City of Rochester
Master Plan

Transportation

Developed and endorsed by:
Land Use Master Plan Committee

Submitted by:
City of Rochester
Planning and Development Department
in coordination with
Appledore Engineering, Inc.
Portsmouth, New Hampshire

Adopted by City of Rochester Planning Board on November 19, 2001
Endorsed by Rochester City Council on October 16, 2001

" Ask for the ancient paths where the god way is; and walk in it and find rest for your souls."
Jeremiah 6:16

"Americans are in the habit of never walking if they can ride."
Louis Philippe Duc DOrleans, 1798

"There is magic to great streets. We are attracted to the best of them not because we have to go there but because we want to go there. The best are as joyful as they are utilitarian. They are entertaining and they are open to all. They permit anonymity at the same time as individual recognition. They are symbols of a community and of its history; they represent a public memory. They are places for escape and or romance, places to act and to dream. On a great street we are allowed to dream; to remember things that may never have happened and to look forward to things that, maybe, never will."
Allan Jacobs Great Streets

"The roads are well built and well maintained, and congestion is not apparent because of the intensity of alternative types of transportation. An intercity bus system, good biking and walking facilities and the proper connecting automobile routes have reduced the impact of growth and energy prices. Rail and bus transportation connect the people of Rochester with adjacent and distant communities...The town has a well thought out and extensive system of walking trails..."
Vision Statement. Citizen Handbook to City of Rochester, NH Master Plan. 1995

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Certification of Transportation Master Plan Adoption - Rochester, New Hampshire

In accordance with New Hampshire RSA 674:4, Master Plan Adoption and Amendment, and New Hampshire RSA 675:6, Method of Adoption, the Rochester Planning Board, having held a duly authorized public hearing on the Rochester Transportation Master Plan Chapter on August 20, 2001 hereby certifies that the Transportation Master Plan Chapter was duly adopted by a majority of the Planning Board's members on November 19, 2001.

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PREFACE

I am very pleased to present the Transportation Chapter of the Master Plan. This is a fine plan and it will provide strong guidance for the City as we continue to implement a range of strategies to enhance our transportation system.

It is critical that we increase the capacity of our road network to accommodate the growing population of Rochester. We seek to maintain good levels of service by widening roads where appropriate, implementing access management approaches such as turning lanes, more effectively matching the different types of roads with the various traffic demands, and accommodating alternative modes of transportation such as bicycling and walking where feasible. We think it reasonable to consider roads in terms of the full range of functions that they serve, in addition to the primary one of moving automobile traffic. For the character of our roads also affects the character of our community.

You will see from the table of contents that we addressed the myriad issues related to transportation – road capacity, downtown traffic, traffic calming, access management, bicycles, sidewalks, public transit, transportation demand management, Class VI roads, truck traffic, rail, Skyhaven Airport, etc. This was a long and challenging process, but ultimately a rewarding one.

My thanks for the fine work of the Planning Board, City Council, Land Use Committee, Planning and Development Department, and Appledore Engineering, in putting this chapter together.

J. Bruce Roberts 3/11/02

Bruce Roberts, Planning Board Chair date

Introduction

The City of Rochester has multiple modes of transportation. The road system ranges from rural country roads that have changed little over the past 30-40 years to a four lane divided toll road that serves as the "gateway" to New Hampshire's lakes and mountains, to a network of local streets. Associated with the road system are more limited facilities for bicycles and pedestrians. The City is also served by commercial rail, public bus transportation, and a small state-owned airport.

Rochester's road system mirrors the historical movement of people and goods and has played an instrumental role in the way that the City has grown and developed. The center of the City lies at the juncture of several major state highways that provide easy access to a variety of regional locations. NH Route 125 and the Spaulding Turnpike provide access to the New Hampshire Seacoast and Boston to the south; US Route 202 provides a link to Concord and Manchester to the west and the State of Maine and Portland to the east; and NH Route 11 and the Spaulding Turnpike provide access to the lakes region and White Mountains to the north.

This document is divided into two major sections - Basic Road System and Special Topics. It is recognized that a central element of transportation within a City is the road network and its service to motor vehicles. A key concern is facilitating the smooth flow of traffic and avoiding congestion. Toward this end a priority of the Transportation Plan is addressing Intersections, as these are the main choke points that aggravate congestion.

It is important to recognize that transportation involves much more than enhancing traffic flow. Equal and special consideration must be given to the myriad other objectives - including bicycling, pedestrian facilities, and fostering a street design which will create healthy neighborhoods and downtowns - which are all too often trumped and excluded by motor vehicle concerns,

> ***Safe and efficient movement of motorized vehicles through the City of Rochester is essential. But it is recognized that other community values must be respected in the development and management of transportation facilities as discussed throughout this plan.***

This section of the Master Plan updates the transportation chapter of the 1992 Master Plan and assesses the current transportation system, evaluates the community's desire for transportation and proposes recommendations for achieving the City's transportation goals. This document was prepared in accordance with NH RSA 674:2-4.

Community Forums

On September 30, 1999 the City sponsored a kickoff Community Forum for the general master plan update at the Silver Platter function facility. This meeting was followed by a Community Forum focused on Transportation on November 18, 1999 held at the Rochester Public Library. Participants in the Transportation Forum were divided into four groups to discuss broad topics identified in the first forum. These included Traffic Congestion, Road Maintenance, Alternative Transportation, and Strategic Location. The specific transportation concerns identified most frequently were:

- Traffic congestion especially in the downtown and Routes 11, 108, and 125.

- The need for a long-range plan for road maintenance and reconstruction (this has actually been instituted but implementation depends upon funding)
- The need for improved signage and lighting at key locations and intersections such as Strafford Square.
- More opportunities for alternative transportation, especially bicycling and walking.

For more information see *Appendix 1 - Community Forum Results*

Community Survey

The Planning and Development Department prepared a Community Survey on the full range of Master Plan topics - Transportation, Land Use, Natural and Cultural Resources, Economic and Community Development, and City Services. Approximately 1,125 surveys were mailed to specific people[1] and 453 were returned/submitted. See *Appendix 2 - Community Survey Results - Transportation.*

Transportation Committee

The Planning Board established a Transportation Master Plan Committee to work with Michael Behrendt, Chief of Planning for the City's Planning Department and Jack Mettee, a consultant with Appledore Engineering, to develop a draft Transportation Plan. Some of the general transportation concerns listed by the Committee are shown in *Appendix 3 - Issues - Transportation Committee*. The Committee unanimously endorsed the draft document on February 15, 2001. The plan was then presented to the public at two Community Workshops held at the Rochester Public Library on February 27 and March 1 for the purpose of soliciting public input. Relatively few substantive public comments were received and then the Committee once again endorsed the draft plan at its final meeting on March 19.

The plan was then forwarded to the Planning Board for it to review, modify, and adopt and to the City Council for its endorsement.

Goals

1) **Transportation Planning**

a) Participate in the coordination of state and local transportation planning.

b) Continually review the City's Land Use Ordinances and Regulations to ensure that transportation standards are compatible with the City's land use.

c) Encourage multiple means of transportation that are well integrated, foster efficient vehicle movement, minimize traffic congestion, reduce vehicle generated air pollution, and promote attractive road corridors both within urban and rural settings.

d) Manage land use and development so that growth occurs in locations and in a manner to prevent significant deterioration of level of service on roads.

e) Maintain a transportation system that allows for the efficient movement of people and goods and provides adequate access to places of employment, residential areas, commercial and shopping areas and recreational facilities.

2) **Basic Road System**

a) Establish a roadway hierarchy that ensures that major roads are largely automobile oriented and local, neighborhood, and urban center roads are respectful of pedestrian character.

b) Establish an ongoing process of funding for transportation projects that provide for:
   i) maintenance of the City's existing transportation infrastructure,
   ii) improvements to traffic flows and patterns,
   iii acquisition of rights-of-way for future transportation projects, and
   iv) greater opportunities for alternative transportation modes such as sidewalks and bicycle routes

c) Encourage public/private cooperation in facilitating additions and improvements to the transportation system.

d) Manage the transportation system in order to maximize the safety of drivers and pedestrians.

e) Create additional road capacity to accommodate projected growth in vehicular traffic giving special attention to intersections.

f) Improve the current roadway system to provide efficient traffic flow in the City's urban area while maintaining a safe environment for pedestrians.

g) Preserve capacity on lower volume arterial roads.

h) Work to stabilize the level of service on roads and intersections in spite of citywide growth.

Make improvements to those roads and intersections where the level of service is presently poor or significant growth is anticipated.

3) Healthy Streets

a) Maintain and expand the system of sidewalks throughout the City. Establish priorities for building new and rebuilding existing sidewalks. Work to link the sidewalk system.

b) Promote design of streets which is responsive to purposes other than efficient movement of vehicle traffic including fostering civic design, protecting neighborhood character, and respecting elements of the urban and rural landscape.

c) Make transportation decisions that are consistent with protection of natural, cultural and historic resources and minimize the impact on residential neighborhoods.

d) Foster the creation of streets and public spaces that are safe, comfortable, and interesting to the pedestrian, thereby encouraging walking.

e) Protect neighborhoods from undue through traffic.

f) Employ traffic calming techniques as appropriate to slow motor vehicles and encourage use of City streets by multiple modes.

4) Transportation Demand Management

a) Encourage, develop and maintain a range of non-automotive transportation alternatives that are easily available to the residents of Rochester.

b) Promote strategies to reduce peak hour single occupancy vehicle use through development of public transit, where feasible, park and ride facilities, encouragement of car and van pools, coordination of private vans services, and other transportation demand management techniques.

5) Pedestrian Use and Bicycle Routes

a) Establish a system of bicycle routes and multi-use paths that is coordinated with state and regional trail systems.

b) Facilitate use of non-motorized means of transportation citywide and in smaller areas where appropriate through development of sidewalks, footpaths, bicycle lanes, and multi-use paths.

c) Consider bicyclists and pedestrians in all transportation decisions for Rochester.

d) Develop a bicycle network that will enable cyclists to safely travel to any location in Rochester and to provide links with adjoining communities. regional destinations.

e) Encourage bicycle use to make it an integral part of daily life in Rochester.

f) Provide end-of-trip bicycle facilities and foster bicycle/transit integration.

6) Truck Traffic

a) Provide for a system of commercial truck routes within the City.

b) Minimize the impact of truck traffic upon residential and sensitive land uses.

c) Manage truck traffic while respecting the rights of the trucking industry and the community's need for efficient delivery of goods and products.

7) Rail and Air

a) Explore ways to expand rail service in Rochester to serve residents and enhance economic development.

b) Work to improve safety along rail corridors.

c) Work to improve viability of Skyhaven Airport.

d) Work to expand Skyhaven.

8) Other Issues

a) Provide necessary parking facilities to accommodate existing and future needs in a manner that is attractive and minimizes impact to adjacent uses through the use of appropriate setbacks and landscaping.

b) Establish a system of parking locations that are convenient to municipal, institutional and commercial services that involve both public and private initiatives.

c) Establish a traffic sign policy and program that serves both residents and visitors in a manner that properly directs individuals to public parking facilities and major community services and attractions.

d) Establish a system of scenic roads that contribute to the quality of those areas within Rochester that exemplify its rural character and heritage.

Basic Road System

Road Classification System

The NH Department of Transportation ("NHDOT" or "DOT") classifies all public roads under an administrative system for the purpose of identifying which level of government is responsible for maintenance. Roads may also classified under a conventional traffic engineering system.

State Classification

This system overseen by NHDOT identifies six classes of roads. Class III highways consist of recreational roads attached to state reservations none of which are present in Rochester. The state lists 186 miles of roads in the City, 43 of which are state roads. The classifications are as follows.

Class I - Primary State Highways

This class does not include those portions of state roads located inside urban compact sections of the City (see Class IV, below). However, the Spaulding Turnpike is Class I throughout the City. The state has full control and pays for construction and maintenance of Class I roads including bridges. There are 27 miles of Class I roads in Rochester of which 17 miles are the Spaulding Turnpike. The following roads are Class I:

- NH 11 - Farmington Road
- NH 16 - Spaulding Turnpike
- NH 108 - Rochester Hill Road
- NH 125 - Milton Road
- NH 202A - Strafford Road, Walnut Street, North Main Street

Class II - Secondary State Highways

Again, this class does not include those portions of state roads located inside urban compact sections of the City (see Class IV, below). The state pays for construction and maintenance of Class II roads which have been improved to the satisfaction of the State Commissioner of Transportation. Other Class II highways not improved to DOT's standards are maintained by the City but are eligible for state aid funds when available. Generally state roads are numbered, but not necessarily. Rochester has 15 miles of Class II highways including the following.

- NH 125 - Calef Road (Gonic)
- US 202 - Washington Street (toward Barrington), Connector, Highland Street (ER)
- Crown Point Road
- Meaderboro Road
- Old Wakefield Road (located off Milton Road by Milton town line)
- Old Dover Road south of Tebbetts Road. (Incidentally, Old Dover Road is no longer identified as Route 16B; there is no Route 16B in Rochester.)
- Pickering Road between Quaker Lane (formerly Mill Street) and a particular point between England Road and the Dover City line (there is a marker on the side of the road). Interestingly, the state only conducts summer maintenance on Pickering Road but the City performs winter

maintenance.

Class IV - Urban Compact Streets

This class consists of all roads within the Urban Compact areas as designated by NHDOT. The City of Rochester is responsible for the maintenance of these roads. However, Class IV roads are eligible for State Transportation Improvement Program funding. Rochester has 78 miles of Class IV streets.

Class V - other municipal roads

This class includes all other traveled roadways that are maintained by the City. There 59 miles of Class V roads in Rochester. If the City spends any money at all on the road it is almost certainly a Class V road[2].

Class VI - unmaintained roads

This class consists of all other public roadways that have been discontinued or not maintained in a suitable condition for five years or more. It is estimated that Rochester has 6 miles of Class VI highways. See *Class VI Roads, Private Roads, and Shared Driveways* section for a list of Class VI roads.

Functional Classification

The following classification was prepared largely by the City of Rochester Department of Public Works in accordance with general criteria for road type. Classifying each road is based on professional judgment in considering various factors including whether the primary road function is mobility or access, traffic volume, capacity, pavement width, length, number of lanes, nature of adjoining land use, and location.

Arterial Roads compose a network of continuous routes that provide mobility for relatively high vehicle volumes and high travel speeds (rural) with minimal interference to through traffic. Arterial roads are major streets that are designed to link with the regional transportation network and primarily provide *mobility*. The following roadways are classified as arterials in Rochester.

Urban Arterials

- North Main Street
- South Main Street
- Wakefield Street
- Washington Street - east of Spaulding Turnpike
- Walnut Street - east of Spaulding Turnpike
- Route 108 (Rochester Hill Road) - north of Hillcrest Drive
- Route 125 (Gonic Road, Charles Street, Columbus Avenue, Wakefield Street, Milton Road) - between Church Street, Gonic and Spaulding Turnpike Connector
- Farmington Road (portion south of Spaulding Turnpike that is not part of Route 11)

Suburban/Rural Arterials

- Route 11 (from Spaulding Turnpike north to Farmington line)
- Route 108 - south of Hillcrest Drive
- Route 125 - south of Church Street, Gonic

- Route 125 - north of Spaulding Turnpike Connector
- Route 202 - west of Spaulding Turnpike
- Route 202A - west of Spaulding Turnpike
- Chestnut Hill Connector
- Spaulding Turnpike
- Turnpike Connector

Collector roads branch off of the arterial system. They provide access to adjacent lands and provide service for travel over relatively short distances, typically to other collectors and local streets. Collector streets are intermediate order streets which provide both *mobility* and *access*. The following roads are classified as collectors in Rochester.

Urban Collectors

- Allen Street
- Brock Street
- Chamberlain Street - between Portland and Franklin
- Charles Street
- Chestnut Hill Road - south of Turnpike overpass
- Eastern Avenue
- Franklin Street
- Kimball Street
- Lowell Street - north of Hemlock
- Main Street - East Rochester
- Main Street - Gonic
- Old Dover Road - to Tingley Street
- Pickering Road to Quaker Lane
- Portland Street
- Salmon Falls Road - between Portland and Highland Streets
- Summer Street - downtown
- Union Street
- Twombly Street
- Whitehall Road - from South Main Street to Hillcrest Drive

Suburban/Rural Collectors

- Autumn Street (East Rochester)
- Betts Road
- Blackwater Road
- Chamberlain Street - between Franklin and Whitehall
- Chesley Hill Road
- Chestnut Hill Road - north of Turnpike overpass
- Cross Road
- Estes Road
- Flagg Road
- Flat Rock Bridge Road

- Four Rod Road
- Gear Road
- Governor's Road
- Grove Street (Gonic)
- Hansonville Road
- Haven Hill Road
- Little Falls Bridge Road
- Lowell Street - south of Hemlock
- Meaderboro Road
- Oak Street
- Old Dover Road - south of Tingley Street
- Pickering Road - from Quaker Lane to City line
- Rochester Neck Road
- Salmon Falls Road - except between Portland and Highland Streets
- Sampson Road
- Tebbetts Road
- Ten Rod Road
- Whitehall Road - from Hillcrest Drive to Salmon Falls Road

Local Roads

Local roads branch off of the collector system (and sometimes arterials) and provide primarily direct *access* to adjacent land, and little *mobility* between locations. They carry a small proportion of the vehicle miles traveled. All local roads (other than private roads) in Rochester are municipal roads. Every road not listed above as a collector or an arterial is considered a local road. In accordance with the Proposed Land Use Map (see *Land Use Chapter*) They may be classified as Urban, Suburban, or Rural in accordance with the zoning district in where they are located

Traffic Volumes

Traffic volume data is important in evaluating traffic characteristics within a community. It is useful for establishing priorities for future roadway improvements. Design and safety standards for roadways typically incorporate traffic count data. The capacity for a two lane road to maintain a relatively high level of service is generally about 10,000 vehicles per day.

Table 1
Historic Traffic Volumes - Rochester Turnpike Toll Booth

Year	Volume	Change to 1997
1970	4,725	337.50%
1980	7,278	184.03%
1990	15,694	31.72%
1997	20,672	

Source: Seacoast MPO, Long Range Transportation Plan

The only permanent count station in Rochester is at the Spaulding Turnpike toll booth. Average annual daily traffic (ADT) counts over the recent decades are reported in the accompanying *Table 1 - Historic Traffic Volumes - Rochester Turnpike Toll Booth.* This gives a sense of the general growth in traffic over the years.

These increases are largely attributable to the increase in traffic experienced over the past 30 years from both through traffic to New Hampshire's White Mountains and Lakes Region as well as the increase in commuter traffic from Rochester and points north to job centers in Dover, Portsmouth and Kittery, Maine and to Route 95 to Massachusetts. Because of the steady increase in business development and associated residential growth that has occurred during this time period in Portsmouth, Dover, Rochester and further north, commuter and business traffic has also increased.

The most heavily traveled road in Rochester is the Spaulding Turnpike which in May 1999 recorded a daily volume of 28,200 vehicles at the count station located between Exits 13 and 14. The NHDOT's Bureau of Transportation Planning monitors traffic throughout the state. In addition, the regional planning commissions conduct their own counts. *Table 2 - Average Weekday Traffic Counts*, below, lists traffic counts in descending order by volume (except Turnpike between Exits 16 and 17) for every road with a daily count exceeding 3,000 for the years 1998 and 1999. All counts below are the total of vehicles passing a specific location in both directions.

Table 2
Average Weekday Traffic Counts

Spaulding Turnpike	
Between Exits 13 and 14	28,200
Between Exits 14 and 15	27,063
Between Exits 12 and 13	26,244
Between Exits 15 and 16	21,538
Between Exits 16 and 17	10,979
NH 125 (Milton south of Chestnut Hill)	21,204
NH 11 (north of Turnpike)	20,680
NH 125 (north of Brock)	19,702
NH 125 (at Exit 12 underpass)	19,619
NH 125 (South Main north of Winter)	16,582
Union Street	16,063
Main Street (NH 202A, at Cocheco Bridge)	15,777
NH 11 (Farmington line)	15,649
NH 202A	15,237
NH 125 (Barrington line)	14,965
Wakefield Street (in front of City Hall)	13,279
NH 108 (Somersworth line)	12,910
NH 125 (south of Connector)	12,659
Columbus Avenue (south of Summer)	12,550
NH 125 (north of Salmon Falls)	12,349
US 202/NH 11 (Connector, east of Turnpike)	11,870
North Main Street (east of Turnpike)	11,508
Columbus Avenue (north of Lowell)	10,558
Allen Street	9,552
US 202/NH 11 (Highland St. south of Grove)	9,492
Hancock Street	9,183
Summer Street (west of Allen)	7,045
Portland Street (east of Franklin)	6,914
US 202 (south of Ax Handle Brook)	6,127
NH 16B (at Willow Brook)	5,628
Chestnut Hill Road (west of Milton)	5,404
NH 125 (Hancock Street, north of Lowell)	5,230
Old Dover Road (between Meadow and Juniper)	5,167
NH 202A (Walnut Street, west of Turnpike)	4,914
Franklin Street	4,677
US 202 (Barrington line)	4,500
Salmon Falls Road (south of Portland)	4,463
Chestnut Hill Road (north of Turnpike)	4,271
Portland Street (north of Salmon Falls)	4,148
Portland Street (north of Corson)	4,127
Old Dover Road (Somersworth line)	3,918
Eastern Avenue	3,866
Charles Street (north of 125)	3,714
Little Falls Bridge Road	3,516
Whitehall Road (at RR)	3,492
Tebbetts Road (at Turnpike underpass)	3,434
Whitehouse Road	3,031

It should be noted that these volumes are based on short term counts and may be influenced by conditions that are not typical. In addition to the permanent station at the toll booth, NHDOT has established 82 stations throughout the City where traffic is recorded. However, in any given year the

state may conduct counts at 50 or fewer locations. Some stations are counted every three to five years. In order to show trends at different locations *Table 3 - Changes in Traffic Counts: 1994 and 1998*, below, compares data from 1994 and 1998. Traffic volumes are listed in descending order by rate of growth in volume from 1994 to 1998.

Table 3
Changes in Traffic Counts: 1994 and 1998

Location	1994 ADT	1998 ADT	Change	% Change
Little Falls Bridge over Cocheco River	1,700	3,100	1,400	82.4%
NH 125 Ramp D over NH 125 Ramp A	5,700	9,400	3,700	64.9%
Whitehouse Rd. S. of Old Dover Rd.	1,600	2,600	1,000	62.5%
Spaulding Tpk. Ext. @ Milton Line	6,800	11,000	4,200	61.8%
US 202 @ Barrington Town Line	3,100	4,400	1,300	41.9%
Whitehall Road @ B & M R.R.	2,400	3,100	700	29.2%
Tebbetts Rd. over Spaulding Tpk.	2,200	2,700	500	22.7%
Spaulding Tpk. North of Ten Rod	19,000	23,000	4,000	21.1%
Spaulding Ave. over Salmon Falls R.	600	720	120	20.0%
Spaulding Tpk. North of US 202	20,000	24,000	4,000	20.0%
Spaulding Tpk/NH 16 @ Roch. Toll	17,558	20,927	3,369	19.2%
Spaulding Tpk. North of NH 125	19,000	22,000	3,000	15.8%
North Main. E. of Spaulding Tpk.	9,800	11,000	1,200	12.2%
Columbus Ave./Summer Street	10,000	11,000	1,000	10.0%
NH Ramp A - NH125/US202 Ramp D	4,200	4,600	400	9.5%
NH 125 @ Barrington Town Line	12,000	13,000	1,000	8.3%
NH 125 north of Brock Street	16,000	17,000	1,000	6.3%
NH 125 under Spaulding @ Exit 12	16,000	17,000	1,000	6.3%
Spaulding Tpk. North of NH 11	16,000	17,000	1,000	6.3%
Charles Street N. of NH 125	3,100	3,200	100	3.2%
NH 125 S. of NH 11 & US 202	11,000	11,000	0	0.0%
Wakefield St. S. of Chestnut Hill	18,000	18,000	0	0.0%
Columbus Ave./Lowell Street	9,200	9,000	(200)	-2.2%
Eastern Ave. S. of US 202&NH 11	3,400	3,300	(100)	-2.9%
Summer Street W. of Allen Street	6,600	6,200	(400)	-6.1%
NH 125 North of Salmon Falls	12,000	11,000	(1,000)	-8.3%
Old Dover Road @ Somersworth Line	3,900	3,400	(500)	-12.8%
Chesley Hill Rd. over Rickers Brk.	340	290	(50)	-14.7%
Flat Rock Bridge Rd. over Salmon Falls R.	870	730	(140)	-16.1%
Old Dover Road over Willow Brook	6,500	4,900	(1,600)	-24.6%
Chestnut Hill Rd. W. of Wakefield	1,100	820	(280)	-25.5%

Source: NHDOT

Of the 31 stations in the table, 23 showed increases in traffic over the four-year period. In addition to the increases recorded on the Spaulding Turnpike and associated ramp areas, there were six locations that increased by 20% or more including Little Falls Bridge Road, Whitehouse Road, US 202 at the Barrington line, Whitehall Road, Tebbetts Road, and Spaulding Avenue. The largest increase, on Little Falls Bridge Road, appears to be directly attributable to the establishment of Wal-Mart on Farmington Road. Growth along US 202 is likely due to increases in regional traffic between the Rochester area and Concord. Increases along Whitehouse Road, Whitehall Road, and Tebbetts Road is likely due to continued development within Rochester and growth in the Rochester-Dover-Somersworth area. Interestingly, nine stations (nearly one third of the total) recorded decreases in traffic volume.

Accidents

One of the key items in determining a roadway's sufficiency is its safety record. As such, it is useful to examine accident data. Accident data is collected by local and state police and provided to NHDOT.

Accident counts should be examined cautiously, however, for several reasons. Not all accidents are reported. Locations are variously given by street address, distance from an intersection, or simply street name. In addition, accident counts would best be considered in light of the total vehicle miles traveled on the particular road over the course of a year. A high accident figure does not necessarily signal a significant problem provided that count is proportionate to the total traffic volume. The high accident locations do warrant further review to determine if accident rates or recurring accident patterns indicate specific problems that should be addressed.

The accident data tends to reinforce the traffic volume data, above. High accident locations include intersections along Columbus Avenue, North and South Main Streets, and Wakefield Street and various sections of Milton Road, Salmon Falls Road and Farmington Road. The highest number of reported accidents occur in the urban core on NH Route 125 and North and South Main Streets. Recent studies have been completed for these two corridors to improve traffic movement and safety. See *Appendix 4 - South Main Street Corridor Study Recommendations* and *Appendix 5* - Route 125 Corridor Study Recommendations.

Road Corridors

For *1998* the following roadways had ten or more accidents according to NHDOT records.

- Milton Road 73
- North Main Street 62
- Wakefield Street 60
- South Main Street 54
- Route 125 40
- Columbus Avenue 34
- Portland Street 28
- Salmon Falls Road 28
- Farmington Road 21
- Route 11 20
- Rochester Hill Road 18
- Washington Street 18
- Chestnut Hill Road 17
- Cross Road 12
- Main Street 11
- Old Dover Road 11
- Whitehall Road 10

Intersections

The highest accident counts are given for both 1998 records and from the 1992 Rochester Master Plan. The respective years are shown in parentheses.

- Columbus Avenue @ Wakefield Street 17 (1998)
- South Main Street @ Columbus Avenue 15 (1998)

• South Main Street @ Portland Avenue	15	(1992)
• Route 125 @ Spaulding Tnpk.	12	(1992)
• South Main Street @ Franklin Street	9	(1998)
• North Main Street @ Ten Rod Road	8	(1992)
• Route 202 @ Salmon Falls	7	(1992)
• Columbus Avenue @ Portland Street	7	(1992)
• Columbus Avenue @ Summer Street	7	(1998)
• Milton Road @ Salmon Falls Road	7	(1998)
• Columbus Avenue @ Upham Street	6	(1998)
• North Main Street @ Union Street	6	(1998)
• Salmon Falls Road @ Whitehall Road	6	(1998)
• Route 125 @ Brock Street	5	(1992)
• Chestnut Hill Road @ Betts Road	5	(1998)
• North Main Street @ Strafford Sq.	5	(1998)
• Old Dover Road @ Pine	5	(1992)
• Portland Street @ Salmon Falls Road	5	(1998)
• Wakefield Street @ Chestnut Hill Road	5	(1998)

Road Planning

Generally, priority roads include those with high average daily traffic volume relative to road capacity ("V/C ratio") and a high number of accidents (particularly relative to volume). Potential improvements to increase capacity include adding lanes, pavement width, and turn lanes, and increasing turning radii. However, as discussed under the *Healthy Streets* section these types of improvements must be implemented selectively and thoughtfully to ensure that other objectives - such as preserving vibrant downtown areas, neighborhood character, and scenic quality - are not impaired.

Land Use

There is a significant relationship between Land Use and Transportation. When road corridors are built or upgraded additional development is encouraged. Conversely, road capacity must be increased to accommodate growth. As growth continues in Rochester it will put more pressure both on central areas through which many arterials are concentrated and on outlying areas. From a road planning perspective growth in urban areas should be carefully managed, appropriate growth in suburban areas should be encouraged, and growth in rural areas should be limited.

Roadway Management System

The Department of Public Works manages the maintenance and reconstruction of the roadway system under local jurisdiction. In 1998 the department worked with the University of New Hampshire Technology Transfer Center to conduct a road condition survey and use the Road Surface Management System to categorize each street in the City based upon pavement condition and drainage. Each street was then rated on pavement condition, drainage, traffic volume and importance. The streets requiring construction were prioritized by this rating and the City ward in which they were located. The Department prepared both five and ten year plans to reconstruct those streets. It was determined that the five- year plan was too ambitious and too costly. Consequently, the City has initiated a ten year plan starting in Fiscal Year 2000. Costs estimates included only the cost to replace roads. It did not incorporate any costs for widening, realignment, sidewalks or utilities. This road reconstruction program was approved by the City Council and is incorporated into this Master Plan by reference.

Respondents in the Community Survey generally supported devoting more resources to roads, particularly road maintenance, as shown in *Table 4 - Support for Road Services*.

Table 4
Support for Road Services

	Devote More Resources	Level now about right	Devote Less in Resources	No Opinion
Road improvements (widening, turn lanes)	38	46	3	13
Road maintenance	53	40	0	7
Snow plowing	15	75	2	8

Transportation Improvement Program

Rochester is part of the Seacoast Metropolitan Planning Organization (MPO) which encompasses Strafford and eastern Rockingham Counties. This organization was established in 1982 through a joint agreement among the NHDOT and the two regional planning commissions. The MPO prepares regional transportation plans on both on a short term (biennial) basis - Transportation Improvement Plan - and on a long term basis to guide development over a 20 year horizon. The plans are prepared pursuant to the federal Transportation Equity Act for the 21st Century (TEA21) and the Clean Air Act Amendments of 1990 (CAAA).

This ongoing planning process provides an opportunity for the City to work cooperatively with neighboring communities to establish a long-term set of transportation projects that can benefit the region as well as Rochester. Participating in this process is very important if the City wishes to receive funding for major transportation projects.

The listed projects are included through a cooperative process among the NHDOT, the MPO, and the local communities. Rochester has one representative on a Transportation Technical Advisory Committee (it has always been a member of the Planning Department) and its four regional planning commission members also serve on the Transportation Policy Committee. See *Appendix 6 - Regional Transportation Goals* which outlines the transportation goals of the MPO.

Table 5 - Approved Transportation Projects for Rochester shows the projects that have been approved by NHDOT and are included in either the current State Transportation Improvement Program or the State's Ten Year Plan..

Table 5
Approved Transportation Projects for Rochester

Road	Project Description	Estimated Total Cost	Construction Year (State FY)
South Main Street	Roadway reconstruction from Whitehall Road to Columbus Avenue	$1.1 million	2002-3
Columbus Avenue Bicycle Path	Bike path between Lowell Street and Upham Street	$20,000	2002
Old Dover Road	Removal of railroad trestle	$475,000	2002
NH 125	Synchronization of 4 traffic lights between Brock and Hancock	$225,000	2002 - Prelim. Engineering
Strafford Square	Intersection redesign - semi-roundabout or double T	$600,000	2009
Route 11 Access Management Study	Study of Rochester, Farmington, and New Durham sponsored by SRPC	$50,000	Underway
Spaulding Turnpike	Construction of second barrel between Exits 11 and 12	$7.4 million	2003
Spaulding Turnpike	Construction of second barrel between Exits 12 and 13	$8.3 million	2004
Spaulding Turnpike	Construction of second barrel between Exits 13 and 14	$9.6 million	2004
Spaulding Turnpike	Construction of second barrel between Exits 14 and 15	$23.4 million	2005
Spaulding Turnpike	Construction of second barrel between Exits 15 and 16	$17.3 million	2006

Table 6 - TIP Projects Submitted for Rochester but NOT Approved shows the projects for which the City has applied for funding in the last three cycles but which were not approved. This table does not include projects which have otherwise been executed, such as improvements to the Wakefield Street/Columbus Avenue intersection which were performed by the City. Also note that the light synchronization component of the Route 125 proposal was subsequently approved as CMAQ project (above). The proposal for a new Exit 10 interchange is still active.

Table 6 TIP - Projects submitted for Rochester but NOT approved				
Location	**Project Description**	**Estimated Cost**	**Year**	**Type Project**
Route 125 - Brock to Columbus	Intersections, widening	$250,000	1995	Road
Route 125 - Connector to Cross Rd	Intersections, widening, drainage, roadbed	$695,000	1997 1999	Road
Route 125 - Lowell Street to Main Street, Gonic	Intersections, widening, light synchronization	$250,000	1997	Road
Connector Bridge - North Main Street to Milton Road	Construction	$6 million	1997 1999	Road
Farmington Branch Corridor	Multi-use path	$170,000	1999	Enhance-ments
Glenwood Avenue - Railroad Crossing	Signalization	$125,000	1999	Hazard Elimination
Haven Hill Road	Railroad overpass replacement	$850,000	1995	Bridge
North Main Street Articulation - Walnut Street to Farmington Road	Curbing, striping, landscap-ing, drainage, sidewalks	$225,000	1997 1999	Enhance-ments
Old Dover Road - Route 125 to Somersworth line	Bicycle lane	$770,000	1997	Enhance-ments
Old Four Rod Road - Ten Rod Road to Route 11	Rebuild/recreate road	$1.2 million	1997	Road
Salmon Falls Road - Route 125 to Somersworth line	Intersections, widening, drainage	$300,000	1995	Road
Spaulding Turnpike - Exit 10	New interchange	$17 million	1997	Road
Spaulding Turnpike - Exit 14	Improvements to interchange	$2 million	1997	Road
Wakefield Street/Milton Road - Union Street to Norway Plains Road	Intersection improvements, widening	$250,000	1995	Road
Wakefield Street/Milton Road - Union Street to Norway Plains Road	Curbing, drainage, sidewalks, landscaping	$250,000	1997	Enhance-ments
Washington Street - North Main Street to Barrington line	Intersection improvements, widening	$2 million	1995	Road
Washington Street - Turnpike to Barrington line	Intersections, widening	$1.1 million	1997	Road
Washington Street - Brock Street	Intersection improvement	$200,000	1995	Road
Washington Street - Estes and Dry Hill Roads	Intersection improvements	$380,000	1999	Road
Washington Street Articulation - North Main Street to Brock Street	Curbing, striping, landscap-ing, drainage, sidewalks	$350,000	1999	Enhance-ments

Potential Projects

Wakefield Street/North Main Street Connector
This proposal seeks to relieve downtown congestion by connecting the Route 11 area near Exit # 14 on the Spaulding Turnpike to the commercial retail area north of the downtown on Route 125. The upgrade to Exit 14 is included as part of the Spaulding widening project in the NHDOT Ten Year Plan. The City has applied for state funding in the past but not been approved due to the scope of the proposal and necessity to complete feasibility studies first. This project was supported by 55% of the respondents in the Community Survey (vs. 18% opposed).

City Council recently voted to not build the Connector project at least along St. James Terrace. The status of the proposal is therefore now uncertain. Alternatively, enhancing access between Spaulding Exit 15 and the Connector/Route 125 interchange could facilitate movement between the Wakefield Street and North Main Street corridors.

Route 11 Loop and Frontage Road
The City seeks to develop a loop road and service/frontage road along Route 11. This would be located on the westerly side of Route 11, in the vicinity of Walmart, extending from the transmission lines (just south of Little Falls Bridge Road) to near the Farmington Town line. The genesis for this project was an economic development study for the Route 11 Corridor prepared by Applied Economic Research. Both the loop road and frontage road have actually been surveyed. See *Map 1 - Route 11 Loop and Frontage Road* on the next page. The full size surveyed map is on record in the City's Planning and Development Department. The City Council had considered establishing the roads through the Official Map statute (RSA 674:11) but decided instead to pursue it through this Master Plan process. The new roads would accommodate:

(a) smaller, high value, high visibility parcels fronting on Route 11 located *in front* of the service road likely used for high turnover retail
(b) larger, medium visibility parcels located *behind* the service road likely used for shopping centers and big box development; and
(c) large and small scale industrial, warehouse, and high impact type uses accessed from both sides of the loop road

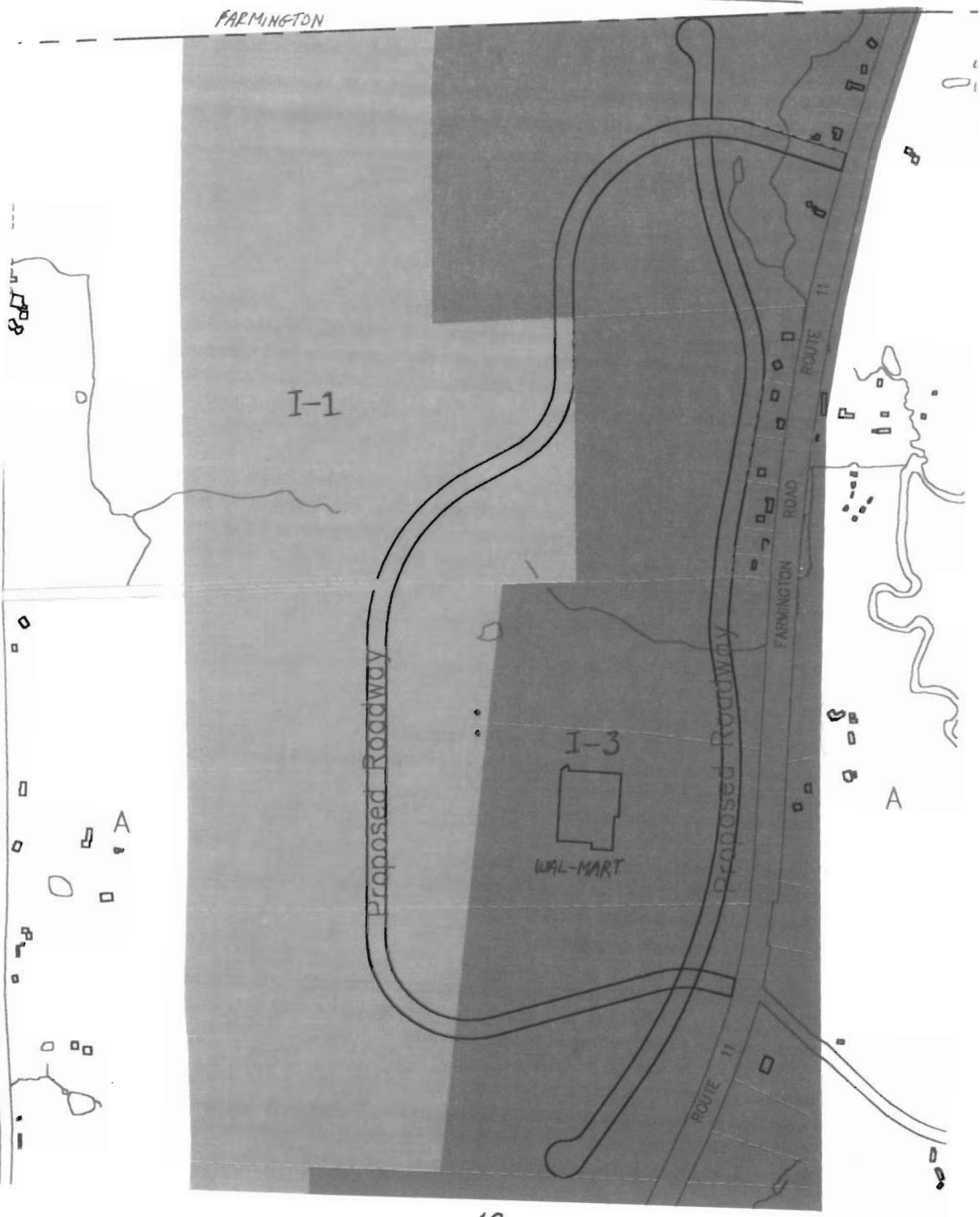
Forging ad hoc partnerships with landowners and developers is necessary to get the roads built. As site plan and subdivision proposals come forward the Planning Board should work with applicants to develop portions of the roads.

Other Prospective New Roads

Ten Rod Road - Route 11 Link
This has been discussed in the past as an extension of Four Rod/Two Rod Road from Ten Rod Road to Route 11. It is unclear whether the right-of-way is still owned by the City of Rochester or whether it was permanently vacated and reverted to abutting property owners.

Rochester Hill Road - Whitehall Road Link
This has been discussed in the past as an extension of Old Ten Rod Road to Shaw Drive off Whitehall Road.

Map 1 Route 11 Loop and Frontage Road



South Main Street
In April 1999 the consulting firm of CLD, Inc. prepared *The South Main Street Corridor Study* for South Main Street between the Columbus Avenue and Whitehall Road intersections. See *Appendix 4 - South Main Street Corridor Study Recommendations*. The study proposed improvements to intersections of South Main Street and the following roads:

- Columbus Avenue
- Linden Street/Grant Street
- Common Street
- Franklin Street/Pharmacy driveway
- Whitehall Road/Harding Road

These improvements included reconfiguration of lanes, larger turning radii, pavement widening and signal modification. The study also provided a recommendation for a three-lane section of South Main Street in the study area that would allow for a continuous two-way center lane with a center lane conversion to exclusive turn lanes at the above intersections. Portions of this project are included in the state approved plan (see *Table 5*, above).

NH Route 125
In May, 1999 CLD, Inc. also prepared *The NH Route 125 Corridor Study* Route 125 between the Spaulding Turnpike Interchange and the Flat Rock Bridge Road. See *Appendix 5 - Route 125 Corridor Study Recommendations*. The study proposed two three-lane sections along Columbus Avenue and Wakefield Street, dual south bound lanes on Milton Road from Lilac Mall to Lilac Plaza, and improvements to the following intersections:

- NH 125/Brock Street
- NH 125/Old Dover Road/Wilson Street
- NH 125/Charles Street
- NH 125/Hancock Street/Lowell Street
- Columbus Avenue(NH 125)/May Street/Upham Street
- South Main Street/Columbus Avenue (See NH Route 108/South Street Project above)
- Columbus Avenue/Portland Street
- Columbus Avenue Summer Street
- Columbus Avenue/Wakefield Street
- Wakefield Street/High School Road/Glenwood Avenue
- Milton Road (NH 125)/Lilac Plaza/Chestnut Hill Road and VIP Driveway
- Milton Road/Norway Plains Road
- Milton Road Flat Rock Bridge Road

These improvements included reconfiguration of lanes, larger turn radii, pavement widening, defining parking areas and signal modification. At each intersection, the City would need to acquire additional land for turning lanes, sidewalks, or other design elements.

Corridor Enhancements
The City has applied for several Transportation Enhancement (TE) projects variously for curbing, drainage, sidewalks, street trees, landscaping/lawn strip, on street parking, better road articulation, and selective intersection improvements for the following road corridors (see *Table 6,* above):

- *North Main Street* - from Union Street to Strafford Square
- *North Main Street* - from Strafford Square to Farmington Road
- *Washington Street* - from Strafford Square to Brock Street
- *Wakefield Street* - from Union Street to Chestnut Hill Road Connector

Other Potential Projects

Kimball Street. The idea of a "rotary" at Allen Street, Kimball Street, Summer Street, and Eastern Avenue has been discussed. Kimball Street is now one way but should probably be made two way. Kimball should probably be the linkage with Eastern Avenue in both directions rather than Allen Street. Appropriate signage should be installed.

Route 125 - Old Dover Link - A new road segment linking NH 125 and Old Dover Road (where Public Works dumps snow presently

Rochester Toll Booth

There has been discussion about the impact of the Rochester toll booth on traffic in Rochester. Citizens are concerned that the presence of the booth causes an undue amount of traffic that should use the Turnpike to exit the Turnpike or avoid the Turnpike and travel on Rochester's roads instead, particularly Old Dover Road. The City should work with NHDOT to explore relocating toll booth if it is found to be detrimental to traffic patterns within the City.

Community Survey

The Community Survey identified the following roads as most in need of upgrading. They are listed by the number of responses received by each road segment in descending order with Lowell Street receiving the most responses. The question did not distinguish between deficiencies due to road condition and road design/geometry. See *Appendix 7 - Roads most in need of upgrade (Community Survey results)* for the complete list.

1) Lowell Street (a major reconstruction has since been completed)
2) Portland Street
3) Franklin Street
4) Chestnut Hill Road
5) Old Dover Road
6) Washington Street
7) North Main Street
8) Chamberlain Street
9) Wakefield Street
10) Chestnut, Jackson, Maple, Pine Streets
11) Salmon Falls Road
12) Walnut Street
13) Pine Street
14) Whitehall Road
15) Route 125 (north from Merchants Plaza)

Intersections

There are a number of the problem intersections in the City, especially those within the Route 125 and Route 108 (Main Street) corridor study areas. Improving intersections is integral to improving traffic

flow. The City should identify the most congested intersections and purchase land for potential capacity improvements at every opportunity. This would be one of the single most important initiatives the City could undertake.

The following four intersections were identified by the Transportation Committee and by respondents to the Community Survey as being most deficient. See *Appendix 8 - Intersections most in need of upgrade (Community Survey results)* for the complete list.

- *Strafford Square*
- *South Main Street and Franklin Street*
- *South Main Street and Commons Street*
- *Route 125 and Old Dover Road* - Four students at the College of Lifelong Learning studied methods to improve this intersection[3].

Other intersections which the Committee identified as problematic include (in alphabetical order):

- *Route 11 and Little Falls Bridge Road.* The intersection is difficult to distinguish when the gas station is illuminated. The street light at the intersection could be upgraded.
- *Route 125 and Turnpike off ramp for southbound traffic onto Route 125*
- *Route 202 and Dry Hill Road* - sight distance is poor
- *Route 202 and Estes Road* - sight distance is poor
- *Route 202 and Salmon Falls* - the stop light is short and drivers rush through it.
- *Columbus Avenue and Summer Street* - left turn lanes off Columbus Avenue are needed
- *Main Street and US 202 (ER)*
- *Meaderboro Road/Estes Road/Walnut Street /Crown Point Road* - sight distance problem entering the intersection; cars parked at the service station and store within the right-of-way sometime block traffic
- *North Main Street and River Street*
- *South Main Street and Grant Street*
- *Washington Street and Brock Street*

Bridges

The NHDOT and the City of Rochester Department of Public Works are responsible for bridge maintenance and construction. If the bridge is on a state-aid road, it is the responsibility of the state and if on a locally maintained road, its is the responsibility of the City. There are 39 bridges in Rochester—11 under the jurisdiction of the City and 28 under the jurisdiction of the DOT.

The NHDOT has a state-wide bridge inspection program that is based on the National Bridge Inspection Standards System. All bridges are inspected every two to three years and depending upon location, use and condition may be inspected on a less formal basis more frequently. In Rochester the last documented inspection was in 1997. Bridge condition is rated on a numerical system (FSR) from 1-100. The higher the number the better the condition of the bridge. Priorities are established for maintenance, repair and replacement of bridges based on this rating program. If a bridge is "red listed" it receives the highest priority for repair/replacement.

Of the bridges maintained by the City the bridge at Portland Street over Willow Brook is rated as structurally obsolete. This bridge needs to be inspected on a frequent basis and repaired/reconstructed as necessary. Based on the 1999 Rochester Transportation Improvement Plan, the Old Dover Road

bridge over Willow Brook is scheduled for replacement during 2000. In addition, the Spaulding Turnpike bridges between Exits 11 and 13 will be replaced as part of the Turnpike widening project.

Two state bridges are red listed: the Spaulding Turnpike Bridges that are scheduled for replacement as part of the widening project. The City had one red listed bridge—the Rochester Neck Road bridge over the Isinglass River but this bridge was reconstructed in 1999. See *Table 7 - Bridge Inventory*.

Table 7 - Bridge Inventory			
Location	**Jurisdiction**	**Last Inspection**	**Sufficiency Rating**
Spaulding Avenue over Salmon Falls River	City	9/97	99.5*
Spaulding Turnpike off Ramp over Willow Brook	NHDOT	8/97	97.0
NH 125 (Ramp) over US 202/NH 11 (Ramp)	NHDOT	7/98	95.4
Spaulding Turnpike over Chestnut Hill Road	NHDOT	8/97	94.8
Spaulding Turnpike over NH 16 Connector	NHDOT	8/97	93.0
Spaulding Turnpike over Cocheco River	NHDOT	8/97	92.6
Little Falls Bridge Road over Cocheco River	City	9/97	92.4
Bridge Street over Cocheco River	City	9/97	92.4
US 202/NH 11 over NH 125	NHDOT	8/97	92.2
US 202/NH 11 over Bost. & Maine RR	NHDOT	7/98	91.2
Spaulding Turnpike over Betts Road	NHDOT	8/97	89.6
Spaulding Turnpike over Cross Road	NHDOT	8/97	89.6
Spaulding Turnpike over Bost. & Maine RR	NHDOT	8/97	88.8
Tebbetts Road over Spaulding Turnpike	NHDOT	7/97	86.0
US 202 over Rickers Brook	NHDOT	7/98	85.3
Spaulding Turnpike over Blackwater Road	NHDOT	7/97	84.7
NH 125 over Isinglass River	NHDOT	8/97	82.8
US 202/NH 11 over Salmon Falls River	NHDOT	8/97	81.9
Spaulding Turnpike over Ten Rod Road	NHDOT	8/97	80.9
Spaulding Turnpike over NH 202A	NHDOT	8/97	80.7
Spaulding Turnpike over Axehandle Brook	NHDOT	7/97	79.5
Spaulding Turnpike over US 202	NHDOT	8/97	79.4
NH 202A over Rickers Brook	NHDOT	7/98	79.3
Maple Street over Cocheco River	City	9/97	76.3
Spaulding Turnpike over Cocheco River	NHDOT	7/97	76.0
Flat Rock Bridge Road over Salmon Falls River	City	9/97	70.7
Four Rod Road over Rickers Brook	City	9/97	68.1
NH 125 over Axehandle Brook	NHDOT	9/97	66.2
Portland Street over Wardley (Willow) Brook	City	9/97	66.1*
NH 11 over Spaulding Turnpike	NHDOT	9/97	62.9
Chesley Hill Road over Rickers Brook	City	9/97	61.5
Old Dover Road over Wardley Brook	City	9/97	52.6
NH 125 over Cocheco River	NHDOT	9/97	50.1*
Spaulding Turnpike NB over Route 125	NHDOT	12/98	32.7**
Spaulding Turnpike SB over Route 125	NHDOT	12/98	30.5**
Pedestrian Walk over Cocheco River	City	9/97	N/A
Bost. & Maine RR over Old Dover Road	City	9/97	Closed
Rochester Neck Road over Isinglass River	City	Reconstructed in 1999	

* Functionally Obsolete ** Structurally Deficient - State Red List *Source: NH DOT*

Downtown Traffic

It is acknowledged that there is considerable traffic congestion in the downtown. Rochester's overall street pattern is radial (hub and spokes) so most major roads converge in the center of the city. The range of approaches to mitigate the traffic include:

- Developing bypasses
- Increasing capacity of and attractiveness of using alternate roads
- Increasing capacity of roads through the downtown
- Encouraging certain types of vehicles (such as trucks) to use alternate routes
- Promoting alternatives to use of single occupancy vehicles at peak times (transit, bicycles, transportation demand management, etc.)
- Promoting land use patterns that are less likely to result in regular traffic through the downtown

In general, one way circular traffic patterns around a downtown core (such as those in Rochester, Dover, and Durham) tend to be more efficient and therefore increase capacity. On the other hand, one way patterns, especially where there are two or more travel lanes, tend to increase speeds and create the sense of a speedway. The pattern was changed pursuant to a traffic recommendation in the 1982 Master Plan. This effect is highly inimical to the pedestrian character of a downtown, and a healthy pedestrian climate is critical to the success of a downtown. Traditional, slower paced, pedestrian friendly downtown always had a two way traffic pattern except for selective, narrow side streets. Thus, there appear to be two competing interests - enhancing traffic flow vs. enhancing the health of the downtown. Also, see discussion of Transect in *Traffic Calming* section, below.

In the survey 28% supported returning to a two way pattern while 52% supported retaining the one way pattern. Further study is needed to determine which interest is paramount in this situation. It should be part of a larger study of capacity around and through the downtown, as, for example, it has also been proposed that Hanson Street be changed to two way traffic or one way in the opposite direction (leading away from the Parson Main Statue).

Other approaches to divert through traffic away from the downtown might include the following:

- The proposed Connector Bridge which would directly link North Main Street and Milton Road
- As an alternative to the Connector Bridge enhancing access between Spaulding Exit 15 and the Connector/Route 125 interchange could facilitate movement between the North Main Street and Milton Road corridors as discussed under Potential Projects subsection.
- Removal/relocation of the Rochester Toll Booth as discussed under Potential Projects subsection.
- Drivers could use circumferential roads instead of traveling through downtown including the Turnpike, Tebbetts Road (although Tebbetts Road is presently in poor condition), and Franklin Street.

Road Specifications

A set of specifications for the various types of roads in the City is presented shown below.

Criteria

Streets generally serve a variety of functions by their particular nature and location. Most of these functions are appropriate and should be accommodated and some perhaps should be discouraged. The following are the range of functions which roads can serve and which should therefore be planned for.

- *Mobility*. Through movement, such as for large arterial roads.
- *Access*. Allowing for connection to property, residential and nonresidential, through side roads and curb cuts (the inverse of mobility).
- *Scenery*. Preserving and enhancing views for the user of the road to scenic fields, woods, mountains, downtown areas, etc.
- *Aesthetics*. A road may or may not retain natural scenic views but it may be important to enhance the quality of development along the road, such as along tourist corridors.
- *Trucking*. The road may be an important corridor for trucks.
- *Bicycling*. It may be an important corridor for bicyclist whether for commuting or recreational purposes
- *Walking*. It may serve many pedestrians because either residential uses front the street or it is a link between pedestrian destinations.
- *Parking*. In certain situations on street parking is encouraged; in others it is inappropriate.
- *Neighborhood "living room"*. In quiet residential areas neighbors may seek to use the road in front of their houses for recreational and social purposes.

Specifications

The proposed specifications for each type of road are outlined in *Table 8 - Arterial and Collector Road Specifications* and in *Table 9 - Local Road Specifications*. These are intended as policy guidelines and should be modified on a case by case basis as appropriate.

Table 8 Arterial and Collector Road Specifications				
	Arterial		**Collector**	
Function	***Urban***	***Rural***	***Urban***	***Rural***
Mobility/Access[4]	Mobility	Mobility	Mobility and Access	Mobility and Access
Right of way width	60	66	60	60
Street width (parking lane, bike lane, travel lane)[5]	8-4-12-12-4-8	5-12-12-5	8-3-11-11-3-8	4-11-11-4
Design Speed (mph)	25-35	35-45	25	25-35
Drainage	Curb and gutter	Ditch	Curb and gutter	Ditch
On Street Parking	Always	Never	Always	Never
Sidewalks (with minimum 4 foot planting strip)	Always	Rarely	Always	Occasionally
Bicycling	In lane or separate lane	5 foot separate lane, ideally a separate path	In lane or separate lane at least 3 feet	4 foot separate lane
Trucking	Acceptable but discouraged through downtown	Encouraged	Generally acceptable	Generally acceptable
Aesthetics	Moderately important; important in downtown and on scenic ways	Moderately important; important in downtown and on scenic ways	Important	Important

Table 9 Local Road Specifications			
FUNCTION	***Urban***	***Suburban***	***Rural***
Mobility/Access	Access	Access	Access
Right of way	50	50	50
Street width - minimum 24 feet (parking and travel)[6]	7-10-10- 7	10-10	10-10
Design speed[7]	25 mph	25 mph	25 mph
Drainage	Curb and gutter	Variable	Swale
On street parking	Usually	Variable	Rarely
Sidewalks (with minimum 4 foot planting strip)	Always	Usually	Variable
Bicycling	Shared lane	Shared lane	Shared lane
Through Trucking	Discouraged	Discouraged	Discouraged
Neighborhood Character	Very important	Important	Important

Alternative Modes and Traffic Mitigation

Access Management

Access management involves various techniques to maintain the capacity of collector and arterial roads by avoiding excessive and poorly located curb cuts.

The City should implement selective access management strategies to ensure efficient and safe movement of traffic. In 1998 the Strafford Regional Planning Commission published a report as part of the Route 16 Corridor Study - *Access Management*. *Table 10 - Access Management Techniques* shows a summary of these techniques. Also see *Appendix 9 -Ten Ways to Manage Roadside Access in Your Community* for detailed descriptions of these and other techniques.

Table 10
Access Management Techniques

- Locate driveways away from intersections.
- Restrict the number of driveways per lot.
- Encourage access from side streets when activity is on corner with arterial unless it will adversely impact residential areas
- Connect parking lots and consolidate driveways.
- Provide residential access through neighborhood streets not along collectors and arterials.
- Promote a interconnected street system rather than dead ends and cul-de-sacs.
- Encourage shared driveways.
- Vary distance between curb cuts/driveways based on roadway posted speed, volume of traffic, order of road, and/or zoning district.
- Increase minimum lot frontage on major collectors and arterials.
- Encourage internal access to commercial shopping center out parcels.
- Encourage automobile interconnection between commercial developments.
- Encourage right turn deceleration and acceleration lanes/tapers except in situations where it may adversely impact downtown areas, scenic ways, and neighborhoods.
- Add protected left hand turn lanes at entrances to retail establishments
- Establish frontage roads for commercial & industrial development.
- Regulate design of driveways including turning radii and circulation patterns
- Discourage signage size and location which will hinder the view of access areas.

Access to a site should be on roads that have adequate capacity to accommodate the additional traffic generated by a development. Developers of projects that will generate, for example, 100 or more peak hour trips should demonstrate that the level of service on affected streets and intersections will not be significantly impacted. If it will be impacted the developer should provide appropriate mitigation measures or contribute to a City fund to pay for the improvements.

There should be standards establishing minimum spacing between curb cuts along congested collectors and arterials. Depending on the highway the City could stipulate spacing not to exceed 1 curb cut per 500 feet, for example. Even on state roads where the NHDOT regulates curb cuts, the City may impose additional/stronger standards. When a subdivision is proposed along a significant collector road the City might stipulate:

- longer frontage,
- fewer lots,
- special lot configuration
- shared driveways,
- specific locations for access,
- access to be taken from a side street, and/or
- a frontage road

Healthy Streets

There is a paradigm shift in the way we build our streets and subdivisions all across America. People are recognizing that roads serve multiple purposes beyond moving traffic and are working to create real neighborhoods that foster walking, bicycling, and interaction among residents. Traffic engineers, city planners, and real estate developers are re-examining conventional assumptions that all streets must be wide, straight, and flat to accommodate maximum traffic volumes and speeds.

Neighborhoods

A number of studies show that a top preference for home buyers is low traffic volume, slow traffic speeds, and minimal noise. Many seek neighborhoods where they and their children can safely walk and bicycle along sidewalks, trails, and greenways and that are near to parks, schools, and even shops. They are also anticipating the changing mobility of their older years. A recent RutgersUniversity study determined that "small towns" rank highest on the list of different types of living places. Fifty percent of Americans want to buy homes in village-style neighborhoods, compared with 22 percent for conventional suburbs (Eagleton Institute, 1987).

These elements, along with well designed alleys, lanes, on street parking, benches, street trees, and street lamps encourage walking, bicycling, and a sense of community. Streets should be well connected to offer a variety of walking routes and to distribute motorized traffic. On such a traditional street the volume of traffic, speed and noise are reduced. By slowing motorized traffic, people discover that the front portions of their homes are pleasant places. They spend more time in front yards and on porches, and meet neighbors along walkways and at street corners[8].

Some of the principles for healthy streets include[9]:

- The streets should be organized in a comprehensible network that manifests the structure of the neighborhood. (See *Appendix 10 - Street Plan Typology*. This excerpt from the Huntersville, NC Land Development Code admirably lays out the 4 traditional street plan types, all of which are interconnected systems. These are in contrast to the non-connected "dendritic" type common today of collector roads and cul de sacs.)

- Cul de sacs are discouraged except where necessary due to natural conditions or other constraints.

- Blocks should average no more than 600 feet in length, i.e. any streets within neighborhoods should have intersecting streets on average every 600 feet or less. This applies even to a long cul de sac (i.e. having one or more crossing smaller secondary cul de sacs); an uninterrupted

1,000 foot long cul de sac without any intervening cross streets takes on the feel of a high speed collector road.

- It is desirable to have streets terminated by a vista to enhance the view of motorists on the road. Vistas can be terminated with important natural features, civic buildings, or even a deflection/curve in the street. At the very least it is preferable that a street be terminated with a view of the front of a house rather than a garage.

- Other than loop roads, streets which curve should follow the same general directional orientation over their entire trajectory rather than curving willy nilly.

- Streets should be narrow and intersections should incorporate small turning radii that require low speeds, yet also reasonably accommodate the infrequent larger visitors to the street -fire, sanitation, plow, and delivery trucks.

See *Appendix 11 – Street Design Guidelines for Healthy Neighborhoods* for an in depth discussion of healthy streets.

Highway Transect

Arterials and major collector roads are and should be auto oriented. However, the design of roads should consider other factors, including the setting. Roads that move through our downtown areas, neighborhoods, and village centers should respect the character of those areas. Laurence Qamar[10] describes the "transect" as follows (also see *Table 11 - The Highway Transect from Town Center to Edge*):

> "The highway is not a continuous tube, detached from the town through which it passes. The function and character of the highway transforms as it passes from the edge to the center back to the edge of the town [as a continuum of]: **Country - Gateway - Main Street - Gateway - Country.**"

Table 11 The Highway Transect from Town Center to Edge	
CENTER	EDGE
Urban	Rural
Slow Speed	Fast Speed
Pedestrian Oriented	Automobile Oriented
Smaller Blocks	Larger Blocks
Main Street	Regional Road
Narrower Lanes	Wider Lanes
In-lane Bicycling	Bicycle Lanes
Parallel Routes	Main Routes
Street Network	Functional Classification
Dispersed Traffic	Concentrated Traffic
Frequent Street Access	Limited Street Access
On-street Parking	No On-street Parking
Small Curb Radii	Large Curb Radii

Civic Design

Even rural arterials may be attractive thoroughfares. For example, where appropriate a center landscaped median can be built in the middle of collectors and arterials, converting them to stately boulevards. This device breaks up the wide expanse of pavement on wide highways, creates an opportunity for attractive landscaping, and makes a positive statement about the community. It is most workable where there are few curb cuts on either side since it precludes left turns into or out of property unless gaps in the median are incorporated. There could be opportunities for this approach on high volume state roads in relatively undeveloped rural sections of Rochester if widening to four lanes becomes necessary.

Traffic Calming

Special techniques may be employed to slow traffic beyond adjusting basic street geometry. Many communities in the United States and particularly in Europe are exploring innovative street designs toward this end - known as "traffic calming".

Traffic calming is generally oriented to neighborhoods, downtown areas, and other settings where pedestrian use is encouraged rather than for arterials and major collectors where the primary objective is to move traffic quickly. Like healthy street design, traffic calming aims to reduce the dominance and speed of motor vehicles.

Examples

Examples of these techniques are explained below. See *Appendix 12 - Traffic Calming Techniques* for additional approaches.

Modern Roundabout - Not to be confused with a traditional New England high speed rotary or traffic circle, this is an intersection treatment that forces motorized traffic to slow down to speeds under 25 mph in order to negotiate a center island that is usually landscaped. Such speeds allow pedestrians to safely cross around the perimeter of the roundabout and bicyclists to safely become part of the circulating traffic. The Strafford Square project, scheduled for construction 2007 is proposed as a modified modern roundabout (or as a double-T intersection).

Speed Hump. Speed Table. Raised Crosswalk - Known affectionately in England as a "sleeping policeman" these techniques involve raising the height of the pavement in a more subtle fashion than the conventional speed *bump (such as the pronounced speed bumps used at the Community Center)*, allowing vehicles to pass over them at the intended speed of the road, but preventing excessive speeds. Raised crosswalks in particular accommodate pedestrians by allowing them to cross at the same elevation as the existing sidewalk and communicate that the pedestrian has the right-of-way.

Median or Chicane - These narrow road width and slow down traffic by inserting a raised section either in the middle of the road (a median) or on the side of the road (a chicane). A series of these elements on a road is known in Belgium as a "woonerf". Rochester's Academy Street is a modified woonerf. Both techniques can provide additional safety for crossing pedestrians; medians may serve as a refuge by allowing pedestrians to cross one lane of traffic at a time, while chicanes provided at crosswalks (curb bulbs or bumpouts) reduce the overall distance from one side of the road to another and slow down traffic at those crossings.

Landscaping - Even planting trees or other vegetation in proximity to the roadway can psychologically narrow the road and induce slower speeds by reducing sight distances.

Some might argue that reducing sight distances reduces safety. To the contrary, when sight distance is adjusted in a careful and responsible way safety should be enhanced. Every road has a given sight distance. A hazard is introduced where the sight distance changes abruptly or where it is otherwise inconsistent with the design speed of a road. If sight distance is adjusted thoughtfully it will induce lower speeds and better vigilance on the part of drivers, thereby enhancing safety.

Portsmouth installed curb bulbs at some crosswalks in areas with high automobile and pedestrian use. Durham incorporated bumpouts in its recent downtown streetscape project. In Dover a neighborhood organization has looked at traffic calming to address high speeds and through traffic on their residential street. The NHDOT appears to be receptive to certain traffic calming techniques when communities show an interest (recently, officials in Rye were shown a roundabout design alternative as a possibility for the Foyes Corner reconstruction)[11].

Conflicts

Traffic calming can be effective where there are strong conflicts between neighborhood uses and through vehicular traffic.

Residential cut-through streets

Local roads which are both single family neighborhoods and cut through streets include, for example, Harding Street, Hemlock Street, Hillcrest Drive, Hillside Drive, Juniper Street, Sunset Drive, Tingley Street, Madison Street, Prospect Street, and Chamberlain Street (between Franklin and Portland).

Residential collector streets

Numerous collector streets with a moderate amount of traffic also are intensively developed neighborhoods including sections of Chestnut Hill Road, Franklin Street, Old Dover Road, and Portland Street.

Conflicts with use and zoning

Problems have resulted where one side of a street is zoned for intensive commercial use and the other side remains single family, notably Hancock Street, Old Dover Road (near the Public Works Facility), Washington Street (east of Brock Street)., and Whitehall Road (opposite Frisbie Hospital). In addition, residents of Railroad Avenue have suffered due to truck traffic serving the industrially zoned area at the end of the road.

Speeding

In cases where the design speed of a road is not consistent with the posted speed limit, among drivers who do not diligently follow speed limits there will be a tendency to speed. Design speed of a road - through the road geometry (width, straightness, radii of curves and intersections, etc.) - psychologically conveys to drivers the appropriate safe speed at which to travel. Where this is out of sync traffic calming measures may be instituted.

These methods have not typically been used in Rochester (with some exceptions), there may be selected opportunities where such techniques could be used on minor streets in residential neighborhoods or in new large subdivisions. Aggressive techniques would likely not be appropriate on collector roads, such as Chestnut Hill Road. Any methods must be carefully designed as there can be plowing and maintenance challenges with speed humps, chicanes, changes in road texture, more tortuous road layouts, etc. ***Rigorous speed limit enforcement is always recommended.*** Also, more subtle and low cost techniques such as striping narrow travel lanes on collector and arterial roads may be used.

Sidewalks

The City of Rochester has approximately 70 miles of sidewalks, the majority of which are concentrated in the urban compact areas of downtown Rochester, East Rochester and Gonic. Most of these are concrete with granite curbing. There are some brick sidewalks. Sidewalks beyond the core areas are more likely to be asphalt. The City does not presently have an inventory of sidewalks. It is important to develop one listing location, type, and condition, as well as location of crosswalks.

Sixty eight percent of the respondents in the Community Survey supported adding sidewalks to selected main streets (vs. 18% opposed) and 68% supported requiring developers to build sidewalks in most new subdivisions (vs. 14% opposed). Fifty nine percent indicated they would walk more if sidewalks were installed as part of an integrated pedestrian system. Making accommodations for pedestrians - including sidewalks, crosswalks, and footpaths - should become an integral part of all city planning, zoning, public works, and transportation endeavors.

Sidewalks are appropriate on urban collectors and arterials and local streets in urban and suburban locations (see *Road Specifications* section). Priority locations for new (or upgraded) sidewalks include:

- myriad densely developed urban neighborhoods;
- higher order roads where there is significant vehicular traffic and potentially significant pedestrian usage (such as along Route 108 near Frisbie Hospital);
- densely developed collector roads (such as Portland Street in the core areas, the lower portion of Chestnut Hill Road); and
- areas around schools (such as Brock Street, Portland Street (East Rochester), Franklin Street, and Chamberlain Street).
- pedestrian oriented downtown and village retail areas

Design

All too many sidewalks built now suffer from a major design flaw - the lack of a planting strip between the sidewalk and the road. Installation of a planting strip should be absolutely mandatory for all sidewalks except those: a) within core downtown areas if there is regular on- street parking to serve as a barrier between pedestrians and traffic; or b) if topographic or other factors *substantially* preclude it (it is recognized that there are cost, maintenance, and right-of-way constraints). A planting strip serves to:

1) increase actual pedestrian safety by separating walkers from cars;
2) enhance appeal (and thus usage) of sidewalk to pedestrians by increasing psychological sense of safety;
3) improve attractiveness by breaking up the expanse of pavement from the roadway to the sidewalk, particularly where street trees are installed in the planting strip; and
4) provide a place for snow storage.

Some communities discourage developers from installing sidewalks in new subdivisions in order to avoid the future expense of plowing them. It is understandable that local governments prefer not to incur this obligation. The City should explore establishing a policy providing that sidewalks which are used less are either plowed later or not at all, or alternatively, that abutting property owners are required to shovel them. It is preferable to build sidewalks that are usable three seasons of the years than not to build them at all due to the expense of plowing them.

Where sidewalks are installed it is preferable to place them on both sides of the road. However, some flexibility in placing them on only one side is appropriate. Installing sidewalks on both sides are most important: a) in a downtown retail setting, b) on higher order roads - arterials and major collectors, and c) in denser urban areas.

Bicycles

In recent years there has been increased demand for bicycle facilities in Rochester. Sixty percent of the respondents to the Community Survey supported building bicycle/multi-use paths (vs. 18% opposed). Thirty nine percent (vs. 34% opposed) supported adding bicycle lanes to selected main streets.

This Plan is based on the premise that providing for bicycles should be an integral part of the City's transportation plan. Bicycling provides many benefits to the City because it:

- produces no air or noise pollution,

- decreases traffic congestion,
- reduces the taxpayer burden,
- helps alleviate parking demand,
- saves energy,
- uses land and road space efficiently,
- provides mobility,
- saves individuals money, and
- improves health and fitness

Bicycle Planning

The Transportation Committee established a Bicycle Subcommittee to prepare a bicycle plan. The Subcommittee addressed the following areas.

Making bicycling integral to planning

It is a goal to make bicycling integral to all transportation planning in the City of Rochester and in the region. If bicycle facilities are planned for during the design phase of a project, they can be accommodated with minimum cost and disruption.

Bicycle Design Policies

See the section below and an in-depth series of guidelines and principles in *Appendix 13 - Bicycle Design Guidelines*.

Bicycle Routes

Presently, there is no formal local inventory of bicycle routes and paths. One should be developed to include locations, type of path, and condition. See list of specific roads oriented to bicycle use and proposed projects in *Bicycle Route* section, below.

End-of-trip facilities

A public private partnership is needed to install higher levels of bicycle parking; provide for long-term bicycle parking to serve commuters, students, and others needing longer-term bicycle storage; and provide other end-of-trip services like showers, changing rooms, and clothing storage.

Bicycle-transit link

The City should work with COAST and other para-transit agencies to coordinate systems, such as assuring that riders can take their bicycles aboard buses and light-rail (if it were feasible to develop in coordination with New Hampshire Northcoast)

Bicycle education and promotion

Bicycle education is concerned with developing safe cycling skills in children, teaching adult cyclists their rights and responsibilities, and teaching motorists how to safely share the road with cyclists. See *Appendix 14 - Bicycle Accident Statistics*. Maps delineating bicycle routes should be developed and disseminated.

Design Guidelines

The standard bicycle facility is a separate, striped, marked four foot paved lane adjacent to the vehicle

travel lane. In tight urban settings where there is insufficient right of way a three foot lane is acceptable. Detached paths, especially along arterials and major collectors are ideal but rarely practicable due to cost and right-of-way constraints. Guidelines for roads are as follows:

- Local roads - shared lane with cars
- Collector roads - separate, marked four foot bicycle lane
- Arterial roads - separate, marked five foot bicycle lane

The City Council has recently adopted this approach on two projects. After much discussion it was decided to build a 4 foot attached lane on Chestnut Hill Road rather than either a detached path or sidewalk. Lowell Street is now being upgraded and four feet of paved shoulder will be added in each direction for a bicycle lane.

At outside stripe (or "fog line") should be painted on all arterial and collector roads, leaving a maximum paved shoulder for bicycles. The shoulder should be marked as a bicycle lane with either the diamond logo or bicyclist logo. See *Appendix 13 - Bicycle Design Guidelines*

Bicycle Network

While adding bicycle facilities to all collector and arterial roads is desirable, roads shown as main commuter corridors, roads on the state plan, particular arterial and collector roads listed below, and the special bicycle projects listed below are priorities.

Main Commuter Corridors

See *Map 2 - Main Commuter Corridors* which includes the following:

- Route 11
- Route 202A
- Route 125 North
- Route 202 East
- Route 202
- Route 125 South
- Old Dover Road (formerly Route 16B)

State Plan

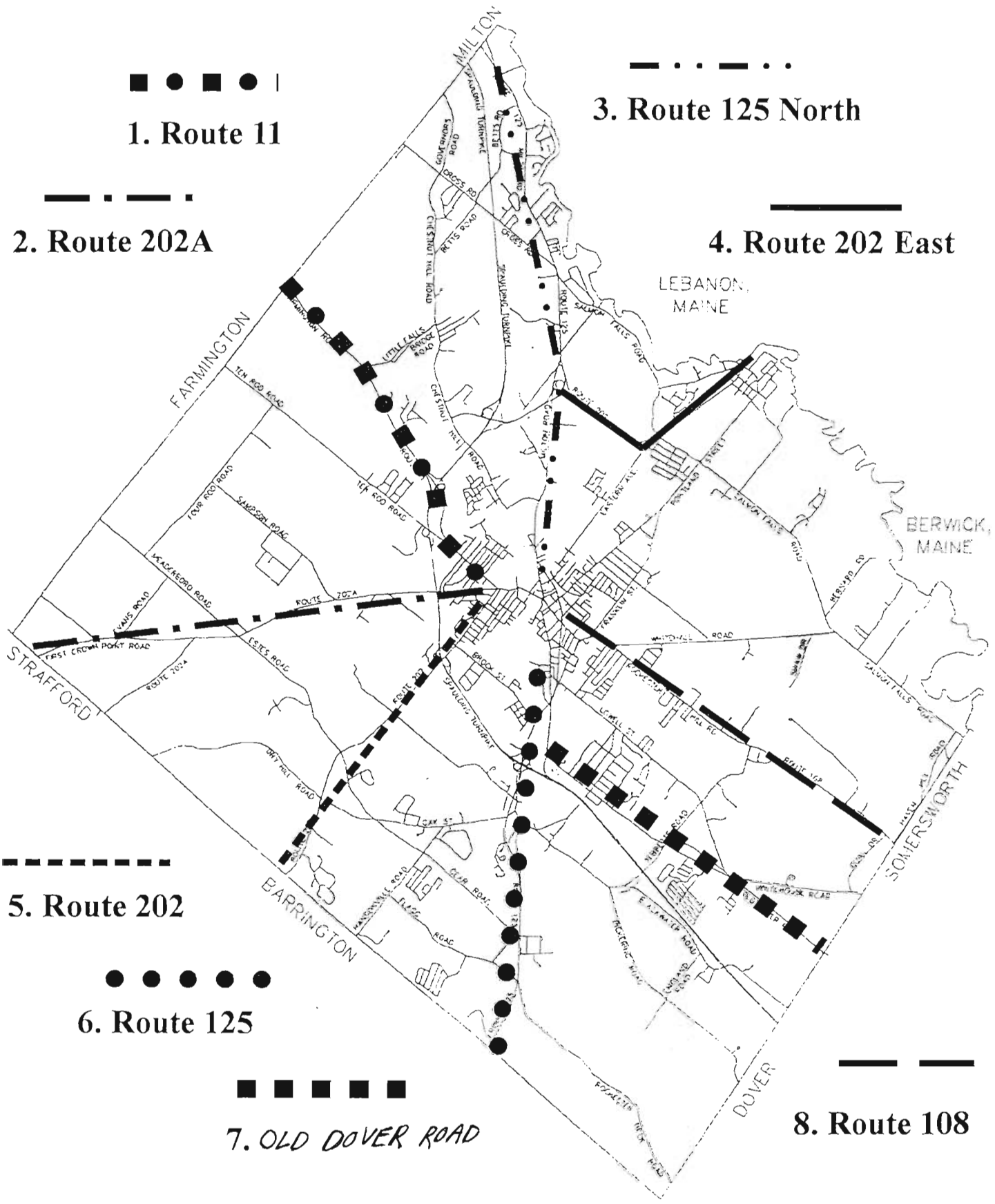
Roads that are included in the state's current Bicycle Plan include the following:

- Portland Street to Main Street, ER, to Route 202 (to Maine)
- Wakefield Street to Chestnut Hill Road Connector to Chestnut Hill Road (to Farmington)
- North Main Street to Walnut Street to Strafford Road (to Strafford)
- Charles Street to Old Dover Road to Tebbetts Road to Pickering Road (to Dover)

These are considered important links with adjacent communities. However, the state is now reviewing the plan and may modify it. Also, these roads are not necessarily endorsed by Rochester as the most important bicycle routes. See *Map 3 - State Bicycle Plan* (please note that this plan is in the process of being changed by NHDOT.

Main Commuter Corridors

Rochester, NH
Bicycle Master Plan



1. Route 11

2. Route 202A

3. Route 125 North

4. Route 202 East

5. Route 202

6. Route 125

7. OLD DOVER ROAD

8. Route 108

It is recommended that bicycle facilities be established (or expanded/upgraded) on the following key arterials and collectors as opportunities develop:

Arterials

- Route 11/Farmington Road
- Route 108/Rochester Hill Road
- Route 125 - Gonic (recognizing the constraint of the bottleneck over the Cocheco River)
- Route 202 - East Rochester
- Route 202/Washington Street
- Route 202A

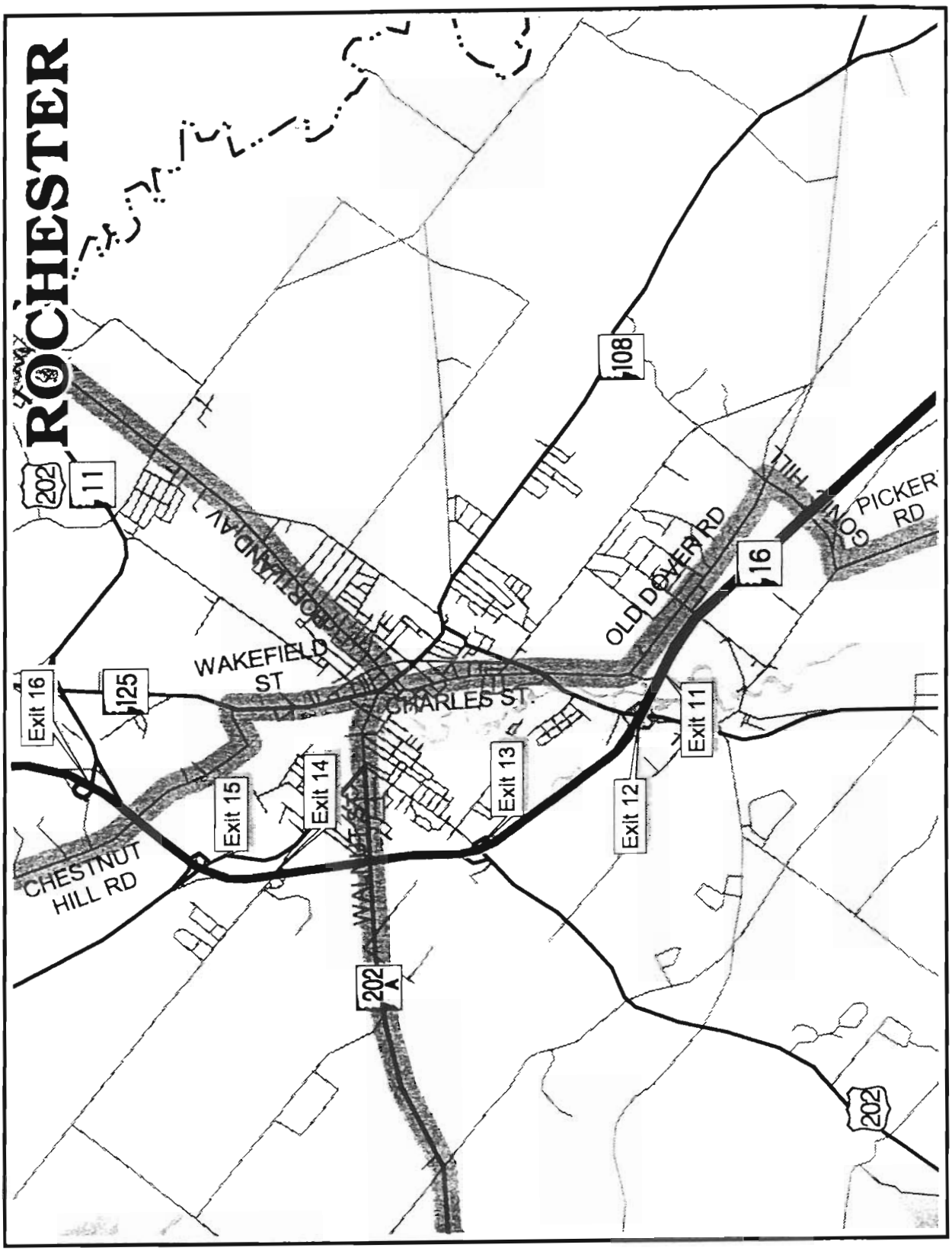
Collectors

- Betts Road
- Blackwater Road
- Chestnut Hill Road
- Cross Road
- Crown Point Road
- Dry Hill Road
- Eastern Avenue
- Estes Road
- Flagg Road
- Gear Road
- Governors Road
- Haven Hill Road
- Four Rod Road
- Franklin Street
- Little Falls Bridge Road
- Lowell Street
- Meaderboro Road
- Oak Street
- Pickering Road
- Portland Street
- Rochester Neck Road
- Salmon Falls Road
- Sampson Road
- Tebbetts Road
- Ten Rod Road
- Whitehall Road
- Whitehouse Road

Bicycle Projects

There are two special projects the City seeks to implement.

Map 3 State Bicycle Plan



Lilac City Greenway

Parts of this would follow the abandoned railroad corridor on the north side of Rochester known as the Farmington Branch Line. Much of the corridor has already been converted to a gravel way with gates excluding motorized vehicles. It would hopefully continue along the abandoned rail corridor through Farmington to the north. Links need to be created toward the south through downtown and on to the Somersworth and Dover line. See *Map 4 - Lilac City Greenway*. It includes these sections:

- Farmington Branch Line railroad corridor from Farmington line to vicinity of Wakefield Street
- Columbus Avenue from Wakefield Street to South Main Street
- Columbus Avenue from South Main Street to Upham Street
- Gonic Branch Path - Columbus Avenue from Upham Street to Lowell Street (this is currently funded and planned for construction in 2001)
- Abandoned corridor from Lowell Street to Old Dover Road (near present trestle). Alternatively, this might go down Lowell Street and through Hemlock/Juniper Streets.
- Bike lanes on Old Dover Road from trestle to Somersworth line
- Bike lanes on Pickering Road and/or bike paths along the old railroad corridor parallel to Pickering Road (if it could be resurrected)

Spaulding Loop

The City should work with NHDOT to establish a bicycle path within the right-of-way of the Spaulding Turnpike as part of the multi-million dollar Spaulding widening project between Exit 11 and Exit 16. This is a rare opportunity. The path could serve both transportation and recreation purposes effectively . This project might involve filling wetlands but if wetland impact can be minimized or mitigated this issue alone should not scuttle an undertaking with such broad public value. See *Map 5 - Spaulding Loop*.

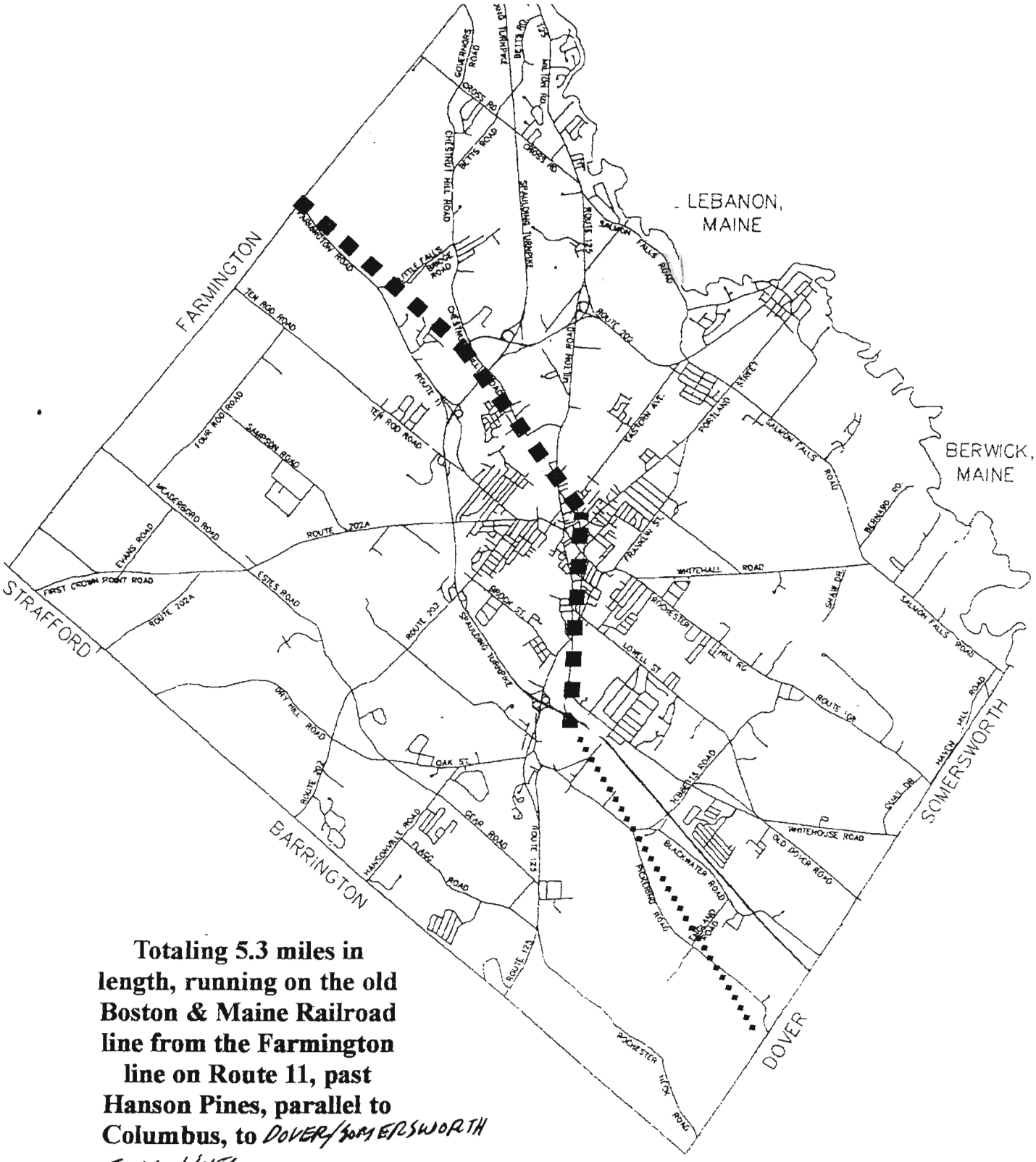
Public/Private Transit

Transportation Providers

Existing transportation providers in the area include:

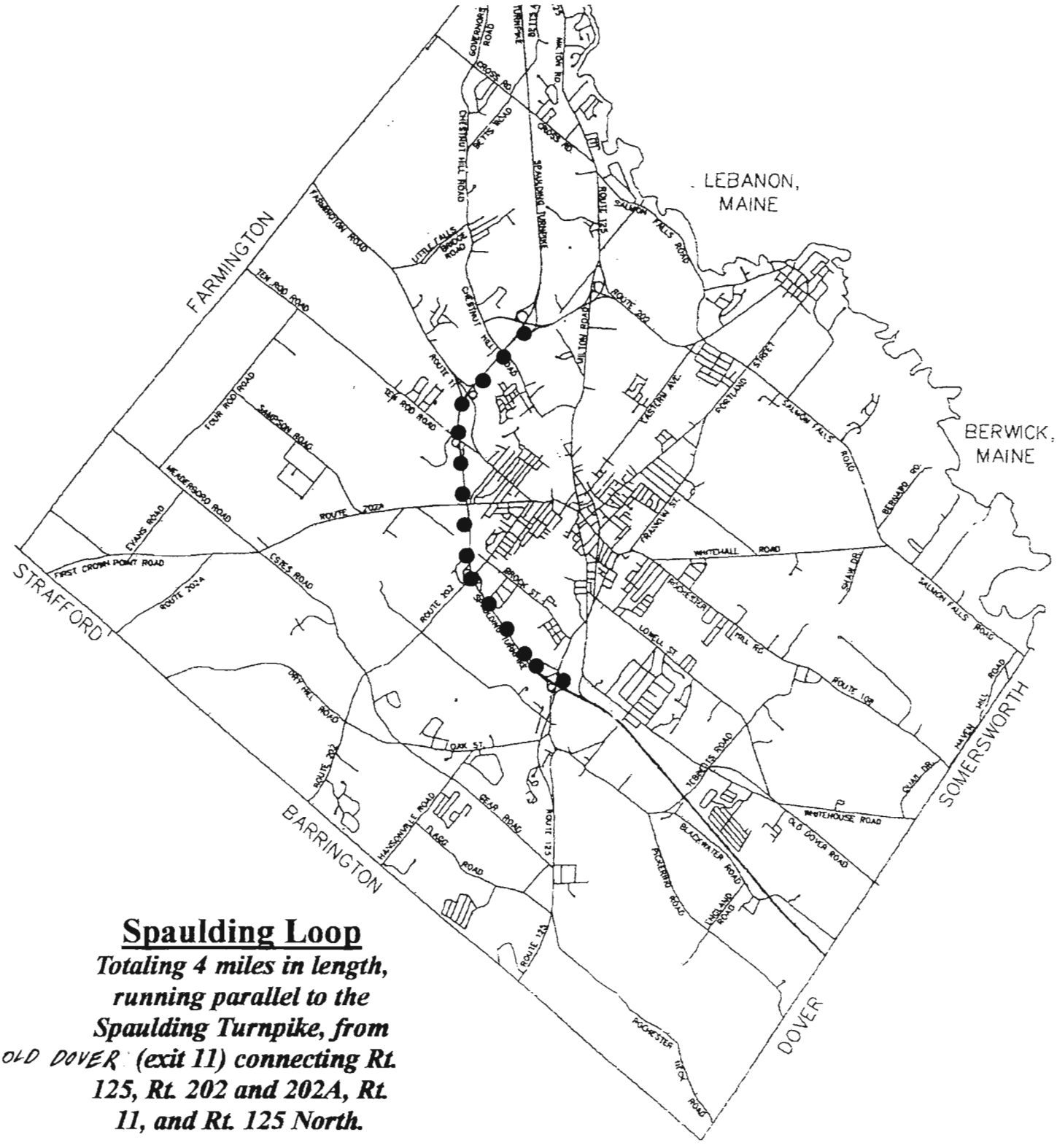
- *COAST* - Cooperative Alliance for Seacoast Transportation. COAST is a non-profit transit organization that serves Southeastern NH. Two of its routes cover Rochester.
- *University of New Hampshire Wildcat Transit.* Wildcat provides fixed bus routes for the use of UNH students, staff, and faculty. Presently, the routes cover Newmarket, Dover, Portsmouth, and Durham.
- Private taxicab companies both within and outside of Rochester. The Town of Exeter developed a demand response program where the town subsidizes taxi service for certain residents. Rochester should investigate that implementing a similar program.
- Special population services. In Strafford and Rockingham Counties there are numerous human service agencies that provide transportation services for their own clients.
- Vans operated by private businesses. It is likely that a number of local companies have vans that might be more efficiently utilized or coordinated
- Private bus companies. This includes C&J Trailways, Vermont Transit, and Coach

Lilac City Greenway



Totaling 5.3 miles in length, running on the old Boston & Maine Railroad line from the Farmington line on Route 11, past Hanson Pines, parallel to Columbus, to DOVER/SOMERSWORTH TOWN LINES

Spaulding Loop



Spaulding Loop

Totaling 4 miles in length, running parallel to the Spaulding Turnpike, from OLD DOVER (exit 11) connecting Rt. 125, Rt. 202 and 202A, Rt. 11, and Rt. 125 North.

Company, none of which now serve Rochester. The City should explore the viability of them expanding into Rochester. C & J Trailways operates from Portsmouth in a new intermodal facility at the south end of Pease International Tradeport. C & J operates 13 round trip runs per day between the Tradeport and Logan Airport via South Station. Vermont Trailways (a subsidiary of Greyhound Bus Lines) operates a fixed route from Portland to Boston via downtown Portsmouth. The company provides service to other New England cities and places beyond. There is one private coach system—the Coach Company—that operates in the Seacoast.

COAST

The City should examine whether different routes or schedules would better serve the employment, shopping, or recreation needs of Rochester's citizens. Perhaps service should expand to include Saturdays.

In the Community Survey 7 % said they ride the COAST bus (vs. 93% who don't), 19% said they would ride it more if it ran more frequently or along different routes (vs. 53% who would not). Nonetheless, 42% supported providing assistance to COAST (vs. 24% who oppose it). While there is presently a relatively low level of ridership in Rochester, the City should continue to give strong support COAST, both financially and in other ways. Typically, public transportation agencies outside of major cities struggle but they offer an important public service in terms of reducing road congestion, enhancing environmental quality, and assisting populations which are often vulnerable.

Para-transit

The Community Forums and Community Survey indicated a need for a coordinated program by the City's various para-transit providers to meet the needs of individuals who do not drive. The human service agencies referred to above provide transportation for employment, shopping and medical care for their clients. The following 12 have offices in Rochester and the first three are located in the Rochester Community Center.

- Strafford County Head Start,
- Strafford County Community Action,
- NH Department of Health & Human Services,
- Developmental Services of Strafford County,
- Homemakers of Strafford County,
- Rochester Child Development Center,
- The Rochester Youth Connection,
- Safe Place,
- St. Charles Children's Home,
- Salvation Army,
- Stafford Guidance, and
- Victims, Inc.

It is possible that some of these services could be coordinated on a joint demand response basis. Developmental Services, with about a dozen vans and a mini-bus, received a federal grant to explore providing greater transportation services in Strafford County, including Rochester. COAST recently completed a study to determine the likelihood of greater coordination amongst the various social

service agencies throughout the Seacoast area. Although there appears to be interest by some of the agencies to work more cooperatively, to date there has not been much progress. There are various models for a coordinated approach. It would probably involve a staff person hired by COAST, the City, the regional planning organizations, or a consortium of agencies. This could work over a tri-city area - Rochester, Dover, Somersworth. Human service providers tend to focus on their own client group. There are questions of liability, cost sharing, and administrative complexity that must be resolved to make such a program workable.

Intra-city Transit

Several years ago the City of Rochester received a federal CMAQ (Congestion Mitigation Air Quality) grant to establish an *intra-city* transit program. With the assistance of Joe Follansbee, former director of COAST, the City explored creating a "pulse" program that would utilize a small fleet of vans or small buses. Runs would be made over several routes back and forth from a central base enabling riders to transfer from one line to another. Unfortunately, in spite of generous federal funding that would cover the purchase of a fleet it was determined that the program would not be viable in the long term based on projected ridership and fee revenue without significant City subsidies. It is unlikely that such an intra-city transit program could be viable any time in the near future.

Land Use Considerations

Development patterns including location, density and project design have a significant impact on the transportation system and choice of travel mode. Conversely, transportation developments in outlying areas induce far flung growth. When different land uses are segregated (single family, multifamily, commercial, etc.) more automobile trips are required than if certain uses are mixed, enabling people to walk or ride bicycles between destinations. Likewise, low density development inhibits transit as a certain level of concentration is needed in the vicinity of potential transit nodes.

Furthermore, as centers for work, shopping, and recreation become further removed from residential areas, driving distances increase potential for congestion on collectors and arterials. The nature of conventional suburban development also favors the automobile rather than other modes: large setbacks, lack of sidewalks, and oversized parking areas in front of buildings discourage people from walking.

Over the past 50 years development patterns and to a large degree people's lifestyle choices have evolved to demand a near total dependency on the single occupancy automobile. It is recognized that the automobile will continue to be the dominant mode of travel in the region. Nonetheless, changes in land use and transportation planning that support alternatives to this mode could have a positive effect on the environment, the nature of sprawl, the character of our communities, the cost of providing services, and residents' quality of life[12].

Transportation Demand Management

Alternative modes of commuting can be encouraged through Transportation Demand Management (TDM) programs. TDM is a transportation planning tool aimed at relieving traffic congestion and air quality degradation through the reduction in single-occupancy vehicles. The challenge is to offer options that are attractive to workers. It is often implemented by employers at individual worksites or by organized groups of employers including approaches such as:

- flextime or staggered work hours to reduce peak hour trips
- carpooling
- van pooling
- policies encouraging workers to walk or ride bicycles to work
- telecommuting

NHDOT Rideshare Program

The NHDOT coordinates a statewide Rideshare program. The coordinator maintains a database of potential ridesharers and relevant information, utilizing computer software to match individuals interested in carpooling or vanpooling. and has also undertaken some marketing efforts to promote the service and alternative commute options in general. The program has had mixed success.

Employer Outreach

Some regional planning commissions make site visits to employers to disseminate information about the New Hampshire Rideshare Program and other TDM initiatives and to educate employers about alternative commute options[13].

Park and Ride

NHDOT administers the Park and Ride program in which a parking lot is set aside for commuters who then car pool or take public transit to other destinations. The NHDOT builds facilities as needed throughout the state. Ideally, they are set up along major routes close to services such as shops, shelters, telephones, and bicycle racks. Presently, there are facilities in Portsmouth, Somersworth, Barrington, and Lee but none in Rochester. Optimal sites would likely be located close to Spaulding Turnpike entrances as well as in the downtown area.

The City should explore creating a multi-modal transportation center near the center of the city which could include a COAST stop, park and ride, connection point for para-transit, and other services. There are several relatively undeveloped parcels of land located on the easterly side of Columbus Avenue in the vicinity of City Hall which might serve this purpose.

Special Topics

Class VI Roads, Private Roads, and Shared Driveways

Class VI Roads

The Planning Board developed a draft policy to discourage virtually any development on a *Class 6* road other than a single family house on an existing lot, with some gravel road upgrade as necessary. This approach has been endorsed in concept. See *Appendix 15 - Planning Board Draft Policy for Class VI Roads*. It has not yet been fully adopted by the Planning Board because several questions must be answered about the precise implementation of the relevant state law regarding Class VI roads.

Class VI roads which remain as narrow gravel ways may be important recreational assets and reinforce a rural character. Notwithstanding the expense of maintaining them for abutting property owners who may be responsible for maintenance (periodic regrading and dust control), from an aesthetic point of view it is desirable that they remain unpaved.

Roads that are believed to be Class VI include the following. All are gravel roads.

- Bickford Road (southwesterly section)
- Chamberlain Street Extension
- Dry Hill Road (northwesterly section)
- Elmo Lane
- England Road (section west of Pickering Road)
- French Hussey (southeasterly section)
- Old Ox Road
- Old Ten Rod Road
- Old Tebbetts Road (portion)
- Wadleigh Road (section west of Anchorage Inn)
- Walnut Grove Road
- a road adjacent to Hart Street

The following are Class V but gravel roads:

- Bickford Road (a portion of the gravel section is Class V)
- Evans Road
- Evans Road Extension
- French Hussey (a portion of the gravel section is Class V)
- Harry Street
- Laura Drive
- Peasley Road

Private Roads

It was the consensus of the Transportation Committee that *private roads* should not be permitted, or at least should be discouraged. In theory, allowing this option for developers is appealing. Private roads can allow for creative and flexible design such as narrower, neighborhood oriented streets and alleys and gravel roads in rural areas. Plus the City can benefit from a tax perspective since it would not be

responsible for maintenance. The major stumbling block is that, in spite of clear covenants and subdivision conditions, all too often lot owners (sometimes first generation but more commonly subsequent owners) have a different opinion about the relative charm of private roads vs. the burdens of maintaining them and put undue pressure on the City to acquire substandard roads and upgrade them at taxpayer expense.

However, accommodating private roads is appropriate in certain cases such as a large Planned Unit Development where there are assurances that they will remain private in perpetuity. Furthermore, certain types of roads such as alleys or rural lanes add character to a project but the City might not wish to accept responsibility to maintain them. In any case where a private road is permitted, there should be clear: a) maintenance standards, b) legal arrangements to ensure their maintenance among the various abutters, c) notification to all present and future abutters that the road is private, and d) assurances that the road will remain private in perpetuity unless it is first brought up to city standards at private expense.

The roads in mobile home parks would appropriately be considered private roads. Other than those there are only a handful of private roads in the city including Butterfly Lane, Levi Street, Deerfield Court, Julia Avenue, Levi Street, and Violet Circle (it is uncertain whether there are others at this time). There are numerous shared driveways, many private drives serving townhouse and apartment complexes, and several long private drives serving 1 property which have their own road name but none of these should technically be considered a private road.

Presently, while there is no explicit ordinance prohibiting private roads but they are discouraged in various ways:

- The Zoning Ordinance requires frontage on a public street (this alone does not necessarily preclude private roads for in some situations proposed lots would have frontage on an existing collector or arterial but a new private road would be built to provide access)
- Generally, the informal City policy is to discourage private roads
- The Planning Board has discretion in promoting what it considers proper planning through the Subdivision Regulations
- Numerous practical concerns - including utilities, maintenance, liability, access, emergency access, drainage - are difficult to address

Shared Driveways

Shared driveways should be acceptable as long as each lot has frontage. The Transportation Committee recognized that under certain circumstances it may be reasonable to allow 2, 3, or perhaps even 4 lots to utilize a shared driveway (rather than for each to have direct access onto a public road) if there are compelling topographic, design, or other reasons. In special circumstances it might appropriate to allow for 2 or 3 lots without frontage or without sufficient frontage ("flag lots") to be developed where there is a significant public interest. For example, in a case where a large tract of land is proposed for subdivision and the only way to support the cost of extending a City street is to subdivide into many lots it might be preferable to allow for a certain number of limited lots to be created off a shared driveway without adequate frontage.

Differentiating between a private road and a shared driveway is to some extent a judgment call. A curb

cut located off a collector road at the boundary between two lots which immediately branches to serve two single family homes on the respective lots, and where each lot owner possesses an easement to use the common access way would clearly be considered a shared driveway. On the other hand, a roadway owned by a Homeowner's Association which lies within a commonly owned 50 foot right of way and which serves 30 houses is clearly a private road. Generally, where there is a separately platted right-of-way (as opposed to an easement crossing one or more lots) and where numerous lots are served the access way would be considered a private road.

Truck Traffic

The City of Rochester has engaged in an ongoing debate about truck traffic the last few years. A number of Rochester residents have objected to commercial truck traffic in residential areas and requested that certain roads be closed. On the other side, members of the trucking community have stated that they have a right to use any public streets and that closing roads would not be effective.

The roads shown below are currently closed to through trucks. It is emphasized that all efforts to regulate trucking have only addressed through trucking. Any truck which has an origin or destination on a closed road has not been affected.

- Autumn Street, East Rochester (restricted from 7 p.m. to 6 a.m.)
- Charles Street
- Church Street, Gonic
- Flat Rock Bridge Road
- Hillcrest Drive
- Hillside Drive
- Juniper Street
- Roy Street
- Sunset Drive
- Chestnut Hill Road (a portion)
- Franklin Street
- Portland Street (a portion)
- Main Street, East Rochester

In 1998 City Council closed Chestnut Hill Road (a portion); Franklin Street; and Portland Street (a portion)/Main Street, East Rochester to *through* trucks—Class 8 and above. See *Appendix 16 - Federal Highway Administration (FHWA) Classifications* for identification of different vehicle classes. These were intended to be closed on a temporary basis pending an analysis of the affects of the closure, but have remained closed. The City adopted a process to identify roads to close to through truck traffic. See *Appendix 17 - City of Rochester No Through Truck Policy.*

The Transportation Committee established a Truck Traffic Subcommittee to develop a plan for truck traffic. The issues related to four basic areas:

- Safety
- Delivery of Goods and Services

- Inadequate Signage
- Through Truck Routes

The Committee met several times and also met with State officials to discuss various proposals to address those issues. The Committee's recommendations (with some modifications) are as follows:

1) Establish a Through Truck Route as shown on *Map 6 - Recommended Truck Routes*. (The NHDOT has stated support in principle for the proposed routes.)

2) Establish a sign program for truck routes. (The NHDOT was not supportive of the Truck Subcommittee's preliminary proposals for signage.)

3) Stipulate that new businesses that use commercial trucks provide a truck route plan for those trucks as part of the site plan approval process.

4) Seek to obtain from all existing businesses that use commercial trucks a truck route plan using the established Truck Routes and other routes developed by the Public Works, Police, and Planning Departments and the New Hampshire Department of Transportation (NHDOT).

5) Re-evaluate all streets currently closed to through trucks based upon the *City of Rochester No Through Truck Policy* and this master plan. Any areas connected with the State system should be reviewed with NHDOT during the evaluation. Make any proposed closures consistent with applicable state and federal law including the following "No State shall enact or enforce any law denying access within 1 road-mile from the National Network using the most reasonable and practicable route available **except for specific safety reasons on individual routes** [bold added]." See *Map 7 - National Network of Highways*.

6) Place better signage for roads that are presently closed. Drivers who are not familiar with the closed roads often don't realize they are closed until after turning onto them. Signs should be placed in both directions of main roads leading to closed roads warning drivers not to turn.

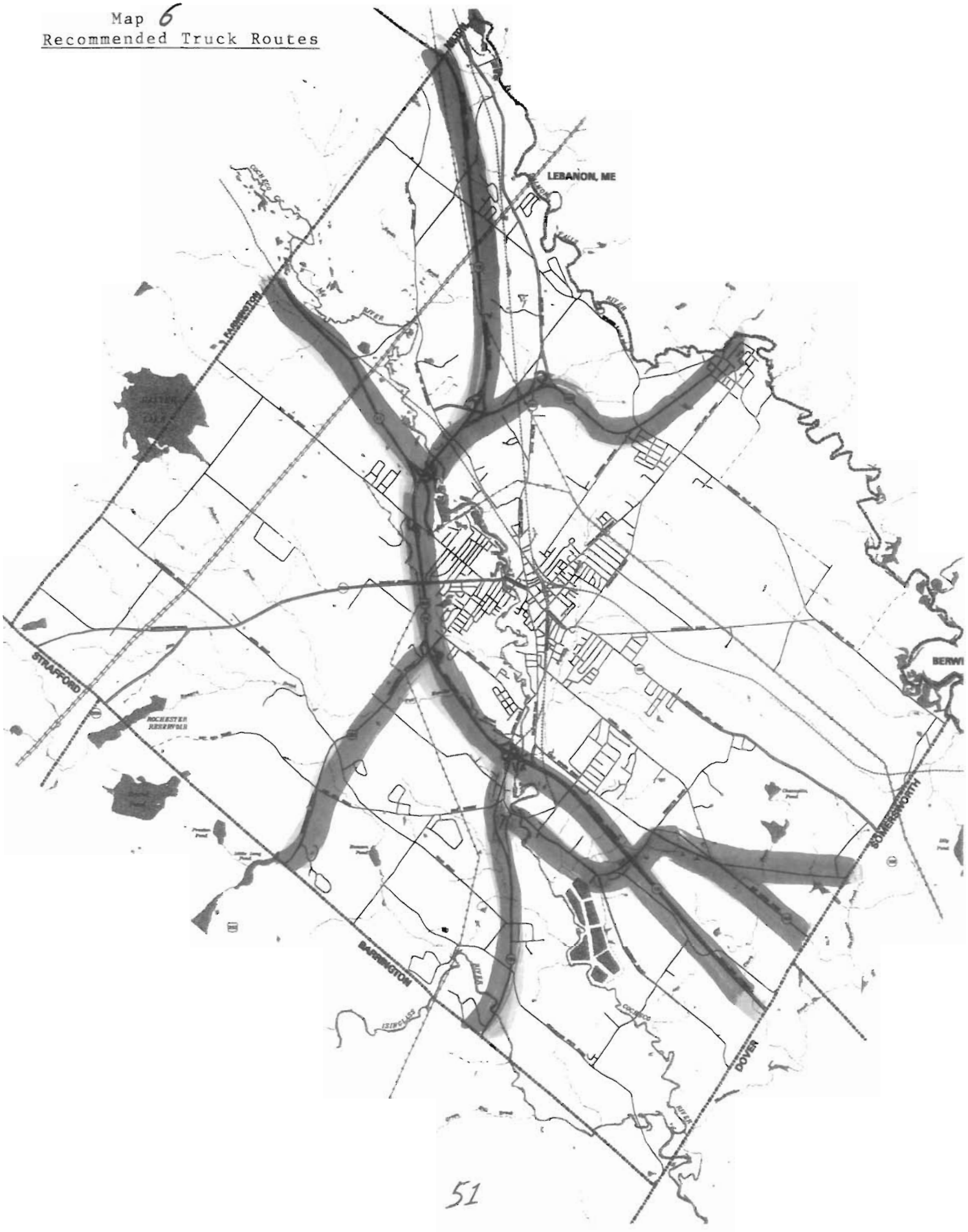
7) Work with the NHDOT to improve directional signage on the State system.

8) Adopt an emergency re-routing plan for all major arterials ASAP.

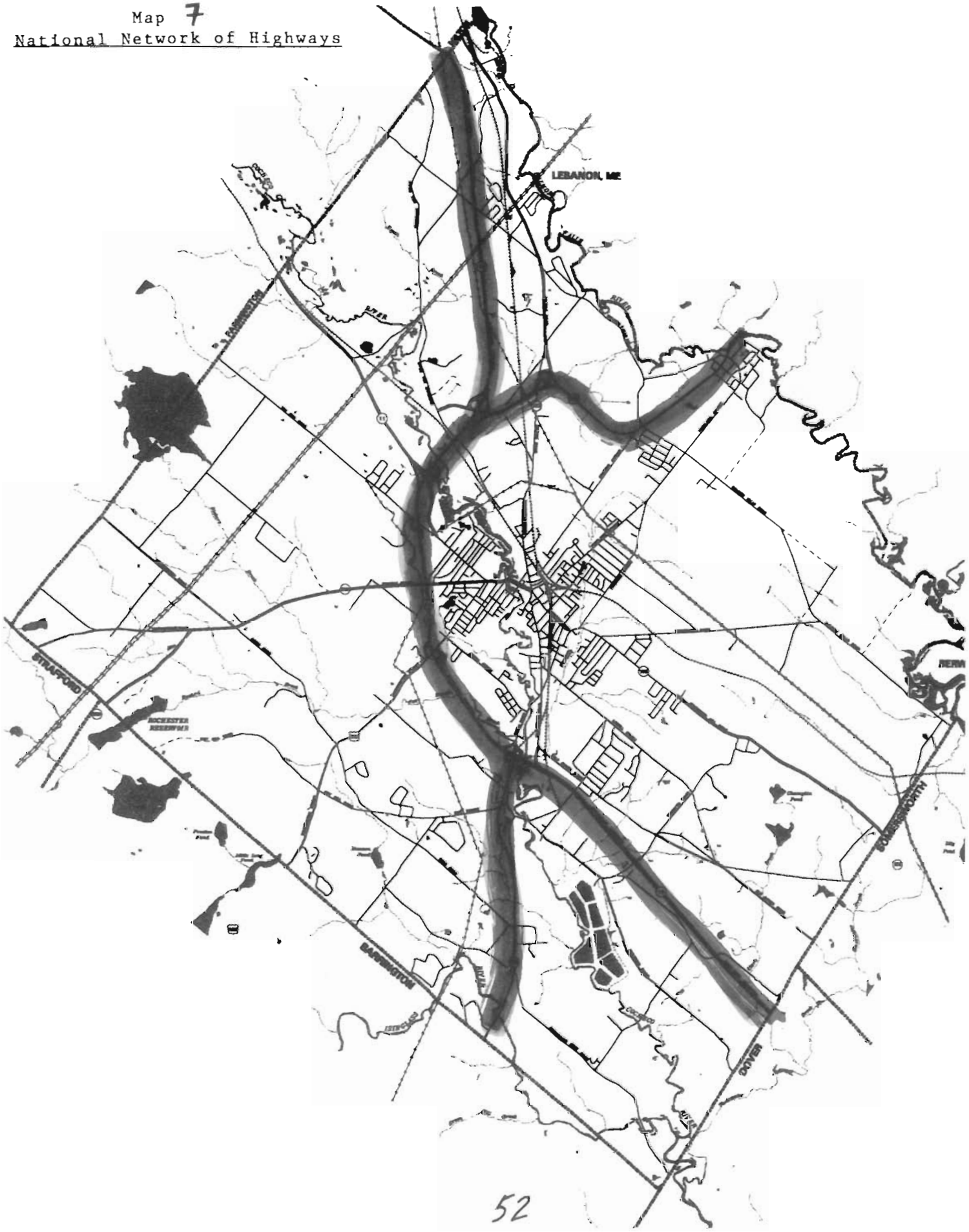
9) The Police Department should rigorously enforce existing traffic regulations, Speeding and reckless driving are of particular concern. This may require additional funding for traffic enforcement personnel.

10) A containment system in the vicinity of the Rochester Reservoir should be devised to protect all present and potential future public water sources from spillage from trucks.

Map 6
Recommended Truck Routes



Map 7
National Network of Highways



Parking

In 1997 the City Council Public Facilities Committee conducted a City-wide parking study (*Public Facilities Parking Report*, October 1, 1997) to inventory and evaluate parking and develop parking strategies for a ten-year period to address City government and school needs. See *Appendix 18 - Parking Report Executive Summary*. Also, see *Table 12 - Inventory of Greater Downtown Parking*, below.

The parking study conducted by the City concluded that there are sufficient parking spaces to meet current demand in the downtown area. If downtown employees park in off-street lots, there should be sufficient on street parking for customers. Most of these lots are within a three to five minute walk of all downtown businesses. The City is also considering the use of a parcel on Charles Street for additional parking. Should more parking be required for special events, the school and community center lots and the area business lots with prior agreements could be used.

Table 12
Inventory of Greater Downtown Parking

Facility	Spaces
Downtown Municipal Lots	
City Hall Parking Lot	120
Columbus/Hanson Parking Lot	22
Columbus/Portland Parking Lot	23
Congress Street (corner) Parking Lot	35
Congress Street (near Main Street) Parking Lot	32
Gene Laroche Park Parking Lot	46
Library Parking Lot (shared with Friendly's)	100
River Street Parking Lot	25
Union Street Parking Lot	108
Subtotal:	511
Downtown On Street Parking:	223
Total Downtown Parking:	***734***
School and Community Center	
Spaulding High School (front)	147
Vocational Tech (front)	117
Vocational Tech (rear)	90
Community Center	211
Total School and Community Center:	***565***

While access to sufficient and well located parking within downtown areas is vital, poorly designed and located parking lots can be harmful to the essential pedestrian character that is the lifeblood of downtowns. Surface parking should be carefully regulated to ensure it does not harm the streetscape: parking lots should be located at the rear of buildings, densely screened if located at the side of buildings, or situated at peripheral lots. Core pedestrian areas such as the block of North Main Street between Wakefield and Union Streets should have buildings fronting directly and continuously along the street and no surface parking fronting on the street.

It is recommended that a consultant develop a parking plan to accomplish the following:

- Develop a strategy for optimal utilization of each facility in terms of short term vs. long term, allocating spaces to particular users, leasing spaces.
- Develop a fee structure for various on street and off street facilities
- Develop a sign program to direct motorists to lots and orient them within lots
- Coordinate with private lot owners for appropriate shared use of facilities (the successful agreement between the City and Friendly's Restaurant is a model).

- Ensure an attractive and efficient pedestrian connection between parking areas and downtown destinations.
- Explore the long term viability of building a parking garage downtown. It is unlikely, however, that one is feasible in the near future as there must be substantial demand within a downtown to support one. The cost is estimated at $15,000 per parking space.

Scenic Ways

Scenic ways are roads usually in rural, relatively undeveloped sections of Rochester where the landscape is either densely wooded alongside the road or open to views across rolling fields or agricultural lands. They may also contain significant historic, cultural, or ecological resources.

The following roads were identified by the Transportation Committee as possessing significant scenic value:

- Blackwater Road
- Chesley Hill Road
- Chestnut Hill Road (north of Turnpike)
- Crown Point Road
- Evans Road
- Four Rod Road
- Meaderboro Road
- Pickering Road
- Rochester Hill Road
- Salmon Falls Road (south of Whitehall)
- Sampson Road
- Sheepboro Road
- Ten Rod Road
- Walnut Street

Policies should be developed to protect their scenic quality including such measures as the following:

- protecting stone walls,
- burying overhead utility lines (of course recognizing prohibitive cost in many cases)
- establishing natural/wooded buffers along the road,
- carefully zoning these areas for low intensity uses rather than for higher impact commercial and automobile oriented uses,
- encouraging cluster development to preserve views - by concentrating development on a given tract of land away from the scenic area.
- requiring longer frontage and larger lot sizes
- stipulating deeper setbacks on wooded parcels
- limiting curb cuts such as by shared driveways and directing access points to be located off side roads
- avoiding installation of left and right turn lanes and large turning radii into new roads and driveways - which results in loss of roadside vegetation and a wide expanse of pavement -

except where traffic volumes are compelling

Scenic Roads (State Program)

The state has a program for designating Scenic Roads by local option under RSA 231:157. Trees 15 inches in diameter or greater may not be cut nor stone walls removed along Scenic Roads as part of any road improvement or utility project without Planning Board approval. At a minimum the roads listed above should be submitted for designation as Scenic Roads. This designation does not apply to state roads so Crown Point Road, Meaderboro Road, a portion of Pickering, Rochester Hill Road, and Walnut Street would not be eligible.

Rail

New Hampshire Northcoast

The only railroad line through Rochester now is the "short line", a spur owned by New Hampshire Northcoast. Northcoast owns the line down to its juncture with the Guilford line which runs to Boston. The company operates about 41 miles of rail from Rollinsford to Ossipee and makes two trips a day through Rochester. This section of the line has been upgraded.

New Hampshire Northcoast, which is owned by Ossipee Aggregates (a.k.a. Boston Sand and Gravel), delivers sand and gravel from Ossipee to Boston where it is used for the central artery project. Soon New Hampshire Northcoast will be hauling MBTA rail cars from Boston to its base in Ossipee for rehabilitation.

Economic Development

There is now one major customer in Rochester - Eastern Propane, which receives propane and oil at its large fuel farm at Tri-State Industrial Park on Northcoast Drive (behind Market Basket). The park also functions as a staging area New Hampshire Northcoast's operations.

Rail connections within Rochester are possible at Granite State Business Park, if the park expands, and at a potential spur at the new Mt. Waldo industrial subdivision which links Allen Street and Glenwood Avenue. The crossing at Mt. Waldo (at the end of Glenwood Avenue) is presently a private crossing. There are no lights or bars. The City is working with the developer and NH Northcoast to effect a full crossing in the future. The estimated cost is $125,000. The City has applied for state funds under the Hazard Elimination Program administered by NHDOT which involves 80% (state funds) and a 20% (local) match.

Passenger Service

It would be desirable to add passenger service to Northcoast's line. Passengers could be brought via its spur to connect with the new Amtrak service (below). Or, if Northcoast found a user north of Ossipee it might seek to upgrade the rail line to Conway, in which case there could be a market for tourist trains to that area.

Safety

Safety is an issue as there is a surprisingly long lead time for the train to come to a full stop. For example, when the train is moving at 30 mph along a level grade loaded with sand and gravel,

approximately 1-1/2 miles distance is needed to stop.

AMTRAK

AMTRAK is scheduled to commence service between Portland and Boston in 2001. This service will run along tracks currently owned by Guilford Transportation (formerly the Boston and Maine Railroad) Intermodal passenger stations will be established in Dover, Durham, Exeter, and Wells, Maine. One could potentially provide connecting bus and/or rail service to Rochester. At present there is no planned passenger rail service to or from Rochester. Fifty six percent of the Community Survey respondents supported seeking a rail link with the new line (vs. 20% opposed). Currently AMTRAK and Guilford Transportation are debating whether the speed limit should be 59 or 79 miles per hour. This decision would likely have an impact on the attractiveness of the service and thus ridership.

Skyhaven Airport

Skyhaven Airport, a stated owned general aviation airport is situated on Route 108 south of the core of the city. While the state maintains ultimate authority over the airport there is a local board, Skyhaven Airport Operations Commission (SAOC) which acts as a local advisory group. Presently, under a lease agreement, the facility is managed by a private fixed based operator (FBO) who assumes day to day responsibility. The facility is open 365 days a years.

Facilities and operations

There are three main uses for a general aviation airport: recreational (including flight training and sightseeing), business use, and scheduled commercial flights. It is a popular facility for recreational purposes and there are several aviation clubs that actively use the facility. A handful of area businesses regularly use the airport - Textron in Farmington (frequently to ship parts) and Irving Oil (about twice a month). The airport also serves as a medivac facility for Frisbie hospital and for nursing homes. There are no scheduled commercial flights out of Skyhaven.

The airport facilities include a 4,000 foot-long runway (there are plans to expand to 5,000 feet); a V-shaped taxiway system; a paved apron and ramp; a terminal building; hangars, T and conventional (5 state owned); and grass tie-downs. The facility also has radio-operated runway lights, a rotating beacon, a lighted wind cone and an off-airport non-directional beacon. Radar and communication services are available through Manchester Approach Control. Both Avgas and jet fuel are available.

Aircraft housed at Skyhaven range from light single-engine planes to small Lear jets to jet warbirds. There are about 100 flights per day (i.e. 100 trip ends at the airport; 1 round trip = 2 flights/trip ends).

SAOC and the Master Plan

SAOC, established by state legislation, serves in an advisory role to the NH Aeronautics Division but it has budgetary and hanger rent responsibility. The seven members of the Commission are representatives from the cities of Rochester, Dover, and Somersworth; the NH House of Representatives; the NH Senate; and the Governor's Office (2 reps).

Hoyle Tanner & Associates, Inc. is presently updating the Airport Master Plan under the auspices of the SAOC (though the firm is under contract with the Aeronautics Division). The plan will examine ways to expand the facilities of the airport and determine its long-term potential. According to

Frederick Hochgraf, member of SAOC, the prior 1994 Airport Master Plan focused on concerns of the Federal Aviation Authority (FAA). This is the first time the affected communities have actively participated in planning for the facility. See *Appendix 19 - Executive Summary for the 1994 Airport Master Plan* (the Airport Master Plan has recently been updated).

Conveyance of Airport

Legislation has been passed by the state authorizing relinquishing ownership of the airport. The state believes that - because it is the only state owned general aviation airport in New Hampshire and there are not enough resources to manage it optimally - efficiencies and expansion are best controlled at the local level.

The NHDOT has requested that the City assume operations and is offering the airport and surrounding land as a package. The City has requested an opportunity to review all relevant financial information prior to making a determination whether to accept the State's offer and on what terms. *If* the City elected to accept the airport one approach would be to establish an Airport Commission as a quasi-independent agency of the City and to hire a staff person to operate it (similar to the arrangement for Ice Arena).

Viability and expansion

Presently, the airport operates at an annual deficit of about $40,000 (not counting the free management it receives). Revenues are derived from hanger rent and sale of general aviation fuel.

There are presently about 60 aircraft based at Skyhaven (with 40 under cover in hangers) and a waiting list for hangers of 45. According to Frederick Hochgraf, a member of Skyhaven Airport Operating Commission (SAOC), airport viability would be assured with about 200 planes renting space on the ground. In order to accommodate that level of activity certain improvements would be required, notably a new ramp and parallel taxiway and expanded parking.

There is potential to increase the number of hangers (including some heated hangers), build an aircraft maintenance facility (perhaps in the northeasterly corner of the property), and establish an airport that is active 24 hours per day (runway lights presently work 24 hours), perhaps offering additional services such as a restaurant and shops, and other synergistic activities. Direct service to the adjacent Granite State Industrial Park should be explored. According to Mr. Hochgraf, Skyhaven's image is as a recreational airport but efforts should be made to boost its commercial role. Fifty seven percent of the respondents to the Community Survey said expansion of Skyhaven Airport is important (vs. 31% who said it was not).

Extensive wetlands on the site pose a significant impediment to expansion. There have been wide-ranging talks with the NH Division of Environmental Services to develop various scenarios for mitigation. It has also been noted that any new structures that might be built should be attractive and not block views of the runways.

Improvements related to airplanes (runway expansion, lights, etc.)are funded 90% by the Federal government. The 10% match can be cash or in-kind. If Rochester should assume ownership, however, the state contribution would drop to 5%. Mr. Hochgraf says that most general aviation airports in New Hampshire function at a level similar to that of Skyhaven.

Other Regional Facilities

Another small privately owned air facility - Little Brook Airpark - is located in Eliot, Maine that can handle small corporate and light aircraft as well as provide servicing and storage.

The closest major airport is at the Pease International Tradeport which is located about 15 miles to the south of the City off the Spaulding Turnpike. Pease offers limited passenger service as well as freight and cargo service. A new passenger terminal and customs and inspection center was opened in 1999 that serves international flights. The Tradeport is home to the NH Air National Guard and has a runway that can accommodate the country's largest commercial and military aircraft. It is expected that soon virtually all of Pease's capacity will allocated for scheduled flights. General aviation activity is discouraged in favor of the larger commercial operations.

Beyond Pease, three large regional airports all within one and half hours from Rochester - Boston's Logan Airport, Manchester Airport, and Portland International Airport - all serve national and international travel. Manchester Airport was expanded several years ago and is fast becoming a major northern New England regional facility.

Importance to Rochester

The airport is a valuable asset for Rochester in terms of:

- *Economic development*: Skyhaven is a special attraction in Rochester and bolsters the city's image. There appears to be a growing commercial interest in the airport. It can be used for area businesses in transporting executives, customers, supplies, and products. Many companies are now maintaining limited inventories and relying on real time operations, which periodically necessitates on-time shipments (such as for Textron).

- *Recreation*: The airport is a significant attraction for amateur pilots in Rochester and throughout the Seacoast area. It is ideal for flight instruction and sightseeing of the Lakes Region.

- *Public health and safety*: Skyhaven is occasionally used as base to fly patients to Maine Medical Center, Mary Hitchcock Hospital, and Boston area hospitals. It can be used as a staging area for disaster operations. Fire fighting can also be conducted from the air.

(Sources: Frederick Hochgraf and Sandra Keans, members SAOC)

Action Plan

1) Transportation Planning

a) Continue to actively participate in the Seacoast MPO planning process for regional transportation planning. Advocate for the City's interests through staff communications as well through participation in both the Technical Review Committee and Policy Committee of the MPO.

b) Continue to pursue funds from state and federal programs, including Transportation Enhancement (TE) and Congestion Mitigation and Air Quality (CMAQ) grant programs.

c) Work cooperatively with state district highway engineers on development projects that impact state roadways.

d) Participate with surrounding communities on regional projects that can benefit Rochester. (The Route 11 Access Management Study is an example.)

e) Adopt the state approved five dollar per vehicle registration tax assessment to help support transportation initiatives.

2) Basic Road System

a) Monitor the "Level of Service" at key intersections—such as the South Main Street/Columbus Avenue intersection—within the downtown core of Rochester to assure that the improvements recommended in the corridor studies achieve the desired results.

b) Continue to implement the recommendations of the two recently completed downtown corridor studies—the *South Main Street Corridor Study* and the *NH Route 125 Corridor Study*.

c) Continue to use the Road Surface Management System (RSMS) on a regular basis, in cooperation with UNH, as a tool for identifying and prioritizing roadway surface improvements.

d) Based upon RSMS continue to fund both routine and preventive roadway maintenance programs through the Operating Budget of the Department of Public Works.

e) Based upon RSMS prepare updated roadway capital projects and integrate into the City's Capital Improvement Program and annual capital budgets.

f) Revise the current road standards in the City's Land Use Code to reflect those delineated in this Master Plan (see Tables 7 and 8).

g) Establish an escrow fund as part of the City's capital improvement program to annually set

aside a specific amount of money for purchase of rights-of-way for future projects identified in the Corridor Studies and/or the MPO Long Range Plan.

h) Purchase additional right-of-way adjacent to roads and intersections to serve potential future projects when it is available (especially for Route 125).

i) Conduct a study to evaluate the impacts upon traffic flow and the health of downtown from converting the one way traffic pattern back to a two way traffic pattern.

3) Bridges

a) Continue to inspect local bridges on a regular basis (ideally every two years) and coordinate with NHDOT in its periodic inspection program.

b) Periodically inspect any local bridge that has been defined as structurally obsolete (e.g., Portland Street over Willow Brook). Seek funds for repairs or reconstruction through the State's Municipal Bridge Program.

c) Work with the NHDOT to assure that sidewalks over the Spaulding Turnpike bridges (at Route 11 and at Tebbetts Road) are maintained.

d) Work with the NHDOT to assure that state bridges that are rebuilt or reconstructed provide adequate space for sidewalks and/or bicycle lanes.

4) New Roads

a) Continue to explore options to alleviate congestion in downtown Rochester such as through bypasses.

b) Clarify whether the land along the old Two Rod Road between Ten Rod Road and Farmington Road is still owned by the City of Rochester as a Class VI road or whether it reverted to the abutting land owners.

c) As site plan and subdivision proposals come forward the Planning Board should work with applicants to develop portions of the loop and service roads proposed for the westerly side of Route 11.

d) Examine the feasibility of a new road in the southeastern portion of the City to link Route 108 and Whitehall Road.

5) Access Management

a) Amend the City's Site Plan and Subdivision Regulations to incorporate access management standards discussed in this Master Plan and those recommended in the Route 11 Access Management Project.

b) Institute access management strategies on roads where land use and development patterns are currently causing, or have the potential to cause, congestion and safety risks. Such roads might include Route 11, North Main Street and Wakefield Street north of the intersection with Columbus Avenue.

c) Establish minimum spacing of access points on collector and arterial roads.

6) Healthy Streets

a) Work to maintain "skinny streets" within sensitive roads - those within residential neighborhoods, on older local roads, and in downtown areas.

b) Carefully manage design speed and geometry of roads to balance the needs of automobile traffic and traditional neighborhood character.

c) Be mindful of the policies promoted in the *Healthy Streets* section and *Appendix 11 - Street Design Guidelines for Healthy Neighborhoods* of this Master Plan.

d) Implement traffic calming methods identified in this plan, as appropriate, particularly on local roads.

e) Maintain the interests of the pedestrian in all transportation planning.

7) Sidewalks

a) Implement the recommendations in the Sidewalks section of this Master Plan. In particular, establish a planting strip for all new sidewalks (where there is sufficient right-of-way).

b) Where appropriate require developers to extend the sidewalk network.

c) Work with the Public Works Department to inventory all sidewalks in the City including location, length, width, material, and condition.

d) Establish a sidewalk plan for the City that is concentrated in the urban areas of downtown Rochester, Gonic and East Rochester and identify priorities for: a) rehabilitation of degraded sidewalks and b) locations for new facilities.

e) Explore a policy providing that sidewalks which are used less are either plowed later or not at all, or alternatively, that abutting property owners are required to shovel them.

8) Bicycling

a) Consider bicycles in all transportation improvement decisions for Rochester.

b) Be mindful of the design guidelines for all new bicycle facilities.

c) Work with NHDOT to establish the two major bicycle projects described in this Master Plan.

d) Assertively pursue discussions with the NHDOT to construct a bike/multi-use path adjacent to the Spaulding Turnpike as part of the impending widening project.

e) Provide convenient public bicycle parking in the downtown area that is linked to pedestrian, bus stop and parking facilities.

9) Public Transit

a) Continue to support the COAST transit system through participation on the COAST Board of Directors and financially through the City's operating budget.

b) Investigate a connection from Rochester to the intermodal transportation center in Dover with SRPC and the City of Dover as part of passenger rail service from Portland to Boston. Continue to seek passenger rail service through Rochester.

c) Explore with COAST whether changes in routes or schedules are appropriate.

d) Explore creating a transit center. This could be somewhere in proximity to Columbus Avenue (for example, near the Bennett Shoe property) which would include a rail stop, a COAST stop, a park and ride, bicycle storage, and some retail/office use.

e) Work with COAST and SRPC to support a transportation coordinator to work with Rochester's and the region's social service agencies to more efficiently coordinate para-transit services the area's special needs population.

10) Transportation Demand Management

a) Amend the City's regulations to require trip reduction for large developments through the use such techniques as increased Floor Area Ratios[14] tied to limits on peak hour trip generation.

b) Encourage use of TDM initiatives such as flexible work hours and ride share programs.

c) Require a traffic impact analysis in the City's subdivision and site plan regulations for any development that exceeds a certain threshold, such as 50 vehicle trips in any one hour.

d) Through the Land Use Codes promote a mix of uses that will encourage walking and bicycling as an alternative to the single occupancy vehicle.

e) Amend the City's Site Plan Review Regulations to require that medium and large development projects incorporate planning for transit, bicycling, and walking.

f) To the greatest extent possible, preserve railroad right-of-ways and, as appropriate, other

corridors, for future transportation use as multi-use trails, bicycle paths or other alternative modes of transportation.

11) Truck Traffic

a) Establish a system of truck routes within the City as delineated in this plan.

b) Work with local businesses to establish individual truck routing plans.

c) Implement a sign program and commercial driver data base to assist the routing of commercial vehicles into and around the City.

d) Amend the Site Plan Regulations to require applicants to submit delivery truck route plan.

e) Adopt other recommendations of the Truck Traffic Subcommittee, as appropriate.

f) Install additional signs for roads which are closed/will remain closed to warn drivers prior to turning onto the closed road.

g) Develop a policy to oversee the overnight parking of commercial vehicles (such as those exceeding 29,500 pounds of gross vehicle weight) within the city. The particular concern is vehicles which might contain hazardous materials.

12) Parking

a) Continue to monitor the parking situation in the downtown areas of Rochester, Gonic and East Rochester to ensure that there is sufficient capacity to meet the needs of citizens and visitors.

b) Hire a consultant to develop a downtown parking plan to analyze signage, inventory, and parking management (long term, short term, leased spaces, meters, chalking tires, etc.).

c) Investigate the long term feasibility of a parking garage downtown.

d) Remove off street parking requirements from the Zoning Ordinance and retain them in the Site Plan Regulations. Ensure that there is flexibility in design, layout, and number of spaces.

13) Rail and Air

a) Work with New Hampshire Northcoast in the following areas:

- Seek passenger service in the future through Rochester
- Establish a link with the upcoming Portland-Boston passenger service.
- Improve railroad crossings through Rochester - installation of lights and bars where necessary
- Establish commercial/industrial connections within Rochester along the short line, at

existing spurs, or at new spurs
- Continue to address safety concerns, mainly regarding speed
- Work to strike a balance between the benefits of high speed trains (shorter trips) and low speed (presumably enhanced safety for people on the ground)

b) Continue to participate in the planning for Skyhaven Airport and ensure that the City continues to be served by the facility in a cost effective manner.

c) Explore creative ways to enlarge the scope of the airport including ancillary services and synergistic activities (such as restaurant and shops).

d) Work to resolve wetlands and other issues impeding expansion of the airport. For example, explore joint wetlands mitigation with NHDOT for the Spaulding Turnpike expansion.

e) Explore City acquisition of the airport if it is financially self supporting.

Endnotes

1. Surveys were distributed as follows:
   Citizens - 500 surveys were mailed to citizens selected at random.
   Chamber of Commerce - Approximately 425 surveys were mailed, one to each member.
   Stakeholders - Approximately 200 surveys were mailed to elected and appointed officials and others identified as active citizens.
   Mixed - Surveys were available at City Hall for anybody to fill one out.

2. According to A Hard Road to Travel by Bernard Waugh, Esq.

3. Students Karen Adams, Timothy Opgenorth, Michael Rosenthal, and William Smith completed an in depth study February 21, 2001 now on file in the Planning Department.

4. Urban roads are weighted somewhat more toward access than their rural counterparts.

5. Travel lanes are 11 or 12 feet wide, bicycle lanes are 3, 4, or 5 feet wide (preferably at least 4), parking lanes are 8 feet wide

6. The policy of the Public Works Department is that all city streets have a minimum paved width of 24 feet. The Healthy Streets approach (see section, below) advocates for "skinny streets" narrower than 24 feet (unless parking is included) which should be explored subject to Public Works concerns. Narrower streets are desirable in terms of promoting neighborhood character and calming traffic. A 7 or 8 foot wide parking lane is appropriate on 1 or both sides of the street in dense urban neighborhoods. It should be provided where it is likely to be used regularly due to the density of the neighborhood and limited provision of off street parking.

7. There are minimum statutory speed limits must be met. Nonetheless, it is appropriate to establish design speeds based upon desirable traffic speed.

8. From "Street Design Guidelines for Healthy Neighborhoods" by Dan Burden

9. From the "Smart Growth Checklist" produced by the Congress for the New Urbanism

10. From a brief paper entitled "Taming the Highway Through Town" by Mr. Qamar, an architect with the firm of Lennertz-Coyle & Associates, Portland, Oregon.

11. 1999-2020 Seacoast Metropolitan Planning Organization Long Range Plan.

12. 1998 Seacoast Metropolitan Planning Organization Transportation Plan

13. Ibid

14. F.A.R. is a standard measure of the intensity of nonresidential development and equals the square footage of building space divided by square footage of the site.

Suggested Reading/Websites

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TRANSPORTATION MASTER PLAN
APPENDICES

See companion document - City of Rochester, NH Transportation Master Plan

List of Appendices

Attachment
Third Community Forum

Traffic Congestion

Definition: Unreasonably slow (time & speed) movement of traffic due to high volume of vehicles, inadequate capacity, inefficient traffic patterns and/or lack of alternative routes.

Question:
What actions can the City take to reduce congestion and improve traffic flow? or "If I came to Rochester five years from today, what would I hope to see happening to improve the problem of traffic congestion in certain parts of Rochester?"

		Votes
1.	Construction of the "Ralph Torr" Bridge north of the Business District to connect North Main Street (Rochester Mall) and the Milton Road via Chestnut Hill Road (Lilac Mall).	10
2.	Provide more bicycle routes, along old trolley routes.	5
3.	Synchronization of the traffic signals on Route 125 from Gonic to Downtown.	5
4.	Implementation of a loop road/alternate routes around the downtown, e.g. from Haven Hill Road @ intersection with Route 108 to Salmon Falls Road @ Whitehall Road intersection.	4
5.	Completion of current state projects, such as widening of the Spaulding Turnpike north of Exit 11.	3
6.	Sidewalks, especially in Gonic and from Gonic north along Route 125.	3
7.	Keep industrial traffic out of residential areas, such as Railroad Avenue in Gonic and Portland Street in downtown.	2
8.	Redirect commercial traffic—revise truck routes.	1
9.	De-politicize planning process by having policies and procedures.	1
10.	Need major routes to be divided with turning lanes, e.g., Route 108 and Eastern Ave.	1
11.	Improve traffic signal at South Main and Columbus Ave..	1
12.	Commuter train from Rochester to Dover to take advantage of new Amtrak service.	1
13.	Pedestrian overpass at old RR grade between tolls and Exit11.	1

Other Ideas - No Vote

14. Widen Columbus Avenue from Portland to Wakefield Street
15. Improve Spaulding off ramps from Exits 13 through 16

Strategic Location Group

Definition: Rochester is a nice, affordable place to live with easy access into the residential and business areas of the City and egress to recreational opportunities and other amenities outside the City.

Question:

Can Rochester take advantage of its strategic location—close to ocean, lakes and mountains—on the Spaulding Turnpike to provide citizens and businesses easy access into and out of the City? or "If I came to Rochester five years from today, what would I hope to see happening to continue to allow citizens and businesses easy access into and out of the City?"

	Votes
1. Build connector roads at strategic locations to alleviate bottlenecks downtown.	7
2. Improve signage and lighting at key locations throughout the city, e.g. Route 125 and 16B; Strafford Square; South Main Street/Franklin Street; Portland, Main and Highland Ave.	7
3. Easier access to industrial parks for trucks.	4
4. Change mix of downtown businesses from retail to offices and/or residential.	3
5. Better use of Rochester's river system.	3
6. Promote use of Skyhaven Airport for commerce and recreation.	3
7. Larger variety of stores downtown.	2
8. Widening of Route 125 and synchronization of signals.	2
9. Better downtown bus access.	2
10. Develop an in-town public transportation system.	2
11. Improve the existing bus system.	1
12. Widening of other access points.	1
13. Develop high-rise downtown apartments.	1
14. Develop low-cost, convenient parking to facilitate commerce, arts and recreation opportunities in the downtown area.	1
15. Two-way traffic on North Main Street.	1

Other Ideas – No Votes

17. Establish Rochester a stop-over location.
18. Great and multiple access from the Spaulding Turnpike

Alternative Transportation

Definition: Any means of moving from one place to another by any means other than a single occupancy vehicle. Examples include: bus, taxi, bike, rail, water, pedestrian, car/van pool

Question:

What steps can the City take to ensure that there are more opportunities for its citizens to use alternative means of transportation? or "If I came to Rochester five years from today, what would I hope to see happening to in terms of opportunities for alternative transportation?"

	Votes
1. Establish a bicycle master plan.	7
2. Add sidewalks on busy streets (Routes 125 & 108, Washington, Eastern Ave., Whitehall, Portland).	7
3. Improvements to walking paths (pave—destinations such as schools, recreation areas, commercial areas).	5
4. Provide access to rivers (Isinglass @ Flagg Road; Cochecho @ Hanson Pines and Little Falls Bridge).	4
5. Small "Mini" bus system targeted to senior population.	4
6. Advertise the various modes of transportation.	3
7. Small bus service for the general public.	2
8. Implement Park & Ride at various locations--Spaulding.	1
9. More COAST bus stops with better identification of stops.	1
10. Land acquisition for bike corridors.	1

Other Ideas - No Votes

13. Encourage use of Skyhaven Airport.
14. Make motor vehicles pay a reasonable share of tax burden.
15. Establish organized car pooling with phone service; small vans—expand CAP program.
16. Install trail markings.
17. Encourage freight and passenger rail service.
18. Use of internet for advertising "ride-share".
19. Provide "interval" transportation links for multi-modal trips.

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Road Maintenance Group

Definition: To meet transportation needs requires a logical, systematic plan which has two components: (a) a periodic inspection & maintenance portion and (b) a long range road and sidewalk rebuilding program in order to provide safe and quality roadways.

Question:

How can Rochester afford to update, operate and maintain its roadways and other infrastructure (sidewalks, drainage, water) at satisfactory levels while still maintaining stable property taxes? or "If I came to Rochester five years from today, what would I hope to see happening to improve the problem of road and sidewalk maintenance in Rochester?"

		Votes
1.	Develop a long-range plan for road maintenance and rebuilding of roads that assigns costs and priorities for scheduling.	8
2.	Continue to pursue outside funding (state/federal grants, etc.) for road projects.	6
3.	Increase public input during the planning process. Encourage public comment by using a system similar to the E911 process.	6
4.	Develop detailed preventative maintenance program which helps extend the life of roads and lessens reliance on complete rebuilding of roads, but keeps them safe.	5
5.	Develop a long range plan for building and maintaining sidewalks throughout the city.	4
6.	Increase community participation in the actual maintenance of streets, e.g. cleaning catch basins, sweeping sidewalks, etc. Develop community groups to do this.	3
7.	Develop, expand, maintain parking lots around the city.	2
8.	Utilize betterment assessments to assist in funding of road construction.	1
9.	Develop a process to analyze the cost-effectiveness of using outside contractors vs. using city public works.	1

Other Idea – No Votes

10. Improve signage around the city

Appendix 2
Community Survey -*TRANSPORTATION*

All numbers below are percentages among total responses received from the 453 individuals who returned surveys. Color coded surveys were sent to four population groups including: a) 500 citizens selected at random from the voter's registration list; b) the 425 (approx.) members of the Rochester Chamber of Commerce; c) 200 (approx.) elected officials, and members of boards, commissions, and other organizations; and d) numerous citizens who picked up the survey at City Hall. (May 17, 2000)

Which of the following do you support, even if it involves some expenditure of tax dollars?

	Yes	No	Neutral/ No Opinion
Adding bicycle lanes to selected main streets	39	34	27
Building bicycle/multi-use paths (such as on abandoned RR's)	60	18	22
Adding sidewalks to selected main streets	68	10	22
Providing assistance to COAST public transit	42	24	35
Building the North Main - Chestnut Hill Connector	55	18	27
Seeking a rail link with the Portland - Boston line	56	20	24

Would you ride a bicycle more than you do now (if at all) if there were more bicycle paths/lanes throughout the city? Yes **37** No **46** Don't know **17**

Would you walk more than you do now (if at all) if there were more sidewalks and a linked trail system throughout the city? Yes **59** No **26** Don't know **15**

Do you ever ride the COAST bus? Yes **7** No **93**

Would you use COAST or other public transportation more if it ran more frequently or along different routes? Yes **19** No **53** Don't know **28**

Do you support the following?

	Yes	No	Neutral/ No Opinion
Requiring developers to build sidewalks in most new	68	14	17
Closing selected roads to through trucking	60	21	20
Changing the downtown traffic pattern back to two-way	28	52	20

Appendix 3
Issues - Transportation Committee

The following were stated by members of the Transportation Committee as being key transportation concerns (listed in no particular order) in a brainstorming session on March 27, 2000.

- congestion in the downtown
- all roads leading to the downtown
- congestion along major corridors
- lack of overall transportation planning
- how will the City deal with traffic problems in the future considering the current congestion
- growth of Pease Tradeport and impact on transportation
- how to deal with transportation problems in light of limited resources
- dangerous intersections
- inadequate road signage
- signage for downtown parking lots
- lights not being synchronized
- inadequate lighting along roads
- truck traffic
- safety of pedestrians
- establish more crosswalks and having motorists respect them
- establishing bicycle routes
- creating a bicycle friendly community
- public transit
- mobility for people who are marginalized (those without automobiles or who cannot drive)
- park and ride lots
- commuter rail line
- future of Skyhaven Airport

Appendix 4
South Main Street Corridor Studies
Recommendations

1. **South Main Street/Columbus Avenue Intersection**
   - Reconfigure the northbound Columbus Avenue Approach with exclusive left-turn, through, and right-turn lanes.
   - Provide larger radius for northbound right-turn truck maneuver (will require the acquisition of right-of-way).
   - Reconfigure the westbound South Main Street approach with an exclusive left-turn, through and shared through/right-turn lanes.
   - Modify traffic signal hardware and signal phasing/timing accordingly to provide a protected westbound left-turn phase.
   - Define parking areas with pavement marking and signage.

2. **South Main Street/Linden Street/Grant Street**
   - Reconfigure the eastbound South Main Street approach with exclusive left-turn, through, and right-turn lanes.
   - Reconfigure the westbound South Main Street approach as exclusive left-turn and shared through/right-turn lanes.
   - Move pole and remove island at end of Grant Street.
   - Convert Grant Street to one way leaving South Main Street.

3. **South Main Street/Common Street**
   - Reconfigure eastbound and westbound South Main Street approaches as exclusive through lanes.
   - Convert Common Street to one-way approaching South Main Street.
   - Reconfigure Common Street approach as exclusive left-turn lanes.

4. **South Main Street/Franklin Street/Pharmacy Driveway**
   - Reconfigure the eastbound South Main Street approach to provide exclusive left-turn and shared through/right-turn lanes.
   - Reconfigure the westbound South Main Street approach as exclusive left-turn and shared through/right-turn lanes.
   - Remove the island and move the utility pole at end of Franklin Street.
   - Reconfigure the southbound approach with exclusive right-turn and shared through/left-turn lanes.
   - Realign Franklin Street so that it intersects South Main Street at a near 90° angle.
   - Reconstruct the Pharmacy Driveway approach with curbing and striping which extends into the site.
   - Add conduit for future signals.
   - Monitor traffic operations for potential future signalization.

5. **South Main Street/Whitehall Road/Harding Street**

- Reconfigure the eastbound South Main Street approach to provide exclusive left-turn and shared through/right-turn lanes.
- Reconfigure the westbound South Main Street approach as exclusive left-turn and shared through/right-turn lanes.
- Remove the island and move the utility pole at end of Franklin Street.
- Reconfigure the southbound approach with exclusive right-turn and shared through/left-turn lanes.
- Realign Franklin Street so that it intersects South Main Street at a near 90° angle. Some widening of Franklin Street will be necessary.
- Reconstruct the Pharmacy Driveway approach with curbing and striping which extends into the site.
- Add conduit for future signals.
- Monitor traffic operations for potential future signalization.

6. **Three-Lane Section Along South Main Street**

Provide a three-lane section along South Main Street within the study area.

- This consists of a continuous two-way center turn lane with a single through lane in each direction.
- The center-turn lane converts to exclusive turn lanes at the major intersections (see intersection improvements).
- Widen existing pavement where necessary to provide wide (5-foot) paved shoulders on each side.
- Define parking areas within pavement markings and signage
- Reduce and/or combine the number of access points along South Main Street to the extent possible with curbing.
- Construct well-defined driveway access points and encourage the use of shared driveways where possible.
- Reconstruct the sidewalks along the south side of South Main Street from Columbus Avenue to Franklin Street.
- Reconstruct the curbing along the south side of South Main Street from Columbus Avenue to Whitehall Road

Appendix 5
Route 125 Corridor Study Recommendations

1. **NH Route 125/Brock Street**
   - Provide loop detector and modify traffic signal to accommodate Rochester Stove Driveway.

1. **NH Route 125/Old Dover Road Wilson**
   - Coordinate the timing/phasing with the traffic signal at Charles Street.
   - Construct a median island on the southbound Columbus Avenue approach.
   - Increase the Columbus Avenue northbound right-turn radius into Old Dover Road to accommodate trucks.

2. **NH Route 125/Charles Street/Credit Union**
   - Coordinate the timing/phasing with the traffic signal at Old Dover Road.
   - Modify the traffic signal (add loop detector and signal heads) to accommodate the Credit union approach (westbound).
   - Reconstruct this approach as a shared driveway between the Credit Union and adjacent site.
   - Modify the Charles Street approach to provide two approach lanes.
   - If the Columbus Avenue/Hancock Street improvements are made (see below) convert Charles Street to one-way eastbound.

3. **NH Route 125/Hancock Street**
   - Modify intersection (Columbus Avenue/Hancock Street/Lowell Street) to allow all turning movements.
   - Convert the west leg of the intersection (Lowell Street) to one-way westbound (leaving intersection).
   - Conceptual Cost: The improvements are not recommended at this time. Future changes in the traffic patterns at Rochester Commons could necessitate these changes.

4. **Columbus Avenue/May Street/Upham Street**
   - Reduce conflict points by making May Street one-way eastbound and Upham Street (west leg) one-way westbound.
   - Provide exclusive left-turn lanes on Columbus Avenue.

5. **South Main Street/Columbus Avenue**
   - Reconfigure northbound Columbus Avenue approach as exclusive left-turn, through, and right-turn lanes.
   - Provide larger radius for northbound right-turn truck maneuver.
   - Reconfigure westbound South Main Street approach as exclusive left-turn lane, through lane, and shared through/right-turn lane.
   - Modify traffic signal hardware and signal phasing/timing accordingly to provide a protected westbound left-turn phase.

- Define parking areas with pavement marking and signage.

6. **Columbus Avenue/Portland Street**
   - Revise the signal timing as future volumes increase/change.

7. **Columbus Avenue/Summer Street**
   - Add exclusive northbound and southbound left-turn lanes on Columbus Avenue (this will require additional right-of-way).
   - Replace the temporary span wire signal system with a permanent mast arm arrangement.
   - Where possible, increase turn radii to better accommodate truck maneuvers.

8. **Columbus Avenue/Wakefield Street**
   - Revise the signal timing as future traffic volumes increase/change.

9. **Wakefield Street/High School Road/Glenwood Avenue**
   - Reconfigure the High School Road approach (eastbound) as an exclusive right-turn lane and shared through/left-turn lane.
   - Provide proper pavement markings/signage on the side street approaches.
   - Provide exclusive left-turn lanes on Wakefield Street.

10. **Milton Road/Lilac Plaza/Chestnut Hill Road**
    - Modify pavement markings/signage to reinforce the one-way exit pattern on the Lilac Plaza approach to the intersection.

11. **Milton Road/Lilac Mall/VIP Driveway**
    - Revise the signal timing as future traffic volumes increase/change

12. **Milton Road/Norway Plains Road**
    - Provide proper pavement marking (double yellow centerline and 12-inch white stop line) on Norway Plans Road approach.

13. **Milton Road/Flat Rock Bridge Road**
    - Remove raised island at end of Flat Rock Bridge Road and realign the approach so that it intersects Milton Road at a near 90° angle.
    - Provide dual departure lanes (exclusive left and right).

14. **Lengthen Right-Turn Lane to Old Dover Road**
    - Extend the NH Route 125 northbound right-turn lane to Old Dover Road southerly to the bridge over the Cocheco River.
    - Define access points with curbing along this segment of roadway.

15. **Three-Lane Section on Columbus Avenue (Upham Street to South Main Street**
    - Reconfigure Columbus Avenue as a three-lane section from Upham Street to South Main Street (requires roadway widening).

- This consists of a continuous two-way center turn lane with a single through lane in each direction.
- The center-turn lane converts to exclusive turn lanes at South Main Street and Upham Street.
- Define parking areas with pavement markings and signage.
- Reduce the number of access points along Columbus Avenue to the extent possible with curbing.
- Construct well-defined driveway access points and encourage the use of shared driveways where possible.

16. **Three-Lane Section on Wakefield Street (Glenwood Avenue to Lilac Plaza)**
    - Reconfigure Wakefield Street as a three-lane section from the Lilac Plaza to High School Road/Glenwood Avenue (requires roadway widening).
    - This consists of a continuous two-way center turn lane with a single through lane in each direction.
    - The center-turn lane converts to exclusive turn lanes at the major intersections (see intersection improvements).
    - Define parking areas with pavement markings and signage.
    - Reduce the number of access points along Wakefield Street to the extent possible with curbing.
    - Construct well-defined driveway access points and encourage the use of shared driveways where possible.
    - Reconstruct the sidewalk between Glenwood Avenue and Lilac Plaza (east side of roadway).

17. **Dual Southbound Lanes on Milton Road Between Lilac Mall and Lilac Plaza** (Chestnut Hill Road)
    - Extend the two southbound lanes from the Lilac Mall signal to the Lilac Plaza signal. The second southbound through lane becomes the right-turn lane at Chestnut Hill Road.

Appendix 6
Regional Transportation Goals

Goal 1: Develop a transportation system which affords mobility for all and provides good access to employment, housing, service and recreation areas.

Goal 2: Manage, maintain, and enhance the existing transportation system in order to maximize safety and efficiency and reduce the need for new roadway/bridge construction.

Goal 3: Reduce the need for roadway construction by developing, maintaining and encouraging use of viable alternatives to the single-occupancy vehicle.

Goal 4: Promote transportation policies and improvements consistent with preserving and enhancing cultural, social, economic and environmental resources.

Goal 4: Promote transportation policies and improvements consistent with preserving and enhancing cultural, social, economic and environmental resources.

Goal 5: Encourage better integration of land use and transportation planning

Goal 6: Establish a transportation system that facilitates economic development.

Source: Seacoast MPO Transportation Plan

Appendix 7
Roads Most in Need of Upgrading

The following roads were mentioned as being most in need of upgrading by the respondents to the Community Survey. The number of times mentioned is listed.

Lowell Street	61
Portland Street	45
Franklin Street	38
Old Dover Road	33
Chestnut Hill Road	27
Washington Street	20
North Main Street	17
Wakefield Street	16
Chamberlain Street	15
Salmon Falls Road	15
Chestnut, Pine, Jackson, Maple Streets	14
Walnut Street	13
Pine Street	12
Whitehall Road	11
Common St.	10
Route 108	9
Route 125 North/Milton Road	9
Route 125 (in vicinity of Merchants Plaza)	9
Spaulding Turnpike (2 lane section)	9
Ten Rod Road	9
Tebbetts Road	9
Tingley Street, Juniper Street, Susan Lane	9
Betts Road	8
Charles, May, Myrtle, Woodman Streets	8
Cross Road	8
South Main St.	8
Estes Road	6
Flagg Road	6
Hanson Street	6
Brock Street	5
Hancock St.	5
Route 11	5
Signal Street	5
Eastern Avenue	4
Columbus Avenue	3
Norway Plains Road	3
Sampson, Sabrina, Isabella	3
Twombly Street	3

Congress Street	2
Church Street (Gonic)	2
England Road (replace bridge)	2
Four Rod Road	2
Gear Road	2
Hansonville Road	2
Little Falls Bridge Road	2
Meaderboro Rd.	2
Summer Street	2
Willey St.	2
West Street	2
Dodge Court (beginning on North Main St.)	1
Dry Hill	1
Duquette Street	1
Green St. (East Rochester)	1
Grove Street (East Rochester)	1
Hale Street	1
Hemlock Street	1
High Street	1
Howe Street	1
Lincoln Street	1
Prospect Street	1
Richardson St.	1
Pleasant Street (East Rochester)	1
Upham Street	1
Walnut Street (East Rochester)	1

Appendix 8
Intersections Most in Need of Upgrading

The following intersections were mentioned as being most in need of upgrading by the respondents to the Community Survey. The number of times mentioned is listed.

Route 202, 202A and North Main Street	160
Route 108 and Franklin Street	40
Route 125 and Old Dover Road	35
Route 108 and the Commons	18
North Main and Union Streets	14
Around the Commons and Hancock Street	10
Route 125 and Charles Street	10
Route 11 and Flat Rock Bridge Road	7
Route 125 and Brock Street	7
Columbus Avenue and Summer Street	6
Columbus Avenue and South Main Street	6
Route 202 and Estes Road	6
Route 202, 202A and Route 11	6
Columbus Avenue and Portland Street	5
Columbus Avenue and Wakefield Street	5
North Main Street and Ten Rod Road (Home Depot)	5
Route 125 and Flat Rock Bridge Road	5
Route 202 and Salmon Falls Road	4
Betts and Cross Roads	3
Brock and Washington Streets	3
May and Upham Streets	3
North Main Street (Connector) to Chestnut Hill Road	3
Route 108 and Whitehall Road	3
Route 125 and Connector road to Chestnut Hill Road	3
Grant and South Main Streets	2
North Main and Twombly Streets	2
North Main and Wakefield Streets	2
Portland Street and Salmon Falls Road	2
Portland and Signal Streets	2
Route 125 and Lowell Street	2
Route 125 and Columbus Avenue	2
Route 125 and Salmon Falls Road	2
Summer and Signal Streets	2
Summer and Wakefield Streets	2
North Main and River Streets	1
North Main and Wakefield Streets	1
Portland and Charles Streets	1
Portland and South Main Streets	1
Portland and Franklin Streets	1
Route 108 and Spaulding Turnpike	1
Walnut Street and Meaderboro Road	1

Ten Ways to Manage Roadway Access in Your Community

Costly improvements are not always the solution to safety and congestion problems. Roads, like other resources, also need to be carefully managed. Corridor access management strategies extend the useful life of roads at little or no cost to taxpayers. Following are ten ways that you can make the most out of your transportation system.

1

Lay the foundation for access management in your local comprehensive plan.

To assure that your roadways are managed properly, your comprehensive plan needs to address certain key issues. *First*, include goals, objectives, and policies related to access management in the plan. Tailor policy statements to advance the access management principles in this brochure. For example, a policy could be adopted promoting interconnection of adjacent developments along major roadways.

Second, make sure that your local transportation plan classifies roadways according to function and desired level of access control. This hierarchy of roadways is reinforced through roadway design and access standards in your land development code. For example, arterials require a much higher level of access control and different design standards than collectors or local streets. Some roadways require special attention because of their importance, the need for additional right-of-way, or due to significant access problems. These areas may be designated for special treatment in the comprehensive plan.

Third, provide for a greater variety of street types with varying design standards. Options could include access lanes, alleys, variations in on-street parking, and so on. This reduces development costs, promotes compact development, increases opportunities to interconnect streets, and helps save your major thoroughfare system. Many communities have only a few residential street design options that apply whether a subdivision has 8 homes or 80. Lack of design flexibility impedes infill development and results in a monotonous street layout. It can also cause a proliferation of substandard and inadequately maintained private streets.

2

Restrict the number of driveways per lot.

Establish a basic requirement that driveways are limited to one per parcel, with special conditions for additional driveways. Lots with larger frontages, or those with needs for separate right and left-turn entrances, could be permitted more than one driveway, in accordance with driveway spacing standards. Limitations on new driveways may be established using a "corridor overlay" approach, which adds new requirements onto the underlying zoning (see Figure1). It is necessary to first identify and map the boundaries of all existing lots and parcels along the corridor. Then you could assign one driveway to each mapped parcel by right. This land may be further subdivided, but all new lots would need to obtain access from the existing access point.

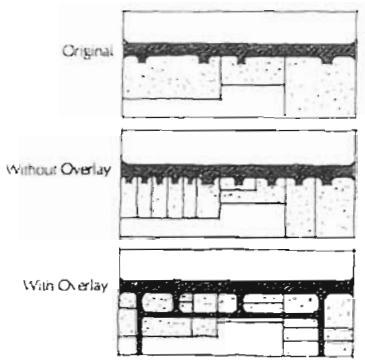


Figure 1. Corridor overlay

3 Locate driveways away from intersections.

Setting driveways and connections back from intersections reduces the number of conflicts and provides more time and space for vehicles to turn or merge safely across lanes. This spacing between intersections and driveways is known as corner clearance. Adequate corner clearance can also be assured by establishing a larger minimum lot size for corner lots. You could impose conditional use limitations where adequate corner clearance cannot be obtained. This helps assure that corner properties do not experience access problems as traffic volumes grow.

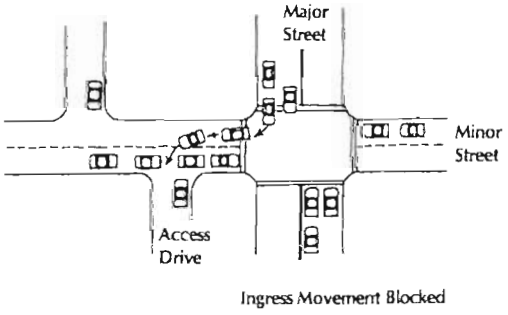


Figure 2. Inadequate corner clearance.

4 Connect parking lots and consolidate driveways.

Internal connections between neighboring properties allow vehicles to circulate between businesses without having to re-enter the major roadway (see Figures 3 and 4). Joint and cross access requirements in your land development code can help to assure connections between major developments, as well as between smaller businesses along a corridor.

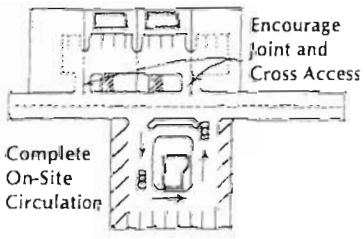


Figure 3. Joint and cross access.

Cross access also needs to be provided for pedestrians. Sidewalks are typically placed far away from buildings on the right-of-way of major roadways, or are not provided at all. Pedestrians prefer the shortest distance between two points and will walk if walkways are provided near buildings. Joint and cross access strategies help to relieve demand on major roadways for short trips, thereby helping preserve roadway capacity. They also help to improve customer convenience, emergency access, and access for delivery vehicles.

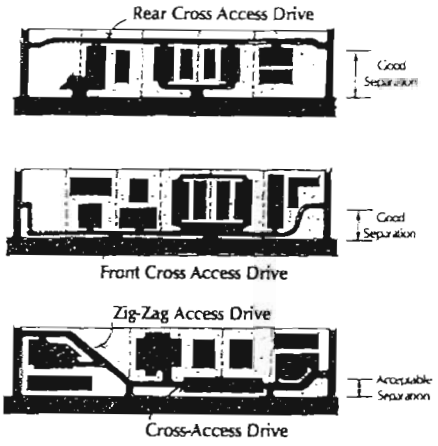


Figure 4. Cross access.

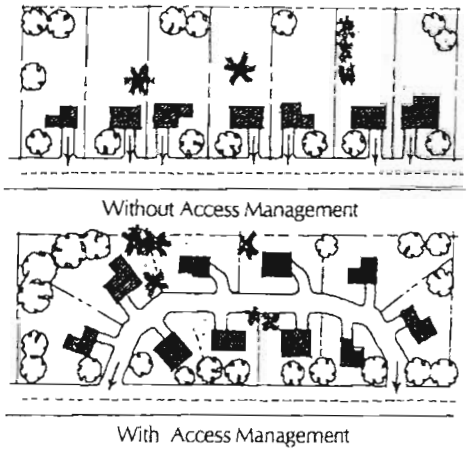


Figure 5. Shared access.

5

Provide residential access through neighborhood streets.

Residential driveways on major roadways result in dangerous conflicts between high-speed traffic and residents entering and exiting their driveway. As the number of driveways increase, the roadway is gradually transformed into a high speed version of a local residential street. Subdivisions should always be designed so that lots fronting on major roadways have internal access from a residential street or lane (also known as "reverse frontage"—see Figures 5 and 6). Minor land division activity can be managed by establishing a restriction on new access points and allowing land to be further subdivided, provided all new lots obtain access via the permitted access point. A variation of this approach is to allow lot splits on major roadways only where access is consolidated. Another step is to prohibit "flag lots" along major thoroughfares. Some property owners subdivide their land

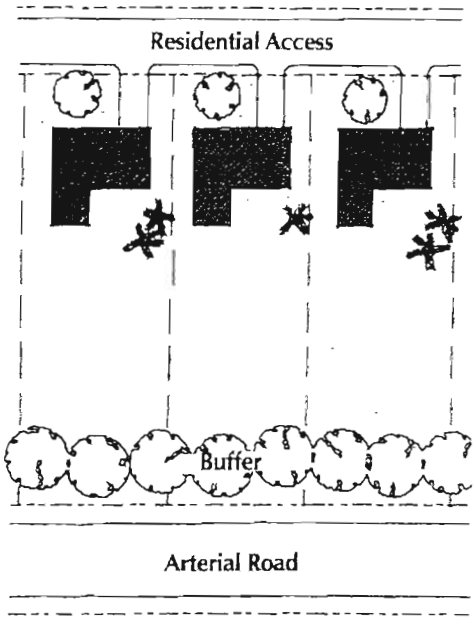


Figure 6. Reverse Frontage.

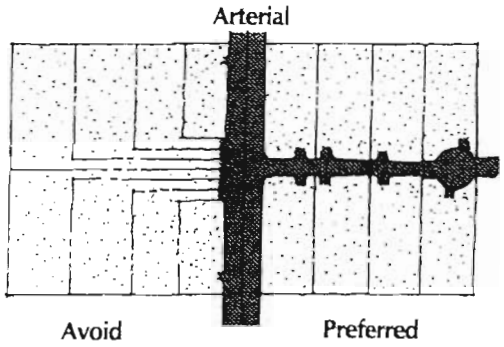


Figure 7. Avoid flag lots.

into lots shaped like flags to avoid the cost of platting and providing a road. Instead, the flag lots are stacked on top of each other, with the "flag poles" serving as driveways to major roads (see Figure 7). This results in closely spaced driveways that undermine the safety and efficiency of the highway. Eventually, residents may petition for construction of a local public road passing the cost of providing a subdivision road onto the community.

6

Increase minimum lot frontage on major roads.

Minimum lot frontages need to be larger for lots that front on major roadways, than those fronting on local roads. Narrow lots are a problem on major roads because they result in closely spaced driveways. Lots need to be deeper and wider along arterials to allow adequate flexibility in site design and to increase separation of access points (see Figure 8). Assuring an adequate lot size also protects the development potential and market value of corridor properties.

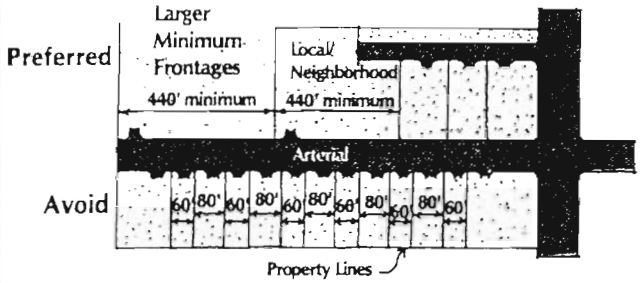


Figure 8. Lot frontage requirements.

7

Promote a connected street system.

As communities grow and land is subdivided for development, it is essential to assure continuation and extension of the existing local street system. Dead end streets, cul-de-sacs, and gated communities force more traffic onto collectors and arterials. Fragmented street systems also impede emergency access and increase the number and length of automobile trips. A connected road network advances the following growth management objectives:

- fewer vehicle miles traveled
- decreased congestion
- alternative routes for short, local trips
- improved accessibility of developed areas
- facilitation of walking, bicycling, and use of transit
- reduced demand on major thoroughfares
- more environmentally sensitive layout of streets and lots
- interconnected neighborhoods foster a sense of community
- safer school bus routes

Connectivity can be enhanced by a) allowing shorter blocks (600 ft.) and excluding cul-de-sacs from the definition of intersection; b) requiring stub streets to serve adjacent undeveloped properties; c) requiring street connec-

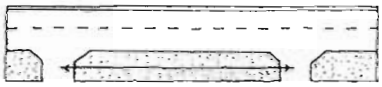
tions to nearby activity centers; d) requiring connections to or continuation of existing or approved public streets; and e) requiring bicycle/pedestrian access-ways at the end of cul-de-sacs or between residential areas and parks, schools, shopping areas or other activity centers. It is also important to allow a greater variety of street types.

8 Encourage internal access to outparcels.

Shopping center developments often include separate lots or "outparcels" fronting on the major roadway. The outparcels are leased or sold to businesses looking for highly valued corridor locations. Access to these outparcels should be incorporated into the access and circulation system of the principal retail center. This reduces the need for separate driveways on the major road, while maintaining overall accessibility to the site. To accomplish this, establish that development sites under the same ownership or those consolidated for development will be treated as one site for the purposes of access management. Then require a unified traffic circulation and access plan for the overall development site.

9 Regulate the location, spacing, and design of driveways.

Driveway *spacing* standards establish the minimum distance between driveways along major thoroughfares (see Figure 9). These standards help to reduce the potential for collisions, as travelers enter or exit the roadway. They also encourage the sharing of access for smaller parcels, and can improve community character by reducing the number of driveways and providing more area for pedestrians and landscaping. The *location* of driveways affects the ability of drivers to safely enter and exit a site. If driveways do not provide adequate sight distance, exiting vehicles may be unable to see oncoming traffic. In turn, motorists on the roadway may not have adequate time to avoid a crash. Driveway *design* standards assure that driveways have an adequate design so vehicles can easily turn onto the site. Standards also need to address the depth of the driveway area. Where driveways are too shallow, vehicles are sometimes obstructed from entering the site causing others behind them to wait in through lanes. This blocks traffic and increases the potential for rear-end collisions.



Adopt minimum spacing standards for driveways

Reinforce with minimum lot frontage and joint access requirements

Figure 9. Driveway spacing standards.

10 Coordinate with the Department of Transportation.

The Florida Department of Transportation is responsible for access permits along state roadways. Local governments oversee land use, subdivision, and site design decisions that affect access needs. Therefore, State and local coordination is essential to effective access management. Lack of coordination can undermine the effectiveness of regulatory programs and cause unnecessary frustration for permit applicants.

Timely communication is key to an effective review procedure. Begin by establishing a coordinated process for review of access permits along state highways. The state per-

mitting official could have applicants send a copy of the complete permit application to the designated local reviewing official. Prior to any decision or recommendation, the state permitting official could then discuss the application with the local reviewing official.

Property owners also may be required to submit the necessary certificates of approval from other affected regulatory agencies, before a building permit is issued. In Florida, this should include a "notice of intent to permit" from the Florida Department of Transportation where access to the state highway system is requested.

An effective method of coordinating review and approval between developers and various government agencies is through a tiered process. The first stage is an informal meeting and "concept review" period, which allows officials to advise the developer about information needed to process a development application. This includes information on required state and local permits, and any special considerations for the development site.

The concept review provides the developer with early feedback on a proposal, before the preliminary plat or site plan has been drafted. Once the preliminary plan is drafted, it can be checked to determine if additional conditions are required for approval. The final plan that is formally submitted should then require only an administrative review.

Local governments could also request a response from the FDOT prior to approval of plats on the state highway system. Applicants could be required to send a copy of the subdivision application to the state access permitting official. This should occur early in the plat review process, preferably during conceptual review. Early monitoring of platting activity would allow the Department of Transportation an opportunity to identify problems and work on acceptable alternatives.

Intergovernmental agreements or resolutions can facilitate coordination between the state and local governments on access management. These tools can be used to clarify the purpose and intent of managing access along major thoroughfares, roadways that will receive special attention, and state and local responsibilities for advancing access management objectives.

Additional References

"Model Land Development Regulations that Support Access Management," Center for Urban Transportation Research, 1994.

Williams, K., Marshall, M. "Managing Corridor Development," Center for Urban Transportation Research, 1996.

Williams, K., Forrester, R., "NCHRP Synthesis 233: Land Development Regulations that Promote Access Management." Transportation Research Board, Washington, D.C.: National Academy Press, 1996.

Training Opportunities

"Access Management: Site Planning," FDOT 1997 (A Training Unit), available through Gary Sokolow.

"Land Development Regulations that Support Access Management," FDOT 1997 (A Training Unit), available through Gary Sokolow.

Visit our Web Page at:

http://www.cutr.eng.usf.edu

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Huntersville Land Development Code

Street Plan Types

The layout of streets should provide structure to the neighborhoods. The formality of the street plan will vary depending upon site conditions and topography. Unique site conditions should be used to create special neighborhood qualities. The following are examples of street plan types, noting advantages and disadvantages.

Organic Network

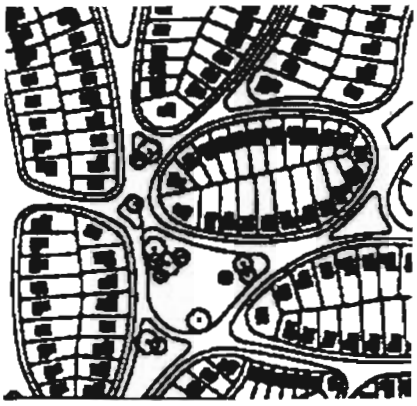
Nantucket

Advantages
- Street hierarchy with main routes for through traffic
- Even dispersal of local traffic throughout network
- Responsive to terrain
- Responsive to environmental conditions
- Small scale suited to pedestrians

Disadvantages
- Variety of blocks and lots that do not conform to any overall plan

Curvilinear Network

Riverside, IL.

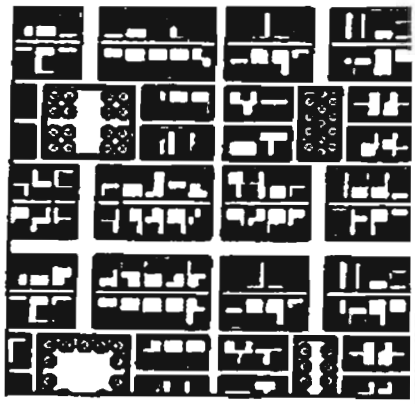


Advantages
- Avoids monotony by deflecting views
- Highly responsive to terrain
- Even dispersal of traffic through the network

Disadvantages
- Little directional orientation
- Uncontrollable variety of lots
- No natural hierarchy of street
- Lack of spatial definition

Orthogonal Grid

Savannah, GA.



Advantages
- Excellent directional orientation.
- Clear spatial definition
- Lot variety controlability
- Street hierarchy with end blocks for through traffic
- Even dispersal of traffic through grid
- Alleys for efficient double loading of service and for utilities location

Disadvantages
- Monotonous unless periodically interrupted
- Does not accommodate environmental interruptions
- Unresponsive to steep or special terrain

Diagonal Network

Mariemont, OH.

Advantages
- Street hierarchy with diagonals for through traffic.
- Diagonals can respond to terrain
- Creates focal points at intersections
- Clear spatial definition

Disadvantages
- Some awkward block shapes at intersections of diagonals and regular grid

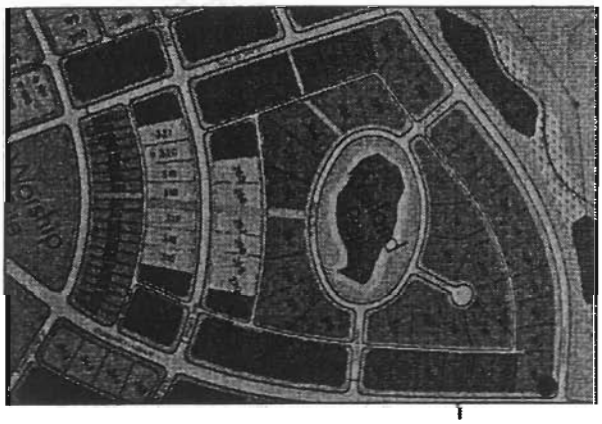
Part V.

Healthy Neighborhood Street Design Principles

The pattern of the neighborhood — block lengths, use of terminating vistas, use of tee intersections, tree canopies, presence of people on streets, visual detail of buildings, attractive parks, creation of an "outdoor room," and other techniques — can be used in combination to achieve desired street speeds.

The following 25 key elements of street design can help create healthy neighborhoods and livable communities.

Element 1. Walkable Neighborhood Size and Mixed Uses.



Partial plan of Celebration, Florida, shows streets, lanes, alleys and trails.

Limit the size of neighborhoods to a walkable scale. The optimal size of walkable neighborhoods is 1/4 to 1/3 mile from outer edge to center, or about a five- to ten-minute walk at an easy pace. By staying within this size and allowing a mix of uses, neighborhoods can meet many peoples' needs without sending traffic into other areas of town. Allowing religious institutions, schools, parks, and small commercial districts in neighborhoods can eliminate as much as 40% of auto trips. Thus, mixed-use neighborhoods can reduce daily household trips to 6 to 7, down from 10-12 for households living in conventional neighborhoods.

Trip/Access Projections for Low-Acreage Developments at Modest Density. Walkable neighborhoods require from 40 to 85 acres of land for development. A 40-acre, lower density, walkable/transit supportive neighborhood generates approximately 1,680 trips (assuming seven dwelling units on each of the 40 acres, six auto trips per day per household). This level of auto trips requires a minimum of two neighborhood connections to properly disperse traffic on a low-volume basis. Two-entry distribution results in each street having 1.4 cars per minute (assumes a 10-hour distribution).

Trip/Access Projections for High-Acreage, Higher-Density Development. At the upper size of walkable, higher density neighborhoods, a 125-acre development with 10 dwelling units/acre (averaging six auto trips per day per household) would generate 7,500 daily auto trips. This number of trips would require eight neighborhood connectors to disperse traffic to the 1.5 cars-per-minute threshold. Thus, even at these densities, avenues can still be

A23

designed to accommodate low-volume traffic and remain desirable places to live, amenable for pedestrian crossings, and suitable for pleasant walks and other outdoor activities.

Element 2. Interconnected and Diverse Neighborhood Street Pattern.

Healthy neighborhoods require a variety of different street types, generally in a rectilinear or grid pattern. An interconnected street pattern with short block lengths provides multiple routes, diffuses automobile traffic and shortens walking distances.

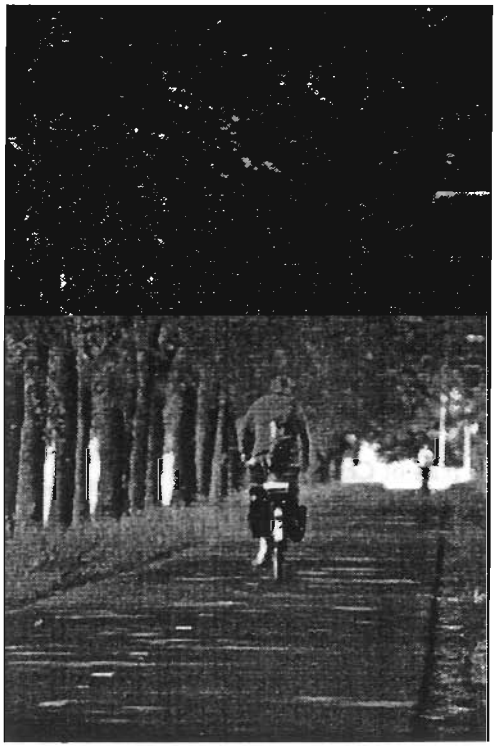
A balanced mix of different street types makes neighborhoods accessible to residents, moves cars efficiently at low speeds and volumes, and keeps the neighborhood quiet, safe and pleasant. (See figures on pp. 19-22 for street types to include.)

Element 3. Shorter Block Length.

Conventional neighborhoods often allow block lengths of 600 feet or more, which allow motorists to gather speed between intersections. When stop signs are used to inhibit speeding, motorists often make up lost time by accelerating out of the stop and increasing speed through succeeding blocks. Traffic speeds can be reduced by making many blocks shorter (average 250-350 feet, with 500-foot maximum), which prevents motorists from comfortably travelling at higher speeds.

Element 4. "Outdoor Rooms" and Front Porches.

Cars are slowed and pedestrian comfort is improved by adding tree canopies, on-street parking and placing building closer to the street to create a sense of a more "enclosed" street, or "outdoor room." From the time of the Greek Empire, traditional street designers have achieved this comfortable sense of enclosure by giving streets a ratio of 2:1 to 3:1 of width (from building to building) to building height. Thus, an 18-foot lane (40-foot right of way), with buildings 25 feet high, requires building-to-building separations of no more than 75 feet. Within these dimensions, the proper feeling of enclosure is achieved. With a 50-foot right-of-way, building setbacks should be about 12.5 feet for best effect, although a 25-foot setback is acceptable. People walking along the street like to feel that they can "reach out and talk to someone" sitting on the front porch, which is possible when porches are within 20 feet of the sidewalk.



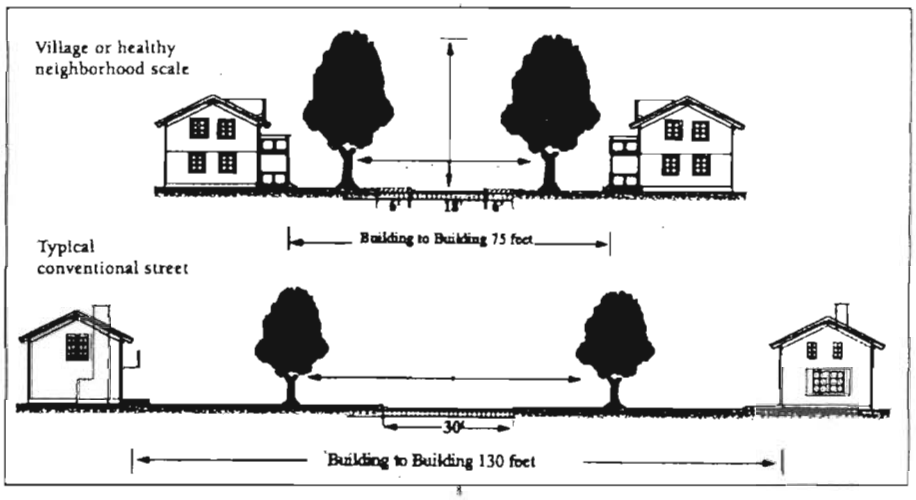
A well-designed bike trail connects residential developments midway between Amsterdam and Harlem, Holland.

Element 5. Traffic Dispersion.

Street capacity and momentary automobile delays do not create problems in a well-developed neighborhood street system. Due to the large number of street connections and short blocks, many neighborhood lanes and streets carry between 100 and 450 cars per day. This access keeps traffic volumes down to 7 to 35 vehicles per hour, making it unlikely that more than a few cars will ever be moving on the same block at the same time. This dispersion allows the following geometric principles to flourish.

Element 6. Speed Control through Geometrics.

The best known form of traffic speed control is through the use of roadway geometrics. These design parameters include street width, centerline radii of curves, stopping sight distances on hills and curves, and intersection turning radii. When the paved width of streets is kept narrow, motorists travel more slowly. When turning radii on curves, at intersections, and at driveways are kept low, motorists turn more slowly and are more likely to yield to pedestrians.



The Outdoor Room: People want enclosure. The physical relationships of buildings, trees and streets make us feel comfortable or uncomfortable. The most satisfactory ratio is for the width of the street corridor (building to building) to be 2-3 times the height of the buildings. If the width exceeds the height by more than 4 times, we begin to lose any sense of enclosure.

(source: Randall Arendt in *Rural By Design*, citing *Spaces: Dimensions of the Human Landscape* by Barrie Greenbie)

Speed can be greatly reduced through a combination of geometric features. Geometrics include the actual width of unoccupied streets, the practical width when cars are parked on each side, and the remaining width on streets narrowed at entry points (neckdowns) or through other traffic-calming devices. As a general rule, neighborhood streets should only be wide enough for 20 mph vehicle speeds, while accommodating infrequent street users such as sanitation and delivery trucks. Neighborhood streets can be arranged to allow the timely access of emergency vehicles into even the most narrow conditions by providing through access on larger avenue systems.

Element 7. Narrower Lane Widths.

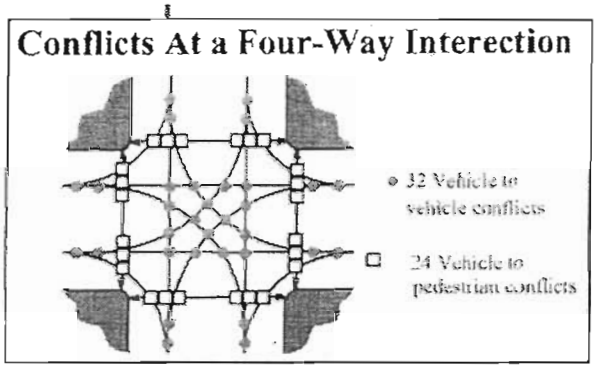
Low-volume streets (0.1 to 1 car per minute) do not need wide travel lanes. Motorists using traditional streets learn to share space with other vehicles by traveling more slowly, and by pulling into open spaces between parked cars when needed. Keeping travel lane widths down to 9-10 feet per travel lane on local roadways helps keep motorist speeds to appropriate 15-20 mph levels on lanes and streets.

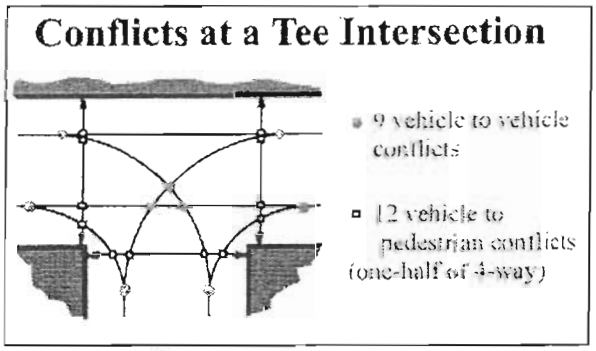
Element 8. Narrower Intersections with Smaller Radii.

Frequent, narrow-width, smaller-radius intersections prevent motorists from attaining high speeds. AASHTO provides specific language supporting such intersections in areas with heavy pedestrian movements: "The minimum radius of curb return where curbs are used or the outside edge of pavement where curbs are not used, should be 15 feet." Due to low volumes of motor vehicles, occasional users of these streets are permitted to cross centerlines on both approach and departure sides of the intersections. Buses rarely travel down traditional streets or lanes, but can negotiate these streets with little difficulty. On a recent trip into a neighborhood with 22-foot wide streets, a large bus (41 feet long, 8-1/2 feet wide) took 8 seconds to round the curve at the junction of two 22-foot wide interconnecting streets.

Element 9. Tee Intersections.

Tee intersections provide two traffic-calming and traffic-safety effects. First, they give designers an opportunity to create strong terminating vistas. When motorists see that their routes soon end, they are less inclined to increase their car's speed. Second, a three-leg intersection reduces the number of potential points of conflict for motorists from 32 to 9. Pedestrians and bicyclists find tee intersections far more comfortable and hospitable. For pedestrians, the points of conflict are cut in half — from 24 to 12.





Tee intersections are safer for pedestrians and motorists. These diagrams compare the number of potential points of conflict between a tee and a four-way intersection.

Element 10. Curves.

Curves can and should be retained in suburban development. Prominent buildings or other terminating vistas should be anchored at the apex of curves. Curves should have centerline radii of 90-120 feet, to force motorists to drive more safely as they travel through neighborhoods. Most motorists feel uncomfortable rounding these types of curves at speeds higher than 20 mph.

Element 11. On-Street Parking.

Traditional streets favor on-street parking over off-street parking. On-street parking can be used as part of the strategy to reduce motorist speed through increased "side friction." On-street parking also creates conditions where large vehicles can use the added space at intersections to improve their effective turning radii. Sight lines are preserved at intersections with 30- to 50-foot parking setbacks from intersecting legs.

Even though many home buyers prefer the convenience of off-street parking, this preference should not completely dictate design. In conventional neighborhoods, garages can dominate up to 50% of a house's façade, which eliminates the personal connections that front porches can provide between the house and street. Pedestrians must negotiate frequent driveway crossings, with cars often blocking sidewalks. In healthy neighborhood design, sidewalk interruptions are reduced by providing on-street parking plus off-street parking through the use of alley entries to backyard garages. This design practice also helps keep sidewalks safe and enjoyable for pedestrians, people with disabilities, bicyclists and children at play.

Element 12. Nature Strips, Landscaping and Trees.

On many boulevards, there is plenty of room to add bike lanes. Adding bike lanes on this boulevard in Augusta, Georgia, would also make it safer for vehicles by providing a buffer from the trees.

Conventional neighborhoods often do not require street landscaping. When streets are stark, motorists increase their speeds. Healthy, traditional neighborhoods require green edges of 6 feet or more on each side and street trees to create a double canopy. With median trees on avenues, a triple canopy is created. These landscaped areas create a friendly, walkable environment by separating pedestrians from motorists and reducing auto speeds. Comparisons show that traffic speeds on many tree-lined streets are 10-15 mph lower than those on non-tree-lined streets. Although some dry regions of the country may not support green canopies, many desert communities, such as Albuquerque, New Mexico, are able to find species for landscaping. The shade that trees provide — reducing air temperature by as much as ten degrees — is even more critical in hotter environments.

The minimum recommended width for road-edge landscaped buffers is 6 feet. Buffers are sometimes limited to smaller dimensions, but these green edges are still very important. On some of Seattle's arterial streets, three-foot planting strips grow certain tree species that set stable vertical walls for streets and walkways.

Trees are planted in orderly rows in landscaped buffers and are set back from street edges or curb lines a distance of 3-4 feet. Trees are usually spaced 25-50 feet apart. While tree-planting intervals of 50 feet on-center are currently the standard in many communities, closer spacing of 25 to 35 feet can improve shade and better reduce speeds. Newly planted trees are usually required to

have a chest height caliper diameter of 2.5 to 3 inches minimum. In a new development, the developer may need to maintain street trees for the first 18 months.

To maintain sight lines, trees and other objects should be restricted from corners for distances of 30 feet on sides where motorists would look right, and 15 feet on sides where they look left.

Selecting the proper tree is crucial. Trees should be appropriate for the specific climate where they are planted. Species should be low-maintenance, easy to care for, and not uproot curbs and sidewalks. Trees and shrubs must be undercut to achieve clear center viewing spaces from 2 feet above ground to 7 feet under canopy. This undercut preserves essential sight lines, and provides convenient conditions for pedestrians who walk along the sidewalks. Evergreens and other non-deciduous trees that create high levels of screening should be avoided on corners. As a general rule, deciduous trees are best for roadside landscaping.

Colorful edges from seasonal plantings on street corners and in median noses can also calm traffic substantially. These spaces can be adopted by neighbors or area businesses, especially on higher-volume commercial streets, where benefactors can be acknowledged through small, tasteful signs.

SHADING PAVED SURFACES

Unshaded concrete, asphalt and stone surfaces; such as parking lots, streets, and driveways, trap heat from the sun driving surrounding temperatures up by as much as 10 degrees in the summer. Shade trees can make outdoor spaces cooler and more inviting places.

- Plant trees along driveways, patios and sidewalks to keep the sun from heating them up.
- Trees should be no further than 10-15 feet from the paved areas to be shaded.
- Plant trees 3-5 feet from the pavement edge to avoid root damage to the pavement.
- Plant trees along appropriate street frontages.
- Design adequate planter areas and provide a suitable soil environment to keep trees healthy.
- Protect trees and plants from cars.
- Provide adequate irrigation and provide as much pervious surface as possible to allow water to penetrate the soil.
- Create a mix of trees of different ages and species to promote a continuous canopy cover.

Element 13. Sidewalks.

Sidewalks, which only came into use when higher speed carriages and cars became common, are essential in neighborhoods. Even with traffic speeds of 15-20 mph, children, seniors and people with disabilities cannot walk safely without sidewalks. Sidewalks by themselves do not reduce vehicle speeds, since they remove pedestrians from the street space. However, by collecting higher volumes of pedestrians, they remind motorists that neighborhoods are places for people.

Walking is a social activity. Two people should be able to walk side by side comfortably on a sidewalk, which requires a minimum width of 5 feet. Sidewalks should be separated from streets through the use of landscaped edges. Sidewalks next to curbs that do not have these green strips, must have a minimum width of 6 feet, so pedestrians still feel comfortable without a buffer between them and the traffic. Sidewalks should *always* be placed on both sides of the street. Designers should not speculate on which side

of the street will have the added value of a place for people to walk or play.

Sidewalks need an additional 2 feet of width if they are adjacent to fences, walls, buildings and shrubs. When these objects are placed directly next to sidewalks, the first 2 feet of sidewalk is no longer functional because people will not walk that close to stationary objects. In downtown Portland, Oregon, sidewalks next to buildings include a 2-3-foot strip of colored pavers, which creates zones that subconsciously encourage people to window shop.

When can sidewalks be omitted? Sidewalks should not be omitted in traditional neighborhood designs. However, due to terrain such as steep hillsides or embankments, designers may have no choice but to put sidewalks only on one side of the street. In these rare cases, extra care should be taken to simplify street crossings. Streets with sidewalks on one side must meet Americans With Disabilities Act (ADA) requirements by ensuring that people with disabilities can still cross to accessible sidewalks.

In Albany, New York, sidewalks in older neighborhoods allow seniors to get out of their homes and walk comfortably and safely on the street. Without a sidewalk, this resident would not get regular exercise or the social interaction she needs to maintain her physical and emotional health.

When streets are created as very low speed environments (10-15 mph), and sidewalks and streets are at the same grade (the Dutch "Woonerf"), sidewalk space should be defined by using colored paver stones, bollards, or other elements.

Element 14. Curbs and Gutters vs. Swales.

In *Rural By Design,* Randall Arendt argues that curbs and gutters can be omitted in some lighter-density, rural, village-style neighborhoods. For many reasons, swales are ecologically preferable in such rural areas. Natural sheeting of rain water to the edges of lanes or streets allows it to percolate down into the earth, dispersing harmful motor vehicle oil drippings and other pollutants into larger areas. Rural-edged roads can also serve as snow storage areas.

In neighborhoods where densities reach 7-12 units per acre, curbs and gutters are usually recommended. Higher runoff of water sheeting from roofs and driveways requires added water retention and treatment. Curb and gutter treatments also encourage cars to park in an orderly fashion and not to intrude into the pedestrian's space by parking partly on the sidewalk. One creative option to handle storm water runoff and retention is to place curbs and gutters behind crushed, embedded stone, loose brick, or other per-

meable designated parking areas which direct motorists to appropriate parking spaces, and yet allow water to sheet into these porous areas for absorption into the soil. Innovative ways to handle storm water runoff and retention need to be explored further.

In urban areas, avenues, main streets, boulevards, and parkways require curbs and gutters because of their greater widths, volumes, and traffic speeds.

Element 15. Street Furniture.

Street furniture such as benches, waste containers, flower and shrub planters, trees, bollards, lampposts, and kiosks encourage people to walk. Benches help seniors and the disabled, who need places to rest every 5-10 minutes when they walk for exercise, or ride public transit. Street furniture, in convenient pocket parks (the size of one lot) or other gathering points such as mail-box groupings or bulletin boards, give residents a reason to come out of their houses, socialize and get to know their neighborhoods. When motorists see pedestrians along streets, especially in groups, they are reminded that streets have many public uses.

A bus shelter with benches in Portland, Oregon, encourages people to walk and take transit.

Element 16. Street Lighting.

In healthy neighborhoods, people should feel comfortable walking at all hours. Street lighting helps pedestrians feel safer at night. Many neighborhoods prefer more, smaller street lamps to the larger, more widely spaced, high-intensity lights often found in conventional neighborhoods. Low-angle, pedestrian-scale lamps that emit full-spectrum light allow for more realistic colors at night. They also reduce glare, letting people see the night sky. Light poles 8-12 feet in height can achieve these desired effects.

Element 17. Bus Stops.

Healthy neighborhoods create environments that support transit. Residents can take advantage of frequent, easily reached bus stops due to the high connectivity of streets. These bus stops are typically found on avenues, main streets and higher-capacity roads. Streets can be patterned so that residents never need to walk more than a quarter mile to reach the nearest stop. Bus stops should always provide shade and benches, which can often be created by combining stops with pocket parks. Without shade and a place to rest, senior residents and other riders feel uncomfortable

waiting for buses. Street crossings leading to and from bus stops should be convenient and well-marked. Motorists should be able to see and anticipate where pedestrians are most likely to cross. Bulbouts should be considered as additional crossing aids to facilitate access to bus stops on avenues, main streets, boulevards, and parkways.

Element 18. Street Crossings — Crosswalks and Medians.

As a general rule, crossings should be well-identified on all avenues, main streets, boulevards, and parkways. Medians should be provided to aid in crossing all wider streets.

Marked crossings help teach children to identify the best places to cross the street. Crossings can also alert motorists of pedestrian activity, and increase their willingness to yield to pedestrians. Crosswalks create more friendly pedestrian environments, make it easier for police to enforce street laws, and likely increase predictability of pedestrian crossing points — which results in safer interactions between cars and pedestrians.

A bulbout on a main street in Brunswick, Georgia, helps pedestrians cross the street by reducing the distance they have to walk and by making it easier for drivers to see them.

All signalized intersections should have marked crosswalks. Local convention should dictate the types of markings used for crossings. Typically zebra-style or ladder crossings are reserved for higher-volume pedestrian and motorist conflict areas, while parallel lines are used for lower-volume streets.

Where can marked crosswalks be omitted? For alley, lane and street corners, pedestrian crossings are always implied, although there may not be marked crosswalks. The law implies that crosswalks, marked or unmarked, exist at all points at which sidewalks and streets intersect. Many municipalities omit markings on side streets paralleling major roadways.

Element 19. Smaller Curb Return Radii.

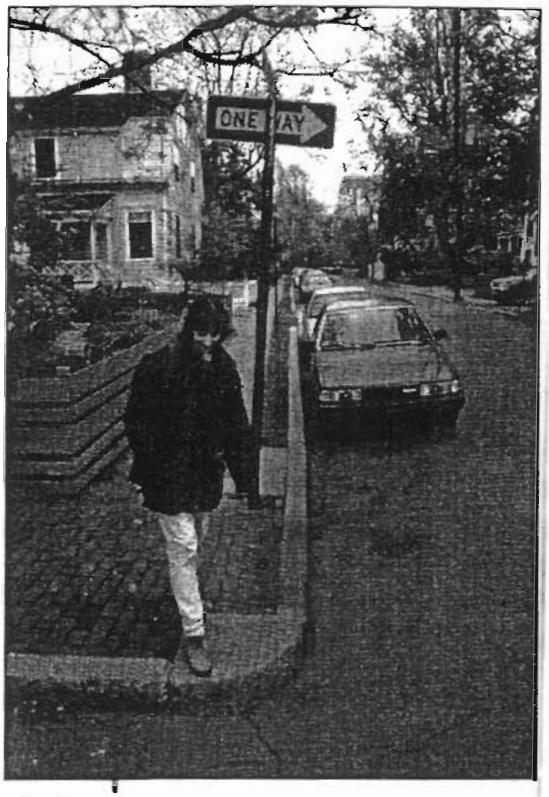
Curb returns are the curved section of curb when one curbed street meets another. Alleys, lanes and streets in healthy neighborhoods should be designed for low turning speeds (6-10 mph). Curb return radii of 10 to 15 feet are ideal in keeping motorist speeds low. Some intersections on avenues, main streets and boulevards may need 25-foot radii. These larger curves should not create problems if sidewalks are set back 6-10 feet from curbs. On-street parking should be restricted 30 feet back

from the intersection on each street leg so that infrequent users of neighborhood roads — such as safety vehicles, moving vans and delivery trucks — can turn efficiently. Large vehicles can use this additional space to make their turns safely.

By keeping street widths and corner radii narrow, pedestrians can cross neighborhood alleys, lanes and streets in 4 to 7 seconds. On wider streets — such as avenues, main streets or boulevards — protective medians which can be reached in 10 seconds allow pedestrians to cross in comfort and safety.

Element 20. Corner Sight Triangles.

Motorists approaching side streets must be able to see the dangers and obstacles that might confront them. Sight triangles are spaces where buildings, fences, walls, trees, and other landscaping are trimmed or set back to permit clear vision for prescribed distances. Motorists approaching at 20 mph need 107 feet to see a pedestrian or hazard and be able to stop in time. Motorists approaching at 30 mph need 196 feet, while those travelling at 40 mph need 320 feet of sight/stopping distance.



Pedestrian coordinator Cara Seiderman measures a popular street in Cambridge, Massachusetts, which has a small curb radius.

Element 21. Bicycles.

Healthy neighborhoods provide high levels of support for bicycle use. Trails are created to link homes, schools, parks, transit, nature areas, and other common destinations. Bicyclists should be accorded support on all public and private roadway systems. Bicycle racks and more secure storage should be provided at public buildings, transit stops and other modal connection points. Studies have shown that 20% of all trips made in urban areas could be more conveniently made by bicycle. In some cities that have installed extensive bicycle facilities, cyclists account for 15-25% of all trips.

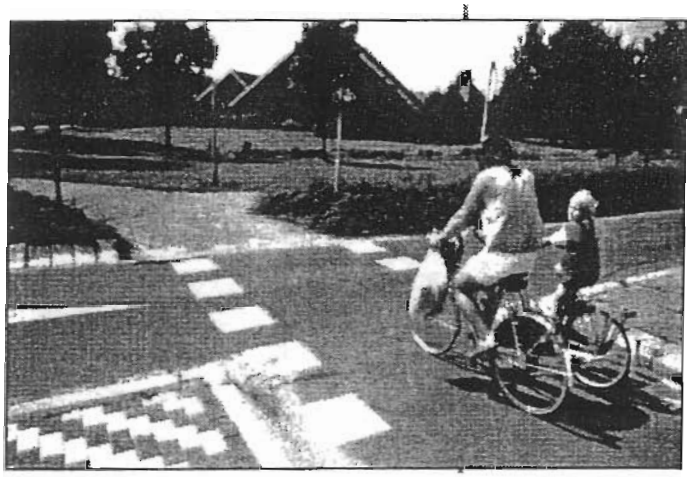
On alleys, lanes, and streets, where speeds are kept at 15-20 mph, bicycles mix comfortably with cars and trucks. On avenues, boulevards and some main streets, bicyclists should be provided with bike lanes. Parkways should have separate bicycle trails that may or may not parallel the roadway.

Bicyclists using trails that cross lanes and streets should be given favored crossing support, including speed tables and medians. When bicyclists cross avenues, main streets, boulevards, and parkways, they should receive support from medians and well marked crossings. Mid-block signals may be appropriate where traffic volumes are high.

Parents are advised to closely supervise their children on trails, alleys, lanes, and street sidewalks until they are seven or eight years old. At older ages (nine years and older), children will want to go to more distant places. Parents should work with their children to set guidelines for riding on lanes and streets, and select sidewalk riding areas on avenues. At age twelve to thirteen, most children receive permission to use bike lanes as safer and more appropriate alternatives to sidewalk riding. In towns where bicycling is well developed, such as Davis, California, children as young as twelve have access to the entire town.

Element 22. Snow Removal.

Removal and storage of snow from streets and sidewalks is challenging where snowfall levels are significant. Snow accumulation, however, should not be used to justify building conventional neighborhoods with conventional roads. Large snowfalls are often predictable. Many communities choose not to plow their alleys in the winter. Parking in streets can be limited to one side of the street during heavy snow days. Plows can store snow in the excess street space created. Landscaped street areas also serve as snow storage areas. On avenues, the medians become effective snow storage spaces. Main streets can be plowed to the center for snow removal. Boulevards and parkways can use traditional snow removal techniques. The ITE *Traditional Neighborhood Street Design Guidelines* suggests that, "If designed appropriately, traditional neighborhood development streets can help minimize the need to truck snow in all but the most severe storms." [p. 32]



Bicyclists fare best when conflicts are separated by a raised median.

Element 23. Emergency Vehicles.

Emergency vehicles can often access traditional neighborhoods as fast as, or faster than, conventional ones. Such vehicles have the unchallenged legal right to all physical street space. Properly designed healthy neighborhoods have frequent entry points, fewer stop signs, and few traffic signals. This design allows emergency vehicles to take direct routes to all properties at moderate speed and with minimal or no delay. Properties in new neighborhoods meet modern fire codes, so average response times allow reasonable rescue time.

Unlike conventional neighborhoods, traditional neighborhoods always have at least two means of access to each property. Alleys in healthy neighborhoods provide additional access for emergency vehicles.

Misunderstanding of the national fire code and insurance carrier requirements is widespread. It is frequently argued that streets must be kept wide to accommodate two fire trucks coming into neighborhoods from two directions at once, and either passing one another, or setting extension legs with engines sitting side-by-side. This assertion is not correct.

When responding to fires, fire trucks can come from different directions, set up in different locations, and extend aerial truck legs into grassy areas, when needed. Aerial ladders are rarely needed for single-family residences, and thus the legs often are not extended. It has also been argued that fire trucks have no reverse gears. While true for some early fire trucks (when the gear was used to pump water), this design flaw was soon corrected, and today's fire trucks are able to use reverse gears.

As with other neighborhood needs, it is unwise to design a neighborhood solely for one purpose, such as emergency response. Without reducing emergency-vehicle access, traditional, healthy streets make important contributions to a community's overall public safety, such as the safety of children and their ability to play in front yards, a stronger sense of community, and reduced crime rates.

Firemen are trained to maneuver on narrow streets. In Monroe County, Florida, they practice backing up an 8-foot-wide lane.

Element 24. Utilities.

Healthy neighborhoods emphasize healthy street canopies, uncluttered spaces and open architecture streets. The higher cost of underground utilities can be significant, but funds may be obtained through cost savings from limiting roadway widths and excessive rights-of-way. Utilities can be placed using access rights on residential property, in alleys, along trails, or on other easements. Underground utilities are preferred in most instances. These underground systems can also eliminate storm damage. Long-term costs for utilities should be estimated before installing above-ground systems. Many European cities use two paver stones (one-meter squares) side-by-side for sidewalks, and place utilities under walkways. When new connections or repairs are needed, pavers are easily lifted and stacked. After work is completed, the pavers are reset without the need for jackhammers or cement mixers. Paver-style walkways can be more easily maintained and allow for tree-root expansion.

Element 25. Resolution of Conflicts.

ITE's language on resolving traditional neighborhood design conflicts says it best: "Whenever a designer or policymaker associated with a TND [traditional neighborhood design], after

due consideration of all relevant factors, determines that an irreconcilable conflict exists among vehicular and non-vehicular users of a TND street space, that conflict should be resolved in favor of the non-vehicular users, unless the public safety will truly be jeopardized by the decision." [p. 12]

Conclusion

These 25 elements of street design are the key to creating healthy neighborhoods and livable communities. In his travels across the country, the principal author has found that historic traditional neighborhoods, and new traditional neighborhoods, are proving their value to residents, property owners and developers. Children, seniors and everyone in between all love to walk, ride bikes and drive through these real places. People all across the nation are rediscovering the meaning and value of neighborhoods focused on the needs of people. And we are learning to create the charm, safety, security, convenience, efficiency, affordability and association made possible from slower, more accessible, intimate streets.

Ben Franklin and Patrick Henry once walked this street in Society Hill, Pennsylvania. The width has never changed. Although tight, there is plenty of room to accommodate cars, bicycles and pedestrians while encouraging social interaction.

As you begin the search for answers in your own community, keep in mind the need to be flexible, to work in a coordinated, collaborative fashion. Think small and experiment. Provide abundant access and linkages. Pay attention to the principles. There are no hard and fast answers for a given site. Communities and social needs are complex and require many forms. The places we love the most are always tinkered with in kind, gentle ways.

A colleague in Winter Park, Florida, the site of our first street testing for the writing of this publication, recently shared with the authors this bit of wisdom: "It is much harder to preserve and protect good streets today than it was to build them originally." But the common sense approach to designing streets and neighborhoods used by our grandparents is coming back. We hope this publication will help.

Appendix C. "Skinny Streets: Better Streets for Livable Communities"

The following excerpts are taken from a document prepared in June 1996 by Livable Oregon, ☎(503) 222-2182. (Reprinted with permission)

Skinny streets are residential streets which are narrower than the modern width usually built in today's residential neighborhoods. Skinny streets are not new, and already exist in many older neighborhoods in Oregon's communities. Skinny streets are cost beneficial for cities and developers and they contribute to the making of great neighborhoods. Increased safety and a greater sense of community for residents are just some of the other benefits of skinny streets.

BENEFITS OF SKINNY STREETS

■ Environmental

More efficient use of land. Land saved by reducing paved surface area provides more opportunities for other land uses, such as open space, farms, community and commercial needs, and housing.

Decrease storm water runoff. Because storm water is not absorbed through paved surfaces, skinny streets reduce storm water runoff by minimizing pavement surface area. Less pavement also reduces the amount of contaminates from road surfaces that are carried into the storm water system by runoff.

■ Financial

Lower maintenance costs. Local governments spend less money building, improving, and maintaining roads when they have less paved surface area. Skinny streets also contribute to more compact development and more efficient land use, minimizing the costs of providing urban services by minimizing the size of service areas.

Increased Market Value. Older residential areas in many existing towns and cities in Oregon often have skinny streets. These areas are characterized by high home values with more of a neighborhood feeling. New developments with skinny streets and other neighborhood friendly elements are currently in high demand.

Lower development costs. With less paved surface, narrower streets cost less to build. Skinny streets also allow for more flexibility in subdivision layout by reducing the amount of land designated for streets, and may result in more lots per gross acre of land.

■ Quality of Life

Encourage walking and bicycling. Skinny streets reduce overall distances between destinations by using land more efficiently, making

walking and bicycling more attractive to residents. Skinny streets also create a safer environment for pedestrians and bicyclists by encouraging reduced traffic speeds.

Sense of Neighborhood/Community. Skinny streets create an environment of safety and convenience which attracts residents to walk, bicycle and play in the neighborhood. Skinny streets maximize opportunities for other neighborhood amenities like parks and landscaping by using land efficiently.

Traffic safety. Skinny streets encourage more cautious driving and slower speeds by eliminating the "speedway" feel of wide streets in residential areas. The more intimate feeling created by narrower residential streets serves as an additional indicator to drivers that they are in a neighborhood.

IMPLEMENTATION

Oregon's Land Conservation and Development Commission issued the Transportation Planning Rule (TPR) in 1990. The TPR requires local governments to adopt local street standards which minimize street width according to functional purpose. This statewide interest in street width recognizes the positive impact of narrower street standards on local government budgets, community livability, and the environment. Local governments in Oregon must comply with this requirement by May, 1997.

Local governments are granted the authority to establish local subdivision standards, which include street width, by Oregon's land use laws (ORS 92.044). Many of Oregon's cities have already adopted narrow residential street standards. Others have allowed skinny streets by granting variances for specific development projects.

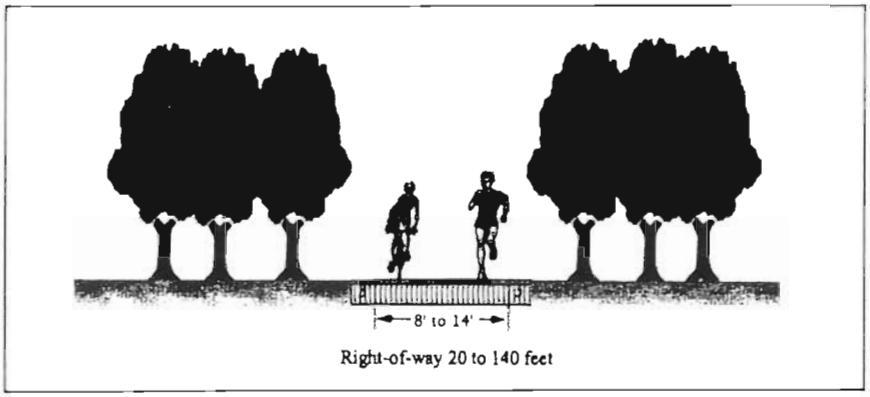
GENERATING SUPPORT / OVERCOMING RESISTANCE

While local governments do have the legal authority to establish local street standards, it is important to recognize that skinny streets may create access issues for local emergency service providers. Generating support for skinny streets requires consideration of their benefits as well as their appropriateness in certain situations.

Local governments can do several things to ensure that the process of establishing narrow residential street standards is sensitive to the concerns of citizens and emergency service providers.

■ Negotiation / Involvement

Emergency service providers have specific concerns about the effects of skinny streets on their response times. Local government officials and staff can pro-actively address these concerns by negotiating with the fire department about their needs for access on residential streets. Both emergency vehicle access and skinny streets should be regarded as public goods which must be balanced to achieve maximum benefit to the



Trail

Figure 1-1

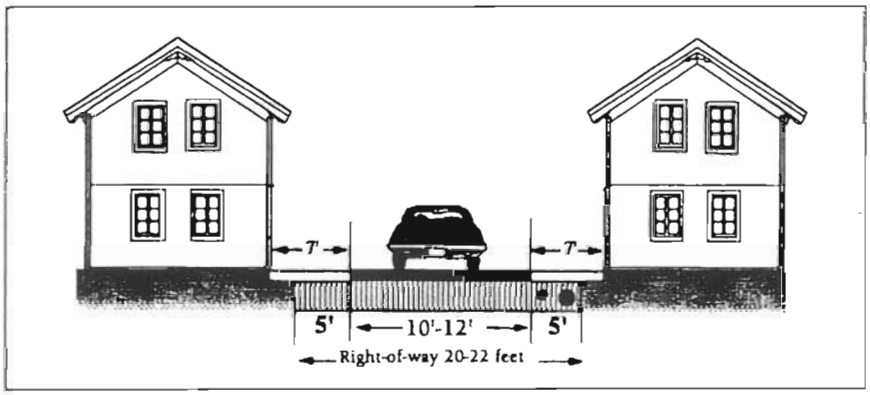
Purpose: Provides non-motorized access throughout the neighborhood.

Street Features

- Shade trees recommended
- Trail width 8-14 ft.
- Design speed 20 mph
- Stopping sight distance 125 ft.
- Clear zone of 3-6 ft.

Buildings and Land Use

- Link to make connections between all homes, parks and schools, and shopping districts



Alley

Figure 1-2

Purpose: Provides access to the rear of property.

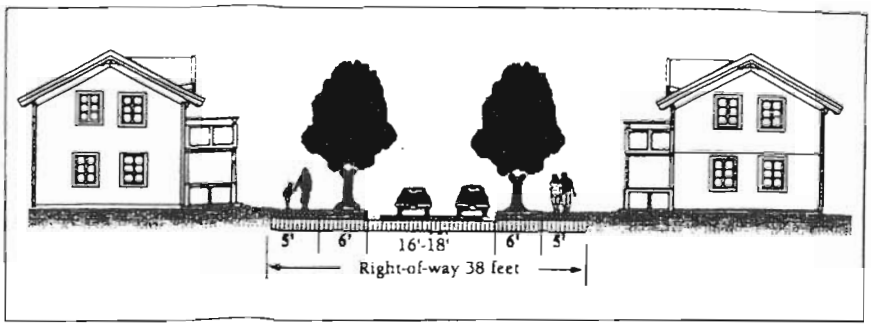
Street Features

- Average speed 10 mph
- Requires a 20-foot ROW
- Utility location underground on one side
- Paved width minimum of 10 ft.

Buildings and Land Use

- Residential — primarily single family
- Consistent building line recommended
- Provides rear access to garages
- Consider accessory unit above garage
- 7-foot minimum setback of building
- Garage door on track, to reduce outward swing.

Figure 1-3



Lane

Purpose: Provides access to single-family homes.

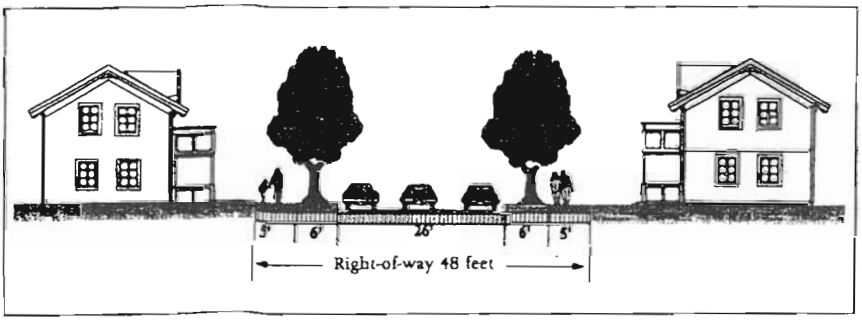
Street Features

- Street width 16-18 ft. with curb, gutter and informal parking
- Planting strips 6 ft.
- Sidewalks 5 ft. on each side
- Average speed 15 mph
- Requires a 38-foot ROW
- Utility location — underground or alley
- Drainage — Curb and gutter
- Two to six blocks long

Buildings and Land Use

- Residential — primarily single family
- Buildings brought close to sidewalk
- Consistent building line recommended

Figure 1-4



Street

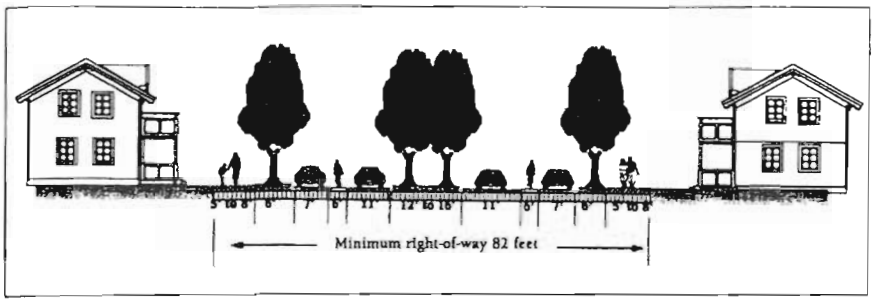
Purpose: Provides access to housing.

Street Features

- Street width 26 ft. with curb, gutter and informal parking
- Planting strips 6 ft.
- Sidewalks 5 ft. on each side
- Average speed 20 mph
- Requires a 48-foot ROW
- Utility location — underground or alley
- Drainage — Curb and gutter
- Two to six blocks long

Buildings and Land Use

- Residential — many residential types
- Residences brought close to sidewalk
- Consistent building line recommended
- Front porches encouraged



Avenue with Parking

Figure 2-1

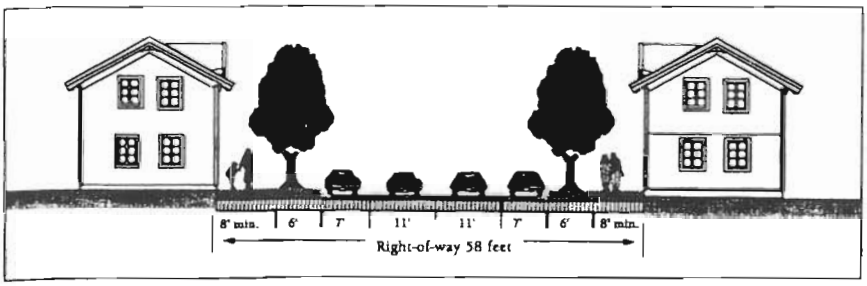
Purpose: Connects town centers and neighborhoods. Avenues go from neighborhoods to town centers, and are not long (no more than one mile). Avenues may circulate around a square or neighborhood park.

Street Features

- Street width 24 ft. on both sides of median with on-street parking (17 ft. if no parking), curb and gutter
- Median width 12-16 ft.
- Travel lanes 11 ft.
- Maximum two travel lanes
- Bike lanes and planting strips 6 ft.
- Sidewalks 5-8 ft. on each side
- Average speed 25-30 mph
- Utility location — underground
- Drainage — Curb and gutter, median can have swale for natural drainage and water retention

Buildings and Land Use

- Mixed residential and commercial use
- Buildings brought close to sidewalk
- Consistent building line recommended
- Place prominent public buildings and plazas at end of vista



Main Street without Median

Figure 2-2

Purpose: Provides access to, and a space for, neighborhood commercial and mixed-use buildings.

Street Features

- Travel lanes 11 ft. w/striped parking
- Maximum 6 travel lanes
- Planting wells 6 ft. / landscaped median optional
- Sidewalks minimum of 8 ft. each side
- Average speed 20-25 mph
- Utility location — underground
- Drainage — Curb and gutter
- Includes bulbouts at intersections and mid-block crossings
- Bike lanes optional but preferred

Buildings and Land Use

- Commercial and mixed use
- Buildings next to sidewalk
- Consistent building line recommended
- Pedestrian awnings, arcades, sidewalk dining and retail recommended

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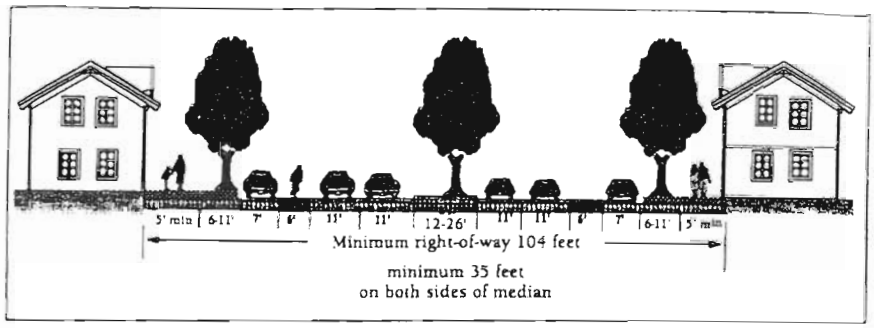


Figure 3-1

Boulevard

Purpose: Provides multi-lane access to commercial and mixed-use buildings, and carries regional traffic.

Street Features

- Lanes 11 ft. with striped parking and bike lanes
- Maximum 6 travel lanes
- Planting wells 6-11 ft.
- Sidewalks 5 ft. minimum each side
- Average speed 30-35 mph
- Utility location — underground
- Drainage — Curb and gutter

Buildings and Land Use

- Commercial and mixed use
- Buildings next to sidewalk
- Consistent building line recommended
- Sidewalks and bike lanes on both sides
- Pedestrian awnings and arcades recommended

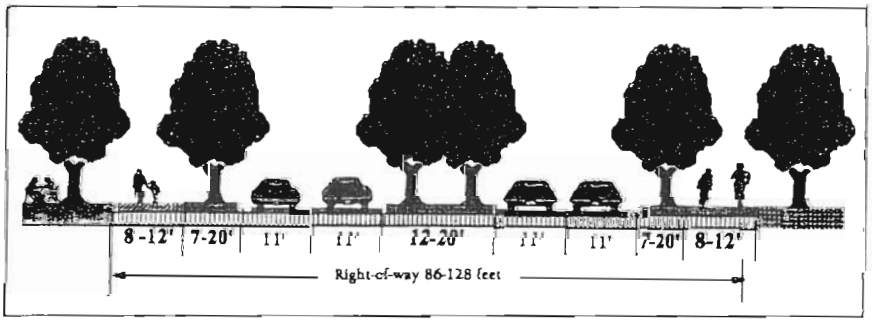


Figure 3-2

Parkway

Purpose: Parkways bring people into town, or pass traffic through natural areas. Parkways are not designed for development. When the parkway enters town, it becomes a boulevard.

Street Features

- Travel lanes 11-12 ft.
- Median width 12-20 ft.
- Average speed 45-55 mph
- Multi-use trails 8-12 ft.
- Planting strips 7-20 ft.
- Bike lane not adjacent to travel lane
- Utility location — underground
- Drainage — swales allowed, or curb and gutter
- 6 ft. minimum paved shoulder on high-speed parkway (>50 mph)

Buildings and Land Use

- No buildings, preserve nature
- Parkways are designed to be on the edge of towns, nature preserves or agricultural areas
- Multi-use trails may be on either or both sides. Criteria for dual trails include absence or presence of rivers, lakes, canals, railroads, etc.

Appendix 12
Traffic Calming Techniques

1. Road Humps and Speed Tables

   Raising the surface of the road over a short distance, generally to the height of the adjacent curb. Humps can be round or flat-topped-the latter being known as speed tables, which can extend over many meters.

2. Chicanes

   Physical obstacles or parking bays, staggered on alternate sides of the highway so that the route for vehicles is tortuous.

3. Traffic Throttles (pinch points)

   The narrowing of a two-way road over a short distance to a single lane. Sometimes these are used in conjunction with a speed table and coincident with a pedestrian crossing.

4. Curb extension (sidewalk widening)

   The sidewalk on one or both sides of the road is extended to reduce the highway to a single lane or minimum width for two-lane traffic. This reduces crossing distances and discourages parking close to intersections and crosswalks.

5. Central refuges (medians)

   Islands situated in the middle of the road to reduce lane widths and provide a refuge for pedestrians and bicyclists crossing major roads.

6. Mini-roundabout (traffic circle)

   Small roundabouts situated at an intersection. Some have raised centers, others are just painted circles on the road.

7. Raised Intersections

   The highway is raised at an intersection, usually by brickwork or a plateau with a ramp on each approach. The platform is a curb level and may well have distinctive surfacing.

8. Entry Treatment Across Intersections

   Surface alterations at side road intersections, generally using brickwork, setts or other textured surface materials. Level of the road may be raised to the level of the sidewalk.

9. Environmental Road Closure

Road closures, generally in residential streets, designed to remove through traffic or prevent undesirable turns.

10. No Entry-with "cycle-slip"

Access to a road is barred in one direction by a No-entry sign. The rest of the road remains two-way, and bicyclists and pedestrians can pass the No-entry sign.

11. Textured Surface

The use of non-asphalt surface such as setts, brickwork, paving or cobbles to reinforce the concept of a traffic restricted area.

12. Shared Surfaces

The traditional distinction between sidewalk and pavement is removed, leaving, pedestrians, bicyclists and motor vehicles to share a common space.

13. Tortuous Roads

Roads are designed to meander, occasionally quite sharply, reducing the view of any stretch of "open road," and thereby encouraging lower vehicle speeds.

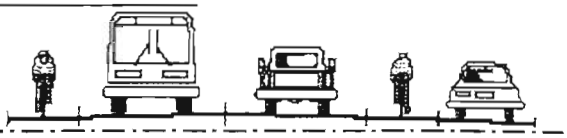
14. Rumble Strips

Lines of cobbles or other raised surfacing designed to warn drivers of excessive speed or of the proximity of a hazard area where lower speeds are desirable.

15. Transverse Bands

Painted lines oriented as transverse bands across the highway at decreasing intervals. They are intended to give drivers the impression they are traveling with increasing speed, so they will react and slow down.

Source: FHWA Case Study No. 19



Definitions: Types of Bicycle Lanes & Paths

Bicycle Lane

A bicycle lane is a portion of the roadway designated for exclusive or preferential use by bicyclists in urban areas. **Bicycle lanes are appropriate on most urban arterials and collector streets.**

Bicycle lanes must always be well marked to call attention to their preferential use by bicyclists.

A **shoulder bikeway** is a street upon which the paved shoulder, separated by a four-inch stripe and no bicycle lane markings, is usable by bicycles. Although the shoulder can be used by bicycles, auto parking can be allowed.

Shared Roadway

On a shared roadway, bicyclists and motorists share the same travel lanes. A motor vehicle driver will usually have to cross over into the adjacent travel lane to pass a bicyclist, unless a wide outside lane is provided (see below). **Shared roadways are adequate for neighborhood streets with very low traffic volumes.**

There are two variations of the shared roadway concept. Those with wide outside lanes, and those with normal lane widths.

On streets with higher volumes and speeds where bicycle lanes are warranted but can not be provided due to severe physical constraints, a wide outside lane may be provided to accommodate bicycle travel. A wide outside lane should be wide enough to allow an average size motor vehicle to pass a bicyclist without crossing over into the adjacent lane.

Off-Street Path

An off-street path (also called an off-street trail or multi-use path) is a facility separated from motor vehicle traffic by an open space or barrier, either within the roadway right-of-way or within an independent right-of-way. Off-street paths are typically used by pedestrians, joggers, skaters, and bicyclists as two-way facilities. Off-street paths may be appropriate in corridors not well served by the street system (if there are few intersecting roadways), to create short cuts that link urban destination and origin points, along continuous greenbelts such as rivers and abandoned rail corridors, and as elements of a community recreational trail plan.

Bicycle Boulevard

A bicycle boulevard is a street with low traffic volumes where the through movement of bicycles is given priority over motor vehicle travel. A bicycle boulevard is created by modifying the operation of a local street to function as a through street for bicycles while maintaining local access for automobiles (closing through traffic). Traffic calming devices are used to control traffic speeds and discourage through trips by automobiles. Traffic control is designed to limit conflicts between automobiles and bicycles and give priority to through bicycle movement. Bicycle lanes are typically not needed on a bicycle boulevard.

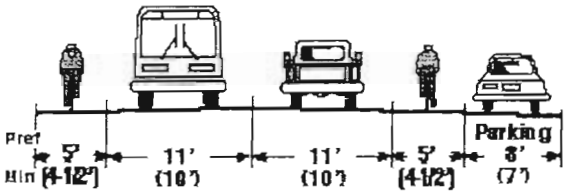
Bicycle Lane Design: Basic Parameters

Bicycle lanes are one-way facilities that carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Bicycle lanes are the preferred facility for urban arterial and collector streets. Bicycle lanes are created by the addition of an 8 inch (200 mm) stripe and stencils. Motorists are prohibited from using bicycle lanes for driving and parking. This does not preclude motor vehicles from using a bicycle lane for emergency avoidance maneuvers or breakdowns.

Curbed streets (2 way streets)

Preferred Travel Lane Width

For a bicycle lane adjacent to curb or parking:
5 foot preferred width.



Bicycle lane widths of 6 feet maximum may be desirable when one or a combination of the following conditions exists:

- traffic volumes and speeds are high;
- adjacent parking use and turnover is high;
- catch basin grates, gutter joints, and other features in the bicycle lane may present an obstacle to cyclists;
- steep grades exist;
- truck volumes are high; or
- bicycle volumes are high.

Bicycle lane widths of 4 feet minimum may be acceptable when:

- physical constraints exist, for a segment of less than 1 mile that links to existing bikeways on both ends; or
- implemented in conjunction with traffic calming devices ; or
- adjacent to parking with [very] low use and turnover; or
- adjacent to an uncurbed street shoulder.

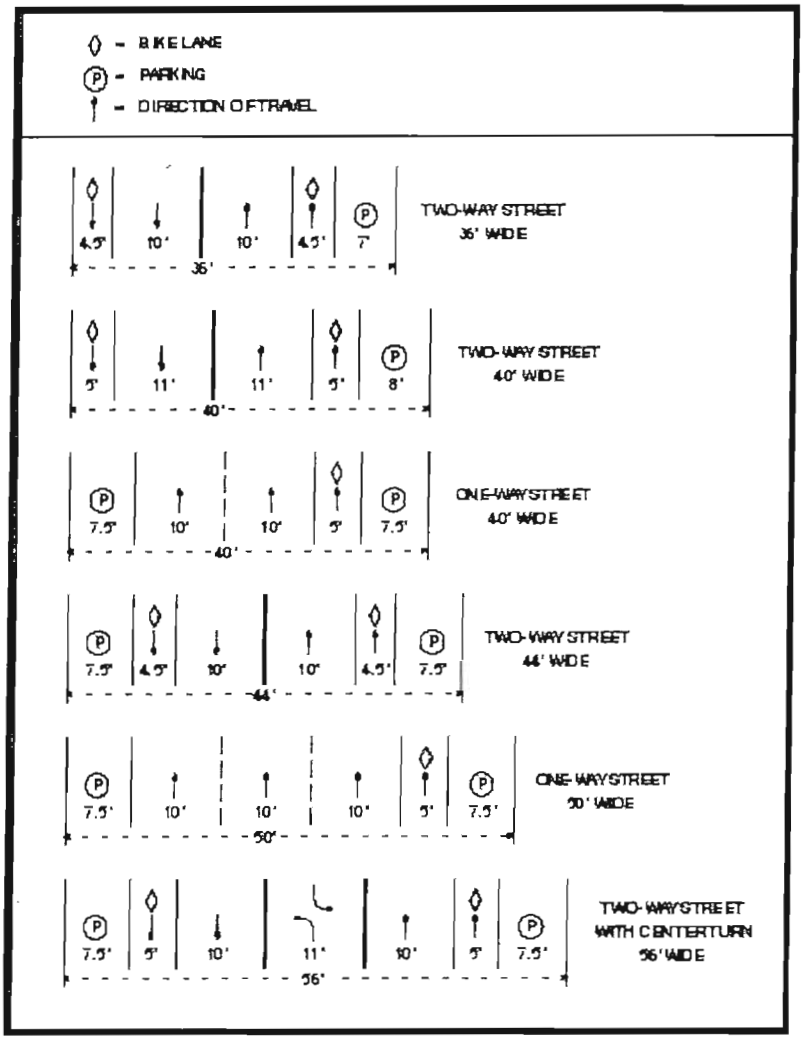
Additionally, for on-street parking, it is recommended that there be an 8 foot preferred (7 foot minimum) parking area width adjacent to the bicycle lane.

It is recommended that the travel lane width adjacent to a bicycle lane be 11 foot (10 foot minimum). A four-foot bicycle lane should not be used in combination with a 7 foot parking lane and/or a 10 foot travel lane.

Bicycle Lanes on One-way Streets

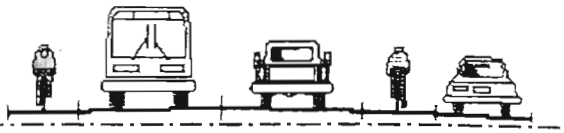
Bicycle lanes on one-way streets should be on the right side of the roadway, except where a bicycle lane on the left will decrease the number of conflicts (e.g., those caused by heavy bus traffic or dual right-turn lanes, etc.). Directional arrow pavement markings should be used to indicate the proper direction of travel and discourage wrong way riding.

Bike Lane Design for Curbed Streets



Uncurbed streets

When providing a shoulder for bicycle use, a width of 6 feet (1.8 m) is recommended. This allows a cyclist to ride far enough from the edge of the pavement to avoid debris, yet far enough from passing vehicles to avoid conflicts. If there are physical width limitations, a minimum 4 foot shoulder may be adequate. On climbing lanes, it is desirable to maintain a 6 foot (1.8 m) shoulder, as uphill cyclists need more space for maneuvering (minimum 5 foot [1.5 m]).



Intersection Design

Intersections are areas where most conflicts between various roadway users occur. By their very nature, intersections put one group of travelers in the path of others. Good intersection design creates a situation where those approaching the intersection have a clear indication what path they must follow and who has the right-of-way. As with other roadway design features, bicyclists must be treated as vehicles: only in extremely rare cases should they be encouraged to proceed through intersections as pedestrians.

Basic Principles

Some basic principles to be followed when designing intersections are:

- Unusual conflicts should be avoided.
- Intersection design should create a path for bicyclists that is direct, logical and as close to the path of motor vehicle traffic as possible.
- Bicyclists following the intended trajectory should be visible and their movements should be predictable.
- Potential safety problems associated with the difference between auto and bicycle speeds should be minimized.

Simple Right Angle Intersections

Simple right angle intersections are usually the simplest to treat for bicycle movement. Bicyclists must be allowed to follow a path that is as direct as possible, using the following techniques:

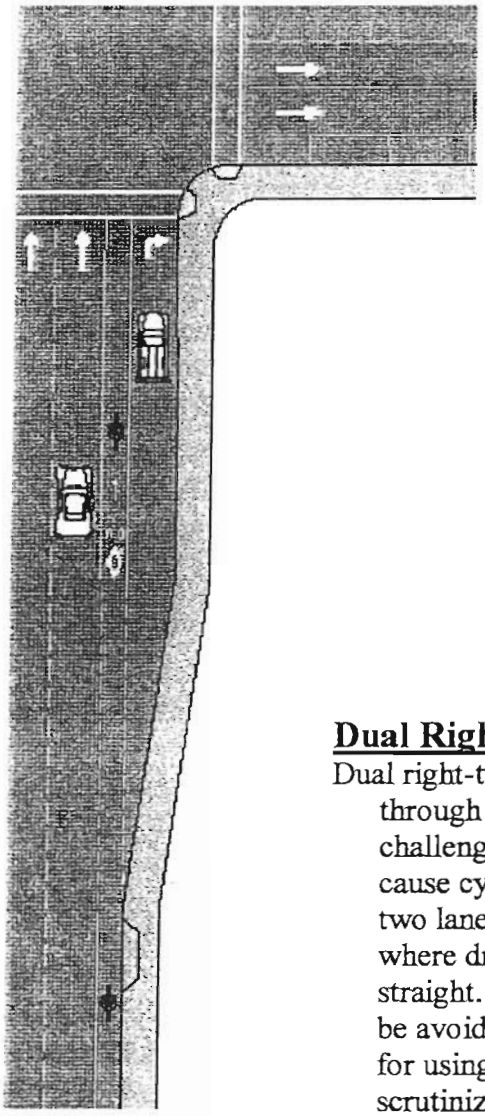
- Bicycle lanes should be striped to a marked or unmarked crosswalk.
- The bicycle lane stripe should be a solid stripe all the way to the crosswalk.
- The lanes should resume at the other side of the intersection.

Complicated Intersections

Intersections with multiple streets entering from different angles can create confusion for users. Such intersections should be avoided and designed instead as simple right angle intersections whenever possible. For an already existing complicated intersection, or if a complex intersection is absolutely needed, bicycle lanes may be striped with dashes to guide bicyclists through a long undefined area.

Intersection Design: Right Turn Lanes

Standard Right Turn Lane Configuration



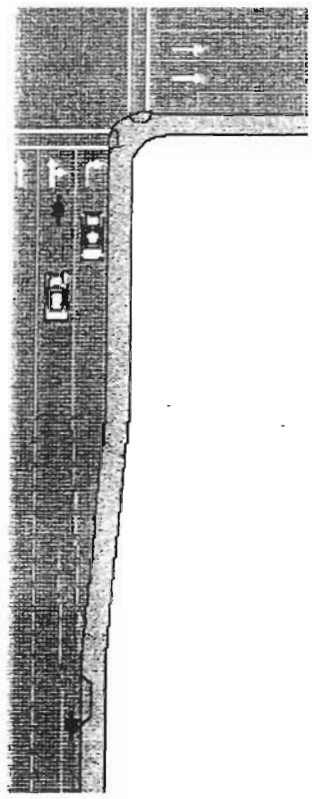
Right-turn lanes present special problems for cyclists because right-turning cars and through bicyclists must cross paths. To alleviate these concerns, the design in this figure should be used for bicycle lanes. The paths of the through bicyclist and the right-turning motor vehicle should cross prior to the intersection. This configuration has three advantages:

- It allows this conflict to occur away from the intersection where other conflicts could occur.
- The difference in travel speeds is an advantage, as a motor vehicle driver can pass a bicyclist rather than ride side-by-side.

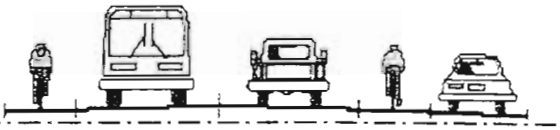
All users are encouraged to follow the rules of the road: through vehicles (including bicyclists) proceed to the left of right-turning vehicles.

Dual Right-Turn Configurations

Dual right-turn lanes or a right-turn, right/through lane configuration are unpleasant challenges for cyclists at intersections because cyclists must either merge across two lanes or merge across into a lane where drivers could be turning or going straight. Both these configurations should be avoided whenever possible. Warrants for using dual turn lanes should be closely scrutinized, so this pattern is used only if absolutely necessary.



A marking should be placed at the beginning of the through bicycle lane. BEGIN RIGHT TURN LANE, YIELD TO BIKES, should be placed at the beginning of the taper



Bicycle Signage

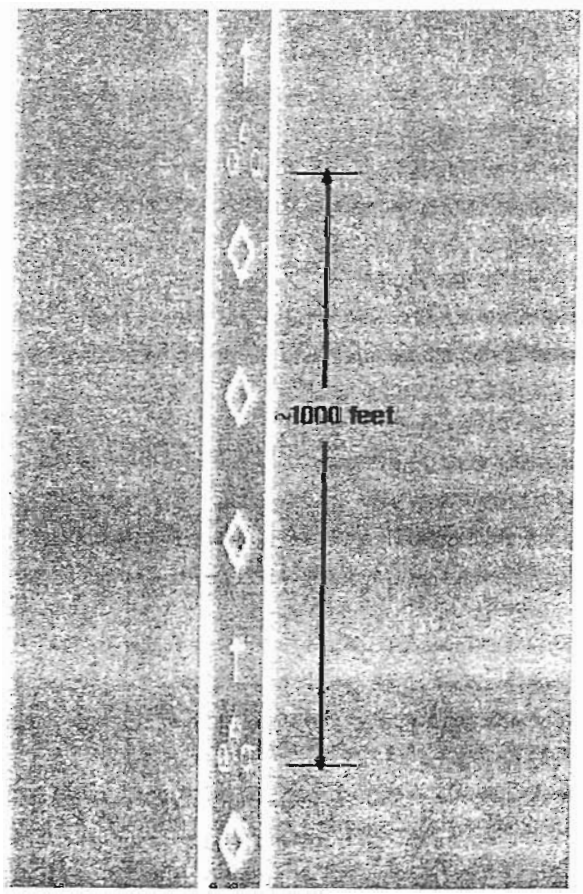
Well-designed roads usually require very little signing, because they are built so all users understand how to proceed. Conversely, an overabundance of warning and regulatory signs may indicate a failure to have addressed problems. The attention of drivers, bicyclists and pedestrians should be on the road and other users, not on signs along the side of the road.

Oversigning of roadways is ineffective and can degrade their usefulness to users. Too many signs are distracting and a visual blight, they create a cluttered effect and waste resources.

The message conveyed by the sign should be easily understandable by all roadway users. The use of symbols is preferred over the use of text.

"XING" rider should be placed in advance of a point where an off-street path crosses a roadway, if the crossing is in an area where it is not expected. **This sign is not appropriate where bicycle lanes and shoulder bikeways cross streets at controlled intersections** (traffic signals and stop signs).

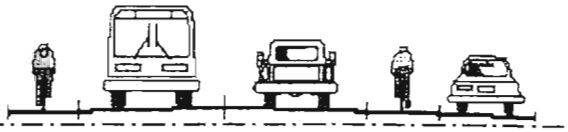
"Right Lane, Bike Only" sign should be used sparingly in cases where clarity is needed



Bicycle Lane Designation

Bicycle Lanes should be designated with the following markings:

- 8-inch (200 mm), white stripe (bicycle lane measurements are taken from the center of the stripe).
- Bicycle stencil, directional arrow, and diamond spaced every 1000 feet or after every major intersection, with three diamonds in between.
- In general, "No Parking" signs are not to be used with bicycle lanes; the bicycle lane should be marked well enough to be a parking deterrent. "No Parking" signs may be used in cases where parking in bicycle lanes is a continual problem. Yellow painted curbs may also be used to indicate that parking is prohibited.
- Bicycle route signs are to be used for directional information or bikeway identification. They should not be used in isolation; they must be used in conjunction with other informational signage.
- Bike lane ahead and Bike Lane ends signs should be used sparingly. The "Bike lane ends" sign may be used to indicate a merge situation.



Shared Roadway: Design

There are no specific bicycle standards or treatments for low-volume, low-speed shared roadways; they are simply the roads as constructed. Shared roadways function well on roads such as local streets and minor collectors with speed limits of 25 mph (40 km/h), or traffic volumes of 3,000 average daily traffic (ADT) or less.

Many urban local streets are carrying greater traffic volumes and at higher speeds than their designation should normally allow. These could function well as shared roadways if excessive traffic speeds and volumes were effectively reduced through traffic calming techniques, such as curb extensions, speed bumps, roundabouts, etc.

Wide outside lane

For higher volume/higher speed streets (above 25 mph or 3000 ADT) where there is inadequate width to provide the required bicycle lanes or shoulder bikeways, a wide outside lane may be provided that accommodates both cyclists and motor vehicles. This could occur on retrofit projects where there are severe physical constraints, and all other options have been pursued, such as removing parking or narrowing travel lanes to minimum acceptable widths.

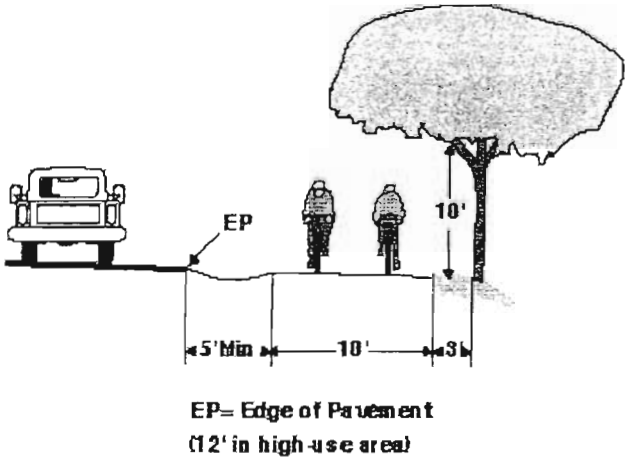
A wide outside lane is typically 14 feet (4.2 m) wide. Usable width is normally measured from curb face to the center of the lane stripe, but adjustments need to be made for drainage grates, parking, and longitudinal ridges between pavement and gutter sections. For widths of 15 feet (4.8 m) or greater, a bicycle lane or shoulder bikeway should be striped.

Signage

In general, no signs are required for a shared roadway not on the city's Bikeway Network. Bicyclists should be expected on all urban local streets, which are mostly shared roadways.

On narrow roads heavily used by cyclists, it may be helpful to install bicycle warning signs with the rider ON ROADWAY. These signs should be used where there is insufficient shoulder width for a significant distance. This signing should be in advance of the roadway condition.

Off-Street Path



EP= Edge of Pavement
(12' in high-use area)

Off-street paths can provide a good facility, particularly for novice riders, recreational trips, and cyclists of all skill levels preferring separation from traffic. **However, if poorly designed, they can be, at best, a poor investment of public dollars, and at worst, dangerous.** Some of the advantageous practices in off-street path design include:

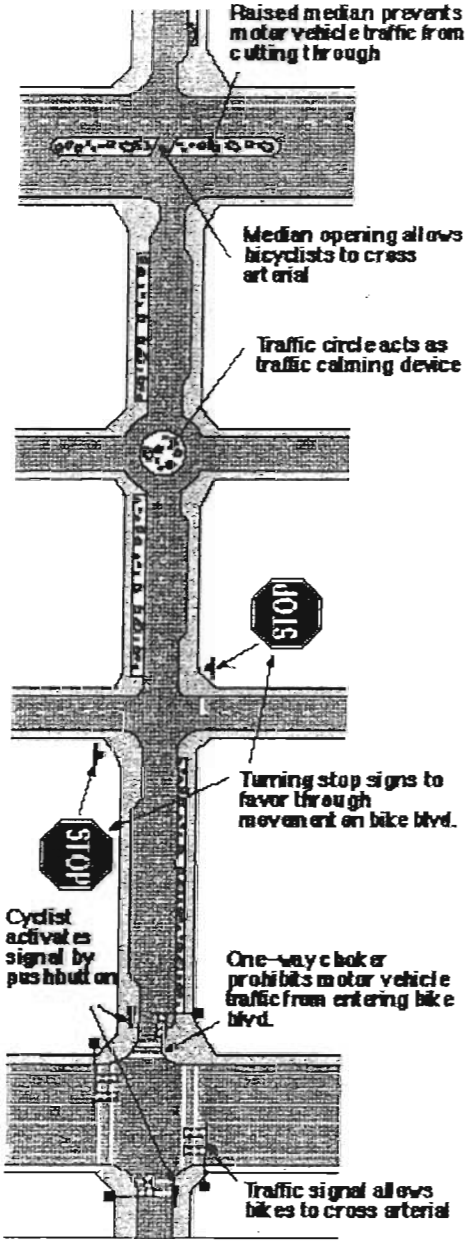
- Implementing frequent access points from the local road network; if access points are spaced too far apart, users will have to travel out of direction to enter or exit the path, which will discourage use;
- Placing directional signs to direct users to and from the path;
- Building to a standard high enough to allow heavy maintenance equipment to use the path without causing it to deteriorate;
- Limiting the number of at-grade crossings with streets or driveways;
- Terminating the path where it is easily accessible to and from the street system, preferably at a controlled intersection or at the beginning of a dead-end street -- poorly designed paths can put pedestrians and cyclists in a position where motor vehicle drivers do not expect them when the path joins the street system.
- Addressing potential security problems up front.

Off-street paths should not be placed directly adjacent to roadways. This creates a situation where a portion of the bicycle traffic rides against the normal flow of motor vehicle traffic, which is contrary to the rules of the road. This can result in bicyclists going against traffic when either entering or exiting the path. This can also result in an unsafe situation where motorists entering or crossing the roadway do not notice bicyclists coming from their right, as they are not expecting vehicles coming from that direction. Even bicyclists coming from the left often go unnoticed, especially when sight distances are poor.

Off-street paths may be considered along roadways under the following conditions:

- The path will generally be separated from all motor vehicle traffic.
- Bicycle and pedestrian use is anticipated to be high.
- There is a commitment to provide path continuity throughout the corridor.
- The path can be terminated at each end onto streets with good bicycle and pedestrian facilities, or onto another safe, well-designed path.
- There is adequate access to local cross-streets and other facilities along the route.
- Any needed grade separation structures do not add substantial out-of-direction travel.
- The total cost of providing the proposed path is proportionate to the need.

As bicyclists gain experience and realize some of the advantages of riding on the roadway, many stop riding on paths placed adjacent to roadways. This can be confusing to motorists, who may expect bicyclists to use the path. When designing a bikeway network, the presence of a nearby path should not be used as a reason to not provide adequate shoulder or bicycle lane width on the roadway.



Bicycle Boulevard

A bicycle boulevard on a local service street can provide a good alternative to a bicycle lane or wide outside lane on a higher volume/higher speed street. It can be an excellent attractor for new and inexperienced cyclists and provide a pleasant ride to reach many destinations. Elements of a bicycle boulevard include the following:

- Selecting a street that provides a direct and continuous connection for bicyclists, as opposed to a route that requires bicyclists to wind through neighborhoods. Bicycle boulevards work best on a street grid system.
- Turning stop signs towards intersecting traffic, so bicyclists can ride without interruption.
- Placing motor vehicle traffic diverters at key intersections to stabilize motor vehicle volumes. The diverters must be designed to allow through bicycle movement. A full diverter must include a cut-through wide enough to accommodate a bicycle with a trailer (4 feet wide).
- Alternatively, placing traffic calming devices on the street to stabilize motor vehicle traffic speeds. These include traffic circles, speed bumps (14 foot or 22 foot), curb extensions, slow points, chicanes, etc. In some situations, both traffic diverters and traffic calming devices will be needed.
- Providing protection where the boulevard crosses higher volume arterial streets (Figure A1.18). This can be accomplished in two ways:
- With a signal where a traffic study has shown that a signal in between arterials will be safe and effective. To ensure that bicyclists will be able to activate the signal, the preferred treatment is a signal loop in the pavement marked with a stencil to show the bicyclists where to stand to trip the loop. Alternatively, a push button that will not require dismounting may be provided, in addition to push button activation for pedestrians.
- With a median refuge. A median refuge should be wide enough so it allows a bicyclist with a trailer to be protected from the travel lanes (minimum 8 feet, 10 feet preferred.) The design should allow bicyclists to see the travel lanes they must cross.
- Placing directional signs to route cyclists to key destinations, to guide cyclists through difficult situations, and to alert motorists of the presence of bicyclists.

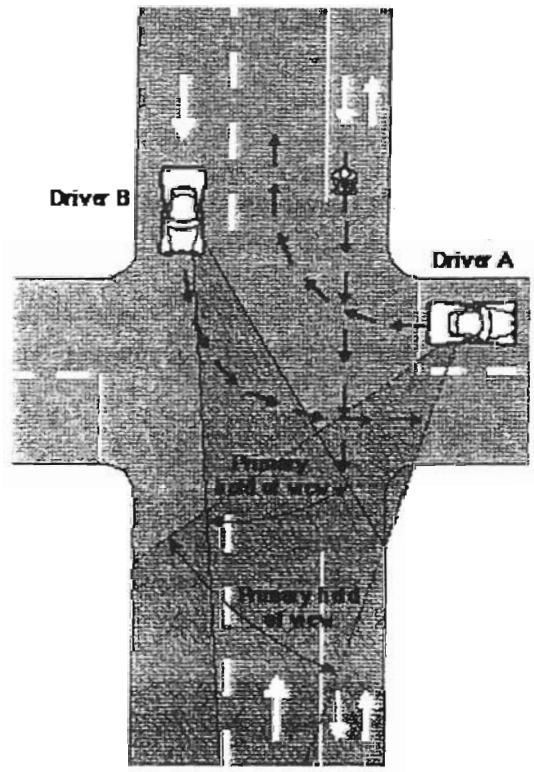
Detrimental Practices (to be avoided)

Sidewalk Bikeways

Early bikeway efforts were aimed at multiple use of sidewalks for pedestrians and bicyclists. While in rare instances this type of facility may be necessary, or desirable for use by small children, in most cases it should be avoided. Cyclists are safer when they are allowed to function as roadway vehicle operators, rather than as pedestrians.

Sidewalks are generally not suited for cycling for several reasons:

- They put cyclists in conflict with pedestrians.
- There are potential conflicts with utility poles, sign posts, benches and other "street furniture."
- Bicyclists face conflicts at virtually every driveway, alley or intersection, as motorists are not expecting bicyclists. A cyclist on a sidewalk is generally not visible to motorists, so that the cyclist emerges unexpectedly. This is especially true of cyclists riding in the direction opposite to adjacent motor vehicle traffic -- drivers are not looking for a vehicle coming from this direction.
- Bicyclists are put into awkward situations at intersections where they cannot safely act like a vehicle but are not in the pedestrian flow either, which creates confusion for other road users.



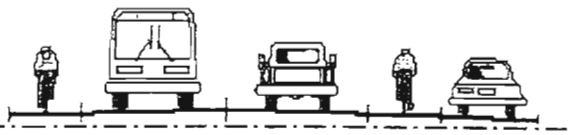
Right-turning driver A is looking for traffic on the left; Left-turning driver B is looking for traffic ahead; In both cases, a wrong-way bicyclist is not in the driver's main field of vision.

Extruded Curbs

These low curbs, when used to separate motor vehicles from cyclists, create an undesirable condition. Bicyclists or motorists may hit the curb and lose control, with the motor vehicle crossing onto the bikeway or more often the cyclist falling onto the roadway. Extruded curbs also make bikeways difficult to maintain and tend to collect debris.

Two-Way Bicycle Lane on one side of road

While this may seem a practical alternative to the expense of two bicycle lanes, it creates a condition that is very dangerous for bicyclists. The bicyclist closest to the motor vehicle lane has opposing motor traffic on one side and opposing bicycle traffic on the other. This configuration also promotes illegal wrong-way riding and creates awkward and dangerous movements in transitions back to standard bikeways.



End-of-Trip Facilities

Every bicycle trip has two basic components: the route selected by the cyclist, and the "end-of-trip" facilities available at the destination. These end-of-trip facilities include parking for the bicycle and showers and changing space for commuters. If the end-of-trip facilities do not meet the users' needs, other means of transportation will be substituted. Clearly, the availability of convenient, secure bicycle parking is a critical factor in an individual's decision whether or not to use a bicycle for commuting. Good, secure bicycle parking offers these benefits:

- it inexpensively and efficiently increases a building's parking capacity;
- it serves those who use bicycles as a mode of transportation; and
- it encourages bicycle use.

Cyclists' needs for bicycle parking range from simply a convenient piece of street furniture, to storage in a bicycle locker that affords weather, theft and vandalism protection, gear storage space, and 24-hour personal access. Where a cyclist's need falls on this spectrum is determined by several factors:

- **Type of trip being made:** whether or not the bicycle will be left unattended all day or just for a few minutes.
- **Weather conditions:** covered bicycle parking is apt to be of greater importance during the colder months.
- **Security of area:** determined by the cyclist's perception of how prone a given area is to bicycle theft. This is fairly subjective, and probably predicated to a degree on an individual's experiences with bicycle theft. A final need for some potential commuting cyclists are shower, locker, and changing rooms at trip destinations. For those cyclists needing to dress more formally, travel longer distances, or cycle during wet or hot weather, the ability to shower and change clothing can be as critical as bicycle storage.

Common terms describing end-of-trip facilities are defined below.

SHORT-TERM PARKING Bicycle parking meant to accommodate visitors, customers, messengers and others expected to depart within two hours. Requires approved standard rack, appropriate location and placement, and weather protection.

LONG-TERM PARKING Bicycle parking meant to accommodate employees, students, residents, commuters, and others expected to park more than two hours. This parking is to be provided in a secure, weather-protected manner and location. Long-term parking type will be either a bicycle locker, a locked room with standard racks and access limited to bicyclists only, or standard racks in a monitored location.

End-of-Trip Parking Features

Bicycle End of trip facilities should have the following characteristics:

SECURE As invulnerable as possible to theft, depending on an appropriate combination of parking type, location, and access.

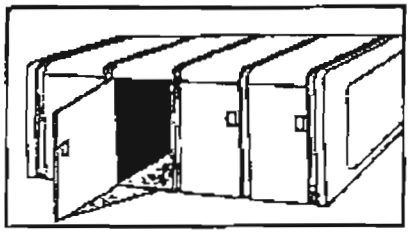
PLENTIFUL Enough short- and long-term bicycle parking spaces to exceed peak season demand. Requests for additional bicycle parking, beyond existing code requirements, are to be met by the property owner.

EASILY-ACCESSIBLE Bicycle parking should not be impeded by nearby stationary objects, parked bicycles or parked cars. Indoor bicycle parking must be on a floor that has an outdoor entrance open for use and a floor location that does not require stairs to access the space; exceptions may be made for parking on upper stories with elevator access within multi-story buildings. Directional signs should be used to locate bicycle parking areas when it is not visible from the street.

ADJACENT TO DESTINATIONS Short-term bicycle parking should be located no farther from the main entrance than the closest auto parking, and within 50 feet of a main entrance to the building. Close proximity to a main entrance is desirable for long-term parking but is not required.

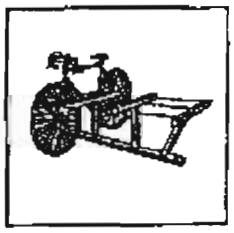
COVERED Having sufficient shelter to protect the parked bicycle from the elements, particularly rain.

SHOWER AND LOCKER FACILITIES Any facility providing showers, changing space, and permanent clothes storage lockers sufficient to the needs of bicycle commuting employees.

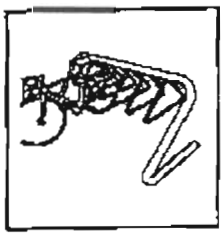


Bicycle Locker

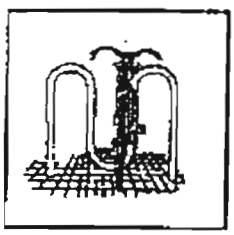
Bike Rail



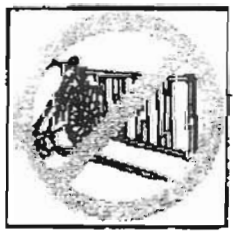
3-pt. Locking



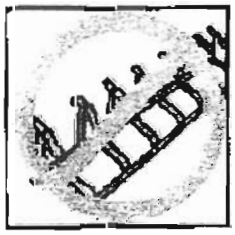
Freestanding



Ribbon Rack



Traditional
(SUBSTANDARD)



Wheelholder
(SUBSTANDARD)

Appendix 14

ROCHESTER POLICE DEPARTMENT
ACCIDENT STATISTICS ---- BICYCLES

1998

DATE OF ACC		REPORT #	LOCATION	FACTORS
04/07/98	Tues 1802	98-314-AC	Intersection Waldron & Lafayette	Bike into car. No injury. No transport.
4/22/98	Weds 0642	98-351-AC	Little Falls Bridge Rd	Veh turning left on Chestnut Hill Rd, struck bicyclist. Minor injury, no transport.
4/27/98	Mon 1315	98-369-AC	Columbus Avenue & Wakefield	Veh struck bicyclist. Child left area.
05/05/98	Tues 1658	98-386-AC	Columbus Avenue & Summer St.	Bike into car. No apparent injury. Bicyclist left scene.
5/09/98	Sat 2115	98-401-AC	Oak St. City.	Bicyclist (9 y.o.) struck. Transported to FMH by parents.
07/19/98	Sun 1654	98-592-AC	State Street	Bike into car. (7 y.o.), no injury.
07/20/98	Mon 1651	98-599-AC	Milton Rd @ Market Basket	Child rode into side of car. One transported.
08/04/98	Tues 1640	98-645-AC	Old Dover Road	Bicyclist struck. No injury
08/11/98	Tues 2232	None	Village @ Riverside	Bicyclist struck in park. Minor injury. Neg. contact with vehicle.
08/18/98	Tues 1120	98-690-AC	Wakefield Street	Bicyclist struck. One transported.

1999

DATE, DAY & TIME ACCIDENT		REPORT #	LOCATION	FACTORS
02/13/99	Sat 1550	99-171-AC	Maple Street (city)	Bicyclist struck (11 y.o.) no serious injury.
04/08/99	Thurs 1748	99-306-AC	River Street	Veh. struck bicyclist (4 y.o.) No serious injury. Negative contact with vehicle.
05/05/99	Wed 1906	99-359-AC	Union Street @ North Main	Veh. struck bicyclist who darted in front of him. No apparent injury.
5/17/99	Mon 2006	99-404-AC	Riches Parking Lot	Bicyclist struck. Neg. contact with veh. No injury
07/26/99	Mon 1553	99-617-AC	Columbus Avenue & South Main	Bicyclist into car. One transported
08/03/99	Tues 1438	99-647-AC	Washington St. (area of 112)	Car vs. bicyclist. (Two boys on bike) Bike making U-Turn. Struck @ yellow line
8/10/99	Tues 2034	99-676-AC	Whitehall Road @ Chamberlain	Veh struck bicyclist. Minor injury
08/30/99	Mon 1248	99-752-AC	Portland Street (area of #240)	Bicyclist struck. Injury. EMS notified.
09/01/99	Wed 1539	99-6604-OF	Highland St. @ Salmon Falls Road	Report of bicyclist struck. Neg. contact with either vehicle.
09/30/99	Thurs 1700	99-852-AC	Wakefield St. @ McDonald's	Bicyclist struck. Minor injuries. Reported later from home.
11/05/99	Fri 1719	99-948-AC	Wakefield St and Summer	Bicyclist struck by car. Minor injury. EMS notified.

2000 (to date)

DATE OF ACC		REPORT #	LOCATION	FACTORS
03/31/00	Fri 1220	00-1691-OF	Union Street	Bicyclist struck. No apparent injury
05/23/00	Tues 2001	00-444-AC	Winter Street and Columbus Avenue	Bicyclist struck. Minor injury. No transport. (Reported later)
07/05/00	Weds 1424	00-551-AC	Milton Road (near #83)	Bicyclist struck. Minor injury. Transported.
07/05/00	Weds 1634	00-552-AC	Rochester Hill Road	Bicyclist struck. Injury. Transported.
07/29/00	Sat 1247	00-639-AC	Highland Street, ER	Bicyclist (child) struck. Minor injury. Transported.
08/05/00	Sat 1731	00-659-AC	Salmon Falls Road (near #311)	Bicyclist struck. Injury. Transported.

YEAR	TOTALS
1998	10
1999	11
2000 (to date)	06
GRAND TOTALS	27

Appendix 15
Draft Planning Board Policy for Class VI Roads

Building permits shall be issued for development on Class VI roads in accordance with this policy.

a) Development on Class VI roads in the city of Rochester is highly discouraged. Such development can cause numerous problems for the public, the City of Rochester, and adjoining property owners because Class VI roads are generally neither improved nor maintained to City standards. However, in order that land situated on such roads still be usable this policy provides for limited use subject to a number of conditions.

b) RSA 674:41 and other applicable law - including provisions of the Rochester Zoning Ordinance and Building Code - shall apply. The zoning requirement for frontage on a public highway may be considered to be waived (under 674:41) but actual frontage width requirements shall still apply.

c) Permits on any particular Class VI road may be granted only if the Rochester City Council has authorized the issuance of permits on that specific road. The City Council may authorize issuance of permits for the erection of buildings either (1) anywhere along the entire Class VI road or (2) only along a specific portion of the road and shall stipulate which (1 or 2) in any decision.

d) There are three steps in obtaining approval for the issuance of a building permit (prior to applying for the actual permit to the Code Enforcement Department):

   1) The Planning Board makes its recommendation to the City Council on the issuance of permits on a particular road.

   2) The City Council authorizes *general* issuance of permits on the particular road.

   3) The Planning Board approves an application for a building permit on a *specific* lot on that road.

e) The Planning Board may, at its option, consolidate steps d1) and d3), above, by approving a specific application subject to City Council's authorizing the issuance of permits on that road. Clearly, where the City Council has already authorized issuance of permits on a particular road subsequent applicants need only apply to the Planning Board for specific approval.

f) The City Council may, at its discretion, deny the issuance of permits on roads or portions of roads.

g) The Planning Board - in approving specific applications - may impose appropriate conditions.

h) If the City Council determines not to authorize issuance of permits on a road where an applicant seeks a building permit that party may appeal to the Zoning Board of Adjustment

in accordance with RSA 674:41 II. An applicant may appeal any decision of the Planning Board in a specific approval to the superior court in accordance with RSA 677:15.

i) Permits shall be issued for construction of detached single family residences intended for owner occupancy only (rather than for rental or speculation purposes), with one such residence per lot regardless of lot size.

j) No approvals shall be granted for two family residential, multifamily residential, nor any nonresidential development, nor for any subdivision of property, located on a Class VI road.

k) If access can practicably be obtained onto a public highway other than a Class VI road that public highway must be utilized for access rather than the Class VI road.

l) The Planning Board shall not grant blanket approvals for permits for multiple lots on a particular Class VI road: each application for an individual lot must be considered separately.

m) Prior to issuance of a building permit an applicant must improve the road to a condition as specified by and to be approved by the Planning Board (with a recommendation from the City Engineer) including use of well graded materials of sufficient depth to handle fire trucks, adequate width for emergency vehicles, appropriate grading to provide drainage away from the road surface, installation of culverts and other drainage structures as necessary, design of suitable road plan, profile, and cross sections, and any other conditions which the City may reasonably require. A widened area may be required to allow for trucks turning around to leave the area.

n) The road shall meet the following specifications:

(1) When only one house is being accessed the all-season passable width of roadway must be at least 18 feet.

(2) When at least two - but fewer than five - houses are being accessed the passable width of roadway must be at least 22 feet.

(3) When five or more houses are being accessed the road must be improved to City of Rochester Class V standards.

o) As part of any authorization for a building permit conditions will not generally be placed on private driveways. However, appropriate conditions may be placed on driveways to allow for emergency access as part of the driveway permit approval.

p) The applicant is not specifically required to maintain the road as part of any authorization for a building permit but he/she is urged to do so, on his/her own or in coordination with other property owners, as the City will not be maintaining the road and access for emergency vehicles should be assured.

q) Any uses customarily accessory to a single family residence may be established on the property, provided however, that only home occupations for which there will be no employees (other than residence family members) and for which no regular traffic is

expected to be generated (as determined by the Zoning Administrator) will be approved.

r) In accordance with RSA 674:41, prior to the issuance of a building permit the applicant must record at the Strafford County Registry of Deeds a Release drafted by the Planning Department (and reviewed by the City Attorney) which:

1) indemnifies the City of Rochester from any liability associated with the road (including passage of emergency vehicles);

2)recognizes that the City is not responsible for maintaining the road and that maintenance is the responsibility of the applicant unless alternative arrangements are made with lot owners and developers of other lots which abut the Class VI road;

3) acknowledges that the City could levy a betterment tax in the future upon the applicant and other abutting lot owners for improvements to the road; and

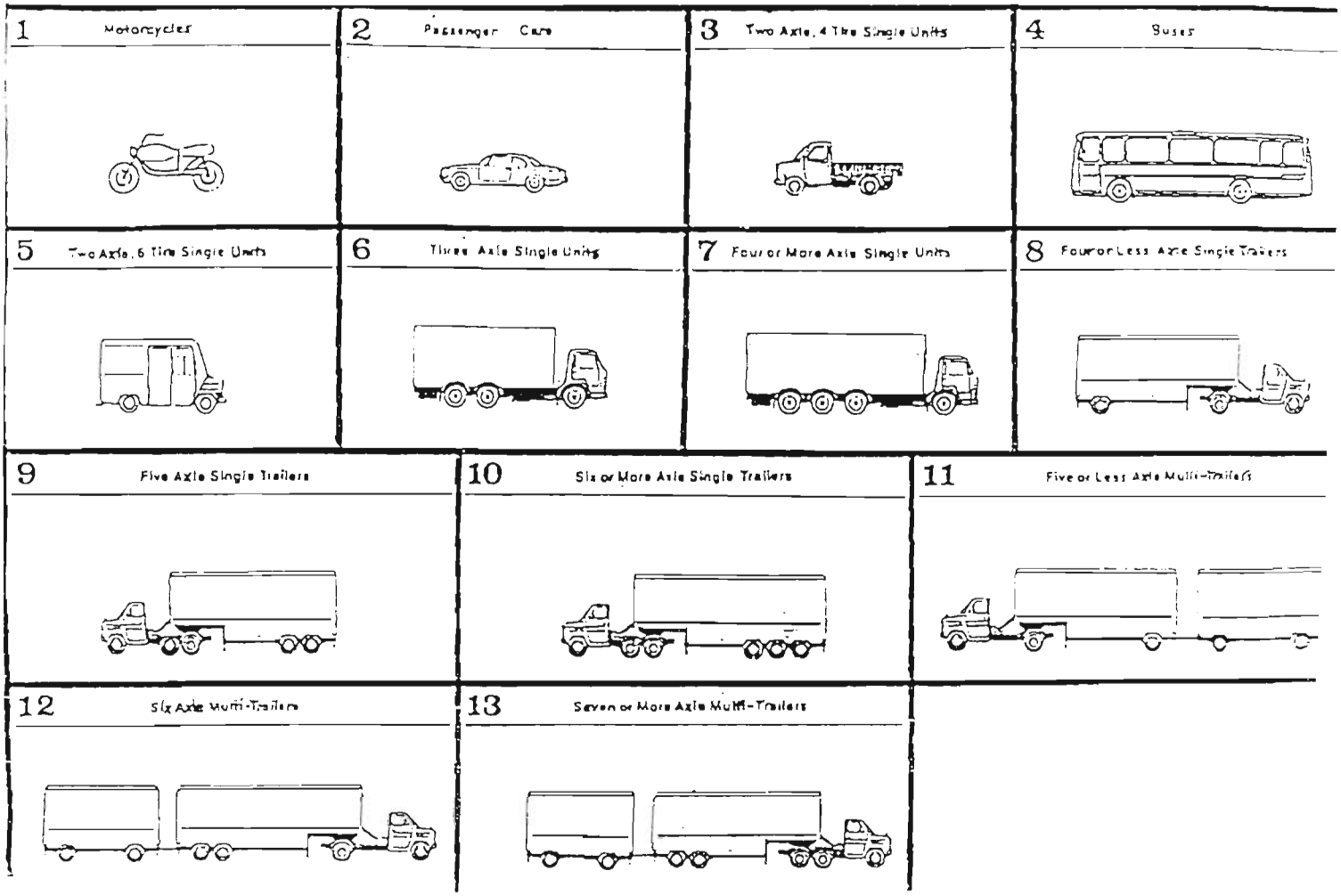
4) is binding upon the applicant's heirs, successors, and assigns.

s) It is recognized that any applicant who chooses to build on a Class VI road does so at his/her own risk. If in the future, abutting landowners seek to upgrade a Class VI road to a Class V road the landowners - rather than the City of Rochester - shall be entirely responsible for the costs of upgrading that road (i.e. to be paid for by an individual developer, abutting landowners jointly through a private agreement, or through a betterment tax on abutting landowners if approved by City Council).

t) Any modifications to the road in the future must be approved by the City of Rochester Public Works Department.

u) The Planning and Public Works Departments shall maintain a record of Class VI roads or portions of Class VI roads upon which the City Council has authorized issuance of building permits.

FHWA VEHICLE CLASSIFICATIONS



SUMMARY OF AXLE CLASSIFICATIONS

1	CYCL	:	Motorcycles
2	CARS	:	Passenger cars, with or without trailers
3	2A-L	:	2 axle, 4 tire pickups, vans, & those w/ trailers
4	BUS	:	Buses
5	2A-6	:	2 axle, 6 tire single units
6	3A-S	:	3 axle, single units
7	4A-S	:	4 axle, single units
8	<5-D	:	4 or less axle, double units (1 unit is a truck)
9	5A-D	:	5 axle, double units (1 unit is a truck)
10	>6-D	:	6 or more axle, double units (1 unit is a truck)
11	<6-M	:	5 or less axle, multi-units
12	6A-M	:	6 axle multi-units
13	>6-M	:	7 or more axle, multi-units

Appendix 17
City of Rochester - No Through Truck Policy

This policy was adopted by the Rochester City Council on *October 6, 1998* to ensure that any petition for the closure to truck traffic on any road, way or street within the City of Rochester is allowed proper study and public input to determine the impact on citizens and businesses within the City.

Upon receipt of any request or petition for the closure of any road, way or street to truck traffic within the City of Rochester, the following procedure shall be followed prior to any vote by the City Council on such closure.

Any request or petition shall be:

1. Referred to the Public Safety Committee of the Council and ex-officio of, who shall request a report from the Planning Department based on the following criteria:

1.1 ***Road Classification or Function***: local, collector, arterial.

1.2 ***Traffic Issues***: traffic counts (peak hours, average daily traffic), vehicle speeds vehicle classification, posted speed limit, accident records, use by pedestrians and cyclists.

1.3 ***Road Geometry***: sight distances, curvature of road, pavement width, grade.

1.4 ***Road Structure***: physical capacity of road bed and surface to handle heavy vehicles and the ability of sidewalks to handle pedestrian traffic.

1.5 ***Character of Area***: adjoining uses (residential, commercial, industrial); zoning classification; presence of schools and other institutions; proximity of structures to roadway; presence of fragile natural and cultural resources.

1.6 ***Adequacy of Alternate Routes***:

2. Information produced in 1., above, shall be forwarded to the Chief of Police, Director of Public Works, City Engineer, and the Economic Development Director, and to a representative of the American Trucking Association for review and comment. The report may also be forwarded to the Strafford Regional Planning Commission and/or the New Hampshire Department of Transportation for comment, when applicable.

3. Upon completion of all reviews the Public Safety Committee shall hold a public hearing, after which it shall review all information and recommendations and report back to the City Council with a recommendation for final action.

PARKING REPORT EXECUTIVE SUMMARY

Downtown Area

There does not appear to be a major downtown parking problem in terms of the total number of spaces available at least for the next three to five years. The one exception is the need for additional off-street public parking in the vicinity of the Rochester Public Library. In the downtown area there are nearly 650 parking spaces with the breakdown of 2/3 off-street and 1/3 on-street. There are, however, a number of issues that could be addressed over the near term that would improve the situation. These include:

A. Repave those lots as needed and perform routine maintenance on an ongoing basis

B. Repaint lines delineating parking spaces on at least an annual basis and better layout to increase available spaces

C. Install high visibility signage

D. Educate customers concerning facility locations

E. Review and act upon changes in the mix of all day and time-limited parking in most of the lots

F. Explore possibility of public/private partnerships in the downtown area to create additional parking. Likely partners could be churches, banks, Salvation Army and Brooks Pharmacy lot. This could be either an on-going or a special events basis

G. Complete parking lot in vicinity of Public Library as means of providing parking in South Main Street

H. Explore option of construction of parking garage for the long term

Spaulding High and Community Center

While there are more than 350 off-street parking spaces at Spaulding and the Vocational Technical Center and 211 spaces at the Community Center parking problems will continue at the schools. At the Community Center problems can be addressed somewhat more readily. Suggestions to actions, some of which are already being taken include:

A. Control number of students allowed to park on school property and eliminate student parking at the Community Center

B. Either eliminate all day parking for trips or relocate longer term parking

C. Look to additional parking through land acquisition (the pink house) or create additional parking in location of former "alternative School" or parking in Hanson Pines area

D. Additional enforcement of parking regulations

PUBLIC FACILITIES PARKING REPORT
October 1, 1997

Committee:

Councilor Janet Pelley, Chairperson
Councilor Chuck Grassie
Richard Bickford, School Board member Mark Chrusz, School Board member.

Our mission statement is to inventory, evaluate, prioritize and develop options and specifications covering local government and school space needs and parking needs for a ten year period with an emphasis on a 3-5 year utilization plan.

Meetings were held on: March 19, 1997
April 9, 1997
April 23, 1997
June 25, 1997

PHASE 1:

The following is a report on municipal and school parking needs only.

On June 25, 1997, Gary Stenhouse City Manager, Dave Ford Commissioner of Public Works, Councilors Chuck Grassie and Janet Pelley went on a walking tour of all the City Municipal lots to see how they could be improved by appearance and to maximize parking spaces. Most of the work can be done by City employees and equipment, which would help to minimize costs.

1. CITY HALL PARKING LOT - 120 Spaces

This has just recently been reconstructed, paved and lined with three more spaces added.

Currently:

(a) Permit Parking	All Day	82 spaces
(b) Customers	Two Hours	21 spaces
(c) Customers	15 Min.	13 spaces
(d) Handicapped	Two Hours	4 spaces

Options:

(a) Eliminate all day parking.
(b) Permit parking for employees on a site located near City Hall.

2. GENE LAROCHELLE PARK PARKING LOT - 46 Spaces
(Across from the 103 Restaurant)

This parking lot was completed in the late 80's and still looks attractive. It is paved and has currently been lined and is used to capacity most of the time. Dave felt there was not any room for expansion and that changes are not needed at this time.

Currently:
(a) All day parking
(b) Parking lot used mostly by the 103 Restaurant patrons (noon to 11:00 pm) & Court visitors 9:00 am - 5:00 pm.

Options:
(a) All Day Permit Parking for downtown employees. The committee feels that this would not hurt any of the business located in this area and would leave more room on the square for shoppers convenience, which is what the merchants have been asking for.
(b) Or, eliminate all day parking for everyone. Downtown employees could park in Municipal Parking lots (2) on Congress St.
(c) Two (three) Hour Parking

3. UNION STREET PARKING LOT - 108 Spaces

Currently:
(a) All Day 68 spaces
(b) Two Hours 40 spaces

Options:
(a) Permit Parking - All Day
(b) Leave some two hour parking
(c) Better signage
(d) More spaces can be added
(e) Lines need to be painted
(f) Trees need to be pruned

4. INTERSECTION COLUMBUS AVE. & PORTLAND ST. - 23 Spaces (Side of Elks)

This is a new municipal parking lot that was added when the Columbus Ave/Portland St. intersection was designed.

Currently:
(a) All Day Parking Used mostly by Elk members instead of using their own parking lot Located in front of their building.

Options:
(a) Permit Parking
(b) Two Hour Parking
(c) Better Signage

5. CORNER/CONGRESS STREETS. - 35 Spaces

Currently:
(a) All Day Parking
(b) No entrance except through ATM machine lane or come in the exit road.
(c)Not utilized. May see two or three cars once in a while.

Options:
(a) Permit Parking
(b) Cut an entrance and exit.
(c) May be able to add spaces.

This would also be an excellent All Day Permit Parking area for the downtown employees. Its only a 2-3 minute walk. It would not take away from the downtown area shoppers as no one currently uses this parking lot.

6. CORNER COLUMBUS/HANSON STREETS. - 22 Spaces (In front & side of Jerry Gravel's Office) Used mostly for clients.

Currently:
(a) All Day Parking

Options:
(a) Permit Parking
(b) Two Hour Parking
(c) Add one more line of parking
(d) Lines need to be painted

7. CONGRESS ST./NEAR MAIN ST. - 32 Spaces (Two Lots)

Currently:
(a) All Day Parking

Options: Lot #1 & Lot #2
(a) Permit Parking
(b) Two Hour Parking
(c) Signage
(d) Needs to be cleaned up
(e) Pave parking lot

(f) Line
(g) May be able to increase number of spaces

8. **RIVER STREET - 25 spaces** (Two lots A & B)

Currently:
(a) Only lot A
(b) All day parking

Options:
(a) Permit parking (Lots A & B)
(b) All day
(c) Two hours
(d) New parking lot B
(e) Need to put up a fence (near Cocheco River)
(f) Pave
(g) Line
(h) Add 12 more spaces

Two other options have been discussed.

1. PARK & RIDE:

This would accommodate people who car pool to work such as the Portsmouth Naval Shipyard, Simplex or Pratt & Whitney's Senior Citizens go on bus trips for the day quite often. Most of them currently leave their cars at the Community Center which has their own parking problems. (25-35 cars)

2. PARKING GARAGE

This would be the ideal plan when finances permit. Studies have been made locating the parking garage in back of City Hall or on City land on Congress St. With better signage, additional spaces, education on the location of the municipal parking lots will greatly enhance parking concerns.

COMMUNITY CENTER PARKING: 211 Spaces

(a) State Dept. Of Human Services (by contract)	75 spaces
(b) Senior Citizens Organization	6 spaces
(c) Headstart	13 spaces
(d) Handicapped	8 spaces
(e) Others	109 spaces

Options:

1. Eliminate the 50-60 High School students that park at the Community Center as of June, 1997.
2. Eliminate Senior Citizens from parking all day when they go on trips by bus.
3. Provide a Park & Ride for all day parking, centrally located for Options #1 & #2.
4. Clean up and pave where the Alternative School was torn down for additional parking.
5. City buy small pink house on Chestnut Hill Road and demolish for additional parking.
6. Land between Chestnut Hill Road and the tracks could be used for additional parking if area is cleaned up and brush and trees removed.
7. Permit Parking - All Day Three Hour Parking 15 minute parking for pickup
8. Enforcement

SPAULDING HIGH SCHOOL & VOC TECH PARKING - 1600 Students

SPAULDING HIGH SCHOOL: FRONT ENTRANCE

Handicapped	2 spaces
Visitors	4 spaces
Faculty	29 spaces
	35 spaces

Cafeteria Area	6 spaces
Gym Area	15 spaces
Special Ed Area	12 spaces
Handicapped (2)	
Regular (10)	33 spaces

Wakefield St. (Near School)	10 spaces
Handicapped (2) Students (8)	
Wakefield St. (Length of triangle)	15 spaces
Chestnut Hill (Hanson Pines Area)	44 spaces

VOC TECH: FRONT LOT - 117 spaces

Handicapped	3 spaces
Visitors	7 spaces
Regular Parking (Faculty & Aides)	107 spaces

VOC TECH: REAR LOT - 90 spaces

First come, first served	
CHILD CARE - Ten Little Indians	11 spaces
Handicapped	3 spaces
Parents	8 spaces

SPAULDING HIGH & VOC TECH GRAND TOTAL PARKING SPACES - 355

School Department requests City to do the following:

1. Paint parking lines
2. Add one more line of parking in back of the Voc Tech near the Auto Trade Shop. (12-15 spaces)
3. Winter - snow not pushed back far enough and covers some parking spaces.
4. Snow needs to be picked up right away after a storm.
5. Allow students to continue parking in the Hanson Pines area. (35 parking spaces when cars park horizontally).

Options:

1. Pave by the Butt Hut (15-20) additional spaces.
2. Only allow permit parking for Junior & Seniors or Seniors only.
3. A new school parking policy will be implemented Sept. 1997 if approved by the School Board.
4. Enforcement of the parking policy.

The key is to educate the students and parents on the new parking policy now so that everyone will be ready in Sept. 1997.

DOWNTOWN STREET PARKING:

1. Behind the Theater	13 spaces
2. Main Street	51 spaces
3. Route 11	36 spaces
4. Wakefield Street	27 spaces
5. Hanson Street	39 spaces
6. Columbus Avenue	25 spaces
7. Liberty St. Area	32 spaces
	223 spaces

PRIVATE/PUBLIC PARTNERSHIPS: (Negotiable)

1. Brooks & Liquor Store	83 spaces
2. Profile Bank Handicap (1)	33 spaces
3. Encore Shoe	105+spaces
4. Church of the Redeemer (2 lots)	159+spaces
5. Rochester Catholic	85 spaces
6. Foster's Daily Democrat	70 spaces
7. Therriens/Terri Ann's	16 spaces
8. Ainsles	10 spaces
9. Southeast Bank	54 spaces
10. First United Methodist Church (5 Handicap)	44 spaces
11. Grange Mutual	16 spaces
12. Library (to be added)	60 spaces

13. Governor's Inn	60 spaces
14. Farmington National Bank (1 Handicap)	10 spaces
15. Foss & Came (to be built)	10 spaces
16. Dynasty	50 spaces
17. Fleet Bank/Elks	108 spaces
18. Former Bankeast (Jerry Rohm)	30 spaces
19. Lease vacant land next City Hall	15 spaces
20. Goodrich Insurance	10 spaces
21. Salvation Army Store (Total 1008 spaces)	

GRAND TOTAL DOWNTOWN PARKING - 1241 spaces

Note: Fair Grounds Parking 5000 spaces

SUMMARY:

DOWNTOWN PARKING:

The results of the Parking Survey show that there is currently adequate parking in the downtown area. Municipal Parking Lots have 402 parking spaces, and downtown street parking adds 233 spaces for a total of 635 parking spaces. This covers the area from George & Ed's Store to the Library. If downtown employees are required to park in the municipal parking lot nearest their work then there will be plenty of parking for customers. Most of the Municipal Parking lots are within a 3-5 minute walk to all downtown businesses.

For special events the City could work with area businesses on a public/private parking partnership which could benefit both parties and would add 1008 more parking spaces when needed.

With permit parking, better signage, additional spaces added and a program to educate the public on where the municipal parking lots are located will greatly enhance downtown parking. Currently there is adequate parking for the downtown businesses.

COMMUNITY CENTER:

The 211 parking spaces needs to be reorganized. The 50-60 High School students will no longer be able to park at the Community Center. The City needs to work with the Community Center on some of the options suggested in this report to increase the amount of parking spaces.

SPAULDING HIGH & VOC TECH SCHOOLS:

There will never be enough parking spaces to accommodate all the students who have cars. The School Department is going in the right direction by issuing a new school parking policy which will only allow Juniors & Seniors parking spaces with a permit. This new parking

policy, police enforcement, and cooperation from the City should help with the parking problems for the 1997-98 school year.

PRIORITIES:

1. Most of the parking suggestions and options in this report can be utilized in a 1-3 yr. period. Some of the work has already been completed.
2. Park & Ride (1-3 yr. period)
3. Public/Private Partnership (1-3 yr. period)
4. Parking Garage (5-10 yr. period)

The committee welcomes any comments, suggestions, options that members of the City Council may have.

The Public Facilities Committee is currently working on Phase 2 of our mission which is school and municipal space needs. This will be a separate report at a later date.

Janet R. Pelley
Chairperson

Appendix 19

Airport Master Plan Update

Executive Summary Report

Skyhaven Airport
Rochester, NH

Prepared for

The New Hampshire Department of Transportation

By

Hoyle, Tanner & Associates, Inc.
Bedford, New Hampshire

June 1994

SUMMARY SKYHAVEN AIRPORT MASTER PLAN UPDATE

The Skyhaven Airport Master Plan Update (AMPU) represents a comprehensive revision of the 1982 AMPU. Since 1982, basic design elements have changed (e.g., runway length) and airside demand has grown. FAA airport design standards have also been revised. The current study updates the assumptions made in the 1982 AMPU to reflect current conditions and presents recommendations for airport improvements.

The objective behind airport master planning is to provide long-term (typically 20 years) guidance for airport development. The master plan ensures that future airport improvements match projected activity levels. Airport development must also be consistent with community goals, environmental constraints, and regional transportation needs.

The Airport Layout Plan (ALP) is a key result from the master planning process. It provides a graphic presentation of the proposed airport improvements and depicts the facility in the context of surrounding land uses. Another principal product, the Capital Improvement Plan (CIP), provides a schedule and cost estimates for implementing the recommended projects

The airport master plan is a planning document and does not replace the environmental, design, and engineering analysis required before construction. In addition, several of the projects will require different levels of environmental review and/or permitting in coordination with the City of Rochester, State of New Hampshire, FAA, and other agencies.

Study Format

The study is separated into two sections which highlight the substantive results of the project. These are followed by four appendices, which contain mostly technical data and analyses prepared in support of major findings. The sections and appendices are summarized below:

Section 1 **Current and Future Role of the Airport**
An evaluation of the airport's role within its regional context. The interaction between Skyhaven and Pease International Tradeport is discussed. Includes a comparison of the existing airport design with the latest FAA standards. Two development alternatives are presented, evaluated, and refined into a preferred alternative.

Section 2 **Airport Development Plan**
Describes the development of an Airport Layout Plan for the preferred alternative resulting from the work presented in Section 1. Includes layouts for key components such as the runway, taxiway, aircraft parking aprons, and other facilities. The Capital Improvement Plan and financial/management plan are also presented in this Section.

Appendix A **Inventory**
A detailed inventory of existing airport land use and facilities. Also includes a description of flight procedures associated with the airport. The inventory identifies the existing airport infrastructure and documents its condition.

Appendix B **Demand Capacity Analysis**
The demand-capacity analysis is a comparison between the projected demand and the capacity of the existing facilities. The areas where demand is expected to exceed capacity are candidates for airport improvement projects.

Appendix C **Environmental Issues**
A brief overview of those environmental issues thought to be most critical at Skyhaven Airport: wetlands, water quality, aircraft noise, land use, and construction impacts. The focus is on wetlands and water quality impacts and potential mitigation efforts.

Appendix D **Airport Plans**
A set of plans depicting the existing and recommended airport layout, land uses, obstructions, and other relevant features.

The Technical Report for the Skyhaven Airport Master Plan Update contains the full text for these sections and technical appendices. The Skyhaven Airport Master Plan Update drawing set accompanies the Technical Report. It is a set of ten drawings that illustrates the facility recommendations contained in the Technical Report. The purpose of the Executive Summary is to briefly outline the main results of the Technical Report and the drawing set.

Existing Activity

Skyhaven Airport is located entirely within the city limits of Rochester, New Hampshire. The airport is owned by the State of New Hampshire. The Department of Transportation (NHDOT) Division of Aeronautics has oversight responsibility for the airport. Policy and funding issues

are retained in the Division with advisory input from the regionally appointed Skyhaven Airport Operating Commission (SAOC). Under a lease agreement with the fixed based operator (FBO), the FBO has assumed responsibility for most of the day-to-day operation of the facility.

The main facilities at Skyhaven Airport include a 4,000 ft long runway, a "V"-shaped taxiway system, an aircraft apron, grass tie-downs, a terminal building, T-hangars, and conventional hangars. The airport also features runway lights, a rotating airport beacon, a lighted wind cone with segmented circle, and an off-airport non-directional beacon (NDB). Both Avgas and Jet-A fuel are available. The airport is located in relatively uncongested airspace. It is a non-towered facility, but radar and communications services are available through Manchester Approach Control.

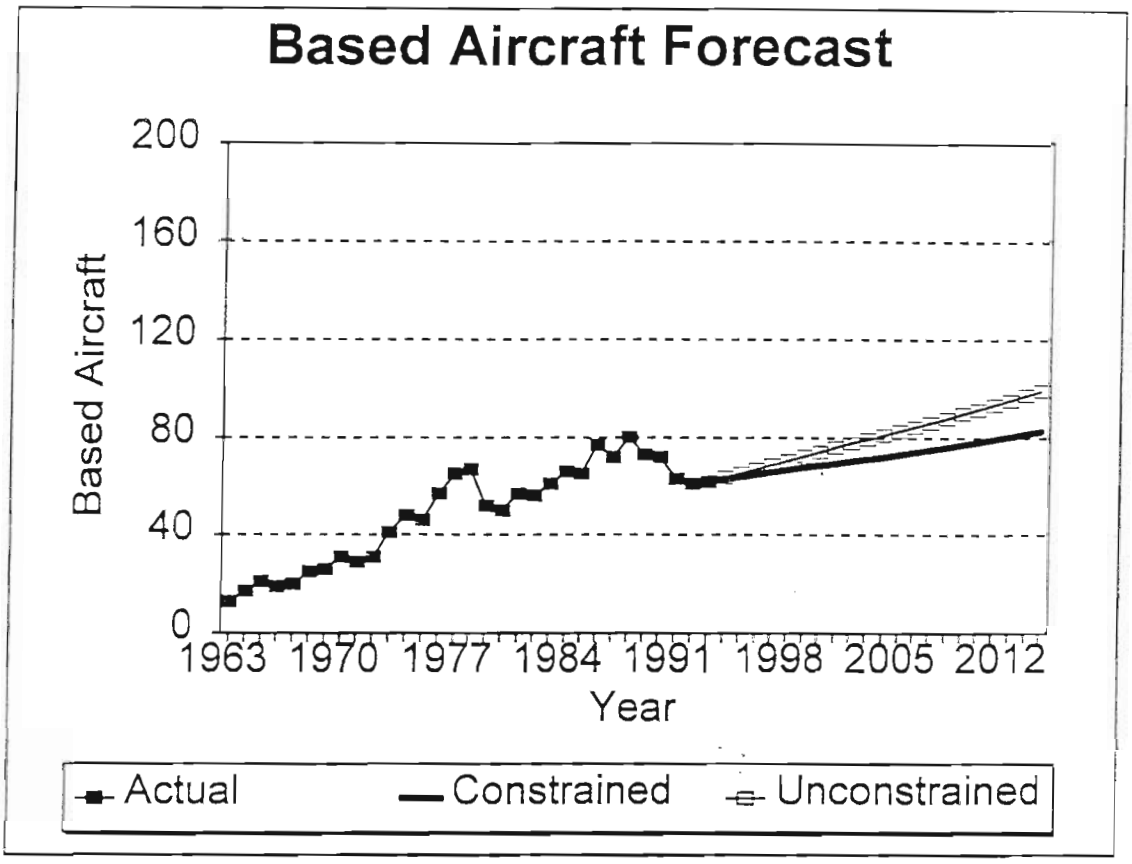
There are currently 62 based aircraft at the airport, including a range of aircraft types from light single-engine piston aircraft to jet warbirds. Based and transient aircraft generate an estimated 21,000 annual operations (i.e., take-offs and landings), resulting in approximately 13,000 annual passenger enplanements. Total operating revenues from the airport to the State were $16,943 in 1993, against operating expenses of $32,629.

Future Activity

Two forecasts of aviation activity were developed as part of this project. An unconstrained forecast was used to measure the maximum potential of the airport to capture the area demand for aviation services. A constrained forecast was also prepared, which measures the demand at Skyhaven if physical constraints such as runway length, instrument approaches, and aircraft parking availability are not overcome. The figure below depicts the historical aviation activity and the two projections expressed in terms of based aircraft.

For future facility planning it is necessary to identify a critical aircraft in the categories of approach speed, wingspan, and weight. The Cessna Citation III business jet represents the most demanding aircraft expected to operate at the airport by the end of the planning horizon, and was selected as the critical aircraft.

Based on the projected demand, shortcomings in capacity were identified in several areas. The most significant discrepancies between capacity and demand were found in runway length, aircraft parking (both apron and hangar), vehicle parking, and approach minima.



Proposed Improvements

The two principal improvements recommended for the airport are an increase in runway length and an expansion of aircraft parking. The runway extension is envisioned as a two-phase project, with a 500 ft extension in each phase. The resulting runway length would be 5,000 ft. Since the current taxiway does not extend along the entire length of the runway, a 900 ft taxiway extension project is recommended. When the runway is extended, the taxiway should be lengthened accordingly. Hold aprons are planned as well.

Aircraft parking improvements are recommended in the form of an apron expansion, as well as the construction of T-hangars. The recommended apron design accommodates the expected increase in based aircraft as well as transient aircraft. An area has been especially designated for handling larger aircraft.

Improvements in the instrument approach technology in place at the airport would increase the facility's ability to attract additional traffic, particularly in the business aviation segment. Operators of business aircraft (typically small jets and turboprops) are sensitive to airport accessibility in poor weather conditions. The emergence of satellite-based instrument approaches appears particularly promising. However, design standards for satellite-based instrument approaches have not yet been made available. The ALP reflects the potential of satellite-based technology by reserving airspace for an improved approach. The exact dimensions of the airspace required will have to be determined once design standards are made available. At this point, a review of the ALP should be conducted, and necessary easements (if any) can then be acquired.

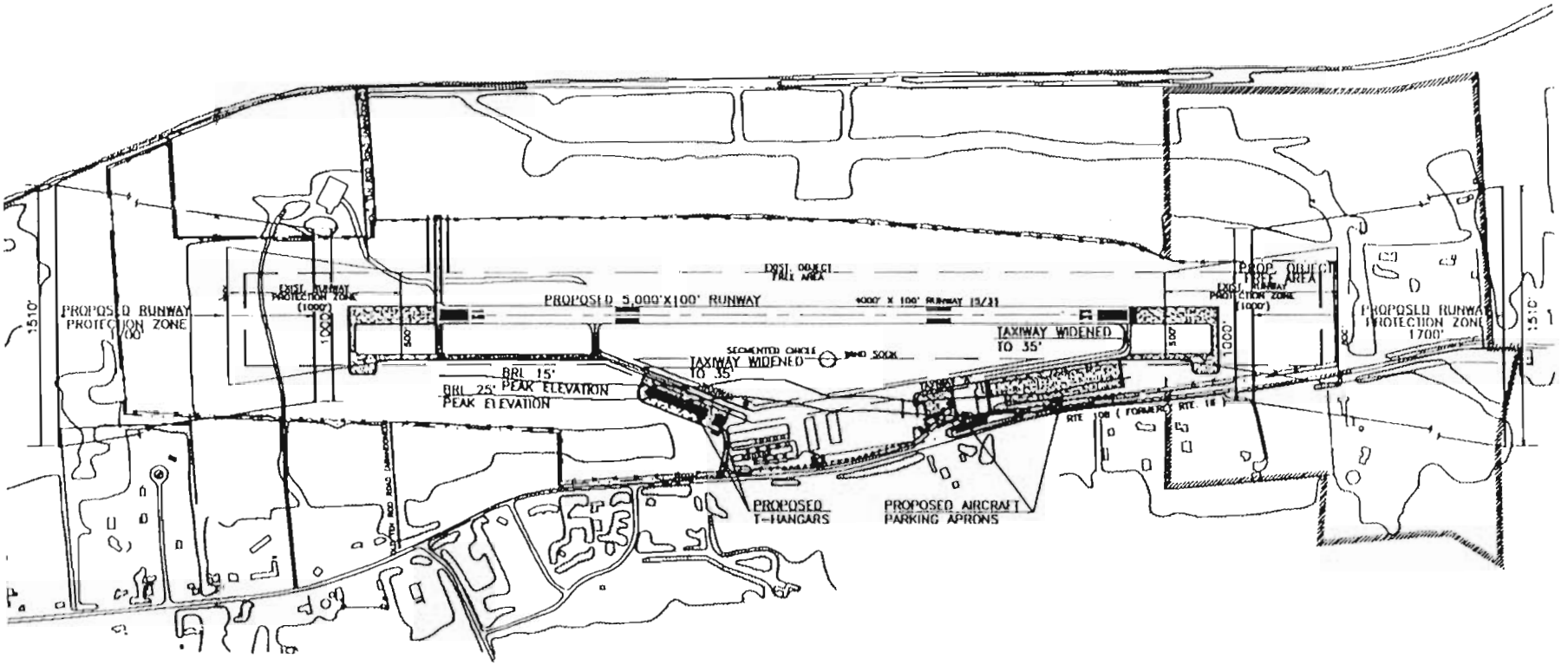
For safety and security reasons, it is recommended that the existing fence be extended to encompass the entire aircraft operations area. Other proposed improvements include an extension of the parking lot, the construction of an equipment storage building, the addition of a taxiway to the adjacent business park, pavement rehabilitation projects, an electrical upgrade, and improvements in approach and taxiway lighting. A reduction of the full-size Airport Layout Plan is shown below, which depicts existing conditions and proposed improvements.

Environmental Issues

The review of environmental issues conducted as part of this study does not constitute an Environmental Assessment (EA) or Environmental Impact Study (EIS). Instead, the goal was to identify any environmental constraints that may limit proposed development at the airport. Before carrying out major projects, such as the proposed runway extension, a detailed environmental analysis would be required in accordance with State and Federal regulations.

The areas of possible concern identified for Skyhaven Airport include wetlands, water quality, aircraft noise, construction impacts, compatible land use, as well as wildlife and habitat impacts. The most significant issue at this airport is the extensive wetland area permeating the property.

Approximately 50% of the Skyhaven Airport property was designated as wetlands in the 1991 *Skyhaven Airport Wetlands Report* completed by New England Environmental Associates. Several of the proposed projects will impact these wetlands if constructed, including the runway extensions, taxiway extensions, the T-hangars, and business park taxiway. For this reason, a considerable effort was expended in the AMPU process to identify potential wetlands concerns and ways to mitigate impacts.


PROPOSED RUNWAY PROTECTION ZONE 1700'
EXIST. RUNWAY PROTECTION ZONE (1000')
EXIST. OBJECT FREE AREA
PROPOSED 5,000'X100' RUNWAY
5000' X 100' RUNWAY 15/33
PROP. OBJECT FREE AREA
EXIST. RUNWAY PROTECTION ZONE (1000')
PROPOSED RUNWAY PROTECTION ZONE 1700'
1510'
1000'
500'
TAXIWAY WIDENED TO 35'
SEGMENTED CIRCLE
WIND SOCK
TAXIWAY WIDENED TO 35'
BRL 15' PEAK ELEVATION
BRL 25' PEAK ELEVATION
TAXIWAY A
RTE 108 (FORMERLY RTE. 18)
PROPOSED T-HANGARS
PROPOSED AIRCRAFT PARKING APRONS
LEGEND
TRUE LINE
AIRPORT PROPERTY LINE
EXIST. FENCE
EXIST. BUILDING
EXIST. OBJECT FREE AREA
EASEMENTS
EXIST. LOT LINE
PROPOSED EDGE OF TAXIWAY
PROPOSED NEW PAVEMENT
PROPOSED FENCE
PROPOSED BUILDING
PROPOSED OBJECT FREE AREA

If all proposed projects are implemented, the total impact to wetlands at Skyhaven Airport will be approximately 13 acres. The majority of these wetlands have been disturbed over the past 25 years. Wetland mitigation was discussed with State Department of Environmental Services and Army Corps of Engineers officials. In examining the site it was determined that on-site mitigation is not feasible. Mitigation for the proposed development and wetlands impacts must therefore take place off-site.

Mitigation will involve the cooperation of the City of Rochester. Wetland parcels in the City that have been disturbed should be identified as potential mitigation candidates for development at Skyhaven Airport. The land should have the same characteristics as the airport and have the ability to support waterfowl. The disturbed wetland should be restored to its natural state. The exact area of restoration and costs were not determined as part of the AMPU process. Further contact with State and federal environmental officials for input on wetland and water quality issues will need to be acquired. Initial contacts with federal officials indicate that an individual permit must be obtained at the beginning of any projects involving wetland impacts. Both State and federal agencies are in agreement that before any more wetland impacts are planned, no matter how small, the total site impacts have to be addressed and mitigation has to be planned accordingly. For this reason, a comprehensive environmental study has been identified as the highest priority in the Capital Improvement Plan.

Potential noise impacts were evaluated by applying the FAA's Integrated Noise Model. The results suggest that noise impacts are minor, and are not expected to change significantly as activity increases or because of the runway extension. No homes are inside the area designated as incompatible for residential uses.

Airport construction impacts are expected in the areas of air quality, noise, water quality, flora, fauna, ground access, and refuse disposal. However, these effects are temporary in nature and generally limited to the duration of construction. By applying the standard mitigation techniques described in the Technical Report, these impacts can be reduced to acceptable levels. Specific instructions for mitigating measures should be included in the appropriate construction contracts.

The issue of compatible land use has not been a major problem at Skyhaven Airport since it is located in an area of agricultural, commercial, and light residential development. However, if activity increases, the impact of the airport on surrounding land uses may become more noticeable. Land use controls should be maintained as part of the City's planning and zoning process in order to avoid costly conflicts in the future.

Capital Improvement Plan

The CIP represents a schedule and cost estimate for implementing the suggested airport improvements. Scheduling of projects has been divided into three phases: short term (1994-1999), intermediate term (2000-2004), and long term (2005-2014). The CIP must be viewed as tentative: planning for the airport should remain flexible, and should incorporate updated estimates of demand and facility requirements. In particular, as design standards for satellite-based approaches become available, the need to purchase easements and/or remove obstructions should be reevaluated.

Many of the capital improvements are eligible for funding under the Airport Improvement Program (AIP). In the State of New Hampshire, projects such as runway extensions and apron expansions are typically funded at a level of 90% by the FAA, 5% by NHDOT and 5% by the local sponsor. Since Skyhaven is owned by the State, however, the NHDOT share increases to 10%. Projects not eligible for AIP funding must either be funded by the State or by private sources. The table below contains a summary of the CIP cost estimates, broken down by funding source.

Capital Improvement Plan: Summary

Phase	Project Cost	FAA	State
Short Term	$2,456,000	$2,165,400	$290,600
Intermediate Term	$1,731,000	$603,000	$1,128,000
Long Term	$2,839,000	$2,446,200	$392,800
Total	$7,026,000	$5,214,600	$1,811,400

Source: HTA

Financial/Management Plan

A brief review of the financial and management aspects of the airport was conducted, focusing on the operating leases. The purpose of the existing lease between the State and the FBO is twofold: to establish the financial and operational responsibilities of the FBO and, thereby, enable the State to enjoy and protect the considerable investment it has made in the airport. The lease review indicated that the existing lease is generally consistent with recommended practices. It upholds the basic tenet that the airport sponsor should receive fair payment for the services rendered.

The lease with the FBO provides certain exclusions from revenue collection which were put in place in response to several years of erratic FBO service. The exclusions, and other parts of the lease, are meant to provide an environment that would foster FBO stability, a very necessary element in the success of the airport. The renegotiation dates in the leases should be used to review this and other operating terms against the current business climate. Adjustments should be made as the conditions warrant.

The Division of Aeronautics has elected to delegate the management of the airport to the FBO through its lease. Such an arrangement is appropriate for an airport the size of Skyhaven. It relieves the Division of Aeronautics from the day-to-day management details which would require additional Division staff. The Skyhaven Airport Operating Commission provides input on operational aspects of the airport from the airport tenants, nearby residents, and other interested parties affected by the airport. This arrangement will be appropriate throughout the planning horizon of this master plan update as the airport is not expected to change significantly in its size or the nature of its operations.

Airside access to the adjacent business park should be considered in the future as a means to enhance activity at the airport. However, the State should be fairly compensated for such through-the-fence activities.

Conclusions

The Airport Master Plan Update was conducted to identify areas needing improvement, develop an airport layout, and present a schedule and cost estimates for proposed improvement projects. The principal improvements are a runway extension and an increase in aircraft parking capacity through an apron expansion and the construction of hangars. Other projects have been recommended to improve safety and operations, such as taxiway extensions, the introduction of satellite-based instrument approaches, hold aprons, taxiway and runway end lighting, pavement rehabilitation, installation of security fencing, and the construction of a taxiway to the adjacent business park.

The master plan update is only the first step in implementing airport improvement projects. The State of New Hampshire has the primary responsibility to ensure that the proposed improvements are realized. This effort should be coordinated with the FAA, the SAOC, the City of Rochester, the FBO, and other airport tenants. Continued participation by the public is vital to the success of proposed projects. The immediate priority is to undertake an environmental analysis focused on identifying mitigation of wetlands impacts associated with the proposed improvements. This study will require coordination at the federal, State, and local

level, and should take a comprehensive look at all improvements proposed for the next 20 years.

The Capital Improvement Plan extends to the year 2014, but conditions will undoubtedly change before then. Both the ALP and the CIP should be reviewed periodically, at least on a yearly basis. Revisions to the plans should be made as needed, so that they continue to reflect current conditions and planning needs. Substantial changes in the airport infrastructure or demand patterns will require a new master plan update. Airport master plans should be updated on a five-year basis unless only minor changes in baseline conditions have occurred.

The proposed airport layout is geared toward accommodating additional based and itinerant activity, particularly business and commercial flights. A comprehensive environmental analysis will be required prior to constructing improvements, but this is typical for construction projects in today's environment. With the improvements identified here, Skyhaven Airport should be well poised to accommodate future growth and continue to serve as an asset to business in the region.