NORTH STAR RESEARCH AND DEVELOPMENT INSTITUTE
3100 THIRTY-EIGHTH AVENUE SO. • MINNEAPOLIS, MINNESOTA • 55406

THE ECONOMIC IMPACT OF THE FREEWAYS ON THE TWIN CITIES METROPOLITAN AREA

for

DEPARTMENT OF HIGHWAYS
STATE OF MINNESOTA

NORTH STAR RESEARCH AND DEVELOPMENT INSTITUTE
3100 38th Avenue South, Minneapolis, Minnesota 55406
February 6, 1971

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Cont.)

LIST OF FIGURES (Cont.)

LIST OF TABLES

INTRODUCTION

In June 1970, the Department of Highways of the State of Minnesota contracted with North Star Research and Development Institute to undertake a study of "The Economic Impact of The Freeway System on the Twin Cities Metropolitan Area".

The economic impact of the freeway system on the Twin Cities Metropolitan Area is widespread and effects numerous aspects of the life of the citizens of the region. The ramifications of the freeway system extend into many aspects of our activities -- social and economic. Because the interrelationships between social and economic factors are complex and due to constraints on both time and resources, it was decided to isolate one particular aspect of the freeway system and study that in some detail. The economic impact was selected as the most fruitful to examine at this time. This report, therefore, relates only to the economic aspects of the impact of the Metropolitan Area freeway system.

The economic impact analysis covers six vital areas of the public and private economy that have been identified with freeway construction and use. These six areas are as follows:

1. Land Use Changes and Potential
2. Effects on Retail Trade
3. Effects on Residential Property Values
4. The Alteration of Property Tax Patterns
5. Economic Impact of the Freeway System on Industrial and Commercial Transportation
6. The General Economic Impact on the Community

A further goal of this research study is to provide basic information for models to identify the kinds and extent of impacts which a freeway may be expected to influence. In most of the six areas listed above, North Star was able to meet this objective. In some of these areas there was a substantial lack of quantitative data. This dictated that the research team supplement the information available with more subjective data resulting largely from personal interviews and their evaluation.

Three segments of the Twin Cities' freeway system were selected by the Department of Highways and North Star as areas for detailed examination. These were:

- I-94 from its junction with I-35W to Marion Street in St. Paul,
- I-494 from the junction with State Highway 5 (near the entrance to the International Airport) to State Highway 100,
- I-35W from its junction with I-94 to the Minnesota River.

These three segments pass through a wide variety of urban and suburban areas and represent both radial and circumferential freeway types.

Within the three freeway segments listed above, subsegments were selected in some cases to provide detailed information. In some cases the freeway system as a whole or the limited-access high-speed highway system (i.e., freeways plus other roads such as County Road 62) as a whole was also referred to when they were considered illustrative.

These spatial considerations combined with the six economic impact areas listed above determined the limits of this study.

This report contains the results of North Star's investigation.

Contributions to this report were made by the following consultants: Dr. Russell Adams, Mr. Phillip Phillips, Mr. Blake Graham, and Mr. Douglas Seidel of the University of Minnesota. North Star staff members contributing to this study were Mr. Robert J. Reid and Mr. William L. K. Schwarz. This report was prepared under the direction of Mr. William L. K. Schwarz, Director, Economic and Management Systems Division.

SUMMARY

Completion and opening of key segments of limited-access high-speed freeways -- principally parts of the interstate highways system -- was achieved in the Twin Cities Metropolitan Area from 1960 to 1968. The purpose of this research study is to assess the economic impact that the sections of freeway completed to date have had on the metropolitan area. Although the entire complex of freeways within the area has been the subject of study, principal attention was given to three segments: Interstate Highway 35W from the Central Business District of Minneapolis southward to the Minnesota River; Interstate Highway 94 connecting the Central Business Districts of Minneapolis and St. Paul; and Interstate Highway 494 along the boundary where Richfield-Edina on the north join Bloomington on the south. Various aspects of the economic effects of the freeway system are summarized in the following sections.

1. Land Use: Changes and Potential

Population and employment patterns in the metropolitan area have changed substantially since the freeways opened. The freeways, as well as other factors, have markedly influenced the movement of population and employment to the suburbs, and at the same time, have provided ready access by suburban dwellers to stores, professional offices, and services in the Central Business Districts. From 1958 to 1965, employment increased nine percent in the cities of Minneapolis and St. Paul, but it grew 39 percent in the suburban areas. Along the freeways, both in the central cities and the suburbs, overall employment grew 34 percent. Much of the suburban growth has been freeway oriented. The combination of freeway proximity and suburban location has resulted in a growth in the suburban portions of the areas studied of 229 percent. The opening of Interstate 494 virtually created from farmland a new axis of intensive development along the freeway corridor, with rapid access to the Central Business Districts of both the Twin Cities and to the International Airport.

2. Effects on Retail Trade

Sales by retail stores in the Central Business Districts of Minneapolis and St. Paul began to drop in volume in about 1958, reaching low points in both cities in 1963 of, respectively, $257 million and $104 million. By 1967, this declining trend had reversed, and retail sales had recovered to, respectively, $281 million and $117 million in the two Central Business Districts. When the effects of inflation are included, the drop in sales volume becomes more pronounced and the recovery, less dramatic.

The number of retail stores in both Central Business Districts has also shown a decline. In 1954 there were 1,450 retail establishments in the Central Business Districts of Minneapolis and St. Paul. In 1967 this number had dropped to 804, a decline of 44.5 percent. Even within the cities themselves the role of the Central Business District in retail sales has declined. The Minneapolis Central Business District accounted for 38 percent of total city sales in 1954, but only 30.9 percent in 1967. In St. Paul these figures went from 28.7 percent to 20.3 percent from 1954 to 1967. These findings are consistent with the movement of population and retail trade away from the Central Business District and toward the suburbs, which is characteristic of this and other metropolitan areas.

The freeways have undoubtedly contributed to the growth of the suburbs and have facilitated movement to the suburbs of retail business. In the opinion of store managers in the Central Business District, freeways have at the same time had an ameliorating effect on the decline of retail business by providing vitally important access to stores in the downtown areas from suburban population centers. Studies of customer origin location by Central Business District stores confirm this conclusion.

3. Residential Property Values

Very few direct freeway effects on residential property values are discernible. There has been a general rise in property values as

a whole in the Twin Cities, but there is no appreciable relative change in value patterns or turnover rates for residential property before and after freeway construction. The only exceptions, in a few cases, are for those streets directly adjacent to freeways, where growth in value tends to be at a slower rate than for streets one or more blocks away.

4. Alteration of Property Tax Patterns

The movement of industrial and warehouse investment into suburban areas is apparent, as is the percentage increase in assessed valuations by suburbs relative to the metropolitan area as a whole. The annual investment in industrial and warehousing facilities in the suburbs has been two to four times that made in Minneapolis and St. Paul during the entire decade of the sixties. Commercial investments during this same period however, have favored the two center cities in eight of the ten years, and during four years, by more than twice the suburban investment.

The resultant trends in assessed valuation due to this investment behavior and to new housing construction brought the suburban areas to equality in assessed value with Minneapolis and St. Paul combined by 1967 at about $650 million each. The suburbs have continued their growth, with a nine percent rate of increase or double that of the entire metropolitan area during the last three years. The suburbs reached 56 percent of the total assessed value of the metropolitan area in 1969.

Land availability combined with good road access leads to frequent selection of suburban, freeway adjacent sites.

The removal of taxable property from the metropolitan tax rolls for freeways is only a small fraction of the total tax base. The total loss in adjusted market value in Minneapolis due to freeways is 2.4 percent, at most. Freeways, however, have accounted for 54 percent of all property removal from tax rolls in Minneapolis for the 13 years from 1956 to 1968. But the small loss of tax base was quickly recovered through overall growth.

5. Economic Impact of Freeways on Commercial and Industrial Freight

The speed with which commercial and industrial freight can be moved has been considerably increased by the freeway system. In consequence, annual savings from $50 million to $100 million are realized through freeway use by commercial and industrial vehicle users. These savings amount to about eight percent of total operating costs for all commercial vehicles driving on urban roads in Minnesota. Preference of businesses for highway access has accelerated the rate of growth of commercial and industrial firms in areas having access to freeways.

6. General Economic Impact on the Community

Roadway accidents have dropped markedly since the opening and use of freeways in the metropolitan area. Since the opening of I-35W in Minneapolis in January 1967, the number of accidents at nine major intersections has decreased 52 percent. A 45-percent drop occurred in St. Paul at six intersections during the same period. Similar percentage drops also characterize the estimated total cost of accidents. Total accident cost savings due to freeway use in urban areas is currently estimated to be $10 million to $12 million per year.

Current traffic volumes in the Twin Cities, including both Interstate Highways I-94 and I-35W and the arterial city streets paralleling them, have reached or exceeded the carrying capacity of the arterial streets alone, indicating that without the presence of the freeway, substantial traffic congestion would have occurred. Reductions of 25 to 40 percent in traffic volume have occurred on major arterial streets in Minneapolis and St. Paul with the opening of the freeways.

1. LAND USE CHANGES AND POTENTIAL

Data and Methods

The impact of the three sections of interstate highway dealt with by this study (Figure 1)* undoubtedly extends throughout the metropolitan area. However, a study such as this must concern itself with the areas most directly affected and a comparison of these areas with the metropolitan area as a whole. Furthermore, if a study with such a broad scope is to be undertaken in a limited period of time at a reasonable cost, it must rely heavily on previously collected data.

The study area selected for the land-use section of this report is composed of the Minnesota Highway Department traffic assignment zones that are located wholly or partially within one-half mile of the interstate study segments. For the purposes of this report, these zones have been aggregated into twenty data areas (See Figure 2). These study areas have been chosen for two reasons. First, one-half mile has been found to be a reasonable zone of maximum impact in previous studies in the Twin Cities area. Thus, there is a degree of continuity and comparability between this and previous studies. Second, traffic assignment zones have been used because they are the best areas for obtaining a wide range of data over a reasonably long time period.

The types of land-use data normally used have been modified for the purposes of this survey. This modification was made for two reasons. First, it is difficult to make an accurate historical record of changes in land use. Various municipalities have made land-use maps in the past, but they are based on differing systems of classification and were compiled at different time. Air photo interpretation has been tried but proved incapable of making a sufficiently detailed classification without a great deal of further investigation. Second, traditional land-use information is not sensitive to the intensity of use, which may be as significant as the type of use, especially when land uses are to be related to highway construction and traffic generation.

---

*Tables and figures are in Appendix A at the end of the report.

Primary Measures Used in this Study

Two basic measures have been used as substitutes for the traditional acreage measurements of land use. These measures are number of dwelling units and number of persons employed. Dwelling-unit data are further broken down as to single and multiple unit structures, and employment data are divided into six broad categories (See Tables 3-8). Data for these subjects have been obtained on an area-wide, comparable basis from the Minnesota Highway Department Traffic Assignment Zone studies (See Figure 1).

Other Information Inputs

The basic area-wide data on employment and dwelling units have been supplemented by more detailed data for certain case study areas. In Minneapolis, a block-by-block inventory of housing construction and demolition was undertaken to shed light on the question of how many units were removed by freeways and how many were built subsequently in close proximity to the freeways. In the rapidly developing Highway 100 - I-494 interchange area, data from local planning commissions and developers were obtained to produce a detailed and up-to-date picture of commercial and industrial growth in the area. Major developers were consulted to obtain the opinions of the business community about freeway impact, and city planning commissions and redevelopment agencies were questioned about the impact of the highways on their plans.

Changes in the Number of Dwelling Units

Freeways are commonly credited by the general public with being responsible for two types of change in the number of dwelling units. First, in previously developed areas, freeways are said to be responsible for a large loss in number of units. Second, in undeveloped areas, freeways are said to be responsible for a large increase in the number of units. Investigation of traffic assignment zone data for the period 1962-68 reveals these generalizations to be simplistic and misleading to the point of being false.

General Metropolitan Pattern

A general picture of the changes in the number of dwelling units over a large portion of the metropolitan area is given by Figure 3. It can be seen from this map that there are several different zones in which numerical change in the number of dwelling units takes place. These appear to be more closely related to the historical and present development of the area (Figures 14 and 15) than to the freeways.

Zones of Absolute and Relative Change

Areas adjacent to the Central Business Districts (CBD's),[1] especially in Minneapolis, have undergone surprisingly large increases in numbers of dwelling units, especially if measured on a unit area basis. Middle-aged residential areas, notably south Minneapolis and western St. Paul, show uniformly low increases in the number of dwelling units. Suburban areas again show large increases in the number of units. The distribution of change looks very different when mapped on a percentage basis (See Figure 4). This is because the great number of existing units in the areas adjacent to the Central Business Districts tend to hide the relatively large numerical change, and the small number of previously existing units in suburban areas magnify gains of much the same size.

Percentage of Dwelling Units in Multiple-Unit Structure

The percentage of new dwelling units constructed in multiple-unit buildings also shows a largely freeway-independent pattern (See Figure 5). This map reveals some strikingly peculiar features due largely to the historical development of the area. Foremost among

---

1. The Minneapolis CBD is defined in this study as roughly the area lying between the Mississippi River on the north, Grant Street on the south, 5th Avenue North--12th Street South on the west, and Portland Avenue on the east. The St. Paul CBD lies in the area bounded on the north by I-94, on the south by the Mississippi River, on the east by Sibley Street, and on the west by Kellogg-Rice Streets.

these is the "gulf" where little multiple-family construction has occurred, which runs from Edina through South Minneapolis to St. Paul. This feature is largely the result of restrictive zoning laws that effectively prohibit the construction of apartment buildings. Although it might be argued that a tongue of multiple-unit dominance extends south along I-35W in Bloomington, the same association does not appear to have occurred elsewhere. This unique feature can be explained most satisfactorily in terms of the Bloomington zoning laws and the previous level of development within the area (See Figures 14 and 15).

Changes Within the Study Area

A more detailed study of changes within the study zone reveals a number of interesting facts (See Table 1 and Figure 6). A large proportion of the metropolitan housing supply was within this relatively small area. The study area contains less than two percent of the land area of the seven county metropolitan zone, but has slightly more than 17 percent of the total housing supply.

During the period 1962-1968, the study area showed a net growth of 18 percent in number of dwelling units, slightly above the metropolitan growth rate of 17 percent. However, some portions of the study area were growing faster than others.

Changes Within Central City Study Areas

Within the central cities, the study areas had a net gain of eight percent in dwelling units from 1962-1968. This refutes the generally held belief that freeways rob the central cities of places for people to live. However, the type and quality of housing may be changed. Apparently, (as shown in more detail by the case study on dwelling units in Minneapolis) initial losses to freeway right-of-way acquisition have already been more than made up by increased construction activity in areas adjacent to the freeways. As previously noted, the middle-aged but sound housing areas in South Minneapolis and western St. Paul showed the smallest growth, both in absolute and

percentage terms (See Figures 3 and 4). Areas within and adjacent to the business core showed more growth, largely due to renewal programs.

Changes Within Suburban Study Areas

The suburban portions of the study area underwent a remarkable 68 percent increase in the number of dwelling units between 1962 and 1968. This compares to an increase of 33 percent during the same period in suburban areas throughout the metropolitan area. This growth in the suburban study areas seems to be due to four major factors:

1. The traditional growth axis of the metropolitan area has been to the south along the corridor followed by I-35W.
2. The location of the airport southeast of Minneapolis, in combination with the high income areas to the southwest, have made this a natural corridor of development.
3. Zoning along the freeway itself has served as a catalyst and has intensified development.
4. The location of the freeway itself has served as a catalyst and has intensified development.

Changes in Employment

General Trends in Total Employment (See Table 2)

During the period 1958-65, total employment in the metropolitan area increased by 24 percent, from about 511,000 to about 634,000 (See Table 2). Within the central cities the increase was nine percent, from 256,000 to 280,000. Within the suburban areas the increase was 39 percent, from 255,000 to 355,000. Thus, during this period, four-fifths of the increase in employment in the metropolitan area was in the suburbs, and the suburban areas overtook the central cities in total employment.

Trends in Total Employment Within the Study Area

Total employment in the study area increased faster than overall metropolitan employment (See Table 2). Both central city and suburban portions of the study area fared better than the central cities and suburban areas in general.

The central cities as a whole showed a nine percent gain in total employment during the period 1958-65, but the study areas gained 14 percent. This indicates that the benefits of improved access to areas along the freeways have more than compensated for the losses of employment due to condemnation of businesses for freeway rights of way.

Suburban portions of the study area showed a gain of 229 percent in total employment, compared to a general gain of 39 percent in suburban areas. This gain can be attributed to several factors:

1. Suburban portions of the study area are located near the airport. Easy access to air travel has proven especially attractive to technologically oriented industries (such as electronics) throughout the nation.
2. A historical trend toward more rapid growth in the southern portion of the metropolitan area (See Figure 14) has been coupled in this area with the development of large shopping areas (Southtown and Southdale) and large industrial parks (such as the Metro Office Park and Normandale Center) by private developers. This development is not unpredictable, given the historic growth trends of the metropolitan area and the location of the airport.
3. Construction of interstate highways (and the study segments in particular) has given additional impetus to the growth in this area. Also, they have served to channelize and focus development within specific locations. Private entrepreneurs have developed the natural advantages of locations with superior access. The actions of Edina, Richfield, and Bloomington in regard to zoning have been important. Local planners have zoned corridors along the freeway for industrial and commercial development; Bloomington even has a "freeway development" zoning classification. Areas more remote from freeways have been reserved for single-family residences. This channeling effect, brought about by private initiative and public planning, has

been one of the most important effects of freeway development in the southern suburbs.

Trends in Employment by Type

Although total employment growth within the study area has exceeded metropolitan growth in both of the central cities and the suburban areas, the various broad categories of employment have shown markedly differing trends (See Tables 3 to 8).

Retail Employment (See Table 3). Overall, the study areas did not show as large an increase in retail employment as the metropolitan area as a whole. However, this is largely due to the higher proportion of the study area within the central cities.

Both the city of Minneapolis and the portions of the study area within the city showed modest declines in retail employment. The greater decline in the study area lends credence to the view that freeways drain retail trade away from the central cities and into suburban shopping centers, although the argument has been made by retail firms in the Minneapolis Central Business District that the decline may have been greater without the freeways. However, the portions of the study area within the city of St. Paul showed a 22-percent gain in retail employment compared to a nine-percent gain for the city as a whole. This probably is due to the development of the Sears - Holiday Inn complex at the Marion Street exit. Development in a city area is determined by the nature of the response made by the local government and merchants to opportunities afforded them by freeways.

Wholesale Employment (See Table 4). The effect of the freeways on wholesale employment has been mixed. Within the central city study areas, there was a net loss of one percent in wholesale employment. This compares to a seven-percent gain for the central cities as a whole.

Closer inspection of the data by district reveals that almost all of the loss occurred in District Nine (See Table 4 and Figure 1),

which is located at the junction of Interstate Highways 94 and 35W at the south edge of the Central Business District. This district had the greatest proportional loss of any to freeway right of way. Moreover, it was a wholesaling center. Although it was not possible to ascertain where firms displaced from this area relocated, it is apparent that at least some of them moved to suburban areas. Thus it appears that the freeways have had a negative impact on wholesale employment in the central cities.

Changes in wholesale employment in suburban areas were quite another matter. Suburban portions of the study area showed a 581-percent gain in wholesale employment, compared to 113-percent gain for suburban areas in general. Thus, wholesalers, who generally sell to the entire metropolitan area and who are highly dependent on good transportation as well as space, were significantly affected by the freeways.

Manufacturing (See Table 5). Within the central cities, manufacturing employment increased by only one percent during the period 1958-1965. Central city study areas showed a five-percent gain in the same period. Suburban study areas showed a 397-percent increase, compared to a 156-percent increase for suburban areas in general. The development of planned industrial parks since 1965 has caused the suburban study areas to continue to gain in manufacturing employment.

The impact that freeways have had on manufacturing plant location can also be seen by examining Figures 9 and 10. From 1946 to 1952, no new manufacturing plants were established in Bloomington, and only one was established in Edina (not within the study area). In Minneapolis, only two plants (both small) were established in the area south of Lake Street. The manufacturing pattern was still highly concentrated in central districts such as the Minneapolis Central Business District and the Midway district of St. Paul.

The pattern of plants established from 1961 to 1967 shows a radical difference. The traditional clusters do remain, but the Minneapolis CBD has become less impotant, and the Midway, more

important, as industrial site locations. A new factor has been added, however. In Bloomington and Edina, along Highways 494 and 35W, new clusters of plants have been established. The orientation of these plants to the freeways is apparent. Discussions with large industrial developers indicate the importance of the freeway in their minds and in the minds of the industrialists. Railroad access, however, has not lost all of its importance. The clusters along the interstates have developed where railroads (such as the Minneapolis, Northfield, and Southern) cross the highways.

Removal and Construction of Dwelling Units in Minneapolis

It was desirable to obtain more detailed information about changes in the number of dwelling units than could be obtained from Traffic Assignment Zone data. By working from Minneapolis City Planning Department records of construction and demolition of dwelling units on a yearly and block-by-block basis, it was possible to compile data on exactly how many dwelling units had been removed by freeway construction and how many units had been added near the freeways. The results are highly significant.

Data from this study demonstrate that area-wide statistics showing the change in the number of dwelling units over a period of several years can be misleading within a central city area. As shown by Figures 11, 12, and 13 and Table 10, removal for freeway construction was approximately balanced by subsequent construction in the area. Overall totals convey a misleading impression due to the small net change.

An example of balanced loss and gain is shown by the data for District Two as shown on Figure 11 and Table 10. This district had large removals in 1960, 1961, 1966, and 1967, due to the construction of I-94 and the West Bank expansion of the University of Minnesota. However, 1968 and 1969 showed large gains in the number of dwelling units due to construction of large apartment developments, especially Borson Towers and Monroe House.

Implications for Inner City Areas

District Two is fairly typical of inner city areas (those areas with development prior to 1875, as shown by Figure 14). Although the net gain was only 99 dwelling units, this area has undergone a tremendous amount of change since the construction of the freeway. Future development also seems inevitable because of the proximity of this area to the University of Minnesota, downtown Minneapolis, and a large health-care complex, as well as the freeway. Large developments are proposed or under way, with Augsburg College and University Community Properties as the developers. Within all of the inner city areas in Minneapolis (roughly within the areas contained by Lake Street and the Mississippi River), the pattern is much the same. Large numbers of substandard, blighted single-family homes and small multiple-unit structures were removed. In their place large (over 100 units) complexes have been built along the freeway. Thus there has been a shift in the type, quality, and cost of dwelling units. Many of the new units have been public housing for the elderly or semipublicly financed projects such as Borson Towers. Without these, the large losses caused by freeway right-of-way acquisition would not have been compensated for.

Implications for Areas Between Lake Street and the South City Limits

Areas south of Lake Street show a different pattern. Fewer dwelling units were removed by freeway construction, and few new units have been built. This is an area of largely sound housing, which makes renewal type projects unneccessary and infeasible. More or less complete development and sound condition have meant that there is little economic motivation for change within the area. This has been reinforced by zoning laws that restrict development mainly to one-family homes (See Figure 5).

Overall Effect

The overall effect on housing of construction of 35W and 94 in Minneapolis seems to have been very small. Areas within one-half mile

of the routes showed a gain of 1,651 dwelling units during the period 1960-1969, and the city of Minneapolis showed a gain of 8,851 units. Both of these gains were more than offset by declines in the number of persons per dwelling unit, resulting in population loss.

Factors Affecting Land Use Change in the Study Areas

No single factor controls the development of land use within a given area. Land use is the result of a complex interaction of causes. The location of freeways may be an important element, but the effect of freeway location is subject to limitations set by the other elements. In combination with other factors, freeways tend to produce certain characteristic land uses. It is the purpose of this section to delineate some of the more important factors in the creation of land uses and how they are affected by freeway construction.

Historical Development Trends

The past trends of development within an area are probably the most important factor in shaping the future development of the area. As a result of past development, an area inherits an inventory and arrangement of land use that is difficult to change. Not only are many of the physical elements established, but persistent trends in the direction and nature of development are started. Some of the more important historical features of the development pattern in the Twin Cities are shown by Figure 14.

The Twin Cities area is a young metropolis; little of its area was developed before 1875. However, the freeway study segments do penetrate these areas of older development near the Minneapolis and St. Paul business districts.

Since 1875, growth within the metropolitan area has concentrated along a few noticeable lines of thrust. The area between the central cores of Minneapolis and St. Paul, now known as the Midway, was quick to develop. The I-94 study segment passes through the heart of this area.

For nearly a century the strongest thrust of growth outward from the Minneapolis Central Business District has been to the south. This has had a significant impact on the nature of the areas through which the study segments of I-35W and I-494 have passed. Continuation of this southward growth has also been significant in explaining land-use changes that have accompanied these freeways.

Location in Relation to Major Development Nodes

Numerous nodal features can be seen in the metropolitan area. The two most persistent and important of these nodes are the Central Business Districts. The location of the freeways in general and the study segments in particular is closely related to the location of the business districts. The I-94 study segment is the link between the business districts, and the I-35W study segment extends directly south from the Minneapolis business district along a previous axis of development.

The study segment of I-494 is less closely related to the Central Business Districts. Its orientation is toward a new and highly significant node, Twin Cities International Airport. I-494 connects the airport with the traditional southern spoke of development along I-35W and with some of the highest-income portions of the metropolitan area in the south and west.

Age and Type of Development

The sequence of development within the freeway study areas that was described in the preceeding section on historical development trends is shown graphically by Figure 14. As a result of this sequence, the freeway study segments pass through areas of differing characteristic age and physical condition. Four basic areas pertinent to freeway development can be delineated on the basis of the age of development and type of land use. These areas are:

1. Central Business District - an area of old development and continuous redevelopment. Density and value are too high for direct penetration by freeways.

2. Renewal areas - areas of the city developed generally before 1875. These are the areas that have either undergone extensive removal and reconstruction or are in the process of renovation and partial reconstruction. The freeway study segments pass through three redevelopment areas:

   The Model City area of Minneapolis, which includes I-35W north of 36th Street.

   The West Bank (or Cedar-Riverside) and Seward areas of Minneapolis, which include the western end of the I-94 study segment. Parts of this area have been redeveloped by the Housing and Redevelopment Authority and the University of Minnesota; large-scale private redevelopment is about to begin.

   The Western and Cathedral No. 1 redevelopment projects in St. Paul, which have already been cleared and rebuilt, and the Summit-University area where redevelopment is in progress.

Freeways in these areas, often made feasible as part of the removal process in redevelopment, serve as a catalyst for redevelopment by improving access to the area. Through improved access, the redevelopment areas are made more attractive to private enterprise, especially commercial and industrial establishments.

3. Stable areas - areas of moderate density development constructed between the period 1875-1900 and the building of the freeways (See Figures 14 and 15). As can be seen by the maps of changes in number of dwelling units (Figure 3) and change in employment (Figure 7), these have been remarkably stable areas.

The stability of these areas can be explained by the fact that there is little developable land left open in these areas and that the development that has already occurred is still in sound condition. Thus, there is little possibility of large-scale change in these more stable areas. This accounts for the small amount of change along I-35W in South Minneapolis and Richfield and I-94 in western St. Paul.

4. Developable areas - areas where less than 60-80 percent of the land was developed at the time of freeway construction (See Figure 15). Freeways naturally have the greatest effect in this type of area. Much open land remains that can be put into freeway-oriented uses. The nature of the area and pattern of land use is less set, especially in the least-developed portions. This allows a great deal of flexibility in adapting the land use to the new conditions created by the freeways.

The portions of the study area in the undeveloped zone included the southern tip of the I-35W sector near the Minnesota River and almost the entire length of I-494. A great deal of development has occurred along I-494 because it not only passes through previously undeveloped areas, but it also connects the airport with the south Minneapolis-Richfield-Bloomington area and the high-income areas to the southwest of the city.

Zoning

Zoning provides a significant restriction on the types of land-use development that occurred along the freeway study segments. Within the areas of western St. Paul, south Minneapolis, and Richfield that showed great stability, zoning regulations generally excluded all but single-family homes. Restrictive zoning regulations have served to protect previously developed areas of single-family homes from disruption by the development of commercial areas or large apartment complexes.

In previously undeveloped areas in Bloomington and Edina, zoning has served a different function. Areas along the freeways have been zoned for commercial and industrial uses (Bloomington even has a "freeway development" zoning category), and areas more remote from the freeways have been reserved for single-family homes. Thus, the freeways have served to channelize and concentrate the commercial and industrial development of some of the most desirable portions of the metropolitan area. Nonresidential users had little choice but to locate in the freeway corridors. This is a clear case where zoning has had a significant effect on the minds of others, notably city planners, and the result has been a definite change in land-use development patterns.

Private Entreprenuership

The perception of new opportunities by private land developers has played a significant role in land-use change within the study area. This has been especially important in previously undeveloped areas, but has also been a factor in some older areas. Among the larger developments effecting this area have been the Southtown and Southdale shopping centers, the Edina Interchange and Normandale Industrial parks, and the Borson Towers apartments. Smaller-scale development has been undertaken by many others, especially Bel-Mar Construction Company. The Cedar-Riverside Associates (University Community Properties) plan a large-scale development project in the future.

Interviews with private developers show that the freeway has been a significant factor in their choice of location and their decision to invest. The developers believe that the freeways provide them with greater accessability to markets. Nevertheless, it is difficult to show objectively whether or not the freeway segments (or freeway system in general) increased the total amount of investment that occurred in the Twin Cities area since freeway construction. It is difficult to determine if less outside capital would have been attracted or more local capital would have gone to other areas had the freeway system not presented its special locational opportunities. It can be said with assurance, however, that the freeways changed the nature and distribution of private investment construction. As a result of the channelization of traffic and improved access afforded by the freeways, private investment seems to have been concentrated in a few large-scale developments located adjacent to the freeways. This may prove useful in avoiding the development of neighborhoods in the suburbs that show mixed patterns of incompatible uses.

General Social and Economic Factors

The effects of national and local economic and social conditions cannot be overlooked in a discussion of land-use change. Although the

influence of these more general factors may be difficult to state precisely, they have nonetheless been highly significant.

The period dealt with by this study has been one of rising interest rates. These high rates have favored the construction of multiple-family dwellings over single-family homes. This, coupled with the rapid growth in population and rapid increase in family formation within the Twin Cities area, has undoubtedly changed the mix between single-family and multiple-family dwelling units in new construction. Thus, the growth of many new apartment complexes along freeways may be due to national and local economic and demographic trends as well as the more specific effects of the freeways.

The period dealt with by this study has been a time of high economic activity and growth, both locally and nationally. This undoubtedly has produced more change than would have occurred in a period of sluggish economic growth.

Social conditions within the study areas, such as minority populations (important in parts of near western St. Paul and South Minneapolis) and changes in the socio-economic level of the residents of various neighborhoods, have also undoubtedly had an effect on local land-use change. Either more or less growth may have occurred in some areas due to investors' perception of the safety and long-run prospects of investments. These effects, which are largely dependent on the subjective judgment of numerous individuals and groups, are difficult to assess. Examination of Figures 3, 4, and 6, relating to dwelling units, and Figure 7, relating to employment, reveal that areas on the near west side (about 300 to 1500 west) in St. Paul and the south side of Minneapolis (from about 3600 to 5000 south) have shown little change in number of dwelling units or jobs. The lack of change in these zones is partially due to uncertainty caused by socio-economic changes occurring in and near them. No hard and fast conclusions based upon currently available evidence are warranted, however.

General Model of Freeway Impact on Land Use in the Twin Cities

The systematic variations in changes in land use that are shown in the study segments would seem to make a more general model of freeway impact possible. It is the purpose of this model to show what types of change can be expected in other areas after freeway construction and what factors could alter the expected impact.

The effects of the freeways on the various portions of the metropolitan area can best be described by a systematic explication of the features shown by Figure 16.

The variations in freeway impact can best be explained by what is called a concentric zone model in urban geographical and sociological studies. However, elements of another model -- the multiple nuclei model -- are also present. This is true not only because both Minneapolis and St. Paul have traditional Central Business Districts, but also because certain other features in the metropolitan area have become the foci of development. Most important among these other factors are the airport and the high-income residential areas.

The Central Business Districts of Minneapolis and St. Paul represent a unique type of land use in relation to the freeways. Though much of the freeway system has been designed to service the Central Business District, freeways never actually enter into this business core because of the high cost of land and its value for other uses. Freeway impact here then is less direct, but nonetheless strong.

The total employment within the Central Business Districts was nearly stable during the period of this study, but great shifts occurred within the total. The amount of manufacturing and retail employment declined, and the amount of employment in financial and professional categories showed marked increase (see Tables 3, 5, 7, and 8).

Some general observations about what effect the freeways had in producing this pattern can be made.

As the metropolitan areas have grown larger, the average distance of residences from the Central Business Districts has increased. This has, in effect, made them less "central" for many people.

Most people have a natural desire to shop as close to home as possible, minimizing the distance or time traveled to shop. Thus it has become more and more desirable for people living in outlying areas to find a closer source of services than the CBD.

The necessary "threshold" -- or number of persons -- needed to support a store can be met in a number of places throughout the metropolitan area.

The above factors would seem to make it inevitable that outlying shopping centers would develop. Most shopping centers are located near freeways and have better access because of this, but the CBD is also served by freeways and has also had its accessability improved. Whether more people come from outlying areas to the CBD or more persons living near the CBD use freeways to travel to outlying areas is a question beyond the scope of this study.

The improved position of the CBD in respect to financial and professional uses appears to be due to the strong agglomerating forces operating in these professions. Face-to-face contact and close proximity are important in financial and professional services and made concentration in one area desirable. The freeways, by improving the accessibility of the CBD, facilitate its development as a financial and professional center.

The most important impact of the freeways on the CBD is in changing its function from a Central Business District to primarily a central financial and professional district.

The areas immediately surrounding the Central Business Districts have also been profoundly affected by freeways. This discussion refers

to the unshaded areas surrounding the Central Business Districts in Figure 16. As shown by Figure 14, these are very old areas, having been developed before 1875.

A unique feature of these areas is the volume of land removed for freeways, freeway interchanges, and freeway feeder routes. Freeways serving the Central Business Districts were able to penetrate these areas because of their lower value. Freeways converge here, and in Minneapolis, a ring route is being built around the Central Business District. Many other portions of these areas have been cleared for urban renewal.

Despite the large amount of land removed from nonroad land uses, these areas seem to show vigorous development. As has been previously mentioned, the unsound or outdated buildings occupying the area make removal of old structures possible. This removal then opens the way for a readjustment of land use to meet the new conditions brought about by freeway proximity and access. These areas are also the sites of major institutions, including hospitals, the State Capitol complex, and the University of Minnesota. These institutions provide a dynamic element within the area and, because of their tremendous capital investment in buildings and land, have a vested interest in upgrading the surrounding areas. The combination of better access, govermental renewal, institutional growth and interest, and increasing private interest makes the future of these areas bright. Increasing quality and density of land use is inevitable.

The areas that developed to moderate density between 1875 and 1964 are shown by the shaded pattern on Figure 16. These are the areas that showed the least change in number of dwelling units (Figure 3) and small increases in employment (Figure 7).

The lack of ability of this area to adjust has been discussed previously. In the more recently developed areas, the majority of the structures are sound. Little land remains open for development. The result has been minimal change in land use along freeways. Because of this minimal change, land use in this area has not adjusted to the new

conditions. These are the areas where single-family homes may be found along the freeway. Thus, it is here that noise is the greatest problem. It is here that stable neighborhoods may be disturbed, bisected, or destroyed by freeway routes, and thus it is here that neighborhood opposition to freeways is greatest.

These areas are and will prove to continue to be a trouble spot in freeway construction. Land use and the technology of the freeway age are sometimes in conflict. Meanwhile, the problems traditional to more central portions of the city -- increasing age and dilapidation of structures -- are expanding.

Previously undeveloped areas have and will continue to show the greatest and most visible land-use changes accompanying freeway construction. However, the nature and extent of the change will depend on a number of other factors. Traditional growth directions of the metropolitan area, notably south and west of Minneapolis, will have the most development near freeways. Freeways with airport access will show great development, especially of services and industries dependent on air travel and air freight. Freeways passing near high-income areas (See Figure 16) will show the greatest commercial development because of the high amount of disposable income available and rapid residential growth.

As the mileage of freeways in undeveloped areas expands, growth will be more selective. The opening of freeways in the northern suburbs will thus bring less immediate effects. Growth will also be smaller because this is not the traditional direction of growth in the metropolitan area, the northern suburbs tend to have lower incomes than those in the south, and the airport is located on the southern edge of the metropolitan area.

Qualifications. All of the views presented here are dependent upon the continuation of a number of present general trends. Table 11 shows some possible changes in these general features and the type of response that could be expected.

2. EFFECTS ON RETAIL TRADE

This section reports the effects that the freeways have had on retail and commercial establishments located in their proximity. The number of these concerns is large, and their business activities contribute substantially to the total retail trade in the Twin Cities. This analysis is based upon data gathered on retail establishments located within the Central Business Districts of Minneapolis and St. Paul as well as those on major streets paralleling segments of freeways I-35W and I-94. Some consideration is given to business activity along I-494, but this subject has been dealt with in greater detail in the section on new land-use changes and potential.

The studies of the retail establishments on streets paralleling and close to I-94 and I-35W offer the best overview of the effects of a freeway on the existing retail and commercial structure. In contrast, the commercial development paralleling I-494 has largely taken place since the opening of the freeway.

Research on this section of the study was complicated by several factors, the most important of which was the lack of concrete, quantitative data. This lack created a problem in arriving at dependable conclusions concerning the changes that have taken place since the opening of the freeways. Many of the business people consulted were reluctant to make information available from their business records for the purposes of this study, in spite of assurances about the protection of the information supplied. Additionally, almost no useful statistical information is a matter of public record. What little information is available in the public domain is very general, often incomplete, and frequently not aggregated in such a way as to be useful for our purposes. However, some information was made available on a confidential basis by some of the larger retail firms in the city who not only recognized the value of the work being done on this study but who also have had a past record of cooperation in matters of public interest and concern.

For these reasons, personal interviews were the largest single method of data collection. There was, as might be expected, no shortage of personal opinion and discussion on the effects of the freeways. This kind of information is valuable however. Opinions based on many years experience, training, and personal knowledge are of value in two ways:

1. They form the basis upon which daily and long-range business decisions are made and they incorporate intuitively a weighting factor for the presence or absence of a freeway, and
2. the decisions of businessmen regarding location of new stores for expansion of existing retail facilities result in symbiotic relationships with their environment.

That is the store is (other factors being equal) located relative to certain geographic and trasportation characteristics. The location in turn modifies these factors. Therefore, the location of a successful store along a freeway will, in the minds of the owners and management, be a recognition of the value of the freeway to the success of the store. At the same time increased use of the freeway by persons going to that store will appear to justify both the location of the retail facility and reinforce the view of the value of the freeway itself. Furthermore, the success of a store in a particular location will tend to encourage other entrepreneurs to locate in its vicinity -- thus, reinforcing the original opinions concerning the value of the location.

Two major topics are considered in this section. The first is the role of the Central Business District as a retail center within the metropolitan area and the growth of outlying shopping centers on or near freeways. The second is a detailed look at the history of small businesses on two major arterial streets paralleling two of the freeway segments in this study.

Retail Sales in the Central Business District

The Central Business Districts in both of the Twin Cities exhibit a pattern of declining numbers of retail establishments which is common in many cities throughout the nation (See Table 12).

The number of retail stores in the Minneapolis CBD declined 47 percent from 1954 to 1967, and in St. Paul, 38 percent. This trend reflects the increasing suburbanization of the Twin Cities population as well as the growth of the local freeway system. At the same time, the business character of the Central Business District has been changing from a product- to a service-oriented center. As might be expected, retail stores tend to follow the population. As people move from the cities to the suburbs where land was cheaper and more readily available stores were able to provide free parking space in large quantities for the automobile-oriented society. It no longer became necessary for drivers to put up with traffic and parking congestion in the CBD.

Similarly, the sales volume of retail stores in the Central Business District (Table 12) showed a decline from 1954 to 1963, but the 1967 figures showed a marked upturn in both Minneapolis and St. Paul. A substantial portion of this increase -- perhaps 60 to 70 percent -- can be attributed to inflation, but inflation in prior periods caused the losses to be understated.

Table 13 indicates that, at least in Minneapolis, the rate of decline of CBD sales as a percentage of total city sales was slowing down. Retail sales as a whole have been increasing in the Twin Cities metropolitan area during the period 1954 to 1967. As Table 14 shows, the role of the CBD's in this growth is more ambivalent. During the period of 1954 to 1958, retail sales in the Minneapolis CBD declined 0.6 percent. This rate of decline increased sharply during 1958 to 1963 when the loss in retail sales as a percentage of the total metropolitan area was 9.6 percent. This trend was apparently reversed, however, during the period 1963 to 1967 when the sales showed an increase of 9.3 percent. A similar pattern, though not so pronounced, is apparent in the relationship of retail sales for the St. Paul Central Business District relative to the metropolitan area as a whole.

Many factors influence the resurgence of retail sales in the Central Business Districts in the Twin Cities. There is no question, however, that freeways I-35W and I-94 will deliver a potential customer

rapidly and efficiently to the stores of the Central Business District. This is a positive factor in maintaining their competitive position in the Twin Cities. Although it is not possible to isolate the particular role of the freeway in this function, detailed studies by one of the largest retail stores in the Central Business District revealed that the location of their customers was oriented toward freeway and other arterial street usage.

Retail Sales -- Suburban

Again, in common with many other metropolitan areas in the United States, the Twin Cities has witnessed the growth of suburban shopping centers, many of which are located on or near freeway corridors and all of which are located with good access to major highways. Such roads are an important factor in the success of the centers, providing a convenient means of access and egress. The freeways enable the shopping centers to extend their trade areas greatly by drawing on many different parts of the metropolitan area for their shoppers. For example, Southtown Shopping Center in south suburban Minneapolis is located on I-494 near the intersection with I-35W. This center, opened in 1960, now contains some 33 stores. Southtown has exhibited a rapid growth rate in total sales volume (See Table 15). The pattern of home locations of customers of Southtown is illustrative of the wide range of residential areas which are convenient to Southtown due to its position immediately adjacent to a major freeway. A recent survey indicates that some 61 percent of the customers who shop at Southtown center live in an area which includes the communities of Minnetonka, Hopkins, St. Louis Park, Edina, Eden Prairie, Bloomington, Burnsville, Richfield, and Mendota. These communities are on or near existing freeway corridors. In addition, another 31 percent of Southtown's customers live in an area which includes Minneapolis south of the CBD and all of St. Paul. The correlation of these origins with existing freeways I-494, I-94, and I-35W clearly indicate the importance of accessibility to the success of these shopping centers.

In a personal interview, the management of the Southtown Shopping Center expressed the view that the freeways definitely play an important part in helping Southtown maintain its position as one of the Twin Cities leading shopping centers, and at the time of development, the proposed freeways were an important factor in the original site selection. Again, it is apparent that the factor of accessbility related to freeways cannot be isolated from such other important elements such as availability of land, market area, and socio-economic criteria. However, accessibility to a freeway or a freeway-type highway is a sine qua non for locating a shopping center in the Twin Cities.

Freeway Effects on Hotels and Motels

Freeway I-494, one of the freeway segments designated for examination in this research study, is unique in one respect. Prior to the development of I-494, there was little or no commercial or industrial development along its corridor. Subsequently, there has been intensive development. This development is obviously freeway-oriented, and the freeway has made the very existence of these establishments possible. One of the more visible types of commercial activity occurring along I-494 is the hotel and motel business. In addition to the access available from the freeway, the proximity of the Twin City International Airport has been another important factor in the growth of this particular type of business. Unfortunately, data were not available to make possible a quantitive analysis of this form of commercial activity. Some insight, however, was gained by interviews with persons concerned with the management of these enterprises.

These interviews show that there is no question in the minds of the management that the interstate highway itself has been a powerful force in attracting not only the developers of these hotels and motels but also the customers using them. This location not only permits attraction of business visitors arriving in the Twin Cities by air but but also those who approach the Twin Cities from the south, east, and west, as well as tourists using the freeways to and from their main point of interest. In the area of I-494, land was available during the early

periods of development at an attractive price. Simultaneously, the area became a corridor of growth for suburban office buildings and light industries. The motels have again benefited by the commercial business attracted to this commercial and industrial development. Thus, I-494 provides quick and easy access between the airport, offices and businesses, shopping facilities, and the numerous hotel and motels. In addition, I-35W and I-94 enable guests at the hotels to utilize the downtown areas of the Twin Cities. The freeway has been an important factor in tying this suburban hotel and motel development to the other commercially important areas of the Twin Cities.

An indication of the importance of this area to the hotel and motel business is the growth in numbers of rooms available. From a base of approximately 550 rooms, most of which have been built in recent years, there are more than 1,100 additional rooms newly opened or presently in the process of being added. Two very obvious examples are the new Radisson South Hotel at the intersection of I-494 and State Highway 100 and the new Holiday Inn nearby. There are some 750 more rooms proposed in the near future for construction in new facilities in this area. The freeway orientation of this new construction is indicative of the value placed upon freeways as a factor in commercial and industrial locations.

In downtown Minneapolis, hotel managers interviewed also had favorable opinions of the role of I-35W and I-94 in the success of their establishments. These interstate segments are certainly not the sole reason for the success that these hotels enjoy, but their influence is felt, and it is significant that many of the more important downtown hotels are located close to the terminal segments of I-35W and I-94. The manager of one major hotel located in this area reported occupancy rates running in the 80 to 85 percent range and an occupancy rate of 95 to 100 percent for its motor inn, located nearby. He credited the freeways for these high occupancy rates in terms of the provision of potential customers, ease of access, and as a cause of a general increase in traffic in the vicinity. It is, of course, also apparent that modernization of the facilities, provision of parking space and investment in new facilities

were also factors in the ability of these older establishments to maintain their profitability in the downtown area.

The Large Retail Firm

Due to the lack of quantitative data in determining the relationship of the freeways to the structure of retail trade, interviews with the management personnel of some of the major firms in the Twin Cities provided the only useful data. These interviews were conducted with the aim of obtaining not only the opinions of these persons regarding the relationships between freeways and their business operations but also to elicit concrete data on the trade areas which they serve in order to examine the correlation, if any, that exists between freeways and customer origin. The persons interviewed, without exception, expressed positive opinions concerning the value of freeways to their business; the interstate segments have played an important role in the success of their stores whether they are located in the CBD or suburban areas.

In planning for future stores, retailers emphasized the importance of freeway or other arterial type access roads; their customers depend on the automobile for transportation. Although it is not absolutely necessary to have a store with direct frontage on a freeway, it is imperative at least that it be located within a short distance from a major roadway. Figure 17 provides some insight into customer origin for a store located on I-494 in Bloomington. A study of this map makes the north-south orientation of the pattern apparent. This generally follows the corridor of I-35W. I-35W enhances the attractiveness of this particular store for persons living as far north as the Minneapolis CBD.

Figures 18, 19, and 20 show the trends in sales of a major store in the Minneapolis CBD, the St. Paul CBD, and a store located near I-494 in Bloomington.

The store located in the Minneapolis CBD is one of a chain of stores having a number of outlets in the Twin Cities. Several of the changes in the direction of the sales trend line on the graph for the

downtown store are associated with changes in the freeway system. These changes are indicated on the graph. Growth in sales in current dollars grew rapidly from 1963 to 1965. In this latter year, a major suburban branch of the store substantially expanded its floor space and capacity. This branch is located in close proximity to a major limited access arterial highway and a freeway, both connected to the entire Twin Cities freeway system. The sharp decline in sales in 1965 was briefly interrupted by the opening of I-35W from the Crosstown (Highway 62) to the CBD. A further sharp decline coincides with the further expansion of the branch store described above. This decline in sales in the downtown store is consistent with changes in the factors related to retail sales such as shifting of retail facilities to growing suburban population centers, improved access by automobile in the suburbs, better parking facilities, a wider dispersal of traffic over space, and proximity to customer residence.

In current dollars 1969 sales approximated those of 1963, but with the application of a factor to compensate for inflation, a sharp drop in sales becomes apparent. Thus, this store shows the effect of the movement of retail selling to the suburbs which has been facilitated by the growth of the freeway system. The improvement in access to the CBD offered by freeways does not appear to have compensated for this loss in the retail marketing sector of the Minneapolis economy. Most retail selling is characterized by a relatively high ratio of customers to dollars spent, and ease of access, parking facilities, and proximity to residences play an important role.

A similar store in downtown St. Paul shows a less dramatic sales trend (Figure 19). Again, several sharp discontinuities in the trend line occur at the same time as changes in competition and the transportation network. These are indicated on the graph.

Several observations related to the retail sales of this store are noteworthy. In coincidence with a decline in sales in 1968, I-94 opened, joining the CBD's of both of the Twin Cities. This facilitated the movement of shoppers between the two metropolitan areas. Minneapolis, with a greater population and greater overall shopping facilities, probably

benefitted from this more than St. Paul, drawing potential St. Paul customers into the Minneapolis area.

The pattern of suburban development in the Twin Cities also bears upon the relatively small decline in sales of the St. Paul downtown store. Starting from a larger population, industrial and commercial base, Minneapolis suburbs have shown extensive growth, particularly south and west of the city. St. Paul suburban growth has been slower. Furthermore, the freeway systems have been much better developed in and around Minneapolis than in St. Paul. These factors are reflected in the fewer and somewhat smaller shopping centers serving the residents of St. Paul and its suburbs. Thus, the stores of the St. Paul CBD have been less affected by the growth of suburban retailing than those of Minneapolis. This situation can be expected to change as the population of the St. Paul area grows and shifts toward the suburbs and the freeway system grows and adapts to their needs.

Figure 20 shows the sales growth of a large discount store lying in proximity to a freeway in Bloomington. When this store was opened in 1965, many of the major freeway segments which could be expected to assist in its growth were already open. Subsequent openings of freeway segments have reinforced sales growth to some degree. Discount stores are mass merchandisers depending on high volume to compensate for lower profit margins per item. Thus, their dependence on large numbers of customers demanding easy access and extensive parking facilities make them obvious candidates for location in developing suburbs closely associated with either a freeway or a limited-access roadway. The large amounts of space necessary for extensive facilities and parking make the lower real estate costs of suburbs appealing, as well.

The data provided above support the view that freeways have facilitated the growth of freeway (and other limited-access highway) oriented suburban stores. At the same time, they have diminished but not reversed the negative factors associated with the downtown location.

The Impact on "Small Business"

To provide data for this portion of the report, extensive, in-depth personal interviews were conducted with owners and managers of firms located on Nicollet Avenue paralleling I-35W between 15th Street and 66th Street in Minneapolis. In addition, similar interviews were made with small businessmen along University Avenue paralleling I-94 between Arundel Street and Franklin Avenue in St. Paul. To provide a suitable framework into which these interviews could be placed, a survey was made of the turnover of businesses along these two streets during the period 1960 to 1969. The source of this information was the reverse listing directory (e.g., the Minneapolis Street Address Directory, 1970, published by Northwestern Bell Telephone Company).

The turnover study shows that on University Avenue between Marion Street and Raymond Avenue, only 44.1 percent of the stores listed in 1960 remained in 1969. A total of 480 establishments were examined; 55.9 percent had changed ownership, changed form, or in some instances, had disappeared entirely from their listed location. On Nicollet Avenue only 164, or 39.5 percent, of some 460 firms listed for 1960 remained in 1969.

The volatility of business turnover on these streets was not restricted to any single type of business. Grocery, drug, and hardware stores, service stations, dry cleaners, home furnishing stores, and cafes were affected. In addition, many commercial establishments in wholesale, distributorship, or office lines were involved.

There are, however, some street segments that seem to have a high rate of turnover relative to the street as a whole, especially on Nicollet Avenue from 29th Street to 31st Street (the Nicollet-Lake area), where only 34.8 percent of the firms located there in 1960 were there in 1969. Another area of particular interest is the "Rustic Lodge" area centered on the intersection of 48th Street and Nicollet Avenue South. Here the percentage of businesses remaining at the end of this nine year period is only 22.2 percent. This is a small and

rather old neighborhood shopping district. The closest freeway access to the north is 46th Street; there, several newer shops and stores have opened, offering services and goods in a newer atmosphere. Presumably they are intercepting much of the potential traffic. To the south, the nearest freeway access is even more remote (some seven blocks) on Diamond Lake Road, which at its Nicollet Avenue intersection is the center of another, much larger, shopping area.

Checks of several subsegments on University Avenue have revealed that most of these seem to have a stability similar to that of the street as a whole. Clearly, there is no way to relate conclusively the volatility illustrated above to the distances of the freeway within the scope and context of this research report; undoubtedly, other factors are involved, all of which are inherent hazards to small business. For this reason, personal interviews were conducted to find out from the owners of some of these firms their views regarding the freeway as it related to their business.

A total of 51 businesses were interviewed on the two streets listed above, and some of each of six categories were picked along each street. The commercial categories are: gasoline service stations, drug and grocery stores, restaurants and liquor stores, hardware, appliance and home furnishing stores, service stores such as shoe repairing and dry cleaning, and a miscellaneous group including a florist, a nursery, an independent used-car lot, and a wholesale paint store. The ages of these firms ranged from 3 years to 52 years, with most of them being in their present location in excess of 20 years. Table 16 tabulates the results of these interviews.

Only twelve percent of those interviewed stated that they felt that their business had declined since the freeway opened, while some 41 percent had the positive view that business was improving since the freeway opening. The remaining 47 percent thought that the freeway had essentially a neutral effect upon the course of their businesses. Although about 65 percent of the businesses reported short term business slow-downs, those that felt that the freeway was harmful over the long-term were a definite minority, and the largest part of this group was

service stations (especially those not near access ramps) and services. These business firms are not necessarily simply neighborhood based as indicated by the fact that 47 percent replied that their customers are not primarily concentrated in their neighborhood and therefore the businesses do rely to some extent on the transportation system for their customers.

3. FREEWAY EFFECTS ON RESIDENTIAL PROPERTY VALUES

Opinions on the effects of freeways on residential property, both positive and negative, are often based on subjective judgments or limited experience. The purpose of this part of this study has been to determine objectively what effects, if any, freeway proximity has on residential property values. To determine this relationship, three major variables are considered:

1. Market value, versus time and location;
2. Turnover (sale and purchase) rate, versus time and location; and
3. A comparison of market and assessed valuation, versus location.

The study included sample subsegments along I-94 in Minneapolis and St. Paul and I-35W in Minneapolis and Richfield. Primary data sources were the reverse listing directories for all sample areas, assessment records for Minneapolis and Multiple Listing Service realty information for Greater Minneapolis and St. Paul.

Changes in market value were considered in two ways: first before and after freeway completion, and second, in terms of relative location; that is, an attempt was made to determine what effects a freeway had on the property values of those homes adjacent to a freeway compared to those homes up to a half-mile removed.

The research for this part of the report was carried out in seven study areas of approximately one-half square mile each, which included fifty-eight separate street segment comparisons (Figure 21). Each subsegment included approximately 750 home sales during the 1953-1968 period, of which approximately one-third were contained in the four-year periods considered as critical in terms of potential freeway impact. The critical periods are 1965-1968 for all segments except the 66th- 75th-Street segment of I-35W in Richfield, which was 1957-1960. The Minneapolis and St. Paul segments of I-94 contained considerably fewer sales than those segements along I-35W and, therefore, less emphasis is placed

on these segments throughout this section. In all cases, half of the total number of sales were included to assure statistical significance.

Changes in Market Value Related to Time

For the analysis of market value change, annual sales price averages for each subsegment were calculated for the years 1953-1968. A fifteen-year period was considered so that patterns in market increase or decrease could be noted. The 46th-58th Street segment of I-35W illustrates this point. There is an erratic pattern of general price increase over time for this segment (Figure 22). This graph shows that there is no distinct relationship between freeway activities and price fluctuations. I-35W was completed through this segment in 1967. If freeway construction or completion had a significantly detrimental effect on property values one would expect to see a significant decrease or lag in average sale price for at least a year or two before freeway opening and up to the present; no such pattern exists. Although there may have been minor price declines, they must have been shortlived.

Variations in market value over time were considered in a second way as well. A comparison was made of change in market value for the sample segments with that of the greater Minneapolis average. This comparison (in six of the seven segments) between the pre-freeway period of 1960-1963 and the construction completion period of 1965-1968 yielded the following results:

	Market Value Change: Residential	
	1960-1963	1965-1968
Greater Minneapolis	+11.7%	+23.4%
I-35W 28th-38th St. (west)	-0.6	+24.2
(east)	+2.9	-29.5
I-35W 46th-58th St. (west)	-6.2	+20.4
(east)	-5.1	+15.0
I-35W 66th-75th St.	No comparative figures available for pre-freeway period	+11.1
I-94 St. Paul	No comparative figures available for pre-freeway period	
I-94 Minneapolis	+16.1	+10.0

The results of this survey show that although the majority of the subsegments were increasing at a slower rate in terms of property values than the Minneapolis average, it is difficult to relate this lag directly to freeway impact. There are two reasons for this:

1. Many of the sample segments were lagging behind and growth rate of the Minneapolis average before freeway construction; and
2. The changes in growth rates are irregular, indicating that this lag results from a combination of many factors.

Changes in Market Value Realted to Location

The second major factor involved in analyzing changes in market value concerned changes in value as a function of distance from the freeway to determine the realtion between freeway proximity and market value. Data were collected and analyzed for average sales prices of homes for the 58 street segments in the seven subsegments. This information was compiled for the entire fifteen-year period of 1953-1968 to determine what overall relationships in market value existed between the streets under consideration. This is illustrated by Figure 23 presenting the 28th-38th Street segement of I-35W. This segment includes Stevens, First, Nicollet, Blaisdell, Pillsbury, Pleasant, Grand, and Harriet Avenues on the west, and Second, Third, Clinton, Fourth, Fifth, Portland, Oakland, Park, and Columbus Avenues on the east. This graph shows that, for this particular segment, there appears to be a relationship between freeway proximity and market value for the first four streets adjacent to the freeway. One can observe an increase in property values with greater distances from the freeway. This finding, however, is offset from inspection of the other data on Figure 23, which shows the relationship of property values to location for the critical years of 1965-1968. This period should reflect the strongest deflating effect related to freeway proximity. The relationship of value to freeway proximity for this period is nearly identical to that of the 1953-1968 period, with the exception of a higher base level of sales value. Although at first glance there may appear to be a causal relationship between freeway proximity and lowered property values, the findings strongly suggest

that the relationship of this sort, which is generally apparent in the segments sampled, existed in large part before freeway activity. One qualification should be made: streets directly adjacent to the freeway increase in value at a slower rate than do streets one or more blocks away. This does not mean that the rate at which sales price increases is more rapid as one moves further away, but that in certain cases, there is a distinct difference in being adjacent to the freeway versus one block or more distant. However, this pattern did not exist in all the sample areas.

In the western portion of the 46th-58th Street segment of I-35W there appeared to be no spatial relationship to property value change. The 66th-75th Street segment of I-35W, on the other hand, showed a decrease in values with distance from the freeway. This relationship existed before, as well as after, freeway construction. The St. Paul segment of I-94 showed a fairly steady increase in average values away from the freeway. Unfortunately, no data exist to determine if this relationship existed before freeway construction as well. The Minneapolis segment of I-94 showed little locational relationship concerning market value. However, both segments of I-94, as previously mentioned, contained considerably fewer sales than the other segments and therefore, less emphasis should be placed on these. In conclusion, it can be seen that there is little relationship between freeway proximity and sales values with the exception of those streets directly adjacent to the freeway which, in certain cases, increased in value at a slower rate than those streets one or more blocks away.

Turnover

The second major variable considered during this study was that of number of sales in an area, or turnover rate. This variable, like market value, was considered in terms of time and space. Investigation was made to determine if there is any relationship between freeway proximity and frequency of sales of homes. The 28th-38th Street segment of I-35W illustrates the methods and findings of this portion of the report. As figure 24 shows, the pattern of sales by year for this segment is erratic but generally upward over time. Sales in the eastern

portion of this segment dropped off in 1966 but increased sharply in 1967 and 1968. At the same time, the western portion of this segment was experiencing a decline in 1966 and 1967 and a rapid rise in sales in 1968. These are years during which this segment would have reflected significant freeway influence in terms of highway construction and freeway opening. The 66th-75th Street segment of I-35W showed a slight decline in sales in 1958 and a slight increase in 1959, the year of freeway opening for this segment. Again, the overall pattern of sales by year for this segment is irregular. This segment differs from the others in that the number of sales for the 1953-1968 period increases only slightly.

The 46th-58th Street segment of I-35W showed a steady increase in number of sales for the western portion during the period 1965-1968. The eastern portion of this segment showed a steady increase in sales for the period 1965-1968 with the exception of 1967, when there was a significant decline. The Minneapolis segment of I-94 showed little increase over the entire 1953-68 period and a very erratic pattern of ups and downs. The years 1965-68 showed a steady decline in sales of homes. Data for the St. Paul segment of I-94 was available only back to 1964, so a long term pattern was not discernible. However, for the period 1964-1968 there was a slight decrease in number of sales until 1967, one year before freeway opening, when there was a sharp increase.

The important conclusions of this portion of the study are:

1. The sales histories of the sampled segments are again too erratic to assign a single factor as the causal force behind a particular gain or loss in number of sales;
2. There is little change in the overall pattern of sales during the years of freeway construction and opening; and
3. The fact that the findings were largely inconsistent during the period of primary freeway influence weights heavily in favor of the argument of little or no relationship between freeway growth and changes in the overall number of sales of homes in the area.

Turnover Related to Time

Turnover was examined in another way to determine if there was a difference in the number of sales before and after freeway construction, which might be related to distance from freeway. This was determined by computing a turnover rate for each of the 58 street segments for the period 1954-1956 and 1966-1968, with the exception of the St. Paul segment of I-94, for which data were available for only the 1966-1968 period. The 46th-58th Street segment of I-35W will be used to illustrate this portion of the study. As Figure 25 shows, there is little relationship between freeway proximity and turnover rate. This was the case for all segments sampled. There was, however, as one would expect, an increase in rates between the two periods.

An attempt was made to determine if freeway proximity had a significant effect on this rate increase by comparing the rates of the sample segments with specified control areas. The average turnover rate for the control streets in the 1954-1956 period was 3.6 percent. The 28th-46th Street segments were considerably higher than this rate, and the 66th Street and I-94 segments were somewhat lower. These findings do not display a consistent pattern of cause and effect, and obviously factors besides freeway proximity are affecting these areas. Thus, in the majority of cases there appeared to be little relation between location and turnover rate.

Relation of Actual Market Value to Assessed Values

The final variable considered in this study was that of a comparison of actual market values for selected homes with that of assessor's estimated market value. This portion of the report deals with 1968 values only. Data for this purpose were drawn from an area along I-35W from 28th to 56th Street to consider comparisons of market and estimated values for streets adjacent to the freeway and those one-half mile away. Fifty addresses along Stevens, Second, Harriet, and Columbus Avenues were considered. An average of actual sales prices for these

homes was determined and compared with the average of the assessor's estimated values for these homes to determine if there were any major differences between actual and estimated values that could be attributed to freeway proximity.

Figure 26 shows a difference in market and estimated values for streets adjacent to I-35W and those streets one-half mile away. Columbus and Harriet, a half mile on either side of I-35W, have market values which are, on the average, greater than those estimated by the assessor's office. This is also the case for Stevens Avenue, but to a smaller degree. Second Avenue has an average market value lower than that estimated by the assessor's office. This indicates that a street directly adjacent to a freeway grows in value at a rate somewhat slower than streets at least one block removed.

Summary

In the majority of cases, there are few instances of direct freeway effects on residential property values. Certainly, one can find individual cases in which the home owner claims that his home has suffered a loss in value because of the presence of a freeway. On the other hand, one could as easily find individual cases in which homes have increased in value in the presence of freeways. However, the findings of this research show both examples as being exceptions rather than the rule. Therefore, the main conclusion is that in the vast majority of the cases (perhaps 90 percent), there is no appreciable relative change in value patterns for residential property before and after freeway construction.

An additional conclusion is that, by and large, there is no difference in relative market values related to distance from the freeway that did not exist before freeway construction. The exceptions to this point, in a few cases, are for those streets directly adjacent to the freeway, where growth in value is sometimes at a slower rate than streets one block or more away from the freeway.

Finally, the study of turnover rates versus time and location also indicates that there is little direct freeway influence on this aspect of property values. A high rate of turnover generally indicates an increase rather than a decrease in property values. Other factors being equal, people reluctantly sell homes at a loss. Freeways tend to have little influence on the rate of sales of homes.

The comparison of average market values and estimated values confirmed two major findings of this report. First, the overall effect of freeways on property values is negligible, as can be seen by the evidence of market value being higher than estimated value in three out of four streets. Second, there is a difference in growth rates in certain cases between streets adjacent to the freeway compared to those at least one block removed.

4. ALTERATION OF PROPERTY TAX PATTERNS

Methodology and Background

The principal sources of information for the analysis of property tax patterns and trends in the Metropolitan Area are assessed valuation figures, which were obtained from the State Department of Taxation, and building-permit data from Minneapolis, St. Paul, and eight suburbs which account for the majority of new investment in the metropolitan area. The assessed valuations reported in the following section for the year 1969 is that level of valuation for which taxes are payable in 1969 but which is based on a valuation made as of January 1 of the previous year (i.e., January 1, 1968). Assessed valuation is a composite figure representing a factoring of a portion of the estimated market value of all properties in a given community. The estimated market values are multiplied by a percentage, which the Minnesota Commissioner of Taxation has recommended to be 33-1/3 percent, to arrive at what is termed the adjusted market value.

The Minnesota State Legislature enacted a sales tax in 1967 and at the same time reduced the personal property tax payable by industrial and commercial firms on inventories or equipment. This created a change in the basis of personal property assessed valuations between 1967 and 1969, and accounts for some of the behavior of the assessed valuations between 1967 and 1969 on some of the graphs in this section. Homesteaded real property is residential property occupied by the owner. Nonhomesteaded real property includes all other types of residential, commercial, and industrial properties.

Building-permit data were used to analyze commercial and industrial investments in the metropolitan area. These building permits are rough estimates prepared by the contractor or developer. Both city inspectors and tax assessors expressed the opinion that these estimates are usually below the actual cost, with the presumed hope of gaining some advantage in assessed value.

Assessed Valuations

The trends in total assessed valuation for the seven county metropolitan area, for Minneapolis and St. Paul, and for the suburbs are presented on Figure 27 for the period from 1955 through 1969. The growth rate of assessed valuation for the entire metropolitan area is fairly uniform over this 14-year period and amounts to 4.2 percent average growth per year. The two central cities of Minneapolis and St. Paul show an increase through 1963 followed by a slight decrease through 1969. The assessed valuation in the suburbs, however, is growing at an increasing rate, with the 1967 to 1969 period exhibiting a 9.1 percent increase per year, more than double the rate for the metropolitan area.

The composition of the Minneapolis and St. Paul assessed valuations in terms of nonhomestead and homestead real property are presented in Figures 28 and 29. Although the levels of valuation are different for the two cities, the trends in assessed valuation are distinctly similar for the 14-year period. The homestead real property valuations show a slight increasing trend through 1967, in almost parallel behavior for the two cities, and then there is a sharp rise of between 16 and 17 percent from 1967 to 1969 for both cities. The 1967 to 1969 increase may be due, in part, to administrative action by the tax assessors because of the sales tax enactment and adjustments in the percentages used to compute adjusted market value of properties. The total increase from 1967 to 1969 in each city is, therefore, not the result of a significant addition to the real homestead property.

The nonhomestead real property valuations for both St. Paul and Minneapolis, again, exhibit parallel behavior. There are fairly rapid increases from 1955 through 1965, followed by decreases, with Minneapolis showing an initial drop from 1965 through 1967 and a more precipitous drop from 1967 through 1969. The percentage decrease from 1967 to 1969 for both cities was very nearly equal, amounting to 19.5 percent in Minneapolis and 17.5 percent in St. Paul. This drop in nonhomestead real property valuation resulted from legislative and administrative

action associated with the sales tax passage and the accompanying opportunity for personal property exclusion.

The geographic distribution of total assessed valuation and nonhomestead assessed valuation for 1955, 1963, and 1969 is presented on Figures 30 and 31. The metropolitan area is divided into a number of subareas including Minneapolis, St. Paul, Anoka County, Washington County, Dakota County, Scott County, Carver County, and then, the northwestern[1] suburbs of Minneapolis, the western[2] suburbs of Minneapolis, the southwestern[3] suburbs of Minneapolis, Roseville and Maplewood, and, finally, the remaining portions of Ramsey and Hennepin Counties.

Figure 30 depicts the percentage distribution of total assessed valuation in the seven-county metropolitan area. Aside from Carver County, which showed a slight decrease from 1955 through 1969, only Minneapolis and St. Paul exhibited any significant decrease during this time. The southwest suburban area of Minneapolis had one of the higher growth rates and the highest share of total valuation outside the central cities. Anoka County had the highest growth over the 14-year period.

Analysis of the relative distribution of total valuation in 1969 reveals four percentage groupings for the thirteen subareas. There are the central cities and Scott and Carver Counties at the high and low ends respectively. In between, eight of the remaining nine subareas are grouped in the four to seven percent range of total valuation. The southwestern suburbs of Minneapolis with about 11 percent of total valuation represent the last of the four groups.

---

(1) Brooklyn Center, Brooklyn Park, Crystal, New Hope, Robbinsdale.

(2) Golden Valley, Hopkins, St. Louis Park.

(3) Bloomington, Edina, Richfield.

Figure 31 presents the nonhomestead assessed valuation by percentage for each area in the same manner as Figure 30 presented the total assessed valuation. The nonhomestead valuation is probably a better indicator of the level and distribution of income producing industrial, commercial and residential properties than total assessed valuation. A comparison of Figures 30 and 31 reveal that the central cities have a greater proportion of the total nonhomestead valuation than of the total assessed valuation in the metropolitan area. During the 14-year period, residential investment has been proportionately greater than job and income producing investment in the suburban areas. However, in both cases, the suburbs are experiencing more new construction investment than the central cities.

It is noteworthy that in both "Other Hennepin County" and "Other Ramsey County" areas, the share of nonhomestead assessed valuation increased during the 1955 to 1963 period but decreased during the 1963 to 1969 time span. This indicates that during the latter period, these two areas did not experience the same rate of income-producing investment as the rest of the suburban metropolitan area, exclusive of Carver County. However, residential investment in these two areas has more than offset this trend as shown by the total assessed valuation trends on Figure 30.

Analysis of the percentage groupings of 1969 nonhomestead valuation indicates a similar number of four groups. The low and the high percentage groups are the same as in the total valuation -- Scott and Carver Counties and the central cities, respectively. The large group in between includes seven of the remaining nine subareas and spans a range of three to six percent, in contrast to the four to seven percent range for eight subareas in the total valuation analysis. The last group includes the southwestern Minneapolis suburbs at 8.6 percent and Dakota County at 7.5 percent of total metropolitan nonhomestead assessed valuation.

Industrial and Commercial Investment

The dollar investment in suburban areas, including only the first ring of suburbs around the central cities where most of the construction

has occurred, is reported for the period from 1950 through 1969 on Figure 32. This investment in commercial and industrial enterprises shows a dramatic growth from 1962 through 1969, amounting to a 500-percent increase in annual investment. Some of this increase reflects inflationary cost increases. However, inflationary effects are comparatively small compared to the overall growth rate.

The level of commercial and industrial investment in the cities of Minneapolis and St. Paul is compared to that in the suburban areas on Figures 33 and 34. Figure 33 shows an index which is the ratio of this investment in the cities to the investment in the suburbs. As indicated, investment in industrial and warehouse construction in the early 1950's was heavily concentrated in the central cities, with a 1953 index of almost seven. It is evident that the trend is a decreasing one and has been since the peak was reached in 1953. The industrial and warehouse investment index crossed the equal investment point (1.0) for the central cities and suburban areas between 1955 and 1956, again moved up to that point in 1958, and subsequently dropped to between 0.2 and 0.5 through 1969.

The commercial investment index is also presented as a Minneapolis and St. Paul to suburban ratio comparison from 1960 through 1969. It is apparent from the plot of this index that investment in commercial properties in the two center cities has exceeded investment in suburban areas through 1967. In fact, the index indicates a 10 percent to 130 percent greater commercial investment in the center cities than in the suburbs. The index drops to less than one (the equal investment point) in 1968 and has remained between 0.6 and 0.4 for the past two years.

Figure 34 presents an investment index indicating the ratio of the cumulative investment starting with the year 1950 in the Minneapolis and St. Paul center cities in proportion to total suburban investment. This graph provides a sense of the movement over time of the cumulative trends of commercial and industrial investment with regard to location in the center cities or in the suburbs.

The graph of the industrial and warehouse investment index shows the fluctuations of the early fifties as previously indicated but reduced in apparent amplitude and followed by a continuing downward trend from 1953 through 1969. It may be reasonable to speculate that the cumulative index may be flattening out around 0.2 or 0.3 if the curve can be validly extrapolated in a continuing trend of that indicated on Figure 34. What this would mean is that investments in industrial and warehouse facilities would stabilize in subsequent years at a fixed ratio of between 5 to 1 and 3 to 1 in favor of suburban areas.

The commercial cumulative investment index also presented on Figure 34 exhibits a distinctly different behavior and it, too, reflects the behavior of commercial investors indicated on Figure 33 but, again, with the fluctuations reduced in amplitude. The cumulative investment since 1960 remained heavily in favor of the central cities, with 50 to 70 percent more commercial investment in the central cities than in the suburbs through 1967. The drop-off from 1967 through 1969 is precipitous. However, this is due to the fact that the graph depicts the cumulative commercial investment only since 1960 and therefore fairly small shifts of investment to the suburbs may result in apparently drastic changes. For example, in the suburbs, the investment of $55 million during 1968 exceeded that in the center cities by $24 million and the 1969, $58 million investment exceeded the center cities investment by $34 million. Therefore, the differences are not as great as might be inferred from the graph. It would be difficult to conclude what the future behavior of this curve will be. It may be reasonable to expect that there will be a continuing downward trend. However, it may be at a substantially reduced rate of decrease accompanied by random fluctuations of relative gain or loss by the center cities. Such commercial investments as the IDS Tower and similar developments in Minneapolis would seem to support the expectation that the central cities of Minneapolis and St. Paul will continue to hold their own in competition with the suburbs and that this commercial investment index curve may not depart drastically from the indicated performance of the 1960's.

In conclusion, movement of industrial and warehouse investment into the suburban areas surrounding the central cities has been well documented. The trends in assessed valuations, again, out of the central cities into the suburbs has also been well established. Looking at these data in light of the reported business preference to locate on sites with good road accessibility and to weigh the results of decisions with regard to site locations and their relationship to freeways, one must conclude that there is a definite relationship, although probably not singular or exclusive, between metropolitan freeway development and the dispersion of assessed valuations and the concurrent movement of industrial and commercial investments throughout the metropolitan area.

The Effect of Freeway Acquisitions on the Minneapolis Tax Base

The effect of the removal of dwellings from freeway right-of-way on the tax base of Minneapolis was discussed in some detail in the section on changes in land use. It was demonstrated that the negative impact of the construction of both I-35W and I-94 on dwelling units was small. The dwelling units removed were rapidly replaced, and in areas within one-half mile of these freeways in Minneapolis there was a net gain of 1651 dwelling units from 1960 to 1969. This represents 18.7 percent of the total gain for Minneapolis (8,851 units) for the same period. The largest single increase in the study area (1485 units) occurred in the area from 18th to Lake Streets west of Chicago Avenue. This area was characterized by large numbers of substandard and blighted single-family dwellings, many of which were removed and replaced with new large multiple-dwelling complexes. Thus, many houses of low market value and consequent low assessed value which contributed few tax dollars to the community were replaced with greater numbers of newer dwelling units of higher assessed value. This represents a net gain of property tax revenue to Minneapolis.

From the economic point of view, the replacement of older and less desirable single-family dwelling units by new multiple-dwelling unit complexes is beneficial. The upgrading of the quality of the units frequently attracts an occupant on a higher economic level with greater disposable income. The fact that few multiple-unit dwelling buildings

qualify for homesteading results in a higher tax yield per unit for the city. Finally, it returns to the city many persons who under other conditions would have left the city for suburban life.

Table 17 represents the total adjusted market value and the assessed value of all taxable real property in the city of Minneapolis from 1957 to 1969. Table 18 shows the losses of adjusted market value by major cause from 1956 to 1968. Acquisition of freeway right-of-way amounted to $23.6 million during this period. This represents 53.8 percent of the total loss of adjusted market value during the period. All other factors amounted to 46.2 percent of the total tax base loss.

Based upon the total adjusted market value of all real property in the city of Minneapolis for the year 1969, the total adjusted market value of the property removed for freeway right-of-way for all years represented 2.4 percent. Due to changes made in the calculations of adjusted market value in 1966 (See Table 17), valid ratios between total adjusted market value and losses of adjusted market value are difficult to calculate. However, in the year 1965, total adjusted market value was 1.01 billion dollars and 14.6 million dollars (or 1.4 percent) had been removed up to this year from the tax rolls for freeway. Using either figure (2.4 percent or 1.4 percent), the impact of freeway removal on the tax base was very small. Losses in adjusted market value for the city of Minneapolis, including freeway and other removal, from 1957 to 1965, were 21.1 percent and from 1957 to 1969 (adjusted) were 17.0 percent. The small loss of tax base was quickly repaired through overall growth.

5. ECONOMIC IMPACT ON COMMERCIAL AND INDUSTRIAL FREIGHT

Methodology

The methodology employed in determining the economic impact of the freeway system on the distribution of commercial and industrial freight included:

1. An examination of the literature to find studies which reported on the freeway and its relationship to industrial and commercial development and the relative importance of freeway access and use to this development.
2. Interviews with a large number of local commercial and industrial companies in order to solicit their opinions with regard to the use of freeways in the metropolitan area and to obtain data with regard to cost and time savings by the use of freeways.
3. The collection and analysis of data on plant locations before and after freeways were built and opened in the metropolitan area.

Much of the information gathered with regard to the freeway system and its relationship to commercial and industrial freight is user opinion or attitude. A management decision is typically based on as much factual data as available within given time and cost constraints and also some intuitive feelings or attitudes on the part of the decision maker, which may be nonquantifiable or even unidentifiable. Both of these will have some bearing on the decision-making process. Thus, by looking at decisions that have been made with regard to plant location, it is appropriate to infer certain advantages to specific sites of intensive development based on their relationship to such factors as freeways, the access points to freeways, and other good roads. Without being able to say that freeway access or proximity has some specific and quantifiable value in the decision making process, it is still possible to say that, on the basis of observation of plant location decisions and of information reported in the literature, freeways can be assessed as to their relative importance to commercial and industrial freight.

During the interviews with commercial and industrial freight users, an attempt was made to determine the value of time savings based on the use of freeways in the metropolitan area. A value for these time savings was unknown or unavailable from most companies. However, most companies had a strong feeling that freeways did indeed save time and money and should be used at every opportunity. A small number of companies did have rough estimates of the dollar cost per hour to operate a commercial vehicle in the metropolitan area. There was close agreement in the hourly costs reported by companies in various types of industries. The figure ranged from $7.50 per hour to $10.00 per hour for all costs including truck maintenance and driver's wages. The estimation of the cost savings to commercial and industrial companies was based on the low figure in this range -- $7.50 per hour -- in the analysis reported in the following sections of this report.

Site Location

The decision to locate a commercial or industrial plant at a new site is based on a composite of numerous factors including such things as space adequacy, highway access, labor market location, land cost, relative distance to market, zoning restrictions or limitations, distance to executive officer's residence, availability of utilities, access to rail transportation, etc. The landmark Route 128 Study, in the metropolitan area of Boston conducted by the Massachusetts Institute of Technology, rated the major factors considered in site selection by industries that located on Route 128. Commercial accessibility and land for expansion were rated as first or second most important to the companies as measured on the basis of percentage of plants and percentage of total investment located on Route 128. In that report, commercial accessibility was used to indicate "ease of access for business purposes such as truck pickup and delivery, salesman and business calls, customers' visits, etc.," and land for expansion indicated "availability of enough land for both present and future space requirements. This space may be needed for enlarged production, more efficient operation in one story buildings versus multiple story buildings, or a combination of these factors."

An unpublished study prepared by a member of the Twin Cities Metropolitan Planning Commission in November 1965 reports the results of a survey of 43 business firms in the Twin Cities Metropolitan Area. This study reported that the most sought after amenity in a new site was good highway and truck accessibility. The other factors previously mentioned were reported less frequently by firms as reasons for selecting new sites for plant locations. The author of the Planning Commission report suggested further that industrial firms, "when commencing the search for a site have a rather vague idea just what is desired, and this vagueness is submerged in statements of efficient transportation." Although this may be true, the relative importance of good transportation is apparent in the emphasis placed on transportation and the recognition of the role of transportation costs in the operations of the company.

Twenty-two interviews were conducted with public officials and businessmen including executives of companies that have been located in the Twin Cities for many years and of companies that represent a variety of industrial and commercial activities. Some of the most active land and industrial park developers, especially those in the industrial development field and public officials who are involved in industrial development work were also consulted. The major importance of freeways in the decision to locate at a specific site is the unanimous opinion among all of these people. Quotes range from "significant" to "of number-one importance" in the selection decision regarding plant sites. Some of the business executives indicated that their decision to locate at a specific site was based on a number of factors, most of them being of relatively equal importance. At the same time, they acknowledged that in the decision-making process, certain factors carry more weight in the minds of some executives than other factors. These reflect personal priorities, responsibilities, or simply preferences.

Although recognizing the importance of freeways, some of these same executives and public officials also offered opinions that freeways were not without some disadvantages or negative impact on a number of aspects of life in the metropolitan area. The need for other types of

transit and the need to minimize the negative effects of freeway development were frequently mentioned in these interviews.

An executive of one of the more active local retail firms, who is responsible for decisions directly related to new site selection and new developments, suggested that commercial development outside of the Central Business District would have been hastened without freeways. He indicated further that access both into and out of the Central Business Districts is provided by the freeways and that without freeway-based ready access, retail and commercial development would have moved to the suburbs as these businesses followed the population, and most importantly, the movement of disposable income into the suburbs. He went on to indicate a recognition of the fact that the employment composition and opportunities were changing in the Central Business District but that the viability of the Central Business District was dependent, to a great extent, on freeway access from suburban areas.

Figure 35 depicts the location of new commercial and industrial facilities for 1958 and 1969 and the distribution of these locations relative to freeways and other roads. The 1958 data represent the location of all new factory and warehouse construction. The 1969 data, on the other hand, indicate only freight terminals and warehouses built during that year. It is evident that commercial and industrial firms tend to locate along good roads. The 1958 locations indicate a preference for the existing quality roads, especially Highways 8, 12, 55, and 100, none of which were freeways. The 1958 construction also was located closer to the Central Business Districts of the two cities than the 1969 construction. The 1969 data, on the other hand, indicate a far greater spread throughout the metropolitan area with a strong preference, again, for the good roads of the time, which of course are freeways.

Nine areas within the metropolitan area have also been outlined on Figure 35. These areas were defined as the "major areal and nucleated concentrations of industrial expansion with the Twin Cities area, 1960-1962," in the previously mentioned unpublished report by a Metropolitan Planning Commission staff member. These areas include most of the plant locations for 1958 and 1969. The 1969 sites in several instances indicate

a continuation of the early 1960's trend to locate along the roadway corridors and to move outward and away from the central cities. These additional data serve to reinforce the conclusions of the previous discussion on the role and importance of freeways or quality roadways in plant location decisions.

Time-Related Cost Savings

The estimation of time-related cost savings for commercial vehicles must be based on a number of assumptions about commercial vehicle traffic volume, average speeds on freeways and other urban roads, and dollar value of time saved. On the basis of discussions with highway engineers, city traffic engineering departments, and commercial and industrial traffic departments, the following assumptions were made in order to compute the time-related cost savings of freeway use by commercial vehicles:

1. The average speed of commercial vehicles on city streets ranges from 15 to 20 miles per hour.
2. Commercial vehicles account for 20 to 40 percent of annual vehicle miles on urban interstates in Minnesota.
3. Seven dollars and fifty cents per hour is used as the value of time to commercial and industrial firms to operate their vehicles on all roads.

Traffic counts conducted by the Minnesota Highway Department outside of the Minneapolis/St. Paul city limits on freeways and other major highways include commercial traffic counts. Based on traffic counts from nine selected points[1] circling the Twin Cities area, commercial traffic volume amounted to 18 percent in 1968 in comparison with 15 percent in 1966. One other piece of information that might be used as a guide in estimating the commercial vehicle volume in vehicle miles per

---

(1) I-35W in Bloomington, I-35W in Richfield, I-494 at 35W, Highway #100 between Highways #7 and #12, I-494 at Highway #5, I-694 at Highway #169, I-35W at Highway #36, Highway #36 at Highway #51, and Highway #100 at Highway #61.

year would be the percentage of commercial vehicles registered for a given year. This figure, as reported on Figure 41, has increased steadily since 1960 to 12.7 percent in 1969. Both the commercial daily traffic volume and commercial vehicle registrations include only commercial vehicles that are readily identifiable, such as trucks, semitrailers, etc. These figures do not include passenger cars that are being used by people in business activities and although these cars are part of the commercial vehicle useage of the freeways, no specific economic benefit is being claimed in this study for this use.

Thus, the commercial vehicle percentage of vehicle miles per year was set at between 20 and 40 percent of the total vehicle miles on urban interstates in Minnesota. As a point of interest, savings have also been computed at a level of commercial useage of 60 percent of total vehicle miles as an assumed absolute upper limit. Figure 36 presents the estimated time-based annual dollar savings for commercial vehicles using urban freeways as a function of the average speed of commercial vehicles on these freeways. The two different sets of lines indicate the savings realized if the average speed on a city street is 15 miles per hour or 20 miles per hour. Lacking an estimate of average speed on urban freeways, it was assumed that for the purposes of reporting, the likely range of average speed for commercial vehicles would be 40 to 45 miles per hour on the urban interstates. Therefore, the dollar savings would range from about $50 million to $100 million per year (depending on the proportion of commercial vehicle miles) to be realized by commercial vehicle users of urban freeways. The upper limit of savings, if the average city speed was only 15 miles per hour and commercial vehicles accounted for 60 percent of total vehicle miles per year, would be about $170 million per year, however the 60 percent figure is highly unlikely. All of these computations include the assumption that the same total number of vehicle miles would be driven with or without the freeways. This is not correct as evidenced by the model presented in a subsequent section of this report. Therefore, these cost savings should be discounted by some percentage -- perhaps 10 or 20 percent, or even more -- to be more realistic; however, the accuracy of these estimates is unknown and may be no better than 20 percent and the discounting thus unnecessary.

An attempt was made to put these savings in terms of the estimated total cost of commercial driving on highways in all urban areas of the state. Figure 37 presents a graph of these percentages as a function of the average speed of commercial vehicles on the interstates in urban areas. Again, assuming 40 to 45 miles per hour average speed as the most likely, the dollar cost savings associated with time savings from commercial driving on urban freeways would vary between 7.8 percent and 8.8 percent of the estimated total cost of all commercial driving on all roads in the state. Both the total sum of estimated savings ($50 million to $100 million per year) and the savings percentage of total driving costs (7.8 to 8.8 percent) are impressive figures. The well-known squeeze on sales, profits, and incomes is being ameliorated in a number of ways by businesses and, certainly, freeway use by commercial and industrial vehicles is one of the ways for local business to operate and compete more effectively at all levels of the economy.

6. GENERAL ECONOMIC IMPACTS ON THE COMMUNITY

Research Methodology

The research on this particular aspect of the freeway impact covered the entire metropolitan area in some cases and in others, especially the accident analysis, concentrated on specific locations within the metropolitan area. Some general information with regard to population, vehicle registration trends, and annual vehicle miles driven, are presented as background material to enhance an understanding of other general economic impacts of freeway development in the metropolitan area. The research involved the accumulation of data and information from many sources, followed by graphical and mathematical analysis of these data to give some insights into the comparative and concurrent developments and trends in these various aspects of community life.

In the case of some parameters such as the percentage of commercial traffic on city streets and freeways or the average speed at which motor vehicles can travel on different types of thoroughfares and freeways, or the actual carrying capacity of the city street, the information was not available in terms of hard and fast numbers. The basis for the values used in this section are, therefore, based on the informed opinions and judgments of highway department and city traffic engineering personnel. Usually this takes the form of a most likely range for these values and is presented in graphical form to span the range of variation in these parameters of highway usage and design.

Background

This section provides background data and information to facilitate a better understanding of the developments concurrent with freeway construction in the metropolitan area. The table on page 63 presents information on the miles of urban roadways and urban interstates in the entire state of Minnesota for the years 1967, 1968, 1969, and a projection for the year 1975. The miles of roadways and interstates are for all urban areas in the state of Minnesota, but the vast majority of these roads are located in the metropolitan area, especially the interstates.

Year	Urban Interstates	Total Urban Roadways
1967	97	14,224
1968	116	14,312
1969	129	14,675
1975	226	16,113

These same data are presented on Figure 38 along with an index presenting the increase in miles of interstates and total urban roadways with 1967 as the base year. This index is a means of depicting the rate of increase in the miles of the two different systems. As would be expected, the rate of increase in the urban interstates is far greater than that for the urban roadways because of the smaller initial interstate mileage in 1967.

Trends in the population and number of vehicles in the seven-county metropolitan area are provided in Figure 39 from 1959 or 1960 through 1969 and 1970. The rate of growth of population and vehicle registration proceeded at a fairly equal rate during the early sixties followed by a very obvious divergence between them from 1967 to the present. The population rate flattens out somewhat and vehicle registrations increase at a more rapid rate.

A comparison of the motor vehicles per capita and the increase in motor vehicles per capita between the metropolitan area, the entire state of Minnesota, and the U. S. is presented on Figure 40. The number of motor vehicles registered per capita in Minnesota and in the metropolitan area from 1960 through 1969 is greater than the national average. These figures for 1969 were 0.52 for the entire U. S. in comparison with 0.58 for Minnesota and 0.6 for the metropolitan area. The average growth over the nine year period for the three different areas was 3.0 percent per year for the U. S., 2.9 percent per year for the metropolitan area, and 2.7 percent per year for Minnesota on the basis of a simple compound interest rate.

The proportion of different types of motor vehicles has been changing over the last ten years in the metropolitan area. Figure 41 indicates the percentage of various types of vehicles relative to the total number of vehicles registered in the metropolitan area. The scale on each vertical axis is the same so that the change in percentage for any one group can be readily compared with the change in percentage for another group. For example, the passenger car percentage showed the greatest change from more than 79 percent in 1962 to 74 percent in 1969. Commercial vehicle registration increased from 1960 through 1969 about 1.6 percentage points and busses remained essentially the same at between one-half percent and one-quarter percent. Commercial vehicles included the following class designation established by the Secretary of State, Motor Vehicle Division: gross weight trucks, urban trucks, miscellaneous trailers (certain semitrailers), semitrailers, and urban semitrailers. The bus category includes all public, private, and school busses. Pleasure and recreation vehicle registrations for motorcycles, campers, trailers, etc., increased 3.8 percentage points from 1962 to more than 13 percent in 1969.

The Minnesota Highway Department compiles data on annual vehicle miles driven on various types of roads in the state of Minnesota. Figure 42 shows annual vehicle miles for all urban roads including freeways, as well as the annual vehicle miles driven only on urban freeways for 1967 through 1969. Total annual urban vehicle miles in Minnesota fall on a fairly straight line when plotted against time. The annual vehicle miles driven on "final" urban interstates also can be linearly related to time.

The extrapolation of total annual vehicle miles was made simply on the basis of extending a straight line constructed from the three points for the years 1967 through 1969. Assuming that the time-based extrapolation is valid, the vehicle miles driven on urban interstate highways may then be estimated as some percentage of the total urban vehicle miles.

The three dashed lines represent three alternative assumptions -- 25, 30, and 40 percent -- for urban interstate vehicle miles as a percentage

of total urban annual vehicle miles by the year 1972. There is a good basis for prediction at about the 30 percent level based on information on highway classifications by the Minnesota Highway Department.

The Minnesota Highway Department classifies freeways by rural and urban and also as either "final" or "traveled-way". Final interstates are those that are completed and in use. Traveled-way freeways are the roadways used by motorists that parallel the planned location of future freeways or from which the interstates will most likely draw traffic. The use of data on this latter classification could be construed as a rough prediction or estimate of future demand on freeways yet to be completed or constructed. As is indicated on Figure 42, the present annual vehicle miles for urban interstates represent about 15 to 16 percent of total annual vehicle miles. However, the combined final and traveled-way freeway annual vehicle miles for 1969 represent 23 percent of total urban vehicle miles in Minnesota. On the basis of this 23-percent figure, it would seem to be reasonable to extrapolate to perhaps 30 percent or higher within the next several years for future vehicle miles that will be driven on urban freeways as a percentage of total annual vehicle miles driven on urban roads.

Model for Predicting Vehicle Miles

This section presents a description of a simplified mathematical model, which was constructed to permit additional analyses in other sections of this report. This model is based on a hypothesis formulated out of the experience of people encountered in the research conducted for this study and on the personal experiences reported by a number of people. The hypothesis upon which this model is based is that a mile of freeway completed in an urban area generates a greater number of total vehicle miles driven than an additional mile of regular roadway constructed. People will go out of their way to drive on the freeways, and this results in an increase in the number of vehicle miles driven on a per capita basis, the model is formulated around the premise that the change in annual vehicle miles from one year to the next is a function of the following three factors:

1. The change in the number of miles of urban freeways as a percentage of total urban roadways.
2. The change in other urban roadway miles as a percentage of total miles of urban roadways.
3. The percentage change of the general economic condition of the population of the area.

In other words, the percentage change in annual vehicle miles driven in urban areas over some time period will increase with additional miles of interstate as well as additional miles of other urban roads and also in some relationship to the general economic condition of the population of the area. For purposes of this model, the measure of economic condition of the population was the average of the change in manufacturing average weekly earnings and the change in wage and salaried employment both expressed as a percentage of the value of each variable at the start of the time period minus the cost of living increase for the time period, also as a percentage. The formula for this model would be as follows:

$$\frac{\Delta VM}{VM_i} = A\left(\frac{\Delta I\text{-}S}{TMUR_i}\right) + B\left(\frac{\Delta OUM}{TMUR_i}\right) + C\left[\frac{\left(\frac{\Delta MWE}{MWE_i}\right) + \left(\frac{\Delta WSE}{WSE_i}\right)}{2} - \frac{\Delta CPI}{CPI_i}\right]$$

Where:

ΔVM = change in annual vehicle miles driven over a given time period.

VM_i = annual vehicle miles driven at beginning of time period.

$\Delta I\text{-}S$ = change in number of miles of urban freeways during time period.

$TMUR_i$ = total miles of all urban roads at beginning of period.

ΔOUM = change in number of miles of other urban roads during time period.

ΔMWE = change in manufacturing average weekly earnings during time period.

MWE_i = manufacturing average weekly earnings at beginning of period.

ΔWSE = change in the number of wage and salary employees employed during the time period.

WSE_i = number of wage and salary employees employed at beginning of period.

ΔCPI = change in the Consumer Price Index during the time period.

CPI_i = Consumer Price Index level at beginning of period.

A,B,C = coefficients of the independent variables to be determined from simultaneous solution of three equations obtained for three different time periods with available data.

The Minnesota Highway Department supplied data for the periods 1967-1968, 1968-1969, and 1969-1975, including some assumptions, for all variables except A, B, and C, which are the coefficients for the independent variables in the equation. From the three equations resulting from the data, the coefficients were calculated to be:

$$A = 13.64$$
$$B = 3.61$$
$$C = 1.67$$

The important conclusion to be drawn from this result is that there is a strong indication that the addition of freeway miles does indeed increase at a more rapid rate the annual vehicle miles driven than the addition of other types of urban roads. On the basis of the ratio of A to B, the rate of increase due to freeways is indicated to be almost four times greater than that due to other roads. As a result of this finding, there are implications with regard to the cost of operating cars in terms of accident rates, operating costs, and other economic factors that are to be examined and discussed in other sections of this report. Again, it is important to recognize that this is a simple model of an undoubtedly complex relationship. However, it is assumed to be sufficiently accurate to be of some use in examing the economic impact of the freeway system in the metropolitan area.

Economic Impact on the Community

That there are economic costs of congestion[1] on city streets is evident. However, these costs are also nonquantifiable within the scope of this study. Time is perhaps the most obvious cost. The amount of time that is lost to congestion and its value have not been determined in this study. Property values of both commercial and residential properties may be adversely affected by congestion. Increased operating costs for motor vehicles result from congestion. Increased accident rates accompany congestion, and there are numerous other costs to which an economic value might be assigned resulting from congestion on urban streets. Businesses also suffer from congestion due to the loss of customers unwilling to undergo the problems concomitant to traffic congestion.

One of the problems in dealing with congestion is the definition of congestion and a determination of when it occurs for various arterial streets in the metropolitan area. Figures 43, 44, and 45 present traffic volume data reported as average daily traffic volume (ADT) for combinations of streets that would most likely be affected by the opening of I-94 and I-35W in Minneapolis and St. Paul. The data cover the period from 1956 through 1969. The east-west streets in Minneapolis that are included in the traffic volume count are Lake Street, Franklin Avenue, 28th Street, 26th Street, and University Avenue. The north-south streets in Minneapolis included Lyndale, Nicollet, Portland, Park, and Cedar Avenues. In St. Paul the east-west streets paralleling I-94 were limited to University and Marshall Avenues. In each case, an attempt was made to include the arterial streets which carried most of the traffic that the freeways would subsequently carry after opening.

The purpose of this analysis was to examine the relative congestion on these arterial streets before and after the freeways were opened. To do this, an approximation of the carrying capacity of the streets was

---

(1) Congestion is defined in the Highway Capacity Manual, 1965, published by the Highway Research Board as an "E" level of service and described as an "unstable flow" condition with "intolerable delay" and a load factor between 85 and 100 percent.

necessary. The method used in estimating this carrying capacity is based on suggestions and figures reported by sources within the Minnesota Highway Department, the Federal Highway Administration, and the Traffic Engineering Offices of Minneapolis and St. Paul.

The carrying capacity of a street is based on a given number of vehicles per lane per hour; and this, reportedly, can range from a low of 500 up to about 1,000, depending on a number of factors including the number of turns, the number of trucks normally in the traffic flow, the existence of turn lanes, and, probably of most importance, the signal light phasing and timing. In addition, streets such as the ones considered here will typically have peak traffic flows during the morning and evening rush hours. The peak-hour traffic flows will be limited to some figure within the range of 500 to 1,000 vehicles per lane per hour. The average daily traffic volume is typically computed by highway and traffic engineers in terms of the peak-hour flow which, as a rule of thumb, reportedly is about 10 percent of the average daily traffic volume. This percentage may drop to 7 or 8 percent on highly commercial streets such as University Avenue where the peak-hour flows are not that much greater than normal traffic flows throughout the business day. In addition, other streets that have exceptionally high peak-hour flows of traffic and very little other traffic may have a peak-hour percentage of up to 14 or 15 percent.

In reference to Figure 43 for the Minneapolis east-west streets, average traffic volumes were in the congestion range during the middle 1960's, dropped in the period from 1964 to 1966, and with the opening of I-94, dropped further to below the congestion level. The effect of the freeway opening was even more pronounced on the north-south streets. Figure 44 indicates that since 1958, the north-south streets had been operating within the congestion range and perhaps at the ultimate capacity for these streets during the mid 1960's. The opening of I-35W drastically reduced the average daily traffic volume on these streets to a level below the estimated congestion range.

An additional note should be made with regard to the volume carried by the freeways subsequent to their opening. The I-94 freeway carried about 65,000 vehicles per day or about 80 percent of the 1969 traffic

volume on the east-west street combination in Minneapolis. This would put the total traffic volume, if the arterial streets were required to carry this capacity, well above the designated range for congestion. Likewise, I-35W is carrying a substantial volume of traffic in comparison to the combination of north-south streets. In fact, the freeway volume as indicated for 1967, 1968, and 1969 is about 105 to 110 percent of the arterial street volume. Again, the total traffic volume in the north-south direction would be far in excess of the carrying capacity of the north-south streets without the freeway.

Figure 45 presents average daily traffic volume for the east-west streets, University and Marshall Avenues, and for the I-94 segment in St. Paul between the Central Business District and the west city limits. The traffic volume since 1956 is within the maximum carrying capacity for these two streets, suggesting a congested situation. The traffic volume on I-94 has increased by a factor of three times since its opening, as indicated on the graph. The concurrent drop in traffic on University and Marshall Avenues is likewise evident, exhibiting a drop from 1966 through 1969 of about 40 percent in the average daily traffic volume. The total traffic flow recorded in 1969 for the two arterial streets and the freeway is, of course, far in excess of the carrying capacity of the two arterial streets without the freeway.

The relief of congestion is well documented on the basis of these figures. In addition, traffic flow on neighborhood streets carrying vehicles to the arterial streets is also probably reduced by the freeway system. The net effect would be a gross reduction of traffic volume on some city streets, including arterial and adjacent neighborhood streets, with the increasing share of traffic being carried by the freeway system. As indicated previously, the economic cost of congestion is indeterminate in the context and scope of this study.

Accident Reduction

The analysis of the effects of freeways on accidents and the cost of these accidents is based on data from 14 intersections in Minneapolis

and St. Paul on the arterial streets used in the previous traffic volume analysis. Figure 46 locates these intersections in relation to the freeway segments of interest in this study. The data for accidents on the freeway system are based on Minnesota Highway Department data for all urban freeways in the state of Minnesota and cover the years 1967, 1968, and 1969. Table 19 presents a tabulation of the various accident data for both urban freeways and other urban roadways.

For each year reported, the injury and fatality accident rate on local roads has been in excess of three times the rate on freeways in urban areas. The ratio of 3 to 1, therefore, will be used in subsequent analyses of cost savings associated with freeway use.

The difference in the fatality rates is not significant at these low levels. Fatalities on urban streets are fairly rare occurences and very often involve pedestrians or operators of motorcycles and motor scooters, which also makes the comparison of fatality rates doubtful.

The rate of injuries per million vehicle miles is, again, in favor of the interstate system by more than 3 to 1 for each year reported. Accident severity, as measured by the number of injuries and fatalities per accident, is comparable for both types of roadway. The differences in rate of severity are not great for each year, and the trends are parallel from one year to the next.

To assess the effect of freeways in the metropolitan area on accident occurrence and accident cost, data were collected for the 14 intersections previously indicated on Figure 46. The data included the number of property-damage accidents, the number of accidents involving personal injury, the number of injuries in each accident, the number of fatal accidents, and the number of fatalities occurring for each of these intersections. The information was obtained for Minneapolis starting in 1961 and for St. Paul in 1966.

The costs incurred in these accidents were estimated on the basis of the National Safety Council's estimate of costs of motor vehicle

accidents for 1969. The 1969 costs were applied to the accident data for each year included in Figure 47. The estimated total cost of accidents for each year reflects both the number and the type of accidents that have occurred at the intersections. The 1969 Safety Council costs for a death were $41,700; for a nonfatal injury, $2,500; and for a property-damage accident, $380. These costs are averages based on an aggregation of data from the entire nation.

Figure 47 is a graph of the estimated total costs of accidents at the 14 intersections in Minneapolis and St. Paul. The timing of the opening of the various freeway segments is also indicated. The effect of the freeway opening is evident, with a significant reversal and downward trend in the total cost of accidents subsequent to the freeway openings. The difference in level between Minneapolis and St. Paul is due to the fact that there were only five intersections located in St. Paul in the analysis in comparison to nine for Minneapolis.

The accident cost data are also presented on Figure 48 but in a different format. The number of accidents and the cost per accident are reported on this figure. In both cities, the effect of freeway openings on the number of accidents is evident. The trends in cost, especially in Minneapolis, where data for a longer time period were available, exhibit somewhat random fluctuations with an increasing trend over a long period of time which is to be expected because of generally increasing costs. The cost per accident in both cities increased rapidly from 1967 through 1969.

The economic benefit of the freeway system in the metropolitan area associated with accident costs savings was calculated on the basis that the indicated ratio of the rate of injury and fatality accidents per vehicle mile for local urban roadways is three times that for urban freeways. The cost per accident figures indicated on Figure 48 were used for the period 1967 through 1969 and then inflated at a rate of five percent per year for the years 1970, 1971, and 1972. The accident rate is based on frequency per million vehicle miles, therefore, an estimate of annual vehicle miles was necessary for 1970 through 1972. Figure 42

presented a projection of annual vehicle miles on all urban roads and on urban freeways on the basis of 25, 30 and 40 percent total urban vehicle miles being driven on urban freeways. The cost savings associated with driving on urban freeways were estimated using the following method:

1. Let the local urban roadways accident rate be three accidents per million annual vehicle miles and the freeway accident rate be one accident per million vehicle miles as previously reported.
2. Calculate the cost of accidents assuming all urban vehicle miles in each year were driven only on local roadways.
3. On the basis of Figure 42, calculate the accident cost for the vehicle miles driven on urban freeways for each year and at the various levels of use of the freeways.
4. Subtract the cost determined in Step 3 from the cost estimated in Step 2.
5. The results obtained in Step 4 will be assumed to be the accident cost savings associated with driving on the freeway. This assumption implies that all of the miles that are driven on urban freeways would be driven on local roadways if the freeway system was not in existence.

The assumption indicated in Statement 5 above means that this method of computation will generate the highest value of accident cost savings for freeway usage. If the previously discussed model for annual vehicle miles is considered, then the total number of vehicle miles should be less with no freeways in use. For example, if that portion of annual vehicle miles associated with freeway driving is reduced by 50 percent to estimate the vehicle miles driven on urban roads if there were no freeways, the accident cost savings from freeway use would amount to 20 percent of the savings computed as described in Steps 1 through 5 and as indicated on Figures 49 and 50.

The accident cost savings calculated on the above basis are presented in two different formats on Figures 49 and 50. The first figure presents the total sum of estimated costs savings associated with reduced accident costs from driving on freeways in the metropolitan area. The estimated 1969 cost savings is ten million dollars and at a 25-percent level of vehicle mileage driven on freeways, the 1972 cost

savings is projected to be about $24 million, at 30 percent about $29 million, and at 40 percent $39 million. Cost savings in cents per vehicle mile driven on the total number of miles of urban roadways including freeways are presented on Figure 50. The 1969 cost savings is about 1.1 cents per mile and increases by 1972 to about 2.3 cents per mile at the 25 percent level, 2.7 cents at 30 percent, and 3.6 cents per mile at 40 percent of total urban vehicle miles being driven on freeways.

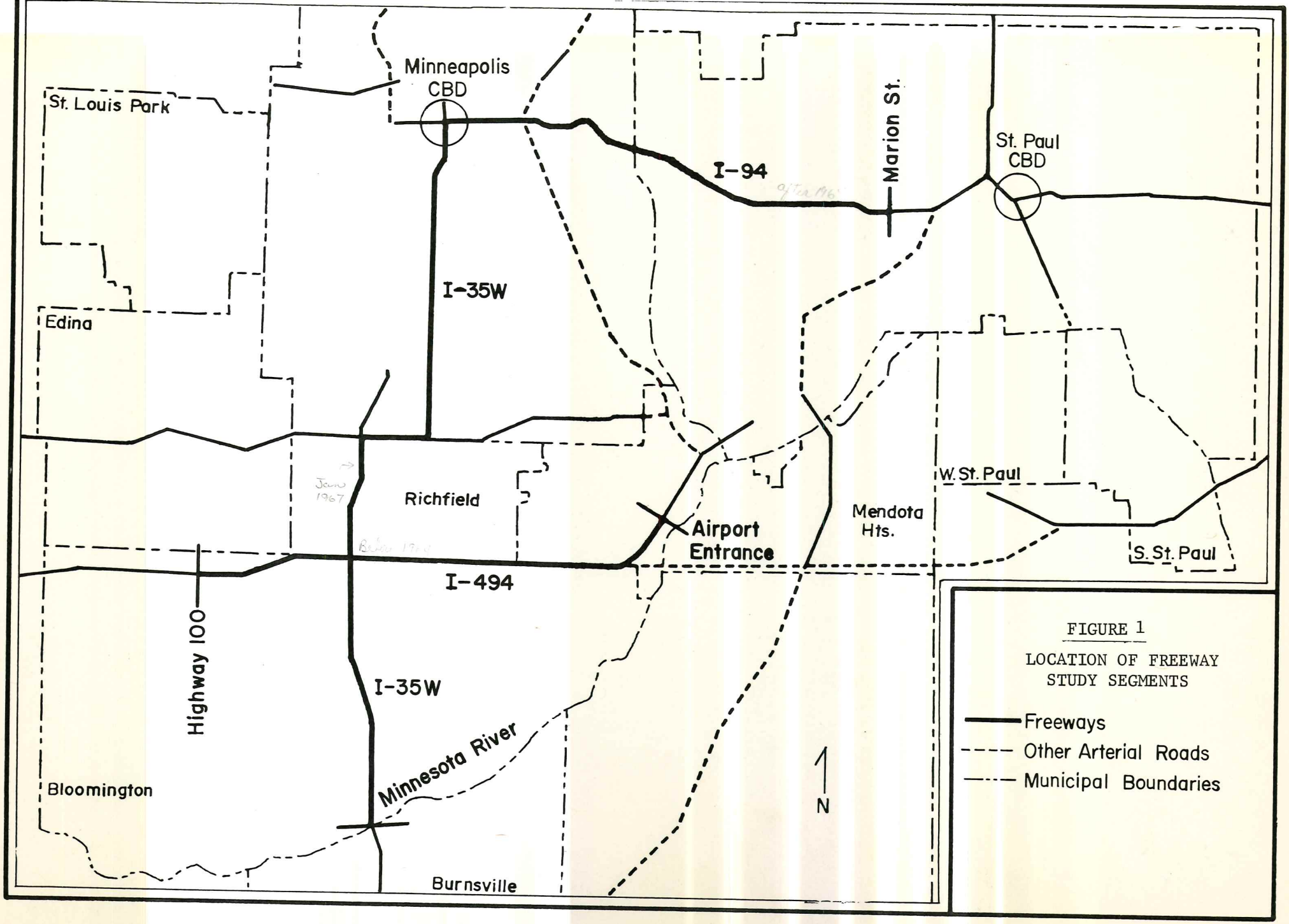
The cost of accidents in the entire state of Minnesota calculated on the same basis as previously indicated would have amounted to 178.6 million dollars in 1968 and 184.2 million dollars in 1967. The calculated accident cost savings as indicated on Figure 49 would have amounted to 4.1 percent of the total state costs in 1968 and 2.7 percent in 1967. These figures should aid in a better understanding of the estimated and projected cost savings associated with freeway use in the metropolitan area.

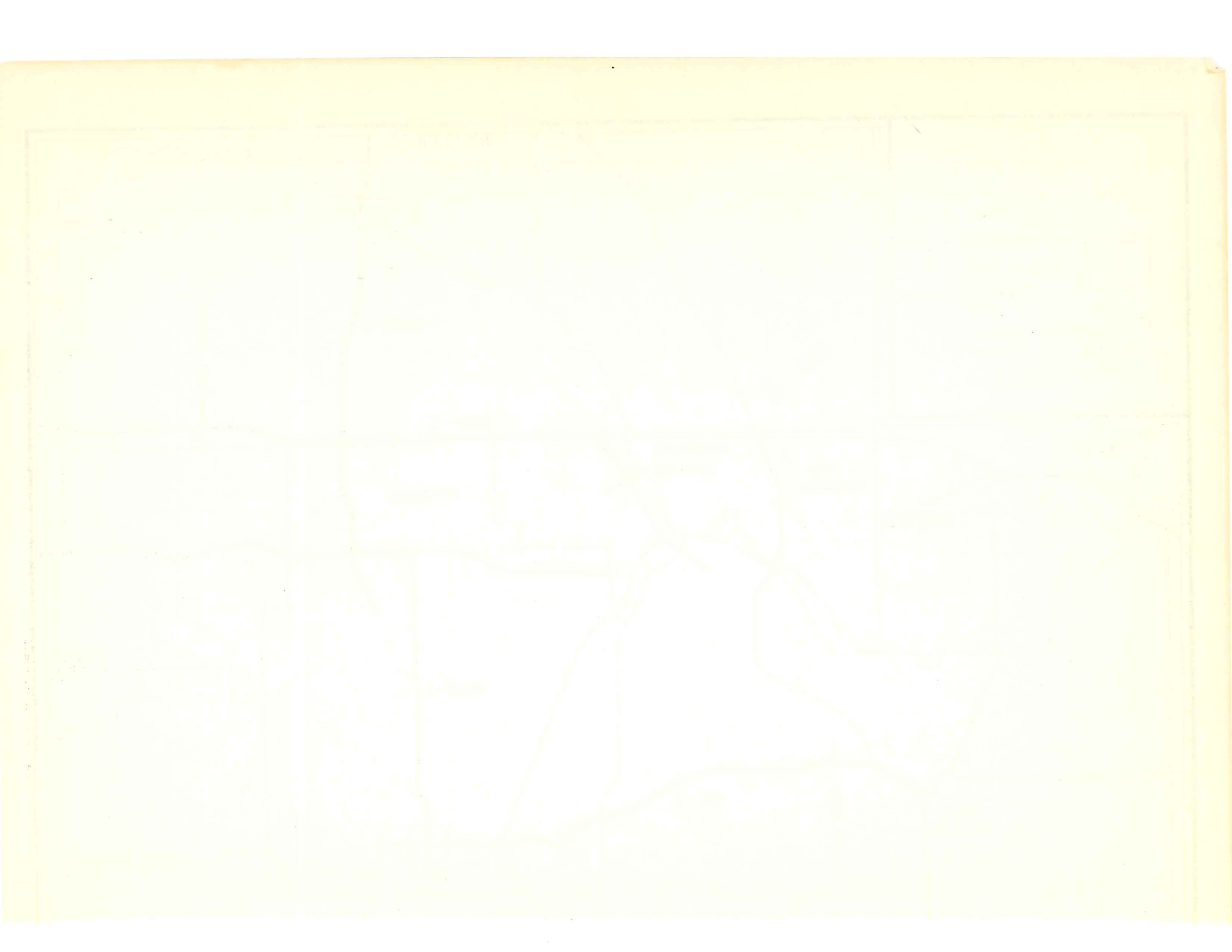
Although the 40-percent figure for vehicle miles driven on urban freeway may be high, it sets a probable upper limit for potential costs savings over this time period. In Minnesota, about 75 percent of the injury and fatality accidents occur in urban areas on urban roadways with only about 40 percent of the vehicle miles being driven on urban roadways. This combination of circumstances results in a fairly consistent pattern of urban roadway accident frequency of four times that of the rural roadway accident rate.

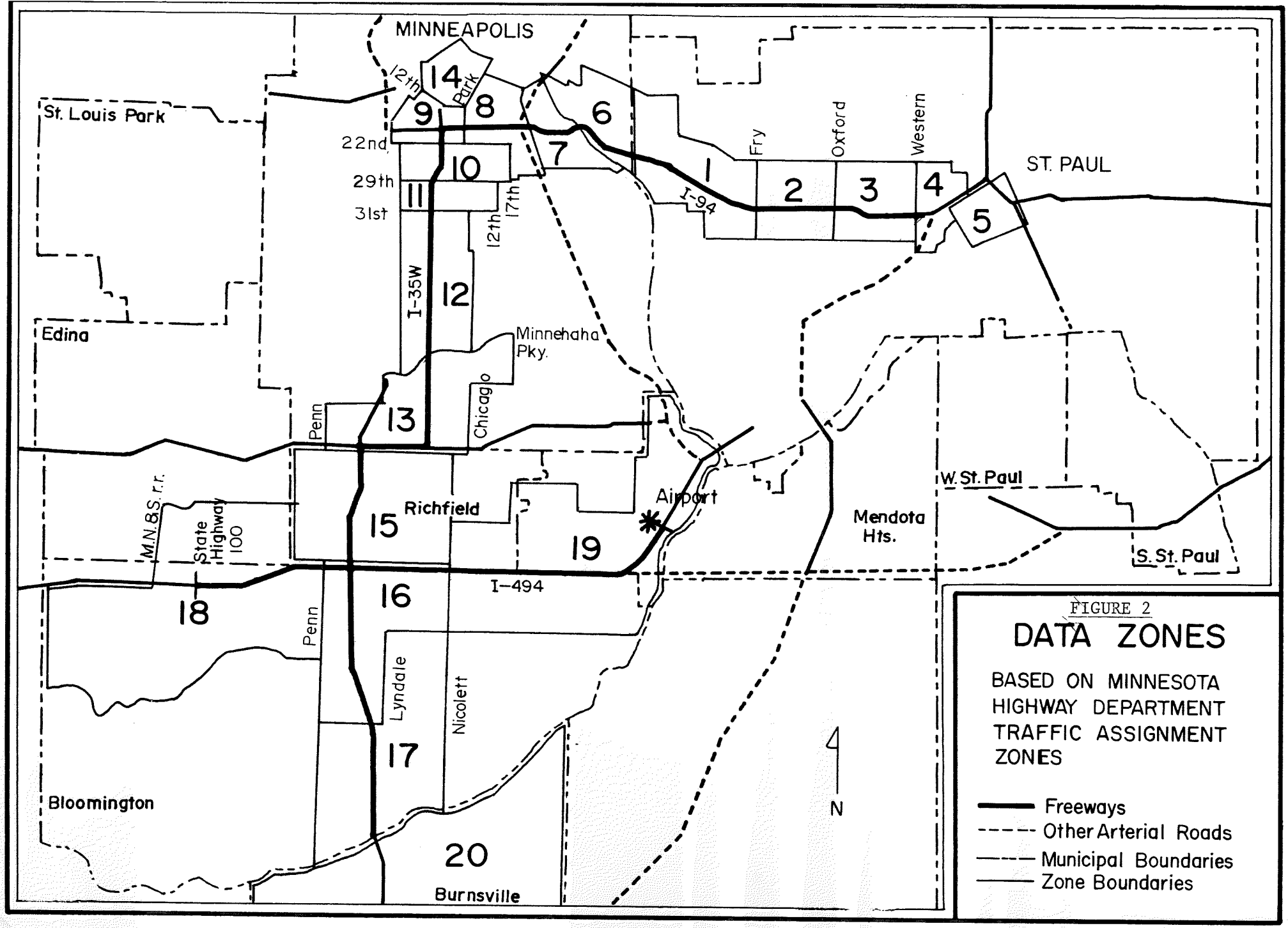
In summary, there is a marked drop in accident occurence at specific arterial street intersections in Minneapolis and St. Paul coincident with the opening and use of freeways in the metropolitan area. The potential cost savings associated with a reduction in accidents has been projected to approach $40 million per year by 1972 under conditions of maximum freeway use, but the more likely cost savings are assumed to be in the range of $25 to $30 million per year by 1972. These annual cost savings would represent between 14 and 22 percent of the total estimated accident cost in the entire state of Minnesota for 1967 or 1968.

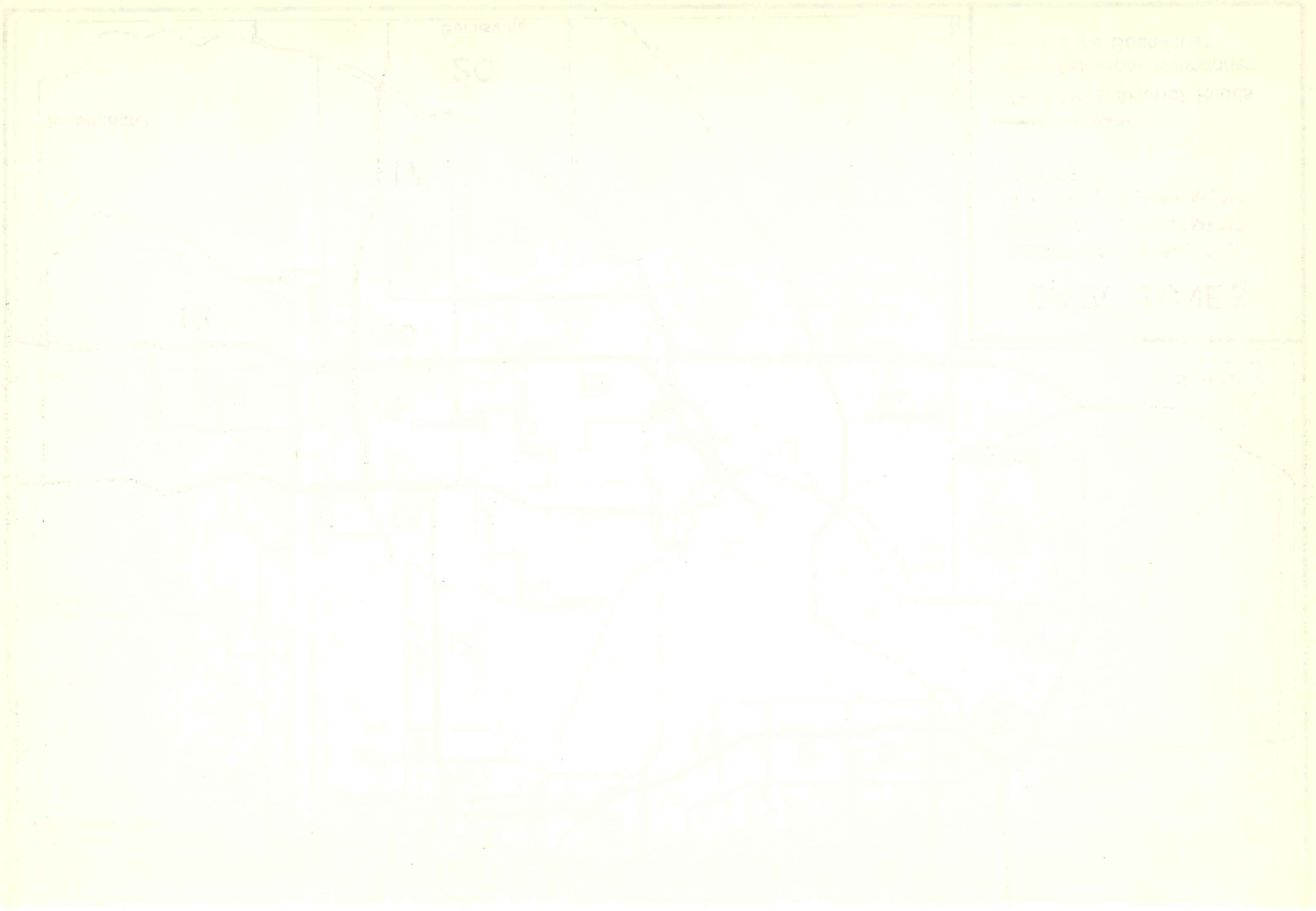
APPENDIX A

FIGURES AND TABLES


Minneapolis
CBD
St. Louis Park
I-94
Marion St.
St. Paul
CBD
I-35W
Edina
Richfield
W. St. Paul
Mendota
Hts.
Airport
Entrance
S. St. Paul
I-494
Highway 100
I-35W
Minnesota River
Bloomington
Burnsville
N
FIGURE 1
LOCATION OF FREEWAY
STUDY SEGMENTS
Freeways
Other Arterial Roads
Municipal Boundaries




MINNEAPOLIS
St. Louis Park
12th
Park
14
9
8
6
22nd
10
7
29th
11
31st
12th
17th
I-35W
12
1
Fry
Oxford
Western
I-94
2
3
4
5
ST. PAUL
Edina
Minnehaha
Pky.
Penn
13
Chicago
M.N.&S. r.r.
State
Highway
100
15
Richfield
19
Airport
W. St. Paul
Mendota
Hts.
S. St. Paul
18
16
I-494
Penn
Lyndale
Nicolett
17
Bloomington
20
Burnsville
N
FIGURE 2
DATA ZONES
BASED ON MINNESOTA
HIGHWAY DEPARTMENT
TRAFFIC ASSIGNMENT
ZONES
Freeways
Other Arterial Roads
Municipal Boundaries
Zone Boundaries



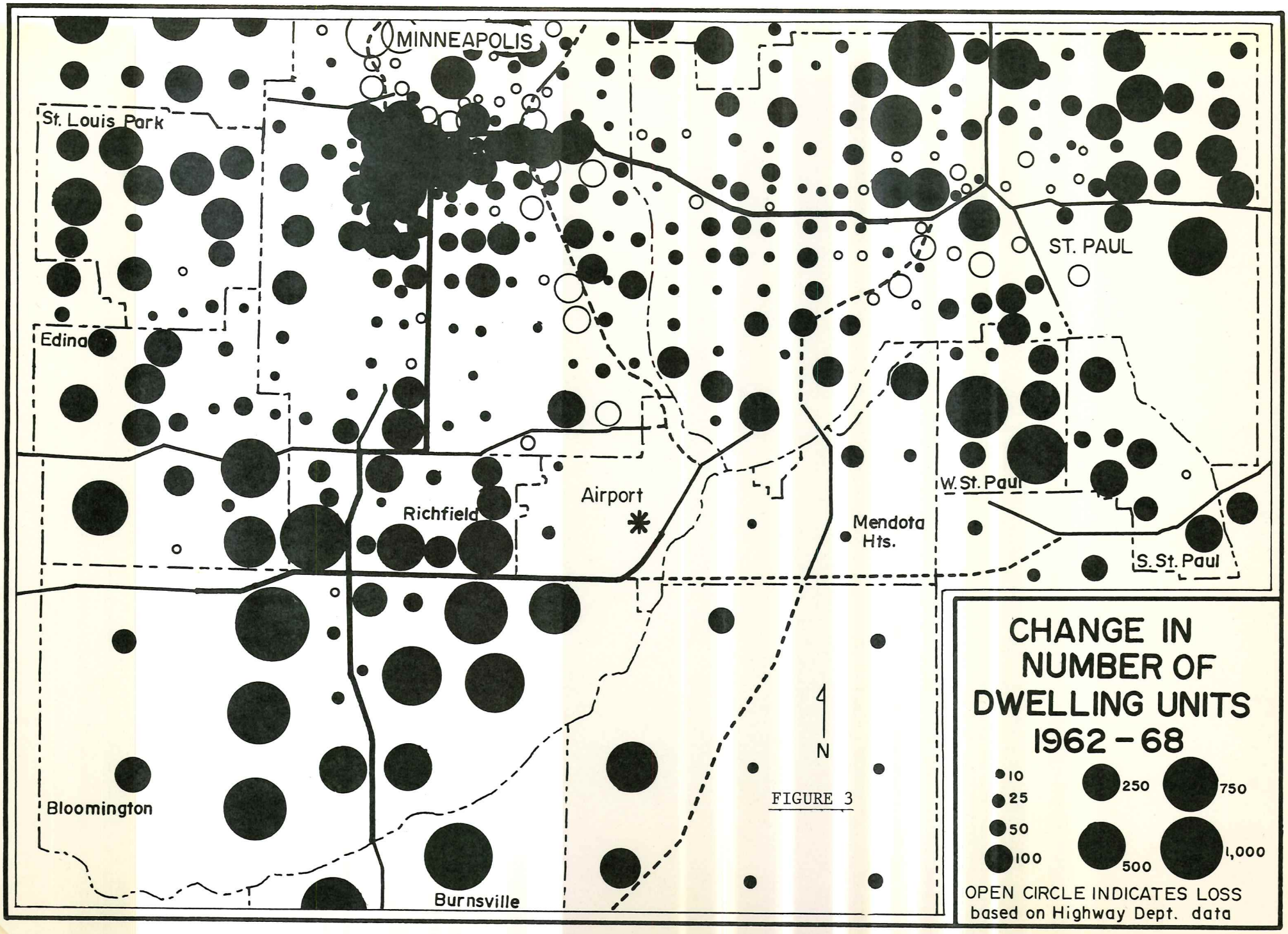
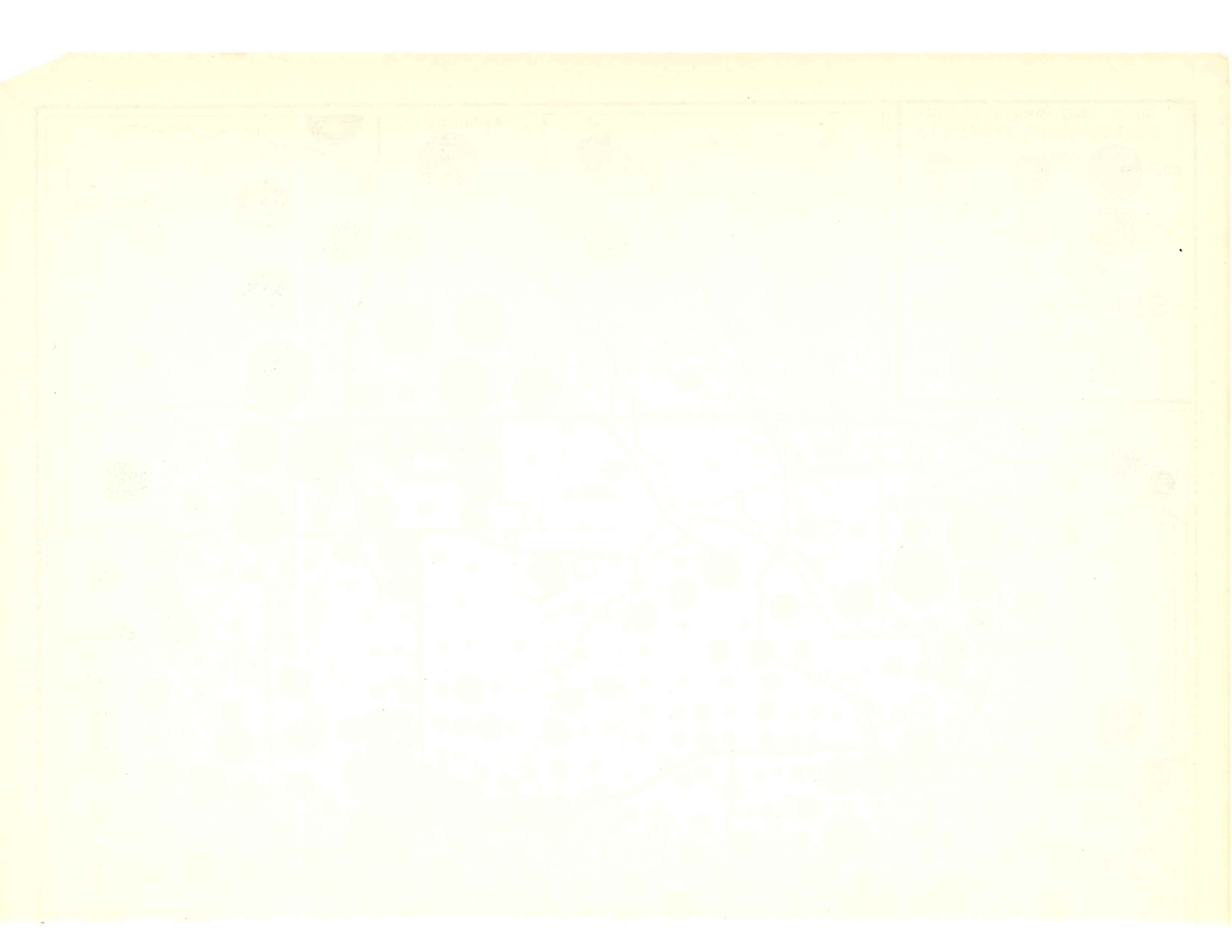
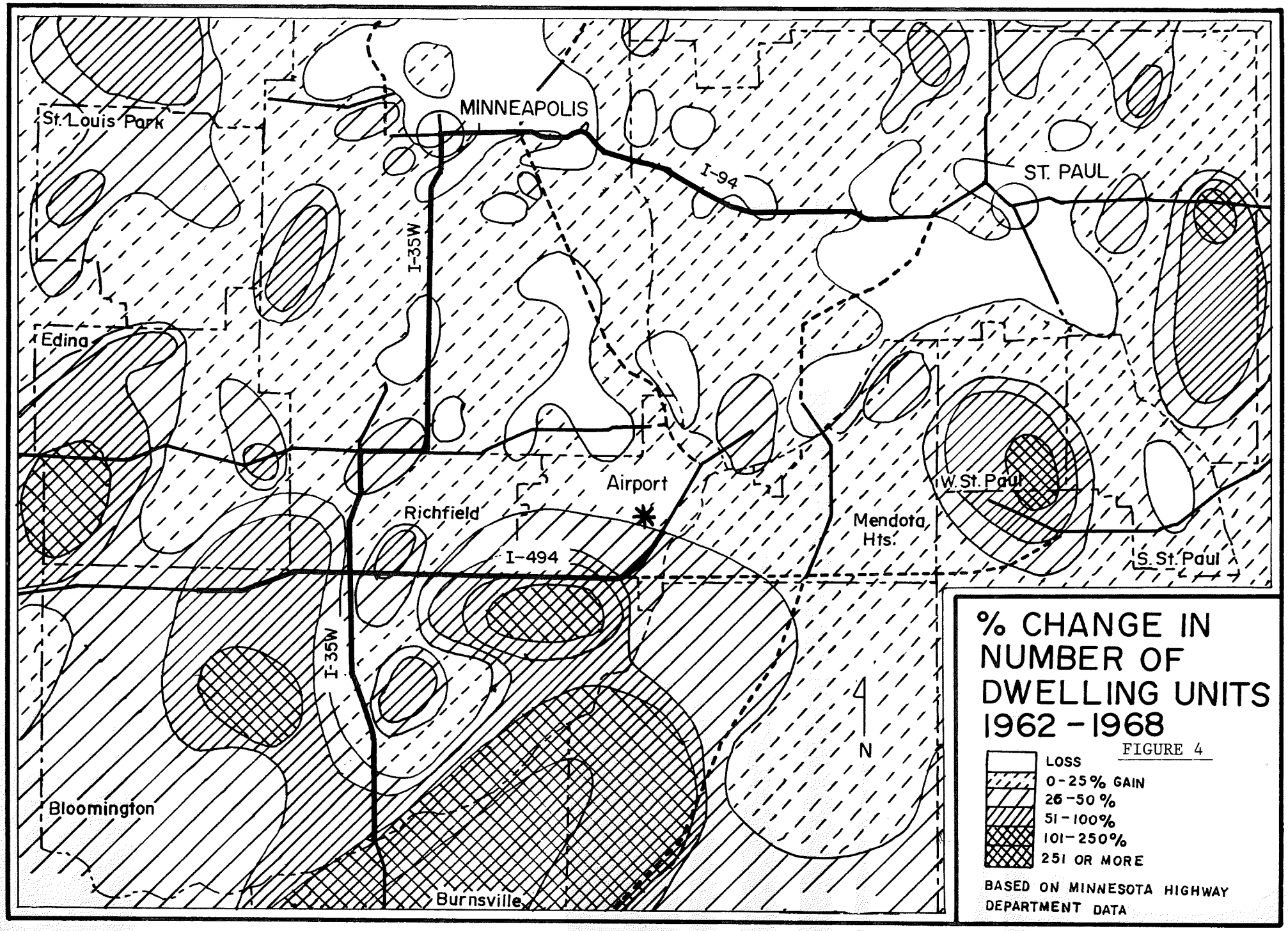
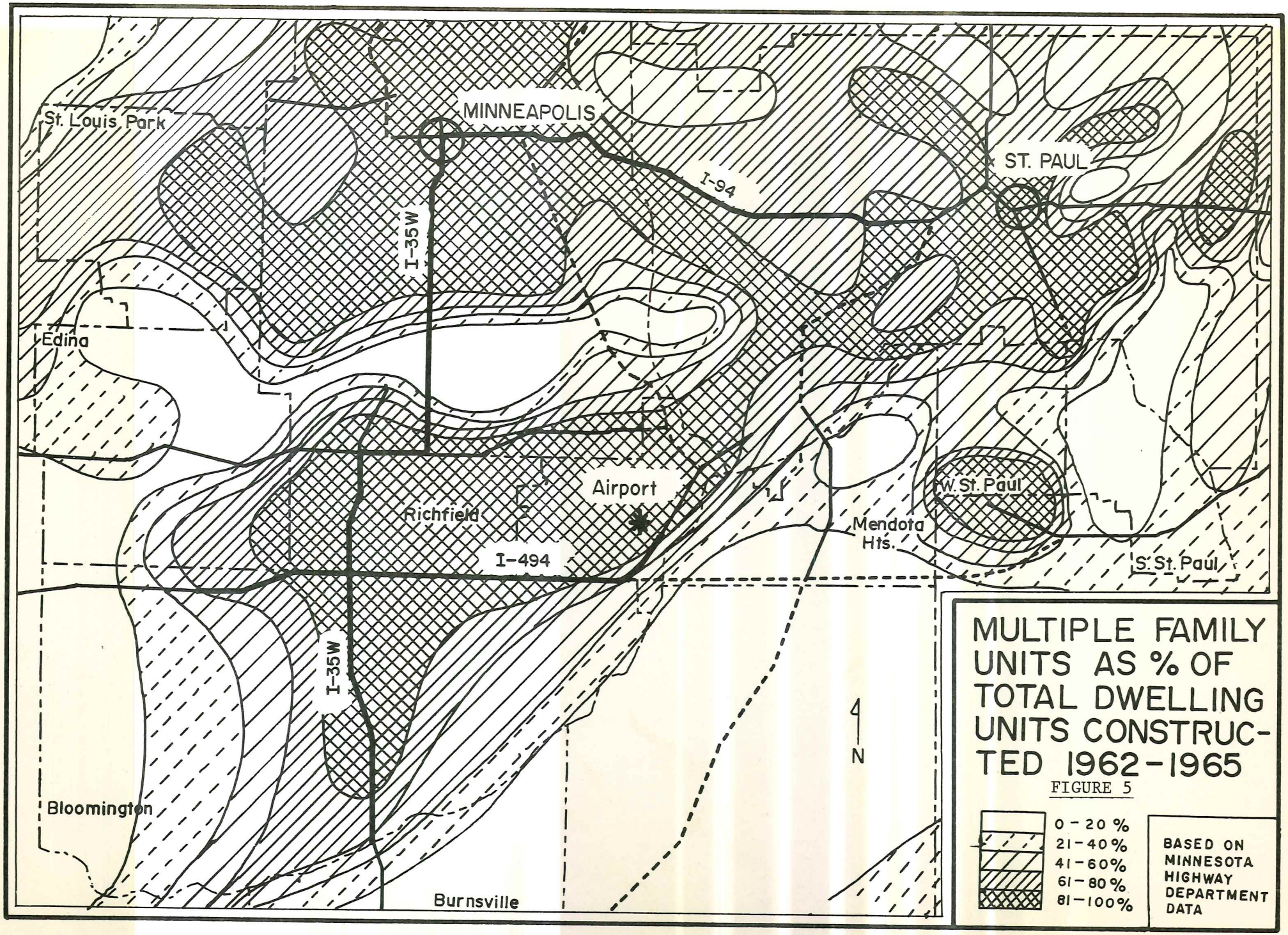

MINNEAPOLIS
St. Louis Park
Edina
ST. PAUL
Airport
Richfield
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
N
CHANGE IN NUMBER OF DWELLING UNITS 1962 - 68
10
25
50
100
250
500
750
1,000
OPEN CIRCLE INDICATES LOSS
based on Highway Dept. data

FIGURE 3




MINNEAPOLIS
St. Louis Park
ST. PAUL
I-94
I-35W
Edina
Airport
Richfield
I-494
W. St. Paul
Mendota Hts.
S. St. Paul
I-35W
Bloomington
Burnsville
N
% CHANGE IN NUMBER OF DWELLING UNITS 1962 - 1968
FIGURE 4
LOSS
0 - 25 % GAIN
26 - 50 %
51 - 100%
101 - 250%
251 OR MORE
BASED ON MINNESOTA HIGHWAY DEPARTMENT DATA


MINNEAPOLIS
St. Louis Park
ST. PAUL
I-94
I-35W
Edina
Airport
Richfield
W. St. Paul
Mendota Hts.
S. St. Paul
I-494
I-35W
N
Bloomington
Burnsville
MULTIPLE FAMILY UNITS AS % OF TOTAL DWELLING UNITS CONSTRUCTED 1962-1965
FIGURE 5
0 - 20 %
21 - 40 %
41 - 60 %
61 - 80 %
81 - 100 %
BASED ON MINNESOTA HIGHWAY DEPARTMENT DATA

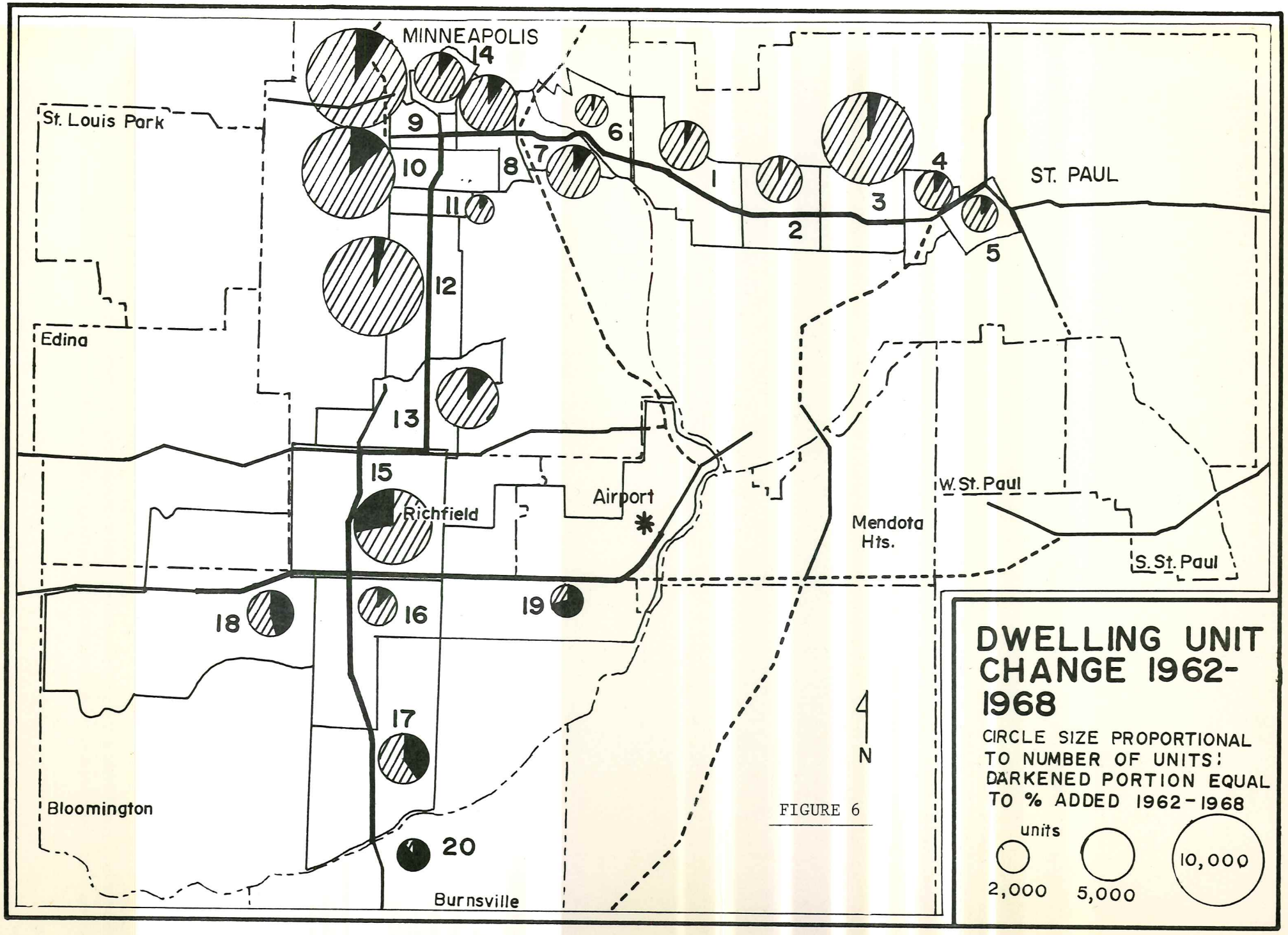
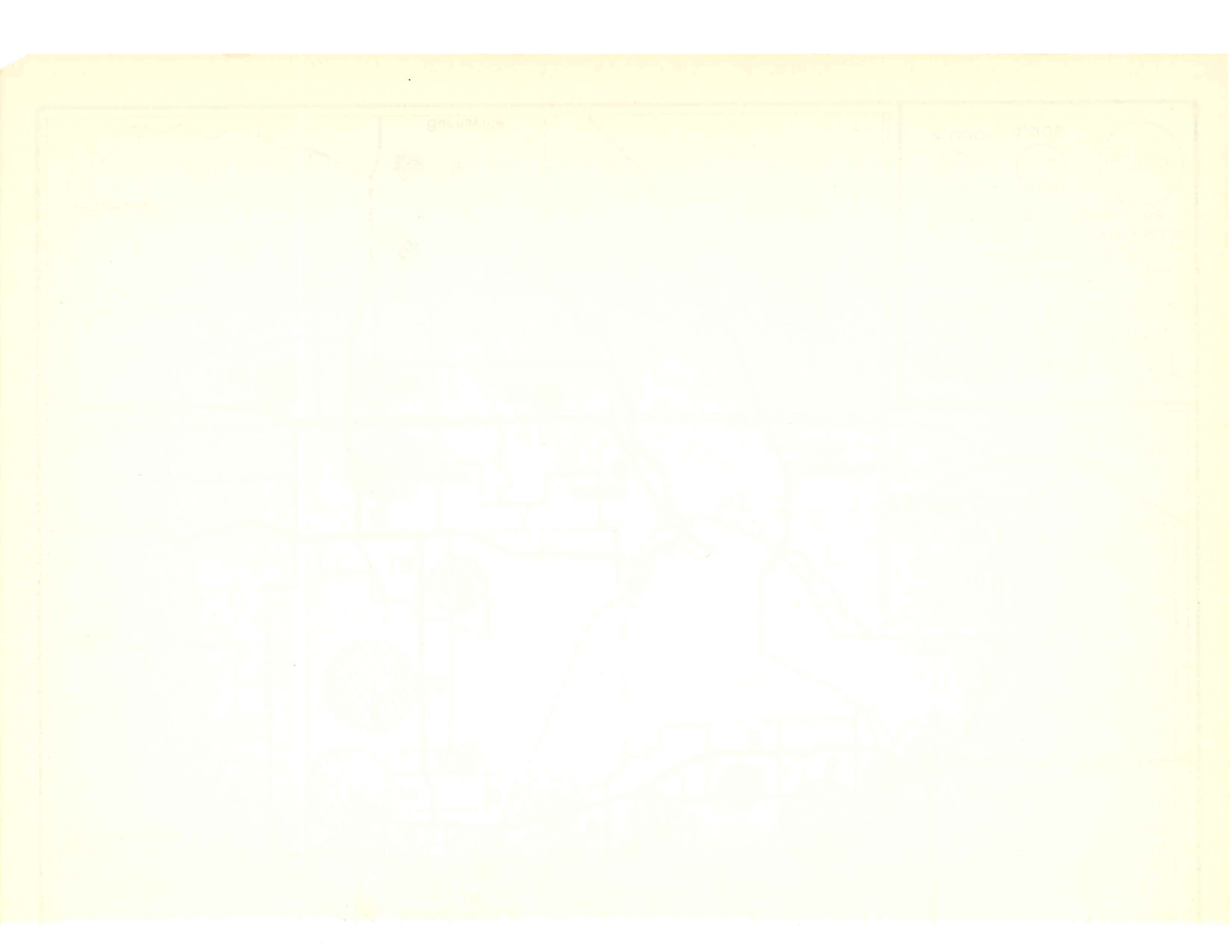
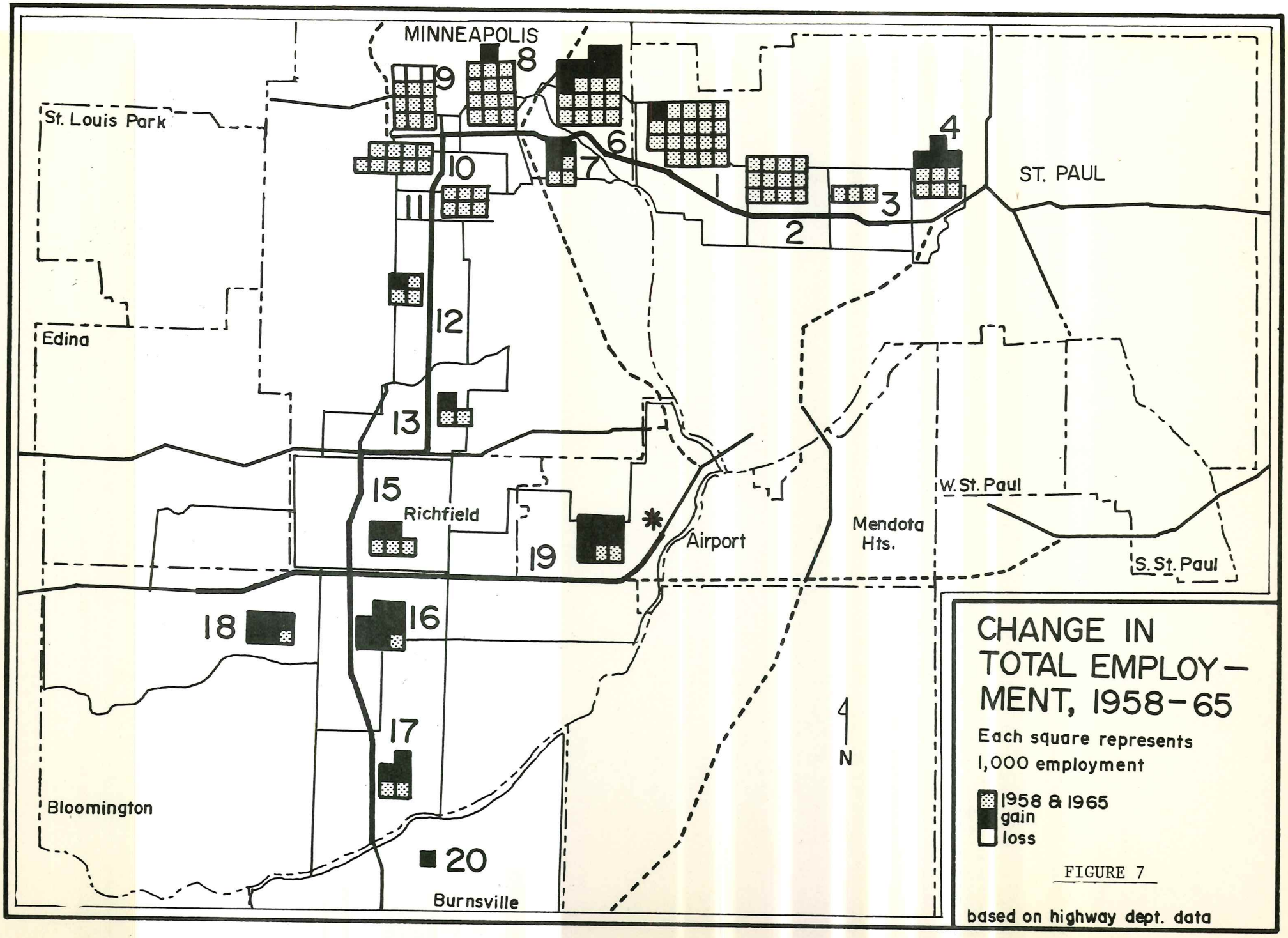
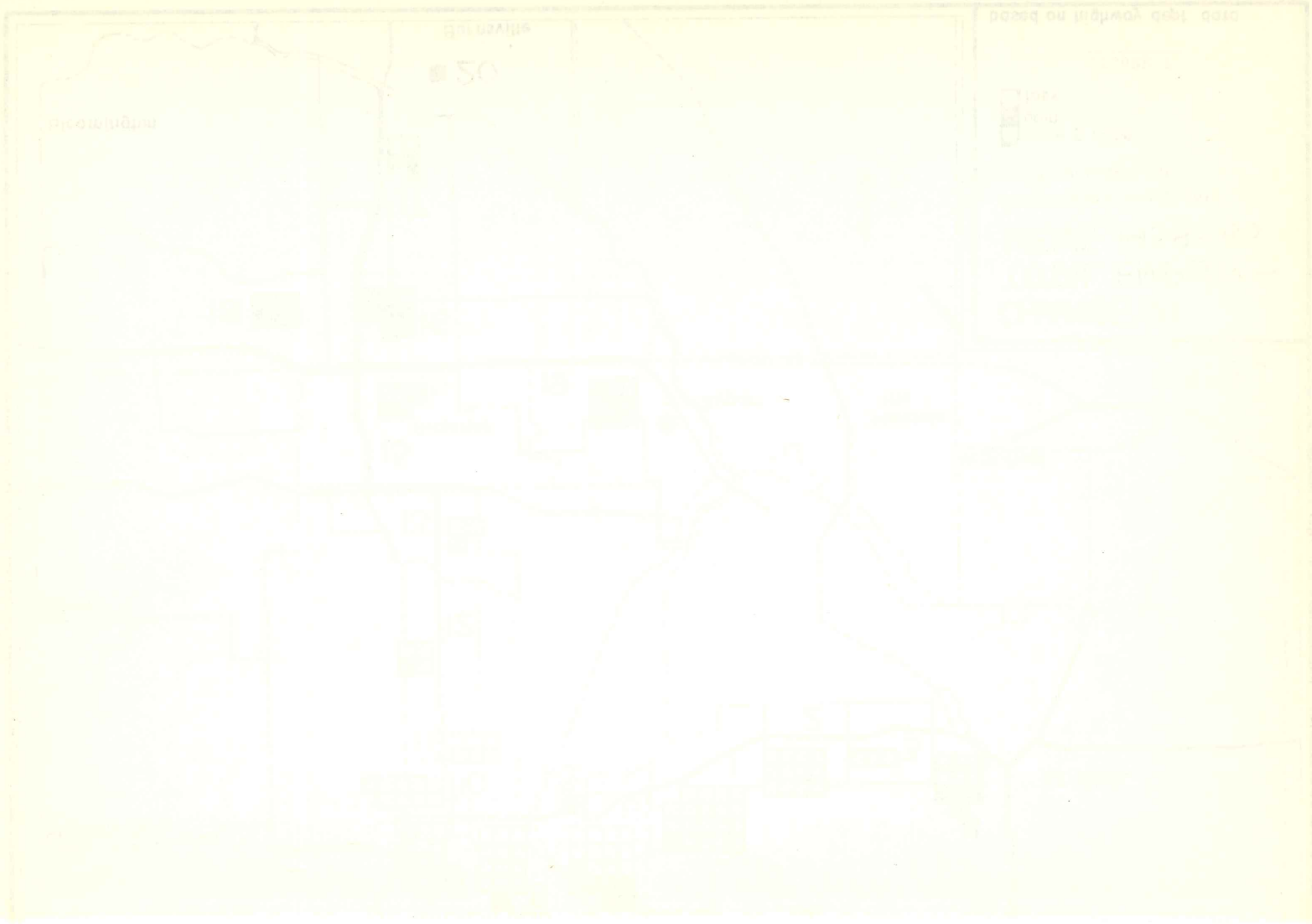

MINNEAPOLIS
St. Louis Park
ST. PAUL
Edina
Airport
Richfield
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
N
DWELLING UNIT CHANGE 1962-1968
CIRCLE SIZE PROPORTIONAL TO NUMBER OF UNITS: DARKENED PORTION EQUAL TO % ADDED 1962-1968
units
2,000
5,000
10,000

FIGURE 6




MINNEAPOLIS
St. Louis Park
ST. PAUL
Edina
Richfield
Airport
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
2
3
4
6
7
8
9
10
11
12
13
15
16
17
18
19
20
N
CHANGE IN TOTAL EMPLOY-MENT, 1958-65
Each square represents 1,000 employment
1958 & 1965 gain
loss
FIGURE 7
based on highway dept. data



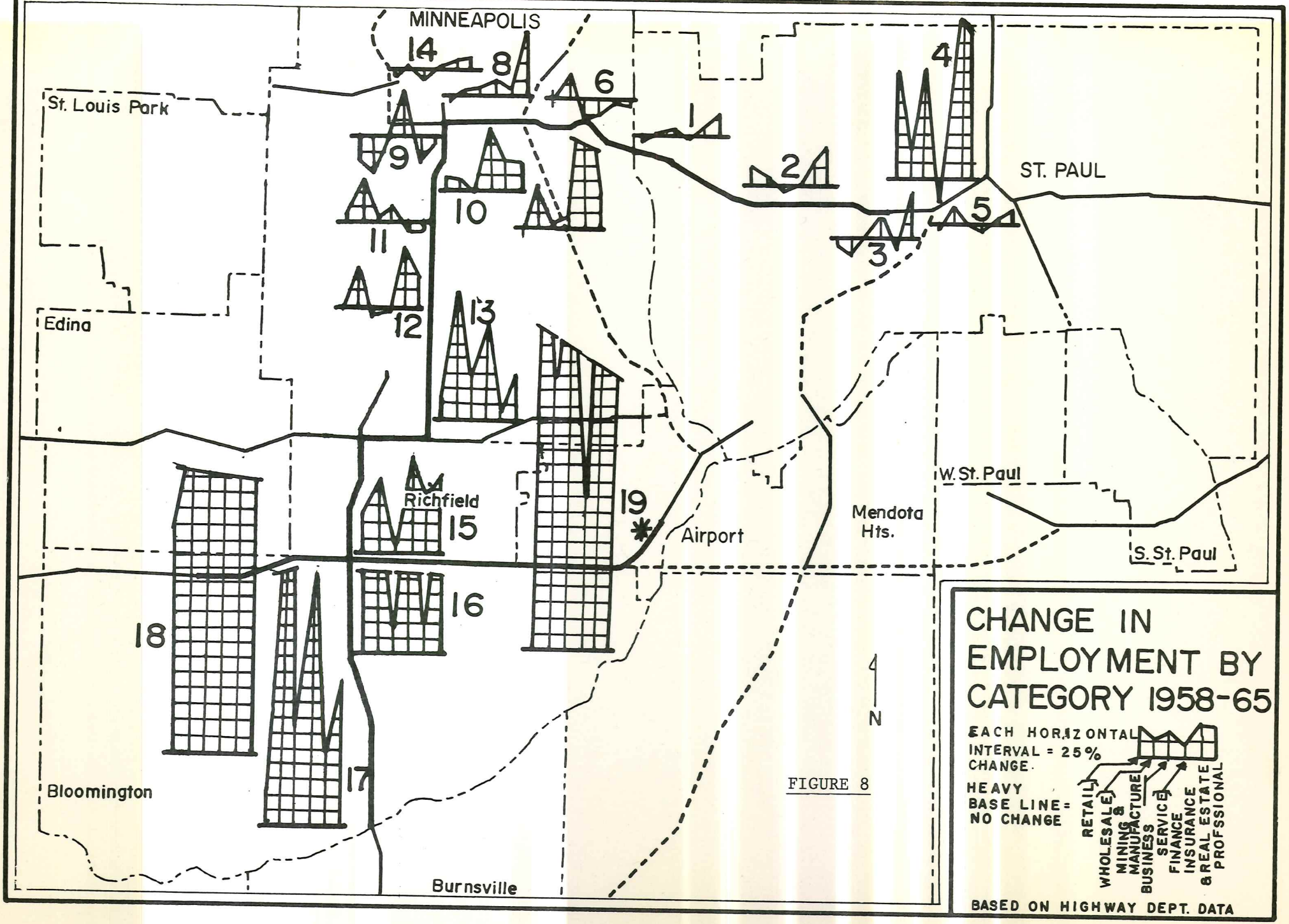
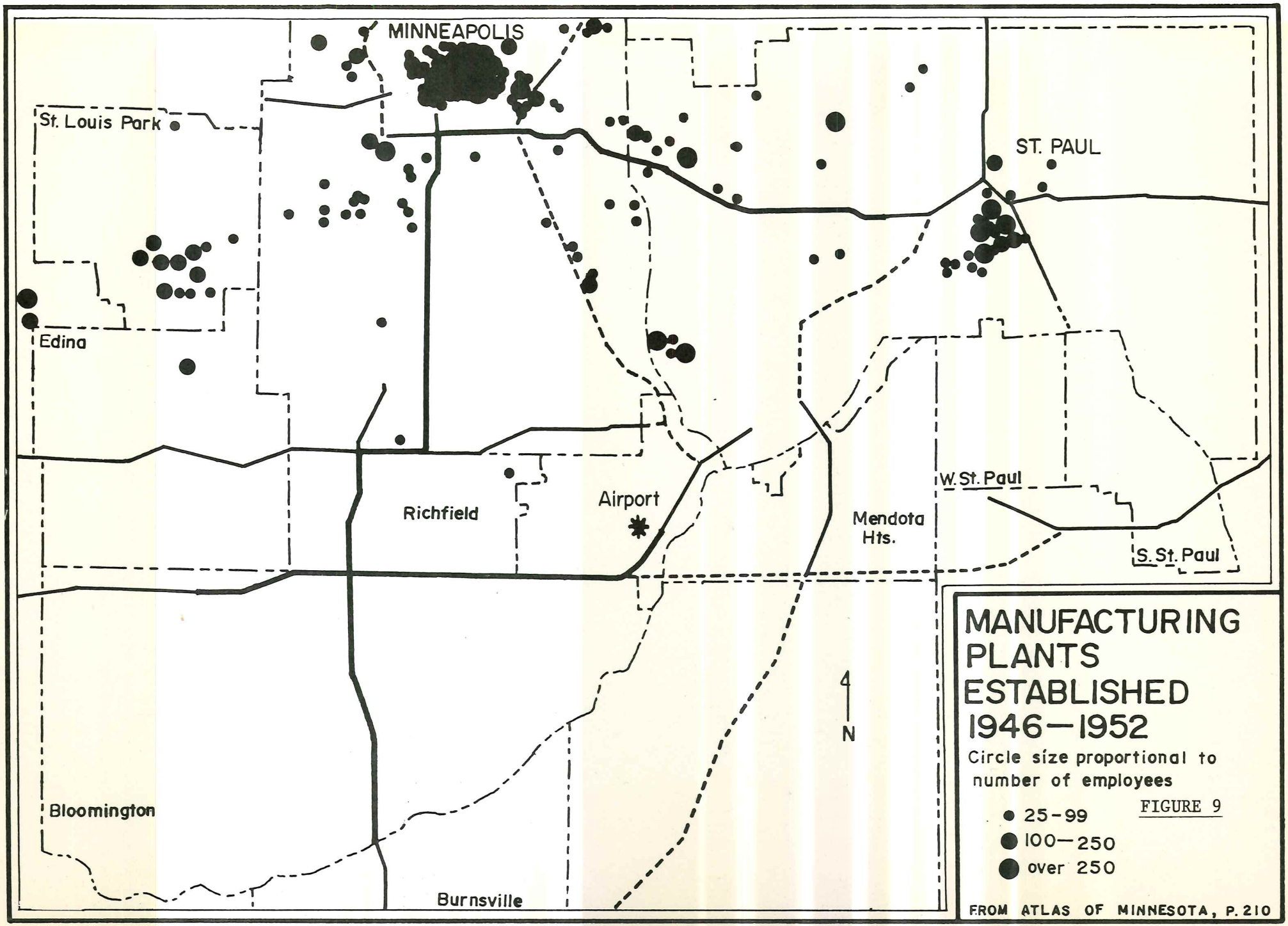

MINNEAPOLIS
St. Louis Park
Edina
Richfield
Bloomington
Burnsville
Airport
Mendota Hts.
W. St. Paul
S. St. Paul
ST. PAUL
1
2
3
4
5
6
8
9
10
11
12
13
14
15
16
17
18
19
N
CHANGE IN EMPLOYMENT BY CATEGORY 1958-65
EACH HORIZONTAL INTERVAL = 25% CHANGE.
HEAVY BASE LINE = NO CHANGE
RETAIL
WHOLESALE
MINING & MANUFACTURE
BUSINESS SERVICE
FINANCE INSURANCE & REAL ESTATE
PROFSSIONAL
BASED ON HIGHWAY DEPT. DATA

FIGURE 8


MINNEAPOLIS
St. Louis Park
ST. PAUL
Edina
Richfield
Airport
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
N
MANUFACTURING PLANTS ESTABLISHED 1946—1952
Circle size proportional to number of employees
25-99
100—250
over 250
FIGURE 9
FROM ATLAS OF MINNESOTA, P. 210

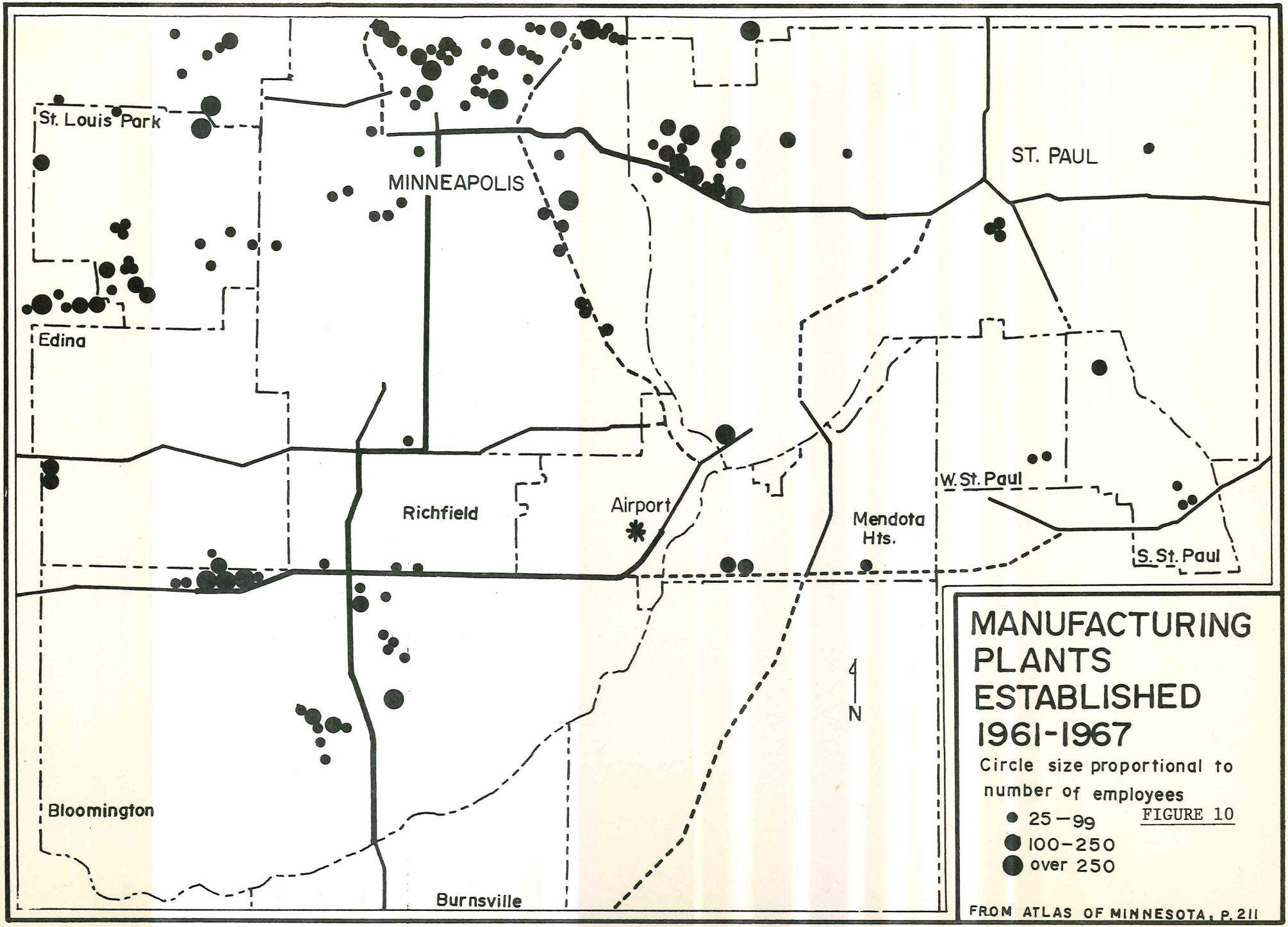

St. Louis Park
MINNEAPOLIS
ST. PAUL
Edina
Richfield
Airport
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
N
MANUFACTURING PLANTS ESTABLISHED 1961-1967
Circle size proportional to number of employees
25-99
100-250
over 250
FROM ATLAS OF MINNESOTA, P. 211

FIGURE 10

DWELLING UNITS, CHANGE BY SECTOR, 1960-1969

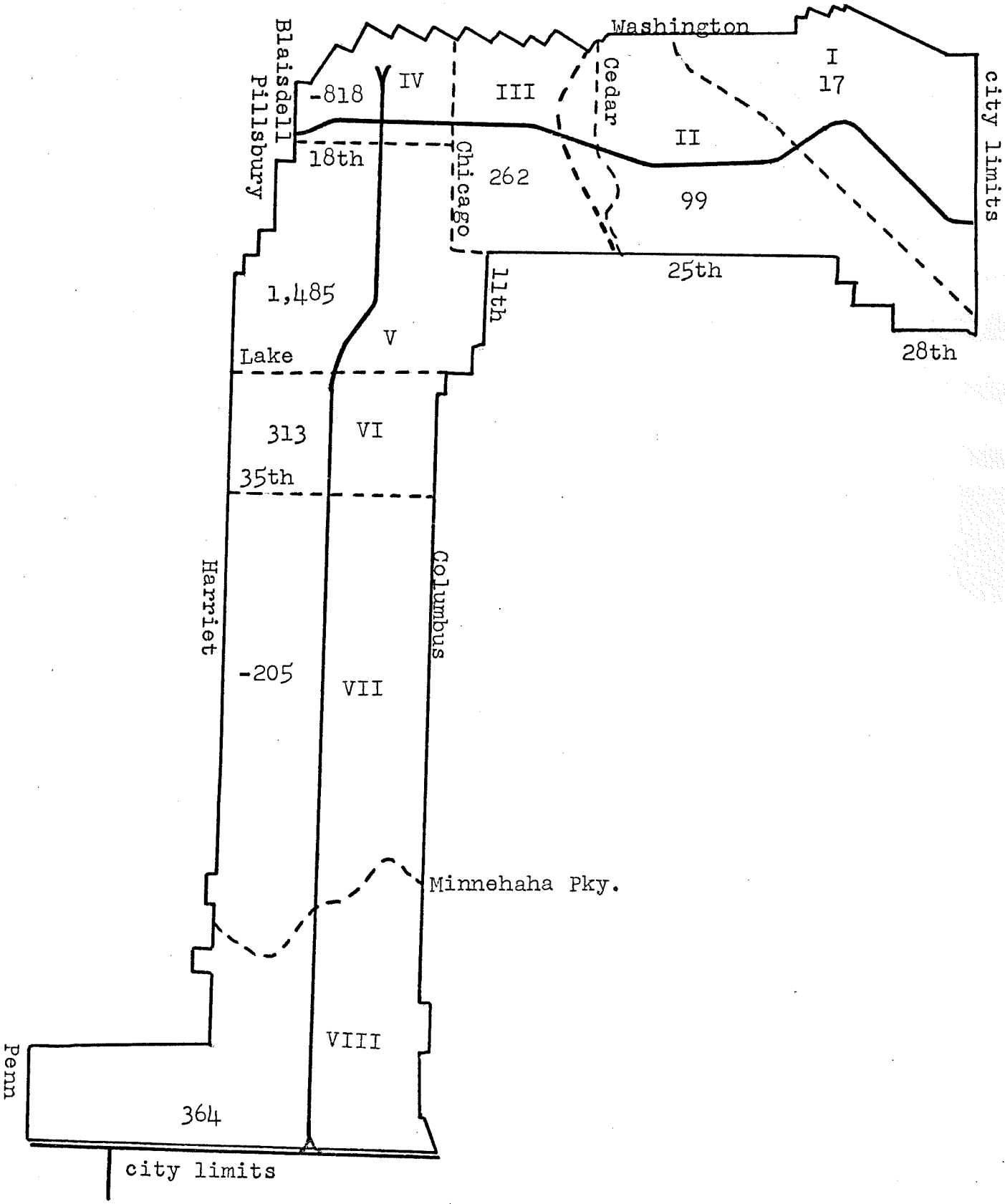
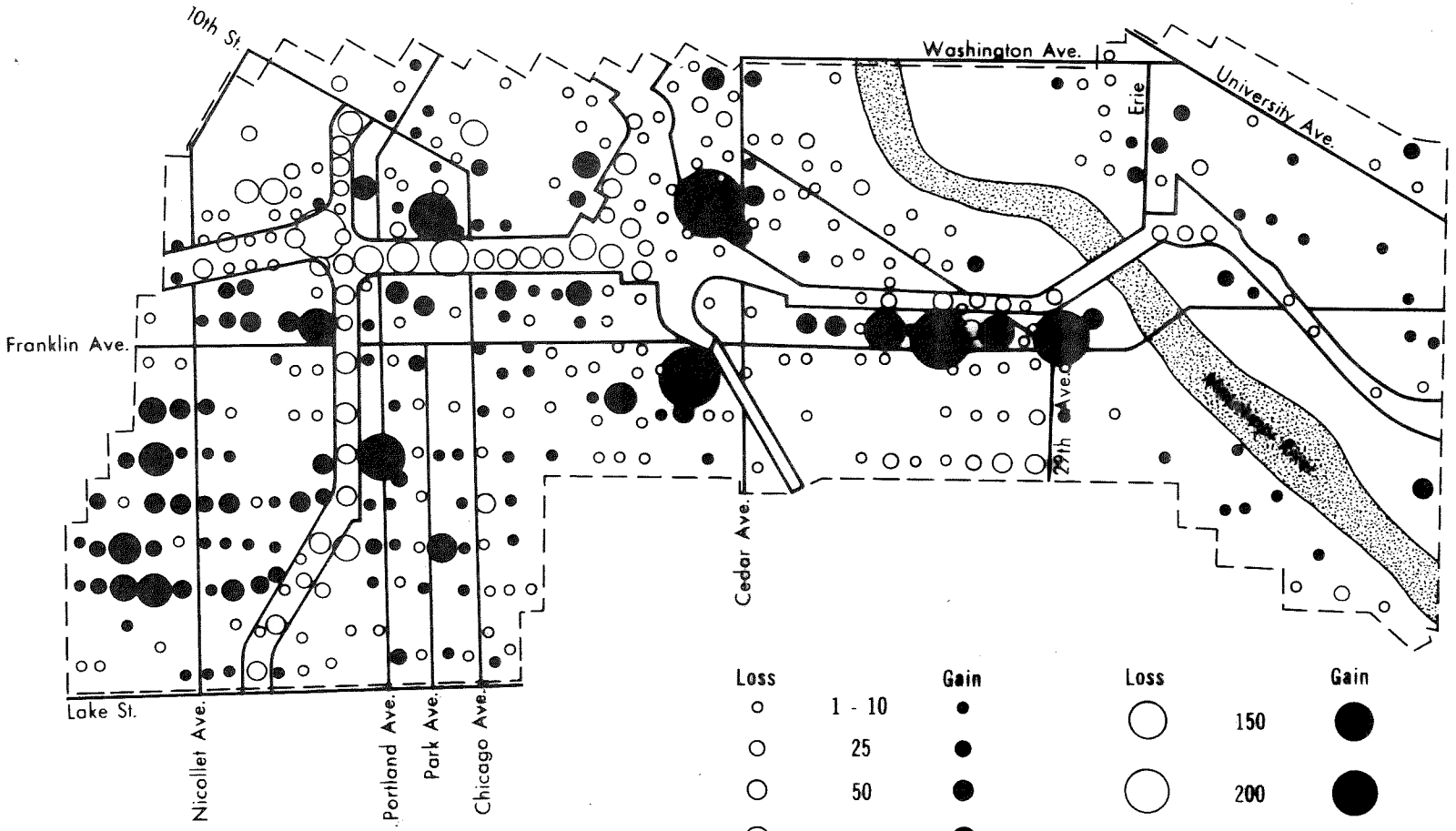


FIGURE 11

FIGURE 12

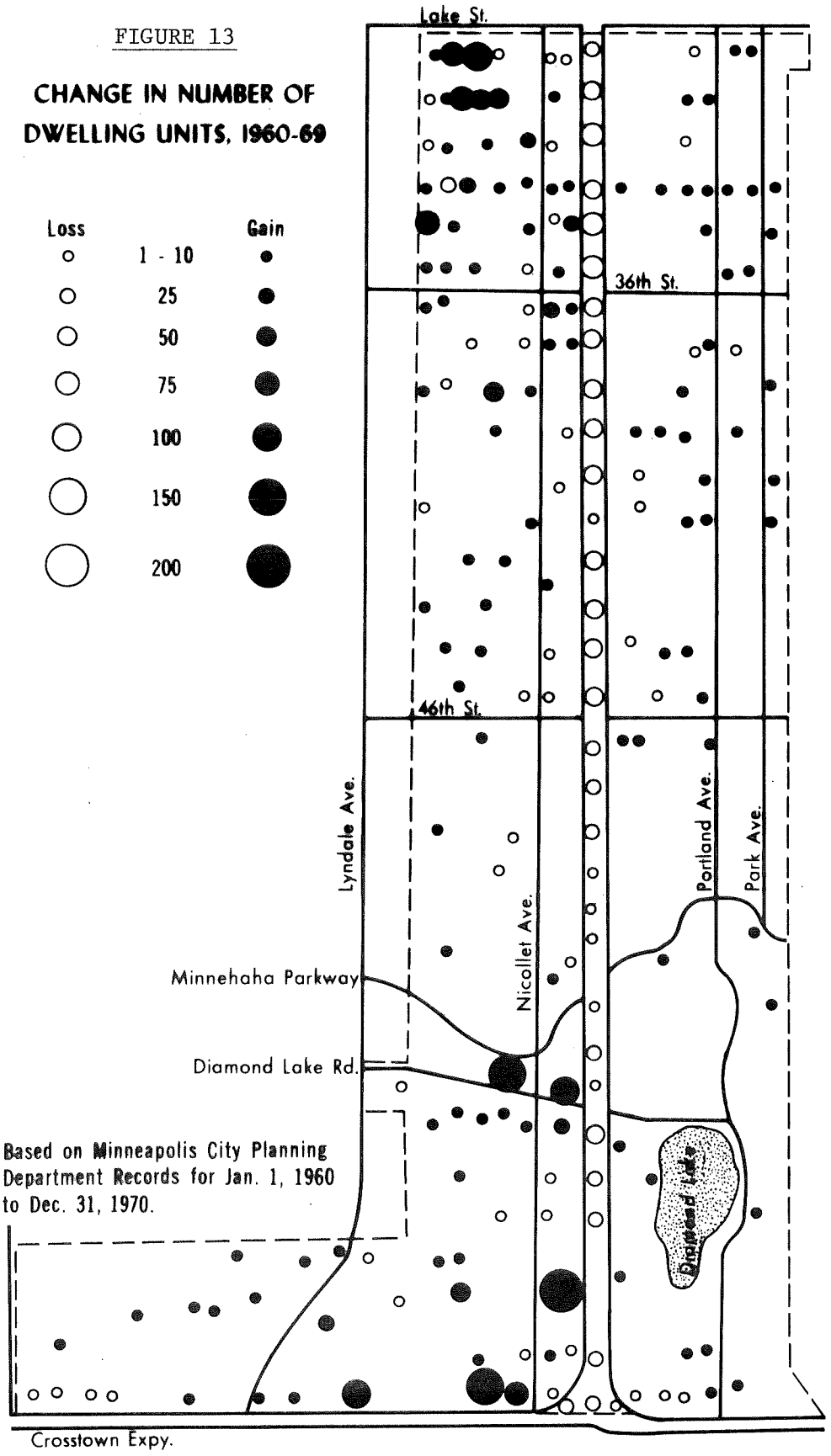
CHANGE IN NUMBER OF DWELLING UNITS, 1960-69



Based on Minneapolis City Planning Department Records for Jan. 1, 1960 to Dec. 31, 1969.

FIGURE 13

CHANGE IN NUMBER OF DWELLING UNITS, 1960-69



Based on Minneapolis City Planning Department Records for Jan. 1, 1960 to Dec. 31, 1970.

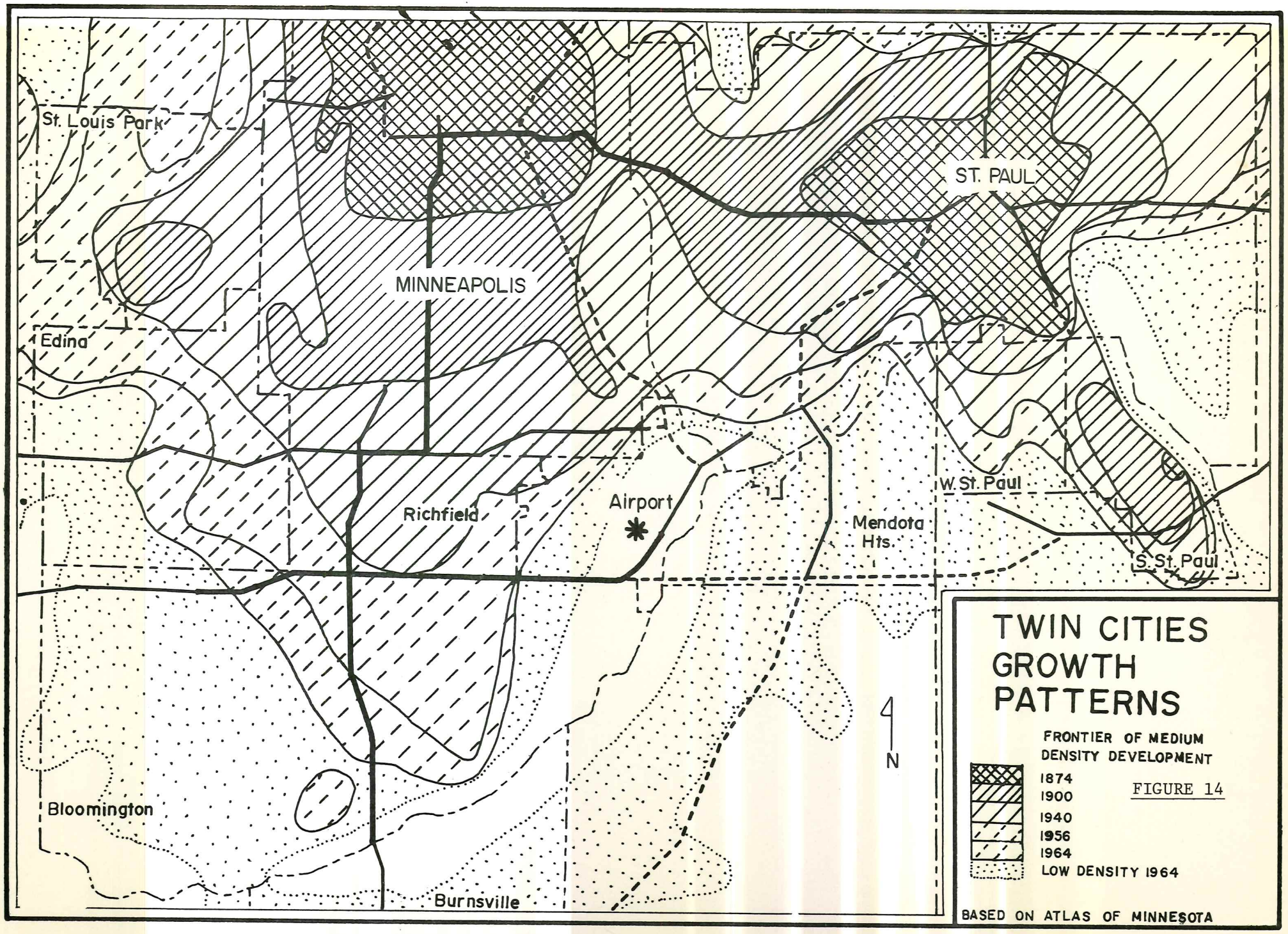
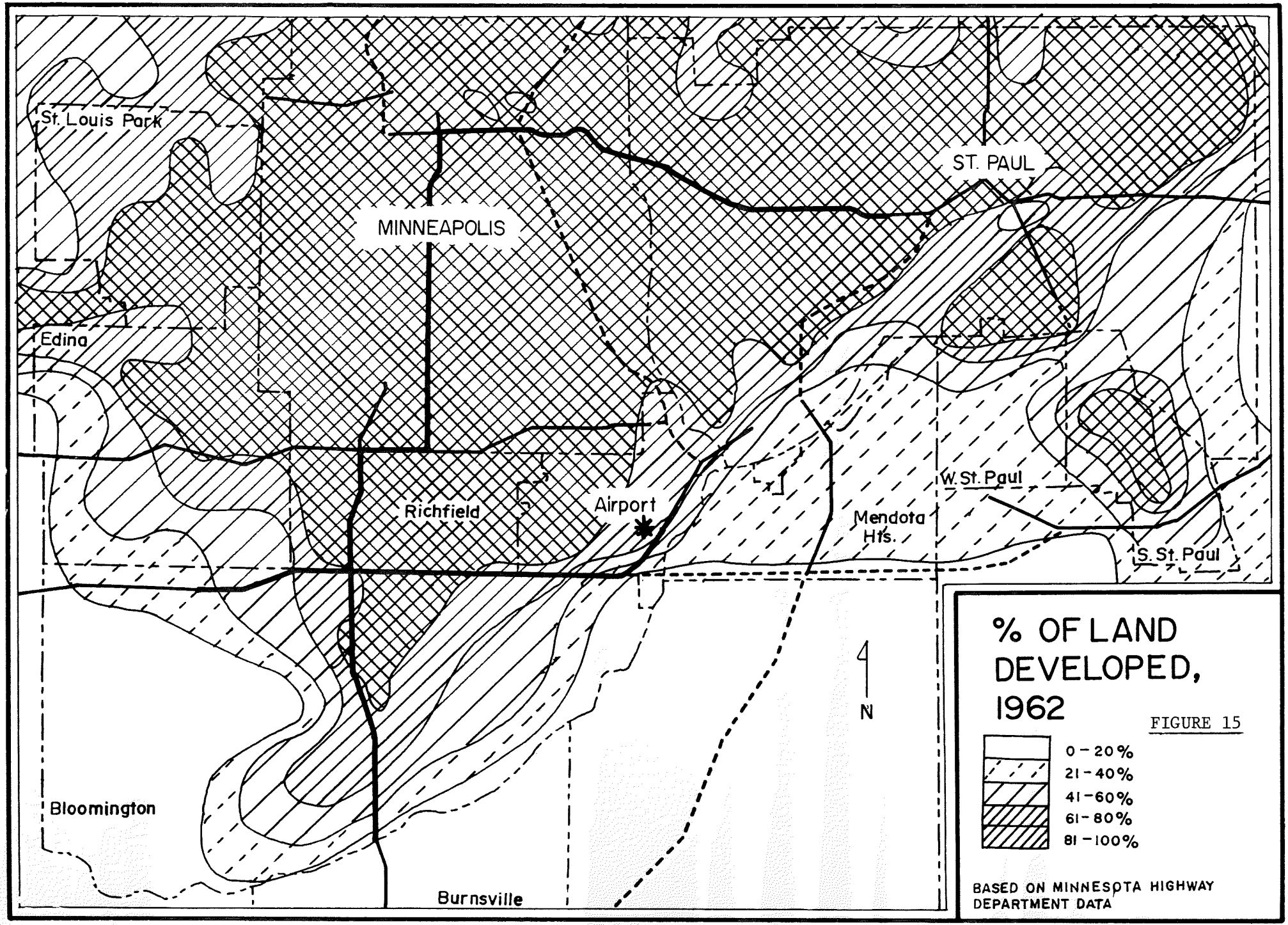
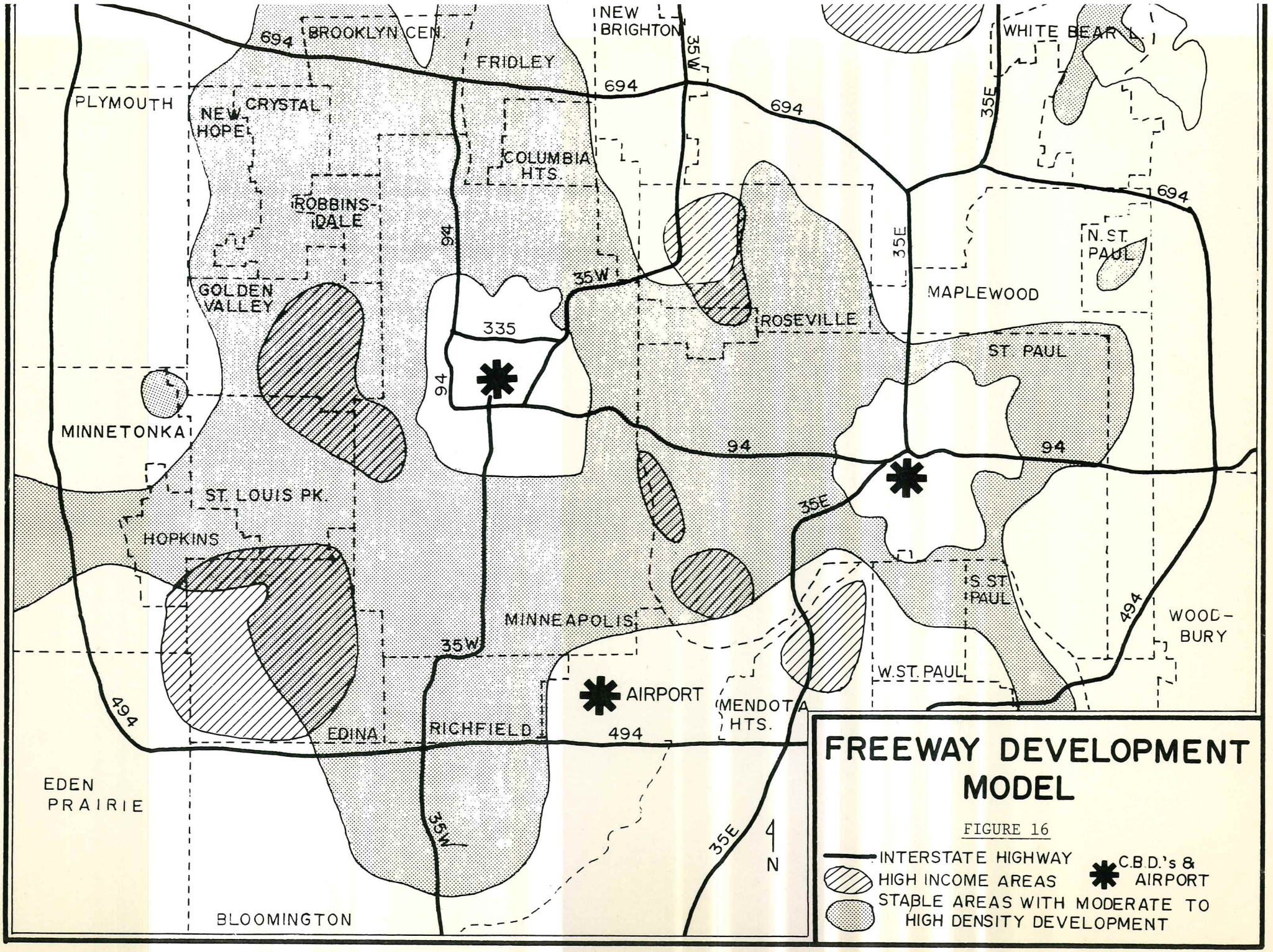

St. Louis Park
MINNEAPOLIS
ST. PAUL
Edina
Richfield
Airport
Mendota Hts.
W. St. Paul
S. St. Paul
Bloomington
Burnsville
N
TWIN CITIES GROWTH PATTERNS
FRONTIER OF MEDIUM DENSITY DEVELOPMENT
1874
1900
1940
1956
1964
LOW DENSITY 1964
BASED ON ATLAS OF MINNESOTA

FIGURE 14


St. Louis Park
MINNEAPOLIS
ST. PAUL
Edina
Richfield
Airport
W. St. Paul
Mendota Hts.
S. St. Paul
Bloomington
Burnsville
N
% OF LAND DEVELOPED, 1962
FIGURE 15
0 - 20 %
21 - 40 %
41 - 60 %
61 - 80 %
81 - 100 %
BASED ON MINNESOTA HIGHWAY DEPARTMENT DATA


694
BROOKLYN CEN.
FRIDLEY
NEW BRIGHTON
35W
WHITE BEAR L.
694
694
35E
PLYMOUTH
NEW HOPE
CRYSTAL
COLUMBIA HTS.
694
ROBBINS-DALE
94
35E
N. ST. PAUL
35W
GOLDEN VALLEY
MAPLEWOOD
335
ROSEVILLE
ST PAUL
94
MINNETONKA
94
94
ST. LOUIS PK.
35E
HOPKINS
S. ST PAUL
494
WOOD-BURY
MINNEAPOLIS
35W
W. ST. PAUL
AIRPORT
MENDOTA HTS.
494
494
EDINA
RICHFIELD
EDEN PRAIRIE
35W
35E
N
BLOOMINGTON
FREEWAY DEVELOPMENT MODEL
FIGURE 16
INTERSTATE HIGHWAY
HIGH INCOME AREAS
STABLE AREAS WITH MODERATE TO HIGH DENSITY DEVELOPMENT
C.B.D.'s & AIRPORT

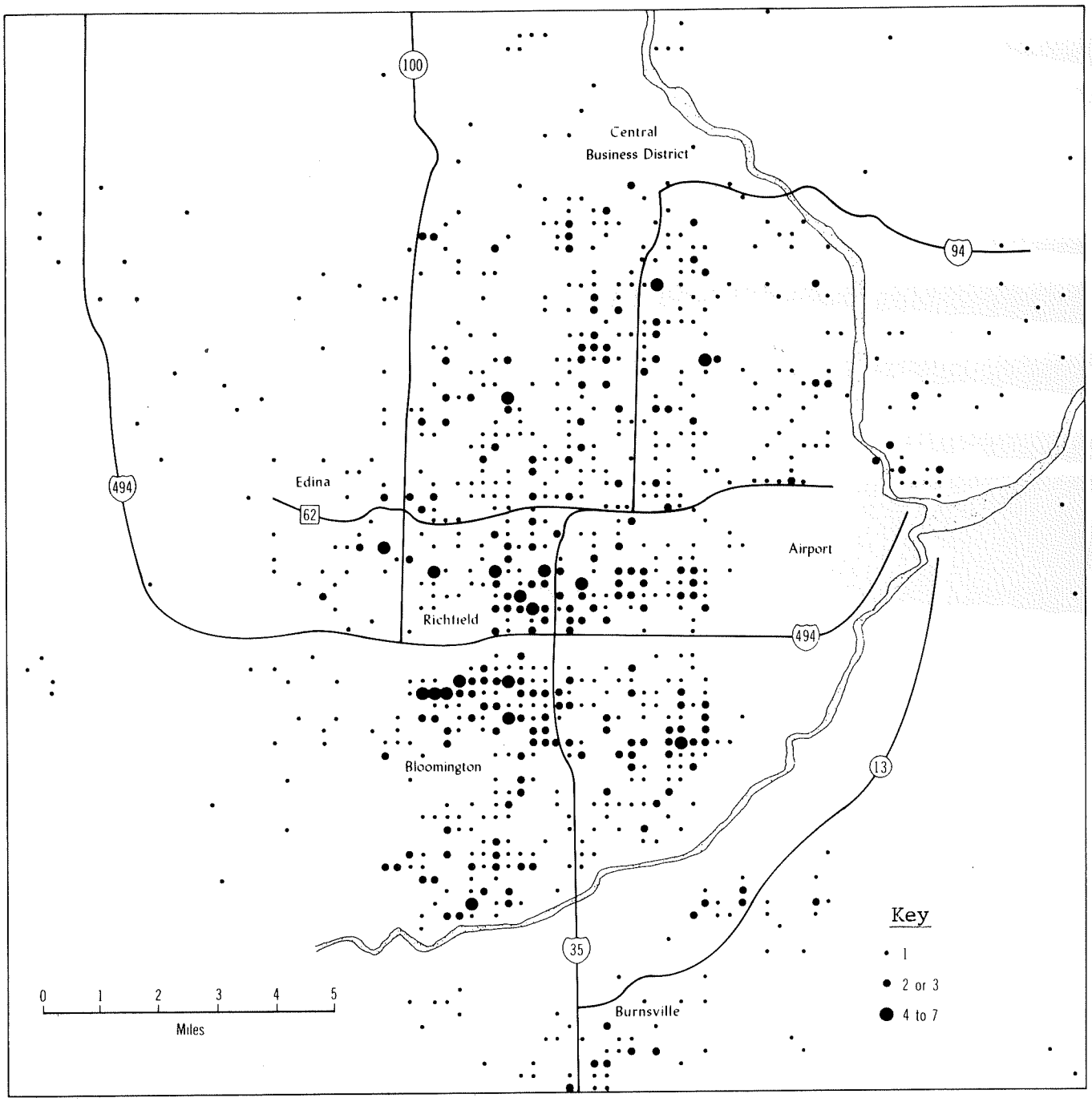


FIGURE 17

CUSTOMER LOCATIONS BY BLOCK OF A SOUTH SUBURBAN RETAIL STORE, 1968

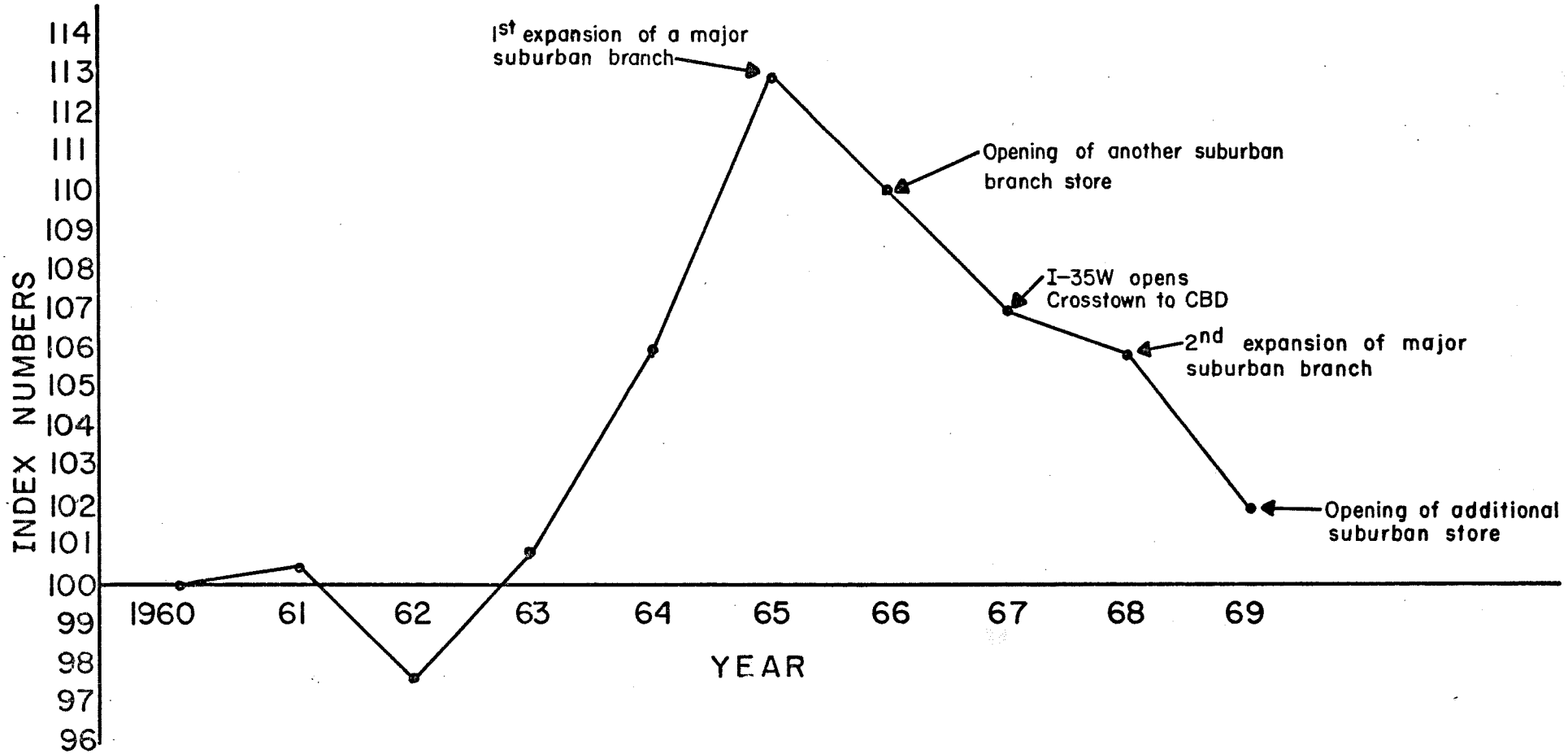


FIGURE 18

SALES TREND
MAJOR MINNEAPOLIS DEPARTMENT STORE LOCATED IN CENTRAL BUSINESS DISTRICT
(Index of Variations in Sales in Current Dollars, 1960 = 100)

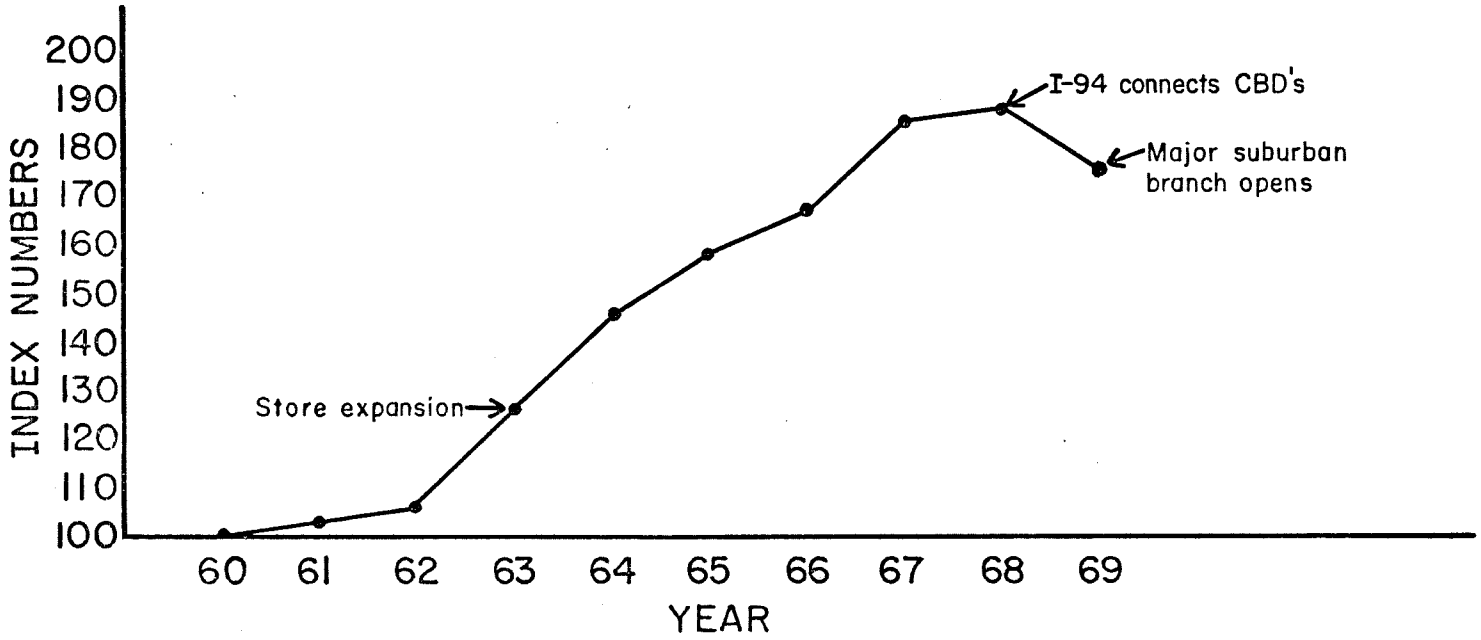


FIGURE 19

SALES TREND
MAJOR ST. PAUL DEPARTMENT STORE LOCATED IN CENTRAL BUSINESS DISTRICT
(Index of Variations in Sales in Current Dollars, 1960 = 100)

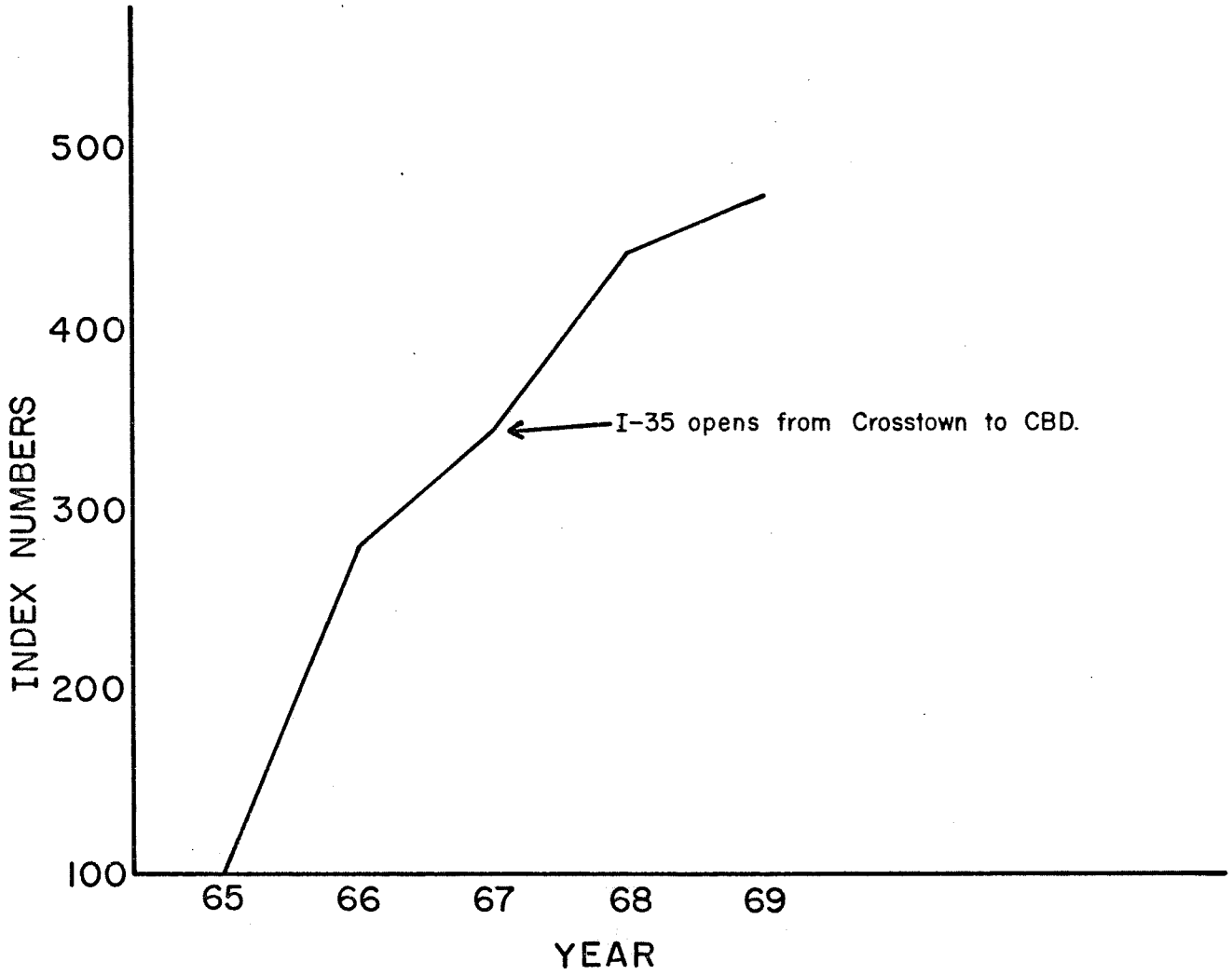


FIGURE 20

SALES TREND
MAJOR SUBURBAN DISCOUNT STORE
(Index of Variations in Sales in Current Dollars, 1965 = 100)

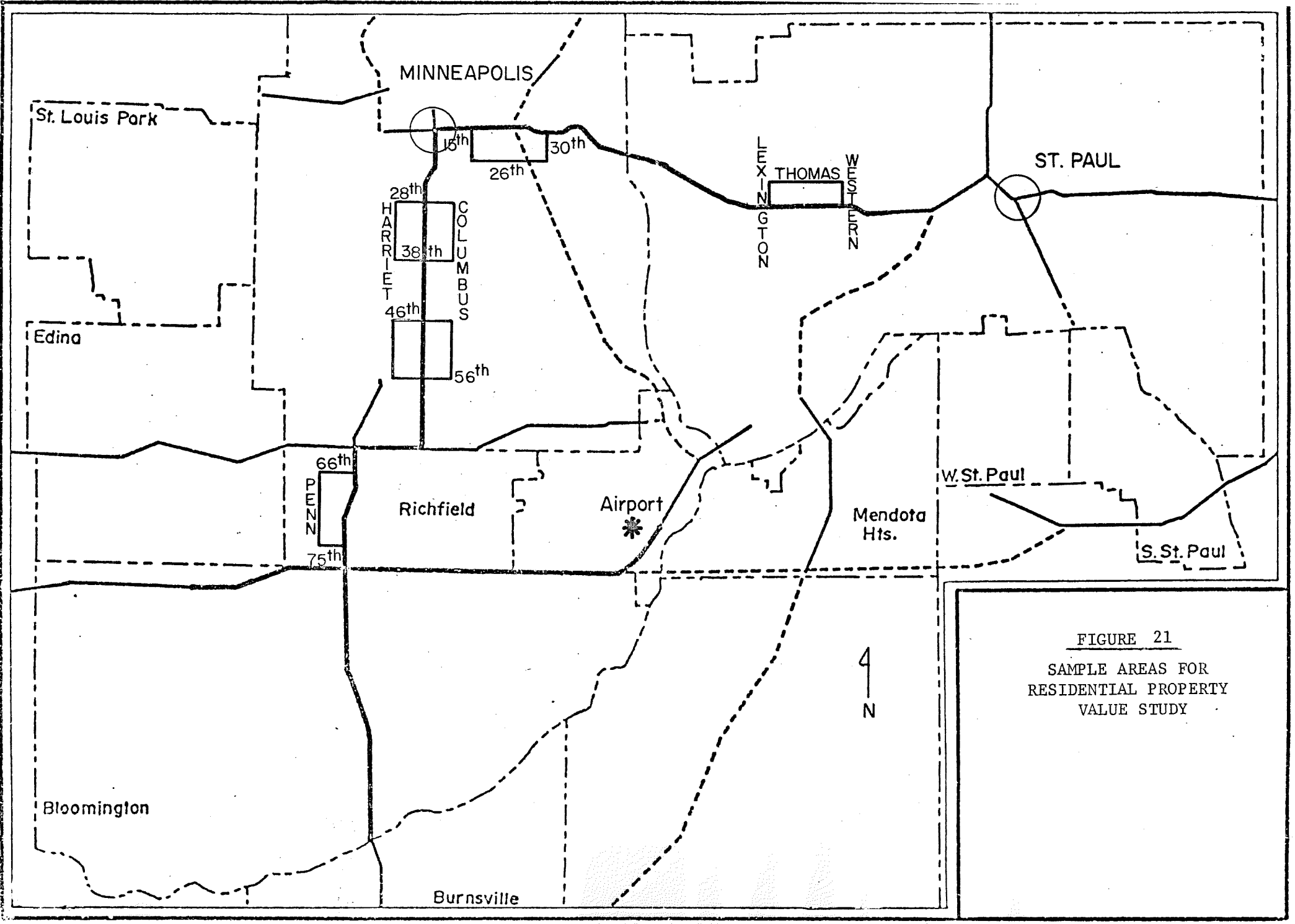


FIGURE 21

SAMPLE AREAS FOR RESIDENTIAL PROPERTY VALUE STUDY

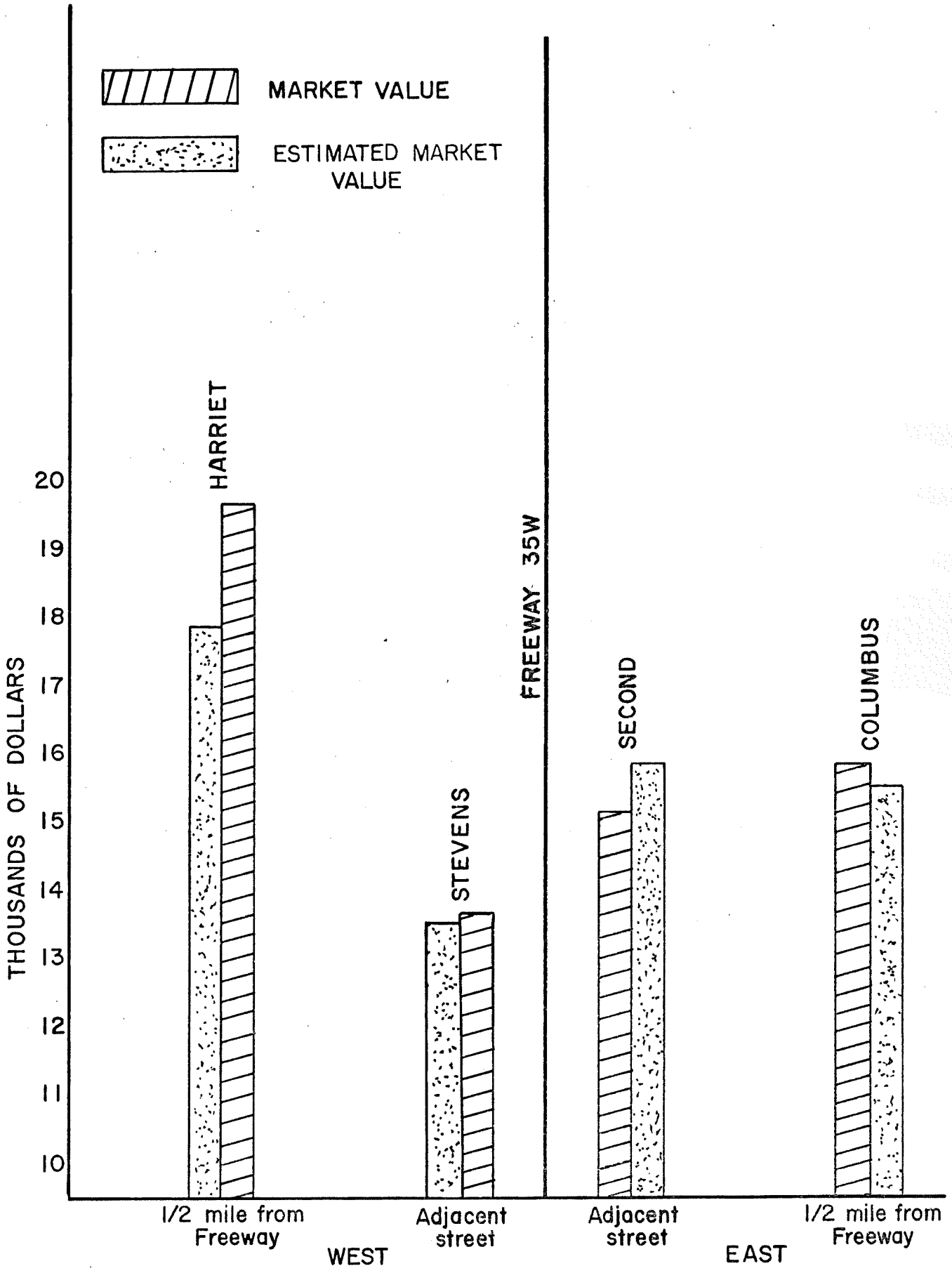


FIGURE 26

AVERAGE MARKET VALUE AND AVERAGE ESTIMATED MARKET VALUE
(by City Assessor's Office) 28th TO 56th STREETS, MINNEAPOLIS

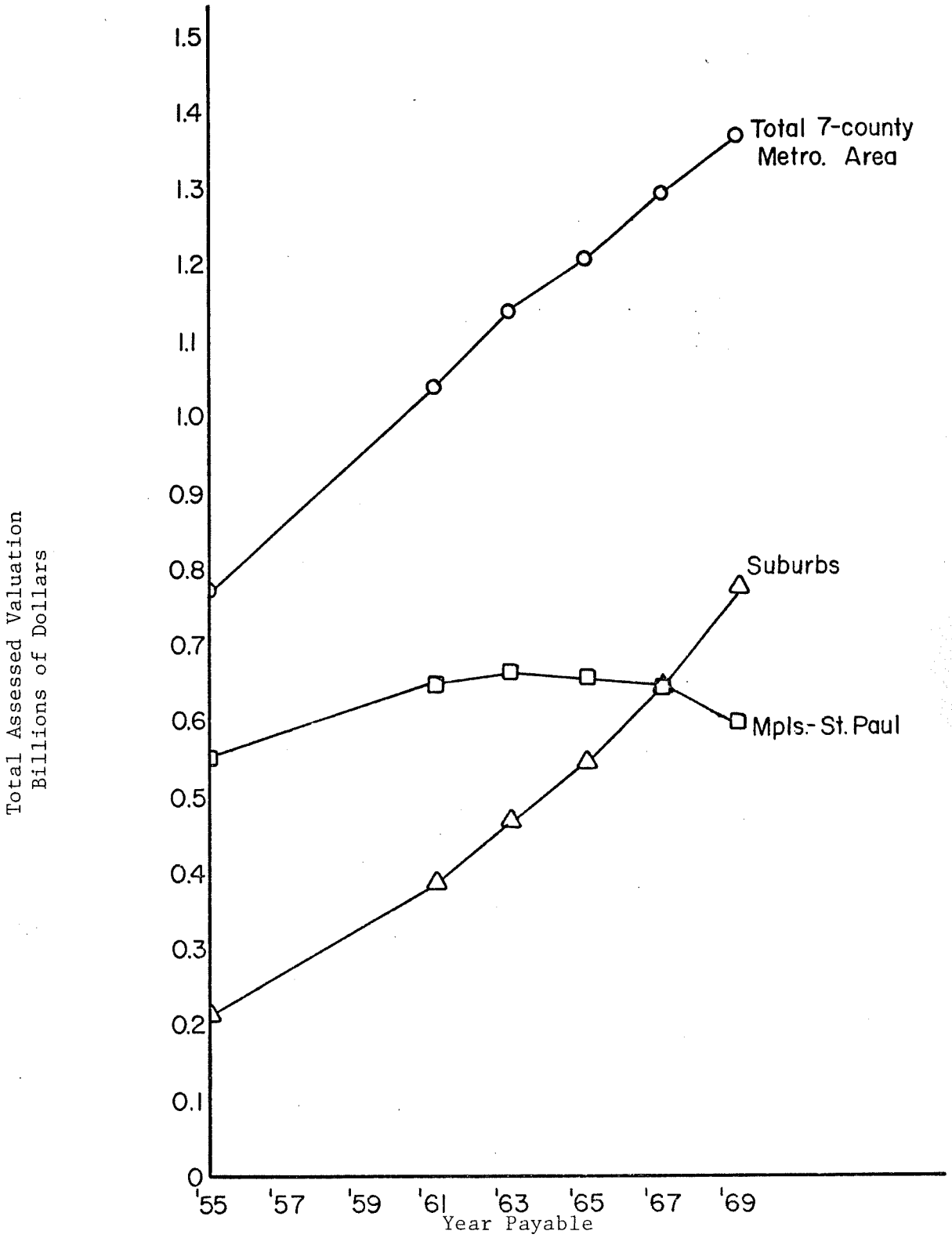


FIGURE 27

COMPARISON OF TOTAL ASSESSED VALUATION IN METROPOLITAN AREA, MINNEAPOLIS/ST. PAUL, AND SUBURBS

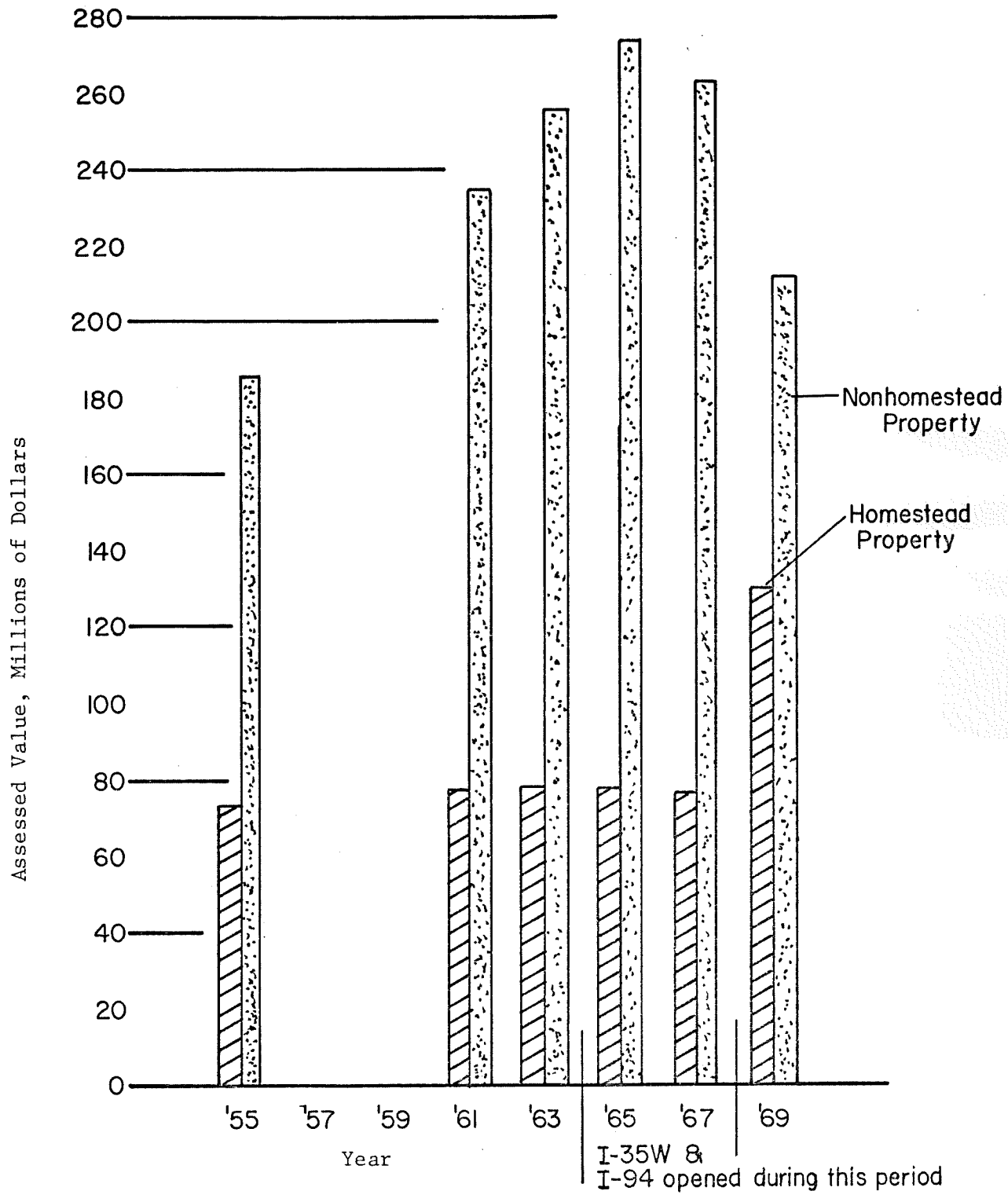


FIGURE 28

REAL PROPERTY ASSESSED VALUATIONS IN MINNEAPOLIS

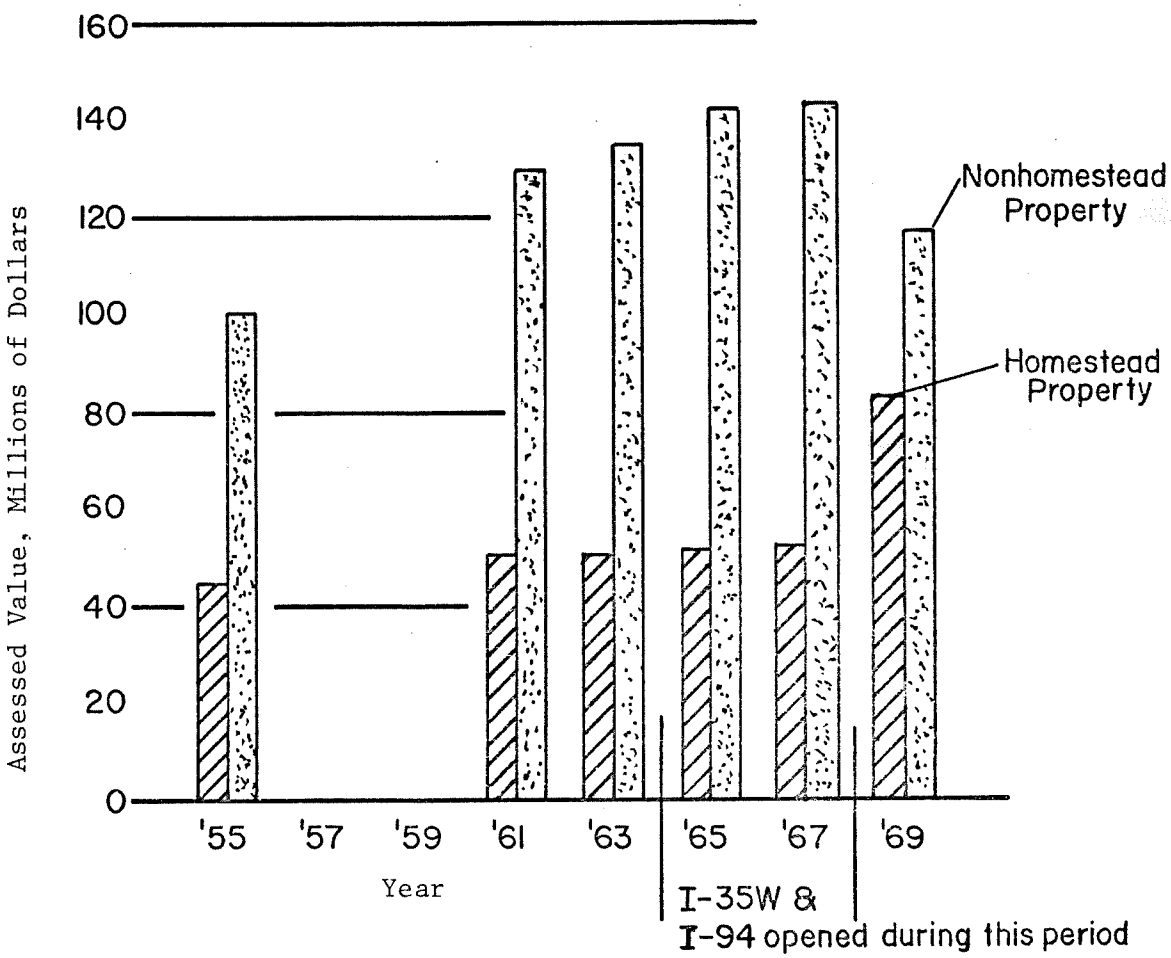


FIGURE 29

REAL PROPERTY ASSESSED VALUATIONS IN ST. PAUL

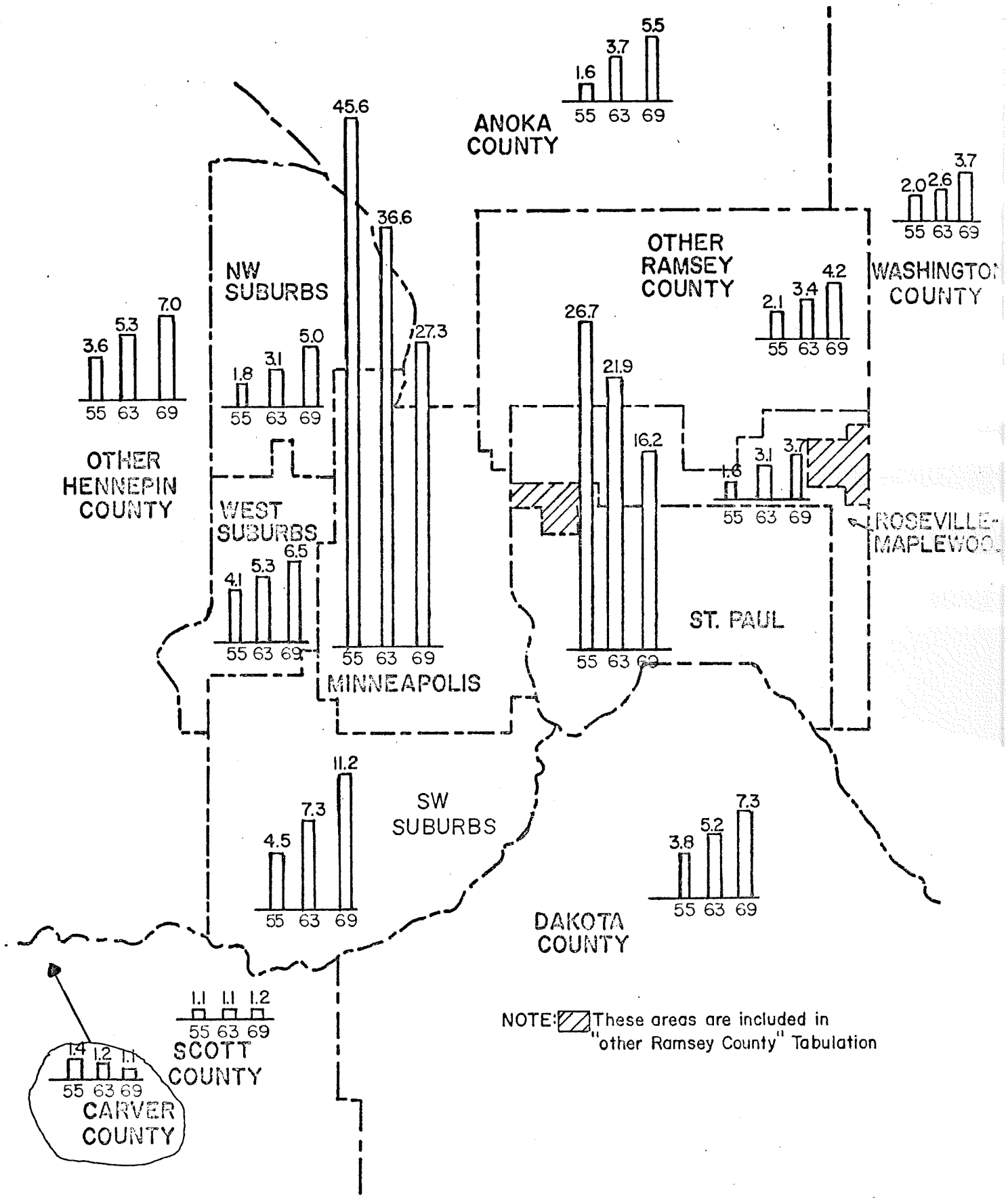


FIGURE 30
TOTAL ASSESSED
VALUATION DISTRIBUTION, PERCENT
1955, 1963, 1969

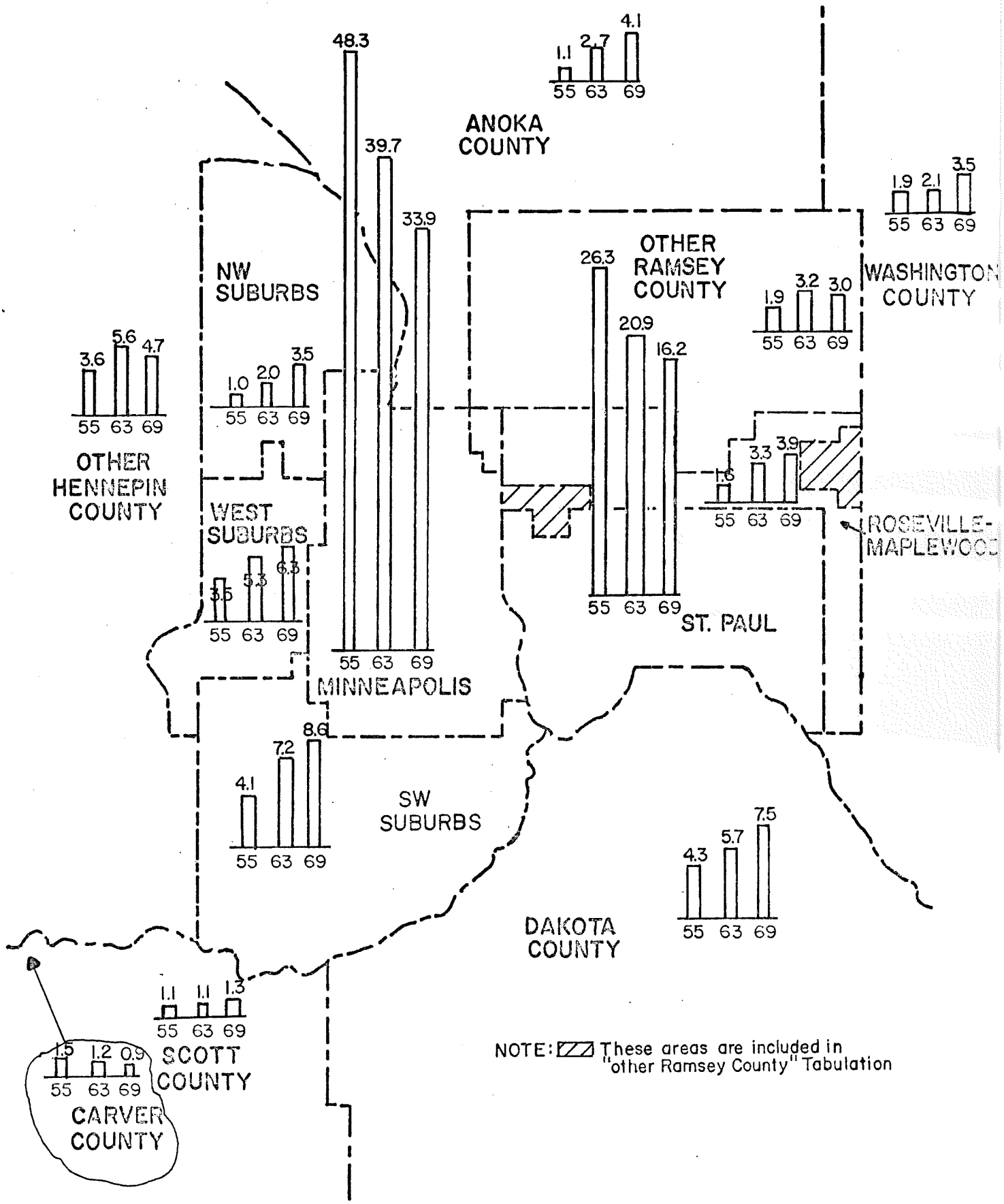


FIGURE 31
TOTAL ASSESSED VALUATION
DISTRIBUTION, PERCENT
1955, 1963, 1969

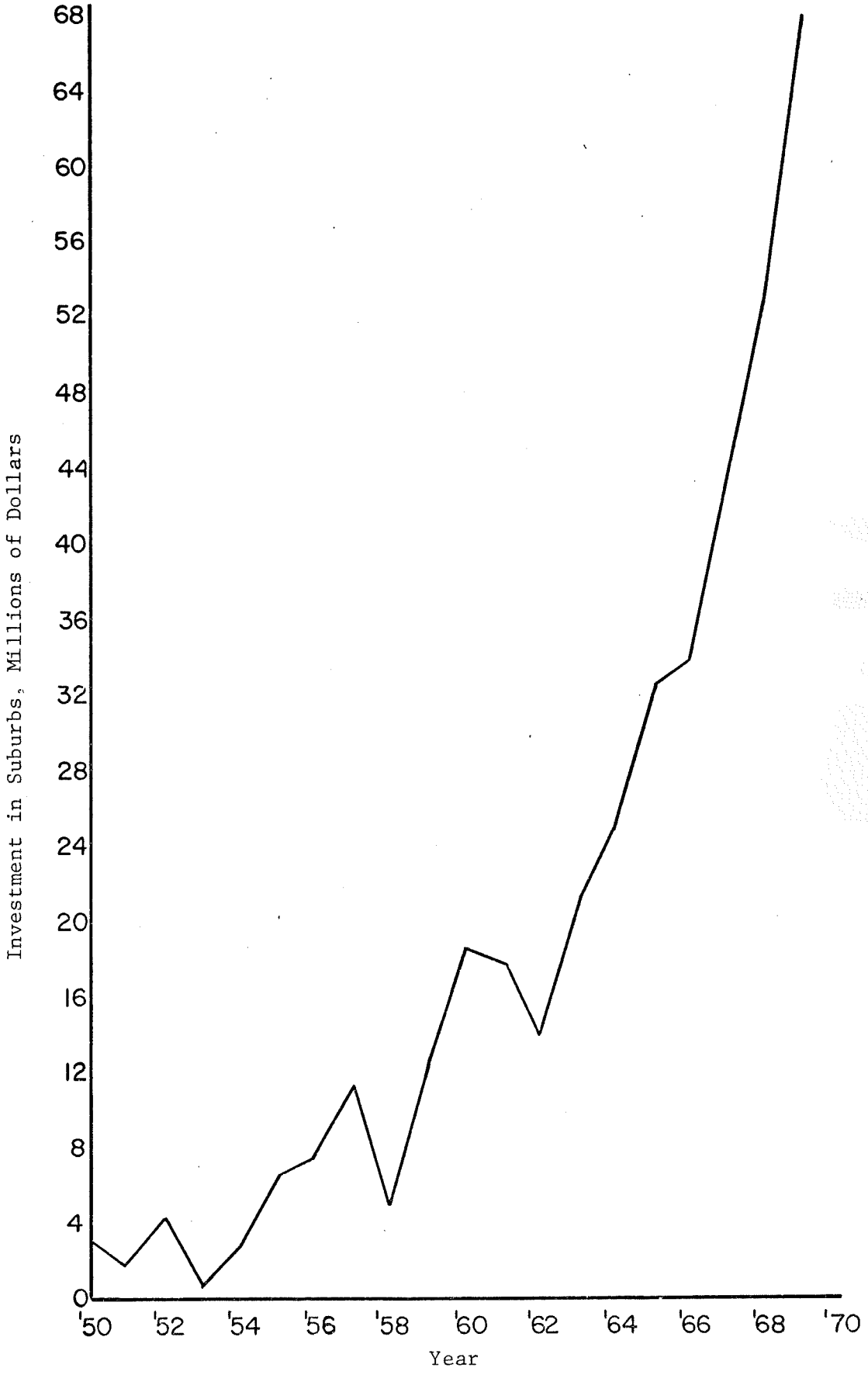


FIGURE 32

NEW COMMERCIAL AND INDUSTRIAL INVESTMENT VALUE IN FIRST RING OF SUBURBS

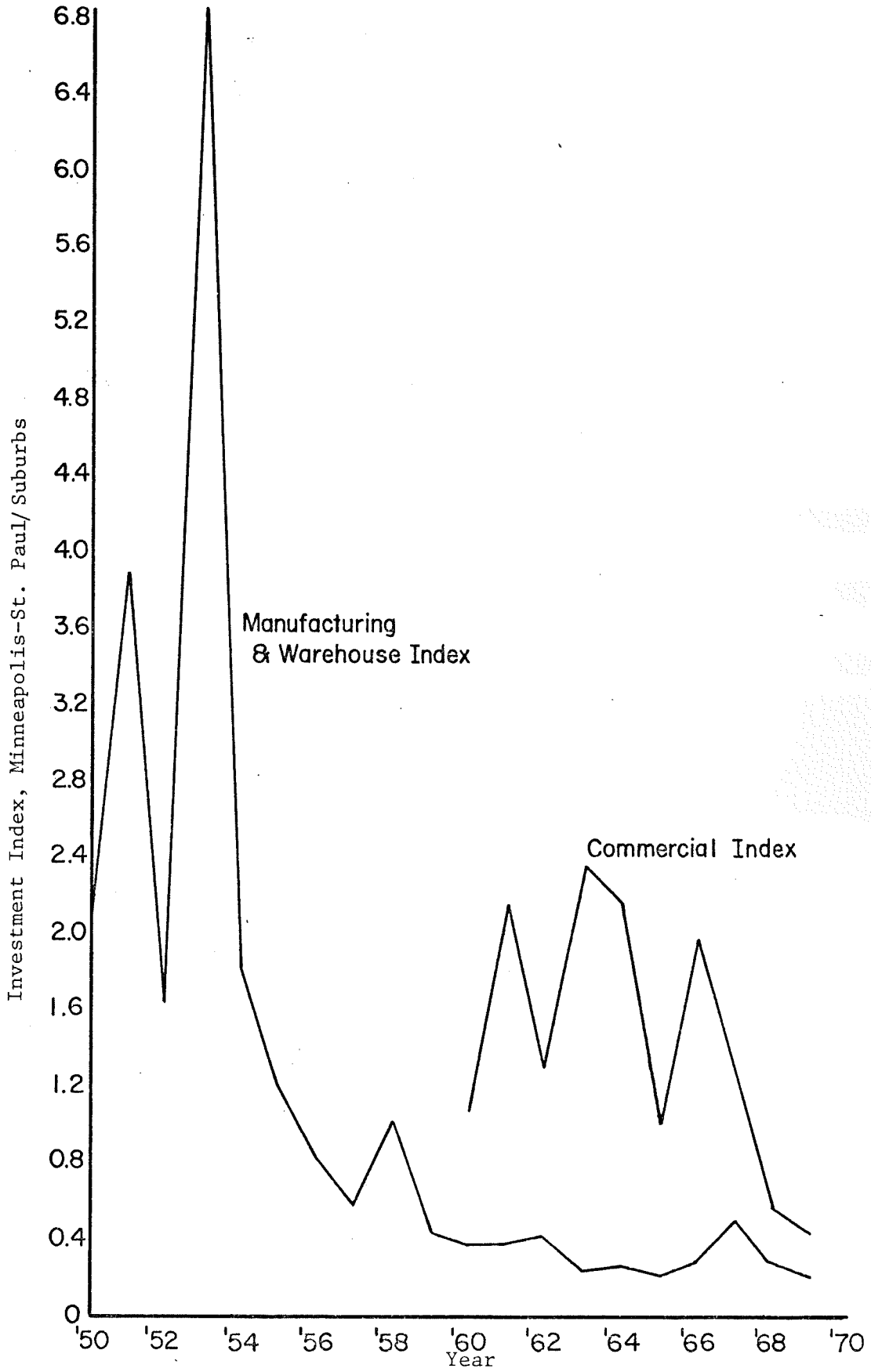


FIGURE 33

COMMERCIAL AND INDUSTRIAL INVESTMENT INDEXES, RATIO OF MINNEAPOLIS-ST. PAUL TO SUBURBAN NEW CONSTRUCTION FOR EACH YEAR

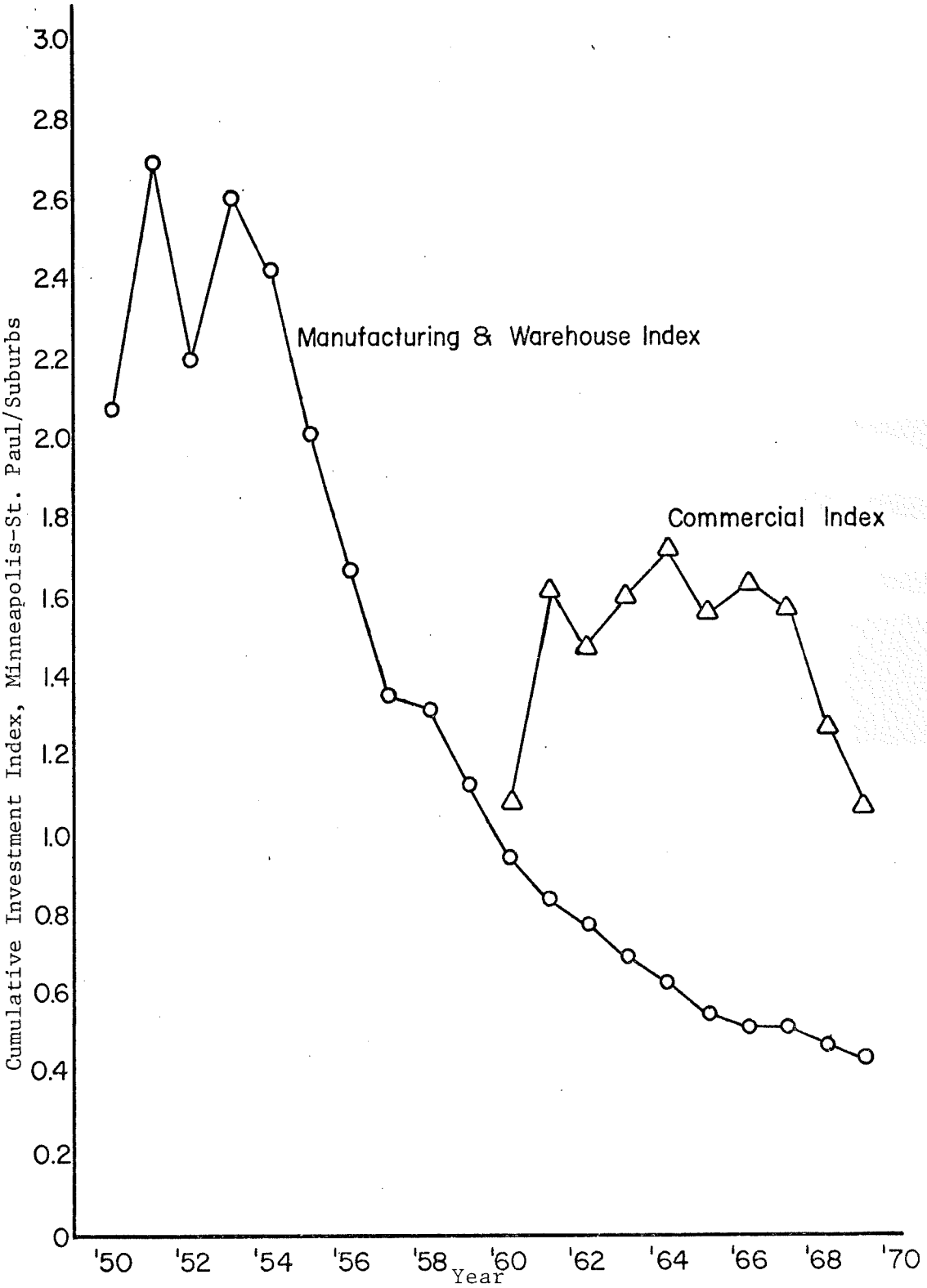


FIGURE 34

CUMULATIVE INVESTMENT INDEXES. RATIO OF MINNEAPOLIS-ST. PAUL TO SUBURBAN COMMERCIAL AND INDUSTRIAL CONSTRUCTION ON A CUMULATIVE BASIS

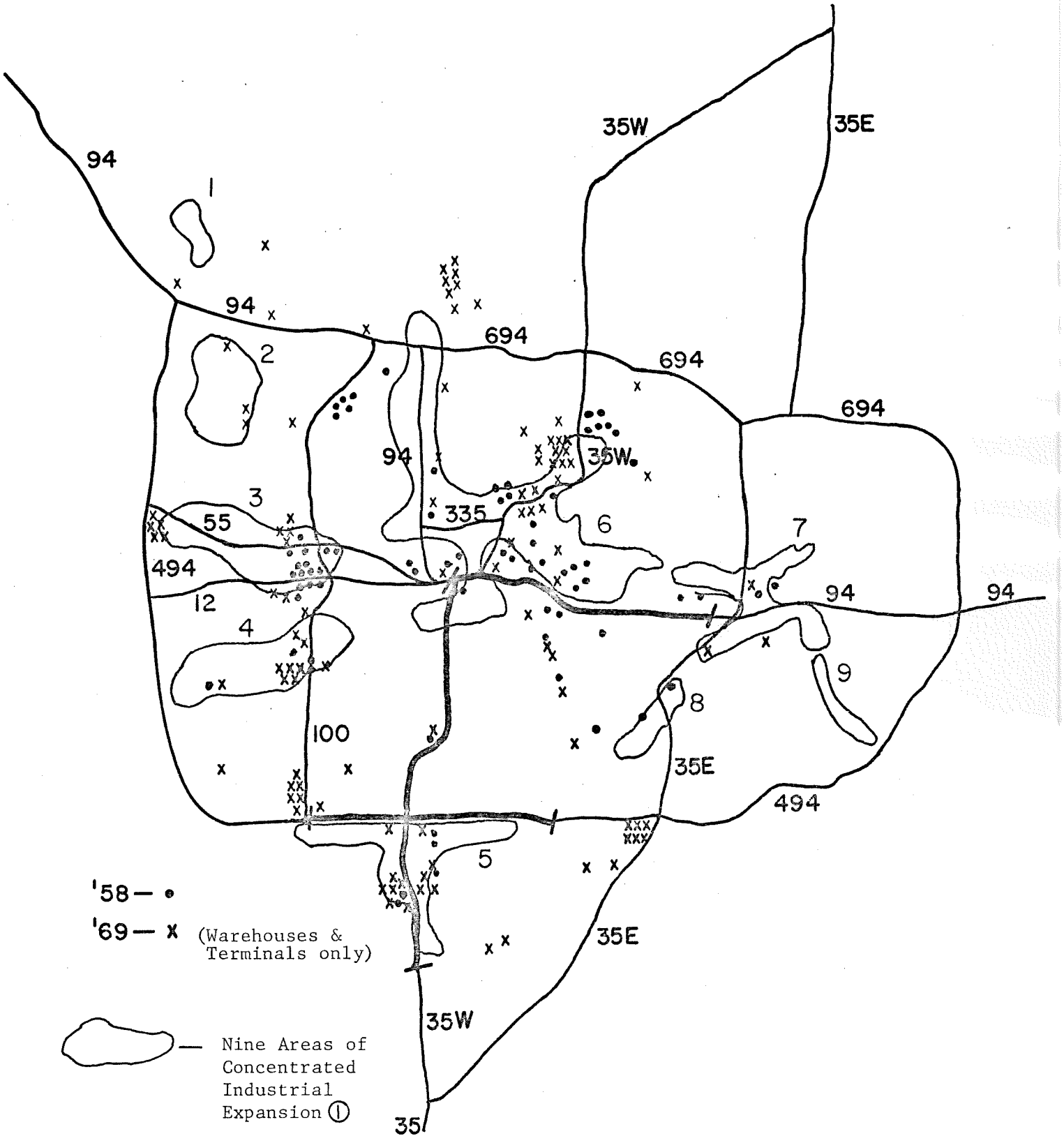


FIGURE 35

COMMERCIAL AND INDUSTRIAL NEW CONSTRUCTION LOCATIONS
RELATIVE TO METROPOLITAN FREEWAY AND ROADWAY SYSTEMS

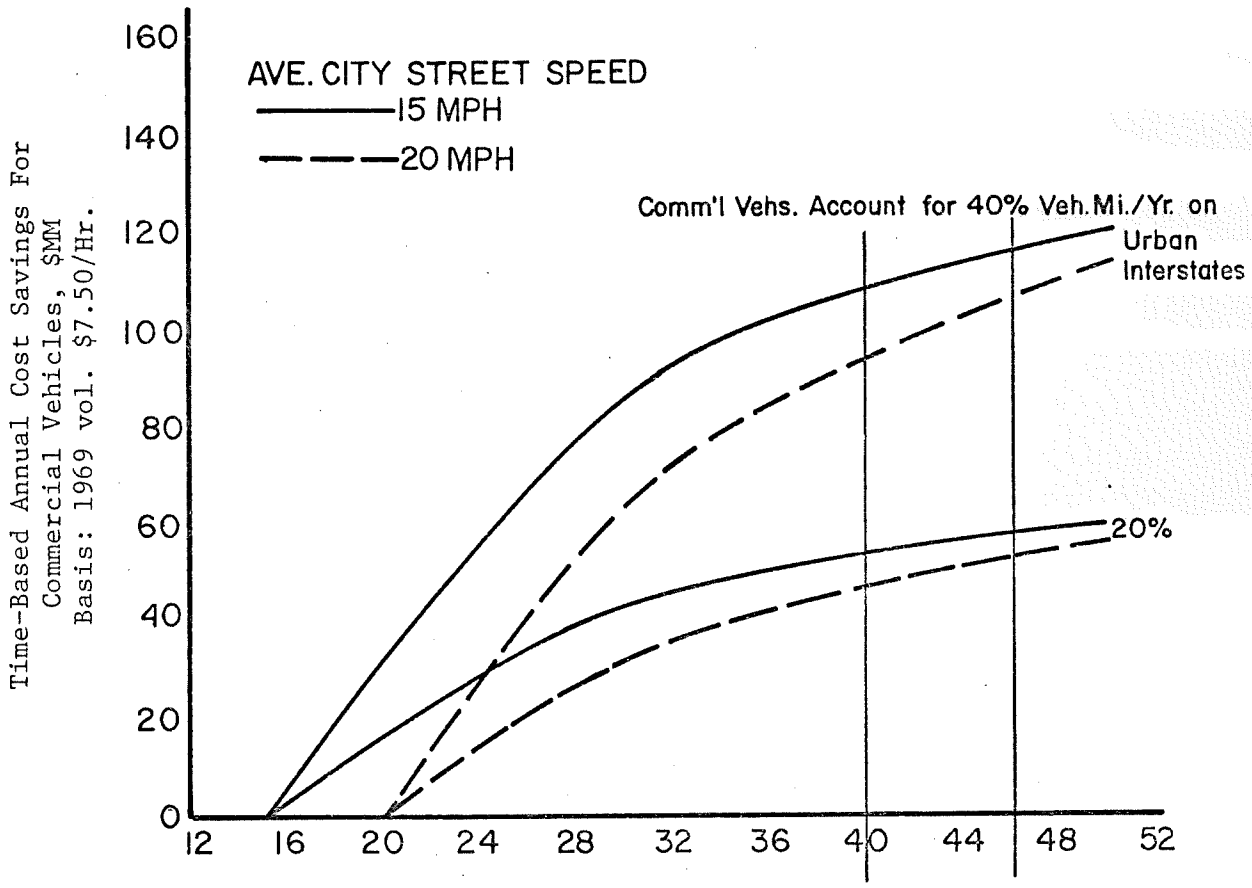


FIGURE 36

TIME-BASED COST SAVINGS FOR COMMERCIAL VEHICLES
USING URBAN FREEWAYS

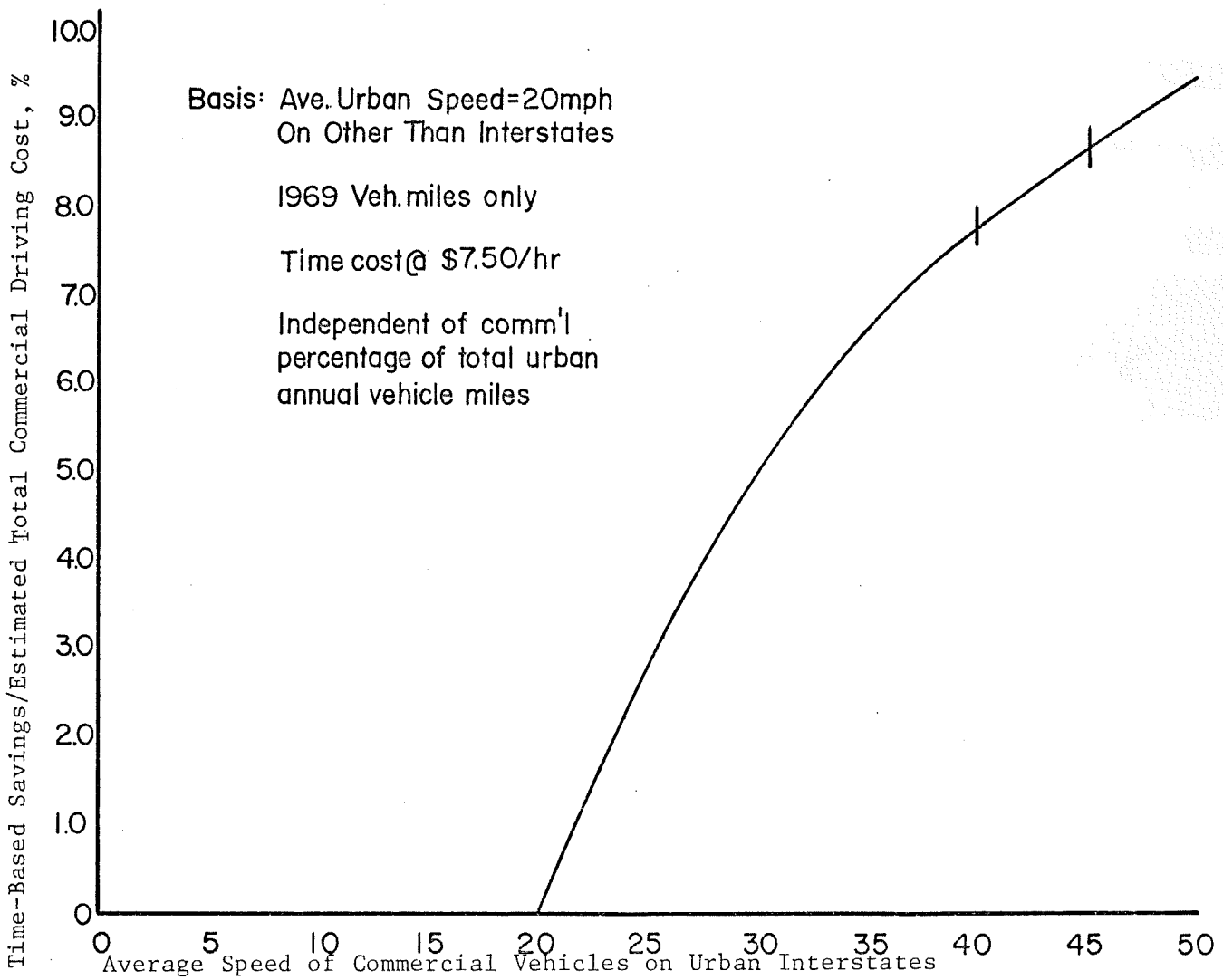


FIGURE 37

COMMERCIAL VEHICLE COST SAVINGS FROM FREEWAY USE AS PERCENT OF ESTIMATED TOTAL COST OF URBAN COMMERCIAL DRIVING

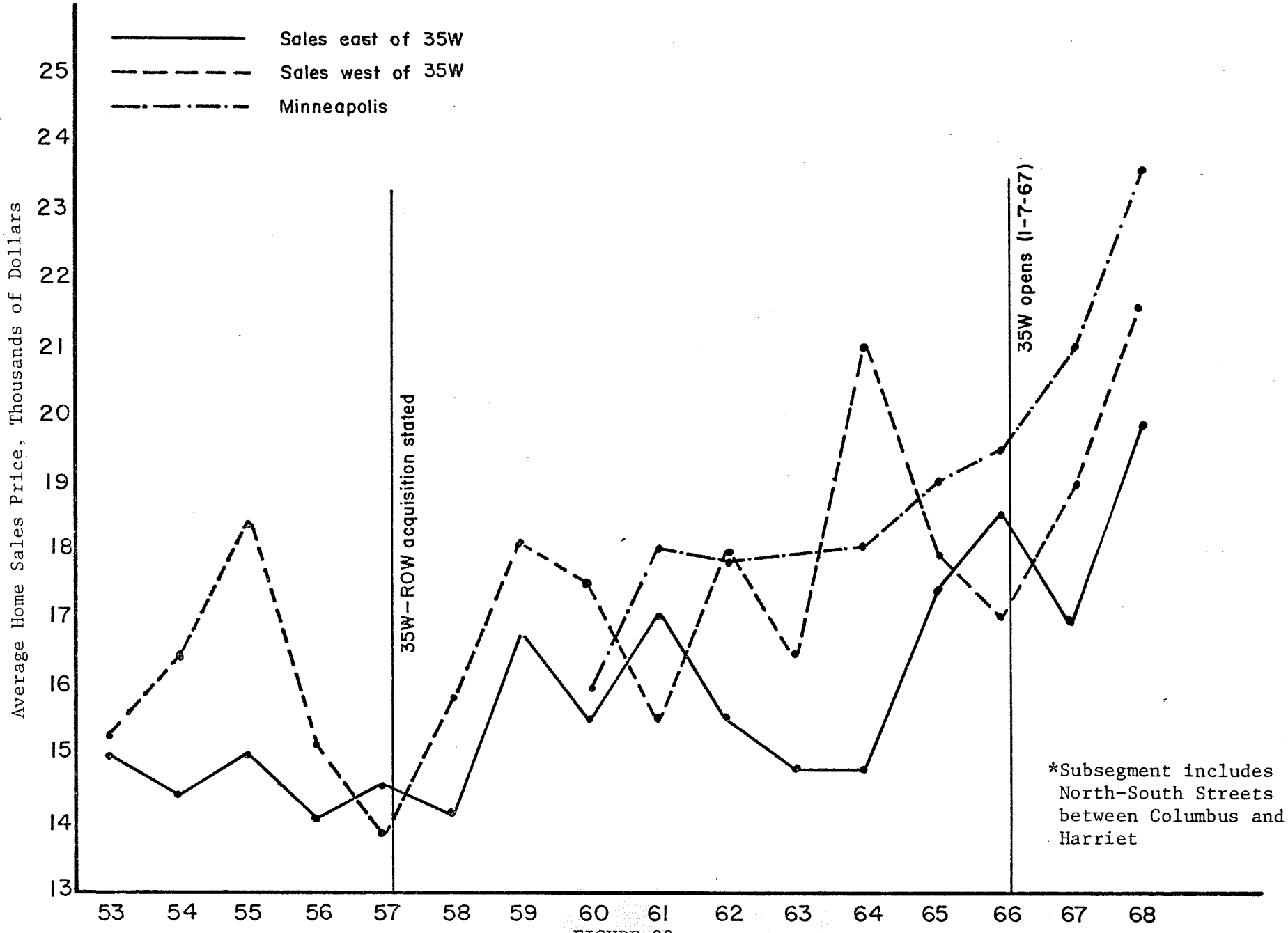


FIGURE 22

AVERAGE HOME SALES PRICE BY YEAR
46th TO 58th STREET SUBSEGMENT* IN MINNEAPOLIS (Sample = 50% of Home Sales)

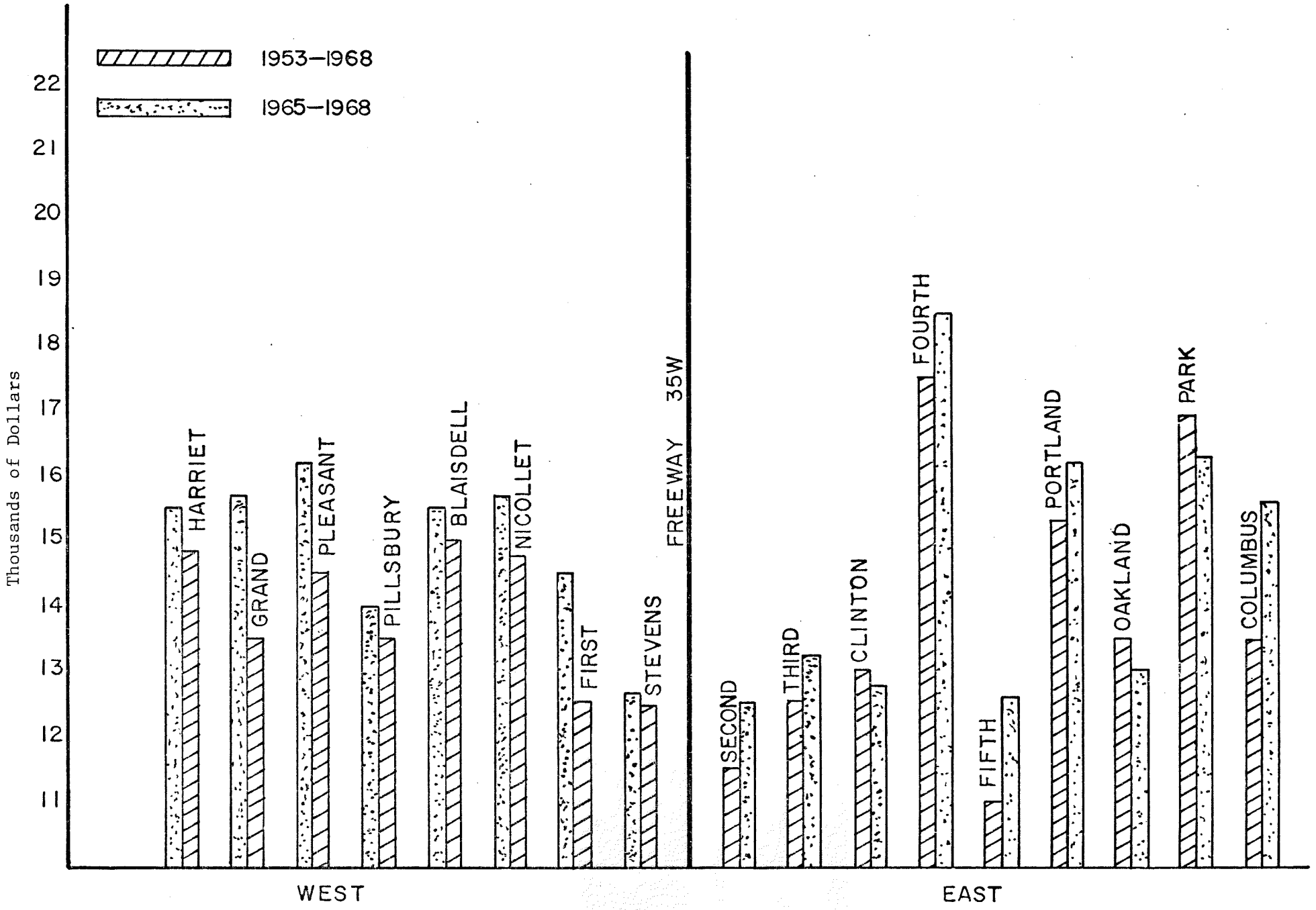


FIGURE 23

AVERAGE SALE PRICE FOR RESIDENTIAL PROPERTIES BY STREET
BETWEEN 28th AND 38th STREETS, MINNEAPOLIS

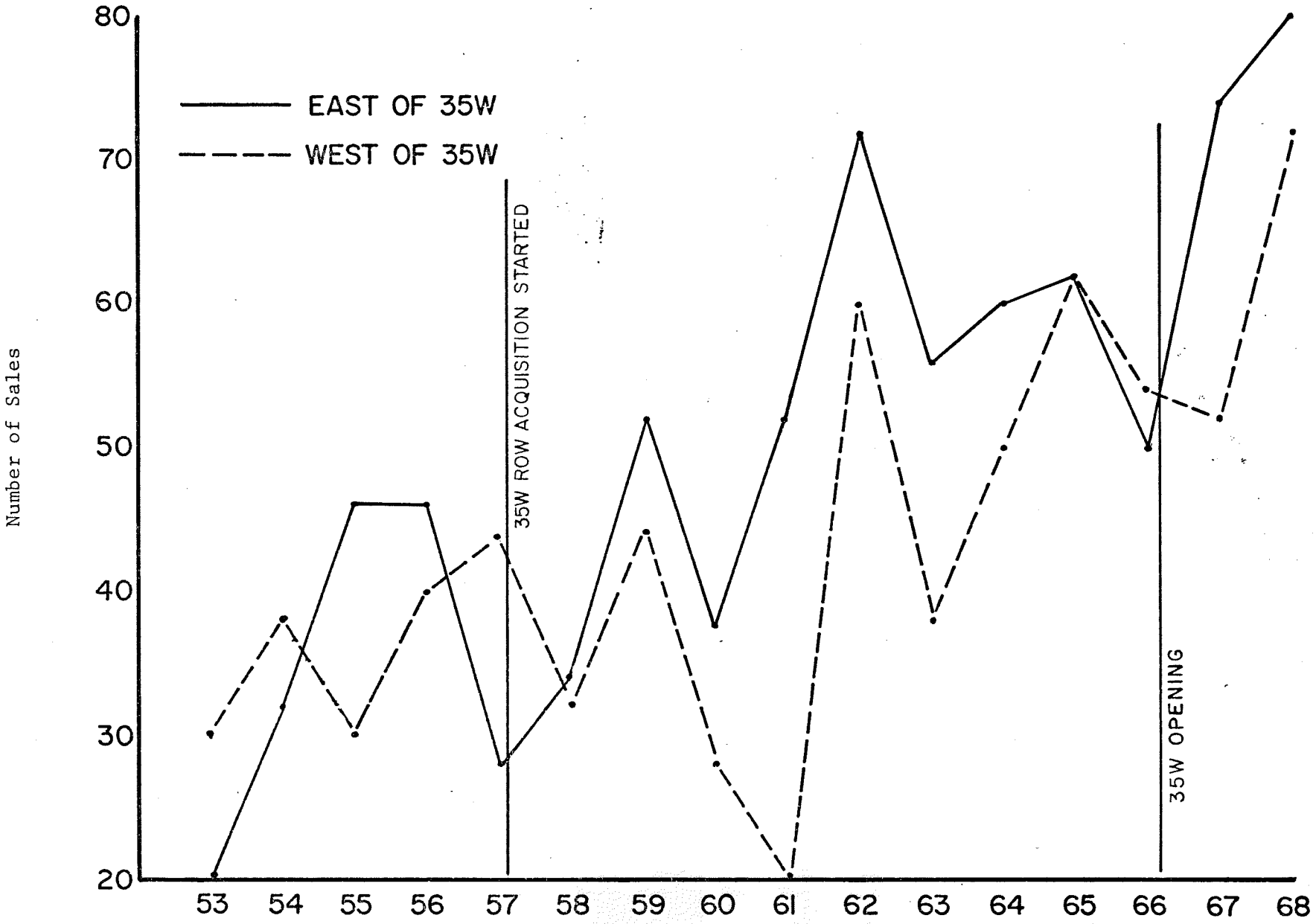


FIGURE 24

NUMBER OF RESIDENTIAL PROPERTY SALES BY YEAR
28th TO 38th STREETS, MINNEAPOLIS

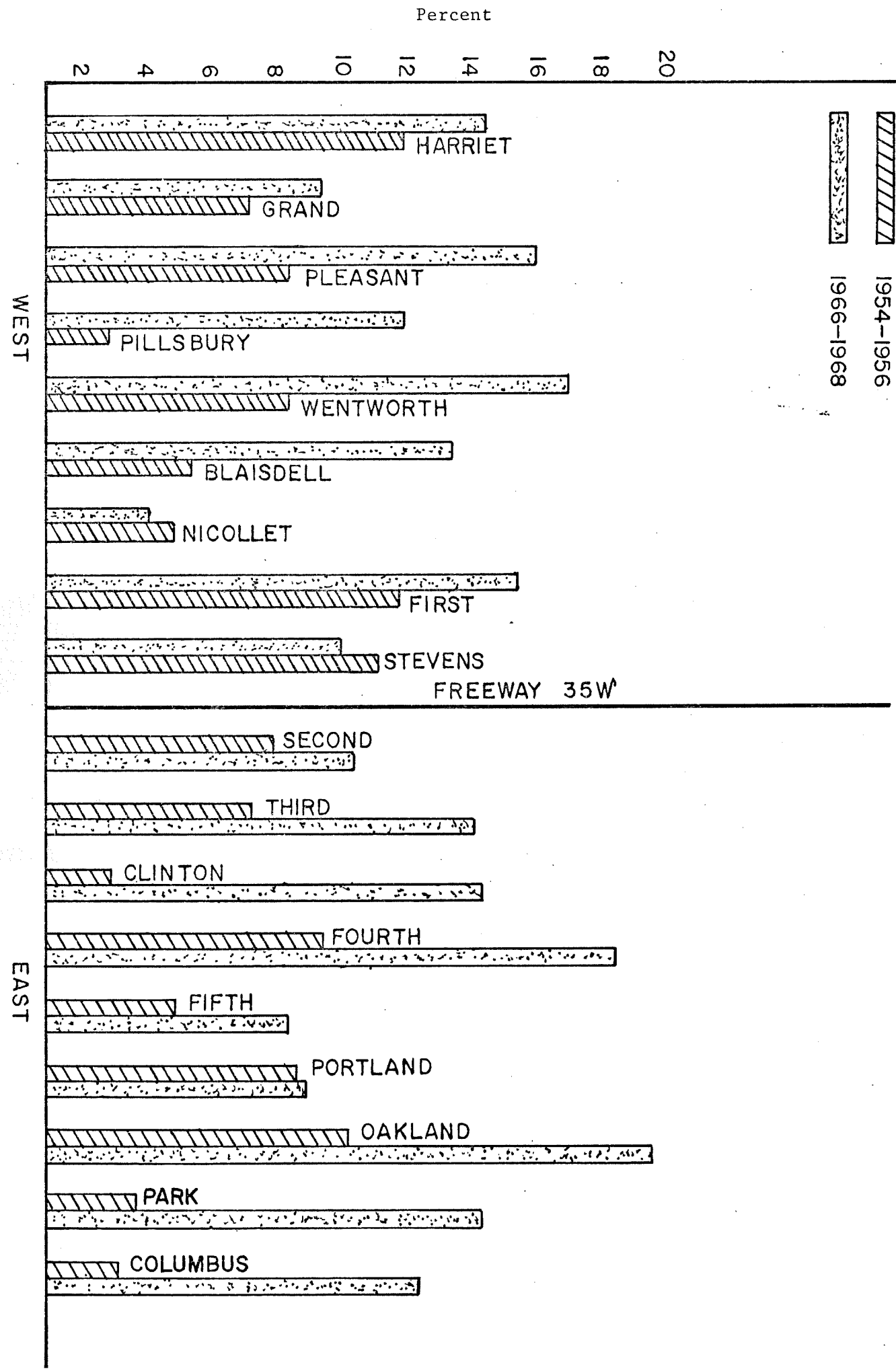
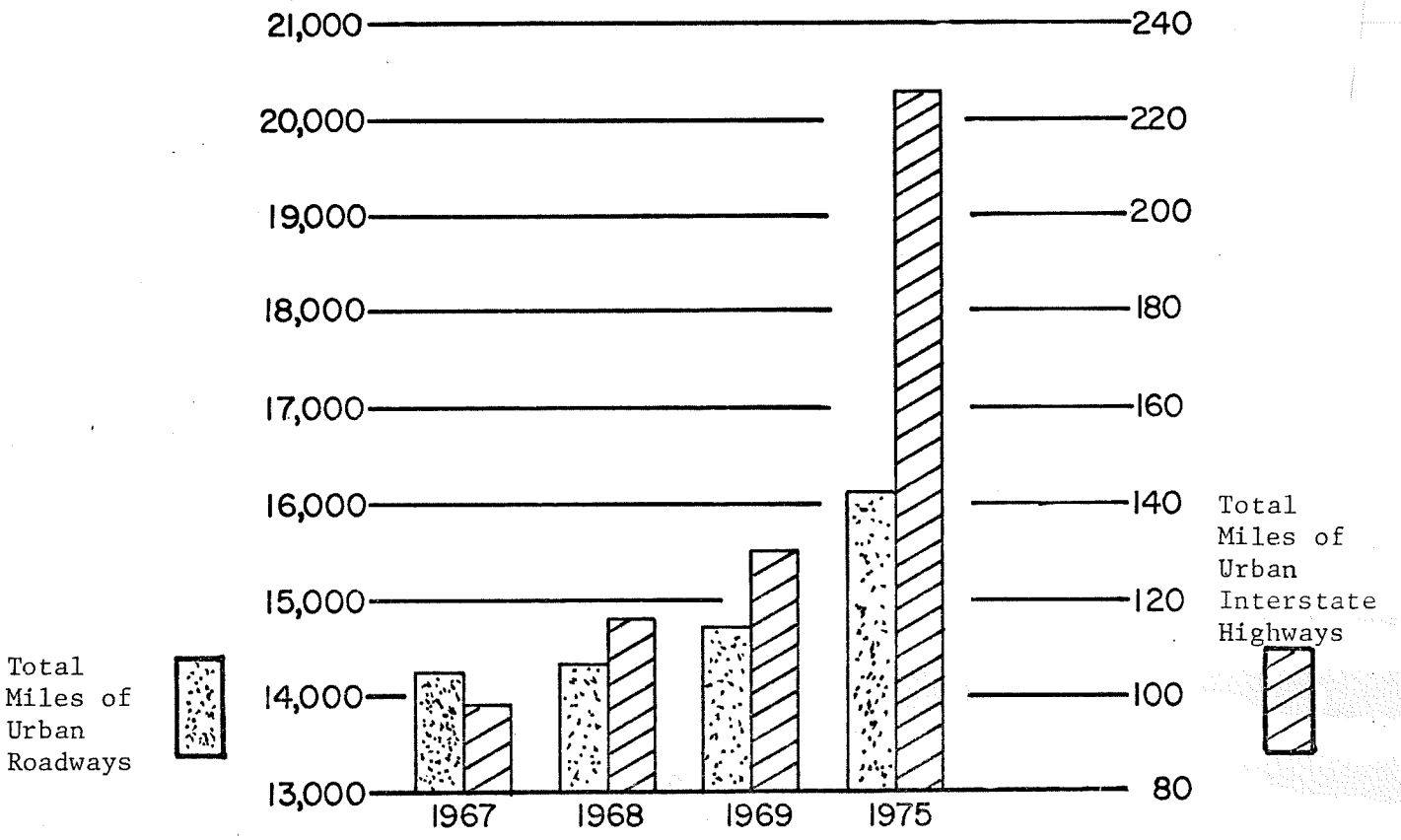


FIGURE 25

SALES TURNOVER RATES BY STREET

BETWEEN 46th AND 58th STREETS, MINNEAPOLIS



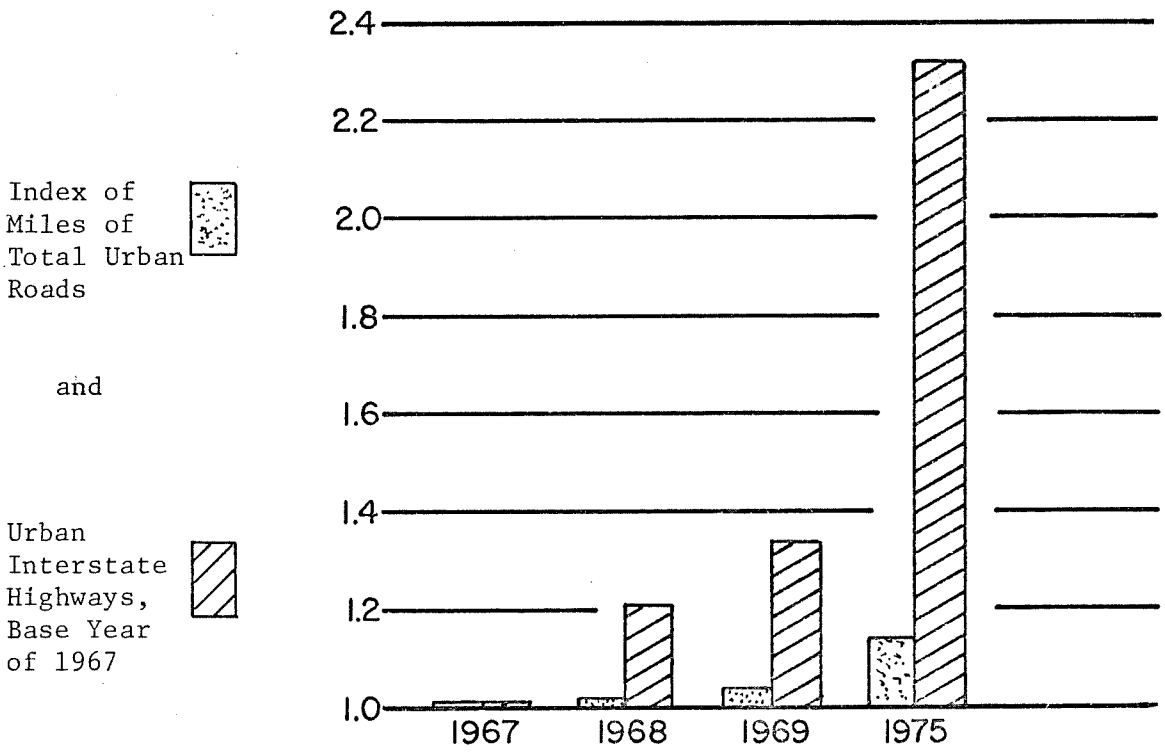


FIGURE 38

URBAN ROADWAY AND INTERSTATE HIGHWAY
MILES IN MINNESOTA
1967, 1968, 1969, and 1975

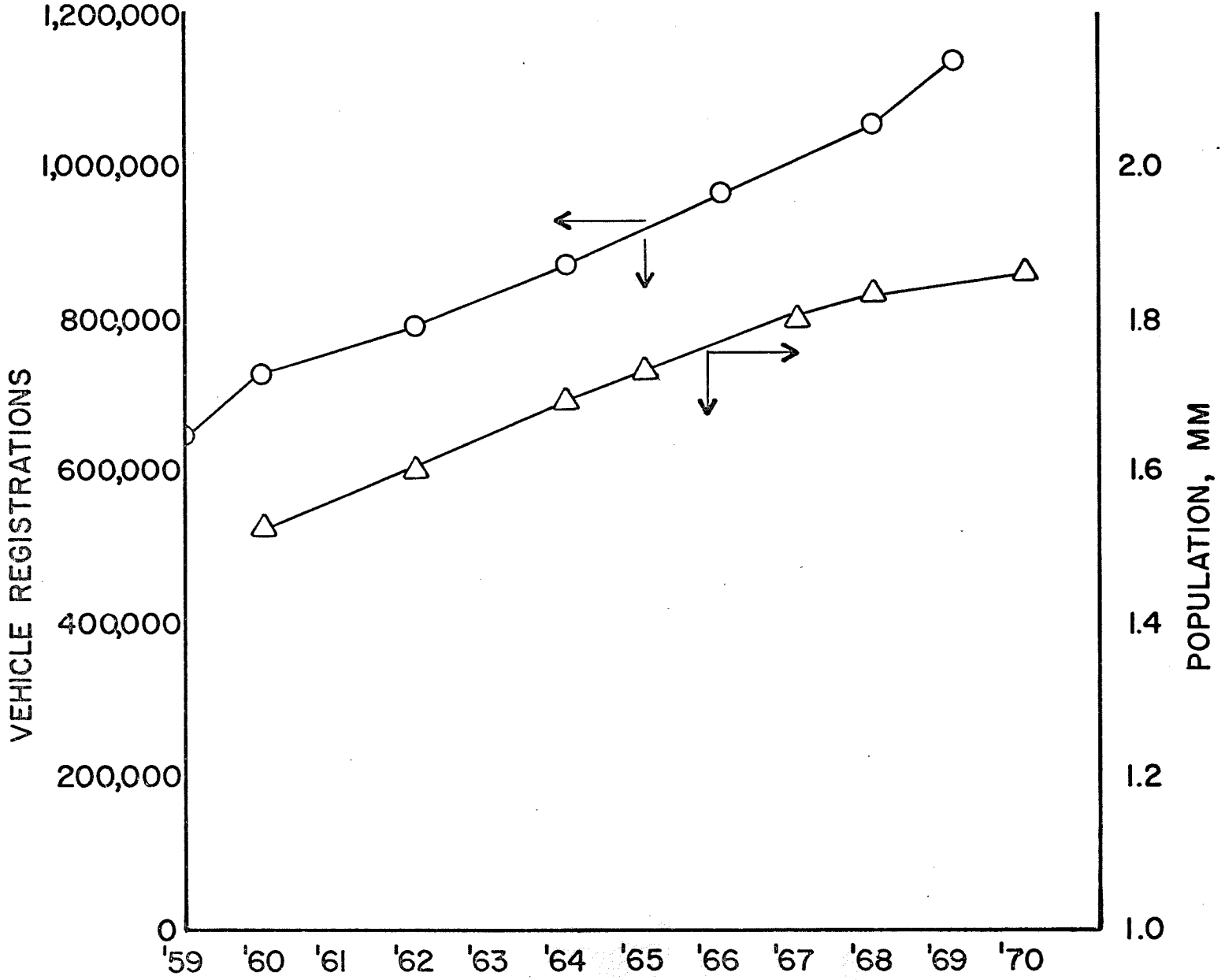


FIGURE 39

POPULATION AND VEHICLE REGISTRATION TRENDS IN 7-COUNTY METROPOLITAN AREA

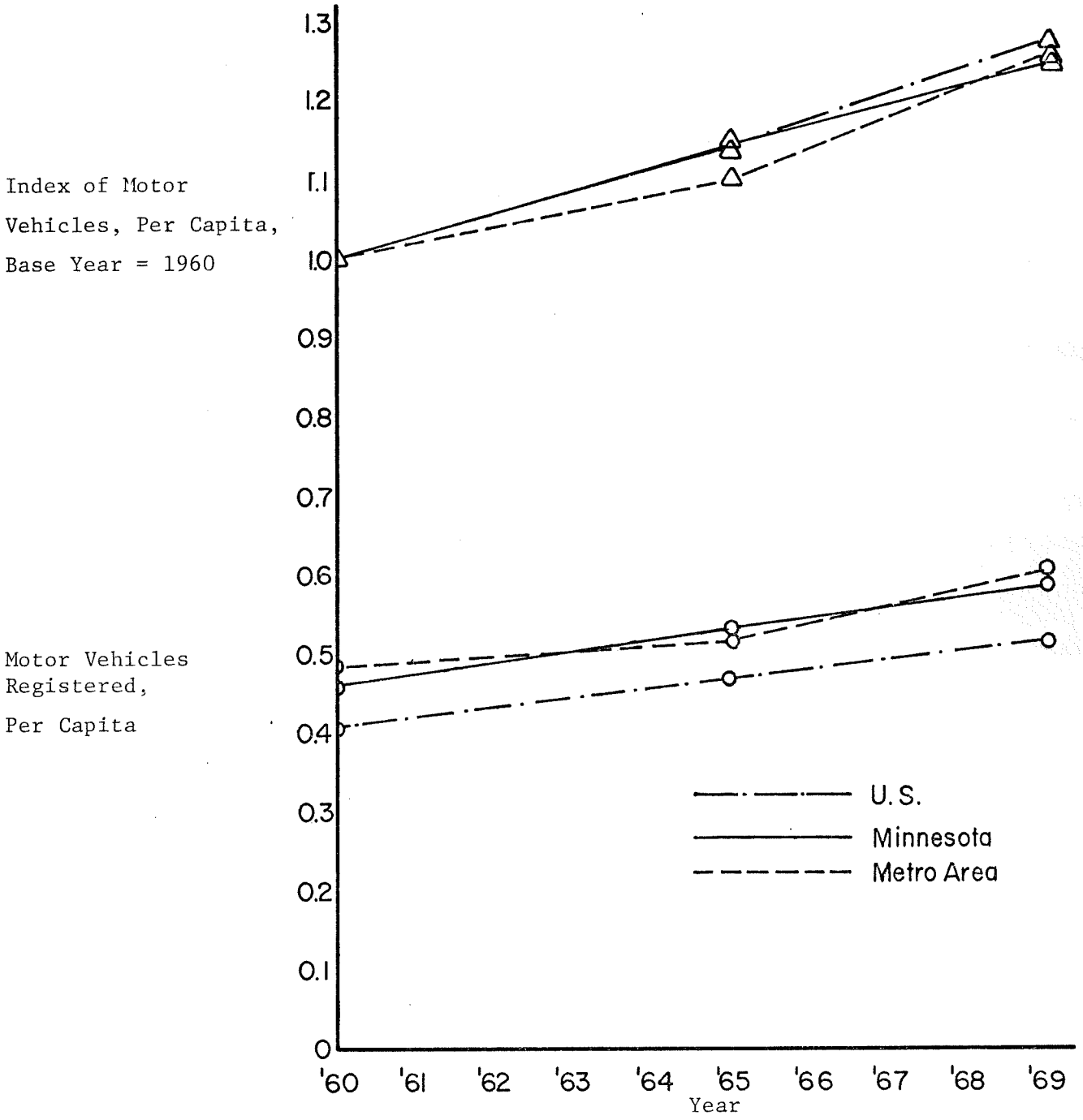


FIGURE 40

COMPARATIVE DATA OF MOTOR VEHICLES PER CAPITA IN U.S., MINNESOTA, AND METROPOLITAN AREA

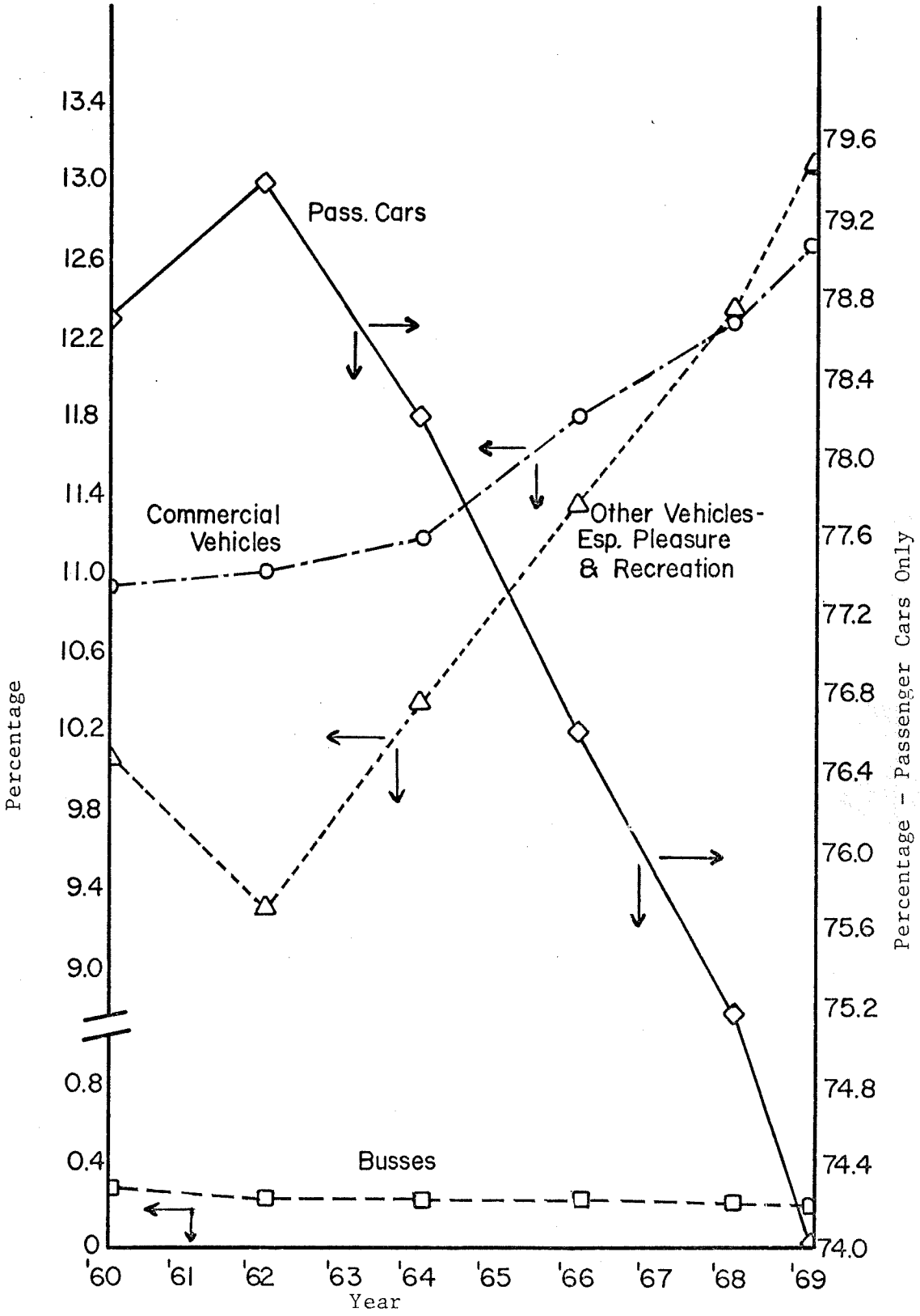


FIGURE 41

PROPORTION OF TOTAL VEHICLE REGISTRATIONS FOR VARIOUS GROUPS OF VEHICLES, %
(7 County Metro Area)

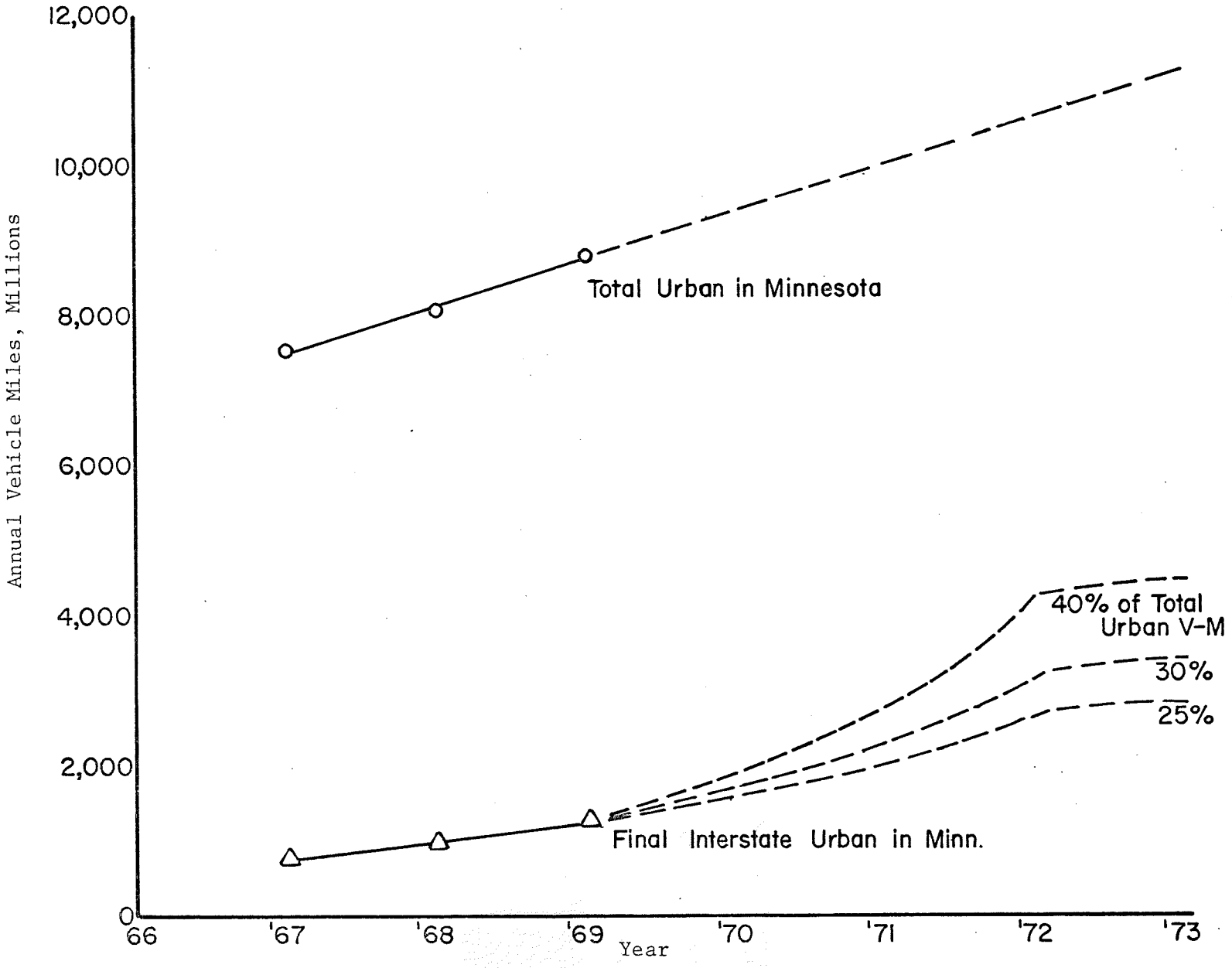


FIGURE 42

TREND AND PROJECTION OF TOTAL ANNUAL VEHICLE MILES ON ALL URBAN ROADS AND ON URBAN INTERSTATES IN MINNESOTA

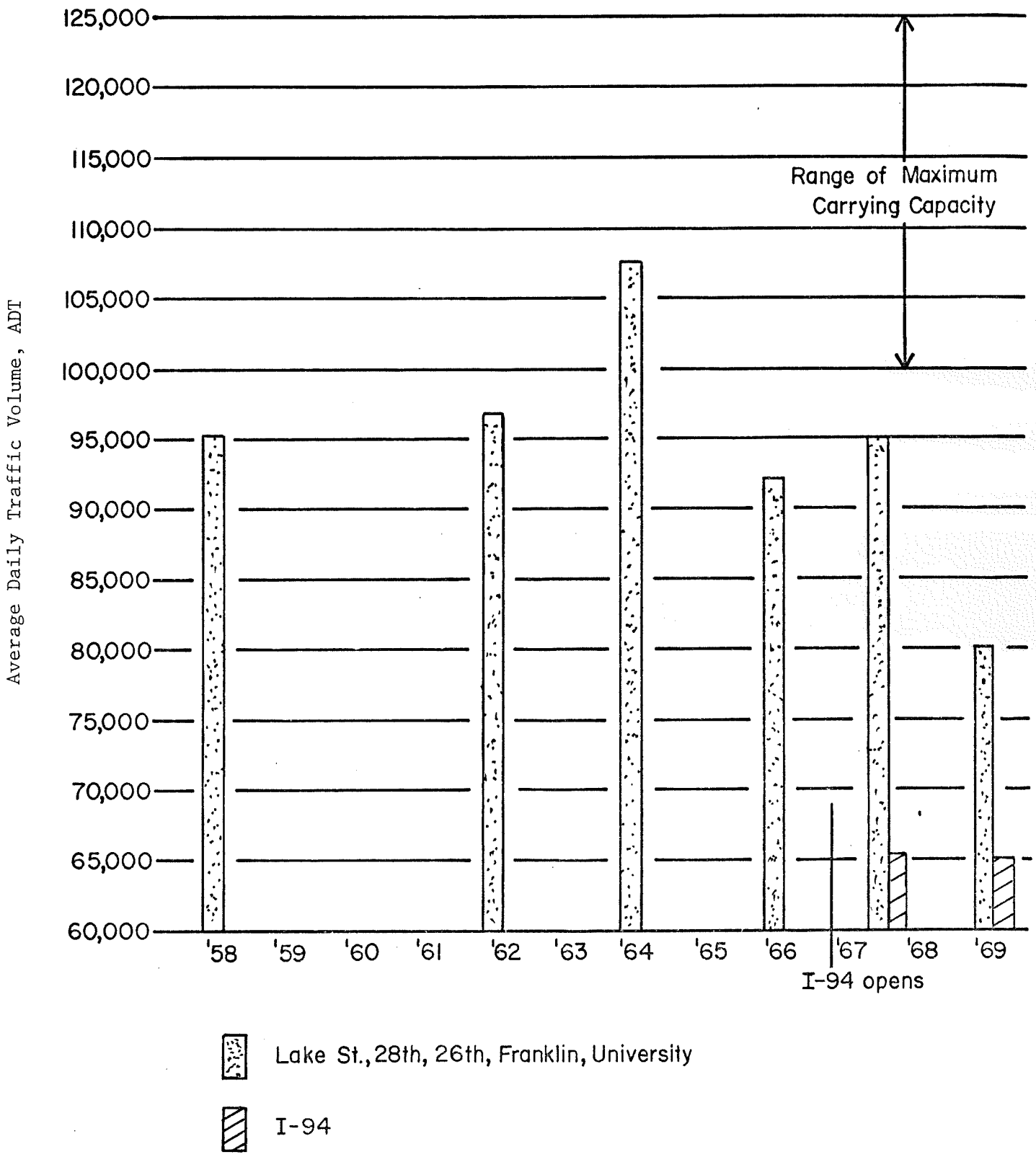


FIGURE 43

TRAFFIC VOLUME ON MINNEAPOLIS EAST/WEST ARTERIAL STREETS

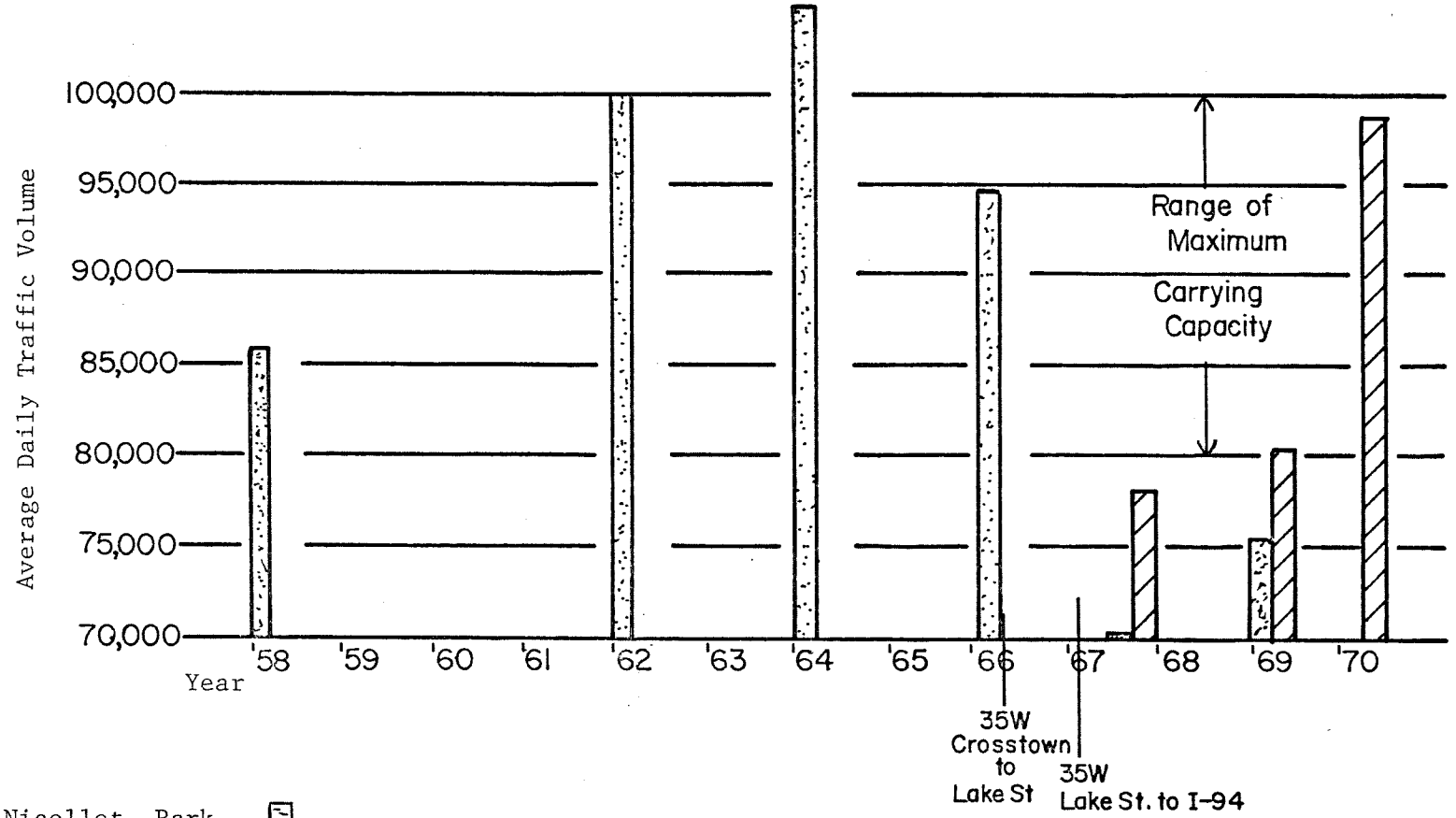


FIGURE 44

TRAFFIC VOLUME ON MINNEAPOLIS NORTH/SOUTH ARTERIAL STREETS*

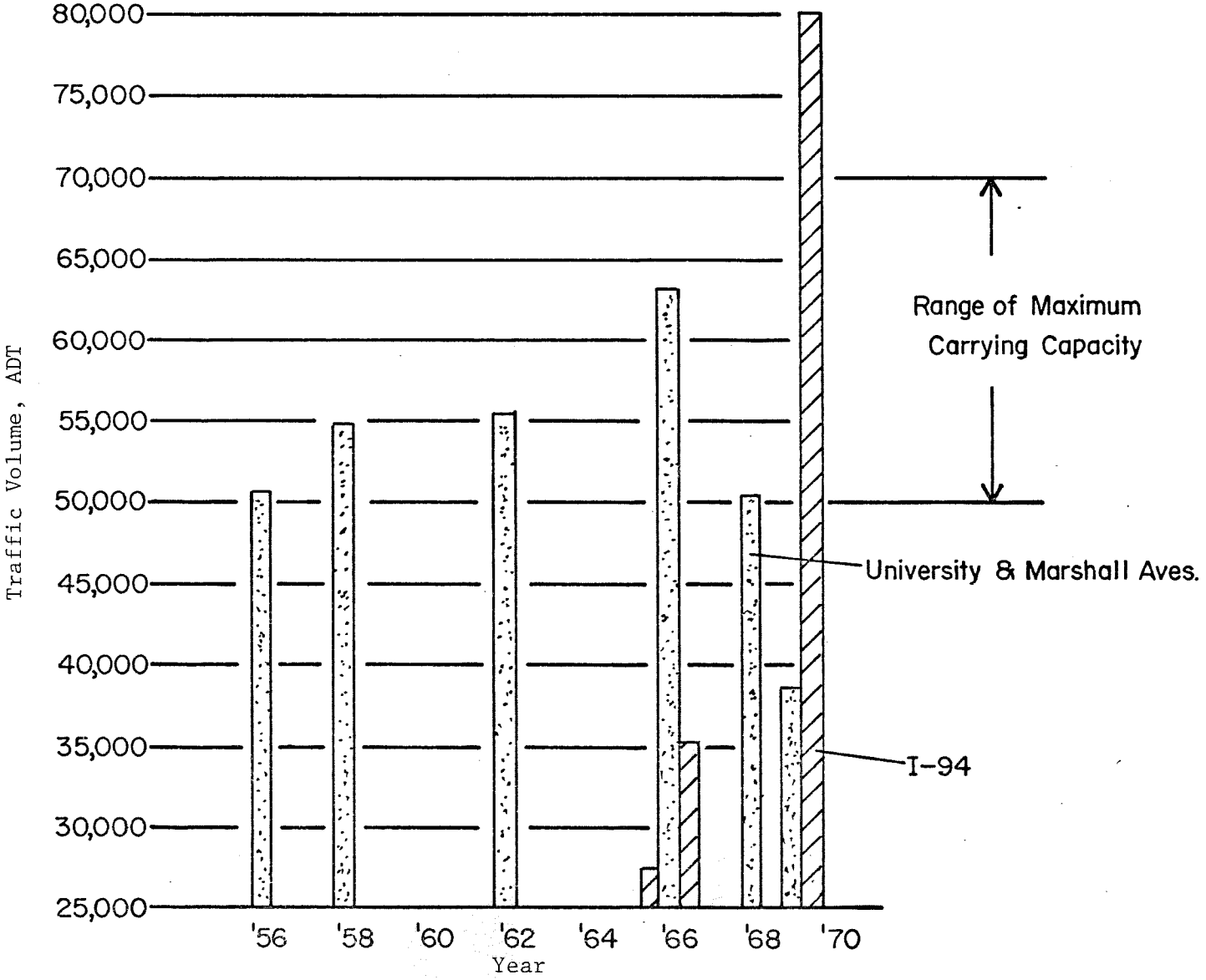
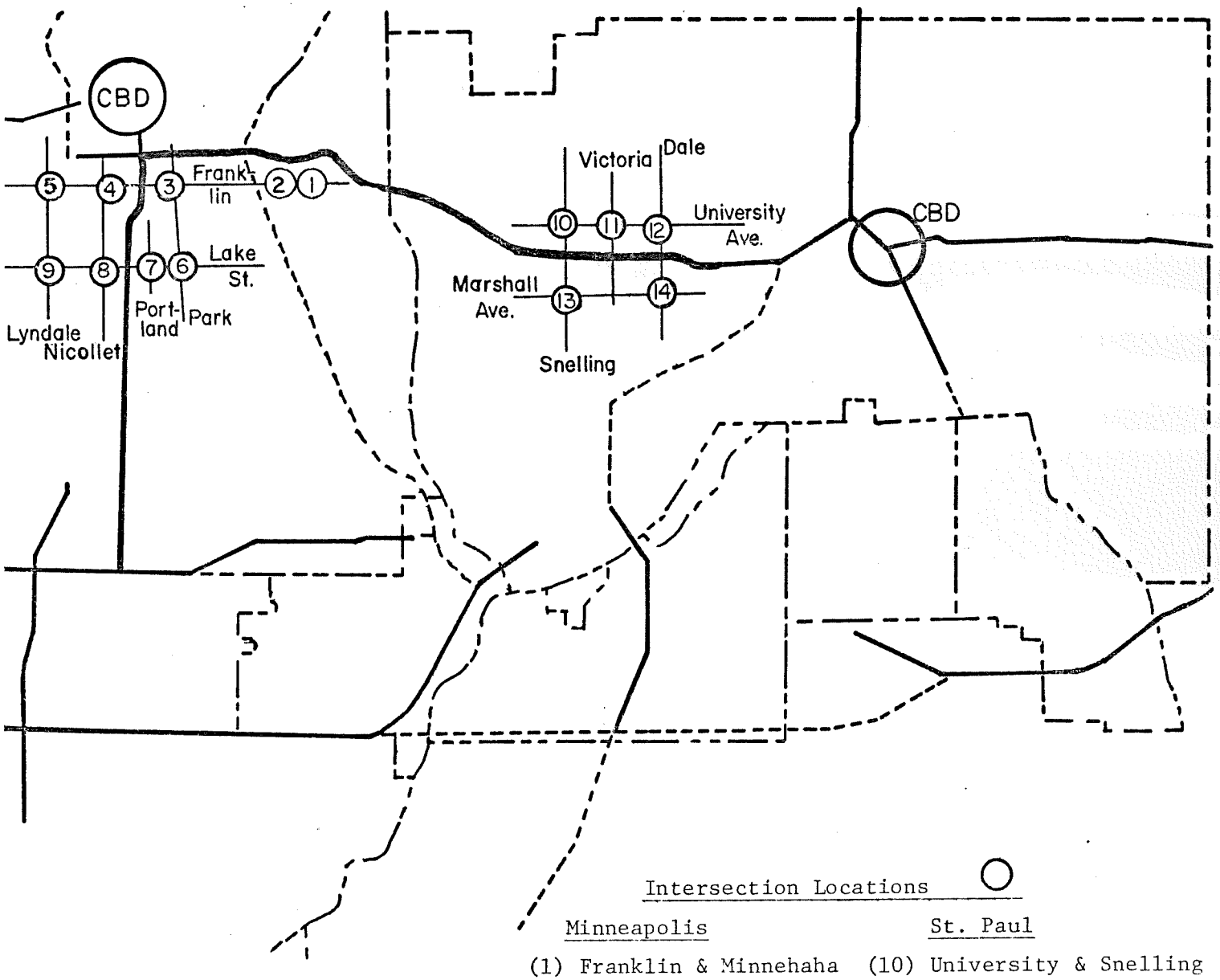


FIGURE 45

AVERAGE DAILY TRAFFIC VOLUME (ADT) ON TWO EAST-WEST ST. PAUL THOROUGHFARES AND I-94

FIGURE 46

INTERSECTION LOCATIONS FOR MINNEAPOLIS AND ST. PAUL
ACCIDENT DATA



Intersection Locations ○

Minneapolis

(1) Franklin & Minnehaha
(2) Franklin & Cedar
(3) Franklin & Park
(4) Franklin & Nicollet
(5) Franklin & Lyndale
(6) Lake & Park
(7) Lake & Portland
(8) Lake & Nicollet
(9) Lake & Lyndale

St. Paul

(10) University & Snelling
(11) University & Victoria
(12) University & Dale
(13) Marshall & Snelling
(14) Marshall & Dale

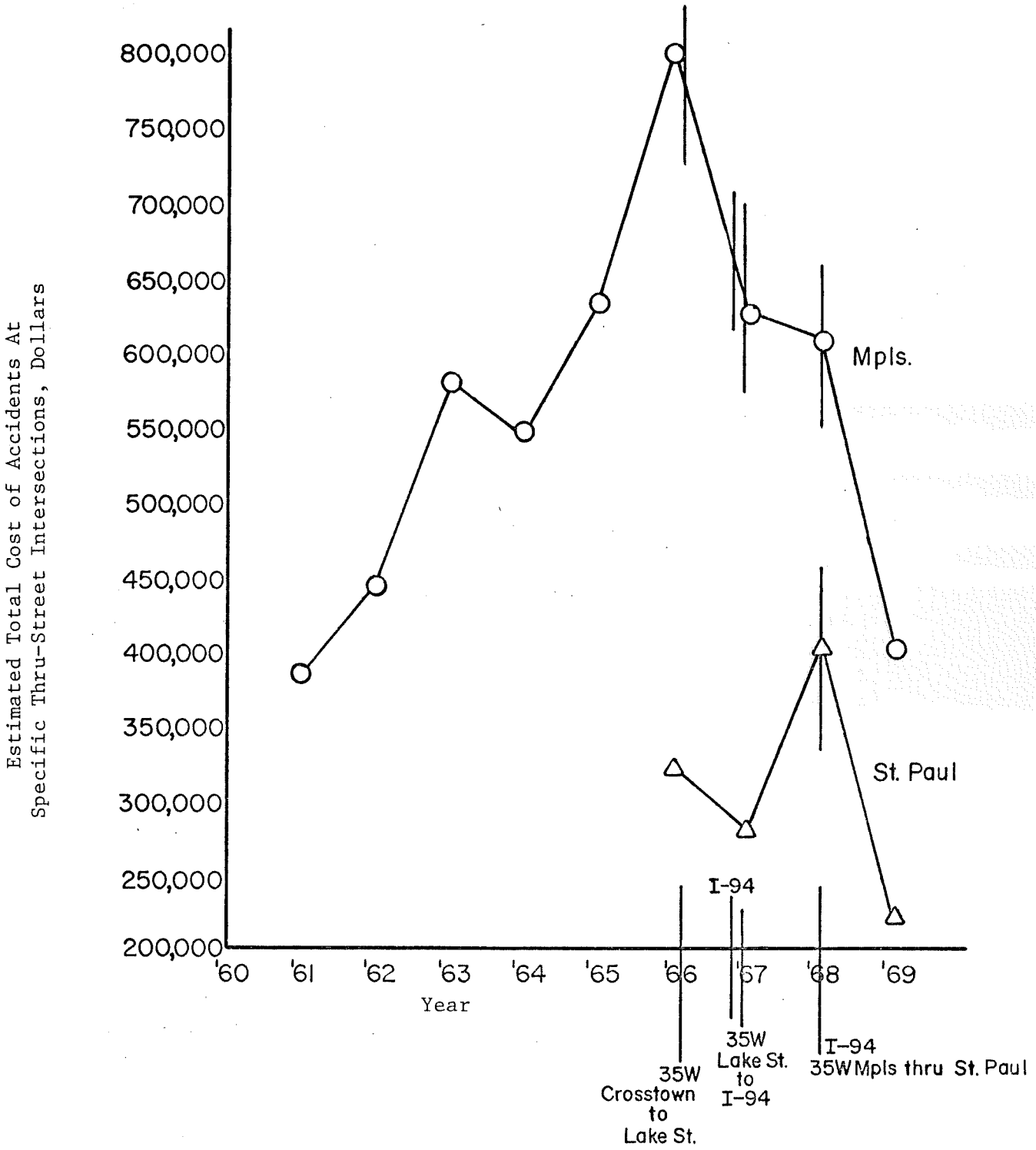


FIGURE 47

TOTAL COST OF INTERSECTION ACCIDENTS BEFORE AND AFTER FREEWAY OPENINGS

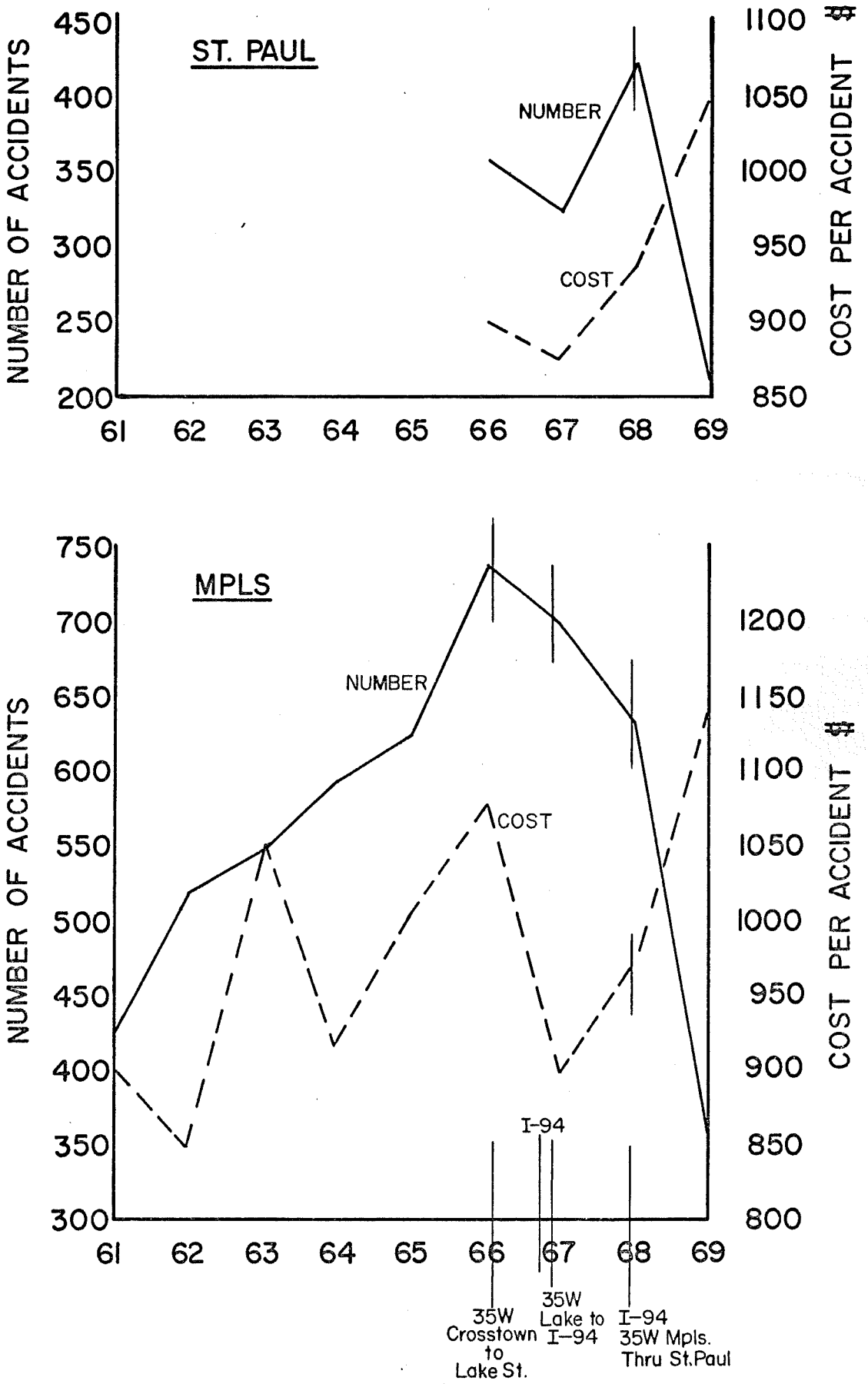


FIGURE 48

INTERSECTION ACCIDENTS ON MAIN ARTERIAL STREETS
IN ST. PAUL AND MINNEAPOLIS

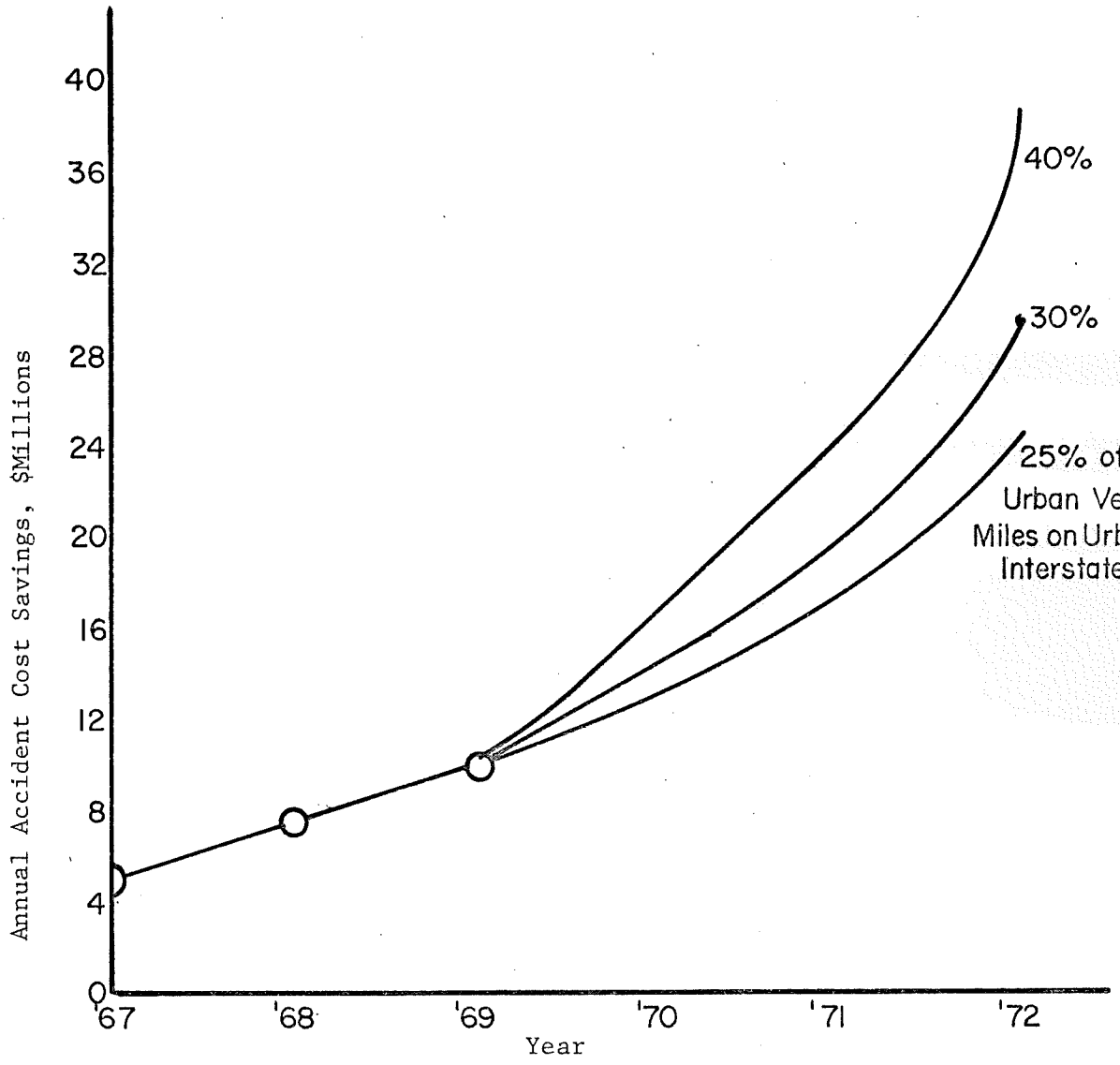


FIGURE 49

ESTIMATED TOTAL ANNUAL ACCIDENT COST SAVINGS DUE TO FREEWAY USAGE IN URBAN AREAS

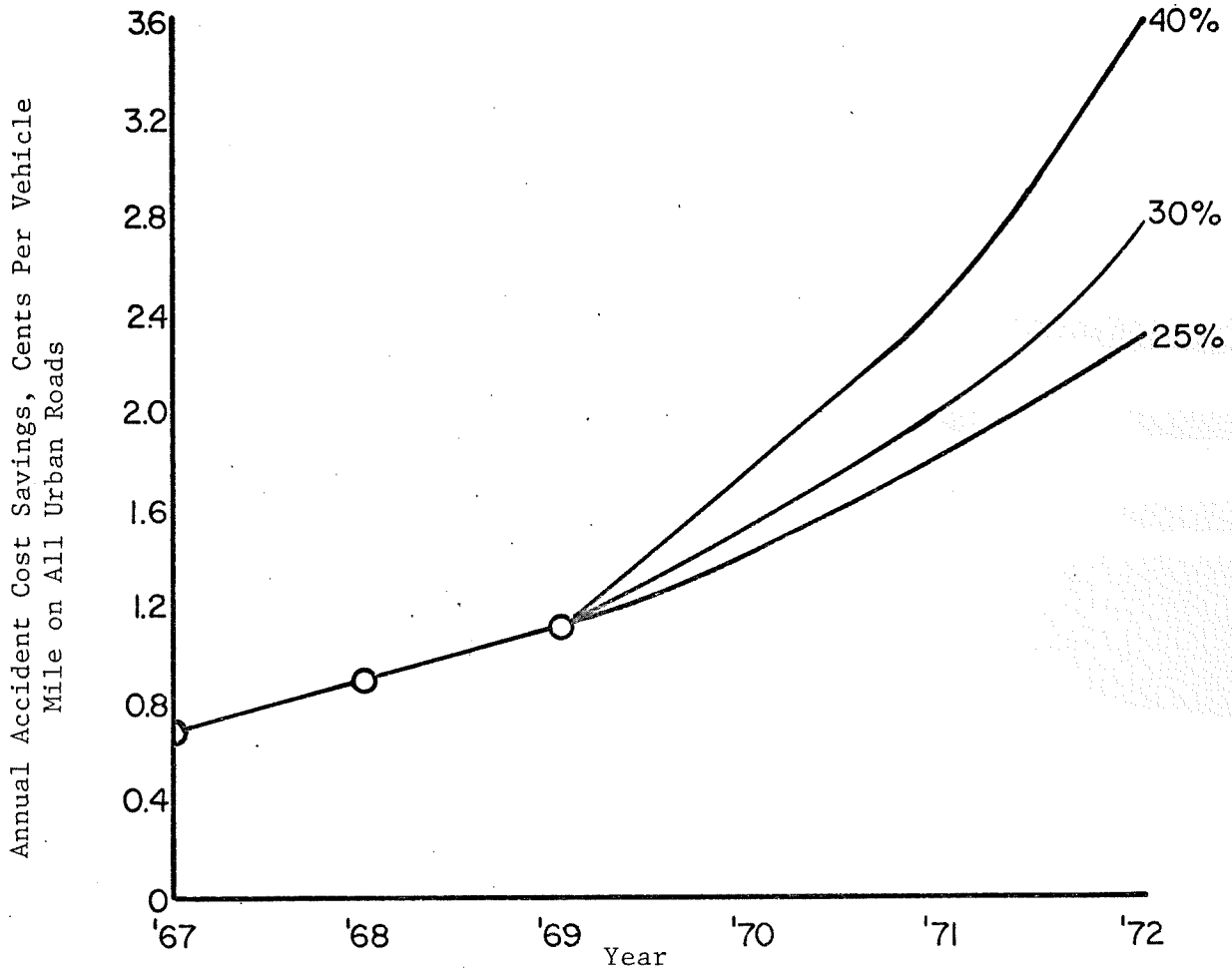


FIGURE 50

ESTIMATED ACCIDENT COST SAVINGS IN CENTS PER MILE DUE TO FREEWAY USAGE IN URBAN AREAS

TABLE 1

CHANGE IN NUMBER OF DWELLING UNITS, 1962-1968

DATA ZONE	DWELLING UNITS 1962	1968	CHANGE, 1962-68	PER CENT CHANGE 1962-1968
1	4,509	4,687	178	4
2	3,759	3,866	127	3
3	9,260	9,599	339	4
4	2,805	3,130	325	12
5	2,369	2,722	353	15
6	2,298	2,340	42	2
7	4,360	4,877	527	12
8	5,543	5,910	367	7
9	10,299	11,253	954	12
10	8,964	10,460	1,514	17
11	1,466	1,590	124	8
12	12,336	12,671	335	3
13	5,594	6,187	593	11
14	4,520	4,927	407	9
15	5,641	7,746	2,105	37
16	3,063	3,329	266	9
17	2,811	4,645	1,834	65
18	2,128	4,047	1,919	90
19	666	2,471	1,751	263
20	255	2,364	2,091	820
C B D 's	6,899	7,649	760	11
MPLS. STUDY AREAS	50,832	55,288	4,456	9
ST. PAUL STUDY AREAS	20,333	21,302	969	5
CENTRAL CITY STUDY AREAS	71,165	76,590	5,425	8
MPLS. TOTAL	173,846	177,615	3,769	2
ST. PAUL TOTAL	102,681	108,173	5,492	5
CENTRAL CITIES TOTAL	275,727	285,788	9,261	3
SUBURBAN STUDY AREA	14,612	24,584	9,722	68
SUBURBAN TOTAL	224,136	297,197	73,061	33
STUDY AREA TOTAL	85,767	101,184	15,397	18
METRO AREA TOTAL	499,863	582,985	83,122	17

TABLE 2

CHANGE IN TOTAL EMPLOYMENT, 1958-1965

DATA ZONE	TOTAL EMPLOYMENT 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	18,405	18,927	522	3
2	11,598	11,848	250	2
3	3,422	3,415	-7	-0
4	5,533	9,539	4,106	76
5	42,633	45,485	2,852	7
6	11,413	17,703	6,290	55
7	3,198	5,861	2,663	83
8	12,993	14,417	1,424	11
9	12,464	8,918	-3,546	-28
10	8,946	9,324	378	4
11	6,119	6,158	39	1
12	3,068	3,863	795	26
13	2,077	3,252	1,176	57
14	82,815	83,102	287	0
15	3,358	5,323	1,965	59
16	1,434	7,539	6,105	426
17	2,002	5,019	3,017	151
18	757	5,530	4,773	631
19	2,403	9,116	6,713	279
20	178	726	548	308
CBD's	125,488	128,587	3,099	3
MPLS.STUDY AREAS	60,278	69,496	9,218	15
ST. PAUL STUDY AREAS	38,858	43,729	4,871	13
CENTRAL CITY STUDY AREAS	99,136	113,225	14,089	14
MPLS. TOTAL	159,518	164,731	5,213	3
ST. PAUL TOTAL	96,328	114,946	18,618	19
CENTRAL CITIES TOTAL	255,846	279,677	23,831	9
SUBURBAN STUDY AREA	10,132	33,253	23,121	229
SUBURBAN TOTAL	255,422	354,518	99,096	39
STUDY AREA TOTAL	109,271	146,478	37,207	34
METRO AREA TOTAL	511,268	634,195	122,927	24

TABLE 3

CHANGE IN RETAIL EMPLOYMENT, 1958-1965

DATA ZONE	RETAIL EMPLOYMENT 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	1,064	939	-125	-12
2	4,114	5,247	1,133	28
3	1,112	955	-157	-14
4	357	982	625	175
5	8,179	6,611	-1,568	-19
6	363	393	-30	-8
7	724	577	-147	-20
8	1,108	977	-131	-12
9	1,035	586	-449	-43
10	906	747	159	18
11	3,631	3,965	334	9
12	809	747	-62	-8
13	411	569	158	38
14	19,223	16,199	-3,024	-16
15	1,207	1,987	780	65
16	212	2,197	1,985	936
17	244	368	124	51
18	104	496	392	377
19	42	404	362	862
20	0	136	136	*
CBD's	27,402	22,810	-4,592	-17
MPLS. STUDY AREAS	8,987	8,561	-426	-5
ST. PAUL STUDY AREAS	6,647	8,123	1,476	22
CENTRAL CITY STUDY AREAS	15,634	16,684	1,050	7
MPLS. TOTAL	43,703	42,301	-1,402	-3
ST. PAUL TOTAL	22,678	24,714	2,036	9
CENTRAL CITIES TOTAL	66,381	67,015	634	1
SUBURBAN STUDY AREA	1,809	5,588	3,779	209
SUBURBAN TOTAL	14,922	39,365	24,443	164
STUDY AREA TOTAL	17,443	22,272	2,829	28
METRO AREA TOTAL	81,303	106,380	25,077	31

*Not Calculable

TABLE 4

CHANGES IN WHOLESALE EMPLOYMENT, 1958-1965

DATA ZONE	WHOLESALE EMPLOYMENT 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	3,021	3,021	0	0
2	250	272	-22	- 9
3	225	167	-58	-26
4	191	277	86	45
5	2,185	2,687	502	23
6	1,078	1,557	479	44
7	265	459	194	73
8	1,704	1,754	50	3
9	1,938	737	-1,201	-62
10	414	478	64	15
11	159	263	104	65
12	159	260	101	64
13	30	94	64	213
14	7,540	6,686	854	11
15	135	301	166	123
16	146	922	776	532
17	18	424	406	2256
18	42	712	670	1595
19	51	288	237	465
20	0	21	21	*
CBD's	9,725	9,373	-352	-4
MPLS. STUDY AREAS	5,747	5,602	-145	-3
ST. PAUL STUDY AREAS	3,687	3,737	50	1
CENTRAL CITY STUDY AREAS	9,434	9,339	-95	-1
MPLS. TOTAL	25,518	26,592	1,074	4
ST.PAUL TOTAL	8,313	9,756	1,443	17
CENTRAL CITIES TOTAL	33,831	36,348	2,517	7
SUBURBAN STUDY AREA	392	2,668	2,276	581
SUBURBAN TOTAL	5,912	12,595	6,683	113
STUDY AREA TOTAL	9,826	12,007	2,181	22
METRO AREA TOTAL	39,743	48,943	9,200	23

*Not Calculable

TABLE 5

CHANGES IN MINING AND MANUFACTURING EMPLOYMENT, 1958-1965

DATA ZONE	MINING & MANUFACTURING 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	6,105	8,431	232	4
2	3,552	3,130	-422	-12
3	497	498	1	0
4	217	625	408	188
5	8,572	8,188	-384	-4
6	2,991	1,895	-1,096	-37
7	709	736	27	4
8	5,125	5,437	312	6
9	680	608	-72	-11
10	3,930	3,719	-211	-5
11	491	507	16	3
12	197	167	-30	-15
13	184	319	135	73
14	12,102	10,382	-1,720	-14
15	296	365	69	23
16	469	2,599	2,130	45
17	781	2,034	1,253	160
18	265	2,434	2,169	818
19	57	1,847	1,790	3140
20	--	--	--	--
CBD's	20,674	18,570	-2,104	-10
MPLS. STUDY AREAS	14,307	13,388	-919	-6
ST. PAUL STUDY AREAS	10,374	12,686	2,312	22
CENTRAL CITIES STUDY AREAS	24,681	26,074	1,393	5
MPLS. TOTAL	56,139	50,699	-5,440	-10
ST.PAUL TOTAL	36,132	42,089	5,957	17
CENTRAL CITIES TOTAL	92,271	92,788	517	1
SUBURBAN STUDY AREA	1,868	9,279	7,411	397
SUBURBAN TOTAL	34,001	87,144	53,143	156
STUDY AREA TOTAL	26,549	35,353	8,804	33
METRO AREA TOTAL	126,218	179,932	53,714	43

TABLE 6

CHANGES IN BUSINESS AND PERSONAL SERVICES EMPLOYMENT, 1958-1965

DATA ZONE	BUSINESS & PERSONAL SERVICES 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	1,224	1,018	-106	-8
2	458	437	-21	-5
3	503	737	234	47
4	83	51	-32	-39
5	2,830	2,615	-215	-8
6	172	123	-49	-28
7	227	249	22	10
8	673	815	142	21
9	1,393	2,447	1,054	76
10	674	1,345	671	100
11	363	447	86	24
12	233	215	-18	-8
13	140	373	233	166
14	9,327	9,627	300	3
15	175	489	314	179
16	30	209	179	597
17	24	132	108	450
18	11	357	346	3145
19	543	1,786	1,243	229
20	18	29	11	61
CBD's	12,157	12,242	85	1
MPLS. STUDY AREAS	3,875	6,014	2,139	55
ST. PAUL STUDY AREAS	2,268	2,243	-25	-1
CENTRAL CITY STUDY AREAS	6,143	8,257	2,114	34
MPLS. TOTAL	17,951	20,808	2,857	16
ST. PAUL TOTAL	7,201	7,631	430	6
CENTRAL CITIES TOTAL	25,152	28,439	3,287	13
SUBURBAN STUDY AREA	801	3,002	2,201	275
SUBURBAN TOTAL	4,650	13,102	8,452	182
STUDY AREA TOTAL	6,944	11,259	4,265	61
METRO AREA TOTAL	29,802	41,541	11,739	39

TABLE 7

CHANGES IN FINANCE, INSURANCE, AND REAL ESTATE EMPLOYMENT, 1958-1965

DATA ZONE	FINANCE, INSURANCE & REAL ESTATE			
	1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	1,210	1,280	70	6
2	262	359	97	37
3	208	170	-38	-18
4	74	286	212	286
5	6,637	7,125	488	7
6	147	135	-12	-8
7	14	60	46	329
8	183	194	11	6
9	1,473	758	-715	-49
10	438	660	220	50
11	173	140	-33	-19
12	116	236	120	103
13	75	85	10	13
14	12,001	14,017	2,016	16
15	177	356	179	101
16	57	82	25	44
17	34	72	38	112
18	58	346	288	499
19	1	17	16	1600
20	0	6	6	*
CBD's	18,638	21,142	2,504	13
MPLS. STUDY AREAS	2,619	2,268	-351	-13
ST. PAUL STUDY AREAS	1,754	2,095	341	19
CENTRAL CITY STUDY AREAS	4,373	4,363	-10	-0
MPLS TOTAL	19,524	20,743	1,219	6
ST. PAUL TOTAL	9,601	11,012	1,411	15
CENTRAL CITIES TOTAL	29,125	31,755	2,630	9
SUBURBAN STUDY AREA	327	879	552	169
SUBURBAN TOTAL	2,820	6,145	3,325	179
STUDY AREA TOTAL	4,700	5,242	542	12
METRO AREA TOTAL	31,945	37,900	5,955	19

*Not Calculable

TABLE 8

CHANGES IN PROFESSIONAL EMPLOYMENT, 1958-1965

DATA ZONE	PROFESSIONAL EMPLOYMENT 1958	1965	CHANGE 1958-65	PER CENT CHANGE 1958-1965
1	723	945	222	31
2	304	494	190	63
3	249	438	189	76
4	371	1,272	901	243
5	4,340	5,536	1,196	28
6	241	218	-23	-10
7	1,292	2,020	728	56
8	3,095	6,693	3,598	116
9	1,677	1,388	-289	-17
10	1,922	2,826	904	47
11	98	79	-19	-19
12	216	331	115	53
13	110	198	88	80
14	5,382	6,323	995	18
15	146	347	201	138
16	41	341	300	732
17	75	251	176	235
18	10	100	90	900
19	3	56	53	1766
20	0	16	16	*
CBD's	9,722	11,859	2,137	22
MPLS.STUDY AREAS	8,651	13,753	5,102	59
ST. PAUL STUDY AREAS	1,647	3,149	1,502	91
CENTRAL CITY STUDY AREAS	10,298	16,902	6,604	64
MPLS. TOTAL	17,957	23,370	4,413	25
ST.PAUL TOTAL	10,183	14,435	4,252	42
CENTRAL CITIES TOTAL	28,140	37,805	9,665	34
SUBURBAN STUDY AREA	275	1,111	836	304
SUBURBAN TOTAL	2,558	9,258	6,700	297
STUDY AREA TOTAL	10,573	18,013	7,440	70
METRO AREA TOTAL	30,698	47,063	16,365	53

*Not Calculable

TABLE 9

SUMMARY OF PERCENTAGE CHANGES IN HOUSING (1962-68) AND EMPLOYMENT (1958-65) BY AREA

AREA	DWELLING UNITS	TOTAL EMPLOYMENT	RETAIL EMPLOYMENT	WHOLESALE EMPLOYMENT	MINING & MANUFACTURING EMPLOYMENT	BUSINESS & PERSONAL SERVICE EMPLOYMENT	FINANCIAL, INSURANCE & REAL ESTATE EMPLOYMENT	PROFESSIONAL EMPLOYMENT
MINNEAPOLIS STUDY AREA	9	15	-5	-3	-6	55	-13	59
MINNEAPOLIS TOTAL	2	3	-3	4	-10	16	6	25
COMPARATIVE	7	12	-2	-7	4	39	-19	34
ST. PAUL STUDY AREA	5	13	22	1	22	-1	19	91
ST. PAUL TOTAL	5	19	9	17	17	6	15	42
COMPARATIVE	0	-6	13	-16	5	-7	4	49
CENTRAL CITIES STUDY AREA	8	14	7	-1	5	34	-0	64
CENTRAL CITIES TOTAL	3	9	1	7	1	13	9	34
COMPARATIVE	5	5	6	-8	4	21	-9	30
SUBURBAN STUDY AREA	68	229	209	581	397	275	169	304
SUBURBAN TOTAL	33	39	164	113	156	182	179	297
COMPARATIVE	35	190	45	468	241	93	-10	7
STUDY AREA TOTAL	18	34	28	22	33	61	12	70
METRO AREA TOTAL	17	32	31	23	43	39	19	53
COMPARATIVE	1	2	-3	-1	-10	22	-7	17

The comparative total is study area total minus the metro area total; positive numbers indicate that the study area is doing better than the whole area; negative numbers, that it is not doing so well

TABLE 10

CHANGE IN NUMBER OF DWELLING UNITS BY ZONE, 1960-1969

ZONES:

1. Mississippi River east to Minneapolis city limits
2. Cedar Avenue to Mississippi River
3. Chicago Avenue to Cedar Avenue
4. North of 18th Street and west of Chicago Avenue
5. 18th Street to Lake Street, west of Chicago Avuenue
6. Lake Street to 35th Street
7. 35th Street to Minnehaha Parkway
8. Minnehaha Parkway to Minneapolis south city limits

YEAR	ZONE: 1	2	3	4	5	6	7	8	YEARLY TOTAL	CITY TOTAL
1960	-31	-151	17	68	75	-65	-275	-70	-392	910
1961	-3	-40	-15	82	355	28	22	-88	341	1696
1962	-57	-6	716	-101	172	89	73	-14	872	2428
1963	24	93	-51	-244	160	68	10	23	83	1083
1964	2	5	-19	-110	-59	49	2	84	-46	930
1965	13	80	-285	-342	19	59	-16	300	-172	65
1966	30	-245	-120	-224	16	19	-16	7	-533	-852
1967	15	-129	-101	189	37	-35	-2	117	91	84
1968	18	231	-42	-78	364	94	2	65	654	863
1969	8	261	162	-58	346	7	-5	32	753	1644
TOTAL	19	99	262	-818	1485	313	-205	456	1651	8851

TABLE 11

CHANGES IN GENERAL TRENDS AND THEIR EFFECT ON AREA GROWTH

Change	Effect
1. General Business Downturn	Slower development along freeways.
2. Lower Interest Rates	A decrease in construction of multiple-family dwelling units, more single-family homes. Greater space requirements would mean the development of larger areas further from the central cities, but still near freeways. Commercial and industrial development might well grow at the expense of apartments in areas immediately adjacent to the freeways.
3. Lower Birth Rates	Slowing of general expansion. Probable continuation of apartment construction boom as fewer families with young children enter the single-family home market.
4. Increased Use of Prefabricated Homes.	See Number 2.
5. New Airport at Ham Lake Site.	Shifting of development pressures from southern to northern suburbs. Problems of readjustment due to the fact that the highest income areas are to the southwest of the metro area. Possible difficulties due to overbuilding along Route 494. Boom in development and rapid change in land use along I-35W and I-35E north of Minneapolis and St. Paul.

TABLE 12

NUMBERS OF ESTABLISHMENTS AND SALES - RETAIL STORES

Minneapolis Central Business District

Year	Percent Completion of Metropolitan Inter-State System	Number of Retail Stores		Sales
1954	0	994		$285,798,000
1958	0	982	47% Decline	283,967,000
1963	18	712		256,837,000
1967	38	520		280,840,000

St. Paul Central Business District

Year	Percent Completion of Metropolitan Inter-State System	Number of Retail Stores		Sales
1954	0	456		$115,167,000
1958	0	459	38% Decline	116,904,000
1963	18	411		104,152,000
1967	38	284		116,720,000

TABLE 13

CENTRAL BUSINESS DISTRICT SALES AS PERCENTAGE OF CITY SALES

Minneapolis		St. Paul	
1954	38.0	1954	28.7
1958	35.5	1958	26.7
1963	31.9	1963	23.0
1967	30.9	1967	20.3

TABLE 14

COMPARISON--PERCENTAGE CHANGE IN SALES FOR METROPOLITAN AREA AND CBD's

	Minneapolis		St. Paul	
	CBD	Metropolitan Area	CBD	Metropolitan Area
1954-58	-0.6	+19.1	+1.5	+19.1
1958-63	-9.6	+20.5	-10.9	+20.5
1963-67	+9.3	+36.1	+12.1	+36.1

TABLE 15

SHOPPING CENTER STATISTICS

Southtown Shopping Center

	No. of Stores	Sales
1963	37	$23,656,000
1967	33	$47,598,000

Southdale Shopping Center

	No. of Stores	Sales
1958	55	$35,160,000
1963	67	$48,271,000
1967	69	$86,956,000

TABLE 16

"SMALL BUSINESS" INTERVIEWS

Nicollet avenue (Upper Figure) and University Avenue (Lower Figure)

	Responses of a Positive Nature			Responses of a Negative Nature		
Types of Firms	Freeway apparently has increased trade area of business.	Freeway has helped to reduce traffic congestion.	General Condition Business showing a definite overall increase.	Short Run Business hurt due to initial impact of land clearance and displacement of people.	General Condition Business showing an overall downward trend.	Are your customers primarily concentrated in your neighborhood area? "Yes" responses.
Service Stations	3/0	0/0	4/0	2/3	0/2	4/2
Drug and Grocery Stores	2/2	4/2	4/2	6/5	1/0	8/2
Restaurants and Liquor Stores	1/0	0/0	1/0	4/3	1/0	3/2
Hardware, Appliance, and Home Furnishings	4/0	1/0	5/0	0/0	0/0	2/0
Services and Miscellaneous	5/0	3/0	5/0	7/3	1/1	2/2
Street Totals	15/2	8/2	19/2	19/14	3/3	19/8
Overall Total	17	10	21	33	6	27

Total Interviews: 51
Nicollet Avenue: 36
University Avenue: 15

TABLE 17

CITY OF MINNEAPOLIS -- REAL ESTATE VALUES
(in millions of dollars)

Year	Adjusted Market Values	Assessed Values
1957	834.6	287.0
1958	860.5	296.5
1959	869.8	301.0
1960	897.5	311.3
1961	914.7	318.5
1962	954.8	333.6
1963	974.4	341.7
1964	997.7	351.0
1965	1,010.6	356.6
1966	970.6(1)	340.0
1967	973.8	341.9
1968	968.2	339.8
1969	976.7	343.2

Notes: (1) Effective in 1966 judicial decisions modified the methods of determining the Adjusted Market Values ("Full and True" Value) resulting in the observed discrepancy.

TABLE 18

REMOVALS OF PROPERTY FROM MINNEAPOLIS TAX ROLLS BY CAUSE
(Adjusted Market Value)

Year	Freeway	M H R A[1]	U of Minnesota	Schools	Misc.
1956		850,000			
1957		700,000			
1958	3,406,865	383,000			
1959	98,380	5,690,130			
1960	1,557.940	10,110			
1961	1,674,025	2,060			
1962	568,300	565,750			
1963	2,022,850	243,155			
1964	1,644,795	804,155	302,050		1,092,670
1965	3,622,370	1,133,420	196,315	209,380	50,680
1966	3,852,480	933,930	614,965	462,780	1,683,570
1967	2,161,655	308,760	280,570	22,300	629,630
1968	2,982,036	2,229,980	189,140	197,980	448,920
TOTAL	23,591,690	13,854,450	1,583,040	892,440	3,905,470
				GRAND TOTAL	43,827,090

(1) MHRA = Minneapolis Housing and Redevelopment Authority

TABLE 19

COMPARATIVE ACCIDENT DATA FOR URBAN INTERSTATE
FREEWAYS AND OTHER URBAN ROADWAYS

Year	Number of Injury and Fatality Accidents		Injury and Fatality Accidents per MM Vehicle Miles		No. of Fatalities per MM Vehicle Miles		No. of Injuries per MM Vehicle Miles		Accident Severity*	
	Interstate	Other	Interstate	Other	Interstate	Other	Interstate	Other	Interstate	Other
1967	551	10892	0.734	3.26	0.023	0.032	1.116	4.22	2.55	2.42
1968	809	11090	0.850	2.84	0.020	0.034	1.270	4.03	1.52	1.43
1969	1313	12887	1.040	3.18	0.024	0.026	1.614	5.00	1.58	1.58

*Number of Injuries and Fatalities per Accident