TRENTON TOPICS

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AREA WIDE TOPICS STUDY
OF
TRENTON, NEW JERSEY

Prepared for the

STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION

in cooperation with the

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

July 1973

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CHAPTER I

THE TOPICS PROGRAM

INTRODUCTION

The urban environment is characterized by large concentrations of people in a relatively small area. Prosperity demands mobility and easy access to the commercial and business centers which exist within our cities. Recently, the great need to improve the existing urban transportation system was recognized in the form of a separately funded Federal Aid Program. The United States Congress, in 1968, put into operation an immediate action program designed to improve the capacity and safety of the existing vehicular transportation system. TOPICS *(Traffic Operations Program to Increase Capacity and Safety)* was created as a section of the 1968 Highway Act. Two hundred million dollars was allocated for 1969-70 and 1970-71 Fiscal Years and was to be distributed to the various urban areas through the State Highway Departments or Departments of Transportation.

Historically, the approach to solving the problems of transportation has been the development of new transportation systems and facilities. The cost of such improvements cannot be measured in money alone, but rather in time, land (which is at a premium in urban areas), the social repercussions caused by the dislocation of large numbers of people, and the general inconvenience to the public. The TOPICS Program, by providing improvements which are designed within the framework of the existing resources of the transportation system, will accomplish the same end with a considerably smaller expenditure.

This Program is an attempt to improve the urban environment through immediate action. TOPICS is designed to bring about engineering studies that would result in completed improvement programs within a relatively short time span. Most improvements will be of a traffic operations nature emphasizing both basic and sophisticated traffic engineering techniques while effectively utilizing the existing capital investment. Typical improvements under TOPICS includes:

- Channelization of intersections.
- Widening of traffic lanes.
- Providing additional traffic lanes on approaches to signalized intersections.
- Installation of control systems to make traffic signal operation responsive to traffic conditions.
- Addition and upgrading of traffic control devices, including signs, pavement markings, and signals.

- Addition and/or upgrading of highway lighting to those sections of streets which indicate a significant number of night accidents.
- Modifications associated with restricting curb parking to increase capacity and safety.
- Short construction or reconstruction of a street where such an improvement is essential for route continuity along a street of otherwise adequate width.

STUDY NETWORK

Since it was not practical to investigate every roadway within the City, a network of major streets was established for this study. The selection of the study system was accomplished in cooperation with City and State officials and consists of all streets designated as Federal Aid Primary, Secondary, and Urban as well as those on the State Aid roadway system. Also included are Municipal streets which either demonstrate a high volume of traffic, are required for circulation within the Central Business District, or demonstrate capacity or safety deficiencies. The Study System is illustrated in Figure I-1 in addition to the governmental jurisdiction over each segment of the system. The fact that a particular street was chosen as part of the Study Network does not necessarily mean that it will be included on the final recommended Federal Aid System which is eligible for TOPICS funding. This determination is dependent upon existing traffic conditions as well as our analysis of problem locations.

THE CITY

The transportation system within the City of Trenton must accommodate the traffic generated by a large number of industrial and commercial employees as well as 16,000 State employees working within the City. The normal frustrations and risks which accompany intra-city driving are magnified by the status of Trenton as the State Capital.

The population trend, as is typical of today's older cities, is downward. In 1960, the population was 114,167; in 1970 it was down to 104,638; and the projected figure for 1980 is 94,800 according to the Mercer County Planning Board. This area in general, however, will still need considerable transportation facilities because of the steady commuter flow of State employees into the City and a significant rise in the population of the adjoining townships. An ever increasing number of people working within Trenton reside in the outlying suburbs. Figure I-2 shows the City of Trenton as it relates geographically to the surrounding communities.

FIGURE I-1
TOPICS STUDY SYSTEM

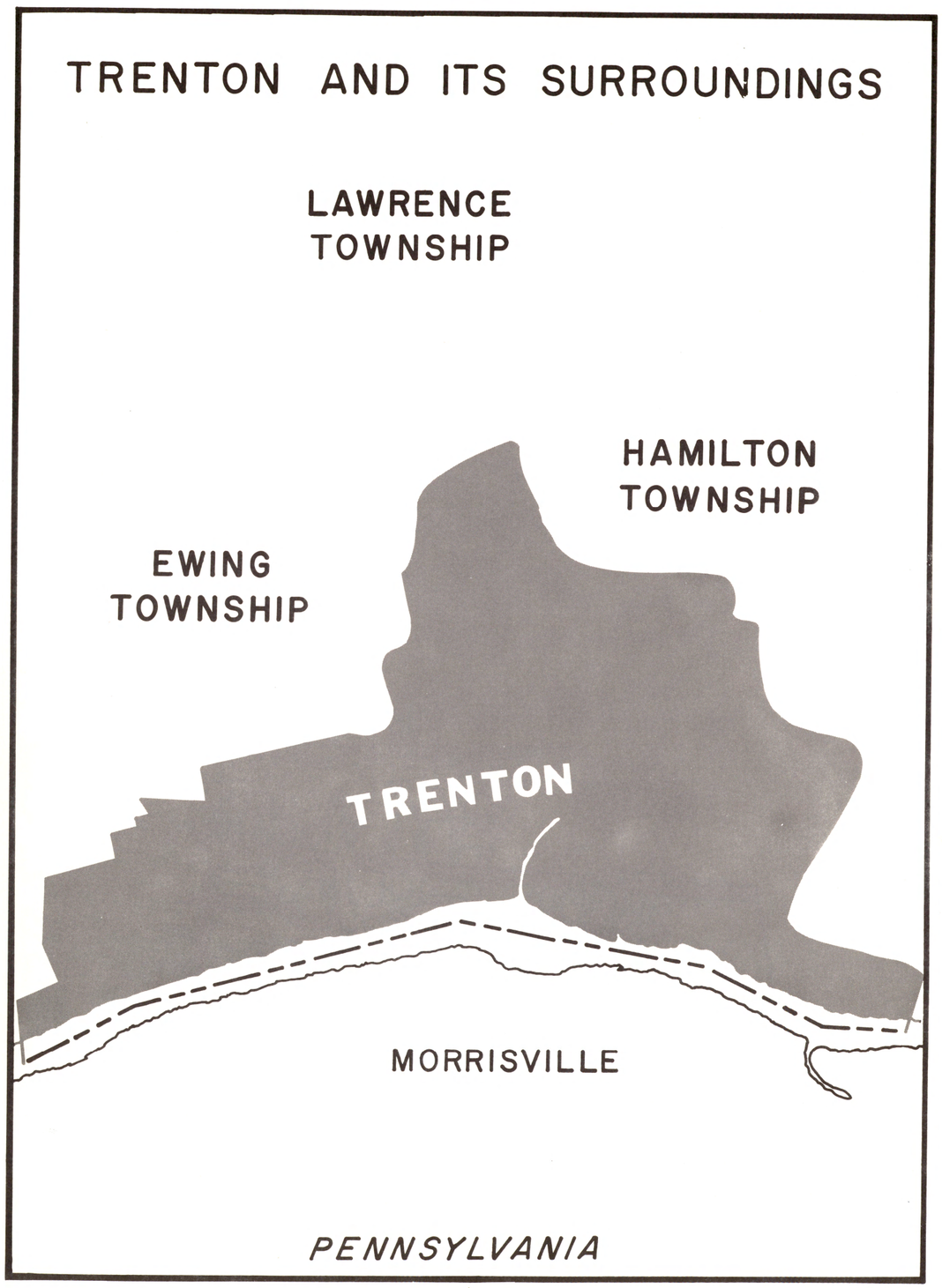


FIGURE I-2

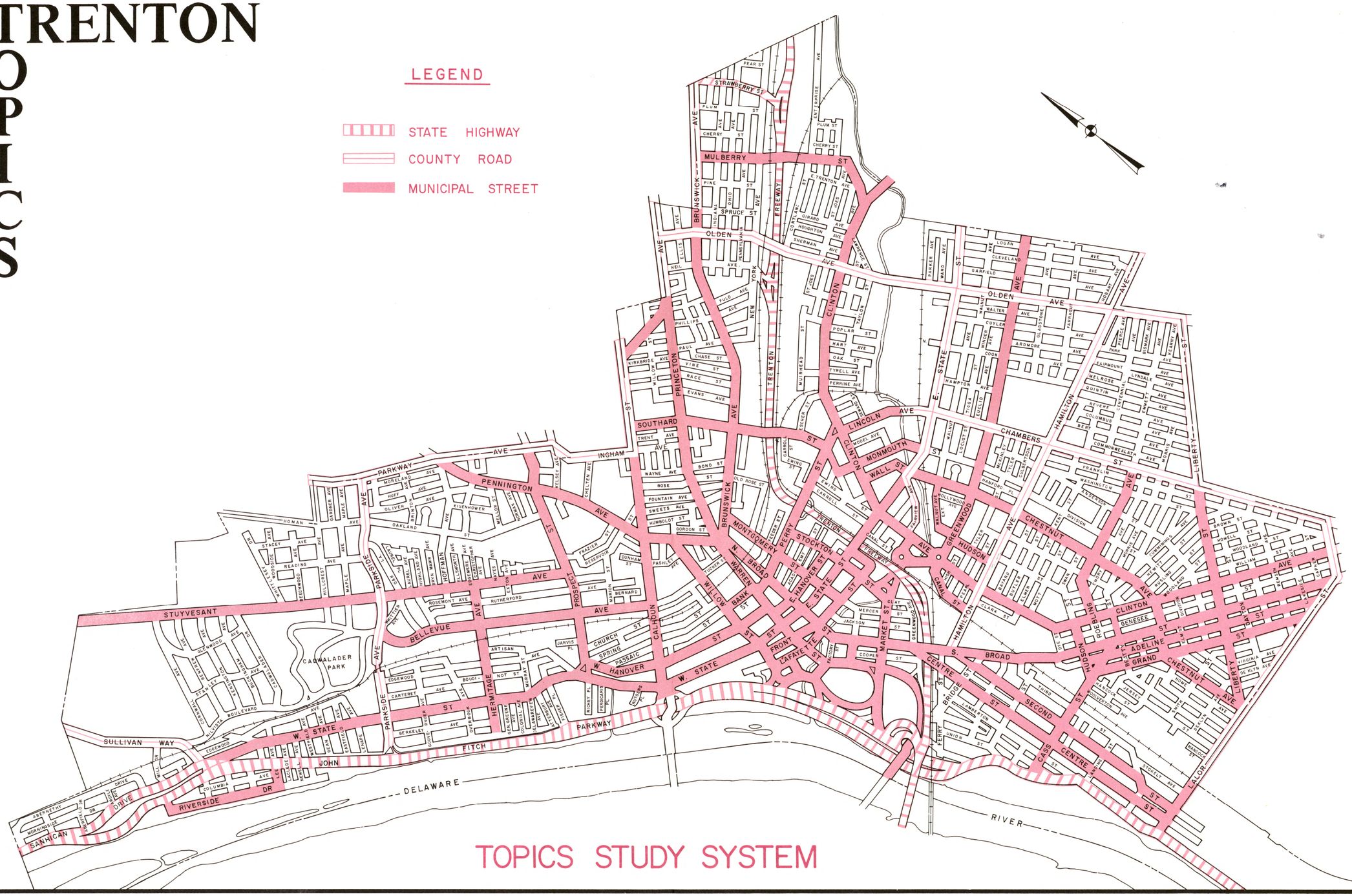
TRENTON TOPICS

LEGEND

STATE HIGHWAY

COUNTY ROAD

MUNICIPAL STREET



TOPICS STUDY SYSTEM

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FIGURE I - I

CHAPTER II

SUMMARY OF EXISTING CONDITIONS

To fully develop a program of improvements which will optimize the safety and efficiency of the existing street network, one must first evaluate the existing conditions which prevail throughout the system. It is to this end that we conducted an extensive data collection and field inventory of traffic related information. This Chapter presents a summary of those existing conditions with detailed information provided in Chapter V as they relate to each specific recommendation.

ROADWAY CHARACTERISTICS

Existing pavement widths, pavement conditions and right-of-way widths were inventoried to establish the physical constraints of the study network within which an improvement program must be developed. Figures II-1 and II-2 show roadway and right-of-way widths for system streets. Right-of-way data was obtained from current City tax maps while pavement widths were determined through field inventory procedures. It should be noted that both right-of-way and pavement width information is shown to represent conditions between intersections and, therefore, spot widenings at intersections are not reflected in this illustration.

TRAFFIC CONTROL DEVICES

Traffic control devices form the framework for virtually all traffic engineering procedures. Through the use of signs, signals, and pavement markings, traffic is regulated, guided, and controlled to provide the optimum in safety and efficiency for the street system.

Traffic Signals

Figure II-3 shows the location and governmental jurisdiction for all traffic signals located in Trenton. Data was collected reflecting the type of control equipment, signal timing and offsets at each signalized intersection. Virtually all signals are fixed time, single dial controlled, providing no flexibility with respect to changes in traffic demand. While some intersections have been partially modernized with the placement of mast arms and over the road signal indications, the majority of intersections have only post mounted signal heads providing two indications in each direction. Overall visibility for motorists approaching these intersections varies from fair to poor,

depending upon the specific location of the post mounted signal heads. Figure II-4 indicates those signals which do not have over the road indications for any approach. Most post mounted signals date back to the early 1900's with some having no visors to protect against sun reflection. Many traffic signals have not received final approval from the New Jersey Department of Transportation. A listing of these existing locations indicating the last step achieved in the approval process is shown in the Appendix A-1. Recommendations as to the action to be taken are also indicated.

One-Way Streets

The establishment of one-way streets is a method often used to combat specific instances of congestion and delay on various arterials. Figure II-5 indicates the existing one-way street operations for all streets.

Parking Regulations

A complete field inventory of existing parking regulations was conducted to determine the existing prohibitions and controls which effect the capacity of the existing street facilities. An inventory of parking ordinances revealed that in many instances the ordinance does not correspond to the field installation with respect to signing. The City must completely revamp their existing sign installations to make sure they conform to the recently codified ordinances.

Pavement Markings

Pavement markings are generally used to guide the motorist, informing him of the appropriate path to take. Additionally, markings supplement regulatory signs with respect to exclusive lane designations. A problem constantly facing a traffic maintenance force is the lack of manpower necessary to install and refurbish pavement markings at all locations as often as is necessary. Consequently, it is not surprising that our inventory of existing markings indicated many areas where the existing paint was badly worn and in need of replacement. On system streets centerlines shall be painted to help separate opposing directions of travel.

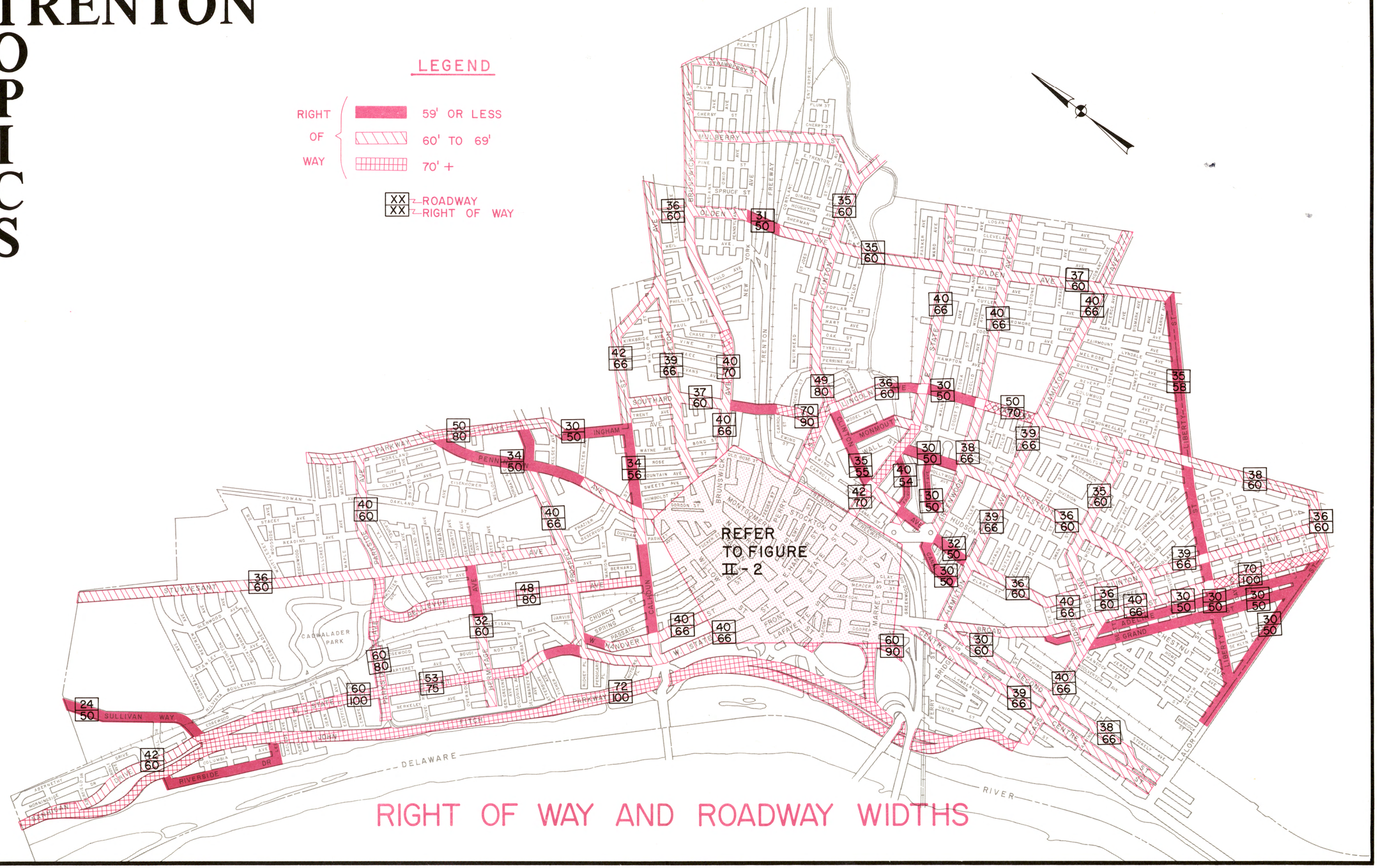
FIGURE II-1
RIGHT OF WAY AND ROADWAY WIDTHS

TRENTON TOPICS

LEGEND

RIGHT OF WAY
- 59' OR LESS
- 60' TO 69'
- 70' +

XX / XX — ROADWAY / RIGHT OF WAY



RIGHT OF WAY AND ROADWAY WIDTHS

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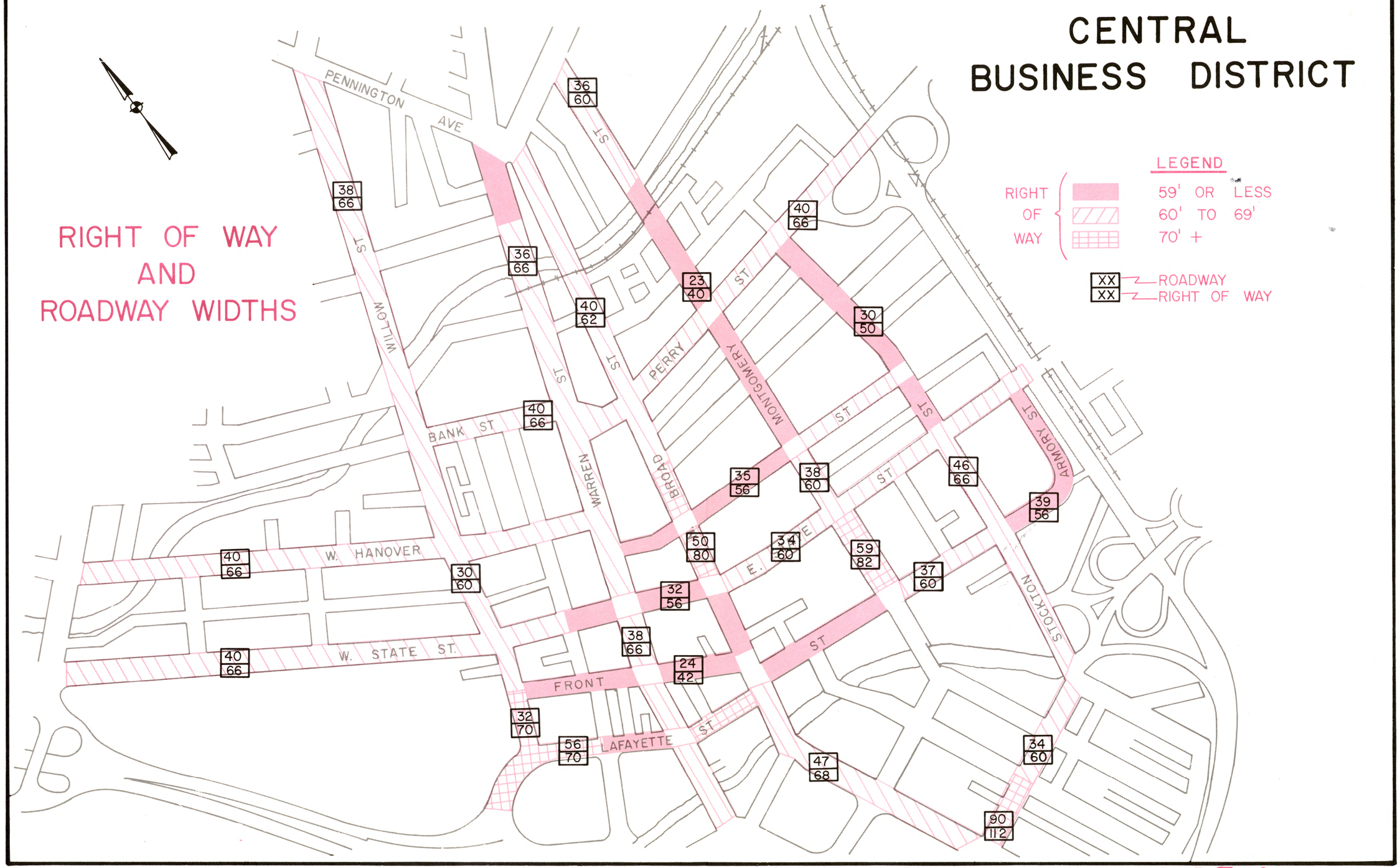
FIGURE II-1

FIGURE II-2
CENTRAL BUSINESS DISTRICT
RIGHT OF WAY AND ROADWAY WIDTHS

CENTRAL BUSINESS DISTRICT

RIGHT OF WAY AND ROADWAY WIDTHS



LEGEND

RIGHT OF WAY
- 59' OR LESS
- 60' TO 69'
- 70' +

XX / XX — ROADWAY / RIGHT OF WAY

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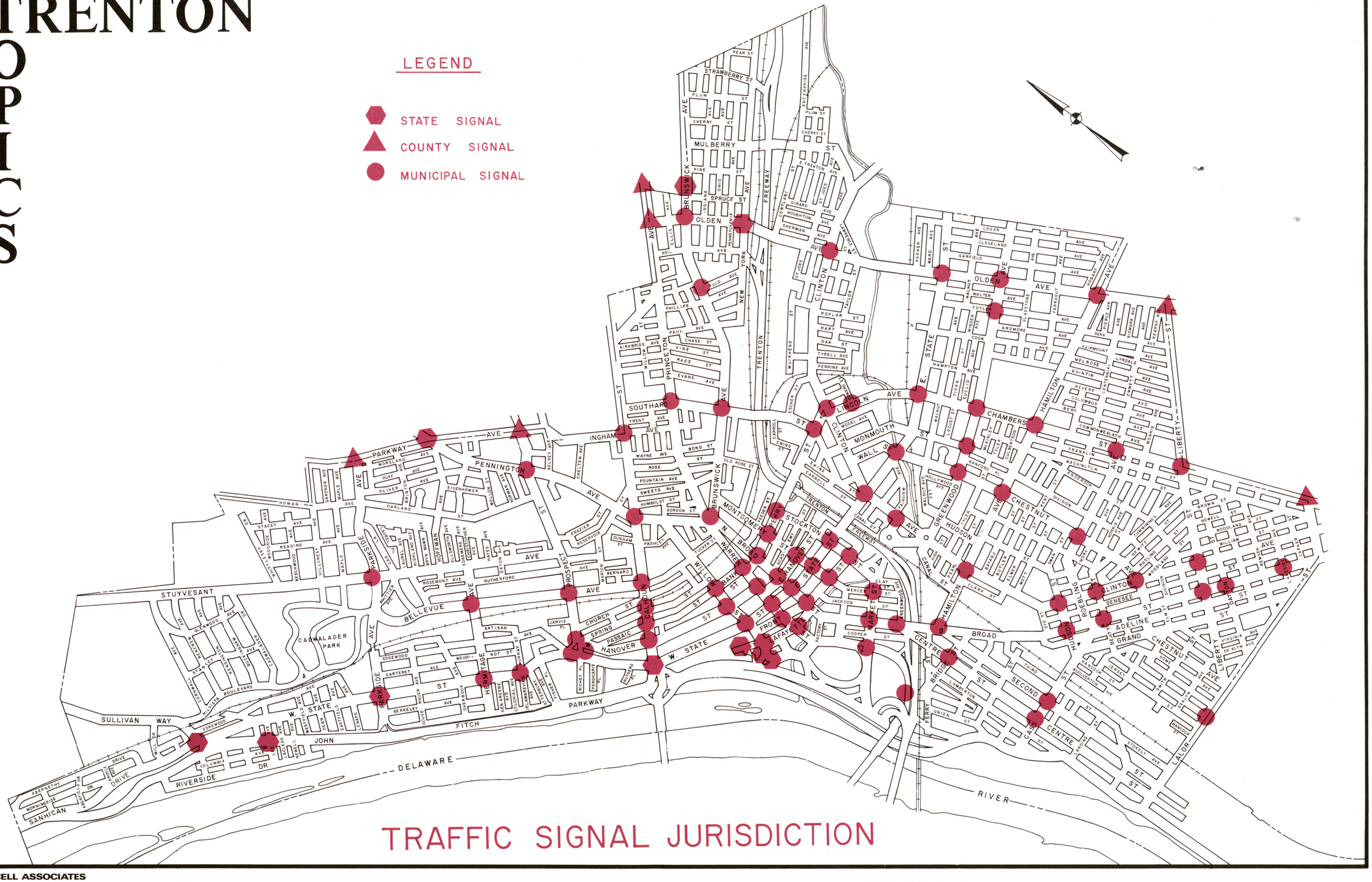
FIGURE II - 2

FIGURE II-3
TRAFFIC SIGNAL JURISDICTION

TRENTON TOPICS

LEGEND

- STATE SIGNAL
- COUNTY SIGNAL
- MUNICIPAL SIGNAL



TRAFFIC SIGNAL JURISDICTION

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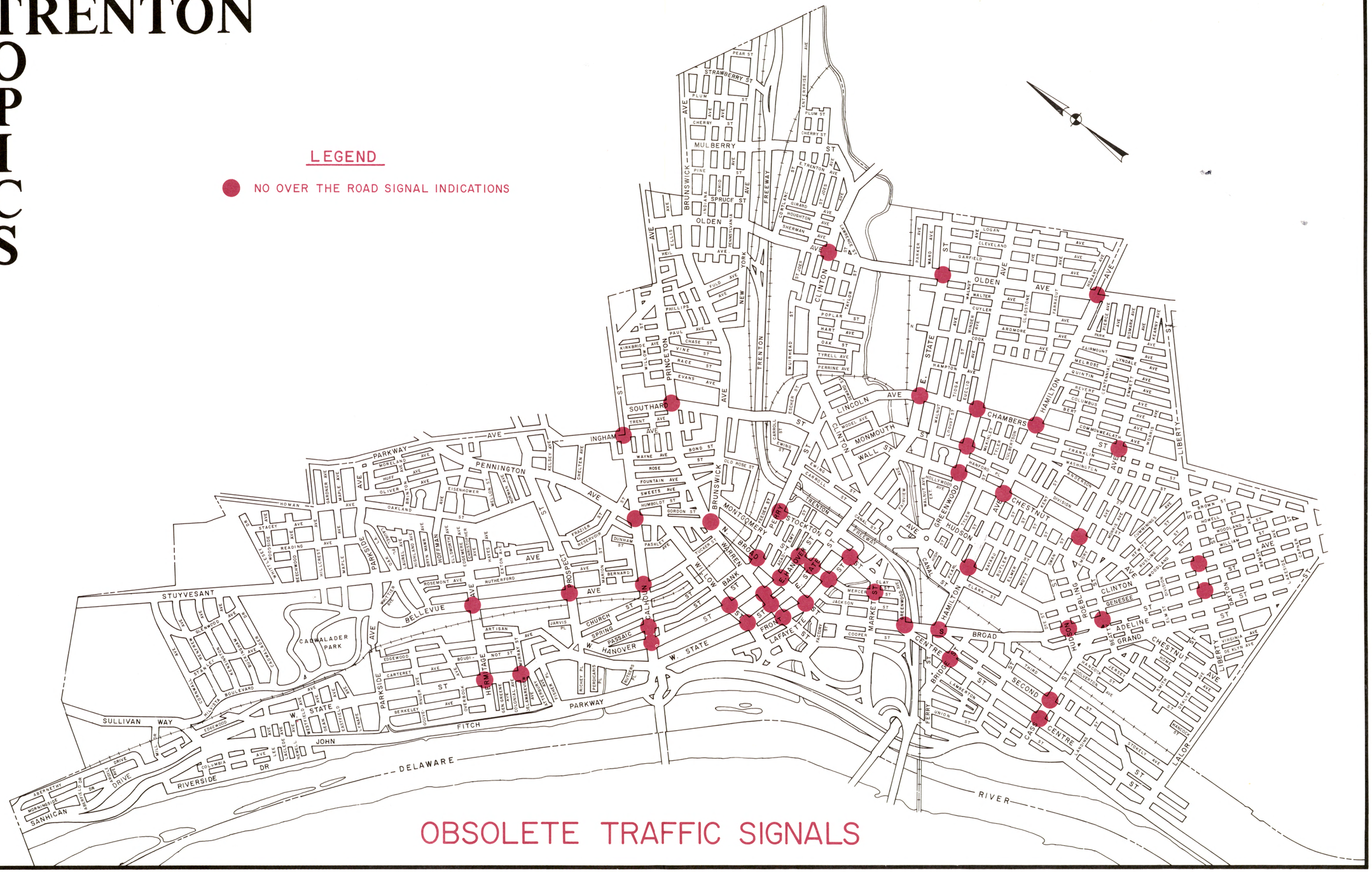
FIGURE II - 3

FIGURE II-4
OBSOLETE TRAFFIC SIGNALS

TRENTON TOPICS

LEGEND

● NO OVER THE ROAD SIGNAL INDICATIONS



OBSOLETE TRAFFIC SIGNALS

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FIGURE II - 4

FIGURE II-5
ONE WAY STREET SYSTEM

OFF-STREET PARKING, CENTRAL BUSINESS DISTRICT

The area of greatest traffic congestion is within the CBD (Central Business District) where the demand for both vehicular circulation and on-street parking is extremely high. In order to minimize the delay to motorists within the CBD, it is necessary to remove some of the on-street parking which exists within the area. However, we must be cognizant of the fact that motorists entering this area to work or shop do require a suitable location in which to park their vehicles. Figure II-6 shows an inventory of all off-street parking within the downtown Trenton area. In addition to this, there are several new facilities planned in conjunction with Planning projects currently underway in Trenton.

TRAFFIC VOLUMES

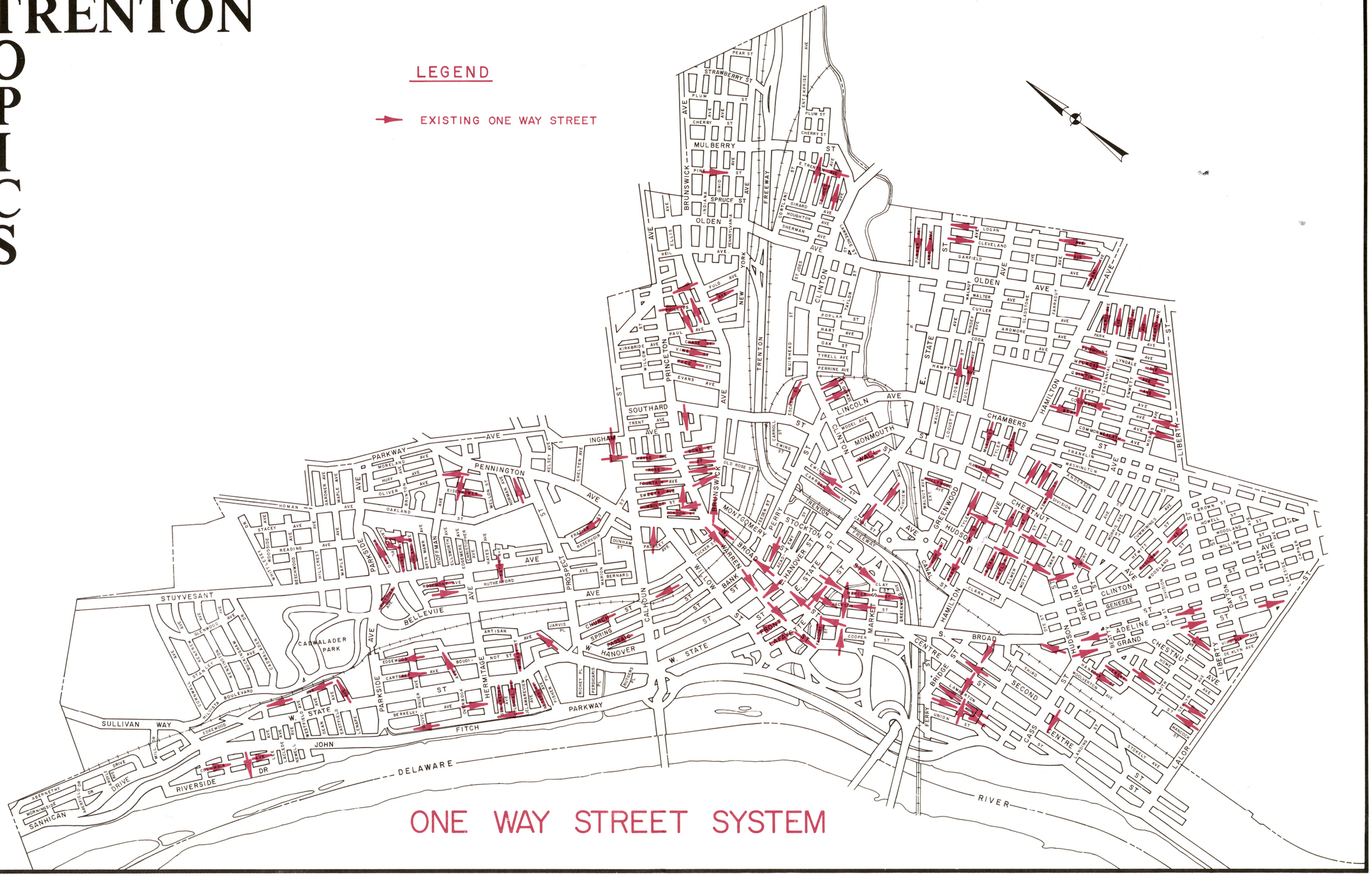
An examination of traffic demand and circulation patterns is necessary to determine the loads placed upon the existing street network. Information with respect to traffic demand was obtained from several sources. Automatic machine counters were placed throughout the study area to supplement 24 hour traffic volume information obtained from the Delaware Valley Regional Planning Commission, the New Jersey Department of Transportation, and the City of Trenton. In addition to these machine counts, intersection turning movement counts were conducted at all signalized intersections during the morning and evening peak hours. This information provides us with data necessary to determine a capacity and a level of service for each intersection. The third type of count classified vehicles into various categories such as passenger car, light truck, heavy truck, and bus. This information is also required to determine the capacity of an intersection as well as determining those areas where truck traffic is particularly heavy creating a potential problem.

Through the collection of this data, and the information provided by the New Jersey Department of Transportation with respect to daily and monthly fluctuations of traffic volumes at various stations, an Average Daily Traffic was calculated for each roadway on the study system. Because of the scarcity of control stations which provide the type of information necessary to determine an ADT, the information must be described as an approximation. However, Figures II-7 and II-8 do provide a good representation of the comparative daily volumes among the various system streets in the CBD and the remainder of the City, respectively.

TRENTON TOPICS

LEGEND

EXISTING ONE WAY STREET



ONE WAY STREET SYSTEM

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FIGURE II - 5

FIGURE II-6
OFF STREET PARKING FACILITIES
CENTRAL BUSINESS DISTRICT

OFF STREET PARKING FACILITIES
CENTRAL BUSINESS DISTRICT

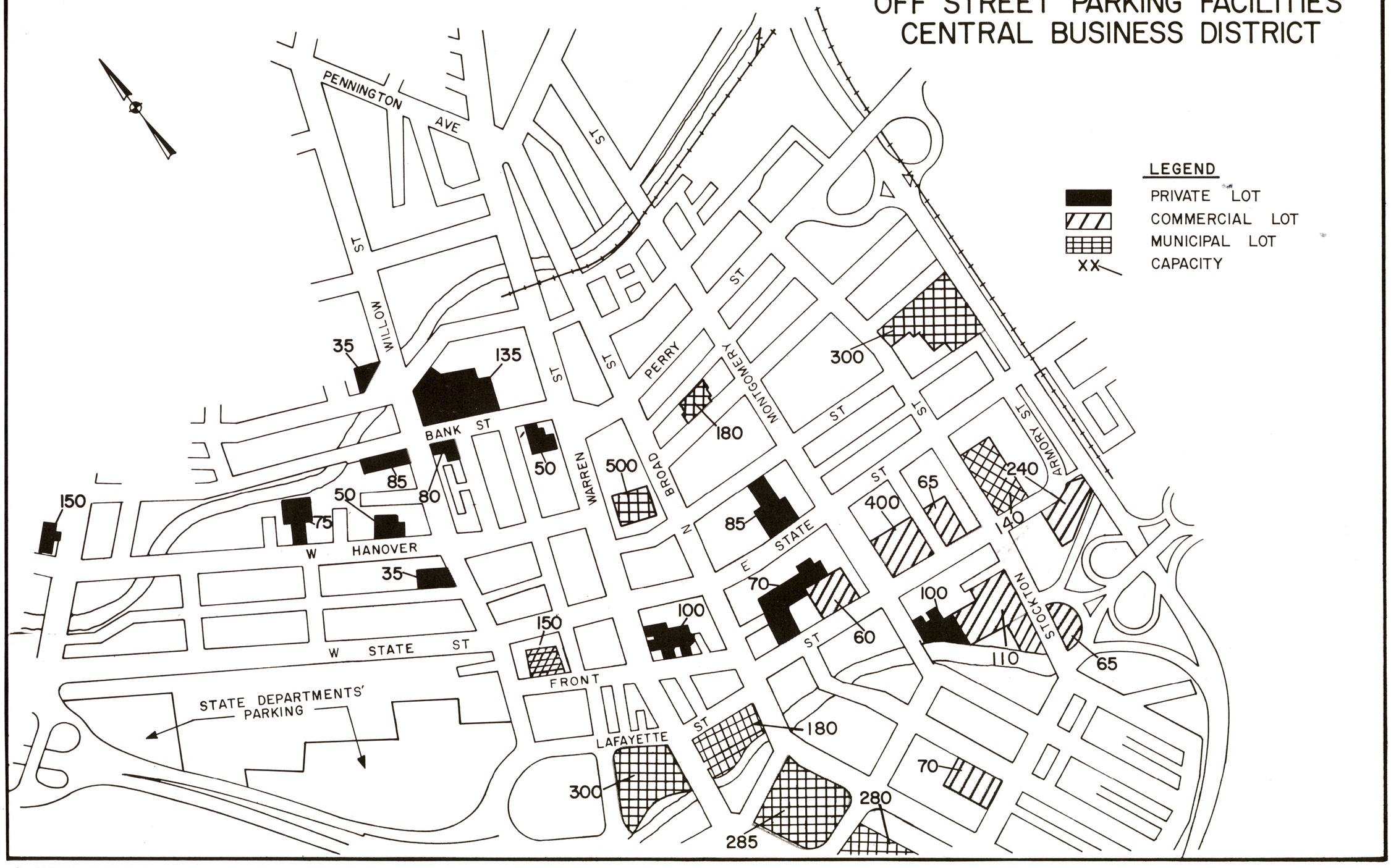

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FIGURE II - 6

FIGURE II-7
1971 AVERAGE DAILY TRAFFIC

TRENTON TOPICS

LEGEND

5,000

10,000

20,000

REFER TO FIGURE II-8

1971 AVERAGE DAILY TRAFFIC

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FIGURE II-7

FIGURE II-8
CENTRAL BUSINESS DISTRICT
1971 AVERAGE DAILY TRAFFIC

1975 - 1980 Projections

While data collection provided us with a good picture of the existing traffic patterns and volumes, it is necessary to determine how well the existing and proposed study system will function within the next five or ten years. To do this, an attempt is made to project traffic volumes for both 1975 and 1980. This projection is accomplished through an examination of past trends with respect to traffic growth within the City of Trenton. Again, information compiled at various permanent counting stations throughout the City was utilized to project a growth or decline of traffic throughout our study system. In conjunction with an analysis of the historic trends of traffic we conducted an evaluation of future plans which may have a decided impact on circulation patterns and traffic volumes. The greatest impact will occur through the extension of Route 29 from its current terminus at Lalor Street, to the south into Hamilton Township. Additionally, the connection between Route 1 and Route 29 also planned for construction within the next 10 years will affect traffic patterns in specific areas of the City. Both of these changes will influence the traffic now using the corridor between Hamilton Township and the CBD in Trenton. This will mean a reduction in traffic on Broad and Clinton Streets as well as some easing of congestion along Market Street between Route 29 and Route 1. Viewing the City as a whole, however, an overall change in traffic is not anticipated and existing traffic volumes should be used to evaluate future needs, with the exception of those areas discussed above.

PUBLIC TRANSPORTATION

In order to properly evaluate and coordinate transportation activities, a comprehensive study of public transit was made. Inventoried items included routes, stations, schedules, and terminal facilities for bus and rail transit.

Mercer Metro is the only local bus company operating within the City of Trenton. Its buses use a network of 10 routes serving every section of the City. Each bus travels major TOPICS system streets and passes through the Central Business District. Designated bus stops are often no longer in use, while buses will stop at intersections with no bus stop designation. Communications between the bus companies and the City's Traffic Division must be improved to eliminate this situation. In the CBD, bus stops, in addition to a large volume of through buses, pose serious problems in relation to automobile and pedestrian traffic. Figures II-9 and II-10 show the existing local bus routes and passenger train facilities throughout Trenton.

CENTRAL BUSINESS DISTRICT

1971 AVERAGE DAILY TRAFFIC

LEGEND

5,000

10,000

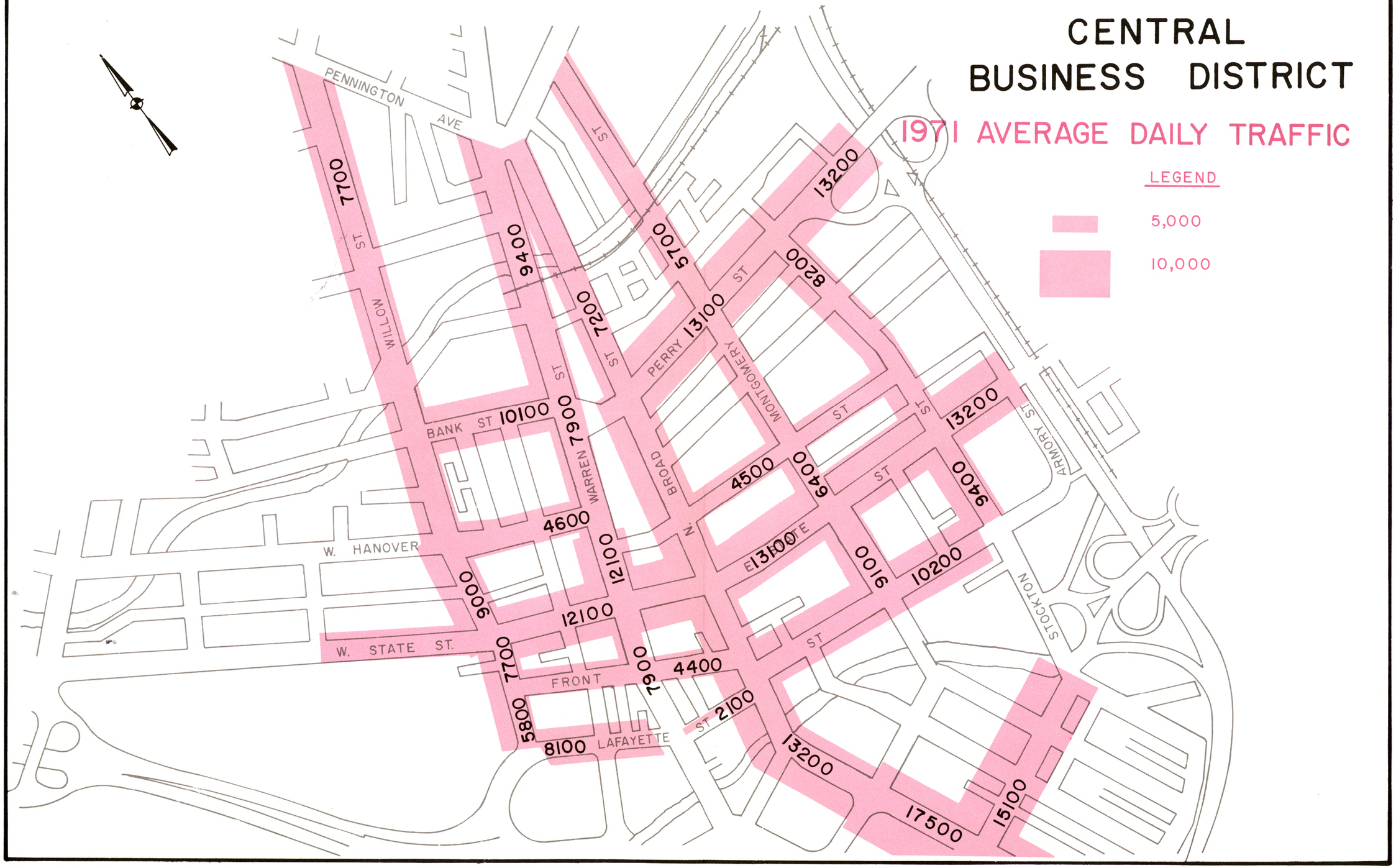

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FIGURE II - 8

FIGURE II-9
PUBLIC TRANSPORTATION

TRENTON TOPICS

LEGEND

- PENN. R.R. STATION
- PENN. R.R. PASSENGER LINE
- MERCER METRO BUS ROUTE
- (X) MERCER METRO BUS ROUTE NUMBER
- BUS TERMINAL



PUBLIC TRANSPORTATION

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FIGURE II-9

FIGURE II-10
CENTRAL BUSINESS DISTRICT
PUBLIC TRANSPORTATION

To satisfy the transportation demands of Trenton's heavy commuter population, eight major bus companies operate 16 routes to cities on the fringes of and outside of Mercer County. Each of these routes includes a stop at the bus terminal in front of the Penn Hotel on Clinton Avenue at Barlow Street. From there, the buses continue south on Clinton Avenue to the Greenwood Circle which gives them access to Routes 1, 29, 33, or 206. Detailed route and schedule information will be found in Appendix A-2.

Across the street from the Penn Hotel is the Penn Central Railroad Station, the only passenger stop in Trenton. Trains leave the City northbound for Princeton, New Brunswick, Newark, and New York, southbound, for Philadelphia and Camden.

Parking lots surrounding the train station and the bus terminal are inadequate. However, additional private parking can be found within walking distance. A far more severe problem is that of access to these lots and to the stations themselves. There exists insufficient "drop off" and "pick up" areas and this deficiency results in delays along streets adjacent to the station. During the hours of greatest demand, 7-8 AM and 5:30-6:30 PM, traffic tie-ups along Clinton Avenue are massive due to stopping and to parking lot traffic. The Greenwood Circle, less than 400' south of the railroad station, experiences more than the usual congestion during these hours. A narrow two-lane bridge on Clinton Avenue between the circle and the station adds to the delay, particularly because it serves as a major truck and bus route.

TRUCK ROUTES

Within the City of Trenton, there are several industrial and commercial areas served by trucks as well as by a number of freight rail lines. To reach these sections and the highly industrialized region southeast of the city, trucks are using TOPICS System arterials such as Brunswick Avenue, Calhoun Street, Clinton Avenue, Olden Avenue, and Princeton Avenue. These streets connect to U.S. Route 1, a principal truck route which curves through the City parallel to the railroad line from the Brunswick Circle to the Delaware River. These roads and the regions they serve are represented in Figure II-11. Streets such as Second Street, Center Street, and Broad Street serve the south end of the City and lead to the Central Business District.

The high volumes of trucks, especially multi-axled trucks, have a generally harmful effect on automobile traffic. Delays are caused by the often slow-moving vehicles,

CENTRAL BUSINESS DISTRICT

PUBLIC TRANSPORTATION

LEGEND

——— LOCAL BUS ROUTES

(X) MERCER METRO BUS LINES

PENNINGTON AVE
WILLOW ST
BANK ST
W. HANOVER
W. STATE ST.
FRONT
LAFAYETTE ST
WARREN ST
BROAD ST
PERRY ST
MONTGOMERY ST
N. ST
E. STATE ST
ARMORY ST
STOCKTON ST

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FIGURE II - 10

FIGURE II-11
TRUCK ROUTES

particularly when a truck is maneuvering a right turn around a tight corner or waiting on a narrow street to make a left turn. Tight corners and narrow streets being the rule in Trenton, heavy trucks are a serious traffic problem. Numerous old, narrow bridges across railroad tracks and the Assumpink Creek hinder truck movement to an even greater extent than automobile flow.

Trucks further cause delay when stopping to make a delivery. This is a severe problem in the CBD, along N. Broad Street north of State Street and along State Street where, despite No Stopping or Standing regulations, trucks pull over to load or unload. The numerous designated loading zones are usually already engaged and trucks often double park on N. Broad Street obstructing traffic flow throughout most of the day.

SNOW REMOVAL

The City maintains 35 plows, four jeeps, and five trucks for use in snow storms. Snow plows are employed only for three inches or more of snow; for less than three inches, streets are only salted. In the case of 10 inches or more, a private contractor is called in to aid in snow removal. There are three snow dumps: One north of Fitch Parkway near the Labor and Industry Building, another at Monmouth Park, and a third in the Coalport area near Escher and Herman Streets.

Municipal equipment is ready for use within 30 minutes of notification. The first areas to be treated are the main streets in the Central Business District and the few hilly areas within the City. A high priority is given to the sidewalks and streets around schools.

The only opportunity during the study to observe the snow removal process in operation was a small snow storm in January of 1971. At this time, techniques proved to be fairly efficient. Roads for which the State had snow removal responsibility were excellently maintained; County roads were poorly plowed. Of course, a true test of snow removal procedures would come with a heavier snow fall.

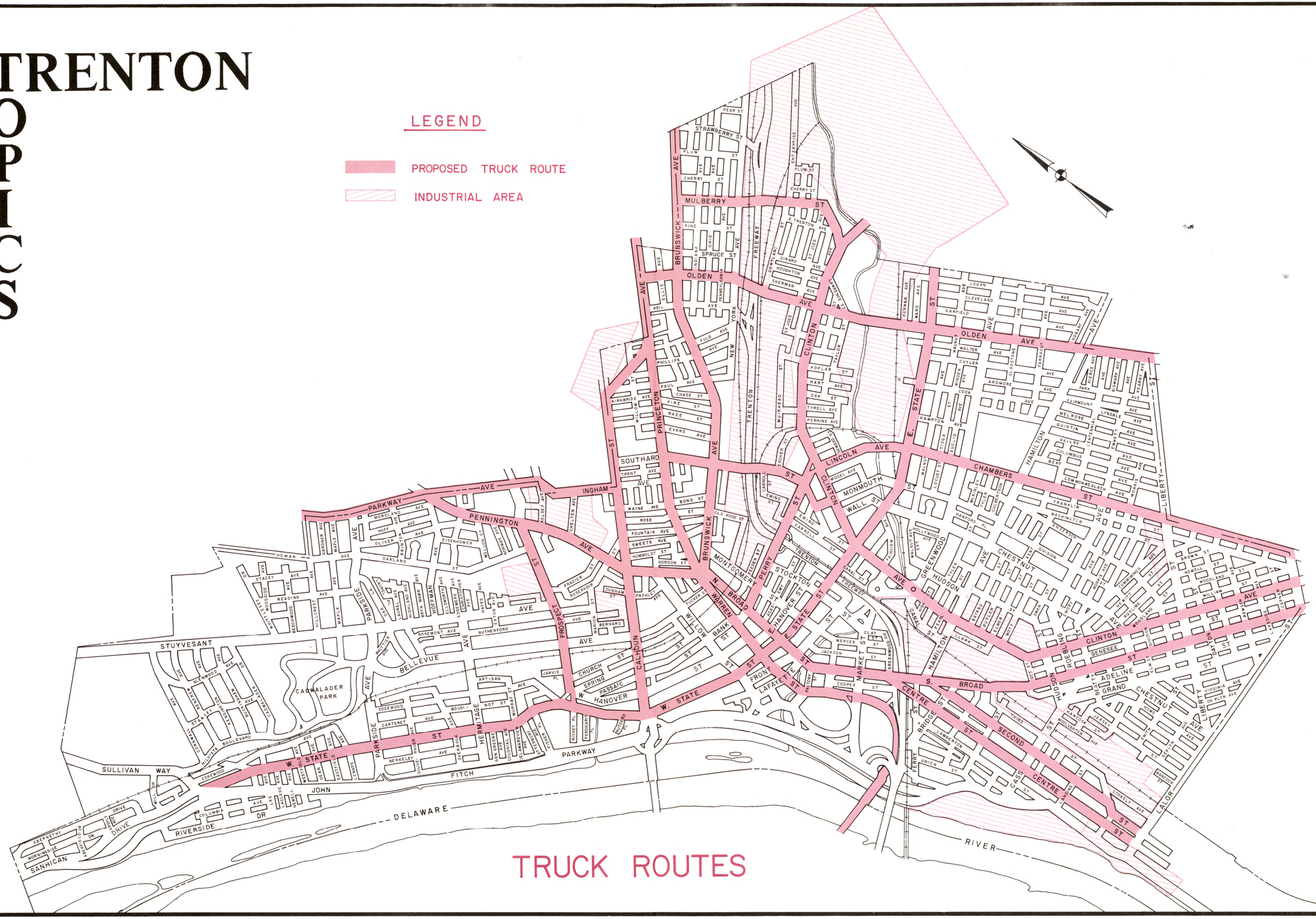
The City has established and signed snow emergency routes where parking is banned during a snowfall to facilitate plowing and salting. Figure II-12 shows the existing snow removal routes throughout the City.

TRENTON TOPICS

LEGEND

PROPOSED TRUCK ROUTE

INDUSTRIAL AREA



TRUCK ROUTES

FIGURE II - 11

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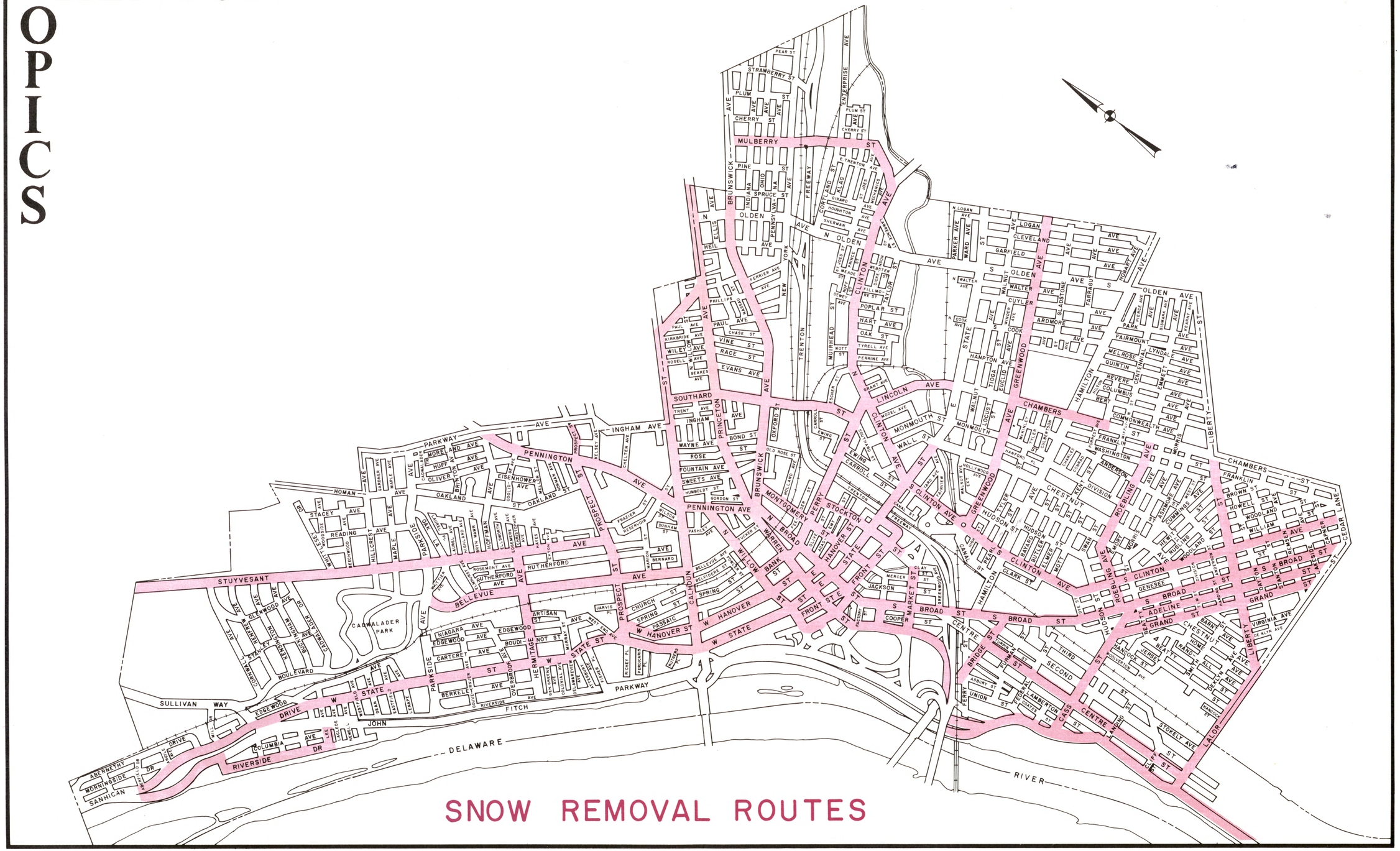
FIGURE II-12
SNOW REMOVAL ROUTES

TRENTON TOPICS



SNOW REMOVAL ROUTES

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FIGURE II-12

CHAPTER III

DETERMINATION OF DEFICIENCIES

The establishment of a TOPICS Improvement Program requires a systematic determination of the location and severity of problem areas throughout the City. Only through this procedure can meaningful recommendations with appropriate priorities be established. The identification of deficiencies within the study network was accomplished in four different ways. These include capacity analysis, speed and delay surveys, accident analysis, and interviews with local officials.

CAPACITY DEFICIENCIES

Capacity Analysis is a procedure intended to provide some measure of the operating characteristics of highway and street facilities. In a study confined to an urban area, the most important capacity consideration relates to signalized intersections. How well an intersection functions is defined in terms of a level of service. These levels of service range from a free flow condition Level A, to an unstable, congested, forced flow condition of Level F. Levels of service are based upon the load factor of a particular approach to an intersection.

Load factor represents the ratio of green phases that are fully utilized by traffic to the total number of green phases available for that approach during the same period. (Usually the peak hour.)

Level of Service	Traffic Flow	Load Factor
A	Free flow	0.0
B	Stable flow	$\leq$ 0.1
C	Stable flow	.1 - .3
D	Approaching unstable flow	.3 - .7
E	Unstable flow	.7 - 1.0
F	Forced flow	-

The parameters which serve as an input to the capacity analysis basically reflect all the physical characteristics of the intersection as inventoried in Chapter II. Therefore, through an evaluation of roadway width, division of signal green time, lane designations, traffic volumes including turning movements, commercial vehicle

composition, and bus stop location, a theoretical operating level of service can be determined for each approach to an intersection. All intersections which exhibited a level of service less than C on one or more approach were considered deficient and were studied further to determine appropriate remedial action. The parameters used to determine capacity represent actual operating conditions. Therefore, an approach to an intersection may have an existing no parking regulation; if this regulation is not enforced, however, the approach is treated as if parking were permitted for purposes of this analysis. Figure III-1 shows all locations where capacity falls below level of service C.

SPEED AND DELAY SURVEYS

Speed and delay data provides information reflecting the mobility of vehicles travelling along our study network as well as locations and causes of serious delay and congestion. This study serves to complement capacity analysis which is basically an analytical tool. The information collected directly relates to the operating conditions of our study system. Test runs were taken in each direction for the morning and evening rush hours as well as the off peak period. An analysis of the data collected provides us with information with respect to average running speed along our study network as well as specific locations where delays were excessive. Figure III-2 and 3 shows a composite for all three periods of the day for the worst average running speeds along the study network. In addition, delays of 45 seconds or more are shown for all locations where they occur. This illustration depicts the worst condition at anytime during the day and provides us with a means of substantiating our capacity analysis. Running speeds of less than 20 mph and delays in excess of 45 seconds were regarded as mobility deficiencies.

SAFETY DEFICIENCIES

The safe movement of vehicles and pedestrians is as important as the uninterrupted flow of traffic through the City. Consequently, a key component of the comprehensive traffic study and a major step in the delineation of deficiencies was the collection and summarization of accident information.

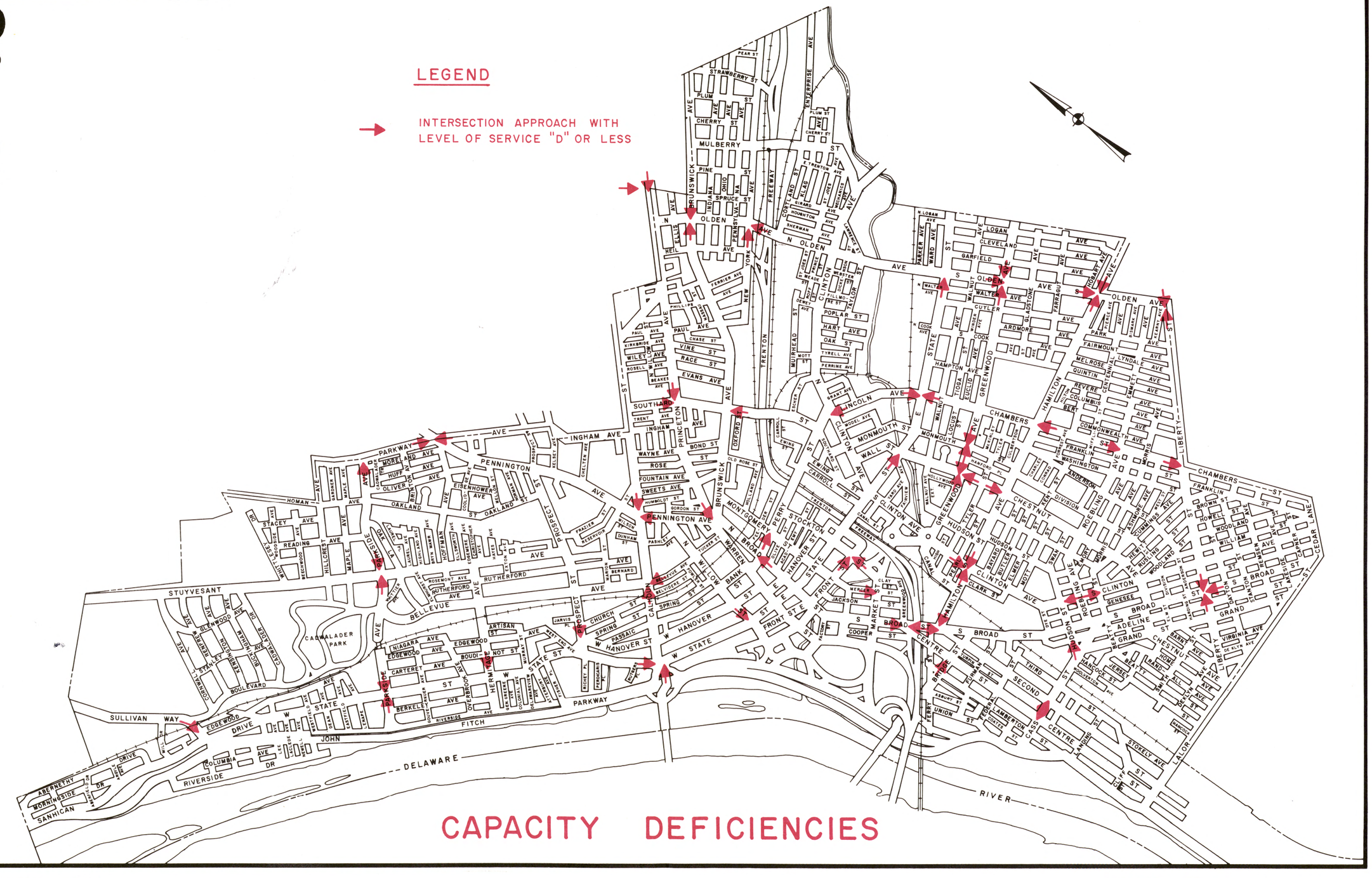
While public attention is often directed at areas which exhibit excessive congestion and delay the impact of traffic accidents upon the public is often greater. On a national basis, it is disconcerting when one realizes that more Americans have died in traffic accidents in the United States than in all the wars ever engaged in from the time of the American Revolution. In the City of Trenton, accidents are an especially serious problem.

FIGURE III-1
CAPACITY DEFICIENCIES

TRENTON TOPICS

LEGEND

INTERSECTION APPROACH WITH LEVEL OF SERVICE "D" OR LESS



CAPACITY DEFICIENCIES

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FIGURE III - 1

FIGURE III-2
1970 SPEED AND DELAY

TRENTON TOPICS

LEGEND

— RUNNING SPEEDS —

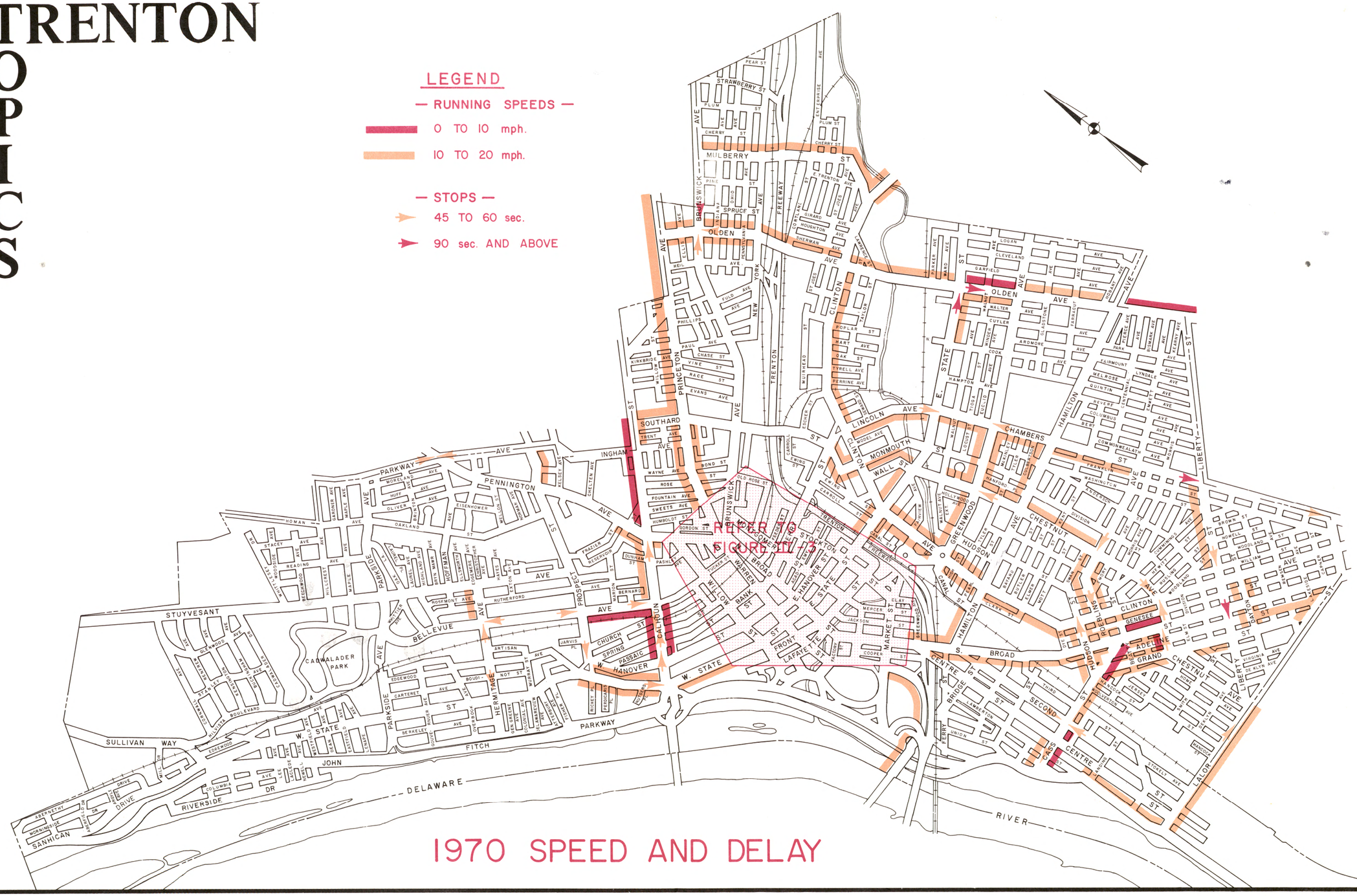
0 TO 10 mph.

10 TO 20 mph.

— STOPS —

45 TO 60 sec.

90 sec. AND ABOVE



1970 SPEED AND DELAY

PURCELL ASSOCIATES
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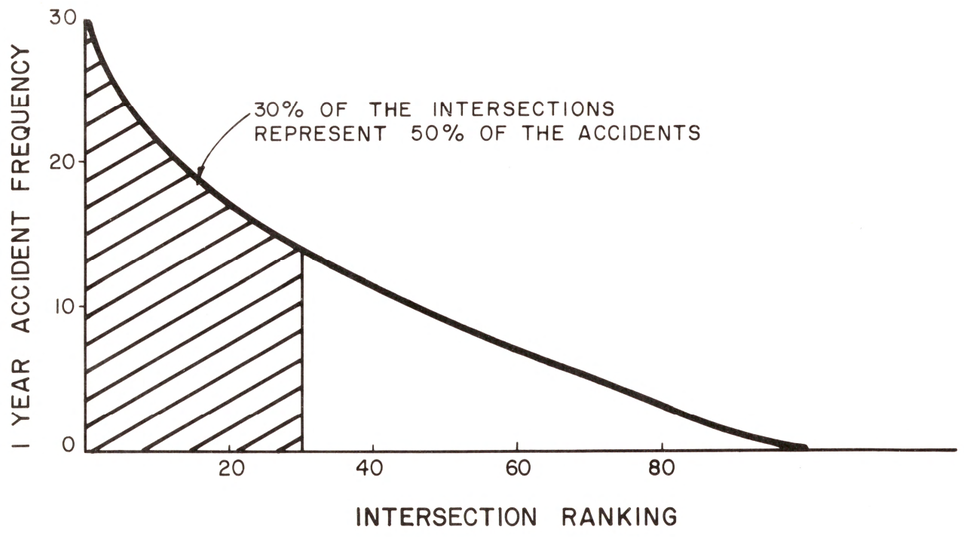
FIGURE III-2

FIGURE III-3
CENTRAL BUSINESS DISTRICT
1970 SPEED AND DELAY

Data was collected from the City's records relating to all accidents which had occurred between September 1969 and August 1970 on the TOPICS Study System. Furthermore, for those areas which were found to exhibit high accident occurrence, an additional three years of analysis was provided. The data was summarized for each location that experienced five or more accidents in the one year period (see Appendix A-3). Figure III-4 is a graphical presentation of the accident frequency.

When accident frequency at signalized intersections are plotted in descending order, the result is a distribution curve as shown below.

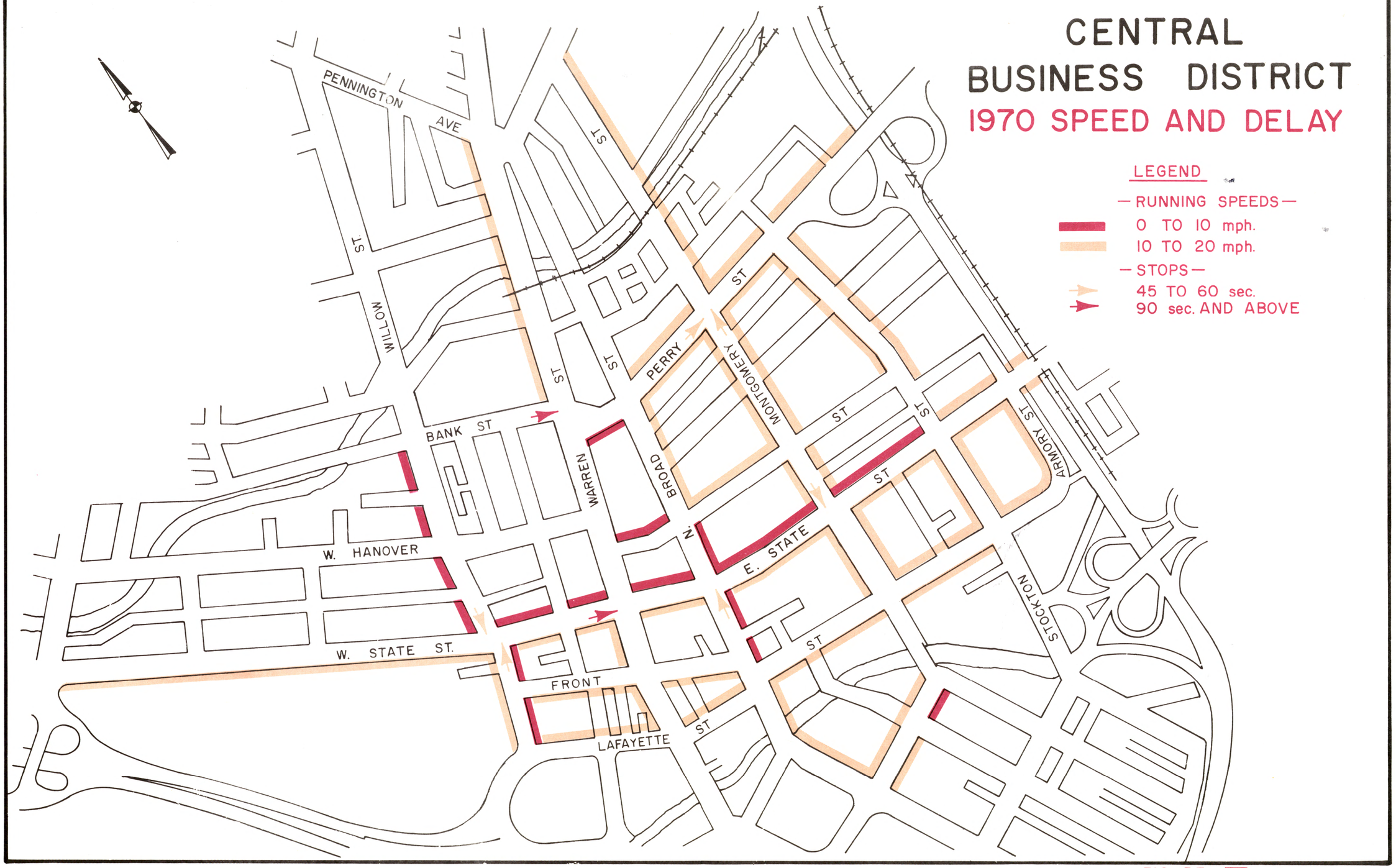


SIGNALIZED INTERSECTIONS

Noting that 50% of the accidents at signalized intersections occurred at 30% of the intersections, this group was used as a cutoff point and a study made of each location listed in Table III-1.

Since the number of accidents at a given location is a function of the traffic volumes, accident frequency alone cannot be used as the sole measure of safety deficiencies. Therefore, using average daily traffic volumes developed previously, accident rates based

CENTRAL BUSINESS DISTRICT
1970 SPEED AND DELAY



LEGEND

— RUNNING SPEEDS —

0 TO 10 mph.

10 TO 20 mph.

— STOPS —

45 TO 60 sec.

90 sec. AND ABOVE

PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

FIGURE III - 3

upon each ten million vehicle occurrences were developed. This analysis enables us to compare two intersections with respect to safety deficiencies. These comparisons are important in ordering priorities for intersection recommendations.

An examination of accident rates reveals 29 locations with 20 or more accidents per 10 million vehicle occurrences. This will be utilized as another criteria for safety deficiency. Table III-2 shows a listing of intersections ranked in descending order of accident rates. Those locations which did not appear in Table III-1 but have rates of 20 or more accidents are marked with an asterisk.

In addition to the signalized intersections described above, we studied non-signalized intersections with an accident frequency of more than 10 in the past year. These locations are listed in Table III-3.

Midblock segments were also examined for accident frequency and the results used in establishing our detailed recommendations.

Accident information for all intersections can be found in Appendix A-3.

LOCAL INPUT

While extensive studies were conducted to identify problem areas throughout the City, the information gathered cannot replace years of experience provided by local officials involved in traffic safety and operations. Through the cooperation of the City's Engineering, Planning, and Police Departments, we were made aware of problem locations within the community which might not have been revealed through a typical engineering study. Additionally, local representatives provided information with respect to future land use changes which would have a decided affect upon traffic patterns.

Developments creating the greatest impact include the Urban Renewal area west of State Street, the Trent Place Project, the Kingsbury Project, and the Trenton Commons Project which proposes to close State Street to traffic for several blocks in the heart of the Central Business District.

Recommendations outlined in Chapter V have been formulated within the framework of these and other projects scheduled for the near future.

A summary of deficiencies throughout the TOPICS Network is shown in Figure III-5.

TABLE III-1

HIGH ACCIDENT FREQUENCY LOCATIONS
(Signalized)

Ranking	Location	Accidents 1 Yr. Period
1	N. Broad Street, Greenwood Avenue, and Centre Street	31
2	State Street and Warren Street	30
3	S. Broad Street and Liberty Street	25
4	Warren Street, Pennington Avenue, Princeton Avenue, and N. Broad Street	25
5	Brunswick Avenue and Olden Avenue	24
6	Clinton Avenue and State Street	23
7	Brunswick Avenue and Southard Street	22
8	Chambers Street and Greenwood Avenue	22
9	S. Broad Street and Market Street	21
10	Montgomery Street and State Street	21
11	Clinton Avenue, Barlow Street, and Fairview Avenue	20
12	Parkside Avenue and State Street	20
13	Bellevue Avenue and Prospect Street	19
14	S. Broad Street, Hamilton Avenue, and Second Street	19
15	Princeton Avenue and Southard Street	19
16	Calhoun Street and State Street	18
17	Olden Avenue and State Street	18

TABLE III-1 (continued)

Ranking	Location	Accidents 1 Yr. Period
18	Pennington Avenue and Prospect Street	18
19	Chambers Street, Lincoln Avenue, and State Street	17
20	Clinton Avenue, Lincoln Avenue, and Perry Street	17
21	Bellevue Avenue and Calhoun Street	16
22	Clinton Avenue and Hamilton Avenue	16
23	Front Street, Armory Drive, and Stockton Street	16
24	Chambers Street and Hamilton Avenue	15
25	Clinton Avenue and Olden Avenue	15
26	Greenwood Avenue and Olden Avenue	15
27	Olden Avenue and New York Avenue	15
28	Perry Street and Stockton Street	15

FIGURE III-4
ACCIDENT FREQUENCY

TRENTON TOPICS

LEGEND

ACCIDENTS OCCURRING FROM SEPT, 1969 TO AUGUST, 1970

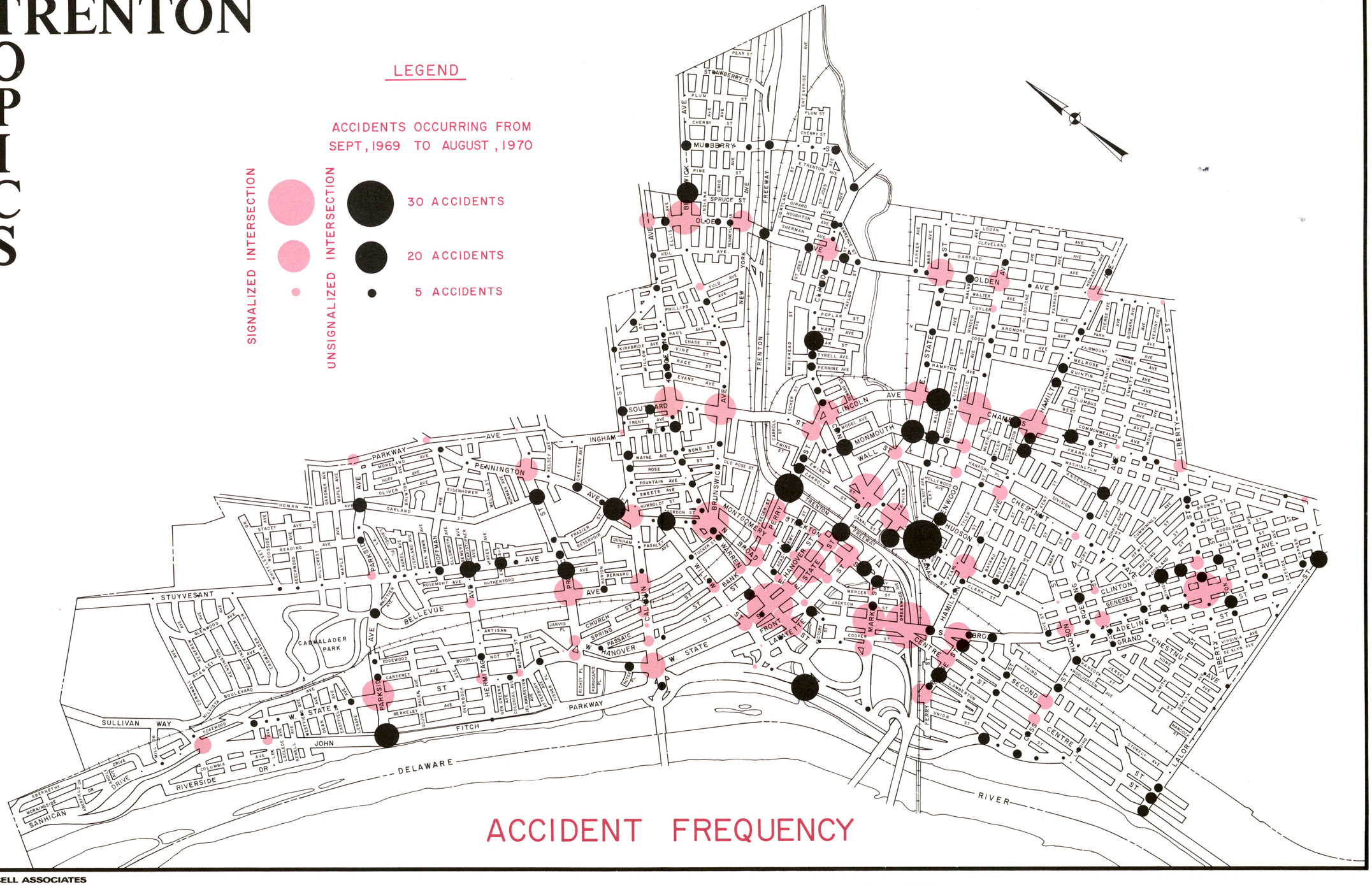
SIGNALIZED INTERSECTION

UNSIGNALIZED INTERSECTION

30 ACCIDENTS

20 ACCIDENTS

5 ACCIDENTS



ACCIDENT FREQUENCY

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FIGURE III-4

FIGURE III-5
OPERATIONAL DEFICIENCIES

TABLE III-2

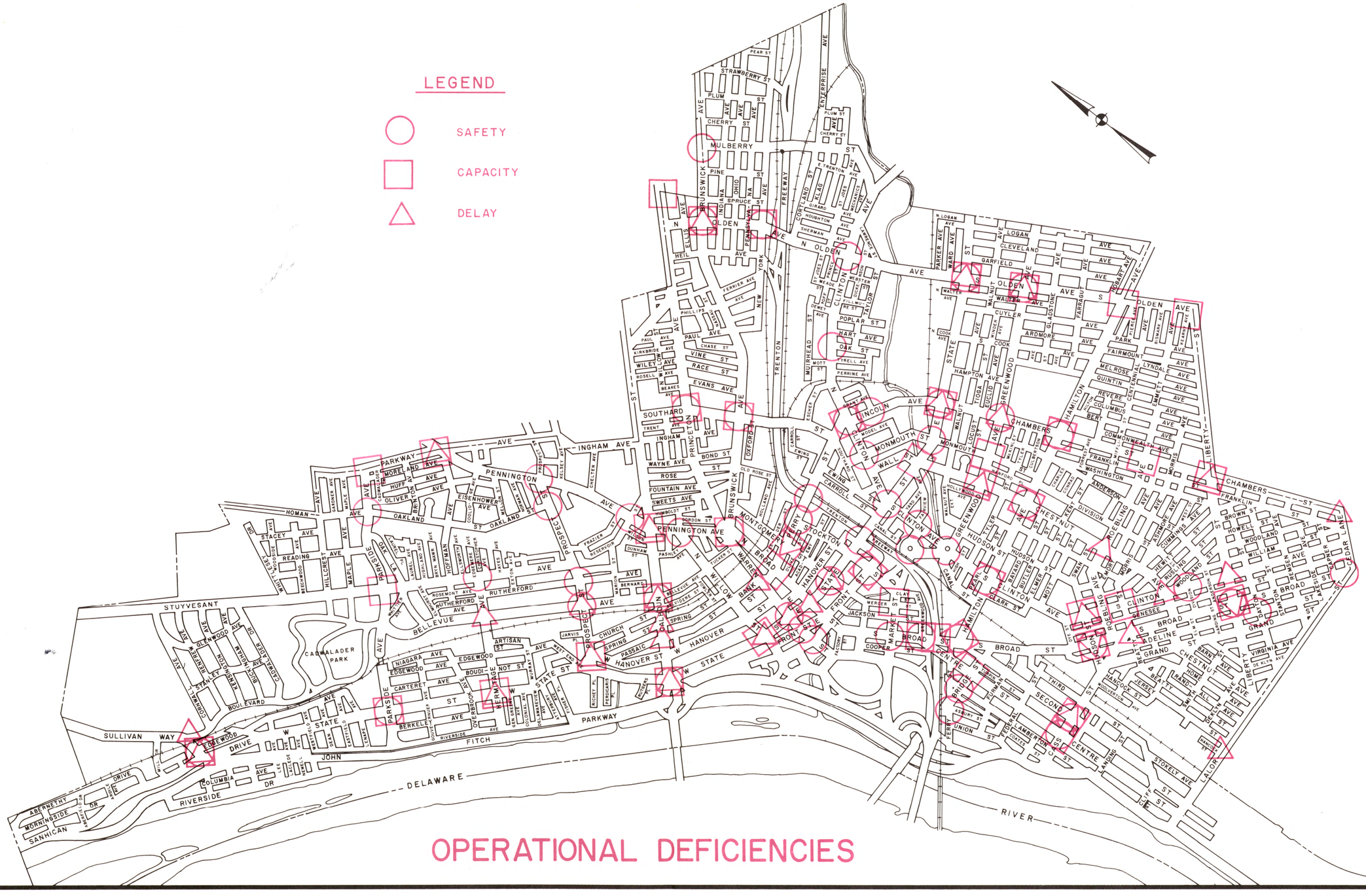
ACCIDENT RATES
Per 10,000,000 Vehicle Occurrences
(Signalized)

Ranking	Location	Rate
1	S. Broad Street, Greenwood Avenue, and Centre Street	48
2	Warren Street, Pennington Avenue, N. Broad Street, and Princeton Avenue	39
3	Cass Street and Second Street	38
4	S. Broad Street and Liberty Street	36
5	State Street and Warren Street	34
6	Brunswick Avenue and Southard Street	30
7	Clinton Avenue and State Street	28
8	Montgomery Street and State Street	28
9	Bellevue Avenue and Prospect Street	28
*10	Lafayette Street and Warren Street	28
11	Bellevue Avenue and Calhoun Street	27
12	S. Broad Street, Hamilton Avenue, and Second Street	26
13	Princeton Avenue and Southard Street	26
14	Perry Street and Stockton Street	24
15	Calhoun Street and State Street	23
16	Stockton Street, Front Street, and Armory Drive	23

TRENTON TOPICS

LEGEND

- SAFETY
- CAPACITY
- DELAY



OPERATIONAL DEFICIENCIES

PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

FIGURE III-5

TABLE III-2 (continued)

Ranking	Location	Rate
17	Chambers Street and Greenwood Avenue	23
*18	Cass Street and Centre Street	22
*19	S. Broad Street and Hudson Street	22
*20	Sanhican Drive and Sullivan Way	21
21	Brunswick Avenue and Olden Avenue	21
22	Bridge Street and Centre Street	20
23	Clinton Avenue, Lincoln Avenue, and Perry Street	20
24	Clinton Avenue and Hamilton Avenue	20
*25	Front Street and Warren Street	20
26	Parkside Avenue and State Street	20
27	Pennington Avenue and Prospect Street	20
*28	Chestnut Avenue and Hamilton Avenue	20
29	S. Broad Street and Market Street	20
30	Clinton Avenue, Barlow Street, and Fairview Avenue	20

TABLE III-3

HIGH ACCIDENT FREQUENCY LOCATIONS
(Non-Signalized)

Rank	Location	Accidents 1 Yr. Period
1	Greenwood Circle	24
2	Perry Street and Trenton Freeway	19
3	Pennington Avenue and Reservoir Street	16
4	Clinton Avenue and Oak Street	15
5	Bridge Street and Union Street	14
6	State Street and Monmouth Street	14
7	Canal Street, State Street, and Armory Drive	13
8	Barlow Street Circle	12
9	S. Broad Street, Cedar Lane, and Lalor Street	12
10	Hermitage Avenue and Stuyvesant Avenue	12
11	Bridge Street and Lamberton Street	11
12	Clinton Avenue and Monmouth Street	11
13	Parkside Avenue, Homan Avenue, and Oakland Street	11
14	Pennington Avenue and Willow Street	11
15	Prospect Street and Oakland Street	11
16	Prospect Street and Rutherford Street	11
17	Brunswick Avenue and Mulberry Street	11
18	Clinton Avenue and Division Street	10
19	Lincoln Avenue and Seward Avenue	10
20	Adeline Street and Dayton Street	9

CHAPTER IV

DESIGN CRITERIA

In order to eliminate the deficiencies described in the previous chapter, a variety of alternate treatments were considered. The goal for each improvement is to eliminate the deficiencies which it was designed to correct, with a minimum expenditure of funds. In order to utilize the full potential of the existing street network, emphasis is placed not only on physical improvements which can often increase capacity and safety for the road user, but operational improvements as well. Changes in parking regulations, lane markings, and signal operation may often serve to eliminate an existing deficiency without requiring major physical changes such as roadway widenings. Although a specific recommendation may be designed to correct a certain deficiency, it is not uncommon for it to improve other aspects of traffic operation as well. Improving the capacity of an intersection will surely reduce the delay incurred by motorists and often will reduce the number of accidents which might occur at this location. This chapter is intended to describe the various physical and operational improvements which can be and are applied to eliminate the deficiencies throughout our study network. It also provides an insight into the basic design criteria and philosophy which is expressed throughout the recommendations.

TRAFFIC SIGNALS

The most dominant single factor in controlling traffic on City streets is the traffic signal. It is essential, therefore, to determine which improvements can be made to increase the capacity and safety of a signal controlled intersection. The signal system within the City of Trenton is a product of the post-war era and consequently, many signals are 30 or more years old. While this equipment was sufficient to meet the needs of its time, it is no longer adequate to accommodate the demands of today's traffic.

Traffic is composed of all varieties of vehicles, varying in function, size, and operating characteristics. In order for intersections to operate at peak efficiency and safety, traffic controls must be modern and efficient requiring signal indications to be in the driver's line of vision and unobstructed by large vehicles. The modernization of an existing traffic signal often includes both controller and visibility improvements. By placing signal heads on mastarms, it is possible to locate them over the lanes of travel placing these indications in the line of sight of the driver. A minimum of

two indications shall be provided for each approach. Before and after studies, conducted for a modernization program in the City of Detroit, concluded that a signal visibility modernization program, which was primarily the installation of over-the-road indications, resulted in an overall decrease in accidents of 47%.[1]

Existing single dial fixed time controllers provide no flexibility to deal with fluctuations in traffic demand. Within the City of Trenton a changeover to three-dial controllers would provide a more efficient signal operation both on an isolated intersection and on a system basis. Variations in demand between the two intersecting streets could be accommodated by providing three separate green time distributions for different times of the day. Arterial delay could be reduced by providing signal progressions favoring the heavier direction of flow at different times of the day.

Signal Systems

A great deal of effort is being expended to improve the various signal control schemes and techniques available to the traffic engineer. However, regardless of the refinement which may be attained in control theories, their effectiveness can only be as great as the equipment will permit. Signalized intersections, when located in close proximity to one another cannot be treated individually. In order to reduce the delay on an arterial, traffic signals must be timed to permit continuous flow of a vehicle platoon at a specific speed. To provide progression between signals on an arterial, a constant time relationship must be maintained between adjacent signals. While this can be accomplished with signals which are not physically interconnected, such an arrangement is subject to fluctuations of electric power and mechanical variations, with constant patrol required to insure continuous coordination. This problem can be overcome by physically interconnecting the signals with wire pairs, leased telephone lines, or radio control. Pulses from a master controller or common cycle generator transmitted to local controllers maintain a constant time relationship among the signals within the system.

The main thrust of our improvement program will be aimed at improving and modernizing the existing traffic signal network. By doing so we can achieve a reduction in accidents, increase in capacity, and reduction in arterial delay.

ONE WAY STREETS

In the past when the flow of traffic was lighter, the conventional two way arterial was sufficient to accommodate traffic circulation within and around the Central

[1] *Special HRB Report 93*

Business Districts. However, the increased vehicular load which these roadways are forced to carry coupled with the rather narrow right-of-ways which are a result of the early establishment of a City like Trenton, creates a situation of severe congestion under peak conditions. To improve the efficiency and level of service of many roadways a recommendation for one way streets is presented.

Advantages:

1. One-way streets organize traffic for improved operation and circulation.
2. Eliminates left turn conflicts inherent in two-way operation.
3. Utilizes the width of the street more efficiently.
4. Safety is improved by reducing the number of conflicts between streams of traffic, eliminating the problem of head-on collisions, increasing the safety to pedestrians crossing the roadway, and improving nighttime safety because of the elimination of on-coming traffic headlight glare.
5. Parking spaces and curb access on both sides of the roadway are open to all motorists.

While businessmen often fear that a one-way operation will have an adverse effect on their business, this has been proven time and again to be false. In fact, once the motorist has become experienced with the one-way system, the businesses in the area will actually benefit from the increased mobility and safety developed by this type of operation. It can be stated that the unidirectional flow greatly improves the operational characteristics for a roadway system, reducing delays and travel time as well as cutting down the number of accidents. The most efficient type of operation is one in which a reasonably constant and uniform speed can be maintained by motorists. While in some cases, two-way streets can provide this smooth flow, it is dependent largely on the proper spacing of traffic signals. However, the operation of a one-way arterial does not depend on spacing and this smooth progression of traffic can be achieved with maximum efficiency. One-way operation for major arterials is often the best alternative for increasing the capacity of a roadway. In lieu of this type of operation, it is often necessary to remove parking to achieve the same efficiency.

It should be clear that one-way operations can be successful only in areas where traffic can move in both directions conveniently. Ideally a closely spaced pair of parallel streets serve best as a one-way couple. One-way streets also make it necessary for some motorists to travel greater distances to reach their destinations.

TRAFFIC SIGNS

Traffic signs provide one of the least costly and most effective means of reducing accidents. They serve to warn the motorist of potential danger, guide him to his destination, or regulate his movements along a roadway. For signing to be effective it must be consistent with respect to design and placement, meeting specific warrants or conditions for installation. Enforcement must be maintained to establish respect for regulatory signing. All regulations must be approved by the New Jersey Department of Transportation for them to be enforced under the law.

The designs and warrants for all signs shall be in compliance with the 1971 edition of the Manual on Uniform Traffic Control Devices.

PAVEMENT MARKINGS

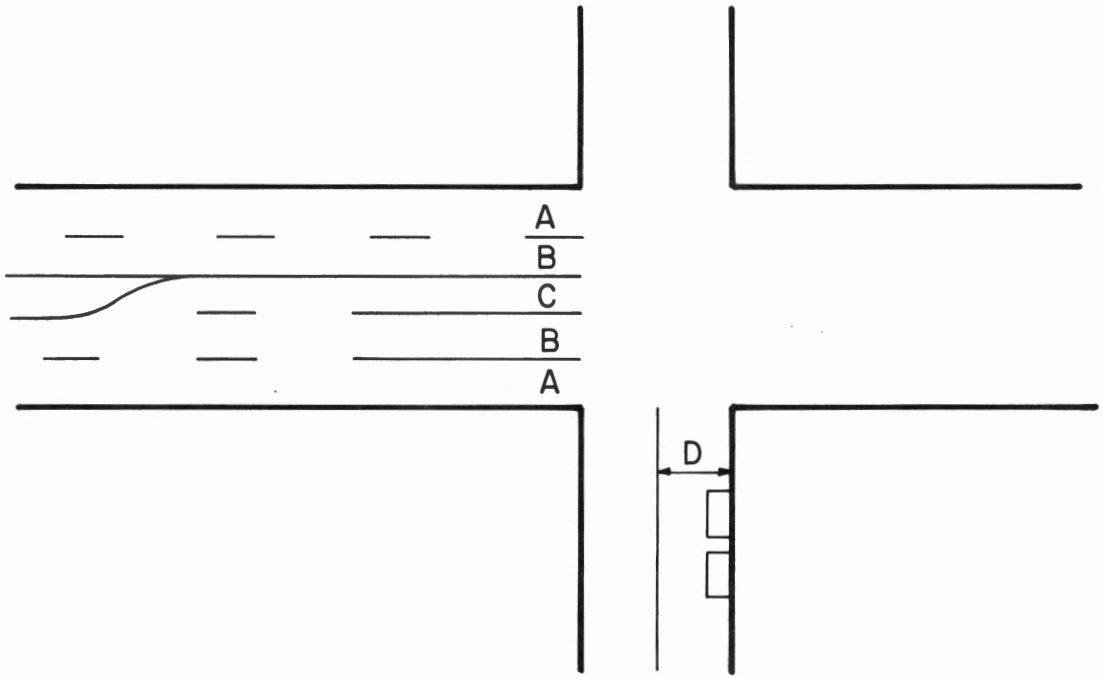
Much like the use of traffic signs, the placement of pavement markings can often help to reduce accidents, improve capacity, and eliminate confusion. Various uses of pavement markings are as follows:

Delineate the pavement centerline.
Delineate the lane divisions of the roadway.
Define pedestrian crossings.
Designate a line at which a vehicle is intended to stop while approaching intersections.
Channelize traffic through complicated and odd shaped intersections.

The standards for pavement markings are also presented in the Manual On Uniform Traffic Control Devices, and shall be adhered to. We recommend the use of single broken yellow lines for separating opposing directions of flow and white markings for all other purposes.

LANE WIDTHS

While working within an existing pavement width, it is essential that the division of the roadway into various lanes be done as efficiently as possible. The following chart indicates a range of lane widths, from minimum to desirable, used throughout the recommendations.



RANGE OF WIDTHS

A	10' - 13'
B	9' - 12'
C	9' - 12'
D	18' - 21'

NOTE:

THE LOWER RANGE OF LANE WIDTHS SHOULD BE USED ONLY WHERE NO OTHER OPTION IS AVAILABLE

PARKING REGULATIONS

Problems associated with curbside parking first become obvious in the Central Business District due to the basic physical characteristics (e.g. concentrated land use, truck deliveries, narrow streets). While providing curbside parking is certainly in the public interest, it should only be provided when it does not hamper the free movement of traffic. However, no reasonable use of streets for parking should be restricted until traffic demands become pressing.

The prohibition of parking increases the capacity of a roadway as well as increasing pedestrian safety. However, in order for downtown business establishments to compete with suburban shopping centers the need for better parking facilities is vital. By combining off-street facilities with on-street parking prohibitions we can eliminate traffic congestion while providing sufficient storage for cars entering the CBD.

BUS STOPS

The location of a bus stop has an effect on the overall capacity and safety of an intersection. Where parking prohibitions do not exist a near-side bus stop will increase capacity by providing no parking for a distance of approximately 100 feet on that approach. When a bus is not at the stop it can be utilized by other vehicles. However, if parking were normally banned on an approach the addition of a near-side bus stop would reduce the capacity of that approach. Far side bus stops effect capacity to a far lesser degree. Furthermore, the use of a far-side bus stop increases pedestrian safety by allowing the passenger to alight the bus and walk to the intersection and cross in back of the bus. A near-side bus stop forces the passenger to cross in front of the bus where he is hidden from the view of on-coming motorists.

We therefore recommend that all bus stops be far-sided, where feasible, and that they be a minimum of 105' long. Wherever near-side bus stops may be located they should be 105' in length.

CURB RETURN RADII

A serious problem is the short corner curb radii at the majority of intersections, resulting in great difficulty to vehicles making a right turn. The condition affects both capacity and safety. This is especially true of commercial vehicles which must slow to a low speed and often cross into adjacent lanes to make a turn. An ideal curb return radius would be 30', however, this is often impossible due to right-of-way restrictions. Where such restrictions exist, the corner radius has been increased so that the curb is seven feet from a building or right-of-way line. We regard seven feet to be the minimum clearance between curb and right-of-way.

RIGHT-OF-WAY

As a policy recommendations were made to minimize the acquisition of right-of-way. Where such acquisition is necessary however it shall conform to the following statutes:

STATE - Chapter 361, Laws of New Jersey 1971. Assembly Bill No. 504, approved December 21, 1971. "Eminent Domain Act of 1971."

Chapter 47, Laws of New Jersey 1972. Senate Bill No. 987, approved June 1, 1972, "Uniform Transportation Replacement Housing and Relocation Act."

FEDERAL - Public Law 91-646, 91st Congress. Senate Bill No. 1, approved January 2, 1971. "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970."

CHAPTER V

TOPICS IMPROVEMENT PROGRAM

PROPOSED FEDERAL AID SYSTEM

Currently the street network in Trenton consists of roadways designated Federal Aid Primary, Secondary and Urban. To complement this system the Federal Aid Primary Type II System has been established under the TOPICS Program. Figure V-1 shows the existing Federal Aid routes with the addition of our recommendation for the Type II System. Federal participation in the funding of improvements can take place on Federal Aid roadways only.

The total system forms a complete network of major roadways serving all sections of the community. Table V-1 shows a breakdown of each Federal Aid classification and the mileage of roadway involved.

TABLE V-1

Mileage of Recommended Federal Aid Network

	Miles
Federal Aid Primary	9.4
Federal Aid Secondary	1.6
Federal Aid Urban	24.1
Federal Aid Primary - Type II	22.3
TOTAL FEDERAL AID MILEAGE	57.4

GENERAL RECOMMENDATIONS

The recommendations presented in this Chapter have been developed in an effort to establish a system-wide improvement program for the City of Trenton, fully utilizing the existing capital investment in its transportation system. While individual improvements for locations throughout the City have been established, there are various recommendations which can and should be applied to the total roadway transportation system.

Traffic Signal Equipment

To achieve maximum efficiency and mobility for vehicles using the street network, traffic signals must be responsive to fluctuations in demand and must be capable of coordination with signals at adjacent intersections providing progression along primary arterials. To achieve this flexibility, we are recommending the installation of three-dial, three offset controllers fully interconnected through a combination of leased telephone lines and direct cable. This equipment provides the flexibility of three different timing schedules during the day, enabling progression to favor the peak flow during the AM and PM Peak Hours, and to provide a balanced progression during the Off-peak Periods. In addition, changes with respect to the division of green time between each street at an intersection enables the distribution of available time as efficiently as possible. A common cycle generator should be utilized to ensure that all signals in the system are properly synchronized. This type of system would greatly reduce stops and delays as well as their corresponding costs as will be shown through the use of SIGOP (Signal Optimization Program) which is discussed in this Chapter.

In several rare instances semi-actuated signals are recommended. When necessary this equipment can also be incorporated into the overall system. This recommendation provides a basic system which can be utilized to control the arterials radiating from the Central Business District. The system can gradually be made more sophisticated by adding sampling detectors on the various arterials as well as a central controller. Ultimately, it is recommended that all the signals within the City be included in one complete system utilizing a digital computer as its central control. However, due to the large expense and high maintenance and operating costs associated with a computer system, it is not recommended that a system of this type be initiated at this time. The current configuration and functioning of intersections within the Central Business District does not lend itself to a system control.

The complete revamping of existing post mounted signals should be accomplished throughout the City. In all cases, over the road indications should be provided as well as appropriate clamp mounted signal heads for pedestrian traffic. The detailed recommendations presented in this Chapter are based on the utilization of vertical signal indications as opposed to horizontal. This was done primarily for the additional flexibility provided by the vertical mounting with respect to the placement and angle of mast arms.

FIGURE V-1
RECOMMENDED FEDERAL AID SYSTEM

Pavement Markings

Centerlines shall be provided on all system streets and should be painted as a single broken yellow line. Thermoplastic should be used in lieu of conventional paint for the installation of centerlines. The usable life, durability, and visibility of thermoplastic markings are considerably greater than those of conventional paint. This will provide for additional safety to the motorist since it will reduce the possibility of fading paint markings that cannot be seen by the motorist. The life expectancy of this type of marking is from three to five years. A side benefit of this program would be the additional time available to Traffic Division maintenance men enabling them to maintain painted markings to a greater degree than is possible currently. Towards the end of the five-year TOPICS Program, similar white thermoplastic markings should be installed to incorporate the recommendations developed under this Study. This would include crosswalks, lane markings, and stop lines which will be installed under this Program.

All pavement markings utilized within the City shall conform to the latest edition of the Manual on Uniform Traffic Control Devices.

Traffic Signs

A problem prohibiting the free movement of traffic in various areas of the City is the low level of enforcement provided for parking regulations. This problem is particularly evident in the Central Business District where vehicles flagrantly violate posted traffic signs while police officers are directing traffic on every street corner of State Street in the CBD. One reason for this may be the large number of posted regulations not covered by legal ordinance and which in fact cannot be enforced in a court of law. The City must completely revamp the on-street sign installations to bring them into conformity with the existing ordinances. Where regulations are required and are not currently covered by an ordinance, one must be promptly passed. All future signing should be done in accordance with the Manual on Uniform Traffic Control Devices.

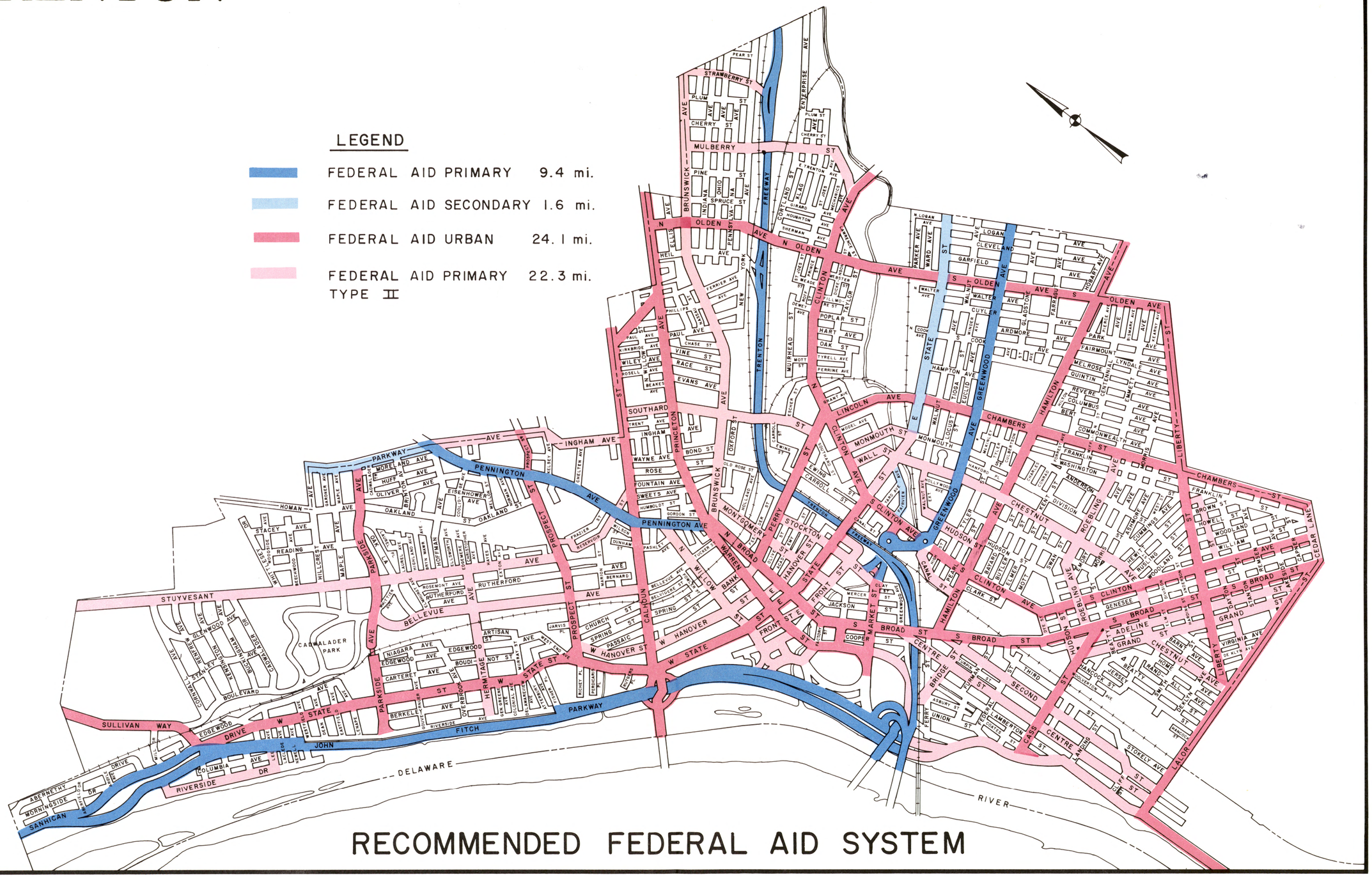
Truck Routes

Because of the high percentage of commercial traffic which utilizes the TOPICS street system, a network of truck routes should be established. This type of regulation specifies that truck traffic must utilize a truck route departing only at the closest point to their destination. The routes as shown in Figure II-11 should be used as a basis for the establishment of a truck network.

TRENTON TOPICS

LEGEND

FEDERAL AID PRIMARY	9.4 mi.
FEDERAL AID SECONDARY	1.6 mi.
FEDERAL AID URBAN	24.1 mi.
FEDERAL AID PRIMARY TYPE III	22.3 mi.



RECOMMENDED FEDERAL AID SYSTEM

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FIGURE V-1

SPECIFIC RECOMMENDATIONS

As a general statement, it was observed that most of the congestion, delay, and accidents occurred at intersections which are currently signalized. Therefore, the main thrust of the detailed recommendation program is to improve the operation and overall safety of the signalized intersections throughout Trenton. Detailed recommendations have been divided into five study areas with arterial considerations given to various roadways within those areas. This type of breakdown also helps to identify specific traffic generators, types of land use, and characteristics peculiar to that area of the City. Figure V-2 shows the City of Trenton divided into the five basic study areas with those roadways which were given arterial considerations clearly defined. In general, the arterials which were treated on an individual basis exhibit the most serious problems at the present time. Recommended parking regulations are shown on the area-wide maps only when they extend for a distance greater than that covered in a specific intersection recommendation.

Table V-2 defines the various symbols which were used throughout our designs. Unless otherwise noted, all signal operations are two-phase with a standard amber clearance of approximately four seconds. Peak hour volumes as well as accident summaries are shown for each intersecton design. In cases where recommendations will create a major change in traffic patterns, projected volumes are shown. Buildings, catch basins, fire hydrants, and utility poles are generally shown only where they relate to the design itself. Therefore, where no widening or curb cutback takes place, this information is omitted. Additionally these items are shown in their approximate locations and are indicated only to determine costs and potential construction problems. All right-of-way information was obtained from tax maps, and in all cases, it was assumed that the center of the right-of-way coincided with the center of the roadway.

TABLE V-2

SYMBOLS FOR DETAILED RECOMMENDATIONS

PROPOSED CURBLINE

EXISTING CURBING TO BE REMOVED

EXISTING RIGHT-OF-WAY LINES

CURB CUTS



EXISTING POST-MOUNTED SIGNAL TO BE REMOVED



PROPOSED POST-MOUNTED SIGNAL



PROPOSED SIGNAL POLE WITH MAST ARM



EXISTING MODERNIZED SIGNAL

UTILITY POLE

EXISTING FIRE HYDRANT

EXISTING CATCH BASIN

EXISTING FIRE CALL BOX



NUMBER OF ACCIDENTS
NUMBER OF INJURIES



FIXED OBJECT



PEDESTRIAN

ACCIDENT SUMMARY

FIGURE V-2
TOPICS STUDY AREAS

WEST END

The first area under consideration is in the West End of Trenton and includes all system roadways west of Calhoun Street between Parkway Avenue and the Delaware River. Parkway Avenue, Stuyvesant Avenue, West State Street and the John Fitch Parkway service the east-west corridor providing access to Ewing Township and areas to the west. Near the western boundary, the John Fitch Parkway splits between Sullivan Way and Sanhican Drive. Parkside Avenue is the major north-south arterial in this sector, with high volumes of traffic moving between Route 29 and areas to the north of the City.

Major traffic generators are the Trenton State Hospital on Sullivan Way, the New Jersey Department of Transportation on Parkway Avenue in Ewing Township, and major commerical and industrial development just west of Calhoun Street between Pennington Avenue and Ingham Avenue. Factories in this section include Westinghouse and the National Biscuit Corporation. The westerly section of this study area is primarily residential and includes Cadwalader Park.

The distance between signals in the West End is generally greater than in other areas of the City. This is primarily due to the residential nature of the area and the larger spacing between major arterials. Figure V-3 shows the location and nature of recommendations in the West End of Trenton.

TRENTON TOPICS

BRUNSWICK AVENUE AND PRINCETON AVENUE

CALHOUN STREET

CLINTON AVENUE

OLDEN AVENUE

CHAMBERS STREET

WEST END

EAST END

CENTRAL BUSINESS DISTRICT

SOUTH CORRIDOR

TOPICS STUDY AREAS

PURCELL ASSOCIATES
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FIGURE V - 2

FIGURE V-3
WEST END

SANHICAN DRIVE AND SULLIVAN WAY

Deficiencies

1. Capacity-- Southbound approach of Sullivan Way operates at level of service "D" in the evening peak.

2. Delay--Due to the capacity restrictions described above, southbound traffic experiences extensive delays in the evening. Delays are intensified by the high peaking characteristics of traffic.

Existing Conditions

1. Roadway width for southbound Sullivan Way permits only one approach lane.

2. Intersection is complex, requiring multi-phase operation.

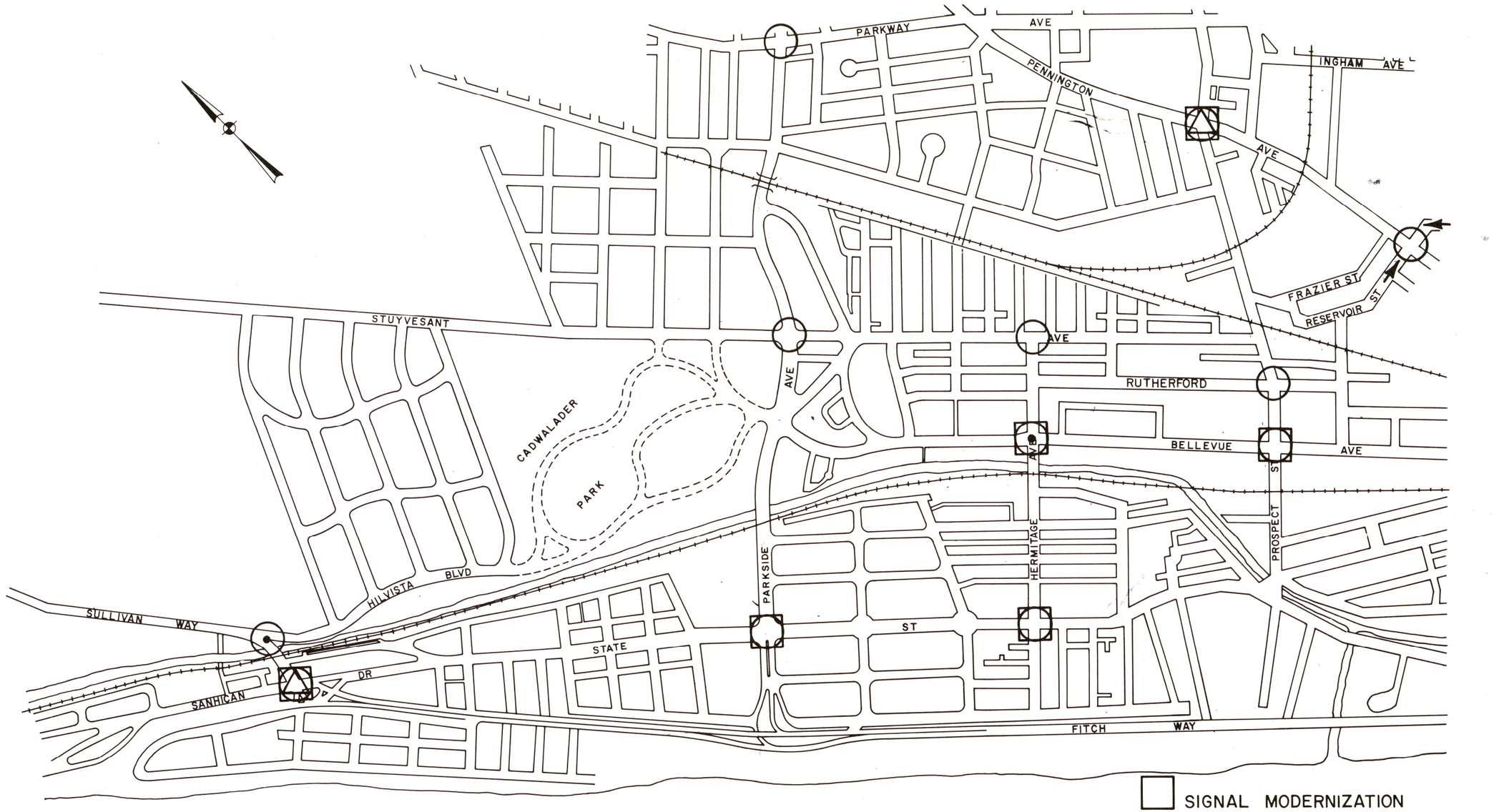
3. Available green time is limited due to multi-phase operation.

4. Located in close proximity to a hospital, where a change in shift releases a large number of vehicles in a short time span.

Recommendations

1. Widen the north leg of this intersection to 38 feet permitting two approach lanes as shown in the accompanying design. This widening will increase the level of service to "C" or better and reduce the corresponding delay.

Right-of-Way: **Yes** **Cost:** $7,500



WEST END

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FIGURE V - 3

FIGURE V-4
SULLIVAN WAY AND SANHICAN DRIVE

HILVISTA BOULEVARD AND SULLIVAN WAY

Deficiencies

1. Delay--In the morning traffic travelling north on Sullivan Way is delayed at Hilvista Boulevard where they must yield the right-of-way.

Existing Conditions

1. Sullivan Way and Hilvista Boulevard form a "Y" intersection.

2. Traffic flow along Sullivan Way is considerably greater than the flow on Hilvista Boulevard.

3. Poor sight distance for northbound Sullivan Way coupled with the requirement that they yield the right-of-way causes motorists to virtually stop to be sure no vehicle is approaching on Hilvista Boulevard.

4. Northbound Sullivan Way traffic yields to eastbound traffic proceeding onto Hilvista Boulevard.

5. The "Y" configuration makes it difficult to judge whether or not a eastbound vehicle is going to use Hilvista Boulevard, adding to the delay on northbound Sullivan Way.

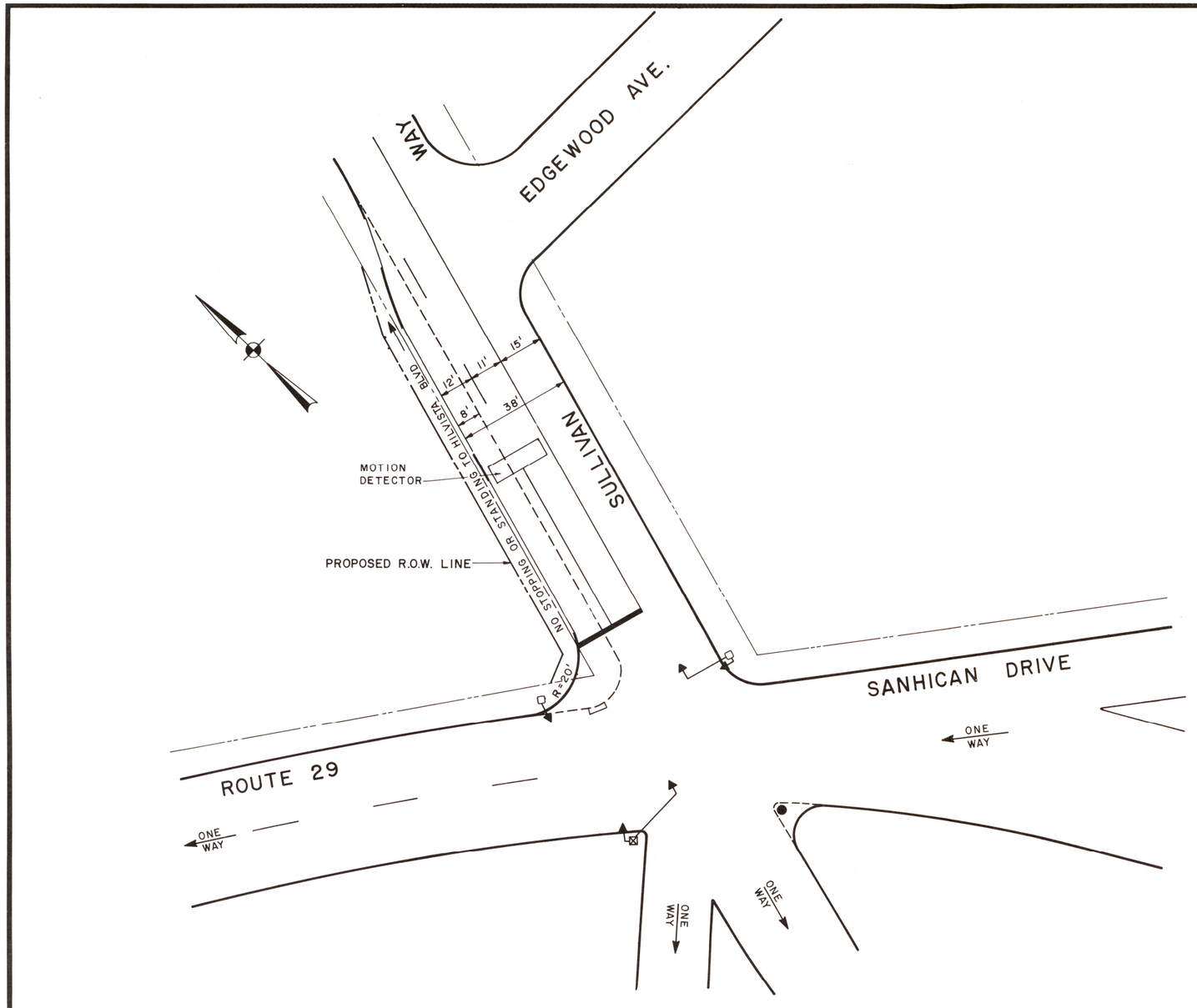
Recommendations

1. Reassign right-of-way to favor the flow along Sullivan Way.

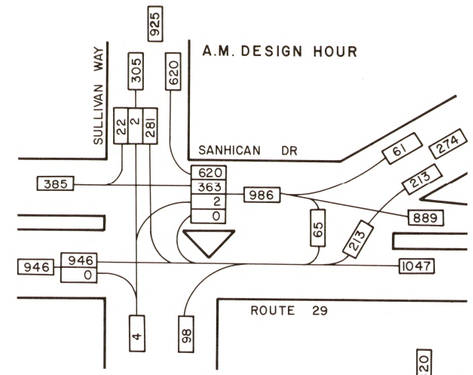
2. Provide channelization and markings as shown in the accompanying plan.

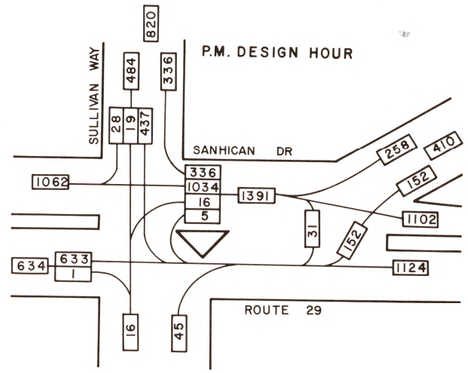
3. Stop Sullivan Way traffic which proceeds onto Hilvista Boulevard as well as westbound Hilvista Boulevard traffic.

Right-of-Way: No **Cost:** $4,000



DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	12
ACCIDENT RATE PER TEN MILLION VEHICLES	22
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	6
INJURY RATE PER TEN MILLION VEHICLES	11

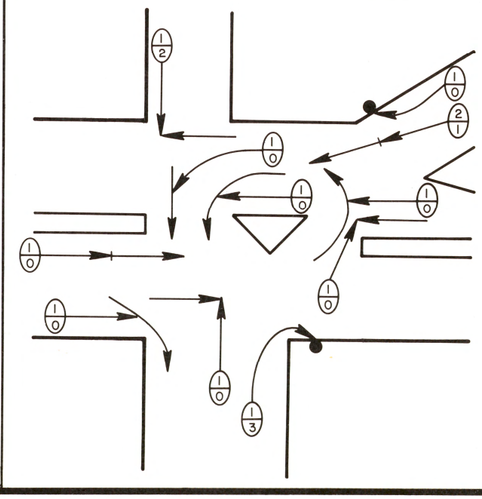


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FIGURE V-4

FIGURE V-5
HILVISTA BOULEVARD AND SULLIVAN WAY

PARKSIDE AVENUE AND STATE STREET

Deficiencies

1. Safety--Twenty accidents in a one-year period.

2. Capacity--Parkside Avenue operates at level of service D northbound and E southbound during the morning peak period.

Existing Conditions

1. Mast arms with over-the-road signal indications exist for all approaches.

2. Trees on the westside of Parkside Avenue obscure signal visibility for northbound Parkside Avenue traffic.

3. Heavy left turn for southbound Parkside Avenue, opposed by heavy through movement.

4. Heavy left turn for eastbound State Street traffic.

5. Parking banned on both Parkside Avenue approaches.

6. Traffic on the northbound Parkside Avenue approach has just left Route 29 where speeds are considerably higher.

Recommendations

1. Provide additional signal indications on the center divider and "Walk-Don't Walk" indications for all crosswalks.

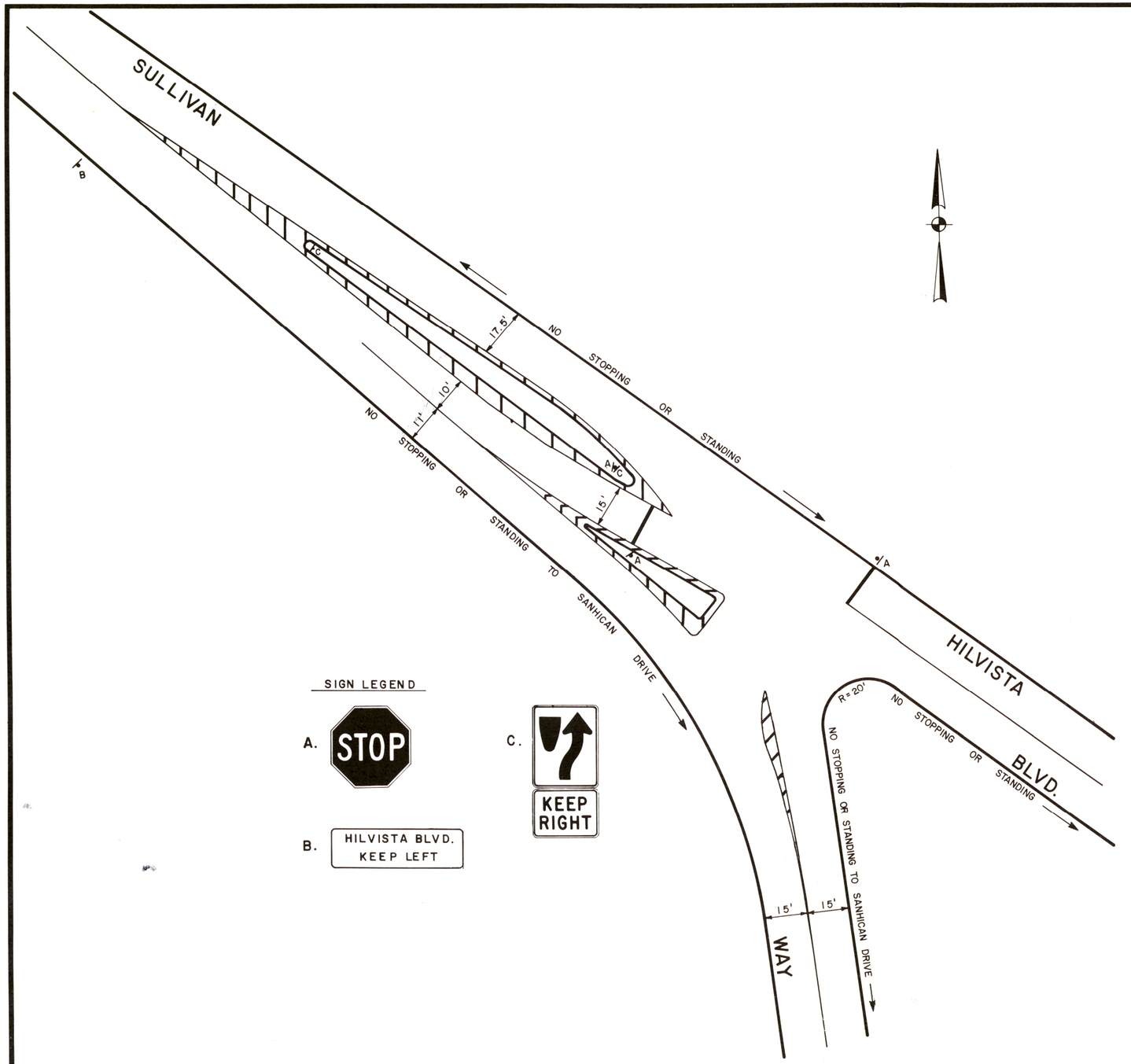
2. Install pavement markings and parking regulations providing protected left turn lanes for State Street as shown in the accompanying drawing.

3. Change to a three-phase signal operation providing southbound Parkside Avenue with a leading green.

4. Install a "Signal Ahead" warning sign for northbound Parkside Avenue.

5. Trim the trees along the west side of Parkside Avenue.

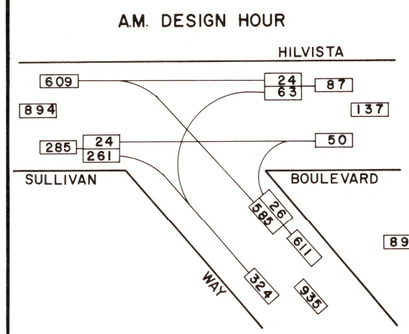
Right-of-Way: No **Cost:** **$4,000**

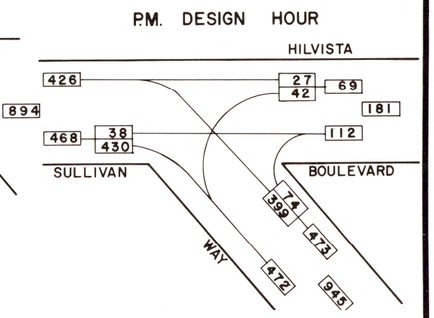


HILVISTA BOULEVARD & SULLIVAN WAY

0 20 40 60 FEET

DESIGN HOUR VOLUMES





THERE WERE FEWER THAN 5 ACCIDENTS
IN ONE YEAR AT THIS LOCATION

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FIGURE V-5

FIGURE V-6
PARKSIDE AVENUE AND STATE STREET

BELLEVUE AVENUE AND PROSPECT STREET

Deficiencies

1. Safety--20 accidents and 13 injuries occurred during a one year period with high accident and injury rates for that year. There were a total of 8 turning accidents on all approaches and a high ratio of night to day accidents.

2. Delay--Eastbound traffic on Bellevue Avenue is delayed up to 90 seconds.

Existing Conditions

1. All approaches have a heavy percentage of left and right turns.

2. Signal equipment consists of two post-mounted signals whose visibility is obscured by trees on southbound and westbound approaches.

Recommendations

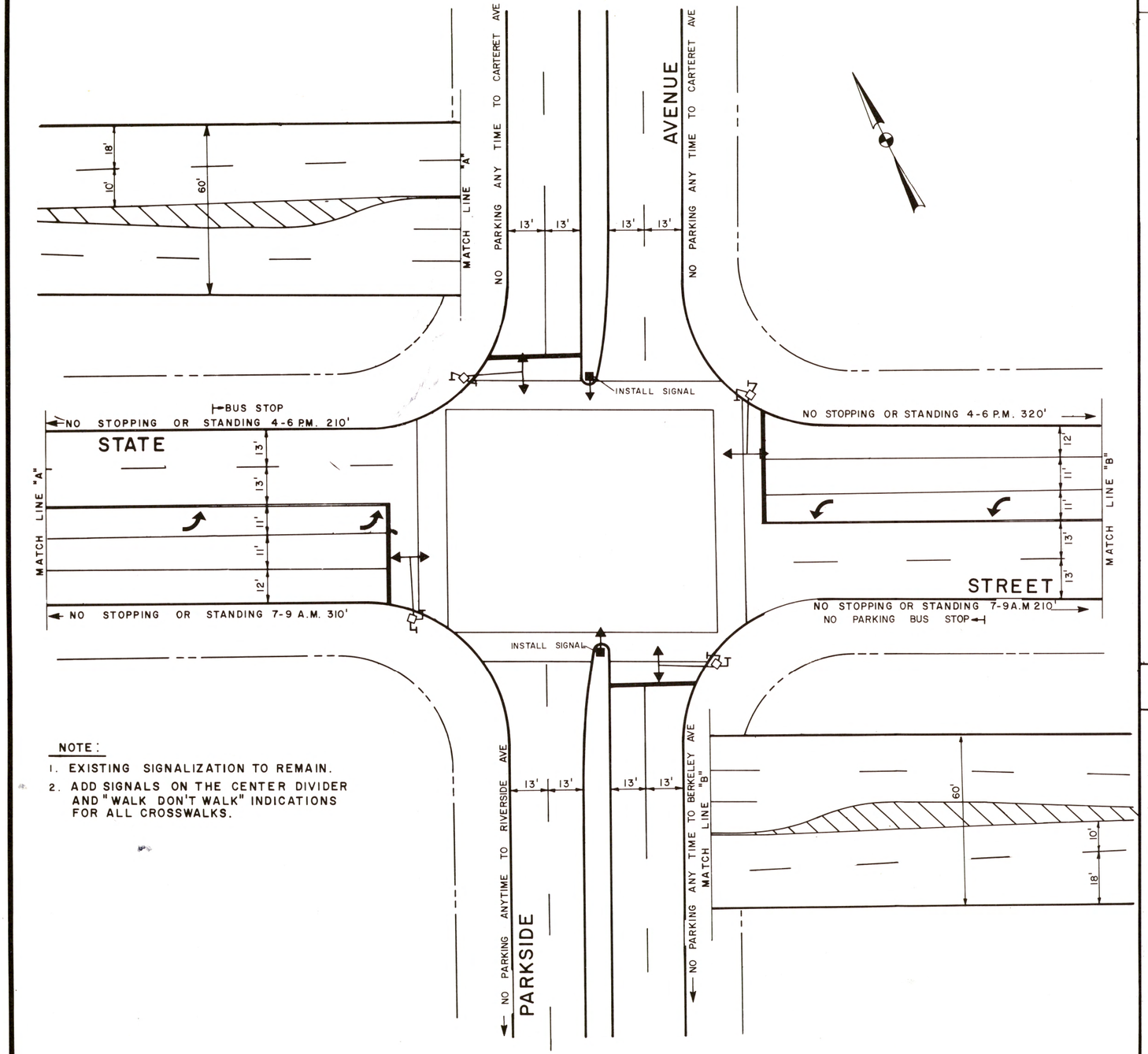
1. Modernize signal equipment and restripe the intersection as shown in the accompanying plan.

2. Cut back corner curb radii to facilitate turning movements.

3. Far side bus stops.

4. Determine adequacy of street lighting.

Right-of-Way: No **Cost:** $22,000



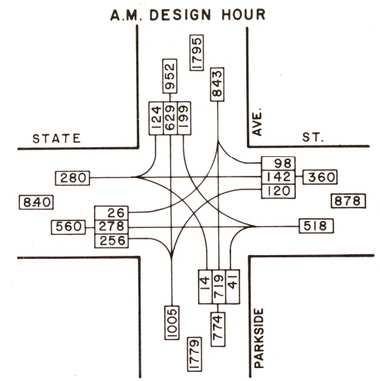
NOTE:

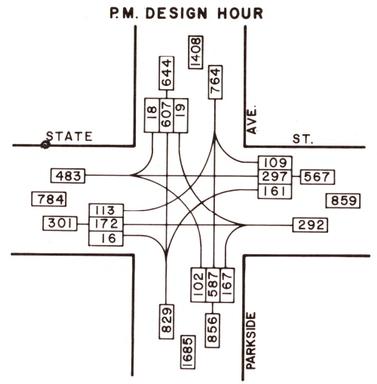
1. EXISTING SIGNALIZATION TO REMAIN.
2. ADD SIGNALS ON THE CENTER DIVIDER AND "WALK DON'T WALK" INDICATIONS FOR ALL CROSSWALKS.

PARKSIDE AVENUE & STATE STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	20
ACCIDENT RATE PER TEN MILLION VEHICLES	20
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	12
INJURY RATE PER TEN MILLION VEHICLES	12
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	36
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	6

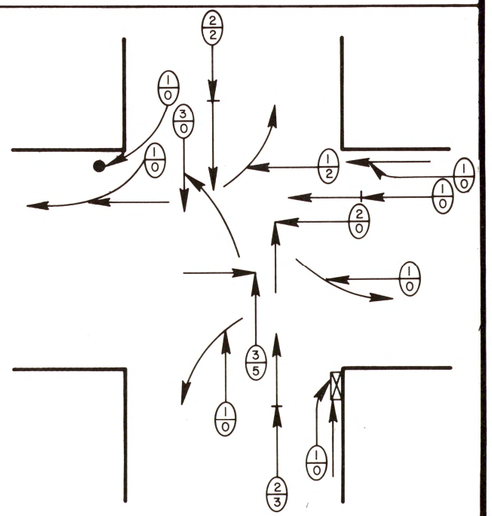


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FIGURE V-6

FIGURE V-7
BELLEVUE AVENUE AND PROSPECT STREET

BELLEVUE AVENUE AND HERMITAGE AVENUE

Deficiencies

1. Delay--traffic on northbound Hermitage Avenue and westbound Bellevue Avenue experiences some delay in the morning because of school crossing.

Existing Conditions

1. Intersection is located in a residential area. On the northwest corner is a church and grammar school.

2. Railroad freight train tracks cross Hermitage Avenue just south of the intersection.

3. The northbound approach for Hermitage Avenue is an upgrade of 5% and the pavement width is only 29 feet.

4. The east curb of Hermitage Avenue is walled by a steep embankment which makes widening along this side difficult.

5. Traffic signals are obsolete.

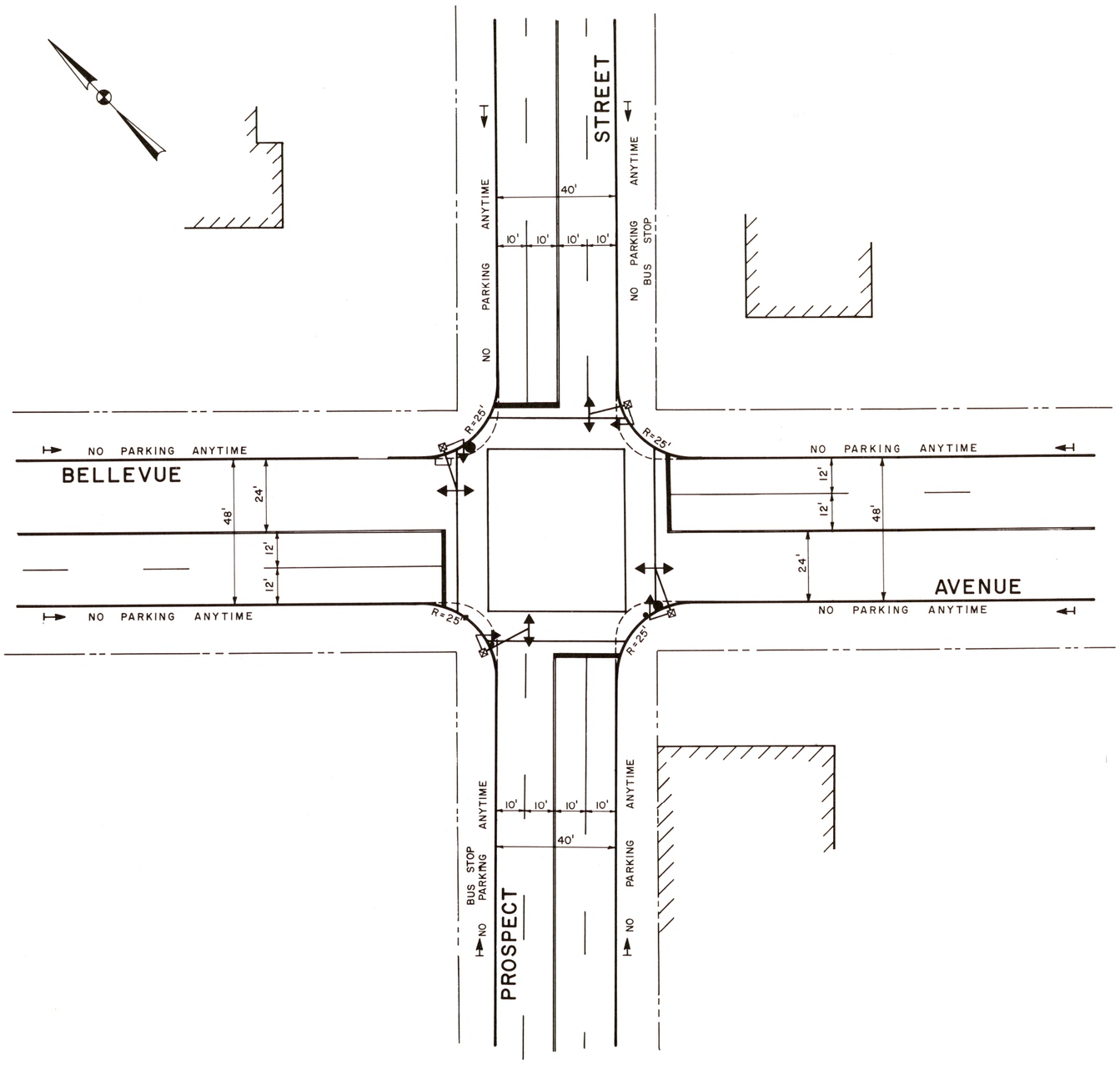
Recommendations

1. Channelize the eastbound approach for a right turn slot. This recommendation will help Bellevue Avenue alignment.

2. Cutback all corners to facilitate right turns.

3. Install traffic signal equipment, pavement markings, and parking prohibitions as shown on the accompanying plan.

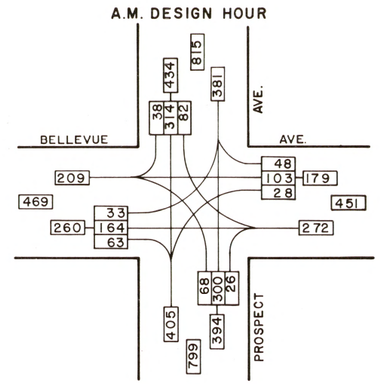
Right-of-Way: **Yes** **Cost:** $24,000

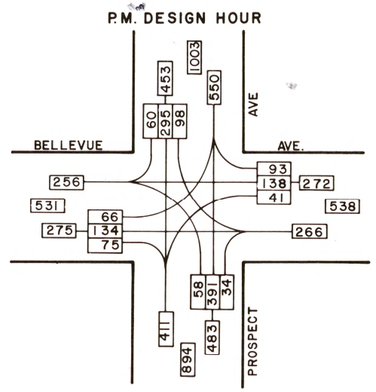


BELLEVUE AVENUE AND PROSPECT STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	20
ACCIDENT RATE PER TEN MILLION VEHICLES	27
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	13
INJURY RATE PER TEN MILLION VEHICLES	19
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	34
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	13

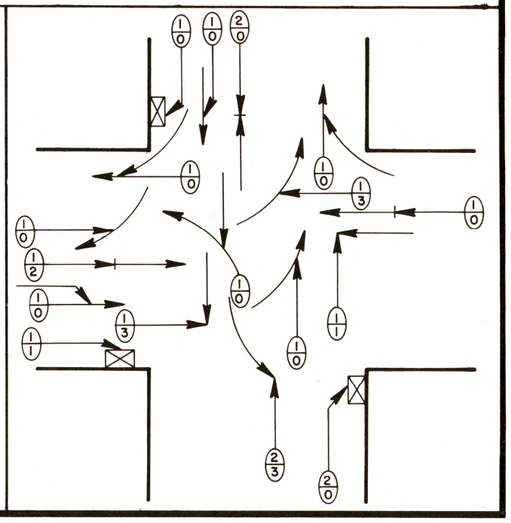


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FIGURE V-7

FIGURE V-8
BELLEVUE AVENUE AND HERMITAGE AVENUE

PENNINGTON AVENUE AND PROSPECT STREET

Deficiencies

1. Safety--Eighteen accidents in one year with several of them involving westbound Pennington Avenue traffic turning left. Three left turning vehicles hit the center island on Prospect Street.

Existing Conditions

1. Modern over-the-road signal indications for all approaches.

2. Channelizing islands at the northwest and southeast corners with a center divider on Prospect Street south of Pennington Avenue.

3. Industrial and commercial land use abutting Pennington Avenue east of Prospect Street.

4. Large demand for on-street parking because of workers in the various plants.

5. The geometrics of this intersection would appear to be a primary factor in the high number of accidents.

6. Signal visibility for southbound Prospect Street traffic is poor due to a curve in the road.

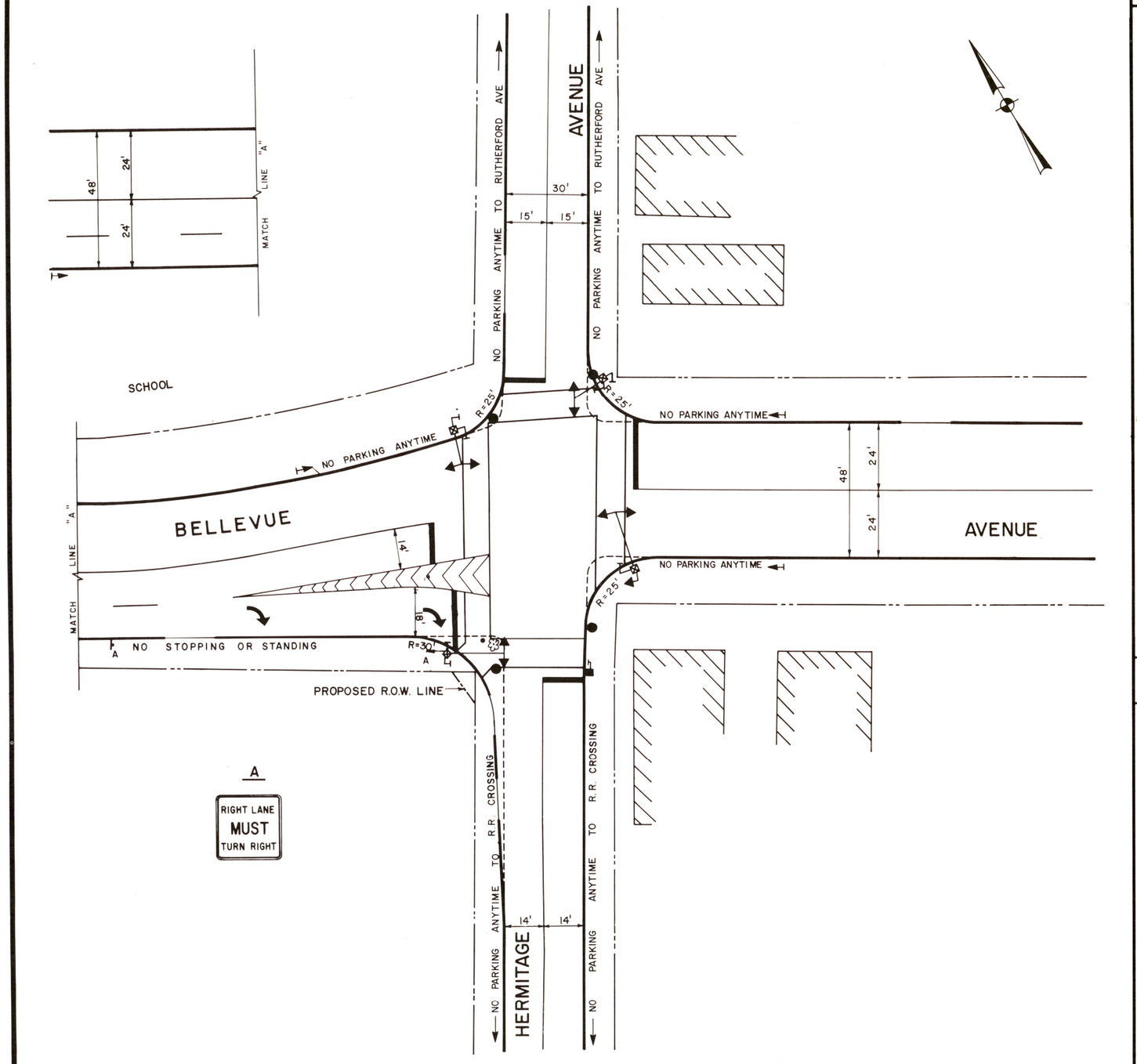
Recommendations

1. Modify roadway alignment and physical islands as shown on the accompanying plan.

2. Install a "Signal Ahead" warning sign for southbound traffic on Prospect Street.

3. Install pavement markings and parking regulations as shown to provide increased safety and capacity.

Right-of-Way: No **Cost:** $8,000



BELLEVUE AVENUE & HERMITAGE AVENUE

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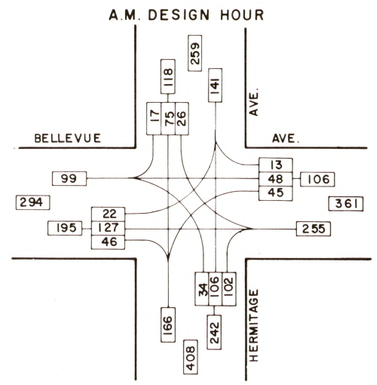
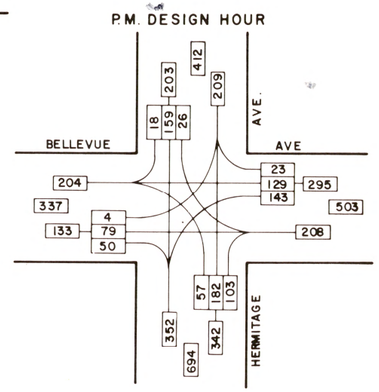
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	7
ACCIDENT RATE PER TEN MILLION VEHICLES	15
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	2
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	22
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	16

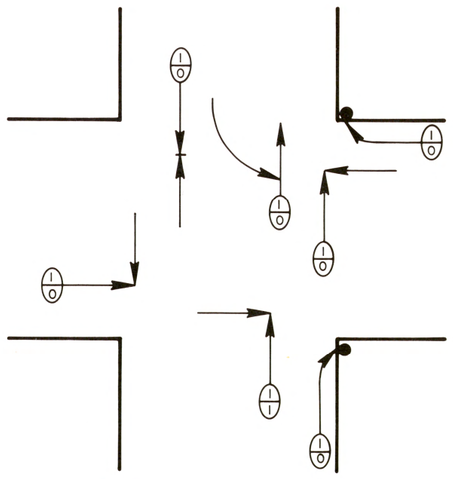


FIGURE V - 8

FIGURE V-9
PENNINGTON AVENUE AND PROSPECT STREET

HERMITAGE AVENUE AND STATE STREET

Deficiencies

1. Capacity--southbound Hermitage Avenue is at level of service 'D.'

2. Delay--the above-noted capacity problem initiates a delay for traffic on the southbound approach.

Existing Conditions

1. Poor signal visibility, particularly on the westbound State Street approach and obsolete signal equipment.

2. Near-side bus stops on both legs of State Street.

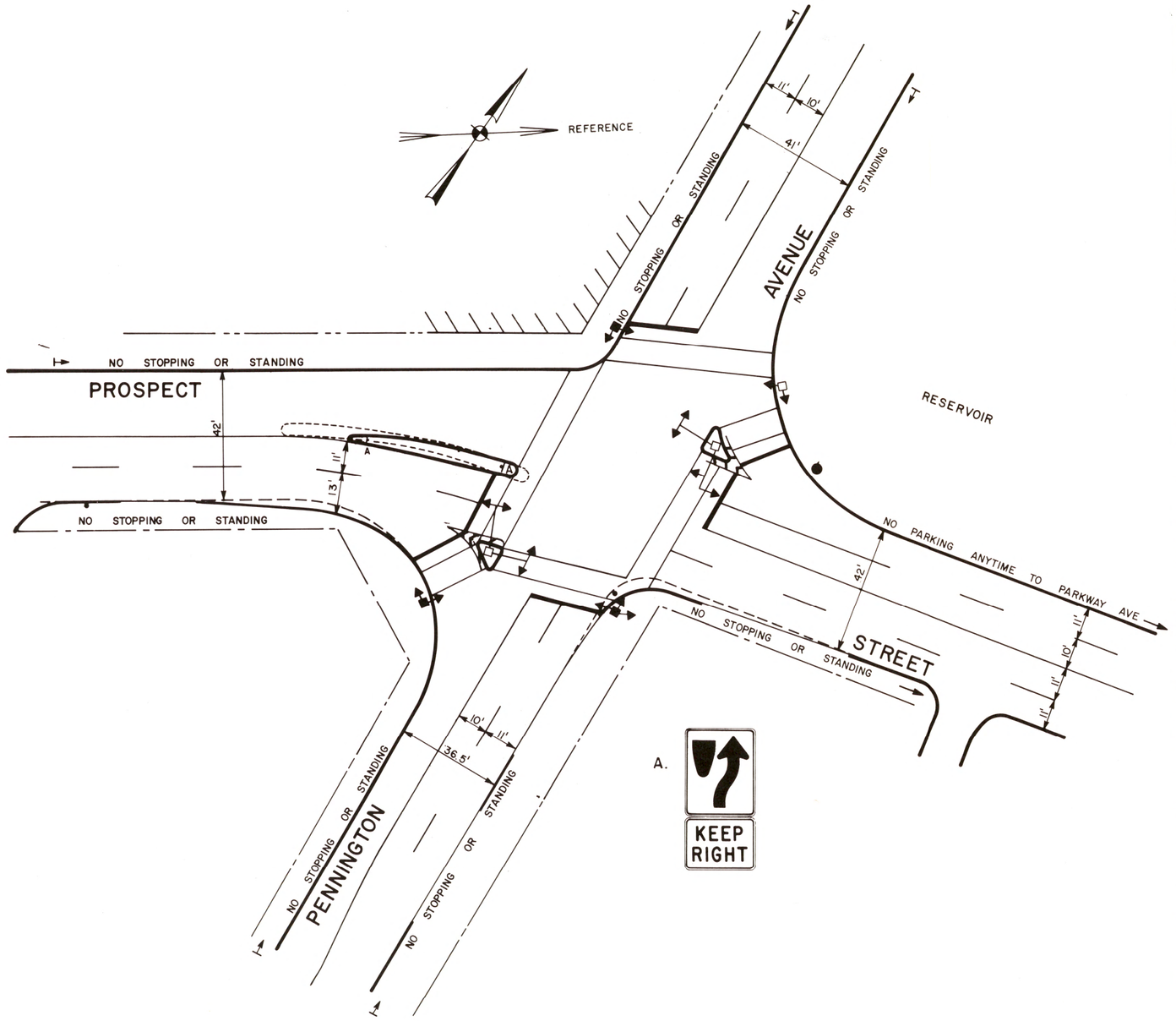
3. Sufficiently wide approaches along State Street to accommodate traffic.

4. Parking to corner along both sides of Hermitage Avenue north of State Street. Hermitage Avenue is 36 feet wide here.

Recommendations

1. Modernize signal equipment as shown in the accompanying plan.
2. Cutback curb radii in all quadrants.
3. Far side bus stops on State Street.

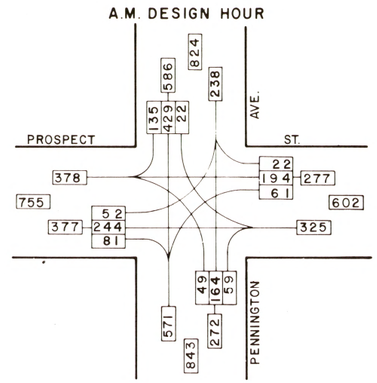
Right-of-Way: **No** **Cost:** $25,000

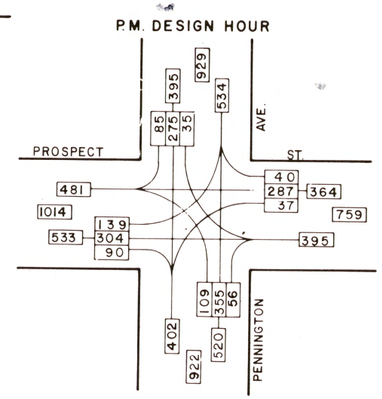


PENNINGTON AVENUE & PROSPECT STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	18
ACCIDENT RATE PER TEN MILLION VEHICLES	20
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	9
INJURY RATE PER TEN MILLION VEHICLES	10
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	20
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	6

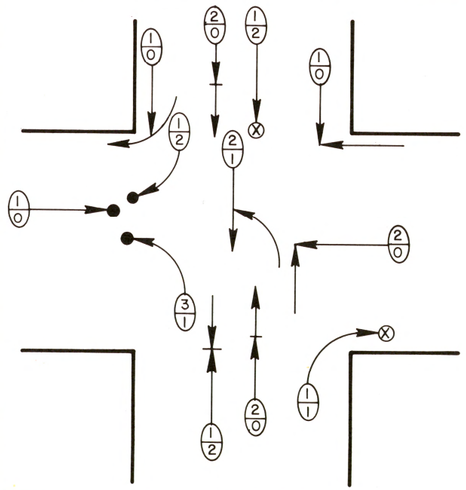


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FIGURE V-9

FIGURE V-10
STATE STREET AND HERMITAGE AVENUE

PENNINGTON AVENUE AND RESERVOIR STREET

Deficiencies

1. Safety--16 accidents occurred during a one-year period. Seven of these were right angle collisions, all involving northbound vehicles.

Existing Conditions

1. The intersection is controlled by stop signs on each Reservoir Street approach.

2. Reservoir Street serves as a short cut for Pennington Avenue traffic bound for Prospect Street.

3. Parking regulations do not exist for this section of Pennington Avenue.

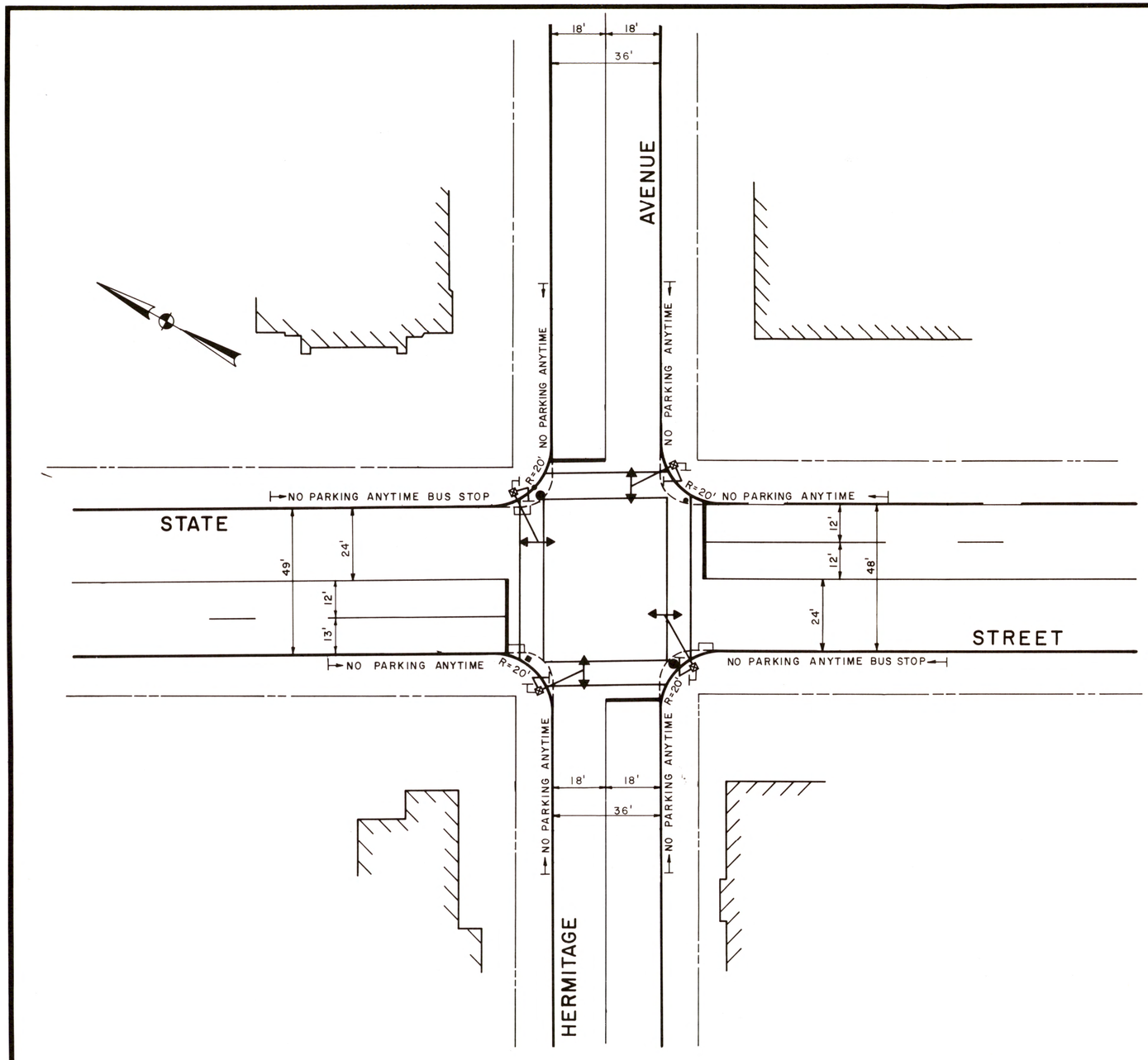
Recommendations

1. Ban parking along Pennington Avenue during peak hours.

2. Make both legs of Reservoir Street one-way into Pennington. This will form a couplet with Frazier Street west of Pennington.

3. Cut back northeast and southwest corners.

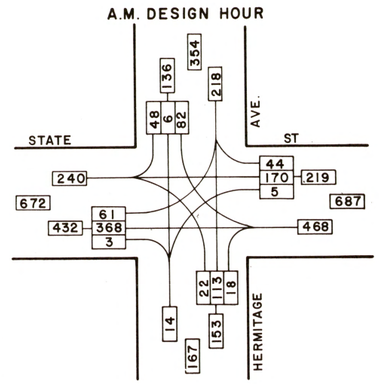
Right-of-Way: No **Cost:** $1,500

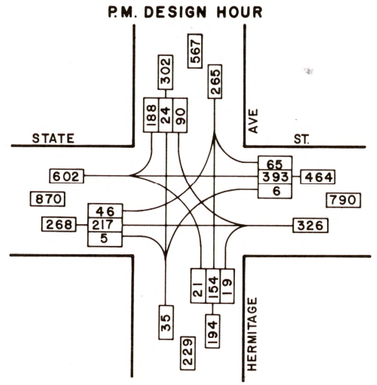


STATE STREET AND HERMITAGE AVENUE

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	8
ACCIDENT RATE PER TEN MILLION VEHICLES	13
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	11
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	5

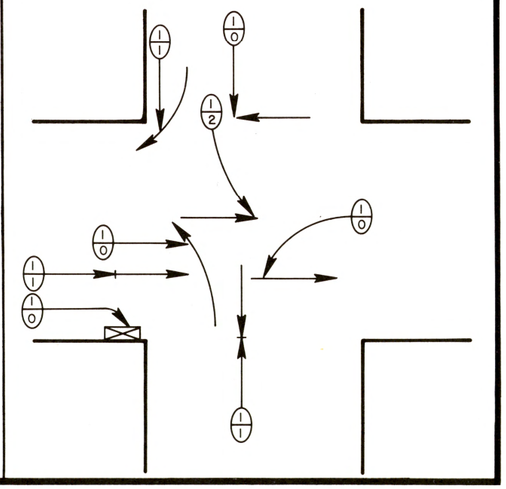


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FIGURE V-10

FIGURE V-11
PENNINGTON AVENUE AND RESERVOIR STREET

PARKSIDE AVENUE AND PARKWAY AVENUE

Deficiencies

1. Capacity-- Northbound Parkside Avenue operates at level of service 'F' both morning and evening peak periods.

Existing Conditions

1. All approaches provide two lanes.

2. Northbound Parkside Avenue has only one discharge lane.

3. The left lanes for both Parkway Avenue approaches are designated exclusively for left turns.

Recommendations

1. Eliminate exclusive left turn designations from Parkway Avenue approaches.

2. Retime traffic signal in accordance with the proposed Signal Optimization Plan.

3. Install "Walk-Don't Walk" pedestrian indications.

Right-of Way: **No** **Cost:** $2,000

FIGURE V-11
PENNINGTON AVENUE AND RESERVOIR STREET

PARKSIDE AVENUE AND PARKWAY AVENUE

Deficiencies

1. Capacity-- Northbound Parkside Avenue operates at level of service 'F' both morning and evening peak periods.

Existing Conditions

1. All approaches provide two lanes.

2. Northbound Parkside Avenue has only one discharge lane.

3. The left lanes for both Parkway Avenue approaches are designated exclusively for left turns.

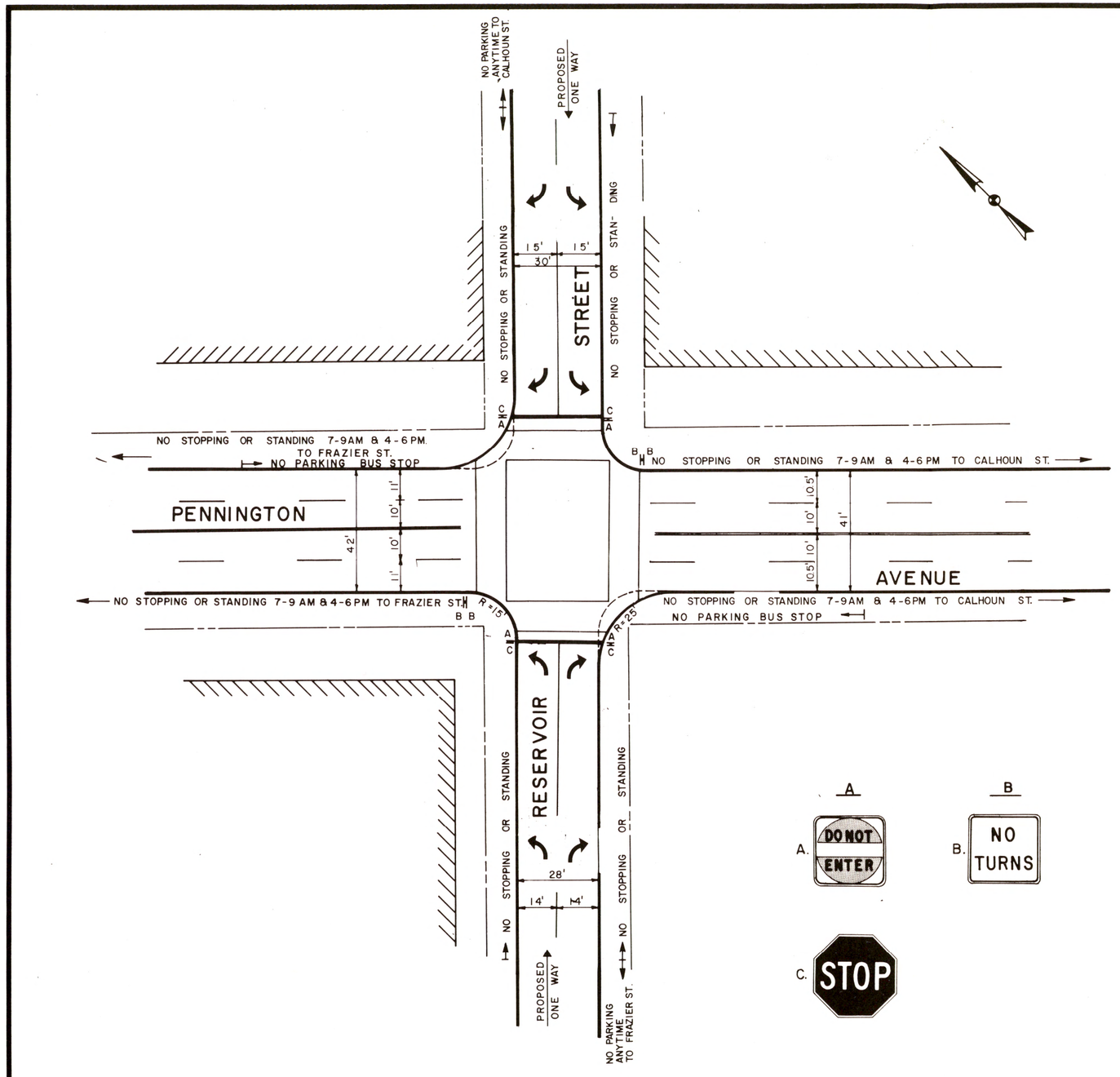
Recommendations

1. Eliminate exclusive left turn designations from Parkway Avenue approaches.

2. Retime traffic signal in accordance with the proposed Signal Optimization Plan.

3. Install "Walk-Don't Walk" pedestrian indications.

Right-of Way: **No** **Cost:** $2,000



A

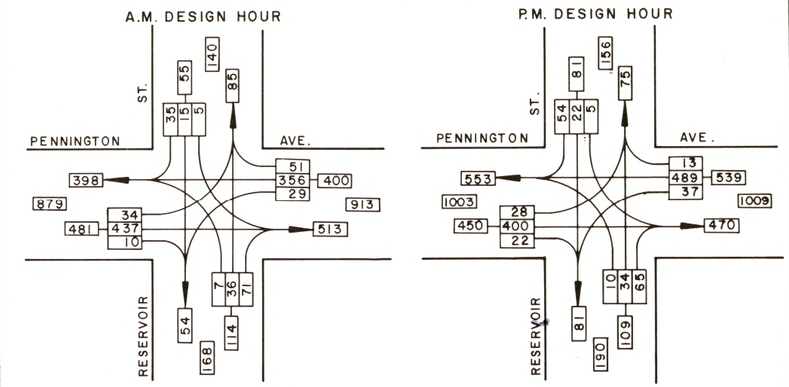
A. DO NOT ENTER

B

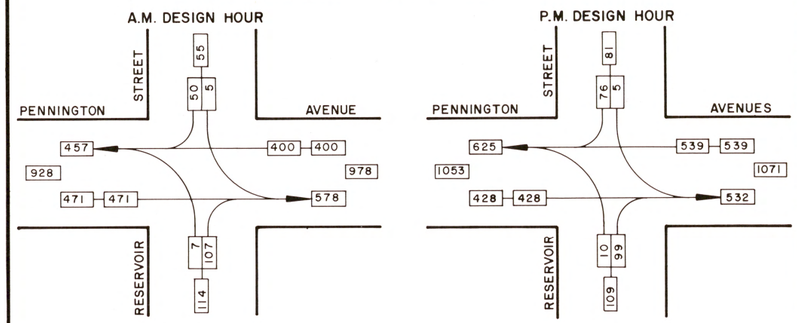
B. NO TURNS

C. STOP

EXISTING VOLUMES

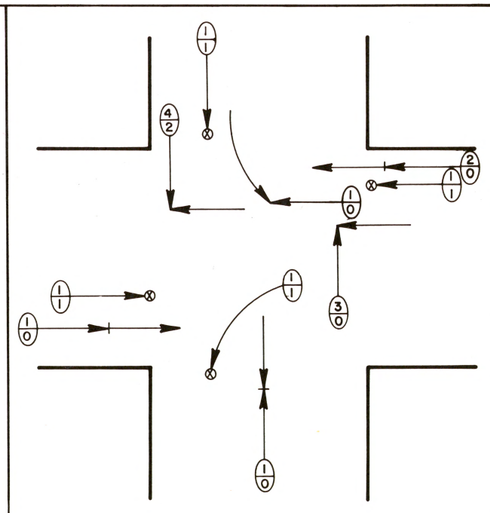


PROJECTED VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	16
ACCIDENT RATE PER TEN MILLION VEHICLES	22
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	6
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	15
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	4



PENNINGTON AVENUE & RESERVOIR STREET

0 20 40 60 FEET

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FIGURE V-11

PARKSIDE AVENUE AND STUYVESANT AVENUE

Deficiencies

1. Capacity--Both approaches of Parkside Avenue exhibit a level of service F.

Existing Conditions

1. Parkside Avenue is offset approximately 13 feet at this intersection.

2. Over-the-road indications exist for all approaches.

3. Topography along Parkside Avenue is such that any widening to eliminate the offset is impossible.

Recommendations

1. Prohibit left turns from Parkside Avenue from 7 to 9 A.M. and from 4 to 6 P.M. These turns reach an hourly peak of only 51 vehicles in the morning and only 63 vehicles in the evening.

2. Reroute turning traffic according to the following scheme:

   a. Southbound left turns-- turn right onto Reading Avenue, one block before Stuyvesant Avenue, circle the block and approach Parkside Avenue from the west on Stuyvesant Avenue.

   b. Northbound left turns-- use Whittier Avenue, a northbound one-way street, to reach Stuyvesant Avenue; turn left at Stuyvesant Avenue and approach Parkside Avenue from the east.

3. Retime signal in accordance with Signal Optimization Plan.

Right-of-Way: No **Cost:** ———

HERMITAGE AVENUE AND STUYVESANT AVENUE

Deficiencies

1. Safety--12 accidents have occurred at this unsignalized intersection in a one year period. They were primarily right angle and turning accidents.

Existing Conditions

1. Hermitage Avenue and Stuyvesant Avenue form a "T" intersection with Hermitage Avenue the stop street. Parking exists on Stuyvesant Avenue opposite the point at which Hermitage Avenue intersects Stuyvesant.

2. Visibility for Hermitage Avenue traffic is poor due to parked vehicles on Stuyvesant Avenue.

Recommendations

1. Parking should be banned between Edgemere Avenue and Christoff Street on the north side of Stuyvesant Avenue.

2. On the south side of Stuyvesant Avenue parking should be banned for 75' west of Hermitage Avenue and the bus stop which is now at that location should be farsided.

Right-of-Way: No **Cost:** ———

PROSPECT STREET AND RUTHERFORD AVENUE

Deficiencies

1. Safety--11 accidents have occurred at this location in a one year period. The types of collisions included sideswipes, right angle, left turn, and rear end collisions.

Existing Conditions

1. Rutherford Avenue is stopped at Prospect Street.

2. Prospect Street experiences a change in alignment at its intersection with Rutherford. This tends to hinder the visibility of oncoming vehicles for traffic stopped on the eastbound approach of Rutherford Street.

3. This location is a school crossing with a guard there during the appropriate times.

Recommendations

1. Ban parking on both the east and west curblines of Prospect Street within 75 feet of Rutherford Avenue.

Right-of-Way: No **Cost:** ———

CALHOUN STREET

Calhoun Street extends from a bridge across the Delaware River to its connection with Princeton Avenue. It is the most direct connection from this bridge to Routes 1 and 206. The bridge itself tends to restrict the movement of traffic since it provides only one moving lane in each direction. In the evening, traffic is often backed up on Calhoun Street because of the problems which exist on the Pennsylvania side. The flow of traffic is generally from Pennsylvania in the morning and back in the evening.

While Calhoun Street is approximately 44 feet wide between State Street and West Hanover Street, it narrows to 34 feet from Hanover Street to Pashley Avenue where it widens out for one block to Pennington Avenue. There are plans to widen Calhoun Street south of Pashley Avenue to Bellevue Avenue. The extent of the widening will be approximately 10 feet. Parking is prohibited along the east side of Calhoun Street within this 34 foot portion.

A good deal of truck traffic utilizes Calhoun Street servicing the commercial and industrial areas near Pennington and Ingham Avenues.

Pavement conditions are extremely poor and this contributes heavily to traffic delay . A complete reconstruction of the roadway is necessary to alleviate this condition. Before undergoing reconstruction, however, consideration must be given to the widening of Calhoun Street between Hanover Street and Ingham Avenue. While such a widening would certainly eliminate the congestion and delay presently experienced by motorists, it would require the demolition of many buildings and would not be within the scope of TOPICS. The City currently has plans to repave Calhoun Street between Bellevue Avenue and Hanover Street.

Our designs for Calhoun Street incorporate the widening between Pashley and Bellevue Avenues with spot widenings at other locations. Recommendations including parking restrictions are shown in Figure V-12.

FIGURE V-12
CALHOUN STREET

CALHOUN STREET AND INGHAM AVENUE

Deficiencies

1. Delay--some delay is experienced by traffic along Calhoun Street as it approaches this offset intersection. The eastbound approach of Ingham Street is also delayed.

Existing Conditions

1. Calhoun Street is offset at Ingham Avenue. The north leg is 40 feet wide, the south leg 34 feet wide.

2. Ingham Avenue is only 30 feet wide with 15 foot approaches.

3. All traffic signal equipment is obsolete providing poor visibility.

4. Right turns from southbound Calhoun Street and the reverse movement, a left turn from eastbound Ingham Avenue, are heavy due to the use of Ingham Avenue and Parkway Avenue as truck routes leading to heavily industrialized areas.

Recommendations

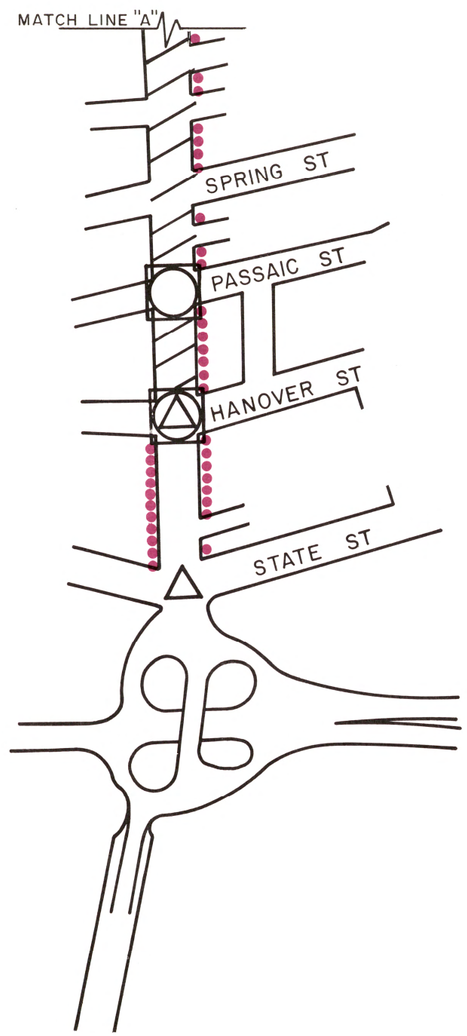
1. Widen the southbound approach of Calhoun Street to improve the Calhoun Street alignment. This will permit two approach lanes.

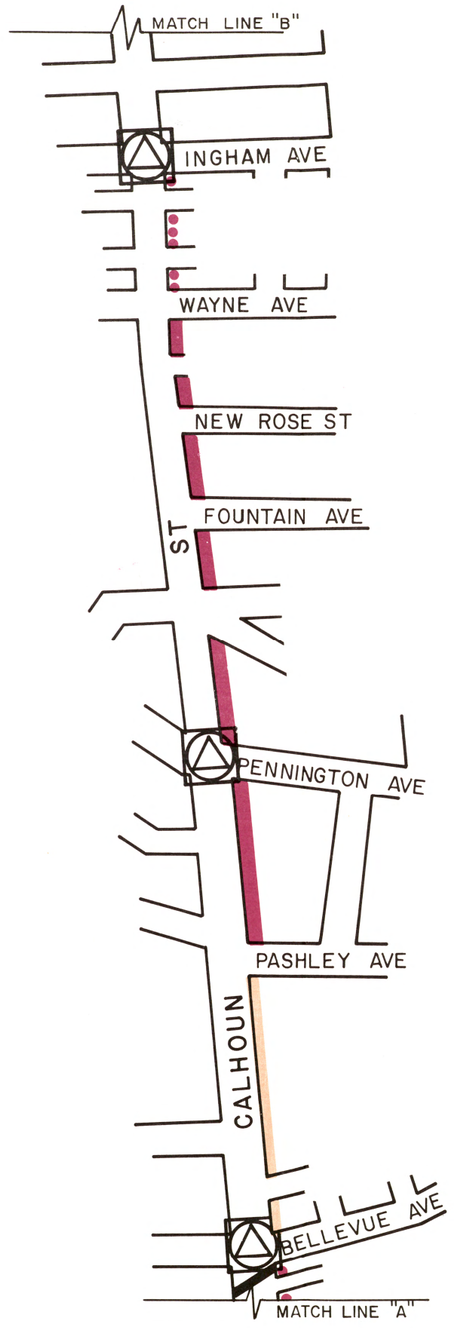
2. Cutback the north curbline of Ingham Avenue for approximately 200 feet on each leg.

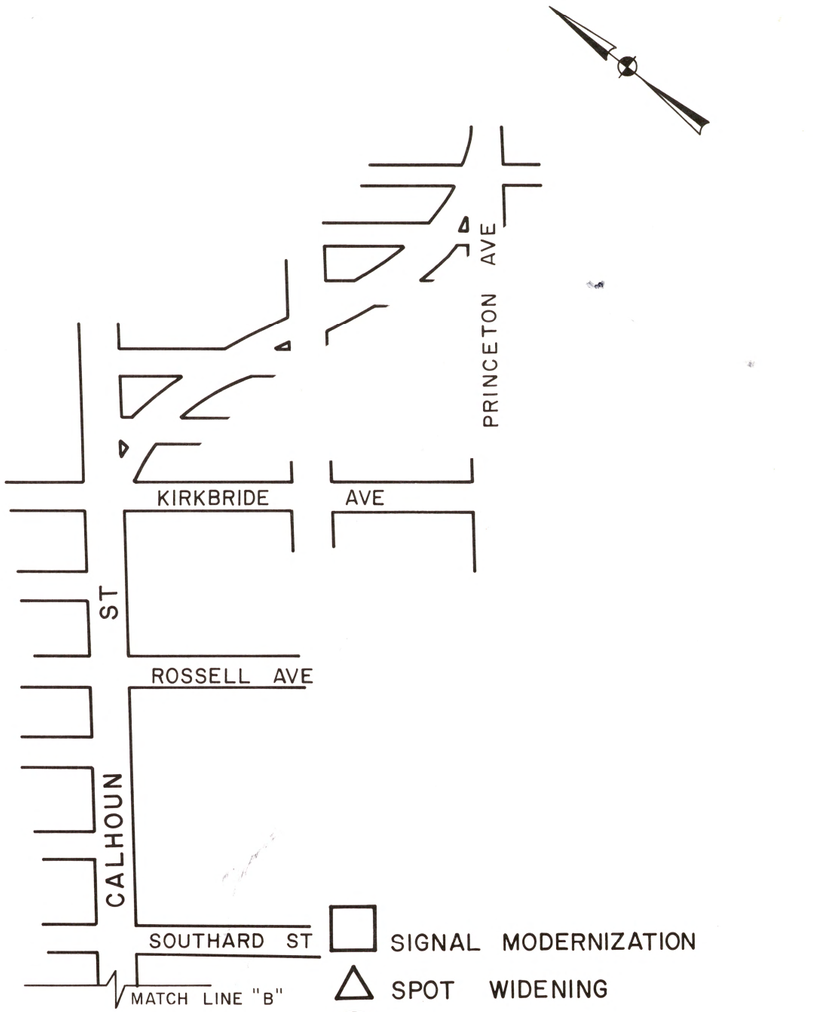
3. Create left turn slots for Ingham Avenue traffic.

4. Install traffic signal equipment, pavement markings, and parking prohibitions as shown in the accompanying plan.

Right-of-Way: Yes **Cost:** $31,000







CALHOUN STREET

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FIGURE V-12

FIGURE V-13
CALHOUN STREET AND INGHAM AVENUE

CALHOUN STREET AND PENNINGTON AVENUE

Deficiencies

1. Safety--Fourteen accidents in a one-year period.

2. Capacity--Westbound Pennington Avenue exhibits a level of service E, both morning and evening. Southbound Calhoun Street operates at level D in the afternoon peak.

Existing Conditions

1. The east leg of Pennington Avenue and south leg of Calhoun Street were widened when the school located in the southeast quadrant was constructed.

2. The two legs of the intersection not widened are 7-9 feet narrower.

3. The west leg of Pennington Avenue has a severe bend at the intersection.

4. Traffic signal equipment is obsolete providing poor visibility.

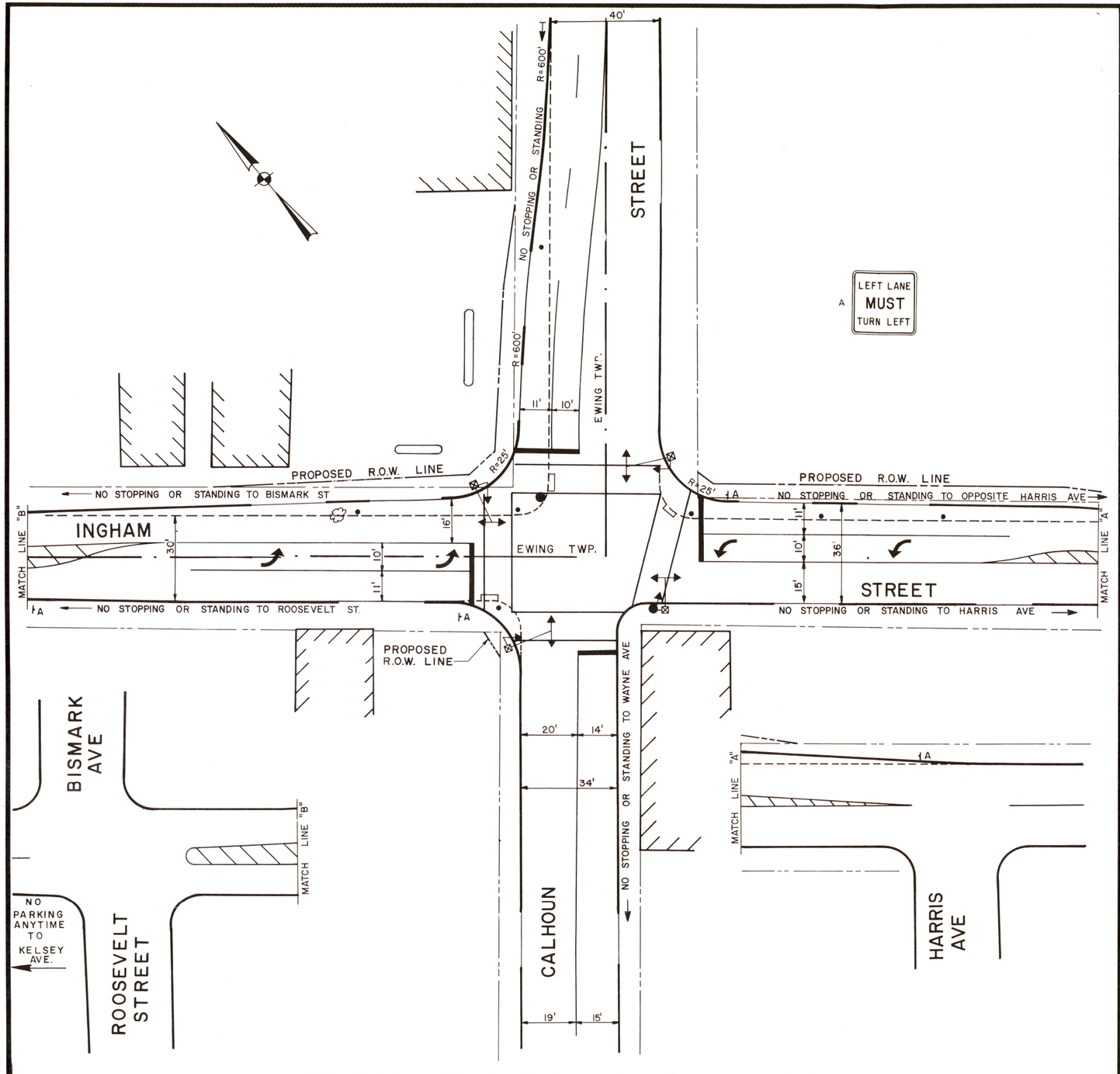
Recommendations

1. Realign the north curbline of Pennington Avenue, eliminating the poor alignment while providing two approach and discharge lanes in each direction.

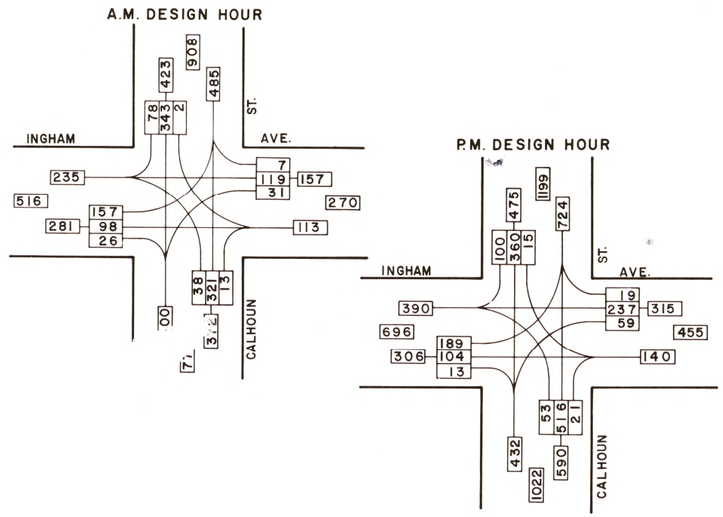
2. Cut back the east curbline of Calhoun Street north of Pennington Avenue, to provide two approach and discharge lanes in each direction.

3. Provide modern signal equipment, pavement markings and parking regulations as shown in the accompanying plan.

Right-of-Way: **Yes** **Cost:** $28,500



DESIGN HOUR VOLUMES



THERE WERE FEWER THAN 5 ACCIDENTS IN ONE YEAR AT THIS LOCATION

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FIGURE V-13

FIGURE V-14
CALHOUN STREET AND PENNINGTON AVENUE

CALHOUN STREET AND BELLEVUE AVENUE

Deficiencies

1. Safety--16 accidents occurred here over a one-year period. Six of these were right angle collisions and three involved pedestrians.

2. Capacity--westbound Bellevue Avenue has a level of service E and northbound Calhoun Street has a level of service F.

3. Delay--speed and delay surveys indicate unacceptable running speeds on all approaches to the intersection.

Existing Conditions

1. Bellevue Avenue approach consists of 3 lanes eastbound. Pavement width is 48 feet.

2. East leg of Bellevue Avenue is only 30 feet in width.

3. This section of Calhoun Street measures 34 feet wide.

4. Near-side bus stops are located on the eastbound and northbound approaches.

5. Bellevue Avenue is one of a series of closely-spaced intersections along Calhoun Street.

6. Traffic signal equipment is out dated.

Recommendations

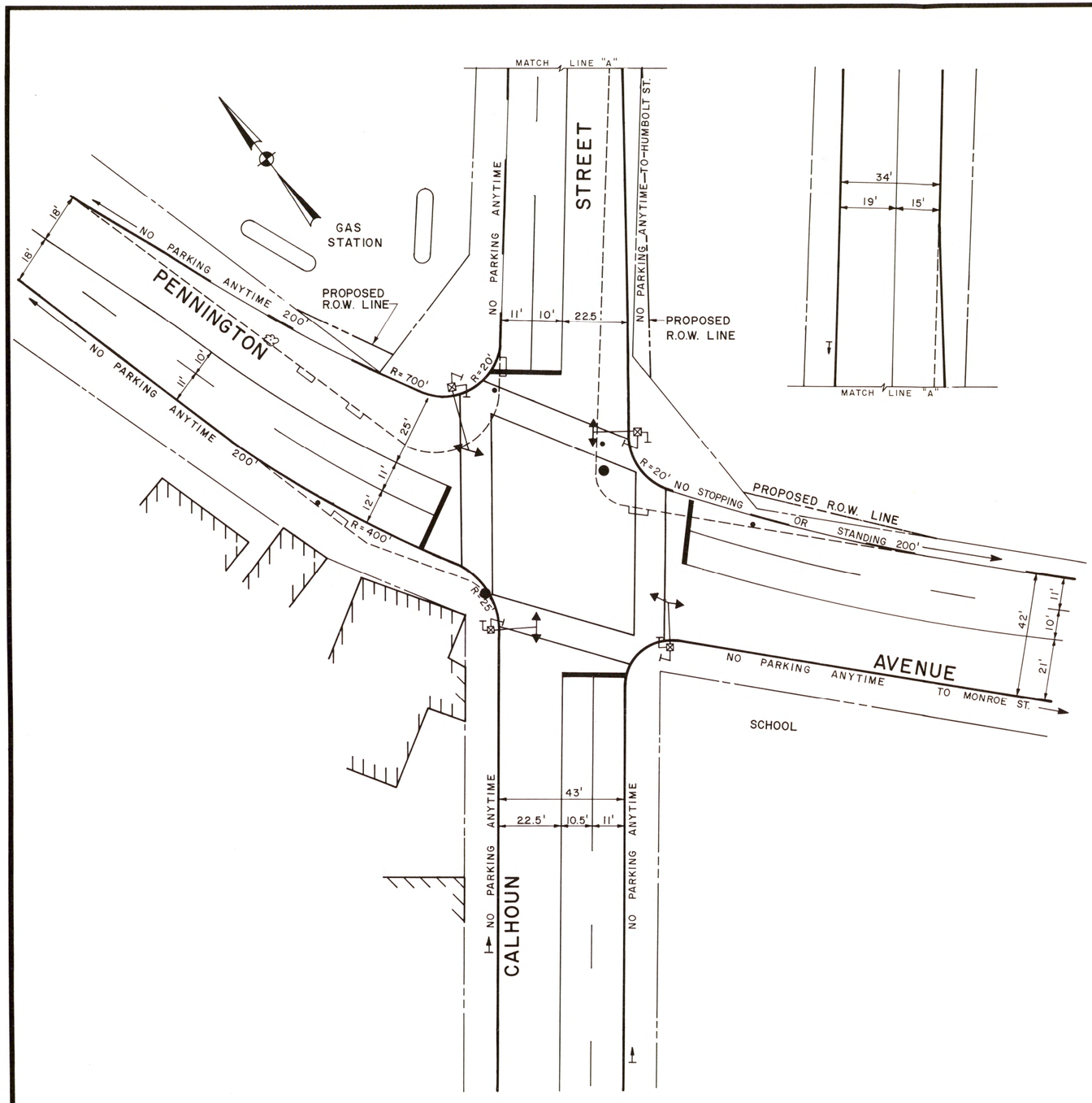
1. Widen Calhoun Street an additional 10 feet along the east curbline to Pashley Avenue.

2. Prohibit stopping and standing along Calhoun Street approaches and prohibit parking along Bellevue Avenue approaches.

3. Designate exclusive left turn lanes on Calhoun Street.

4. Modernize signals, install signs,and markings as shown in the accompanying plan.

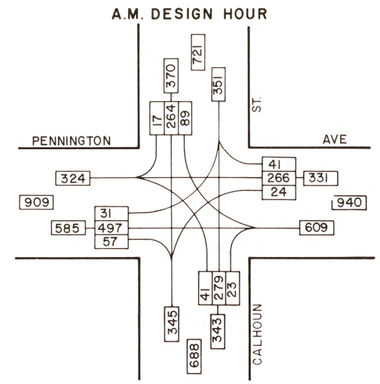
Right-of-Way: **Yes** **Cost:** $22,000

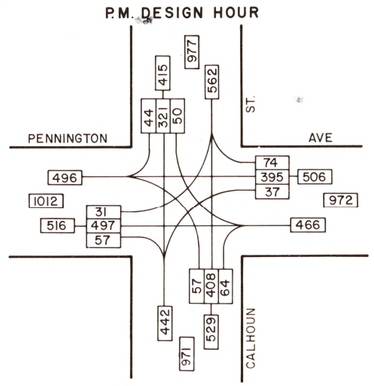


CALHOUN STREET & PENNINGTON AVENUE

0 50 100 150 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	14
ACCIDENT RATE PER TEN MILLION VEHICLES	17
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	6
INJURY RATE PER TEN MILLION VEHICLES	7
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	55
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	24

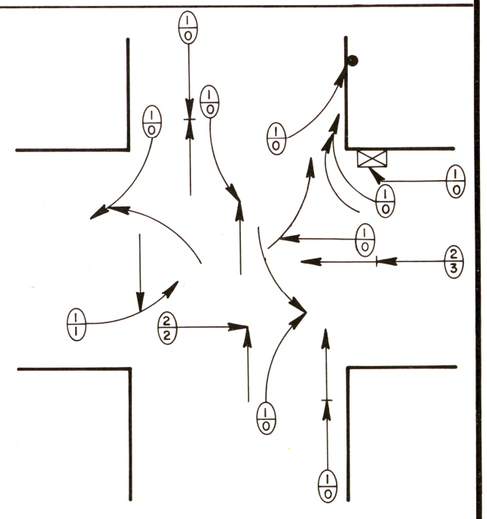


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FIGURE V-14

FIGURE V-15
CALHOUN STREET AND BELLEVUE AVENUE

CALHOUN STREET AND PASSAIC AVENUE

Deficiencies

1. Delay--excessive delays in both directions for Calhoun Street traffic.

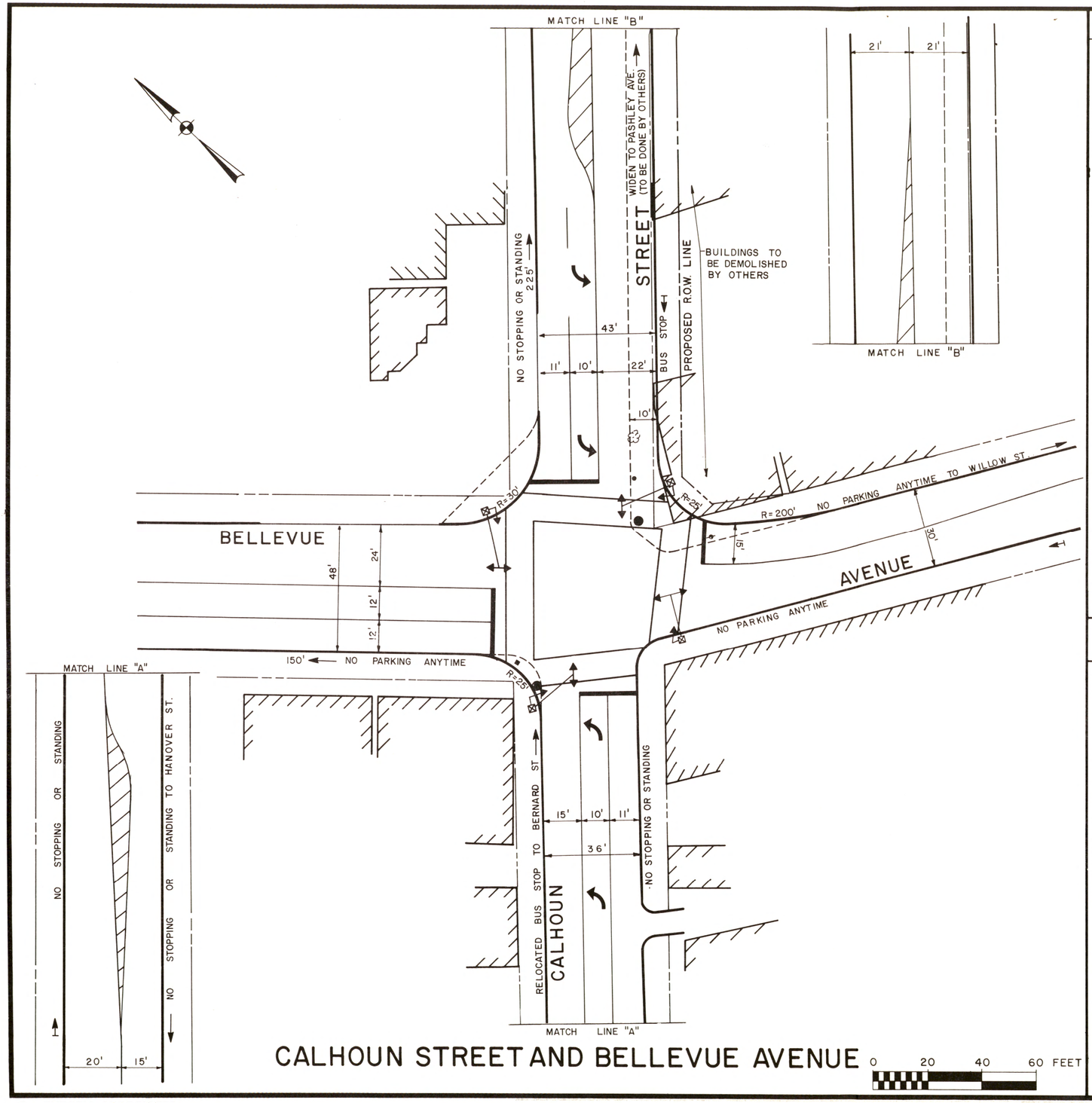
Existing Conditions

1. The west leg of Passaic Avenue is one-way away from Calhoun Street.
2. Calhoun Street is only 34 feet wide in this area.
3. Traffic is controlled by two pedestal-mounted signals.
4. This intersection is one of a series of signalized intersections within one block of each other along Calhoun Street.

Recommendations

1. Ban stopping and standing along the east curb of Calhoun Street.
2. Ban parking along the south side of Passaic Avenue east of Calhoun Street.
3. Install new traffic signal equipment, pavement markings, and parking regulations as shown in the accompanying plan.

Right-of-Way: No **Cost:** $21,000



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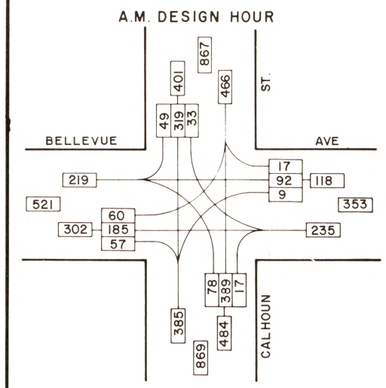
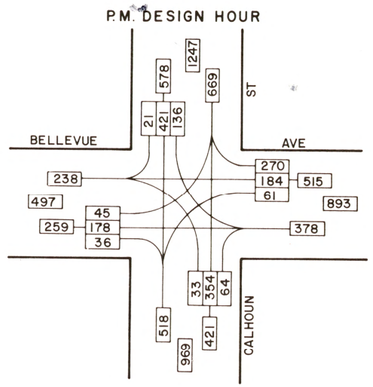
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	16
ACCIDENT RATE PER TEN MILLION VEHICLES	27
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	4
INJURY RATE PER TEN MILLION VEHICLES	7
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	30
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	12

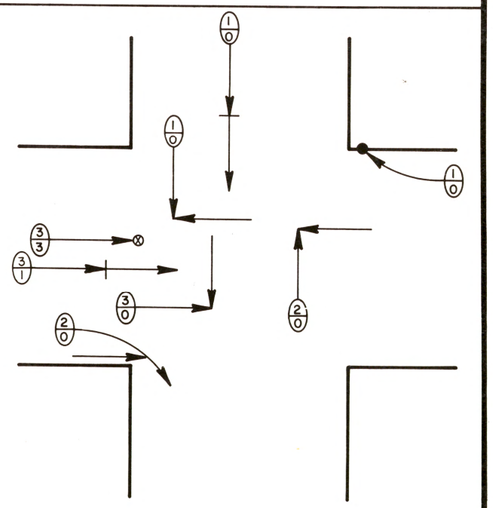


FIGURE V - 15

FIGURE V-16
CALHOUN STREET AND PASSAIC STREET

CALHOUN STREET AND HANOVER STREET

Deficiencies

1. Mobility--In the evening traffic is delayed and movement slow due to backups from the Calhoun Street bridge to Pennsylvania.

Existing Conditions

1. Calhoun Street south of Hanover Street is 44 feet wide, while it is only 34 feet wide north of Hanover Street.

2. The alignment of Hanover Street changes as it crosses Calhoun Street.

3. Signal equipment is post mounted providing poor visibility.

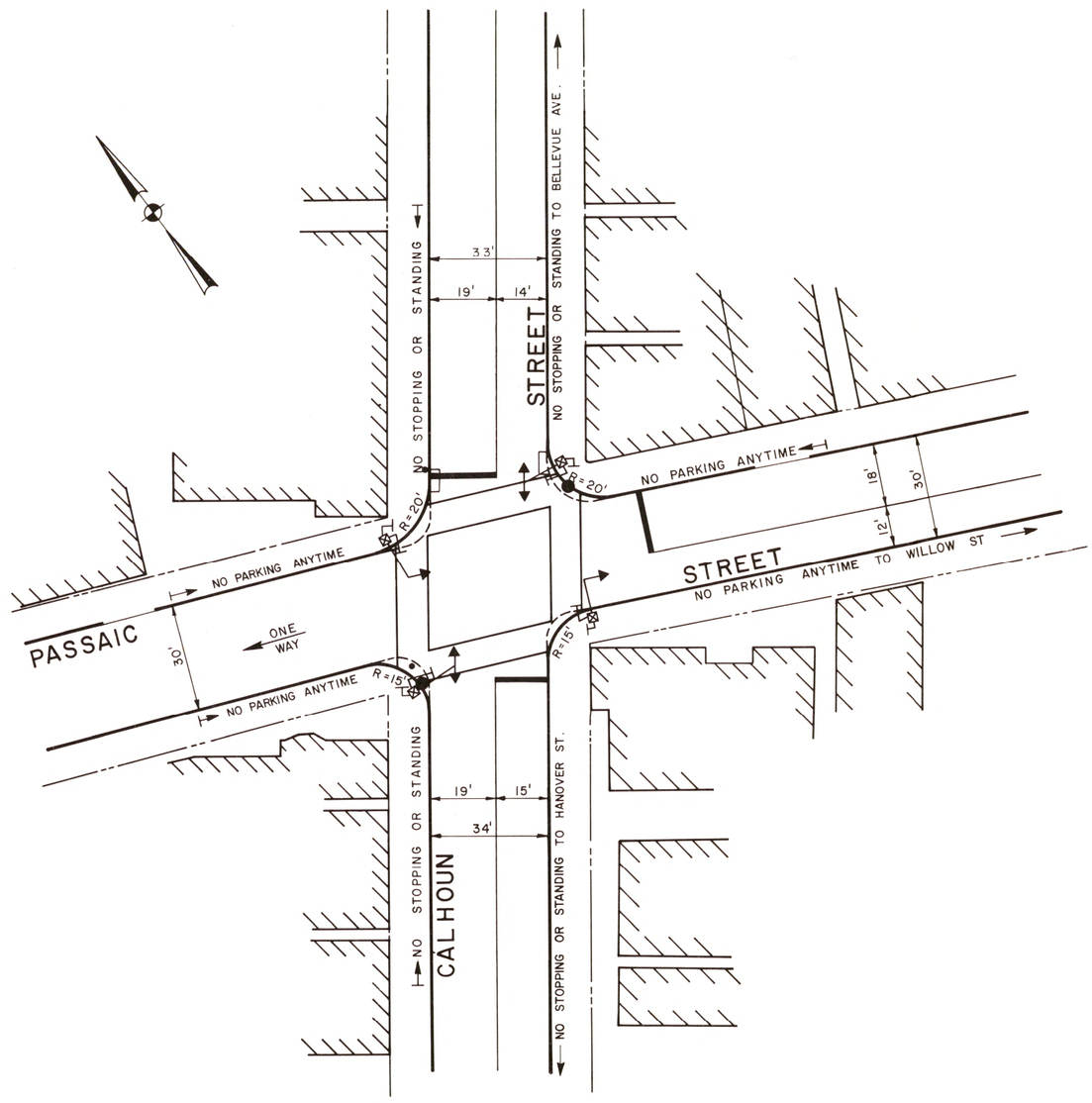
Recommendations

1. Realign the north curbline of Hanover Street as shown in the accompanying plan.

2. Widen the north leg of Calhoun Street transitioning back to its current width. This will enable a two lane operation for Calhoun Street at this intersection.

3. Install modern traffic signal equipment, pavement markings, and parking regulations as shown on the plan.

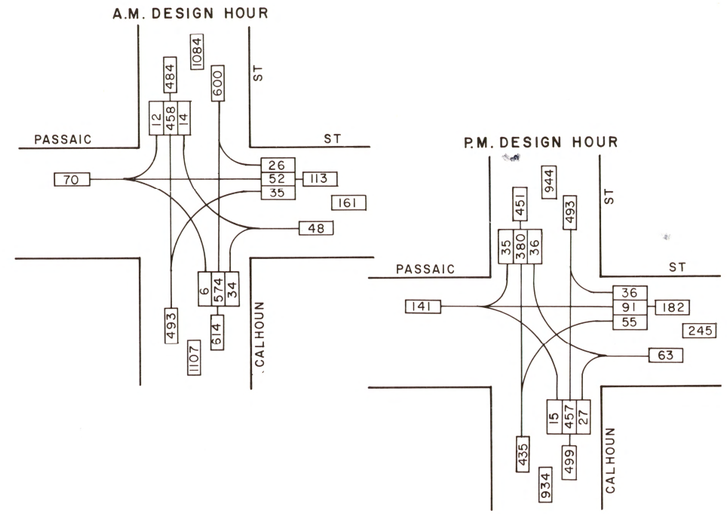
Right-of-Way: **Yes** **Cost:** $28,500



CALHOUN STREET & PASSAIC STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES



THERE WERE FEWER THAN 5 ACCIDENTS IN ONE YEAR AT THIS LOCATION

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FIGURE V-16

FIGURE V-17
CALHOUN STREET AND HANOVER STREET

CALHOUN STREET AND STATE STREET

Deficiencies

1. Safety--Eighteen accidents of various types have occurred at this location.

2. Delay--Severe delay to motorists caused by traffic backing up on the Calhoun Street bridge, blocking Calhoun Street southbound as well as turns from State Street onto the bridge.

3. Capacity--The level of service for traffic coming off the bridge in the morning is "F."

Existing Conditions

1. High volumes of traffic utilize the Calhoun Street bridge.

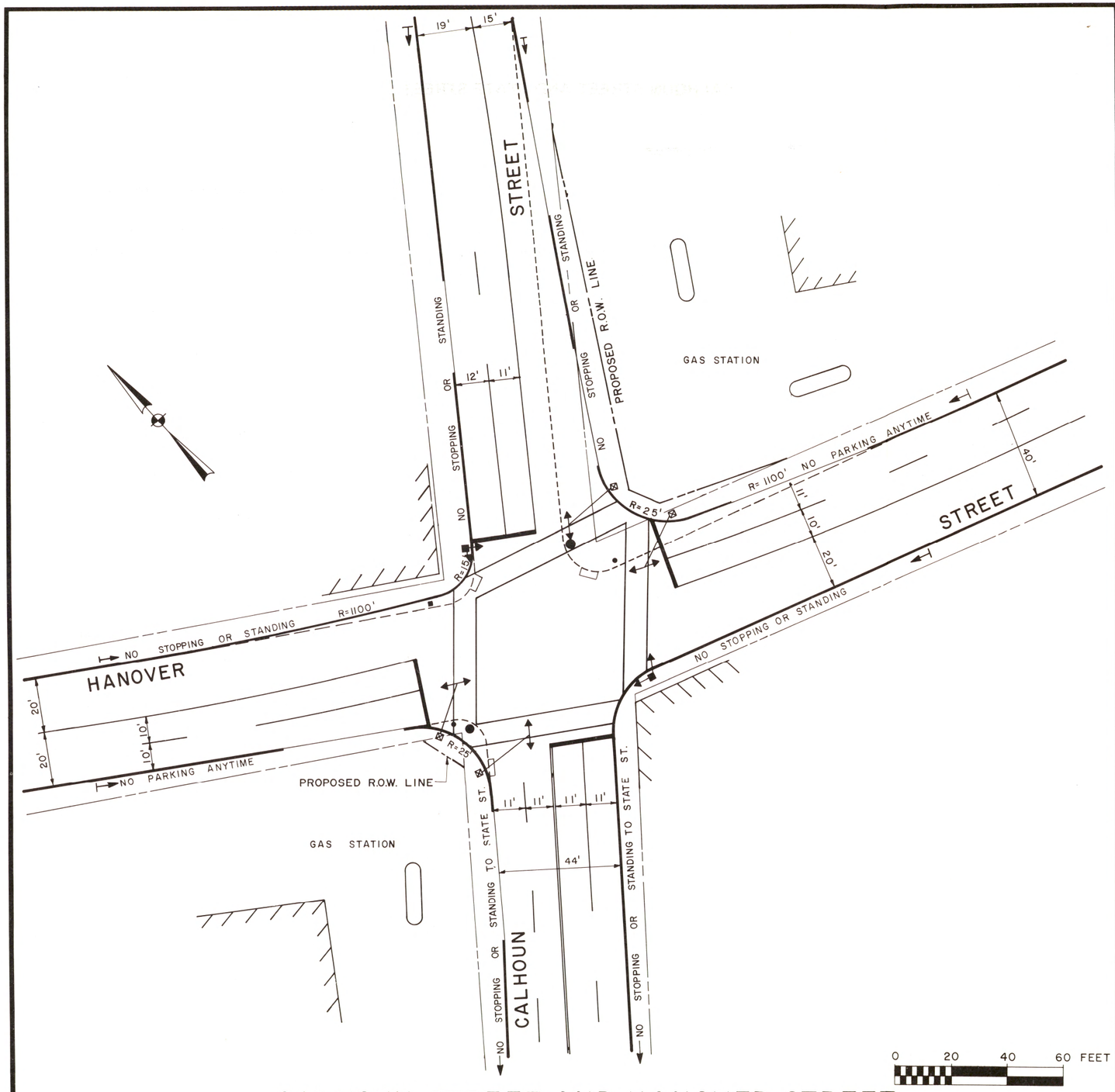
2. Existing over-the-road signal indications provide good visibility.

3. Traffic wishing to use the ramp leading to Route 29 west is forced to wait with traffic destined for Pennsylvania.

Recommendation

As shown in the accompanying plan an opening should be provided enabling traffic bound for Route 29 west to utilize the right turn lane southbound on Calhoun Street.

Right-of-Way: Yes **Cost:** $4,000



CALHOUN STREET AND HANOVER STREET

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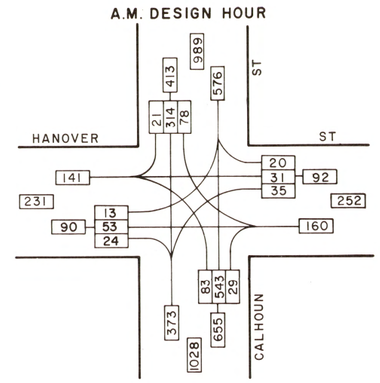
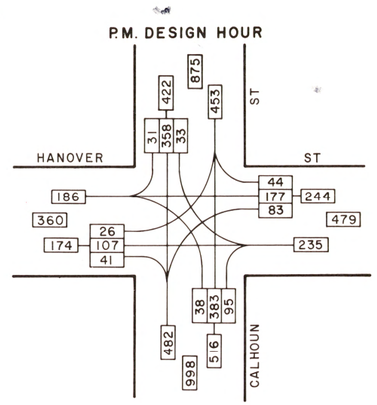
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	7
ACCIDENT RATE PER TEN MILLION VEHICLES	13
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	4
INJURY RATE PER TEN MILLION VEHICLES	7
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	23
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	8

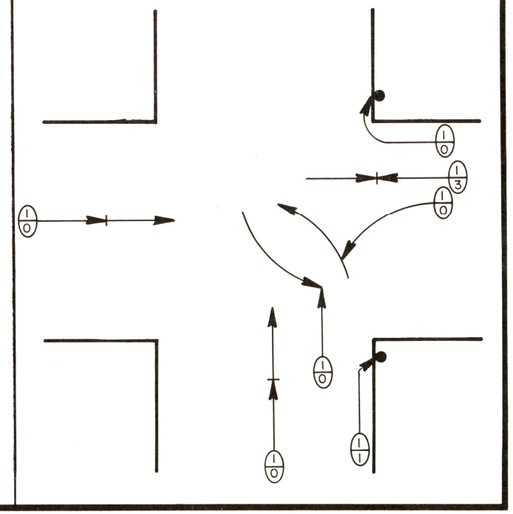


FIGURE V-17

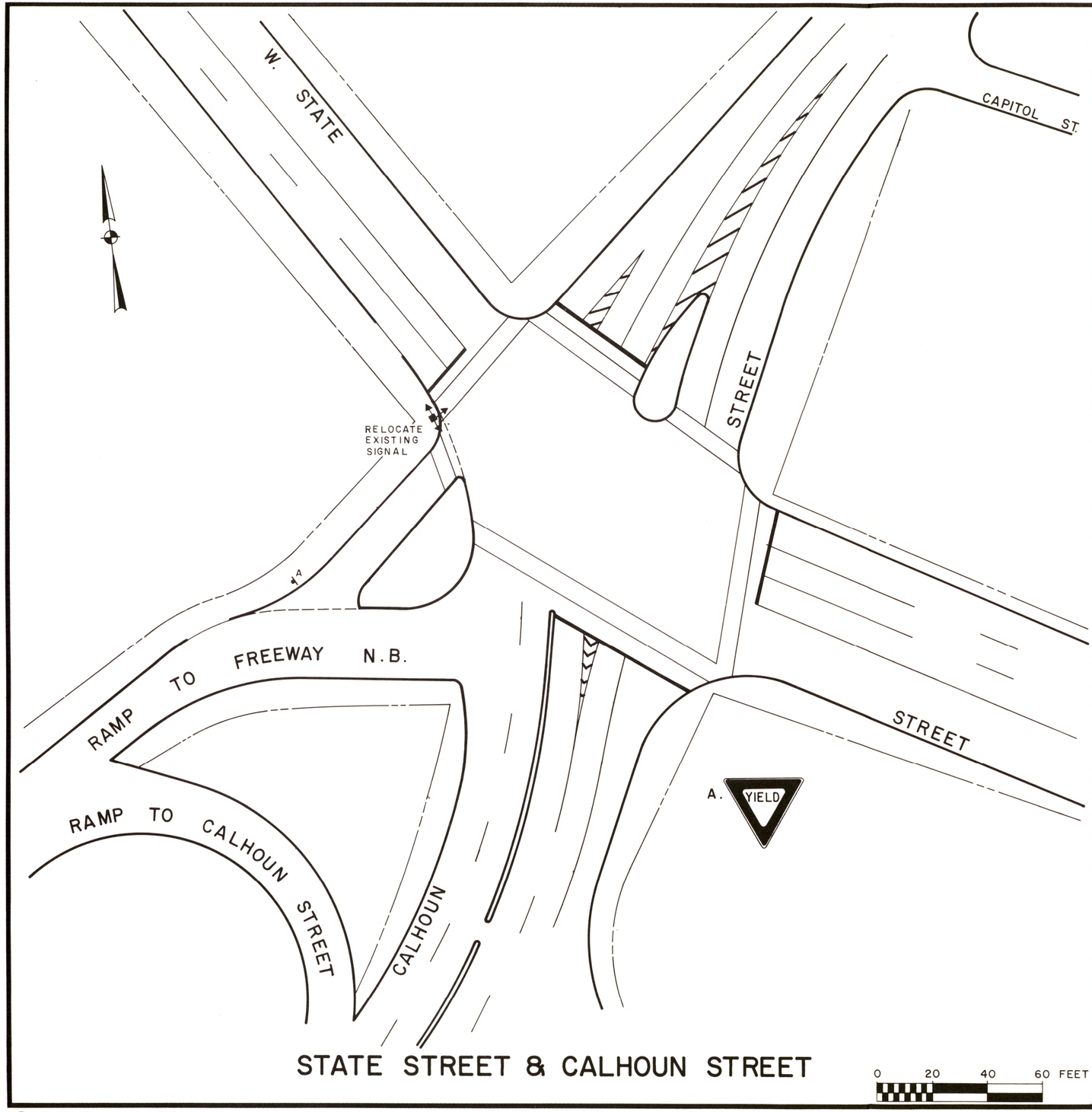
FIGURE V-18
STATE STREET AND CALHOUN STREET

PRINCETON AVENUE AND BRUNSWICK AVENUE

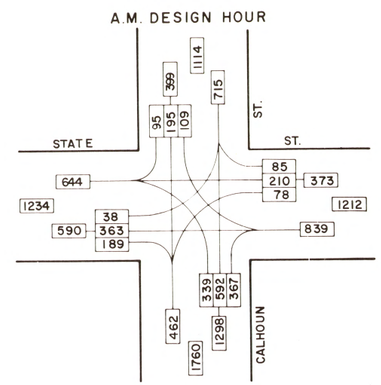
This area includes the arterials of Princeton and Brunswick Avenues from the Central Business District north to the City Line as shown in Figures 19 and 20. Princeton Avenue and Brunswick Avenue form the main access from the Central Business District to Routes 1 and 206. They are a direct link to the Route 1 Circle.

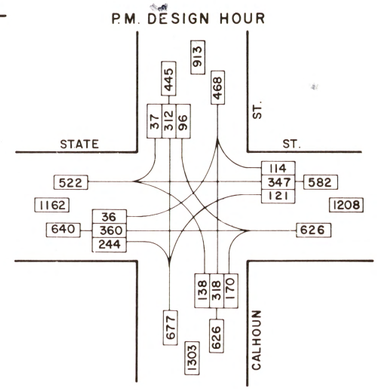
Princeton Avenue is primarily residential with an occasional neighborhood store. The roadway width is sufficient to provide the free movement of traffic with parking permitted on both sides. Pavement conditions along Princeton Avenue ranges from poor to fair. The intersection of Princeton and Olden is being studied as part of the Mercer County TOPICS Program.

Brunswick Avenue is similar in nature to Princeton Avenue with the exception of some industrial land use abutting the rail line. Southard Street extends from Calhoun Street east crossing the Trenton Freeway. Since it is one of the few crossings in that vicinity, relatively large volumes of traffic are generated along this arterial. The traffic signal at Brunswick and Southard Streets provides over the road indications with fairly good visibility. Princeton Avenue and Southard Street, on the other hand, has only post mounted indications. Figure 21 shows the detailed recommendation for this intersection. Designs for Olden Avenue and Brunswick Avenue and Olden Avenue and New York Avenue are discussed as part of the arterial consideration for Olden Avenue.



DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	18
ACCIDENT RATE PER TEN MILLION VEHICLES	28
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	3
INJURY RATE PER TEN MILLION VEHICLES	5
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	29
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	4

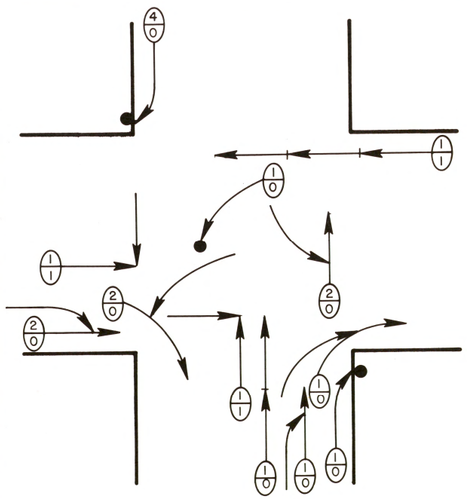


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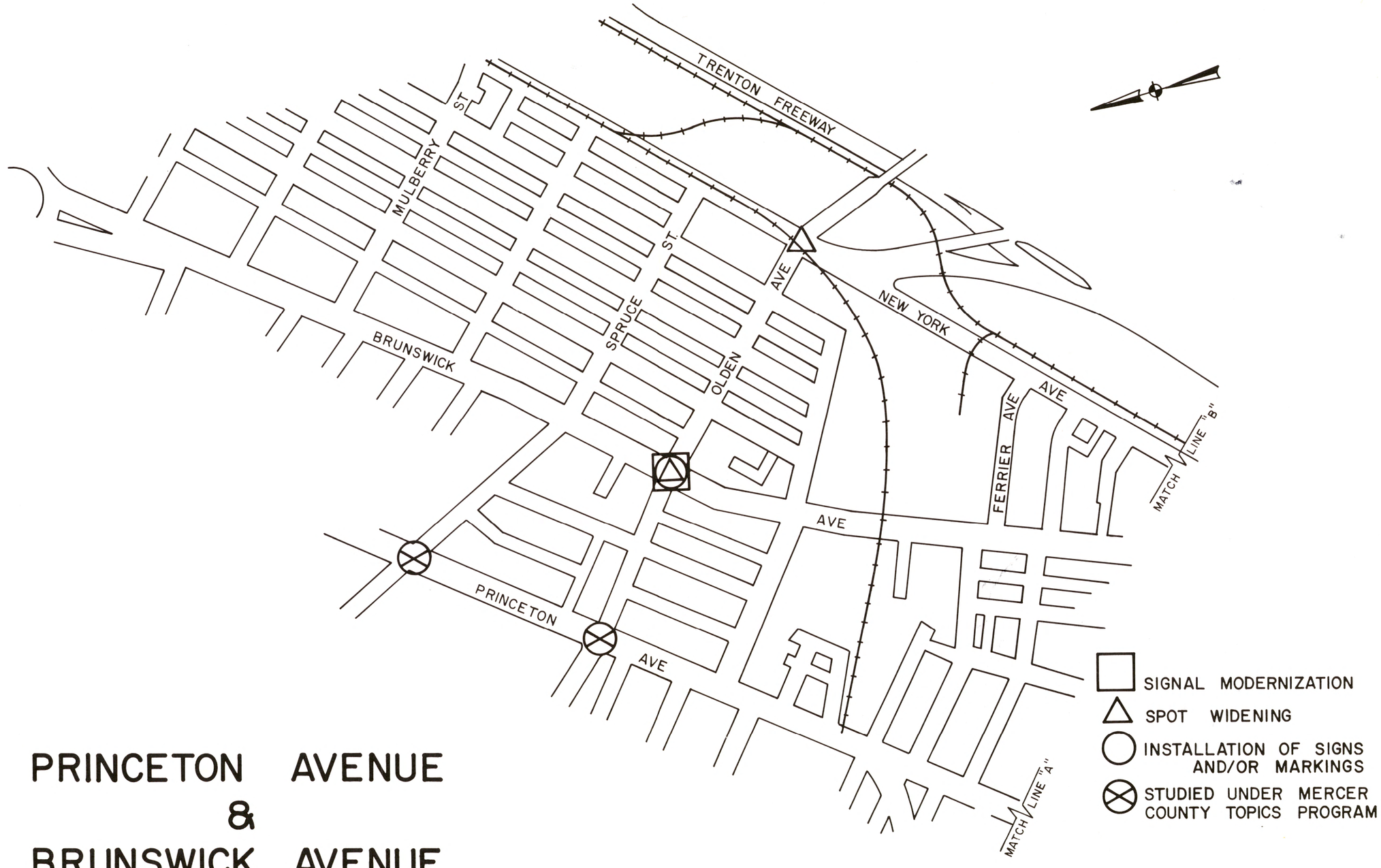
FIGURE V-18

FIGURE V-19
PRINCETON AVENUE AND BRUNSWICK AVENUE



PRINCETON AVENUE & BRUNSWICK AVENUE

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FIGURE V - 19

FIGURE V-20
PRINCETON AVENUE AND BRUNSWICK AVENUE

PRINCETON AVENUE AND SOUTHARD STREET

Deficiencies

1. Safety--nineteen accidents have occurred in a one-year period. Six of these were rear end and five right angle collisions.

2. Capacity--there is a capacity deficiency for westbound Southard Street.

Existing Conditions

1. There is a school located in the northeast quadrant of the intersection.

2. Southard Street undergoes a change in alignment as it crosses Princeton Avenue.

3. Signal equipment consists of two post mounted signals.

4. Parked cars are present on all approaches.

5. The northwest quadrant is occupied by apartment buildings generating a high demand for parking.

Recommendations

1. Realign the south curb of Southard Street as shown in the accompanying plan.

2. Install modern traffic signal equipment, pavement markings, and parking restrictions as shown in the accompanying plan.

Right-of-Way: No **Cost:** $23,000

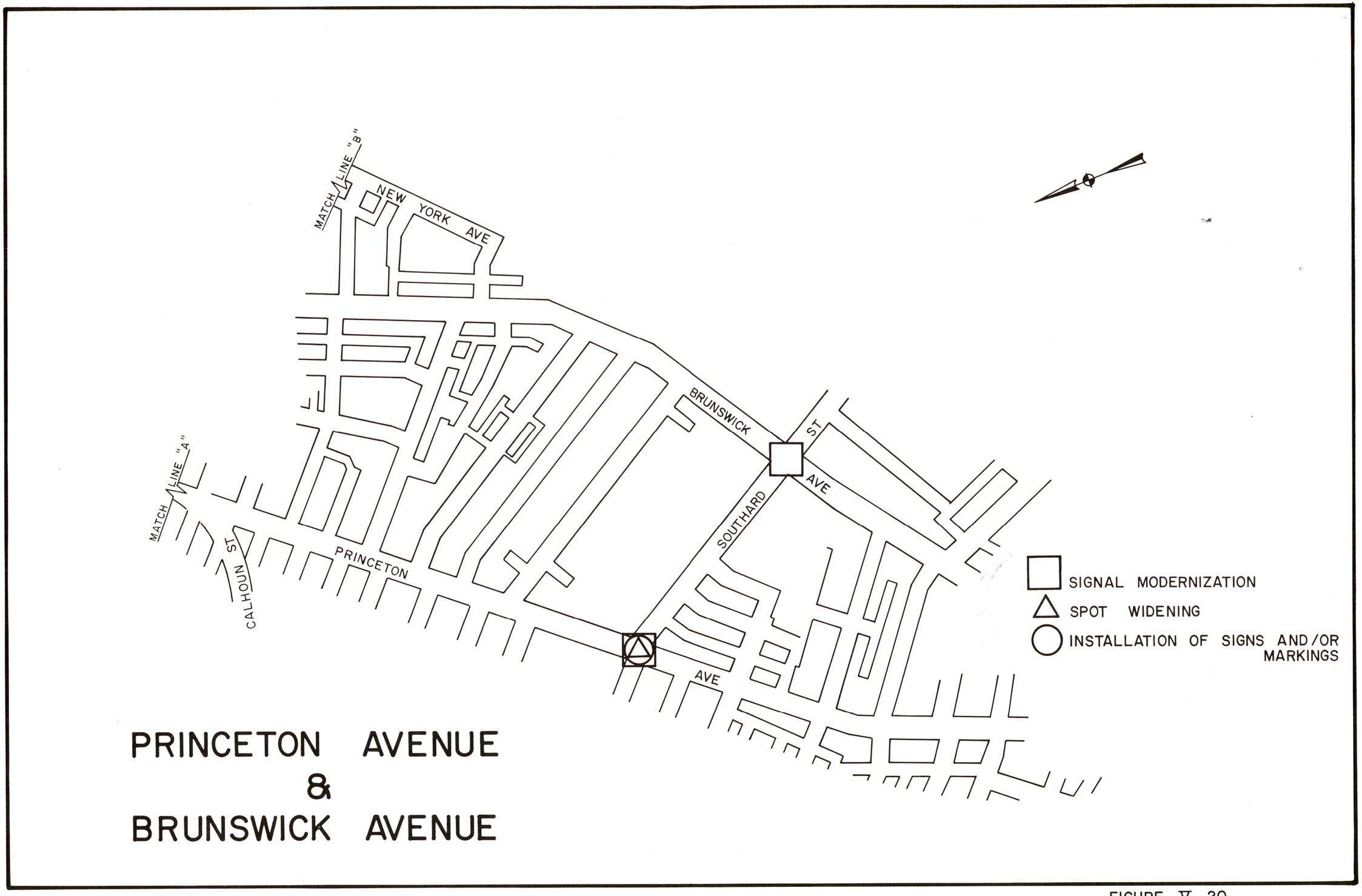

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FIGURE V-20

FIGURE V-21
PRINCETON AVENUE AND SOUTHARD STREET

BRUNSWICK AVENUE AND SOUTHARD STREET

Deficiencies

1. Safety--22 accidents in a one-year period at a rate of 30 per 10 million vehicle occurrences. These include 8 right angle collisions. More than half the total number of accidents occurred after dark.

2. Capacity-- westbound Southard Street operates at level of service E in the morning.

Existing Conditions

1. Existing over-the-road signal indications for all approaches.

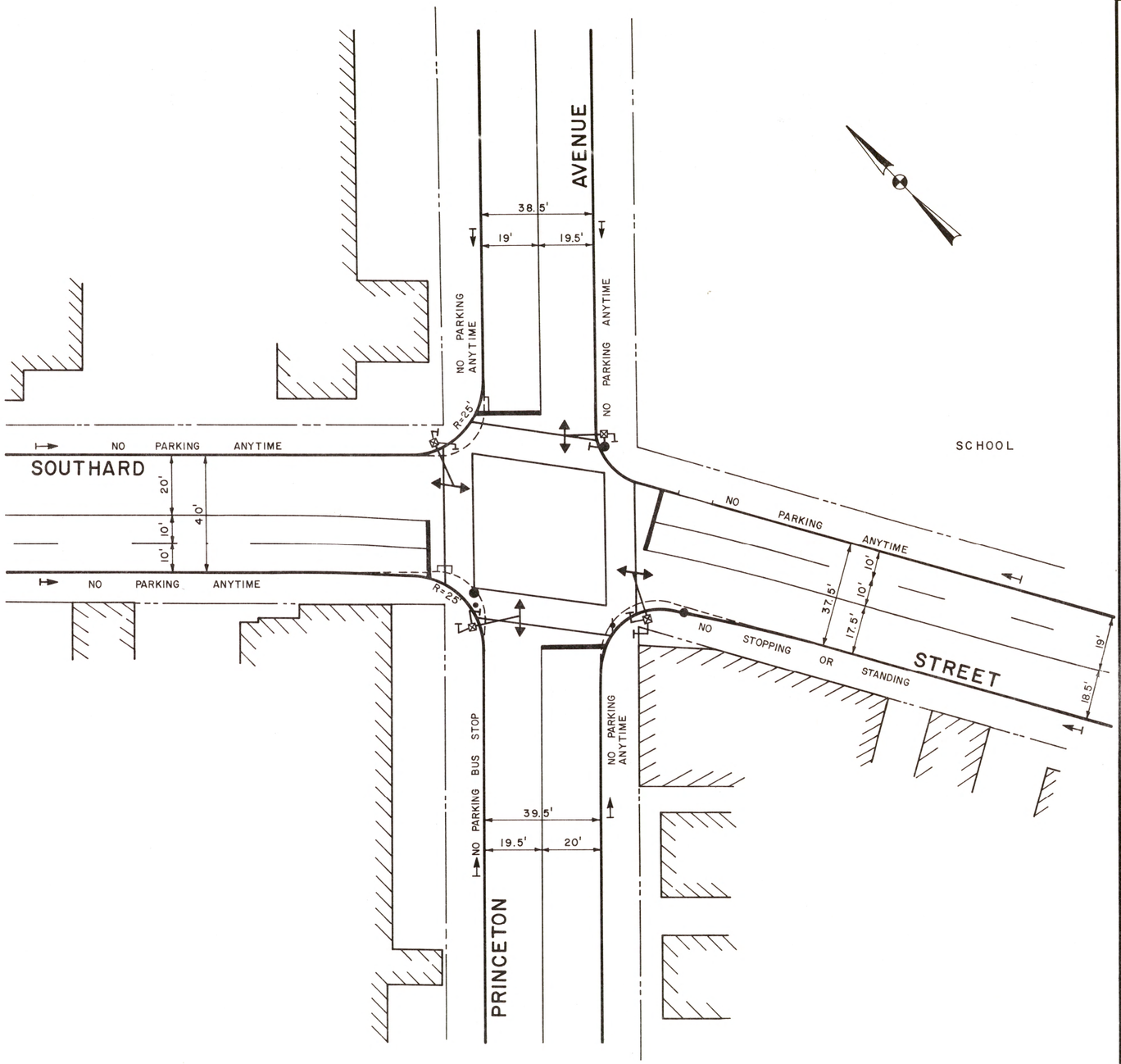
2. Parking prohibitions existing on critical approaches.

Recommendations

1. Follow current 3.5 second amber with a 2 second all red to help eliminate the right angle and turning collisions and install "Walk-Don't Walk" indications for all crosswalks.

2. Conduct a survey to determine the adequacy of street lighting in the area.

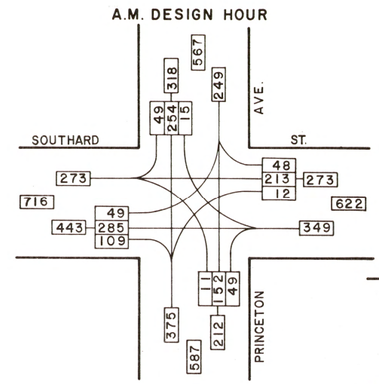
Right-of-Way: **No** **Cost:**

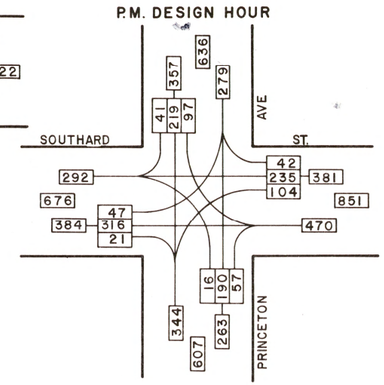


PRINCETON AVENUE AND SOUTHARD STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	19
ACCIDENT RATE PER TEN MILLION VEHICLES	26
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	3
INJURY RATE PER TEN MILLION VEHICLES	4
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	38
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	19

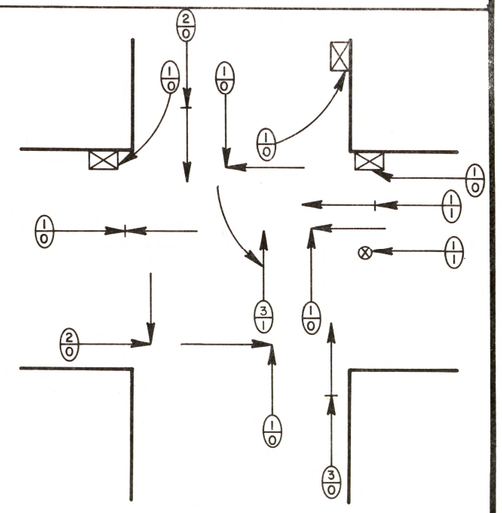


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FIGURE V-21

EAST END

This large area encompasses the northeast portion of Trenton and includes many major arterials:

- Olden Avenue
- Lincoln Avenue-Chambers Street
- North Clinton Avenue
- East State Street
- Greenwood Avenue
- Hamilton Avenue

Olden Avenue and Chambers Street run in an east-west direction while State Street, Greenwood Avenue and Hamilton Avenue are aligned in a north-south direction. North Clinton Avenue curves in such a manner that it is in the north-south direction at its intersection with Olden Avenue and runs east-west as it enters the Greenwood Avenue circle.

This circle was the scene of twenty-four accidents in a one-year period. This location is a short distance from the Barlow Street Circle which serves as a major interchange for the Route 1 Freeway. A solution for both the accidents and congestion at these locations must be sought. Since a solution to problems in this area could well involve major construction of highway ramps it was not considered to be within the scope of this study.

Olden Avenue, North Clinton Avenue and Chambers Street are given arterial consideration and discussed individually. State Street, Greenwood Avenue and Hamilton Avenue are similar in nature and provide access to the same general area of Hamilton Township. Their widths approach forty feet and are able to provide for the smooth flow of traffic even with parking permitted. However, at major intersections congestion occurs due to high traffic volumes on both intersecting streets.

The land use throughout the East End is primarily residential with some industrial usage along Clinton Avenue.

Figure V-22 shows the area and a summary of recommendations.

STATE STREET AND MONMOUTH STREET

Deficiencies

1. Safety--14 accidents have occurred at this unsignalized intersection in the past year; these were predominantly right angle collisions.

Existing Conditions

1. Intersection is controlled by stop signs with State Street the through street.

2. This location is at the intersection of two bridges which are old and in bad repair.

3. The headwalls of these bridges tend to obscure northbound State Street traffic from the view of motorists waiting at the stop sign on the eastbound approach of Monmouth Street.

4. There is a curve and an increase in grade as eastbound Monmouth Street traffic approaches State Street.

Recommendations

1. Reconstruct the State Street bridge; however, funding shall not be under the TOPICS Program.

2. Place a "Stop Sign Ahead" warning sign 200' west of State Street for eastbound traffic.

Right-of-Way: No

Cost: ——

New bridge $500,000

FIGURE V-22
EAST END

OLDEN AVENUE

Olden Avenue (County Road No. 22) extends from Mercerville Road in Hamilton Township, west through the City of Trenton, terminating in Ewing Township at its intersection with Parkway Avenue. It is the only east-west arterial which provides an unbroken link between link these two areas. The pavement width along Olden Avenue within the City is approximately 36 feet. Along Olden Avenue at Liberty Street travelling west, the land use is primarily one and two family residences. With the exception of emergency snow provisions and regulations to enable street cleaning, there are very few parking restrictions along Olden Avenue in this vicinity. Truck traffic along Olden Avenue is relatively heavy creating problems with respect to the smooth flow of traffic because of the narrow pavement width coupled with parking on both sides of the roadway. At signalized intersections, there is an occasional "No Parking" regulation at the corner to provide for two approach lanes or two discharge lanes. Once past State Street the land use tends to change from residential to industrial. At the intersection of Olden Avenue and North Clinton Street, Olden Avenue is off-set approximately 35 feet, creating serious delays in the flow along Olden Avenue. Between Clinton Avenue and New York Avenue, land use is a mixture of industrial, residential and commercial. The existing 'No Parking' regulations in this area are completely ignored and both sides of the street are parked solidly. This can be attributed to the industrial plants whose workers use the parking along the street. West of New York Avenue, the land use once again becomes residential and retail.

At Princeton Avenue, Olden Avenue becomes a four lane roadway as it leaves the City of Trenton entering Ewing Township.

Due to heavy volumes and a high percentage of truck traffic motorists on Olden Avenue experience serious delays and congestion. Our recommendations at signalized intersections generally include spot widenings to provide two approach and discharge lanes in each direction. In addition, peak hour parking restrictions should be instituted as shown in our Summary of Recommendations in Figure V-23.

EAST END



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FIGURE V - 22

FIGURE V-23
OLDEN AVENUE

BRUNSWICK AVENUE AND OLDEN AVENUE

Deficiencies

1. Safety--of a yearly total of 24 collisions, 12 involved westbound vehicles; four were side swipes at the westbound approach; four pedestrian and five right angle accidents occurred here.

2. Capacity--Brunswick Avenue has a level of service "E" on its northbound approach and "D" on its southbound approach.

3. Delay--Extensive delays are common in both directions on Brunswick Avenue.

Existing Conditions

1. Brunswick Avenue provides direct access to Route 1; Olden Avenue is another major through route.

2. Small businesses bordering these streets generate pedestrian traffic and a need for parking space.

3. Near side bus stops are located at each approach.

4. Heavy truck traffic and heavy turning volumes are characteristic of each approach.

Recommendations

1. Widen both Olden Avenue approaches to provide two traffic lanes.

2. Ban parking on all approaches and mark pavement for two approach lanes in each direction for greater intersection capacity.

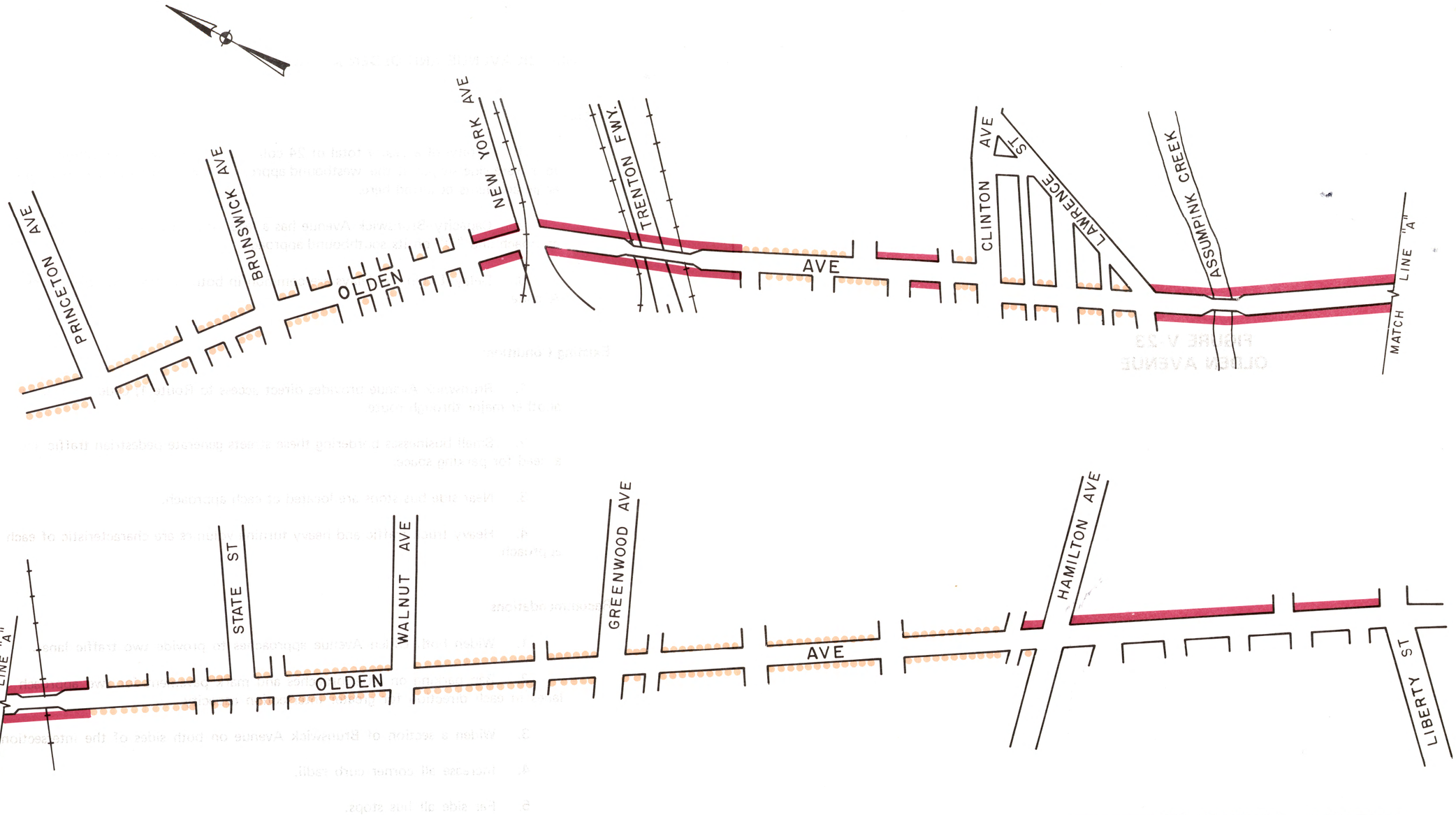
3. Widen a section of Brunswick Avenue on both sides of the intersection.

4. Increase all corner curb radii.

5. Far side all bus stops.

6. Install additional traffic signal equipment including "Walk-Don't Walk" indications for all crosswalks.

Right-of-Way: **Yes** **Cost:** **$28,500**



OLDEN AVENUE

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FIGURE V-23

FIGURE V-24
BRUNSWICK AVENUE AND OLDEN AVENUE

OLDEN AVENUE AND CLINTON AVENUE

Deficiencies

1. Safety--there were 15 accidents of various types at this intersection.

2. Delays--occur along Olden Avenue in both directions during peak hours and throughout most of the day.

Existing Conditions

1. Buildings in the northeast and southwest quadrants are abandoned.

2. Narrow pavement width of Clinton Avenue (34 feet) which cannot be widened due to proximity of buildings to curb line.

3. Olden Avenue is offset 35 feet at this intersection causing a break in the flow of Olden Avenue traffic.

4. Left turns from both Olden Avenue approaches are prohibited from 4 to 6 p.m.

5. Taxi stand 40 feet back from intersection on eastbound approach of Olden Avenue.

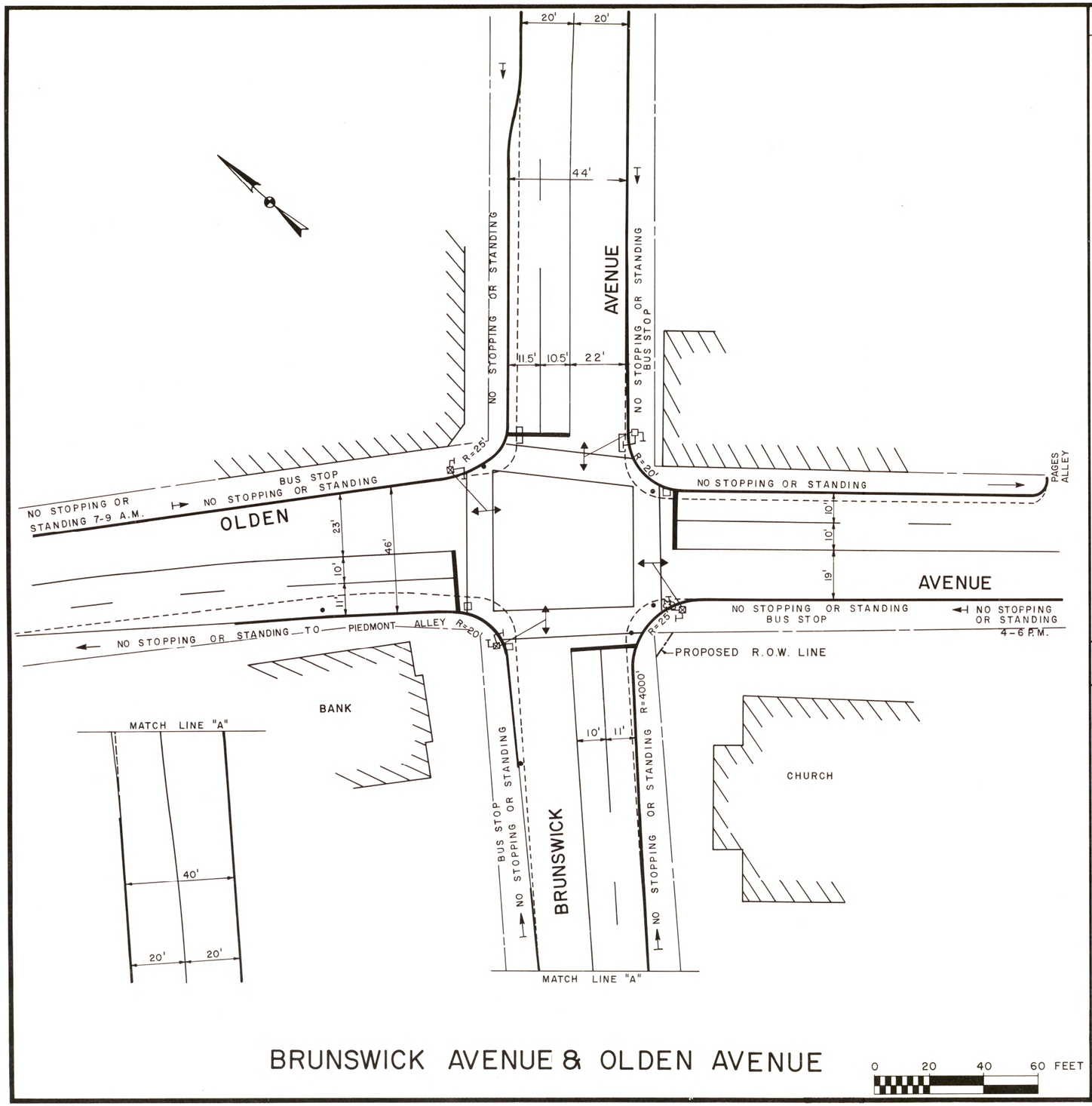
Recommendations

1. Realign Olden Avenue to allow smoother traffic flow with 2 approach lanes in each direction.

2. Install No Stopping or Standing along both sides of Olden Avenue for 200 feet in both directions.

3. Install new traffic signal equipment, signs and markings as shown in the accompanying plan.

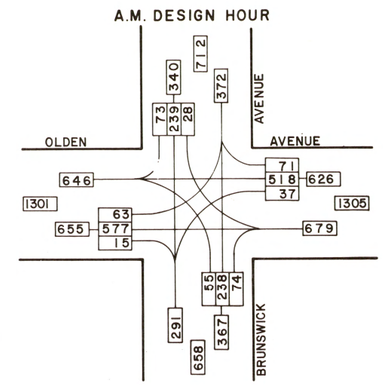
Right-of-Way: **Yes** **Cost:** $33,000

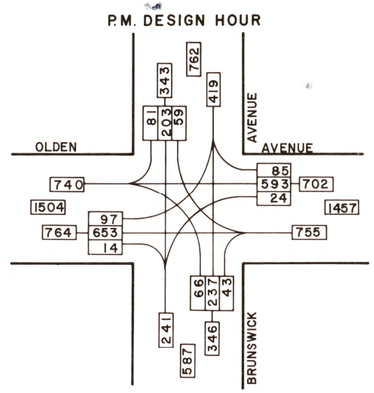


BRUNSWICK AVENUE & OLDEN AVENUE

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	24
ACCIDENT RATE PER TEN MILLION VEHICLES	21
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	11
INJURY RATE PER TEN MILLION VEHICLES	10
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	35
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	24

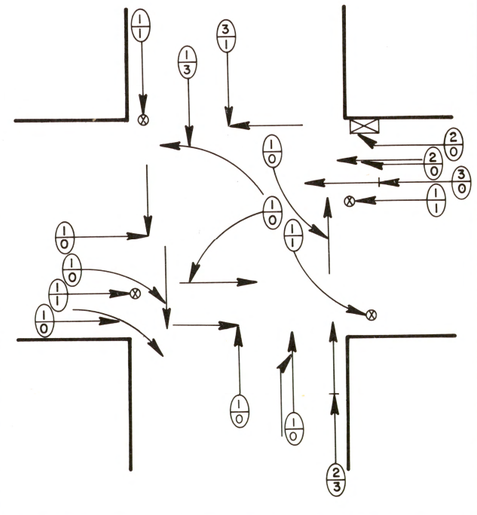


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FIGURE V-24

FIGURE V-25
OLDEN AVENUE AND CLINTON AVENUE

OLDEN AVENUE AND STATE STREET

Deficiencies

1. Safety--in one year 18 accidents occurred at this intersection. There were 7 rear-end collisions along State Street.

2. Capacity--northbound State Street is at level of service 'E.'

3. Delay--P.M. peak hour traffic experiences delays of more than 90 seconds at the northbound approach of State Street.

Existing Conditions

1. Eastbound Olden Avenue traffic is often backed up from the downstream intersection of Olden Avenue and Greenwood Avenue.

2. Northbound traffic has a high percentage of left turns opposing heavy straight through traffic.

3. Small retail shops border the intersection.

4. A bank in the northeast quadrant, with driveways from Olden Avenue and State Street, causes some interference during banking hours.

5. Outdated signal equipment consists of two 4-way pedestal mounted traffic signals.

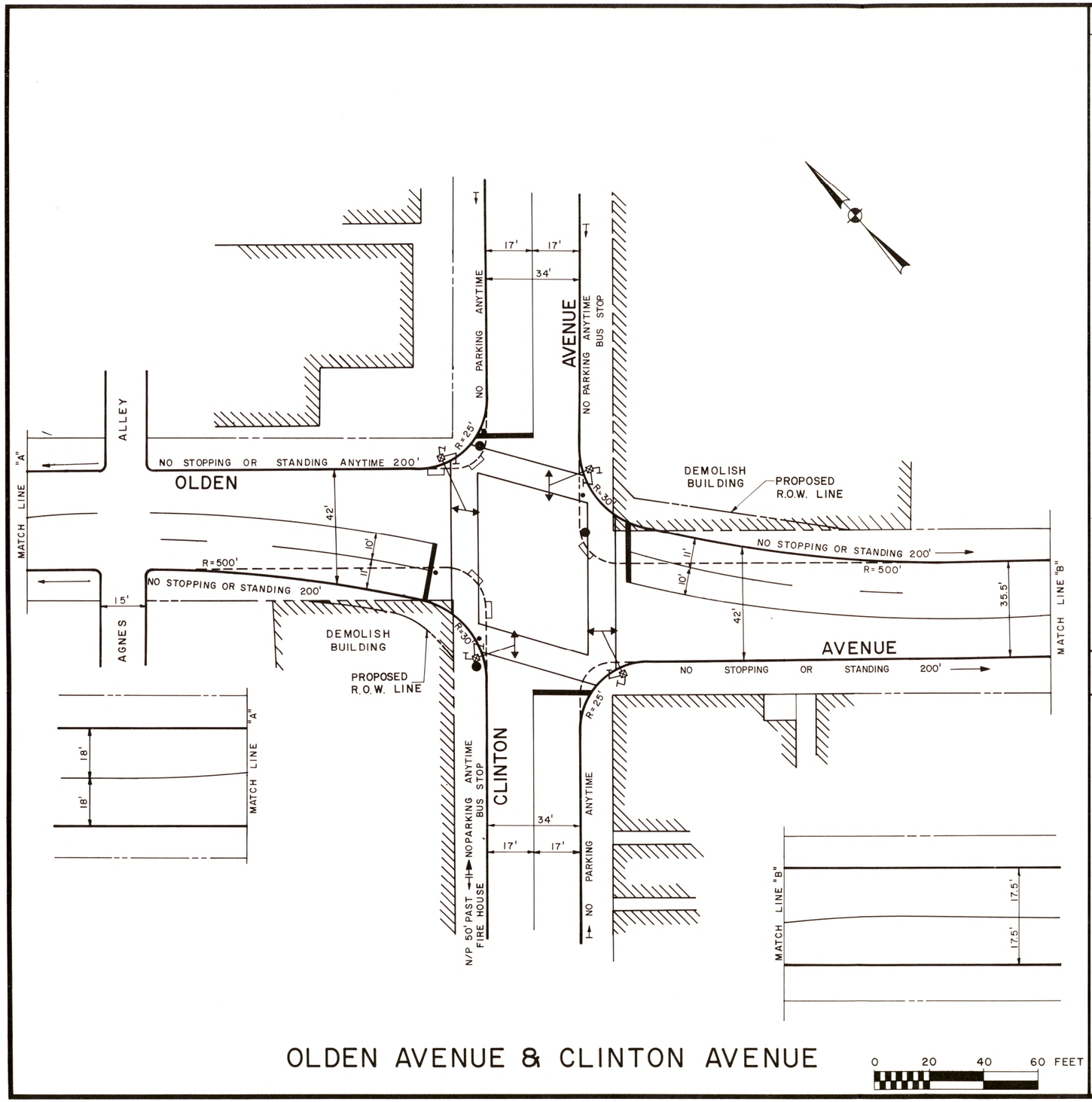
Recommendations

1. Widen both legs of Olden Avenue to allow 42' pavement widths at the intersection.

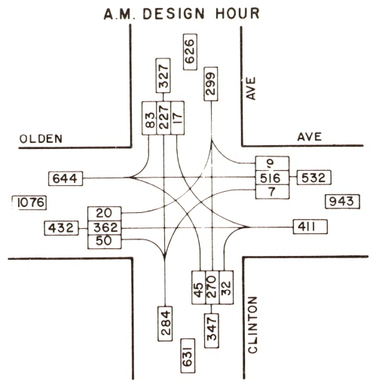
2. Cutback the west curbline of State Street to provide two approach lanes in each direction.

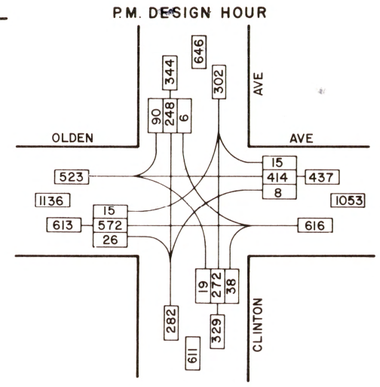
3. Install modern signals, pavement markings and parking regulations in accordance with the accompanying plan.

Right-of-Way: No **Cost:** $33,000



DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	15
ACCIDENT RATE PER TEN MILLION VEHICLES	14
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	5
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	21
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	2

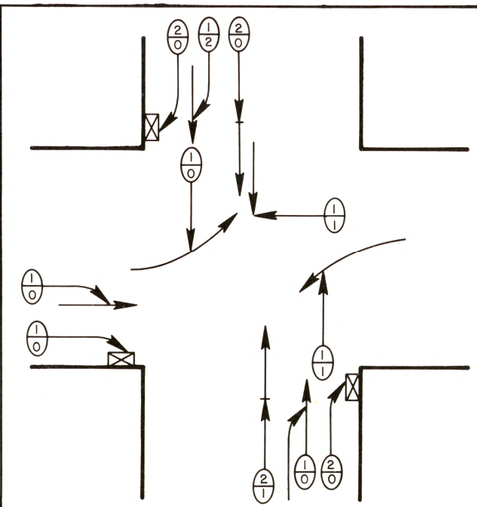


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FIGURE V-25

FIGURE V-26
OLDEN AVENUE AND STATE STREET

GREENWOOD AVENUE AND OLDEN AVENUE

Deficiencies

1. Safety--15 was the total number of accidents occurring here in one year. High ratio of night-to-day accidents.

2. Capacity--Greenwood Avenue northbound and Olden Avenue eastbound operate at level of service 'F' in the evening peak hour. Greenwood Avenue southbound is at level of service 'D' in the morning peak hour.

3. Delay--extensive delays are experienced by eastbound Olden Avenue traffic during the P.M. peak hour.

Existing Conditions

1. Parking restrictions, other than for bus stops, do not exist on any of the legs.

2. Approach widths on Olden Avenue are 18 feet.

3. Bus stops are located on three approaches.

4. Signalization consists of two 20-foot mast arms and a post mounted 4-way signal.

5. Greenwood Avenue is striped for two approach lanes with the center lanes opposing one another and no designation for left turn only.

Recommendations

1. Widen Olden Avenue on both sides of the intersection to permit two approach lanes in each direction.

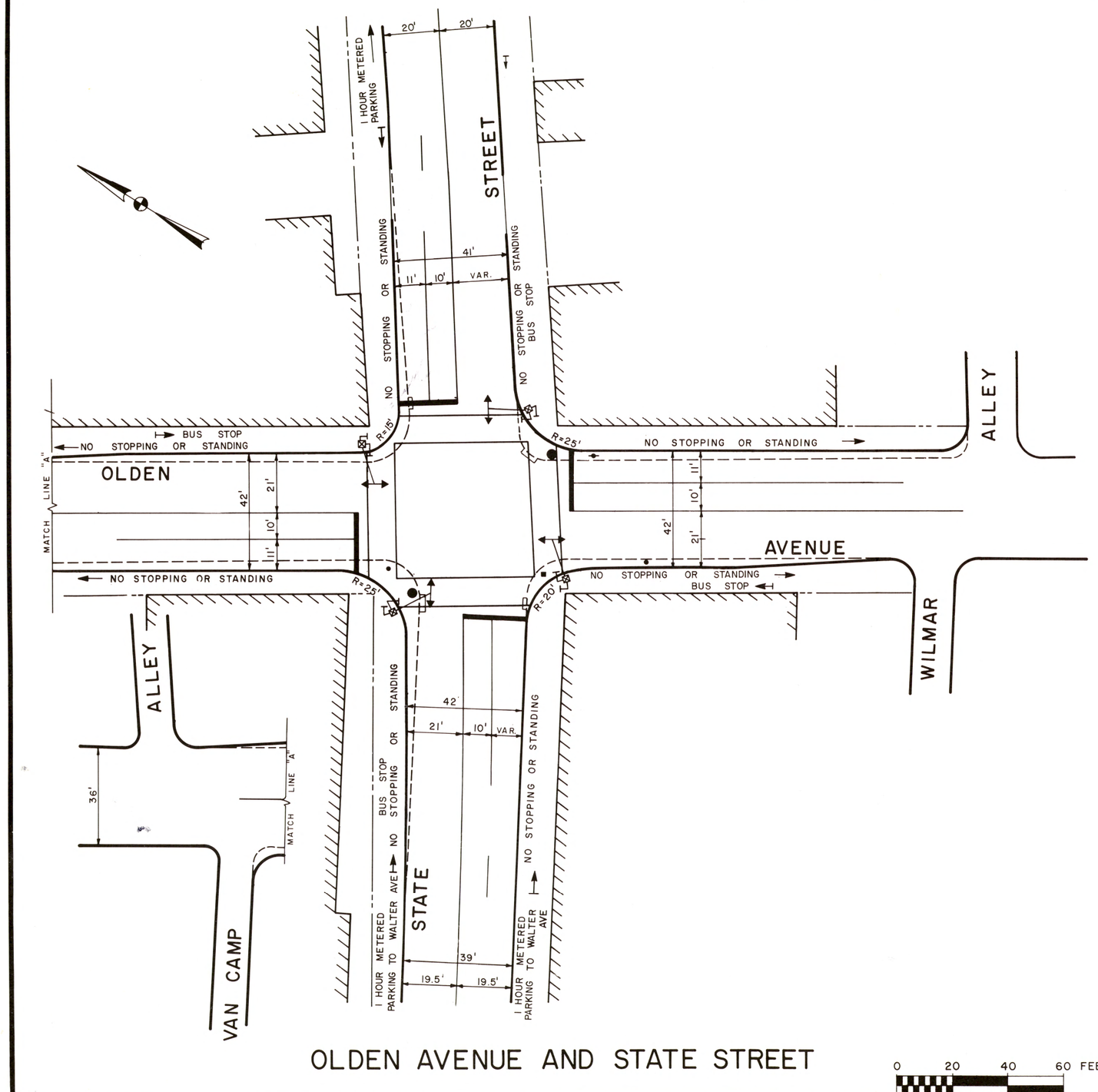
2. Cutback the east curb of Greenwood Avenue for approximately 100 feet on either side of the intersection.

3. Additional mast arm signal equipment is necessary for increased safety.

4. Relocate all bus stops to the far side of each approach.

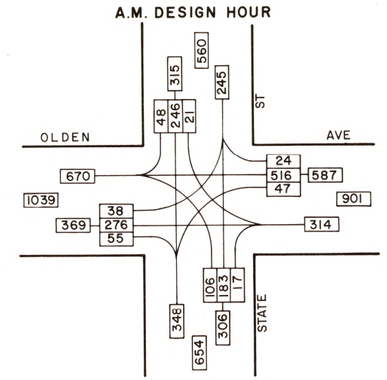
5. Determine adequacy of existing street lighting.

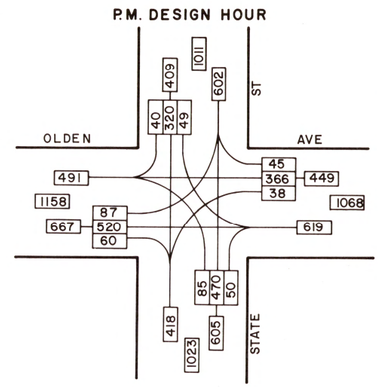
Right-of-Way: No **Cost:** $29,000



OLDEN AVENUE AND STATE STREET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	18
ACCIDENT RATE PER TEN MILLION VEHICLES	16
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	3
INJURY RATE PER TEN MILLION VEHICLES	3
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	26
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	5

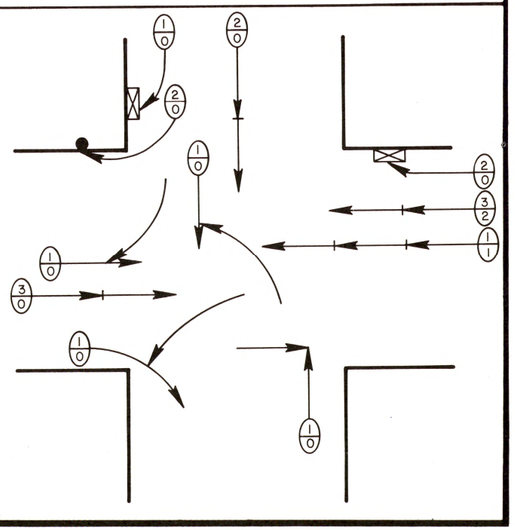


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FIGURE V-26

FIGURE V-27
OLDEN AVENUE AND GREENWOOD AVENUE

HAMILTON AVENUE AND OLDEN AVENUE

Deficiencies

1. Capacity–Southbound Hamilton Avenue has a level of service of F during A.M. peak hours and northbound Hamilton and eastbound Olden have levels of service of F during P.M. peak hours.

Existing Conditions

1. Olden Avenue is a heavily traveled route providing access to industrial areas, Route 1, and the Department of Transportation in Ewing.

2. Hamilton Avenue serves as a through route for Hamilton Township--Central Business District traffic.

3. Traffic signal equipment is outdated.

Recommendations

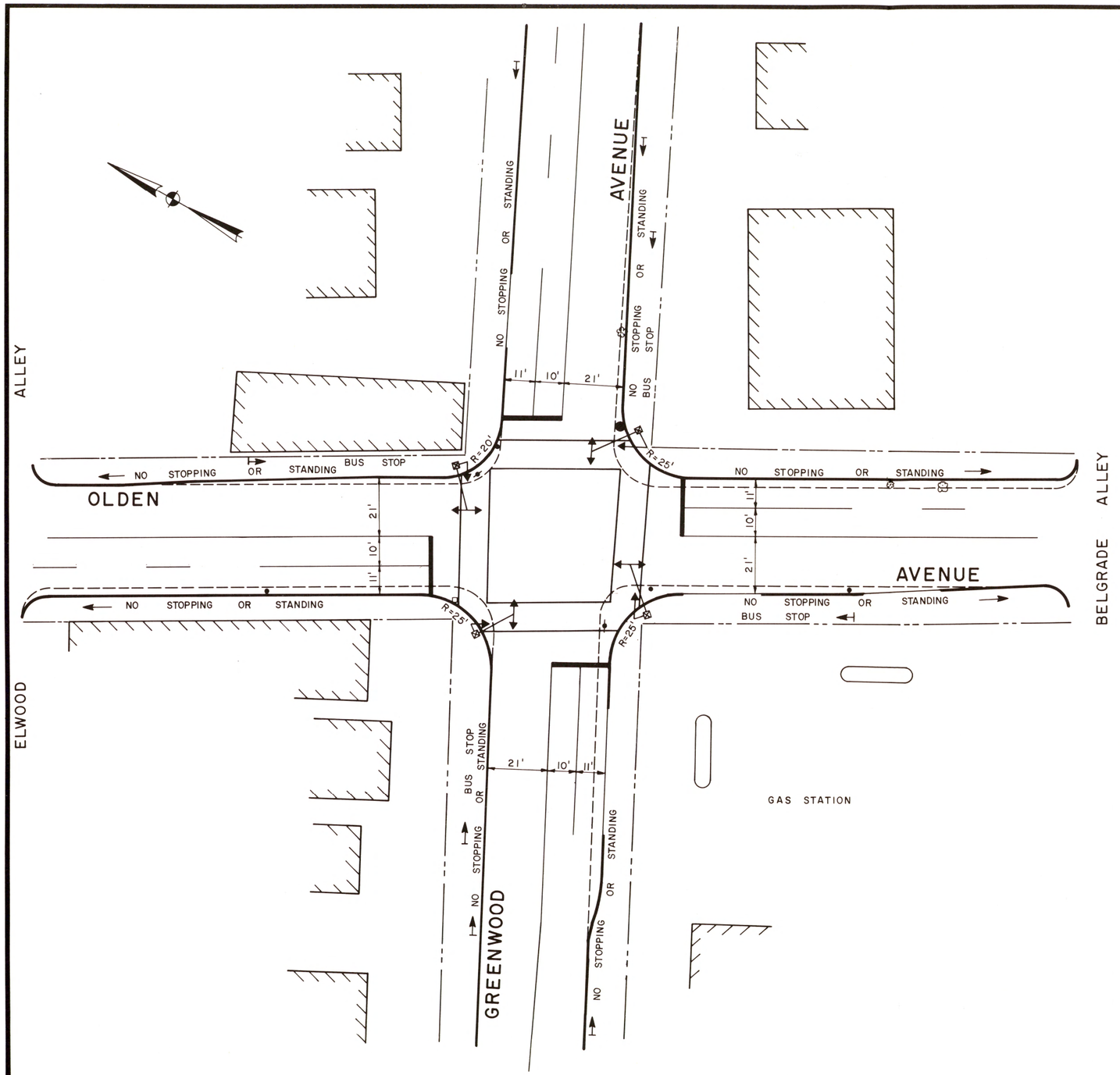
1. Widen a short portion of both sides of Olden Avenue. This will allow two approach lanes in each direction.

2. Use "No Stopping or Standing" regulations on all approaches, near and far side.

3. Relocate bus stops to the far side of each approach.

4. Install modern traffic signal equipment, pavement markings and signs as shown in the accompanying plan.

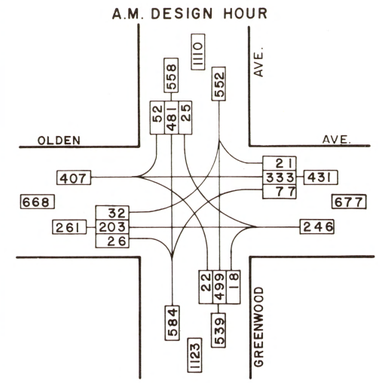
Right of Way: **Yes** **Cost:** $24,500

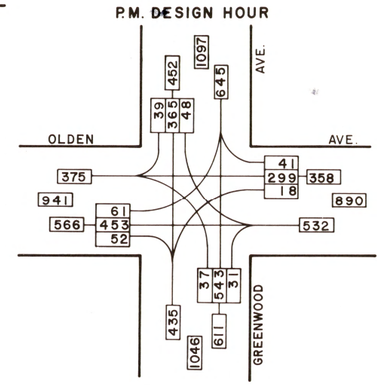


OLDEN AVENUE AND GREENWOOD AVENUE

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	15
ACCIDENT RATE PER TEN MILLION VEHICLES	14
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	8
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	32
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	16

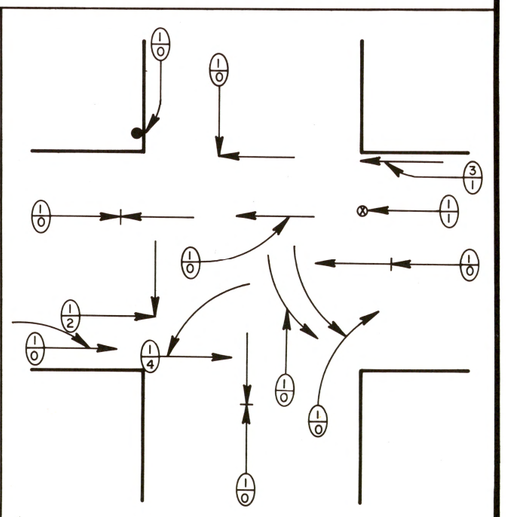


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FIGURE V-27

FIGURE V-28
OLDEN AVENUE AND HAMILTON AVENUE

OLDEN AVENUE AND NEW YORK AVENUE

Deficiencies

1. Safety -- There were a total of fifteen accidents in a one year period, including five rear end collisions and four right angle collisions. This resulted in a total of eleven injuries.

2. Capacity -- Capacity deficiencies exist for Olden Avenue westbound and New York Avenue northbound.

Existing Conditions

1. There is a sudden change in alignment in Olden Avenue at this location.

2. Westbound Olden Avenue approaches the intersection immediately after crossing a bridge.

3. Railroad tracks run down the middle of New York Avenue.

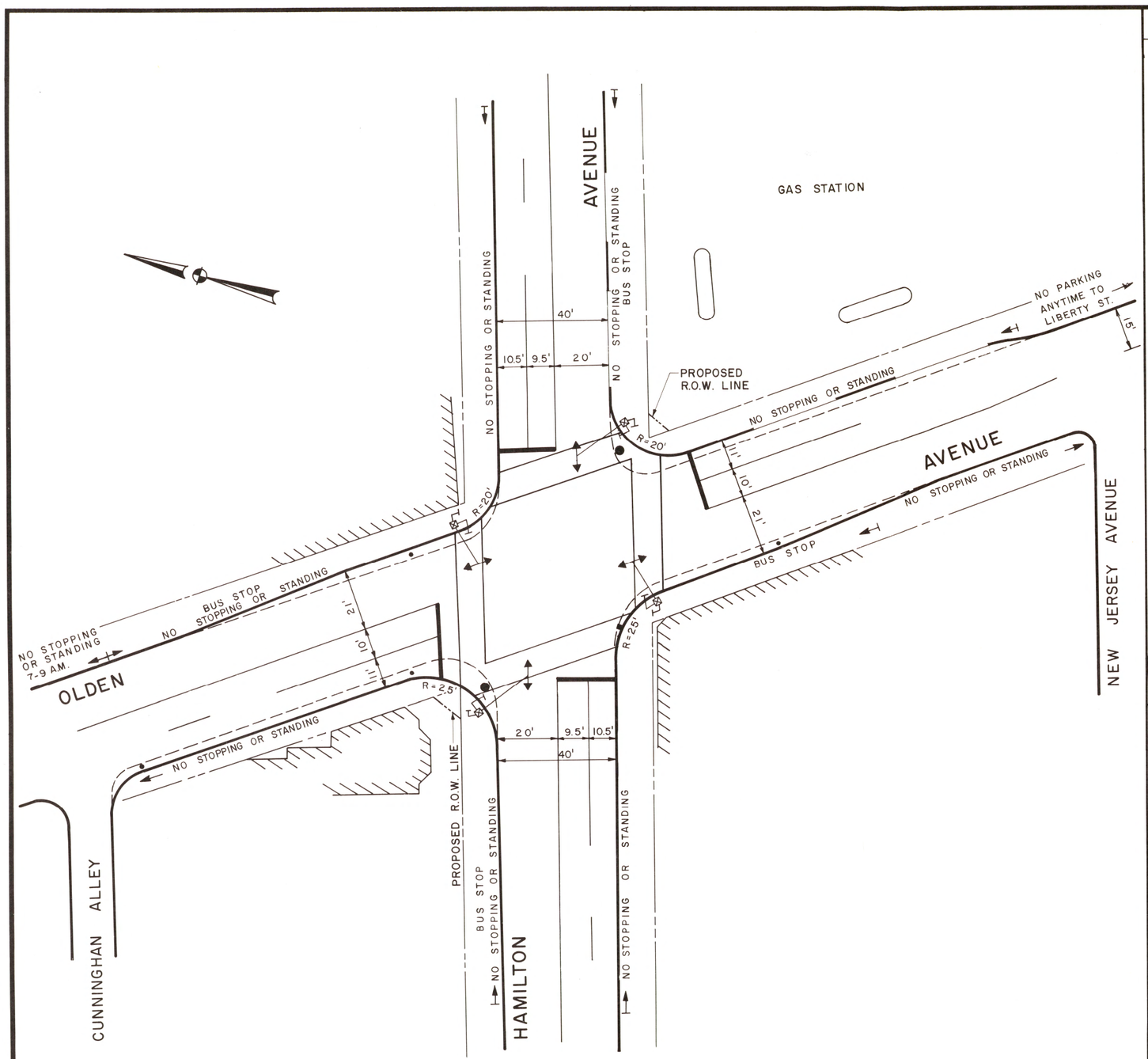
4. Existing mast arm signals provide fairly good visibility on all approaches.

5. The north leg of New York Avenue is narrower than the south leg and offset slightly to the west.

Recommendations

1. To provide suitable discharge lanes for northbound New York Avenue traffic, it is recommended that the north leg of New York Avenue be paved an additional fifteen feet and the northeast corner be cut back to provide thru traffic on New York Avenue a suitable discharge lane. This will require traffic to ride across existing tracks.

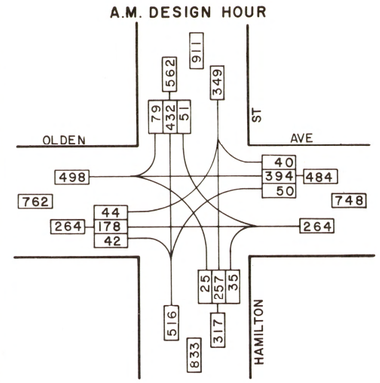
Right-of-Way: Yes **Cost:** $8,000

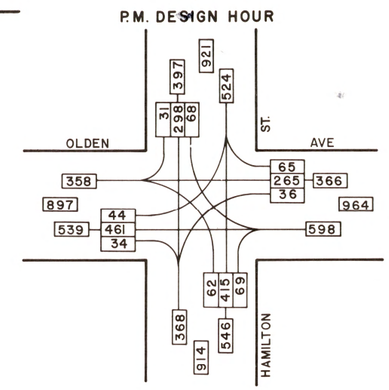


OLDEN AVENUE AND HAMILTON AVENUE

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	11
ACCIDENT RATE PER TEN MILLION VEHICLES	11
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	1
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	23
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	14

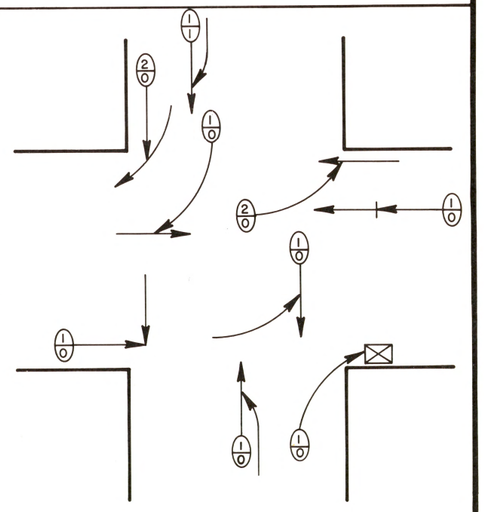


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FIGURE V-28

CHAMBERS STREET,

Chambers Street and Lincoln Avenue extend from Clinton Avenue in an easterly direction to Hamilton Township. This arterial tends to serve the same corridor as Broad Street and South Clinton Avenue. Portions of this roadway are extremely narrow requiring full time parking bans. On the other hand, between Greenwood Avenue and Hamilton Avenue abutting the High School, Chambers Street widens to a 50-foot roadway. This is one of the most congested and troublesome streets within the City of Trenton. Figure V-29 summarizes the recommendations for this arterial.

The rush hour regulation between Hamilton Avenue and Cedar Lane will eliminate side stream interference during peak flow conditions. The full time parking ban from Greenwood Avenue to Clinton Avenue is dictated by the narrow roadway widths. The intersection of Roebling Avenue and Chambers Street is being improved as part of the overall arterial treatment*. Land use along Chambers Street is primarily residential. Peak hour traffic is highly directional with the peak directional flow representing 60% or more of the total volume.

* *The design is shown in Figure V-33, no right-of-way is required and the estimated construction cost is $22,000.*

FIGURE V-29
CHAMBERS STREET

CHAMBERS STREET, STATE STREET AND LINCOLN AVENUE

Deficiencies

1. Safety--17 accidents in a one-year period.

2. Capacity--Lincoln Avenue approach has a level of service 'F' and Chambers Street a level of service 'D.'

3. Delay--Lincoln Avenue traffic experiences delays at State Street, particularly in the evening.

Existing Conditions

1. The Lincoln Avenue bridge over the Canal and the railroad ends only 150 feet before the intersection of State Street and Lincoln Avenue. Eastbound traffic has poor visibility due to the grade, curve, and walls of the bridge.

2. Visibility of post-mounted signals is poor on all approaches.

3. Daytime traffic on Lincoln Avenue is 10 percent commercial traffic, adding to delays on the bridge.

4. Chambers Street east of State Street is only 29 feet wide. Buildings are very close to the roadway along the Chambers Street leg, inhibiting pavement widening.

Recommendations

1. Offset center line on Lincoln Avenue and Chambers Street to allow for exclusive left turn lanes.

2. Install peak hour No Stopping or Standing regulation on State Street approaches and on both sides of Chambers Street and Lincoln Avenue.

3. Widen State Street by cutting back the east curb line.

4. Install new signal equipment, signs,and pavement markings as shown in the accompanying plan.

Right-of-Way: No **Cost:** $22,000

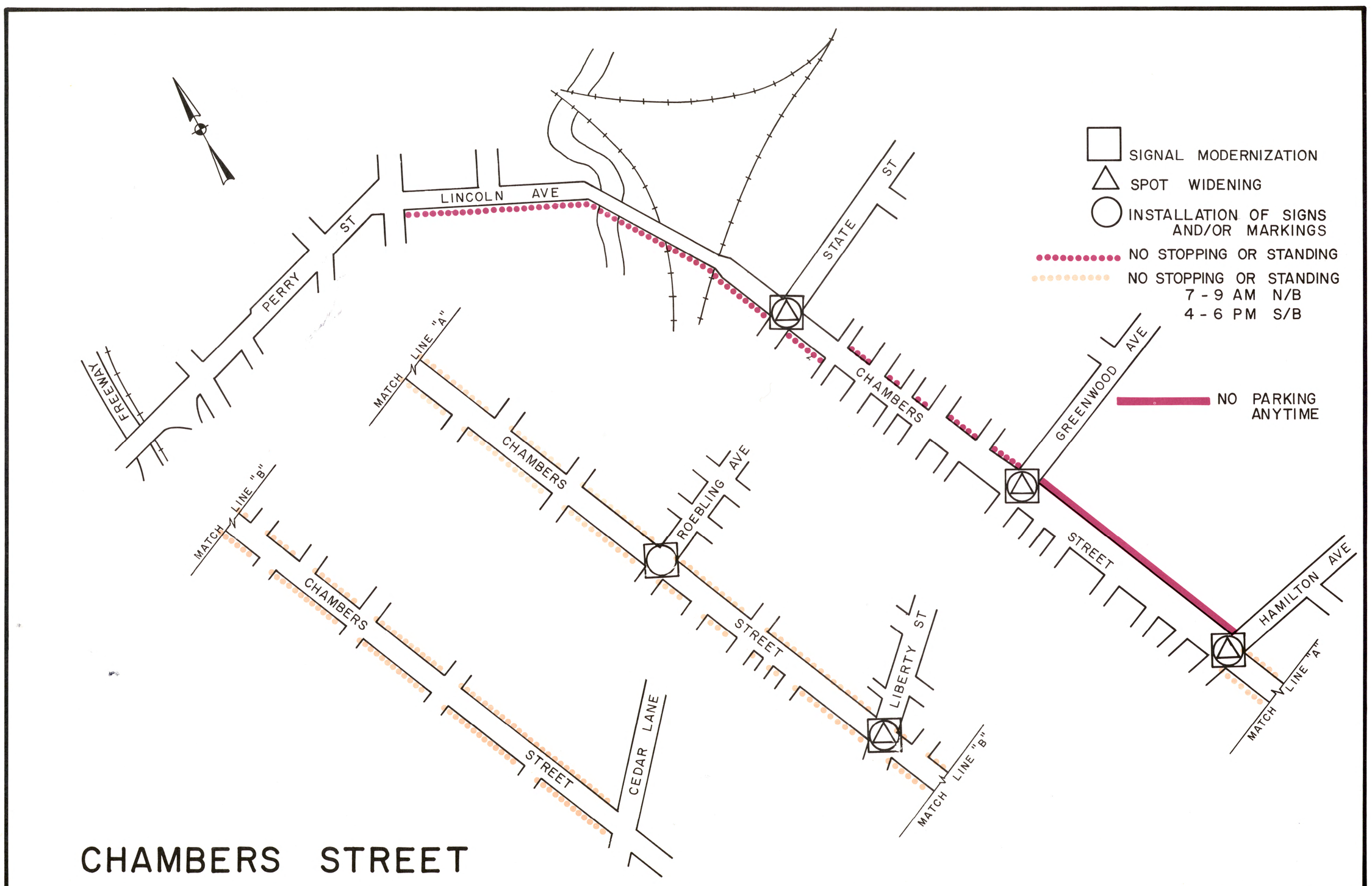

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FIGURE V - 29

FIGURE V-30
CHAMBERS STREET, STATE STREET
AND LINCOLN AVENUE

CHAMBERS STREET AND GREENWOOD AVENUE

Deficiencies

1. Safety--A yearly record of 22 accidents results in an accident rate of 23 per 10 million vehicles. This includes 5 left turning accidents and 6 right angle collisions.

2. Delay--traffic on Chambers Street westbound is subject to heavy delays in the morning peak.

Existing Conditions

1. Chambers Street now has three approach lanes in each direction none of which are designated as exclusive turning lanes.

2. Land bordering Greenwood Avenue allows sufficient room for widening.

3. Trenton High School on Chambers Street generates considerable pedestrian traffic.

4. Signal equipment is substandard.

5. Delays occur along Chambers Street at signalized intersections adjacent to Greenwood Avenue.

Recommendations

1. Retain 3 approach lanes on Chambers Street westbound approach, but designate one for an exclusive left turn lane.

2. The narrower width of Chambers Street eastbound should accommodate 2 approach lanes.

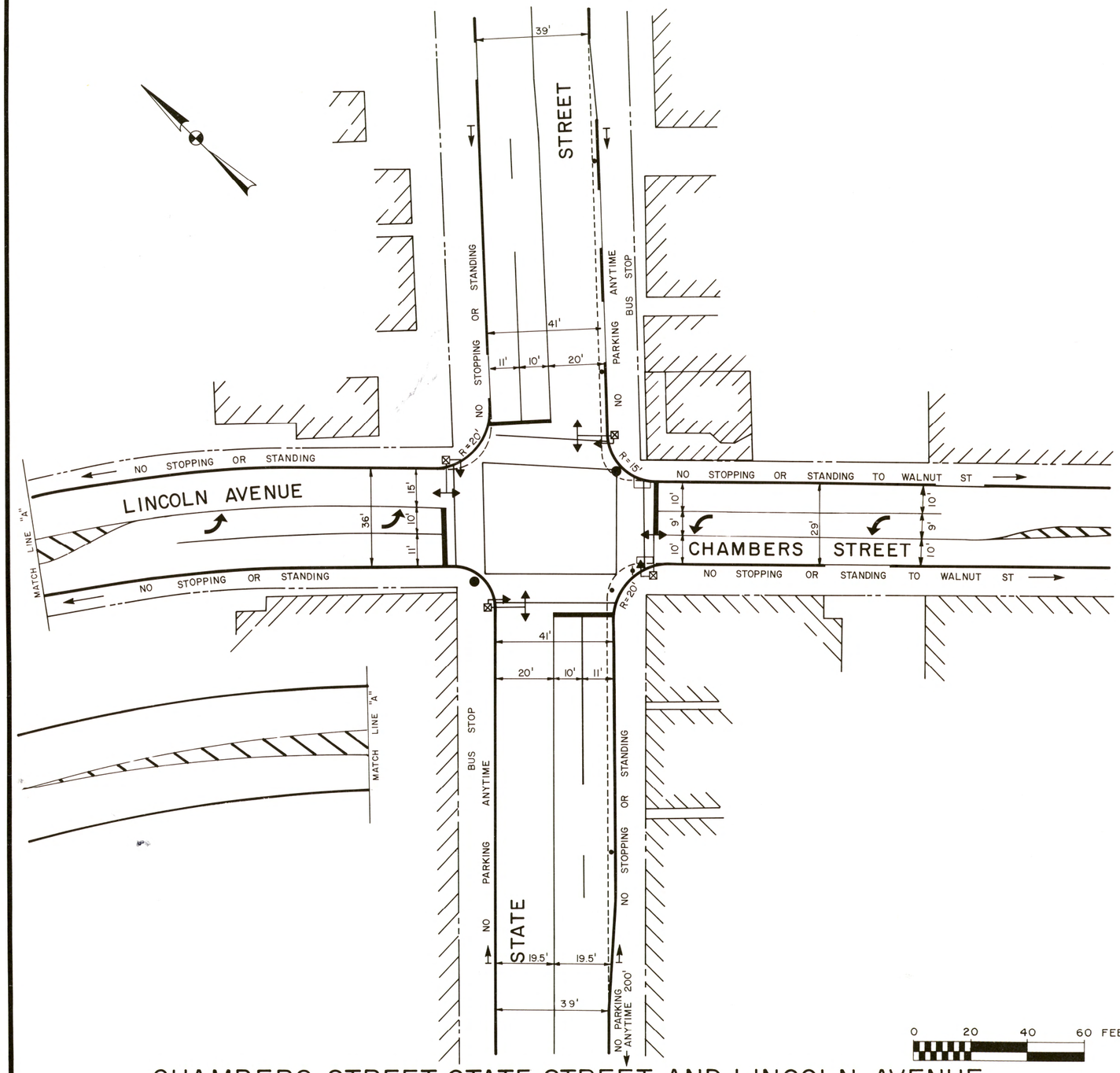
3. Ban parking along the north curb of Chambers Street between Greenwood and Hamilton Avenues.

4. Widen the southerly leg of Greenwood Avenue and install a No Stopping or Standing regulation.

5. Cutback the southeast curb to a 30' radius.

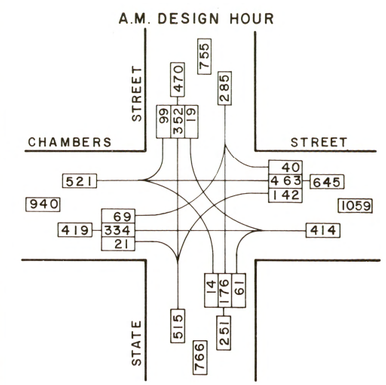
6. Install modern signal equipment, pavement markings and parking regulations as shown in the accompanying plan.

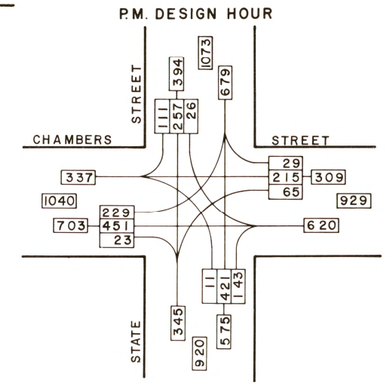
Right-of-Way: No **Cost:** $20,000



CHAMBERS STREET, STATE STREET AND LINCOLN AVENUE

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	17
ACCIDENT RATE PER TEN MILLION VEHICLES	18
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	5
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	24
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	8

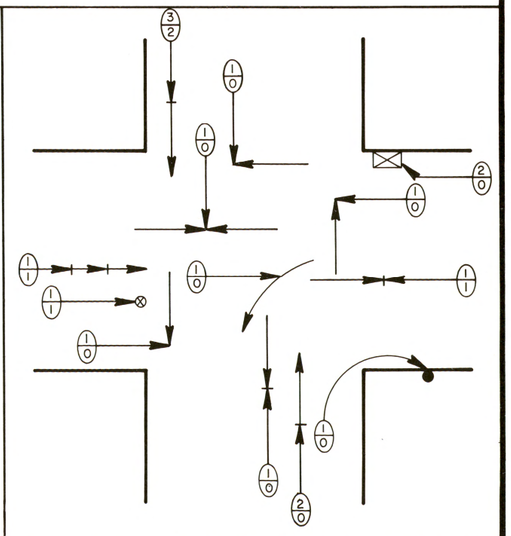


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FIGURE V-30

FIGURE V-31
CHAMBERS STREET AND GREENWOOD AVENUE

CHAMBERS STREET AND HAMILTON AVENUE

Deficiencies

1. Safety--there were a total of fifteen accidents at this location in a one year period. The type of accidents were varied.

2. Capacity--deficiencies exist for Chambers Street westbound particularly in the morning.

Existing Conditions

1. The east leg of Chambers Street is approximately 36 feet in width as opposed to the west leg, adjacent to the high school,which is 50 feet wide.

2. Eastbound Chambers Street is provided with a left turn slot which is opposed by a straight through lane for westbound Chambers Street.

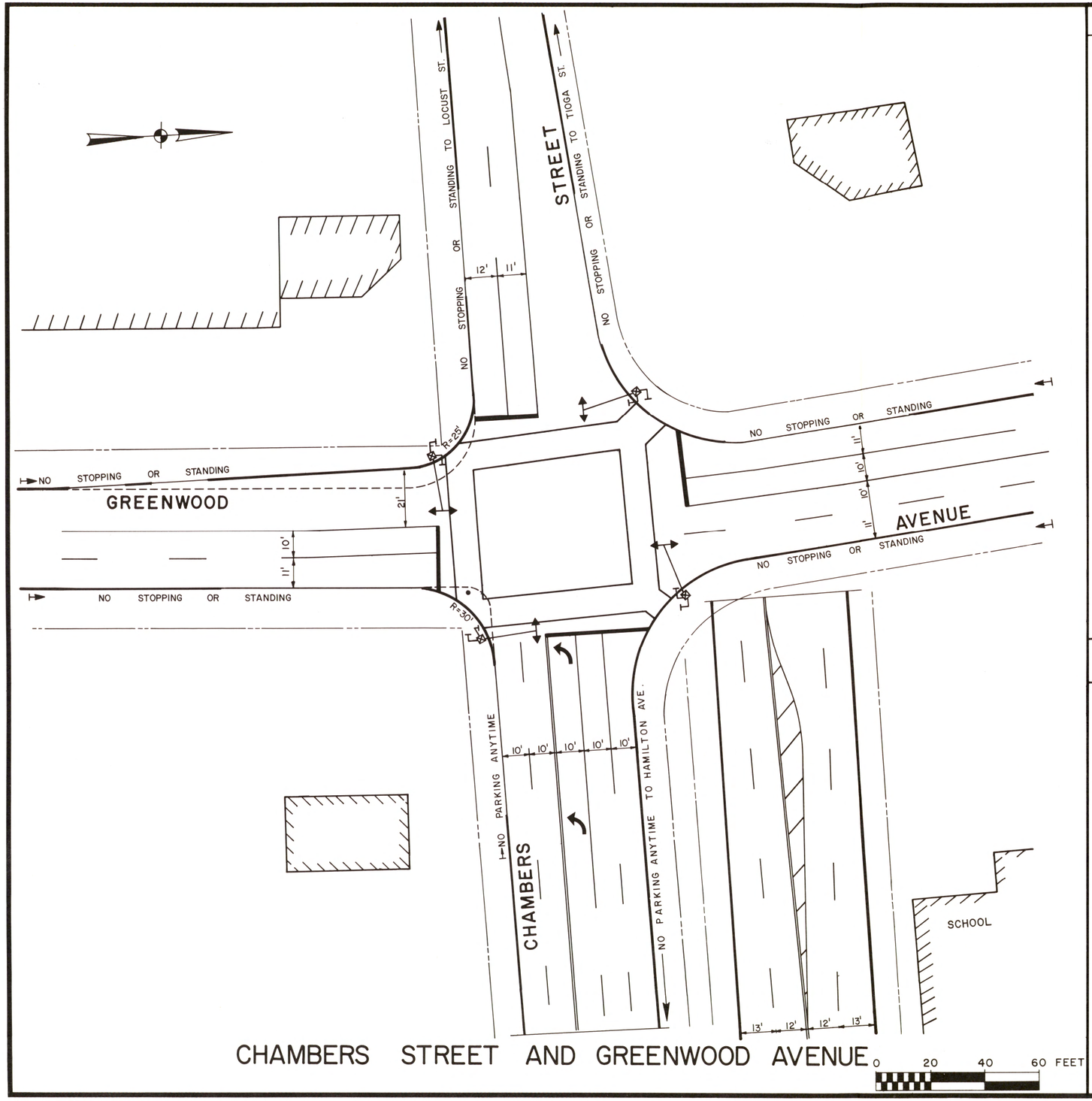
Recommendations

1. Widen the westbound approach of Chambers Street to provide two approach lanes to this intersection.

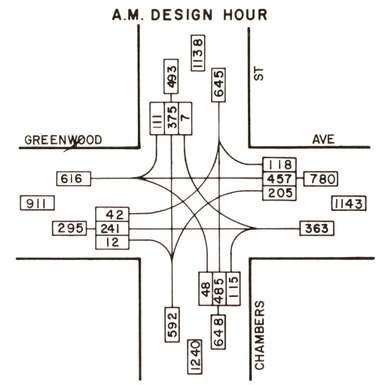
2. Restripe the eastbound approach to provide two approach lanes eliminating the conflict between the eastbound left turn lane and the opposing straight through lane.

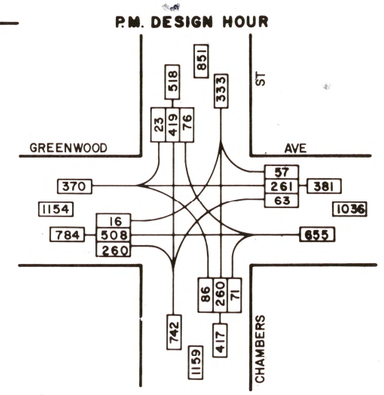
3. Install modern traffic signal equipment, pavement markings, and parking regulations as shown in the accompanying plan.

Right-of-Way: **Yes** **Cost:** $33,500



DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	22
ACCIDENT RATE PER TEN MILLION VEHICLES	23
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	6
INJURY RATE PER TEN MILLION VEHICLES	6
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	32
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	13

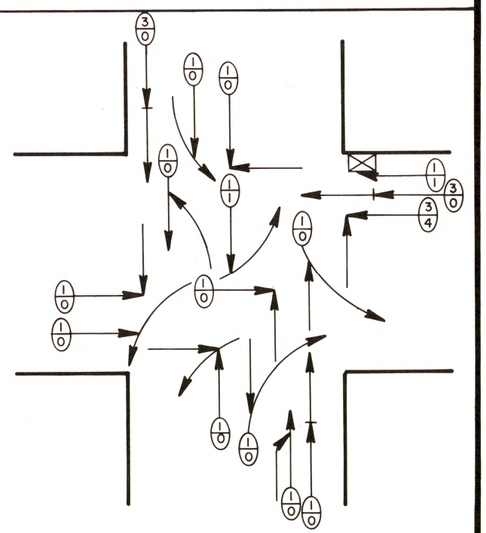


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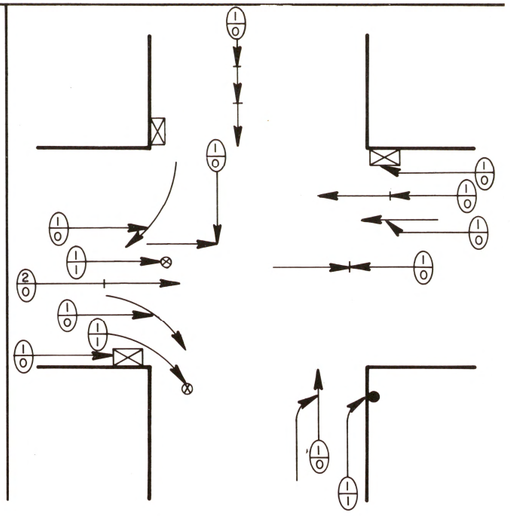
FIGURE V-31

FIGURE V-32
CHAMBERS STREET AND HAMILTON AVENUE

INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	15
ACCIDENT RATE PER TEN MILLION VEHICLES	16
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	2
INJURY RATE PER TEN MILLION VEHICLES	2
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	38
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	14



CHAMBERS STREET AND HAMILTON AVENUE

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FIGURE V- 32

FIGURE V-33
CHAMBERS STREET AND ROEBLING AVENUE

CHAMBERS STREET AND LIBERTY STREET

Deficiencies

1. Capacity--Chambers Street operates at level of service D in the eastbound direction during the evening peak.

Existing Conditions

1. This intersection has been partially improved by Mercer County in the past several years.

2. At least one over-the-road indication exists for each approach to this intersection.

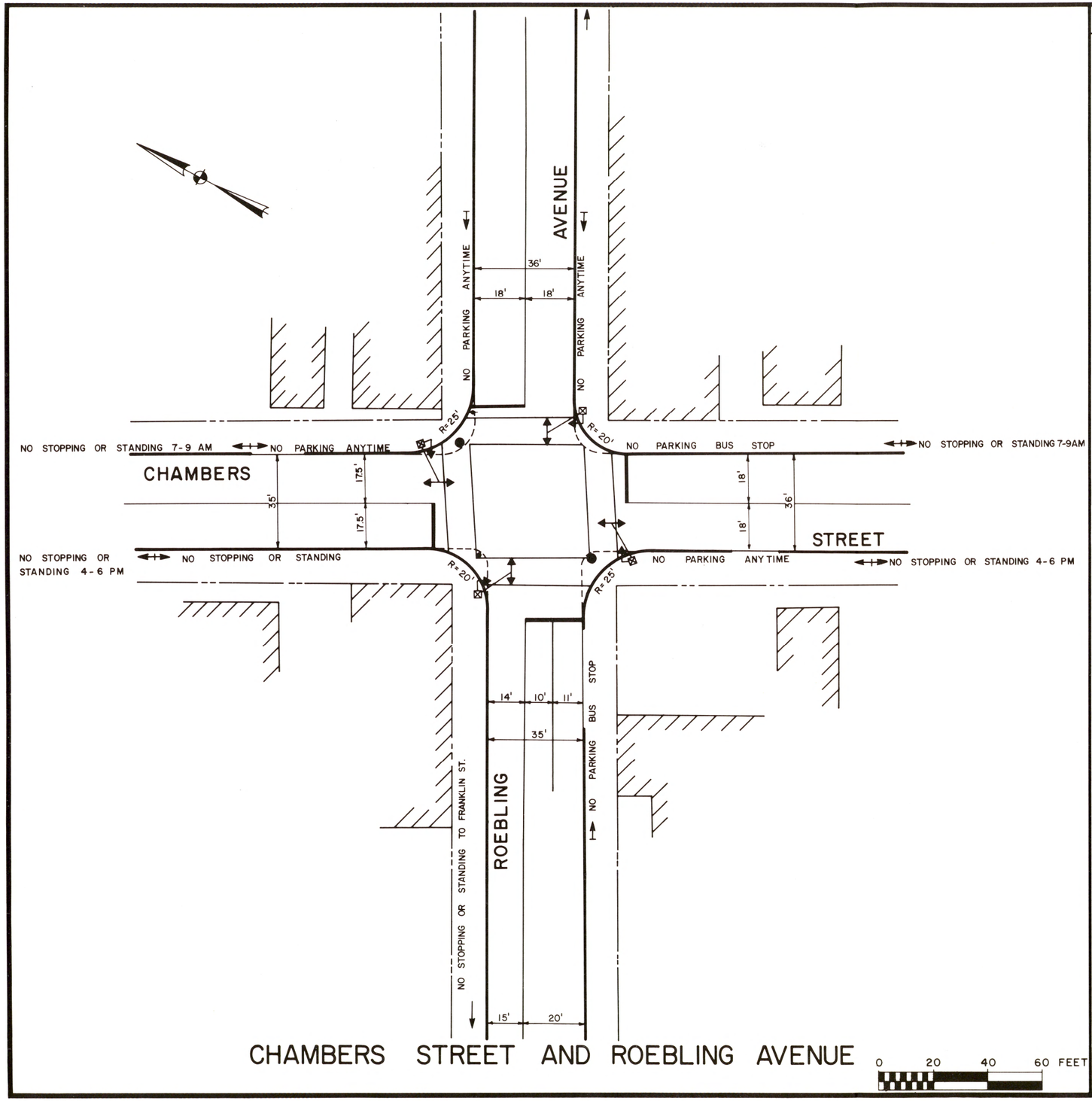
3. The east leg of Chambers Street had been widened to a width of 40 feet as well as a portion of the north leg of Liberty Street.

Recommendations

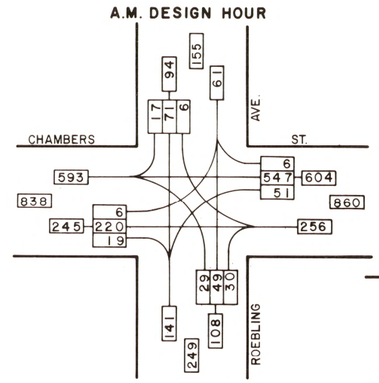
1. Widen the south leg of Liberty Street to provide two approach and discharge lanes for each direction of traffic.

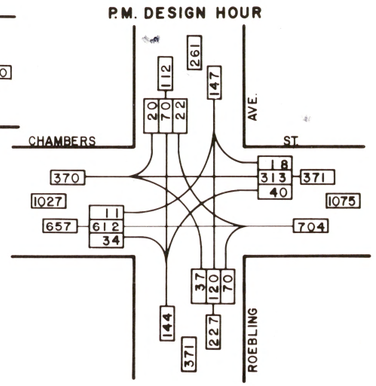
2. Install additional over the road indications, pavement markings and parking restrictions as shown in the accompanying plan.

Right-of-Way: **Yes** **Cost:** $22,500



DESIGN HOUR VOLUMES





THERE WERE FEWER THAN 5 ACCIDENTS
IN ONE YEAR AT THIS LOCATION

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FIGURE V-33

FIGURE V-34
CHAMBERS STREET AND LIBERTY STREET

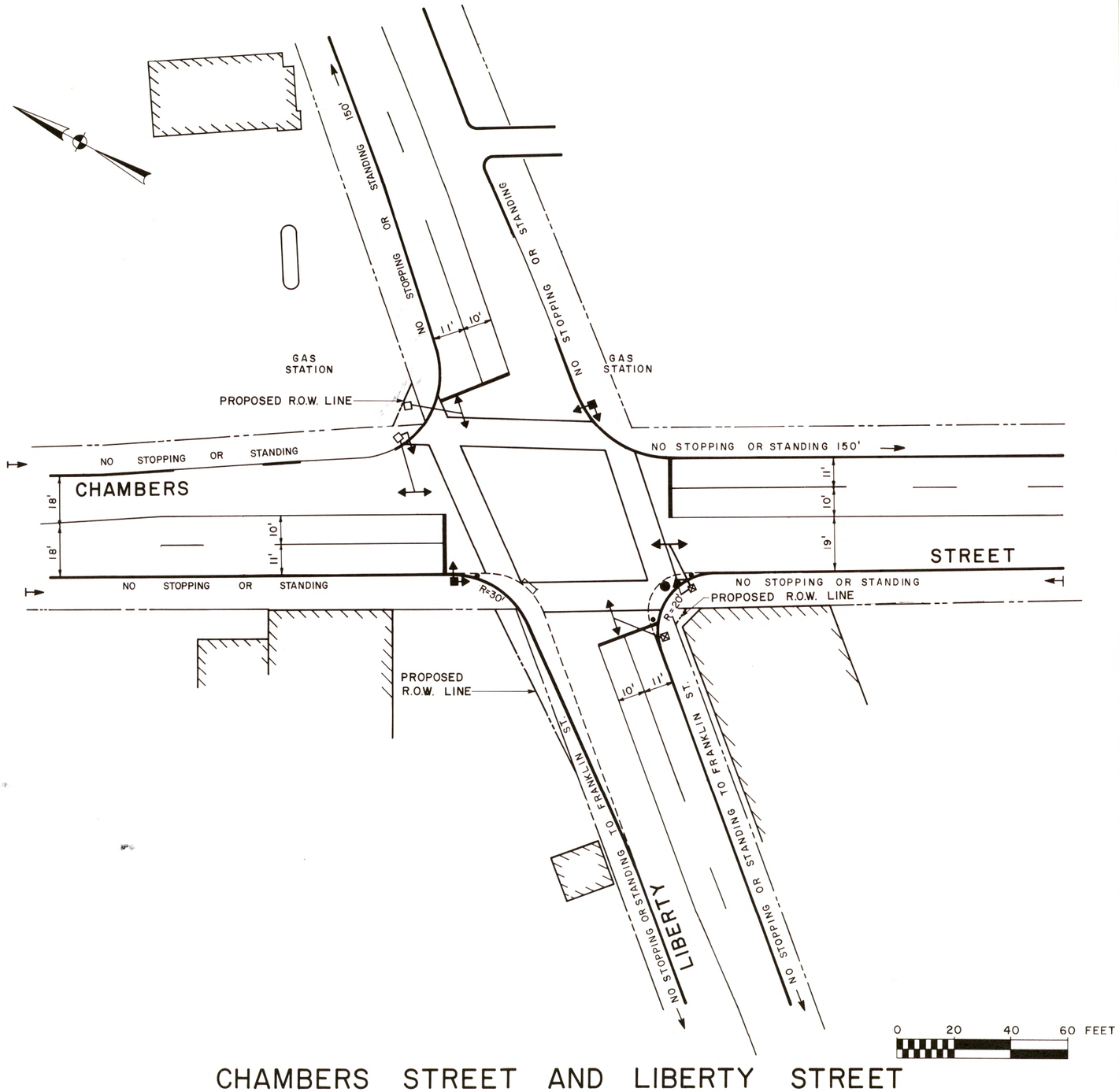
N. CLINTON AVENUE

While Clinton Avenue tends to loop in a circular fashion from Cedar Lane up to Olden Avenue, the characteristics of the roadway and the type of traffic utilizing it change dramatically at the Greenwood Avenue Circle. From the Circle, in a northerly direction, the land use abutting North Clinton Avenue is a combination of commercial, residential, and industrial. The roadway width is 35 feet in many locations. With parking permitted on both sides of the street, the result is a constricted operation.

Between Lincoln Avenue and Poplar Avenue there is industrial and commercial land use along North Clinton Avenue.

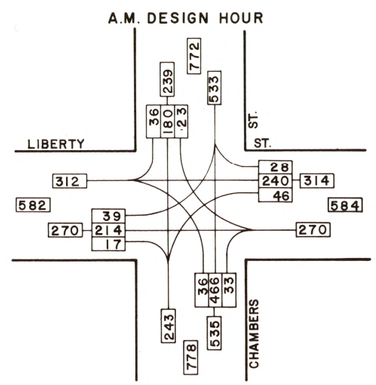
A "No Parking Anytime" restriction is recommended for the west side of Clinton Avenue within this area. This regulation will not only improve the flow of traffic but will reduce accidents as well. At Oak Street for instance, there have been five side swipe accidents along Clinton Avenue. The proposed regulation should help to eliminate this problem. A check for the adequacy of street lighting should be conducted in this vicinity as well. The ratio of night-to-day accidents at Oak Street was nearly three-to-one. At Clinton Avenue and Monmouth Street it was six-to-five.

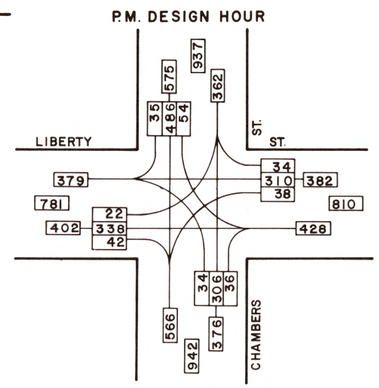
Clinton Avenue near Olden Avenue is developed with small retail stores and there is a high demand for parking. While the banning of parking would be beneficial to the movement of traffic in this area, it is not recommended due to the adverse effect it would have on the small businesses along Clinton Avenue.



CHAMBERS STREET AND LIBERTY STREET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	9
ACCIDENT RATE PER TEN MILLION VEHICLES	13
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	0
INJURY RATE PER TEN MILLION VEHICLES	0
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	39
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	18

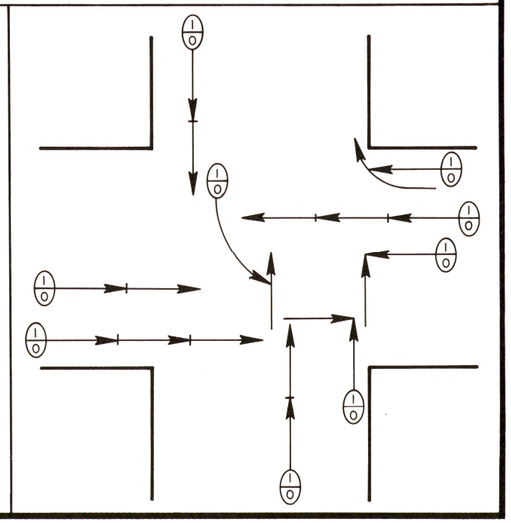


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FIGURE V-34

FIGURE V-35
CLINTON AVENUE

CLINTON AVENUE AND MONMOUTH STREET

Deficiencies

1. Safety--11 accidents have occurred in the past year at this unsignalized location. Six of these accidents have been right angle collisions. In all cases a vehicle traveling on Clinton Avenue northbound was involved in the right angle collision.

Existing Conditions

1. Intersection is controlled by stop signs with Clinton Avenue the through street.

2. Parking on Clinton Avenue south of Monmouth Street tends to obscure the visibility of approaching vehicles traveling northbound.

3. Visibility of the stop signs on both Monmouth Street approaches is very good.

Recommendations

1. Parking should be banned for 150' on the east side of Clinton Avenue south of Monmouth Street. This will improve visibility for traffic entering Clinton Avenue from Monmouth Street.

Right-of-Way: No **Cost: ———**

CLINTON AVENUE

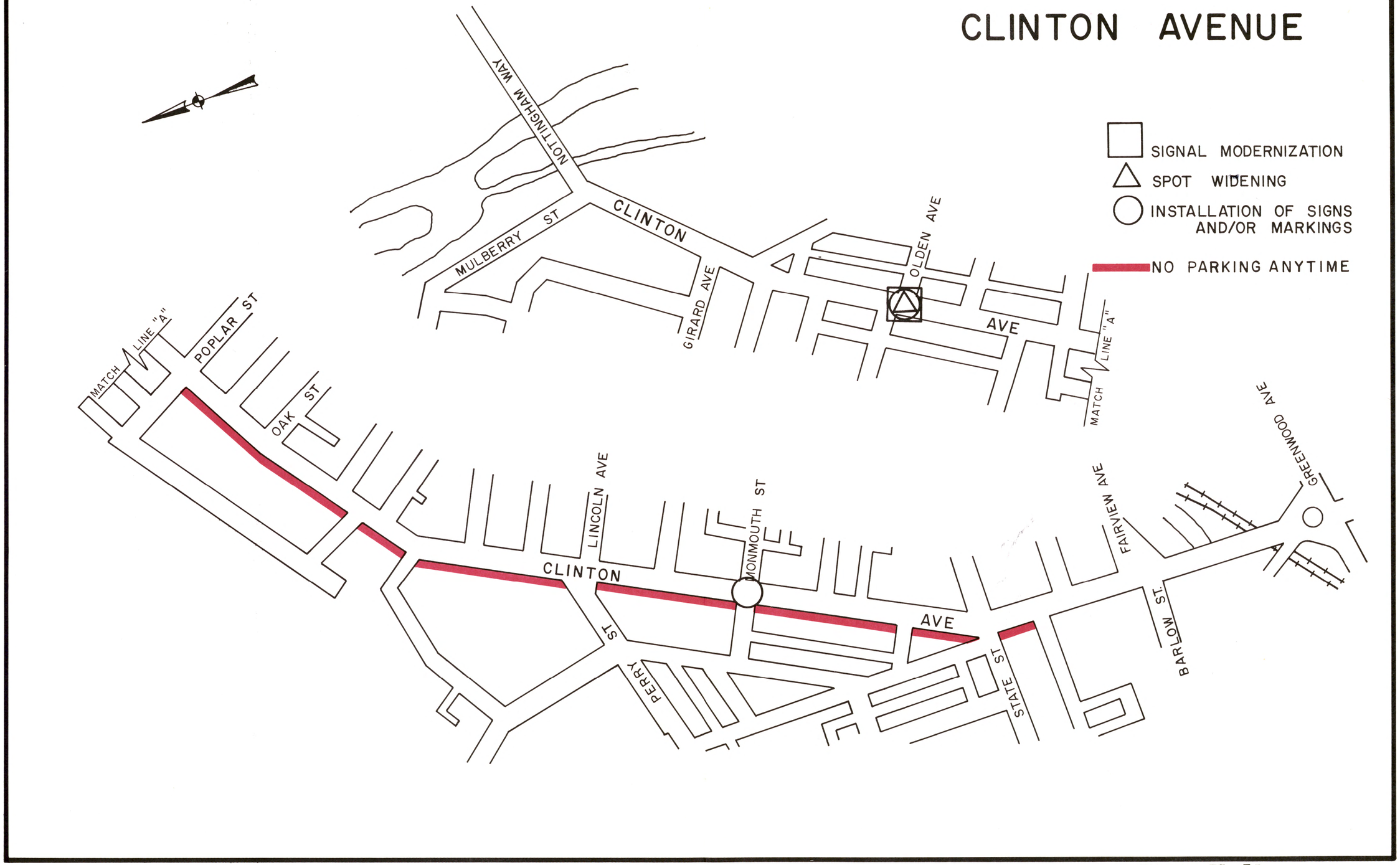

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FIGURE V - 35

SOUTH CORRIDOR

The South Corridor consists of that area bound by Clinton Avenue on the north, Lalor Street on the east, the Trenton Freeway on the west, and the Delaware River on the south. Traffic patterns in this region are primarily in-bound in the morning and out-bound in the evening. The high concentration of people working in Trenton and living in Hamilton Township and east causes a highly directional peak flow and results in congestion. Virtually all traffic using Clinton Avenue, S. Broad Street, Cass Street, and Lalor Street during the P.M. peak are destined for South Broad Street east of the City. Motorists use every street and alley that will provide them access to the various arterials funnelling into South Broad Street. While the construction of Route 29 into Hamilton Township will certainly alleviate a good portion of the traffic currently using the streets in the southeast corridor, it can be anticipated that with the ever increasing development of Hamilton Township, traffic volumes along S. Broad Street, Clinton Avenue, and Route 29, itself, will still be maintained at a relatively high level.

Recommendations for the south corridor are shown in Figures V-36 and V-37. The recommendations include the conversion of S. Broad Street and Clinton Avenue to one-way operation, S. Broad Street one-way eastbound between Dye and Dayton Streets, Clinton Avenue one-way westbound from Cedar Lane to Dye Street.

Lalor Street which experiences severe delay at certain times of the day will no longer be a problem when the Route 29 extension is constructed. The primary cause of the current problem is the transition in roadway width at Jersey Street. This forces eastbound traffic to merge from two lanes to one.

FIGURE V-36
SOUTH CORRIDOR

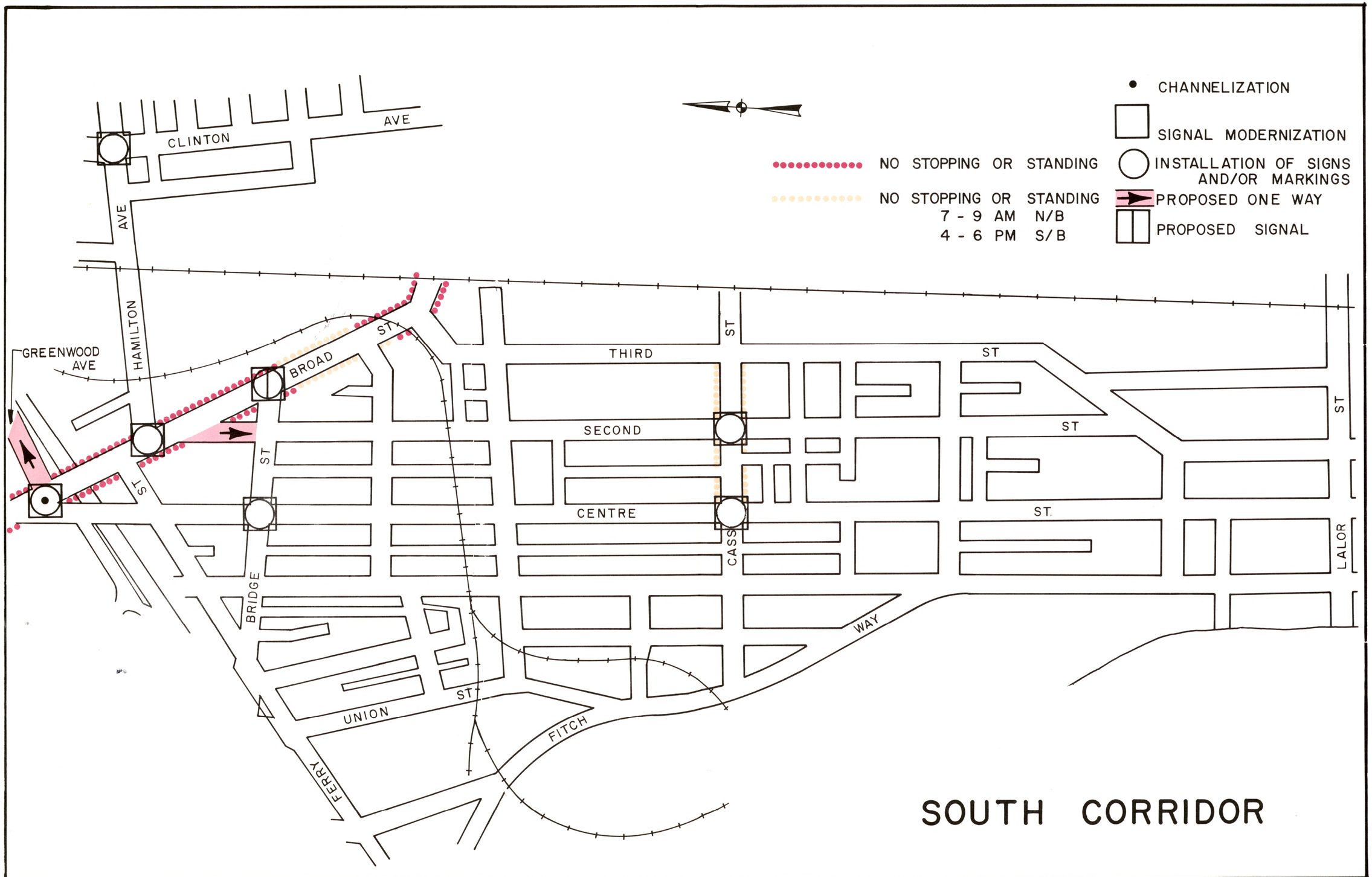

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FIGURE V - 36

FIGURE V-37
SOUTH CORRIDOR

BRIDGE STREET AND CENTRE STREET

Deficiencies

1. Safety--of the 13 accidents in the study year, 7 were right angle accidents.

2. Capacity--Bridge Street traffic is at level of service D in the eastbound direction.

Existing Conditions

1. Bridge Street is a heavily travelled arterial, particularly in the P.M. peak. It provides access to a free bridge into Pennsylvania.

2. Centre Street traffic has access to Route 1 through an entrance near S. Broad Street or through the Greenwood Circle north of S. Broad Street.

3. Bridge Street pavement is only 35 feet wide with both sides of both legs solidly parked.

4. Traffic signals are obsolete.

Recommendations

1. Install modern traffic signals to improve visibility and reduce accidents, as shown in the accompanying plan.

2. Offset the center line on Bridge Street to allow 2 through lanes for northbound traffic in the P.M. peak.

3. Cutback curbs wherever there is sufficient space.

Right-of-Way No **Cost:** $21,500

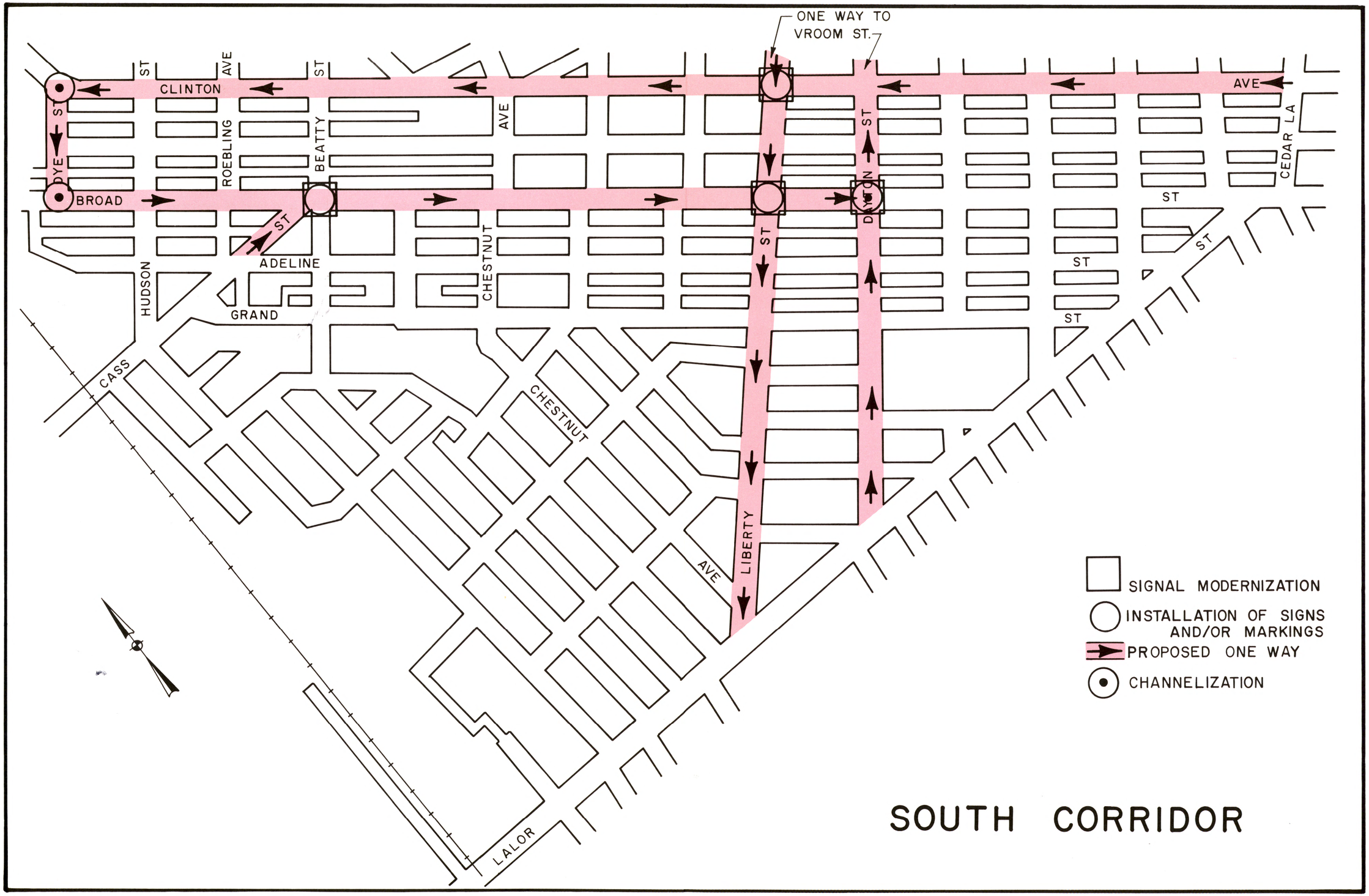

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FIGURE V - 37

FIGURE V-38
BRIDGE STREET AND CENTRE STREET

CASS STREET AND SECOND STREET

Deficiencies

1. Safety--Extremely high accident and injury rates for 11 accidents and 8 injuries in one year. Eight right angle collisions occurred; six involving westbound vehicles.

2. Capacity--level of service D was computed for the eastbound Cass Street approach in the evening.

3. Delay--Second Street traffic experiences delays in both directions at Cass Street.

Existing Conditions

1. Cass Street is used during the peak hours as an alternate to the Broad-Clinton corridor between Hamilton Township and the Central Business District.

2. Second Street is a major truck route.

3. Traffic signal equipment is obsolete.

4. There is a very heavy left turn from southbound Second Street in the evening peak.

5. Parking restrictions are provided along Second Street for the grammer school in the northwest quadrant.

6. Eastbound traffic on Cass Street has limited visibility of the far side signal indication due to a tower on the northwest corner.

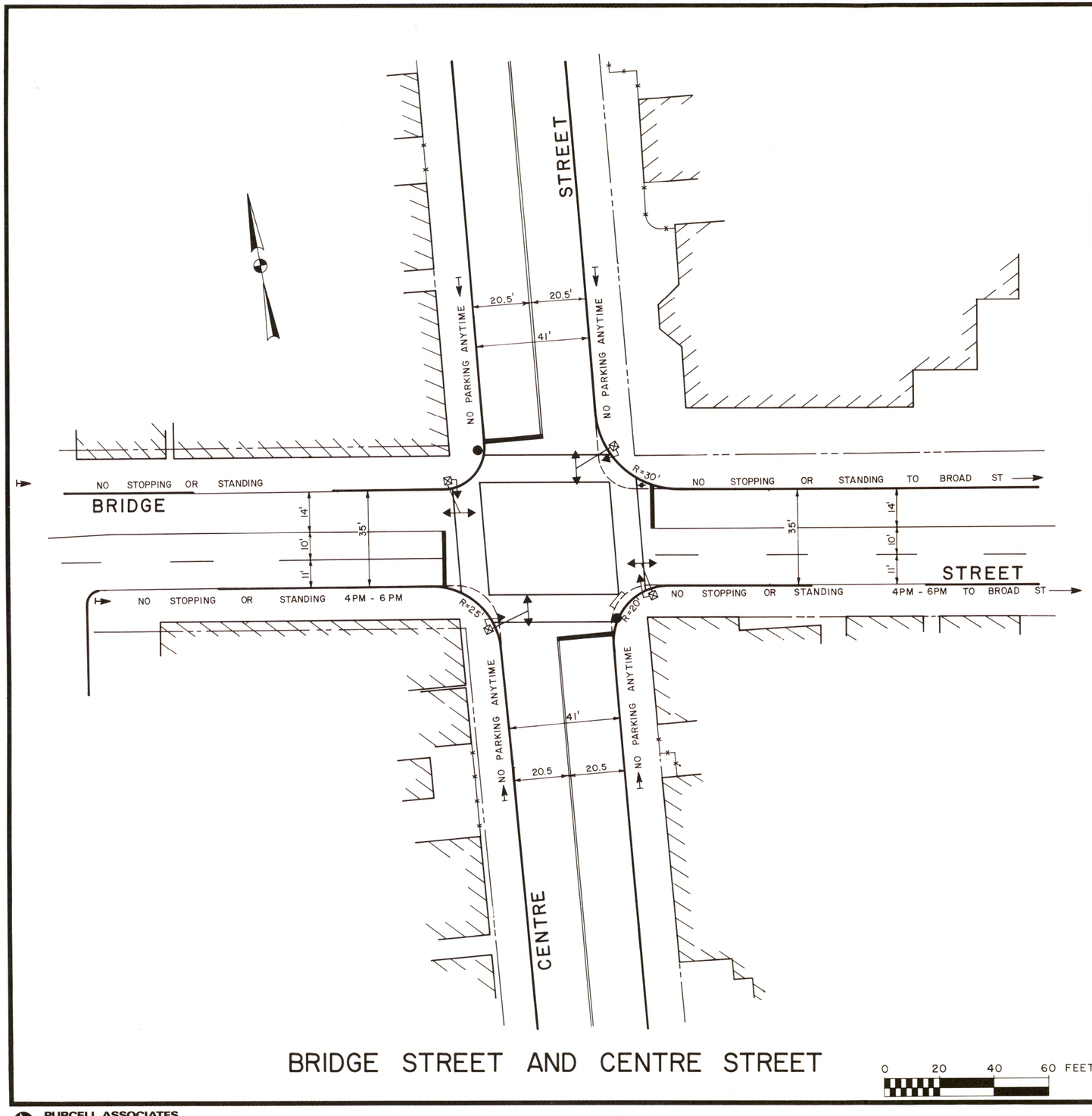
Recommendations

1. Stripe Cass Street for four 10-foot lanes.

2. Install a peak hour No Stopping or Standing regulation along Cass Street from Centre Street to Third Street.

3. Install new traffic signal equipment, pavement markings, and signs in accordance with the accompanying plan.

Right-of-Way: No **Cost:** $23,000



BRIDGE STREET AND CENTRE STREET

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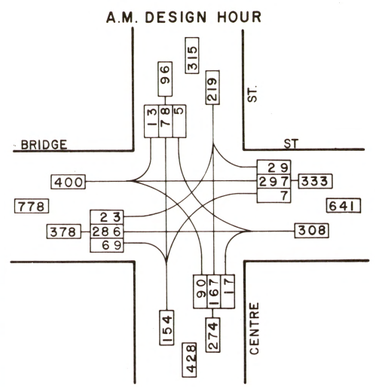
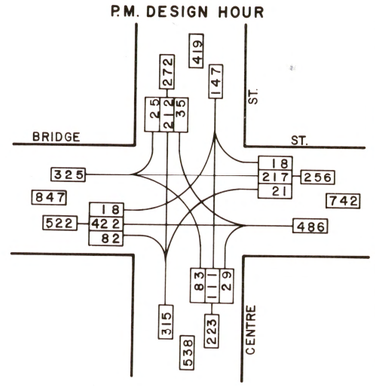
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	13
ACCIDENT RATE PER TEN MILLION VEHICLES	20
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	4
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	22
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	13

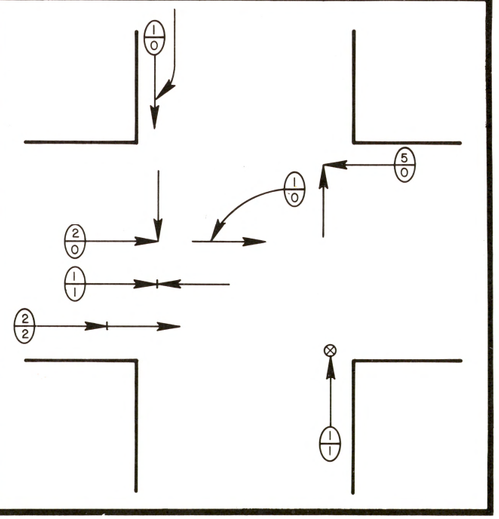


FIGURE V-38

FIGURE V-39
CASS STREET AND SECOND STREET

CASS STREET AND CENTRE STREET

Deficiencies

1. Safety--8 accidents and 8 injuries per year gave a very high accident and injury rate to this intersection. In May of 1970 a fatality was caused by one of these collisions.

2. Capacity--westbound Cass Street operates at level of service F in the morning.

3. Delay--Cass Street traffic finds major delays in this area.

Existing Conditions

1. Cass Street is currently used as a thoroughfare for outbound traffic attempting to avoid the Broad-Clinton South Corridor.

2. Centre Street is a truck route to the industrial areas near the River.

3. Traffic signals are pedestal mounted indications.

4. In the P.M. a heavy left turn from southbound Centre Street causes some delay to thru traffic in the opposite direction.

Recommendations

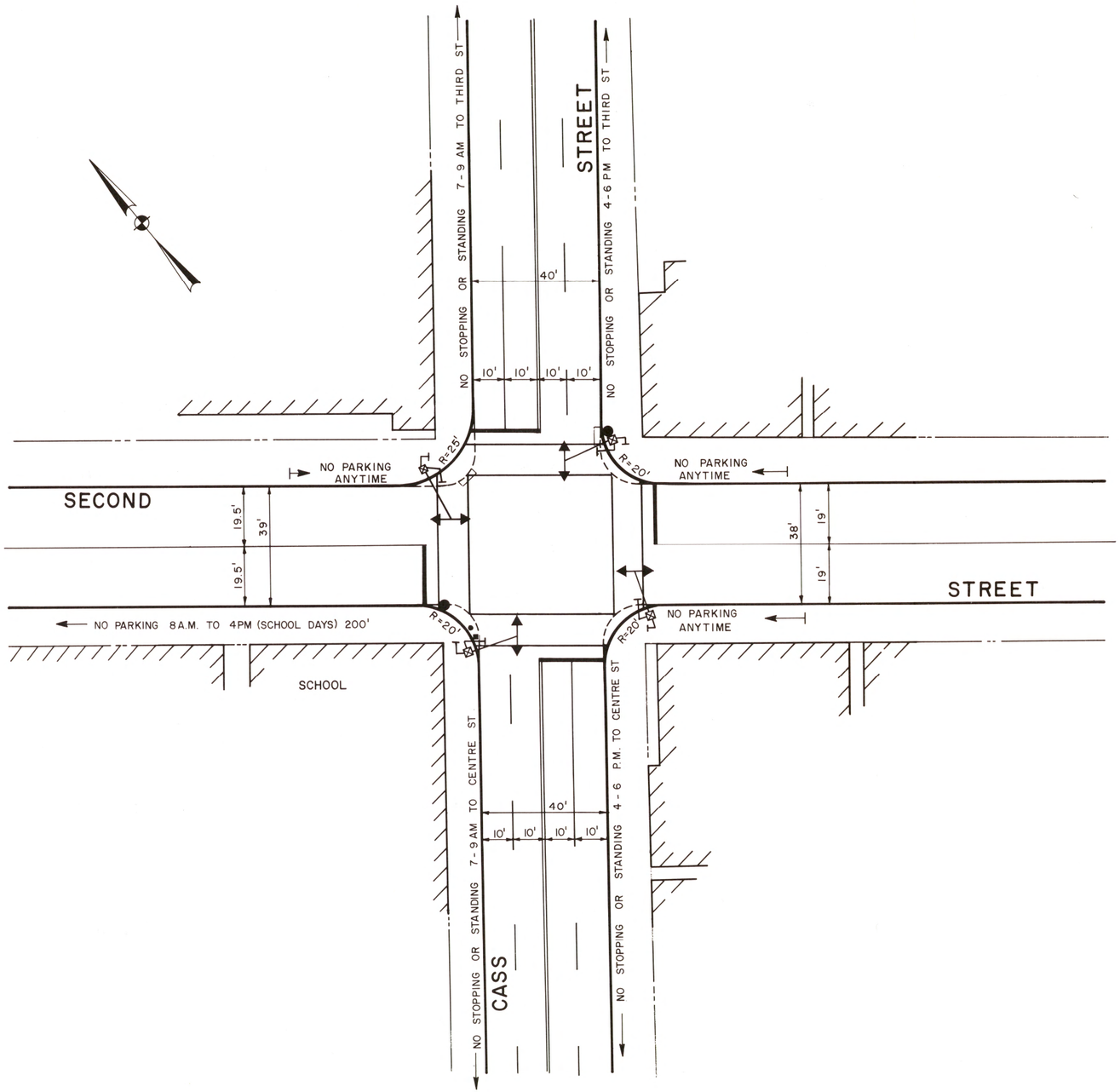
1. Stripe Cass Street for four 10-foot lanes.

2. Post peak hour No Stopping or Standing restrictions along Cass Street to Second Street.

3. Modernize traffic signal equipment as shown in the accompanying plan.

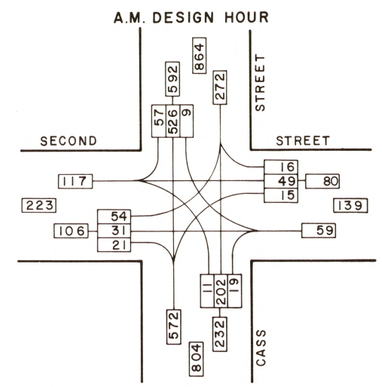
4. Cut back corner curb radii.

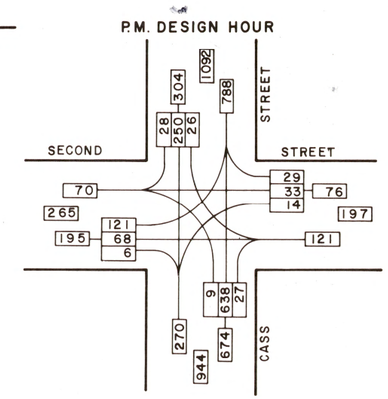
Right-of-Way: No **Cost:** $23,000



CASS STREET AND SECOND STREET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	11
ACCIDENT RATE PER TEN MILLION VEHICLES	38
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	8
INJURY RATE PER TEN MILLION VEHICLES	27
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	21
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	8

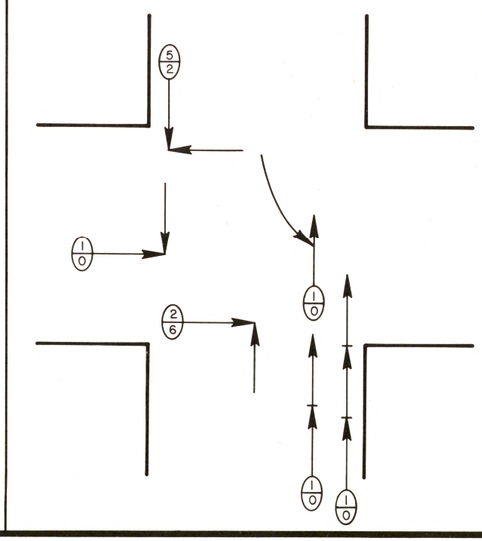


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FIGURE V-39

FIGURE 40
CASS STREET AND CENTRE STREET

S. BROAD STREET, GREENWOOD AVENUE, AND CENTRE STREET

Deficiencies

1. Safety--The greatest number of accidents (31) in the one-year period at a signalized intersection occurred here. The highest accident rate for the City (48 per 10 million vehicles) also occurred at this intersection. Westbound vehicles on S. Broad Street were involved in nine rear end collisions.

2. Capacity--Westbound approach in the A.M. and eastbound approach in the P.M. are at level of service "D."

Existing Conditions

1. Signals are poorly located, particularly for eastbound approach where left turning vehicles must pass the only signal head facing eastbound traffic.

2. There is poor signal visibility on all approaches due to obsolete signal equipment.

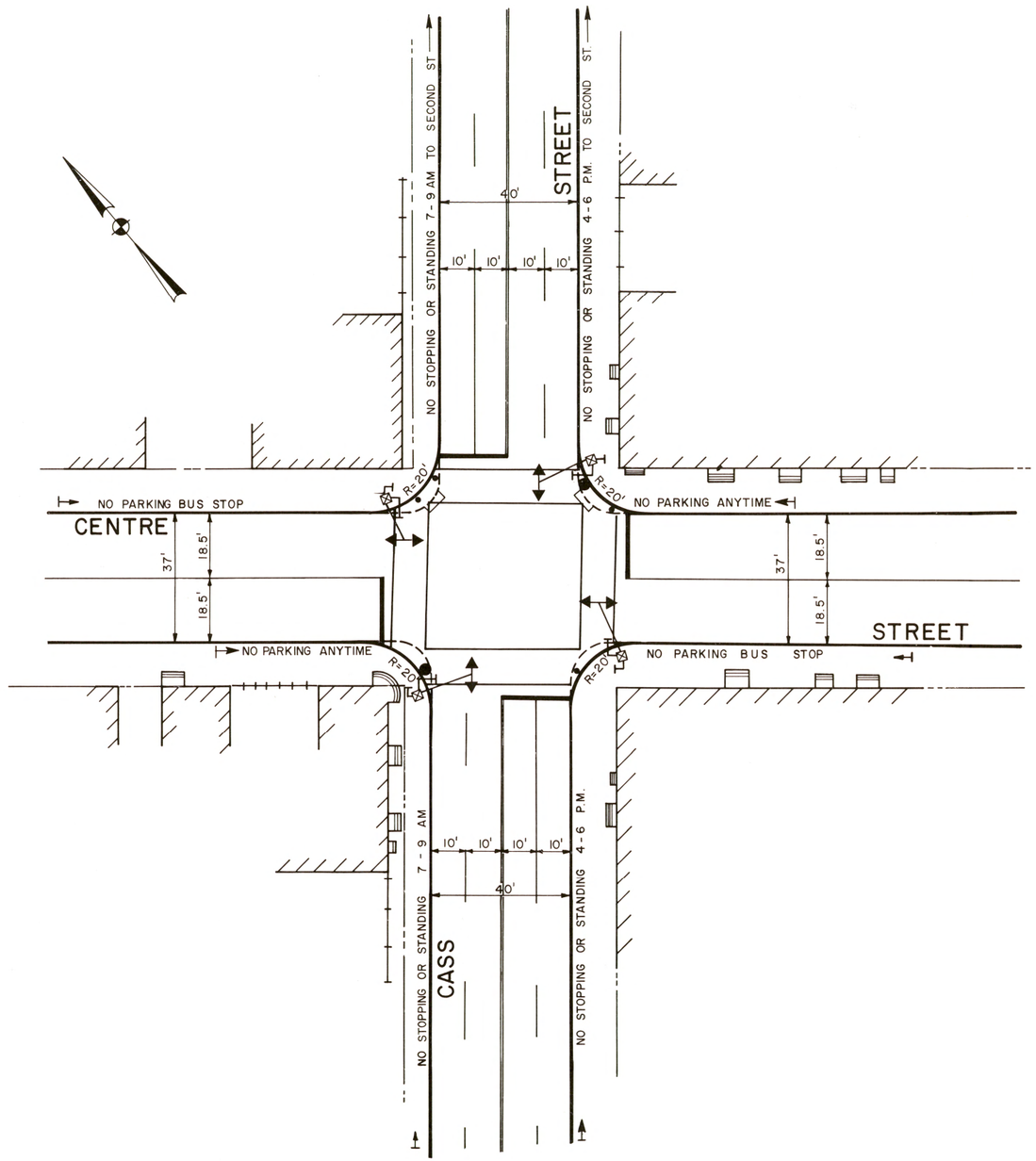
3. Confusion exists due to the general layout of the intersection; small island at Centre Street approach; two entrances to Centre Street; angled Centre Street approach.

4. Peak hour volumes along S. Broad Street are very heavy: approximately 950 vehicles westbound in A.M. and 750 vehicles eastbound in P.M.

Recommendations

1. Modernize intersection as shown in the accompanying drawing.
2. Enlarge island to better define permitted turning movements.
3. Restripe S. Broad Street for four lanes; remove parking on S. Broad Street.
4. Make Greenwood Avenue one-way away from S. Broad Street to Clay Street.
5. Ban left turns from S. Broad Street westbound.

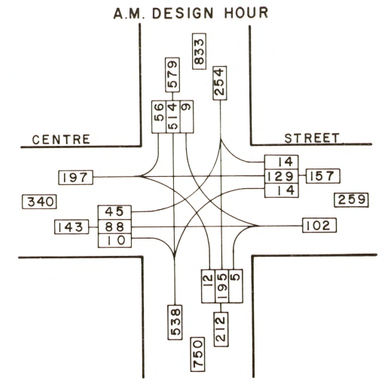
Right-of-Way: No **Cost:** $23,500

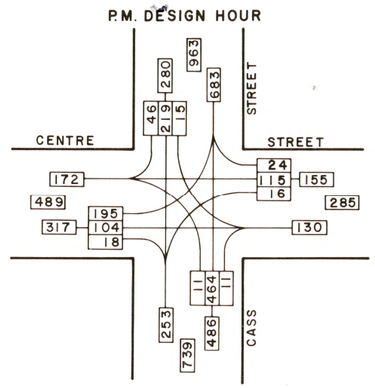


CASS STREET AND CENTRE STREET

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	8
ACCIDENT RATE PER TEN MILLION VEHICLES	22
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	8
INJURY RATE PER TEN MILLION VEHICLES	22
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	32
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	9
* FATALITY	+ 2 FAT

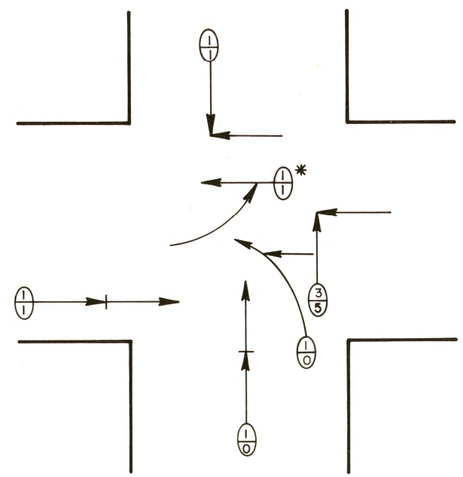


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FIGURE V-40

FIGURE V-41
S. BROAD STREET, GREENWOOD AVENUE AND CENTRE STREET

S. BROAD STREET, HAMILTON AVENUE, AND SECOND STREET

Deficiencies

1. Safety--19 accidents, including six rear end collisions on S. Broad Street and many left turn accidents, occurred over a one-year period.

2. Capacity--Hamilton Avenue approach operates at level of service 'D'. S. Broad Street eastbound operates at level of service 'F'.

3. Delay--S. Broad Street is delayed inbound in the morning and outbound in the evening.

Existing Conditions

1. S. Broad Street is a major arterial with direct access to the Central Business District and the State Complex.

2. Second Street and S. Broad Street are both major trucking routes with commercial vehicles averaging over 10 percent of the traffic.

3. There are heavy left turns from S. Broad Street eastbound.

4. "Z" shaped intersection causes conflicts between left turning traffic from Hamilton Avenue and left turn and straight through movements from Second Street because Second Street traffic cannot continue moving westbound on S. Broad Street, but is stopped at Hamilton Avenue.

5. Enforcement of existing 'No Parking Any Time' regulation on S. Broad Street is inadequate.

6. Existing parking regulations do not conform to peak direction flow.

7. Traffic signals are obsolete and poorly located.

Recommendations

1. Make Second Street one-way southbound from S. Broad Street to Bridge Street thereby eliminating a major conflict.

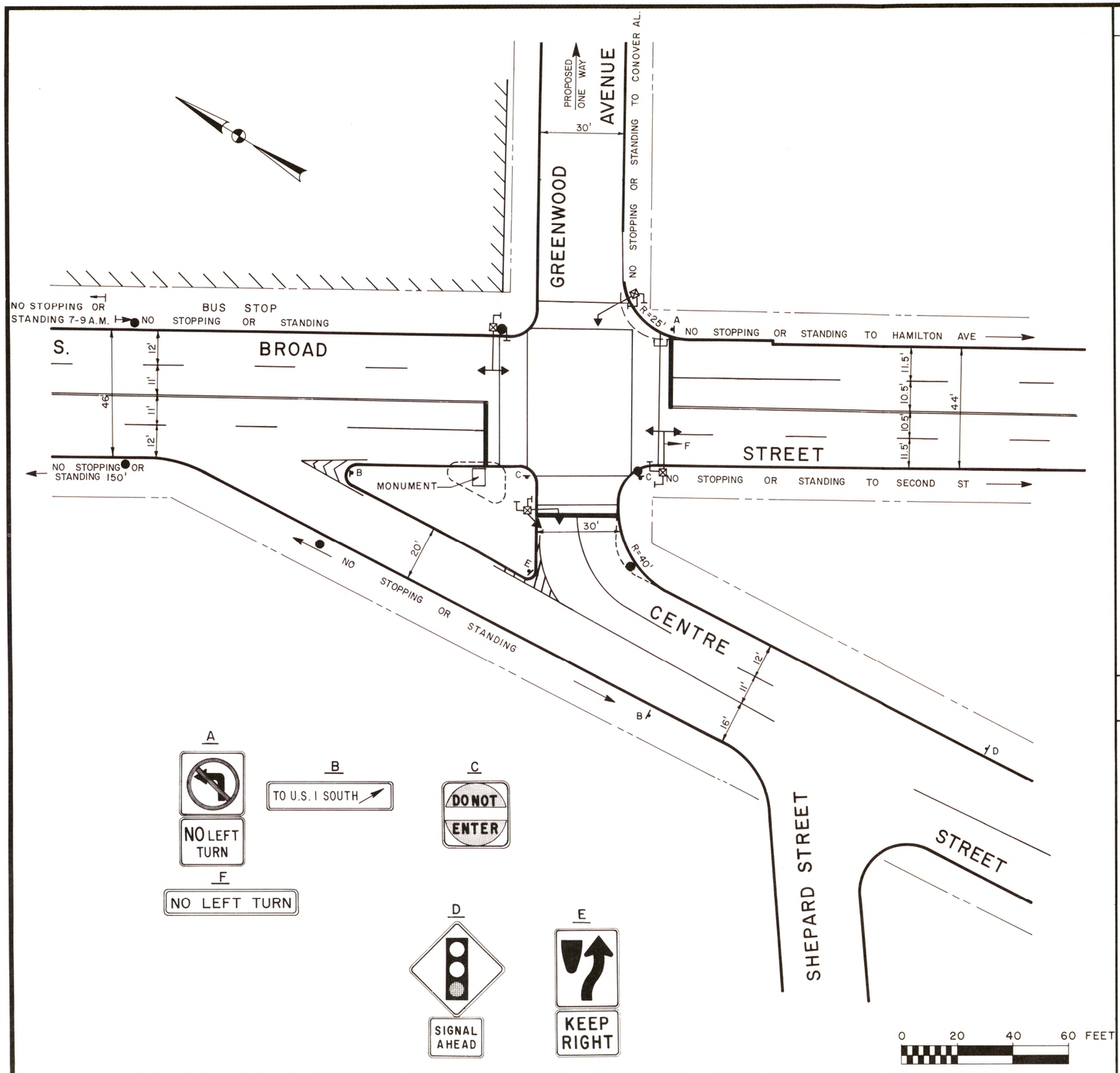
2. Modernize intersection by installing new signal equipment.

3. Restripe S. Broad Street for four 10-foot lanes, banning stopping and standing at all times along S. Broad Street from adjacent signalized intersections.

4. Cut back existing curb at northeast corner of Hamilton and S. Broad.

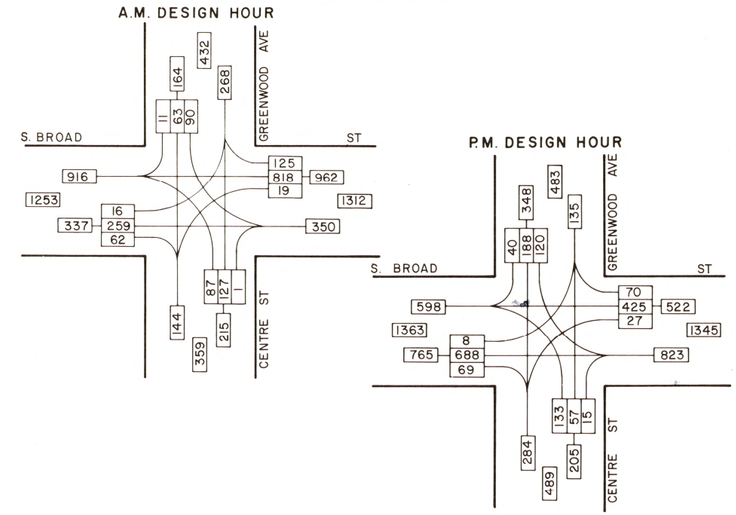
NOTE: When this recommendation is implemented a signal will be warranted at Bridge Street and S. Broad Street. The design is shown on Figure V-43.

Right-of-Way: No **Cost: $19,000**



S. BROAD STREET, GREENWOOD AVENUE AND CENTRE STREET

EXISTING VOLUMES



SEE FIGURE V-43 FOR PROPOSED VOLUMES

INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	31
ACCIDENT RATE PER TEN MILLION VEHICLES	48
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	10
INJURY RATE PER TEN MILLION VEHICLES	16
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	60
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	16

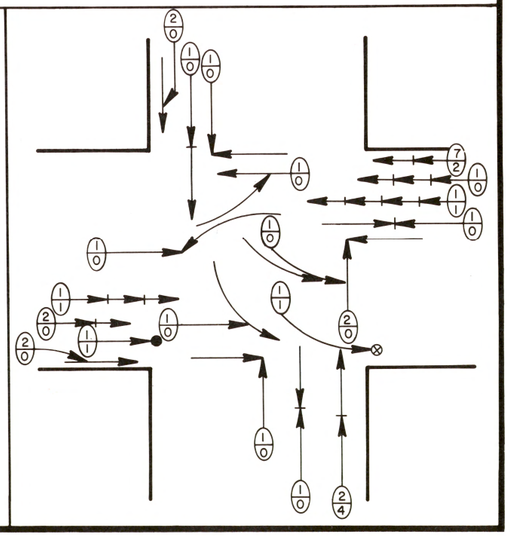


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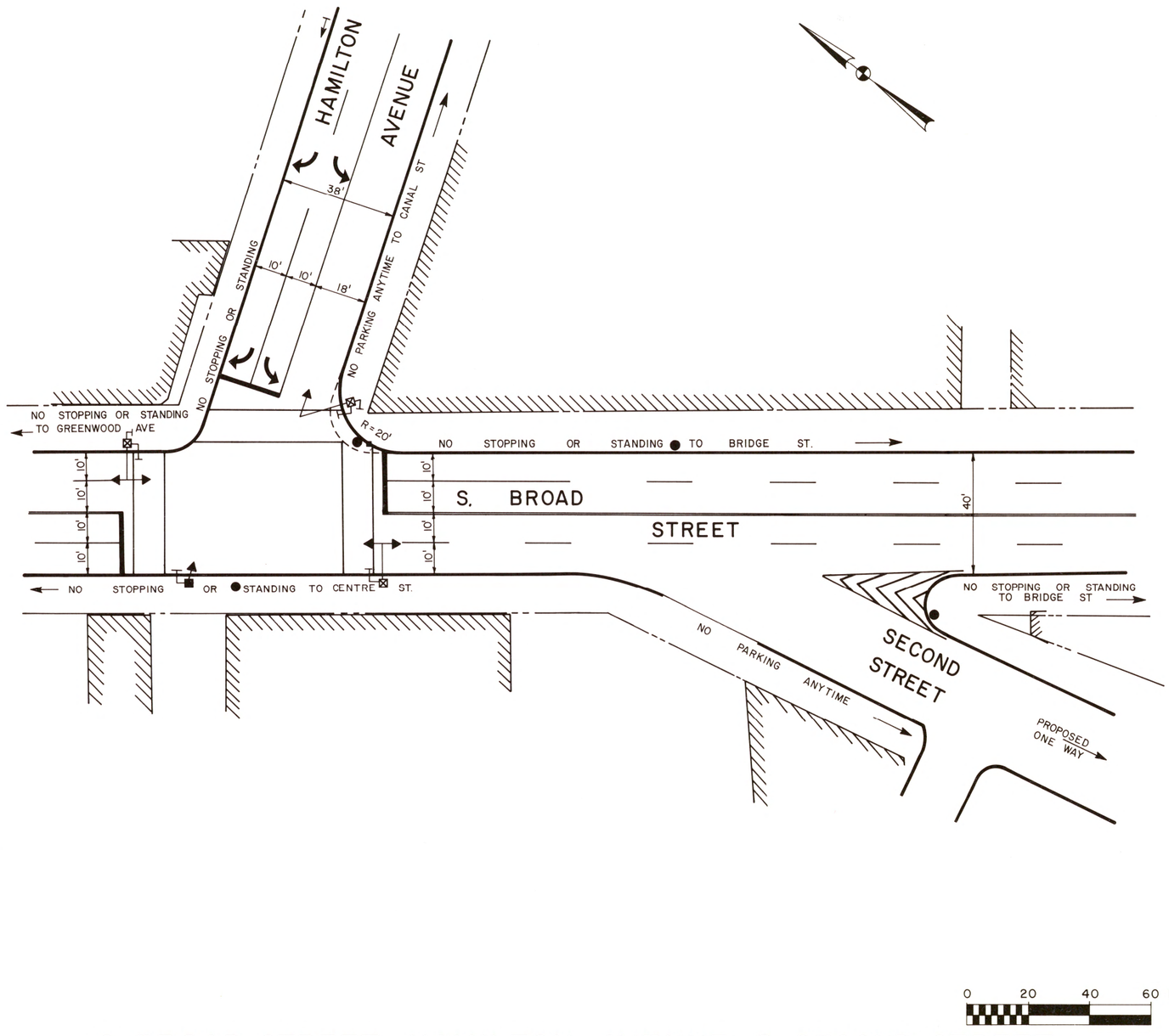
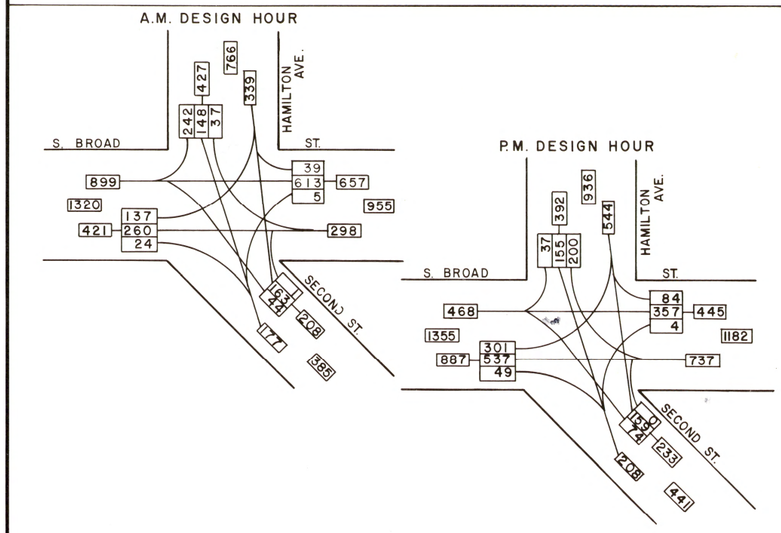
FIGURE V-41

FIGURE V-42
S. BROAD STREET, HAMILTON AVENUE
AND SECOND STREET



S. BROAD STREET, HAMILTON AVENUE, & SECOND STREET

DESIGN HOUR VOLUMES



SEE FIGURE V-43 FOR PROPOSED VOLUMES

INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	19
ACCIDENT RATE PER TEN MILLION VEHICLES	26
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	6
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	36
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	17

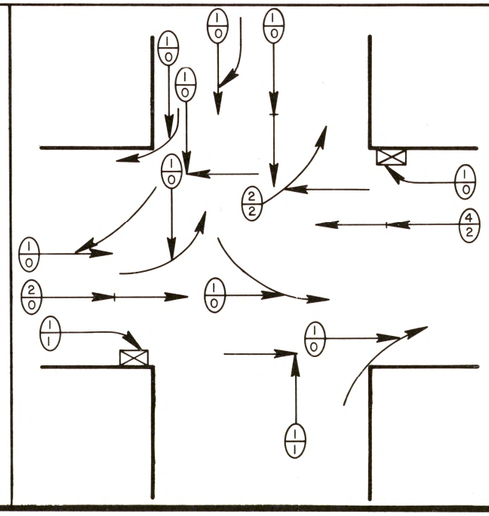


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FIGURE V-42

FIGURE V-43
BRIDGE STREET AND S. BROAD STREET

S. Broad Street--Clinton Avenue, One-Way Operation

S. Broad Street is approximately 38 feet wide between Dye Street and Liberty Street. At that point, S. Broad Street widens to approximately 70 feet in width. This portion of S. Broad Street is developed almost exclusively retail with parking along its entire length.

The high volumes of commuter traffic coupled with the existing parking situation tends to hinder the free flow of traffic. In addition, large volumes of traffic utilize Cass Street and severe congestion exists where Cass and S. Broad Streets merge, just in advance of the traffic signal at Beatty Street.

The physical characteristics of Clinton Avenue are very similar to that of S. Broad Street, with the exception of the retail land use.

In order to alleviate the existing condition, without eliminating the much needed parking on S. Broad Street, the conversion to one-way operation is recommended.

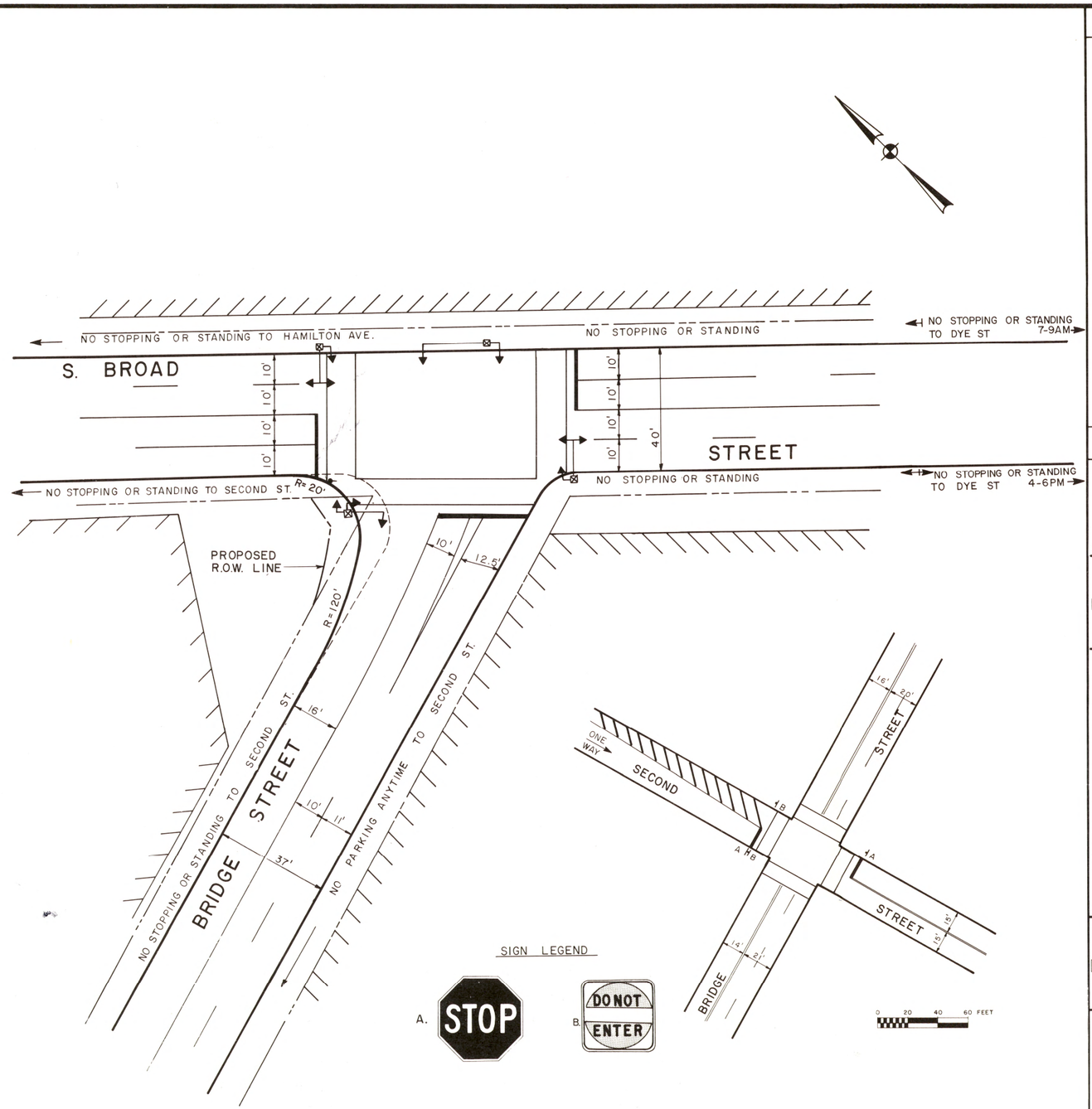
Dye Street at the west terminus would require channelization, signs and marking as shown in Figures V-44 and V-50. At the south end, motorists travelling northbound on S. Broad Street can turn right at any intersection to reach Clinton Avenue until reaching Dayton Street. At this point, they must turn right. Dayton Street will be converted to one-way operation northbound to help facilitate this movement. Figure V-48 shows the proposed operation of this intersection.

Eastbound S. Broad Street traffic will have a greatly improved operation at Liberty Street where a large number of accidents had previously occurred. Liberty Street will operate one-way southbound complementing Dayton Street. Both roadways should be made one-way between Lalor Street and Vroom Street. When the changeover to this one-way operation occurs, signalization of Dayton Street and Clinton Avenue may be required.

Along the length of S. Broad Street and Clinton Avenue, all signalized intersections should be improved as shown in the individual recommendations which follow. In general, parking will be permitted on both sides of the street except at the approaches to signalized intersections.

An additional benefit derived from the one-way operation will be increased safety. As an example, the high number of right angle collisions at Division Street and Clinton Avenue should be reduced by the one-way operation coupled with the banning parking on the Clinton Avenue approach for 75' on the south curbline.

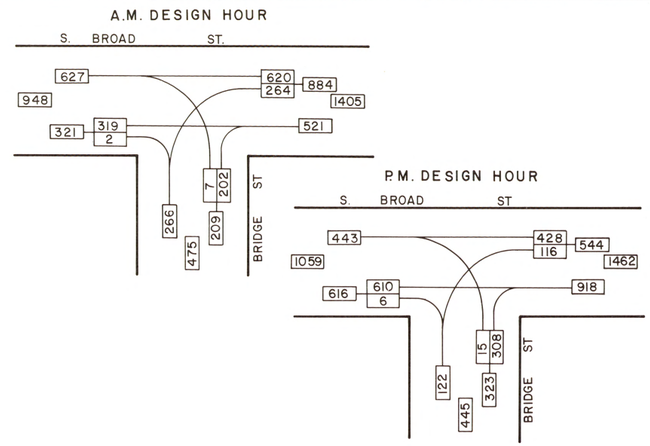
There is no right-of-way acquisition required for this recommendation and the total cost for modernizing five signalized intersections, channelizing two unsignalized intersections, and installing signs and markings is $120,000.



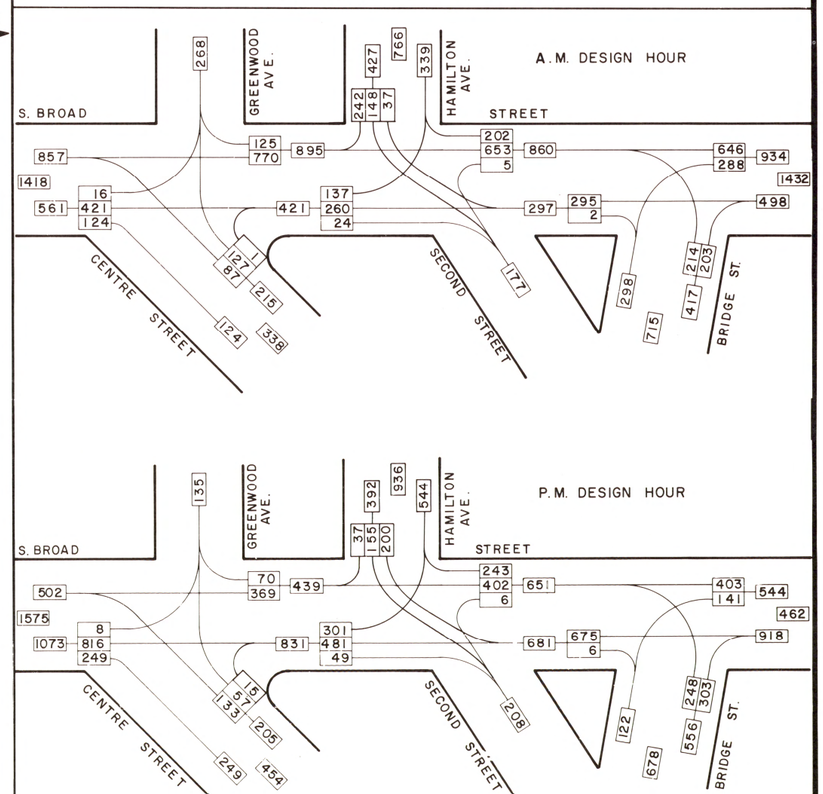
BRIDGE STREET & S. BROAD STREET

0 20 40 60 FEET

EXISTING VOLUMES



PROJECTED VOLUMES



NOTE

THERE WERE FEWER THAN 5 ACCIDENTS IN ONE YEAR AT THE INTERSECTION OF BRIDGE STREET AND S. BROAD STREET

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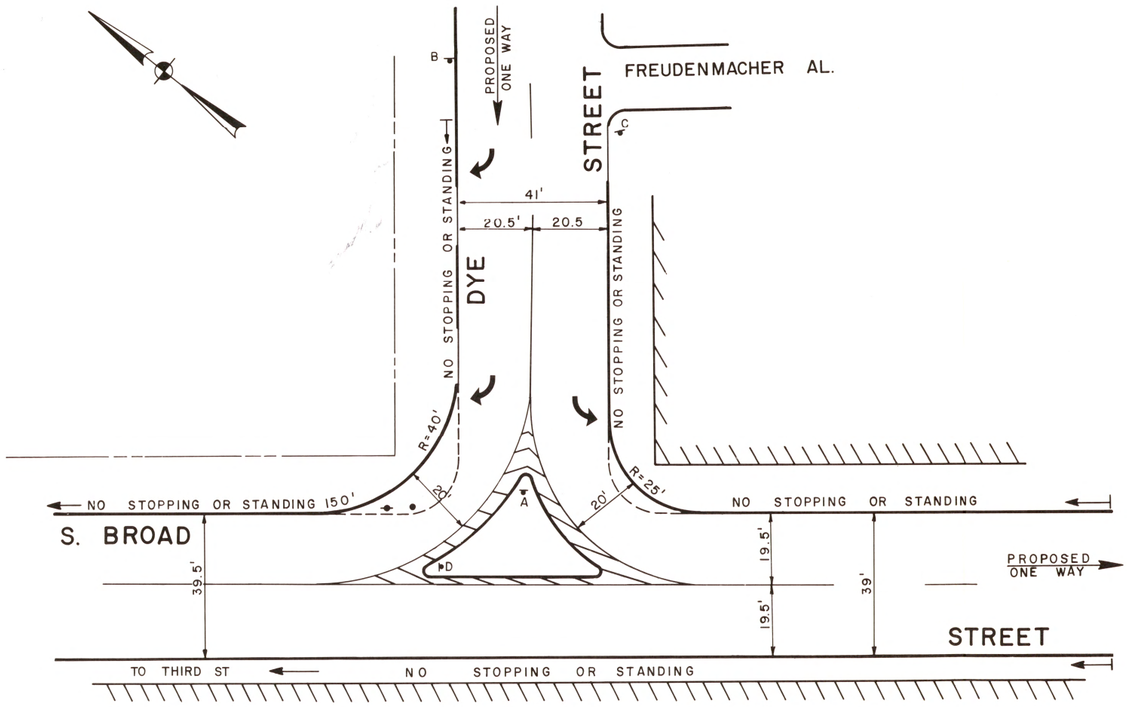
FIGURE V-43

FIGURE V-44
S. BROAD STREET AND DYE STREET



A — CENTRAL BUSINESS DISTRICT → / ← U.S. 206 SOUTH

B — U.S. 206 SOUTH KEEP LEFT

C — CENTRAL BUSINESS DISTRICT KEEP RIGHT

D

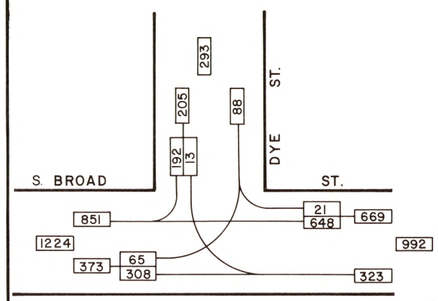


S. BROAD STREET & DYE STREET

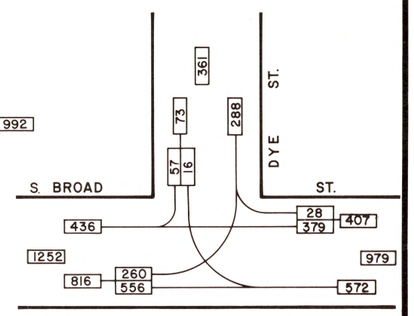
0 20 40 60 FEET

EXISTING VOLUMES

A.M. DESIGN HOUR

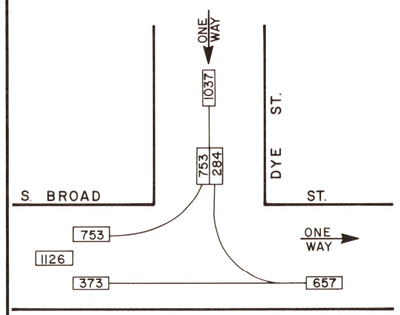


P.M. DESIGN HOUR



PROJECTED VOLUMES

A.M. DESIGN HOUR



P.M. DESIGN HOUR

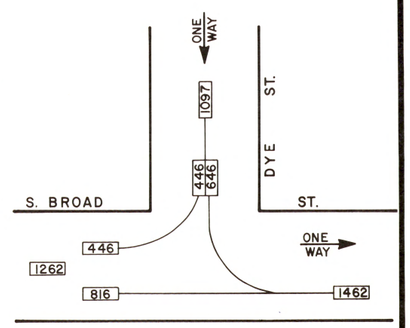


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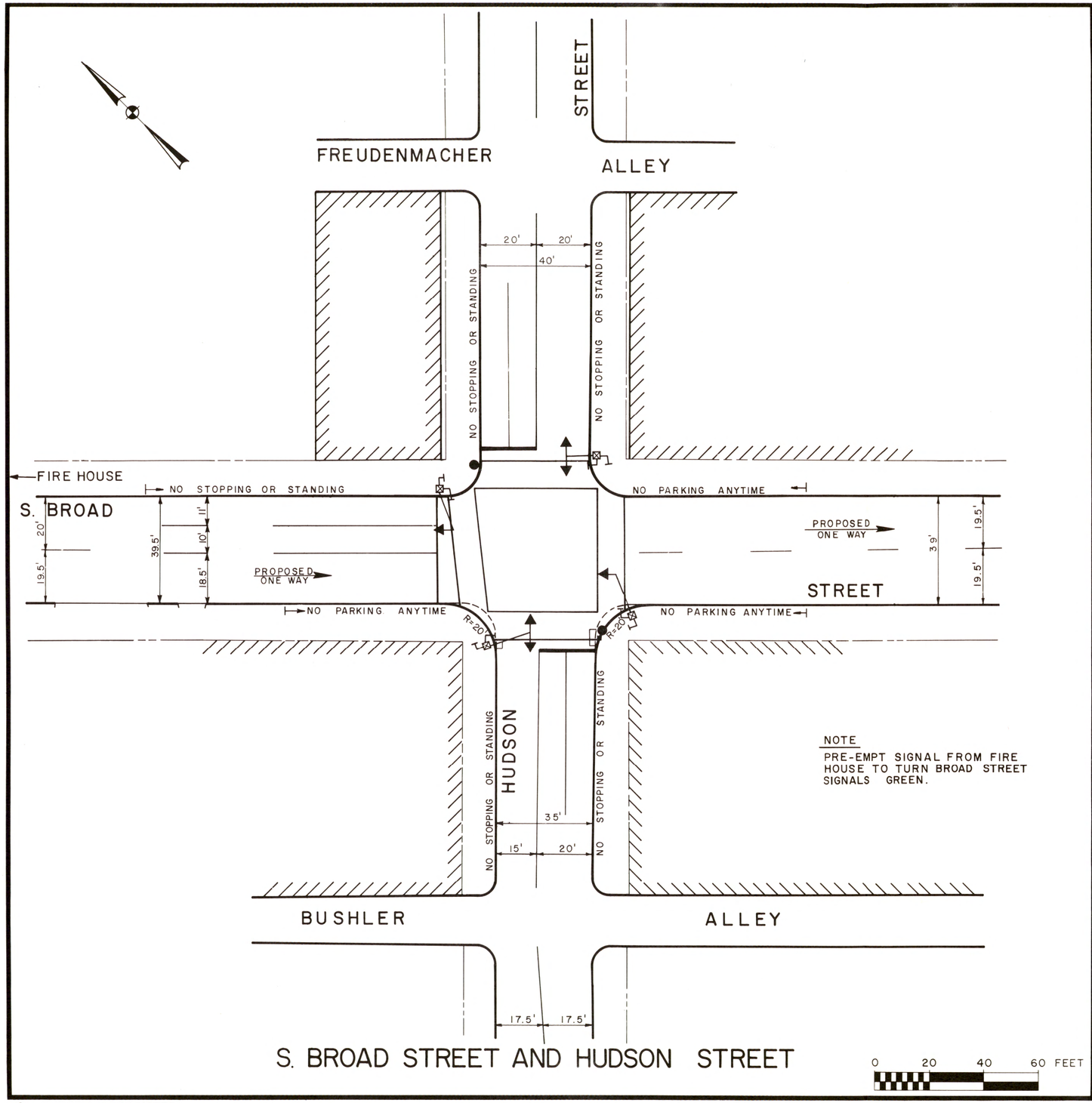
FIGURE V-44

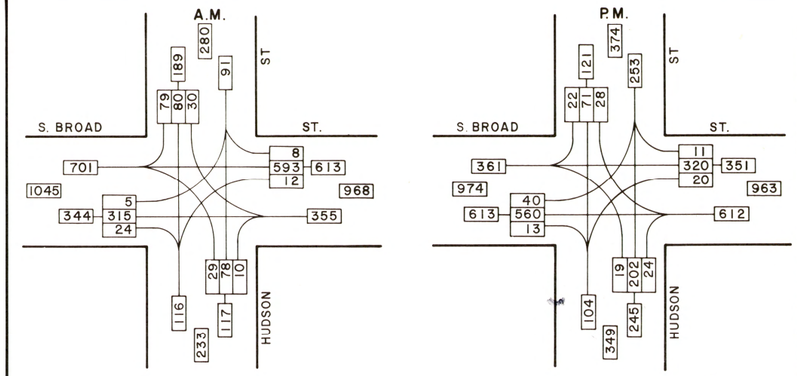
FIGURE V-45
S. BROAD STREET AND HUDSON STREET



NOTE

PRE-EMPT SIGNAL FROM FIRE HOUSE TO TURN BROAD STREET SIGNALS GREEN.

EXISTING VOLUMES



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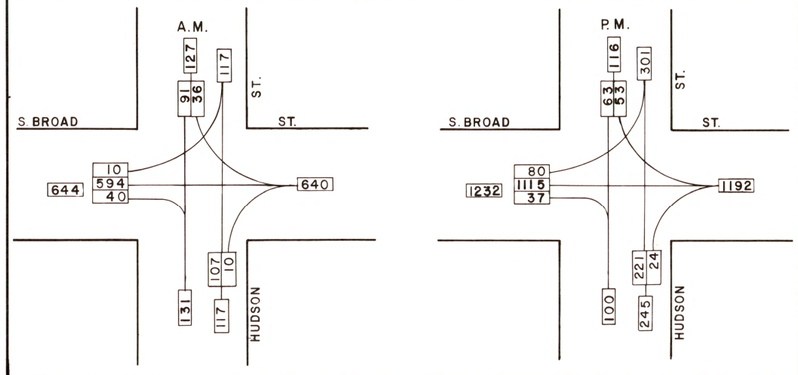

INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	12
ACCIDENT RATE PER TEN MILLION VEHICLES	22
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	3
INJURY RATE PER TEN MILLION VEHICLES	6
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	28
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	6

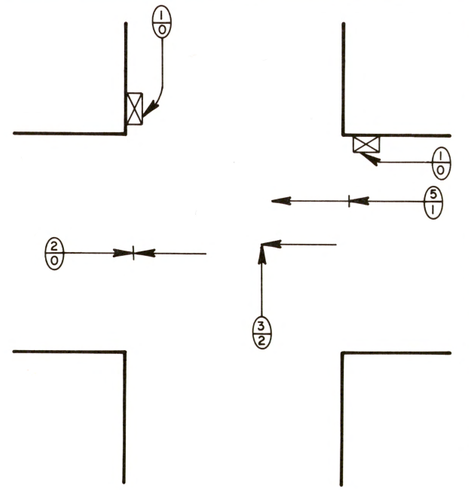

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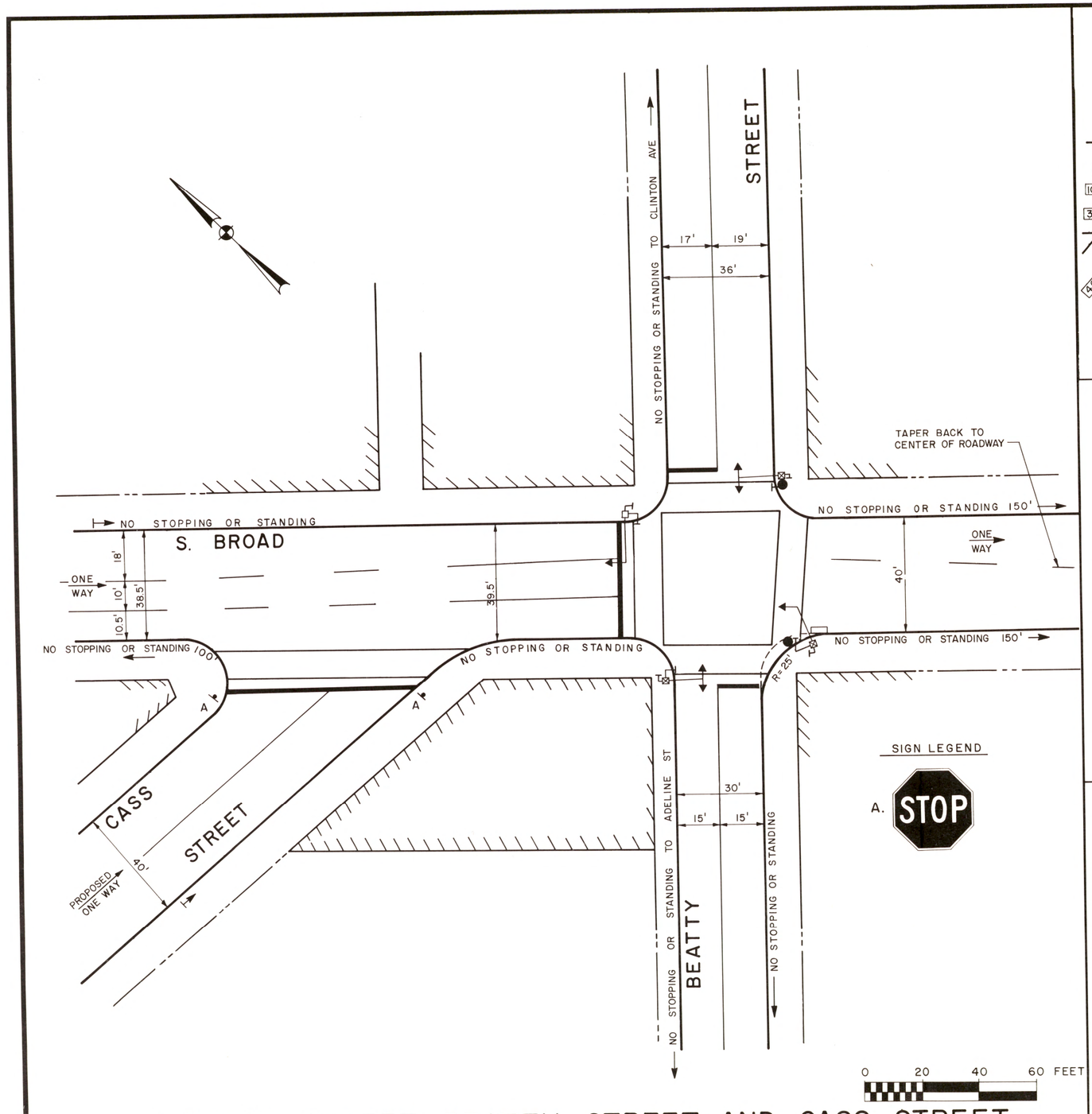
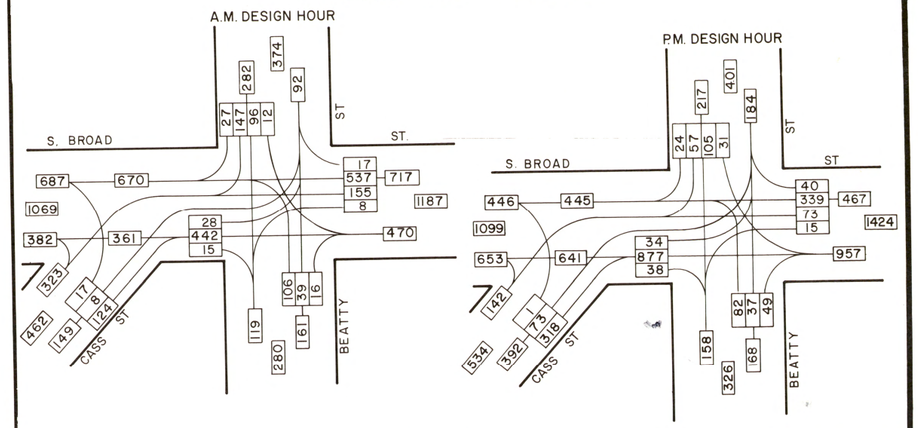
FIGURE V - 45

FIGURE V-46
S. BROAD STREET, BEATTY STREET
AND CASS STREET

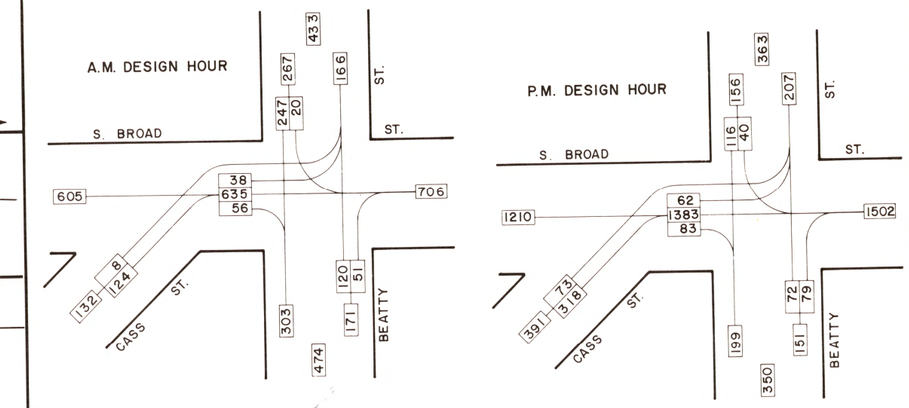


S. BROAD STREET, BEATTY STREET AND CASS STREET

EXISTING VOLUMES



PROJECTED VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	11
ACCIDENT RATE PER TEN MILLION VEHICLES	13
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	1
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	49
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	11

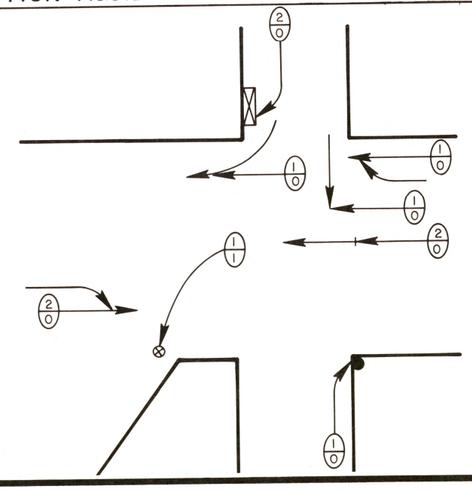


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FIGURE V-46

FIGURE V-47
S. BROAD STREET AND LIBERTY STREET

FIGURE V-48
S. BROAD STREET AND DAYTON STREET

CLINTON AVENUE AND HAMILTON AVENUE

Deficiencies

1. Safety--a total of sixteen accidents of various types occurred here.

2. Capacity--both Hamilton Avenue approaches are at level of service "F;" eastbound Clinton Avenue is at level of service "E" for the evening peak hour traffic.

3. Delay--northbound Hamilton Avenue traffic experiences heavy delays during the P.M. peak hour.

Existing Conditions

1. Narrow eastbound approach width of Clinton Avenue.

2. Proximity of intersection to heavy industrial area.

3. Location along route to Greenwood Circle and Route 1.

4. Heavy left turn on Clinton Avenue eastbound at all times of the day.

5. Heavy truck and bus traffic.

6. Inadequate signal equipment.

Recommendations

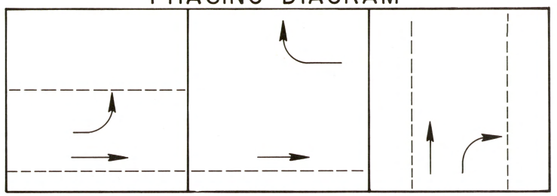
1. Install left turn slots along Clinton Avenue to create smoother traffic flow.

2. Use No Stopping or Standing regulation on all legs of intersection.

3. Install modern traffic signal equipment, pavement markings, and parking regulations as shown in the accompanying plan.

Right-of-Way: No **Cost:** $23,000

PHASING DIAGRAM



SIGNAL LEGEND

NOTE:
*3M OPTICALLY PROGRAMMED SIGNALS ARE ALL RIGID MOUNTED.

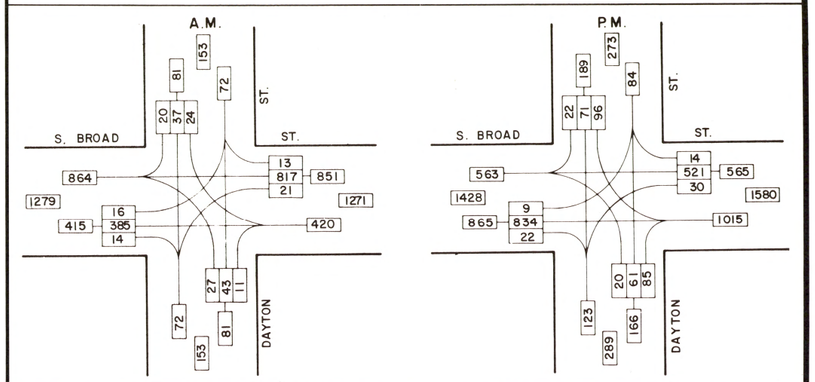
MOUNT 10' HIGH

SIGN LEGEND

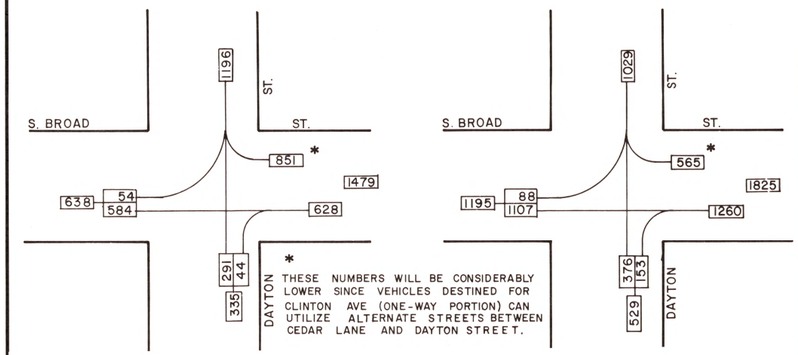
S. BROAD STREET AND DAYTON STREET

0 20 40 60 FEET

EXISTING VOLUMES



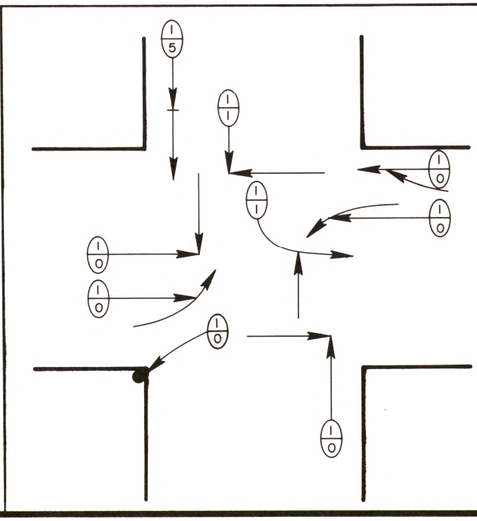
PROJECTED VOLUMES



* THESE NUMBERS WILL BE CONSIDERABLY LOWER SINCE VEHICLES DESTINED FOR CLINTON AVE (ONE-WAY PORTION) CAN UTILIZE ALTERNATE STREETS BETWEEN CEDAR LANE AND DAYTON STREET.

INTERSECTION ACCIDENT SUMMARY

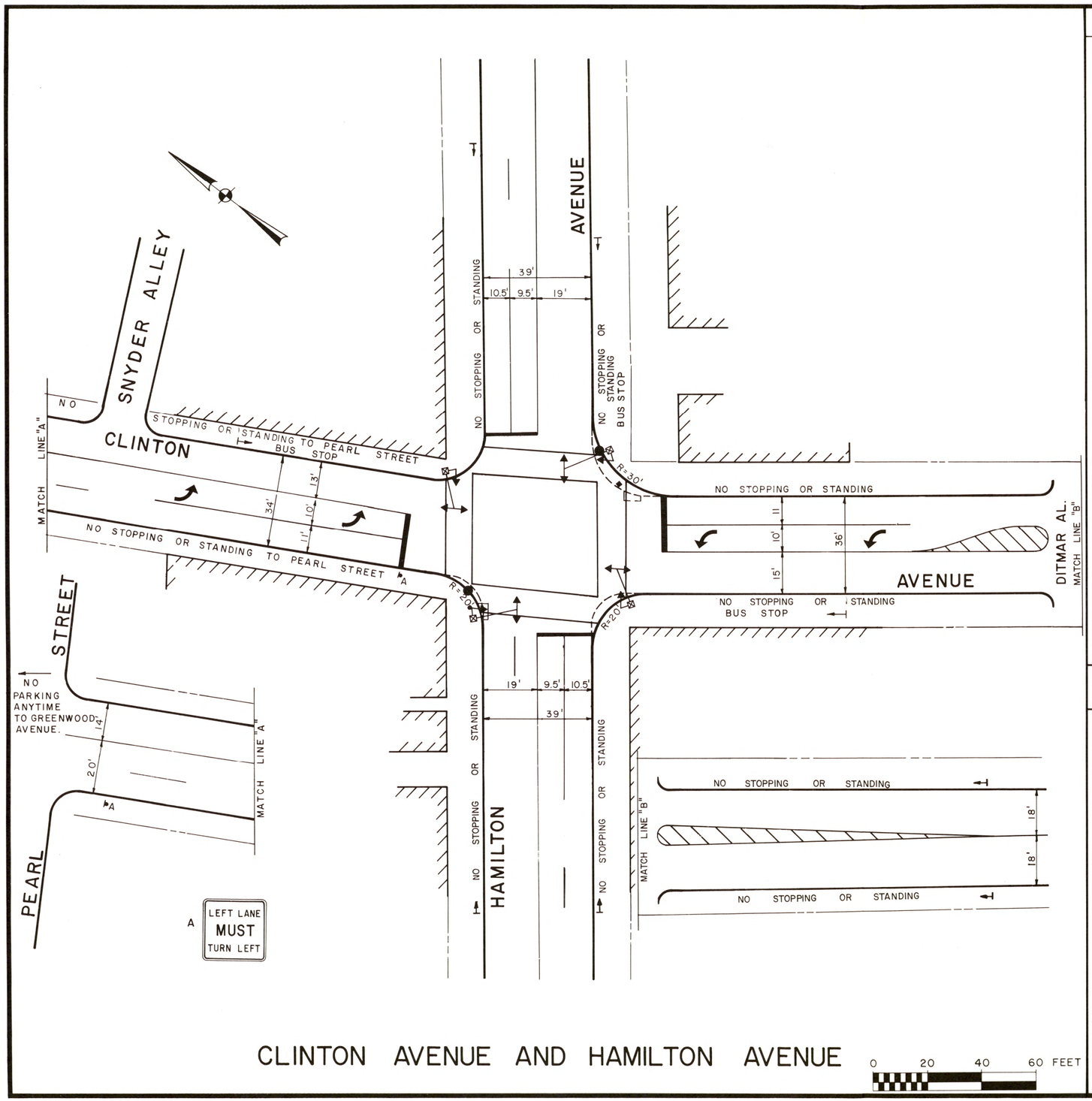
NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	9
ACCIDENT RATE PER TEN MILLION VEHICLES	10
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	7
INJURY RATE PER TEN MILLION VEHICLES	8



PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

FIGURE V-48

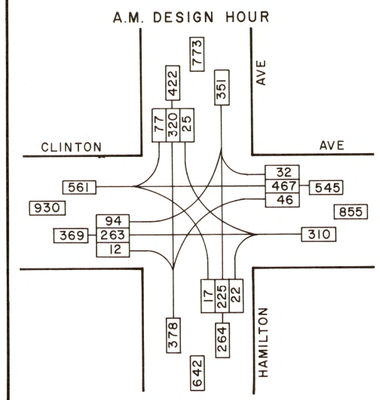
FIGURE V-49
CLINTON AVENUE AND HAMILTON AVENUE

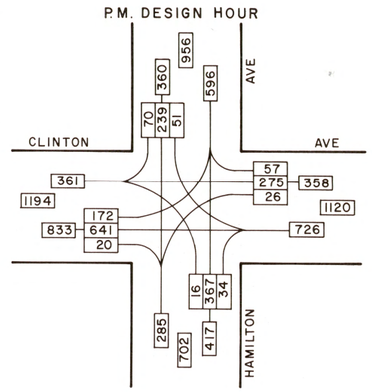


CLINTON AVENUE AND HAMILTON AVENUE

0 20 40 60 FEET

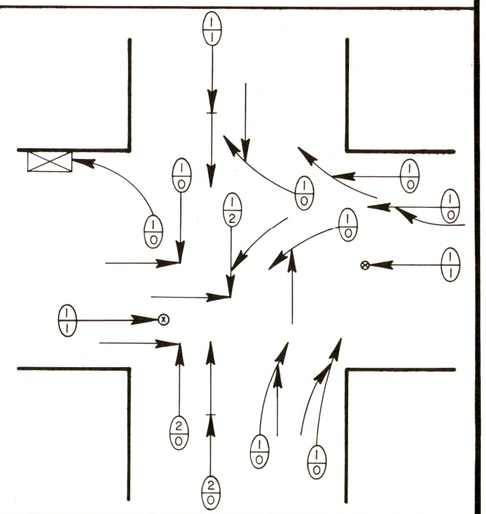
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

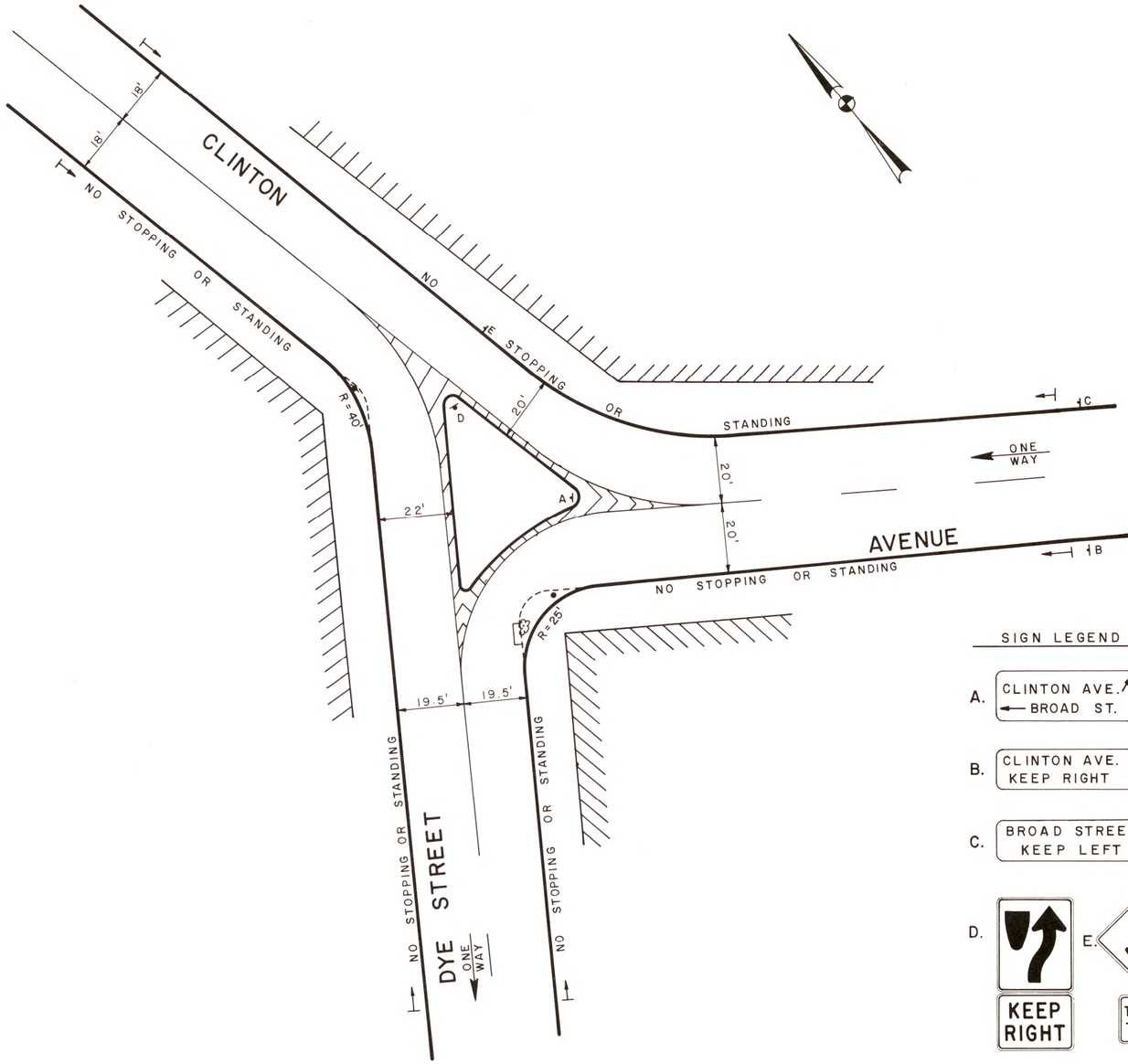
NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	16
ACCIDENT RATE PER TEN MILLION VEHICLES	20
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	6
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	28
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	3



PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

FIGURE V-49

FIGURE V-50
CLINTON AVENUE AND DYE STREET



SIGN LEGEND

A. CLINTON AVE. ← BROAD ST.

B. CLINTON AVE. KEEP RIGHT

C. BROAD STREET KEEP LEFT

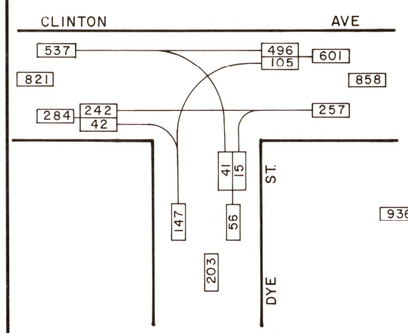
D.

E. 

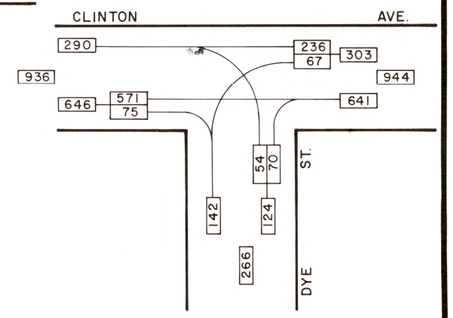
0 20 40 60 FEET

EXISTING VOLUMES

A.M. DESIGN HOUR

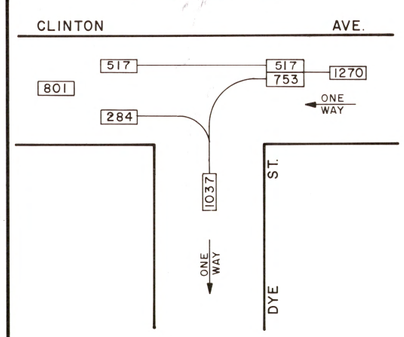


P.M. DESIGN HOUR

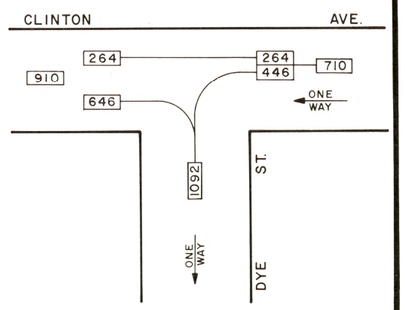


PROJECTED VOLUMES

A.M. DESIGN HOUR



P.M. DESIGN HOUR



CLINTON AVENUE & DYE STREET

PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

FIGURE V-50

FIGURE V-51
CLINTON AVENUE AND LIBERTY STREET

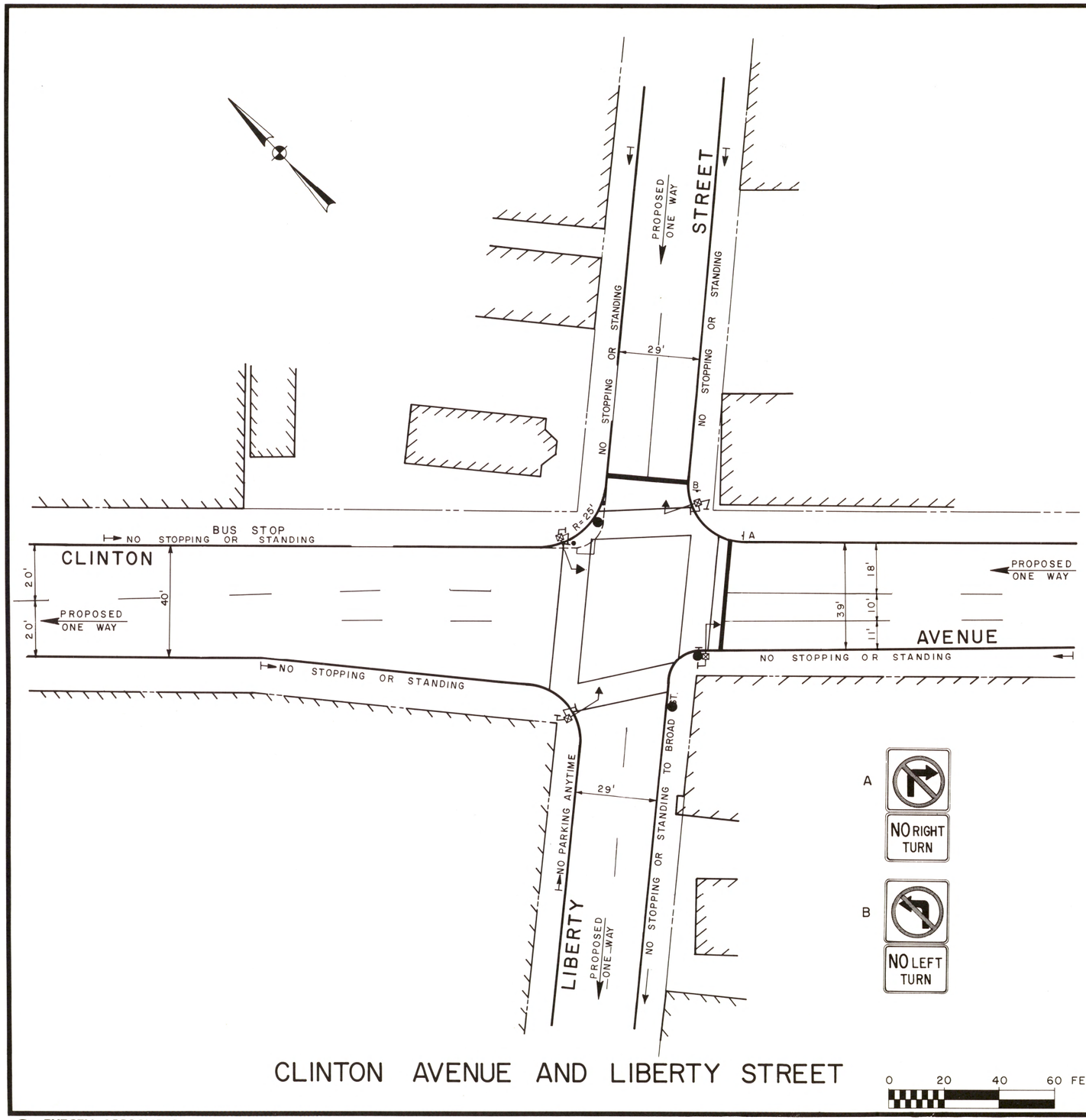
CENTRAL BUSINESS DISTRICT

For the purposes of this Study, the Central Business District will be defined as the area east of Calhoun Street and west of the Trenton Freeway. The northerly boundary will be just north of the War Memorial Statue at N. Broad Street, Warren Street, Pennington Avenue, and Brunswick Avenue. While the heart of the business area is a good deal smaller, the designated Central Business District includes all of the State complex which contributes so heavily to the influx of motorists every day. This designated area contains probably the largest generators of traffic for the entire City. Within the Central Business District, there is proposed urban renewal area as well as plans by the City to establish a pedestrian mall along State Street between Stockton Street and Willow Street. The plan is conceived in two stages with the final stage being predicated on the extension of Academy Street between N. Broad and Warren Streets. The land through which Academy Street would be extended is currently owned by the Trenton Parking Authority and such an extension would be beneficial whether or not the pedestrian mall concept is ultimately adopted. As part of the concept of a pedestrian plaza, the City's Planning Division proposes to construct three parking garages in the first phase of this operation and two more in the second phase. The proposed pedestrian mall, extension of Academy Street and location of future garages are all shown in Figure V-52. Recommendations are shown for various one-way operations and these should be implemented whether or not the pedestrian mall concept is adopted.

In conjunction with the on-going urban renewal project, Lafayette Street will be widened from Memorial Drive to N. Broad Street and Front Street realigned from N. Broad Street to Montgomery Street. Traffic signal designs will be accomplished as part of the Urban Renewal Construction.

The recommendations made for the Central Business District take into consideration the future plans which exist for this area. While plans for the near future do exist for the closing of State Street, several recommendations are based on the current operation and can be implemented as an interim solution to the problems which exist within this study area.

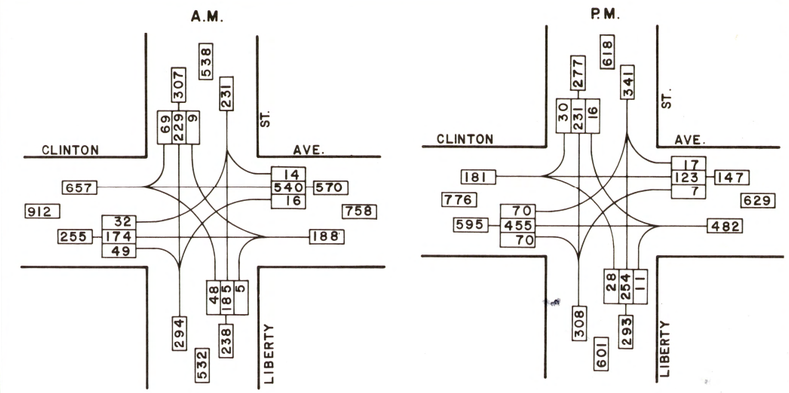
State Street intersections present the most serious problems in the Central Business District with heavy pedestrian traffic, narrow roadway widths, parked cars and trucks, and heavy vehicular volumes. Police are on duty directing traffic at all intersections along State Street from Willow Street to Stockton Street.



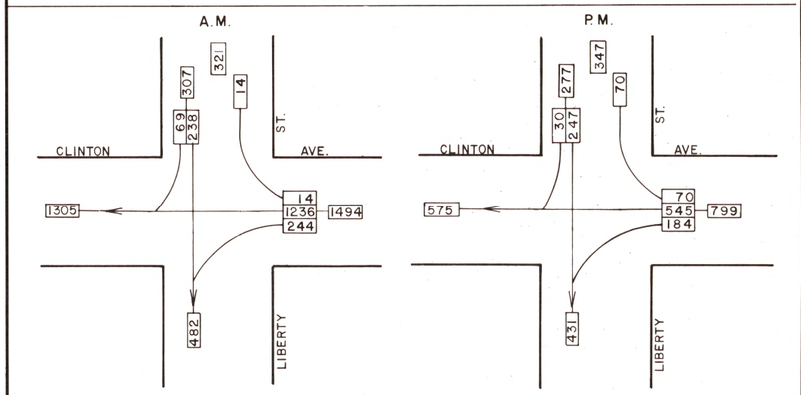
CLINTON AVENUE AND LIBERTY STREET

PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

EXISTING VOLUMES



PROJECTED VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	9
ACCIDENT RATE PER TEN MILLION VEHICLES	13
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	2
INJURY RATE PER TEN MILLION VEHICLES	3
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	19
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	13

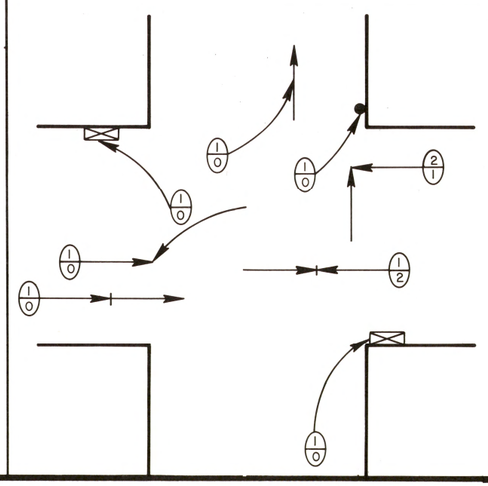


FIGURE V-51

FIGURE V-52
CENTRAL BUSINESS DISTRICT

STOCKTON STREET, MONTGOMERY STREET ONE-WAY COUPLET

Stockton Street and portions of Montgomery Street between State and Perry Streets are quite narrow, not permitting the movement of two-way traffic without the banning of parking. Both the intersections of Stockton Street with Perry Street and Montgomery Street with State Street have experienced a high number of accidents in the past year. The latter intersection experienced twenty-one accidents, eight of which were rear end collisions and five side swipes. Perry Street and Stockton Street, while experiencing fifteen accidents, had a rate of twenty-four accidents per ten million vehicle occurrences.

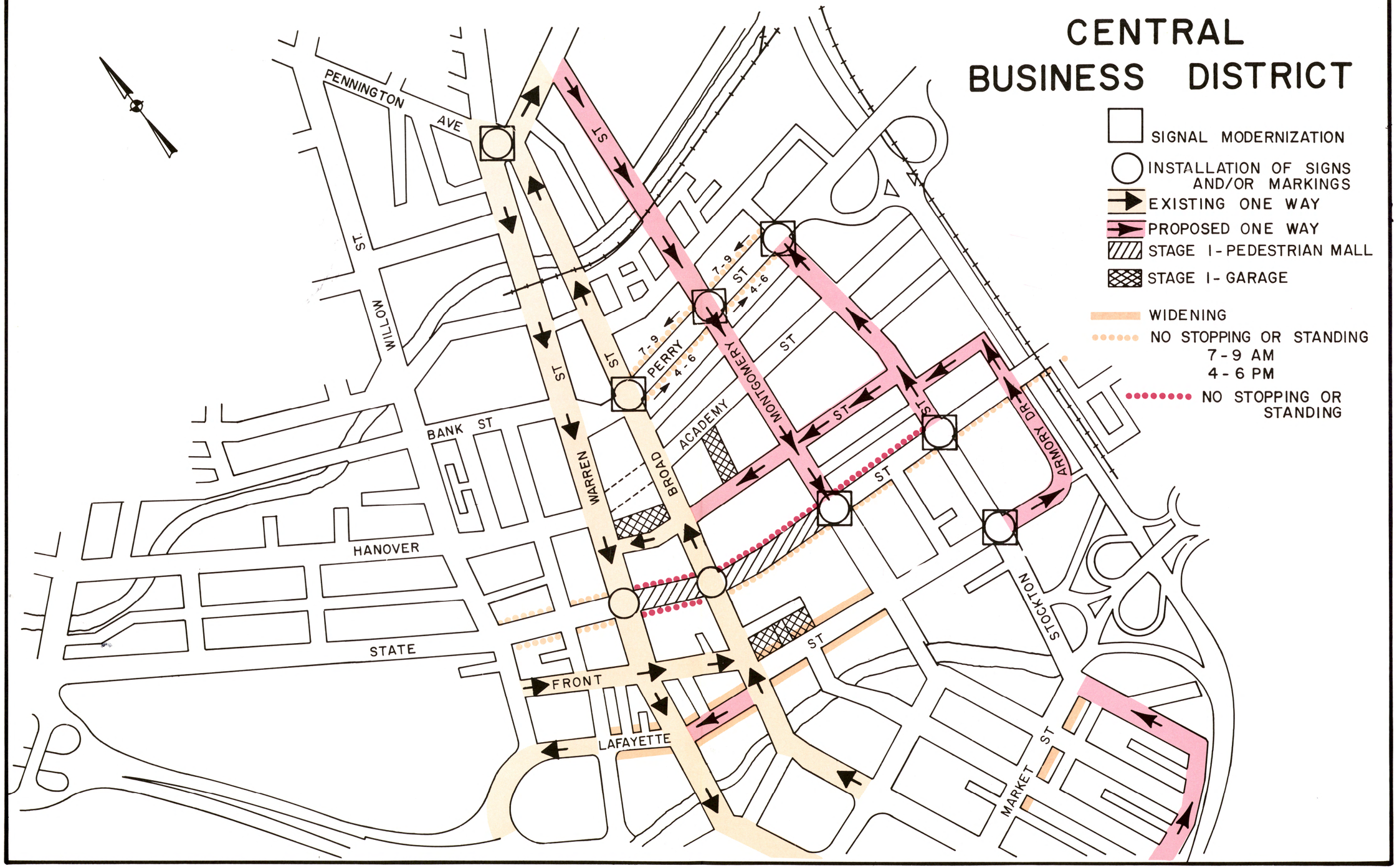
The two intersections along State Street experience the normal delay and congestion associated with the problems on State Street.

The recommendation for Montgomery Street and State Street includes the banning of several turning movements to eliminate the problems associated with heavy turning movements and heavy pedestrian activity. At Stockton Street and State Street turning movements will be permitted since this intersection will act as a terminus in the circulation pattern around the Central Business District. Additionally, pedestrian activity at this intersection is not as great as it is to the west along State Street.

The intersection of Perry Street and Stockton Street presents an additional problem due to the location of a fire house on the northwest quadrant. Because of this, eastbound Perry Street traffic will be stopped in advance of the intersection with a signal pre-empt control wired into the fire house. The changeover to one-way operation for Montgomery Street between Brunswick Avenue and State Street and for Stockton Street between State Street and Perry Street will help the general circulation around the Central Business District while eliminating some of the problems which exist at various intersections.

	Right-of-Way	Cost
Perry Street and Stockton Street	No	$24,500
Perry Street and Montgomery Street	No	$18,500
Stockton Street and State Street	Yes	$23,000
Montgomery Street and State Street	No	$21,000

CENTRAL BUSINESS DISTRICT



PURCELL ASSOCIATES
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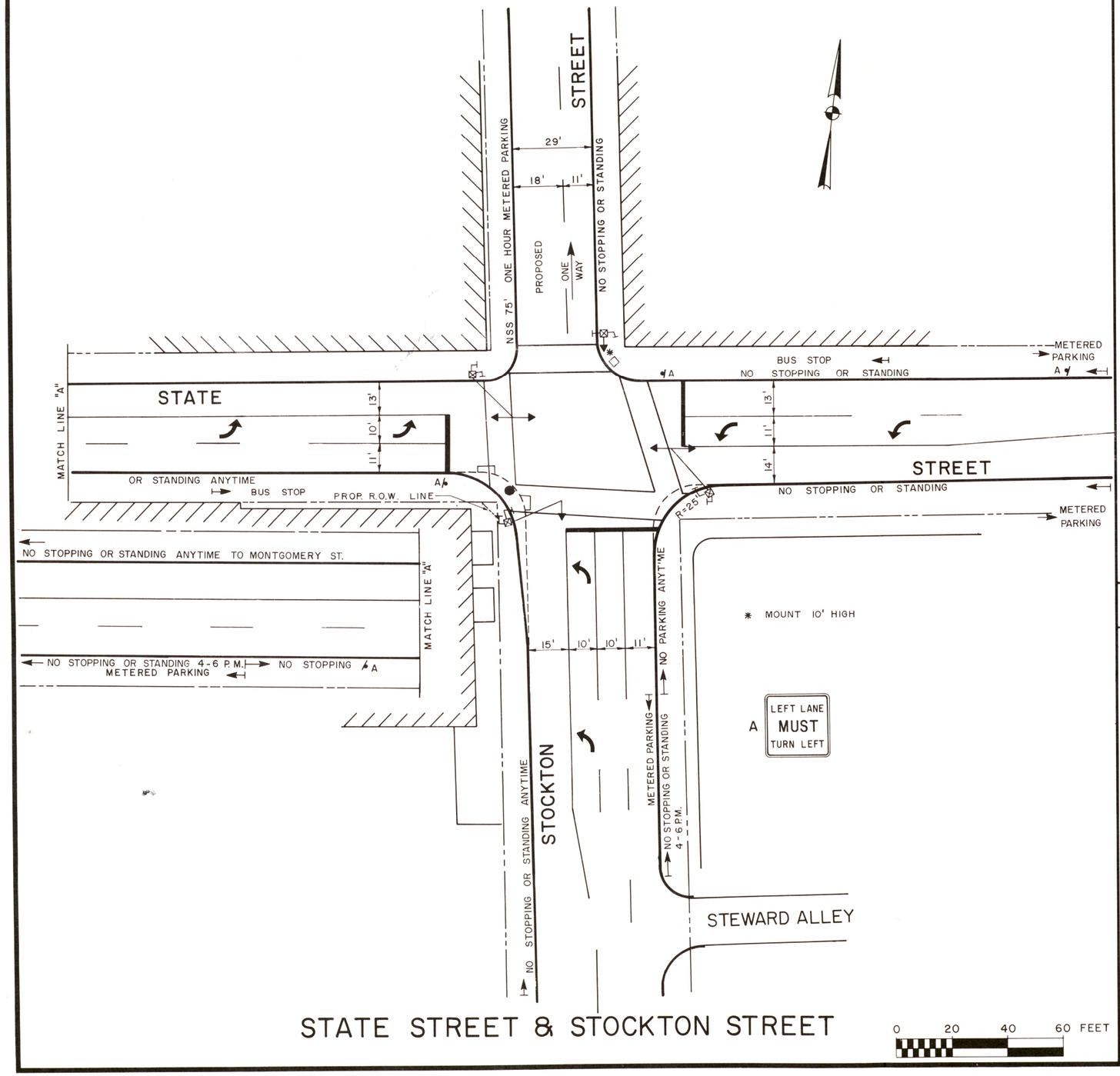
FIGURE V - 52

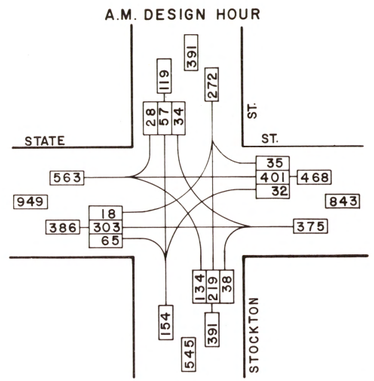
FIGURE V-53
STATE STREET AND STOCKTON STREET



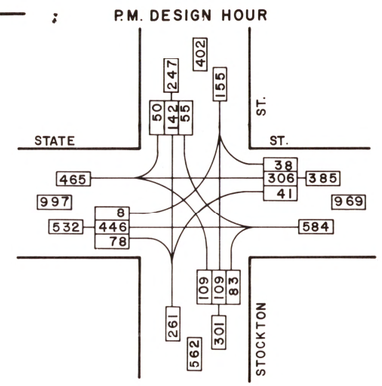
STATE STREET & STOCKTON STREET

DESIGN HOUR VOLUMES

A.M. DESIGN HOUR

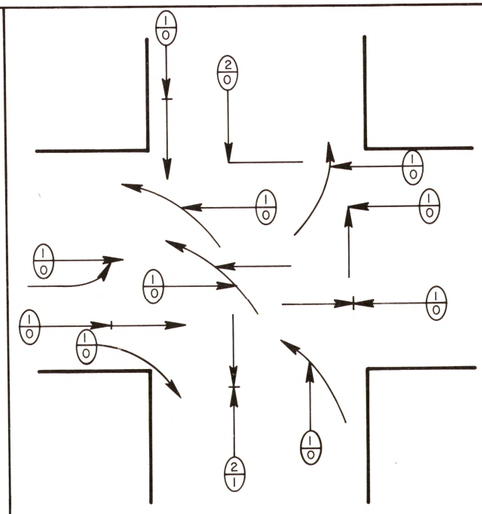


P.M. DESIGN HOUR



INTERSECTION ACCIDENT SUMMARY

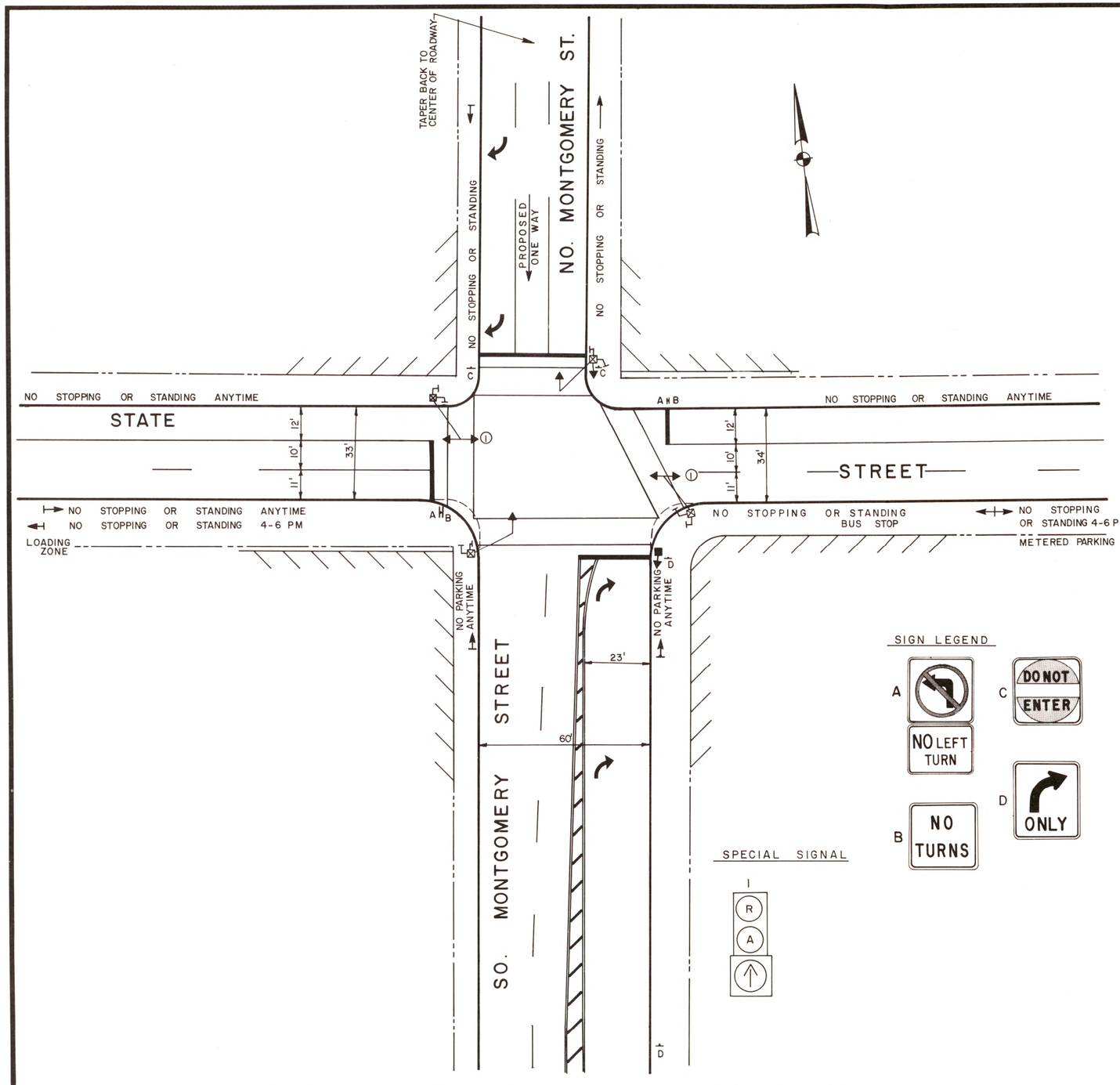
NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	14
ACCIDENT RATE PER TEN MILLION VEHICLES	17
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	1
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	43
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	9



PURCELL ASSOCIATES
ENGINEERS • ARCHITECTS • PLANNERS

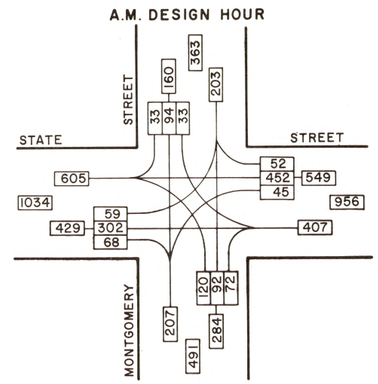
FIGURE V-53

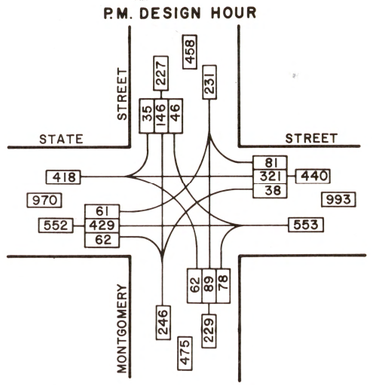
FIGURE V-54
STATE STREET AND MONTGOMERY STREET



STATE STREET & MONTGOMERY STREET

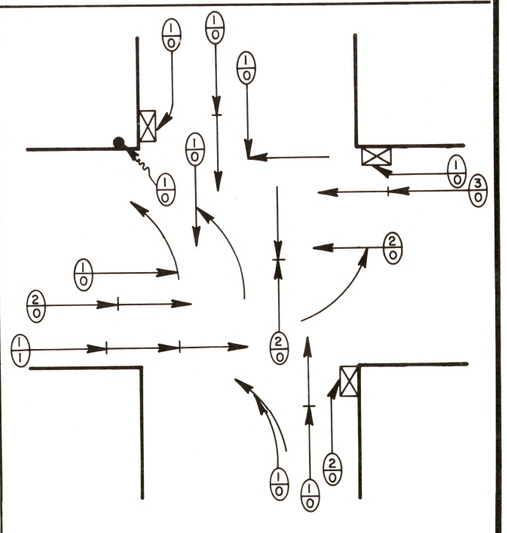
DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	21
ACCIDENT RATE PER TEN MILLION VEHICLES	28
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	1
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	51
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	15



PURCELL ASSOCIATES
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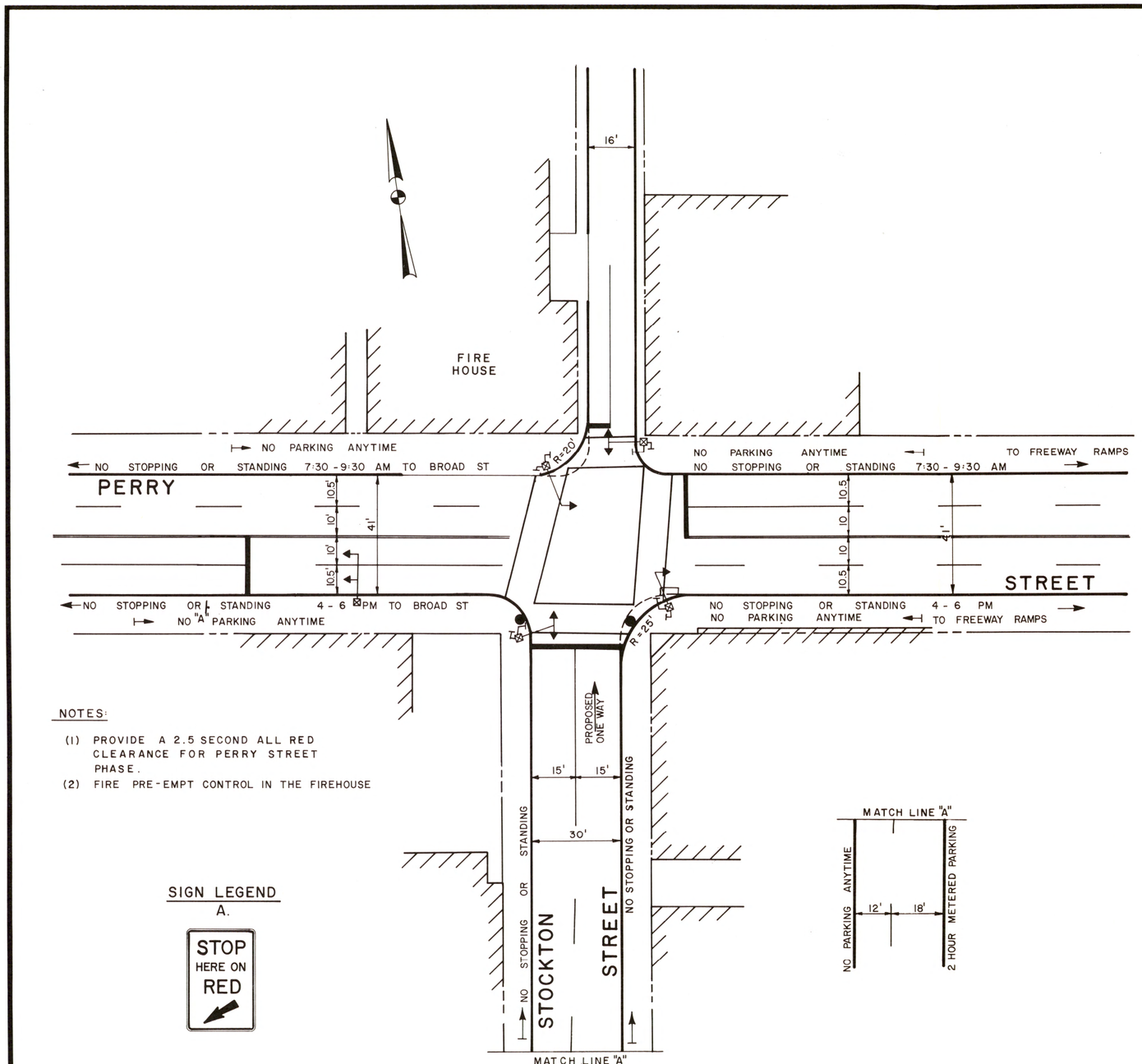
FIGURE V-54

FIGURE V-55
PERRY STREET AND STOCKTON STREET



NOTES:

(1) PROVIDE A 2.5 SECOND ALL RED CLEARANCE FOR PERRY STREET PHASE.
(2) FIRE PRE-EMPT CONTROL IN THE FIREHOUSE

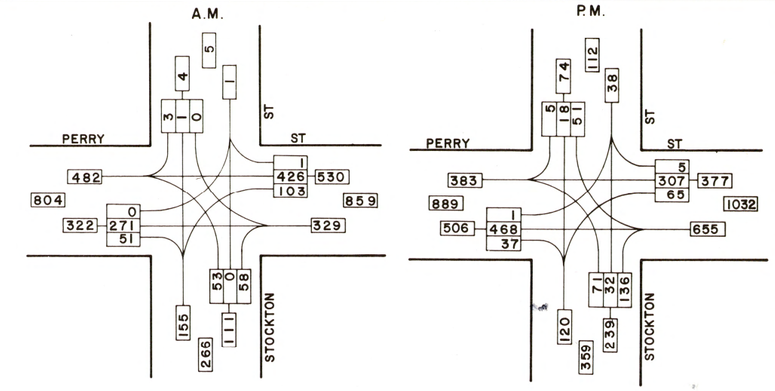
SIGN LEGEND

A.

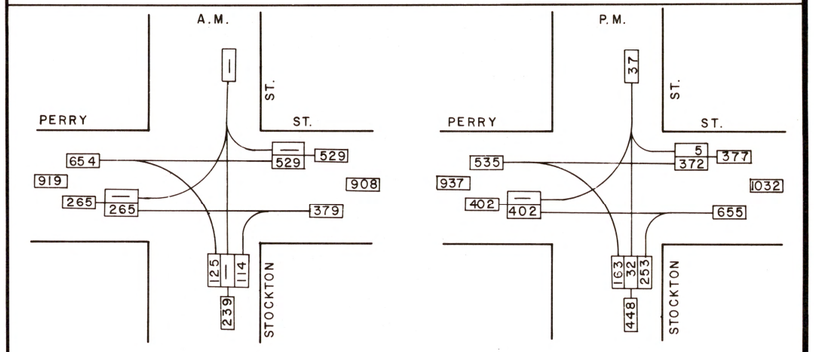
PERRY STREET & STOCKTON STREET

0 20 40 60 FEET

EXISTING VOLUMES

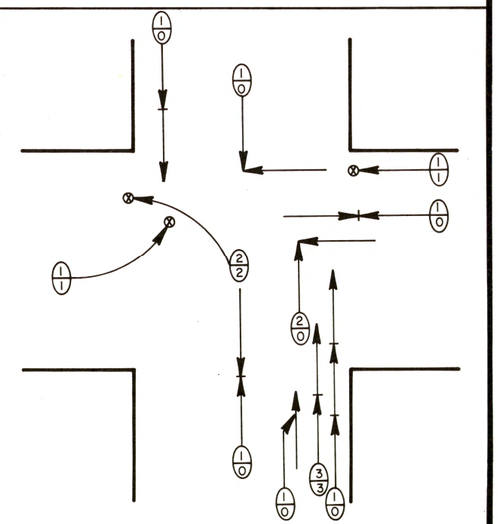


PROJECTED VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	15
ACCIDENT RATE PER TEN MILLION VEHICLES	24
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	7
INJURY RATE PER TEN MILLION VEHICLES	11
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	37
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	16



PURCELL ASSOCIATES
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FIGURE V-55

FIGURE V-56
PERRY STREET AND MONTGOMERY STREET

N. BROAD STREET AND PERRY STREET

Deficiencies

1. Safety--Westbound vehicles were involved in seven collisions, five of which occurred while maneuvering a difficult right turn. There were several left and right turning accidents from N. Broad Street.

2. Capacity--Perry Street westbound approach is at level of service "D."

3. Delay--Perry Street traffic experiences delays in both directions.

Existing Conditions

1. Right turning vehicles experience difficulty in maneuvering from Perry Street westbound due to small curb radius, angle of westbound approach, parking along westbound approach to corner, and bus stop on far right side of N. Broad Street.

2. Double parking and unloading of trucks occurs along N. Broad Street approach on both sides.

3. Congestion at adjacent Perry Street intersections blocks turns at this intersection.

4. Traffic signal equipment is below par.

Recommendations

1. Cut back curb at northeast corner to facilitate turns.

2. Install No Stopping or Standing on Perry Street during rush hours.

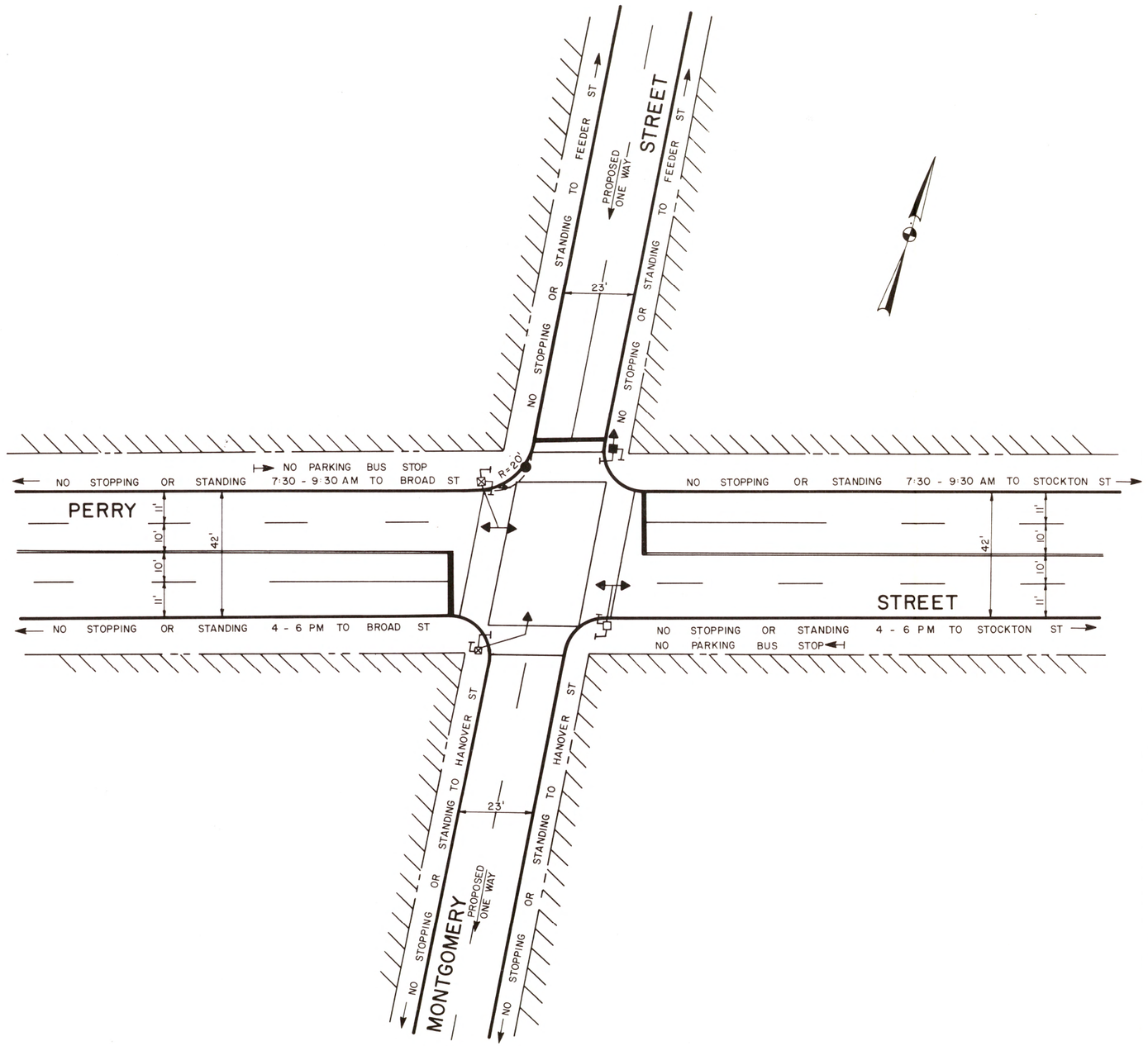
3. Designate exclusive right turn lanes on northbound and westbound approaches.

4. Modernize signal equipment for a safer intersection.

5. Optimize signal timing to increase capacity and decrease delay.

6. Enforce parking restrictions to prevent obstructions to traffic.

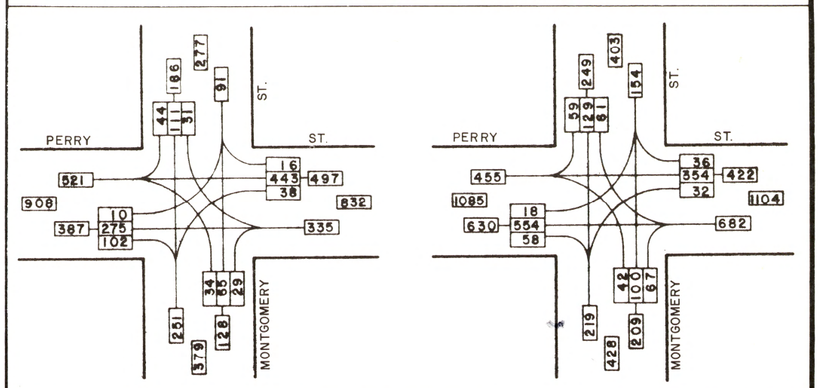
Right-of-Way: **Yes** **Cost:** $23,000



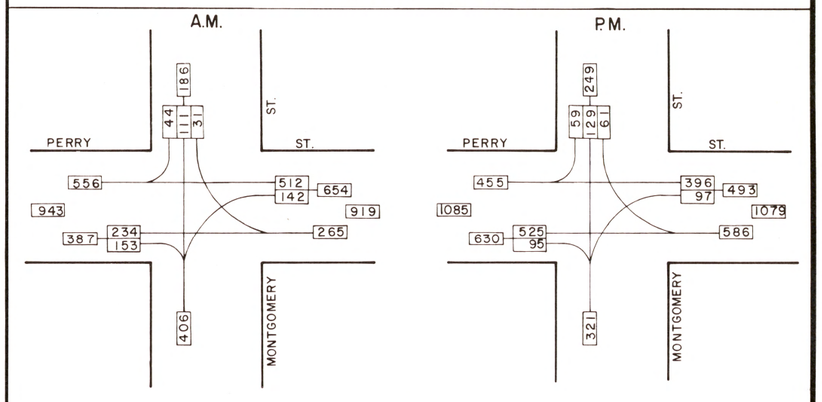
PERRY STREET & MONTGOMERY STREET

0 20 40 60 FEET

EXISTING VOLUMES

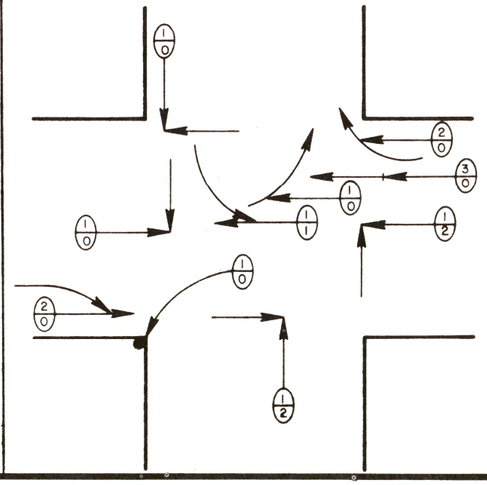


PROJECTED VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	14
ACCIDENT RATE PER TEN MILLION VEHICLES	19
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	7
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	65
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	33



PURCELL ASSOCIATES
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FIGURE V-56

FIGURE V-57
N. BROAD STREET AND PERRY STREET

BRUNSWICK AVENUE, N. BROAD STREET, PENNINGTON AVENUE, PRINCETON AVENUE AND WARREN STREET

Deficiencies

1. Safety--25 accidents occurred during the one-year study period.

2. Capacity--Princeton Avenue operates at level of service 'D' during the A.M. peak.

Existing Conditions

1. Princeton Avenue which is 38 feet wide and operates as a two-way street, becomes Warren Street as it crosses the intersection. Warren Street is one-way away from the intersection, functioning as part of a one-way couplet with N. Broad Street.

2. The Princeton-Warren Street route carries traffic from the Route 1-Brunswick Circle into the Central Business District and into the parking area for the State Buildings.

3. This intersection serves as a point of exchange for the N. Broad-Warren couplet.

4. Some confusion results from the alignment of Pennington Avenue with N. Broad Street where eastbound traffic cannot continue straight through and enters the intersection to face opposing traffic.

5. Traffic signals are obsolete.

6. East and southbound approaches are wide enough for two lane operation but function as single lane approaches due to unrestricted parking to the corners.

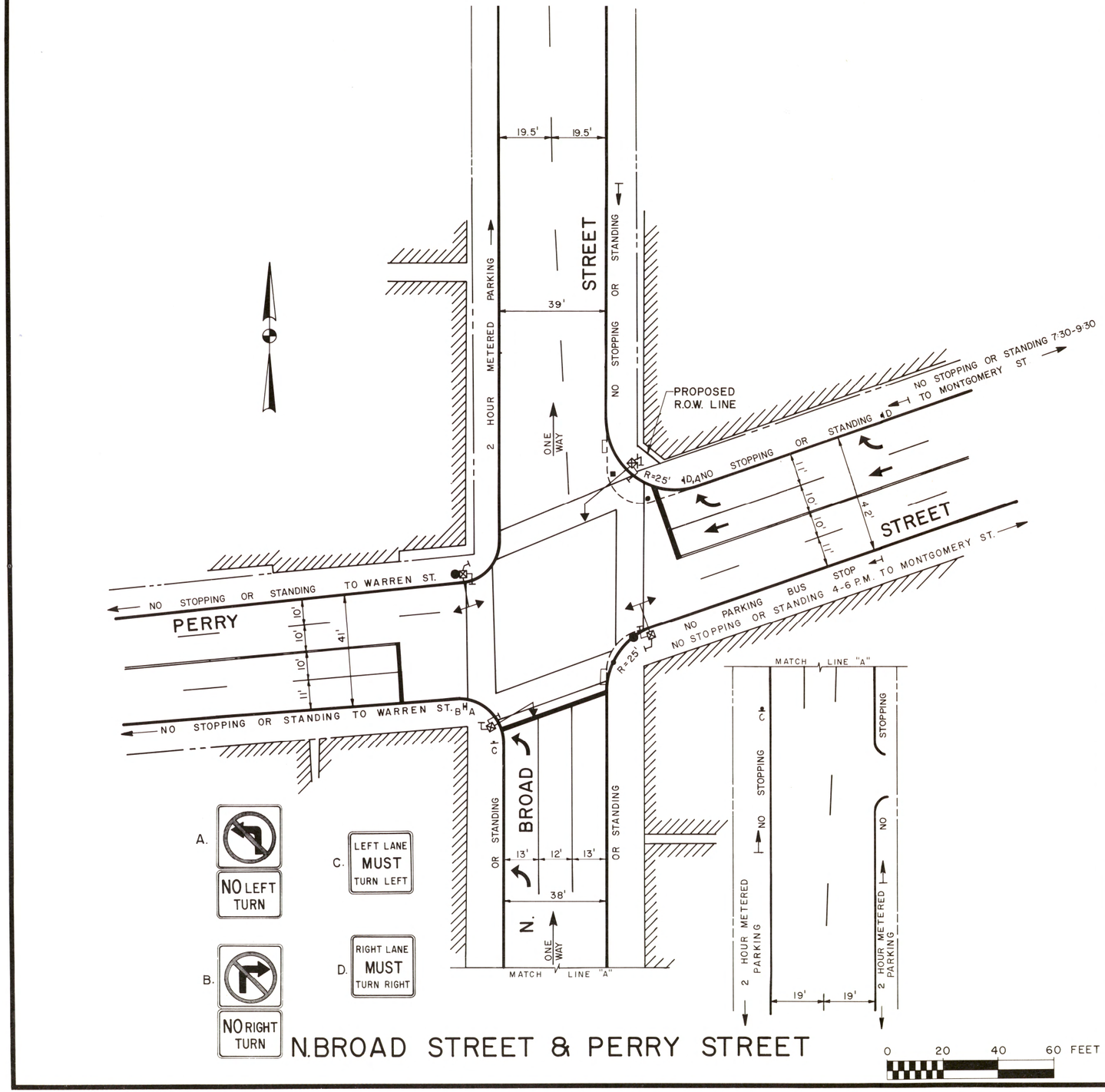
Recommendations

1. Channelize the westbound approach to permit a left turn lane. This will effectively accomodate U-turns. Also allow for separate right turn and straight through lanes on this approach. Channelization will eliminate confusion and give proper alignment to the eastbound and southbound approaches.

2. Ban stopping and standing along the approaches on southbound Princeton Avenue and eastbound Pennington Avenue giving traffic two lanes on each approach.

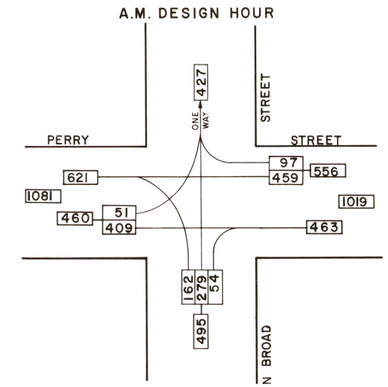
3. Equip the intersection with modern mast-arm traffic signals to improve visibility and increase safety. Implement these improvements in accordance with the accompanying plan.

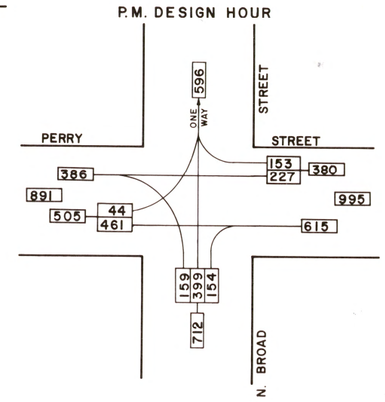
Right of Way: No **Cost:** $19,000



N. BROAD STREET & PERRY STREET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	13
ACCIDENT RATE PER TEN MILLION VEHICLES	18
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	2
INJURY RATE PER TEN MILLION VEHICLES	3
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	70
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	34

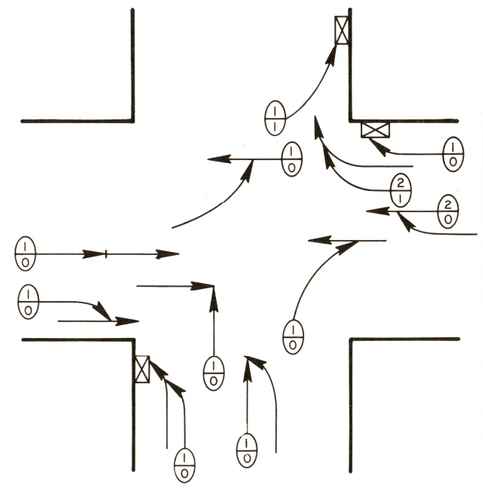


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FIGURE V-57

FIGURE V-58
BRUNSWICK AVENUE, N. BROAD STREET, WARREN STREET, PENNINGTON AVENUE AND PRINCETON AVENUE

FRONT STREET, STOCKTON STREET AND ARMORY DRIVE

Deficiencies

1. Safety--there have been a total of sixteen accidents in a one year period at the rate of twenty-three accidents per ten million vehicle occurrences. Six of these have been rear end collisions.

Existing Conditions

1. Stockton Street undergoes a change in alignment at this intersection.

2. The northbound through lane for Stockton Street is in conflict with the left turn lane for southbound Stockton Street.

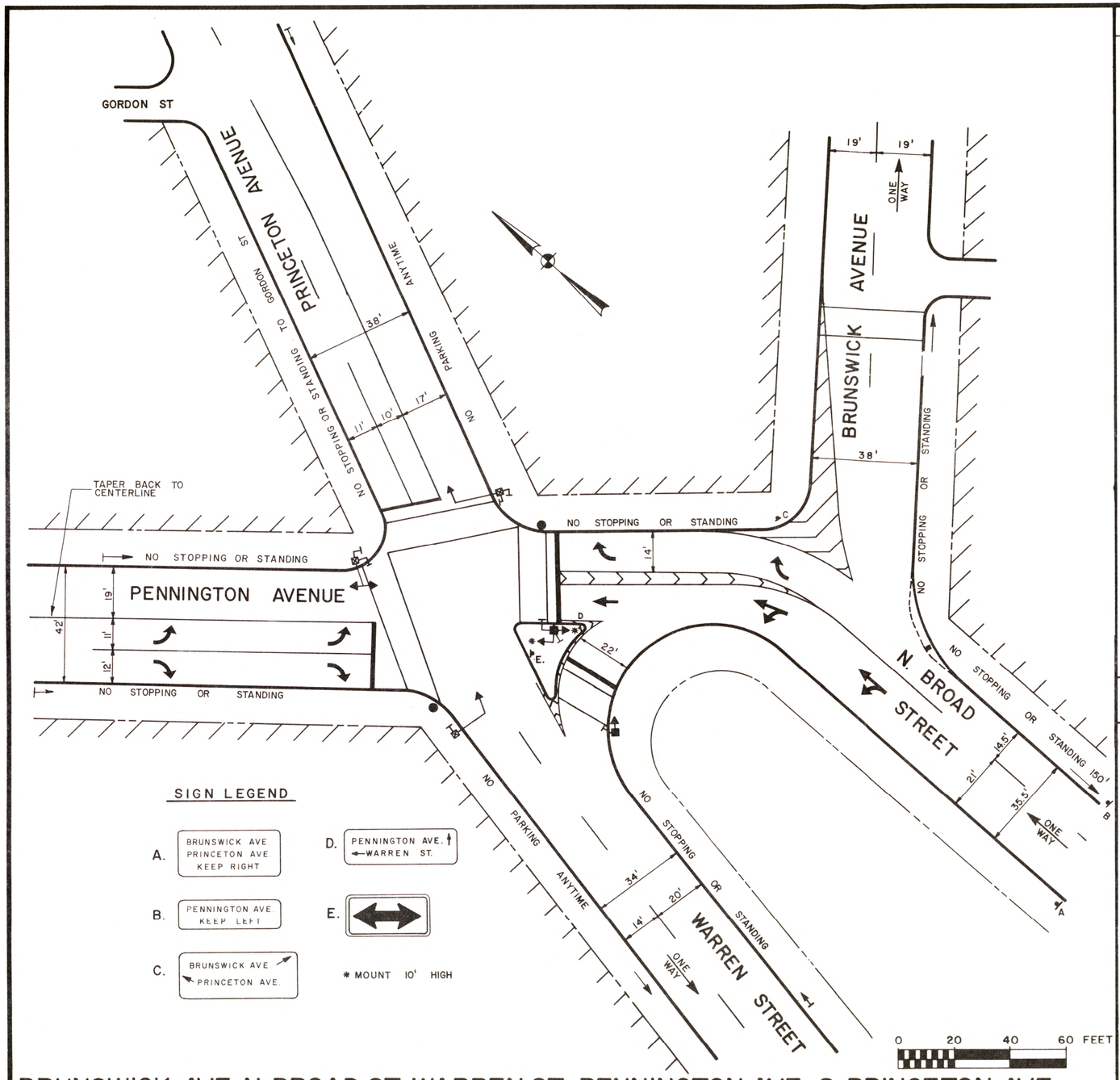
3. The signal equipment at this location is all post mounted providing poor visibility.

Recommendations

1. Make Armory Drive one-way eastbound from Stockton Street to State Street closing the exit ramp from U. S. Route 1.

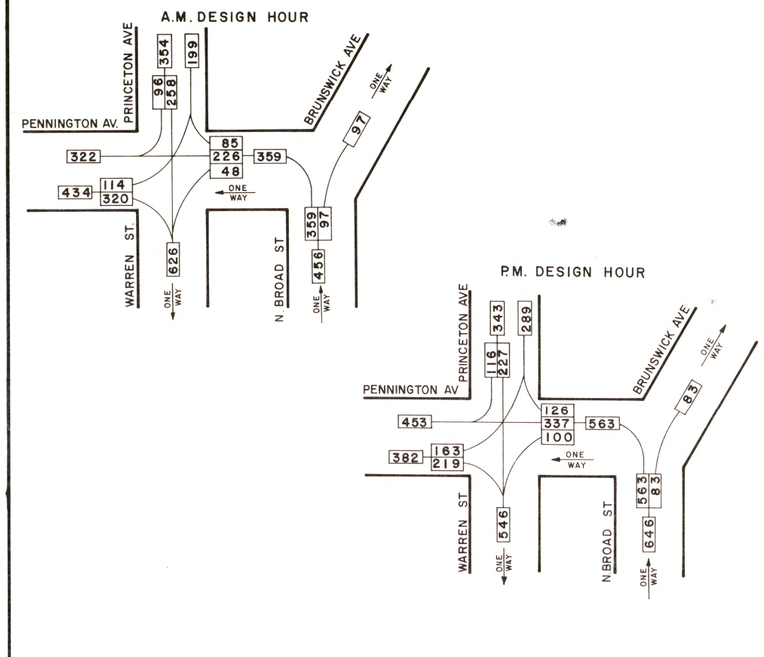
2. Modernize traffic signal equipment and install pavement markings, channelization, and parking regulations as shown on the accompanying plan.

Right-of-Way: No **Cost:** $23,000



BRUNSWICK AVE., N. BROAD ST., WARREN ST., PENNINGTON AVE., & PRINCETON AVE.

DESIGN HOUR VOLUMES



INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	26
ACCIDENT RATE PER TEN MILLION VEHICLES	39
NUMBER OF INJURIES SEPT. 1969 – AUGUST 1970	5
INJURY RATE PER TEN MILLION VEHICLES	8
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	36
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	7

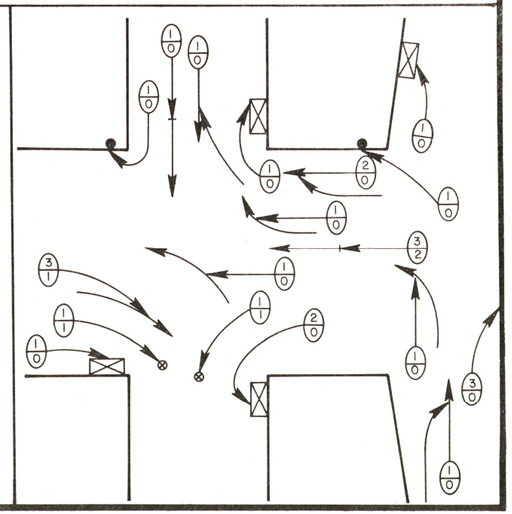


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FIGURE V-58

FIGURE V-59
FRONT STREET, STOCKTON STREET, AND ARMORY DRIVE

N. BROAD STREET AND STATE STREET

Deficiencies

1. Delay--State Street experiences delay and congestion at this intersection as well as at adjacent locations in the Central Business District.

Existing Conditions

1. State Street is marked for two approach lanes in each direction with the curb lane used as a bus stop. This requires thru traffic to bear to the left to go around the bus and then back to the right to avoid oncoming traffic in the other direction. The N. Broad Street approach has a taxi stand located on the right hand side.

Recommendations

1. Markings on State Street should provide for one approach lane and two discharge lanes in each direction with the bus stops farsided. With no turns permitted, the one approach lane will operate efficiently and the buses stopped on the far side of the intersection will create less interference than their present location.

2. The taxi stand should be moved further south on the N. Broad Street approach and No Stopping or Standing provided for at least 120 feet in advance of the intersection. This will provide an additional approach lane, improving the operation of N. Broad Street.

FIGURE V-59
FRONT STREET, STOCKTON STREET, AND ARMORY DRIVE

N. BROAD STREET AND STATE STREET

Deficiencies

1. Delay--State Street experiences delay and congestion at this intersection as well as at adjacent locations in the Central Business District.

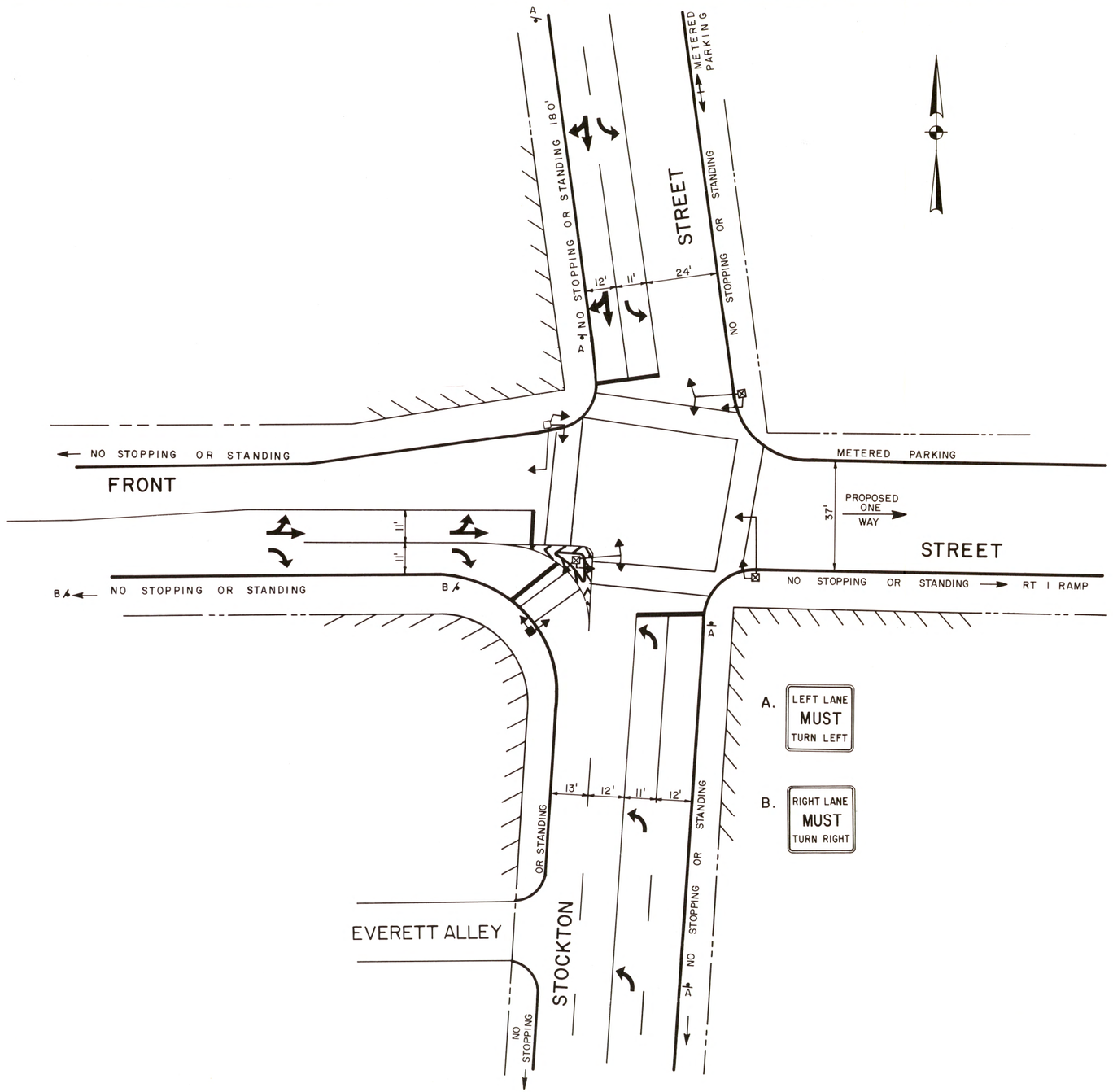
Existing Conditions

1. State Street is marked for two approach lanes in each direction with the curb lane used as a bus stop. This requires thru traffic to bear to the left to go around the bus and then back to the right to avoid oncoming traffic in the other direction. The N. Broad Street approach has a taxi stand located on the right hand side.

Recommendations

1. Markings on State Street should provide for one approach lane and two discharge lanes in each direction with the bus stops farsided. With no turns permitted, the one approach lane will operate efficiently and the buses stopped on the far side of the intersection will create less interference than their present location.

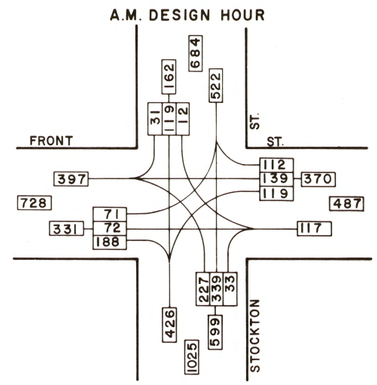
2. The taxi stand should be moved further south on the N. Broad Street approach and No Stopping or Standing provided for at least 120 feet in advance of the intersection. This will provide an additional approach lane, improving the operation of N. Broad Street.

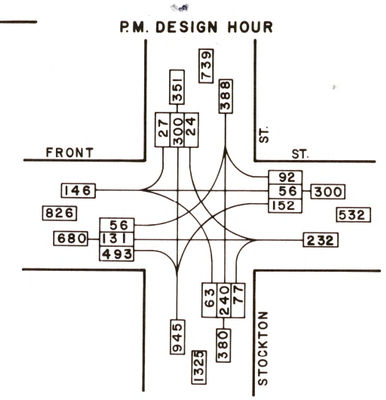


FRONT STREET, STOCKTON STREET, AND ARMORY DRIVE

0 20 40 60 FEET

DESIGN HOUR VOLUMES





INTERSECTION ACCIDENT SUMMARY

NUMBER OF ACCIDENTS SEPT. 1969 - AUGUST 1970	16
ACCIDENT RATE PER TEN MILLION VEHICLES	23
NUMBER OF INJURIES SEPT. 1969 - AUGUST 1970	1
INJURY RATE PER TEN MILLION VEHICLES	1
NUMBER OF ACCIDENTS 3 YR. PERIOD 1966 - 1968	26
NUMBER OF INJURIES 3 YR. PERIOD 1966 - 1968	7

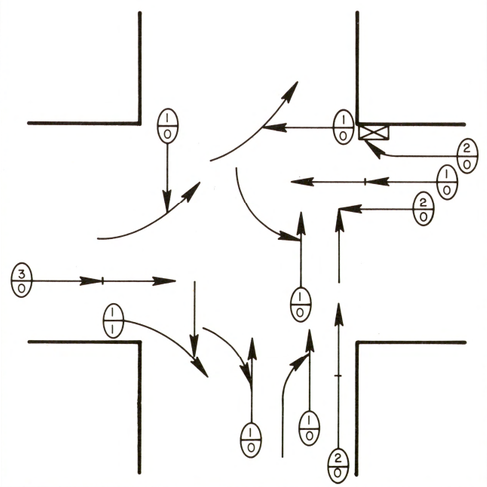


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FIGURE V - 59

WARREN STREET AND STATE STREET

Deficiencies

1. Safety--this location experienced the second highest number of accidents in a one year period: a total of thirty. Twelve of these were rear end collisions, four involved pedestrians, five were right angle collisions and five were side swipes. Eleven were injured in the past year at this intersection.

2. Capacity--State Street operates below level of service 'C' throughout a good portion of the day.

3. Delay--heavy delays are experienced by State Street traffic at this intersection as well as at other locations within the Central Business District.

Existing Conditions

1. The Warren Street-State Street intersection is similar in configuration to N. Broad and State Street. Warren Street is one-way southbound while Broad is one-way northbound The one major difference between the two intersections is the banning of all turns at N. Broad and State Street. At Warren and State Street, turns are permitted.

2. Parking along Warren Street and stopping along State Street cause congestion.

Recommendations

1. Ban all turns at this intersection. This will help to eliminate many conflicts and greatly reduce the accident experience. N. Broad Street and State Streets experienced eleven accidents in the same time period with comparable traffic volumes.

2. Prohibit parking on Warren Street between State Street and Hanover Street due to the narrowing of roadway width which occurs for this one block.

3. Provide three approach and discharge lanes for Warren Street with the appropriate parking restrictions.

Market Street

In the past year Market Street has been widened to approximately 90 feet between S. Broad Street and Warren Street. North of S. Broad Street, the roadway width changes drastically, providing insufficient capacity for motorists using this arterial between the State Complex to the south and Route 1 to the north. Therefore, it is recommended that Market Street for a between Jackson Street and Stockton Street be widened to an 80 foot right-of-way width.

This will require the demolition of buildings along the east side of Market Street for a distance of several blocks. The funding for this improvement should be done under the Urban Arterial Program. The buildings which would be demolished are currently considered substandard and such demolition might ultimately result in the improved use of land in this area.

Some changes will be required to the Trenton Freeway access circle to provide for the widening of Market Street. Congestion exists within the circle itself, and a complete study of this highway interchange is recommended.

THE SIGNAL PLAN

The signalization for the City of Trenton was executed by use of the SIGOP Computer Program. This program develops a signal plan for a system so as to minimize some specified combination of propensities for stops and delays. It can also be used to evaluate existing signal plans in a like manner.

The Specification of the System

For the purposes of the SIGOP application, the Trenton system was divided into two parts:

- A 15 signal network as specified in Table V-3
- A 36 signal network as specified in Table V-4

In the SIGOP application, each set of signals was considered as a *network* rather than as a group of *arterials* in doing the signal timing. Weights or importance factors were computed within the program on the basis of link volume and an externally specified coherence factor.

The output of the program includes, among other things, aggregated delay and stop propensities for specified groups of links. These groups were defined so as to correspond to the prime arterials within each network and to the side street links impinging on those arterials. The link groups for the two networks are defined in Tables V-5 and 6.

The system was divided into the two smaller networks because of the natural grouping of signals and not because of any limitation on the part of the program. Refer to Figure V-60.

Cases Considered

For each network, the following cases are considered:

- Evaluation of the *existing* 70 second single dial system in three time periods (AM peak, PM peak, off-peak) using volume data collected in conjunction with this study.

- Determination of optimum cycle length* and detailed timing for each of three time periods (AM peak, PM peak, off-peak) for a *proposed system* which includes certain recommended physical and operational improvements.

*A range of 60 to 100 seconds in steps of 5 seconds was considered.

TABLE V-3

SIGOP
15 Signal Network

Intersection Node Designation	Location
1	Parkside Avenue and Parkway Avenue
2	Parkway Avenue and Pennington Avenue
3	Parkway Avenue and Prospect Street
4	Ingham Avenue and Calhoun Street
6	Calhoun Street and Pennington Avenue
8	Calhoun Street and Bellevue Avenue
9	Calhoun Street and Spring Street
10	Calhoun Street and Passaic Street
11	Calhoun Street and Hanover Street
12	Calhoun Street and State Street
13	State Street and Prospect Street
14	State Street and West End Avenue
15	State Street, Delawareview Street and Murray Street
16	State Street and Hermitage Avenue
17	State Street and Parkside Avenue

TABLE V-4

SIGOP

36 Signal Network

Intersection Node Designation	Location
19	Brunswick Avenue and Spruce Street
20	Olden Avenue and Princeton Avenue
21	Olden Avenue and Brunswick Avenue
22	Olden Avenue and New York Avenue
23	Olden Avenue and Clinton Avenue
24	Olden Avenue and State Street
25	Olden Avenue and Greenwood Avenue
26	Olden Avenue and Hamilton Avenue
27	Olden Avenue and Liberty Street
29	Perry Street and Southard Street
30	Perry Street, N. Clinton Avenue and Lincoln Avenue
31	Lincoln Avenue, Chambers Street and State Street
32	Chambers Street and Greenwood Avenue
33	Chambers Street and Hamilton Avenue
34	Chambers Street and Roebling Avenue
35	Chambers Street and Liberty Street
36	Chambers Street and Cedar Lane
37	Greenwood Avenue and Monmouth Street
39	State Street and Clinton Avenue
40	Wall Street, Chestnut Avenue and State Street
41	Greenwood Avenue and Chestnut Street
42	Hamilton Avenue and Chestnut Street
43	Roebling Avenue and Chestnut Street
44	Clinton Avenue and Fairview Avenue
45	Clinton Avenue and Hamilton Avenue
46	Clinton Avenue and Hudson Street
47	Clinton Avenue and Beatty Street
48	Clinton Avenue and Chestnut Street
49	Clinton Avenue and Liberty Street
50	S. Broad Street and Market Street
51	S. Broad Street, Greenwood Avenue and Centre Street
52	S. Broad Street and Hamilton Avenue
53	S. Broad Street and Hudson Street
54	S. Broad Street and Beatty Street
55	S. Broad Street and Liberty Street
56	S. Broad Street and Dayton Street
57	S. Broad Street and Lakeside Avenue

TABLE V-5

LINK GROUPS FOR 15 SIGNAL NETWORK

Group	Intersections	Significance
1	1, 2, 3, 4,	Arterial 1 - Parkway Ave.
4	1, 2, 3, 4,	Side-street links onto Parkway Ave.
2	4, 6, 8, 9, 10, 11, 12	Arterial 2 - Calhoun St.
5	4, 6, 8, 9, 10, 11, 12	Side street links into Arterial 2
3	12, 13, 14, 15, 16, 17	Arterial 3 - W. State St.
6	12, 13, 14, 15, 16, 17	Side street links into Arterial 3

TABLE V-6

LINK GROUPS FOR 36 SIGNAL NETWORK

Group	Intersections	Significance
1	20, 21, 22, 23, 24, 25, 26, 27	Arterial 1 + Cross St. links - Olden Ave.
2	23, 30, 39, 44	Arterial 2 + Cross St. links - N. Clinton Ave.
3	49, 48, 47, 46, 45	Arterial 3 + Cross St. links - S. Clinton Ave.
4	24, 61, 40, 39	Arterial 4 + Cross St. links - E. State St.
5	25, 61, 32, 37, 41	Arterial 5 + Cross St. links - Greenwood Ave.
6	26, 33, 42, 45, 52	Arterial 6 + Cross St. links - Hamilton Ave.
7	29, 30, 31, 32, 33, 34, 35, 36	Arterial 7 + Cross St. links - Chambers St.
8	50, 51, 52, 53, 54, 55, 56	Arterial 8 + Cross St. links - S. Broad St.

- Determination of optimum cycle length* and detailed timing for the *existing* single dial system, and an estimation of the impact that the inflexibility of a single dial system has on the two time periods for which it is not explicitly set.**

Design for the peak period of the hours under consideration was executed. Peak hour factors were specified for each intersection individually.

Inputs

The program requires input information on the

- volume by movement
- composition and equivalence factors for trucks and turns
- breakdown of primary and secondary (turn-in) flow
- platoon coherence and midblock effect
- speed
- number of effective approach and departure lanes
- characteristic arrival and departure headways for each link

Some of these values may be specified for the entire system (MACRO), rather than on a link by link basis.

The program also requires a specification of the minimum red times (pedestrian crossings), the use of critical or total flow in split determination, and the costs (or balance) assigned to stops and delay. Critical flow (per lane) is used in the Trenton analysis. Based on previous SIGOP work and on cost assignment generally, stops were assigned a cost of $1.50/100 stops and delay was assigned a cost of $1.60/vehicle-hour of delay.

Useful Features

In addition to the final timing plan, the program outputs a number of extremely useful intermediate results. These results were quite useful in locating and reviewing trouble spots in the system. These trouble spots were then reviewed to develop traffic engineering improvements to alleviate the critical problem. The progression was then re-run.

*A range of 60 to 100 seconds in steps of 5 seconds was considered.

**The critical nature of traffic movement in one time period generally dictates timing for that period for each link.

FIGURE V-60
SIGNAL OPTIMIZATION NETWORK

The following are the prime features of value in the identification and review process:

-- An enumeration of the percent of the hour needed for green *at each intersection for each time period*

Should this percentage approach 100%, it is obvious the intersection will not function well. Should some be in the order of 80%, but others be in the order of 40%, and there be some physical grouping of the two sets, the potential and need for two distinct systems is raised.

-- An enumeration of the specific *phases* at each intersection which will exceed capacity for specified cycle length(s) and loads.

Such failures point to the need for greater cycle lengths than those indicated (in some cases) or to the need for traffic engineering improvements. Based on the particular movements in the phase, these improvements may be turning restrictions (reducing conflicts), parking modifications (increasing departure lanes), or geometric improvements. The program in no way indicates a solution, but does effectively point the engineer to the problem.

-- An enumeration of the flows *from* various contiguous intersections *to* each intersection, along with discharge ability.

This is useful for error-checking.

-- An enumeration of optimum offsets and realizable offsets for each link.

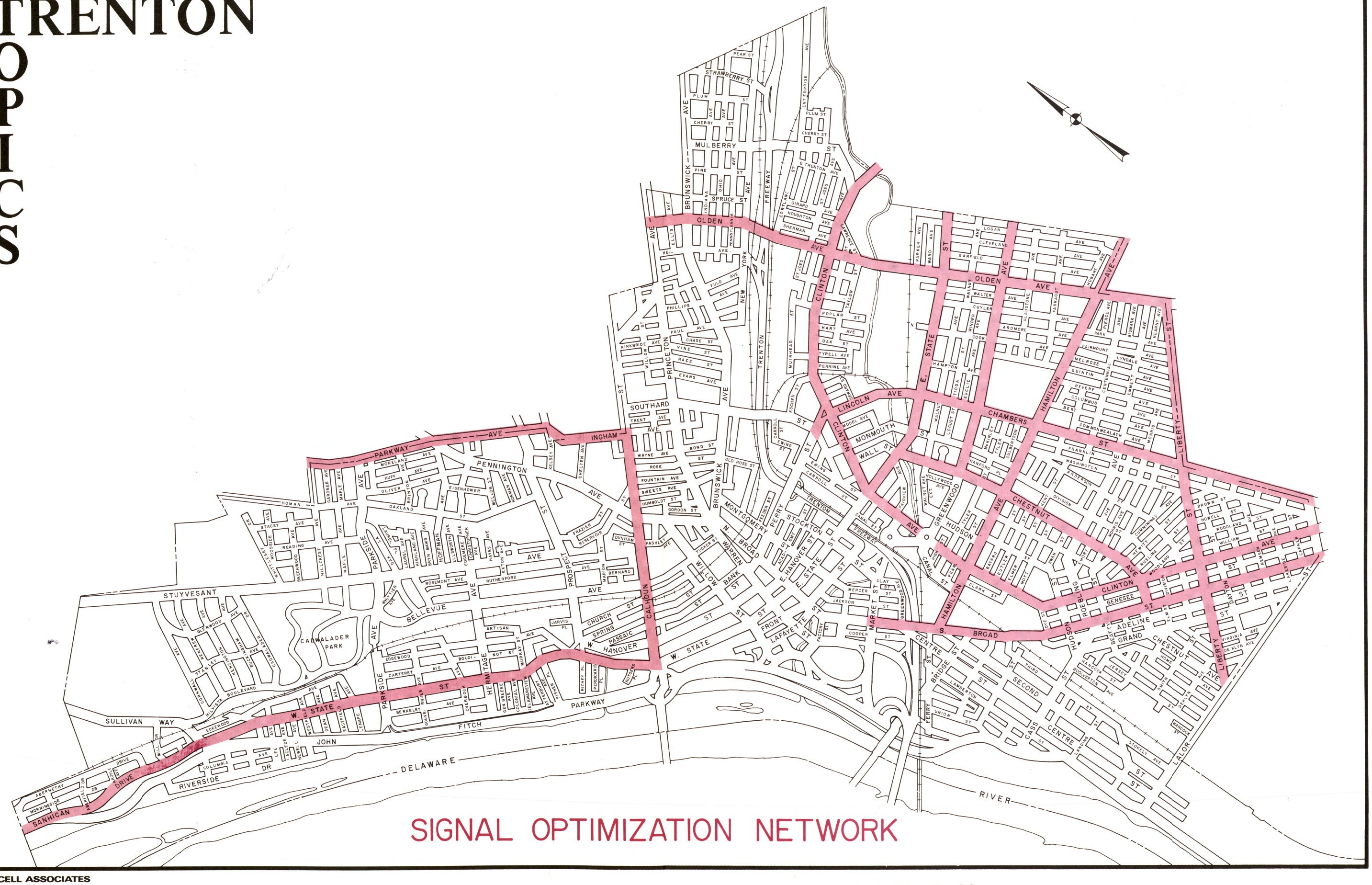
This allows an insight into the compromises necessitated in the arterial or network closure.

Final Output Form

Among other things, the program indicates stops, delays, residual queues, and costs for each defined link group and the total system. These results, in conjunction with indication of cycle length suitability (by lack of significant phase capacity problems, see above), enable the engineer to select a most appropriate (optimum) cycle length. For each cycle length considered, an optimum detailed plan *for that cycle length* is generated, so that the optimum detailed plan is readily available.

The information available to the engineer for the selected (or any candidate) cycle length is:

TRENTON TOPICS



SIGNAL OPTIMIZATION NETWORK

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FIGURE V-60

-- A detailed timing plan for each intersection specifying the start of each indication and of the offset point in *percent of cycle* so that field work may be done directly from the output sheets.

The output sheets also include a reference check for the field man so that he can verify visually that the signal is correctly timed relative to its neighbor.

-- Estimates of the propensities for delays and stops and of residual queues (vehciles that clear after one cycle) at each intersection.

The specific results for the two networks defined in the Trenton system are contained in the next two sections.

Results: 15 Signal Network

Table 7 lists the Optimization Time Period (OTP) codes assigned for the nine cases considered. OTP3, for example, is the existing system, AM peak.

All data (delay, stops, etc.) shown in both this section and the one following are *hourly* figures based on the *peak* rate.

For each link, for defined link groups, and for the total system, statistics were generated on

- -- propensity for delay
- -- propensity for stops
- -- costs based on stops and delay
- -- overflow* vehicles, delay, and stops

Based on an analysis of these statistics and on a reivew of problem locations within the system (RATIO too high, phase failures, link failures), recommended cycle lengths were selected with optimized timings. This analysis followed a first inspection which motivated a set of traffic engineering improvements**, and is based upon the revised, improved situation.

Table 8 summarizes the recommended cycle lengths by OTP with the appropriate statistics also summarized. Based on overflow statistics and upon individual intersections, the system "optimum cost" was not always chosen. As indicated in the column "VARIATION FROM OPT COST," this variation is generally not significant.

Table 8 also contains estimates of the improvement over the existing (base system which is realized with the "optimized existing" and "proposed" systems. For the "optimized existing," figures are shown assuming that the specific period (AM, PM, OFF-PEAK) is the *one* to be optimized on the single-dial system existing. *All* these improvements would be realized with the recommended three-dial system installed, but without the recommended operational improvements. *With* the operational improvements *and* the three-dial system, the most significant improvements will be realized.

For the "optimized existing" alternate, it is recommended that the AM settings (OTP 13) be implemented.

* *The vehicles which are not processed in the first available green; the sum of the residual queues.*

** *The OTP's 6, 7, and 8, the proposed improved system.*

TABLE V-7

DEFINITION OF OTP'S CONSIDERED

Condition	Period	OTP Code #
Existing	AM	3
	PM	4
	Off-peak	5
Optimized Existing	AM	13
	PM	14
	Off-peak	15
Proposed	AM	6
	PM	7
	Off-peak	8

TABLE V-8

RECOMMENDED CYCLE LENGTH BY OTP AND STATISTICS (15 SIGNAL NETWORK)

OTP		Recommended Cycle Length	Detailed Timing See Table	Delay (HR/OTP)	Stops (STOPS/OTP)	Cost ($/OTP)	OVERFLOW Vehicles	OVERFLOW Delay (HR/OTP)	OVERFLOW Stops (STOP/OTP)	Variation From Optimum Cost	IMPROVEMENT OVER BASE AM	IMPROVEMENT OVER BASE PM	IMPROVEMENT OVER BASE OFF-PEAK
EXISTING	3	*	*	43	9,400	210	127	1	145	-	BASE		
	4	*	*	53	11,357	255	228	1	275	-		BASE	
	5	*	*	32	6,507	84	5	0	5	-			BASE
OPT. EXISTING	13	65	TECH. MEM.	27	7,392	155	46	0	46	0.65%	26%		
	14	65	TECH. MEM.	45	11,205	239	316	2	383	0%		6.3%	
	15	65	TECH. MEM.	16	4,099	46	41	0	40	4.5%			45%
PROPOSED	6	70	TECH. MEM.	23	5,532	120	29	0	30	0%	43%		
	7	70	TECH. MEM.	38	8,992	195	0	0	0	0%		23%	
	8	70	TECH. MEM.	38	3,169	37	0	0	0	0%			56%

* *Existing 70 Second System*

NOTES:

1. *Existing system is base.*
2. *Rates shown based on per hour figures for OTP.*
3. *Costs for OFF-PEAK not comparable to peaks:*

	PEAK	OFF-PEAK
Delay	$1.60/Hr.	$1.60/Hr.
Stops	$1.50/100	$0.50/100

4. *Hours of delay rounded to nearest hour.*

Information relating to the detailed timing plans for the "optimized existing" and "proposed" conditions are presented in the Appendix. For convenience in pin setting, these timings are given in fractions of a cycle rather than seconds. Multiple "offset" and "split" listings for a given phase are redundant and may be ignored. Offsers are indicated for all phases, but - as usual - only the Phase 1 offset is of importance in setting the signal.
as usual - only the Phase 1 offset is of importance in setting the signal.

The detailed timing plans contain information for convenient visual checks of the field settings. The "upstream release" is the time* between the *upstream* green indication and the *downstream* green indication (the subject intersection). Note that the

-- *upstream* green indication is that green seen from the "upstream release intersection," the intersection contributing the main flow which moves *to* the downstream intersection *thru* the upstream intersection.

-- *downstream* green indication is that green seen from the "upstream intersection."

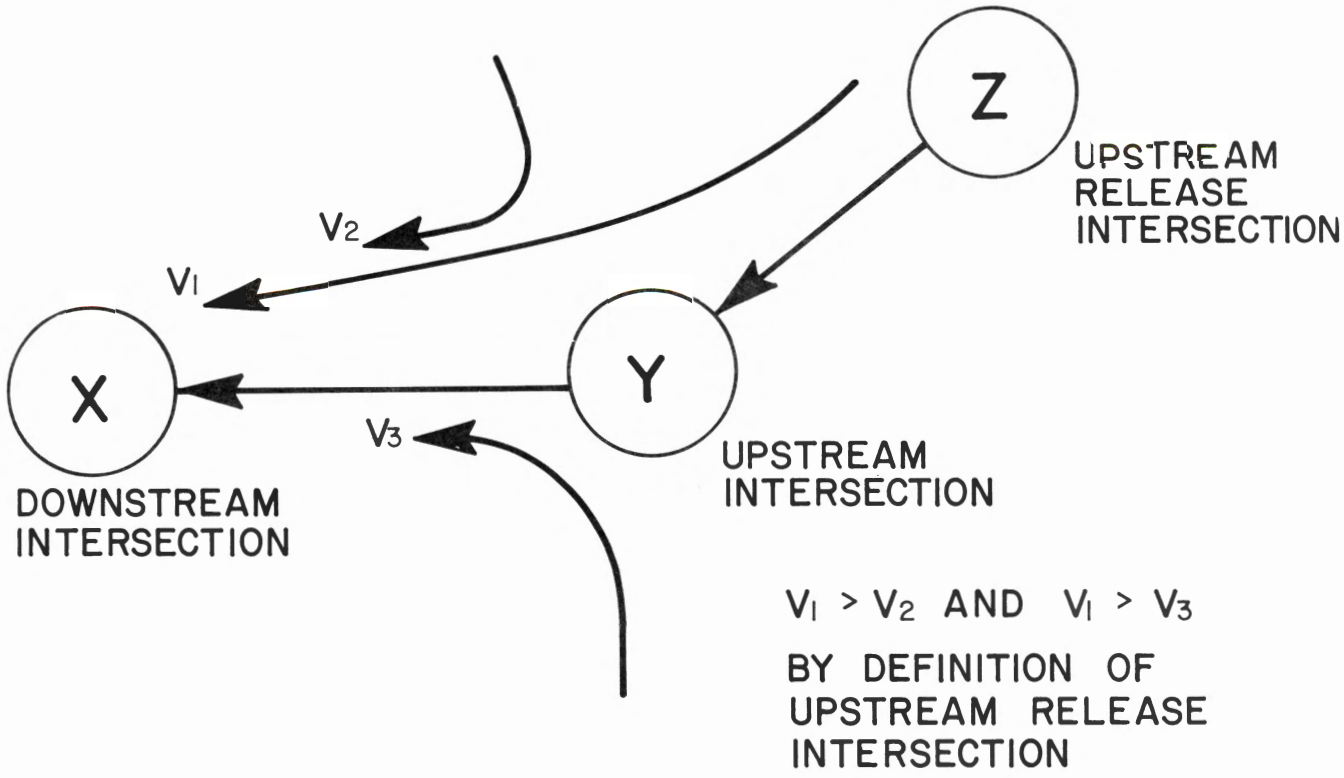
This is illustrated in Figure V-61. On an arterial, both indications can generally be seen from the "upstream release intersection" and can be simply timed with a stopwatch.

Results: 36 Signal Network

The type of results presented herein for the 36 signal network closely parallel those presented for the 15 signal network. The longer network gave rise to more operational problems that required the SIGOP analysis for pin-pointing. Than did the smaller network.

Table 9 summarizes the recommended cycle lengths by OTP with the appropriate statistics also summarized. This table also contains the estimates of the improvement over the existing (base) system which is realized with the "optimized existing" and "proposed" systems. For the "optimized existing," figures are again shown assuming that the specific period (AM, PM, OFF-PEAK) is the *one* to be optimized on the single-dial system existing.

* *In these tables, the percentage.*



CHECKING OFFSETS BY VISUAL MEANS

FIGURE V-61

TABLE V-9

RECOMMENDED CYCLE LENGTH BY OTP AND STATISTICS (" SIGNAL NETWORK)

OTP		Recommended Cycle Length	Detailed Timing See Table	Delay (HR/OTP)	Stops (STOPS/OTP)	Cost ($/OTP)	OVERFLOW Vehicles	OVERFLOW Delay (HR/OTP)	OVERFLOW Stops (STOP/OTP)	Variation From Optimum Cost	IMPROVEMENT OVER BASE AM	IMPROVEMENT OVER BASE PM	IMPROVEMENT OVER BASE OFF-PEAK
EXISTING	3	*	*	159	31,930	734	765	7	1,082	-	BASE		
	4	*	*	202	40,713	933	885	7	1,013	-		BASE	
	5	*	*	126	25,859	330	10	0	10	-			BASE
OPT. EXISTING	13	70	TECH. MEM.	142	31,456	699	652	4	791	2.4%	7.1%		
	14	75	TECH. MEM.	209	40,802	946	547	3	614	4.1%		1.4%**	
	15	65	TECH. MEM.	106	24,204	290	0	0	0	2.1%			12.1%
PROPOSED	6	80	TECH. MEM.	149	27,718	653	239	2	266	3.3%	11.0%		
	7	80	TECH. MEM.	205	35,890	866	262	2	275	1.1%		7.2%	
	8	65	TECH. MEM.	103	23,542	282	0	0	0	3.7%			14.5%

* *Existing 70 Second System*

***Cycle length selected so as to reduce overflow severity at the expense of some increase (1.4%) in total cost.*

NOTES:

1. *Existing system is base.*
2. *Rates shown based on per hour figures for OTP.*
3. *Costs for OFF-PEAK not comparable to peaks:*

	PEAK	OFF-PEAK
Delay	$1.60/Hr.	$1.60/Hr
Stops	$1.50/100	$0.50/100

4. *Hours of delay rounded to nearest hour.*

CHAPTER VI

PRIORITIES AND COST ESTIMATES

Priorities are based upon the severity of the problem, cost of the improvement, right- of-way problems which may occur, and system considerations, (ie., if several intersections along a major arterial are being improved in a particular year, we try to implement all the recommendations on that arterial).

Recommendations for the first year were selected primarily for the ease of implementation, then based upon severity of existing problems.

All estimated costs exclude right-of-way acquisition.

YEAR 1

S. Broad Street, Centre Street, and Greenwood Avenue	$ 23,500
Hamilton Avenue, S. Broad Street and Second Street	19,000
S. Broad Street and Bridge Street	21,500
State Street and Parkside Avenue	4,000
Warren Street, N. Broad Street, Princeton Avenue and Pennington Avenue	19,000
Princeton Avenue and Southard Street	23,000
Bellevue Avenue and Prospect Street	20,000
Front Street, Stockton Street and Armory Drive	23,000
Olden Avenue and State Street	33,000
Hamilton Avenue and Clinton Avenue	23,000
Perry Street and Montgomery Street	18,000
Perry Street and Stockton Street	24,500
Perry Street and N. Broad Street	23,500
State Street, Chambers Street and Lincoln Avenue	22,000
Bridge Street and Centre Street	21,500
Sullivan Way and Hilvista Boulevard	4,000
Pennington Avenue - Resevoir Street	1,500
Total	$324,500

All miscellaneous recommendations which are of negligible cost should be implemented in Year 1.

YEAR 2

Convert S. Broad Street and Clinton Avenue to one-way operation:

S. Broad Street and Dye Street	$ 2,000
S. Broad Street and Hudson Street	22,000
S. Broad Street, Beatty and Cass Street	20,000
S. Broad Street and Liberty Street	19,500
S. Broad Street and Dayton Street	26,000
Clinton Avenue and Dye Street	4,500
Clinton Avenue and Liberty Street	20,000
	$114,000
Signs and Markings	6,000
	$120,000

Traffic signal modernizations in CBD in conjunction with Commons project	$100,000
Olden Avenue and Brunswick Avenue	28,500
Olden Avenue and Clinton Avenue	33,000
Olden Avenue and Greenwood Avenue	29,000
Olden Avenue and Hamilton Avenue	24,500
Olden Avenue and New York Avenue	8,000
	$343,000

YEAR 3

Calhoun Street

Repave from Bellevue Avenue to Hanover Street	$100,000
Calhoun Street and Ingham Avenue	31,000
Calhoun Street and Pennington Avenue	28,000
Calhoun Street and Passaic Street	21,000
Calhoun Street and Hanover Street	28,500
State Street and Stockton Street*	23,000
State Street and Montgomery Street*	21,000
Sanhican Drive and Sullivan Way	8,000
Pennington Avenue and Prospect Street	8,000
Chambers Street and Greenwood Avenue	20,000
Chambers Street and Hamilton Avenue	33,500
Total	$322,500

**Implementation of this recommendation may vary depending upon final CBD plan.*

YEAR 4

Thermoplastic Long Line Contract		$ 50,000
Chambers Street and Roebling Street		22,000
Chambers Street and Liberty Street		22,500
Bellevue Avenue and Hermitage Street		22,000
Thermoplastic Short Line Contract		60,000
Widen Calhoun Street from Bellevue Avenue to Pashley Avenue		135,000
Calhoun Street and Bellevue Avenue		22,000
	Total	$333,500

YEAR 5

Repave Calhoun Street, Pennington Avenue to Ingham Avenue		$120,000
Cass Street and Second Street		23,000
Cass Street and Centre Street		23,000
State Street and Hermitage Street		25,000
Begin Implementation of Computer Control System		150,000
	Total	$341,000

CHAPTER VII

MAINTENANCE AND EVALUATION

ORGANIZATION OF CITY TRAFFIC DIVISION

In order to properly maintain and monitor the recommendation program resulting from this report, it is necessary for the City of Trenton to provide a long range program of administrative, operational, and functional activities within which a traffic division can grow while providing optimum service. During the course of this Study, the position of Director of Traffic and Transportation was established within the City of Trenton. It will be the responsibility of this individual to not only provide the proper maintenance and operational improvements necessary on a day-to-day basis, but to handle the City's long range transportation planning needs as well.

Under the supervision of the Director, there should be two distinct bureaus. One with the responsibility of day-to-day traffic operations and the other for transportation planning. Some of the responsibilities of the Bureau of Traffic Operations should include:

1. Installation and Maintenance of parking meters, traffic signals, signs and markings.

2. Engineering studies such as speed and delay, volumes, parking trends and accident analysis.

3. Engineering design of intersections, traffic signals, sign placement and pavement markings.

4. Locate street lighting.

The Planning Bureau should be responsible for:

1. City-wide and regional planning.

2. Route location and transit studies.

3. Coordinating detours.

4. Programming improvement projects.

5. Coordinating work with other City agencies, consultants, New Jersey Department of Transportation and Federal agencies.

6. Planning and operation of a City-wide traffic signal system, communication and surveillance center.

At the present time the majority of personnel working within the Traffic and Transportation Division are assigned to the Bureau of Traffic Operations. However, even in this Bureau several additional personnel are required in key positions. The Bureau of Transportation Planning, on the other hand, is relatively new and manpower needs will grow as this Bureau expands its work to include the functions described above.

In order to establish and maintain a first rate organization, salary scales must be made compatible to positions elsewhere in communities of the same size or larger. Police and traffic division personnel must work together to insure proper enforcement at those locations where safety and operational deficiencies are due to violations of existing ordinances.

EVALUATION PROGRAM

In order to gauge the success of the TOPICS Program, it will be necessary to evaluate the benefits which the recommendations in Chapter V may bring. This Chapter will discuss the various methods which can be used to determine how well a specific recommendation or group of recommendations has served to eliminate the deficiencies for which it was intended.

Accident Deficiencies

A before-and-after study of high accident locations should be conducted to measure the effectiveness of various improvements. In a study of this nature, it is important to determine whether the reduction in the number of accidents is due to something other than chance. A common statistical procedure used to evaluate this is the Chi-square test. Based upon the Chi-square test, Figure VII-1 shows the percentage reduction in accidents needed for statistical significance. The horizontal axis indicates the total number of accidents before safety improvements were instituted. The vertical axis indicates the percent accident reduction required for it to be significant at a 5 percent significance level.

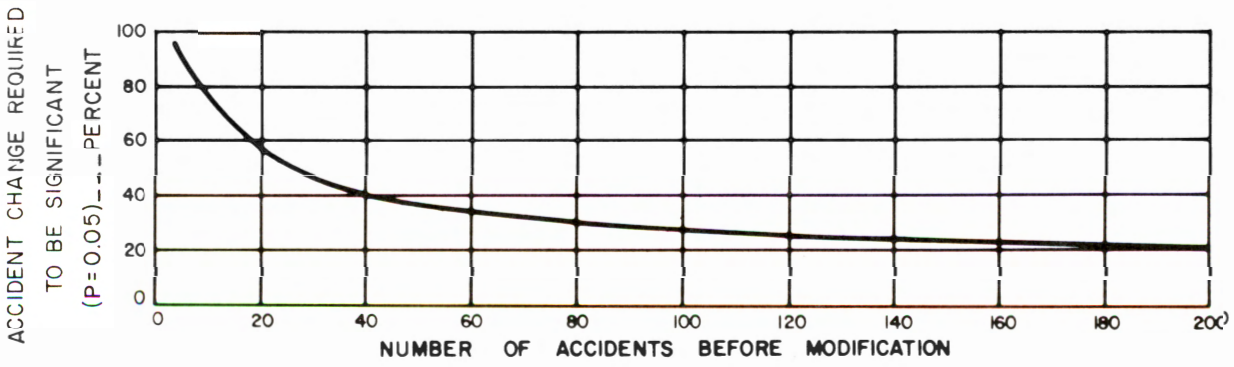


Figure VII-1

If the point falls above the curve, it can be said that you are 95 percent confident that the improved accident experience is not due to chance alone. Therefore, if the first year recommendations involve fifteen intersections at which a total of two hundred accidents had occurred, a reduction in the year following the improvements to a total of one hundred and sixty accidents or less would indicate that the improvement in accident experience could not be attributed to chance.

Capacity Deficiencies

Improvements with respect to capacity deficiencies are immediately obvious since the same analysis can be applied to the recommended intersection operation as was used to evaluate the existing conditions. This analysis is purely analytical however, and does not consider factors such as pedestrian activity or downstream interference.

The load factor of an intersection approach can be physically determined in the field. This is accomplished by counting the number of loaded green phases during a peak period thereby determining an actual load factor. This approach should be utilized to evaluate improvements after they have been implemented.

Mobility Deficiencies

To evaluate the effect which our improvement program has on mobility, speed and delay studies should be conducted and compared to our initial data. This comparison will reveal areas where running speeds have increased and excessive delays are reduced. Improvement in mobility will result primarily from the overall timing changes for the signal system as a result of SIGOP. The changeover to multi-dial equipment will enable us to provide progression favoring the peak directions of travel at the appropriate times.

APPENDIX A-1

SUMMARY OF NON-APPROVED SIGNALS

The New Jersey Department of Transportation requires that the following steps be taken before granting approval of a signalized intersection:

1. Preliminary application is made to the Department for permission to design or to redesign an intersection with respect to signalization.

2. Authorization to design is granted by the Department if the location meets one or more of the warrants as specified in the Manual on Uniform Traffic Control Devices.

3. A preliminary intersection design is submitted for Department approval, which, when given, constitutes an authorization to install the signal.

4. Department of Transportation personnel inspect the installation and file their report with the Commissioner of Transportation. If the report indicates that the intersection has been constructed according to the approved plan, final approval is granted.

The following is a listing of non-approved traffic signals in the City of Trenton with their corresponding stage of development at the time of this Study:

Location & Date of Last Action	**Recommendation**
I - Authorization to Design	
Olden Ave. & Princeton Ave.-1968	Studied under Mercer County TOPICS
II - Authorization to Install	
Broad St. & Hanover St.-1945	Request Inspection
Willow St. & State St.-1945	Request Inspection
Princeton Ave. & Southard St.-1946	Request Inspection as per our design
Prospect St. & Parkway Ave.-1954	Add pedestrian indication N/E and S/W corners.
III - Awaiting Inspection	
Parkside Ave. & Parkway Ave.-1958	Request Inspection as per our recommendation

Location & Date of Last Action	Recommendation
IV - Awaiting Final Approval	
Cass St. & Centre St.-1951	Approve as per our design
Warren St. & Front St.-1951	Redesign pending under Urban Renewal Project
Calhoun St. & Pennington Ave.-1952	Approve as per our design
Clinton Ave. & Liberty St.-1955	Approve as per our design
Clinton Ave. & Chestnut St.-1957	Approve
Clinton Ave. & Hudson St.-1957	Approve
Perry St. & Stockton St.-1959	Approve as per our design
N. Broad St. & Front St.-1961	Redesign pending under Urban Renewal Project
Pennington Ave. & Prospect St.-1970	Approve as per our design
V - Temporarily Approved	
Parkside Ave. & Stuyvesant Ave.-1960	Add pedestrian indications N/E & S/W corners
Clinton Ave. & Fairview Ave.-1964	Approve
VI - No Information Available	
Brunswick Ave. & Fuld St.	Approve
Calhoun St. & Ingham Ave.	Approve as per our design
Clinton Ave. & Beatty St.	Approve
Hanover St. & Montgomery St.	Approve
Pennington Ave. & Parkway Ave.	Add pedestrian indications N/W & S/E corners
Prospect Ave. & Spring St.	Approve
State St. & Calhoun St.	Approve
State St. & Chambers St.	Approve as per our design
State St. & Chestnut St.	Approve
State St. & Clinton Ave.	Approve

WARRANTS FOR TRAFFIC SIGNALS

Traffic Signal Location	MUTCD Warrant
Bellevue Avenue & Hermitage Avenue	4
Bellevue Avenue & Prospect Street	1
Bridge Street & Centre Street	1
S. Broad Street & Beatty Street	1
S. Broad Street & Dayton Street	1
S. Broad Street, Greenwood Avenue & Centre Street	1
S. Broad St., Hamilton Avenue & Second Street	1
N. Broad Street & Hanover Street	1
S. Broad Street & Hudson Street	1
S. Broad Street & Lakeside Avenue	2*
S. Broad Street & Liberty Street	1
N. Broad Street, Pennington Avenue, Princeton Avenue & Warren Street	1
N. Broad Street & Perry Street	1
N. Broad Street & State Street	1
Brunswick Avenue & Fuld Avenue	2
Brunswick Avenue & Olden Avenue	1
Brunswick Avenue & Southard Street	1
Brunswick Avenue & Spruce Street	1*
Calhoun Street & Hanover Street	7
Calhoun Street & Ingham Avenue	1
Calhoun Street & Passaic Avenue	None
Calhoun Street & Pennington Avenue	1
Calhoun Street & Spring Street	1*
Calhoun Street & State Street	1
Cass Street & Centre Street	1
Cass Street & Second Street	2
Chambers Street & Greenwood Avenue	1

Traffic Signal Location	MUTCD Warrant
Chambers Street & Hamilton Avenue	1
Chambers Street & Liberty Street	1
Chambers Street & Roebling Avenue	2
Chambers Street, State Street & Lincoln Avenue	1
Chestnut Avenue & Roebling Avenue	7
Clinton Avenue & Beatty Street	8
Clinton Avenue & Chestnut Avenue	7
Clinton Avenue & Fairview Avenue, Barlow Circle	1
Clinton Avenue & Hamilton Avenue	1
Clinton Avenue & Hudson Street	None*
Clinton Avenue & Liberty Street	1
Fitch Parkway & Lee Avenue	None
Front Street & N. Broad Street	1
Front Street, Stockton Street & Armory Drive	1
Greenwood Avenue & Chestnut Avenue	1
Greenwood Avenue & Cuyler Avenue	2
Greenwood Avenue & Olden Avenue	1
Hamilton Avenue & Chestnut Avenue	1
Hamilton Avenue & Olden Avenue	1
Hermitage Avenue & State Street	1
Lalor Street & Beatty Street	2*
Lincoln Avenue & Seward Street	2*
Market Street & S. Broad Street	1
Market Street & Mercer Street	1
Market Street & Warren Street	1
Monmouth Street & Greenwood Avenue	1
Montgomery Street & Front Street	1
Montgomery Street & Hanover Street	7
Montgomery Street & Perry Street	1

Traffic Signal Location	MUTCD Warrant
Montgomery Street & State Street	1
Olden Avenue & Clinton Avenue	1
Olden Avenue & Liberty Street	1
Olden Avenue & New York Avenue	1
Olden Avenue & State Street	1
Parkside Avenue & Parkway Avenue	1
Parkside Avenue & State Street	1
Parkside Avenue & Stuyvesant Avenue	1
Parkway Avenue & Pennington Avenue	1
Parkway Avenue & Prospect Street	1
Pennington Avenue & Prospect Street	1
Perry Street & Clinton Avenue	1
Perry Street & Stockton Street	1
Princeton Avenue & Olden Avenue	1
Princeton Avenue & Southard Street	1
Princeton Avenue & Spruce Street	1
Prospect Street, Spring Street & Prospect Street & Hanover Street	1
Prospect Street, State Street & Richey Place	1
Southard Street & Perry Street	1
State Street & Chestnut Avenue, Wall Street	1*
State Street & Clinton Avenue	1
State Street & Delawareview Avenue	None
State Street & Monmouth Street	1
Stockton Street & Monmouth Street	1
Stockton Street & State Street	1
Sullivan Way & Sanhican Drive	1
Union Street and Bridge Street	1*
Warren Street & Bank Street	1
Willow Street, Bank Street & Passaic Street	1
Warren Street & Front Street	1

Traffic Signal Location	MUTCD Warrant
Warren Street & Hanover Street	1
Warren Street & Lafayette Street	1
Warren Street & State Street	1
Willow Street & Hanover Street	1
Willow Street & Lafayette Street	1
Willow Street & State Street	1

*Based upon limited information

WARRANTS

1 - Minimum Vehicular Volume
2 - Interruption of Continuous Traffic
3 - Minimum Pedestrian Volume
4 - School Crossing
5 - Progressive Movement
6 - Accident Experience
7 - Systems Warrant
8 - Combination of Warrants

APPENDIX A - 2

BUS ROUTES

Colonial Coach Company

Destination: Philadelphia
Route: Morrisville free bridge and Levittown
Schedule: 15 runs daily

Continental Trailways

Destination: New Brunswick, New York
Route: Yardville and Hightstown, by Route 33
Schedule: Approximately 2 dozen runs

Destination: Philadelphia
Route: Fort Dix and Moorestown by Route 206
Schedule: Same as above

Greyhound

Destination: New Brunswick and New York
Route: Route 1
No stops other than bus terminal.

Destination: Philadelphia
Route: Route 1
No stops other than bus terminal.

Mercer Metro

N Bus

Destination: Asbury Park
Route: Route 1
Schedule: 8 buses daily

V Bus

Destination: Fort Dix, McGuire Air Force Base
Route: Broad Street and Bordentown
Schedule: 12 buses daily, 6 on Sunday

Public Service

Destination:	Philadelphia, Camden
Route:	Broad Street, Route 206, using Adeline Street and Grand Street within the City Limits
Schedule:	Every hour 6:00 AM to 11:00 PM daily

Star Transit

Destination:	Hightstown
Route:	Route 33
Schedule:	Every half hour

Destination:	Lambertville and New Hope
Route:	Route 29 from the bus terminal
Schedule:	Rush hour service only

Destination:	Yardley
Route:	Route 1, Morrisville
Schedule:	6 runs daily

Suburban Transit

Destination:	New Brunswick and New York
Route:	Route 206, Route 1
Schedule:	Hourly, every day

Trenton-Philadelphia Coach Company

Destination:	Philadelphia
Route:	Morrisville free bridge
Schedule:	15 trips daily

BUS ROUTES

Mercer Metro - Local

G	Terminal:	South Broad Street and Lakeside Boulevard in Hamilton Township
	Route:	Enters Trenton along Olden Avenue at Liberty Street, passes Penn RR Station, Bus Terminal and Central Business District. Leaves the City along Prospect Street to Ewingville Road.
	Terminal:	Trenton State Teachers College, Ewing.
	Schedule:	12 hour service every 30 minutes except on Sundays and Holidays.
H	Terminal:	State Complex on Lafayette Street
	Route:	From State Street and Broad Street goes northeast through Ewingville on Route 31 to Pennington and to Hopewell. Route differs slightly after 6 PM Monday through Saturday and all day Sunday.
	Terminal:	Broad Street and Elm Street in Hopewell.
	Schedule:	6 AM to approximately 6 PM service, to Hopewell only during rush hours. Limited Saturday and Sunday service.
K	Terminal:	South Broad Street and Pettyridge Road in Groveville
	Route:	Broad Street, passes State Complex and Central Business District, east on Brunswick Avenue and along Routes 1 and 583.
	Terminal:	Princeton Pike in Bakersville
	Schedule:	6 AM to 12 PM Monday through Saturday, to 9:30 PM on Sunday. No service to Princetown Pike on Sunday.
L	Terminal:	Kuser Road and White Horse Road in White Horse
	Route:	Enters the City along South Broad Street, through the Central Business District and east along North Clinton Avenue.

Mercer Metro - Local (continued)

	Terminal:	Mulberry Street in East Trenton
	Schedule:	5:00 AM to 7:00 PM every 30 minutes, only 8 runs on Sunday
P	Terminal:	Nottingham Way at its junction with Route 33 in Hamilton Square.
	Route:	Greenwood Avenue or Route 33 east, passes through the Penn RR Station and the Central Business District, through Calhoun Street north to Route 206 and Princeton University.
	Terminal:	Harrison Street in Princeton
	Schedule:	5:30 AM to 12:30 AM every half hour. No Hamilton Square service on Sunday.
Q	Terminal:	Virginia Avenue and Lalor Street, Trenton
	Route:	North through the Central Business District to Parkway Avenue
	Terminal:	Parkway Avenue in Ewing Township at the General Motors plant.
	Schedule:	12 hour daytime service Monday through Friday; a few rush hour runs deviate slightly from their regular route to pass Parkway Village and Josephson Apartments in Ewing. Weekend service is limited.
R	Terminal:	Mary Street and Broad Street, Hamilton
	Route:	Roebling Avenue to Clinton Avenue, past Penn RR Station through West State Street
	Terminal:	Afton Avenue and Sanhican Drive, West Trenton.
	Schedule:	Half-hour service Monday through Saturday from 5:30 AM to 9:30 PM. Little Sunday service.
S	Terminal:	Ward Avenue and State Street near the Fairgrounds in Hamilton Township.
	Route:	East and West State Street through the City to Sullivan Way and the New Jersey State Hospital.

Mercer Metro - Local (continued)

	Terminal:	Upper Ferry Road and Manor Drive in West Trenton.
	Schedule:	Earliest morning runs leave State Street and Olden Avenue in Trenton. Full service begins at 6:30 AM and operates on the half-hour until 9:30 PM. Sunday runs are on the hour from 7:00 AM to 9:00 PM.
T	Terminal:	Quaker Gardens in Mercerville
	Route:	Hutchinsons Mill, past the Trenton Speedway and the State Fairgrounds, along Hamilton Avenue, past the Penn RR Station and the Central Business District to the New Jersey State Hospital.
	Terminal:	New Jersey State Department of Transportation on Parkway Avenue and Lower Ferry Road.
	Schedule:	Hourly buses from Hutchinsons Mill or from Quakers Bridge from 5:00 AM to 9:30 PM Monday to Saturday. Two hour service on Sunday.
X	Terminal:	Broad Street and Lakeside Avenue (G bus route) in Hamilton Township.
	Route:	North-South Olden Avenue to Parkway Avenue
	Terminal:	General Motors Plant on Parkway Avenue in Ewing Township.
	Schedule:	Half-hour service during rush hours, hourly service during the day; from 6:00 AM to 6:00 PM weekdays. No Saturday, Sunday or holiday service.

ACCIDENT SUMMARY - A - 3
SEPTEMBER 1969 - AUGUST 1970

I. SIGNALIZED INTERSECTIONS

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
1	S. Broad St., Centre St. & Greenwood Ave.	2	15	5	4	0	3	1	1	31	48	10	16
2	State St. & Warren St.	0	12	5	5	0	2	4	2	30	34	11	17
3	S. Broad St. & Liberty St.	0	9	7	2	1	5	1	0	25	36	10	11
4	N. Broad St., Pennington Ave., Warren St. & Princeton Ave.	1	4	13	0	2	1	2	2	25	39	5	8
5	Brunswick Ave. & Olden Ave.	0	5	5	5	2	3	3	1	24	21	11	10
6	Clinton Ave. & State St.	0	8	2	0	4	4	3	2	23	28	3	4
7	Brunswick Ave & Southard St.	3	3	3	8	2	1	1	1	22	30	9	12
8	Chambers St. & Greenwood Ave.	0	8	2	6	1	5	0	0	22	23	6	6
9	S. Broad St. & Market St.	2	4	6	3	1	2	3	0	21	20	9	8

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
10	Montgomery St. & State St.	1	8	5	1	0	4	0	2	21	28	1	1
11	Clinton Ave., Barlow St., & Fairview Ave.	0	1	4	7	2	4	0	2	20	20	7	7
12	Parkside Ave. & State St.	0	5	2	5	1	6	0	1	20	20	12	12
13	Bellevue Ave. & Prospect St.	2	2	6	1	3	5	0	0	19	27	13	19
14	Broad St., Hamilton Ave. & Second St.	0	7	3	2	3	4	0	0	19	26	6	8
15	Princeton Ave. & Southard St.	1	6	1	5	1	4	1	0	19	26	3	4
16	Calhoun St. & State St.	0	2	5	1	0	4	1	5	18	28	3	5
17	Olden Ave. & State St.	0	9	4	1	1	1	0	2	18	16	3	3
18	Pennington Ave. & Prospect St.	1	4	0	3	1	2	2	5	18	20	9	10

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
19	Chambers St., Lincoln Ave. & State St.	2	6	2	4	0	1	1	1	17	18	5	5
20	Clinton Ave., Lincoln Ave. & Perry St.	2	6	3	1	0	1	3	1	17	20	6	7
21	Bellevue Ave. & Calhoun St.	0	3	1	5	3	0	4	0	16	27	4	7
22	Clinton Ave. & Hamilton Ave.	0	2	2	3	4	3	2	0	16	20	5	6
23	Front St., Armory Dr., & Stockton St.	0	6	3	2	1	4	0	0	16	23	1	1
24	Chambers St. & Hamilton Ave.	1	3	4	2	3	0	2	0	15	16	2	2
25	Clinton Ave. & Olden Ave.	0	4	7	1	1	1	0	1	15	14	5	5
26	Greenwood Ave. & Olden Ave.	2	2	4	2	0	3	1	1	15	14	8	8
27	Olden Ave. & New York Ave.	0	5	2	4	0	1	0	3	15	17	11	12
28	Perry St. & Stockton St.	2	5	1	3	0	0	4	0	15	24	7	11

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
29	Calhoun St. & Pennington Ave.	1	3	4	2	0	3	0	1	14	17	6	7
30	Montgomery St. & Perry St.	0	5	1	3	2	2	0	1	14	19	5	7
31	Perry St. & Southard St.	1	4	3	1	1	3	0	1	14	18	5	7
32	State St. & Stockton St.	3	2	1	3	0	4	1	0	14	17	1	1
33	Lafayette St. & Warren St.	0	1	5	5	1	2	0	0	14	28	6	13
34	Bridge St. & Centre St.	1	2	1	7	0	1	1	0	13	20	4	2
35	N. Broad St. & Perry St.	0	1	6	1	2	3	0	0	13	18	2	3
36	S. Broad St. & Hudson St.	2	5	2	3	0	0	0	0	12	22	3	6
37	Sanhican Dr. Sullivan Way & Route 29	0	3	0	3	1	3	0	2	12	22	6	11
38	S. Broad St., Beatty St. & Cass St.	0	2	5	1	1	0	1	1	11	13	1	1

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
39	N. Broad St. & State St.	0	3	4	0	0	1	3	0	11	13	5	6
40	Cass St. & Second St.	0	2	0	8	0	1	0	0	11	38	8	27
41	Chestnut Ave. & Hamilton Ave.	0	3	3	3	1	0	1	0	11	20	5	9
42	Hamilton Ave. & Olden Ave.	0	1	2	1	4	3	0	0	11	11	1	1
43	Market St., Warren St. & Union St.	2	4	1	2	0	0	0	2	11	13	4	5
44	State St. & Willow St.	0	3	2	1	1	1	1	2	11	15	3	4
45	Greenwood Ave. & Monmouth St.	0	2	4	2	0	1	1	0	10	16	1	2
46	Olden Ave. & Princeton Ave.	0	2	1	3	0	3	1	0	10	7	6	4
47	S. Broad St. & Dayton St.	0	1	1	3	1	2	0	1	9	10	7	8
48	Chambers St. & Liberty St.	0	5	0	2	1	1	0	0	9	13	0	0

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
49	Chestnut Ave., State St. & Wall St.	0	3	0	1	1	4	0	1	9	17	0	0
50	Clinton Ave. & Liberty St.	1	1	0	2	1	4	0	0	9	13	2	3
51	Front St. & Warren St.	0	3	2	1	1	1	1	0	9	13	2	7
52	Perry St., Bank St. & Warren St.	0	4	2	3	0	0	0	0	9	13	2	3
53	Calhoun St. & Spring St.	0	2	1	2	1	1	0	1	8	16	1	2
54	Cass St. & Centre St.	0	2	0	4	0	2	0	0	8	22	8	22
55	Hermitage Ave. & State St.	1	1	1	1	0	4	0	0	8	13	5	8
56	Parkside Ave. & Parkway Ave.	0	2	1	2	1	0	0	2	8	10	4	5
57	Prospect St., Richley Pl. & State St.	0	3	3	0	0	1	0	1	8	17	6	13
58	Willow St., Bank St. & Passaic St.	0	1	0	4	0	3	0	0	7	11	3	5

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
59	Bellevue Ave. & Hermitage Ave.	1	0	0	3	0	1	0	2	7	15	1	2
60	Calhoun St. & Hanover St.	1	2	0	0	0	2	1	1	7	13	4	7
61	Chestnut Ave. & Greenwood Ave.	0	2	1	0	1	2	1	0	7	12	4	8
62	Hanover St., Prospect St. & Spring St.	1	1	0	1	1	3	0	0	7	17	3	7
63	Beatty St. & Clinton Ave.	0	4	0	1	0	1	0	0	6	10	6	10
64	N. Broad St. & Hanover St.	0	2	0	0	3	1	0	0	6	14	2	5
65	Brunswick Ave., Ferrier St. & Miller St.	0	2	3	0	0	0	1	0	6	8	5	7
66	Fitch Parkway & Lee Ave.	0	0	1	1	2	2	0	0	6	9	4	8
67	Front St. & Montgomery St.	0	2	1	2	1	0	0	0	6	11	0	0
68	Hanover St. & Montgomery St.	0	3	1	0	0	2	0	0	6	15	0	0

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
69	Market St. & Mercer St.	0	0	1	3	0	1	1	0	6	10	1	2
70	Chestnut Ave. & Roebling Ave.	1	2	1	0	1	0	0	0	5	21	2	9
71	Greenwood Ave. & Cuyler Ave.	0	2	0	2	0	1	0	0	5	7	2	3
72	Hanover St. & Warren St.	0	1	2	0	0	2	0	0	5	8	0	0
73	Parkside Ave. & Stuyvesant Ave.	1	0	0	2	0	1	0	1	5	6	0	0
74	State St., Delawareview St. & Murray St.	1	2	1	0	1	0	0	0	5	15	1	3
75	N. Broad St. & Front St.	0	2	2	0	0	0	0	0	4	7	2	4
76	Calhoun St. & Passaic St.	0	0	0	1	1	2	0	1	4	8	0	0
77	Chambers St. & Cedar La.	0	1	1	0	0	2	0	0	4	8	1	2
78	Parkway Ave. & Pennington Ave.	0	3	0	0	0	1	0	0	4	7	1	2

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
79	Calhoun St. & Ingham Ave.	1	2	0	0	0	0	0	0	3	4	1	2
80	Chambers St. & Roebling Ave.	0	0	1	2	0	0	0	0	3	5	8	14
81	Fitch Parkway & Willow St.	0	1	0	0	0	0	0	2	3	2	1	1
82	Liberty St. & Olden Ave.	0	1	0	1	0	1	0	0	3	3	3	3
83	Beatty St. & Lalor St.	0	0	0	2	0	0	0	0	2	4	0	0
84	Lafayette St. & Willow St.	0	1	1	0	0	0	0	0	2	4	1	2
85	Princeton Ave. & Spruce St.	1	1	0	0	0	0	0	0	2	2	1	1
86	Chestnut Ave. & Clinton Ave.	0	0	0	0	0	0	1	0	1	2	2	4
87	Clinton Ave. & Hudson St.	0	0	0	1	0	0	0	0	1	2	1	2
88	Hanover St. & Willow St.	0	1	0	0	0	0	0	0	1	2	1	2

ACCIDENT SUMMARY - I. SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
89	Ingham Ave., Parkway Ave. & Prospect St.	0	0	0	0	1	0	0	0	1	2	1	2
90	State St., Prospect St., & West End Ave.	1	0	0	0	0	0	0	0	1	2	0	2

ACCIDENT SUMMARY
SEPTEMBER 1969 - AUGUST 1970

NON-SIGNALIZED INTERSECTIONS

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
1	Greenwood Circle	0	10	6	4	0	0	1	3	24	27	1	1
2	Perry Street & Trenton Freeway	0	3	4	3	0	7	1	1	19	26	6	8
3	Pennington Ave. & Reservoir St.	1	2	0	7	0	2	4	0	16	22	6	8
4	Clinton Ave. & Oak St.	0	3	7	3	0	1	1	0	15	27	4	7
5	Bridge St. & Union St.	2	1	2	0	1	3	2	3	14	23	4 + 1 fat.	7
6	State St. & Monmouth St.	0	2	1	7	0	2	1	1	14	22	0	0
7	Canal St., State St. and Armory Dr.	0	3	1	6	1	2	0	0	13	21	4	7
8	Barlow St. Circle	0	4	6	1	0	0	0	1	12	16	1	1
9	S. Broad St., Cedar Lane and Lalor St.	2	0	0	0	3	6	0	1	12	11	3 + 1 fat.	3

ACCIDENT SUMMARY - NON-SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
10	Hermitage Ave. & Stuyvesant Ave.	0	1	1	3	1	6	0	0	12	25	1	2
11	Bridge St. & Lamberton St.	0	1	2	4	3	1	0	0	11	18	3	5
12	Clinton Ave. & Monmouth St.	0	1	1	6	1	1	1	0	11	20	3	6
13	Parkside Ave., Homan Ave. & Oakland St.	0	4	0	6	0	0	0	6	11	16	8	12
14	Pennington Ave. & Willow St.	0	3	4	1	0	2	1	0	11	20	1 fat.	0
15	Prospect St. & Oakland St.	1	3	1	1	0	3	1	1	11	27	2	5
16	Prospect St. & Rutherford St.	1	1	3	2	2	1	1	0	11	22	6	12
17	Brunswick Ave. & Mulberry St.	0	2	1	5	1	2	0	0	11	20	4	7
18	Clinton Ave. & Division St.	0	2	1	6	0	1	0	0	10	15	6	9

ACCIDENT SUMMARY - NON-SIGNALIZED INTERSECTIONS (continued) SEPTEMBER 1969 - AUGUST 1970

Rank	Intersection	Head On	Rear End	Side Swipe	Right Angle	Right Turn	Left Turn	Ped.	Fixed Object	Total	Acc. Rate	Injuries	Injury Rate
19	Lincoln Ave. & Seward Ave. (now signalized)	0	3	2	0	2	0	3	0	10	23	1 + 1 fat.	2
20	Adeline St. & Dayton St.	0	0	0	9	0	0	0	0	9	30	4	13