Executive Summary

Vanasse Hangen Brustlin, Inc. [VHB] has evaluated the traffic impacts associated with the proposed Meadow Walk at Lynnfield Mixed-Use Redevelopment located on the Colonial Golf Club site in Lynnfield, Massachusetts. This traffic impact and access study has been prepared with extensive input and review by the Town of Lynnfield and the Town's peer review consultant Greenman Pedersen, Inc.

The site is generally bounded by Walnut Street to the east, Audubon Road to the west, I-95 to the south, and wetland areas to the north. Under existing conditions the site is currently occupied by the Colonial Golf Club (18-hole golf course), Boston Sports Club (55,000 sf), a Conference Center (14,500 sf), and the Sheraton Hotel (280 rooms). As currently proposed, the redevelopment would involve the removal of the existing Conference Center portions of the site as well as nine holes of the 18-hole Colonial Golf Club facility. Both the hotel and Boston Sports Club would remain. In place of the uses to be removed, the current proposal involves the construction of approximately 390,000 sf of "lifestyle retail" space, 80,000 sf of office space and 220 residential units (180 Apartments and 40 Age-Restricted units). Primary access to the site is proposed on Walnut Street in the area of the existing Colonial Golf Club Driveway and Secondary Access is proposed on Audubon Road in the area of the existing Colonial Golf Club/Sheraton Driveway.

Based on VHB's knowledge of the area, standard methodology used for traffic impact and access evaluations, and discussions with the Towns of Lynnfield and Wakefield, the following intersections were included in this assessment:

Lynnfield:

- Main Street at South Common Street
- Main Street at Summer Street
- Summer Street at South Common Street
- Summer Street at Walnut Street
- Summer Street at Thomas Road
- Walnut Street at Thomas Road
- Walnut Street at I-95 Southbound Ramps/Site Drive (2)
- Walnut Street at I-95 Northbound Ramps
- Salem Street at Walnut Street
- Salem Street at Summer Street
- Salem Street at Route 1 Ramps (2)

Wakefield:

- Audubon Road at Site Drive

- Audubon Road at I-95 Southbound Ramps
- Salem Street at Pleasure Island Road
- Salem Street at Montrose Avenue
- Salem Street at I-95 Northbound Ramps

In addition to the intersections mentioned above, VHB conducted a preliminary safety evaluation for the intersection of Walnut Street at Gianna Drive at the request of the Town of Lynnfield. It was concluded that Gianna Drive is located along a horizontal curve that hinders line-of-sight when approaching Gianna Drive southbound and while looking left exiting Gianna Drive. While there are speed limit signs north and south of Gianna Drive along Walnut Street, the installation of warning signage is recommended to help enforce the speed limit as well as alert drivers of the hidden street ahead.

Manual turning movement counts [collecting *peak hour* data] were conducted at each of the study-area intersections during the weekday morning peak period (7:00 AM-9:00 AM), weekday evening peak period (4:00 PM-6:00 PM) and Saturday midday peak period (11:00 AM-1:00 PM) in November and December 2006. Concurrent with the TMCs, automatic traffic recorder (ATR) counts were conducted on Walnut Street and Audubon Road in November 2006 for a period of 72 hours.

The proposed project is expected to generate approximately 472 new morning peak hour trips (306 entering/166 exiting), 1,440 new evening peak hour trips (652 entering/788 exiting), and 2,017 new Saturday midday peak hour trips (1,052 entering/965 exiting). Due to the seasonal nature of golf-related traffic and the fact that Conference Center traffic is not present every day, no traffic credit was taken for the removal of each of these current uses. This provides a conservative assessment of the expected increase in traffic to/from the site.

Capacity analyses were conducted for each of the study area intersections under 2007 Existing conditions, 2012 No-Build conditions (without the proposed redevelopment), and 2012 Build conditions (with the proposed redevelopment). Based on the results of these analyses and the anticipated site-generated traffic, the proponent will implement mitigation measures at the following locations:

- Walnut Street at I-95 Southbound Ramps/Colonial Golf Club Driveway
- Walnut Street at I-95 Northbound Ramps
- Walnut Street at Salem Street
- Walnut Street at Summer Street
- Audubon Road at Colonial Golf Club Driveway
- Pleasure Island Road at I-95 Southbound Ramps

In addition to the intersection/roadway mitigation proposed as part of the project, the proponent will also implement a comprehensive Transportation Demand Management (TDM) program on the site to promote alternative modes of transportation and reduce vehicle traffic to/from the site.

Overall, VHB concludes that the implementation of the above-mentioned mitigation measures not only accommodates future site-generated traffic but also improves some existing operational deficiencies in the vicinity of the site.

1

Introduction

Vanasse Hangen Brustlin, Inc. (VHB) has been retained by National Development to evaluate the transportation impacts associated with the proposed Meadow Walk at Lynnfield Mixed-Use redevelopment in Lynnfield, Massachusetts. This traffic impact and access study has been prepared with extensive input and review by the Town of Lynnfield and the Town's peer review consultant Greenman Pedersen, Inc. This study includes a thorough evaluation of existing transportation conditions in and around the project site, an estimation of traffic impacts associated with the development program, and has formulated a series of enhancements for addressing existing capacity deficiencies as well as project-related impacts.

Redevelopment Description

The proposed Meadow Walk at Lynnfield redevelopment envisions a mixed-use neighborhood development at the site of the current Colonial Golf Club in Lynnfield. As proposed, the project will contain a variety of residential, office, and retail uses along with open space, pedestrian, bicycle, and roadway connections so as to create a self-sustaining "urban village" designed following smart growth principles.

Under existing conditions the site is currently occupied by the Colonial Golf Club (18-hole golf course), Boston Sports Club (55,000 sf), a Conference Center (14,500 sf), and the Sheraton Hotel (280 rooms). As currently proposed, the redevelopment would involve the removal of the existing Conference Center portions of the site as well as nine holes of the 18-hole Colonial Golf Club facility. Both the hotel and Boston Sports Club would remain. In place of the uses to be removed, the current proposal involves the construction of approximately 390,000 sf of "lifestyle retail" space, 80,000 sf of office space and 220 residential units (180 Apartments and 40 Age-Restricted units). Primary access to the site is proposed on Walnut Street in the area of the existing Colonial Golf Club Driveway and Secondary Access is proposed on Audubon Road in the area of the existing Colonial Golf Club/Sheraton Driveway. Figure 1 shows the proposed site plan.

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Not to Scale

Vanasse Hangen Brustlin, Inc.

Proposed Site Plan

Figure 1

Meadow Walk at Lynnfield
Lynnfield, Massachusetts

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Study Area

The study area selected for the project generally extends along Summer Street from Main Street to Salem Street, Walnut Street from Summer Street to Salem Street, Audubon Road from the Site Driveway to Salem Street, and Salem Street from the Route 128 Northbound Ramps to the Route 1 Ramps. As shown in Figure 2, within these general boundaries, the study area encompasses the following intersections:

Lynnfield:

- Main Street at South Common Street
- Main Street at Summer Street
- Summer Street at South Common Street
- Summer Street at Walnut Street
- Summer Street at Thomas Road
- Walnut Street at Thomas Road
- Walnut Street at I-95 Southbound Ramps/Site Drive (2)
- Walnut Street at I-95 Northbound Ramps
- Salem Street at Walnut Street
- Salem Street at Summer Street
- Salem Street at Route 1 Ramps (2)

Wakefield:

- Audubon Road at Site Drive
- Audubon Road at I-95 Southbound Ramps
- Salem Street at Pleasure Island Road
- Salem Street at Montrose Avenue
- Salem Street at I-95 Northbound Ramps

In addition to the 18 intersections mentioned above, VHB will also conduct a preliminary safety evaluation for the intersection of Walnut Street at Gianna Drive at the request of the Town. This evaluation is summarized in the Existing Conditions Chapter.

Study Methodology

This traffic assessment has been conducted generally in conformance with those guidelines set forth by the Massachusetts Executive Office of Environmental Affairs (EOEA)/ Executive Office of Transportation (EOT) and the Town of Lynnfield. The assessment was conducted in a multi-step process including three primary stages. The first stage involved an assessment of existing traffic conditions within the project area including an inventory of existing roadway geometry, observations of traffic flow, daily, and peak period traffic counts, and a review of traffic safety and pedestrian/bicycle facilities in the area.

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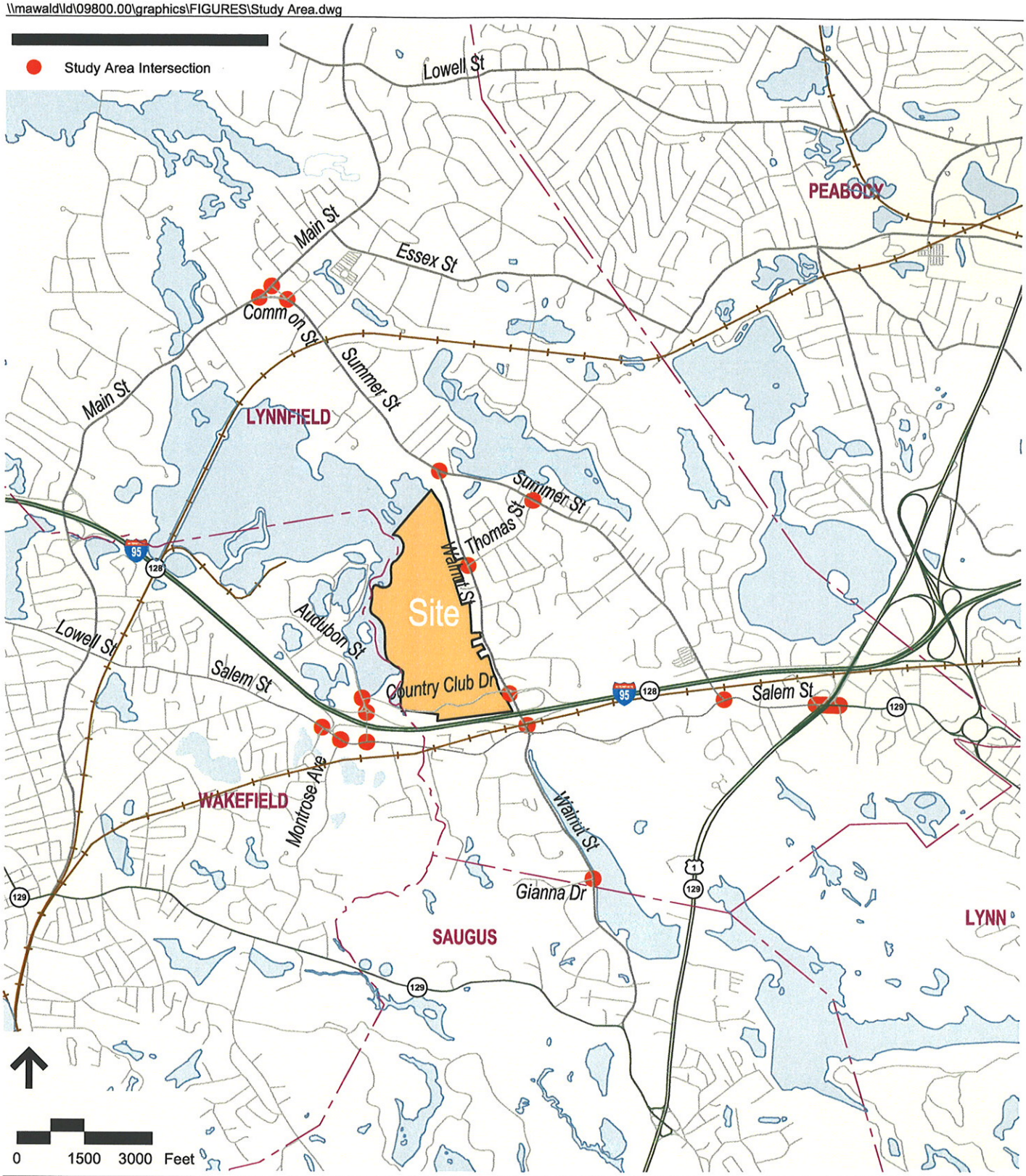

Vanasse Hangen Brustlin, Inc.

Site Location Map and
Study Area Intersections

Figure 2

Meadow Walk at Lynnfield
Lynnfield, Massachusetts

The second stage of the study established the framework for evaluating the transportation impacts of the proposed project. Future traffic demands on the study area roadways due to projected background traffic growth and other proposed area development that will occur independent of the proposed development were determined along with the assessment of specific travel demand forecasts for the project. Specific traffic impacts associated with both the proposed development program was then identified and is summarized later in this report.

For the purposes of this assessment, the baseline analysis is founded on existing traffic volumes and conditions observed by VHB in 2006 and grown one year to represent 2007 Existing Conditions. Under the 2012 No-Build Condition normal background traffic growth and traffic associated with other known projects was also incorporated into the analysis. Planned roadway improvements associated with those background projects as well as Town and MassHighway sponsored improvements were also incorporated into the analysis. Traffic associated with the development was then overlaid onto the 2012 No-Build conditions to develop the 2012 Build condition.

The third and final stage involved conducting traffic analyses to identify both existing and projected future intersection and roadway capacities and demands. This information forms the basis for the development of transportation infrastructure investments needed to support both existing and future traffic impacts associated with regional development as well as specific impacts associated with the proposed development.

2

Existing Conditions

Evaluation of the transportation impacts associated with the proposed project requires a thorough understanding of the existing transportation system in the project study area. A complete inventory and evaluation of the existing transportation system in the study area was conducted. The analysis of existing transportation conditions is based on the existing network, roadway and intersection geometry, traffic control, existing daily and peak hour traffic volumes, traffic safety conditions, and existing public transportation. A detailed description of existing conditions within the study area is presented in this section. Figure 3 shows the roadway jurisdictions within the study area.

Roadway Geometry

A mixture of residential, commercial and office uses characterizes the study area. The major travel routes and intersections within the study area are described below.

Roadways

Summer Street

Summer Street is a northwest/southeast running, suburban arterial roadway that is under local Town of Lynnfield jurisdiction. This roadway provides a connection between the northernmost Lynnfield Center and South Lynnfield, as it runs between Main Street and Salem Street. Summer Street provides a single travel lane in each direction along the length of the roadway, with a posted speed limit of 35 miles per hour [mph] in each direction. Sidewalks line the northeast side of Summer Street and there are intermittent sidewalks along the southwest side of the road. Land use along Summer Street is predominantly residential with the exception of the northernmost end which consists of the Lynnfield Center Golf Club, the Town Library, various municipal buildings and a church. On-street parking is permitted along the northeast side of the roadway within Lynnfield Center.

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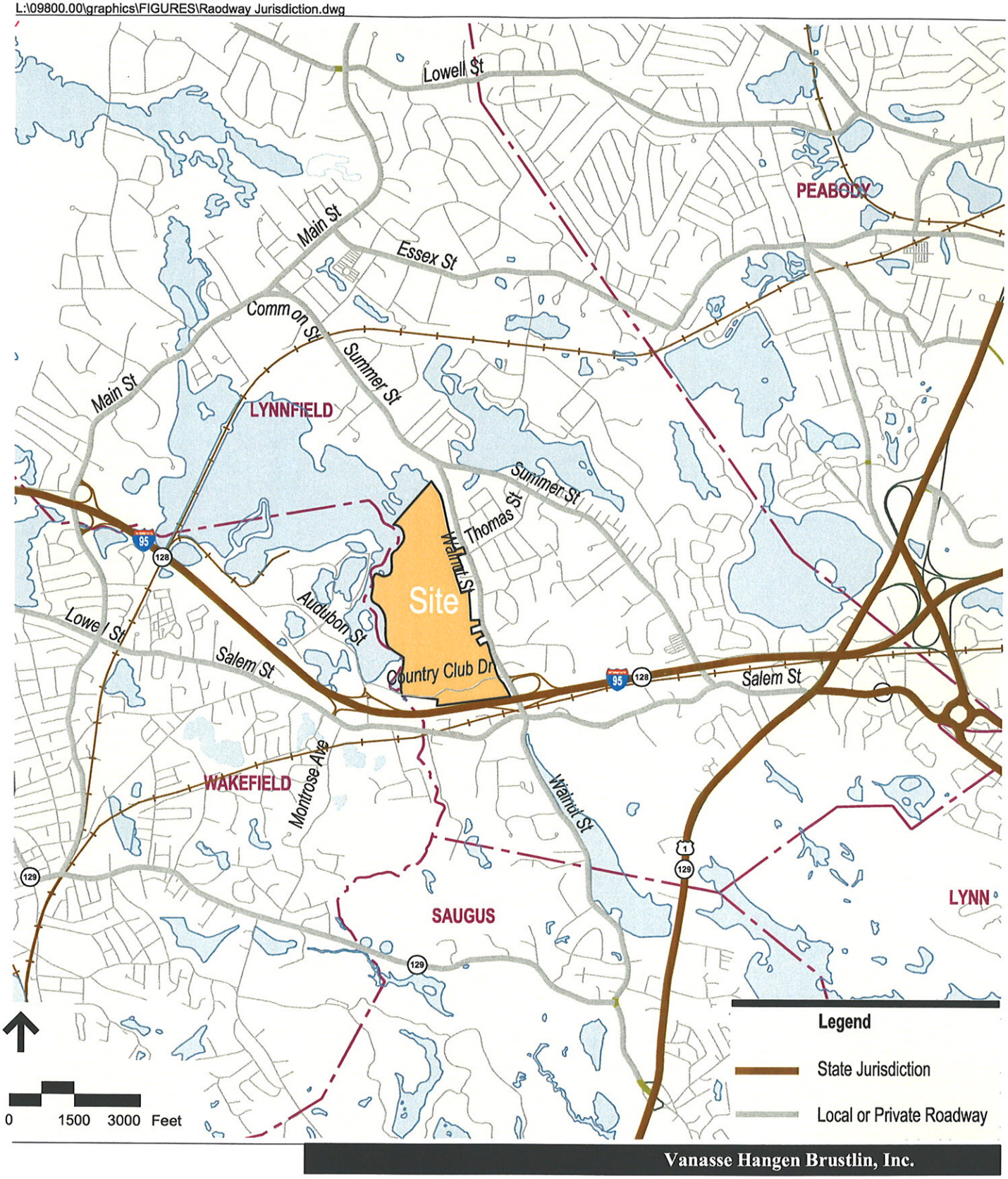


Roadway Jurisdiction Map Figure 3

Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Salem Street

Salem street is an east/west running, arterial roadway that extends from Wakefield to the west and Peabody to the east. Within the study area, Salem Street is under local Town of Wakefield jurisdiction west of the townline, and Lynnfield jurisdiction east of the townline to Route 1. The jurisdiction of Salem Street becomes MassHighway east of Route 1. Salem Street provides a single travel lane in each direction with turning lanes present at major intersections. Salem Street provides access to Route 1 and Interstate 95/ Route 128. The posted speed limit on Salem Street between Walnut Street and Summer Street is 25 miles per hour [mph] and 30 miles per hour [mph] elsewhere, in both directions of travel. Sidewalks are intermittent along both sides of this roadway. Land use in the area is a mix of residential, retail and office.

Walnut Street

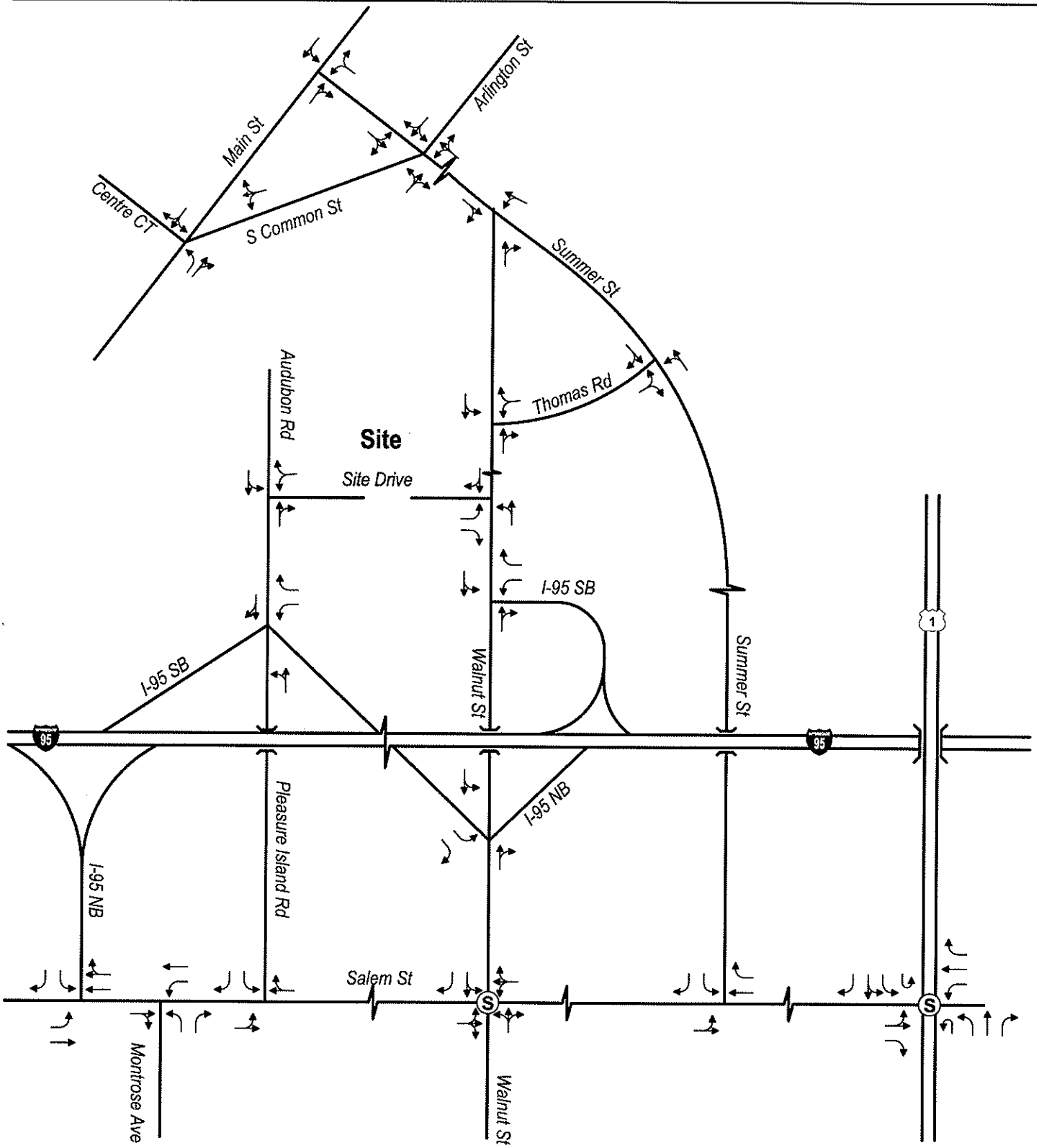
Walnut Street is a north/south running, suburban arterial roadway that extends from Summer Street in the north, to the Saugus line in the south. The length of the roadway is under local Town of Lynnfield jurisdiction, aside from the short section between the exit 43 Interstate 95 access ramps, which is under MassHighway jurisdiction. Within the study area, Walnut Street provides a single travel lane in each direction, with a posted speed limit of 30 miles per hour [mph] north of Salem Street, and 35 miles per hour [mph] south of Salem Street. This intersection is the only signalized intersection along Walnut Street within the study area. South of this intersection, there is a restriction on access for trucks over 2 ½ tons. Sidewalks are present on the east side of Walnut Street for the length of the roadway within the study area. Land use along Walnut Street is predominately residential with the exception of the area immediately adjacent to the I-95 where there is a hotel, fitness club and golf course.

Intersections

The following sections describe the study-area intersections in detail. Figure 4 shows the observed existing intersection geometry and traffic control at each study-area intersection.

Main Street at South Common Street/Centre Court

- Four-way skewed unsignalized intersection
- Main Street runs northeast/ southwest; stop-controlled South Common Street intersects Main Street from the east
- The southwest and westbound approaches both consist of a single general-purpose lane
- The northbound approach consists of one left-turn lane into Centre Court and one shared through/right-turn lane
- Centre Court is one-way away from the intersection



Not to Scale

Vanasse Hangen Brustlin, Inc.

Study Area Intersection Geometry Figure 4

Meadow Walk at Lynnfield
Lynnfield, Massachusetts

- On-street parking is prohibited along the both sides of South Common Street
- Pedestrian facilities include sidewalks along both sides of Main Street and along the south side of South Common Street; crosswalks cross both roadways
- Surrounding land use consists of a memorial park, residential and mixed retail

Main Street at Summer Street

- Three-way unsignalized intersection
- Main Street runs northeast/ southwest; stop-controlled Summer Street intersects Main Street from the southeast
- All approaches consist of a single general-purpose lane
- On-street parking is permitted along the northeast side of Summer Street
- Pedestrian facilities include sidewalks along both sides of Main Street and along the northeast side of Summer Street; crosswalks cross both roadways
- Surrounding land use consists of a memorial park, a church and residential

Summer Street at South Common Street/Arlington Street

- Four-way skewed unsignalized intersection
- Summer Street runs northwest/ southeast; South Common Street intersects Summer Street from the west
- The eastbound South Common Street, westbound Arlington Street, and southbound Summer Street approaches are stop-controlled while the northbound Summer Street approach runs free
- All approaches consist of a single general-purpose lane
- On-street parking is permitted along the northeast side of Summer Street
- Pedestrian facilities include sidewalks along both sides of Summer Street southeast of the intersection, on the northeast side of Summer Street northwest of the intersection and along the south side of South Common Street; crosswalks cross all approaches
- Surrounding land use consists of a memorial park, public library, municipal buildings and a post office

Summer Street at Walnut Street

- Three-way unsignalized intersection
- Summer Street runs east/ west; stop-controlled Walnut Street intersects Summer Street from the south
- All approaches consist of a single general-purpose lane
- Pedestrian facilities include sidewalks along the north side of Summer Street and along the east side of Walnut Street
- Surrounding land use is residential

Summer Street at Thomas Road

- Three-way unsignalized intersection
- Summer Street runs east/ west; Thomas Road intersects Summer Street from the south
- All approaches consist of a single general-purpose lane
- Pedestrian facilities include sidewalks along the north side of Summer Street and along the east side of Thomas Road
- Surrounding land use is residential

Walnut Street at Thomas Road

- Three-way unsignalized intersection
- Walnut Street runs north/ south; Thomas Road intersects Walnut Street from the east
- All approaches consist of a single general-purpose lane
- Pedestrian facilities include sidewalks along the east side of Walnut Street and along both sides of Thomas Road
- Surrounding land use is residential

Walnut Street at Interstate 95 Southbound Ramps/ Site Drive

- Four-way offset unsignalized intersection
- Walnut Street runs north/ south; the stop-controlled site drive intersects Walnut Street from the west; the stop-controlled I-95 southbound ramps intersect Walnut Street from the east, just south of the Site Driveway
- Both Walnut Street approaches consist of a shared through/ left-turn lane and a channelized yield-controlled right-turn lane
- The Site Drive approach consists of an exclusive left-turn and exclusive right-turn lane
- The I-95 southbound off-ramp consists of an exclusive left-turn lane and a channelized yield-controlled right-turn lane
- Pedestrian facilities include sidewalks along the east side of Walnut Street and crosswalks crossing the I-95 ramps
- Surrounding land use consists mainly of the Colonial Golf Club, hotel, fitness club, and residential uses

Walnut Street at Interstate 95 Northbound Ramps

- Four-way unsignalized intersection
- Walnut Street runs north/ south; the stop-controlled I-95 northbound off-ramp intersects Walnut Street from the west; the I-95 northbound onramp intersects Walnut Street from the east
- The northbound Walnut Street approach consists an exclusive through lane and a channelized yield-controlled right-turn lane; the southbound Walnut Street approach consists of a shared through/ left-turn lane

- The I-95 northbound off-ramp consists of an exclusive left-turn lane and a channelized stop-controlled right-turn lane
- The east/ west running Salem Street intersects Walnut Street approximately one-hundred feet south at a signalized intersection
- Pedestrian facilities include sidewalks along the east side of Walnut Street and crosswalks crossing the I-95 onramps
- Surrounding land use consists of residential to the south and Interstate 95 to the north

Salem Street at Walnut Street

- Four-way signalized intersection
- Walnut Street runs north/ south; Salem Street runs east/ west
- Both Walnut Street approaches consist of a shared through/ left-turn lane and a channelized yield-controlled right-turn lane
- Both Salem Street approaches consist of a single general-purpose lane
- Trucks over 2 ½ tons are not permitted to travel on Walnut Street south of Salem Street
- Pedestrian facilities include sidewalks along the east side of Walnut Street and along the north side of Salem Street to the west of the intersection and both sides of Salem Street to the east; no crosswalks or pedestrian buttons are present
- Surrounding land use consists of residential to the south and Interstate 95 to the north

Audubon Road at Site Drive

- Three-way unsignalized intersection
- Audubon Road runs north/ south; the Site Drive intersects Audubon Road from the east
- All approaches consist of a single general-purpose lane
- Pedestrian facilities include intermittent sidewalk along the west side of Audubon Road
- Surrounding land use consists of hotel, office and the Colonial Golf Club

Audubon Road/ Pleasure Island Road at Interstate 95 Southbound Ramps

- Four-way unsignalized intersection
- Audubon Road runs north/ south and is known as Pleasure Island Road south of the intersection; the stop-controlled I-95 southbound off-ramp intersects Audubon Road from the east; the I-95 southbound onramp intersects Audubon Road from the west
- The northbound Pleasure Island Road approach consists a shared through/ left-turn lane; the southbound Audubon Road approach consists of a channelized yield-controlled right-turn lane and exclusive through lane
- The I-95 southbound off-ramp consists of an exclusive left-turn lane and a channelized stop-controlled right-turn lane
- Pedestrian facilities include faded crosswalks crossing the I-95 off-ramps and a worn path along the east side of Audubon Road

- Surrounding land use consists of hotel, office, the Colonial Golf Club, and Interstate 95 to the south

Salem Street at Pleasure Island Road

- Three-way unsignalized intersection
- Salem Street runs east/ west; the stop-controlled Pleasure Island Road intersects Salem Street from the north
- Additional traffic control at this intersection includes a flashing red beacon for the southbound approach
- All approaches consist of a single general-purpose lane although Pleasure Island Road operates as an exclusive left-turn and exclusive right-turn lane approach
- Pedestrian facilities include intermittent sidewalk along the south side of Salem Street
- Surrounding land use consists of office, small retail and a gas station

Salem Street at Montrose Avenue

- Three-way unsignalized intersection
- Salem Street runs east/ west; the stop-controlled Montrose Avenue intersects Salem Street from the south
- The Salem Street eastbound approach consists of a single general purpose lane; the westbound Salem Street approach consists of an exclusive through and an exclusive left-turn lane
- The Montrose Avenue approach consists of an exclusive left-turn and an exclusive right-turn lane
- Pedestrian facilities include intermittent sidewalk along the north side of Salem Street and along the west side of Montrose Avenue; crosswalks cross both roadways
- Surrounding land use consists of scattered residential, I-95 ramps and an under-construction gas station

Salem Street at Interstate 95 Northbound Ramps

- Three-way unsignalized intersection
- Salem Street runs east/ west; the stop-controlled I-95 northbound ramps intersect Salem Street from the north
- Additional traffic control at this intersection includes a flashing red beacon for the off-ramp approach and flashing yellow for the Salem Street approaches
- The eastbound Salem Street approach consists of an exclusive through and exclusive left-turn lane; the westbound approach consists of two exclusive through lanes and a channelized yield-controlled right-turn lane
- The I-95 northbound offramp consists of an exclusive stop-controlled left-turn lane and a channelized yield-controlled right-turn lane
- No pedestrian facilities are present

- Surrounding land use consists of scattered residential and I-95

Summer Street at Salem Street

- Three-way unsignalized intersection
- Salem Street runs east/ west; Summer Street intersects Salem Street from the north
- All approaches consist of a single general-purpose lane although Summer Street operates as an exclusive left and exclusive right-turn approach and westbound on Salem Street operates as an exclusive through and exclusive right-turn approach
- Pedestrian facilities include sidewalks along the north side of Salem Street and both sides of Summer Street; crosswalks cross Summer Street
- Surrounding land use consists of residential, a fire house and a gas station

Salem Street at Route 1 Ramps

- Four-way signalized intersection
- The Route 1 ramps runs north/ south; Salem Street runs east/ west
- The northbound Route 1 approach consists of a channelized yield-controlled u-turn lane, exclusive right-turn, exclusive through and exclusive left-turn lanes; the Route 1 southbound approach consists of a channelized yield-controlled u-turn lane, an exclusive right-turn lane, a shared through/right-turn lane, and a shared through/left-turn lane
- The Salem Street eastbound approach consists of a shared through/left-turn lane and a channelized yield-controlled right-turn lane; Salem Street westbound consists of shared through/left-turn lane, an exclusive through lane and a channelized yield-controlled right-turn lane
- Pedestrian facilities include sidewalks along all approaches of the intersections; crosswalks cross all approaches and pedestrian buttons are present
- Surrounding land use consists of residential to the south and Interstate 95 to the north

Traffic Volumes

To determine the existing operational conditions at the study area intersections, a review of existing condition traffic volumes was conducted. Daily traffic volume data were collected along Walnut Street and Audubon Road, both north of the Site Driveways in November 2006 for a period of 72 hours. The observed traffic volume data are summarized below in Table 1.

Table 1
Existing Traffic Volume Summary

Location	Daily		Peak Hour								
			Weekday Morning			Weekday Evening			Saturday Midday		
	Weekday (vpd)*	Saturday (vpd)*	Vol. (vph)**	"K" Factor***	Directional Flow	Vol. (vph)**	"K" Factor	Directional Flow	Vol. (vph)**	"K" Factor	Directional Flow
Audubon Road north of Sheraton Site Driveway	10,400	2,000	1,325	12.7%	92% NB	1,205	11.6%	90% SB	205	10.2%	66% SB
Walnut Street north of Sheraton Site Driveway	6,800	6,000	685	10.0%	72% SB	560	8.2%	62% NB	475	8.0%	52% NB

Source: 72-hour Automatic Traffic Recorder (ATR) counts conducted by VHB in November 2006.
* Daily traffic expressed in vehicles per day.
** Peak hour volumes expressed in vehicles per hour.
*** Percent of daily traffic, which occurs during the peak hour.
Notes: EB = eastbound, WB = westbound, SB = southbound, NB = northbound. Peak hours do not necessarily coincide with the peak hours of the turning movement counts.

As shown in Table 1, Audubon Road carries approximately 10,400 vehicles on a typical weekday with 12.7 percent occurring during the morning peak hour and 11.6 percent occurring during the evening peak hour, while it carries 2,000 vehicles on a Saturday with 10.2 percent during the midday peak hour. The differential between weekday and Saturday daily volumes on Audubon Road is due in large part to the fact that Audubon Road primarily services office buildings north of the site, thereby making Saturday traffic on the roadway significantly lower than that of the weekday. Walnut Street carries approximately 6,800 vehicles on a typical weekday with 10.0 percent during the morning peak hour and 8.2 percent during the evening peak hour. On a Saturday, it carries approximately 6,000 vehicles daily with 8.0 percent during the midday peak hour.

In addition, manual turning movement counts (TMCs) were conducted at the study area intersections during the weekday morning peak period (7:00 AM-9:00 AM), weekday evening peak period (4:00 PM-6:00 PM) and Saturday midday peak period (11:00 AM-2:00 PM) in November and December 2006. VHB conducted ATR counts during the TMC data collection periods to ensure that November and December data was outside holiday season influence. ATR counts concluded that there was negligible variation been the data collected prior to Thanksgiving and data collected between Thanksgiving and Christmas. In should be noted, also, that due to the fact that the traffic counts were conducted so close to the end of the year, the 2006 traffic data was grown one percent to represent 2007 Existing Conditions.

■

Seasonal Variation

MassHighway Statewide Traffic Data Collection was reviewed for the months of November and December to determine seasonal variation in traffic volumes associated with urban roadways during these months. Based on the assessment, November and December traffic volumes are higher than the statewide average month traffic volume level for urban and arterial collector roadways. Since the count data were found to be higher than annual

average conditions, no seasonal adjustments were applied to the data. MassHighway Season Factors are contained in the Appendix of this document. The resulting 2007 Existing Conditions traffic volume networks for the weekday morning, weekday evening, and Saturday midday peak hour are summarized in Figures 5 through 7.

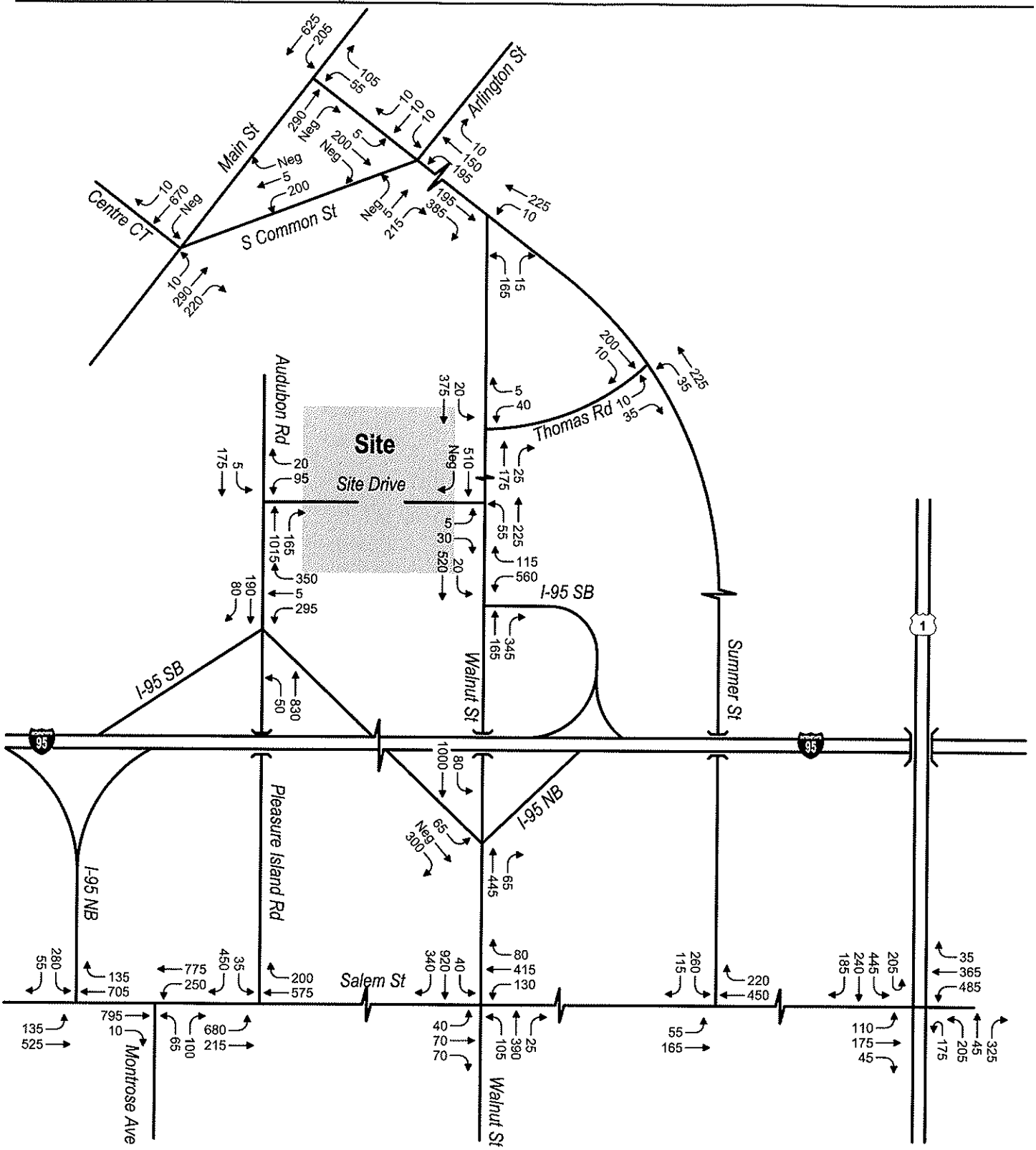
Safety Assessment

To identify potential vehicle crash trends and/or roadway deficiencies in the project study area, crash data for the study area intersections was obtained from MassHighway for the years 2003 to 2005. A summary of the study intersections vehicle crash history is presented in Table 2.

Crash rates are calculated based on the number of crashes at an intersection and the volume of traffic traveling through that intersection on a daily basis. Rates that exceed MassHighway's average for crashes at intersections in the district in which the town or city is located (District 4 for Lynnfield) could indicate safety or geometric issues for a particular intersection and warrant further examination. The latest published crash rate by MassHighway in District 4 is 0.88 for signalized intersection and 0.63 for unsignalized intersections. These rates imply that, on average, 0.88 crashes occurred per million vehicles entering signalized intersections throughout District 4, and 0.63 crashes occurred per million vehicles entering unsignalized intersections. It should be noted that the location for some crashes cannot be precisely determined from the database due in large part to how the vehicle crashes are reported and entered into the database. For instance, a crash record classified as "I-95 at exit 43" may have occurred at either the intersection of Walnut Street with the Northbound Ramps, Walnut Street with the Southbound Ramps, or on the interstate in close proximity to the ramps. Additionally, some crashes may have occurred but were either not reported or not included in the database, and therefore not considered.

Review of the crash data indicates that the intersections of Walnut Street and the I-95 Ramps experienced a total of 28 vehicle crashes, the highest number of vehicle crashes in the study area. It should be noted that the reporting of crashes at this location did not consistently indicate which ramp experienced the crash or whether the crash occurred on the ramp and not on I-95 in proximity to the ramps. The location of the all the crashes could not be precisely decided, therefore. The majority of the crashes at the location were classified as rear-end collisions, which indicates that drivers must quickly stop when they realize the presence of a vehicle ahead. This condition may potentially be the result of the lack of available gaps and a large number of turning vehicles with no controls for this movement. Most crashes occurred during off-peak periods and under dry conditions.

The second highest location also involves I-95 Ramps, at Audubon Road with the I-95 Southbound Ramp. A total of 25 crashes were reported at the ramp, accounting for a 1.17 crash rate at this location. The majority of the collisions were rear-ends – similar to the Walnut Street I-95 ramps. Most crashes occurred at off-peak periods and under dry conditions.

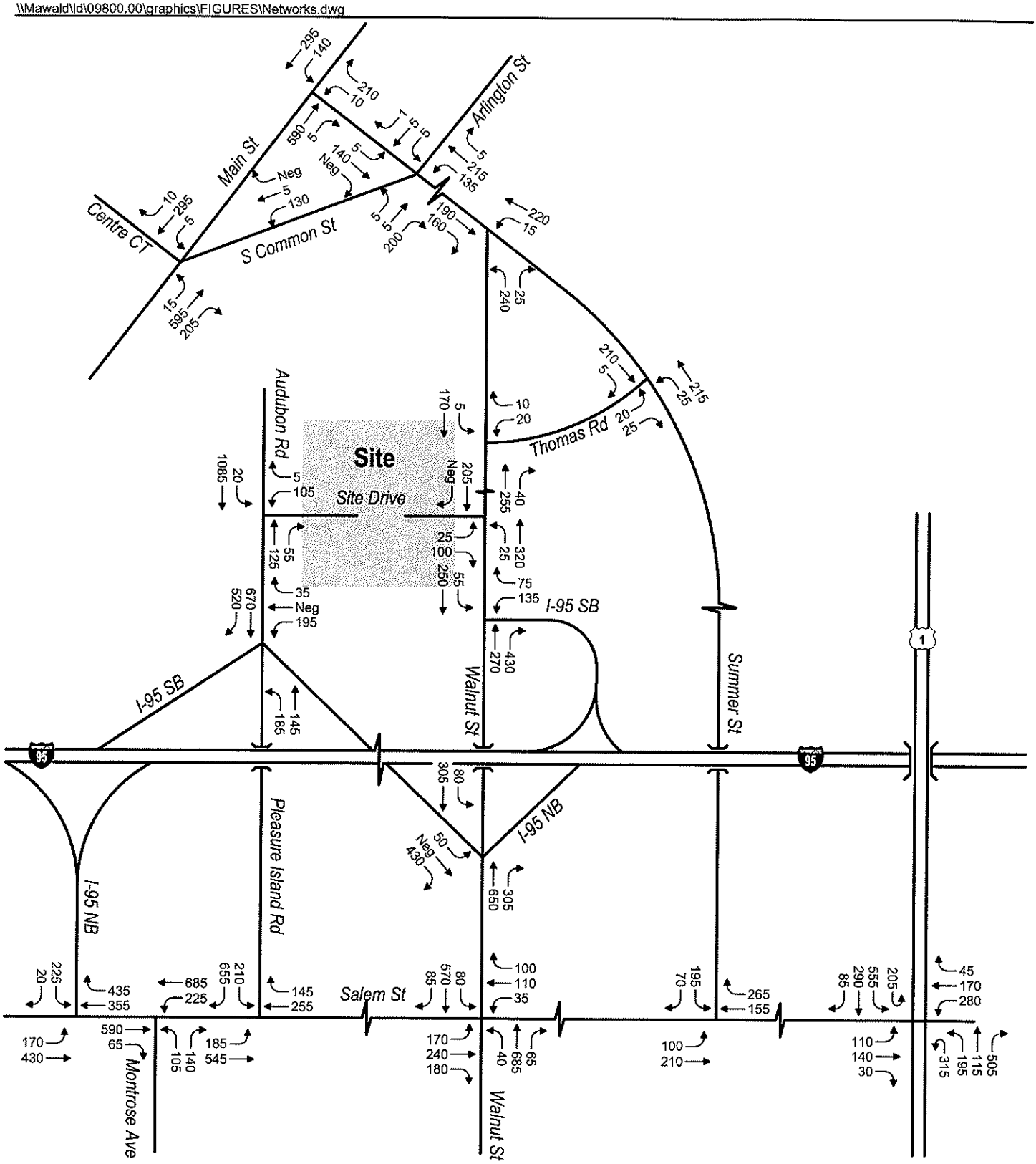


Not to Scale

Vanasse Hangen Brustlin, Inc.

2007 Existing Conditions
Weekday Morning Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 5

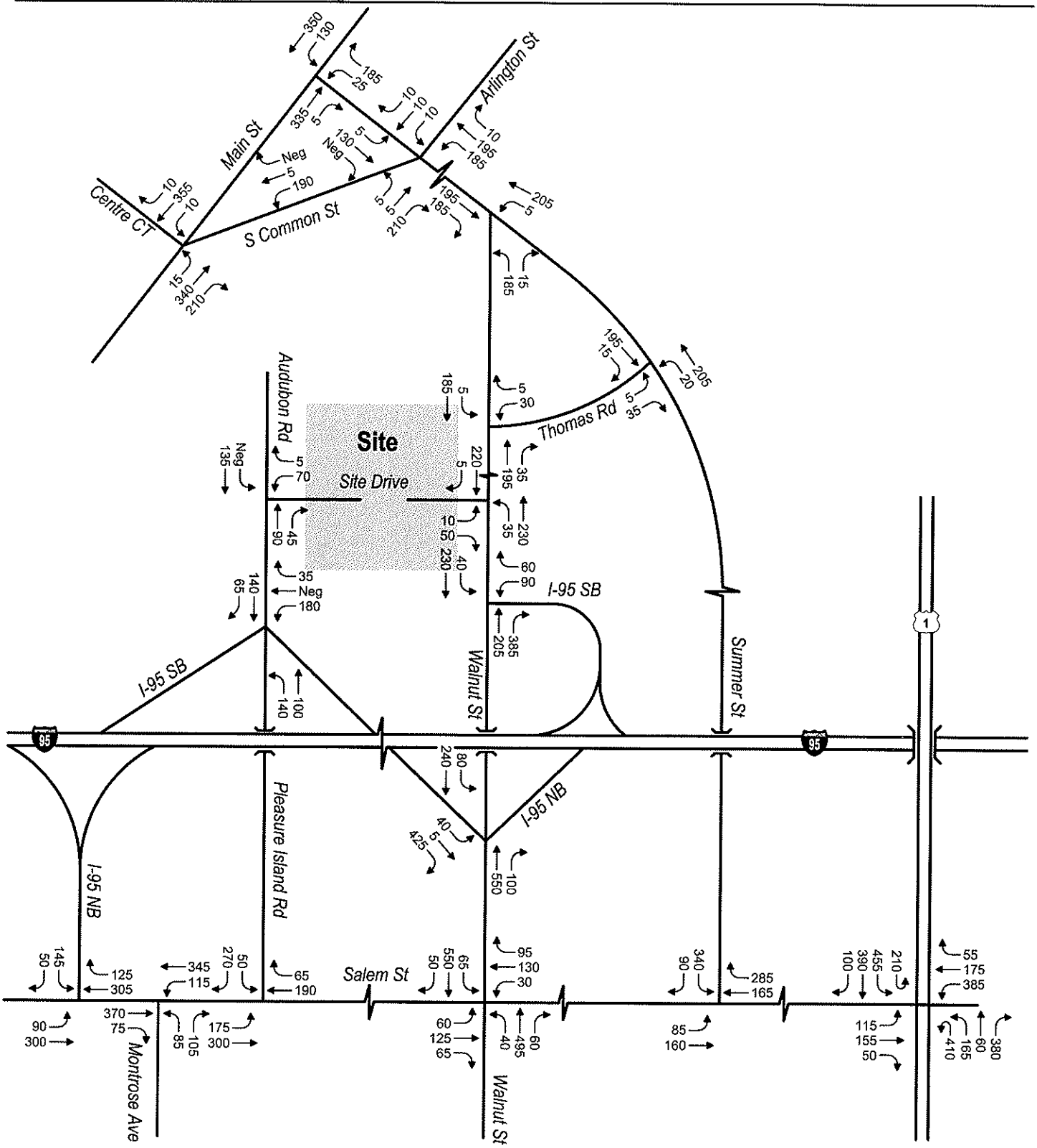


Not to Scale

Vanasse Hangen Brustlin, Inc.

2007 Existing Conditions
Weekday Evening Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 6



Not to Scale

Vanasse Hangen Brustlin, Inc.

2007 Existing Conditions
Saturday Midday Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 7

Salem Street at the Route 1 ramps experienced 21 crashes during the three year period. Similar to crash reporting at Walnut Street and the I-95 Ramps, collision reports at this location did not consistently indicate which ramp experienced the crash or whether the crash occurred on the ramp and not Route 1 in close proximity to the ramps. As such, crash rates could not be accurately calculated for the ramps. Most crashes occurred during off-peak periods and under dry conditions. It should be noted, also, that there is a relatively even distribution of collision types at the ramps; angle, rear-end, sideswipe, and single-vehicle collision type all average four/five crashes in the three year period.

As discussed in subsequent sections of this report, the Proponent is planning significant mitigation that will improve relative safety at both the exit 42 and exit 43 ramp terminals. The effect should dramatically improve on the existing safety concerns.

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Table 2

Vehicular Crash Summary [2003 – 2005]

	Main Street at		Summer Street at:				Salem Street at:					Walnut Street at:		Audubon Road at:	
	S. Common St.	Summer St.	S. Common St.	Walnut St.	Thomas Rd.	Salem St.	Montrose Ave.*	I-95 NB Ramps*	Pleasure Island Rd.	Walnut St.	Route 1 Ramps	Thomas Rd.	I-95 Ramps	Site Drive	I-95 SB Ramps
Signalized?	No	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No
Year															
2003	1	1	0	0	0	0	3	4	4	4	9	0	11	0	7
2004	1	2	0	0	0	1	4	4	6	3	2	0	6	0	8
2005	1	0	1	0	0	0	2	2	2	6	10	0	11	0	10
Total	3	3	1	0	0	1	9	10	12	13	21	0	28	0	25
Collision Type															
Angle	3	1	0	0	0	0	5	3	6	9	4	0	4	0	4
Head-on	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Rear-end	0	1	0	0	0	1	1	4	4	2	5	0	10	0	12
Sideswipe	0	0	1	0	0	0	0	0	0	1	4	0	4	0	1
Single Vehicle Crash	0	0	0	0	0	0	2	2	1	0	4	0	8	0	5
Unknown	0	1	0	0	0	0	1	1	0	1	3	0	2	0	3
Total	3	3	1	0	0	1	9	10	12	13	21	0	28	0	25
Severity															
Fatality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Injury	1	1	0	0	0	0	4	3	4	6	7	0	11	0	6
Property	1	1	1	0	0	1	5	6	7	3	13	0	14	0	15
Unknown	1	1	0	0	0	0	0	1	1	4	1	0	3	0	3
Total	3	3	1	0	0	1	9	10	12	13	21	0	28	0	25
Time of day															
Weekday, 7:00 AM-9:00 AM	1	1	0	0	0	0	2	0	1	0	0	0	7	0	5
Weekday, 4:00 PM – 6:00 PM	1	1	0	0	0	0	1	2	3	1	0	0	2	0	6
Saturday, 11:00 AM – 2:00 PM	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Weekday, other time	1	1	1	0	0	0	4	4	7	6	12	0	15	0	12
Weekend, other time	0	0	0	0	0	1	2	4	1	4	9	0	4	0	2
Total	3	3	1	0	0	1	9	10	12	13	21	0	28	0	25
Pavement Conditions															
Dry	3	3	0	0	0	0	5	9	9	9	12	0	15	0	17
Wet	0	0	1	0	0	0	3	0	3	4	8	0	8	0	7
Snow	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0
Ice/Slush	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0
Unknown	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1
Total	3	3	1	0	0	1	9	10	12	13	21	0	28	0	25
MassHighway Crash Rate	0.20	0.20	0.12	0.00	0.00	0.08	0.41	0.50	0.49	0.45	n/a	0.00	n/a	0.00	1.17
Does Intersection Exceed MassHighway Rate?	No	No	No	No	No	No	No	No	No	No	n/a	No	n/a	No	Yes

Source: MassHighway database.
Note that it is not always possible, with the database, to determine the precise locations of crashes. Some locations have been combined in order to provide the most accurate information available.
N/A Indicates multiple locations; crash rate could not be calculated.
* Temporary traffic signals are in place at this intersection. However, this intersection was unsignalized during the three-year period covered by the summarized crash records

Salem Street at Walnut Street experienced 13 crashes during the three year period. Roughly 70 percent of these crashes were angle-type collisions, which normally indicates that the traffic signal is not processing turning movements efficiently. Similarly, the intersections of Salem Street with Pleasure Island Road, I-95 Northbound Ramps, and Montrose Avenue reported 11, 10, and 9 crashes, respectively, with the majority of crashes either angle-type of rear-end collisions.

All other intersections experienced fewer than five vehicle crashes in the three-year period.

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Gianna Drive Safety Evaluation

VHB conducted a sight distance evaluation for the intersection of Walnut Street and Gianna Drive as requested by the Town of Lynnfield. Measurements were taken for Stopping Sight Distance and Intersection Sight Distance at this intersection in accordance with guidelines provided by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance considerations are divided into two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD). Stopping sight distance (SSD) is the distance required for a vehicle approaching an intersection from either direction to perceive, react, and come to a complete stop to avoid colliding with an object in the road. In this respect, SSD can be considered as the minimum visibility criterion for the safe operation of an unsignalized intersection.

Intersection sight distance (ISD) is based on the time required for perception, reaction and completion of the desired critical exiting maneuver (typically, a left turn) once the driver on a minor street approach (or a driveway) decides to execute the maneuver. Calculations for ISD include the time to (1) turn left and clear the near half of the intersection without conflicting with the vehicles approaching from the left; and (2) upon turning left, to accelerate to the operating speed on the roadway without causing approaching vehicles on the main road to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection. The AASHTO sight distance criteria are contained in the Appendix of this document. Table 3 presents a summary of the ISD and SSD analysis, based on the observed 85th percentile speed[1] of 37 mph traveling northbound and 39 mph traveling southbound along Walnut Street.

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[1] The 85th percentile speed of 37 mph northbound and 39 mph southbound based on an ATR vehicle speed study conducted by VHB. The posted speed limit is 30 mph in this area.

Table 3
Sight Distance Summary

Road	Stopping Sight Distance (feet)			Intersection Sight Distance (feet)		
	Traveling	Required [a]	Measured [b]	Looking	Minimum [a]	Measured [b]
Walnut Street at Gianna Drive	southbound	270 ft	200 ft	left	290 ft	180 ft
	northbound	290 ft	500+ ft	right	290 ft	345 ft

a Based on guidelines established in A Policy on the Geometric Design of Highways and Streets, Fifth Edition, American Association of State Highway and Transportation Officials (AASHTO), 2004 or the 85th percentile speed of 37 mph northbound and 39 mph southbound based on an ATR vehicle speed study conducted by VHB. The posted speed limit is 30 mph in this area.

b From field measurements taken by VHB

Gianna Drive is located along a horizontal curve with significant line-of-sight obstruction due to a retaining wall when approaching Gianna Drive traveling southbound and while looking left exiting Gianna Drive. A convex mirror has been installed on a utility pole opposite Gianna Drive to help drivers see oncoming southbound vehicles while turning onto Walnut Street. As shown in Table 3, the available SSD at the intersection of Walnut Street and Gianna Drive (southbound) fall below the AASHTO requirements. SSD northbound approaching Gianna Drive exceeds AASHTO required values.

As with SSD measurements north of Gianna Drive, ISD measurements looking left fall short of minimum ISD, suggested by AASHTO, due to the steep vertical curve. Available ISD looking to the south (right) exceeds the AASHTO values.

It should be noted that this is an existing problem at Gianna Drive with Walnut Street and that the contribution of new traffic to Walnut Street due to the proposed project is negligible. While there are speed limit signs north and south of Gianna Drive along Walnut Street, the installation of warning signage is recommended to help enforce the speed limit as well as alert drivers of the hidden street ahead. Signs such as "BLIND DRIVE AHEAD" or "SHARP CURVE" could be installed north of Gianna Drive to help improve safety at this location.

Pedestrian and Bicycle Facilities

A field inventory was conducted to determine the current availability of pedestrian facilities in the vicinity of the site. Currently, a fairly extensive pedestrian and bicycle infrastructure is available near the site, including continuous sidewalks along the north side of Salem Street and the east side of Walnut Street within close proximity of the proposed redevelopment. The site will have an extensive pedestrian and bicycle network and we will connect to existing facilities where possible.

Public Transportation

The Massachusetts Bay Transportation Authority (MBTA) offers several public transportation options within the vicinity of proposed site. Bus Route 136, Reading Depot - Malden Station, provides transit opportunity approximately 1.5 miles west of the site. Alternatively, Bus Routes 434, Peabody – Haymarket Express, and 436, Central Square – Lynn, offer transit options approximately 2.5 miles east of the site. All three routes provide connections to additional MBTA bus routes and the rapid transit system. Additionally, MBTA commuter rail lines to North Station in Boston may be accessed in neighboring town of Lynn, Reading, and Wakefield.

3

Future Conditions

To determine the impacts of the site-generated traffic volumes on the surrounding roadway network, future traffic conditions were developed. A 5-year horizon (2012) was evaluated in accordance with the Executive Office of Environmental Affairs/ Executive Office of Transportation (EOEA/EOT) criteria. The 2012 design horizon was selected both for consistency with standard EOEA/EOT guidelines, and also to coincide with the Colonial Golf Club redevelopment program.

These future traffic projections include regional background traffic growth and planned roadway improvements resulting in the No-Build conditions. Anticipated site-generated traffic volumes were superimposed upon the No-Build traffic volume networks to reflect the year 2012 Build condition in the study area.

No-Build Conditions

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. A frequently used procedure is to identify estimated traffic generated by planned new major developments that would be expected to affect the project study area roadways. An alternative procedure is to estimate an annual percentage increase and apply that increase to study area traffic volumes. To allow for a conservative analysis, historic traffic growth (or ambient growth), and traffic from specific area projects were included as defined below. Planned roadway improvements were also considered in the No-Build conditions.

Historic Traffic Growth

To develop the 2012 No-Build conditions layer, two elements of traffic growth were considered. MassHighway 2005 Traffic Volumes indicate 0.2 to 0.5 annual traffic growth according to the I-95 permanent count stations 0595L (south of Peabody ton line) and 5099 (south of Walnut Street). No other permanent count stations within close proximity of the site were available. Furthermore, traffic reports prepared by

other developments[2] in the area assumed a one percent growth for the area. To insure conservative analysis for this report, a 1.0 percent annual growth rate was assumed in our future conditions analysis. Historic traffic growth reference is contained in the Appendix of this document

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Site-Specific Growth

In addition to accounting for background growth, the traffic associated with other planned and/or approved developments near the site were considered. The following comprehensive listing of projects was discussed with the Towns of Lynnfield and Wakefield and was considered in the preparation of this report:

Table 4
Background Developments

Lynnfield	
Project	Location
Lynnfield Crossing :: 36 Condominiums	Salem Street
Grandview Estates :: 9 Single-Family Homes and 40 Townhouses	Salem Street
41-unit Senior Housing Development	Salem Street
Lynnfield Commons :: 200-unit 40B Apartments	Salem Street / Route 1
Trucking Terminal	Kimball Lane
Wakefield	
Project	Location
Irving Gas Station / Convenience Store	Salem Street
Al Prime Gas Station	Salem Street / Lowell Street
Dunkin Donuts	Salem Street
28-unit Condominium Development	Salem Street
200-unit Apartment Development (Colonial Point) *	Audubon Road

* The Colonial Point apartment development is speculation at this point. However, the Town of Wakefield has asked us to consider it in our background growth for the proposed project.

An automobile auction development on Kimball Lane in Saugus was also taken into consideration for the background growth. However, no formal application has been filed for this project, which would include a traffic study and site development plans. Without detailed development size or projected new site-specific traffic generation, it was assumed that the traffic increases in the area due to the automobile auction project would be inclusive of the 1.0 percent annual growth rate, previously discussed. As such, the 2012 No-Build traffic volume networks were developed by applying the appropriate growth rates and adding the traffic generated by the background projects identified above. VHB used traffic generation figures for

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[2] "Traffic Impact and Access Study, Proposed Gasoline Station/Convenience Store", Greenman-Pederson, Inc., January 2004

approved developments where Traffic Impact and Access Studies were available. Figures 8 through 10 illustrate the 2012 No-Build traffic volumes for the weekday morning, evening and Saturday midday peak periods.

■

Future Roadway Conditions

In assessing future traffic conditions, proposed roadway improvements near and within the study area were considered. Two roadway improvement projects are currently proposed within the study area. The first includes three locations along Salem Street at I-95 Northbound Ramps (Exit 42), Montrose Avenue, and Pleasure Island Road. The Salem Street improvement project is currently under design by the Town of Wakefield, initially designed by Bruce Campbell & Associates (now BETA Group). This project is to be constructed by MassHighway under Project File Number 603311. The other improvement project includes Salem Street at Route 1 Ramps. This project is still undergoing design. The specific roadway improvements along that are being considered or planned for the area are listed below.

Salem Street at I-95 Northbound Ramps

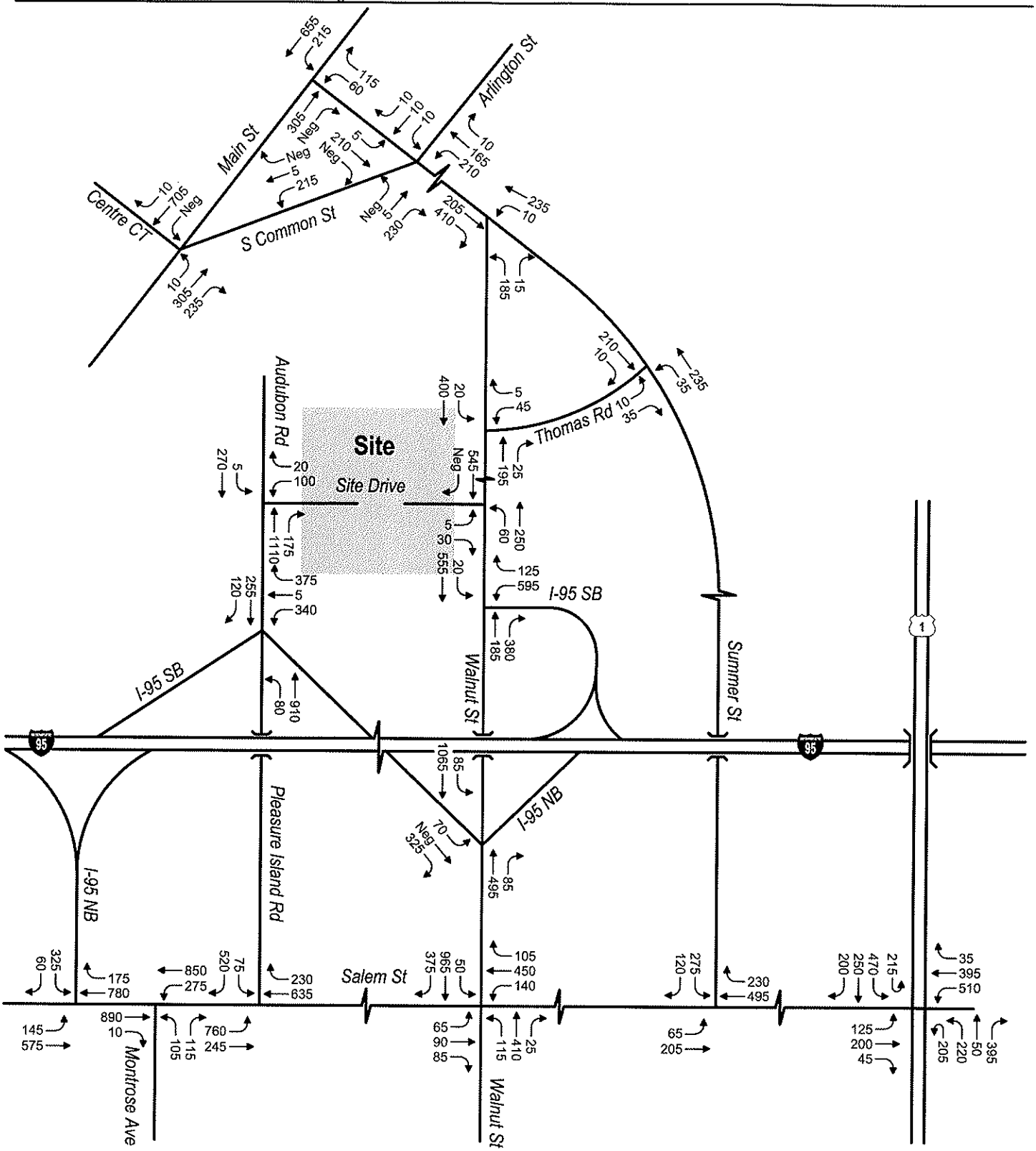
- Install fully-actuated traffic control signal
- Provide signal coordination with signals proposed at Salem Street with Montrose Avenue and Pleasure Island Road
- Restripe Salem Street eastbound to provide a 200-foot exclusive left-turn lane and a through lane
- Restripe Salem Street westbound to provide two through lanes with a channelized right turn

Salem Street at Montrose Avenue

- Install fully actuated traffic control signal
- Provide signal coordination with signals proposed at Salem Street with the I-95 northbound ramps and Pleasure Island Road
- Restripe Salem Street eastbound to provide a through lane and two receiving lanes
- Restripe Salem Street westbound to provide a 200-foot exclusive left-turn lane and a through lane
- Widen and restripe Montrose Avenue to provide an exclusive left-turn lane and an exclusive right-turn lane

Salem Street at Pleasure Island Road

- Install fully actuated traffic control signal

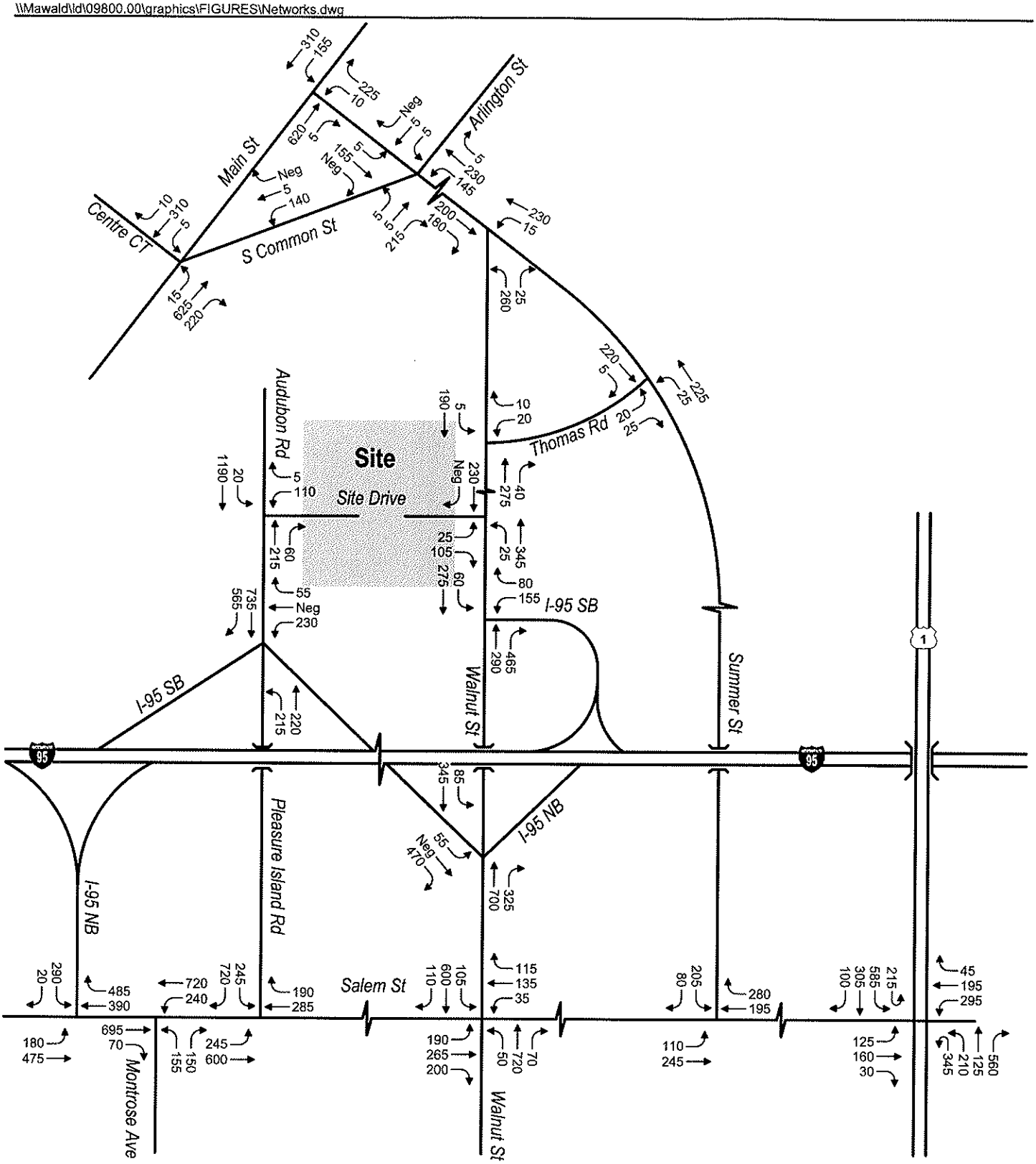


Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 No-Build Conditions
Weekday Morning Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 8

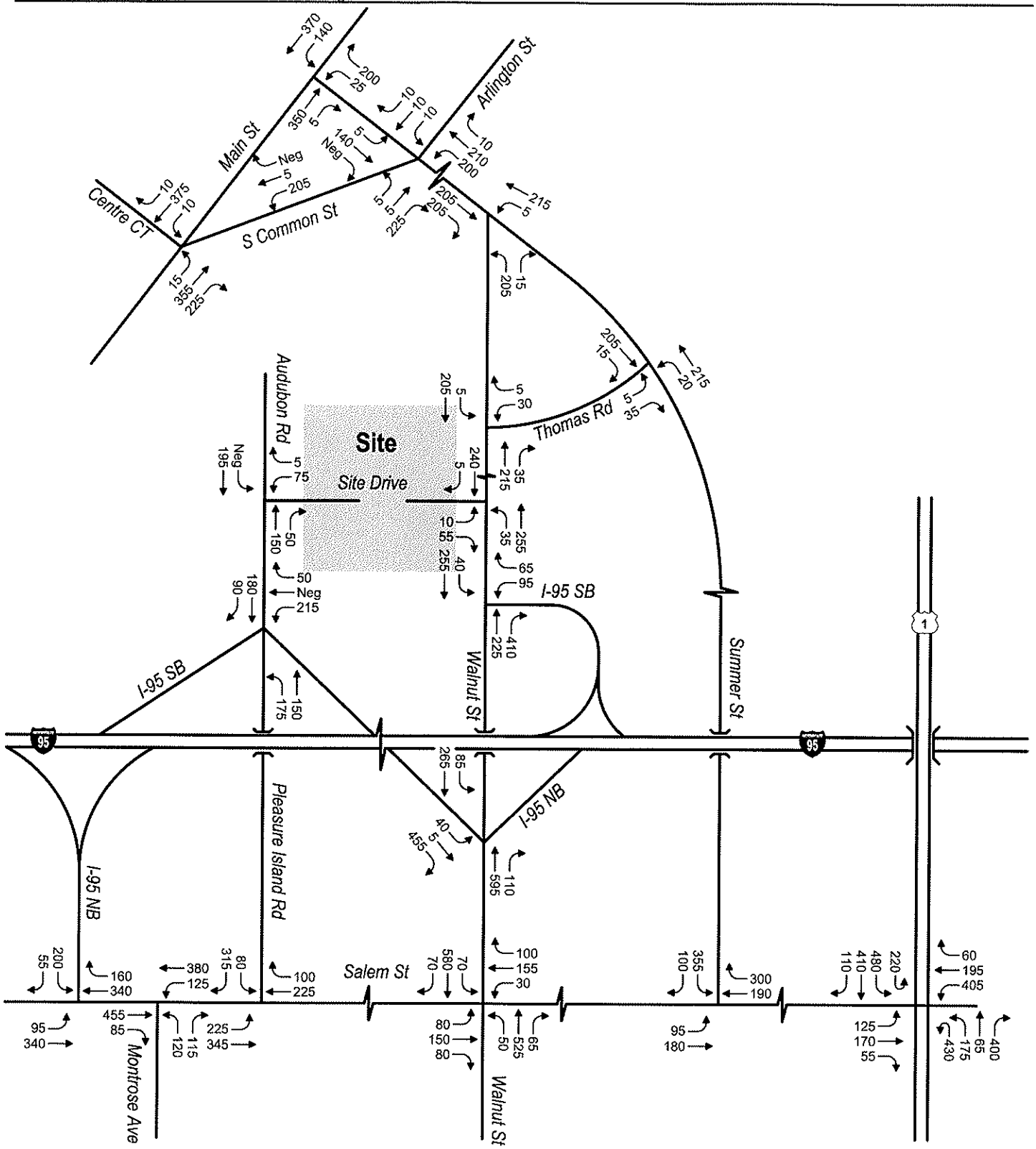


Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 No-Build Conditions
Weekday Evening Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 9



Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 No-Build Conditions
Saturday Midday Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 10

- Provide signal coordination with signals proposed at Salem Street with the I-95 northbound ramps and Montrose Avenue
- Widen and restripe Salem Street westbound to provide an exclusive right-turn lane and two through lanes
- Widen and restripe Salem Street eastbound to provide an exclusive left-turn lane and a through lane

These improvements are currently at the 75 percent design level with MassHighway and the project is on the State Transportation Improvement Plan (TIP) for 2010. As such, it is assumed to be implemented in the 2012 No-Build Conditions analysis. As part of the Irving Gas Station/Convenience Store project mentioned in Table 4, the proponent of that project has committed to design and implementation of temporary signals at intersections of Salem Street with I-95 Ramps and Montrose Avenue. The temporary traffic have been implemented at these locations and they are currently operational.

Implementation of the Salem Street improvements is essential to accommodating future traffic demands along this corridor independent of the proposed project. To ensure efficient traffic operations along Salem Street under future Build conditions, the proponent is committed to fund the construction of any incomplete work.

Salem Street at Route 1 Ramps

- Revise westbound lane designation from an exclusive left-turn lane and a through lane to an exclusive left-turn lane and a shared left-turn/through lane
- Provide signal phasing adjustments
- This project is currently in the planning stage

Build Conditions

Build traffic volumes were determined by estimating site-generated traffic volumes and distributing these volumes over the study area roadways.

Trip Generation

To estimate the volume of traffic generated by the proposed redevelopment, VHB conducted an extensive evaluation of potential site trip generation for the proposed project. The rate at which any development generates traffic is dependent upon a number of factors such as size and location. To determine the expected volume of traffic associated with the redevelopment, VHB used trip generation rates published by the Institute of Transportation Engineers [ITE] *Trip Generation*[3]. The following ITE land use codes were determined to be the most appropriate to apply to the proposed development:

- LUC 220 – apartments
- LUC 252 – senior adult housing units
- LUC 710 – office
- LUC 820 – shopping center

The traffic projections for this redevelopment project consider the existing uses already on-site in the form of a golf course and a convention center. They also reflect the capture of retail customer visits drawn from vehicles currently passing the site on Walnut Street and Audubon Road in the form of pass-by traffic. Further, as this is a mixed use project, the projections also reflect the efficiency between the mix of retail, residential, hotel and offices on the site. For the purpose of providing a conservative assessment, no traffic credit was taken for the golf and convention center uses.

Shared Vehicle-Trips

Given the mixed-use nature of the project, some of the traffic to be generated by this development will be contained on site as "internal trips." The retail portion of the development will provide goods and services to the residents and office employees that will reduce the need for them to travel off site. Similarly, these businesses will be supported by the residents and office employees and will draw a portion of their customer base from on site. While these shared trips represent new traffic to the individual uses, they would not show up as new vehicle trips on the surrounding roadway network aside from the internal roadways.

Appendix C of the ITE Trip Generation Handbook summarizes multiple studies that have been conducted at mixed-use sites. Based on the results of these studies, an average of 36 percent of the total trips generated by these sites were internal trips. These studies went into further detail and quantified the internal capture rate of each of the uses on site. ITE also provides a multi-use trip generation calculation in Chapter 7 of the Trip Generation Handbook. VHB followed this methodology for the proposed project and assigned use-specific internal capture rates to the residential, retail, and office components. Based on the ITE multi-use trip generation

[3] Trip Generation; Seventh Edition; Institute of Transportation Engineers; Washington, D.C.; 2003.

calculations, it was determined that four to nine percent internal capture rate could occur between the various uses on the site, which provides a conservative analysis compared to the 36 percent average calculated in other studies.

Internal capture calculations are contained in the Appendix of this document.

Pass-by Vehicle Trips

In addition to the shared trips expected to occur within the site, not all of the remaining trips generated by the retail component of the project will be new traffic that is added to the study area roadways. Retail uses typically attract a significant percentage of their traffic from the traffic streams passing the site, particularly during peak periods. These trips, which are considered pass-by, are already on the roadway system traveling to and from locations other than the site (such as home, work, or other shopping destinations). In Massachusetts, a maximum pass-by rate of 25 percent is considered the standard in accordance with EOEA/EOT guidelines. Studies at numerous similar developments throughout the United States and New England suggest that this pass-by percentage could be as high as 40-50 percent during the peak commuter hours. In order to be consistent with the State's policies, a 25 percent pass-by rate was used for weekday morning peak hour trip generation calculations and 10 percent of the adjacent street traffic for weekday evening and Saturday midday peaks. It should be noted that diverted link was not considered for this analysis, thereby providing a more conservative assessment.

Trip Generation Comparison: Empirical Data vs. ITE

In recent years, "lifestyle" or open air retail centers have become more and more popular with several of these developments being constructed in the greater Massachusetts area. Typically, these types of developments have a mix of retail and restaurant uses which tend to complement each other. The retail and restaurant components tend to provide upscale products and services beyond that of typical retail shopping opportunities. Customers usually spend more time in this type of atmosphere and enjoy the many amenities that are built into the program including vast sidewalk networks, outdoor seating, and a village green which is proposed as part of this project. Because of the upscale nature of the development, the customer base is somewhat limited from that of typical shopping centers which offer a wider range of goods and services at more standard price points. Subsequently, traffic rates for lifestyle retail developments tend to deviate from that of standard traffic generation rates of typical shopping centers. For informational purposes, the potential differential in traffic between lifestyle retail with that of standard shopping centers has been presented below.

Table 5 presents a comparison of trip generation rates published by the Institute of Transportation Engineers (ITE) *Trip Generation*[4] and those provided by empirical data that is based on studies conducted at three area shopping centers, which are the more modern "open air" or "lifestyle" centers. These include:

- The Shoppes at Farmington – Canton, CT
- The Derby Street Shoppes – Hingham, MA
- The Shoppes at Blackstone Valley – Millbury, MA

As shown in Table 5, trip generation calculations based on empirical rates render total gross trips significantly lower than those suggested by ITE. In order to ensure conservative analysis, VHB used trip generation rates provided by ITE.

Table 5
Retail Trip Generation Comparison: Empirical Data vs. ITE LUC 820

	390 KSF Retail			
Period	Empirical Trip Gen	ITE 820 Trip Gen **	Net Difference	Percent Difference
Weekday Daily	10,578	16,449	5,871	55%
Weekday Morning	104	354	250	240%
Weekday Evening	898	1,537	639	71%
Saturday Daily	14,395	21,778	7,383	51%
Saturday Midday	1,367	2,096	729	53%

* Empirical rates based on studies conducted at three Massachusetts- and Connecticut-based shopping centers.
** Based on ITE Land Use Code 820 - Shopping Center.

The empirical trip generation calculations are contained in the Appendix.

Trip Generation Summary

Under existing conditions the site is currently occupied by the Colonial Golf Club (18-hole golf course), Boston Sports Club (55,000 sf), a Conference Center (14,500 sf), and the Sheraton Hotel (280 rooms). As currently proposed, the redevelopment would involve the removal of the existing Conference Center portions of the site as well as nine holes of the 18-hole Colonial Golf Club facility. Both the hotel and Boston Sports Club would remain. In place of the uses to be removed, the current proposal involves the construction of approximately 390,000 sf of lifestyle retail space, 80,000 sf of office space and 220 residential units (180 Apartments and 40 Age-Restricted units). Primary access to the site is proposed on Walnut Street in the area of the existing Colonial Golf Club Driveway and Secondary Access is proposed on Audubon Road in the area of the existing Colonial Golf Club/Sheraton Driveway. It should be noted that due to the seasonal nature of golf-related traffic and the fact that Conference Center traffic is not present every day, no traffic credit was taken for

[4] Trip Generation, Seventh Edition, Institute of Transportation Engineers, Washington, DC (2003)

the removal of each of these current uses. This provides a conservative assessment of the expected increase in traffic to/from the site.

Table 6 presents the total net new vehicle trips anticipated from the redevelopment project. By considering the anticipated internal trip sharing, the associated project impacts should be less intensive compared to a non mixed-use project.

As shown in Table 6, the proposed redevelopment program is expected to add approximately 472 morning peak hour trips (306 entering/166 exiting), 1,440 evening peak hour trips (652 entering/788 exiting), and 2,017 Saturday midday peak hour trips (1,052 entering/965 exiting) on the area roadway network.

Table 6
Trip Generation Summary*

Use	Apartments	Age Restricted	Office	Retail	Total (Gross)	Shared	Pass-by *	Total (New)
Size	180 units	40 units	80,000 sf	390,000 sf				
Weekday								
Daily (vpd)	1,232	139	1,123	16,449	18,943	1,412	1,720	15,811
Morning Peak (vph)								
Enter	18	1	138	216	373	26	41	306
Exit	74	2	19	138	233	26	41	166
Total	92	3	157	354	606	52	82	472
Evening Peak (vph)								
Enter	76	3	29	738	846	72	122	652
Exit	41	2	140	799	982	72	122	788
Total	117	5	169	1,537	1,828	144	244	1,440
Saturday								
Daily (vpd)	1,157	100	190	21,778	23,225	967	800	21,458
Midday Peak (vph)								
Enter	47	6	17	1,090	1,160	46	62	1,052
Exit	47	6	14	1,006	1,073	46	62	965
Total	94	12	31	2,096	2,233	92	124	2,017

* 25% of external retail trips for the weekday morning or 10% of total traffic passing the site for all other conditions.
vpd vehicles per day
vph vehicles per hour
Based on ITE Trip Generation, 7th Edition.

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Trip Distribution and Assignment

The directional distribution of traffic approaching and departing the development is a function of several variables. These include the population densities, shopping opportunities, competing uses, existing travel patterns, and the efficiency of the roadways leading to the site.

Due to the varying trip characteristics of the redevelopment uses – residential, office, and retail – each use is expected to experience a different distribution pattern. Thus, regional trip distribution percentages were calculated separately for each of the project's uses.

The residential trip distribution patterns were determined using journey-to-work data derived from the 2000 US Census for the Town of Lynnfield. The trip distribution for the retail component was developed based on a gravity model utilizing the Census data for communities included in the market trade area. Based on the distribution of population within the projected market trade area, arrival and departure patterns for project-related traffic were estimated and adjusted, if appropriate, based on known local factors such as locations of competing opportunities and efficiency of local roadways. The assignment of site-generated traffic to specific travel routes was based on observed traffic flow conditions on available routes, and the assumption that most motorists will seek the fastest and most direct routes to and from the site.

At the request of the Town, VHB performed travel time runs on Wednesday, January 3, 2007 to verify the appropriateness of the selected travel routes and influence area with regards to trip distribution. The data was collected during the evening peak period (4:00 PM to 6:00 PM) and based on standard practice. The following routes were considered to and from the site:

- Route 1 to Walnut Street to site
- Route 1 to Salem Street to site
- Route 1 to I-95/Route 128 to site
- I-95 northbound to Exit 43 (Walnut Street) to site
- I-95 northbound to Exit 42 (Salem to Pleasure Island) to site
- I-95 northbound to Exit 41 Main Street to Summer Street to site
- Middleton; Route 62 and East Street to Route 1 to I-95/Route 128 to site
- Middleton; Route 62 and East Street to Boston Street to Main Street to Summer Street to Walnut Street to site
- North Reading; Haverhill Street at Route 62; 62 west to Route 28 to Route 129 to I-95/Route 128 to Exit 43 (Walnut Street) to site
- North Reading; Haverhill Street at Route 62; Haverhill Street south to Chestnut Street to Lowell Street to Main to Summer Street to Walnut Street to site

Average inbound and outbound travel times were calculated and compared where appropriate. The results of the travel time runs were incorporated into the assumptions made for travel routes and influence area for the distribution of traffic approaching and departing the development. Travel time results and route maps are provided in the Appendix.

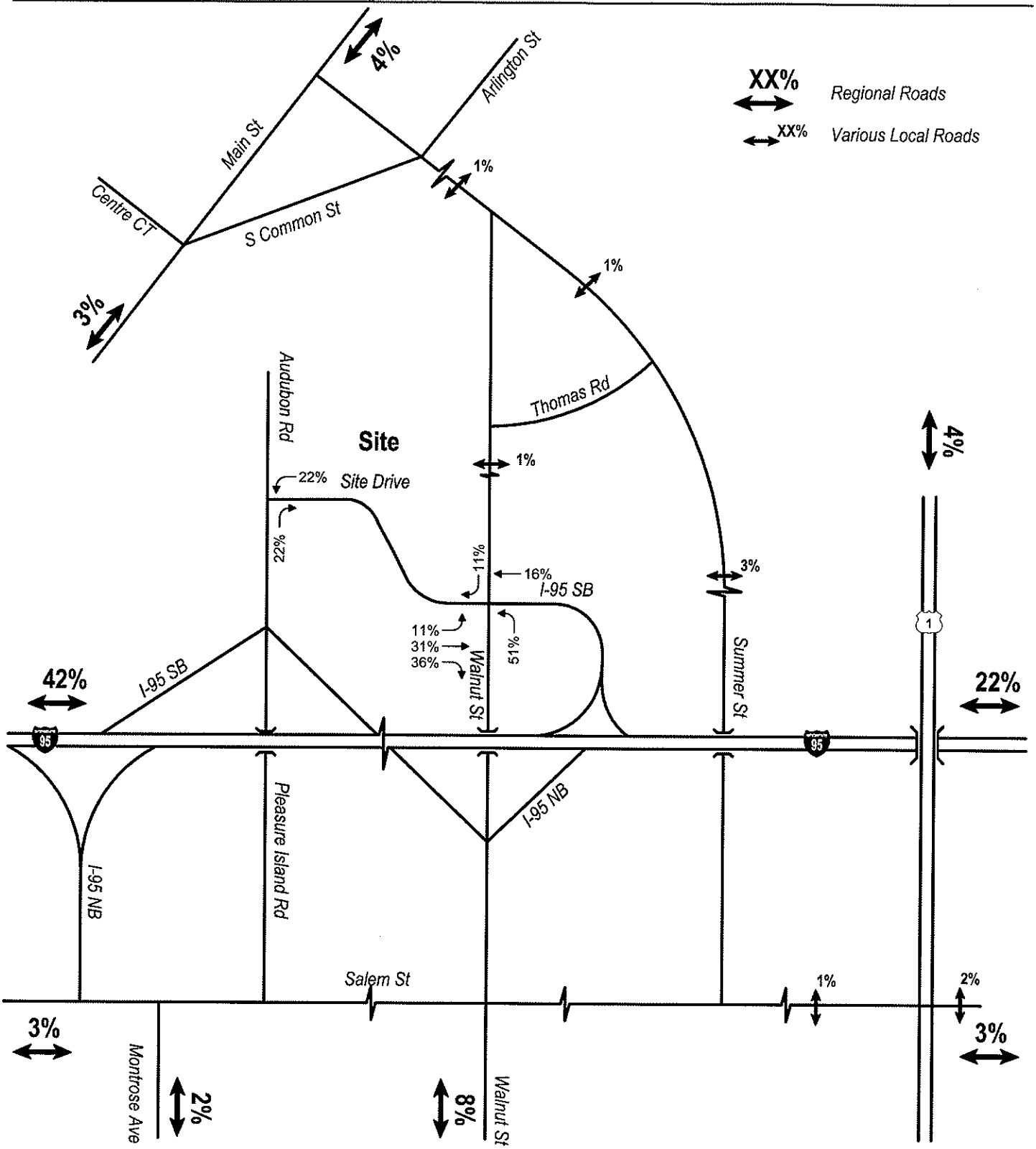
It should be noted, also, that it was assumed that approximately 75 percent of the site traffic using I-95/Route 128 to arrive in the area would use Exit 43 and enter the site via the eastern site driveway, which is considered the primary access point. The remaining 25 percent would use Exit 42 and enter the site via the western site driveway on Audubon Road. Based on the anticipated layout of the development, which is oriented toward the eastern side of the site, the Exit 43 northbound and southbound off-ramps provide a more direct route to the site. This assumption was also confirmed by the travel time runs previously described.

Table 7 summarizes the resulting trip distribution patterns for the project. The individual trip distribution patterns for residential, office, and retail uses are shown in Figures 11 through 13, respectively.

Table 7
Vehicle Trip Distribution Summary

		Percent of Total		
Route	Direction	Residential	Office	Retail
Route 128	North	22%	37%	15%
Route 128	South	42%	20%	35%
Walnut Street	North	16%	23%	17%
Walnut Street	South	8%	5%	6%
Salem Street	East	7%	10%	4%
Salem Street	West	3%	3%	13%
Montrose Avenue	South	2%	2%	10%
Total	--	100%	100%	100%

The site-generated traffic volumes were assigned to the roadway network based on the trip distribution pattern and combined with the 2012 No-Build traffic volumes to develop the 2012 Build peak hour conditions. Figures 14 through 16 illustrate the Build traffic volumes for the weekday morning, evening and Saturday midday peak periods.



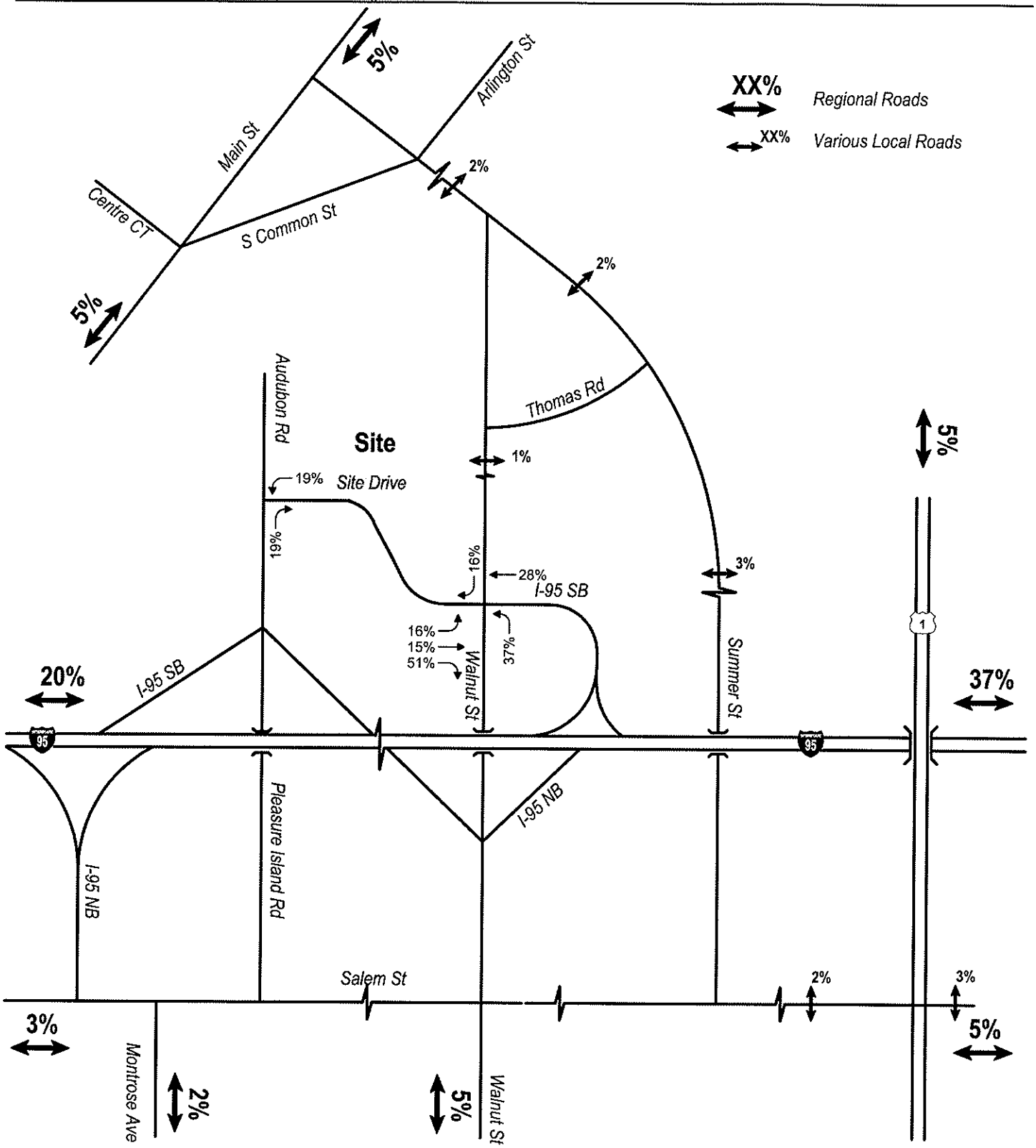
Not to Scale

Vanasse Hangen Brustlin, Inc.

Residential Trip Distribution

Figure 11

Meadow Walk at Lynnfield
Lynnfield, Massachusetts



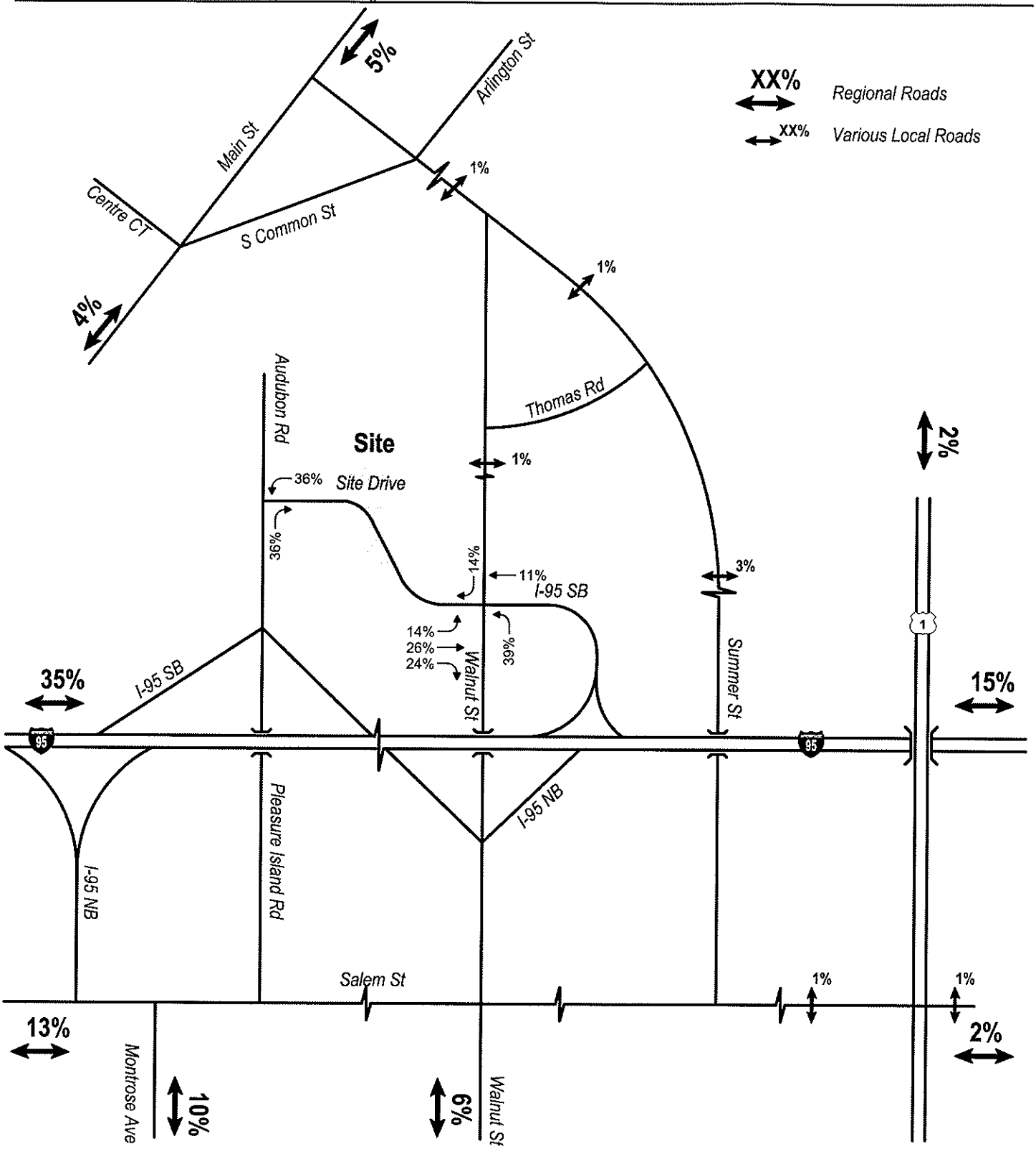
Not to Scale

Vanasse Hangen Brustlin, Inc.

Office Trip Distribution

Figure 12

Meadow Walk at Lynnfield
Lynnfield, Massachusetts



Not to Scale

Vanasse Hangen Brustlin, Inc.

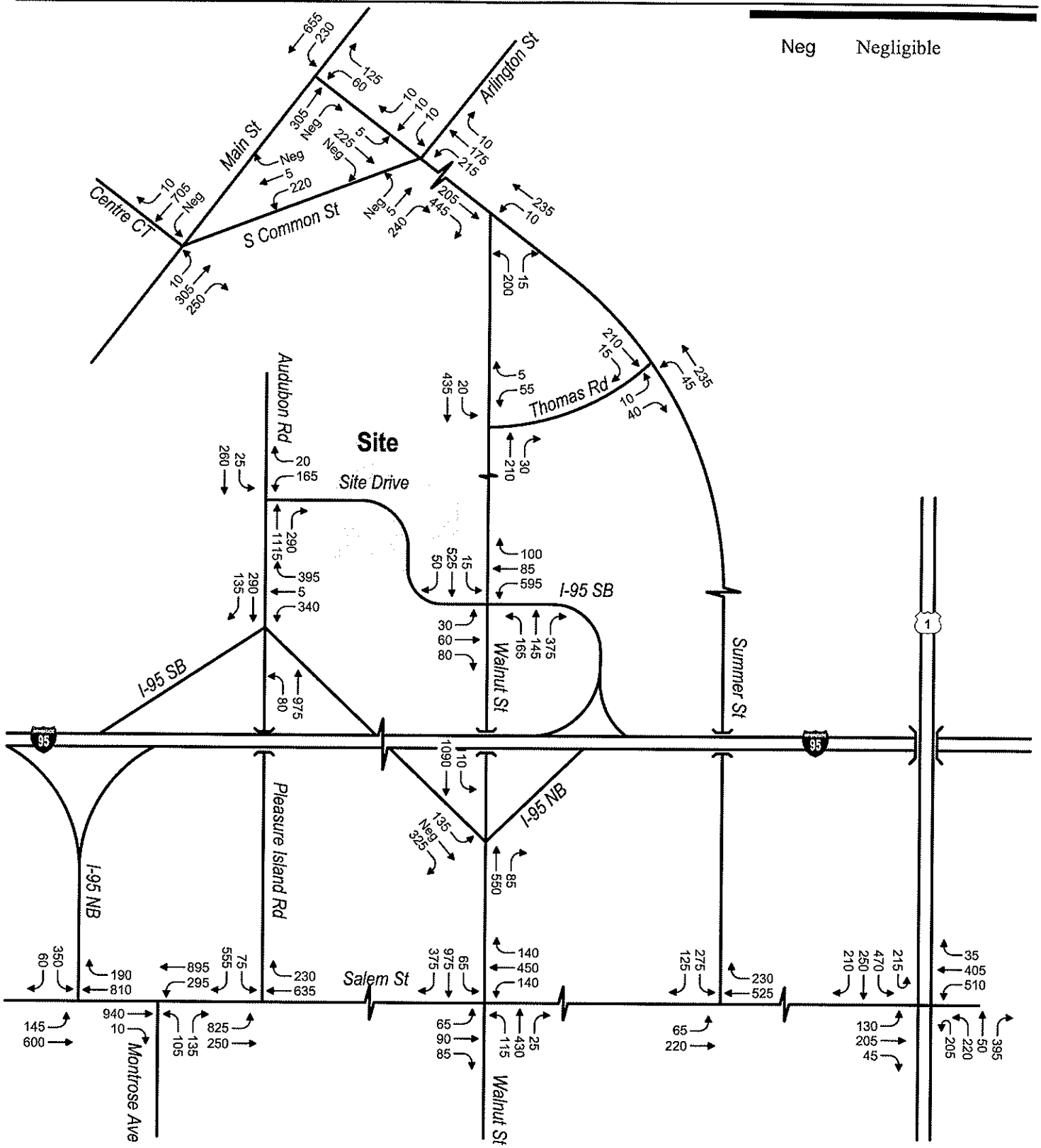
Retail Trip Distribution

Figure 13

Meadow Walk at Lynnfield
Lynnfield, Massachusetts

\\mawald\ld\09800.00\graphics\FIGURES\9800net1.dwg

Neg Negligible



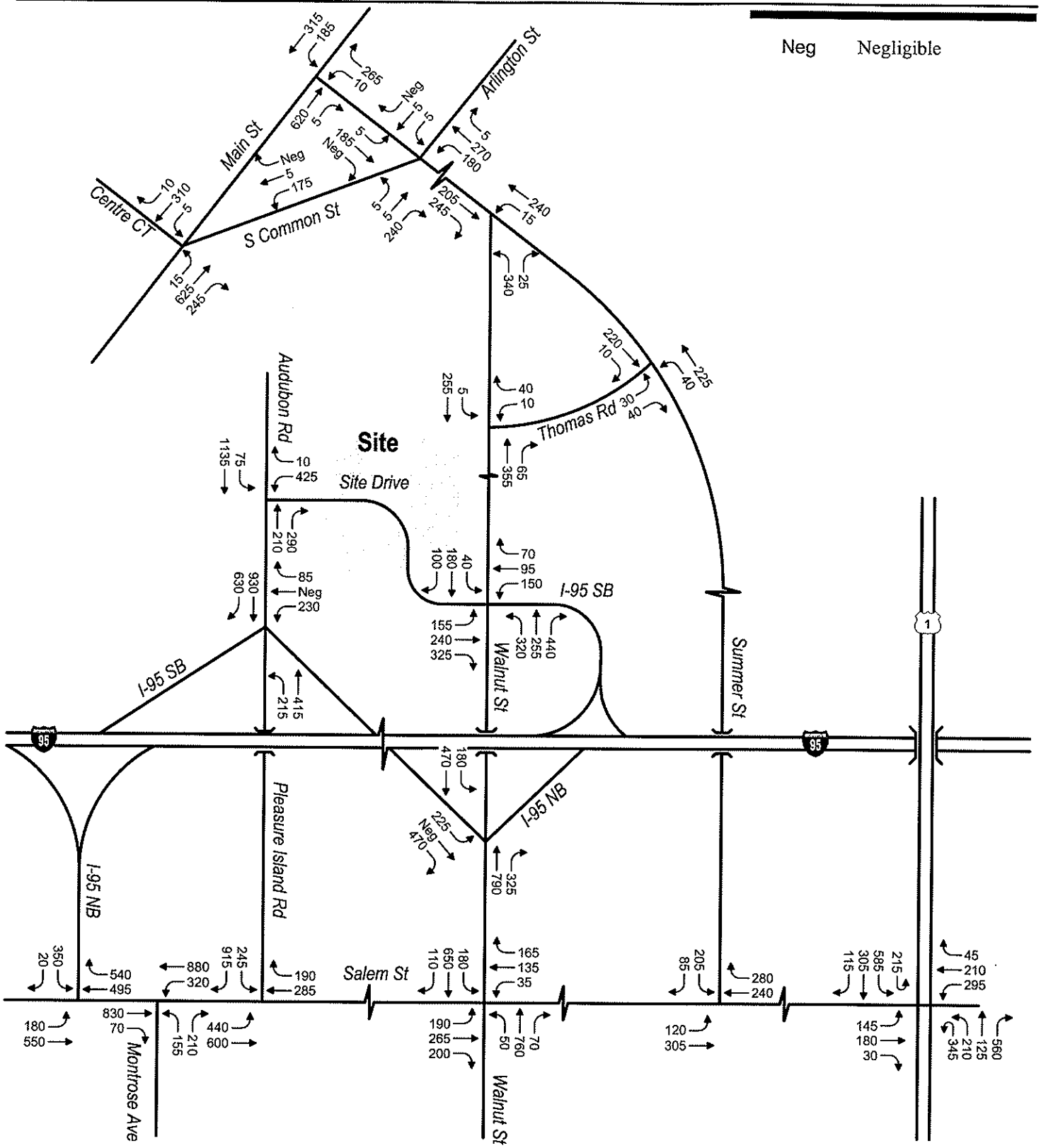
Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 Build Conditions
Weekday Morning Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 14

Neg Negligible



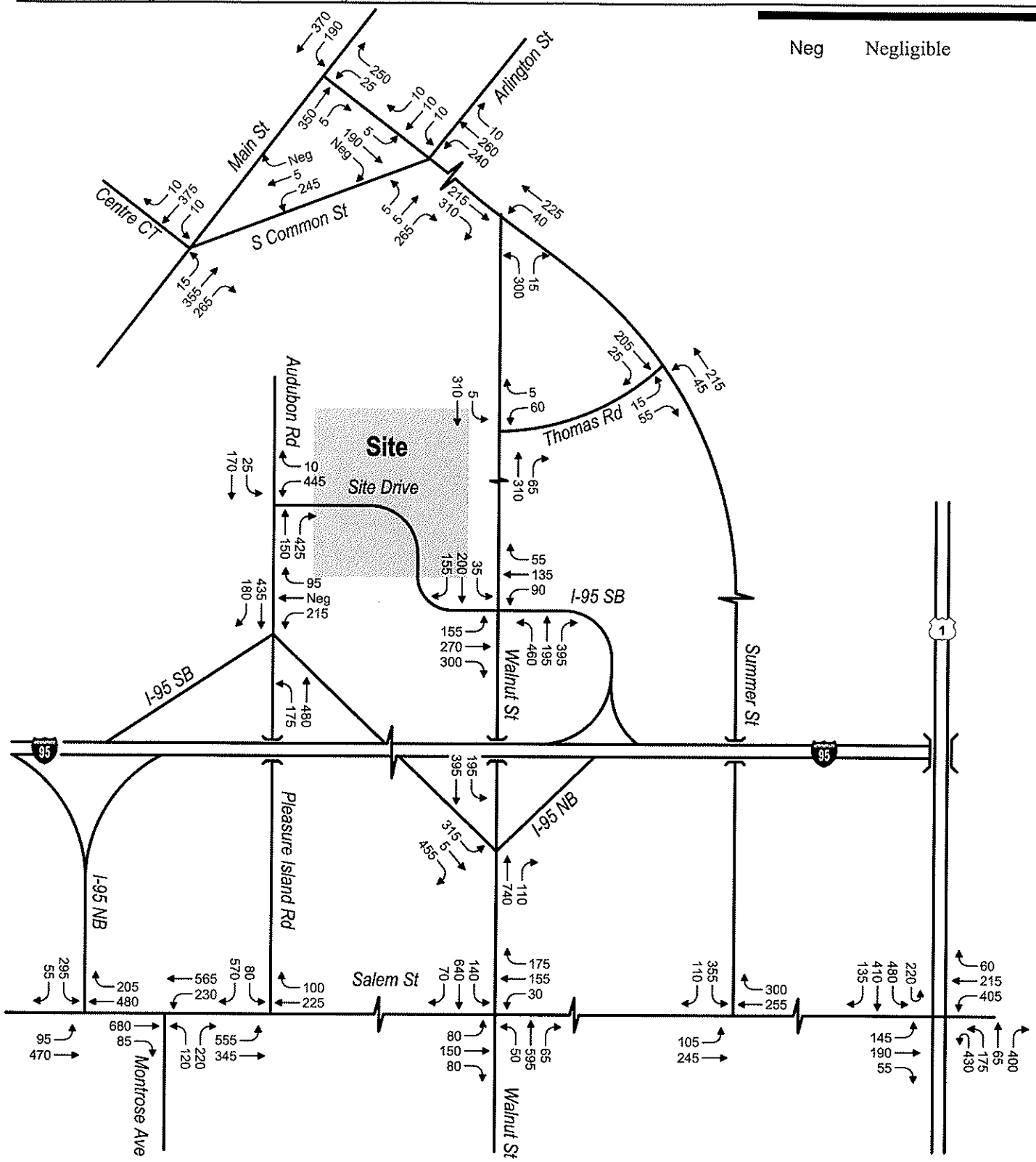
Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 Build Conditions
Weekday Evening Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 15

Neg Negligible



Not to Scale

Vanasse Hangen Brustlin, Inc.

2012 Build Conditions
Saturday Midday Peak Hour
Traffic Volumes
Meadow Walk at Lynnfield
Lynnfield, Massachusetts

Figure 16

4

Traffic Operations Analysis

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were conducted with respect to Existing and projected No-Build and Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service.

Level-of-Service Criteria

The evaluation criteria used to analyze area intersections and roadways in this traffic study are based on the 2000 *Highway Capacity Manual* [HCM][5]. Level of service [LOS] is the term used to denote the different operating conditions that occur on a given roadway segment under various traffic volume loads. It is a qualitative measure that considers a number of factors including roadway geometry, speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level-of-service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

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, however, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. Thus, the LOS designation is for the critical movement entering or exiting the side street, which is generally the left-turn out of the side street.

It should be noted that the analytical methodologies typically used for the analysis of unsignalized intersections use conservative analysis parameters, such as long critical gaps. Actual field observations indicate that drivers on minor streets generally accept shorter gaps in traffic than those used in the analysis procedures and therefore experience less delay than reported by the analysis software. The analysis methodologies also do not fully take into account the beneficial grouping effects

[5] Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2000.

caused by nearby signalized intersections. The net effect of these analysis procedures is the over-estimation of calculated delays at unsignalized intersections in the study area. Cautious judgment should therefore be exercised when interpreting the capacity analysis results at unsignalized intersections.

Level-of-Service Analysis

Level of service analyses were conducted for the Existing, No-Build, and Build conditions (without improvements) for the study-area intersections.

Signalized Intersection Capacity Analysis and Queues

Table 8 presents a summary of the capacity analyses as well as average and 95th percentile queues for the signalized intersections in the study area. The results shown are for the 2007 Existing Conditions scenario as compared to the 2012 No-Build and Build conditions (without improvements). The capacity analyses and queue worksheets are included in the appendix.

Table 8

Signalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Walnut Street at Salem Street	Morning	WB LT-TH-RT	> 1.2	+	F	615	723	> 1.2	+	F	734	837	>1.2	+	F	782	881
		EB LT-TH-RT	0.55	28	C	86	144	0.91	60	E	142	261	0.92	64	E	144	265
		NB LT-TH	> 1.2	+	F	453	462	> 1.2	+	F	434	640	>1.2	+	F	512	720
		NB RT	0.02	7	A	0	10	0.02	7	A	0	10	0.01	7	A	0	10
		SB LT-TH	0.83	21	C	409	614	0.89	25	C	466	789	0.96	34	C	526	857
		SB RT	0.28	9	A	56	100	0.32	9	A	72	122	0.32	9	A	72	122
		Overall	> 1.2	+	F			> 1.2	+	F			>1.2	+	F		
	Evening	WB LT-TH-RT	0.40	17	B	69	128	0.47	18	B	86	154	0.53	19	B	100	177
		EB LT-TH-RT	> 1.2	+	F	448	530	> 1.2	+	F	539	617	>1.2	+	F	554	632
		NB LT-TH	0.88	27	C	260	490	1.14	95	F	404	605	>1.2	+	F	558	588
		NB RT	0.04	8	A	0	16	0.04	8	A	0	16	0.04	8	A	0	16
		SB LT-TH	1.19	117	F	393	571	> 1.2	+	F	515	697	>1.2	+	F	635	829
		SB RT	0.05	8	A	0	18	0.07	8	A	0	20	0.07	8	A	0	20
		Overall	> 1.2	+	F			> 1.2	+	F			>1.2	+	F		
	Saturday	WB LT-TH-RT	0.61	21	C	81	127	0.63	21	C	97	147	0.75	25	C	122	181
		EB LT-TH-RT	0.74	28	C	79	147	0.90	44	D	111	244	1.00	72	E	118	264
		NB LT-TH	0.50	8	A	104	181	0.62	11	B	128	222	0.92	30	C	196	426
		NB RT	0.04	5	A	0	12	0.04	5	A	0	12	0.04	5	A	0	12
		SB LT-TH	0.63	10	A	149	234	0.72	13	B	176	267	>1.2	+	F	438	586
		SB RT	0.03	5	A	0	10	0.05	5	A	0	12	0.05	5	A	0	12
		Overall	0.67	13	B			0.78	18	B			1.2	78	E		
Salem Street at Pleasure Island Road	Morning	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.55	18	B	166	170	0.55	18	B	166	170
		WB RT						0.32	9	A	60	77	0.32	9	A	61	78
		EB LT						>1.2	+	F	655	836	>1.2	+	F	737	921
		EB TH						0.22	1	A	6	7	0.22	1	A	7	8
		SB LT						0.27	29	C	36	76	0.27	29	C	36	76
		SB RT						0.70	19	B	190	315	0.75	20	C	213	352
		Overall						1.03	147	F			1.09	+	F		
	Evening	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.33	25	C	71	110	0.41	28	C	72	110
		WB RT						0.13	7	A	0	22	0.18	8	A	22	48
		EB LT						0.71	23	C	137	155	1.07	80	F	302	428
		EB TH						0.73	16	B	271	438	0.73	16	B	282	436
		SB LT						0.42	20	B	98	162	0.41	19	B	98	162
		SB RT						0.72	12	B	162	273	0.87	17	B	287	667
		Overall						0.71	16	B			0.90	28	C		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
\+ Delay cannot be accurately calculated when v/c is greater than 1.2 or 1/PHF for any movement.

Table 8 (continued)
Signalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at Pleasure Island Road	Saturday	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.24	23	C	51	86	0.26	24	C	53	93
		WB RT						0.07	13	B	0	23	0.10	13	B	11	34
		EB LT						0.34	9	A	52	97	0.84	22	C	150	487
		EB TH						0.28	2	A	18	50	0.29	3	A	20	57
		SB LT						0.44	32	C	58	67	0.37	29	C	56	62
		SB RT						0.37	8	A	29	21	0.75	13	B	161	161
		Overall						0.35	11	B			0.66	16	B		
Salem Street at Montrose Avenue	Morning	WB LT-TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.87	8	A	61	108	0.93	13	B	67	116
		WB TH						0.87	8	A	61	108	0.93	13	B	67	116
		EB TH						0.56	13	B	110	197	0.59	14	B	117	202
		EB TH-RT						0.56	13	B	110	197	0.59	14	B	117	202
		NB LT						0.52	33	C	67	90	0.52	33	C	67	90
		NB RT						0.10	29	C	0	24	0.12	29	C	0	25
		Overall						0.79	13	B			0.84	15	B		
	Evening	WB LT-TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.66	6	A	45	157	>1.2	11	B	142	142
		WB TH						0.66	6	A	45	157	>1.2	11	B	142	142
		EB TH						0.44	8	A	62	162	0.52	8	A	78	188
		EB TH-RT						0.44	8	A	62	162	0.52	8	A	78	188
		NB LT						0.58	33	C	82	132	0.58	33	C	82	132
		NB RT						0.11	28	C	0	44	0.15	28	C	0	52
		Overall						0.64	11	B			0.81	13	B		
	Saturday	WB LT-TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.34	3	A	25	43	0.95	7	A	83	129
		WB TH						0.34	3	A	25	43	0.95	7	A	83	129
		EB TH						0.29	5	A	36	56	0.42	7	A	54	145
		EB TH-RT						0.29	5	A	36	56	0.42	7	A	54	145
		NB LT						0.54	33	C	70	104	0.53	33	C	70	102
		NB RT						0.09	29	C	0	32	0.18	29	C	0	38
		Overall						0.38	9	A			0.61	11	B		
Salem Street at I-95 NB Ramps	Morning	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.52	3	A	60	92	0.70	11	B	184	184
		WB TH-RT						0.52	3	A	60	92	0.70	11	B	184	184
		EB LT						1.03	7	A	104	148	0.59	13	B	24	66
		EB TH						1.03	7	A	104	148	0.56	8	A	152	201
		SB LT						0.64	32	C	96	121	0.66	32	C	103	131
		SB RT						0.04	0	A	0	0	0.04	0	A	0	0
		Overall						0.63	9	A			0.68	13	B		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2 or 1/PHF for any movement.

Table 8 (continued)
Signalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at I-95 NB Ramps (Exit 42)	Evening	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.36	7	A	23	78	0.55	15	B	110	156
		WB TH-RT						0.36	7	A	23	78	0.55	15	B	110	156
		EB LT						0.86	6	A	80	136	0.59	11	B	30	82
		EB TH						0.86	6	A	80	136	0.51	7	A	138	211
		SB LT						0.57	31	C	83	106	0.62	31	C	100	100
		SB RT						0.01	0	A	0	0	0.01	0	A	0	0
		Overall						0.56	10	B			0.59	15	B		
	Saturday	WB TH	*UNSIGNALIZED UNDER EXISTING CONDITIONS*					0.23	1	A	8	12	0.33	4	A	42	110
		WB TH-RT						0.23	1	A	8	12	0.33	4	A	42	110
		EB LT						0.26	3	A	30	53	0.36	4	A	50	90
		EB TH						0.26	3	A	30	53	0.36	4	A	50	90
		SB LT						0.47	32	C	56	81	0.57	31	C	82	109
		SB RT						0.04	0	A	0	0	0.04	0	A	0	0
		Overall						0.29	7	A			0.40	9	A		
Salem Street at Route 1 Ramps	Morning	WB LT	> 1.2	+	F	570	798	> 1.2	+	F	541	740	>1.2	+	F	549	748
		WB TH*	1.03	97	F	334	540	> 1.2	+	F	592	794	>1.2	+	F	603	806
		WB RT	0.02	0	A	0	0	0.02	0	A	0	0	0.02	0	A	0	0
		EB LT-TH	1.00	97	F	246	441	1.14	+	F	335	509	1.17	+	F	354	530
		EB RT	0.03	0	A	0	0	0.03	0	A	0	0	0.03	0	A	0	0
		NB U	0.46	40	D	72	136	0.68	52	D	116	194	0.68	52	D	116	194
		NB LT	0.70	50	D	165	241	1.00	106	F	200	353	1.00	106	F	200	353
		NB TH	0.14	39	D	32	65	0.21	45	D	40	78	0.21	45	D	40	78
		NB RT	0.42	24	C	51	83	0.59	31	C	98	151	0.60	31	C	100	153
		SB U	0.19	6	A	46	69	0.20	6	A	51	75	0.20	6	A	51	75
		SB LT	1.03	100	F	309	514	0.90	61	E	298	467	0.90	61	E	298	467
		SB LT-TH	1.05	103	F	354	570	0.91	63	E	337	513	0.91	63	E	337	513
		SB RT	0.16	20	B	5	25	0.25	18	B	31	56	0.27	18	B	35	61
		Overall	1.09	99	F			1.12	111	F			1.13	114	F		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
\+ Delay cannot be accurately calculated when v/c is greater than 1.2 or 1/PHF for any movement.

Table 8 (continued)
Signalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at Route 1 Ramps	Evening	WB LT	0.93	73	E	240	402	0.68	40	D	192	261	0.69	40	D	200	270
		WB TH*	0.52	39	D	131	203	0.69	40	D	210	281	0.70	40	D	217	289
		WB RT	0.03	0	A	0	0	0.03	0	A	0	0	0.03	0	A	0	0
		EB LT-TH	0.99	91	F	239	354	1.09	118	F	326	423	>1.2	+	F	412	504
		EB RT	0.02	0	A	0	0	0.02	0	A	0	0	0.02	0	A	0	0
		NB U	0.72	46	D	161	259	0.82	55	E	191	353	0.82	56	E	193	353
		NB LT	0.59	44	D	135	210	0.66	46	D	149	245	0.66	47	D	150	245
		NB TH	0.32	39	D	75	128	0.36	40	D	84	150	0.36	40	D	85	150
		NB RT	0.65	28	C	105	165	0.70	27	C	112	170	0.71	27	C	119	178
		SB U	0.18	6	A	41	63	0.19	6	A	43	65	0.19	6	A	43	65
		SB LT	1.10	119	F	363	621	> 1.2	+	F	480	729	>1.2	+	F	484	729
		SB LT-TH	1.12	125	F	415	687	> 1.2	+	F	544	807	>1.2	+	F	548	807
		SB RT	0.06	18	B	0	16	0.07	20	C	1	22	0.08	21	C	1	24
		Overall	0.95	65	E			0.99	103	F			1.04	111	F		
	Saturday	WB LT	> 1.2	+	F	484	584	1.04	107	F	317	427	1.08	118	F	337	448
		WB TH*	0.55	42	D	151	203	1.06	111	F	350	458	1.09	121	F	372	481
		WB RT	0.04	0	A	0	0	0.04	0	A	0	0	0.04	0	A	0	0
		EB LT-TH	1.00	101	F	244	414	0.93	78	E	257	418	1.05	109	F	323	498
		EB RT	0.03	0	A	0	0	0.03	0	A	0	0	0.03	0	A	0	0
		NB U	0.90	64	E	264	443	1.07	114	F	330	540	1.07	114	F	330	540
		NB LT	0.47	43	D	119	190	0.57	48	D	132	209	0.57	48	D	132	209
		NB TH	0.16	39	D	40	80	0.19	43	D	46	88	0.19	43	D	46	88
		NB RT	0.42	24	C	60	107	0.46	27	C	62	110	0.48	27	C	68	117
		SB U	0.16	5	A	40	61	0.18	7	A	49	75	0.18	7	A	49	75
		SB LT	0.99	85	F	342	565	1.05	102	F	392	606	1.05	102	F	392	606
		SB LT-TH	1.00	84	F	387	620	1.06	102	F	443	665	1.06	102	F	443	665
		SB RT	0.07	20	B	0	15	0.07	18	B	0	16	0.09	18	B	0	17
		Overall	1.06	78	E			1.06	78	E			1.07	83	F		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2 or 1/PHF for any movement.

As shown in Table 8, some locations within the study area are expected to undergo planned improvements that transition them from unsignalized intersections with poor operations under the Existing conditions to signalized intersections with much improved operations under the No-Build and Build conditions. Three of the five signalized intersections are expected to operate at LOS F during at least one of the peak periods under Existing, No-Build, and Build conditions including: Walnut Street at Salem Street, Salem Street at Pleasure Island Road, and Salem Street at Route 1 Ramps, without the aid of future improvements.

As can be seen in the Table, Salem Street at Montrose Avenue is unsignalized under Existing conditions. Under No-Build conditions, the intersection operated at LOS B, B, and A during weekday morning, weekday evening, and Saturday midday peak periods, respectively. The intersection is expected to operate at LOS B during all peak periods under Build conditions.

The intersection of Salem Street with the I-95 Northbound Ramps, similarly, is unsignalized under Existing conditions. Under No-Build conditions, as shown in the table, the intersection operates at LOS A during morning and Saturday peak periods and is expected to maintain at least LOS B under all Build conditions. During the evening peak period, the intersection is expected to experience LOS B under No-Build conditions and is expected to continue to operate at this level of service under Build conditions.

Mitigation proposed at some of these locations is discussed in detail in the next chapter. Once these changes are implemented, the locations are all expected to operate at improved levels of service during all analysis periods.

■

Unsignalized Intersection Capacity Analysis and Queues

Table 9 presents a summary of the capacity analyses and 95th percentile queues for the unsignalized intersections in the study area. The results shown are for the 2007 Existing Conditions scenario as compared to the 2012 No-Build and Build conditions (without improvements). The capacity analyses and queue worksheets are included in the appendix.

Table 9

Vanasse Hangen Brustlin, Inc.

Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Main Street at South Common Street	Morning	WB LT-TH-RT	680	0.00	0	A	0	715	0.00	0	A	0	715	0.00	0	A	0
		EB LT	10	0.01	9	A	1	10	0.01	10	A	1	10	0.01	10	A	1
		EB TH-RT	510	0.39	0	A	0	540	0.41	0	A	0	555	0.42	0	A	0
		NB LT-TH-RT	205	> 1.2	+	F	546	220	> 1.2	+	F	642	225	> 1.2	+	F	666
	Evening	WB LT-TH-RT	305	0.01	0	A	1	325	0.01	1	A	1	325	0.01	1	A	1
		EB LT	15	0.01	8	A	1	15	0.01	8	A	1	15	0.01	8	A	1
		EB TH-RT	800	0.55	0	A	0	845	0.58	0	A	0	870	0.60	0	A	0
		NB LT-TH-RT	135	0.90	101	F	163	145	1.07	155	F	212	180	+	+	F	315
	Saturday	WB LT-TH-RT	375	0.01	0	A	1	395	0.01	0	A	1	395	0.01	1	A	1
		EB LT	15	0.01	8	A	1	15	0.01	8	A	1	15	0.01	8	A	1
		EB TH-RT	550	0.40	0	A	0	580	0.43	0	A	0	620	0.46	0	A	0
		NB LT-TH-RT	195	0.94	91	F	198	210	1.09	138	F	257	265	+	+	F	375
Main Street at Summer Street	Morning	WB LT-TH	830	0.18	4	A	16	870	0.19	4	A	18	885	0.21	5	A	19
		EB TH-RT	290	0.23	0	A	0	305	0.24	0	A	0	305	0.24	0	A	0
		NB LT-RT	160	0.95	88	F	218	175	1.14	148	F	303	185	+	+	F	344
	Evening	WB LT-TH	435	0.16	4	A	14	465	0.19	5	A	17	500	0.22	6	A	21
		EB TH-RT	595	0.41	0	A	0	625	0.43	0	A	0	625	0.43	0	A	0
		NB LT-RT	220	0.62	27	D	100	235	0.69	33	D	126	275	0.81	44	E	182
	Saturday	WB LT-TH	480	0.12	3	A	10	510	0.13	3	A	11	560	0.18	5	A	16
		EB TH-RT	340	0.24	0	A	0	355	0.25	0	A	0	355	0.25	0	A	0
		NB LT-RT	210	0.43	17	C	55	225	0.48	18	C	64	275	0.60	23	C	96
Summer Street at South Common Street/ Arlington Street	Morning	WB LT-TH-RT	30	0.21	31	D	19	30	0.25	37	E	23	30	0.28	43	E	27
		EB LT-TH-RT	220	0.35	12	B	39	235	0.38	13	B	44	250	0.41	13	B	50
		NB LT-TH-RT	355	0.20	5	A	18	385	0.21	6	A	20	400	0.22	6	A	21
		SB LT-TH-RT	205	0.00	0	A	0	215	0.00	1	A	0	230	0.00	0	A	0
	Evening	WB LT-TH-RT	10	0.08	23	C	7	10	0.10	27	D	8	10	0.14	38	E	11
		EB LT-TH-RT	210	0.29	11	B	29	225	0.31	12	B	34	250	0.37	13	B	43
		NB LT-TH-RT	355	0.11	4	A	9	380	0.12	4	A	10	455	0.15	4	A	13
		SB LT-TH-RT	145	0.00	0	A	0	160	0.00	1	A	0	195	0.00	1	A	0

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Summer Street at South Common Street/ Arlington Street	Saturday	WB LT-TH-RT	30	0.14	22	C	12	30	0.16	25	D	14	30	0.25	42	E	23
		EB LT-TH-RT	220	0.37	12	B	43	235	0.40	13	B	49	275	0.51	15	B	74
		NB LT-TH-RT	390	0.13	4	A	11	420	0.14	5	A	13	510	0.18	5	A	17
		SB LT-TH-RT	135	0.00	0	A	0	145	0.00	0	A	0	195	0.00	0	A	0
Summer Street at Walnut Street	Morning	WB LT-TH	235	0.01	1	A	1	245	0.01	1	A	1	235	0.01	1	A	1
		EB TH-RT	550	0.38	0	A	0	615	0.43	0	A	0	660	0.45	0	A	0
		NB LT-RT	180	0.54	24	C	77	200	0.65	31	D	111	215	0.72	37	E	136
	Evening	WB LT-TH	235	0.01	1	A	1	245	0.02	1	A	1	255	0.02	1	A	1
		EB TH-RT	350	0.22	0	A	0	380	0.24	0	A	0	450	0.28	0	A	0
		NB LT-RT	265	0.61	23	C	102	285	0.69	28	D	131	365	0.96	64	F	284
	Saturday	WB LT-TH	210	0.00	1	A	0	220	0.00	1	A	0	230	0.01	1	A	0
		EB TH-RT	380	0.26	0	A	0	410	0.28	0	A	0	525	0.36	0	A	0
		NB LT-RT	200	0.52	20	C	73	220	0.60	23	C	95	315	0.96	67	F	284
Summer Street at Thomas Road	Morning	EB LT-RT	30	0.09	11	B	7	45	0.14	11	B	12	50	0.15	12	B	13
		NB LT-TH	240	0.01	1	A	1	270	0.03	1	A	2	280	0.04	2	A	3
		SB TH-RT	195	0.15	0	A	0	220	0.16	0	A	0	225	0.17	0	A	0
	Evening	EB LT-RT	45	0.11	11	B	9	45	0.11	11	B	9	70	0.17	12	B	15
		NB LT-TH	240	0.02	1	A	2	250	0.02	1	A	2	265	0.03	1	A	2
		SB TH-RT	215	0.14	0	A	0	225	0.14	0	A	0	230	0.15	0	A	0
	Saturday	EB LT-RT	40	0.08	10	B	7	40	0.09	10	B	7	70	0.16	11	B	14
		NB LT-TH	225	0.02	1	A	1	235	0.02	1	A	1	260	0.04	2	A	3
		SB TH-RT	210	0.15	0	A	0	220	0.15	0	A	0	230	0.16	0	A	0
Walnut Street at Thomas Road	Morning	WB LT-RT	45	0.14	14	B	13	50	0.18	15	C	16	60	0.24	17	C	23
		NB TH-RT	190	0.12	0	A	0	220	0.14	0	A	0	240	0.15	0	A	0
		SB LT-TH	380	0.00	1	A	0	420	0.02	1	A	1	455	0.02	1	A	1
	Evening	WB LT-RT	30	0.09	12	B	7	30	0.09	12	B	7	50	0.19	15	B	18
		NB TH-RT	295	0.18	0	A	0	315	0.20	0	A	0	420	0.26	0	A	0
		SB LT-TH	175	0.00	1	A	0	195	0.00	1	A	0	260	0.00	1	A	0

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Walnut Street at Thomas Road	Saturday	WB LT-RT	35	0.09	12	B	7	35	0.09	12	B	7	65	0.23	17	C	22
		NB TH-RT	230	0.15	0	A	0	250	0.16	0	A	0	375	0.24	0	A	0
		SB LT-TH	190	0.00	1	A	0	210	0.00	1	A	0	315	0.00	1	A	0
Walnut Street at Site Driveway	Morning	EB LT	5	0.02	18	C	2	5	0.02	20	C	2	*Intersection realigned in Build Condition with proposed site drive in place*				
		EB RT	30	0.07	12	B	5	30	0.07	12	B	6					
		NB LT-TH	280	0.06	2	A	5	310	0.07	2	A	6					
		SB TH-RT	510	0.31	0	A	0	545	0.33	0	A	0					
	Evening	EB LT	25	0.07	13	B	6	25	0.08	14	B	6					
		EB RT	100	0.16	10	B	14	105	0.17	10	B	15					
		NB LT-TH	345	0.02	1	A	1	370	0.02	1	A	1					
		SB TH-RT	205	0.13	0	A	0	230	0.14	0	A	0					
	Saturday	EB LT	10	0.03	13	B	2	10	0.03	14	B	2					
		EB RT	50	0.08	10	A	7	55	0.09	10	B	8					
		NB LT-TH	265	0.03	1	A	2	290	0.03	1	A	2					
		SB TH-RT	225	0.14	0	A	0	245	0.15	0	A	0					
Walnut Street at I-95 SB Ramps (Exit 43)	Morning	WB LT	560	> 1.2	+	F	1317	595	> 1.2	+	F	1525	*Intersection realigned in Build Condition with proposed site drive in place*				
		WB RT	115	0.20	12	B	19	125	0.23	13	B	23					
		NB TH-RT	510	0.34	0	A	0	565	0.38	0	A	0					
		SB LT-TH	540	0.02	1	A	1	575	0.02	1	A	1					
	Evening	WB LT	135	0.50	30	D	66	155	0.67	45	E	107					
		WB RT	75	0.14	13	B	13	80	0.16	13	B	14					
		NB TH-RT	700	0.42	0	A	0	755	0.46	0	A	0					
		SB LT-TH	305	0.05	2	A	4	335	0.05	2	A	4					
	Saturday	WB LT	90	0.31	20	C	32	95	0.37	23	C	41					
		WB RT	60	0.12	12	B	10	65	0.14	12	B	12					
		NB TH-RT	590	0.39	0	A	0	635	0.42	0	A	0					
		SB LT-TH	270	0.03	1	A	2	295	0.03	1	A	3					
Walnut Street at Realigned Site Driveway/ I-95 SB Ramps	Morning	WB LT	*Operates as two independent T-type intersections prior to site occupancy*										595	> 1.2	+	F	*
		WB TH											85	>1.2	+	F	*
		WB RT											100	0.96	77	F	211
		EB LT-TH-RT											170	> 1.2	+	F	*
		NB LT-TH-RT											685	0.19	4	A	18
		SB LT-TH-RT											590	0.01	0	A	1

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Walnut Street at Realigned Site Driveway/ I-95 SB Ramps (Exit 43)	Evening	WB LT	*Operates as two independent T-type intersections prior to site occupancy*										150	>1.2	+	F	*
		WB TH											95	>1.2	+	F	341
		WB RT											70	>1.2	+	F	341
		EB LT-TH-RT											720	>1.2	+	F	*
		NB LT-TH-RT											1015	0.26	6	A	26
		SB LT-TH-RT											320	0.03	1	A	3
	Saturday	WB LT	*Operates as two independent T-type intersections prior to site occupancy*										90	>1.2	+	F	*
		WB TH											135	>1.2	+	F	*
		WB RT											55	>1.2	+	F	*
		EB LT-TH-RT											725	>1.2	+	F	*
		NB LT-TH-RT											1055	0.43	9	A	56
		SB LT-TH-RT											405	0.03	1	A	2
Walnut Street at I-95 NB Ramps (Exit 43)	Morning	EB LT	65	> 1.2	+	F	209	70	> 1.2	+	F	*	135	> 1.2	+	F	*
		EB RT	300	> 1.2	+	F	483	325	> 1.2	+	F	622	325	> 1.2	+	F	643
		NB TH-RT	510	0.34	0	A	0	580	0.39	0	A	0	635	0.42	0	A	0
		SB LT-TH	1080	0.09	3	A	7	1150	0.10	4	A	9	1090	0.14	5	A	12
	Evening	EB LT	50	0.98	+	F	119	55	> 1.2	+	F	171	225	> 1.2	+	F	*
		EB RT	430	0.75	23	C	171	470	0.86	34	D	253	470	1.03	71	F	395
		NB TH-RT	955	0.60	0	A	0	1025	0.65	0	A	0	1115	0.71	0	A	0
		SB LT-TH	385	0.12	4	A	10	430	0.14	4	A	12	655	0.36	10	A	40
	Saturday	EB LT	40	0.33	44	E	33	45	0.47	66	F	51	315	> 1.2	+	F	*
		EB RT	425	0.60	16	C	102	455	0.67	19	C	129	455	0.80	30	D	200
		NB TH-RT	650	0.44	0	A	0	705	0.48	0	A	0	850	0.57	0	A	0
		SB LT-TH	320	0.10	3	A	9	350	0.12	4	A	10	690	0.34	9	A	37
Audubon Road at Site Driveway	Morning	WB LT-RT	115	0.86	99	F	146	120	1.20	+	F	219	185	> 1.2	+	F	469
		NB TH-RT	1180	0.80	0	A	0	1285	0.87	0	A	0	1370	0.93	0	A	0
		SB LT-TH	180	0.01	1	A	1	275	0.01	0	A	1	285	0.06	2	A	5
	Evening	WB LT-RT	110	1.05	+	F	206	115	> 1.2	+	F	304	435	> 1.2	+	F	*
		NB TH-RT	180	0.12	0	A	0	275	0.18	0	A	0	500	0.33	0	A	0
		SB LT-TH	1105	0.02	1	A	1	1210	0.02	1	A	1	1210	0.08	3	A	7

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Audubon Road at Site Driveway	Saturday	WB LT-RT	75	0.14	12	B	13	80	0.20	14	B	18	455	> 1.2	+	F	*
		NB TH-RT	135	0.10	0	A	0	200	0.15	0	A	0	575	0.42	0	A	0
		SB LT-TH	135	0.00	0	A	0	195	0.00	0	A	0	195	0.05	2	A	4
Audubon Road/ Pleasure Island Road at I-95 SB Ramps	Morning	WB LT	295	> 1.2	+	F	652	340	> 1.2	+	F	*	340	> 1.2	+	F	*
		WB RT	350	1.14	+	F	371	375	> 1.2	+	F	514	395	> 1.2	+	F	636
		NB LT-TH	880	0.04	1	A	3	990	0.07	2	A	6	1055	0.07	2	A	6
		SB TH-RT	270	0.17	0	A	0	375	0.23	0	A	0	425	0.27	0	A	0
	Evening	WB LT	195	> 1.2	+	F	*	230	> 1.2	+	F	*	230	> 1.2	+	F	*
		WB RT	35	0.05	9	A	4	55	0.08	10	A	7	85	0.17	12	B	15
		NB LT-TH	330	0.24	7	A	24	435	0.30	8	A	32	630	0.37	9	A	42
		SB TH-RT	1190	0.80	0	A	0	1300	0.87	0	A	0	1560	1.04	0	A	0
	Saturday	WB LT	180	0.64	34	D	103	215	1.11	+	F	278	215	> 1.2	+	F	*
		WB RT	35	0.04	9	A	3	50	0.07	9	A	5	95	0.20	14	B	18
		NB LT-TH	240	0.12	5	A	10	325	0.15	5	A	14	655	0.22	5	A	21
		SB TH-RT	205	0.19	0	A	0	270	0.25	0	A	0	615	0.57	0	A	0
Salem Street at Pleasure Island Road	Morning	WB TH-RT	775	0.62	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		EB LT-TH	895	1.18	+	F	662										
		SB LT	35	> 1.2	+	F	*										
		SB RT	450	> 1.2	+	F	691										
	Evening	WB TH-RT	400	0.26	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		EB LT-TH	730	0.19	4	A	18										
		SB LT	210	> 1.2	+	F	472										
		SB RT	655	1.06	75	F	482										
	Saturday	WB TH-RT	255	0.17	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		EB LT-TH	475	0.15	4	A	13										
		SB LT	50	0.32	26	D	33										
		SB RT	270	0.53	15	B	80										

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Salem Street at Montrose Avenue	Morning	WB LT	250	0.42	13	B	52	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH	775	0.60	0	A	0										
		EB TH-RT	805	0.50	0	A	0										
		NB LT	65	> 1.2	+	F	*										
		NB RT	100	0.38	21	C	43										
	Evening	WB LT	225	0.28	11	B	29	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH	685	0.42	0	A	0										
		EB TH-RT	655	0.45	0	A	0										
		NB LT	105	> 1.2	+	F	631										
		NB RT	140	0.37	19	C	43										
	Saturday	WB LT	115	0.13	9	A	12	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH	345	0.25	0	A	0										
		EB TH-RT	445	0.30	0	A	0										
		NB LT	85	0.57	28	D	87										
		NB RT	105	0.22	13	B	21										
Salem Street at I-95 NB Ramps	Morning	WB TH	705	0.37	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH-RT	135	0.29	0	A	0										
		EB LT	135	0.22	11	B	21										
		EB TH	525	0.37	0	A	0										
		SB LT	280	> 1.2	+	F	*										
		SB RT	55	0.15	14	B	13										
	Evening	WB TH	355	0.16	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH-RT	435	0.37	0	A	0										
		EB LT	170	0.17	9	A	16										
		EB TH	430	0.30	0	A	0										
		SB LT	225	> 1.2	+	F	*										
		SB RT	20	0.04	12	B	3										
	Saturday	WB TH	305	0.14	0	A	0	*SIGNALIZED UNDER NO-BUILD CONDITIONS*					*SIGNALIZED UNDER BUILD CONDITIONS*				
		WB TH-RT	125	0.16	0	A	0										
		EB LT	90	0.08	8	A	7										
		EB TH	300	0.20	0	A	0										
		SB LT	145	0.75	57	F	130										
		SB RT	50	0.08	10	B	6										

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Table 9 (continued)
Unsignalized Intersection Capacity Analyses

Location	Peak Period	Movement	2007 Existing Conditions					2012 No-Build Conditions					2012 Build w/out Improvements				
			Demand [a]	v/c [b]	Delay [c]	LOS [d]	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)	Demand	v/c	Delay	LOS	95th Percentile Queue (ft)
Salem Street at Summer Street	Morning	WB TH	450	0.30	0	A	0	495	0.33	0	A	0	525	0.35	0	A	0
		WB RT	220	0.15	0	A	0	230	0.15	0	A	0	230	0.15	0	A	0
		EB LT-TH	220	0.10	3	A	8	270	0.12	4	A	10	285	0.12	4	A	10
		SB LT	260	1.06	113	F	290	275	> 1.2	+	F	439	275	> 1.2	+	F	479
		SB RT	115	0.23	13	B	22	120	0.26	14	B	25	125	0.28	15	B	28
	Evening	WB TH	155	0.10	0	A	0	195	0.13	0	A	0	240	0.16	0	A	0
		WB RT	265	0.18	0	A	0	280	0.19	0	A	0	280	0.19	0	A	0
		EB LT-TH	310	0.10	3	A	8	355	0.11	4	A	9	425	0.13	4	A	11
		SB LT	195	0.60	26	D	94	205	0.73	38	E	139	205	0.89	68	F	203
		SB RT	70	0.10	10	A	8	80	0.12	10	A	10	85	0.14	11	B	12
	Saturday	WB TH	165	0.11	0	A	0	190	0.12	0	A	0	255	0.16	0	A	0
		WB RT	285	0.18	0	A	0	300	0.19	0	A	0	300	0.19	0	A	0
		EB LT-TH	245	0.09	4	A	7	275	0.10	4	A	9	345	0.12	4	A	10
		SB LT	340	0.88	49	E	234	355	1.03	85	F	333	355	> 1.2	+	F	501
		SB RT	90	0.12	10	A	10	100	0.14	10	B	12	110	0.17	11	B	15

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b volume-to-capacity ratio for the critical movement
c delay of critical approach only, rounded to the nearest whole second
d level of service of the critical movement
+ Delays can be assumed to exceed 120 seconds; i.e., LOS F.

As shown in Table 9, the intersections of Walnut Street at the I-95 Southbound Ramps, Walnut Street at the I-95 Northbound Ramps, Audubon Road at Site Driveway, and Audubon Road/Pleasure Island Road at the I-95 Southbound Ramps are expected to operate at LOS F during at least one of the peak periods under Existing, No-Build, and Build conditions including: As part of the mitigation program for this project, significant improvements are proposed at these locations. Detailed discussion of the proposed improvements is contained in the Mitigation chapter of this report.

The critical movement at Summer Street at South Common Street/Arlington Street currently operates are LOS D or better during weekday morning, weekday evening, and Saturday midday peak periods. Under 2012 No-Build conditions, the critical traffic movement at this intersection is expected to experience LOS E, D, and D during morning, evening, and Saturday peaks, respectively. Under Build conditions, the critical movement is expected to operate at LOS E during all three peak periods.

The critical movement at the intersection of Summer Street with Walnut Street currently experiences a LOS C during all peak periods. It is expected to operate at LOS D during morning and evening peaks and continue to operate at LOS C during the Saturday peak period under 2012 No-Build Conditions. During the 2012 Build conditions, this location is expected to experience LOS E and F during the peak periods.

The critical movement at Summer Street at Thomas Road currently operates at LOS B during all peak periods. Under 2012 No-Build and Build conditions, this critical traffic movement is expected to continue to operate at LOS B during all peak periods. Similarly, the critical movement at Walnut Street at Thomas Road currently operates at LOS B during all peak periods. Under 2012 No-Build and Build conditions, this critical traffic movement is expected to continue to operate at LOS B or better during all peak periods.

The critical movement at Walnut Street at Site Driveway currently operates at LOS C or better during all peak periods and is expected to continue to operate at this level of service in the future 2012 No-Build and 2012 Build Conditions.

The critical movements at the intersections of Salem Street with Pleasure Island Road, Montrose Avenue, and the I-95 Northbound Ramps all currently experience LOS F. These are all expected to undergo planned improvements that transition them from unsignalized intersections with poor operations under the Existing conditions to signalized intersections with much improved operations under the No-Build and Build conditions.

■

Roundabout Capacity Analysis

As shown in Figure 1, the first internal intersection on site is proposed to be a roundabout. Capacity analyses were conducted for the proposed roundabout on the project site for the 2012 Build Conditions. This analysis was performed using SIDRA, which is a software program specializing in the analysis of roundabouts and rotaries. The results of the analysis are shown in Table 10. The capacity analyses displayed in Table 10 represent peak traffic volumes within the project site. As shown, the roundabout is expected to operate at LOS B during all peak periods.

Table 10
Roundabout Capacity Analysis* Summary

	2012 Build Condition		
Location/Time Period	Demand [a]	Delay [b]	LOS [c]
On-Site Roundabout			
Morning Peak Hour			
South Loop Drive	75	9	A
East Driveway	300	10	A
North Loop Drive	85	13	B
Central Drive	45	9	A
Overall Intersection	- -	10	B
Evening Peak Hour			
South Loop Drive	378	12	B
East Driveway	633	10	B
North Loop Drive	390	15	B
Central Drive	190	12	B
Overall Intersection	- -	12	B
Saturday Midday Peak Hour			
South Loop Drive	384	15	B
East Driveway	834	11	B
North Loop Drive	390	17	B
Central Drive	195	15	B
Overall Intersection	- -	14	B

* Analysis performed using SIDRA software

5

Mitigation

The analysis of project-related impacts indicates that with the implementation of area improvements (documented in this chapter), the additional site-generated traffic associated with the proposed development can be accommodated at the study area intersections. Furthermore, the proposed project has the potential to mitigate existing intersection deficiencies and improve locations that operate at constrained levels independent of the proposed project.

As demonstrated in the intersection operation analyses, many of the study area intersections currently experience, or would be expected in the future No-Build and Build conditions to experience peak hour operational deficiencies. The following section discusses a series of measures aimed at both enhancing the general nature of the proposed development, to mitigate potential off-site impacts associated with the addition of project-related traffic, and to help address many of the regions long-standing transportation issues.

Proposed Mitigation Measures

To mitigate the project's impacts and to address existing deficiencies in this area, the Proponent is committed to implementing the following mitigation measures associated with the proposed development. These measures include strategies related to improving intersection capacity, traffic safety, traffic flow and progression, as well as shortening queue lengths at several intersections. Intersection capacity strategies include measures such as intersection and roadway widening and/or traffic control improvements. This section discuss, by location, proposed site access and off-site capacity enhancing strategies to mitigate project impacts and address existing operating and safety deficiencies, where possible.

■

Proposed Site Access Mitigation

Walnut Street at I-95 Southbound Ramps/Colonial Golf Club Site Driveway (Exit 43)

It is anticipated that this intersection would serve as the primary site access for the proposed site. Given the anticipated amount of traffic that would be traveling through this intersection under 2012 Build conditions, signalization of this intersection is recommended. VHB conducted preliminary review of traffic signal warrants, which are included in the Appendix to this document and generally indicate that signalization of this location is appropriate. In addition, geometric modifications are recommended at this location to accommodate the proposed project as well as introduce additional efficiency to the intersection. The proposed improvements at this location include:

- Installation of a fully-actuated traffic signal at this intersection.
- Realignment of the Site Driveway with the Route 128 Southbound exit ramps (Exit 43) to create a four-legged intersection.
- Widening the northbound approach of Walnut Street to provide one exclusive left-turn lane and one through lane.
- Widening the southbound approach of Walnut Street to provide one exclusive left-turn lane and one through/right-turn lane.
- Widening/restriping of the eastbound and westbound approaches, to accommodate exclusive left-turn, through, and right-turn lanes for both approaches.

These improvements will adequately accommodate the project's traffic volumes in addition to providing additional efficiency and reserve capacity. It is expected that the intersection will operate at LOS D, LOS C, and LOS B during morning, evening, and Saturday midday peak periods, respectively, with the proposed improvements in place.

Audubon Road at Colonial Golf Club Site Driveway

This intersection is expected to serve as the secondary access for the proposed site. As such, a signal warrant analysis was run to determine whether signalization of this intersection is required. VHB conducted preliminary review of traffic signal warrants, which are included in the Appendix to this document and generally indicate that signalization of this location is appropriate. This intersection currently operates at LOS F under existing conditions and is expected to continue to operate at LOS F independent of the proposed project with significant delay for the side street movements. To improve capacity at this intersection under future conditions,

signalization is recommended. In addition, geometric modifications are recommended at this location to accommodate the proposed project as well as existing deficiencies at this location. The proposed improvements at this location include:

- Installation of a fully-actuated traffic signal at this intersection.
- Coordination with new Pleasure Island Road/I-95 Southbound Ramps (Exit 42) signal. (Discussed later in this chapter)
- Widening the southbound approach of Audubon Road to provide two through lanes.
- Widening the westbound approach of Colonial Golf Club Driveway to provide an exclusive left-turn lane and a shared left-/right-turn lane.
- Widening the northbound approach of Audubon Road to provide a through lane and a shared through/right-turn lane.

Capacity analyses show that this location is expected to operate at a reasonable level of service with these improvements in place. It is expected that the intersection will operate at LOS A, LOS B, and LOS B during morning, evening, and Saturday midday peak periods, respectively, with the proposed improvements in place.

Detailed signage will be provided on the site driveway dual left-turn lane approach to Audubon Road so that vehicles will be in the proper left-turn lane as they approach this intersection. This will serve to reduce weaving movements between the I-95 southbound on-ramp and Audubon Road southbound. In addition, the gore area for the I-95 southbound on-ramp will be extended to better accommodate weave movements.

Improved Connection to Audubon Road

It is anticipated that the site driveway at Audubon Road would serve as the secondary site access for the proposed site. The current connection from Audubon Road to the site is a fairly narrow roadway with multiple speed bumps to control vehicle speeds along the corridor. The speed bumps were put in place to limit speeds in this area since there are several roadway crossings as part of the golf course. Under the proposed plan, this roadway would be improved to accommodate a more sustainable traffic flow to and from Audubon Road, and all of the speed bumps would be removed.

■

Proposed Off-Site Mitigation

Walnut Street at Salem Street/Walnut Street at I-95 Northbound Ramps (Exit 43)

Vehicle queues on the Walnut Street southbound approach to the intersection of Walnut Street at Salem Street cause queues to spill back onto the I-95 Northbound Off Ramp under Existing conditions. In addition, this intersection is expected to operate at constrained levels during the weekday evening peak hour under 2012 No-Build conditions, independent of the proposed project. In 1995, plans for improvements at this intersection were prepared by Bruce Campbell & Associates on behalf of the Town of Lynnfield and were submitted to MassHighway. These plans also included improvements to the intersection of Walnut Street and the I-95 Northbound Ramps. To maximize separation between the two intersections, the I-95 ramp was proposed to be shifted north. At the intersection of Walnut Street and Salem Street, Walnut Street was proposed to be widened to provide two general-purpose lanes on the northbound and southbound approaches. The Salem Street eastbound and westbound approaches were proposed to be widened to provide an exclusive left-turn lane and a shared through/right-turn lane. At the intersection of Walnut Street and the I-95 Northbound Off Ramp, modifications to the curb radii were proposed and Walnut Street was proposed to be widened to provide two general purpose lanes on the northbound and southbound approaches. During the initial design review process, the Town of Lynnfield decided not to pursue implementation of this improvement project therefore the design was put on hold.

To determine if the previously proposed improvements were adequate to accommodate traffic volumes associated with the proposed project, VHB conducted capacity analysis under 2012 Build conditions assuming implementation of these improvements. The results of this analysis show a significant improvement in operations at the intersection of Walnut Street and Salem Street. However, operations at the intersection of Walnut Street and the I-95 Northbound Off Ramp are still expected to be at LOS F due to such high turning volumes at an unsignalized intersection. Signalization of this intersection would be required to improve the capacity of the side street movements. VHB conducted analysis of this intersection assuming implementation of a traffic signal and the results show that acceptable level of service and improved vehicle queues can be achieved with additional geometric modifications. Therefore, the Proponent is recommending improvements at these locations, which include:

<u>Walnut Street at Salem Street</u>

- Widening the southbound approach of Walnut Street to provide an exclusive left-turn lane, two exclusive through lanes and a channelized right-turn lane.

- Widening the northbound approach of Walnut Street to provide a shared left-turn/through lane and a channelized right-turn lane.
- Widening Salem Street eastbound approach to provide an exclusive left-turn lane and a shared through/right-turn lane.
- Widening Salem Street westbound approach to provide an exclusive left-turn lane, an exclusive through lane and an exclusive right-turn lane.
- Install a new traffic signal.
- Modifying traffic signal timing, phasing, and coordinating the traffic signal with that proposed at the intersection of Walnut Street and the I-95 Northbound Ramps.

Walnut Street at I-95 Northbound Ramps

- Installation of a fully-actuated traffic signal.
- Shifting I-95 Northbound Off Ramp north and modify curb radii.
- Widening Walnut Street to provide an exclusive through lane and an exclusive right-turn lane on the northbound approach.
- Widening Walnut Street to provide an exclusive through lane and an exclusive left-turn lane on the southbound approach.
- Coordinating the traffic signal with that at Walnut Street and Salem Street.

Construction of these proposed improvements will provide much needed capacity at these intersections. Additional capacity at these intersection approaches will provide storage space for queued vehicles. In addition, shifting the I-95 northbound ramp to the north will provide additional queue storage for Walnut Street southbound and creates separation between the two intersections to improve efficiency of operations. Table 11 presents the results of these proposed improvements.

Audubon Road at I-95 Southbound Ramps (Exit 42)

This intersection currently operates at LOS F under existing conditions and is expected to continue to operate at LOS F independent of the proposed project with significant delay for the side street movement due to heavy through traffic along Pleasure Island Road/Audubon Road during peak periods. The proposed improvements at this location include:

- Installation of a fully-actuated traffic signal at this intersection.
- Coordination with new Audubon Road at Colonial Golf Club Driveway signalized intersection.
- Widening the southbound approach to provide two exclusive through lanes and an exclusive right-turn lane.
- Widening the northbound approach to provide two exclusive through lanes and an exclusive right-turn lane.

VHB conducted preliminary review of traffic signal warrants, which are included in the Appendix to this document and generally indicate that signalization of this location are appropriate.

Salem Street at Pleasure Island Road

As previously discussed in Future Roadway Conditions, improvements are currently proposed by the MassHighway for this intersection and are on the state TIP for 2010. Signal timing modifications are proposed at this location as part of this project to ensure maximum efficiency with the added project traffic.

In addition and as previously noted, implementation of the Salem Street improvements is essential to accommodating future traffic demands along this corridor independent of the proposed project. To ensure efficient traffic operations along Salem Street under future Build conditions, the proponent is committed to fund the construction of any incomplete work.

Salem Street at I-95 Northbound Ramps (Exit 42)

As previously discussed in Future Roadway Conditions, improvements are currently proposed by the MassHighway for this intersection and are on the state TIP for 2010. Signal timing modifications are proposed at this location as part of this project to ensure maximum efficiency with the added project traffic.

In addition and as previously noted, implementation of the Salem Street improvements is essential to accommodating future traffic demands along this corridor independent of the proposed project. To ensure efficient traffic operations along Salem Street under future Build conditions, the proponent is committed to fund the construction of any incomplete work.

Salem Street at Montrose Avenue

As previously discussed in Future Roadway Conditions, improvements are currently proposed by the MassHighway for this intersection and are on the state TIP for 2010. Signal timing modifications are proposed at this location as part of this project to ensure maximum efficiency with the added project traffic.

In addition and as previously noted, implementation of the Salem Street improvements is essential to accommodating future traffic demands along this corridor independent of the proposed project. To ensure efficient traffic operations along Salem Street under future Build conditions, the proponent is committed to fund the construction of any incomplete work.

Walnut Street at Summer Street

The critical movement at this intersection currently operates at LOS C and is expected to operate at LOS D under the future 2012 No-Build Conditions. With the proposed project in place, the critical movement is expected to experience a decline in level of service. It is recommended that a channelized right-turn lane for the Summer Street southbound approach be provided. One potential solution to further improve operations would be the implementation of all-way STOP control, which would provide protection for critical left-turning movements from Walnut Street. It should be noted, however, that due to the conservative nature of the trip generation analysis, as discussed in previous sections, the actual critical movement at this intersection under future conditions may, in fact, experience levels of service and delay significantly better than the analysis indicates. Therefore, the Proponent recommends a traffic monitoring program at this intersection prior to the implementation of additional intersection improvements at this location. Should the monitoring program indicate the need for additional improvements, the Proponent will consult with the Town as to the desirability of an all-way STOP condition. For informational purposes, capacity analysis has been conducted for this scenario.

Capacity analyses for all intersections with proposed improvements show that these locations are expected to operate at reasonable levels of service with improvements in place. Table 11 summarizes the results of the capacity analysis conducted assuming the implementation of the improvement identified above. Figures 17 through 21 present concepts of the proposed mitigation actions at each location identified above.

Main Street at South Common Street
Main Street at Summer Street
Salem Street at Summer Street

These three intersections form a triangle known as the Town Common, which is an area of concern for the Town of Lynnfield. Based on analysis conducted in this study, the proposed project is expected to have only a minimal impact in this area. However, through discussions with the Town, the proponent has committed to assisting the Town of Lynnfield in determining potential improvements to this area.

Meadow Walk at Lynnfield, Massachusetts

Vanasse Hangen Brustlin, Inc. VHB

Conceptual Intersection Improvement Plan

Lynnfield Walnut Street at Proposed Site Drive and I-95 Southbound Ramps (Exit 43)

Figure 18

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Meadow Walk at Lynnfield, Massachusetts

Vanasse Hangen Brustlin, Inc. VHB

Conceptual Intersection Improvement Plan

Wakefield Audubon Road at Colonial Golf Course Driveway and I-95 Southbound Ramps (Exit 42)

Figure 19

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Meadow Walk at Lynnfield, Massachusetts

Vanasse Hangen Brustlin, Inc. VHB

Conceptual Intersection Improvement Plan

Lynnfield Walnut Street at Salem Street and I-95 Northbound Ramps (Exit 43)

Figure 20

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Meadow Walk at Lynnfield, Massachusetts

Vanasse Hangen Brustlin, Inc. VHB

Conceptual Intersection Improvement Plan

Summer Street at Walnut Street

Figure 21

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Table 11
Intersection Capacity Analyses with Improvements

Location	Peak Period	2012 No-Build Conditions					2012 Build w/out Improvements					2012 Build w/ Improvements					
		Movement	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Walnut Street at Site Driveway/ I-95 SB Ramps (Exit 43)	Morning	WB LT	595	+	F	1525	WB LT	595	+	F	*	WB LT	0.93	38	D	316	488
		WB RT	125	13	B	23	WB TH	85	+	F	*	WB TH	0.11	13	B	29	54
		EB LT	5	20	C	2	WB RT	100	77	F	211	WB RT	0.07	13	B	0	23
		EB RT	30	12	B	6	EB LT-TH-RT	170	+	F	*	EB LT	0.43	45	D	20	47
		NB LT-TH	310	2	A	6	NB LT-TH-RT	685	4	A	18	EB TH	0.69	60	E	41	85
		NB TH-RT	565	0	A	0	SB LT-TH-RT	590	0	A	1	EB RT	0.06	41	D	0	39
		SB LT-TH	575	1	A	1						NB LT	0.92	58	E	67	183
		SB TH-RT	545	0	A	0						NB TH	0.21	13	B	0	0
												NB RT	0.27	1	A	0	0
												SB LT	0.04	21	C	6	21
												SB TH-RT	1.00	69	E	338	565
												Overall	0.95	38	D		
	Evening	WB LT	155	45	E	107	WB LT	150	+	F	*	WB LT	0.68	49	D	95	175
		WB RT	80	13	B	14	WB TH	95	+	F	341	WB TH	0.47	43	D	61	108
		EB LT	25	14	B	6	WB RT	70	+	F	341	WB RT	0.05	40	D	0	39
		EB RT	105	10	B	15	EB LT-TH-RT	720	+	F	*	EB LT	0.50	35	C	108	153
		NB LT-TH	370	1	A	1	NB LT-TH-RT	1015	6	A	26	EB TH	0.80	48	D	188	227
		NB TH-RT	755	0	A	0	SB LT-TH-RT	320	1	A	3	EB RT	0.33	15	B	17	29
		SB LT-TH	335	2	A	4						NB LT	0.54	11	B	103	126
		SB TH-RT	230	0	A	0						NB TH	0.26	7	A	74	91
												NB RT	0.29	0	A	0	0
												SB LT	0.19	34	C	22	51
												SB TH-RT	0.78	48	D	160	249
												Overall	0.68	24	C		
	Saturday	WB LT	95	23	C	41	WB LT	90	+	F	*	WB LT	0.70	38	D	41	76
		WB RT	65	12	B	12	WB TH	135	+	F	*	WB TH	0.34	23	C	52	91
		EB LT	10	14	B	2	WB RT	55	+	F	*	WB RT	0.04	21	C	0	21
		EB RT	55	10	B	8	EB LT-TH-RT	725	+	F	*	EB LT	0.61	28	C	64	113
		NB LT-TH	290	1	A	2	NB LT-TH-RT	1055	9	A	56	EB TH	0.67	28	C	114	175
		NB TH-RT	635	0	A	0	SB LT-TH-RT	405	1	A	2	EB RT	0.20	6	A	3	24
		SB LT-TH	295	1	A	3						NB LT	0.65	11	B	108	169
		SB TH-RT	245	0	A	0						NB TH	0.18	6	A	32	49
												NB RT	0.28	0	A	0	0
												SB LT	0.15	23	C	13	36
												SB TH-RT	0.90	51	D	140	296
												Overall	0.73	19	B		

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
d volume-to-capacity ratio
+ Delay cannot be accurately calculated when v/c is greater than 1.2
* Queue cannot be calculated

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions				2012 Build w/out Improvements				2012 Build w/ Improvements					
			Demand	Delay	LOS	95th Percentile Queue (ft)	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Walnut Street at I-95 NB Ramps (Exit 43)	Morning	EB LT	70	+	F	*	135	+	F	*	EB LT	0.54	36	D	84	138
		EB RT	325	+	F	622	325	+	F	643	EB RT	0.82	47	D	120	181
		NB TH-RT	580	0	A	0	635	0	A	0	NB TH	0.57	8	A	104	136
		SB LT-TH	1150	4	A	9	1090	5	A	12	NB RT	0.06	5	A	1	0
											SB LT	0.65	42	D	62	67
											SB TH	0.90	10	A	335	338
											Overall	0.88	18	B		
	Evening	EB LT	55	+	F	171	225	+	F	*	EB LT	0.83	54	D	176	262
		EB RT	470	34	D	253	470	71	F	395	EB RT	1.04	89	F	242	292
		NB TH-RT	1025	0	A	0	1115	0	A	0	NB TH	0.84	18	B	186	320
		SB LT-TH	430	4	A	12	655	10	A	40	NB RT	0.23	0	A	0	0
											SB LT	0.84	68	E	138	264
											SB TH	0.38	8	A	140	189
											Overall	0.88	36	D		
	Saturday	EB LT	45	66	F	51	315	+	F	*	EB LT	0.83	39	D	140	268
		EB RT	455	19	C	129	455	30	D	200	EB RT	0.76	30	C	112	170
		NB TH-RT	705	0	A	0	850	0	A	0	NB TH	0.95	23	C	121	439
		SB LT-TH	350	4	A	10	590	9	A	37	NB RT	0.08	3	A	0	0
											SB LT	1.20	157	F	121	214
											SB TH	0.37	3	A	36	49
											Overall	0.95	34	C		

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
d volume-to-capacity ratio
+ Delay cannot be accurately calculated when v/c is greater than 1.2
* Queue cannot be calculated

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	2012 Build w/out Improvements v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	2012 Build w/ Improvements Movement	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Walnut Street at Salem Street	Morning	WB LT-TH-RT	>1.2	+	F	734	837	>1.2	+	F	782	881	WB LT	0.60	35	D	83	134
		EB LT-TH-RT	0.91	60	E	142	261	0.92	64	E	144	265	WB TH	0.99	67	E	313	441
		NB LT-TH	>1.2	+	F	434	640	>1.2	+	F	512	720	WB RT	0.11	23	C	0	32
		NB RT	0.02	7	A	0	10	0.01	7	A	0	10	EB LT	1.05	151	F	49	124
		SB LT-TH	0.89	25	C	466	789	0.96	34	C	526	857	EB TH-RT	0.34	26	C	67	114
		SB RT	0.32	9	A	72	122	0.32	9	A	72	122	NB LT-TH	0.99	55	D	322	561
		Overall	>1.2	+	F			>1.2	+	F			NB RT	0.02	10	B	0	12
													SB LT	0.21	10	A	13	16
													SB TH	0.48	10	A	143	181
													SB RT	0.33	8	A	53	86
													Overall	1.00	34	C		
	Evening	WB LT-TH-RT	0.47	18	B	86	154	0.53	19	B	100	177	WB LT	0.56	46	D	23	74
		EB LT-TH-RT	>1.2	+	F	539	617	>1.2	+	F	554	632	WB TH	0.44	37	D	86	147
		NB LT-TH	1.14	95	F	404	605	>1.2	+	F	558	588	WB RT	0.12	34	C	0	55
		NB RT	0.04	8	A	0	16	0.04	8	A	0	16	EB LT	0.74	37	D	123	164
		SB LT-TH	>1.2	+	F	515	697	>1.2	+	F	635	829	EB TH-RT	1.01	75	E	365	460
		SB RT	0.07	8	A	0	20	0.07	8	A	0	20	NB LT-TH	0.98	51	D	497	770
		Overall	>1.2	+	F			>1.2	+	F			NB RT	0.05	14	B	1	24
													SB LT	1.02	81	F	61	146
													SB TH	0.34	26	C	90	129
													SB RT	0.07	5	A	4	5
													Overall	1.00	42	D		
	Saturday	WB LT-TH-RT	0.63	21	C	97	147	0.75	25	C	122	181	WB LT	0.21	26	C	14	34
		EB LT-TH-RT	0.90	44	D	111	244	1.00	72	E	118	264	WB TH	0.63	31	C	77	120
		NB LT-TH	0.62	11	B	128	222	0.92	30	D	196	426	WB RT	0.14	25	C	0	36
		NB RT	0.04	5	A	0	12	0.04	5	A	0	12	EB LT	0.33	19	B	27	56
		SB LT-TH	0.72	13	B	176	267	>1.2	+	F	438	586	EB TH-RT	0.42	20	B	69	125
		SB RT	0.05	5	A	0	12	0.05	5	A	0	12	NB LT-TH	0.91	35	C	273	489
		Overall	0.78	18	B			>1.2	78	F			NB RT	0.04	11	B	0	20
													SB LT	0.65	17	B	43	78
													SB TH	0.37	7	A	112	143
													SB RT	0.04	12	B	6	13
													Overall	0.78	21	C		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2
* Queue cannot be calculated

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions				2012 Build w/out Improvements				2012 Build w/ Improvements					
			Demand [a]	Delay [b]	LOS [c]	95th Percentile Queue (ft)	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	v/c [d]	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Audubon Road at Site Driveway	Morning	WB LT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	WB LT	0.48	30	C	39	72
		WB LT-RT	120	+	F	219	185	+	F	469	WB LT-RT	0.48	30	C	39	72
		NB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NB TH	0.60	4	A	40	65
		NB TH-RT	1285	0	A	0	1370	0	A	0	NB TH-RT	0.60	4	A	40	65
		SB LT-TH	275	0	A	1	285	2	A	5	SB LT-TH	0.13	2	A	15	17
		SB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	SB TH	0.13	2	A	15	17
											Overall	0.59	6	A		
	Evening	WB LT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	WB LT	0.74	35	D	169	169
		WB LT-RT	115	+	F	304	435	+	F	*	WB LT-RT	0.74	35	D	169	169
		NB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NB TH	0.22	4	A	34	34
		NB TH-RT	275	0	A	0	500	0	A	0	NB TH-RT	0.22	4	A	34	34
		SB LT-TH	1210	1	A	1	1210	3	A	7	SB LT-TH	0.66	10	A	214	316
		SB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	SB TH	0.66	10	A	214	316
											Overall	0.68	15	B		
	Saturday	WB LT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	WB LT	0.69	31	C	129	149
		WB LT-RT	80	14	B	18	455	+	F	*	WB LT-RT	0.69	31	C	129	149
		NB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	NB TH	0.27	13	B	12	47
		NB TH-RT	200	0	A	0	575	0	A	0	NB TH-RT	0.27	13	B	12	47
		SB LT-TH	195	0	A	0	195	2	A	4	SB LT-TH	0.19	5	A	30	31
		SB TH	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	SB TH	0.19	5	A	30	31
											Overall	0.37	17	B		

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
d volume-to-capacity ratio
+ Delay cannot be accurately calculated when v/c is greater than 1.2
* Queue cannot be calculated

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions				2012 Build w/out Improvements				2012 Build w/ Improvements					
			Demand [a]	Delay [b]	LOS [c]	95th Percentile Queue (ft)	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	v/c [d]	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Audubon Road at I-95 SB Ramps	Morning	WB LT	340	+	F	*	340	+	F	*	WB LT-TH	0.72	29	C	134	218
		WB RT	375	+	F	514	395	+	F	636	WB RT	0.64	27	C	90	184
		NB LT-TH	990	2	A	6	1055	2	A	6	NB LT	0.14	5	A	14	29
		SB TH-RT	375	0	A	0	425	0	A	0	NB TH	0.76	12	B	250	392
											SB TH	0.18	8	A	46	72
											SB RT	0.09	0	A	0	0
											Overall	0.74	16	B		
	Evening	WB LT	230	+	F	*	230	+	F	*	WB LT-TH	0.69	39	D	142	197
		WB RT	55	10	A	7	85	12	B	15	WB RT	0.06	29	C	0	34
		NB LT-TH	435	8	A	32	630	9	A	42	NB LT	0.63	11	B	39	117
		SB TH-RT	1300	0	A	0	1560	0	A	0	NB TH	0.36	5	A	87	162
											SB TH	0.56	12	B	160	236
											SB RT	0.46	1	A	0	0
											Overall	0.63	11	B		
	Saturday	WB LT	215	+	F	278	215	+	F	*	WB LT-TH	0.63	33	C	113	166
		WB RT	50	9	A	5	95	14	B	18	WB RT	0.06	26	C	0	34
		NB LT-TH	325	5	A	14	655	5	A	21	NB LT	0.39	4	A	24	60
		SB TH-RT	270	0	A	0	615	0	A	0	NB TH	0.23	3	A	34	92
											SB TH	0.37	7	A	37	72
											SB RT	0.18	0	A	0	0
											Overall	0.43	9	A		

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
d volume-to-capacity ratio
+ Delay cannot be accurately calculated when v/c is greater than 1.
* Queue cannot be calculated

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions				2012 Build w/out Improvements				2012 Build w/ Improvements				
			Demand [a]	Delay [b]	LOS [c]	95th Percentile Queue (ft)	Demand	Delay	LOS	95th Percentile Queue (ft)	Movement	Demand	Delay	LOS	95th Percentile Queue (ft)
Summer Street at Walnut Street	Morning	WB LT-TH	245	1	A	1	235	1	A	1	WB LT-TH	245	14	B	n/a
		EB RT-TH	615	0	A	0	660	0	A	0	EB TH	205	12	C	n/a
		NB LT-RT	200	31	D	111	215	37	E	136	EB RT	445	21	C	n/a
											NB LT-RT	215	15	B	n/a
	Evening	WB LT-TH	245	1	A	1	255	1	A	1	WB LT-TH	255	15	C	n/a
		EB RT-TH	380	0	A	0	450	0	A	0	EB TH	205	12	B	n/a
		NB LT-RT	285	28	D	131	365	64	F	284	EB RT	245	12	B	n/a
											NB LT-RT	365	22	C	n/a
	Saturday	WB LT-TH	220	0	A	0	230	1	A	0	WB LT-TH	230	14	B	n/a
		EB RT-TH	410	0	A	0	525	0	A	0	EB TH	215	13	B	n/a
		NB LT-RT	220	23	C	95	315	67	F	284	EB RT	310	15	B	n/a
											NB LT-RT	315	21	C	n/a

a demand in vehicles per hour for unsignalized intersections; the demand applies to only the most critical street approach or lane group
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
n/a queue cannot be calculated for three-way stop control

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions					2012 Build w/out Improvements					2012 Build w/ Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at I-95 Northbound Ramps	Morning	WB TH	0.52	3	A	60	92	0.95	11	B	184	176	0.72	11	B	194	183
		WB TH-RT	0.52	3	A	60	92	0.95	11	B	184	176	0.72	11	B	194	183
		EB LT	1.03	7	A	104	148	0.42	13	B	24	66	0.55	12	B	27	79
		EB TH	1.03	7	A	104	148	0.42	8	A	152	201	0.56	8	A	151	212
		SB LT	0.64	32	C	96	121	0.53	32	C	103	131	0.67	33	C	104	129
		SB RT	0.04	0	A	0	0	0.18	0	A	0	0	0.04	0	A	0	0
		Overall	0.63	9	A			0.61	13	B			0.70	13	B		
	Evening	WB TH	0.36	7	A	23	78	0.55	15	B	110	156	0.58	23	C	166	262
		WB TH-RT	0.36	7	A	23	78	0.55	15	B	110	156	0.58	23	C	166	262
		EB LT	0.86	6	A	80	136	0.59	11	B	30	82	0.56	11	B	36	95
		EB TH	0.86	6	A	80	136	0.51	7	A	138	211	0.51	7	A	124	209
		SB LT	0.57	31	C	83	106	0.62	31	C	100	24	0.63	32	C	101	124
		SB RT	0.01	0	A	0	0	0.01	0	A	0	0	0.01	0	A	0	0
		Overall	0.56	10	B			0.59	15	B			0.57	19	B		
	Saturday	WB TH	0.23	1	A	8	12	0.33	4	A	42	110	0.33	6	A	52	107
		WB TH-RT	0.23	1	A	8	12	0.33	4	A	42	110	0.33	6	A	52	107
		EB LT	0.26	3	A	30	53	0.36	4	A	50	90	0.36	4	A	50	90
		EB TH	0.26	3	A	30	53	0.36	4	A	50	90	0.36	4	A	50	90
		SB LT	0.47	32	C	56	81	0.57	31	C	82	109	0.57	31	C	82	109
		SB RT	0.04	0	A	0	0	0.04	0	A	0	0	0.04	0	A	0	0
		Overall	0.29	7	A			0.41	9	A			0.40	10	A		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions					2012 Build w/out Improvements					2012 Build w/ Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at Montrose Avenue	Morning	WB LT	0.87	8	A	61	108	0.93	13	B	67	116	0.93	24	C	363	363
		WB TH		n/a		n/a		0.93	13	B	67	116	0.93	24	C	363	363
		EB TH-RT	0.56	13	B	110	197	0.59	14	B	117	202	0.59	13	B	119	276
		NB LT	0.52	33	C	67	90	0.52	33	C	67	90	0.52	33	C	67	90
		NB RT	0.10	29	C	0	24	0.12	29	C	0	25	0.12	29	C	0	25
		Overall	0.79	13	B			0.84	15	B			0.84	21	C		
	Evening	WB LT	0.66	6	A	45	157	>1.2	11	B	142	34	0.73	11	B	64	91
		WB TH		n/a		n/a		>1.2	11	B	142	34	0.66	8	A	288	311
		EB TH-RT	0.44	8	A	62	162	0.52	8	A	78	188	0.54	9	A	75	127
		NB LT	0.58	33	C	82	132	0.58	33	C	82	132	0.76	46	D	86	172
		NB RT	0.11	28	C	0	44	0.15	28	C	0	52	0.15	31	C	0	58
		Overall	0.64	10	B			0.81	13	B			0.72	13	B		
	Saturday	WB LT	0.34	3	A	25	43	0.95	7	A	83	129	0.50	7	A	54	90
		WB TH		n/a		n/a		0.95	7	A	83	129	0.54	5	A	97	199
		EB TH-RT	0.29	5	A	36	56	0.42	7	A	54	145	0.46	9	A	63	174
		NB LT	0.54	33	C	70	104	0.53	33	C	70	102	0.52	33	C	70	102
		NB RT	0.09	29	C	0	32	0.18	29	C	0	38	0.17	29	C	0	38
		Overall	0.38	9	A			0.61	11	B			0.53	12	B		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2

Table 11 (continued)
Intersection Capacity Analyses with Improvements

Location	Peak Period	Movement	2012 No-Build Conditions					2012 Build w/out Improvements					2012 Build w/ Improvements				
			v/c [a]	Delay [b]	LOS [c]	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)	v/c	Delay	LOS	Average Queue (ft)	95th Percentile Queue (ft)
Salem Street at Pleasure Island Road	Morning	WB TH	0.55	18	B	166	170	0.55	18	B	166	170	0.92	44	D	222	227
		WB RT	0.32	9	A	60	77	0.32	9	A	61	78	0.40	21	C	67	96
		EB LT	>1.20	+	F	655	836	>1.20	+	F	737	921	0.97	31	C	166	313
		EB TH	0.22	1	A	6	7	0.22	1	A	7	8	0.20	1	A	4	4
		SB LT	0.27	29	C	36	76	0.27	29	C	36	76	0.53	38	D	41	93
		SB RT	0.70	19	B	190	315	0.75	20	C	213	352	0.59	9	A	145	232
		Overall	1.03	147	F			1.09	+	F			0.93	26	C		
	Evening	WB TH	0.33	25	C	71	110	0.41	28	C	72	110	0.53	32	C	82	147
		WB RT	0.13	7	A	0	22	0.18	8	A	22	48	0.13	10	A	0	30
		EB LT	0.71	23	C	137	155	1.07	80	F	302	428	0.77	24	C	148	231
		EB TH	0.73	16	B	271	438	0.73	16	B	285	436	0.74	16	B	157	213
		SB LT	0.42	20	B	98	162	0.41	19	B	98	162	0.41	19	B	98	162
		SB RT	0.72	12	B	162	273	0.87	17	B	287	667	0.85	13	B	190	368
		Overall	0.71	16	B			0.90	28	C			0.82	18	B		
	Saturday	WB TH	0.24	23	C	51	86	0.26	24	C	53	93	0.26	24	C	60	94
		WB RT	0.07	13	B	0	23	0.10	13	B	11	34	0.07	10	B	0	23
		EB LT	0.34	9	A	52	97	0.84	22	C	150	487	0.71	12	B	60	234
		EB TH	0.28	2	A	18	50	0.29	3	A	20	57	0.32	4	A	20	57
		SB LT	0.44	32	C	58	67	0.37	29	C	56	62	0.27	28	C	60	65
		SB RT	0.37	8	A	29	21	0.75	13	B	161	70	0.82	15	B	77	60
		Overall	0.35	11	B			0.66	16	B			0.77	14	B		

a volume-to-capacity ratio
b average delay in seconds per vehicle, rounded to the nearest whole second
c level of service
+ Delay cannot be accurately calculated when v/c is greater than 1.2

As shown in Table 11, the intersection of Walnut Street at Salem Street is expected to improve from LOS F to LOS D or better with the recommended improvements. In addition, the intersection of Walnut Street at the I-95 Northbound Ramps is expected to improve to LOS C or better. With the installation of a traffic signal at the intersection of Walnut Street at the Colonial Golf Club Driveway/I-95 Southbound Ramps, this intersection is expected to improve from LOS F to LOS D, LOS C, and LOS B during the weekday morning, evening and Saturday midday peak periods, respectively. Along Audubon Road, the Site Driveway and I-95 Ramps signals improve the intersections from a LOS F to LOS B or better.

The critical movement at the intersection of Summer Street and Walnut Street is expected to operate at failing levels of service under future conditions without improvement during at least one peak period. With the proposed improvements in place, the intersection is expected to experience LOS C or better.

As discussed previously, Salem Street at the intersections of the I-95 Ramps, Montrose Avenue, and Pleasure Island Road are expecting planned improvements that include signalizing these locations. With minor retiming at these locations to accommodate updated traffic volumes in the area, it is expected that improved levels of service can be achieved.

Transportation Demand Management (TDM)

Transportation Demand Management (TDM) refers to measures that can be put in place to minimize or lessen the impact of vehicular traffic to an area. TDM plans are generally most effective with residential or office developments, where the same people are regularly at a given site. While retail uses are less compatible with TDM planning, employee and customer traffic can be managed to some degree. The most important objective in implementing the TDM program is to provide appropriate alternatives to the single-occupant motor vehicle as the principal travel mode to and from the site.

With the proposed mixture of office, residential and retail uses, there is an opportunity for several effective TDM measures to be implemented as part of the project. The site's balanced mix of uses and the development of the dense, vibrant street environment will all help promote alternative modes of travel and reduce the number of cars traveling to the site.

For the retail component of the site, separate TDM measures have been developed for both employees and site patrons. The residential and office components of the site allow for additional measures to be put in place due to the regular nature of visitors to those uses. The following measures are proposed by the Proponent for the overall redevelopment.

■

General TDM Measures

The mixed-use nature of the site, which will include several amenities intended to service residents and workers at the site, will help reduce the need for employees and residents to travel off-site. The mix of residential and office can also provide a means to better balance the entering and exiting traffic volumes, thereby allowing for better management of project-related traffic during the morning and evening commuter peak periods. The following specific TDM measures will be implemented for the project as a whole:

TDM Coordinator

An on-site TDM coordinator will be appointed to oversee site-related transportation demand management. The person (or persons) in this role will coordinate with other parties within the Meadow Walk at Lynnfield area to help promote a lesser reliance on single-occupant motor-vehicle travel to the site. To that end, the TDM measures identified in the following section will be implemented under the direction and supervision of this person. The duties of the TDM Coordinator will include, but not be limited to: disseminating information on alternate modes of transportation and developing related marketing materials; developing and implementing appropriate TDM measures; and monitoring the effectiveness of those measures.

Commuter Information

The TDM coordinator will provide central commuter information centers within the complex to assist employees as well as residents and visitors. These locations could include one of the lobbies of an apartment/office building, or at the entrance of a retail facility among other possible locations that could be identified by the TDM coordinator. Information to be provided will include local bus schedule and taxi company contacts.

Facilitate Bicycle and Pedestrian Travel

Travel to the site by biking or walking will be promoted by the Proponent through the provision of convenient bicycle parking. Bike racks will be provided at locations in the vicinity of various buildings within the overall development. The exact location will be determined through consultation with the Town of Lynnfield. Walking to/from and within the site will be encouraged by the provision of a pedestrian-friendly site layout, which features sidewalks and crosswalks at key points both within the site and connecting to the existing pedestrian network. These measures will help to promote non-vehicular travel to the site.

Promote Alternative Transportation

The TDM coordinator will also post local bus and train schedules at central points within the lobbies of various buildings within the site. Specific measures to promote ridership are also noted below for specific uses.

■

Office TDM Measures

Employers within the site will be encouraged to implement appropriate TDM measures by the TDM coordinator. As not every TDM program will be suitable for every type of employer, the coordinator will offer technical assistance to individual tenant employers to evaluate potential programs and to implement them when appropriate. Potential employer-based TDM measures include the following:

- Provide flexible hours so that employees have the option of commuting outside the peak traffic periods. Similar benefits can also be realized through staggered work hours so that employee trips occur over a broader period and thereby reduce peak hour demands.
- Consider telecommuting options.
- Hold promotional events for bikers and walkers.
- Provide incentives for bicycle and HOV commuting.
- Prioritize local hiring.
- Offer direct deposit to employees.
- Provide a guaranteed ride home program to eliminate an often-cited deterrent to carpool and vanpool participation.
- Sponsor vanpools and subsidize expenses.
- Provide preferential carpool and vanpool parking within the parking garages and spaces near office building entrances as a convenience to participants and to promote ridesharing.
- Provide subsidies to employees who purchase monthly or multiple trip transit passes.

■

Retail TDM Measures

The Proponent will be seeking to attract a variety of small retail shops and service tenants on the ground floor of several of the residential and office buildings. These will potentially include cafes, florists, salons and other convenience type uses. These types of uses will help meet the needs of the Meadow Walk at Lynnfield residents, employees, and shoppers of the major retail uses in the area that are within walking distance. As many of these businesses will be small shops, there will not be the same opportunities for TDM effectiveness found at other larger scale retail stores. Regardless, all retail tenants will be subject to considering the employer-based requirements of the overall TDM Plan. Other specific measures to be implemented

in association with the retail shops include the following:

- ™ Flexible work hours
- ™ Hold promotional events for bikers and walkers.
- ™ Provide incentives for bicycle and HOV commuting.
- ™ Prioritize local hiring.
- ™ Offer direct deposit to employees.

■

Residential TDM Measures

In addition to providing a pedestrian friendly, mixed-use environment, the planned development will also consider a variety of additional strategies to reduce the need for auto trips by residents. This could include working with a car-sharing service (such as Zipcar®) to provide cars for periodic use by residents. Several of the TDM measures to be implemented for the entire site should also be attractive to residents at Meadow Walk at Lynnfield. Specifically, the provision of bicycle racks, pedestrian walkways and proximity to public transportation should also help minimize the need for vehicular travel.

6

Conclusion

This Traffic Impact and Access Study presented a detailed traffic assessment to evaluate the impacts associated with the Meadow Walk at Lynnfield Mixed-Use Redevelopment. This study includes a thorough evaluation of existing transportation conditions in and around the project site, an estimation of traffic impacts associated with the development program, and has formulated a series of enhancements for addressing existing capacity deficiencies as well as project-related impacts. In total, the redevelopment will consist of 80,000 square feet of office space, 220 residential units, along with 390,000 square feet of associated retail uses. The overall development will be constructed in a dense, self-sustaining "urban village" setting designed following smart growth principles. The variety of uses promotes a significant amount of internal trip-sharing, and several of the uses, including the street front retail among others, will minimize the need for office workers and residents to leave Meadow Walk at Lynnfield for shopping purposes.

Detailed traffic analysis identified locations impacted by the project. A comprehensive transportation mitigation program was developed to mitigate potential impacts with the additional traffic associated with the project, and to help address existing operational and safety deficiencies where possible. The Proponent will also implement non-physical and site-design improvements including a Transportation Demand Management (TDM) plan.