

ROUTE 28 - BOURNE  
General MacArthur Boulevard  
Traffic Circulation Study

\*\*\* DRAFT REPORT \*\*\*

by the  
Cape Cod Planning and Economic Development Commission

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CLIENT DRAFT

Route 28 - General MacArthur Boulevard

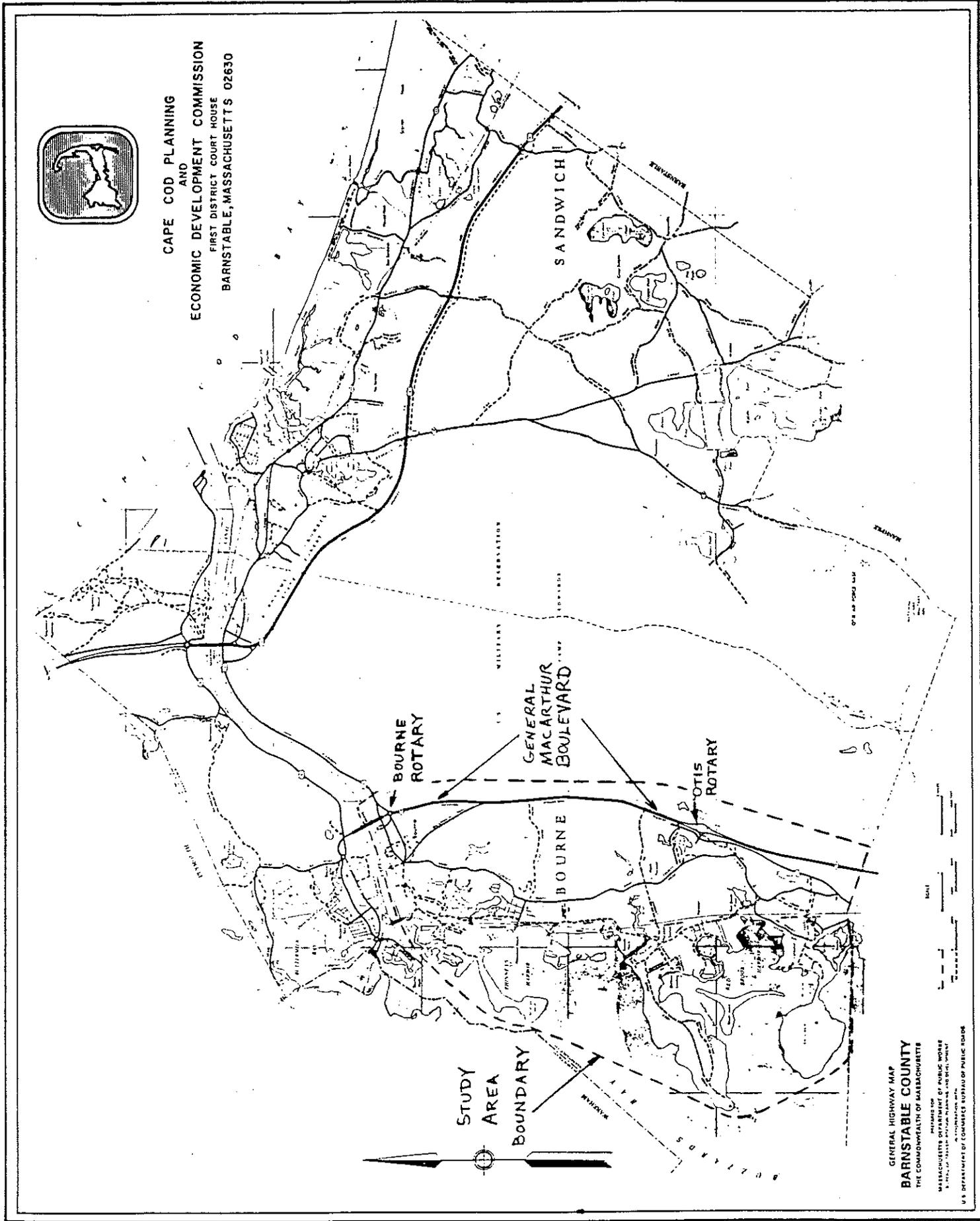
Traffic Circulation Study

INTRODUCTION

General MacArthur Boulevard is a four-mile section of Route 28 in Bourne between the Bourne Rotary and the Otis Rotary (see Figure 1). The highway serves two main purposes. Its primary purpose is as a regional highway from the Bourne Bridge to Falmouth and Mashpee. Since Falmouth is an access point to the islands, the highway also serves travellers to and from Nantucket and Martha's Vineyard. As a secondary purpose, MacArthur Boulevard provides direct access to considerable commercial development including retail, office and light industrial uses.

In recent years, several significant developments have been constructed or proposed along this section of Route 28. Several Environmental Impact Reports (EIRs) prepared by traffic consultants for these developments predicted a marked degradation

FIGURE 1 - STUDY AREA



in traffic operations and safety because of the cumulative impacts of the area's development and the increase in background traffic. While many EIRs recommended various forms of mitigation, the studies did not present a comprehensive plan of mitigation which would maintain safety and traffic flow.

As a result, the Massachusetts Department of Public Works (MDPW) requested that the Cape Cod Planning and Economic Development Commission (CCPEDC), which is carrying out a Corridor Planning Study for the entire length of Route 28 on Cape Cod, concentrate its initial efforts along this section of Route 28. In this assignment, CCPEDC was asked to evaluate existing conditions, assess the impact of proposed and expected new development in the area, and work with MDPW District 7 engineers to identify measures which might be taken to preserve the regional transportation capabilities of this important state highway link.

#### Method

The methodology for this study can be divided into two main parts. The first is data collection and analysis related to safety. This includes the gathering, review and analysis of accident reports and conflict data. The other main part is the development of a computer model of Route 28 and its environs to analyze traffic flows and the impacts of future development. The

area modelled (referred to as the "network") is bounded roughly by the Cape Cod Canal to the north, the Massachusetts Military Reservation to the east, the Bourne/Falmouth town line to the south and Buzzard's Bay to the west. Data inputs include length, capacity, and travel times/speeds of all roadways within the network; land-use and socio-economic data; and traffic volumes and turning movement counts at selected locations in the study area. Using the computer model, various alternatives and traffic projections can be analyzed to determine impacts on the area roads.

Key differences between the methodology of the CCPEDC study and that used in the studies performed by private consultants is that the primary focus of the CCPEDC study is on safety, not simply level-of-service. All other EIRs were deficient in this regard, none contained a complete set of accident reports for MacArthur Boulevard. Also, the traffic volume analyses in the CCPEDC study show system-wide changes in traffic volumes, not simply changes at site drives and streets adjacent to the sites. This is a superior method to analyze the total effects of new development and to evaluate alternative mitigation measures.

#### Existing Conditions

A system for identifying locations along MacArthur Boulevard is

presented in Figure 2. The scale used in this report is referred to by the "CCPEDC STATION" numbers found on the right hand side. Station 0+00 is the location on MacArthur Boulevard immediately south of the Bourne Rotary. The existing U-turns are identified by the CCPEDC Station and the U-turn direction. For example, 113+25 N-S designates a U-turn 11,325 feet (about 2 miles - near Otis Park Drive) south of the Bourne Rotary, used by northbound traffic to reverse direction to southbound. The station numbering used on MDPW plans as well as the mile markers are also shown on Figure 2.

#### GEOMETRICS:

The construction of MacArthur Boulevard began with the northbound lanes, which were completed in 1937. The southbound lanes were added in 1941. The present four-mile/four-lane configuration has remained largely unchanged since that time with the exception of changes to U-turns and additional curb cuts along the southbound lanes.

Each of the travel lanes are 12 feet wide. The two directions of travel are separated by a wooded median that is in general, between 50 and 100 feet wide. There are nine u-turns located on the Boulevard to reverse direction and/or access secondary streets. Four of these are used to travel from the southbound

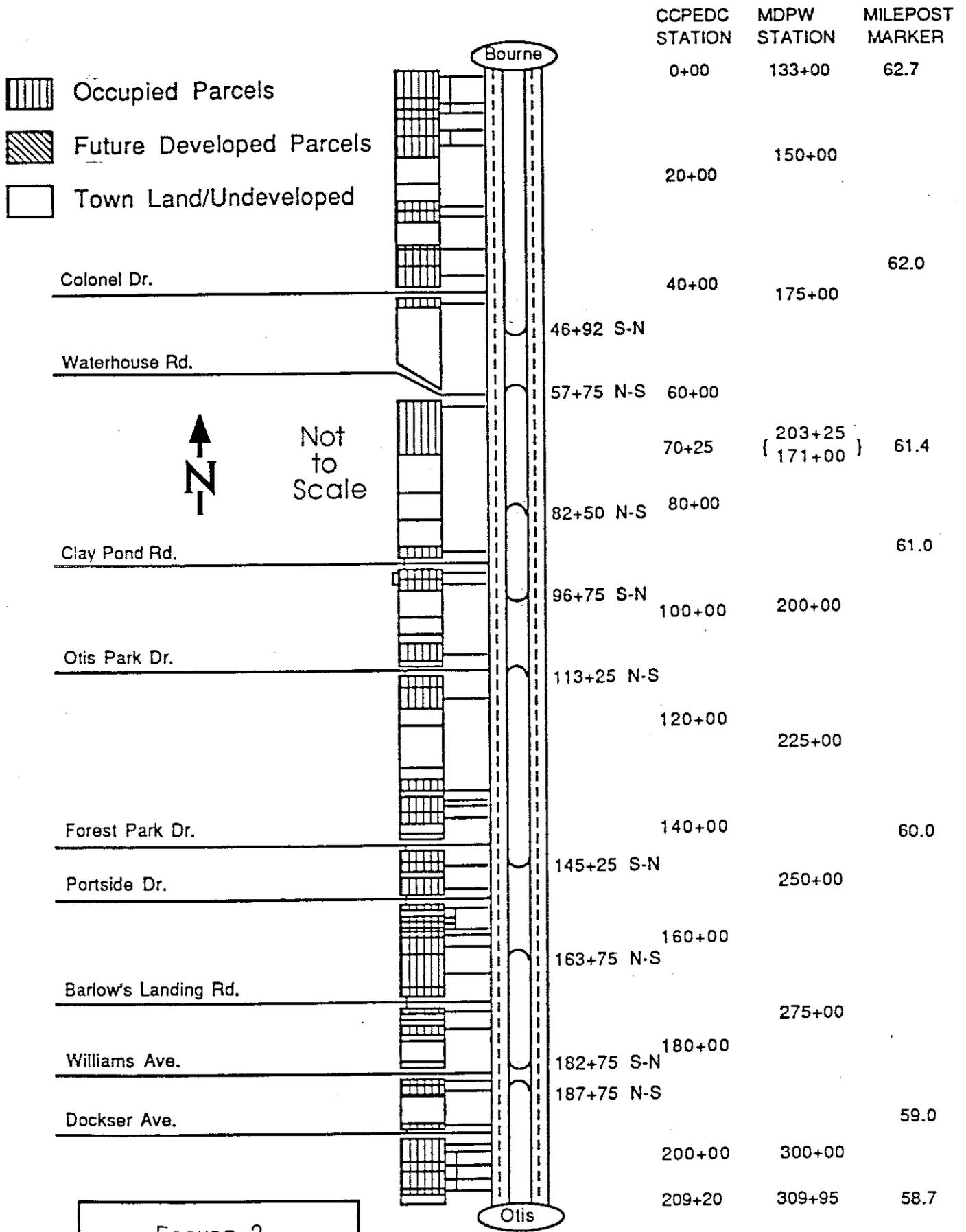


FIGURE 2  
EXISTING CONDITIONS

lanes to the northbound lanes and five are used to travel from the northbound lanes to the southbound lanes.

All curb cuts are along the southbound lanes, with the exception of access to the town land fill and the MDPW garage. On the southbound lanes, there are 51 curb cuts providing access to over 50 businesses located in 43 buildings.

The speed limit is 55 mph on most of MacArthur Boulevard. Exceptions are reduced speed limits entering the rotaries and a 40 mph speed limit along the first 1.3 miles southbound (from the Bourne Rotary to just beyond Waterhouse Road).

Major roads in the study area that intersect MacArthur Boulevard include Waterhouse Road, Clay Pond Road and Barlows Landing Road. These are essentially 24 feet wide, two lane roads. Waterhouse Road has a "Y" configuration and is yield controlled. The other two are "T" configurations and are stop sign controlled. Several other roads also intersect the southbound lanes of MacArthur Boulevard, many of these are "dead-end" subdivision roads.

#### TRAFFIC VOLUMES:

Cape Cod traffic volumes are extremely seasonal in nature. Peak season verses annual traffic volumes for the primary roads in the study area are as follows:

	Annual	Summer
Bourne Bridge	32,734	46,708
Mac Blvd (near Bourne Rotary)	25,649	35,027
Mac Blvd (near Otis Rotary)	28,020	38,383
Clay Pond Road	4,026	5,079
Waterhouse Road	1,398	1,963
Trowbridge Road	6,167	8,661
Barlows Landing Road	5,416	7,396
County Road	3,298	4,637
Shore Road	4,984	6,436

#### ACCIDENTS:

Any comprehensive accident analysis involves two principal stages: identification and classification of hazardous road locations; and a diagnosis of accident causation with recommendations for improvement. In this study, accident data was gathered from both Bourne Police and State Police accident reports. The most recent two years of accident data (November 1986 through October 1988) were analyzed for the purposes of this report. A detailed analysis of the accident history along MacArthur Boulevard during this 24 month period is presented in the following section.

## SAFETY ANALYSES



### Accident History

A total of 109 reported accidents occurred on MacArthur Boulevard between November 1986 and October 1988, inclusively. Of the 109 accidents, 31 occurred at the Bourne Rotary, 10 occurred at the Otis Rotary and 68 occurred on MacArthur Boulevard (26 on Route 28 northbound and 42 on Route 28 southbound). Figure 3 shows the locations of the accidents which occurred on MacArthur Boulevard (a more detailed map of accident locations can be found in Appendix A). The exact locations of 8 of these 68 accidents could not be determined from the accident reports.

Table 1 contains a summary of accidents by type, time-of-day, day-of-week, and month-of-year for MacArthur Boulevard. The breakdown by accident type indicates that a significant portion of the accidents are of the rear-end or angle type collision. Further analysis indicates that the rear-end type accidents are generally two vehicle collisions that involve a vehicle slowing and turning to enter a U-turn, side drive or side street. The angle type accidents are generally two vehicle collisions that involve a vehicle weaving to or from a U-turn, side drive or side street.

The breakdown of MacArthur Boulevard accidents by time-of-day,

# TABLE 1

## SUMMARY OF ACCIDENT INFORMATION

Study Period - 2 Years

### TYPE OF ACCIDENT

Rear End - 24  
 Angle - 20  
 ROR/HFO - 7  
 Lost Control - 16  
 Unknown - 1

### TIME OF DAY

	12	1	2	3	4	5	6	7	8	9	10	11
AM	0	3	0	1	0	0	1	3	3	0	4	0
PM	1	4	5	5	5	5	4	3	1	1	5	1

### DAY OF WEEK

Sun	Mon	Tue	Wed	Thu	Fri	Sat
11	11	5	10	8	12	10

### MONTH OF YEAR

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
6	2	6	6	9	6	10	6	3	8	2	4

x = Accidents along MacArthur Boulevard

2 Year Study Period  
Nov 1986 - Oct 1988

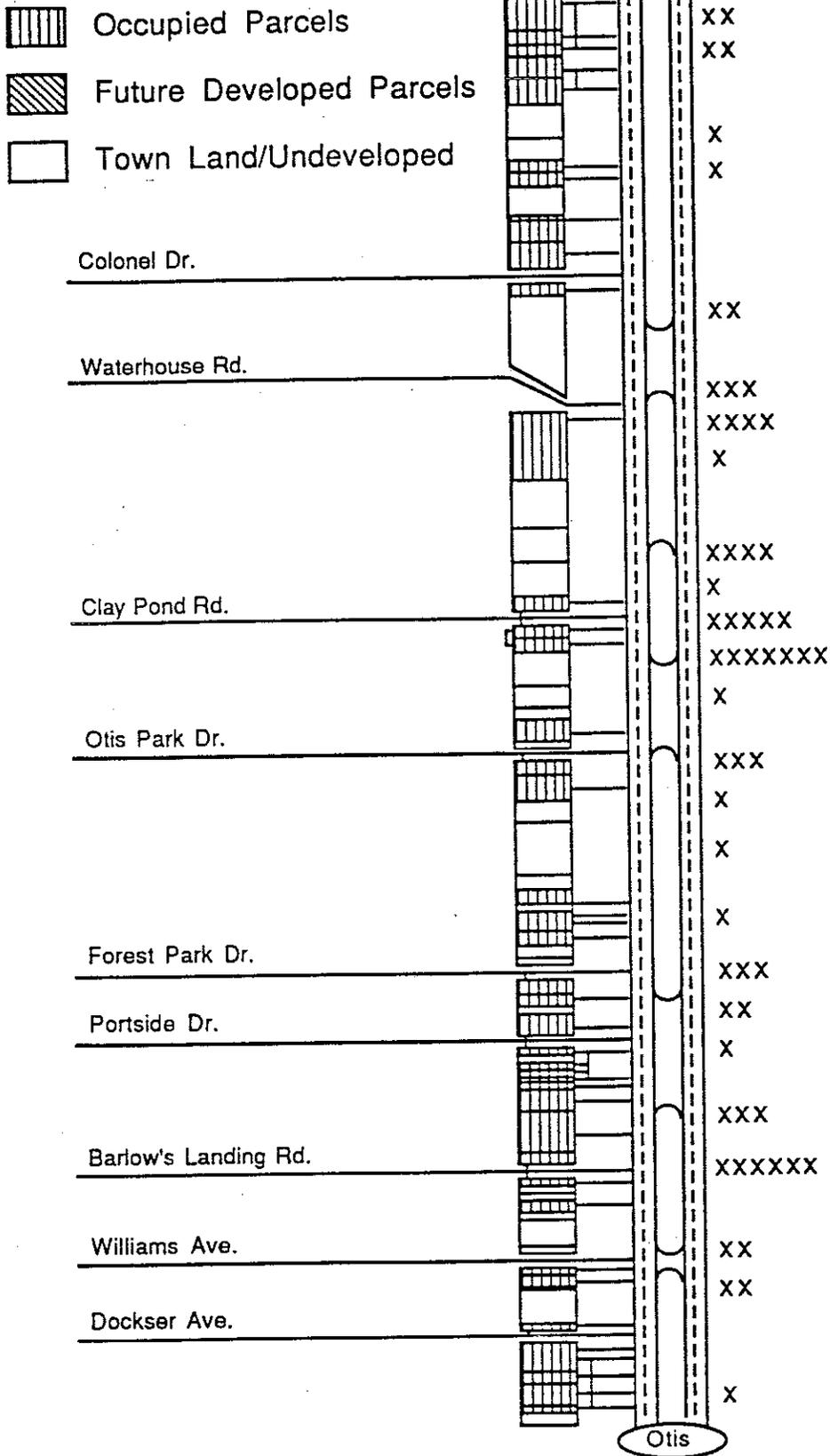


FIGURE 3

day-of-week and month-of-year are shown graphically in Figures 4-6. The breakdown by time-of-day shows a large portion of the accidents occur in the afternoon hours between noon and 6 PM. The breakdown by day-of-week indicates a relatively uniform distribution of accidents with the exception of Tuesday. The accident distribution by month indicates that accidents, in general, are not simply a peak season occurrence. Although the highest number of accidents occurred in May, October and especially July, when traffic volumes along the Boulevard were greatest, a significant number occurred in the "off-season" months of January, March and April.

#### ACCIDENT FREQUENCY AND ACCIDENT RATE:

Hazardous road locations can be identified by accident frequency and accident rate. Accident frequency is simply the number of accidents at a specific location during a specific time period. In this case, the time period was 24 months.

The calculation of the Accident Rate is a numerical technique in which the accident data is compared to the population at risk (also called the "exposure" data). The most common forms of exposure data are Million Entering Vehicles (MEV), used in the analysis of intersections, and Million Vehicle Miles Travelled (MVMT), used in the analysis of road segments. In this study, the

**MACARTHUR BOULEVARD**  
**ACCIDENT DISTRIBUTION BY TIME OF DAY**  
 Study Period: Nov 1986 - Oct 1988

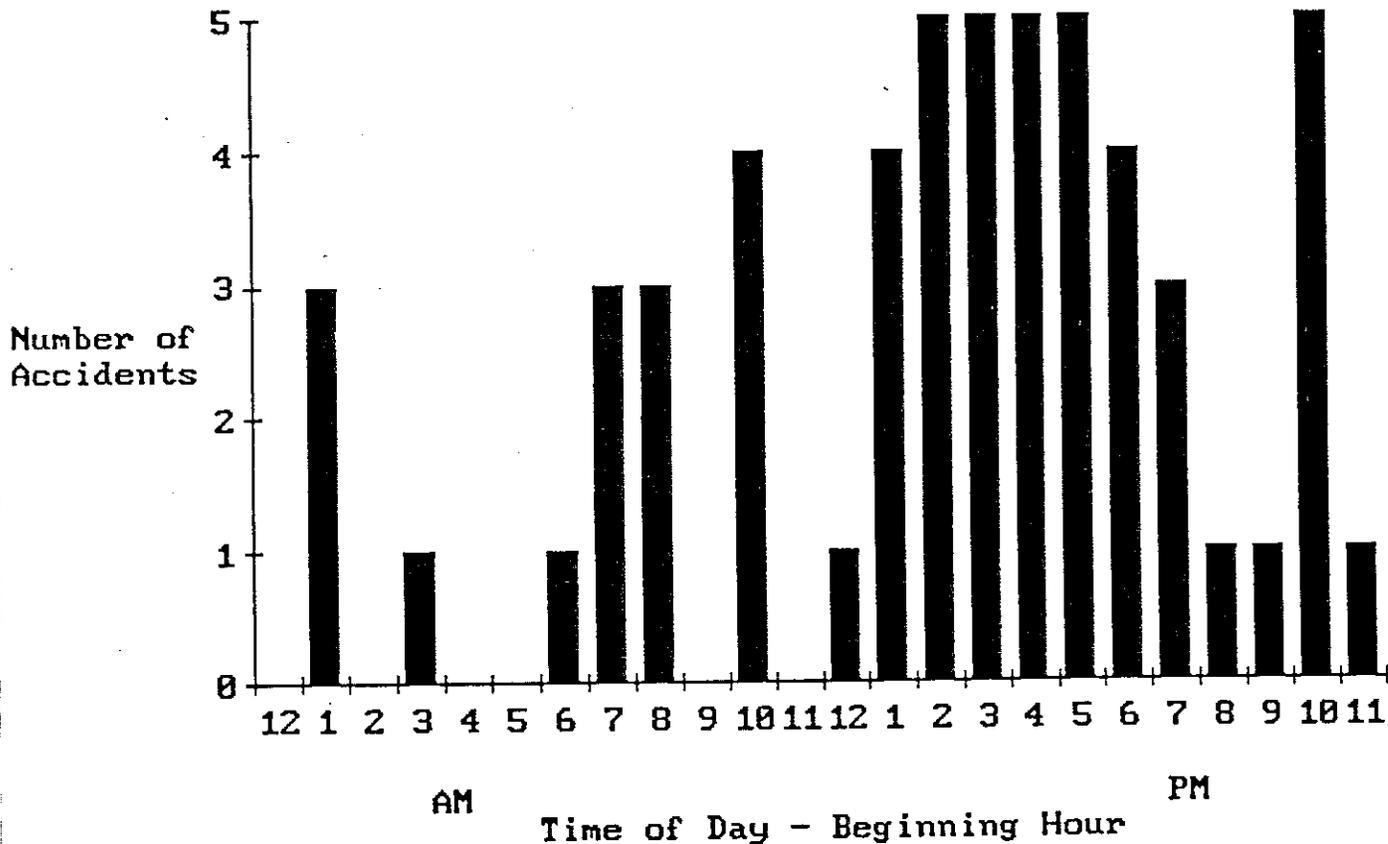


FIGURE 4

MACARTHUR BOULEVARD  
ACCIDENT DISTRIBUTION BY DAY OF WEEK  
Study Period: Nov 1986 - Oct 1988

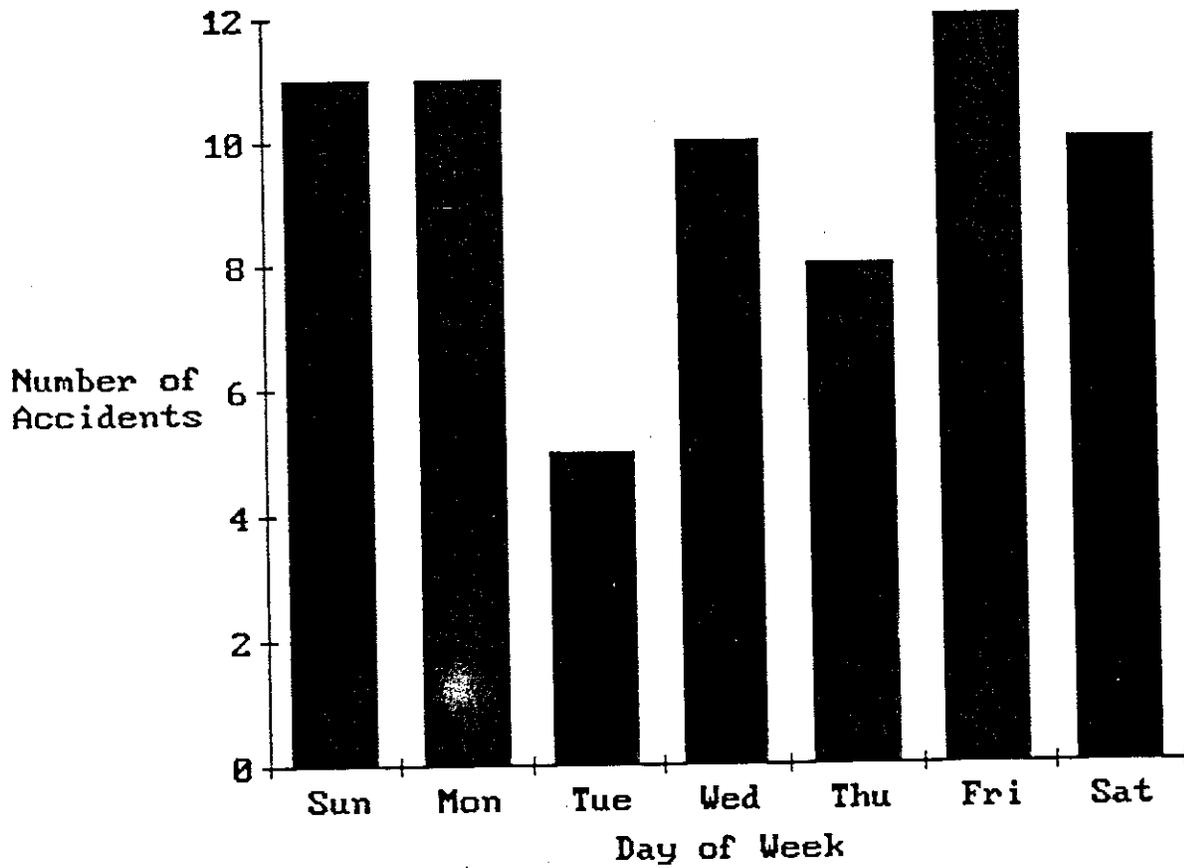
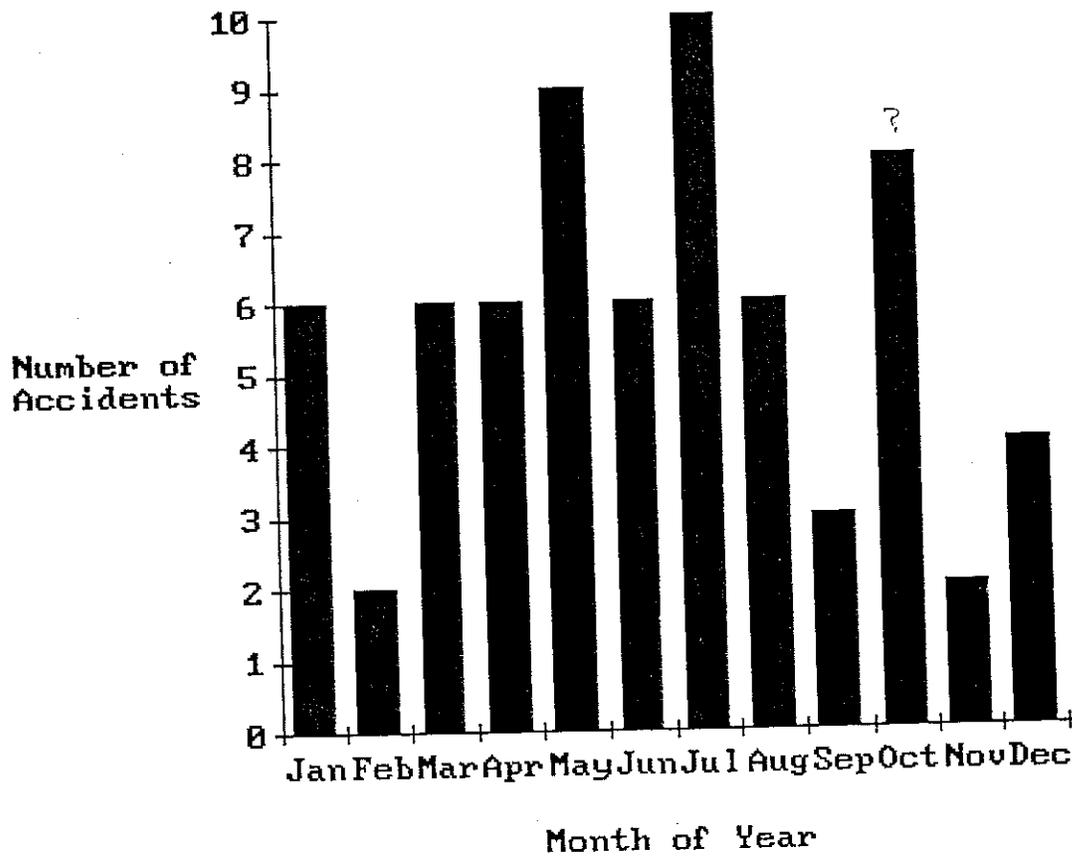


FIGURE 5

MACARTHUR BOULEVARD  
ACCIDENT DISTRIBUTION BY MONTH OF YEAR  
Study Period: Nov 1986 - Oct 1988



accident data on Route 28 NB and SB was compared to both forms of exposure data.

Table 2 contains the accident frequency and accident rate results for all intersection accidents along the Boulevard. Of the 68 accidents which occurred, at least 20 accidents (29%) involved vehicles entering or exiting a U-turn.

Table 3 contains the accident frequency and accident rate results per half-mile segment for all accidents on MacArthur Boulevard. Of the 42 accidents which occurred in the southbound lanes, 21 accidents (50%) involved vehicles entering or exiting site drives.

The accident rate analysis indicates that the sections of MacArthur Boulevard in the vicinity of Clay Pond Road and Barlow's Landing Road have the greatest safety hazards. These areas, or locations of highest risk, are examined more closely to determine the nature and extent of the safety deficiency.

#### LOCATIONS OF HIGHEST RISK:

With a total of 6 accidents, the intersection with Barlows Landing Road is ranked highest based upon both accident frequency and accident rate per MEV. The half-mile segment of Route 28

Intersection Accident Rate  
MacArthur Boulevard

Intersection	Total Accidents in 2 years	MEV in 2 years	Accident Rate per MEV	Rank by Frequency	Rank by Rate
Route 28 @					
Barlows Landing Rd	6	12.27	0.49	1	1
McDonalds site drive	5	11.36	0.44	(2)	2
CPR/McD/Ted/Gen to S-N U-turn 96+75 SB	5	12.82	0.39	(2)	3
N-S U-turn 82+50 SB lanes	2	11.15	0.18	(4)	(7)
S-N U-turn 182+75 SB lanes	2	10.56	0.19	(4)	(6)
Waterhouse Rd/ N-S U-turn 57+75 SB lanes	3	11.34	0.26	(3)	(4)
Clay Pond Rd	3	11.55	0.26	(3)	(4)
S-N U-turn 46+92 NB lanes	2	10.30	0.19	(4)	(6)
N-S U-turn 113+25 SB lanes	2	10.89	0.18	(4)	(7)
N-S U-turn 163+75 NB lanes	2	9.96	0.20	(4)	5

More than one location with same rank = (X)

The above is a conservative analysis.

Only accidents in which the intersection was stated as being a contributing element (i.e. either the accident included a vehicle entering or exiting the intersection, or was stated as being caused by a vehicle entering or exiting the intersection) were included.

Accident Rate per MVM  
Time period - 24 months (730 days)

Southbound Lanes

6 accidents occurred at unknown locations

	Section								Total for Entire Blvd
	0+00- 26+40	26+40- 52+80	52+80- 79+20	79+20- 105+60	105+60- 132+00	132+00- 158+40	158+40- 184+80	184+80 209+20	
<b>Basic Data</b>									
Length in miles	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.46	3.96
ADT x 10(-2)	145	145	145	145	145	145	145	145	145
Total Accidents	2	1	3	15	3	2	9	1	42
Fatal Accidents	0	0	0	0	0	0	0	0	0
Injury Accidents	2	1	3	3	0	0	0	0	12
Property Damage Only	0	0	0	2	1	0	2	0	7
Severity Unknown	0	0	0	6	2	2	7	1	25

Rates

Accidents per mile	4.00	2.00	6.00	30.00	6.00	4.00	18.00	2.17	10.61
Vehicle miles x 10(-6)=M	5.29	5.29	5.29	5.29	5.29	5.29	5.29	4.87	41.92
Accident Rate	0.38	0.19	0.57	2.83	0.57	0.38	1.70	0.21	1.00

Ranking by:

Accidents	(4)	(5)	(3)	1	(3)	(4)	2	(5)
Accidents/mi	(4)	6	(3)	1	(3)	(4)	2	5
Accident Rate	(4)	6	(3)	1	(3)	(4)	2	5

Northbound Lanes

2 accidents occurred at unknown locations

	Section								Total for Entire Blvd
	0+00- 26+40	26+40- 52+80	52+80- 79+20	79+20- 105+60	105+60- 132+00	132+00- 158+40	158+40- 184+80	184+80 209+20	
<b>Basic Data</b>									
Length in miles	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.46	3.96
ADT x 10(-2)	136	136	136	136	136	136	136	136	136
Total Accidents	5	2	5	2	2	4	2	2	26
Fatal Accidents	0	0	0	0	1	0	0	0	1
Injury Accidents	3	1	1	1	1	0	0	1	8
Property Damage Only	2	0	3	0	0	2	2	1	11
Severity Unknown	0	1	1	1	0	2	0	0	6

Rates

Accidents per mile	10.00	4.00	10.00	4.00	4.00	8.00	4.00	4.35	6.57
Vehicle miles x 10(-6)=M	4.96	4.96	4.96	4.96	4.96	4.96	4.96	4.57	39.31
Accident Rate	1.01	0.40	1.01	0.40	0.40	0.81	0.40	0.44	0.66

Ranking by:

Accidents	(1)	(3)	(1)	(3)	(3)	2	(3)	(3)
Accidents/mi	(1)	(4)	(1)	(4)	(3)	2	(4)	3
Accident Rate	(1)	(4)	(1)	(4)	(4)	2	(4)	3

Total Southbound and Northbound

	Section								Total for Entire Blvd
	0+00- 26+40	26+40- 52+80	52+80- 79+20	79+20- 105+60	105+60- 132+00	132+00- 158+40	158+40- 184+80	184+80- 209+20	
<b>Basic Data</b>									
Length in miles	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	3.96
ADT x 10(-2)	281	281	281	281	281	281	281	281	281
Total Accidents	7	3	8	17	5	6	11	3	68
Fatal Accidents	0	0	0	0	1	0	0	0	1
Injury Accidents	5	2	4	4	1	0	0	1	20
Property Damage Only	2	0	3	2	1	2	4	1	18
Severity Unknown	0	1	1	7	2	4	7	1	31
<b>Rates</b>									
Accidents per mile	14	6	16	34	10	12	22	6	17.17
Vehicle miles x 10(-6)=M	10.26	10.26	10.26	10.26	10.26	10.26	10.26	10.26	81.23
Accident Rate	0.68	0.29	0.78	1.66	0.49	0.58	1.07	0.29	0.84
<b>Ranking by:</b>									
Accidents	4	(7)	3	1	6	5	2	(7)	
Accidents/mi	4	(7)	3	1	6	5	2	(7)	
Accident Rate	4	(7)	3	1	6	5	2	(7)	

More than one location with same rank = (X)

which includes Barlows Landing Road is ranked second based upon accident rate per MVM travelled. A total of 11 accidents occurred in this segment, which includes the two U-turns to the north and south of Barlow's Landing Road.

The one-half mile segment which includes Clay Pond Road and the two U-turns to the north and south is another high accident area. The segment is ranked first based upon accident rate per MVM travelled. The McDonalds' site drive, located within this segment, and the U-turn south of Clay Pond Road are ranked second and third, respectively, based upon accident rate per MEV. A total of 17 accidents occurred in this segment.

Based on the accident history, the U-turn at Waterhouse Road is also an area of particular concern.

### Conflict Analysis

The methodology of conflict analysis is described in Manual of Traffic Engineering Studies, 4th edition, published by the Institute of Transportation Engineers and is as follows:

"The counting of traffic conflicts allows an estimate to be made of accident potential at particular locations. Because traffic accident data may be inadequate for analysis of a selected location, checks of conflicts permit some evaluation of the

collision potential without waiting for accidents to happen." A traffic conflict is identified by sudden lane changing, braking to avoid collision, illegal or unsafe maneuvers.

Public comment and field observation have identified the nine U-turns along MacArthur Blvd. as being areas of safety-related concern. Traffic conflict counts were taken at all of the U-turns during August and September 1988. For one-hour periods, three observers were stationed at each U-turn area. Observer 1 was stationed in the median on the concave side of the U-turn and was responsible for recording the number of vehicles using the U-turn, queue lengths, and delay. Observers 2 and 3 were stationed up the traffic streams on both sides of MacArthur Blvd., respectively, and were responsible for counting the approaching traffic volumes and the numbers of conflicts by category. These categories include: Conflicts Due to U-Turning Vehicles, Right Turning Vehicles, Slow Moving Vehicles; and illegal or unsafe maneuvers which may only involve a single vehicle.

Conflict rates were determined various ways based upon this data and can be found in Table 4. Northbound to southbound U-turns 82+50 (north of Clay Pond Rd) and 163+75 (north of Barlows Landing Rd) both had relatively high mainline conflict rates for the reverse direction (the southbound lanes). U-turn 82+50 had the second highest U-turn conflict rate. The highest U-turn

TABLE 4

Conflict Rates for MacArthur Boulevard U-turns

U-turn Direction Link Station Direction	Total Mainline Confl/Total			U-turn Confl/
	Mainline Veh x10(-2)	Intital Dir x10(-3)	Reverse Dir x10(-3)	U-turn Veh. x10(-2)
South of Colonel Dr 81 46+92 S-N	2.8	8.1	55.6	18
Waterhouse Rd 82 57+75 N-S	0.9	17.3	1	8
North of Clay Pond Rd 83 82+50 N-S	8.8	10.7	163.4	52
South of Clay Pond Rd 84 96+75 S-N	4.6	66.5	43.4	18
South of Otis Park Dr 85 113+25 N-S	2	8.1	43.1	15
South of Forest Park Dr 86 145+25 S-N	3.5	44.2	21.2	39
North of Barlows Land Rd 87 163+75 N-S	n/a	3.6	124.8	n/a
North of Williams Ave 88 182+75 S-N	2.5	36.9	13.9	16
South of Williams Ave 89 187+75 N-S	4.4	55.2	30.5	58

conflict rate occurred at northbound to southbound U-turn 187+75 (south of Williams Ave). Although this U-turn has relatively low volumes, the number of conflicts associated with it is high. These U-turns with high conflict rates are indicative of potential safety problems at these locations.

### Diagnosis of Accident Causation

The process of evaluating the information to aggregate accident causation is a complex one. After reviewing all recorded aspects of the accident (such as environmental and road surface conditions, recorded geometrics, intended and actual vehicle maneuvers, etc.), on-site observations of the accident location were made.

In general, the accidents along MacArthur Boulevard cluster around U-turn entrances and exits, and intersections where the number of turning maneuvers are greatest (refer to Figure 3). For the identified high-accident locations, detailed information on accident type and cause is as follows:

Barlows Landing Road and the adjacent U-turns: The majority of accidents which occurred in the vicinity of Barlows Landing Road were of two collision types: REAR and LC (lost control of vehicle). All of the REAR-type collisions were caused by

vehicles exiting Barlows Landing Road and being struck from behind by upcoming vehicles. All of LC-type collisions occurred as a result of vehicles attempting to slow to enter Barlows Landing Road and skidding on either wet or icy pavement. In all cases, the accidents reflect the potential danger created by curb-cuts and numerous turning conflicts along a high speed roadway.

Clay Pond Road and the adjacent U-turns (includes Tedeschi and McDonalds site drives): Of all the accidents that occurred within this area, 83% are of two collision types: ANGLE and REAR. Most of the ANGLE-type collisions were caused by vehicles crossing lanes to enter the U-turn and most of the REAR-type collisions were caused by vehicles exiting the site drives and being struck in the rear by an upcoming vehicle. As in the case with Barlows Landing Road, the problem seems to be the ineffective and unsafe combination of "freeway speeds" and "local maneuvers".

N-S U-turn 57+75 (southbound lanes only) at Waterhouse Road: The accidents which occurred at this U-turn are the result of vehicles either exiting the U-turn to reverse direction on MacArthur Boulevard or attempting to crossover into Waterhouse Road. Most importantly, personal injuries were reported at each of the accidents indicating the need for improvement at this location.

## Recommendations for Improvement

The accident locations and accident characteristics indicate the inherent risks associated with turning maneuvers along a high speed, multi-lane roadway. Inadequate weaving areas, such as the McDonalds site drive to U-turn 96+75, create an additional hazard. It is therefore recommended that the most hazardous U-turns along MacArthur Boulevard be eliminated or relocated. Based upon the results of the accident analysis and the conflict analysis, the following are the most hazardous U-turns:

N-S U-turn 82+50 - N of Clay Pond Rd  
S-N U-turn 96+75 - S of Clay Pond Rd  
N-S U-turn 163+75 - N of Barlows Landing Rd  
S-N U-turn 182+75 - S of Barlows Landing Rd  
N-S U-turn 187+75 - S of Williams Ave

## Suggestions for Further Improvement

Approximately 400' south of the Bourne Rotary, four accidents have occurred in the 24 months due to vehicles coming over a rise in the northbound lanes and confronting stopped traffic due to congestion at the rotary. Further review of the horizontal and vertical curves at this location is recommended to determine if additional signage or other improvements are warranted.

Finally, additional "Rotary Ahead" warning signs may be appropriate prior to the approaches to both the Bourne Rotary and Otis Rotary.

#### CONCLUSION REGARDING ACCIDENT AND CONFLICT ANALYSES:

In summary, there are two general findings from the accident/conflict analysis of MacArthur Boulevard. The first is the high accident frequency associated with the U-turns, especially those with inadequate weave distances between the U-turn and site drives. The other is the high accident rate and accident frequency along the southbound lanes of MacArthur Boulevard as compared to the northbound lanes. This is the direct result of higher turning movements on the southbound lanes due to intersecting streets and site drives.

Based on this analysis, the following are recommendations to improve safety:

- 1) Reduce conflict points by consolidating curb cuts on the Boulevard.
- 2) Eliminate the most hazardous U-turns.

3) Maintain adequate weave areas between site drives/intersecting streets and U-turns through the utilization of collector/distributor roadways.

The alternative mitigation strategies examined in this study focus on the findings of the accident/conflict analysis.

## DEVELOPMENT OF TRANSPORTATION MODEL

Traffic flows on MacArthur Boulevard and on many of the secondary roads in the study area were simulated using modelling software known as T.H.E. (The Highway Emulator). T.H.E was developed by the Central Transportation Planning Staff and is useful in relating socio-economic data to trip generation, and alternate route diversion of traffic due to congestion. The model developed for General MacArthur Boulevard and its environs is referred to as GMacB.

### Network Layout

The study area is bounded by the Cape Cod Canal to the north, the Massachusetts Military Reservation to the east, the Bourne/Falmouth town line to the south, and Buzzard's Bay to the west. The roadway network consists of all state and federal aid highways as well as important arterials and collectors within the study area. The study area is broken up into traffic zones connected by a series of roadway "links" and "nodes". Traffic entering or exiting the study area at one of the boundaries is generated by an "external zone". All traffic zones are connected to network nodes by a "zone connector".

The GMacB network is made up of 64 internal zones, 6 external zones, 289 links (including zone connectors) and 155 nodes. Of the internal zones, 19 were primarily residential, the remaining 45 were used to simulate traffic generation of presently developed parcels at or near MacArthur Blvd.

A schematic representation of the GMacB network is shown in Fig. 7 showing most of the important links and nodes. Zones 20-63, representing the existing developments along MacArthur Boulevard, are not included due to the limitation of space. Some zone connectors enter the network at "Dummy Nodes": intersections which don't actually exist but are locations which serve as "average" loading points. The connection of Portside Drive to Barlow's Landing Road is to be deleted per proposed traffic circulation to be implemented.

#### Data Collection

Several types of data were necessary to code GMacB, including the length, capacity, and travel speeds of all the roadways comprising the network; land use and socio-economic data; and traffic volumes and turning movement counts at many of the locations within the study area, especially to include the roads entering from external zones.

Town of Bourne

General MacArthur Boulevard & environs

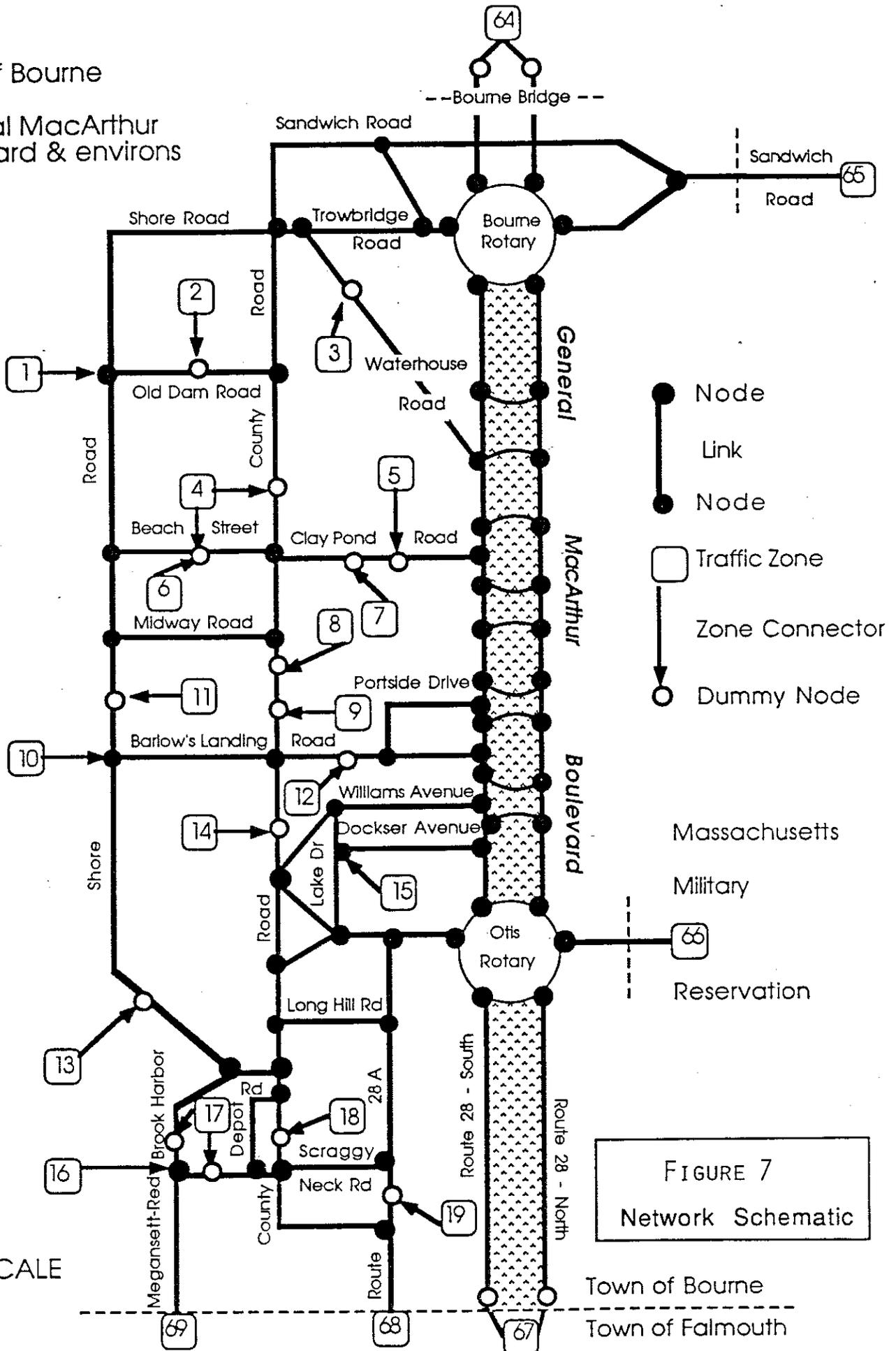


FIGURE 7  
Network Schematic

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Link characteristics such as speed, length, width and terrain, were obtained in the field and used to calculate capacities to be entered into GMacB.

Socio-economic data comprised the number of households, household income, number of retail employees, and number of non-retail employees within each internal zone. The data were used in GMacB to estimate the traffic generated by all zones to establish origin/destination patterns within the network. A number of sources were used including census data, USGS maps and field observations by staff and volunteers. In Fig. 8, the breakdown of four sections of MacArthur Boulevard is shown; for these sections land use, frontage, area, and peak hour trip generation estimates are shown in Figs. 9-12.

The validity of GMacB rests on the calibration of the model to actual traffic volumes. Over a hundred counts were taken in some form within the study area in 1988. Methods include manual turning movement counts at all of the U-Turns and several intersections; automatic traffic recording at many locations performed with CCPEDC and VHB personnel and equipment; permanent traffic counting stations operated by MDPW; and information provided within several of the EIRs provided for review.

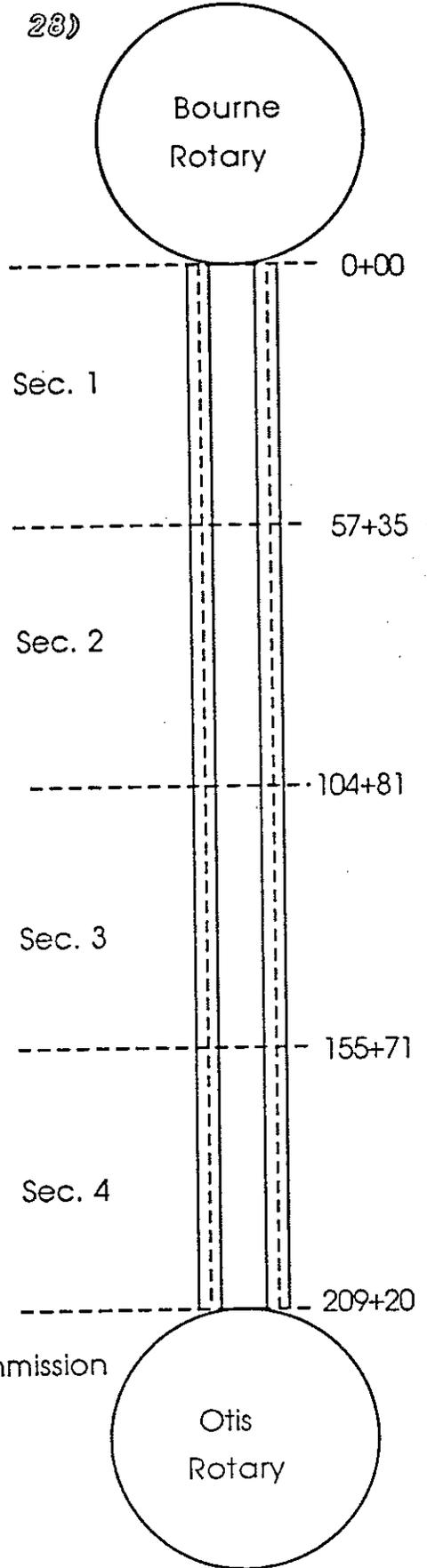
*General MacArthur Boulevard (Route 28)*

TOWN OF BOURNE

Land Use - Trip Generation  
Frontage & Acreage

Route 28 Corridor Schematic

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Prepared by  
Cape Cod Planning and Economic Development Commission

FIGURE 8

# General MacArthur Boulevard

## Section 1

Occupant/Land Use	Area	Frontage	P.M Peak Hr.		Station
			Trips		
		50			0+00
Office & Retail	3.77	420	110		
/ Funeral Home	1	215	10		6+00
/ Restaraunt	1/2	210	9		
Mazda / Car Dealer	2.63	259	49		
Nissan / Car Dealer	2.25	420	46		14+00
town land		512			
vacant	2.57	316			22+00
Nautilus / Health Club	1.44	213	34		Angelo Drive
Bigelow Boatyard	1.55	220	7		
/ Nursing Home	7.20	404			30+00
Wiggins Precast	3.11	121	15		
R.V. Storage & Repair	6	251			
/ Office & Retail	2	256	207		38+00
Tractor Co.	1 1/4	225	5		Colonel Drive
					46+00
Hostetter / vacant	15.26	1523			46+92
					54+00
					57+35

FIGURE 9

# General MacArthur Boulevard

## Section 2

Occupant/Land Use	Area	Frontage	P.M. Peak Hr. Trips	Station
				57+35 58+00
		344		60+00 Waterhouse Road
/ Campground	44.8	965	106	66+00
Brigadoon north		298		
		150		Brigadoon Road +00
Brigadoon south		250		
		43		Harbor Hill Drive
Value Center	12.11	546		
				82+50
Bourne Retail Outlet		540		
				82+00
Texaco / Gas		210	14	
		40		90+00
Tedeschi	2.75	200	157	91+01 Clay Pond Road
McDonalds	1.70	250	106	
				96+75
Capiello /	17	536		98+00
Heimlich /		450		
				104+81

FIGURE 10

# General MacArthur Boulevard

## Section 3

Occupant/Land Use	Area	Frontage	P.M. Peak Hr.		Station
			Trips		
-----					-----104+81
Otis Industrial Park lot#40	0.91	150			
Honda /	1.82	300	30		
O.I.P. lot #43		150			109+00
		162			-----
Baker Boy (incl. in Otis Pk. Dr.)		166			-----
Bourne Outlet Center	9.03	378	387		-----
vacant	7.91	304			-----
Heritage Commercial Park	40	860			-----125+00
lot 10	1.2	187			-----
Conference Medal & Trophy	0.95	150	20		-----
lot 10.2	0.95	150			-----133+00
Denmark Pharmacy	2	300	20		-----
Naughton Realty	1	150	8		-----
lot 77.2	1.86	200			-----
lot 77		160			-----141+00
		212			-----
Commodore Restaraunt / Dental	1.05	200	11		-----
lot 161	1.12	150			-----149+00
Portside Mall	1.14	243	154		-----
		144			-----
Cooper Tires	0.66	123	24		-----
lot 169	0.56	101			-----152+75 Portside Drive
-----					-----155+71

FIGURE 11

# General MacArthur Boulevard

## Section 4

Occupant/Land Use	Area	Frontage	P.M. Peak Hr. Trips	Station
lot 170 } incl.: Casey's Pub,	0.59	101	} 37	155+71
lot 171 } Pizza, Hair, Realty	0.62	101		
lot 172 } Guardian storage	0.64	100		
lot 173 } Medco Systems	0.66	100		
lot 221 Medco Systems	2.82	340	28	161+00
lot 222 } Pocasset Crossings	0.93	200	} 151	163+75
lot 223 }	0.93	200		
lot 224	0.93	200		
lot 78 Cape Cod Bank	1.07	150		169+00
		298		172+30 Barlow's Lnd. Rd.
Country store	0.80	120	122	
lot 80.1	0.75	127		
Auto Dealer (new)	0.61	127		177+00
Kent Auto service	0.66	200	17	
lot 80.3	0.33	50		
		475		182+75
Real Estate & Bullder	1.00	100		185+00
vacant		30		185+75
Barrets Real Estate			4	William's Avenue
Harley Davidson			20	
vacant		940 total		
vacant				
vacant				193+00
Barber Shop & Hair Salon			8	
		90		195+75 Dockser Avenue
Motel			16	
			24	
Electric Supply				201+00
Furniture Store		1300 total		
Diner			} 80	
Gas Station - vacant				
				209+20

FIGURE 12

## Travel Demand Forecasting

In order to analyze future traffic impacts, trends and relationships between traffic and quantifiable variables must be determined. This is necessary to project the volumes of traffic at each of the external zones in GMacB. The data used were the combined-bridges August Average Daily Traffic (ADT - the dependent variable). The independent variable used was the number of housing units (HU) in Falmouth. Using regression analysis, a coefficient of correlation ( $R^2$ ) of 0.92 was determined for the relationship between ADT and HU; that is to say, 92 percent of the variation in the data is explained by the regression model. The relationship is:

$$ADT = -391103 + 49952 \ln(HU)$$

The trend of housing unit building permits in Falmouth for the period of 1972-1988 was also analysed using regression, the relationship was found to be:

$$HU = 10759 + 406.7(t)$$

where  $t=1$  at 1972,  $R^2 = 0.99$

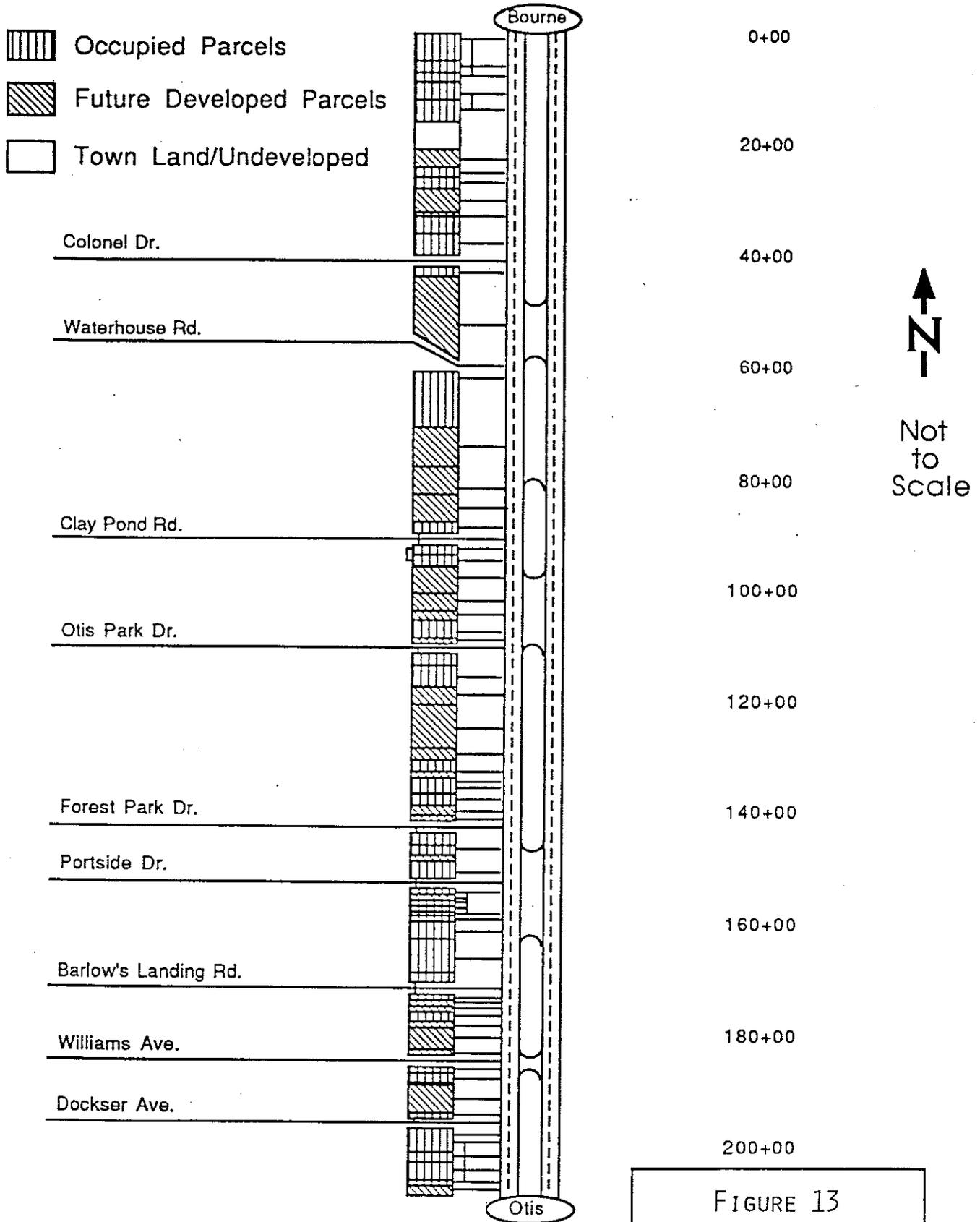
These relationships were used to estimate background traffic growth for both the 1993 and 2003 horizon planning years.

## ALTERNATIVE NETWORK CONFIGURATIONS

Issues of safety, congestion, and convenience have led to the development of several network configurations of MacArthur Boulevard to be analyzed with GMacB under the future build scenarios (FBS). These scenarios include the five-year horizon half-build scenario (1993 HBS) and the fifteen-year horizon total-build scenario (2003 TBS). In the 1993 HBS, it is assumed that all developable parcels will be generating traffic at one-half the Institute of Transportation Engineers (ITE) Trip Generation (4th edition) report rates. In the 2003 TBS, it is assumed that all developable parcels will be generating traffic at the full ITE rates. In both cases, it is assumed that there will be an even mix of 33.3% retail, 33.3% office and 33.3% light industrial land uses. The primary alternatives are schematically represented by Figs. 13-17. Variations of many of these alternatives were also analyzed and are included in the Appendix.

Alternative 1 - No changes to existing road network and U-turns:

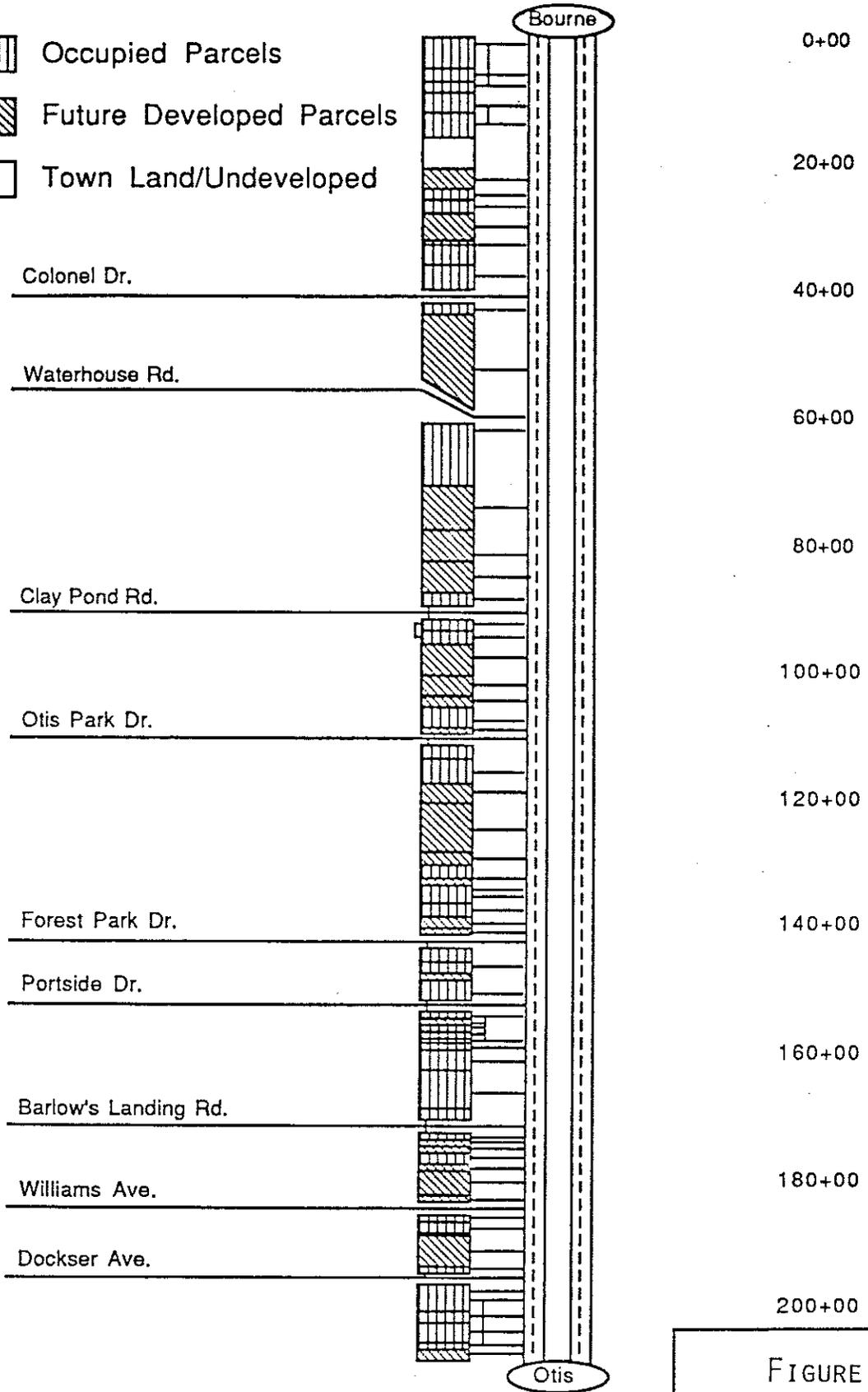
Future-build scenarios (FBS) with no change in the road network configuration (The connection of Portside Drive to Barlow's Landing Road has been eliminated per new traffic circulation required by Town of Bourne). This serves as the basis of comparison for the other alternatives and is shown in Fig. 13.



FUTURE BUILD SCENARIO  
(FBS)

FIGURE 13  
Alternative 1

-  Occupied Parcels
-  Future Developed Parcels
-  Town Land/Undeveloped

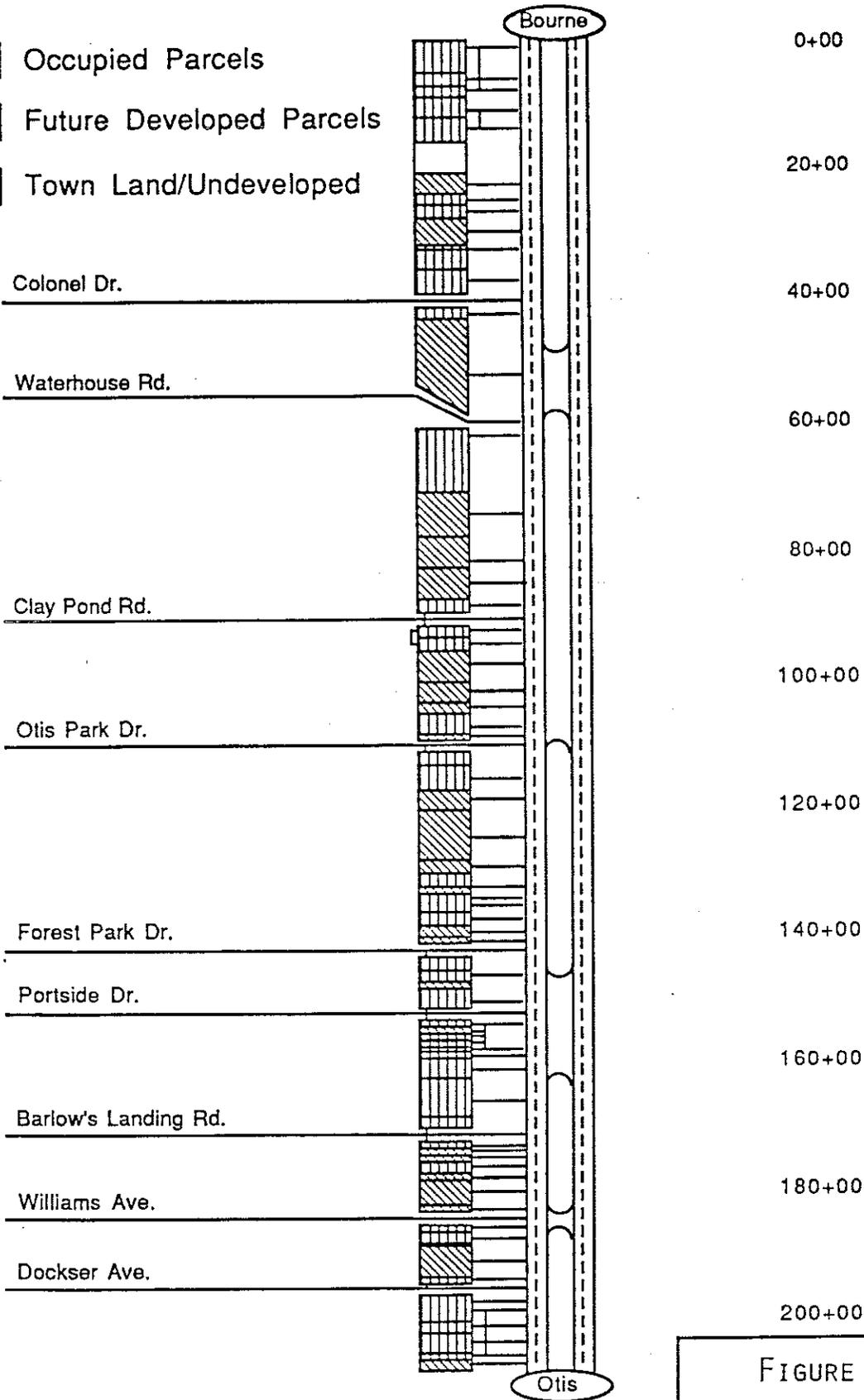


  
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FBS: NO U-TURNS

FIGURE 14  
 Alternative 2

-  Occupied Parcels
-  Future Developed Parcels
-  Town Land/Undeveloped

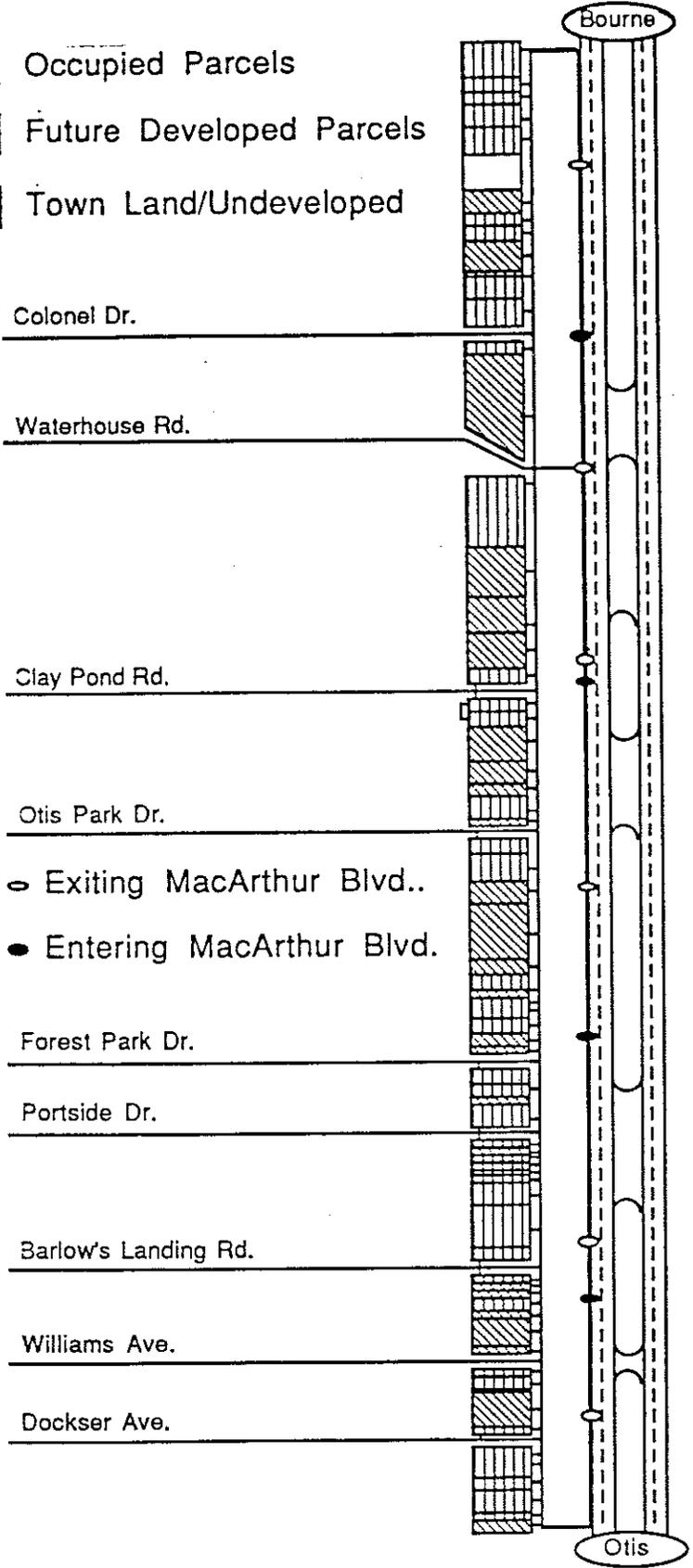


  
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FBS: NO CLAY POND RD.  
U-TURNS

FIGURE 15  
 Alternative 3

-  Occupied Parcels
-  Future Developed Parcels
-  Town Land/Undeveloped



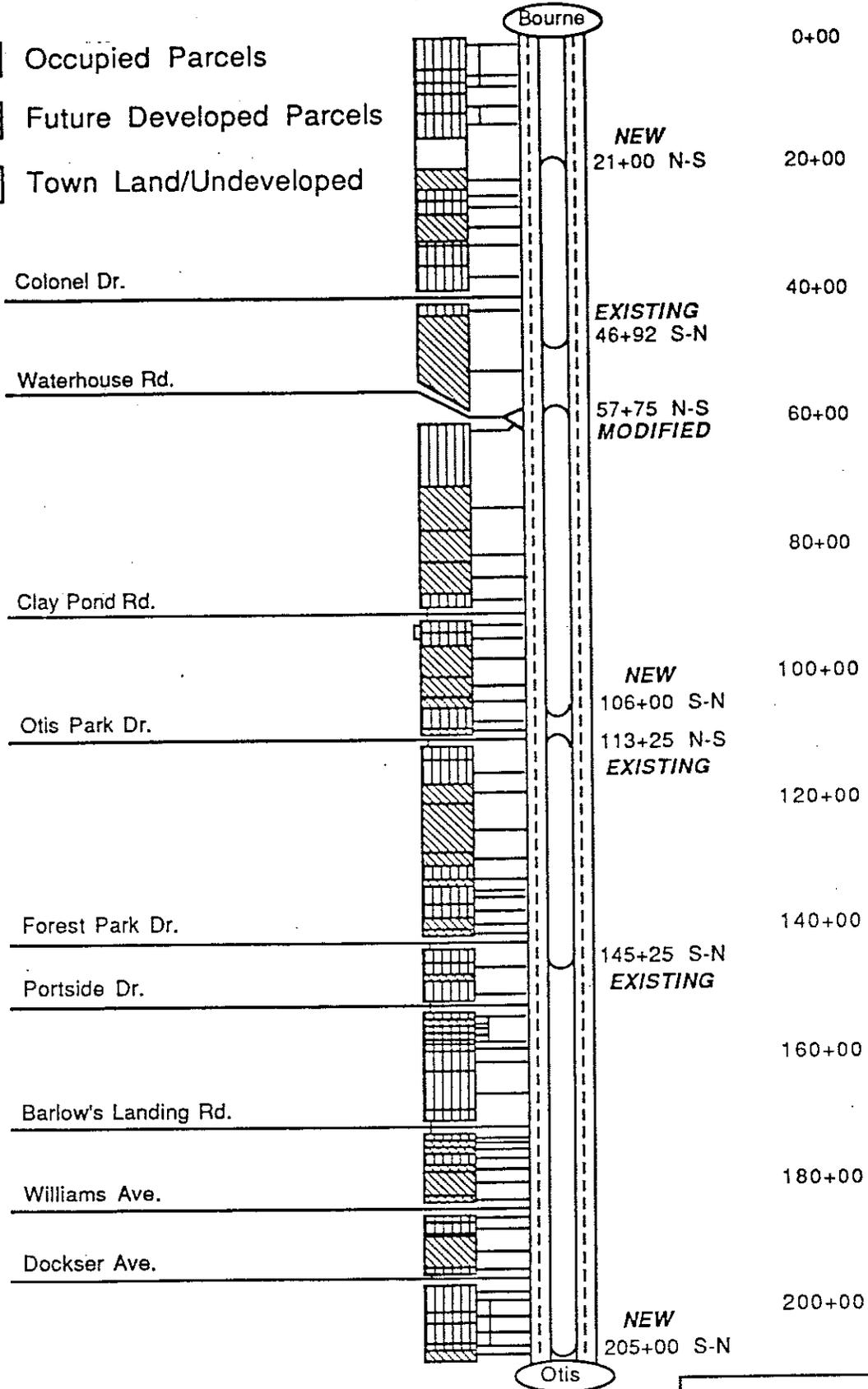
0+00  
20+00  
40+00  
60+00  
80+00  
100+00  
120+00  
140+00  
160+00  
180+00  
200+00

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FBS: FRONTAGE ROAD

FIGURE 16  
Alternative 4

-  Occupied Parcels
-  Future Developed Parcels
-  Town Land/Undeveloped



FBS: PREFERRED U-TURN  
CONFIGURATION

FIGURE 17  
Alternative 5

Alternative 2 - Eliminate all U-turns:

FBS with all nine U-Turns eliminated. The safety issues involved for vehicles using the U-turns are complex; decelerating in a passing lane in order to access the U-turn and then merging from a complete stop into the opposite passing lane make for an unusual set of maneuvers. This alternative is useful to examine the amount of diversion to the rotaries and internal roadways of Bourne and is shown in Fig. 14.

Alternative 3 - Eliminate the U-turns at Clay Pond Road:

FBS with the elimination of the U-turns immediately north and south of Clay Pond Road (82+50 N-S and 96+75 S-N). These two U-turns were found to be among the worst of the nine in terms of safety (based on accidents and conflict analyses), possibly due to the shortness of the weaving sections between the site drives or Clay Pond Road and the merging and diverging areas of the U-turns. This alternative is shown in Fig. 15.

Alternative 4 - A full-length one-way Frontage Road:

FBS with a full-length one-way frontage road on the west side of the existing southbound lanes. This alternative allows controlled access off/on MacArthur Boulevard relative to the location of the U-turns and is shown in Fig. 16.

Alternative 5 - Eliminate and/or relocate the most hazardous U-turns:

FBS with U-turn locations as shown in Fig. 17. As part of the joint effort of MDPW and CCPEDC, specific locations of proposed U-turns were addressed for feasibility and appropriateness. This alternative included the elimination of the U-turns north and south of Clay Pond Road, north of Barlow's Landing Road and north and south of Williams Ave; the construction of new U-turns north of the Otis Rotary, south of Clay Pond Road, north of Waterhouse Road; and the redesign of the Waterhouse Road intersection to not allow access from the adjacent U-turn.

#### Results Of Alternatives

The amounts of summer Friday P.M. peak hour traffic using various links of the roadway network under the 1993 HBS are presented in Tables 5 and 6. The volumes on several of the Town roads determined by each of the five alternatives are shown in Table 5. Traffic volumes on links used to reverse direction are shown in Table 6. Such links include the various U-turns as well as the southern segment of the Otis Rotary and the northern segment of the Bourne Rotary. These segments are found between the southbound exiting and northbound entering Route 28 accesses at the Otis Rotary, and between the northbound exiting and

Table 6  
Summer P.M. Peak Hour Traffic Volumes

U-Turn Location	1988	1993 HBS and Alternatives				
	BASE	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Bourne Rotary no. segment	266	510	1183	902	694	366
21+00 N-S	-	-	-	-	-	334
46+92 S-N	52	51	-	51	54	53
57+75 N-S	96	294	-	167	275	505
82+50 N-S	190	440	-	-	-	-
96+75 S-N	87	291	-	-	-	-
106+00 S-N	-	-	-	-	-	271
113+25 N-S	75	187	-	187	117	280
145+25 S-N	32	381	-	260	96	482
163+75 N-S	180	149	-	144	187	-
182+75 S-N	123	356	-	399	391	-
187+75 N-S	29	30	-	30	35	-
205+00 S-N	-	-	-	-	-	279
Otis Rotary so. segment	373	476	1230	688	981	429

ALTERNATIVES

- 1 HBS (Half-Build Scenario - Fig. 13)
- 2 HBS - No U-Turns (Fig. 14)
- 3 HBS - No Clay Pond Rd. U-Turns (Fig. 15)
- 4 HBS - Full-Length One-Way Frontage Road (Fig. 16)
- 5 HBS - Preferred U-Turn Configuration (Fig. 17)

The U-turn configuration modelled as Alternative 5 is intended to address safety concerns at existing U-turns and to relieve some of the congested links in the network. In general, changes were for the better:

* Bourne Rotary	-28%
* Otis Rotary	-10%
* MacArthur Boulevard	
Southbound	0%
Northbound	-1%
* County Road	5%
* Shore Road	2%
* Waterhouse Road	-8%
* Clay Pond Road	-6%
* Barlow's Landing Road	0%

GMacB was also ran for Alternatives 1 and 5 to represent summer daily (24 Hour) traffic volumes. These results are presented in Tables B1 and B2 in Appendix B.

The results indicate that by eliminating all nine of the existing U-turns would divert an unacceptable amount of traffic to the rotaries and town roads. To eliminate certain hazardous U-turns without providing a substitute means to reverse direction would likewise stress other links. Alternative 5 was developed to

provide the necessary capacity and convenience with the elimination of the most hazardous U-turns. Reducing the number of conflict points by combining site accesses onto a frontage road (Alternative 4) will also increase safety. The preferred alternative described in the following section is a combination of Alternatives 4 and 5.

#### Preferred Alternative

Based on the safety and traffic analyses, the preferred alternative is the elimination or modification of the most hazardous U-turns and the construction of several new U-turns, in conjunction with the establishment of a one-way frontage road. The recommended changes in U-turns are as follows:

- \* Eliminate the two U-turns north and south of Clay Pond Road.
- \* Eliminate the U-turn north of Barlows Landing Road.
- \* Eliminate the two U-turns north and south of Williams Ave.
- \* Modify the Waterhouse Road intersection to prohibit access from the adjacent U-turn.

\* Construct 3 new U-turns as follows:

- north to south U-turn 0.4 miles south of the Bourne Rotary.
- south to north U-turn 0.3 miles south of Clay Pond Road.
- south to north U-turn 0.1 miles north of Otis Rotary.

These recommendations would result in U-turns at the following locations (please refer to Figure 17).

- \* 21+00 N-S. A newly constructed U-turn 0.4 miles south of the Bourne Rotary to serve most drivers who use the rotary to reverse direction as well as access for northbound traffic to Waterhouse Road.
- \* 46+92 S-N. An existing U-turn 0.9 miles south of the Bourne Rotary accessed by several parcels upstream and users of the town dump.
- \* 57+75 N-S. An existing U-turn 1.1 miles south of the Bourne Rotary with the elimination of the straight-across access to Waterhouse Road. This facility would serve to access parcels south of Waterhouse Road as well as Clay Pond Road.
- \* 106+00 S-N. A newly constructed U-turn 2.0 miles south of the

Bourne Rotary to serve several parcels north and south of as well as Clay Pond Road.

- \* 113+25 N-S. An existing U-turn 2.1 miles south of the Bourne Rotary used by northbound traffic to access parcels south of Otis Park Drive.
- \* 145+25 S-N. An existing U-turn 2.8 miles south of the Bourne Rotary to serve several parcels south of as well as Otis Park Drive.
- \* 205+00 S-N. A newly constructed U-turn 3.9 miles south of the Bourne Rotary (0.1 miles north of the Otis Rotary) to serve drivers which would otherwise use the Otis Rotary to reverse direction.

#### Long Range Conditions

The 15 year planning horizon is used to analyze Alternative 1 (Fig. 13.), and the recommended U-turn configuration of Alternative 5 (Fig. 17). The resulting traffic volumes for various links and U-turns under this 15 year Total Build Scenario (2003 TBS) are presented in Tables 7 and 8.

Table 7  
 Summer P.M. Peak Hour Traffic Volumes

Location	1993 HBS		2003 TBS	
	Alt. 1	Alt. 5	Alt. 1	Alt. 5
A	2352	2353	2968	2979
B	2121	2095	2631	2629
C	350	367	438	422
D	588	598	569	573
E	500	461	700	665
F	376	352	341	333
G	628	626	631	640

ALTERNATIVES

- 1: Future Build Scenarios - existing 9 U-turns (Fig. 13)
- 5: Future Build Scenarios - preferred U-turn config. (Fig. 17)

HBS: Half Build Scenario  
 TBS: Total Build Scenario

LOCATIONS

- A Southbound MacArthur Boulevard, N. of Otis Park Dr.
- B Northbound MacArthur Boulevard, opposite location A
- C County Road, S. of Midway Rd.
- D Shore Road, S. of Midway Rd.
- E Waterhouse Road, N. of MacArthur Blvd.
- F Clay Pond Road, E. of County Rd.
- G Barlow's Landing Road, E. of County Rd.

Table 8  
Summer P.M. Peak Hour Traffic Volumes

U-Turn Location	1993 HBS		2003 TBS	
	Alt. 1	Alt. 5	Alt. 1	Alt. 5
Bourne Rotary no. segment	510	336	618	395
21+00 N-S	-	334	-	542
46+92 S-N	51	53	59	59
57+75 N-S	294	505	423	764
82+50 N-S	440	-	648	-
96+75 S-N	291	-	347	-
106+00 S-N	-	271	-	362
113+25 N-S	187	280	219	306
145+25 S-N	381	482	185	896
163+75 N-S	149	-	134	-
182+75 S-N	356	-	313	-
187+75 N-S	30	-	27	-
205+00 S-N	-	279	-	376
Otis Rotary so. segment	476	429	1224	453

ALTERNATIVES:

- 1: Future Build Scenarios - existing 9 U-turns (Fig. 13)
- 5: Future Build Scenarios - preferred U-turn config. (Fig. 17)

HBS: Half Build Scenario  
TBS: Total Build Scenario

Heavy demand on some of the U-turns indicates that further mitigation may be necessary to maintain safety and flow on MacArthur Boulevard in 2003. These improvements are likely to include adding acceleration lanes at all U-turns and excluding multi-axle vehicles from the U-turns. Thorough and continuous monitoring of the use of the U-turns and other links will be necessary in order to update the model and make new recommendations as necessary.

It should be noted that based on existing zoning by-laws along MacArthur Boulevard and projected background growth in traffic volumes, there is inadequate infrastructure to accommodate the estimated future year (2003) traffic volumes. There simply is not a reasonable match between expected development and roadway infrastructure.

#### GENERAL RECOMMENDATIONS

Any proposal to alter the existing configuration of MacArthur Boulevard and its environs must address three interrelated issues: safety, traffic flow, and feasibility of implementation. Keeping these issues in mind, CCPEDC recommends the U-turn configuration described above coupled with a "retrofitted" one-way frontage road system on the west side of MacArthur Boulevard. In order to maintain safer weaving distances, an

entrance to the frontage road should be located at least 1000 feet downstream of an exit of an N-S U-turn, and an exit from the frontage road should be located at least 1000 feet upstream of an entrance to an S-N U-turn. The frontage road would be constructed as a series of segments in the following manner:

- \* New development with a large amount of frontage - construction of a frontage road segment at time of development. Access to such parcels will be directly onto the frontage road segment.

- \* New development with a small amount of frontage - dedication of a strip of land to be used for a future frontage road segment. Access to such parcels would temporarily be a standard driveway. Permanent access via the frontage road would occur when adjacent parcels are developed or redeveloped.

- \* Change of use of an existing development with a small amount of frontage - if adjacent to a developed parcel with a frontage road segment, or if the cumulative frontage when combined with a new development warrants a frontage road segment, then construction of a frontage road segment should be made on this parcel with access via such. Otherwise, a strip of land should be dedicated for use as a future frontage road segment.

- \* Change of use of an existing development with a large amount of frontage - construction of a frontage road segment at time of redevelopment with access via the frontage road system.

\* Parcels with frontage on more than one road should generally have access via the less heavily travelled road.

This U-turn/frontage road scheme is intended to have several attractive features:

1. IMPROVED SAFETY - Several unnecessarily hazardous U-turns are eliminated, new and retained U-turns will have safe weaving distances to/from curb cuts, and the number of conflict points for through traffic is reduced.
  
2. BETTER TRAFFIC FLOW - Many multipurpose trips will be able to be routed on the frontage road, thus eliminating some demand on MacArthur Boulevard. As a by-product of the safety issue, the reduced number of conflict points allows for a more continuous, thus smoother, through-trip traffic flow. Vehicles exiting the frontage road intending to use a U-turn would have shorter delays since they need only wait for a gap in the right lane, merge, then safely weave over to the left lane for access to the U-turn.
  
3. FEASIBILITY - The proposed changes to U-turns along with the long-term development of a frontage road is more feasible than a radical and costly mitigation measure such as grade separation or additional travel lanes the full length of the Boulevard.

## Conclusion

In general, there is consistency between the recommendations contained in this report and the recommendations made in the EIRs for Brookside Associates, Value Center and the Bourne Retail Outlet. All three EIRs included recommendations for the closure of the U-turn north of Clay Pond Road and the relocation of the U-turn south of Clay Pond Road further south. CCPEDC concurs with these recommendations. All three EIRs identified the need for improvements at the Waterhouse Road U-turn but proposed different alternatives. The Brookside consultants recommended locating it further north, the Value Center and Bourne Retail Outlet consultants recommended constructing an additional U-turn to its south. CCPEDC analysis indicates the need for two northbound to southbound U-turns in the vicinity of Waterhouse Road. Hence, the CCPEDC recommendation to leave the Waterhouse Road U-turn but redesign the Waterhouse Road intersection to prevent vehicles from crossing both southbound lanes, in conjunction with the construction of a new U-turn to the north.

Two key areas where our recommendations differ from those of the private consultants are as follows:

- 1) In the Brookside EIR, the need for acceleration lanes was addressed at the U-turn north of Waterhouse Road. It was unclear whether other U-turns should have acceleration lanes as well.

While CCPEDC concurs with the eventual need for acceleration lanes, it is recommended that all be modified at the same time to maintain consistency. An exception may be the new U-turn north of Otis Rotary, which will have a much wider turning radius than the others. When constructed, this U-turn should include an acceleration lane.

2) Control of curb cuts on the southbound lanes is an important part of our recommendations. Without a system of frontage roads and shared site drives, it is difficult if not impossible to maintain satisfactory weave distances between U-turns and site drives. With the development of a frontage road, access to Route 28 can be provided based on traffic volumes and weave distances. Therefore, it is important to note that the U-turn configuration is recommended only in conjunction with a developing frontage road system.

APPENDIX

A

# General MacArthur Boulevard

## Section 1

X = Accident Locations  
2 Year Study Period

## Accident Locations

Occupant/Land Use	Area	Frontage	Trips	Station
		50		0+00
Office & Retail	3.77	420	110	
/ Funeral Home	1	215	10	2 x 2 x 6+00
/ Restaraunt	1/2	210	9	1 x
Mazda / Car Dealer	2.63	259	49	1 x
Nissan / Car Dealer	2.25	420	46	14+00
town land		512		
vacant	2.57	316		1 x 22+00
Nautilus / Health Club	1.44	213	34	
Bigelow Boatyard	1.55	220	7	1 x Angelo Drive
/ Nursing Home	7.20	404		30+00
Wiggins Precast	3.11	121	15	
R.V. Storage & Repair	6	251		
/ Office & Retail	2	256	207	
Tractor Co.	1 1/4	120	5	Colonel Drive
		225		
Hostetter / vacant	15.26	1523		12 x 46+92 46+00
				54+00
				57+35

# General MacArthur Boulevard

## Section 2

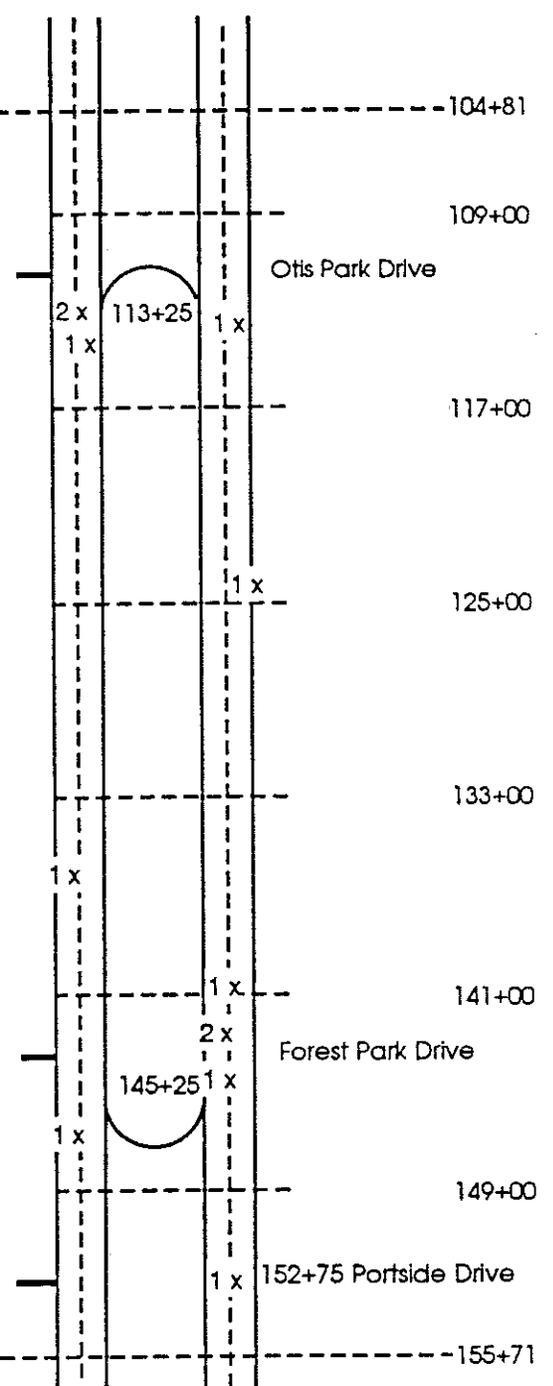
Occupant/Land Use	Area	Frontage	Trips	Station
				57+35 58+00
		344		60+00 Watermouse Road
/ Campground	44.8	965	106	66+00
Brigadoon north		298		
		150		Brigadoon Road +00
Brigadoon south		250		
		43		Harbor Hill Drive
Value Center	12.11	546		82+00
Bourne Retail Outlet		540		
Texaco / Gas		210	14	90+00
		40		91+01 Clay Pond Road
Tedeschi	2.75	200	157	
McDonalds	1.70	250	106	
Capiello /	17	536		98+00
Helmlich /		450		104+81

# General MacArthur Boulevard

## Section 3

Station

Otis Industrial Park lot#40	0.91	150				104+81
Honda /	1.82	300	30			
O.I.P. lot #43		150				109+00
Baker Boy (Incl. In Otis Pk. Dr.)		162				
Bourne Outlet Center	9.03	378	387			117+00
vacant	7.91	304				
Heritage Commercial Park	40	860				125+00
lot 10	1.2	187				
Conference Medal & Trophy	0.95	150	20			133+00
lot 10.2	0.95	150				
Denmark Pharmacy	2	300	20			
Naughton Realty	1	150	8			
lot 77.2	1.86	200				141+00
lot 77		160				
Commodore Restaraunt / Dental	1.05	150	11			
lot 161	1.12	150				149+00
Portside Mall	1.14	243	154			
		144				
Cooper Tires	0.66	123	24			
lot 169	0.56	101				152+75 Portside Drive
						-155+71



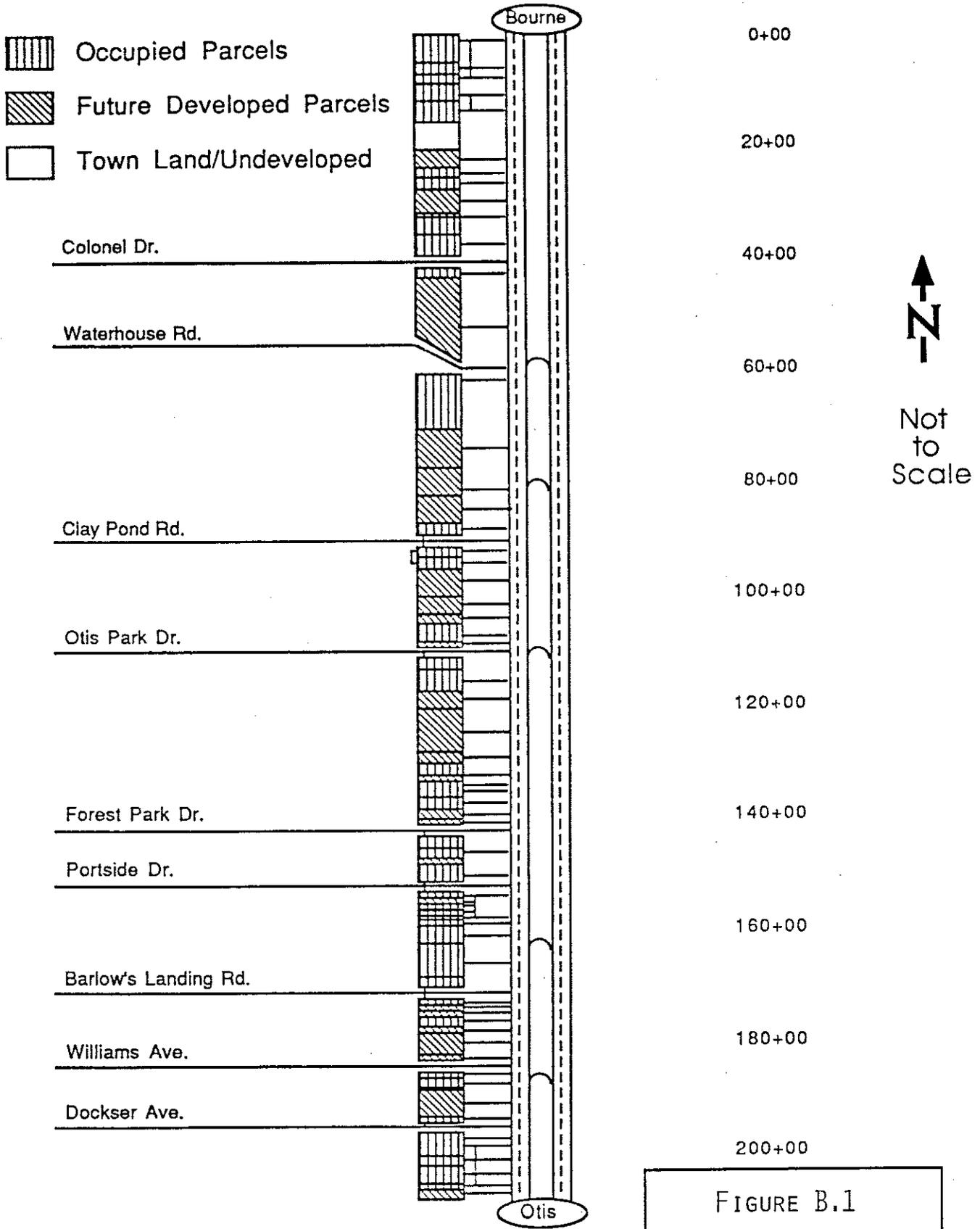
# General MacArthur Boulevard

## Section 4

Occupant/Land Use	Area	Frontage	Trips	Station
lot 170 } lot 171 } Incl.: Casey's Pub, lot 172 } Pizza, Hair, Realty lot 173 Guardian storage	0.59 0.62 0.64 0.66	101 101 100 100	} 37 8	155+71
lot 221 Medco Systems	2.82	340	28	161+00
lot 222 } lot 223 } Pocasset Crossings lot 224	0.93 0.93 0.93	200 200 200	} 151	163+75
lot 78 Cape Cod Bank	1.07	150		169+00
Country store lot 80.1 Auto Dealer (new)	0.80 0.75 0.61	298 120 127 127	122	172+30 Barlow's Lnd. Rd.
Kent Auto service lot 80.3	0.66 0.33	200 50	17	177+00
Real Estate & Builder vacant Barrets Real Estate Harley Davidson vacant vacant vacant Barber Shop & Hair Salon	1.00	475 100 30 940 total	4 20 8	182+75 185+75 William's Avenue 193+00
Motel		90	16	195+75 Dockser Avenue
Electric Supply			24	
Furniture Store Diner		1300 total	} 80	201+00
Gas Station - vacant				209+20

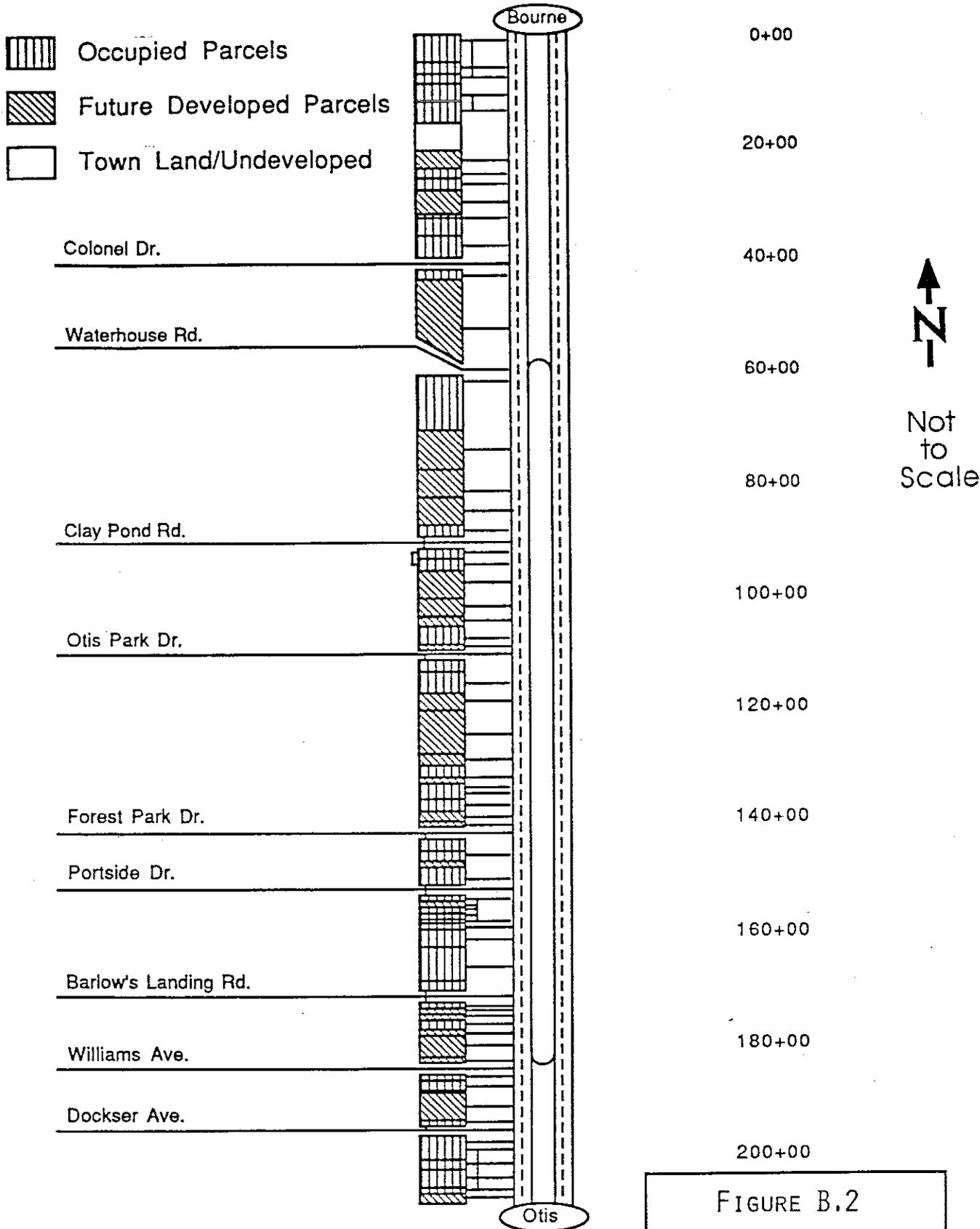
APPENDIX

B



FBS: NO SOUTH-TO-NORTH  
U-TURNS

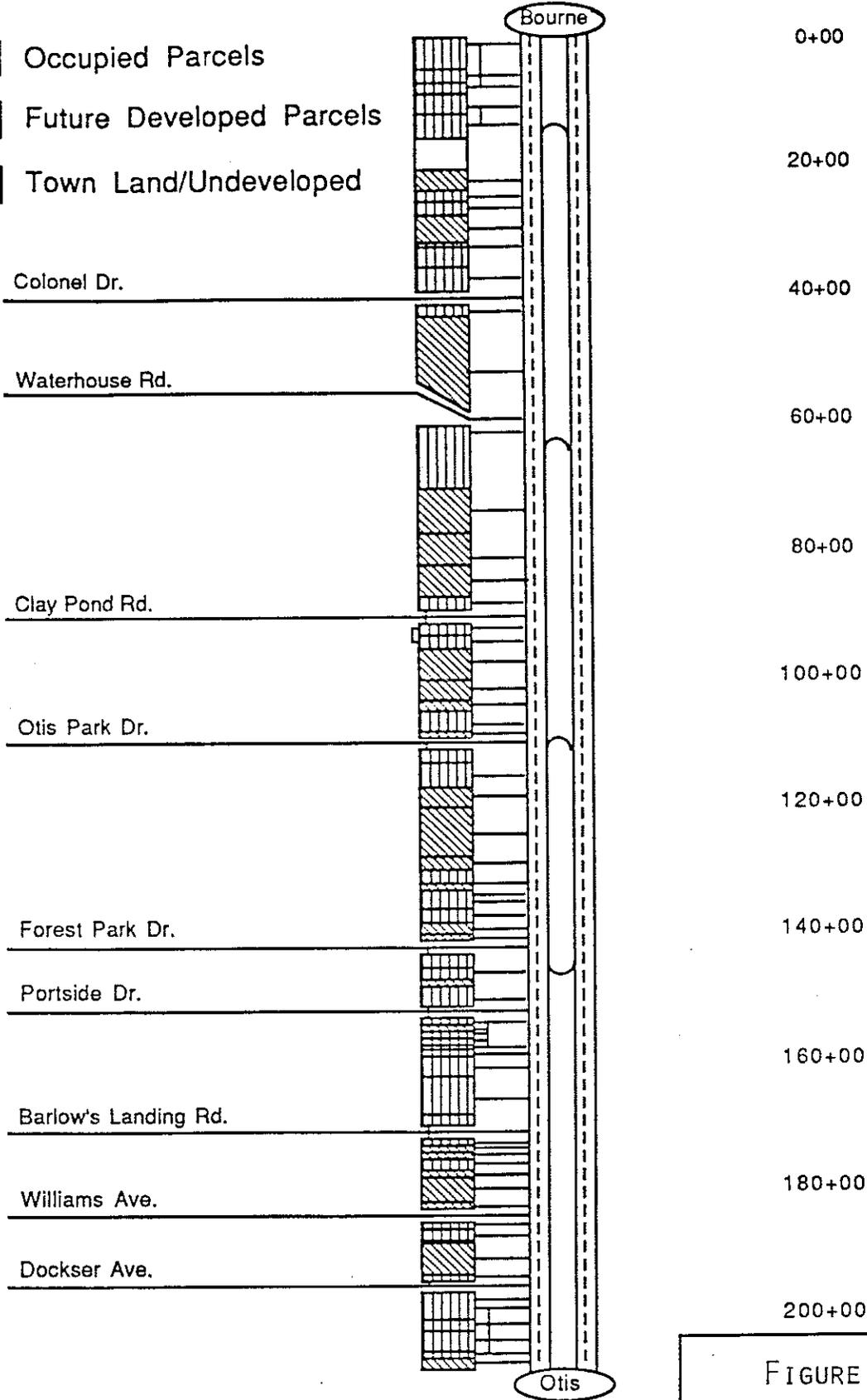
FIGURE B.1  
Alternative A1



FBS: TWO U-TURNS

FIGURE B.2  
Alternative A2

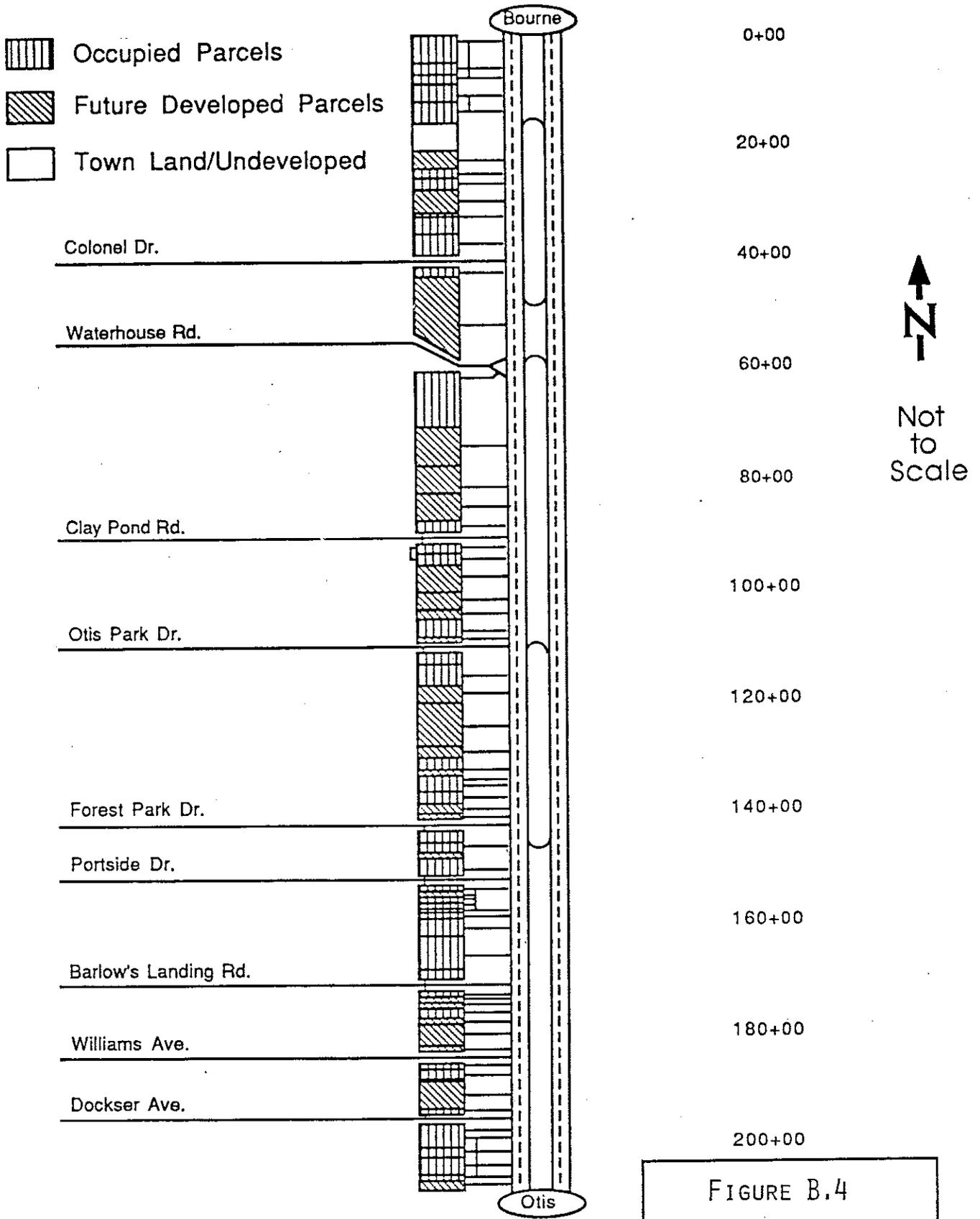
-  Occupied Parcels
-  Future Developed Parcels
-  Town Land/Undeveloped



↑  
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Not  
to  
Scale

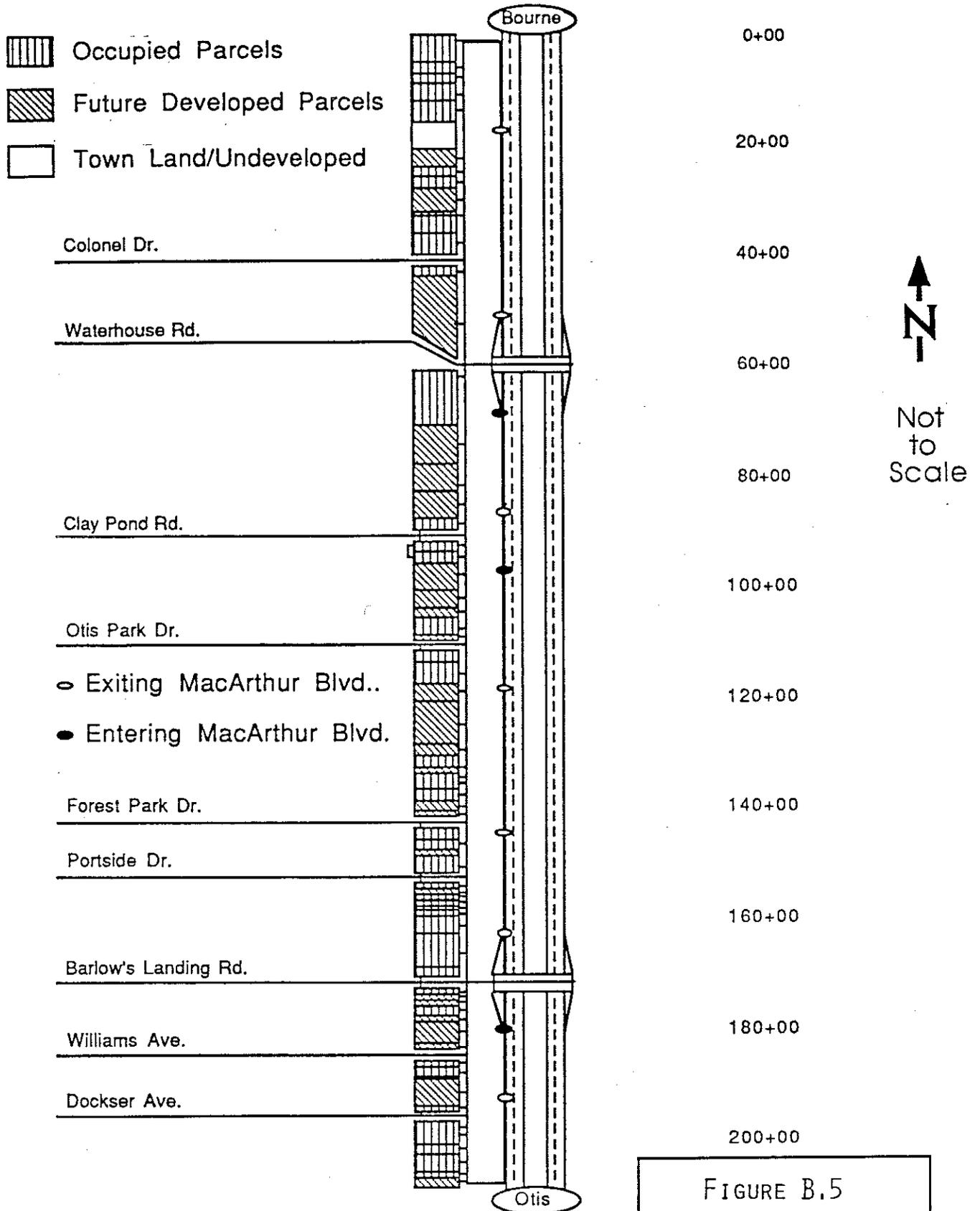
FBS: U-Turn Modification  
(2 Exist., 2 New)

FIGURE B.3  
Alternative A3



FBS: U-Turn Modification  
 (3 Exist., 1 Mod., 1 New)

FIGURE B.4  
 Alternative A4



FBS: FRONTAGE ROAD W/  
GRADE SEPARATION

FIGURE B.5  
Alternative A5

Table B.1  
Summer P.M. Peak Hour Traffic Volumes

1988 Location	1993 HBS and Alternatives				
	Alt. 1	Alt. A1	Alt. A2	Alt. A3	Alt. A4
A	2352	2535	2732	2548	2548
B	2121	2317	2273	2296	2285
C	350	382	484	367	376
D	588	590	615	596	597
E	500	533	526	498	444
F	376	325	329	311	301
G	628	614	777	627	627

ALTERNATIVES

- 1 HBS (Half-Build Scenario - Fig. 13)
- A1 HBS - No South-to-North U-Turns (Fig. B.1)
- A2 HBS - Two U-Turns Only (Fig. B.2)
- A3 HBS - 3 N-S + 1 S-N U-Turns (Fig. B.3)
- A4 HBS - 3 N-S + 2 S-N U-Turns (Fig. B.4)

LOCATIONS

- A Southbound MacArthur Boulevard, N. of Otis Park Dr.
- B Northbound MacArthur Boulevard, opposite location A
- C County Road, S. of Midway Rd.
- D Shore Road, S. of Midway Rd.
- E Waterhouse Road., N. of MacArthur Blvd.
- F Clay Pond Road, E. of County Rd.
- G Barlow's Landing Road, E. of County Rd.

Table B.3  
Summer Daily Traffic Volumes

Location	1993 HBS		2003 TBS	
	Alt. 1	Alt. 5	Alt. 1	Alt. 5
A	31269	31410	38084	38176
B	24581	23567	31456	30113
C	3891	5554	5004	6391
D	4092	5097	4654	5796
E	7863	6886	9913	8910
F	4023	4234	3652	5186
G	7661	7615	6914	7352

ALTERNATIVES

- 1: Future Build Scenarios - existing 9 U-turns (Fig. 13)
- 5: Future Build Scenarios - preferred U-turn config. (Fig. 17)

HBS: Half Build Scenario  
TBS: Total Build Scenario

LOCATIONS

- A Southbound MacArthur Boulevard, N. of Otis Park Dr.
- B Northbound MacArthur Boulevard, opposite location A
- C County Road, S. of Midway Rd.
- D Shore Road, S. of Midway Rd.
- E Waterhouse Road, N. of MacArthur Blvd.
- F Clay Pond Road, E. of County Rd.
- G Barlow's Landing Road, E. of County Rd.

Table B.4  
Summer Daily Traffic Volumes

U-Turn Location	1993 HBS		2003 TBS	
	Alt. 1	Alt. 5	Alt. 1	Alt. 5
Bourne Rotary no. segment	8354	6372	10251	6525
21+00 N-S	-	5665	-	8183
46+92 S-N	458	458	464	464
57+75 N-S	4837	6844	6682	10766
82+50 N-S	6341	-	9665	-
96+75 S-N	3220	-	4315	-
106+00 S-N	-	3025	-	4291
113+25 N-S	4024	7063	4648	7631
145+25 S-N	6091	6045	11380	11124
163+75 N-S	4345	-	4359	-
182+75 S-N	3630	-	4465	-
187+75 N-S	641	-	694	-
205+00 S-N	-	4524	-	4066
Otis Rotary so. segment	10408	8379	11140	9930

ALTERNATIVES:

- 1: Future Build Scenarios - existing 9 U-turns (Fig. 13)
- 5: Future Build Scenarios - preferred U-turn config. (Fig. 17)

HBS: Half Build Scenario  
TBS: Total Build Scenario