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Route 137 & Route 39 CH-2 Zone Planning Study

Prepared for

Planning Board
Town of Harwich, Massachusetts

Prepared by

The Cape Cod Commission

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Executive Summary

Introduction

The Town of Harwich has requested the Cape Cod Commission evaluate the potential traffic impacts associated with future development of the commercially zoned land surrounding the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection in Harwich, MA. This commercial land is formally referred to as the CH - 2 Zone and is comprised of four land quadrants surrounding the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection.

This transportation study involved assistance from Michael Pessolano, the Town Planner and the Town's Planning Board. The process included field reconnaissance, reviewing historical traffic data and information provided by the Town Planner. Commission staff has evaluated the existing traffic conditions (both average and summer conditions) and potential traffic impacts and access associated with the development of land located with the CH - 2 Zone based on two land use scenarios. The first scenario (Scenario 1) evaluates the cumulative traffic impacts from each undeveloped parcel. The second scenario (Scenario 2) evaluates traffic impacts based on a combination of parcels to form large developable lots. Future traffic impacts were assessed and recommendations are submitted for review as part of this draft report for the CH - 2 Zone.

Project Description & Study Area

The CH - 2 Zone is a commercially zoned area of land located in East Harwich (see Figure 2). This commercial land is comprised of 28 buildable lots on approximately 105.7 acres of land surrounding the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection.

The existing commercial development in the CH - 2 Zone consists of 213,617 square feet of building space constructed on fifteen of the twenty-eight building lots. The existing land uses located in the CH - 2 Zone include a fire station, a rehabilitation center, a post office, a movie theater, a horse stable and a paint and supply store in Quadrant 1, a supermarket, a bank and several retail stores in Quadrant 2, a gas station and a retail plaza in Quadrant 3 and an automobile dealership, a vacant office building and the lumberyard in Quadrant 4.

The potential building development within the CH - 2 Zone was based on worksheets provided by the Town Planner relative to the development that could either be added to an existing building or the size building that could be built on a respective piece of land. Under local zoning regulations, the CH -2 Zone has the potential to accommodate an additional 516,404 sq. ft of gross building area. Undeveloped or underdeveloped land within the CH -2 Zone include:

Quadrant	Undeveloped or Underdeveloped Land
Quadrant 1	157, 468 sq. ft
Quadrant 2	164, 692 sq. ft
Quadrant 3	125,872 sq. ft
Quadrant 4	237,550 sq. ft

If the CH - 2 Zone were fully developed, this would result in a total of 730,021 sq. ft of gross floor area on 105.7 acres.

Existing Roadway Conditions

The CH - 2 Zone is traversed by Brewster-Chatham Road (Route 137) in a north/south direction and Orleans-Harwich Road (Orleans-Harwich Road (Route 39)) in an east/ west direction. Brewster-Chatham Road is a two-lane roadway approximately 24 feet wide with no paved shoulders. Brewster-Chatham Road does widen to four lanes at the intersection with Orleans-Harwich Road. Orleans-Harwich Road is also a 24 feet wide two-lane roadway that widens to four lanes at the intersection with Brewster-Chatham Road. Brewster-Chatham Road intersects Orleans-Harwich Road to form a four-legged signalized intersection.

In order to analysis existing traffic conditions at the intersection of Brewster-Chatham Road / Orleans-Harwich Road, traffic counts were conducted to supplement the traffic data from the "Cape Cod Commission Turning Movement Count Data 1988-1996". Figure 3 displays the afternoon peak hour counts for both the average and peak season at the Brewster-Chatham Road/ Orleans-Harwich Road intersection.

Based on existing traffic data, Commission staff has evaluated the existing traffic conditions at the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection for both the average annual traffic condition and the peak season traffic condition. The analysis indicated that the intersection operated satisfactory (LOS B) during the off peak months but failed (LOS F) during the peak season.

Build Condition

In order to assess the potential traffic impacts for the CH - 2 Zone, existing traffic volumes were projected to a future "Build" year. The year 2010 was chosen as the "Build" year for analysis proposes. The existing traffic volumes were increased to account for anticipated future traffic growth unrelated to the CH - 2 Zone and then the anticipated CH - 2 Zone traffic was superimposed upon the existing condition for both Scenario 1 and Scenario 2.

Scenario 1 consisted of analyzing each lot as if it were developed independently. This development scenario consisted of 516,404 square feet of gross floor area being developed on 23 different parcels. Scenario 2 consisted of combining some of the larger parcels to simulate large-scale development. Scenario 2 combines lots B15, B16 and B17 in Quadrant 1 to form lot C1, lots A1 and B1 in Quadrant 2 to form lot C2, lots B4 and B5 in Quadrant 3 to form lot C3. The remaining seven vacant lots

in Quadrant 4 were combined into two larger lots. Lots B6, B7, B8 and B9 were combined to form lot C4 and lots B12, B13 and B14 were combined to form lot C5 in Quadrant 4.

To determine the impact that the additional traffic would have on the local roadway system, it was necessary to estimate access points associated with each parcel and the trip distribution through the CH - 2 Zone (see Figures 6 and 10). The trip distribution was determined based on the existing traffic patterns through the area. It has been assumed that the distribution of CH - 2 Zone traffic through the Brewster-Chatham Road / Orleans-Harwich Road will be similar to the existing distribution of traffic using the intersection.

The Town of Harwich Planning Department has estimated the potential land available for commercial development in the CH - 2 Zone under Full Build conditions. In order to estimate vehicle trips associated with these developments, assumptions as to the types of commercial developments were made. It was assumed that the commercial development would be comprised of 30 percent office/ service space and 70 percent retail space. Using these growth assumptions, trip generation estimates were determined for both the Scenario 1 and Scenario 2.

Based on Institute of Transportation Engineers land use categories, average trip rates for both development scenarios were determined. These average trip generations rates were then applied to the two development scenarios to determine new potential traffic volumes for both Scenario 1 and Scenario 2. As shown in the Trip Generation Tables Scenario 1 has a higher Average Daily Traffic (ADT) and higher Peak Hour traffic volumes than Scenario 2. This is a result of the higher average trip generation rate for the more intensive Lot-by Lot development scenario (Scenario 1). As a precautionary measure, new potential traffic volumes were reduced by 20 percent to offset the fact that some of the retail development may not be built by the design year.

In addition to the trips associated with the projected CH - 2 Zone development, a background growth rate of two percent annually was assumed. This growth is associated with the normal increase in traffic expected over a period and would account for some growth in adjacent communities. For analysis purposes, background traffic was projected to the year 2010. The background growth and the trips associated with Ch -2 growth was added to the existing base network. Figures 11 and 12 display the estimated afternoon peak hour traffic volumes for both Scenario 1 and Scenario 2. Figures 13 and 14 display the average annual conditions as well as the peak season condition for both Scenario 1 and Scenario 2 at the Brewster-Chatham Road / Orleans-Harwich Road intersection.

Commission staff evaluated the potential traffic impacts on the major driveways along Brewster-Chatham Road and Orleans-Harwich Road. The majority of these driveways would operate at an undesirable level of service for both Scenario 1 and Scenario 2.

Commission staff evaluated potential traffic impacts on the Brewster-Chatham Road / Orleans-Harwich Road intersection associated with the development of land located within the CH - 2 Zone in Harwich, MA. Based on our calculations the Brewster-Chatham Road / Orleans-Harwich Road intersection would operate at an unsatisfactory level (LOS F) for both the average and peak season condition under

Scenario 1 or Scenario 2. Based on our traffic projections for Scenario 2, six (6) additional turning lanes would be required for the intersection to perform at a satisfactory level for the average annual traffic condition. For the intersection to perform at a satisfactory level under Scenario 2 during the peak season nine (9) additional turning lanes would be required. Under Scenario 1, ten (10) additional turning lanes would be required for the intersection to operate at a satisfactory level for both the average and summer traffic conditions. Adding the number of lanes needed to meet future peak season demands is neither practical from a right-of-way perspective, nor desirable from a community character perspective.

Alternatives

Commercial Development of the CH - 2 Zone has the potential to severely impact traffic conditions at the Brewster-Chatham Road / Orleans-Harwich Road intersection and access locations along each roadway. Several alternatives to improve the operations at the Brewster-Chatham Road/ Orleans-Harwich Road intersection are listed below. These alternatives were derived in conjunction with the Harwich Town Planner, the Harwich Planning Board and Cape Cod Commission staff.

1. Purchase CH-2 Zone land as open space to limit future development.
2. Widen the Brewster-Chatham Road/ Orleans-Harwich Road intersection.
3. Replace the Brewster-Chatham Road/ Orleans-Harwich Road intersection with a modern roundabout.
4. Construct new roadways within the study area.
5. Access consolidation and access management.
6. Enhance pedestrian accommodations within the CH-2 Zone.
7. Nothing.

Recommendation

Based on the analysis in this report, considerable traffic impacts will accompany the commercial build-out of the CH-2 Zone. The associated traffic impacts could be substantially reduced by purchasing commercial land within the CH-2 zone. Land purchases restricted as open space would limit traffic increases in this area. If land purchases can not be made, a modern roundabout should be considered at the intersection of Route 137 and Route 39. A modern roundabout would have the ability to handle existing traffic volumes as well as future traffic volumes if the CH-2 Zone becomes fully developed. As an interim solution, minor improvements to the Route 137 and Route 39 intersection could be constructed to improve safety as well as capacity at the intersection.

Introduction

The Town of Harwich has requested the Cape Cod Commission evaluate the potential traffic impacts associated with future development of the commercially zoned land surrounding the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection in Harwich, MA, as shown in Figure 1. This commercial land is formally referred to as the CH - 2 Zone and is comprised of four land Quadrants surrounding the Route 137/Route 39 intersection, located in East Harwich (see Figure 2). The commercial land is comprised of 28 buildable lots on approximately 105.7 acres of land.

This transportation study involved cooperation with Michael Pessolano, the Town Planner and the Town's Planning Board. The process included field reconnaissance, reviewing historical traffic data and information provided by the Town Planner. Commission staff has evaluated the existing traffic conditions (both average and summer conditions) and potential traffic impacts and access associated with the development of land located with the CH - 2 Zone based on two land use Scenarios. The first Scenario (Scenario 1) evaluates the cumulative traffic impacts from each undeveloped parcel. The second Scenario (Scenario 2) evaluates traffic impacts based on a combination of parcels to form large developable lots. Future traffic impacts were assessed and recommendations are submitted for review as part of this draft report for the CH - 2 Zone.

Existing Conditions

The existing commercial development in the CH - 2 Zone consists of 213,617 square feet of building space constructed on fifteen of the twenty-eight building lots. The existing land uses located in the CH - 2 Zone include a fire station, a rehabilitation center, a post office, a movie theater, a horse stable and a paint and supply store in Quadrant 1, a supermarket, a bank and several retail stores in Quadrant 2, a gas station and a retail Plaza in Quadrant 3 and an automobile dealership, a vacant office building and a lumberyard in Quadrant 4.

Roadway and Intersection Descriptions

The CH - 2 Zone is traversed by Brewster-Chatham Road (Route 137) in a north/south direction and Orleans-Harwich Road (Route 39) in an east/ west direction. Brewster-Chatham Road is a two-lane roadway approximately 24 feet wide with no paved shoulders. Brewster-Chatham Road does widen to four lanes at the intersection with Orleans-Harwich Road. Orleans-Harwich Road is also a 24 feet wide two-lane roadway that widens to four lanes at the intersection with Brewster-Chatham Road. Brewster-Chatham Road intersects Orleans-Harwich Road to form a four-legged

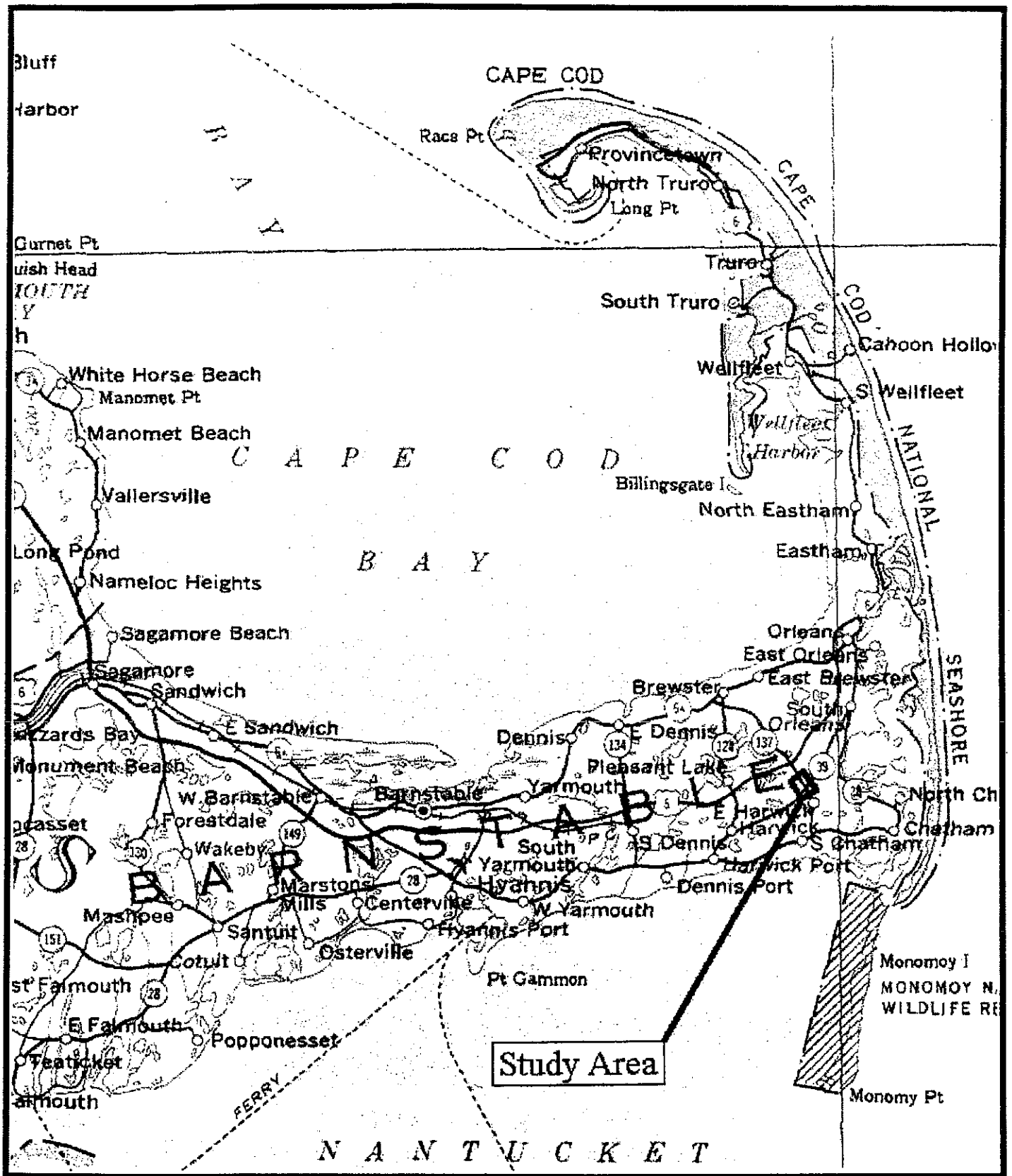

FIGURE 1
LOCUS MAP
HARWICH, MA

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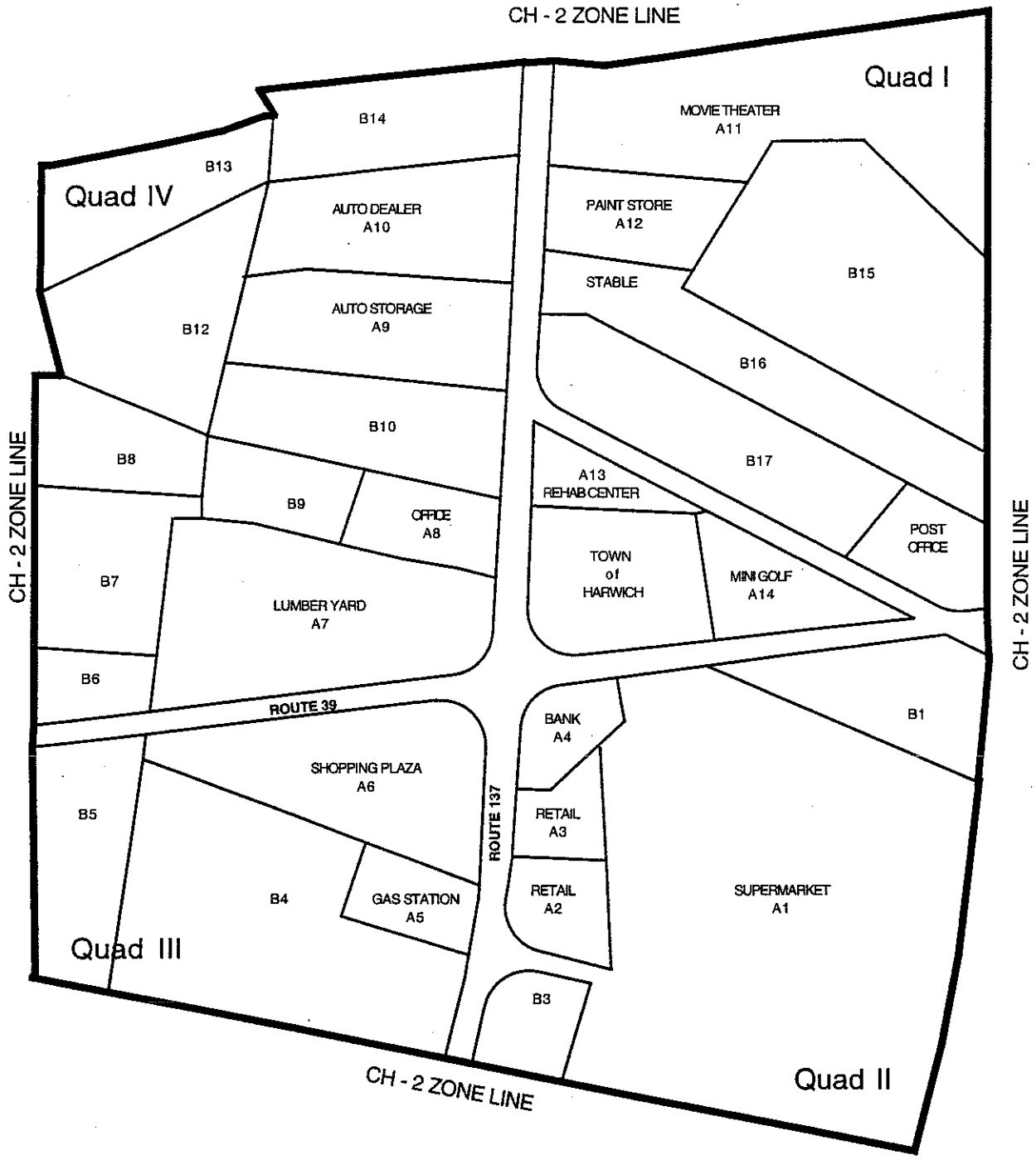

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FIGURE 2
CH - 2 ZONING MAP
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signalized intersection. A new roadway is under construction in the northeast quadrant of the CH-2 Zone. This new roadway will intersect Route 137 north of the rehabilitation center and will connect to Route 39 just west of the existing East Harwich Post Office. Only one sidewalk exists at the Brewster-Chatham Road/Harwich-Orleans Road Intersection. Quadrant II has a meandering sidewalk in front of the retail stores extending from the Route 39 supermarket driveway to the Route 137 supermarket driveway. The existing signalized intersection is not equipped for protected pedestrian crossings.

Observed Traffic Volumes

Daily and peak hour traffic volume data from the "Cape Cod Commission Turning Movement Count Data 1988-1996" and the "Cape Cod Traffic Counting Report 1997" for the CH-2 area were summarized for both the average and summer conditions. Traffic counts were conducted to supplement the traffic data from the "Cape Cod Commission Turning Movement Count Data 1988-1996" at the intersection of Brewster-Chatham Road/ Orleans-Harwich Road (appendix A[1]). Figure 3 displays the afternoon peak hour counts and daily traffic for both the average and peak season at the Brewster-Chatham Road/ Orleans-Harwich Road intersection.

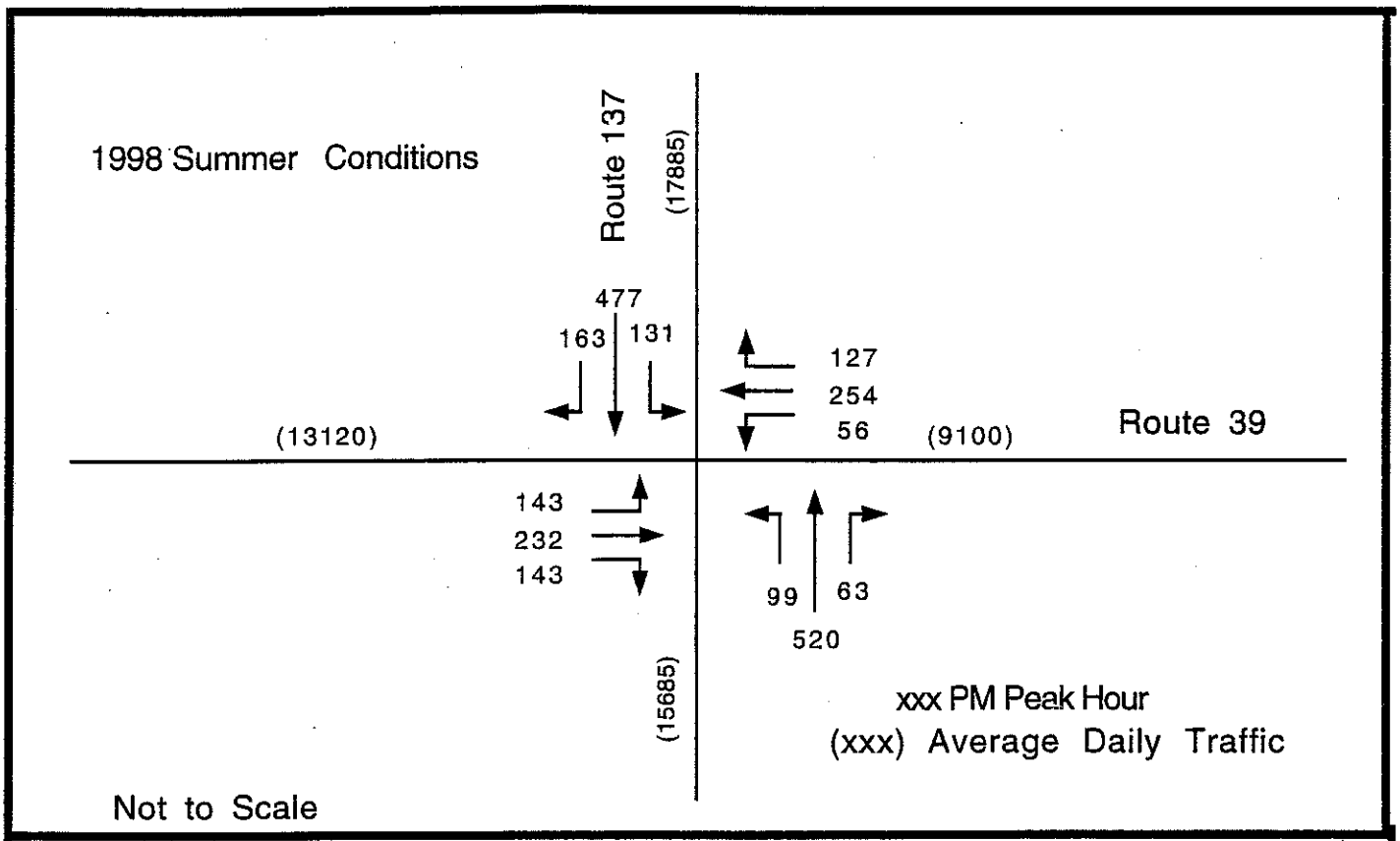
Existing Accident Records

Traffic accident data from the Cape Cod Commission Capewide Accident Record Information System (CARIS) compiled from the Massachusetts Highway Department was reviewed for a three-year period (1994 to 1996) for the Brewster-Chatham/Orleans-Harwich intersection (appendix B[1]). This data is summarized in the Table below. As can be seen from the accident data, 20 accidents occurred over the three year period with the highest number of accidents in the left turn and angle accidents categories.

Table 1 - ACCIDENT SUMMARY

Type of Accident	Approach				
	EB	WB	SB	NB	Total
Rear End		1	1		2
Left turn	1		3	1	5
Straight		1			1
Right turn					0
Sideswipe	1	1		1	3
Fixed Object		1			1
Pedestrian or Bike					0
Right angle 2	2		1	1	6
Other	2				2
Total					20

[1] Available upon request.



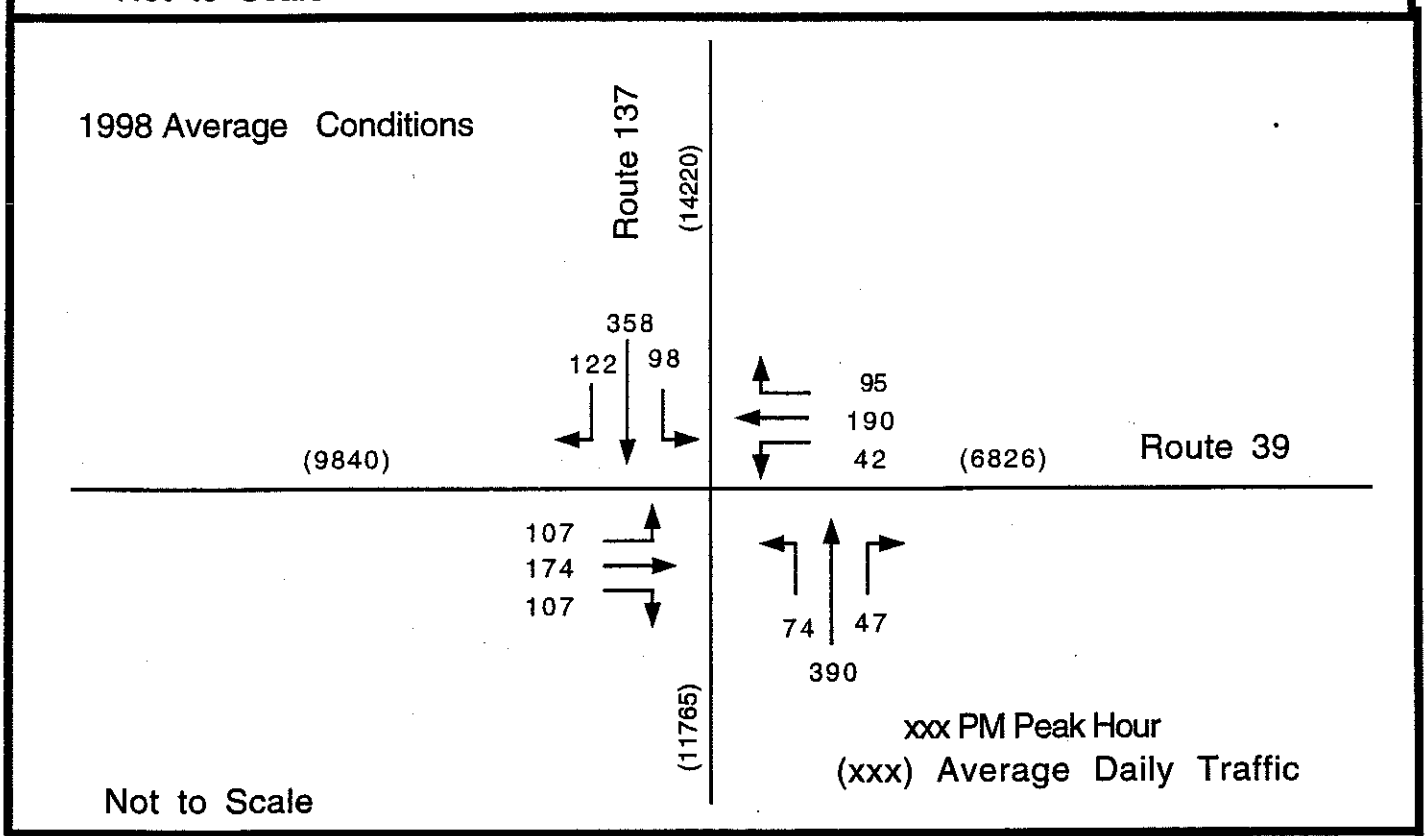


FIGURE 3
EXISTING CONDITIONS
ROUTE 137/ROUTE 39
HARWICH, MA

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As can be seen in the table above, three of the five left turn accidents occurred from the southbound approach. The left turn accidents may be corrected by the introduction of left turn arrows and protected movements at the traffic signals. Right angle accidents are often indicative of inadequate visibility at the traffic signal. Overhead traffic signals could correct this problem.

Build Condition

Methodology

The potential building development within the CH - 2 Zone was based on data provided by the Town Planner relative to the development that could either be added to an existing building or the size building that could be built on a respective piece of land. Under local zoning regulations, the CH -2 Zone has the potential to accommodate an additional 516,404 sq. ft of gross building area. Undeveloped or underdeveloped land within the CH -2 Zone consists of 157, 468 sq. ft in Quadrant 1, 164, 692 sq. ft in Quadrant 2, 125,872 sq. ft in Quadrant 3 and 237,550 sq. ft in Quadrant 4. If the CH - 2 Zone were fully developed, this would result in a total of 730,021 sq. ft of gross floor area on 105.7 acres.

Scenario 1 consisted of analyzing each lot as if it were development independently. This development Scenario consisted of 516,404 square feet of gross floor area being developed on 23 different parcels as shown in Table 2. Scenario 2 consisted of combining some of the larger parcel to simulate large-scale development as shown in Table 3. Scenario 2 combines lots B15, B16 and B17 in Quadrant 1 to form lot C1, lots A1 and B1 in Quadrant 2 to form lot C2, lots B4 and B5 in Quadrant 3 to form lot C3. The remaining seven vacant lots in Quadrant 4 were combined into two larger lots. Lots B6, B7, B8 and B9 were combined to form lot C4 and lots B12, B13 and B14 were combined to form lot C5 in Quadrant 4.

Potential Traffic

The Town of Harwich Planning Department has estimated the potential land available for commercial development in the CH - 2 Zone under Full Build conditions. In order to estimate vehicle trips associated with these developments, assumptions as to the types of commercial developments were made. It was assumed that the commercial development would be comprised of 30 percent office/ service space and 70 percent retail space. Using these growth assumptions, trip generation estimates were determined for both Scenario 1 and Scenario 2.

TABLE 2

POTENTIAL FLOOR AREA - SCENARIO 1 (LOT BY LOT)

QUAD NO.	ID NO.	LAND [1]	Ex. FLOOR [2]	POTENTIAL Add. FLOOR [2]	POTENTIAL Tot. FLOOR [2]
I	A11	8.25	19,157	-	19,157
I	A12	1.94	16,400	-	16,400
I	A13	1.15	5,000	-	5,000
I	A14	1.94	432	13,218	13,650
I	B15	6.3	3,000	44,750	47,750
I	B16	3.9	-	27,600	27,600
I	B17	5.77	450	71,900	72,350
TOTAL		29.25	44,439	157,468	201,907
II	A1	18.12	61,992	48,000	109,992
II	A2	1.26	7,500	1,300	8,800
II	A3	1.15	7,500	500	8,000
II	A4	1.46	2,600	7,600	10,200
II	B1	2.55	-	18,000	18,000
II	B3	1.39	-	9,700	154,992
TOTAL			79,592	85,100	164,692
III	A5	1.15	2,214	5,786	8,000
III	A6	4.58	40,872	-	40,872
III	B4	7.41	-	52,700	52,700
III	B5	3.43	-	24,300	24,300
TOTAL		16.57	43,086	82,786	125,872
IV	A7	6.9	25,600	23,400	49,000
IV	A8	1.48	1,600	8,700	10,300
IV	A9	3.4	-	24,050	24,050
IV	A10	2.5	19,300	-	19,300
IV	B6&7	3.58	-	25,150	25,150
IV	B8	1.68	-	11,800	11,800
IV	B9	1.13	-	7,850	7,850
IV	B10	3.58	-	25,300	25,300
IV	B12	3.77	-	26,700	26,700
IV	B13	2.9	-	20,500	20,500
IV	B14	2.5	-	17,600	17,600
TOTAL		33.42	46,500	191,050	237,550
GRAND TOTAL		105.17	213,617	516,404	730,021

[1] Area expressed in acres.
[2]Existing, potential and total floor area expressed in square feet.

TABLE 3

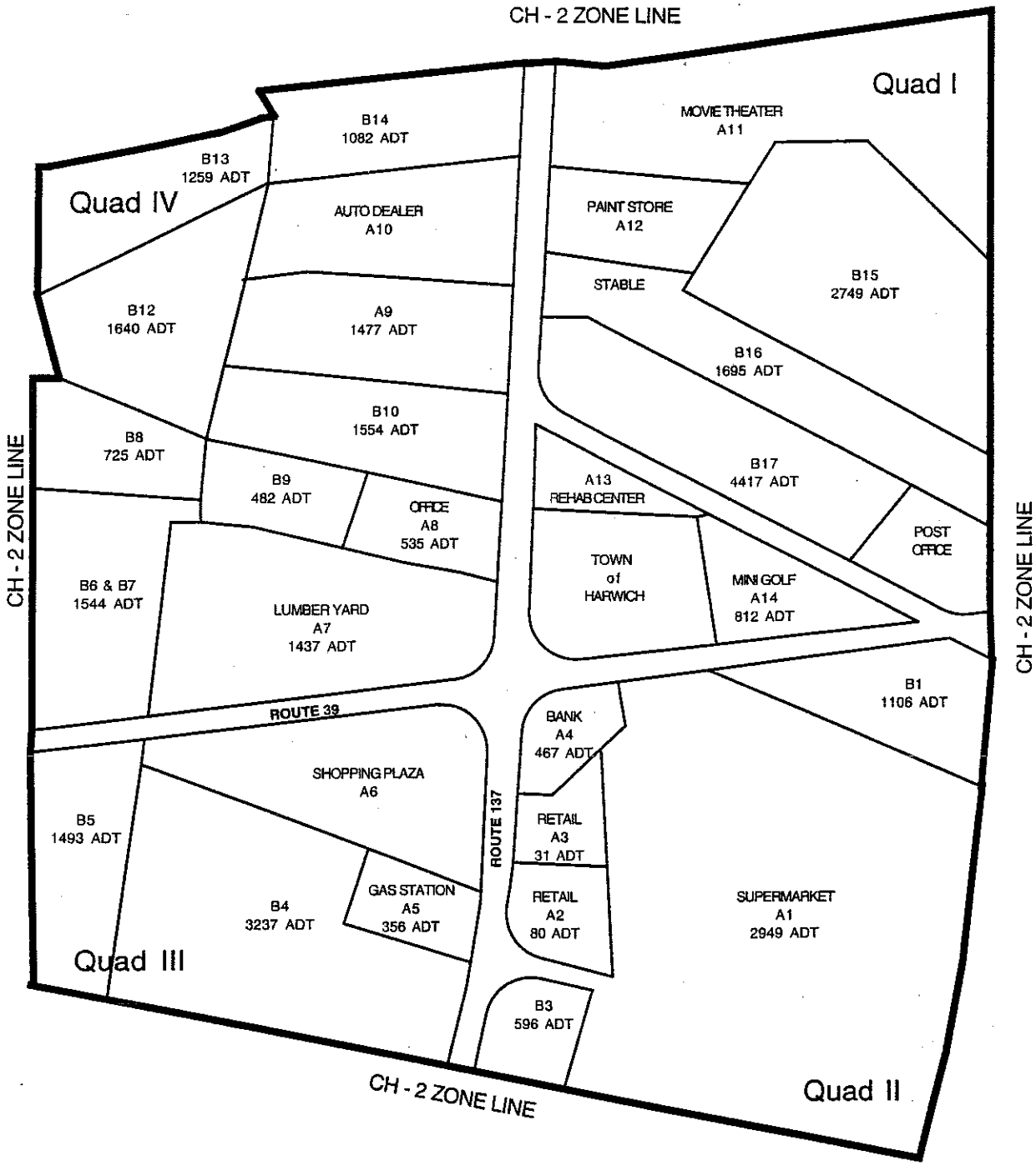
POTENTIAL FLOOR AREA - SCENARIO 2 (MERGED LOT)

QUAD NO.	ID NO.	LAND [1]	Ex. FLOOR [2]	POTENTIAL Add. FLOOR [2]	POTENTIAL Tot. FLOOR [2]
I	A11	8.25	19,157	-	19,157
I	A12	1.94	16,400	-	16,400
I	A13	1.15	5,000	-	5,000
I	A14	1.94	432	13,218	13,650
I	C1	15.97	3,450	144,250	147,700
TOTAL		29.25	44,439	157,468	201,907
II	A2	1.26	7,500	1,300	8,800
II	A3	1.15	7,500	500	8,000
II	A4	1.46	2,600	7,600	10,200
II	B3	1.39	-	9,700	154,992
II	C2	20.67	61,992	66,000	127,992
TOTAL		25.93	79,592	85,100	164,692
III	A5	1.15	2,214	5,786	8,000
III	A6	4.58	40,872	-	40,872
III	C3	10.84	-	77,000	77,000
TOTAL		16.57	43,086	82,786	125,872
IV	A7	6.9	25,600	23,400	49,000
IV	A8	1.48	1,600	8,700	10,300
IV	A9	3.4	-	24,050	24,050
IV	A10	2.5	19,300	-	19,300
IV	C4	9.97	-	70,100	70,100
IV	C5	9.17	-	64,800	64,800
TOTAL		33.42	46,500	191,050	237,550
GRAND TOTAL		105.17	213,617	516,404	730,021

[1] Area expressed in acres.
[2]Existing, potential and total floor area expressed in square feet.

Based on Institute of Transportation Engineers land use categories, average trip rates for both development scenarios were determined (see appendix C[1]). These average trip generations rates were then applied to the two development scenarios to determine new potential traffic volumes for both Scenario 1 and Scenario 2. The lot by lot and merged lot traffic generation scenarios are shown graphically in Figures 6,7,8 and 9 for both the average daily and PM peak hour. The lot by lot scenario (Scenario 1) is expected to generate 3,273 PM peak hour trips and 31,723 daily trips in the study area under the full build condition. The merged lot scenario (Scenario 2) is expected to generate 2,668 PM peak hour trips and 25,844 daily trips

[1] Available upon request.



Not to Scale

FIGURE 4
SCENARIO 1 - LOT BY LOT
POTENTIAL ADDITIONAL AVERAGE DAILY TRAFFIC (ADT)
HARWICH, MA

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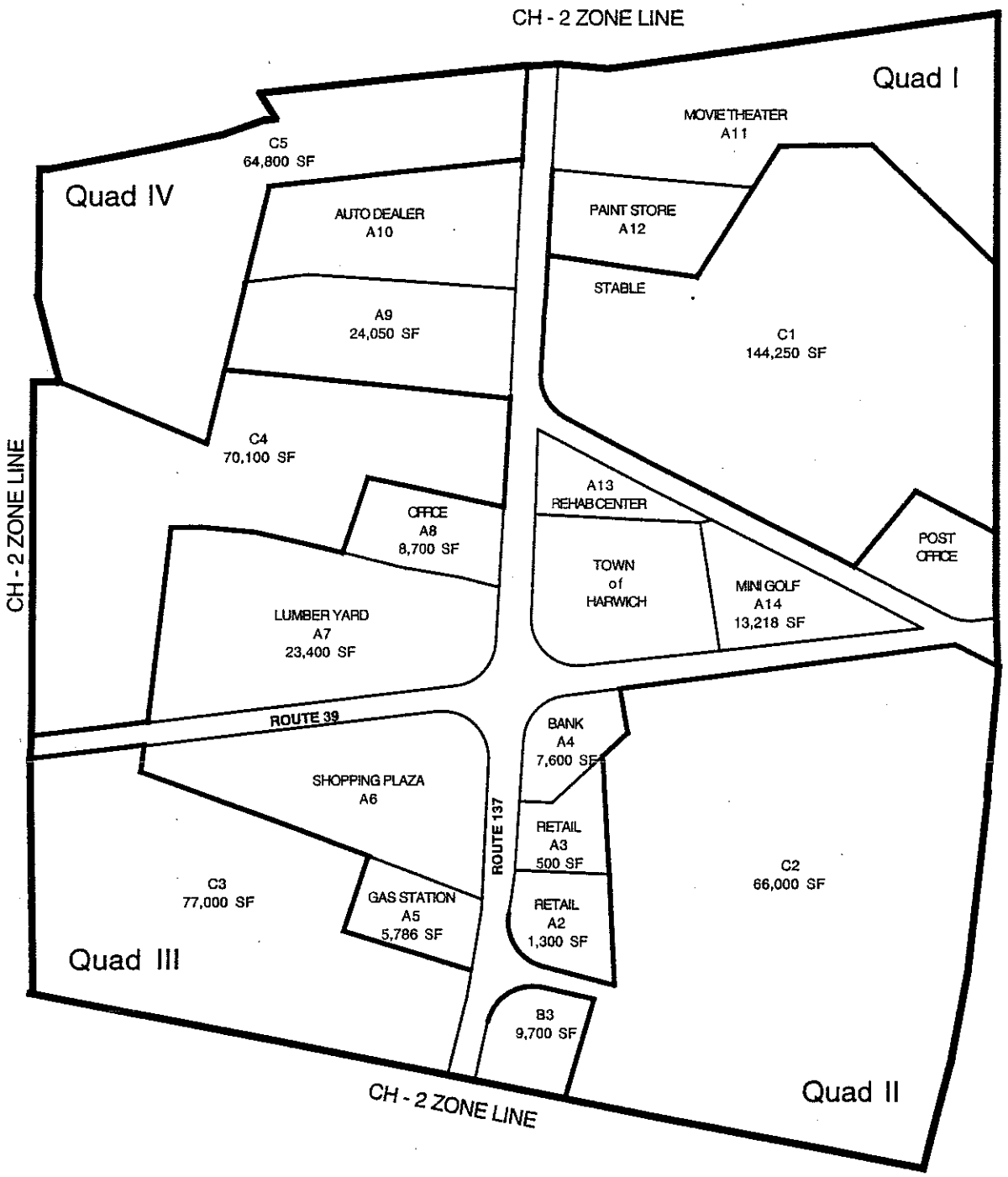

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FIGURE 5
SCENARIO 2 - MERGED LOTS
POTENTIAL ADDITIONAL BUILDING DEVELOPMENT
HARWICH, MA

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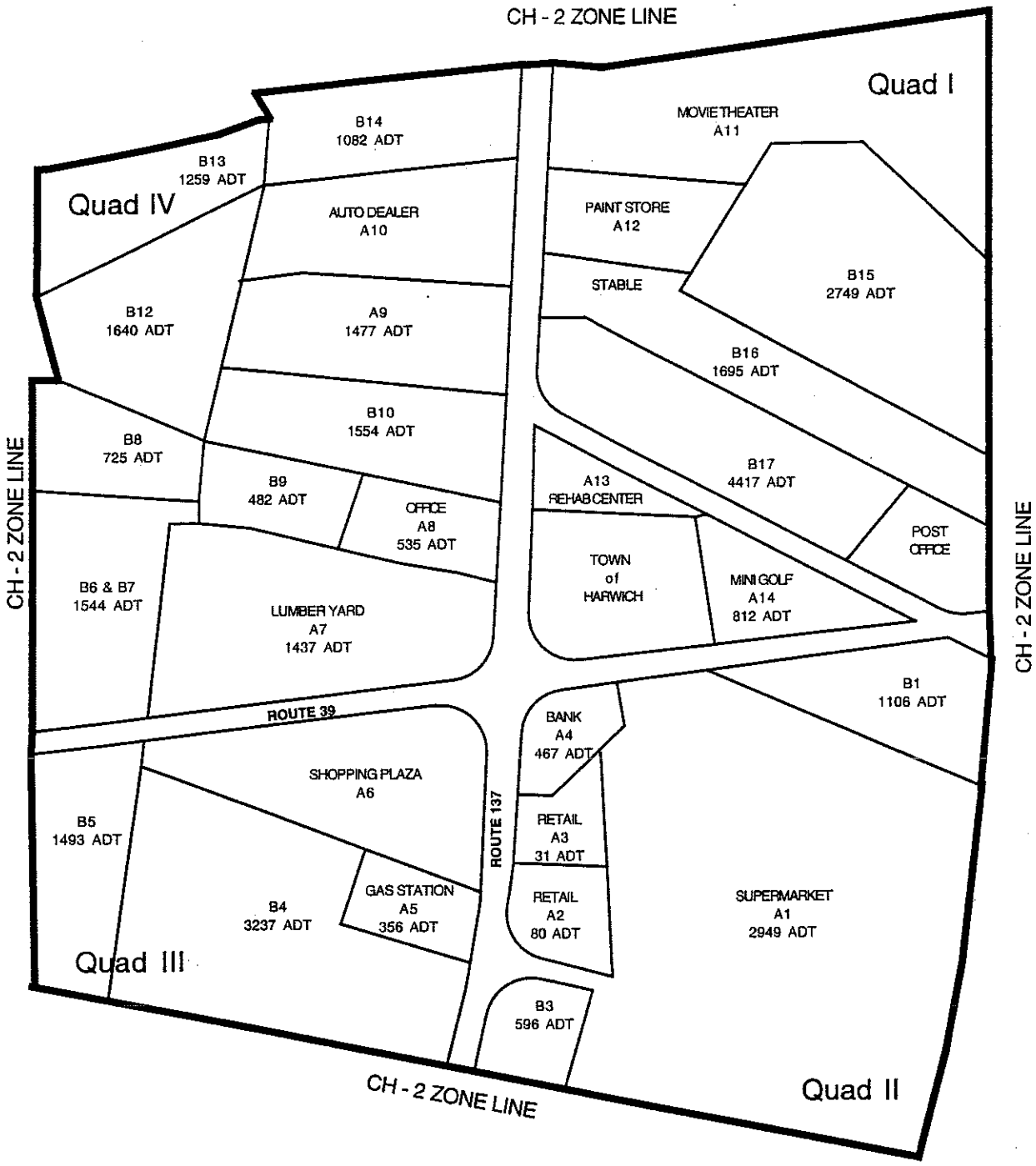

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FIGURE 6
SCENARIO 1 - LOT BY LOT
POTENTIAL ADDITIONAL AVERAGE DAILY TRAFFIC (ADT)
HARWICH, MA

Cape Cod Commission

January 1999

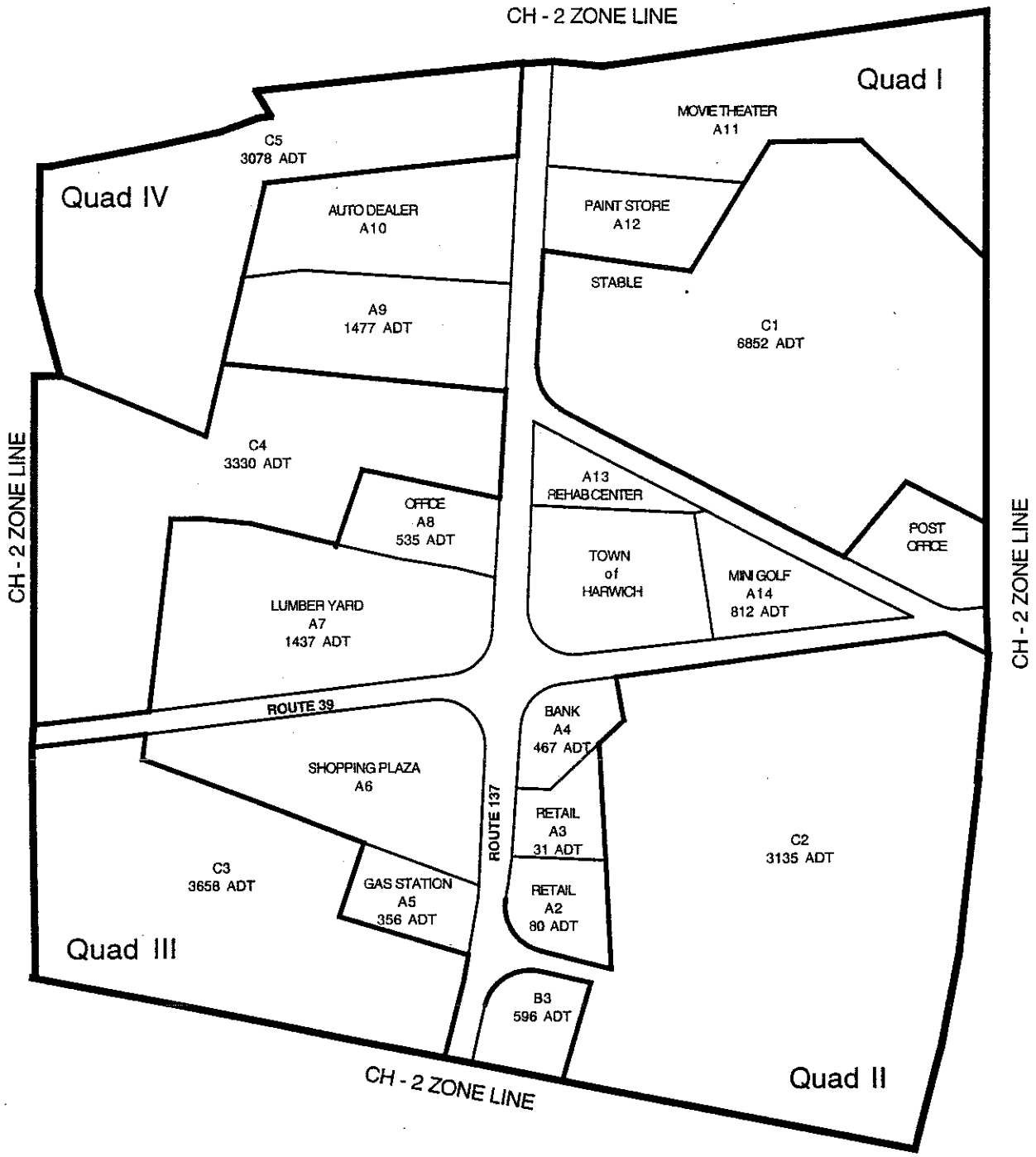

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FIGURE 7
SCENARIO 2 - MERGED LOTS
POTENTIAL ADDITIONAL AVERAGE DAILY TRAFFIC (ADT)
HARWICH, MA

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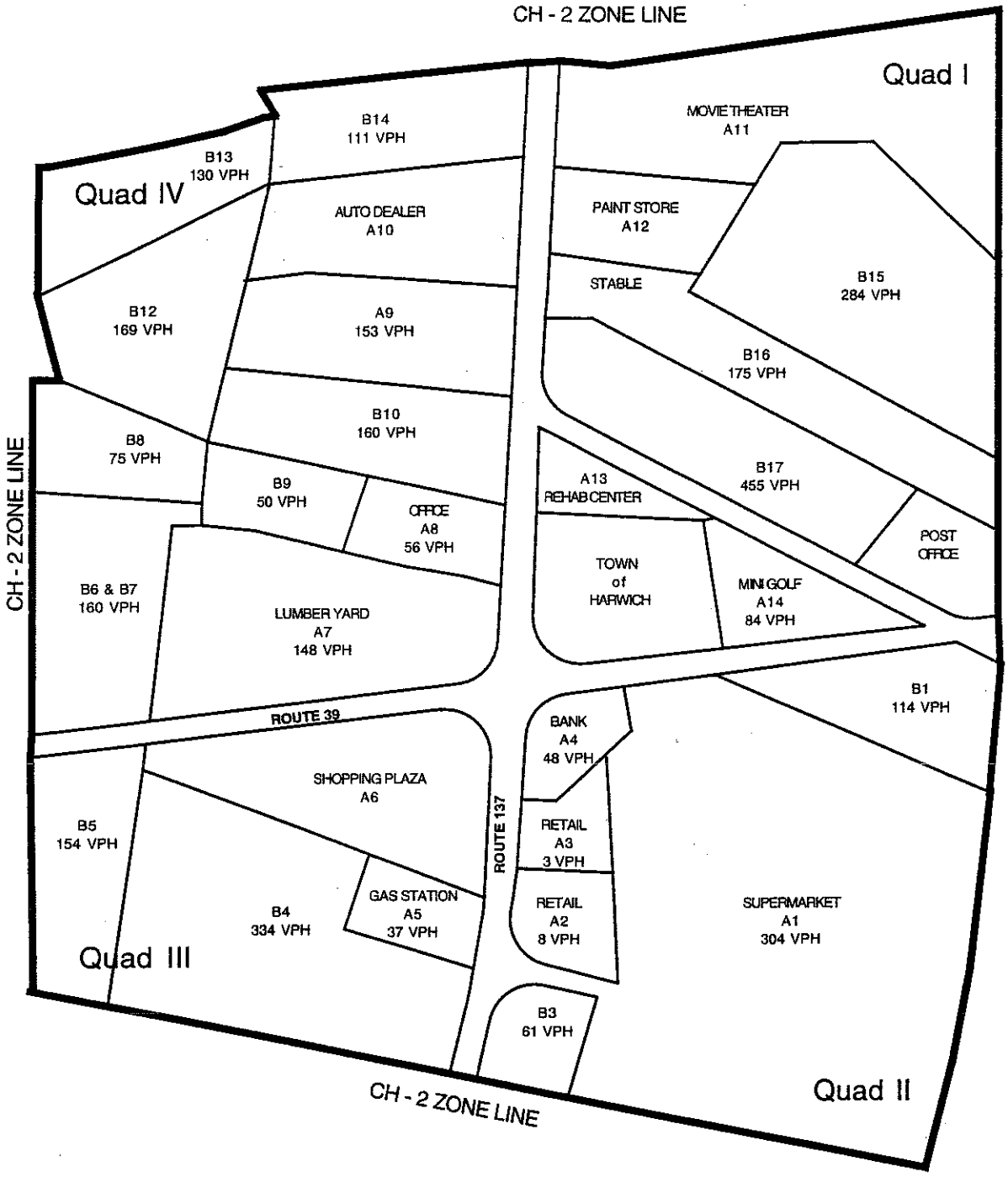
January 1999



Not to Scale

VPH - Vehicles Per Hour

FIGURE 8
SCENARIO 1 - LOT BY LOT
POTENTIAL ADDITIONAL PEAK HOUR TRAFFIC
HARWICH, MA

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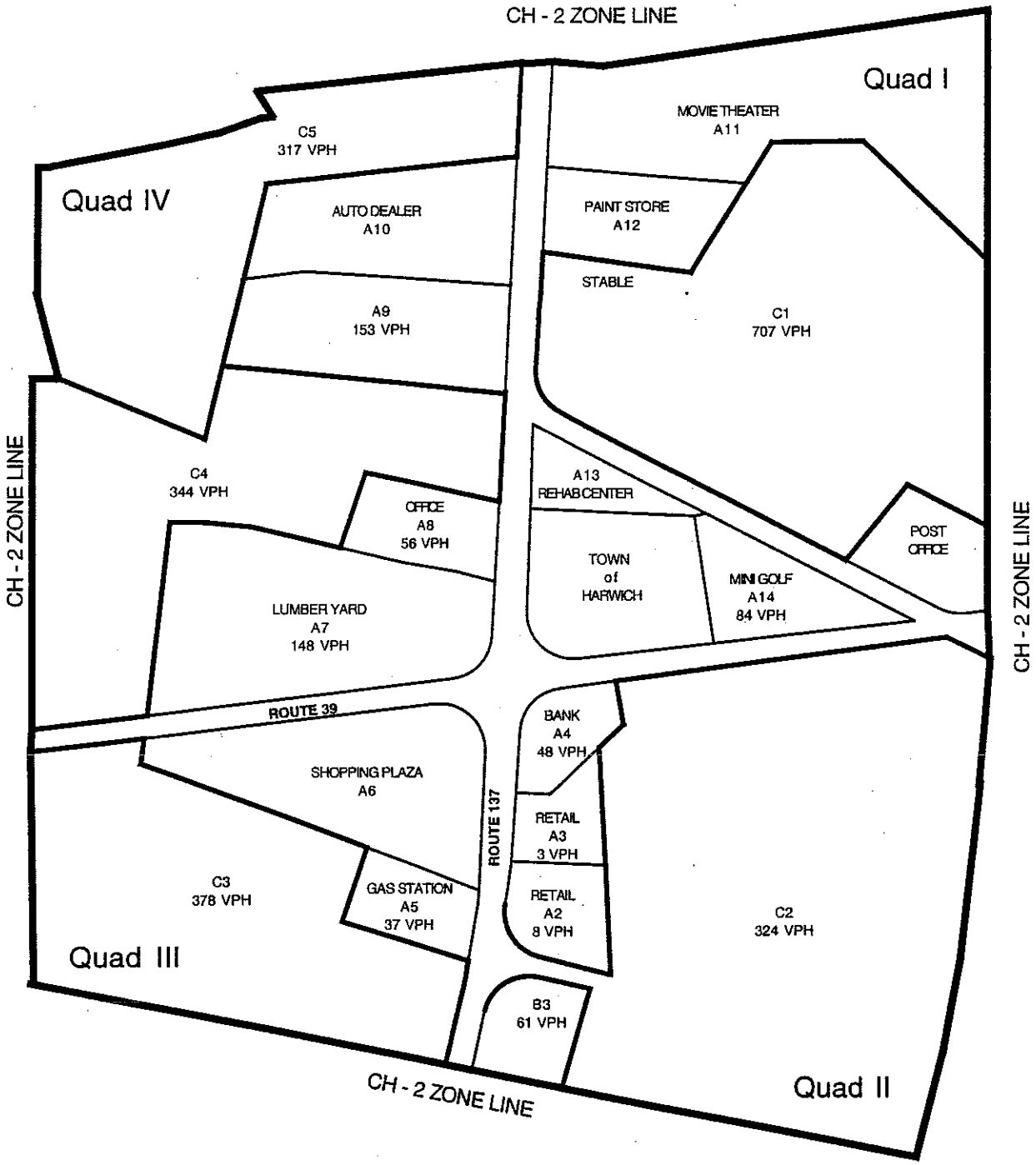

Not to Scale

VPH - Vehicles Per Hour

FIGURE 9
SCENARIO 2 - MERGED LOTS
POTENTIAL ADDITIONAL PEAK HOUR TRAFFIC
HARWICH, MA

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January 1999

in the study area at full build. As stated above, Scenario 1, the lot by lot traffic projection has higher Average Daily Traffic (ADT) and higher Peak Hour traffic volumes than the merged lot traffic projection. This is a result of the higher average trip generation rate for the more intensive Lot-by Lot development scenario (Scenario 1).

Build Year

In order to assess the potential traffic impacts for the CH - 2 Zone, existing traffic volumes were projected to a future "Build" year. The year 2010 was chosen as the "Build" year for analysis proposes. The existing traffic volumes were increased by 2% per year to account for anticipated future traffic growth unrelated to the CH - 2 Zone and then the anticipated CH - 2 Zone traffic was superimposed upon the existing condition for both Scenario 1 and Scenario 2.

Access Points

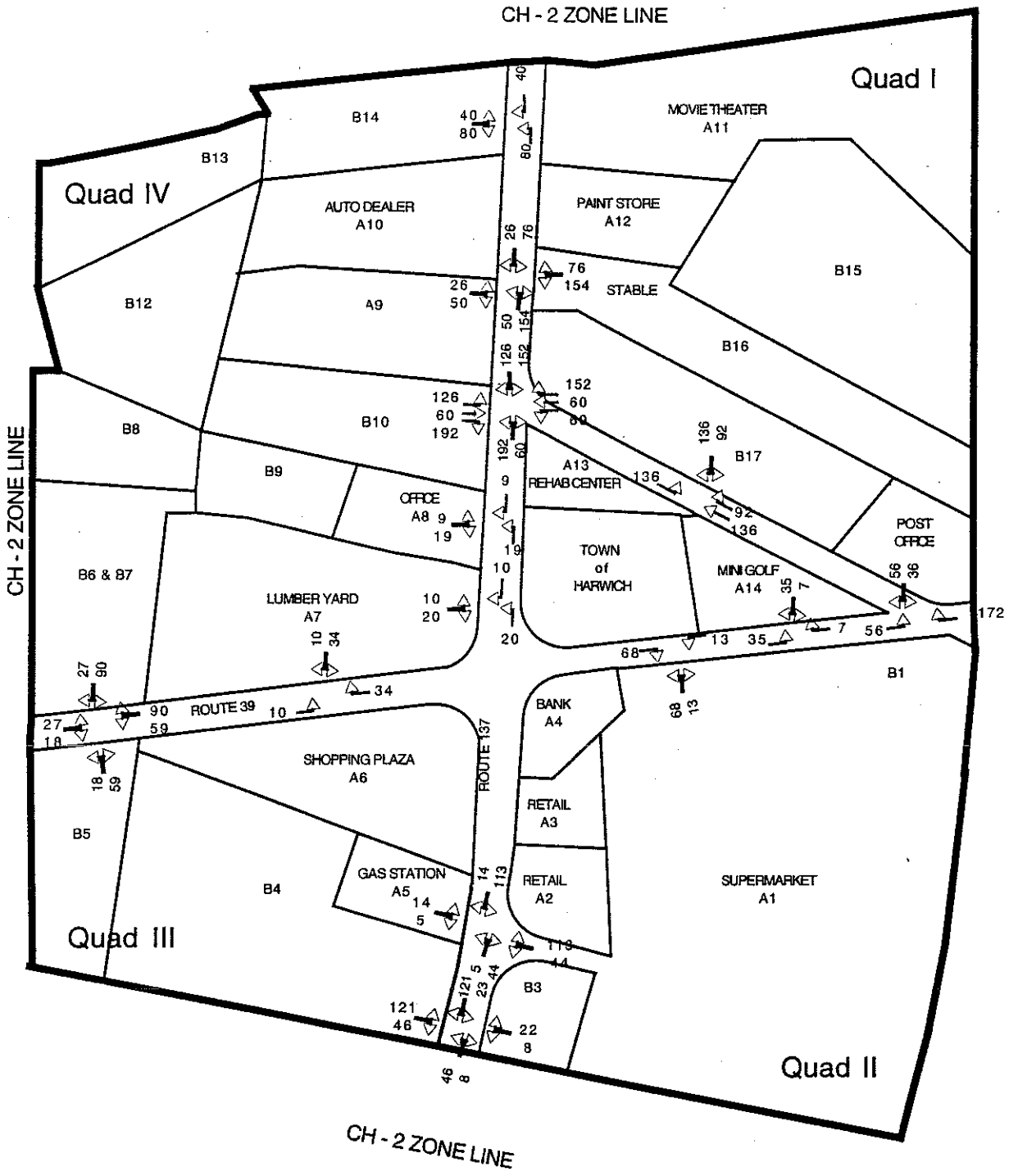
To determine the impact that the additional traffic would have on the local roadway system, it was necessary to estimate access points associated with each parcel and the trip distribution through the CH - 2 Zone. Figures 10 and 11 shown the potential additional peak hour turning movements from the estimated driveway locations for both the lot by lot and merged lot scenarios. The trip distribution was determined based on the existing traffic patterns through the area. It has been assumed that the distribution of CH - 2 Zone traffic through the Brewster-Chatham Road / Orleans-Harwich Road intersection will be similar to the existing distribution of traffic using the intersection.

Traffic Growth

Historical Traffic Growth

The CH - 2 Zone, comprised of four land Quadrants surrounding the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection has been the subject of study for some time. Traffic studies for this area has been conducted previously in 1970 as part of the "Traffic Operations Study" by Norman A. Abend for The Cape Cod Planning and Economic Development Commission and in the 1989 "Harwich Commons Shopping Center Traffic Impact Report" by Louis Berger & Associates, Inc. Traffic data from these studies indicates that the area has experienced significant traffic growth over the past 30 years with a major portion of that growth occurring over the past 10 years.

The 1970 Norman Abend report indicates that 30 years ago 1,905 vehicles passed through the Brewster-Chatham/Orleans-Harwich intersection during a four hour

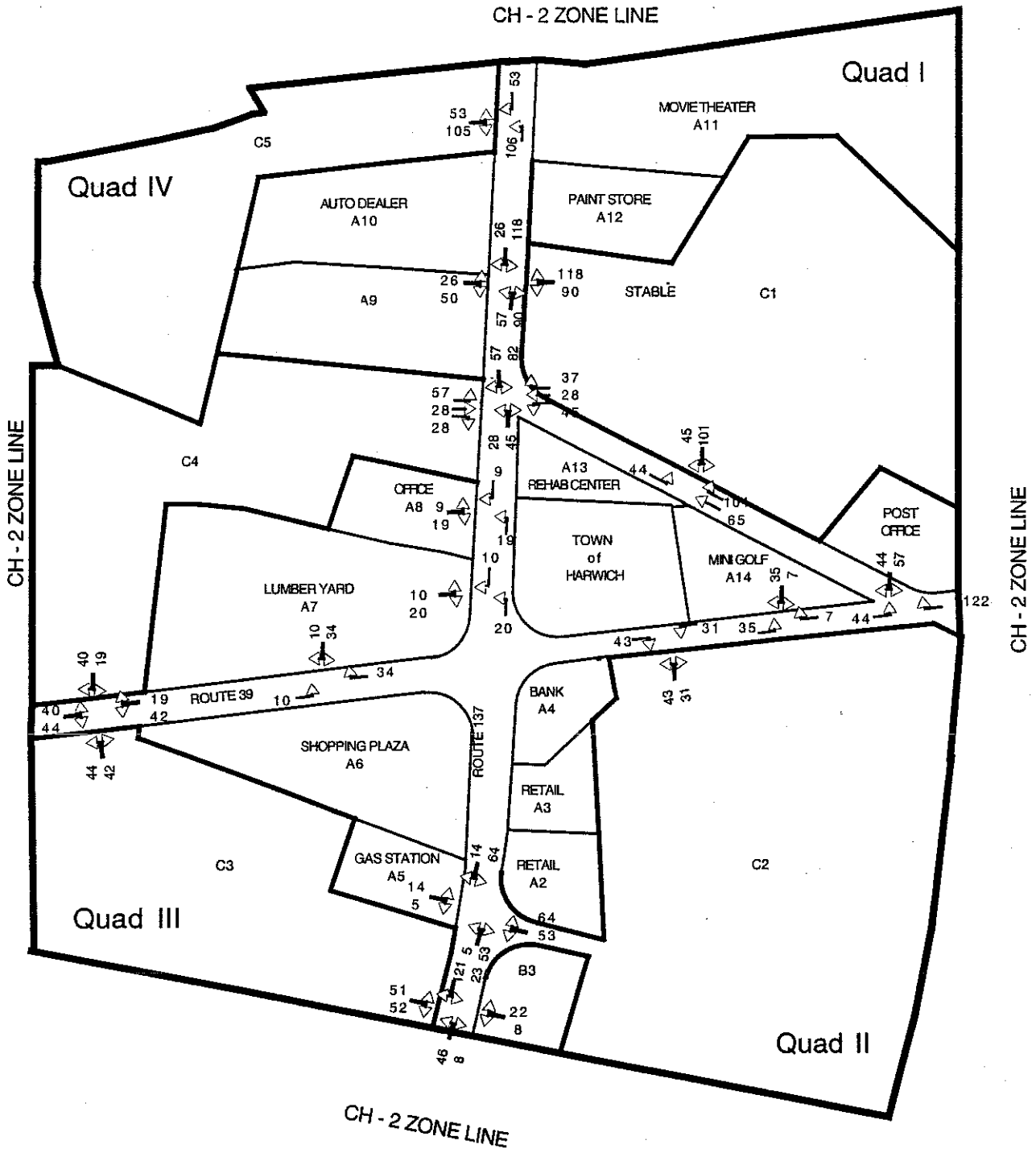


Not to Scale

FIGURE 10
SCENARIO 1 - LOT BY LOT
POTENTIAL ADDITIONAL PEAK HOUR TURNING MOVEMENTS
HARWICH, MA

Cape Cod Commission

January 1999

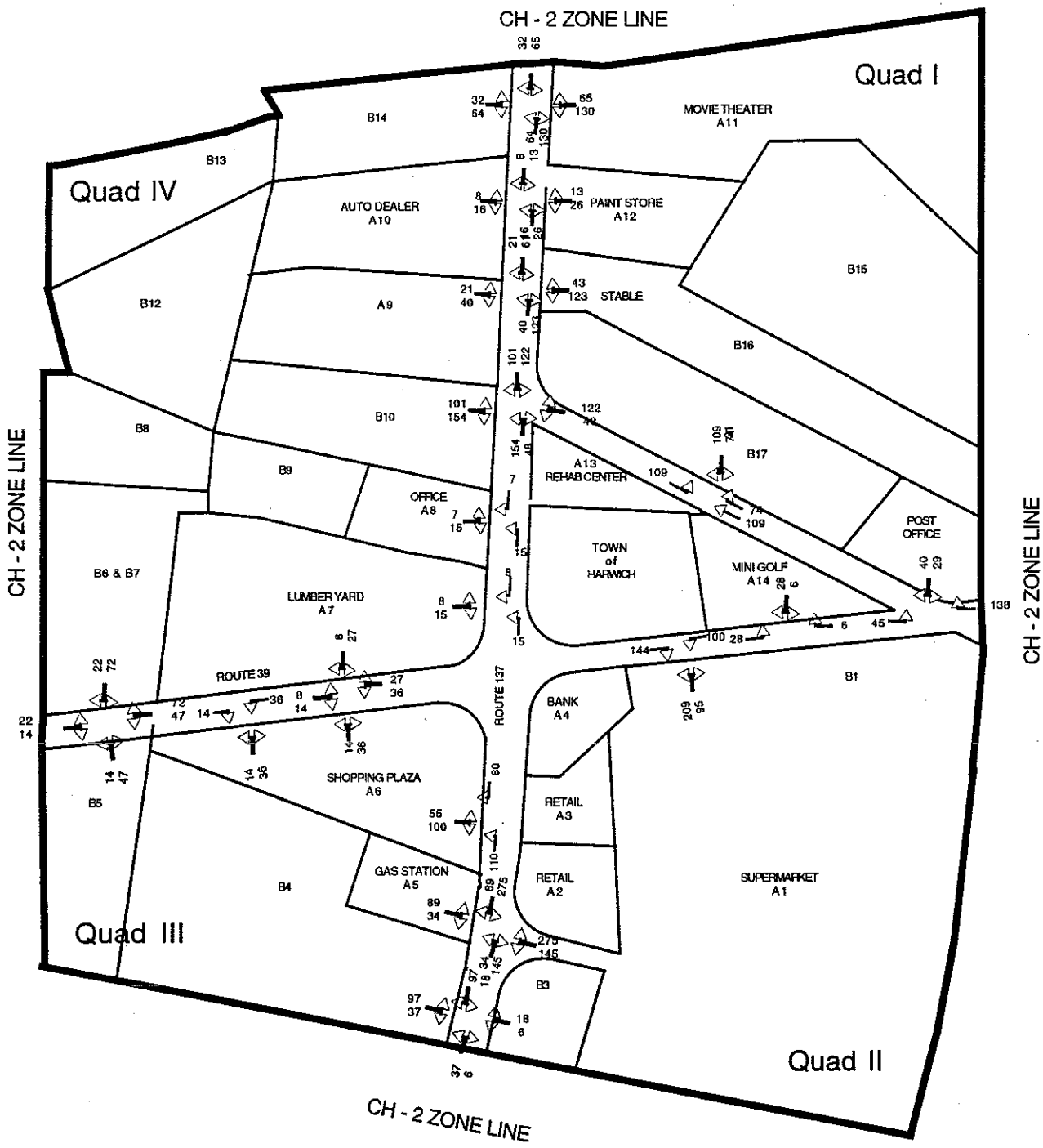


Not to Scale

FIGURE 11
SCENARIO 2 - MERGED LOTS
POTENTIAL ADDITIONAL PEAK HOUR TURNING MOVEMENTS
HARWICH, MA

Cape Cod Commission

January 1999

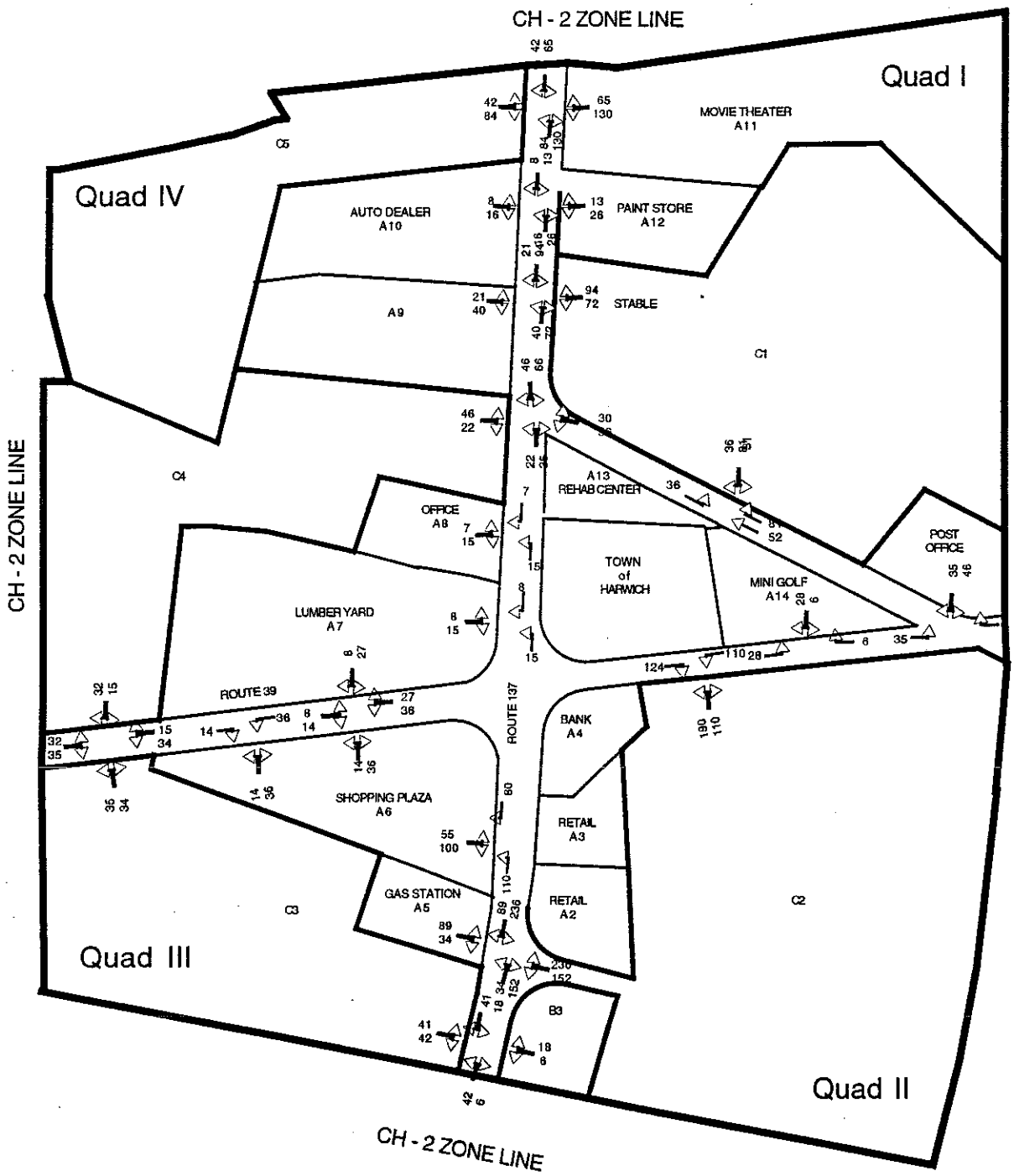


Not to Scale

FIGURE 12
SCENARIO 1 - LOT BY LOT
"BUILD" PEAK HOUR TURNING MOVEMENTS
HARWICH, MA

Cape Cod Commission

January 1999



Not to Scale

FIGURE 13
SCENARIO 2 - MERGED LOTS
"BUILD" PEAK HOUR TURNING MOVEMENTS
HARWICH, MA

Cape Cod Commission

January 1999

count or approximately 475 vehicles per hour during a summer afternoon. The Louis Berger report indicates that 10 years ago 1,420 vehicles passed through the Brewster-Chatham/Orleans-Harwich intersection during a typical summer afternoon peak hour. That represents a 300 percent increase in traffic for that 20 years period. The present traffic counts for the Brewster-Chatham/Orleans-Harwich intersection indicate that 2,410 vehicles passed through the intersection during a summer afternoon peak hour. The present traffic counts represent a 500 percent increase in traffic from the 1970 counts and a 170 percent increase over the past 10 years. Based on the traffic count data available, the CH-2 Zone is experiencing a 17 percent increase in traffic per year since 1970.

Future Traffic Growth

In addition to the trips associated with the projected CH - 2 Zone development, a background growth rate of two percent annually was assumed. This growth is associated with the normal increase in traffic and for some traffic growth in adjacent communities. For analysis purposes, background traffic was projected to the year 2010. The background growth and the trips associated with CH -2 growth was added to the existing base network. As a precautionary measure, new potential traffic volumes were reduced by 20 percent to offset the fact that some of the retail development may not be built by the design year. Figures 11 and 12 display the estimated afternoon peak hour traffic volumes for both Scenario 1 and Scenario 2. Figures 13 and 14 display the average annual conditions as well as the peak season condition for both Scenario 1 and Scenario 2 at the Brewster-Chatham Road / Orleans-Harwich Road intersection.

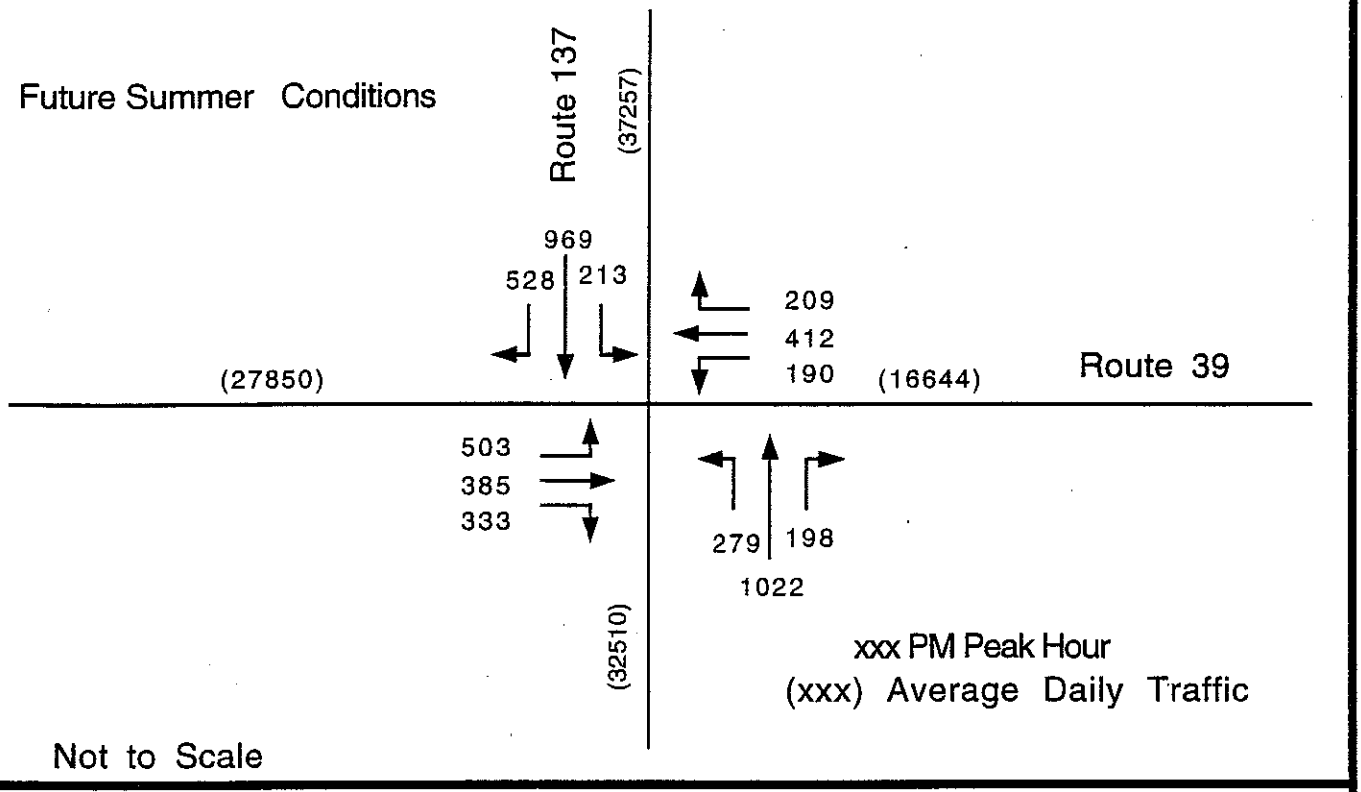
Analysis

Existing Conditions

Based on existing traffic data, Commission staff evaluated the existing traffic conditions at the Brewster-Chatham Road (Route 137)/ Orleans-Harwich Road (Route 39) intersection for both the average annual traffic condition and the peak season traffic condition. The analysis indicated that the intersection operated satisfactory (LOS B) during the off peak months but failed (LOS F) during the peak season.

Future Conditions

Commission staff evaluated the potential traffic impacts on the major driveways along Brewster-Chatham Road and Orleans-Harwich Road. The majority of these driveways would operate at an undesirable level of service for both Scenario 1 and Scenario 2.



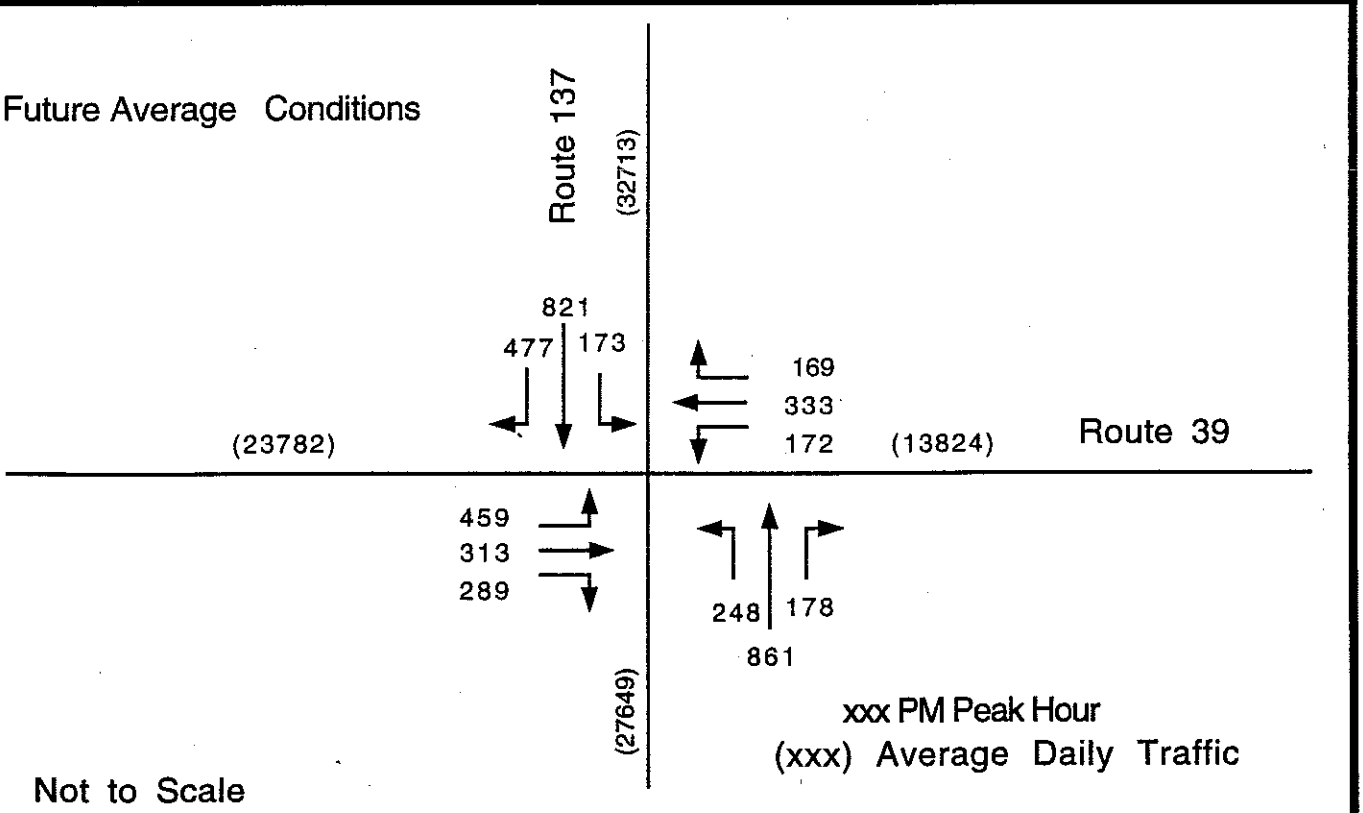
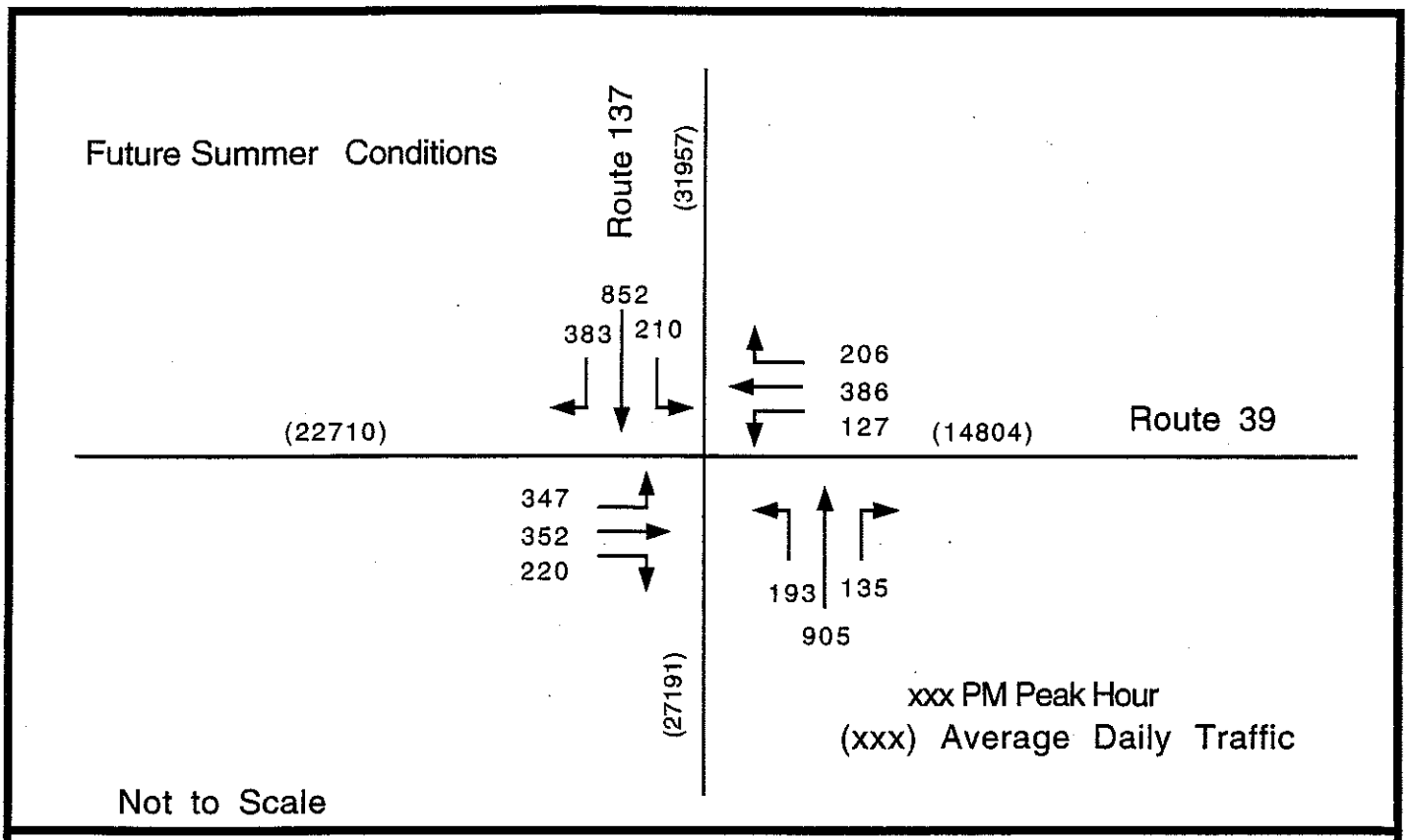


FIGURE 14
SCENARIO 1 - FUTURE CONDITIONS
ROUTE 137/ROUTE 39
HARWICH, MA

Cape Cod Commission

January 1999



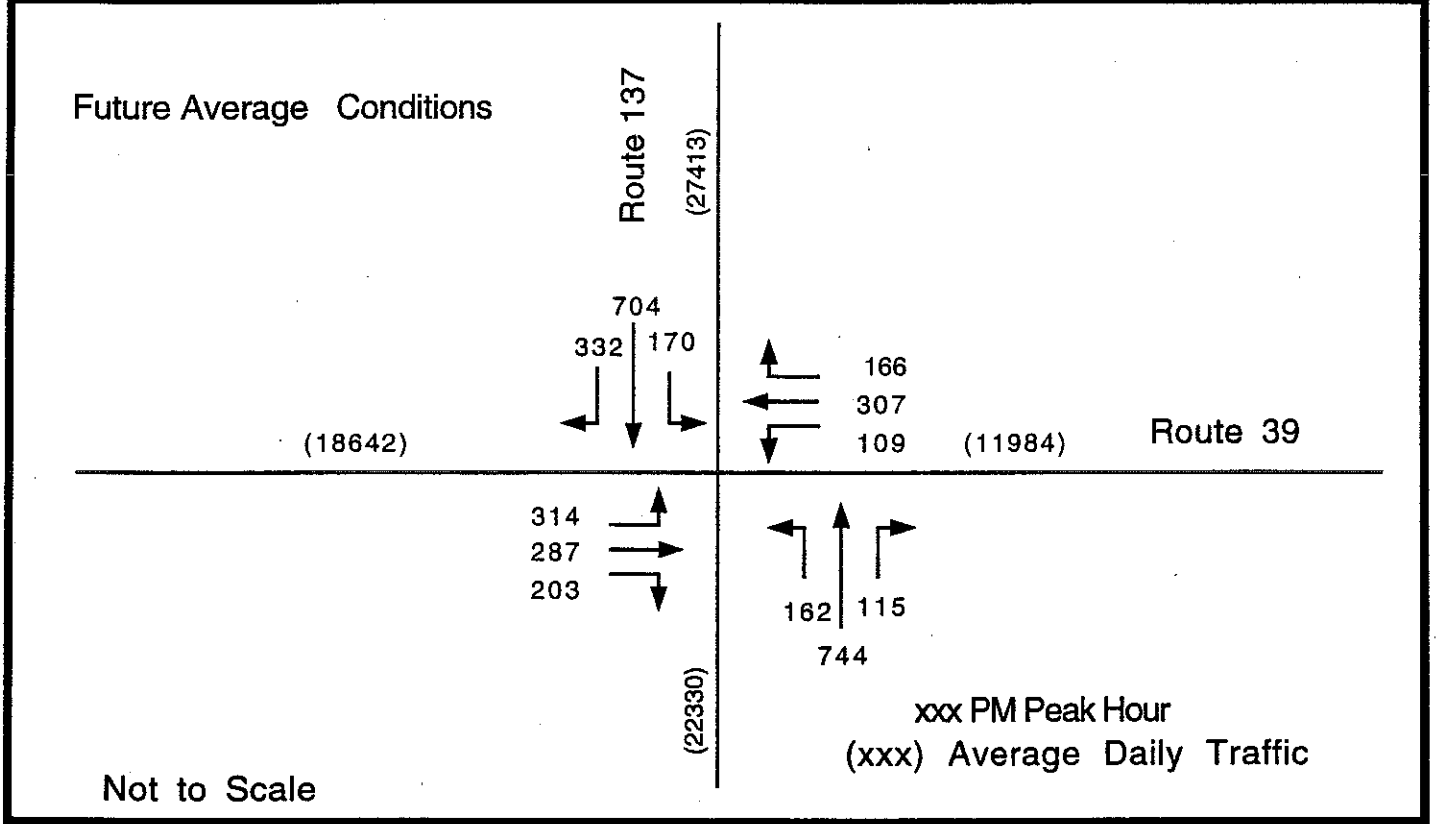


FIGURE 15
SCENARIO 2 - FUTURE CONDITIONS
ROUTE 137/ROUTE 39
HARWICH, MA

Cape Cod Commission

January 1999

Commission staff evaluated potential traffic impacts on the Brewster-Chatham Road/ Orleans-Harwich Road intersection associated with the development of land located within the CH - 2 Zone in Harwich, MA. Based on our calculations the Brewster-Chatham Road / Orleans-Harwich Road intersection would operate at an unsatisfactory level (LOS F) for both the average and peak season condition under Scenario 1 or Scenario 2. Based on our traffic projections for Scenario 2, six (6) additional turning lanes would be required for the intersection to perform at a satisfactory level for the average annual traffic condition. For the intersection to perform at a satisfactory level under Scenario 2 during the peak season nine (9) additional turning lanes would be required. Under Scenario 1, ten (10) additional turning lanes would be required for the intersection to operate at a satisfactory level for both the average and summer traffic conditions.

Alternatives

As demonstrated by this report the CH - 2 Zone has the potential to severely impact traffic conditions at the Brewster-Chatham Road / Orleans-Harwich Road intersection and access locations along each roadway. Several alternatives to improve the operations at the Brewster-Chatham Road/ Orleans-Harwich Road intersection were presented to the Harwich Planning Board to elicit responses as to the type of improvements desired by the Town of Harwich. Listed below are alternatives recommended by the Harwich Town Planner, the Harwich Planning board and Cape Cod Commission staff for further consideration.

1. Purchase CH-2 Zone land as open space to limit future development.

2. Widen the Brewster-Chatham Road/ Orleans-Harwich Road intersection.

3. Replace the Brewster-Chatham Road/ Orleans-Harwich Road intersection with a modern roundabout.

4. Construct new roadways within the study area.

5. Access consolidation and access management.

6. Enhance pedestrian accommodations within CH-2 Zone.

7. Nothing.

Alternatives Analysis

This section describes the advantages and disadvantages associated with the seven (7) design alternatives derived from our meeting and observations. A rating (low, moderate, high) of the costs, Right-of-Way acquisitions, effectiveness and benefits to community character for each alternative is shown in Table 4.

1. The idea to purchase land around the CH-2 Zone was raised at a public meeting to discuss the CH-2 area. This strategy would most likely need to be implemented in stages. The CH-2 Zone is comprised of 28 buildable lots of which 13 are undeveloped. The 13 undeveloped lots could be purchased outright. Purchasing the 13 undeveloped would reduce the potential building space by over 50% from the CH-2 Zone. The remaining open space for the 15 underdeveloped lots would need to be subdivided from their existing developed parcels and purchased.

   The major hurdle for the concept would be the initial cost to the Town of Harwich. Purchasing the 13 undeveloped lots, which consist of 41.22 acres of commercial land would be expensive to implement. The cost to subdivide and purchase the remaining underdeveloped land would also need to be calculated to fully implement this concept.

   Purchasing CH-2 Zone commercial parcels for conservation land would not require any Right-of-Way acquisition to implement.

   This idea would be a very effective approach to eliminating traffic impacts from the CH-2 Zone. Purchasing CH-2 Zone land and preserving that land in a conservation trust would ensure that any additional traffic impacts would be from external traffic growth. The Town of Harwich would be able to plan on normal traffic growth patterns for the coming years.

   Preserving the CH-2 Zone land in a conservation trust would ensure the character of the East Harwich area as it exists today. The conservation land would stop further development of the land and the traffic impacts associated with the development.

   If the Town of Harwich decides to purchase some of the CH-2 Zone land, it is recommended that the Town of Harwich strategically purchase parcels of land that will control driveway access for the remaining parcels on the roadway system. Purchasing specific parcels of land to regulate driveways would serve as an effective access management plan for the CH-2 Zone.

2. The idea of widening the existing Brewster-Chatham Road/Orleans-Harwich Road intersection was introduced at an earlier meeting on the CH-2 Zone. Mentioned at that meeting were the ideas of providing a right turn only lane for the Route 137 southbound approach to the Route 137/Route 39 intersection and providing exclusive left turn lanes on the Route 137 approaches to the intersection.

   The cost to construct the widened roadway has been estimated at approximately $125,000. This cost would include the design and construction of geometric changes to the intersection and updated traffic signal equipment.

Widening the intersection may require some minor Right-of-Way acquisition by the Town. Providing left turn lanes and a right turn only lane on Route 137 southbound may require additional Right-of-Way in front of the lumberyard property.

Widening the Route 139/Route 39 intersection would only provide short term traffic relief for the CH-2 Zone. Widening the intersection will provide adequate level of service for normal growth rates (nondevelopment) to the area, but the development of commercial property will accelerate the traffic impacts. At the current development rate the CH-2 Zone is experiencing, widening of the existing intersection will not effectively manage the traffic impacts associated with the development.

Widening the intersection and updating the traffic signal equipment will have an impact on community character. Updates to the traffic signal equipment may include the installation of mastarms and overhead lights. The installation of mastarms and overhead traffic light will change the character of the intersection and the area.

3. A modern roundabout is basically a variation of the traffic circle. However, roundabouts are distinguished from traffic circle by their operational and design characteristics. Like rotaries, roundabouts have yield at entry operations. However roundabouts go further in the yield at entry by instituting geometric curves at their entrances. The entry curves deflect traffic before vehicles enter the roundabout and thus slow traffic down before entering the roundabout. Unlike yield signs, the entry curves work because they are a physical barrier that motorists can not ignore.

   A modern roundabout could be constructed at the Brewster-Chatham Road/ Orleans/Harwich Road intersection by installing a center median, splitter islands, signs, and retaining the entering and exit lanes. Based on the simple roadway construction required, it is believed that a modern roundabout could be constructed for approximately the same cost as a traffic signal upgrade.

   Constructing a modern roundabout may require some minor Right-of-Way acquisition by the Town. The center island and the circular roadway may exceed the current Right-of-Way at the Brewster-Chatham Road/Orleans-Harwich Road intersection.

   A modern roundabout at the Brewster-Chatham Road/ Orleans-Harwich Road intersection would function at an acceptable level of service under the existing conditions (LOS A) as well as under the full build potential development in the CH-2 Zone (LOS C). A modern roundabout with the same lane configurations that exists today could handle the future conditions traffic at an acceptable level of service (LOS C).

   A modern roundabout would have less of an urban look than an upgraded traffic signal with mastarms and numerous signal heads. The main feature of the roundabout is the center island. The center median of the roundabout would be constructed at ground level and could be landscaped or grassed over. A modern roundabout also has additional benefits to the community. A modern roundabout is designed so that a vehicle must enter and drive around the center island at a

slow rate of speed. In this way, a modern roundabout can enhance a community by serving as a traffic-calming device.

4. Constructing a roadway within the CH-2 Zone to bypass the Brewster-Chatham Road/ Orleans Road Intersection was discussed at one of our meetings. Two different roadways were discussed at that meeting. The first roadway would connect Route 137 to Route 39 from within Quadrant II (behind the existing lumberyard). A second bypass route would connect Route 137 to Route 39 in Quadrant III.

   The new roadways construction would be a costly alternative to ease the traffic impacts from the CH-2 Zone development. New roadway construction costs can be as high as $1,000,000 per mile. Although new roadway construction would alleviate some of the traffic congestion at the Route 39/Route 137 intersection, the new roadway could also have a negative effect. New roads would increase access to land parcels within the CH-2 Zone, which could benefit the development of land in the CH-2 Zone. New roadway construction would also have a negative effect on the surrounding environment and the community character of Harwich.

   In addition to the negative effects of new road construction, addition right of way land purchases and easements would be required for roadway construction, sidewalks, drainage and other roadway related impacts.

5. Access management practices could be implemented to provide reasonable access to development within the CH-2 Zone and benefits to the local roadway system. Access management practices provide location and spacing for driveways and private roadways along town roads, minimizing the number of driveways, consolidating existing driveways, encouraging shared driveways, controlling the geometric design of driveways and locating driveways as far away from roadway intersections as possible.

   The cost to implement access management guidelines would be relatively low. Access management guidelines could be incorporated into the Town of Harwich By-Laws. The access management By-Laws would require developments to implement best access management practices for their properties. The Town would not be required to take land or impose hardship on undeveloped properties.

   Access management practices could be a low cost effective tool to enhance the traffic flow on Route 39 and Route 137. However, access management practices would not solve the traffic impact problems on either Route 39, Route 137 or the Brewster-Chatham Road/ Orleans-Harwich Road intersection. Access management practices would not prohibit the development of the CH-2 Zone nor would access management practices enhance the community character of Harwich.

6. Pedestrian enhancement to the CH-2 Zone would include sidewalks on all approaches to the Brewster-Chatham Road/ Orleans-Harwich Road Intersection. These sidewalks could be separated from the roadway by a grass strip and could be constructed to meander along the roadway similar to the existing sidewalk in Quadrant II. In addition to sidewalks, pedestrian access connecting the four quadrant should be implemented along with any proposed design alternatives.

Cost to implement sidewalk range from $13 to $25 a linear foot (LF). Sidewalks could be constructed within the existing right-of-way for each roadway. In a community such as Harwich, sidewalks for pedestrian and bicycle activities can greatly enhance the walkability of the area and add to the community character and effectively reduce the automobile traffic in the CH-2 Zone.

7. The Town of Harwich could take the hands off approach and do nothing to plan for the development of the CH-2 Zone. The traffic impacts associated with the CH-2 Zone have been documented in this report and their impact will be felt on the roadways leading into the CH-2 Zone and at the CH-2 Zone Brewster-Chatham Road/ Orleans-Harwich Road intersection. The intersection would continue to operate at Level Of Service F during the summer months and would only worsen as the region is developed.

   No direct construction or land acquisition costs would be associated with this alternative, although the environmental and the community impacts would be substantial. The indirect costs associated with the do nothing alternative include environmental costs and personal injuries due to increased accident potential and " quality-of-life" costs for the area residents.

Table 4 - ALTERNATIVES ANALYSIS

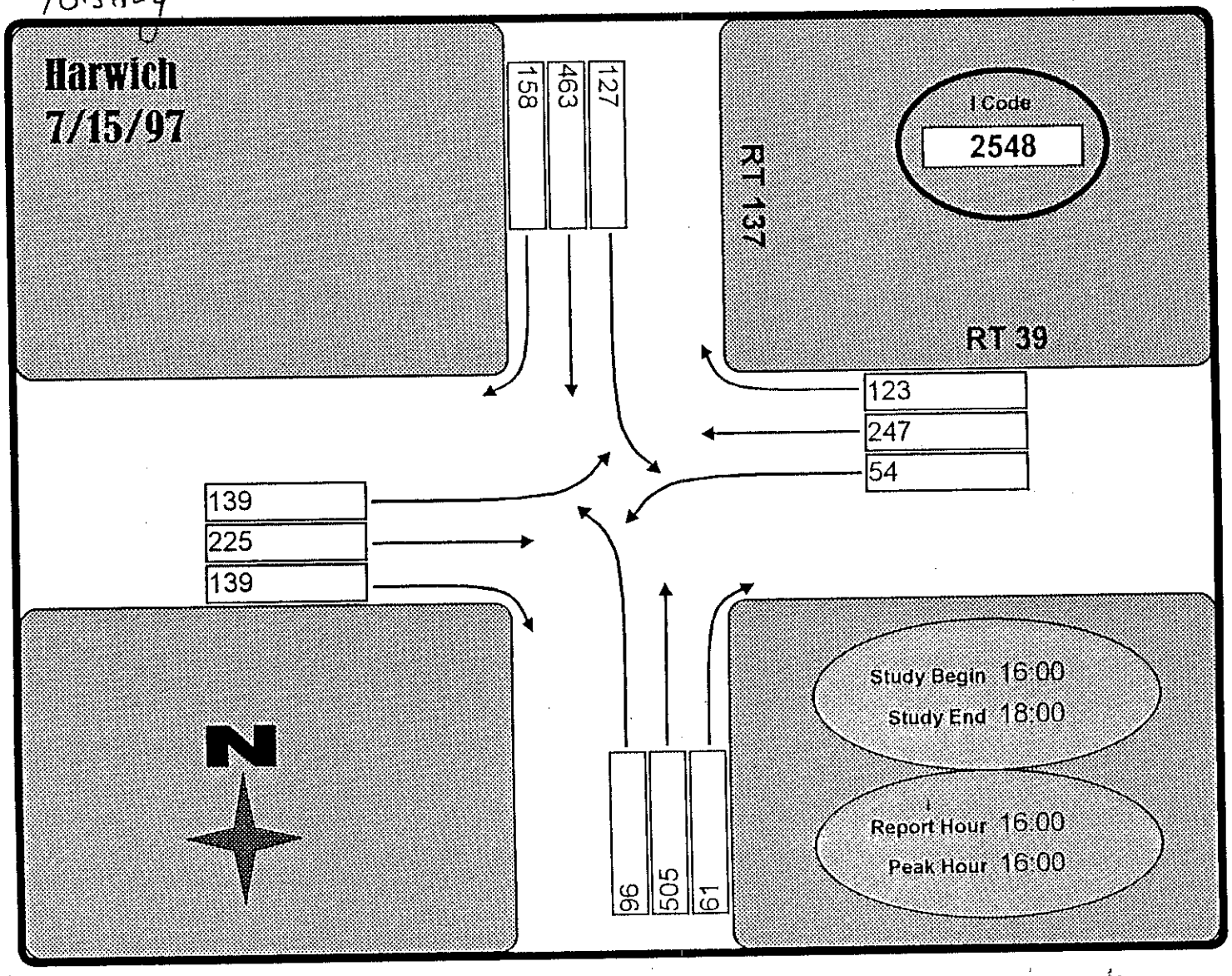
Alternative	Initial Cost	Right-of-Way Acquisition	Effectiveness	Impacts to Community Character
Open Space	High	None	High	Positive
Widen Intersection	Moderate	Minor	Low	Negative
Roundabout	Low	Minor	High	Positive
New Roadway	Moderate	Extensive	Low	Negative
Access Management	Low	Minor	Moderate	Positive
Pedestrian Access	Low	Minor	Moderate	Positive
Do Nothing	Low	None	Low	Negative

Conclusion

Although many factors influence the development that will occur in the future, the Brewster-Chatham Road/ Orleans-Harwich Road intersection has experienced substantial traffic growth over the last thirty years and is expected to continue to growth in the near future. This traffic impact study has addressed the traffic impacts associated with the development potential of the CH-2 Zone. The report also presented possible solutions to the Brewster-Chatham Road/ Orleans-Harwich Road intersection. The proposed alternatives will facilitate traffic flow as outlined in the alternative analysis section of this report.

Appendix A
Traffic Counts

Tuesday



This is a one hour count.

Tmcs

Cape Cod Commission Turning Movement Counts - Data Entry

Lookups!

Calculations!

Count 2548

1997

Vehicle Total 2268

TN # 8 Town Harwich

Major Road Rt 137

Major Road : (1=N-S, 2=E-W) 1

Minor Road Rt 39

Study Begin 16:00 Study End 18:00

Date 7/15/97

Alt. Modes

Paul

	Right Turns	Throughs	Left Turns
From North	158	463	127
From East	123	247	54
From South	61	505	96
From West	70	225	139

Enter Vehicle Total

Report Hour 16:00

Peak Hour 16:00

||| MOVEMENTS DON'T EQUAL VEH TOTAL

	Report_Hour	Study_Period
Bikes		
Peds		

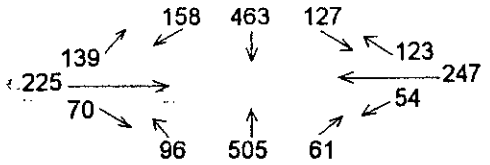
When 2/5/98

Cape Cod Commission Turning Movement Counts

Harwich — Rt 137 N-S @ Rt 39

Site Code	Date/Time of Study	Peak Hour:	Report Hour:	Total Entering Volume:
2548	Tue 7/15/97 16:00 - 18:00	16:00	16:00	2,268

Other Data Available:



Printing Date: **5/5/98**

N

Town Harwich

North/South Street Route 137

East/West Street Route 39

Counted By CDC

Weather Sunny 65°

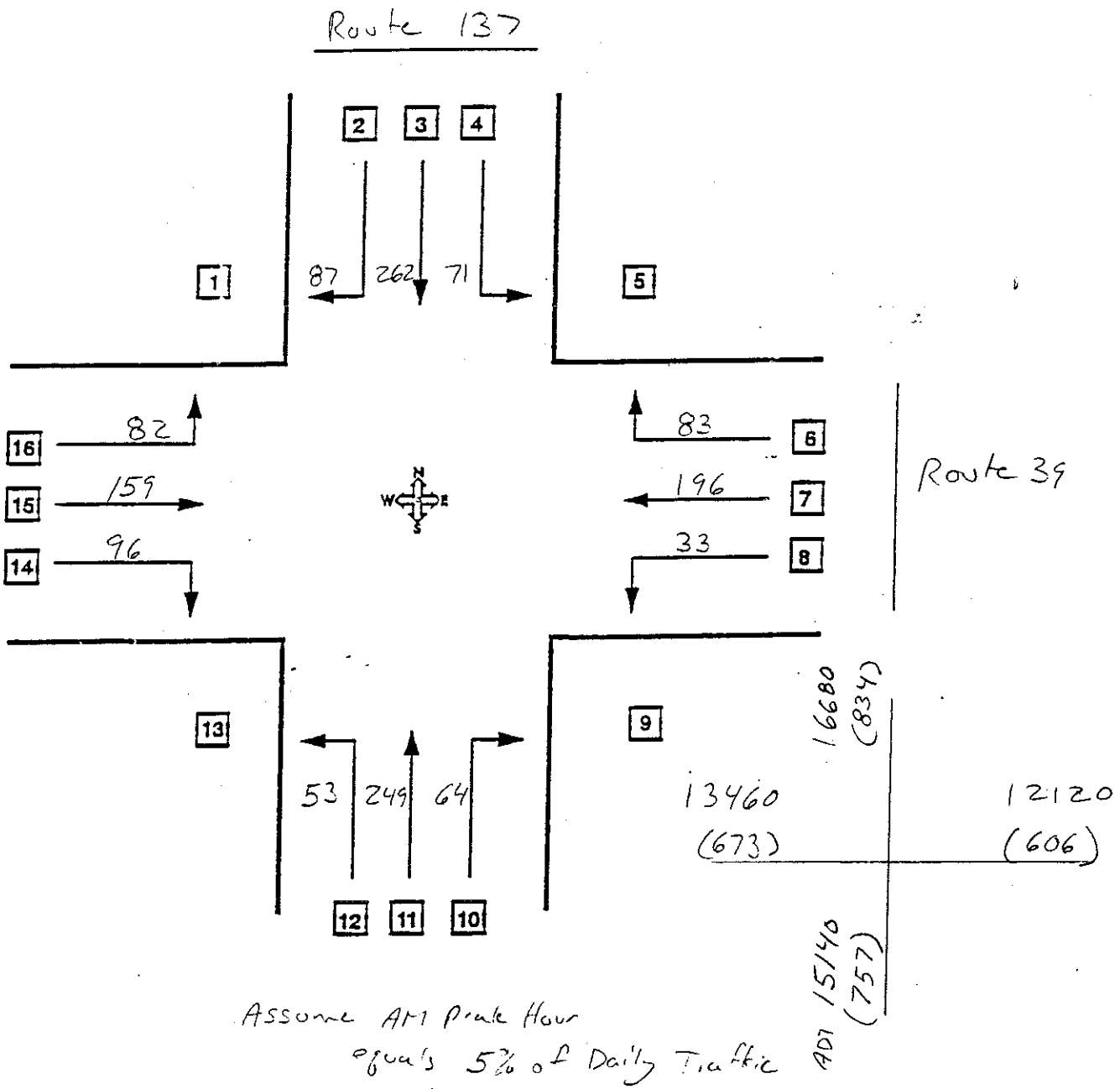
Project Ch-2 Planning Study Site Number 2548

Count Board #

Date 6/4/98 Day of Week Thursday

Start Time 8:00 AM End Time 9:00 AM Interval 1 hour

AM Peak Hour



Assume AM Peak Hour equals 5% of Daily Traffic

Cape Cod Commission

Site Code : 00002548
N S Street: Rt 137
E W Street: Rt 39
Weather : Clear

Sum of the Cars and Trucks

DATE: 6/04/98

Time Begin	From North RT	THRU	LT	From East RT	THRU	LT	From South RT	THRU	LT	From West RT	THRU	LT	Vehicle Total
7:00 AM	18	53	7	6	27	9	9	42	16	8	18	17	230
7:15	18	51	7	15	23	10	13	38	10	25	36	5	251
7:30	18	49	12	14	26	6	10	56	18	53	30	51	343
7:45	23	74	12	16	38	6	18	61	14	19	28	24	333
HR TOTAL	77	227	38	51	114	31	50	197	58	105	112	97	1157
8:00 AM	17	67	17	15	46	7	9	65	17	25	29	16	330
8:15	20	65	13	18	52	6	12	62	13	15	41	20	337
8:30	22	66	19	23	46	10	18	65	21	18	49	18	375
8:45	28	64	22	27	52	10	14	57	13	38	40	28	393
HR TOTAL	87	262	71	83	196	33	53	249	64	96	159	82	1435
DAY TOTAL	164	489	109	134	310	64	103	446	122	201	271	179	2592

PEAK PERIOD ANALYSIS FOR THE PERIOD: 7:00 AM - 9:00 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	Thru	Left	Total	PERCENTS Right	Thru	Left
North	8:00 AM	0.92	87	262	71	420	21	62	17
East	8:00 AM	0.88	83	196	33	312	27	63	11
South	7:45 AM	0.90	57	253	65	375	15	67	17
West	7:30 AM	0.65	112	128	111	351	32	36	32

Entire Intersection

North	8:00 AM	0.92	87	262	71	420	21	62	17
East		0.88	83	196	33	312	27	63	11
South		0.88	53	249	64	366	14	68	17
West		0.79	96	159	82	337	28	47	24

Site Code : 00002548
N-S Street: Rt 137
E- Street: Rt 39
Weather : Clear

PAGE: 1
FILE: 2548

Movements by: Cars

DATE: 6/04/98

Time Begin	From North RT	THRU	LT	From East RT	THRU	LT	From South RT	THRU	LT	From West RT	THRU	LT	Vehicle Total
7:00 AM	18	52	7	6	27	9	9	42	16	8	18	17	229
7:15	17	50	7	14	23	10	13	37	8	24	33	5	241
7:30	15	44	11	13	24	6	10	55	18	50	30	50	326
7:45	23	67	11	14	36	6	17	58	13	15	25	23	308
HR TOTAL	73	213	36	47	110	31	49	192	55	97	106	95	1104
8:00 AM	15	61	17	14	44	7	9	59	15	21	26	14	302
8:15	19	61	13	18	49	6	12	62	13	14	41	19	327
8:30	22	64	19	22	44	10	18	62	18	18	49	16	362
8:45	25	63	21	26	51	10	14	52	13	38	39	27	379
HR TOTAL	81	249	70	80	188	33	53	235	59	91	155	76	1370
DAY TOTAL	154	462	106	127	298	64	102	427	114	188	261	171	2474

PEAK PERIOD ANALYSIS FOR THE PERIOD: 7:00 AM - 9:00 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	Thru	Left	Total	PERCENTS Right	Thru	Left
North	8:00 AM	0.92	81	249	70	400	20	62	18
East	8:00 AM	0.86	80	188	33	301	27	62	11
South	7:45 AM	0.91	56	241	59	356	16	68	17
West	7:30 AM	0.63	100	122	106	328	30	37	32

Entire Intersection

North	8:00 AM	0.92	81	249	70	400	20	62	18
East		0.86	80	188	33	301	27	62	11
South		0.89	53	235	59	347	15	68	17
West		0.77	91	155	76	322	28	48	24

Cape Cod Commission

Site Code : 00002548
N Street: Rt 137
E Street: Rt 39
Weather : Clear

Movements by: Trucks

DATE: 6/04/98

T e	From North			From East			From South			From West			Vehicle
Begin	RT	THRU	LT	RT	THRU	LT	RT	THRU	LT	RT	THRU	LT	Total
00 AM	0	1	0	0	0	0	0	0	0	0	0	0	1
.15	1	1	0	1	0	0	0	1	2	1	3	0	10
7:30	3	5	1	1	2	0	0	1	0	3	0	1	17
45	0	7	1	2	2	0	1	3	1	4	3	1	25
H TOTAL	4	14	2	4	4	0	1	5	3	8	6	2	53
00 AM	2	6	0	1	2	0	0	6	2	4	3	2	28
15	1	4	0	0	3	0	0	0	0	1	0	1	10
8:30	0	2	0	1	2	0	0	3	3	0	0	2	13
8:45	3	1	1	1	1	0	0	5	0	0	1	1	14
H TOTAL	6	13	1	3	8	0	0	14	5	5	4	6	65
DAY TOTAL	10	27	3	7	12	0	1	19	8	13	10	8	118

PEAK PERIOD ANALYSIS FOR THE PERIOD: 7:00 AM - 9:00 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	Thru	Left	Total	PERCENTS Right	Thru	Left
North	7:30 AM	0.83	6	22	2	30	20	73	7
East	7:30 AM	0.81	4	9	0	13	31	69	0
South	7:45 AM	0.59	1	12	6	19	5	63	32
West	7:15 AM	0.69	12	9	4	25	48	36	16

Entire Intersection

North	7:15 AM	0.75	6	19	2	27	22	70	7
East		0.69	5	6	0	11	45	55	0
South		0.53	1	11	5	17	6	65	29
West		0.69	12	9	4	25	48	36	16

SITE # 20502

Year 1996

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 137 Serial # 652500

ORIENT N of CMS

ROAD Rt 39 Lookups!

Begin Date 6/25/96 Tue 0.86

End Date 6/27/96 Thu 0.86

6 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X ☐

WEATHER Clear

	Total	DR 1 NB	DR 2 SB
RAW ADT	15597	7863	7736
PH VOL	1270	657	613
PH Date	6/25/96	6/25/96	6/25/96
PH tod	16	16	16
4~5 Av	1250	650	601
AADT	13,413	6,762	6,653

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

O MEANS - do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

Year	AADT
1987	6820
1996	13415

$\frac{13415 - 6820}{6820}$ = 97% increase / 9 years = 11% / year

SITE # 20502

Year 1989

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 137 Serial # 652500

ORIENT N of CMS

ROAD Rt 39 Lookups!

Begin Date 07/07/89 Fri 0.72

End Date 07/10/89 Mon 0.72

7 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X: X W

WEATHER Mixed sun

	Total	DR 1 NB	DR 2 SB
RAW ADT	11976	5799	6177
PH VOL	1004	500	562
PH Date	7/8/89	7/8/89	7/8/89
PH tod	11	10	13
4-5 Av	929	459	470
AADT	8,623	4,175	4,447

For exciting information on printing different layouts, finding -sorting -printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do lookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/27/98

Beg WO Count Season

Year	AADT
1987	6820
1989	8625

$$\frac{8625 - 6820}{6820} = 26\% / 2 \text{ years}$$

13 % year

SITE # 20502

Year 1987

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 137 Serial # 652500

ORIENT N of CMS

ROAD Rt 39 Lookups!

Begin Date 06/10/87 Wed 0.85

End Date 06/12/87 Fri 0.85

4 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X ☐

WEATHER Sun & rain

	Total	DR 1 NB	DR 2 SB
RAW ADT	8025		
PH VOL	689		
PH Date	6/12/87		
PH tod	14		
4-5 Av	646		
AADT	6,821		

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

SITE # 20503

Year: 1995

TN: 8 TOWN: Harwich TN2: 2nd TOWN:
ROUTE: Rt 137 Serial #: 652500
ORIENT: S of CMS:
ROAD: Rt 39 Lookups!

Begin Date: 6/21/95 Wed 0.86
End Date: 6/23/95 Fri 0.86
WEATHER: Clear

5 Requests by MHD: [ ] Type M
Done by other agency: [ ] T = true

Extra or Extraneous Type an X: [ ]

	Total	DR 1 NB	DR 2 SB
RAW ADT	11735	5779	5956
PH VOL	1005	530	475
PH Date	6/22/95	6/22/95	6/22/95
PH tod	16	16	16
4-5 Av	1005	530	475
AADT	10,092	4,970	5,122

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS: do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed: 1/6/98

Beg WO Count Season

Year	AADT
1995	10090
1987	5550

$\frac{10090 - 5550}{5550} = 82\%$ increase / 8 = 10% / year

Year	AADT
1989	6525
1995	10095

$\frac{10095 - 6525}{6525} = 55\%$ / 6 years

9% / year

SITE # 20503

Year 1989

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 137 Serial # 652500

ORIENT S of CMS

ROAD Rt 39 Lookups!

Begin Date 07/07/89 Fri 0.72

End Date 07/10/89 Mon 0.72

7 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X: X W

WEATHER Mixed sun

	Total	DR 1 NB	DR 2 SB
RAW ADT	9063	4581	4482
PH VOL	819	435	410
PH Date	7/8/89	7/8/89	7/8/89
PH tod	11	10	11
4-5 Av	731	349	382
AADT	6,525	3,298	3,227

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout – accessible by changing from "Entries" in the upper left-hand corner.

O MEANS - done lookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/27/98

Beg WO Count Season

Year	AADT
1987	5550
1989	6525

$\frac{6525 - 5550}{5550} = 18\% / 2 \text{ years}$

9% / year

SITE # 20503

Year 1987

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 137 Serial # 652500

ORIENT S of CMS

ROAD Rt 39 Lookups!

Begin Date 06/10/87 Wed 0.85

End Date 06/12/87 Fri 0.85

4 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X ☐

WEATHER Sun & rain

	Total	DR 1 NB	DR 2 SB
RAW ADT	6531		
PH VOL	557		
PH Date	6/12/87		
PH tod	14		
4-5 Av	462		
AADT	5,551		

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout – accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

SITE # 20522

Year 1996

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655000

ORIENT E of CMS

ROAD Rt 137 Lookups!

Begin Date 8/19/96 Mon 0.75

End Date 8/21/96 Wed 0.75

14 Requests by MHD [ ] Type M

Done by other agency [ ] T = true

Extra or Extraneous Type an X [ ]

WEATHER Clear

	Total	DR 1 EB	DR 2 WB
RAW ADT	8586	4288	4296
PH VOL	684	378	377
PH Date	8/19/96	8/19/96	8/19/96
PH tod	12	12	16
4-5 Av	728	365	362
AADT	6,440	3,216	3,222

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

Year	AADT
1996	6440
1987	3220

$\frac{6440 - 3220}{3220}$ = 100% increase / 9 year = 11% / year

Year	AADT
1992	4800
1996	6440

$\frac{6440 - 4800}{4800}$ = 34% / 4 year = 8.5% / year

SITE # 20522

Year 1992

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655000

ORIENT E of CMS

ROAD Rt 137 Lookups!

Begin Date 07/20/92 Mon 0.75

End Date 07/23/92 Thu 0.75

10 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X ☐

WEATHER Mixed

	Total	DR 1 EB	DR 2 WB
RAW ADT	6400	3179	3221
PH VOL	567	302	279
PH Date	7/21/92	7/21/92	7/22/92
PH tod	16	16	16
4-5 Av	548	280	268
AADT	4,800	2,384	2,416

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS: do relookups on these fields before publishing each year.

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

Year	AADT
1989	3685
1992	4800

$\frac{4800-3685}{3685} = 30\% / 3$ yrs

10% / yr

SITE # 20522

Year 1989

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655000

ORIENT E of CMS

ROAD Rt 137 Lookups!

Begin Date	07/07/89	Fri	0.72	7
End Date	07/09/89	Sun	0.72	

Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X: X W

WEATHER Sunny

	Total	DR 1 EB	DR 2 WB
RAW ADT	5118	2530	2588
PH VOL	442	260	235
PH Date	7/8/89	7/8/89	7/8/89
PH tod	15	13	15
4-5 Av	424	212	212
AADT	3,685	1,822	1,863

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

* MEANS - do recalcknes on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/27/98

Beg WO Count Season

Year	AADT
1987	3220
1989	3685

$\frac{3685 - 3220}{3220} = 14\% / 2 \text{ years}$

7% year

SITE # 20522

Year 1987

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655000

ORIENT E of CMS

ROAD Rt 137 Lookups!

Begin Date 06/10/87 Wed 0.85

End Date 06/12/87 Fri 0.85

4

Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X ☐

WEATHER Sun & rain

	Total	DR 1 EB	DR 2 WB
RAW ADT	3787		
PH VOL	333		
PH Date	6/11/87		
PH tod	14		
4-5 Av	328		
AADT	3,219		

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year.

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

SITE # 20523

Year 1989

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655100

ORIENT W of CMS

ROAD Rt 137 Lookups!

Begin Date 07/07/89 Fri 0.72

End Date 07/10/89 Mon 0.72

WEATHER Mixed sun

7 Requests by MHD Type M

Done by other agency T = true

Extra or Extraneous Type an X: X W

	Total	DR 1 EB	DR 2 WB
RAW ADT	7582	3713	3869
PH VOL	699	359	345
PH Date	7/8/89	7/8/89	7/8/89
PH tod	11	11	10
4-5 Av	624	317	307
AADT	5,459	2,673	2,786

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year.

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/27/98

Beg WO Count Season

Year	AADT
1987	4400
1996	

4400 × 1.98 = 8712

Year	AADT
1987	4400
1939	5460

$\frac{5460 - 4400}{4400} = 24\%$ / 2 years

12%/year

SITE # 20523

Year 1987

TN 8 TOWN Harwich TN2 2nd TOWN

ROUTE Rt 39 Serial # 655100

ORIENT W of CMS

ROAD Rt 137 Lookups!

Begin Date 06/10/87 Wed 0.85

End Date 06/12/87 Fri 0.85

4 Requests by MHD ☐ Type M

Done by other agency ☐ T = true

Extra or Extraneous Type an X

WEATHER Sun & rain

	Total	DR 1 EB	DR 2 WB
RAW ADT	5175		
PH VOL	453		
PH Date	6/10/87		
PH tod	16		
4-5 AV	432		
AADT	4,399		

For exciting information on printing different layouts, finding +sorting +printing all counts in a given town, etc., check out the "Readme Print" layout - accessible by changing from "Entries" in the upper left-hand corner.

MEANS - do relookups on these fields before publishing each year

The Boneyard

WARNING: Do not attempt to type in the GREEN Areas these are Lookups!

Changed 1/6/98

Beg WO Count Season

Appendix B
Accidents

Town		DOW#	Month#	Year
8	Harwich	2	1	1994

MHD Accident Report Data

Case #	2262007
Type	Inju
Date	1/10/94-Monday
Hour	1
#Veh.	1
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	E
Manner	Unknown
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RTE. 137
Minor Street	RTE. 39

Town		DOW#	Month#	Year
8	Harwich	3	6	1994

MHD Accident Report Data

Case #	2343309
Type	Inju
Date	6/7/94-Tuesday
Hour	16
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	N S
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	3	6	1994

MHD Accident Report Data

Case #	2344659
Type	Inju
Date	6/14/94-Tuesday
Hour	17
#Veh.	2
#Inj.	4
#Kill.	0
Veh. Dir. 1 2 3	W E
Manner	Head_on
Light	Dawn_or_
Weather	Cloud
Surface	No_Defects
Major Street	RTE 137
Minor Street	RTE. 39

Town		DOW#	Month#	Year
8	Harwich	5	7	1994

MHD Accident Report Data

Case #	2360205
Type	Inju
Date	7/14/94-Thursday
Hour	13
#Veh.	2
#Inj.	2
#Kill.	0
Veh. Dir. 1 2 3	E N
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	4	8	1994

MHD Accident Report Data

Case #	2379475
Type	Prop
Date	8/24/94-Wednesday
Hour	12
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	E S
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RTE 137
Minor Street	RTE 39

Town		DOW#	Month#	Year
8	Harwich	5	8	1994

MHD Accident Report Data

Case #	2381895
Type	Inju
Date	8/25/94-Thursday
Hour	21
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	S E
Manner	Angle
Light	Darkness
Weather	Clear
Surface	No_Defects
Major Street	ROUTE 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	7	9	1994

MHD Accident Report Data

Case #	2395535
Type	Hit_
Date	9/17/94-Saturday
Hour	14
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	
Manner	Angle
Light	Darkness
Weather	Foggy
Surface	No_Defects
Major Street	RTE 137
Minor Street	RTE 39

Town	DOW#	Month#	Year
8 Harwich	4	5	1995

MHD Accident Report Data

Case #	2526960
Type	Prop
Date	5/31/95-Wednesday
Hour	8
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	S N
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	6	6	1995

MHD Accident Report Data

Case #	2546804
Type	Prop
Date	6/23/95-Friday
Hour	18
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RTE 137
Minor Street	RTE 39

Town	DOW#	Month#	Year
8 Harwich	1	7	1995

MHD Accident Report Data

Case #	2553713
Type	Prop
Date	7/30/95-Sunday
Hour	14
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	W W
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	5	9	1995

MHD Accident Report Data

Case #	2575296
Type	Inju
Date	9/7/95-Thursday
Hour	24
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	E E
Manner	Angle
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	3	10	1995

MHD Accident Report Data

Case #	2588374
Type	Prop
Date	10/10/95-Tuesday
Hour	9
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	E E
Manner	Unknown
Light	Daylight
Weather	Clear
Surface	No_Defects
Major Street	RT 137
Minor Street	RT 39

Town	DOW#	Month#	Year
8 Harwich	2	1	1996

MHD Accident Report Data

Case #	02635230
Type	Property Only
Date	1/8/96-Monday
Hour	10
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	W W
Manner	REAR
Light	Daylight
Weather	Snowy
Surface	Snow
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	4	4	1996

MHD Accident Report Data

Case #	02699159
Type	Property Only
Date	4/17/96-Wednesday
Hour	23
#Veh.	1
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	W
Manner	UNKNW
Light	Dark(Road Lit)
Weather	Dry
Surface	Clear
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	7	8	1996

MHD Accident Report Data

Case #	02768904
Type	Injury Accident
Date	8/24/96-Saturday
Hour	13
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	N N
Manner	ANGL
Light	Daylight
Weather	Dry
Surface	Cloudy
Major Street	ORLEANS RD
Minor Street	RTE 137

Town	
8	Harwich

DOW#	Month#	Year
5	8	1996

MHD Accident Report Data

Case #	02769152
Type	Property Only
Date	8/29/96-Thursday
Hour	07
#Veh.	2
#Inj.	0
#Kill.	0
Veh. Dir. 1 2 3	S N
Manner	REAR
Light	Daylight
Weather	Dry
Surface	Clear
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	4	10	1996

MHD Accident Report Data

Case #	02793257
Type	Injury Accident
Date	10/9/96-Wednesday
Hour	12
#Veh.	2
#Inj.	3
#Kill.	0
Veh. Dir. 1 2 3	S N
Manner	ANGL
Light	Daylight
Weather	Dry
Surface	Cloudy
Major Street	RTE 137
Minor Street	RTE 39

Town		DOW#	Month#	Year
8	Harwich	6	10	1996

MHD Accident Report Data

Case #	02797998
Type	Injury Accident
Date	10/25/96-Friday
Hour	17
#Veh.	2
#Inj.	2
#Kill.	0
Veh. Dir. 1 2 3	S N
Manner	ANGL
Light	Daylight
Weather	Dry
Surface	Clear
Major Street	RT 137
Minor Street	RT 39

Town	DOW#	Month#	Year
8 Harwich	6	12	1996

MHD Accident Report Data

Case #	02824004
Type	Injury Accident
Date	12/6/96-Friday
Hour	17
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	N W
Manner	ANGL
Light	Dark(Road Lit)
Weather	Dry
Surface	Rain
Major Street	RT 137
Minor Street	RT 39

Town		DOW#	Month#	Year
8	Harwich	3	12	1996

MHD Accident Report Data

Case #	02835088
Type	Injury Accident
Date	12/31/96-Tuesday
Hour	10
#Veh.	2
#Inj.	1
#Kill.	0
Veh. Dir. 1 2 3	E W
Manner	ANGL
Light	Daylight
Weather	Icy
Surface	Snow
Major Street	RTE 137
Minor Street	RTE 39

Appendix C
Trip Generation

Quad #	ID #	Lot Size (Acres)	Potential Additional Gross Floor Area (sf)	Building Size (sf)	Land Use*	Additional Trip Generation Peak Hour	Daily
I	A14	1.94	13218	9253	Retail Store	71	712
				3965	Services\Office	13	100
I	B15	6.3	44750	31325	Retail Store	240	2412
				13425	Services\Office	44	337
I	B16	3.9	27600	19320	Retail Store	148	1487
				8280	Services\Office	27	208
I	B17	5.77	71900	50330	Retail Store	385	3875
				21570	Services\Office	70	542
TOTAL		**17.91**	**157468**			998	9673
II	A1	18.12	48000	33600	Retail Store	257	2587
				14400	Services\Office	47	362
II	A2	1.26	1300	910	Retail Store	7	70
				390	Services\Office	1	10
II	A3	1.15	500	350	Retail Store	3	27
				150	Services\Office	0	4
II	A4	1.46	7600	5320	Retail Store	41	410
				2280	Services\Office	7	57
II	B1	2.55	18000	12600	Retail Store	96	970
				5400	Services\Office	18	136
II	B3	1.39	9700	6790	Retail Store	52	523
				2910	Services\Office	9	73
TOTAL		**25.93**	**85100**			**538**	**5229**
III	A5	1.15	5786	4050	Retail Store	31	312
				1736	Services\Office	6	44
III	B4	7.41	52700	36890	Retail Store	282	2840
				15810	Services\Office	52	397
III	B5	3.43	24300	17010	Retail Store	130	1310
				7290	Services\Office	24	183
TOTAL		**11.99**	**82786**			**525**	**5086**
IV	A7	6.9	23400	16380	Retail Store	125	1261
				7020	Services\Office	23	176
IV	A8	1.48	8700	6090	Retail Store	47	469
				2610	Services\Office	9	66
IV	A9	3.4	24050	16835	Retail Store	129	1296
				7215	Services\Office	24	181
IV	B6&7	3.58	25150	17605	Retail Store	135	1355
				7545	Services\Office	25	189
IV	B8	1.68	11800	8260	Retail Store	63	636
				3540	Services\Office	12	89
IV	B9	1.13	7850	5495	Retail Store	42	423
				2355	Services\Office	8	59
IV	B10	3.58	25300	17710	Retail Store	135	1363
				7590	Services\Office	25	191
IV	B12	3.77	26700	18690	Retail Store	143	1439
				8010	Services\Office	26	201
IV	B13	2.9	20500	14350	Retail Store	110	1105
				6150	Services\Office	20	154
IV	B14	2.5	17600	12320	Retail Store	94	949
				5280	Services\Office	17	133
TOTAL		**30.92**	**191050**			**1212**	**11735**
GRAND TOTAL		**86.75**	**516404**			**3273**	**31723**
			Total Retail	361483		2766	27831
			Total Service	154921		507	3892

* Assumes the commerical development be comprized of 70 percent retail and 30 percent office/service space.

Quad #	ID #	Lot Size (Acres)	Potential Additional Gross Floor Area (sf)	Building Size (sf)	Land Use*	Additional Trip Generatio Peak Hour	Daily
I	A14	1.94	13218	9253	Retail Store	71	712
				3965	Services\Office	13	100
I	C1	15.97	144250	100975	Retail Store	633	6247
				43275	Services\Office	74	605
TOTAL	**5**	**17.91**	**157468**			**791**	**7664**
II	A2	1.26	1300	910	Retail Store	7	70
				390	Services\Office	1	10
II	A3	1.15	500	350	Retail Store	3	27
				150	Services\Office	0	4
II	A4	1.46	7600	5320	Retail Store	41	410
				2280	Services\Office	7	57
II	B3	1.39	9700	6790	Retail Store	52	523
				2910	Services\Office	9	73
II	C2	20.67	66000	46200	Retail Store	290	2858
				19800	Services\Office	34	277
TOTAL	**5**	**25.93**	**85100**			**444**	**4309**
III	A5	1.15	5786	4050	Retail Store	31	312
				1736	Services\Office	6	44
III	C3	10.84	77000	53900	Retail Store	338	3335
				23100	Services\Office	40	323
TOTAL	**3**	**11.99**	**82786**			**415**	**4014**
IV	A7	6.9	23400	16380	Retail Store	125	1261
				7020	Services\Office	23	176
IV	A8	1.48	8700	6090	Retail Store	47	469
				2610	Services\Office	9	66
IV	A9	3.4	24050	16835	Retail Store	129	1296
				7215	Services\Office	24	181
IV	C4	9.97	70100	49070	Retail Store	308	3036
				21030	Services\Office	36	294
IV	C5	9.17	64800	45360	Retail Store	284	2806
				19440	Services\Office	33	272
TOTAL	**6**	**30.92**	**191050**			**1018**	**9857**
GRAND TOTAL	**19**	**86.75**	**516404**			**2668**	**25844**

* Assumes the commerical development be comprized of 70 percent retail and 30 percent office/service space.