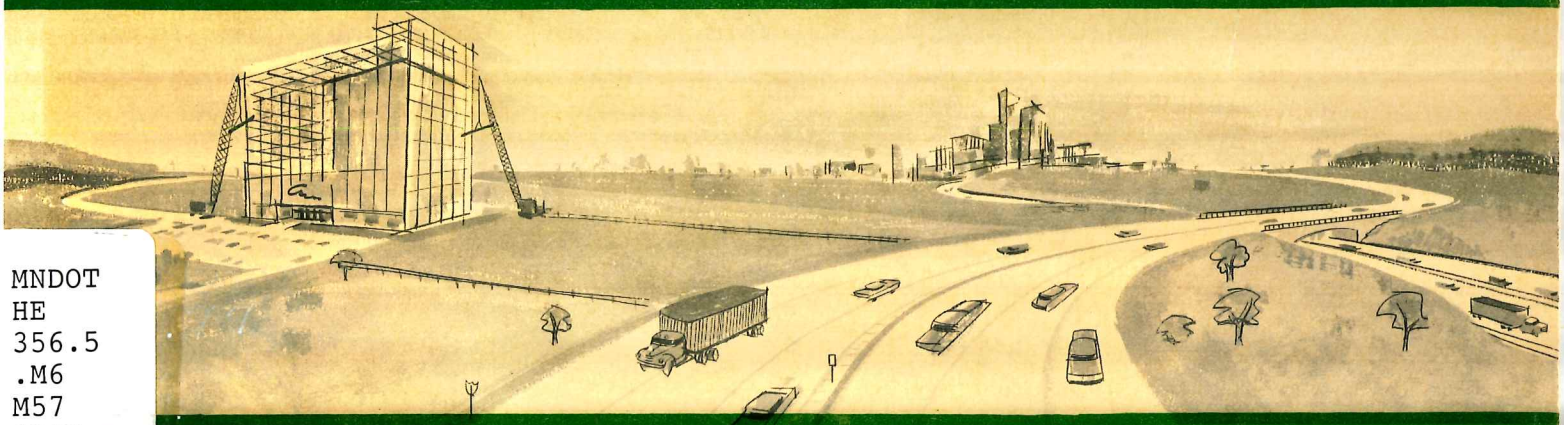
BELTLINE COMMERCIAL INDUSTRIAL DEVELOPMENT

A CASE STUDY IN THE MINNEAPOLIS-ST. PAUL METROPOLITAN AREA



By UNIVERSITY OF MINNESOTA
Departments of Agricultural Economics and Geography, under contract with the
HIGHWAY DEPARTMENT in cooperation with the U. S. DEPARTMENT OF COMMERCE, BUREAU OF PUBLIC ROADS.

NOVEMBER 1960

BELT LINE COMMERCIAL-INDUSTRIAL DEVELOPMENT

A Case Study in the Minneapolis-St. Paul Metropolitan Area

by

JOHN R. BORCHERT

November, 1960

MINNESOTA HIGHWAY RESEARCH PROJECT

Department of Agricultural Economics
and
Department of Geography

of the

University of Minnesota under contract with Minnesota Highway Department in cooperation with U.S. Department of Commerce, Bureau of Public Roads

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ABSTRACT

A segment of Trunk Highway 100 (T.H. 100 commonly called the "Belt Line") has served since the 1930's as a circumferential and urban distributor route on the western side of the Twin Cities metropolitan area. A segment of the proposed Interstate Freeway system, to be opened around the year 1965, will provide a new "super" Belt Line located west of the present one. This is a comparative study of the present and proposed Belt Line routes. This study has proceeded in three major steps.

A study of the proposed new "super" Belt Line.

First, it was shown that the present and future highways are analogous with respect to (a) their position in the western fringe of the urbanized area at time of construction and (b) their intersection with major radial highways and railways.

Comparing the old Belt Line with the new.

Second, the pattern of commercial and industrial development of land was traced from 1940 to 1959 in the vicinity of the present Belt Line. It appears that certain retail and service establishments are locationally associated with residential density, certain others with highway traffic. Warehousing and manufacturing development are associated with both highway and rail access in combination. All commercial and industrial uses tend to cluster in the vicinity of intersections with major radial highways or railways.

Tracing commercial development along the old Belt Line.

Third, on the basis of the similar locations of the two routes, it was assumed that, as available industrial land is absorbed on the present Belt Line, demand for industrial land in western circumferential highway locations will shift to the new Belt Line. It was also assumed that neighborhood-oriented and traffic-oriented commercial uses along the new route will develop, as they have along the present Belt Line, commensurate with the growth of traffic and urbanization of the neighboring land. Using these two assumptions in conjunction with the growth rates and locational characteristics established from the study of the present Belt Line, commercial and industrial uses were projected for the new route.

Assumption: development along the new Belt Line will parallel development along the old.

Planning and land-value implications of the findings of the study are discussed. It is proposed that projections of this type are of specific value in highway programming, land acquisition, and planning in the fringes of large urban areas.

Value and implications of the study.

REVIEW OF FINDINGS AND CONCLUSIONS

The major findings and conclusions of this study can be discussed under two principal headings: Planning Implications and Highway Land Acquisition in Urbanizing Areas. For maps indicating the highways which were studied and their location within the Minneapolis-St. Paul metropolitan complex, the reader is referred to Figures 1 and 2, pages 10 and 13, in the body of the text. Figure 3, on page 14, shows the location of suburban communities which are mentioned in the following discussion.

Major findings and conclusions.

Planning Implications

Highway's Role in Area Development. Much commercial and industrial growth today is near major highways. Because of this obvious association it often seems fitting to attribute that growth simply to the highways. But that is an oversimplification.

Highways and industrial growth are associated.

The construction or up-grading of T.H. 100 was one vital factor in a developmental process. Besides the highway, these factors were significant: (1) residential and neighborhood shopping center developers, (2) industries and industrial developers, (3) municipalities which organize, build, and maintain the network of local streets and thoroughfares, sewer and water lines, and (4) railroads. These factors have formed a complex within which the commercial and industrial development process has moved forward.

Five factors affecting area development.

The chronological order in which these five agents have appeared in the developmental process has varied. In the southern part of the city of St. Louis Park and the northern part of the village of Edina, the order of development along the Belt Line was:

How five factors combined in the developmental process.

(1) railroad
(2) residential and commercial builder
(3) municipal sewer and water
(4) highway
(5) manufacturing and warehousing development

St. Louis Park and Edina.

In the Belt Line strip through Golden Valley, the order was generally:

(1) railroad
(2) highway
(3) residential builder
(4) municipal sewer
(5) manufacturing and warehousing

Golden Valley.

Along a portion of T. H. (I. R.) 494 the sequence is likely to be:

Along a portion of planned T. H. (I. R.) 494.

(1) railroad
(2) highway
(3) sewer
(4) industrial developer
(5) residential builder

Examples of these and other possible sequences could be cited from other areas. In general the railroad has come first in the developmental sequence; and rail, highway, and sewer--in any order--have preceded significant manufacturing and warehousing growth. Aside from these preconditions, however, any sequential combination of the five developmental factors is plausible.

The Timing of Highway Construction in the Developmental Sequence. If the highway comes late in the developmental sequence, it is impossible to avoid disruption of an established urban land-use pattern. Then planning by affected municipalities must be directed toward retention of values, adjustment, and redevelopment. If the highway comes early in the sequence, municipal and private planning may be directed toward reservation of vacant land and provision of facilities for the highest-value, most desirable, or most essential uses in the most probable locations.

Timing of the highway is significant.

Different geographical ideas produce different developmental patterns.

These variations in sequence and timing stem in large part from the fact that various agents in the developmental process are operating with basically different geographical ideas. The concern of residential developers municipalities and their residents has been local.

Their task has been the expansion of the metropolis. Their geographical frame of reference has been the neighborhood, the municipality, or at most the metropolitan area. The major objective of the railway or highway builder has been interstate or intercity movement. To the municipality and developers the city has been the "universe".

To railway and highway builders the city has often been a large "place" to be connected with many other distant and equally important "places". Each group represents an important point of view held by a large segment of the public. Each group must understand the geographical frame of reference and the point of view of the other if there is to be an agreed plan of development in any community bordering a major highway.

Development Along Trunk Highway (Interstate Route) 494. On proposed T. H. (I. R.) 494, the new Belt Line, the highway will be introduced at an early stage in the developmental process. The route has been well chosen to minimize the disturbance of already-urbanized land in the circumvention of the irregular western edge of the metropolitan mass. Thus, planning along the route can be concentrated mainly upon reservation of land and provision of facilities for the best and most probable uses.

The "super" Belt Line will be introduced early in the developmental process.

Demand for industrial land will center near intersections of railroad and highway.

Demand for manufacturing and warehousing land is probable in the vicinity of certain rail-highway locations along T.H. (I.R.) 494, especially (1) between T.H. 55 and T.H. 12 and (2) near the interchange of T.H. (I.R.) 494, T.H. 100 and the Minneapolis, Northfield, and Southern Railway. In those areas there is a need to reserve land, to provide sewers and local streets to feed major highways, and to prepare for metropolitan and intercity traffic stimulated by industrial land uses concentrated near the highways.

No frontage roads presently planned for the "super" Belt Line.

There is a need for similar preparations for commercial development and accompanying focusing of traffic at all interchanges, particularly those in the path of maximum urban expansion--the interchanges with T.H. 169, T.H. 7, County State Aid Highway (CSAH) 5, T.H. 12, and T.H. 55. Although no frontage roads are contemplated on T.H. (I.R.) 494 at present, it may be necessary to introduce them in the vicinity of a few major intersections to provide for the most efficient use of the land.

Planning should consider land not demanded for industrial - commercial uses.

A policy should be developed toward the large amount of land which fronts the major highways but is extremely unlikely to be demanded for commercial or industrial use (Figure 39). This study has shown that more than 1,000 acres adjoining the proposed T.H. (I.R.) 494, and within 2,500 feet of a major highway intersection, probably will not be demanded for commercial purposes. Even more such land lies outside the 2,500-foot range. This land will ultimately be used for

residential or public purposes, or it will be unused. Lessons may be drawn from the experience of parts of Edina, St. Louis Park, and Golden Valley. There, various combinations of natural features, plantings, and subdivision design have segregated high-value residential developments from the main traffic artery and created amenity for both residents and travelers. Highway developers, municipalities, and private residential developers can plan cooperatively to achieve the same results along T.H. (I.R.) 494.

Highway Land Acquisition

The area through which T.H. (I.R.) 494 will pass is certain to undergo accelerated urban development in the next two decades. The highway program is only one contributor to the inexorable urban growth process. The cost of land along the route may be expected to rise throughout the period of urbanization. The urbanizing process increases the need for a highway. It also increases the cost of providing right-of-way for a highway as time passes. The purchase of all necessary land for this route now would have been wise even if the highway were not to be built up to ultimate design standards for another 15 years. There is a need for continuing study and projection of urbanized areas and their land-use patterns to know where highway needs and land acquisition problems are going to intensify. There is also a need to consider longer-range highway planning and a lengthening of the time span between land acquisition and completed construction.

Land values are certain to increase in the area of the proposed highway.

Present and projected land values.

The acquisition of land for T.H. (I.R.) 494 is taking place in the vicinity of the advancing metropolitan frontier. The real value of land today in this changing frontier zone depends basically upon two variables: (1) the value of land for its probable next major use and (2) the annual taxes and interest for the duration of the waiting time likely to elapse before the next major use is realized. The longer the waiting time, the lower is today's real value. The higher the next major use, the greater is today's real value. This study has attempted to estimate the limits of probable waiting time and probable ultimate uses along T.H. (I.R.) 494. Thus it may contribute to the determination of land values for highway-land acquisition.

Variables affecting land values.

The study exemplifies a type of data and analysis which could be obtained readily at any time for any area included within a continuing geographical survey of land uses. This argues for frequent updating of the land-use inventory and forecast prepared as part of the Twin Cities Area Transportation Study. This would provide information of value in highway planning, land acquisition, and programming. Observed land-use trends are the resultants of a bewildering complex of social, economic, and technologic forces. The rate of these trends is subject to change almost without notice. This is a further argument for frequent updating of the land-use inventory and frequent review and revision of projections.

Studies like the present one should be frequently updated.

BELT LINE COMMERCIAL-INDUSTRIAL DEVELOPMENT

A Case Study in the Minneapolis-St. Paul Metropolitan Area

T.H. 100 circumscribes the Twin Cities and also serves as a distributor route to major intersecting radial highways on the periphery of the Twin Cities metropolitan area (Figure 1). The portion of T.H. 100 lying west of Minneapolis is the most heavily-used. The segment is approximately 12 miles long, extending north-south through a series of suburban communities from Robbinsdale to the northern boundary of Bloomington. It is the subject of one major part of this study (Figure 1).

Location of T.H. 100.

Most of the western segment of the Belt Line was opened as a four-lane highway between 1936 and 1938. Only the section between 50th Street and Excelsior Avenue was opened earlier. A four-lane concrete pavement was constructed there in 1928. Since the original construction surfacing has been improved, the north- and south-bound lanes have been divided, additional grade separations and traffic interchanges have been constructed, and both access and crossing points have been limited.

Opening of the Belt Line.

Along the parts of the route opened in the 1930's an unusually wide right-of-way was acquired and an exceptionally large amount of landscaping was done. Both of these accomplishments were results of the fortuitous combination of two factors. One factor was the imaginative, resourceful, and dedicated effort of Mr. Carl Graeser, the

Beautification of the Belt Line route.

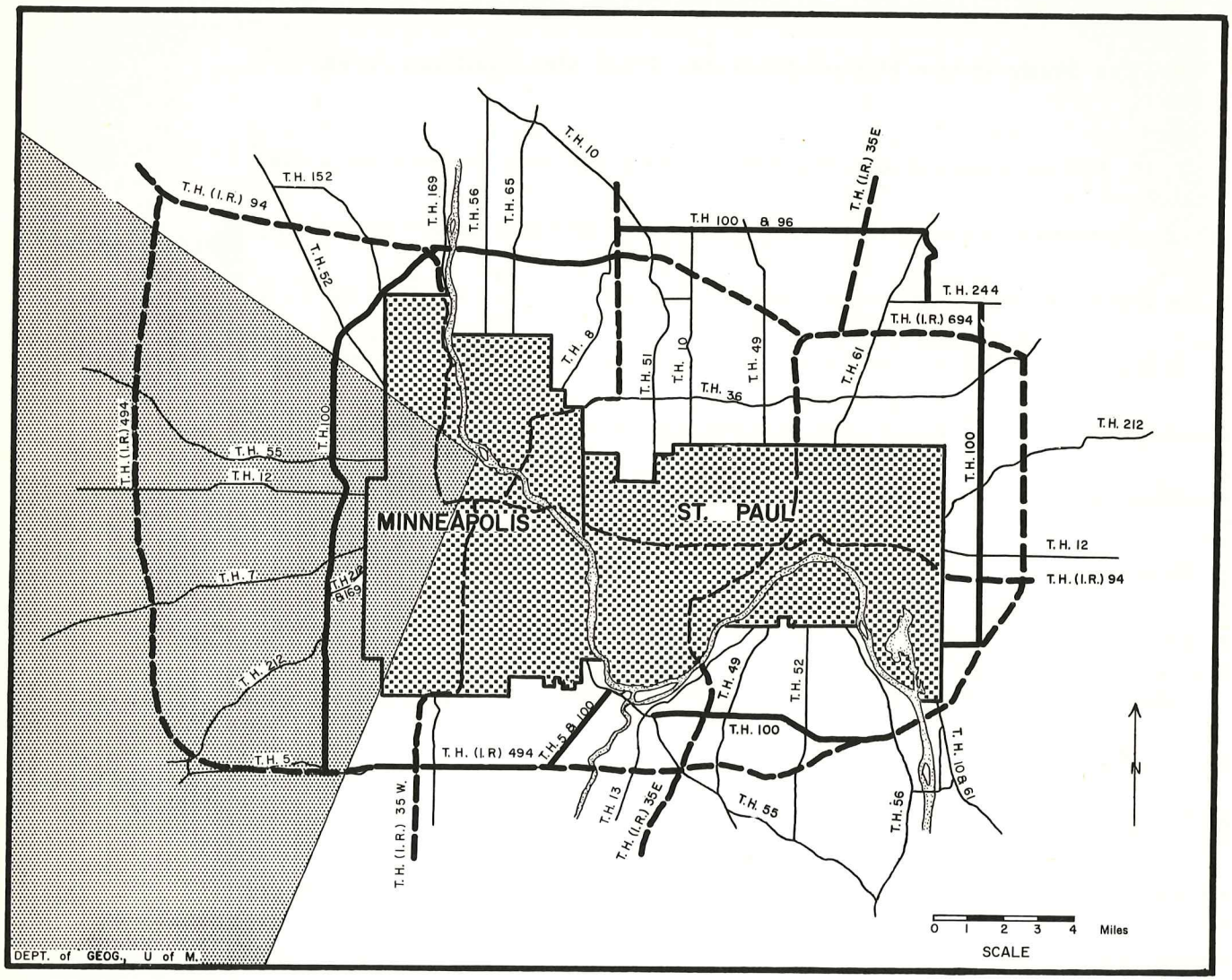

Figure 1.

The present and projected Belt Line highways around the Minneapolis-St. Paul metropolitan area. Heavy solid lines mark the position of T.H. 100. Heavy dashed lines mark the Interstate Highway routes. The "western quadrant", to which this study refers, is indicated by fine stippling.

project engineer, and the encouragement of his chief, Mr. O. L. Kipp, who was then construction engineer in the Minnesota Highway Department. The other factor was the availability of WPA labor to implement a national policy for outdoor beautification.

Plans are now well advanced for a new "super"Belt Line. It will be part of T.H. (I.R.) 494 in the Federal Interstate Freeway system. The route of T.H. (I.R.) 494 will lie west of the present Belt Line (Figure 2). It is expected to be opened in 1965. The new T.H. (I.R.) 494 is planned to be a divided highway with restricted access and no grade crossings. No frontage roads are contemplated in existing plans.

The "super" Belt Line is part of the Federal Interstate Freeway system.

The position of T.H. (I.R.) 494 in the changing geographic patterns of the metropolitan area in 1965 will be analogous in many ways to the position of the west segment of T.H. 100 in 1940. Both are arcs within the same western quadrant of metropolitan Minneapolis (Figure 2). Both are crossed by the same major highways and railways radiating from the central city. Both will have been constructed in the fringe of urban expansion (Figure 3). Each will have had the highest design standards used in Minnesota at the time of its construction. Therefore, developments of various land uses along T.H. 100 since its completion may foreshadow future developments along T.H. (I.R.) 494. They may also shed further light upon Belt Line developments in general.

Similarities between the Belt Line and the "super" Belt Line.

Projection and planning — the purposes of this study.

This report includes an analysis of the location of commercial and industrial land development along the west segment of T.H. 100, an attempt to project the amount and location of demand for land for similar developments on proposed T.H. (I.R.) 494, and a discussion on the findings of the study as they pertain to highway planning.

1. The Old Belt Line -- T.H. 100

Scope and objectives.

This first portion of the study concerns the demand for land for different uses, the types of locations in which major classes of non-residential use have developed, and types of structure and parcel size which have characterized different uses and different locations along the Belt Line. Finally, there is an attempt to estimate the amount of remaining land which is likely to be developed for commercial or industrial purposes and the consequence of reaching the ceiling of available land for development. The study strip is roughly one mile wide; it embraces, and is generally centered on, the highway.

The Development of Commercial and Industrial Land

Commercial - industrial development centered in the study strip.

Four hundred and thirty-one acres of land were developed for commercial or industrial purposes in the study strip during the 14 years 1945-1959. This is approximately 5.6 per cent of a total of 7680 acres in the study strip. This is a substantial part of the increase which occurred during that period in the Twin Cities metropolitan area as a whole--perhaps 10 per cent, or more, of the land used for new manu-

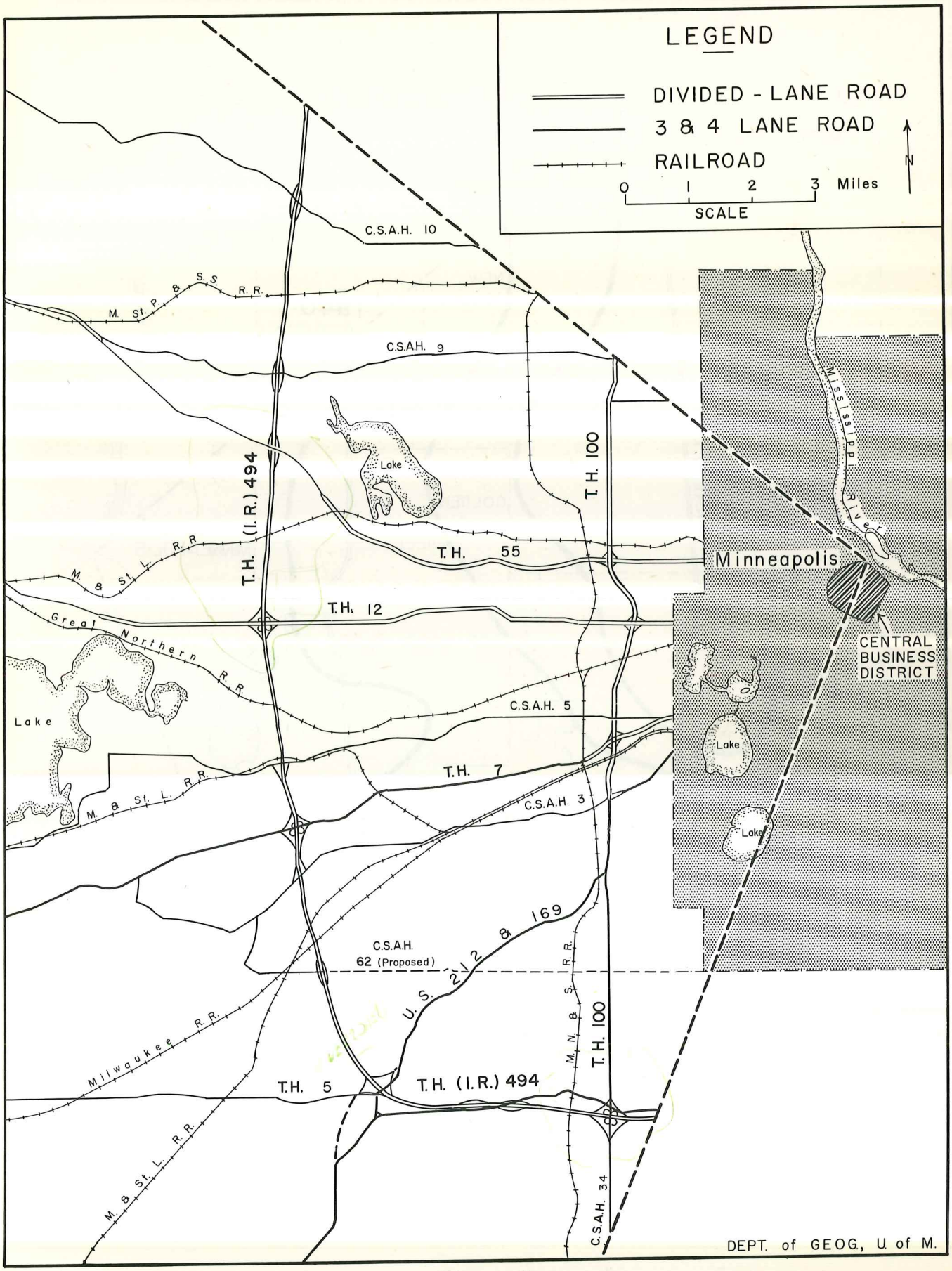

Figure 2.

The old Belt Line (T.H. 100), proposed new Belt Line (T.H. (I.R.) 494), and major radial highways and railways in the western quadrant of the Twin Cities metropolitan area.

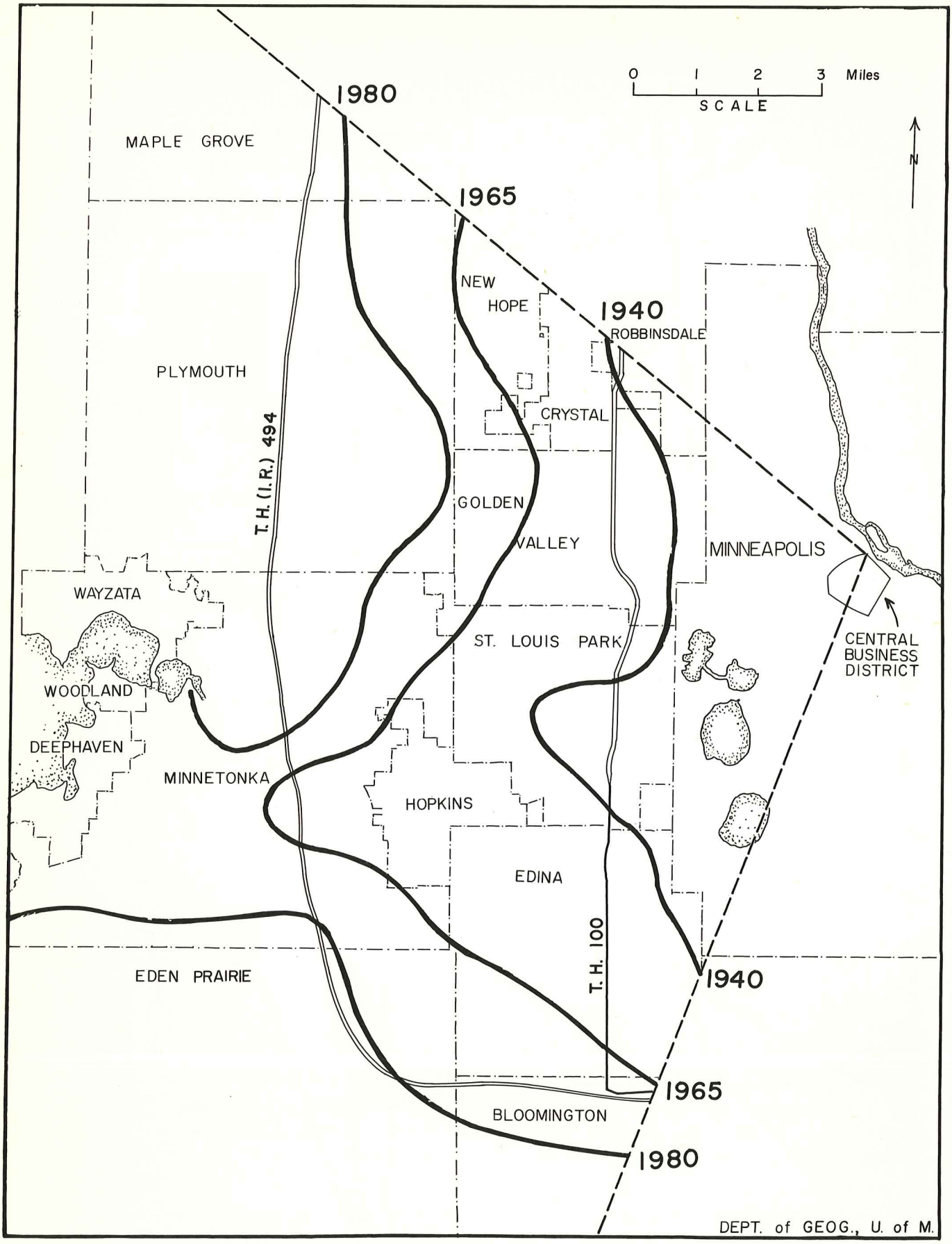

Figure 3.

The similar positions of the old and new Belt Lines with reference to the advancing urban frontier. Heavy solid lines indicate generalized western boundaries of 500 or more dwelling units per square mile at successive times.

facturing and warehousing development and perhaps 10 to 15 per cent of the land used for new retail and service establishments. 1/ Yet the study strip includes only about two per cent of the urbanized or partly urbanized land of the metropolitan area.

For purposes of this study, developed or used land is defined as those ownership parcels which have been improved by the erection of structures. Acreage figures refer to the parcels on which the structures stand. 2/ Four major use classes have been recognized.

Use classes defined.

1. Manufacturing--Dominant function is primary production or fabrication. May also include office or warehouse space on premises. Category includes one technical training school with shops, storage space, and office.
2. Warehousing--Storage and wholesale distribution are dominant functions. May also include office space on the premises.

1/Percentages based upon a comparison with growth rates indicated in Metropolitan Land Study, Twin Cities Metropolitan Planning Commission, 1960, pp. 42-43. Percentages are merely indicative for data in the two studies are not strictly comparable.

2/In this study strip there are relatively few cases in which the parcel area is significantly larger than the used or landscaped area.

3. Shopping Center-Type Retail and Service Uses--Stores and service establishments of types needed to serve a residential neighborhood and traditionally included in neighborhood shopping centers. 3/

4. Highway-Oriented Retail and Service Uses--Service and retail establishments which are dependent upon a large volume of traffic or a high degree of metropolitan accessibility but are amenable to locations away from the central business district. 4/

Two hundred twenty-eight businesses included in the four use categories.

The latter two categories are subdivisions of the broad retail and service group. The general meanings of these four major categories of land use are self-evident. Specific definitions are listed in Appendix 1. As of 1959 a total of 228 establishments are included in the four classes.

Observations from survey and plat maps and aerial surveys.

Observations from a current field survey and plat maps, together with earlier aerial photographic surveys, were used to determine the acreage and location of establishments at six different times--1940,

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3/ These subclasses of the general retail and service group are borrowed from a study by Brian Berry, "Ribbon Developments in the Urban Business Pattern", Annals of the Association of American Geographers, 49:2 (June, 1959), pp. 145-155.

4/ Ibid.

1945, 1951, 1953, 1957, and 1959. Acreage of each used parcel was taken from detailed plat maps, scale one inch to 200 feet, for 1959. The time period in which the present use was established was determined from the sequence of aerial photographs. The use was determined by field observation for 1959 and interpreted from aerial photographs for earlier years. Table 1 shows the acreage of the four major uses in 1940 and the area of increment during each of the subsequent time intervals. 5/ The maps in Figures 4-14 illustrate the evolution of the geographic pattern.

Table 1 -- Additions to Commercial and Industrial Acreage in the Old Belt Line Strip.

Year First Mapped	Shopping Center Uses (Acres)	Highway-Oriented Uses (Acres)	Manufacturing Uses (Acres)	Warehousing Uses (Acres)	Total	Cumulative Total
1940	3.8	15.3	40.1*	7.9**	67.1	67.1
1945	2.1	13.0	0.0	0.1	15.2	82.3
1951	18.1	32.1	49.5	7.7	107.4	189.7
1953	4.0	28.2	27.7	1.0	60.9	250.6
1957	4.1	20.6	78.4	42.4	145.5	396.1
1959	8.1	16.7	23.3	54.4	102.5	498.6
Total	40.2	125.9	219.0	113.5	498.6	

*A quarrying-washing-block manufacturing enterprise. Most of the land was occupied by quarry and storage yards.

**Two large terminal grain elevators.

5/No land has shifted from commercial and industrial to other uses although this may occur in the future.

Figure 4-14. Development of Commercial-Industrial land uses, T. H. 100 Study Strip, 1940-59

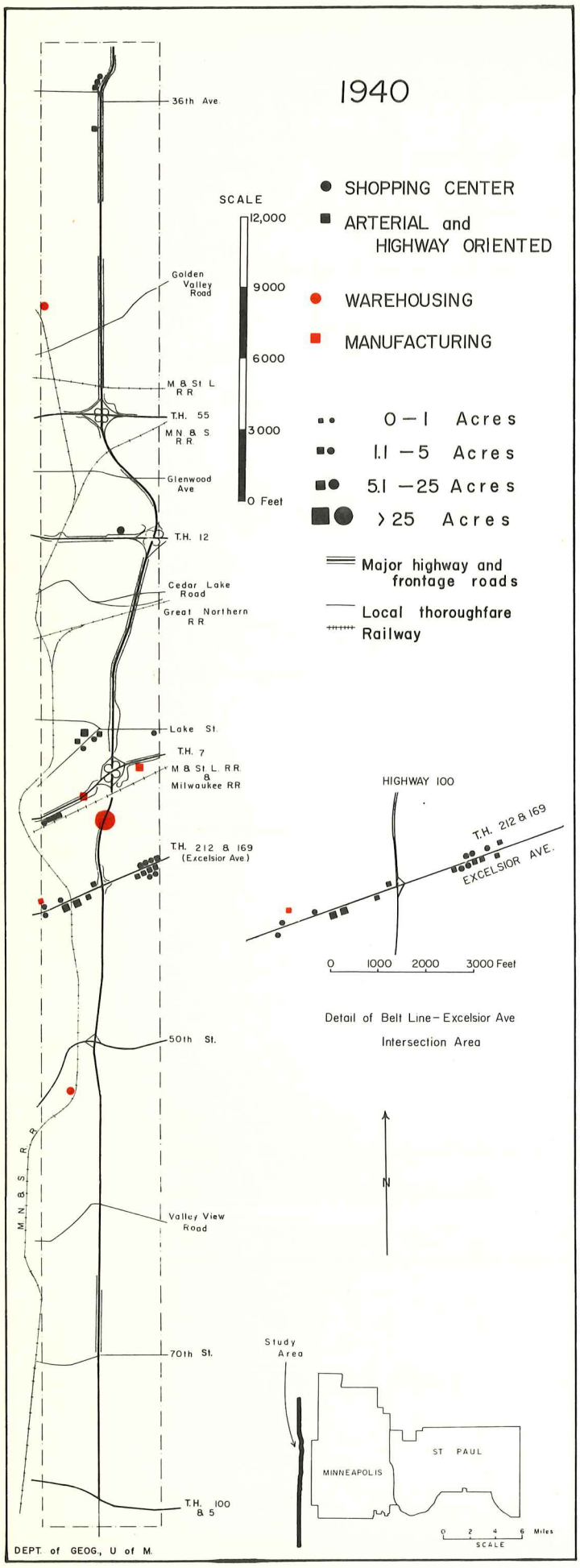


Figure 4.

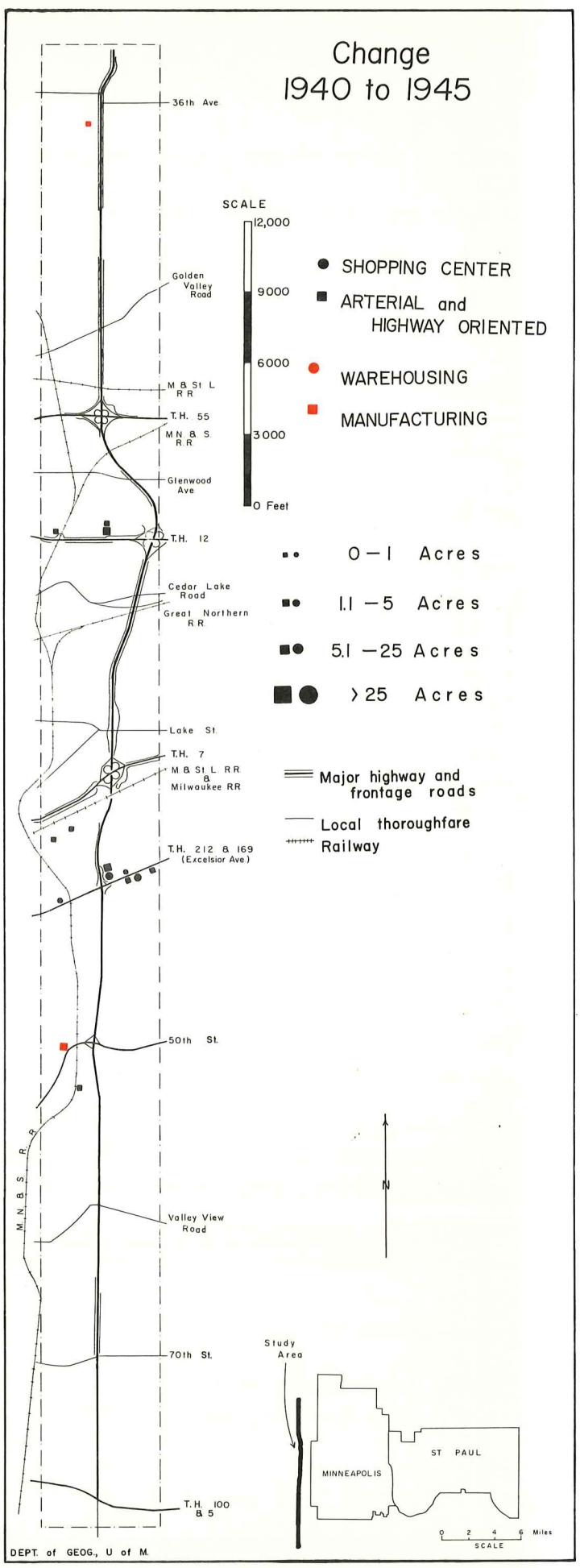


Figure 5.

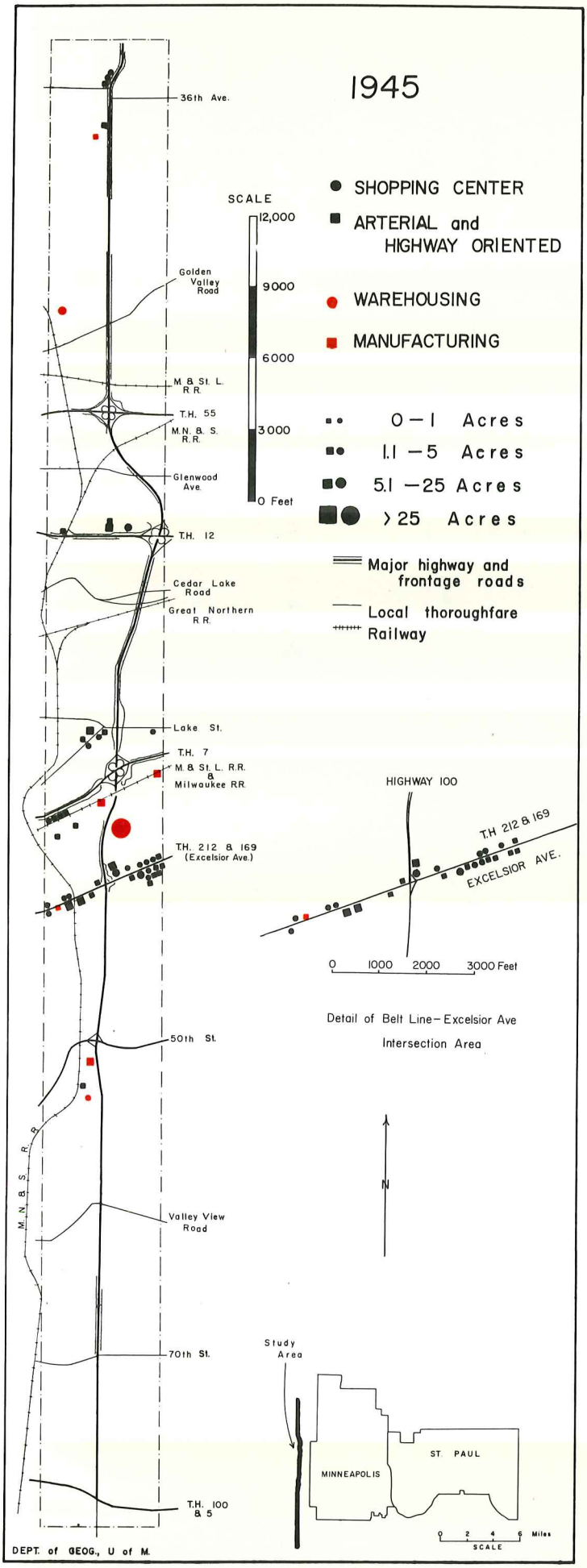


Figure 6.

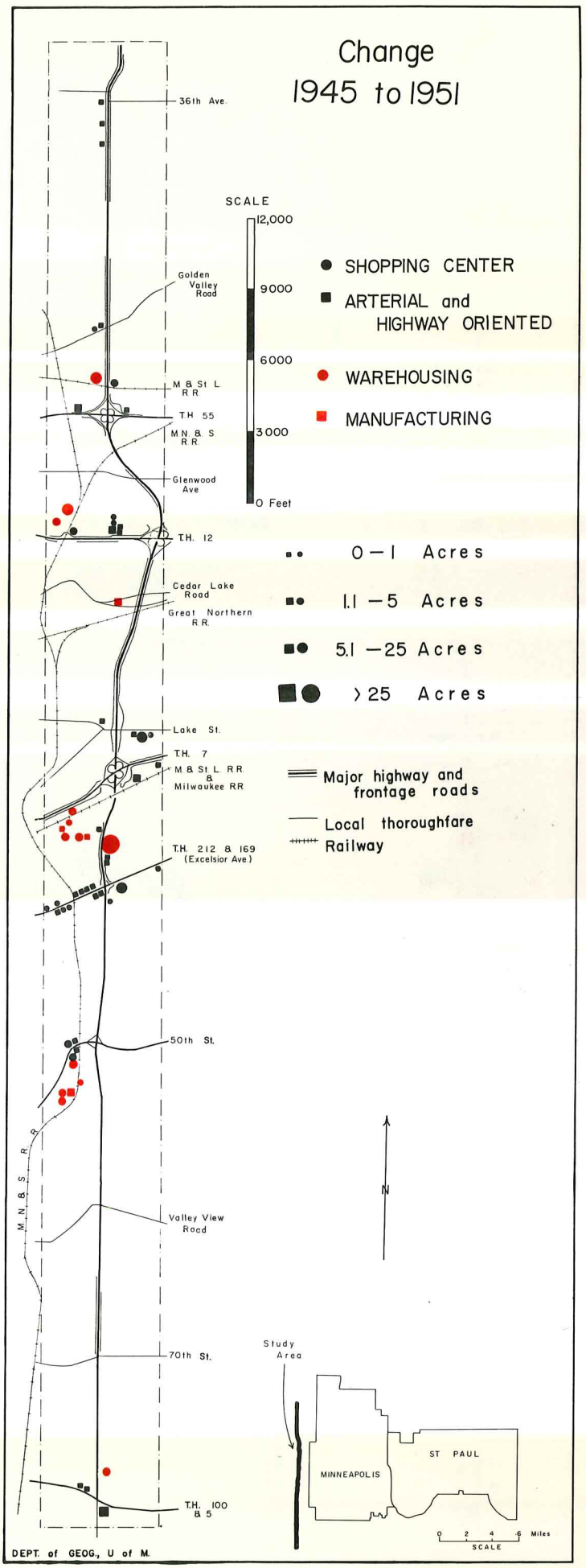


Figure 7.

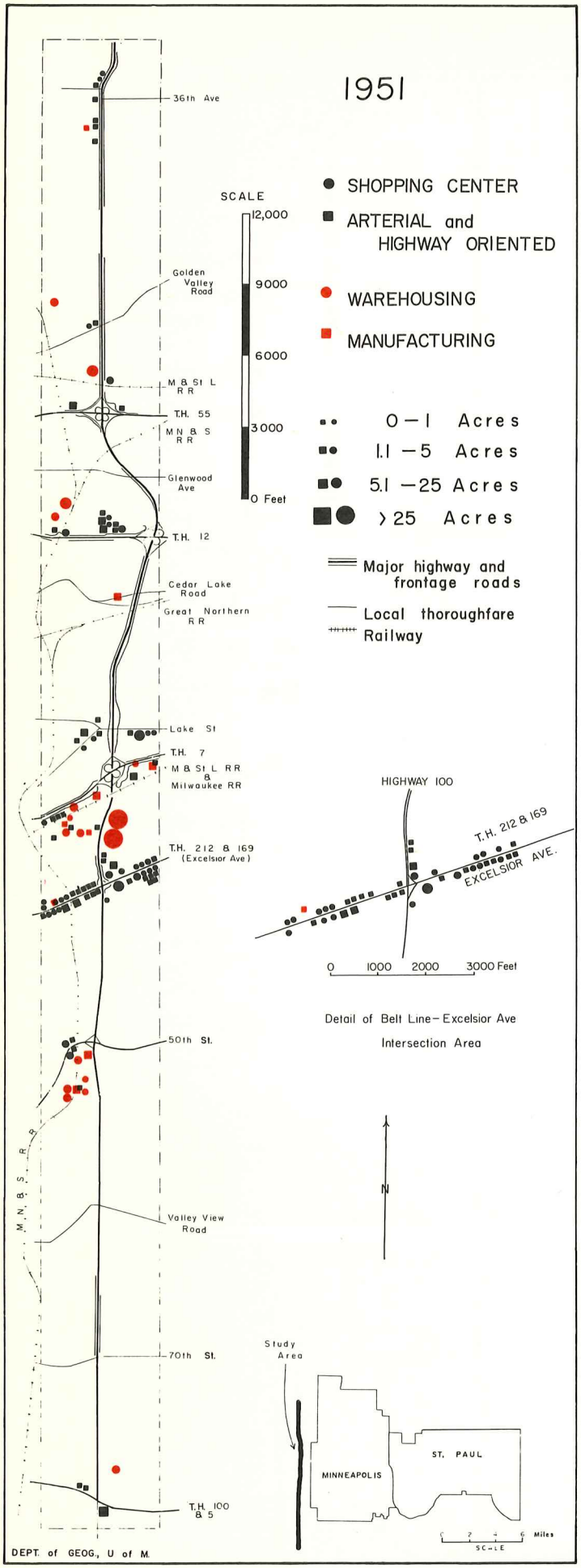


Figure 8.

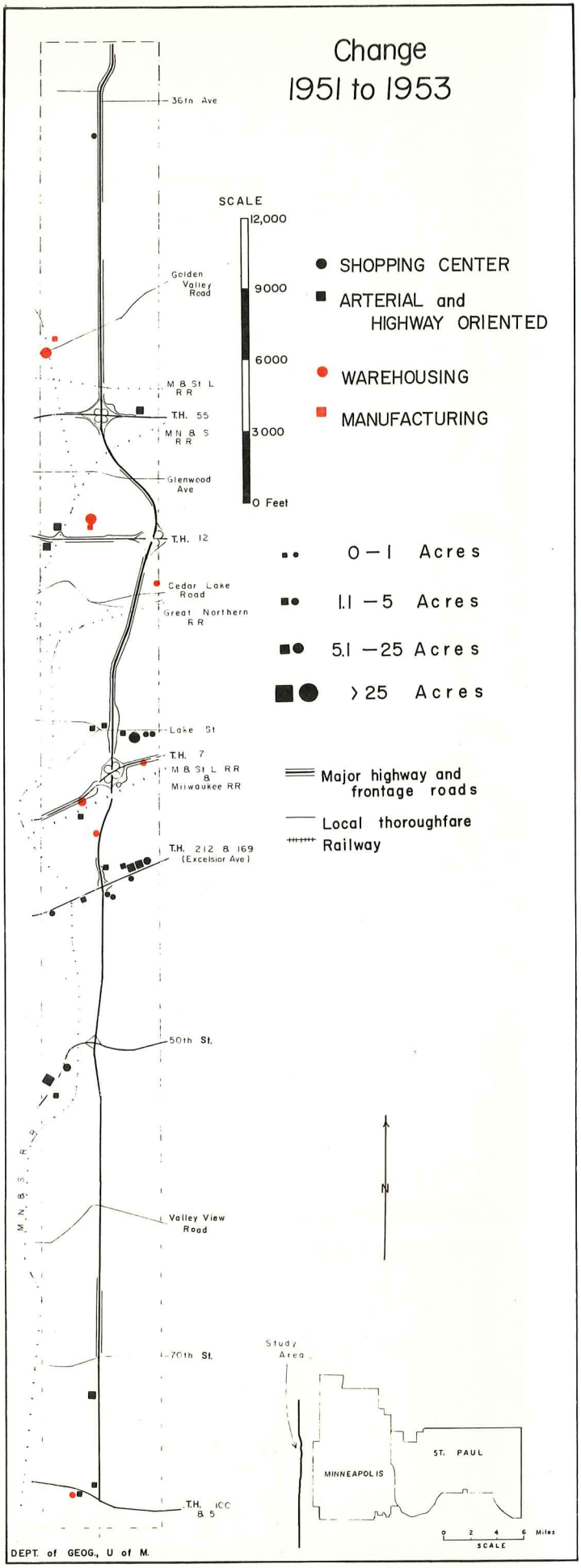


Figure 9.

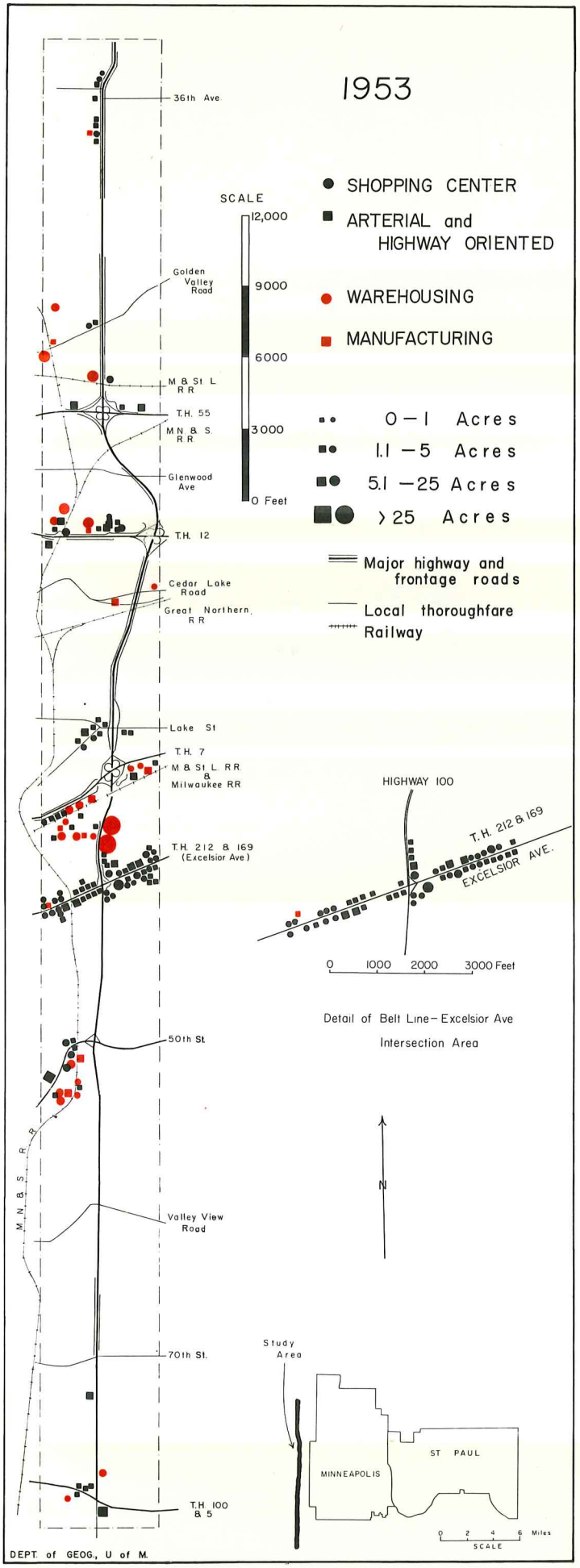


Figure 10.

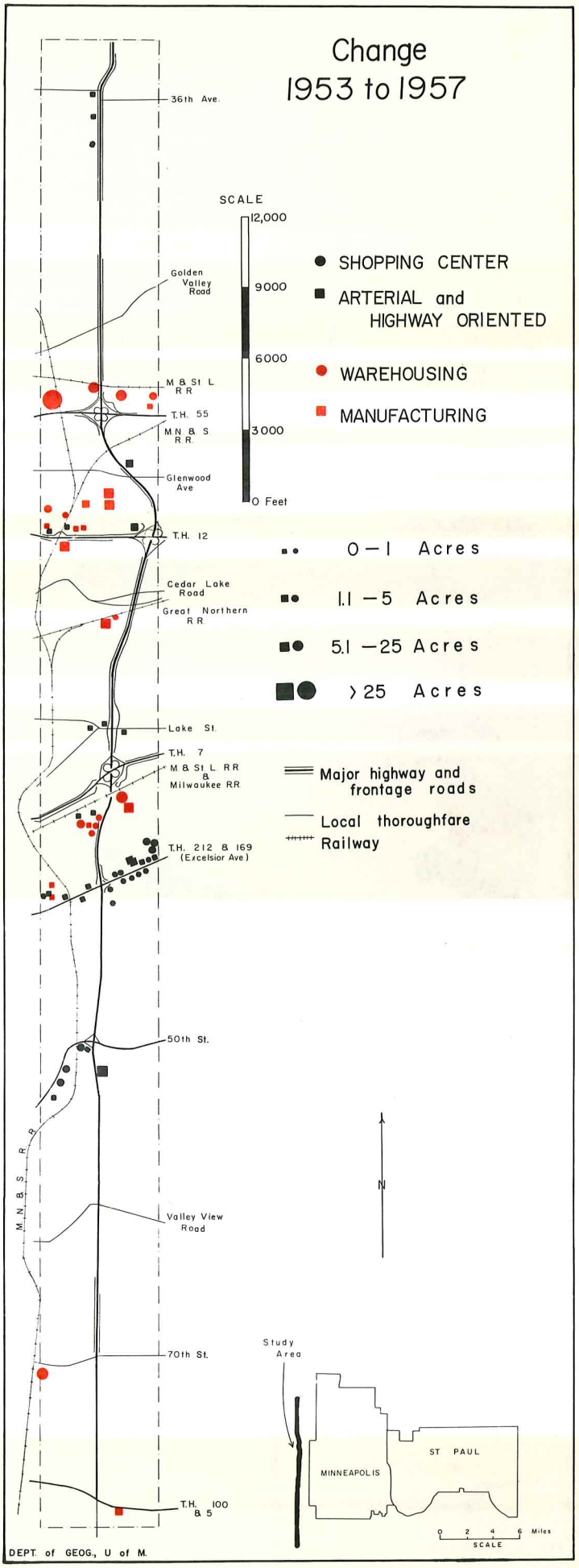


Figure 11.

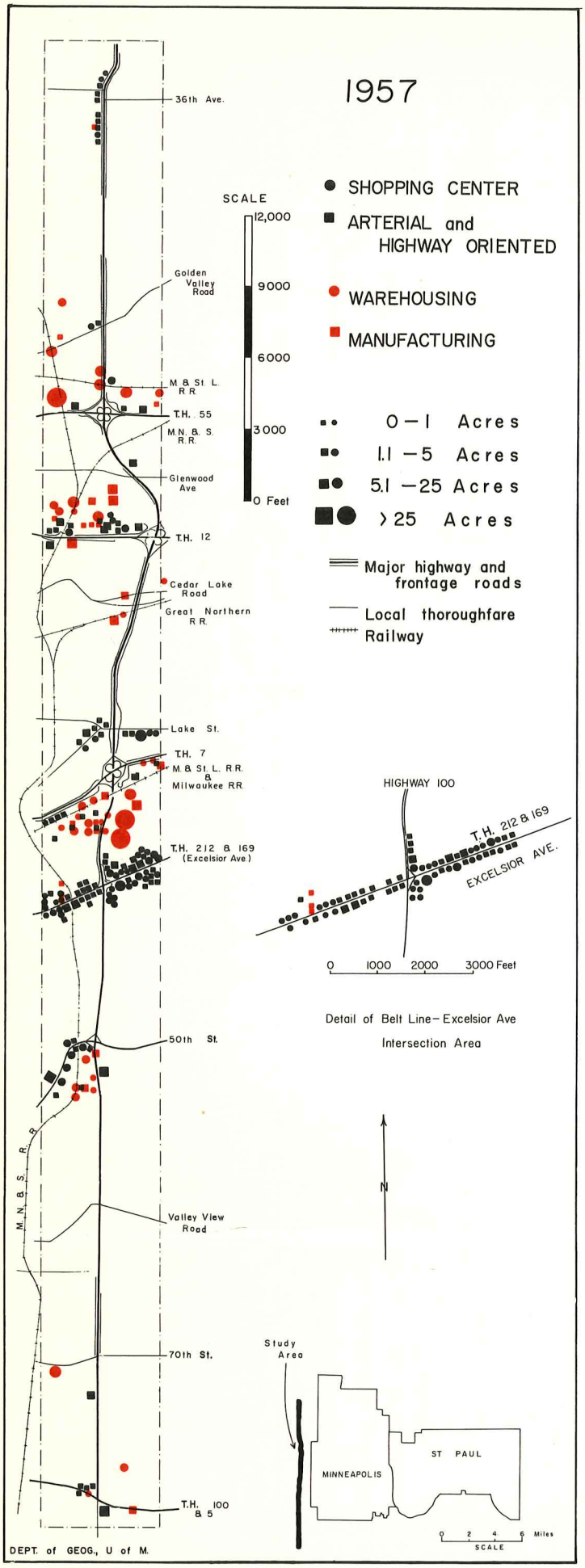


Figure 12.

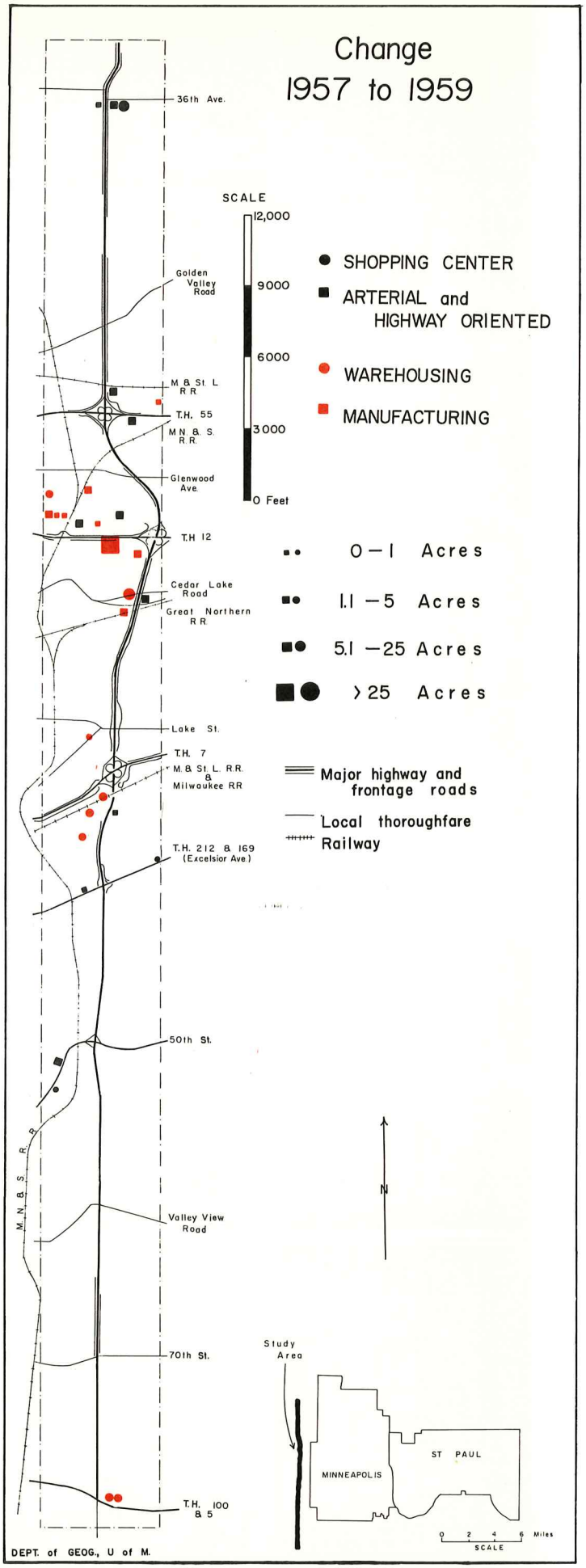
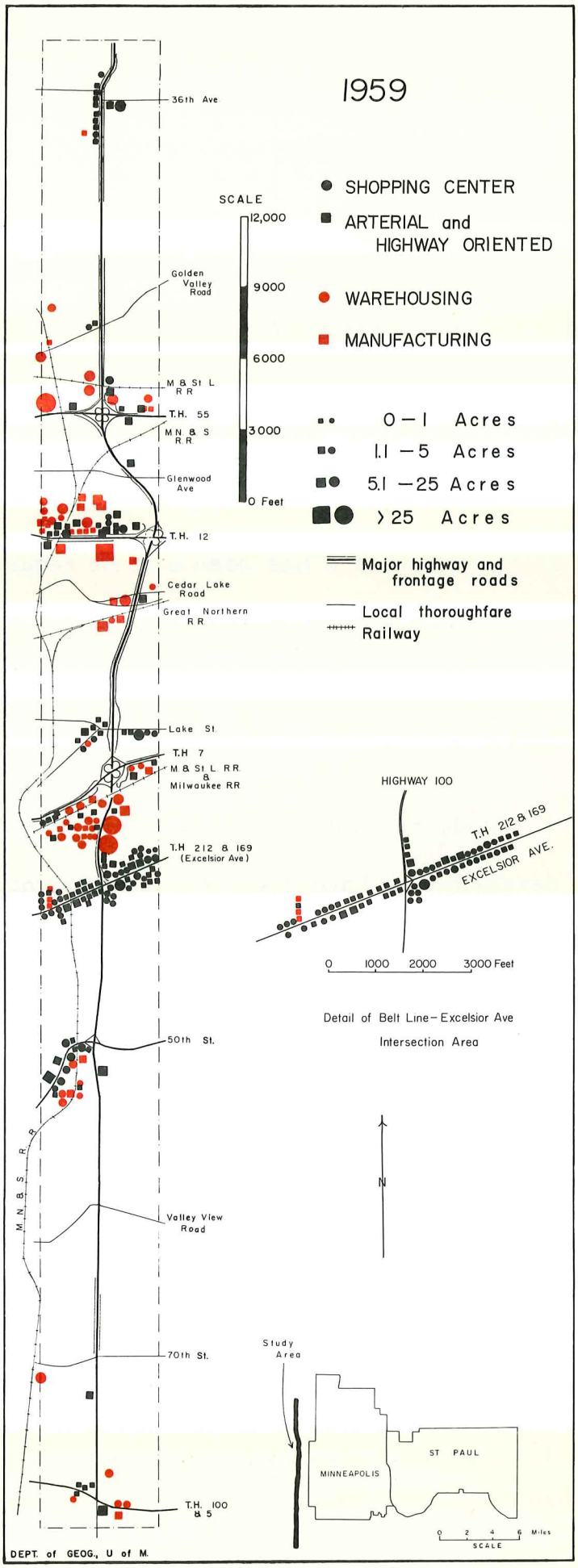


Figure 13.

Figure 14.


1959
SHOPPING CENTER
ARTERIAL and HIGHWAY ORIENTED
WAREHOUSING
MANUFACTURING
SCALE
12,000
9000
6000
3000
0 Feet
0 – 1 Acres
1.1 – 5 Acres
5.1 – 25 Acres
> 25 Acres
Major highway and frontage roads
Local thoroughfare
Railway
36th Ave
Golden Valley Road
M & St L RR
T.H. 55
M N & S RR
Glenwood Ave
T.H. 12
Cedar Lake Road
Great Northern RR
Lake St
T.H 7
M & St L RR & Milwaukee RR
T.H 212 & 169 (Excelsior Ave)
50th St
M N & S R R
Valley View Road
70th St
T.H. 100 & 5
HIGHWAY 100
T.H 212 & 169
EXCELSIOR AVE.
0 1000 2000 3000 Feet
Detail of Belt Line – Excelsior Ave Intersection Area
N
Study Area
MINNEAPOLIS
ST PAUL
0 2 4 6 Miles
SCALE
DEPT. of GEOG., U of M.

The Pattern of Development

Level and gently-rolling land used for commercial and industrial development.

In general commercial and industrial establishments have been constructed on level or gently sloping land. There are no commercial or industrial establishments in well-drained areas where the local relief in any given 10-acre grid exceeds 50 feet. 6/ Only one modern manufacturing or warehousing establishment, with about one per cent of the acreage in those two use classes, is located on land with more than 30 feet of local relief. Thus well-drained, level, or gently rolling land has been a basic requirement for all four major commercial and industrial uses, and modern warehousing or industrial uses have been confined for all practical purposes to the more nearly level areas.

Aside from these site characteristics, commercial and industrial developments have also exhibited a number of locational affinities which are illustrated on the maps in Figures 4-14.

2. Shopping Center Uses and Residential Growth

Shopping centers develop in proportion to residences.

Shopping center uses have tended to develop in direct proportion to residential development. On the advancing frontier of the Twin Cities metropolitan area, residential subdivision has tended to fall

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6/ Local relief is defined as the difference in elevation between the highest and lowest point within the 10-acre grid square.

into one of four fairly well-defined density categories. Those categories may be defined on the basis of number of dwelling units per square mile. 7/

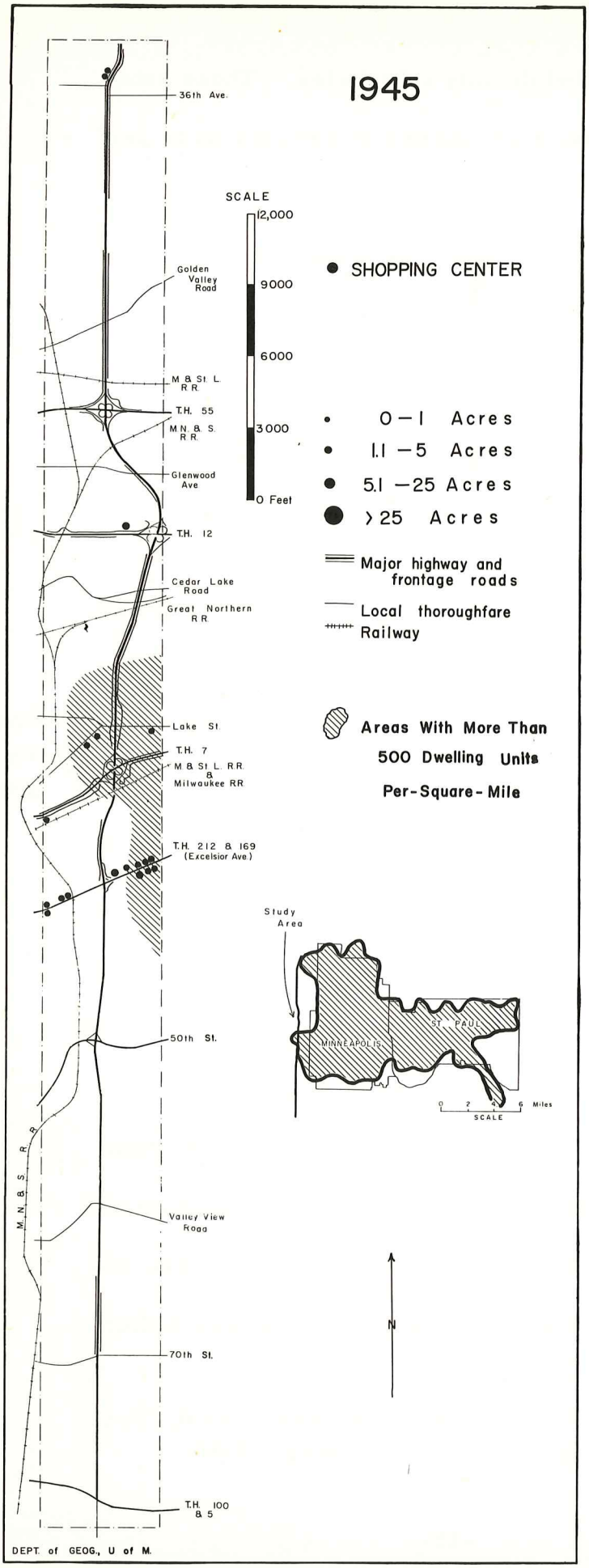
Density Class	Dwelling Units Per Square Mile
High	500 or more
Medium	250-499
Low	80-249
Dispersed	0-79

Dwelling unit density and shopping center uses.

The maps in Figures 15-17 indicate the close relationship between dwelling-unit density and shopping center uses. For each of the years 1945, 1951, and 1958, the study strip was divided into segments according to category of dwelling-unit density. On the basis of density differences, four different segments could be identified for each of the three time periods. Thus there were four times three, or 12, segments in all. Of the 12, three were in the Dispersed-density class, three were Low-density, two were Medium-density, and four were High-density. From Table 2 it is apparent that the different residential density classes have had quite different intensities of commercial development. The only exception occurs in the anomalous case of Robbinsdale, at the north end of the study strip, where the Belt Line leg narrowly misses the old, established business center.

7/ J. R. Borchert, "The Twin Cities Urbanized Area--Past, Present, and Future", Geographical Review (forthcoming issue).

Figure 15.



Figures 15-17.

Development of shopping center-type land uses in relation to built-up residential area.

Figure 16.

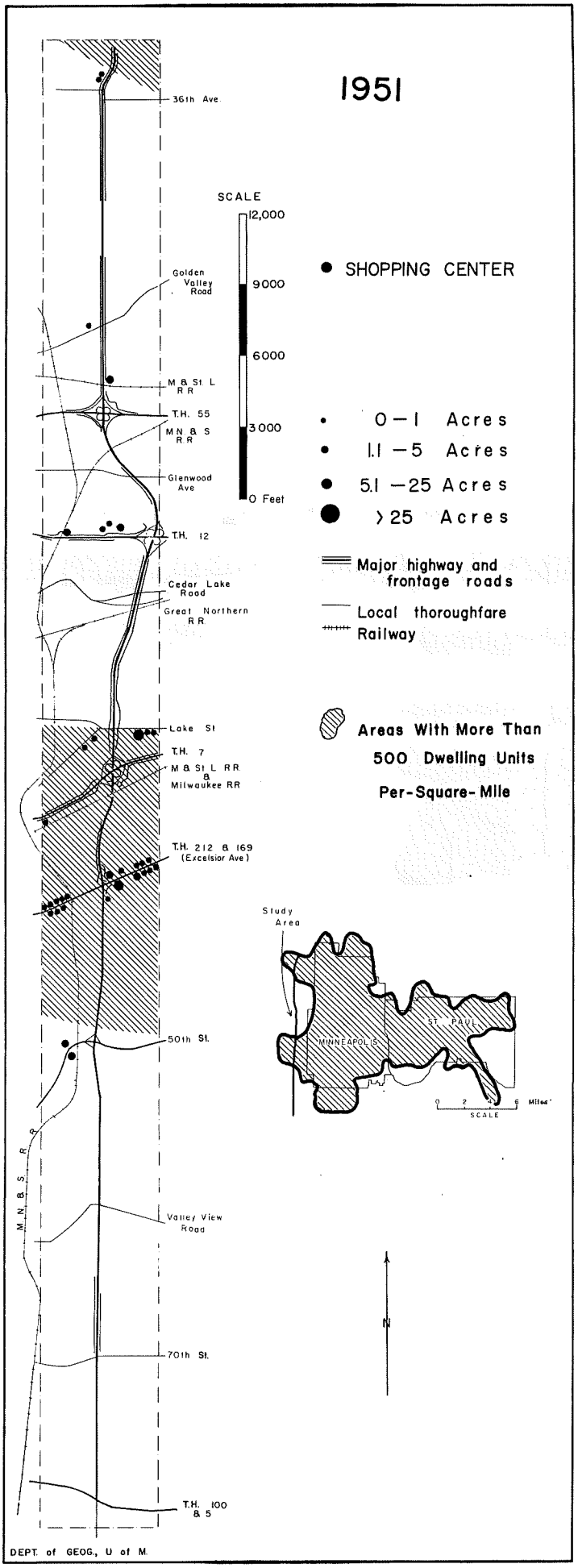
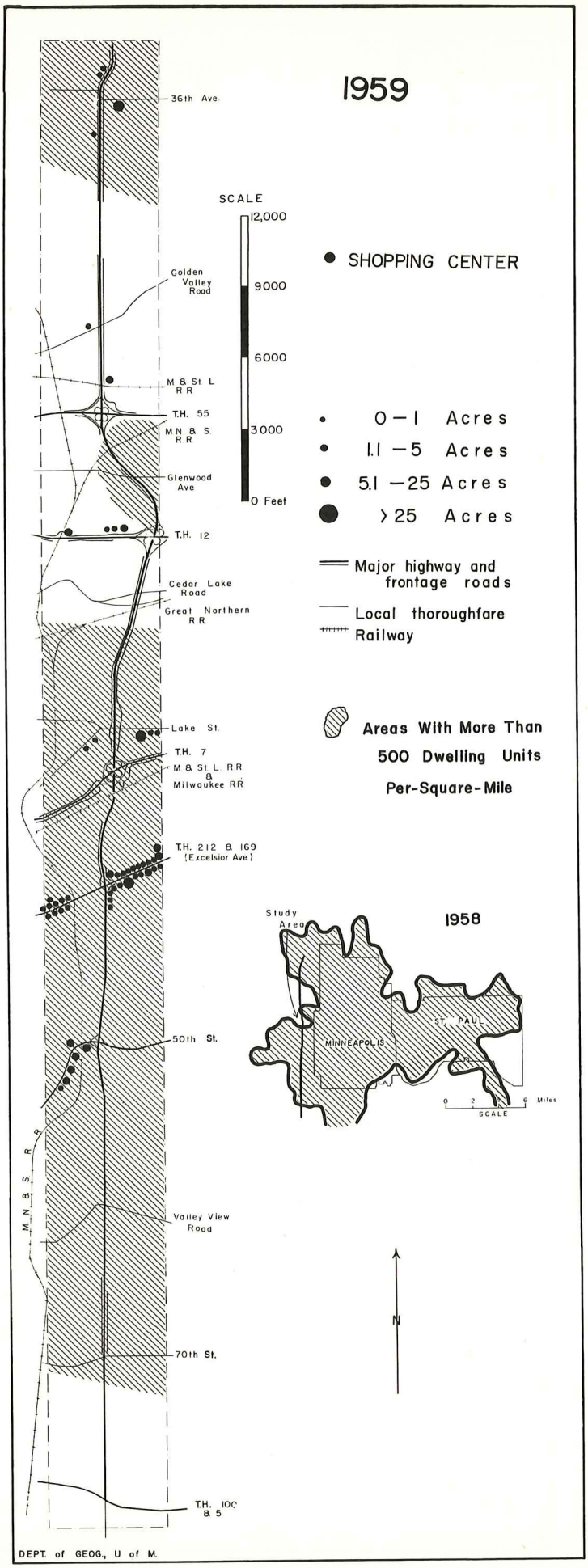

1951
36th Ave.
SCALE
12,000
9000
6000
3000
0 Feet
Golden Valley Road
M & St L RR
T.H. 55
M N & S RR
Glenwood Ave
T.H. 12
Cedar Lake Road
Great Northern RR
Lake St
T.H. 7
M & St L RR & Milwaukee RR
T.H. 212 & 169 (Excelsior Ave)
50th St.
M N & S R R
Valley View Road
70th St.
T.H. 100 & 5
SHOPPING CENTER
0 — 1 Acres
1.1 — 5 Acres
5.1 — 25 Acres
> 25 Acres
Major highway and frontage roads
Local thoroughfare
Railway
Areas With More Than 500 Dwelling Units Per-Square-Mile
Study Area
MINNEAPOLIS
ST. PAUL
0 2 4 6 Miles
SCALE
N
DEPT. of GEOG., U of M.

Figure 17.


1959
SCALE
12,000
9000
6000
3000
0 Feet
SHOPPING CENTER
0 — 1 Acres
1.1 — 5 Acres
5.1 — 25 Acres
> 25 Acres
Major highway and frontage roads
Local thoroughfare
Railway
Areas With More Than 500 Dwelling Units Per-Square-Mile
36th Ave.
Golden Valley Road
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M N & S RR
Glenwood Ave
T.H. 12
Cedar Lake Road
Great Northern RR
Lake St.
T.H. 7
M & St L RR & Milwaukee RR
T.H. 212 & 169 (Excelsior Ave)
50th St.
M N & S R R
Valley View Road
70th St.
T.H. 100 & 5
DEPT. of GEOG., U of M.
Study Area
1958
MINNEAPOLIS
ST. PAUL
0 2 6 Miles
SCALE
N

The data suggest that the growth of acreage devoted to shopping center-type uses has been directly proportional to the growth of dwelling unit density. It is also apparent, however, that there is no simple or direct relationship between residential growth and the highway pattern. While spokes of metropolitan residential development have followed some routes, they have ignored others. This is a result of the fact that residential growth directions have been determined by a number of forces, of which the modern highway pattern is only one. Other factors include the attitude of developers toward flat land, streetcar and early road patterns, and municipal sewer and water systems.

Describing the traffic density pattern.

Table 2 -- Acreage of Shopping Center Uses Per Square Mile, in the Study Strip, in Segments of Different Dwelling-Unit Densities.

Acres of Shopping Center Uses Per Square Mile			
Dispersed Residential Density	Low Residential Density	Medium Residential Density	High Residential Density
0.0	0.0	0.4	0.1*
0.0	0.1	0.5	2.0*
0.1	0.1		2.3
			3.5
Mean 0.05		0.45	1.98

*Segments located in Robbinsdale.

3. Highway-Oriented Business Uses and Traffic Volume

Establishments in the highway-oriented class are the only group which showed a tendency to locate near heavy traffic. To describe

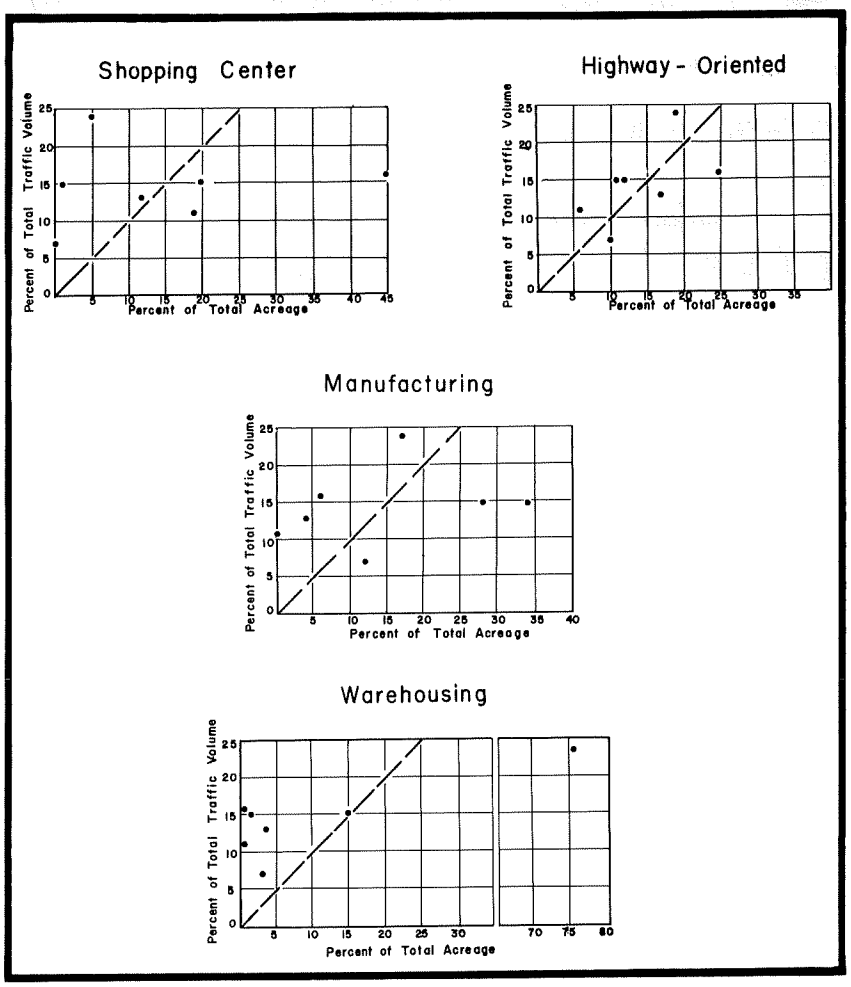
the traffic density pattern, the study strip was divided into seven parts. Each part contained one major intersection of the Belt Line and a radial highway. All of the major radials belong to the state or federal systems; all carry heavy burdens of both commuter and inter-city traffic. The seven parts of the study strip and the traffic volumes are indicated in Table 3. A total was obtained for the average daily number of vehicles entering or leaving each intersection on both the

Table 3 -- Traffic Volume and Acreage of Major Land Uses, Segments of the Belt Line Adjoining 7 Major Highway Intersections.

Major Intersecting Highway	Average Daily Vehicle Flow Through the Intersection (000's)	Individual Intersection Traffic Count as Per Cent of Total for 7 Intersections	Highway Oriented Use Acreage as Per Cent of Strip Total	Shopping Center Use Acreage as Per Cent of Strip Total	Manufacturing Use Acreage as Per Cent of Strip Total	Wholesaling Use Acreage as Per Cent of Strip Total
T.H. 12	151	24	19	12	17	76
T.H. 169 (Excelsior Ave.)	100	16	25	45	6	1
T.H. 55	96	15	12	1	34	2
T.H. 7 (Lake Street)	96	15	11	20	28	15
T.H. 212 (50th Street)	80	13	17	12	4	3
T.H. 152	71	11	6	19	0	1
78th St. (T.H. 5-100)	40	7	10	0	13	3

Belt Line and the major radial highway. The total at each major intersection was then taken as an index of the density of traffic within each of the seven segments of the study strip. This traffic density index was then compared with the acreage of land in each of the four major use classes. The results of the comparison are indicated in Table 3 and the graph in Figure 18. More than the other three classes, the highway-oriented retail and service uses appear to be located in response to the presence of a large volume of traffic.

Figure 18.



4. Concentration of Retail and Service Establishments Near Major Highway Intersections

Location of retail and service establishments.

Retail and service establishments generally have located in the vicinity of major highway intersections. This applies to neighborhood-oriented shopping center establishments as well as to highway-oriented establishments.

Classifying establishments.

All highway-oriented and shopping center-type establishments were classified according to their distance from one of eight major intersections. Those intersections included the seven listed in Table 3 and, also, the intersection of the Belt Line with T.H. 278 in Robbinsdale, at the north end of the study strip. The results are indicated in Table 4.

Explaining the distribution pattern of retail and service uses.

Table 4 indicates that 91 per cent of all retail and service establishments located on the Belt Line are less than 2,500 feet from a major highway intersection. This is almost twice the percentage which could be expected if these uses were distributed evenly along the study strip. Long stretches of the highway have stood without commercial development for long periods of time; yet they are served by frontage roads, and they have been free of competing, noncommercial land uses. The land remote from major intersections was ignored by commercial establishments. This distribution pattern can be explained only by the attraction of major intersections where the number of directions of rapid access is maximized. It is also

noteworthy that the modal distance from the major intersections was the same for every year of observation. In other words, there was a tendency for a loose commercial-use pattern to develop initially then gradually increase in density, rather than a tendency for development to begin immediately adjacent to the intersection and expand outward.

Table 4 -- Retail and Service Establishments (Shopping Center and Highway-Oriented) in Relation to Available Highway Frontage.

	Distance From Major Intersection (feet)	Per Cent of Total Frontage	Per Cent of Total Retail & Service Establishments
Belt Line (33 establishments)	0-500	10	37
	500-1000	10	19
	1000-1500	10	13
	1500-2000	10	10
	2000-2500	10	12
	2500	50	9
Major Radials (120 establishments)	0-500	18	16
	500-1000	18	13
	1000-1500	18	15
	1500-2000	18	33
	2000-2500	18	12
	2500	10	11

Table 4 also indicates that four-fifths of the establishments in these intersection areas front the radial highways rather than the Belt Line. This is related to the timing of Belt Line construction and also to zoning policy.

Why radial highways have more firms than the Belt Line.

Timing of Belt Line Highway Construction

Many retail and service establishments are neighborhood-oriented. Their growth has depended for its stimulus upon nearby residential development. Maximum development of shopping center uses has occurred in the oldest, largest, most densely built tongues of residential neighborhoods which project northwest and southwest from Minneapolis across the Belt Line study strip (Maps, Figures 15-17).

Residential development stimulates the growth of retail and service establishments.

The Belt Line cuts across those two established residential spokes in Robbinsdale, on the north, and in the southern part of St. Louis Park and the adjacent northern part of Edina. The southwest spoke, extending into St. Louis Park and Edina, was the wider and better developed of the two. Commercial strip developments were already partly established on two radial routes within that spoke--Lake Street and Excelsior Boulevard (Figure 19). Thus, when the Belt Line was built, development near the major intersections was increased in the established commercial strips on the radials, and it was inhibited by the existence of partly built-up residential areas along the Belt Line (Figure 20).

In recent years, commercial uses have replaced residential uses for a short distance south of Excelsior Boulevard. This is evidence that Belt Line frontage so near a major intersection is valuable enough to justify redevelopment from residential to commercial uses (Figure 21). The "late arrival" of the Belt Line in that area, cutting through a district in which residential development was already underway in 1928, has forced commercial growth along the Belt Line to await rezoning and redevelopment, and it has favored commercial development along pre-existing radial highways.

Redevelopment from residential to commercial uses.

5. Zoning Policy

There have been great variations in zoning policy among the different municipalities through which the Belt Line passes. Edina has permitted only one commercial establishment--a large motel-restaurant--to front the Belt Line. According to the village planning director, there is a policy against extending that zone except in the southern part of the village, where the Belt Line approaches the future interchange with T.H. (I.R.) 494 (Figure 2). Thus, in Edina there is an avowed intent to emphasize or "advertise" the predominantly residential character of the village by encouraging that residential image along the major through traffic artery. In Edina it is often said that "The Belt Line is our front yard." (Figure 22).

Edina. "The Belt Line is our front yard."

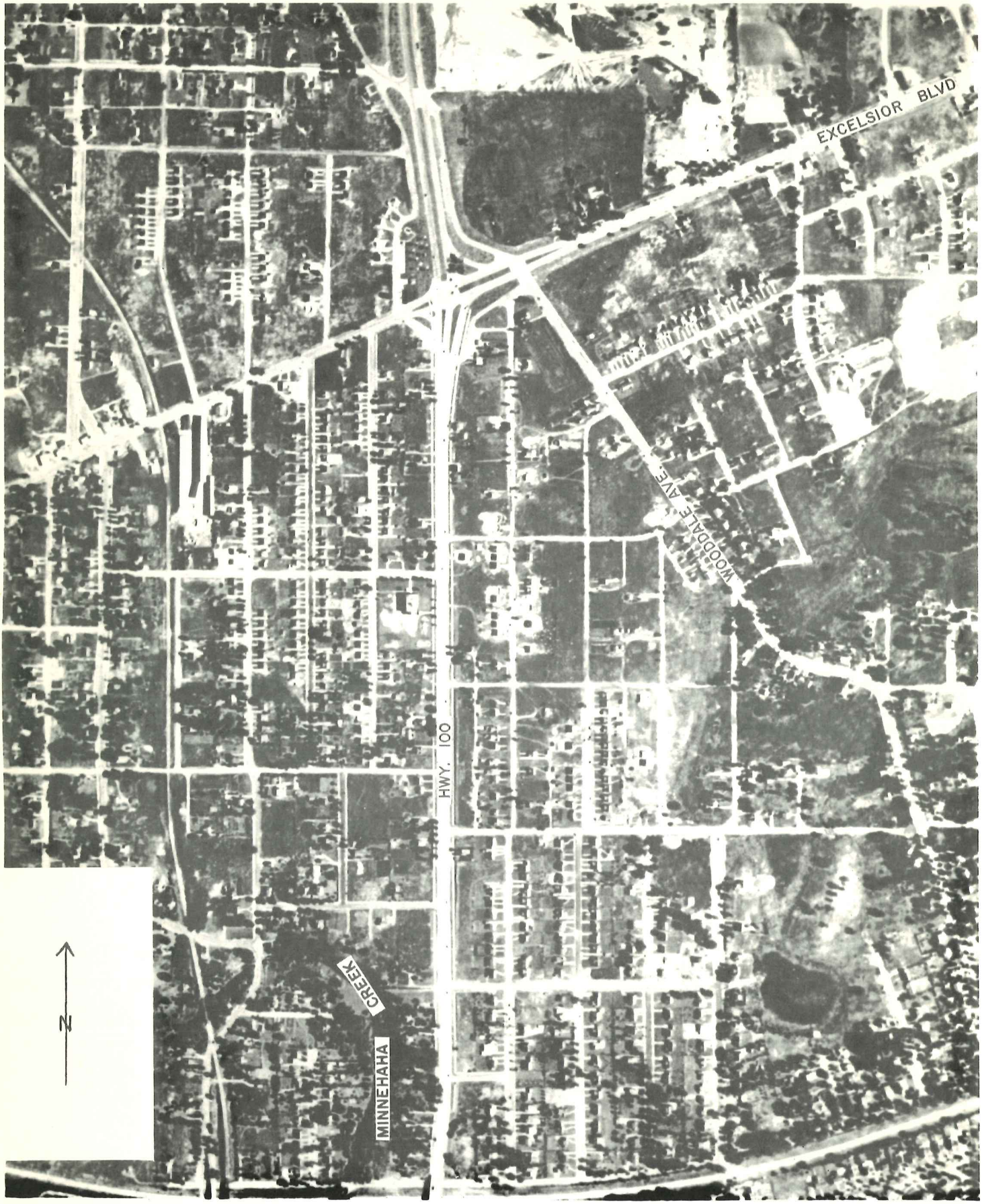


Figure 19.

Aerial view of the vicinity of T.H. 100 and T.H. 212-169 in St. Louis Park, 1940. Note complete street grid (evidence of an established subdivision) and considerable residential building already established in this area.

Figure 20.

Aerial view of the area shown in Figure 19 almost two decades later, in 1959. Note congested residential development on either side of T.H. 100 in the old subdivided area and the large shopping area which has evolved with residential growth in the vicinity.

Figure 21A

This is one of the many major business establishments which have located along "Miracle Mile" in St. Louis Park at the intersection of Excelsior Boulevard and the Belt Line.

Figure 21.

Current redevelopment from housing to new office building in the section of St. Louis Park in which urban growth preceded highway construction.

Figure 22.

Typical frontage in high-value residential district along the Belt Line in the village of Edina.

Golden Valley for many years enforced a 300-foot setback, and more recently a 200-foot setback for commercial or industrial uses fronting the Belt Line. The setback is measured from the edge of the main travelled roadway. The effect of this requirement has been to restrict nonresidential development to those uses which require large parcels of land and extensive landscaping or extensive parking facilities. This, in turn, favored relatively large, highly capitalized enterprises and discouraged strip development of small establishments crowded against the highway or frontage roads (Figures 23 and 24). The enforced setback requirement has been so demanding upon any potential developer that it has had almost the same effect as controlled access. The village has apparently developed a sense of community obligation to preserve the beautification inspired by engineer Carl Graeser and carried out by the WPA. An annual civic "Lilac Festival" takes its name from the lilac plantations along the Belt Line.

Golden Valley. Commercial establishments are set back from highway.

In contrast, the village of Crystal has permitted commercial uses within 22 feet of the Belt Line right-of-way; and St. Louis Park has permitted them within five feet. Commercial strip development has occurred on the Belt Line in those two municipalities (Figure 25).

Crystal and St. Louis Park. Firms have been allowed to front the highway.

It is clear that circumstances of timing and zoning have forced much retail and service development away from Belt Line frontage. Yet 153 retail and service establishments had located in the study

strip by 1959, 80 per cent of them since 1945. These establishments located near the major intersections, but they adjusted their choice of specific site to the conditions imposed by local zoning regulations and availability of land. If feasible sites were not available for development on the Belt Line, adjustments were made through (1) development of small sites on radial highways, (2) redevelopment of existing residential areas, (3) utilization of vacant lots in existing commercial strips, or (4) extending the "waiting period" on vacant land until a developer with a potentially large capital investment appeared.

Factors affecting Belt Line frontage.

6. Manufacturing-Warehousing and Accessibility

Tables 5 and 6 indicate the relationship between manufacturing and warehousing establishments and distance from a major state or U. S. highway. Excluding the large, old quarry site on the Belt Line, 89 per cent of the manufacturing and warehousing establishments, embracing 74 per cent of the acreage, are within 1,000 feet of a major highway, and 75 per cent of the establishments, embracing 57 per cent of the acreage are within 1,000 feet of both a major highway and a railroad line. Until this time, there is only one large development outside the 1,000-foot zone. That is a very large, new hardware wholesaling warehouse and office building. It fronts a major highway and is served by a rail siding, but the building is more than 1,500 feet from the highway, and the railway spur is more than 3,000

Location of manufacturing and warehousing.

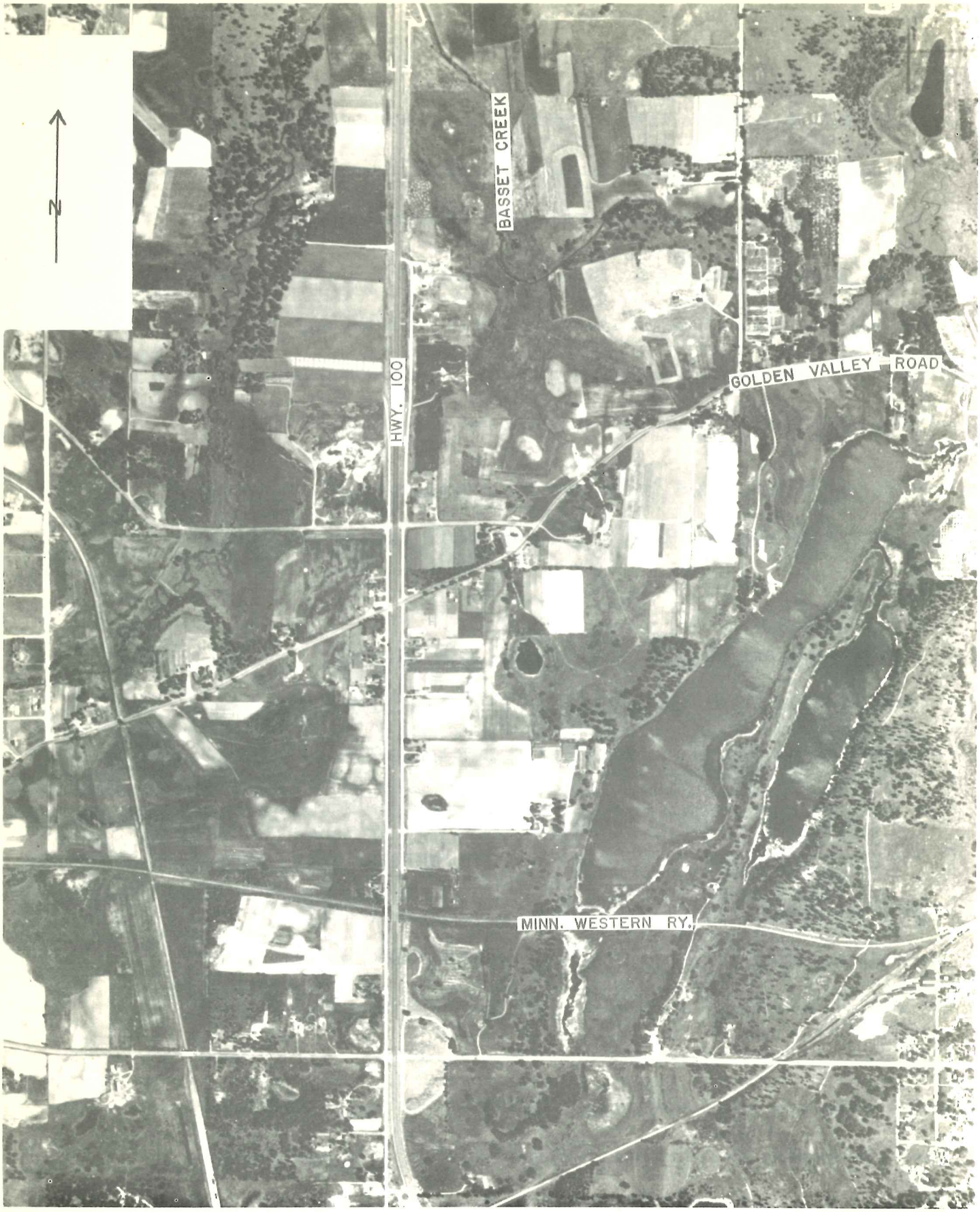


Figure 23. -- Aerial view of T.H. 100 northward from intersection with T.H. 55 in Golden Valley, 1940 . Most land was in agricultural use. Zoning ordinance was already in force for all land in the picture.

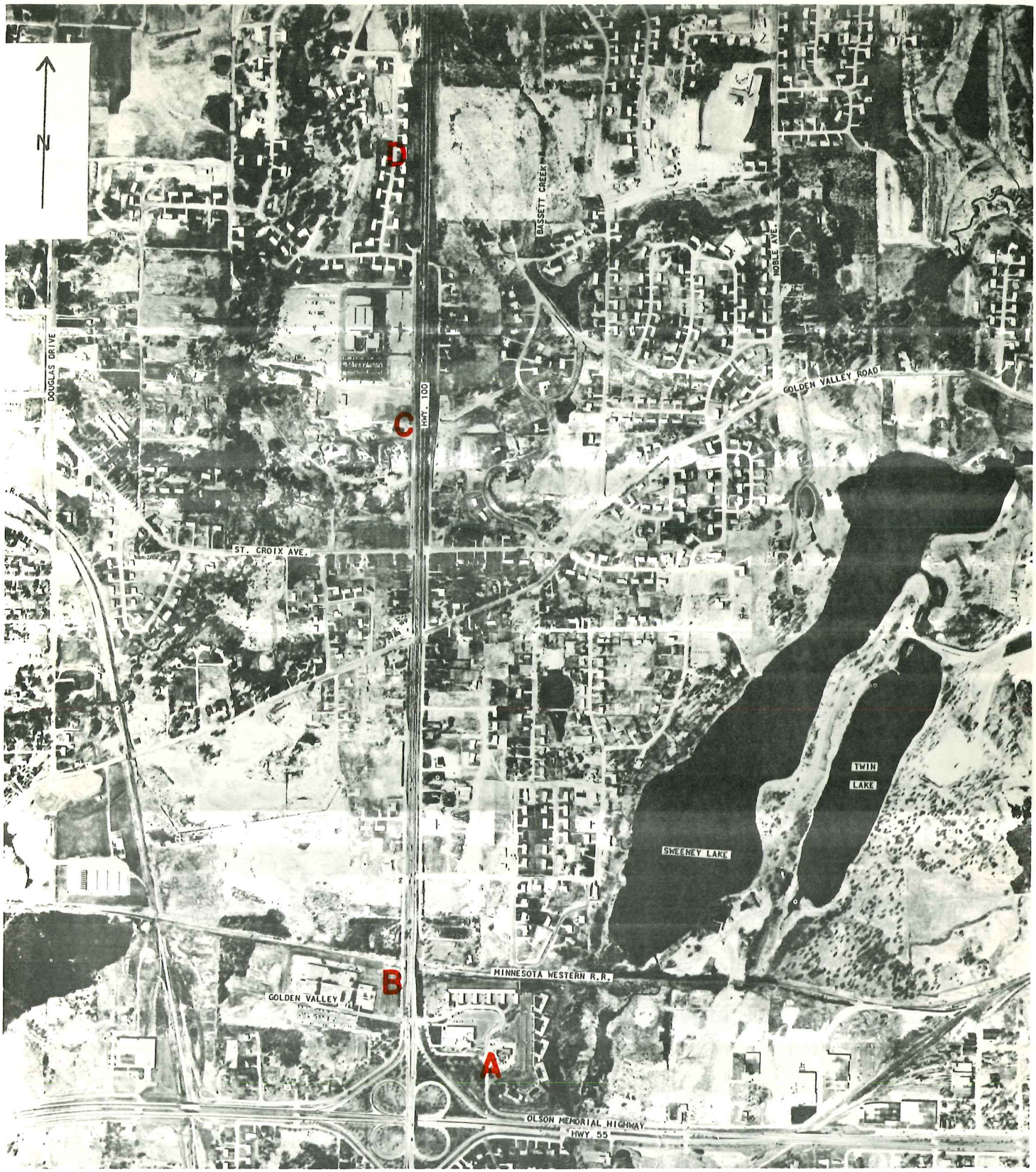


Figure 24. -- Aerial view of area shown in Figure 23 almost two decades later, in 1959. Ample, richly landscaped right-of-way of T.H. 100 is a legacy from early timing of land acquisition. Frontage roads serve existing commercial area (A), existing or potential industrial areas (B), highway shops and potential commercial area (C). New residential neighborhood is designed to turn its back to T.H. 100 and face local street where adjacent land lies higher than the highway and there is no frontage road (D).

feet long. Highway and trackage needs are met for this establishment although the land requirement for the establishment was larger than most others in the study strip.

Table 5 -- Number of Manufacturing and Warehousing Establishments in Relation to Distance From Major Highway and Railway Line, 1959.

Distance From Railroad Line (feet)	Distance From Major Highway (00 feet)						
	0-5	5-10	10-15	15-20	20-25	25-30	Total
0-500	22	24	2	0	3	0	51
500-1000	8	6	1	0	1	0	16
1000-1500	2	1	0	0	0	0	3
1500-2000	1	1	0	0	0	0	2
2000-2500	2	0	0	0	0	0	2
2500-3000	0	0	0	0	0	0	0
3000	5	0	1	0	0	0	6
Total	40	32	4	0	4	0	80

Industrial development near the Belt Line and T.H. 5.

The cluster of establishments (Table 6) nearest a highway and farthest from trackage represents the developments near the intersection of the Belt Line with T. H. 5 at the south end of the study strip. That is the only significant industrial cluster without trackage.

Industrial development without trackage.

Although most manufacturing and warehousing establishments have developed near a railway line, many are not actually served by trackage. Of those establishments within 1,000 feet of a railway line, tracks actually serve only 38 per cent of the manufacturing establishments (with 49 per cent of the acreage) and 27 per cent of the ware-

Table 6 -- Acreage of Manufacturing and Warehousing Uses in Relation to Distance From Major Highway and Railway Line, 1959.

Distance From Railway Line (feet)	Distance From Major Highway (00 feet)						
	0-5	5-10	10-15	15-20	20-25	25-30	Total
0-500	91.1	46.7	5.8	29.5	0.3	0	173.4
500-1000	15.7	15.3	9.7	0	3.4	0	44.1
1000-1500	1.0	6.2	0	0	0	0	7.2
1500-2000	0.8	0.4	0	0	0	0	1.2
2000-2500	18.9	0	0	0	0	0	18.9
2500-3000	0	0	0	0	0	0	0
3000	19.4	0	28.7	0	0	0	48.1
Total	146.9	68.6	44.2	29.5	3.7	0	292.9

houses (with 51 per cent of the acreage). Among all manufacturing and warehousing in the study strip, trackage serves 30 per cent of the establishments on 49 per cent of the acreage. These data reflect a tendency for manufacturing and warehousing establishments to be located near each other as well as near rail lines, and a tendency for only the larger establishments to use rail transportation.

The industrial pattern is related to distance to the CBD.

In addition to major highway and rail access, distance from the Minneapolis central business district (CBD) also appears to be a factor in the industrial pattern. To provide a measure of this relationship, the industrial areas were arranged in seven groups. Six of the groups are associated with major highway-railway intersections. The highways and railways are identified in Table 7. The seventh

group, located at the junction of T. H. 5 and the Belt Line, has no trackage. It is in the vicinity of the proposed interchange between T.H. 100 and T.H. (I.R.) 494. A railway line passes approximately 3,000 feet to the west of this district, and trackage is likely to be involved in future expansion on the west side of the Belt Line (see below).

Table 7 -- Relationship Between Manufacturing and Warehousing Acreage and Distance From Minneapolis CBD (by shortest divided highway route) in Trackage-Highway Locations.

Location	Miles from CBD	Per Cent of Total Manufacturing-Warehousing Acreage			
		1959	1957	1953	1951
MNS RR-T.H. 12	2.5	31	22	18	0
MNS RR-T.H. 55	3.0	26	34	25	0
GN RR-T.H. 100	3.0	10	7	4	0
MSI RR-MILW RR-T.H. 7-T.H. 100	4.5	13	14	22	50
MNS RR-Excelsior Ave.	5.5	5	7	14	0
MNS RR-T.H. 169-212	6.5	4	5	11	19
T.H. 100-T.H. 5(no railway)	10.5	11	11	6	31

The evolution of a highway pattern.

The graph in Figure 26 shows that there was almost a linear relationship, in 1959, between distance from the Minneapolis CBD, by the shortest divided highway route, and acreage of manufacturing and warehousing development in five of the six trackage-highway districts. It should be emphasized that the present relationship has evolved over the past decade through a series of intermediate stages during which both highway improvements and industrial development had different patterns than they have today. In general, as the highway pattern be-

Figure 25. -- Commercial strip development along Highway 100 in an area of late establishment of zoning and setback regulations.

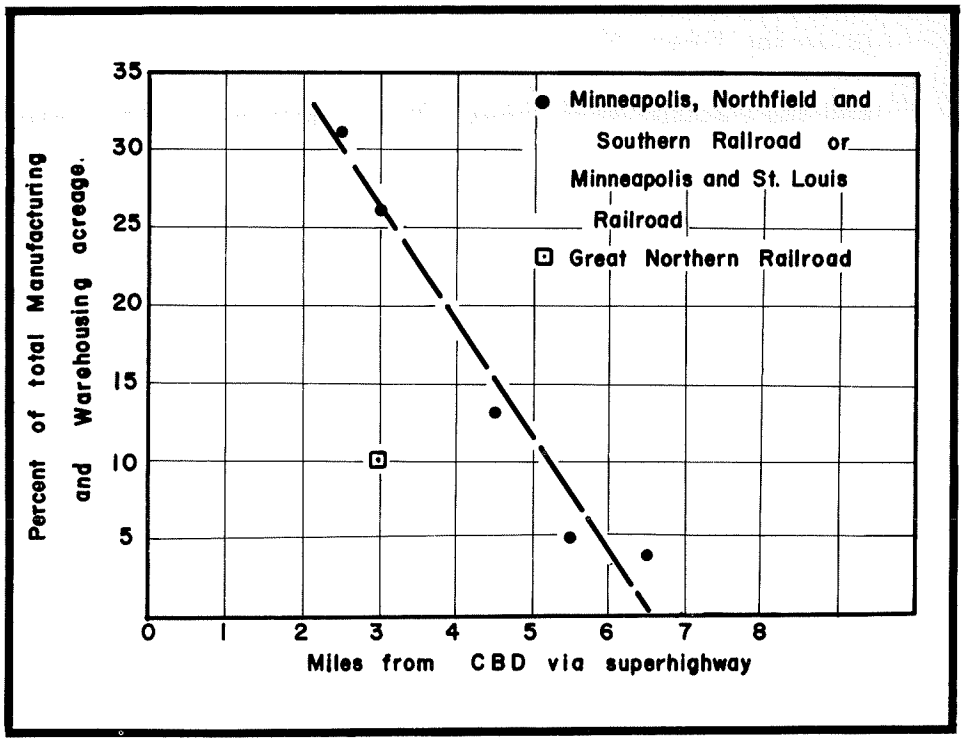


Figure 26. -- The relationship between industrial development and distance from the Minneapolis CBD for the six major highway-rail trackage locations in the T.H. 100 study strip, 1959.

comes more complete, the closer becomes the relationship between distance from the CBD and manufacturing-warehousing development.

It is noteworthy that the five locations in nearly linear relationship with distance from the CBD all involve either the Minneapolis, Northfield, and Southern (MNS) or Minneapolis and St. Louis (MSL) railways. Both lines lead southward from the fast growing western side of the Twin Cities Metropolitan Area, bypass the metropolitan mass to the east, and provide direct connections to the eastern United States through Chicago or Peoria. Both railroads have actively sought industries of widely varying size on their lines. Both are headquartered on the Minneapolis side of the Twin Cities area; both look mainly to the Twin Cities for their business. The sixth location is on the Great Northern railway's main line between the Twin Cities and the Pacific Northwest. That company traditionally has been more concerned with through traffic to and from the West. Also, there was no major radial highway near the intersection of the Great Northern with the Belt Line. The result was a lag in development. The Great Northern now serves the large new industrial park south of T.H. 12, west of T.H. 100. The combination of two major highways, trackage on two rail lines, and proximity to the Minneapolis CBD is producing a major node of industrial development in this location. It is likely that the "Great Northern" dot will shift in the next few years into its proper position on the graph in Figure 26.

Rail management encourages industrial development along trackage.

In short, it is clear that regional and metropolitan accessibility has been the major factor in locating manufacturing and warehousing establishments. This accessibility is provided (1) by highway to the Minneapolis CBD and the bulk of the metropolitan area, (2) by highway to the trade hinterland west, southwest, and northwest of Minneapolis; and (3) by rail to the major markets and industrial areas of the East. For both (1) and (2), above, there is an evident advantage in location near a high speed highway which is both a western circumferential and an urban distributor.

Accessibility is the major factor determining location.

7. Summary of Locational Patterns

The Belt Line and related major highways have gathered a large amount of commercial and industrial development near their major intersections. However, the development has been the result of several different stimuli.

The development of commercial and industrial enterprises.

Of 458 acres (excluding the large quarry in St. Louis Park), 40 acres have been developed for shopping center uses attributable mainly to residential growth. One hundred twenty-six acres are devoted to highway-oriented uses related primarily to traffic density on the highway and only secondarily to adjacent residential development. Two hundred ninety-two acres are used for manufacturing and warehousing establishments. They are concerned with highway access to the centers of the metropolitan complex and also with highway and rail access to the Twin Cities trade territory and the eastern manufacturing centers.

The various stimuli which have triggered development.

Furthermore, the spatial relationships between the commercial and industrial developments and the highway have depended in part upon the timing of highway construction relative to residential development and upon zoning regulations.

Describing the physical appearance and value of building improvements.

The Character of Development

In addition to their distinctive spatial patterns, the various Belt Line commercial and industrial uses have distinctive characteristics of structure and land parcel size. Three categories of development have been defined for the purpose of describing the physical appearance and value of building improvements in the study strip. The categories have been worked out from data accumulated in studies along T. H. 100 west and south of Minneapolis and in Faribault, Minnesota (see Appendix 2). The categories are defined as follows:

Three types of building improvements.

Building Improvement Class	Description of Structure and Adjacent Open Space	Median assessor's Full and True value of Buildings per acre of land
I.	Frame, metal, or plain concrete block structure. Generally less than 15 per cent of land under roof.	$ 8,000
II	One-story structure of concrete block (on no more than three sides), or other masonry. Land generally more than 15 per cent under roof.	$24,000
III	One or two story masonry structure, decorative materials on at least one side. Land generally more than 20 per cent under roof.	$60,000

Tables 8 and 9 show what kinds of business are housed by each class of building. No shopping center uses are housed in Class I structures. Otherwise all three classes of structure are occupied by all use categories. This indicates a tendency for every quality of structure to serve every major use. The most common type of building is Class II. This class accounts for two-thirds of all structures and dominates every use except warehousing (Figure 27). On the other hand, there is a tendency for shopping center and warehousing uses to occupy the more valuable and attractive structures and highway-oriented service establishments or manufacturing establishments to occupy less valuable structures. Ninety-five per cent of the Class I structures house highway-oriented or manufacturing uses (Figure 28); 67 per cent of the Class III structures house shopping center and warehousing uses (Figure 29). Classes II and III include 100 per cent of the shopping center uses and 96 per cent of the warehousing. Classes I and II include 94 per cent of the highway-oriented uses and 84 per cent of the manufacturing uses.

The tendency for every class of structure to serve every major use.

Table 10 indicates that major uses also tend to be distinguished one from another by differences in parcel size. The average parcel size for manufacturing and warehousing establishments is larger than that for retail and service uses; and manufacturing and warehousing firms have also shown a clearer trend toward increasing the

Various uses distinguished by parcel size.

Table 8 -- Per Cent of Each Building Improvement Class Occupied by Various Major Uses

Building Class	Total No. of Buildings 1/	Per Cent Shopping Center	Per Cent Highway Oriented	Manufacturing	Warehousing	Per Cent Total
I	27	0	63	33	4	100
II	109	15	55	20	10	100
III	31	33	16	16	35	100

Table 9 -- Per Cent of Each Major Use Housed by Various Classes of Buildings.

Major Use	Total No. of Buildings 1/	Per Cent Class I	Per Cent Class II	Per Cent Class III	Total Per Cent
Shopping Center	26	0	61	39	100
Highway Oriented	82	21	73	6	100
Manufacturing	36	25	61	14	100
Warehousing	23	4	48	48	100

1/ The establishments classified in Tables 8 and 9 lie in an area approximately 1,000 feet narrower than the study strip in which other data were collected. The establishments excluded from Tables 8 and 9 are situated along T.H. 12 at the west edge of the study strip or along T.H. 169 at the east edge. The addition of these establishments probably would have little or no effect upon the conclusions from Tables 8 and 9.

size of their land parcels in the post war period. The large jump in average acreage per shopping center-type establishment in 1959 is the result of one development with a very large parking area which dominates a relatively small total. In its context the large jump cannot be taken as indicative of a long period trend.

Table 10 -- Average Acreage of Establishments Which Appeared in Study Strip in Different Time Intervals by Major Uses.

Time Interval	Shopping Center	Highway Oriented	Manufacturing	Warehousing	All Retail and Service	All Manufacturing and Warehousing
Pre-1940	0.3	0.7	-	3.9	0.6	3.9
1940-45	0.5	1.9	-	0.1	1.4	0.1
1945-51	1.4	1.0	3.1	1.3	1.1	2.6
1951-53	0.8	1.4	4.0	0.5	1.3	3.2
1953-57	0.6	1.4	5.6	3.5	1.1	4.6
1957-59	4.0	1.4	4.7	4.5	1.8	4.6

Over the years, there has been a marked change in the kind of firm which has built manufacturing or warehousing facilities in the study strip. In the 1940's only grain elevators and a concrete-mixing plant located in the study strip. Since then, a great variety of companies have found the Belt Line area attractive. This change has accompanied the growth of the urban frontier up to and then far beyond the Belt Line. The changes can be noted in detail in Table 11. It is noteworthy that both the early grain elevators and the later manufacturing and distribution establishments represent a movement outward from the central city as a result of either expansion or replacement of old or obsolete facilities.

As the urban frontier advances, a great variety of companies build warehousing and manufacturing facilities.

Classes of structure and parcel sizes differ between the Belt Line and the radial highways. Warehousing and manufacturing establishments which face the Belt Line account for only one-fourth of the to-

Table 11 -- Comparison of Pre-World War II and Recent Manufacturing and Warehousing Development in Study Strip.

Establishments Comprising 100 Per Cent of Existing Acreage, 1940.

Use	Acres	Building Improvement Class
Grain Elevator	2.9	II
Grain Elevator	5.0	II
Ready-Mixed Concrete	2.7	I

Establishments Comprising 75 Per Cent of all Manufacturing & Warehousing Acreage Added during the 1957-1959 Period

Use	Acres	Building Improvement Class
Tire Manufacturer, Warehouse and Office	2.8	III
Agricultural Machinery Manufacturer, Warehouse and Office	3.0	III
Food Specialty Manufacturer, Warehouse and Office	3.5	III
Electrical Manufacturer, Warehouse and Office	5.5	III
Grocery Distributor, Warehouse and Office	5.6	III
Tire Manufacturer, Warehouse and Office	6.2	III
Medical Supplies Distributor, Warehouse and Office	8.0	II
Home Appliance Distributor, Warehouse and Office	9.7	III
Tire & Rubber Manufacturer, Warehouse and Office	11.0	III
Construction Equipment Distributor, Warehouse and Office	11.0	II
Floor Maintenance Equipment Manufacture and Office	19.3	III
Paper Products Manufacturing & Office	25.9	III
Hardware Distributor, Warehouse and Office	28.7	III

tal in the study strip. But they are newer. In fact, 75 per cent of warehousing and manufacturing structures were built after 1957. On the major radial highways, by contrast, only one-third of the buildings were erected that recently. As a result, the developments on the Belt Line tend to be larger (average 6.5 acres compared to 3.3 on the radials) and higher in value (50 per cent Class III, 8 per cent Class I, compared with 32 per cent Class III, 16 per cent Class I on the radial highways). In other words compared with those on the radial highways, establishments on the Belt Line are fewer but on the average newer, larger, and of higher value.

Warehousing and manufacturing developments along the Belt Line and radial highways.

Most of the manufacturing and warehousing establishments in the study strip are in the highway-trackage belt either in the central part of St. Louis Park or in Golden Valley and the adjacent northern edge of St. Louis Park. Therefore those are the places where one must seek the explanation for the differences between industrial development fronting the Belt Line and that fronting the radials.

Explaining the differences between industrial development fronting radial highways and the Belt Line.

In the central part of St. Louis Park, the Belt Line cut through an already urbanized area in which public sewer and water were available as a result of prior urban development. As a result, early industrial growth in the Belt Line study strip was attracted to that area. But it was attracted mainly to locations on the radial routes. In that part of St. Louis Park there was an established precedent for residential use in the area through which the Belt Line passed.

Lack of sewers delays industrial development.

By contrast, in Golden Valley and the northern part of St. Louis Park, the Belt Line crossed an open area which had not yet become urbanized in the late 1930's. There were no public sewers available until 1957. Industrial development was delayed in part by that fact. In Golden Valley it was also delayed in part by the extraordinarily high setback requirement for nonresidential structures (discussed above), which narrowed the number of potential users who could afford to develop Belt Line frontage in that municipality. That restriction was possible, of course, only because the land through which the highway passed was not already urbanized.

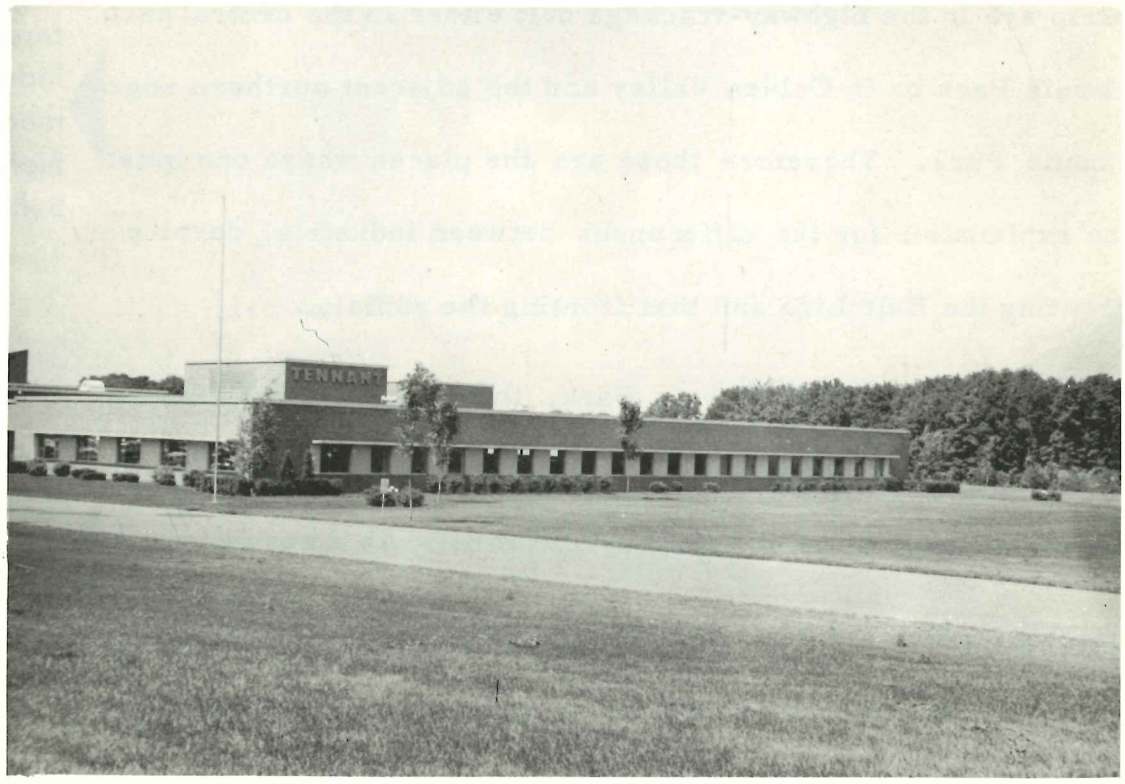


Figure 27. -- Examples of commercial and industrial establishments in Building Class III.

In general, the later the development has come, the higher the value of the average manufacturing or warehousing establishment. In the earlier developments the typical establishments and land parcels have tended to be more numerous but smaller and of lower value. When the highway preceded widespread urbanization, development has been relatively slow. Where urbanization and accompanying public sewer facilities preceded the highway, industrial development has followed more quickly.

The highway, urbanization, and industrial development.

Figure 28. -- Examples of commercial or industrial establishments in Building Class I.

8. The Diminishing Area of Potential Industrial Land

The demand for land for manufacturing and warehousing purposes.

Table 12 and the graph in Figure 30 show the rate at which land has been developed for manufacturing and warehousing purposes in the study strip since the Belt Line was opened. One may assume that this represents the general demand for land for those two major uses in the vicinity of a major circumferential highway in the western quadrant of the Twin Cities metropolitan area. The demand has been produced by economic growth of the region in combination with the shift of established firms from old or obsolete buildings and locations in the central city.

Figure 29. -- Examples of commercial and industrial establishments in Building Class II.

Total manufacturing and warehousing development through 1959 occupied 288 acres of land in the Belt Line study strip. The rate of land development has been particularly rapid in the past five years.

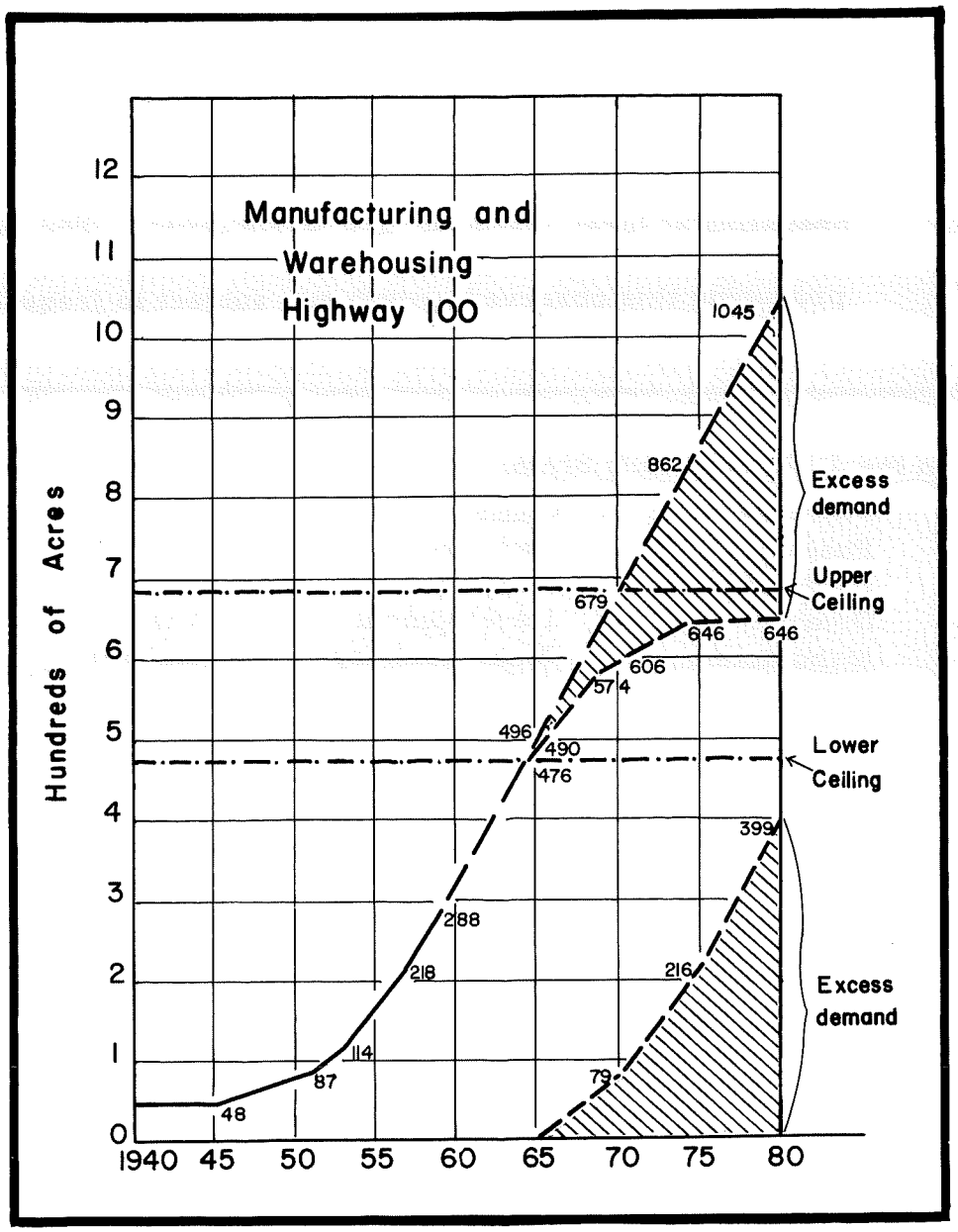


Figure 30. -- Past and Projected Growth of Developed Acreage for Industrial Uses in the T.H. 100 Study Strip.

Estimating when the land supply will be depleted.

If development is projected at recent rates, it is possible to estimate the time at which the land supply will be exhausted for this particular type of development in the vicinity of this particular circumferential highway.

It must be emphasized, of course, that the growth which has been observed and projected is a resultant of a bewildering complex of technologic, economic, and social legacies, fads, and decisions operating at local, national, and world levels. The component forces producing this observed growth are subject to frequent change, often

Table 12 -- The Past and Projected Demand for Warehousing and Manufacturing Land in the T. H. 100 Study Strip.

Year	Cumulative Past and Projected Demand Manufacturing & Warehousing Acreage	Cumulative Past and Projected Development of Manufacturing & Warehousing Acreage	Remaining First Class Land in Study Strip	"Excess Demand" to be transferred to alternate location
1940	48	48	442	0
1945	48	48	442	0
1951	87	87	403	0
1953	114	114	376	0
1957	218	218	272	0
1959	288	288	202	0
1964	476	476	0	0
Projected Time of Depletion of Supply of First Class Potential Industrial Land - 1964				
1965	496	490	0	6
1970	679	600	0	79
1975	862	646	0	216
1980	1045	646	0	399

without notice. Some of the changes, which may come, patently cannot be anticipated because they will depend upon knowledge which lies in the future. Thus the projections undertaken here should be subjected to regular review and revision. They should be part of a continuing study.

The growth rate of manufacturing-warehousing land use in the study strip was projected forward two decades, to 1980. The 1957-59 growth rate was used, and increased at a rate of 4 per cent per five-year period to allow for a projected increase in the rate of

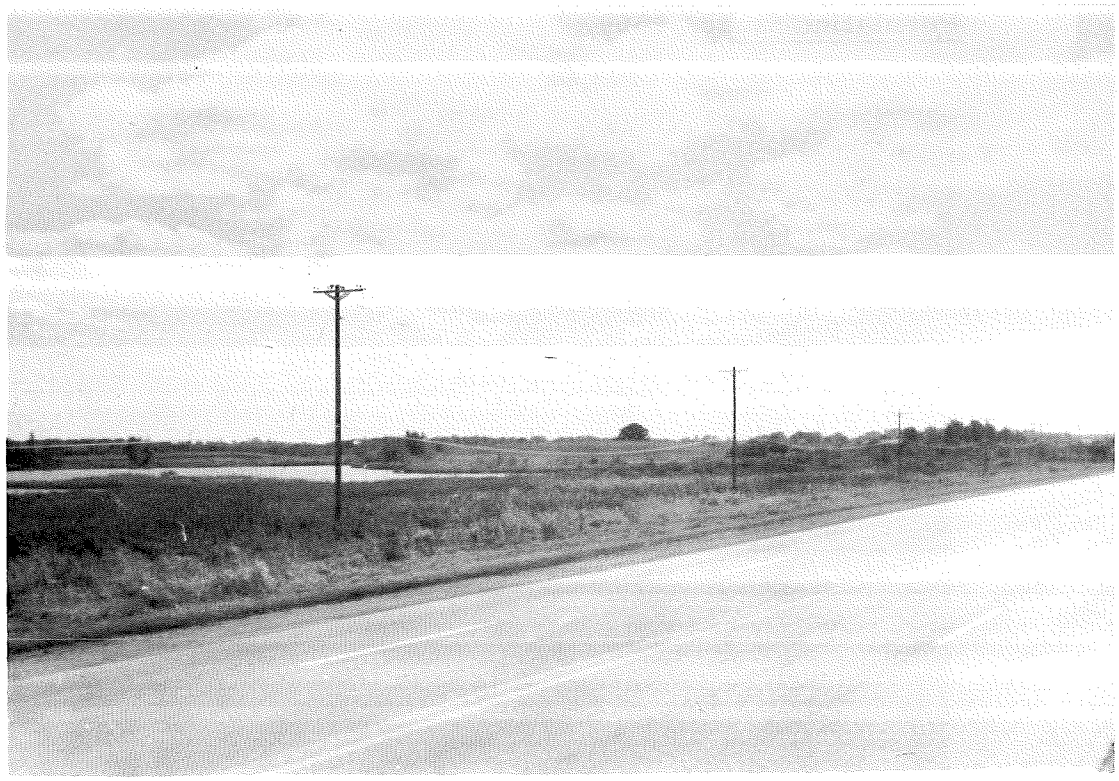


Figure 31. -- An example of land which this report excludes from the "potential commercial-industrial" class because of poor drainage conditions, east side of Highway 100 south of 79th Street (see map, Figure 3).

growth of metropolitan population. 8/ In other words, the extrapolation assumes that (1) the rates of economic growth and industrial relocation which have characterized this metropolitan area in recent years will continue; (2) the growth and relocation rate are related to the total population growth of the metropolitan area, and (3) the proportion of metropolitan demand for industrial land which has accrued to the major western circumferential highway locations will continue to accrue to the same type of location.

Assumptions underlying the projections of land demand.

8/ The most detailed and readily available population projections appear in the Twin Cities Metropolitan Planning Commission's Population Study, 1959.

Figure 32. -- Land too rough for industrial or commercial development, Golden Valley.

The assumption of continued economic growth also underlies the projection of highway need as well as these land-use projections. Growth calls for continued replacement and expansion of warehousing and manufacturing to serve the city and the region, just as it calls for expansion of the road network. Steady, though unspectacular, growth has characterized the Twin Cities metropolitan area since the beginning of this century. The directional growth trends have changed very little in a century. They appear to be related to certain terrain patterns, the positions of St. Paul and Minneapolis relative to each other and relative to the Twin Cities trade territory. 9/

9/J. R. Borchert, op. cit.

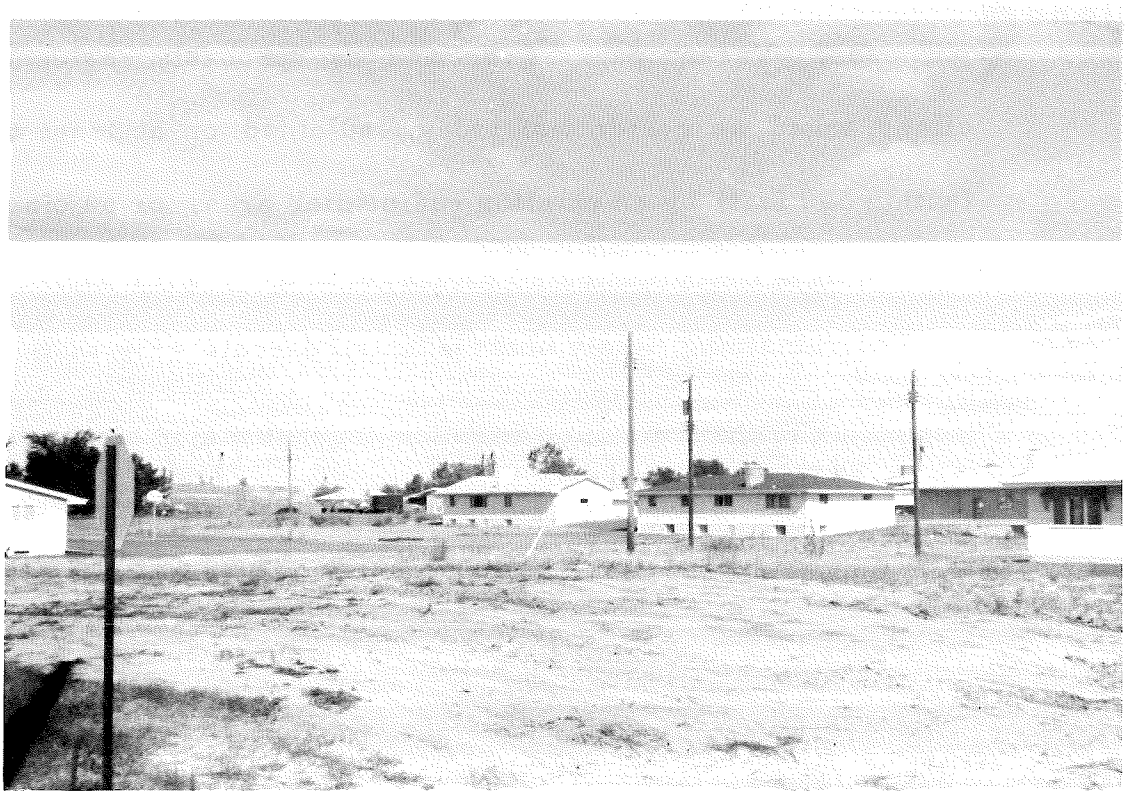


Figure 33. -- An example of open land which this report excludes from the "potential commercial-industrial" class because of the adjacent, actively-building residential area shown in the picture, Golden Valley.

All of these factors are quite stable. Hence it is unlikely that the position of the western quadrant within the metropolitan growth pattern will change greatly.

Growth of manufacturing and warehousing uses.

The growth of manufacturing and warehousing use was projected against ceilings which were estimated from the amount of vacant land remaining in the study strip.

A total vacant land figure was estimated from plat maps. From the total was subtracted that land which is wet or too rough (more than 50 feet local relief in a 10-acre grid - Figures 31 and 32) and land which is likely to be used for residential rather than industrial purposes. Vacant parcels defined as "probably residential" are either zoned as residential today, adjoined on at least two sides (within 500 feet) by an existing residential area, or adjoined on one side by an actively-building residential area (Figure 33).

Classifying land areas.

The remaining, likely nonresidential parcels were then classified according to their distance from the nearest major highway and railway. Within 1,000 feet of a major highway, 188 acres of probable nonresidential land remain less than 1,000 feet from an existing rail line, less than 2,500 feet from a major highway intersection, or both. That 188 acres was defined as the "first class" land remaining for industrial development. Another 211 vacant acres remain more than 1,000 feet from a major highway but less than 2,500 feet from a major intersection, less than 1,000 feet from a rail line, or both.

Land defined as "marginal".

These 211 acres were defined as "marginal" land for industrial development. 10/

There is an additional area of approximately 750 acres which is vacant and would be classified as "probably nonresidential" (by the above definition). However industrial building is unlikely because that land is located too far from either a major highway or railway line, or it is too rough for development (if past practice on the Belt Line is continued).

Land classified as "probably nonresidential".

According to the extrapolation, the ceiling of first class land will be reached in 1964 (Table 12 and Figure 30). It was assumed that after that date only land defined as locationally marginal will be available, and the rate of development will decrease as a result. Thus, after 1965 the growth curve was decelerated at the same rate at which it accelerated during the earlier period of development. As a result, the projected growth approaches the ceiling of marginal land less rapidly after 1965, and much less rapidly after 1975.

Deceleration of land development in the Belt Line strip.

After 1965 there is a widening difference between the projected curve of demand for land on a western circumferential and the projected development in the vicinity of Highway 100. That difference

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10/ Land at the south end of the study strip, in the vicinity of the intersection of the Belt Line and T.H. 5, was excluded from the estimates of remaining land. That intersection is as far from the Minneapolis CBD as certain others on the new T.H. (I.R.) 494 will be. In fact, it will be on T.H. (I.R.) 494. It has therefore been treated in this study as one of several equally-accessible, available areas on T.H. (I.R.) 494, to which excess demand will be transferred when other, more accessible Belt Line sites are filled.

is assumed to be "surplus" demand, available for "transfer" to a new circumferential route. The rate of growth of that theoretical surplus demand is also indicated in Figure 19 and Table 12. The picture which emerges shows available "first class" acreage within the study strip being quickly occupied. Demand for such land will persist after the existing supply near T.H. 100 is depleted. It seems probable that this demand will overflow into some similar area. By assuming that the similar area will be the strip along T.H. (I.R.) 494, the following section of this report attempts to estimate the likely amount, location, and timing of manufacturing and warehousing development there.

Surplus demand likely to overflow into strip along the "super" Belt Line.

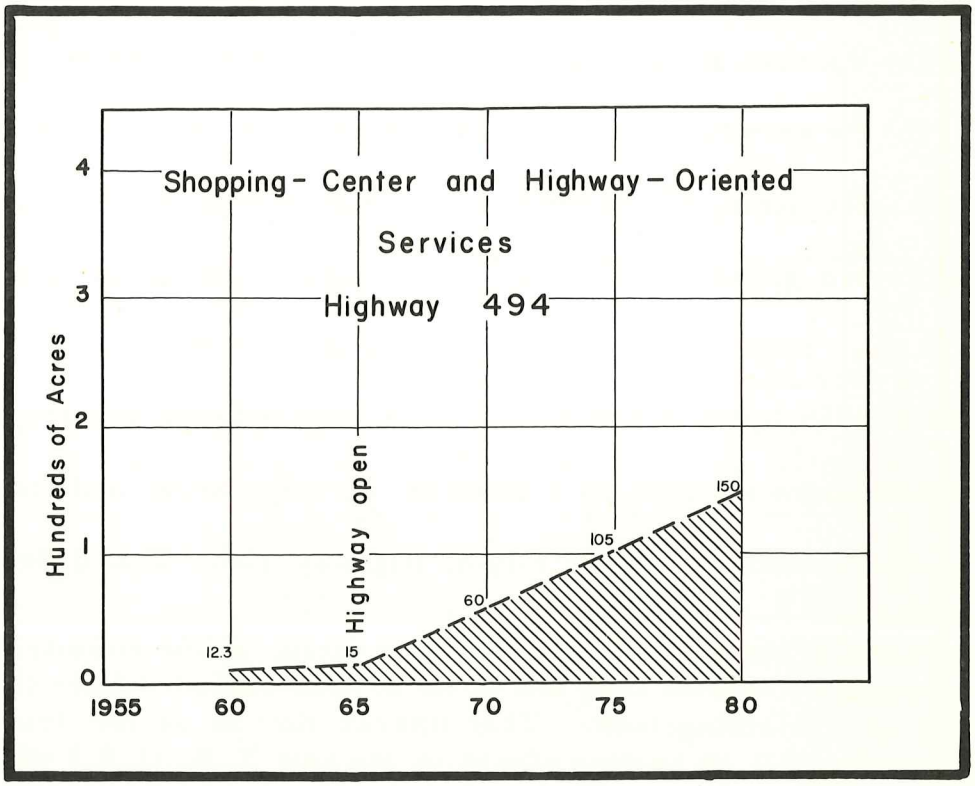

Figure 34. -- Potential demand for land for retail and service uses in T.H. (I.R.) 494 study strip, based on projected traffic volume and residential development.

The assumption of "transfer of surplus demand" from T.H. 100 to T.H. (I.R.) 494 rests upon the analogy of the two routes which was discussed earlier in this report. The assumption would have to be modified if a different highway building agency were to construct still another "belt line", west of T.H. 100 but not as far west as T.H. (I.R.) 494. To a very limited extent CSAH 18 occupies that kind of position. The assumption is also invalidated if land clearance in the central cities should divert industrial relocation and expansion to more central locations and away from the suburbs. There is no evident trend in this direction at this time, but the possibility should not be overlooked.

Assumptions which may be invalidated.

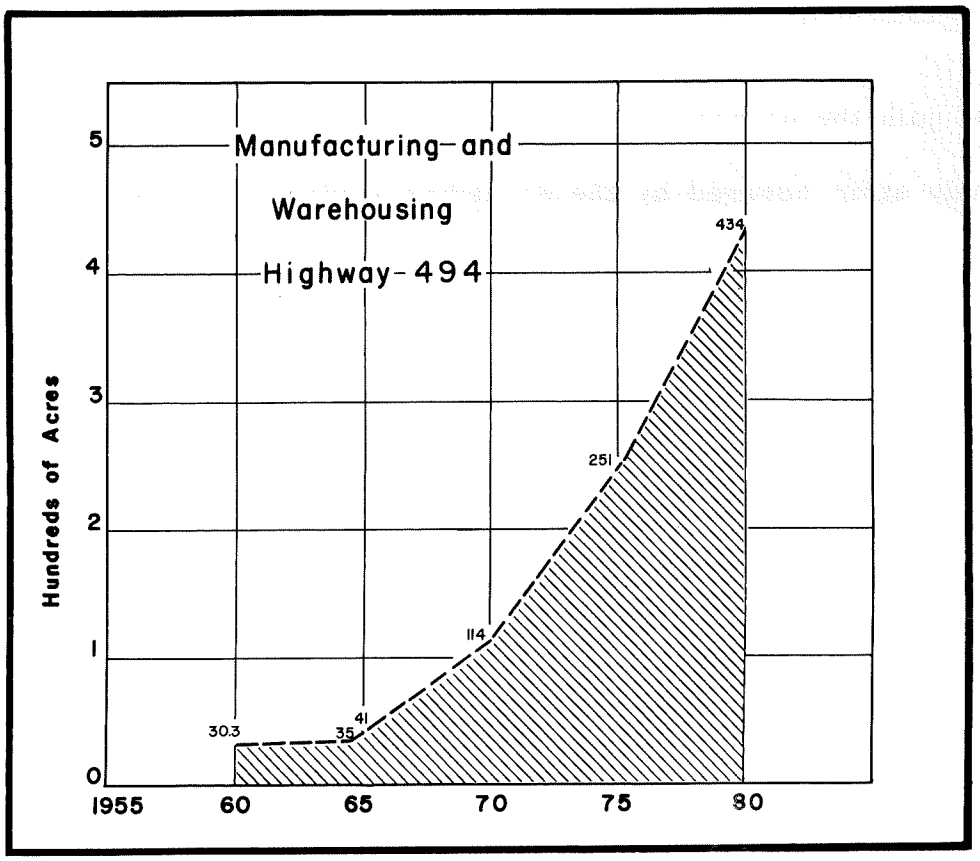

Figure 35. -- Potential demand for land for industrial uses in T.H. (I.R.) 494 study strip, based on projected excess of demand over supply in Highway 100 study strip.

No attempt has been made to project the demand for land for retail and service uses on T.H. 100. The growth of those uses is related to traffic on T.H. 100, itself, and to residential development in that area. Such demand cannot be shifted from T.H. 100 to any other highway. It is assumed only that growth of retail and service uses on T.H. 100 will continue in response to increasing traffic and residential growth as long as there is land available to accomodate them.

The growth of retail and service uses on T. H. 100.

9. The New Belt Line -- T.H. (I.R.) 494

Figures 1, 2, and 3 indicate the route of the new "super" Belt Line, T.H. (I.R.) 494. It will be roughly parallel to the old Belt Line and approximately five miles farther west. It will turn eastward and join the present T.H. 100 at 78th Street, the south end of the study strip covered by the preceding major section of this report. The entire segment of T.H. (I.R.) 494 will be built to Freeway standards, access will be restricted, and at present no frontage roads are contemplated.

Location of the "super" Belt Line.

In order to examine and project the land-use pattern on T.H. (I.R.) 494, a second study strip was created. It is shown on the map in Figure 22. The strip embraces all of the land within 2,500 feet of the proposed highway, extending from a point near its northern terminus at the junction with proposed T.H. (I.R.) 494, southward to its junction with T.H. 100, the present Belt Line. An attempt has been made to project the demand for land in this study strip.

Creation of a second study strip along T. H. (I.R.) 494.

Projected Land Uses

Retail and Service Uses. On the basis of projected residential expansion, 11/ it was estimated that the increase in number of dwelling units in the T. H. (I. R.) 494 study strip in the ten years from 1970 to 1980 will approximate the increase in the T. H. 100 strip during the six year period of explosive growth between 1945 and 1951. Shopping-center uses (neighborhood-oriented retail and service functions) on T. H. 100 expanded at an average rate of 3.0 acres per year from 1945 to 1951. Thus an aggregate rate about two-thirds as great, or about 2.0 acres per year is appropriate for the longer period on T. H. (I. R.) 494. That rate was applied arbitrarily to T. H. (I. R.) 494 from the date of opening (1965) forward to 1980.

Estimating the rate of growth along the "super" Belt Line.

Traffic projections for 1980 were obtained from the Twin Cities Area Transportation Study (TCATS) which is currently being compiled by the Minnesota Highway Department and U. S. Bureau of Public Roads. Projected 1980 traffic volume on T. H. (I. R.) 494 approximates that on T. H. 100 in 1960. Thus traffic-induced land uses--the highway-oriented retail and service establishments--may be expected to grow in the vicinity of T. H. (I. R.) 494 from 1965 to 1980 at about the same rate as they have grown in the T. H. 100 study strip from 1945 to 1959. That rate has averaged approximately 7.0 acres per year. There has been no clear trend either upward or downward in average annual growth over that 14-year period.

Predicting traffic induced land uses.

11/See J. R. Borchert, ibid.

Thus the combined demand for shopping center and highway-oriented uses can be projected at an average rate of 9.0 acres per year along the T.H. (I.R.) 494 study strip from 1965 to 1980. That figure is based upon projections of traffic volume and residential growth, and it assumes that relationships between those variables will be similar to the relationships which have occurred along T.H. 100. If there are no access roads on T.H. 494, these establishments will be forced to locate exclusively on the radial highways near the intersections with T.H. (I.R.) 494. If access is also restricted on the major radials, this type of development may be frustrated unless frontage roads or some other provisions are planned.

Demand for highway-oriented uses projected at 9.0 acres per year.

Manufacturing and Warehousing. It was assumed that the demand for land for warehousing and manufacturing establishments on T.H. (I.R.) 494 will develop from the same causes as the demand for land for that purpose on T.H. 100. It was further assumed that demand for a western circumferential highway location will shift after 1965 from T.H. 100 to T.H. (I.R.) 494, as the former becomes completely built-up and the latter is opened to traffic. Therefore, the "excess" demand for manufacturing and warehousing land, which had been projected for T.H. 100 (Figure 30 and Table 12), was applied to the T.H. (I.R.) 494 study strip.

The development of manufacturing and warehousing demand.

Table 13 and the graphs in Figures 34 and 35 indicate the projected growth rate for the two broad classes of commercial and in-

dustrial land uses--manufacturing, warehousing and retail-services--for T.H. (I.R.) 494. The projection builds upon the present base. Existing commercial and industrial land uses are shown on the map in Figure 36. They consist of only a few highway-oriented retail and service establishments and several sand and gravel pits. The present uses have developed at an aggregate average rate of only a little more than one acre per year for more than three decades. Growth is projected at that slow rate until 1965, at which time it is assumed that the new highway will be open. Thereafter, the growth rates are determined by the projection of excess manufacturing and warehousing land demand from T.H. 100, together with the projection of residential growth and traffic along T.H. (I.R.) 494.

At present, highway oriented retail and service establishments are growing at a slow rate along T. H. 100.

Table 13 -- The Past and Projected Demand for Commercial and Residential Land in the T.H. (I.R.) 494 Study Strip.

Year	Cumulative Manufacturing-Warehousing Acreage (including quarries)	Cumulative Retail and Service Acreage
1959	30	12
	New Highway Opened, 1965	
1965	41	15
1970	114	60
1975	251	105
1980	434	150

Probable Sites and Locations

Evaluation of Sites. After the major land uses along T. H. (I. R.) 494 had been projected, the land in the study strip was appraised for its suitability for commercial and industrial development. First, physical site characteristics were considered. In the T. H. 100 study strip, land with more than 30 feet of local relief per 10-

Land suitable for industrial development.

Table 14 -- Acreage of Grid Squares Readily Suitable for Small-Scale Development of Manufacturing and Warehousing Uses, T. H. (I. R.) 494. (10-acre grid completely open, well-drained and under 1,000 feet from both railway and major highway.)

Railway Line	1st Class Acres	2nd Class Acres	Approximate Distance From Minneapolis CBD by Shortest Divided Highway Route, 1980
Minneapolis, St. Paul and Sault Ste Marie Railroad Co.	0	30	11
Minneapolis St. Louis Railway Co. (MW)	10	10	10
Great Northern Railway Co.	0	10	10
Minneapolis St. Louis Railway Co. (Dak)	10	0	11
Minneapolis St. Louis Railway Co.-MILW	0	10	12
Minneapolis Northfield and Southern Railway	0	10	10
	20	70	

acre grid square was marginal for commercial or industrial development (see page 17) and there was no commercial or industrial development where local relief exceeded 50 feet. Development has also avoided swamp or marsh land, and it has been inhibited or prevented in areas of pre-existing residential use.

Table 15 -- Acreage of Grid Square Readily Suitable For Medium-Scale Development of Manufacturing & Warehousing Uses, T.H. (I.R.) 494. (10-acre grids completely open, well-drained and under 1,000 feet from major highway and under 3,500 feet from railway.)

Railway Line	1st Class Acres	2nd Class Acres	Approximate Distance From Minneapolis CBD by Shortest Divided Highway Route, 1980
Minneapolis, St. Paul and Sault Ste Marie Railroad Co.	40	110	11
Minneapolis St. Louis Railway Co. (MW)	70	30	10
Great Northern Railway Co.	20	70	10
Minneapolis St. Louis Railway Co. (Dak)	10	0	11
Minneapolis St. Louis Railway Co.-MILW	0	10	12
Minneapolis Northfield and Southern Railway	65	40	10
	205	270	

Determining the various characteristics of land in the study strip.

The study strip along T.H. (I.R.) 494 was then divided into 10-acre grids. Aerial photographs, topographic maps, and field checks were used to determine the fraction of each grid devoted to urban uses, farmsteads, crops and pasture, woods, swamp or marsh. The local relief was also determined for each grid. These attributes were mapped. Those grid squares were then selected which have no

Table 16 -- Acreage of Grid Squares Readily Suitable for Large-Scale Manufacturing-Warehousing Development T.H. (I.R.) 494. (10-acre grids completely open, well-drained, under 1,000 feet from major highway, and under 6,000 feet from railway.)

Railway Line	1st Class Acres	2nd Class Acres	Approximate Distance From Minneapolis CBD by Shortest Divided Highway Route, 1980
Minneapolis, St. Paul and Sault Ste Marie Railroad Co.	70	180	11
Minneapolis St. Louis Railway Co. (MW)	160	20	10
Great Northern Railway Co.	20	70	10
Minneapolis St. Louis Railway Co. (Dak)	10	0	11
Minneapolis St. Louis Railway Co.-MILW	10	20	12
Minneapolis Northfield and Southern Railway	75	40	10
	345	330	

lake or swamp, less than fifty feet of local relief, and no more than one-half of their area already occupied by nonfarm structures. These grids were considered eligible for possible commercial or industrial use. They were divided into two groups, and those two groups were further subdivided as follows:

A. Vacant land for potential large developments (10-acre grid square entirely free of existing urban uses).

Table 17 -- Acreage of Open Land in Grid Squares With Potential for Retail and Service Uses. (10-acre grids 50 per cent up to 100 per cent open, well-drained, within 1,000 feet of major highway, and under 2,500 feet from future major highway interchange.

Intersection Major Highway	1st Class Acres	2nd Class Acres	Total	Approximate Acres Zoned Commercial 1959
T.H. 55	228	102	330	0
T.H. 12	90 1/	112 2/	202	92
CSAH 5	41 3/	81	122	0
T.H. 7	23	69	92	0
CSAH 67	0	48	48	0
T.H. 169-212	64	179	243	96
T.H. 100	212 4/	146 5/	358	0
Total	658	737	1395	188

1/Includes 50 acres within 6,000 feet of MSL (MW) R.R.

2/Includes 20 acres within 6,000 feet of MSL (MW) R.R.

3/Includes 10 acres within 6,000 feet of GN and MSL (Dak) R.R.'s

4/Includes 20 acres within 6,000 feet of MNS R.R.

5/Includes 10 acres within 6,000 feet of MNS R.R.

1. "1st Class" less than 30 feet local relief.

2. "2nd Class" 30 to 50 feet local relief.

Classifying land parcels.

B. Vacant land for potential smaller developments (10-acre grid square at least one-half free of existing urban uses).

1. "1st Class" less than 30 feet local relief.

2. "2nd Class" 30 to 50 feet local relief.

Because of the large and growing average size of parcel for manufacturing and warehousing, only group A, above, was considered as potentially suitable for those uses. The classes of physical site conditions listed above are mapped in Figure 36.

Evaluation of Locations. Various classes of location are also shown on the map in Figure 36. Grids more than 1,000 feet from a major highway are eliminated from consideration. (A "major highway" is a highway whose 1980 average traffic is projected in excess of 5,000 vehicles daily 12/ and one which will have a traffic interchange with T.H. (I.R.) 494.)

Grids must be near a major highway.

12/Traffic projections for state highways from Minnesota Highway Department; projections for county highways from "Highway Planning for Hennepin County, Minnesota", George W. Barton and Associates, Evanston, Ill., 1959.

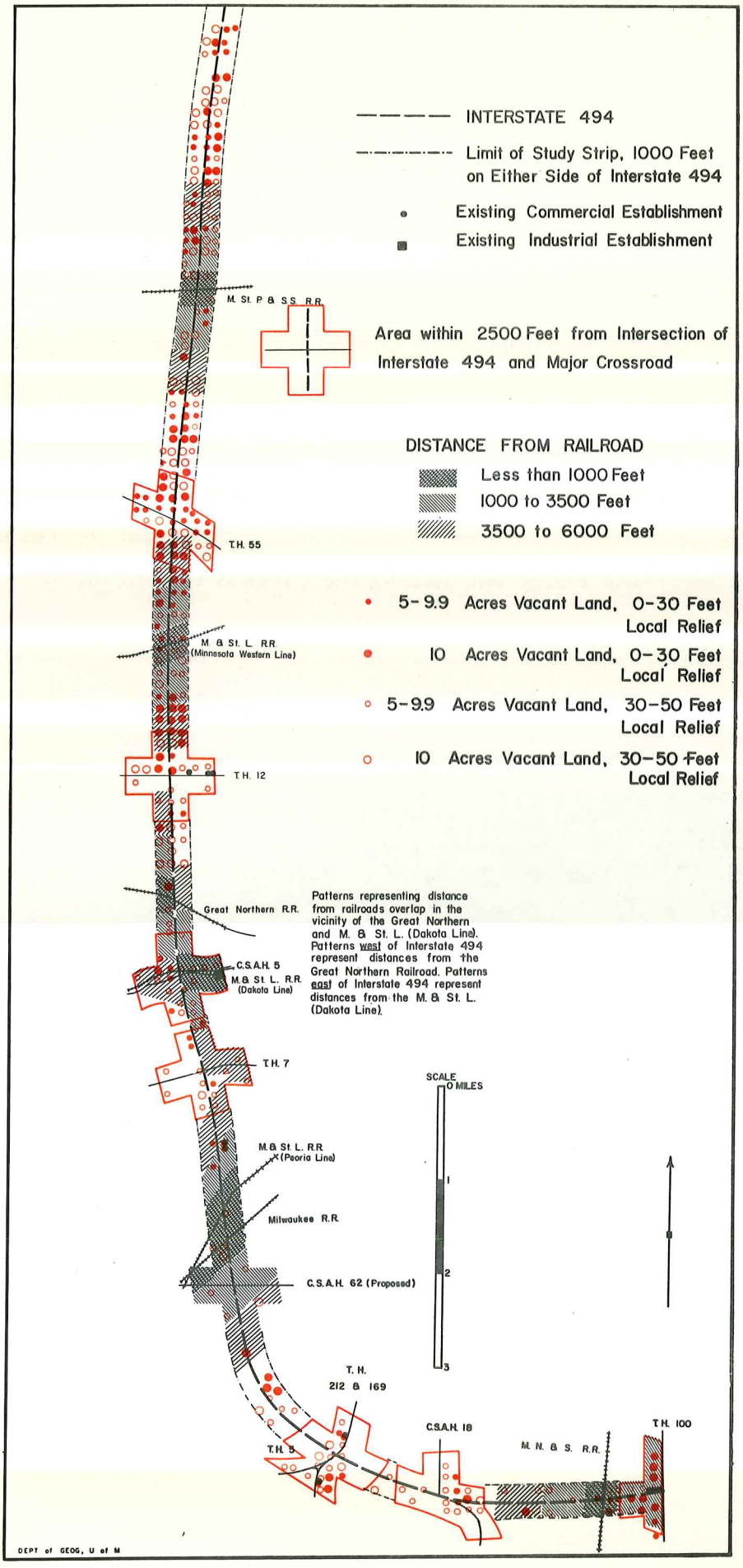

Figure 36.

Existing and potential areas for commercial and industrial development in the T. H. (I. R.) 494 study strip. The largest amount of highway-trackage land, least built-up and nearest the Minneapolis CBD, is concentrated in the vicinity of the junctions of T. H. (I. R.) 494 with T. H. 12, T. H. 55, and T. H. 100.

All potential locations indicated on the map in Figure 36 are within 1,000 feet of a major highway. Potential retail and service use districts are shown within 2,500 feet of major highway interchanges. Also, three classes of potential manufacturing or warehousing locations are indicated. One class includes land within 1,000 feet of a railway line. That is the distance which embraces most manufacturing and warehousing establishments along T.H. 100 today. The second class includes all land between 1,000 and 3,500 feet from a railway line--the range embracing the largest establishments on the Belt Line today. A third class includes land between 3,500 and 6,000 feet from a railway track--the range within which a large industrial park, comparable to the largest in America, could be developed.

Classifying manufacturing and warehousing locations.

Figure 37. -- Aerial view of the Route 494 study strip northward from T.H. 12, showing the largest area of level or gently-rolling, open land nearest the Minneapolis CBD.

The geographic location of vacant acreages of first and second class sites is shown in the map in Figure 36. The information on the map is summarized in Table 14-17. The acreage figures in the tables are, of course, suggestive of order of magnitude; they are not definitive.

Vacant acreages by classification.

Probable Development. Certain conclusions are clear from the map and tables. With regard to manufacturing and warehousing development, two major points emerge. (1) There is not a large discrepancy between the amount of suitable land (in terms of both site and location) and the potential demand for land over the next two decades. Land which is suitable is likely to be in demand. (2) The major concentrations of suitable land are located in the part of the

Drawing conclusions from the data.

Figure 38. -- Aerial view of the Route 494 study strip in the vicinity of the intersection with the Minneapolis and St. Louis Railway (Peoria line) and the Milwaukee Railroad. Rough terrain may be expected to inhibit commercial or industrial development in this area.

strip intersected by (a) the Minnesota Western division of the Minneapolis, St. Louis Railway Co. (MSL-MW), T.H. 55, and T.H. 12 (Figure 37), and (b) the Minneapolis, Northfield, and Southern Railway (MNS) and T.H. 100. These two rail-highway locations are also slightly nearer to the central city than all except one of the others (Figure 38). Thus if their land is priced competitively, they are likely to attract most of the demand for manufacturing and warehousing land which accrues to the vicinity of T.H. (I.R.) 494 after 1965.

A different picture emerges with respect to retail and service development. Considering their site and location, a total of 1,395 acres

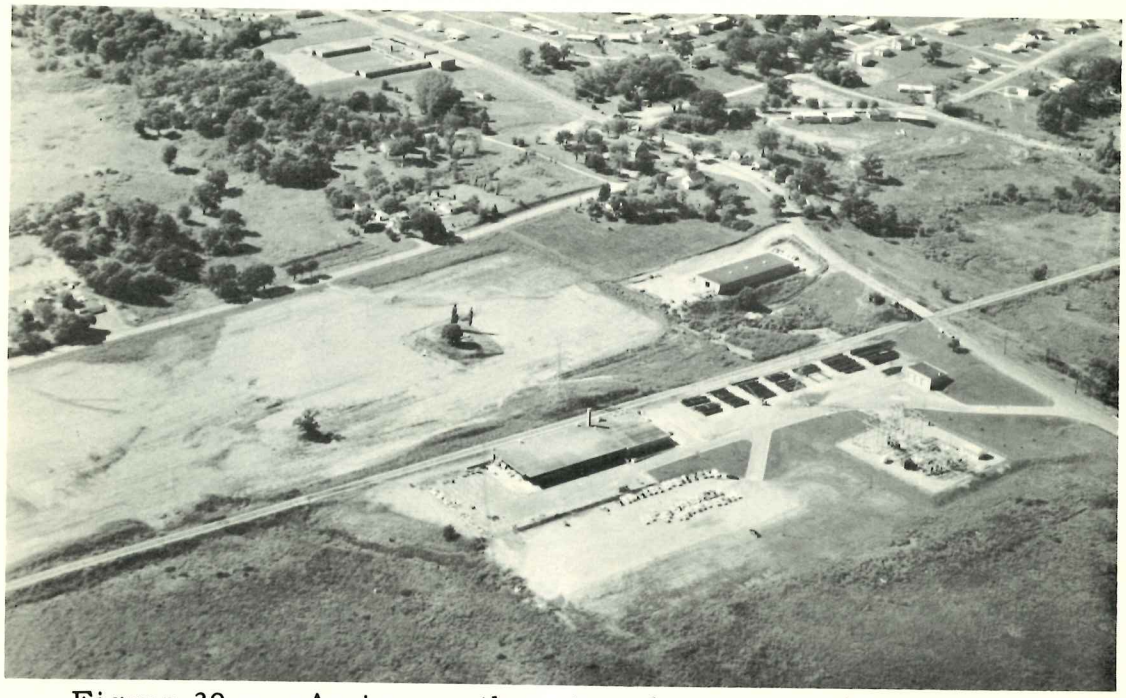

Figure 39. -- A view northwestward across northern edge of the potential industrial-commercial area near the intersections of T. H. 100, T.H. (I.R.) 494, and the Minneapolis, Northfield and Southern Railway. The upper part of the picture shows rolling to rough residential land. The lower portion shows level land with trackage and beginnings of industrial development. Highway frontage lies below and to left of the area pictured.

could be called "potential commercial land". This compares with a projected demand of only 135 acres of new land for retail and service uses over the next two decades. Thus there is a danger of overzoning for retail and service uses in the T.H. (I.R.) 494 strip. A total of 188 acres are already zoned for commercial uses; however, they are located at only two major intersections. While those will be the sites of two important interchanges, the projected traffic pattern and the residential development pattern suggest that at least half of the pressure for shopping center and highway-oriented uses along T.H. (I.R.) 494 will come at the other major interchanges. Thus the vicinity of the future interchanges at T.H. 12, T.H. 212, and T.H. 169 appear to be already somewhat overzoned for commercial purposes.

There is a danger of overzoning for retail and service uses in the "super" Belt Line area.

In light of the historical geography of the present Belt Line, one may make some further estimates of probable patterns of development in the 494 strip. Earlier development and smaller establishments may be expected to cluster on the major radial routes where access is available. Developments with land fronting on T. H. (I.R.) 494 will have to plan and provide a system of service roads or streets. Those developments are likely to be larger, costlier, and more systematically planned and executed. Major commercial and industrial developments will be limited to the times and places in which public sewers, and perhaps water, are available. Finally, commercial

Predicting other development along the Belt Line.

and industrial development will not begin nearest the highway intersections or highway-rail crossings and spread outward. Rather it will spread thinly at first, generally within 1,000 to 2,500 feet from the intersections; then the concentration of establishments will gradually increase.

Review of Findings and Conclusions

The reader is referred to the preface of this report for a review and discussion of major findings and a statement of conclusions.

APPENDIX I

All functional classifications of establishments were carried out by the same team of two people. Definitions were kept simple and specific. Initially each establishment was placed in one of three groups: (1) Retail and Service, (2) Manufacturing, and (3) Warehousing. The manufacturing establishments often contained integrated office and warehouse space, and the warehousing establishments often included office space. These establishments were classified on the basis of their dominant space-using function.

Manufacturing was defined as any processing in which materials are changed in form or composition. Warehousing was defined as storage of materials, without change in form or composition, followed by distribution. Retail and Service uses were those which provided personal services or sold consumer goods. Lumber yards with retail stores or display wares were included in this group. Except for one case --the technical training school noted on page 15--the assignment of each establishment to one of these three categories was accomplished rapidly and without dispute by the field team.

Although each establishment was classified in one of these three broad categories, its name and exact function was also noted. From the specific list of establishments, the Retail and Service group was subdivided into two parts. These two subgroups were taken from a study of locational groupings of business types in four large cities by Brian Berry, published in 1959. 1/ Berry identified and listed certain "types" of,

1/Brian Berry, "Ribbon Developments in the Urban Business Pattern", Annals of the Association of American Geographers, 49:2 (June, 1959) pp. 145-155.

business which tend to be in certain "conformations" on the land, on the map, or in statistical arrangements. The three "conformations" identified by Berry were called "Nucleated Shopping Centers", "Highway-Oriented Facilities", and "Urban Arterial Districts". The types of business in each group are as follows (Berry, op. cit., Table 1, p. 147):

Nucleated Shopping Centers	Highway-Oriented Facilities	Urban Arterial Districts
General Store	Gas	Auto repair
Grocery	Restaurant	Bars
Barber	Motel	Shoe repair
Cleaners/laundry	Fruit and produce stands	Furniture
Drugs	Building services and supplies	Auto accessories
Hardware	Lumber yard	Appliances
Beauty	Miscellaneous repair including plumbing	Fuel
Bakery	Radio-TV sales and service	Gift and novelty
Real estate and insurance		Food lockers
Variety		Florists
Clothing		Printing
Dairy		Office equipment and supplies
Lawyer		Funeral Homes
Jewelry		Missions
Post Office		Second-hand stores
Department		
Shoes		
Sporting goods		
Bank		
Professional offices		

These three groups were changed to two for this study by combining the Highway-Oriented and Urban Arterial classes. All of the establishments in the Retail and Services category used in this study could be identified as business types listed by Berry. Thus they could readily be divided into these two sub-groups: "Shopping Center" and "Highway Oriented-Urban Arterial".

APPENDIX II

Physical characteristics of 312 commercial and industrial establishments were examined in connection with earlier studies of the Minnesota Highway Research Project. The establishments are located in the city of Faribault, Minnesota, and along 78th and 66th Streets, arterial highways in the south suburban area of metropolitan Minneapolis.

Five physical characteristics were noted for each establishment: (1) the construction materials of the building, (2) the building area, (3) the number of stories in the building, (4) the area of used land, including landscaping, and (5) the use of outside space. On the basis of these five characteristics, the establishments were aggregated into four "Building Improvement" groups. The definitions of the first three groups were noted in the report (page 17); Group IV is defined in the following table. The first three types occurred in the T.H. 100 study strip at the time of this study.

Building Improvement Class	Description of Structure and Adjacent Open Space	Assessor's Full and True Value of Buildings per acre of used land (dollars)				
		Minimum	Q_1	Median	Q_3	Maximum
I	Frame, metal, or plain concrete block structure. Less than 15 per cent of land under roof	0.01	0.11	0.21	0.43	1.03
II	One-story structure of concrete block (on no more than three sides), or other masonry. Land more than 15 per cent under roof.	0.11	0.38	0.62	0.83	1.71

III	One or two story masonry structure, decorative materials on at least one side. Land 20 to 80 per cent under roof.	0.30	0.83	1.46	2.01	2.78
IV	Two story masonry building. Land 80 per cent or more under roof.	0.87	1.84	2.42	3.05	4.75

While there is overlap among the four categories, the 2nd and 3rd quartiles of the four classes are very nearly mutually exclusive. For practical purposes one may say that the following rounded figures describe the median and the range within which half the cases fall.

Building Improvement Class	Assessor's Full and True Value of Buildings per acre of Used Land (Dollars) Q_1	Q_3	Median
I	0.10	0.40	0.20
II	0.40	0.85	0.60
III	0.85	1.90	1.40
IV	1.90	3.00	2.40

Note that the median full-and-true building value per square foot of used land increases by about $1.00 from Class III to Class IV. A recent study provides data on the mean full-and-true building value per square foot of land, for warehouse, industrial, plant office, and retail uses in the "frame" (lower buildings surrounding the

"core", or central business district) of the Minneapolis Central Commercial Area. 1/ The mean value is approximately $1.14 per story per square foot of land. For example, one-story buildings average about $1.14 full-and-true building value per square foot of land; two story buildings average about $2.28, etc. Thus the addition of a second story to an average masonry structure in Faribault, or in the suburban locations which were examined, appears to add about the same full-and-true value per square foot of land as it does in the "frame" area of central Minneapolis. In other words, the Building Improvement Classes used in this study appear to be articulated with categories of larger structures which exist in the central city.

1/ Land and Space Use Survey, Central Commercial Area, Minneapolis Planning Commission Publication 105, Central Minneapolis Series 5, May 1959.

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