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A TRAFFIC STUDY FOR THE  
BRIDGEPORT INDUSTRIAL AREA  
SIOUX CITY, IOWA

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A TRAFFIC STUDY FOR THE  
BRIDGEPORT INDUSTRIAL AREA  
SIOUX CITY, IOWA

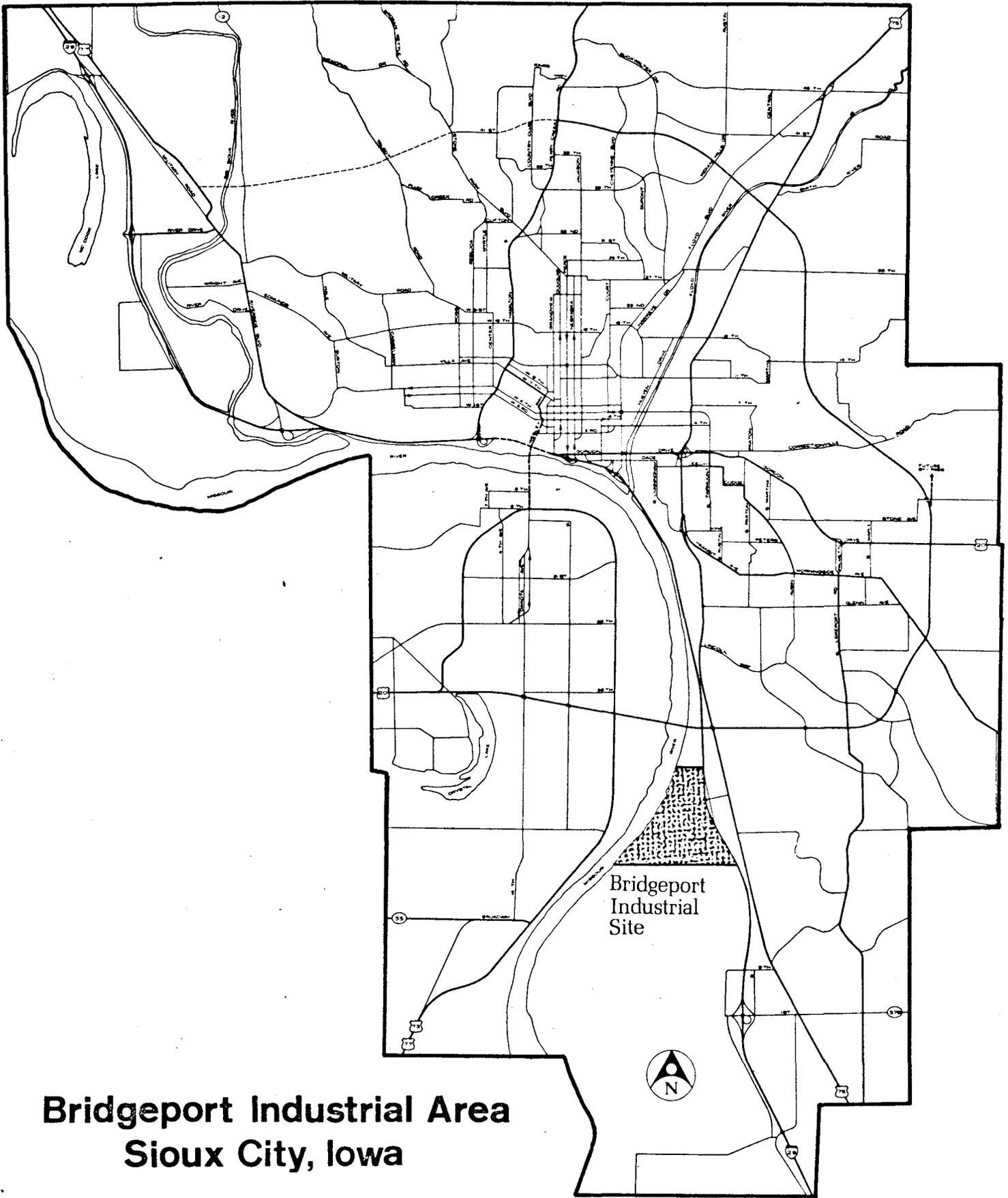
March 1973

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## INTRODUCTION

The Bridgeport Industrial area in Sioux City, Iowa is located between the Missouri River and Interstate 29 (I-29), south of proposed Interstate 129 (I-129). Access to the area is provided by a full diamond interchange at I-29 and Outer Drive. Outer Drive also links the area with U.S. Route 75 to the east. Figure 1 indicates the location of this area in relation to the overall Sioux City metropolitan area. It also shows the existing roadway network in this part of the city.

The purpose of this report is to review present and anticipated future employment figures for this area, project future traffic volumes and recommend geometric improvements which will be necessary in order to efficiently handle future traffic volumes. Since the entire development of the area will not occur at one time, or within a short period of time, improvements have been recommended for various stages of development. Data used in this study was provided by the Traffic Department of Sioux City, the Industrial Development Council and the Iowa State Highway Department. Also, interviews were held with existing developments in the Bridgeport Industrial area to determine existing employment and anticipated growth.



**Bridgeport Industrial Area  
Sioux City, Iowa**

FIGURE 1

## PROPOSED DEVELOPMENT AND TRAFFIC CONSIDERATIONS

In order to quantify the traffic access needs of a major development, estimates of future traffic generation and distribution are needed. The volume of vehicular traffic generated by a major development, such as the Bridgeport Industrial Area, is determined by the size, composition and the timing of the development. Should these factors change, then the traffic generation will show a corresponding change.

### Existing and Proposed Developments and Employment Projections

The Industrial Development Council of Sioux City, Iowa was most helpful by supplying estimates of future employment population. These data were based on existing and proposed developments, and estimates of future development. It was found, at the time of this writing, that eleven firms had developed or would be developing in this area. This included the Big Soo Terminal complex and the small commercial developments at the intersection of Harbor Drive and Outer Drive.

At the present time approximately 600 employees work in this area. The new firms which recently acquired property in this area will soon complete construction of their facilities raising the total employment to approximately 1,400 employees. This growth can be expected within the next two years since these firms have acquired the property and plan on construction.

Interviews held with employers in the area indicated the data supplied by the Industrial Development Council to be reasonably accurate. Those employers interviewed included Hoerner-Waldorf Corporation, Advance Industrial, Yellow Equipment Terminal Line, Midwest Shop Supplies and Downtown Realty Company.

The Bridgeport Industrial Park area has numerous industrial sites which have yet to be acquired. It is anticipated that these sites will be purchased and growth in this area will continue with the existing and under construction sites acting as a catalyst to future development. Figure 2 supplied by the Industrial Development Council of Sioux City, Iowa indicates the street plan, anticipated site arrangements, and employment estimates made for this area. The name of firms which are located or have bought property and intend to develop in the area are shown on this figure. This accounts for the present 600 employees and the anticipated 1,400. A total of 6,200 employees have been projected by the Industrial Development Council as the ultimate employment population for this area.

Based on research data conducted on various industrial parks throughout the United States, the number of employees which could be ultimately anticipated in a development of this nature was briefly reviewed. The Bridgeport Industrial Park which covers approximately 375 acres is anticipated to have a building coverage of 25 percent due to its location adjacent to the Missouri River. Because of the type of area and nature of business, primarily industrial, the number of employees per 1,000 gross square feet of floor area will be rather low with sizeable warehouse areas having few employees. As a result, it is felt that there will be approximately one employee per 1,000

gross square feet of floor area. Using these relationships the following calculations were made to estimate the ultimate employment population of the area.

$$\begin{aligned} 375 \text{ acres} \times 0.25 \text{ coverage} &= 93.75 \text{ acres or} \\ 4,083,750 \text{ gross square feet (GSF) of floor space} \\ 1.00 \text{ employee per 1,000 gross square feet} &= \\ \frac{4,083,750 \text{ GSF} \times 1.00 \text{ employees}}{1,000 \text{ GSF}} &= 4,084 \text{ employees} \end{aligned}$$

In view of the above calculations the estimated ultimate employment population, supplied by the Industrial Development Council of Sioux City for the Bridgeport Industrial area, appears to be somewhat high. Therefore, a lower value of 5,000 employees was used as the ultimate employment population in this area for use in this study.

#### Existing Traffic Volumes

The traffic volumes presently in the area of the Interstate 29/Outer Drive interchange were obtained from the Iowa State Highway Department. This information was supplemented by automatic hose counts conducted by the Traffic Department of Sioux City, Iowa.

The average daily traffic (ADT) during 1972 on Interstate 29 at the Outer Drive Interchange was found to be 12,415 and 11,883 vehicles north and south of Outer Drive respectively. Outer Drive had an ADT of 4,471 and 2,269 east and west of the interchange. The automatic hose counters were placed on the four ramps of the I-29/Outer Drive interchange. Data obtained

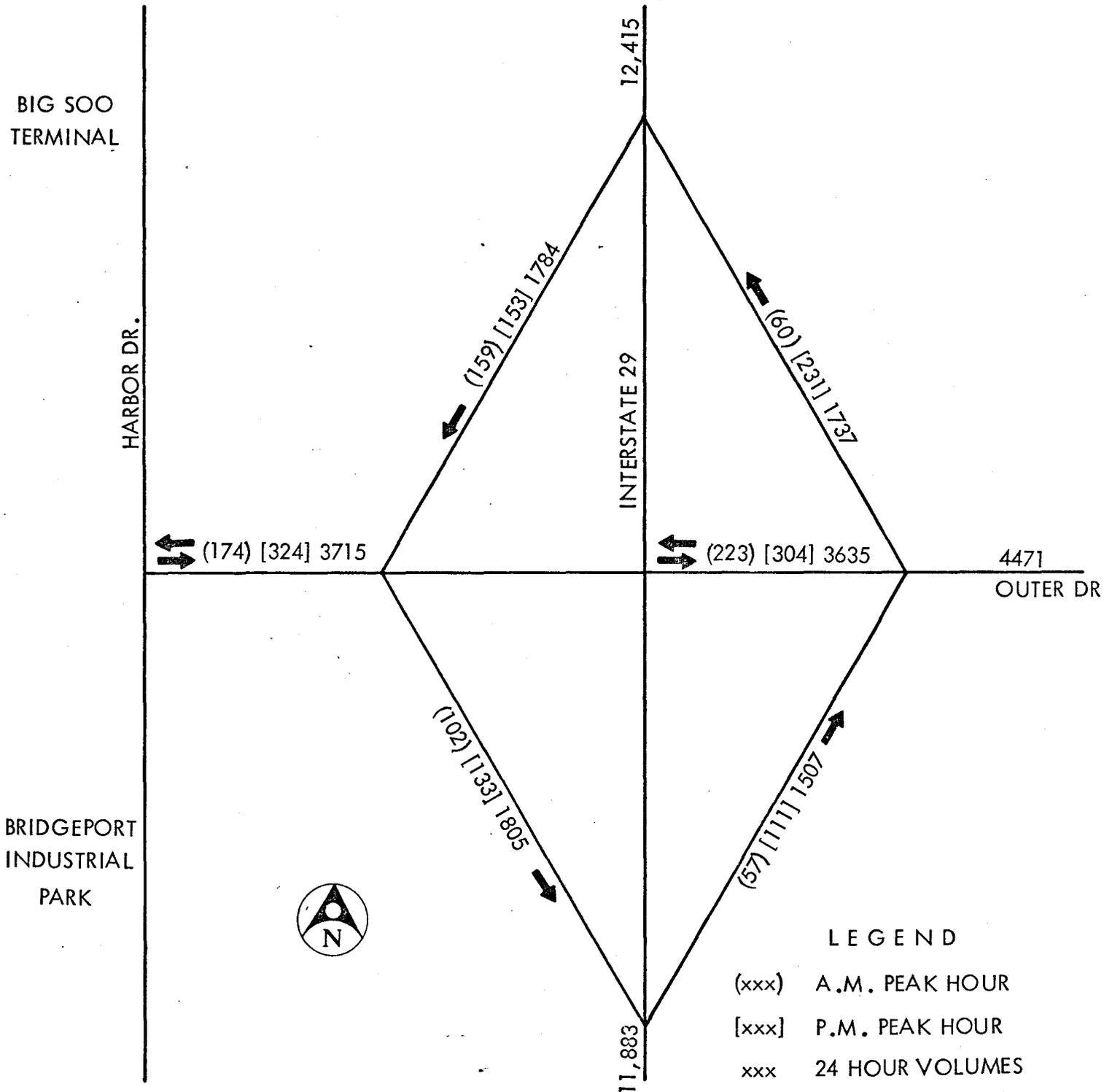
from these counters were compared to the ADT figures supplied by the highway department. It was found that the two sets of figures were reasonably close. Figure 3 indicates the a.m., p.m. and daily traffic volumes on the ramps and Outer Drive.

The volume count information supplied by the Iowa State Highway Department and the Sioux City Traffic Department provided an insight to traffic patterns which presently exist at this interchange. For example, it was found that approximately 60% of the traffic exiting I-29 from the north and 87% from the south turn east.

Fifty-five percent of the traffic coming from the west turns north onto I-29. The greatest portion of traffic which emanates from the east turns onto the ramps and is evenly divided with 56% going south and 44% going north. As might be expected the through traffic volumes on Outer Drive are a small percent of the total. At the present time the traffic volumes during the peak hour periods on the ramps and ramp intersections of the I-29/Outer Drive interchange are relatively light. There exists no capacity problems and congestion is almost non-existent.

With future development of new facilities, such as I-29 just north of this interchange, traffic patterns may change slightly. Traffic which comes from the southeast section of Sioux City may find it more convenient to use I-129, thence south on I-29. Continued growth in the area to U.S. Route 75 east of the interchange, however, could offset this reduction and volumes using the interchange could continue to grow. Until

EXISTING TRAFFIC VOLUMES  
 INTERSTATE 29 AT OUTER DRIVE  
 BRIDGEPORT INDUSTRIAL AREA



LEGEND

- (xxx) A.M. PEAK HOUR
- [xxx] P.M. PEAK HOUR
- xxx 24 HOUR VOLUMES

FIGURE 3

the completion of I-129 it can be anticipated that the north-south volumes of traffic using this interchange, serving the southeast portion of Sioux City, will continue to grow.

#### Traffic Generation Factors

The number of vehicle trips which would be generated on an average day by the Bridgeport Industrial Area was calculated using various procedures as follows:

1. This procedure utilizes a relationship between the number of employees and the average daily vehicle trips. Previous studies of this type of development indicate a figure of 2.5 trips per employee.
2. A second procedure used relates the number of vehicle trips on an average day to the number of acres in the development. Based upon the character and location of such a development, a trip generation factor of 50 to 100 trips per acre can be used. For the type development proposed, its location and the size of the metropolitan area, a figure of 50 trips per acre to and from the site was found appropriate for the Bridgeport Industrial Area.
3. A third method employed in determining total vehicular trips is to relate trips to 1,000 gross square feet (G.S.F.) of floor area. A range of values have been used from 2.5 to 4.0 trips per 1,000 GSF. Considering the location, both geographically in the United States and in the Sioux City area, a figure of 3.0 trips per 1,000 GSF was selected.

Using these methods of derivation the daily trips were determined for the Bridgeport Industrial area and are listed below.

1. 2.5 trips per employee x 5,000 employees = 12,500 trips
2. 50 trips per acre x 375 acres = 18,750 trips
3. 3 trips x 4,083,750 G.S.F. ÷ 1,000 = 12,250 trips

The three methods of deriving total vehicle trips resulted in values ranging from 12,250 to 18,750 trips per day. It becomes apparent that the one derivation which is considerably different from the other two utilizes acres as a basis for trip generation. In previous studies of this nature, the use of employees or gross floor area for the determination of trip generation has proven to be more reliable than acreage. In consideration of other growth contiguous to the Bridgeport Industrial Park, a "design day" figure of 14,000 vehicle trips per day to and from the Bridgeport Industrial area was selected for use in this study.

#### Peak Hour Traffic Volumes

The most important factor in determining the adequacy of a street and highway system is the determination of the number of vehicles which will occur during peak hour periods. To determine the volumes that would exist on Harbor Drive, Outer Drive and the I-29/Outer Drive interchange, during the a.m. and p.m. peak hour were used. The first was the traffic which would be generated by the Bridgeport Industrial Area. The second was an estimation of growth peripheral to this area, mainly to the east of I-29.

## Bridgeport Industrial Development

In the first instance the major generator in a development such as the Bridgeport Industrial area is employee trips. For the most part the major portion of employees will arrive during the morning and leave in the late afternoon. However, there will most likely be a number of employers who will have more than one shift. This will reduce the total number of employees that will arrive in the morning peak period and leave in the late afternoon peak period. In industrial developments as much as 33 percent of the employees will be working shifts other than the normal day shifts. Furthermore, there will be numerous employers in the area with different working hours so that all employee trips would not occur during a one-hour period. It is more likely that these trips will be spread over a one and one-half hour period. The average absenteeism taking into account vacation, sick leave and various employees away at other locations on business, is approximately 10 percent. Vehicle occupancy will amount to approximately 1.2 persons per vehicle. Thus, the following equation was developed to determine the number of employee vehicle trips which could be expected during the a.m. and p.m. peak hour period.

Total employees - 5,000

$$\frac{5,000 \times 0.67 \text{ daytime employees} \times 0.90 \text{ absenteeism factor}}{1.5 \text{ hour peak period} \times 1.2 \text{ person per vehicle}} = 1,675 \text{ vph}^*$$

\* vph = vehicles per hour

Another method of determining the volume of traffic during the peak hour periods is by estimating the a.m. and p.m. peak hour periods as a percent of the total daily trips. The a.m. and p.m. peak hour periods are expected to contain approximately 30 to 40 percent of the daily total trips. Since a one and one-half peak period is anticipated for both the a.m. and p.m. periods, each hour will contain approximately 12% of the daily total. Using 14,000 daily trips it can be determined that 1,680 vehicle trips would occur during a morning or evening peak hour. These two methods of determining peak hour traffic volumes result in basically the same volume of traffic.

#### Peripheral Development

Using the existing volume count information a four percent growth factor per year was used to determine future volumes. The Industrial Development Council of Sioux City, Iowa anticipates that it will take ten years for full development of the Bridgeport Industrial area. Thus, existing volumes were projected for ten years.

#### Directional Distribution of Traffic

The directional distribution of trips to and from the Bridgeport Industrial area is of prime importance in order to analyze the existing roadway system and especially the I-29/Outer Drive interchange. To ascertain this distribution various sources of information were examined. The SIMPCO General Plan was reviewed to determine zone to zone trip movements from the

traffic zone containing the Bridgeport Industrial area. Also, the population distribution within the metropolitan area and the future roadway system which would serve the Sioux City area and the Bridgeport area, in particular, was examined. From these sources estimates of the directional distribution of peak hour employee traffic was determined.

A vast majority of trips made to and from the area will use the Interstate 29 interchange at Outer Drive. An estimated 90 percent of all traffic destined to and from this site would use this interchange. The remaining 10 percent would use Harbor Drive to and from the south. The traffic using the I-29/Outer Drive interchange would have an estimated distribution as follows:

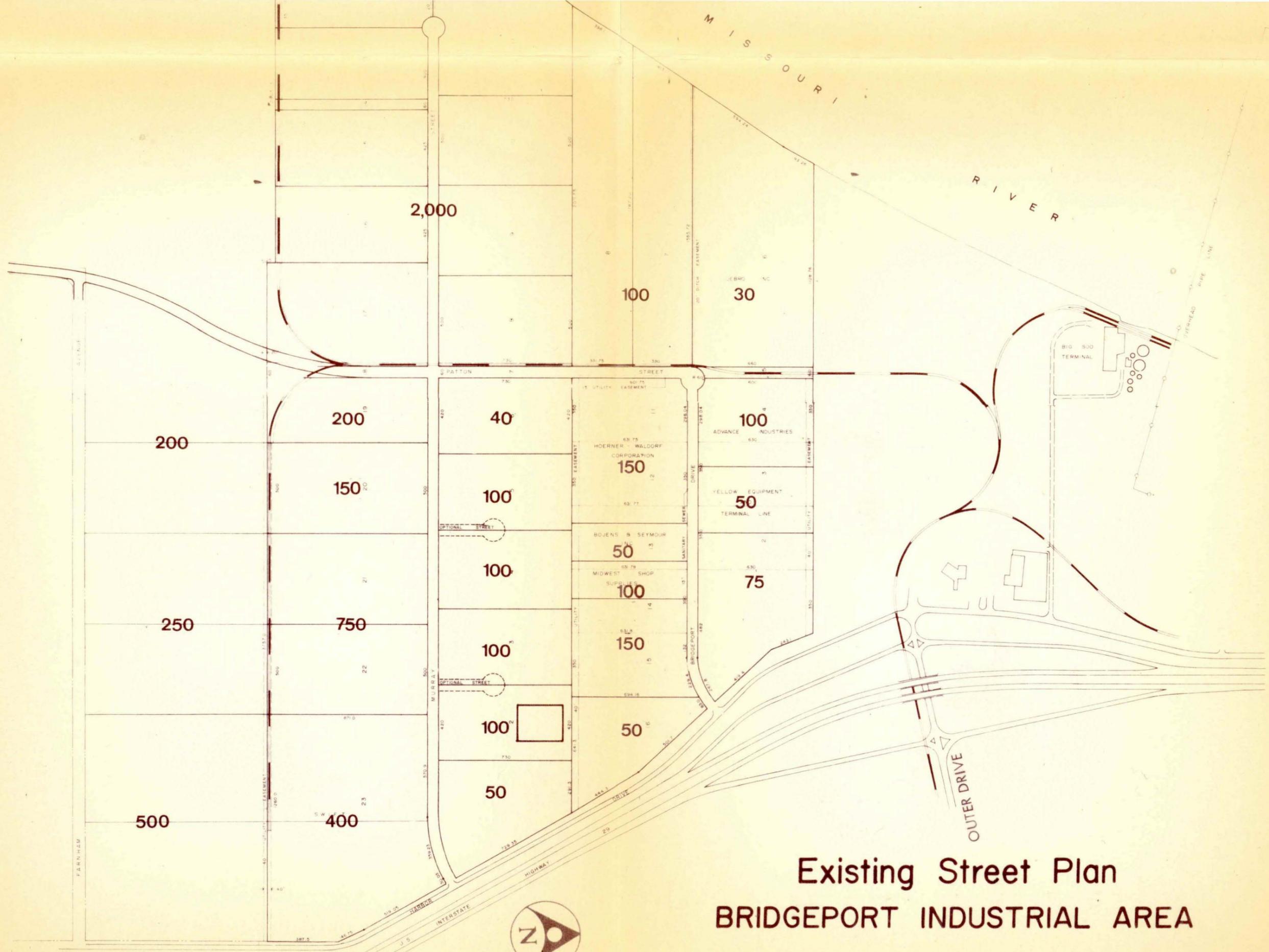
I-29 North - 75%

I-25 South - 5%

Outer Drive East - 20%

Using a peak hour volume of 1,675 vehicles derived earlier, the distribution of traffic at the I-29/Outer Drive interchange for the a.m. and p.m. peak hour periods has been prepared and is shown on Figure 4.

Peripheral growth based on existing volumes expanded by four percent for ten years indicate peak hour volume as shown in Figure 5.



**Existing Street Plan  
BRIDGEPORT INDUSTRIAL AREA**

FIGURE 2

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FUTURE EMPLOYEE TRAFFIC VOLUMES

INTERSTATE 29 AT OUTER DRIVE

BRIDGEPORT INDUSTRIAL AREA

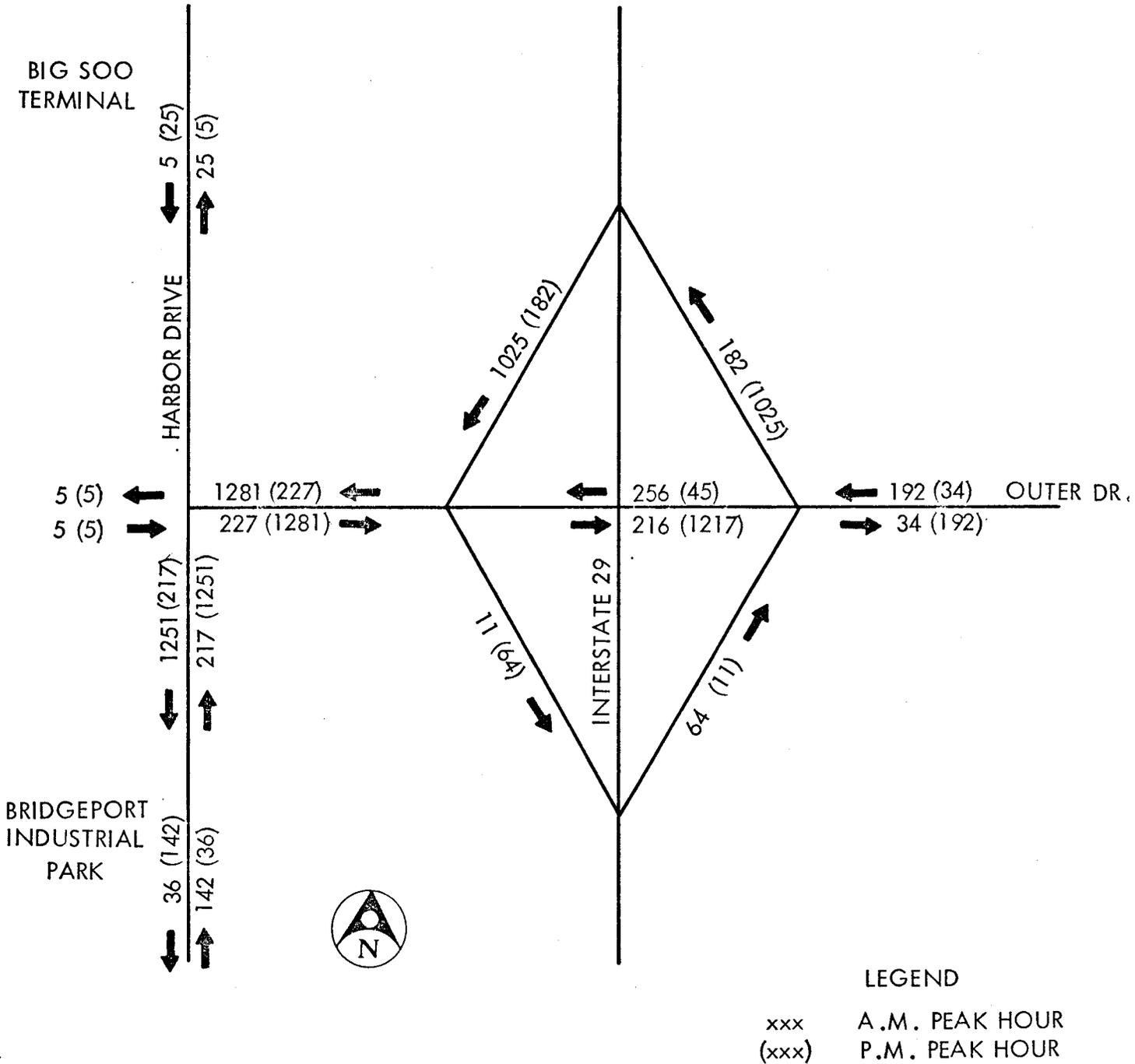


FIGURE 4

PROJECTED PERIPHERAL TRAFFIC VOLUMES

INTERSTATE 29 AT OUTER DRIVE

BRIDGEPORT INDUSTRIAL AREA

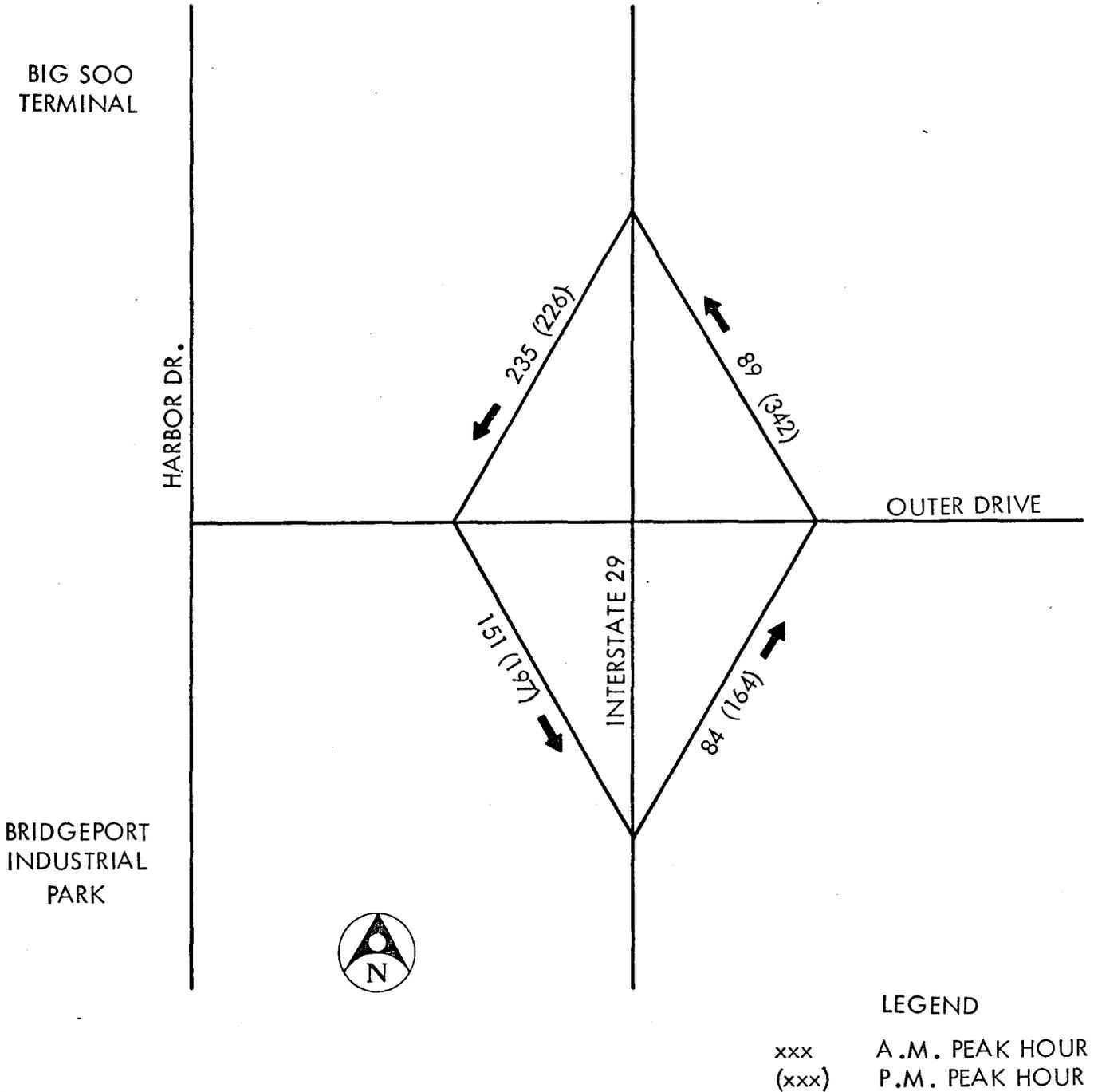


FIGURE 5

## ANALYSES AND RECOMMENDATIONS

The development of the Bridgeport Industrial Park area brings with it potential traffic problems at the interchange of I-29 and Outer Drive. The severity of the traffic problems will be in direct proportion to the amount of development which may occur. Considerable research data is available on the amount of vehicular traffic generated by industrial parks. As indicated earlier the anticipated employee population as projected by the Industrial Development Council of Sioux City, seems rather high and it may take a number of years before the sites are all purchased and used as anticipated. It is doubtful that severe traffic congestion problems will occur within the next two years. However, in years to come as the area develops so will the traffic congestion problems.

### Geometric Review and Traffic Demand

The geometrics of the I-29/Outer Drive interchanges are shown in Figure 3, referred to earlier. With the exception of the widening of Outer Drive to four 12-foot lanes as proposed by the Iowa State Highway Department, no other improvements are planned in the area including the intersection of Harbor Drive and Outer Drive.

The volume of traffic anticipated when the site is fully developed, however, will be of such a magnitude that the demand will far exceed the capacity of the present facilities. The combined peak hour volumes of traffic anticipated in ten years by the fully developed Bridgeport Industrial area and peripheral growth is shown in Figure 6. High volumes of traffic (in excess

COMBINED FUTURE RAMP VOLUMES

INTERSTATE 29 AT OUTER DRIVE

BRIDGEPORT INDUSTRIAL AREA

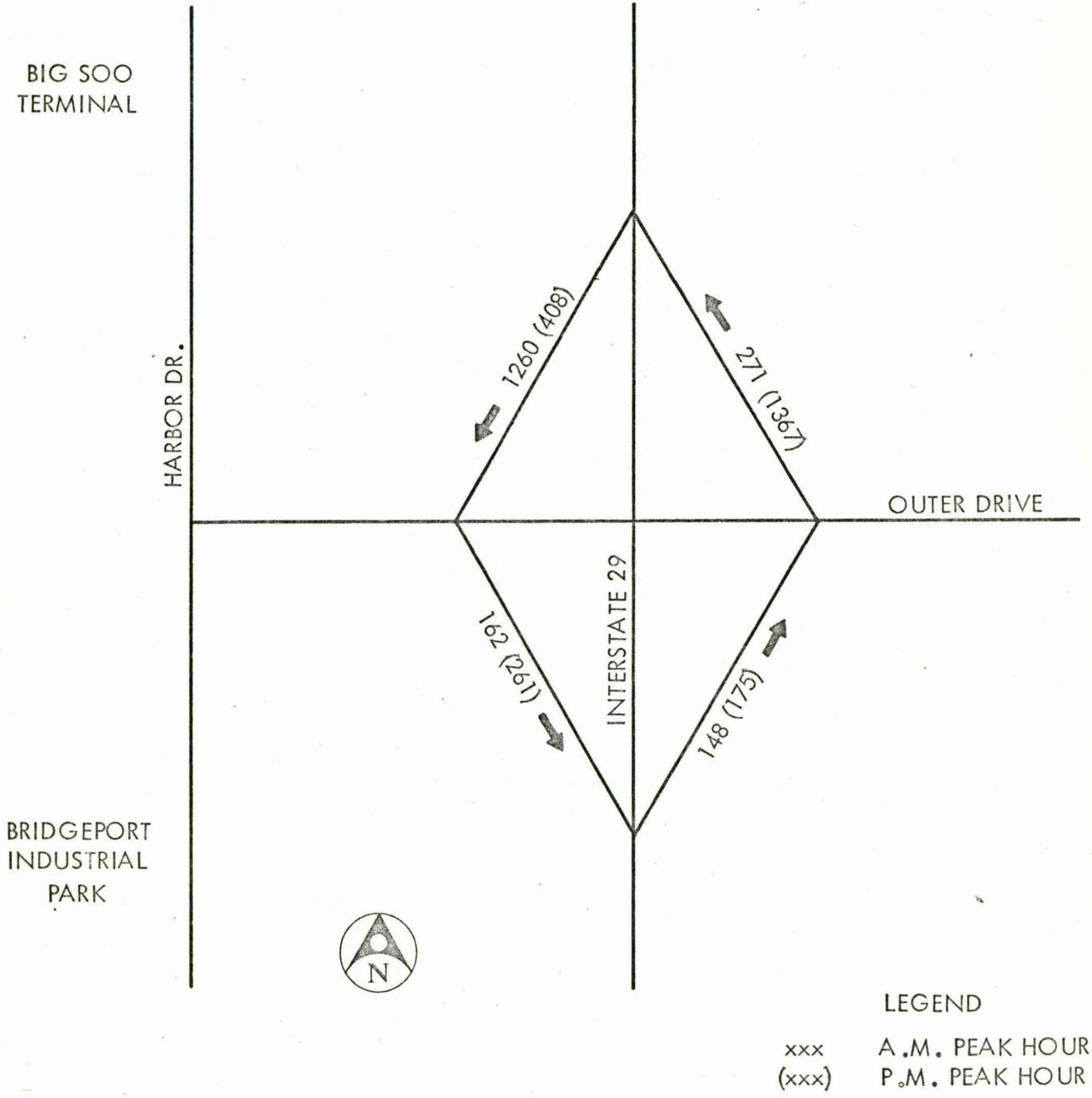


FIGURE 6

of 1,000 vehicles) will desire to use the southbound off-ramp from I-29 during the a.m. peak hour. The same volume of traffic will desire to use the northbound on-ramp during the p.m. peak hour. With volumes of traffic this high both a.m. and p.m. peak hour movements will be quite difficult if not impossible. A backup will no doubt occur during the a.m. peak hour onto the southbound through lanes of I-29. The heavy volume of left-turn traffic attempting to use the northbound on-ramp during the p.m. peak hour will find this maneuver quite difficult and serious backups will occur.

The geometrics of the interchange are such that southbound traffic during the a.m. peak hours will have limited distance to negotiate the right- and left-turn movements required from the southbound off-ramp to Harbor Drive and then to the Bridgeport Industrial area. With additional volumes coming from the east on Outer Drive this movement will become even more difficult.

#### Review of Development Stages

In order to adequately handle future volumes of traffic at the I-29/Outer Drive interchange it is recommended that improvements be implemented when the employment population reaches various levels. Based on the capacity to demand relationship of the intersections and ramps as they presently exist, employment figures of 2,000 and 4,000 have been used as a basis for implementing various improvements.

When the employment population reaches 2,000 employees, total daily traffic and especially peak hour movements will begin to experience difficulty at the intersection of Harbor

Drive and Outer Drive, the Outer Drive and the I-29 ramps. It is expected that a significant amount of truck traffic will be generated which will introduce further constraints on the capacity of the existing facilities. The primary deficiency at this interchange is the close proximity of Harbor Drive to the west ramps of Interstate 29. As volumes of traffic increase the lack of storage space between the two intersections will become more apparent and will cause backups on the southbound off-ramp especially during the a.m. peak hour. As employee population increases and traffic volumes grow, traffic signals may be required at Outer Drive and I-29 ramp termini. In addition, it may be necessary to provide signals at Harbor Drive and Outer Drive. However, with the present geometrics, it would be very difficult to signalize these three locations and maintain an efficient flow of traffic.

It is anticipated that when the employment population of the Bridgeport Industrial Area reaches the 2,000 level, improvements will have to be made at the intersection of Harbor Drive and Outer Drive. It will be necessary that Harbor Drive be shifted to the west to provide adequate spacing between its intersection with Outer Drive and the west ramps of I-29. At the present time there exists only 150 feet between these two intersections. A minimum of 300 feet should be provided between the west ramp terminals of I-29 and Harbor Drive. This would accommodate any future traffic control devices in an efficient manner. Sufficient land in the southwest quadrant of this intersection should also be reserved in order to provide needed geometric changes of the interchange configuration.

Additional improvements will be required at the I-29 Outer Drive interchange area when the employment population of the Bridgeport Industrial area reaches the 4,000 level. These improvements will be required for the following reasons.

- During the a.m. peak hour, traffic on the southbound off-ramp of I-29 will back onto the southbound through lanes of the freeway. Serious congestion will be experienced at both the east and west ramp termini and the intersection of Outer Drive and Harbor Drive. The volume of traffic (shown in Figure 4) will not be able to safely and efficiently negotiate the intersections of Outer Drive and the west ramps, and Outer Drive and Harbor Drive.
- During the p.m. peak hour traffic leaving the Bridgeport Industrial Park will be required to turn right from Harbor Drive onto Outer Drive to gain access to I-29. The bulk of this traffic will desire to turn left from Outer Drive to the on-ramp for northbound I-29. The volume of traffic desiring to negotiate the left turn will create severe backups especially to the west. The queue of vehicles attempting to negotiate this turn may back through the intersection of Outer Drive and the I-29 west ramps and into Harbor Drive blocking that intersection as well. Even under signal control this movement will become exceedingly difficult.

In order to help solve these traffic problems and facilitate the movement of traffic in the area changes in the interchange configuration, and the ingress and egress to the Bridgeport Industrial Park will be required.

### Conclusions

The Bridgeport Industrial Area may prove to be one of the prime locations for industrial growth in Sioux City. If the area develops as anticipated, changes will be required in the present geometrics of the Interstate 29/Outer Drive interchange and the Outer Drive/Harbor Drive intersection. By following the guidelines set forth in the recommendations below, traffic congestion will not impose a hardship on employees who work in the area. Furthermore, it will not deter further growth in this area of Sioux City, Iowa.

Since the Interstate 29/Outer Drive interchange is presently serving development other than the Bridgeport Industrial Park and will serve future growth in the entire area including the industrial park, it is imperative that the city plan commission and traffic department keep a close surveillance of the activity in this area. The recommendations of this study are based on the growth of employees in the Bridgeport Industrial Park. It must be remembered, however, that other developments will effect traffic at this interchange area. Development could occur on Route 75 north and south of Outer Drive which would add to the traffic problems and should be closely observed.

## Recommendations

It is recommended that major revisions to the I-29/Outer Drive interchange be implemented and a new access facility to the Bridgeport Industrial area be provided. Figure 7 indicates the proposed improvements in two stages for 2,000 and 4,000 employment figures in the Bridgeport Industrial Park, respectively. The first stage improvements should be implemented within the next three to five years, depending on the rate of growth in population. The second stage improvements should be implemented sometime after this date, eight to ten years, depending again on the population growth in the area. These improvements are as follows:

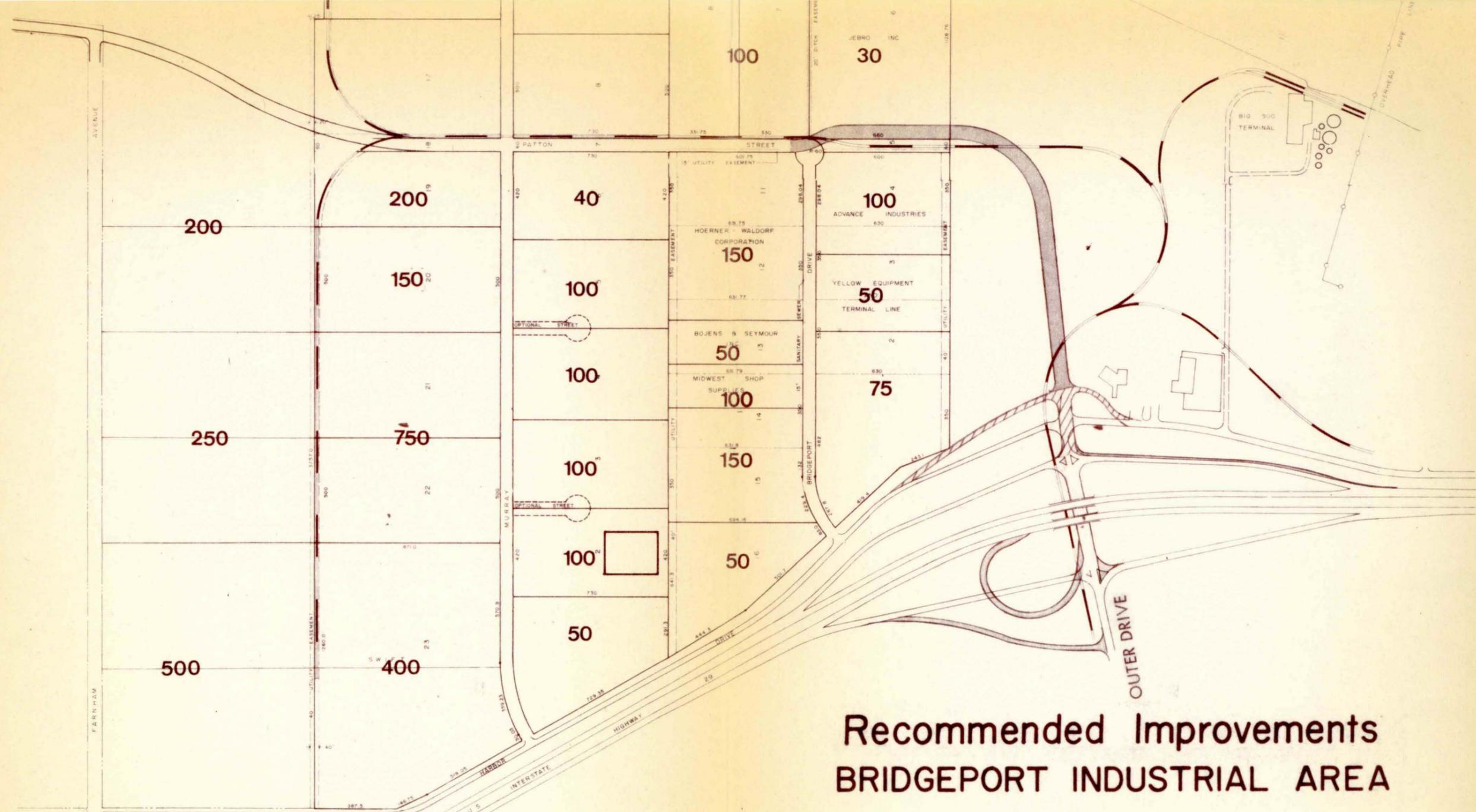
### Stage I Improvements

1. Harbor Drive should be relocated to the west to allow greater distance between this facility and the west ramp termini of I-29. Driveways along the northwest portion of the Harbor Drive/Outer Drive intersection should be clearly defined with curbing and reasonable driveway widths and spacings. Signalization should be considered as traffic volumes in the area increase and actual traffic counts justify such an installation.
2. The southbound off-ramp from I-29 should be widened to provide for two lanes of traffic. Once vehicles have passed the gore point on the freeway three lanes should be provided for 200 feet in advance of Outer Drive. This will allow for a single left-turn movement and a dual right-turn movement to handle the a.m. peak hour traffic flows without backing traffic onto the freeway.

## Stage II Improvements

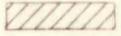
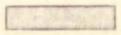
1. The northbound off-ramp of I-29 should be shifted to the east and a loop ramp be constructed for eastbound traffic desiring to go north on I-29. This improvement will eliminate the east to north left-turn movement which will be in excess of 1,000 vehicles during the p.m. peak hour.
2. Outer Drive should be extended westerly as a four-lane facility connecting with Patton Street at Bridgeport Drive. This facility will eliminate the need for high volumes of right turn and left-turn traffic at the intersection of Harbor Drive and Outer Drive. Signal controls will function in a more efficient manner and can be interconnected with future signalization at the off-ramp of I-29.

The ability to move people and goods safely and efficiently at this interchange will be the key to the success of the Bridgeport Industrial area as well as the development in the surrounding area. Based on the rate of growth in population of this area and the resultant traffic volumes, the City will be able to implement the improvements using the guidelines set forth in this report.



## Recommended Improvements BRIDGEPORT INDUSTRIAL AREA

### LEGEND

-  STAGE I
-  STAGE II



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FIGURE 7

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