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ROUTE 28 TRAFFIC CIRCULATION STUDY YARMOUTH - ORLEANS

*** Draft Existing Conditions Report***
by the
Cape Cod Commission
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Department of Transportation, Federal Highway Administration

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1.0 INTRODUCTION

This report is the fourth and final part of a corridor planning study which is being conducted by the Cape Cod Commission (CCC) as part of a transportation planning contract with the Massachusetts Highway Department. The purpose of the study is to address the needs of the entire length of Route 28 on Cape Cod. This portion of the study examines Route 28 from the Eastham-Orleans Rotary to the Yarmouth-Barnstable town line.

BACKGROUND

The unique geography of Cape Cod has had an indelible impact on its transportation infrastructure. Figure 1.1 shows the primary transportation routes through the study area. It can be seen that Routes 6A, 6, and 28 provide for the principal longitudinal traffic flows. In addition to the Cape's narrow shape which forces regional traffic to pass through many towns, the transportation infrastructure is also restricted by physical barriers such as rivers, bays, ponds, and wetlands. Although the Cape is only six and a half miles wide on the average, is more than ten times as long, or 63 miles.

The study area encompasses 6 towns. These range from large towns with urbanized areas, such as Yarmouth, to small rural towns, such as Chatham. Selected statistics for study area towns are contained in Table 1.1. Although the towns in the study area are dissimilar in size and population, all exhibit a characteristic population swell during the summer tourist season. This influx of summer residents and visitors places a tremendous strain on the Cape's transportation network.

The continuing growth of traffic in the study area has made it critical that a study be performed in order to develop recommendations for improvements in traffic safety and circulation. Long term plans need to be developed for the corridor so that additional safety and circulation problems can be avoided in the future. Interim improvements and new development should be consistent with the long term plan.

The study area suffers primarily from conflicts between highway function and land use intensity. The Federal - Aid Highway Systems in The Commonwealth of Massachusetts Atlas designates Routes 28 as an arterial of statewide significance and describes its basic function as "...the movement of large numbers of people and vehicles by way of long distance travel corridors." The land use along much of Route 28, however, has led to a large volume of traffic using this route for direct land access. Increased demands on the highway for both mobility and land access has led to congestion and thus degraded the basic function of Route 28 - mobility. More important, however, congestion has links to reductions in safety. These two issues, mobility and safety, will be the primary focus of this report.

Traffic patterns at the western end of the study area are strongly influenced by conditions in the Hyannis area. Conditions in this regional urban center have been addressed in the *Barnstable* portion of the corridor study and are currently being addressed in a transportation study being conducted by the Town of Barnstable in conjunction with Yarmouth and several major traffic generators. The complexity and interdependence of traffic flows in this area illustrates the importance of communication and cooperation between local, regional, and state agencies. This portion of the Route 28 study, as well as the Barnstable portion, should provide invaluable information for agencies involved in the Hyannis study.

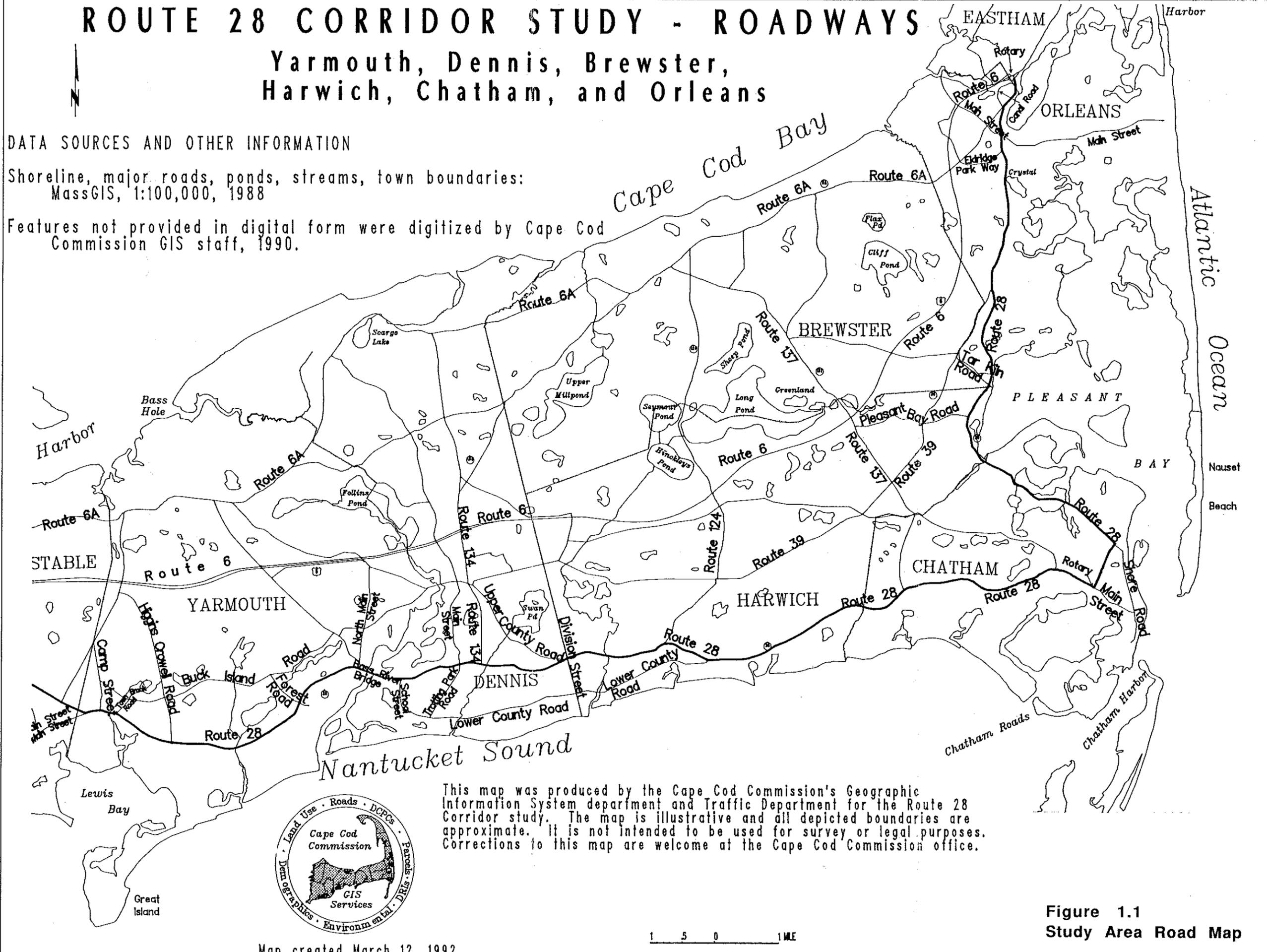
ROUTE 28 CORRIDOR STUDY - ROADWAYS

Yarmouth, Dennis, Brewster,
Harwich, Chatham, and Orleans

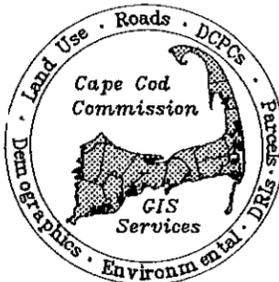
DATA SOURCES AND OTHER INFORMATION

Shoreline, major roads, ponds, streams, town boundaries:
MassGIS, 1:100,000, 1988

Features not provided in digital form were digitized by Cape Cod
Commission GIS staff, 1990.



This map was produced by the Cape Cod Commission's Geographic Information System department and Traffic Department for the Route 28 Corridor study. The map is illustrative and all depicted boundaries are approximate. It is not intended to be used for survey or legal purposes. Corrections to this map are welcome at the Cape Cod Commission office.



Map created March 12, 1992

Figure 1.1
Study Area Road Map

Barnstable County Population 1990-2000

TOWN	1990 CENSUS		PEAK PROJECTION 1990		PROJECTED RESIDENTS 2000		PROJECTED PEAK 2000		1990-2000		1990-2000	
		% OF TOTAL		% OF TOTAL		% OF TOTAL		% OF TOTAL	DIFFERENCE	% CHANGE	DIFFERENCE	% CHANGE
BARNSTABLE	40,949	21.94%	81,800	15.26%	51,300	22.20%	96,800	16.02%	10,351	25%	15,000	18%
BOURNE	16,064	8.61%	37,900	7.07%	18,400	8.00%	42,500	7.03%	2,336	15%	4,600	12%
BREWSTER	8,440	4.52%	28,300	4.91%	10,400	4.52%	33,200	5.49%	1,960	23%	6,900	26%
CHATHAM	6,579	3.53%	23,600	4.40%	8,200	3.56%	25,500	4.22%	1,821	25%	1,900	8%
DENNIS	13,864	7.43%	62,900	11.73%	19,300	8.39%	65,700	10.87%	5,436	39%	2,800	4%
EASTHAM	4,462	2.39%	21,800	4.07%	5,200	2.26%	24,300	4.02%	738	17%	2,500	11%
FALMOUTH	27,960	14.98%	69,300	12.93%	32,100	13.95%	76,200	12.61%	4,140	15%	6,900	10%
HARWICH	10,275	5.51%	31,300	5.84%	13,600	5.91%	34,300	5.68%	3,225	32%	3,000	10%
MASHPEE	7,884	4.22%	25,800	4.81%	11,800	5.13%	34,800	5.76%	3,916	50%	9,000	35%
ORLEANS	5,838	3.13%	16,700	3.12%	7,400	3.22%	18,500	3.06%	1,562	27%	1,800	11%
PROVINCETOWN	3,561	1.91%	18,800	3.51%	3,800	1.65%	19,400	3.21%	239	7%	600	3%
SANDWICH	15,489	8.30%	29,200	5.45%	19,000	8.26%	37,000	6.12%	3,511	23%	7,800	27%
TUFO	1,573	0.84%	15,900	2.97%	2,200	0.96%	17,700	2.93%	627	40%	1,800	11%
WELLFLEET	2,493	1.34%	16,800	3.13%	3,100	1.35%	18,800	3.11%	607	24%	2,000	12%
YARMOUTH	21,174	11.35%	58,000	10.82%	24,300	10.56%	59,700	9.88%	3,126	15%	1,700	3%
COUNTY TOTAL	186,605	100.00%	536,100	100.00%	230,100	100.00%	604,400	100.00%	43,495	23%	68,300	13%
MASSACHUSETTS	6,016,425											

Note: Peak population represents year-round residents plus seasonal residents and overnight visitors in transient accommodations including camps.

SOURCE: U.S. Census, 1990 (resident population); projections of 1990 peak population and resident and peak population in 2000, by Cape Cod Planning and Economic Development Commission, 1982

STUDY AREA

The study area boundary is illustrated in Figure 1.1. It can be seen that the scope of the study includes sections of Route 28 which pass through six towns. The extent of the study scope was necessary because of the regional nature of this transportation corridor. To the west, the study will include roadways in Barnstable which are used as links to the Route 6 interchange at Willow Street. To the northeast, the study will include analysis of the Eastham/Orleans rotary. The constraints of geography and travel demand has had affects on roadways other than Route 28. Many local roadways which serve as alternatives to Route 28 receive special attention because of the interrelationship between these roadways and Route 28.

Environmental Parameters

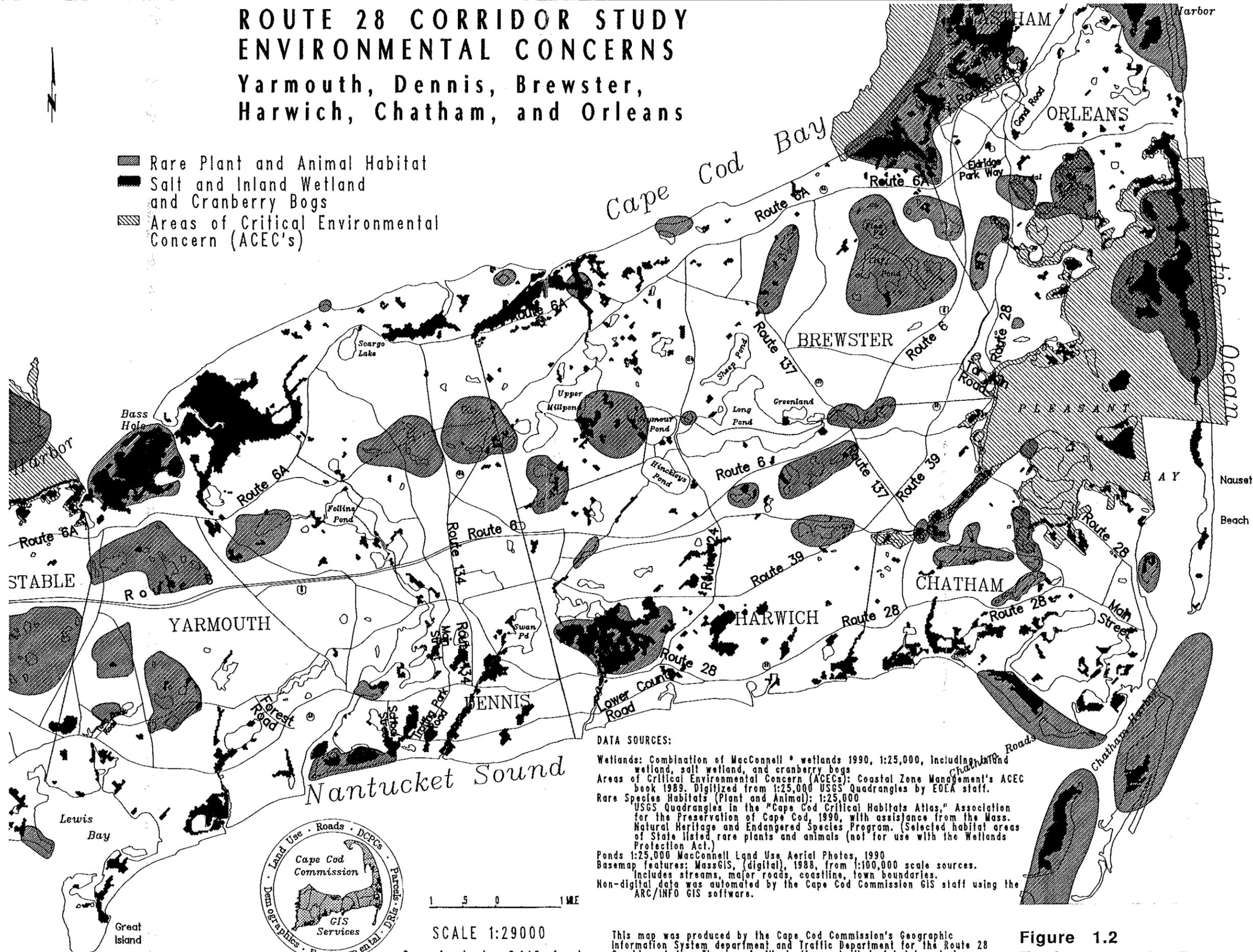
Environmentally sensitive areas are shown on Figure 1.2. Included are entities such as ponds, streams, and wetlands; rare animal and vegetation habitats, and Areas of Critical Environmental Concern (ACECs). ACECs have been designated by Secretary of the Executive Office of Environmental Affairs through an extensive process of research, public review, and input at the local level. Also included are historical sites registered by the Massachusetts Historic Commission.

Land Use

Land use categories are identified and presented in Figure 1.3. The uses identified for much of the corridor are for the most part Residential and Commercial, with significant stretches of Woodland in the segment from Orleans to Chatham. Also, shown are other categories such as Industrial (including gravel pits), Transportation (airports), Open Land & Recreation, Wetlands, and Waste Disposal (including landfills).

ROUTE 28 CORRIDOR STUDY ENVIRONMENTAL CONCERNS Yarmouth, Dennis, Brewster, Harwich, Chatham, and Orleans

-  Rare Plant and Animal Habitat
-  Salt and Inland Wetland and Cranberry Bogs
-  Areas of Critical Environmental Concern (ACEC's)



DATA SOURCES:
 Wetlands: Combination of MacConnell * wetlands 1990, 1:25,000, including salt wetland, salt wetland, and cranberry bogs
 Areas of Critical Environmental Concern (ACECs): Coastal Zone Management's ACEC book 1989. Digitized from 1:25,000 USGS Quadrangles by EOE staff.
 Rare Species Habitats (Plant and Animal): 1:25,000 USGS Quadrangles in the "Cape Cod Critical Habitats Atlas," Association for the Preservation of Cape Cod, 1990, with assistance from the Mass. Natural Heritage and Endangered Species Program. (Selected habitat areas of State listed rare plants and animals (not for use with the Wetlands Protection Act).
 Ponds: 1:25,000 MacConnell Land Use Aerial Photos, 1990
 Basemap features: MassGIS, (digital), 1988, from 1:100,000 scale sources. Includes streams, major roads, coastline, town boundaries.
 Non-digital data was automated by the Cape Cod Commission GIS staff using the ARC/INFO GIS software.



1 5 0 1 MILE
 SCALE 1:29000
 One inch to 2416 feet

Map created March 4, 1992

This map was produced by the Cape Cod Commission's Geographic Information System department and Traffic Department for the Route 28 Corridor study. The map is illustrative and all depicted boundaries are approximate. It is not intended to be used for survey or legal purposes. Corrections to this map are welcome at the Cape Cod Commission office.

**Figure 1.2
Environmental Parameters**

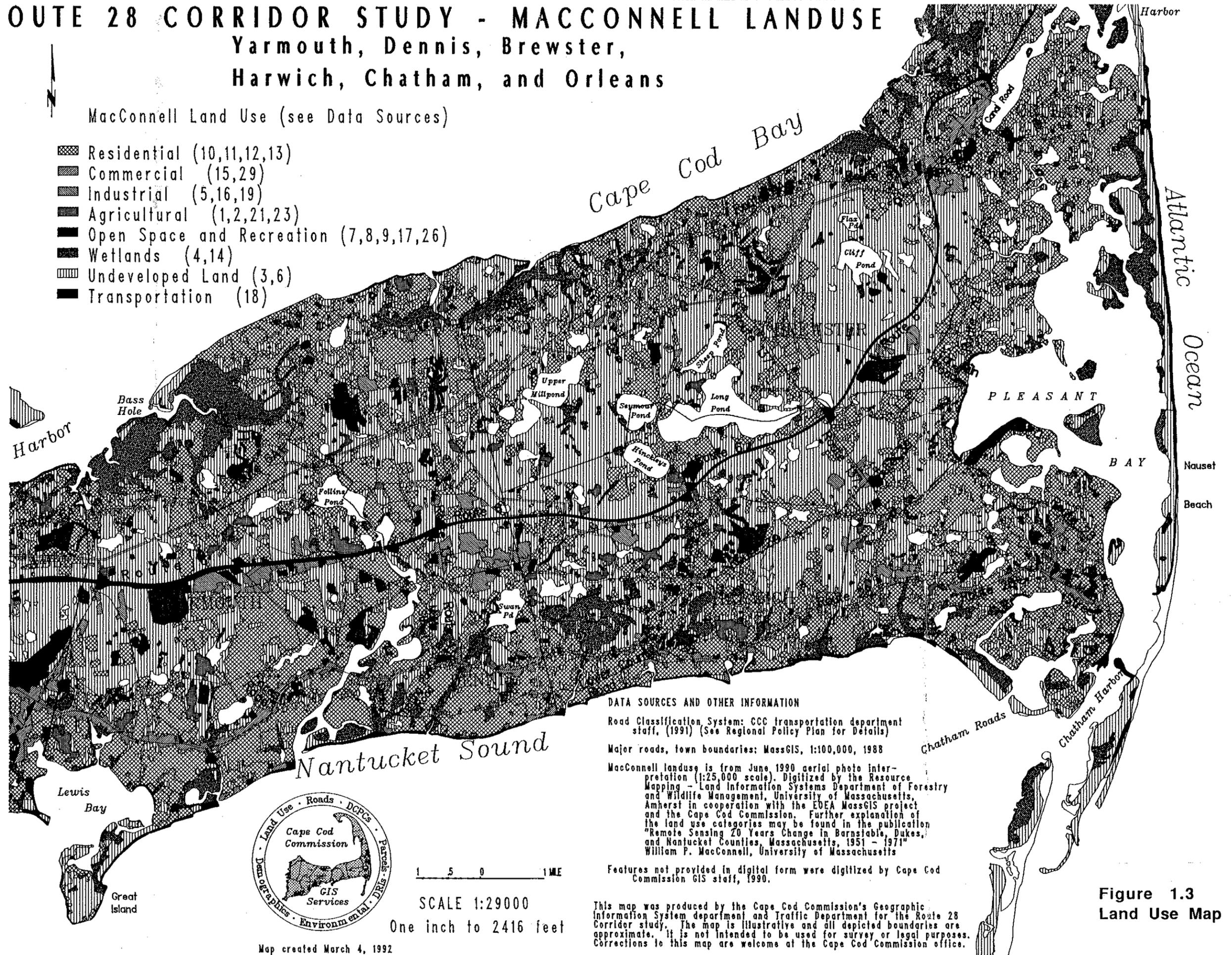
ROUTE 28 CORRIDOR STUDY - MACCONNELL LANDUSE

Yarmouth, Dennis, Brewster,
Harwich, Chatham, and Orleans



MacConnell Land Use (see Data Sources)

- Residential (10,11,12,13)
- Commercial (15,29)
- Industrial (5,16,19)
- Agricultural (1,2,21,23)
- Open Space and Recreation (7,8,9,17,26)
- Wetlands (4,14)
- Undeveloped Land (3,6)
- Transportation (18)



DATA SOURCES AND OTHER INFORMATION

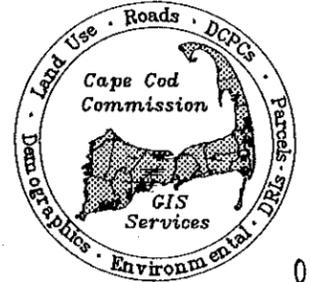
Road Classification System: CCC transportation department staff, (1991) (See Regional Policy Plan for Details)

Major roads, town boundaries: MassGIS, 1:100,000, 1988

MacConnell landuse is from June 1990 aerial photo interpretation (1:25,000 scale). Digitized by the Resource Mapping - Land Information Systems Department of Forestry and Wildlife Management, University of Massachusetts, Amherst in cooperation with the EDEA MassGIS project and the Cape Cod Commission. Further explanation of the land use categories may be found in the publication "Remote Sensing 20 Years Change in Barnstable, Dukes, and Nantucket Counties, Massachusetts, 1951 - 1971" William P. MacConnell, University of Massachusetts

Features not provided in digital form were digitized by Cape Cod Commission GIS staff, 1990.

This map was produced by the Cape Cod Commission's Geographic Information System department and Traffic Department for the Route 28 Corridor study. The map is illustrative and all depicted boundaries are approximate. It is not intended to be used for survey or legal purposes. Corrections to this map are welcome at the Cape Cod Commission office.



1 5 0 1 ME

SCALE 1:29000

One inch to 2416 feet

Map created March 4, 1992

Figure 1.3
Land Use Map

Route Identification Conventions

Cape Cod's geography has lead to many a driver's confusion when faced with the signs denoting the general direction of travel on the route being opposite of the cardinal direction. For example, drivers travelling south from Eastham to Chatham along Route 28 in Orleans are following signs indicating "Route 28 North." This system has some logic: the origin, or "zero" mile of Route 28 is the Eastham/Orleans Rotary. Since Route 28 eventually ends in New Hampshire, a driver's journey from beginning to end would be northbound overall, despite significant stretches on the Cape which are southbound and even eastbound. The convention used in this report is to refer to travel on Route 28 in the direction of upwardly increasing mile markers as *Upbound* and travel towards the Eastham/Orleans Rotary (at Mile 0.00) as *Downbound*. Intersecting streets may be referred to geographically: the approaches from the beaches on Nantucket Sound or the Atlantic Ocean may be referred to as *Landbound*, with the opposite approach referred to as *Beachbound*. The text of the report includes the MHD directional classification where Route 28N is equivalent to Upbound and Route 28S is equivalent to Downbound. Additional references to locations may also be included where helpful. For example, Route 28S in Orleans is Downbound, "towards Eastham."

Management Segments

The characteristics of the study area roadway are not uniform along its entire length. For this reason, this portion of Route 28 has been divided into *management segments*. This system is a "top-down" approach: we recognize that changes within the management segments can affect all segments' performances as components of the highway network. The basis for this segmentation scheme resulted from the following constraints:

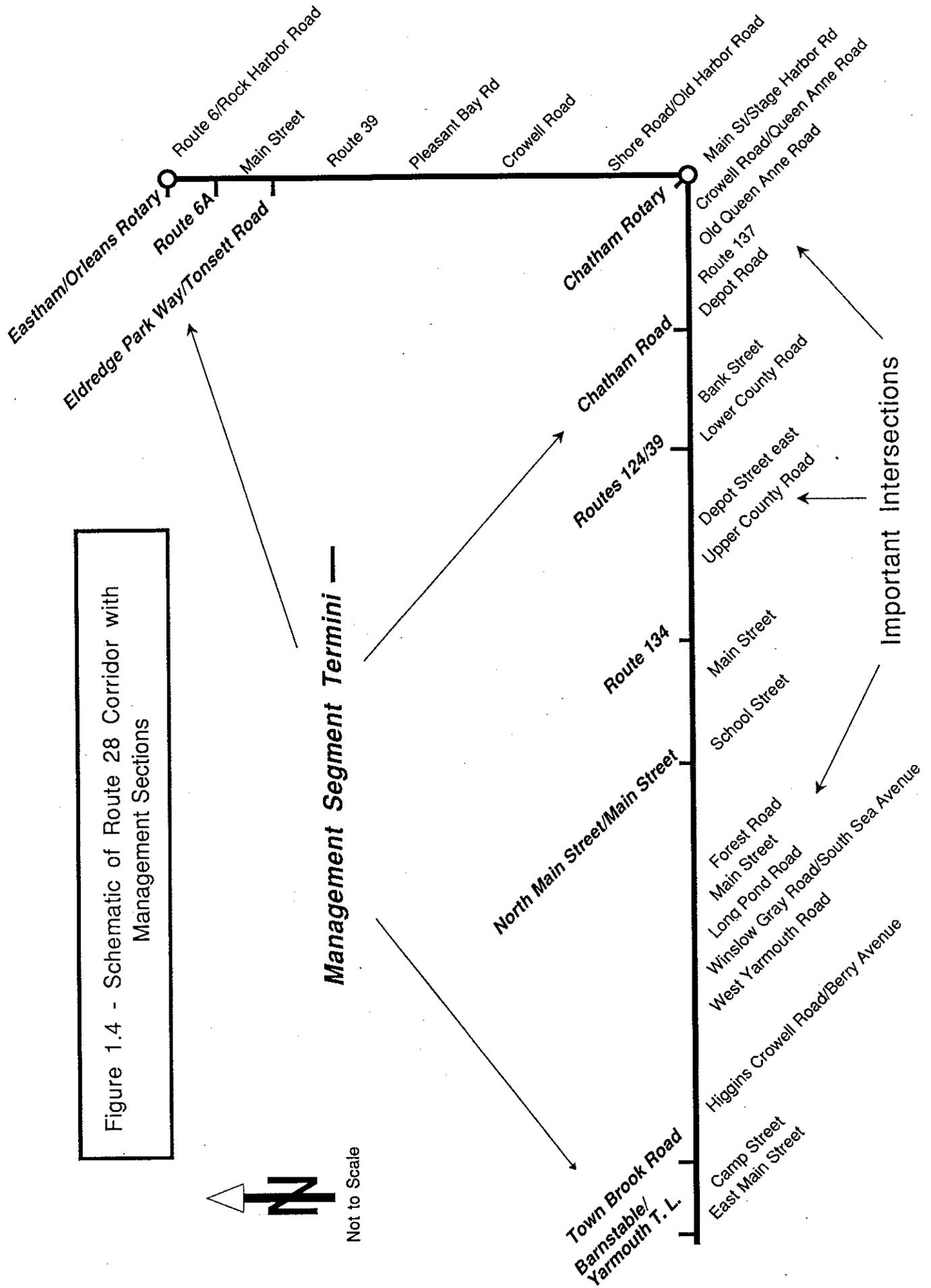
- Geographical - vehicular origins and destinations, availability of alternate routes, etc.
- Roadway Function - the conflict between mobility and local access.
- Roadside Development - variety of land uses influences regional travel patterns as well as turning conflicts.
- Traffic Volumes - an overall result of above factors, among others.
- Right-of-Way - travelled way, adjacent environment: wetlands, historic structures, etc.
- Magnitude of Potential Solutions - opportunities for improvement given all of the above factors.

The termini of Route 28 management segments are defined as the following intersections:

Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
C	Eldredge Park Way/Tonsett Rd [1.25] to Chatham Rotary	8.55
D	Chatham Rotary [9.80] to Chatham Road	4.60
E	Chatham Road [14.40] to Routes 124 & 39	2.70
F	Routes 124 & 39 [17.10] to Route 134	3.15
G	Route 134 [20.25] to N. Main/Main Streets (Yarmouth)	2.00
H	N. Main/Main Streets (Yarmouth) [22.25] to Town Brook Rd	4.50
I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

These segments are presented in Figure 1.4 along with other important intersections. Note that the orientation of the intersecting streets is based solely on importance: management segment termini are shown on the Land side of Route 28 and other important intersections are shown on the Beach side. The actual orientation of each varies, and is shown in the study area map of Figure 1.1.

Figure 1.4 - Schematic of Route 28 Corridor with Management Sections



Not to Scale

2.0 SUMMARY OF EXISTING CONDITIONS

For this draft of the existing conditions report, samples of link and intersection volumes and operations will be presented in a series of tables and graphs. The following table includes a list of selected representative links and intersections, one for each management segment, that will be used throughout the text.

Management

Segment	Selected Representative Link	Selected Representative Intersection
A	Eastham/Orleans Rotary to Canal St	Route 6A
B	Main St to Eldredge Pkwy	Main Street (Orleans)
C	Route 39 to Pleasant Bay Rd (Orleans-Harwich town line)	Route 39 (Orleans)
D	Queen Anne Road to Old Queen Anne Rd	Old Queen Anne Road (north leg)
E	Bank St to Lower County Rd	Lower County Road
F	Depot St (east) to Upper County Rd (Harwich-Dennis town line)	Route 134
G	School St to N. Main St (Dennis-Yarmouth town line)	Main St (Dennis)/Trotting Park Rd
H	Forest Rd to Main St (S. Yarmouth)	Forest Road
I	E. Main St (Hyannis) to Yarmouth Rd (Yarmouth-Barnstable town line)	Camp Street

Worksheets and other information pertaining to other locations along the corridor are included in the appendix.

TRAFFIC VOLUMES

Seasonal traffic volumes along key segments of study area roadways are substantial -

approximately 22,000 vehicles per day on Route 28 at either end of the study area. Peak season traffic volumes at selected locations are presented in Figure 2.1. These volumes can be compared to average annual traffic volumes, shown in Figure 2.2 to illustrate the seasonal traffic increase. The average seasonal increase in traffic volumes from average annual volumes to July volumes was almost 37% in 1991. The Commission's *1991 Traffic Counting Report* can be referred to for a more in-depth discussion of seasonal traffic fluctuations.

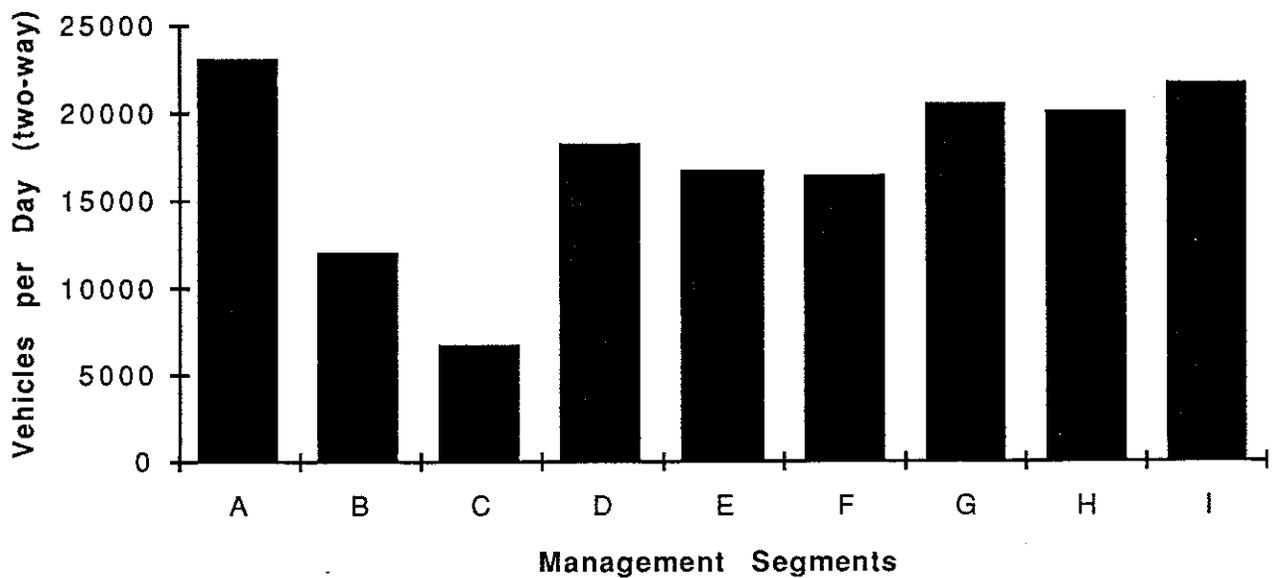
Seasonal P.M. Peak Hour Volumes

Seasonal P.M. Peak Hour volumes for the selected locations are presented in Figure 2.3. The highest flow occurs along the segment between Route 6A and the Eastham/Orleans Rotary with about 1780 vehicles per hour. This segment is a confluence of Route 6A and Route 28, hence the sharp decline of volumes in the following segment. The lowest occurred in the third segment, very rural in character, from Orleans to Chatham with about 600 vehicles per hour. Volumes increase in the more commercially active segment from the Chatham Rotary into Harwich to about 1420 vehicles per hour, then decrease for the less active segment from Chatham Road to Routes 124/39 to about 1340 vehicles per hour. The four segments through the remainder of Harwich, Dennis, and Yarmouth generally have the highest volumes for their length: 1520, 1460, 1420, and 1540 vehicles per hour, respectively.

Seasonal P.M. Turning Movement Counts

Figure 2.4 shows a the results of all turning movement counts performed or collected for this report. A complete listing is available in the appendix.

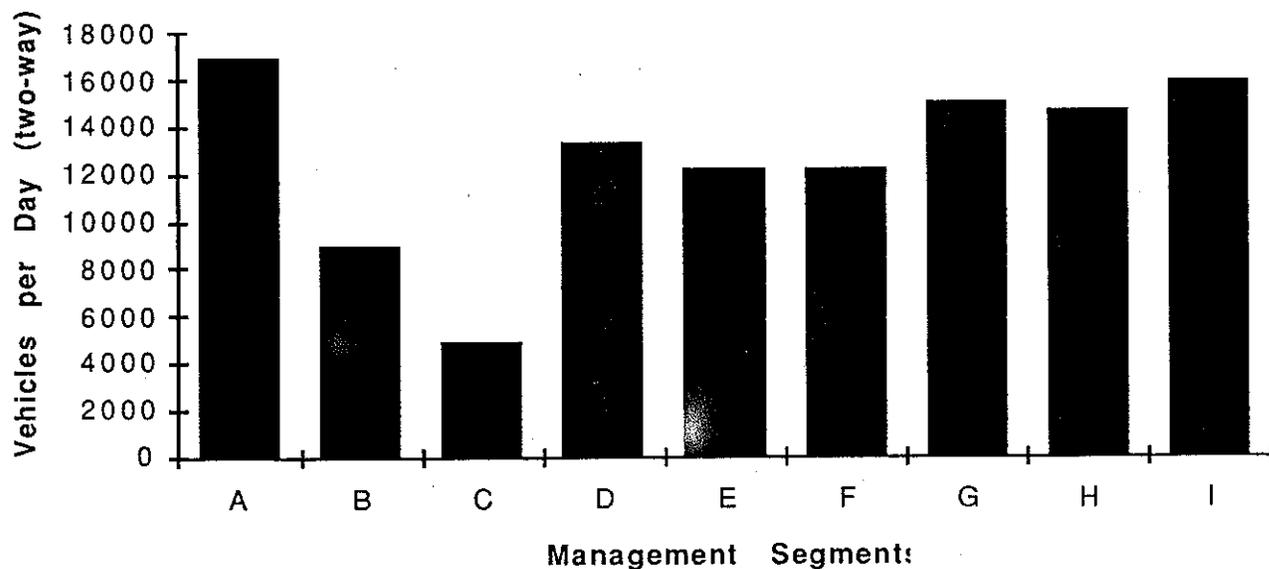
Summer Average Daily Traffic Volumes



Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
C	Eldredge Park Way/Tonsett Rd [1.25] to Chatham Rotary	8.55
D	Chatham Rotary [9.80] to Chatham Road	4.60
E	Chatham Road [14.40] to Routes 124 & 39	2.70
F	Routes 124 & 39 [17.10] to Route 134	3.15
G	Route 134 [20.25] to N. Main/Main Streets (Yarmouth)	2.00
H	N. Main/Main Streets (Yarmouth) [22.25] to Town Brook Rd	4.50
I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

Figure 2.1 - Peak Season Daily Traffic Volumes

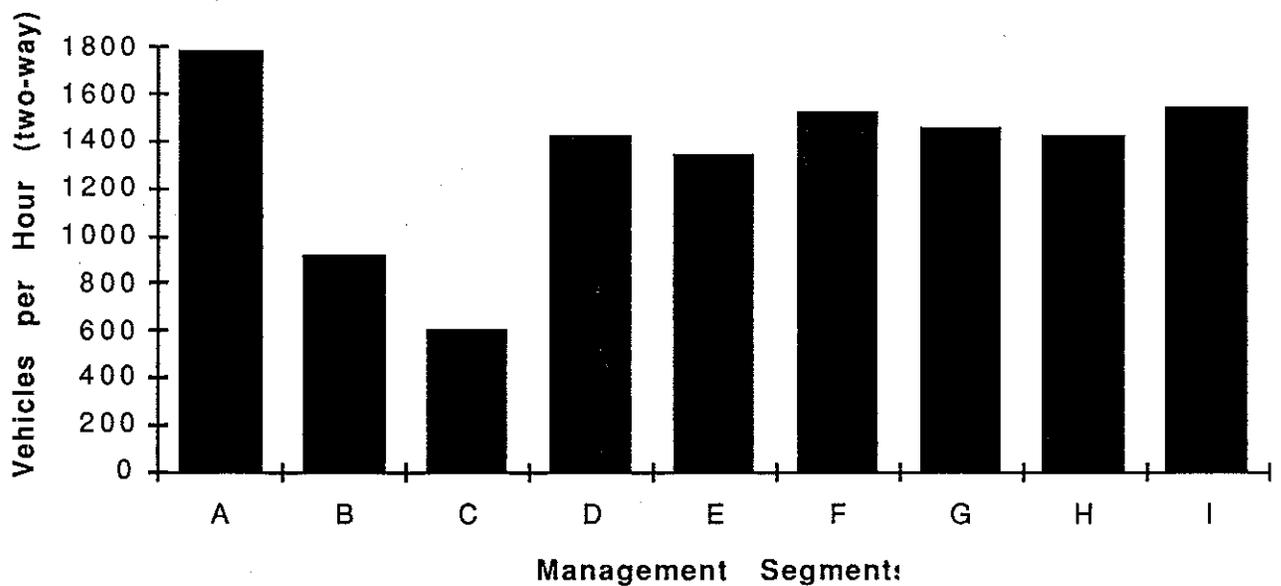
Annual Average Daily Traffic Volume



Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
C	Eldredge Park Way/Tonsett Rd [1.25] to Chatham Rotary	8.55
D	Chatham Rotary [9.80] to Chatham Road	4.60
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Figure 2.2 - Average Daily Traffic Volumes

P.M. Peak Hour Traffic Volume



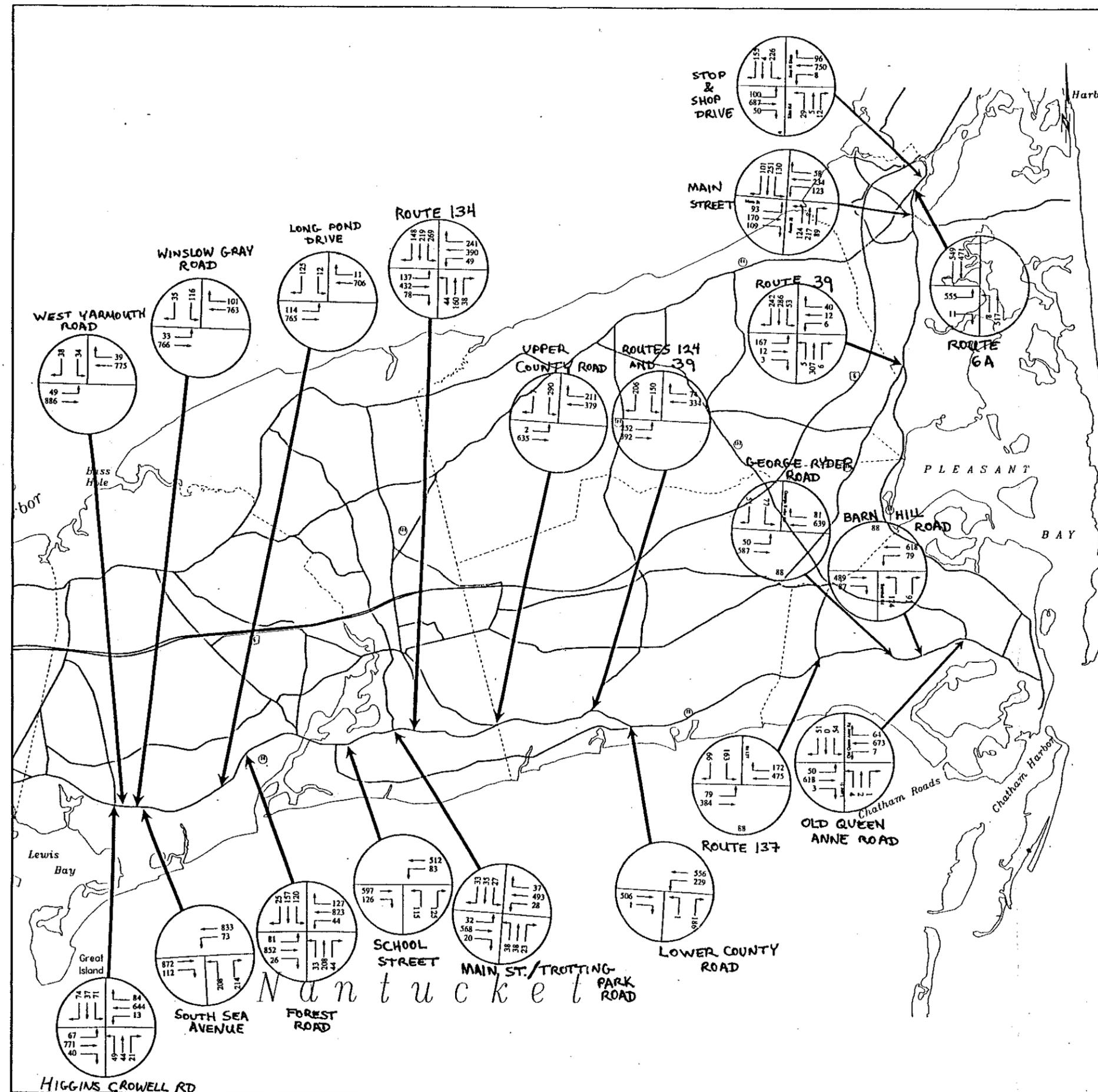
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I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

Figure 2.3 - Seasonal P.M. Peak Hour Volumes

CAPE COD REGIONAL TRANSPORTATION
CLASSIFICATION MAP

Yarmouth, Dennis, Brewster, Harwich, Chatham, and Orleans

Figure 2.4
Seasonal P.M. Peak Hour
Turning Movements



DATA SOURCES AND OTHER INFORMATION
 Road Classification System: CCC transportation department staff, (1991) (See Regional Policy Plan for Details)
 Public Bus Routes: Peter Pan, Buzzards, Plymouth and Bracton, and Regional Transit Authority bus schedules, (1990)
 Railroads: MassGIS, 1:100,000, 1988
 Airports: MacConnell Land use data (1990)
 Shoreline, ponds, coastline, major roads, town boundaries: MassGIS, 1:100,000, 1988
 Features not provided in digital form were digitized by Cape Cod Commission GIS staff, 1990.
 MacConnell land use is from June 1990 aerial photo interpretation as digitized by the Resource Mapping - Land Information Systems, Department of Forestry and Wildlife Management, University of Massachusetts, Amherst in cooperation with LOEA MassGIS Project.



This map was produced by the Cape Cod Commission's Geographic Information System department and Traffic Department for the Regional Policy Plan. The map is illustrative and all depicted boundaries are approximate. It is not intended to be used for survey or legal purposes.

Precise boundaries and designations should be further refined through towns' Local Comprehensive Plans.
Map created Nov. 11, 1991

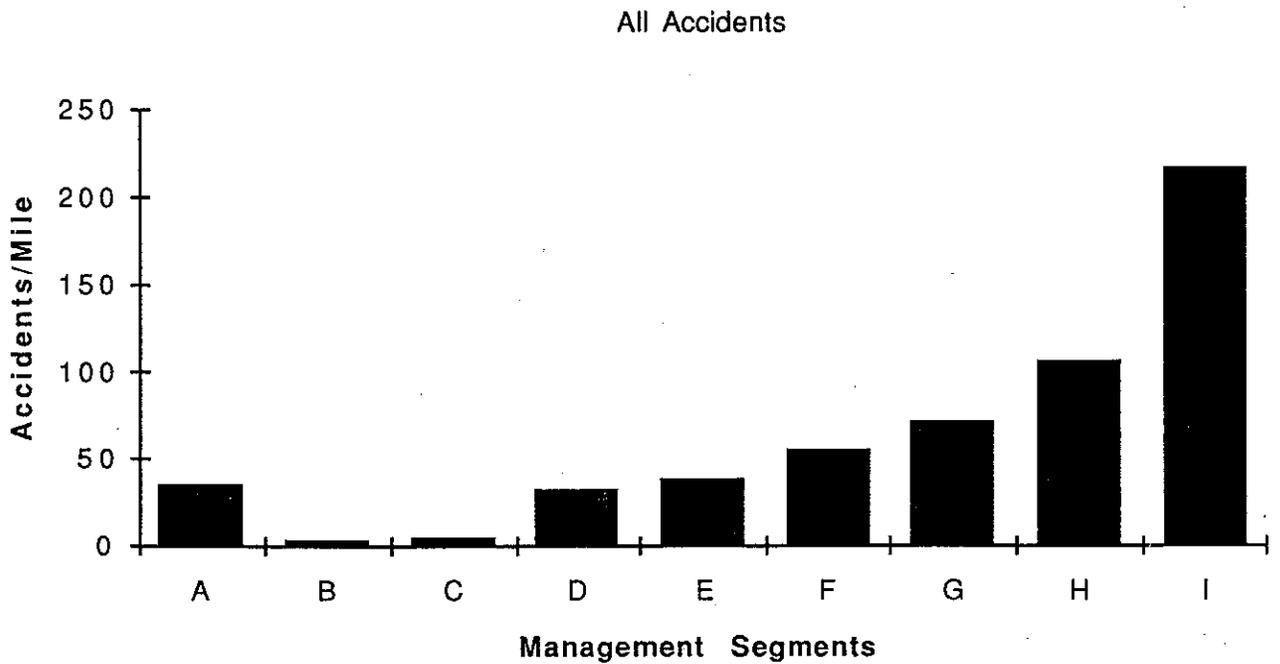
SAFETY OVERVIEW

Accident data for the entire study area section of Route 28 were provided by MHD for the years 1988, 1989, and 1990. For this draft of the existing conditions report a full safety analysis will not be presented. However, our analysis has yielded the following findings:

A total of 1232 accidents occurred during the study period on Route 28, of which 483 were recorded in sufficient detail to ascertain their location. Of these 483, 282 were Property Damage Only Accidents, 199 were Injury Accidents, and 2 accidents included Fatalities. It was assumed in the analysis that the 749 un-locatable accidents occurred in a distribution consistent with the severity and general location of the 482 locatable accidents. Therefore, the values presented in the results are factored to account for all 1232 accidents, not just the 483 with identifiable locations.

Figure 2.5 shows the overall density of accidents along the corridor by management segment. Notice that the general trend begins with a moderate amount for the segment from the rotary to Route 6A, drops severely in the lesser travelled and developed portions of Orleans and Chatham, then increases dramatically through the segments approaching Hyannis. This relationship is shown in another way in Figure 2.6 by accident severity.

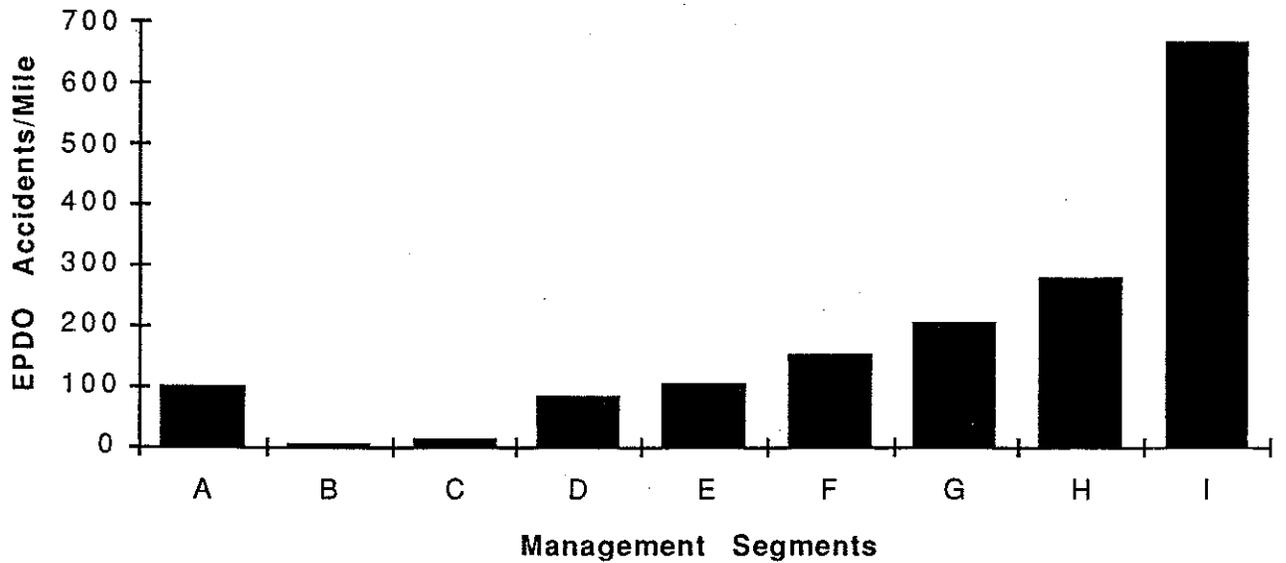
The accident severity method used in this study is called the Equivalent Property Damage Only (EPDO) method. This method requires assigning a numerical value for the type and degree of severity. Consistent with the state of Massachusetts' methodology, accidents involving a fatality are given 10, accidents involving personal injury are given a 5, and accidents involving property damage only are given a 1. The total EPDO is then calculated for each segment. The relationships of the segments' may be more dramatic in Figure 2.6 than in Figure 2.5, since the more severe accidents have a greater effect on the results.



Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
C	Eldredge Park Way/Tonsett Rd [1.25] to Chatham Rotary	8.55
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G	Route 134 [20.25] to N. Main/Main Streets (Yarmouth)	2.00
H	N. Main/Main Streets (Yarmouth) [22.25] to Town Brook Rd	4.50
I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

Figure 2.5 - Accidents Per Mile by Management Segment

Accident Severity



Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
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D	Chatham Rotary [9.80] to Chatham Road	4.60
E	Chatham Road [14.40] to Routes 124 & 39	2.70
F	Routes 124 & 39 [17.10] to Route 134	3.15
G	Route 134 [20.25] to N. Main/Main Streets (Yarmouth)	2.00
H	N. Main/Main Streets (Yarmouth) [22.25] to Town Brook Rd	4.50
I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

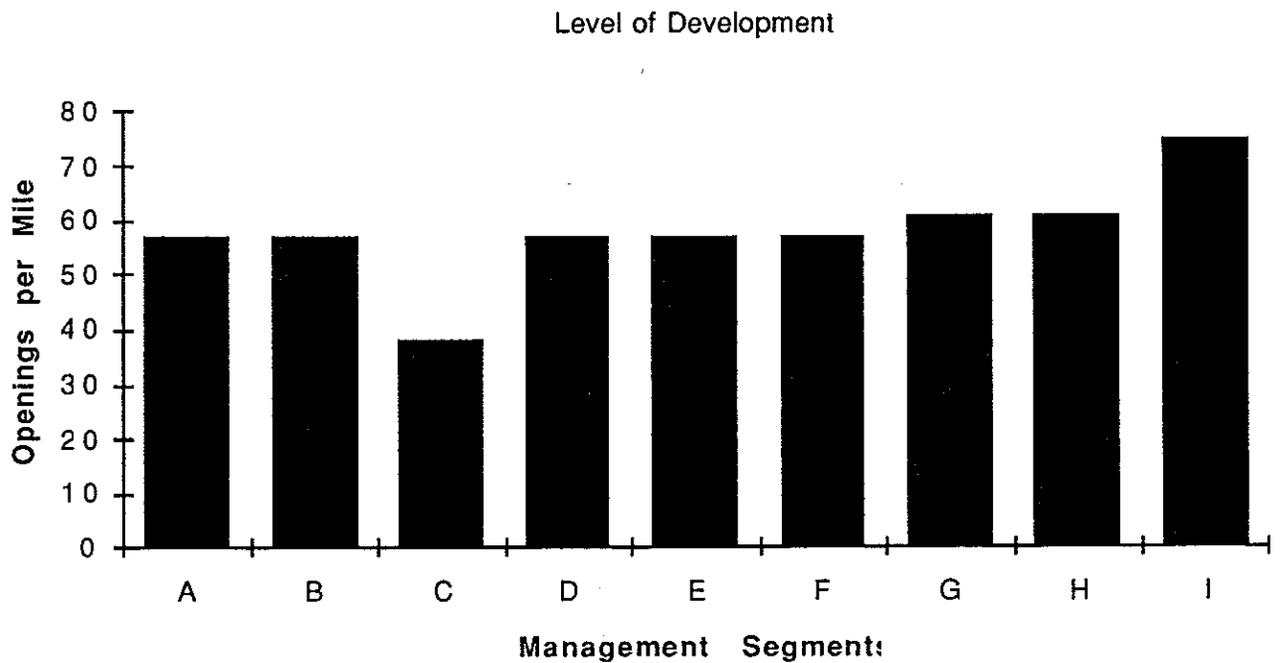
Figure 2.6 - Accident Severity by Management Segment

LAND USE & LEVEL OF DEVELOPMENT

Characteristics such as mileage, the number of intersecting street openings (a street crossing the route is counted as having two openings), and the number of private (including commercial as well as residential) driveways, for each segment are tallied to determine the total number of openings, the density of openings per mile, and the "Level of Development" (L.O.D.). The category L.O.D. is made in reference to Access Management for Streets and Highways published by the Federal Highway Administration in 1982.

Route 28 is generally a two lane highway in the study area. Land use varies along the route. Typical land uses are: rural, residential and commercial. Commercial activity ranges from historic "Main Street" to "tourist-oriented" strip development. Curb cut densities (including street) in the most developed segments range from 61 to 75 openings per mile. Density in the least developed segment of Route 28 is about 38 openings per mile. The remaining segments have densities of about 57 openings per mile. These densities are presented in Figure 2.7.

Although each access point is a means of convenience for local travel, these are a source of conflict for through travel. L.O.D. can be a key indicator of the safety deficiencies of these segments and can be referred to when examining the concentrations of accidents in the following chapter. The hazards of unchecked curb cut growth are magnified by inadequate spacing: on the average, the construction of each new curb cut decreases by half the existing spacing for that roadway segment.



Management Section	Intersection to Intersection	Segment Length (miles)
A	Eastham/Orleans Rotary [0.00] to Route 6A	0.50
B	Route 6A [0.50] to Eldredge Park Way/Tonsett Rd	0.75
C	Eldredge Park Way/Tonsett Rd [1.25] to Chatham Rotary	8.55
D	Chatham Rotary [9.80] to Chatham Road	4.60
E	Chatham Road [14.40] to Routes 124 & 39	2.70
F	Routes 124 & 39 [17.10] to Route 134	3.15
G	Route 134 [20.25] to N. Main/Main Streets (Yarmouth)	2.00
H	N. Main/Main Streets (Yarmouth) [22.25] to Town Brook Rd	4.50
I	Town Brook Rd [26.75] to Yarmouth/Barn. town line [27.30]	0.55

Figure 2.7 - Level of Development

CAPACITY ANALYSIS

Results of capacity analysis for selected Route 28 links and intersections are presented in Table 2.1. The results for the segments are consistent with the other factors mentioned above. The first segment with its relatively high volume has a low level of service, but not so low as the segments from Chatham center through Yarmouth. This is due to the additional capacity available by the 4-lane cross-section from the Rotary to Route 6A. The rural segments from Orleans to Chatham experience comparatively better volume/capacity and levels of service. The selected intersections' capacity analyses may or may not be representative of their segments as a whole; the reader should consult the full listing in the appendix. A different summary of the capacity analyses is presented in Figure 2.8. Most intersections referred to in Figure 2.4 now are shown with the existing P.M. Peak Hour Peak Season level of service for each. The diagrams for the unsignalized locations indicate the critical maneuvers and reserve capacity upon which the level of service is based. Information for signalized locations includes the average vehicular delay and the level of service.

TABLE 2.1 - Route 28 Capacity Analyses

P.M Peak Hour Existing Summer Conditions

	MANAGEMENT SEGMENTS								
	A	B	C	D	E	F	G	H	I
SELECTED LINK ANALYSES									
Downbound Volumes	903	429	282	673	597	718	779	673	792
Upbound Volumes	875	487	318	744	746	571	685	749	747
Two-Way Volumes	1778	916	600	1417	1343	1288	1464	1420	1539
V/C	0.69	0.50	0.33	0.70	0.68	0.66	0.71	0.71	0.73
LOS*	D	D	D	E	E	E	E	E	E

SELECTED INTERSECTION ANALYSES

Reserve Capacity of Critical Manuever	0	n/a	-24	-51	352	n/a	-16	n/a	-158
Average Delay	n/a	21.02	n/a	n/a	n/a	118.57	n/a	9.06	n/a
LOS**	E	C	F	F	B	F	F	B	F

* Note: LOS based on service level flow rates.

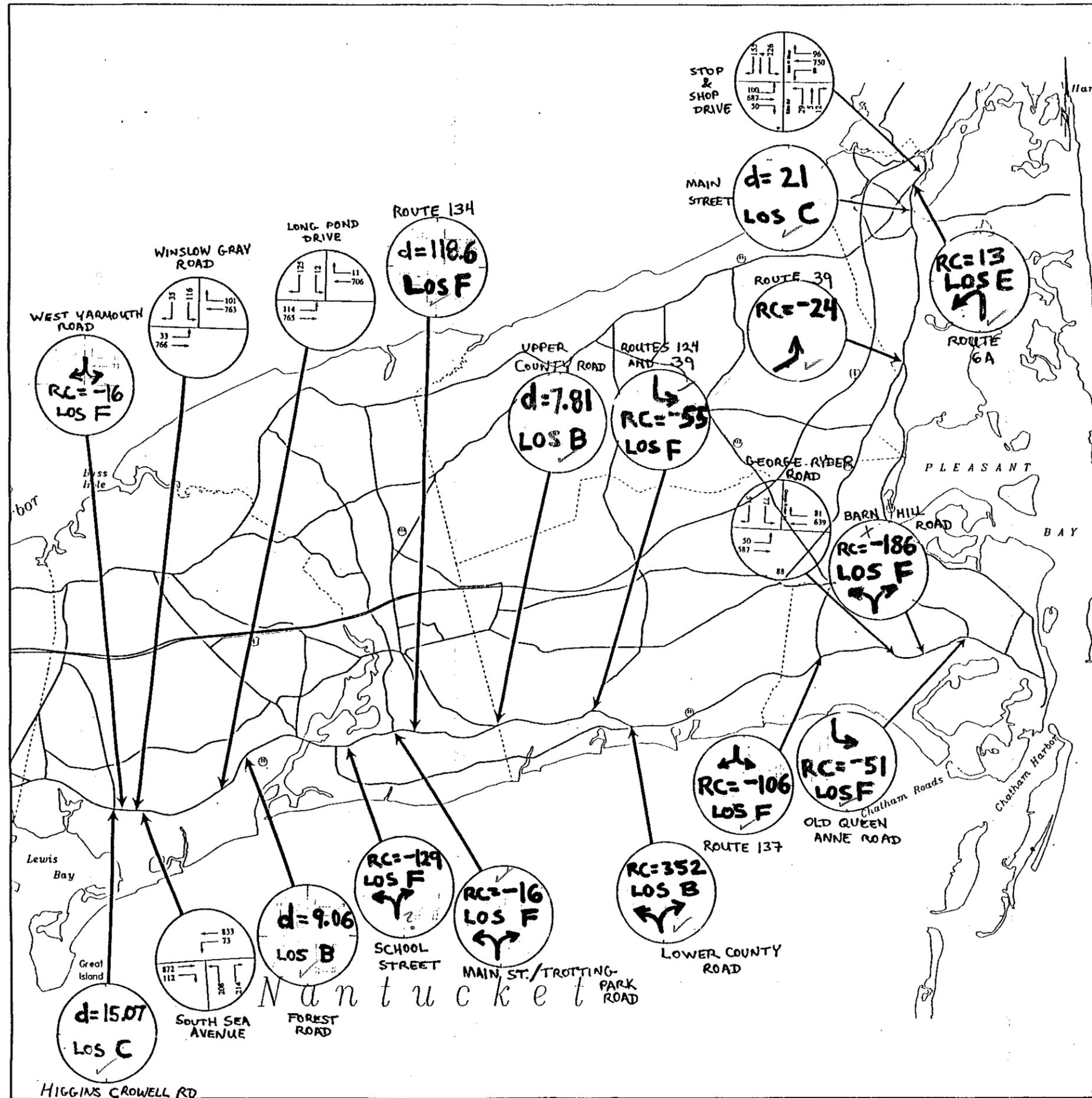
**Note: LOS based on average seconds of delay for signalized locations or reserve capacity of critical manuever for unsignalized intersections.

Segment	Selected Representative Link	Selected Representative Intersection
A	Eastham/Orleans Rotary to Canal St	Route 6A
B	Main St to Eldredge Pkwy	Main Street (Orleans)
C	Route 39 to Pleasant Bay Rd (Orleans-Harwich t.l.)	Route 39 (Orleans)
D	Queen Anne Rd to Old Queen Anne Rd	Old Queen Anne Rd (north leg)
E	Bank St to Lower County Rd	Lower County Road
F	Depot St (east) to Upper County Rd (Har.-Dennis t.l.)	Route 134
G	School St to N. Main St (Dennis-Yarmouth t.l.)	Main St (Dennis)/Trotting Pk
H	Forest Rd to Main St (S. Yarmouth)	Forest Road
I	E. Main St (Hyannis) to Yarmouth Rd (Yarmouth-Barnstable t.l.)	Camp Street

CAPE COD REGIONAL TRANSPORTATION
CLASSIFICATION MAP

Yarmouth, Dennis, Brewster, Harwich, Chatham, and Orleans

Figure 2.8
Peak Season Intersection Levels of Service



DATA SOURCES AND OTHER INFORMATION
 Road Classification System: CCC Transportation Department staff, (1991) (See Regional Policy Plan for Details)
 Public Bus Routes: Polar Bus, Bonanza, Plymouth and Brockton, and Regional Transit Authority bus schedules, (1990)
 Railroads: MassGIS, 1:100,000, 1988
 Airports: MacConnell Land use data (1990)
 Shoreline, ponds, coastline, major roads, town boundaries: MassGIS, 1:100,000, 1988
 Features not provided in digital form were digitized by Cape Cod Commission GIS staff, 1990.
 MacConnell land use is from June 1988 aerial photo interpretation as digitized by the Resource Mapping - Land Information System, Department of Forestry and Wildlife Management, University of Massachusetts, Amherst in cooperation with LOEA MassGIS Project.



This map was produced by the Cape Cod Commission's Geographic Information System department and Traffic Department for the Regional Policy Plan. The map is illustrative and all depicted boundaries are approximate. It is not intended to be used for survey or legal purposes.

Precise boundaries and designations should be further refined through towns' Local Comprehensive Plans. Map created Nov. 11, 1991

CONCLUSION

The Route 28 Corridor through this section of Cape Cod is characterized by a variety of problems and opportunities. In the Future Conditions Report to be submitted in May 1992, alternatives will be developed through a series of meetings with public officials from each of the study area towns. Forecasts of the impact future land use activities on travel demand will be evaluated against alternatives regarding the three elements of traffic impacts - the supply: roadway improvements and new roadway construction; demand: the type, intensity and quantity of development generating traffic; and travel demand management: the timing and efficiency of traffic using the network (through flextime, car-pooling, etc.).

Presentation of information in the Final Draft Report to be submitted at the end of August 1992, will include a higher level of detail base on the management section methodology introduced in this report. For each management section information will be provided including current and projected volumes and capacity analyses. Safety analyses will also be further detailed.

APPENDICES

To conserve resources, worksheets are not included in this draft of the report. Worksheets are available upon request from the Commission staff.