MASTER PLAN 1988
FOR THE
CITY OF DOVER, NEW HAMPSHIRE

TRANSPORTATION

Adopted by the
Dover Planning Board
November 22, 1988

This plan was prepared by the
Storch Associates and Fredette Associates, Inc
under the auspices of the
Dover Planning Board and Planning Department

RESOLUTION

RESOLUTION: TO ADOPT THE TRANSPORTATION CHAPTER OF THE DOVER MASTER PLAN

WHEREAS: The Planning Board and Planning Department in conjunction with Storch Associates have written and completed in accordance with RSA 674:3, the Transportation Chapter of the Dover Master Plan; and

WHEREAS: A concerted effort was undertaken to include participation by the general public; and

WHEREAS: A formal public hearing on said Chapter, in accordance with RSA 675:6, was held before the Planning Board on November 8, 1988.

NOW THEREFORE, BE IT RESOLVED BY THE DOVER PLANNING BOARD, THAT:

1. The Transportation Chapter of the Master Plan consisting of:

   Technical Memorandum No. 1, Problem Intesection Locations;

   Technical Memorandum No. 2, Central Avenue Corridor Study; and

   Technical Memorandum No. 3, Littleworth Road(NH Rt.9) Corridor Study, is adopted and certified in accordance with RSA 674:4; and

2. The Planning Board Chairman is authorized to sign and label as "adopted" the final reproduced documents of said Chapter; and

3. The Planning Department is authorized to develop an abbreviated summary of the said Chapter.

November 02, 1988 — Harold Preston

Date of Planning Board Action — Planning Board Chairman

Members in Favor: Seven - all present

Members Opposed: None

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TECHNICAL MEMORANDUM NO. 1 - PROBLEM INTERSECTION LOCATIONS

Technical Memorandum No. 1

PROBLEM INTERSECTION LOCATIONS

I. Introduction

A. Background

In January, 1988, the City of Dover retained the consulting firms of Storch Associates of Manchester, New Hampshire and Fredette Associates, Inc. of Salem, New Hampshire to provide technical input into the Transportation Component of the 1988 Master Plan. This technical input may be expressed in the following task objectives:

Task 1. Identify existing conditions and recommend improvements for twelve problem intersection locations.

Task 2. Investigate options for improving traffic flow in the downtown Central Avenue Corridor, including land widening, one-way circulation pattern, or new bypass roadway.

Task 3. Identify long range highway improvement needs for the Route 9 Corridor in the City of Dover per major industrial rezoning proposed in the Master Plan.

This Technical Memorandum No. 1 - Problem Intersection Locations documents the results of Task 1 of the Transportation Component.

B. Methodology

Technical Memorandum No.1 - Problem Intersection Locations, generally consists of an inventory of existing conditions at twelve problem intersections identified by the City Planning Department for inclusion in the City's short-term capital improvement program. These intersections are identified in Maps 1 and 2 and are based in part on a recent survey by the Dover Police Department identifying twelve potentially hazardous intersections within the City. Included is the identification of existing physical problems, traffic count data, accident history, and intersection capacity for the purpose of identifying and ranking intersection improvements.

Also reported herein are recommendations for roadway and/or traffic control improvements intended to mitigate the identified intersection problems. These improvements are proposed within the context of providing the City of Dover with an outline of cost effective, near-term (through 1993) funding requirements to both alleviate existing problems and provide for anticipated traffic growth needs at these locations.

The preliminary findings and recommendations of this study task were presented to the City of Dover Transportation Committee on March 28, 1988. This Final Report reflects the input provided by the Committee at that time.

C. Other Studies

This study has made use of traffic data from the following sources:

- Automatic Traffic Recorder Counts by the New Hampshire Department of Transportation at various times from 1979 through 1987.

- Traffic Accident Summaries by the New Hampshire Department of Transportation from 1984 to 1987.

- Peak hour traffic counts conducted by the City of Dover and Strafford Regional Planning Commission between 1987 and 1988.

- "An Analysis of the N.H. Route 108 Corridor in Dover, New Hampshire", by Strafford Regional Planning Commission, December 1987.

- "Traffic Impact Analysis for the Mast Road Development Consortium, Dover, New Hampshire", by Holden Engineering and Surveying, Inc. April 1987.

D. Acknowledgements

We would like to acknowledge the advice and assistance provided by the following departments and organizations:

- City of Dover Department of Planning and Community Development.

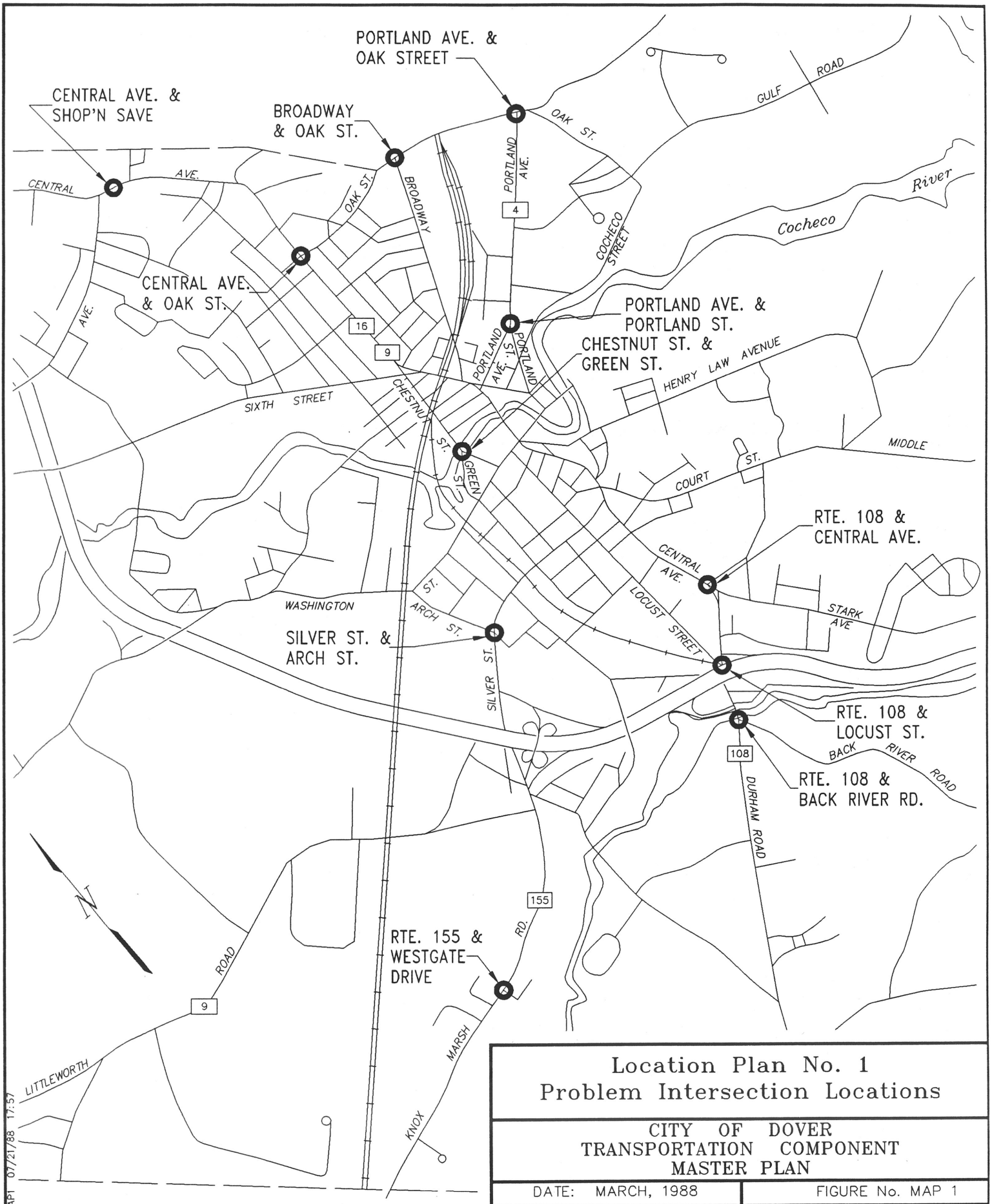
- City of Dover Department of Public Works.

- City of Dover Department of Public Safety.

- City of Dover Transportation Committee and involved citizens.

- Strafford Regional Planning Commission.

- New Hampshire Department of Transportation, Bureau of Transportation Planning.



Location Plan No. 1
Problem Intersection Locations

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. MAP 1

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

APPROXIMATE SCALE: 1"= 2000'

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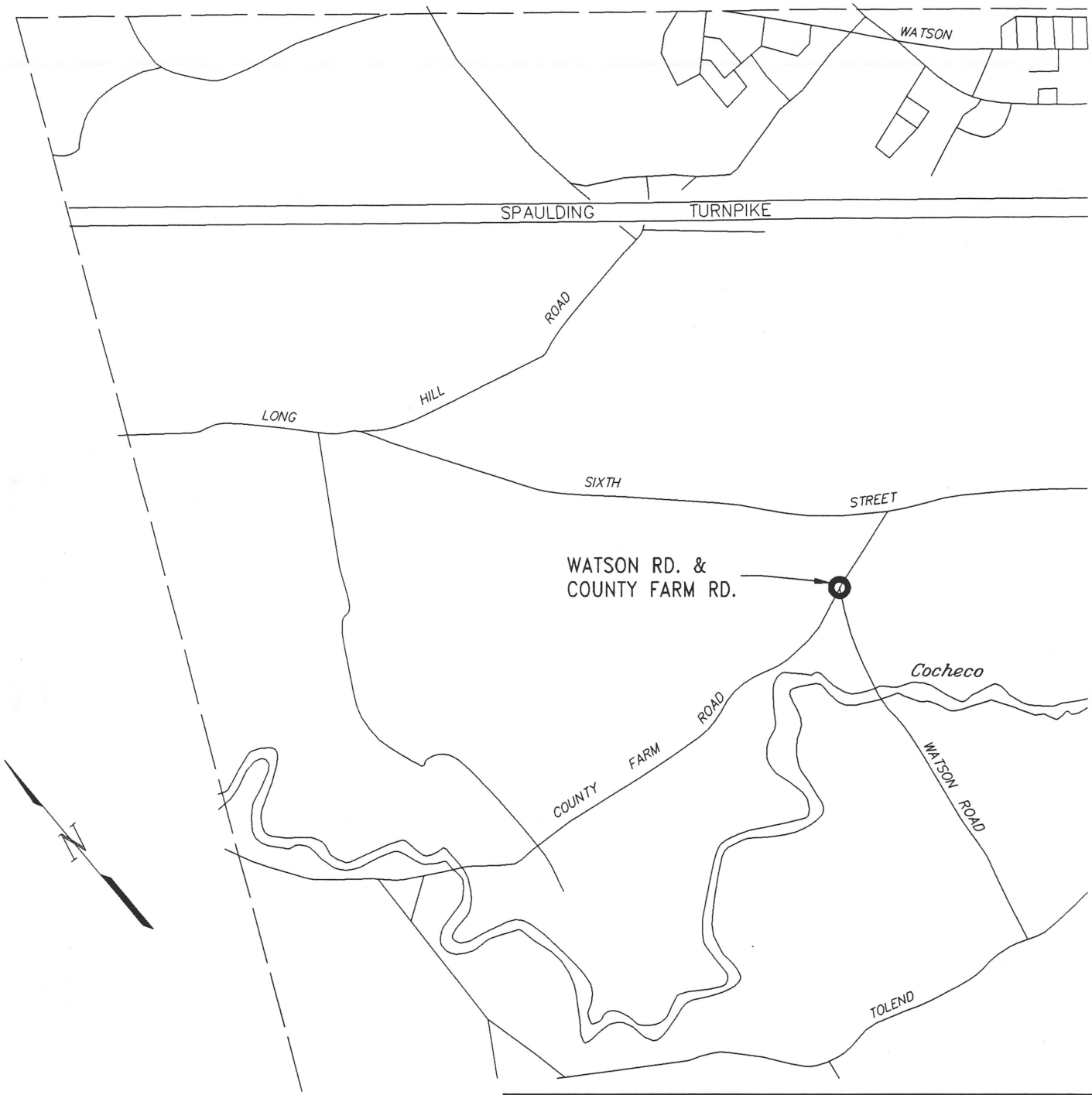

APPROXIMATE SCALE: 1"= 2000'

Location Map No. 2
Problem Intersection Locations

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. MAP 2

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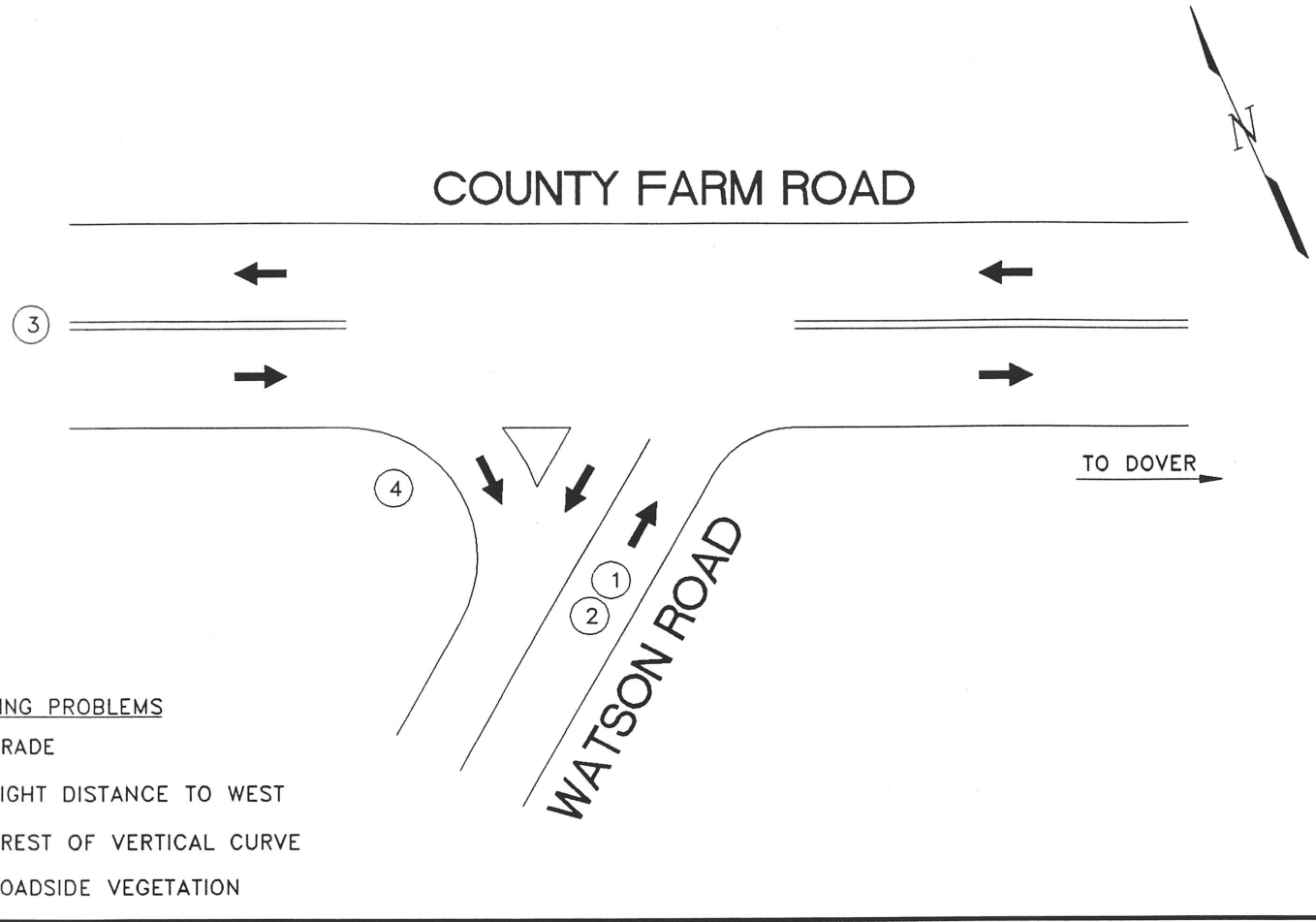
II. Problem Intersection Identification

A. Summary of 1988 Existing Conditions

The 1988 existing conditions for each of the 12 problem intersections have been summarized graphically on the 1988 Existing Conditions Plans. In addition to this, each plan identifies the key problem areas in terms of deficiencies related to physical roadway layout and traffic operations.

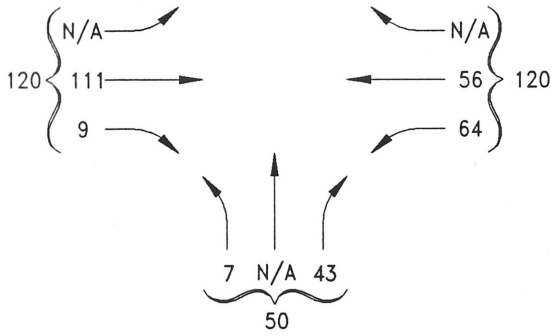
The Existing Conditions Plans for each problem intersection have been arranged in order on the following Figures 1 to 12. The following sections of this report will describe in more detail the items summarized on these figures.



EXISTING PROBLEMS

(1) GRADE
(2) SIGHT DISTANCE TO WEST
(3) CREST OF VERTICAL CURVE
(4) ROADSIDE VEGETATION

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 290

MINOR STREET
LEVEL OF SERVICE: A

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 2
PERSONAL INJURY ACCIDENTS: 2

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.577

INTERSECTION
NUMBER
1

EXISTING CONDITIONS
Watson Road at County Farm Road

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 1

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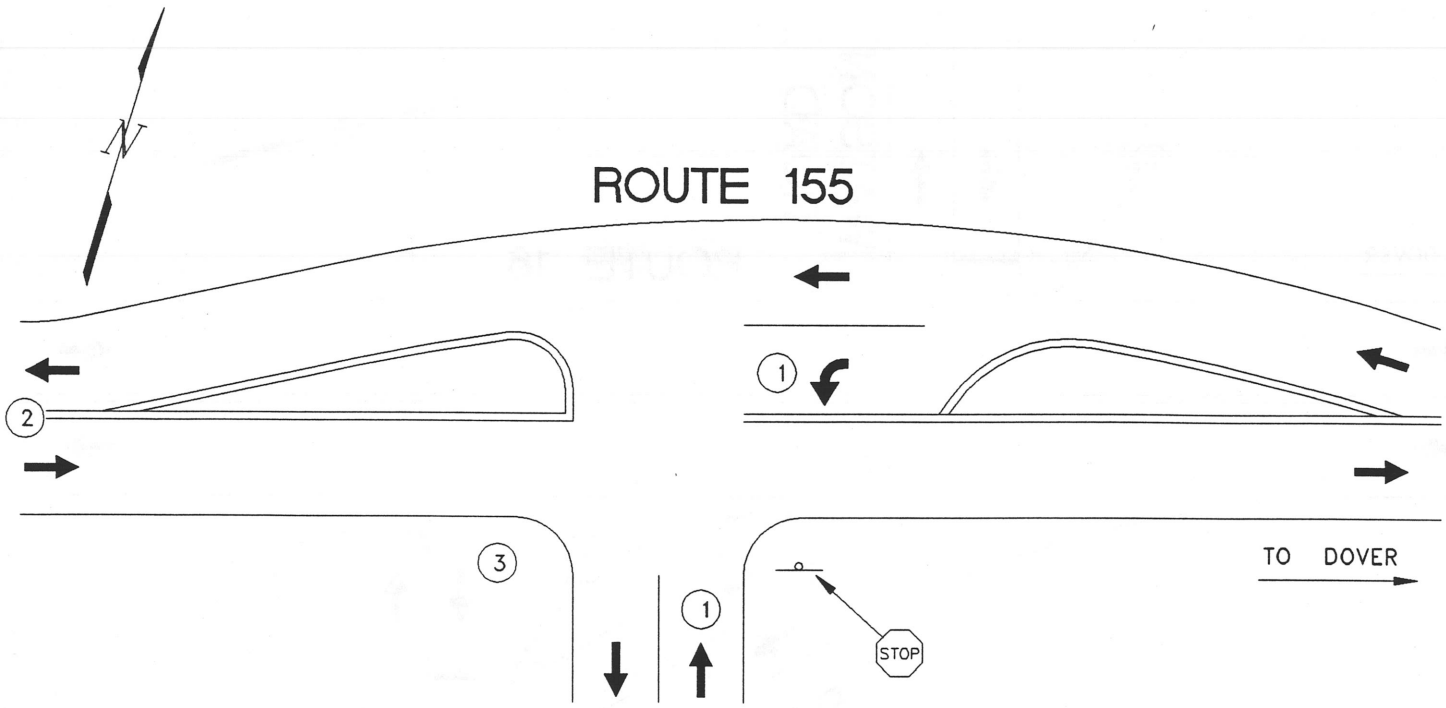


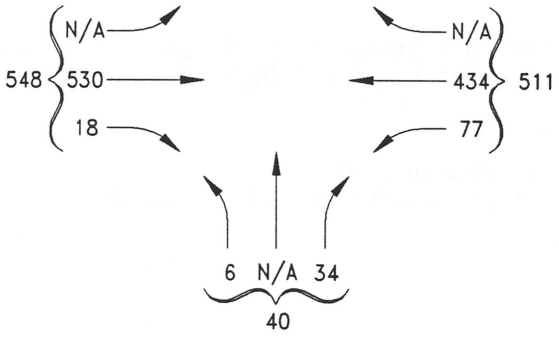
EXISTING PROBLEMS

(1) SIGHT DISTANCE TO WEST

(2) CREST OF VERTICAL CURVE

(3) RAISED FILL AREA BEHIND CURB

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1099

MINOR STREET
LEVEL OF SERVICE: D

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 5
PERSONAL INJURY ACCIDENTS: 3

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.381

INTERSECTION
NUMBER
2

EXISTING CONDITIONS
Route 155 at Westgate Apartments

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 2

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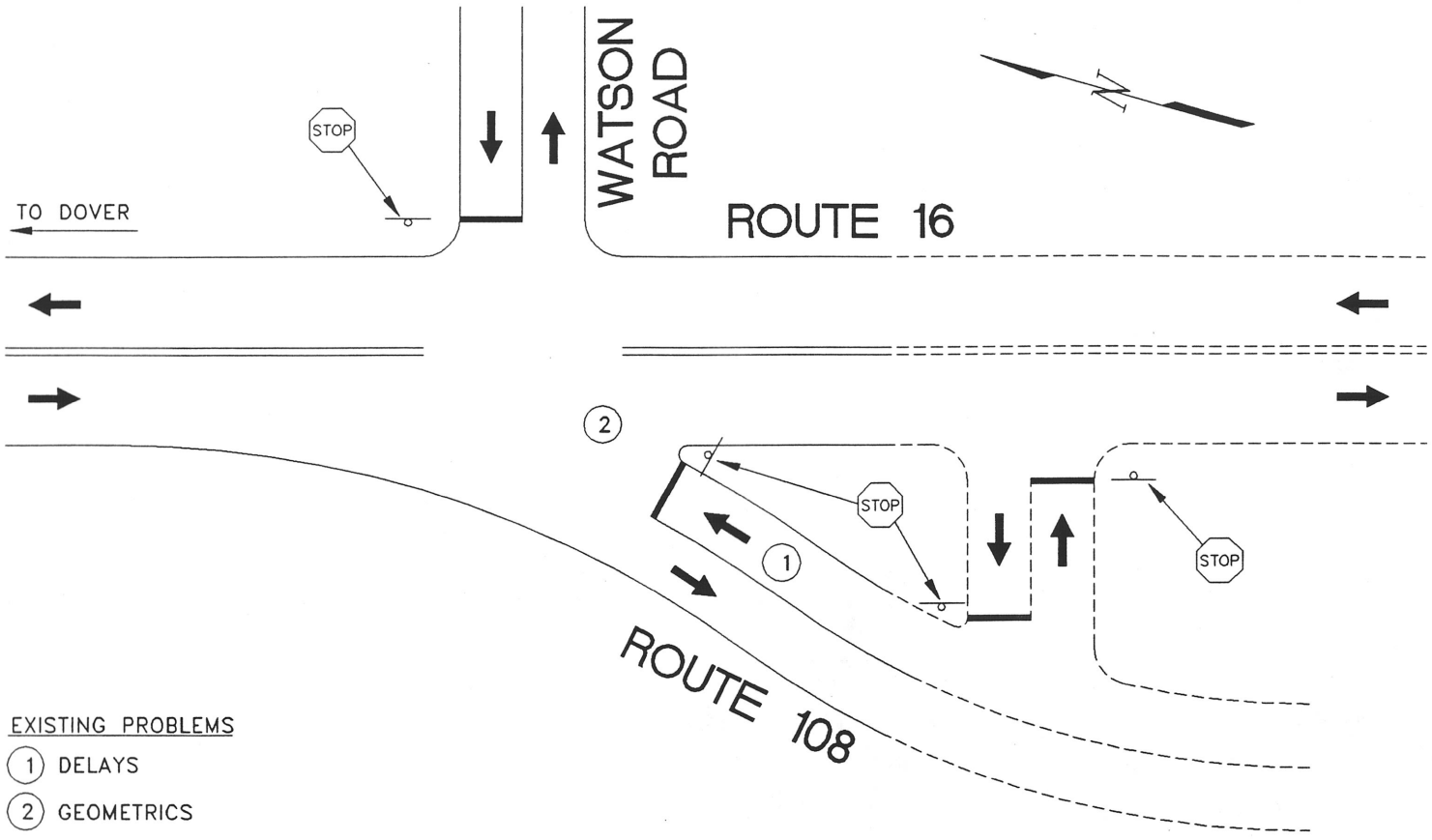
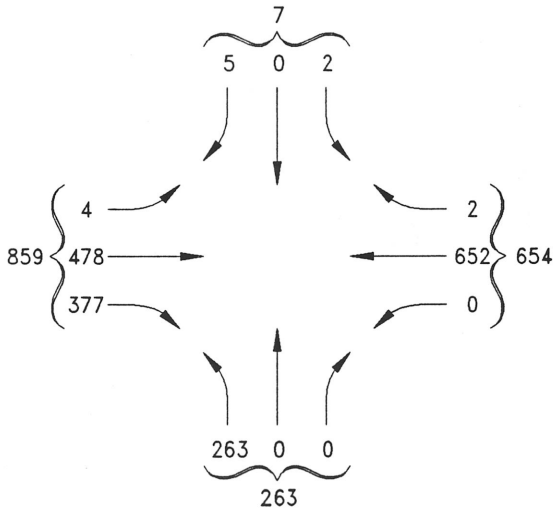


EXISTING PROBLEMS

(1) DELAYS

(2) GEOMETRICS

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1783

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 23
PERSONAL INJURY ACCIDENTS: 3

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 1.079

INTERSECTION
NUMBER
3

EXISTING CONDITIONS
Route 108 at Route 16

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 3

FREDETTE ASSOCIATES, INC.
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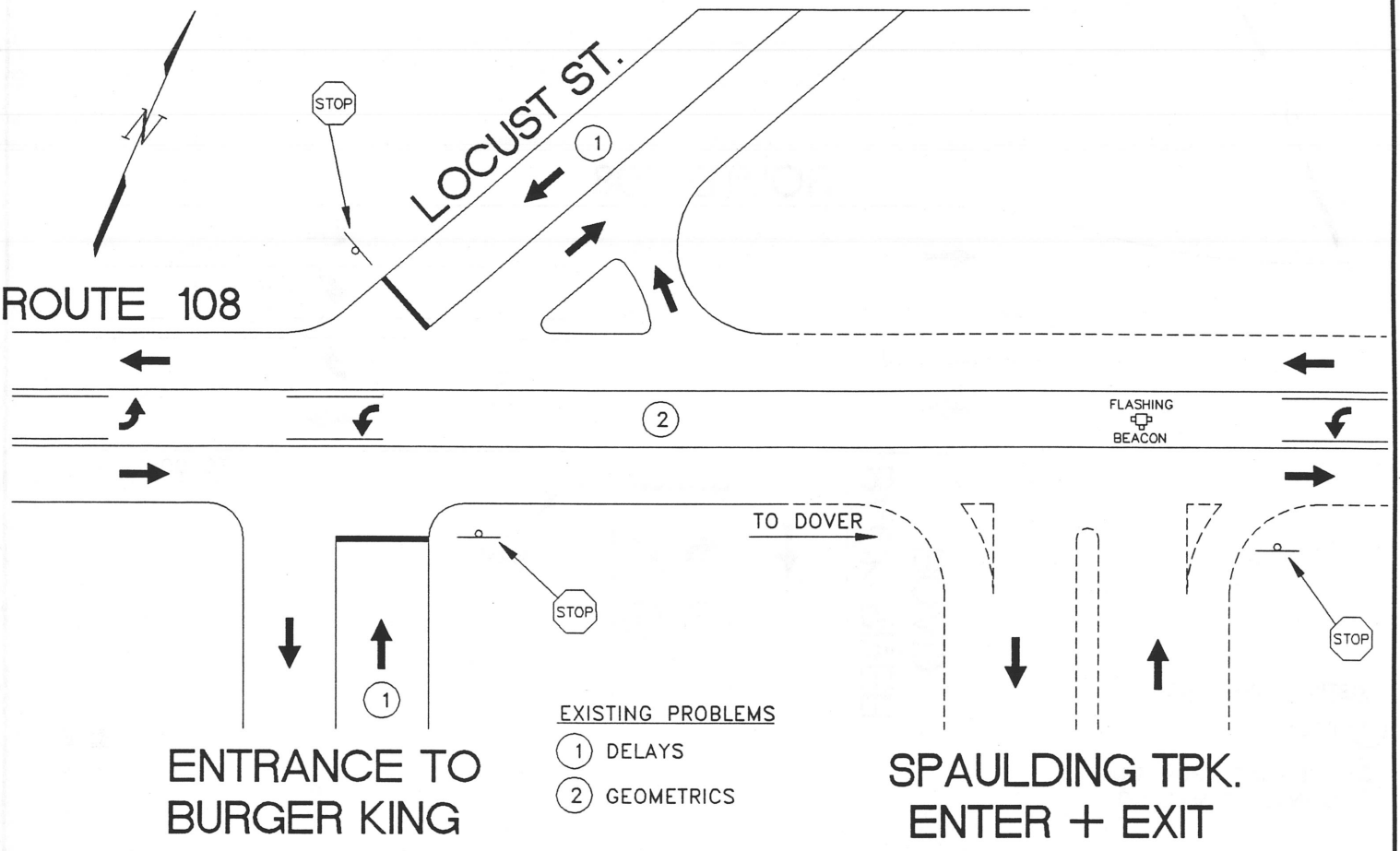
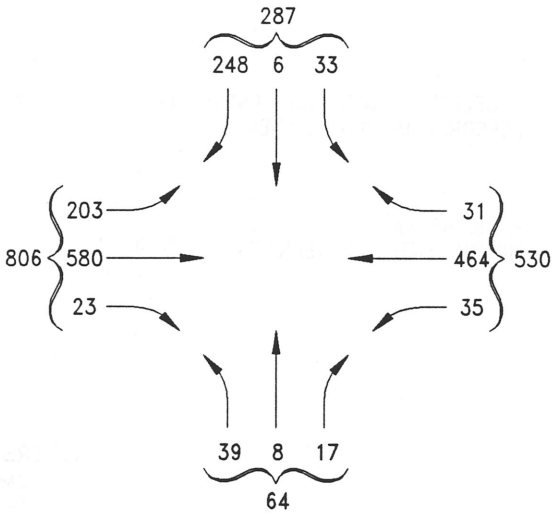


1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1687

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 11
PERSONAL INJURY ACCIDENTS: 2

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.545

INTERSECTION
NUMBER
4

EXISTING CONDITIONS
Route 108 at Locust Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 4

FREDETTE ASSOCIATES, INC.
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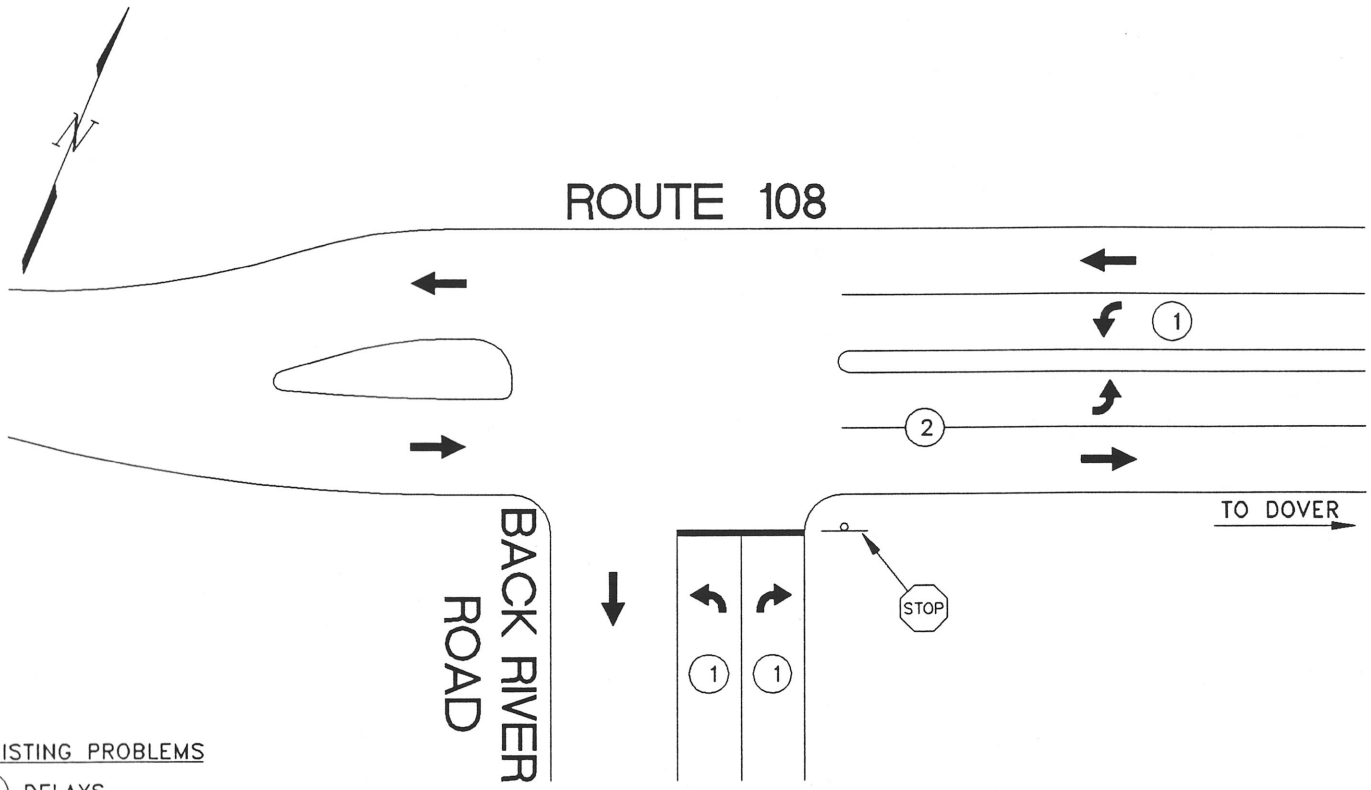
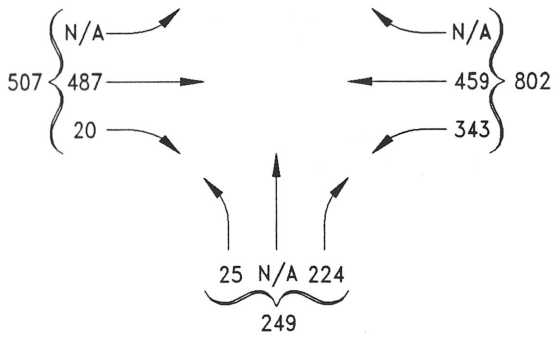


EXISTING PROBLEMS

(1) DELAYS

(2) QUEUEING FROM TRAFFIC SIGNAL AT MILL STREET

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1558

MINOR STREET
LEVEL OF SERVICE: E

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 18
PERSONAL INJURY ACCIDENTS: 2

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.966

INTERSECTION NUMBER 5

EXISTING CONDITIONS
Route 108 at Back River Road

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 5

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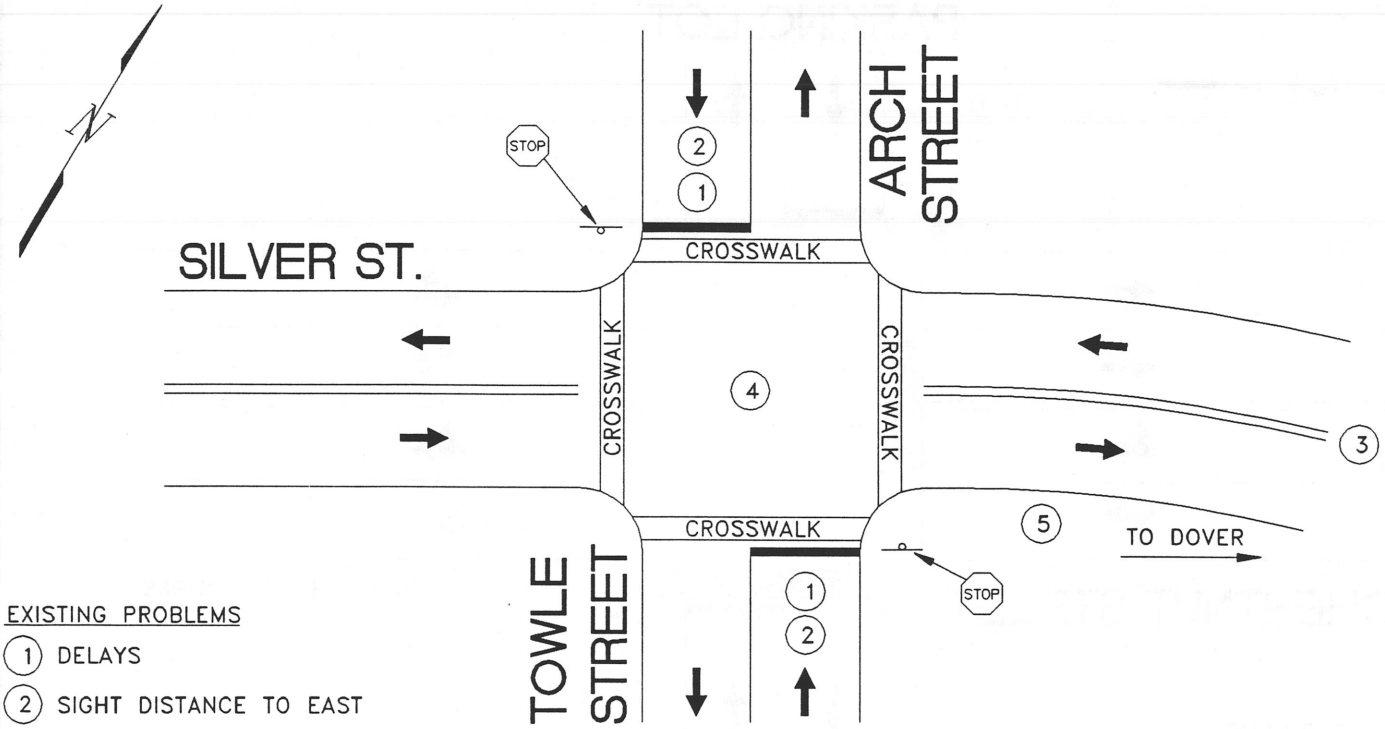
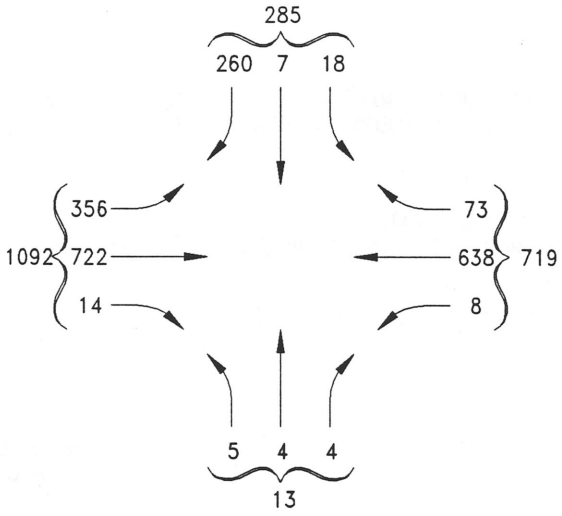


EXISTING PROBLEMS

(1) DELAYS
(2) SIGHT DISTANCE TO EAST
(3) CREST OF VERTICAL CURVE
(4) SCHOOL CROSSING
(5) TREES

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2109

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 11
PERSONAL INJURY ACCIDENTS: 4

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.436

INTERSECTION NUMBER 6

EXISTING CONDITIONS
Silver Street at Arch Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 6

FREDETTE ASSOCIATES, INC.
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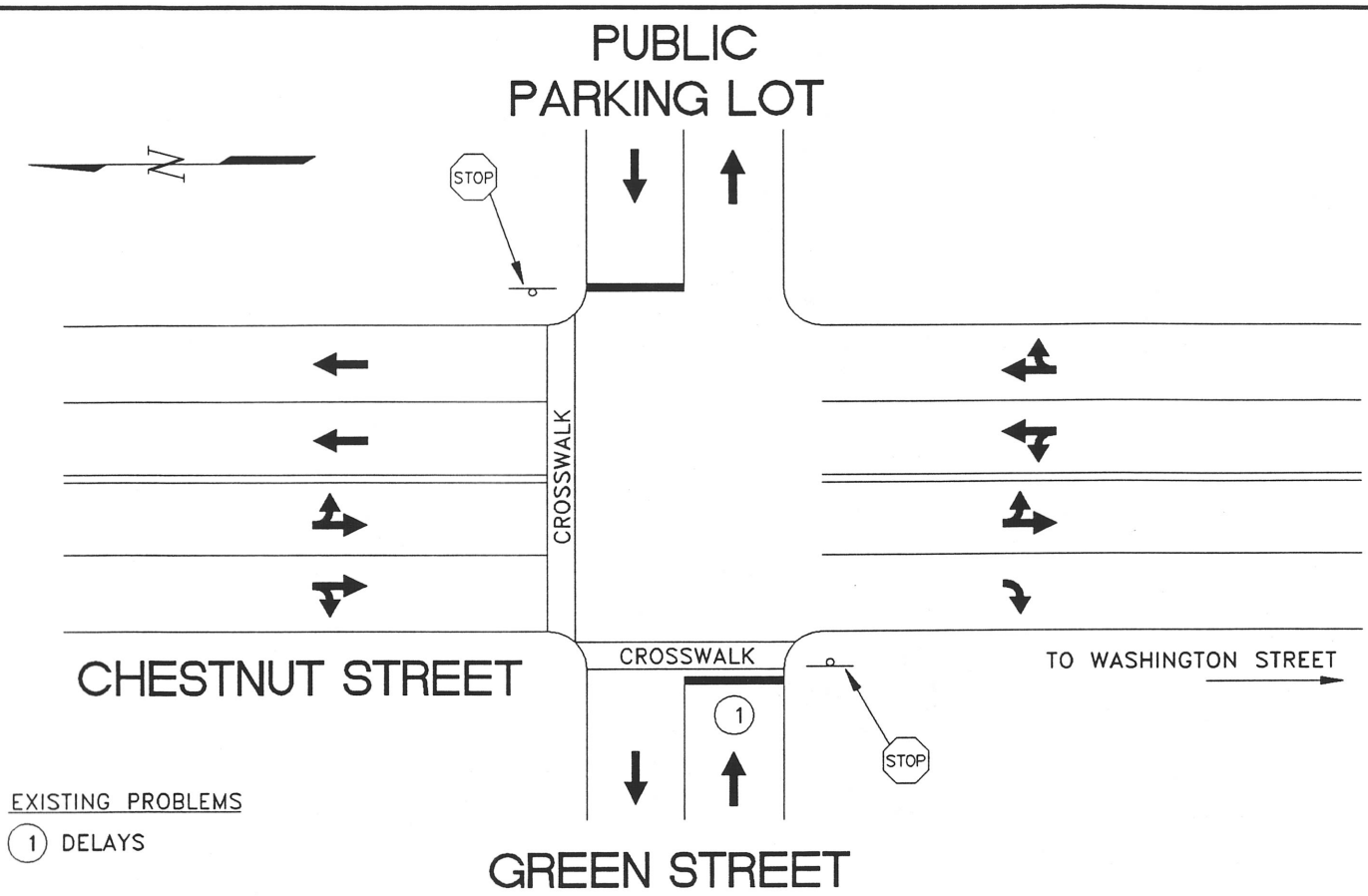

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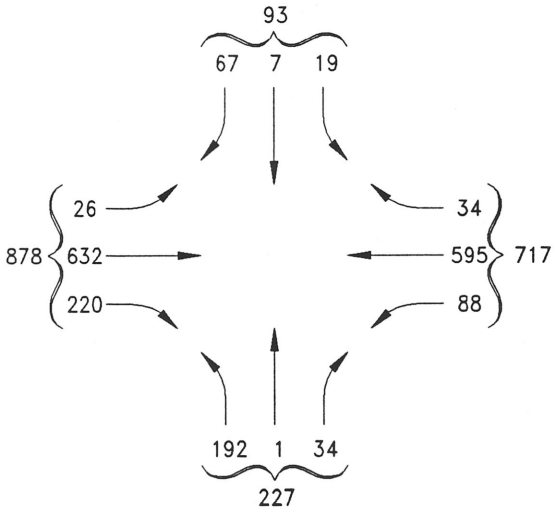

TOTAL ENTERING VOLUME: 1915

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 12
PERSONAL INJURY ACCIDENTS: 2

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.524

INTERSECTION
NUMBER
7

EXISTING CONDITIONS
Chestnut Street at Green Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 7

FREDETTE ASSOCIATES, INC.
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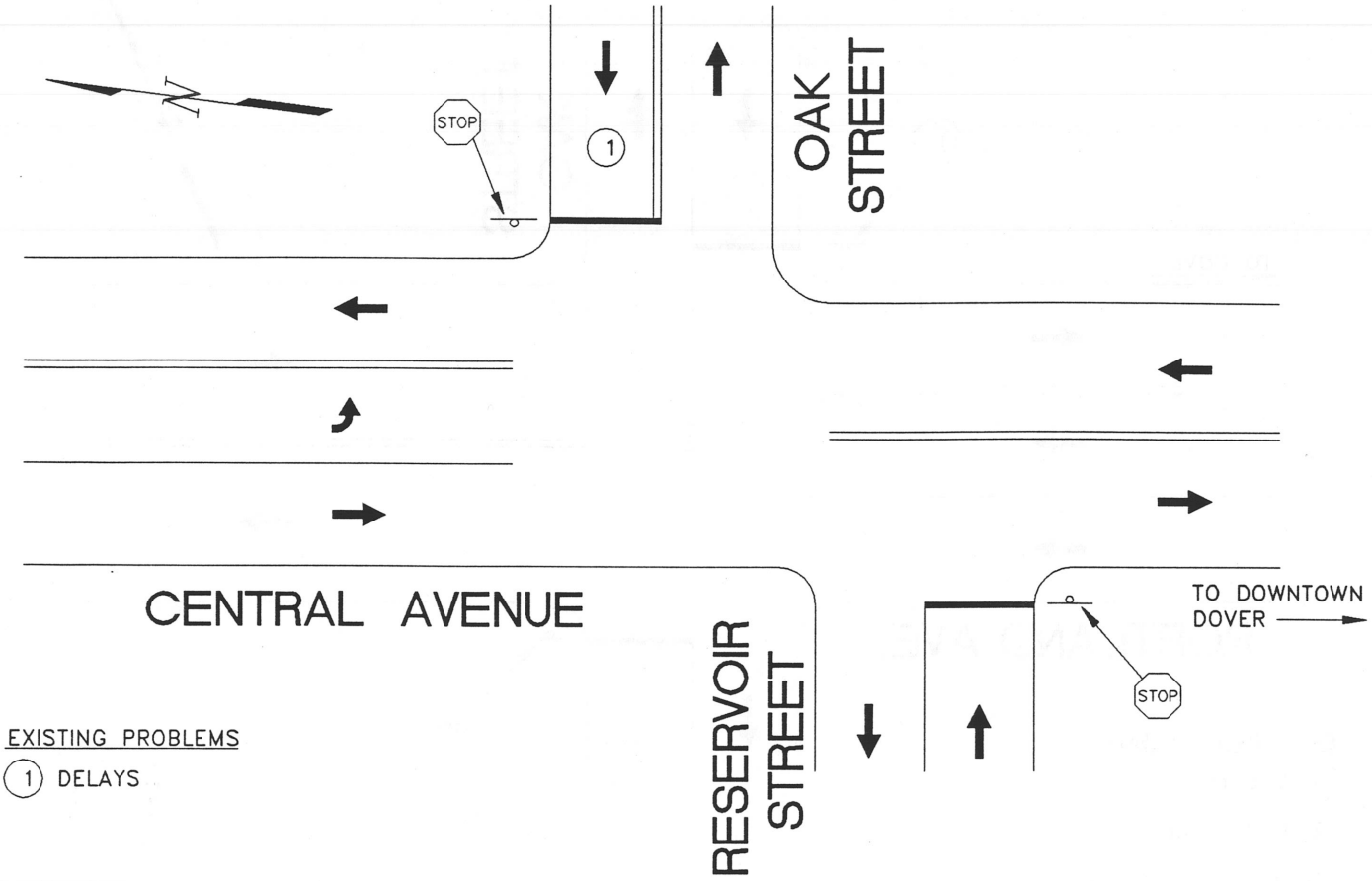
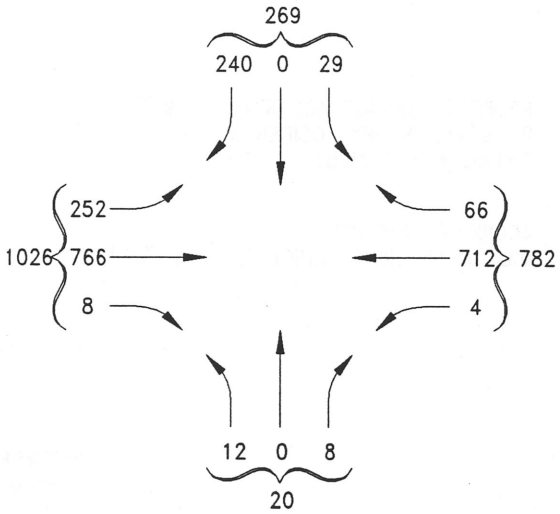


EXISTING PROBLEMS

(1) DELAYS

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2097

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 22
PERSONAL INJURY ACCIDENTS: 7

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.878

INTERSECTION NUMBER 8

EXISTING CONDITIONS
Central Avenue at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 8

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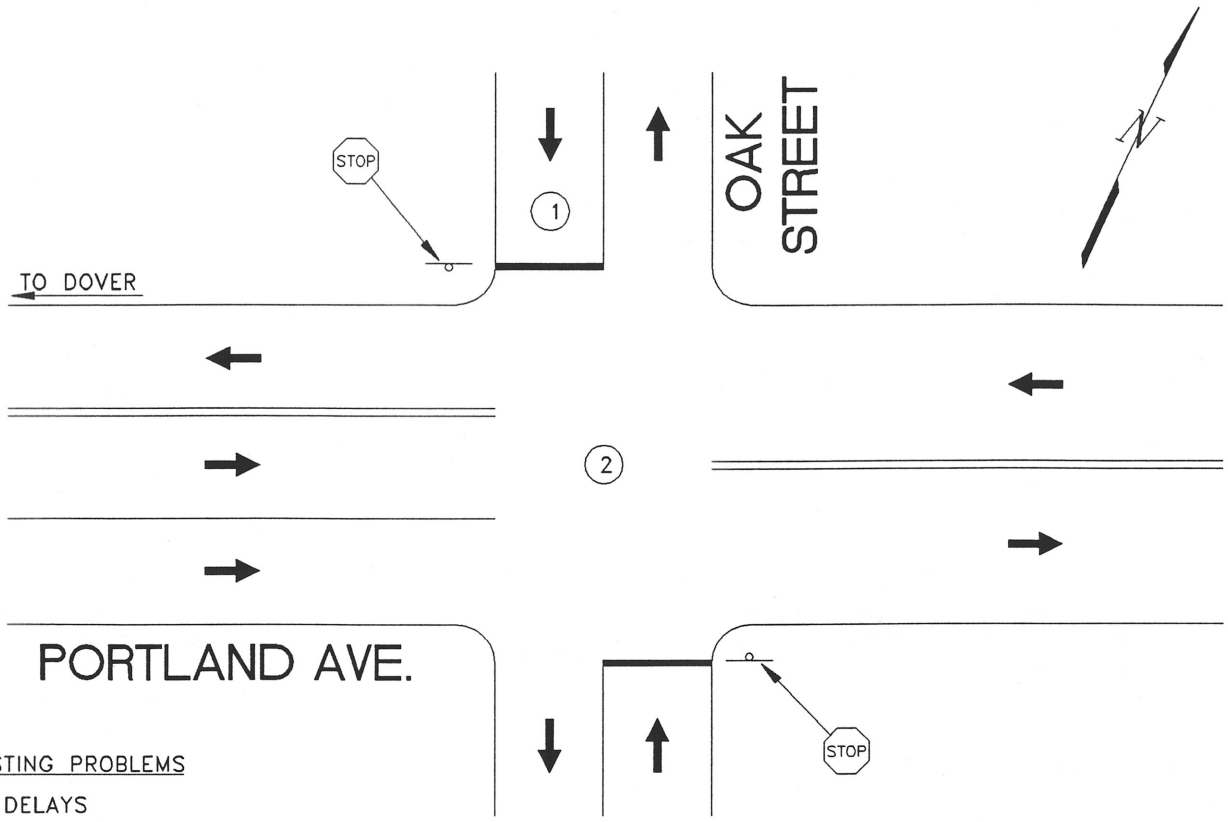
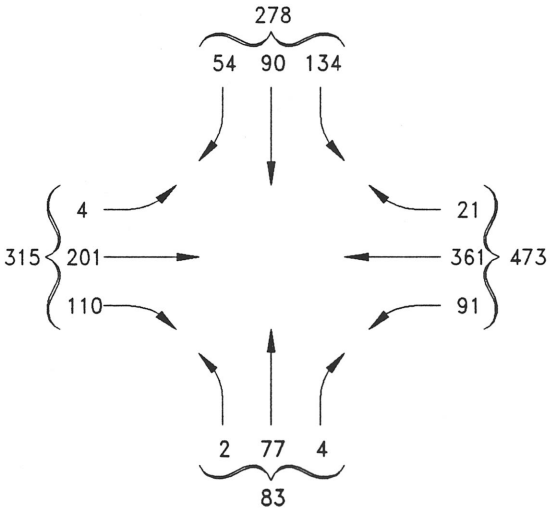


EXISTING PROBLEMS

(1) DELAYS

(2) HIGH SPEEDS

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1149

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS:	19
PERSONAL INJURY ACCIDENTS:	6
FATAL ACCIDENTS:	1
ACCIDENT RATE PER MILLION ENTERING VEHICLES:	1.383

INTERSECTION NUMBER 9

EXISTING CONDITIONS
Portland Avenue at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 9

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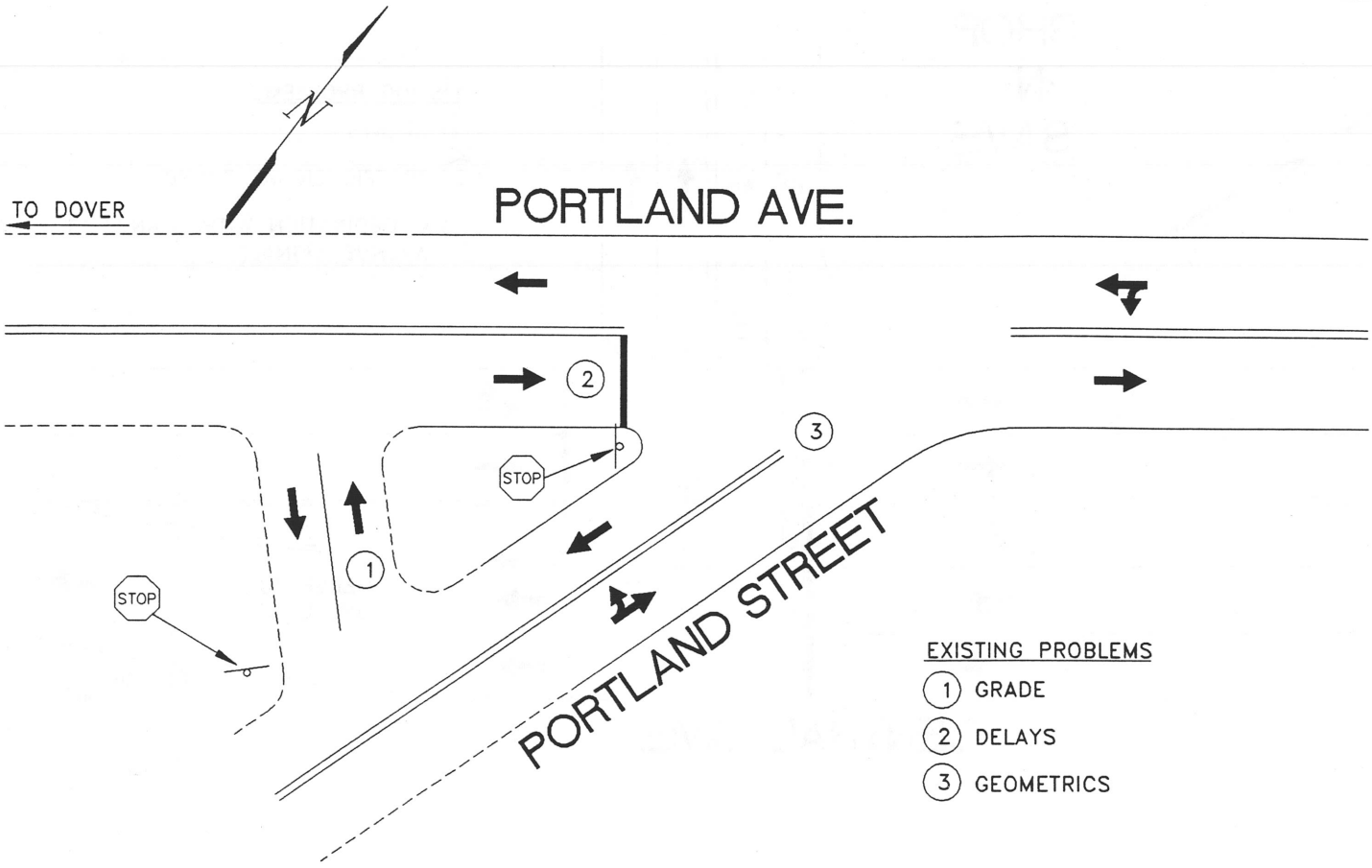
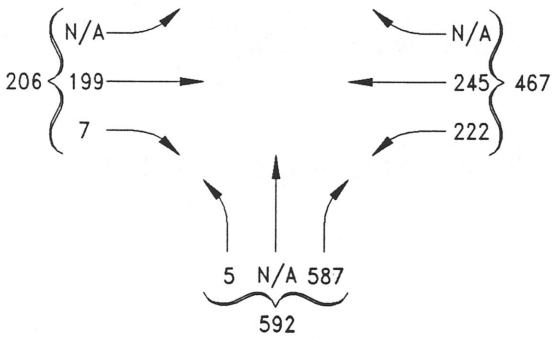


1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1265

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 3
PERSONAL INJURY ACCIDENTS: 0

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.198

INTERSECTION NUMBER 10

EXISTING CONDITIONS
Portland Avenue at Portland Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 10

FREDETTE ASSOCIATES, INC.
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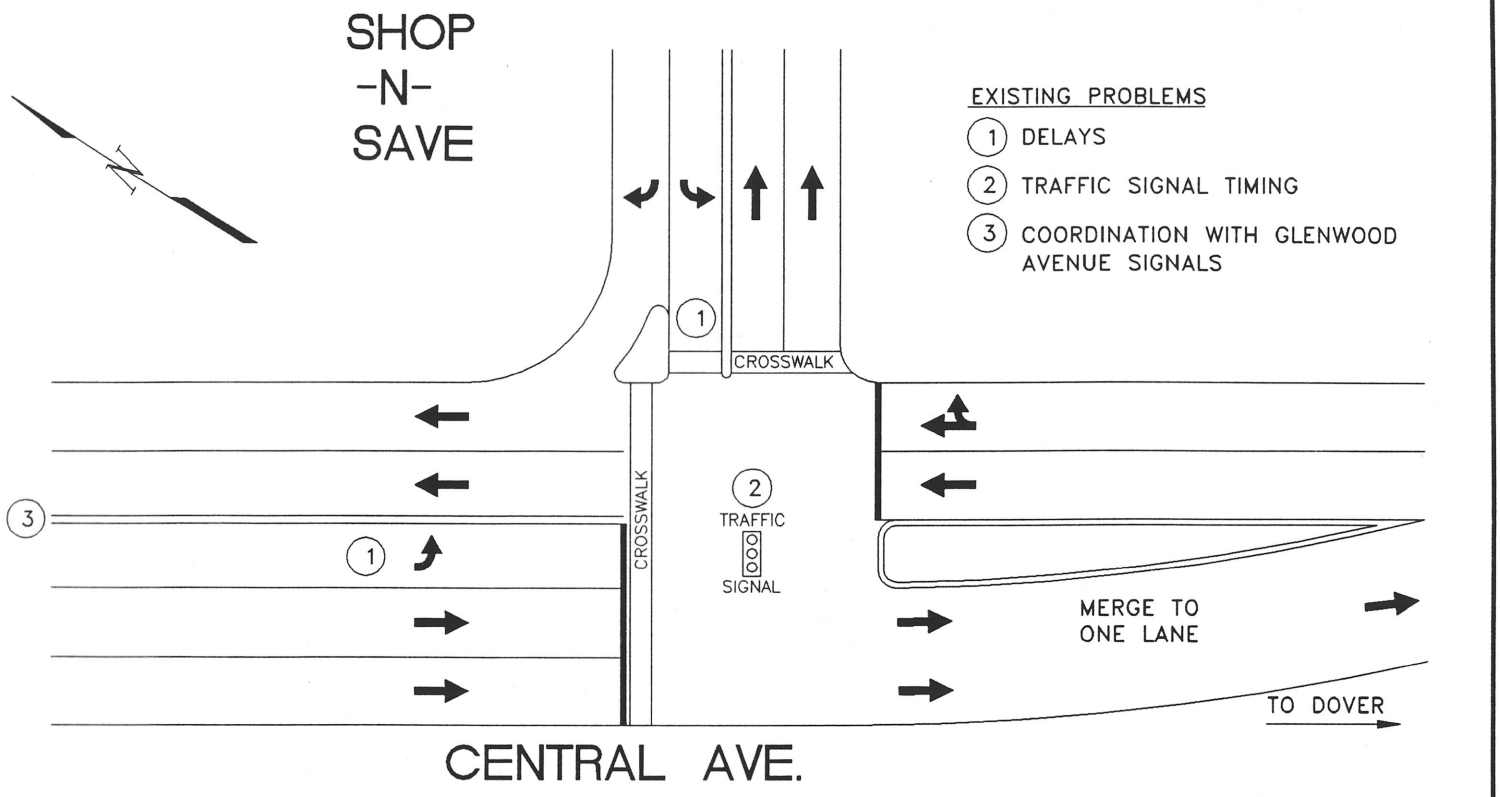
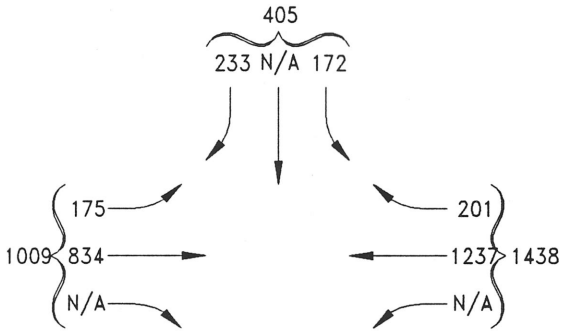


1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2852

MINOR STREET
LEVEL OF SERVICE: B

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 4
PERSONAL INJURY ACCIDENTS: 1

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 0.117

INTERSECTION
NUMBER
11

EXISTING CONDITIONS
Central Avenue at Shop'n Save

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 11

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994 Candia Road – Manchester, N.H. 03103

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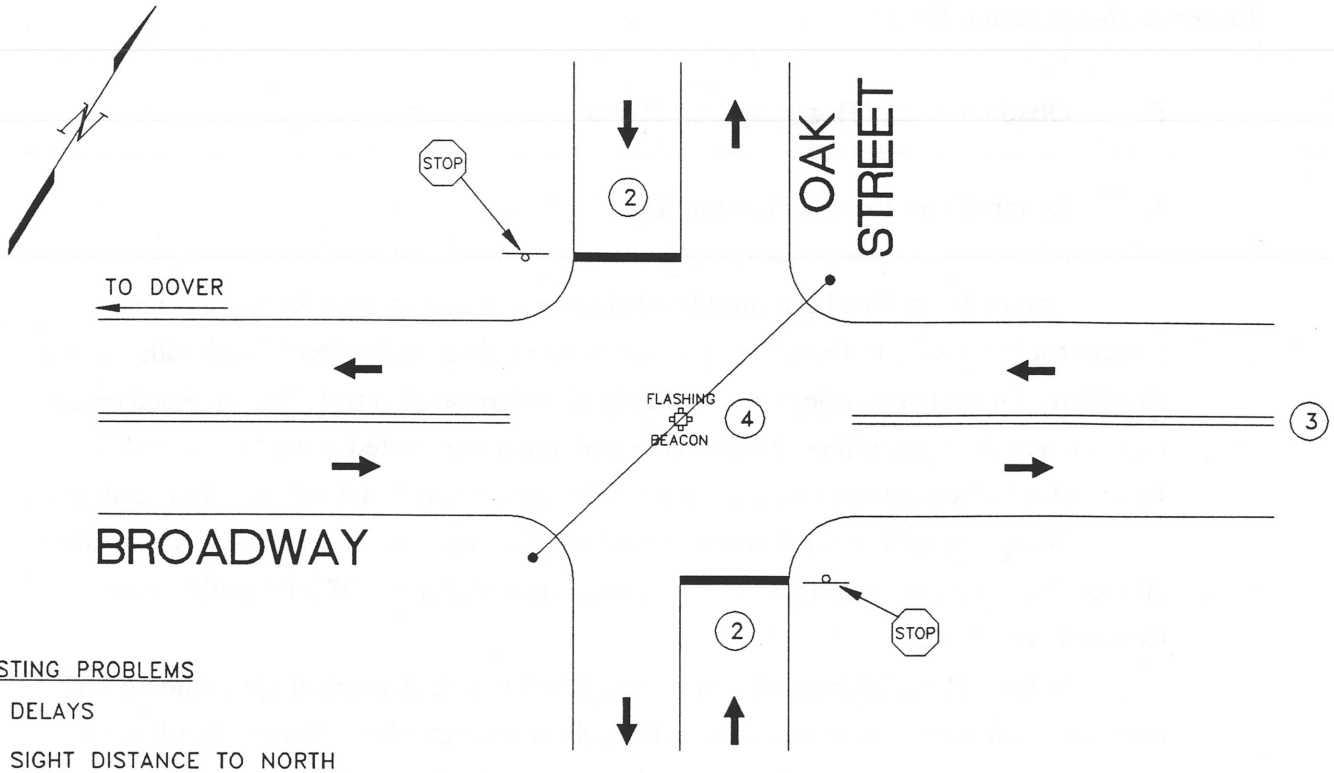


EXISTING PROBLEMS

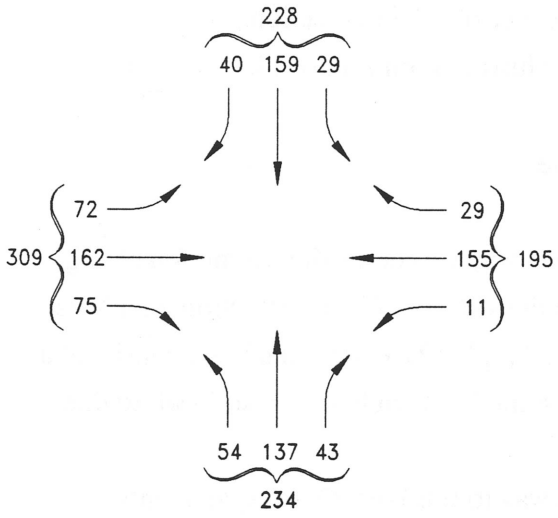
(1) DELAYS

(2) SIGHT DISTANCE TO NORTH

(3) CREST OF VERTICAL CURVE

(4) ACCCIDENTS

1988 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 966

MINOR STREET
LEVEL OF SERVICE: F

1984–1986 ACCIDENT HISTORY

PROPERTY DAMAGE ACCIDENTS: 30
PERSONAL INJURY ACCIDENTS: 6

ACCIDENT RATE PER
MILLION ENTERING VEHICLES: 2.598

INTERSECTION
NUMBER
12

EXISTING CONDITIONS
Broadway at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 12

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

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B. Observations of Roadway Conditions

1. County Farm Road At Watson Road

County Farm Road is a rural two-lane roadway that extends from 6th Street to points east in the City of Dover. Its pavement width is approximately 22 feet with 1-2 foot shoulders. Pavement markings in the vicinity of its intersection with Watson Road consist of a double yellow centerline. No posted speed limits were noted along County Farm Road. Due to its general curvelinear alignment, design speeds are estimated to be 40 mph.

Watson Road is a rural two-lane roadway with a pavement width of approximately 20 feet. No pavement markings or stop control was noted at its "T" intersection with County Farm Road.

Watson Road intersects County Farm Road at a skew angle of approximately 60 degrees with a steep approach up-grade for a short distance along Watson Road. East bound right turn movements along County Farm Road utilize a channelized right turn opening of approximately 12 feet in width to negotiate the skewed - angle corner.

Corner sight distance at the intersection is restricted to the west of Watson Road, generally limited by the vertical grade along County Farm Road. Unobstructed views appear to be approximately 300 feet. This view is also partially obscured by roadside vegetation and trees located on the south-west corner of the intersection.

The physical layout of the intersection is illustrated on Figure 13.

2. Route 155 at West Gate Apartment Drive

Route 155 is a two-lane highway providing primary connection to the Spaulding Turnpike and the downtown area to the east. In the vicinity of its intersection with West Gate Apartment Drive the posted speed limit is 50 mph. Pavement markings consist of a double yellow centerline with a designated westbound left turn lane and solid white lines defining the outer edge of the travelled lanes.

West Gate Drive is the main access driveway to the West Gate Apartments residential development. The pavement width is approximately 30 feet with posted stop control at its intersection with Route 155. No pavement markings are provided.

West Gate Drive intersects Route 155 forming a "T" intersection at a 90 degree angle. Corner sight distance views are partially obstructed to the west due to the vertical grade along Route 155. These views along with views for westbound traffic negotiating left turns into the driveway do not clearly observe eastbound approaching vehicles at distances between 250 to 500 feet. Turning movements from West Gate Apartment Drive may also have views affected by the raised curb and fill area located on the southwest corner of the intersection that further contribute to eastbound vehicles being temporarily "hidden" from the view of vehicles wishing to access the highway.

The physical layout of the intersection is illustrated on Figure 14.

3. Route 108 at Route 16

A problem observed at this intersection is the extreme skew of the Route 108 northbound approach to Route 16. This skew complicates a driver's sight distance, and coupled with heavy flows of peak period traffic, creates a difficult intersection approach to negotiate.

The existing roadway facilities for this intersection are further detailed on Pages 30 and 31 in the N.H. Route 108 Corridor Study prepared by the Strafford Regional Planning Commission, December 30, 1987.

The physical layout of the intersection is illustrated on Figure 15.

4. Route 108 at Locust Street

A problem observed at this intersection is the skewed Locust Street approach to Route 108, coupled with the near proximity of the Burger King entrance and the ramps to the Spaulding Turnpike. Multiple uncontrolled traffic movements to and from Route 108 occur with the 100 to 200 foot segment bounded by these two intersections.

The existing roadway facilities for this intersection are further detailed on Pages 27 to 29 in the N.H. Route 108 Corridor Study prepared by the Strafford Regional Planning Commission, December 30, 1987.

The physical layout of the intersection is illustrated on Figure 16.

5. Route 108 at Back River Road

A problem observed at this intersection is the difficulty in Back River Road traffic entering Route 108 during peak traffic periods. The near proximity at the Mill Street/Spaulding Turnpike Ramps, with its signalized operation, results in queueing of northbound Route 108 traffic across the Back River Road approach, thereby blocking Back River Road traffic movement.

The existing roadway facilities for this intersection are further detailed on Pages 23 and 24 in the N.H. Route 108 Corridor Study prepared by The Strafford Regional Planning Commission, December 30, 1987.

The physical layout of the intersection is illustrated on Figure 17.

6. Silver Street at Arch Street

Silver Street is a two-lane urban arterial providing a primary connection between Central Avenue in downtown Dover to the Spaulding Turnpike. In the vicinity of its intersection with Arch Street and Towle Drive the roadway is marked as a school zone with 20 mph advisory speed limits. General vehicle speeds were observed to be approximately 35 mph. Pavement markings consist of a double yellow centerline and faded school/pedestrian crosswalks. Advance 'Dangerous Intersection' signing is also posted.

Arch Street is a two-lane roadway that extends from Washington Street to Silver Street. Stop control is provided at its intersection with Silver Street with posted sign and painted stop line. Corner sight distance at the intersection is restricted to the east of Arch Street, generally limited by the vertical grade along Silver Street. Unobstructed views appear to be approximately 340 feet.

Towle Drive is a local two way residential street that intersects Silver Street directly opposite Arch Street. Posted stop control and painted stop line is provided. Corner sight distance for vehicles entering the intersection from Towle Drive is restricted to the east. In this case the horizontal and vertical alignment of Silver Street combined with a raised yard and tree located on private residential property at the south-east corner restrict views to approximately 270 feet.

The physical layout of the intersection is illustrated in Figure 18.

7. Chestnut Street at Green Street

Chestnut Street is a downtown collector arterial route that extends from Central Avenue north of 6th Street to Washington Street. In the vicinity of its intersection with Green Street the roadway is approximately 44 feet wide providing for two thru lanes in each direction. General vehicle speeds were observed to be 30-35 mph. Pavement markings consist of a double yellow centerline, broken white lane lines and solid white lines outlying the outer edge of the travelled lanes.

Green Street is a two-lane local street 32 feet in width street, that connects to Washington Street to the south and Chestnut Street to the east. Stop sign control is posted at its intersection with Chestnut Street (stop sign is slightly obstructed by "No Parking" sign) and supplemented with a painted stop line (faded).

Corner sight distance at the intersection is restricted to the north of Green Street, generally limited by the horizontal and vertical alignment along Chestnut Street. Unobstructed views appear to be approximately 350 feet.

A 28 foot wide, two way parking lot driveway intersects with Chestnut Street directly opposite Green Street. Posted stop control and painted stop line (faded) is provided. Corner sight distance for vehicles entering the intersection from the parking lot is similarly restricted to the north with a clear view of approximately 350 feet.

Faded pavement markings were noted for two pedestrian crosswalks, one on the north leg and one on the west leg of the intersection.

The Post Office is located in the southwest quadrant of this intersection, with a one-way customer parking lot entrance from Green Street approximately 70 feet west of Chestnut Street.

The physical layout is illustrated on Figure 19.

8. Central Avenue at Oak Street

Central Avenue (N.H. Route 16) is the primary north-south arterial route through downtown Dover. In the vicinity of its intersection with Oak Street the roadway is marked for two lanes of thru traffic with an additional southbound left turn lane. The roadway pavement is approximately 50 feet wide. The speed limit is posted at 30 mph. A slight up-grade for the northbound direction exists south of the Oak Street intersection, changing to a moderate up-grade north of the intersection.

Oak Street is a two-lane residential collector roadway that extends from Central Avenue to east of Portland Avenue connecting to Cocheco Street and Elliot Bridge Road. The posted speed limit along Oak Street is 25 mph with double yellow center line pavement markings. Posted stop control is provided at its intersection with Central Avenue. Corner sight distance was observed to be greater than 350 feet.

Reservoir Street is a local 22 foot wide two-way street that intersects with Central Avenue approximately 35 feet to the south opposite Oak Street. Posted stop control is provided. Corner sight distance was observed to be greater than 350 feet.

The physical layout at the intersection is illustrated on Figure 20.

9. Portland Avenue at Oak Street

Portland Avenue (N.H. Route 4) is a two-lane highway providing connection from points east of Dover to the downtown area. In the vicinity of its intersection with Oak Street the posted speed limit is 55 mph to the east and 35 mph to the west. General speeds were observed to be 50 mph. Pavement markings consist of a double yellow centerline and solid white lines marking the outer edge of the travel lanes. An additional lane is provided for the eastbound approach to the intersection. This lane generally functions as a truck climbing lane for traffic negotiating the eastbound upgrade on Portland Avenue extending approximately 1/4 mile to the west of the Oak Street intersection.

Oak Street is a two-lane residential collector roadway that extends from Central Avenue to east of Portland Avenue, connecting to Cocheco Street at Elliot Bridge Road. The posted speed limit along Oak Street is 25 mph with double yellow center line pavement markings. Stop control is provided at its intersection with Portland Avenue with posted sign and painted stop lines for each approach.

Corner sight distance at the intersection is restricted to the west of Oak Street, generally limited by the vertical grade along Portland Avenue. Unobstructed views appear to be approximately 600 feet. Vehicles entering or crossing Portland Avenue from southbound Oak Street may also have views affected by roadside vegetation and trees located on the north-west corner of the intersection.

The physical layout of the intersection is illustrated on Figure 21.

10. Portland Avenue at Portland Street

Portland Avenue (N.H. Route 4) is a two-lane roadway providing primary connection from points east of Dover to the downtown area. In the vicinity of its intersection with Portland Street the pavement width varies from 28-30 feet with pavement markings consisting of a double yellow centerline. The posted speed limit is 30 mph.

Portland Street is a two-lane bidirectional roadway that provides connection from Portland Avenue to Main Street. Its pavement width is approximately 28 feet with double yellow centerline pavement markings. Portland Street intersects Portland Avenue on an approximate 45 skew angle with a steep approach up-grade for an extended distance in the eastbound direction.

Thru movements are directed through the intersection via the westbound Portland Avenue approach and eastbound Portland Street. Stop control is posted for the eastbound Portland Street approach. Eastbound right turn movements along Portland Avenue utilize a channelized right turn opening on the southwest corner that varies in width from 28-14 feet and has a severe down grade.

Eastbound approach traffic along Portland Street negotiates a steep up-grade to pass through the intersection. Left turn movements must maneuver through the skewed angle intersection or alternately climb a severe grade utilizing the channelized ramp on the south-west corner.

Clear sight distance is generally provided for turning movements at the intersection although the steep grades and unusual intersection configuration tends to inhibit driver decisions.

The physical layout at the intersection is illustrated on Figure 22.

11. Central Avenue at Shop 'n Save

Central Avenue (N.H. Route 16) is the primary north-south arterial route through downtown Dover. In the vicinity of its intersection with the Shop 'n Save Driveway the roadway provides for two 12 foot through lanes in each direction with an additional 10 foot wide southbound left turn lane.

The Shop 'n Save Drive intersects Central Avenue forming a 'T' intersection at a 90 degree angle. The driveway is divided and provides one left turn lane and one channelized right turn lane at Central Avenue.

The intersection is controlled by a fully actuated traffic signal that provides protected phasing for southbound left hand turn movements along Central Avenue into the Shop 'n Save Driveway and left hand turn movements exiting the Shop 'n Save Drive and travelling south along Central Avenue. This intersection is coordinated with the signal at Glenwood Avenue to provide traffic progression along Central Avenue.

Observations of existing operations show extended periods of green time for thru traffic movements along Central Avenue. This creates unnecessary delays and queuing for southbound left turning traffic along Central Avenue and westbound left turning traffic along the Shop'n Save Driveway that must wait for the following signal phases.

The road layout at the intersection is illustrated on Figure 23.

12. Broadway and Oak Street

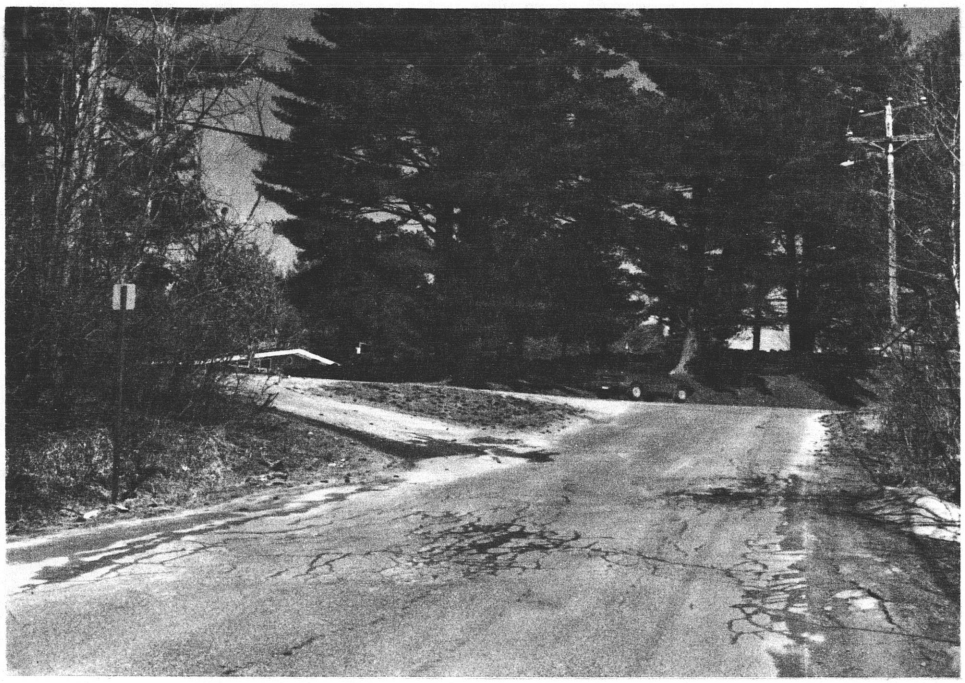
Broadway is a two-lane roadway that provides arterial connection between Central Avenue in downtown Dover to rural areas north in Rollinsford and Somersworth. In the vicinity of its intersection with Oak Street, the roadway width varies from 30 to 36 feet. Pavement markings consist of a double yellow centerline with a speed limit posted at 30 mph. General speeds were observed to be 35-40 mph. A moderate up-grade for the northbound Broadway direction extends through the intersection. An overhead flashing beacon is located at the intersection and flashes advisory yellow for Broadway traffic and red for Oak Street traffic.

Oak Street is a two-lane residential collector roadway that extends from Central Avenue to east of Portland Avenue connecting to Cocheco Street at Elliot Bridge Road. The posted Speed Limit along Oak Street is 25 mph with double yellow center line pavement markings. Stop control is provided at its intersection with Broadway Street with posted sign and painted stop line (faded) for each approach supplemented by the overhead flashing red Beacon.

Corner sight distance at the intersection is restricted to the north of Oak Street, generally limited by the vertical grade along Broadway Street. Unobstructed views appear to be approximately 350 feet. Turning movements from Oak Street eastbound may also have views affected by utility poles and occasional obstructions located on the asphalt lot at the north-west corner of the intersection.

The roadway layout at the intersection is illustrated on Figure 24.

INTERSECTION 1: COUNTY FARM ROAD/WATSON ROAD

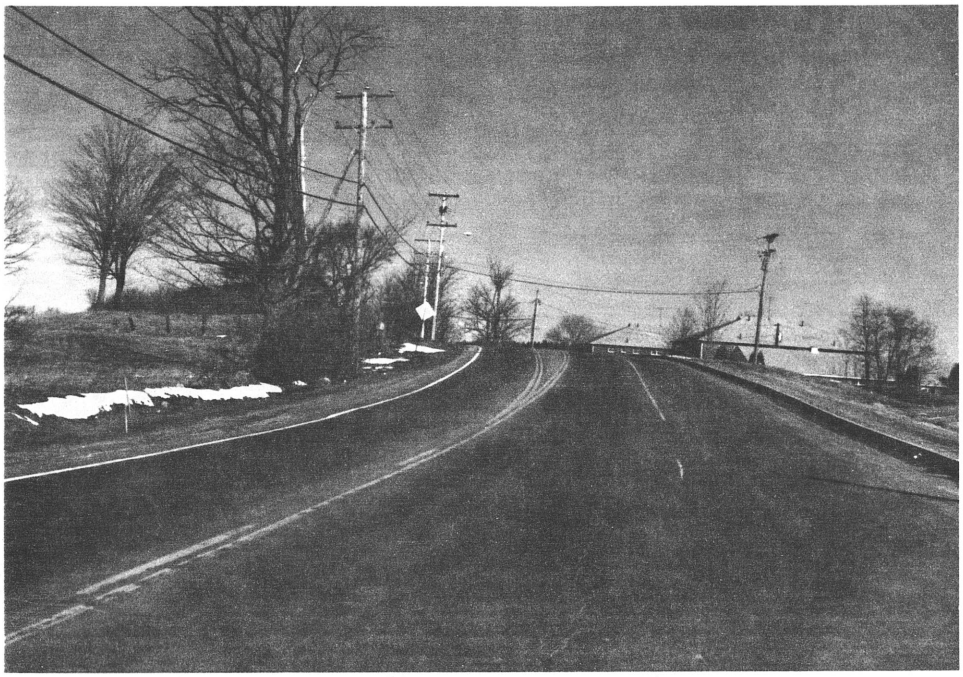


Watson Road Northbound Approach To Intersection

Drivers View Looking West Along
County Farm Road At Intersection

FIGURE NO.13

INTERSECTION 2: ROUTE 155/WEST GATE DRIVE

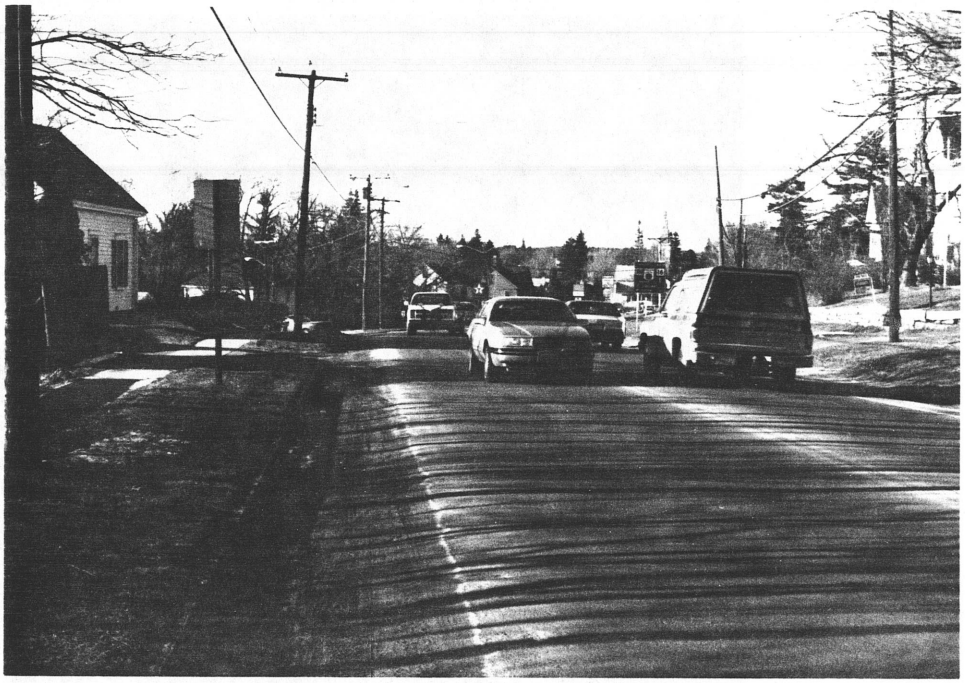


Route 155 Eastbound Approach To Intersection

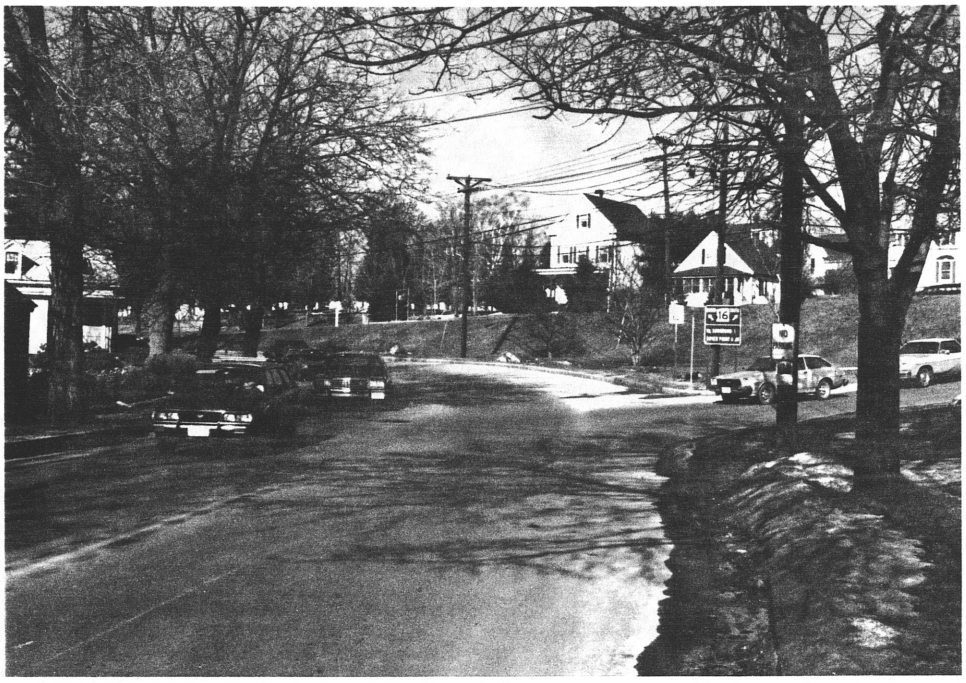
Drivers View Looking West Along
Route 155 At Intersection

FIGURE NO. 14

INTERSECTION 3: ROUTE 108/ROUTE 16



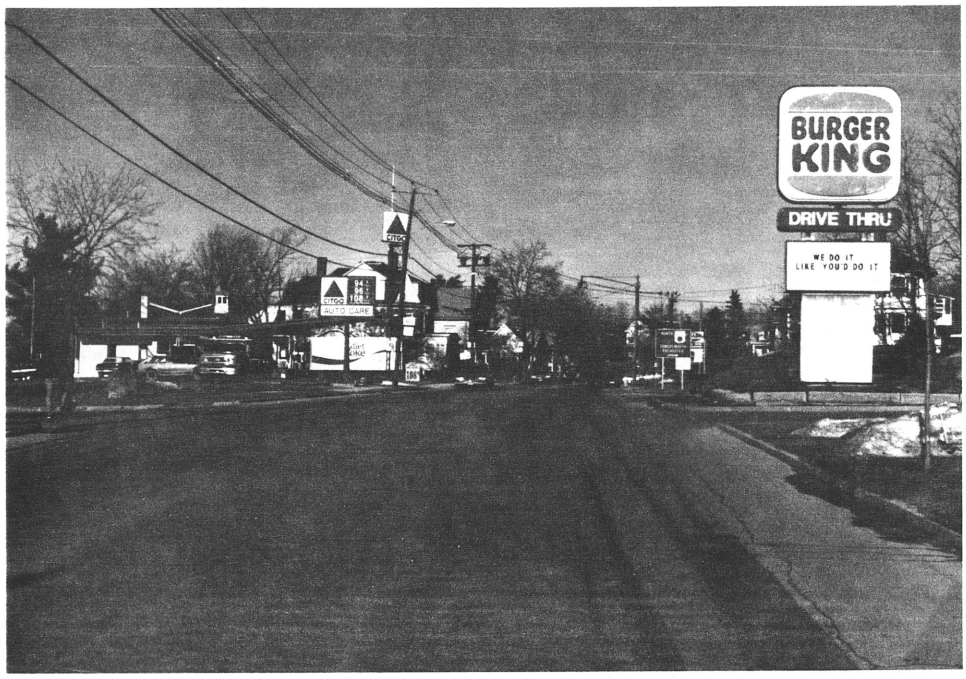
Route 16 Northbound Approach To Intersection



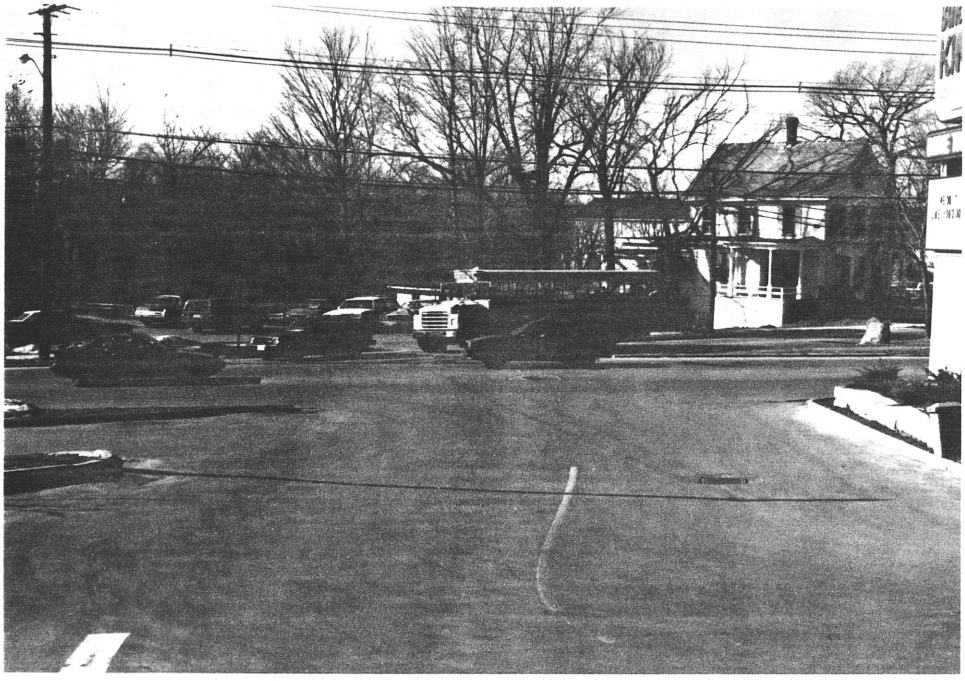
Route 108 Eastbound Approach To Intersection

FIGURE NO. 15

INTERSECTION 4: ROUTE 108/LOCUST STREET



Route 108 Eastbound Approach Through Intersection

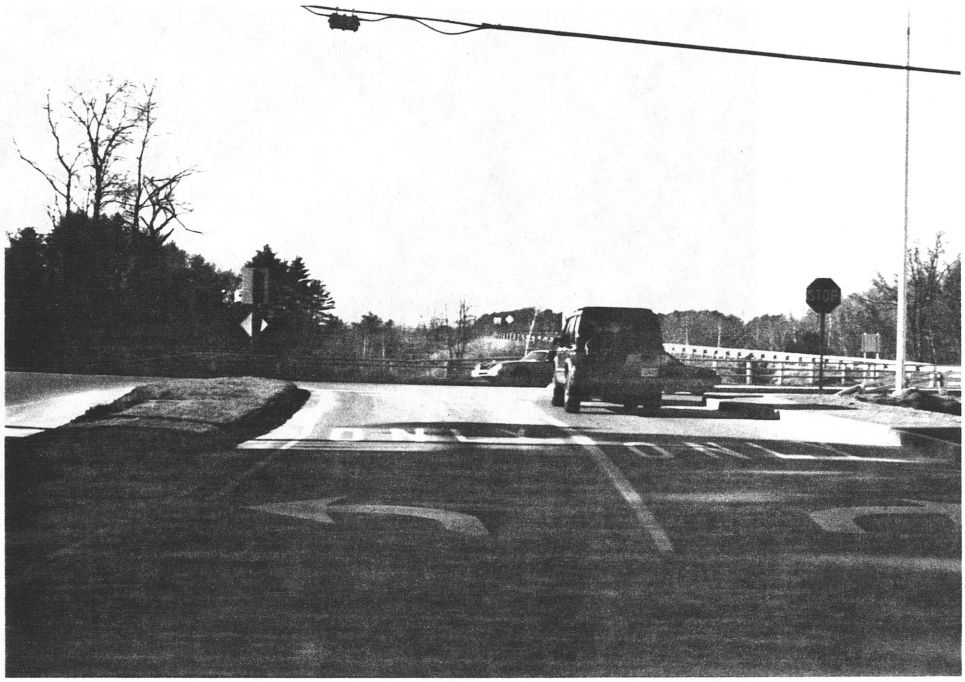


Looking North At Locust Street Intersection
From Burger King Driveway

FIGURE NO. 16

INTERSECTION 5: ROUTE 108/BACK RIVER ROAD

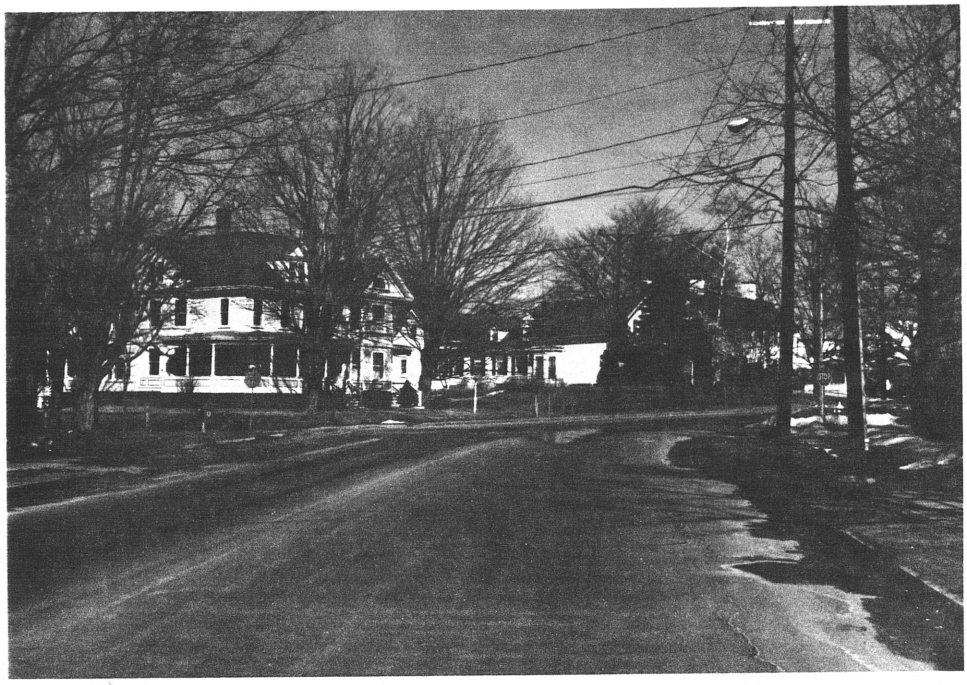
Route 108 Eastbound Approach Through Intersection



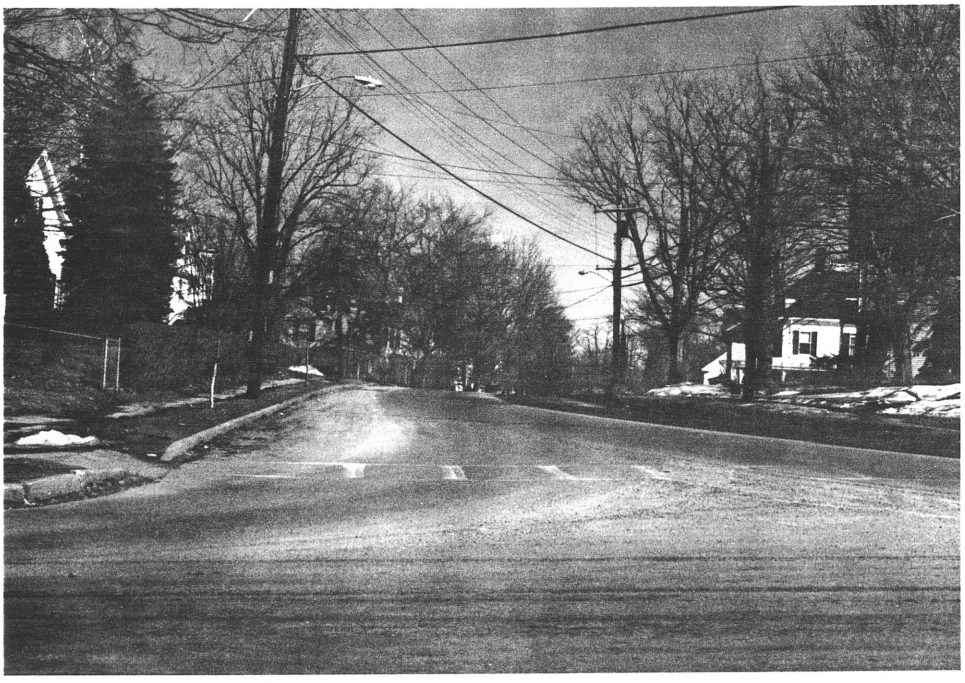
Back River Road Northbound Approach To Intersection

FIGURE NO. 17

INTERSECTION 6: SILVER STREET/ARCH STREET



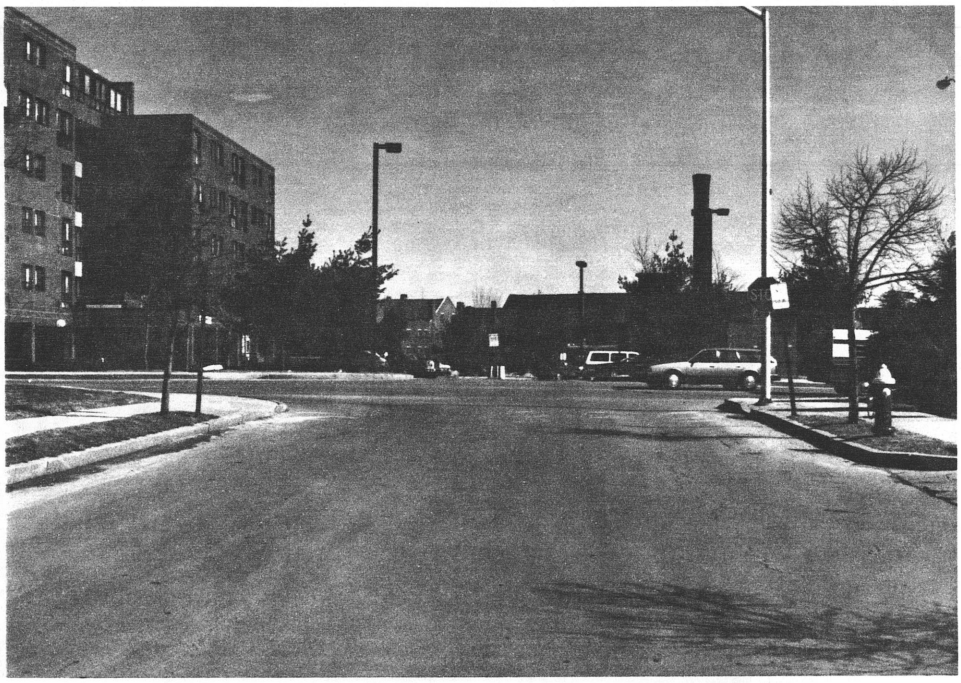
Silver Street Eastbound Approach To Intersection



Drivers View Looking East Along
Silver Street At Intersection

FIGURE NO. 18

INTERSECTION 7: CHESNUT STREET/GREEN STREET

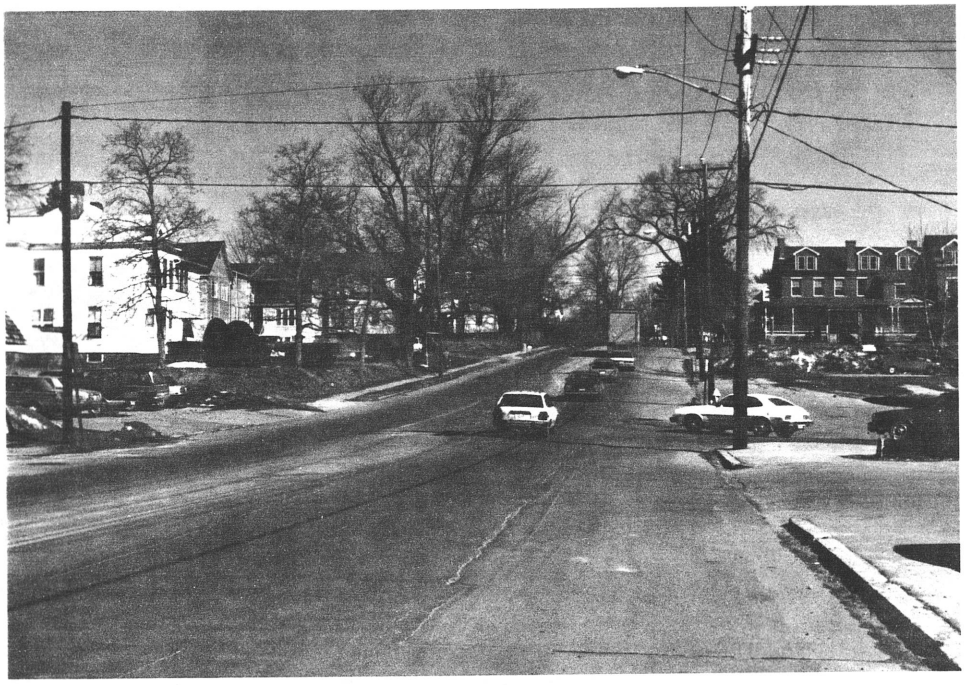


Green Street Approach To Intersection

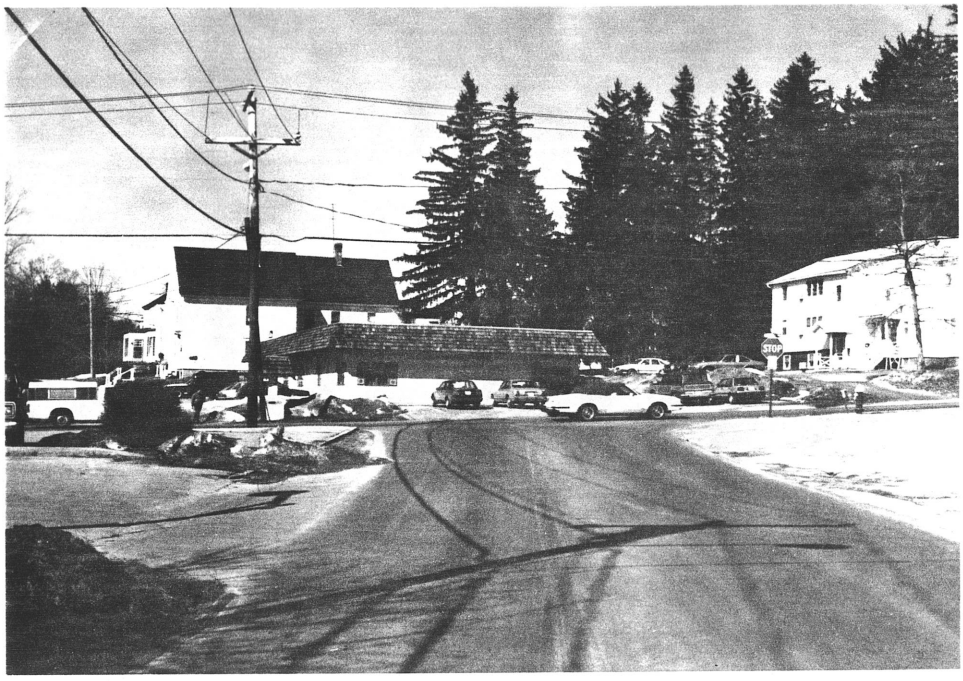
Drivers View Looking North Along
Chesnut Street At Intersection

FIGURE NO. 19

INTERSECTION 8: CENTRAL AVENUE/OAK STREET



Central Avenue Northbound Approach Through Intersection



Oak Street Westbound Approach To Intersection

FIGURE NO. 20

INTERSECTION 9: PORTLAND AVENUE/OAK STREET

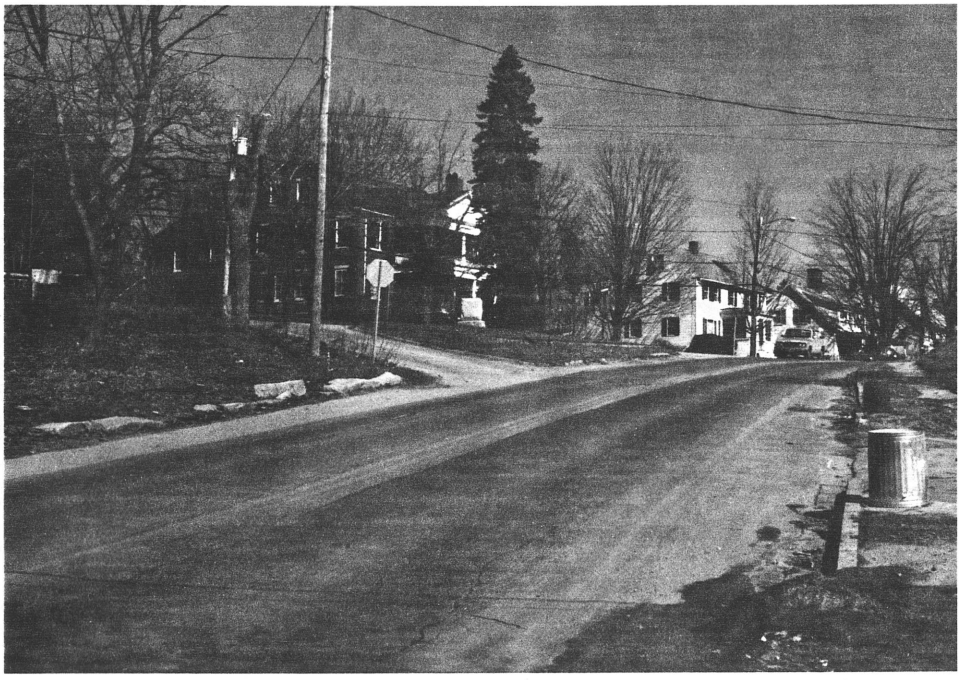
Portland Avenue Eastbound Approach Through Intersection

Drivers View Looking West Along
Portland Avenue At Intersection

FIGURE NO. 21

INTERSECTION 10: PORTLAND AVENUE/PORTLAND STREET

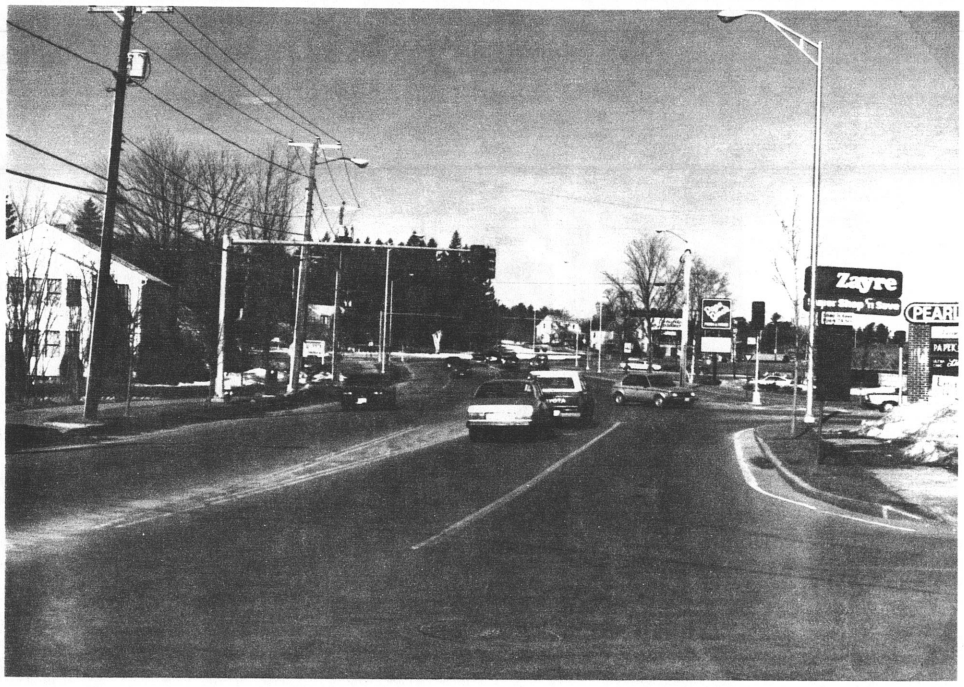
Portland Avenue Eastbound Approach To Intersection



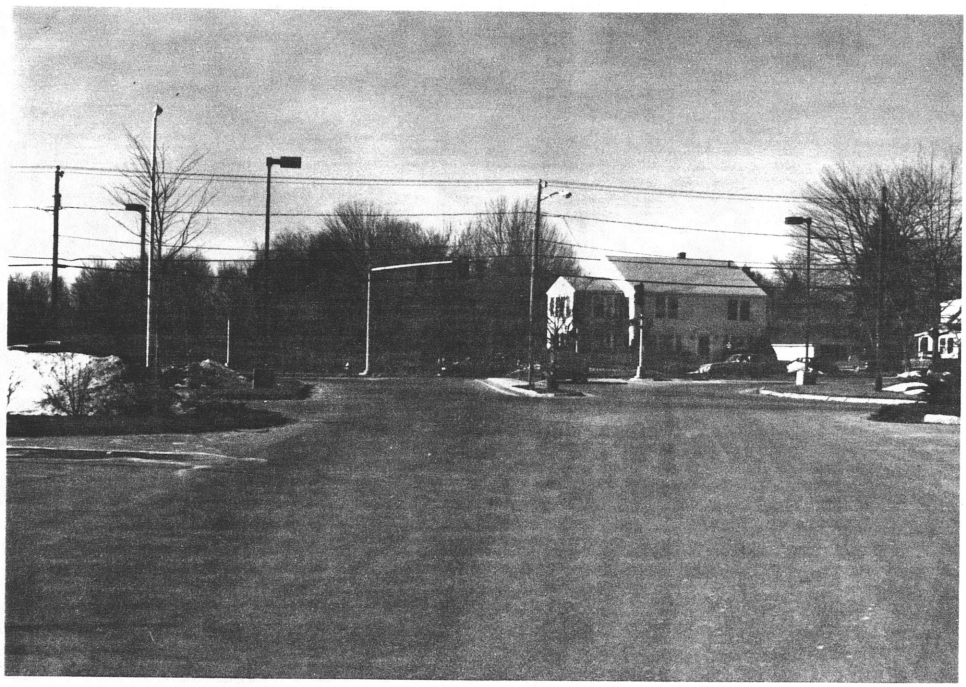
Portland Street Approach To Intersection

FIGURE NO. 22

INTERSECTION 11: CENTRAL AVENUE/SHOP'N'SAVE DRIVE



Central Avenue Northbound Approach Through Intersection

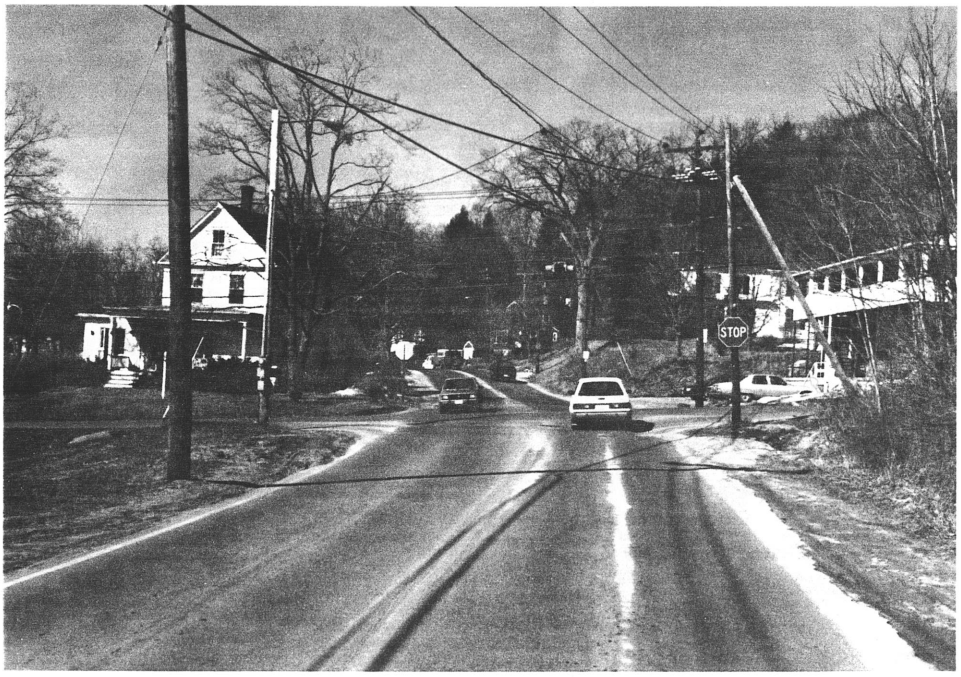


Shop 'N' Save Westbound Approach To Intersection

FIGURE NO. 23

INTERSECTION 12: BROADWAY STREET/OAK STREET

Broadway Street Northbound Approach Through Intersection



Oak Street Westbound Approach To Intersection

FIGURE NO. 24

III. Traffic Volumes

A. Traffic Data Sources

A substantial amount of traffic data was available from the Strafford Regional Planning Commission and from recent traffic studies for specific projects, including the Route 108 Corridor Study and the Mast Road Development Consortium.

This data was supplemented and updated by additional traffic data collected by the City of Dover. Table 1 provides a summary of the intersection turning movement counts referenced in this study.

All of these counts were seasonally adjusted to 1988 average weekday conditions utilizing historical traffic growth data described in the next section.

TABLE 1
TRAFFIC DATA SOURCES

Intersection		Source*	Date/Time Period
1.	Watson Rd. at County Farm Rd.	I	2/1/88, 3:30-5:30 PM
2.	Route 155 at West Gate Apart.	IV	1986 PM Peak Hour
3.	Route 108 at Central Ave.	III	1988 PM Peak Hour
4.	Route 108 at Route 16	III	1988 PM Peak Hour
5.	Route 108 at Back River Road	III	1988 PM Peak Hour
6.	Silver Street at Arch Street	I	1/28/88, 3:30-5:30 PM
7.	Chestnut Street at Green St.	I	2/11/88, 3:30-5:30 PM
8.	Central Ave. at Oak Street	II	6/23/86, 3:30-4:30 PM
9.	Portland Ave. at Oak Street	II	10/27-28/87, 4:15-5:15 PM
10.	Portland Ave. at Portland St.	I	2/16/88, 3:30-5:30 PM
11.	Central Ave. at Shop ' Save	I	2/3/88, 3:30-5:30 PM
12.	Broadway at Oak Street	II	6/13/86, 3:30-4:30 PM

*Reference

I. City of Dover (summaries in Appendix A)
II. Strafford Regional Planning Commission (SRPC)
III. Route 108 Corridor Study (SRPC) 1987
IV. Traffic Impact Analysis for the Mast Road Development Consortium (Holden Engineering & Surveying), 1987.

B. Historical Traffic Growth Patterns

Included in Appendix B is a compilation of historical traffic data from the N.H.D.O.T. Continuous Traffic Count Station on N.H. Route 16 (Dover Point Road) south of New Hampshire Route 108. Given are summaries of traffic volume variations on an annual, monthly, weekly and hourly basis. This data was utilized to adjust actual traffic count data to average weekday conditions for the present year (1988).

Based on the annual growth of traffic at this count station since 1979, the average daily traffic has increased at approximately 4.7 percent per year. Growth in the 30th highest hour at each year since 1980 (comparable to a weekday PM peak hour) indicates an annual growth at 3.5 percent. This study assumes this latter annual growth rate for PM peak hour traffic conditions.

Included also in Appendix B is a compilation of short term Average Daily Traffic (ADT) counts conducted and compiled by N.H.D.O.T. at various locations in the City since 1981. This data is presented for information only. Because of the short term nature of the counts (1 week) and the annual adjustment procedure utilized, inferences of actual annual traffic growth from these figures cannot be made with certainty.

C. Design Hour Traffic Volumes

Design of highway facilities are typically based upon the 30th highest hour occurring during the year. It is not considered economical to design highway improvements for the extreme peak hours occurring only a few times per year (in a shopping center area, this is often during the Christmas Season). On the other hand, design for too frequent a condition leads to unacceptable recurring traffic congestion.

In an urban area, the 30th highest hour is likely to be close to the average peak one-hour volume occurring during a typical week day, and typically is 8 to 10% of the AADT. A review of available traffic data indicates that at most locations in the corridor, peak weekly traffic volumes occurred between 4:00 and 5:30 PM.

Thus this study utilizes the weekday PM peak hour as the design hour traffic condition. 1988 design hour traffic volumes at each of the 12 problem intersection locations are illustrated on the applicable existing condition plan (Figures 1 through 12) in Section IIA of this memorandum.

IV. Traffic Levels Of Service

A. Definitions

Level of service (LOS) is a qualitative measure describing driver satisfaction with a number of factors influencing the degree of traffic congestion. These factors include speed and travel time, traffic interruption, freedom to maneuver, safety, driving comfort and convenience, and delays. There are six levels of service describing traffic flow. The highest is LOS A, describing a free-flow condition. The lowest, LOS F, is described as forced flow, and is characterized by traffic volumes at the roadway capacity and extreme congestion.

LOS C, which is normally utilized for design purposes, describes a stable condition of traffic operation. It has a somewhat restricted movement due to higher traffic volumes, but flow conditions are not objectionable for motorists.

LOS D, which is acceptable for traffic operations in urban environments and during peak hours of traffic flow, reflects a more restricted movement for motorists. Queues and delays may occur during short peaks, but lower demands occur often enough to permit clearance of developing queues, thus, preventing excessive backups. LOS E is defined as the actual capacity of the roadway and involves delay to all motorists due to congestion. Levels of Service E and F are generally considered unacceptable.

Level of service is defined separately for both signalized and unsignalized intersections. Level of service for signalized intersections is defined in terms of average delay per vehicle entering the intersection. Delay is considered a measure of driver discomfort, frustration, fuel consumption and travel time. Table 2 summarizes the criteria for signalized intersection level of service.

Level of service for unsignalized intersections is based on the number of acceptable gaps available in a main street traffic flow that may be utilized by minor street vehicles. The criteria shown in Table 3 are based on the available reserve (or unused) capacity (measured in passenger cars per hour) for the minor street movement, and the delay to the minor street traffic.

TABLE 2

LEVEL OF SERVICE CRITERIA FOR
SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	Greater than 60.0

SOURCE: 1985 Highway Capacity Manual

TABLE 3

LEVEL OF SERVICE CRITERIA FOR
UNSIGNALIZED INTERSECTIONS

RESERVE CAPACITY (pcph)	LEVEL OF SERVICE	EXPECTED DELAY TO MINOR STREET TRAFFIC
400	A	Little or no delay
300 - 399	B	Short traffic delays
200 - 299	C	Average traffic delays
100 - 199	D	Long traffic delays
0 - 99	E	Very long traffic delays
*	F	*

* When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement to the intersection.

SOURCE: 1985 High Capacity Manual

B. Intersection Levels of Service

In order to determine the present level of service at the problem intersections under the 1988 design hour conditions presented herein, analyses were performed using the Federal Highway Administration's Highway Capacity Software which is based upon the methodology of the 1985 Highway Capacity Manual. Copies of the calculations are contained in Appendix C. 1988 design hour levels of service for the Route 108 intersections at Route 16, Locust Street and Back River Road have been excerpted from the N.H. Route 108 Corridor Study by the Strafford Regional Planning Commission, 1987.

Table 4 contains a summary of present levels of service for the 12 problem intersections. All are unsignalized except for the Central Avenue intersection at Shop n' Save. Calculated levels of service were found to be in general agreement with levels of service observed in the field.

TABLE 4
TRAFFIC LEVEL OF SERVICE

INTERSECTION AND CRITICAL APPROACH(ES)	1988 PEAK HOUR LOS
A. Unsignalized Intersections	
1. County Farm @ Watson	
- All turns from Watson	A
2. Route 155 @ Westgate (West)	
- All turns from Westgate	D
3. Route 108 @ Route 16	
- All turns from Route 108	F
- All turns from Watson	C
4. Route 108 @ Locust Street	
- All turns from Locust	F
- All turns from Burger King	F
5. Route 108 @ Back River Road	
- Back River W/B left	E
- Back River W/B right	B*
6. Silver Street @ Arch Street	
- All turns from Arch or Towle	F
- E/B left turn from Silver	E
7. Chestnut Street @ Green Street	
- E/B left turns from Green	F
- N/B left turns from Chestnut	C
8. Central Avenue @ Oak Street	
- All turns from Oak Street	F
- S/B left turns from Central	C
9. Portland Avenue @ Oak Street	
- E/B turns from Oak Street	F
10. Portland Avenue @ Portland Street	
- E/B movement from Portland Avenue	F
12. Broadway @ Oak Street	
- E/B turns from Oak Street	E
- W/B turns from Oak Street	F
B. Signalized Intersections	
11. Central Avenue @ Shop n' Save	
- Overall intersection	B**

* Level of service degrades when blocked by traffic queues on Route 108 N.B.
** Assumes optimized signal timing

V. Accident History

Storch Associates has summarized and reviewed the history of accidents at each of the twelve problem intersections during the years 1984, 1985 and 1986 (partial data included for 1987). Accident statistics were based on reported accidents summarized by the New Hampshire Department of Transportation, Transportation Planning and System Management, Accident Statistics Group (included in Appendix D).

Accident data has been summarized by location, type of collision, and whether property damage, personal injury, or a fatality occurred. Although most traffic accidents result from careless behavior of drivers or pedestrians, a look at the type of collisions that reoccur at particular intersections or roadway segments can help to determine whether improved roadway features or traffic control devices could reduce the accident rate. Examples of such remedies could include the removal of a fixed object that exists too close to the travel way which is often hit or the signalization of an intersection in order to reduce the incidence of angle-type collisions.

In addition to analyzing the types of collisions reoccurring at a particular place, accident rates help to distinguish potentially dangerous intersections. The accident rate of an intersection represents the historical number of accidents occurring per million vehicles which enter the intersection. An intersection with an accident rate of 1.5 or more accidents per MEV (million entering vehicles) may warrant a detailed accident analysis, as suggested in the "Manual of Traffic Engineering Studies" published by the Institute of Transportation Engineers, 1976.

The annual number of accidents at a particular intersection is also used as an indicator for establishing a more restrictive form of traffic control. The Federal Highway Administration's "Manual on Uniform Traffic Control Devices", 1986, considers a reportable intersection accident frequency of 5 or more per year as a basis for further examining warrants for signalization or multiway stop sign control.

Table 5 summarizes the annual number of reported accidents at the problem intersection locations for the years 1984 through October 1987. Those locations indicating greater than 5 accidents in a particular year include:

- Route 108 at Route 16
- Route 108 at Locust Street
- Route 108 at Back River Road
- Chestnut Street at Green Street
- Central Avenue at Oak Street
- Broadway at Oak Street
- Portland Avenue at Oak Street

Table 6 summarizes the total three year intersection accident history from 1984 through 1986, per the number at accidents, type of accidents and computed annual accident rate per million entering vehicles. Broadway at Oak Street was the only study area intersection having an accident rate greater than 1.5 MEV. with a calculated rate of 2.598.

The information gained from the accident history at these twelve problem intersections will be useful in developing recommended improvement plans, as well as in preparing a priority ranking of these intersections with regard to funding implementation. Corrective measures will be sought for those intersections with a high incidence of accidents as part of the recommended improvement plan.

TABLE 5

ANNUAL ACCIDENT SUMMARY
FOR 1984, 1985 AND 1986

	INTERSECTION	YEAR			
		1984	1985	1986	1987
1.	Watson Rd. at County Farm Road	1	0	1	0
2.	Route 155 at West Gate Apartments	3	2	0	0
3.	Route 108 at Route 16	10	4	9	1
4.	Route 108 at Locust Street	5	1	5	8
5.	Route 108 at Back River Road	5	6	7	1
6.	Silver Street at Arch Street	3	4	4	2
7.	Chestnut Street at Green Street	1	4	7	2
8.	Central Avenue at Oak Street	1	7	14	4
9.	Portland Avenue at Oak Street	7	7	5	3
10.	Portland Avenue at Portland Street	2	1	0	0
11.	Central Avenue at Shop n' Save	3	0	1	0
12.	Broadway at Oak Street	12	10	8	8
	TOTALS	53	46	61	29

*January through October 1987

Ref. Total reported accidents by N.H.D.O.T. Accident Statistics Group

Note: These figures represent the minimum number of accidents at each intersection. The actual number may be higher due to reporting deficiencies.

TABLE 6

SUMMARY OF INTERSECTION ACCIDENT DATA
1984 - 1986 (3 YEAR TOTAL)

		Accident Rate per Millon Entering	Total # Accidents	Property Damage Accidents	Personal Injury Accidents	Fatal Accidents	Types of Collison					
							Broadside	Angle	Rear End	Hit Fixed Objects	Other	Unknown
1.	Watson Road @ County Farm Rd.	0.577	2	2	2	-	-	-	-	-	-	2
2.	Route 155 @ West Gate Apartments	0.381	5	5	3	-	-	-	-	1	-	4
3.	Route 108 @ Route 16	1.079	23	23	3	-	-	5	5	1	-	12
4.	Route 108 @ Locust Street	0.545	11	11	2	-	-	3	2	1	-	5
5.	Route 108 @ Back River Road	0.966	18	18	2	-	-	1	4	1	-	12
6.	Silver Street @ Arch Street	0.436	11	11	4	-	-	3	1	-	1	6
7.	Chestnut Street @ Green Street	0.524	12	12	2	-	1	-	-	2	-	9
8.	Central Avenue @ Oak Street	0.878	22	22	7	-	-	1	4	1	1	15
9.	Portland Avenue @ Oak Street	1.383	19	19	6	1	-	1	1	1	2	14
10.	Portland Avenue @ Portland Street	0.198	3	3	-	-	-	1	1	-	-	1
11.	Central Avenue @ Shop n' Save	0.117	4	4	1	-	-	-	2	-	-	2
12.	Broadway at Oak Street	2.598	30	30	6	-	-	10	2	4	-	14

Ref: Total reported accidents by N.H.D.O.T. Accident & Statistics Group

Note: These figures represent the Minimum number of accidents at each intersection. The actual number may be higher due to reporting deficiences.

VI. Recommended Improvements

A. Introduction

Conceptual improvements for each of the 12 problem intersections are identified in the following section. The improvement concepts take into account the existing conditions and accident analysis, and have been developed to accommodate the 1993 design hour condition, as well as providing for the safe movement of pedestrians, as applicable. The intent of these improvement recommendations is to provide the City with an outline of cost effective, near-term (through 1993) funding requirements for traffic control and roadway improvements necessary to alleviate the existing problems identified.

B. Procedure

Proposed improvements are identified as Low Cost (maintenance related) which can be implemented now with a minimal expenditure of funds; and as Capital Intensive which would require a significant funding allocation to be programmed into the City's capital improvement plan.

Peak hour intersection volumes and traffic growth rates identified in Chapter III of this Memorandum are utilized to develop a 1993 design year condition at each location. Specific growth projections for localized future development reported for Route 108 and Route 155 intersections are derived from SRPC's Route 108 Corridor Study and the Mast Road Development Consortium Study referenced in Chapter 1C of this Memorandum.

In order to estimate whether traffic signal warrants (per the Manual on Uniform Traffic Control Devices, Federal Highway Administration, 1986) are met at applicable problem intersection locations, the eighth highest daily hour volume was estimated proportionally from N.H.D.O.T. historical traffic count data along Route 16 in Dover for an average weekday period. This results in an adjustment factor of 0.66 applied to the design PM peak hour traffic volumes. A minimum twelve hours of vehicle counts during a typical weekday should be undertaken to confirm signal warrants herein estimated at each of the project intersections prior to implementing the improvements.

A revised intersection capacity analysis is included for each intersection where capacity improvements are applicable. Capacity analysis worksheets are included in Appendix E.

An estimate of the cost of designing and constructing the recommended improvements at each location (in 1988 dollars) is also included. Potential right-of-way implications are noted, but associated costs are not estimated.

Traffic signal improvements herein referred to generally assume fully actuated signal control with pedestrian crossings. System interconnection for coordination of adjacent signals is noted as applicable. Estimated costs assume mast arm signal supports and underground electrical service.

C. Recommended Intersection Improvements

Table 7 summarizes the recommended improvements at each intersection and provides a cost estimate in 1988 dollars. Also included is the year of justification of the improvement (based on safety needs, signal warranting volumes, or capacity needs). These improvements are discussed in more detail below.

TABLE 7
SUMMARY OF RECOMMENDED IMPROVEMENTS

Intersection	Low Cost/ Maintenance**	Capital Intensive	Year of Justification	Cost of Capital Intensive Improvements
Watson @ County Farm	Signing, Brush Clearing	Realign Watson	1988	$85,000***
Rt. 155 @ West Gate Apt.	Signing, Regrade Berm	Flashing Beacon	1988	$ 7,000
Rt. 108 @ Rt. 16	----	Signalize, Channelize Minor Widening	1988	$180,000*
Rt. 108 @ Locust	----	Signalize, Channelize	1988	$200,000*
Rt. 108 @ Back River	Signing	Signalize	1988	$120,000*
Silver @ Arch	Repaint Crosswalks	Signalize, Channelize**	1988	$110,000
Chestnut @ Green	Repaint Crosswalks	Close Green at Chestnut	1988	$ 5,000
Central @ Oak	----	Signalize, Realign Oak	1988	$225,000
Portland @ Oak	Brush Clearing, Speed Reduction	Signalize	1988	$ 90,000
Portland Ave@ Portland St	Signing, Left Turn Restriction	----	1988	----
Central @ Shop n' Save	Signal Timing	----	1988	----
Broadway @ Oak	4-Way Stop	----	1988	----

* Recommend construction as one corridor project
** Recommend early implementation
*** Does not include right-of-way acquisition

1. County Farm Road at Watson Road

The existing problems associated with this intersection are:

- Steep up-grade along Watson Road approach;
- Restricted sight distance along County Farm Road west of the intersection.

In order to mitigate both of these problems it is recommended that Watson Road be realigned to the east of its present intersection with County Farm Road. At this new location improved approach grades and corner site distance will be obtained. This will require right-of-way from the parcel on the southeast corner of the intersection.

Regrading of the Watson Road approach does not eliminate the restricted site distance problem while regrading of County Farm Road would require extensive road reconstruction and associated impacts to properties adjacent to the roadway.

A low cost improvement to the existing condition, recommended for early implementation, would be the installation of a stop sign for the Watson Road approach, the clearing of brush on the southwest corner, and the installation of an "Intersection Ahead" advance warning sign along eastbound County Farm Road.

The proposed improvements are conceptually illustrated on Figure 25.

2. Route 155 at West Gate Apartment Drive

The main problem associated with this intersection is the partially obscured sight distance from West Gate Drive along Route 155 to the west of the intersection.

Total elimination of this deficiency by lowering the grade of Route 155 would require extensive reconstruction of Route 155 and is considered cost prohibitive. Traffic signal installation is not recommended since projected traffic volumes for vehicles turning onto Route 155 from the residential development will not meet Traffic Signal Warrants by 1993.

Recommended low cost improvements to the existing condition are installation of an "Intersection Ahead" sign along eastbound Route 155 prior to the intersection and the removal of a raised curb and fill area located on the southwest corner that presently contributes to reduced visibility at the intersection between West Gate Drive and Route 155 to the west.

A recommended capital intensive improvement would be the installation of a flashing beacon to provide additional warning advisory to vehicles approaching the intersection. This improvement is recommended, in part, due to the high speed potential along Route 155.

The proposed improvements are conceptually illustrated on Figure 26.

3. Route 108 at Route 16

The existing problems associated with this intersection are:

- Delays for Route 108 traffic turning onto Route 16 destined to Downtown Dover;
- Skew angle of intersection.

The installation of traffic signals along with channelization of turning movements and associated minor pavement widening is recommended to mitigate the above noted problems. It is estimated that traffic signal warrants are presently exceeded based on the 1988 PM peak hour design volumes.

The recommended improvements are excerpted from the N.H. Route 108 Corridor Study prepared by the Strafford Regional Planning Commission, December 30, 1987, and include the following:

1. Signalization of Route 16/108/Watson intersection and coordination with Route 108 signal system to the west.
2. Channelization and minor roadway widening to include:
   a. Left turn storage lanes on Route 16 at Watson Road and at Jenness Street;
   b. An exclusive right turn lane from Route 16 southbound to Route 108 with channelizing island;
   c. Minor adjustments to the island area bounded by Route 108/16/Jenness Street to allow better alignment between Route 108 and Watson Road
   d. Minor road surface repairs at the southeast corner of Route 108 and Jenness Street.

4. Route 108 at Locust Street

The existing problems associated with both this intersection, and the nearby Spaulding Turnpike Northbound Ramps are:

- Delays for traffic turning onto Route 108 from Locust Street, the
- Burger King Driveway and the Spaulding Turnpike Northbound Ramps.
- Close proximity of the adjacent intersection of the Spaulding Turnpike northbound ramp.
- Skew angle of the Locust Street intersection.

The installation of traffic signals along with improved roadway geometry is recommended to mitigate the above noted problems. It is estimated that traffic signal warrants are presently exceeded along Locust Street based on the 1988 PM peak hour design volumes. It is estimated that traffic signal warrant will be met at the Spaulding Turnpike ramp by 1993.

The recommended improvements are excerpted from the NH Route 108 Corridor Study prepared by the Strafford Regional Planning Commission, December 30, 1987, and include the following:

1. Signalization of the Route 108/Locust/Burger King intersection, together with the Route 108/Spaulding Turnpike Ramp intersection, to operate as one unified intersection. Also include this intersection in a coordinated signal system along Route 108 from Route 16 to Back River Road.
2. Relocate island and monument on Locust Street approach to the northeast, coupled with minor widening on the west side of Locust Street to provide two southbound approach lanes on Locust Street (exclusive right turn lane and thru/left lane).
3. Update striping on Route 108 to provide left turn lanes into Locust Street and Spaulding Turnpike Ramps and new signalized crosswalks.
4. Minor widening and new channelization on the Burger King drive to provide both a left turn and a thru/right turn lane.

The conceptual plan for this major intersection improvement is illustrated on Figure 28. The close proximity of the two jointly signalized intersections will require an additional signal phase for exclusive movements from the Spaulding Turnpike Ramp passing through the Locust Street intersection. This additional phase will result in an anticipated level of service C operation for projected 1993 peak hour conditions.

In addition, existing uncontrolled driveway openings from the Citgo Service Station (on the northeast corner) onto Route 108 will emerge in the immediate vicinity of the intersection and will require more restrictive traffic control in order that the integrity of the proposed signal installation will not be compromised. These considerations will require extensive review during the preliminary design process.

5. Route 108 at Back River Road

The main problem associated with this intersection is the extended queuing of northbound Route 108 traffic stopped at the adjacent Mill Street intersection to the north and subsequent delays to turning movements at Back River Road. Significant residential development planned for the Mast Road area is anticipated to compound this problem by 1993.

The installation of traffic signals and required coordination with the existing signal operation at the Mill Street/Spaulding Turnpike Ramp intersection is recommended to mitigate the above noted problem. Both of these intersections, in turn, should be included in a coordinated signal system along Route 108 from Route 16 to Back River Road. It is estimated that traffic signal warrants at the Route 108/Back River Road intersection are presently exceeded based on the 1988 PM peak hour design volumes.

These improvements are also indicated in the N.H. Route 108 Corridor Study prepared by the Strafford Regional Planning Commission, December 30, 1987.

An immediate, low cost improvement to the existing condition would be posting of a "Do Not Block Intersection" sign for northbound Route 108 traffic so as to help keep the intersection clear of quered vehicles.

The conceptual plan for these intersection improvements is illustrated on Figure No. 29.

The combined operation of both the Back River Road and the Mill Street/Ramp intersection is estimated to operate at level of service D under the indicated signal phasing. A detailed signal system analysis of this intersection under the coordinated operation of all Route 108 signals between Back River Road and Route 16 (recommended during the preliminary design phase of these Route 108 improvements) may indicate a need for additional vehicle clearance or exclusive vehicle intervals which may result in a lower (LOS "E") overall level of service by 1993.

6. Silver Street at Arch Street

The existing problems associated with the operation of this intersection are:

- Delays for traffic turning onto and crossing Silver Street from Arch Street and Towle Street;
- Restricted sight distance east of the intersection along Silver Street;
- Concern for school children crossing busy intersection;

The installation of traffic signals along with channelization of turning movements is recommended to mitigate the above noted problems. It is estimated that Traffic Signal Warrants are presently exceeded based on the 1988 PM peak hour design volumes. The signal installation should include provision for an exclusive pedestrian walk phase. This signal should also be coordinated with the planned signal at Silver/Locust Street. Such coordination can be designed to encourage travel at a specified maximum speed in order to avoid stopping at a second red light.

In addition, realignment of the existing north curb along the westbound Silver Street approach to generally provide a constant roadway width through the intersection will improve the overall lane alignment for vehicular traffic and will reduce the length of crosswalk on the east leg of the intersection.

Painted channelization for exclusive left turn lanes on Silver Street and an exclusive right turn lane on Arch Street can be installed within the present pavement width. Stop bars for the left turn lanes on Silver Street will have to be set back to allow space for encroaching turning traffic movements at the intersection.

The prohibition of all parking along each of the approaches to this intersection should be enforced, particularly along the proposed three-lane sections. An existing mailbox (U.S. Postal Service) on the eastern side of Arch Street should be relocated to preclude traffic from stopping in the vicinity of the intersection.

The conceptual plan for this intersection improvement is illustrated on Figure No. 30.

7. Chestnut Street at Green Street

The main problems associated with the operation of this intersection include:

- Restricted visibility of the painted crosswalk area to vehicles approaching from the north on Chestnut Street due to crest vertical curvature of the roadway at the crosswalk area;
- The 4-lane width of Chestnut Street coupled with the demand for Chestnut Street crossings by residents of nearby senior citizen housing;
- Delays for the high volume of traffic along Green Street wishing to turn left onto Chestnut Street;
- Peak period traffic backups at the Green Street entrance to the Post Office caused by high volumes of postal customers, the above delays on Green Street, and the close proximity of the postal entrance to Chestnut Street.

While traffic signalization would mitigate the above problems, the installation of new signals less than 300 feet from the presently signalized Chestnut/Washington intersection is not desireable with regard to traffic flow along Chestnut Street. Recommended by the Transportation Committee as an alternative would be the closure of Green Street at Chestnut Street. Green Street, between Chestnut Street and Fayette Street would become one-way westbound to direct exiting post office vehicles toward Washington Street. The existing traffic circulation through the post office customer lot would be reversed (Fayette to Green). Needed additional post office parking (at least 10-15 new spaces) can be provided along the closed off segment of Green Street east of Fayette Street.

These recommended improvements are illustrated on Figure 31, and will mitigate the present vehicle delays experienced at the Chestnut/Green intersection. While vehicle-pedestrian sight distance at the Green Street crosswalk is generally adequate for a 35 mph speed, the installation of new crosswalk markings and posted advance signing for the pedestrian crossing on the Chestnut Street southbound approach is recommended as a short term improvement. During heavy traffic periods, potential pedestrian crossing delays may be alleviated by utilizing the presently signalized Chestnut Street crosswalk at Washington Street.

These recommended improvements are illustrated on Figure 31.

8. Central Avenue at Oak Street

The major problem associated with the operation of this intersection is delay for the high volume of traffic along Oak Street wishing to turn onto Central Avenue.

The installation of traffic signals along with the proposed realignment/widening of the Oak Street approach to eliminate the existing offset in alignment with Reservoir Street is recommended to mitigate the above noted problem. Coordination of this signal with adjacent signals at Old Rollinsford Road (planned) and Fourth Street is also recommended. It is estimated that traffic signal warrants are presently exceeded based on the 1988 PM peak hour design volumes.

The proposed improvements are illustrated on Figure 32.

9. Portland Avenue at Oak Street

The main problems associated with the operation of this intersection are:

- Delays for high volumes of traffic turning onto and crossing Portland Avenue from Oak Street;
- High speeds of vehicles traveling along Portland Avenue which compound the delays to Oak Street vehicles turning at the intersection.

The installation of traffic signals along with channelization of left turn movements along Portland Avenue is recommended. It is estimated that Traffic Signal Warrants are presently exceeded based on the 1988 PM peak hour design volumes.

The painting of left turn standby lanes on Portland Avenue can be accomplished within the existing three lane width by utilizing the present eastbound passing lane. Conversion of this passing lane to a two-way left turn lane west of the intersection (within the City of Dover) is also suggested.

As an interim measure to partially mitigate existing problems, a low cost improvement would be an extension of the existing 35 mph speed zone further east along the highway within the jurisdiction of the Town of Rollinsford in order to lower vehicle speeds along each approach to the intersection. Because of the nature of Route 4 at this location, such a speed reduction may only be effective with increased enforcement efforts.

The trimming of tree branches and brush along the westbound shoulder of Portland Avenue just west of Oak Street is also recommended to improve the corner sight distance visibility for Oak Street southbound vehicles.

The recommended improvements are illustrated on Figure 33.

10. Portland Avenue at Portland Street

The existing problems associated with the operation of this intersection are:

- Up-grade along Portland Street approach;
- Skew angle of intersection;
- Delays for eastbound traffic along Portland Avenue that must stop and wait for an adequate gap in the through traffic pattern to proceed east through the intersection.

Review of the physical layout of the intersection did not reveal any feasible, cost effective solution to the geometric deficiencies noted.

A recommended low cost improvement that would reduce potential traffic conflicts at the intersection would be the restriction of left turns from the Portland Street approach as illustrated on Figure 34.

Due to the steep grade along Portland Street, non-stop traffic movements should be maintained for the northbound direction to avoid potential problems with stopping on the upgrade during icy winter conditions. For this reason, the installation of traffic signals is not recommended although present peak hour design volumes indicate that traffic signal warrants are met. Hence, the existing stop sign control along Portland Avenue eastbound should be maintained.

The designation of Portland Street as one-way southbound would alleviate the up-grade problem, however, the resultant increase in northbound traffic volumes along Main Street from Portland Street to Portland Avenue and eastbound along Portland Avenue from Main Street to Portland Street is considered to be unacceptable.

11. Central Avenue at Shop n' Save

The major problem associated with the operation of this presently signalized intersection is the extended period of stopped time for left turn movements into, and all movements out of, the Shop n' Save driveway.

In order to mitigate these unnecessary delays and resultant queuing, it is recommended that the existing signal timing and coordination with the signal at Glenwood Avenue be investigated and adjusted as necessary.

With the implementation of this improvement it is anticipated that an acceptable level of service C condition will be provided for the 1993 PM peak hour design volumes.

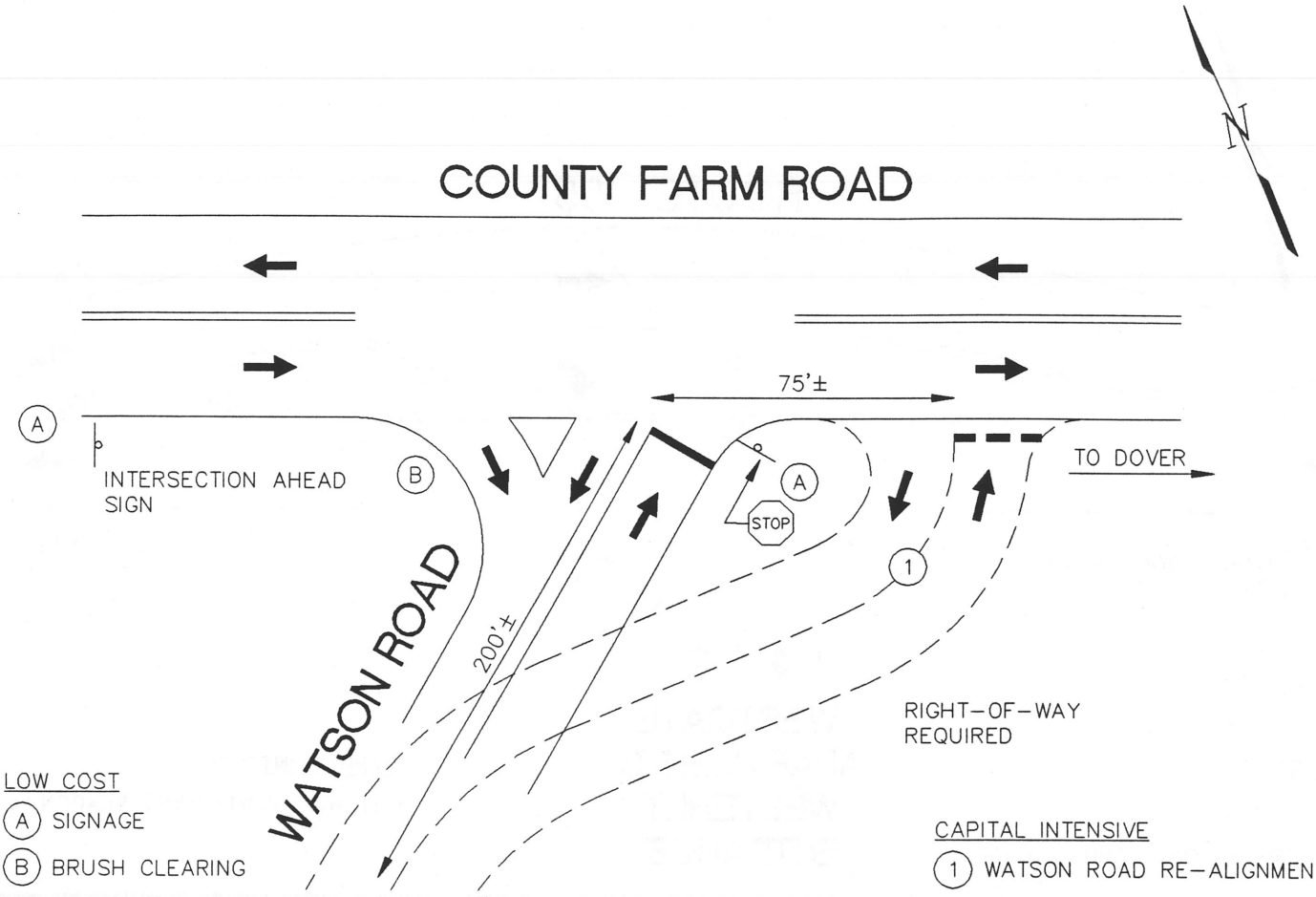
12. Broadway and Oak Street

The existing problems associated with the operation of this intersection are:

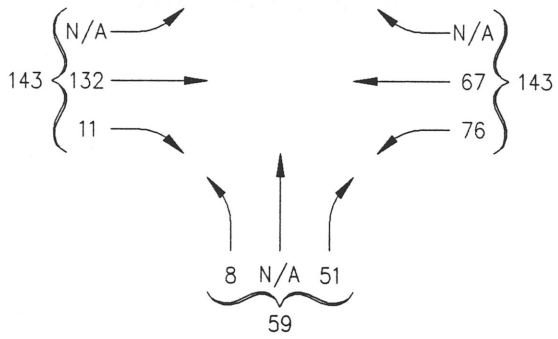
- Delays for vehicles crossing or turning onto Broadway from Oak Street;
- Restricted sight distance along Broadway north of the intersection;
- High number of accidents and accident rate.

In order to mitigate these problems it is recommended that 4-way stop sign control be implemented at the intersection as illustrated conceptually on Figure 36. To supplement this traffic control particularly in regard to the sight distance restriction on Broadway to the north, it is recommended that the present overhead flashing beacon be revised to flash a four-way red indication. A stop ahead sign is also recommended on the Broadway southbound approach to this intersection (in Rollinsford). This low cost improvement is anticipated to provide an acceptable level of service C for the projected 1993 PM peak hour design volumes.

Traffic signal installation is not recommended at this time since traffic volumes utilizing the intersection neither meet Traffic Signal Warrants now, nor in 1993 if the number of accidents are sufficiently reduced under the 4-way stop control. However, at the time of this study, there was preliminary discussion of potential new commercial development along Broadway just south of the intersection. If plans for this development become established, an updated traffic study of the intersection should be prepared and signal warrants reinvestigated.



1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 345

MINOR STREET
LEVEL OF SERVICE: A

COST OF IMPROVEMENTS

LOW COST: $500

CAPITAL INTENSIVE: $85,000

INTERSECTION NUMBER 1

RECOMMENDED IMPROVEMENTS
Watson Road at County Farm Road

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 25

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

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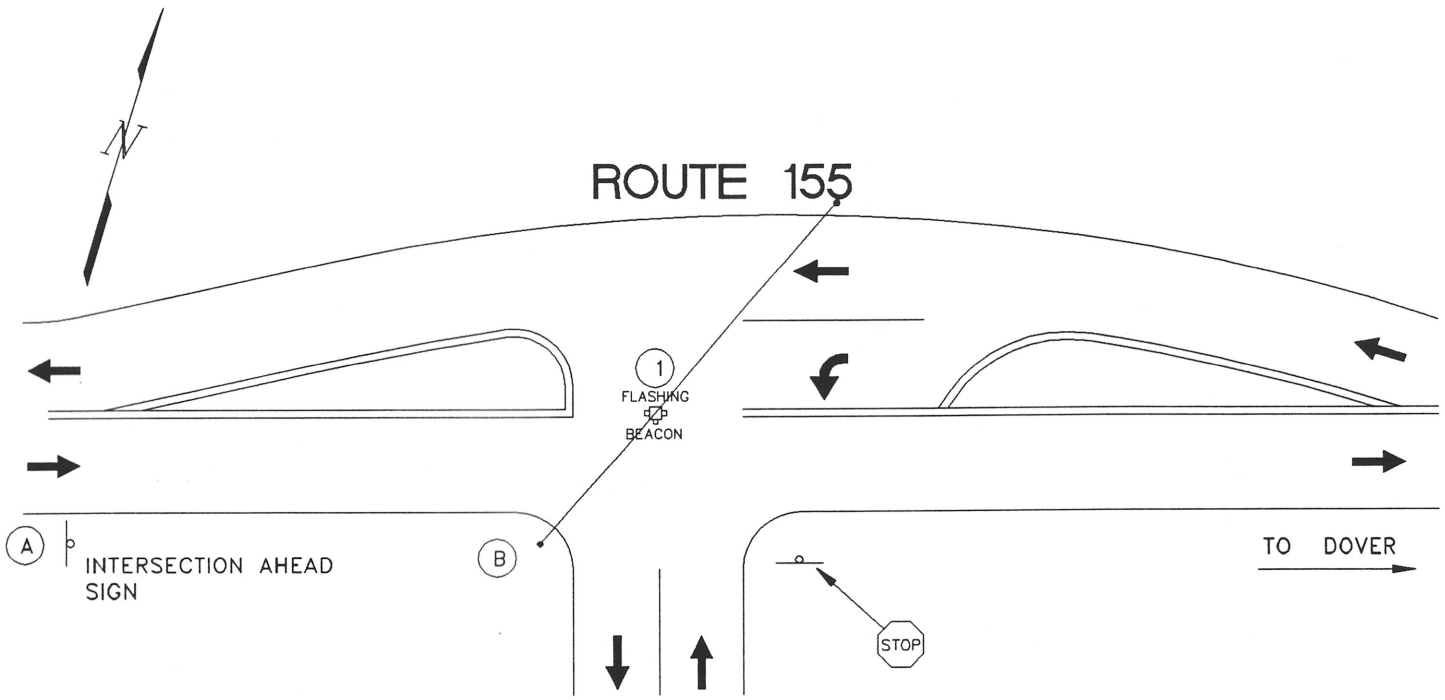


LOW COST

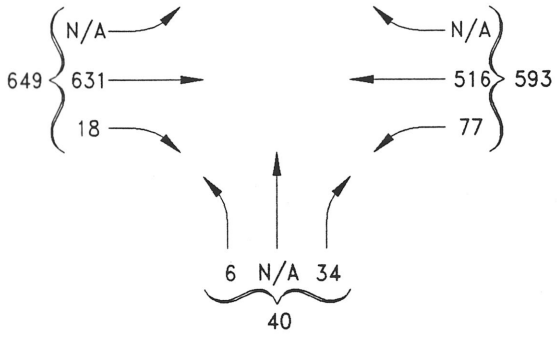
(A) SIGNAGE

(B) CURB REMOVAL AND GRADING

CAPITAL INTENSIVE

(1) INSTALL FLASHING BEACON

1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1282

MINOR STREET
LEVEL OF SERVICE: D

COST OF IMPROVEMENTS

LOW COST: $1500

CAPITAL INTENSIVE: $7000

INTERSECTION NUMBER 2

RECOMMENDED IMPROVEMENTS
Route 155 at Westgate Apartments

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 26

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

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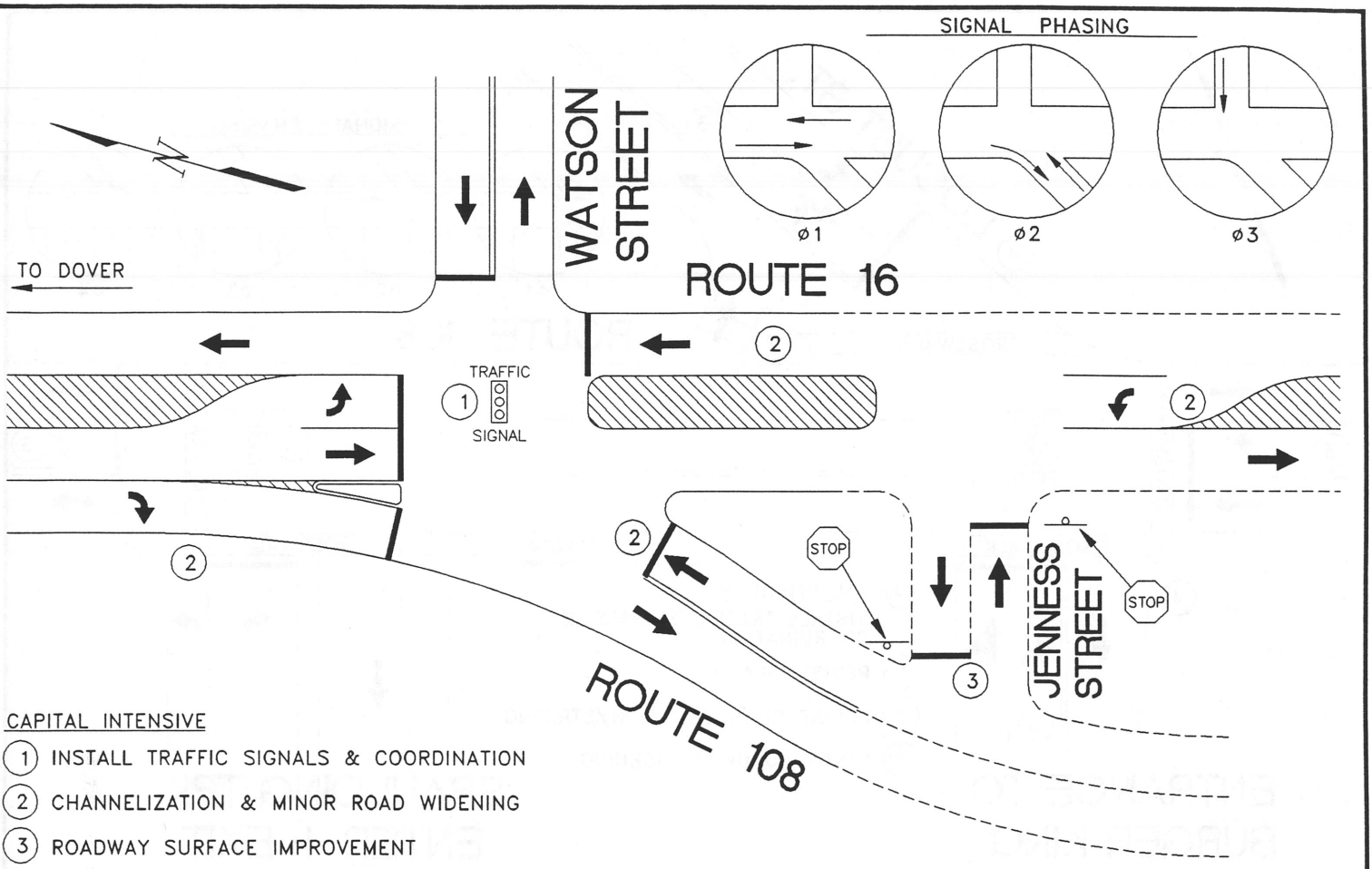
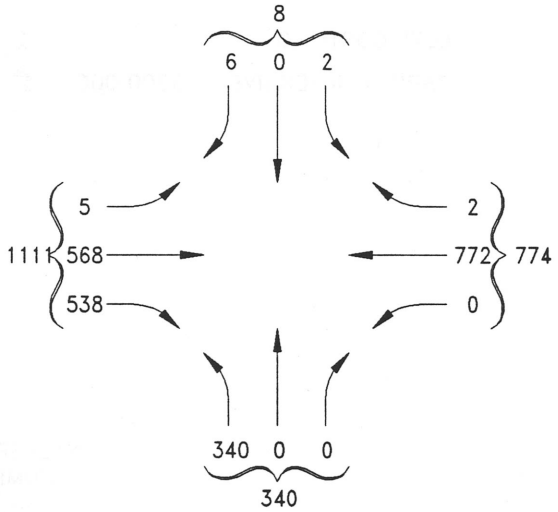


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2233

OVERALL SIGNALIZED
LEVEL OF SERVICE: B

COST OF IMPROVEMENTS

LOW COST: 0

CAPITAL INTENSIVE: $180,000

INTERSECTION NUMBER
3

RECOMMENDED IMPROVEMENTS
Route 108 at Route 16

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 27

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

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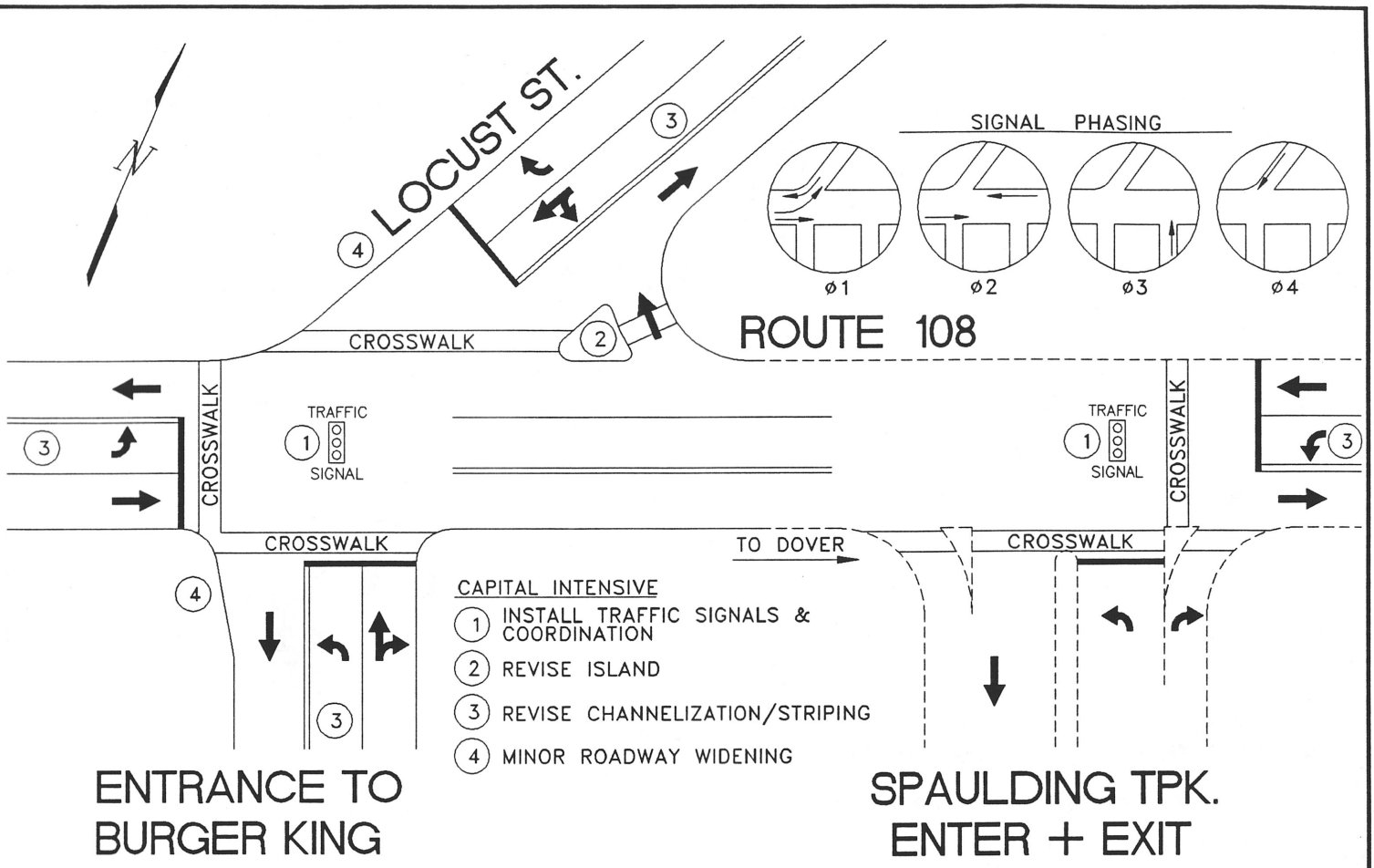
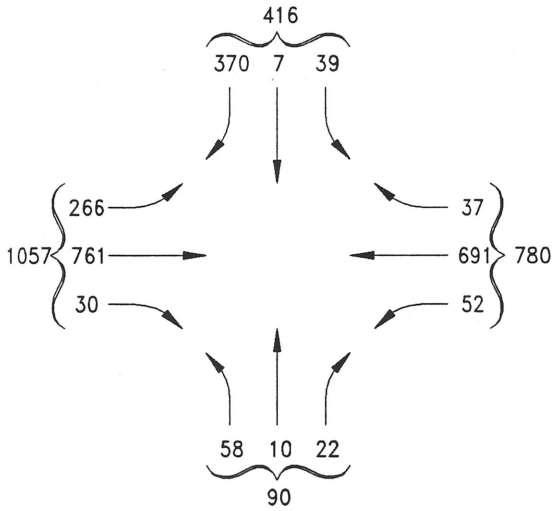


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2343

OVERALL SIGNALIZED
LEVEL OF SERVICE: C

COST OF IMPROVEMENTS

LOW COST: 0

CAPITAL INTENSIVE: $200,000

INTERSECTION NUMBER 4

RECOMMENDED IMPROVEMENTS
Route 108 at Locust Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 28

FREDETTE ASSOCIATES, INC.
PROFESSIONAL ENGINEERS AND LAND SURVEYORS
P.O. Box 644, Salem, New Hampshire 03079
Tel. (603) 893-7497

STORCH ASSOCIATES
engineers – surveyors – landscape architects
planners – environmental scientists
994 Candia Road – Manchester, N.H. 03103

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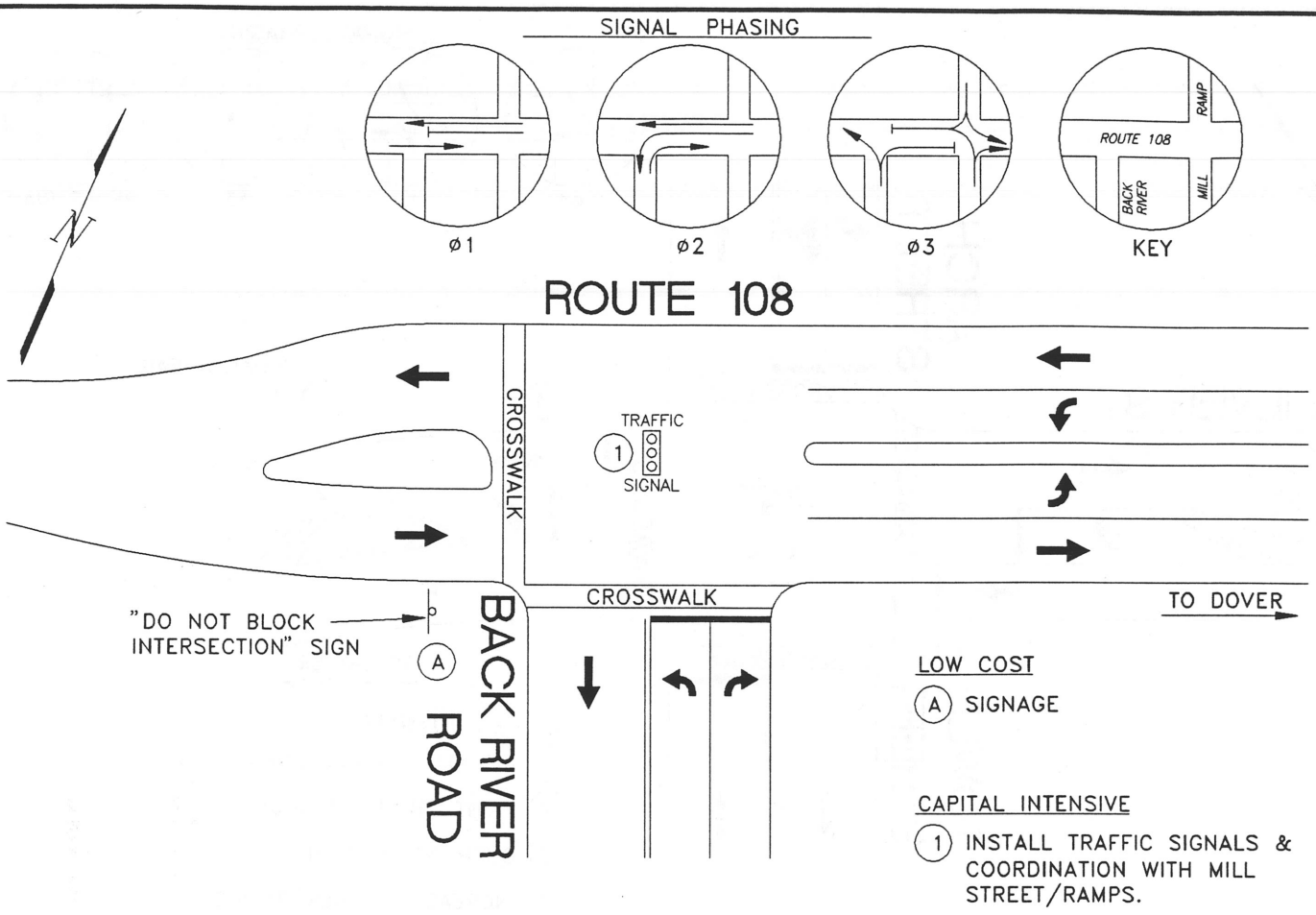
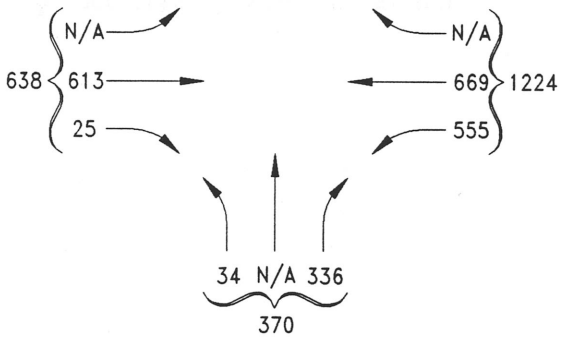


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2232

OVERALL SIGNALIZED* LEVEL OF SERVICE: B

* – LOS D AT ADJACENT MILL STREET INTERSECTION

COST OF IMPROVEMENTS

LOW COST: $100

CAPITAL INTENSIVE: $120,000

INTERSECTION NUMBER 5

RECOMMENDED IMPROVEMENTS
Route 108 at Back River Road

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 29

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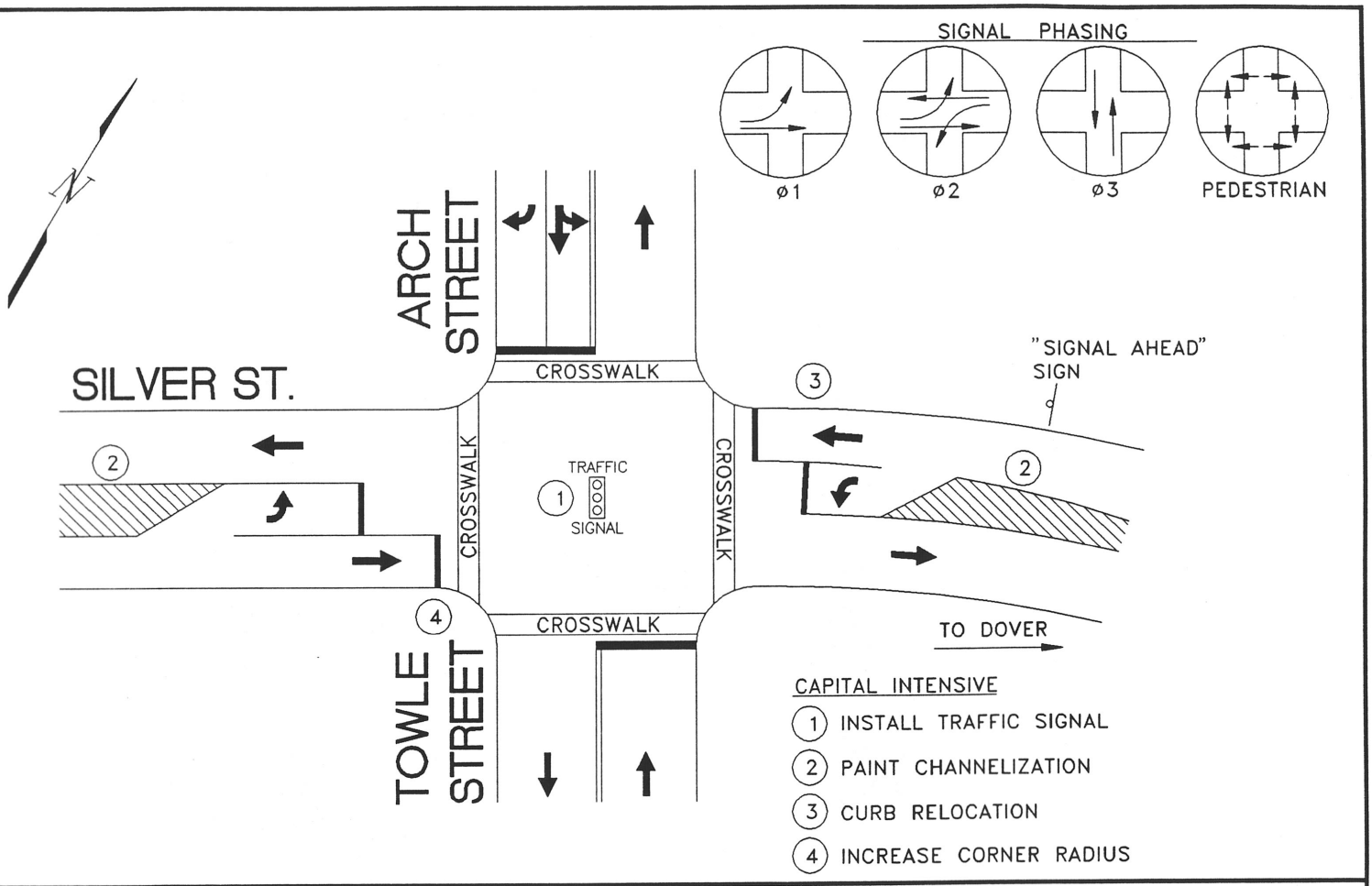

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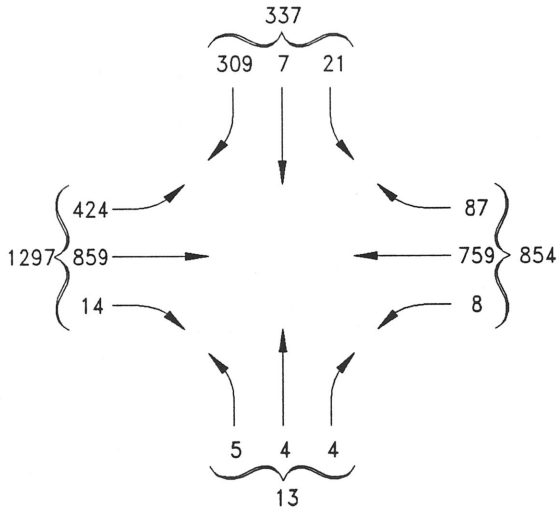

TOTAL ENTERING VOLUME: 2501

OVERALL SIGNALIZED
LEVEL OF SERVICE: C

COST OF IMPROVEMENTS

LOW COST: 0

CAPITAL INTENSIVE: $110,000

INTERSECTION NUMBER 6

RECOMMENDED IMPROVEMENTS
Silver Street at Arch Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 30

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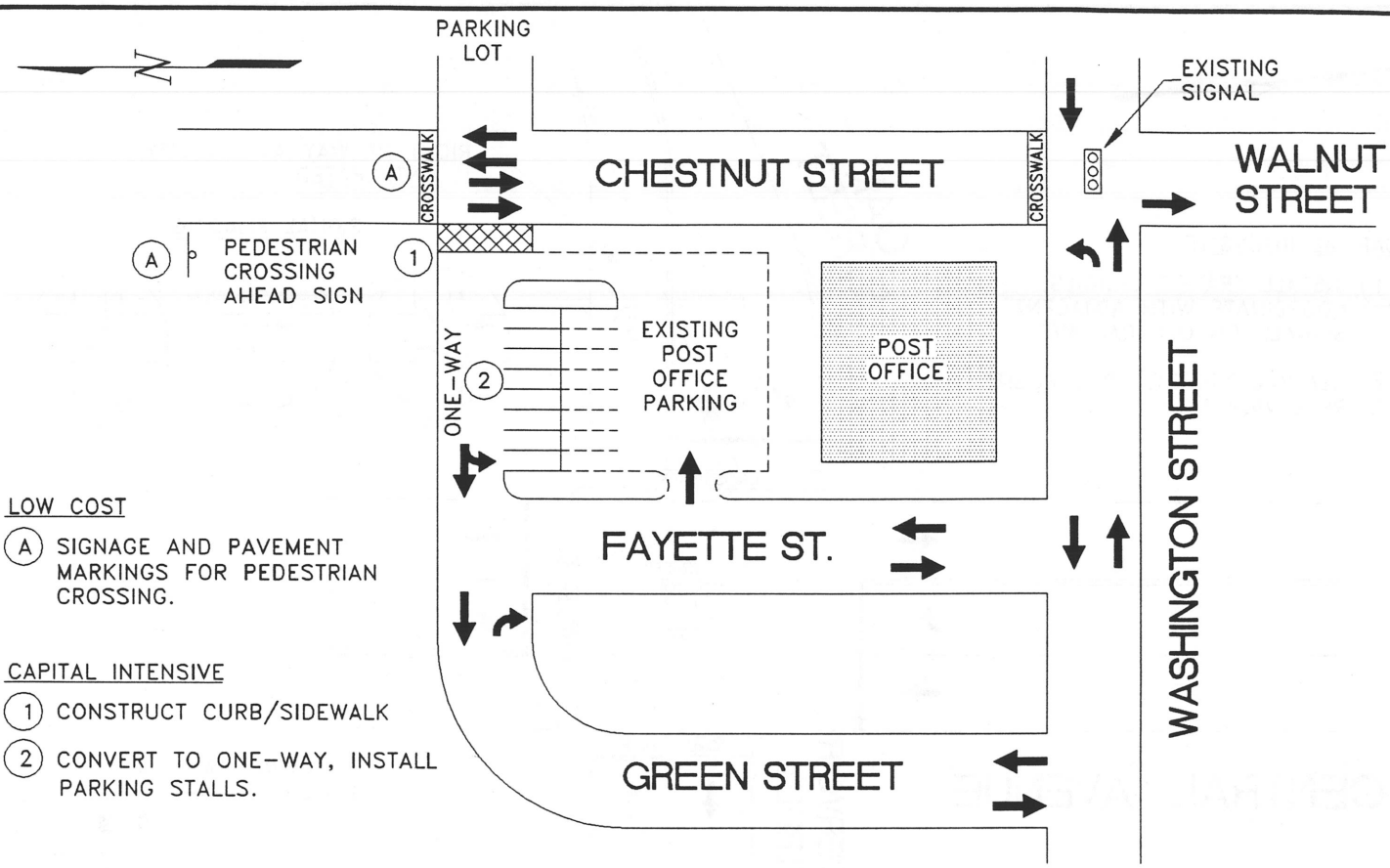
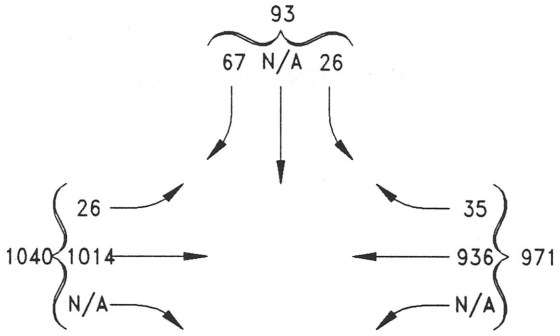


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2104

COST OF IMPROVEMENTS

LOW COST: $300

CAPITAL INTENSIVE: $5000

INTERSECTION NUMBER 7

RECOMMENDED IMPROVEMENTS
Chestnut Street at Green Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 31

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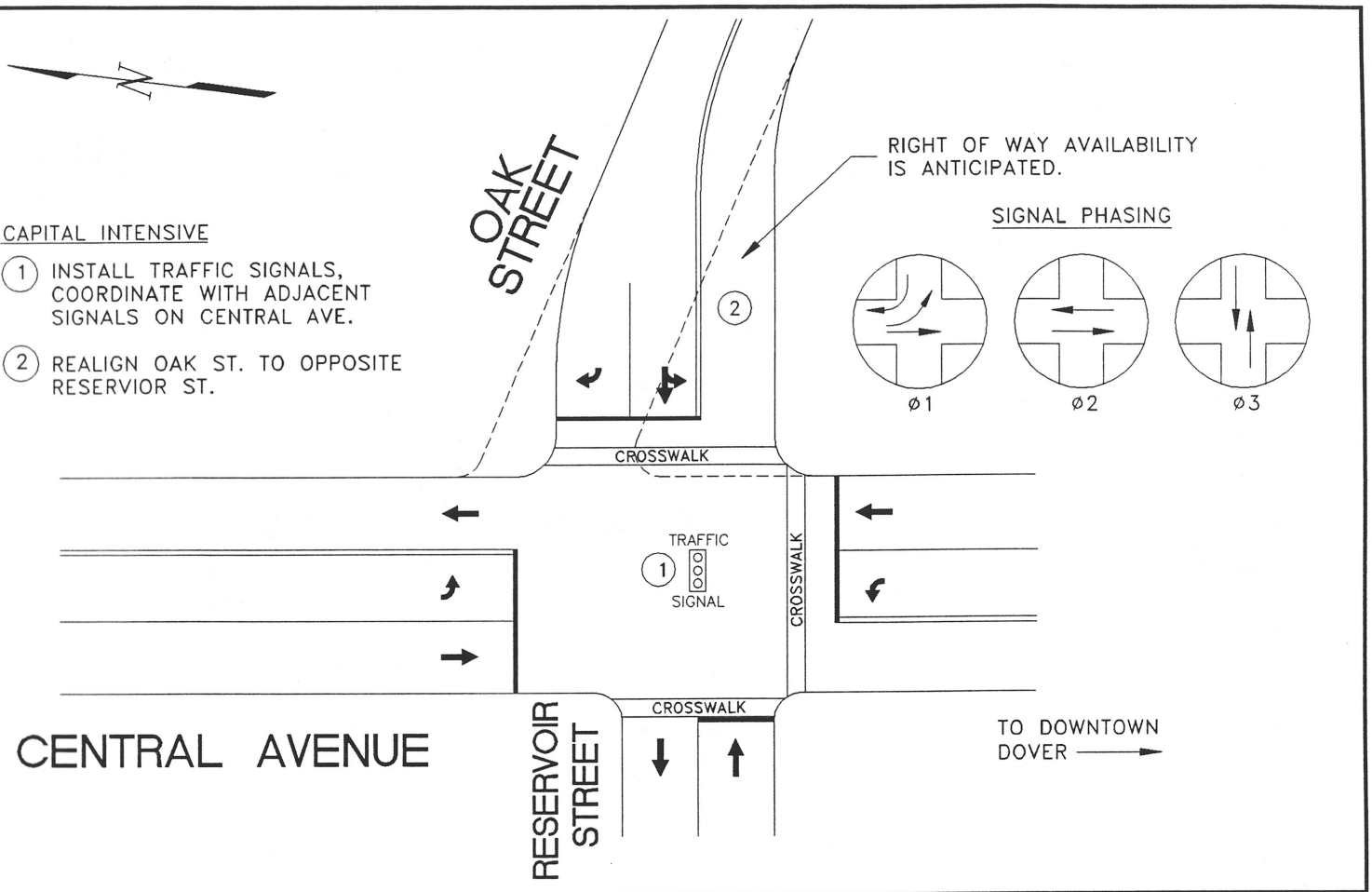
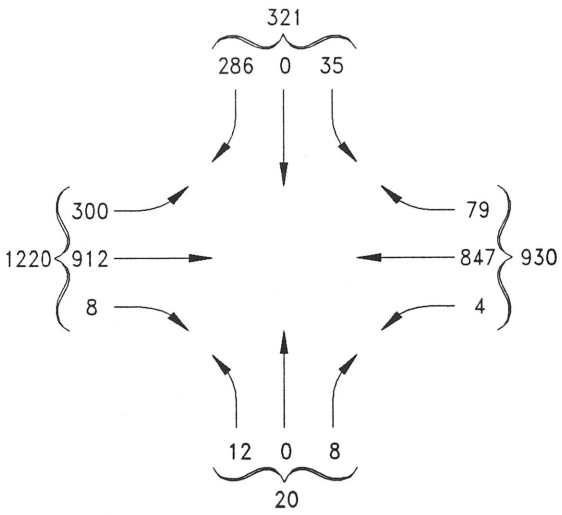


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 2491

OVERALL SIGNALIZED LEVEL OF SERVICE: C

COST OF IMPROVEMENTS

LOW COST: 0

CAPITAL INTENSIVE: $225,000

INTERSECTION NUMBER 8

RECOMMENDED IMPROVEMENTS
Central Avenue at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 32

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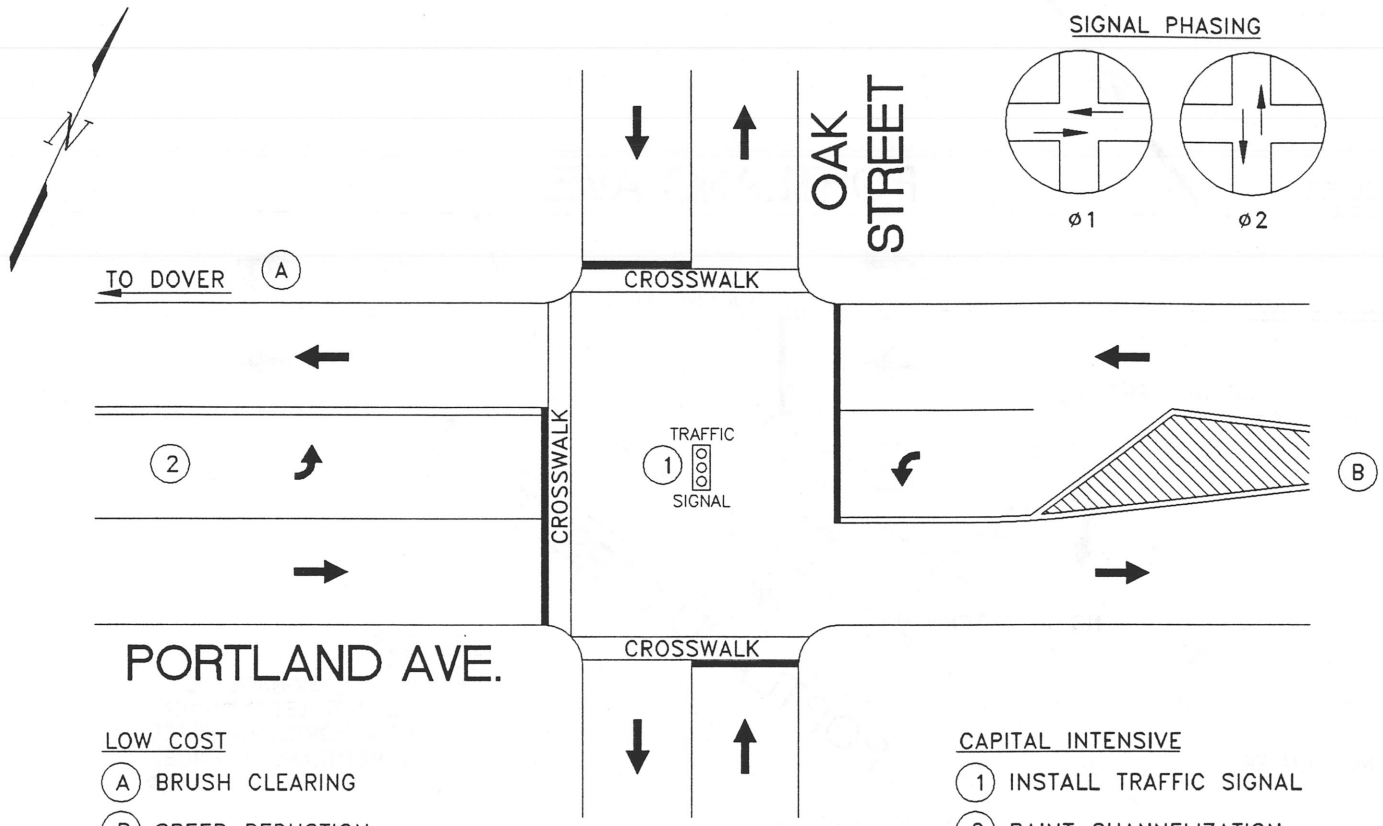
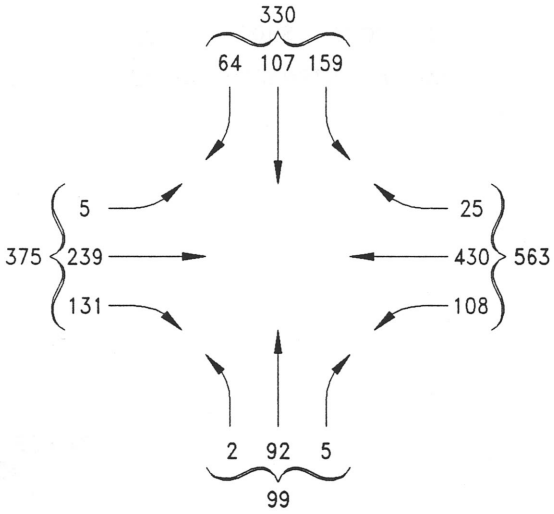


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1367

MINOR STREET
LEVEL OF SERVICE: B

COST OF IMPROVEMENTS

LOW COST: $300

CAPITAL INTENSIVE: $90,000

INTERSECTION NUMBER 9

RECOMMENDED IMPROVEMENTS
Portland Avenue at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 33

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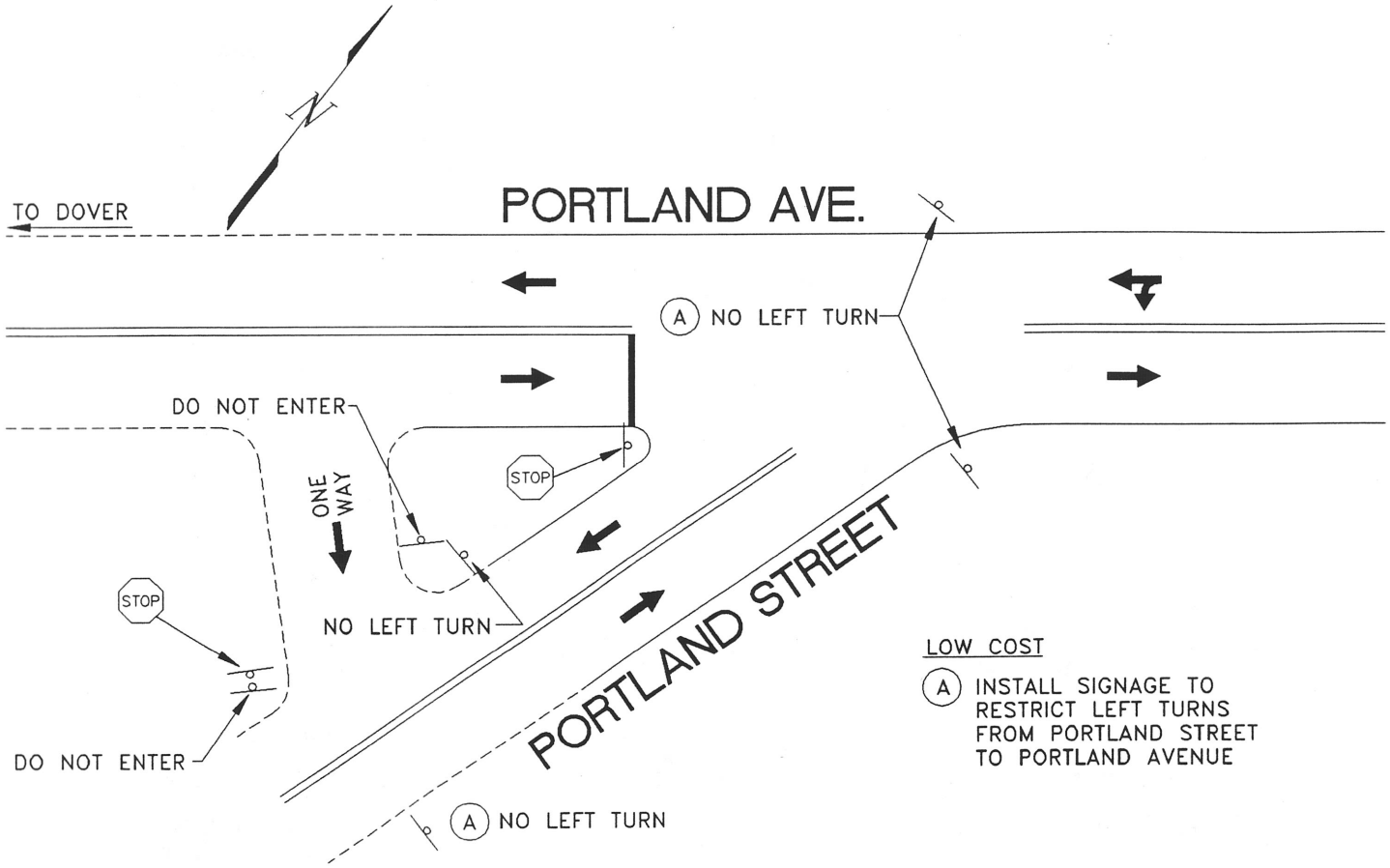
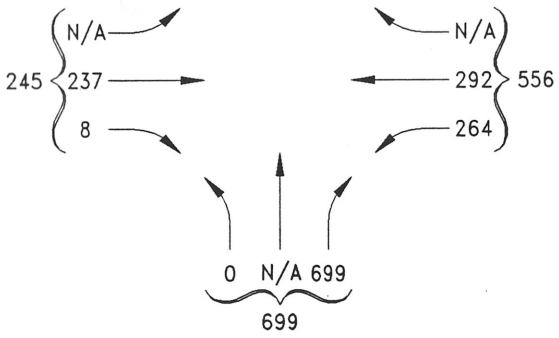


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1500

MINOR STREET
LEVEL OF SERVICE: F

COST OF IMPROVEMENTS

LOW COST: $900

CAPITAL INTENSIVE: 0

INTERSECTION NUMBER 10

RECOMMENDED IMPROVEMENTS
Portland Avenue at Portland Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 34

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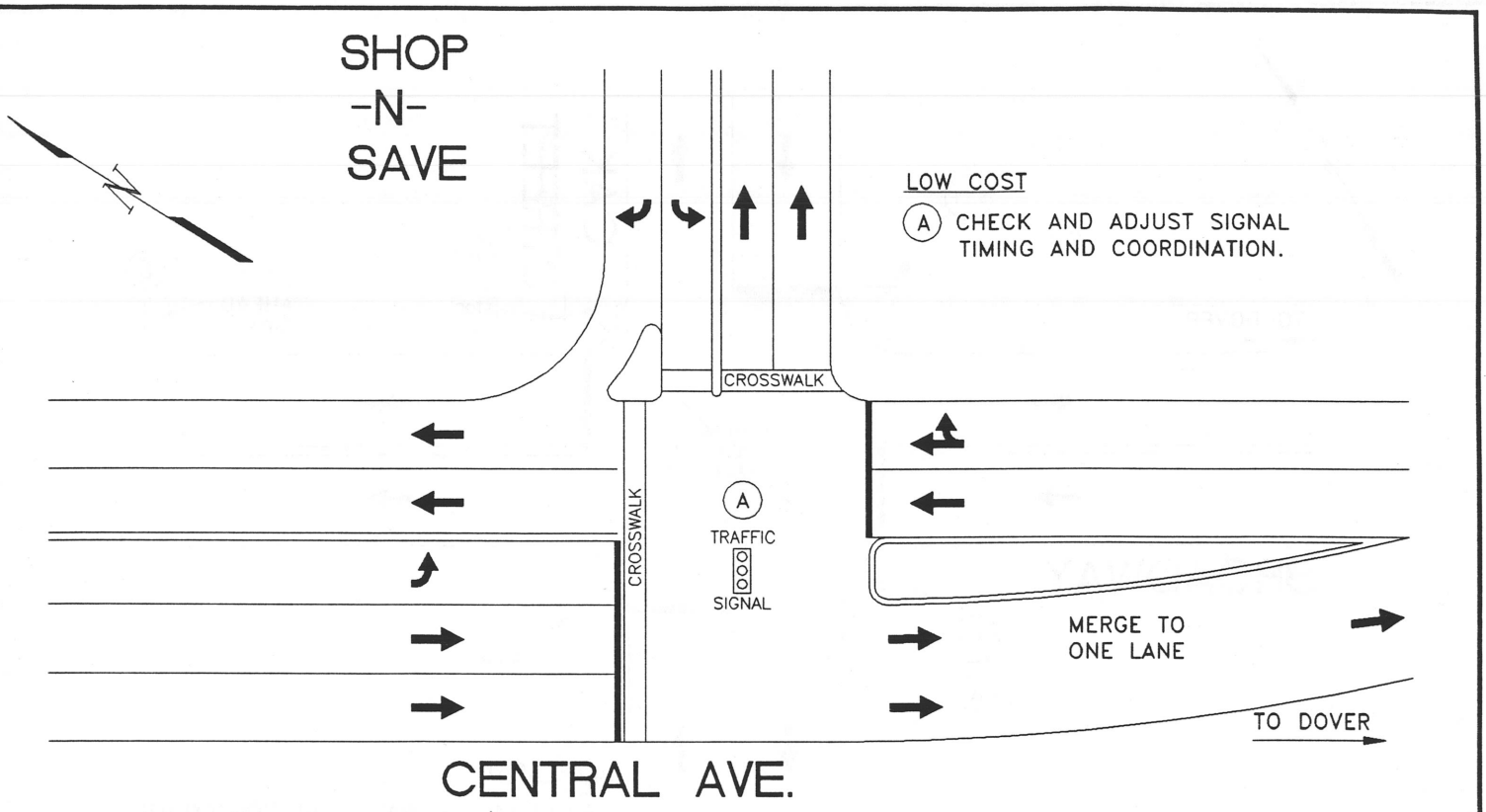
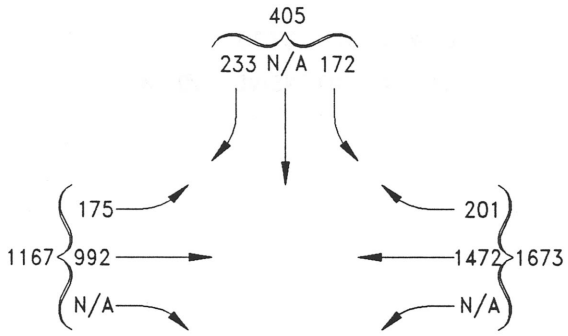


1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 3245

OVERALL
LEVEL OF SERVICE: C

COST OF IMPROVEMENTS

LOW COST: $500

CAPITAL INTENSIVE: 0

INTERSECTION NUMBER
11

RECOMMENDED IMPROVEMENTS
Central Avenue at Shop'n Save

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 35

FREDETTE ASSOCIATES, INC.
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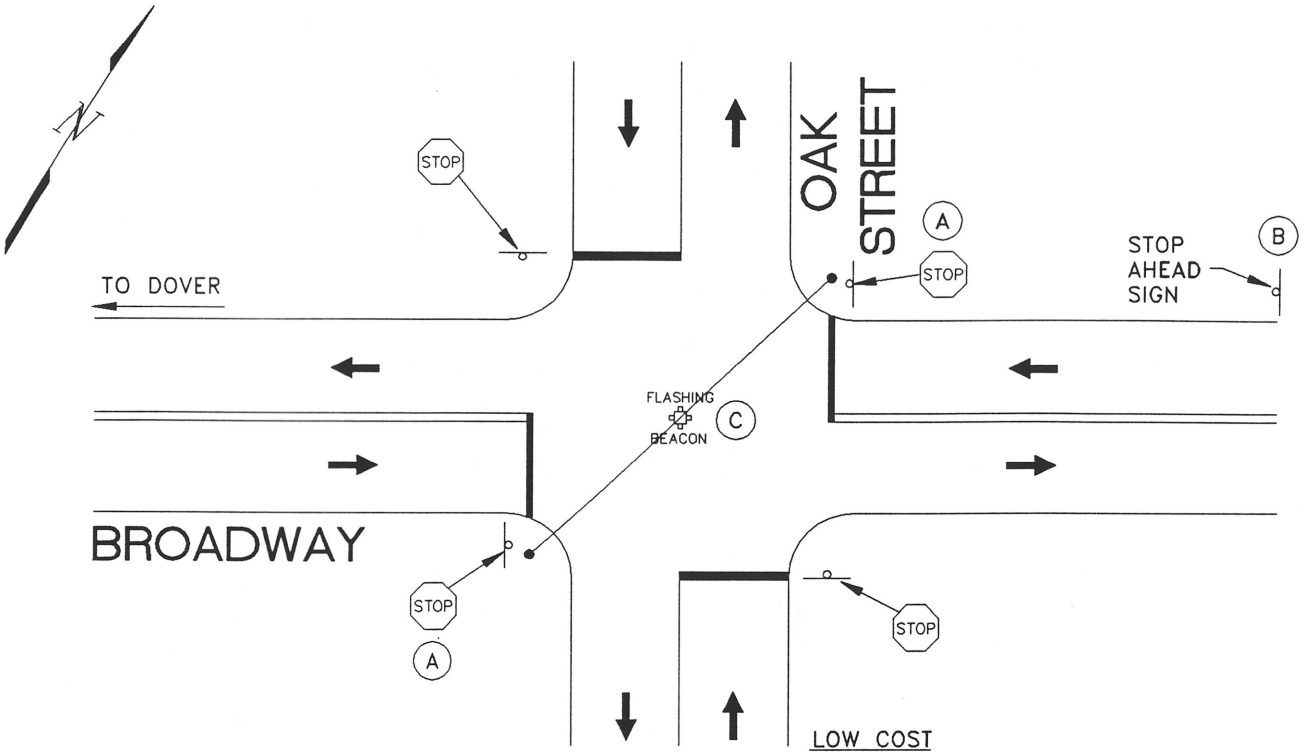


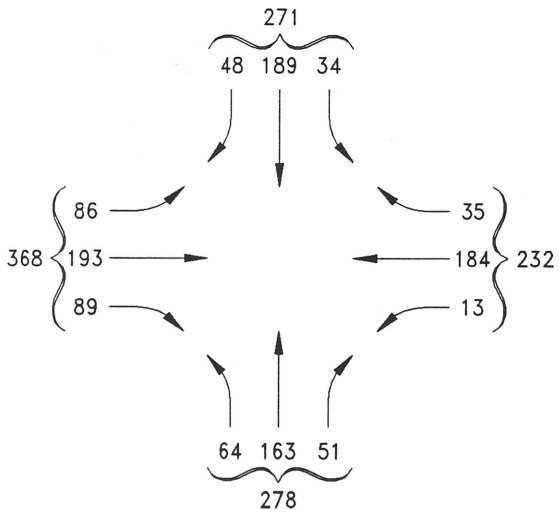
LOW COST

(A) INSTALL 4-WAY STOP SIGN CONTROL

(B) STOP AHEAD SIGNAGE

(C) CONVERT BEACON TO 4-WAY FLASHING RED

1993 DESIGN HOUR VOLUMES



TOTAL ENTERING VOLUME: 1149

OVERALL INTERSECTION
LEVEL OF SERVICE: C

COST OF IMPROVEMENTS

LOW COST: $700

CAPITAL INTENSIVE: 0

INTERSECTION NUMBER 12

RECOMMENDED IMPROVEMENTS
Broadway at Oak Street

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: MARCH, 1988

FIGURE No. 36

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Technical Memorandum No. 2

CENTRAL AVENUE CORRIDOR STUDY

I. Introduction

A. Background

In January, 1988, the City of Dover retained the consulting firms of Storch Associates of Manchester, New Hampshire and Fredette Associates, Inc. of Salem, New Hampshire to provide technical input into the Transportation Component of the 1988 Master Plan. This technical input may be expressed in the following task objectives:

Task 1. Identify existing conditions and recommend improvements for twelve problem intersection locations.

Task 2. Investigate options for improving traffic flow in the downtown Central Avenue Corridor, including land widening, one-way circulation pattern, or new bypass roadway.

Task 3. Identify long range highway improvement needs for the Route 9 Corridor in the City of Dover per major industrial rezoning proposed in the Master Plan.

This Technical Memorandum No. 2 - Central Avenue Corridor Study documents the results of Task 2 of the Transportation Component.

This study of the Downtown segment of the corridor completes a comprehensive, long term transportation plan for the entire Central Avenue corridor in conjunction with a 1987 study of the southern portion of the corridor (south of Silver Street) and a 1984 study of the northern portion of the corridor (Oak Street through Weeks Circle).

B. Methodology

Technical Memorandum No.2 - Central Avenue Corridor Study, evaluates alternative roadway network improvements to the Central Avenue corridor through the downtown area of the City of Dover. The objective of this study is to develop a recommendation for corridor improvements which will both mitigate existing deficiencies in downtown traffic flow, as well as provide for the transportation needs of future traffic growth in the City.

II. Corridor Characteristics

A. Study Area Roadways

The study area is illustrated in Figure 1 and includes these three primary routes:

1. Central Avenue from Oak Street to just south of Silver Street, including the Main Street loop;
2. Chestnut Street from Central Avenue to Washington Street; and
3. Locust Street from Washington Street (and Walnut Street) to just south of Silver Street.

Additional key roadway segments included Sixth Street, Broadway, Portland Avenue, Portland Street, Washington Street, Silver Street, and N.H. Route 108.

B. Present Roadway Facility

An inventory of physical roadway features and traffic control on selected corridor segments and key intersections is depicted in Figure 2. Indicated are the following:

- Paved roadway width (curb-to-curb)
- Number of through traffic lanes in each direction (exclusive turn lanes not included)
- One-way streets
- Traffic signals
- Number, type and location of designated curbside parking spaces.

Central Avenue is the primary arterial route through the City of Dover. It services both the central core and outer business districts of the City. It generally provides one through travel lane in each direction with designated curbside parking on each side. In the central core area between Broadway and Washington Street, the corridor splits into a one-way street loop with two through travel lanes in each direction: Central Avenue for southbound flow; and Main Street for northbound flow. This area comprises the retail/commercial core of the downtown area and has been recently renovated with landscaped sidewalk and curbside parking facilities.

Chestnut Street functions both as a bypass of Central Avenue and as the primary service route for the outer business district just west of the downtown core area. It is a recently reconstructed four lane roadway between Washington Street and approximately First Street. North to Central Avenue it generally provides one through travel lane in each direction.

ROLLINSFORD

TOWN LINE

OAK STREET

BROADWAY

HILL STREET

MAIN STREET

PORTLAND AVENUE

PORTLAND AVE.

PORTLAND STREET

4

16

9

CENTRAL AVENUE

MAIN STREET

HENRY LAW AVENUE

COURT STREET

CENTRAL AVENUE

CITY HALL

SUMMER

SPRING

TRACEY

LOCUST STREET

WALNUT STREET

CHESTNUT ST.

THIRD STREET

FIRST STREET

GREEN ST.

THOMAS ST.

SILVER ST.

CL. R.R.

16

108

Bellamy River

SIXTH STREET

FOURTH STREET

River

Cocheco

WASHINGTON ST.

WASHINGTON ST.

ARCH STREET

SPAULDING TURNPIKE

155

N

LEGEND

- CENTRAL AVENUE WIDENING
- ONE-WAY CIRCULATION PATTERN
- NEW BYPASS ROADWAY

0 400' 800' 1200' 1600'

LOCATION MAP
CENTRAL AVENUE CORRIDOR STUDY

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 1

FREDETTE ASSOCIATES, INC.
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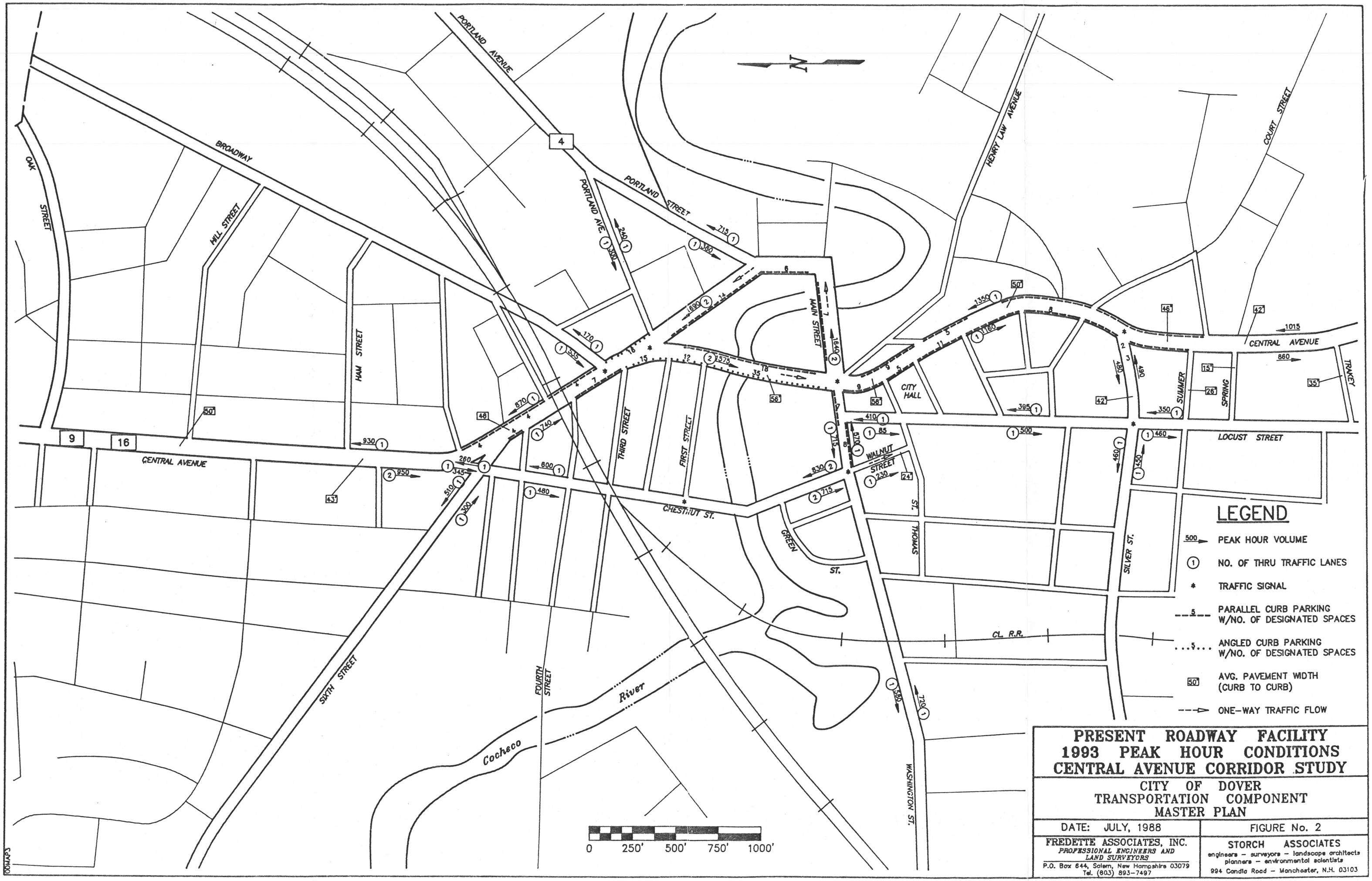

LEGEND

- 500 → PEAK HOUR VOLUME
- (1) NO. OF THRU TRAFFIC LANES
- * TRAFFIC SIGNAL
- ---5--- PARALLEL CURB PARKING W/NO. OF DESIGNATED SPACES
- ...5... ANGLED CURB PARKING W/NO. OF DESIGNATED SPACES
- 50' AVG. PAVEMENT WIDTH (CURB TO CURB)
- ---→ ONE-WAY TRAFFIC FLOW

PRESENT ROADWAY FACILITY
1993 PEAK HOUR CONDITIONS
CENTRAL AVENUE CORRIDOR STUDY

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 2

FREDETTE ASSOCIATES, INC.
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Locust Street also functions as a bypass route of Central Avenue. It is a local collector route through a primarily residential area, with an increased density of institutional (City of Dover) land use near its northern terminus near Washington Street and an increased density of light industrial uses near its southern terminus with Central Avenue (Route 108).

The C.L. Railroad right-of-way is an abandoned one-track facility which begins as a spur from the Boston and Maine Railroad tracks near Chestnut and Third Streets, crosses Washington Street at grade, crosses under Silver Street, and terminates at the Central Avenue (NH Route 108) intersection at Cataract Street in the vicinity of the Spaulding Turnpike overpass.

C. Traffic Volumes

As was established in "Technical Memorandum No. 1, Problem Intersection Locations" the weekday PM peak hour was selected as the critical design hour condition for corridor evaluation. Present peak traffic conditions in the study area were defined by either new or previously conducted traffic counts at the intersections outlined in Table 1. Corresponding turning movement diagrams and count summaries are included in Appendix A.

TABLE 1

TRAFFIC COUNT DATA SOURCES

Intersection	Source*	Date/Time Period
Central at Oak	2	06/23/86, 3:30-4:30 PM
Central at Broadway	1	04/07/88, 3:30-5:30 PM
Chestnut at Sixth	1	03/02/88, 3:30-5:30 PM
Chestnut at Washington	1	03/03/88, 3:30-5:30 PM
Washington at Locust	1	02/24/88, 3:30-5:30 PM
Central at Main & Portland Avenue	4	1990 PM Peak Hour
Central at Washington	4	1990 PM Peak Hour
Main at Portland Street	4	1990 PM Peak Hour
Central at Silver	3	1993 PM Peak Hour
Locust at Silver	3	1993 PM Peak Hour
Central at NH 108/16	3	1993 PM Peak Hour
NH 108 at Locust/ Spaulding Ramp	3	1993 PM Peak Hour
NH 108 at Mill/ Spaulding Ramp	3	1993 PM Peak Hour

* Reference (per Section I-C.)
1. City of Dover count (See Appendix A)
2. Strafford Regional Planning Commission count (See Appendix A)
3. NH 108 Corridor Study (SRPC), 1987 (See Appendix A)
4. Traffic Impact Study for Dover Mills by Costello, Lomasney & deNapoli, 1987 (See Appendix A)

Design year traffic projects for the study area roadway network were projected from this data base utilizing the peak period traffic growth rate of 3.5 percent per year and seasonal adjustment factors documented in Technical Memorandum No. 1. The resulting 1993 design hour volumes along key segments of the corridor are illustrated on Figure 2.

D. System Deficiencies

The primary problem with the present Central Avenue corridor is a deficiency in the capacity of the overall two-lane facility to handle presently heavy corridor flows. Through traffic flow is additionally delayed by uncoordinated signalization and turning movements to and from side streets and driveways and parking traffic maneuvers. The limitations on Central Avenue capacity can also be evidenced, indirectly, by the heavy volume of traffic now utilizing the parallel Chestnut and Locust Streets as alternate routes. These routes now carry volumes ranging from 40 to 70 percent of the peak hour flows along Central Avenue.

Other localized problem areas which contribute to the present deficiencies in corridor traffic flow include:

- Delays for Broadway traffic approaching Central Avenue (presently signalized).
- Delays for Chestnut Street traffic approaching Central Avenue northbound (presently stop sign controlled).
- Delays for Locust Street traffic approaching Washington Street (presently stop sign controlled).
- Delays for Silver Street traffic approaching Central Avenue (presently signalized).
- Delays for Central Avenue traffic at the Main Street intersection (presently signalized).

III. Origin - Destination Study

A. Overview and Findings

An Origin - Destination (O-D) Study of the traffic into and through the downtown district of the City of Dover was completed as a part of this report. The O-D study was designed to provide additional information on the characteristics of Central Avenue Corridor traffic. Specifically, this study was to determine how the traffic funnelled through the downtown area of Dover. Also determined were presence of any commonly traveled routes through downtown for which a bypass or connector road might reduce the number of cars that now use the downtown streets only to get through the area to another destination.

The evaluation of the data that was collected in the O-D Study shows conclusively that the downtown district of Dover is more of a traffic generator than it is a funnel through which cars must travel to another destination. The analysis of the data collected shows that 70 percent of the traffic entering and leaving the downtown district were going to or coming from a destination within the downtown area.

The second highest frequency of occurrence were cars that had entered the downtown and were exiting the study area via Central Avenue northbound. This movement accounted for 15 percent of the cars. A presumptive conclusion is that many of these cars had a destination of the hospital district or the Central Avenue shopping district (the so called Miracle Mile) north of the hospital.

B. Study Design

The O-D Study was designed to analyze traffic to and through the downtown area of Dover. The area selected is generally characterized as the area east of the Spaulding Turnpike bounded on the south by the Exit 6/Central Avenue area and on the north by the Oak Street/Central Avenue intersection. The study was designed to capture all of the cars that entered and departed from this area via the main roads. The count locations that cordoned off the downtown area (or Nodes as they are referred to) are described below and graphically represented on Figure 3.

Node	Description
1	Stark Avenue south of Woodland Road
2	Central Avenue north of Locust Street
3	Locust Street north of Central Avenue
4	Knox Marsh Road (Silver Street) west of Arch Street
5	Sixth Street west of Whittier Street
6	Central Avenue south of Oak Street
7	Broadway south of Oak Street
8	Portland Street just south of City Limits

NODE #7

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 792

NODE	# OF VEHICLES	%
1	13	1.64
2	12	1.52
3	5	0.63
4	9	1.14
5	5	0.63
6	8	1.01
8	6	0.76
NO-MATCH	734	92.7

TOTAL OUTBOUND TRAFFIC: 939
NO-MATCH OUTBOUND VEHICLE: 611 (65.1%)

NODE #8

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 867

NODE	# OF VEHICLES	%
1	16	1.85
2	14	1.61
3	3	0.35
4	6	0.69
5	3	0.35
6	17	1.96
7	5	0.58
NO-MATCH	803	92.6

TOTAL OUTBOUND TRAFFIC: 1286
NO-MATCH OUTBOUND VEHICLE: 786 (61.2%)

NODE #1

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 2063

NODE	# OF VEHICLES	%
2	97	4.70
3	63	3.05
4	74	3.59
5	80	3.88
6	306	14.83
7	102	4.94
8	140	6.79
NO-MATCH	1201	58.2

TOTAL OUTBOUND TRAFFIC: 1415
NO-MATCH OUTBOUND VEHICLE: 959 (67.7%)

NODE #2

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 1479

NODE	# OF VEHICLES	%
1	146	9.87
3	44	2.97
4	58	3.92
5	53	3.58
6	228	15.42
7	70	4.73
8	98	6.63
NO-MATCH	782	52.9

TOTAL OUTBOUND TRAFFIC: 1787
NO-MATCH OUTBOUND VEHICLE: 1328 (74.3%)

NODE #3

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 766

NODE	# OF VEHICLES	%
1	45	5.87
2	53	6.92
4	38	4.96
5	25	3.26
6	121	15.80
7	38	4.96
8	37	4.83
NO-MATCH	409	53.4

TOTAL OUTBOUND TRAFFIC: 681
NO-MATCH OUTBOUND VEHICLE: 495 (72.7%)

NODE #4

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 2362

NODE	# OF VEHICLES	%
1	89	3.77
2	118	5.0
3	45	1.91
5	49	2.07
6	325	13.76
7	100	4.23
8	193	8.17
NO-MATCH	1443	61.1

TOTAL OUTBOUND TRAFFIC: 1811
NO-MATCH OUTBOUND VEHICLE: 1522 (78.4%)

NODE #5

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 397

NODE	# OF VEHICLES	%
1	45	11.33
2	53	13.35
3	4	1.01
4	5	1.26
5	6	1.51
7	4	1.01
8	3	0.76
NO-MATCH	277	69.8

TOTAL OUTBOUND TRAFFIC: 697
NO-MATCH OUTBOUND VEHICLE: 461 (66.1%)

NODE #6

DISTRIBUTION OF INBOUND VEHICLES
TOTAL INBOUND VEHICLES: 2459

NODE	# OF VEHICLES	%
1	47	1.91
2	55	2.24
3	19	0.77
4	35	1.42
5	5	0.20
7	7	0.28
8	19	0.77
NO-MATCH	2272	92.4

TOTAL OUTBOUND TRAFFIC: 2577
NO-MATCH OUTBOUND VEHICLE: 1563 (60.1%)

LEGEND
ONE-WAY TRAFFIC FLOW

0 250' 500' 750' 1000'

ORIGIN-DESTINATION STUDY
CENTRAL AVENUE CORRIDOR STUDY

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 3

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F:\DRAWINGS\745\STUDYMAP 08/01/88 16:12

On the afternoon of February 10, 1988 two to four people were assigned to each of the Nodes from approximately 2:00 PM to 5:30 PM. During this time they recorded the first three digits of each license plate that passed through their Node. The 3 digit license plate numbers were grouped into 15 minute blocks of time and the direction of travel, inbound or outbound was recorded.

After the license plate data was collected, all of the incoming plate numbers for each Node within a 15 minute period were compared with the outbound data from each Node. The matched plate numbers were to show the general pattern of traffic flow through the downtown district of Dover.

C. Data Analysis

All of the collected license plate data from the O-D Study was compiled as described above with the help of a computer. In the first review of this data, there appeared to be over a 120 percent match of outbound cars with the inbound cars. Based on the review of this data it was determined that because the study area was so large there were too many vehicles to be compared in 15 minute blocks as anticipated. In effect, there was a better statistical probability of a random match of a 3 digit number than there was of matching the actual car that was recorded.

This initial analysis of the data left no opportunity to draw a verifiable conclusion from the field work that had been done. To solve this problem a data base program was designed to do a much more complex evaluation of the data. The key elements of the data base program developed to evaluate the O-D Study data area are as follows:

1) An assumption was made that all of the plate numbers that were recorded in any given 15 minute interval were evenly distributed over that 15 minute interval (e.g. of 30 cars in a time interval from 2:00 PM to 2:15 PM it was assumed that the first car was recorded at 2:00:00 PM then subsequent cars at 2:00:30, 2:01:00, 2:01:30 and so on at even 30 second intervals).

2) The City Planning Staff collected data to determine the approximate travel time from Node to Node within the study area. The average travel times between Nodes is summarized in Table 2.

From the field data collected by the planning staff there was a variance of $\pm$ 30 percent in the travel time between Nodes. The variance of 30 percent is applied to the average travel times to create a time window at each outbound Node.

For an incoming plate number to be scored as a match it must match an outbound plate number within the time window created at each outbound Node.

TABLE 2

ORIGIN - DESTINATION STUDY Travel Time Between Nodes								
Inbound Node	Outbound Node 1	2	3	4	5	6	7	8
1	-	2.41	8.28	4.67	10.50	9.63	9.98	8.88
2	2.41	-	8.16	4.67	10.38	9.52	9.98	8.77
3	8.28	8.16	-	4.00	7.35	8.38	8.73	7.63
4	4.67	4.67	4.00	-	3.35	7.06	8.25	6.92
5	10.50	10.38	7.35	3.35	-	3.13	5.42	7.96
6	9.63	8.52	8.38	7.06	3.13	-	4.55	7.10
7	9.98	9.98	8.73	8.25	5.42	4.55	-	7.45
8	8.88	8.77	7.63	6.92	7.96	7.10	7.45	-

3) The data base program then analyzed each of the approximately 11,200 plate numbers that were incoming to the study area. Based on the average travel time and variance to each of the other nodes a window of actual time was established for a potential outbound match of the inbound plat numbers. Within this window all the potential matches were recorded.

Using this data base program there are an unlimited number of variations in which the data can be organized, analyzed and recorded. For the purposes of verifying the findings as outlined in Section III-A of this report, data is presented in the following tables.

TABLE 3

ORIGIN - DESTINATION STUDY

TOTAL PLATE COUNT BY NODE

Node	Inbound	Outbound	Total
1	2063	1415	3478
2	1479	1787	3266
3	766	681	1447
4	2362	1811	4173
5	397	697	1094
6	2459	2577	5036
7	792	939	1731
8	867	1286	2153
TOTAL	11185	11193	22378

TABLE 4

ORIGIN DESTINATION STUDY

Summary of Non-Matched Plate Numbers by Node

	Inbound		Outbound	
	Number	Percent	Number	Percent
1	1201	58.2	959	67.7
2	782	52.8	1328	74.3
3	409	53.4	495	72.7
4	1443	61.1	1522	84.0
5	277	69.8	461	66.1
6	2272	92.4	1563	60.1
7	734	92.7	611	65.1
8	803	92.6	786	61.2
	7921	70.8%	7725	69.0%

TABLE 5

ORIGIN DESTINATION STUDY
Summary of Matching Plate Numbers

Number of Matched Inbound Plate Number / % of Total Inbound Plates
- by outbound node -

Inbound Node	Outbound Node 1	2	3	4	5	6	7	8
1	xxx /xx.x	97 /4.70	63 /3.05	74 /3.59	80 /3.88	306 /14.88	102 /4.94	140 /6.79
2	146 /9.87	xxx /xx.x	44 /2.97	58 /3.92	53 /3.58	228 /15.42	70 /4.73	98 /6.63
3	45 /5.87	53 /6.92	xxx /xx.x	38 /4.96	25 /3.26	121 /15.80	38 /4.96	37 /4.83
4	89 /3.77	118 /5.00	45 /1.91	xxx /xx.x	49 /2.07	325 /13.76	100 /4.23	193 /8.17
5	45 /11.33	53 /13.35	4 /1.01	5 /1.26	xxx /xx.x	6 /1.51	4 /1.01	3 /.076
6	47 /1.91	55 /2.24	19 /0.77	35 /1.42	5 /0.20	xxx /xx.x	7 /0.28	19 /0.77
7	13 /1.64	12 /1.52	5 /0.63	9 /1.14	5 /0.63	8 /1.01	xxx /xx.x	6 /0.76
8	16 /1.85	14 /1.61	3 /0.35	6 /0.69	3 /0.35	11 /1.96	5 /0.58	xxx /xx.x

TABLE 6

ORIGIN DESTINATION STUDY

Summary of Multiple Matched Plate Numbers

	In Bound			Out Bound		
No. of Matches	No of Plates	% of inbound by Node	No. of Dup. Matches	No of Plates	% of outbound by Node	No. of Dup. Matched
1	1973	17.7	0	2290	20.5	0
2	822	7.4	822	757	6.8	757
3	287	2.6	574	266	2.4	532
4	125	1.1	375	98	0.9	294
5	39	0.3	156	46	0.4	184
6	11	0.1	55	8	0.1	40
7	4	0.0	24	3	0.0	18
8	1	0.0	7	-	-	-
9	2	0.0	16	-	-	-
10	-	-	-	-	-	-
11						
12						
TOTALS			2029			1825

IV. Corridor Improvement Alternatives

A. Central Avenue Widening

This alternative is based on the "widening" of Central Avenue to provide an overall four-lane section with two through travel lanes in each direction. This "widening" can generally be accommodated within the present curb-to-curb roadway width through the elimination of on-street parking spaces. Actual construction of wider pavement would be limited to localized areas as necessary.

The proposed Central Avenue widening from Oak Street to south of Silver Street is depicted on Figure 4. The removal or reconfiguration of on-street parking generally allows for operation of four traffic lanes throughout the corridor segment. The existing one-way loop in the downtown area (Central Avenue/Main Street) is retained with the present two-lane one-way movement. Actual construction of pavement widening is required in the vicinity of Ham Street and for left turn lanes at the intersections of Oak Street, Chestnut/Sixth Street, Washington Street and Silver Street.

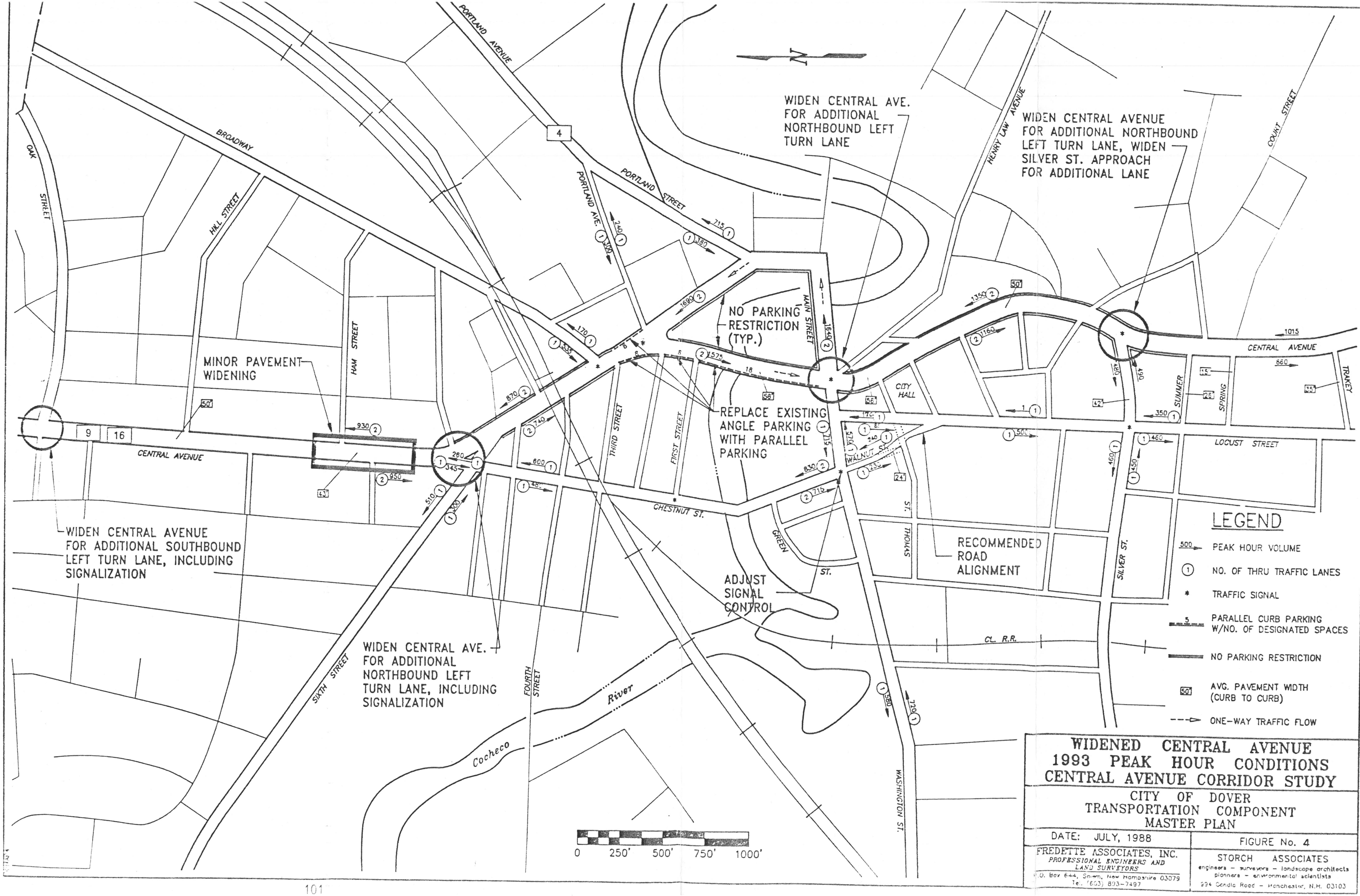
1993 design hour volumes at key roadway segments along the corridor are indicated, and are generally the same as those volumes depicted in Figure 2.

Figure 4 also illustrates the locations and numbers of designated on-street parking spaces as well as parking restrictions. Approximately 175 existing designated parking spaces are eliminated to accommodate the additional two traffic lanes. Present angle parking along Central Avenue between Third Street and Washington Street is replaced with parallel parking to minimize potential conflicts between parking vehicles and the two through traffic lanes.

Although not directly related to the widening of Central Avenue, this alternative also includes the realignment of Walnut Street to Locust Street and the establishment of two-way traffic flow along Walnut Street. Included at the recommendation of the Transportation Committee, this realignment would eliminate the presently difficult left turn movement from Locust Street to Washington Street.

This alternative also includes new or upgraded signalization at Silver Street, Washington Street, Chestnut/Sixth Street and Oak Street. Overall corridor signal coordination is also suggested.

The estimated cost of implementing this alternative is $0.9 to 1.2 million dollars, exclusive of right-of -way and parking space relocation.



WIDENED CENTRAL AVENUE 1993 PEAK HOUR CONDITIONS CENTRAL AVENUE CORRIDOR STUDY

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 4

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B. One Way Circulation Pattern

This alternative is based on the general concept of implementing an enlarged one-way roadway loop around the downtown area for a two-lane traffic movement in each direction: Central Avenue one-way northbound from Silver Street to Chestnut Street, and Chestnut and Locust Streets one-way southbound from Central Avenue to Silver Street. The intent of this alternative is to provide the needed corridor flow capacity of two through travel lanes in each direction, but without the need to remove on-street parking.

The proposed lane uses and 1993 design hour traffic flows are indicated in Figure 5. Traffic flow volumes reflect the proposed circulation pattern.

This revised circulation pattern generally accommodates corridor flows between Chestnut Street and Silver Street. The widening of Central Avenue to a four lane section north of Chestnut Street is still required as described in the previous alternative.

In order to accommodate design hour traffic movements circulating through the Downtown area, the following exceptions to a true "one-way" system are needed:

a. Maintain one northbound travel lane along Chestnut Street (in addition to marking two southbound travel lanes).

b. Maintain the present one-way southbound operation of Central Avenue between Third Street and Washington Street. This accommodates the present commercial zone along Central Avenue as well as maintains the Broadway approach to points south along the corridor.

This alternative requires the following major construction items:

a. Widen Silver Street to provide a two-lane east bound movement between Locust Street and Central Avenue. Also increase the corner radius on the southwest corner of the Silver/Central intersection.

b. Realign Walnut Street to connect to Locust Street in the vicinity of Hale Street. This realignment would carry the two-lane southbound movement of corridor traffic. Locust Street between Washington Street and Hale Street would also become one-way southbound.

c. New or upgraded signalization at Silver/Central, Silver/Locust,Washington/Chestnut, Washington/Central, and Central/Chestnut/Sixth. Overall corridor signal coordination is also recommended.

d. Widening of Chestnut Street near Central Avenue and rechannelization of the present Central/Chestnut/Sixth intersection(s).

Figure 5 also illustrates the locations and numbers of designated on-street parking spaces as well as parking restrictions. Approximately 55 existing designated parking spaces are eliminated to accommodate the localized lane widenings. Included in this parking reduction is conversion of angle to parallel parking along the easterly side of Central Avenue between Second and Washington Streets to minimize potential conflicts between parking vehicles and the through traffic lanes.

The estimated cost of implementing his alternative is $0.75 to 1.0 million dollars, exclusive of right-of-way and parking space relocation.

C. New Bypass Roadway

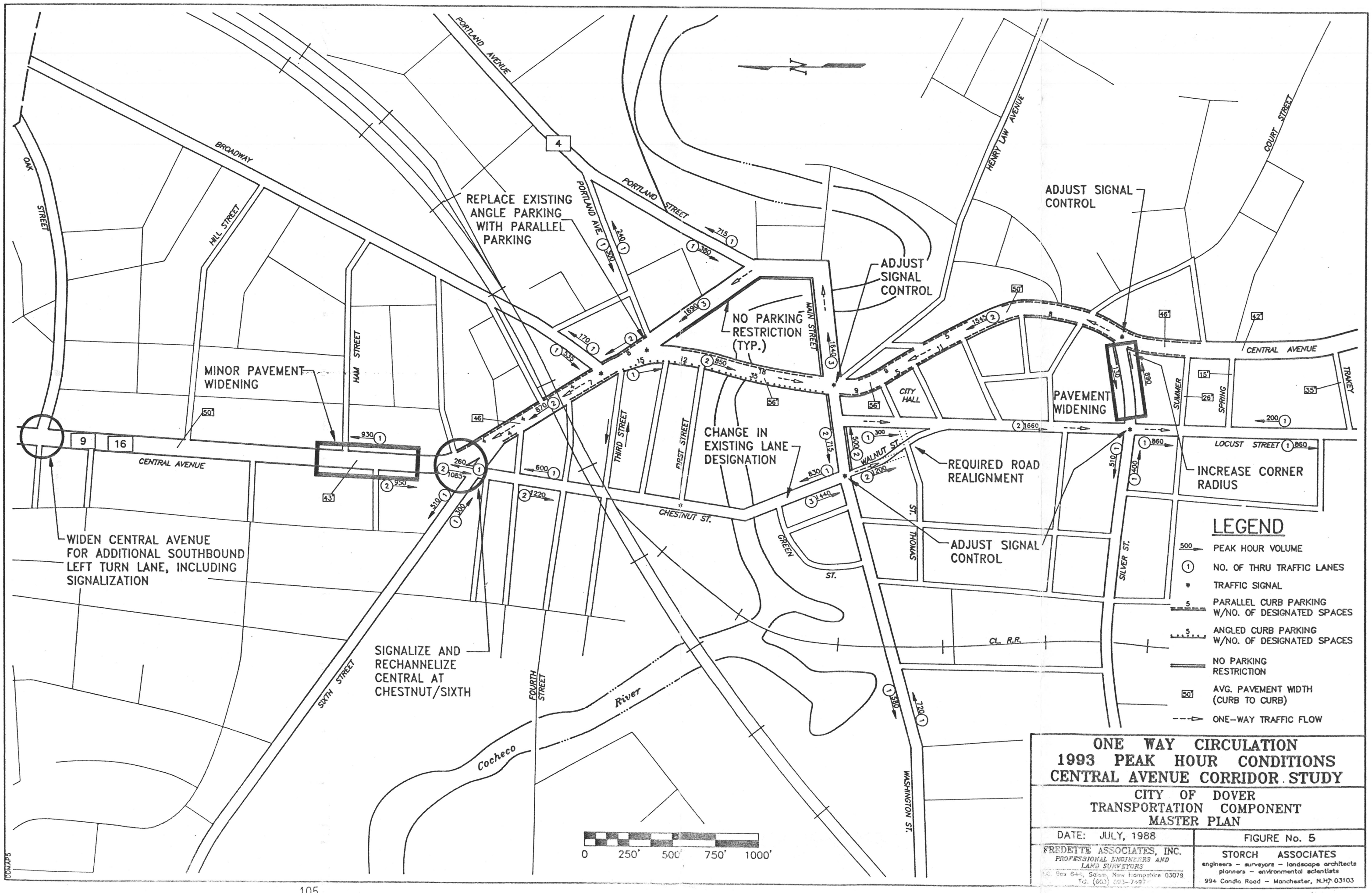
The alignment of this bypass roadway is illustrated in Figure 1 and follows the alignment of the existing C.L. Railroad tracks between the Chestnut/Third intersection and the Central/Locust intersection. A two-lane bypass roadway is envisioned.

Further elaboration of this alternative was discontinued early in this study because of the following major drawbacks.

a. Lack of a cost effective intersection with Silver Street due to the present grade separation at the junction of the two facilities.

b. The location of the southern terminus of the bypass in the vicinity of the Locust/Central intersection which would compound present problems at the intersection (See Technical Memorandum No. 1).

c. High capital improvement cost which would not lessen the need for capital improvements to alleviate present problems along Central Avenue.



ONE WAY CIRCULATION
1993 PEAK HOUR CONDITIONS
CENTRAL AVENUE CORRIDOR STUDY

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 5

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V. Comparison of Alternatives

A. Procedure

A further comparison was made among the following three alternatives for the 1993 Central Avenue Corridor: continued use of the Present Roadway Facility, the Widened Central Avenue option and the One Way Circulation pattern. This comparison was developed in terms of the following quantitative and qualitative factors:

- Impact on local street traffic through downtown neighborhoods (i.e. traffic increases on local streets due to circulation of corridor traffic).
- Downtown on-street parking along Central Avenue (measured in terms of number of existing spaces lost).
- Quality of through traffic flow (delay to corridor through travel).
- Quality of local traffic flow (delays to circulating local traffic).
- Key intersection Level of Service (Level of Service described in next section).
- Impacts to public transportation (i.e. delays and bus stop locations).
- Cost of major capital improvements.

Level of Service determinations are described in Section B of this chapter. Section C summarizes and compares the factors developed for each of the three alternatives.

B. Traffic Levels of Service

Level of Service (LOS) is a qualitative measure describing driver satisfaction with a number of factors influencing the degree of traffic congestion. These factors include speed and travel time, traffic interruption, freedom to maneuver, safety, driving comfort and convenience, and delays. There are six levels of service describing traffic flow. The highest is LOS A, describing a free-flow condition. The lowest, LOS F, is described as forced flow, and is characterized by traffic volumes at the roadway capacity and extreme congestion.

LOS C, which is normally utilized for design purposes, describes a stable condition of traffic operation. It has a somewhat restricted movement due to higher traffic volumes, but flow conditions are not objectionable for motorists.

LOS D, which is acceptable for traffic operations in urban environments and during peak hours of traffic flow, reflects a more restricted movement for motorists. Queues and delays may occur during short peaks, but lower demands occur often enough to permit clearance of developing queues, thus preventing excessive backups. LOS E is defined as the actual capacity of the roadway and involves delay to all motorists due to congestion. Levels of Service E and F are generally considered unacceptable.

Level of Service for signalized intersections is defined in terms of average delay per vehicle entering the intersection. Delay is considered a measure of driver discomfort, frustration, fuel consumption and travel time. Table 7 summarizes the criteria for signalized intersection level of service.

Level of Service analyses were performed for the following key intersections: Central/Silver, Central/Washington, and Central/Broadway. These analyses were conducted using the methodology of the 1985 Highway Capacity Manual and the resulting levels of service are summarized in the next section of this chapter. Copies of the capacity calculations are included in Appendix B.

TABLE 7

LEVEL OF SERVICE CRITERIA FOR
SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	Greater than 60.0

SOURCE: 1985 Highway Capacity Manual

C. Findings

The comparative factors for each of the three alternatives are summarized on the following tables:

- Table 8, Maintain Present Roadway Facility
- Table 9, Widened Central Avenue
- Table 10, One Way Circulation

TABLE 8

ALTERNATIVE COMPARISON SUMMARY
MAINTAIN PRESENT ROADWAY FACILITY

Change From Present (1988) Conditions

Area of Concern	Positive Change	No Change	Negative Impact	Comments
Local Street Traffic through Downtown Neighborhoods			X	Traffic increases to avoid congestion along Central Ave.
Downtown on-street parking along Central Avenue		X		
Traffic Circulation				
- through trips			X	Increased travel time and delay
- local trips			X	Increased travel time and delay
Key Intersection Level of Service				
- Central/Silver			X	Over capacity (LOS F)
- Central/Washington			X	Over capacity (LOS F)
- Central/Broadway			X	Under capacity *(LOS C-D)
Public Transportation			X	Increased travel time and delay
Major Capital Improvements		X		NA

* Assumes Optimized Signal Timing.

TABLE 9

ALTERNATIVE COMPARISON SUMMARY
WIDENED CENTRAL AVENUE

Area of Concern	Positive Change	No Change	Negative Impact	Comments
Local Street Traffic through Downtown Neighborhoods	X			Traffic attracted to Central Avenue
Downtown on-street parking along Central Avenue			X	Loss of 175 designated spaces (includes 5 spaces along Silver)
Traffic Circulation				
- through trips	X			Less travel time and delay
- local trips	X			Less travel time and delay
Key Intersection Level of Service				
- Central/Silver	X			Under capacity (LOS C)
- Central/Washington	X			Under capacity (LOS C)
- Central/Broadway	X			Under capacity (LOS C)
Public Transportation	X			Less travel time and delay

Major Capital Improvements			X	Estimated Cost $900,000 to $1.2 million for:
				- Widening Central for a fifth lane and signalize/resignalize at:
				  - Silver
				  - Washington
				  - Chestnut/Sixth
				  - Oak
				- Widening Silver Street approach to Central Avenue.
				- Minor roadway/curb widening along Central at Ham.
				- Corridor signal coordination
				- Walnut Street realignment: (right-of-way required)

TABLE 10

ALTERNATIVE COMPARISON SUMMARY
ONE WAY CIRCULATION

Area of Concern	Positive Change	No Change	Negative Impact	Comments
Local Street Traffic through Downtown Neighborhoods			X	Locust Street corridor and west (85% increase on Locust Street)
Downtown on-street parking along Central Avenue			X	Loss of 55 designated spaces (includes 20 spaces along Washington and Silver)
Traffic Circulation				
- through trips	X			Less travel time and delay
- local trips			X	Indirect routing due to one-way restrictions
Key Intersection Level of Service				
- Central/Silver	X			Under capacity (LOS C)
- Central/Washington	X			Under capacity (LOS D)
- Central/Broadway	X			Under capacity (LOS C)
Public Transportation	X			Less travel time and delay
Major Capital Improvements			X	Estimated Cost $750,000 to $1 million for: - Walnut Street realignment: (right-of-way required) - Widening Silver from Locust to Central (right-of-way required) - Widen/Signalize Central at Oak - Signalize/channelize Central at Chestnut/Sixth - Minor roadway/curb widening along Central at Ham - Corridor signage and resignalization/coordination implementing one-way

The following major findings can be derived from inspection of the three comparative tables:

1. Without further improvements to the downtown segment of the Central Avenue corridor, traffic flow will continue to degrade through the year 1993 with increasing localized breakdowns in traffic operations.
2. Both the Widened Central Avenue and One Way Circulation alternatives, as proposed, provide acceptable traffic flow operations along the corridor under year 1993 conditions.
3. The capital cost (in 1988 dollars) of implementing either of the two proposed alternatives is comparable: $0.9 million to 1.2 million dollars for the Widened Central Avenue and $0.75 to 1.0 million dollars for the One-Way Circulation alternative.
4. Presently designated on-street parking spaces will be lost under either of the alternatives: 175 spaces lost under the Widened Central Avenue and 55 spaces lost under the One Way Circulation alternative.
5. Increased traffic flow on local neighborhood streets by corridor-related traffic will result under the no-build alternative (trips bypassing the otherwise congested Central Avenue) and the One-Way Circulation alternative (additional circulation on the local street system because of directional flow restrictions imposed by the one-way system).

VI. Recommendations

The following recommendations for the Downtown segment of the Central Avenue corridor are made for the City of Dover Master Plan. These recommendations were presented to, and concurred by, the City of Dover Transportation Committee.

1. Implement the widened Central Avenue alternative depicted in Figure 4. Stage the implementation of widening and improvements with the easiest-to-implement roadway sections done first. This will result in localized benefit of some improvements in the interim period before completion of the entire corridor improvement from the Miracle Mile to Route 108.
2. The incremental removal of on-street parking to accommodate the Central Avenue widening should be coordinated with a phased plan for replacement parking at nearby off-street locations.
3. On initial implementation of the Central Avenue widening between Broadway and Washington Street, retain the present angle parking along Central Avenue. Assess the impact of this parking on the operations and safety of travel along this roadway segment as traffic flows increase. If or when necessary, this parking can be converted to parallel parking.
4. Implement the Walnut Street realignment to Locust Street, and conversion to two-way flow.

Technical Memorandum No. 3

LITTLEWORTH ROAD (N.H. ROUTE 9) CORRIDOR STUDY

I. Introduction

A. Background

In January, 1988, the City of Dover retained the consulting firms of Storch Associates of Manchester, New Hampshire and Fredette Associates, Inc. of Salem, New Hampshire to provide technical input into the Transportation Component of the 1988 Master Plan. This technical input may be expressed in the following task objectives:

Task 1. Identify existing conditions and recommend improvements for twelve problem intersection locations.

Task 2. Investigate options for improving traffic flow in the downtown Central Avenue Corridor, including land widening, one-way circulation pattern, or new bypass roadway.

Task 3. Identify long range highway improvement needs for the Route 9 Corridor in the City of Dover per major industrial rezoning proposed in the Master Plan.

This Technical Memorandum No. 3 - Littleworth Road (N.H. Route 9) Corridor Study documents the results of Task 3 of the Transportation Component.

B. Methodology

The purpose of the report is to examine the long range traffic impacts of the proposed future zoning of lands located along the Route 9 Corridor west of Route 155 in the City of Dover. The study area is outlined on Figure 1.

In the 1985 report to the Dover Planning Department, the Strafford Regional Planning Commission presented the following comments on the Route 9 Corridor that remain relevant to date:

> "This corridor is one of the major industrial areas within the City. Two industrial parks are presently located within it, along with the General Electric manufacturing plant. Housing also exists in the corridor. It is primarily located on Littleworth Road, Bellamy Avenue, Old Littleworth Road and Columbus Avenue.

In most urban areas, traffic peaks over an extended period of time. Also, since traffic usually originates from numerous locations it is spread over an entire road system and does not unduly congest one particular area. Traffic in an industrial area however, has a different pattern. It usually intensifies during short periods of time due to shift changes in the work force, in one particular corridor. The result is often brief periods of traffic congestion.

Currently, the Littleworth traffic corridor is experiencing traffic congestion common to many industrial areas: traffic tie-ups during late afternoon shift changes. This problem is made even more difficult due to the fact that other individuals are also returning to their homes, located along the Littleworth traffic corridor, at approximately the same time.

It is presently anticipated that significant economic development will occur in Dover over the next several years. Since some of this economic expansion could result in the location of new industrial facilities in the Littleworth traffic corridor, a great deal of public attention has been focused on the development of land in the general area of Littleworth Road.

The purpose of this analysis is to provide Dover City officials with a more accurate understanding of traffic conditions within the Littleworth traffic corridor. However, as previously noted, additional information about traffic in the area is needed before a solution to present traffic problems can be designed."

This technical memorandum is an extension of the 1985 study and includes a review of existing traffic conditions, the projection of future traffic volumes generated by the proposed land use plan, the evaluation of the impacts of those projected volumes on the future roadway system, and the recommendation of roadway improvements as necessary to accommodate future traffic demands on the corridor.

The study process has consisted of the following steps:

- On-site investigations of existing roadway and traffic control features along the corridor.
- Review of the 1988 automatic recorder traffic counts on Route 9 (Littleworth Road), Bellamy Road and Cosby Road.
- Review of 1988 manual peak hour turning movement counts taken at the following intersections:

  Route 9/Route 155
  Route 9/Industrial Park Drive (East)
  Route 9/Industrial Park Drive (West)

- Estimation of the future (2008) traffic volumes that would be generated by both the present and proposed land use plan.
- Determination of the future traffic levels of service along the Route 9 corridor, in particular at the critical intersection of Route 9 and Route 155.

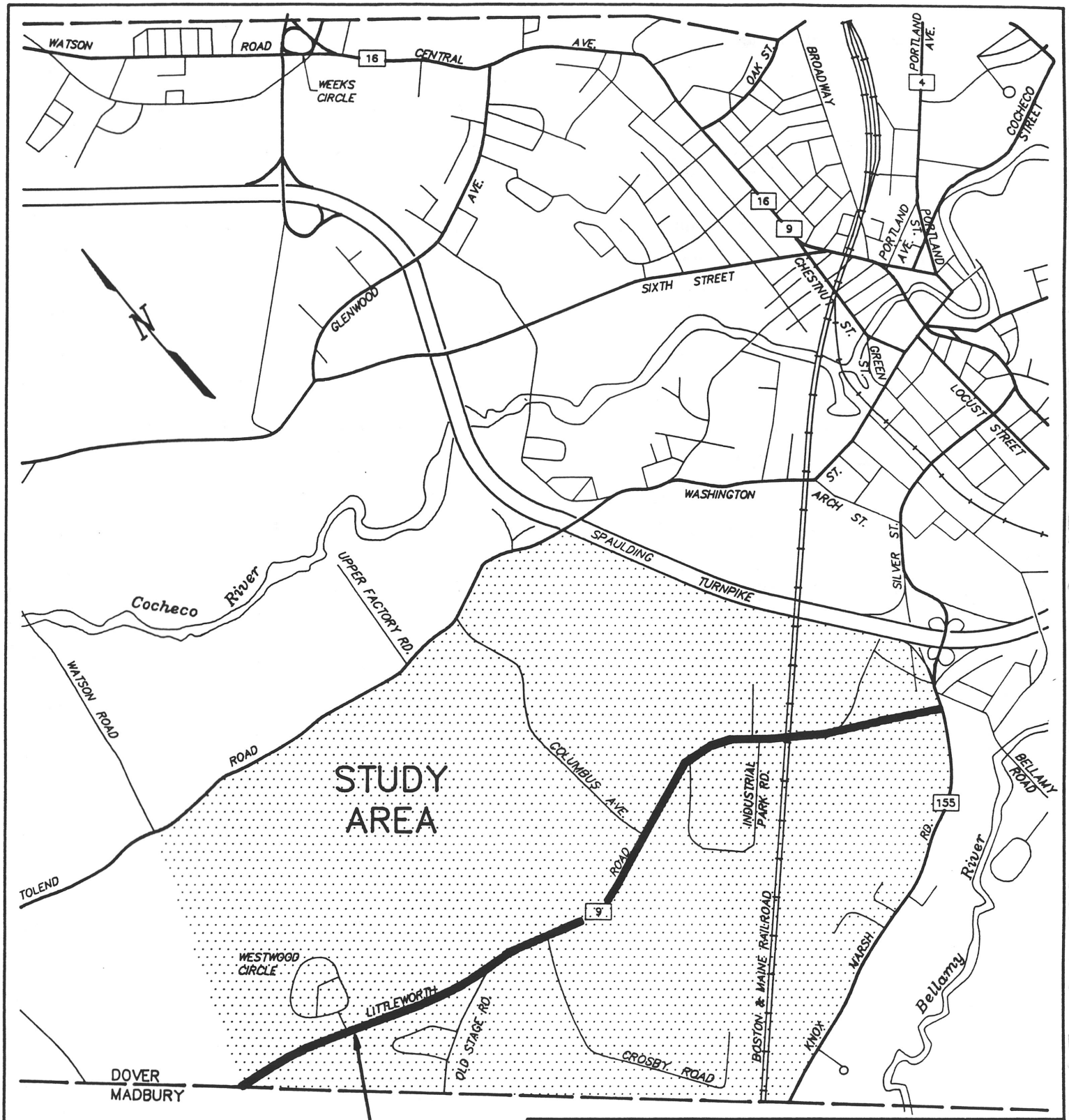
- Evaluation of the overall impact of the land use plan on the transportation system.
- Recommendation of improvements to the highway system to accommodate future corridor traffic demands.

The preliminary findings and recommendations of this study task were presented to the City of Dover Transportation Committee on June 29, 1988. This Final Report reflects the input provided by the Committee at that time.

C. Acknowledgements

We would like to acknowledge the advice and assistance provided by the following departments and organizations:

- City of Dover Department of Planning and Community Development.
- City of Dover Department of Public Works.
- City of Dover Department of Public Safety.
- City of Dover Transportation Committee and involved citizens.
- Strafford Regional Planning Commission.
- New Hampshire Department of Transportation, Bureau of Transportation Planning.



LOCATION MAP
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 1

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MAP12

II. Existing Conditions

A. Physical Roadway Conditions

Route 9 is a two lane highway providing connection between Route 155 in the City of Dover to points west in the Town of Madbury and the City of Rochester to the north via the Route 125 corridor. The posted speed limit in the study area is 35 mph east of Columbus Avenue and 40 mph to the west. The present pavement width is 24 feet with 4 foot treated shoulders within a basic 66 foot right-of-way.

Route 155 is a two lane highway providing connection to the Spaulding Turnpike and Downtown Dover to the north and points south and west through the adjacent Town of Madbury. Approximately 500 feet south of its interchange with the Spaulding Turnpike, Route 155 intersects with Route 9 at a signalized "T" intersection.

The general road layout and traffic control in the project area is illustrated on Figure 2.

The following basic lane approaches presently exist at the intersection of Route 9 and Route 155:

Northbound Route 155	1 Exclusive Left Turn Lane 1 Thru Lane
Southbound Route 155	2 Thru Lanes (Second lane presently under construction) 1 Free Flow Right Turn Lane
Eastbound Route 9	1 Exclusive Left Turn Lane 1 Exclusive Right Turn Lane

Further descriptions of existing road conditions are contained in a 1985 report prepared by the Strafford Regional Planning Commission and are included in Appendix A of this report.

B. Traffic Volumes and Operations

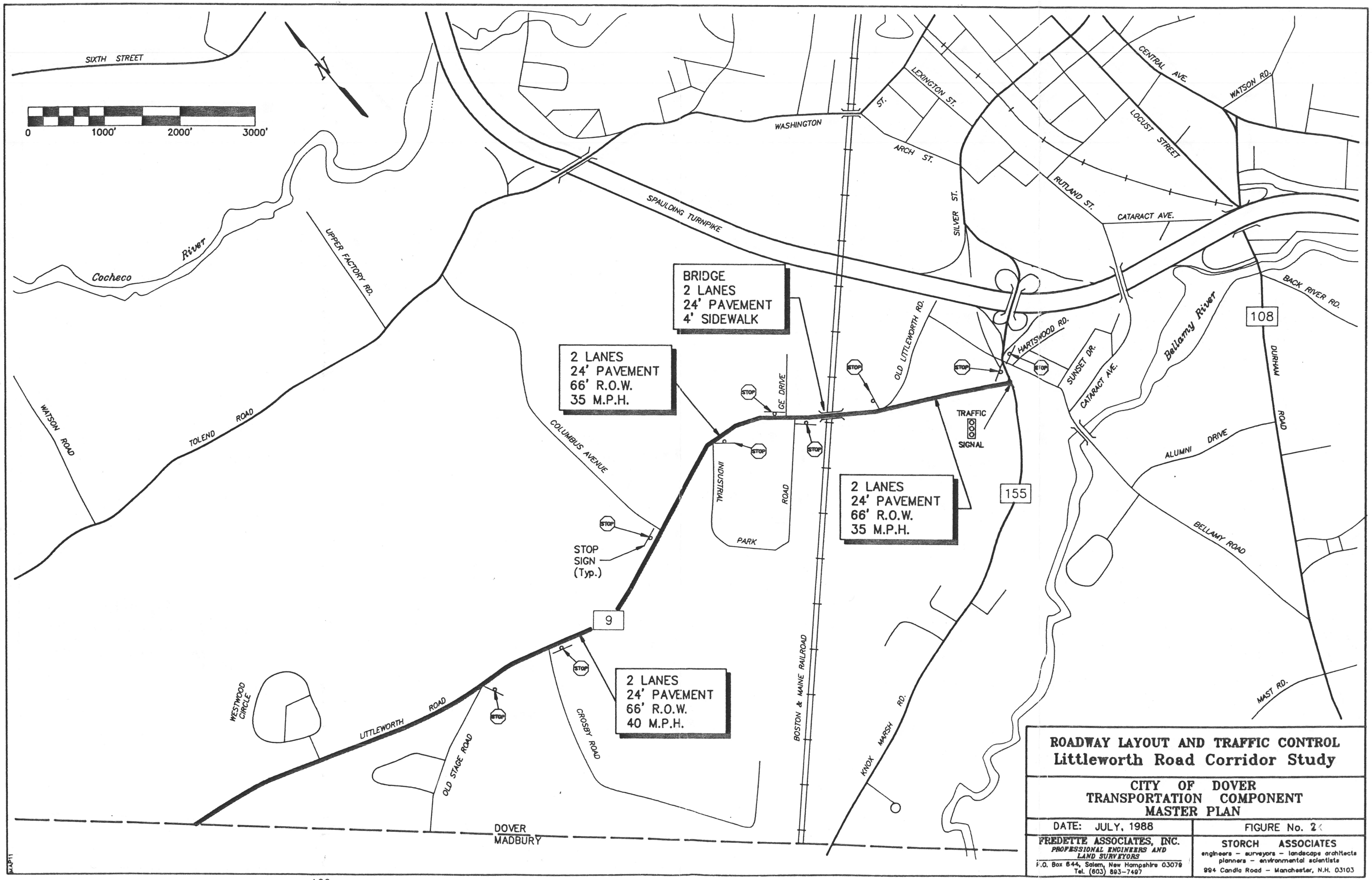
Automatic recorder traffic counts were conducted in April, 1988 for Route 9 near Route 155, Bellamy Road near Route 155 and Crosby Road near Route 9.

Weekday turning movement counts were conducted from 3:30 to 5:30 PM during the month of April, 1988 at the following intersections:

Route 9/Route 155
Route 9/Industrial Park Drive (East)
Route 9/Industrial Park Drive (West)

Summary results of the traffic counts are included in Appendix B.

The resultant 1988 Annual Average Weekday Traffic and PM Peak Hour design volumes were estimated utilizing monthly automatic traffic recorder reports published by the New Hampshire Department of Transportation for the permanent counting station along Route 16 in Dover (refer to Appendix B of Technical Memorandum No. 1) and are illustrated on Figure 3.



ROADWAY LAYOUT AND TRAFFIC CONTROL
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 2

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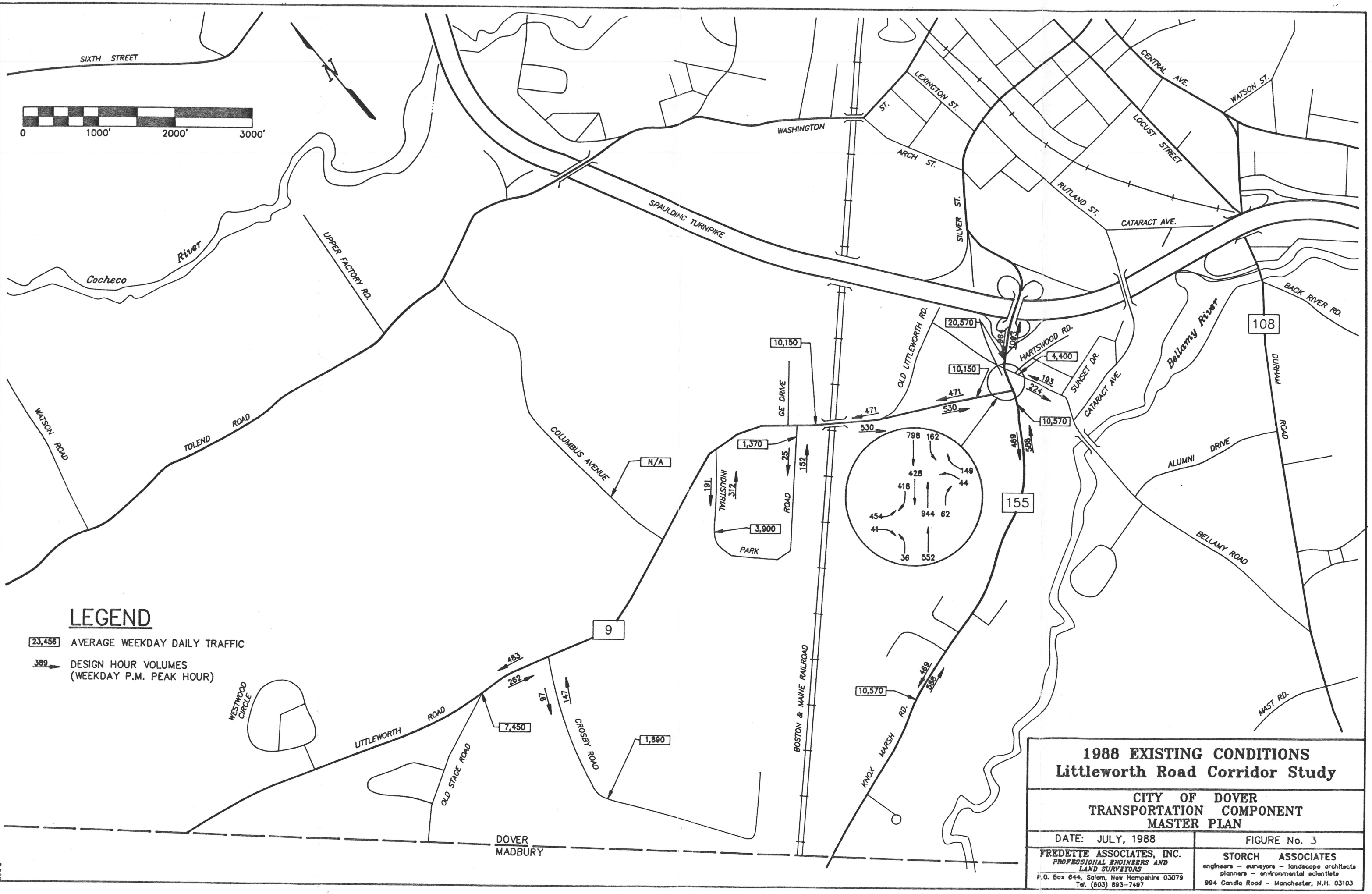
MAP11



1988 EXISTING CONDITIONS
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 3

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MAP6

III. Projected Traffic Conditions

A. Proposed Land Use Plan

The proposed corridor rezoning plan is illustrated in Figure 4. Four zonal areas are located on the corridor:

Area A. Presently zoned industrial, this large area extends on both sides of Route 9 and includes the present industrial sites along Crosby Road, Industrial Park Road, and the General Electric site. 300 undeveloped acres are available in this area.

Area B. This proposed industrial zone includes 232 acres and is situated just north of Route 9 and west of Columbus Avenue.

Area C. This proposed industrial zone includes 180 acres and is situated just east of Columbus Avenue, extending from Route 9 to Tolend Road.

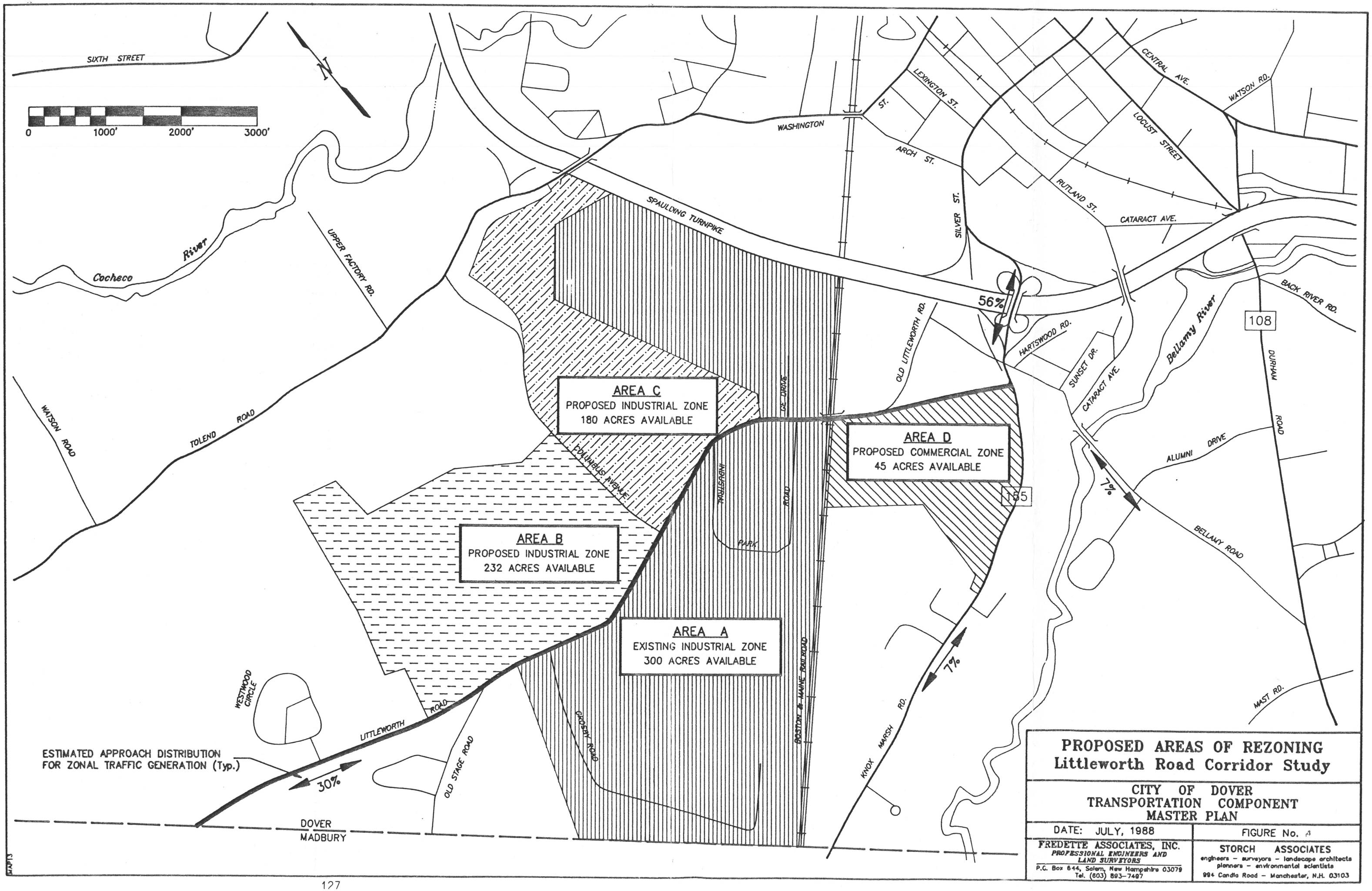
Area D. This proposed commercial zone includes 45 acres along the southwest corner of the Route 9/Route 155 intersection.

B. Traffic Generation

The estimate of increased traffic that would be generated by the additional future development along Route 9 is summarized in Table 1. Industrial zoned areas are assumed to be developed with light industrial facilities. The commercial zoned area is assumed to be developed with a shopping center development of approximately 650,000 square feet.

General estimates of vehicle trip generation have been developed utilizing trip generation rates published by the Institute of Transportation Engineers, "Trip Generation", 1982 (refer to Appendix C). Available industrial gross acres were reduced by 33 percent to account for existing wetland restrictions and other potential site restrictions. In addition, peak hour trip generation rates were utilized with consideration of staggered work shifts for the large industrial trip generators in the area (presently practiced by General Electric manufacturing plant).

In determining the number of additional vehicles that would be generated by the proposed commercial zone, it has been assumed that the majority of the users would be (1) residents of the immediate area or, (2) people who are currently travelling on Route 9 or Route 155. Therefore only 40 percent of the traffic generated by future commercial development has been added to the traffic system.



PROPOSED AREAS OF REZONING
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 4

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TABLE 1

CORRIDOR TRIP GENERATION

Proposed Development	Net Devel. Area	Daily Factor	Daily Trips (AADT)	PM Factor In - Out		PM Trips In - Out	
Existing Industrial (Area A)	200 Acres	60	12000	3.5	6.5	700	1300
Proposed Industrial (Area B)	155 Acres	60	9300	3.5	6.5	540	1010
Proposed Industrial (Area C)	120 Acres	60	7200	3.5	6.5	420	780
Proposed Commercial (Area D)	650,000 G.S.F.	40	26000	2.0	2.0	1300	1300

C. Trip Distribution and Assignment

In forecasting traffic growth, trip distribution refers to the origin and destination pattern of the trips that begin or return to the proposed developments. Trip distribution is dependent on the geographical locations of population, employment and other attractions.

Traffic assignment refers to the determination of which route will be used in travelling from the trip origin to its destination. Traffic assignment depends primarily on the travel time using available alternative routes.

For purposes of analysis, it is assumed that the additional generated trips entering and leaving the proposed industrial development will travel in each direction by a volume proportional to the percentage distribution shown on Figure 4. This distribution is based on measurements of directional flow of existing industrial traffic at the Industrial Park and Crosby Road intersections and existing directional traffic flow at the intersection of Route 9 and Route 155.

D. Projected Background Traffic Volumes

Existing background traffic volumes (excluding existing local industrial traffic volumes) were projected to a 20 year planning horizon (Year 2008) by assuming a 2 percent increase per year for traffic along Route 9 and Route 155 in the project area. This is a conservatively low growth assumption for the non-industrial traffic base as the documented historical growth in the area (NHDOT count station on Dover Point Road) indicates overall peak hour growth of 3.5 percent per year.

Addition to these volumes of present local industrial traffic and of projected local traffic growth for either the presently zoned corridor or the proposed corridor rezoning results in an effective minimum annual corridor growth of 3.8 percent or 6.6 percent, respectively, over the 20 year study period.

E. Road Network Improvements Scenarios

Preliminary analysis of the projected volumes utilizing the study area roadway network indicated that the capacity of the Route 9/Route 155 intersection would define the upper limits of Route 9 corridor growth potential under acceptable traffic operations. For the purpose of this analysis, a full build out of this intersection (maximum feasible roadway widening) includes the following basic lane approaches along with the planned relocation of Bellamy Road to the east to align with Route 9 at its new intersection with Route 155:

Northbound Route 155	1 Exclusive Left Turn Lane 2 Thru Lanes
Southbound Route 155	1 Exclusive Left Turn Lane 2 Thru Lanes
Eastbound Route 9	2 Exclusive Left Turn Lanes 1 Thru Lane
Westbound Route 9	1 Exclusive Left Turn Lane 1 Thru Lane 1 Right Turn Lane

It is anticipated that the above noted widening of Route 155 will require extension into or through the existing Spaulding Turnpike Interchange area. The projected 2008 traffic volumes along the Route 9 Corridor for the present and proposed zoning also indicate the need for a minimum 4 lane facility, including turning lanes at major intersections east of Crosby Road.

In order to supplement the projected capacity requirements at the Route 9/Route 155 intersection, the re-alignment of Route 9 via a new connector roadway to connect into a new interchange with the Spaulding Turnpike as shown on Figure 5, was considered as an optional design scenario. The

indicated alignment and configuration of this interchange and approach roadway is for schematic purposes only, although the indicated interchange location allows a reasonable spacing of about one mile to adjacent interchanges at Route 155 and Route 16/Weeks Circle. The estimated cost (in 1988 dollars) of such a facility, exclusive of right-of-way costs,is approximately $5 to $8 million for the interchange and $1.5 to $2.0 million for a four-lane connector roadway.

F. Traffic Levels of Service

Level of Service (LOS) is a qualitative measure describing driver satisfaction with a number of factors influencing the degree of traffic congestion. These factors include speed and travel time, traffic interruption, freedom to maneuver, safety, driving comfort and convenience, and delays. There are six levels of service describing traffic flow. The highest is LOS A, describing a free-flow condition. The lowest, LOS F, is described as forced flow, and is characterized by traffic volumes at the roadway capacity and extreme congestion.

LOS C, which is normally utilized for design purposes, describes a stable condition of traffic operation. It has a somewhat restricted movement due to higher traffic volumes, but flow conditions are not objectionable for motorists.

LOS D, which is acceptable for traffic operations in urban environments and during peak hours of traffic flow, reflects a more restricted movement for motorists. Queues and delays may occur during short peaks, but lower demands occur often enough to permit clearance of developing queues, thus preventing excessive backups. LOS E is defined as the actual capacity of the roadway and involves delay to all motorists due to congestion. Levels of Service E and F are generally considered unacceptable.

Level of Service for signalized intersections is defined in terms of average delay per vehicle entering the intersection. Delay is considered a measure of driver discomfort, frustration, fuel consumption and travel time. Table 2 summarizes the criteria for signalized intersection level of service.

SIXTH STREET

N

0 1000' 2000' 3000'

NEW INTERCHANGE WITH SPAULDING TURNPIKE

WASHINGTON ST.

LEXINGTON ST.

ARCH ST.

SILVER ST.

CENTRAL AVE.

WATSON RD.

LOCUST STREET

RUTLAND ST.

CATARACT AVE.

SPAULDING TURNPIKE

Cocheco River

UPPER FACTORY RD.

PROPOSED CONNECTOR ROAD WITH RE-ALIGNMENT OF ROUTE 9

OLD LITTLEWORTH RD.

HARTSWOOD RD.

SUNSET DR.

CATARACT AVE.

Bellamy River

BACK RIVER RD.

108

DURHAM ROAD

PROPOSED NEW INTERSECTION

PROPOSED TRAFFIC SIGNAL

GE DRIVE

TRAFFIC SIGNAL

ALUMNI DRIVE

WATSON ROAD

TOLEND ROAD

COLUMBUS AVENUE

INDUSTRIAL PARK ROAD

155

BELLAMY ROAD

9

WESTWOOD CIRCLE

LITTLEWORTH ROAD

OLD STAGE ROAD

CROSBY ROAD

BOSTON & MAINE RAILROAD

KNOX MARSH RD.

MAST RD.

DOVER

MADBURY

MAP14

PROPOSED ROUTE 9 INTERCHANGE WITH SPAULDING TURNPIKE
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 5

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TABLE 2

LEVEL OF SERVICE CRITERIA FOR
SIGNALIZED INTERSECTIONS

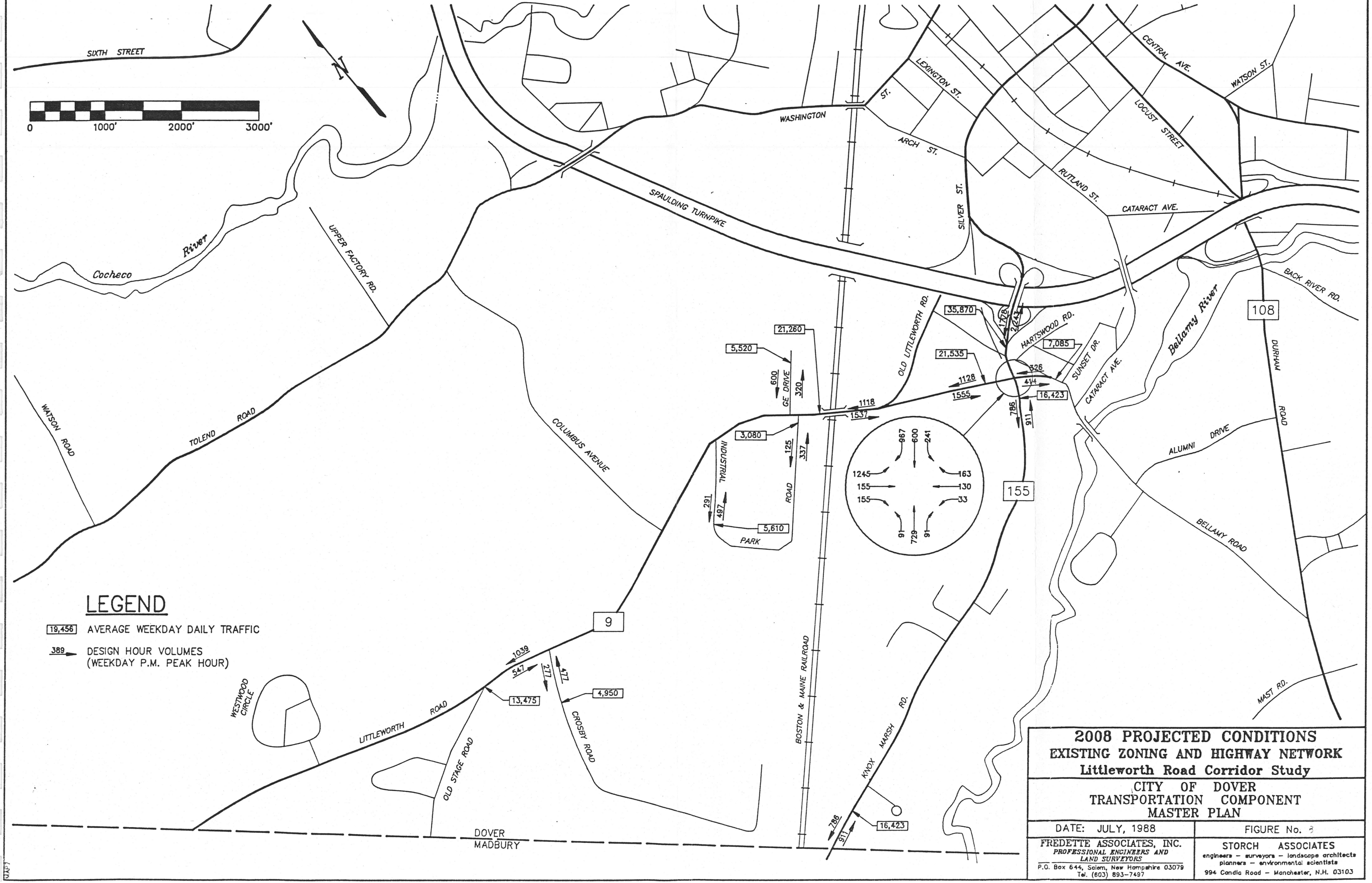
LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	5.0
B	5.1 to 15.0
C	15.1 to 25.0
D	25.1 to 40.0
E	40.1 to 60.0
F	Greater than 60.0

SOURCE: 1985 Highway Capacity Manual

Capacity analyses were performed at the critical Route 9/Route 155 intersection for the following long range development scenarios:

- "1988 Conditions" - Based on current traffic volumes utilizing the adjacent roadways under existing conditions. Refer to Figure 3.
- "2008 Conditions - No Rezoning" - Assuming full build out of Route 9/Route 155 intersection only. Refer to Figure 6.
- "2008 Conditions - With Rezoning" - Assuming full build out of Route 9/Route 155 Intersection only. Refer to Figure 7.
- "2008 Conditions - No Rezoning" - Assuming Route 9 Interchange with Spaulding Turnpike and upgrade of Route 9/Route 155 Intersection. Refer to Figure 8.
- "2008 Conditions - With Rezoning" - Assuming Route 9 Interchange with Spaulding Turnpike and upgrade of Route 9/Route 155 Intersection. Refer to Figure 9.

The capacity analyses were conducted using the methodology of the 1985 Highway Capacity Manual and resulting levels of service are summarized in Table 3. Copies of the capacity calculations are included in Appendix D.



LEGEND

19,456 AVERAGE WEEKDAY DAILY TRAFFIC

389 DESIGN HOUR VOLUMES (WEEKDAY P.M. PEAK HOUR)

2008 PROJECTED CONDITIONS
EXISTING ZONING AND HIGHWAY NETWORK
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 3

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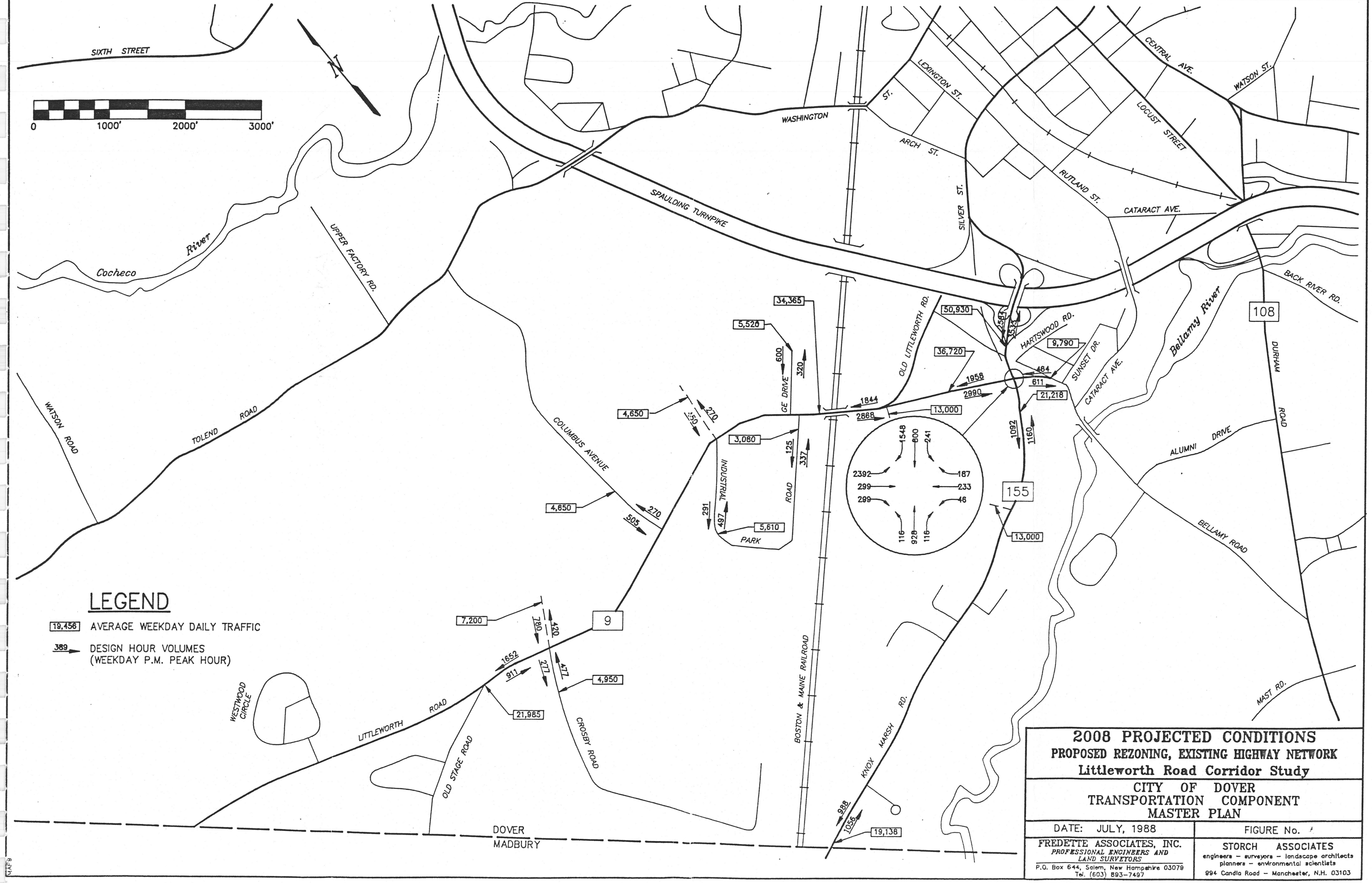

LEGEND

19,456 AVERAGE WEEKDAY DAILY TRAFFIC

389 DESIGN HOUR VOLUMES (WEEKDAY P.M. PEAK HOUR)

2008 PROJECTED CONDITIONS

PROPOSED REZONING, EXISTING HIGHWAY NETWORK

Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 7

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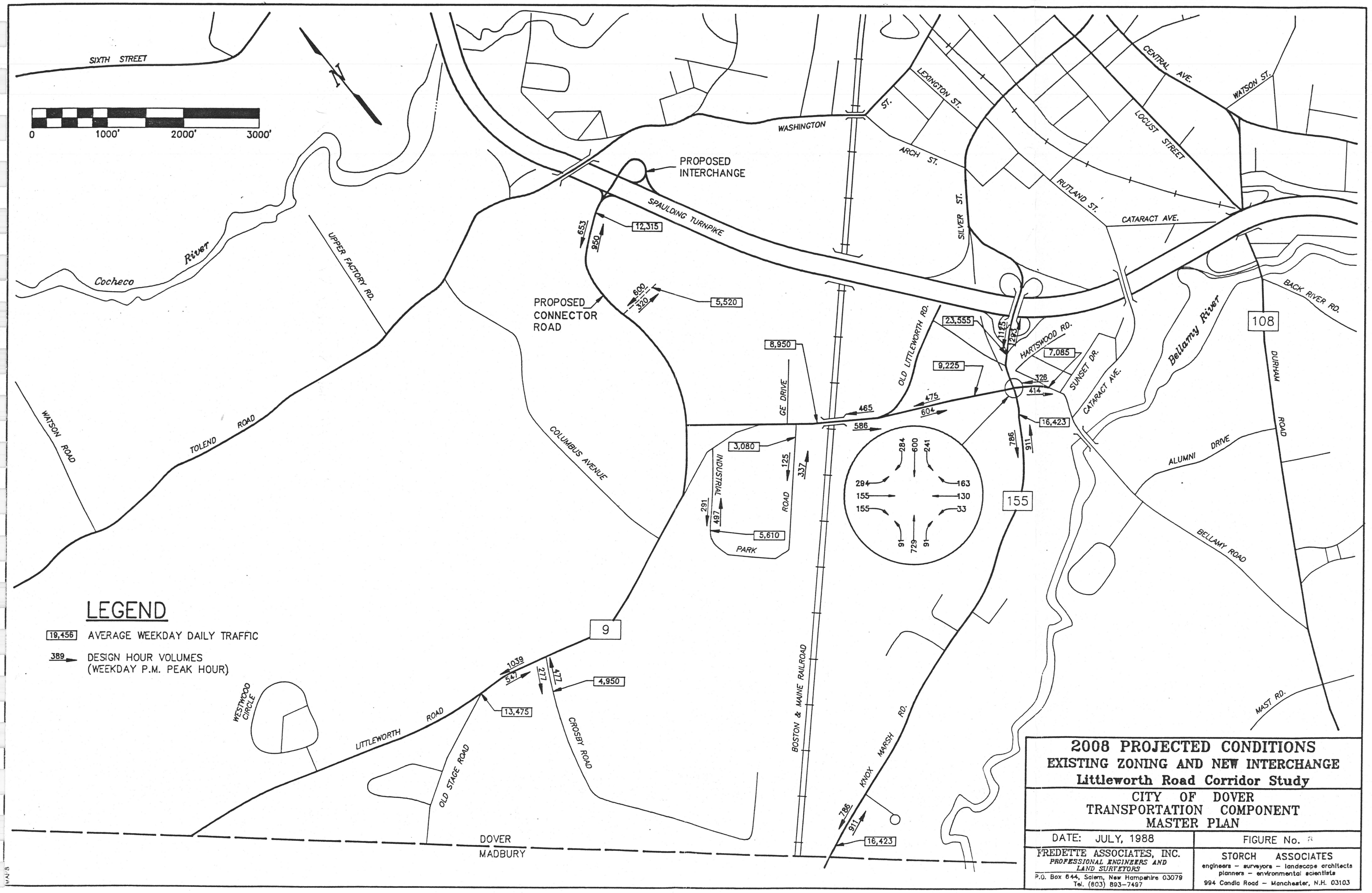
MAP 9



LEGEND

19,456 AVERAGE WEEKDAY DAILY TRAFFIC

389 DESIGN HOUR VOLUMES (WEEKDAY P.M. PEAK HOUR)

2008 PROJECTED CONDITIONS
EXISTING ZONING AND NEW INTERCHANGE
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 8

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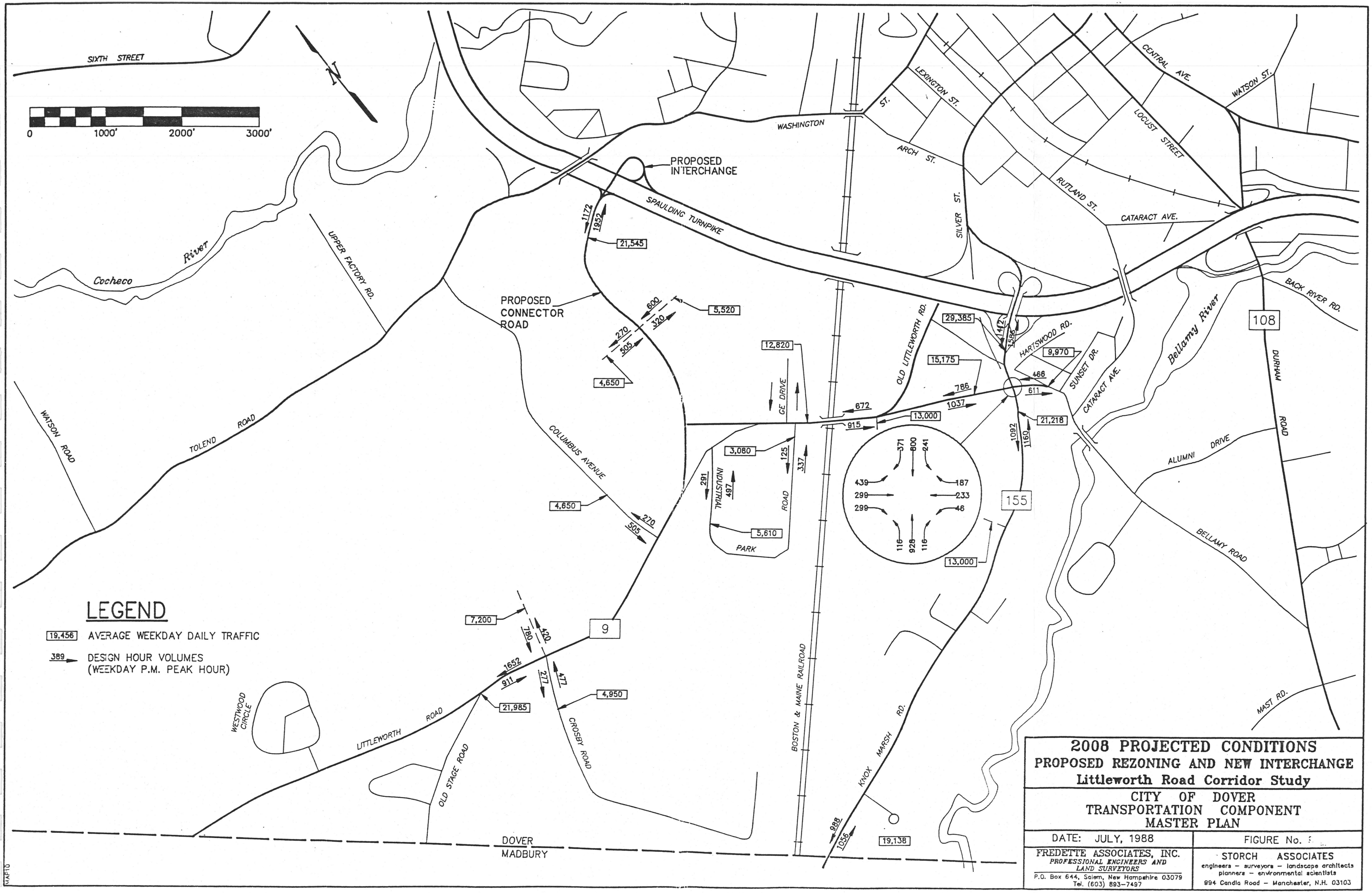

LEGEND

19,456 AVERAGE WEEKDAY DAILY TRAFFIC

389 DESIGN HOUR VOLUMES (WEEKDAY P.M. PEAK HOUR)

2008 PROJECTED CONDITIONS
PROPOSED REZONING AND NEW INTERCHANGE
Littleworth Road Corridor Study

CITY OF DOVER
TRANSPORTATION COMPONENT
MASTER PLAN

DATE: JULY, 1988

FIGURE No. 5

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MAP10

TABLE 3

LEVEL OF SERVICE SUMMARY

ROUTE 9/ROUTE 155 INTERSECTION

	No Route 9 Interchange		With Route 9 Interchange	
Present 1988 LOS	No Rezoning 2008 LOS	With Rezoning 2008 LOS	No Rezoning 2008 LOS	With Rezoning 2008 LOS
PM	PM	PM	PM	PM
C	F	F	C	D/E

Turning movements from Route 9 onto Route 155 presently experience some delay with overall Level of Service C operations during the PM Peak Hour. With no proposed rezoning and the assumed growth in background traffic, the full build out of road improvements at this intersection will be operating at or over capacity (Level of Service F) by 2008.

With the total additional volumes generated by proposed rezoning, capacity conditions will be exceeded (Level of Service F) prior to the year 2008.

With the addition of a new Route 9 alignment and interchange with the Spaulding Turnpike, satisfactory Level of Service C operations are anticipated through the year 2008 assuming full build out of intersection improvements and no proposed rezoning. With the proposed rezoning plan the intersection will operate at Level of Service D/E.

G. Corridor Growth Implications

The key location constraining the potential capacity of the Route 9 Corridor is the Route 9/Route 155 intersection.

Based on the continued growth of highway traffic, turning movements from Route 9 to northbound Route 155 and the Spaulding Turnpike will cause the intersection of Route 9 and Route 155 (assumed full build out of intersection improvements) to reach capacity by the Year 2008. This condition will occur with no proposed rezoning of existing vacant lands in the City of Dover.

Utilizing the trip generation rates expected to be developed as a result of the implementation of the proposed rezoning, combined with an analysis of the existing surrounding traffic characteristics, it can be concluded that these new development areas will accelerate the timing when saturated conditions are reached at the intersection of Route 9 and Route 155.

However, assuming the full build out of improvements to the Route 9/Route 155 intersection is supplemented by the realignment of Route 9 to a new interchange on the Spaulding Turnpike, the former intersection will accommodate projected traffic growth with or without the City's proposed rezoning plan.

In light of the above findings, particularly with regard to the conservatively low estimate of potential corridor traffic growth utilized in the analysis, it is concluded that a new interchange with the Spaulding Turnpike is needed whether or not zoning changes are implemented along the Route 9 Corridor. It can also be concluded that without the new interchange, rezoning of the corridor for additional industrial or commercial growth cannot be reasonably accommodated by the present roadway system.

IV. Recommendations

Presented below are recommendations for highway improvements needed to accommodate the proposed traffic growth along the Littleworth Road corridor. Unless otherwise noted, these recommendations are based on accommodation of the proposed corridor rezoning plan as depicted in Figure 9. The implementation of a new interchange on the Spaulding Turnpike is also assumed which, at the time of this writing, is being discussed with the New Hampshire Department of Transportation.

1. Construct a new interchange with the Spaulding Turnpike in the vicinity of Tolend Road. The exact location and configuration of this interchange is beyond the scope of this memorandum although the indicated location between the Silver Street and Weeks Circle interchanges provides a reasonable interchange spacing of approximately one-mile.

2. Construct a new connector roadway (4-lanes minimum) between this interchange and a new signalized intersection with Littleworth Road east of Columbus Avenue. The New Hampshire Route 9 designation should be relocated to this new route.

3. Construct the aforementioned full build out of improvements to the Route 9/Route 155 intersection including: relocation of Bellamy Road to opposite Littleworth Road (presently being planned by NHDOT); widening of Route 155 and Littleworth Road to at least five-lane sections in the vicinity of the intersection; and extension of this widening of Route 155 into the present Spaulding Turnpike interchange to accommodate merging and weaving maneuvers. Bellamy Road north of Route 155 should be closed with access directed to Old Littleworth Road. These improvements will be required with or without rezoning.

4. Widen Route 155 south of Littleworth Road to at least a four lane section adjacent to the proposed commercial/retail zone. Localized widening to six lanes, for addition of left and right turn lanes, is recommended at a future primary entrance to the commercial site.

5. Except as noted below, widen Littleworth Road to at least a four-lane section (five lanes desirable for left turn lane implementation) from Route 155 through Old Stage Road. Localized widening to six lanes for addition of left and right turn lanes is recommended at key intersections (see Item 6 below). With implementation of the proposed interchange, the four-lane widening of the Littleworth Road bridge structure over the Boston and Maine Railroad tracks is not necessary, although minor widening for additional lateral roadway clearance would be desirable. Without the proposed rezoning and interchange, this four-lane widening could be limited to east of, and including, the Industrial Park Road (west) intersection.

6. To the extent practicable, minimize the proliferation of uncontrolled site entrances along the corridor. Recommended as a long term goal would be the concentration of future site and side street traffic at the following primary intersections, upgraded with exclusive turn lanes and signalization:

   a. Littleworth Road at Old Littleworth Road and future commercial site.

   b. Littleworth Road at Industrial Park Road (East) and General Electric Drive. The present offset between both site entrances (about 50 feet) should be eliminated. Widening of Littleworth Road for turn lanes at this intersection may need to be extended back to or through the railroad crossing structure.

   c. Littleworth Road at Industrial Park Road (West) should also be considered as a major intersection, although its ultimate traffic control requirements will depend largely on the final configuration of the Littleworth Road connection to the proposed interchange connector road.

   d. Littleworth Road at Columbus Avenue. Columbus Avenue will need to be reconstructed to serve as a major collector road for industrial site traffic to the north.

   e. Littleworth Road at Crosby Road and future industrial site.

f. Route 155 and future commercial/retail site (primary site access south of Littleworth Road intersection).

g. Interchange Connector Roadway and future industrial site entrance(s) (one major intersection).

The above intersection locations will provide an approximately one-quarter mile spacing between traffic signals. Coordination of signals along Littleworth Road is recommended.

7. The present 66 foot right of way along Littleworth Road is marginally adequate for a four lane curbed roadway with sidewalks. A continuous 5-lane section (central lane for left turn usage at key intersections) would be desirable as a long term goal with recommendations for a right-of-way width of 80 feet (for curbed roadway with sidewalks) or 100 feet (for uncurbed roadway with shoulders).