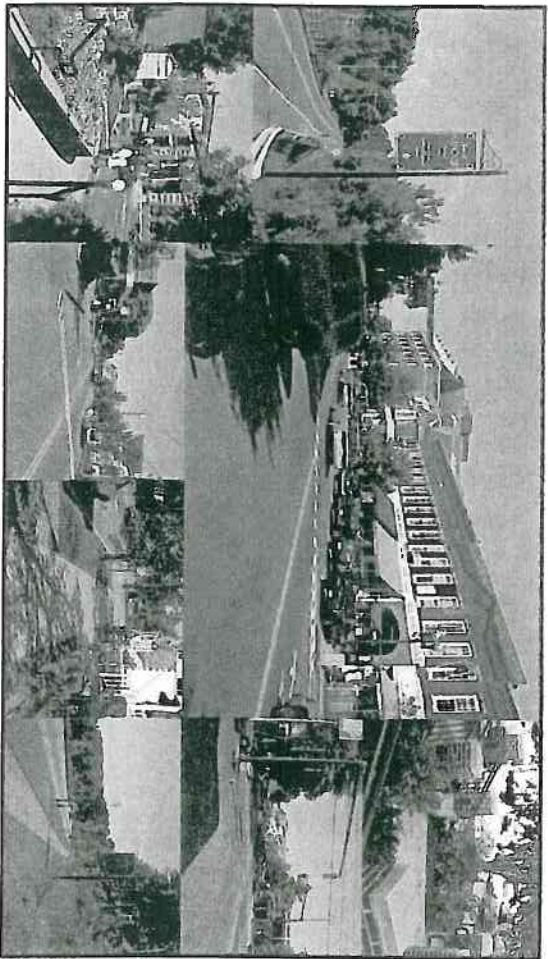


Hanover Traffic Survey October 2001



UVA
Upper Valley Lake Survey
Regional Planning Commission

January 30, 2002

I. INTRODUCTION

Contained in this report are the results of the 2001 Hanover Traffic Survey conducted by the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) at the request of the Town. This report is part of a long-range traffic study initiated in 1986 to accurately measure typical traffic patterns in the Town of Hanover. All traffic and turning movement counts were performed in October as it is believed by the Town that October exhibits typical traffic patterns. This information is intended to assist the Town in managing their road network and in planning road infrastructure improvements.

This report has been organized into three sections containing traffic count data and analysis; intersection data and an analysis of intersection performance; and the final section provides some general recommendations as well as suggestions for subsequent traffic survey work.

II. TRAFFIC COUNTS

The UVLSRPC performed traffic counts at the same 12 locations as studied in 1999. Traffic volumes were measured at each location for approximately two weeks, from which Average Daily Traffic (ADT) measurements were determined. These locations are:

- (1) Etna Road, north of Trescott Road
- (2) Hanover Center Road, north of Dogford Road

- (3) NH Route 10, at Lebanon City Line
- (4) NH Route 10, at Lyme Town Line
- (5) NH Route 10, south of Reservoir Road
- (6) NH Route 120, at Lebanon City Line
- (7) NH Route 120, north of Greensboro Road
- (8) Rennie Road, east of Goose Pond Road
- (9) Ruddsboro Road, east of Etna Road
- (10) Trescott Road, east of Grasse Road
- (11) East Wheelock Street, east of Park Street
- (12) West Wheelock Street, at Vermont State Line

A. TRENDS AT TRAFFIC COUNT SITES

This section describes general trends in traffic volumes observed at count locations. For the purpose of discussion, count locations have been divided into two groups: 1) Gateway Locations - the main entrances into the Town of Hanover; and 2) Local Roads - roads and segments of certain roads that do not serve as main Town entrances and serve primarily, but not limited to, local traffic.

See Table 1 for average daily traffic volumes observed at each location. Figures 1, 2, 3 and 4 illustrate trends in traffic growth observed over time.

1. Gateway Traffic Volumes

For the purposes of this study, gateway traffic count locations consist of the main entrances to Hanover. They include: NH Route 10, at Lyme Town Line; NH

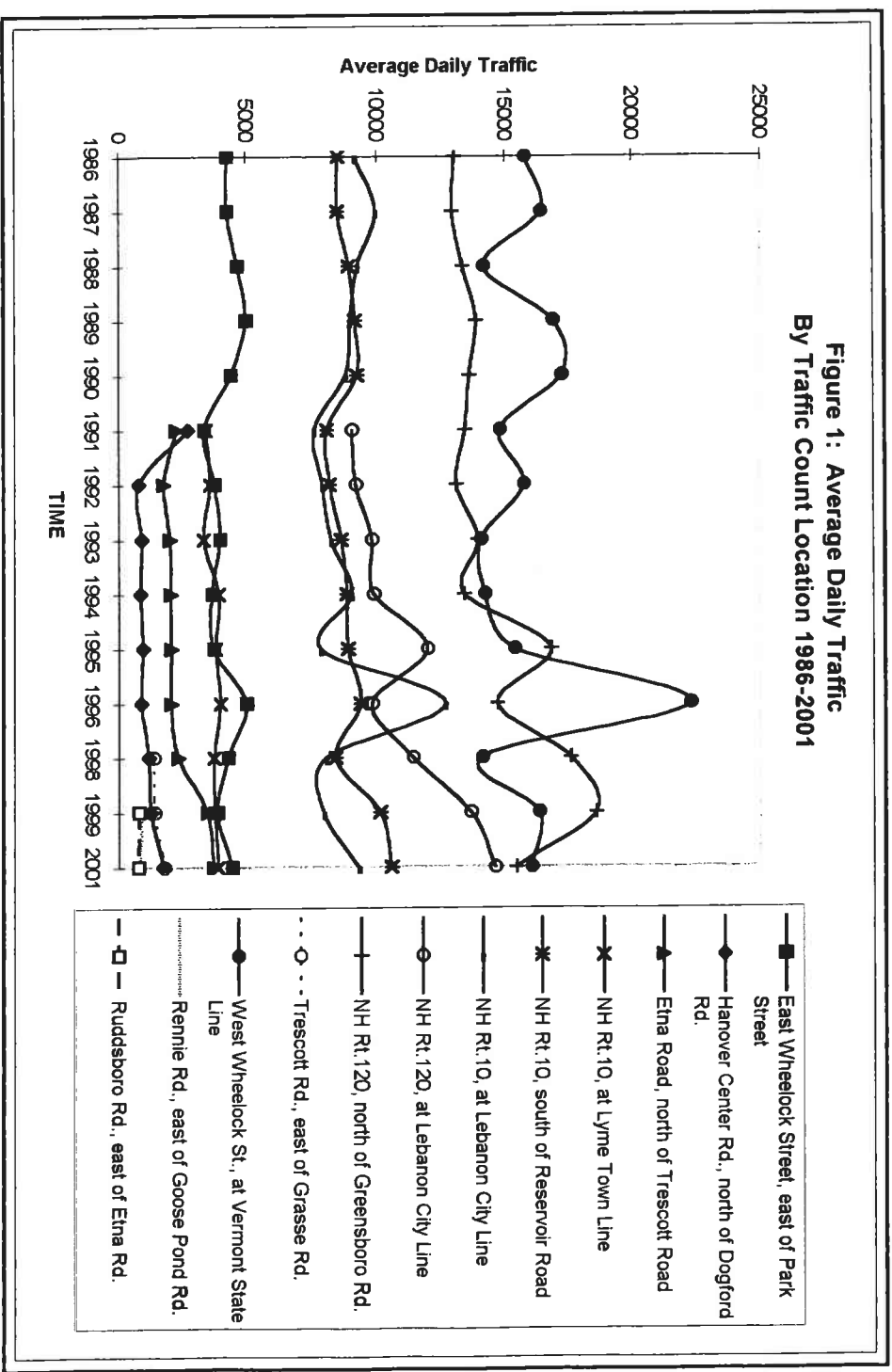
Table 1: 1986 - 2001 Average Daily Traffic Volumes

Location	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1998	1999	2001
Gateway Roads	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
NH Rt. 10, at Lyme Town Line						3400	3560	3300	3900	3790	3990	3720	3748	3878
NH Rt. 120, at Lebanon City Line						9070	9220	9800	9870	11960	9800	11380	13695	14633
West Wheelock St., at Vermont State Line	15810	16450	14150	16910	17250	14800	15770	14060	14200	15390	22250*	14110	16373	16059
NH Rt. 10, at Lebanon City Line	9180	9940	9280	9000	8830	7590	7910	8280	9070	7880	12710	8090	7980	9322
Local Roads	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
East Wheelock Street, east of Park Street	4250	4250	4660	5000	4400	3300	3750	3950	3640	3710	5030	4300	3868	4442
NH Rt. 10, south of Reservoir Road	8560	8530	8950	9200	9250	8100	8220	8660	8890	8940	9400	8460	10115	10527
Elna Road, north of Trescott Road						2220	1750	1990	2000	2030	2030	2280	3432	3700
NH Rt. 120, north of Greensboro Rd.	13050	12960	13350	13880	13610	13450	13130	13960	13440	16840	14700	17580	18578	15466
Trescott Rd., east of Grasse Rd.												1365	1383	1763
Rennie Rd., east of Goose Pond Rd.													892	820
Ruddsboro Rd., east of Elna Rd.													788	750
Hanover Center Rd., north of Dogford Rd.						2660	790	920	880	960	900	1170	1243	1711

Source: UVLSRPPC Traffic Counts 1986-2001
 * Count taken at different location

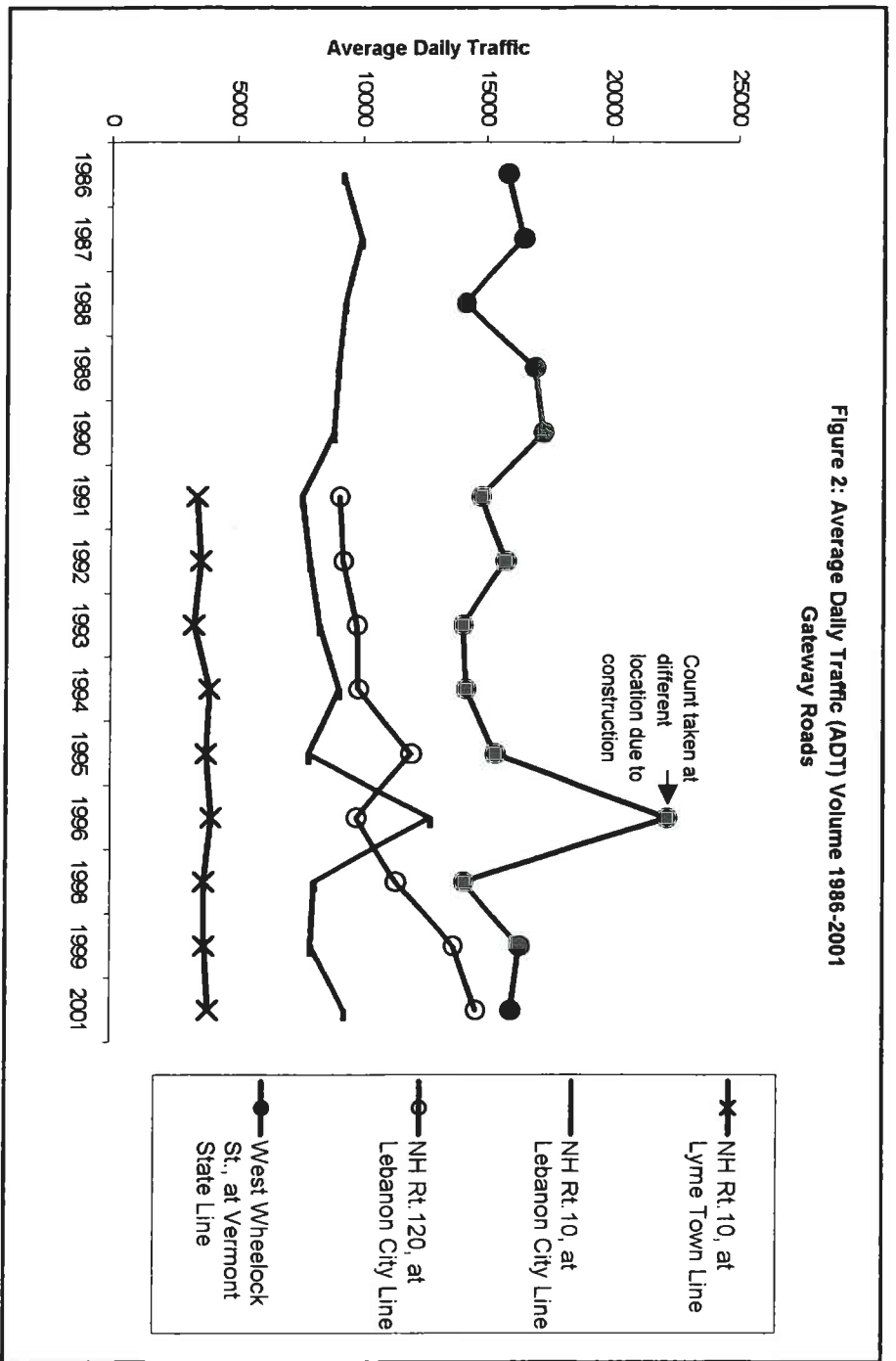
2001
 Hanover
 Traffic
 Survey

2001
Hanover
Traffic
Survey



Source: UVLSRPC Traffic Counts 1986-2001

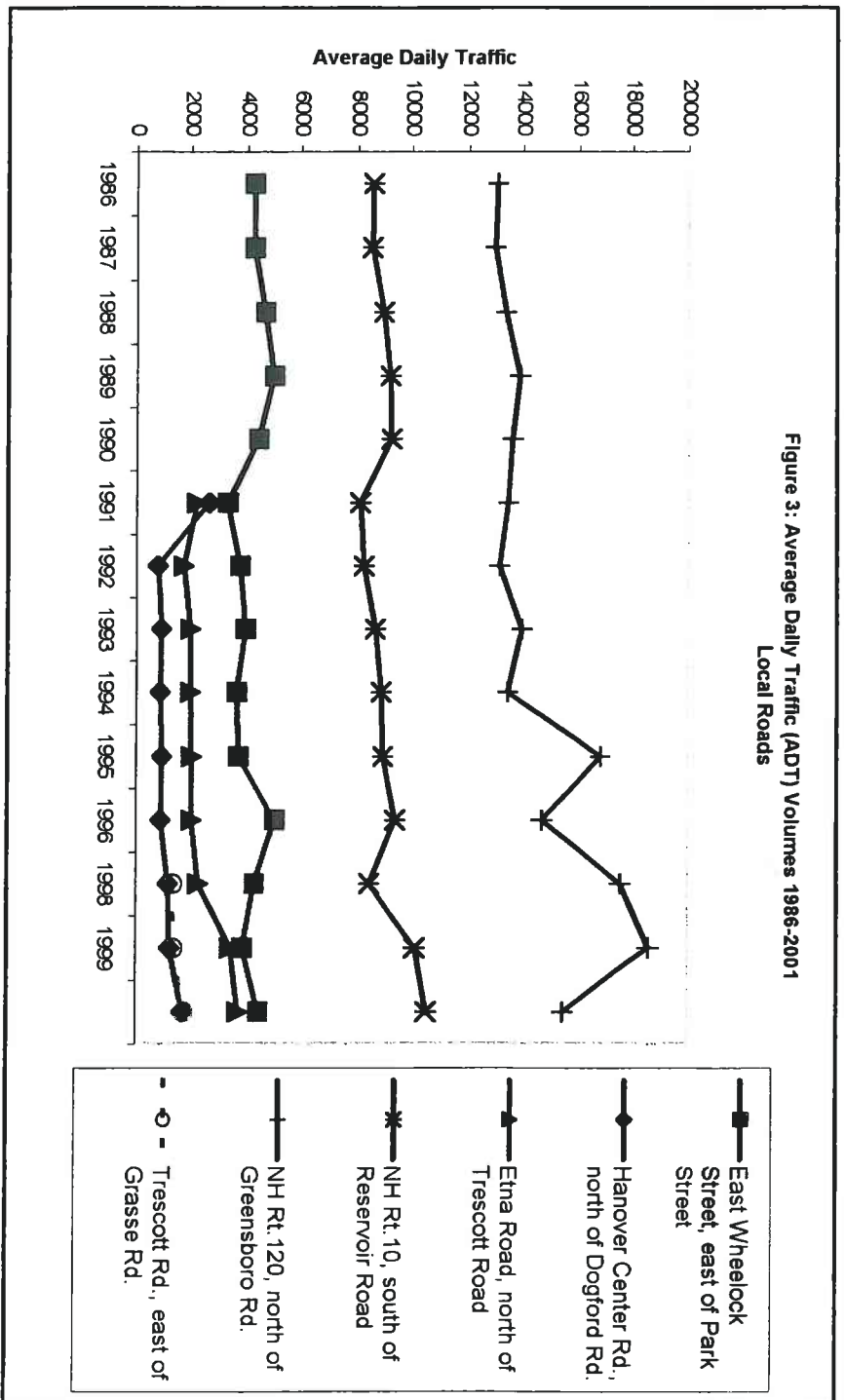
Figure 2: Average Daily Traffic (ADT) Volume 1986-2001
Gateway Roads



Source: UVL SRPC traffic counts 1986-2001

2001
Hanover
Traffic
Survey

2001
Hanover
Traffic
Survey



Route 10, at Lebanon City Line; NH Route 120, at Lebanon City Line; and West Wheelock Street, at the Vermont State line.

Figure 2 charts the traffic volumes of all gateway roads. The highest volume location continues to be West Wheelock Street at the Vermont State Line (on the Ledyard Bridge), followed by NH Route 120 at the Lebanon City Line. Traffic continues to increase at gateway locations. The most notable increase is NH Route 10 at the Lebanon City Line, which has increased by 1,342 ADT or 17 percent between 1999 and 2001. Volumes at NH Route 120 at the Lebanon City Line continue to grow steadily every year and have increased dramatically (5,563 ADT, 61 percent) during the past ten years (1991-2001). The only location that experienced a decrease in traffic volume between 1999 and 2001 is West Wheelock Street at the Vermont State Line, which lost 1.9 percent during that period (See Table 2 for percent change in average daily traffic). According to UVL SRPC data, traffic volumes along Ledyard Bridge have fluctuated throughout the long-term study period but have not experienced a significant sustained increase or decrease.

2. Local Road Traffic Volumes

For the purposes of this study, the following are referred to as local roads: East Wheelock Street, east of Park Street; Hanover Center Road, north of Dogford Road; Etna Road, north of Trescott Road; NH Route 10, south of Reservoir Road; NH Route 120, north of

Greensboro Road; Trescott Road, east of Grasse Road; Rennie Road, east of Goose Pond Road; and Ruddsboro Road, east of Etna Road. Please note, these locations do not necessarily support only local traffic.

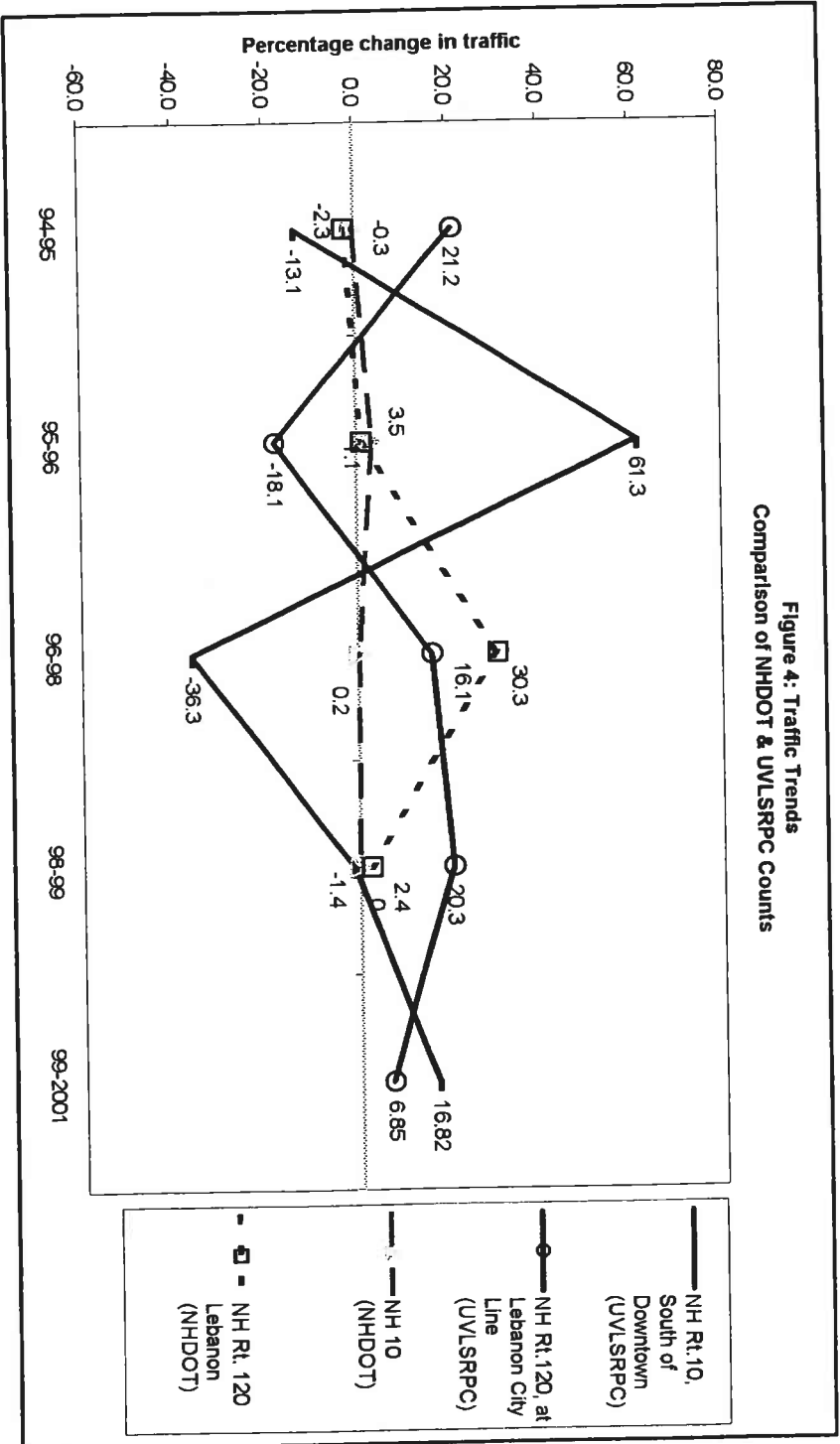
See Figure 3 for traffic volumes of all local roads counted. NH Route 120 has the highest traffic volume of all local roads, followed by NH Route 10 south of Reservoir Road. The largest increase in traffic during this two-year period occurred again on Etna and Hanover Center Roads, which experienced 38 percent growth (an increase of 468 ADT) north of Dogford Road and 8 percent (268 ADT) north of Trescott Road. Trescott Road and East Wheelock Street also experienced significant increases in traffic volumes, nearly 27 and 15 percent respectively.

Traffic volumes on Etna and Hanover Center Roads have been observed to be relatively steady between 1992 and 1996, but have risen significantly in the last few years. This recent growth may be indicative of a number of variables including non-local through-trips and/or the increasing rural residential development resulting in increased commuter and shopping traffic along this rural corridor. A number of other variables may also have played a role in this increase, such as: increased household car ownership, a change in occupational commuting patterns, and/or an increase in daily trips per household. Further studies would be needed to determine the cause(s) of this pattern.

Hanover
Traffic
Survey

2001

2001
Hanover
Traffic
Survey



Location	Table 2: Percentage Change in Average Daily Traffic												
	1986-1987	1987-1988	1988-1989	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1998	1998-1999	1999-2001
Gateway Roads													
NH Rt.10, at Lyme Town Line						4.71	-7.30	18.18	-2.82	5.28	-6.77	0.75	3.47
NH Rt.120, at Lebanon City Line						1.65	6.29	0.71	21.18	-18.06	16.12	20.34	6.85
West Wheelock St., at Vermont State Line	4.05	-13.98	19.51	2.01	-14.20	6.55	-10.84	1.00	8.38	44.57	-36.58	16.04	-1.92
NH Rt.10, at Lebanon City Line	8.28	-6.64	-3.02	-1.89	-14.04	4.22	4.68	9.54	-13.12	61.29	-36.35	-1.36	16.82
Local Roads													
East Wheelock St., east of Park St.	0.00	9.65	7.30	-12.00	-25.00	13.64	5.33	-7.85	1.92	35.58	-14.51	-10.05	14.84
NH Rt.10, south of Reservoir Rd.	-0.35	4.92	2.79	0.54	-12.43	1.48	5.35	2.66	0.56	5.15	-10.00	19.56	4.07
Etha Rd., north of Trescott Rd.						-21.17	13.71	0.50	1.50	0.00	12.32	50.53	7.81
NH Rt.120, north of Greensboro Rd.	-0.69	3.01	3.97	-1.95	-1.18	-2.38	6.32	-3.72	25.30	-12.71	19.59	5.68	-16.75
Trescott Rd., east of Grasse Rd.												1.32	27.48
Rennie Rd., east of Goose Pond Rd.													-8.07
Ruddsboro Rd., east of Etha Rd.													-4.82
Hanover Center Rd., north of Dogford Rd.						-70.30	16.46	-4.35	9.09	-6.25	30.00	6.24	37.65

Source: UVLSRPC Traffic Counts 1986-2001

2001
Hanover
Traffic
Survey

2001
Hanover
Traffic
Survey

B. A SUMMARY OF TRAFFIC COUNTS

Since 1996, traffic volumes and patterns in Hanover have been in a state of fluctuation due to various construction projects. However, long-term trends suggest that traffic volumes have not experienced large growth except for at a few key locations. Traffic in Downtown Hanover has remained relatively constant since the mid 1980s, while major travel routes and roads in more rural areas experienced large amounts of traffic growth. Route 120 has experienced significant growth since the mid-1990s largely due to the relocation of the Medical Center and the construction of Centerra along this corridor. Hanover Center Road and Trescott Road have experienced significant traffic growth very recently, perhaps resulting from an increase in scattered residential development patterns in the Upper Valley as well as from altered commuting patterns. Some commuters may be bypassing the congestion along the I-89 and NH 120 corridors and using Ruddsboro Road, Hanover Center Road and Trescott Road to access employment and/or services in Hanover or Lebanon. Overall, traffic volumes have not increased significantly in Hanover; however, traffic circulation patterns have changed somewhat and traffic has increased dramatically along certain roads. These trends are largely due to new and expanding commercial development along NH Route 120, more rural residential development in the Upper Valley and increased traffic congestion along other regionally important transportation routes.

III. INTERSECTION ANALYSIS

Turning movement counts were performed at the same 13 locations as in the 1999 Survey. The UVLSRPC performed turning movement counts at the following intersections:

- (1) Etna Road/Trescott Road
- (2) Greensboro Road/Etna Road
- (3) Hanover Center Road/Rennie Road
- (4) Main Street/Lebanon Street
- (5) Main Street/South Street
- (6) Main Street/Wheelock Street
- (7) Maple Street/School Street
- (8) NH Route 120/Buck Road
- (9) NH Route 120/Greensboro Road
- (10) Park Street/Lebanon Street
- (11) Park Street/Lyme Road
- (12) Park Street/East Wheelock Street
- (13) South Street/Currier Place/South College Street

Figures 5 and 6 illustrate peak hour intersection volume trends over time. Figure 7 and Table 4 illustrate percent change in observed intersection volumes between 1999 and 2001. See Table 5 for intersection LOS listed by year, from 1986 to 2001.

Turning movement counts are measurements of traffic movements at a given intersection. The data collected

2001
Hanover
Traffic
Survey

indicate the volume of vehicles making each possible movement (i.e., left, right or straight) at each approach (northbound, southbound, eastbound and westbound) at each intersection.

The turning movement counts were conducted once during the morning (6:45 to 8:45 AM) for AM peak data and once during the afternoon (3:45 to 5:45 PM) for PM peak data. AM and PM peak hour data are determined from this information, indicating the highest hour of traffic volumes during these periods. The Level of Service (LOS) was calculated from this information to measure how well each intersection functions under the current level of traffic.

LOS measures the average vehicle delay at an intersection in a qualitative manner. The average vehicle delay is a measure of seconds per vehicle. The numeric delay figure is then simplified into six categories established in the Highway Capacity Manual (Washington, D.C., Transportation Research Board, 1998). These six categories range from "A" to "F" - "A" representing those intersections with the least delay and "F" indicating those with extreme delay and heavy congestion. The generalized criteria for LOS are represented in the table below.

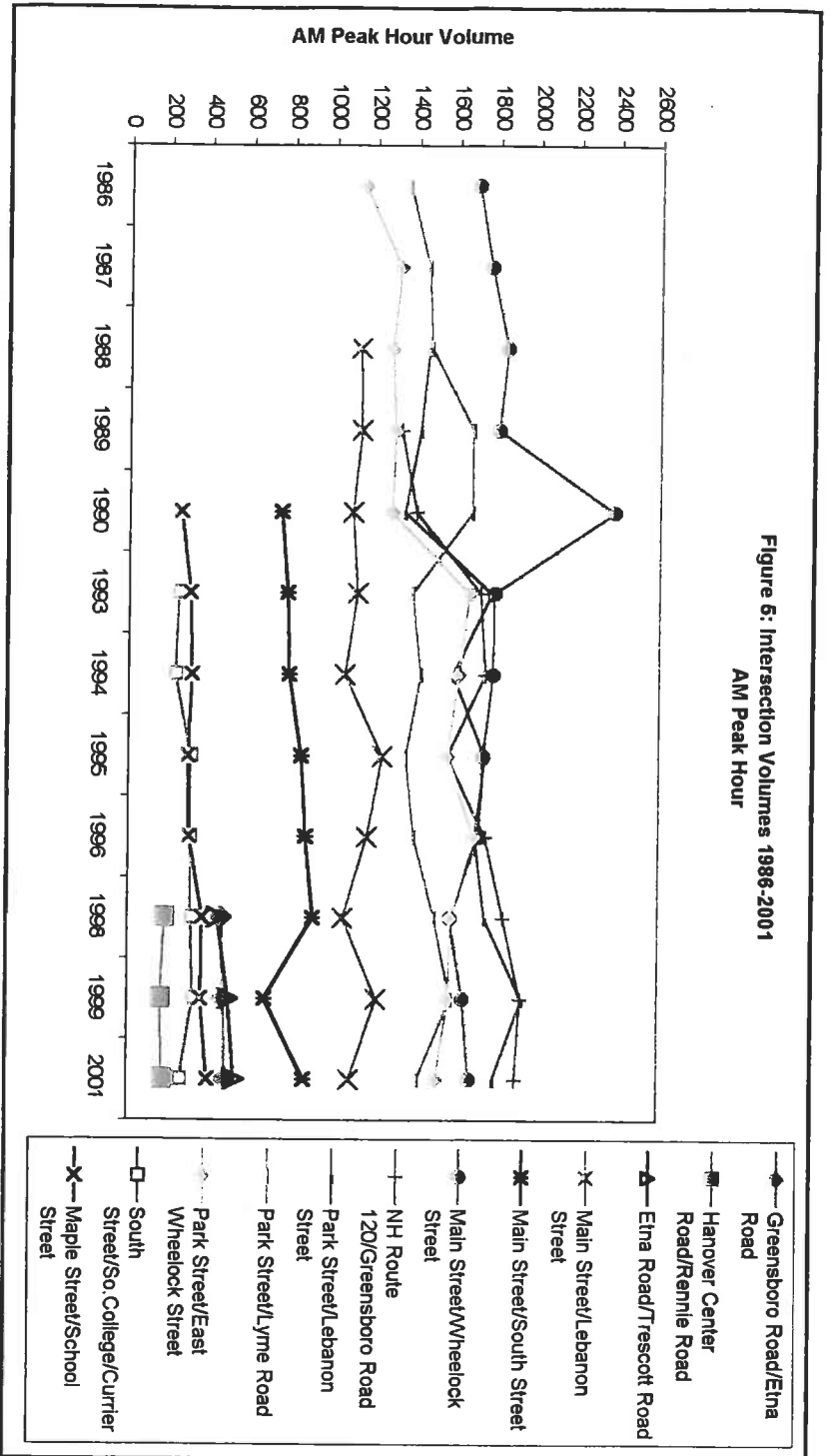
Table 3: LOS Criteria

LOS	Prevailing Conditions
A	Little to no congestion
B	Slight congestion
C	Average congestion
D	Above average congestion
E	High levels of congestion
F	Extreme congestion

Intersection LOS was measured using methodologies referenced in the Highway Capacity Manual. Provided in this report are intersection LOS measurements which are indicative of the overall intersection performance (i.e. average vehicle delay).

There are two key factors to consider when analyzing LOS measurements over a long-term study period. First, intersection geometry and signalization can change over time and such changes are likely as roadway projects occur. Second, the methodology for calculating LOS has changed numerous times throughout the years, most recently in 2000. As a result, LOS measurements may not yield linear results; therefore, this analysis will mainly concentrate on traffic trends at intersections and the LOS measurements will provide good information on existing intersection performance and more recent short-term trends.

Figure 6: Intersection Volumes 1986-2001
AM Peak Hour

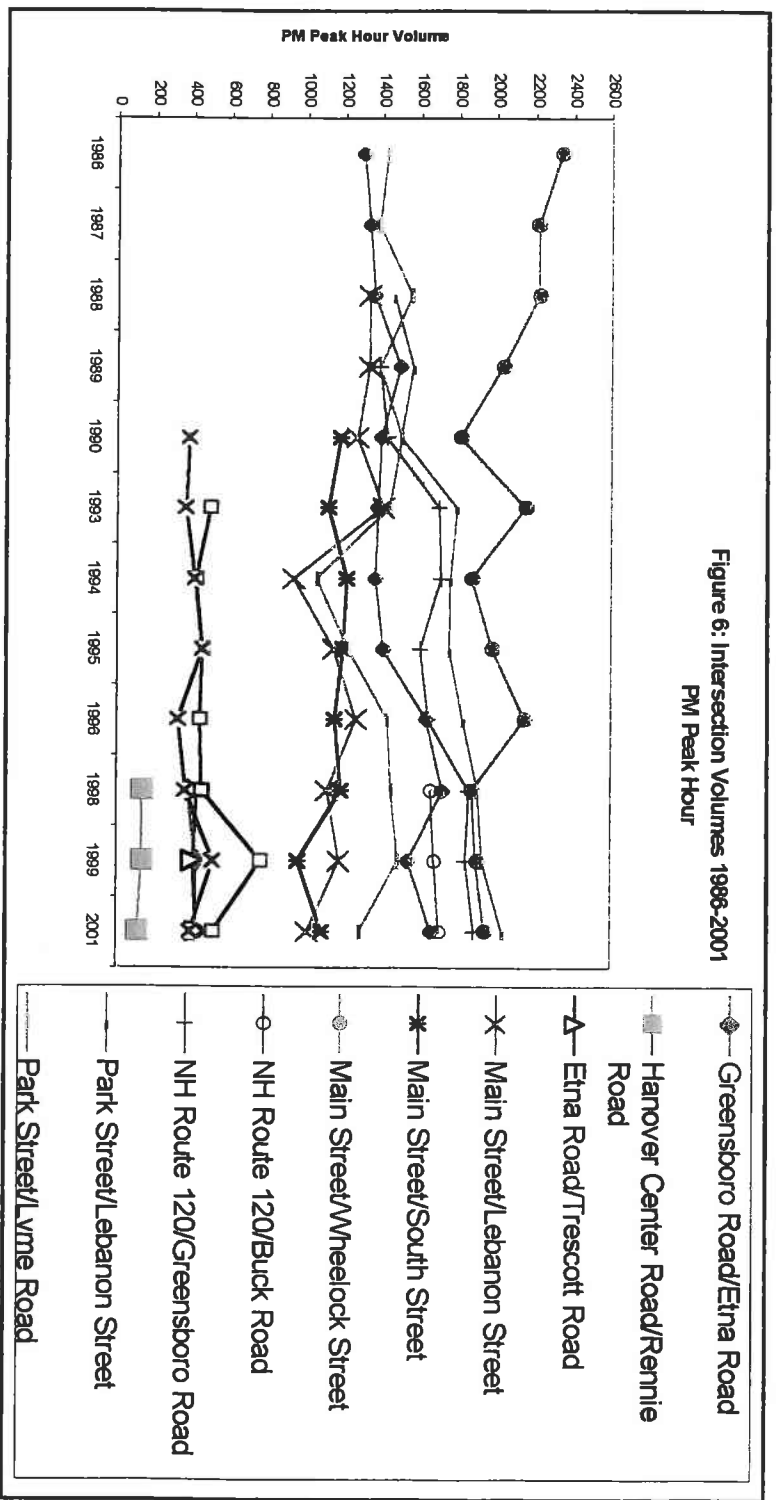


Source: UVL SRPC traffic counts 1986-2001

2001
Hanover
Traffic
Survey

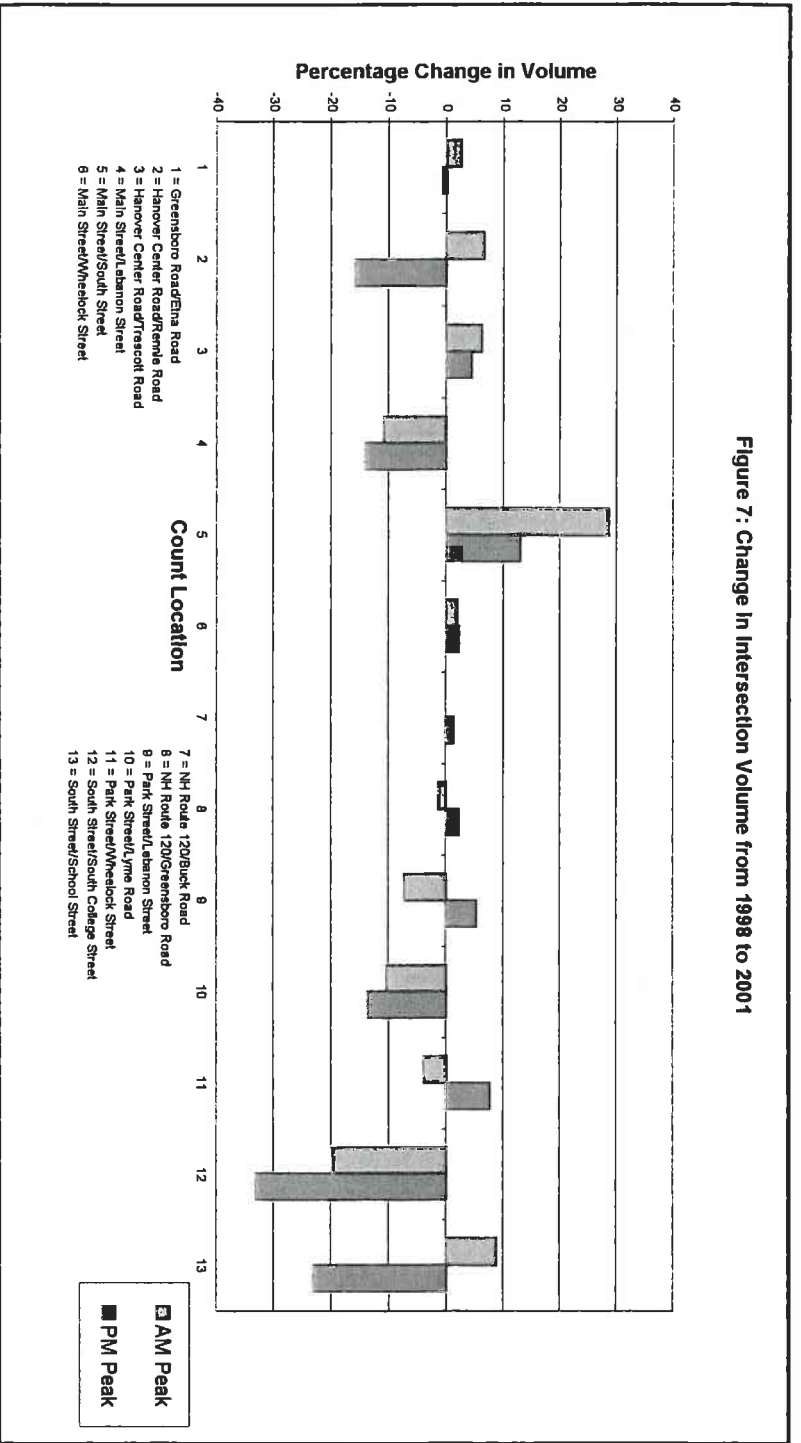
2001
Hanover
Traffic
Survey

Figure 6: Intersection Volumes 1986-2001
PM Peak Hour



Source: UVLSRPC traffic counts 1986-2001

Figure 7: Change in Intersection Volume from 1998 to 2001



Source: VLRSRPC traffic counts 1986-2001

Table 4: INTERSECTION VOLUMES 1999 TO 2001

INTERSECTION:	AM PEAK VOLUMES:		PM PEAK VOLUMES:		PERCENT CHANGE:	
	1999	2001	1999	2001	AM	PM
Greensboro Road/Etna Road (2)	473	485	416	413	3	-1
Hanover Center Road/Rennie Road (3)	165	176	133	112	7	-16
Etna Road/Trescott Road (1)	495	526	399	417	6	5
Main Street/Lebanon Street (4)	1208	1078	1174	1009	-11	-14
Main Street/South Street (5)	668	859	953	1077	29	13
Main Street/Wheelock Street (6)	1636	1670	1899	1943	2	2
NH Route 120/Buck Road (8)	***	***	1680	1703	***	1
NH Route 120/Greensboro Road (9)	1919	1895	1843	1887	-1	2
Park Street/Lebanon Street (10)	1925	1785	1934	2038	-7	5
Park Street/Lyme Road (11)	1574	1411	1486	1284	-10	-14
Park Street/East Wheelock Street (12)	1565	1504	1541	1661	-4	8
South Street/So. College/Currier (13)	325	261	752	503	-20	-33
Maple Street/School Street (7)	363	395	505	388	9	-23

Source: UVL SRPC traffic counts 1986-2001

2001
Hanover
Traffic
Survey

A. TURNING MOVEMENT COUNT RESULTS

This section describes traffic trends observed at intersection locations throughout Town and not at traffic count locations. Intersection turning movement counts are generally used to measure intersection performance. A synopsis of the results includes discussion with trends observed in intersection volumes as well as intersection LOS.

As evidenced in Table 4 and in Figure 7, many intersections experienced a decrease in peak hour traffic volumes between 1999 and 2001. Despite this general trend of reduced volumes, some locations experienced an increase in traffic. For instance, the intersection of Main Street/South Street experienced a dramatic increase in both peak hour traffic volumes. The Etna Road/Trescott Road intersection also experienced an increase in AM and PM peak hour volumes. The Hanover Center Road/Rennie Road and Maple Street/School Street intersections experienced increases in AM peak hour traffic and a large decrease during the PM peak hour. Large decreases in traffic volumes were also observed at the intersections of Main Street/Lebanon Street, Park Street/Lyme Road and at South Street/Currier Place.

Etna Road/Trescott Road

AM peak hour: 7:30-8:29 AM PM peak hour: 4:30-5:29 PM
 AM peak hour volume: 526 PM peak hour volume: 417
 1999 LOS: A 1999 LOS: A
 2001 LOS: A 2001 LOS: A

Greensboro Road/Etna Road

AM peak hour: 7:15-8:14 AM PM peak hour: 4:45-5:44 PM
 AM peak hour volume: 485 PM peak hour volume: 413
 1999 LOS: A 1999 LOS: A
 2001 LOS: A 2001 LOS: A

Hanover Center Road/Rennie Road

AM peak hour: 7:00-7:59 AM PM peak hour: 4:15-5:14 PM
 AM peak hour volume: 176 PM peak hour volume: 112
 1999 LOS: A 1999 LOS: A
 2001 LOS: A 2001 LOS: A

Main Street/Lebanon Street

AM peak hour: 7:30-8:29 AM PM peak hour: 4:00-4:59 PM
 AM peak hour volume: 1078 PM peak hour volume: 1009
 1999 LOS: C 1999 LOS: B
 2001 LOS: C 2001 LOS: B

Main Street/South Street

AM peak hour: 7:30-8:29 AM PM peak hour: 4:45-5:44 PM
 AM peak hour volume: 859 PM peak hour volume: 1077
 1999 LOS: B 1999 LOS: B
 2001 LOS: B 2001 LOS: B

Main Street/East Wheelock Street

AM peak hour: 7:15-8:14 AM PM peak hour: 4:45-5:44 PM
 AM peak hour volume: 1670 PM peak hour volume: 1943
 1999 LOS: F 1999 LOS: D
 2001 LOS: D 2001 LOS: C

2001
 Hanover
 Traffic
 Survey

2001
Hanover
Traffic
Survey

Maple Street/School Street
 AM peak hour: 7:45-8:44 AM
 AM peak hour volume: 395
 1999 LOS: A
 2001 LOS: A

Park Street/Wheelock Street
 AM peak hour: 7:30-8:29 AM
 AM peak hour volume: 1504
 1999 LOS: D
 2001 LOS: E

NH Route 120/Buck Road
 No AM data collected
 PM peak hour: 4:45-5:44 PM
 PM peak hour volume: 1703
 1999 LOS: A
 2001 LOS: A

South Street/Currier Place/South College Street
 AM peak hour: 7:30-8:29 AM
 AM peak hour volume: 261
 1999 LOS: A
 2001 LOS: A

NH Route 120/Greensboro Road
 AM peak hour: 7:30-8:29 AM
 AM peak hour volume: 1895
 1999 LOS: D
 2001 LOS: B

PM peak hour: 4:30-5:29 PM
 PM peak hour volume: 1887
 1999 LOS: F
 2001 LOS: F

Park Street/Lebanon Street
 AM peak hour: 7:30-8:29 AM
 AM peak hour volume: 1785
 1999 LOS: F
 2001 LOS: F

PM peak hour: 4:45-5:44 PM
 PM peak hour volume: 2038
 1999 LOS: F
 2001 LOS: F

Park Street/Lyme Road
 AM peak hour: 7:30-8:29 AM
 AM peak hour volume: 1411
 1999 LOS: F
 2001 LOS: F

PM peak hour: 4:00-4:59 PM
 PM peak hour volume: 1284
 1999 LOS: C
 2001 LOS: D

Despite some observed short-term decreases, intersection traffic volumes have remained fairly constant since 1986 with a few exceptions (See Figures 5, 6 and 7). There have been significant long-term increases in AM peak hour intersection traffic volumes at certain intersections, such as Park Street/East Wheelock Street and at Maple Street/School Street. During PM peak periods, there have been significant long-term increases in traffic at Route 120 and Greensboro Road, Park Street and Lebanon Street and at Park Street and East Wheelock Street. At the same time of day Main Street and Wheelock Street have experienced a significant decrease in traffic since 1986.

In 2001, two locations - Park Street/Lebanon Street and Park Street/East Wheelock Street - experienced high to extreme congestion during both AM and PM peak hours. Most notable of those is the intersection of Park Street/Lebanon Street, which continues to

Table 5: 1986-2001 Intersection LOS Determinations

Intersection:	AM/PM:	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1998	1999	2001
Greensboro Road/Etna Road (2)	AM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
	PM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
Hanover Center Road/Rennie Road (3)	AM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
	PM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
Etna Road/Trescott Road (1)	AM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
	PM	***	***	***	***	***	***	***	***	***	***	***	A	A	A
Main Street/Lebanon Street (4)	AM	***	***	C	C	C	C	B	B	B	B	B	B	C	C
	PM	***	***	C	C	C	C	B	B	B	B	B	B	B	B
Main Street/South Street (5)	AM	***	***	***	***	***	B	B	B	B	B	B	B	B	B
	PM	***	***	***	***	***	B	B	B	B	B	B	B	B	B
Main Street/Wheelock Street (6)	AM	C	C	E	E	E	C	C	C	C	C	C	C	F	D
	PM	D	D	D	D	D	D	D	D	D	D	D	C	D	C
NH Route 120/Buck Road (8)	AM	***	***	***	***	***	***	***	***	***	***	***	***	***	***
	PM	***	***	***	***	***	***	***	***	***	***	***	B	A	A
NH Route 120/Greensboro Road (9)	AM	***	***	***	A	B	C	C	C	C	B	B	B	D	B
	PM	***	***	***	A	C	C	C	C	B	B	B	B	F	F
Park Street/Lebanon Street (10)	AM	***	***	D	D	D	D	D	D	D	D	D	D	F	F
	PM	***	***	D	D	D	C	D	C	D	D	D	D	F	F
Park Street/Lyme Road (11)	AM	C	C	C	C	C	B	B	B	C	C	C	C	F	F
	PM	B	B	F	F	F	C	C	B	B	C	C	C	C	D
Park Street/East Wheelock Street (12)	AM	B	B	C	C	C	C	C	C	C	C	C	C	D	E
	PM	B	B	C	C	D	B	B	B	D	C	C	C	F	F
South Street/So. College/Currier (13)	AM	***	***	***	***	***	A	A	A	A	A	A	A	A	A
	PM	***	***	***	***	***	A	A	A	A	A	A	A	A	A
Maple Street/School Street (7)	AM	***	***	***	***	A	A	A	A	A	A	A	A	A	A
	PM	***	***	***	***	A	A	A	A	A	A	A	A	A	A

Source: UVL SRPC Traffic Counts 1986-2001

2001
Hanover
Traffic
Survey

20

experience an LOS of F in 2001. Intersection performance continues to decline at the Park Street/Lyme Road and Park Street/East Wheelock Street intersections. The Route 120/Greensboro Road intersection continues to exhibit an LOS F during the PM peak hour but has improved performance during the AM peak. The LOS performance improved at Main Street/Wheelock Street. See Table 5 for intersection performance information from 1986 to 2001.

might include public transit, traffic management, traffic calming, access management, other roadway design alternatives, encouraging residential development in close proximity to employment centers, ridesharing, and the encouragement of walking and bicycling to jobs. Optimally, any such study would consider these issues both within the local context as well as encompassing a region-wide geographic area.

IV. RECOMMENDATIONS

1. General

- Further studies would be warranted to determine the cause(s) of the changing traffic patterns in Hanover. A more detailed analysis would be needed to determine the likelihood of non-local through-trips; increasing residential population expansion into the countryside; increased household car ownership; a change in occupational commuting patterns; and/or an increase in daily trips per household playing a role in this change.
- A determination of potential solutions or methods to reduce traffic congestion could be of great benefit. This investigation of solutions should focus on capacity issues including consideration of new roads such as a connector road linking Routes 120 and 10 and potentially extending to I-91 in Wilder, Vermont. Other possible issues to address

2. Next Survey

- Incorporate other available traffic data from the New Hampshire Department of Transportation and the Vermont Agency of Transportation.
- Count pedestrian movements in intersections within the downtown area to obtain more accurate LOS results.