SECTION 7
TRANSPORTATION

TRANSPORTATION

EXECUTIVE SUMMARY

The Carver town-wide transportation study was initiated as part of the Town's Master Plan process. Transportation issues in Carver will evolve directly in proportion to the extent to which the town manages its growth. Major constraints on the roadway system include a rural system of roads, the absence of a public stormwater system, the prevalence of wetlands and ground water, and a limited budget for roadway maintenance and improvement. Given these limiting factors, the town will need to coordinate all new development in order to minimize both the public infrastructure costs as well as its impacts on the rural life style desired by the residents. New growth should be directed to those areas where there is sufficient infrastructure capacity. Short, mid and long term improvements are suggested.

Transportation System Conditions
Some roadways currently have congestion problems, including Routes 44 and 58. Several intersections with geometric deficiencies or a high number of accidents, especially along Route 58, are poorly designed and in need of redesign for safety. The only public transit service currently offered is the Dial-A-Ride service for travel within Carver and to the surrounding four towns; this service is for the elderly and physically-challanged residents. Pedestrian and bicycle facilities are limited and lacking connectivity, since few roadways have sidewalks.

Projected Buildout And Implications Of Buildout
The current transportation system which consists of approximately 100 miles of roadways cannot fully meet the projected growth in traffic if the buildout based upon existing zoning is achieved. The arterials, collectors, and local roads are not wide enough to accommodate a potential 200% increase in residential units and a projected ten-fold increase in commercial and industrial development. Furthermore, the zoning regulations and sub-division by-laws do not address many of the issues needed to ensure that a projected 132 miles of new roadways will be built according to standards which will protect the environment and ensure a more efficient system of circulation. The town's budget for the Department of Public Works and the lack of standards for alternate modes such as transit, bicycles, and pedestrians will further limit the capacity of the overall transportation system.

Goals And Objectives
The major transportation goals and objectives relate to creating a transportation system which is responsive to the needs for economic development and resource protection. The existing street pattern was developed in response to the needs of an agricultural community that was relatively isolated from major population centers. The varied topography and presence of wetlands across the landscape further constrained the development of an efficient layout. With the increased suburbanization of Carver, the transportation system must be refined so as to accommodate additional growth while mitigating the impacts upon natural resources and a local agrarian economy.

The Recommended Transportation Plan
The ultimate plan requires the adoption of new guidelines, enhancement strategies, and funding. Table 7-1 lists the recommended actions designed to improve a rural road system, alleviate the existing traffic flow constraints as well as better accommodate future travel conditions. The following map graphically summarizes the major recommended improvement actions. In summary, the following actions were recommended:

- Defining a Route 58 cross-section and plan to accommodate new growth

- Defining a Street Functional Classification Plan to guide development and street improvements
- Creating a network of bikeways and walkways for both local and regional access
- Developing a local and regional transit plan
- Recommending various bylaw and sub-division amendments to manage new roadway designs and minimize the impacts of numerous curb-cuts on resource areas and traffic flow
- Identifying additional revenue sources for road maintenance and construction

Although some of the long term actions can be divided into separate phases, the whole plan is expected to be implemented within the long term (20 years). Costs were estimated as *Low* (less than $10,000), *Medium* ($10,000 to $50,000), and *High* (greater than $50,000). Costs for local and regional transit plans are difficult to estimate, yet these items may be fundable through a local Transportation Management Association (TMA), the MBTA, and other private employer programs.

Table 7-1
Summary of Recommended Plan

Recommended Action	Implementation Time Frame	Cost Estimate	First Step Towards Implementation
TRANSPORTATION DEMAND MANAGEMENT			
Concentrated Development			
Promote village-style clusters	Short Term	Low	Zoning By-law change
Promote mixed-use developments	Song Term	Low	Zoning By-law change
Local and Regional Transit Plan			
Proposed local circulator bus	Long Term	Varies	Feasibility study, local coordination
Proposed shuttles to rail stations	Short Term		
Improved Dial-a-Ride service for the elderly and physically-challenged	Short Term		
Park & Ride Service	Short term		
Network of Bikeways/Walkways Throughout Town			
Recreational/commuter network in agreement with local plans	Long Term	Medium	Local approvals, preliminary engineering
Scenic Roads			
Designate and protect scenic roads	Short Term	Low	Approve plan, signage, zoning
TRANSPORTATION SAFETY MANAGEMENT			
Isolated Intersections			
Upgrade safety	Short Term	Med. – High	Coordination of agencies
Improve traffic flow	Short Term	Med. – High	Preliminary engineering
Access Management			
Curb-cut guidelines	Short Term	Low	Zoning By-law change
Roadway design guidelines	Short Term	Low	Zoning By-law change
Subdivision roadway standards revision	Short Term	Varies	Zoning By-law change/DPW policy
MAJOR NETWORK IMPROVEMENTS			
Route 58 Corridor			
Three lanes with wide shoulders, and sidewalks	Long Term	High Low	Coordination of agencies, Preliminary engineering
Traffic circulation and control improvements at selected locations	Short Term		Preliminary engineering
Route 44 Corridor			
From Plymouth town line to Route 58: Four lanes with median and shoulders	Short Term	High	Construction bid awarded
Widening of local roads, acquisition of additional right of way where needed	Mid Term	Med	Local approvals, Preliminary engineering
South Carver Local Network			
Widening of local roads, acquisition of additional right of way where needed	Mid Term	Med	Local approvals, Preliminary engineering

INTRODUCTION

The first phase of work included a review of the Town's Zoning By-laws, the 1977 Master Plan, and the MBTA's reports on commuter rail options for the region. In addition, discussions by the master planning team were held with several entities including the Police and Public Works Departments, the Director of Carver's Senior Center, and the staff of the Southeastern Regional Planning and Economic Development District (SRPEDD). The second phase of research consisted of data collection and analysis. Accident data and detailed roadway information was obtained from the Carver Police Department. Traffic volume was obtained from SRPEDD. Site reconnaissance, including evaluations of pavement conditions, intersection operations, and roadway safety, was carried out by the Police Chief and Director of Public Works. Key issues were identified and goals developed with the aid of public meetings, the data collection process, and review by SEA Consultants, Inc. Land use projections, based on current Town zoning practices, were developed by the team. Order of magnitude estimates were utilized to convert this buildout to traffic volume projections for both the year 2020 and the full buildout of Carver. These volumes were added to the existing traffic on the network and then the roadways were evaluated for operational constraints. In addition, the needs of pedestrians and bicyclists were examined in terms of facilities required for their use. Finally, with the goals and objectives as a guide, a recommended plan was developed for the Town of Carver.

7.1 TRANSPORTATION SYSTEM CONDITIONS

Major Roadways

Effective evaluation of the transportation impacts associated with Carver's potential development first requires a thorough understanding of the existing transportation system in the town. Significant research and field visits to Carver have been conducted to assess the primary routes.

Local circulation

The following is a description of the study area roadways. Table 7-2 summarizes characteristics of the roadways serving the town while Map 7-3 illustrates the locations of the major roadways and intersections. The roadways examined were either selected due to function or were identified by the subcommittee members as issues of local concern.

Table 7-2
General Characteristics of Major Town Roadways

Roadway	Jurisdiction	Functional Class	R.O.W. (Ft)	Paved Width	# of Lanes	Sidewalks	Structural Condition
Route 58 (Main St.)	Town	RMC	50’	35’ (12+4+1.5)	2	No	Good
Route 58 (between Route 44 and Plymouth St.)	MHD	RPA	50'-70'	38'-plus	3	No	Good
Route 44	Town	RPA	40’	24-26’	2	No	Good
Tremont Street	Town	RMC	50’	26’28’	2	No	Good
Center St.	Town	RMC	40’	24’	2	No	Good
South Meadow Road	Town	RMC	50	24-26’	2	Sidewalks on NW side	Fair

Functional Class Abbreviations:
RPA&UE – Rural Principal Arterial and Urban Extensions
RMA&UE – Rural Minor Arterial and Urban Extensions
OUPA – Other Urban Principal Arterial
UMA/RMC – Urban Minor Arterial / Rural Major Collector
UC/RMC – Urban Collector / Rural Minor Collector

- **Regional Connections**

  In general, the Town of Carver is provided a low level of regional access with no major highways serving the town, although Interstate 495 (I-495) runs just south of the town line in Wareham. Route 44 and Route 58 provide local connections between the regional highway system and the Town. The extension of Route 44 west from Plymouth will at last give the Town direct access to Route 3 as well as west to Route 495. Given the diverse locations of Carver’s resident labor force, Carver will increasingly become a more desirable place to live.

- **Route 58**

  Main Street is Route 58, a state highway, following a north-south alignment from the Plympton town line to the Wareham town line just north of the intersection of Route 495. Route 58 provides access to I-495 in Wareham and Route 44 in North Carver. While the right of way for this road is 50’, the developed right of way is 35 feet including two 12 foot

Figure 7-1: Route 58

travel ways and a 4 foot shoulder. Horizontal and vertical alignments generally contain mild curves and gentle grades. Weight restrictions are posted along Route 58; two-axle trucks are limited to 15 tons, three-axle trucks to 23 tons, and five-axle trucks to 36 tons. Pavement conditions were observed to be good. The primary land use along Route 58 in Carver is residential/ agricultural, with commercial and industrial clustered in North Carver, Center Carver, and isolated sections in South Carver.

In concept the 50 foot cross-section provides for two 12 foot lanes, 6 foot shoulders, and 7 feet for utilities and sidewalk. This cross-section is wide enough so that a third lane can be added at key intersections by utilizing some of the shoulder and utility right of way on each side. Given the importance of this road for north/south circulation, the 1977 Master Plan had recommended a 60 foot right of way.

Route 58 is expected to be heavily impacted from potential development.

- **Route 44**

The existing Route 44 is a bi-directional roadway following an east-west alignment that currently continues from the Plymouth town line to the Middleborough town line. Route 44, also called Plymouth Street, connects with Route 58 in North Carver and becomes part of Route 58 until separating again about a half-mile to the north. The existing Route 44 is one lane per direction with between 24-26 feet of pavement in a 40 foot of right-of-way. There are no sidewalks along the roadway. Horizontal and vertical alignments generally consist of gentle curves and slight inclines. The road surface was recently rebuilt. There is no development at present along the highway portion of Route 44 in Carver, while the road east of Route 58 is a primarily residential street with some commercial uses.

Figure 7-2: Route 44

Route 44 is a major highway, under the jurisdiction of the Massachusetts Highway Department. MHD plans to build a new Route 44 that will extend directly east from the current intersection of Routes 58 and 44 in North Carver to Route 3 in Plymouth. A contract has been awarded for a 6.01 mile section extending easterly of Route 58 to approximately 800 feet west of the Kingston-Plymouth town line. The roadway's cross-section is proposed to include two 12-foot wide travel lanes per direction, 10-foot wide outside shoulders, 4-foot wide inside shoulders and a concrete median for separation of directions of travel for a total cross-section width of approximately 89 feet.

Construction bids have been awarded; the estimated completion date is 3-5 years.

- **Other Roadways**
  In general, the other roadways included in the analysis are two-lane bi-directional roadways which either function as major or minor collector roadways. There is limited traffic control along most of these roadways. Four roads have been identified in South Carver as needing widening in response to the projected development of the Makepeace site. Three of the four roads, Tremont, Cranberry and Federal have sufficient right of way but will need to be widened. Wareham Street lacks sufficient right of way presently to be widened. A similar condition exists throughout town. The existing roads were developed to serve the needs of the local farmers. As development takes place, the town will have to improve the right of way of many of the local roads.

Traffic volumes

In developing the traffic flow networks for analysis, existing traffic volumes were obtained from SRPEDD for the Town of Carver, as well as other recent studies. These counts were completed between 1990 and 1999. Average daily traffic counts were available for 19 locations. The average daily traffic flows are illustrated in Map 7-4 and summarized in Table 7-3. Turning movements counts at intersections, capacity analysis, and AM/PM peak hour counts will need to be developed if more detailed transportation system analysis is to be carried out.

Table 7-3
Average Daily Traffic Volumes

Location	2000	1999	1998	1997	1995	1994	1993	1992	1991	1990
Route 58 (Main St)										
Spring St Plympton line	820									
S Meadow Rd (N)					10,000					10,775
S Meadow Rd (S)					7,500					
West St (N)					11,614					
West St (S)				10,800	12,253					11,950
Plympton Street										
Route 58 Plympton Line		11,590	8,800		8,000				7,600	
Route 58/44 (N)				17,170						
Route 44 (S)										13,280
Plymouth Street										
Routes 44/58 (S)				19,410						
Plymouth Line (W)					3,100				2,800	
Route 58 (E)						7,400				
Route 58 (W)							9,000			8,220
Middleboro										
Route 44										
Middleboro line	11,953						9,000			
High Street										
at Brook Street			890							
Tremont Street										
at the Plymouth town line			5,800							
at Wareham line	12,400						8,400			7,660
at Cranberry Road										6,070
Rochester Road										
north of Pine Street			1,000							
Weneham St										
Plymouth line						5,600				

Safety analyses

Safety considerations were investigated by reviewing accident history along study area roadways by reviewing the records of the Carver Police Department for the calendar years 1995 through 1999. The data collected indicated the number of accidents, location and time of accident. An accident spot map was created from the data obtained from the Carver Police and is shown in Map 7-5. Discussions were also carried out with the Highway Superintendent and the transportation planning staff of SRPEDD.

A total of 102 accidents were reported by the Police Chief at the key intersections within Carver during the five-year period, 1995-1999. The location with the highest accident experience during that five year period (21 accidents) is the intersection of Route 58 and the Route 44 off-ramp, which does not have a traffic signal. The location with the second highest accident experience (17 accidents over 5 years) is the intersection of Route 58 and Plymouth Street (Route 44). The average accidents per year at these locations are 4.2 and 3.4, respectively. The accident rates do not necessarily indicate safety problems within the intersections.

The third highest number of accidents, 11 or an average of 2.2 accidents per year took place at the intersection of Center Street and Wenham Road. While the intersection of Center and Main Street has been the focus of study for the installation of a traffic light, accident data (0.8/year) has not supported this improvement. SRPEDD also pointed to three intersections with low accident counts but notably troublesome corners at Main and West Streets in Center Carver, High and Gate Streets in North Carver, and Route 58 and High Street in North Carver.

SRPEDD also compiled data on the total number of accidents along individual roadways in Carver during the years 1996, 1997, and 1998. This study found Main Street (from Tremont to Plymouth Street) to be the scene of the most accidents, by far. Tremont Street, which extends from South Carver to the Plymouth town line, also saw many accidents, as did Plymouth Road, High Street and Wenham Road in North Carver.

Dangerous locations

Tables 7-5, 7-6, and 7-7 also provide historical information and observations by various local and regional agencies/departments. Map 7-6 shows the dangerous locations. The following intersections are of particular concern:

Plymouth Street and North Main Street Interchange

- Intersection will improve with extension of Route 44
- Approximately 3.4 accidents per year occured at this location in the five year period although in 1997-1998 this intersection reported 16 accidents/year (SRPEDD).
- The interchange is signalized.
- Route 58 is 3 lanes wide in this section and has shoulders.
- Traffic along Plymouth Street will decrease from 12,000 ADT to 3,400 ADT with new Route 44.

Route 44/Route 58

- New intersection will be grade separated
- Future developments, depending upon use and design, could add significant traffic

Center Street/Wenham Road

- High accident location (34 accidents from 1994 through 1996).
- Traffic will decline with Route 44 extension

Main Street and South Meadow Road

- Moderate accident location.

Purchase Street and North Main Street

- Moderate accident location.
- Purchase, Silva and Wenham Street might serve as major E/W collector

Tremont Street and South Main Street at Lakeview Street

- Moderate accident location
- New development in South Carver should assist in up-grading problem intersections

Table 7-4
Major Intersecting Ways

Intersection	Traffic Control	Accidents/ Year	Potential Safety Deficiency	Potential Flow Deficiency
Plymouth St. and North Main St.	S	3.4		✓
Plymouth St. and North Carver Green	S*	0.0		
Plymouth St. and Center St.	U	0.8		
Purchase St. and North Main St.	S	1.8		
Center St. and Wenham Rd.	S*	2.2		
Center St. and Main St.	U	0.8		✓
Purchase St. and Fosdick Rd.	U	0.2		
Main St. and South Meadow Rd.	U	2.0		
South Main St. and Rochester Rd.	U	1.2		
South Main St. and Indian Rd.	U	0.2		
Tremont St. and Lakeview St.	U	1.2		
Rte. 44 off-ramp and North Main St.	U	4.2		
North Main St. and Green St.	U	1.0		
West St. and Main St.	S			
Tremont St. and South Main St.	S*	1.4		

U = Unsignalized intersection
S = Signalized intersection; S* = Flashing light
Accidents/year – based upon reported accidents for 1995 to 1999 from the Carver Police Department accident database. Zero fatalities, one accident involving a pedestrian, and one accident involving a bicyclist were reported.
Potential Safety Deficiency – greater than 5 accidents per year
Potential Flow Deficiency – as observed by the Carver Police Department

Table 7-5
Carver Police Department Observations

LOCATIONS	OBSERVATIONS
Carver Square Shopping Center, Center Carver	A turn lane in each direction could help ease traffic flow into this shopping area from Main Street.
Center and Main streets	A turn lane onto Center Street from Main Street could be helpful.
Plymouth and North Main streets	A "No Turn on Red" sign in all directions could make it easier for drivers exiting businesses at that intersection to pull into traffic.
Route 58 near Rochester Road	A third lane would help with traffic flow during September and October, when King Richard's Faire and the Cranberry Festival make conditions difficult on Route 58.

Table 7-6
Carver Highway Department Observations

LOCATIONS	OBSERVATIONS
Tremont Street, Federal Road, Wareham Street, and Cranberry Road	Makepeace Development will require widening and up-grading of these roads. Existing widths vary from 20 feet to 28' . Right of ways vary from 40-50 ' Several culverts will need rebuilding. No sidewalks.
Route 58	Widening should take place at critical intersections i.e at Post Office, in order to construct left turn lane.
Route 58/Town Hall	A light should be installed at Town Hall/ Fire Department
Tremont and Route 58,	Culvert/Bridge Repairs
Route 44 at Plymouth and Green Street	Culvert/Bridge Repairs

Public Transit

Currently the town has limited local transit facilities or service in place. The following summarizes the existing transit service:

- Dial-A-Ride service is provided by the Greater Attleboro-Taunton Regional Authority (GATRA) for the elderly and physically challenged. The person in need of transit must call ahead of time to schedule a pick-up. Persons with medical appointments/needs take priority for service. In discussions with Carver's Council on Aging, it was identified that some seniors have a difficult time making use of this service because they need assistance to get from their homes to the van, and drivers are not permitted to give this assistance.
- No commuter rail service is planned to operate with a stop or station in Carver. The MBTA recently completed a commuter rail line between Boston and the Plymouth area. The Kingston station is located at Marion Drive and Route 3. The Plymouth Station is located at Cordage Park. The closest station is located in Kingston, about 7 miles from Town Hall. A station in Middleborough, on a separate commuter rail line that also connects to Boston, is located about the same distance from Center Carver.

Pedestrians & Bicyclists

The most noticeable issue in terms of pedestrians and bicyclists is the need for developing a system of continuous facilities including different types of walking facilities or bicycle facilities. The major system of sidewalks is between Town Hall, the High School and South Meadow Village, a large manufactured home park. The last leg of this system, between Town Hall and South Meadow Road, is to be constructed shortly. Sidewalks do not exist on the major collectors and arterials except between the Governor Carver Elementary School and Town Hall in Center Carver. At this time, there are no plans for bike paths or sidewalks.

The Open Space Plan prepared in 1996 recommended a series of bike trails along some of the scenic as well as major collector roads. A map identifying existing and proposed bike trails follows.

Other Issues

The Zoning By-laws for the Town of Carver, Massachusetts were reviewed for transportation-related issues. In addition, current building practices and land development patterns for the area were considered. Characteristics or current regulations indicate the following other issues related to transportation:

- Roadway design standards in the sub-division by-law allow no flexibility to accommodate clustered development
- Lack of concentrated development areas that would support transportation demand management or transit
- No Functional Classification Street Plan to guide road improvements
- Pavement Management Plan needs to be up-dated
- Inadequate definition of desirable traffic operation conditions
- No requirement to conduct traffic studies for single-family house subdivisions
- No impact fee requirement based upon traffic impact studies

7.2 PROJECTED BUILDOUT & IMPLICATIONS OF BUILDOUT

In analyzing the transportation impacts of potential development in Carver, it was necessary to estimate the amount of traffic that various land uses can be expected to generate. If developed to its full potential under current zoning, the town of Carver is expected to grow by 8,048 dwelling units, 12,622,200 square feet of gross leasable retail space, and 9,208,000 square feet of gross floor area for office and manufacturing uses. The following sections summarize the procedures used in estimating the traffic to be generated by the potential development of Carver and the expected distribution of this traffic on study area roadways.

Trip Generation

Traffic generated by the various land uses normally follows well-established patterns with respect to magnitude, duration, and temporal distribution. Measurements of numerous such developments conducted by various organizations including the Institute of Transportation Engineers (ITE) have established trip generation rates which have been compiled and used for guidelines for transportation analysis. For many land uses, measurements have been conducted by ITE which have been compiled for analysis purposes and provide analysts with guidelines in forecasting travel associated with new land uses. The daily and peak hour trip generation forecasts for Carver's potential increases in development were based on the Institute of Transportation Engineers (ITE) *Trip Generation Manual*[1]. Under the full development case, Carver's growth will consist of the land uses as listed in Table 7-8, categorized by town section. Forecasts were completed for average season conditions for both year 2020 and full development cases.

The forecasted traffic is the total number of trips that could be added to Carver's transportation network over and above the current traffic levels. Although these numbers may seem quite high, it should be stressed that they represent the worst case scenario of developing all currently developable land to the highest degree possible according to the current zoning regulations. Several factors may reduce these traffic projections:

- The developable land may be developed at lower densities than the maximum allowable by the current zoning regulations.
- The current zoning regulations may be substantially changed.
- Several types of development such as fast food establishments and gas stations gain most of their customers from traffic already on the roads and happening to pass-by the facilities. Hence, the more pass-by trips, the less new trips.
- Alternative modes of travel will potentially be increased by the addition of public transit, bikeways, and walkways, thereby reducing driving trips.
- An increase in the employment base of Carver, linked with development of appropriate housing types can reduce the amount and length of several work trips by increasing the number of people who both live and work in town.

[1] Institute of Transportation Engineers, *Trip Generation Manual*, 6th Edition, Washington, D.C., 1997.

Table 7-8
Carver's Potential Development

Land Use	Year 2020 Potential Development	Year 2020 Average Daily VPD	Year 2020 Pm Peak Hour VPH	Full Buildout Potential Development	Full Buildout Average Daily VPD	Full Buildout Pm Peak Hour VPH
North Section						
Single Family Detached Housing	563 du	5,376	569	1,878 du	17,935	1,897
Condominium/Townhouse	36 du	211	20	121 du	709	67
Mobile Home	20 du	96	11	66 du	318	37
Shopping Centers	50.1 ksf	2,150	187	5,008.7 ksf	214,973	18,732
Manufacturing	52.8 ksf	202	39	5,281.0 ksf	20,173	3,908
North Section Subtotals:		**8,035**	**826**		**254,108**	**24,641**
Central Section						
Single Family Detached Housing	999 du	9,539	1,009	3,330 du	31,798	3,363
Condominium/Townhouse	51 du	299	28	170 du	996	94
Mobile Home	35 du	169	20	116 du	559	65
Shopping Centers	54.2 ksf	2,326	203	5,416.8 ksf	232,489	20,259
Manufacturing	23.1 ksf	88	17	2,307.0 ksf	8,813	1,707
Central Section Subtotals:		**12,421**	**1,277**		**274,655**	**25,488**
South Section						
Single Family Detached Housing	646 du	6,169	652	2,155 du	20,578	2,177
Condominium/Townhouse	39 du	229	21	130 du	762	72
Mobile Homes	25 du	120	14	82 du	395	46
Shopping Centers	22.0 ksf	944	82	2,196.7 ksf	94,282	8,216
Manufacturing	16.2 ksf	62	12	1,620.0 ksf	6,188	1,199
South Section Subtotals:		**7,524**	**781**		**122,205**	**11,710**
TOWN TOTALS:		**27,980**	**2,884**		**650,968**	**61,839**

du = dwelling unit, ksf = thousand square feet, vpd = vehicles per day, vph = vehicles per hour

If Carver is developed to its full potential, then approximately 650,000 new trips per day could occur. Within a 20-year time frame, it is projected that approximately one third of this residential development would occur, resulting in approximately 22,000 new trips per day and about 1% of the commercial and industrial development could occur, generating 6,000 trips per day. If this development occurs at a constant rate over the 20 years (5% per year), then approximately 300 trips per day would be added to the network each year.

Trip Distribution & Assignment

Directional distribution of generated trips to and from the developable sites typically are expected to follow existing traffic patterns which, in turn, are a function of population densities, shopping opportunities, areas of employment, and recreational activities. By the very nature of this analysis, projecting Carver's year 2020 and buildout transportation needs, there would be a significant increase in newly developed virgin land (which is zoned for various levels of development) resulting in new traffic patterns, unlike traditional traffic impact analysis studies. To develop the traffic patterns of new trips, the Town of Carver was divided into three broad sections – the North, Central, and East sections.

Implication of Growth

From the above analysis, we would find the following problems:

- Projected growth is anticipated to exacerbate accident levels at already dangerous locations.

- Route 58 would be severely congested and could not handle all of the projected traffic without improvements.
- Increases in both commercial and residential traffic are expected on Route 44.
- Central Carver would have the most difficult time adjusting to the projected increase given the limited road network for both north/south and East/West traffic.
- The Town of Carver will need to concentrate development at key nodes to facilitate alternative modes of transit including walking, transit, bicycling.

7.3 GOALS AND OBJECTIVES/ISSUES

The goals and objectives of the long range transportation component of the Carver Master Plan follow from an understanding of the transportation needs identified in the master planning process.

Ultimately, the goals are used to guide the Town in meeting its transportation needs and also, allow the Community to measure the achievement of the plan. In 1977, a Master Plan was prepared for the Town of Carver. The goals for transportation were as follows:

- Develop an adequate overall street pattern including a north-south collector street in East Carver
- Establish an overall street improvement and maintenance program including the adoption of consistent standards for the town and private developers
- Upgrade existing streets, elimination of substandard conditions
- Obtain easements to provide for needed streets, utility, bike and pedestrian ways designed to meet future needs

These goals are still valid and were used as a basis for development of more specific goals tailored to Carver's current needs. The following lists the set of transportation goals and objectives as developed for the current Master Plan.

Develop a transportation plan which is responsive to the community's economic development, land use, and open space plans, and which is compatible with the plans of neighboring communities.

- Establish bikeways, greenways, and walkways which link together neighborhoods and open spaces.
- Provide continuous, adequate sidewalks along all major arterials and collectors and ensure that safe crossing areas are appropriately highlighted at the major demand locations, particularly for the safety of school children, the elderly, and those with disabilities.
- Create a safe, visible bicycle network between neighborhoods, schools, parks, community centers, and employment centers; provide adequate storage facilities in key public areas and work locations.
- Incorporate bicycle design and walkway features in all infrastructure projects in a manner that is consistent with the "Transportation", "Open Space" and "Historical/Cultural" components of the Master Plan.
- Implement traffic circulation and control improvements in support of controlled access and parking to serve local businesses along the Route 58 corridor.
- Explore the implementation of shuttle bus service for commuters and major tourist attractions to nearby commuter rail stations.
- Adopt new roadway design standards for open space cluster subdivisions including recommendations for sidewalks, roads,

Create a transportation system that provides safe and efficient arterials to accommodate through movements and movement to major commercial and business centers while minimizing unnecessary traffic through neighborhoods.

- Implement improvements at intersections that have been recently identified as major problem areas through discussions with the Town's Police Chief and as a result of the Transportation Subcommittee meetings.
- Implement improvements along Route 58 to alleviate congestion and improve safety.
- Implement improvements on the major roads adjacent to the Makepeace Project in South Carver and Old Route 44 in North Carver in order to support new development.
- Explore the development of a north/south connection in East Carver to provide access to new development parcels in this area. Consider several alternative approaches in order to mitigate impact upon resource areas.

Implement actions that minimize the negative impact and enhance positive features related to the environment and Town resources.

- Adopt stormwater regulations ("Best Management Practices") in order to avoid significant impacts on the Town's water resources and wetland areas.
- Incorporate streetscaping and landscaping plans in all roadway improvement projects.
- Adopt new roadway standards for open space cluster sub-divisions including new sidewalks, street lighting standards, and maintenance agreements.
- Incorporate Environmental Impact Review in large scale development projects.
- Modify local zoning by-law to require off-site mitigation actions as part of site plan review.

Develop a transportation system that is cost-effective and affordable, maximizing the use of federal and state transportation funds, equitably incorporating private financing, and minimizing Town expenditures.

- Identify and pursue federal and state funding programs to support roadway and transit actions.
- Develop local funding mechanism for local public and private contributions to implement improvement plan.

7.4 THE RECOMMENDED PLAN

Introduction

The Recommended Plan has been divided into three primary sections for discussion. In the first section Transportation Demand Management (TDM) elements are discussed. TDM describes a system of actions whose purpose it is to alleviate traffic problems through improved management of vehicle trip demand. The purpose of TDM is to maximize the mobility of people, not simply vehicles. In the second section Transportation Safety Management (TSM) elements are discussed. TSM elements are primarily traffic engineering methods, such as efficient signal operations and coordination, providing turn lanes or modifying circulation patterns, used to improve the safety and operation of the roadway system. The third and final section details Major Network Improvements. Both Routes 58 and 44 are discussed.

Transportation Demand Management Elements

Encourage concentrated development in centers

It is recommended that new development be concentrated in centers along Route 44, 58, and Tremont Street to heighten the potential for alternate mode usage. Allowing mixed-use development in a single area or zone enables people to live, work, and shop in that zone. Trip lengths are diminished. As trips shorten, the likelihood of switching to a mode other than a single occupant vehicle is increased – more people begin to walk and bicycle to satisfy their travel needs. Concentrated development is also encouraged to sustain a transit system as well as to promote less consumption of open land than under current zoning regulations.

Local and regional transit plan

The focus of this section is the development of transit alternatives that would enhance the use of mass transit and reduce vehicular dependency and travel. Three transit alternatives may be appropriate in the Town of Carver

- a local circulator bus that serves the residents and makes it more desirable to leave the car at home,
- a shuttle bus to nearby MBTA commuter rail stations, and
- an improved Dial-A-Ride service for the elderly and physically challenged.

Community Land Uses:

1. Town Hall/Police Station
2. Fire Station
3. Library
4. Public Works Department
5. Other Town facilities
6. Senior Center
7. Schools
8. Parks
9. Major residential complexes
10. Health centers

To be successful, a local circulator bus and shuttle system should limit walking distance for any resident to less than a quarter of a mile and should connect to both the Kingston and Middleborough MBTA commuter rail stations. A local circulator can reasonably cover the Town of Carver with one route that travels on some of the major roadways but is also within the quarter mile maximum for most potential passengers. The local circulator could be subsidized by participating local employers whose employees would benefit from this service; this would work well with the

Housing Committee's goal of creating more housing in Carver for people working in the town. Several key land uses within the town that ought to be considered for servicing by the proposed route are defined as "Community Land Uses". In addition to the locations suggested for servicing, major employers and major shopping areas should be accessible by the route.

Network of bikeways and walkways

The most noticeable need in terms of pedestrians and bicyclists is the need for developing a system of continuous facilities, whether it is different types of walking facilities or bicycle facilities.

Pedestrian Facilities: Actions to improve conditions would be to close the gaps, and provide sidewalks (one or two sides) along all major roadways in the community. Footpaths, trails, or other walking facilities should be provided as a further action to access the recreation and conservation areas in town. In addition, walking facilities are recommended along roadways which pass historic sites shown on Map 5-4 . A potential priority system for addressing the sidewalk deficiencies in Carver is presented in Table 7-9.

Table 7-9
Construction Priority Of New Sidewalks*

GAPS WITHIN ONE HALF MILE	ROADWAY CLASSIFICATION		
	Arterial	Collector	Local
Schools	1	2	3
Churches	1	2	3
Parks/Recreation Areas	2	3	4
Shopping	3	4	5

* Priority ratings range from 1 for the highest and 5 for the lowest.

The above priority plan can be used to assist in scheduling the construction of new sidewalks as funds become available, while the following recommended guidelines provide some design specification and standards to be followed during construction.

The recommended guidelines for replacement and installation of sidewalks were developed with the aid of two research publications[2,3]. Table 7-10 provides a set of guidelines that can be followed when new sidewalks are to be constructed or existing sidewalks are replaced. The information in the table may be used to determine where sidewalks should be provided based on the roadway classification and whether or not the sidewalk is being considered along an existing or new road.

[2] Transportation Research Board, National Cooperative Highway Research Program No. 139, *Pedestrian and Traffic-Control Measures*, Washington, DC, November 1988.
[3] Department of Transportation, Federal Highway Administration, *A Manual for Planning Pedestrian Facilities*, Washington DC, June 1974.

Table 7-10
Recommended Guidelines For Sidewalk Installation

Land Use / Roadway Classification	New Urban & Suburban Streets	Existing Urban & Suburban
Commercial & Industrial / All Streets	Both sides	Both sides. Every effort should be made to add sidewalks where they do not exist.
Residential / Major Arterials	Both sides	Same as above.
Residential / Collectors	Both sides	Multi-family – both sides. Single family dwellings – prefer both sides, require at least one side.
Residential / Local Streets – More than 4 units/acre	Both sides	Prefer both sides, require at least one side.
1 to 4 units/acre	Prefer both sides; require at least one side.	One side preferred.
Less than 1 unit/acre	One side preferred; require shoulder both sides.	Require at least 4 foot shoulder on both sides.

Source: Transportation Research Board, NCHRP 139, *Pedestrian and Traffic Control Measures*.

To supplement the information in the table, the following set of standards has been developed to assist in the decision making process and provide some general design guidelines to be followed during construction:

1. Any local street within two blocks of a school site that would be on a walking route to school should have a sidewalk on at least one side.
2. Sidewalks may be omitted on one side of new streets where that side clearly cannot be developed and where there are no existing or anticipated uses that would generate pedestrian trips on that side.
3. Where there are service roads, the sidewalk adjacent to the main road may be eliminated and replaced by a sidewalk adjacent to the service road on the side away from the main road.
4. All new sidewalks should be at least five feet wide and must comply with the access requirements/standards detailed in the Americans with Disabilities Act and Amendments.
5. Where the right-of-way exists, there should be a buffer of at least three or four feet between the edge of roadway and the edge of the sidewalk.
6. Vertical granite curbs are desired to provide a barrier between motor vehicles and pedestrians when the sidewalk is within ten feet of the traveled way.

Bicycle Facilities

Alternatives for improving bicycle facilities in Carver include designating bicycle routes, designing bicycle paths, installing bicycle storage facilities in key locations (i.e., employment and shopping centers, Town buildings, transit stops), and disseminating the information to the community through mapping and signage.

The beginning of a possible town-wide bicycle network was developed for recreational travel. See Map 7-1 for an illustration of this potential network. The network was also developed in

conjunction with the Historical and the Open Space Committees of the Master Plan. For commuters, direct connections and level bikeways are the key. For the recreational bicyclists, varied terrain, points of interest, and scenic views are of importance. It is important that commuter routes and routes leading to the schools be enhanced through widening, striping, or both. Signing along these routes can also serve to make motorists more aware and possibly reduce travel speeds. Key routes to the Town's major recreation areas are also vital. Key destinations such as the Town Hall, the library, and the North Carver business district must also provide adequate storage facilities.

Pavement Management

In 1997 the Town of Carver Highway Department updated a pavement management plan completed by SRPEDD in 1992. This report noted three major findings. First, the amount of road mileage which needed reconstruction was increasing since the last report primarily due to a lack of funding for preventive maintenance on some roads which fell from fair to poor conditions. It was estimated that 25% of the town's roads need reconstruction. Second, the Town will need to increase by at least 30% the funding for road improvement. Chapter 90 funds have provided some $285,000 annually. A suitable budget to maintain the road network would require some $400,000. Third, given the limitations in State Chapter 90 as well as Federal funding, the Town will need to increase its funding to maintain its roads in good or excellent condition.

Transportation Safety Management Elements

The transportation system in Carver will experience significant increases in traffic flows over the next twenty years. To accommodate these higher flows it is crucial that the road system be safe. Addressing this issue, we have suggested major network improvements for several roadways throughout the town and outlined potential access management criteria.

Access Management

In addition to improving the safety at several existing intersections, safety should also be managed on a system-wide basis. To this end, the following recommendations are made to manage access to the roadway network and provide for an adequate network while allowing new development.

- Require preparation of traffic impact statements to analyze the impacts of large subdivision and development projects
- Develop specific curb-cut design and management guidelines for open space sub-divisions
- Improve road surfaces, especially drainage design. Guidelines for proposed roadways should be adjusted to alleviate the drainage problems which currently occur.
- Improve roadway and walkway lighting. Classification of proposed future roads is recommended to determine the level of lighting required by the town to be installed by the developer.
- Adopt roadway design standards to include pedestrian and bicycle facilities within larger rights-of-way.
- Incorporate site plan review and traffic study requirements for all proposed subdivisions and major commercial developments in the Zoning By-laws.

Major Network Improvements

Both Routes 58 and 44 serve as the Town's commercial corridors as well as the primary interregional roadways. With a significant increase in development, each of these roadways will need to accommodate more traffic while offering access to all of the current and future corridor

developments. Therefore, it is essential that each corridor be carefully planned to address these needs. In the following two sections recommendations are made for each corridor.

Route 58 Cross-Section and Plan

- Expand Route 58.
- Limit curb-cuts or require access be provided from a parallel facility.
- Signalize key intersections.

Route 44 Cross-Section and Plan

- Continue moving forward and working with the Mass Highway plans.
- Expand Route 44 to a four-lane cross-section.
- Limit curb-cuts or require access be provided from a parallel facility.

South Carver: Road Widenings

- Cranberry Road
- Federal road
- Tremont Street

South Carver: Right of Way Widening

- Wareham Street widening

Stormwater Protection

The Federal Environmental Protection Agency has adopted Phase II Stormwater regulations to "preserve, protect, and improve" local water resources from polluted storm water runoff. Local governments and operators of earth removal operations as well as developers will be required to implement programs and practices to control polluted storm water and non-stormwater discharges. Municipalities that fall within the program (Carver will probably be included) will be required to develop and implement best management practices to satisfy each of six program elements.

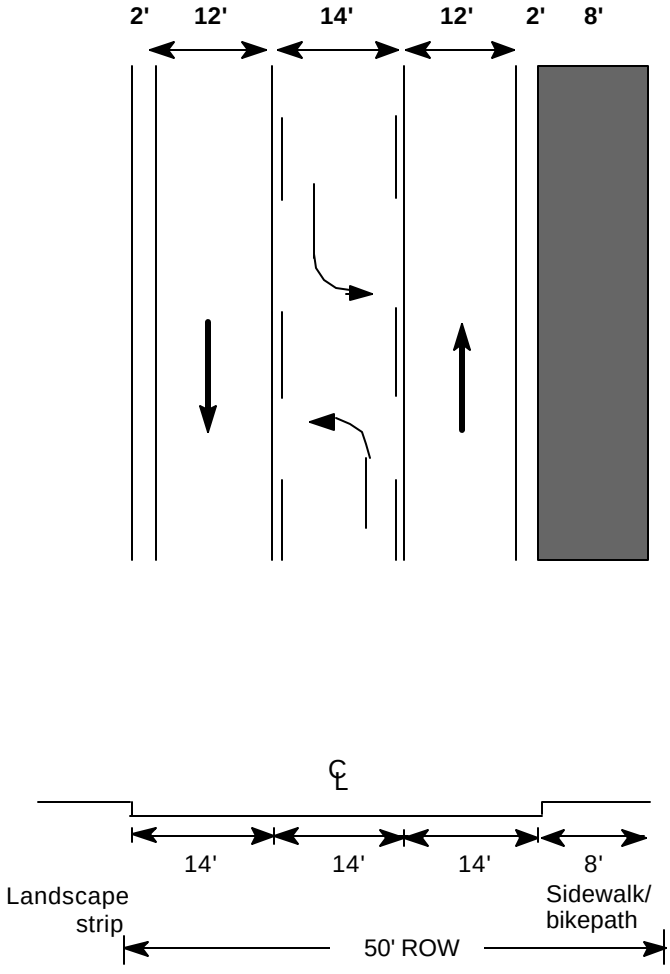
- Request Buzzards Bay Project to undertake town-wide survey of stormwater outfalls and assist town in preparation of stormwater program which will address six program elements including:
    1. Public Education and Outreach
    2. Public Involvement and Participation
    3. Illicit discharge Detection and elimination
    4. Construction of Site Storm Water Runoff Control
    5. Post Construction Management in New Development
    6. Pollution Prevention and Good Housekeeping

Adoption of Roadway and Sub-division Standards

In order to properly manage new growth, the town needs to have a consistent set of standards for roadway construction. Additional guidelines will need to be incorporated into the subdivision regulations in order to guide the development of new cluster, village and mixed use development plans. Examples of these regulations have been provided the Master Plan Committee. Table 7-10 identified suggested street standards.

Figure 7-8

Two Lane Cross-section with Center Two-way Left Turn Lane



Summary

Can accommodate up to 20,000 to 26,000 vpd prior to congestion.

Advantages:

Reduces delay to through vehicles from left movement.

Reduces frequency of rear-end and angle type collisions.

Provides spatial separation between opposing directions.

Cross-section may be accommodated in existing right-of-way.

Disadvantages:

No refuge in median for pedestrians.

May encourage strip commercial development.

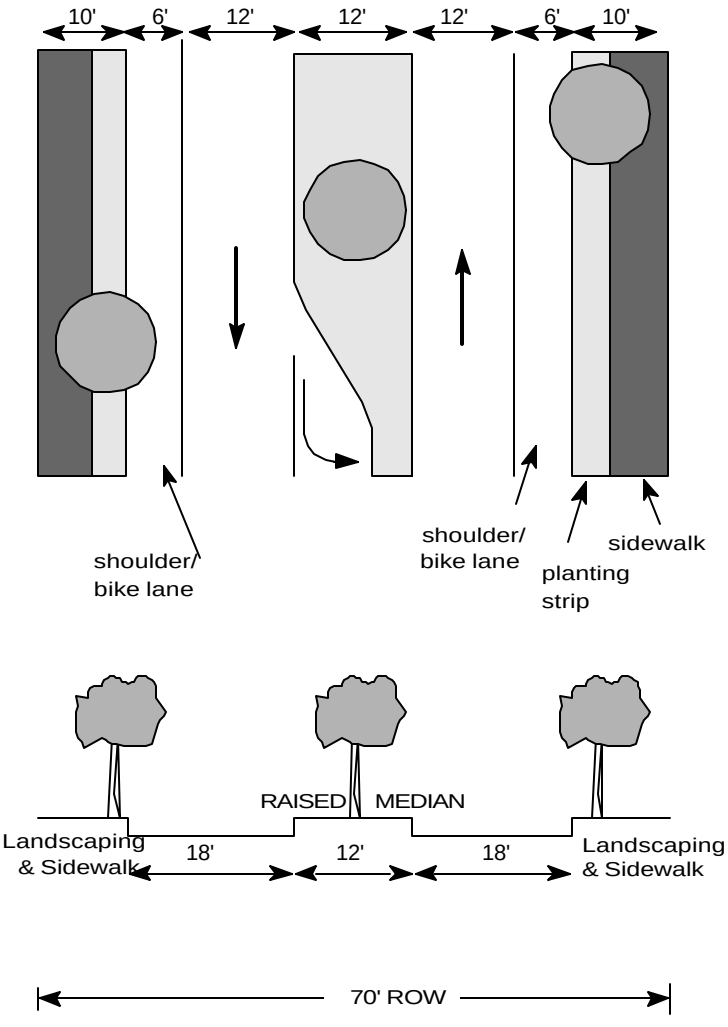
Pedestrians and bicyclists only have access to one side of street and must share facility.

Corridor Treatments - Route 138 Proposed Cross-section

not to scale

Figure 7-9

Two Lane Cross-section with Raised Median



Summary

Can accommodate
up to 20,000 to 22,000 vpd
prior to congestion.

Advantages:

Reduces frequency of rear-end and angle type collisions.

Provides spatial separation between opposing directions.

Provides a median refuge area for pedestrians.

Pedestrians and bicyclists have separate facilities.

Disadvantages:

Requires wider pavement and shoulders.

Increased delay to left-turning vehicles - need to accommodate u-turns.

Will require additional right-of-way.

Indirect routing for large trucks.

Corridor Treatments - Route 138 Preferred Cross-section

not to scale

Table 7-11
Suggested Street Standards

Characteristic	Arterial*	Type of Street Collector	Local	Open Space Subdivision
Width				
Right-of-way	64 ft.	60 ft.	40 ft.	40
Pavement - total	40 ft.*	36 ft.	24 or 26 ft.	20-26
- travel lanes	2 x 12 ft.	2 x 10 ft.	2 x 12 ft.	2 x 10 ft.
- shoulder & parking	2 x 8 ft.	2 x 8 ft.	1 x 8 ft.	?
Sidewalk/Bikeway	2 x 5 ft.	2 x 5 ft.	1 or 2 x 5 ft.	required
Berms	varies	required	required	required
Minimum Horizontal Radius	1000 ft.	500 ft.	200 ft. or less	
Grade				
Minimum	0.6%	0.6%	0.5%	0.5%
Maximum	6%	8%	12%	?
Intersection				
Minimum intersection angle	80%	75%	60%	45%
Minimum intersection offset	250 ft.	125 ft.	125 ft.	?
Sight stopping distance	400 ft.	250 ft.	200 ft.	200 ft.
Speed Permitted				
Maximum	50 mph	35 mph	25 mph	?

* Minimum, heavier volumes of traffic may require more travel lanes.
Source: Generally accepted standards - compiled and revised by SRPEDD for the Town of Carver

Hierarchy; paved surface widths

Streets shall be permitted with paved widths less than that required for conventional subdivisions, as follows:

Minor local street - minimum paved surface width of 20 feet, if it will carry no more than 200 average daily trips, and prohibit on-street parking.

Major local street - minimum paved surface width of 24 feet, if it will carry no more than 350 average daily trips and prohibit on-street parking.

Divided street - with paved surface widths as appropriate to major or minor local streets with two street segments combined.

The following chart shall be used to determine the anticipated average daily traffic levels of proposed residential development:

Housing Types	Average Weekday Trip Generation Rates
Single Family detached	10.0 Trips/Dwelling Unit (D.U.)
Duplex, Multiplex, Townhouse	8.1 Trips/D.U.
Apartments	0.4 Trips/D.U.
Mobile Home	5.38 Trips/D.U.
Retirement Village	3.3 Trips/D.U