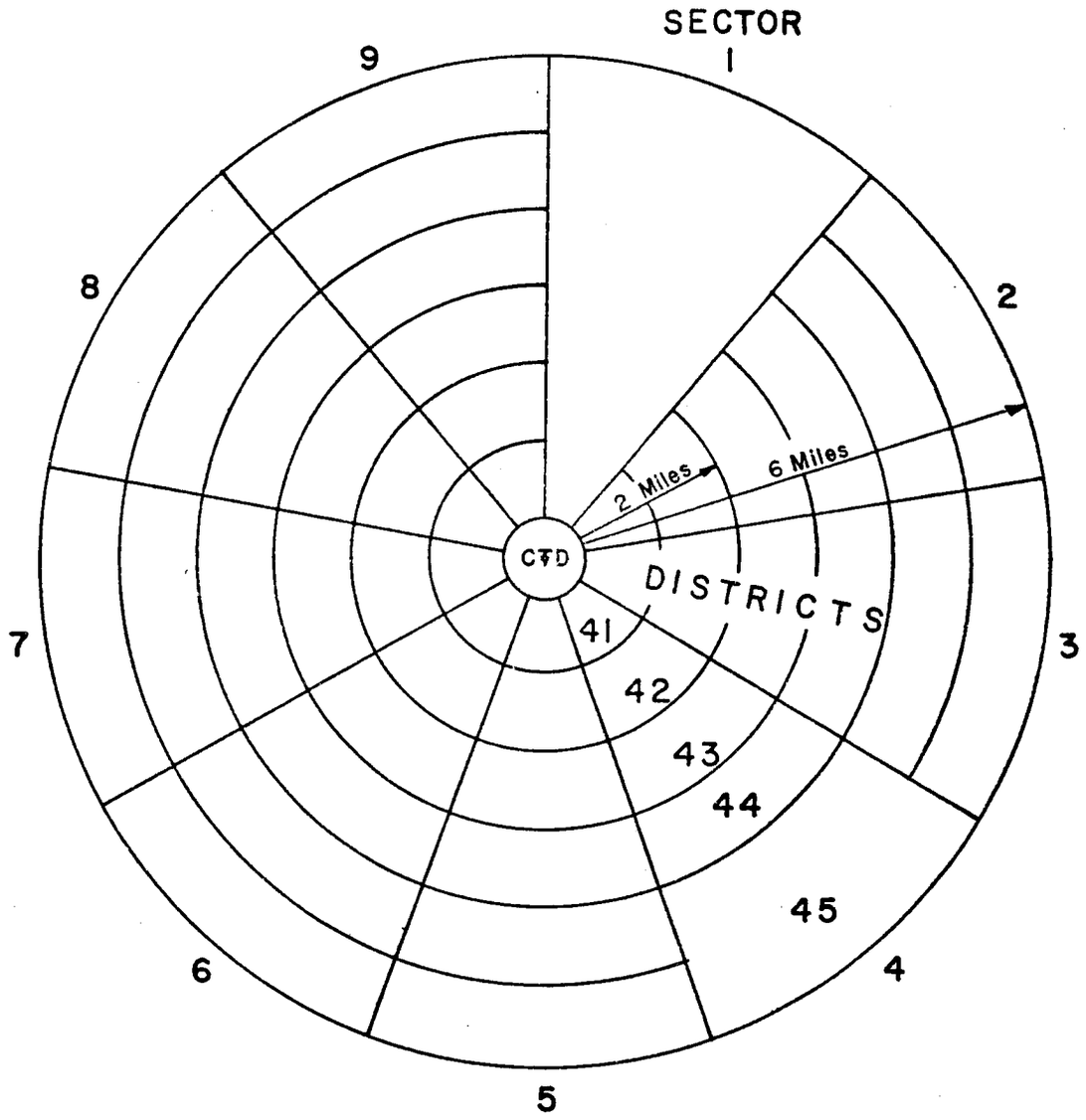


Fig. 3.--This figure illustrates the division of the study area into a geometric pattern. Deviations from these limits occur in the study because natural boundaries were followed whenever possible.

the first radius encompassed the Central Traffic District which was considered to be a void area of the study. Successive circles were drawn at mile intervals, i.e., 2.5 miles, 3.5 miles, etc., from the center of the Central Traffic District. In the County the interval was increased sometimes to 2 or 3 miles due to the larger and less populated areas. As was done in the sector boundaries, the district boundary lines followed natural boundaries and conformed with the census tract boundaries whenever possible.

Each district was identified by a two digit number, the first digit identifying the sector and the second digit identifying the district. In each sector the districts had identifying digits which increase in value as the distance of the district from the Central Traffic District increases. All districts surrounding the Central Traffic District had numbers that contain two digits, the first digit identifying the sector with the second digit being one (1); e.g., the first district in Sector 4 was called District 41, the next district out from the center was District 42, etc. Figure 3 illustrates the division of the study area into sectors and districts geometrically. Figures 1 and 2 show the study area divided into sectors and districts following natural boundaries. The initial boundary for the first district in each sector was the limits of the Central Traffic District as delimited by the respective sector boundaries. The most distant boundary of each sector was the County Line.

The boundary between District 11 and District 12 began at the center of the intersection of Center Street and Maple Avenue and extended west along Maple Avenue until Indiana S.R. 63 was reached.

It then followed S.R. 63 to the middle of the Wabash River. The boundary between District 12 and District 13 began at the intersection of Fort Harrison Road and Thirteenth Street. It followed Fort Harrison Road west to Seventh Street; Seventh Street north to McCullough Road; and McCullough Road west to the middle of the Wabash River. The boundary between District 13 and District 14 began at the intersection of Twenty-second Street and Hawthorne Avenue and extended west along Hawthorne Avenue until the middle of the Wabash River. The boundary between District 14 and District 15 began at the intersection of Hasselburger Road and old Road U.S. 41 and extended west along Hasselburger Road until the middle of the Wabash River. The outer extent of District 15 was the County Line.

The boundary between District 21 and District 22 began at the intersection of the Penn-Central Railroad tracks and Eighth Avenue. It then extended west along Eighth Avenue to Twelfth Street; Twelfth Street north to Buckeye Street; Buckeye Street west to Eleventh Street; and then north along Eleventh Street to end at Maple Avenue. The boundary between District 22 and District 23 began at the intersection of Thirteenth Street and Florida Avenue and then went south along Thirteenth Street to Delaware; and east on Delaware to Lafayette Avenue; Lafayette Avenue north to Lost Creek; and then it followed Lost Creek east to Twenty-fifth Street. The boundary between District 23 and District 24 extended from the intersection of Twenty-fifth Street and Fort Harrison Road north along Twenty-fifth Street to Hawthorne Avenue. The boundary between District 24 and District 25 began at the intersection of Twenty-second Street and Hawthorne Avenue and extended

east along Hawthorne Avenue to the intersection of Hawthorne Avenue and Westpark Drive. The boundary between District 25 and District 26 started at the intersection of Roberson Road and Foxworthy Road and extended west along Foxworthy Road to about 1/2 mile west of old Road U.S. 41 where it met the sector line between Sector 1 and Sector 2. The outer extent of District 26 was the County Line.

The boundary between District 31 and District 32 began at the south intersection of Ohio Boulevard and Twenty-fifth Street. It then went north on Twenty-fifth Street to Locust Street; west on Locust Street to Nineteenth Street; north on Nineteenth Street to Eighth Avenue; and then west on Eighth Avenue to terminate at the Penn-Central Railroad crossing. The boundary between District 32 and District 33 began at the south intersection of Ohio Boulevard and Fruitridge Avenue. It followed Fruitridge Avenue to the Penn-Central Railroad tracks; west across the tracks to Fourth Avenue; west on Fourth Avenue to Kester Avenue; north on Kester Avenue to Maple Avenue; and finally west on Maple Avenue to Duane Avenue. The boundary between District 33 and District 34 began at the intersection of Kean Lane and Park Lane and extended north along Kean Lane, which is the city limits, to the intersection of Hawthorne Avenue and Westpark Drive. The boundary between District 34 and District 35 began about 1/2 mile north of Indiana S.R. 42 on Grey Road and continued to its termination at the intersection of Hunt Road and Coffee Road. The outer limits of District 35 was the County Line.

The boundary between District 41 and District 42 began at the intersection of Twenty-fifth Street and Hulman Street. It extended

east on Hulman to Brown Avenue; north on Brown Avenue to College Avenue; east on College Avenue to Fruitridge Avenue; and then north on Fruitridge Avenue to Ohio Boulevard. The boundary between District 43 and District 44 began at the intersection of Park Lane and Kean Lane; extended along Kean Lane south to Margaret Avenue; and then followed Margaret Avenue west to Twenty-fifth Street. The boundary between District 44 and District 45 began at the intersection of Hamilton Road and Gross Road. It extended east on Gross Road to Brown Road and then north on Brown Road to terminate about 3/4 mile north of Indiana S.R. 42. The county line was the outer limits of District 45.

The boundary between District 51 and District 52 began at the intersection of First Street and Hulman Street. It extended east on Hulman Street to Thirteenth Street and then north on Thirteenth Street to end at Washington Avenue. The boundary between District 52 and District 53 began at the intersection of Dillman Street and Margaret Avenue and extended east on Margaret Avenue to Twenty-fifth Street. The boundary between District 53 and District 54 began at the intersection of Eaton Road and Collins Road and extended west on Collins Road to about 3/4 mile west of U.S. 41. The outer limits of District 54 was the County Line.

The boundary between District 61 and District 62 began at the intersection of First Street and Hulman Street and extended east on Hulman Street to the middle of the Wabash River. The boundary between District 62 and District 63 began at the intersection of Dillman Street and Margaret Avenue and extended west on Margaret Avenue to the middle of the Wabash River. The boundary between District 63 and District 64

began at the intersection of Rigney Road and Cantrell Road, and extended west on Cantrell Road to Indiana S.R. 63; north on S.R. 63 to Honey Creek; west along Honey Creek to Morris Road; north on Morris Road to Mechlin Road; and then west on Mechlin Road to the middle of the Wabash River. The outer limits of District 64 was the County Line.

The boundary between District 71 and District 72 began at the branching in the Penn-Central Railroad tracks 1/4 mile west of West Terre Haute. The boundary followed the southern extension of the Penn-Central Railroad tracks to Sugar Creek; south along Sugar Creek to the Levee Road; and then east on the Levee Road to the middle of the Wabash River. The outer limits of Section 72 was the County Line.

The boundary between District 81 and District 82 began at the intersection of Tiffin Road and Gosnell Road. It extended north on Gosnell Road to the Thralls Road; east on Thralls Road to Wrin Road; and then east on Wrin Road to about 1/2 mile east of Road U.S. 150. The outer limits of Section 82 was the County Line.

The boundary between District 91 and District 92 began about 1/2 mile west of Indiana Route 150 on Wagner Road, and extended east on Wagner Road to Watson Road; south on Watson Road to Deering Road; east on Deering Road to the railroad spur, south along the railroad for about a mile; and then east to the middle of the Wabash River. The outer limits of Section 92 was the County Line. Sector 9 concludes the defining of sector and district boundaries.

Classifying Land

This study was based on the assumption that the residential density in any district will remain the same in future years.[4] In order to obtain the 1960 residential density, it was necessary to gather information relative to the number of people in a district and the acreage occupied by these people. The collection of data for each individual district was influenced by its location and street pattern. Different techniques were used, depending upon whether the district contained a grid system of streets as existed in most parts of the city, or whether it consisted of rural-like areas with very little of the area given to roads or streets.

To ascertain the portion of the grid area in each district that was used for streets and alleys and therefore was unavailable for other purposes, an area bounded on the west by the center line of North Nineteenth Street; on the east by the center line of North Twenty-fifth Street; on the south by the center of Eighth Avenue; and on the north by the center line of Maple Avenue, was selected for measurement purposes. From quarter-section maps, measurements were taken of each lot in the area and also of each street and alley. The total number of square feet in the lots was found to be 5,013,306.3. The total number of square feet in the streets and alleys was found to be 1,938,469. The total of these two figures was 6,951,775.3 square feet. Since this area was a quarter section and was therefore 2640 feet on a side, it

---

[4]John Hanley, interview held at the Area Planning Commission Office, Terre Haute, Indiana, April, 1970.

should have contained 6,969,000 square feet. From inspection it was determined that the variation was probably in the lot measurements shown on the quarter-section maps. Therefore, the total area of the lots used was 6,969,600 square feet. From these figures it was derived that 27.81 per cent of the Grid Section was occupied by streets and alleys. This figure was used throughout the study, where a grid system of streets existed, for determining the acres occupied by streets and alleys. By subtracting this from the total district acres, a "net usable acres" was determined. This determination was necessary since the land was classified on a block basis as described below.

A 1960 Land Use Map of the City of Terre Haute, which was the most recent land use map available, was used to classify three types of land use on a city block basis. This map was color-coded and delineated, on a parcel-by-parcel basis, the land use in the general categories of Residential, Commercial, Industrial, Government, Vacant, etc. In the "grid area" which was actually an area which contained a grid system of streets, this map was used to classify the land in each block on a percentage basis.

The classifications were made (1) in residential use, (2) in other than residential use, and (3) vacant. Land In Residential Use included single and multiple dwelling units and any land associated with them such as gardens, yards, driveways, and parking lots. Land In Other Than Residential Use included parks, schools, industry, public buildings and commercial establishments. The remaining balance of the land was classified as Vacant. These classifications were made by field measurements and examination of the land use map.

The percentage of land, by the three categories of use, for each block in each district now existed. By compiling these percentages the number of blocks in Residential Use, in Other Than Residential Use, and Vacant land was established. The Vacant land was considered to be "available for residential use." By using these figures and the "acres per block" figures the researcher derived the actual acres in the grid section that were being used in each of the three above mentioned categories.

In the non-grid areas within the city limits of Terre Haute field examination was done by the researcher to delineate on U.S.G.S. maps the same three classifications. The percentage of land in each category was then measured by an areagraph. The Land In Residential Use was determined by assigning 2.94 persons and 20,000 square feet to each house dot in the non-grid areas.[5] The land in Other Than Residential Use was determined by observation. The area outside the city limits of Terre Haute was treated as a non-grid area and was divided into Land In Residential Use, Land In Non-Residential Use, and Land Available for Residential Use, by using the U.S.G.S. maps available.

These maps were all prepared from aerial photographs taken in the spring of 1960 and were assumed to be the land use at the time of the 1960 Decennial Census. These two sources permitted a time comparability of the data gathered for analyzing the problem.

---

[5] Ibid.

Density of Population

As stated previously each dwelling unit designation on the U.S.G.S. map was assigned a population value of 2.94 persons. These units were also assigned an area of 20,000 square feet. This value of person per dwelling unit was derived from census data showing the number of persons in Vigo County and the number of dwelling units. Since virtually all of this area was not serviced by water or sewers the 20,000 quare feet per dwelling unit figure was used to arrive at the 1960 population density per district.[6] Inside the city boundary, a block statistic publication of the Bureau of the Census was used to plot the number of persons in each block on the base map that outlined the sectors and districts. The totals of the block populations were then compiled and a district population established. To determine the population in the non-grid areas, the dwelling unit dots were totalled for each district and this total multiplied by 2.94 (people per D.U.).

By combining the totals of the population figures by districts, information then existed relative to both number of people and the use of land by three categories for each district. This allowed for the calculation of a population density, or people per acre, for each of the districts investigated. This density was the quotient obtained when the "Acres in Residential Use" in each district was divided by the "existing population" of the district. As stated earlier, the

---

[6] Ibid.

technique used in this study assumed that as the available land was used for residential purpose, it would be used in each district at the same rate, i.e., people per acre, that it was being used at the time of the 1960 census. In other words, it was assumed that neighborhoods which in 1960 contained two dwelling units per acre of ground, would continue to have homes built with comparatively large lots. It was also assumed that neighborhoods that had eight or ten dwelling units per acre would continue to have homes or apartment buildings built that had smaller lots per D.U.[7] Using this assumption, the residential capacity for each district was calculated by multiplying the Acres Available for Residential Use by the Population Density and adding the product to the Existing Residential Population. Now, the quotient of the Existing Residential Population divided by the Residential Capacity provided the Per Cent Capacity of the district involved.

---

[7] Ibid.

CHAPTER II

TOTAL POPULATION PROJECTION

In order to forecast the location of future population and housing it was necessary to have an estimate of the number of people that will reside in Vigo County in the target year of 1990. In order to arrive at an estimated figure, historical data relative to Vigo County population from the U.S. Bureau of the Census publications were collected. These values are shown in the following table.

TABLE 1

VIGO COUNTY POPULATION
HISTORICAL DATA

Year	Population
1900	63,035
1910	87,930
1920	100,212
1930	98,861
1940	99,709
1950	105,160
1960	108,458

The years were given "X" axis values and the population charts were given "Y" axis values. By using the Method of Least Squares a trend (best fit) was established and by using the equation $y = \frac{\Sigma xy}{\Sigma x^2} x$, the calculations shown in Table 2 were completed. The

TABLE 2

DETERMINATION OF TREND (BEST FIT) LINE EQUATION
VIGO COUNTY POPULATION

Year	x	y	$x = X-\bar{X}$
1900	0	63,035	-30
1910	10	87,930	-20
1920	20	100,212	-10
1930	30	98,861	0
1940	40	99,709	10
1950	50	105,160	20
1960	60	108,458	30
	$\Sigma X = 210$ $\bar{X} = 30$	$\Sigma Y = 663,365$ $\bar{Y} = 94,766$	

Notes:

Least Square Formula: $Y = \left(\frac{\Sigma xy}{\Sigma x^2} \right) X$; $Y = \frac{1,702,260}{2,800} X$;

$Y = 607.95 X$

Calculation: $Y-\bar{Y} = \frac{\Sigma xy}{\Sigma x^2} (X-\bar{X})$; $Y-94,766 = 607.95 (X-30)$;

Trend Line Equation: $Y = 76,527.50 + 607.95 X$

TABLE 2--Continued

$y = Y-\bar{Y}$	x^2	xy
-31,731	900	951,930
- 6,836	400	136,720
5,446	100	- 54,460
4,095	0	0
4,943	100	49,430
10,394	400	207,880
13,692	900	410,760
	$\Sigma x^2 = 2,800$	$\Sigma xy = 1,702,260$

resulting equation established a line which best fit the population growth in Vigo County from 1900 to 1960. The projection of this line to 1990 showed that the Vigo County population will be 131,243 at that year. This projection is shown in Figure 4. A publication of the Bureau of Business Research at Indiana University forecasts a figure for Vigo County of 131,113 in the year 1985 and at the rate of increase indicated for 1990 figures will be about 135,000.[8]

In 1960, there were 3,868 persons residing in the Central Traffic District and, as assumed by the Density Saturation Gradient Method, this area will decrease considerably due to enroachment of commercial enterprise. In addition the plans for expansion of Indiana State University definitely established that many of the people now in the Central Traffic District would be moved out.

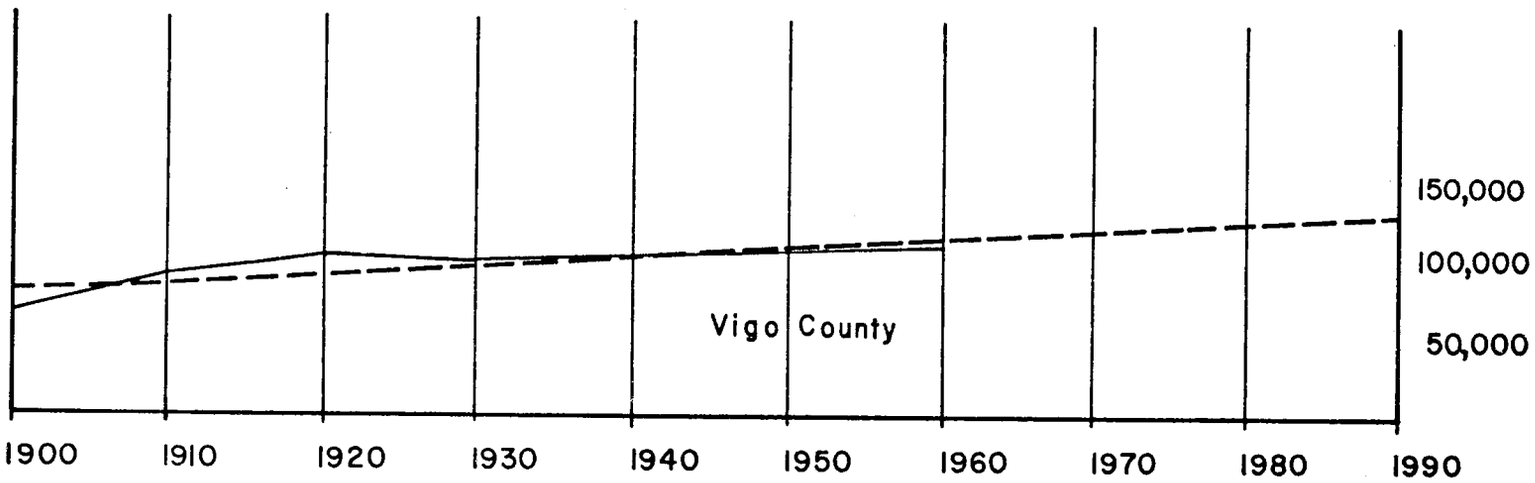
However, it was also evident that the University will create more population in this area.[9] As the researcher compiled this information, it became evident that a judgment as to the increase in total population would have to be made, taking all pertinent factors into account. While this study was attempting to forecast the location by numbers of the population, and not primarily to forecast overall numbers, it still was important to have a reasonable overall forecast as

---

[8]Bureau of Business Research, Indiana Population Projection (Bloomington, Indiana: Indiana University Graduate School of Business, 1966), p. 193 and p. 217.

[9]Area Planning Department, Neighborhood Analysis (Terre Haute, Indiana: Area Planning Department, 1968), p. 3 and p. 13.

VIGO COUNTY POPULATION TRENDS & PROJECTIONS 1900—1990



BASIC SOURCE: U.S. CENSUS

LEGEND:
HISTORICAL ————
TREND – – – – –

Fig. 4.--This figure illustrates the Vigo County population trends and projections from 1900 to 1990.

an input. After considerable discussion with other planners and school officials a projected population figure for 1990 for Vigo County was set at 137,006 people. This figure was then used in distribution of the population increase to the different sectors.

Weighting the Sectors

Each sector was compared and contrasted in order to proportion the total increase in population. Each of the sectors was classified on a "Potential Growth" basis. After considerable discussion with Mr. John Hanley from the Area Planning Commission the following growth factors were assigned to the sectors:

TABLE 3

WEIGHTING THE SECTORS

Sector	Weight
1	1
2	2
3	3
4	2
5	4
6	2
7	1
8	2
9	1

The weighting was on a scale of five. The sector with the most potential growth received the highest value. The total weight given

the sectors was 18. This value was then divided into 28,548 which is the increase of population in Vigo County from 1960 to 1990. Thus, a weight of one equaled 1,586 people. By multiplying the weight of the sector by 1,586 it was possible to determine the population increase for that particular sector between 1960 and 1990.

Forecasting

Curves were drawn for each sector to show the relationship between the per cent capacity and the distance from the center of the study area for 1960. Then each of the above mentioned curves was "tilted" at a point about 1-3/4 inches from the origin point of the graph. This tilting produced a curve that increased the "per cent capacity" reading on the graph as the distance from the origin increased when the point considered was to the right of the "tilt" point but it decreased the "per cent capacity" for the points to the left of the "tilt" point.[10] This was in conformance with the observations that the fringe areas of the Central Business District were losing population due to the encroachment of commercial enterprises, and that the new construction of homes was being done at the periphery of the present city. The core area of Terre Haute was not expanding. It was taking on a new face. Old buildings were being torn down by urban renewal programs and other areas were being bought by Indiana State University.

As lines were projected vertically from the district centers and then projected horizontally from the point at which they inter-

---

[10]Urban Planning Division, op. cit., pp. 4-5.

cepted the forecast curve, a forecast "per cent of capacity" was obtained. When this newly ascertained "per cent of capacity" figure was applied to the "residential capacity" figures, a per cent capacity forecast for each district, for the year 1990, was ascertained. As the forecasted per cent capacity was applied to the previously calculated "residential capacity", a forecasted population figure resulted. A sufficient number of iterations of each curve were made to assure that the total growth of the sector agreed with the part of the population increase assigned to that sector earlier.

Sector 1 had a total area of 10,860.45 acres, 3,728.77 acres of which were available for residential use. The population in Sector 1 for 1960 was 6,304. With the weighted increase of 1,586 the population in 1990 for Sector 1 was projected to be 7,890.

Figure 5 shows the curves for Sector 1. The curve for Sector 1 is not a smooth "S" shaped curve as expected. District 13 and District 14 had a very small amount of land available for residential use, 15.67 acres. Most of the land in these districts was used by industry or was contained in the floodplain of the Wabash River. Therefore, the per cent capacity did not decrease proportionately with the increased distance from the center of the study area as expected. District 13 and District 14 have per cent capacities of 100 and 83 respectively.

Sector 2 received a weight of 2 which means an increase of 3,172 people in 1990 from 1960. Sector 2 is illustrated in Figure 6. The distribution of the 3,172 people almost forms the expected "S" shaped curve. It failed to do so because of the sudden increased size of District 25 and District 26 over the other districts. The first

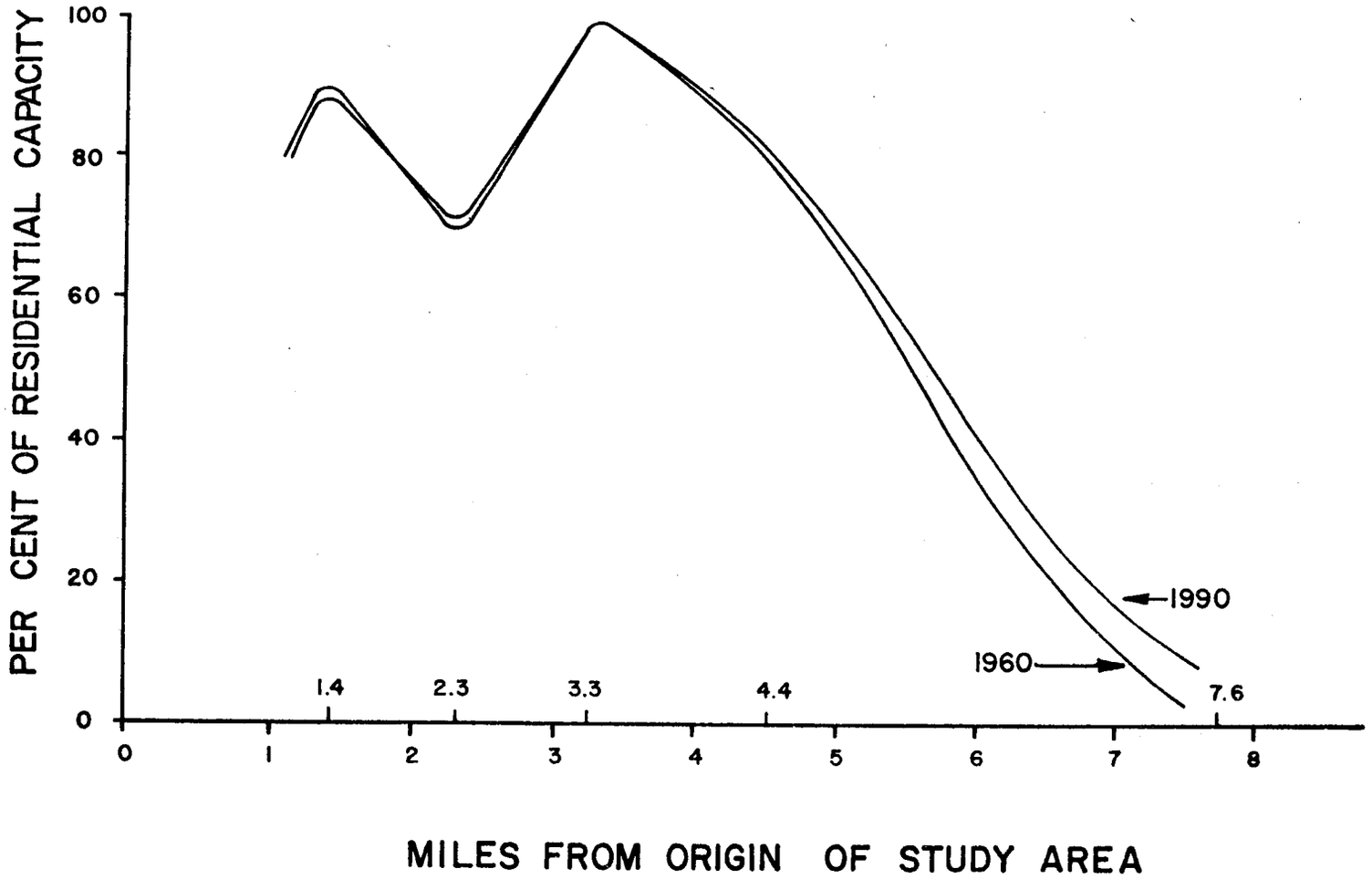


Fig. 5.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 1.

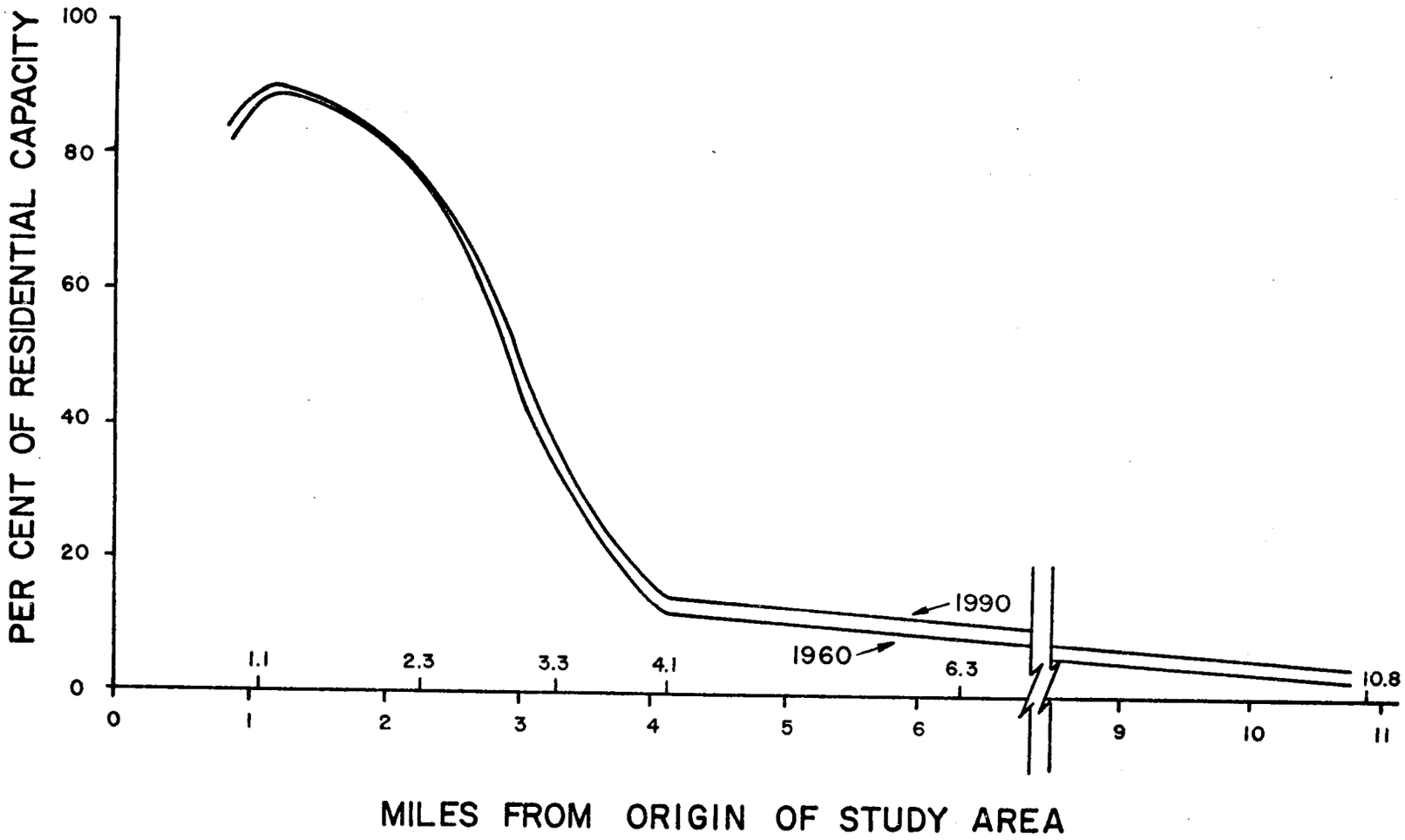


Fig. 6.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 2.

districts averaged 500 acres and then District 25 increased to 5,867.80 and District 26 to 17,776.94 acres. The increased size caused their centroids to be spaced at intervals of 2 and 4 miles instead of 1 mile and the increase of Available Land for Residential Use enabled them to absorb a tremendous population increase with little effect to the per cent of capacity. Large district size caused many curves of this study to taper off suddenly instead of gradually as distance from the centroid increased.

Figure 7 which represents Sector 3 is the best "S" shaped curve of the nine sectors. This is due to the high population increase of 4,758 people, the constant increase of available land in successive districts, and the even spacing of the district centroids. The tilting of the curve for 1990 showed a decrease of 1 per cent of capacity in District 31 to the left of the pivotal point; an increase of 1 per cent capacity in District 32 to the right of the pivotal point; and an increase of 3 per cent capacity in District 33, District 34, and District 35.

Sector 4 experiences a sudden drop in per cent of capacity in District 42 as seen in Figure 8. District 42 was an area that contained a low population density (13.48 per acre) but a proportionately high amount of available land (nearly one-third of the total area) for a district in a residential area so close to the Central Traffic District. District 42 contained very little low-cost housing and the present home owners are trying to maintain that status with zoning laws.[11] This

---

[11]Terre Haute City Planning and Redevelopment Commission, op. cit., pp. 50-54.

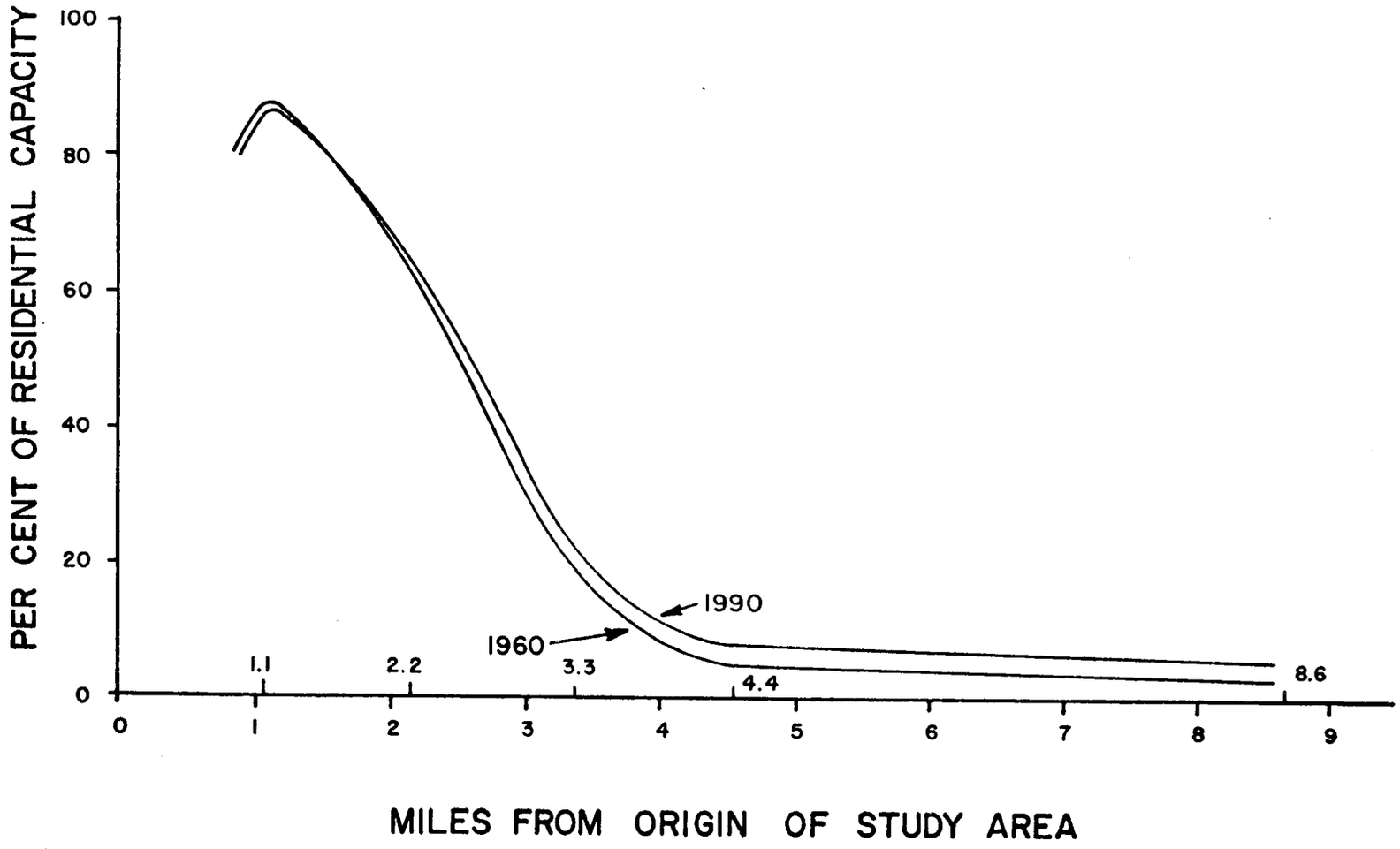


Fig. 7.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 3.

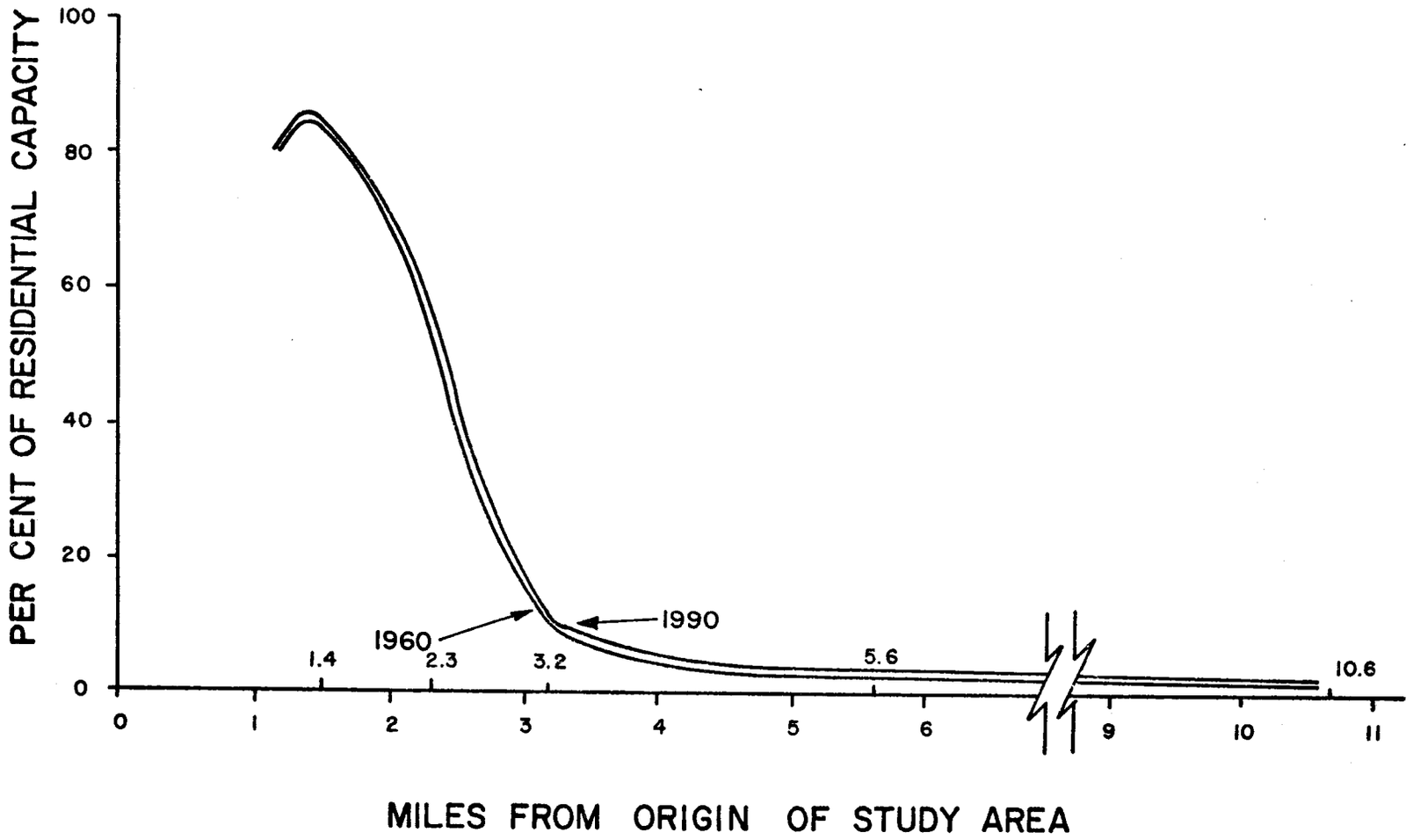


Fig. 8.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study are for 1960 and 1990 in Sector 4.

keeps sudden expansion of low-cost housing from occurring and helps maintain a moderate density of population. District 43 was the fringe area between city and rural living. It had potential for residential growth, sewers, water, and roads. But people that desire plenty of space, building new homes without pressures of city living, will skip District 43 and build in the county in District 44 and District 45. These two districts had a total of 49,943.58 acres of available land. Most of it has potential for homesteads. An additional incentive in District 44 and District 45 was the elongated lakes created by strip mining. They often provide scenic settings, swimming, fishing, and potable water for the prospective home owner.

Sector 5 received the most "weight." The high value of 4 was assigned for primarily three reasons. One reason is that U.S. 41, a four-lane accessible highway, passed through the center of Sector 5. This meant fast transportation into and out of the city. Another reason for the weight of 4 was the fact that there was a general trend of home building in that direction. It was necessary to use the city grid section technique for assessing the data in District 53 even though it was in the county. The third reason for the population increase of 6,344 in Sector 5 was 26,681 acres of available land.

Figure 9 illustrates the sudden decrease in per cent of capacity of Sector 5. It resembles Sector 4. The sudden decrease was caused by the increased size of District 54 over District 53, nearly 10 times larger, and the greater interval of the centroid, 6 miles instead of 1 mile. The curve will eventually form the expected "S" shape. The trend can be seen in District 54 where the curve begins a greater

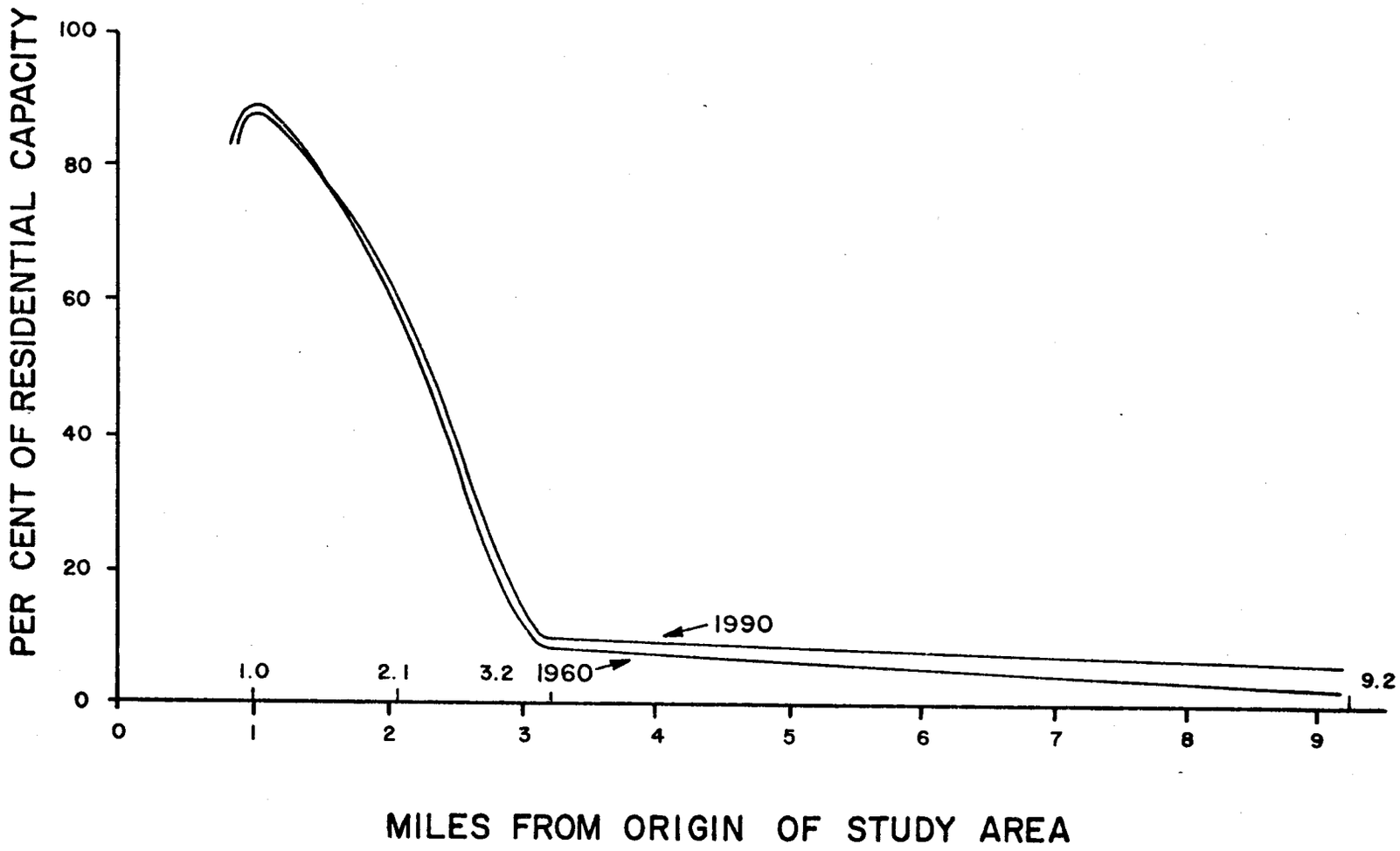


Fig. 9.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 5.

tilting upwards in per cent capacity than the other districts. It goes from 2 percent in 1960 to 5 percent in 1990 which is a tremendous upswing for a district so large.

Sector 6 will have an increase of 3,172 people. This increase will occur in District 63 and District 64 as seen in Figure 10. District 61 had no available land. It was either park, industry, or occupied. District 62 had some available land for building. The construction that has taken place has been because of urban redevelopment and also people have just shifted location within the district. These people that move out will be replaced at the same rate. District 63 and District 64 lost much of their total land to the floodplain of the Wabash River and to industry. The remaining available land (28,603.67 acres) was of the highest quality and often contained woodland which is inviting to the home builder. The Vigo County Plat Book showed an increased number of small parcels of land in District 63 and District 64 which indicated land sub-divided for home building rather than farming.

Sectors 7, 8 and 9 are not a part of the city of Terre Haute. They lie on the west side of the Wabash River and extend to the county line (see Figures 1 and 2). The result of their location can be seen in Figures 11, 12, and 13. Figure 11 (Sector 7) is the only one that approximates a curve. District 71 contained West Terre Haute and therefore reflected the population as a metropolitan area. A complete "S" shaped curve does not exist. Two districts are not enough to complete the function between distance and per cent capacity to form the curve.

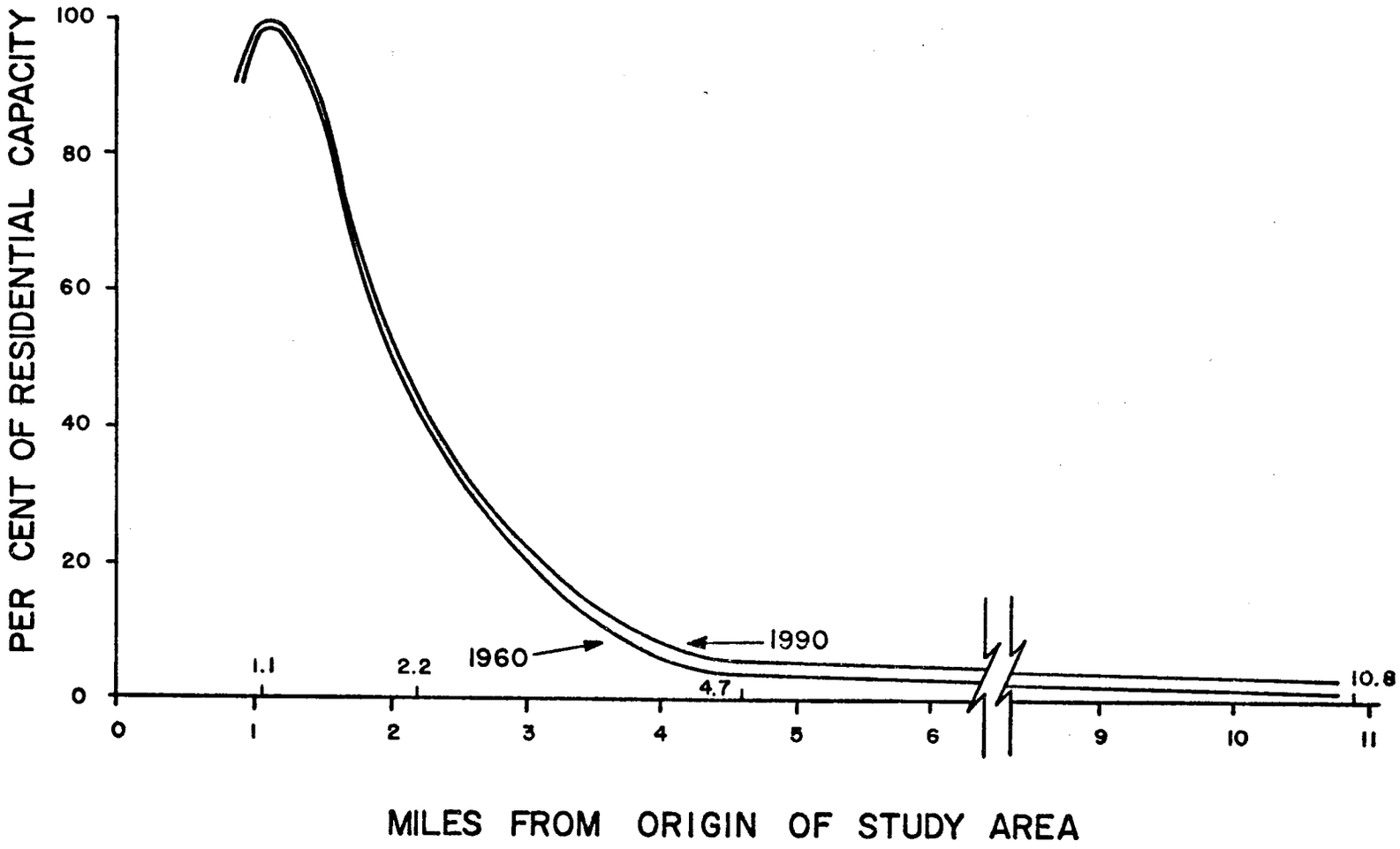


Fig. 10.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 6.

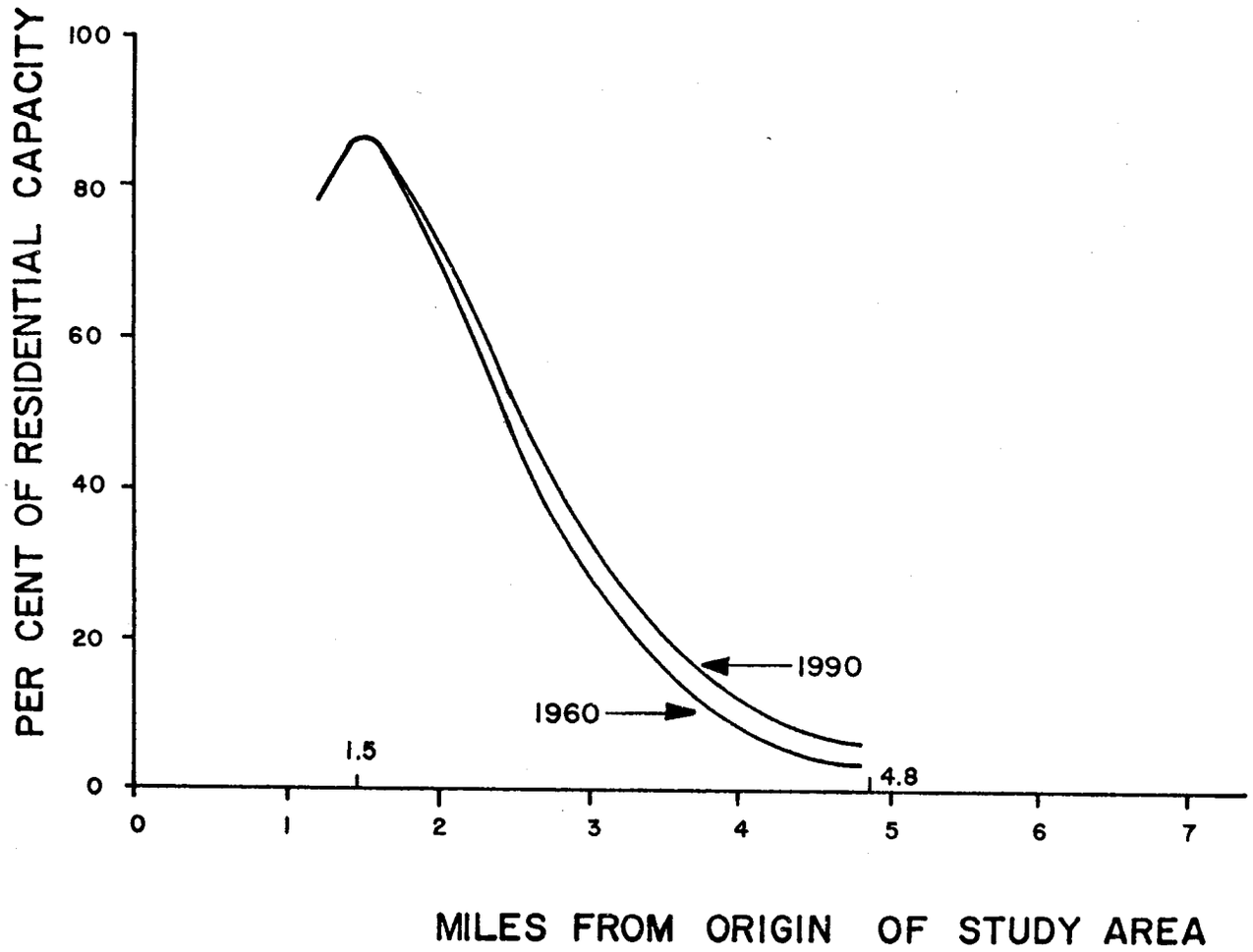


Fig. 11.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 7.

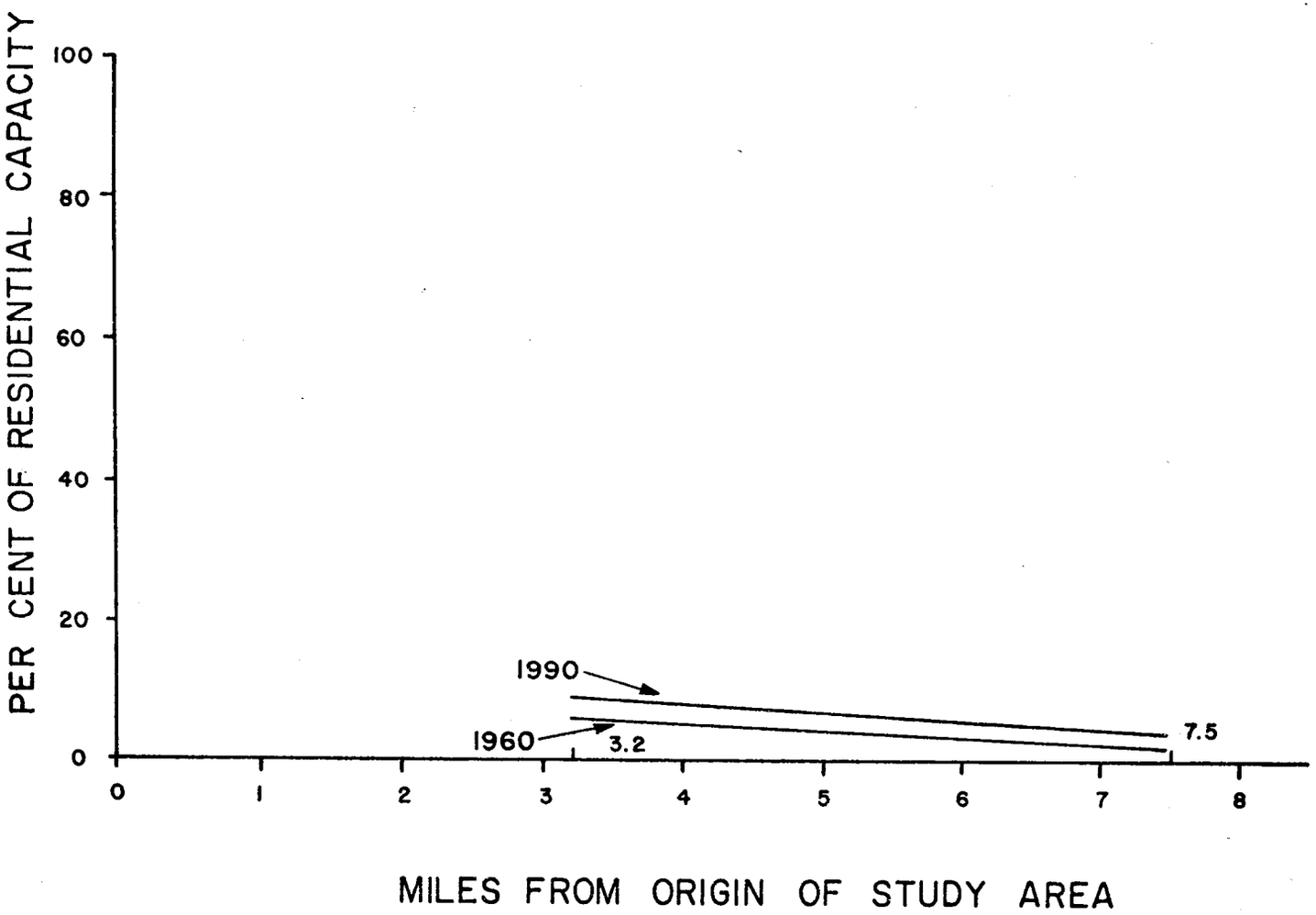


Fig. 12.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 8.

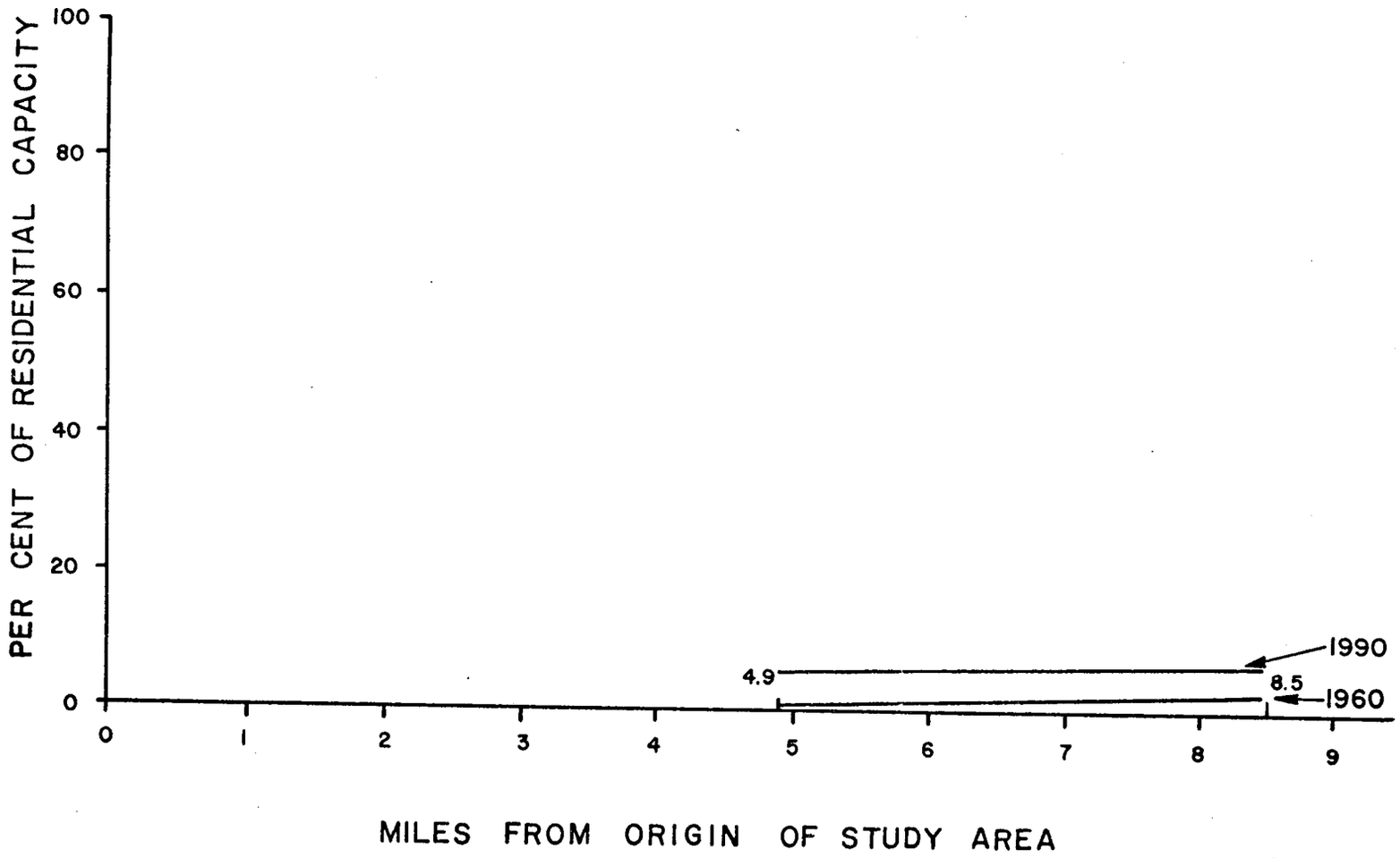


Fig. 13.--Graph illustrating the relationship between per cent of residential capacity and distance from center of study area for 1960 and 1990 in Sector 9.

As a whole, Sectors 7, 8, and 9, are similar to the districts located in the county area in the other sectors of the study.

The distribution of the predicted population for Sectors 7, 8, and 9, was done primarily on the basis of available land and any noticeable population trends since there were no curves to tilt. District 71 will remain the same because of its present high per cent of capacity (87%) and because the 82.65 acres of available land are not attractive or contiguous. District 72 will absorb all of the 1,586 predicted population. It has 13,044.37 available acres and there are some subdivisions in this district that can be expanded. Sector 8 received an increase of 3,172 people. It has 21,989 available acres for development. This sector had a number of small communities that will act as nuclei for building. Small communities are attractive to the home builder because they offer conveniences similar to a city without the pressures of high taxes and noisy streets. Sector 9 received a weight of 1 or 1,586 people. District 91 and District 92 have a total of 5,062.41 available acres. Most of the non-available land lies in the Wabash floodplain. There was only one small settlement in each of the districts. The pattern of development for homes was a scattered one. This prevented a curve from existing in Sector 9.

CHAPTER III

CONCLUSION AND PROJECTIONS

Conclusion

The purpose of this study was to determine the probably population distribution and density for Vigo County in 1990 by using the Density Saturation Gradient Method. With the least square method combined with justifiable alterations, the population for Vigo County in 1990 was set at 137,006. This represented an increase of 28,548 persons from the 1960 population. Two basic assumptions were made when distributing this population increase throughout the study area. The population density in any district will remain the same from 1960 to 1990 and there will be a movement of people from the center of the study area toward the less populated outer areas. Sectors 1 through 6 showed this movement and density of population to be valid. Their curves approximated the required "S" shaped curve for 1960 and 1990. Sectors 7, 8 and 9 did not show such a distinct distribution of people since these two sectors did not have a dense population near the center of the study area. Without such a population concentration, it was impossible to illustrate with a curve the trend of moving out of the dense downtown area.

It was also found that the sectors which had major transportation arteries and the most available land had the greater potential for growth by 1990. The sectors with secondary transportation routes and less available land will eventually develop, but the present trend is

to build where there is plenty of space available combined with fast and convenient transportation into and out of the central city.

Projections

A review of the above conclusions and the technique used in this study resulted in the following recommendations for future research relating to the present study:

1. A similar study should be completed using the same technique for Terre Haute in the near future. The usefulness of this study will be determined only by the passage of time and future research employing 1970 data.
2. Further work in the study area using the Density Saturation Gradient Method should be refined by taking more independent variables into consideration and by updating the resource data. Soil types and cost of land are important factors that were not possible to consider in this study. Newer maps and 1970 Census data should help show any recent trends.
3. Statistical techniques could be used to show correlations between density of an area and its distance from the center of the study area.

APPENDIX A

DEFINITIONS

Grid Section	That part of the total area that has a street system.
Non-grid Section	That part of the area that does not have a street system.
Residential Use	That area occupied by residential units.
Non-residential Use	That area occupied by other than residential units.
Vacant	That area not occupied.
Central Traffic District	That area bounded in general by the Wabash River, Tippecanoe Street, the C. & E. I. Railroad and Poplar Street.
Sector	Pie-shaped area emanating from the Central Traffic District and ending at the County Line.
Planimeter	A mechanical instrument for measuring the area of a plane surface.
Areagraph	A measuring device for determining the area of a plane surface.
Block	An area, usually square or rectangular in shape, bounded by streets.
Population Dot	A dot on the U.S.G.S. Map denoting a dwelling unit and given a value of 2.94 persons.

APPENDIX A--Continued

Origin	A point located at the intersection of 5th Street and Mulberry Street. This is the focal point of the circles drawn at varying intervals in order to establish the district boundaries.
District	Area bounded by the sector lines and by lines about one mile apart which divide each sector into smaller areas.
Residential Density	The number of people per unit of area such as the number of people occupying one acre of ground.
Residential Capacity	The largest number of people that can occupy an area at a given residential density.
Per cent Capacity	The quotient derived (in per cent) when dividing the existing population by the residential capacity.

APPENDIX B

FORMULAS

Population Density = $\frac{\text{Acres in Residential Use}}{\text{Existing Population}}$

Residential Capacity = (Acres Available for Residential Use x Population Density) + Existing Residential Population

Per cent Capacity = $\frac{\text{Existing Residential Population}}{\text{Residential Capacity}}$

Total Area = Land in Residential Use + Other than Residential Use + Land Available for Residential Use (Vacant)

APPENDIX C

POPULATION INCREASE DISTRIBUTION

District	1960	1990	Difference
11	3300	3263	- 37
12	2009	2038	+ 29
13	12	12	0
14	503	509	+ 6
15	480	2068	+1588
21	5211	5153	- 58
22	3900	3900	0
23	3502	3844	+ 342
24	201	235	+ 34
25	3197	3877	+ 680
26	2542	4716	+2174
31	10078	9964	- 114
32	9043	9220	+ 177
33	2306	2610	+ 304
34	1309	2060	+ 751
35	3528	7168	+3640
41	7936	7843	- 93
42	2824	2878	+ 54
43	1796	1987	+ 191
44	1562	2213	+ 651
45	3626	5995	+2369
51	8330	8237	- 93
52	7678	7678	0
53	1632	1832	+ 200
54	3938	10175	+6237
61	6	6	0
62	469	469	0
63	341	562	+ 221
64	2421	5372	+2951
71	3681	3681	0
72	2914	4500	+1586
81	1463	2238	+ 775
82	2185	4582	+2397
91	268	1238	+ 970
92	399	1015	+ 616

APPENDIX D

COMPUTATION OF PER CENT CAPACITY

NO.		Districts 11	12	13
1.	Maps-Planimeter	263.45	200.33	
2.	R/W=1 x .2781	73.27	55.71	
3.	NET=1 - 2	190.18	144.62	
4.	Maps-Count	74.00	48.00	
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	2.57	3.01	
6.	Land-use and Zoning Maps	47.40	28.90	
7.	5 x 6	121.82	86.99	
8.	Land-Use and Zoning Maps	21.10	6.06	
9.	5 x 8	54.23	18.22	
10.	Land-Use and Zoning Maps	5.50	13.04	
11.	5 x 10	14.14	39.25	
12.	Maps-Planimeter	583.83	391.79	484.43
13.	Maps-Planimeter	6.18	3.96	1.87
14.	Maps-Planimeter	577.65	387.83	482.56
15.	12-(13+14)	0.00	0.00	0.00
16.	11 + 15	14.14	39.25	0.00
17.	Maps-Planimeter	847.28	592.12	484.43
18.	Maps-Count	3300.00	2009.00	12.00
19.	7 + 13	128.00	90.95	1.87
20.	$\frac{18}{19}$	25.78	22.09	6.41
21.	18+(16x20)	3664.00	2876.00	12.00
22.	$\frac{18}{21}$	90.00	70.00	100.00

Sector Number 1

APPENDIX D--Continued

Districts		
14	15	
		Total Acres in Grid Section
		R/W in Grid Section
		Net Usable Acres in Grid Section
		Blocks in Grid Section
		Acres Per Block
		Blocks in Residential Use
		Acres in Residential Use
		Blocks in Non-Residential Use
		Acres in Non-Residential Use
		Blocks Available for Residential Use
		Acres Available for Residential Use
2086.15	6850.47	Acres in Non-Grid
77.59	57.39	Acres in Residential Use in Non-Grid
1992.89	3137.37	Acres in Non-Residential Non-Grid
15.67	3713.10	Acres Avail. for Resid. Use in Non-Grid
15.67	3713.10	Total Acres Avail. for Residential Use
2086.15	6850.47	Total Acres in District
503.00	480.00	Existing Residential Population
77.59	57.39	Existing Land in Residential Use
6.48	8.36	Population Density
605.00	31522.00	Residential Capacity
83.00	2.00	Per Cent Capacity

Sector Number 1--Concluded

APPENDIX D-- Continued

NO.		Districts 21	22	23
1.	Maps-Planimeter	325.01	302.05	345.47
2.	R/W=1 x .2781	90.39	84.00	96.08
3.	NET=1 - 2	234.62	218.04	249.39
4.	Maps-Count	70.00	77.00	106.00
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	3.35	2.83	2.35
6.	Land-use and Zoning Maps	55.30	53.90	42.40
7.	5 x 6	185.26	152.54	99.64
8.	Land-use and Zoning Maps	8.40	8.50	4.20
9.	5 x 8	28.14	24.06	9.87
10.	Land-use and Zoning Maps	6.30	14.60	59.40
11.	5 x 10	21.11	41.32	139.59
12.	Maps-Planimeter	0.00	224.85	236.43
13.	Maps-Planimeter	0.00	0.00	9.65
14.	Maps-Planimeter	0.00	224.85	111.52
15.	12 - (13 + 14)	0.00	0.00	105.61
16.	11 + 15	21.11	41.32	245.20
17.	Maps-Planimeter	325.01	526.90	581.90
18.	Maps-Count	5211.00	3900.00	3502.00
19.	7 + 13	185.26	152.54	109.29
20.	$\frac{18}{19}$	28.13	25.57	32.04
21.	18 + (16 x 20)	5805.00	4957.00	11358.00
22.	$\frac{18}{21}$	90.00	79.00	31.00

Sector Number 2

APPENDIX D--Continued

Districts			
24	25	26	
88.78			Total Acres in Grid Section
24.69			R/W in Grid Section
64.09			Net Usable Acres in Grid Section
21.00			Blocks in Grid Section
3.05			Acres Per Block
3.30			Blocks in Residential Use
10.09			Acres in Residential Use
.50			Blocks in Non-Residential Use
1.53			Acres in Non-Residential Use
17.20			Blocks Available for Residential Use
52.46			Acres Available for Residential Use
651.38	5867.80	17776.94	Acres in Non-Grid
5.80	467.40	337.92	Acres in Residential Use in Non-Grid
576.71	560.01	1264.82	Acres in Non-Residential in Non-Grid
68.87	4840.39	16174.20	Acres Avail. Resid. Use in Non-Grid
121.33	4840.39	16174.20	Total Acres Avail. for Resid. Use
740.16	5867.80	17776.94	Total Acres in District
201.00	3197.00	2542.00	Existing Residential Population
15.89	467.40	337.92	Existing Land in Residential Use
12.65	6.83	7.52	Population Density
1736.00	36256.00	124172.00	Residential Capacity
12.00	9.00	2.00	Per Cent Capacity

Sector Number 2--Concluded

APPENDIX D--Continued

NO.		Districts 31	32	33
1.	Maps-Planimeter	802.97	933.95	948.61
2.	R/W=1 x .2781	223.30	259.73	263.81
3.	NET= 1 - 2	579.67	674.22	684.80
4.	Maps-Count	185.00	194.00	131.00
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	3.13	3.48	5.23
6.	Land-use and Zoning Maps	140.10	115.85	32.45
7.	5 x 6	438.51	403.16	169.71
8.	Land-use and Zoning Maps	25.97	10.99	2.87
9.	5 x 8	81.29	38.25	15.01
10.	Land-use and Zoning Maps	18.93	67.16	95.68
11.	5 x 10	59.25	233.72	500.41
12.	Maps-Planimeter	40.11	347.19	1026.19
13.	Maps-Planimeter	0.00	6.49	13.19
14.	Maps-Planimeter	40.11	297.29	755.78
15.	12 - (13 + 14)	0.00	43.41	257.22
16.	11 + 15	59.25	277.13	757.63
17.	Maps-Planimeter	843.08	1281.14	1974.80
18.	Maps-Count	10078.00	9043.00	2306.00
19.	7 + 13	438.51	409.65	182.90
20.	$\frac{18}{19}$	22.98	22.07	12.61
21.	18 + (16 x 20)	11440.00	15160.00	11866.00
22.	$\frac{18}{21}$	88.00	60.00	19.00

Sector Number 3

APPENDIX D--Continued

Districts		
34	35	
		Total Acres in Grid Section
		R/W in Grid Section
		Net Usable Acres in Grid Section
		Blocks in Grid Section
		Acres Per Block
		Blocks in Residential Use
		Acres in Residential Use
		Blocks in Non-Residential Use
		Acres in Non-Residential Use
		Blocks Available for Residential Use
		Acres Available for Residential Use
4396.71	17950.49	Acres in Non-Grid
175.85	472.91	Acres in Residential Use in Non-Grid
614.86	1653.26	Acres in Non-Residential Non-Grid
3606.00	15824.32	Acres Avail. for Resid. Use in Non-Grid
3606.00	15824.32	Total Acres Avail. for Residential Use
4396.71	17950.49	Total Acres in District
1309.00	3528.00	Existing Residential Population
175.85	472.91	Existing Land in Residential Use
7.44	7.46	Population Density
26842.00	121579.00	Residential Capacity
5.00	3.00	Per Cent Capacity

Sector Number 3--Concluded

APPENDIX D--Continued

NO.		Districts 41	42	43
1.	Maps-Planimeter	657.52	488.75	111.61
2.	R/W=1 x .2781	182.86	135.92	31.04
3.	NET= 1 - 2	474.67	352.83	80.57
4.	Maps-Count	148.00	56.00	37.00
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	3.21	6.30	2.18
6.	Land-use and Zoning Maps	112.68	30.68	26.92
7.	5 x 6	361.70	193.28	58.69
8.	Land-use and Zoning Maps	16.40	3.72	0.54
9.	5 x 8	52.64	23.44	1.18
10.	Land-use and Zoning Maps	18.92	21.60	9.54
11.	5 x 10	60.73	136.08	20.80
12.	Maps-Planimeter	7.54	90.67	1544.05
13.	Maps-Planimeter	0.00	16.13	43.87
14.	Maps-Planimeter	7.54	20.53	532.18
15.	12 - (13 + 14)	0.00	54.01	968.00
16.	11 + 15	60.73	190.09	988.80
17.	Maps-Planimeter	665.06	579.42	1655.66
18.	Maps-Count	7936.00	2824.00	1796.00
19.	7 + 13	361.70	209.41	102.56
20.	$\frac{18}{19}$	21.94	13.49	17.51
21.	18 + (16 x 20)	9269.00	5388.00	19110.00
22.	$\frac{18}{21}$	86.00	52.00	9.00

Sector Number 4

APPENDIX D--Continued

Districts		
44	45	
		Total Acres in Grid Section
		R/W in Grid Section
		Net Usable Acres in Grid Section
		Blocks in Grid Section
		Acres Per Block
		Blocks in Residential Use
		Acres in Residential Use
		Blocks in Non-Residential Use
		Acres in Non-Residential Use
		Blocks Available for Residential Use
		Acres Available for Residential Use
11776.91	44780.90	Acres in Non-Grid
199.27	430.67	Acres in Residential Use in Non-Grid
1817.28	4797.95	Acres in Non-Residential in Non-Grid
9959.63	39983.95	Acres Avail. Resid. Use in Non-Grid
9959.63	39983.92	Total Acres Avail. for Resid. use
11776.91	44780.90	Total Acres in District
1562.00	3626.00	Existing Residential Population
199.27	430.67	Existing Land in Residential Use
7.84	8.42	Population Density
79632.00	340267.00	Residential Capacity
2.00	1.00	Per Cent Capacity

Sector Number 4--Concluded

APPENDIX D--Continued

NO.		Districts 51	52
1.	Maps-Planimeter	571.57	870.72
2.	R/W= 1 x .2781	158.95	242.15
3.	NET = 1 - 2	412.62	628.57
4.	Maps-Count	140.00	250.00
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	2.95	2.51
6.	Land-use and Zoning Maps	99.80	150.63
7.	5 x 6	294.41	378.08
8.	Land-use and Zoning Maps	28.00	14.98
9.	5 x 8	82.60	37.60
10.	Land-use and Zoning Maps	12.20	84.39
11.	5 x 10	35.99	211.82
12.	Maps-Planimeter	4.51	585.29
13.	Maps-Planimeter	2.09	28.90
14.	Maps-Planimeter	2.42	451.65
15.	12 - (13 + 14)	0.00	104.74
16.	11 + 15	35.99	316.56
17.	Maps-Planimeter	576.08	1456.01
18.	Maps-Count	8330.00	7678.00
19.	7 + 13	296.50	406.98
20.	$\frac{18}{19}$	28.09	18.87
21.	18 + (16 x 20)	9341.00	13650.00
22.	$\frac{18}{21}$	89.00	56.00

Sector Number 5

APPENDIX D--Continued

Districts		
53	54	
144.31		Total Acres in Grid Section
40.13		R/W in Grid Section
104.18		Net Usable Acres in Grid Section
29.00		Blocks in Grid Section
3.59		Acres Per Block
22.63		Blocks in Residential Use
81.29		Acres in Residential Use
.87		Blocks in Non-Residential Use
3.12		Acres in Non-Residential Use
5.50		Blocks Available for Residential Use
19.75		Acres Available for Residential Use
3073.13	31380.31	Acres in Non-Grid
118.46	521.03	Acres in Residential Use in Non-Grid
728.14	6776.96	Acres in Non-Residential Non-Grid
2226.53	24082.32	Acres Avail. for Resid. Use in Non-Grid
2246.28	24082.32	Total Acres Avail. for Residential Use
3217.44	31380.31	Total Acres in District
1632.00	3938.00	Existing Residential Population
199.75	521.03	Existing Land in Residential Use
8.17	7.56	Population Density
19985.00	186000.00	Residential Capacity
8.00	2.00	Per Cent Capacity

Sector Number 5--Concluded

APPENDIX D--Continued

NO.		Districts 61	62
1.	Maps-Planimeter		108.48
2.	R/W = 1 x .2781		30.17
3.	NET = 1 - 2		78.31
4.	Maps-Count		34.00
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$		2.30
6.	Land-use and Zoning Maps		13.24
7.	5 x 6		30.45
8.	Land-use and Zoning Maps		2.44
9.	5 x 8		5.61
10.	Land-use and Zoning Maps		18.32
11.	5 x 10		42.14
12.	Maps-Planimeter	133.29	519.36
13.	Maps-Planimeter	0.21	0.00
14.	Maps-Planimeter	133.08	519.36
15.	12 - (13 + 14)	0.00	0.00
16.	11 + 15	0.00	42.14
17.	Maps-Planimeter	133.29	627.84
18.	Maps-Count	6.00	469.00
19.	7 + 13	0.21	30.45
20.	$\frac{18}{19}$	28.57	15.40
21.	18 + (16 x 20)	6.00	1118.00
22.	$\frac{18}{21}$	100.00	42.00

Sector Number 6

APPENDIX D--Continued

Districts		
63	64	
		Total Acres in Grid Section
		R/W in Grid Section
		Net Usable Acres in Grid Section
		Blocks in Grid Section
		Acres Per Block
		Blocks in Residential Use
		Acres in Residential Use
		Blocks in Non-Residential Use
		Acres in Non-Residential Use
		Blocks Avaiable for Residential Use
		Acres Available for Residential Use
3586.79	42512.59	Acres in Non-Grid
50.96	370.98	Acres in Residential Use in Non-Grid
1755.77	15739.94	Acres in Non-Residential Non-Grid
1831.02	26772.65	Acres Avail. for Resid. Use in Non-Grid
1831.02	26772.65	Total Acres Avail. for Residential Use
3586.79	42512.59	Total Acres in District
341.00	2421.00	Existing Residential Population
50.96	370.98	Existing Land in Residential Use
6.69	6.53	Population Density
12591.00	177246.00	Residential Capacity
3.00	1.00	Per Cent Capacity

Sector 6--Concluded

APPENDIX D--Continued

NO.		District 71
1.	Maps-Planimeter	
2.	R/W = 1 x .2781	
3.	NET = 1 - 2	
4.	Maps-Count	
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	
6.	Land-use and Zoning Maps	
7.	5 x 6	
8.	Land-use and Zoning Maps	
9.	5 x 8	
10.	Land-use and Zoning Maps	
11.	5 x 10	
12.	Maps-Planimeter	2173.66
13.	Maps-Planimeter	574.84
14.	Maps-Planimeter	1516.17
15.	12 - (13 + 14)	82.65
16.	11 + 15	82.65
17.	Maps-Planimeter	2173.66
18.	Maps-Count	3681.00
19.	7 + 13	574.84
20.	$\frac{18}{19}$	6.41
21.	18 + (16 x 20)	4211.00
22.	$\frac{18}{21}$	87.00

Sector Number 7

APPENDIX D--Continued

District	
72	
	Total Acres in Grid Section
	R/W in Grid Section
	Net Usable Acres in Grid Section
	Blocks in Grid Section
	Acres Per Block
	Blocks in Residential Use
	Acres in Residential Use
	Blocks Available for Residential Use
	Acres Available for Residential Use
18046.67	Acres in Non-Grid
398.07	Acres in Residential Use in Non-Grid
4604.23	Acres in Non-Residential Non-Grid
13044.37	Acres Avail. for Resid. Use in Non-Grid
13044.37	Total Acres Avail. for Residential Use
18046.67	Total Acres in District
2914.00	Existing Residential Population
398.07	Existing Land in Residential Use
7.32	Population Density
98399.00	Residential Capacity
3.00	Per Cent Capacity

Sector Number 7--Concluded

APPENDIX D--Continued

NO.		District 81
1.	Maps-Planimeter	
2.	R/W = 1 x .2781	
3.	NET = 1 - 2	
4.	Maps-Count	
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	
6.	Land-use and Zoning Maps	
7.	5 x 6	
8.	Land-use and Zoning Maps	
9.	5 x 8	
10.	Land-use and Zoning Mpas	
11.	5 x 10	
12.	Maps-Planimeter	6446.31
13.	Maps-Planimeter	211.20
14.	Maps-Planimeter	2618.44
15.	12 - (13 + 14)	3616.67
16.	11 + 15	3616.67
17.	Maps-Planimeter	6446.31
18.	Maps-Count	1463.00
19.	7 + 13	211.20
20.	$\frac{18}{19}$	6.93
21.	18 + (16 x 20)	26527.00
22.	$\frac{18}{21}$	6.00

Sector Number 8

APPENDIX D--Continued

District	
82	
	Total Acres in Grid Section
	R/W in Grid Section
	Net Usable Acres in Grid Section
	Blocks in Grid Section
	Acres Per Block
	Blocks in Residential Use
	Acres in Residential Use
	Blocks Available for Residential Use
	Acres Available for Residential Use
19628.19	Acres in Non-Grid
309.92	Acres in Residential Use in Non-Grid
945.95	Acres in Non-Residential Non-Grid
18372.32	Acres Avail. for Resid. Use in Non-Grid
18372.32	Total Acres Avail. for Residential Use
19628.19	Total Acres in District
2185.00	Existing Residential Population
309.92	Existing Land in Residential Use
7.05	Population Density
131710.00	Residential Capacity
2.00	Per Cent Capacity

Sector Number 8--Concluded

APPENDIX D--Continued

NO.		District 91
1.	Maps-Planimeter	
2.	R/W = 1 x .2781	
3.	NET = 1- 2	
4.	Maps-Count	
5.	$\frac{\text{Acres}}{\text{Blocks}} = \frac{3}{4}$	
6.	Land-use and Zoning Maps	
7.	5 x 6	
8.	Land-use and Zoning Maps	
9.	5 x 8	
10.	Land-use and Zoning Maps	
11.	5 x 10	
12.	Maps-Planimeter	4570.27
13.	Maps-Planimeter	37.19
14.	Maps-Planimeter	1526.15
15.	12 - (13 + 14)	3006.93
16.	11 + 15	3006.93
17.	Maps-Planimeter	4570.27
18.	Maps-Count	268.00
19.	7 + 13	37.19
20.	$\frac{18}{19}$	7.21
21.	18 + (16 x 20)	21948.00
22.	$\frac{18}{21}$	1.00

Sector Number 9

APPENDIX D--Concluded

District	
92	
	Total Acres in Grid Section
	R/W in Grid Section
	Net Usable Acres in Grid Section
	Blocks in Grid Section
	Acres Per Block
	Blocks in Residential Use
	Acres in Residential Use
	Blocks Available for Residential Use
	Acres Available for Residential Use
4463.83	Acres in Non-Grid
54.64	Acres in Residential Use in Non-Grid
2353.71	Acres in Non-Residential Non-Grid
2055.48	Acres Avail. for Resid. Use in Non-Grid
2055.48	Total Acres Avail. for Residential Use
4463.83	Total Acres in District
399.00	Existing Residential Population
54.64	Existing Land in Residential Use
7.30	Population Density
15404.00	Residential Capacity
3.00	Per Cent Capacity

Sector 9--Concluded

APPENDIX E

FORECAST OF CHANGES FROM YEAR 1960 TO YEAR 1990

11		12		13	
1960	1990	1960	1990	1960	1990
14.14	14.14	39.25	39.25	0.00	0.00
847.28	847.28	592.12	592.12	484.43	484.43
3300.00	3263.00	2009.00	2038.00	12.00	12.00
128.00	126.57	90.95	92.25	1.87	1.87
25.78	25.78	22.09	22.09	6.41	6.41
3664.00	3664.00	2876.00	2876.00	12.00	12.00
90.00	89.00	70.00	71.00	100.00	100.00

1960 Total Population Sector 1	6304
1990 Total Population Sector 1 (Forecast)	7890
TOTAL INCREASE	1586

APPENDIX E--Continued

14		15		
1960	1990	1960	1990	
15.67	15.67	3713.10	3713.10	Total Acres Available for Residential Use
2086.15	2086.15	6850.47	6850.47	Total Acres in District
503.00	509.00	480.00	2068.00	Existing Residential Population
77.59	78.55	57.39	247.37	Existing Land in Residential Use
6.48	6.48	8.36	8.36	Population Density
605.00	605.00	31522.00	31522.00	Residential Capacity
83.00	84.00	2.00	7.00	Per Cent Capacity

Sector 1--Concluded

APPENDIX E--Continued

21		22		23		24	
1960	1990	1960	1990	1960	1990	1960	1990
21.11	21.11	41.32	41.32	245.20	245.20	121.33	121.33
325.01	325.01	526.90	526.90	581.90	581.90	740.16	740.16
5211.00	5153.00	3900.00	3900.00	3502.00	3844.00	201.00	235.00
185.26	183.18	152.54	152.54	109.29	119.97	15.89	18.58
28.13	28.13	25.57	25.57	32.04	32.04	12.65	12.65
5805.00	5805.00	4957.00	4957.00	11358.00	11358.00	1736.00	1736.00
90.00	89.00	79.00	79.00	31.00	34.00	12.00	14.00

1960 Total Population Sector 2	18,553
1990 Total Population Sector 2 (Forecast)	21,725
TOTAL INCREASE	3,172

APPENDIX E--Continued

25		26		
1960	1990	1960	1990	
4840.39	3840.39	16174.20	16174.20	Total Acres Avail. for Residential Use
5867.80	5867.80	17776.94	17776.94	Total Acres in District
3197.00	3877.00	2542.00	4716.00	Existing Residential Population
467.40	567.64	337.92	627.13	Existing Land in Residential Use
6.83	6.83	7.52	7.52	Population Density
36256.00	36256.00	124172.00	124172.00	Residential Capacity
9.00	11.00	2.00	4.00	Per Cent Capacity

Sector 2--Concluded

APPENDIX E--Continued

31		32		33	
1960	1990	1960	1990	1960	1990
59.25	59.25	277.13	277.13	757.63	757.63
843.08	843.08	1281.14	1281.14	1974.80	1974.80
10078.00	9964.00	9043.00	9220.00	2306.00	2610.00
438.51	433.59	409.65	417.76	182.90	206.97
22.98	22.98	22.07	22.07	12.61	12.61
11440.00	11440.00	15160.00	15160.00	11866.00	11866.00
88.00	87.00	60.00	61.00	19.00	22.00

1960 Total Population Sector 3	26,264
1990 Total Population Sector 3 (Forecast)	31,022
TOTAL INCREASE	4,758

APPENDIX E--Continued

34		35		
1960	1990	1960	1990	
3606.00	3606.00	15824.32	15824.32	Total Acres Available for Residential Use
4396.71	4396.71	17950.49	17950.49	Total Acres in District
1309.00	2060.00	3528.00	7168.00	Existing Residential Population
175.85	276.88	472.91	960.86	Existing Land in Residential Use
7.44	7.44	7.46	7.46	Population Density
26842.00	26842.00	121579.00	121579.00	Residential Capacity
5.00	8.00	3.00	6.00	Per Cent Capacity

Sector 3--Concluded

APPENDIX E--Continued

41		42		43	
1960	1990	1960	1990	1960	1990
60.73	60.73	190.09	190.09	988.80	988.80
665.06	665.06	579.42	579.42	1655.66	1655.66
7936.00	7843.00	2824.00	2878.00	1796.00	1987.00
361.70	357.47	209.41	213.34	102.56	113.47
21.94	21.94	13.49	13.49	17.51	17.51
9269.00	9269.00	5388.00	5388.00	19110.00	19110.00
86.00	85.00	52.00	53.00	9.00	10.00

1960 Total Population Sector 4	17,744
1990 Total Population Sector 4 (Forecast)	20,916
TOTAL INCREASE	2,172

APPENDIX E--Continued

44		45		
1960	1990	1960	1990	
9959.63	9959.63	39983.95	39983.95	Total Acres Available for Residential Use
11776.91	11776.91	44780.90	44780.90	Total Acres in District
1562.00	2213.00	3626.00	5995.00	Existing Residential Population
199.27	282.27	430.67	711.99	Existing Land in Residential Use
7.84	7.84	8.42	8.42	Population Density
79632.00	79632.00	340267.00	340267.00	Residential Capacity
2.00	3.00	1.00	2.00	Per Cent Capacity

Sector 4--Concluded

APPENDIX E--Continued

51		52	
1960	1990	1960	1990
35.99	35.99	316.56	316.56
576.08	576.08	1456.01	1456.01
8330.00	8237.00	7678.00	7678.00
296.50	293.23	406.98	406.98
28.09	28.09	18.87	18.87
9341.00	9341.00	13650.00	13650.00
89.00	88.00	56.00	56.00

1960 Total Population Sector 5	21,578
1990 Total Population Sector 5 (Forecast)	27,922
TOTAL INCREASE	6,344

APPENDIX E--Continued

53		54		
1960	1990	1960	1990	
2246.28	2246.28	25182.32	25182.32	Total Acres Available for Residential Use
3217.44	3217.44	31380.31	31380.31	Total Acres in District
1632.00	1832.00	3938.00	10175.00	Existing Residential Population
199.75	224.23	421.03	1345.89	Existing Land in Residential Use
8.17	8.17	7.56	7.56	Population Density
19985.00	19985.00	186000.00	186000.00	Residential Capacity
8.00	9.00	2.00	5.00	Per Cent Capacity

Sector 5--Concluded

APPENDIX E--Continued

61		62	
1960	1990	1960	1990
0.00	0.00	42.14	42.14
133.29	133.29	627.84	627.84
6.00	6.00	469.00	469.00
0.21	0.21	30.45	30.45
28.57	28.57	15.40	15.40
6.00	6.00	1118.00	1118.00
100.00	99.00	42.00	42.00

1960 Total Population Sector 6	3,237
1990 Total Population Sector 6 (Forecast)	6,409
TOTAL INCREASE	3,172

APPENDIX E--Continued

63		64		
1960	1990	1960	1990	
1831.02	1831.02	26772.65	26772.65	Total Acres Available for Residential Use
3586.79	3586.79	42512.59	42512.59	Total Acres in District
341.00	562.00	2421.00	5372.00	Existing Residential Population
50.96	84.00	370.98	822.66	Existing Land in Residential Use
6.69	6.69	6.53	6.53	Population Density
12591.00	12591.00	177246.00	177246.00	Residential Capacity
3.00	5.00	1.00	3.00	Per Cent Capacity

Sector 6--Concluded

APPENDIX E--Continued

71		72		
1960	1990	1960	1990	
82.65	82.65	13044.37	13044.37	Total Acres Available for Residential Use
2173.66	2173.66	18046.67	18046.67	Total Acres in District
3681.00	3681.00	2914.00	4500.00	Existing Residential Population
574.84	574.84	398.07	614.75	Existing Land in Residential use
6.41	6.41	7.32	7.32	Population Density
4211.00	4211.00	98399.00	98399.00	Residential Capacity
87.00	87.00	3.00	5.00	Per Cent Capacity

1960 Total Population Sector 7	6,595
1990 Total Population Sector 7 (Forecast)	8,181
TOTAL INCREASE	1,586

APPENDIX E--Continued

81		82		
1960	1990	1960	1990	
3616.67	3616.67	18372.32	18372.32	Total Acres Available for Residential Use
6446.31	6446.31	19628.19	19628.19	Total Acres in District
1463.00	2238.00	2185.00	4582.00	Existing Residential Population
211.20	322.94	309.92	649.93	Existing Land in Residential Use
6.93	6.93	7.05	7.05	Population Density
26527.00	26527.00	131710.00	131710.00	Residential Capacity
6.00	8.00	2.00	4.00	Per Cent Capacity

1960 Total Population Sector 8	3,648
1990 Total Population Sector 8 (Forecast)	6,820
TOTAL INCREASE	3,172

APPENDIX E--Continued

91		92		
1960	1990	1960	1990	
3006.93	3006.93	2055.48	2055.48	Total Acres Available for Residential Use
4570.27	4570.27	4463.83	4463.83	Total Acres in District
268.00	1238.00	399.00	1015.00	Existing Residential Population
37.19	171.71	54.64	139.05	Existing Land in Residential Use
7.21	7.21	7.30	7.30	Population Density
21948.00	21948.00	15404.00	15404.00	Residential Capacity
1.00	6.00	3.00	7.00	Per Cent Capacity

1960 Total Population Sector 9	667
1990 Total Population Sector 9 (Forecast)	2,253
TOTAL INCREASE	1,586

SELECTED BIBLIOGRAPHY

Books

Gottmann, Jean, and Harper, Robert A. Metropolis on the Move. New York: John Wiley and Sons, Inc., 1967.

Huntsberger, David V. Elements of Statistical Inference. Boston, Massachusetts: Allyn and Bacon, Inc., 1967.

Johnson James H. Urban Geography--An Introductory Analysis. London: Pergamon Press, Ltd., 1967.

Mann, P. H. An Approach to Urban Sociology. London: Rathedge and Kegan Paul, Ltd., 1965.

Mayer, H. M., and Kohn, C. F. Readings in Urban Geography. Chicago, Illinois: University of Chicago Press, 1969.

Vernon, Raymond. The Myth and Reality of our Urban Problems. Cambridge, Massachusetts: Harvard University Press, 1966.

Periodicals

Berry, B. L. J.; Simmons, James W.; and Tennant, Robert J. "Urban Population Densities: Structure and Change." Geographical Review, LIII (July, 1963), 389-405.

Clark, C. "Urban Population Densities." Journal of the Royal Statistical Society, CXIV (Series A, 1951), 490-496.

Colby, C. C. "Centrifugal and Centripetal Forces in Urban Geography." Annals of the Association of American Geographers, XXIII (March, 1933), 1-20.

Murphy, R. F., and V nce, C. F. "Delimiting the CBD." Economic Geography, XXX (July, 1954), 189-222.

Public Documents

Area Planning Department. Neighborhood Analysis. Terre Haute, Indiana: Area Planning Department, 1968.

Bureau of Business Research. Indiana Population Projections. Bloomington, Indiana: Indiana University Graduate School of Business, 1966.

Terre Haute Central Business District Development Committee. Central Business District Study. Mishawaka, Indiana: City Planning Associates Incorporated, 1960.

Terre Haute City Planning and Redevelopment Commission. Comprehensive Development Plan for the Terre Haute Planning Area: Part I. Mishawaka, Indiana: City Planning Associates Incorporated, 1960.

Terre Haute City Planning and Redevelopment Commission. Comprehensive Development Plan for the Terre Haute Planning Area: Part II. Mishawaka, Indiana: City Planning Associates Incorporated, 1961.

Urban Planning Division. Sample Problem Illustrating Use of the Density Saturation Gradient Method for Land Use Analysis and Forecasting. Indianapolis, Indiana: Indiana Bureau of Public Roads, 1969.

U.S. Department of Commerce. Bureau of the Census. Statistical Abstract of the United States: 1969. Washington, D.C.: Government Pringing Office, 1969.

U.S. Department of Commerce. Bureau of the Census. United States Census of Housing: 1960. Vol. III, City Blocks, Series HC (3), No. 157. Washington, D.C.: Government Printing Office, 1961.

Vigo-Wade Abstract Company. Vigo County Official Farm Plat Book and Directory. Laporte, Indiana: County Plat and Directory Company, 1969.