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**FAX
Transmittal**

Deliver To:	Elizabeth Epstein Cara Seiderman	From:	Patrick Dunford Traffic Engineer
Company:	City of Cambridge	VHB Project No.:	04535.26
Telephone No.:		FAX No.:	349-4669
Total Number of Pages (Including Transmittal Form)			12
Original of Telecopy Message			Will not be sent
Date and Time:			May 15, 1996

Attached is a copy of the traffic summary memorandum that was distributed the other evening to the Porter Square Neighbor's Association. This purpose of this document was to assess existing traffic conditions and some of the project impacts, and it should not be confused with the actual traffic impact and access study.

I've also enclosed copies of the pedestrian counts that we conducted at the Porter Square intersection. I hope that this information can be of use to you. Also, thank you for the bicycle information that you faxed over last night; that will be very helpful.

Please call if you have any questions regarding this matter.



To: Mr. John Civilinski
Gravestar, Inc.
One Broadway
Cambridge, MA 02142

Date: May 10, 1996

Project No.: 04535.26

From: Patrick Dunford
Traffic Engineer

Re: Cambridge- Porter Square
Center - Traffic Summary

At your request and authorization, Vanasse Hangen Brustlin, Inc. (VHB) has evaluated several transportation issues associated with the proposed Porter Square Center expansion in Cambridge, Massachusetts. The following memorandum will discuss the impact of the Porter Square Center expansion project on the amount of traffic generated by the site, on-site parking demand, and bicycle and pedestrian access.

Development Proposal

The current development proposal calls for the existing Porter Square Star Market to be expanded from its present size of 40,340 square feet (sf) to approximately 55,870 sf (a 15,530 sf expansion). Under this proposal, Star Market will expand into the building space presently occupied by the CVS store. There is also consideration of incorporating some of the Cambridge Savings Bank space within the proposed Star Market. For the purposes of this study, it was conservatively assumed that all of the bank space would be occupied by the proposed Star Market expansion. As part of this project, the existing CVS will be relocated to 12,000 sf of building space in a new retail building constructed on the southwesterly corner of the site adjacent to the Porter Square intersection and White Street. An additional maximum development of 9,500± sf will also be constructed on the second story of the CVS building, and 1,200 sf of retail vendor space will be provided adjacent to the CVS building. The Shawmut Bank ATM building presently at this location will be razed. With the proposed expansion project, the Porter Square Center will have a total of 148,850 sf of building space. This represents an increase of approximately 22,370 sf over the center's existing total building size of 126,510 sf.

Existing Conditions

The Porter Square intersection is located directly to the west of the site and is characterized by the skewed angle at which Somerville Avenue intersects Massachusetts Avenue, and the large mixture of vehicular and pedestrian traffic. The Porter Square intersection actually consists of two separate intersections - the Massachusetts Avenue/Somerville Avenue intersection and the Somerville Avenue/White Street/ Massachusetts Avenue intersection. Both of these intersections operate together as part of a coordinated signal system along Massachusetts Avenue. Traffic operations at Porter Square are also effected by the large number of pedestrian crossings, particularly those being made diagonally from the Porter Square MBTA station to the site.

The traffic signal at the Massachusetts Avenue/Somerville Avenue intersection presently operates with two phases: Phase 1, in which Massachusetts Avenue through-traffic has the green signal, and Phase 2, which accommodates southbound Massachusetts Avenue traffic (including left turns onto Somerville Avenue) and northbound Somerville Avenue traffic. (Left turns from Somerville Avenue onto Massachusetts Avenue are not allowed at this intersection.) While Phase 1 is running at the Massachusetts Avenue/Somerville Avenue intersection, the right-turn from Massachusetts Avenue to White Street and right-turn from White Street movements are both running. Somerville Avenue traffic has a green indication in both directions under Phase 2. An exclusive pedestrian phase is also provided at both intersections.

Traffic volumes were counted in March and April 1996 at those intersections that could be potentially impacted by the project. These counts were conducted during the weekday evening (4:00 PM to 6:00 PM) and Saturday midday (11:30 AM to 1:30 PM) peak hours, when the impact of the project would potentially be the greatest. The existing weekday evening and Saturday midday peak hour turning movement volumes at study area intersections are shown in Figures 1 and 2, respectively.

Access to the Porter Square Center is presently provided by four separate driveways. A right-turn in/right-turn out driveway is provided at the northwest corner of the site onto Massachusetts Avenue. Based on traffic counts conducted by VHB, this driveway was observed to accommodate only 17 percent of the traffic entering the site and 23 percent of the traffic exiting the site. Almost half of the traffic entering the site was observed to use the driveway located at the southerly side of the site on White Street; only minimal traffic was observed exiting the site from this driveway. There are also two site driveways provided on Elm Street - the northerly site driveway, which accommodates exiting traffic only, and the southerly site driveway, which provides full access onto Elm Street. The southerly driveway presently accommodates approximately 40 percent of the entering site traffic. While only 10 percent of the site traffic presently enters the site from Elm Street, almost 75 percent of the traffic leaving the site exits onto this road. This notable difference between entering and exiting traffic at Elm Street is due to a prominent cut-through pattern between White Street and Elm Street, and the lack of left-turn access from the site onto Massachusetts Avenue. Both factors are discussed in the following section.

Local Traffic Cut-Through Patterns

Based on field observations conducted by VHB, between 30 and 40 percent of the traffic entering the site at the White Street driveway is non-site related traffic that is using the site to cut through to Elm Street. This creates additional congestion in the parking lot and adds to the exiting demand from the site onto Elm Street. This pattern generally seems to mostly comprised of motorists from Massachusetts Avenue traveling to Somerville.

Motorists wishing to exit the site and head southbound on Massachusetts Avenue presently do not have direct left-turn access from the site to this road. Therefore, these motorists have to cut through neighborhood streets in Cambridge and Somerville to get to Massachusetts Avenue. The most prominent route observed was for motorists to turn right from the site onto Elm Street, proceeding a short distance until turning right onto Mossland Street and then across Somerville Avenue to either Beacon Street, Oxford Street, or Roseland Street to Massachusetts Avenue. A similar pattern was shown by vehicles turning left from the site onto Elm Street, and left again onto Beech Street. The signalized intersection of Massachusetts Avenue and Beech Street is the closest point north of the site that a legal left-turn can be made onto Massachusetts Avenue. While it is difficult to quantify the exact number of "diverted" left turns that presently cut through the neighborhoods in this fashion, a reasonable estimate can be obtained through general observations and a comparison of the entering and exiting volumes at the Elm Street driveways. Typically with retail centers, there will be a balance of entering and exiting vehicles at each driveway for a given direction (i.e., under peak conditions, the same number of vehicles can be expected to arrive and depart to and from the north). It can be assumed that the observed discrepancy in this case is partly due to the diverted left turns. Following

this, it is estimated that during the weekday evening and Saturday midday peak hours, there are presently between 150 and 200 vehicles, respectively, diverted onto local streets because they cannot turn left directly onto Massachusetts Avenue.

Trip Generation

VHB has conducted an evaluation of the expected trip generation of the Porter Square Center expansion project. The rate at which retail uses generate traffic is dependent on a number of factors such as size, location, and proximity of competing uses. The peak traffic hours of retail uses do not always coincide with the peak hour of the adjacent street system; however, the critical impact on the adjacent street system generally occurs during the adjacent street system's peak hours. As a result, the critical time periods for the analysis of project-related impacts will be the weekday evening and Saturday midday peak hours. The number of vehicle trips generated by the project were estimated, and then broken down into new and pass-by trips to determine the amount of new site-generated traffic which would be added to area roadways. Pass-by trips are trips that are already on the adjacent roadway system independent of the proposed development. As motorists travel past the site on their way to another destination, they stop at the site, before continuing on to their original destination.

Two different methodologies were considered in estimating the amount of traffic that could be generated by the proposed site expansion. With either alternative, the increased traffic generated by the site would result from the 15,530 sf Star Market expansion, the maximum additional development of 9,500 sf of retail space and the 1,200 sf of retail vendor stalls. As the CVS facility is expected to maintain its existing customer base and, as there will not be any significant increase in building size, there is not expected to be any significant increased traffic generated by this component of the site.

Under the first trip generation methodology, the individual components of the site were considered to generate traffic independently of each other. Given the shared business between the uses on the site, this methodology ultimately was not used for estimating the total amount of traffic generated by the site. Instead, the proportion of increased site traffic that would be generated by each of the individual uses was estimated.

Traffic counts conducted at three existing Star Markets by CID Associates¹ were used to estimate the amount of traffic generated by the proposed expansion of the existing supermarket on this site. The selected stores were all located in densely settled areas around Boston in close proximity to public transportation. Using the observed rate of trip generation per building area at these sites, the amount of traffic generated by the increased Star Market building size was estimated. However, while a supermarket expansion will typically result in increased trip generation, the individual spending per customer also usually increases. Therefore, a supermarket expansion does not typically result in a linear increase in trip generation. Instead, while the number of customers does increase, the overall increase in business is more attributable to the increased spending per customer. Because the rates observed at these stores do not account for this, the resulting trip generation estimates are conservatively high and should only be used for comparative purposes. The amount of traffic generated by the maximum development of 9,500± sf of retail space located above the relocated CVS store and the 1,200± sf of retail vendor stalls was estimated using rates contained in the Institute of Transportation Engineers' (ITE) Trip Generation² for specialty retail uses.

The second trip generation methodology considered was based on data contained in ITE Trip Generation for shopping centers. Trip generation rates for various retail developments have been formulated by the Institute of Transportation Engineers (ITE) and published in Trip Generation. The data collected by ITE for shopping centers, Land Use Code (LUC) 820, are based on several studies of retail uses of this type. The rates in this manual take into account the shared business between the

¹ Star Market Plus, Allston, Massachusetts; CID Associates, Peterson-Griffin Architects, Ltd., Peabody and Brown, Boston (1994).

² Trip Generation, Fifth Edition; Institute of Transportation Engineers; Washington, D.C. (1991).

individual uses in a shopping center and, accordingly, were used to estimate the total increase in traffic generated by the site expansion. The project-generated traffic increases were estimated by applying ITE shopping center trip generation rates to the existing and proposed Porter Square Center footage to determine the incremental change in vehicle trips due to the 22,370[±] sf retail expansion. This additional traffic was then applied to existing traffic volumes observed at the Porter Square Center Shopping Center.

A comparison of both methodologies for estimating the trip generation of the proposed expansion of the Porter Square Center is shown below in Table 1.

**Table 1
 Porter Square Center Trip Generation Comparison**

Time Period	Star Market *			Retail (10,700 sf)**	Total	ITE Shopping Center Rates***
	Proposed (55,870 sf)	Existing (40,340 sf)	Increase due to expansion			
Weekday Daily						
enter	1,950	1,410	540	225	765	440
exit	<u>1,950</u>	<u>1,410</u>	<u>540</u>	<u>225</u>	<u>765</u>	<u>440</u>
Total	3,900	2,820	1,080	450	1,530	880
Weekday Evening Peak hour						
enter	155	110	45	30	75	40
exit	<u>170</u>	<u>125</u>	<u>45</u>	<u>25</u>	<u>70</u>	<u>45</u>
Total	325	235	90	55	145	85
Saturday Daily						
enter	1,940	1,400	540	225	765	575
exit	<u>1,940</u>	<u>1,400</u>	<u>540</u>	<u>225</u>	<u>765</u>	<u>575</u>
Total	3,880	2,800	1,080	450	1,530	1,150
Saturday Midday Peak Hour						
enter	175	125	50	30	80	55
exit	<u>160</u>	<u>120</u>	<u>40</u>	<u>25</u>	<u>65</u>	<u>60</u>
Total	335	245	90	55	145	115

* Based on traffic counts conducted by CID Associates at three Boston-area Star supermarkets. Daily trip generation estimated using ITE rates reduced by factors developed from CID traffic counts.
 ** Source: Trip Generation, 5th Edition; Institute of Transportation Engineers; Land Use Code 814 (Specialty Retail Center).
 *** Source: Trip Generation, 5th Edition; Institute of Transportation Engineers; Land Use Code 920 (Shopping Center). Trip generation calculated based on difference between trip generation for the existing and proposed conditions.

As shown in Table 1, using the ITE rates for the entire shopping center results in lower trip generation estimates than using rates developed considering the uses independently of each other. This is because the rates developed at stand-alone facilities do not account for the shared business between the individual stores within the plaza. Accordingly, the ITE data were used to estimate the total amount of traffic generated by the expansion of the site. Using the ITE shopping center rates, it is estimated that the proposed expansion will result in additional 85 and 115 vehicle trips during the weekday and Saturday midday peak hours, respectively. Based on the trip generation estimates developed from the stand-alone facilities, approximately two-thirds of the increased traffic generated by the site can be

assumed to be generated by Star Market during peak hours. Likewise, it can be expected that a third of the increased site traffic will be generated by the proposed 10,700 sf of retail space (including the 1,200 sf of retail vendor stalls). Accordingly, during the weekday evening peak hour, the Star Market expansion will generate 55 additional vehicle trips and the 10,700 sf of retail space (including the 1,200 sf of vendor stalls), will generate 30 vehicle trips. During the Saturday midday peak hour, approximately 75 and 40 additional vehicle trips will be generated by the respective Star Market and retail components of the site.

The counts conducted at the existing Boston area Star supermarkets revealed that between 7 and 11 percent of site patrons typically arrive by way of public transportation during peak hours. During these same time periods, approximately 38 percent of store patrons were pedestrians arriving from local neighborhoods. Therefore, the proposed expansion will also result in additional business in the form of pedestrians and customers arriving by the MBTA. The increased number of patrons arriving by these modes would be generated in addition to the increased vehicular traffic already presented. Given the proximity of the Porter Square MBTA station it is reasonable to expect that a significant amount of site patrons will continue to walk, bike or arrive by public transportation, as under existing conditions.

Parking Demand

As part of this project, an evaluation of the parking conditions at the Porter Square Center was conducted, particularly with regard to employee parking activity. This study incorporated a previous parking study conducted by VHB, as well as more recent observations of parking activity at the plaza.

VHB has also conducted an evaluation of the anticipated parking demand resulting from the proposed Porter Square Center expansion project. Based on a parking study conducted by VHB in November 1995, the 375-space Porter Square Center parking lot was operating near capacity on during the weekday evening period and at capacity throughout a Saturday afternoon. The parking situation at the plaza was observed again in April 1996 and it was found that the weekday demand had lessened slightly, but that the Saturday demand had remained near capacity. Further observations revealed that between 45 and 50 employee vehicles were parked in the main parking lot during the peak weekday and Saturday periods. At the same time this was observed, there were only 18 and 43 vehicles parked in the exclusive employee parking lot during the respective weekday evening and Saturday midday peak periods. The employee parking lot is located on the west side of Elm Street approximately 100 feet south of White Street. There is a total of 46 striped parking spaces in this lot and an additional 8 vehicles were typically observed to be parked in a line in the center of the lot, for a total lot capacity of 54 vehicles.

Data regarding parking demand of various individual uses have been compiled by the Urban Land Institute in *Shared Parking*³. The data contained in that report indicate that the peak parking demand for retail uses typically occurs in the month of December. Parking demand in November, when the parking accumulation study was conducted by VHB, is typically 80 percent of that which occurs in the peak month of December. Parking demand throughout the remainder of the year is usually only slightly lower - approximately 75 percent of peak month conditions. Therefore, given that the lot was observed to be at capacity in November, it is not likely that parking demand at the Porter Square Center would be significantly lower throughout the rest of the year.

To determine the increased parking demand resulting from the project, both the existing parking demand and standardized ITE parking data were considered. A comparison of the observed parking demand at this site and that projected using the ITE data is presented below in Table 2.

³ *Shared Parking*; Urban Land Institute; Washington, D.C. (1983).

Table 2
Porter Square Center - Peak Parking Demand Comparison

Time Period	Existing Porter Square Center 125,510± sf		Proposed Porter Square Center 149,890± sf	
	Observed*	ITE data**	Observed*	ITE data**
Weekday Evening	375	312	N/A	378
Saturday Midday	375	311	N/A	382

* Source: Parking accumulation study conducted by VHB on November 16 and November 18, 1996.

** Source: Parking Generation, Second Edition; Institute of Transportation Engineers; Washington, D.C. (1987).

As shown above in Table 2, parking demand at the Porter Square Center is presently higher than would be expected using ITE data for similarly sized shopping centers. This is particularly noteworthy given the public transportation available in close proximity to the site, which typically helps to reduce parking demand. Based on the above, the ITE data do not appear to be applicable to the Porter Square Center. Instead, it can be assumed that parking demand at the site will increase proportionally to the increase in building area on the site. Since the relocated CVS building will be approximately the same size as the existing building, it can be assumed that any increase in parking demand for CVS will be negligible. Therefore, the increased parking demand on this site will result from the expansion of the Star Market and the additional development of 10,700± sf of retail space, including the 1,200 sf of retail vendor stalls.

Based on the previous parking accumulation study, the peak parking demand at the site is presently about 3 spaces per 1,000 sf of floor area. Therefore, the proposed 10,700± sf of additional retail space would generate a demand of 33 more spaces under peak conditions and the 15,530 sf Star Market expansion would result in an additional 47 spaces, for an overall increased demand of 80 spaces. However, as previously mentioned, a supermarket expansion does not typically result in a linear increase in trip generation, but rather, an increase in the individual spending per customer usually occurs. While there will be increases in the amount of traffic generated and parking demand, this will not occur at the same rate that is presently observed at the site. Therefore, in keeping with the anticipated increase in trip generation for the site, which is a maximum of 60 vehicles per hour, the Star Market expansion should only result in an additional demand of approximately 27 spaces (60 total spaces minus the 33 spaces needed for the new retail use, resulting in the 27 spaces needed for the Star Market vehicles). Regardless of the exact split between the retail and Star parking demand, it is not expected that the increased parking demand would exceed the expected increase in trip generation for the entire site (60 vph). With the existing supply of on-site parking, the anticipated demand at this site would exceed the existing parking supply. Measures to increase the amount of on-site parking available for patrons are described in the following section.

Following a review of parking conditions at this site, it is recommended that employee parking be entirely prohibited in the Porter Square Center parking lot. Based on field observations of employee parking activity, this would result in an additional 45 to 50 parking spaces being available for customers. The possibility of providing customer parking at the parking lot on Elm Street, which is presently designated for employee use only, has also been investigated. There are presently 46 striped parking spaces in this lot, with room for an additional 8 spaces in the center of the lot, for a total lot capacity of 54 spaces. While leasing arrangements would require that some of these spaces be restricted for employee use, the remainder could be used for customer parking. Therefore, employee

parking could be restricted to those tenants having parking requirements in their leases, and a substantial number of spaces could be provided for customers in this lot. Information regarding the individual tenant requirements is needed to determine the exact number of spaces that could be provided. To help promote the use of these spaces, signing could be provided in the parking lot to alert patrons that these spaces are available. With the combination of on-site employee parking being prohibited and the Elm Street lot being available for use by patrons, approximately 90 additional parking spaces could be provided for customer use - 45 on-site spaces and approximately 35 spaces for customers at the Elm Street parking lot. This conservative estimate of 80 additional parking spaces would help to offset the approximately 31 spaces that would be lost under with the current development proposal.

The proponent has also committed to investigating the possibility of reducing the amount of employees parking at the main Porter Square Center parking lot by providing free MRTA passes to plaza employees. Other possible measures to reduce the remaining employee parking demand could include ridesharing matching services, and incentives for employees to carpool.

Conclusion

Based on the information presented above, approximately 85 and 115 additional vehicle trips will be generated by the proposed Porter Square Center renovation project during the weekday evening and Saturday midday peak hours, respectively. Capacity analyses of the study area intersections have indicated that this project will not have a significant impact on traffic operations at these locations.

With the combination of the prohibition of on-site employee parking and the Elm Street parking lot being available for use by both employees and patrons, approximately 90+ additional parking spaces could be provided for customer use. This would help to offset the approximately 31 spaces that would be lost under the current development proposal. While the on-site parking supply would be reduced from 375 spaces to 344 spaces, 45 to 50 of the existing spaces currently being used on-site by employees would now be available for customer use.

Based on a review of parking conditions at this site, it is recommended that employee parking be entirely prohibited in the Porter Square Center parking lot. Based on field observations of employee parking activity, this would result in an additional 45 to 50 parking spaces being available for customer use. There are presently 46 striped parking spaces in the Elm Street parking lot, with room for an additional 8 vehicles to parallel park in the center aisle, for a total lot capacity of 54 spaces. Employee parking at the Elm Street lot could be restricted to those tenants having parking requirements in their leases, and a substantial number of customer spaces could be provided in this lot. It is recommended that signing be provided in the parking lot to alert patrons that these spaces are available. With the prohibition of on-site employee parking and the Elm Street parking lot being available to both customer and by patrons, approximately 80 additional parking spaces could be provided for customer use. This would help to offset the approximately 31 spaces that would be lost under the current development proposal (a total of 344 spaces will be provided on the site).

As part of this project, the existing site driveway on Massachusetts Avenue would be narrowed considerably from its present width of 55 feet. This would provide for a considerably shorter pedestrian crossing at this driveway and enhance overall pedestrian safety.

CITY/TOWN : CAMBRIDGE
 CLIENT : VHB/4535.26
 LOCATION : MASS AVE/SOMERVILLE AVE
 WEATHER : CLOUDY/COLD

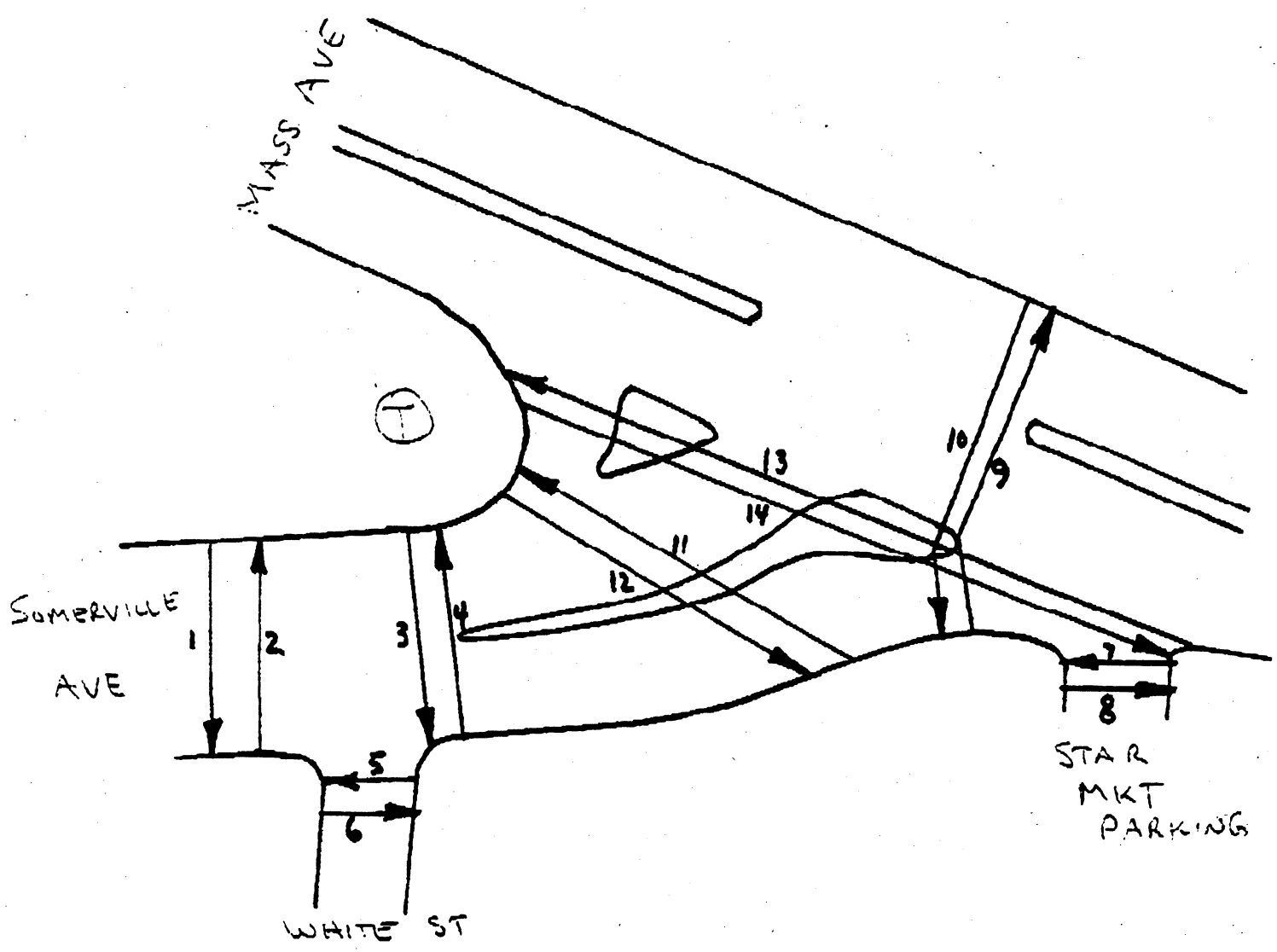
TRANSDATA SERVICES
 74 MACON ROAD
 BURLINGTON, MA 01803
 (617) 272-4388 FAX (617) 272-0783

Site Code : 04903236
 Start Date: 03/23/96
 File I.D. : 04903236
 Page : 1

PEDESTRIANS

Manual Classification Study

Date	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Class 14	Total
03/23/96															
11:20	16	14	65	70	7	34	52	23	16	1	7	5	19	11	319
11:45	8	11	64	67	7	30	22	25	9	6	14	8	14	4	289
12:00	14	20	63	60	20	16	25	30	15	7	14	5	10	9	301
12:15	13	12	85	27	12	32	42	16	11	7	17	4	8	0	346
Hr Total	51	57	297	284	48	92	118	94	51	21	49	22	51	20	1255
12:30	10	16	60	81	19	20	26	27	15	1	11	6	28	1	312
12:45	13	16	67	79	12	16	33	34	12	9	17	7	14	14	332
13:00	18	26	55	70	21	24	28	19	21	14	13	0	15	6	330
13:15	15	15	74	79	21	9	21	16	15	13	12	3	17	1	310
Hr Total	56	73	256	309	73	69	108	86	64	37	53	15	64	22	1285
TOTAL	107	130	553	593	121	161	226	180	115	58	102	37	115	42	2540
Percent	4.2%	5.1%	21.8%	23.3%	4.8%	6.3%	8.9%	7.1%	4.5%	2.3%	4%	1.5%	4.5%	1.7%	



TRANSDATA SERVICES

74 MACTON ROAD

BURLINGTON, MA 01803

(617) 272-4288 FAX (617) 272-0782

CITY/TOWN : CAMBRIDGE

CLIENT : 4535.26

LOCATION : MASS AVE/SOMERVILLE AVE

WEATHER : CLEAR/COLD

Site Code : 04903276

Start Date: 03/27/96

File I.D. : 04903276

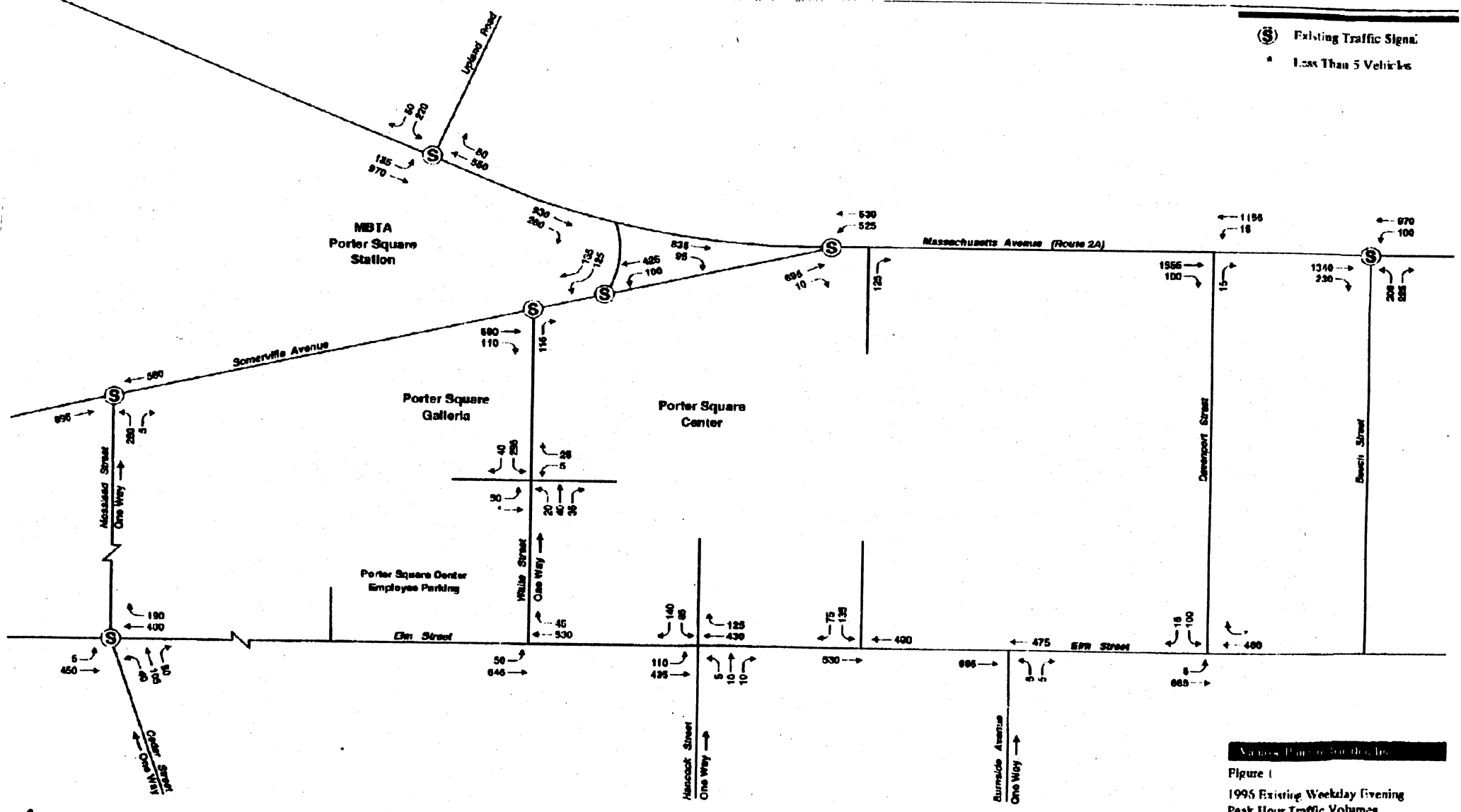
Page : 1

PEDESTRIANS,

Manual Classification Study

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Class 14	Total
Date 03/27/96															
16:00	6	11	69	39	11	13	12	15	4	6	13	6	3	1	199
16:15	15	7	73	34	12	9	17	19	11	3	16	3	7	4	230
16:30	15	7	76	48	12	13	29	18	9	7	6	4	5	8	357
16:45	11	12	78	51	11	8	14	12	8	9	6	2	10	9	246
Hr Total	47	37	296	162	46	43	77	64	32	25	41	15	25	22	932
17:00	22	18	138	39	15	13	9	33	15	7	11	1	19	14	354
17:15	17	9	105	52	15	15	10	21	8	8	10	1	14	14	299
17:30	26	14	172	40	6	16	17	13	14	6	6	4	16	5	357
17:45	31	6	128	40	15	14	16	26	22	7	2	3	10	11	334
Hr Total	99	47	543	171	52	58	52	93	59	28	29	9	59	44	1344
TOTAL	146	84	939	333	99	101	129	157	91	53	70	24	84	66	2276
Percent	6.4%	3.7%	36.9%	14.6%	4.3%	4.4%	5.7%	6.9%	4%	2.3%	3.1%	1.1%	3.7%	2.9%	

(S) Existing Traffic Signal
* Less Than 5 Vehicles




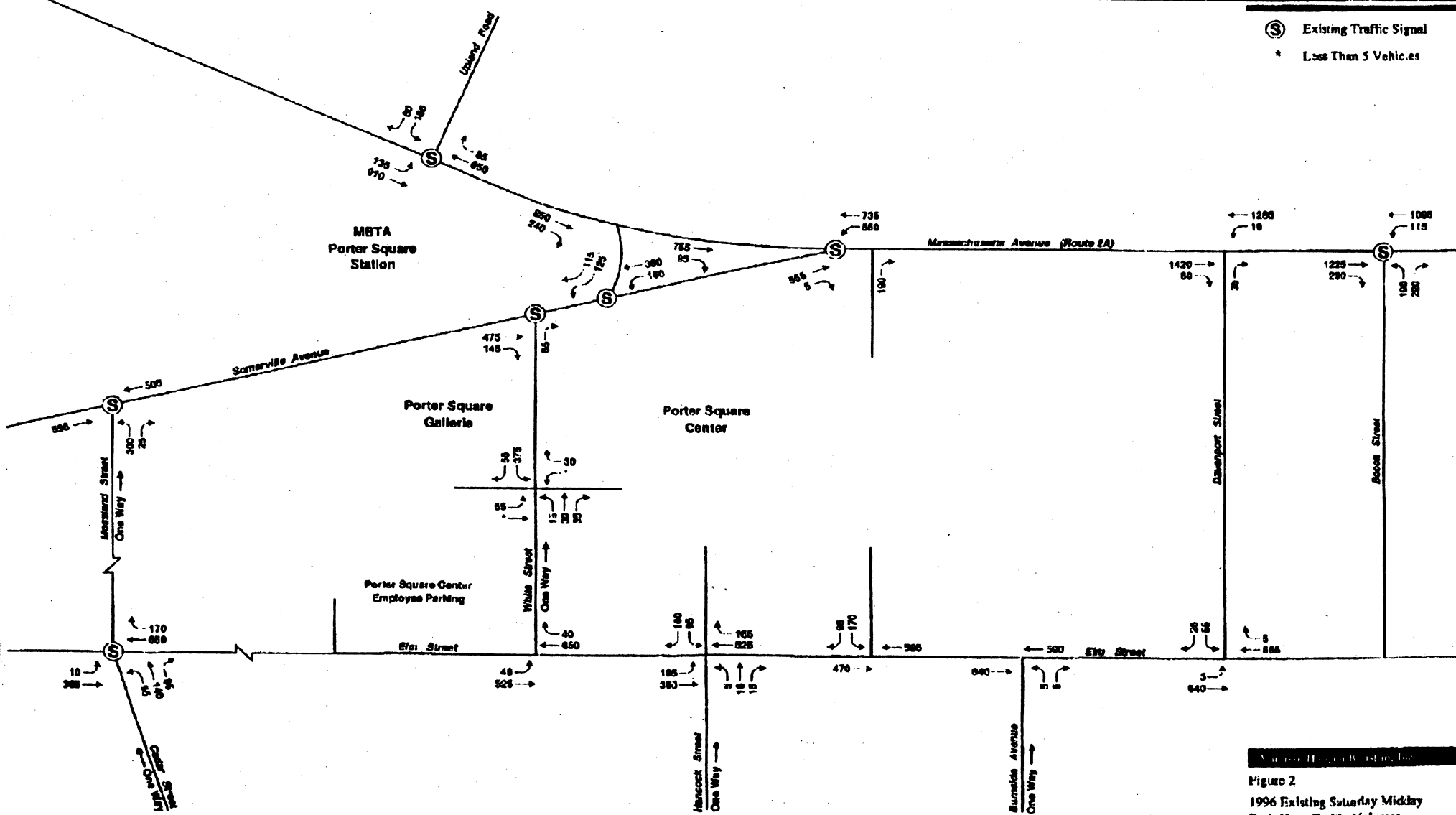
Various Portions for the City

Figure 1
1995 Existing Weekday Evening
Peak Hour Traffic Volumes
(5:00 PM - 6:00 PM)



Not to Scale

 Existing Traffic Signal
 * Less Than 5 Vehicles



 North
 Not To Scale

Figure 2
 1996 Existing Saturday Midday
 Peak Hour Traffic Volumes
 (12:15 PM - 1:15 PM)

*Proposed
Porter Square Center
Renovation and Expansion*

Cambridge,
Massachusetts

Prepared for **Gravestar, Inc.**
Cambridge, Massachusetts

Prepared by **VHB/Vanasse Hangen Brustlin, Inc.**
Watertown, Massachusetts

Proposed Porter Square Center Renovation and Expansion

Cambridge,
Massachusetts

Prepared for **Gravestar, Inc.**
One Broadway
Cambridge, MA 02142
617-492-4118

Prepared by **VHB/Vanasse Hangen Brustlin, Inc.**
Transportation, Land Development, Environmental Services
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617 924 1770

June 1996

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INTRODUCTION

Gravestar, Inc. of Cambridge, Massachusetts is proposing to renovate and expand the existing Porter Square Shopping Center on Massachusetts Avenue (Route 2A) in Cambridge, Massachusetts. This project will involve the expansion of the existing plaza as well as modifications to the existing site access and the overall configuration of the site.

Vanasse Hangen Brustlin, Inc. (VHB) has been retained to evaluate the potential project-related traffic impacts on area roadways, including recommendations to minimize impacts and provide safe and efficient site access. Consideration was also given to possible modifications to the existing Porter Square intersection design independent of the proposed project. As part of this project, VHB has attempted to improve existing traffic operations in the area while expanding the retail center. In addition, VHB has also addressed the present parking demands experienced at the plaza under peak conditions. Throughout this process, VHB has attempted to balance the needs of the plaza, including improved access and parking, with the needs of the neighborhood, the local roadway system and the needs of pedestrian and bicycle traffic in the area. The goal of this challenging task was to provide the optimal access to the shopping center while improving the safety and efficiency of existing local vehicular, bicycle and pedestrian traffic. Consideration was also given to the urban design element of this project and maintaining and enhancing the identity of Porter Square.

Input from both the cities of Cambridge and Somerville, as well as the Porter Square Neighbors Association, was incorporated into this study. Several issues were studied at the request of both cities, including addressing peak parking demands at the shopping center, the desire for left-turn access from the site onto Massachusetts Avenue, and possible ways of improving both bicycle and pedestrian safety at the Porter Square intersection. Particular attention was also given to enhancing pedestrian flow and safety between the Porter Square MBTA station and the existing shopping center. Once these critical issues were identified and assessed, VHB evaluated several site access alternatives that attempted to address all of these issues to varying degrees. With all of the alternatives considered, the needs of each group were balanced so as to not adversely effect the needs of a different group. After conducting analysis and evaluating each alternative, the preferred alternatives were selected. The recommended access alternatives are presented for consideration by both cities as part of potential improvement plans for Porter Square independent of the proposed project. The proposed site plan has been designed to accommodate any of the final alternatives considered, without requiring any changes to building or parking layout.

Project Description

The proposed project calls for the existing Porter Square Star Market to be expanded from its present size of 40,340 square feet (sf) to approximately 55,870 sf (a 15,530 sf expansion). Star Market will expand into a portion of the building space presently occupied by the Cambridge Savings Bank and all of that occupied by CVS. Consideration is also being given to incorporating a portion of the Cambridge Savings Bank into the new Star Market and continuing banking activity to some degree. As part of this project, a new 22,000 sf, two-story retail building will be constructed on the southwesterly corner of the site adjacent to the Porter Square intersection and White Street. The Fleet Bank ATM building presently at this location will be removed. An additional 1,200 sf of retail vendor space will be provided adjacent to the northerly side of the new building. With the proposed expansion project, the Porter Square Center will have a total of 148,880 sf of building space, which is an increase of approximately 22,370 sf over the existing plaza's building size.

The Porter Square Center is located at the northeast corner of Porter Square, which is the intersection of Massachusetts Avenue and Somerville Avenue. The site is bound by Davenport Street to the north, Elm Street to the east and White Street to the south. This site features a Star Market supermarket, a Decelle's department store, a CVS drug store, and 12 other retail/commercial tenants. A site location map is provided in Figure 1.

As part of this project, there will be a new parking layout which will provide a total of 344 on-site parking spaces (an overall reduction of 31 parking spaces). Primary access to the site will continue to be provided by way of a driveway on White Street that will be relocated approximately 55 feet east of its present location. A right-turn in/right-turn out driveway is also provided on Massachusetts Avenue, and will remain in its present location with construction of the proposed project. The exact use of this driveway could change depending on several improvements being considered to the Porter Square intersection, as discussed in the Recommendations section of this report. There are also two site driveways presently provided onto Elm Street: the northerly driveway, which accommodates exiting movements only, and the southerly driveway, which allows for two-way traffic flow. Construction of the project is expected to be completed in 1997. The proposed site plan is provided in Figure 2.

Study Area

A comprehensive area of study for the proposed project was chosen based on field observations by VHB and includes five local roadways and fourteen intersections. The study area intersections are listed below and are highlighted in Figure 3.

Massachusetts Avenue at:

- Upland Road
- Somerville Avenue
- Porter Square Center
- Davenport Street
- Beech Street

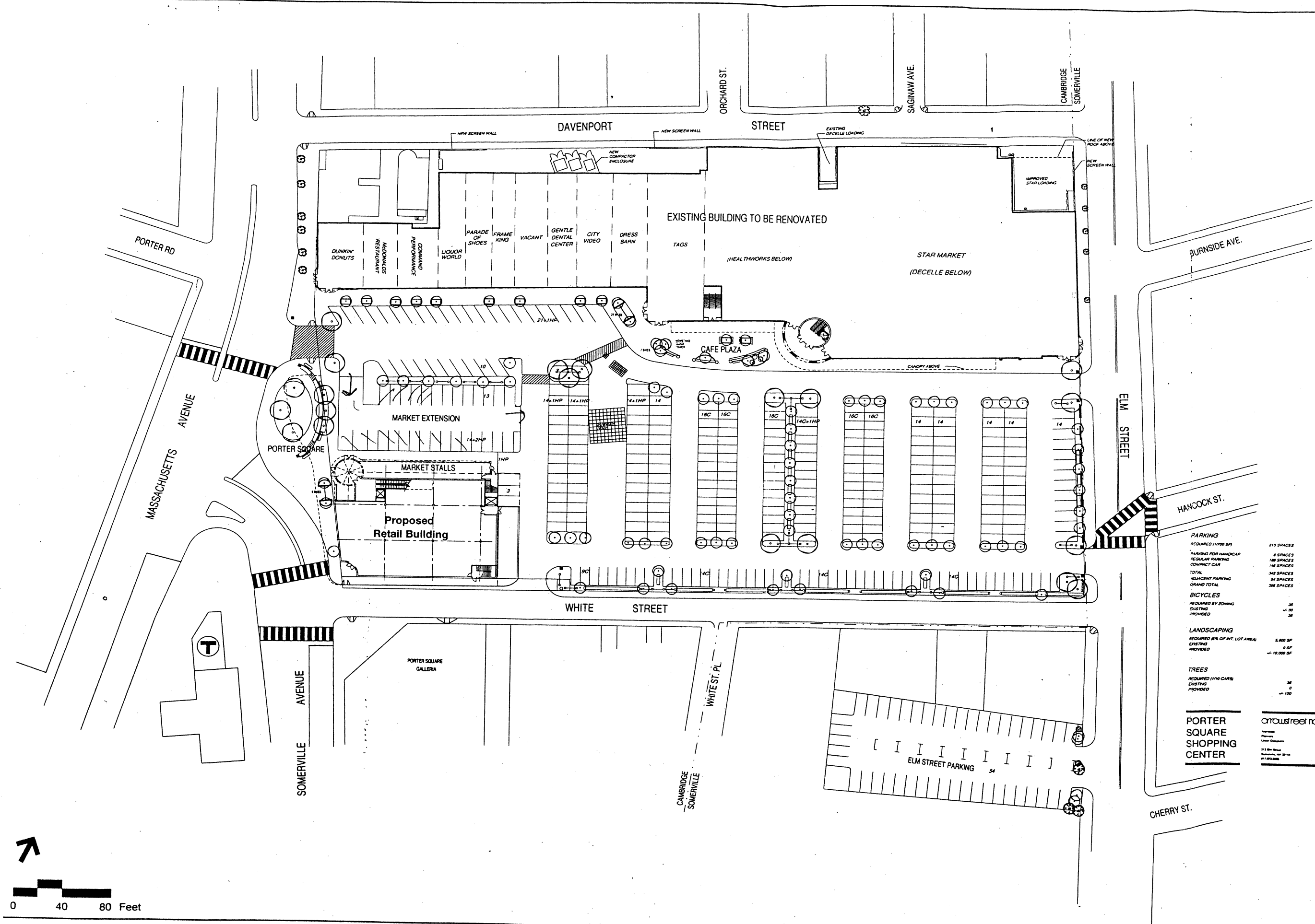


Source: USGS Quadrangles Boston North and Boston South, MA

Vanasse Hangen Brustlin, Inc.

Site Location Map

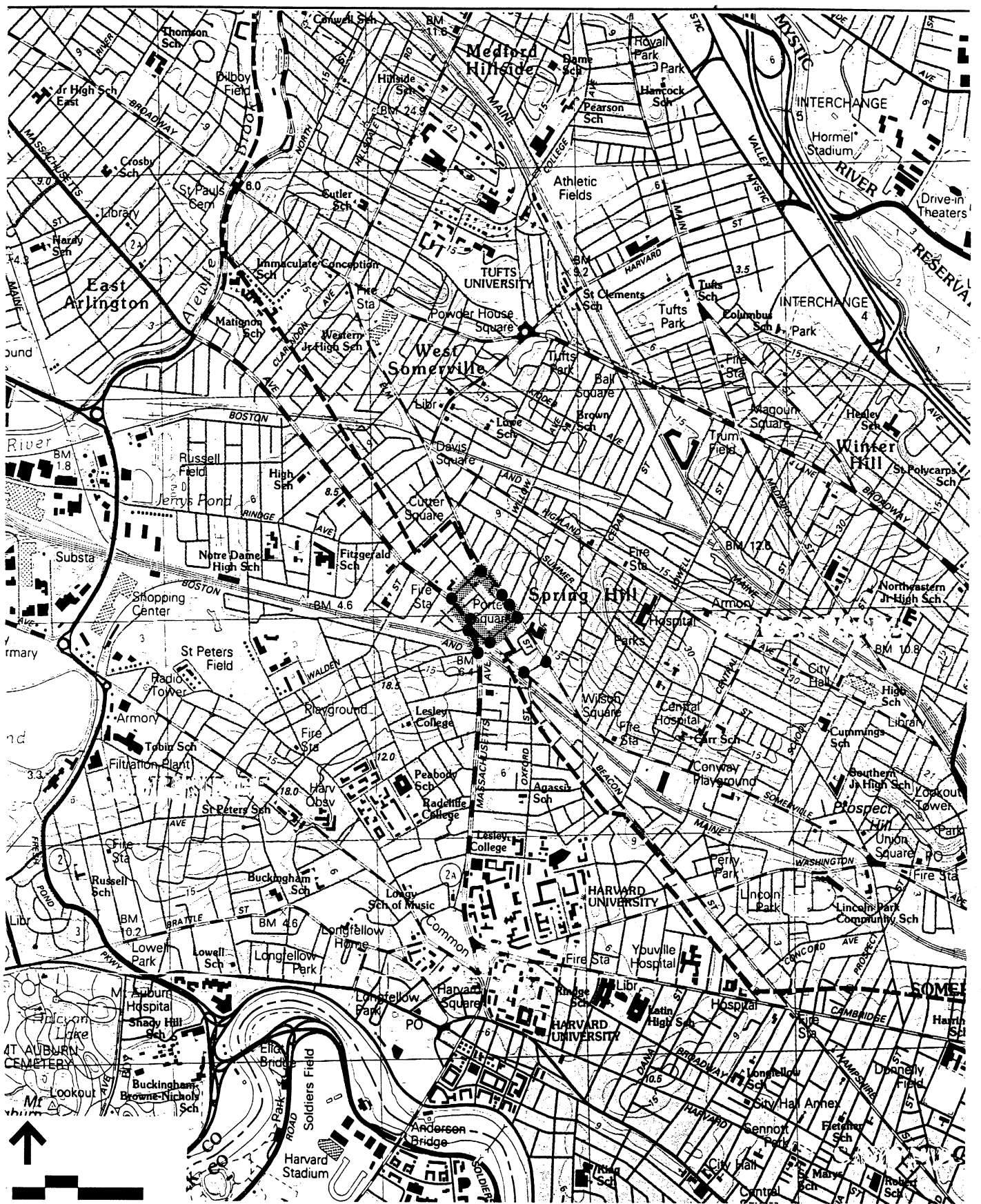
Figure 1



PARKING	
REQUIRED (11700 SF)	215 SPACES
PARKING FOR HANDICAP	8 SPACES
REGULAR PARKING	188 SPACES
COMPACT CAR	148 SPACES
TOTAL	348 SPACES
ADJACENT PARKING	50 SPACES
GRAND TOTAL	398 SPACES
BICYCLES	
REQUIRED BY ZONING	36
EXISTING	11-30
PROVIDED	36
LANDSCAPING	
REQUIRED (% OF INT. LOT AREA)	6,800 SF
EXISTING	0 SF
PROVIDED	11,100 SF
TREES	
REQUIRED (1/100 CAR)	36
EXISTING	0
PROVIDED	11-100
PORTER SQUARE SHOPPING CENTER	circulstreet inc
	215 Elm Street Somerville, MA 02144 617-888-8888

Vanasse Hangen Brustlin, Inc.

Figure 2
Conceptual Site Plan



Source: USGS Quadrangles Boston North and Boston South, MA

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Study Area Map

Figure 3

Elm Street at:

- White Street
- Porter Square Center /Hancock Street
- Porter Square Center exit driveway
- Burnside Avenue
- Davenport Street
- Mossland Street/Cedar Street

Somerville Avenue at:

- Mossland Street
- White Street

White Street at:

- Porter Square Center/Porter Square Galleria parking garage

An inventory of existing physical conditions within the study area limits is presented in the following section.

EXISTING CONDITIONS

Evaluation of the transportation impacts associated with the proposed shopping center requires a thorough understanding of the existing transportation system in the project study area. Existing transportation conditions observed in the study area include existing roadway geometrics, traffic control devices, daily and peak hour traffic volumes, roadway operating characteristics, and traffic accidents. The following section presents a summary of this information.

Existing Roadway Network

The project study area is characterized by a mixture of dense commercial and residential uses. The study area intersections consist mainly of intersections of local collector roadways with urban arterial roadways. The major travel routes within the study area are described in detail below.

Massachusetts Avenue (Route 2A)

Massachusetts Avenue (Route 2A) is an urban arterial roadway that runs in a general north/south direction through the study area. Within the study area, Massachusetts Avenue is a four-lane, city-owned and -maintained roadway in the vicinity of the site. The roadway consists of approximately 72-feet of pavement within a 95-foot wide right-of-way, and the northbound and southbound travel lanes are separated by a five-foot wide median. Both the roadway and right-of-way taper to a greater width at the Porter Square intersection. There are several median breaks provided along Massachusetts Avenue within the study area, but U-turns are prohibited within the study area. Traveling north on Massachusetts Avenue, left turns or U-turns are prohibited at all median breaks until the intersection of Massachusetts Avenue and Walden Street.

The Porter Square intersection is located directly to the west of the site and is characterized by the skewed angle at which Somerville Avenue intersects Massachusetts Avenue, and the large mixture of vehicular and pedestrian traffic. The Porter Square intersection actually consists of two separate intersections - the Massachusetts Avenue/Somerville Avenue intersection and the Somerville Avenue/White Street/Massachusetts Avenue intersection. Both of these intersections operate together under pretimed control as a coordinated system, which also includes the intersection of Massachusetts Avenue and Upland Road. Traffic operations at

Porter Square are also effected by the large number of pedestrian crossings, particularly those being made diagonally from the Porter Square MBTA station to the site.

The traffic signal at the Massachusetts Avenue/Somerville Avenue intersection presently operates with two phases: Phase 1, in which Massachusetts Avenue through-traffic has the green signal, and Phase 2, which accommodates southbound Massachusetts Avenue traffic (including left turns onto Somerville Avenue) and northbound Somerville Avenue traffic. (Left turns from Somerville Avenue onto Massachusetts Avenue are not allowed at this intersection.) While Phase 1 is running at the Massachusetts Avenue/Somerville Avenue intersection, the right-turn from Massachusetts Avenue to White Street and right-turn from White Street movements are both running. Somerville Avenue traffic has a green indication in both directions under Phase 2. An exclusive pedestrian phase is also provided at both intersections.

Somerville Avenue

In the immediate vicinity of the site Somerville Avenue has a variable width within a variable width right-of-way. Somerville Avenue is also intersected by White Street approximately 150 feet south of Porter Square. Somerville Avenue is an urban arterial roadway that extends from Route 28 in Somerville northerly to Massachusetts Avenue in Cambridge. This road is owned and maintained by the City of Cambridge and Somerville. Land use along Somerville Avenue within the study area is a mixture of commercial and industrial.

Elm Street

Elm Street is an urban collector roadway that runs from its intersection with Somerville Avenue, known as Wilson Square, northerly to Davis Square. Within the study area the width of this city-owned and -maintained roadway is approximately 40 feet within a 60-foot right-of-way. Land use along this roadway is a mixture of residential, with some commercial uses, including the Porter Square Center. The John F. Kennedy School is located on the easterly side of Elm Street between Mossland Road and the site. Parking is allowed on both sides of Elm Street throughout the study area. Between Wilson Square and the site, Elm Street is intersected by several local roadways heading out of Somerville onto Elm Street. Two of these roadways located to the east of Wilson Square - Porter Street and Linden Street allow for two-way traffic. Heading northwesterly on Elm Street, the remaining roadways intersecting Elm Street from the east are one-way heading from Somerville into Cambridge. Willow Street, which intersects Elm Street opposite Beech Street to the north of the site, offers motorists the next opportunity to head into Somerville.

The Cambridge Somerville city line runs along the westerly side of Elm Street adjacent to the site. At the southeasterly corner of the site the line crosses White Street and runs along the southerly edge of this roadway to White Street Place, where it continues in a southerly direction in the center of the road.

Traffic Volumes

Traffic volumes in the study area were counted both mechanically and manually in March and April 1996. Automatic traffic recorder (ATR) counts were conducted on Massachusetts Avenue to obtain both weekday and Saturday traffic volumes. The observed traffic volumes at this location are shown below in Table 1.

Table 1
Observed Traffic Volume Summary

Location	Direction	ADT*	Weekday				Saturday		
			Morning Peak Hour Volume**	K Factor***	Evening Peak Hour Volume	K Factor	Midday Peak Hour Volume	K Factor	
Massachusetts Ave.	northbound	21,800	1,100	5.0	1,700	7.8	21,700	1,450	6.7
south of Davenport Street	southbound	20,100	1,750	8.7	1,200	6.0	19,300	1,300	6.5
	Total	41,900	2,850	6.8	2,900	6.9	41,000	2,750	6.6

Source: Based on ATR counts performed by Vanasse Hangen Brustlin, Inc. between March 28 and 30, 1996.

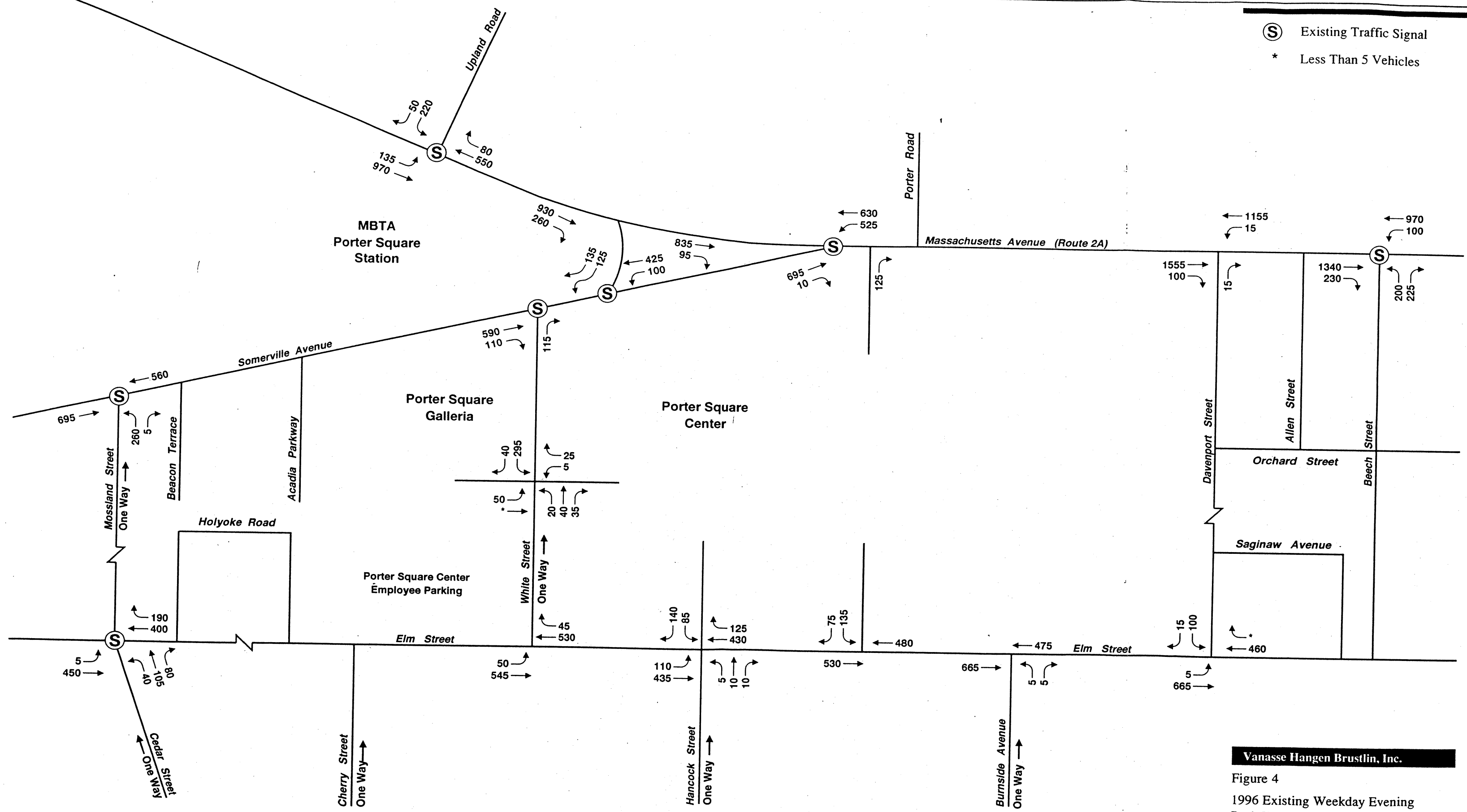
- * Average Daily Traffic expressed in vehicles per day.
- ** Expressed in vehicles per hour (vph).
- *** Represents the percent of daily flow occurring during the peak hour.

As shown in Table 1, Massachusetts Avenue carries an average volume of approximately 41,900 vehicles per day (vpd) on a typical weekday. Weekday daily traffic volumes were observed to peak between 8:00 and 9:00 AM during the morning commuter peak period and again between 5:00 and 6:00 PM during the evening commuter peak period. During the weekday morning and evening peak hours approximately 2,850 and 2,900 vehicles were observed to pass the site, respectively. On Saturday, Massachusetts Avenue carries approximately 41,000 vehicles on a daily basis and 2,750 vehicles during the midday peak hour, which, based on turning movement counts conducted by VHB, typically occurs between 12:15 and 1:15 PM.

While the Porter Square shopping center is presently open during the weekday morning peak hour, it was not observed to generate a significant amount of traffic during this time period. Therefore, the combined critical peak demand periods of site traffic and adjacent street traffic will occur during the weekday evening and Saturday midday peak hours. Thus, the following analysis focuses on these two peak periods.

The automatic traffic recorder counts were supplemented by conducting manual turning movement and vehicle classification counts at the study area intersections during the weekday evening (4:00 PM to 6:00 PM) and Saturday midday (11:30 AM to 1:30 PM) peak hours. Existing weekday evening and Saturday midday peak hour turning movement volumes at study area intersections are shown in Figures 4 and 5, respectively.

Ⓢ Existing Traffic Signal
 * Less Than 5 Vehicles

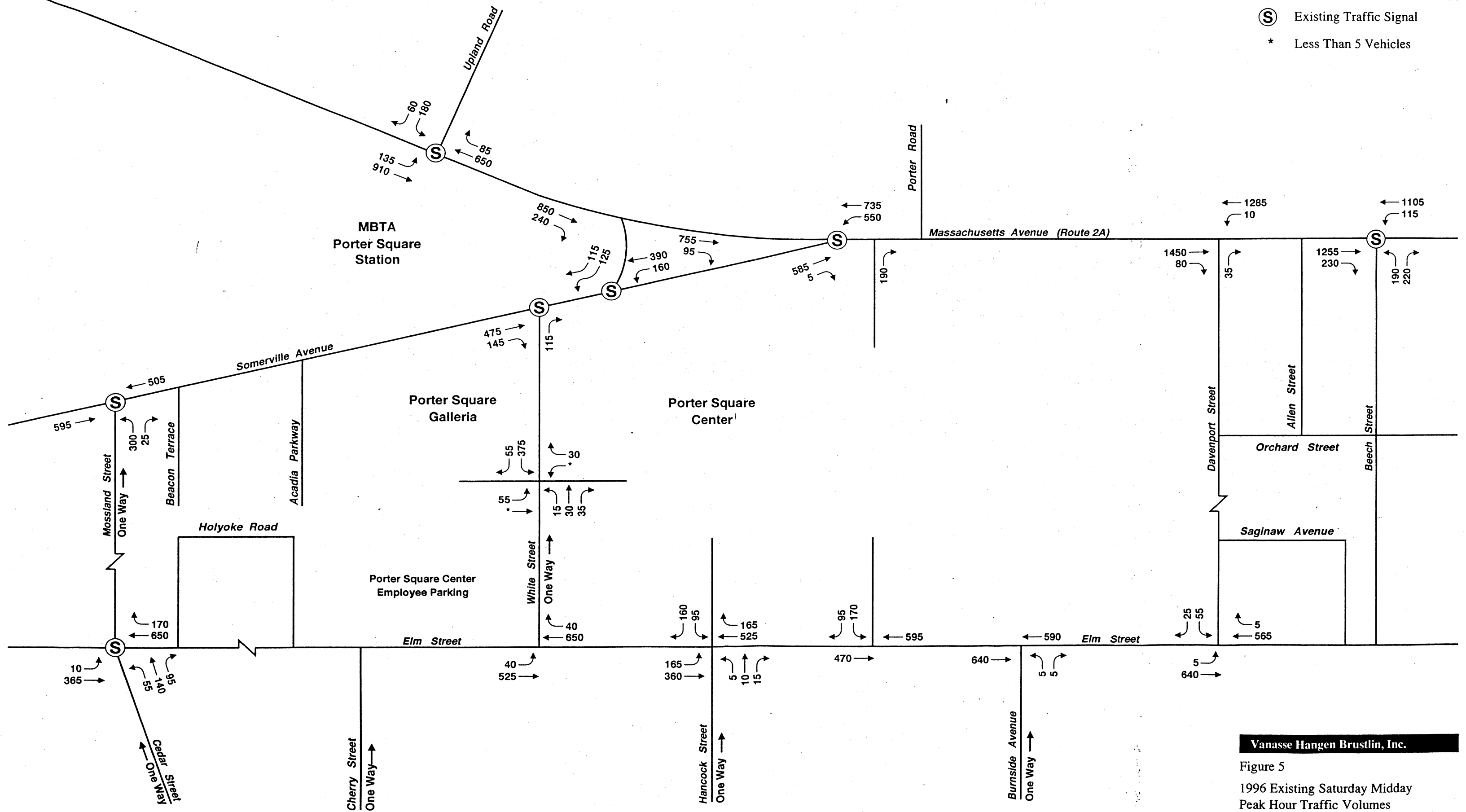


Vanasse Hangen Brustlin, Inc.

Figure 4
 1996 Existing Weekday Evening
 Peak Hour Traffic Volumes
 (5:00 PM - 6:00 PM)

Not to Scale

Ⓢ Existing Traffic Signal
 * Less Than 5 Vehicles



Vanasse Hangen Brustlin, Inc.

Figure 5
 1996 Existing Saturday Midday
 Peak Hour Traffic Volumes
 (12:15 PM - 1:15 PM)

Not to Scale

Observed Traffic Flows

Observations of traffic flows and operations made during the data collection phase of this study indicate that traffic generally flows in a slightly congested fashion throughout the study area for most of the day. Traffic flow in the vicinity of Porter Square was observed to be effected by pedestrian traffic generated from the MBTA station, local retail uses and residences. Specific travel characteristics in the study area are noted in the following paragraphs.

Porter Square Intersection

Traffic along Massachusetts Avenue was generally observed to flow in a slightly congested manner during the peak hours. Travel speeds along this road were observed to be approximately 30 miles-per-hour (mph) throughout the day. Traffic along Somerville Avenue was observed to generally flow smoothly throughout the day and during the peak hours studied. However, delays to motorists under peak hour conditions result from the presence of the traffic signal at Porter Square, along with the observed pedestrian activity in the area. Queuing of southbound Massachusetts Avenue traffic was typically observed under peak hour conditions. This queuing typically is caused by the queue at the Massachusetts Avenue/Upland Road intersection backing up into the Porter Square intersection. Possible measures to minimize vehicle queuing at the Massachusetts Avenue/Upland Road intersection will be discussed in the Recommendations section of this report. As previously stated the southbound Massachusetts Avenue approach to this intersection consists of an exclusive left-turn lane, a shared left-turn/through lane and a single through-lane. Field observations revealed that almost all of the traffic in the shared left-turn/through lane turned left onto Somerville Avenue. Motorists wishing to travel southbound on Massachusetts Avenue from this lane were occasionally observed to be "trapped" in this lane by vehicles waiting for the left-turn signal indication.

Elm Street

Travel speeds along Elm Street were observed to be in the 30 to 35 mph range during peak hour conditions. Traffic along this roadway was observed to flow relatively smoothly along Elm Street throughout the day. However, there were conflicts observed at the Porter Square Center driveways under peak hour conditions. Motorists exiting the site from the northerly site exit driveway were frequently observed to have difficulty exiting when large trucks were parked in the loading zone adjacent to the shopping center. These trucks sometimes limit the sight distance for these motorists so they pull out into the roadway to gain better visibility. This results in southbound Elm Street traffic being blocked by motorists waiting for a gap in the northbound Elm Street traffic stream. A similar situation has also been observed to result from vehicles parked between the two driveway blocking sight distance. Measures to improve this situation are being undertaken by the City of Somerville and are discussed in the

Planned Roadway Improvements section of this report. Additional measures to improve safety at this location will be discussed in the Recommendations section of this report.

Cut-Through Traffic and Diverted Traffic

Based on field observations conducted by VHB, between 30 and 40 percent of the traffic entering the site at the White Street driveway is non-site related traffic that is using the site to cut through to Elm Street. This creates additional congestion in the parking lot and adds to the exiting demand from the site onto Elm Street. This pattern generally seems to be mostly comprised of motorists from Massachusetts Avenue traveling to Somerville. It is estimated that this cut through traffic results in approximately 90 and 150 vehicles traveling on local roadways during the respective weekday evening and Saturday midday peak hours.

Motorists wishing to exit the site and head southbound on Massachusetts Avenue presently do not have direct left-turn access from the site to this road. Therefore, these motorists have to cut through neighborhood streets in Cambridge and Somerville to get to Massachusetts Avenue. The most prominent route observed was for motorists to turn right from the site onto Elm Street, proceeding a short distance until turning right onto Mossland Street and then across Somerville Avenue to either Beacon Street, Oxford Street, or Roseland Street to Massachusetts Avenue. A similar pattern was shown by vehicles turning left from the site onto Elm Street, and left again onto Beech Street. The signalized intersection of Massachusetts Avenue and Beech Street is the closest point north of the site that a legal left-turn can be made onto Massachusetts Avenue heading south. While it is difficult to quantify the exact number of "diverted" left turns that presently cut through the neighborhoods in this fashion, a reasonable estimate can be obtained through general observations and a comparison of the entering and exiting volumes at the Elm Street driveways. Typically with retail centers, there will be a balance of entering and exiting vehicles at each driveway for a given direction (i.e., under peak conditions, the same number of vehicles can be expected to arrive and depart to and from the north). It can be assumed that the observed discrepancy in this case is partly due to the diverted left turns. Following this, it is estimated that during the weekday evening and Saturday midday peak hours, there are presently between 150 and 200 vehicles, respectively, diverted onto local streets because they cannot turn left directly onto Massachusetts Avenue.

Pedestrian Activity

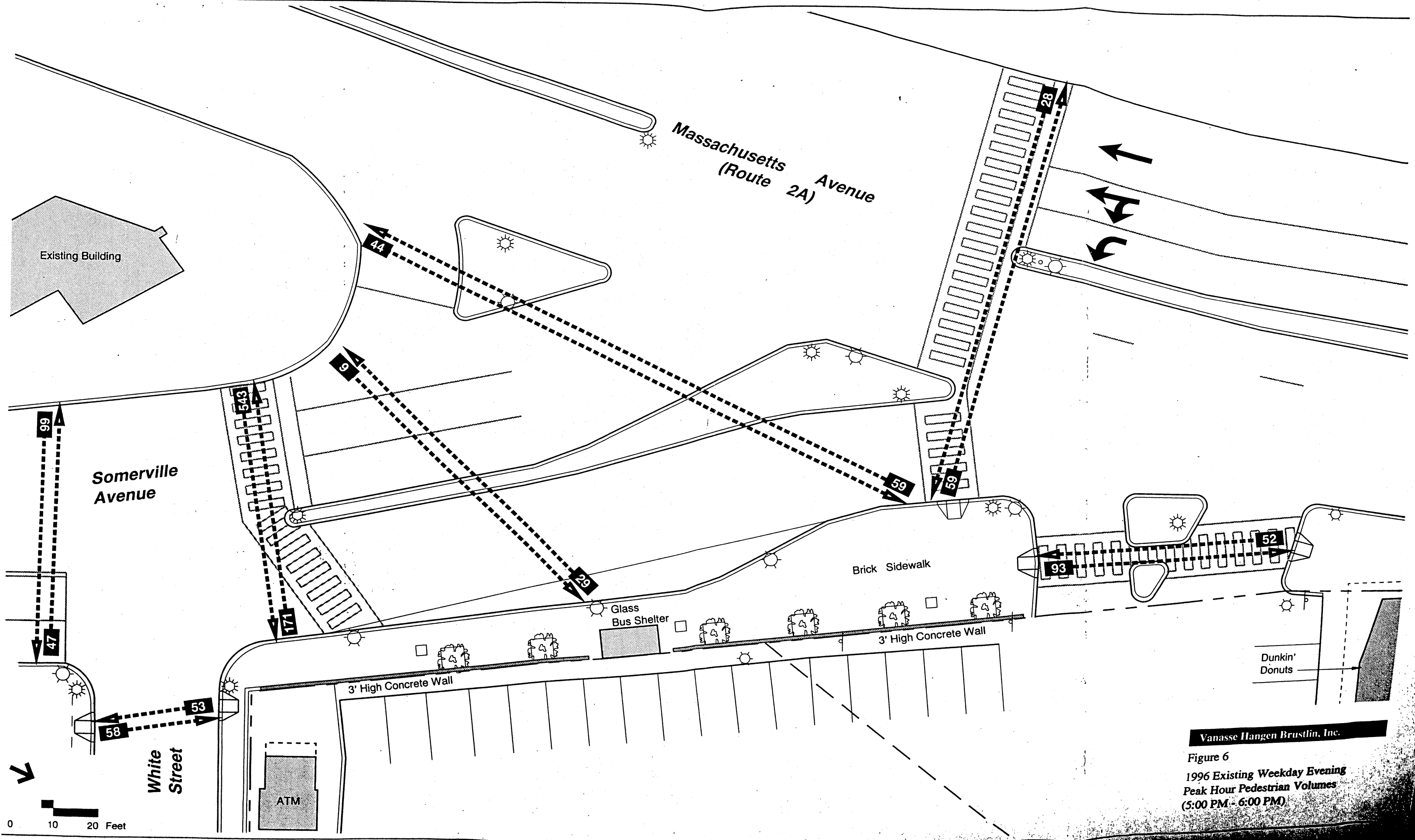
Pedestrian volume counts and observations were conducted at throughout the study area during the weekday evening and Saturday midday peak hours. There are several significant pedestrian traffic generators in the project area, the most notable being the Massachusetts Bay Transit Authority (MBTA) Porter Square subway station, which is located between Massachusetts Avenue and Somerville Avenue. There is also a MBTA bus stop located adjacent to the site on Massachusetts Avenue. Based on field observations, pedestrian traffic was observed to be constant throughout a typical weekday, with the highest amount of activity occurring during the morning and evening commuter peak periods. Saturday

pedestrian activity was observed to be constant throughout the afternoon. Sidewalks are provided on both sides of all of the study area roadways. Existing weekday evening and Saturday midday peak hour pedestrian volumes at the Porter Square intersection are shown in Figures 6 and 7, respectively.

There are pedestrian phases and crosswalks provided at all of the signalized study area intersections. While there were steady volumes of pedestrian traffic, utilization of the pedestrian phases at the study area traffic signals was observed to be moderate at these locations throughout the day. Use of the pedestrian signals was generally observed to be greater for crossings at wider intersections. At those more narrow intersections pedestrians were observed to cross the street on non-conflicting signal phases. While some of the pedestrian crosswalks are faded and not clearly visible, motorists in the area generally seem to be aware of the presence of pedestrian traffic in the area. There are two crosswalks provided across the Porter Square intersection, both featuring exclusive pedestrian phases. The crosswalk across Somerville Avenue to the north of White Street features a 22 second pedestrian phase for pedestrians to cross the roadway. This phase was formerly pedestrian actuated but has recently been changed by the City of Cambridge to be called automatically every cycle. Before this was done, pedestrians were generally observed to drift across this intersection in groups without the aid of the signals. Since the change, pedestrians crossing the street at this location were observed to cross the street during the exclusive pedestrian phase, but they still continued to cross during the Massachusetts Avenue phase of the signal. There is also a pedestrian phase that is called every cycle for the crosswalk across White Street. This 15 second phase occurs during the Somerville Avenue northbound/southbound phase of the cycle. Pedestrians were observed to typically cross White Street during all phases of the signal cycle at this location.

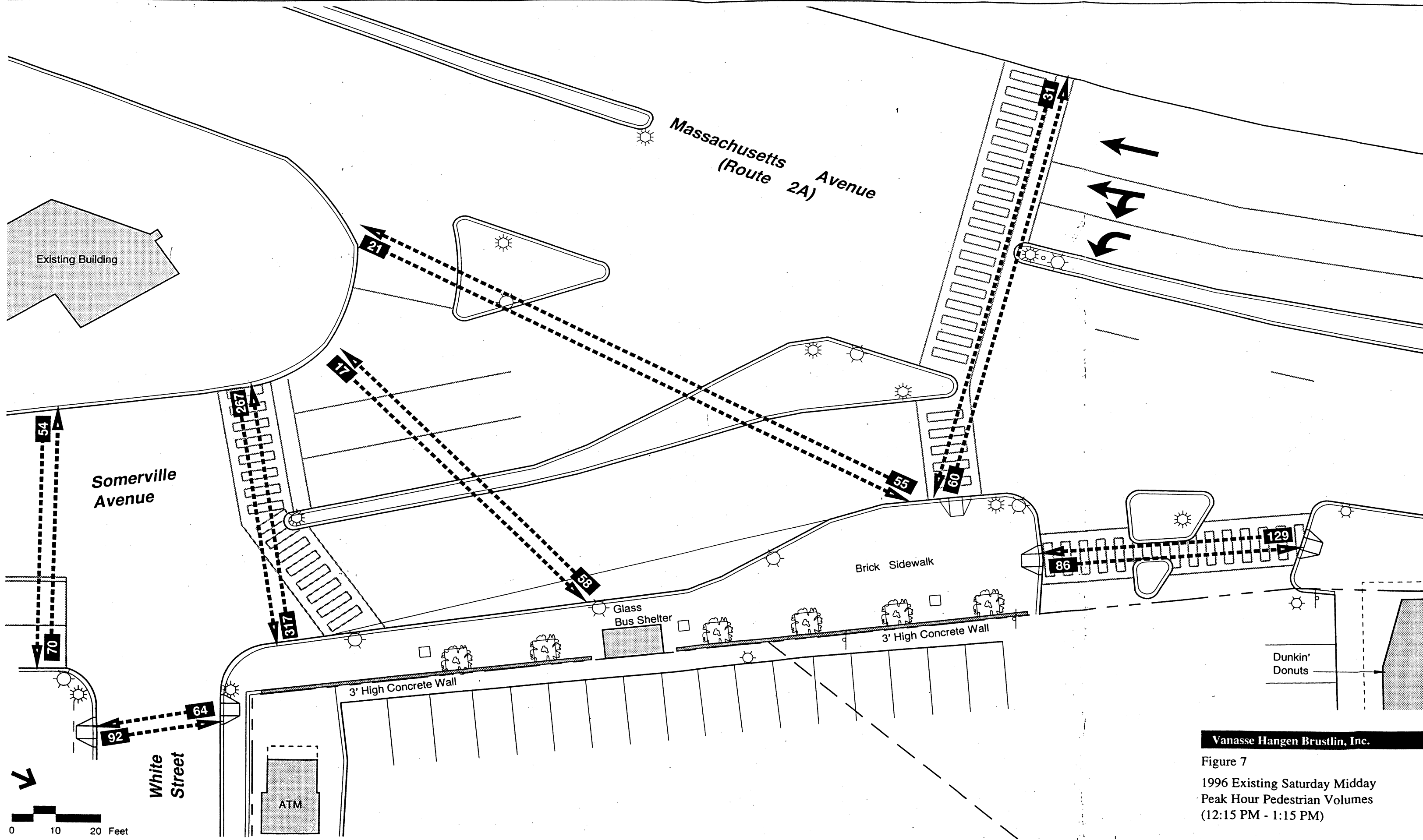
The crosswalk across Massachusetts Avenue at Porter Square has two separate sections: a 25-foot crossing across Somerville Avenue to a refuge island, and an approximately 75-foot crossing from the island to the westerly side of the roadway. An exclusive pedestrian phase is called for the Somerville Avenue crossing during the Massachusetts Avenue phase of the cycle. There are pedestrian actuation buttons provided at this island and at the westerly side of Massachusetts Avenue. When actuated, a 22 second exclusive pedestrian phase is called. Given the width of this intersection, most pedestrians wait for the exclusive pedestrian phase of the signal to cross the road under peak hour conditions.

Based on standard engineering practices, the 22-second exclusive pedestrian phase is sufficient for crossing the intersection. However, many local residents feel that there is not adequate time provided to safely cross the intersection. This may partly be due to a misperception of how these signals operate. The 22-second phase is comprised of a 7-second WALK indication and a flashing 15-second DON'T WALK indication. The purpose of this operation is to have pedestrians leave the curb to cross the road during the 7-second WALK phase. The flashing DON'T WALK interval is then displayed long enough to allow the pedestrian to travel from the curb to the center of the furthest lane before opposing vehicles receive a green indication. Therefore, the purpose of the DON'T WALK indication is to allow for pedestrians in the crosswalk to make it to the other side of the street and also to discourage any other pedestrians from beginning to cross the street at that time. One common



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Figure 6
1996 Existing Weekday Evening
Peak Hour Pedestrian Volumes
(5:00 PM - 6:00 PM)



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Figure 7
1996 Existing Saturday Midday
Peak Hour Pedestrian Volumes
(12:15 PM - 1:15 PM)

misperception of pedestrians is that they believe they are supposed to be able to cross the street during the WALK interval only, which is not intended to be the case.

Pedestrians wishing to cross the Porter Square intersection are required to wait for the 22-second pedestrian phase before crossing the roadway. On a weekday, this results in some pedestrians having to wait for 78-seconds out of the 100-second cycle before they have an opportunity to cross the roadway. This typically is seen as being a long wait for those pedestrians arriving just after the pedestrian phase has ended. However, taking away any more green time from vehicular traffic could result in excessive delays and queuing and result in driver impatience. Long term measures to improve pedestrian traffic operations are described in the Recommendations section of the report.

Public Transportation

Based on information obtained from the Massachusetts Bay Transit Authority (MBTA) regular bus service is provided within the study area. There are approximately four bus routes that run directly through Porter Square. Three of these routes run directly past the site on Massachusetts Avenue: Route # 77 (Arlington Heights - Harvard Station), Route # 77A (North Cambridge - Harvard Station) and Route # 96 (Medford Square - Harvard Station). Route # 83 (Rindge Avenue - Central Square) operates along Somerville Avenue and Massachusetts Avenue within the study area.

Route # 77 (Arlington Heights - Harvard Station) typically operates from 4:45 AM to 1:30 AM on weekdays and at 8 minute intervals during peak periods. This route also operates on Saturdays at approximate 10 minute intervals from 4:45 AM to 1:30 AM and on Sunday from 6:00 AM to 1:30 AM, at approximate 20 minute intervals. Route # 77A (North Cambridge - Harvard Station) operates on weekdays only from approximately 4:30 AM to 1:30 AM and at 10 minute intervals during peak periods.

Route # 83 (Rindge Avenue - Central Square) typically operates on weekdays from 5:00 AM to 1:30 AM and at 10 to 15 minute intervals during peak periods. This route also operates on Saturdays from 5:00 AM to 1:30 AM, at approximate 25 minute intervals during peak conditions. Sunday service on this route runs from 7:20 AM to 1:30 AM, at approximate 40 minute intervals throughout most of the day. Route # 96 (Medford Square - Harvard Station) typically operates on a schedule similar to Route # 83. Peak hour service usually runs at 20 minute intervals on weekdays and at approximate 30 minute intervals on Saturdays during peak conditions. Sunday service on this route begins one hour earlier at 6:20 AM and runs at one-hour intervals throughout the day.

There is a bus inlet provided adjacent to the site on the northbound Somerville Avenue approach to the Porter Square intersection. This bus loading area is intended to accommodate northbound busses on Somerville Avenue and to help minimize the effects of the bus activity on traffic flow through this intersection. However, this bus boarding area was observed to be underutilized during the peak periods observed. As such it is recommended that this bus inlet be removed as discussed in the Recommendations section of the report.

Local bus service was observed to be generally well utilized throughout the day. While the MBTA does have different seasonal schedules for its busses, the differences in scheduling and frequency are relatively minor.

The MBTA red line extends from the Alewife Station to the north in Cambridge southerly to Mattapan and Braintree. Service on this line runs from 5:30 AM to 1:00 AM on weekdays and Saturdays with trains running on 6 to 13 minute intervals throughout the day. Sunday service runs from 6:00 AM to 12:50 AM at 11 to 15 minute intervals throughout the day.

There are numerous connecting points between most MBTA bus and train routes so the site could potentially be reached by bus from anywhere within the cities of Cambridge and Somerville.

Bicycle Traffic

Bicycling and walking are significant transportation modes in Cambridge. This section of the report will investigate some of the current deficiencies in the bicycle and pedestrian circulation system in Porter Square and evaluate alternatives that would address those areas.

When discussing the requirements and implication of different bicycle facilities for the Porter Square area, it is important to consider the varying skill levels and needs of different bicycle groups. The 1992 FHWA manual, "Selecting Roadway Design Treatments to Accommodate Bicycles"¹, divides bicyclists into three distinct user groups:

- Group A - Advanced Bicyclists: experienced bicyclists who can operate under most traffic conditions;
- Group B - Basic Bicyclists: casual or new adult and teenage bicyclists who are less confident of their ability to operate in traffic without special provision for bicycles; and
- Group C - Pre-teen bicyclists whose roadway use is initially monitored by parents and who are eventually accorded independent access to the system.

Given the overall urban environment of the Porter Square area and observed traffic volumes, Porter Square is generally not suited to safely accommodating Group C bicyclists. Therefore, the focus of any improvements in this area should be on accommodating the Group A and B bicyclists.

Once the type of user has been identified, the type of treatment used to accommodate these bicyclists can be determined and evaluated. According to AASHTO² there are three distinct types of bicycle facility classification. The first, a bicycle path, is a physically separate from motorized vehicle traffic by an open space or a barrier and either within the highway right-of-



¹ FHWA, "Selecting Roadway Design Treatments to Accommodate Bicycles", Publication No. FHWA-RD-92-073, January 1994.

² American Association of State Highway and Transportation Officials (AASHTO), Guide for the Development of Bicycle Facilities, 1991.

way or within an independent right-of-way. The second, a bicycle lane, is a portion of the roadway which has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists. The third, a shared roadway or bicycle route, is any roadway upon which bicycle lane is not designated and which may be legally used by bicycles regardless of whether such facility is specifically designated as a bikeway. These facilities are sometimes referred to as Class I, II and III bicycle facilities, respectively. Within the project study area all of the roadways presently allow for bicycle travel but there are not any bicycle paths or bike lanes in the project study area. Given the urban location and lack of available space, it does not appear likely that bike paths could be installed in this immediate vicinity of Porter Square along Massachusetts Avenue. However, a review of the study area roadway system revealed that it is possible to provide bike lanes on Massachusetts Avenue.

The desired travel patterns of pedestrians and bicyclists are similar to those of motorists as they seek the most direct routes between locations. The amount of vehicular traffic on a street is a factor to be considered when evaluating whether a street should be designated as a bicycle route or whether a separated bicycle path or bicycle lanes should be constructed. However, as previously mentioned, it appears that the only physical improvements that could be made to accommodate bicycle traffic would be bike lanes. Based on traffic counts conducted by the Central Transportation Planning Staff, bicycle traffic in the Porter Square area has grown steadily since the 1980's. The most recent bicycle counts conducted at this intersection, on September 27, 1995 by CTPS, revealed that a total of 196 bicyclists passed through Porter Square during the weekday evening peak hour. Given this demand, in combination with the observed vehicular traffic, there is a need for special bicycle treatments. A review of existing roadway plans for Porter Square and Massachusetts Avenue in the vicinity of the site revealed that there is presently sufficient roadway width to provide 5-foot wide bike lanes along Massachusetts Avenue. For the most efficient operations, this would require that parking be prohibited on Massachusetts Avenue adjacent to the retail stores on the westerly side of the road. Long-term decisions will also have to be made by the City of Cambridge regarding on-street parking beyond this project's study area if bike lanes are to be provided along this roadway. Typically, when bicycle lanes are provided, there is an increase in the amount of biking activity on the road. It is expected that this would also be the case along Massachusetts Avenue if bicycle lanes were provided.

There is also possibility that additional measures could be taken to accommodate bicycle traffic at the study area traffic signals. Bicycles are vehicles and should obey the same rules and regulations that govern motor vehicle traffic. This means that they should obey traffic signals and should not be moving during any exclusive pedestrian phases. Possible treatments being considered by VHB include the provision of concurrent pedestrian-bicycle signals and providing bicycle phases to some of the study area traffic signals. One such location where this is being considered is the northbound Massachusetts Avenue approach to Upland Road. If bike lanes were provided on Massachusetts Avenue, then it might be possible to have a bicycle phase that would run while traffic was exiting from Upland Road onto Massachusetts Avenue.

There is presently a minimum of adequate bicycle parking facilities in the vicinity of Porter Square Center. Bicycles were also frequently observed to be parked along sidewalks, chained

to utility poles or sign posts. Often the manner in which the bicycles are parked restricts the effective width of the sidewalks. As part of this project new bicycle racks will be provided on the site to accommodate local bicycle traffic. These racks will have a total capacity of 35 bicycles and will be designed to accommodate the short-term users typically found at shopping centers. The bicycle racks will be located in the plaza area in front of the entrances to Star and Tag's as well as in the plaza area adjacent to the Massachusetts Avenue site driveway. The bicycle racks will be located so as not to interfere with either pedestrian or vehicular traffic.

Porter Square Center Parking Demand

As part of this project, an evaluation of the parking conditions at the Porter Square Center was conducted, particularly with regard to employee parking activity. This study incorporated a previous parking study conducted by VHB, as well as more recent observations of parking activity at the plaza.

VHB has also conducted an evaluation of the anticipated parking demand resulting from the proposed Porter Square Center expansion project. Based on a parking study conducted by VHB in November 1995, the 375-space Porter Square Center parking lot was operating near capacity on during the weekday evening period and at capacity throughout a Saturday afternoon. The parking situation at the plaza was observed again in April 1996 and it was found that the weekday demand had lessened slightly, but that the Saturday demand had remained near capacity. Further observations revealed that between 45 and 50 employee vehicles were parked in the main parking lot during the peak weekday and Saturday periods. At the same time this was observed, there were only 18 and 43 vehicles parked in the exclusive employee parking lot during the respective weekday evening and Saturday midday peak periods. The employee parking lot is located on the west side of Elm Street approximately 100 feet south of White Street. There is a total of 46 striped parking spaces in this lot and an additional 8 vehicles were typically observed to be parked in a line in the center of the lot, for a total lot capacity of 54 vehicles.

Data regarding parking demand of various individual uses have been compiled by the Urban Land Institute in *Shared Parking*³. The data contained in that report indicate that the peak parking demand for retail uses typically occurs in the month of December. Parking demand in November, when the parking accumulation study was conducted by VHB, is typically 80 percent of that which occurs in the peak month of December. Parking demand throughout the remainder of the year is usually only slightly lower - approximately 75 percent of peak month conditions. Therefore, given that the lot was observed to be at capacity in November, it is not likely that parking demand at the Porter Square Center would be significantly lower throughout the rest of the year. However, there is a significant student population in this area which leads to the possibility of business being slightly slower during the summer months when the student population in Cambridge is lower. Based on discussions with individual

▼
3 Shared Parking: Urban Land Institute; Washington, D.C. (1983).

business representatives in the plaza, this center does not experience the notable seasonal peak typically associated with larger shopping malls. Instead, the plaza experiences relatively level business throughout the year, with some peaks associated with shoppers at Star Market during Thanksgiving and other holidays.

To determine the increased parking demand resulting from the project, both the existing parking demand and standardized Institute of Transportation Engineers (ITE) parking data were considered. A comparison of the observed parking demand at this site and that projected using the ITE data is presented below in Table 2.

**Table 2
Porter Square Center - Peak Parking Demand Comparison**

Time Period	Existing Porter Square Center 126,510+ sf		Proposed Porter Square Center 148,880+ sf	
	Observed*	ITE data**	Observed*	ITE data**
	Weekday Evening	375	312	N/A
Saturday Midday	375	311	N/A	382

* Source: Parking accumulation study conducted by VHB on November 16 and November 18, 1996.

** Source: Parking Generation, Second Edition; Institute of Transportation Engineers; Washington, D.C. (1987).

As shown above in Table 2, parking demand at the Porter Square Center is presently higher than would be expected using ITE data for similarly sized shopping centers. This is particularly noteworthy given the public transportation available in close proximity to the site, which typically helps to reduce parking demand. Based on the above, the ITE data do not appear to be applicable to the Porter Square Center. Instead, it can be assumed that parking demand at the site will increase proportionally to the increase in building area on the site. Since the relocated CVS building will be approximately the same size as the existing building, it can be assumed that any increase in parking demand for CVS will be negligible. Therefore, the increased parking demand on this site will result from the expansion of the Star Market and the additional development of 10,700± sf of retail space, including the 1,200 sf of retail vendor stalls.

Based on the previous parking accumulation study, the peak parking demand at the site is presently about 3 spaces per 1,000 sf of floor area. Therefore, the proposed 10,700± sf of additional retail space would generate a demand of 33 more spaces under peak conditions and the 15,530 sf Star Market expansion would result in an additional 47 spaces, for an overall increased demand of 80 spaces. However, a supermarket expansion does not typically result in a linear increase in trip generation, but rather, an increase in the individual spending per customer usually occurs along with some increase in the total number of patrons. While there will be increases in the amount of traffic generated and parking demand, this will not occur at

the same rate that is presently observed at the site. [The project trip generation will be discussed in detail in the Site-Generated Traffic section of the report.] Therefore, in keeping with the anticipated increase in trip generation for the site, which is a maximum of 60 vehicles per hour, the Star Market expansion should only result in an additional demand of approximately 27 spaces (60 total spaces minus the 33 spaces needed for the new retail use, resulting in the 27 spaces needed for the Star Market vehicles). Regardless of the exact split between the retail and Star parking demand, it is not expected that the increased parking demand would exceed the expected increase in trip generation for the entire site (60 vph). With the existing supply of on-site parking, the anticipated demand at this site would exceed the existing parking supply. Measures to increase the amount of on-site parking available for patrons are described in the following section.

Following a review of parking conditions at this site, it is recommended that employee parking be entirely prohibited in the Porter Square Center parking lot. Based on field observations of employee parking activity, this would result in an additional 45 to 50 parking spaces being available for customers. The possibility of providing customer parking at the parking lot on Elm Street, which is presently designated for employee use only, has also been investigated. There are presently 46 striped parking spaces in this lot, with room for an additional 8 spaces in the center of the lot, for a total lot capacity of 54 spaces. While leasing arrangements would require that some of these spaces be restricted for employee use, the remainder could be used for customer parking. Therefore, employee parking could be restricted to those tenants having parking requirements in their leases, and a substantial number of spaces could be provided for customers in this lot. Information regarding the individual tenant requirements is needed to determine the exact number of spaces that could be provided. To help promote the use of these spaces, signing could be provided in the parking lot to alert patrons that these spaces are available. With the combination of on-site employee parking being prohibited and the Elm Street lot being available for use by patrons, approximately 90 additional parking spaces could be provided for customer use - 45 on-site spaces and approximately 35 spaces for customers at the Elm Street parking lot. This conservative estimate of 80 additional parking spaces would help to offset the approximately 31 spaces that would be lost under with the current development proposal.

The proponent has also committed to investigating the possibility of reducing the amount of employees parking at the main Porter Square Center parking lot by providing subsidized MBTA passes to plaza employees. Other possible measures to reduce the remaining employee parking demand could include ridesharing matching services, incentives for employees to carpool and a remote lot for employee parking. These measures and others will be discussed in detail in the Recommendations section of the report.

Accident Summary

Accident data for study area roadways and intersections were requested from the Cambridge and Somerville Police Departments from 1993 through 1996. These data were studied to identify any prevalent accident trends. A summary of this information is provided in Table 3.

**Table 3
Accident Summary 1993 - 1996**

	Massachusetts Avenue at:					Somerville Ave. at:			Elm Street at:				
	Upland Rd.	Somerville Ave.	Porter Square Ctr.	Davenport St.	Beech St.	Mossland St.	White St. Mass Ave.	Mossland St./ Cedar St.	White St.	Porter Square Ctr.	Hancock	Burnside	Davenport
<u>Year</u>													
1993	0	25	0	2	9	1	2	7	0	0	1	2	0
1994	2	21	0	0	7	1	1	4	0	0	6	0	0
1995	5	26	0	3	7	0	1	1	0	0	2	0	0
<u>1996*</u>	<u>0</u>	<u>6</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>1</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>0</u>
Total	7	78	0	5	25	2	5	12	0	0	11	2	0
<u>Time of Day</u>													
7-9 AM	1	5	0	2	3	0	0	2	0	0	2	0	0
4-6 PM	0	12	0	0	3	0	1	2	0	0	3	0	0
Other	6	61	0	3	19	0	4	8	0	0	6	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>
Total	7	78	0	5	25	2	5	12	0	0	11	2	0
<u>Severity</u>													
Personal Injury	3	10	0	0	5	0	0	0	0	0	0	0	0
Bicycle or pedestrian	0	4	0	0	2	0	2	0	0	0	0	0	0
Property Damage Only	4	64	0	5	18	0	3	0	0	0	0	0	0
<u>Unknown</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>12</u>	<u>0</u>	<u>0</u>	<u>11</u>	<u>2</u>	<u>0</u>
Total	7	78	0	5	25	2	5	12	0	0	11	2	0

Source: Cambridge and Somerville Police Departments.
* January 1, 1996 through April 30, 1996

As shown in Table 3, the intersection of Massachusetts Avenue and Somerville Avenue (Porter Square) has the highest accident experience in the project study area. This intersection has averaged approximately 25 reported accidents per year since 1993. Four of these accidents involved either bicycles or pedestrians, which was also the highest total within the study area. (All of the bicycle or pedestrian accidents shown in table resulted in personal injury). The next highest intersection for accidents was the intersection of Massachusetts Avenue and Beech Street. This intersection averaged approximately 8 accidents per year, which is not unusual for a signalized intersection in an urban environment. There were also two reported bicycle accidents at this intersection during the same time period. Measures to enhance both bicycle and pedestrian safety at this location and throughout the study area will be described in the Recommendations section of the report.

The accident data for this analysis were provided by the Cambridge and Somerville Police Departments. It is possible that other accidents might have occurred within the study area and were not reported, or were reported to an agency besides the local police departments. In particular, this would probably indicate that there were some accidents that did occur at the site driveways that were either not reported or attributed to nearby intersections.

FUTURE CONDITIONS

To estimate future travel demands on the roadway network, existing traffic volumes in the study area were projected to the year 1998, by which time the proposed project is expected to be occupied and established. Independent of the proposed project, traffic volumes on the roadway network in 1998 will include existing traffic, new traffic resulting from both general background traffic growth and traffic related to specific development projects expected to be completed by 1998. As mentioned previously, the proposed shopping center is proposed to be constructed and opened before 1998. Potential background traffic growth unrelated to the proposed project was considered in the development of the 1998 No-Build traffic volume networks. Anticipated project-related traffic volumes were then added to the 1998 No-Build traffic flow networks to reflect 1998 Build conditions with the proposed project completed.

Planned Roadway Improvements

Based on discussions with the Cities of Cambridge and Somerville, there are no major roadway projects planned within the study area in the immediate future. However Cambridge is planning a design project along Massachusetts Avenue. As part of this study consideration was also given to possible modifications to the existing Porter Square intersection design independent of the proposed project. These modifications include providing left-turn access from the site onto Massachusetts Avenue, enhancing pedestrian flow and safety between the Porter Square MBTA station and the existing shopping center, and improving the overall quality of traffic operations at this intersection. As previously stated, there is presently enough roadway width provided on Massachusetts Avenue that bicycle lanes could be provided in both directions. This would involve the elimination of two parking spaces located on the southbound side of Massachusetts Avenue located adjacent to the retail stores. However, there are other parking issues beyond this projects study area that could conflict with the provision of bike lanes. Further study of these issues is required to determine how bicycle traffic can be accommodated beyond Porter Square.

The City of Somerville recently made changes to Elm Street adjacent to the site. These changes included eliminating crosswalks at the northerly site driveway and near the southerly side driveway opposite White Street. These crosswalks have been replaced by a new triangular crosswalk setup which crosses Elm Street at the southerly site driveway to either side of Hancock Street, with a crosswalk also being provided directly across Hancock Street. While the old crosswalks have been eliminated most pedestrians generally cross the roadway at the former crosswalk location and other random points along Elm Street. Two busstops on Elm

Street are also in the process of being relocated. The bus stop located in the vicinity of the John F. Kennedy elementary school will be moved to the north on Elm Street to opposite White Street. The bus stop on the westerly side of Elm Street will be moved to the south between the two site driveways. Discussions with the city have also revealed that parking between the two existing site driveways on Elm Street will soon be prohibited as a means of improving sight distance for exiting site traffic at both driveways.

The City of Cambridge recently revised how pedestrian traffic is accommodated at the Porter Square intersection. There are presently single crosswalks crossing Somerville Avenue and Massachusetts Avenue. There are pedestrian actuated signals at the Somerville Avenue crosswalk. Based on field observations, these signals were observed to be actuated infrequently. The Massachusetts Avenue crosswalk features two sets of pedestrian signals to aid in crossing the street. The pedestrian signals at the portion of the crosswalk crossing Somerville Avenue are called every cycle during the phase of the signal when Massachusetts Avenue traffic has a green indication in both directions.

Background Traffic Growth

Traffic growth is a function of expected land development in the region. To predict the rate at which traffic can be expected to grow between 1996 and the forecast period of 1998, historical traffic volumes and site-specific growth in the area were examined.

Annual Traffic Growth

A review of traffic volume data on Massachusetts Avenue in the vicinity of the site indicates that traffic volumes in the Cambridge have remained relatively stable in recent years. Traffic counts conducted on Massachusetts Avenue in 1981 were compared to counts conducted by VHB in March 1996. This comparison indicated that volumes at this location have increased by one percent per year over this fifteen year period. Representatives of the Cambridge Traffic, Parking & Transportation Department confirmed that this observed one-percent yearly growth rate is still applicable to the study area. Accordingly, existing traffic volumes in the study area were increased by one percent per year to account for potential future traffic growth.

Site-Specific Growth

Based on discussions with representatives of the Cambridge Traffic, Parking & Transportation Department and the City of Somerville, there are no planned developments of major significance within the study area which might affect traffic volumes.

No-Build Traffic Volumes

The 1998 No-Build weekday evening and Saturday midday peak hour traffic networks were developed by applying a one percent annual growth rate to the existing 1996 base peak hour traffic volumes. The resulting 1998 No-Build weekday evening and Saturday midday peak hour traffic volumes are shown in Figures 8 and 9, respectively.

Site-Generated Traffic

The volume of traffic to be generated by the expansion of the Porter Square Shopping Center was estimated in a two step process. In the first step, the total volume of traffic to be generated by the proposed retail expansion was estimated. In the second step the vehicle trips generated by the project were broken down into new and pass-by trips to determine the amount of new site-generated traffic which would be added to area roadways.

The rate at which retail uses generate traffic is dependent on a number of factors such as size, location, and proximity of competing uses. The peak traffic hours of retail uses do not always coincide with the peak hour of the adjacent street system; however, the critical impact on the adjacent street system generally occurs during the adjacent street system's peak hours. As a result, the critical time periods for the analysis of project-related impacts will be the weekday evening and Saturday midday peak hours.

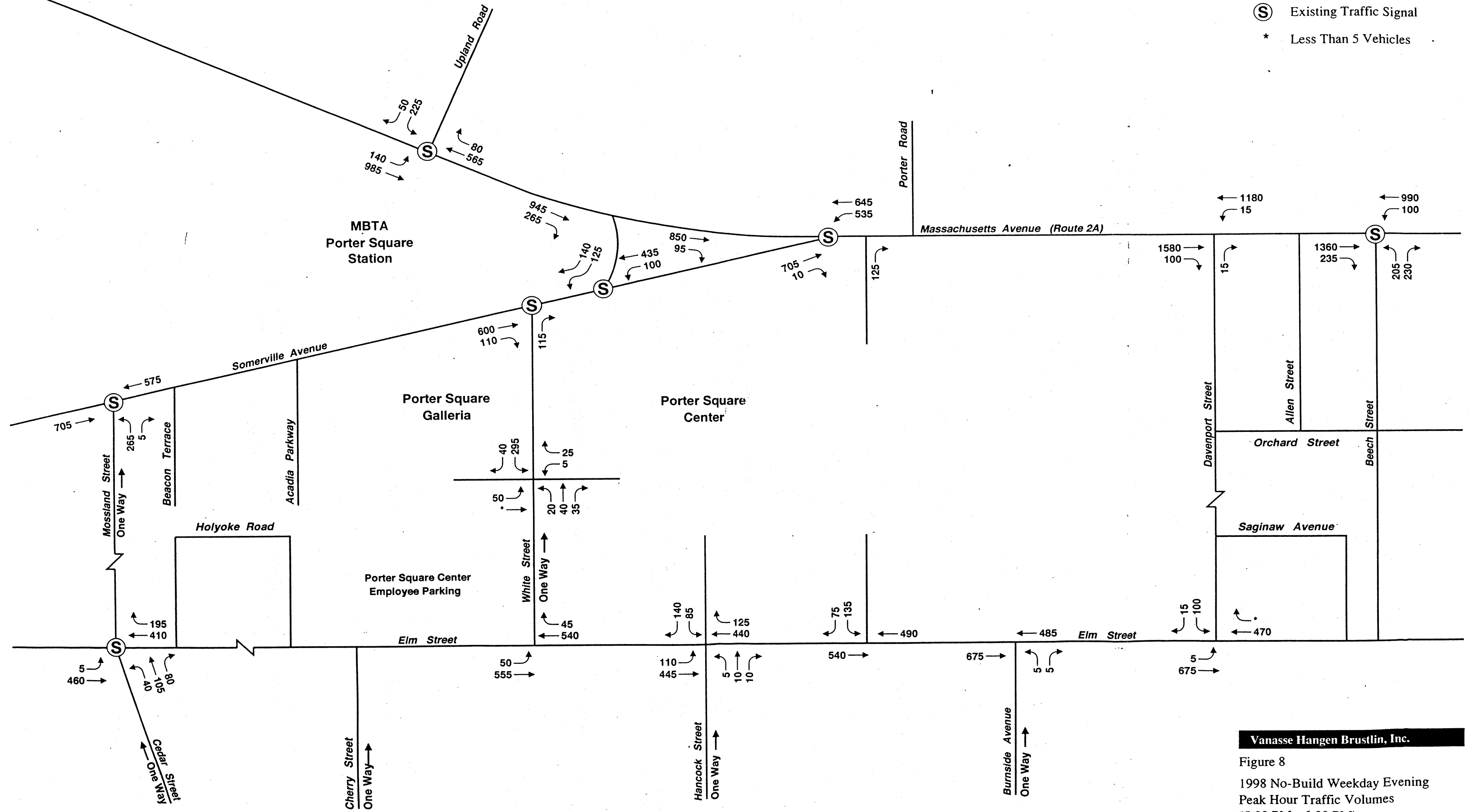
Trip generation estimates for the proposed development were based on standardized Institute of Transportation Engineers (ITE) trip generation data. The number of vehicle trips expected to be generated by the proposed development is described in detail in the following sections.

Porter Square Center Retail Expansion

Trip generation rates for various retail developments have been formulated by the Institute of Transportation Engineers (ITE) and published in Trip Generation¹. The data collected by ITE for shopping centers, Land Use Code (LUC) 820, are based on several studies of retail uses of this type. The project-generated traffic increases were estimated by applying ITE shopping center trip generation rates to the existing and proposed Porter Square Center footage to determine the proportion of the incremental change in vehicle trips that could be expected due to the 22,000+ sf retail expansion. As previously discussed, while a supermarket expansion will typically result in increased trip generation, the individual spending per customer also usually increases. Therefore, a supermarket expansion does not typically result in a linear increase in trip generation. Instead, while the number of customers does increase, the overall increase in business is more attributable to the increased spending per customer.

▼
¹ Trip Generation, Fifth Edition; Institute of Transportation Engineers; Washington, D.C. (1991).

Ⓢ Existing Traffic Signal
 * Less Than 5 Vehicles

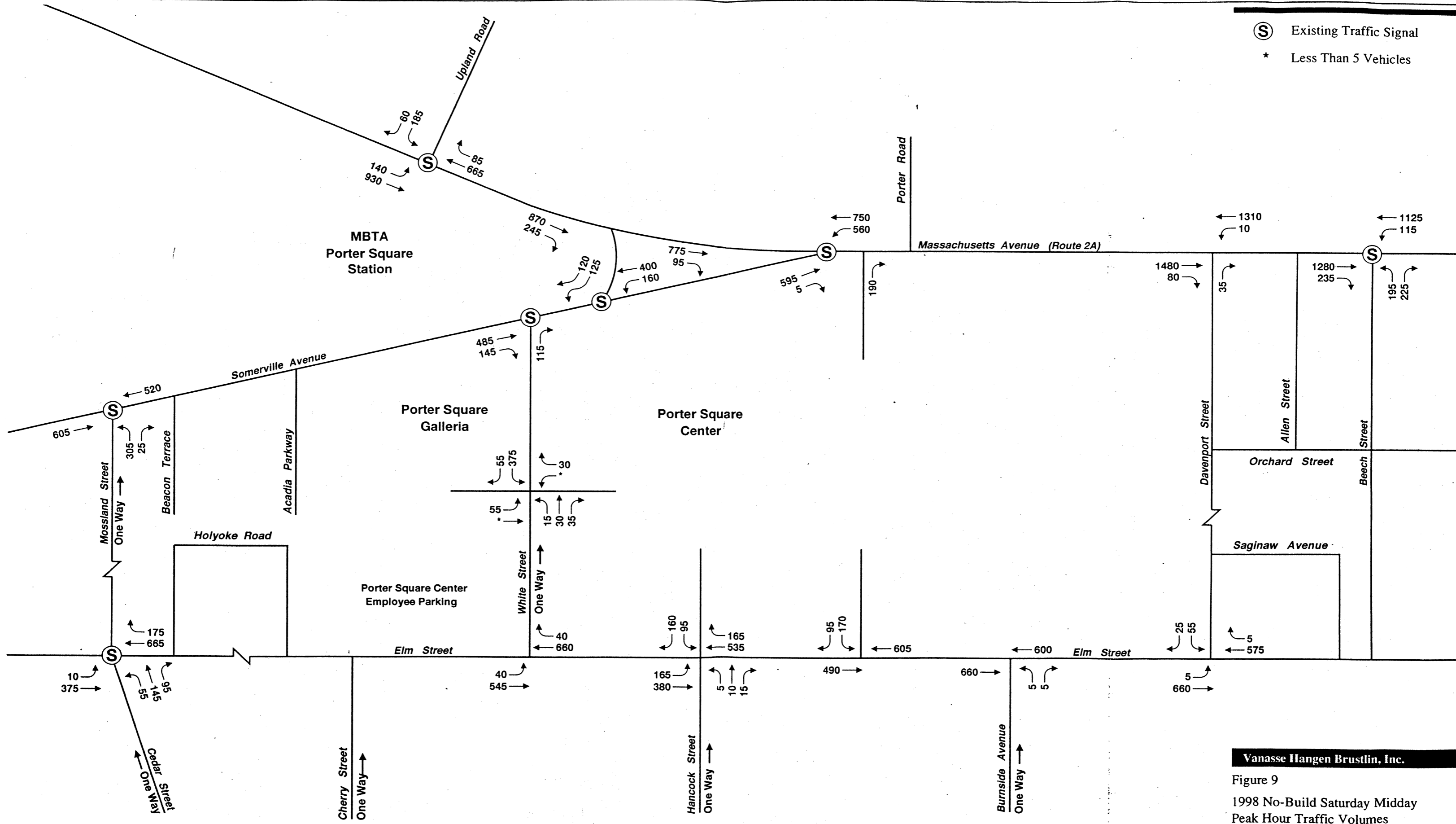


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Figure 8
 1998 No-Build Weekday Evening
 Peak Hour Traffic Volumes
 (5:00 PM - 6:00 PM)

Not to Scale

(S) Existing Traffic Signal
 * Less Than 5 Vehicles



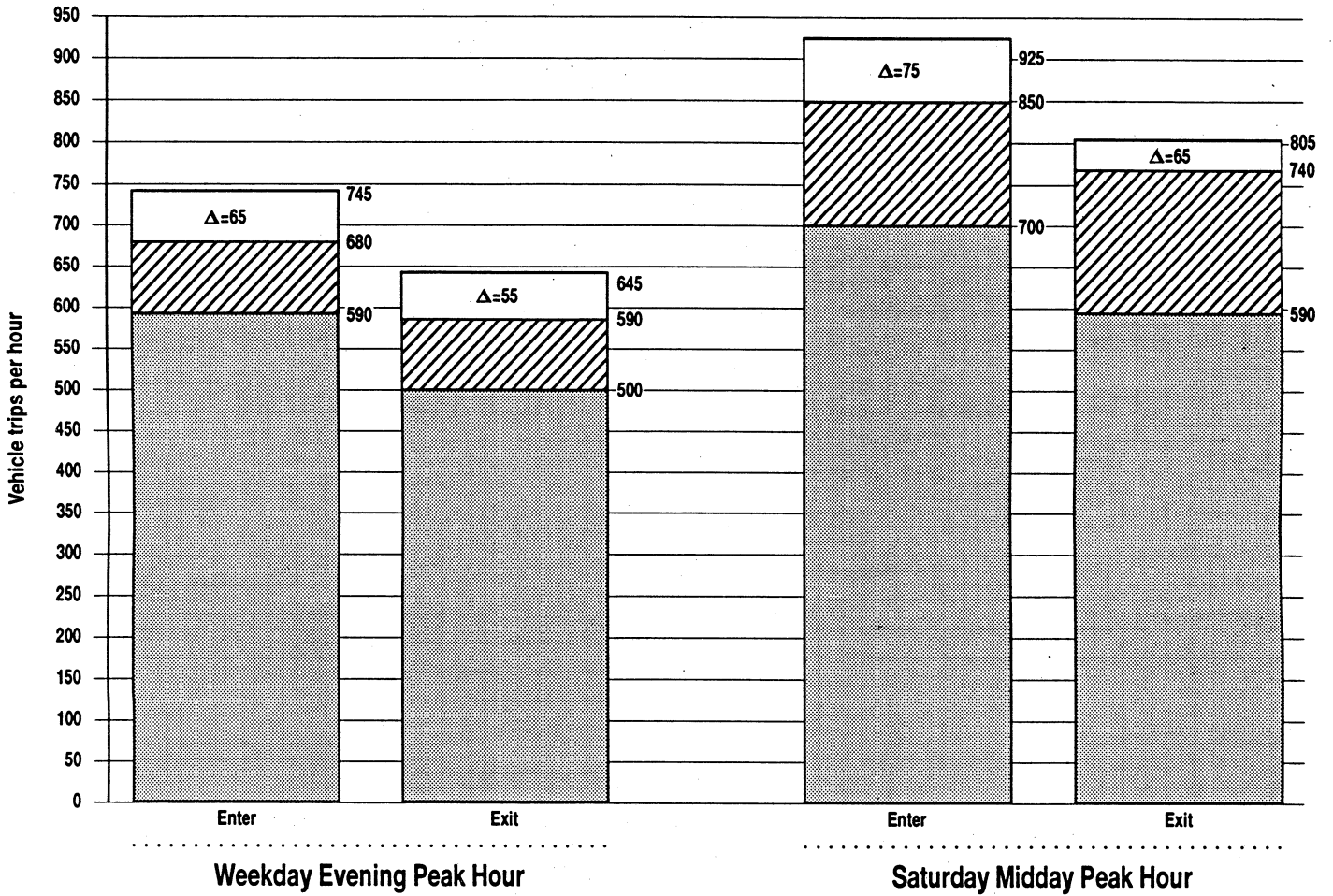
↙ Not to Scale

Vanasse Hangen Brustlin, Inc.
 Figure 9
 1998 No-Build Saturday Midday
 Peak Hour Traffic Volumes
 (12:15 PM - 1:15 PM)

The resulting percent increase in site generated traffic based on the ITE data was applied to the actual volumes that were observed entering and exiting the site. However, as previously discussed, not all of the traffic entering and exiting the site is actually generated by the site. Based on field observations conducted by VHB, between 30 and 40 percent of the traffic entering the site at the White Street driveway is non-site related traffic that is using the site to cut through to Elm Street. To account for the cut-through traffic, the anticipated percent increase was applied to the estimated site generated traffic only, not including the cut through traffic. The proposed renovation project is not expected to increase the amount of cut-through traffic at the center. As described in the Recommendations section of the report, measures will be taken as part of this project to help minimize the amount of cut-through traffic at the Porter Square Center.

The trip generation estimates used in this study were also found to be comparable to other estimates developed using different methodologies, including evaluating the individual components of the shopping center independent of each other. A breakdown of these methodologies is provided in the Appendix to this report.

The resulting trip generation for the proposed Porter Square expansion is shown in Table 4 and in Figure 10.



Estimated Cut-through Traffic

L:\04535\GRAPHICS\FIGURES\4535-TGI.PWS

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Trip Generation Increases

Figure 10

Table 4
Porter Square Center Trip Generation

Time Period	Porter Square Center		Increase due to expansion
	Proposed (148,880+ sf)	Existing (126,510+ sf)	
Weekday Daily*			
enter	4,535	4,095	440
exit	<u>4,535</u>	<u>4,095</u>	<u>440</u>
Total	9,070	8,190	880
Weekday Evening			
Peak Hour			
enter	745	680	65
exit	<u>645</u>	<u>590</u>	<u>55</u>
Total	1,390	1,270**	120***
Saturday Daily*			
enter	5,875	5,300	575
exit	<u>5,875</u>	<u>5,300</u>	<u>575</u>
Total	11,750	10,600	1,150
Saturday Midday			
Peak Hour			
enter	925	850	75
exit	<u>805</u>	<u>740</u>	<u>65</u>
Total	1,730	1,590**	140***

* Source: Trip Generation, Fifth Edition; Institute of Transportation Engineers (ITE); Washington, D.C. Land Use Code (LUC) 820 (Shopping Center).

** Source: Traffic counts conducted by VHB in March 1996 at Porter Square Center site driveways.

*** Source: Trip Generation, Fifth Edition; (ITE); Washington, D.C. LUC 820 (Shopping Center). Percent increase from existing to proposed condition applied to observed traffic volumes.

As shown in Table 4, the proposed project will result in a total of 120 and 140 additional vehicle trips during the weekday evening and Saturday midday peak hours, respectively. The daily trip generation estimates were based solely on ITE shopping center data. While the shopping center probably generates higher volumes than indicated by the ITE data, it can be expected that the incremental increase in daily volumes will be consistent with these data.

Not all of the traffic generated by the site will be new traffic on the study area roadways. A portion of the vehicle-trips generated by the proposed shopping center will be drawn from the existing traffic streams passing the site in the form of pass-by traffic. The volume of pass-by traffic is expected to vary during the day, with a significant pass-by component during the typical peak traffic hours on the adjacent roadways, and less of a pass-by component during other hours of the day. ITE data suggest that 40 to 60 percent of the traffic generated by a retail center of the size proposed may be pass-by traffic. However, to provide a conservative (worst-case) assessment of project impacts, a pass-by trip factor of only 25 percent was used for the shopping center for the following traffic analysis. Thus, it was assumed that during the

most critical traffic periods, 75 percent of site traffic would be new traffic on area roadways. A summary of new and pass-by trips expected to be generated by the proposed project is shown in Table 5.

**Table 5
Porter Square Expansion Trip Generation Summary**

<u>Time Period</u>	<u>Total Trips*</u>	<u>New Trips</u>	<u>Pass-By Trips**</u>
Weekday Daily			
enter	440	330	110
exit	<u>440</u>	<u>330</u>	<u>110</u>
Total	880	660	220
Weekday Evening Peak Hour			
enter	65	50	15
exit	<u>55</u>	<u>40</u>	<u>15</u>
Total	120	90	30
Saturday Daily			
enter	575	430	145
exit	<u>575</u>	<u>430</u>	<u>145</u>
Total	1,150	860	290
Saturday Midday Peak Hour			
enter	75	60	15
exit	<u>65</u>	<u>50</u>	<u>15</u>
Total	140	110	30

* Source: Trip Generation, Fifth Edition; Institute of Transportation Engineers (ITE); Washington, D.C. Land Use Code (LUC) 820 (Shopping Center).

** Pass-by traffic drawn from existing traffic passing the site assumed to be 25 percent of the total traffic generated by the proposed development.

As shown in Table 5, the proposed project will generate approximately 90 and 110 new vehicle-trips during the weekday evening and Saturday midday peak hours, respectively.

Traffic counts and surveys conducted at three existing Star Markets by CID Associates⁵ were used as a reference to assess the different modes of transportation that shoppers use to travel to the Porter Square Center. The stores studied are located on Beacon Street in Brookline, on Boylston Street in the Fenway section of Boston, and on Mount Auburn Street in Cambridge.

▼
⁵ Star Market Plus, Allston, Massachusetts; CID Associates, Peterson-Griffin Architects, Ltd., Peabody and Brown., Boston (1994).

The selected stores were all located in densely settled areas around Boston in close proximity to public transportation. These counts revealed that between 7 and 11 percent of site patrons typically arrive by way of public transportation during peak hours. During these same time periods, approximately 38 percent of store patrons were pedestrians arriving from local neighborhoods. Therefore, the proposed expansion will also result in additional business in the form of pedestrians and customers arriving by the MBTA. The increased number of patrons arriving by these modes would be generated in addition to the increased vehicular traffic already presented. Given the proximity of the Porter Square MBTA station it is reasonable to expect that a significant amount of site patrons will continue to arrive by public transportation, as under existing conditions.

Truck Trip Generation

In both Cambridge and Somerville, truck deliveries are not allowed before 7:00 AM or after 9:00 PM. Locally, truck traffic is allowed on Massachusetts Avenue, Somerville Avenue and Elm Street. While there are truck prohibitions on most local streets between these major routes, signs notifying truckers of this were not always clearly present. As such, trucks were occasionally observed traveling on some local streets, including Beech Street. To address the concerns of local residents, VHB conducted traffic counts and general observations on the number of large vehicles traveling on Beech Street. The counts revealed that between 6:30 and 9:00 AM on Wednesday, May 15, 1996 approximately 25 trucks were observed traveling on Beech Street. Of these trucks, 17 were observed traveling south on Elm Street from Davis Square and turning right onto Beech Street. During this time, there was only a single truck observed traveling from the shopping center on Davenport Street to Beech Street. The total amount of trucks traveling on this road is consistent with the early traffic counts conducted by VHB. While this figure could differ slightly on a daily basis, it is highly unlikely that the number of site generated trucks would increase substantially along this route. The trucks observed included vehicles as small as a UPS truck and a large single unit vendor truck.

The management of Star Market has indicated that their truck drivers are instructed to follow designated truck routes to and from the site with specific instructions not to travel on Beech Street. Star has also instituted several other policies to reduce the impact of truck deliveries on local neighborhoods. These include reducing truck idling time, strict enforcement of delivery curfews and improved scheduling of deliveries to reduce conflicts between large trucks and vendor vehicles.

There are presently a total of 500 truck deliveries to the Porter Square Center per week, including smaller vendor vehicles. Approximately 86 percent of the total deliveries being made to this site are being made to Star, Decelles, and Liquor World. Of this, approximately 270 to 300 truck deliveries are made to Star on a weekly basis. Large (55+ feet long) vehicles are required to make their deliveries to loading docks and by appointment only. This helps avoid any conflicts between multiple trucks attempting delivery at the same time to the limited loading dock space. As part of this project, there are only expected to be an additional

5 warehouse and 25 vendor deliveries per week. This represents an approximately 10 percent increase in loading over existing conditions.

It is important to note that most of the large trucks servicing the supermarket are Star tractor-trailers driven by Star Supermarket employees. Star Supermarket maintains control over the schedule and routing of deliveries to the site. Star is aware that the routing of trucks through neighborhood streets is a potential concern for area residents. Trucks will be required to access/egress the site on local routes capable of accommodating truck traffic, as they are today.

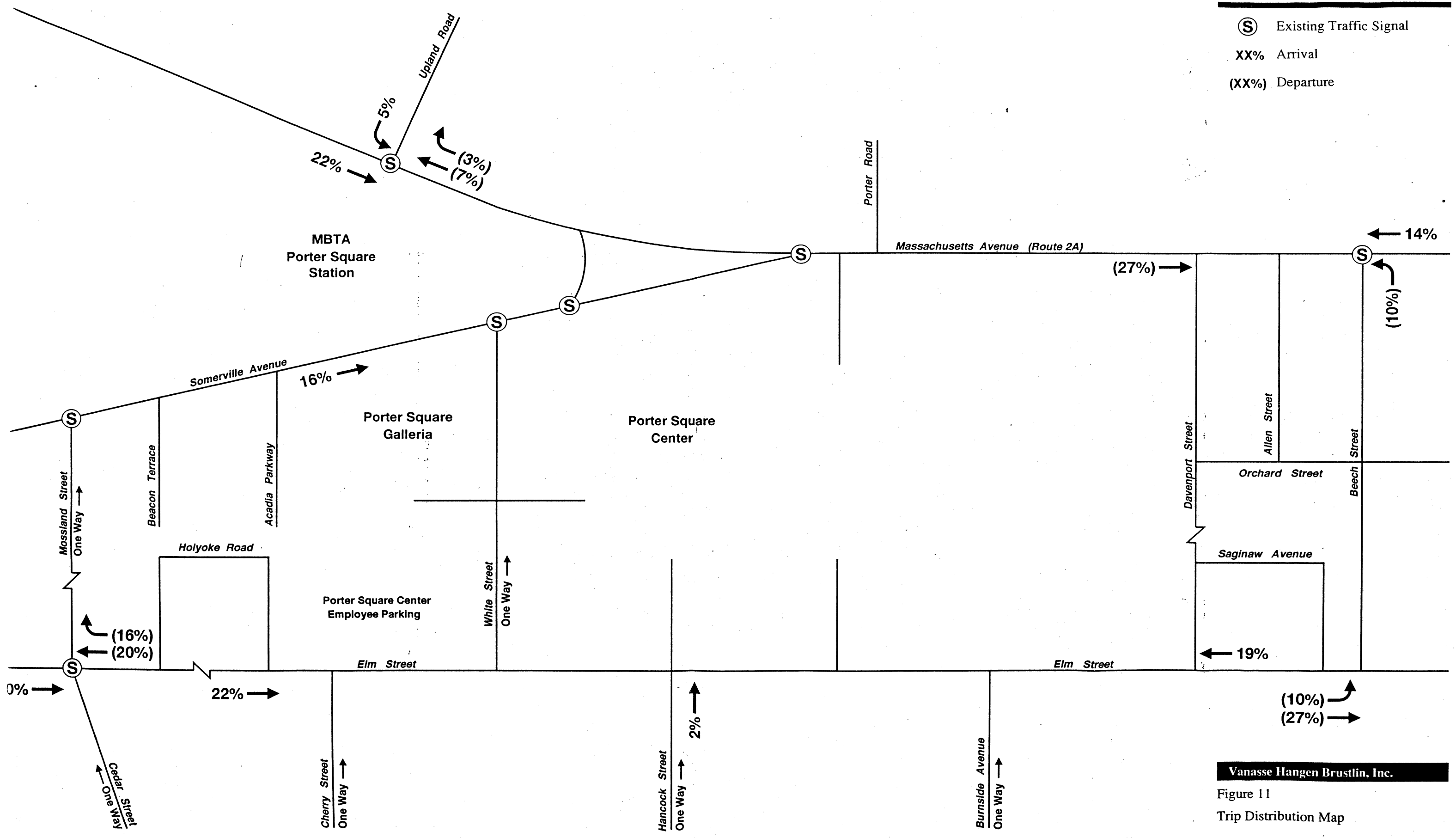
The loading dock for Star Market is located on the northeasterly corner of the shopping center property. The dock is presently oriented so that trucks must access the dock from Davenport Street. Given the narrow width of Davenport Street, backing into the loading docks takes most large tractor trailers several maneuvers before they are at the dock. This results in Davenport Street traffic being blocked during the maneuvers, and the southbound Elm Street travel lane being blocked. Maneuvering to the loading dock also frequently blocks northbound Elm Street traffic on a temporary basis.

There is a loading zone provided on the westerly side of Elm Street adjacent to Star Market. This on-street area is typically used by both trucks waiting to access the loading dock and single unit vendor trucks that deliver to both the main dock or a delivery door at the side of Star. The presence of these trucks was generally observed to interfere with the sight lines of motorists attempting to exit the site from the northerly exit-only driveway. The proponent is presently involved with developing measures to minimize on-street unloading as well as improving the existing main loading dock. As part of this project the loading dock will be screened to help minimize the visual impact on the local neighborhood.

Trip Distribution

The directional distribution of site-generated traffic is a function of population densities, competing shopping opportunities, existing travel patterns at area intersections, and traffic conditions on area roadways. The proposed project is primarily an expansion of the Porter Square Center and, as such, the directional distribution of new site-generated traffic is expected to follow the existing travel patterns observed on study area roadways. Existing and planned retail developments in Cambridge and neighboring communities were also considered in determining the distribution. The resulting distribution was developed assuming that the site access remained as under existing conditions. However, as discussed in the Site Access Alternatives section of the report, several alternatives were considered involving enhanced access to the site, including the provision of left turns from the site onto Massachusetts Avenue. As a worst case scenario for trip distribution it was assumed that access to the site would remain in its present form. If left turns could be provided from the site onto Massachusetts Avenue, then the amount of traffic exiting the site at Elm Street and onto neighborhood street could be reduced considerably. The arrival/departure patterns for new site-generated traffic are illustrated in Figure 11 and shown below in Table 6.

(S) Existing Traffic Signal
 XX% Arrival
 (XX%) Departure



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Figure 11
Trip Distribution Map

Table 6
Trip Distribution Summary

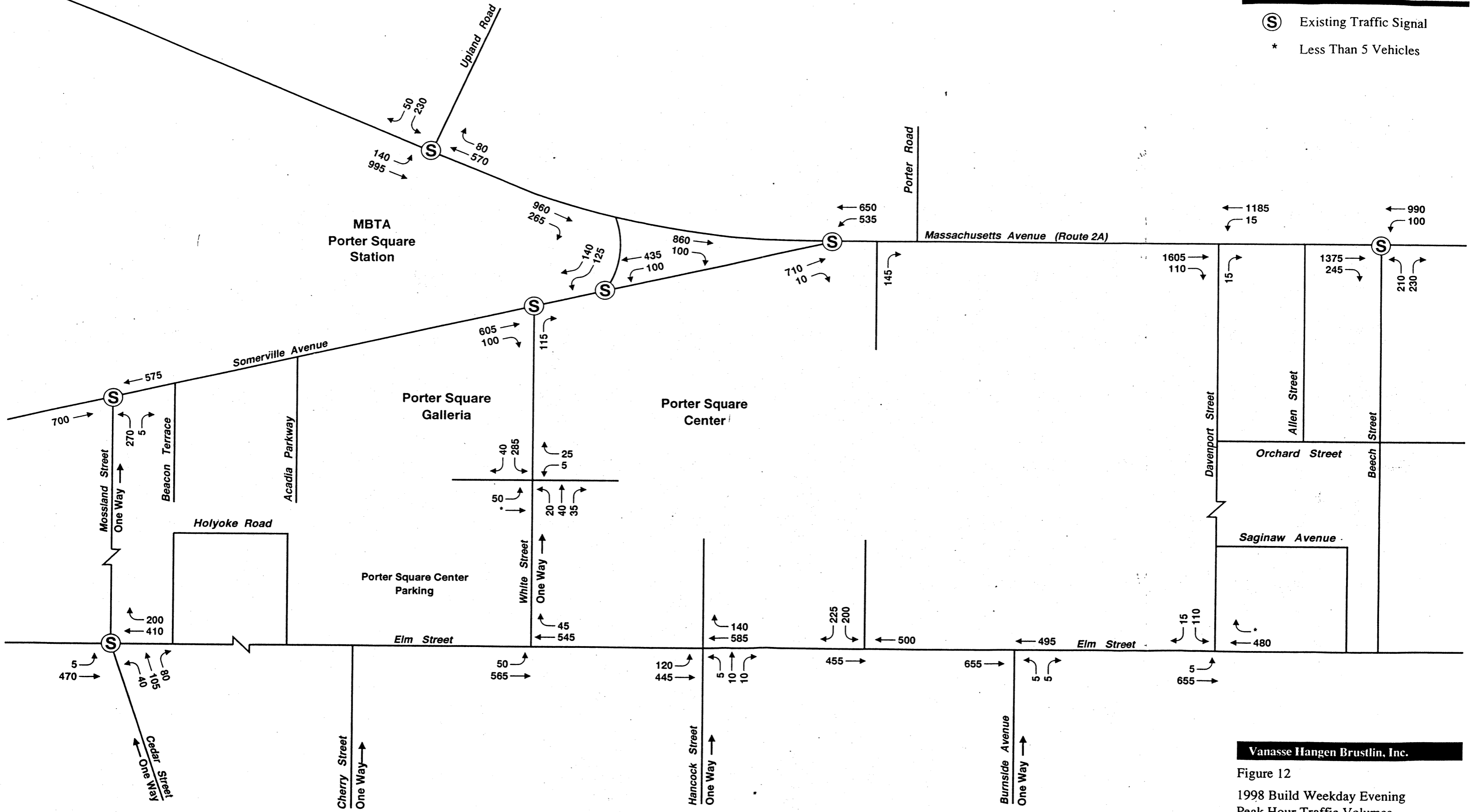
<u>To/From</u>	<u>Travel Route</u>	<u>Percent of Site Traffic Assigned to Route</u>	
		<u>Arrival</u>	<u>Departure</u>
North	Massachusetts Avenue	14	27
	Elm Street	19	37
South	Massachusetts Avenue	22	0
	Somerville Avenue	16	10
	Elm Street	18	26
East	Cedar Street	4	0
	Hancock Street	2	0
West	Upland Road	5	0
Total		100	100

Site Access Patterns

It is expected that the majority of site traffic (approximately 69 percent) will continue to use the main site entrance on White Street to access the site. Secondary access to the site will also continue to be provided by driveways located on Massachusetts Avenue and Elm Street. As previously mentioned, there is a prominent cut-through pattern through the Porter Square Center. This was primarily observed to occur in the form motorists entering the site at the White Street site driveway and continuing easterly to the Elm Street southerly driveway. Therefore, not all of the traffic entering the site at the White Street driveway can be considered to be actual site generated traffic.

Based on the conservative arrival/departure pattern shown in Table 6 and Figure 11, site-generated traffic volumes were added to the 1998 No-Build peak hour traffic volumes. The distribution of pass-by trips was based on observed traffic patterns on study area roadways adjacent to the project site. The resulting 1998 Build weekday evening and Saturday midday peak hour traffic volumes are shown in Figures 12 and 13, respectively.


Ⓢ Existing Traffic Signal
* Less Than 5 Vehicles

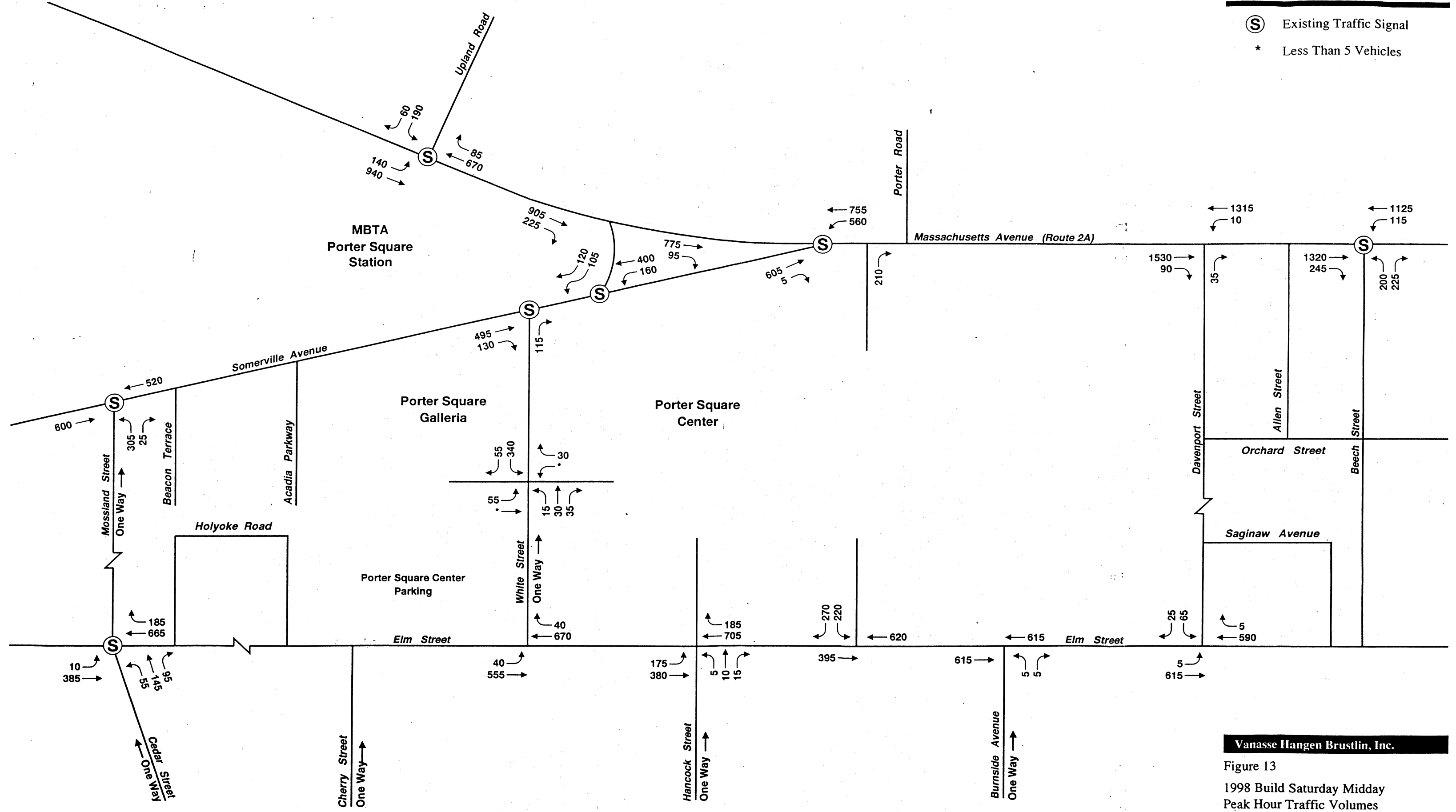


Vanasse Hangen Brustlin, Inc.

Figure 12
1998 Build Weekday Evening
Peak Hour Traffic Volumes
(5:00 PM - 6:00 PM)

Not to Scale

 Existing Traffic Signal
 * Less Than 5 Vehicles



Vanasse Hangen Brustlin, Inc.

Figure 13
 1998 Build Saturday Midday
 Peak Hour Traffic Volumes
 (12:15 PM - 1:15 PM)

 Not to Scale

Traffic Volume Increases

The proposed shopping center will add new traffic volumes the study area roadways. The amount of new traffic generated by the proposed project is shown below in Table 7.

Table 7
Traffic Volume Increases

<u>Location</u>	<u>Peak Hour</u>	<u>1996 Existing</u>	<u>1998 No-Build</u>	<u>1998 Build</u>	<u>Vehicle-trip Increase</u>
Massachusetts Avenue south of Davenport St.	Weekday Evening	2,810	2,860	2,900	40
	Saturday Midday	2,815	2,870	2,935	65
Massachusetts Avenue north of Upland Road	Weekday Evening	1,820	1,855	1,875	20
	Saturday Midday	1,825	1,865	1,885	20
Somerville Avenue south of White Street	Weekday Evening	1,260	1,285	1,280	-5
	Saturday Midday	1,125	1,160	1,145	-5
Elm Street north of Davenport Street	Weekday Evening	1,225	1,245	1,245	0
	Saturday Midday	1,265	1,290	1,270	-20
Elm Street south of White Street	Weekday Evening	1,125	1,145	1,160	15
	Saturday Midday	1,215	1,245	1,265	20

As shown in Table 7, development of the proposed shopping center will have moderate impacts on traffic volumes occurring during the weekday evening and Saturday midday peak hours. Assuming a worst-case scenario of the site access remaining as it is under existing conditions, with no exiting left-turn provided from the site, the proposed project would only increase traffic by 40 and 65 vehicle trips on Massachusetts Avenue during the weekday evening and Saturday midday peak hours. The proposed project should only result in minimal increases in traffic on local roadways - in some instances traffic volumes will actually decrease. This is due to measures that will be taken as part of this project to help minimize the amount of traffic from Cambridge cutting through the center to travel to Somerville. These measures will help to discourage this traffic and will be discussed in detail in the Recommendations section of this report.

Traffic Operations Analysis

The previous sections of this report quantified traffic flow parameters on study area roadways under existing and future conditions. In this section, the quality of traffic flow given these demands is addressed. As the basis for this assessment, capacity analyses were conducted for the six signalized and eight unsignalized study area intersections under Existing, No-Build, and Build peak hour conditions. These analyses were conducted assuming a worst-case scenario that access to the Porter Square Center remained in its existing form, particularly that no left turns would be accommodated from the site onto Massachusetts Avenue.

Level-of-Service Criteria

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway facility under various traffic volume loads. LOS is a qualitative measure of the effect of a number of factors including roadway geometrics, travel speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or intersection. The evaluation criteria contained in the 1994 Highway Capacity Manual⁶ were used to analyze study area intersections. These criteria are described in the Appendix of this report.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. Typically, LOS D is considered acceptable for peak hour conditions at signalized intersections in urban areas.

The level of service designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection and the LOS designation is for overall conditions at the intersection. For unsignalized intersections the analysis assumes that traffic on the main line is not affected by traffic on the side streets. Thus, the LOS designation is for the critical movement exiting the side street, which is generally the left-turn movement, and not for the overall intersection.

▼
⁶ Highway Capacity Manual, Special Report 209; Transportation Research Board, Washington, D.C. (1994).

As described in the following paragraphs, capacity analyses were conducted for 1996 Existing, 1998 No-Build, and 1998 Build conditions at the signalized and unsignalized study area intersections.

Signalized Intersection Capacity Analysis

Six existing signalized intersections (two of which are actually operating together within Porter Square) were analyzed under the 1996 Existing, 1998 No-Build, and 1998 Build conditions. To account for the urban environment of the area and the accompanying pedestrian traffic, the effect of pedestrians on traffic signal operations was also included in the analysis of the study area signalized intersections. Likewise, the amount of bus activity in the vicinity of signalized study area intersections was also assessed and accounted for in the analysis. There is a bus inlet provided adjacent to the site on the northbound Somerville Avenue approach to the Porter Square intersection. This bus loading area helps to minimize the effects of the bus activity on traffic flow through this intersection, but was also observed to be underutilized during the peak periods observed. The results of the signalized intersection analysis are summarized in Table 8.

Table 8
Signalized Intersection Capacity Analysis Results

Location	Peak Hour	1996 Existing			1998 No-Build			1998 Build		
		V/C*	Delay**	LOS***	V/C	Delay	LOS	V/C	Delay	LOS
Massachusetts Ave. at Somerville Ave. (Porter Square)	Weekday Evening	0.53	24	C	0.54	25	D	0.55	26	D
	Saturday MIDDAY	0.55	26	D	0.56	28	D	0.57	29	D
Somerville Ave. at Massachusetts Ave./ White Street (Porter Square)	Weekday Evening	0.48	+	F	0.49	+	F	0.49	+	F
	Saturday MIDDAY	0.59	+	F	0.59	+	F	0.58	+	F
Massachusetts Ave. at Beech Street	Weekday Evening	0.83	+	F	0.84	+	F	0.84	+	F
	Saturday MIDDAY	0.88	21	C	0.90	22	C	0.90	25	C
Massachusetts Ave. at Upland Street	Weekday Evening	0.61	12	B	0.63	12	B	0.64	13	B
	Saturday MIDDAY	0.55	11	B	0.56	11	B	0.57	11	B
Somerville Ave. at Mossland Street	Weekday Evening	0.38	8	B	0.38	8	B	0.38	9	B
	Saturday MIDDAY	0.37	8	B	0.38	8	B	0.38	8	B
Elm St. at Cedar St./ Mossland Street	Weekday Evening	0.56	11	B	0.57	12	B	0.57	12	B
	Saturday MIDDAY	0.75	20	C	0.77	22	C	0.78	24	C

* V/C = volume-to-capacity ratio.

** Delay = average delay per vehicle in seconds.

*** LOS = level of service.

The analysis shown in Table 8 indicates that four of the six signalized study area intersections are presently operating at LOS D or better under peak hour conditions. These intersections are all projected to remain at LOS D or better under the 1998 No-Build and Build conditions.

The capacity analysis indicates that the Somerville Avenue/White Street portion of the Porter Square intersection is presently operating at LOS F under peak hour conditions. However, the traffic operations indicated by the analysis were not entirely consistent with the traffic operations actually observed and are partly the result of the conservative nature of the analysis. Traffic flow through the intersection is also obviously effected by the presence of the previously discussed pedestrian traffic. In an effort to promote more consistent use of the crosswalks and exclusive pedestrian phase, the pedestrian phase is called every cycle, which takes away green time that would otherwise be used for Somerville Avenue traffic. However, given the volume of pedestrians, the delays to Somerville Avenue traffic are to some degree acceptable to balance the overall needs of pedestrians and vehicles at this intersection.

Southbound Somerville Avenue traffic waiting to turn onto White Street was observed to consistently experience delays under peak hour conditions. However, vehicles queued waiting to make this turn were not observed to interfere with traffic operations at the Massachusetts Avenue/Somerville Avenue portion of the Porter Square intersection. Furthermore, almost all of the vehicles were observed to be consistently processed through the intersection in a single cycle, which is not typically the case with LOS F traffic operations. With construction of the proposed project, traffic volumes at the Somerville Avenue/White Street portion of the Porter Square intersection are expected to remain at the same approximate level as under the 1998 No-Build condition. This is due to the proposed measures that will be taken to help minimize the amount of cut-through traffic entering the site at the White Street site driveway. These measures will help to offset the additional site generated traffic that will also enter the site by this driveway. Considering the above, it is not expected that traffic operations at this intersection will be adversely effected by the construction of the proposed project.

The intersection of Massachusetts Avenue and Beech Street presently operates at LOS F and LOS C during the respective weekday evening and Saturday midday peak hours. However, the proposed project is only expected to add 30 and 55 vehicle trips to this intersection during the weekday evening and Saturday midday peak hour conditions, most of which will be on Massachusetts Avenue. The LOS F traffic operations at this intersection are primarily the result of the 100-second cycle length provided during the weekday evening peak hour. The signal timing and phasing are also set up to favor the flow of Massachusetts Avenue, which carries a considerably heavier volume of traffic than Beech Street. However, field observations reveal that during the weekday evening peak hour, most of the vehicles waiting in the queue on Beech Street were processed through the signal in one cycle.

At the request of the City of Somerville, VHB has also evaluated traffic operations at the intersection of Somerville Avenue and Mossland Street. This intersection was recently signalized along with the Somerville Avenue/Beacon Street intersection, which is located approximately 200 feet to the south. These two intersections operate together as part of a coordinated system. The capacity analysis indicates that the Somerville Avenue/Mossland Street intersection is presently operating at LOS B under peak hour conditions and will continue to do so under future conditions. However, this intersection operates on a cycle length that is as long as 120 seconds during the weekday evening peak hour. The Beacon Street and Mossland Street approaches to this intersection operate on separate phases. Typically when side streets intersect a main road this close together both will receive green indications simultaneously while the main street traffic is stopped. In this instance, Mossland Street traffic is stopped while the northbound Somerville Avenue traffic continues to run. This was most likely done to provide for progression of Somerville Avenue traffic. However, because of this, Mossland Street traffic has to wait for approximately 90 or more seconds before proceeding. Vehicles waiting in a queue at this signal were typically observed to proceed through the signal in only one cycle. While providing progression of traffic on a main roadway is a common engineering practice, measures to help minimize delay to Mossland Street traffic will be described in the Recommendations section of the report.

Unsignalized Intersection Capacity Analysis

Unsignalized intersection capacity analyses were conducted at study area intersections for the weekday evening and Saturday midday peak hours under 1996 Existing, and 1998 No-Build and Build conditions. A summary of the capacity analysis for unsignalized study area intersections is provided in Table 9.

Table 9
Unsignalized Intersection Capacity Analysis Results

Location	Peak Hour	1996 Existing			1998 No-Build			1998 Build		
		Demand*	Delay**	LOS***	Demand	Delay	LOS	Demand	Delay	LOS
Massachusetts Ave. at Porter Square Center	Weekday Evening	125	9	B	125	9	B	145	10	B
	Saturday Midday	190	9	B	190	9	B	210	10	B
Massachusetts Ave. at Davenport Street	Weekday Evening	15	17	C	15	18	C	15	19	C
	Saturday Midday	10	15	C	10	15	C	10	16	C
Elm Street at White Street	Weekday Evening	50	4	A	50	4	A	50	4	A
	Saturday Midday	40	5	A	40	5	A	40	5	A
Elm Street at Porter Square Ctr./ Hancock Street	Weekday Evening	235	25	D	235	27	D	25	17	C
	Saturday Midday	255	81	F	255	102	F	30	22	D
Elm Street at Porter Square Ctr./	Weekday Evening	135	28	D	135	30	D	200	45	F
	Saturday Midday	170	50	F	170	57	F	220	87	F
Elm Street at Burnside Avenue	Weekday Evening	10	11	C	10	11	C	10	11	C
	Saturday Midday	10	12	C	10	13	C	10	12	C
Elm Street at Davenport Street	Weekday Evening	115	27	D	115	29	D	125	31	E
	Saturday Midday	80	20	D	80	21	D	90	23	D
White Street at Porter Square Ctr./ Porter Square Galleria	Weekday Evening	50	8	B	50	8	B	50	8	B
	Saturday Midday	55	10	B	55	10	B	55	9	B

* Demand = demand in vehicles per hour for the critical movement at the intersection.

** Delay= Average delay per vehicle in seconds.

*** LOS = level of service.

N/A = Not applicable.

As shown in Table 9, five of the eight study area signalized intersections are presently operating at LOS D or better under peak hour conditions, and will continue to do so under future conditions. Another, the intersection of Elm Street and Davenport Street, will decrease

slightly from LOS D to LOS E during the weekday evening peak hour with construction of the proposed project.

The intersection of Elm Street at Porter Square southerly driveway/Hancock Street is presently operating at LOS D and LOS F during the weekday evening and Saturday midday peak hours, respectively. However, with construction of the proposed project the southerly site driveway will be converted to an entrance-only driveway. As such traffic operations at this intersection should improve to LOS C and LOS D during the respective weekday evening and Saturday midday peak hours.

The intersection of Elm Street and the Porter Square Center exit-only driveway is presently operating at LOS D and LOS F during the weekday evening and Saturday midday peak hours, respectively. With construction of the proposed project, the capacity analysis indicates that traffic operations will be at LOS F during both of the peak hours studied. Based on field observations conducted by VHB, most of the congestion at this intersection results from the proximity of the southerly site drive to this driveway, as well as the presence of on-street parking between these two driveways. As discussed in the Recommendations section of this report, the southerly site driveway will be redesignated as an entrance only driveway, while the northerly site drive will continue to accommodate exiting site traffic only. This will provide for more efficient traffic flow at both driveways as well as on Elm Street in the immediate vicinity of the site. Discussions with the City of Somerville have also revealed that the city intends to prohibit parking between both driveways in the near future. This will help to improve the sight distance of vehicles exiting the site and improve overall safety on Elm Street adjacent to the site.

Both Elm Street site driveways are presently burdened with exiting site traffic that is unable to turn left directly onto Massachusetts Avenue. This is because patrons wishing to exit the site and travel south on Massachusetts Avenue presently have to exit onto Elm Street and travel through the local neighborhoods. These motorists then cut through neighborhood streets in Cambridge and Somerville to get back to Massachusetts Avenue. As part of this project, VHB has investigated several possible access alternatives involving providing direct left-turn access from the site onto Massachusetts Avenue. These alternatives will be discussed in detail in the Recommendations section of the report. With the provision of left-turns directly from the site onto Massachusetts Avenue, the exiting demand at the Elm Street site driveway would be considerably lessened as would the associated delay.

5

Conclusions and Recommendations

Conclusions

The analysis presented in this report indicates that with implementation of the proposed roadway improvements, site generated traffic can be safely and efficiently accommodated by area roadways and traffic flow can be improved over existing conditions. At those intersections where the project is expected to have a significant impact, appropriate measures are recommended to mitigate project impacts. As part of this project, VHB attempted to improve existing traffic operations in the area while renovating and expanding the Porter Square Center. In developing the recommendations described in the following section, VHB evaluated several alternatives that balanced the needs of the shopping center with the needs of the neighborhood, the local roadway system and the needs of pedestrian and bicycle traffic in the area. The goal of this project was to provide the optimal access to the shopping center while improving the safety and efficiency of existing local vehicular, bicycle and pedestrian traffic. The urban design element of this project was also considered in providing a site design that would maintain the identity of Porter Square while still serving the needs of the site and the local transportation system.

Recommendations

Previous sections of this report have quantified the traffic-related impacts of the proposed Porter Square Center expansion and several existing and projected operational deficiencies have been identified. In this section of the report, potential measures are discussed to improve existing traffic flow, to mitigate project-related impacts and to provide safe and efficient access to the project site.

The following recommendations are proposed to improve existing traffic flow conditions in the study area, accommodate project-related traffic and provide safe and efficient site access.

Porter Square Intersection Improvement Alternatives

As part of this project, VHB has developed and evaluated several conceptual site access alternatives for the proposed Porter Square Center project. This section of the report will discuss both the positive and negative features of each plan with regard to site access, parking, and traffic circulation and building layout on the site. Consideration was also given to providing left-turn access to and from the site, since neither are presently provided. As previously discussed, all of the plans considered involved a balance of the numerous transportation issues that exist on and around the site. The ultimate goal of this project is to provide for safe and efficient access to the site while allowing for the future development of improvements to the entire Porter Square intersection and vicinity. With all of the alternatives, consideration was given to enhancing the safety and efficiency of the high volume of pedestrian traffic at this intersection, as well as allowing for the future provision of bicycle lanes on Massachusetts Avenue. Improvements to parking, and bicycle and pedestrian traffic will be discussed separately following the discussion of the various alternatives considered.

Based on a review of the existing traffic signal equipment at the Porter Square intersection, the traffic controller at this intersection is older model that does not have very versatile operating features. With any alternative involving modifying the existing traffic signals, a new traffic signal controller could be required at both intersections and loop detectors could possibly also have to be installed.

Alternative A - Signalized Site Exit with entering right-turns

The first site access plan evaluated by VHB involved the reconfiguration of the Massachusetts Avenue site driveway to allow for exiting left-turn movements, in addition to the existing right-turn in/right-turn out access. Separate exiting left- and right-turn lanes would be provided in addition to a single right-turn entrance lane. The main driveway would be separated from the parking field by median islands. Under this alternative the exiting movements would be under signalized control. This would involve an additional phase being introduced to the signal operations to accommodate exiting left- and right-turns from the site. This phase would coincide with the exclusive pedestrian phase at the Somerville Avenue/White Street/Massachusetts Avenue portion of the Porter Square intersection. Overall delay could be minimized at this intersection by replacing the existing exclusive pedestrian phasing with concurrent pedestrian phasing, in which pedestrians would be allowed to cross the road while certain vehicle movements would be running. While it might not be possible to provide concurrent pedestrian phasing at all of the crosswalk locations, particularly the crosswalk located across Massachusetts Avenue at the main site driveway, it would be recommended that it be used wherever possible. A capacity analysis revealed that while there would be increased delay to both

Massachusetts Avenue and Somerville Avenue traffic, the Porter Square intersection would still operate at an acceptable level.

Under Alternative A, it would only be possible to provide a single one-sided parking bay on each side of the main driveway, using both compact spaces and aisles. Access to and from the high-turnover spaces adjacent to the plaza would be effected by both the proximity of the islands separating the driveway from the parking area and by the narrow aisle widths. From a pure access standpoint, this alternative offers several benefits in that it accommodates exiting left-turns while maintaining the existing right-turn in/right-turn out access. However, not being able to provide three parking bays adjacent to Massachusetts Avenue results in too low of a parking count for the plaza as a whole. Furthermore, this access scheme would result in a total of five adjacent travel lanes near the main driveway - two exiting lanes, one entrance lane and two parking aisles. This would create a wide open area that would not be consistent with the urban design element of Porter Square.

Alternative B - Signalized Site Driveway - Exit Only

The second access alternative examined consisted of allowing only exiting site traffic at the Massachusetts Avenue driveway. As with the previous alternative, separate exiting left- and right-turn lanes would be provided. As previously stated, most of the traffic entering the site at this driveway originates from Massachusetts Avenue. The entering right-turns presently being made at this driveway would now enter the site by way of the White Street driveway. The movement from Massachusetts Avenue onto White Street presently has the same amount of green time as the Massachusetts Avenue northbound movement. Therefore, there would be no additional delay for northbound Massachusetts Avenue traffic entering the site. However, this could be somewhat confusing to motorists that might expect the plaza entrance to be at its existing location on Massachusetts Avenue. To help guide patrons from the northbound Massachusetts Avenue traffic stream into the site, it would be recommended that a sign be posted in advance of the right-turn lane to Somerville Avenue informing motorists of the entrance location.

With this alternative, a four separate rows of parking could be provided between the existing retail stores and the proposed two-story retail building. This alternative provides more parking than Alternative A, but might result in the new signalized exiting left-turn movement not operating as efficiently as it could. This would be due to parking maneuvers adjacent to the site driveway blocking vehicles attempting to enter the site. However, it is expected that this would only occur on a temporary basis and would not significantly effect the overall efficiency of the traffic signal.

This alternative would also require that an additional phase be introduced to the signal operations to accommodate exiting left- and right-turns from the site. As with the previous alternative, this phase would coincide with the exclusive pedestrian phase at the Somerville Avenue/White Street/Massachusetts Avenue portion of the

Porter Square intersection. To help guide the flow of exiting left-turn traffic from the site it would be recommended that a dashed line be provided from the site driveway to guide motorists to the southbound Massachusetts Avenue departure lanes. This would help to minimize possible confusion by motorists as to where they should be entering the southbound Massachusetts Avenue lanes. Likewise, standard "KEEP RIGHT" signing should be provided in the median island to also help guide motorists turning left from the site.

Under this alternative, the Somerville Avenue approach to the Porter Square intersection would be shifted approximately 10 feet to the west. This would create a plaza area in front of the Porter Square Center that would provide for a more attractive open space for pedestrian traffic crossing Massachusetts Avenue. A similar feature would be provided at the southwesterly corner of the site where a more open pedestrian landing area would be provided adjacent to the new retail building. Also as part of this alternative, it is recommended that the existing MBTA bus stop directly adjacent to the site be relocated either to the north or south of the site. Field observations revealed that the existing bus turn-out is presently underutilized. VHB will contact the MBTA to discuss the possibility of this relocation.

Alternative C Signalized Site Driveway - Single Entering and Exiting Lanes

Under this alternative the Massachusetts Avenue access driveway would be located adjacent to the retail stores closest to Massachusetts Avenue. Single entering and exiting lanes would be provided, with exiting left- and right-turns using the same lane. The goal of this design was to provide for efficient site access while increasing the parking count to an acceptable level. However, a review of the impacts to on-site parking revealed that this access scheme would still reduce the total amount of parking to a point where it would be too constraining to the site from a marketing perspective. A capacity analysis was also conducted for the intersection using this proposed access scheme. The results indicated that both the site driveway and the entire intersection would operate at capacity with long delays. This is because approximately twice the amount of green time would have to be provided for a single lane approach than would be with separate left- and right-turn lanes. Based on this analysis, it was determined that separate left- and right-turn lanes would have to be provided under any alternative involving traffic exiting the site under signalized control.

For similar reasons, it is not possible to provide left-turn access into the site. While introducing exiting movement to the signal operations would only require one additional phase, also allowing entering movements would require that another additional phase be added to the signal. This is because neither northbound traffic from Somerville Avenue or Massachusetts Avenue could be running while the left turns were being made into the site. By doubling the number of phases at this intersection excessive delay would be experienced on all approaches to Porter Square

and the intersection would not operate at an acceptable level. Because of this, additional alternatives involving closing White Street and accommodating that traffic through the main shopping center driveway were not pursued any further.

Alternative D - Left-Turn from Somerville Avenue to Massachusetts Avenue

Another Porter Square improvement alternative considered involved the providing left-turn access from Somerville Avenue onto Massachusetts Avenue southbound. This alternative would also require that an additional phase be introduced to the signal operations to accommodate left-turns from Somerville Avenue. Given the existing travel routes between Somerville Avenue and Massachusetts Avenue south of the site, it is expected that almost all of the left-turn demand at this intersection onto Massachusetts Avenue would originate from the site. The existing right-turn in/right-turn out access would be maintained at the Massachusetts Avenue access drive. However, the proposed driveway would be approximately 24 feet wide, as compared to its present width of 55 feet. This would provide for a considerably shorter pedestrian crossing at this driveway.

Under this plan, a left-turn lane would be provided on the Somerville Avenue approach to the Porter Square intersection while maintaining the two existing through-lanes onto Massachusetts Avenue. Exiting site traffic wishing to access Massachusetts Avenue heading south would now exit the site at the White Street driveway, turn right onto Somerville Avenue and then left onto Massachusetts Avenue. Under this alternative, Somerville Avenue would be shifted approximately 10 feet to the west to provide an open plaza area adjacent to the Porter Square Center. As with Alternative B, the existing MBTA bus stop would also be relocated as previously described.

While this alternative allows for the greatest number of on-site parking spaces, there are certain drawbacks to the flow of traffic adjacent to the site. While it appears possible that an additional signal phase could be provided for left turns onto Massachusetts Avenue from Somerville Avenue there are also geometric constraints that must be considered. Providing a left-turn lane onto Massachusetts Avenue would require that the southbound Somerville Avenue approach to White Street be shifted to the west to accommodate the new lane. This would make the dual left-turn maneuver onto Somerville Avenue more difficult than it presently is today. This would also result in the left-turn storage lane onto White Street being shortened to the point where queued vehicles could effect traffic flow at Porter Square. The new left-turn lane onto Massachusetts Avenue would not be as long as needed given the expected volume. Based on the factors listed above, it does not appear feasible that this alternative could effectively provide the balance of transportation needs for the Porter Square area.

Preferred Site Access Alternatives

After weighing the different needs of the shopping center, the neighborhood, including bicyclists and pedestrians, and existing traffic on the local roadway system two preferred access alternatives were chosen from those previously discussed. The first access plan is designed to serve the present needs of the Porter Square Center and the adjacent roadway system, while the second will accommodate the long-term needs of both the shopping center and Porter Square as a whole.

The configuration of the site plan, particularly near the Massachusetts Avenue site driveway, will allow for future improvements to the Porter Square intersection that are being considered independent of this project. Based on the data and analysis presented in this report, it was concluded that the existing site access plan could accommodate the additional traffic generated by the project. However, some changes will be implemented as part of this project to accommodate existing site traffic in a more efficient manner. As such, it is recommended that primary access to the Porter Square Center continue to be provided by the White Street site driveway. However, this driveway will be relocated approximately 55 feet east of its present location to allow for the development of the proposed two-story retail building. The existing right-turn in/right-turn out Massachusetts Avenue driveway will also be maintained, but will be narrowed considerably from its present width of 55± feet to approximately 28± feet. This will help to create a more pedestrian-friendly environment while still providing access to the site and serving the urban design needs of the center.

By maintaining the right-turn in/right-turn out access, it is possible to provide for a total of 344 on-site parking spaces, which should be sufficient for the center with the implementation of transportation demand management measures that will be discussed in the parking management portion of this section. There will be four separate rows of parking provided between the existing retail stores and the proposed two-story retail building.

The proposed access plan to the Porter Square Center will also allow for the future development of the preferred Porter Square intersection improvement plan. This alternative is similar to Alternative B in that only exiting movements would be allowed at the Massachusetts Avenue site driveway. However, to provide for an acceptable total on-site parking count no median islands would be provided to separate the main driveway from the parking aisles. There would be no reduction in the on-site parking count of 344 spaces from the preferred alternative plan being proposed as part of this project.

Under both of the preferred alternatives, access to and from the site onto Elm Street will also be enhanced by redesignating the southerly driveway as an entrance only driveway, while the northerly site driveway would continue to accommodate exiting

traffic only. This new pattern would help to discourage the observed cut-through pattern from White Street onto Elm Street. Traffic entering the site from White Street can presently proceed parallel to that roadway directly to the Elm Street southerly driveway. With the southerly driveway being changed to entrance only, this traffic would now have to weave through the parking field to get to the northerly exit driveway. While some motorists would not find this to be a major obstacle, it is expected that many would proceed further north along Massachusetts Avenue to find another less obstructive route to get to Somerville. Likely routes for this cut-through traffic heading to the Davis Square section of Somerville could possibly include Russell Street and other local roadways to the north of the site. Given the lack of a clear cut-through route such as the Porter Square Center, it is expected that this traffic will be dissipated among the new possible routes north of the site. While there was not observed to be any considerable amount of cut-through traffic from Elm Street onto Massachusetts Avenue, it is expected that any such traffic would also be discouraged by having to weave through the parking field.

Under this alternative, the Somerville Avenue approach to the Porter Square intersection would be shifted approximately 10 feet to the west. This would create a plaza area in front of the Porter Square Center that would provide for a more attractive open space for pedestrian traffic crossing Massachusetts Avenue. A similar feature will already be provided adjacent to the proposed two-story retail building on the southwesterly corner of the site where there will be an open pedestrian landing area.



Pedestrian Traffic Enhancements

After a review of local pedestrian operations, VHB has considered several alternatives for improving pedestrian traffic flow across the Porter Square intersection. These improvements are long-term measures to be implemented as part of the Porter Square intersection improvements alternatives discussed in the previous section. With the proposed site plan, the two-story retail building has been located such that there will be an open plaza area provided at the corner of Somerville Avenue and White Street. This corner of the intersection is presently cluttered with signal equipment, light poles, a concrete wall and other hindrances. This results in this corner of the intersection not being an attractive "landing space" or destination for the high volume of pedestrians crossing Somerville Avenue from the MBTA station. By providing more attractive pedestrian destinations at this location, the existing crosswalk location should become the preferred route for pedestrians. As part of the long-term planning for this area mid-block diagonal pedestrian crossings between the two existing Porter Square signals could also be minimized by providing plantings, bollards, or other hindrances to discourage pedestrians from crossing the middle of the intersection. Providing landscaping in the median on Somerville Avenue could also help to achieve this goal. After crossing Massachusetts Avenue from the MBTA station, it is expected that most site-generated pedestrians will access

the site by proceeding adjacent to the north side of the new two-story retail building. This will help to remove pedestrian traffic from the Massachusetts Avenue driveway.

Under the preferred alternative for this proposed project there will not be any changes in the existing operations of the Porter Square intersection pedestrian signals and crosswalks. Given the minimal additional traffic generated by the project, it is not expected that there will be any notable increase in delays to pedestrians in crossing this intersection. As part of the long-term planning for Porter Square it is recommended that the possibility of concurrent pedestrian phasing be looked into further. This would most likely only take place at the Somerville Avenue/White Street portion of the Porter Square intersection. However, the possibility of shifting the crosswalk closest to the Massachusetts Avenue site driveway is also still being evaluated. Under that scenario, exiting left turns from the site could be accommodated in the same phase as a pedestrian phase across Massachusetts Avenue, provided that the crosswalk on the easterly side of Massachusetts Avenue was on the Dunkin' Donuts side of the site driveway.

Bicycle Traffic Enhancements

Based on a review of the existing local roadway system, it appears that the only physical improvements that could be made to accommodate bicycle traffic in the vicinity of Porter Square would be bike lanes. Given the existing bicycle traffic in combination with the observed vehicular traffic, there is a need for special bicycle treatments. A review of existing roadway plans for Porter Square and Massachusetts Avenue in the vicinity of the site revealed that there is presently sufficient roadway width to provide 5-foot wide bike lanes along Massachusetts Avenue. For the most efficient operations, this would require that parking be prohibited on Massachusetts Avenue adjacent to the retail stores on the westerly side of the road. Long-term decisions will also have to be made by the City of Cambridge regarding on-street parking beyond this project's study area if bike lanes are to be provided along this roadway. Typically, when bicycle lanes are provided, there is an increase in the amount of biking activity on the road. It is expected that this would also be the case along Massachusetts Avenue if bicycle lanes were provided.

There is also possibility that additional measures could be taken to accommodate bicycle traffic at the study area traffic signals. Possible treatments being considered by VHB include the provision of concurrent pedestrian-bicycle signals and providing bicycle phases to some of the study area traffic signals. One such location where this is being considered is the northbound Massachusetts Avenue approach to Upland Road. If bike lanes were provided on Massachusetts Avenue, then it might be possible to have a bicycle phase that would run while traffic was exiting from Upland Road onto Massachusetts Avenue.

There is presently a minimum of adequate bicycle parking facilities in the vicinity of Porter Square Center. Bicycles were also frequently observed to be parked along sidewalks, chained to utility poles or sign posts. Often the manner in which the bicycles are parked restricts the effective width of the sidewalks. As part of this project new bicycle racks will be provided on the site to accommodate local bicycle traffic. These racks will have a total capacity of 35 bicycles and will be designed to accommodate the short-term users typically found at shopping centers. The bicycle racks will be located in the plaza area in front of the entrances to Star and Tag's as well as in the plaza area adjacent to the Massachusetts Avenue site driveway. The bicycle racks will be located so as not to interfere with either pedestrian or vehicular traffic.

There are also concerns at the Porter Square intersection with how bicycle turning movements could be accommodated in conjunction with vehicular traffic. Specifically, the right-turn from Massachusetts Avenue onto Somerville Avenue is presently difficult for cyclists to make at the same time as cars. While this movement is frequently made by vehicle entering the site from Massachusetts Avenue, half of these right-turns are traveling to points on Somerville Avenue other than the shopping center. VHB has evaluated possible measures to improve this situation, including relocating this intersection (the right-turn slot from Massachusetts Avenue to Somerville Avenue) or modifying the existing retaining wall that surrounds the plaza area adjacent to the MBTA station. However, moving this right-turn movement any further to the north away from the MBTA station would result in too sharp of a curve for most motorists to negotiate (there is presently only a 25-foot radius provided at this turn). It is also not feasible to relocate this turn any further south, as the resulting grade difference between Massachusetts Avenue and Somerville Avenue would not conform with the required engineering standards.

Conflicts between vehicles and pedestrians also arise when bicyclists are traveling northbound on Massachusetts Avenue while a motorist is turning right into the shopping center. Under existing conditions, bicyclists have to look over their shoulder to watch out for right-turns crossing their path and turning into the site. The long-term preferred alternative of two exiting lanes at the Massachusetts Avenue driveway would add to the right turn movement from Massachusetts Avenue to Somerville Avenue. However, the conflict between right-turns entering the site at the Massachusetts Avenue driveway and bicyclists traveling north on Massachusetts Avenue would be eliminated.

Parking Management

VHB has also conducted an evaluation of parking conditions at the Porter Square Center, particularly with regard to employee parking activity. This study incorporated a previous parking study conducted by VHB as well as more recent observations of parking activity at the plaza.

Based on a parking observations conducted by VHB in November 1995 during the peak holiday season and again in April 1996, the 375-space Porter Square Center parking lot is presently operating near capacity on a weekday evening period and at capacity throughout a Saturday afternoon. Further observations revealed that between 45 and 50 employee vehicles were typically parked in the main parking lot during the peak weekday and Saturday periods, while at the same time the Elm Street parking lot was typically largely underutilized under peak hour conditions. The employee parking lot is located on the west side of Elm Street approximately 100 feet south of White Street. There is a total of 46 striped parking spaces in this lot and an additional 8 vehicles were typically observed to be parked in a line in the center of the lot, for a total lot capacity of 54 vehicles.

Several Transportation Demand Management (TDM) measures were considered and evaluated by VHB involving different ways to reduce the amount of on-site employee parking. One possible measure being investigated to reduce the amount of employees parking at the main Porter Square Center parking lot is to provide subsidized MBTA passes to all plaza employees. Weekly MBTA passes cost between twenty and thirty dollars per week and could be a cost effective way of increasing the amount of on-site parking available to shopping center patrons. The effectiveness of this measure depends on the willingness of employees to use the MBTA, as well as there being MBTA service in close proximity to the employees' homes. As part of the ongoing process of evaluating the effectiveness of TDM measures, surveys will be conducted of Porter Square Center employees to identify their existing methods of arriving to work and if they would be willing to use public transportation.

Based on the number of employees presently parking in the main parking lot during peak parking conditions it is recommended that all on-site employee parking be prohibited. Some employee parking can be maintained in the existing parking lot on Elm Street, which is presently available for employee use only. There are several possibilities being examined regarding the future use of the Elm Street parking lot. One such possibility involves this lot being used for both employees and a limited number of customer spaces. In that instance employee spaces could be restricted to ride-sharing vehicles only or to a set number of employees for each store.

As previously mentioned the employee parking lot on Elm Street presently has 46 striped spaces and room for approximately 8 more vehicles to be parked in the center aisle, for a total lot capacity of 54 vehicles. This total could be increased by approximately 15 to 20 vehicles by providing a parking attendant on Saturdays and other peak parking days throughout the year. The attendant would park employee cars two rows deep on one side of the lot, depending on when those employees arrive and depart work. For instance, the vehicles of employees working full-time shifts could be blocked in by part-time employee vehicles that would arrive after and leave work before full-time employees. This measure would required that a paid attendant be present at the lot throughout the entire day.

The proponent has also committed to trying to locate a remote parking facility that could be used by Porter Square Center employees. While there is a general shortage of parking space near Porter Square, the proponent is investigating using nearby office or municipal parking lots for employee use on Saturdays. As part of this project, the MBTA will be contacted to help identify any parking areas that might be available at or near a MBTA red line station, or a bus route that runs through the Porter Square area.

Off-site Locations

The analysis of roadway operating conditions indicates a need to upgrade the existing transportation system to better accommodate existing and future traffic demands. VHB has developed several mitigation measures based on a thorough review of traffic operations at the study area intersections. With implementation of the improvements planned as part of the project, traffic operations at study area intersections will be enhanced. The traffic generated by the proposed shopping center will be safely and efficiently accommodated by the transportation system with the provision of the measures described below.

Porter Square Intersection

Presently, left-turns onto Somerville Avenue can be made from two lanes on the southbound Massachusetts Avenue approach to Porter Square, one of which is a shared left-turn/through-lane. While left-turn vehicles have a red arrow through vehicles are sometimes caught in this lane behind stopped left-turn traffic. While most motorists seem to be aware of this and keep to the right through-lane, vehicles were still observed to pull out of the shared lane into the through lane when blocked by left-turning vehicles. As the present configuration does not comply to standard engineering practices, it is recommended that two exclusive left-turn lanes and a single through-lane be provided on this approach. This will require that additional signing be posted in advance of the intersection and pavement markings be provided to keep southbound Massachusetts Avenue traffic in the right lane.

Field observations of this intersection revealed that the vehicle queue from the southbound approach to the Massachusetts Avenue/Upland Road intersection frequently extends into the Porter Square intersection. While this typically does not block any movements besides the southbound through-movement, this situation could be improved to some degree. As such, it is recommended that the existing coordination system between these two intersections be reviewed to see if the southbound Massachusetts Avenue traffic at the Upland Road could be given more green time. The Upland Road approach to this intersection was frequently observed to receive more green time than necessary during peak conditions.

Somerville Avenue at Mossland Street

Based on both observations of existing traffic operations and capacity analyses conducted at this intersection, it has been determined that traffic operations can be improved at this location over existing conditions. This signalized intersection is presently coordinated with the intersection of Somerville Avenue and Beacon Street, which is located approximately 200 feet to the south. Both of these intersections are presently operating under a single controller and a cycle length that varies between 90 seconds and two minutes under peak hour conditions. While this intersection presently operates at LOS B under peak hour conditions, the westbound Mossland Street approach to this intersection presently operates at LOS D and LOS C during the respective weekday evening and Saturday midday peak hours. Accordingly, due to the long cycle length motorists, exiting from Mossland Street onto Somerville Avenue sometimes experience unnecessarily long delays.

The present operations of this signal system favor Somerville Avenue traffic flow, which results in long delays to side street traffic. During the phase in which Beacon Street traffic exits onto Somerville Avenue, the main roadway has a green indication while Mossland Avenue traffic is still stopped. This is most likely due the prominent left-turn movement from Beacon Street onto Somerville Avenue. While stopping Mossland Street traffic helps to process the Beacon Street traffic along Somerville Avenue to the north it might not be necessary to do this for the entire Beacon Street phase of the signal. By allowing Mossland Street traffic to run during the latter portion of the Beacon Street phase, delay to Mossland Street traffic could be reduced. It is estimated that this measure could possibly reduce delay to Mossland Street traffic by approximately 20 seconds. Further review of the capabilities of the existing signal controller is needed to better determine how operations at this intersection can be improved. VHB will also investigate the possibility of both of these intersections being included in the City of Cambridge's city-wide signal system, if it was warranted by the resulting benefits to local traffic flow.

Memorandum

To: Liz Epstein
Deputy Director for Community Development

Fr: Barry M. Pell, P.E.
Rizzo Associates, Inc.

Re: **Proposed Porter Square Center Renovation and Expansion
Traffic and Parking**

Dt: July 16, 1996

I have reviewed the proposed Porter Square Center project, as analyzed in the *Traffic Impact and Access Study* (VHB, Inc.; June 1996). This memorandum discusses my evaluation of major issues and concerns pertaining to the Center access and parking, as well as traffic operation in the vicinity of Porter Square. My evaluation is summarized under the following headings:

1. Project Trip Generation
2. Project Parking Demand
3. Site Access and Circulation
4. Porter Square Intersection Operation and Design
5. Transportation Demand Management (TDM) Mitigation

I. Project Trip Generation

The *Traffic Impact and Access Study (TIAS)* determines future site trip generation by applying an 11 percent increase to existing site traffic (excluding estimated cut-through traffic). The 11 percent factor is less than the increase in building area (17.9 percent). This is justified by the consultant by the claim that supermarket expansions do not typically result in a linear increase in traffic but instead produce increased spending per customer.

The *Trip Generation* manual, the national guideline of the Institute of Transportation Engineers (ITE), does not support the consultant's methodology to reduce the trip rate for the expanded supermarket. (If studies are available which substantiate this claim, they should be included for technical review.) Furthermore, since supermarket trip rates during peak demand periods are significantly higher than shopping center trip rates, the proposed *net* expansion

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comprised of some 70 percent supermarket space and 30 percent retail space should be weighted more heavily toward the higher supermarket trip rates (rather than a linear increase proportional to building area).

In general site trip generation is analyzed by applying trip rates given in the *Trip Generation* manual for specific land uses. Shopping centers are given as one category; however, supermarkets are listed separately to distinguish their often significantly different trip generation characteristics.

It is recommended that the trip generation methodology be based on existing driveway counts (with adjustment for cut-through traffic) and increased in accordance with ITE rates for shopping center and supermarket space. A comparison of the analyses results for the critical weekday afternoon and Saturday midday peak hours is given in Table 1.

Table 1 Project Trip Generation

	Proposed (148,880 sf)	Existing (126,510 sf)	Increase due to Expansion
TIAS			
Weekday Evening Peak Hour			
Project Trips	1,210	1,090	120
Cut-Through (30%)*	<u>180</u>	<u>180</u>	<u>-</u>
Total Site	1,390	1,270	120
Saturday Midday Peak Hour			
Project Trips	1,430	1,290	140
Cut-Through (40%)*	<u>300</u>	<u>300</u>	<u>-</u>
Total Site	1,730	1,590	140
Rizzo Associates, Inc.			
Weekday Evening Peak Hour			
Project Trips	1,360	1,130**	230
Cut-Through (30%)*	<u>180</u>	<u>180</u>	<u>-</u>
Total Site	1,540	1,310	230
Saturday Midday Peak Hour			
Project Trips	1,590	1,330**	260
Cut-Through (40%)*	<u>300</u>	<u>300</u>	<u>-</u>
Total Site	1,890	1,630	260

* Percentage of vehicles entering White Street from Massachusetts Avenue

** Includes estimated 40 trips at Elm Street lot

My analysis indicates an increase in project generation of 110 trips (afternoon peak) and 120 trips (Saturday peak) over the *TIAS* report. The reasons for this difference are:

- Supermarket trip rates should not be reduced for larger-sized stores.

RIZZO ASSOCIATES, INC.

- The proposed expansion will increase the proportion of supermarket space compared to retail space. Supermarket trip rates are substantially higher than retail space trip rates.

Moreover, as discussed in the *TLAS*, a portion of this driveway traffic increase attracted to the expanded Center will derive from traffic already on streets in the area and not traveling to the site as a new trip. This "pass-by" factor may range from 25 to 40 percent during weekday peak hours but is likely to be only 15 to 20 percent on Saturday when single-purpose (non-work) shopping trips are more prevalent. (The *TLAS* uses a 25 percent factor for both peak periods.)

In summary, I have analyzed that the project could generate an additional 172 *new* vehicle trips (afternoon peak) and 195 *new* vehicle trips (Saturday peak). This compares to 90 new trips (afternoon peak) and 110 new trips (Saturday peak) in the *TLAS* report. Despite this discrepancy, when distributed among the five principal travel directions along Massachusetts Avenue, Somerville Avenue, and Elm Street, it is anticipated that there will not be a significant difference from the traffic increases and impact on these streets predicted in the *TLAS* report.

2. Project Parking Demand

Current parking supply is comprised of the 375-space main lot and 54-space (46 striped spaces plus 8 along the center line) Elm Street employee lot. The *TLAS* recorded a peak utilization of 418 spaces (375 in the main lot and 43 in the Elm Street lot).

The *TLAS* parking analysis assumes that present supply is adequate for current demand. It determines future additional need as 60 spaces, based on the peak hourly increase in trip generation for the site. The total peak demand would then presumably be 478 spaces (418 plus 60).

The *TLAS* may underestimate the potential future parking demand for the following reasons:

- It assumes that current at-capacity utilization is equal to the demand. (The resulting parking rate, 3.0 spaces per 1,000 sf is applied to the retail expansion.) In fact, if all main lot spaces are filled, it is likely that peak demand is higher than supply and currently accommodated on off-site neighborhood streets.
- The peak hourly increase in trip generation is not equivalent to the increase in demand. Rather it is the *accumulation* of parking, based on trip generation and turnover *throughout* the day, which determines peak demand. (For example, if 40 additional vehicles enter the site from 4:00 to 5:00 P.M., 60 vehicles enter in the peak hour from 5:00 to 6:00 P.M., and their parking duration is two hours, the increase in parking demand would be 100

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vehicles, not 60 vehicles.) (The methodology is also inconsistent because the *TIAS* estimates increased peak hour trip generation as 75 entering vehicles, not 60 vehicles. Moreover, the Rizzo trip generation analysis suggests a much higher peak hour incoming vehicle volume increase of 130 vehicles.

- The *TIAS* suggests that future parking demand for the expanded supermarket will occur at a lower rate because the expansion will incorporate a longer stay at the supermarket rather than a proportional increase in customers. This argument is questionable, since the extension of parking duration will reduce parking turnover and therefore *increase* the parking accumulation.

Similar to the trip generation analysis, it is recommended that required parking be determined as an increase over current demand. However, current use should reflect not only the two Center lots, but on-street neighborhood parking used by Center customers.

The application of parking rates contained in the *ITE Parking Generation* manual for shopping center and supermarket space results in a current peak demand (Saturday midday) of 432 spaces. Measured demand in the two lots during this hour is 418 spaces.

The resulting peak deficit, for approximately 14 customer vehicles, is likely distributed as on-street parking across Massachusetts Avenue and in the adjacent neighborhood, illegal parking and/or vehicles waiting in the parking lot, and vehicles circulating around the lot searching for a space.

Application of the parking rates (correlated to existing demand) to the expanded Center results in a peak (Saturday midday) demand for 504 spaces, or an increased demand for 72 spaces. The proposed parking supply (*TIAS*, Figure 2) provides 396 spaces, comprised of 342 spaces (189 regular spaces, 145 compact car spaces, and 8 handicapped spaces) in the main lot and 54 spaces in the Elm Street lot. The resulting deficit is 108 spaces.

The *TIAS* data indicates there is a current peak (Saturday) of 93 employee vehicles (50 parking in the main lot and 43 parking in the Elm Street lot). If the expansion (18 percent building area) is associated with a 10 percent increase in peak employment, the number of peak hour employee vehicles could increase to approximately 105 to 110 (successful TDM components could reduce this demand).

In summary, it is recommended that all employees be required to park at a remote lot of minimum size for 100 spaces, with shuttle bus connection to the Center. (The exceptions would be for carpool/vanpool spaces and employees whose shifts do not include any time during 3:30 to 7:30 P.M. on weekdays and 11:00 A.M. to 3:00 P.M. on Saturday. Parking for these employees should be prohibited from the main lot.) It is noted that this plan relies on customer use of the Elm Street lot during peak demand periods. Appropriate signing on- and

off-site should be provided to facilitate customer use of these spaces during peak periods. Table 2 summarizes the parking analyses.

Table 2 Project Parking Summary

Measured Existing Demand	PM Peak	Saturday Peak
Main Lot ¹	375	375
Elm Street Lot ¹	18	43
Excess Demand ²	—	14
Total Demand	393	432

Future Parking Demand		
TIAS		
Demand 478 spaces	(60 space increase over existing lot use)	
Supply		
- Main Lot	342	
- Elm Street Lot	54	
Total	396	spaces (deficit = 82 spaces)
Rizzo Associates, Inc.		
Demand 504 spaces	(72 space increase over existing demand)	
Supply		
- Main Lot		
- Elm Street Lot	342	
- Remote Site	54	
Total	108	(proposed 100 to 110 spaces)
	504	spaces

1 TIAS (VHB, Inc., June 1996)

2 Rizzo Associates, Inc. analysis (includes on-street parking, illegal lot parking/waiting, and circulating vehicles)

3. Site Access and Circulation

The proposed site plan maintains the exiting access arrangement on (1) Massachusetts Avenue, right turn in/out; (2) White Street (in/out); (3) Elm Street, north (out only); and (4) Elm Street, south (in/out). There are proposed minor geometric changes, including relocating the White Street driveway 55 feet east (away from Somerville Avenue) and narrowing the Massachusetts Avenue driveway width from 55± feet to 28± feet. The TIAS also recommends an operating change to permit only entering traffic at the southerly Elm Street driveway.

The TIAS considers four alternatives which would modify traffic patterns, particularly benefiting Center vehicles. Three of these alternatives provide exiting left turns from the Massachusetts Avenue driveway, under signal control. The fourth alternative provides left turns from Somerville Avenue at Massachusetts Avenue. Thus, Center traffic exiting the

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Proposed Porter Square Center Renovation and Expansion Traffic and Parking

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White Street driveway could turn right onto Somerville Avenue and left onto Massachusetts Avenue.

All of these alternatives are intended to address the issue of existing Center traffic destined south on Massachusetts Avenue. This demand is estimated to represent 27 percent (22 percent on Massachusetts Avenue and 5 percent on Upland Road) of Center traffic. It is presently accommodated principally from Elm Street, to the south via Mossland Street or to the north via Beech Street. This component of site exiting traffic diverted onto local streets is presently between 150 to 200 vehicles during peak hours. It will increase by 20 to 40 vehicles per peak hour (divided between two routes) with the Center's expansion. For comparison, Center traffic using these diversion routes represents about one-third of total peak hour traffic using either Mossland Street or Beech Street for access south on Massachusetts Avenue.

Enabling more direct left turns to Massachusetts Avenue would benefit the local streets presently traveled by these vehicles. However, there are two significant disadvantages for Porter Square:

- The signal operation will be more complex, reducing efficiency and increasing vehicle queuing and congestion.
- The pedestrian environment will be adversely impacted. The alternatives result in less pedestrian protection since some exclusive pedestrian intervals would operate concurrently with vehicle turning movements. Additional left turning movements complicate the intersection for pedestrians. Presently, the most heavily traveled crosswalk (between White Street and the MBTA station) is provided with only a six second walk interval, once every two minutes. Consequently, many pedestrians cross during other periods of the signal cycle. Alternatives B and D would shift significant components of Center entering or exiting traffic to White Street and increase conflicts with this pedestrian crosswalk.

The proposed restriction of the Elm Street (south) driveway for entry only may be expected to reduce cut-through volumes using the Center by no more than 10 to 20 percent.

The site circulation plan is a major improvement over existing conditions in terms of providing a clear organization of parking aisles and median islands to define aisle ends. I am concerned, however, about the skewed angle parking along the main driveway at Massachusetts Avenue. It is likely that vehicles entering at Massachusetts Avenue will attempt the awkward turn to enter the spaces along the stores. Also, vehicles backing quickly from the angle spaces on the south side will conflict with traffic entering the driveway. It is recommended that these spaces be designed for 90-degree angle parking. To compensate for the lost width, the parking in the area called "market extension" can be provided at a skewed angle, with entry only on the west side and exit only on its east side. This operation will also

avoid conflicts between vehicles exiting this parking area and entering the Massachusetts Avenue driveway.

It is noted that the proposed site plan appears to eliminate the present curbside package pick-up at Star Market.

4. Porter Square Intersection Operation and Design

The extended intersection of Massachusetts Avenue, Somerville Avenue, and White Street is controlled with one traffic signal. There are three phases within each cycle, described in Table 3.

Phase	Vehicle Movements	Pedestrian Movements
1	Massachusetts Avenue <ul style="list-style-type: none"> ■ Southbound, through ■ Northbound, through, and right turn to Somerville Avenue and White Street White Street, right turn only	None
2	Massachusetts Avenue <ul style="list-style-type: none"> ■ Southbound, through, and left turn to Somerville Avenue and White Street (permissive) Somerville Avenue <ul style="list-style-type: none"> ■ Northbound to Massachusetts Avenue, right turn only 	None
3	None	All

Pedestrian crossings are protected on phase 3. This phase has approximately six seconds "walk" time and a nine-second clearance (flashing "don't walk") interval. The cycle length was observed during the morning peak to operate with a 120-second cycle. Thus, pedestrians are given a protected opportunity to cross for only six seconds every two minutes, requiring a waiting time of 114 seconds. (I recommend that waiting times for pedestrian crossing should not exceed 60 to 75 seconds.)

The *TLAS* indicates that the Massachusetts Avenue/Somerville Avenue intersection operates currently during peak periods at level of service "C/D" and in the future will operate at level of service "D." The White Street intersection is indicated to operate at level of service "F"

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(existing and future). I believe, however, that the capacity analysis format is inadequate to properly model this complex intersection and that the intersection operates better than the analysis predicts.

A significant reason for the ability of this intersection to process large volumes of traffic is the prohibition of left turns from Somerville Avenue to Massachusetts Avenue (and to some extent, from White Street to Somerville Avenue). While I believe that the intersection has some reserve capacity and could be reconfigured/rephased to accommodate these left turns, I do not recommend these changes, whereby vehicle movements would dominate the intersection operation even more than at present and street crossings could lengthen. Nor do I propose that the (occasionally) confusing shared left/through lane on Massachusetts Avenue be resolved as part of the Center expansion. Most motorists are familiar with the signal phasing and avoid being "trapped" by waiting left turn queues.

The *TIAS* site plan (Figure 2) depicts a reconfigured Somerville Avenue approach to Massachusetts Avenue. In this schematic plan, the Massachusetts Avenue crosswalk is actually lengthened from 75 feet to 80 feet. However, the channelized island is removed and the additional 24-foot crossing of Somerville Avenue is eliminated. The advantages of this concept should be weighed against the reduced vehicular capacity associated with more difficult double lane left turning from Massachusetts Avenue and the greater potential for illegal left turns from Somerville Avenue.

My recommendations are as follows:

- Reconfigure the Somerville Avenue approach to achieve a reduced turning angle for vehicles to/from Massachusetts Avenue. This will require cutting back a portion of the sidewalk adjacent to the proposed retail building (shown in the *TIAS* site plan), but will retain the shortened crosswalk for Massachusetts Avenue.
- Modify the signal phasing/timing. Use a cycle length of no greater than 100 seconds and increase the "walk" time up to the limit of vehicle level of service "D/E." An additional vehicle phase may be needed to clear White Street vehicles turning right to Somerville Avenue and onto Massachusetts Avenue.
- The reconfigured intersection geometry may permit a crosswalk to be added between the MBTA station and Dunkin Donuts parallel with Massachusetts Avenue.
- Queues and congestion at Porter Square often result due to the nearby signal at Massachusetts Avenue/Upland Road. As noted in the *TIAS*, coordination between these intersections should be reviewed to determine a more efficient offset arrangement. The amount of green time for Upland Road should also be evaluated.

5. Transportation Demand Management (TDM) Mitigation

In order to minimize potential adverse impacts of this project on traffic flow and parking on the surrounding intersections and neighborhood streets, it is recommended that the developer commit to implementing a comprehensive transportation demand management (TDM) program. The objective of this program is to reduce the amount of vehicular demand (both traffic and parking) associated with the Center, particularly during peak traffic hours. The program is focused principally on employee access.

The key elements of the TDM program are proposed as follows:

- **Employee Parking.** The most easily controlled activity with the greatest benefit to reduce Center traffic and parking impact on a daily basis is employee parking. It is recommended, as described above, that all employees park at a remote lot, with shuttle bus connection to the Center. It is estimated that this lot will require space for approximately 100 vehicles. (The exceptions would be for carpool/vanpool spaces and employees whose shifts do not include any time during 3:30 to 7:30 P.M. on weekdays and 11:00 A.M. to 3:00 P.M. on Saturday. Parking for these employees should be prohibited from the main lot.)
- **Subsidy for Nonautomobile Access.** Employers should be required, as a lease provision, to provide a 75 percent payment of a monthly "T"-pass for full-time employees not traveling to work by motorized vehicle.
- **Carpool/Vanpool Program.** A carpool/vanpool matching program should be established, with preferential parking in the Elm Street lot and a guaranteed ride home option. The number of designated carpool/vanpool spaces will be based on the number of participating vehicles in the program.
- **Bicycle Parking.** Secure bike racks (in accordance with alternatives provided by the city) should be provided at convenient locations, protected from vehicle traffic, and not interfering with pedestrian movement at sidewalks and Center crosswalks. The capacity should be provided at a ratio of 1 space per 10 vehicle parking spaces. The main lot should provide a minimum capacity for 40 bicycles. The remote employee lot should provide space for 10 bicycles, to accommodate bicycle commuters who find it more convenient to travel to this lot and then bus shuttle to the Center. Lockers and showers should also be provided for employee bicycle commuters.
- **Package Delivery.** Star Market should be required to offer a package home delivery service.

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Proposed Porter Square Center Renovation and Expansion Traffic and Parking

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- **Truck Management.** Truck deliveries should be prohibited during peak traffic hours on weekdays from 7:00 to 9:00 A.M. and 4:00 to 6:30 P.M. The city should indicate to Star Market and other retailers desired truck routes for access to and from the Center.

- **Transportation Coordinator.** One individual should be designated to administer the Center's TDM program. This can be a part-time assignment for an existing employee. The functions of this individual would include:
 1. Establish and operate vanpool/carpool program (with state assistance), designation of vanpool/carpool spaces, and operation of the guaranteed ride home program.
 2. Administer the T-pass program.
 3. Administer the operation of the remote employee parking lot and shuttle bus operation.
 4. Disseminate information to employees on public transit access.
 5. Maintain a kiosk in the Center with public transportation information.
 6. Conduct an annual monitoring program with report to the neighborhood and city, including traffic and parking counts and the distribution of arrival mode for employees and customers.
 7. Monitor the truck management plan to ensure compliance with routes and delivery times.
 8. Represent the Center in neighborhood meetings regarding traffic and parking.
 9. Prepare special traffic management plans, such as for peak Christmas shopping periods.

399501M6.BMP



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September 10, 1996

Ref: 04535.26

Ms. Elizabeth Epstein
Deputy Director for Community Development
City of Cambridge
Community Development Department
57 Inman Street
Cambridge, MA 02139

Re: Response to Comments
Porter Square Center
Cambridge, Massachusetts

Dear Ms. Epstein:

Vanasse Hangen Brustlin, Inc. (VHB) has reviewed the comments presented in the memorandum from Rizzo Associates, Inc. dated July 16, 1996, regarding the Traffic Impact and Access Study for the Proposed Porter Square Center Renovation and Expansion Project. VHB is providing the following responses corresponding to the attached Rizzo Associates memorandum:

1. **Project Trip Generation**

As defined in ITE Trip Generation¹, a shopping center is an integrated group of commercial establishments owned and managed as a unit, with on-site parking and sometimes featuring outparcel buildings. In the traffic study, VHB projected peak hour trip generation using ITE land use code (LUC) 820 Shopping Center calibrated with the actual traffic counts from the Porter Square Center. This methodology was chosen because, in our experience, it generates the most accurate estimate for this type of expansion. Furthermore, the estimates in the traffic study are supported by proprietary supermarket industry data for similar type expansions. I have attached a summary of the trip generation methodology as a reference. While the Star Market expansion will account for approximately 70 percent of the expanded building space on this site, the nature of this plaza as a shopping center with multiple shopping opportunities will not change.

Rizzo Associates suggests that since the supermarket represents the majority of the expansion, ITE supermarket rates (LUC 850) should apply to the supermarket portion of the expansion. ITE describes a supermarket as a free-standing building, with an average size of 36,000 square feet (sf). ITE LUC 850 is also established on a limited database that yields unrealistic results particularly for larger supermarkets. Application of the ITE LUC 850 rate does not take into consideration shared or multi-purpose trips to the shopping center. Furthermore, the ITE data indicate that the supermarket should presently be generating approximately 845 vehicle trips during the Saturday peak hour of the generator.

¹Trip Generation, Fifth Edition: Institute of Transportation Engineers; Washington, DC (1991).



Ms. Elizabeth Epstein
Project No.: 04535.26
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With the 13,630 sf supermarket expansion (which has been reduced from the conservative estimate of 15,530 sf presented in the traffic study), the ITE database indicate that Star Market would generate 1,540 vehicle trips, which is nearly double the existing traffic volumes generated by Star Market using the same regression equation. While the Star Market expansion will generate some additional traffic volumes, the overstated projections from the ITE data clearly reveal the shortcomings of that database. Again, it is our experience that the appropriate methodology for projecting traffic generated for this type project was used in the TIAS.

Pass-by Trips

While we believe, based on several customer surveys of other supermarkets, that the Saturday pass-by percentage is higher than 15 to 20 percent, the difference from using this lower pass-by rate is only approximately 10 vehicle trips during both peak hours. This small difference would have no practical effect on projected traffic operations at any of the studied locations.

2. Project Parking Demand

On-Street Parking

The parking availability along neighborhood streets is not situated to readily accommodate shopping center patrons. Walking distances, traffic conditions and parking restrictions do not provide suitable parking options for plaza patrons. Throughout the review process for this project, VHB has attended a number of meetings with city officials from Somerville and Cambridge, as well as members of the surrounding neighborhood. During these meetings, parking on local neighborhood streets has not been mentioned as a noticeable problem today. To validate this, VHB recently conducted a second analysis of parking utilization within the main lot, the employee lot and legal spaces on the street around the shopping center. During this survey, there was no evidence of shopping center-related vehicles using on-street parking.

Parking demand is typically measured by the ratio of supply vs. demand and is referred to as the parking utilization rate. The utilization rate identifies the percent of parking supply being consumed. Utilization accounts for the accumulation of parked vehicles as well as the reduction of parked vehicles as they leave. The example presented by Rizzo Associates does not account for vehicles leaving the site. Furthermore, our recent parking survey indicates that the typical parking duration is only 40 minutes -- substantially less than the two hours referenced in Rizzo Associates memorandum.

As supported by ITE Trip Generation, the site is expected to experience a reduction in trip generation rate as the square footage is expanded. As shoppers are provided more services, their duration of stay may have a tendency to be slightly longer. The Traffic Impact and Access Study acknowledges this and references an appropriate increase in parking demand.



Parking Deficit

Based on a thorough review of parking conditions at the Porter Square Center, it has been determined that a total of 50 off-site parking spaces for remote employee parking, in combination with the proposed Transportation Demand Mitigation (TDM) measures, can adequately address the anticipated parking deficit. These remote spaces are planned to be provided during the peak period (Saturday between 11:00 AM and 5:00 PM) and special events. Preferably, the majority of the spaces will be at locations either within walking distance of the site or at Alewife station.

As part of the initial traffic study for this project, VHB conducted parking counts and observations at the Porter Square Center in November 1995 on a weekday and a Saturday the week before Thanksgiving. The counts revealed that the lot was operating at capacity for most of the Saturday afternoon and near capacity between 5:30 and 7:30 PM during the weekday observation period. The results of the parking study are typical of a shopping center featuring a supermarket during the peak holiday season. VHB has since conducted follow-up observations on a typical weekday and Saturday in August 1996. These counts revealed that the peak weekday demand between both the main parking lot and the Elm Street employee lot was 309 vehicles out of a total capacity of 430 parking spaces. During the Saturday observation period, the peak demand was observed to be 342 vehicles, out of the same 430 space capacity.

The approximately 20 percent lower parking demand observed in August can be largely attributed to a seasonal variation experienced at the shopping center. While this site does not experience the seasonal variations in business found at a mall or other large retailer due to holiday shopping, the increased business at Star from Thanksgiving and the approaching holiday season at the rest of the site does result in a greater parking demand. Given the nature of this site, it is expected that parking demand at the site likely remains at the level found in August, except for the during periods preceding major holidays, such as Thanksgiving and Christmas. However, for analysis purposes, it was conservatively assumed that the parking counts conducted in August represented the lowest parking demand experienced at the center for the entire year. By comparing the peak holiday parking condition to the *assumed* lowest condition, an average parking demand can be estimated for the entire year. This will almost undoubtedly result in a conservative estimate of the average demand at the center, since there will likely be several other days throughout the year when parking demand is lower than the randomly chosen day in August.

Once the existing parking conditions at the Porter Square Center were assessed it was possible to evaluate the likely increased demand resulting from the proposed renovation and expansion of the center. Parking Generation, an industry reference produced by the Institute of Transportation Engineers (ITE), was used to estimate the increase in parking demand at the site. This source is largely based on suburban locations and, as such, the average results from ITE must be calibrated to account for the unique characteristics of this urban center such as the proximity of the MBTA access, higher percentage of walk-up traffic, and non-shopping center vehicles illegally parked in the main lot. In projecting the



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overall parking demand increase, Rizzo Associates apparently used a similar methodology to estimate the percentage increase in parking demand that we used to determine the percentage increase in trip generation. Specifically, ITE Parking Generation estimates that an increase from 126,510 square feet (sf) to 148,880 sf in shopping center size would generate a 23 percent increase in demand. Applied to the observed peak season Saturday peak hour parking demand of 418 yields an estimated demand of 515. However, applied to the peak hour demand of 342 in the August utilization study, a 23 percent increase in parking demand yields a projected demand of 421. The average of these two results - a projected average demand of 468 spaces measured against a 399-space proposed parking supply - results in a conservatively estimated average deficit of 69 spaces (the TIAS projected a peak parking deficit of 80 spaces). It should again be noted that parking demand throughout the year is expected to be more typical of the levels found in August, with the exception of during periods preceding major holidays. Therefore, while the analysis for the parking needs for this site will be based on the average condition of a 69-space deficit, the likely deficit throughout most of the year will be more in the range of the 22-space deficit expected based on the August data (a 421-space demand measured against the 399 space capacity).

A similar analysis was also conducted to assess the peak weekday parking needs of the shopping center. As stated in Parking Generation, the expanded shopping center should generate a 21 percent increase in parking demand on weekdays. Applied to the observed peak season weekday peak hour parking demand of 393 yields an estimated demand of 476. However, applied to the peak hour demand of 309 in the August utilization study, a 21 percent increase in parking demand yields a projected demand of 374. The average of these two results - 425 spaces measured against a 399-space proposed parking supply - results in a conservatively estimated average deficit of 26 spaces. However, parking demand throughout the year is expected to be more similar to that found in August, as opposed to the peak periods before major holidays. In fact, while we have conservatively assumed that the observations in August represent the lowest parking demand of the year, ITE data actually indicate otherwise. According to the ITE data, there are only *three* months out of the year when typical shopping center traffic volumes are higher than in August. Therefore, there will likely actually be a surplus of parking on weekdays for most of the year, as with the 374 space demand observed in August measured against the 399 space capacity. It is expected that any deficit experienced during peak periods can be easily offset by the proposed TDM measures, including the removal of employee vehicles from the main lot and stricter enforcement of illegal on-site parking.

VHB and Gravestar agree that provisions for additional off-site employee parking will eliminate concerns with the on-site parking supply. Accordingly, Gravestar has secured an initial provision that 50 off-site employee parking spaces be provided during the critical Saturday 11:00 AM to 5:00 PM peak period as a means of maximizing the availability of on-site spaces for shopping center patrons. [Based on data contained in ITE Trip Generation, an industry reference containing rates of traffic generation by various land uses, Sunday traffic volumes at similarly sized shopping centers are typically half of those found on Saturdays. This finding is also consistent with sales data obtained from Star Market comparing daily sales volumes. Accordingly, there does not appear to be the need to



provide remote spaces on Sundays, given the considerably lower volume of business and resulting parking surplus.] The provision of remote spaces on Saturday, coupled with a comprehensive travel/parking demand management program, will more than adequately address the projected parking deficit projected on the site. It should also be noted that this analysis was based on parking counts that included non-shopping center related vehicles, such as MBTA patrons. As part of the TDM mitigation, there will be a greater enforcement of illegal parking and the overall parking demand on the site should be reduced. The removal of these illegally parked vehicles should also help to offset the increase parking demand resulting from this project. During the peak holiday season, the proponent has also committed to providing parking for Porter Square Center employees at the office parking spaces located next to the Mt. Auburn Street Star Market. Employees using this remote lot during the peak holiday season will be transported to and from the site by a shuttle bus. Furthermore, the TDM program includes a monitoring component, by which the measures of effectiveness of the entire TDM program can be assessed. These subsequent observations will be conducted by the proponent on a regular basis at predetermined intervals. By conducting these additional studies, the effectiveness of the program can be quantified both after the initial conception of the program, and also after it has been in place and fully established.

3. Site Access and Circulation

While introducing a new phase to the Massachusetts Avenue/Somerville Avenue traffic signal will result in more complex signal operations an evaluation which included a TRAF-Netsim analysis conducted for this intersection indicates that this intersection can operate at an acceptable level of service with the proposed signalized site access. Regardless, the proposal for site access currently does not include left-turn access from the site. The site plan has, however, been developed such that left-turn access can be implemented in the future.

Pedestrian Accommodations

The six-second WALK interval is supplemented with a 16 second flashing DON'T WALK interval in which pedestrians are cleared from the intersection. Therefore, pedestrians are actually given a total of 22 seconds to safely cross the roadway. This total of 22 seconds of pedestrian crossing time is consistent with standard engineering practices for an intersection of this type. Likewise, the resulting total waiting time for those pedestrians arriving at the end of the previous pedestrian phase is no greater than 78 seconds during either the weekday evening or Saturday midday peak hour. The City of Cambridge recently revised signal operations at this location so the pedestrian phase is called every cycle automatically. Subsequent field observations have indicated that pedestrian utilization of the crosswalk and accompanying signal phase has improved since this change was made by the city.



Parking Layout

The latest site plan has been revised so that 90-degree spaces will be provided along the both sides of the main driveway adjacent to the retail stores. The purpose of this design was to help reduce congestion from parking maneuvers while presenting a design that would be compatible with future signalization of this driveway. When the site plan is to be finalized all recommendations warranting attention will be considered.

4. Porter Square Intersection Operation and Design

As addressed in the previous section, the pedestrian cross time is 22 seconds. The weekday morning cycle lengths are set at 120 seconds to accommodate traffic demands and minimize delays. During the weekday evening and Saturday midday peak periods cycle lengths are 100 and 90 seconds, respectively.

The conceptual site plan presented in the traffic study was for use at a conceptual level only. The actual roadway configuration has been modified since the initial study and now features a reduced turning angle on the Somerville Avenue approach for vehicles traveling to and from Massachusetts Avenue.

VHB considered the possibility of providing a crosswalk directly between the MBTA station and Dunkin' Donuts parallel with Massachusetts Avenue. While this would appear to be the preferred path of most pedestrians, the implications to the signal operation do not allow for this, as an extremely long pedestrian crossing phase would be required. Instead, locating the crosswalks as shown in the site plan, in addition to the implementation of the other measures recommended to help discourage mid-block crossings, should help provide for optimal pedestrian operations at this location.

5. Transportation Demand Management (TDM) Mitigation

As previously noted there are differences in opinion regarding the total amount of additional off-site parking that is needed to support the proposed project. Regardless of the amount of off-site spaces required, it is agreed upon by both Rizzo Associates, Inc. and VHB that all on-site employee parking should be completely relocated in the main Porter Square Center parking lot. In addition, Gravestar has already taken more aggressive steps to eliminate MBTA rides from parking in the lot (the result of this may have already shown up on the most recent parking survey). In addition, Gravestar is committed to a comprehensive travel and parking demand management program designed to further reduce single-occupancy vehicles on the site. This program incorporate most of the items listed in Rizzo Associates memorandum. The proposed TDM program accompanies this letter.

Truck Management

With regard to truck management, comments from city agencies and local groups have been noted regarding the times and manner in which deliveries to the site are made. As



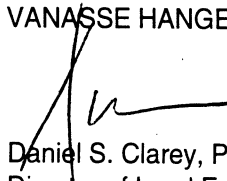
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such, the proponent remains committed to arranging truck deliveries so as not to interfere with the character of the nearby neighborhoods. Delivery times will continue to be restricted to between 7:00 AM and 9:00 PM, and there are additional alternatives being considered to help minimize the impacts of loading activity on the adjacent street system.

I trust the response is helpful in the city's ongoing review of the proposed project. As always we are available to discuss any aspect of this project. Please do not hesitate to call me or Patrick Dunford of my staff should you have any questions regarding this matter.

Very truly yours,

VANASSE HANGEN BRUSTLIN, INC.



Daniel S. Clarey, P.E.
Director of Land Engineering

cc: Susan Clippinger - Cambridge Traffic & Parking
Anne Johnson - Somerville Traffic & Parking
Barry Pell - Rizzo Associates
John Civilinski - Gravestar, Inc.
Drew Leff - Leff Consulting, inc.
Hugh Hahn - VHB
Pat Dunford - VHB

1. Method 1 - Observed Volumes increased based on ITE data

Porter Square Expansion Trip Generation Summary*

Time Period	Existing 126,510 sf	Proposed 148,880 sf	Increase due to Expansion	Percent Increase
Weekday Daily				
enter	4,095	4,535	440	
exit	<u>4,095</u>	<u>4,535</u>	<u>440</u>	
Total	8,190	9,070	880	10.4%
Weekday Evening				
Peak Hour				
enter	385	425	40	
exit	<u>385</u>	<u>425</u>	<u>40</u>	
Total	770	850	80	10.4%
Saturday Daily				
enter	5,300	5,875	575	
exit	<u>5,300</u>	<u>5,875</u>	<u>575</u>	
Total	10,600	11,750	11,500	10.8%
Saturday Midday				
Peak Hour				
enter	520	575	50	
exit	<u>520</u>	<u>575</u>	<u>50</u>	
Total	1,040	1,150	100	10.6%

* Source: Trip Generation, Fifth Edition; Institute of Transportation Engineers (ITE); Washington, D.C. Land Use Code (LUC) 820 (Shopping Center).

	Observed Site Traffic*		Increased Site Traffic
Weekday Evening			
Peak Hour			
enter	590		65
exit	<u>500</u>		<u>55</u>
Total	1,090	x 10.4% =	120
Saturday Midday			
Peak Hour			
enter	700		75
exit	<u>590</u>		<u>65</u>
Total	1,290	x 10.6% =	140

* Observed Porter Square trip generation with cut-through traffic deducted.



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617 924 1770
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Memorandum

To: Ms. Elizabeth Epstein
Deputy Director for Community
Development
Community Development Program
57 Inman Street
Cambridge, MA 02139

Date: September 11, 1996

Project No.: 04535.26

From: Daniel S. Clarey, P.E.
Director of Land Engineering

Re: Cambridge - Porter Square
Center

Attached please find the results of two parking accumulation and turnover studies conducted by Vanasse Hangen Brustlin, Inc. (VHB) at the Porter Square Center. The counts were conducted on Thursday, August 15, 1996 and Saturday, August 17, 1996 during the respective peak periods, as identified by previous parking studies of this site conducted by VHB in November 1995. The study area for these counts was comprised of the Porter Square Center main parking lot, the Elm Street parking lot and the roads surrounding the site.

As shown in the attached data, there is presently a total capacity of 430 parking spaces at the Porter Square Center - 376 in the main parking lot and 54 spaces in the Elm Street employee parking lot. As part of this study, the total number of parked vehicles in both lots was counted at 20 minute intervals during peak periods. The last three digits of each vehicles license plate were also recorded so that it could also be determined how long the average vehicle is parked in the main lot. The results of the accumulation study indicate that the peak weekday parking demand occurred between 6:10 and 6:30 PM when a total of 309 parked vehicles were observed - 298 in the main lot and 11 in the Elm Street lot.

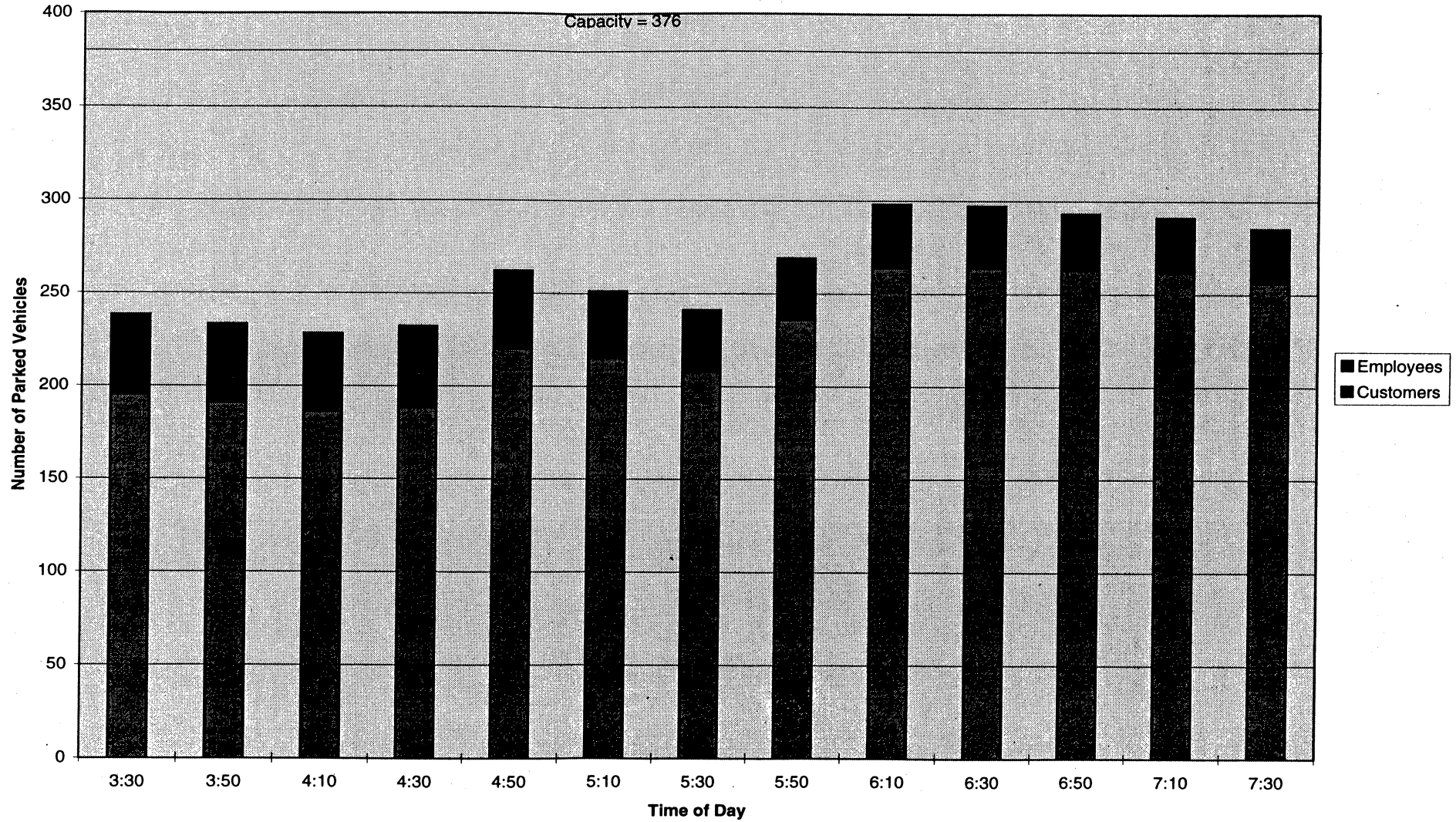
The results of the Saturday accumulation study reveal that the peak parking demand occurred between 2:20 and 2:40 PM when a total of 342 vehicles were observed parked in the combination of both lots - 315 in the main lot and 27 in the Elm Street employee lot. Based on the Saturday data, it was also determined that patrons of Porter Square Center typically are only parked in the main lot for an average of 40 minutes.

Please do not hesitate to call me if you have any questions regarding this matter.

cc: Drew Leff
John Civilinski
Barry Pell - Rizzo Associates
Project File

Weekday Parking Accumulation and Duration													
* Based on parking counts conducted by VHB on Thursday, August 15, 1996													
Total main lot capacity =													
Total Elm St. lot capacity =													
Combined lot capacity =													
Time of Day	3:30	3:50	4:10	4:30	4:50	5:10	5:30	5:50	6:10	6:30	6:50	7:10	7:30
Main lot	238	233	228	232	262	251	241	269	298	297	293	291	285
Elm St. lot	24	23	20	18	16	12	11	10	11	10	9	7	7
Combined Total Occupied	262	256	248	250	278	263	252	279	309	307	302	298	292

Weekday Evening Parking Accumulation



Space	3:30	3:50	4:10	4:30	4:50	5:10	5:30	5:50	6:10	6:30	6:50	7:10	7:30
J1	NBR	NBR	NBR	X	33T	33T	33T	3BM	RH1	RH1	IZI	X	LJS
J2	LKB	LKB	LKB	X	HZE	HZE	HZE	421	WLM	NBL	NBL	MPO	MPO
J3	BGE	BGE	BGE	BGE	TBK	762	X	SIR	X	IZU	IZU	IZJ	IZJ
J4	FBN	FBN	293	201	X	YGJ	YGJ	YGJ	YGJ	YGJ	X	128	128
J5	X	X	X	DLT	DLT	DLT	DLT	DLT	DLT	YSD	YSD	770	HOF
J6	XTD	X	MIZ	X	NBR	790	790	790	790	OEY	851	851	851
J7	X	XNJ	XNJ	XNJ	XNJ	XNJ	XNJ	MLN	MLN	ZPK	VAP	VAP	VAP
J8	90L	X	YEH	YEH	SXH	331	ZWB	2YH	2YH	2YH	X	JMP	JMP
J9	RTM	X	VOV	X	WOB	VST	FKV	FKV	BEY	BEY	WJV	AGJ	AGJ
J10	YGY	X	X	ASV	X	CSD	X	X	ZWK	599	ITU	TLC	TLC
J11	837	837	837	837	837	NEJ	NEJ	NEJ	NEJ	ZAD	ZAD	894	X
J12	X	X	ZWR	ZWR	X	593	X	CCR	CCR	CCR	CCR	CCR	CCR
J13	713	278	XDH	X	KFY	X	X	X	TWJ	X	622	622	622
J14	PLP	X	NSW	NSW	NSW	X	X	AYX	X	X	X	VTA	VTA
J15	X	YXC	YXC	X	ZMM	TWX	X	X	AFX	AFX	AFX	X	X
J16	GJP	X	DSJ	X	YLJ	YLJ	X	XCJ	XCJ	X	MTG	X	WRC
J17	147	4AS	4AS	X	X	X	X	TIW	X	X	XNM	XNM	XNM
J18	X	X	X	X	X	OAH	OAH	ZPT	XJR	YJP	BGV	BGV	ZHM
J19	693	VCZ	VCZ	LHC	LHC	X	ZTP	WRX	ZET	ZET	ARV	XEO	VPK
J20	VEO	YDE	XLR	IDO	WBM	X	WLJ	WLJ	DRB	WNY	X	X	75
J21	ASA	ASA	682	EAA	ZMA	X	X	WCP	WCP	SKM	X	YBI	EDK
J22	FBB	X	NKK	X	VDP	VDP	VDP	WRP	X	X	X	VNA	X
J23	ZEV	X	X	X	GVC	X	X	X	HMC	HMC	X	X	X
J24	X	B57	ZTZ	X	XWI	X	36X	SYX	TIL	TIL	FNJ	FNJ	KZE
J25	ATS	9AZ	9AZ	9AZ	X	X	X	265	WYF	WMV	X	BSE	KZB
J26	ZLN	ZLN	SCT	X	ZES	X	GJR	X	GNX	WWK	X	X	DBR
J27	819	819	X	888	X	X	XLA	YXA	AJA	TYJ	WHC	X	X
J28	ONG	ONG	ONG	X	X	X	X	X	X	X	X	X	X
J29	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!	EDJ!
J30	X	FOP	X	X	KZB	X	X	X	X	WLZ	WLZ	WLZ	WLZ
J31	X	X	X	X	JNT	JNT	X	876	876	620	X	PAE	PAE
J32	WWK	WWK	WWK	WWK	ZFN	ZFN	ZFN	ZFN	X	YGB	YGB	YGB	YGB
J33	XKG	CYA	X	X	X	X	Z20	X	SYT	SYT	SYT	SYT	SYT
J34	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL	YSL
J35	VGW	VGW	X	X	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!
J36	X	X	X	X	X	X	X	X	X	X	X	X	IVR

J37	DMC	XAX	OAC	X	HEC!	HEC!	HEC!	HEC!	HEC!	HEC!	HEC!	HEC!	HEC!
J38	X	X	X	X	X	X	X	X	X	X	WHR	WHR	WHR
J39	944!	944!	944!	944!	944!	944!	944!	944!	944!	944!	X	744	744
J40	467	467	467	467	467	HDR	HDR	NFW	NFW	NFW	NFW	NFW	NFW
J41	ZWK	X	X	270!	270!	270!	270!	270!	270!	270!	270!	270!	270!
J42	X	213	213	213	X	XAM!	XAM!	XAM!	XAM!	XAM!	XAM!	XAM!	XAM!
J43	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	CTC!	GEE
J44	17L	17L	17L	RPM	RPM	WGZ	WGZ	X	X	X	TBC	TBC	TBC
J45	YKJ	YKJ	X	X	X	ZWV	X	X	YHL	YHL	YHL	X	144
J46	KSP	X	X	779	X	XFH	X	CBW	3CH	3CH	X	X	565
J47	RWM	RWM	RWM	RWM	RWM	RWM	RWM	JGZ	X	X	X	X	XIW
J48	XYV	X	X	X	X	X	X	VYB	VYB	VYB	VYB	VYB	X
J49	X	X	X	X	X	X	X	X	X	WTJ	WTJ	WTJ	WFB
J50	WVI	X	X	X	X	X	X	RON	RON	RON	RON	RON	RON
J51	X	ZJI	ZJI	VSW	X	X	X	HON	HON	HON	HON	HON	X
J52	078	78	X	X	BHK	BHK	BHK	X	X	YCE	VSZ	VSZ	201
J53	CK	CK	CK	CK	CK	CK	CK	X	X	X	X	VAW	VAW
J54	BOB	BOB	BOB	BOB	BOB	9SK	X	MER	MER	X	X	CVM	X
J55	X	KRO	KRO	KRO	KRO	X	X	HON	HON	HON	X	OAM	X
J56	CO1	X	HOF	X	RRV	998	X	YFX	YFX	X	FMF	FMF	FMF
J57	YBP	YBP	YBP	YBP	YBP	YBP	YBP	WRB	WRB	X	X	X	680
J58	G81	WJE	764	X	YME	X	479	X	X	X	X	SCL	SCL
J59	CFG	CFG	CFG	CFG	CFG	CFG	X	YVH	YVH	X	KKW	KKW	NGT
J60	LAV	LAV	LAV	LAV	X	X	GVE	WBY	WBY	WBY	WBY	405	405
J61	359	X	X	X	3C1	RXS	RXS	CNT	X	X	HXA	HXA	HXA
J62	X	XKR	WXF	X	X	PFW	FYC	FYC	FYC	FYC	RXS	X	X
J63	STT	X	X	EMW	EMW	EMW	EMW	EMW	X	X	NMZ	X	X
J64	X	WJO	X	X	YCE	971	X	X	HJB	TIP	TIP	X	X
J65	X	X	X	EDY	EJX	EJX	EJX	541	541	XIS	XIS	X	ZMO
J66	X	X	X	X	X	X	X	WIR	WIR	WIR	WIR	X	X
J67	X	X	X	X	X	X	X	X	X	X	MHE	MHE	DYG
J68	X	X	X	X	308	X	X	X	YEZ	YEZ	YEZ	YEZ	YEZ
J69	X	X	X	X	X	X	X	XJE	X	X	DBR	DBR	X
J70	X	X	X	X	X	X	X	ZTR	ZTR	ZTR	ZTR	ZTR	WVY
J71	YDK	YDR	X	X	X	X	X	X	X	X	X	X	WMW
J72	165	X	X	X	X	XJX	XJX	XJX	XJX	XJX	X	X	X
J73	OAB	X	X	X	X	WNM	X	X	X	X	YLC	YLC	WBA
													472

J74	X	X	X	X	X	X	X	746	746	746	746	746	746
J75	X	X	264	X	X	BLX	YWZ	YWZ	YWZ	YWZ	X	GCR	GCR
J76	X	X	X	X	X	X	VOV	VOV	X	XTX	XTX	BMS	BMS
J77	297	297	X	X	96Z	96Z	X	KLK	KLK	KLK	KLK	KLK	9AF
J78	699	X	X	YXO	YXO	YXO	YXO	X	IUD	IUD	IUD	IUD	IUD
J79	X	KSP	HMC	HMC	X	X	X	935	935	WPC	WPC	X	X
J80	X	X	X	X	X	X	X	X	X	9BG	9BG	9BG	9BG
J81	X	X	X	X	X	X	X	WNY	WNY	X	XNW	XNW	XNW
J82	VWH	VWH	VWH	VWH	X	X	X	X	DIA	DIA	DIA	X	X
J83	X	X	X	X	X	X	X	X	X	X	90X	90X	90X
J84	X	X	X	X	X	X	X	X	X	X	EXW	EXW	LEX
J85	X	X	X	X	X	X	X	X	X	X	X	534	534
J86	X	X	X	X	X	X	X	X	88	282	282	282	282
J87	X	X	X	X	X	X	X	X	X	X	X	X	930
J88	X	X	X	X	X	X	X	501	X	XEX	ZTV	X	AFV
J89	X	823	823	823	X	X	X	X	X	X	X	FVX	FVX
J90	X	X	X	VNJ	X	X	ROE	X	3AT	X	X	X	772
J91	X	X	X	X	YJZ	YJZ	X	X	X	X	X	NCP	XHY
J92	XVN	X	X	YOI	X	X	X	X	8XE	X	X	X	X
J93	985	985	985	985	985	FYC	WJK	X	4AG	X	905	905	905
J94	611	X	BJJ	X	WSX	WSX	WSX	X	XLV	XNG	5WW	X	133
J95	GDB	GDB	X	J81	2VH	XMH	XMH	X	EPC	EPC	EPC	JCC	X
J96	X	X	BYS	BYS	GCS	GCS	GCS	XMJ	X	X	SVE	SVE	ERT
J97	X	WWJ	399	399	399	399	X	3BS	YBY	YBY	YBY	LOL	XCE
J98	X	X	X	X	TVS	X	X	MYR	X	X	NMG	DRK	DRK
J99	X	SPR	SPR	SPR	SPR	SPR	X	CNS	X	X	YFA	WRM	X
J100	491	491	491	X	X	X	RSM	RSM	FOR	FOR	X	X	X
J101	ZVG	ZVG	X	X	X	X	XFZ	ZYI	ZYI	XCR	XCR	XCR	XCR
J102	X	X	X	X	X	X	YTL	YTL	YTL	X	TOY	X	X
J103	X	X	X	X	X	X	X	X	YAA	YAA	YAA	YAA	X
J104	X	X	X	X	X	X	X	BFS	X	X	X	X	X
J105	013	X	X	X	X	X	X	X	X	WFF	WFF	WFF	WFF
J106	X	X	X	X	X	X	X	68U	ZBX	ZBX	ZBX	ZBX	X
J107	X	X	X	X	X	X	X	X	X	EYH	EYH	X	X
J108	X	X	X	X	X	X	EBY	EBY	EBY	EBY	EBY	X	X
J109	WWY	X	X	X	X	X	X	X	X	ZIE	X	X	X
J110	X	X	X	X	X	X	X	X	X	VVL	337	X	X

J111	PPC	PPC	PPC	PPC	PPC	WGA	WGA	WGA	X	YFS	ZOM	ZOM	ZOM
J112	BW	X	X	X	WRF	X	X	X	XKJ	9AM	CFJ	X	891
J113	XBFE	XBFE	XBFE	XBFE	XBFE	X	X	X	WCR	YVX	YVX	X	X
J114	019E	019E	019E	019E	019E	019E	019E	KXN	KXN	KXN	KXN	66H	66H
J115	X	X	X	X	X	X	VKW	X	WNW	WNW	NNL	AX4	AA
J116	WBA	X	JCF	JCF	X	ERBE	ERBE	TRB	TRB	TRB	TRB	TRB	TRB
J117	XABE	XABE	XABE	XABE	XABE	XABE	XABE	262	X	XEZ	XEZ	XEZ	XEZ
J118	245E	245E	245E	245E	245E	245E	245E	245E	245E	245E	245E	WVH	WVH
J119	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE	DGCE
J120	WSM	WSM	WSM	WSM	WSM	X	GPE	X	X	X	X	XPP	X
E1	X	X	X	GRB	GRB	GRB	GRB	X	X	TXK	X	XIC	X
E2	X	X	X	X	X	X	X	X	X	HCV	HCV	DCO	OGG
E3	X	X	X	X	X	X	X	X	ZED	X	XCB	XCB	XCB
E4	X	X	X	X	TEB	X	X	X	280	X	X	ZFI	ZFI
E5	X	X	X	X	X	X	X	X	AVG	X	X	X	X
E6	X	X	X	X	X	XYS	X	X	X	X	498	X	X
E7	X	ZWS	X	X	X	X	X	X	WCY	X	X	X	WIA
E8	OJR	X	060	X	X	X	X	X	XPJ	X	X	X	X
E9	X	X	X	X	YDR	YDR	YDR	X	TOJ	HLB	X	ZJE	X
E10	X	X	X	X	X	X	X	X	NHY	XJM	XJM	WJL	DNK
E11	X	VES	X	X	X	WEK	X	X	BPD	ZWJ	X	X	DIW
E12	AMV	AMV	X	X	X	X	X	5PS	5PS	ZOE	432	FLJ	ZDM
E13	VPG	X	WZV	X	X	X	X	AXO	WNE	X	X	X	TBJ
E14	GHC	X	55P	55P	55P	X	X	13V	X	9AH	9AH	9AH	820
E15	IZT	IZT	FZR	CFV	KZX	VKB	VKB	VKB	X	RSK	RSK	RSK	RSK
E16	BGF	BGF	BGF	BGF	BGF	BGF	ZZX	ZZX	ZZX	ZZX	ZZX	ZZX	ZZX
E17	X	YRK	890	890	922	VVX	9B1	SCF	5WB	X	XDE	CGV	CGV
E18	AEV	AEV	AEV	KBO	CAV	X	PEB	830	X	AJM	WNN	WBF	HXH
E19	YHI	YHI	3BK	3BK	3BK	3BK	3BK	ZFN	ZFN	YNB	YNB	PSN	PSN
E20	X	X	X	WGH	WGH	WGH	WGH	WGH	DRC	FSK	FSK	FSK	FSK
E21	GAF	OAX	OAX	X	HJH	X	WBT	WBT	WBT	WBT	9XJ	X	PZY
E22	249	X	X	ZBM	ZBM	ZBM	ZBM	EPW	X	XKY	XKY	XKY	XKY
E23	X	X	920	920	X	ZFO	432	432	432	432	VMK	X	ZJR
E24	X	X	X	VNA	GXH	GXH	127	TNS	TNS	TNS	TNS	XRP	X
E25	5XE	X	X	X	X	WOH	WOH	XAS	XAS	YGN	YGN	YGN	X
E26	X	X	X	X	X	X	20V	CIL	CIL	CIL	CIL	CIL	XTF
E27	PWB	X	X	X	X	X	XBN	WTG	WTG	X	680	680	X

E28	KME	X	X	X	X	X	X	X	XFF	XFF	X	WCE	WCE
E29	X	X	X	X	WYC	WYC	WYC	WYC	WYC	WYC	VIW	VIW	X
E30	X	X	FGC	X	X	X	GAV	GAV	RFP	RFP	RFP	RFP	X
E31	X	X	X	939	939	939	939	RWV	RWV	X	WRD	WRD	XCE
E32	102	X	X	X	X	X	X	XRH	XRH	X	WOA	WOA	WOA
E33	X	X	XDM	XDM	X	CPR	CPR	CPR	CPR	X	9FX	BGW	X
E34	X	X	X	X	JAV	JAV	JAV	X	WNR	WNR	WNR	WNR	YXL
E35	X	X	RNN	X	X	OKO	X	X	YKP	YKP	X	9HI	YLC
E36	DEL	DEL	DEL	DEL	DEL	X	LSG	LSG	LSG	LSG	LSG	LSG	LSG
E37	X	YPS	YPS	YPS	YPS	YPS	YPI	X	JSR	JSR	JSR	X	XVK
E38	ARX	X	X	X	KFF	HLD	O4N	KNL	KNL	KNL	KNL	X	YCG
E39	863!	863!	863!	863!	863!	863!	863!	863!	863!	EKR	X	SJW	221
E40	X	X	YSF	YSF	YSF	YSF	YSF	YSF	YSF	4CY	DXY	DXY	DXY
E41	DYL	DYL	X	X	YSR	WLZ	WLZ	613	X	EBT	EBT	X	DXY
E42	X	WTK	TZC	TZC	TZC	TZC	TZC	PHP	YWE	AYF	TBC	BLN	BLN
E43	X	XSC	XSC	XSC	VXG	VXG	VXG	VXG	VXG	VXG	FPL	OO2	OO2
E44	X	RBC	X	X	WJB	XSA	AMN	AMN	AMN	X	VZP	VZP	VZP
E45	946	SOI	XOG!	XOG!	XOG!	XOG!	XOG!	XOG!	XOG!	XOG!	XOG!	XOG!	DML
E46	YDB	YDB	WZR	ARN	XGV	XGV	XGV	XGV	STG	4BB	4BB	4BB	GPW
E47	X	PAK	NTK	NTK	9AE	TH	TH	TH	TH	14	14	14	14
E48	X	VLT	VLT	VLT	VLT	VLT	VLT	VCB	3CM	3CM	3CM	3CM	3CM
E49	AJV	AAP	AAP	AAP	EDB!	EDB!	EDB!	EDB!	EDB!	EDB!	EDB!	EDB!	YDB
E50	PTM	X	YAV	YAV	YSR	WCH	VWY	VWY	XPA	PLV	PLV	PLV	PLV
E51	CBC	BVW	BVW	FEH	22L	XIC	XIL	JWC	OCR	9BC	9BC	9BC	9BC
E52	XAR	WBF	WBF	LSJ	CWF	ZPI	BGX	X	JWG	JWG	JWG	JWG	JWG
E53	RIO	ETN	ETN	47L	NRS	WFX	ZSY	ARH	ARH	ARH	ARH	ARH	ARH
E54	8NN	8NN	556	VIE	VIE	633	633	633	84G	BAA	9AV	HKG	HKG
E55	5FD	5FD	X	SGX	CGN	X	BFS	BFS	GEG	GEG	GEG	GEG	XAN
E56	X	DMC	DMC	BGY	419	419	9EV	9EV	9EV	9EV	9EV	9EV	9EV
E57	FFD	X	TDX	TDX	GOI	WIF	ZMA	ZMA	ZMA	ZMA	X	WCF	MEX
E58	SEN	SEN	SEN	SEN	DFY	DFY	AFX	XYE	CBH	VDR	VDR	VDR	VDR
E59	75M	AHJ	AHJ	AHJ	AHJ	AHJ	VCX	VCX	ZLK	ZLK	ZLK	ZLK	XWD
E60	DLG	DLG	X	321	JHN	JHN	JHN	JHN	JHN	YBW	X	X	AXD
E61	X	914	275	579	579	X	TLL	TLL	TLL	ZNJ	CYL	GFG	GFG
E62	X	X	VHI	VHI	VHI	X	X	X	EN	EN	WIV	LTS	X
E63	X	X	X	X	X	PFA	PFA	PFA	PFA	GLU	GLU	GLU	GLU
E64	ZES	ZES	ZES	X	STK	STK	STK	X	ZAJ	YXA	YXA	YXA	YXA

E65	GAG	X	X	X	PSJ	PSJ	PSJ	PSJ	PSJ	OAC	887	887	887
E66	93K	WAP	X	X	TDO	TDO	TDO	TDO	X	6JJ	6JJ	6JJ	VMX
E67	VXR!	VXR!	VXR!	VXR!	VXR!	VXR!	VXR!	VXR!	4AE	WZB	X	X	RVA
E68	HAB	361	X	X	WPO	WPO	507	507	VXR	XCI	X	MYP	MYP
E69	X	YFS	DCB	DCB	DCB	X	VEN	X	307	ZVY	ZVY	ZVY	WIP
E70	X	X	AVF	335	AYI	AYI	AYI	AYI	YCE	YCE	YCE	XOF	139
E71	YRPI	YRPI	YRPI	YRPI	YRPI	YRPI	YRPI	YRPI	VJB	VJB	TEC	TEC	97L
E72	X	WVM	SJZ	SJZ	SJZ	SJZ	X	YFI	WJJ	WJJ	WJJ	AJA	X
E73	J26	BKH	X	WBJ	879	96W	96W	96W	SEA	YBS	YBS	WFP	X
E74	AYA	ZLK	VBK	GJC	GJC	GJC	GJC	GJC	GJC	IEA	NRH	X	WNO
E75	YEH	CSX	CSX	X	AYH	AYH	ZFC	MKT	MKT	MKT	MKT	MKT	MKT
E76	908	908	VDP	VDP	VDP	X	ZGL	961	XYJ	XYJ	XYJ	MJJ	MJJ
E77	PJB	PJB	PJB	PJB	PJB	PJB	CJM	CJM	CJM	CJM	VTE	VTE	VTE
E78	682	682	XFZI	XFZI	XFZI	XFZI	XFZI	XFZI	XFZI	XFZI	XBS	XBS	XBS
E79	ZWX	ZWX	X	NGL	ESL	OCS	OCS	OCS	VTY	VTY	VTY	VTY	VTY
E80	XVC	XVC	XVC	XVC	FDE	FDE	JYT	JYT	BDY	YDY	22S	7NN	7NN
E81	X	19C	X	X	191	X	X	X	X	X	X	X	877
E82	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI
E83	GST	GST	GST	GST	48N	X	78A	78A	X	X	X	659	877
E84	860	3AW	EIC	EIC	EIC	EIC	EIC	4AG	IRL	XJE	XJE	JTS	JTS
E85	JAI	JAI	VNG	YGG	X	ZKO	X	ZDT	ZDT	ZHW	ZHW	XHH	XHH
E86	BKV	BKV	BKV	BKV	750	750	XTK	XTK	XTK	XTK	XTK	GGR	XKZ
E87	830	830	TBN	NFY	YLD	YLD	YLD	YLD	YLD	YLD	BKN	WIH	ABL
E88	693	X	YCW	YCW	YCW	YCW	YCW	YCW	ZFP	IMP	IMP	3BO	3BO
E89	EGM	LOS	ALG	CTY!	CTY!	CTY!	CTY!	CTY!	CTY!	CTY!	CTY!	CTY!	X
E90	255	255	255	255	2AC	2AC	2AC	ZYB	ZZA	ZZA	ZZA	XTW	XTW
E91	XXD	XXD	XXD	CHF	YGN	TWS	OO8	ZTG	RVK	DMX	SRY	BRJ	BRJ
E92	X	X	MKT	X	WVO	ZWK	ZWK	ZWK	ZWK	ZWK	OO3	LJD	LJD
E93	EDB	HVY	CCE	X	403	403	DMJ	PIY	PIY	PIY	PIY	PIY	PIY
E94	XBL	XBL	XRC	WWK	WWK	WWK	WWK	WWK	ZRC	ZRC	ZRC	ZRC	ZRC
E95	XFT	XFT	XFT	XFT	XFT	ZZJ	ZZJ	ZZJ	ZZJ	YTX	X	WRP	WRP
E96	ZST	X	ZAH	XRN	XRN	CCC	X	SBE	SBI	SBI	SBI	SBI	X
E97	X	YGT	YGT	X	XTG	DIN	GJY	WFS	YSM	WYV	SYZ	SYZ	YCO
E98	ZAS	ZAS	X	X	WIH	TFE	TFE	TFE	TFE	TFE	TFE	KBF	KBF
E99	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE	YFZE
E100	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE	VNJE
E101	XYME	XYME	XYME	XYME	XYME	XYME	XYME	XYME	X	KSV	X	X	X

E102	436E	436E	436E	436E	436E	436E	436E	436E	436E	X	WSO	JBT	X
E103	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI	XRJI
E104	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE	WEYE
E105	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE
E106	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	TWMI	473	473
E107	WPS	X	X	708E	708E	708E	708E	708E	708E	708E	708E	708E	708E
E108	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME	JMME
E109	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE	ELKE
E110	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI	PMZI
E111	X	X	X	R24E	R24E	R24E	R24E	R24E	R24E	R24E	R24E	R24E	R24E
E112	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE	ZFTE
E113	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE
E114	724	724	724	724	724	724	724	724	724	724	724	724	724
E115	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE	EDAE
E116	840	840	840	840	840	840	840	840	840	840	840	840	840
E117	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE	V2BE
E118	114E	114E	114E	114E	114E	114E	114E	114E	114E	114E	114E	114E	114E
E119	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE
E120	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI	WNAI
E121													
E122													
E123													
E124													
P1	ZKM	ZKM	X	X	X	X	X	CYG	ZPV	WZC	WZC	WZC	WZC
P2	X	X	549	XIG	ZDW	X	X	X	92F	X	PGJ	X	73T
P3	YGD	YGD	X	WGN	WGN	X	X	X	BGT	BGT	BGT	BGT	X
P4	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE	RAVE
P5	XNY	RWZ	RWZ	OAL	336	WCL	ZXV	7CP	7CP	TIP	TIP	TIP	TIP
P6	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE
P7	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE	WPBE
P8	WES	WES	SHB	356	356	356	356	356	356	356	CTF	X	XEI
P9	126	SRY	AOO	AOO	JSA	TSP	818	CYF	CYF	CYF	CYF	CYF	CYF
P10	X	XVE	WTF	RXHI	RXHI	RXHI	RXHI	RXHI	RXHI	RXHI	RXHI	RXHI	RXHI
P11	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE	HWNE
P12	JTO	XJI	CYE	YHZ	FCJ	XMA	CKJ	XPT	VED	EVY	VAX	ECH	PML
P13	ZAN	X	X	X	XPL	9AV	X	GLV	X	X	X	X	X
P14	FX	X	X	X	XLT	X	WSM	X	X	X	X	GPD	X

P15	X	XHD	X	X	X	823	71V	XWD	XYF	X	X	X	X	
P16	EPP	688	ZSP	WBR	VTE	AXL	X	WMI	XBG	XBG	3BE	3BE	3BE	
P17	XBR	XBR	XBR	9BB	XOG	XZW	X	OAD	OAD	XLJ	XLJ	XAS	XAS	
P18	725	X	X	191	191	191	191	WTC	WTC	4AX	X	IYB	X	
P19	625	625	FLA	7MY	X	WBX	WBX	9BD	HDM	935	2XS	X	ZWC	
P20	WME	WME	XSW	AVI	WNH	WNH	TWK	PLV	PTB	DBR	XWT	X	X	
P21	YRS	YRS	X	DAD	DAD	WJX	X	PFP	437	X	YXP	YXP	CMT	
P22	X	PXD	293	RMY	X	WXD	WXD	STR	STR	STR	WCM	JRP	X	
P23	021	YXB	X	3BL	3BL	3BL	3BL	WIR	WIR	WYE	X	X	X	
P24	BFP	KMC	KMC	X	13	WYO	WYO	X	V51	X	XER	X	VDE	
P25	LWO	LWO	LWO	ZLM	ZLM	ZLM	TIL	X	399B	OAA	3CF	X	WBE	
P26	X	CMH	X	XHH	WBI	WBI	CGY	CGY	ZTD	ZTD	IWB	IWB	WRN	
P27	LTO	X	LAI	LAI	XRY	WJP	X	ABL	VFZ	VFZ	VFZ	CGS	CGS	
P28	TNS	TNS	GWD	GWD	GWD	GWD	JLE	ABK	ABK	ABK	XNF	658	ZXI	
P29	VKT	ZRY	ZZE	EVG	EVG	59C	ZWL	ZYK	WNJ	762	XLN	XLN	X	
P30	4DM	103	XAP	ZVY	ZVY	ZVY	ZVY	X	NMP	NMP	TGX	WFX	X	
P31	312	312	PZJ	PZJ	TFN	VER	ZST	4ND	4ND	ZSK	ZGY	EJY	EJY	
P32	EWY	TRT	X	YCO	YCO	ZZJ	ZZJ	92F	WOR	TOP	TOP	MOP	XNJ	
P33	DNC	NFS	508	508	508	508	SGK	SGK	YVD	XVF	X	BRS	X	
P34	7NW	7NW	DAP	HWK	HWK	WJG	DRE	PWL	PWL	321	321	TTW	XAR	
P35	WCP	WCP	WPC	WCP	YOJ	3BM	3BM	TGW	TGW	TGW	TGW	IWX	KGG	
P36	YXR	YXR	YXR	XWR	8HC	8HC	8HC	WID	WID	WID	CTK	XO2	X	
P37	HBF	HBF	632	632	TWW	87BE	87BE	87BE	87BE	87BE	HBH	HBH	HBH	
P38	XBV	XLY	PJD	GCY	EWJ	EWJ	WEP	WEP	BCV	BCV	220	GXE	GXE	
P39	FLN	BPP	HWK	JWD	JWD	3AE	GJR	966	WES	RJX	JGK	803	803	
P40	X	XSS	XSS	XSS	XSS	LOT	LOT	YGI	YGI	YGI	XRA	XRA	X	
P41	LAO	LAO	VEH	VEH	884	884	884	YLV	BKO	BKO	ESR	ZWK	YNH	
P42	X	902	NJD	X	HKE	HKE	HKE	CBM	CBM	165	165	OSS	OSS	
P43	WVR	MLP	MLP	MLP	MLP	MLP	MLP	IRG	240	9BG	9BG	9BG	VHS	
P44	543	543	543	ROE	X	651	HXE	301	CYB	ZTC	683	683	683	
P45	X	XJA	WHC	ACF	329	X	656	ZWR	X	886	886	886	XK2	
P46	WPI	WPI	X	CRK	CRK	CRK	VJC	VJC	WOC	WOC	WOC	XOY	524	
P47	YPWE	YPWE	YPWE	YPWE	YPWE	YPWE	YPWE	YPWE	YPWE	YPWE	67	VHJ	VHJ	LAO
P48	298	TAM	PLK	GCV	GCV	PCE	PCE	621	NAM	WPM	MCW	WJN	WJN	
P49	X	XRJ	X	13	KLJ	GHR	X	XJV	ZEC	ZEC	ZEC	GRE	GRE	
P50	WPX	WPX	X	TBW	VWW	326	ZWV	ZWV	ZWV	ZWV	ZWV	DSK	GGE	
P51	JZY	RJV	RJV	WNG	CRW	176	176	VZF	PIH	667	667	NWF	NWF	

P52	439	439	VMO	859	4WA	4WA	KAA	YCF	YOZ	X	YAV	YAV	X
P53	KLN	KLN	KLN	X	ZOM	XDW	866	697	VKX	VKX	VKX	VKX	VKX
P54	718	718	XLE	RNT	YRP	599	599	599	WHL	WJG	ZVH	LFV	X
P55	TWI	X	HTI	ALJ	XHI	SZE	SZE	ZAC	WRZ	3AW	X	ZPX	ZPX
P56	WFR	SYH	SYH	IBX	X	XRH	297	YEI	4AG	W2F	XSW	ZEF	ZEF
P57	X	BXR	XBO	EYX	GWE	GWE	X	ABK	YED	CCE	YNM	YNM	JFX
P58	X	X	X	X	X	X	X	X	X	X	X	X	TXE
P59	X	X	X	X	X	X	X	114	PZZ	X	X	X	X
P60	X	536	536	536	536	X	X	CJX	YXS	TIP	TIP	GPA	X
P61	XFX	X	X	YLO	X	624	X	MLE	XLS	VYM	KDE	ZAG	X
P62	FCN	FCN	IDJ	IDJ	IDJ	IDJ	X	XLR	3BN	3BN	3BN	3BN	3BN
P63	MBL	SDX	SEL	KKL	KKL	AED	X	DNN	NCW	268	268	HNR	XEM
P64	HGX	VLJ	X	252	X	GRO	ZHA	ZHA	ZHA	WPG	X	X	MYV
P65	WJN	X	RNL	X	CSY	X	MEN	GTE	GTE	GTE	GTE	GTE	GTE
P66	290	X	X	X	74	74	YBJ	ZLH	ZLH	KZE	KZE	KZE	FHP
P67	829	829	829	829	829	4AG	X	BDX	WGV	WGV	ZBD	ZBD	KRB
P68	001	5DR	5DR	LVI	YMV	5OM	X	TWG	TWG	TWG	X	232	ZVM
P69	X	X	X	X	ZWY	X	SM2	X	JSR	X	176	176	176
P70	750!	750!	750!	750!	750!	750!	750!	750!	750!	750!	750!	750!	750!
P71	X	X	XHE	SYD	X	XIG	X	WNC	WNC	YCW	YCW	OCV	VAM
P72	254	X	X	SNO	PVB	X	GSO	ZTP	ZTP	SFN	SFN	PNB	HHH
P73	X	DKO	DKO	DKO	8CG	8CG	WYD	X	ZGB	XFH	X	X	ZJE
P74	X	X	X	YDK	YDK	XJK	DVB	97	RCR	S10	IDR	704	704
P75	X	X	EIT	XJP	XJP	JLZ	JLZ	JLZ	JLZ	X	GBX	SJI	898
P76	X	XHV	XHV	58L	58L	X	HMM	X	IAG	IAG	SBE	SBE	SBE
P77	X	ROR	X	KJC	YCW	YCW	XAV	XEY	XEY	XHH	XHH	3CE	EVK
P78	KAB	KAB	YJC	VSS	VSS	VSS	VSS	XKX	XXL	XXL	YCF	ZFJ	ZFJ
P79	X	HWK	X	VTE	VTE	XWH	XLY	YDB	YDB	YDB	XKB	FYC	IFC
P80	JM2	JM2	X	ZAX	JIZ	7RC	7RC	7RC	WBK	XEZ	XEZ	XJZ	XJZ
P81	FKB	OLA	X	276	FCL	FCL	X	MKO	TAG	X	X	YSP	FNL
P82	52K	52K	FCP	515	EWX	X	CKW	CKW	AYL	950	KGL	PEY	X
P83	579E	579E	579E	579E	579E	579E	579E	579E	579E	579E	3BX	3BX	X
P84	X	RCJ	X	X	X	WWG	WWG	WWG	X	XTD	XTD	XTD	XTD
P85	KIE	KIE	X	WJE	X	X	X	X	894	894	894	YPY	X
P86	X	X	X	X	ZMF	CRTI	CRTI	CRTI	CRTI	CRTI	CRTI	CRTI	CRTI
P87	X	YOD	X	X	X	X	BYH	X	GWS	GWS	GWS	X	12G
P88	X	X	X	X	545	545	545	X	X	BLT	658	658	X

P89	X	X	X	X	X	PYC	X	HHY	HHY	X	X	X	XGF
P90	ZIVE	ZIVE	ZIVE	ZIVE	X	X	X	FHY	WVM	YBV	YJC	ZMO	X
P91	X	X	X	X	LGV	LGV	AAH	AAH	TIJ	TIJ	TIJ	YVN	239
P92	X	X	X	X	X	X	FCP	FCP	ZFT	558	558	X	X
P93	X	X	X	X	ZPI	GNF	X	X	WLR	DID	X	CST	X
P94	X	X	X	X	BNX	WEY	WEY	X	X	X	XOH	X	VEH
P95	X	X	X	X	X	X	X	X	X	X	X	X	X
P96	X	X	X	X	X	MBH	MBH	X	DMF	DMF	627	627	X
P97	ZMF	ZMF	X	X	X	RVA	X	X	ZKR	X	HAY	HAY	X
P98	X	X	X	X	X	X	X	X	ZFO	YVZ	X	XVY	XVY
P99	ZGH	ZGH	X	TBC	X	X	X	X	X	368	X	X	GEG
P100	X	X	X	MHK	WEY	YYP	X	PWS	XKF	XKF	X	YSG	YKZ
P101	X	X	X	X	XWE	X	X	X	168	X	WNW	X	X
P102	X	X	X	X	XMB	X	X	X	X	2VL	2VL	2VL	XYL
P103	X	X	XYL	XYL	XYL	XYL	TCW	X	MMS	MMS	X	X	2KE
P104	X	X	WNE	OAP	X	X	X	X	SMJ	SMJ	SMJ	X	X
P105	X	X	46	X	X	9	X	XCX	X	X	X	NCN	X
P106	X	X	X	X	X	XKS	XKS	X	X	X	X	X	X
P107	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE	MOOE
P108	189	189	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE	WPXE
P109	869E	869E	869E	869E	869E	X	X	X	Y6YE	Y6YE	Y6YE	Y6YE	Y6YE
P110	729E	729E	729E	729E	729E	729E	729E	729E	729E	729E	729E	729E	729E
P111	X	X	SNO	X	X	778	X	BGT	CJE	WBL	WRL	X	X
P112	RVHE	RVHE	RVHE	RVHE	RVHE	X	X	X	X	740E	740E	740E	740E
P113	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE
P114	XEVE	XEVE	XEVE	XEVE	XEVE	X	X	DOW	DOW	DOW	DOW	DOW	DOW
P115	WVL	WVL	WCI	X	X	X	X	X	48	48	48	48	48
P116	X	X	GAG	X	250E	250E	250E	250E	250E	250E	250E	250E	250E
P117	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE	WBCE
P118	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE	GHVE
P119	XAE	XAE	XAE	XAE	X	X	X	X	X	Y60E	Y60E	Y60E	Y60E
P120	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE	CTHE
P121	X	X	SYD	X	X	X	X	X	880	880	X	BLA	X
P122	X	X	X	X	X	X	X	X	X	X	X	X	LMY
P123	YOLE	YOLE	YOLE	YOLE	YOLE	YOLE	YOLE	YOLE	YOLE	YOLE	X	X	RX2
P124	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF	GWAF
P125	FMNE	FMNE	FMNE	FMNE	X	X	X	X	X	NCP	NCP	WON	WON

P126	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI	WLI
P127	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	X	X	X	66H	66H	66H	66H
P128	MGKE	MGKE	X	X	XEIE	XEIE	XEIE	XEIE	XEIE	XEIE	XEIE	XEIE	XEIE
P129	SE9E	X	X	X	X	X	X	X	X	X	X	X	X
P130	SFPE	SFPE	SFPE	SFPE	VXME	VXME	VXME	VXME	VXME	VXME	VXME	VXME	VXME
P131	X	X	MGO	MGO	MGO	MGO	MGO	MGO	X	26T	26T	X	X
P132	X	X	X	X	ZOH	ZOH	ZOH	ZOH	ZOH	ZOH	ZOH	ZOH	ZOH
Empty	134	139	144	140	110	121	131	103	74	75	79	81	87
Occupied	238	233	228	232	262	251	241	269	298	297	293	291	285
Total	372	372	372	372	372	372	372	372	372	372	372	372	372
Employees													
Elm St. Lot	24	23	20	18	16	12	11	10	11	10	9	7	7
main lot	43	42	42	44	42	36	33	33	34	33	30	29	29
Total Employees	67	65	62	62	58	48	44	43	45	43	39	36	36
Main lot													
Vehicles parked > 2 hrs	12	12	14	17	20	22	22	22	20	18	17	16	12
employees	43	42	42	44	42	36	33	33	34	33	30	29	29
Total employee/ MBTA	55	54	56	61	62	58	55	55	54	51	47	45	41
	3:30	3:50	4:10	4:30	4:50	5:10	5:30	5:50	6:10	6:30	6:50	7:10	7:30
Customers	195	191	186	188	220	215	208	236	264	264	263	262	256
Employees	43	42	42	44	42	36	33	33	34	33	30	29	29
Total Parked Vehicles	238	233	228	232	262	251	241	269	298	297	293	291	285
MBTA/other	12	12	14	17	20	22	22	22	20	18	17	16	12
Total Main lot and Elm Street	262	256	248	250	278	263	252	279	309	307	302	298	292

Saturday Parking Accumulation and Duration

* Based on parking counts conducted by VHB on Saturday, August 17, 1996

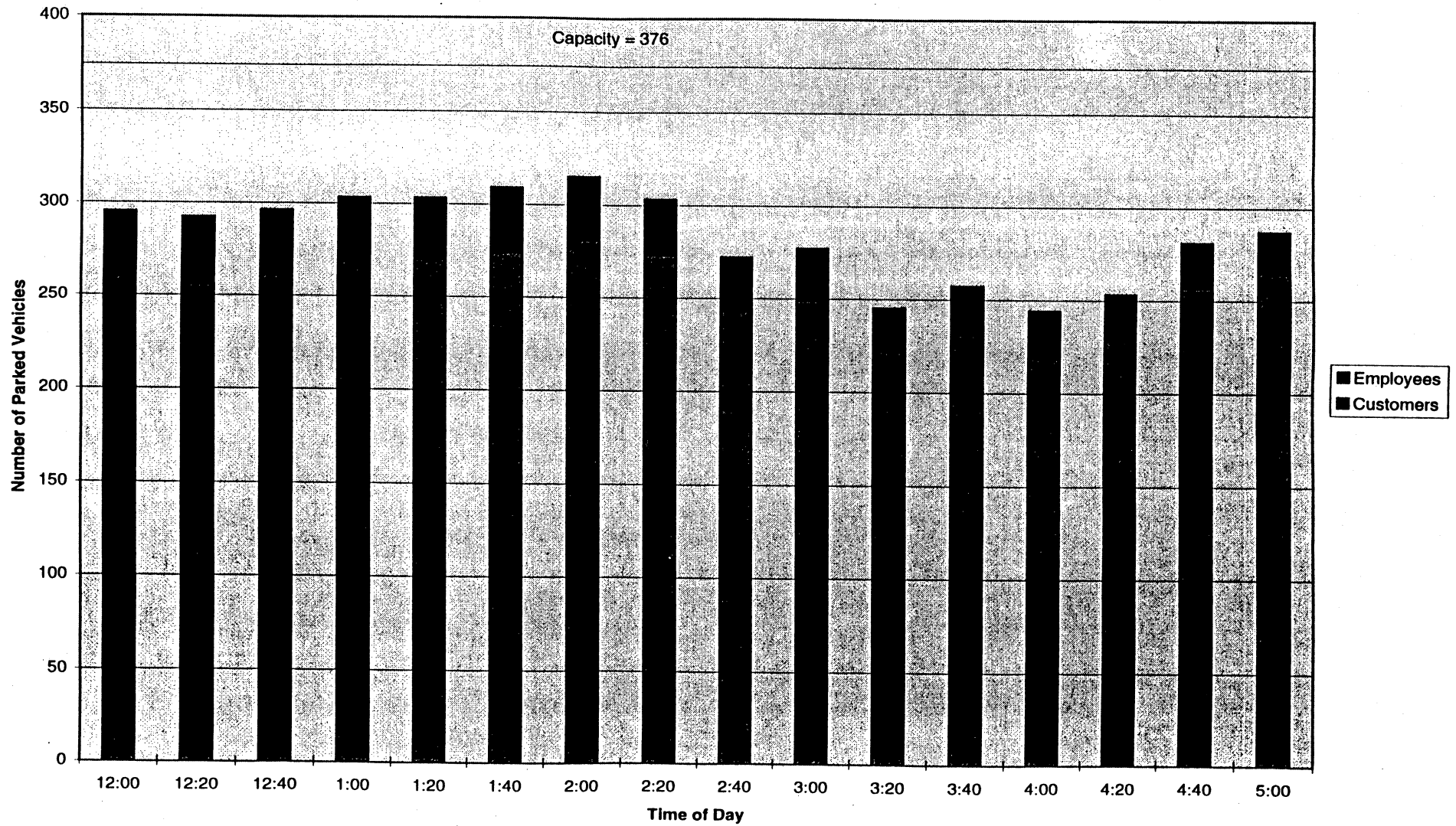
Total main lot capacity = 376
 Total Elm St. lot capacity = 54
 Combined lot capacity = 430

Time of Day	12:00-12:20	12:20-12:40	12:40-1:00	1:00-1:20	1:20-1:40	1:40-2:00	2:00-2:20	2:20-2:40	2:40-3:00	3:00-3:20	3:20-3:40	3:40-4:00	4:00-4:20	4:20-4:40	4:40-5:00	5:00-5:20
Main lot	295	292	296	303	303	309	315	303	272	277	245	257	244	253	281	287
Elm St. lot	31	30	32	30	29	29	27	20	19	19	18	17	17	14	14	14
Combined Total Occupied	326	322	328	333	332	338	342	323	291	296	263	274	261	267	295	301

Summary of Porter Square Star Market Parking Duration

Lot	Employee? (E,N,Both)	Avg Stay (min)
All	N	40
All	E	210
All	Both	44

Saturday Parking Accumulation



Space	R_12.00	R_12.20	R_12.40	R_1.00	R_1.20	R_1.40	R_2.00	R_2.20	R_2.40	R_3.00	R_3.20	R_3.40	R_4.00	R_4.20	R_4.40	R_5.00	
E1	XNZE																
E2	TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME TWME																
E3	TIYE	TIYE	114!	114!	114!	114!	114!	114!	114!	114!	114!	114!	114!	114!	114!	114!	
E4	VWFE																
E5	WNF	VZZ			SCX		X	EGT		X	WTR	X	WLO	KBU	4CA		
E6	245	XBT			ZFO	BKW			GXO	ZOE			3AW				
E7	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	NLHI	303		X	X	
E8	513	X	X	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	WWK!	
E9	79R					X	YZO	X	BDN	771	X	BRP		X	341		
E10	HKJ					X	ZJS	PTJ	4AF	381		HSN		XRA			
E11	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	LEA!	
E12	YEX				YOZ	YXX	X	GEX!	GEX!	GEX!	GEX!	GEX!	GEX!	GEX!	GEX!	GEX!	
E13	TWT	AMT				X	WAG					X	228	X	YTS		
E14	KZB						X	X	X	BPK	KZM	X	X	X	X	923	
E15	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	XLDE	
E16	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	5GME	
E17	XVE				533		X	X	X	XNT	X	X	X	X	X	WHR	
E18	DGR!	DGR!	DGR!	DGR!	DGR!	DGR!	DGR!	DGR!	DGR!	DGR!	X	X	X	X	FEE		
E19	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	XKGI	X	X	WNC	485
E20	X	909	X	GRW				X	X	WTV	X	X	VGW				
E21	9BC				X	GFE	SNF		X	X	X	X	X	X	VB5		
E22	XJA							X	KNP	27N	X	ZXV	605	HKN			
E23	IBH					X	X	X	610		X	X	X	X	X	X	
E24	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	ONG!	
E25	XVN	X	X	X	X	WBD			X	YJO							
E26	88A	GAD				GKC			X	XJA		WEN	GKC	PIC	X	492	
E27	X	XDM		YXX		X	X	TNJ	X	KSN	ZWK		X	YSZ	X	X	
E28	ZAL				X	EVX	XOZ	YSZ		X	X	779	WPE	X	593		
E29	VSE				622			O18		X	WWK		X	ZJP	9BG		
E30	CGP		X	WSX	9AH	9AG	JRI		399	X	X	X	X	X	X	X	
E31	JNP		KHD	WOR	ZDZ	X	MDF	KGL		X	X	X	X	YCK			
E32	7HV	X	YVJ					IXW	AFA	XVP	X	X	ZXV	X	X	56X	
E33	766	TZD	713	TRY	ZPT	BSK		ZPE			WTX	WGP	FMX	XAG	RAB	X	
E34	189	All	ZYN	269	CSA	SNE		ZCC	GGX		412		X	X	SGN		

E35	X	XBV	RVF			341	X	EWf	X	EDX	X	WZB	RMP		HFT		
E36	DRH		NSP	XRR			X	TET	DFA		ZWL		YJZ	X	X	X	
E37	X	X	X	WXP	586	X	X	ZKJ			X	X	CWC	X	WYD	X	
E38	89V	ZWG	X	YWS	YFP					558	IKS	YWP		XBN	ZYO		
E39	22I			853		X	DRM		XHL	XHS	885	CJV	X	WZG	VSb	X	
E40	GCA		WBA	254	EIW	X	XRC				X	X	ZXS	YHP	MIM		
E41	XDW	GGV	X	TWI		XRW	3BX	ATR					TZV	NOF	ZNA		
E42	ZLS			XFI	LM2	X	EBA	534	X	OAV	X	X	YEA	T20	X	X	
E43	VGS	MPW				X	ATE	WBJ	X	X	AFE	X	X	KFY			
E44	571	X	X	XBZ		ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI	ZSGI
E45	170		XJD	BPG	YVD			2NY		550		GRY					
E46	ZLT	XBG		WYK		ZWP	X	ZJT		YYP	X	CEC			GNF		
E47	FNZ	157	X	NSP		SGI	ZOG	ZKI	X	X	VDT						
E48	X	YVG	X	IAP	ZJX	X	XTD	498	PBC						DLS		
E49	X	ETL		ZFC					DSA	X	X	FYP	WCV	485	TSO		
E50	TFX						109	GXF			GCB						
E51	X	7PW				KEG		YAE	VHG	X	XXN		X	FCB			
E52	273			SZP				101	639	IGT		X	X	KCX	WBT	MXX	
E53	GBL		X	MVH			XYE			X	WLS		WYV	FJN			
E54	9JW	8SL	398			XXP					X	X	WJL		YNF		
E55	X	XFP		X	178		X	X	WNY		X	840	ANE	X	X	X	
E56	X	X	BST				ZSW	XKZ		X	X	EMS	X	TTV	WRY	X	
E57	228	X	X	X	X	76M					X	O54	X	X	X	X	
E58	X	X	CHM		161	X	KTR	ZPI	X	SMZ						245	
E59	218						WVH	CXY			X	942		X	X	X	
E60	TXB	X	X	179	X	ZEI				YJM	AHM		X	X	VON		
E61	WRB					X	840					3AX	X	X	SAB		
E62	X	X	X	WBE	TFP	XVC		XEL			X	X	X	XKV	X	X	
E63	YSC					XJR	X	ZON		EGP	VNC		X	X	X	X	
E64	X	851			SBE	X	XAI	X	ZWI					AEA			
E65	X	X	X	ABJ						739							
E66	VAP			VSF	X	WEZ	X	X	VYH	X	X	594	X	X	X	X	
E67	X	XVA				EED		XIM				X	XRH				
E68	656							XJM	X	X	GUW			X	C7Q		
E69	VWX	RVO		XNT		109	XON		X	X	FSN						
E70	GHM		X	CUA		X	7CC	144	ZWJ		ZEK			X	613		
E71	XZF	WII		645	NIP		ZKL	CVX	ZEV				EPT				

E72	X	645	VSG	WPH			WJN	ZGP		X	X	AVS				
E73	930						XEF	X	YEZ			X	X	COL		
E74	ZLO		X	CEV			X	ZCY			FJL	X	X	X	X	
E75	TRR	X	XDN	XVG		X	YGV		X	XNF			YWF			
E76	289		X	MOV				862		X	289					
E77	715			X	4EE	Y55				WJO	XBF	X	X	X	GGT	
E78	X	X	XCW	X	X	PII			X	X	X	XLV	X	NZL		
E79	963	XCW	X	X	118					X	LGH				518	X
E80	X	TMW		O88	GVJ	379		X	X	X	X	X	X	X	X	X
E81	X	X	X	HIH	ZFS	X	X	X	X	738	YCA					
E82	391			HOB		X	X	997	X	939	X	WBH			X	ZEY
E83	X	BKN		YCW		X	ZEY	X	3CE		X	X	X	XHW	BJF	
E84	RMR		X	XKC	BDN	X	X	XKR		JKO			YSV	X	WHF	
E85	348	ZLX	ZAD		WBO		X	GXT	APJ		X	X	X	OOG		
E86	VMZ			X	HEF			X	XIZ	X	FMG		X	X	YBV	
E87	ECA		PBW	XZT	PAZ				YEX	HUB	X	X	X	296	X	X
E88	X	121	TCY		480	X	KTL	AEL		X	X	X	268	268		
E89	HIN	X	KSR	VCY	VHI					YFZ	X	X	DKP	X	X	X
E90	SBY				ABV		GAP	X	WHM					X	X	3CC
E91	X	285	X		933	X	XMB	ZMP	VYI	X	X	JTL	X	X	X	WRX
E92	X	153			XVI	X	X	CXJ					EED		NFC	
E93	WHE		X	XYL						X	X	X	X	X	X	X
E94	EVG			X	WNB						X	X	X	XDR		
E95	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!	908!
E96	YBO	YPG			X	X	174			X	X	X	X	X	X	X
E97	WJT!	WJT!	WJT!	WJT!	WJT!	WJT!	WJT!	WJT!	WJT!	X	X	XJX	VNE			
E98	WNE		IHT			X	AJA		WNN					X	X	ZFB
E99	ZLT			PGT	X	X	X	AYH				NGI	X	259	WWH	
E100	CPS		8MV		X	IXF	X	RMN	X	ALD	X	X	X	76M		
E101	WJZ	3BR	X	ZYI			YNX	BSB	X	166		ZFL				385
E102	XNK	X	NNG		X	X	39G		X	WVN				3AF	WJE	X42
E103	463	WFZ	WLV							RRK		HHF			VGV	
E104	X	X	WHE!	WHE!	WHE!	WHE!	WHE!	WHE!	WHE!	WHE!	WHE!	X	X	250		
E105	XMA			XDZ	WMN			X	X	EMV	GNB		X	X	FRC	
E106	HEJ	X	X	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!	WGF!
E107	WZY			533	WTZ	X	FAY	X	X	X	X	X	LNM			X
E108	XGO	X	VGS	X	YWF					X	X	63T			X	X

E109	X	957	X	X	X	X	X	RGF		XE6						
E110	XBL		KLK			X	X	X	X	423			X	FHK		
E111	HXA		X	X	JTL	YOE	KPP						X	X	629	
E112	IDL				X	X	WWD	X	X	X	X	X	X	X	X	X
E113	X	X	WRY	X	YJP			X	X	X	X	X	EHY	X	7NV	XAM
E114	YNC				X	IZC	X	X	X	X	X	X	X	X	X	X
E115	YMI					287	X	X	X	X	X	X	EEC			
E116	XVP			ZWT		XOF	WBG		X	SU9	X	X	NIA	X	X	X
E117	XXB	SHH	747			WBZ			YJN	X	X	X	X	TBE	220	
E118	X	ECJ				J81	WPBI	WPBI	WPBI	WPBI	WPBI	WPBI	WPBI	WPBI	WPBI	WPBI
E119	RXS		YIK	WFV	WGO	2TK	WYW	X	GSC	X	X	X	X	ZOB	X	X
E120	HTG	664	X	X	4RV	ABJ	72W	X	X	X	X	X	X	X	X	X
T1	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE	ABBE
T2	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE	EEHE
T3	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE	SLCE
T4	XYME	XYME	XYME	XYME	XYME	XYME	XYME	X	X	X	X	X	X	X	X	ZEV
T5	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE	XRJE
T6	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE	MHEE
T7	GDBE	GDBE	GDBE	X	X	X	VXR		X	SZH	X	X	X	X	X	ERF
T8	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE	3AFE
T9	X	X	ZZW		WEX			X	X	X	X	GDA	X	SJX	YOK	X
T10	CSC	X	X	VHY					X	XIL	X	ZCD				BPT
T11	CCKE	CCKE	CCKE	CCKE	COKE	CCKE	CCKE	CCKE	CCKE	CCKE	CCKE	CCKE	CCKE	415		
T12	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE	FPVE
T13	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E	O24E
T14	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE	XFRE
T15	XPCE	XPCE	XPCE	XPCE	XPCE	XPCE	XPCE	XPCE	X	X	KDM					
T16	FCN	X	724E	724E	724E	724E	724E	724E	724E	724E	724E	724E	724E	724E	724E	724E
T17	X	X	WEW			WLF			X	GGE	WBR					
T18	X	X	CWH	X	652			X	X	ZFA				X	WVL	
T19	587							GHK				X	X	X	ITJ	
T20	658				X	XVME	XVME	XVME	XVME	XVME	XVME	XVME	XVME	XVME	XVME	XVME
T21	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE	VZBE
T22	OTD			JZP	X	869!	869!	869!	869!	869!	869!	869!	869!	869!	869!	869!
T23	AVGE	AVGE	AVGE	AVGE	AVGE	AVGE	AVGE	272				X	EHH	X	XBB	
T24	594		X	X	X	X	X	X	X	X	X	X	X	X	X	X
T25	GFV	X	X	X	X	X	DGM	X	X	4SH			X	X	CXF	

T26	XRX	WSG			868			CHI	4FK			X	ENB			
T27	463				X	164			HNK			X	O42			
T28	PJBE	PJBE	PJBE	PJBE	PJBE	PJBE	PJBE	PJBE	PJBE	PJBE	ZKK					X
T29	NLW	X	LXN		GVY			WDW				AXL	X	WVE	DXP	X
T30	ZFG	X	X	ZAO	X	YOZ		RWN	YBF				X	X	ZWM	X
T31	DCZ				X	XOW				590	XPB	X	XSL			
T32	X	982	X	X	X	X	X	X	X	X	XO1		X	EED	WVO	381
T33	949!	949!	949!	949!	949!	949!	949!	949!	949!	949!	949!	949!	949!	X	X	SVL
T34	X	X	X	X	X	BFC		BFC	X	IEA		X	X	RNT		X
T35	X	X	4AT	X	X	ZZV	914	YOE	X	MLS			697	X	X	X
T36	X	X	X	X	JDC								XBK			PZN
T37	LTS	HTG		X	ZLA		HJT		X	WVN	X	X	X	WYM	KDW	
T38	X	RJW	X	X	OKH	XRJ						WGM	X	X	NET	YSJ
T39	X	ZVD		X	XL2	X	TZT		WIM	X	X	GFO	CSB		FUZ	
T40	JC2		X	PVM		X	DLS		X	X	WTW		CCD		LMF	
T41	GYQ	VCC	4BR	9AB			AGF	CMG	WGF	TAO	MJC		X	110	ZZN	
T42	WNP	X	YSA	NCM	BMG		X	VJV	GTG	DLS	X	DAC				
T43	XAO				X	PXR		205		TDE	X	HPK	AHV	X	XDM	
T44	WJBE	WJBE	WJBE	WJBE	WJBE	WJBE	WJBE	X	BKG	X	WNF	798	X	LCM		XNT
T45	25Q	FKF		X	2AE	256		DTA				WJE	X	277	BGF	
T46	XAR				658	X	WWD		X	X	X	O79	X	X	X	BZA
T47	NYS	WBE		X	59M	763			WVW	P39	628		X	VXG		
T48	CEN		X	873		873	ZRG		JTM	X	X	WZH	KCX	866	YAE	
T49	X	63T				ZHR	KOG	PWX	X	X	PRG	4KH	X	X	BLV	X
T50	X	X	X	X	X	2GS	CBM	JFG	X	YRK		GFV	VBB	X	XYB	
T51	X	VJO		X	BSM			SGJ		X	X	HN2		JWG		
T52	X	XHS		X	X	HPW	WFT			X	PKB	XIS	LPW	X	3BM	
T53	X	X	D94	X	X	ZFX	HWR					X	WXZ	X	543	
T54	22L	YXZ		X	BUZ		DLF	FMS	X	GBX	X	X	AOS	X		WOA
T55	ZWN		SYM				XOL					X	X	XPH	X	9AZ
T56	309		8VZ	ZWK	X	PWB	WLJ			WRN				DRO	X	PLP
T57	KEK	X	WPW		X	TDK	9BB	YNH			X	FRE		68	XZT	
T58	X	NWE			X	TFB	ZEN			X	X	X	349		LON	
T59	X	TVT				AAL						WNA	X	X	898	
T60	NRZ	X	VED	X	CKR			9AH		YDI		515			XKT	
T61	ZHC		125		402	EXB		BHP	AVR	ZFO	LEE		X	X	AVG	91A
T62	ZLA	X	325	X	NGO				X	YYD	LAO	94L				

T63	TVT			CRA	GLE		TXN	888		WES	YDA		WIY			
T64	WYO	KHP	ZXO		X	WRH		GRW	ZZH	BRW	XAD	4AR	MTP	X	ABR	
T65	823		287	X	JJY	CHV					354					WVH
T66	857	DMS	DSJ	HPR	YDC	X	YJK				195	KPC				
T67	RVE	WMT	ZEI		XNW	X	NJO		LTX	JLS						
T68	XRM	GZD	JGR	YXY		XIM	VNR	YKX			X	SPM				
T69	TWTE	TWTE	TWTE	TWTE	KGZ	TBN				X	FPB		CVH	GEY	X	ZOE
T70	X	ZTE	X	831					JLV		XTC	X	BNW	YME		
T71	FGA	ZEP	X	LWT			KZE	IGT	885	X	FSK					
T72	BVK	TRY		X	EMR	ZVX		RZY	JZE	8BW	YYY	MGG				328
T73	LZF	X	X	BRJ		CCL	X	ZPF	WYE	8CR	MBP					X
T74	4BR		JWA	X	9AZ	WWP	ZWY		YGA	WBT	22G	ZZE	KGL			X
T75	KYA	WIP					XKX	WOM		576	BHY	16WE	16WE	16WE	16WE	16WE
T76	TKG					24BE	24BE	24BE	24BE	24BE	ZFJ		WBJ	WRE		X
T77	X	YDI		YDI			WBA			263	GYG					
T78	NBF	FBK							C44	8CM						
T79	CFA	WLE	XBP	WRK		FBK	IHN	491		XXZ	4JT	X	MVY			
T80	IZA			HHF	X	WPR						X	XOM	ZZX		
T81	YEN				X	YYF		IPN	X	X	X	WWD				
T82	ZZG	ANY			SPE						83D	GFG				
T83	YBR	XWY	VXE		X	YBE		XRE		XHA	EMW	AHJE	AHJE	AHJE	AHJE	AHJE
T84	X	X	PXH	599		WRW	ZOP		ZCT	RVF	WGT	BJD	WRX			
T85	WBK		X	EMA	695		GPE	AWX	X	SEF	X	14T	2AD	X	ALH	ESM
T86	XDT	YJD	X	X	FGA	X	259				X	33V	YZV		ESW	
T87	XRFB	94L	X	ZFO	407	WRR			NHB			X	YTX			
T88	EMS			24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI	24RI
T89	TJO	RZV	452			DRM		XRI			XRI	X	9BA		NLG	
T90	WRK		X	XAD	CBM		X	X	X	XR1	XHI	TJKE	TJKE	TJKE	TJKE	TJKE
T91	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE	WMIE
T92	ZMM	X	X	X	X	VGD	ZXW	X	WYD		X	MWC				
T93	MOO				XHD	XTX								X	PDY	
T94	X	FVI					RMB	RTN	3CF				XNI	XNB		WBY
T95	BPV	CKA	X	406		RHJ				X	YCV	X	XBA	X	GTG	
T96	695			X	VSB	GJO		CHP								WWS
T97	JYD	X	X	DPK	CYS		X	YFT		X	X	RXWE	RXWE	RXWE	RXWE	RXWE
T98	8CE	JEZ	WRL		X	X	109		GFD	X	402	WZF	X	X	XIE	
T99	REG		X	YVB			X	88L								YYS

T100	X	X	LTY			3BK		GSN	PEY	DOL				ZDD			
T101	ACD					VYS		OAB	YOR	WES					AHD		
T102	WRD	PSJ	HDK	404	FCB	PTT	TNH	495	XBU	XYL							
T103	HIS		FRY		537	CSF			X	X	107	WYB	WEV				
T104	YCR						3AP	XER	EPH		WRD	ECV	XBE		XIL	BRP	
T105	FBV	X	GBM		AMD	T2W	814	X	ZWT	ZWK		ZWO	FDM	YMO		O74	
T106	XBZ		872	X	209						3CC	X	CSP	YSZ	X	VON	
T107	40K		X	X	X	X	X	X	X	BCL	X	X	X	X	X	MPC	
T108	X	X	560		WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	WAJI	
T109	463	513	X	X	X	X	X	O5O	X	4JJ	40F	X	X	XWD	TIW		
T110	PEO	19N	19N	WJX			GRN	MZT			X	VON	X	272	XHX	BNP	
T111	3AP	WLOE	WLOE	WLOE	WLOE	ATC		SOG	CHV	ZHC			ZOH				
T112	X	CYB				ZVE	434	XAG		105	114	O2O	3AS	YZB	VSF		
T113	XRG	X	255						LLE			YNM	VER	WRL	X	FLC	
T114	847	XYJ		WIV			388	ELZ		FGP	BLC			OZX	GBK		
T115	YPB	YLX	80M			GHH	823	ANH				XCH	GER	EWG	X	363	
T116	IBB	TCS	XTC	10D		MDC				ZLT			TRO				
T117	VAO		EWT				OSU	WSF		YHH	HGC	NKW	410	FBB		WWD	
T118	CTM	X	VYP		WZN		AYR	XJB	721	ZFC	ZFI	VZD	YCX	WPA	X	VVF	
T119	VMA	X	663	X	X	YKX		KJL	DHC	YLK	ETT	WLO		511		541	
T120	JAZ		FSW	X	HBJ	DTY		RLD	BZV	ZEI	675		XHV	FJW	X	TZM	
T121	VVG			X	LCB		SKL		X	SSN	GCD	711		BWR			
T122	XLR	X	VAK	X	X	PBV						LZF	X	X	81	LFD	
T123	7ZR	VGD		YRP		YRPE	YRPE	YRPE	YRPE	YRPE	YRPE	X	XHO				
T124	BVL			X	YRM						X	X	492				
M1	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	RYRI	X	X	X	X
M2	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	EDKE	X	X	X	X
M3	X	X	X	362		X	PBV	VBZ	X	X	X	X	X	X	X	X	
M4	869E	869E	869E	869E	869E	869E	869E	869E	869E	869E	869E	X	X	X	X	X	
M5	2OB	X	ZSG				REB	X	X	DML		X	X	X	X	X	
M6	JTME	JTME	JTME	JTME	JTME	JTME	JTME	JTME	JTME	JTME	JTME	X	X	X	X	X	
M7	EEC					X	ENE	BAE		X	X	X	X	7RV	X	BWA	
M8	MXME	MXME	MXME	MXME	MXME	MXME	X	RJY						X	X	X	
M9	ZFZ							X	3AS	X	X	X	X	X	X	VGP	
M10	X	X	AXK	AKF			YVP	X	X	X	X	X	X	X	X	X	
M11	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	RETE	X	X	X	BUG	X
M12	WGT		X	X	X	X	PWN	X	X	X	X	X	X	X	X	OO9	

M13	X	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	TTV!	X	X	ZCV
M14	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE	WIZE
M15	DZF	WNE		X	X	ZJX			X	VME					X	X
M16	040	X	XIG	X	X	X	X	X	X	X	X	X	X	X	X	X
M17	464	X	X	X	X	857	X	X	X	X	X	X	X	X	545	
M18	X	X	X	X	X	X	X	X	X	ZXW		X	X	X	X	X
M19	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE	ZRZE
M20	7BT	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE	FLKE
M21	NFCE	NFCE	NFCE	X	X	X	X	PWV		X	X	X	X	X	X	X
M22	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE	ZKVE
M23	X	VNJE	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI	VNJI
M24	234		X	KPR						X	XNW					
M25	BWL			X	X	XWP		X	X	X	VBN	WRPE	WRPE	WRPE	WRPE	WRPE
M26	ZJC				X	X	NGA				X	X	X	X	X	X
M27	X	X	X	X	MLP	WAF	8RT	X	IDO	DDW		WSZ		X	X	TJH
M28	GRB	PEY		X	X	ZZW	X	BOH		X	WDV				X	CXH
M29	XCI	HSX		LIA		WJY	X	87C		450	X	XTY	YHW			
M30	HAA	X	X	X	X	701				X	NAO	X	X	46G	X	X
M31	DXM	X	590					XVX	X	91M	X	X	X	X	X	X
M32	CFB				X	X	X	X	X	X	X	X	X	X	378	
M33	TDA			X	X	ZKO			X	ZZN					X	X
M34	X	X	X	X	X	ARN	X	856	551	X	267	X	YRV	X	80G	
M35	RGY			VGf	X	KJR				PBV	X	X	X	HHY	X	250
M36	X	522		X	X	6BE		X	X	DZH		X	X	JTD		
M37	ZGD			X	PFK			X	X	XXV			X	X	X	X
M38	X	X	X	X	X	ZPN		X	X	X	X	X	X	YVE	WXE	
M39	TWG			X	9BJ	X	KGK		X	BYY	X	X	X	X	X	X
M40	X	TWG		X	X	BMT	X	X	X	X	X	WBY				YKH
M41	CJT	X	X	TMS		XSO	X	X	X	X	X	X	X	X	X	BDY
M42	X	X	X	X	X	TXS		X	X	X	X	EVM		X	X	X
M43	X	X	149	X	X	KLP	X	X	X	X	X	X	X	X	X	X
M44	EGL			X	XIA	XVO	895			X	X	X	X	X	X	X
M45	BNW							PKL		X	X	X	X	X	X	YST
M46	X	X	X	X	X	X	IPH	X	X	YJN	X	X	X	X	X	X
M47	WTT			X	ZFY				X	X	X	X	X	X	X	X
M48	X	X	X	X	4AW	AHD	RRT	X	X	X	X	X	X	X	X	X
M49	YND	X	X	204	X	X	X	X	X	X	X	X	X	X	X	X

M50	X	X	X	BZC	CCE					X	X	X	X	X	X	X
M51	24L		HYN					X	X	MTG	RXJ				ZOE	
M52	MXD	CLP		X	X	SHF	X	964		X	X	X	X	BVH	X	644
M53	XRK	X	X	X	XZJ	JAS	SIK	X	X	X	X	BHY			MFN	CBL
M54	X	WYK					XRW	X	X	Y LX		X	PEL	IYZ	PGY	
M55	FWT			440	3AP	WLI	X	X	SNP	BKE	X	X	X	X	MAX	X
M56	X	X	X	X	BPJ	RXJ	X	YOG	X	EHP	WIO		XWD		AJX	
M57	WCR					X	O78	X	O16		X	X	X	VFK		X
M58	X	TLY			VIZ	BVC			X	ARN	XRA	X	YEN			
M59	176	X	X	MYB	X	XCV	X	NGP		X	X	BTK	ZOX	X	X	X
M60	179			X	4ZW			X	495			X	X	MXD	9BJ	
M61	614	X	XDR			XAY	XXZ	WJY					X	X	XTM	X
M62	X	419	X	NJV		358	X	IZR		X	X	X	X	ZCO		
M63	140	TZS	KHX	AYD			XJM	BEK		B28	X	XWM	X	217		X
M64	257	VVK			WNP				X	CKP			617	X	AGB	868
M65	FEG	XOF				47F		PFK	X	X	X	X	3BK			
M66	PBH		SJT	CAP	ESL	WWZ				ZBF	X	KYJ				X
M67	RJI	X	X	ZBC			O3O	858		X	X	XSB	X	YFX	NCK	
M68	TXS	KXC			VTYE	VTYE	VTYE	VTYE	VTYE	VTYE	WOC		ZOZ	X	M33	DHS
M69	783		ZHT					91J		X	CHV		FRM			
M70	X	TAR	X	294		X	XCO			ZKH	X	X	WZA	ZJV	995	
M71	XZC					594				GNB	RJI			PKB		VKE
M72	XBW				NBM	X	346	FBE		ZAB		WHE		642		
M73	YOM		800	RXJ	ZZG		WKD	XRR		165	458	NBF		ZJF		9AC
M74	HHE			ZBK	ZEC	YDX		PGC			XWA	O8T		PRP		SGE
M75	PXH	GGY		343		256	WGO		X	YPA		XBI	NHH		FNX	
M76	XIH		WHO			X	GSM	201		ZAW			X	XPK	8V8	4AK
M77	PAF	592	ZML		WJP	WYK			458	ZEC			EPE	963		
M78	XGM				ZKP	CSG	XBJ	3CC	TOH	EJW	X	591			CRR	
M79	SPL							X	LKT	CCN	567	AMA	X	ZCV	ELX	
M80	ZZF	WHM	TRN	TJG		4AF				DWA	NEY		YHP	ZSH		PFB
M81	OAH	626		SWP	TNN		ETR			O57	WBJ			YNO	4BA	
M82	ULV	ZJJ	X	EIW	YED		4AR		LTO		X	526	X	YVW	O15	ZWE
M83	MST	X	X	GXF		ECW	X	SLLI	SLLI	SLLI	SLLI	SLLI	SLLI	SLLI	SLLI	SLLI
M84	X	DRE			XDM		415		X	PZM		NFZ	OAH			X
M85	XRX		YTV				SHZ			EJC		GIB	X	YJX	YXK	
M86	X	688	BRF		KVF	OIK	X	X	ZSL	354		XWR	FJJ			

M87	CRV		XCG		78Q	ZAL		ZRH		ZPJ	ATL					X
M88	WNC		XNP	953	AXE	LOI	TJX	XGW			X	209		BYK		
M89	YWL				MRT	WTZ		WBV		VPA	YAI	XNV	X	PKS	IRK	X
M90	UY5			WMS	WIR	729	CSK	DSK		XVY	MUF	YSM	ATJ	X	439	FNW
M91	BBC	YVN			BSK	CBG		XZY	RZH	X	X	XNX		ZHD	HVI	
M92	OAD		33R			XIT	LBD			WVZ	WZB	YTN	LDF	BYK		
M93	PSX		FCD		22J	573		HWK		XCG		X	X	X	781	X
M94	86L	X	X	927						X	X	538	X	ATC	X	X
M95	228				94	X	X	X	X	ZMG	X	X	X	X	X	X
M96	JJC		X	IWM		X	X	VGB	XCV	X	X	X	X	X	X	X
M97	X	X	X	X	X	X	88N	X	X	X	DGI	VRO	X	X	X	X
M98	255	647	TWP	XWI	X	USJ		WNL	X	GEJ	X	X	X	AJB	X	BPT
M99	204	JAV		306	WHE		9AZ	X	NSP	360			870		MSW	
M100	X	BHD	ZOH		FPA	SGI				GEV	ZFL		XAJ	X	X	779
M101	WZX	X	DIY			KKH				X	XVP	OAB	PCT	87T	X	X
M102																
M103	X	X	OJM		JXY	JYX	PTN	YGH		WJN	X	9BA	VME	CRP		WNA
M104	JXR				IPI						LRF	415	X	DTY		
M105	X	VRG		TRT		X	X	O96				WEL	ZET	XKE	GLJ	
M106	89V	VOE	XYF	FCP	FCP	X	X	XEC	X	STN		JMP	X	X	X	X
M107	X	9BB			SCS	CAZ	STP	XCG	X	YNF	ZBZ			ZBZ	VYW	
M108	X	X	XRY		X	X	NEP	HDV	GLM	YCZ		X	VRL	X	EBA	
M109	X	X	WDC	XTE	X	WPB	XFG	X	XRO		X	CAC	X	X	LTF	
M110	SCS		X		XWR		X	9AZ	MAT		ZEN	ZPL	WNJ		SDP	WMO
M111	BLN				DYD	X	X	MXE!	MXE!	MXE!	MXE!	MXE!	MXE!	MXE!	MXE!	MXE!
M112	AFL		DYD		WCK	X	XBK	AAB	O24	GXD	VKZ		412	NAE	3CF	655
M113	YGS		ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!	ZKE!
M114	X	WNA		MNM			X	399		X	ZZE		XJW			YSD
M115	GCZ	679	XNM	ZDZ	YSN	XXZ	XAA				ZFE	YDI		XON	YXJ	
M116	4AG					LBL	XHS	ZMS	13U	ZRL		GBK	XGC	9BB	TPV	
M117	WWT	9AH			YSO		X	XZM	XTT	ZYN	3IX			3EN		JLW
M118	X	CTS		DHG		RJB				WGW				X	X	LNM
M119	GEM	DLY	IVR		LPI			MLN		829	X	X	YGD		X	770
M120	ANA	X	EDG	LFI	ZPH	ZPN		HPT	RPM		ZFL		ZHO		MEM	
M121	ECH	X	VTM	MOV	USM	ZIV			3CF	VJJ	WLY	X	WGN	TRW		X
M122	DLL	GPR		996	653	PXC	BRP	HJB		X	WFL	X	WRD	ENA	PZN	GDN
M123	VYM	TIY		150	WAE		RRV		X	9BD		ZGR	WOA		943	

M124	YFI			WSX		EVD	ISI	296	DSE	WPL							
M125	LWVE	LWVE	LWVE	LWVE	LWVE	LWVE	LWVE	GTG	361	AVL							
M126	PEX	ZAJ	402		VYP	197		HCJ	X	X	BGW	EDM	X	X	XRE	YJZ	
M127	430							X	X	X	X	X	160	HJC		X	
M128	WJE	X	VKT		28T	CJJ	VZJ		X	X	X	5SV		X	KVD		
M129	XFB	ANP		BTV	ZEO	VYR	RCC	X	AAH	XRF	X	X	X	X	615		
M130	XRW	X	ZHO	XNM	YJW	WZF	JXH	X	X	X	X	X	X	X	X	YTJ	
M131	BBC	X	ZOP	BVB	X	552		X	X	X	X	X	X	X	X	X	
M132	X	X	X	LLV				X	X	X	X	X	X	X	PJL	X	
Employees																	
Elm St. Lot	31	30	32	30	29	29	27	20	19	19	18	17	17	14	14	14	
main lot	35	36	35	33	33	35	34	30	29	28	23	26	25	25	24	22	
Total Employees	66	66	67	63	62	64	61	50	48	47	41	43	42	39	38	36	
Main lot																	
Vehicles parked > 2 hrs	9	10	14	17	18	20	21	24	23	22	22	21	18	16	16	16	
employees	35	36	35	33	33	35	34	30	29	28	23	26	25	25	24	22	
Total employee/ MBTA	44	46	49	50	51	55	55	54	52	50	45	47	43	41	40	38	



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617 924 1770
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October 9, 1996

Ref: 04535.26

Ms. Elizabeth Epstein
Deputy Director for Community Development
City of Cambridge
Community Development Department
57 Inman Street
Cambridge, MA 02139

Re: Parking Accumulation Study
Porter Square Center
Cambridge, Massachusetts

Dear Ms. Epstein:

Vanasse Hangen Brustlin, Inc. (VHB) has conducted a supplemental parking analysis of the Porter Square Center at the request of the Porter Square Neighbor's Association (PSNA). The purpose of these additional counts and observations was to simulate the impact of the proposed project on the shopping center parking supply by temporarily removing 31 parking spaces. While this simulation does not incorporate the additional parking demand that will be generated by the additional retail space, the PSNA felt that this would be offset by not having the complete Transportation Demand Mitigation (TDM) program implemented during the simulation.

As you had requested in your last meeting with VHB, Star Market has provided VHB with customer transaction data as a means of assessing both the seasonal and daily fluctuations in business at Star Market throughout the year. While these data only relate to the Star portion of the shopping center, they should prove helpful in estimating parking activity at the center throughout the entire year.

1. Parking Simulation

As mentioned above, a parking simulation was conducted at the Porter Square Center between Monday, September 30, 1996 and Sunday, October 6, 1996. As part of this "test", a total of 31 parking spaces were blocked off in the shopping center parking lot to simulate conditions at the center after construction of the proposed project. The number of available spaces in the main parking lot was reduced to 345 as part of this experiment. As part of this project, a total of 52 spaces will also be provided in the Elm Street parking lot for both customer and employee use, resulting in a total capacity of 397 spaces between the two lots. Parking accumulation counts were conducted by VHB throughout the week during the peak periods at half-hour intervals. Weekday observations were conducted between 3:00 PM and 8:00 PM and the weekend counts were conducted between 12:00 Noon and 5:00 PM.



Ms. Elizabeth Epstein
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Graphs summarizing the results of the parking demand in the main parking lot for each day are provided attached to this letter in Figures 1 through 5¹.

As shown in the attached graphs, the results of the parking simulation were consistent with previous studies conducted by VHB. During all of the days and time periods observed there was sufficient capacity at the Porter Square Center to accommodate the observed demand. Throughout the week employee utilization of the Elm Street lot was observed to be higher than during previous studies, but the demand at this lot generally decreased when the customer demand in the main parking lot peaked. While this study is somewhat limited in that the additional retail space has not yet been constructed, it was assumed that that would be offset by the planned TDM measures. The TDM program, which includes actions such as subsidizing employee transit passes and providing new customer delivery services, is intended to reduce both customer and employee parking demand. Incidentally, Gravestar has also investigated the feasibility of "shuttling" customers from remote parking locations to bolster the TDM program. Given the location of the likely off-site locations and the retail customers intuitive desire to park as close the front door as possible, customer utilization would likely be very low. Therefore, the focus of the supplemental off-site parking is on employee parking.

As shown in Figure 4, Saturday parking demand was observed to be higher than during the other days of the week, but the reduced parking supply was still observed to accommodate the parking demand for the entire afternoon. The level of parking activity at Porter Square Center was higher than that observed during the counts conducted by VHB in August, but was still lower than the peak conditions observed in November 1995. Accordingly, it appears that the planned parking management plan for Saturday is still appropriate, as it was based on an average of the peak November conditions and the assumed lowest condition of August.

Parking accumulation at the Porter Square Center was also observed on Sunday, October 6, 1996. These counts revealed that parking was approximately 20 percent lower than the demand observed on Saturday the day before. The peak demand on Sunday was observed to occur at 12:00 Noon when a total of 334 vehicles were parked in the two parking lots. This demand is considerably lower than the total capacity of 397 parking spaces that will be provided as part of this project. Based on these data, and additional information supplied by Star Market, there does not appear to be any need for additional off-site parking spaces on Sunday.

While the parking simulation had some notable shortcomings, particularly not having the additional retail development in place as well as the planned TDM program, it did prove useful in further assessing parking demand at the center. Furthermore, analysis of the Sunday data revealed that there would be sufficient parking capacity at the shopping center even without the planned TDM measures.

¹ To be consistent with earlier studies, the graphs only show parking demand in the main lot. However, parking demand in the Elm Street lot is discussed in the following section and is also noted in the attached tables.



2. Star Market Customer Transaction Data

To assess the different levels of business at the center, the primary tenant of the center, Star Market, provided VHB with daily customer transaction data between July 1995 and September 1996. In Figure 6, the daily customer transaction data were broken down as average customer volumes for each day and have been expressed as a percentage of the average daily volume of customers for the entire week. As previously mentioned, the recently conducted Sunday parking counts indicated a peak parking demand of 334 vehicles between the two lots - approximately 16 percent lower than the peak demand of 399 vehicles observed during the previous day, Saturday. However, customer transaction data provided by Star Market show that on average the number of transactions on Sunday are only 7 percent lower than those on Saturday. This would seem to indicate that the level of parking activity would be much closer together on both days than that shown by the counts conducted on both days by VHB.

There are several factors which account for the discrepancy between the number of customer transactions and the observed parking demand. While Star Market is open on Sundays, several other businesses in the shopping center are either closed or do a lower volume of business. These include Liquor World and Gentle Dental which are both closed, and other businesses such as City Video, which typically do a heavier volume of business on Fridays or Saturdays. Therefore, while the number of transactions at Star may only be slightly lower on Sunday, there is a notable decrease in activity at the other businesses. Another factor in the difference between the transaction data and parking counts relates to the different types of shopping activity that occur on Saturday and Sunday. A recent parking turnover study conducted by VHB revealed that customer vehicles are parked in the lot for 40 minutes on average on a typical Saturday. Since parking demand was observed to be considerably lower on Sunday than Saturday, it would appear that customer vehicles parked on a typical Sunday turn over at a higher rate than on Saturday. This is consistent with our previous experience with supermarkets and shopping centers, in that people tend to shop for a longer amount of time on Saturdays than any other day of the week. Accordingly, while the number of transactions may be similar, Star customers probably shop for a considerably longer time on Saturdays than on Sunday. The parking turnover study also indicated that customer duration on Friday was two to three minutes shorter than on Saturday. It is likely that during the other days of the week the trend of shorter customer parking durations would continue, as shopping activity throughout the rest of the week typically is more impulse-oriented with quicker shopping trips.

The 15-months of Star Market data were also plotted as shown in Figure 7 to demonstrate the seasonal fluctuation in the volume of business at Star Market. The data are plotted as percentage of the average daily volume for the entire month. As previously mentioned, the number of additional off-site parking spaces needed for Saturday was determined by taking an average condition between peak conditions in November and the month of August, when the lowest parking demand was assumed occur. As mentioned in our letter of September 10, 1996, the month of August is actually one of the higher months for Star Market activity and not the lowest, as we had conservatively assumed. Furthermore, while data for October 1996 are not yet available, October data from 1995 indicate that that month also represents an above average month for Star Market activity. Therefore, the 50 off-site spaces proposed for



Ms. Elizabeth Epstein
Project No.: 04535.26
October 9, 1996
Page 4

employee use on Saturdays should be conservatively high, since this figure was based on an average between a peak month and an assumed low month, which actually ended up being an above average month.

The transaction data also do not account for people being more reluctant to leave their homes to go shopping in the winter months. Instead, it is likely that customers purchase more goods and stay longer during their less frequent shopping trips. This is particularly notable given the severity of the winter in which these customer counts were recorded. Likewise, since customers may shop more frequently during the spring and summer months, that in turn would allow them to make smaller purchases and not stay as long. Therefore, it is likely that parking duration was at or near its highest point during the time of the November parking counts. With parking duration being shorter in the other months of the year, overall demand should also be lower.

I trust the response is helpful in the city's ongoing review of the proposed project. As always, we are available to discuss any aspect of this project. Please do not hesitate to call me or Dan Clarey should you have any questions regarding this matter.

Very truly yours,

VANASSE HANGEN BRUSTLIN, INC.

A handwritten signature in cursive script, reading 'Patrick Dunford'. The signature is written in black ink on a white background.

Patrick Dunford
Traffic Engineer

cc: Daniel S. Clarey - VHB
Susan Clippinger - Cambridge Traffic & Parking
Anne Johnson - Somerville Traffic & Parking
Barry Pell - Rizzo Associates
John Civilinski - Gravestar, Inc.
Drew Leff - Leff Consulting, Inc.
Paul Myers - PSNA
Hugh Hahn - VHB

Figure 1

Tuesday Parking Accumulation

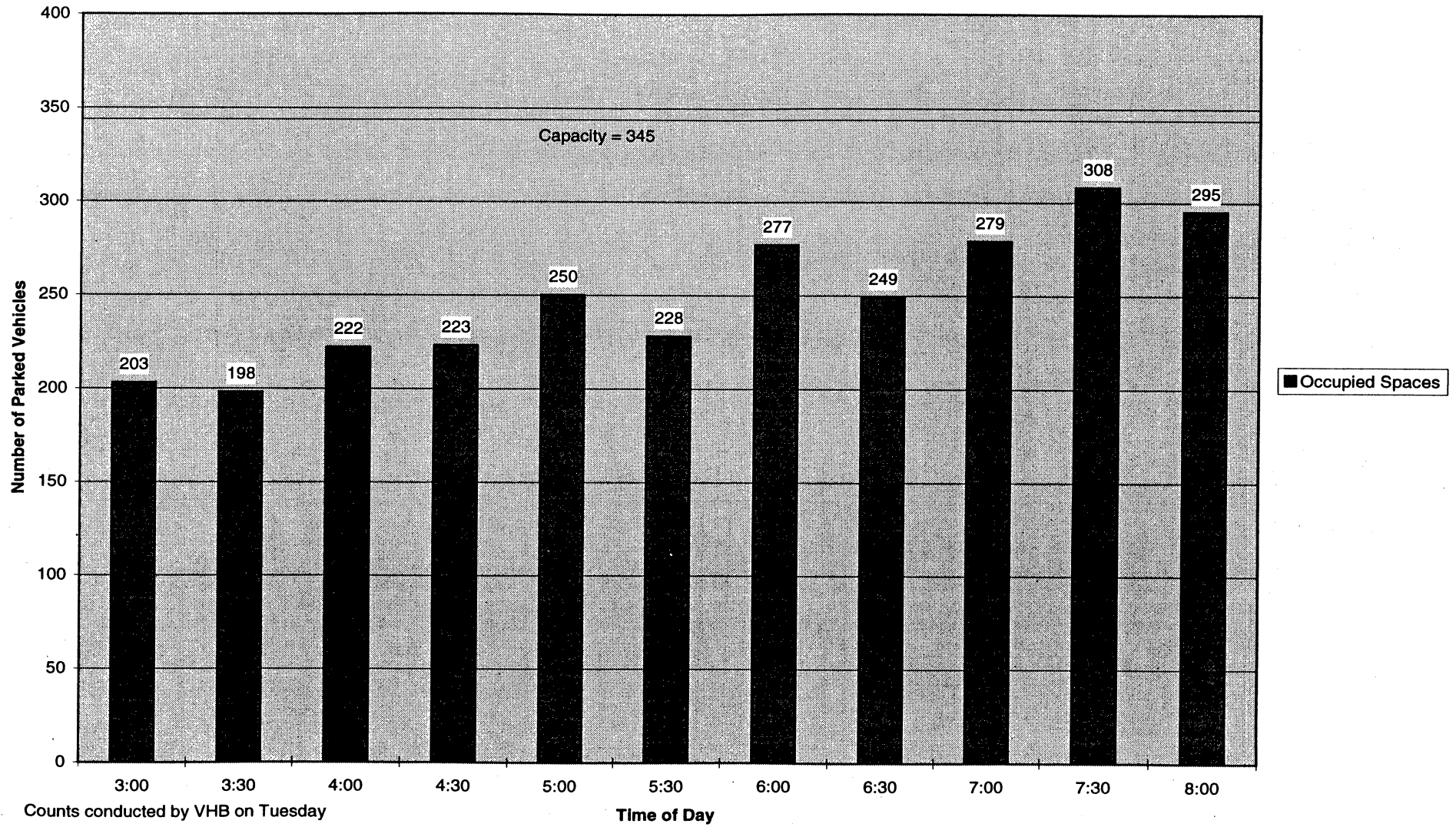


Figure 2

Thursday Parking Accumulation

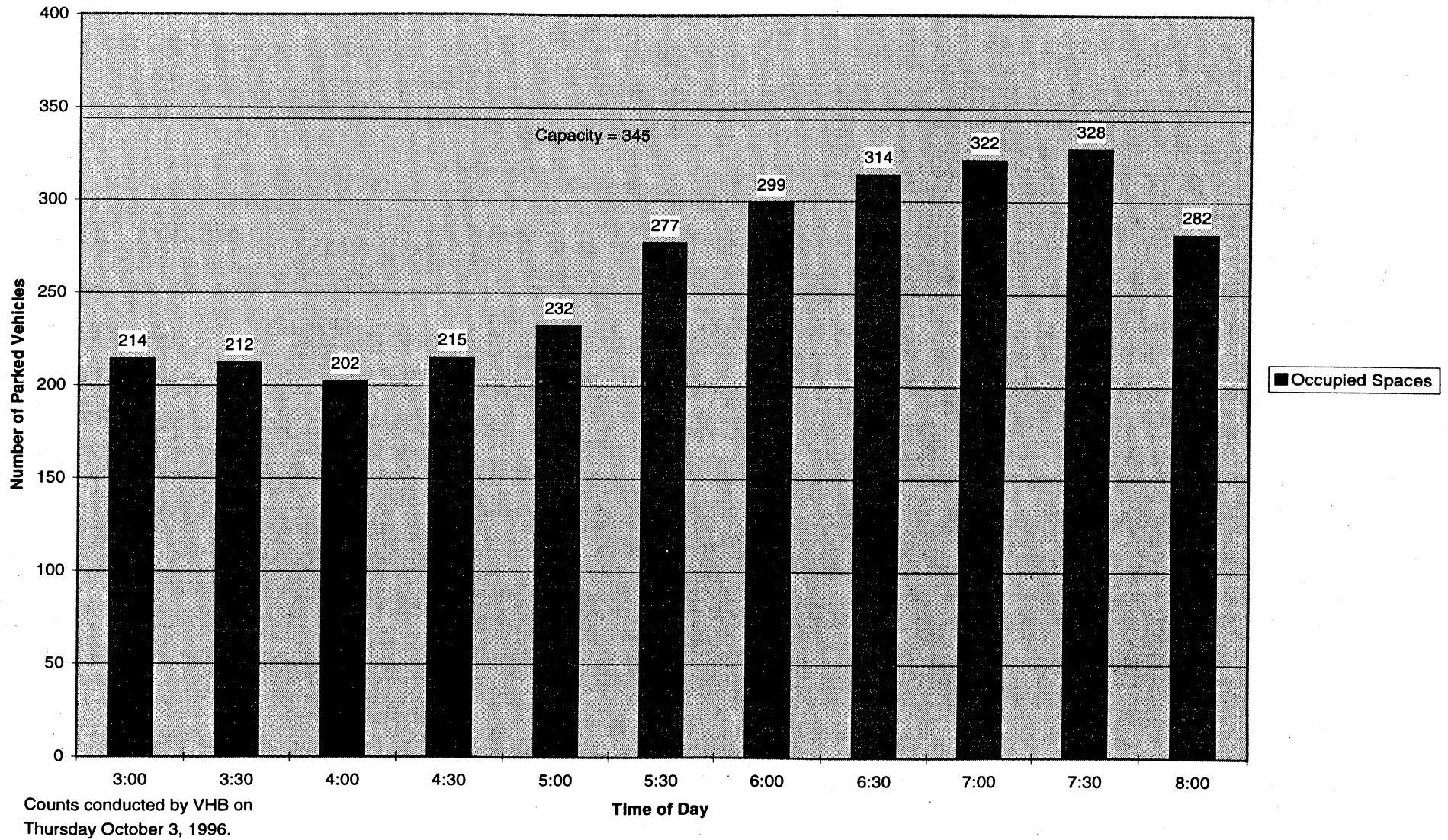


Figure 3

Friday Parking Accumulation

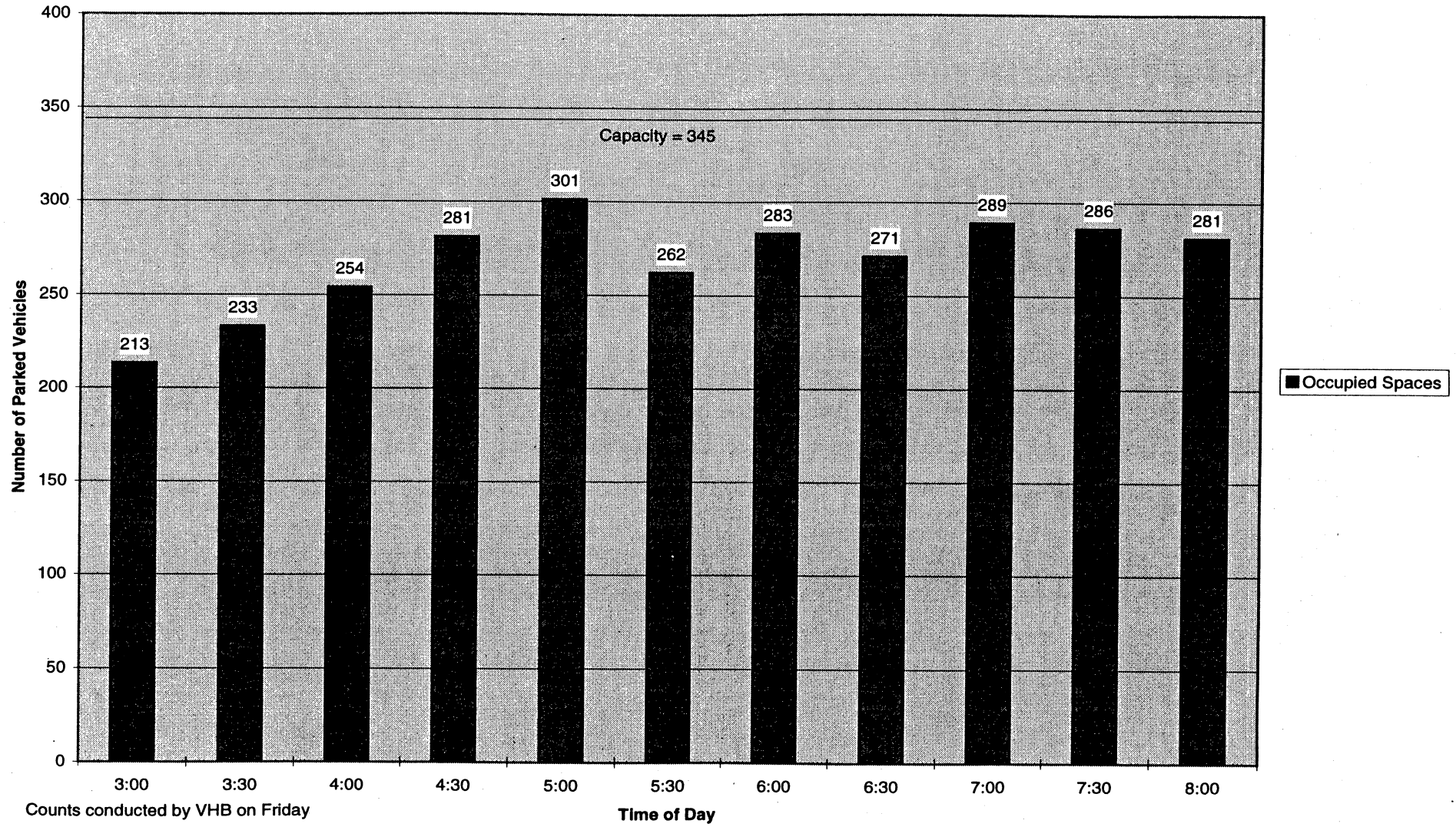
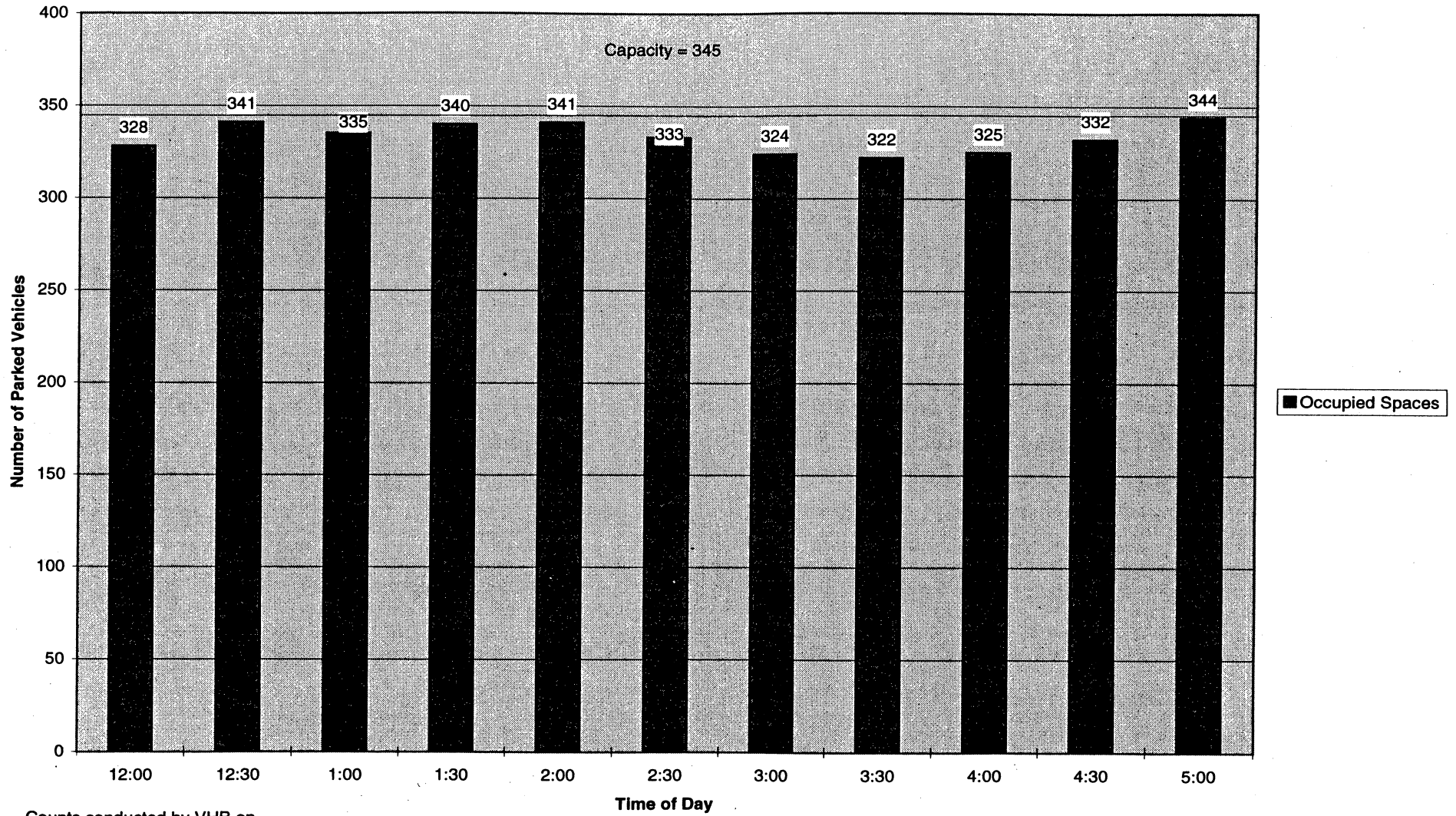


Figure 4

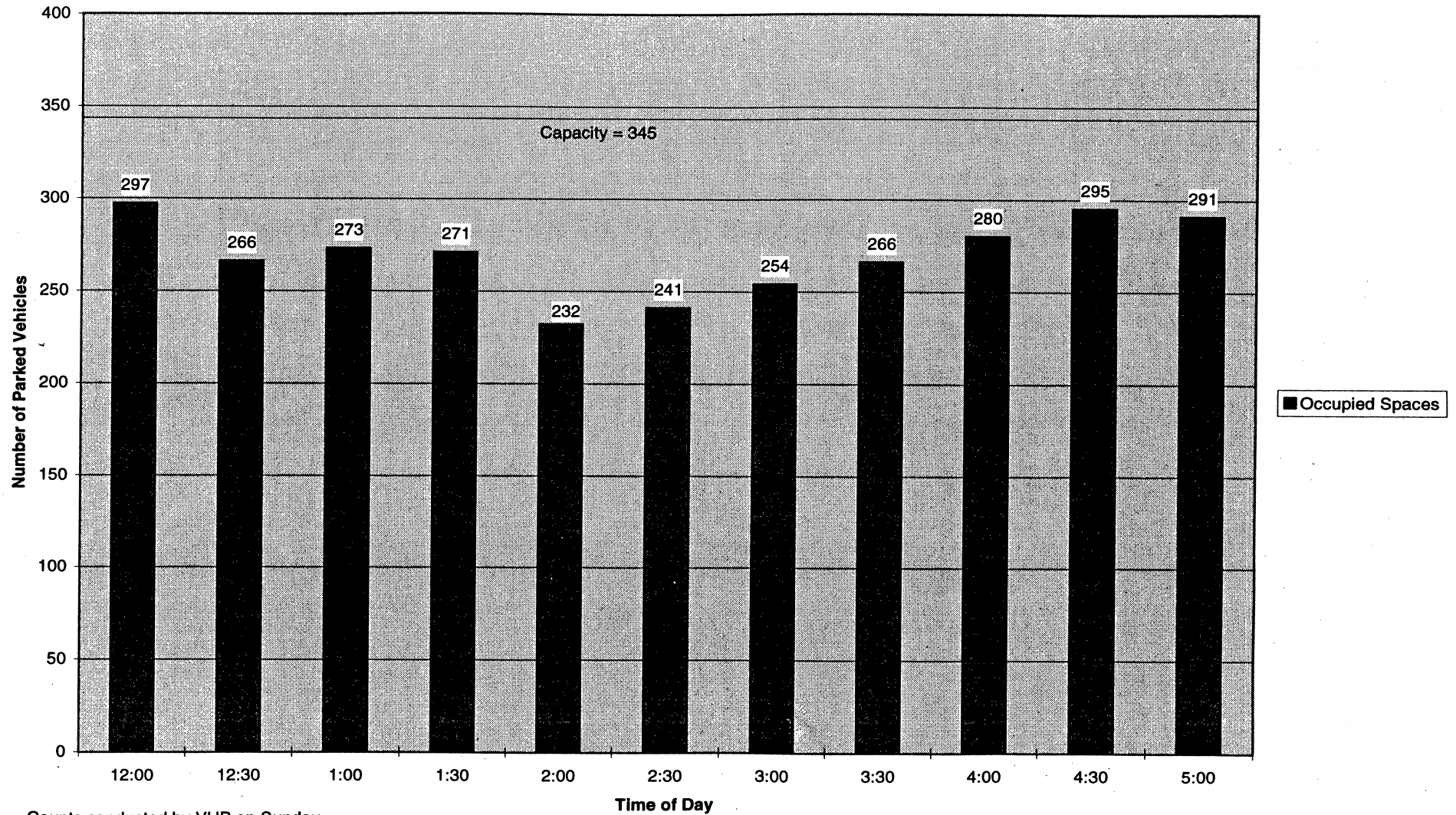
Saturday Parking Accumulation



Counts conducted by VHB on
Saturday October 5, 1996.

Figure 5

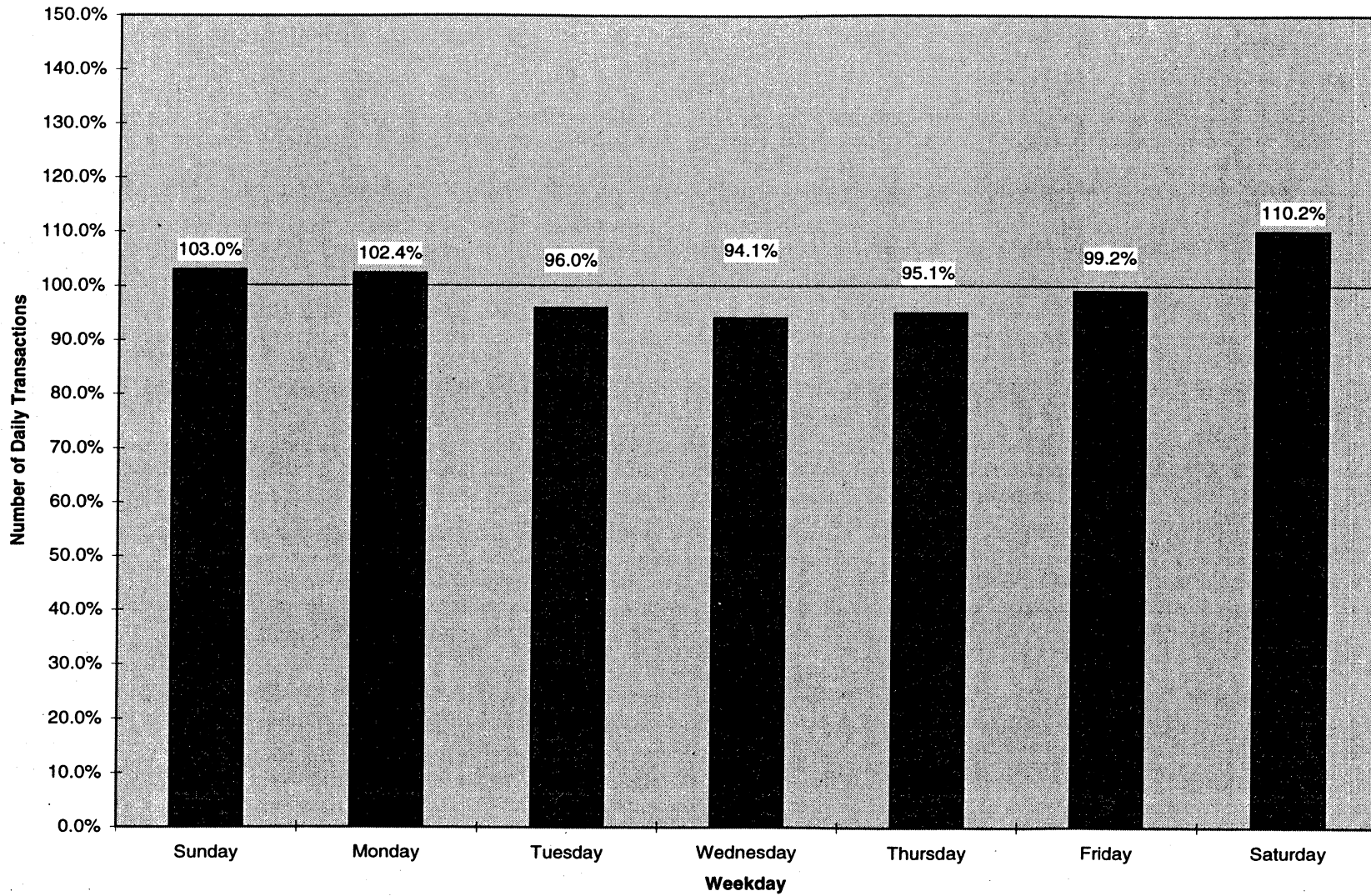
Sunday Parking Accumulation



Counts conducted by VHB on Sunday
October 6, 1996.

Figure 6

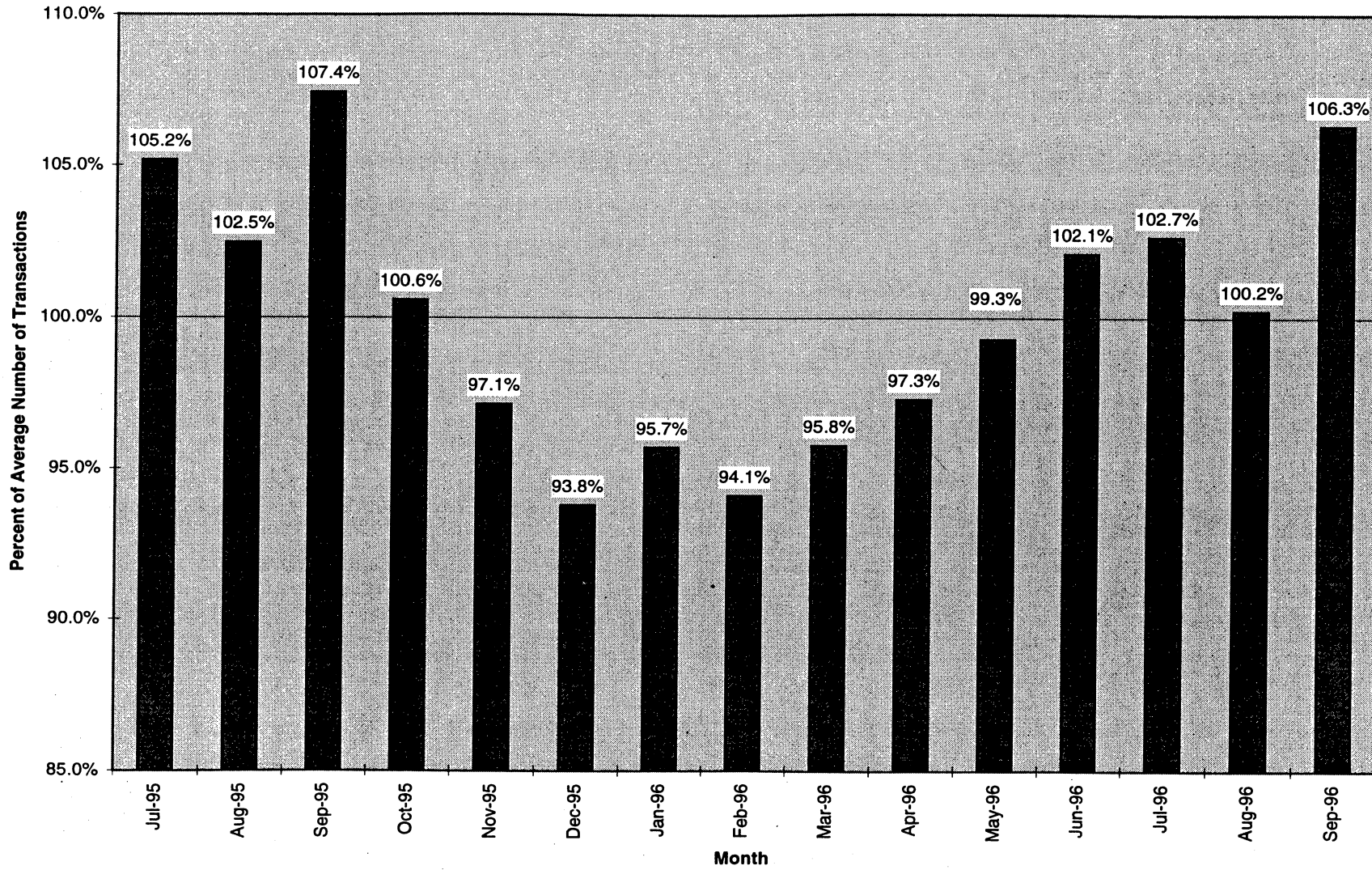
Star Daily Transaction Volumes - Weekday Averages



15 months of data

Figure 7

Star Daily Customer Transaction Volumes - Monthly Averages



Porter Square Center Parking Simulation

Date =	10/1/96	Tuesday	Total Lot Capacity	376
			Spaces "removed"	31
			Total Available	345

	Occupied Spaces	Empty Spaces	Elm Street Lot	Total Demand
3:00	203	142	55	258
3:30	198	147	54	252
4:00	222	123	46	268
4:30	223	122	44	267
5:00	250	95	39	289
5:30	228	117	36	264
6:00	277	68	32	309
6:30	249	96	32	281
7:00	279	66	30	309
7:30	308	37	29	337
8:00	295	50	28	323

Thurs

Porter Square Center Parking Simulation				
Date =	10/3/96	Thursday		
			Total Lot Capacity	376
			Spaces "removed"	31
			Total Available	345
	Occupied Spaces	Empty Spaces	Elm Street Lot	Total Demand
3:00	214	131	64 *	278
3:30	212	133	57 *	269
4:00	202	143	48	250
4:30	215	130	45	260
5:00	232	113	46	278
5:30	277	68	33	310
6:00	299	46	27	326
6:30	314	31	26	340
7:00	322	23	22	344
7:30	328	17	24	352
8:00	282	63	25	307

* Employees were doubling up in Elm St. lot during mid P.M.

Fri

Porter Square Center Parking Simulation				
Date =	10/4/96	Friday		
			Total Lot Capacity	376
			Spaces "removed"	31
			Total Available	345
	Occupied Spaces	Empty Spaces	Elm Street Lot	Total Demand
3:00	213	132	50	263
3:30	233	112	42	275
4:00	254	91	42	296
4:30	281	64	38	319
5:00	301	44	32	333
5:30	262	83	24	286
6:00	283	62	23	306
6:30	271	74	22	293
7:00	289	56	22	311
7:30	286	59	20	306
8:00	281	64	19	300

Sat

Porter Square Center Parking Simulation					
Date =	10/5/96	Saturday		Total Lot Capacity	376
				Spaces "removed"	31
				Total Available	345
	Occupied Spaces	Empty Spaces	Elm Street Lot	Total Demand	
12:00	328	17	54	382	
12:30	341	4	53	394	
1:00	335	10	53	388	
1:30	340	5	55	395	
2:00	341	4	58	399	
2:30	333	12	55	388	
3:00	324	21	55	379	
3:30	322	23	49	371	
4:00	325	20	48	373	
4:30	332	13	39	371	
5:00	344	1	35	379	

Sun

Porter Square Center Parking Simulation				
Date =	10/6/96	Sunday		
			Total Lot Capacity	376
			Spaces "removed"	31
			Total Available	345
	Occupied Spaces	Empty Spaces	Elm Street Lot	Total Demand
12:00	297	48	37	334
12:30	266	79	31	297
1:00	273	72	31	304
1:30	271	74	29	300
2:00	232	113	29	261
2:30	241	104	29	270
3:00	254	91	29	283
3:30	266	79	28	294
4:00	280	65	28	308
4:30	295	50	28	323
5:00	291	54	28	319



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 617 924 1770
 FAX 617 924 2286

Memorandum

To:	Mr. Barry Pell, P.E. Vice President Rizzo Associates, Inc. 235 West Central Street Natick, MA 01760-3755	Date:	October 11, 1996
		Project No.:	04535.26
From:	Patrick Dunford Traffic Engineer	Re:	Cambridge - Porter Square Center

Attached please find the additional Star Market transaction data that you had requested at our meeting on Thursday, October 10, 1996. These additional data are being provided to help assess the parking demand at Porter Square Center on both Thursdays and Fridays throughout the entire year. As you had requested, the building sizes and uses for each of the shopping center tenants are also attached, both for the existing and proposed conditions. We are still searching for weather records for some of the higher than usual Star Market days, and that information will be passed on to you once it has been obtained.

Figure 1 provides a summary of Star Market daily customer transactions on Thursdays for a 15-month period. As with the previous Star Market data, this information has been expressed as a percentage of the average Thursday customer volumes. VHB had previously conducted a parking count on August 15, 1996 and the Star Market transaction data for this day are also highlighted in Figure 1. The data indicate that while this was an average Thursday for Star Market business, only 309 of the 430 available spaces in the main lot and the Elm Street lot were occupied. Therefore, the parking demand for the entire site was less than 75 percent of the total capacity on a typical Thursday for Star Market business. Peak days throughout the year include the Thursdays before Labor Day and the Fourth of July, as well as Thursdays during the early weeks of September, when food shopping by returning students may account for higher than normal sales. While there may be increased business at Star from these periods of intense food shopping, the rest of the center does not necessarily follow suit.

Friday Star Market transaction data are expressed in Figure 2 in a similar fashion to the Thursday data. As with Thursdays, Friday transactions were relatively constant throughout the year, with the exception of peak days occurring before holidays such as Labor Day and Easter.

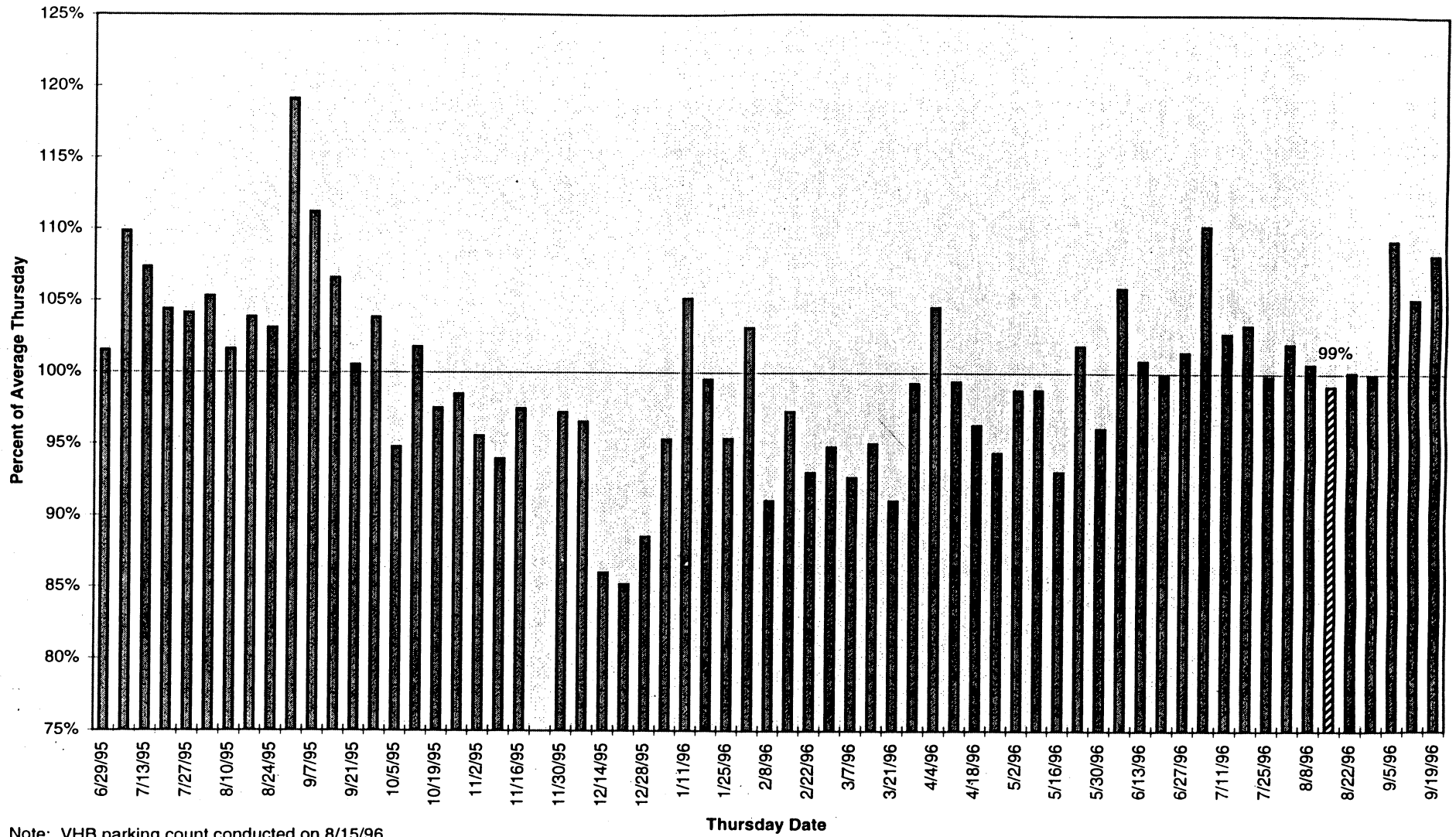
To supplement this information, VHB also compared Thursday customer transactions to those on Friday. These data are shown in Figure 3 and indicate that the number of customers on Thursday is typically lower than Friday throughout the year. In those instances when Thursday volumes were higher than Friday, there was less than a ten percent difference between the two.

Please do not hesitate to contact me if you have any questions regarding this matter.

cc: Dan Clarey
Drew Leff
Liz Epstein
Susan Clippenger
Lauren Preston
Project File

Figure 1

Porter Square Center
Star Market - Thursday Daily Transactions



Note: VHB parking count conducted on 8/15/96.

Figure 2

Porter Square Center
Star Market - Friday Daily Transactions

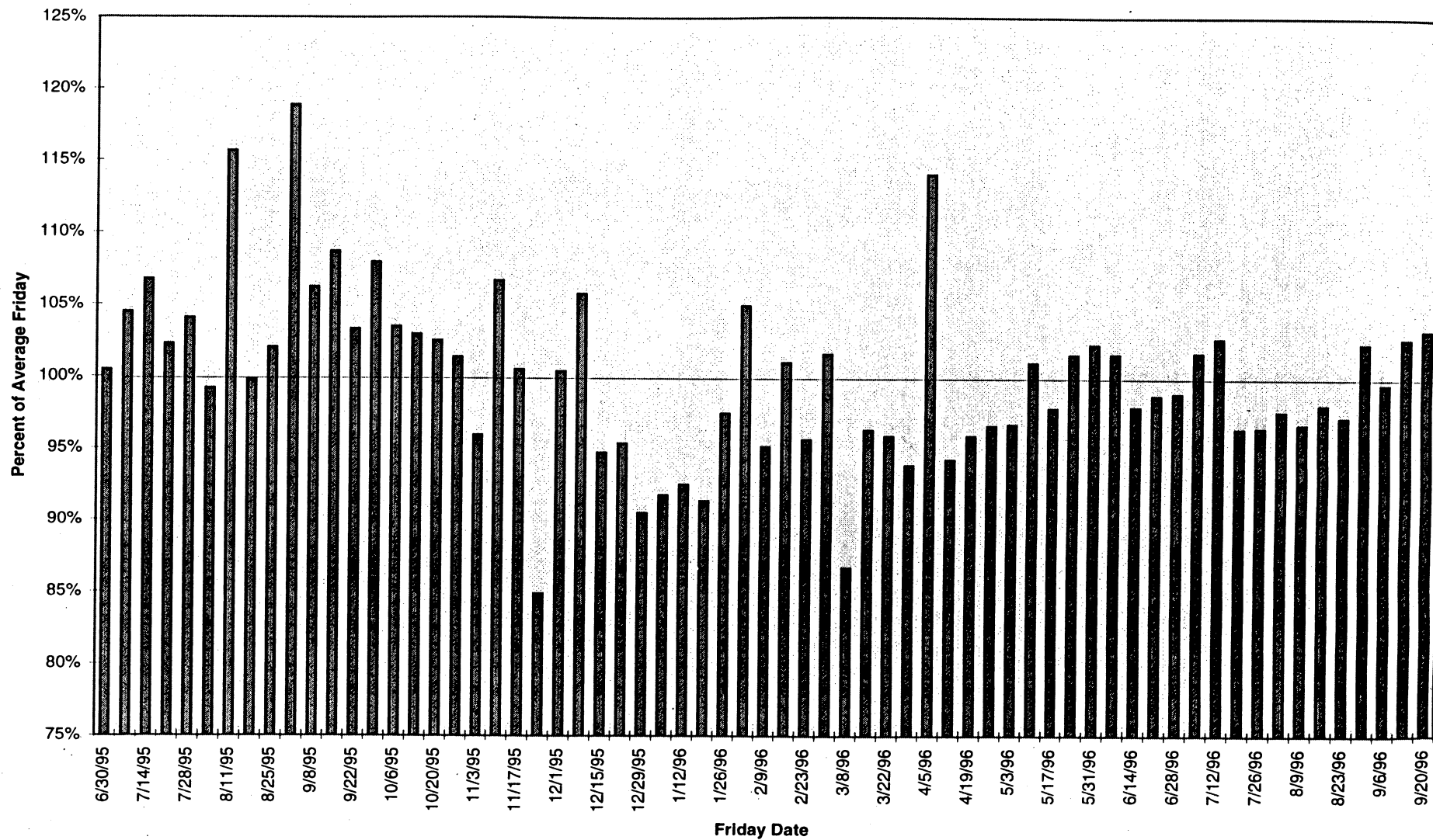
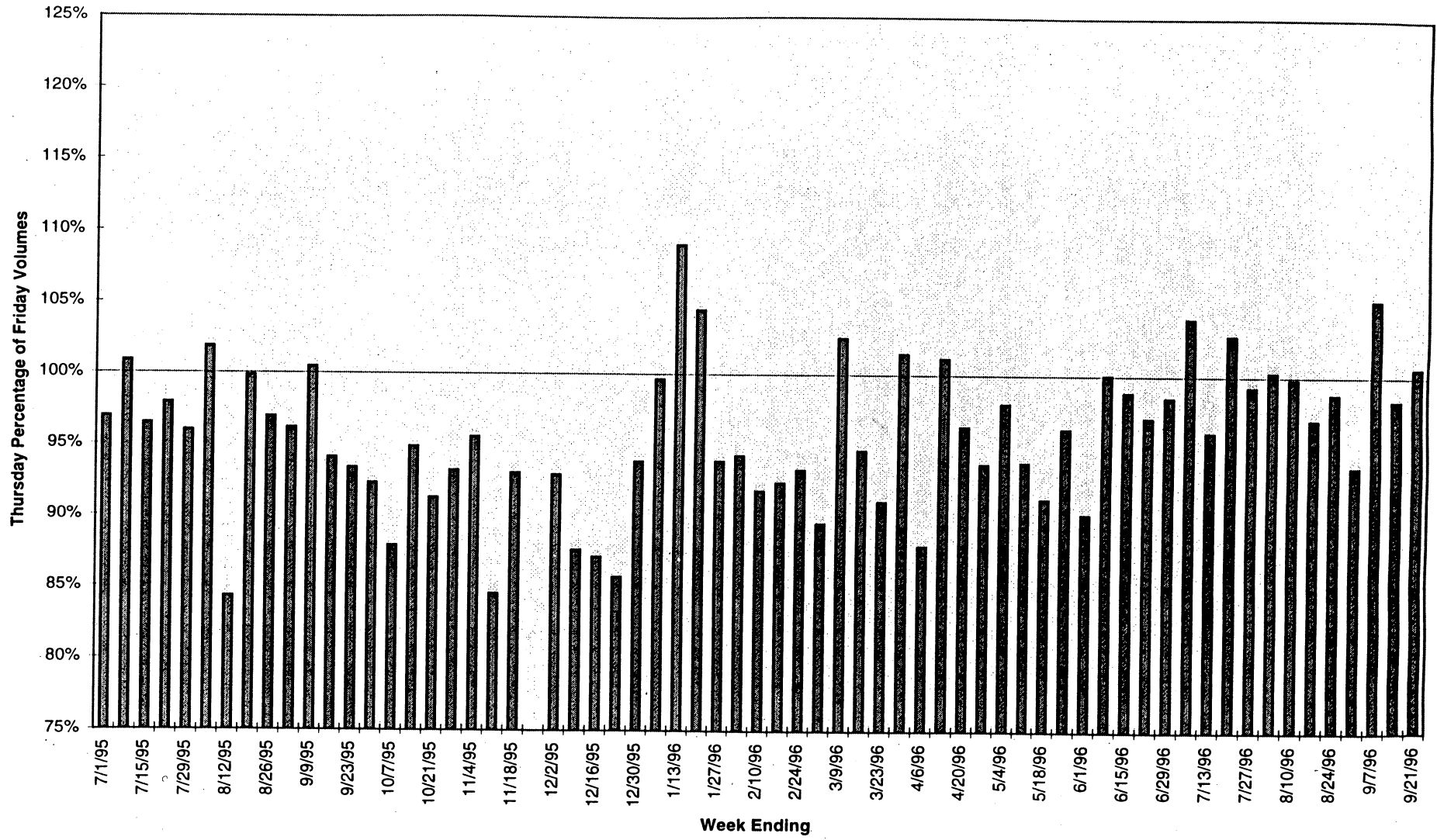


Figure 3

Thursday/Friday Daily Transaction Comparison



MEMORANDUM

TO: Pat Dunford, VHB via Fax: 924.2286
 FROM: Drew M. Leff
 DATE: October 11, 1996
 RE: Porter Square Shopping Center Tenants and Square Footage

TENANT	USE/COMMENT	XMAS IMPACT	LEASEABLE SF	FUTURE SF
Dunkin Donuts	fast food	no	1,796	1,796
McDonalds	fast food	no	2,579	2,579
Command Performance	hair salon	minor	2,392	2,392
Liquor World	liquor store	yes	2,000	2,000
Parade of Shoes	shoe store	yes	2,000	2,000
Frame King	framing shop	some	2,640	2,640
"vacant"		assume yes	1,500	1,500
Gentle Dental	dentist	no	1,800	1,800
City Video	video store	no	2,500	2,500
Dress Barn	women's clothing	yes	4,480	4,480
Tags	hardware store + housewares	some	7,800	7,800
CVS	pharmacy & health & beauty aids	some	11,906	12,000
Star Market	grocery store	minor	40,340	54,000
Cambridge Savings Bank	bank	minor	4,368	2,100
Healthworks	women's health club	no	13,165	13,165
Decelle	family clothing	yes	25,000	25,000
Arcade	5 "carts" for new entrepreneurs/vendors - gifts/food/candy, etc - not an independent traffic generator	some	NA	1,500
Second Floor	unknown? retail /office /service	assume yes	NA	9,500
Total			126,266	148,761

↑

NOV 10 10:15 96

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services



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Watertown
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617 924 1770
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Memorandum

To: Mr. Barry Pell, P.E.
Vice President
Rizzo Associates, Inc.
235 West Central Street
Natick, MA 01760-3755

Date: October 15, 1996

Project No.: 04535.26

From: Patrick Dunford
Traffic Engineer

Re: Cambridge - Porter Square
Center

Attached please find the additional Star Market customer transaction data for the weekends between Thanksgiving and Christmas, as well as for a full week before Christmas. This information is presented in the attached Figure 1, with daily transactions being expressed as a percentage of the Saturday mean for the entire year. As shown in the graph, daily transactions at Star Market during the holiday season were typically lower than the median Saturday. A major snowstorm was forecast for Wednesday, December 20, 1996, which probably accounts for the higher amount of Star business on the previous day. While there was also snowfall on December 1, 1996, it is not sure if the weather resulted in customers putting off shopping until the following day.

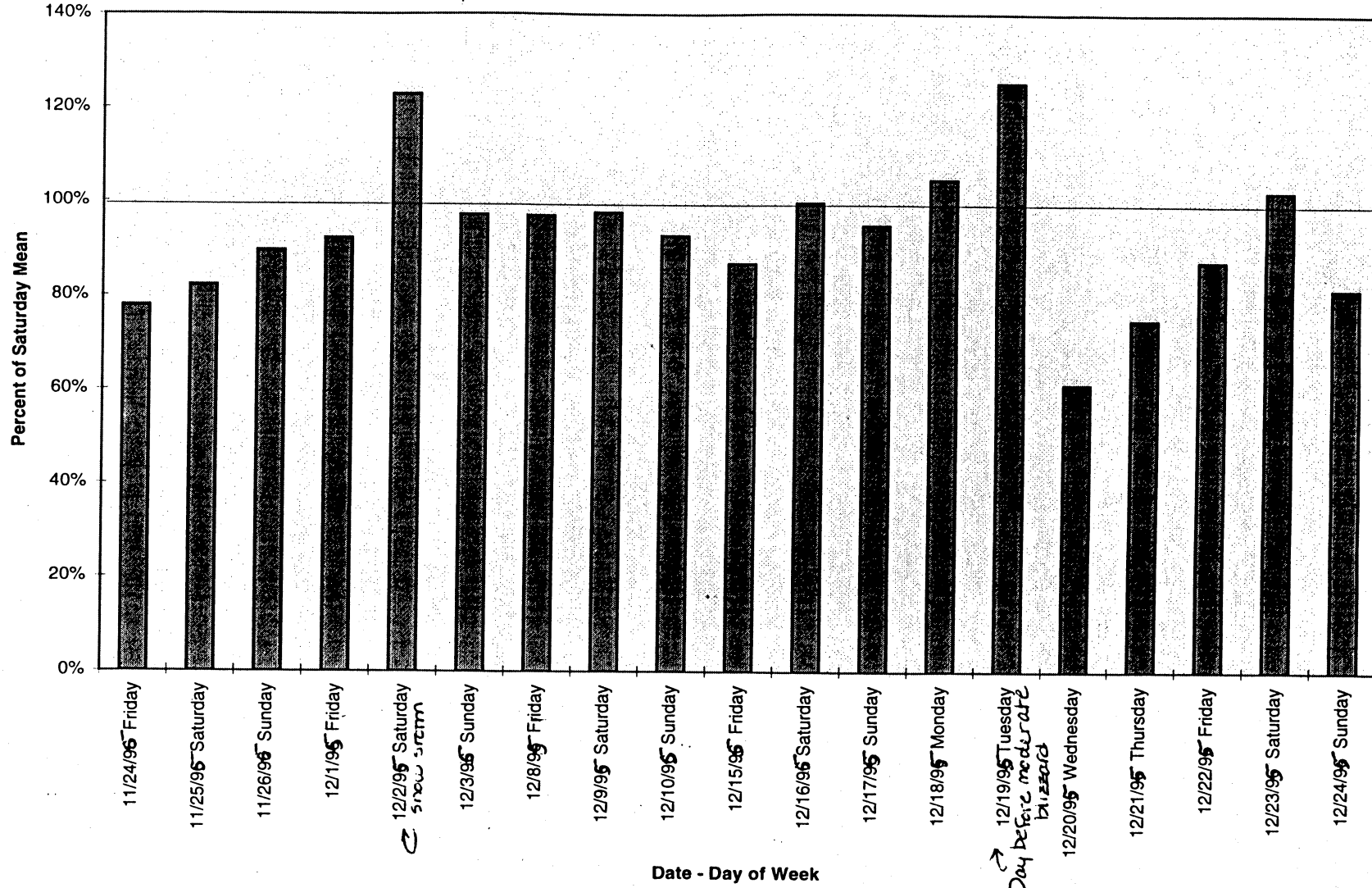
Since our last meeting, weather conditions have also been obtained for some of the unusually busy days for Star Market. For the Saturday and Sunday following New Year's Day, the number of Star Market transactions was 20.9 percent and 7.3 percent above the Saturday mean, respectively. A major snowstorm began on late Sunday, January 7, 1996. It appears that the higher than normal amount of business occurring on both days was probably due to shoppers stocking up on food and supplies to prepare for the storm.

Please do not hesitate to contact me if you have any questions regarding this matter.

- cc: Dan Clarey
- Hugh Hahn
- Drew Leff
- Liz Epstein
- Susan Clippenger
- Lauren Preston
- Project File

Figure 1

Porter Square Center
Star Market - Holiday Season Daily Transactions



Note: all FF15 Dates



CITY OF CAMBRIDGE
COMMUNITY DEVELOPMENT DEPARTMENT

SUSAN B. SCHLESINGER,
Assistant City Manager for
Community Development

To: Robert W. Healy, City Manager *goh*
From: Susan Schlesinger, Assistant City Manager for Community Development
Re: Council Order #050, dated 11/25/96 RE: REPORT ON ALL TRAFFIC
STUDIES AND ANALYSIS RELEVANT TO THE PORTER SQUARE
SHOPPING CENTER RENOVATION AND EXPANSION.
Date: December 11, 1996

Attached are copies of the four documents which analyze the traffic issues related to the proposed expansion and renovations to the Porter Square Shopping Center. Six of the documents were prepared for the owner of the site by Vanasse Hangen Brustlin, Inc. (VHB). One document was prepared for the Community Development Department by Rizzo Associates (Rizzo). These documents include analysis of parking and traffic patterns, including the shift of the curb cut on White Street.

The documents are:

1. Porter Square Shopping Center Traffic Summary - May 10, 1996, VHB
2. Traffic Impact and Access Study, June, 1996, VHB
3. Memorandum - Review of Traffic Impact and Access Study, July 16, 1996, Rizzo
4. Response to Rizzo Memorandum - September 10, 1996, VHB
5. Parking Accumulation and Turnover Studies - September 11, 1996, VHB
6. Parking Accumulation Study, October 9, 1996, VHB
7. Cambridge- Porter Square Center, October 11, 1996, VHB

These documents formed the basis for development of the parking monitoring program and transportation demand management plan for the shopping center which would be put in place through the Memorandum of Agreement among Gravestar, Inc., the City of Cambridge and the Porter Square Neighbors Association.

We have requested that the City of Somerville forward any relevant traffic reports to the Community Development Department. Any materials received will be forwarded as supplements to this memo.



CITY OF CAMBRIDGE
CAMBRIDGE, MASSACHUSETTS 02139

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EXECUTIVE DEPARTMENT
ROBERT W. HEALY
City Manager

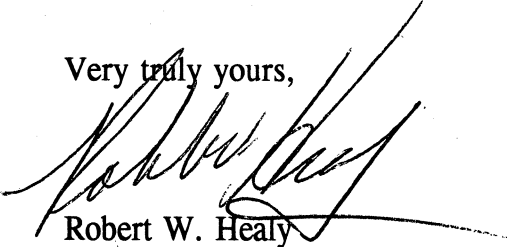
RICHARD C. ROSSI
Deputy City Manager

December 16, 1996

To The Honorable, The City Council:

Please find attached a response to Awaiting Report Item No. 28, regarding a report on all traffic studies and analysis relevant to the Porter Square Shopping Center renovation and expansion, received from Assistant City Manager for Community Development Susan Schlesinger.

Very truly yours,



Robert W. Healy
City Manager

RWH/mec
attachment

Consent Agenda #24

S-621

Regarding a report on all traffic studies and analysis relevant to the Porter Square Shopping Center renovation and expansion.

In City Council December 16, 1996

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