Summary

The circulation plan for the City of Dover is undertaken to identify and correct existing problems, and by anticipating future travel demand, to avoid their recurrence in the future. Data collected along with recommendations resulting from the 1967 Dover-Somersworth Transportation Study and the 1970 Downtown Dover Urban Renewal Plan are utilized herein.

The first step in developing the plan is the survey and evaluation of the existing street system. This consists of a street use classification, street system inventory and evaluation, determination of existing and expected traffic flow, and an evaluation of street capacity and traffic accidents.

The 1990 Land Use Plan was developed concurrently with the Circulation Plan, utilizing the nucleated pattern of land development as a theoretical guide. The resulting design concept for the proposed street system was conceived to serve this nucleated pattern and is indicated by a series of radial and circumferential streets connecting the outlying nuclei with each other and the Central Business District.

The proposed circulation facilities are developed from the inventory and future land use plan. Proposed improvements are designated for development in three time frames which represent levels of priority: immediate (1971 to 1975), short-range (1975 to 1985), and long-range (beyond 1985). Within each time frame proposed improvements are classified into new streets, improvements to existing streets, and intersection improvements.

Four new major streets are proposed: an outer connector which is a semicircumferential connecting the Spaulding Turnpike at the Somersworth interchange with Sixth Street, Tolend Road, Littleworth Road, Knox Marsh Road, and Durham Road; an inner connector, another semicircumferential located between the Central Business District and the Spaulding Turnpike and connecting Glenwood Avenue and Central Avenue with the Turnpike at Sawyer's Mill (Locust Street and Central Avenue); the Oak Street extension, a semicircumferential about the Central Business District, formed by the extension of Oak Street across the Cocheco River to Watson Street and Central Avenue; and the Chestnut Street extension, a bypass route of the Central Business District in the short-range time frame proposed to become a local circulation route for the downtown area in the long-range.

In conjunction with the above-mentioned new streets, improvements to certain existing streets are proposed including: First Street, Central Avenue Bridge, Miracle Mile (northern Central Avenue), Fourth Street, Pierce Street, Broadway, Sixth Street, Glenwood Avenue, Watson Street, Washington Street Bridge, and Oak Street.

Improvements to existing intersections such as signing, signalizing, marking, channelizing, and increasing sight distance are also proposed. In addition, the existing southerly one-way direction of traffic flow on Central Avenue in the Central Business District is proposed to be reversed in the long-range in conjunction with the development of the Chestnut Street extension.

The proposed street system should have a profound impact on traffic patterns to and through the City and patterns of land development in rural areas. The downtown street system, particularly Central Avenue, should be relieved of the existing congestion created by through traffic; and new industrial, commercial, and residential development should be stimulated by the implementation of both the outer connector and the Oak Street extension.

The adequacy of terminal facilities (parking and loading) in the Central Business District and other areas of generation is evaluated herein. A deficiency of parking spaces is indicated - about 100 spaces in the Central Avenue - Washington Street area, about 40 spaces in the City Hall area, and about 30 spaces to be removed by proposed traffic improvements. It is expected that the current urban renewal project and the development of the Chestnut Street extension should provide land for the needed parking spaces.

Loading facilities were investigated in regard to the effect which they have on the flow of traffic. Several locations in the downtown area are indicated as detrimental in this regard.

Methods of implementing and maintaining the circulation plan are proposed also. Among the possible tools are priorities of improvements, planning standards for subdivision controls, zoning, and municipal development of streets, official mapping urban renewal, the TOPICS Program and periodic upgrading.

CIRCULATION

The purpose of undertaking a circulation study is twofold. One intent is to identify and correct existing circulation problems; the other is to anticipate future travel demand and appropriately plan for it.

The preparation of the circulation plan for Dover is coordinated with two recent, related studies; the 1967 Dover-Somersworth Transportation Study and the 1970 Downtown Dover Urban Renewal Plan.

Survey and Evaluation of Existing Street System

A circulation facility survey and evaluation was undertaken of the Dover street system. Specific areas of study consisted of a street use classification, street system inventory, and an analysis of traffic volumes, street capacity, and traffic accidents.

Street Use Classification

The street use classification study, which identifies streets in regard to their present use, provides insight into the adequacy of transportation service. The classification likewise provides the basis for the application of planning standards to the various types of uses. Four basic classifications were utilized.*

Expressway - This classification represents the highest order of street usage. These streets have controlled access and grade separation at intersections and generally connect major population centers.

Major Arterial - This classification represents the second order of street usage. In Dover, the major arterial network generally has unlimited access. Together with expressways, these streets provide the network for through traffic.

Collector - This classification provides service between major arterials and local streets, and connects adjacent neighborhoods.

Local - This classification includes all those streets not classified above. Generally, the classification represents streets that predominantly provide access to property on the right-of-way.

Regional Highway System. Expressways and major arterials are the use classifications which are of regional significance.

*Classifications recommended by the National Committee on Urban Transportation, 1958.

Two expressways, the Spaulding Turnpike and I-95 pass through the Dover Area of Influence. I-95, the major Atlantic coastal route runs north-south about seven miles southeast of Dover. The Spaulding Turnpike, the other expressway, connects I-95 at Portsmouth with Dover and Rochester. It passes about one mile to the west of the center of Dover and provides an adequate bypass of the downtown area. It is, however, a toll facility with a collection booth in Dover which affects traffic patterns in the City.

There are five state highways which pass through Dover, as indicated on Figure 1, Existing Street System. Route 16, which links Dover to Portsmouth, Rochester and the White Mountains, passes through the CBD (Central Business District) following the Dover Point Road, Stark Avenue, and Central Avenue. Route 9, which connects Dover with Concord, Somersworth, and southern Maine, also passes through the downtown area following Littleworth Road, Silver Street, and Central Avenue. Another east-west link, Route 4 links the CBD via Portland Avenue to Rollinsford and South Berwick, Maine. Route 155 and Route 108, following Knox Marsh Road and Durham Road, respectively, provide access between Dover and Durham.

Dover Street System. Figure 2 shows the existing functional classification of the Dover street system according to the above-mentioned four classifications. The evaluation and analysis of this chapter deals mostly with the three highest orders of use; expressways, major arterials, and collectors.

The basic pattern of the street system is a modified radial formation focusing on the CBD. The modification, represented by the predominant north-south concentration of major arterials, is caused by the two rivers which have restricted the development of east-west routes. There are few major circumferential routes connecting these radials with the exception of the turnpike which allows access at only three points near downtown Dover. This deficiency of adequate circumferential routes, due basically to the expense of river crossings requires a large portion of the through traffic to utilize the radials and pass through the CBD, thus contributing to the existing congestion.

The existing collector streets form a good basic network and provide access between existing residential development and the major arterials. The location of the majority of the existing residential development has been adjacent to collector streets. The existing pattern of collector streets in relatively undeveloped portions of the City provide the basic network for the development of the future street system in these areas.

Street System Inventory and Evaluation

A street system inventory was conducted to evaluate the effectiveness of the street system. Expressways, major arterials, and collectors in Dover were evaluated in regard to several factors,

Table 1. Street Characteristics Inventory

Street	Section From	Section To	Width (Feet) R.O.W.(1)	Width (Feet) Pavement	Sidewalks(2)	Pavement Condition(3)	Horizontal Alignment(3)	Vertical Alignment(3)	Grade(3)	Shoulders(3)	Estimated 1970 Traffic Volume (AAWT)(4)	Projected 1990 Traffic Volume (AAWT)(4)
EXPRESSWAYS												
Spaulding Turnpike	Newington	Dover Point Road	300	2-48	None	G	G	G	G	G	18,400	25,000
	Dover Point Interchange	Central Avenue Interchange	300	2-48	None	G	G	G	G	G	6,600	14,400
	Central Avenue Interchange	Silver Street Interchange	300	2-48	None	G	G	G	G	G	10,700	22,900
	Silver Street Interchange	Somersworth Interchange	300	2-48	None	G	F	G	G	G	13,600	24,400
	Somersworth Interchange	Rochester	300	2-48	None	G	G	G	G	G	4,400	8,300
Turnpike Connector	Spaulding Turnpike	Traffic Circle	80	48	None	G	G	G	G	G	9,300	19,600
MAJOR ARTERIALS												
Broadway	St. John Street	Central Avenue	50	32	Both	F	F	G	G	-	5,800	8,000
Central Avenue	Locust Street	Stark Avenue	66	32	One	G	G	F	G	P	11,000	18,200
	Stark Avenue	Lower Square	66	42	Both	G	G	G	G	-	18,200	20,900
	Lower Square	Sixth Street	66	46±	Both	G	G	G	G	-	17,600	20,400
	Sixth Street	Oak Street	70	32	Both	G	G	G	G	-	14,700	21,600
	Oak Street	Glenwood Avenue	66	32	One	G	P	F	P	F	14,700	18,400
	Glenwood Avenue	Traffic Circle	66	48	One	G	F	F	F	G	16,800	21,000
Dover Point Road	Spaulding Turnpike	Stark Avenue	66	32	None	G	F	G	G	G	7,800	14,000
Durham Road	Madbury	Mast Road	66±	32	None, One	G	G	G	G	P	6,200	12,500
	Mast Road	Central Avenue	66	32	None	G	G	G	F	G	5,100	10,600
Knox Marsh Road	Madbury	Littleworth Road	50-60	26	None, One	F	F	F	G	P	3,400	5,500
	Littleworth Road	Silver Street	60	32	None, One	G	F	G	G	-	9,000	14,700
Littleworth Road	Madbury	Columbus Avenue	66	32	None	G	F	G	G	G	2,300	5,600
	Columbus Avenue	Knox Marsh Road	66	32	None	G	F	F	G	G	5,100	8,200
Main Street	Washington Street	Portland Street	50	32	One	G	G	G	F	-	15,400	17,900
Main Street	Portland Street	Upper Square	50	24	Both	G	G	G	F	-	13,200	15,300
Old Rochester Road	Rochester Road	Somersworth	60	32	None	G	G	G	G	F	2,700	5,600
Portland Avenue	Rollinsford	Portland Street	100	48	None	G	G	F	P	G	6,000	11,000
	Portland Street	Central Avenue	60	32	Both	G	G	F	G	-	2,800	5,500
Portland Street	Portland Avenue	Main Street	50	28	One	G	G	P	P	G	3,400	5,600
Rochester Road	Traffic Circle	Rollinsford	60	32	None	G	G	G	G	P	7,700	13,800
St. John Street	Portland Avenue	Broadway	50	26	Both	F	G	F	G	-	3,800	8,000
Silver Street	Knox Marsh Road	Central Avenue	60	32	One, Both	G	P	G	G	-	7,200	12,600
Stark Avenue	Dover Point Road	Central Avenue	66	32	One	G	G	F	G	P	7,500	19,400
Washington Street	Lower Square	Main Street	66	48	Both	G	P	G	F	-	15,400	17,900
COLLECTORS												
Arch Street	Washington Street	Silver Street	50±	32±	None	F	G	G	G	G	(5)	-
Atlantic Avenue - Gulf Road	Piscataqua River	Portland Avenue	50	24	None	F	F	F	F	G	2,400	3,500
Back River Road	Piscataqua Road	Durham Road	60±	32	One	F	P	F	F	P	2,700	7,000
Back Road	Middle Road	Henry Law Avenue	50±	28	None	F	F	F	F	F	(5)	(5)
Bellamy Road	Durham Road	Knox Marsh Road	60±	26	One, None	F	F	F	G	G	1,200	2,900
Broadway	Rollinsford	St. John Street	66	32	Both	G	G	G	F	-	6,000	10,100
Chestnut Street	Sixth Street	Cocheco River	66	36	Both, One, None	F	G	G	G	-	(5)	-
County Farm Road	Rochester	Sixth Street	50	26	None	G	F	F	F	F	(5)	-
Court Street	Middle Road	Central Avenue	50±	28	One	F	F	G	F	P	1,000	3,500
First Street	Chestnut Street	Central Avenue	50	26	Both	F	G	G	G	-	(5)	-
Fourth Street	Washington Street	Central Avenue	50	30	None, Both	F	F	G	G	-	4,250	4,900
Glenwood Avenue	Sixth Street	Central Avenue	50	24	None	G	G	G	G	F	2,400	3,600
Hale Street	Locust Street	Central Avenue	55	26	Both	G	G	G	G	-	(5)	-
Ham Street	Broadway	Central Avenue	50	32	One	P	G	F	G	-	2,200	4,500
Henry Law Avenue	Court Street	Lower Square	50	26±	None, Both	P	F	F	F	F	1,300	2,400
Horne Street	Glenwood Avenue	Sixth Street	50±	24±	One, Both	G	G	G	G	G	(5)	-
Locust Street	Washington Street	Silver Street	50	24	One	F	G	G	G	-	2,900	11,700
	Silver Street	Washington Street	50	24	Both	F	G	G	F	-	1,600	5,200
Mast Road - Spruce Lane	Piscataqua Road	Durham Road	60±	28	None	F	F	F	G	F	(5)	-
Middle Road	Dover Point Road	Court Street	50±	26	None	F	F	F	F	F	(5)	-
Oak Street	Broadway	Central Avenue	50	24	One	F	F	G	G	G	2,200	3,200
Old Rochester Road	Rochester Road	Traffic Circle	50±	26±	None	F	G	G	G	G	(5)	-
Pierce Street	Broadway	Central Avenue	60	28	Both	G	G	G	G	-	1,540	4,900
Piscataqua Road	Madbury	Back River Road	60±	28	None	F	F	P	F	P	1,400	2,100
St. Thomas Street	Locust Street	Central Avenue	40	24	Both	G	G	G	G	-	(5)	-
Second Street	Chestnut Street	Central Avenue	50	26	Both	G	G	G	G	-	(5)	-
Sixth Street	Long Hill Road	Glenwood Avenue	50	26	None	F	F	F	F	F	1,100	1,900
	Glenwood Avenue	Central Avenue	60	28	Both	F	G	G	P	F	7,200	8,400
Third Street	Chestnut Street	Central Avenue	50	32	Both	F	G	G	G	-	(5)	-
Tolend Road	Barrington	Washington Street	60±	32	None	P	F	F	G	F	(5)	-
Washington Street	Tolend Road	Arch Street	60	36	Both	F	G	G	F	-	4,400	6,600
	Arch Street	Central Avenue	60	32	Both	G	G	G	F	-	6,250	8,700
Whittier Street	Glenwood Avenue	Washington Street	50	24	One	F	F	F	F	F	3,200	3,800

(1)Right-of-Way.
(2)None = No sidewalks.
One = Sidewalks on one side only.
Both = Sidewalks on both sides.
(3)G = Good
F = Fair
P = Poor
(4)Average Annual Weekday Traffic.
(5)Data not available.

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Central Avenue	Locust Street	Stark Avenue	66	32	One	G	G	F	G	P	11,000	18,200
	Stark Avenue	Lower Square	66	42	Both	G	G	G	G	-	18,200	20,900
	Lower Square	Sixth Street	66	46±	Both	G	G	G	G	-	17,600	20,400
	Sixth Street	Oak Street	70	32	Both	G	G	G	G	-	14,700	21,600
	Oak Street	Glenwood Avenue	66	32	One	G	P	F	P	F	14,700	18,400
	Glenwood Avenue	Traffic Circle	66	48	One	G	F	F	F	G	16,800	21,000
Dover Point Road	Spaulding Turnpike	Stark Avenue	66	32	None	G	F	G	G	G	7,800	14,000
Durham Road	Madbury	Mast Road	66±	32	None, One	G	G	G	G	P	6,200	12,500
	Mast Road	Central Avenue	66	32	None	G	G	G	F	G	5,100	10,600
Knox Marsh Road	Madbury	Littleworth Road	50-60	26	None, One	F	F	F	G	P	3,400	5,500
	Littleworth Road	Silver Street	60	32	None, One	G	F	G	G	-	9,000	14,700
Littleworth Road	Madbury	Columbus Avenue	66	32	None	G	F	G	G	G	2,300	5,600
	Columbus Avenue	Knox Marsh Road	66	32	None	G	F	F	G	G	5,100	8,200
Main Street	Washington Street	Portland Street	50	32	One	G	G	G	F	-	15,400	17,900
Main Street	Portland Street	Upper Square	50	24	Both	G	G	G	F	-	13,200	15,300
Old Rochester Road	Rochester Road	Somersworth	60	32	None	G	G	G	G	F	2,700	5,600
Portland Avenue	Rollinsford	Portland Street	100	48	None	G	G	F	P	G	6,000	11,000
	Portland Street	Central Avenue	60	32	Both	G	G	F	G	-	2,800	5,500
Portland Street	Portland Avenue	Main Street	50	28	One	G	G	P	P	G	3,400	5,600
Rochester Road	Traffic Circle	Rollinsford	60	32	None	G	G	G	G	P	7,700	13,800
St. John Street	Portland Avenue	Broadway	50	26	Both	F	G	F	G	-	3,800	8,000
Silver Street	Knox Marsh Road	Central Avenue	60	32	One, Both	G	P	G	G	-	7,200	12,600
Stark Avenue	Dover Point Road	Central Avenue	66	32	One	G	G	F	G	P	7,500	19,400
Washington Street	Lower Square	Main Street	66	48	Both	G	P	G	F	-	15,400	17,900
COLLECTORS												
Arch Street	Washington Street	Silver Street	50±	32±	None	F	G	G	G	G	(5)	-
Atlantic Avenue - Gulf Road	Piscataqua River	Portland Avenue	50	24	None	F	F	F	F	G	2,400	3,500
Back River Road	Piscataqua Road	Durham Road	60±	32	One	F	P	F	F	P	2,700	7,000
Back Road	Middle Road	Henry Law Avenue	50±	28	None	F	F	F	F	F	(5)	(5)
Bellamy Road	Durham Road	Knox Marsh Road	60±	26	One, None	F	F	F	G	G	1,200	2,900
Broadway	Rollinsford	St. John Street	66	32	Both	G	G	G	F	-	6,000	10,100
Chestnut Street	Sixth Street	Cocheco River	66	36	Both, One, None	F	G	G	G	-	(5)	-
County Farm Road	Rochester	Sixth Street	50	26	None	G	F	F	F	F	(5)	-
Court Street	Middle Road	Central Avenue	50±	28	One	F	F	G	F	P	1,000	3,500
First Street	Chestnut Street	Central Avenue	50	26	Both	F	G	G	G	-	(5)	-
Fourth Street	Washington Street	Central Avenue	50	30	None, Both	F	F	G	G	-	4,250	4,900
Glenwood Avenue	Sixth Street	Central Avenue	50	24	None	G	G	G	G	F	2,400	3,600
Hale Street	Locust Street	Central Avenue	55	26	Both	G	G	G	G	-	(5)	-
Ham Street	Broadway	Central Avenue	50	32	One	P	G	F	G	-	2,200	4,500
Henry Law Avenue	Court Street	Lower Square	50	26±	None, Both	P	F	F	F	F	1,300	2,400
Horne Street	Glenwood Avenue	Sixth Street	50±	24±	One, Both	G	G	G	G	G	(5)	-
Locust Street	Washington Street	Silver Street	50	24	One	F	G	G	G	-	2,900	11,700
	Silver Street	Washington Street	50	24	Both	F	G	G	F	-	1,600	5,200
Mast Road - Spruce Lane	Piscataqua Road	Durham Road	60±	28	None	F	F	F	G	F	(5)	-
Middle Road	Dover Point Road	Court Street	50±	26	None	F	F	F	F	F	(5)	-
Oak Street	Broadway	Central Avenue	50	24	One	F	F	G	G	G	2,200	3,200
Old Rochester Road	Rochester Road	Traffic Circle	50±	26±	None	F	G	G	G	G	(5)	-
Pierce Street	Broadway	Central Avenue	60	28	Both	G	G	G	G	-	1,540	4,900
Piscataqua Road	Madbury	Back River Road	60±	28	None	F	F	P	F	P	1,400	2,100
St. Thomas Street	Locust Street	Central Avenue	40	24	Both	G	G	G	G	-	(5)	-
Second Street	Chestnut Street	Central Avenue	50	26	Both	G	G	G	G	-	(5)	-
Sixth Street	Long Hill Road	Glenwood Avenue	50	26	None	F	F	F	F	F	1,100	1,900
	Glenwood Avenue	Central Avenue	60	28	Both	F	G	G	P	F	7,200	8,400
Third Street	Chestnut Street	Central Avenue	50	32	Both	F	G	G	G	-	(5)	-
Tolend Road	Barrington	Washington Street	60±	32	None	P	F	F	G	F	(5)	-
Washington Street	Tolend Road	Arch Street	60	36	Both	F	G	G	F	-	4,400	6,600
	Arch Street	Central Avenue	60	32	Both	G	G	G	F	-	6,250	8,700
Whittier Street	Glenwood Avenue	Washington Street	50	24	One	F	F	F	F	F	3,200	3,800

(1)Right-of-Way.
(2)None = No sidewalks.
One = Sidewalks on one side only.
Both = Sidewalks on both sides.
(3)G = Good
F = Fair
P = Poor
(4)Average Annual Weekday Traffic.
(5)Data not available.

all of which are discussed below. This evaluation is presented in Table 1. In addition, the locations of critical problem areas are shown on Figure 1.

Pavement Width and Condition. One factor which affects the ability of a street to carry traffic is the pavement width. The existing widths of pavement in Dover's major streets are presented in Table 1.

In comparison to standards presented in Appendix Table A-1 inadequate pavement widths are predominant throughout Dover. Generally the pavement should be wide enough to accommodate two 12-foot travel lanes plus parking lanes or shoulders (42-foot minimum total). The most critical deficiencies in pavement width exist on the following streets:

Central Avenue between Locust Street and Stark Avenue

Knox Marsh Road between Madbury town line and Littleworth Road

Broadway between St. John Street and Central Avenue

St. John Street

Main Street between Portland Street and Upper Square

Bellamy Road

Glenwood Avenue

Whittier Street

St. Thomas Street

Atlantic Avenue - Gulf Road

Pierce Street

Areas of inadequate pavement width are designated by an "N" on Figure 1.

The condition of street pavement affects road-user comfort and safety. Through the operation of a regular maintenance program, Dover has kept most of the heavily-used roads in fair-to-good condition. Two streets, however, have severe pavement deficiencies and should be assigned a high priority in the City's maintenance program. They are Tolend Road and Ham Street. They are noted with a "P" on Figure 1.

Sidewalks. The streets with existing sidewalks are listed in Table 1. The provision for sidewalks, especially where pedestrian and vehicular traffic is heavy, should be of paramount

importance to the community. Thus, sidewalks should be provided along major roadways in areas of high vehicular and pedestrian traffic generation (business areas and schools) and in concentrations of residential developments.

As a general policy guide, the City should consider constructing sidewalks on at least one side of the street in areas where the net residential density* is greater than two families per acre and the number of families at that density warrants them. Subdividers, however, should be required to construct sidewalks in front of every developed lot less than one-half an acre in area.

Right-of-Way Width. The right-of-way width of a street is the area between the private property lines on both sides of the street. The entire width is generally not paved and areas near the side of the road are often used for shoulders, sidewalks, and planting areas. Generally, the larger the differences between the pavement and right-of-way widths, the easier a street is to widen, since it indicates little or no additional land acquisition.

Table 1 shows the right-of-way widths for Dover's streets. With the exception of the turnpike, Central Avenue between Sixth Street and Oak Street and the eastern portion of Portland Avenue, the many major arterials and collector streets in Dover do not have adequate rights-of-way (70 and 60 feet respectively).

Horizontal Alignment. Horizontal alignment describes the curvature of a roadway on an horizontal plane. It is evaluated in degrees of curvature, feet of radius of the street centerline, and sight distance. Poor horizontal alignment can be both dangerous (sharp or hidden curves) and uncomfortable (poor transition to and through curves).

The evaluation of the horizontal alignment of Dover's major streets is presented in Table 1. Specific locations of poor horizontal alignment are designated by an "H" on Figure 1.

Vertical Alignment. Vertical alignment describes the curvature of the roadway in the vertical plane. Hills and troughs in the road are examples of vertical alignment. It is measured by length and degrees of radius of the curve and sight distance. As is the case with horizontal alignment, poor vertical alignment can also be dangerous and uncomfortable for the driver.

The evaluation of the vertical alignment of Dover's major streets is presented in Table 1. Specific locations of poor vertical alignment are shown on Figure 1 and designated with a "V".

Grade. The grade of a street is important for safety and comfort considerations. There are only a few locations in Dover

*Net residential density is the number of families divided by the total area of residential land (excluding streets).

where the grade is considered excessive. These are designated on Figure 1 with a "G". Generally, excessive grade is not a problem in Dover and furthermore, very little can be done to eliminate the few areas where excessive grades exist.

Shoulders. The shoulder is that portion of the roadway between the outer edge of the travel lane and the inside edge of the ditch, gutter, curb, or side slope. Shoulders provide a place for vehicles to stop along the roadway and a safety transition between the roadway and side of the road. Shoulders which are too narrow, or of an unsuitable material, are noted on Figure 1 by an "S". Most of the problems exist on streets outside the downtown area where volumes are low and vehicular speeds tend to be high.

Intersections. The control of traffic at intersections is necessary for safety and uniform traffic flow. The conventional methods of control consist of signing, pavement marking, signalization and channelization. Inadequate or improperly controlled intersections are usually indicated by high accident rates and congestion.

High accident intersections are plotted on Figure 1. Of these, the most dangerous intersections are at:

Central Avenue - Stark Avenue

Lower Square

Silver Street - Locust Street

Sixth Street - Whittier Street

Rochester Road - Somersworth Traffic Circle

Rochester Road - Old Rochester Road

Congestion, the other indicator of inadequate intersection control, is greatest along Central Avenue downtown during the peak hours. The areas where congestion is particularly acute are at Upper and Lower Square. Other areas of congestion include Miracle Mile*, Central Avenue - Hale Street intersection, and the Littleworth Road - Knox Marsh Road intersection.

Many of the existing traffic control facilities in Dover are generally obsolete and ineffective. Presently the following intersections are signalized by city-owned signal systems. The Central Avenue - Glenwood Avenue intersection is controlled by a new, fully-actuated system, which appears to function adequately. However, all other signals in the City, namely those at Central Avenue and Silver Street, Central Avenue and Broadway, Central Avenue

*Local designation of the strip commercial development at the northern portion of Central Avenue between Glenwood Avenue and the Somersworth traffic circle.

and Third Street, and Upper Square are all over fifteen years old, and since installation, have not been rephased to reflect changing traffic conditions.

Many of the intersections in Dover have wide-open paved areas which increase possibilities for vehicle conflict and multiply the possible conflict points. Channelization, which restricts vehicle paths, is often the most appropriate solution to such problems.

The high accident intersections in Dover are characterised by poor sight distance from the approaching legs. This lack of clear corner visibility does not give drivers entering the same intersection adequate time to respond and react to each other. Most of the accidents are caused by minor obstacles which lie in the driver's line of sight, such as trees and other plants, signs, or fences.

At-Grade Railroad Crossings. In Dover, the railroad line, although not particularly hazardous, is a cause of considerable traffic disruption. The Boston & Maine Railroad has a major line running through downtown Dover which crosses Central Avenue and Chestnut Street, and spur routes which cross several other streets in the City. The Central Avenue crossing is of most concern because of the high traffic volumes crossing the tracks. Little can be done in the near future to relieve the congestive effect since the railroad plans to continue frequent use of the line. An alternative method of diminishing the disruptive effect of the crossing might be to divert as much of the through traffic from Central Avenue as possible.

Bridges. In downtown Dover there are four major bridges over the Cocheco River crossing at Central Avenue, Washington Street, lower Washington Street (River Street), and Fourth Street. All but the Fourth Street Bridge are in need of replacement or repair. The Central Street Bridge is obsolescent and unsafe. A recent report by the New Hampshire Department of Public Works and Highways states that, "immediate plans for its replacement should be considered." This bridge is located in the downtown Dover Urban Renewal Area, and its replacement or reconstruction is presently planned. The Washington Street bridge, recently evaluated by state bridge engineers has also been deemed in need of replacement. The lower Washington Street bridge, which crosses the Cocheco River at River Street, has been classified as unsafe to all but pedestrian traffic and is presently closed to vehicles.

Existing and Expected Traffic Flow

Traffic flows or volumes measure the use which is presently being made of Dover's streets. The combination of these traffic flows produces the traffic patterns for the City. Through estimates of future traffic flows and resulting traffic patterns, long-range highway needs can be determined.

Figure 3 shows the current traffic volumes (AAWT - average annual weekday traffic) for the major streets in Dover. Also shown are the predicted 1990 volumes. Both existing and projected volumes are also listed in Table 1. These projections are developed to indicate what the traffic flow should consist of if no major improvements of the street system are undertaken.

Of particular concern are the projected increases in and around downtown Dover. The projected volumes are based primarily on an expected stability of the business area as it develops fully as a major commercial center, serving the general and specialized shopping and service needs of the entire City. In addition, the development of neighborhood commercial centers, serving the convenience shopping needs of the residents of the immediate area, is expected to influence travel patterns and attract people in automobiles to these areas.

Street Capacity

The capacity of a street is determined by its ability with its particular physical characteristics (width, alignment, condition, and intersections) to handle traffic flow without congestion and at a reasonable operating speed.

Generally, in a highly developed area, the capacity of intersections governs the amount of vehicles which can pass over the roadway. Whereas, in less developed areas street characteristics govern capacity. In downtown Dover it is the intersections, particularly those on Central Avenue which determine the level of traffic flow. Capacity evaluations of these intersections are extremely complex undertakings and the data for such evaluations are not available in Dover. However, intersections which are operating at or near capacity are easily identified by frequent congestion and high accident rates. These intersections are:

Somersworth Traffic Circle

Central Avenue - Glenwood Avenue

Central Avenue at the railroad tracks

Upper Square

Lower Square

Central Avenue - Silver Street

Central Avenue - Locust Street - Back River Road - Durham Road

Littleworth Road - Knox Marsh Road

One factor, not associated with intersections, which restricts the street capacity of the CBD street network is the angle

parking on Central Avenue. The amount of roadway available for travel is reduced and smooth flow is disrupted by vehicles entering and leaving the spaces. The Dover-Somersworth Transportation Study recommended that angle parking on Central Avenue be removed as soon as replacement parking spaces could be provided. Removal of this type of parking could result in as much as a forty percent increase in the roadway capacity.

In the less developed areas of Dover, where the capacity is determined by the design features of the road (width, alignment, and grade), there appears to be few existing or anticipated capacity deficiencies. With the exception of the narrow pavement sections previously mentioned, roadway capacity outside of this downtown area appears to be adequate.

1990 Land Use

The nucleated pattern of land development, selected as a theoretical guide for land use in Dover in Phase I of the Comprehensive Development Plan, served as the foundation upon which the future land use plan was developed.

Although the Future Land Use chapter is following this chapter in sequence, both the circulation and future land use plan were developed concurrently with each plan serving the needs of the other.

The nucleated pattern, with its commerical center and high density residential concentrations, requires connection by major arterials with each other and the CBD. These connections between each outlying "nucleus" from the basic circumferential connector pattern and the connection between these nuclei and the CBD form the basic radial pattern. The resultant design concept of the overall street pattern is shown by inset on Figure 4.

Proposed Circulation Facilities

In accordance with the above-mentioned deficiencies in the existing system, and the expected future travel demands, the following circulation proposals are presented. The proposals are categorized by new circulation facilities, existing street improvements, and intersection improvements and are shown on Figures 4 and 5 for the entire City and the CBD, respectively. In addition, the proposed improvements are assigned to certain periods of development indicating a time frame within which the improvement should be constructed. These phases are not rigid, but simply reflect priorities of improvements which should parallel stages of land development and maximize the efficiency of the entire system. The phases are assigned three time frames: immediate improvements (1971-1975), short-range improvements (1975-1985), and long-range improvements (beyond 1985). Although this comprehensive development plan is based on the design year of 1990, proposals herein are expected to serve the needs of the City beyond that period.

Immediate Improvements (1971 - 1975)

These improvements are proposed primarily to correct existing critical deficiencies or implement circulation improvements which are presently being planned in Dover.

New Streets. The following new streets are proposed to be constructed between 1971 and 1975:

1. Chestnut Street Extension. To accommodate the anticipated increase in both local and through traffic expected on Central Avenue in the future, a new major arterial route is proposed, extending between the intersection of Sixth and Chestnut Streets and the intersection of Hale Street and Central Avenue. As shown on Figures 4 and 5, the proposed route should follow the alignment of Chestnut Street north of the Cocheco River. South of the intersection of Walnut and St. Thomas Streets it is proposed that the route curve eastward along Hale Street to Central Avenue. Development of this route would require the construction of a new bridge over the Cocheco River. Within the immediate and short-range time periods (to 1985) this route would operate with two-direction traffic. The section of the route between First Street and Washington Street, including the proposed bridge, is located within the Downtown Dover Urban Renewal Project.

2. Relocated Green Street. This improvement is proposed in conjunction with the Chestnut Street Extension in the Urban Renewal Project. (Refer to Figure 5.) The existing street is in poor condition and, due to its existing proximity to the river, hinders efficient development of the area. The future use classification of this route is intended as a collector street.

3. Outer Connector (Phase One). The ultimate development of this major arterial route should connect the Spaulding Turnpike at the Somersworth interchange with Sixth Street, Tolend Road, Littleworth Road, Knox Marsh Road, and Durham Road. In total there are about four miles of roadway involved with one railroad and two river crossings required. Access to this route should be controlled to the extent that curb cuts and new street intersections are minimized. Proposals during the immediate time frame call for only partial construction of the route, specifically the construction of a full interchange at the Somersworth interchange with a connection to Sixth Street. It is anticipated that the construction of the complete route should parallel land development in the area and progress with the needs of the development. The location of the route on Figure 4 is approximate and the final location of the route should be determined only after careful engineering study.

Improvement of Existing Streets. The following existing routes are proposed to be improved between 1971 and 1975:

1. First Street. Present proposals under the downtown Urban Renewal Project call for the removal of existing pavement

and repaving at the existing right-of-way. The existing use classification, collector, is intended to remain the same.

2. Central Avenue Bridge. Due to the poor condition of the existing structure, it is proposed that the Central Avenue bridge over the Cocheco River be either reconstructed or replaced. The bridge is located within the Downtown Dover Urban Renewal Area and, therefore, should be improved in conjunction with the project.

3. Miracle Mile Improvement. Numerous accidents presently occur all along Miracle Mile, most of which are caused by the multiplicity of access points, restricted sight distance due to roadway curvature and improperly placed signs, and the relatively high speed of traffic on Central Avenue. One point along Miracle Mile, the entrance to the Seigal City parking lot, has a disproportionately high share of these accidents.

Two minor measures can be taken to help reduce the traffic hazard on Miracle Mile. The access point to Seigal City should be moved further north on Central Avenue. Many of the accidents at this location are caused by vehicles heading north which slow down or stop as they turn into the parking lot. Since this access is located at the end of a curve, through vehicles traveling north cannot see the turning vehicles in time to stop. The signal at Glenwood Avenue also contributes to the problem. Many vehicles, which accelerate after the stoplight, do not anticipate a stopped or slowing vehicle and due to their acceleration, have no time to stop.

A second measure to relieve accidents on Miracle Mile is the establishment of regulations in the zoning ordinance to restrict property owners from placing or planting any obstructions near driveway or parking lot access points. An appropriate statement requiring all existing signs and plantings to conform within a certain period of time should help remove the existing hazard. Presently signs adjacent to the rights-of-way severly restrict the vision of the driver entering Central Avenue.

Intersection Improvements. The following intersections are proposed to be improved between 1971 and 1975. They are shown on Figures 4 and 5.

1. Central Avenue - Spaulding Turnpike - Mill Road - Durham Road - Back River Road. This improvement was proposed in the recent Dover-Somersworth Transportation Study, and include three separate, but interrelated intersections. Presently the area experiences periods of extreme congestion and hazardous traffic operation. Proposals call for channelization at the Durham Road - Back River Road intersection, signalization and channelization at the Turnpike ramp - Mill Street - Cental Avenue intersection, signing at Charles Street, and channelization and left-hand turning lanes from Central Avenue to Charles Street and Mill Street. An additional improvement, not outlined in the Dover-Somersworth Transportation Study, is the removal of the trees and

trimming of shrubs on the northerly side of Durham Road near the bridge. This should considerably improve sight distance and help diminish the hazardous nature of the intersection.

2. Silver Street - Central Avenue. This improvement was also recommended in the Dover-Somersworth Transportation Study and involves two related intersections: Silver Street - Central Avenue and Hanson Street - Court Street - Church Street - Central Avenue. Presently the Silver Street - Central Avenue intersection is controlled by signals which were installed and timed in 1946. The physical condition of the signals and their timing renders them obsolete for today's traffic needs. The Dover-Somersworth Study proposals call for new signals with left-hand turn phases and an appropriate left-hand turning lane and channelization on Central Avenue. These improvements are considered appropriate under the existing conditions.

The second intersection, Hanson Street - Court Street - Church Street - Central Avenue experiences numerous traffic accidents. The cause is in part due to the large street pavement area which allows vehicle paths to cross at an unlimited number of points (called conflict points). Proposals call for a reduction in this conflict area by pavement narrowing and restriction of parking near the intersection. As with the above intersection, their improvements are recommended herein.

3. Portland Avenue - Portland Street. This proposal, recommended in the Dover-Somersworth Transportation Study, consists of minor signing, pavement narrowing, and restriction of parking. The existing sight distance is poor due to the difference in elevation of the approaching streets. The recommended improvements should reduce the traffic hazard created by this intersection.

4. Washington Street - Main Street. The proposals call for minor traffic engineering improvements involving channelization of one-way turning movements from Washington Street onto Main Street. This proposal was also presented in the Dover-Somersworth Transportation Study and are recommended herein.

5. Lower Square. Lower Square is the local designation of the intersection of Central Avenue and Washington Street. This intersection, although presently channelized, experiences a considerable number of traffic accidents each year and is also a primary cause of congestion on Central Avenue. Traffic is controlled only by one stop sign on Central Avenue heading south which permits all turning movements. Replacement of existing channelizing islands, signalization, and restriction of parking on all approaches to the intersection are recommended to improve traffic operation and reduce the number of accidents. It is intended that these improvements would be undertaken in conjunction with the Downtown Dover Urban Renewal Project.

It should be noted that long-range proposals for the CBD as shown on Figure 5, call for reversal of one-way traffic flow on Central Avenue between Washington Street and Sixth Street. Therefore any channelization developed in the short-range will be obsolete when the direction of flow is reversed. Therefore, a minimum amount of expense would be involved in short-range channelization.

6. Upper Square. This improvement was recommended in the Dover-Somersworth Transportation Study. The intersections of Broadway, Third Street, Portland Avenue, Main Street, and Second Street with Central Avenue are involved in the proposals. These intersections presently experience numerous minor accidents and periods of extreme congestion. The intersections at Upper Square and Lower Square severely restrict traffic flow through the downtown area and are a major cause of congestion. Presently the intersections are controlled by traffic islands and signals. Angle parking at both the central islands and along the curb impede traffic flow. The signals at the Broadway - Central Avenue and Third Street - Central Avenue intersections are over 25 years old and are not functioning at the present time.

Recommendations in the Dover-Somersworth Study call for replacement of angle parking with parallel parking at the curb and the entire removal of all parking at the central island and the four angle spaces at the Main Street - Central Avenue curb. New traffic signals are proposed at the existing locations, along with channelization of all turning movements. These improvements are recommended herein because of their appropriateness for existing conditions. In regard to the channelization, minimum expense should be incurred since the direction of flow may be reversed in the long-range.

7. Silver Street - Locust Street. Frequent traffic accidents at this intersection cause injury, inconvenience, and expense to the City of Dover and its citizens. Presently the only controls at this intersection are a stop sign at Locust Street and frequent traffic direction by a police officer. Poor site distance for vehicles entering the intersection from Silver Street is one of the major deficiencies of the intersection.

The poor sight distance and consequent hazardous nature of the intersection can be improved by removal of a few shrubs and mounds of earth at the corners of the intersection. This should permit a driver stopped on Locust Street to see at least 400 feet down the center line of Silver Street. The area where obstructions are prohibited is called the "sight triangle," the dimensions of which are recommended under Zoning in this report. If enforcement of the sight triangle becomes impractical, then signalization of the intersection should be considered.

8. Central Avenue - Stark Avenue. This intersection experiences surprisingly few traffic accidents despite the poor

sight distance, small angle of intersecting streets, and large conflict area. Presently, the only control of this intersection is a stop sign on Central Avenue. Because of the potential hazard created at this intersection, drivers delay at the intersection and then with extreme caution proceed into the intersection, thereby detering its efficient operation.

It is felt that improvement of this intersection, allowing traffic to operate freely and safely, is justified on the basis that it would encourage drivers to utilize the Central Avenue - Turnpike interchange and stimulate business in the Sawyer's Mill Area. Channelization will be required to reduce the extremely large conflict area of the intersection. Because of the poor sight distance caused by differences in elevation of the entering streets, signalization is also recommended. In the long-range time period, the proposed Oak Street Extension should be meeting Central Avenue at this intersection. The above improvements should become significantly desirable at that time.

9. Sixth Street - Whittier Street. Numerous severe accidents render this intersection one of the most dangerous in the City. Present control consists of stop signs on Whittier Street and a "Dangerous Intersection" sign on Sixth Street. As with other high accident intersections in the City, this one suffers similarly with very restricted sight distance from the approaches. Traffic heading west on Sixth Street has an obstructed view of traffic entering on Whittier Street due to a vertical curve just before the intersection. Those vehicles heading east on Sixth Street likewise have their view obstructed by trees along the road on a horizontal curve. Due to the relatively high speed of vehicles on Sixth Street, drivers do not have time to react and avoid a vehicle entering the intersection from Whittier Street. Similarly, vehicles on Whittier Street cannot see vehicles on Sixth Street because of plantings, trees, fences, and a mound of earth near the right-of-way.

To relieve this hazardous situation, it is proposed that the street at the vertical curve on Sixth Street be excavated and the bump in the road be removed. Also, the same sight distance recommended for the Silver Street - Locust Street intersection (400 feet along the Sixth Street center line) is recommended for this intersection. Adherence to this requirement would necessitate removal of some of the existing obstructions.

10. Central Avenue - Ham Street. As in the case of previously-mentioned intersections, the restricted sight distance at this intersection is a major cause of accidents. Vehicles traveling north on Central Avenue, due to a combination of vertical and horizontal curve, cannot see vehicles entering the intersection from Ham Street. Likewise, vehicles entering from Ham Street have an obstructed view of Central Avenue due to a large tree near the right-of-way and vehicles on Central Avenue. Although the removal of the curve on Central Avenue is impractical, the situation could

be improved greatly by removing the tree near the intersection and eliminating parking near the intersection on Central Avenue.

11. Central Avenue - Hale Street. This intersection, on the fringe of downtown Dover and adjacent to the City Hall, is frequently congested and experiences numerous minor automobile accidents. Traffic is presently controlled by a stop sign on Hale Street. As at other intersections, the sight distance of vehicles entering the intersection is restricted by parked vehicles on the west side of Central Avenue. Prohibition of this parking near the intersection would greatly improve the operation of the intersection.

Other Proposals. Certain other proposals not included in the above categories are recommended herein for immediate implementation:

1. Signing at the Dover Point Interchange. There are four exits from the Spaulding Turnpike into Dover; at the Dover Point Road, Central Avenue, Silver Street, and the Somersworth Traffic Circle. The uninitiated driver heading north approaching the first exit at Dover Point Road is faced with a sign that indicates Dover as the next exit. Only after the vehicle passes that exit do the signs indicate that the following three exists provide access to Dover. Traffic taking the first exit must travel through the downtown area to get to destinations north of the downtown. Through proper signing, this traffic should be encouraged to utilize the other three interchanges, particularly the Somersworth interchange, which would relieve the downtown of some of the through traffic. Therefore, it is proposed that signs should be placed before the Dover Point interchange indicating that Dover can be reached by all four exits, and the wording should be such as to particularly encourage those destined to Somersworth and northern sections of Dover to use the last interchange.

2. Police Officer as Traffic Controller. The City of Dover presently spends a considerable amount of municipal revenue utilizing police officers to direct traffic at hazardous or congested intersections. This operation is necessary and the officers provide a valued service to the City. However, the efficient operation of an intersection is an extremely complex matter and the needs of each intersection vary considerably.

It is proposed that officers directing traffic, particularly along Central Avenue, carefully study the operation of the intersection, so that they may operate it in the most efficient manner.

Careful observance of such matters as the degree to which each traffic stream is favored, the handling of simultaneous turning movements, and the order in which different flows are directed can have a profound affect on the amount of traffic an intersection can accommodate.

Short-Range Improvements (1975-1985)

These improvements are proposed for the short-range, between 1975 and 1985, and reflect the second priority of circulation needs.

New Streets. The following new streets are proposed for development during the short-range time frame from 1975 to 1985.

1. Outer Connector (Phase Two). During this time frame the link of this route between Sixth Street and Knox Marsh Road should be provided. This improvement would necessitate the construction of a bridge over the Cocheco River and another bridge over the railroad line, and one and a half miles of roadway.

2. Inner Connector (Phase One). Two alternatives for this proposed route are shown on Figure 4. The purpose of these routes is to provide bypasses to the downtown area for the predominantly residential land north of the downtown area. Presently this traffic must go through the downtown to get to any destination south and thereby contributes to the CBD congestion. The proposed inner connector also links Central Avenue at both ends with Sixth Street, Fourth Street, Washington Street, and Silver Street. It is proposed that the northern section, from Sixth Street south be constructed on the short-range.

The locations of the alternative routes of the inner connector are shown only approximately since this route is proposed in a highly developed area, and locating it would required detailed study. At present, however, the southern end of the route is proposed to follow the right-of-way of the Boston & Maine Railroad spur route. Presently the track is in daily use serving the industries in the Sawyer's Mill Area, however, there is no way to speculate its degree of use in the future. Should the right-of-way become available, the City should consider acquiring it since it would provide an appropriate right-of-way for the inner connector. The amount of taking for this route would be minimal. Should the City be unable to acquire the spur route, a combination of existing streets should be considered since this southern link is necessary for the overall effectiveness of the inner connector.

There are two alternative routes proposed for the northern section of the inner connector. One follows Grove Street from just north of the railroad tracks to its end, where a new right-of-way would have to be acquired to make the connection to Central Avenue. This alternative has its disadvantages; namely poor grade at Sixth Street and the narrow right-of-way and residential character of Grove Street. The other alternative shown indicates the right-of-way following the short spur route from just north of the Cocheco River to Sixth Street where it becomes Horne Street. To avoid conflict with the elementary school at the northern end of Horne Street, the proposed route diverges from the Horne Street right-of-way and connects with Central Avenue at Glenwood Avenue. The major disadvantages of this proposal are that it would require

the taking of more residential property and might disrupt the residential character of Horne Street.

3. Relocated Lincoln Street. This street, located within the CBD, is proposed to be abandoned east of the Sawyer School on Fifth Street to improve traffic flow through the Sixth Street - Central Avenue intersection. A short new route is proposed to connect Lincoln Street to Fifth Street. (Refer to Figure 5.)

4. Oak Street Extension. This route is proposed to provide a bypass of the CBD for east-west traffic. By connecting the CBD radial routes (Central Avenue, Broadway, Portland Avenue, Atlantic Avenue, Henry Law Avenue, and Court Street) and creating a semicircle north of the CBD, this route should create an effective circumferential for the downtown area. It is proposed that the link between Henry Law Avenue and Court Street be constructed in the short-time range (1975 to 1985).

The location indicated in Figure 4 shows Oak Street at Atlantic Avenue extended across the Cocheco River, Henry Law Avenue, and Court Street to Watson Street. From there it follows Watson Street to Central Avenue.

Improvement of Existing Routes. The following existing routes are proposed to be improved between 1975 and 1985.

1. Fourth Street - Pierce Street. Presently Fourth and Pierce Streets are east-west major access routes to and through the downtown area. Together with Broadway, these streets provide major east-west linkage. However, the intersection of these three streets with Central Avenue are offset, requiring two turning movements for through traffic.

Proposals developed in conjunction with the CBD Plan (see Figure 5) call for realignment of Fourth Street and the widening of both Pierce and Fourth Streets. Thus a convenient east-west route would be provided through the CBD. This improved route should also provide a bypass for trucks of the low Broadway railroad bridge (see next item). This improvement and the proposed increased bridge clearance should considerably facilitate truck travel in the area. The improved routes should continue to function as collector streets.

2. Broadway at Railroad Bridge. On Broadway, just west of Pierce Street, the Boston & Maine Railroad tracks cross over the railway via an old stone bridge. The 9-foot, 6-inch clearance of this bridge above the roadway is so low that trucks from the industries and commercial areas downtown must use alternative routes. Quite frequently trucks attempt to drive under the bridge and become jammed beneath it. The desirable bridge clearance for new bridges is 14 feet, which is four and one-half feet higher than the existing clearance. Although obtaining this clearance is highly impractical, it is proposed that the roadway be excavated

within the vicinity of the birdge to obtain the greatest clearance practicable. An additional one and one-half to two feet of clearance would make a considerable difference, although some trucks would not be able to clear it. The allowable depth of excavation would depend on the depth of utilities under the road, the position and depth of the bridge footings, and the elevation of abutting properties.

3. Sixth Street and Glenwood Avenue. The development of the northern portion of the outer connector should considerably increase the traffic volume on Sixth Street and Glenwood Avenue by providing linkages to the CBD and Miracle Mile. These routes should be functioning as major arterials and, therefore, should be widened to accommodate the anticipated increased traffic flow. The narrow pavement on Glenwood Avenue is particularly deficient in this regard.

4. Watson Street Improvement. In conjunction with the proposed Oak Street Extension, it is recommended that Watson Street (which is the western portion of that extension) be improved. Although the road passes through a cemetery, there appears to be adequate land to acquire additional right-of-way to increase the road capacity and reduce the curvature. In addition, the steep grade at Central Avenue would have to be lessened.

5. Washington Street Bridge. In the opinion of state bridge engineers, the existing Washington Street Bridge over the Cocheco River is in a deteriorating condition and its structural safety during the short-range period is questionable. Therefore, it is felt advisable to periodically evaluate the structural capacity of the bridge and either replace or repair it when justified.

Intersection Improvement. The following intersection improvement is proposed for the time from 1975 to 1985. This improvement is noted on Figure 6.

Rochester Road - Old Rochester Road. This intersection is presently controlled by a stop sign on Old Rochester Road and a blinking red light on Rochester Road. The intersection is potentially dangerous with several factors contributing to that danger. The sight distance on all approaches is only fair, the angle of intersection is poor (about 30 degrees), the relative speed differential is high, and the area of conflict is extremely large. The site distance could be improved by enforcement of requirements for not placing or planting any obstruction within the "sight triangle." If the sight distance cannot be sufficiently improved to allow safe operation and the future traffic volumes warrant it, signalization of this intersection may be necessary. To reduce the area of conflict, channelization is also proposed.

Long-Range Improvements

The following improvements are proposed for long-range

development in the City of Dover beyond 1985.

New Streets. The following new streets are proposed for long-range development.

1. Outer Connector (Phase Three). In this time frame, it is proposed that the southern section of the outer connector from Knox Marsh Road to Durham Road be constructed. A bridge over the Cocheco River will be required. Development of this link would complete the outer connector.

2. Inner Connector. The southern and final section of the inner connector from Sixth Street to the southern end is proposed for this time frame. It is anticipated that the railroad right-of-way might be available for City acquisition at this time.

3. Oak Street Extension. The completion of the Oak Street extension is proposed for long-range completion also. This would include the development of the link from Atlantic Avenue to Henry Law Avenue. A bridge over the Cocheco River would be required with the link.

Improvement of Existing Streets. The following existing route is proposed for long-range improvement.

Oak Street. In conjunction with the completion of the Oak Street extension, it is proposed that Oak Street be improved to complete the circumferential about the downtown. The existing route should be widened and the poor horizontal alignment corrected in order to accommodate the increase in volume created by the completion of the circumferential. The intended function of Oak Street will be as a major arterial.

CBD Street System. The long-range circulation pattern of the CBD is shown on Figure 8. The commercial core of the downtown is expected to be located in the block between Chestnut Street, First Street, Central Avenue, and Third Street. This would represent a shift north and west of the existing core. As this shift occurs, the Chestnut Street extension and Central Avenue should increasingly function as local circulation routes about the downtown providing easy access to parking areas and commercial facilities. To facilitate this access, the existing one-way direction of traffic flow is proposed to be altered. The Chestnut Street extension, which up to the long-range period would be two-directional, is proposed for one-way operation south from Sixth Street to Hale Street. To complete the circular flow pattern, Hale Street is proposed to operate one-way east, and Central Avenue between Hale and Sixth Streets is proposed to reverse its existing direction of flow and operate one-way north. Washington Street and Main Street would continue to operate in the existing one-way direction. This reversal of the one-way street pattern will require rechannelization of Upper and Lower Squares and resetting and retiming of traffic signals.

Intersection Improvements. The following intersections are proposed for long-range improvement.

1. Elimination of Somersworth Traffic Circle. The completion of the inner and outer connectors should create a large increase in traffic using the Somersworth Circle. The existing traffic situation at the circle is hazardous and congested and the expected increase in flow should render the circle almost inoperable. It is therefore proposed that in the long-range a standard one-way intersection be developed. It is expected that an at-grade channelized and signal-controlled intersection could accommodate the traffic. With this improvement, the safety and capacity of the interchange would be enhanced and less land would be consumed by street right-of-way.

2. Knox Marsh Road - Littleworth Road. The proposed outer connector and development of industry in the areas should place increased demands on the Knox Marsh Road - Littleworth Road intersection. At peak periods the intersection is presently congested, but the inconvenience is short in duration and can be controlled by a police officer. However, in the future the traffic demand on this intersection could warrant the installation of traffic signals.

Impact of Proposed Circulation Facilities

Access to, through, and within the City of Dover should be greatly enhanced by the proposed circulation facilities. The Chestnut Street extension should enhance the vitality of the CBD by providing local access to the downtown commercial and industrial facilities. The inner connector should provide access to Miracle Mile, the CBD and the Spaulding Turnpike. The most beneficial effect however, should be the removal of considerable through traffic from the downtown area, thus relieving the growing congestion problem. The outer connector should improve access for the growing industrial and residential uses west of the Spaulding Turnpike. In addition, travel to Somersworth, Durham, and the Spaulding Turnpike should be facilitated. The Oak Street extension should partially ease the growing demand for east-west travel within and through the City. The growth of through traffic is due in part to the increase in travel between the Dover - Somersworth - Rollinsford area and Durham.

The proposed facilities should also have an impact on land development. In this regard, the outer connector and Oak Street extension are most important. The development of the outer connector, by linking the turnpike with all the radial routes, should be paralleled with associated industrial, commercial, and residential growth. Construction of this route should provide the necessary stimulus to the development of the predominantly undeveloped area west of the turnpike. The Oak Street extension should provide a similar catalyst to the development east of the CBD.

Terminal Facilities

The adequacy of parking and loading (terminal facilities) in Dover is evaluated in this section. Four areas of major parking demand were studied.

CBD

Industrial Park Area

Miracle Mile Area

Sawyer's Mill Area

The area of major parking demand, and therefore, major emphasis herein, is the CBD. Outside the CBD parking appears adequate during normal times of operation. Spaces were counted as shown in Table 2, but due to the adequacy of spaces, further study of areas outside the CBD was not undertaken.

Most of the data utilized herein were compiled by Metcalf & Eddy, Inc., during a parking survey conducted on Friday, November 13, 1970. A Friday was selected because the downtown stores remained open at night and, therefore, it was thought that this day would reflect the highest downtown parking demand.

Supply of Parking Spaces

The locations of existing on- and off-street parking facilities within the CBD are shown on Figure 6. The off-street spaces are classified by the type of parking (angle, parallel, unmetered) and the off-street spaces are categorized by the intended use of the lot.

A tabulation of total CBD parking spaces, listed by type, is shown in Table 2. The supply of spaces outside of the CBD is also shown.

In the CBD there are 939 on-street spaces and 1,500 off-street spaces. The on-street parking spaces are tabulated according to time limitation. The off-street parking is classified by ownership and use.

Public off-street parking spaces include all parking lots open to the general public. The private commercial off-street facilities are reserved for customers and employees of various businesses, whereas private industrial parking is for employees and visitors of industries.

Parking Accumulation

The CBD parking accumulation for off-street private, curb,

and off-street public spaces is shown on Figure 7. The total use is also shown representing the sum of the above three curves.

Off-street private parking accumulation rises and falls sharply with the workday and experiences an appreciable decrease in demand during the lunchtime period. Curb parking accumulation rises more slowly in the morning, experiences a slight noontime decline, then a slow decline to dinnertime, and a slight increase caused by evening shoppers.

Off-street public parking experiences the least fluctuation in accumulation with minor decrease at noontime and dinnertime. This lack of variation is in part caused by long-term parking in the First Street lot.

The total parking accumulation reflects the variations in the three types of parking spaces. The accumulation rises sharply, reaching the daily peak at about 11:00 AM. A slight decrease is then experienced from 11:00 AM to 3:00 PM, then a rapid decline until about 6:30 PM, when the demand for shoppers' parking increases the usage. At the peak period, 63 percent of all parking spaces are occupied. This figure represents a balance of downtown core parking spaces which have high percentage occupancy and the fringe parking spaces which have low percentage occupancy.

Occupancy of Parking Spaces

Parking space occupancy, the percent of time during the study period in which the space is occupied, is an important indicator of the demand for individual parking spaces and areas. From this data, one can determine how parking space usage relates to location of the space.

Generally curb parking throughout the study area had the highest occupancy. More particularly, the occupancy of the curb spaces at the Central Avenue - Washington Street intersection was the greatest in the study area. These spaces were occupied approximately 90 percent of the study period, which due to inefficiency of vehicle access and egress, is very close to the practical capacity of curb spaces. For all curb spaces the area of highest occupancy was, as would be expected, along Central Avenue between Upper Square and St. Thomas Street (approximately 85 percent). Other spaces of high occupancy were in front of the Post Office (87 percent), on Central Avenue between Upper Square and St. Thomas Street (85 percent), along Athinson Street and lower St. Thomas Street (85 percent), along Fourth Street (85 percent), and spaces adjacent to City Hall (80 percent).

Of the public off-street lots the highest use, 81 percent, occurred in the small Broadway Street lot, which is unmetered. The high occupancy is probably caused by long-term parkers. A 72 percent occupancy existed in the municipal lot between Central Avenue and Locust Street, which is exceptionally high considering the 15

Table 2. Parking Supply

Area	Approximate number of spaces
Central Business District	
Curb Parking	939
10-hour meter	30
2-hour meter	327
1-hour meter	243
15-minute meter	12
Unmetered	327
Off-Street Parking	1,500
Public, 10-hour meter	71
2-hour meter	75
15-minute meter	24
Unmetered	15
Leased	76
For Official Use	135
Private, Commercial for customers and employees	716
Industrial for employees and visitors	388
Total Downtown Spaces	2,439(1)
Miracle Mile Area	1,607
Sawyer's Mill Area	448
Industrial Park Area	414

(1)Difference between this total and total for parking survey conducted in conjunction with the Urban Renewal Project is due to a slight variation in the study area.

minute parking limit, which although increasing space turnover, considerably reduces the practical capacity of the lot. The Third Street lot had an overall occupancy of 64 percent, which remained fairly constant throughout the study period. The First Street lot had a lower occupancy, 56 percent, which was considerably reduced by the leased spaces which became predominantly vacant after work hours. Off-street lots adjacent to the City Hall averaged about 55 percent occupancy, but were almost completely occupied during the work hours.

Private off-street parking had overall low occupancy because most were used by employees who vacated the lots after work. However, during the work hours, the occupancy was, of course, much higher, in most lots over 80 percent.

Supply Versus Demand for Parking

The demand for parking is the amount of parking that is generated by the various land uses in the CBD. Parking use is only a measure of what is existing, whereas parking demand is what would be used if the parking facilities were available and convenient.

Based on the existing number of CBD trip destinations,* parking demand in Dover was estimated. As in most central business districts, this study indicated an oversupply of parking spaces in the study area. However, this does not indicate that additional parking areas are not needed. Parking facilities must not only be adequate in supply, but must also be convenient to the destination of parkers. In Dover, the surplus spaces are created by parking in the fringe areas of the downtown, which are too far removed from the shopping and employment facilities to be fully utilized. In reality there is a deficiency of spaces convenient to the core of the CBD, between Upper and Lower Squares. This deficiency is presently estimated at about 100 spaces; however, it should increase as circulation improvements are implemented which require removal of some street parking spaces.

Another marked deficiency of parking spaces also exists adjacent to the City Hall. Approximately forty additional off-street spaces should satisfy the parking demand in this area.

Parking Proposals

There are two considerations which affect the proposals for new parking facilities: the deficiency of spaces in the core area and the removal of curb parking in the CBD caused by traffic improvements.

The existing deficiency in the core area, noted by the gap of demand over supply and the high occupancy rate in these areas, should be relieved by providing about 100 off-street parking spaces in the block between Central Avenue, Washington Street, Walnut Street, and the Cocheco River. It is desirable to locate these spaces within 200 feet of the Central Avenue - Washington Street block faces.

To improve flow of traffic and reduce existing congestion on Central Avenue, it is proposed that the existing angle parking on Central Avenue be replaced by parallel parking. This will create an additional deficiency of about 50 parking spaces. It is intended that the spaces not be removed until alternative spaces are provided. Preferably these spaces should also be provided with 200 feet of the core area. Additional intersection improvements to be discussed later in this report should remove about another 30 spaces from the CBD. Replacement spaces for those lost should be made available at the time the improvements are undertaken.

*Data from the Dover-Somersworth Transportation Study.

The Downtown Dover Urban Renewal Project which is presently in the planning phase, will most likely alter the land uses in the downtown area and, therefore, the demand for parking. Clearance of substandard structures in the project area should release land for provision of the required spaces and any additional parking demand generated by the project.

Provision of the forty additional spaces for City Hall use could be made in conjunction with the development of the southerly end of the Chestnut Street extension. The alignment of this new route in the City Hall area should be designated so that additional land could be available to meet the parking demand.

Loading Facilities

Loading facilities in Dover were evaluated in regard to the degree with which their location disrupted the flow of traffic. In this regard most of the problems were within the downtown area. Location of areas where loading has a detrimental effect on traffic is shown on Figure 6. The most critical of these areas is on Fourth Street adjacent to the Swift & Company building, on Central Avenue in front of Herb's Super Market, on Locust Street in back of the State Liquor Store, and along Washington Street between Central Avenue and Walnut Street. There is little that can be done about the Fourth Street and Locust Street loading problems. The roadways are narrow, land areas small, and goods are usually delivered by a large truck or semi-trailer. What can be done, however, is to discourage deliveries at times of high traffic flow.

On Central Avenue and Washington Street, on-street loading areas can be provided, depending on the frequency of deliveries. This, of course, would necessitate the sacrifice of on-street parking spaces.

In general, curb loading spaces should be provided only when:*

1. No alley or off-street loading space is available.

2. No other curb loading space exists within 100 feet of the proposed loading zone without crossing a street or alley.

3. There will be a minimum of 10 to 15 stops per day.

In the future, it is expected that by enforcement of the loading requirements of the zoning ordinance, older structures presently relying on curb loading facilities will be replaced with structures with sufficient off-street loading facilities.

*Recommendation from the Institute of Traffic Engineers, Traffic Engineering Handbook.

Implementing the Plan

To be of any service to the community, the Circulation Plan must, of course, be implemented. The various tools to aid in this implementation process are discussed below.

Priorities

The improvements recommended above are listed in three time frames which represent three degrees of priority. These priorities are based on the degree of community need for the improvement and the amount of benefit expected.

Planning Standards

Planning standards for circulation and terminal facilities are presented in Appendix Tables A-1 through A-4. These standards are intended for use by the City in developing new streets or upgrading existing ones. They are also intended to provide a basis for review of circulation-related requirements in the Dover Zoning Ordinance and Subdivision Regulations.

Official Mapping

An official map is a document, adopted by the City Council, that pinpoints the location of future streets and other public facilities. In effect, the map informs developers that the City intends to acquire certain specified property in the future. When used realistically, an official map can serve as a positive influence to sound development of future public facilities.

In the recent past the City has not adopted an official map, although there is provision for adoption in the New Hampshire Planning Legislation (R.S.A. Chapter 36). In view of the roads proposed in the Circulation Plan, particularly those in existing undeveloped areas, it would be judicious for the City to locate the proposed roads and designate them on an official map. This would entail a location survey and study for the proposed routes, since exact locations must be shown on the official map.

Urban Renewal

The current Downtown Dover Urban Renewal Project should implement the circulation proposals which fall within the project boundary. As a result, the City would receive benefit of the two-thirds federal share for the development of eligible improvements.

TOPICS Program

The TOPICS Program (Traffic Operations Program to Increase Capacity and Safety), established by the Federal Aid Highway Act of 1968, provides federal assistance to communities for improvement of traffic operations on existing streets. The City of Dover,

having prepared the Dover-Somersworth Transportation Study, is eligible for these funds, and to date has applied for the improvement of three intersections: Portland Avenue - Portland Street, Central Avenue - Silver Street, and Durham Road - Back River Road - Central Avenue. Other intersection improvements, recommended herein in conjunction with the Dover-Somersworth Transportation Study, should be eligible for TOPICS funds and appropriate applications are recommended.

Periodic Upgrading

Many of the deficiencies indicated in the street system inventory (narrow pavement, poor horizontal and vertical alignment, poor grade, etc.) have not been dealt with herein because of their minimal relationship to the overall circulation system. However, this does not mean that such problems cannot or should not be corrected. It is advisable, therefore, that the City of Dover maintains a periodic street improvement program to correct some of the deficiencies noted. Based on accident rates, traffic volumes at these locations, and the City's financial capacity, progressive upgrading of the complete street network should be attempted.

Table A-1. Street Cross-Sectional Design Standards

Characteristic	Collector: Urban/industrial areas	Collector: Rural areas	Local
Type	Full access	Full access	Full access
Design speed	40	50	40
Average daily traffic (approximate)	2,500 to 10,000	600 to 2,500	Under 600
Right-of-way width, feet	60 to 72	60	50
Moving lanes:			
Number	2	2	2
Width (each), feet	12	12	12
Parking lanes:(1)			
Number	2	1	1
Width (each), feet	10	10	8
Shoulder width (each), feet	9	9	9
Total width of pavement (including shoulders), feet	40 to 44	34 to 40	32
Planting strip width (each), feet	4 to 10	3 to 8	3 to 8
Sidewalk width (each), feet(2)	6	5	5
Curbing required	Urban areas only		

(1) Parking lanes are to be part of the standard cross-section in place of right-hand shoulders for urban roadways.

(2) Subdividers should be required to construct sidewalks on at least one side of the street right-of-way in front of lots less than one-half acre where the net residential density is greater than two families per acre. Sidewalks are to be placed within the planting strips for urban roadways.

Note: Design standards for expressways shall be determined by the New Hampshire Department of Public Works and Highways.

Source: Generally accepted cross-sectional standards adjusted by Metcalf & Eddy, Inc. to reflect the needs of Dover.

Table A-2. Recommended Geometric Design Standards

Characteristic	Collector: Urban/industrial areas	Collector: Rural areas	Local
Horizontal alignment			
Minimum radius at center line, feet	500	880	500
Vertical alignment			
Clear sight distance at 4.5 feet above pavement, feet	275	350	275
Grade			
Maximum percent	4	4	6
Minimum percent	0.5	0.5	0.5
Intersection			
Minimum intersection angle, degrees	60	60	60
Minimum center line offset, feet	125	125	125
Minimum radius at edge of roadway, feet	50	30	25
Sight distance, feet	400	650	400
Dead-end streets			
Maximum length, feet	Not permitted	Not permitted	400
Minimum turnaround radius at edge of roadway, feet	-	-	60

Source: Generally accepted geometric design standards adjusted by Metcalf & Eddy, Inc. to reflect the needs of Dover.

Table A-3. Off-Street Parking Regulations

	Uses	Number of spaces per unit
1.	Single- and two-family dwelling	One and one-half for each dwelling unit
2.	Multifamily dwelling	One and one-half for each dwelling unit
3.	Lodging house	One and one-half for each lodging unit
4.	Theater, restaurant, auditorium, church, or similar place of public assembly with seating facilities	One for each four seats of total seating capacity
5.	Automotive retail and service establishment and other retail and service establishments utilizing extensive display areas, either indoor or outdoor, which are unusually extensive in relation to customer traffic	One per 1,000 square feet of gross floor space. In the case of outdoor display areas, one for each 1,000 square feet of lot area in such use
6.	Other retail, service, finance, insurance, or real estate establishment	One per each 300 square feet of gross floor space
7.	Hotel, motel, tourist court	One for each sleeping room plus one for each 400 square feet of public meeting room and restaurant space
8.	Wholesale establishment, warehouse, or storage establishment	One per each 1,000 square feet of gross floor space
9.	Manufacturing or industrial establishment	One per each 500 square feet of gross floor space OR 0.75 per each employee of the combined employment of the two largest successive shifts, whichever is larger
10.	Hospital	One for each two beds at design capacity
11.	Nursing home	One for each two beds at design capacity

Table A-3. Off-Street Parking Regulations (Continued)

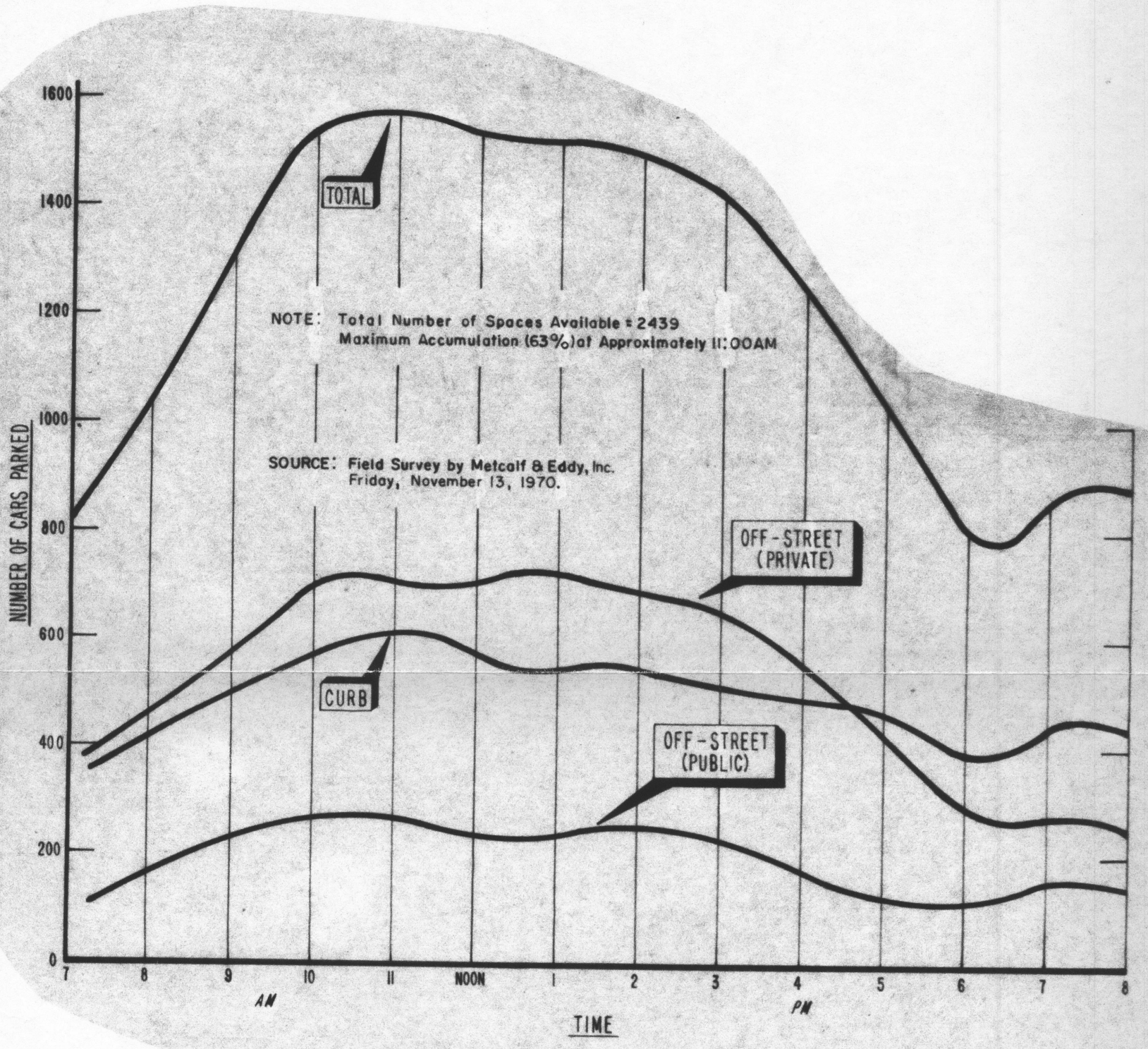
	Uses	Number of spaces per unit
12.	Business, trade, or industrial school or college	One for each 200 square feet of gross floor area in classrooms
13.	Other school	Two per classroom in an elementary and junior high school; four per classroom in a senior high school plus space for auditorium or gymnasium, whichever has the larger capacity
14.	Community facility (town building, recreation, etc.)	One per each 400 square feet of gross floor space
15.	Dormitory, fraternity, sorority, YMCA, or similar use	One for each sleeping room
16.	Public utility	One for each 400 square feet of gross floor area devoted to office use One for each 800 square feet of gross floor area per other use
17.	Transportation terminal establishment	One for each 600 square feet of gross floor area
18.	Mixed use	Sum of various uses computed separately

Source: Nationally-recognized standards adjusted by Metcalf & Eddy, Inc. to reflect the needs of Dover.

Table A-4. Off-Street Loading Standards

Use	Number of spaces per unit
Retail trade, manufacturing and hospital establishment with over 5,000 square feet of net floor area	One per 20,000 square feet or fraction thereof of net floor area up to two spaces; one additional space for each 60,000 square feet or fraction thereof of net floor area over 40,000 square feet
Business services, other services, community facility (school, church, town building, recreation, etc.) or public utility establishment with over 5,000 square feet of net floor area	One per 75,000 square feet or fraction thereof of net floor area up to two spaces; one additional space for each 20,000 square feet or fraction thereof of net floor area over 150,000 square feet

Source: Nationally-recognized standards adjusted by Metcalf & Eddy, Inc. to reflect the needs of Dover.



DOVER NEW HAMPSHIRE

CBD
PARKING
ACCUMULATION

NOV., 1970

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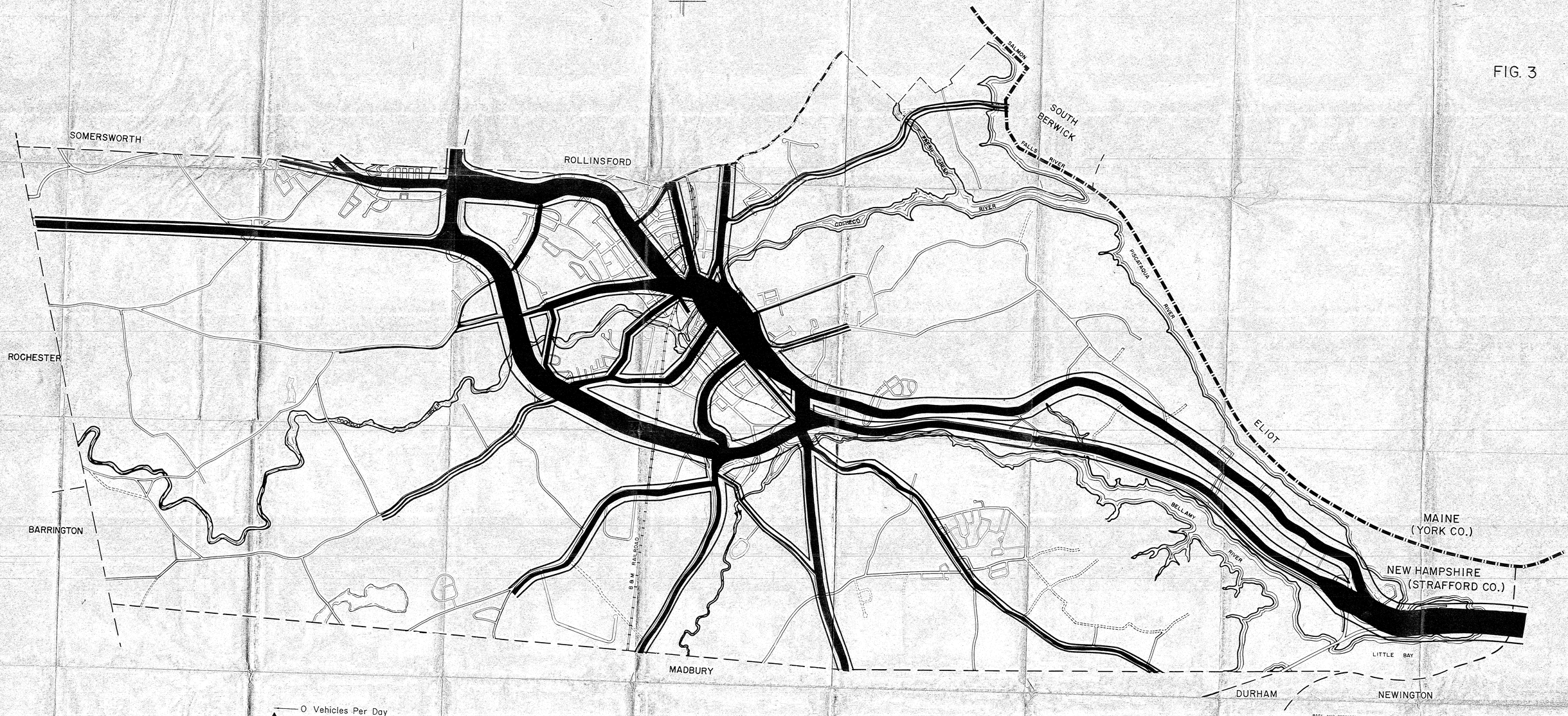
FIG. 3

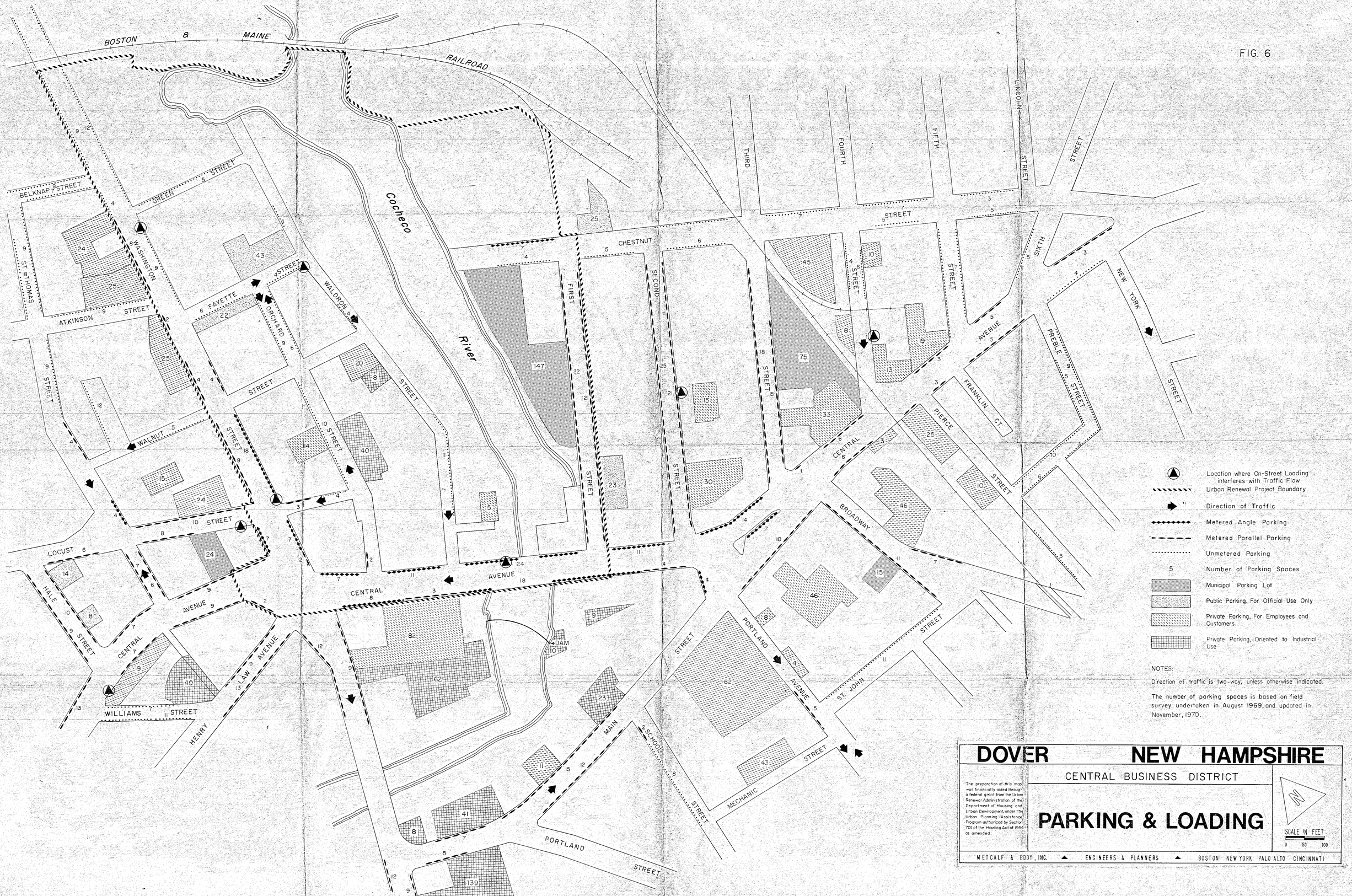


BASE MAP PREPARED BY THE STAFF OF THE DOVER PLANNING BOARD

DOVER NEW HAMPSHIRE

The preparation of this map was financially aided through a federal grant from the Urban

FIG. 6



Location where On-Street Loading interferes with Traffic Flow

Urban Renewal Project Boundary

Direction of Traffic

Metered Angle Parking

Metered Parallel Parking

Unmetered Parking

5 Number of Parking Spaces

Municipal Parking Lot

Public Parking, For Official Use Only

Private Parking, For Employees and Customers

Private Parking, Oriented to Industrial Use

NOTES:

Direction of traffic is two-way, unless otherwise indicated.

The number of parking spaces is based on field survey undertaken in August 1969, and updated in November, 1970.

DOVER NEW HAMPSHIRE

CENTRAL BUSINESS DISTRICT

PARKING & LOADING

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N

SCALE IN FEET
0 50 100

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FIG. 5

BOSTON & MAINE RAILROAD

Cocheco River

BELKNAP STREET

GREEN STREET

RELOCATED GREEN STREET

WASHINGTON STREET

ST. THOMAS

ATKINSON STREET

FAYETTE STREET

ORCHARD STREET

WALDRON STREET

CHESTNUT STREET EXTENSION

CHESTNUT STREET

PROPOSED CHESTNUT ST. BRIDGE

WALNUT STREET

MYRTLE STREET

LOCUST STREET

HALE STREET

CENTRAL AVENUE

NEW CENTRAL AVE. BRIDGE

DAM

WILLIAMS STREET

HENRY LAW AVENUE

NEW WASHINGTON ST. BRIDGE

PORTLAND STREET

MAIN STREET

SCHOOL STREET

MECHANIC STREET

PORTLAND AVENUE

ST. JOHN STREET

BROADWAY

CENTRAL AVENUE

FIRST STREET

SECOND STREET

THIRD STREET

FOURTH STREET

FIFTH STREET

SIXTH STREET

LINCOLN STREET

NEW YORK AVENUE

PREBLE STREET

FRANKLIN CT.

PIERCE STREET

New Street

Existing Street to be improved

One-way Traffic, all other streets two-way

Intersection to be improved

DOVER NEW HAMPSHIRE

CENTRAL BUSINESS DISTRICT

CIRCULATION PLAN

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FIG. 2

SOMERSWORTH

ROLLINSFORD

SOUTH BERWICK

SALMON FALLS RIVER

ROCHESTER

COCHECO RIVER

PISCATAQUA RIVER

ELIOT

BARRINGTON

B & M RAILROAD

MADBURY

BELLAMY RIVER

MAINE (YORK CO.)

NEW HAMPSHIRE (STRAFFORD CO.)

LITTLE BAY

DURHAM

NEWINGTON

BASE MAP PREPARED BY THE STATE OF NEW HAMPSHIRE PLANNING BOARD

Expressway

Major Arterial

Collector

Local

DOVER NEW HAMPSHIRE

EXISTING STREET CLASSIFICATION

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SCALE IN FEET

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DECEMBER 1970

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Base to be separated