#### TOWN OF NEEDHAM MASSACHUSETTS

PLANNING BOARD

Needham, MA 02192 781-455-7550 February 23, 2021

#### APPLICATION FOR SITE PLAN REVIEW AND SPECIAL PERMITS

Project Determination: X Major	or Project
Min-	or Project
This application must be completed, signed, and submrepresentative in accordance with the Planning Board Special Permit Granting Authority pursuant to Section	's Rules as adopted under its jurisdiction as a
Location of Property: 100-110 West Street, Needha	am, MA 02492
Name of Applicant: <u>WELL LCB Needham Landl</u>	ord LLC
Address: C/O LCB Senior Living: 3 Edgewater Driv	e, Suite 101, Norwood, MA 02062 Tel.#:
Applicant is Owner Tenant	X
Property Owner's Name: HCRI Massachusetts	s Properties Trust II
Address: 4500 Dorr Street, Toledo, Ohio 4361	5Tel.#: _(419) 247-2800
Characteristics of Property: Lot Area: 4.298 acres	Present Use: Vacant Building
Map #: 63_ Parcel #: 37_ Zoning District: ASB, S	SRB, and ASOD
Description of Project for Site Plan Review and Spec 5.1.1.7, 5.1.3, and 7.4. of the Zoning By-law:	ial Permits under Sections 1.4.6, 3.15.3.2., 5.1.1.5,
See Exhibit A attached hereto.	
. Signature of Applicant (or his representative)	Roy A. Cramer, Esq.
	Evans Huber, Esq.
Address if not Applicant	Frieze Cramer Rosen & Huber LLP 60 Walnut Street, Wellesley, MA 02481
Tel. #	781 943 4030
Owner's permission if other than applicant	HCRI Massachusetts Properties Trust II
	By: Meny Filen Pisanelli
SUMMARY OF PLANN	Mary Ellen Pisanelli Authorized Signatory
10 . 00.	
Received by Planning Board Almall	Date 3 9 2
Hearing Date	
Decision Required by	Parties in Interest Notified of Public Hearing(date)
Granted(date)	Decision and Notices of the Decision sent(date)
Denied(date)	
Withdrawn(date)	Fee Paid Fee Waived

NOTE: Reports on Minor Projects must be issued within 35 days of filing date.

# Exhibit A Application for Site Plan Review And Special Permits LCB Senior Living Property at 100-110 West Street, Needham, MA

#### Description of Project for Site Plan Review Under Section 7.4 of the Zoning By-Law

WELL LCB Needham Landlord LLC, is proposing to redevelop the property to include an 83-unit Assisted Living and Alzheimer's/Memory Care facility and 72 Independent Living Apartments. The existing 3 story brick building will remain. The existing footprint of the building will not change. As allowed by Section 3.15 of the Town's Zoning Bylaws, a partial fourth story will be added to create 10 of the proposed 72 Independent Living Apartments. The parking lot to the south of the building will remain unchanged except for selected new landscaping and the parking lot west of the building and adjacent to the railroad right of way will be modified slightly, including selected new landscaping.

All of the foregoing is more particularly shown on the plans filed herewith.

Applicant seeks Site Plan Review pursuant to Section 7.4 of the Bylaw, and Special Permits pursuant to Section 1.4.6 of the Bylaw (alteration of a non-conforming structure, which is nonconforming with respect to the requirements of Sections 4.4.8.4 and 4.4.9); Section 3.15.3.2 (b), (c), and (d) (uses allowed in the ASOD by Special Permit), and Sections 5.1.1.5 and 5.1.1.7, waiving strict compliance with the requirements of Section 5.1.3 (h) and (i) of the Bylaw.

#### TOWN OF NEEDHAM MASSACHUSETTS

PLANNING BOARD

500 Dedham Ave Needham, MA 02192 781-455-7550 February 23, 2021

#### APPLICATION FOR SITE PLAN REVIEW AND SPECIAL PERMITS

Project Determination: X	gor Project
Mi	nor Project
This application must be completed, signed, and sub- representative in accordance with the Planning Boar Special Permit Granting Authority pursuant to Secti	d's Rules as adopted under its jurisdiction as a
Location of Property: 100-110 West Street Needl	nam. MA 02492
Name of Applicant: WELL LCB Needham Land	djord LLC
Address: C/O LCB Senior Living: 3 Edgewater Dri (781) 619-9320	ve, Suite 101, Norwood, MA 02062 Tel.#:
Applicant is Owner Tenant	x
Property Owner's Name: HCRI Massachuset	ts Properties Trust II
Address: 4500 Dorr Street, Toledo, Ohio 436	15 Tel.#: _(419) 247-2800
Characteristics of Property: Lot Area: 4.298 acres	Present Use: Vacant Building
Map #: 63 Parcel #: 37 Zoning District: ASB.	SRB. and ASOD
Description of Project for Site Plan Review and Spe 5.1.1,7,5.1.3, and 7.4, of the Zoning By-law:	cial Permits under Sections 1.4.6, 3.15.3.2., 5.1.1.5,
See Exhibit A attached hereto.  Signature of Applicant (or his representative	
	Roy A. Cramer, Esq. Evans Huber, Esq.
Address if not Applicant	Frieze Cramer Rosen & Huber LLP 60 Walnut Street, Wellesley, MA 02481
Tel.#	781 943 4030
Owner's permission if other than applicant	HCRI Massachusetts Properties Trust II
	By: Mary Ellen Pisanelli
	Authorized Signatory
***	NING BOARD ACTION
Received by Planning Board	Date
Hearing Date	
Decision Required by (date) (90 days after hearing for special permit)	Parties in Interest Notified of Public Hearing(date)
Granted(date)	
Denied(date)	
	Fee Paid
Withdrawn (date)	Fee Waived

Exhibit A
Application for Site Plan Review
And Special Permits
LCB Senior Living
Property at 100-110 West Street, Needham, MA

#### Description of Project for Site Plan Review Under Section 7.4 of the Zoning By-Law

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Applicant seeks Site Plan Review pursuant to Section 7.4 of the Bylaw, and Special Permits pursuant to Section 1.4.6 of the Bylaw (alteration of a non-conforming structure, which is nonconforming with respect to the requirements of Sections 4.4.8.4 and 4.4.9); Section 3.15.3.2 (b), (c), and (d) (uses allowed in the ASOD by Special Permit), and Sections 5.1.1.5 and 5.1.1.7, waiving strict compliance with the requirements of Section 5.1.3 (h) and (i) of the Bylaw.



# 2021 MAR 11 AM 9: 44

#### SECRETARY'S CERTIFICATE

March 2, 2021

I, MATTHEW G. MCQUEEN, Executive Vice President - General Counsel & Corporate Secretary of Welltower Inc., a Delaware corporation (the "Company"), HEREBY CERTIFY as follows:

- 1. HCRI Massachusetts Properties Trust II and WELL LCB Needham Landlord LLC (collectively, "Subsidiaries") are a wholly owned direct or indirect subsidiary of the Company.
- 2. Attached hereto as Exhibit A is a true and correct copy of certain sections of the resolutions of the Board of Directors of the Company, dated April 29, 2020 (the "Resolutions"), regarding the authority of the executive officers to enter into, execute, and deliver, in the name and on behalf of the Company and Subsidiaries, any contract, agreement, conveyance, note, deed, or any other document or instrument that may be deemed by such officer necessary or advisable in connection with the business of the Company and Subsidiaries in the ordinary course and to prescribe duties and powers to other officers of the Company and Subsidiaries.
- 3. The Resolutions have not been amended, modified, or repealed in any respect and are in full force and effect as of the date hereof.
- 4. Pursuant to the authority granted in the Resolutions, Mary Ellen Pisanelli, the Senior Vice President Legal & Administration of the Company, has been delegated authority to enter into, execute, and deliver, in the name of and on behalf of the Company and Subsidiaries, any document or instrument that she deems necessary or advisable in connection with an Application for Site Plan Review and Special Permits to be submitted to the Town of Needham, Massachusetts with respect to that certain property located at 100-110 West Street, Needham, MA 02492.

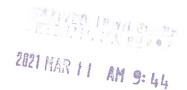
IN WITNESS WHEREOF, I have hereunto set my hand as of the date first set forth above.

nd as of the aa.

Docussigned by:

Matthew G. McQueen – Executive Vice
President, General Counsel & Corporate
Secretary

#### Exhibit A



#### **Grant of Powers to Certain Executive Officers**

RESOLVED, that each of Thomas J. DeRosa, as Chairman of the Board & Chief Executive Officer, Shankh Mitra, as Vice Chair, Chief Operating Officer & Chief Investment Officer, Timothy G. McHugh, as Executive Vice President - Chief Financial Officer, Matthew G. McQueen, as Senior Vice President - General Counsel & Corporate Secretary, and Ayesha Menon as Senior Vice President - Strategic Investments be, and each of them hereby is, authorized to enter into, execute, and deliver, in the name and on behalf of the Company, any contract, agreement, conveyance, note, deed, or any other document or instrument that may be deemed by such officer necessary or advisable in connection with the business of the Company in the ordinary course, without further act or resolution of the Board of Directors of the Company (the "Board").

#### **Delegation of Power to Executive Officers**

RESOLVED, that, pursuant to Article IV, Section 11 of the By-Laws and in addition to the delegation to Mr. DeRosa above, the Board hereby delegates to each of Thomas J. DeRosa, as Chairman of the Board & Chief Executive Officer, Shankh Mitra, as Vice Chair, Chief Operating Officer & Chief Investment Officer, as Timothy G. McHugh, as Executive Vice President - Chief Financial Officer, as Matthew G. McQueen, as Senior Vice President - General Counsel & Corporate Secretary, Ayesha Menon as Senior Vice President - Strategic Investments, the power to prescribe duties and powers to other officers of the Company, without further act or resolution of the Board, including, but not limited to, the power to:

- (a) appoint or elect the directors, managers, or officers of any current or future direct or indirect subsidiary or affiliate of the Company; and
- (b) enter into, execute, and deliver, in the name and on behalf of the Company or any of its subsidiaries and affiliates, any contract, agreement, conveyance, note, deed, or any other document or instrument that may be deemed necessary or advisable in connection with the business of the Company or any of its subsidiaries and affiliates in the ordinary course.

#### General Authority

**RESOLVED**, that any specific resolutions that may be required to have been adopted by the Board in connection with the actions contemplated by any of the foregoing resolutions be, and they hereby are, adopted, and the officers of the Company be, and each of them hereby is, authorized to certify as to the adoption of any and all such resolutions and attach such resolutions hereto;

**RESOLVED**, that all actions heretofore taken by any director or officer of the Company in connection with, or otherwise in contemplation of, the actions contemplated by any of the foregoing resolutions be, and they hereby are, ratified, confirmed, and approved; and

**RESOLVED**, that the officers of the Company be, and each of them hereby is, authorized and empowered on behalf of the Company and in its name to take or cause to be taken all actions and to execute and deliver all such agreements, certificates, instruments, and documents that the officers of the Company, or any one or more of them, approve as necessary or desirable in connection with the foregoing resolutions, such approval to be conclusively evidenced by the taking of any such action or the execution and delivery of any such agreement, certificate, instrument, or document by an officer of the Company.

#### FRIEZE CRAMER ROSEN & HUBER LLP

COUNSELLORS AT LAW

60 Walnut Street, Wellesley, Massachusetts 02481 781-943-4000 • FAX 781-943-4040

EVANS HUBER
781-943-4043
EH@128LAW.COM

March 3, 2021

Members of the Needham Planning Board

And

Lee Newman
Director of Planning and Community Development
Public Services Administration Building
500 Dedham Ave
Needham, MA 02492

Re: 100 West Street, Needham

Dear Planning Board Members and Ms. Newman:

Pursuant to Chapter 40A of the Massachusetts General Laws, the Needham Zoning By-Law, the Needham Planning Board Rules, and Sections 3.3 and 4.2 of Major Project Site Plan Special Permit No. 93-4 dated October 12, 1993 (as amended), I hereby submit applications for Further Site Plan Review and Special Permits on behalf of WELL LCB Needham Landlord LLC ("WELL LCB"), of which this letter is a part. WELL LCB, the developer and operator of the property at 100 West Street, is a joint venture between LCB Senior Living, LLC and Welltower, Inc., which owns the property through HCRI Massachusetts Properties Trust II.

The original Planning Board Decision authorizing the former uses at the site (nursing home and assisted living facilities) dated October 12, 1993, was amended on February 8, 1994, February 25, 1995, May 6, 1996, August 20, 1996 and April 20, 2004. Most recently, until 2017, the site was occupied by Avery Crossing, a 60 unit assisted living/memory care facility, Avery Manor, a 142-bed skilled nursing facility, and medical offices comprising approximately 8,308 square feet.

The property is a 4.298 acre parcel (187,219 square feet) located at the corner of Highland Avenue and West Street. The entire building, and the great majority of the property, is located in the Avery Square Business District (ASB) and the Avery Square Overlay District (ASOD), with a portion of the property located in the Single Residence B Zoning District. The property is currently vacant and is improved by a three-story brick building of approximately

FRIEZE CRAMER ROSEN & HUBERLLP

Needham Planning Board Members Lee Newman March 3, 2021 Page 2

186,000 square feet, outdoor parking areas to the south and west of the building and an indoor parking area.

WELL LCB is proposing to redevelop the property to include an 83 unit Assisted Living and Alzheimer's/Memory Care facility and 72 Independent Living Apartments. The existing 3 story brick building will remain. The existing footprint of the building will not change and a partial fourth story will be added to create 10 of the proposed 72 Independent Living Apartments. The parking lot to the south of the building will remain unchanged except for selected new landscaping and the parking lot west of the building and adjacent to the railroad right of way will be modified slightly, including selected new landscaping, all as more particularly shown on the Plans filed with the Application.

The Applicant certifies pursuant to the Zoning By-Law, Section 7.4 that the project can be constructed and/or that the proposed uses thereof can be commenced without need for the issuance of any variance from any provisions of the Zoning By-Law by the Zoning Board of Appeals.

The zoning relief required for the Project is the following:

- 1. Special Permit for Further Site Plan Review of a Major Project, pursuant to Zoning By-Law Section 7.4, Article 2 of the Planning Board Rules, and Sections 3.3 and 4.2 of Major Project Site Plan Special Permit No. 93-4 dated October 12, 1993, as amended.
- 2. Special Permit pursuant to Section 1.4.6 of the Zoning By-Law to allow alteration of a non-conforming structure. The structure is a legally pre-existing non-conforming as to the requirements of Sections 4.4.8.4 and 4.4.9.
- 3. Special Permit pursuant to Section 3.15.3.2 (b), (c), and (d) of the Zoning By-Law to allow uses allowed in the ASOD by Special Permit.
- 4. Special Permit pursuant to Sections 5.1.1.5 and 5.1.1.7 of the Zoning By-Law to waive strict adherence to the off-street parking requirements of Section 5.1.3 of the Zoning By-Law, with respect to subsections (h) (parking space layout) and (i) (width of maneuvering aisle). Please note that waivers with respect to the particular ways in which the structure does not comply with these requirements have previously been granted by prior decisions of this Board.

This Application for Further Site Plan Review and Special Permits include the following documents:

1. Traffic Impact Study, prepared by McMahon Associates, 120 Water Street, Unit 1, Boston, MA 02109, dated February 2021.

FRIEZE CRAMER ROSEN & HUBERLLP

Needham Planning Board Members Lee Newman March 3, 2021 Page 3

- Existing Conditions and Proposed Conditions Site Plans, and Zoning and Parking Tables, prepared by Kelly Engineering Group, 0 Campanelli Drive, Braintree, MA 02184.
- 3. Stormwater management report prepared by Kelly Engineering Group, dated February 25, 2021.
- 4. Landscaping Plan, prepared by Hawk Design Inc., P.O. Box 1309, Sandwich, MA 02563.
- 5. Floor plans, roof plan, elevation plans, photographs and renderings (including existing and proposed views of the property from various vantage points), prepared by The Architectural Team, Inc., 50 Commandants Way, Chelsea, MA 02150.
- 6. Letter from this office dated March 1, 2021, discussing compliance with the criteria for Site Plan Review.
- 7. Filing fee to the Town of Needham in the amount of \$18,922.

Pursuant to the Board's Covid-19 procedures, these documents are being submitted electronically; additionally two (2) hard copies of the application (1 with original signatures) and all supporting materials, including wet-stamped plans, are being mailed to the Planning Department along with the application fee; and, lastly, one hard copy of (a) the Application for Further Site Plan Review and Special Permits, (b) this letter, and the other letter from this office referred to in item 6, above, (c) the Kelly Engineering Stormwater Management Report, and (d) all the plans (no smaller than 11 x 17), is being mailed to each Board member, and to Lee Newman.

The Applicant hereby requests, pursuant to Zoning By-Law Section 7.4.4, that the Planning Board waive the submission by Applicant of any of the required information not submitted herewith.

The Applicant has previously submitted a copy of these plans to the Design Review Board ("DRB"). The Applicant met with the Design Review Board on February 22, 2021, at which time the DRB approved these plans.

#### FRIEZE CRAMER ROSEN & HUBER LLP

Needham Planning Board Members Lee Newman March 3, 2021 Page 4

I would appreciate your scheduling this matter for hearing at the Board's April 6, 2021 meeting.

Thank you for your cooperation.

Sincerely, Arch

Evans Huber

Cc: Roy A. Cramer, Esq.

#### FRIEZE CRAMER ROSEN & HUBER LLP

COUNSELLORS AT LAW

60 WALNUT STREET, WELLESLEY, MASSACHUSETTS 02481 781-943-4000 • FAX 781-943-4040

EVANS HUBER
781-943-4043
EH@128LAW.COM

March 4, 2021

Members of the Needham Planning Board

And

Lee Newman
Director of Planning and Community Development
Public Services Administration Building
500 Dedham Ave
Needham, MA 02492

Re: 100 - 110 West Street, Needham

Dear Planning Board Members and Ms. Newman:

I am writing on behalf of WELL LCB Needham Landlord LLC, with respect to the Application for Further Site Plan Review and Special Permits for the Project at 100-110 West Street. The purpose of this letter is to provide the Planning Board with additional information in connection with this Project and, in particular, to discuss how the project will conform to the Review Criteria for Site Plan Review, as set forth in Section 7.4.6 of the Zoning By-Law.

The following are the criteria for the Planning Board to consider during the site plan review process pursuant to Section 7.4.6 of the Zoning By-Law, and the description of how the Project meets those criteria.

(a) Protection of adjoining premises against seriously detrimental uses by provision for surface water drainage, sound and sight buffers and preservation of views, light, and air;

The proposed project has been designed to protect adjoining premises from detrimental impacts by provision for surface water drainage, sound and sight buffers, and preservation of views, light and air, as follows:

The site has been designed to ensure that there will be no off-site drainage impacts. A drainage system exists on site. The drainage system will ensure that peak storm generation levels will remain unchanged. The proposed site layout plans were presented to the Engineering Department and, as set forth more fully in the Stormwater Management Report filed as part of this Application, it was agreed the proposed project is exempt from the Needham Stormwater Bylaw.

Needham Planning Board March 4, 2021 Page 2

An extensive landscape plan has been developed for screening and enhancing the existing site. Noise and visual impacts have been minimized by locating the proposed 4<sup>th</sup> floor well set back from the north, east, and south sides of the building, which in many places is set back from the façade of the building further than the Bylaw requires and, overall, occupies a smaller percentage of the existing roof area than the Bylaw allows. The neighbors to the west will be protected by means of the existing buffering provided by a combination of existing trees and vegetation, new plantings, and the MBTA rail lines.

The lighting system for the project has been designed to fully comply with the Town of Needham lighting requirements and will consist of decorative cut off fixtures on low poles, as well as bollards to provide illumination for pedestrian walkways on site.

The Design Review Board has reviewed and approved the landscaping plan and the exterior lighting plan.

(b) Convenience and safety of vehicular and pedestrian movement within the site and on adjacent streets, the location of driveway openings in relation to traffic or to adjacent streets and, when necessary, compliance with other regulations for the handicapped, minors and the elderly;

Convenience and safety of vehicular and pedestrian movement within the site and on adjacent streets, and the proper location of driveway openings in relation to traffic and to adjacent streets, has been assured. As shown on the plans filed with this application, the project has been designed to ensure that there will be safe vehicular and pedestrian circulation throughout the site. The access to and egress from the property will be via existing driveway openings off West St. and Highland Ave. that will remain and provide access to the site. Sidewalks exist on both West St. and Highland Ave. that connect to the sidewalks on the site. This allows for easy pedestrian access to the site.

Sidewalk access has been provided adjacent to the primary exterior parking stalls for pedestrian safety. Bylaw compliant handicap access and parking is provided.

(c) Adequacy of the arrangement of parking and loading spaces in relation to the proposed uses of the premises;

Adequacy of the arrangement of parking and loading spaces in relation to the proposed uses of the premises has been achieved. The proposed exterior parking area complies with the Town of Needham Bylaw requirements for number of spaces, illumination, loading, parking space size, location, design and number of handicap spaces, width of maneuvering aisles, setbacks, and landscaping. The parking is distributed throughout the site to provide convenience for employees and visitors. With respect to the interior parking, Special Permits are requested for parking space layout for certain tandem spaces, and for the aisle width in one portion of the garage. Both of these conditions have existed for many years. Please see the Layout and Zoning Plan for additional details of the parking layout.

Needham Planning Board March 4, 2021 Page 3

(d) Adequacy of the methods of disposal of refuse and other wastes resulting from the uses permitted on the site;

The site has been designed such that adequate methods of disposal of refuse resulting from the uses permitted on the site have been assured. A dumpster enclosure is provided adjacent to the loading area west of the building. The dumpster enclosure will be screened by means of a fence. Refuse will be removed from the site by a licensed hauler.

(e) Relationship of structures and open spaces to the natural landscape, existing buildings and other community assets in the area and compliance with other requirements of this By-Law; and

The matters to be considered by this Board in connection with relationship of structures and open spaces to the natural landscape, existing buildings, and other community assets in the area, have been addressed, and with the exception of the special permits requested, the project complies with all other requirements of the Town Bylaw. The existing building is surrounded by existing commercial buildings to the North, East, and West ranging in size from one story to multi-story buildings, and residential homes to the South. The footprint of the existing building will remain unchanged, and the relatively minor façade changes have been designed to maintain the historic character of the existing building. The addition of the fourth floor on a portion of the building is harmonious with the design of this building and the nearby commercial buildings. There is a natural landscape buffer which will be maintained to the South of the site. To the West of the site are a natural landscape buffer, which will be enhanced by the proposed landscaping plan, as well as the existing MBTA railroad Right of Way. The Senior Center for the Town of Needham is within walking distance of the property.

The project has been designed to maximize landscaped area and limit impervious areas. This is accomplished by the site design and by keeping a portion of the existing parking garage that will accommodate 34 parking spaces. The open space will full comply with the requirements of the Bylaw.

The Design Review Board has reviewed and approved all proposed changes to the exterior of the building, as well as the proposed new fourth floor.

(f) Mitigation of adverse impacts on the Town's resources including the effect on the Town's water supply and distribution system, sewer collection and treatment, fire protection, and streets; and may require when acting as the Special Permit Granting Authority or recommend in the case of minor projects, when the Board of Appeals is acting as the Special Permit Granting Authority, such appropriate conditions, limitations, and safeguards necessary to assure the project meets the criteria of a through f.

Needham Planning Board March 4, 2021 Page 4

Mitigation of adverse impacts on the Town's resources including the effect on the Town's water supply and distribution system, sewer collection and treatment, fire protection, and streets has been assured. The proposed use is expected to have minimal impacts on Town resources due to the nature of the use. It is a clean, quiet, low impact use. The project has been designed to limit adverse impacts to the Town resources as follows:

The project will connect to the Town's water system that is located on Highland Ave. We have met with the Engineering Department and there were no concerns raised regarding water pressure and flow for this area of Town. The project will maintain the existing sewer connections to the Town's sewer system by means of the connections to the sewer main located on Highland Ave.

The proposed site layout plans were presented to the Fire Department prior to finalizing the layouts and the Fire Department was satisfied with the proposed circulation.

As shown in the Traffic Impact Analysis submitted with this application, the project is expected to have a minimal impact on vehicle trips and level of service on Highland Avenue and West Street during peak hours, even when compared to no-build conditions, and is expected to generate less traffic than the prior use of the site.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Evans Huber

Cc: Roy A. Cramer, Esq.

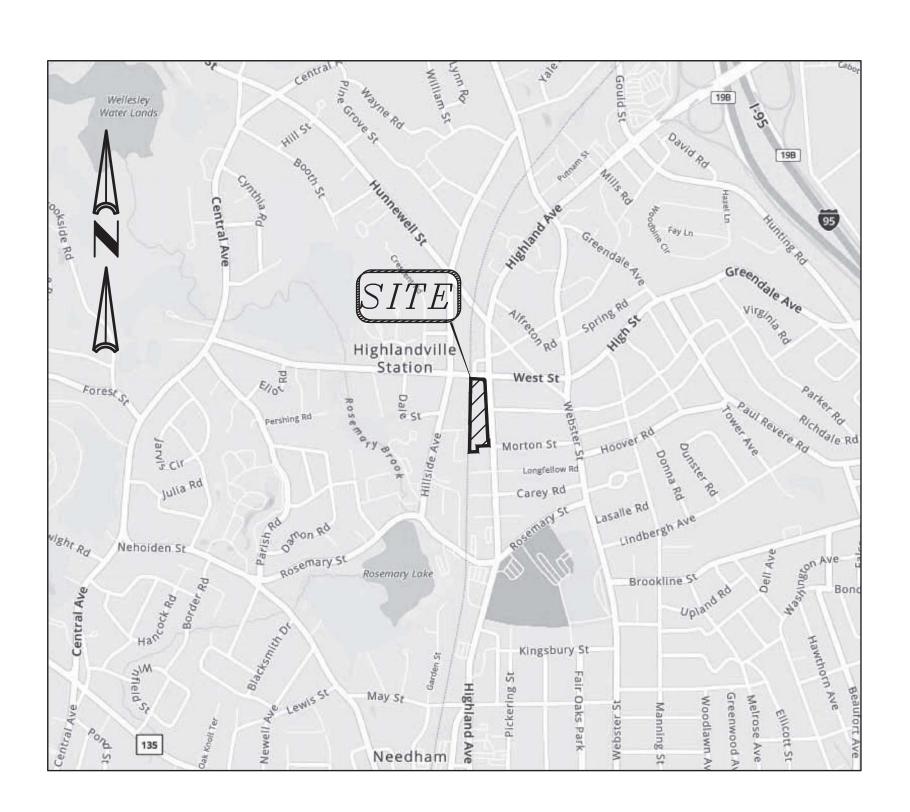
# SITE DEVELOPMENT PLANS

FOR

# THE RESIDENCE AT CARTER MILL 100 WEST STREET NEEDHAM, MA

JANUARY 29, 2021

	SHEET INDEX								
SHEET No.	DESCRIPTION		LATEST	REVISED	DATE	CONST	RUCTIO	N REV	ISIONS
1	COVER SHEET								
2	EXISTING CONDITIONS PLAN								
3	LAYOUT PLAN								
4	GRADING PLAN								
5	DETAIL SHEET								
	PHOTOMETRIC PLAN								



LOCATION MAP

## OWNER:

WELLTOWER INC. 4500 DORR ST TOLEDO, OHIO 43615

# OWNER/APPLICANT:

LCB SENIOR LIVING, LLC 3 EDGEWATER DRIVE NORWOOD, MA 02062

## CIVIL ENGINEERS:

KELLY ENGINEERING GROUP, INC. 0 CAMPANELLI DRIVE BRAINTREE, MA 02184

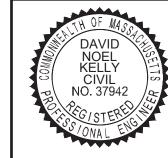
## ARCHITECT:

THE ARCHITECTURAL TEAM
50 COMMANDANT'S WAY AT ADMIRAL'S HILL
CHELSEA, MA 02150

# LANDSCAPE ARCHITECT:

HAWK DESIGN, INC P.O. 1309 SANDWICH, MA 02563





•	SCALE NA	JOB # F: \P\2020-030
S1125	DATE 01/29/21	DRAWN BY CJL
	SHEET	CHKD BY
	1 OF 6	DAM
	FILE #	APPD BY

100 WEST STREET NEEDHAM, MA

KELLY ENGINEERING GROUP civil engineering consultants

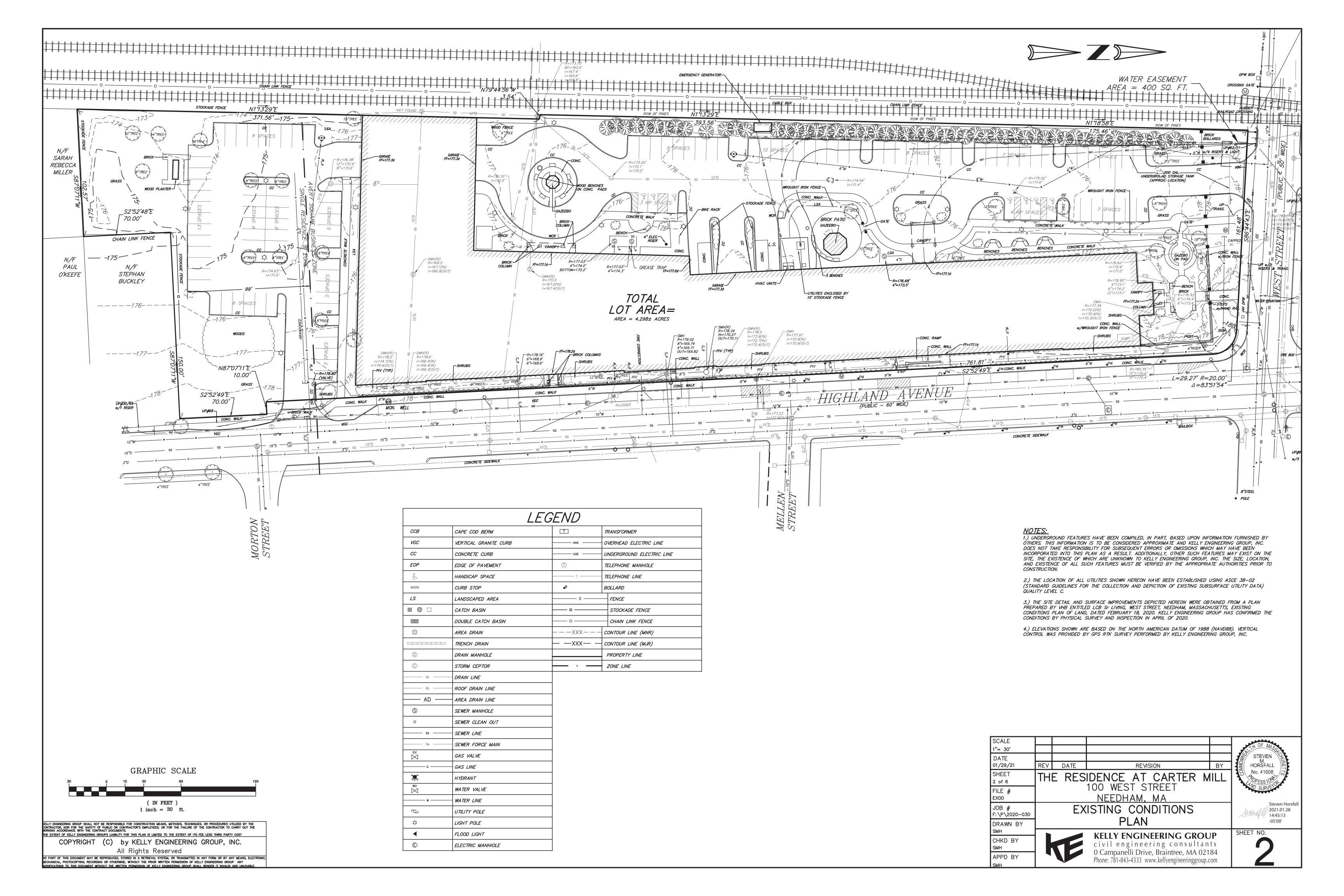
KELLY ENGINEERING GROUP
civil engineering consultants
O Campanelli Drive, Braintree, MA 02184
Phone: 781-843-4333 www.kellyengineeringgroup.com

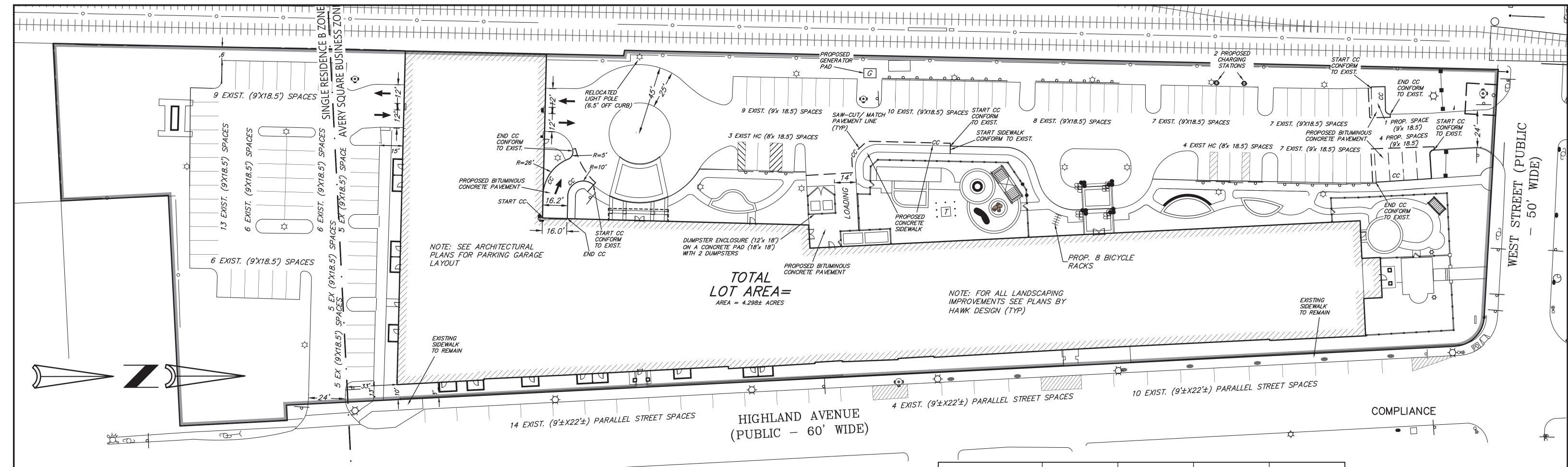
LY ENGINEERING GROUP SHALL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, OR PROCEDURES UTILIZED BY THE ITRACTOR, NOR FOR THE SAFETY OF PUBLIC OR CONTRACTOR'S EMPLOYEES; OR FOR THE FAILURE OF THE CONTRACTOR TO CARRY OUT THE EXING ACCORDANCE WITH THE CONTRACT DOCUMENTS.

EXTENT OF KELLY ENGINEERING GROUPS LIABILITY FOR THIS PLAN IS LIMITED TO THE EXTENT OF ITS FEE LESS THIRD PARTY COST

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### ZONING LEGEND

ZONING DISTRICT: AVERY SQUARE BUSINESS DISTRICT/ SINGLE RESIDENCE B/ AVERY SQUARE OVERLAY DISTRIC'
(DIMENSIONAL REQUIREMENTS PROVIDED FOR AVERY SQUARE BUSINESS DISTRICT AND ASOD)

	REQUIRED	<b>EXISTING</b>	PROPOSED	COMPLIANCE
MIN. AREA	10,000 S.F.	187,219 S.F. (4.30 AC)	SAME	YES
MIN. FRONTAGE	80'	856'±	SAME	YES
MIN. SETBACK FRONT	10'	10 <b>'</b> ±	10'	YES (NOTE 1)
MIN. SETBACK SIDE (RESIDENTIAL DISTRICT)	50' (NOTE 1)	33'±	SAME	PRE-EXISTING NONCONFORMING
MIN. SETBACK SIDE	NA	0'±	SAME	YES
MIN. SETBACK REAR	NA	NA	SAME	YES
MAX. STORIES	4	3	4	YES
4TH FL. SETBACKS (NOTE 2)				
EAST FACADE	15'	NA	15' (NOTE 2)	YES
WEST FACADE	0'	NA	0' (NOTE 2)	YES
SOUTH FACADE	35'	NA	35' (NOTE 2)	YES
NORTH FACADE	110'	NA	110' (NOTE 2)	YES
4TH FL. AREA (NOTE 3)	35%	NA	APPROX. 32.9% (NOTE 3)	YES
MAX. HEIGHT	44' - 49' (NOTE 4)	41'-9" (NOTE 4)	44' & 49' (NOTE 4)	YES
LOT COVERAGE	NA (NOTE 5)	0.34	SAME	YES
FLOOR AREA RATIO	1.1 (NOTE 6)	1.00±	1.01	YES
PARKING TOTAL	149 (NOTE 7)	193	149 (NOTE 7)	YES
DRIVEWAY OPENINGS	18'-25' (TWO WAY)	24'	24'	YES

NOTE 1. YARD ASSUMPTIONS:
HIGHLAND AVE. AND WEST ST. ARE FRONT YARDS
MBTA RAIL AND SOUTH LOT LINE ARE SIDE YARDS
THERE ARE NO REAR YARDS

EXISTING BUILDING WILL REMAIN 10' FROM HIGHLAND AVE PROPERTY LINE. PROPOSED PATIOS ARE 3' FROM FRONT PROPERTY LINE, BUT ARE NOT CONSIDERED TO BE STRUCTURES.

THE TOWN OF NEEDHAM ZONING BYLAW SECTION 4.4.8.4, 50' SETBACK TO RESIDENTIAL DISTRICT

NOTE 2. SETBACKS ARE MEASURED FROM EXISTING BUILDING FACADE. (BYLAW SECTION 3.15.4.1) AS SHOWN ON THE ARCHITECTURAL PLANS, SETBACK DIMENSIONS VARY. PROPOSED SETBACKS ARE MINIMUMS.

NOTE 3. PER BYLAW SECTION 3.15.4.1 TOTAL FLOOR AREA OF THE 4TH FLOOR MAY NOT EXCEED 35% OF THE TOTAL ROOF AREA OF THE BUILDING. MECHANICAL EQUIPMENT IS NOT INCLUDED IN THE CALCULATION OF MAXIMUM ALLOWABLE FLOOR AREA. THE PROPOSED PERCENTAGE OF ROOF COVERAGE INCLUDES ROOF TERRACES. IF THOSE ARE EXCLUDED, THE PERCENTAGE OF ROOF COVERAGE IS APPROX. 25.3%

NOTE 4. EXISTING BUILDING HEIGHT OF 33±' TO TOP OF ROOF. 41'9" TO TOP OF HIGHEST POINT (MECHANICAL OR ELEVATOR OVERRIDE)

MAX ALLOWABLE BUILDING HEIGHT IS 44' TO TOP OF 4TH STORY AND ALL MECHANICALS OTHER THAN ELEVATOR OVERRIDE; 49' TO TOP OF ELEVATOR OVERRIDE. ACTUAL HEIGHTS ARE PLANNED TO BE SLIGHTLY LESS THAN MAX ALLOWABLE.

BUILDING HEIGHT WAS CALCULATED FROM THE AVERAGE GRADE PLANE OF THE EXISTING BUILDING OF 177.6±. THE PROPOSED 4TH STORY ELEVATION IS 221.6±
THE PROPOSED ELEVATOR OVERRUN ELEVATION IS 226.6±.

NOTE 5. THE TOWN OF NEEDHAM ZONING BYLAW SECTION 4.4.2 (E) THERE IS NO LIMITATION ON LOT COVERAGE IN THE AVERY SQUARE BUSINESS DISTRICT OR THE AVERY SQUARE OVERLAY DISTRICT.

TOTAL BUILDING COVERAGE= 63,700 S.F./ 187,219 S.F.= 0.34

NOTE 6. FLOOR AREA RATIO:

EXISTING FAR = 186,300 S.F./187,219 S.F. = 1.00 FAR PROPOSED FAR = 189,220 S.F./187,219 S.F. = 1.01 FAR

THE CALCULATION OF PROPOSED FAR DOES NOT INCLUDE UNDERGROUND PARKING, AS ALLOWED IN THE AVERY SQUARE OVERLAY DISTRICT.

THE APPLICABLE BYLAW DEFINITION OF FLOOR AREA EXCLUDES "UNENCLOSED PORCHES AND BALCONIES," THE FAR CALCULATION FOR THIS PROJECT DOES NOT INCLUDE THE AREA OF PROPOSED FIRST FLOOR PATIOS AND ROOF TERRACES, ALL OF WHICH WILL BE UNENCLOSED.

NOTE 7. REQUIRED PARKING:

72 INDEPENDENT LIVING UNITS X 1.0 SPACES/UNIT + 96 ASSISTED LIVING BEDS x 0.5 SPACES/ BEDS + 58± EMPLOYEES X 1 SPACE/2 EMPLOYEES ON LARGEST SHIFT

= 149 SPACES REQUIRED (TOWN OF NEEDHAM ZONING BYLAW SECTION 3.15.5)

PROVIDED:

34 GARAGE SPACES & 115 EXTERIOR PARKING SPACES = 149 SPACES (EXCLUDES 28 PARALLEL PARKING SPACES ON HIGHLAND AVE. ADJACENT TO THE PROPERTY THAT CAN BE COUNTED AS OFF-STREET PARKING PURSUANT TO SECTION 5.1.1.7 OF THE BYLAW FOR A TOTAL PARKING SUPPLY OF 177 SPACES.)

	REQUIRED	EXISTING	PROPOSED	COMPLIANCE
ZONING BYLAW 5.1.3 PARKIN	G PLAN AND DESIGN	REQUIREMENTS		
A) PARKING ILLUMINATION	AVG 1 FOOT CANDLE	NA	AVG 2± FC	YES
B) LOADING REQUIREMENTS	1	2	1	YES
C) HANDICAPPED PARKING	6	7±	SAME	YES
D) DRIVEWAY OPENINGS	2	2	SAME	YES
E) MAX. COMPACT CARS	50% (8'X16')	38%	23% (NOTE 8)	YES
F) PARKING SPACE SIZE	9'x18.5'	9'x18.5'	SAME	YES
G) BUMPER OVERHANG	1' OVERHANG	NONE REQUIRED	SAME	YES
H) PARKING SPACE LAYOUT	(NOTE 9)	0	INCL. 5 TANDEM (NOTE 9)	SPECIAL PERMIT
) AISLE WIDTH EXTERIOR	24' (90 DEG. STALL)	24'	SAME	YES
I) AISLE WIDTH INTERIOR	24' (90 DEG. STALL)	16'-8"	SAME (NOTE 10)	SPECIAL PERMIT
J) PARKING SETBACK				
-FRONT	10'	13 <b>'</b> ±	SAME	YES
-SIDE	4'	9'±	SAME	YES
-REAR	4'	NA	SAME	YES
-BUILDING	5'	15 <b>'</b> ±	SAME	YES
K) LANDSCAPED AREAS	10%	>10% (NOTE 11)	11%- 12% (NOTE 11)	YES
L) TREES	1 PER 10 SPACES	(NOTE 12)	(NOTE 12)	YES
M) LOCATION	WITHIN LOT	WITHIN LOT	SAME	YES
N) BICYCLE RACKS	8	0	8	YES

NOTE 8. COMPACT PARKING: 34 PROPOSED COMPACT SPACES IN PARKING GARAGE (23%).

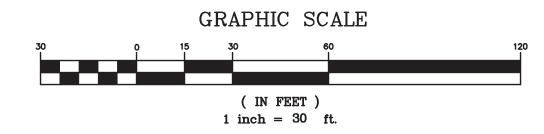
NOTE 9. PARKING SPACE LAYOUT:
5 TANDEM SPACES PROPOSED IN PARKING GARAGE. A SPECIAL PERMIT IS REQUESTED FROM THE PLANNING BOARD.

NOTE 10: INTERIOR AISLE WIDTHS IN THE GARAGE ARE 16'-8". A SPECIAL PERMIT IS REQUESTED FROM THE PLANNING BOARD, BECAUSE THE EXISTING COLUMN TO COLUMN SPACING IS A UNIQUE CIRCUMSTANCE.

NOTE 11. LANDSCAPE AREAS: BETWEEN 11% AND 12% OF THE INTERIOR PORTION OF THE PARKING AREAS IS LANDSCAPED. THE AREAS OUTSIDE THE PERIMETER OF THE PAVED PARKING AREAS ARE NOT INCLUDED IN THIS CALCULATION. THIS SATISFIES THE REQUIREMENT THAT 10% OF THE PARKING AREA BE LANDSCAPED, AS WELL AS THE REQUIREMENT THAT AT LEAST ONE QUARTER OF THE LANDSCAPED AREA BE LOCATED IN THE INTERIOR OF THE PARKING AREA.

NOTE 12. TREES: SEE LANDSCAPE PLAN BY HAWK DESIGN, INC.

SCALE 1"= 30'					DAVID THE STATE OF MASS
DATE 01/29/21	REV	DATE	REVISION	BY	NOEL KELLY CIVIL NO. 37942
SHEET 3 OF 6	TH		DENCE AT CARTER M		NO. 3/942 CONTRACTOR NO. 3/942 CONTRACTOR NO. 3/942
FILE # LAOO			100 WEST STREET NEEDHAM, MA		Digitally signed by Da Noel Kelly P.E. DN: cn=David Noel K
JOB # F: \P\2020-030		LA	YOUT AND ZONING		P.E., o=Kelly Engineer GRoup, Inc., ou, email=dkelly@kellyr neeringgroup.com, c Date: 2021.01.28 14:3
DRAWN BY			PLAN		-05'00'
CJL CHKD BY BGL APPD BY DNK	-	E	KELLY ENGINEERING GROU civil engineering consultan O Campanelli Drive, Braintree, MA 021 Phone: 781-843-4333 www.kellyengineeringgroup.c	t s	SHEET NO.



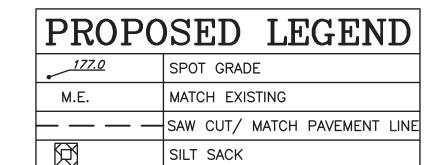
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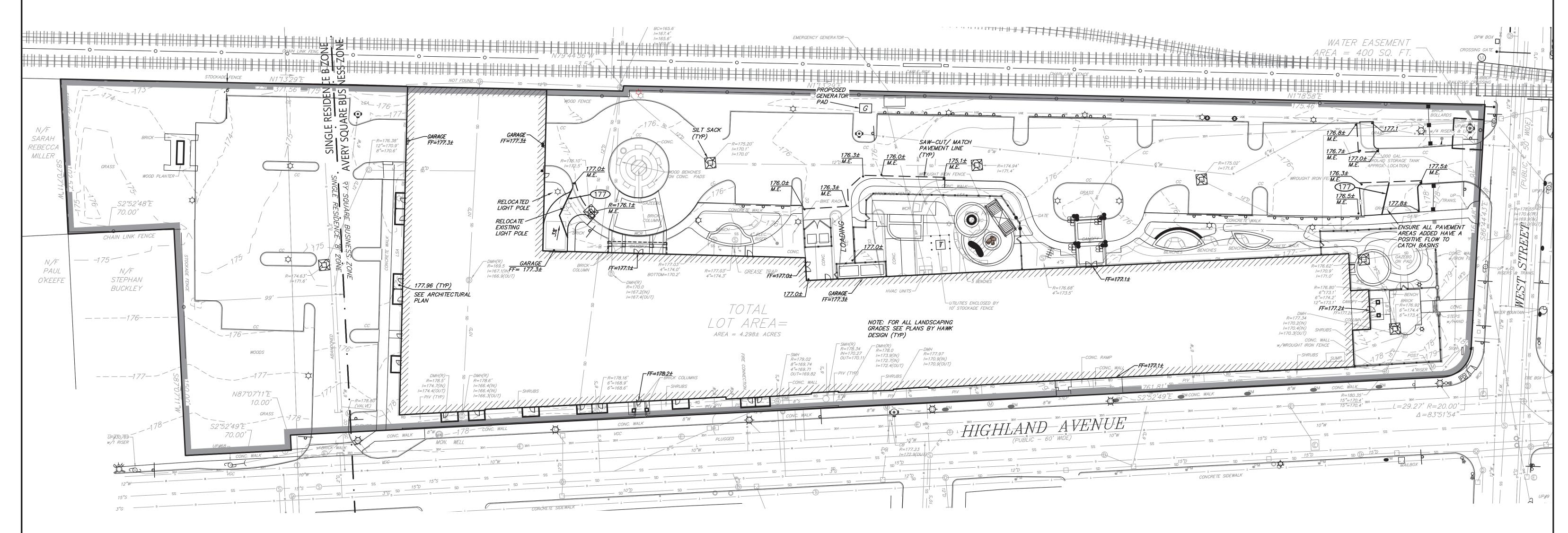
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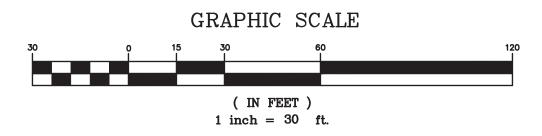
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NOTE: FOR EXISTING SYMBOL LEGEND SEE SHEET 2







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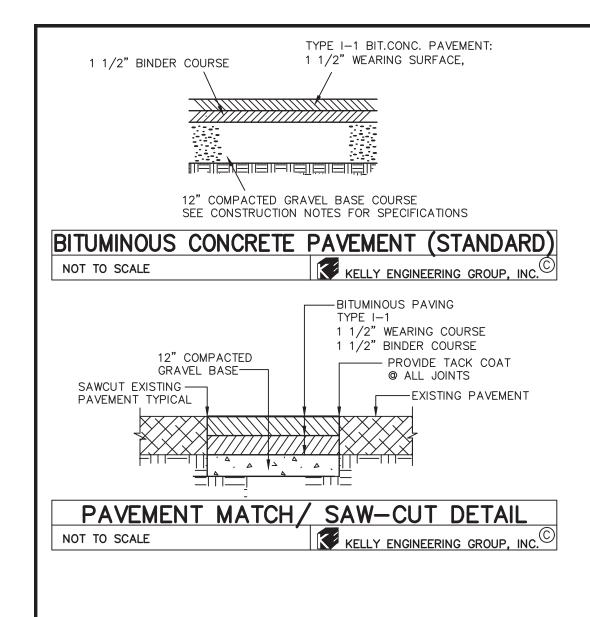
SCALE 1"= 30'				
DATE 01/29/21	REV	DATE	REVISION	BY
SHEET 4 of 6	ТН	E RES	DENCE AT CARTER	MILL
FILE # SP00			100 WEST STREET NEEDHAM, MA	
JOB # F:\P\2020-030			GRADING	

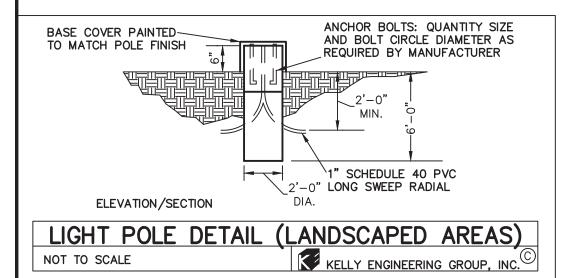
GRADING
PLAN

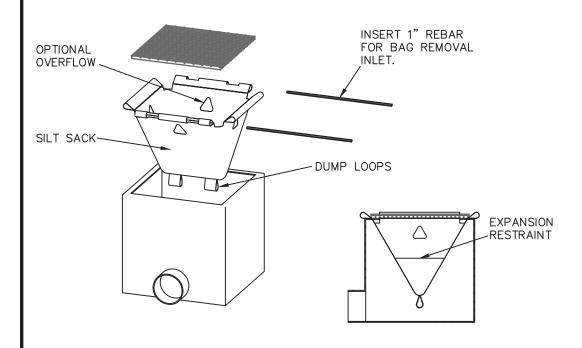
KELLY ENGINEER

KELLY ENGINEERING GROUP civil engineering consultants 0 Campanelli Drive, Braintree, MA 02184 Phone: 781-843-4333 www.kellyengineeringgroup.com











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BIT. CONC. PAVING

SEE LAOUT PLAN FOR WIDTH OF SIDEWALK

2% MAX SLOPE

4"

6"

12"

6"

6"

6"

COMPACTED GRAVEL OR CRUSHED STONE

NOTE: PROVIDE EXPANSION JOINTS AT 25' O.C.

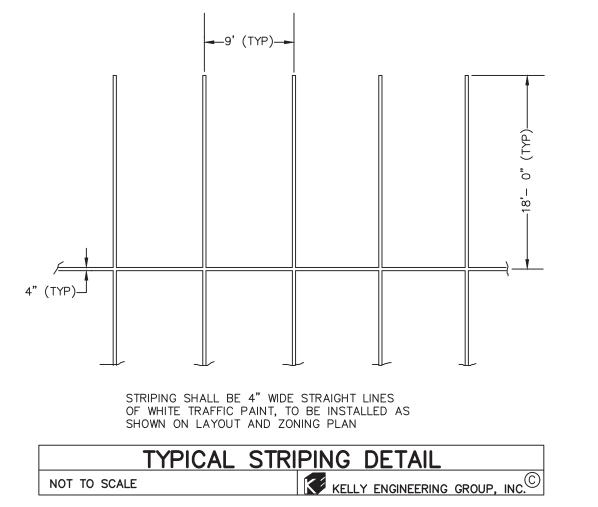
INTEGRAL SIDEWALK / CURB DETAIL KELLY ENGINEERING GROUP, INC. NOT TO SCALE #3 REBARS TOP 18" LOAM FOR PLANTING AREAS AND BOTTOM BIT. CONC. PAVEMENT — 4" LOAM FOR LAWN FERTILIZE (SEE DETAIL) -PORTLAND CEMENT CONCRETE PORTLAND CEMENT -6"COMPACTED GRAVEL CONCRETE OR CRUSHED STONE NOTE: PROVIDE EXPANSION JOINTS AT 5'-0" O.C. IF CAST IN PLACE.

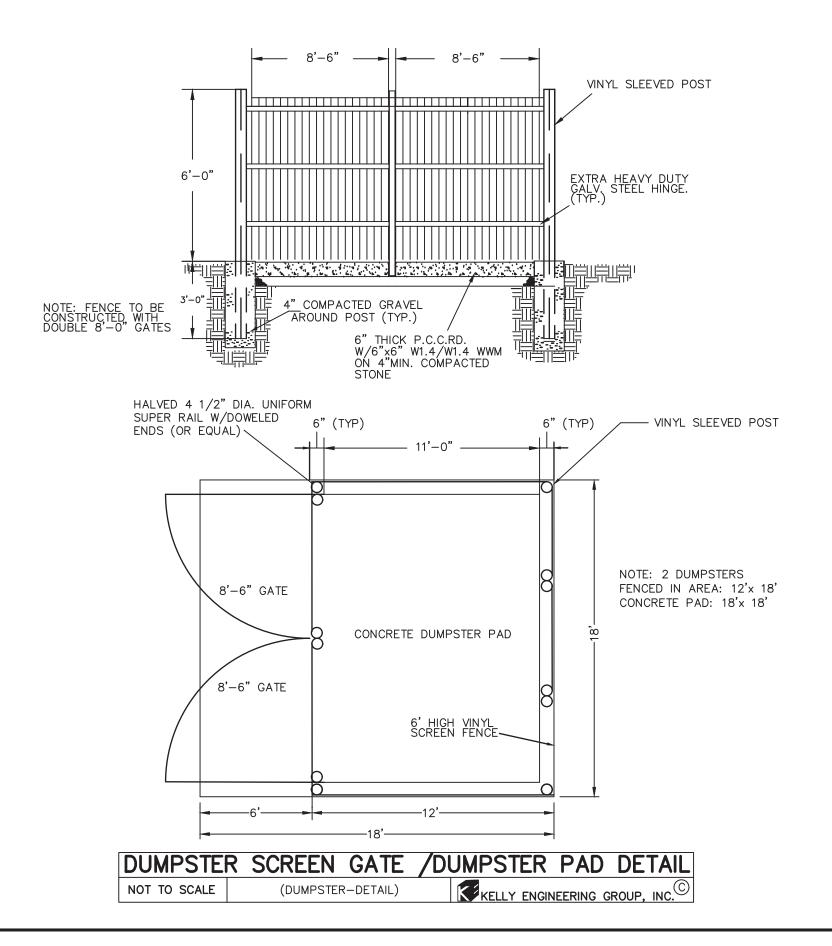
(PRECAST CONC. CURBS MAY BE SUBSTITUTED)

CONCRETE CURB DETAIL

NOT TO SCALE

KELLY ENGINEERING GROUP, INC.©





#### CONSTRUCTION NOTES

A1. THE CONTRACTOR SHALL REPORT TO THE OWNER AND ENGINEER OF ANY SIGNIFICANT VARIATIONS IN EXISTING SITE CONDITIONS FROM THOSE SHOWN ON THESE PLANS. ANY PROPOSED REVISIONS TO THE WORK, IF REQUIRED BY THESE SITE CONDITIONS, SHALL NOT BE UNDERTAKEN UNTIL REVIEWED AND APPROVED BY THE OWNER AND THE ENGINEER.

A2. THE CONTRACTOR SHALL NOTIFY THE TOWN OF NEEDHAM DEPARTMENT OF PUBLIC WORKS AT LEAST 48 HOURS IN ADVANCE OF ANY REQUIRED INSPECTIONS.

A3. IN ORDER TO PROTECT THE PUBLIC SAFETY DURING CONSTRUCTION, THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING AT ALL TIMES ALL NECESSARY SAFETY DEVICES AND PERSONNEL, WARNING LIGHTS, BARRICADES, AND POLICE OFFICERS.

A4. ALL WORK SHALL CONFORM TO A SPECIAL PERMIT TO BE ISSUED BY THE TOWN OF NEEDHAM.

A5. THE LOCATION OF UNDERGROUND UTILITIES AS REPRESENTED ON THESE PLANS IS BASED UPON PLANS AND INFORMATION PROVIDED BY THE RESPECTIVE UTILITY COMPANIES OR MUNICIPAL DEPARTMENTS SUPPLEMENTED BY FIELD IDENTIFICATION WHEREVER POSSIBLE. NO WARRANTY IS MADE AS TO THE ACCURACY OF THESE LOCATIONS OR THAT ALL UNDERGROUND UTILITIES ARE SHOWN. THE CONTRACTOR SHALL CONTRACT DIG SAFE AT LEAST 72 HOURS PRIOR TO THE START OF CONSTRUCTION. DIG SAFE TELEPHONE NUMBER IS 1–888–344–7233.

A6. THE CONTRACTOR SHALL VERIFY THE LOCATION, SIZE AND DEPTH OF EXISTING UTILITIES PRIOR TO TAPPING INTO, CROSSING OR EXTENDING THEM. IF THE NEW WORK POSES A CONFLICT WITH EXISTING UTILITIES, THE ENGINEER SHALL BE NOTIFIED PRIOR TO THE CONTRACTOR CONTINUING.

A7. REFER TO ARCHITECTURAL PLANS FOR EXACT BUILDING DIMENSION AND DOOR LOCATIONS.

A8. ALL PROPOSED SITE GAS, ELECTRIC, TELEPHONE, CATV FEATURES SHOWN ON SITE DEVELOPMENT PLANS ARE INTENDED AS A GUIDE ONLY. FINAL CONFIGURATION TO BE CONFIRMED WITH PROJECT MEP ENGINEER AND UTILITY

B1. REFER TO PLUMBING PLANS FOR EXACT SIZE AND LOCATION OF SANITARY AND WATER CONNECTIONS.

B2. REFER TO ELECTRICAL PLANS FOR THE LIGHTING CIRCUITS, FIXTURE DETAIL AND BUILDING CONNECTION LOCATION.

B3. ALL H.D.P.E. HIGH DENSITY POLYETHYLENE PIPE SHALL BE ADS N-12 OR APPROVED EQUAL. SEWER SHALL BE SDR 35 WITH RUBBER RING JOINTS. WATER LINES SHALL BE CL 52 D.I.P. (DUCTILE IRON PIPE), REINFORCED CONCRETE PIPE RCP SHALL BE CLASS III.

B4. NO LEDGE, BOULDERS, OR OTHER UNYIELDING MATERIALS ARE TO BE LEFT WITHIN 6" OF THE SEWER IN THE TRENCH, NOR ARE THEY TO BE USED FOR BACKFILL FOR THE FIRST 12" ABOVE THE PIPES.

C1. WALKS SHALL BE 4" THICK AND SHALL BE CONSTRUCTED ON 6" OF COMPACTED BANK GRAVEL. CONCRETE FOR WALKS SHALL HAVE A MINIMUM 28 DAY COMPRESSION STRENGTH OF 4,000 PSI. WALKS SHALL BE REINFORCED WITH WWM 6x 6 W1.4/W1.4 CONFORMING TO ASTM A184.

C2. BASE MATERIAL SHALL BE CLEAN BANK RUN GRAVEL, CONFORMING TO M.D.P.W. M1.03.1, WITH NO STONES LARGER THAN THREE (3) INCHES IN DIAMETER AND SHALL BE PLACED AND ROLLED WITH AT LEAST A TEN TON ROLLER. THE SURFACES SHALL BE WET DURING ROLLING TO BIND THE MATERIAL. ALL STONES OF 4" DIAMETER OR LARGER SHALL BE REMOVED FROM THE SUB-BASE PRIOR TO PLACING BASE MATERIAL. PULVERIZED MATERIAL MAY BE USED AS BASE MATERIAL PROVIDING IT MEETS THIS SPECIFICATIONS. AREAS TO BE REPAVED SHALL BE PULVERIZED AND REGRADED TO PROVIDE POSITIVE FLOW TO DRAINAGE AND AWAY FROM BUILDING. PAVE WITH 1 1/2" WEARING COURSE ON 1 1/2" BINDER COURSE. ALL VALVES BOXES, MANHOLES AND OTHER UTILITIES APPURTENANCES SHALL BE ADJUSTED TO CONFORM TO FINAL GRADE

C3. GENORATOR PAD SHALL BE INSTALLED PER MANUFACTURING SPECIFICATIONS.

C4. PAVEMENT AREA SHALL BE PAVED TO A THICKNESS AS SHOWN ON THE PLANS MEASURED AFTER COMPACTION, WITH A BINDER COURSE AND TOP COURSE OF CLASS I BITUMINOUS CONCRETE PAVEMENT, TYPE I-1.

C5. THE AGGREGATE SHALL BE COMPOSED, MIXED AND LAID HOT IN TWO COURSES AS SPECIFIED IN THE "COMMONWEALTH OF MASSACHUSETTS STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGE", 1988 EDITION. SECTION 460 FOR CLASS I BITUMINOUS CONCRETE PAVEMENT, AS SPECIFICALLY SET FORTH IN SECTION 460.20 AND 460.82.

C6. DUMPSTER PAD SHALL BE 8" THICK REINFORCED CONCRETE SLAB WITH CONTROL JOINTS EVERY 10'. THE PAD SHALL BE CONSTRUCTED OVER 6" OF GRAVEL BASE, COMPACT TO 95% REINFORCEMENT SHALL BE WWF 6x6— W1.4 x W1.4 PLACED AT THE CENTER OF THE SLAB. THE FRONT END OF COMPACTOR PAD SHALL HAVE EMBEDDED A 6"x 6"x 3/8" STEEL ANGLE.

C7. ALL EXISTING PAVING TO BE DISTURBED SHALL BE CUT ALONG A STRAIGHT LINE THROUGH ITS ENTIRE THICKNESS. BUTT NEW PAVING INTO THE EXISTING PAVEMENT TO REMAIN AND TACK COAT THE JOINT.

C8. ANY PAVEMENT REMOVED FOR UTILITY TRENCH EXCAVATION OR OTHERWISE DAMAGED DURING CONSTRUCTION SHALL BE REPLACED WITH A PAVEMENT SECTION CONSISTING OF 1 1/2" WEARING COURSE OVERLAYING A 1 1/2" BINDER COURSE OVERLAYING A 12" COMPACTED GRAVEL BASE COURSE.

D1. ALL AREAS TO BE PLANTED WITH GRASS SHALL BE TREATED WITH 100 POUNDS OF GROUND LIMESTONE PER 1,000 S.F. OF AREA PLANTED. ALL AREAS TO BE PLANTED WITH GRASS SHALL BE FERTILIZED WITH 10-10-10 AT THE RATE OF 1,000 POUNDS PER ACRE OR AS REQUIRED BY SOIL TEST. 40% OF THE NITROGEN SHALL BE ORGANIC FORM.

D2. ALL LANDSCAPED AREAS TO BE LOAMED AND SEEDED SHALL HAVE THE FOLLOWING MIX.

PERENNIAL RYE 25%
KENTUCKY BLUE 25%
CREEPING RED FESCUE OR
PENNLAWN FESCUE 50%
SEED AT THE RATE OF 5#/1,000 S.F.

D3. ALL DISTURBED AREAS TO BE LOAMED AND SEEDED SHALL HAVE A MINIMUM OF 4 INCHES OF TOPSOIL SPREAD EVENLY THROUGHOUT. PROVIDE EROSION CONTROL MEASURES AS NECESSARY TO PROVIDE SLOPE STABILITY UNTIL VEGETATION IS ESTABLISHED. (NOTE: IF THERE IS A CONFLICT BETWEEN THESE PLANS AND LANDSCAPE PLANS THE LANDSCAPE PLANS SHALL DICTATE.

E1. THE CONTRACTOR SHALL REGULARLY INSPECT THE PERIMETER OF THE PROPERTY TO CLEANUP AND REMOVE LOOSE CONSTRUCTION DEBRIS BEFORE IT LEAVES THE SITE. ALL DEMOLITION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE SITE TO A LEGAL DUMP SITE. ALL TRUCKS LEAVING THE SITE SHALL BE COVERED.

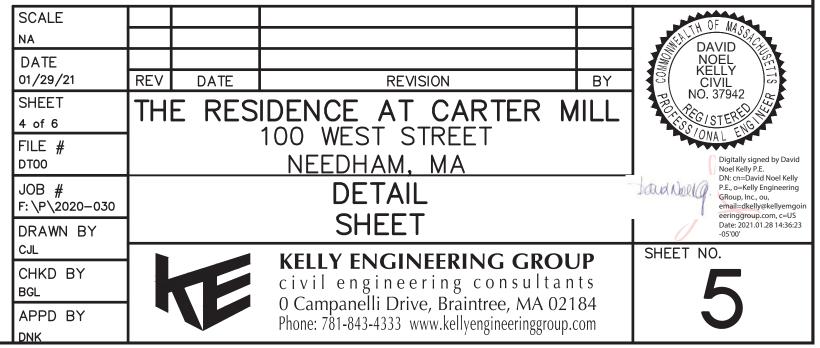
E2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO INSTITUTE EROSION CONTROL MEASURES ON AN AS NECESSARY BASIS, SUCH THAT EXCESSIVE SOIL EROSION DOES NOT OCCUR. MEASURES SHALL INCLUDE SILT SACKS IN DRAINAGE INLETS, MULCHING AND PLANTING OF DISTURBED AREAS.

E3. PRIOR TO THE COMMENCEMENT OF ANY OTHER WORK A SILT SACK SHALL BE INSTALLED IN EACH EXISTING DRAINAGE INLET.

E4. AFTER INSTALLATION OF EACH DRAINAGE INLET A SILT SACK SHALL BE INSTALLED IN EACH INLET TO PREVENT SEDIMENT FROM ENTERING THE STORM DRAIN SYSTEM.

E5. AT THE END OF CONSTRUCTION ALL DRAINAGE STRUCTURES ARE TO BE CLEANED OF SILT, STONES AND OTHER DEBRIS.

E6. DURING CONSTRUCTION THE EROSION CONTROL MEASURES SHALL BE INSPECTED ONCE PER WEEK AND WITHIN 24 HOURS OF ANY STORM EVENT GENERATING MORE THAN 1/2" OF RAINFALL. THE EROSION CONTROL MEASURES SHALL BE CLEANED REGULARLY AND ADJUSTED IF NECESSARY TO ENSURE THAT NO SILT OR DEBRIS LEAVES THE SITE.



The

Plan View
Scale - 1" = 28ft

SCHEDULE QUANTITY MANUFACTURER **DESCRIPTION** LAMP SYMBOL LABEL CATALOG NUMBER WATTAGE **LAMPS** ALG72XX VOLT CSL M150 30K Allegra Bell Shaped LED 0.9 132 Lumenpulse CRI70 4 FINISH DIM XX ST Area Light w/ Type 4 AL-1Distribution ALG72XX VOLT CSL M150 30K Allegra Bell Shaped 0.9 132 Lumenpulse CRI70 4BLS FINISH DIM XX ST Area Light w/ Type 4 AL-1b Back Light Sheild NOTES: Distribution

0.9

0.35

0.9

0.9

0.9

0.9

0.45

0.9

0.9

132

39

20.83

19.5

11.99

24

71

18.59

2.0 +2.0 +1.8 +1.8 +2.1 +2.8 +3.6 +5.1 +6.0 +5.7 +4.0 +2.6 +1.7 +0.9 +0.5

3.6 + 3.4 + 2.6 + 2.2 + 2.3 + 2.8 + 3.4 + 4.5 + 5.1 + 4.9 + 3.6 + 2.5 + 1.6 + 0.9 + 0.5 + 0.2 + 0.2 + 0.3 + 0.2 + 0.2 + 0.3 + 0.2

Lumenpulse

Lightology

Brownlee Lighting Inc

Brownlee Lighting Inc

Spectrum Lighting

Lightology

Lightology

Lightology

Lithonia Lighting

13

13

28

AL-3

EX-1

EX-2

EX-3

EX-4

EX-5

EX-6

EX-7

EX-8

ALG72XX VOLT CSL M150 30K

CRI70 5S FINISH DIM XX TM

7176 18 AS H08 30K XX

176 34 AS H21 30K XX

SP4ES 20L 30K DX // AR4LED SG

RADB LED P4 30K SYM DDBXD

TLG482514

MF XX

TLG749332

TLG482515

TLG748574

Allegra Bell Shaped

Area Light w/ Type 5

Square Distribution

BEAM 7176 Exterior

Sconce - 18" Body

BEAM 7176 Exterior

Sconce - 34" Body

Pitch Wall Sconce

Bowman 6

Roton 18

Radean Bollard

Estimator Series

Luminous Cylinder Wall

Luminous Cylinder Wall

Recessed 4" Downlight

Bowman 4

LED

LED

LED

LED

LED

LED

LED

LED

LED

- RECESSED LIGHTS IN CANOPY @ 12'-0" AFG
- WALL SCONCES @ 6'-0" & 8'-0" AFG
7.88131

- TASK HEIGHT: AT SURFACE

-REFLECTANCES ASSUMED:

- SURFACE: 50

- MOUNTING HEIGHTS: 16'-0" AFG

- CALCULATION POINT SPACING: 7'X7' OC

7.8 + 5.6 + 3.4 + 1.8 + 1.0 + 0.7 + 2.0 + 2.0 + 0.3 + 0.4 + 0.5 + 0.7 + 1.6 + 0.7 + 1.6 + 0.7 + 1.6 + 0.7 + 1.6 + 0.7 + 1.6 + 0.7 + 0.9 + 0.5 + 0.7 + 1.6 + 0.7 + 1.5 + 0.9 + 0.6 + 0.4 + 0.8 + 0.7 + 0.9 + 0.6 + 0.4 + 0.8 + 0.7 + 0.9 + 0.6 + 0.4 + 0.8 + 0.7 + 0.9 + 0.6 + 0.4 + 0.8 + 0.7 + 0.1 +

 $\begin{array}{c} + 1.6 & + 1.7 & + 1.8 & + 3.1 & + 5.5 & + 6.4 & + 3.7 & + 2.0 & + 1.2 & + 0.8 & + 0.7 & + 9.2 & + 2.8 & + 0.4 & + 0.2 & + 0.2 & + 3.8 & + 35.0 & + 1.5 & + 1.4 & + 1.8 & + 3.2 & + 5.4 & + 5.6 & + 3.4 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.2 & + 1.4 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 2.2 & + 7.6 & + 11.3 & + 1.4 & + 1.8 & + 1.4 & +$ 

0.5 +0.9 +0.8 +0.3 +0.2 +0.1 +0.6 +1.4 +0.4 +1.4 +0.8 +0.2 +0.2 +0.2 +0.8 +16.2 +2.8 +0.5 +0.6 +1.9 +1.9 +1.9 +1.9 +1.0 +0.9

**EX:5** +1.7 +1.1 +0.8 +0.7 +0.6 +0.6 +7.5 +9.8 +0.3 +0.1 +0.1 +0.1 +0.4 +8.3 **EX:8** +0.2 +0.9 +4.0 +0.6 +0.2 +0.1 +0.2 +0.3 +0.4 +3.4 +7.3 +6.3 +1.4 +0.3 +0.2 +0.3

DISCLAIMER:

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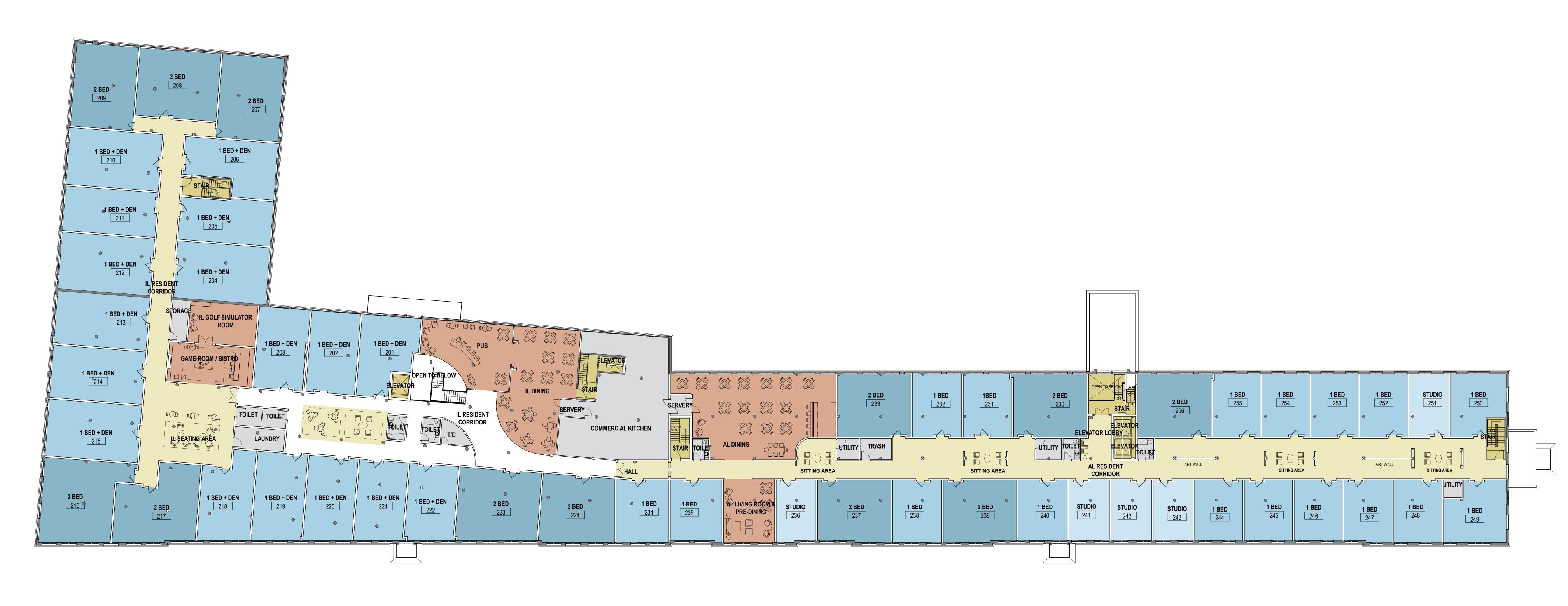
STATISTICS						
DESCRIPTION	SYMBOL	AVG.	MAX	MIN.	MAX/MIN	AVG/MIN
Outer Perimeter	+	0.3 fc	35.0 fc	0.0 fc	N/A	N/A
Parking Lot	+	1.7 fc	8.0 fc	0.1 fc	80.0:1	17.0:1
Parking Lot	+	2.5 fc	24.0 fc	0.1 fc	240.0:1	25.0:1

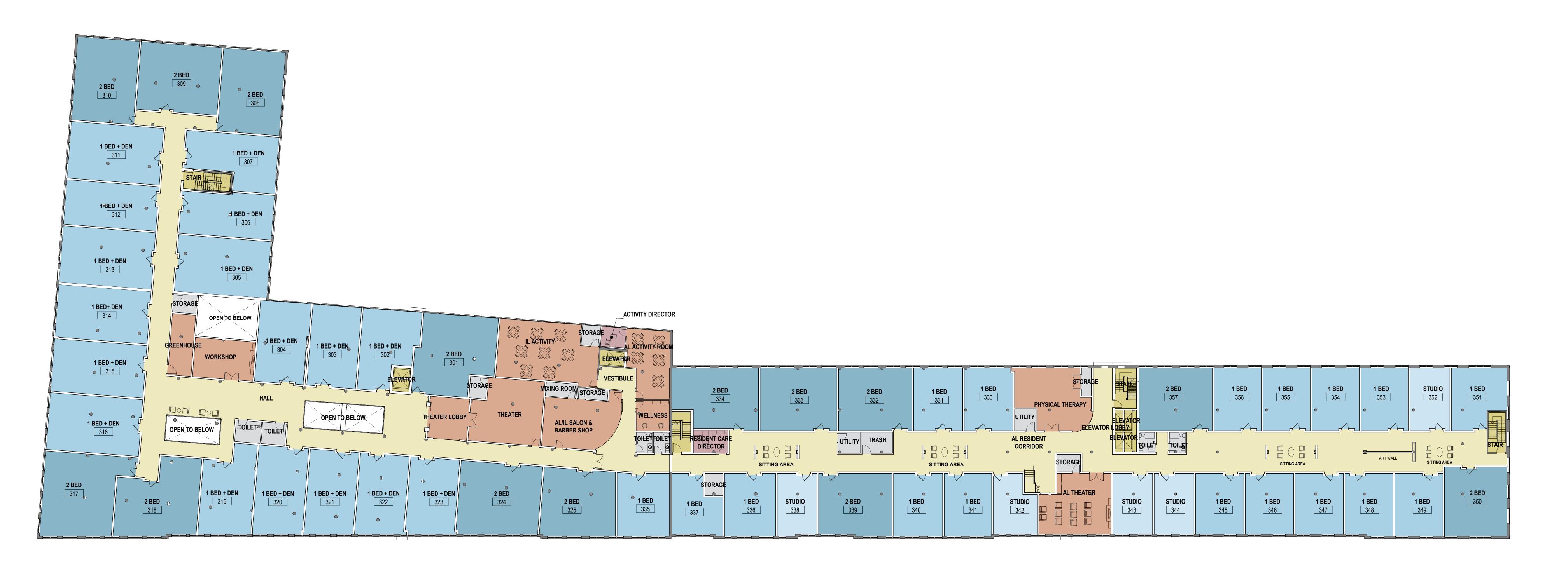
Designer
Robert J. Lindstrom
Date
1/12/2021
Scale
Not to Scale
Drawing No.
Summary

1 of 1



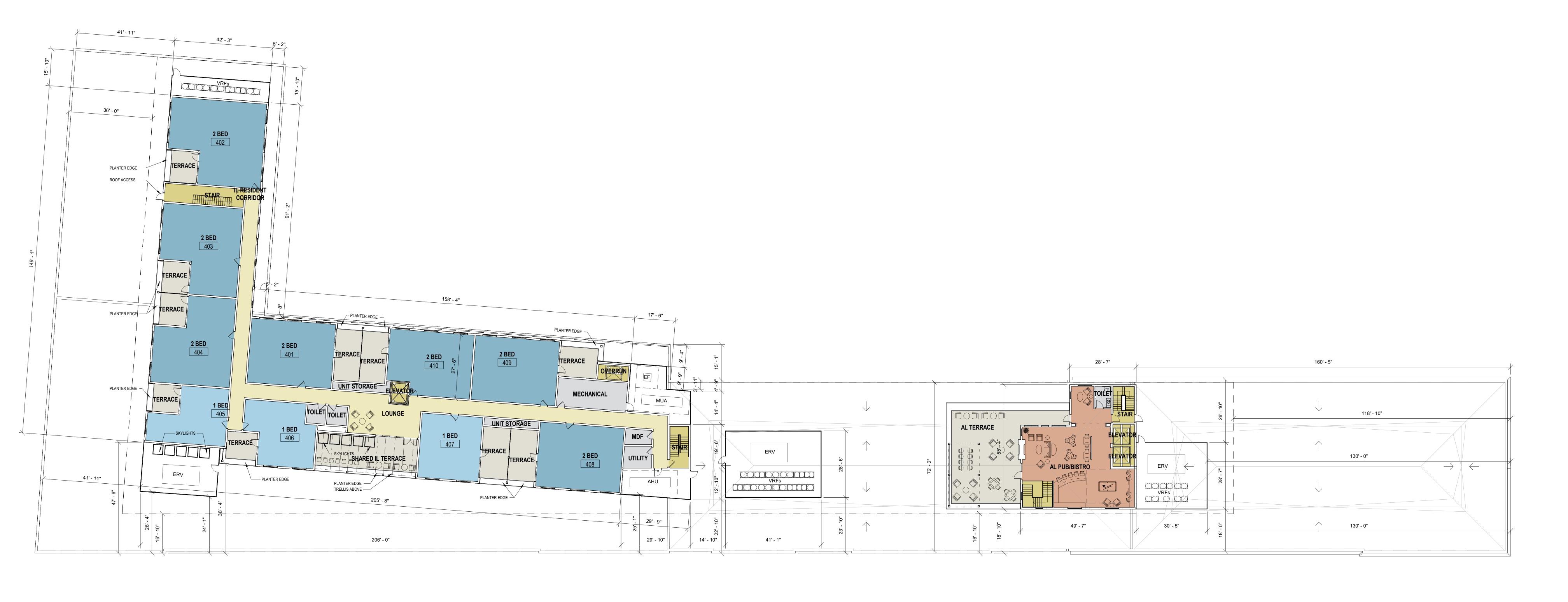






SQUARE FOOTAGE OF EXISTING ROOF	62,775 SF
SQUARE FOOTAGE OF PROPOSED IL FOURTH FLOOR & AL COMMON SPACE (INCLUDING TERRACES)	20,650 SF
PERCENT OF ROOF COVERED (INCLUDING TERRACES)	32.9%
SQUARE FOOTAGE OF PROPOSED IL FOURTH FLOOR & AL COMMON SPACE (EXCLUDING TERRACES)	15,900 SF
PERCENT OF ROOF COVERED (EXCLUDING TERRACES)	25.3%

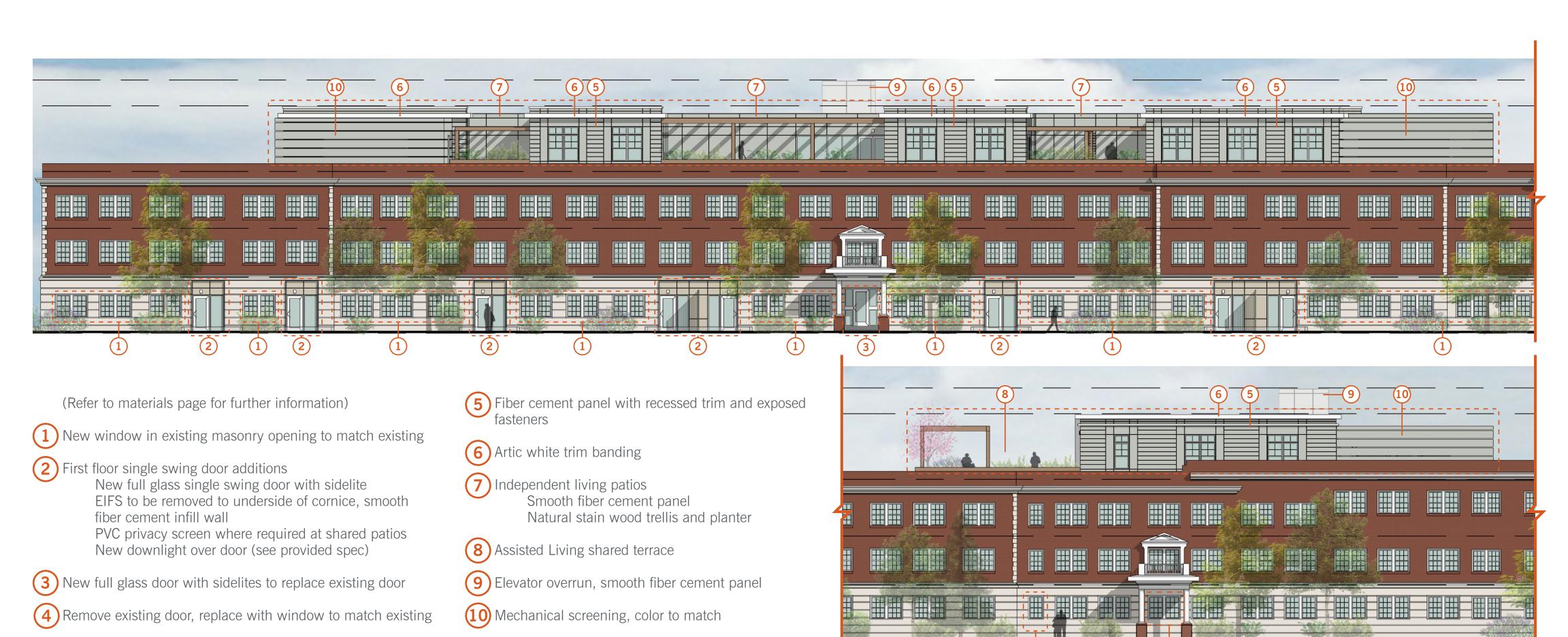
ERV - ENERGY RECOVERY VENTILATOR VRF - VARIABLE REFRIGERANT FLOW MUA - MAKE UP AIR AHU - AIR HANDLING UNIT EF - EXHAUST FAN





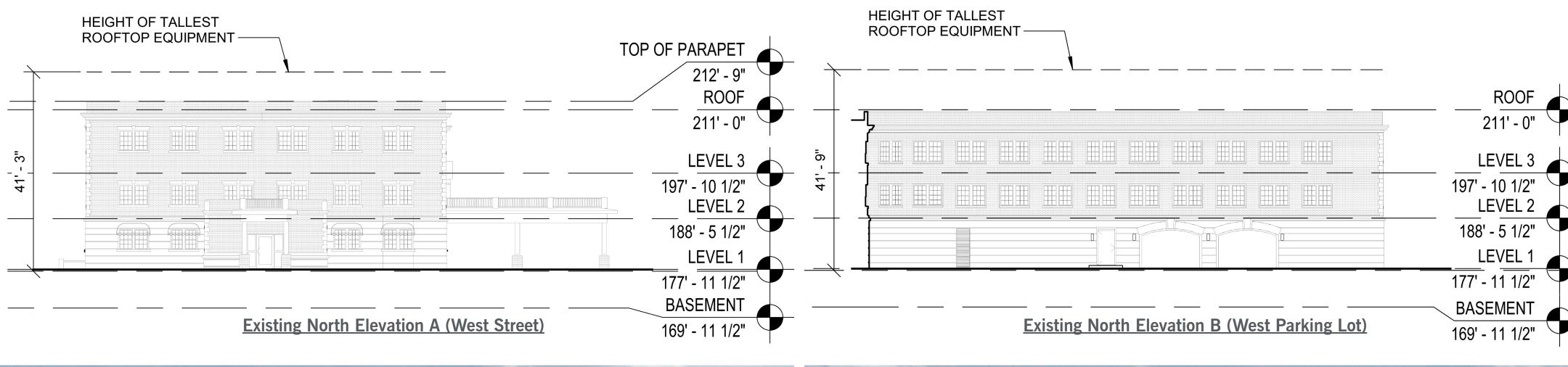
**Proposed East Elevation** 

See Enlarged Below

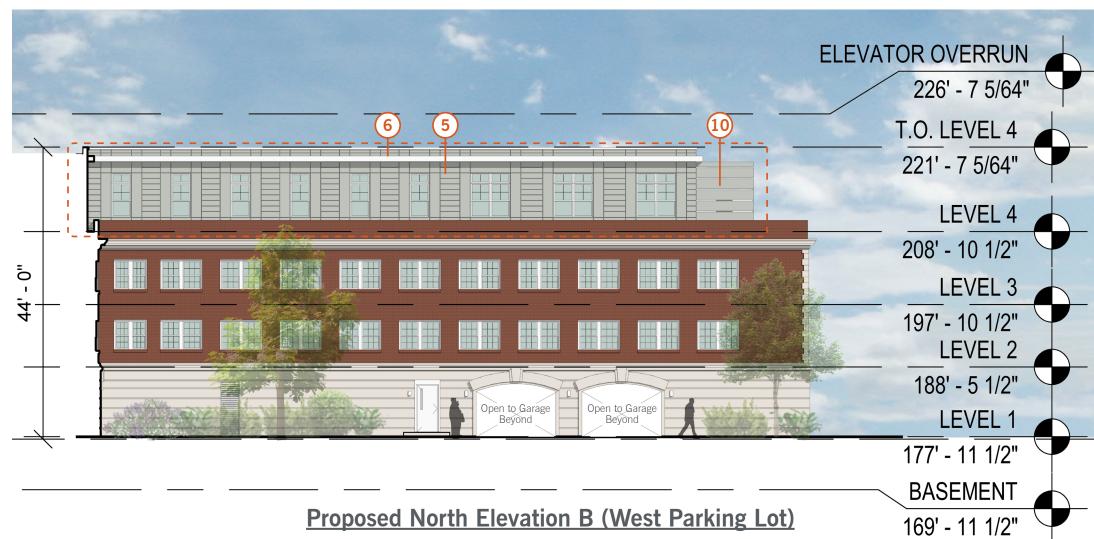




169' - 11 1/2"







(Refer to materials page for further information)

First floor single swing door additions

New full glass single swing door with sidelite

EIFS to be removed to underside of cornice, smooth

fiber cement infill wall

PVC privacy screen where required at shared patios

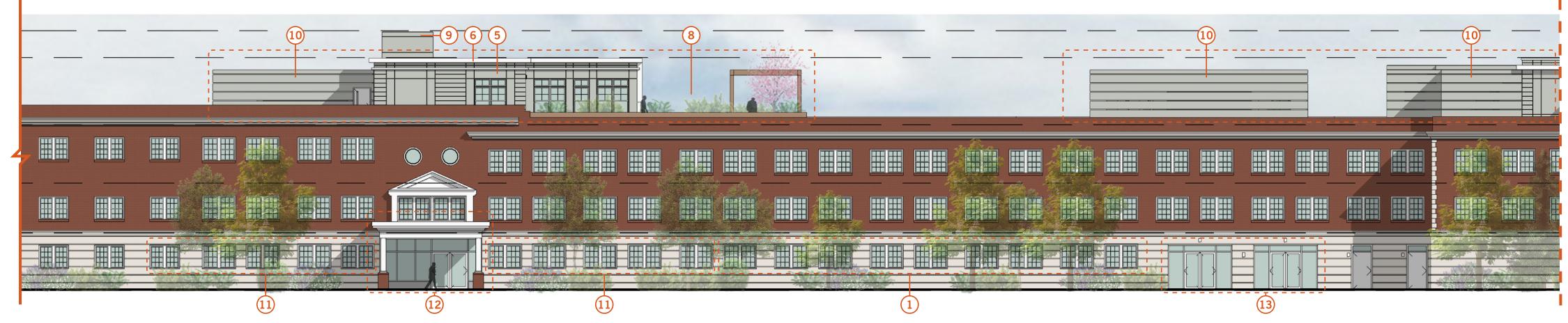
New downlight over door (see provided spec)

- 5 Fiber cement panel with recessed trim and exposed fasteners
- 6 Artic white trim banding
- 9 Elevator overrun, smooth fiber cement panel
- 10 Mechanical screening, color to match
- 11) Remove awnings from windows









NOT FOR CONSTRUCTION

(Refer to materials page for further information)

- New window in existing masonry opening to match existing
- 5 Fiber cement panel with recessed trim and exposed fasteners
- 6 Artic white trim banding
- 7 Independent living patios
  Smooth fiber cement panel
  Natural stain wood trellis and planter
- 8 Assisted Living shared terrace
- 9 Elevator overrun, smooth fiber cement panel
- 10 Mechanical screening, color to match

- 11) Remove awnings from windows
- Porte-cochere

Remove EIFS to underside of roof
New glass entry vestibule with double door
Smooth fiber cement infill wall
Remove balluster from top of porte-cochere,
clean and reface elements as needed

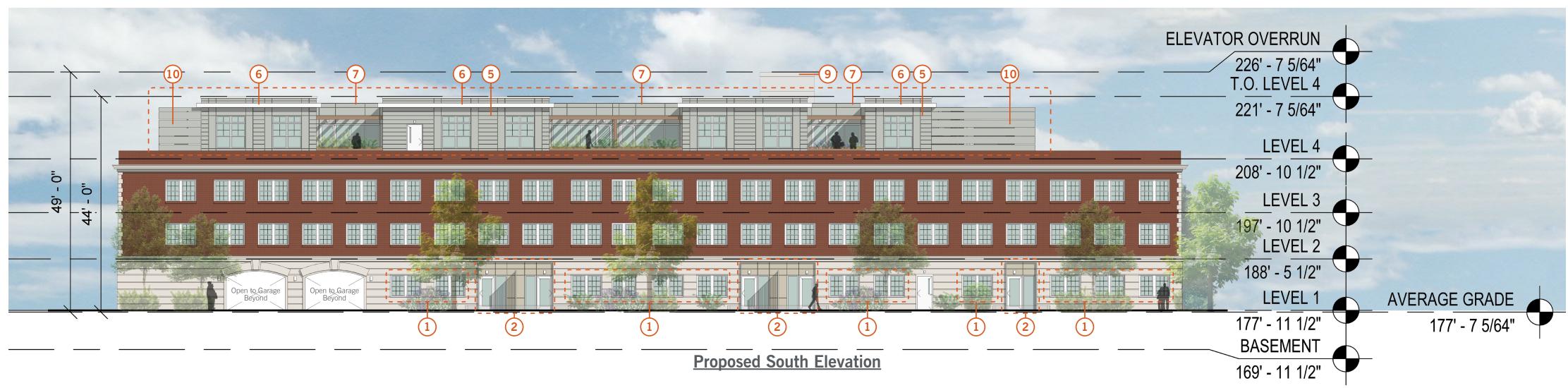
- 13 Infill existing garage openings with new storefront system to match existing windows
- 14 Portico

Remove ballusters from top of portico Clean and reface trim elements as needed New storefront windows in place of existing french doors

15) New opening into garage to match existing







(Refer to materials page for further information)

- 1 New window in existing masonry opening to match existing
- 2 First floor single swing door additions

  New full glass single swing door with sidelite

  EIFS to be removed to underside of cornice, smooth fiber cement infill wall

PVC privacy screen where required at shared patios New downlight over door (see provided spec)

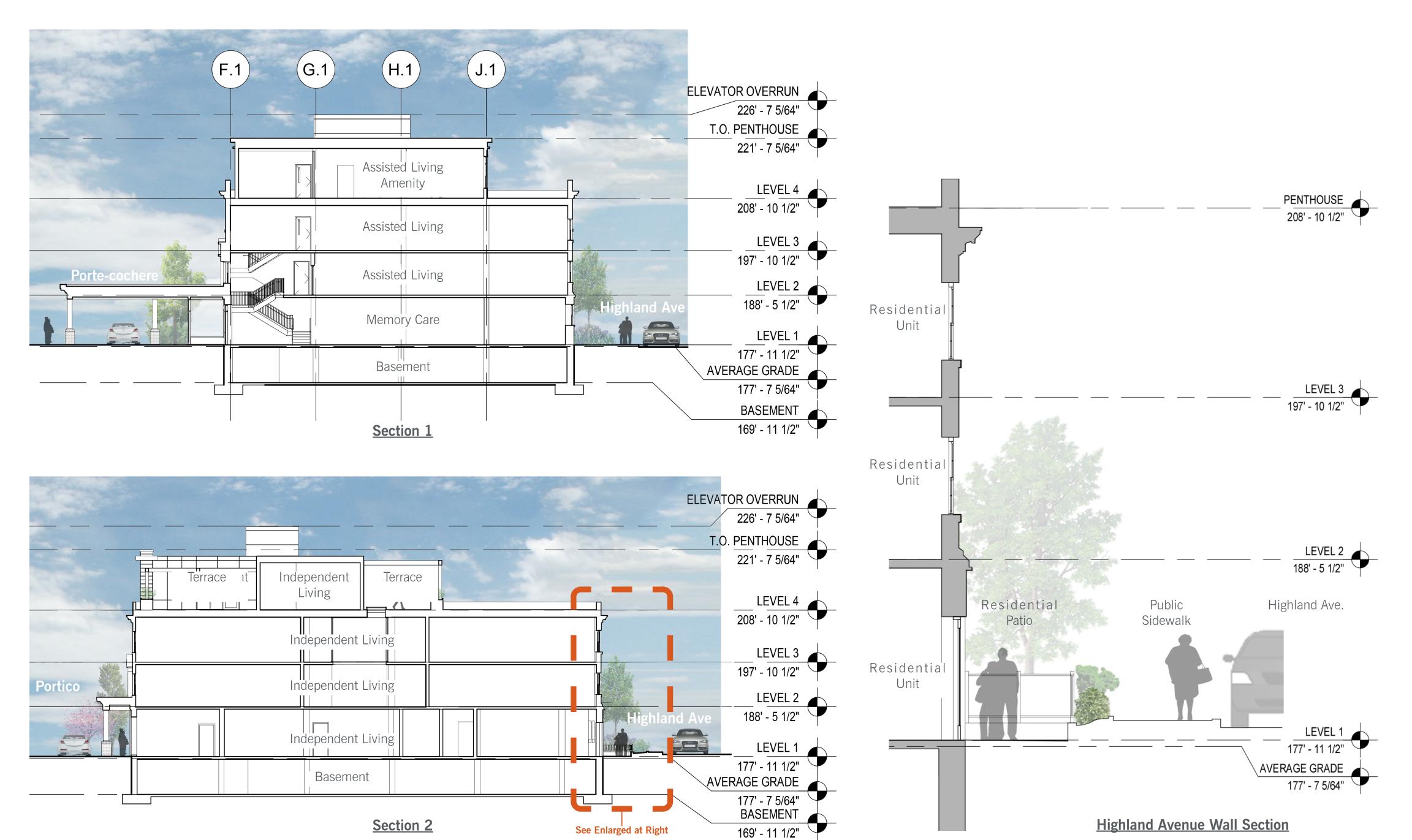
- 3 New full glass door with sidelites to replace existing door
- 4 Remove existing door, replace with window to match existing

- Fiber cement panel with recessed trim and exposed fasteners
- 6 Artic white trim banding
- 7 Independent living patios
  Smooth fiber cement panel
  Natural stain wood trellis and planter
- 8 Assisted Living shared terrace
- 9 Elevator overrun, smooth fiber cement panel
- 10 Mechanical screening, color to match

#### The Residence at Carter Mill



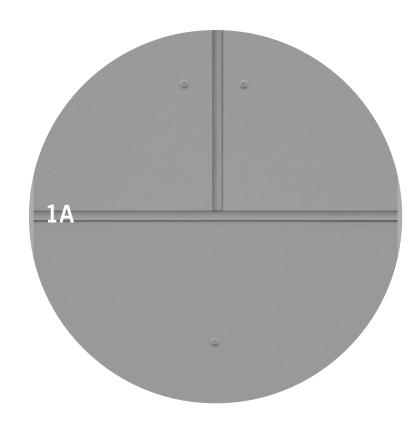




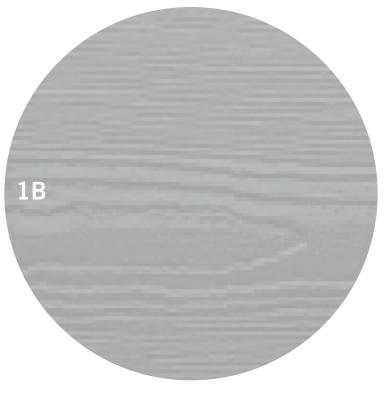








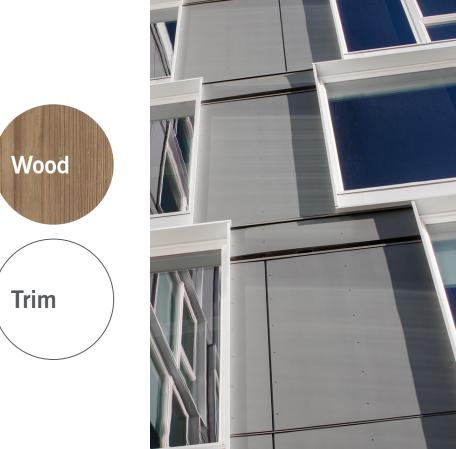
Fiber Cement - Panel with recess trim & exposed fasteners
Color - Light Mist



Fiber Cement - Panel with 3/4" reveal Color - Light Mist



Fiber Cement - Panel with 3/4" reveal Color - Cobble Stone



Recess reveal examples





**Partial South Elevation** 



**Precedent Images** 



#### The Residence at Carter Mill

# THE RESIDENCE AT CARTER MILL

100 WEST STREET
NEEDHAM, MASSACHUSETTS

# LANDSCAPE PERMIT PLANS

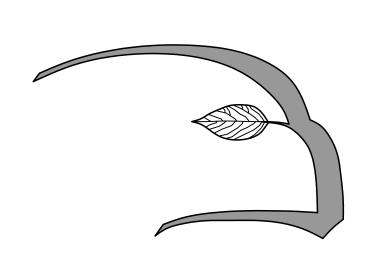
LIST	OF DRAWINGS:	SET Date
L1.0	SITE LANDSCAPE MASTER PLAN	2/24/21
L2.1	NORTH PLANTING PLAN	2/24/21
L2.2	CENTRAL PLANTING PLAN	2/24/21
L2.3	SOUTH PLANTING PLAN	2/24/21
L2.4	WEST BUFFER PLANTING PLAN	2/24/21
L3.1	NORTH MATERIALS PLAN	2/24/21
L3.2	BUILDING ARRIVAL & RESIDENT COURTYARD MATERIALS PLAN	2/24/21
L3.3	ASSISTED LIVING ARRIVAL MATERIALS PLAN	2/24/21
LD1	PLANT SCHEDULE & PLANTING DETAILS	2/24/21
LD2	PLANTING NOTES	2/24/21
LD3	CONSTRUCTION DETAILS	2/24/21

APPLICANT:

LCB Senior Living, LLC 3 Edgewater Drive Norwood, MA 02062 Tel: 781-619-9320

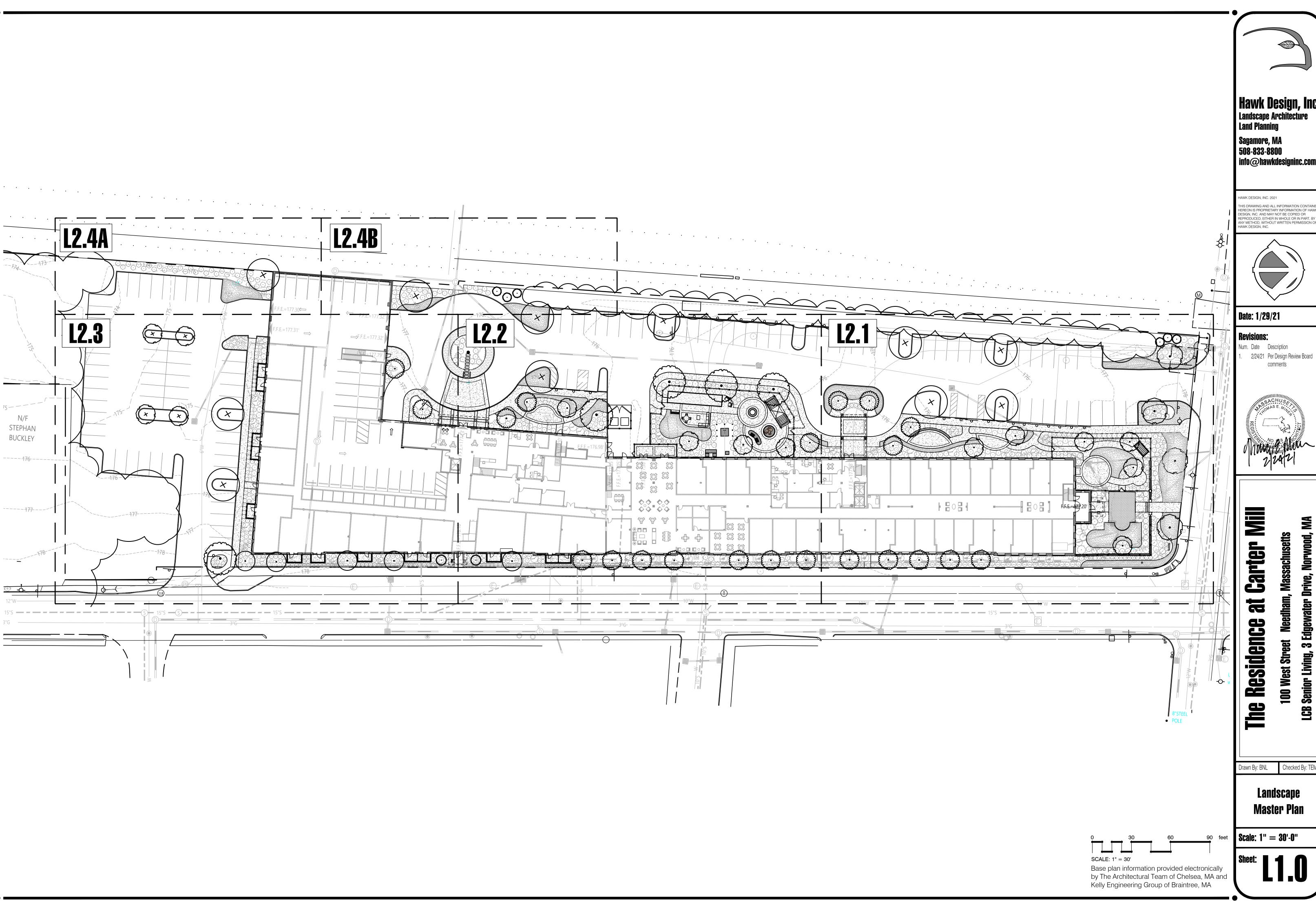
OWNER:

Welltower, Inc. 4500 Dorr Street Toledo, OH 43615 Tel: 419-247-2800 PREPARED BY:



Hawk Design, Inc.
Landscape Architecture
Land Planning

Sagamore, MA
508-833-8800
info@hawkdesigninc.com

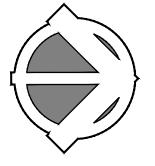




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Date: 1/29/21

**Revisions:** 

Num. Date Description 2/24/21 Per Design Review Board comments

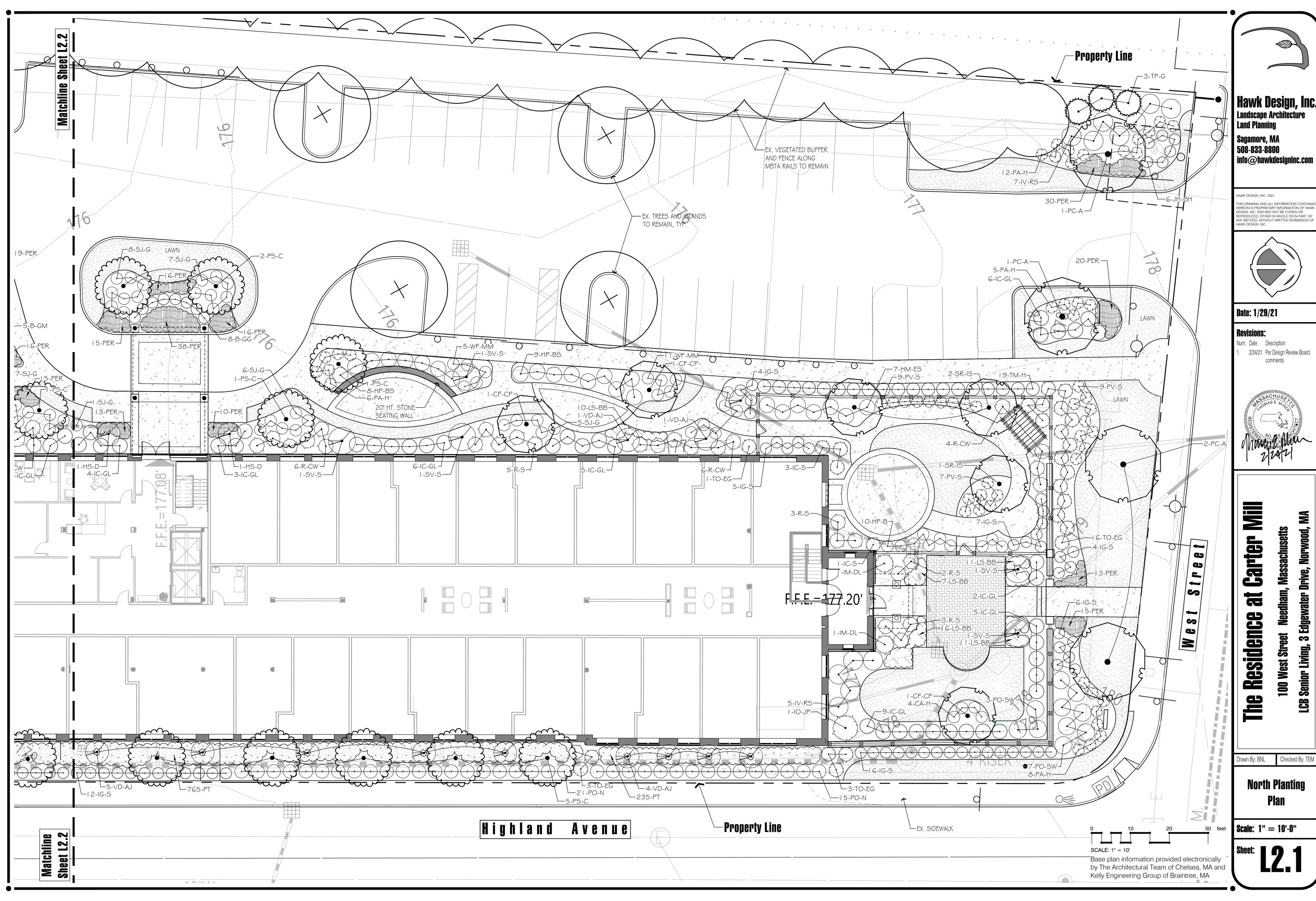


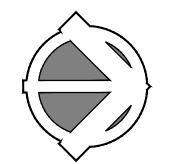
at Carter Mill Residence

Drawn By: BNL Checked By: TEM

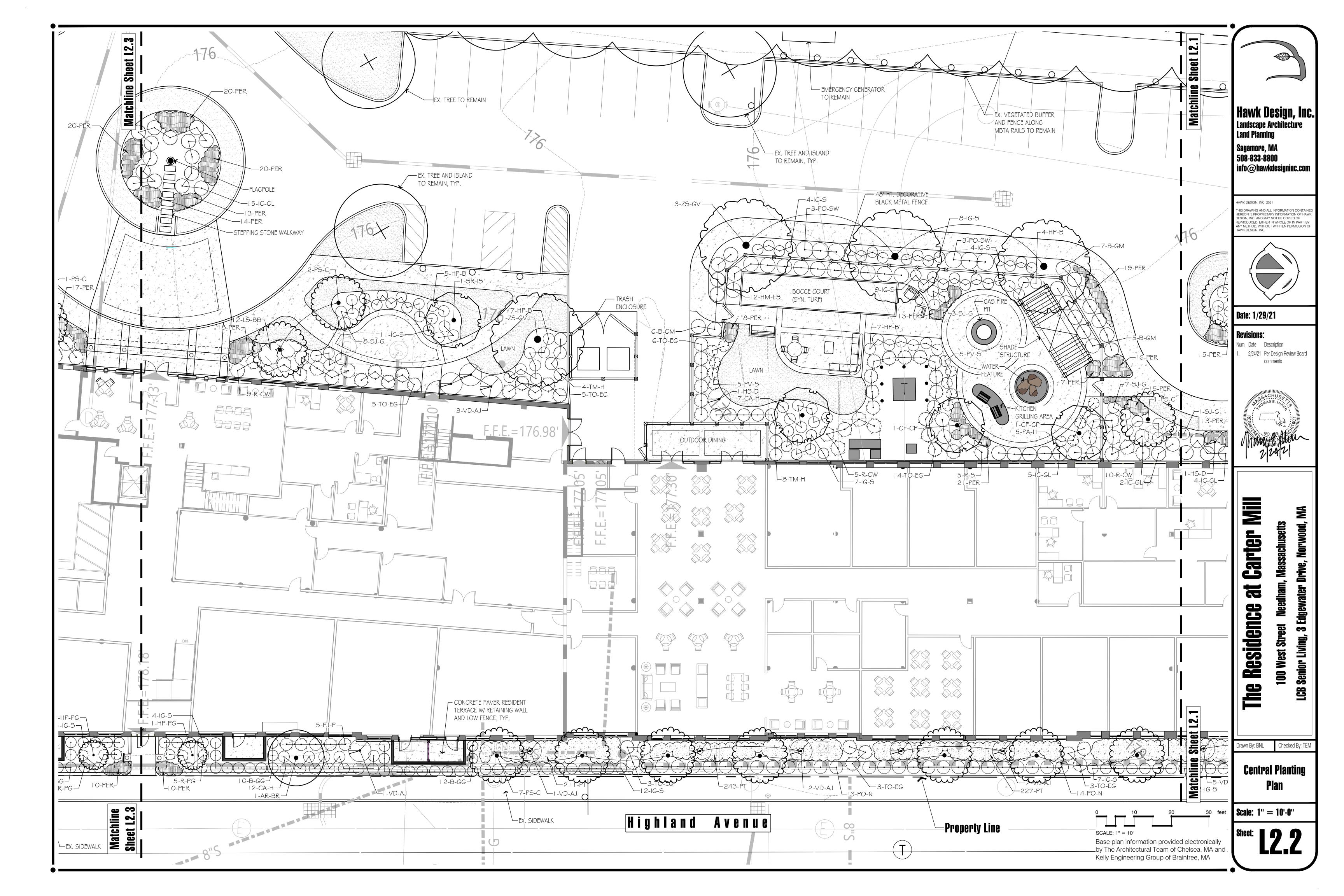
Landscape **Master Plan** 

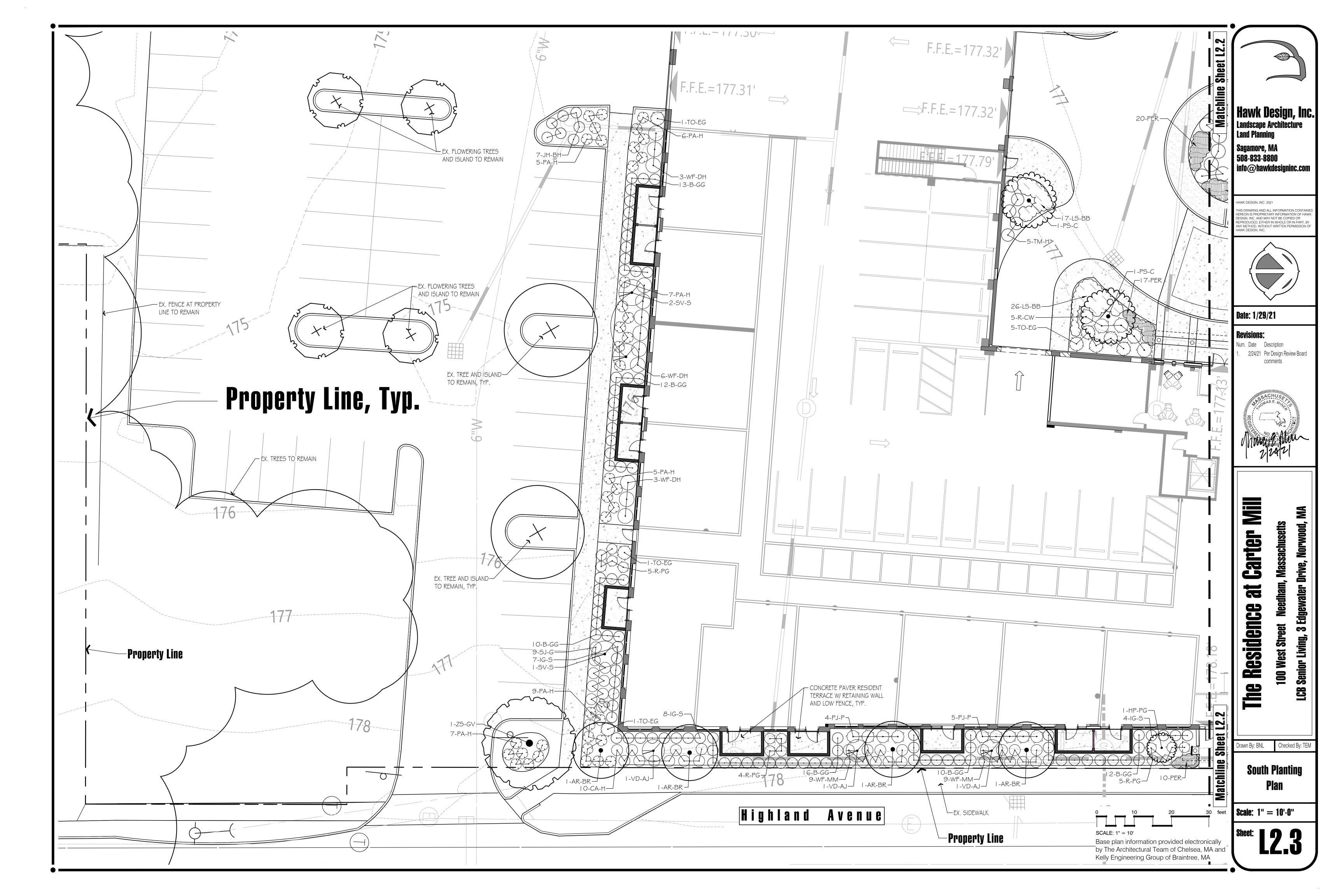
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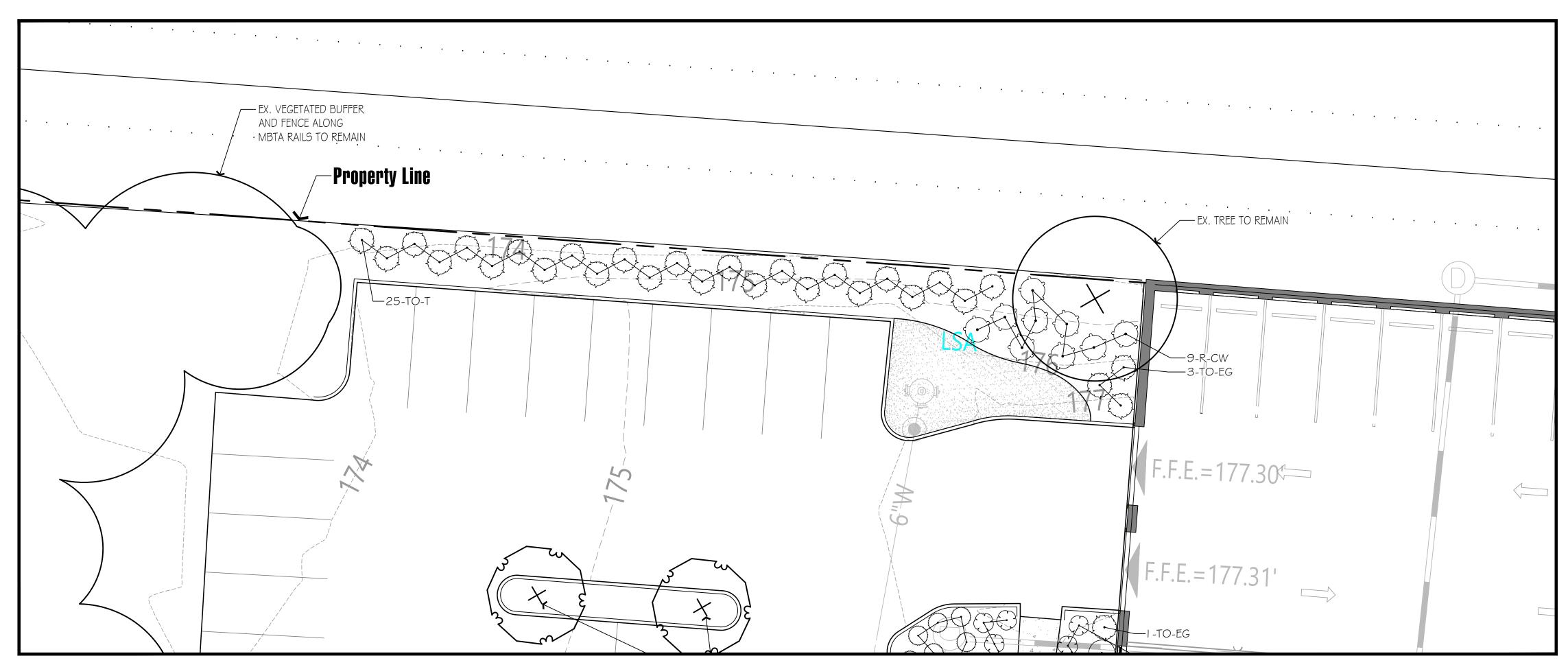












A Property Line Buffer Planting

Scale: 1"=10'-0"

Property Line, Typ.

Priperty Line

Priperty Line

F.F.E.=177.32

F.F.E.=177.32

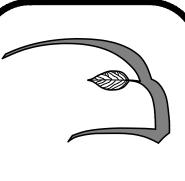
ACTIONS AND THE PRIPERTY AN

Property Line Buffer Planting

Scale: 1"=10'-0"

SCALE: 1" = 10'

Base plan information provided electronically by The Architectural Team of Chelsea, MA and Kelly Engineering Group of Braintree, MA

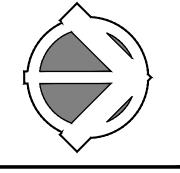


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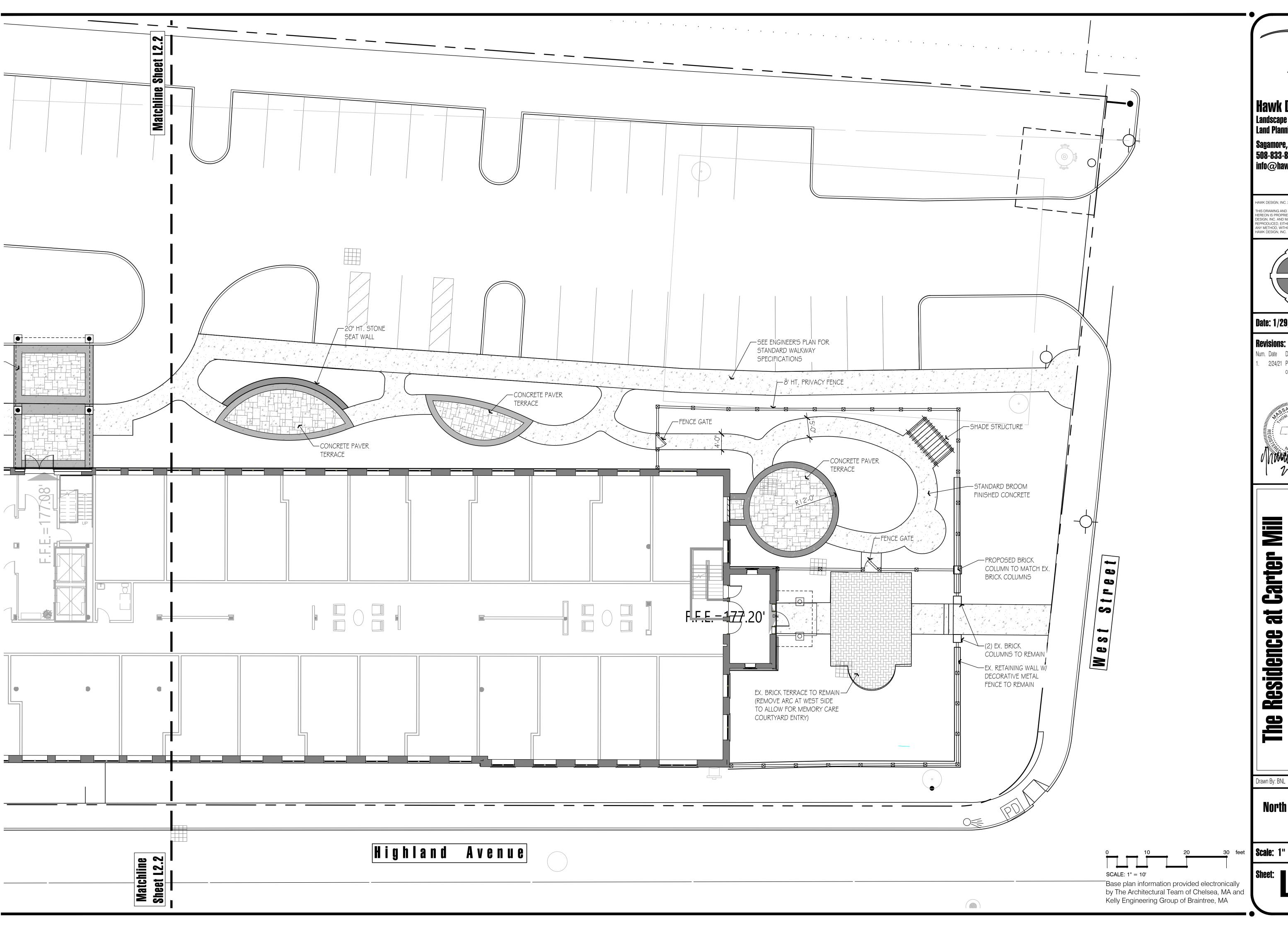
The Residence at Carter Mill

Drawn By: BNL Checked By: TEM

West Buffer Planting Plans

**Scale:** 1" = 10'-0"

eet: **L2.4** 





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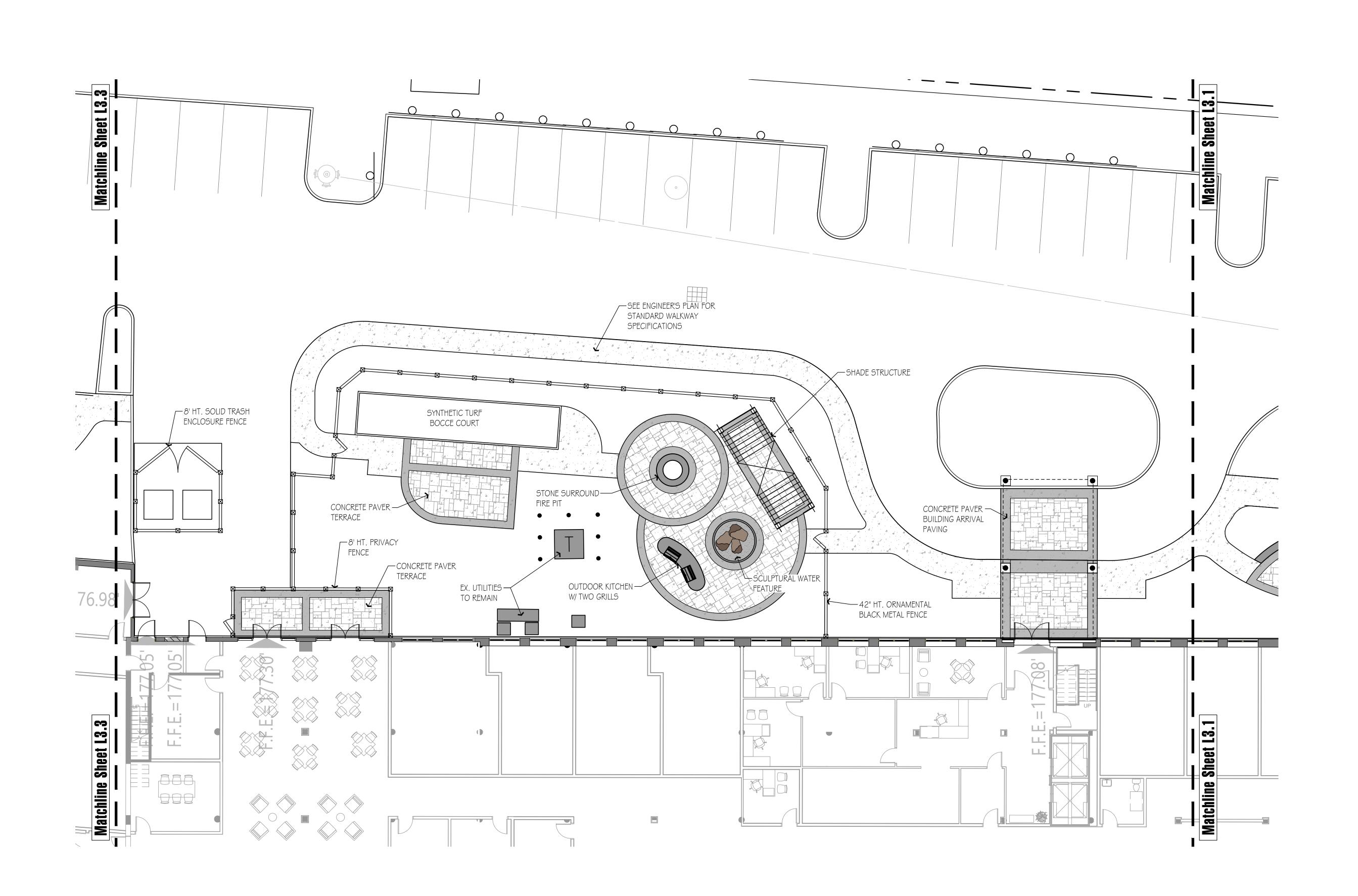
Num. Date Description 2/24/21 Per Design Review Board comments

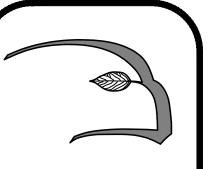


Drawn By: BNL Checked By: TEM

**North Materials** Plan

**Scale:** 1" = 10'-0"

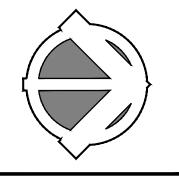




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Carter Mill

The Residence at Carter Mi 100 West Street Needham, Massachusetts LCB Senior Living, 3 Edgewater Drive, Norwood, MA

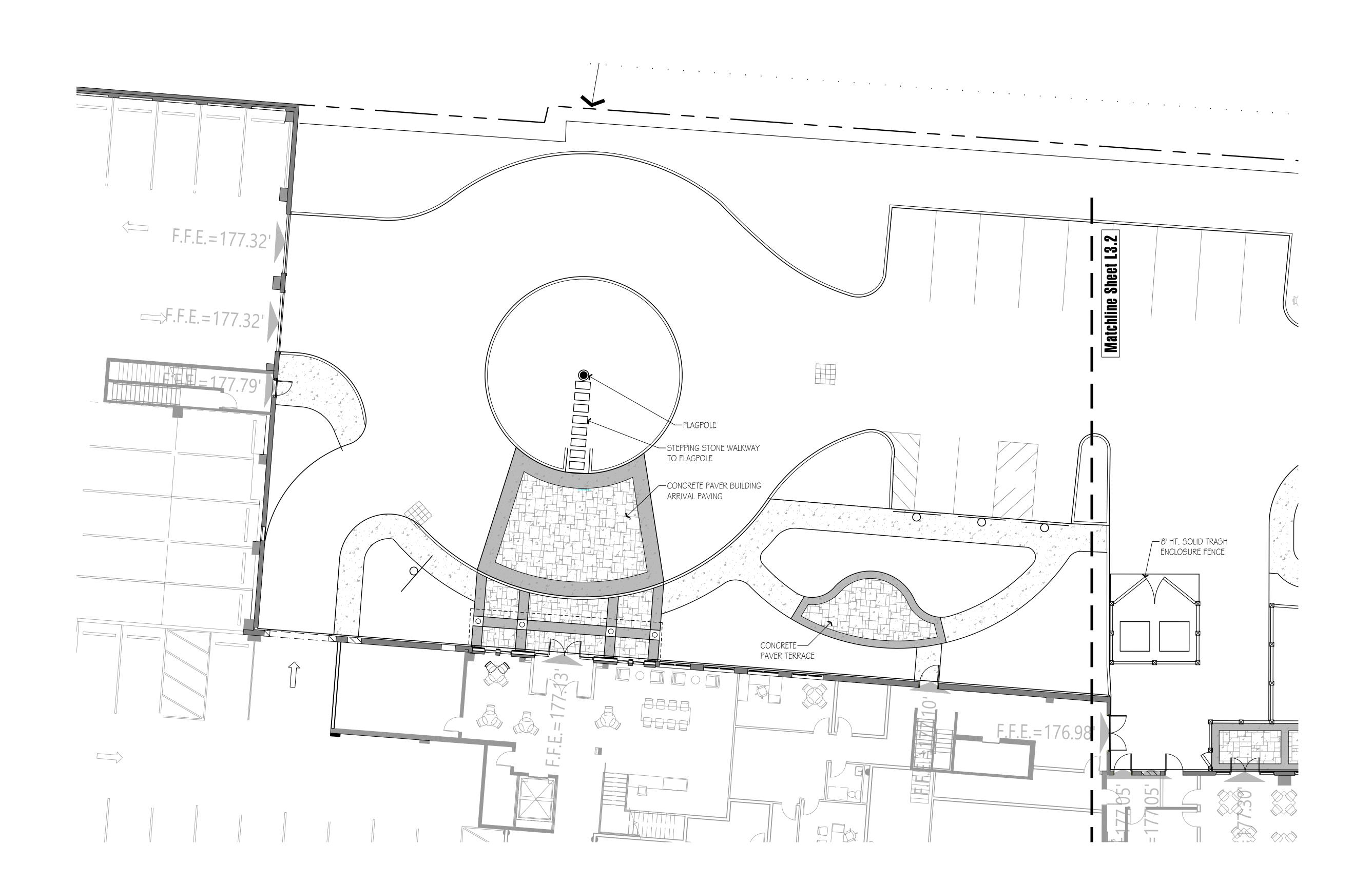
Drawn By: BNL Checked By: TEM

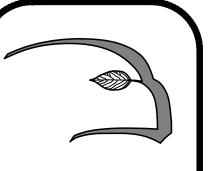
Building Arrival & Resident Courtyard Materials Plan

**Scale:** 1" = 10'-0"

Base plan information provided electronically by The Architectural Team of Chelsea, MA and Kelly Engineering Group of Braintree, MA

Sheet: L3.2



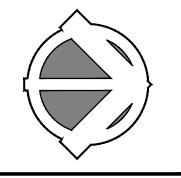


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Date: 1/29/21

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Carter Mill

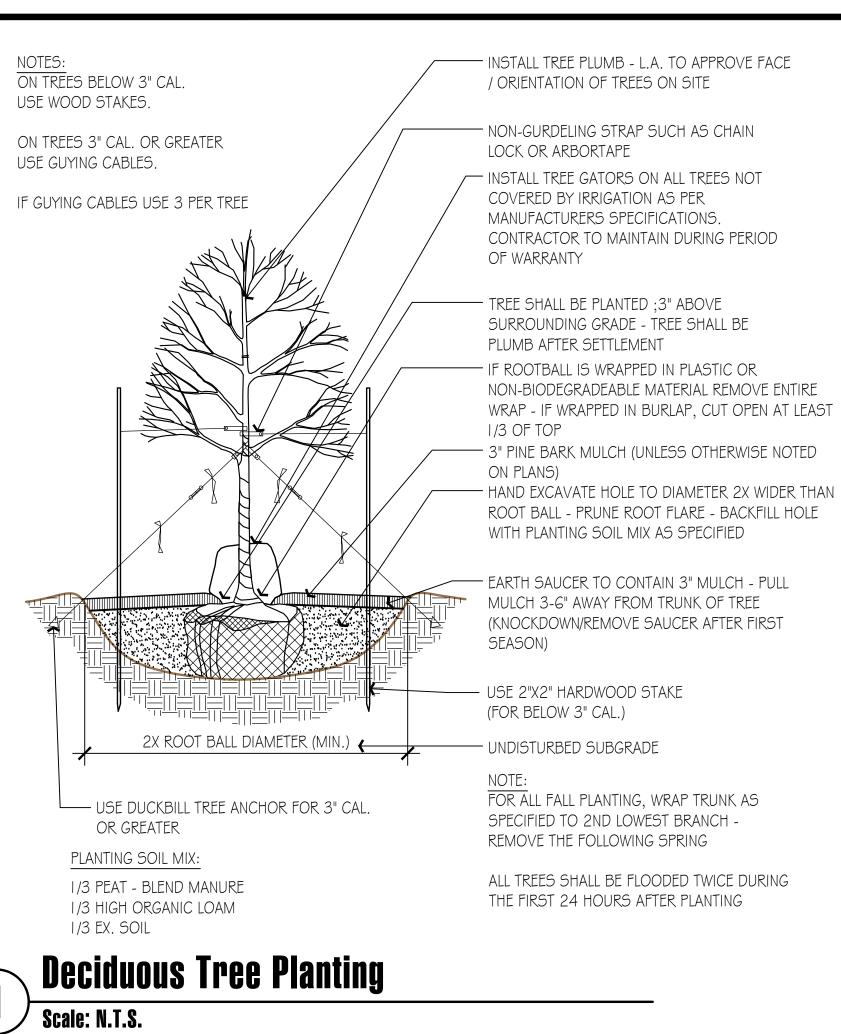
LCB Senior Living, 3 Edgewater Drive, Norwood, MA Ħ **Residence** 100 West Street Ne The

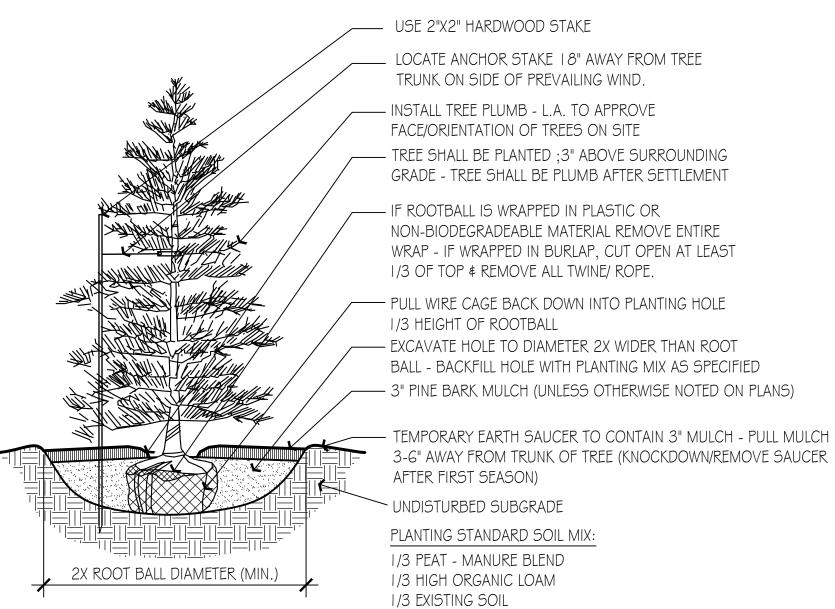
Drawn By: BNL Checked By: TEM

**Assisted Living Entrance Materials** Plan

**Scale:** 1" = 10'-0"

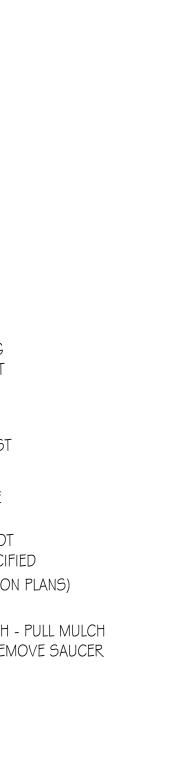
Base plan information provided electronically by The Architectural Team of Chelsea, MA and Kelly Engineering Group of Braintree, MA



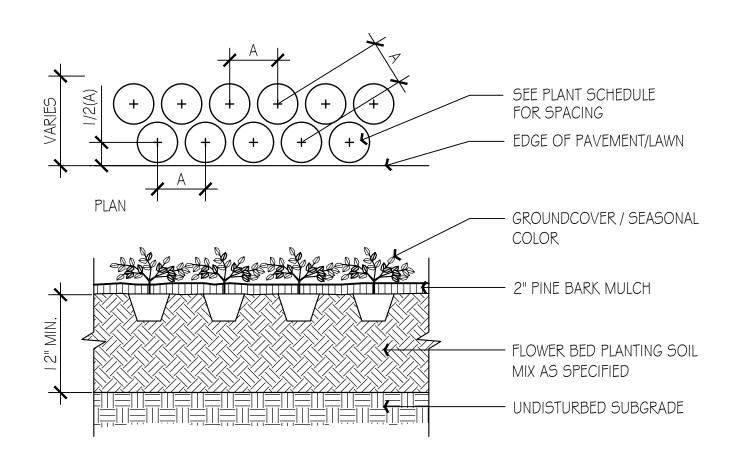


**Conifer Tree Planting** 

Scale: N.T.S.



	REMOVE ALL DEADWOOD (DO NOT REMOVE AN' OTHER VEGETATION)
J 1/2	SHRUBS SHALL BE PLANTED ;2" ABOVE SURROUNDING GRADE - SHRUBS SHALL BE PLU AFTER SETTLEMENT
	CUT AND REMOVE BURLAP FROM TOP 1/3 OF ROOTBALL. IF ROOTBALL IS WRAPPED IN PLASTI OR NON-BIODEGRADEABLE MATERIAL REMOVE ENTIRE WRAP
	3" PINE BARK MULCH (UNLESS OTHERWISE NOT ON PLANS)
	TEMPORARY MOUND WITH EXCAVATED SOIL TO ABOVE FINISHED GRADE
	BACKFILL WITH PLANTING STANDARD MIX
	ROOTBALL ON UNDISTURBED SUBGRADE
2X ROOT BALL DIA. (MIN.)	PLANTING STANDARD SOIL MIX:  1/3 PEAT - MANURE BLEND  1/3 HIGH ORGANIC LOAM  1/3 EXISTING SOIL
Shrub Planting	
om an i ianting	

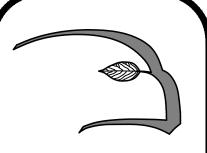


## Perennial & Groundcover Planting 4 Scale: N.T.S.

## Schedule of Soils

LOCATION	DEPTH	DESCRIPTION		
GENERAL PLANTING BEDS	12"	1/3 PEAT - MANURE BLEND 1/3 HIGH ORGANIC LOAM 1/3 EXISTING SOIL		
FLOWER BEDS	12"	SCREENED LOAM 1/3 PEAT - MANURE BLEND LIME - PELATIZED OR GROUND (50 LB. PER 100 SF.) GROUND BONE MEAL (50 LB. PER 100 SF.) 10-10-10 INORGANIC FERTILIZER (50 LB. PER 5000 SF.)		
LAWNS - SOD & SEED	6"	6" SCREENED LOAM		
PITS/TREE WELLS "STANDARD MIX" FOR BACKFILL	12"	I/3 PEAT - MANURE BLEND SOIL MIX 'A' - I/3 HIGH ORGANIC LOAM I/3 EXISTING SOIL		

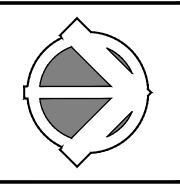
TREES	QTY	BOTANICAL NAME	COMMON NAME	CONT	CAL	PLANT SIZ
AR-BR	5	Acer rubrum `Bowhall Red`	Bowhall Columnar Red Maple	B & B	3-3.5" CAL.	
ZS-GV	5	Zelkova serrata `Green Vase`	Green Vase Zelkova	B & B	3-3.5" CAL.	
EVERGREEN TREES	Toty	BOTANICAL NAME	COMMON NAME	CONT	CAL	PLANT SIZ
TP-G	QTY 6				CAL	
IP-G	В	Thuja plicata `Green Giant`	Green Giant Arborvitae	B & B		8-10` HT.
FLOWERING TREES	QTY	BOTANICAL NAME	COMMON NAME	CONT	CAL	PLANT SIZ
CF-CP	6	Cornus florida `Cherokee Princess`	Cherokee Princess Dogwood	B & B	3-3.5" CAL.	
HP-PG	2	Hydrangea paniculata `PeeGee Tree`	Tree Form Pee Gee Tree Hydrangea	B & B	2-2.5"-CAL.	
PC-A	4	Pyrus calleryana `Aristocrat`	Aristocrat Flowering Pear	B & B	3-3.5" CAL.	
PS-C	21	Prunus sargentii `Columnaris`	Columnar Sargent Cherry	B & B	3-3.5" CAL.	
SR-IS	4	Syringa reticulata `Ivory Silk`	Ivory Silk Japanese Tree Lilac	B & B	3-3.5" CAL.	
	T	I	T	T = =	1	1
SHRUBS	QTY	BOTANICAL NAME	COMMON NAME	CONT	CAL	SIZE
B-GG	103	Buxus x `Green Gem`	Green Gem Boxwood	Cont.		2` HT.
B-GM	18	Buxus x `Green Mountain`	Green Mountain Boxwood	B & B		2-2.5` H1
CA-H	33	Clethra alnifolia `Hummingbird`	Hummingbird Summersweet	B & B		18-24" H
HM-ES	19	Hydrangea macrophylla `Endless Summer`	Endless Summer Hydrangea	B & B		2-2.5` HT
HP-B	33	Hydrangea paniculata `Bobo`	Bobo Panicled Hydrangea	Cont.		18-24" H
HP-BS	17	Hydrangea paniculata `Bombshell`	Bombshell Hydrangea	Cont.		2-2.5` HT
HS-D	3	Hibiscus syriacus `Diana`	Diana Rose of Sharon	B & B		5-6` HT.
IC-GL	62	Ilex crenata `Green Lustre`	Green Luster Japanese Holly	B & B		2-2.5` H
IC-S	4	Ilex crenata `Steeds`	Steeds Japanese Holly	B & B		5-6` HT.
IG-S	139	Ilex glabra `Shamrock`	Shamrock Inkberry	B & B		2-2.5` HT
IM-DL	2	Ilex x meserveae `Dragon Lady`	Dragon Lady Meserve Holly	B & B	B & B	
IO-JP	1	Ilex opaca `Jersey Princess`	Jersey Princess Holly	B & B		5-6` HT.
IV-RS	12	Ilex verticillata `Red Sprite`	Red Sprite Winterberry	B & B		2-2.5` HT
JH-BH	13	Juniperus horizontalis `Bar Harbor`	Bar Harbor Creeping Juniper	Cont.		18-24" SF
PA-H	75	Pennisetum alopecuroides `Hameln`	Hameln Fountain Grass	2 GAL		
PJ-P	15	Pieris japonica `Prelude`	Prelude Andromeda	Cont.		2-2.5` H
PO-N	63	Physocarpus opulifolius `Nanus` Dwarf Ninebark		B & B		2-2.5` H
PO-SW	16	Physocarpus opulifolius `Summer Wine`	Summer Wine Ninebark	B & B		3-3.5` H7
PV-S	35	Panicum virgatum `Shenandoah`	Shenandoah Switch Grass	3 GAL		
R-CW	60	Rhododendron `Cunningham`s White`	Cunningham White Rhododendron	B & B		2-2.5` HT
R-PG	19	Rhododendron `Purple Gem`	Purple Gem Rhododendron	Cont.		18-24" H
R-S	18	Rhododendron `Scintillation`	Scintillation Rhododendron	B & B		2-2.5` H
SJ-G	54	Spiraea japonica `Goldflame`	Goldflame Spirea	Cont.		18-24" H
SV-S	8	Syringa vulgaris `Sensation`	Sensation Lilac	B & B		5-6` HT.
TM-H	36	Taxus x media `Hicksii`	Hicks Yew	B & B		3-3.5` H
TO-EG	95	Thuja occidentalis `Emerald Green`	Emerald Green Arborvitae	B & B		6-7` HT.
TO-T	25	Thuja occidentalis `Techny`	Techny Arborvitae	B & B		6-7` HT.
VD-AJ	24	Viburnum dentatum `Autumn Jazz`	Autumn Jazz Viburnum	B & B		5-6` HT.
WF-DH	12	Weigela florida `Dark Horse`	Dark Horse Weigela	Cont.		2-2.5` HT
WF-MM	34	Weigela florida `My Monet`	My Monet Weigela	Cont.		15-18" H
GROUND COVERS	QTY	BOTANICAL NAME	COMMON NAME	CONT		
LS-BB	110	Liriope spicata `Big Blue`	Creeping Lily Turf	1 GAL.		
PER	427	Perennials	Assorted Perennials	1 gal		
PT	1,681	Pachysandra terminalis	Japanese Spurge	4"pot		



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Date: 1/29/21

**Revisions:** 

Num. Date Description 2/24/21 Per Design Review Board comments



**Carter Mill** A Residence 100 West Street

3 Edgewater Drive, Norwood,

LCB Senior Living,

Drawn By: BNL Checked By: TEM

**Plant Schedule** and Planting **Details** 

**Scale:** As Noted

The

Base plan information provided electronically by The Architectural Team of Chelsea, MA and Kelly Engineering Group of Braintree, MA

## General Landscape Notes:

#### 1.1) CONTRACTOR REQUIREMENTS

- A) ALL WORK SHALL COMPLY WITH APPLICABLE CODES AND REGULATIONS, FROM ALL FEDERAL, STATE AND LOCAL AUTHORITIES.
- B) THE CONTRACTOR SHALL ARRANGE FOR AND OBTAIN ALL PERMITS AND LICENSES REQUIRED FOR THE COMPLETE WORK SPECIFIED HEREIN AND SHOWN ON ALL THE DRAWINGS. THE CONTRACTOR SHALL PAY FOR ANY FEES NOT WAIVED.

#### 1.2) UTILITIES

- A) LANDSCAPE CONTRACTOR IS REQUIRED TO CONTACT THE RELEVANT UTILITY COMPANIES PRIOR TO DOING ANY EXCAVATION ON THE SITE. IF ANY WORK IS TO BE DONE AROUND UNDERGROUND UTILITIES, THE APPROPRIATE AUTHORITY OF THAT UTILITY MUST BE NOTIFIED OF THE IMPENDING WORK.
- B) UTILITIES SHALL BE LOCATED AND MARKED PRIOR TO ANY INSTALLATION. ADJUSTMENTS MAY BE NECESSARY IN THE FIELD TO ACCOMMODATE UTILITY LOCATIONS. REPORT ANY CONFLICTS TO THE LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
- C) THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGES DONE TO EXISTING UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF SATISFACTORY REPAIR OF ALL DAMAGE IN KIND RESULTING FROM THEIR FAILURE TO COMPLY.
- I.3) <u>PROTECTION OF EXISTING WORK:</u> IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM ALL WORK IN A MANNER THAT PROTECTS WORK COMPLETED BY OTHERS, SUCH AS CURBS, UTILITIES, STORM DRAINAGE, FENCES, DRIVEWAY APRONS, DRIVES, VEGETATION, ETC. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF SATISFACTORY REPAIR OF ALL DAMAGE IN KIND RESULTING FROM THEIR FAILURE TO COMPLY.
- I.4) QUANTITIES: A COMPLETE LIST OF PLANTS INCLUDING A SCHEDULE OF QUANTITIES, SIZES, TYPES, AND NAMES IS INCLUDED IN THIS SET OF DRAWINGS. IN THE EVENT OF DISCREPANCIES BETWEEN QUANTITIES OF PLANT IN THE PLANT LIST AND THE QUANTITIES SHOWN ON THE DRAWINGS, THE PLAN SHALL GOVERN. THE LANDSCAPE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT OF UNLABELED PLANTS IN PLAN FOR CLARIFICATION. THE LANDSCAPE ARCHITECT SHALL BE ALERTED BY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO FINAL BID NEGOTIATION.
- I.5) <u>APPLICABLE PLANT MATERIALS STANDARDS:</u> ALL PLANT MATERIALS ARE TO COMPLY WITH THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK AS PUBLISHED BY THE AMERICAN ASSOCIATION OF NURSERYMEN. PLANTING METHODS WILL BE IN ACCORDANCE WITH SITE-SPECIFIC REQUIREMENTS.
- I.6) PLANT HARDINESS: ALL TREES AND SHRUBS SHALL BE NURSERY GROWN WITHIN A USDA PLANT HARDINESS ZONE, WHICH IS THE SAME AS, OR COLDER THAN, THE ZONE IN WHICH THE PROJECT IS LOCATED.
- 1.7) <u>PLANTING SEASONS:</u> PLANTING SHALL ONLY OCCUR DURING SPECIFIED SEASONS. SPRING SEASON SHALL BE FROM MARCH 1 TO JUNE 15. FALL PLANTING SEASON SHALL BE FROM SEPTEMBER 15 THROUGH NOVEMBER 15. NO PLANTING SHALL OCCUR WHEN THE GROUND IS FROZEN.
- I.8) PLANT SUBSTITUTIONS: NO SUBSTITUTIONS OF PRODUCTS, PLANT TYPES OR SIZES SHALL BE MADE WITHOUT THE WRITTEN APPROVAL OF THE LANDSCAPE ARCHITECT. REQUESTS FOR SUBSTITUTION SHALL BE IN WRITING, AND SHALL STATE THE REASON FOR THE SUBSTITUTION REQUEST, THE SUGGESTED ALTERNATIVE AND THE CHANGES IN COST. REQUESTS FOR SUBSTITUTION IN PLANT MATERIALS SHALL STATE THE NAMES OF NURSERIES THAT HAVE BEEN UNABLE TO SUPPLY THE ORIGINALLY SPECIFIED MATERIAL.
- I .9) THE LANDSCAPE ARCHITECT SHALL RESERVE THE RIGHT TO INSPECT ALL PLANT MATERIALS AT THE NURSERY, UPON SITE DELIVERY AND DURING INSTALLATION TO INSURE SPECIFICATIONS AND PROCEDURES ARE ADHERED TO.
- I.10) MINIMUM SIZES: ALL PLANTS 3' OR GREATER IN HEIGHT OR SPREAD SHALL BE BALLED AND BURLAPPED. SIZES SPECIFIED IN THE PLANT LIST ARE MINIMUMS ON WHICH THE PLANTS ARE TO BE HUDGED.
- I.II) DEAD PLANTS: DEAD PLANTS ARE TO BE REMOVED FROM THE SITE IMMEDIATELY, AND REPLACED WITH THE SAME PLANT & SIZE REGARDLESS OF SEASON, WEEKLY FROM THE JOB BY THE CONTRACTOR. THE CONTRACTOR SHALL MAINTAIN AN UPDATED COMPREHENSIVE LIST OF ALL DEAD MATERIALS REMOVED AND PRESENT A COPY OF THE LIST TO THE OWNER AND LANDSCAPE ARCHITECT AT THE END OF EVERY MONTH DURING THE CONTRACT PERIOD.
- I.12) PLANT MATERIAL REMOVAL: NO EXISTING TREES SHALL BE REMOVED WITHOUT THE WRITTEN AUTHORIZATION FROM THE LANDSCAPE ARCHITECT EXCEPT WHERE NOTED ON THE PLANS. CONTRACTORS WHO REMOVE EXISTING TREES WITHOUT WRITTEN APPROVAL WILL BE REQUIRED TO MAKE REMEDIES DETERMINED BY THE GOVERNING URBAN FORESTER OR EQUIVALENT AUTHORITY. NO GRUBBING SHALL OCCUR WITHIN EXISTING TREE AREAS UNLESS SPECIFICALLY NOTED ON THE PLANS.
- I.I3) ALL DISTURBED AREAS NOT TO RECEIVE PLANT MATERIALS ARE TO BE LOAMED AND SEEDED AND BLENDED INTO EXISTING GRADE AND CONDITIONS. SEE SECTION 4.0.
- I.14) <u>LEDGE BOULDERS</u>: IF DURING SITE EXCAVATION, LEDGE BOULDERS ARE AVAILABLE, THESE ARE TO BE STOCKPILED FOR USE IN EARTH BERMS IF APPLICABLE, WITH HAWK DESIGN, INC. PRIOR TO INSTALLATION. THIS ITEM WILL ONLY APPLY IF SO SPECIFIED ON DRAWINGS. BOULDERS SIZES TO BE STOCKPILED WILL RANGE FROM TWO TO FIVE FEET IN DIAMETER. SEE APPROPRIATE DETAIL FOR INSTALLATION COORDINATION.
- I.15) <u>SLEEVES:</u> LANDSCAPE OR SITE CONTRACTOR SHALL PLACE INDIVIDUAL SLEEVES FOR LIGHTING AND IRRIGATION UNDER ANY PROPOSED WALKWAY OR VEHICULAR ROADWAY PRIOR TO INSTALLATION. COORDINATE SLEEVE LOCATIONS WITH IRRIGATION AND LIGHTING CONTRACTORS PRIOR TO INSTALLATION.
- 1.16) DO NOT CLOSE OR OBSTRUCT ANY STREET, SIDEWALK, ALLEY OR PASSAGEWAY WITHOUT PRIOR NOTIFICATION AND PERMISSION. CONDUCT OPERATIONS AS TO INTERFERE AS LITTLE AS POSSIBLE WITH THE USE ORDINARILY MADE OF ROADS, DRIVEWAYS, ALLEYS, SIDEWALKS OR OTHER FACILITIES NEAR ENOUGH TO THE WORK TO BE EFFECTED THEREBY.

## **Planting Materials:**

2.1 PLANTING MATERIAL ITEMS IN SECTION 2.0 ARE TO BE INCORPORATED DURING PLANT INSTALLATION UNLESS OTHERWISE DEEMED UNNECESSARY IN ACCORDANCE WITH SOIL TEST RECOMMENDATIONS. SEE SECTION 3.1.

## MULCH - MULCH WILL BE DOUBLE-SHREDDED PINE BARK MULCH. - TREES AND SHRUBS SHALL RECEIVE AN EVEN 3" MULCH LAYER.

- GROUNDCOVERS, PERENNIALS AND ANNUALS SHALL RECEIVE AN EVEN 2" MULCH LAYER.

MANURE- TO BE WELL ROTTED, ODORLESS, UNLEACHED COW MANURE, CONTAINING NOT MORE THAN 15% BEDDED MATERIALS SUCH AS STRAW, WOOD CHIPS OR SHAVINGS, AGED NOT LESS THAN TWO YEARS OLD.

HERBICIDE- A PRE-EMERGENCE WEED KILLER IS TO BE USED ON ALL LAWN AND PLANTING AREAS PRIOR TO INSTALLATION AS PER MANUFACTURER'S SPECFICATIONS. \*HERBICIDES ARE NOT TO BE APPLIED IN RESTRICTED CONSERVATION AREAS.

FERTILIZER- ALL TREES AND SHRUBS TO HAVE SLOW RELEASE PACKET OR PELLET PLACED INTO THE PLANT PIT WITH A MINIMUM ANALYSIS OF 10-10-10. ALL GROUNDCOVERS, PERENNIALS AND ANNUALS ARE TO RECIEVE A BROADCAST APPLICATION OF A 14-14-14 FERTILZER AT 3 LB PR 100 SQ. FT. APPLY AS PER MANUFACTURER'S INSTRUCTIONS. \*FERTILIZERS ARE NOT TO BE APPLIED IN RESTRICTED CONSERVATION AREAS.

TOPSOIL- ACCEPTABLE TOPSOIL SHALL BE FERTILE, FRIABLE NATURAL LOAM, UNIFORM IN COMPOSITION, FREE OF STONES, LIMBS, PLANTS AND THIER ROOTS, DEBRIS AND OTHER EXTRANEOUS MATTER OVER ONE INCH IN DIAMETER. THE SOIL SHALL BE CAPABLE OF SUSTAINED PLANT GROWTH AND HAVE A 5% MINIMUM ORGANIC CONTENT. IN SITUATIONS WHICH REQUIRE A CUSTOM TOPSOIL OR STRUCTURAL SOIL, THE SOIL MIXTURE SPECIFICATION WILL BE PROVIDED BY THE LANDSCAPE ARCHITECT.

SOIL AMENDMENTS: APPLY AS NECESSARY ACCORDING TO SOIL TEST RESULTS, AS PER MANUFACTURES SPECIFICATIONS.

ANTI-DESICCANT- "WILT PRUF" NCF OR EQUAL APPLY AS PER MANUFACTURERS' SPECIFICATIONS.

## **Plant Installation:**

- 3.1) SOIL TESTING: LANDSCAPE CONTRACTOR SHALL PROVIDE A CERTIFIED SOIL ANALYSIS PRIOR TO ANY PLANT INSTALLATION TO DETERMINE ANY NECESSARY AMENDMENTS TO THE EXISTING SOIL CONDITIONS FOR SEEDING AND PLANTING. THE ANALYSIS WILL ALSO BE REQUIRED FOR ESTABLISHING THE FERTILIZER PROGRAM REQUIRED. COORDINATE RESULTS AND PROVIDE WRITTEN RECOMMENDATIONS TO HAWK DESIGN, INC. 15 DAYS PRIOR TO INSTALLATION.
- 3.2) ALL PLANTS SHALL BE TRANSPORTED TO THE SITE IN COVERED TRUCKS, TARPAULIN COVERS SHALL BE UTILIZED TO PREVENT WIND DAMAGE OF LOAD.
- 3.3) DELIVER PLANT MATERIALS IMMEDIATELY PRIOR TO PLACEMENT. KEEP PLANT MATERIALS MOIST. DO NOT STORE PLANT MATERIAL ON PAVED AREAS. ROOTS OR BALLS SHALL BE PROTECTED FROM THE SUN OR DRYING WINDS. AS REQUIRED BY TEMPERATURE OR WIND CONDITIONS, APPLY ANTI-DESICCANT EMULSION TO PREVENT DRYING OUT OF PLANT MATERIALS.

### 3.4) CONDITIONS FOR PLANT REJECTION:

- A) REJECT PLANTS WHEN BALL OF EARTH SURROUNDING ROOTS HAS BEEN CRACKED OR BROKEN PREPARATORY TO OR DURING THE PROCESS OF PLANTING.
- B) WHEN BURLAP, STAVES AND ROPES REQUIRED IN CONNECTION WITH TRANSPLANTING HAVE BEEN DISPLACED PRIOR TO ACCEPTANCE.
- C) WIND DAMAGED PLANT MATERIAL FROM POOR TARPAULIN COVER PROCEDURES ARE SUBJECT TO REJECTION.
- 3.5) ALL PLANT MATERIAL, WHICH CANNOT BE PLANTED IMMEDIATELY ON DELIVERY, SHALL BE SET ON THE GROUND IN A SHADED LOCATION AND SHALL BE TEMPORARILY PROTECTED WITH SOIL OR OTHER ACCEPTABLE MATERIAL. TEMPORARY WATERING OR IRRIGATION SHALL BE INCORPORATED AND REGULARLY CONDUCTED ON PLANTINGS IN HOLD AREAS.
- 3.6) IN CASE OF CONFLICTS DURING CONSTRUCTION WITH UTILITIES, ROCK MATERIALS, TREE ROOTS OR OTHER OBSTRUCTIONS FOR THE EXCAVATION OF SHRUB BEDS AND TREE PITS. CONTACT LANDSCAPE ARCHITECT FOR APPROVED ALTERNATE LOCATIONS.
- 3.7) SOIL PERMABILITY: TEST DRAINAGE OF PLANTING BEDS AND PITS BY FILLING WITH WATER TWICE IN SUCCESSION. CONDITIONS PERMITTING THE RETENTION OF WATER FOR MORE THAN 24 HOURS SHALL BE BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT.

## 3.8) SOIL EXCAVATIONS:

- A) EXCAVATE TREE PITS AND SHRUB BEDS TO DEPTHS REQUIRED BY PLANTING DETAILS. ALL PITS SHALL BE CIRCULAR IN OUTLINE, EXCEPT FOR WHOLE BEDS. SEE APPROPRIATE PLANTING DETAILS.
- B) SOIL EXCAVATIONS FOR BALLED & BURLAP AND CONTAINER PLANTINGS MUST BE NO LESS THAN 2X ROOT BALL DIAMETER, SEE PLANTING DETAILS. IF QUESTIONABLE SUBSURFACE SOIL CONDITIONS EXIST SUCH AS POOR DRAINAGE CONDITIONS, RUBBLE OR OBSTRUCTIONS, REPORT TO THE LANDSCAPE ARCHITECT AND CONSTRUCTION MANAGER BEFORE PLANTING.

## 3.9) GRADING

- A) VERIFY GRADES PRIOR TO PLANTING, THE CONTRACTOR SHALL VERIFY THAT CONSTRUCTED GRADES ARE AS INDICATED ON PLANS. THE CONTRACTOR SHALL NOTIFY THE LANDSCAPE ARCHITECT IF ADJUSTMENTS TO PLANT PLACEMENT MAY BE REQUIRED DUE TO FIELD CONDITIONS AND FINAL GRADING.
- B) POSITIVE DRAINAGE SHALL BE MAINTAINED AWAY FROM AND AROUND BUILDINGS (REFER TO ENGINEERS GRADING PLANS). REPORT ANY CONFLICTS TO HAWK DESIGN, INC. PRIOR TO INSTALLATION.
- C) FINISH GRADE OF PLANTINGS SHALL BE EQUIVALENT TO FORMER EXISTING GRADE OF PLANT IN THE NURSERY.
- 3.10) BALLED AND BURLAPED (B&B) MATERIALS:
- A) CUT WIRE BASKETS ONCE IN THE PLANT PIT AND PEEL WIRE BACK.
- B) TAGS AND TWINE ARE TO BE REMOVED AND BURLAP IS TO BE ROLLED BACK ONE-THIRD ON ALL B&B PLANT MATERIAL. ANY SYNTHETIC BURLAP SHALL BE COMPLETELY REMOVED FROM ANY PLANT MATERIAL

## **Plant Installation Cont'd**

- 3.11) CONTAINER GROWN STOCK: SHALL BE REMOVED FROM CONTAINER BY CUTTING CONTAINER AWAY TO AVOID ROOT DAMAGE TO PLANT ROOT SYSTEM. IF PLANT ROOT IS BOUND, SLICE ROOT BALLS APPROXIMATELY 2" DEEP WITH KNIFE OR SHARP SPADE.
- 3. I 2) DO NOT USE MUDDY OR FROZEN SOIL TO BACKFILL PLANTINGS.
- 3.13) WATERING: THOROUGHLY WATER UNTIL SOIL IS SATURATED AROUND ALL TREES AND SHRUBS AFTER PLANTING AND THROUGHOUT THE TIME PERIOD UNTIL FINAL ACCEPTANCE FROM CLIENT. DURING DRY CONDITIONS, WATER AS REQUIRED TO MAINTAIN PLANTS IN A WILT-FREE CONDITION.
- 3.14) PRUNING: TREES SHALL BE PRUNED TO BALANCE TOP GROWTH WITH ROOTS AND TO PRESERVE THEIR NATURAL CHARACTER AND TYPICAL GROWTH HABIT. PRUNING SHALL BE RESTRICTED IN GENERAL TO THE SECONDARY BRANCHES AND SUCKER GROWTH. ALL CUTS TO BE FLUSH WITH TRUNK. DO NOT CUT A LEADER. THE LANDSCAPE ARCHITECT WILL REJECT ALL PLANTS DISFIGURED BY POOR PRUNING PRACTICES. ALL PRUNING CUTS SHALL REMAIN UNPAINTED.
- 3.15) <u>STAKING AND GUYING</u>: ALL TREES TO BE STAKED AND GUYED WITHIN 48 HOURS OF PLANTING. METHODS AND MATERIALS FOR STAKING AND GUYING ARE ILLUSTRATED IN INDIVIDUAL PLANTING DETAILS. NEATLY FLAG ALL GUY WIRES WITH ROT RESISTANCE YELLOW TREE MARKING RIBBON.
- 3.16) <u>STAKE OUT PLANT LOCATIONS</u>: PRIOR TO PLANTING THE CONTRACTOR SHALL LAYOUT THE EXTENT OF THE PLANT BEDS AND PROPOSED LOCATIONS FOR B&B PLANTS FOR REVIEW BY THE OWNER AND LANDSCAPE ARCHITECT.

#### 3.17) PLANTING FIELD ADJUSTMENTS

- A) THE CONTACTOR IS TO SLIGHTLY ADJUST PLANT LOCATIONS IN THE FIELD AS NECESSARY TO BE CLEAR OF DRAINAGE SWALES AND UTILITES.
- B) LARGE GROWING PLANTS ARE NOT TO BE PLANTED IN FRONT OF WINDOWS OR UNDER BUILDING OVERHANGS. NOTIFY THE LANDSCAPE ARCHITECT OF DISCREPANCIES IN PLANTING PLAN VS. FIELD CONDITIONS.
- C) SHRUBS PLANTED NEAR HVAC UNITS ARE TO BE LOCATED SO THAT SHRUBS AT MATURITY WILL MAINTAIN ONE FOOT (I') AIRSPACE BETWEEN THE UNIT AND THE PLANT. ANY PLANTING SHOWN ADJACENT TO CONDENSER UNITS SHALL BE PLANTED TO SCREEN THE UNITS. SHOULD THE CONDENSER UNITS BE INSTALLED IN LOCATIONS DIFFERENT FROM THOSE SHOWN ON THE PLAN, IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE LANDSCAPE ARCHITECT AND INSTALL THE MATERIAL AROUND THE CONDENSERS AND ADJUST THE OTHER PLANTING ACCORDINGLY.
- 3.18) PLANT BED EDGES/LINES: GROUPS OF SHRUBS, PERENNIALS AND GROUNDCOVERS SHALL BE PLACED IN A CONTINUOUS MULCH BED WITH SMOOTH CONTINUOUS LINES. ALL MULCHED BED EDGES SHALL BE CURVILINEAR IN SHAPE, FOLLOWING THE CONTOUR OF THE PLANT MASS. TREES LOCATED WITHIN 4 FEET OF PLANT BEDS SHALL SHARE THE SAME MULCH BEDS.
- 3.19) A.D.A. THE AMERICAN WITH DISABILITIES ACT STANDARDS REQUIRE THAT A 7 FOOT VERTICAL CLEARANCE BE MAINTAINED FROM TREE BRANCHES TO FINISHED GRADE WHERE PEDESTRIANS SIDEWALKS AND/OR TRAILS ARE LOCATED. THE CONTRACTOR IS TO ADJUST TREE PLANTINGS IN FIELD TO SLIGHTLY MINIMIZE BRANCH OVERHANG AND COMPLY WITH THE A.D.A. ACT.
- 3.20) TREE SPACING MINUMUMS: TREES SHALL BE LOCATED A MINIMUM OF 4 FEET FROM RETAINING WALLS AND WALKS WITHIN THE PROJECT. IF A CONFLICT ARISES BETWEEN ACTUAL SIZE OF AREA AND PLANS, THE CONTRACTOR SHALL CONTACT THE LANDSCAPE ARCHITECT FOR RESOLUTION. FAILURE TO MAKE SUCH CONFLICTS KNOWN TO LANDSCAPE ARCHITECT WILL RESULT IN CONTRACTOR'S LIABILITY TO RELOCATE MATERIALS.

## Seeding and Sodding:

- 4.1) SEEDING OF LAWN AREAS: GRASS SEED APPLICATION SHALL BE SPREAD AT THE RATE OF 5 LBS. PER 1,000 SQUARE FEET, SEEDING SHALL BE ACCOMPLISHED BY MEANS OF A HYDRO-SEEDING PROCESS.
- 4.2) WATERING OF SEEDED AREAS: 24 HOURS AFTER HYDRO SEEDING, THE CONTRACTOR SHALL WATER THE SEEDED AREA LIGHTLY AND SUFFICIENTLY TO A DEPTH OF TWO INCHES (2") 2 TIMES A DAY (BETWEEN THE HOURS OF 7 PM AND 7 AM), UNTIL THE SEEDS ARE ESTABLISHED.
- 4.3) SEEDED AREA PROTECTION: THE CONTRACTOR SHALL ERECT SUITABLE SIGNS AND BARRICADES NOTIFYING THE PUBLIC TO KEEP OFF THE SEEDED AREAS UNTIL WELL ESTABLISHED. ANY TRAFFIC DAMAGE AND VANDALISM THAT MAY OCCUR PRIOR TO FINAL ACCEPTANCE OF THE WORK SHALL BE REPAIRED AND RESEEDED AT THE OWNER'S EXPENSE. ANY DISTURBED OR DAMAGED BY THE CONTRACTOR SHALL BE REPAIRED IN ACCORDANCE WITH THE SPECIFICATIONS AT THE CONTRACTOR'S EXPENSE.
- 4.4) LAYING OF SOD: A KENTUCKY BLUEGRASS SOD MIX BY LOCAL SOURCE AS SELECTED BY CONTRACTOR, SHALL BE FRESHLY CUT FROM THE SAME FIELD WITH 1/2 -3/4 INCHES OF SOIL. SOD SHALL BE LAID IMMEDIATELY WITH ANY STORED SOD BEING UNROLLED GRASS SIDE UP AND KEPT WATERED. LAY COURSES TIGHTLY TOGETHER WITHOUT OVERLAPPING WITH THE JOINTS STAGGERED. AFTER SODDING IS COMPLETE, ROLL LIGHTLY. THE CONTRACTOR SHALL WATER THE SODDED AREAS TO A DEPTH OF AT LEAST SIX INCHES AFTER THE SODDING PROCESS. OWNER SHALL THEN BE RESPONSIBLE FOR WATERING. THE FREQUENCY SHALL BE DETERMINED BY RAIN FALL AND WINDS WITH THE UPPER TWO OR THREE INCHES OF SOIL NOT DRYING OUT MARKEDLY.
- 4.5) SODDED AREA: INSPECTION AND ACCEPTANCE: FOUR WEEKS AFTER CONTRACTOR COMPLETES INSTALLATION, LANDSCAPE ARCHITECT SHALL INSPECT THE LAWN TO DETERMINE THE ACCEPTABILITY OF THE INSTALLATION. SODDED AREAS FAILING TO SHOW ADEQUATE ROOTING INTO THE SUBSOIL, OVERLAPPING, COURSE SEPARATION, UNEVENNESS OF THE SURFACE, UNEVEN COURSE COLOR AND EXCESSIVE BROADLEAF WEED CONTENT SHALL BE REPLACED. THE COST SHALL BE BORNE BY THE CONTRACTOR EXCEPT WHERE VANDALISM OR NEGLECT ON THE PART OF OTHERS NOT UNDER THE CONTRACTORS CONTROL HAS RESULTED IN DAMAGE.
- 4.6) FINAL APPROVAL: SEEDED AND SODDED AREAS WILL RECEIVE FINAL APPROVAL IF COVERAGE IS FULL AND CONSISTENT, FREE OF BARE SPOTS AND WEED FREE. WHEN GRASS IS CUT AT 2" HEIGHT NO SOIL SHOULD BE VISIBLE. SOD AREAS MUST HAVE RECEIVED A MINIMUM OF TWO MOWINGS. AREAS SODDED AFTER NOVEMBER 1ST WILL BE ACCEPTED THE FOLLOWING SPRING ONE MONTH AFTER THE START OF THE GROWING SEASON, IF THE ABOVE CRITERIA HAS BEEN MET.

## **Maintenance:**

- 5.1) MAINTENANCE DURING INSTALLATION: MAINTENANCE OPERATIONS SHALL BEGIN IMMEDIATELY AFTER EACH PLANT IS PLANTED AND SHALL CONTINUE AS REQUIRED UNTIL FINAL ACCEPTANCE AND THEN FOR THE GUARANTEE PERIOD. PLANTS SHALL BE KEPT IN A HEALTHY, GROWING CONDITION BY WATERING, PRUNING, SPRAYING, WEEDING AND ANY OTHER NECESSARY OPERATIONS OF MAINTENANCE. PLANT SAUCERS AND BEDS SHALL BE KEPT FREE OF WEEDS, GRASS AND OTHER UNDESIRED VEGETATION. PLANTS SHALL BE INSPECTED AT LEAST ONCE PER WEEK BY THE CONTRACTOR DURING THE INSTALLATION PERIOD AND ANY NEEDED MAINTENANCE IS TO BE PERFORMED PROMPTLY.
- 5.2) GRASS AND WEED CONTROL: THE CONTRACTOR SHALL BE RESPONSIBLE FOR MOWING ALL GRASS AROUND LANDSCAPE BEDS AND INDIVIDUAL TREES AND SHRUBS UNTIL FINAL ACCEPTANCE. WEED CONTROL AREAS SHALL INCLUDE ALL LANDSCAPE BEDS AND THE AREA WITHIN 2 FEET OF THE OUTER EDGE OF THE MULCH AREA OR INDIVIDUAL TREE/SHRUBS.
- 5.3) THE CONTRACTOR SHALL WATER, FERTILIZE, WEED, CULTIVATE, REMULCH, SPRAY TO CONTROL INSECT INFESTATION AND DISEASE AND PERFORM ANY OTHER GOOD HORTICULTURAL PRACTICE NECESSARY TO MAINTAIN THE PLANTS IN A LIVING HEALTHY CONDITION UPON THE TIME FOR TERMINATION OF HIS RESPONSIBILITY FOR CARE AS SET OUT HEREIN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PLANTS THROUGHOUT LIFE OF THE CONTRACT.
- 5.4) ALL PLANTS STOLEN, DAMAGED OR DESTROYED BY FIRE, AUTOMOBILES, VANDALISM OR ANY OTHER CAUSE, WITH THE EXCEPTION OF PLANTS DAMAGED OR DESTROYED BY THE OWNERS MAINTENANCE OPERATIONS, SHALL BE REPLACED BY THE OWNER PRIOR TO THE DATE OF FINAL ACCEPTANCE.
- 5.5) LANDSCAPE CONTRACTOR SHALL PREPARE MAINTENANCE SPECIFICATIONS AND SCHEDULE ANNUAL CARE OF ALL PLANTED AND LAWN AREAS INCLUDING FERTILIZING, WEEDING, MULCHING, BED EDGING, PRUNING AND PEST PREVENTION AND TREATMENT.

## **Plant Material Guarantee:**

\*CONTRACTOR SHALL GUARANTEE IN WRITING ALL PLANT MATERIAL AND LANDSCAPE IMPROVEMENTS FOR A PERIOD OF ONE YEAR. THE GUARANTEE IS TO INCLUDE THE FOLLOWING:

- 6.1) INSPECTIONS: PERFORM PERIODIC INSPECTIONS DURING GUARANTEE PERIOD WITH RESULTING WRITTEN REPORTS TO OWNER, PROJECT ADMINISTRATOR AND LANDSCAPE ARCHITECT STATING CONDITIONS AND RECOMMEND MAINTENANCE MODIFICATIONS. THE CONTRACTOR MUST CONTACT THE OWNER AND LANDSCAPE ARCHITECT AT LEAST 10 DAYS IN ADVANCE TO SCHEDULE ACCEPTANCE INSPECTION(S).
- 6.2) REMOVAL AND REPLACEMENT OF PLANTS PROVIDED BY CONTRACTOR TO BE DONE WITHIN THIRTY DAYS OF NOTIFICATION BY OWNER OF THEIR UNSATISFACTORY CONDITION DURING GROWING SEASONS. REPLACEMENT MATERIALS MUST BE EQUAL IN TYPE AND SIZE PER THE PROJECT'S PLANT LIST.
- 6.3) WHEN REPLACEMENT PLANT SPECIES IS EITHER NOT READILY AVAILABLE OR NO LONGER SUITABLE TO EXISTING SITE CONDITIONS WRITTEN NOTICE RECOMMENDATION OF SUBSTITUTION TO BE PROVIDED TO THE OWNER AND LANDSCAPE ARCHITECT WITHIN FIFTEEN DAYS FOR APPROVAL.
- 6.4) REMOVAL OF TREE'S SUPPORTS AND DEAD LIMBS PRIOR TO END OF GUARANTEE INSPECTION PERIOD.
- 6.5) CONTINUE WITH MAINTENANCE, SEE SECTION 5.0
- 6.6) GUARANTEE SHALL BEGIN UPON DATE OF FINAL ACCEPTANCE FROM OWNER AND WILL CONTINUE FOR ONE YEAR.

## Site Cleanup:

- 7.1) SITE WORK CONDITIONS: EXCESS WASTE MATERIAL SHALL BE REMOVED DAILY WHEN PLANTING IN AN AREA HAS BEEN COMPLETED, THE AREA SHALL BE CLEARED OF ALL DEBRIS, SOIL PILES AND CONTAINERS DAILY. WHERE EXISTING GRASS AREAS HAVE BEEN DAMAGED OR SCARRED DURING PLANTING OPERATIONS, THE CONTRACTOR SHALL RESTORE DISTURBED AREAS TO THEIR ORIGINAL CONDITIONS AT HIS EXPENSE.
- 7.2) CLEAN PAVED AREAS UTILIZED FOR HAULING OR EQUIPMENT STORAGE AT END OF EACH WORKDAY.
- 7.3) MAINTAIN VEHICLES AND EQUIPMENT IN CLEAN CONDITION TO PREVENT SOILING OF ROADS, WALKS OR OTHER PAVED OR SURFACED AREAS.
- 7.4) REMOVE PROTECTIVE BARRIERS AND WARNING SIGNS AT TERMINATION OF LAWN ESTABLISHMENT.

## **Irrigation Notes:**

- 8.1) ALL IRRIGATION SYSTEM COMPONENTS SHALL BE SUPPLIED BY REGIONALLY AUTHORIZED DISTRIBUTORS TO PROVIDE SINGLE SOURCE RESPONSIBILITY FOR WARRANTY SERVICE AND OPERATIONS TO CONFORM TO SPECIFICATIONS IN ALL RESPECTS.
- 8.2) THE CONTRACTOR IS TO SUBMIT PLANS PREPARED BY A IRRIGATION SPECIALIST TO THE LANDSCAPE ARCHITECT FOR APPROVAL PRIOR TO INSTALLATION.
- 8.3) ALL LINE VOLTAGE TO CONTROLLER AND ASSOCIATED BREAKER, CONDUIT ETC TO BE PERFORMED BY A LICENSED ELECTRICIAN.

8.4) ALL WIRES FOR RAIN SENSOR TO BE RUN IN SCHEDULE 40 PVC CONDUIT FOR APPLICATIONS IN EXPOSED

- AREAS UNLESS OTHERWISE DIRECTED BY THE LANDSCAPE ARCHITECT.

  8.5) SLEEVES TO BE COORDINATED. LOCATED AND INSTALLED UNDER ALL HARDSCAPE FEATURES SUCH AS
- WALKS, WALLS AND DRIVEWAYS. THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE LANDSCAPE ARCHITECT OF ALL CONFLICT AND DISCREPANCIES.
- 8.6) CONTRACTOR WILL REVIEW WITH CLIENT ALL IRRIGATION PROCEDURES AND PROCESSES (I.e. TIMERS, ZONES AND ALL OTHER ITEMS INVOLVED W/ THE IRRIGATION SYSTEM) AND PROVIDE NECESSARY DOCUMENTATION FOR OPERATION OF IRRIGATION SYSTEM.
- DIRECTED BY THE LANDSCAPE ARCHITECT OR CLIENT.

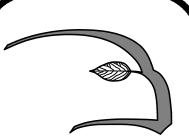
  8.8) UNLESS INDICATED OTHERWISE, ALL PLANT BEDS ARE TO BE IRRIGATED WITH DRIP IRRIGATION, ALL LAWN

AREAS TO BE IRRIGATED WITH SPRAY HEADS.

8.7) THE CONTRACTOR IS TO PROVIDE WIRES FOR FUTURE EXPANSION IN 16" DIAMETER VALVE BOX AS

Base plan information provided electronically by The Architectural Team of Chelsea. MA and

Kelly Engineering Group of Braintree, MA



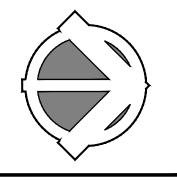
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Date: 1/29/21

## **Revisions:**

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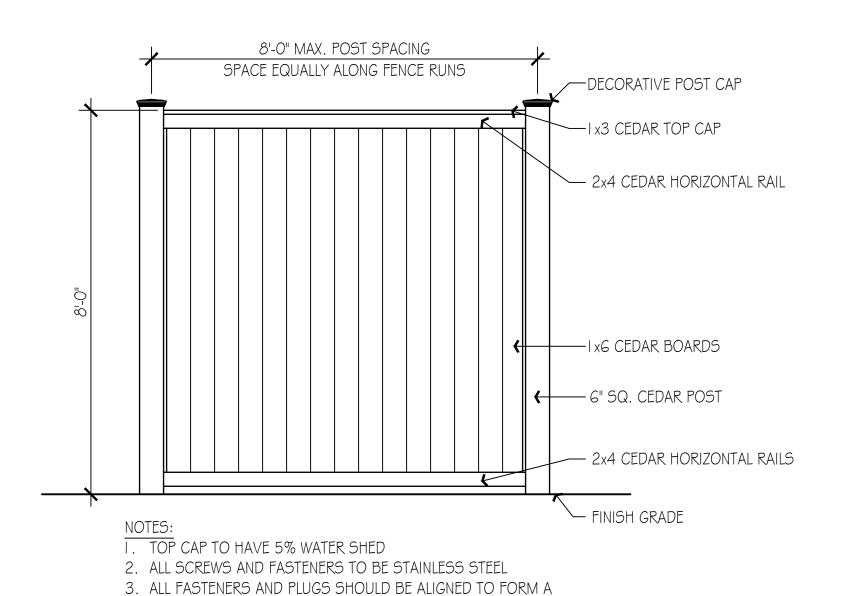
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Planting Notes

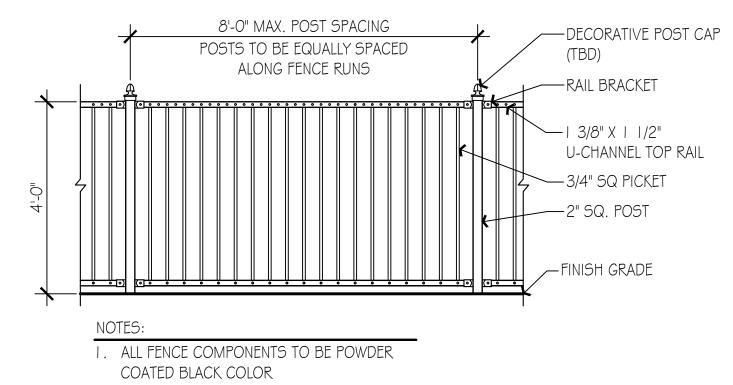
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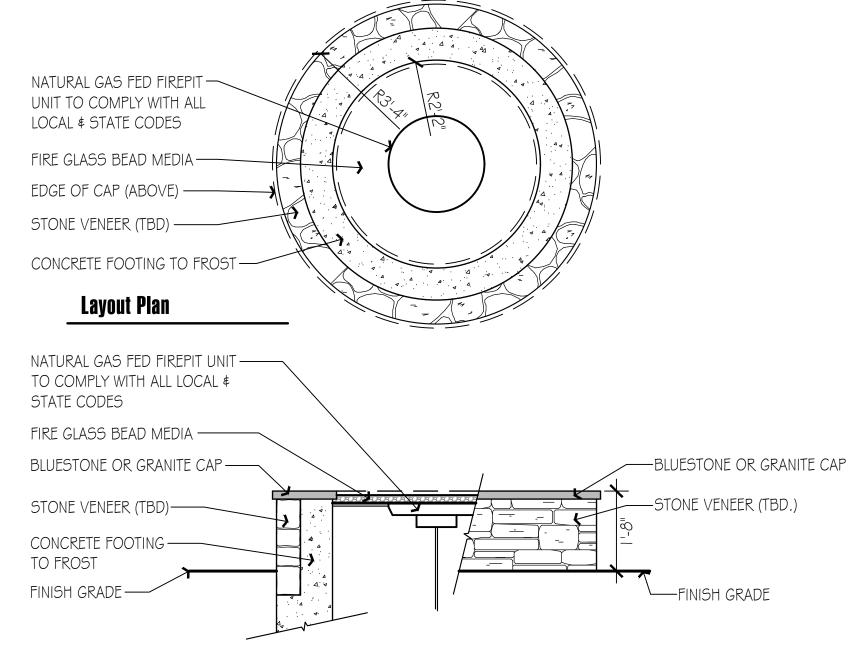
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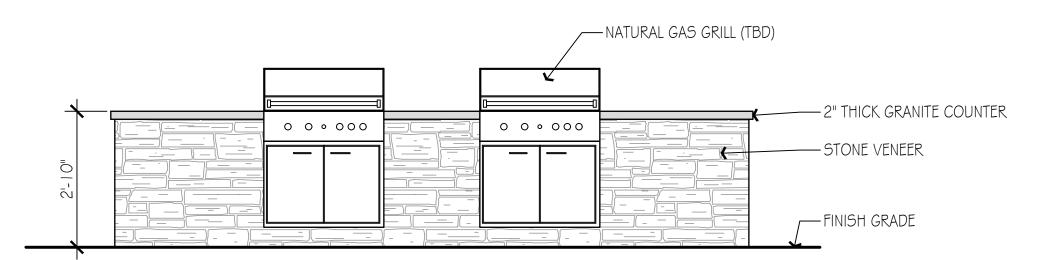
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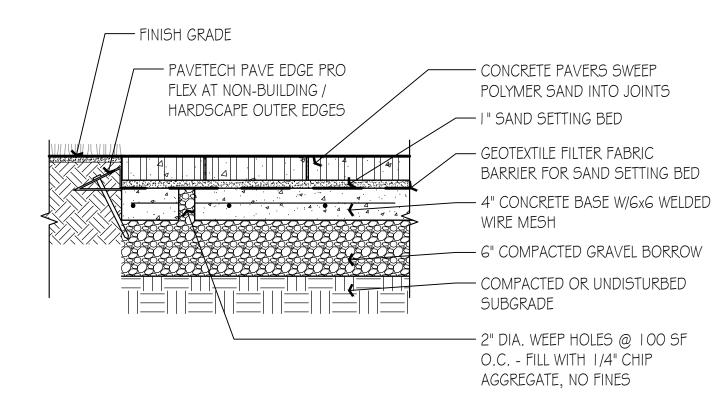
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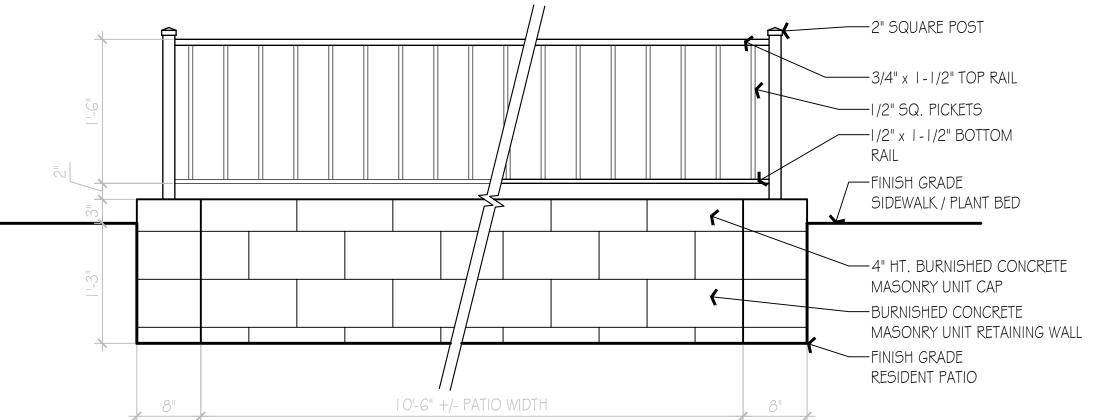




**Outdoor Kitchen Area** 



Brick Paver



Resident Patio Retaining Wall and Fence



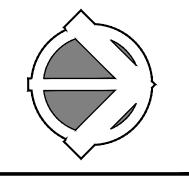
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Date: 1/29/21

## **Revisions:**

Num. Date Description 2/24/21 Per Design Review Board comments



**Carter Mill** A Residence 100 West Street

3 Edgewater Drive, Norwood,

**LCB Senior Living,** 

Drawn By: BNL Checked By: TEM

Construction **Details** 

**Scale:** As Noted

Base plan information provided electronically by The Architectural Team of Chelsea, MA and

Kelly Engineering Group of Braintree, MA

The

**Section - Elevation** 



# **Traffic Impact Study**

## The Residence at Carter Mill

100-110 West Street Needham, MA



Prepared by

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Prepared for LCB Senior Living

Updated February 2021

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#### INTRODUCTION

McMahon Associates has completed a review of the existing traffic operations and potential traffic impacts associated with the proposed Residence at Carter Mill redevelopment project at 100-110 West Street in Needham, MA. The purpose of this traffic impact study is to evaluate existing and projected traffic operations and safety conditions associated with the proposed redevelopment within the study area.

The assessment documented in this traffic impact study is based on a review of existing traffic volumes, recent crash data, and the anticipated traffic generating characteristics of the proposed project. The study examines existing and projected traffic operations (both with and without the proposed redevelopment) at key intersections in the vicinity of the project site. The study area was selected based on a review of the surrounding roadway network and estimated trip generating characteristics of the proposed project. This study provides a detailed analysis of traffic operations during the weekday morning and weekday afternoon peak hours, when the combination of adjacent roadway volumes and project trips would be expected to be the greatest. The study also reviews the previous on-site uses and their impacts to traffic and parking within the study area relative to the proposed project.

Based on the analysis of the proposed project and a review of the previous land use, the proposed project is estimated to have a lesser impact on study area traffic and to require less parking than both the previous land use and the proposed on-site parking supply. The proposed project is shown to have a negligible impact on the area roadways and intersections. The following report documents these findings.

#### **Project Description**

The proposed Residence at Carter Mill redevelopment would be located at 100-110 West Street in Needham, MA, as shown in Figure 1. The site currently consists of a vacant building and associated parking that was previously used as an assisted living community, skilled nursing facility, and medical offices. The site is bounded by residential properties to the south, West Street to the north, Highland Avenue to the east, and Massachusetts Bay Transit Authority (MBTA) Commuter Rail tracks to the west. The proposed project would renovate the existing structure to include 83 units of senior assisted living and memory care units (96 beds) and 72 units of independent senior housing. A total of 149 parking spaces would be provided on-site, including 34 interior garage spaces and 115 exterior spaces. Access to the site would continue to be provided via the two existing full-access driveways, one on West Street and one on Highland Avenue.

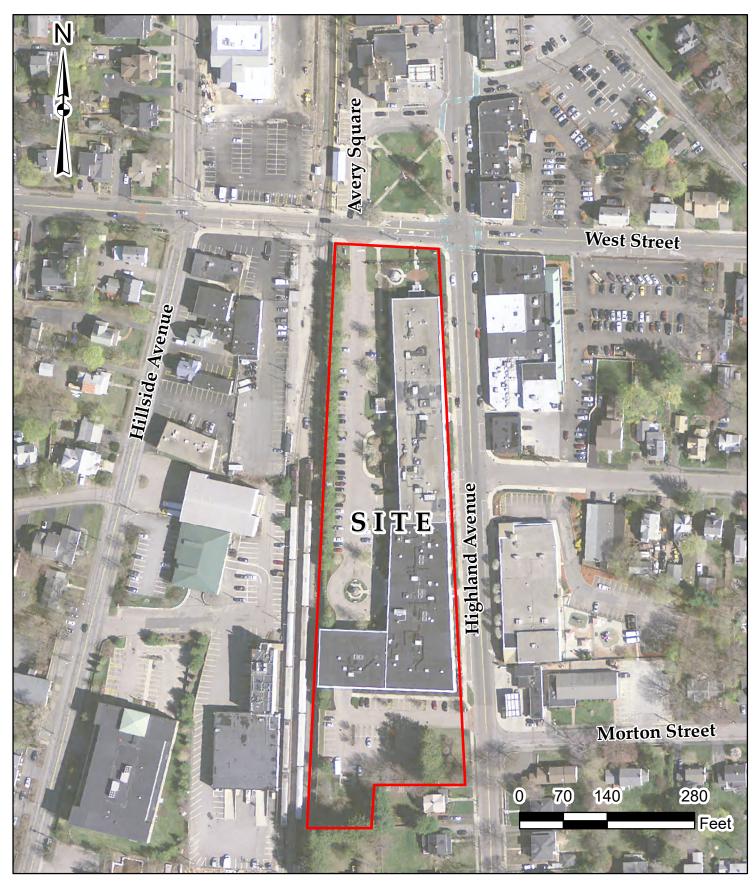




Figure 1 Site Location Map The Residence at Carter Mill Needham, Massachusetts

#### Study Methodology

This traffic impact study evaluates existing and projected traffic operations within the study area for the weekday morning and weekday afternoon peak hour traffic conditions when the combination of the adjacent roadway volumes and estimated project trips would be greatest.

The study was conducted in three steps. The first step consisted of an inventory of existing traffic conditions within the project study area. As part of this inventory, manual turning movement counts were collected at key intersections during the weekday morning and afternoon peak periods. A field visit was also completed to document intersection and roadway geometries and available sight distances at the site driveways. Crash data for the study area intersections was obtained from the Massachusetts Department of Transportation (MassDOT) to determine if the study area has any existing traffic safety deficiencies.

The second step of the study builds upon the data collected in the first step to establish the basis for evaluating potential transportation impacts associated with the projected future conditions. During this second step, the projected traffic demands associated with any planned future developments that could influence traffic volumes at the study area intersections were assessed. Consistent with MassDOT traffic study guidelines, Existing traffic volumes were forecasted to the future year 2026 to determine 2026 No Build (without project) conditions and 2026 Build (with project) conditions.

The third step of this study determined if measures are necessary to improve future traffic operations and safety, minimize potential traffic impacts, and provide safe and efficient access to the site with the proposed project in place.

#### Study Area Intersections

Based on a review of the anticipated traffic generating characteristics of the proposed project and a review of the adjacent roadways serving the project site, the following study area intersections were selected for analysis:

- Highland Avenue at West Street
- West Street at Hillside Avenue
- West Street at the Site Driveway/Avery Square
- Highland Avenue at the Site Driveway/Morton Street

The traffic impact study presented in this report documents existing and future traffic conditions for the study area intersections noted above.

#### **EXISTING CONDITIONS**

An accurate assessment of the potential traffic impacts associated with the proposed senior living redevelopment requires a comprehensive understanding of the existing traffic conditions within the project study area. The existing conditions assessment included in this study consists of an inventory of intersection and roadway geometries, an inventory of traffic control devices, the collection of peak period traffic volumes, and a review of recent crash data. The existing conditions in the vicinity of the project site are summarized below.

#### Transportation Network

The project site benefits from excellent access via the local and regional roadway system. A brief description of the principal roadways and public transportation providing access to the project site is presented below.

#### Highland Avenue

Highland Avenue generally runs in the north-south direction through the Town of Needham and is classified as an urban principal arterial under Town of Needham jurisdiction. Highland Avenue generally provides one travel lane in each direction, each measuring approximately 14 feet in width with 8-foot-wide parking spaces on both sides of the roadway adjacent to the site. A sidewalk is provided on both sides of Highland Avenue and crosswalks are provided across Highland Avenue at its signalized intersection with West Street. No bicycle facilities are provided. South of the site on Highland Avenue, a speed limit of 30 mph is posted for vehicles travelling in the southbound direction, and a speed limit of 25 mph is posted for vehicles travelling in the northbound direction.

#### West Street

West Street generally runs in the east-west direction through the Town of Needham. West Street is classified as an urban collector under Town of Needham jurisdiction. West of the site, West Street provides one travel lane in each direction, measuring approximately 16.5 feet wide in the eastbound direction and approximately 12.5 feet wide in the westbound direction. Sidewalks are provided on the north and south side of West Street. At the signalized intersection of West Street and Highland Avenue, crosswalks and left turn lanes are provided on the West Street approaches. No bicycle facilities are provided on West Street. An advisory speed limit of 30 miles per hour (mph) is posted west of the site for vehicles travelling westbound, and an advisory speed limit of 25 mph is posted in both directions of travel to the east of the site.

#### Hillside Avenue

Hillside Avenue generally runs in the north-south direction through the Town of Needham, and is classified as an urban collector under Town of Needham jurisdiction. Hillside Avenue provides one travel lane in each direction, with sidewalks provided on both sides of the roadway north of West Street, and a sidewalk provided on the west side of the roadway

south of West Street. A crosswalk is provided across Hillside Avenue on the north side of its intersection with West Street. An advisory speed limit of 30 miles per hour is posted in the southbound direction south of West Street.

#### **Public Transportation**

The MBTA Commuter Rail Needham Heights station is located just north of the intersection of West Street, Avery Square, and the site driveway. The station services the Needham line, which provides commuter rail service between Needham Heights and Boston's South Station between 6:05 AM and 12:00 AM. The MBTA bus route 59 provides stops along Highland Avenue with service between Needham Junction and Watertown Square. Bus stops in the vicinity of the site are located at the intersection of Highland Avenue at Mark Lee Road to the north of the site, and the intersection of Highland Avenue at Dana Place south of the site. Each of the bus and train stops are located within 500 feet of the project site.

#### Existing Traffic Volumes

#### **Existing Peak Hour Traffic Volumes**

To assess peak hour traffic conditions, manual turning movement counts were conducted at the study area intersections during the weekday morning and weekday afternoon peak periods.

Turning movement counts were conducted on Thursday, December 5, 2019 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM at the intersections of Highland Avenue at West Street, West Street at the site driveway/Avery Square, and Highland Avenue at the site driveway/Morton Street. Counts at the intersection of West Street at Hillside Avenue were conducted on Tuesday, January 5, 2021 from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. The results of the turning movement counts are tabulated by 15-minute periods and are provided in Appendix A of this report. The four highest consecutive 15-minute intervals during each of these count periods constitute the peak hours that are the basis of the traffic analysis provided in this report. Based on a review of the peak period traffic data, the weekday morning peak hour at the study area intersections was identified as 7:15 AM to 8:15 AM and the weekday afternoon peak hour was identified as 4:30 PM to 5:30 PM.

A 48-hour Automatic Traffic Recorder (ATR) count was conducted on Highland Avenue north of Morton Street on from Wednesday, December 18 to Thursday, December 19, 2019. The ATR count included hourly vehicle volume and vehicle speed information which is provided in Appendix A of this report and summarized in Table 1 below.

**Table 1: ATR Data Summary** 

	(4)	AM Commuter <sup>(2)</sup>	PM Commuter <sup>(3)</sup>	85 <sup>th</sup> Percentile
Direction	ADT <sup>(1)</sup>	Peak Hour	Peak Hour	Speed (mph)
Northbound	6,190	492	407	32
<u>Southbound</u>	<u>5,950</u>	<u>320</u>	<u>518</u>	<u>34</u>
Combined	12,140	812	925	33

- (1) Average daily traffic volume in vehicles per day.
- (2) Weekday morning commuter peak (7:00 AM to 9:00 AM) occurs between 7:30 AM and 8:30 AM.
- (3) Weekday afternoon commuter peak (4:00 PM to 6:00 PM) occurs between 4:30 PM and 5:30 PM.

As shown in Table 1, the ATR count on Highland Avenue shows an Average Daily Traffic (ADT) volume of approximately 6,190 vehicles in the northbound direction and approximately 5,950 vehicles in the southbound direction. The 85<sup>th</sup> percentile speeds in the northbound and southbound directions are 32 mph and 34 mph, respectively.

#### Seasonal Variation

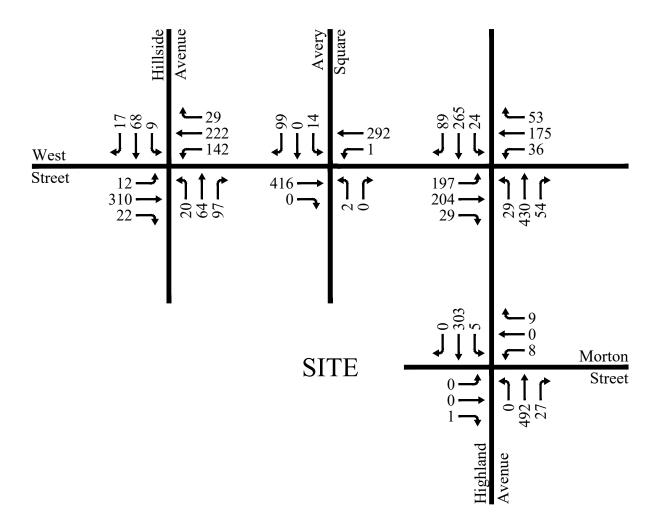
In order to account for seasonal variation in traffic volumes, continuous count data from a MassDOT count station on I-95 in Newton, MA were reviewed. Based on the seasonal trends of the data, traffic counts collected during the month December are shown to be approximately 4% lower than the average month. Therefore, in order to provide a conservative analysis, the existing peak hour traffic volumes collected in December 2019 were adjusted upward by approximately 4% to represent an average month. The seasonal adjustment data from the continuous count station referenced is provided in Appendix B of this report.

Due to the Covid-19 pandemic, the peak period traffic volumes counted at the intersection of West Street at Hillside Avenue in January of 2021 are considered to be lower than typical conditions. As a result, the peak hour volumes at West Street and Hillside Avenue were adjusted upwards to reflect typical traffic conditions that were present prior to the pandemic. The adjustment was based on a comparison of seasonally adjusted volumes between the December 2019 volume set and the data collected in January 2021 along West Street.

The resulting peak hourly traffic flows for the Existing conditions are depicted in Figure 2 for the weekday morning peak hour and Figure 3 for the weekday afternoon peak hour.

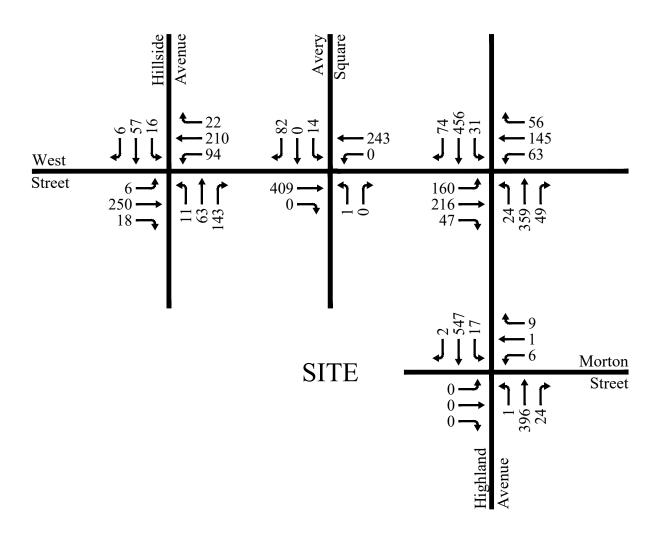
The project site is currently vacant. However, the project site was previously occupied by an assisted living community, skilled nursing facility, and medical offices. The previous site uses are shown to have a higher number of trips and higher parking demand than the currently proposed redevelopment. The traffic associated with the previous land uses were not included in the Existing condition volumes and are discussed in subsequent sections of this report in more detail.













#### Crash Summary

Crash data for the study area intersections was obtained from MassDOT for the five-year period from 2013 through 2017. A summary of the crash data is presented in Appendix C.

The MassDOT Crash Rate Worksheet calculations were used to determine whether the crash frequencies at the study area intersections were unusually high given the travel demands at each location. The MassDOT Crash Rate Worksheet calculates a crash rate expressed in crashes per million entering vehicles. The calculated rate is then compared to the average rate for signalized and unsignalized intersections statewide and within MassDOT District 6. For signalized intersections, the statewide average crash rate is 0.78 crashes per million entering vehicles and the MassDOT District 6 crash rate is 0.71 crashes per million entering vehicles. For unsignalized intersections, the statewide average crash rate is 0.57 crashes per million entering vehicles and the MassDOT District 6 crash rate is 0.52 crashes per million entering vehicles.

The signalized intersection of Highland Avenue at West Street is reported to have experienced a total of 30 crashes during the five-year period analyzed, resulting in a crash rate of 0.77 crashes per million entering vehicles, which is below the statewide average crash rate and above the MassDOT District 6 average crash rate. The intersection is not currently identified as a MassDOT Highway Safety Improvement Project (HSIP) high-crash cluster. Of the 30 reported crashes at the intersection of Highland Avenue at West Street, ten were angle collisions, nine were rear-end collisions, and nine were sideswipe collisions. Four of the reported crashes resulted in personal injury, 25 resulted in property damage only, and the severity of one crash was not reported. Based on conversations with the town of Needham, this intersection is anticipated to be reconstructed in the future to improve pedestrian lighting, drainage, and traffic operations which would be expected to have a positive impact safety at the intersection.

The unsignalized intersection of West Street at Hillside Avenue is reported to have experienced a total of 44 crashes from 2013 to 2017, resulting in a crash rate of 2.11 crashes per million entering vehicles, which is higher than both the statewide average crash rate and the MassDOT District 6 crash rate for unsignalized intersections. Of the 44 crashes, 36 were angle collisions, three were rear-end collisions, one was a head-on collision, and three were single vehicle crashes. Of the 44 crashes, 26 crashes resulted in property damage only, while 15 resulted in personal injury and three were of unknown severity. The intersection is listed as a MassDOT HSIP high-crash cluster between the years of 2015 and 2017. The intersection has been identified for pedestrian improvements as part of the MassDOT Complete Streets Funding Program and is discussed in more detail in subsequent sections of this report.

A total of six crashes were reported at the intersection of West Street at the site driveway/Avery Square from 2013 to 2017, resulting in a crash rate of 0.34 crashes per

million entering vehicles. Four of the reported crashes were angle collisions. All of the reported crashes at the intersection resulted in property damage only.

At the intersection of Highland Avenue at the site driveway/Morton Street, five crashes were reported during the five-year study period, resulting in a crash rate of 0.21 crashes per million entering vehicles. Of these crashes, three were rear-end collisions. Three of the five reported crashes resulted in personal injury, and the other two resulted in property damage only.

All of the crashes summarized as part of this analysis occurred during the time that the project site was previously occupied and operating as the assisted living community, skilled nursing facility, and medical offices. With the anticipated reduction in overall vehicle trips and a negligible change in anticipated travel patterns associated with the project site, the proposed redevelopment would not be expected to worsen existing safety concerns at the study area intersections.

#### **FUTURE CONDITIONS**

To determine future traffic demands on the study area roadways and intersections, the Existing traffic volumes were projected to the future-year 2026. Traffic volumes on the study area roadways in 2026 are assumed to include all existing traffic, as well as new traffic resulting from general growth in the study area and from other planned development projects, independent of the proposed project. The potential background traffic growth, unrelated to the proposed project, was considered in the development of the 2026 No Build (without project) peak hour traffic volumes. The estimated traffic increases associated with the proposed project were then added to the 2026 No Build volumes to reflect the 2026 Build (with project) traffic conditions. A more detailed description of the development of the 2026 No Build and 2026 Build traffic volume networks is presented below.

#### Future Roadway Improvements

Planned roadway improvement projects can impact travel patterns and future traffic operations. MassDOT project information and the Town of Needham were consulted to develop an understanding of future area roadway improvement projects. Three projects which may affect traffic conditions at the study area intersections were identified.

A MassDOT roadway improvement project on Highland Avenue is currently in the preconstruction phases. This project would construct roadway improvements such as widened sidewalks, separated bicycle facilities, and vehicle turn lanes at intersections along Highland Avenue between its intersections with Route 9 in Newton and Webster Street in Needham, just under 0.4 miles to the north of West Street. This project would alter traffic operations along Highland Avenue within its project limits, but is not expected to significantly affect travel volumes at the study area intersections for the proposed assisted living redevelopment. For this reason, changes associated with the Highland Avenue improvement project are expected to be captured within the overall background growth rate described below.

The Town of Needham is planning an improvement project at the intersection of Highland Avenue at West Street. The project is currently in the design phase and the exact scope of the improvement project is not known at this time, but is expected to include a new southbound exclusive right-turn lane, updated traffic signal phasing and timings as well as new signal equipment, posts and mast arms. The capacity analysis described in this report utilizes the anticipated lane configurations and optimized traffic signal timings and phasing for future 2026 No Build and 2026 Build conditions. Additional improvements include the upgrading of pedestrian lighting and roadway reconstruction to address existing drainage issues along Highland Avenue.

The Town of Needham has identified potential improvements for the intersection of West

Street at Hillside Avenue as part of the MassDOT Complete Streets Funding Program. As part of the program, the Town's prioritization plan has been approved by MassDOT and was accepted as of June 1, 2020. The pedestrian improvement project has been identified as priority #6 in the Town's prioritization plan through the program with a desired construction start date of May 2021. The improvements identified in the Town's prioritization plan include:

- Removal of the brick inlay area located to the west of the intersection.
- Pedestrian refuge islands on each approach of West Street to reduce pedestrian crossing widths and divert vehicles from their straight-line path to reduce vehicle speeds.
- New, high-visibility crosswalk across West Street to the west of the intersection to improve visibility of the crosswalk.
- In-road warning light system, and flashing beacons, such as RRFBs at the West Street
  crosswalk to alert vehicles to crossing pedestrians especially when solar glare is
  present.
- Sign warnings of expected solar glare.
- New ADA-compliant wheelchair ramps at all crosswalks as necessary per the DPW Town-wide Handicap Ramp Assessment.

The improvements identified above are intended to improve pedestrian safety at the intersection, particularly for those crossing West Street.

#### **Background Traffic Growth**

Traffic growth is generally a function of changes in motor vehicle use and expected land development within the area. In order to predict the rate at which traffic on the study area roadways can be expected to grow during the seven-year forecast period (2019 to 2026), both planned area developments and historic traffic growth were reviewed.

#### Site-Specific Growth

Based on discussions with the Town of Needham Planning Department, no site-specific developments were identified which would be anticipated to impact traffic volumes within the study area. A proposal for a zoning change in an area approximately 0.6 miles to the north of the site and bounded by Highland Avenue, Gould Street, and I-95 is currently being studied by the Town. This zoning change may allow additional development to occur in this area which could affect vehicle volumes along Highland Avenue, but the extent and exact scale of the impact is unknown at this time.

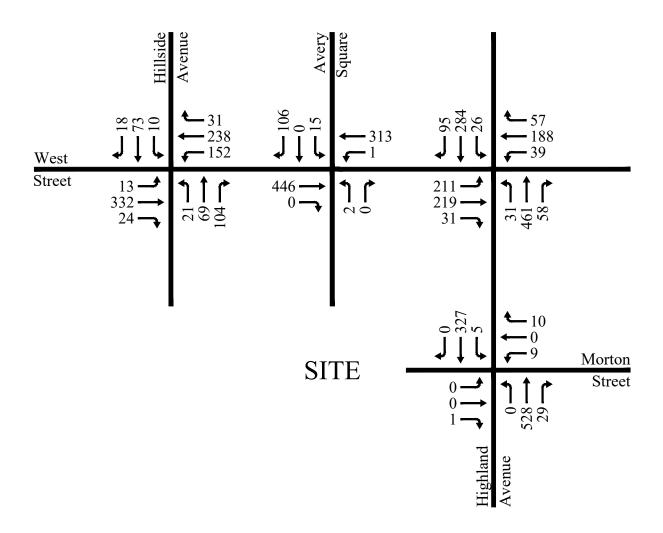
#### **Historic Traffic Growth**

Based on discussions with the Town of Needham Engineering Department, an annual growth rate of one percent per year was identified. The one percent growth rate, compounded annually, was utilized to capture traffic growth associated with general changes in population, other smaller developments, and developments that may not be known at this time.

#### 2026 No Build Traffic Volumes

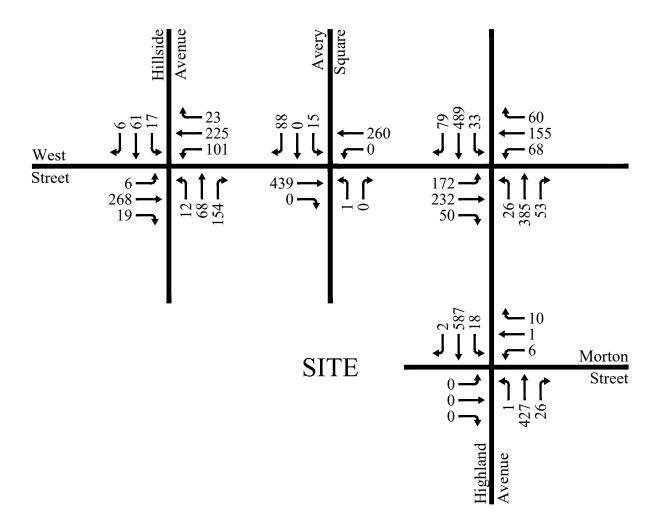
The Existing peak hour traffic volumes were grown by one percent per year (compounded annually) over the seven-year study horizon (2019 to 2026) to establish the 2026 No Build weekday morning and afternoon peak hour traffic volumes, which are illustrated in Figure 4 and Figure 5, respectively, and are documented in the traffic projection model presented in Appendix D of this report.













#### Site-Generated Traffic

In order to estimate the number of vehicle trips associated with the proposed Residence at Carter Mill redevelopment, the Institute of Transportation Engineers' (ITE) publication, *Trip Generation Manual*, 10th Edition, was referenced. ITE is a national research organization of transportation professionals, and *Trip Generation Manual*, 10th Edition provides traffic generation information for various land uses compiled from studies conducted by members nationwide. Vehicle trip estimates for the proposed Residence at Carter Mill redevelopment were developed based on data presented in this publication for Land Use Codes 252 (Senior Adult Housing – Attached), and 254 (Assisted Living). This reference establishes vehicle trip rates (in this case expressed in trips per dwelling unit for senior adult housing and number of beds for assisted living) based on actual traffic counts conducted at similar types of existing land uses. Table 2 presents the estimated vehicle trips associated with the proposed Residence at Carter Mill redevelopment.

**Table 2: Proposed Project Trips** 

		Weekday AM Weekday		y PM			
		Peak Hour			Peak Hour		
Description	Size	In	Out	Total	In	Out	Total
Senior Adult Housing (1)	72 Units	5	9	14	11	9	20
Assisted Living <sup>(2)</sup>	96 Beds	<u>11</u>	<u>7</u>	<u>18</u>	<u>9</u>	<u>15</u>	<u>24</u>
Total Project Trips		16	16	32	20	24	44

- (1) ITE Land Use Code 252 (Senior Adult Housing Attached), based on 72 dwelling units.
- (2) ITE Land Use Code 254 (Assisted Living), based on 96 beds (including 30 memory care beds).

As shown in Table 2, the proposed Residence at Carter Mill redevelopment is estimated to result in approximately 32 new vehicle trips (16 entering vehicles and 16 exiting vehicles) during the weekday morning peak hour and approximately 44 new vehicle trips (20 entering vehicles and 24 exiting vehicles) during the weekday afternoon peak hour. The number of estimated peak hour trips would result in approximately one additional vehicle trip on the adjacent roadways every one to two minutes during the weekday morning and afternoon peak hours.

As outlined previously, the project site is served by both bus and rail transit. It can be expected that a portion of the trips to and from the project site would travel utilizing the existing MBTA transit service, reducing the number of overall site trips. Additionally, a number of services and amenities exist in the immediate area around the site which would be expected to reduce the number of vehicle trips by residents and visitors. The Center at the Heights (Needham senior center), a pharmacy, grocery store, USPS post office, the Needham Public Library and a number of doctor's offices and banks are located within an approximately ten-minute walking distance from the site.

Due to the building on site being currently vacant, no trip generation credit was taken as part of the development of the project volumes shown in Table 1. However, for comparison, and to demonstrate the lesser impact of the proposed redevelopment, Table 2 provides a summary of the trip generation associated with the previous assisted living community, nursing facility, and medical office estimated using ITE data.

**Table 3: Previous Site Trips** 

		Weekday AM		Weekday PM			
		Peak Hour Peak Hou			ur		
Description	Size	In	Out	Total	In	Out	Total
Assisted Living <sup>(1)</sup>	60 Beds	7	4	11	6	10	16
Nursing Facility <sup>(2)</sup>	142 Beds	17	7	24	10	21	31
Medical Office <sup>(3)</sup>	<u>11,000 sf</u>	<u>24</u>	<u>7</u>	<u>31</u>	<u>11</u>	<u>28</u>	<u>39</u>
Total Previous Use Trips		48	18	66	27	59	86

- (1) ITE Land Use Code 254 (Assisted Living), based on 60 beds.
- (2) ITE Land Use Code 620 (Nursing Home), based on 142 beds.
- (3) ITE Land Use Code 720 (Medical-Dental Office Building) based on 11,000 square feet.

As seen in Table 3, the previous land uses are estimated to have generated nearly twice as many vehicle trips as the proposed Residence at Carter Mill redevelopment during the weekday morning and weekday afternoon peak hours. The skilled nursing facility of the previous land use required far more employees than the proposed assisted living facility and the previous medical offices would have a higher number of employees and patients/visitors than the proposed independent living portion of the redevelopment. Together, the proposed redevelopment is shown to result in a significant decrease in the number of trips entering and exiting the project site, not just during the peak hours, but over the course of an entire typical day.

The proposed Residence at Carter Mills project is estimated to generate approximately 514 vehicle trips daily during a typical weekday while the previous land use is estimated to have generated approximately 926 vehicle trips per typical weekday. This reduced number of vehicle trips accessing the project site would also be expected to reduce the demands on parking and capacity of the adjacent roadways and intersections.

#### Project Trip Distribution and Assignment

The additional traffic estimated to be generated by the proposed redevelopment was distributed onto the study area roadways and intersections based on the existing travel patterns of the adjacent roadways. Vehicle trips accessing the project site were assigned to the site driveways based on ease of access to and from the roadway network. The resulting

arrival and departure patterns are presented in Figure 6 and are documented in the traffic projection model found in Appendix D.

The project-related traffic was then assigned to the surrounding roadway network based on the project trip distribution patterns presented in Figure 6. The resulting distributed new project trips are shown in Figure 7 and Figure 8 for the weekday morning and weekday afternoon peak hours, respectively.

Due to the proximity to a number of nearby amenities, residents of the proposed project would be expected to walk along study area roadways to access nearby locations. Within a ten-minute walk of the project site are the Center at the Heights, the Needham Public Library, a pharmacy, grocery store, USPS post office, doctor's offices and banks. With the configuration of the proposed project and its proximity to the intersection of Highland Avenue and West Street, many residents and employees would be expected to utilize the crosswalks at the existing signalized intersection. Signalized crossings provide additional comfort and safety over crossings at unsignalized, free flowing approaches. Due to the location of the Center at the Heights, northwest of the project site, some residents may be interested in crossing West Street at Hillside Avenue.

Based on a review of a typical schedule of activities (pre-COVID), the majority of events at the Center at the Heights during the day occur between 9:00 AM and end by 4:00 PM. Some evening events also occur after 6:00PM with a select few events occurring between 4:00PM and 6:00PM two days a week. Based on this schedule, the majority of pedestrian traffic between the project and the Center at the Heights would be expected to travel across West Street during off-peak hours for vehicular traffic. The improvements identified by the Town of Needham as part of MassDOT's Complete Street Funding Program would provide striped crossings across West Street and would enhance the pedestrian amenities offered at the West Street at Hillside Avenue intersection.

The proposed senior living residential project is not shown to generate a substantial amount of vehicular traffic to and from the study area intersections of Highland Avenue with West Street and West Street with Hillside Avenue. The increase in project trips results in a less than a two percent increase over the existing peak hour volumes at each of the nearby study area intersections of Highland Avenue with West Street and West Street with Hillside Avenue. The relatively small increase in project trips is not shown to significantly impact the operations at the study area intersections. It should also be noted that the increase in project trips is a result of the existing building being vacant. When accounting for the previous onsite land uses being in operation, an overall decrease in project trips would have occurred.

#### 2026 Build Traffic Volumes

To establish the 2026 Build peak hour traffic volumes, the distributed new project trips were then added to the 2026 No Build peak hour traffic volumes to reflect the 2026 Build peak

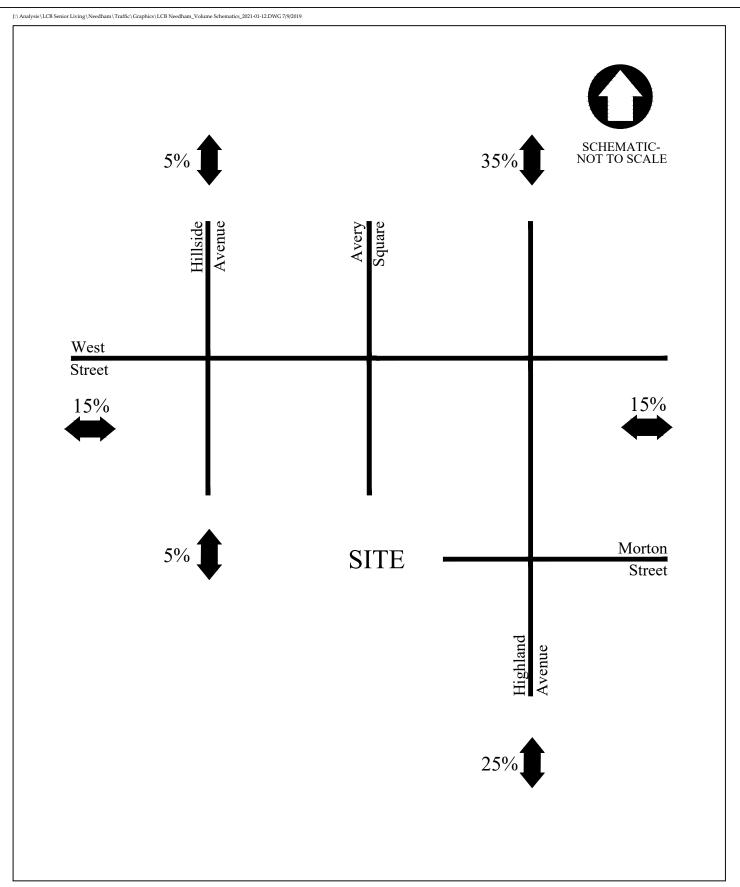




Figure 6
Directions of Arrival and Departure
Peak Hour Traffic Volumes
The Residence at Carter Mill
Needham, Massachusetts

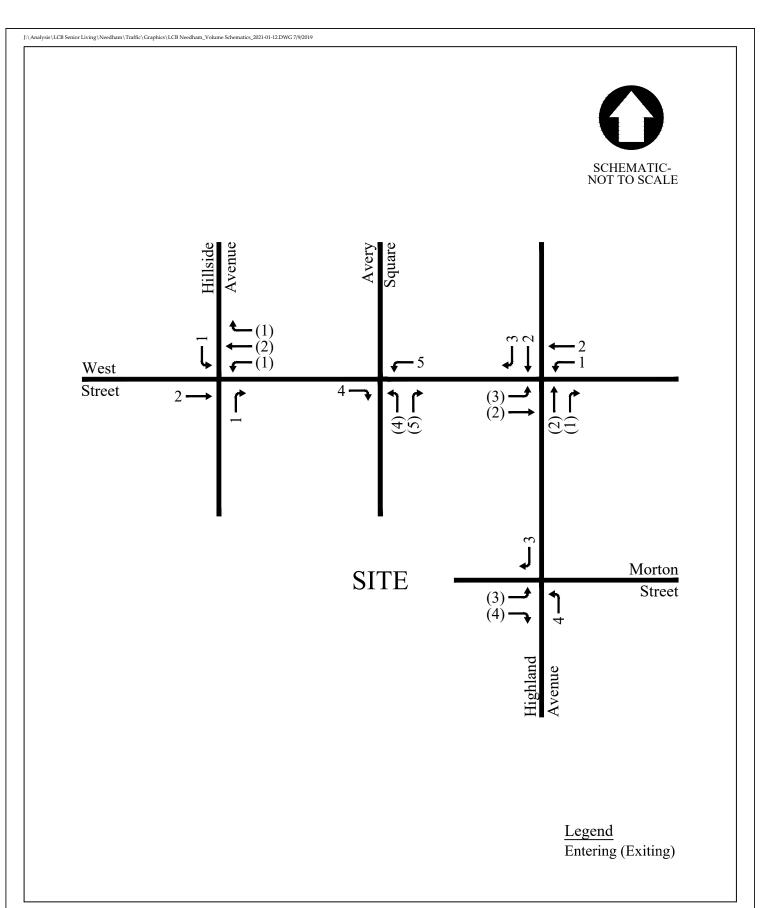




Figure 7 Weekday Morning Peak Hour New Project Trips The Residence at Carter Mill Needham, Massachusetts



Figure 8
Weekday Afternoon Peak Hour
New Project Trips
The Residence at Carter Mill
Needham, Massachusetts



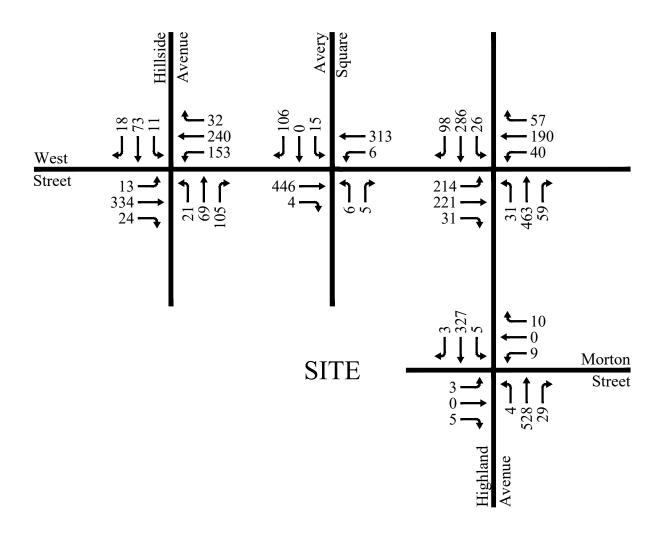
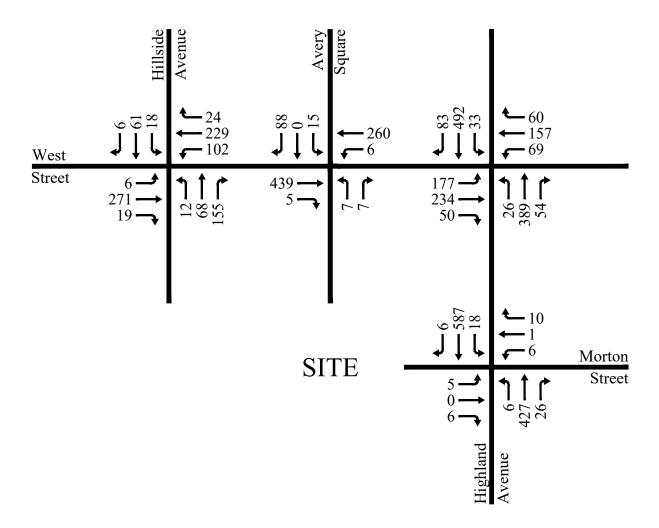




Figure 9 2026 Build Weekday Morning Peak Hour Traffic Volumes The Residence at Carter Mill Needham, Massachusetts







#### TRAFFIC OPERATIONS ANALYSIS

In previous sections of this report, the quantity of traffic at the study area intersections has been discussed. This section describes the overall quality of the traffic flow at the study area intersections during the weekday morning and weekday afternoon peak hours. As a basis for this assessment, intersection capacity analysis was conducted using the Synchro capacity analysis software at the study area intersections under the Existing, 2026 No Build and 2026 Build peak hour traffic conditions. The analysis is based on Synchro capacity analysis methodologies and procedures contained in the *Highway Capacity Manual*, 6<sup>th</sup> Edition (HCM), which is summarized in Appendix E. A discussion of the evaluation criteria and a summary of the results of the capacity analysis are presented below.

#### Level-of-Service Criteria

Average total vehicle delay is reported as level-of-service (LOS) on a scale of A to F. LOS A represents delays of 10 seconds or less and LOS F represents delays in excess of 50 seconds for unsignalized intersections and greater than 80 seconds for signalized intersections. A more detailed description of the LOS criteria is provided in Appendix E.

#### Capacity Analysis Results

Intersection capacity analysis was conducted using Synchro capacity analysis software for the study area intersections to evaluate the Existing, 2026 No Build and 2026 Build traffic conditions during the weekday morning and weekday afternoon peak hours. As mentioned previously, the peak hour traffic volumes utilized as part of this analysis are provided in the traffic projection model, attached in Appendix D of this report.

The Synchro capacity analysis results for the Existing, 2026 No Build and 2026 Build traffic conditions are presented in Appendix F, Appendix G, and Appendix H, respectively. The overall results of the intersection capacity analysis for the signalized intersection of Highland Avenue at West Street are presented in Table 4 below, and the results for the stop-controlled approaches to each of the unsignalized study area intersections are presented in Table 5. A more detailed summary of the capacity analysis for each study area intersection is provided in Appendix I. The results of the specific capacity analysis at the study area intersections are discussed below.

As stated previously, the study area intersections that were counted and analyzed during the weekday peak hours under the Existing conditions do not include the site in operation under its previous land use. Therefore, the analysis summarized below does not reflect the operations that would have been associated with the previously operational site.

**Table 4: Signalized Intersection Capacity Analysis** 

	Peak		Existing		202	6 No B	uild	20	)26 Bui	ld
Intersection	Period	LOS <sup>(1</sup>	Delay <sup>(2)</sup>	$V/C^{(3)}$	LOS	Delay	V/C	LOS	Delay	V/C
West Street at	AM	D	41.7	0.70	D	42.7	0.88	D	43.1	0.88
Highland Avenue	PM	D	40.3	0.71	D	40.7	0.79	D	41.5	0.80

- (1) Level-of-Service
- (2) Average vehicle delay in seconds
- (3) Volume to capacity ratio

As shown in Table 4, the signalized intersection of Highland Avenue at West Street is shown to currently operate at overall LOS D during the weekday morning and weekday afternoon peak hours. With the proposed lane configuration and signal improvements under the 2026 No Build condition, the intersection is shown to continue to operate at overall LOS D during both peak hours. With the proposed project in place, the intersection is projected to continue to operate at overall LOS D with less than one second increase in average vehicle delay compared to the 2026 No Build conditions, for both morning and afternoon peak hours. All movements at the intersection are projected to operate at the same LOS under 2026 No Build and 2026 Build conditions indicating limited impact on traffic operations due to the proposed redevelopment.

**Table 5: Unsignalized Intersection Capacity Analysis** 

		Peak		Existing		202	6 No B	uild	20
Intersection	Approach	Period	LOS(1)	Delay <sup>(2)</sup>	$V/C^{(3)}$	LOS	Delay	V/C	LOS
West Street at	NB	AM	Е	49.5	0.74	F	>50.0	0.93	F
Hillside Avenue		PM	C	23.3	0.58	D	29.2	0.67	D
	SB	AM	F	>50.0	0.68	F	>50.0	0.84	F
		PM	D	29.5	0.38	E	36.5	0.46	E
West Street at	NB	AM	C	21.7	0.02	C	23.9	0.02	C
Site Driveway/		PM	C	19.5	0.02	C	21.2	0.02	C
Avery Square	SB	AM	В	13.1	0.25	В	13.9	0.29	В
		PM	В	12.2	0.19	В	12.7	0.21	В
Highland Avenue	e EB <sup>(4)</sup>	AM	В	10.2	0.01	В	10.4	0.01	C
at Site Driveway,	/	PM	A	0.0	0.00	A	0.0	0.00	C
Morton Street	WB	AM	C	18.0	0.08	C	19.7	0.10	C
		PM	С	19.9	0.09	С	21.4	0.10	С

<sup>(1)</sup> Level-of-Service

<sup>(2)</sup> Average vehicle delay in seconds

<sup>(3)</sup> Volume to capacity ratio

<sup>(4)</sup> Change in LOS from No Build to Build due to the current vacant condition of the project:

As shown in Table 5, the northbound approach at the intersection of West Street at Hillside Avenue is shown to operate at LOS E during the weekday morning peak hour and LOS C during the weekday afternoon peak hour under existing conditions. Under both 2026 No Build and 2026 Build conditions, the northbound approach is projected to operate at LOS F during the weekday morning peak hour and LOS D during the weekday afternoon peak hour. The southbound approach to the intersection of West Street at Hillside Avenue is shown to currently operate at LOS F during the weekday morning peak hour and LOS D during the weekday afternoon peak hour. The southbound approach is expected to continue to operate at LOS F during the weekday morning peak hour under future No Build and Build conditions. During the weekday afternoon peak hour, the southbound approach is projected to operate at LOS E under No Build and Build conditions. Operations along West Street are not shown to be materially impacted by the additional vehicle trips from the proposed development when compared to the 2026 No Build conditions.

The site driveway approach to West Street is shown to currently operate at LOS C during the weekday morning and weekday afternoon peak hours. Under 2026 No Build and 2026 Build conditions, the site driveway approach is projected to continue to operate at LOS C during both peak hours analyzed. The southbound Avery Square approach is shown to currently operate at LOS B during the weekday morning and afternoon peak hours, and is projected to continue to operate at LOS B under future conditions, without and with the proposed project in place.

At the intersection of Highland Avenue at the site driveway and Morton Street, the stop-controlled westbound Morton Street approach is shown to currently operate at LOS C during the weekday morning and weekday afternoon peak hours. Under future conditions both without and with the proposed project in place, the Morton Street approach is projected to continue to operate at LOS C during both peak hours with a negligible amount of additional average vehicle delay. Under 2026 Build conditions, the site driveway on Highland Avenue is projected to operate at LOS C during both the weekday morning and weekday afternoon peak hours.

The analysis described above under the 2026 Build condition is expected to show better traffic operations at the study area intersections than the operations that would have occurred if the previous, more intense on-site uses were still in operation.

## Site-Generated Parking Demand

The Residence at Carter Mill redevelopment proposes to include a total of 149 parking spaces on-site, including 34 interior garage spaces and 115 exterior spaces. Ten of the interior garage spaces would be tandem spaces for individuals living in the independent living units that may have two cars.

In order to determine the projected parking demand for the Residence at Carter Mill redevelopment, parking generation data from the ITE publication, *Parking Generation Manual*, 5th Edition was referenced. The Parking Generation Manual provides parking generation information for various land uses compiled from studies conducted by members nationwide. Weekday parking demand estimates for the proposed redevelopment were developed based on data presented in this publication for Land Use Codes 252 (Senior Adult Housing – Attached) and 254 (Assisted Living), and are presented in Table 6 below.

Table 6: Proposed Site Parking Generation

		Weekday Peak
Description	Size	<b>Parking Demand</b>
Senior Adult Housing <sup>(1)</sup>	72 Dwelling Units	44
Assisted Living <sup>(2)</sup>	96 Beds	<u>37</u>
Total Estimated Parking Demand		81

<sup>(1)</sup> ITE Land Use Code 252 (Senior Adult Housing - Attached), based on 72 dwelling units.

As shown in Table 6, the proposed Residence at Carter Mill redevelopment is projected to generate an average peak parking demand of 81 vehicles during a typical weekday based on ITE data. The project proposes to include 149 parking spaces: 34 interior garage spaces and 115 exterior spaces. Comparing the projected parking demand to the proposed parking supply shows that the site would have a peak period utilization rate of approximately 54%.

The *Parking Generation Manual* also provides information indicating how much parking is supplied at each of the studies included in the analysis. For senior adult attached housing, an average parking supply ratio of 0.9 parking spaces per independent senior housing unit was identified. For an assisted living site that is located within a half mile of rail transit, an average parking supply ratio of 0.4 parking spaces per unit was identified. Using these average supply ratios provided by ITE, the number of parking spaces that would be supplied for a project similar in size and type to the proposed site would be approximately 98 parking spaces. The proposed project is providing 51 additional parking spaces than the parking supplies calculated based on ITE.

The zoning for this project would include the following parking supply requirements:

- 0.5 parking spaces per bed for the assisted living community (96 beds proposed)
- 1 parking space for every two employees on the largest shift of the assisted living community (58 employees on the largest shift)
- 1 parking space per unit of independent living (72 units proposed)

Based on a review of the data presented within the *Parking Generation Manual* for independent living, the proposed supply requirement of 1 parking space per independent dwelling unit is considered to be conservative. As identified previously, data from the

<sup>(2)</sup> ITE Land Use Code 254 (Assisted Living), based on 96 beds.

Parking Generation Manual for independent senior living suggests that facilities where data was collected provided a parking supply ratio of 0.9 spaces per independent dwelling unit. Within the Town of Needham's Elder Services Zoning District, the parking supply requirement is 0.5 parking spaces per independent living dwelling unit.

Based on the proposed parking supply rates and the proposed build program, the zoning proposal would require 149 parking spaces and the project proposes to include 149 parking spaces.

In addition, while the proposed project is shown to provide more than sufficient on-site parking to meet the anticipated average peak parking demands of the proposed Residence at Carter Mill redevelopment, there is also a variety of on-street parking that could be used by visitors in close proximity to the project site which would further reduce the need for additional parking spaces to be supplied on site.

The previous land uses are shown to require more parking than the proposed project. Table 7, below, provides a summary of the estimated parking demand associated with the previous uses on the site, which included assisted living, a skilled nursing facility, and medical office land uses.

**Table 7: Previous Site Parking Demand** 

		Weekday Peak
Description	Size	Parking Demand
Assisted Living <sup>(1)</sup>	60 Beds	26
Nursing Facility <sup>(2)</sup>	142 Beds	52
Medical Office <sup>(3)</sup>	<u>11,000 sf</u>	<u>32</u>
Total Estimated Parking Demand		110

<sup>(1)</sup> ITE Land Use Code 254 (Assisted Living), based on 60 beds.

As shown, the previous land uses are estimated to have had a peak weekday parking demand of approximately 110 vehicles which is 29 more parking spaces than the projected parking demand of the proposed Residence at Carter Mill.

Based on the parking review above, the proposed project is expected to provide a parking supply that exceeds the peak demand of the proposed assisted living and independent living uses on site. The analysis also shows that the proposed project is estimated to have a lesser parking demand than the previous land uses on site. The reduced parking demand of the redevelopment compared to the previous land uses may also reduce the need for on-street parking within the study area.

<sup>(2)</sup> ITE Land Use Code 620 (Nursing Home), based on 142 beds.

<sup>(3)</sup> ITE Land Use Code 720 (Medical-Dental Office Building) based on 11,000 square feet.

#### Site Access and Circulation

Access to the project site is proposed to continue to be provided by two full-access driveways, one located on West Street opposite Avery Square, and one located on Highland Avenue opposite Morton Street. The proposed site driveways would not be significantly modified as part of the project and therefore, the safety and operations at the driveways are not expected to be impacted. The driveways are estimated to experience less traffic volume than the previously occupied site, further reducing potential operational issues associated with the site driveways.

## Sight Distance

A field review of the available sight distance was conducted at the site driveways on West Street and Highland Avenue. The American Association of State Highway and Transportation Officials (AASHTO) publication, *A Policy on Geometric Design*, 2018 Edition, defines minimum and recommended sight distances at intersections. The minimum sight distance is based on the required stopping sight distance (SSD) for vehicles traveling along the main road. According to AASHTO, "If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient time to anticipate and avoid collisions."

In order to accurately assess required sight distance on West Street, a speed study of vehicles at free flow speeds was performed on West Street near the project site. The recorded speeds were reviewed and the 85th percentile speeds were determined to be 24 mph in the eastbound direction and 23 mph in the westbound direction. Because the measured speeds are lower than the posted advisory speed limits on West Street, in order to present a conservative analysis, the posted speed limits of 25 mph in the eastbound direction and 30 mph in the westbound direction were utilized to determine the required sight distance at the site driveway on West Street. For the site driveway on Highland Avenue, the 85th percentile speeds measured from the ATR counts were 32 mph in the northbound direction and 34 mph in the southbound direction and were utilized accordingly for the sight distance review.

Table 8 summarizes the AASHTO sight distance standards for the posted speeds on West Street, the 85<sup>th</sup> percentile speeds on Highland Avenue, and the available sight distance measured at each driveway.

**Table 8: Sight Distance Requirements** 

		Speed	85th %		Sight	Meets
Site Driveway		Limit	Speed	SSD <sup>(1)</sup>	Distance	Required
Location	Looking	(mph)	(mph)	Required	Measured	SSD?
West Street	Left (West)	25	24	155	210	Yes
	Right (East)	30	23	200	500+	Yes
Highland Avenue	Left (North)	30	34	240	150	No
	Right (South)	25	32	220	500+	Yes

<sup>(1)</sup> AASHTO stopping sight distance (see AASHTO equations 3-2 and 3-3) equations for the speed limits or 85th percentile speeds.

As shown in Table 8, the available sight distance for vehicles exiting the site onto West Street looking left towards the west was measured to be approximately 210 feet which exceeds the required AASHTO sight distances for the 30 mph advisory speed limit. At the West Street site driveway looking right towards the east, available sight distance was measured at more than 500 feet down West Street, which exceeds the required and recommended AASHTO sight distances for the 25-mph advisory speed limit. Additional sight lines are available toward vehicles turning from Highland Avenue who would be expected to travel at slower rates of speed.

At the site driveway on Highland, the available sight distance for vehicles exiting the site looking left towards the north was observed to be restricted to approximately 150 feet due to existing on-street parking on the west side of Highland Avenue. The project is not proposing any site changes which would be expected to diminish sight lines more than the existing condition. The available sight distance would not meet the required AASHTO sight distance for the measured 85th percentile speed of 34 mph in the southbound direction. However, it is expected that vehicles exiting the site driveway would exit in two stages, first crossing the sidewalk then turning onto Highland Avenue. As such, sight distance at the site driveway was measured at a point approximately seven feet from the edge of Highland Avenue. The sight distance looking to the left from this point was measured to be approximately 400 feet, which exceeds the AASHTO sight distance for the measured 85th percentile speed of 34 mph in the southbound direction. At the Highland Avenue site driveway looking right towards the south, available sight distance was measured at more than 500 feet, which exceeds the required AASHTO sight distances for the measured 85th percentile speed of 32 mph in the northbound direction.

<sup>(2)</sup> AASHTO intersection sight distance (see AASHTO equations 9-1 and 9-2) equations for the speed limits or 85th percentile speeds.

#### **CONCLUSION**

The proposed project includes the redevelopment of the current vacant building at 100-110 West Street in Needham, MA into the Residence at Carter Mill consisting of 83 units of senior assisted living and 72 units of independent senior. Access to the site would continue to be provided via existing full-access driveways on West Street and Highland Avenue.

Based on the analysis presented in this assessment, the proposed project is estimated to generate approximately 32 new vehicle trips (16 entering vehicles and 16 exiting vehicles) during the weekday morning peak hour and approximately 52 new vehicle trips (26 entering vehicles and 26 exiting vehicles) during the weekday afternoon peak hour compared to the existing vacant site. The trip generation of the proposed redevelopment is shown to be significantly less than that of the previous land uses during the weekday peak hours and over the course of a typical work day.

The capacity analysis indicates that the proposed Residence at Carter Mill redevelopment is projected to have a limited impact on the operations of the roadway network adjacent to the site. The signalized intersection of Highland Avenue at West Street is projected to operate at overall LOS D during the weekday morning and weekday afternoon peak hours under 2026 future conditions with or without the proposed project in place. The intersection is shown to experience an increase of less than one second of overall average vehicle delay during the analyzed peak hours as a result of the project.

The northbound and southbound approaches to the intersection of West Street and Hillside Avenue are shown to currently operate at LOS F during the weekday morning peak hour. Based on the capacity analysis completed as part of this study, the proposed project is not shown to have a significant impact on the overall average delay at the intersection. The project is projected to result in a negligible increase in delay on the stop-controlled Avery Square and Morton Street approaches opposite the site driveways. During both the weekday morning and weekday afternoon peak hours, the exiting movements from the site driveway on West Street are projected to operate at LOS B and the exiting movements from the site driveway on Highland Avenue are projected to operate at LOS C.

Available sight distances at the site driveway on West Street exceed required sight distances. Although the project is not proposing changes to the site access, sight distance looking north from the site driveway on Highland Avenue does not currently meet sight distance requirements. However, available sight lines are expected to provide safe access to the site via two-stage exiting, where a driver can assess the safety of turning onto Highland Avenue by moving closer to the roadway before making a turning decision from a distance closer to Highland Avenue than the AASHTO standard distance. With two-stage exiting, available sight distance looking north along Highland Avenue would exceed that required by AASHTO standards.

Based on the parking supply requirements included in the zoning proposal for the project, the proposed project would require 149 parking spaces. A review of estimated parking demand shows that the proposed parking supply requirements and the proposed on-site parking supply of 149 spaces is expected to exceed the typical peak parking demand of 81 spaces associated with the proposed redevelopment. The reduced parking demand of the redevelopment compared to the previous land uses may also reduce the need for on-street parking within the study area.

Based on the evaluation documented within this traffic impact study, the proposed Residence at Carter Mill redevelopment is not shown to have a significant impact on the overall traffic operations of the study area roadways and is not shown to require improvements to mitigate its limited impacts.



# Appendix for Traffic Impact Study

# The Residence at Carter Mill

100-110 West Street Needham, MA



Prepared by

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Prepared for LCB Senior Living

**Updated February 2021** 

## APPENDIX A

Turning Movement Counts



N/S: Highland Avenue E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name: Highland at Morton-Hildreth AM Site Code : 12051901

Start Date : 12/5/2019

Page No : 1

Groups Printed- Cars - Heavy Vehicles - Bikes by Direction

	Highland Avenue						Mo	rton S	treet	*		High	land A	venue			Hild	lreth P	lace		]
		Fı	om No	rth			F	rom E	ast			Fr	om So	uth			Fr	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	50	2	0	52	2	0	0	1	3	0	70	0	0	70	0	0	0	0	0	125
07:15 AM	0	83	0	0	83	1	0	0	1	2	1	90	0	0	91	0	0	0	0	0	176
07:30 AM	0	85	0	0	85	3	0	1	1	5	1	116	0	0	117	0	0	0	4	4	211
07:45 AM	0	71	1	0	72	1	0	5	0	6	10	149	0	0	159	1	0	0	3	4	241
Total	0	289	3	0	292	7	0	6	3	16	12	425	0	0	437	1	0	0	7	8	753
08:00 AM	0	82	1	0	83	3	0	2	0	5	7	122	0	0	129	0	0	0	1	1	218
08:15 AM	0	65	1	0	66	4	0	0	2	6	4	99	0	0	103	0	0	0	0	0	175
08:30 AM	0	73	2	0	75	1	0	1	1	3	5	102	0	0	107	0	0	0	0	0	185
08:45 AM	0	68	1	0	69	1	0	1	0	2	2	116	1	0	119	0	0	0	0	0	190
Total	0	288	5	0	293	9	0	4	3	16	18	439	1	0	458	0	0	0	1	1	768
Grand Total	0	577	8	0	585	16	0	10	6	32	30	864	1	0	895	1	0	0	8	9	1521
Apprch %	0	98.6	1.4	0		50	0	31.2	18.8		3.4	96.5	0.1	0		11.1	0	0	88.9		
Total %	0	37.9	0.5	0	38.5	1.1	0	0.7	0.4	2.1	2	56.8	0.1	0	58.8	0.1	0	0	0.5	0.6	
Cars	0	541	7	0	548	15	0	10	0	25	29	830	1	0	860	1	0	0	0	1	1434
% Cars	0	93.8	87.5	0	93.7	93.8	0	100	0	78.1	96.7	96.1	100	0	96.1	100	0	0	0	11.1	94.3
Heavy Vehicles																					
% Heavy Vehicles	0	6.2	12.5	0	6.3	6.2	0	0	66.7	15.6	3.3	3.9	0	0	3.9	0	0	0	25	22.2	5.2
Bikes by Direction	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	6	6	8
% Bikes by Direction	0	0	0	0	0	0	0	0	33.3	6.2	0	0	0	0	0	0	0	0	75	66.7	0.5



N/S: Highland Avenue

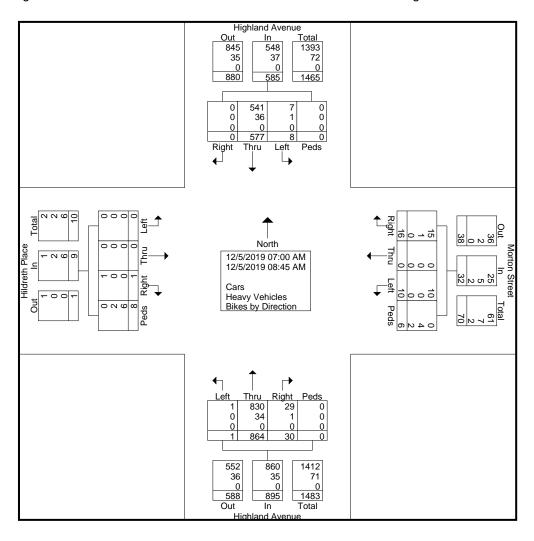
E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name: Highland at Morton-Hildreth AM

Site Code : 12051901 Start Date : 12/5/2019

Page No : 2



		Highl	land A	venue			Mo	rton S	treet			High	and A	venue			Hile	dreth I	Place		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 07	:00 AM	to 08:4	45 AM - 1	Peak 1 o	of 1														
Peak Hour for	Entire 1	Intersec	tion Be	gins at	07:15 AN	1															
07:15 AM	0	83	0	0	83	1	0	0	1	2	1	90	0	0	91	0	0	0	0	0	176
07:30 AM	0	85	0	0	85	3	0	1	1	5	1	116	0	0	117	0	0	0	4	4	211
07:45 AM	0	71	1					5		6	10	149			159	1					241
08:00 AM	0	82	1	0	83	3	0	2	0	5	7	122	0	0	129	0	0	0	1	1	218
Total Volume	0	321	2	0	323	8	0	8	2	18	19	477	0	0	496	1	0	0	8	9	846
% App. Total	0	99.4	0.6	0		44.4	0	44.4	11.1		3.8	96.2	0	0		11.1	0	0	88.9		
PHF	000	944	500	000	950	667	000	400	500	750	475	800	000	000	780	250	000	000	500	563	878



N/S: Highland Avenue

E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth AM Site Code : 12051901

Start Date : 12/5/2019

Page No : 1

**Groups Printed- Cars** 

		High	land A	venue			Moi	rton St		psiine			and A	venue			Hil	dreth P	lace		
			om No					rom E				0	om So					rom W			
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	45	1	0	46	2	0	0	0	2	0	65	0	0	65	0	0	0	0	0	113
07:15 AM	0	78	0	0	78	1	0	0	0	1	1	83	0	0	84	0	0	0	0	0	163
07:30 AM	0	77	0	0	77	3	0	1	0	4	1	113	0	0	114	0	0	0	0	0	195
07:45 AM	0	70	1	0	71	1	0	5	0	6	10	145	0	0	155	1	0	0	0	1	233
Total	0	270	2	0	272	7	0	6	0	13	12	406	0	0	418	1	0	0	0	1	704
08:00 AM	0	79	1	0	80	3	0	2	0	5	7	117	0	0	124	0	0	0	0	0	209
08:15 AM	0	62	1	0	63	3	0	0	0	3	4	96	0	0	100	0	0	0	0	0	166
08:30 AM	0	69	2	0	71	1	0	1	0	2	5	98	0	0	103	0	0	0	0	0	176
08:45 AM	0	61	1	0	62	1	0	1	0	2	1	113	1	0	115	0	0	0	0	0	179
Total	0	271	5	0	276	8	0	4	0	12	17	424	1	0	442	0	0	0	0	0	730
Grand Total	0	541	7	0	548	15	0	10	0	25	29	830	1	0	860	1	0	0	0	1	1434
Apprch %	0	98.7	1.3	0		60	0	40	0		3.4	96.5	0.1	0		100	0	0	0		
Total %	0	37.7	0.5	0	38.2	1	0	0.7	0	1.7	2	57.9	0.1	0	60	0.1	0	0	0	0.1	

		Highland Avenue Morton Street From North From East								0	and Av					dreth P rom W					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Tota
Peak Hour An	alysis F	rom 07:	00 AM	to 08:4	45 AM - I	Peak 1 o	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:30 AN	1															
07:30 AM	0	77	0	0	77	3	0	1	0	4	1	113	0	0	114	0	0	0	0	0	195
07:45 AM	0	70	1					5		6	10	145			155	1				1	233
08:00 AM	0	79	1	0	80	3	0	2	0	5	7	117	0	0	124	0	0	0	0	0	209
08:15 AM	0	62	1	0	63	3	0	0	0	3	4	96	0	0	100	0	0	0	0	0	166
Total Volume	0	288	3	0	291	10	0	8	0	18	22	471	0	0	493	1	0	0	0	1	803
% App. Total	0	99	1	0		55.6	0	44.4	0		4.5	95.5	0	0		100	0	0	0		
DHE	000	011	750	000	909	833	000	400	000	750	550	212	000	000	705	250	000	000	000	250	860



N/S: Highland Avenue E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth AM Site Code : 12051901

Start Date : 12/5/2019

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**Groups Printed- Heavy Vehicles** 

		High	land A	venue			Mo	rton S		iiicu II			and A	venue			Hilo	lreth P	lace		
		Fı	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	5	1	0	6	0	0	0	1	1	0	5	0	0	5	0	0	0	0	0	12
07:15 AM	0	5	0	0	5	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	12
07:30 AM	0	8	0	0	8	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	11
07:45 AM	0	1	0	0	1	0	0	0	0	0	0	4	0	0	4	0	0	0	1	1	6
Total	0	19	1	0	20	0	0	0	1	1	0	19	0	0	19	0	0	0	1	1	41
08:00 AM	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	0	0	0	1	1	9
08:15 AM	0	3	0	0	3	1	0	0	2	3	0	3	0	0	3	0	0	0	0	0	9
08:30 AM	0	4	0	0	4	0	0	0	1	1	0	4	0	0	4	0	0	0	0	0	9
08:45 AM	0	7	0	0	7	0	0	0	0	0	1	3	0	0	4	0	0	0	0	0	11
Total	0	17	0	0	17	1	0	0	3	4	1	15	0	0	16	0	0	0	1	1	38
Grand Total	0	36	1	0	37	1	0	0	4	5	1	34	0	0	35	0	0	0	2	2	79
Apprch %	0	97.3	2.7	0		20	0	0	80		2.9	97.1	0	0		0	0	0	100		
Total %	0	45.6	1.3	0	46.8	1.3	0	0	5.1	6.3	1.3	43	0	0	44.3	0	0	0	2.5	2.5	

		0	and A					rton St				0	land A					lreth F			
		Fr	om No	rth			F	rom Ea	ast			Fr	om So	uth			Fi	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 07:	00 AM	to 08:4	15 AM - I	Peak 1 c	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:00 AN	1															
07:00 AM	0	5	1	_					1	1	0	5	0	0	5	0	0	0	0	0	12
07:15 AM	0	5	0	0	5	0	0	0	0	0	0	7			7	0	0	0	0	0	12
07:30 AM	0	8	0	0	8	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	11
07:45 AM	0	1	0	0	1	0	0	0	0	0	0	4	0	0	4	0	0	0	1	1	6
Total Volume	0	19	1	0	20	0	0	0	1	1	0	19	0	0	19	0	0	0	1	1	41
% App. Total	0	95	5	0		0	0	0	100		0	100	0	0		0	0	0	100		
PHF	.000	.594	.250	.000	.625	.000	.000	.000	.250	.250	.000	.679	.000	.000	.679	.000	.000	.000	.250	.250	.854



N/S: Highland Avenue

E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth AM Site Code : 12051901

Start Date : 12/5/2019

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**Groups Printed- Bikes by Direction** 

		TT: ~l.	ا ۸ استا				Ma			icu- Diki	55.5, 2						TT:1.	Jacobb D	1		1
		0	land A					rton S				0	land A					lreth P			
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
07:30 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	4	4	5
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2
Total	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	6	6	8
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	6	6	8
Apprch %	0	0	0	0		0	0	0	100		0	0	0	0		0	0	0	100		
Total %	0	0	0	0	0	0	0	0	25	25	0	0	0	0	0	0	0	0	75	75	

		0	and A					rton St rom Ea				0	and A					dreth F			
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 07:	00 AM	to 08:4	5 AM - I	Peak 1 c	of 1									•			•	•	
Peak Hour for	Entire I	ntersect	tion Be	gins at	07:00 AN	Peak 1 of 1															
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1
07:30 AM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	4	4	5
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2
Total Volume	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	6	6	8
% App. Total	0	0	0	0		0	0	0	100		0	0	0	0		0	0	0	100		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.500	.500	.000	.000	.000	.000	.000	.000	.000	.000	.375	.375	.400



N/S: Highland Avenue

E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name: Highland at Morton-Hildreth PM

Site Code : 12041900 Start Date : 12/4/2019

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Groups Printed- Cars - Heavy Vehicles - Bikes by Direction

		High	land A	venue			Mo	rton St	reet			Highl	and A	venue			Hild	lreth P	lace		
		Fı	rom No	rth			F	rom Ea	ast			Fr	om So	uth			Fr	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	109	1	0	110	1	0	2	1	4	0	98	0	0	98	1	0	0	3	4	216
04:15 PM	0	118	1	0	119	3	0	3	13	19	5	97	0	0	102	0	0	0	3	3	243
04:30 PM	1	112	4	0	117	3	0	0	12	15	6	117	0	0	123	0	0	0	1	1	256
04:45 PM	0	139	4	3	146	4	1	2	3	10	5	91	0	0	96	0	0	0	2	2	254
Total	1	478	10	3	492	11	1	7	29	48	16	403	0	0	419	1	0	0	9	10	969
																•					
05:00 PM	1	145	7	1	154	1	0	4	0	5	8	85	0	0	93	0	0	0	1	1	253
05:15 PM	0	130	1	0	131	1	0	0	1	2	4	86	1	0	91	0	0	0	1	1	225
05:30 PM	0	137	2	0	139	1	0	3	0	4	4	85	0	0	89	0	0	0	0	0	232
05:45 PM	0	116	4	5	125	0	2	3	3	8	5	85	1	2	93	0	0	0	3	3	229
Total	1	528	14	6	549	3	2	10	4	19	21	341	2	2	366	0	0	0	5	5	939
Grand Total	2	1006	24	9	1041	14	3	17	33	67	37	744	2	2	785	1	0	0	14	15	1908
Apprch %	0.2	96.6	2.3	0.9		20.9	4.5	25.4	49.3		4.7	94.8	0.3	0.3		6.7	0	0	93.3		
Total %	0.1	52.7	1.3	0.5	54.6	0.7	0.2	0.9	1.7	3.5	1.9	39	0.1	0.1	41.1	0.1	0	0	0.7	0.8	
Cars	2	993	22	0	1017	14	2	17	0	33	35	736	2	0	773	1	0	0	0	1	1824
% Cars	100	98.7	91.7	0	97.7	100	66.7	100	0	49.3	94.6	98.9	100	0	98.5	100	0	0	0	6.7	95.6
Heavy Vehicles	0	13	2	7	22	0	1	0	16	17	2	8	0	0	10	0	0	0	9	9	58
% Heavy Vehicles	0	1.3	8.3	77.8	2.1	0	33.3	0	48.5	25.4	5.4	1.1	0	0	1.3	0	0	0	64.3	60	3
Bikes by Direction	0	0	0	2	2	0	0	0	17	17	0	0	0	2	2	0	0	0	5	5	26
% Bikes by Direction	0	0	0	22.2	0.2	0	0	0	51.5	25.4	0	0	0	100	0.3	0	0	0	35.7	33.3	1.4



N/S: Highland Avenue

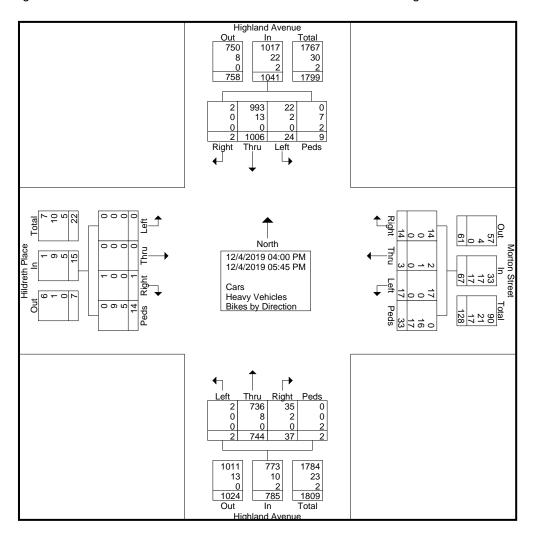
E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth PM

Site Code : 12041900 Start Date : 12/4/2019

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		High	land A	venue			Mo	rton St	treet			High	land A	venue			Hilo	lreth P	lace		
		Fr	om No	rth			F	rom Ea	ast			Fr	om So	uth			Fr	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 04	:00 PM	to 05:4	5 PM - P	eak 1 o	f 1														
Peak Hour for	Entire 1	Intersec	tion Be	gins at (	04:15 PM	1															
04:15 PM	0	118	1	0	119	3	0	3	13	19	5	97	0	0	102	0	0	0	3	3	243
04:30 PM	1											117			123	0	0	0	1	1	256
04:45 PM	0	139	4	3		4	1													ļ	
05:00 PM	1	145	7	1	154	1	0	4	0	5	8	85	0	0	93	0	0	0	1	1	253
Total Volume	2	514	16	4	536	11	1	9	28	49	24	390	0	0	414	0	0	0	7	7	1006
% App. Total	0.4	95.9	3	0.7		22.4	2	18.4	57.1		5.8	94.2	0	0		0	0	0	100		
PHF	.500	.886	.571	.333	.870	.688	.250	.563	.538	.645	.750	.833	.000	.000	.841	.000	.000	.000	.583	.583	.982



N/S: Highland Avenue E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth PM Site Code : 12041900

Start Date : 12/4/2019

Page No : 1

**Groups Printed- Cars** 

									Grou	ps r riiit	cu- ca										
		Highl	and A	venue			Mo	rton St	reet			Highl	land Av	enue			Hild	lreth P	lace		
		Fr	om No	rth			F	rom Ea	ast			Fr	om Sou	ıth			Fr	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	107	1	0	108	1	0	2	0	3	0	97	0	0	97	1	0	0	0	1	209
04:15 PM	0	116	1	0	117	3	0	3	0	6	5	95	0	0	100	0	0	0	0	0	223
04:30 PM	1	112	4	0	117	3	0	0	0	3	6	115	0	0	121	0	0	0	0	0	241
04:45 PM	0	138	4	0	142	4	1_	2	0	7	5	90	0	0	95	0	0	0	0	0	244
Total	1	473	10	0	484	11	1	7	0	19	16	397	0	0	413	1	0	0	0	1	917
05:00 PM	1	142	6	0	149	1	0	4	0	5	8	85	0	0	93	0	0	0	0	0	247
05:15 PM	0	127	1	0	128	1	0	0	0	1	4	86	1	0	91	0	0	0	0	0	220
05:30 PM	0	137	2	0	139	1	0	3	0	4	4	83	0	0	87	0	0	0	0	0	230
05:45 PM	0	114	3	0	117	0	1	3	0	4	3	85	1	0	89	0	0	0	0	0	210
Total	1	520	12	0	533	3	1	10	0	14	19	339	2	0	360	0	0	0	0	0	907
Grand Total	2	993	22	0	1017	14	2	17	0	33	35	736	2	0	773	1	0	0	0	1	1824
Apprch %	0.2	97.6	2.2	0		42.4	6.1	51.5	0		4.5	95.2	0.3	0		100	0	0	0		
Total %	0.1	54.4	1.2	0	55.8	0.8	0.1	0.9	0	1.8	1.9	40.4	0.1	0	42.4	0.1	0	0	0	0.1	

		0	and A					rton St				0	land A					lreth F			
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1														
Peak Hour for	Entire 1	Intersec	tion Be	gins at	04:15 PM	1															
04:15 PM	0	116	1	0	117	3	0	3	0	6	5	95	0	0	100	0	0	0	0	0	223
04:30 PM	1											115			121	0	0	0	0	0	241
04:45 PM	0	138	4	0	142	4	1			7	5	90	0	0	95	0	0	0	0	0	244
05:00 PM	1	142	6		149	1	0	4			8										247
Total Volume	2	508	15	0	525	11	1	9	0	21	24	385	0	0	409	0	0	0	0	0	955
% App. Total	0.4	96.8	2.9	0		52.4	4.8	42.9	0		5.9	94.1	0	0		0	0	0	0		
PHF	.500	.894	.625	.000	.881	.688	.250	.563	.000	.750	.750	.837	.000	.000	.845	.000	.000	.000	.000	.000	.967



N/S: Highland Avenue E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth PM Site Code : 12041900

Start Date : 12/4/2019

Page No : 1

**Groups Printed- Heavy Vehicles** 

										iiicu- ii	. , , , ,										1
		High	land A	venue			Mo	rton St	treet			Highl	land A	venue			Hild	lreth P	lace		
		Fı	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	2	2	5
04:15 PM	0	2	0	0	2	0	0	0	4	4	0	2	0	0	2	0	0	0	3	3	11
04:30 PM	0	0	0	0	0	0	0	0	7	7	0	2	0	0	2	0	0	0	0	0	9
04:45 PM	0	1	0	2	3	0	0	0	2	2	0	1_	0	0	1	0	0	0	1	1	7
Total	0	5	0	2	7	0	0	0	13	13	0	6	0	0	6	0	0	0	6	6	32
05:00 PM	0	3	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
05:15 PM	0	3	0	0	3	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	5
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	2
05:45 PM	0	2	1	5	8	0	1	0	2	3	2	0	0	0	2	0	0	0	2	2	15
Total	0	8	2	5	15	0	1	0	3	4	2	2	0	0	4	0	0	0	3	3	26
Grand Total	0	13	2	7	22	0	1	0	16	17	2	8	0	0	10	0	0	0	9	9	58
Apprch %	0	59.1	9.1	31.8		0	5.9	0	94.1		20	80	0	0		0	0	0	100		
Total %	0	22.4	3.4	12.1	37.9	0	1.7	0	27.6	29.3	3.4	13.8	0	0	17.2	0	0	0	15.5	15.5	

		Highl	land A	venue			Mo	rton St	treet			High	land A	venue			Hilo	lreth F	lace		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:00 PM	I															
04:00 PM	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	0	2	2	5
04:15 PM	0	2	0	0	2	0	0	0	4	4	0	2			2	0	0	0	3	3	11
04:30 PM	0	0	0	0	0	0	0	0	7	7	0	2	0	0	2	0	0	0	0	0	9
04:45 PM	0	1	0	2	3	0	0	0	2	2	0	1	0	0	1	0	0	0	1	1	7_
Total Volume	0	5	0	2	7	0	0	0	13	13	0	6	0	0	6	0	0	0	6	6	32
% App. Total	0	71.4	0	28.6		0	0	0	100		0	100	0	0		0	0	0	100		
PHF	.000	.625	.000	.250	.583	.000	.000	.000	.464	.464	.000	.750	.000	.000	.750	.000	.000	.000	.500	.500	.727



N/S: Highland Avenue

E/W: Morton Street/Hildreth Place

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at Morton-Hildreth PM Site Code : 12041900

Site Code : 12041900 Start Date : 12/4/2019

Page No : 1

**Groups Printed- Bikes by Direction** 

		Highl	and A	venue			Mo	rton St		2111			and A	venue			Hile	dreth P	lace		
		Fr	om No	rth			F	rom Ea	ast			Fr	om So	uth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
04:15 PM	0	0	0	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9
04:30 PM	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	1	1	6
04:45 PM	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	3_
Total	0	0	0	1	1	0	0	0	16	16	0	0	0	0	0	0	0	0	3	3	20
05:00 PM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	1	1	0	0	0	2	2	0	0	0	1	1	4
Total	0	0	0	1	1	0	0	0	1	1	0	0	0	2	2	0	0	0	2	2	6
Grand Total	0	0	0	2	2	0	0	0	17	17	0	0	0	2	2	0	0	0	5	5	26
Apprch %	0	0	0	100		0	0	0	100		0	0	0	100		0	0	0	100		
Total %	0	0	0	7.7	7.7	0	0	0	65.4	65.4	0	0	0	7.7	7.7	0	0	0	19.2	19.2	

		0	and A					rton St				0	and A					dreth P			
		Fr	om No	rth			F	rom Ea	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:00 PM	Į															
04:00 PM	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2
04:15 PM	0	0	0	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	0	0	9
04:30 PM	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	1	1	6
04:45 PM	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	3
Total Volume	0	0	0	1	1	0	0	0	16	16	0	0	0	0	0	0	0	0	3	3	20
% App. Total	0	0	0	100		0	0	0	100		0	0	0	0		0	0	0	100		
PHF	.000	.000	.000	.250	.250	.000	.000	.000	.444	.444	.000	.000	.000	.000	.000	.000	.000	.000	.750	.750	.556



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West AM

Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

**Groups Printed- Cars - Heavy Vehicles - Bikes by Direction** 

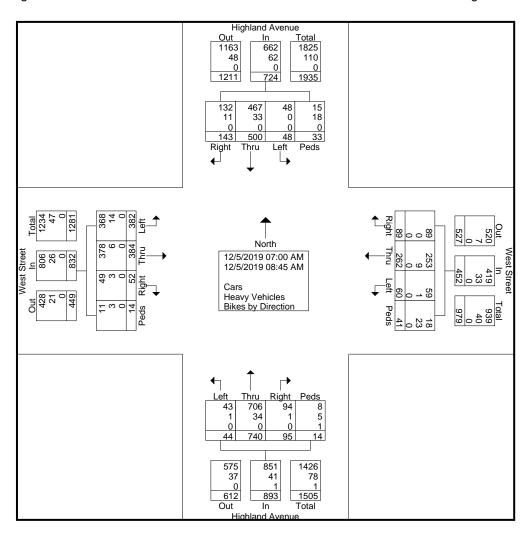
		Highl	and A	venue		•	W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	14	44	7	3	68	6	15	3	0	24	3	64	3	3	73	5	39	49	1	94	259
07:15 AM	9	75	3	12	99	11	15	6	1	33	8	81	2	1	92	8	48	54	3	113	337
07:30 AM	16	71	5	1	93	8	22	11	8	49	17	87	5	1	110	5	53	48	1	107	359
07:45 AM	21	55	4	3	83	14	36_	9	10	69	10	122	8	5	145	8	52	42	5_	107	404
Total	60	245	19	19	343	39	88	29	19	175	38	354	18	10	420	26	192	193	10	421	1359
	1															ı					1
08:00 AM	27	66	3	4	100	8	52	13	10	83	11	117	7	1	136	5	46	46	1	98	417
08:15 AM	21	65	6	5	97	18	37	4	6	65	19	85	5	0	109	8	52	46	1	107	378
08:30 AM	17	69	10	4	100	11	43	9	3	66	12	89	8	3	112	7	46	55	2	110	388
08:45 AM	18	55	10	1	84	13	42	5	3	63	15	95	6	0	116	6	48	42	0	96	359
Total	83	255	29	14	381	50	174	31	22	277	57	386	26	4	473	26	192	189	4	411	1542
Grand Total	143	500	48	33	724	89	262	60	41	452	95	740	44	14	893	52	384	382	14	832	2901
Apprch %	19.8	69.1	6.6	4.6		19.7	58	13.3	9.1		10.6	82.9	4.9	1.6		6.2	46.2	45.9	1.7		
Total %	4.9	17.2	1.7	1.1	25	3.1	9	2.1	1.4	15.6	3.3	25.5	1.5	0.5	30.8	1.8	13.2	13.2	0.5	28.7	
Cars	132	467	48	15	662	89	253	59	18	419	94	706	43	8	851	49	378	368	11	806	2738
% Cars	92.3	93.4	100	45.5	91.4	100	96.6	98.3	43.9	92.7	98.9	95.4	97.7	57.1	95.3	94.2	98.4	96.3	78.6	96.9	94.4
Heavy Vehicles																					
% Heavy Vehicles	7.7	6.6	0	54.5	8.6	0	3.4	1.7	56.1	7.3	1.1	4.6	2.3	35.7	4.6	5.8	1.6	3.7	21.4	3.1	5.6
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	7.1	0.1	0	0	0	0	0	0

N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West AM

Site Code : 12052019 Start Date : 12/5/2019

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		Highl	and A	venue			W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 07:	00 AM	to 08:4	15 AM - I	Peak 1 c	of 1														
Peak Hour for	Entire 1	Intersect	tion Be	gins at (	07:45 AN	1															
07:45 AM	21	55	4	3	83	14	36	9	10	69	10	122	8	5	145	8	52	42	5		
08:00 AM	27	66	3	4	100	8	52	13	10	83	11	117	7	1	136	5	46	46	1	98	417
08:15 AM	21	65	6	5		18	37	4	6	65	19										
08:30 AM	17	69	10	4	100	11	43	9	3	66	12	89	8	3	112	7	46	55	2	110	388
Total Volume	86	255	23	16	380	51	168	35	29	283	52	413	28	9	502	28	196	189	9	422	1587
% App. Total	22.6	67.1	6.1	4.2		18	59.4	12.4	10.2		10.4	82.3	5.6	1.8		6.6	46.4	44.8	2.1		
PHF	.796	.924	.575	.800	.950	.708	.808	.673	.725	.852	.684	.846	.875	.450	.866	.875	.942	.859	.450	.959	.951



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at West AM Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

**Groups Printed- Cars** 

									Orou	ps r r iii	cu- Ca	1.0									
		Highl	and A	venue			W	est Str	eet			Highl	land Av	venue			$\mathbf{W}$	est Str	eet		
		Fr	om No	rth			Fı	om Ea	ast			Fr	om Sou	ıth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	12	40	7	2	61	6	12	3	0	21	3	59	3	1	66	3	39	45	1	88	236
07:15 AM	7	70	3	6	86	11	13	6	0	30	8	74	2	1	85	8	48	53	3	112	313
07:30 AM	15	64	5	0	84	8	22	10	3	43	16	85	5	0	106	5	53	47	0	105	338
07:45 AM	19	55	4	2	80	14	36	9	3	62	10	118	8	3	139	8	49	42	4	103	384
Total	53	229	19	10	311	39	83	28	6	156	37	336	18	5	396	24	189	187	8	408	1271
08:00 AM	26	63	3	2	94	8	51	13	5	77	11	113	6	1	131	4	45	45	1	95	397
08:15 AM	19	62	6	2	89	18	37	4	4	63	19	81	5	0	105	8	51	43	0	102	359
08:30 AM	17	64	10	0	91	11	42	9	1	63	12	84	8	2	106	7	45	51	2	105	365
08:45 AM	17	49	10	1_	77	13	40	5	2	60	15	92	6	0	113	6	48	42	0	96	346
Total	79	238	29	5	351	50	170	31	12	263	57	370	25	3	455	25	189	181	3	398	1467
Grand Total	132	467	48	15	662	89	253	59	18	419	94	706	43	8	851	49	378	368	11	806	2738
Apprch %	19.9	70.5	7.3	2.3		21.2	60.4	14.1	4.3		11	83	5.1	0.9		6.1	46.9	45.7	1.4		
Total %	4.8	17.1	1.8	0.5	24.2	3.3	9.2	2.2	0.7	15.3	3.4	25.8	1.6	0.3	31.1	1.8	13.8	13.4	0.4	29.4	

			and Av					est Str rom Ea				0	land A					est Str rom W			
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 07:	00 AM	to 08:4	45 AM - I	Peak 1 c	of 1												•		
Peak Hour for	Entire 1	Intersec	tion Be	gins at	07:45 AN	1															
07:45 AM	19	55	4	2								118	8	3	139	8			4		
08:00 AM	26	63	3	2	94	8	51	13	5	77	11	113	6	1	131	4	45	45	1	95	397
08:15 AM	19	62	6	2	89	18	37	4	4	63	19						51	43	0	102	359
08:30 AM	17	64	10															51		105	365
Total Volume	81	244	23	6	354	51	166	35	13	265	52	396	27	6	481	27	190	181	7	405	1505
% App. Total	22.9	68.9	6.5	1.7		19.2	62.6	13.2	4.9		10.8	82.3	5.6	1.2		6.7	46.9	44.7	1.7		
PHF	.779	.953	.575	.750	.941	.708	.814	.673	.650	.860	.684	.839	.844	.500	.865	.844	.931	.887	.438	.964	.948



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at West AM Site Code : 12052019 Start Date : 12/5/2019

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**Groups Printed- Heavy Vehicles** 

								OIU	upsiii	mieu- m	avy v	incics									
		Highl	and A	venue			W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			Fı	rom Ea	ast			Fr	om Sou	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	2	4	0	1	7	0	3	0	0	3	0	5	0	2	7	2	0	4	0	6	23
07:15 AM	2	5	0	6	13	0	2	0	1	3	0	7	0	0	7	0	0	1	0	1	24
07:30 AM	1	7	0	1	9	0	0	1	5	6	1	2	0	1	4	0	0	1	1	2	21
07:45 AM	2	0	0	1	3	0	0	0	7	7	0	4	0	1	5	0	3	0	1	4	19
Total	7	16	0	9	32	0	5	1	13	19	1	18	0	4	23	2	3	6	2	13	87
08:00 AM	1	3	0	2	6	0	1	0	5	6	0	4	1	0	5	1	1	1	0	3	20
08:15 AM	2	3	0	3	8	0	0	0	2	2	0	4	0	0	4	0	1	3	1	5	19
08:30 AM	0	5	0	4	9	0	1	0	2	3	0	5	0	1	6	0	1	4	0	5	23
08:45 AM	1	6	0	0	7	0	2	0	1	3	0	3	0	0	3	0	0	0	0	0	13
Total	4	17	0	9	30	0	4	0	10	14	0	16	1	1	18	1	3	8	1	13	75
Grand Total	11	33	0	18	62	0	9	1	23	33	1	34	1	5	41	3	6	14	3	26	162
Apprch %	17.7	53.2	0	29		0	27.3	3	69.7		2.4	82.9	2.4	12.2		11.5	23.1	53.8	11.5		
Total %	6.8	20.4	0	11.1	38.3	0	5.6	0.6	14.2	20.4	0.6	21	0.6	3.1	25.3	1.9	3.7	8.6	1.9	16	

		0	land A					est Str				0	land A					est Str			
		Fr	om No	rtn			F	rom E	ast			<u> Fr</u>	om So	utn			Fl	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 07:	:00 AM	to 08:4	45 AM - F	Peak 1 c	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:00 AM	1															
07:00 AM	2			_			3							2	7	2		4		6	23
07:15 AM	2	5	0	6	13	0	2	0	1	3	0	7									24
07:30 AM	1	7	0	1	9	0	0	1			1								1		
07:45 AM	2	0	0	1	3	0	0	0	7	7	0	4	0	1	5	0	3	0	1	4	19
Total Volume	7	16	0	9	32	0	5	1	13	19	1	18	0	4	23	2	3	6	2	13	87
% App. Total	21.9	50	0	28.1		0	26.3	5.3	68.4		4.3	78.3	0	17.4		15.4	23.1	46.2	15.4		
PHF	.875	.571	.000	.375	.615	.000	.417	.250	.464	.679	.250	.643	.000	.500	.821	.250	.250	.375	.500	.542	.906



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West AM

Site Code : 12052019 Start Date : 12/5/2019

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**Groups Printed- Bikes by Direction** 

										icu- Diki	55 25 25										1
		High	land A	venue			W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om Sou	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Apprch %	0	0	0	0		0	0	0	0		0	0	0	100		0	0	0	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	0	0	100	100	0	0	0	0	0	

		0	and A					est Str				0	and A					est Str			
		<u> </u>	om No	rth			F	rom Ea	ast			Fr	om So	uth			Fi	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 07:	00 AM	to 08:4	15 AM - I	Peak 1 c	of 1														
Peak Hour for	Entire I	Right   Thru   Left   Peds   App. Total   Right   u   Left   Peds   App. Total   Right   Thru   Left   Thru   Thru   Left   Thru   Th																			
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
% App. Total	0	0	0	0		0	0	0	0		0	0	0	100		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.000	.000	.000	.000	.250



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West PM

Site Code : 12042019 Start Date : 12/4/2019

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**Groups Printed- Cars - Heavy Vehicles - Bikes by Direction** 

		Highl	and A	venue			W	est Str	eet	•		Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	11	84	10	1	106	14	38	10	3	65	16	90	2	7	115	11	50	43	4	108	394
04:15 PM	15	105	12	5	137	11	30	14	12	67	13	61	9	6	89	7	37	42	3	89	382
04:30 PM	13	101	5	3	122	12	34	16	21	83	9	101	6	6	122	5	53	36	0	94	421
04:45 PM	12	118	2	2	134	15	26	11	7	59	20	84	4	1	109	12	57	43	1	113	415
Total	51	408	29	11	499	52	128	51	43	274	58	336	21	20	435	35	197	164	8	404	1612
05:00 PM	16	113	14	1	144	13	39	22	5	79	11	71	9	0	91	12	62	43	1	118	432
05:15 PM	30	106	9	1	146	14	40	12	3	69	7	89	4	1	101	16	36	32	2	86	402
05:30 PM	8	116	8	1	133	14	33	8	3	58	10	70	7	0	87	15	38	30	0	83	361
05:45 PM	20	98	13	8	139	14	31	18	13	76	8	80	2	2	92	9	52	28	2	91	398
Total	74	433	44	11	562	55	143	60	24	282	36	310	22	3	371	52	188	133	5	378	1593
Grand Total	125	841	73	22	1061	107	271	111	67	556	94	646	43	23	806	87	385	297	13	782	3205
Apprch %	11.8	79.3	6.9	2.1		19.2	48.7	20	12.1		11.7	80.1	5.3	2.9		11.1	49.2	38	1.7		
Total %	3.9	26.2	2.3	0.7	33.1	3.3	8.5	3.5	2.1	17.3	2.9	20.2	1.3	0.7	25.1	2.7	12	9.3	0.4	24.4	
Cars	118	823	73	17	1031	105	265	110	44	524	94	637	41	15	787	86	384	291	8	769	3111
% Cars	94.4	97.9	100	77.3	97.2	98.1	97.8	99.1	65.7	94.2	100	98.6	95.3	65.2	97.6	98.9	99.7	98	61.5	98.3	97.1
Heavy Vehicles																					
% Heavy Vehicles	5.6	2.1	0	22.7	2.8	1.9	2.2	0.9	34.3	5.8	0	1.4	4.7	34.8	2.4	1.1	0.3	2	38.5	1.7	2.9
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

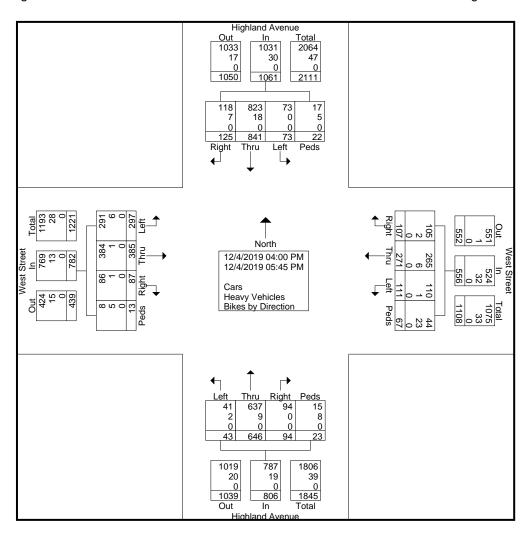


N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West PM

Site Code : 12042019 Start Date : 12/4/2019

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		Highl	and A	venue			W	est Str	eet			High	land A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om So	uth			Fı	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	:00 PM	to 05:4	5 PM - P	eak 1 o	f 1														
Peak Hour for	Entire 1	Intersec	tion Be	gins at	04:30 PM	1															
04:30 PM	13	101	5	3					21	83	9	101		6	122	5	53	36	0	94	421
04:45 PM	12	118	2	2	134	15	26	11	7	59	20							43		Į.	
05:00 PM	16	113	14	1	144	13	39	22	5	79	11	71	9	0	91	12	62	43	1	118	432
05:15 PM	30				146	14	40									16			2		
Total Volume	71	438	30	7	546	54	139	61	36	290	47	345	23	8	423	45	208	154	4	411	1670
% App. Total	13	80.2	5.5	1.3		18.6	47.9	21	12.4		11.1	81.6	5.4	1.9		10.9	50.6	37.5	1		
PHF	.592	.928	.536	.583	.935	.900	.869	.693	.429	.873	.588	.854	.639	.333	.867	.703	.839	.895	.500	.871	.966



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at West PM Site Code : 12042019

Start Date : 12/4/2019

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**Groups Printed- Cars** 

		High	land A	venue			W	est Str		psiine			and A	venue			W	est Str	eet		]
		0	om No					rom E				- 0	om So					rom W			
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	11	82	10	1	104	14	37	10	1	62	16	89	2	4	111	11	50	41	3	105	382
04:15 PM	13	104	12	4	133	10	30	13	6	59	13	60	9	5	87	7	36	42	3	88	367
04:30 PM	11	98	5	1	115	12	32	16	11	71	9	97	5	5	116	5	53	34	0	92	394
04:45 PM	11	117	2	2	132	15	25	11	6	57	20	83	3	1	107	12	57	43	1	113	409
Total	46	401	29	8	484	51	124	50	24	249	58	329	19	15	421	35	196	160	7	398	1552
05:00 PM	16	108	14	0	138	13	39	22	4	78	11	71	9	0	91	12	62	41	0	115	422
05:15 PM	29	103	9	1	142	13	40	12	3	68	7	89	4	0	100	16	36	32	1	85	395
05:30 PM	8	116	8	0	132	14	31	8	2	55	10	68	7	0	85	14	38	30	0	82	354
05:45 PM	19	95	13	8	135	14	31	18	11	74	8	80	2	0	90	9	52	28	0	89	388
Total	72	422	44	9	547	54	141	60	20	275	36	308	22	0	366	51	188	131	1	371	1559
Grand Total	118	823	73	17	1031	105	265	110	44	524	94	637	41	15	787	86	384	291	8	769	3111
Apprch %	11.4	79.8	7.1	1.6		20	50.6	21	8.4		11.9	80.9	5.2	1.9		11.2	49.9	37.8	1		
Total %	3.8	26.5	2.3	0.5	33.1	3.4	8.5	3.5	1.4	16.8	3	20.5	1.3	0.5	25.3	2.8	12.3	9.4	0.3	24.7	

		0	and A					est Str				0	land A					est Str			
		Fr	om No	rth			F	rom E	ast			<u> </u>	om So	uth			Fi	rom W	<u>est</u>		
Start Time	Right	Thru	Left	Peds	App. Total	Right	u u u						Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:30 PM	I															
04:30 PM	11	98	5	1	115	12	32	16	11	71	9	97		5	116	5	53	34	0	92	394
04:45 PM	11	117	2	2		15	25	11	6	57	20							43	1		
05:00 PM	16	108	14	0	138	13	39	22	4	78	11	71	9	0	91	12	62	41	0	115	422
05:15 PM	29				142	13	40									16					
Total Volume	67	426	30	4	527	53	136	61	24	274	47	340	21	6	414	45	208	150	2	405	1620
% App. Total	12.7	80.8	5.7	0.8		19.3	49.6	22.3	8.8		11.4	82.1	5.1	1.4		11.1	51.4	37	0.5		
PHF	.578	.910	.536	.500	.928	.883	.850	.693	.545	.878	.588	.876	.583	.300	.892	.703	.839	.872	.500	.880	.960



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living

File Name : Highland at West PM Site Code : 12042019 Start Date : 12/4/2019

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**Groups Printed- Heavy Vehicles** 

								OIU	upsiii	meu- m	avy v	incics									
		Highl	and Av	venue			W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			Fı	rom Ea	ast			Fr	om So	uth			Fı	om W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	2	0	0	2	0	1	0	2	3	0	1	0	3	4	0	0	2	1	3	12
04:15 PM	2	1	0	1	4	1	0	1	6	8	0	1	0	1	2	0	1	0	0	1	15
04:30 PM	2	3	0	2	7	0	2	0	10	12	0	4	1	1	6	0	0	2	0	2	27
04:45 PM	1	1	0	0	2	0	1_	0	1	2	0	1	1	0	2	0	0	0	0	0	6
Total	5	7	0	3	15	1	4	1	19	25	0	7	2	5	14	0	1	4	1	6	60
05:00 PM	0	5	0	1	6	0	0	0	1	1	0	0	0	0	0	0	0	2	1	3	10
05:15 PM	1	3	0	0	4	1	0	0	0	1	0	0	0	1	1	0	0	0	1	1	7
05:30 PM	0	0	0	1	1	0	2	0	1	3	0	2	0	0	2	1	0	0	0	1	7
05:45 PM	1	3	0	0	4	0	0	0	2	2	0	0	0	2	2	0	0	0	2	2	10
Total	2	11	0	2	15	1	2	0	4	7	0	2	0	3	5	1	0	2	4	7	34
Grand Total	7	18	0	5	30	2	6	1	23	32	0	9	2	8	19	1	1	6	5	13	94
Apprch %	23.3	60	0	16.7		6.2	18.8	3.1	71.9		0	47.4	10.5	42.1		7.7	7.7	46.2	38.5		
Total %	7.4	19.1	0	5.3	31.9	2.1	6.4	1.1	24.5	34	0	9.6	2.1	8.5	20.2	1.1	1.1	6.4	5.3	13.8	

			and Av					est Str rom Ea				0	land A					est Str rom W			
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1												•		
Peak Hour for	Entire 1	Intersec	tion Be	gins at	04:00 PM	I															
04:00 PM	0	2	0	0	2	0	1	0	2	3	0	1	0	3				2	1	3	12
04:15 PM	2					1	0	1									1	0	0	1	15
04:30 PM	2	3	0	2	7	0	2		10	12	0	4	1	1	6	0	0	2	0	2	27
04:45 PM	1	1	0	0	2	0	1	0	1	2	0	1	1	0	2	0	0	0	0	0	6
Total Volume	5	7	0	3	15	1	4	1	19	25	0	7	2	5	14	0	1	4	1	6	60
% App. Total	33.3	46.7	0	20		4	16	4	76		0	50	14.3	35.7		0	16.7	66.7	16.7		
PHF	.625	.583	.000	.375	.536	.250	.500	.250	.475	.521	.000	.438	.500	.417	.583	.000	.250	.500	.250	.500	.556



N/S: Highland Avenue E/W: West Street

City, State: Needham, MA Client: LCB Senior Living File Name: Highland at West PM

Site Code : 12042019 Start Date : 12/4/2019

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**Groups Printed- Bikes by Direction** 

	T									icu- Dike	55 5 5 5										1
		High	land A	venue			W	est Str	eet			Highl	and A	venue			W	est Str	eet		
		Fr	om No	rth			F	rom E	ast			Fr	om Soi	uth			Fı	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

		0	and A					est Str				0	land A					est Str			
		Fr	om No	rth			F	rom Ea	ast			Fr	om So	uth			Fı	rom W	est		<u> </u>
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thr u	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 of	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:00 PM	Į															
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_AM

Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

% Bikes by Direction

Groups Printed- Cars & CW Pedestrians - HV & CCW Pedestrians - Bikes by Direction Avery Square West Street West Street Avery Square From North From East From South From West Left Peds Left Peds Start Time Right Right Thru Right Thru Left Peds Right Thru Left Peds Thru App. Total App. Total App. Total App. Total Int. Total 07:00 AM 07:15 AM 07:30 AM 07:45 AM Total 08:00 AM 08:15 AM 08:30 AM 08:45 AM Total Grand Total Apprch % 75.8 10.7 13.5 Total % 92.3 0.9 1.7 0.9 4.3 1.7 12.4 0.4 0.4 0.4 0.4 2.6 1.7 Cars & CW Pedestrians % Cars & CW % HV & CCW Bikes by Direction

			ery Squ					est Stre					ery Squ					est Stre			
		Fr	om No	rth			F	rom Ea	ıst			Fr	om Soi	ıth			F1	rom We	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis Fı	om 07:	00 AM	to 08:4	5 AM - 1	Peak 1 o	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at (	)7:45 AN	Л															
07:45 AM	29	0	0	7	36	1	0	0	0	1	0	0	0	2	2	0	0	0	2	2	41
08:00 AM	18	0	5	1	24	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	25
08:15 AM	19	0	1	4	24	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	26
08:30 AM	29	0	7	5	41	0	0	0	0	0	0	1	0	0	1	0	0	0	2	2	44
Total Volume	95	0	13	17	125	1	0	1	0	2	0	1	1	3	5	0	0	0	4	4	136
% App. Total	76	0	10.4	13.6		50	0	50	0		0	20	20	60		0	0	0	100		
PHF	.819	.000	.464	.607	.762	.250	.000	.250	.000	.500	.000	.250	.250	.375	.625	.000	.000	.000	.500	.500	.773

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_AM

Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- Cars & CW Pedestrians

											· Curs cc											1
				ery Sq					est Stre					ery Squ					est Stre			
			Fı	rom No	orth			F	rom Ea	ıst			Fr	om Sou	ıth			Fı	rom We	est		
Star	rt Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07	:00 AM	18	0	2	3	23	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	25
07	':15 AM	15	0	3	8	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
07	':30 AM	17	0	3	0	20	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	21
07	':45 AM	29	0	0	7	36	1	0	0	0	1	0	0	0	2	2	0	0	0	2	2	41
	Total	79	0	8	18	105	1	0	0	1	2	0	0	0	4	4	0	0	0	2	2	113
08	3:00 AM	18	0	5	1	24	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	25
08	3:15 AM	19	0	1	4	24	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	26
08	3:30 AM	29	0	7	5	41	0	0	0	0	0	0	1	0	0	1	0	0	0	2	2	44
08	3:45 AM	18	0	2	1	21	0	0	1	0	1	1	0	1	1	3	0	0	0	0	0	25
	Total	84	0	15	11	110	0	0	2	0	2	1	1	2	2	6	0	0	0	2	2	120
Gra	and Total	163	0	23	29	215	1	0	2	1	4	1	1	2	6	10	0	0	0	4	4	233
Ar	oprch %	75.8	0	10.7	13.5		25	0	50	25		10	10	20	60		0	0	0	100		
	Total %	70	0	9.9	12.4	92.3	0.4	0	0.9	0.4	1.7	0.4	0.4	0.9	2.6	4.3	0	0	0	1.7	1.7	

		Ave	ery Squ	are			W	est Stre	eet			Av	ery Squ	are			W	est Stre	eet		1
		Fr	om No	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 07:	00 AM	to 08:4	45 AM - 1	Peak 1	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:45 AN	M															
07:45 AM	29	0	0	7	36	1	0	0	0	1	0	0	0	2	2	0	0	0	2	2	41
08:00 AM	18	0	5	1	24	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	25
08:15 AM	19	0	1	4	24	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	26
08:30 AM	29	0	7	5	41	0	0	0	0	0	0	1	0	0	1	0	0	0	2	2	44
Total Volume	95	0	13	17	125	1	0	1	0	2	0	1	1	3	5	0	0	0	4	4	136
% App. Total	76	0	10.4	13.6		50	0	50	0		0	20	20	60		0	0	0	100		
PHF	.819	.000	.464	.607	.762	.250	.000	.250	.000	.500	.000	.250	.250	.375	.625	.000	.000	.000	.500	.500	.773

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_AM

Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- HV & CCW Pedestrians

								noups	Timed	- 11 V & V	CC VV I	cucsura	ans								1
		Av	ery Squ	ıare			W	est Str	eet			Av	ery Squ	ıare			W	est Stre	eet		
		Fr	om No	rth			F	rom Ea	ıst			Fr	om So	uth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

		Ave	ery Squ	are			W	est Stre	eet			Av	ery Squ	are			W	est Stre	eet		]
		Fr	om No	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 07:	00 AM	to 08:4	15 AM - I	Peak 1	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:00 AN	M															
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_AM

Site Code : 12052019 Start Date : 12/5/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- Bikes by Direction

									Orot	ips i iii	itcu- Diki	o by D	nection	1								,
			Av	ery Sq	uare			W	est Str	eet				ery Squ				W	est Stre	eet		
			Fı	om No	orth			F	rom Ea	ist			Fr	om So	uth			Fı	rom W	est		
Start Tin	ne I	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
To	otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 A	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
To	otal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand To	tal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch	%	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total																						

		Ave	ery Squ	are			W	est Stre	et			Av	ery Squ	are			W	est Stre	eet		1
		Fr	om No	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis Fı	rom 07:	00 AM	to 08:4	45 AM - 1	Peak 1 o	of 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	07:00 AN	M															
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_PM

Site Code : 12042019 Start Date : 12/4/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

% Bikes by Direction

Groups Printed- Cars & CW Pedestrians - HV & CCW Pedestrians - Bikes by Direction Avery Square West Street West Street Avery Square From North From East From South From West Left Peds Left Peds Left Peds Start Time Right Thru Right Thru Left Peds Right Right Thru Thru App. Total App. Total App. Total App. Total Int. Total 04:00 PM 04:15 PM 04:30 PM 04:45 PM Total 05:00 PM 05:15 PM 05:30 PM 05:45 PM Total Grand Total Apprch % 76.9 10.1 14.3 85.7 95.9 0.5 3.2 0.5 Total % 73.7 9.7 12.4 0.5 0.5 2.8 0.5 Cars & CW Pedestrians % Cars & CW % HV & CCW Bikes by Direction

	1																				1
			ery Squ					est Stre					ery Sqı					est Stre			
		F1	om No	rth			F	rom Ea	ıst			Fr	om Sou	ıth			Fı	rom We	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. T
Peak Hour An	alysis F	rom 04	:00 PM	to 05:4	45 PM - P	Peak 1 o	f 1														
Peak Hour for	Entire 1	Intersec	tion Be	gins at	05:00 PN	1															
05:00 PM	24	0	4	3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
05:15 PM	19	0	1	1	21	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	
05:30 PM	20	0	3	2	25	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	
05:45 PM	32	0	2	7	41	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Total Volume	95	0	10	13	118	0	0	0	0	0	0	0	1	2	3	0	0	0	1	1	1
% App. Total	80.5	0	8.5	11		0	0	0	0		0	0	33.3	66.7		0	0	0	100		
PHF	742	000	625	464	720	000	000	000	000	000	000	000	250	500	375	000	000	000	250	250	_

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_PM

Site Code : 12042019 Start Date : 12/4/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- Cars & CW Pedestrians

								Toups	Timtee	- Cars &	C 11 1 1	acsura	113								-
			ery Sq					est Str					ery Sqı					est Str			
		F	rom No	orth			F	rom Ea	ast			Fı	om So	uth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	19	0	1	4	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
04:15 PM	10	0	2	4	16	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	19
04:30 PM	13	0	3	3	19	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	21
04:45 PM	23	0	5	3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
Total	65	0	11	14	90	0	0	0	1	1	0	0	0	4	4	0	0	0	0	0	95
05:00 PM	24	0	4	3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
05:15 PM	19	0	1	1	21	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	23
05:30 PM	20	0	3	2	25	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	26
05:45 PM	32	0	2	7	41	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	42
Total	95	0	10	13	118	0	0	0	0	0	0	0	1	2	3	0	0	0	1	1	122
Grand Total	160	0	21	27	208	0	0	0	1	1	0	0	1	6	7	0	0	0	1	1	217
Apprch %	76.9	0	10.1	13		0	0	0	100		0	0	14.3	85.7		0	0	0	100		
Total %	73.7	0	9.7	12.4	95.9	0	0	0	0.5	0.5	0	0	0.5	2.8	3.2	0	0	0	0.5	0.5	

		Ave	ery Squ	are			W	est Stre	eet			Av	ery Squ	iare			W	est Stre	eet		
		Fr	om Noi	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 o	f 1														
Peak Hour for	Entire I	ntersect	ion Be	gins at	05:00 PN	1															
05:00 PM	24	0	4	3	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
05:15 PM	19	0	1	1	21	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	23
05:30 PM	20	0	3	2	25	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	26
05:45 PM	32	0	2	7	41	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	42
Total Volume	95	0	10	13	118	0	0	0	0	0	0	0	1	2	3	0	0	0	1	1	122
% App. Total	80.5	0	8.5	11		0	0	0	0		0	0	33.3	66.7		0	0	0	100		
PHF	.742	.000	.625	.464	.720	.000	.000	.000	.000	.000	.000	.000	.250	.500	.375	.000	.000	.000	.250	.250	.726

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_PM

Site Code : 12042019 Start Date : 12/4/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- HV & CCW Pedestrians

			ery Squ					est Stre					ery Squ					est Stre			
		Fr	om No	rth			F	rom Ea	st			Fr	om Soi	uth			F1	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

		Ave	ery Squ	are			W	est Stre	eet			Av	ery Squ	are			W	est Stre	eet		]
		Fr	om No	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour An	alysis F	rom 04:	00 PM	to 05:4	5 PM - F	eak 1 o	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:00 PN	1															
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

350 Myles Standish Blvd. Suite 103 Taunton, MA 02780

(508)-823-2245

File Name: West St at Avery Sq\_PM

Site Code : 12042019 Start Date : 12/4/2019

Page No : 1

N/S: Avery Square E/W: West Street McMahon Associates Needham Heights, MA

Groups Printed- Bikes by Direction

								Olot	ibs i iii	neu- Dik	es by D	nection	1								,
		Av	ery Sq	uare		W			Av	ery Squ	ıare			W	est Str	eet					
		Fı	rom No	orth			F	rom Ea	ıst			Fr	om So	uth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
Total %																					

		Ave	ery Squ	are			W	est Stre	eet			Av	ery Squ	are			W	est Stre	eet		]
		Fr	om No	rth			F	rom Ea	st			Fr	om Sou	ıth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Ana	alysis Fı	rom 04:	00 PM	to 05:4	5 PM - P	eak 1 o	f 1														
Peak Hour for	Entire I	ntersec	tion Be	gins at	04:00 PM	1															
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0_
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

05293Aspeed Site Code: Y-19986.11

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

Northbound	)IVI/ L. C	TUDGI															
Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		85th	95th
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Percent	Percent
12/18/19	0	0	2	6	18	5	2	0	0	0	0	0	0	0	33	37	40
01:00	0	0	1	3	2	0	0	2	0	0	0	0	0	0	8	47	48
02:00	0	0	0	2	1	1	1	0	0	0	0	0	0	0	5	41	43
03:00	0	0	0	0	3	2	1	0	0	0	0	0	0	0	6	40	43
04:00	0	0	0	7	5	7	0	0	0	0	0	0	0	0	19	37	39
05:00	0	0	2	11	24	13	2	1	0	0	0	0	0	0	53	38	40
06:00	1	0	3	50	85	15	1	0	0	0	0	0	0	0	155	34	37
07:00	11	7	35	169	115	26	1	0	0	0	0	0	0	0	364	33	36
08:00	17	8	88	225	125	14	1	0	0	0	0	0	0	0	478	32	34
09:00	17	7	90	187	116	23	3	0	0	0	0	0	0	0	443	33	35
10:00	21	27	50	197	125	21	1	0	0	0	0	0	0	0	442	33	34
11:00	54	31	134	185	71	11	0	0	0	0	0	0	0	0	486	30	34
12 PM	29	17	135	236	85	6	1	0	0	0	0	0	0	0	509	30	33
13:00	20	8	121	200	91	13	0	0	0	0	0	0	0	0	453	31	34
14:00	21	29	151	211	65	4	2	0	0	1	0	0	0	0	484	29	33
15:00	29	25	132	198	54	5	0	0	0	0	0	0	0	0	443	29	33
16:00	23	10	129	174	51	4	0	0	0	0	0	0	0	0	391	29	33
17:00	22	15	158	176	39	1	0	0	0	0	0	0	0	0	411	29	32
18:00	15	28	123	145	48	1	0	0	0	0	0	0	0	0	360	29	33
19:00	14	9	73	128	47	8	0	0	0	0	0	0	0	0	279	31	34
20:00	6	1	33	107	52	/	0	0	0	0	0	0	0	0	206	32	34
21:00	2	0	24	91	37	3	0	0	0	0	0	0	0	0	157	32	34
22:00	2	1	4	25	25	8	1	1	0	0	0	0	0	0	67	34	39
23:00 Total	0 304	0 223	<u>3</u> 1491	13 2746	6 1290	<u>3</u> 201	1 18	<u> </u>	0	0	0	0	0	0	26 6278	35	39
									0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0270		
Percent AM	4.8%	3.6%	23.7%	43.7%	20.5%	3.2%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		-	
Peak	11:00	11:00	11:00	08:00	08:00	07:00	09:00	01:00							11:00		
Vol.	54	31	134	225	125	26	3	2							486		
PM																	
Peak	12:00	14:00	17:00	12:00	13:00	13:00	14:00	22:00		14:00					12:00		
Vol.	29	29	158	236	91	13	2	1		1					509		

## Transportation Data Corporation

Mario Perone, mperone1@verizon.net tel (781) 587-0086 cell (781) 439-4999

05293Aspeed Site Code: Y-19986.11

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

Northbound																	
Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		85th	95th
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Percent	Percent
12/19/19	0	0	1	11	10	4	1	0	0	0	0	0	0	0	27	36	39
01:00	0	0	1	7	0	4	1	0	0	0	0	0	0	0	13	38	41
02:00	0	0	0	1	3	0	0	0	0	0	0	0	0	0	4	34	34
03:00	0	0	0	1	5	1	0	0	0	0	0	0	0	0	7	34	38
04:00	0	0	0	2	9	1	1	2	0	0	0	0	0	0	15	43	48
05:00	1	0	2	11	25	17	0	0	0	0	0	0	0	0	56	37	39
06:00	3	1	11	66	54	22	1	0	0	0	0	0	0	0	158	34	38
07:00	32	20	82	190	78	15	0	0	0	0	0	0	0	0	417	31	34
08:00	19	9	117	181	125	17	1	0	0	0	0	0	0	0	469	32	34
09:00	15	9	72	163	129	19	0	0	0	0	0	0	0	0	407	33	34
10:00	15	0	49	179	107	31	2	0	0	0	0	0	0	0	383	33	37
11:00	33	9	82	186	126	17	1	0	0	0	0	0	0	0	454	33	34
12 PM	17	9	103	204	93	15	0	0	0	0	0	0	0	0	441	32	34
13:00	17	7	90	186	98	13	0	0	0	0	0	0	0	0	411	32	34
14:00	28	21	157	203	85	12	0	0	0	0	0	0	0	0	506	31	34
15:00	32	20	85	162	101	11	2	0	0	0	0	0	0	0	413	32	34
16:00	19	10	134	173	62	14	0	0	0	0	0	0	0	0	412	31	34
17:00	23	27	121	170	44	5	0	0	0	0	0	0	0	0	390	29	33
18:00	12	12	89	147	43	4	1	0	0	0	0	0	0	0	308	30	33
19:00	11	1	66	141	49	4	0	0	0	0	0	0	0	0	272	31	34
20:00	4	1	50	139	55	3	1	0	0	0	0	0	1	0	254	31	34
21:00	4	0	14	91	42	8	0	0	0	0	0	0	0	0	159	33	35
22:00	3	0	8	24	22	17	1	0	0	0	0	0	0	0	75	36	39
23:00	1	0	3	14	21	6	0	0	0	0	0	0	0	0	45	34	38
Total	289	156	1337	2652	1386	260	13	2	0	0	0	0	1	0	6096		
Percent	4.7%	2.6%	21.9%	43.5%	22.7%	4.3%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM Peak	11:00	07:00	08:00	07:00	09:00	10:00	10:00	04:00							08:00		
Vol.	33	20	117	190	129	31	2	2							469		
PM								<b>_</b>									
Peak	15:00	17:00	14:00	12:00	15:00	22:00	15:00						20:00		14:00		
Vol.	32	27	157	204	101	17	2						1		506		
Total	593	379	2828	5398	2676	461	31	6	0	1	0	0	1	0	12374		
Percent	4.8%	3.1%	22.9%	43.6%	21.6%	3.7%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile: 21 MPH 50th Percentile: 27 MPH 85th Percentile: 32 MPH 95th Percentile: 34 MPH

Stats 10 MPH Pace Speed: 21-30 MPH

 Number in Pace :
 8226

 Percent in Pace :
 66.5%

 Number of Vehicles > 30 MPH :
 3176

 Percent of Vehicles > 30 MPH :
 25.7%

Mean Speed(Average): 27 MPH

05293Aspeed Site Code: Y-19986.11

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

Southbound																	
Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		85th	95th
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Percent	Percent
12/18/19	0	0	1	8	11	8	2	0	0	0	0	0	0	0	30	38	41
01:00	0	0	0	2	3	2	1	0	0	0	0	0	0	0	8	39	42
02:00	0	0	1	3	1	0	0	0	1	0	0	0	0	0	6	50	53
03:00	0	0	0	1	2	3	1	3	0	0	0	0	0	0	10	47	49
04:00	0	0	1	1	6	5	0	0	0	0	0	0	0	0	13	38	39
05:00	1	0	2	8	27	17	4	0	1	0	0	0	0	0	60	38	42
06:00	5	0	1	41	87	31	4	1	0	0	0	0	0	0	170	36	39
07:00	9	4	35	102	112	43	6	1	0	0	0	0	0	0	312	35	39
08:00	13	0	20	112	138	37	6	0	0	0	0	0	0	0	326	34	38
09:00	13	1	8	97	165	58	7	0	0	0	0	0	0	0	349	36	39
10:00	15	3	22	130	161	57	5	0	0	0	0	0	0	0	393	35	38
11:00	24	8	43	133	142	52	5	1	0	0	0	0	0	0	408	34	38
12 PM	17	5	50	172	136	35	1	0	0	0	0	0	0	0	416	34	37
13:00	16	3	35	154	162	42	3	0	0	0	0	0	0	0	415	34	37
14:00	24	10	44	176	161	40	3	0	0	0	0	0	0	0	458	34	37
15:00	44	17	76	193	123	19	4	0	0	0	0	0	0	0	476	33	34
16:00	30	7	91	241	117	18	0	0	0	0	0	0	0	0	504	32	34
17:00	24	17	130	255	100	13	0	0	0	0	0	0	0	0	539	31	34
18:00	14	14	100	215	86	9	0	0	0	0	0	0	0	0	438	31	34
19:00	8	3	34	126	79	17	2	0	0	0	0	0	0	0	269	33	36
20:00	3	2	13	61	62	13	1	0	0	0	0	0	0	0	155	34	37
21:00	1	1	8	33	30	17	1	0	0	0	0	0	0	0	91	36	38
22:00	2	0	5	25	23	12	3	0	0	0	0	0	0	0	70	36	39
23:00	0	0	0	6	13	4	3	0	0	0	0	0	0	0	26	38	42
Total	263	95	720	2295	1947	552	62	6	2	0	0	0	0	0	5942		
Percent	4.4%	1.6%	12.1%	38.6%	32.8%	9.3%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
AM	11:00	11:00	11:00	11:00	09:00	09:00	09:00	03:00	02:00						11:00		
Peak									02.00								
Vol.	24	8	43	133	165	58	7	3	1						408		
PM	15:00	15:00	17:00	17:00	13:00	13:00	15:00								17:00		
Peak																	
Vol.	44	17	130	255	162	42	4								539		

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05293Aspeed Site Code: Y-19986.11

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

Start   1	Southbound	31 <b>7</b> 17 <b>L</b> 1 <b>C</b>																
1219/19	Start	1	16	21	26	31	36	41	46	51	56	61	66	71	76		85th	95th
02:00 0 0 0 0 0 0 0 2 2 0 1 0 0 0 0 0 0 0 0	Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total	Percent	Percent
03:00	12/19/19	0	0	0	1	11	4	1	0	0	0	0	0	0	0	17	38	40
03:00 0 0 0 0 0 1 1 1 5 2 0 0 0 0 0 0 0 0 0 9 41 43 04:00 0 0 0 0 0 3 8 8 8 2 2 0 0 0 0 0 0 0 0 0 0 0 0 0 21 06:00 2 0 0 2 12 32 13 2 2 2 0 0 0 0 0 0 0 0 0 0 0 65 37 41 06:00 14 0 6 31 93 39 2 1 0 0 0 0 0 0 0 0 0 176 36 39 07:00 13 0 19 120 110 40 4 4 0 0 0 0 0 0 0 0 0 0 0 366 34 38 08:00 12 1 1 13 82 147 45 3 0 0 0 0 0 0 0 0 0 0 336 34 38 08:00 12 1 1 13 82 147 45 3 0 0 0 0 0 0 0 0 0 333 35 38 10:00 16 2 26 116 167 55 7 1 0 0 0 0 0 0 0 0 334 36 39 10:00 16 2 2 6 116 167 55 7 1 0 0 0 0 0 0 0 0 3390 35 38 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 384 34 38 12PM 27 3 3 39 165 135 40 3 0 0 0 0 0 0 0 0 0 0 384 34 38 14:00 29 2 2 27 147 180 51 3 0 0 0 0 0 0 0 0 0 0 395 34 38 14:00 29 2 2 27 147 180 51 3 0 0 0 0 0 0 0 0 0 0 395 34 38 14:00 29 1 2 27 147 180 51 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	01:00	0	0	0	0	2	2	3	2	0	0	1	0	0	0	10	48	62
06:00 0 0 0 0 0 3 8 8 8 2 0 0 0 0 0 0 0 0 0 0 21 39 42 06:00 2 0 2 12 13 32 13 22 2 0 0 0 0 0 0 0 0 0 0 176 36 39 07:00 13 0 19 120 110 40 4 0 0 0 0 0 0 0 0 0 0 0 306 34 38 08:00 12 1 1 13 82 147 45 3 0 0 0 0 0 0 0 0 0 0 306 34 38 08:00 10 0 0 6 92 165 51 9 1 0 0 0 0 0 0 0 0 0 334 36 39 10:00 10 0 6 92 165 51 9 1 0 0 0 0 0 0 0 0 0 0 334 36 39 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 334 36 39 11:00 12 7 3 39 165 135 40 3 0 0 0 0 0 0 0 0 0 0 384 34 38 11:00 12 7 3 39 165 135 40 3 0 0 0 0 0 0 0 0 0 0 0 384 34 38 14:00 29 2 27 147 180 51 3 0 0 0 0 0 0 0 0 0 0 0 0 395 34 38 16:00 29 4 50 226 160 30 4 1 0 0 0 0 0 0 0 0 0 0 0 395 34 38 16:00 19 6 79 235 164 21 1 0 0 0 0 0 0 0 0 0 0 0 0 439 34 38 16:00 19 6 79 235 164 21 1 0 0 0 0 0 0 0 0 0 0 0 0 445 33 36 16:00 19 6 79 235 164 21 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0	0	0	0	2	0	1	0	0	0	0	0	0	0	3	42	44
06:00		0	0	0	1	1	5	2	0	0	0	0	0	0	0	9	41	43
06:00		0	0	_	_	8	8	2	0	0	0	0	0	0	0	21	39	42
08:00 12 1 1 13 0 19 120 110 40 4 0 0 0 0 0 0 0 0 0 0 306 34 38 08:00 12 1 1 1 13 82 147 45 3 0 0 0 0 0 0 0 0 0 0 0 303 35 38 09:00 10 0 6 92 165 51 9 1 0 0 0 0 0 0 0 0 0 334 36 39 10:00 16 2 26 116 167 55 7 1 0 0 0 0 0 0 0 0 0 334 36 39 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 0 334 34 38 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 334 34 38 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 0 384 34 38 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 0 384 34 38 11:00 12 7 30 117 172 41 5 0 0 0 0 0 0 0 0 0 0 0 0 0 384 34 38 11:00 15 2 20 128 176 48 5 10 0 0 0 0 0 0 0 0 0 0 0 0 0 12 34 37 13:00 15 2 20 128 176 48 5 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		2	-	_				_	2	0	0	0	0	0	-		-	
08:00			-	_	_			2	1	0	0	0	0	0	0	_	36	
09:00   10			0				40	4	0	0	0	0	0	0	0		_	
10:00   16			1	_	_			_	0	0	0	0	0	Ū	-			
11:00   12   7   30   117   172   41   5   0   0   0   0   0   0   0   0   384   34   38     12 PM   27   3   39   165   135   40   3   0   0   0   0   0   0   0   0			-		-			9	1	0	0	0	0	0	-			
12 PM					-			7	1	0	0	0	•	Ū	•			
13:00			-					_	•	•	0	O	•	Ū	ū		_	
14:00         29         2         27         147         180         51         3         0         0         0         0         0         439         34         38           15:00         20         4         50         226         160         30         4         1         0         0         0         0         0         439         34         38           16:00         19         6         79         235         164         21         1         0         0         0         0         0         495         33         34           17:00         18         2         101         245         101         5         0         0         0         0         0         0         472         31         34           18:00         14         5         67         206         134         16         1         0         0         0         0         0         0         443         33         34           19:00         9         1         45         140         100         21         0         0         0         0         0         0         0         0			_					_	•	0	0	0	0	•	-		_	_
15:00   20								_	•	0	0	0	1	Ū	-		-	
16:00   19			_					3	0	U	0	O	U	Ū	ū		_	
17:00			•					4	1	•	0	Ü	U	Ū	•			
18:00			•	-		_		1	•	U	0		O	U	•			-
19:00   9			_					0	•	U	0	U	U	U	ū		-	
20:00   5   0   17   83   70   15   1   0   0   0   0   0   0   0   191   34   37			5					1	J	•	0	0	U	Ū	•			
21:00			1					0	•	U	0	0	O	•	•			
22:00         0         0         2         24         46         19         1         0         0         0         0         0         0         92         36         39           23:00         0         0         0         0         0         0         0         0         0         0         0         38         37         39           Total         226         37         561         2230         2242         595         61         8         0         0         0         0         0         0         5962           Percent         3.8%         0.6%         9.4%         37.4%         37.6%         10.0%         1.0%         0.1%         0.0% <t< td=""><td></td><td>5</td><td>U</td><td></td><td></td><td></td><td></td><td>1</td><td>U</td><td>U</td><td>0</td><td>0</td><td>U</td><td>U</td><td>•</td><td>-</td><td></td><td></td></t<>		5	U					1	U	U	0	0	U	U	•	-		
23:00   0   0   0   0   7   18   13   0   0   0   0   0   0   0   0   0		1	_					1	•	U	0	U	U	U	ū		-	-
Total         226         37         561         2230         2242         595         61         8         0         0         1         1         0         0         5962           Percent         3.8%         0.6%         9.4%         37.4%         37.6%         10.0%         1.0%         0.1%         0.0%         0		-	•					1	•	•	Ü	•	U	Ū	ū			
Percent         3.8%         0.6%         9.4%         37.4%         37.6%         10.0%         1.0%         0.1%         0.0%					- '							0	0				37	39_
AM Peak Peak Vol.         10:00         11:00         11:00         10:00         10:00         01:00         10:00           Vol.         16         7         30         120         172         55         9         2         1         390           PM Peak Vol.         14:00         16:00         17:00         14:00         14:00         13:00         15:00         13:00         16:00           Vol.         29         6         101         245         180         51         5         1         1         525           Total         489         132         1281         4525         4189         1147         123         14         2         0         1         1         0         0         11904           Percent         4.1%         1.1%         10.8%         38.0%         35.2%         9.6%         1.0%         0.1%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%												0.0%	0.0%			5962		
Peak         10:00         11:00         17:00         10:00         09:00         01:00         01:00         10:00         10:00           Vol.         16         7         30         120         172         55         9         2         1         390           PM Peak Peak         14:00         16:00         17:00         14:00         14:00         13:00         13:00         16:00           Vol.         29         6         101         245         180         51         5         1         1         525           Total         489         132         1281         4525         4189         1147         123         14         2         0         1         1         0         0         11904           Percent         4.1%         1.1%         10.8%         38.0%         35.2%         9.6%         1.0%         0.1%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%		3.0 /6	0.076	9.470	31.470	37.076	10.0 /6	1.0 /6	0.176	0.076	0.076		0.076	0.076	0.076			
PM Peak         14:00         16:00         17:00         14:00         14:00         13:00         13:00         16:00           Vol.         29         6         101         245         180         51         5         1         1         525           Total         489         132         1281         4525         4189         1147         123         14         2         0         1         1         0         0         11904           Percent         4.1%         1.1%         10.8%         38.0%         35.2%         9.6%         1.0%         0.1%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%		10:00	11:00	11:00	07:00	11:00	10:00	09:00	01:00			01:00				10:00		
Peak     14:00     16:00     17:00     14:00     14:00     14:00     15:00     13:00     16:00       Vol.     29     6     101     245     180     51     5     1     1     525       Total     489     132     1281     4525     4189     1147     123     14     2     0     1     1     0     0     11904       Percent     4.1%     1.1%     10.8%     38.0%     35.2%     9.6%     1.0%     0.1%     0.0%     0.0%     0.0%     0.0%     0.0%     0.0%	Vol.	16	7	30	120	172	55	9	2			11				390		
Vol.         29         6         101         245         180         51         5         1         1         525           Total         489         132         1281         4525         4189         1147         123         14         2         0         1         1         0         0         11904           Percent         4.1%         1.1%         10.8%         38.0%         35.2%         9.6%         1.0%         0.1%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%		14:00	16:00	17:00	17:00	14:00	14:00	13:00	15:00				13:00			16:00		
Total         489         132         1281         4525         4189         1147         123         14         2         0         1         1         0         0         11904           Percent         4.1%         1.1%         10.8%         38.0%         35.2%         9.6%         1.0%         0.1%         0.0%		29	6	101	245	180	51	5	1				1			525		
<u>Percent 4.1% 1.1% 10.8% 38.0% 35.2%</u> 9.6% 1.0% 0.1% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0	Total	489	132	1281	4525	4189	1147	123	14	2	0	1	1	0	0	11904		
AFILE OANDU	Percent	4.1%			38.0%		9.6%	1.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

15th Percentile: 24 MPH 29 MPH 50th Percentile: 85th Percentile: 34 MPH 38 MPH 95th Percentile:

26-35 MPH Stats 10 MPH Pace Speed:

Number in Pace : 8714 Percent in Pace: 73.2% Number of Vehicles > 30 MPH: 5477 Percent of Vehicles > 30 MPH: 46.0% Mean Speed(Average): 29 MPH

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

05293Avolume Site Code: Y-19986.11

Start	18-Dec-19		NB		SB	Co	ombined	19-Dec	;	NB		SB	Co	mbined
Time	Wed	A.M		1. A.M	. P.M			. Thu	A.M		. A.M			
12:00		9	125	11	112	20	237		7	119	6	103	13	222
12:15		8	125	6	104	14	229		8	115	5	92	13	207
12:30		11	135	5	82	16	217		7	111	4	95	11	206
12:45		5	124	8	118	13	242		5	96	2	122	7	218
01:00		3	109	1	112	4	221		5	96	3	103	8	199
01:15		1	117	5	106	6	223		2	108	2	93	4	201
01:30		2	112	0	105	2	217		0	109	2	90	2	199
01:45		2	115	2	92	4	207		6	98	3	109	9	207
02:00		4	113	2	110	6	223		1	122	2	115	3	237
02:15		0	101	3	122	3	223		1	109	0	126	1	235
02:30		1	117	0	121	1	238		2	126	1	102	3	228
02:45		0	153	1	105	1	258		0	149	0	96	0	245
03:00		4	119	3	118	7	237		2	115	2	123	4	238
03:15		1	104	2	114	3	218		3	112	1	116	4	228
03:30		1	112	1	107	2	219		1	93	0	132	1	225
03:45		0	108	4	137	4	245		1	93	6	124	7	217
04:00		5	123	6	136	11	259		3	113	4	125	7	238
04:15		2	91	0	128	2	219		5	103	2	123	7	226
04:30		6	86	6	106	12	192		2	100	7	134	9	234
04:45		6	91	1	134	7	225		5	96	8	143	13	239
05:00		10	120	8	135	18	255		9	112	8	124	17	236
05:15		10	111	19	139	29	250		10	98	16	114	26	212
05:30		12	90	11	137	23	227		20	96	11	110	31	206
05:45		21	90	22	128	43	218		17	84	30	124	47	208
06:00		16	113	36	107	52	220		25	85	37	125	62	210
06:15		33	91	41	129	74	220		36	73	33	117	69	190
06:30		52	74	31	99	83	173		45	69	48	95	93	164
06:45		54	82	62	103	116	185		52	81	58	106	110	187
07:00		64	94	74	82	138	176		69	80	68	95	137	175
07:15		84	50	87	82	171	132	_	93	73	59	79	152	152
07:30		109	80	66	58	175	138		128	71	93	75	221	146
07:45		107	55	85	47	192	102		127	48	86	67	213	115
08:00		124	48	66	38	190	86		133	85	74	51	207	136
08:15		126	48	80	44	206	92		130	67	90	32	220	99
08:30		115	66	96	47	211	113		111	58	70	46	181	104
08:45		113	44	84	26	197	70		95	44	69	62	164	106
09:00		113	53	78	25	191	78		114	46	73	39	187	85
09:15		108	37	90	25	198	62		118	45	95	32	213	77
09:30		123	45	83	23	206	68		81	28	84	36	165	64
09:45		99	22	98	18	197	40		94	40	82	19	176	59
10:00		118	24	98	25	216	49		98	25	87	20	185	45
10:15		100	16	94	18 17	194	34		104	13	100	21	204	34
10:30		121	16	105	10	226	33 21		105	12 25	100	24 27	205	36
10:45 11:00		103	11	96		199 <b>214</b>	21		76 115		103 101	13	179 216	52 25
11:15		116 131	12 6	98 98	9 7	214	13		118	12 19	96	12	214	31
11:30		131	4	97	6	228	10		122	6	98	9	220	15
11:45		108	4	115	4	223	8		99	8	89	4	188	12
Total		2492	3786	2085	3857	4577	7643		2410	3686	2018	3944	4428	7630
Day Total	al		278		942		2220			6096		962		058
% Total		20.4%	31.0%	17.1%	31.6%	12		,	20.0%	30.6%	16.7%	32.7%	12	000
70 TOTAL	4	_0.770	31.070	17.170	31.070			4	_0.070	00.070	10.1 /0	JZ.1 /0		
Peak	_	11:00	12:00	11:00	04:45	11:00	04:45	_	07:30	02:00	10:15	04:00	07:30	02:15
Vol.	_	486	509	408	545	894	957	_	518	506	404	525	861	946
P.H.F.		0.927	0.943	0.887	0.980	0.976	0.924		0.974	0.849	0.981	0.918	0.974	0.965

AADT 12,139

ADT

ADT 12,139

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

05293Avolume Site Code: Y-19986.11

Start	18-Dec-19	NB		Hour	Totals	5	SB	Hour	Totals	Combin	ed Totals
Time	Wed		Afternoon	Morning	Afternoon	Morning	Afternoon	Morning			Afternoon
12:00		9	125			11	112				
12:15		8	125			6	104				
12:30		11	135			5	82				
12:45		5	124	33	509	8	118	30	416	63	925
01:00		3	109			1	112				
01:15		1	117			5	106				
01:30		2 2	112			0 2	105				
01:45			115	8	453	2	92	8	415	16	868
02:00		4	113			2	110				
02:15		0	101				122				
02:30		1	117			0	121				
02:45		0	153	5	484	1	105	6	458	11	942
03:00		4	119			3	118				
03:15		1	104			2	114				
03:30		1	112			1	107				
03:45		0	108	6	443	4	137	10	476	16	919
04:00		5 2	123			6	136				
04:15		2	91			0	128				
04:30		6	86			6 1	106				
04:45		6	91	19	391		134	13	504	32	895
05:00		10	120			8	135				
05:15		10	111			19	139				
05:30		12	90			11	137				
05:45		21	90	53	411	22	128	60	539	113	950
06:00		16 33	113			36	107				
06:15		33	91			41	129				
06:30		52	74			31	99				
06:45		54	82	155	360	62	103	170	438	325	798
07:00		64	94			74	82				
07:15		84	50			87	82				
07:30		109	80			66	58				
07:45		107	55	364	279	85	47	312	269	676	548
08:00		124	48			66	38				
08:15		126	48			80	44				
08:30		115	66			96	47				
08:45		113	44	478	206	84	26	326	155	804	361
09:00		113	53			78	25				
09:15		108	37			90	25				
09:30		123	45			83	23				
09:45		99	22	443	157	98	18	349	91	792	248
10:00		118	24			98	25				
10:15		100	16			94	18				
10:30		121	16			105	17				
10:45		103	11	442	67	96	10	393	70	835	137
11:00		116	12			98	9				
11:15		131	6			98					
11:30		131	4			97	6				
11:45		108	4	486	26	115	4	408	26	894	52
Total		2492	3786			2085	3857			4577	7643
Combined		6278				50	42			12	220
Total		02/0	•			59	74			124	220
Percentag	0.0%										
e	0.076										

Highland Avenue north of Morton Street City, State: Needham, MA Client: McM/E. Gruber

05293Avolume Site Code: Y-19986.11

Start	19-Dec-19	N		Hour	Totals	S	BB	Hour	Totals	Combine	ed Totals
Time	Thu	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		7	119			6	103				
12:15		8	115			5	92				
12:30		7	111			4	95				
12:45		5	96	27	441	2	122	17	412	44	853
01:00		5 2	96			3	103				
01:15			108			2	93				
01:30		0	109			2	90				
01:45		6	98	13	411	3	109	10	395	23	806
02:00		1	122			2 0	115				
02:15		1	109				126				
02:30		2	126			1	102		400	_	
02:45		0	149	4	506	0	96	3	439	7	945
03:00		2	115			2	123				
03:15			112			1	116				
03:30		1	93	7	440	0	132	0	405	40	000
03:45		1	93	7	413	6	124	9	495	16	908
04:00		3 5	113			4	125				
04:15		5	103			2	123				
04:30		2 5	100	45	440	7	134	24	505	20	007
04:45		5	96	15	412	8	143	21	525	36	937
05:00		9	112			8	124				
05:15		10	98			16	114				
05:30		20	96	50	200	11	110	C.E.	470	404	000
05:45		17	84	56	390	30	124	65	472	121	862
06:00 06:15		25 36	85 73			37 33	125 117				
06:30		45 52	69 81	450	200	48	95	470	440	224	754
06:45				158	308	58	106	176	443	334	751
07:00		69 93	80			68	95				
07:15 07:30		128	73 71			59 93	79				
		128		447	272		75 67	206	216	700	E00
07:45		127 133	48 85	417	272	86	67	306	316	723	588
08:00 08:15		130	67			74 90	51 32				
08:30		130	58			70					
08:45		111 95	44	469	254	69	46 62	303	191	772	445
09:00		114	46	409	254	73	39	303	191	112	443
09:00		118	45			95	32				
09:30		81	28			84	36				
09:45		94	40	407	159	82	19	334	126	741	285
10:00		98	25	407	133	87	20	334	120	741	200
10:00		104	13			100	21				
10:13		104	12			100	24				
10:35		76	25	383	75	103	27	390	92	773	167
11:00		115	12	505	73	103	13	330	52	773	107
11:15		118	19			96	12				
11:30		122	6			98	9				
11:45		99	8	454	45	89	4	384	38	838	83
Total		2410	3686	707	70	2018	3944	304	50	4428	7630
Combined											
Total		609	96			59	62			120	158
Percentag	2 22/										
e	0.0%										
Total		4902	7472			4103	7801			9005	15273
Percent		39.6%	60.4%			34.5%	65.5%			37.1%	62.9%
		0				3 2 / 0	32.270				
ADT	ΑI	OT 12,139	AAI	DT 12,139							

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377A Site Code : Y1998611

Start Date : 1/5/2021

Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

					apo i iiii			10 114	no a ba		CO Dy L	ii conon					
	H	Hillside A	venue			West S	Street			Hillside A	Avenue			West S	Street		
		From N	Vorth			From	East			From S	South			From '	West		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	2	3	1	0	0	23	6	0	7	3	0	2	3	31	0	0	81
07:15 AM	2	3	2	0	1	20	12	0	13	1	1	1	4	36	2	1	99
07:30 AM	0	8	2	2	4	32	11	2	13	6	2	0	1	32	3	2	120
07:45 AM	2	6	8	5	4	53	17	0	13	3	2	4	6	49	3	0	175
Total	6	20	13	7	9	128	46	2	46	13	5	7	14	148	8	3	475
08:00 AM	1	12	0	0	5	37	26	0	14	14	3	1	1	49	2	0	165
08:15 AM	1	8	4	0	2	39	16	0	19	8	2	2	6	64	1	2	174
08:30 AM	1	11	1	4	3	43	24	0	16	13	4	1	2	52	2	0	177
08:45 AM	8	15	1_	1	9	29	28	0	17	8	4	1	6	46	3	0	176
Total	11	46	6	5	19	148	94	0	66	43	13	5	15	211	8	2	692
Grand Total	17	66	19	12	28	276	140	2	112	56	18	12	29	359	16	5	1167
Apprch %	14.9	57.9	16.7	10.5	6.3	61.9	31.4	0.4	56.6	28.3	9.1	6.1	7.1	87.8	3.9	1.2	
Total %	1.5	5.7	1.6	1	2.4	23.7	12	0.2	9.6	4.8	1.5	1	2.5	30.8	1.4	0.4	
Cars & Peds	16	66	18	12	28	267	139	2	111	56	15	12	28	346	16	5	1137
% Cars & Peds	94.1	100	94.7	100	100	96.7	99.3	100	99.1	100	83.3	100	96.6	96.4	100	100	97.4
Trucks & Buses																	
% Trucks & Buses	5.9	0	5.3	0	0	3.3	0.7	0	0.9	0	16.7	0	3.4	3.6	0	0	2.6
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

		Hills	side Av	/enue			W	est Sti	reet			Hills	side Av	/enue			W	est Sti	reet		
		Fi	rom No	orth			F	rom E	ast			Fı	rom Sc	outh			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	07:00	AM to (	08:45 AI	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begins	s at 08:0	00 AM															
08:00 AM	1	12	0	0	13	5	37	26	0	68	14	14	3	1	32	1	49	2	0	52	165
08:15 AM	1	8	4	0	13	2	39	16	0	57	19	8	2	2	31	6	64	1	2	73	174
08:30 AM	1	11	1	4	17	3	43	24	0	70	16	13	4	1	34	2	52	2	0	56	177
08:45 AM	8	15	1	1	25	9	29	28	0	66	17	8	4	1	30	6	46	3	0	55	176
Total Volume	11	46	6	5	68	19	148	94	0	261	66	43	13	5	127	15	211	8	2	236	692
% App. Total	16.2	67.6	8.8	7.4		7.3	56.7	36	0		52	33.9	10.2	3.9		6.4	89.4	3.4	0.8		
PHF	.344	.767	.375	.313	.680	.528	.860	.839	.000	.932	.868	.768	.813	.625	.934	.625	.824	.667	.250	.808	.977
Cars & Peds	10	46	6	5	67	19	144	94	0	257	66	43	10	5	124	15	203	8	2	228	676
% Cars & Peds	90.9	100	100	100	98.5	100	97.3	100	0	98.5	100	100	76.9	100	97.6	100	96.2	100	100	96.6	97.7
Trucks & Buses	1	0	0	0	1	0	4	0	0	4	0	0	3	0	3	0	8	0	0	8	16
% Trucks & Buses	9.1	0	0	0	1.5	0	2.7	0	0	1.5	0	0	23.1	0	2.4	0	3.8	0	0	3.4	2.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377A Site Code : Y1998611

Start Date : 1/5/2021

Page No : 1

Groups Printed- Cars & Peds

							noups i	micu	Cars a r	cus							
	ŀ	Hillside A	Avenue			West S	Street			Hillside A	Avenue			West S	Street		
		From N	North			From	East			From S	South			From \	Nest		
tart Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	2	3	1	0	0	22	5	0	6	3	0	2	3	28	0	0	75
07:15 AM	2	3	2	0	1	20	12	0	13	1	1	1	4	35	2	1	98
07:30 AM	0	8	2	2	4	31	11	2	13	6	2	0	1	32	3	2	119
07:45 AM	2	6	7	5	4	50	17	0	13	3	2	4	5	48	3	0	169
Total	6	20	12	7	9	123	45	2	45	13	5	7	13	143	8	3	461
	1	12	0	0	5	37	26	0	14	14	2	1	1	46	2	0	161
08:15 AM	1	8	4	0	2	38	16	0	19	8	2	2	6	61	1	2	170
08:30 AM	1	11	1	4	3	42	24	0	16	13	3	1	2	50	2	0	173
08:45 AM	7	15	1_	1	9	27	28	0	17	8	3	1	6	46	3	0	172
Total	10	46	6	5	19	144	94	0	66	43	10	5	15	203	8	2	676
	16	66	18	12	28	267	139	2	111	56	15	12	28	346	16	5	1137
Apprch %	14.3	58.9	16.1	10.7	6.4	61.2	31.9	0.5	57.2	28.9	7.7	6.2	7.1	87.6	4.1	1.3	
Total %	1.4	5.8	1.6	1.1	2.5	23.5	12.2	0.2	9.8	4.9	1.3	1.1	2.5	30.4	1.4	0.4	
	77:00 AM 17:15 AM 17:30 AM 17:45 AM Total 18:00 AM 18:15 AM 18:30 AM 18:30 AM 18:45 AM Total 18:45 AM Total 18:45 AM	art Time Right   17:00 AM   2   17:15 AM   2   17:30 AM   0   17:45 AM   2   17:45 AM   2   17:45 AM   1   18:45 AM   1   18:45 AM   7   10   10   10   10   10   10   10	From Nart Time   Right   Thru   17:00 AM   2   3   3   17:15 AM   2   3   3   17:15 AM   2   6   17:45 AM   2   6   Total   6   20   18:00 AM   1   12   18:15 AM   1   8   18:30 AM   1   11   18:45 AM   7   15   Total   10   46   and Total   16   66   66   60 pprch %   14.3   58.9	17:00 AM	From North	From North	Hillside Avenue	Hillside Avenue   From North   From East	Hillside Avenue   From North   From East	Hillside Avenue   From Form East   From North   From East	From North   From East   From Start Time   Right   Thru   Left   Peds   Right   Thru   Left   Peds   Right   Thru   Left   Peds   Right   Thru   Left   Peds   Right   Thru   Right   Right   Thru   Right   Right   Thru   Right   Right   Thru   Right   Right	Hillside Avenue   From North   From East   Hillside Avenue   From South	Hillside Avenue   From North   From East   From South	Hillside Avenue   From North   From East   From South   From South	Hillside Avenue	Hillside Avenue   From North   From East   From South   From West Street   From South   From West	Hillside Avenue

		Hill	side Av	enue			V	est Str	eet			Hill	side A	enue/			V	/est Str	reet		
		F	rom No	orth			F	rom Ea	ast			F	rom Sc	uth			F	rom W	est		
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	07:00	AM to	08:45 A	M - Pea	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begin	s at 08:0	MA 00															
08:00 AM	1	12	0	0	13	5	37	26	0	68	14	14	2	1	31	1	46	2	0	49	161
08:15 AM	1	8	4	0	13	2	38	16	0	56	19	8	2	2	31	6	61	1	2	70	170
08:30 AM	1	11	1	4	17	3	42	24	0	69	16	13	3	1	33	2	50	2	0	54	173
08:45 AM	7	15	1	1	24	9	27	28	0	64	17	8	3	1	29	6	46	3	0	55	172
Total Volume	10	46	6	5	67	19	144	94	0	257	66	43	10	5	124	15	203	8	2	228	676
% App. Total	14.9	68.7	9	7.5		7.4	56	36.6	0		53.2	34.7	8.1	4		6.6	89	3.5	0.9		
PHF	.357	.767	.375	.313	.698	.528	.857	.839	.000	.931	.868	.768	.833	.625	.939	.625	.832	.667	.250	.814	.977

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377A Site Code : Y1998611

Start Date : 1/5/2021 Page No : 1

								ntea- i	UCKS & E								
	ŀ	Hillside A	Avenue			West S	Street			Hillside A	Avenue			West S	Street		
		From N	Vorth			From	East			From S	South			From '	West		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	0	6
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
07:30 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
07:45 AM	0	0	1	0	0	3	0	0	0	0	0	0	1	1	0	0	6
Total	0	0	1	0	0	5	1	0	1	0	0	0	1	5	0	0	14
08:00 AM	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	4
08:15 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	4
08:30 AM	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	4
08:45 AM	111	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	4
Total	1	0	0	0	0	4	0	0	0	0	3	0	0	8	0	0	16
Grand Total	1	0	1	0	0	9	1	0	1	0	3	0	1	13	0	0	30
Apprch %	50	0	50	0	0	90	10	0	25	0	75	0	7.1	92.9	0	0	
Total %	3.3	0	3.3	0	0	30	3.3	0	3.3	0	10	0	3.3	43.3	0	0	

			side Av					est Str					side Av					est Str			
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	07:00	AM to	08:45 A	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begin	s at 07:4	45 AM															
07:45 AM	0	0	1	0	1	0	3	0	0	3	0	0	0	0	0	1	1	0	0	2	6
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	3	0	0	3	4
08:15 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	4
08:30 AM	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	2	0	0	2	4
Total Volume	0	0	1	0	1	0	5	0	0	5	0	0	2	0	2	1	9	0	0	10	18
% App. Total	0	0	100	0		0	100	0	0		0	0	100	0		10	90	0	0		
PHF	.000	.000	.250	.000	.250	.000	.417	.000	.000	.417	.000	.000	.500	.000	.500	.250	.750	.000	.000	.833	.750

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377A Site Code : Y1998611

Start Date : 1/5/2021

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Groups Printed- Bikes by Direction

_									iteu- bir	les by Di								
		H	Hillside A	venue			West S	Street			Hillside A	Avenue			West S	Street		
			From N	lorth			From	East			From S	South			From \	Vest		
	Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
	07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0_
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total %																	

			side Av					est Str					side Av					est Str			
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	07:00	AM to	08:45 A	M - Pea	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begin	s at 07:0	MA 00															
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

### Transportation Data Corporation

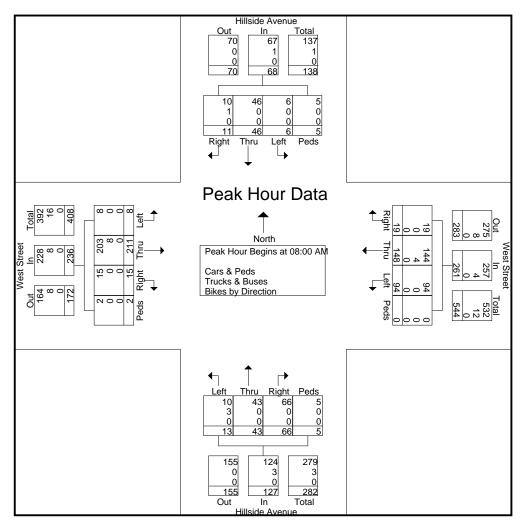
Mario Perone, mperone1@verizon.net tel (781) 587-0086 cell (781) 439-4999

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu File Name: 05377A Site Code: Y1998611 Start Date: 1/5/2021

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		Hills	ide Av	enue			W	est St	reet			Hills	side Av	/enue			W	est St	reet		l
		Fr	om No	orth			F	rom E	ast			Fr	om Sc	uth			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	07:00	AM to (	08:45 A	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	ection	Begins	s at 08:0	MA OC															
08:00 AM	1	12	0	0	13	5	37	26	0	68	14	14	3	1	32	1	49	2	0	52	165
08:15 AM	1	8	4	0	13	2	39	16	0	57	19	8	2	2	31	6	64	1	2	73	174
08:30 AM	1	11	1	4	17	3	43	24	0	70	16	13	4	1	34	2	52	2	0	56	177
08:45 AM	8	15	1_	1	25	9	29	28	0	66	17	8	4	1	30	6	46	3	0	55	176
Total Volume	11	46	6	5	68	19	148	94	0	261	66	43	13	5	127	15	211	8	2	236	692
% App. Total	16.2	67.6	8.8	7.4		7.3	56.7	36	0		52	33.9	10.2	3.9		6.4	89.4	3.4	0.8		
PHF	.344	.767	.375	.313	.680	.528	.860	.839	.000	.932	.868	.768	.813	.625	.934	.625	.824	.667	.250	.808	.977
Cars & Peds	10	46	6	5	67	19	144	94	0	257	66	43	10	5	124	15	203	8	2	228	676
% Cars & Peds	90.9	100	100	100	98.5	100	97.3	100	0	98.5	100	100	76.9	100	97.6	100	96.2	100	100	96.6	97.7
Trucks & Buses	1	0	0	0	1	0	4	0	0	4	0	0	3	0	3	0	8	0	0	8	16
% Trucks & Buses	9.1	0	0	0	1.5	0	2.7	0	0	1.5	0	0	23.1	0	2.4	0	3.8	0	0	3.4	2.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377AA

Site Code : Y1998611 Start Date : 1/5/2021

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Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

				- 0.0	apo i iiii		0 4 1 00	10 1140	no a ba		CO Dy D	110011011					
		Hillside A	venue			West S	Street			Hillside A	Avenue			West S	Street		
		From N	lorth			From	East			From S	South			From '	West		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	1	5	6	4	9	43	18	2	26	12	5	3	5	41	0	2	182
04:15 PM	0	13	2	1	4	43	15	0	16	8	0	0	3	38	2	0	145
04:30 PM	1	11	1	0	1	35	13	0	28	12	1	1	4	53	1	0	162
04:45 PM	2	12	2	0	2	32	22	0	31	13	2	0	1	44	1	0	164
Total	4	41	11	5	16	153	68	2	101	45	8	4	13	176	4	2	653
05:00 PM	2	7	3	1	4	44	19	0	20	7	3	1	2	46	1	0	160
05:15 PM	4	8	3	0	5	46	11	0	15	9	3	0	2	27	3	0	136
05:30 PM	5	13	2	5	2	48	16	1	11	7	3	1	7	33	1	0	155
05:45 PM	2	9	3	1	8	44	13	0	12	11	3	1	4	35	0	2	148
Total	13	37	11	7	19	182	59	1	58	34	12	3	15	141	5	2	599
Grand Total	17	78	22	12	35	335	127	3	159	79	20	7	28	317	9	4	1252
Apprch %	13.2	60.5	17.1	9.3	7	67	25.4	0.6	60	29.8	7.5	2.6	7.8	88.5	2.5	1.1	
Total %	1.4	6.2	1.8	1	2.8	26.8	10.1	0.2	12.7	6.3	1.6	0.6	2.2	25.3	0.7	0.3	
Cars & Peds	17	78	22	12	35	333	127	3	159	79	20	7	28	316	9	4	1249
% Cars & Peds	100	100	100	100	100	99.4	100	100	100	100	100	100	100	99.7	100	100	99.8
Trucks & Buses																	
% Trucks & Buses	0	0	0	0	0	0.6	0	0	0	0	0	0	0	0.3	0	0	0.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

		Hills	side Av	/enue			W	est Str	eet			Hills	side Av	venue			W	est Stı	reet		
		F	rom No	orth			F	rom Ea	ast			Fr	rom Sc	outh			F	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	04:00	PM to 0	05:45 PI	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begins	s at 04:0	00 PM															
04:00 PM	1	5	6	4	16	9	43	18	2	72	26	12	5	3	46	5	41	0	2	48	182
04:15 PM	0	13	2	1	16	4	43	15	0	62	16	8	0	0	24	3	38	2	0	43	145
04:30 PM	1	11	1	0	13	1	35	13	0	49	28	12	1	1	42	4	53	1	0	58	162
04:45 PM	2	12	2	0	16	2	32	22	0	56	31	13	2	0	46	1	44	1	0	46	164
Total Volume	4	41	11	5	61	16	153	68	2	239	101	45	8	4	158	13	176	4	2	195	653
% App. Total	6.6	67.2	18	8.2		6.7	64	28.5	0.8		63.9	28.5	5.1	2.5		6.7	90.3	2.1	1		
PHF	.500	.788	.458	.313	.953	.444	.890	.773	.250	.830	.815	.865	.400	.333	.859	.650	.830	.500	.250	.841	.897
Cars & Peds	4	41	11	5	61	16	152	68	2	238	101	45	8	4	158	13	175	4	2	194	651
% Cars & Peds	100	100	100	100	100	100	99.3	100	100	99.6	100	100	100	100	100	100	99.4	100	100	99.5	99.7
Trucks & Buses	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
% Trucks & Buses	0	0	0	0	0	0	0.7	0	0	0.4	0	0	0	0	0	0	0.6	0	0	0.5	0.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377AA Site Code : Y1998611

Start Date : 1/5/2021

Page No : 1

Groups Printed- Cars & Peds

							ii oups i	IIIIleu-	Cars & r	cus							
		Hillside A	Avenue			West S	Street			Hillside <i>F</i>	Avenue			West S	Street		
		From N	North			From	East			From S	South			From \	West		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	1	5	6	4	9	43	18	2	26	12	5	3	5	41	0	2	182
04:15 PM	0	13	2	1	4	43	15	0	16	8	0	0	3	37	2	0	144
04:30 PM	1	11	1	0	1	34	13	0	28	12	1	1	4	53	1	0	161
04:45 PM	2	12	2	0	2	32	22	0	31	13	2	0	1	44	1_	0	164
Total	4	41	11	5	16	152	68	2	101	45	8	4	13	175	4	2	651
05:00 PM		7	3	1	4	43	19	0	20	7	3	1	2	46	1	0	159
05:15 PM	4	8	3	0	5	46	11	0	15	9	3	0	2	27	3	0	136
05:30 PM	5	13	2	5	2	48	16	1	11	7	3	1	7	33	1	0	155
05:45 PM	2	9	3	1	8	44	13	0	12	11	3	1	4	35	0	2	148
Total	13	37	11	7	19	181	59	1	58	34	12	3	15	141	5	2	598
Grand Total	1	78	22	12	35	333	127	3	159	79	20	7	28	316	9	4	1249
Apprch %	13.2	60.5	17.1	9.3	7	66.9	25.5	0.6	60	29.8	7.5	2.6	7.8	88.5	2.5	1.1	
Total %	1.4	6.2	1.8	1	2.8	26.7	10.2	0.2	12.7	6.3	1.6	0.6	2.2	25.3	0.7	0.3	

			side Av					est Str					side Av					/est Str			
		F	rom No	orth			F	rom Ea	ast			F	rom Sc	uth			F	rom W	est		
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	04:00	PM to	05:45 P	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begin	s at 04:0	M9 00															
04:00 PM	1	5	6	4	16	9	43	18	2	72	26	12	5	3	46	5	41	0	2	48	182
04:15 PM	0	13	2	1	16	4	43	15	0	62	16	8	0	0	24	3	37	2	0	42	144
04:30 PM	1	11	1	0	13	1	34	13	0	48	28	12	1	1	42	4	53	1	0	58	161
04:45 PM	2	12	2	0	16	2	32	22	0	56	31	13	2	0	46	1	44	1	0	46	164
Total Volume	4	41	11	5	61	16	152	68	2	238	101	45	8	4	158	13	175	4	2	194	651
% App. Total	6.6	67.2	18	8.2		6.7	63.9	28.6	0.8		63.9	28.5	5.1	2.5		6.7	90.2	2.1	1		
PHF	.500	.788	.458	.313	.953	.444	.884	.773	.250	.826	.815	.865	.400	.333	.859	.650	.825	.500	.250	.836	.894

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377AA Site Code : Y1998611

Start Date : 1/5/2021

Page No : 1

Groups Printed- Trucks & Buses

						010	Jupo i ii	nica i	ucks & L	Juscs							
	ŀ	Hillside A	venue			West S	Street		I	Hillside A	venue			West S	Street		
		From N	lorth			From	East			From S	outh			From \	Nest		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
04:30 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0_
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
05:00 PM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0_
Total	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Grand Total	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
Apprch %	0	0	0	0	0	100	0	0	0	0	0	0	0	100	0	0	
Total %	0	0	0	0	0	66.7	0	0	0	0	0	0	0	33.3	0	0	

		Hills	side Av	enue			West Street					Hill	side Av	/enue			V	est Stı	eet		
		F	rom No	orth			F	rom Ea	ast			F	rom Sc	outh			F	rom W	est		
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	04:00	PM to 0	5:45 PI	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begins	at 04:1	15 PM															
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
04:30 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1_
Total Volume	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	3
% App. Total	0	0	0	0		0	100	0	0		0	0	0	0		0	100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.000	.000	.250	.000	.000	.250	.750

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu

File Name: 05377AA

Site Code : Y1998611 Start Date : 1/5/2021

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Groups Printed- Bikes by Direction

						Gio	ups em	iteu- bir	les by Di								
	H	Hillside A	venue			West S	Street			Hillside A	Avenue			West S	Street		
		From N	Vorth			From	East			From S	South			From \	West		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0_
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total %																	

		Hillside Avenue West Street From North From East											side Av					/est Sti			
		F	rom No	orth			F	rom Ea	ast			F	rom Sc	uth			F	rom W	est		
Start Time	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Right			Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	04:00	PM to 0	5:45 PI	M - Pea	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	section	Begins	at 04:0	00 PM															
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0	0		0	0	0	0		0	0	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

### Transportation Data Corporation

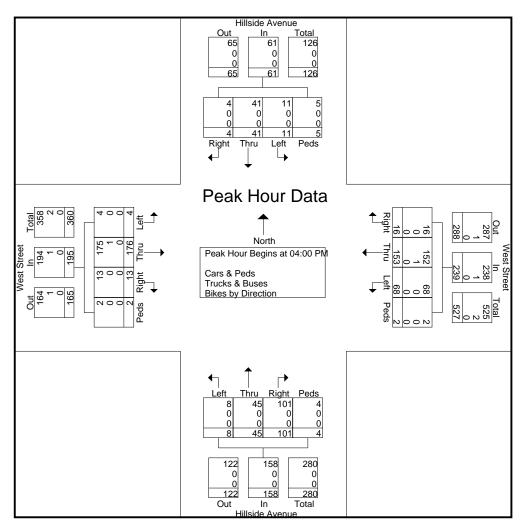
Mario Perone, mperone1@verizon.net tel (781) 587-0086 cell (781) 439-4999

N/S: Hillside Avenue E/W: West Street

City, State: Needham, MA Client: McM/Leina Xu File Name : 05377AA Site Code : Y1998611 Start Date : 1/5/2021

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		Hills	ide Av	enue/			W	est St	reet			Hills	side A	/enue			W	est Sti	reet		
		Fr	om No	orth			F	rom E	ast			Fr	om Sc	uth			Fi	rom W	est		
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour A	nalysis	From	04:00	PM to	05:45 PI	M - Pe	ak 1 of	1													
Peak Hour fo	r Entire	e Inters	ection	Begin	s at 04:0	00 PM															
04:00 PM	1	5	6	4	16	9	43	18	2	72	26	12	5	3	46	5	41	0	2	48	182
04:15 PM	0	13	2	1	16	4	43	15	0	62	16	8	0	0	24	3	38	2	0	43	145
04:30 PM	1	11	1	0	13	1	35	13	0	49	28	12	1	1	42	4	53	1	0	58	162
04:45 PM	2	12	2	0	16	2	32	22	0	56	31	13	2	0	46	1	44	1_	0	46	164
Total Volume	4	41	11	5	61	16	153	68	2	239	101	45	8	4	158	13	176	4	2	195	653
% App. Total	6.6	67.2	18	8.2		6.7	64	28.5	0.8		63.9	28.5	5.1	2.5		6.7	90.3	2.1	1_		
PHF	.500	.788	.458	.313	.953	.444	.890	.773	.250	.830	.815	.865	.400	.333	.859	.650	.830	.500	.250	.841	.897
Cars & Peds	4	41	11	5	61	16	152	68	2	238	101	45	8	4	158	13	175	4	2	194	651
% Cars & Peds	100	100	100	100	100	100	99.3	100	100	99.6	100	100	100	100	100	100	99.4	100	100	99.5	99.7
Trucks & Buses	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
% Trucks & Buses	0	0	0	0	0	0	0.7	0	0	0.4	0	0	0	0	0	0	0.6	0	0	0.5	0.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



## APPENDIX B

Seasonal Adjustment Data

## SEASONAL ADJUSTMENT DATA

### The Residence at Carter Mill

### Needham, MA

MassDC	OT Continuou	s Count Station			December	% Above
ID	Town	Roadway	Year	AADT	ADT	AADT
4165	Newton	Yankee Division	2014	145,000	139,000	-4%
		Highway				

## **APPENDIX C**

Crash Summary

## **CRASH ANALYSIS**

The Residence at Carter Mill Needham, MA

Needitalii, WA	West Street at Highland Avenue	West Street at Hillside Avenue	West Street at Avery Square/ Site Driveway	Highland Avenue at Morton Street/ Site Driveway	
Year	,			_	
2013	5	5	2	2	
2014	10	8	0	1	
2015	7	12	1	0	
2016	3	9	1	1	
2017	5	10	2	1	
Type					
Angle	10	36	4	0	
Rear-end	9	3	1	3	
Sideswipe	9	0	0	1	
Head-on	0	1	0	0	
Single Vehicle	2	3	1	1	
Unknown	0	1	0	0	
Severity					
Property Damage	25	26	6	2	
Personal Injury	4	15	0	3	
Fatality	0	0	0	0	
Unknown	1	3	0	0	
Weather					
Clear	24	34	5	4	
Cloudy	3	8	0	1	
Rain	2	1	1	0	
Snow	1	1	0	0	
Time					
7:00 AM to 9:00 AM	4	2	0	0	
9:00 AM to 4:00 PM	17	32	3	3	
4:00 PM to 6:00 PM	4	4	0	0	
6:00 PM to 7:00 AM	5	6	3	2	
Total	30	44	6	5	
Crash Rate	0.77	2.11	0.34	0.21	
State Average	0.78	0.57	0.57	0.57	
District 6 Average	0.71	0.52	0.52	0.52	

Source: MassDOT

## APPENDIX D

Traffic Projection Model

### TRAFFIC PROJECTION MODEL

Weekday Morning Peak Hour The Residence at Carter Mill

Needham, MA Seasonal Existing Background New New New New New Counted Counted /COVID Volumes Growth 7 yrs No Build Project Project Project Project Project Build Volumes Volumes Adjustment (at 1% Volumes PERCENT Trips PERCENT Trips Trips Volumes Intersection Dir. Turn per year) ENTER ENTER **EXIT** EXIT TOTAL West Street at EB L 20% Highland Avenue T 10% R WB L 5% 10% T R NB L T 15% R 5% SB L 15% Т R 20% West Street at EB L Hillside Avenue T 15% (Counted 2021) R WB L 15% R 5% NB L 5% R SB L 5% Τ R West Street at EB T Site Driveway/Avery Square R 25% 30% WB L T NB L 25% 30% R SB L Τ R EB L Highland Avenue at 20% Site Driveway/Morton Street T R 25% WB L R NB L 25% Т R SB L T R 20% 

Peak Hour: 7:45 AM - 8:45 AM

### TRAFFIC PROJECTION MODEL

Weekday Afternoon Peak Hour The Residence at Carter Mill Needham, MA

Needham, MA			2019	2021	Seasonal	Existing	Background	2026	New	New	New	New	New	2026
			Counted	Counted	/COVID	Volumes	Growth 7 yrs	No Build	Project	Project	Project	Project	Project	Build
			Volumes	Volumes	Adjustment	voidines	(at 1%	Volumes	PERCENT	Trips	PERCENT	Trips	Trips	Volumes
Intersection	Dir	Turn	voluntes	voiumes	Aujustinent		per year)	voluntes	ENTER	ENTER	EXIT	EXIT	TOTAL	volunies
West Street at		L	154		6	160	12	172	EITER	0	20%	5	5	177
Highland Avenue		T	208		8	216	16	232		0	10%	2	2	234
Ü		R	45		2	47	3	50		0		0	0	50
	WB	L	61		2	63	5	68	5%	1		0	1	69
		T	139		6	145	10	155	10%	2		0	2	157
		R	54		2	56	4	60		0		0	0	60
	NB	L	23		1	24	2	26		0		0	0	26
		T	345		14	359	26	385		0	15%	4	4	389
		R	47		2	49	4	53		0	5%	1	1	54
	SB	L	30		1	31	2	33		0		0	0	33
		T	438		18	456	33	489	15%	3		0	3	492
		R	71		3	74	5	79	20%	4		0	4	83
West Street at	EB	L		4	2	6	0	6		0		0	0	6
Hillside Avenue		T		176	74	250	18	268	15%	3		0	3	271
(Counted 2021)		R		13	5	18	1	19		0		0	0	19
	WB	L		68	26	94	7	101		0	5%	1	1	102
		T		153	57	210	15	225		0	15%	4	4	229
		R		16	6	22	1	23		0	5%	1	1	24
	NB			8	3	11	1	12		0		0	0	12
		T		45	18	63	5	68		0		0	0	68
		R		101	42	143	11	154	5%	1		0	1	155
	SB	L		11	5	16	1	17	5%	1		0	1	18
		T		41	16	57	4	61		0		0	0	61
		R		4	2	6	0	6		0		0	0	6
West Street at	EB		394		15	409	30	439		0		0	0	439
Site Driveway/Avery Square		R	0		0	0	0	0	25%	5		0	5	5
	WB		0		0	0	0	0	30%	6		0	6	6
		T	233		10	243	17	260		0		0	0	260
	NB		1		0	1	0	1		0	25%	6	6	7
		R	0		0	0	0	0		0	30%	7	7	7
	SB	L	13		1	14	1	15		0		0	0	15
		T	0 79		0	0 82	0	0		0		0	0	0
		R	79		3	82	6	88		0		0	0	88
Highland Avenue at	EB	L	0		0	0	0	0		0	20%	5	5	5
Site Driveway/Morton Street		T	0		0	0	0	0		0		0	0	0
		R	0		0	0	0	0		0	25%	6	6	6
	WB		6		0	6	0	6		0		0	0	6
		T	1		0	1	0	1		0		0	0	1
		R	9		0	9	1	10	050/	0		0	0	10
	NB		1		0	1	0	1	25%	5		0	5	6
		T	379		17	396	31	427		0		0	0	427
	CD	R	23		1	24	2	26		0		0	0	26
	SB	L T	16		1 21	17	1 40	18		0		0	0	18 587
		I R	526 2		0	547 2	40 0	587 2	209/			0		6
		ĸ	۷		U		U		20%	4		U	4	ь

Peak Hour: 4:30 PM - 5:30 PM

# APPENDIX E

Highway Capacity Manual Methodologies

#### CAPACITY/LEVEL-OF-SERVICE ANALYSES METHODOLOGY

The detailed capacity/level-of-service analysis contained in this traffic impact study was performed in accordance with the standard techniques contained in the *Highway Capacity Manual*. (1) By definition, capacity represents "the maximum rate of flow that can reasonably be expected to pass a point on a uniform section of a lane or roadway under prevailing roadway, traffic, and control conditions." The level of functioning of an intersection or a uniform section of a lane or roadway can be expressed in terms of levels of service. Level of service (LOS) is defined as "a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers". Such measures include "speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety."

At unsignalized intersections, a methodology for evaluating the relative functioning of intersections controlled by stop or yield signs has been developed, and is based on several assumptions, including:

- Major street flows are not affected by the minor (stop-sign controlled) street movements.
- Left turns from the major street to the minor street are influenced only by opposing major street through flow.
- Minor street left turns are impeded by all major street traffic plus opposing minor street traffic.
- Minor street through traffic is impeded by all major street traffic.
- Minor street right turns are impeded only by the major street traffic coming from the left.

The concept of stop-controlled or yield-controlled intersection analysis is based on the estimate of average total delay on minor streets. The methodology of analysis relies on three elements: the size and distribution of gaps in the major traffic stream, the usefulness of these gaps to the minor stream drivers, and the relative priority of the various traffic streams at the intersection. The results of the analysis provide an estimate of average total delay for the various critical movements at the unsignalized intersections. Correlation between average total delay and the respective levels of service are provided for unsignalized intersections as follows:

<sup>(1)</sup> Transportation Research Board, Highway Capacity Manual, 6<sup>th</sup> Edition, published by the Transportation Research Board, Washington, DC, 2016.

Unsign	ialized Intersections
Level of Service	Control Delay Per Vehicle
	(seconds)
A	0 - 10
В	>10 – 15
С	>15 – 25
D	>25 – 35
E	>35 – 50
F	> 50

At signalized intersections, an additional element must be considered: time allocation. Level of service is based on the average control delay per vehicle for various movements within the intersection. Volume/capacity relationships also affect the operations of signalized intersections. Thus, both volume/capacity and delay must be considered to evaluate the overall operation of a signalized intersection. Correlation between average delay per vehicle and the respective levels of service are provided for signalized intersections as follows:

	Signalized Intersections
Level of	<b>Control Delay Per Vehicle</b>
Service	(seconds)
A	<u>&lt;</u> 10
В	>10 – 20
С	>20 – 35
D	>35 – 55
E	>55 – 80
F	> 80

# APPENDIX F

2019 Existing Capacity/Level-of-Service Analysis

	۶	<b>→</b>	•	•	+	•	•	<b>†</b>	<b>/</b>	<b>/</b>	<b>↓</b>	✓
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	f)		ሻ	ĥ			4			4	
Traffic Volume (vph)	197	204	29	36	175	53	29	430	54	24	265	89
Future Volume (vph)	197	204	29	36	175	53	29	430	54	24	265	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%		· <u>-</u>	0%			0%			0%	
Storage Length (ft)	0	070	0	175	070	0	0	070	0	0	070	0
Storage Lanes	1		0	1,3		0	0		0	0		0
Taper Length (ft)	25		U	25		U	25		U	25		U
Satd. Flow (prot)	1736	1807	0	1805	1820	0	0	1803	0	0	1759	0
Flt Permitted	0.270	1007	U	0.608	1020	U	U	0.963	U	U	0.943	U
Satd. Flow (perm)	493	1807	0	1155	1820	0	0	1742	0	0	1664	0
Right Turn on Red	473	1007	No	1100	1020	No	U	1742	No	U	1004	No
Satd. Flow (RTOR)			INO			INU			INU			INU
		30			30			30			30	
Link Speed (mph)		180			604							
Link Distance (ft)								813			295	
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00	0.05	0.05	0.05
Peak Hour Factor	0.96	0.96	0.96	0.87	0.87	0.87	0.88	0.88	0.88	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	3%	4%	0%	1%	0%	4%	4%	0%	0%	4%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	205	243	0	41	262	0	0	583	0	0	398	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	
Total Split (s)	15.0	45.0		30.0	30.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.4%	40.2%		26.8%	26.8%		40.2%	40.2%		40.2%	40.2%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	35.1	35.1		19.3	19.3			37.1			37.1	
Actuated g/C Ratio	0.36	0.36		0.20	0.20			0.38			0.38	
v/c Ratio	0.50	0.38		0.20	0.20			0.89			0.64	
Control Delay	39.0	28.5		38.2	52.8			49.2			33.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
3												
Total Delay	39.0	28.5		38.2	52.8			49.2			33.2	

Lane Group	Ø9	
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Growth Factor		
Heavy Vehicles (%)		
Bus Blockages (#/hr)		
Parking (#/hr)		
Mid-Block Traffic (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	9	
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	7.0	
Minimum Split (s)	22.0	
Total Split (s)	22.0	
Total Split (%)	20%	
Yellow Time (s)	2.0	
All-Red Time (s)	0.0	
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag		
Lead-Lag Optimize?		
Recall Mode	None	
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		

	•	$\rightarrow$	•	<	•	•	1	Ť		-	<b>↓</b>	4
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С		D	D			D			С	
Approach Delay		33.3			50.8			49.2			33.2	
Approach LOS		С			D			D			С	
Queue Length 50th (ft)	107	129		24	172			374			223	
Queue Length 95th (ft)	#185	198		54	251			#600			352	
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								
Base Capacity (vph)	308	777		310	489			749			715	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.67	0.31		0.13	0.54			0.78			0.56	

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 98.8

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

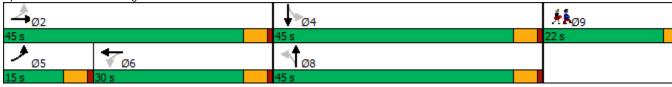
Intersection Signal Delay: 41.7 Intersection LOS: D
Intersection Capacity Utilization 70.4% ICU Level of Service C

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Int Delay, s/veh	Intersection												
Movement		15.7											
Traffic Vol, veh/h			EDT	EDD	WDL	MDT	WDD	NDI	NDT	NDD	CDI	CDT	CDD
Traffic Vol, veh/h		FRF		FRK	WBL		WRK	NRL		NRK	SRF		2RK
Future Vol, veh/h		10		00	1.10		00	0.0		07	•		47
Conflicting Peds, #/hr													
Sign Control   Free   Free   Free   Free   Free   Free   Free   Free   Free   Stop   Stop	· ·												
RT Channelized   None   None   None   - None   None   - None   - None													
Storage Length			Free						•		•		
Veh in Median Storage, # - 0		-	-			-	None		-		-		None
Grade, %         -         0         -         -         0         -         -         0         0         0         0         9           Meany Welcicles, %         0         4         0         0         3         0         23         0         0         0         9           MinorT         15         378         27         153         239         31         22         70         105         14         103         26           Mijor/Minor         Mali         275         0         0         410         0         0         1054         1008         397         1075         1006         262           Stage 1         -         -         -         -         6.27         581         -		-	-			-	-		-		-		-
Peak Hour Factor		# -		-			-						
Heavy Vehicles, %													
Mymit Flow   15   378   27   153   239   31   22   70   105   14   103   26													
Major/Minor         Major1         Major2         Minor1         Minor2         Minor1         Minor2         Minor2         Minor2         Minor2         Minor2         Conflicting Flow All Stage 1         275         0         0         410         0         0         1054         1008         397         1075         1006         262         262         Stage 1         -         -         -         427         427         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         566         566         -         567         581         -         509         440         -         -         6.29         -         6.1         5.5         -         6.1         5.5         -         6.1         5.5         -         6.1         5.5         -         -         6.29         7.1         6.5         6.29         7.1         6.0         9.0         9.0         9.0         9.0         9.0         9.0 <td></td>													
Conflicting Flow All   275   0   0   410   0   0   1054   1008   397   1075   1006   262	IVIVMt Flow	15	3/8	2/	153	239	31	22	70	105	14	103	26
Conflicting Flow All   275   0   0   410   0   0   1054   1008   397   1075   1006   262													
Conflicting Flow All   275   0   0   410   0   0   1054   1008   397   1075   1006   262	Major/Minor M	ajor1		ľ	Major2		[	Minor1		Λ	/linor2		
Stage 1         -         -         -         427         427         -         566         566         -           Stage 2         -         -         -         -         627         581         -         509         440         -           Critical Hdwy         4.1         -         -         4.1         -         -         7.33         6.5         6.2         7.1         6.5         6.29           Critical Hdwy Stg 1         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Critical Hdwy Stg 2         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Follow-up Hdwy         2.2         -         2.2         -         3.707         4         3.3         3.5         4         3.881           Pot Cap-1 Maneuver         1300         -         1160         -         -         186         242         657         199         243         760           Stage 2         -         -         -         -         -         -         -         -         -         - <t< td=""><td></td><td></td><td>0</td><td></td><td></td><td>0</td><td></td><td></td><td>1008</td><td></td><td></td><td>1006</td><td>262</td></t<>			0			0			1008			1006	262
Stage 2         -         -         -         -         627         581         -         509         440         -           Critical Hdwy         4.1         -         -         4.1         -         -         7.33         6.5         6.2         7.1         6.5         6.29           Critical Hdwy Stg 1         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Critical Hdwy Stg 2         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Follow-up Hdwy         2.2         -         -         2.2         -         -         8.3707         4         3.3         3.5         4         3.381           Pollow-up Hdwy         2.2         -         -         1160         -         -         186         242         657         199         243         760           Stage 1         -         -         -         -         -         438         503         -         550         581         -           Plation blocked, %         -         -         -         -         94			-	-	-		-						
Critical Hdwy       4.1       -       -       4.1       -       -       7.33       6.5       6.2       7.1       6.5       6.29         Critical Hdwy Stg 1       -       -       -       -       -       6.33       5.5       -       6.1       5.5       -         Critical Hdwy Stg 2       -       -       -       -       -       6.33       5.5       -       6.1       5.5       -         Follow-up Hdwy       2.2       -       -       2.2       -       3.707       4       3.3       3.5       4       3.81         Pot Cap-1 Maneuver       1300       -       -       1160       -       -       186       242       657       199       243       760         Stage 1       -       -       -       -       -       566       589       -       513       511       -         Stage 2       -	o o	-	-	-	-	-	-			-			-
Critical Hdwy Stg 1         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Critical Hdwy Stg 2         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Follow-up Hdwy         2.2         -         -         2.2         -         -         3.707         4         3.3         3.5         4         3.811           Pot Cap-1 Maneuver         1300         -         1160         -         -         186         242         657         199         243         760           Stage 1         -         -         -         -         566         589         -         513         511         -           Stage 2         -         -         -         -         -         438         503         -         550         581         -           Platoon blocked, %         - <t< td=""><td></td><td>4.1</td><td>-</td><td>-</td><td>4.1</td><td>-</td><td>-</td><td></td><td></td><td>6.2</td><td></td><td></td><td>6.29</td></t<>		4.1	-	-	4.1	-	-			6.2			6.29
Critical Hdwy Stg 2         -         -         -         -         6.33         5.5         -         6.1         5.5         -           Follow-up Hdwy         2.2         -         -         2.2         -         -         3.707         4         3.3         3.5         4         3.81           Pot Cap-1 Maneuver         1300         -         1160         -         -         186         242         657         199         243         760           Stage 1         -         -         -         -         -         566         589         -         513         511         -           Stage 2         -         -         -         -         -         438         503         -         550         581         -           Plation blocked, %         -         -         -         -         -         -         438         503         -         550         581         -           Plation blocked, %         -         -         -         -         94         199         654         106         200         755           Mov Cap-1 Maneuver         1294         -         -         -         555	<b>3</b>		-	-		-	-						
Follow-up Hdwy 2.2 2.2 3.707		-	-	-	-	-	-			-			-
Pot Cap-1 Maneuver         1300         -         1160         -         -         186         242         657         199         243         760           Stage 1         -         -         -         -         -         566         589         -         513         511         -           Stage 2         -         -         -         -         -         438         503         -         550         581         -           Plation blocked, %         -         -         -         -         -         438         503         -         550         581         -           Mov Cap-1 Maneuver         1294         -         1154         -         94         199         654         106         200         755           Mov Cap-2 Maneuver         -         -         -         -         94         199         -         106         200         -           Stage 1         -         -         -         -         555         577         -         503         429         -           Stage 2         -         -         -         -         270         422         -         400         569		2.2	-	-	2.2	-	-			3.3			3.381
Stage 1         -         -         -         -         566         589         -         513         511         -           Stage 2         -         -         -         -         438         503         -         550         581         -           Platoon blocked, %         -<		1300	-	-	1160	-	-	186	242	657	199		
Stage 2	· · · · · · · · · · · · · · · · · · ·	-	-	-	-	-	-	566	589	-		511	-
Platoon blocked, %		-	-	-		-	-	438	503	-	550	581	-
Mov Cap-2 Maneuver         -         -         -         94         199         -         106         200         -           Stage 1         -         -         -         -         555         577         -         503         429         -           Stage 2         -         -         -         -         -         270         422         -         400         569         -           Approach         EB         WB         NB         NB         SB           HCM Control Delay, s         0.3         3.1         49.5         52.1           HCM LOS         E         F         F    Minor Lane/Major Mvmt  NBLn1  EBL  EBT  EBR  WBL  WBT  WBR SBLn1  Capacity (veh/h)  265  1294  - 1154  - 210  HCM Lane V/C Ratio  0.742  0.011  - 0.132  - 0.678  HCM Control Delay (s)  49.5  7.8  0 - 8.6  0 - 52.1  HCM Lane LOS  E  A  A  A  A  - F			-	-		-	-						
Stage 1         -         -         -         -         555         577         -         503         429         -           Stage 2         -         -         -         -         -         270         422         -         400         569         -           Approach         EB         WB         NB         NB         SB           HCM Control Delay, s         0.3         3.1         49.5         52.1           HCM LOS         E         F         F    Minor Lane/Major Mvmt  NBLn1  EBL  EBT  EBR  WBL  WBT  WBR SBLn1  Capacity (veh/h)  265  1294  - 1154  - 210  HCM Lane V/C Ratio  0.742  0.011  - 0.132  - 0.678  HCM Control Delay (s)  49.5  7.8  0  - 8.6  0  - 52.1  HCM Lane LOS  E  A  A  A  - F	Mov Cap-1 Maneuver	1294	-	-	1154	-	-	94	199	654	106	200	755
Stage 2         -         -         -         -         -         270         422         -         400         569         -           Approach         EB         WB         NB         SB           HCM Control Delay, s         0.3         3.1         49.5         52.1           HCM LOS         E         F    Minor Lane/Major Mvmt  NBLn1  EBL  EBT  EBR  WBL  WBT  WBR SBLn1  Capacity (veh/h)  265  1294  - 1154  - 210  HCM Lane V/C Ratio  0.742  0.011  - 0.132  - 0.678  HCM Control Delay (s)  49.5  7.8  0  - 8.6  0  - 52.1  HCM Lane LOS  E  A  A  - A  A  - F	Mov Cap-2 Maneuver	-	-	-	-	-	-	94	199	-	106	200	-
Approach         EB         WB         NB         SB           HCM Control Delay, s         0.3         3.1         49.5         52.1           HCM LOS         E         F             Minor Lane/Major Mvmt         NBLn1         EBL         EBT         EBR         WBL         WBT         WBR SBLn1           Capacity (veh/h)         265         1294         -         -         1154         -         -         210           HCM Lane V/C Ratio         0.742         0.011         -         -         0.132         -         -         0.678           HCM Control Delay (s)         49.5         7.8         0         -         8.6         0         -         52.1           HCM Lane LOS         E         A         A         -         A         A         -         F	Stage 1	-	-	-	-	-	-	555	577	-	503	429	-
HCM Control Delay, s   0.3   3.1   49.5   52.1     HCM LOS	Stage 2	-	-	-	-	-	-	270	422	-	400	569	-
HCM Control Delay, s   0.3   3.1   49.5   52.1     HCM LOS													
HCM Control Delay, s   0.3   3.1   49.5   52.1     HCM LOS	Annroach	FR			WR			NR			SB		
Minor Lane/Major Mvmt         NBLn1         EBL         EBT         EBR         WBL         WBT         WBR SBLn1           Capacity (veh/h)         265         1294         -         -         1154         -         -         210           HCM Lane V/C Ratio         0.742         0.011         -         -         0.132         -         -         0.678           HCM Control Delay (s)         49.5         7.8         0         -         8.6         0         -         52.1           HCM Lane LOS         E         A         A         -         A         A         -         F													
Minor Lane/Major Mvmt         NBLn1         EBL         EBT         EBR         WBL         WBT         WBR SBLn1           Capacity (veh/h)         265         1294         -         -         1154         -         -         210           HCM Lane V/C Ratio         0.742         0.011         -         -         0.132         -         -         0.678           HCM Control Delay (s)         49.5         7.8         0         -         8.6         0         -         52.1           HCM Lane LOS         E         A         A         -         A         A         -         F		0.5			J. I								
Capacity (veh/h) 265 1294 1154 210  HCM Lane V/C Ratio 0.742 0.011 0.132 0.678  HCM Control Delay (s) 49.5 7.8 0 - 8.6 0 - 52.1  HCM Lane LOS E A A - A A - F	TIGIVI EUS							L			Г		
Capacity (veh/h) 265 1294 1154 210  HCM Lane V/C Ratio 0.742 0.011 0.132 0.678  HCM Control Delay (s) 49.5 7.8 0 - 8.6 0 - 52.1  HCM Lane LOS E A A - A A - F													
HCM Lane V/C Ratio       0.742 0.011       -       -       0.132       -       -       0.678         HCM Control Delay (s)       49.5 7.8 0       -       8.6 0       -       52.1         HCM Lane LOS       E       A       A       -       A       A       -       F					EBT			WBT	WBR S	SBLn1			
HCM Control Delay (s) 49.5 7.8 0 - 8.6 0 - 52.1 HCM Lane LOS E A A - A A - F	1 3 \ /				-			-					
HCM Lane LOS E A A - A A - F				0.011	-	-		-	-				
				7.8	0	-			-	52.1			
LICM 0Eth 0/tile O(yeh) E 2 0 0 E 4 2					Α	-		Α	-				
	HCM 95th %tile Q(veh)		5.3	0	-	-	0.5	-	-	4.2			

Intersection												
Int Delay, s/veh	2.2											
	ΓDI	EBT	EDD	WDI	WDT	WDD	MDI	NDT	NDD	CDI	CDT	CDD
Movement	EBL		EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	<b>}</b>	0	1	<b>4</b>	Λ	1	- ♣	0	11	- ♣	00
Traffic Vol, veh/h	0	416 416	0	1	292	0	2	0	0	14 14	0	99 99
Future Vol, veh/h	0		0	1 3	292 0	0	4	0	0	0	0	4
Conflicting Peds, #/hr	Free	0 Free		Free	Free		Stop	Stop		Stop	Stop	Stop
Sign Control RT Channelized	riee -	riee	Free None	riee -	riee -	Free None	310p	Siup -	Stop None	310p -	Slop -	None
Storage Length	-	-	None -	-	-	None	_	-	None -		-	None
Veh in Median Storage,		0	-	-	0	-	-	0	-	-	0	-
Grade, %	π -	0	_	_	0	-	-	0	-		0	-
Peak Hour Factor	95	95	95	82	82	82	50	50	50	75	75	75
Heavy Vehicles, %	2	4	2	0	3	2	0	2	2	0	2	0
Mvmt Flow	0	438	0	1	356	0	4	0	0	19	0	132
IVIVITIL I IOVV	U	730	- 0		550	U	4	- 0	U	17	- 0	132
NA - 1 /N A1	-1- 4		_	A-1. 0			1' 1			A' C		
	ajor1			Major2			/linor1	700		/linor2	700	0.10
Conflicting Flow All	-	0	0	441	0	0	869	799	441	796	799	360
Stage 1	-	-	-	-	-	-	441	441	-	358	358	-
Stage 2	-	-	-	-	-	-	428	358	-	438	441	- / 2
Critical Hdwy	-	-	-	4.1	-	-	7.1	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	- 2.2	-	-	6.1	5.52	2 210	6.1	5.52	- 2 2
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4.018		3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	-	1130	-	0	274	319	616	307	319	689
Stage 1	0	-	-	-	-	0	599 609	577 628	-	664	628 577	-
Stage 2 Platoon blocked, %	0		-	-	-	0	009	028	-	601	3//	-
Mov Cap-1 Maneuver		-	-	1127	-	_	220	318	614	307	318	686
Mov Cap-1 Maneuver	-	-	-	1127	-	-	220	318	014	307	318	000
Stage 1	-	-	-	-	-	-	599	575	-	664	627	-
Stage 1 Stage 2	-	-	-	-	-	-	489	627	-	601	575	-
Staye 2	-	-	<del>-</del>	-	-	-	407	027	-	001	575	-
				14.5								
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			21.7			13.1		
HCM LOS							С			В		
Minor Lane/Major Mvmt		NBLn1	EBT	EBR	WBL	WBT S	SBL <sub>n1</sub>					
Capacity (veh/h)		220	-	-	1127	-	595					
HCM Lane V/C Ratio		0.018	-		0.001	-	0.253					
HCM Control Delay (s)		21.7	-	-	8.2	0	13.1					
HCM Lane LOS		С	-	-	Α	Α	В					
HCM 95th %tile Q(veh)		0.1	-	-	0	-	1					

Intersection												
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	0	0	1	8	0	9	0	492	27	5	303	0
Future Vol, veh/h	0	0	1	8	0	9	0	492	27	5	303	0
Conflicting Peds, #/hr	0	0	0	0	0	0	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	2,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	71	71	71	78	78	78	89	89	89
Heavy Vehicles, %	2	2	0	0	2	11	2	3	0	0	4	2
Mvmt Flow	0	0	4	11	0	13	0	631	35	6	340	0
Major/Minor I	Minor2			Minor1			Major1		N	/lajor2		
Conflicting Flow All	1011	1025	344	1006	1008	652	344	0	0	669	0	0
Stage 1	356	356	-	652	652	-	-	-	-	-	-	-
Stage 2	655	669	_	354	356	_	_	_		_	_	_
Critical Hdwy	7.12	6.52	6.2	7.1	6.52	6.31	4.12	-	-	4.1	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-		_		-	_	_
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.3			3.399	2.218	_	_	2.2	_	_
Pot Cap-1 Maneuver	218	235	703	222	240	452	1215	-	-	931	-	-
Stage 1	661	629	-	460	464			_	_		_	_
Stage 2	455	456	-	667	629	-	-	-	-	-	-	-
Platoon blocked, %								_	_		-	-
Mov Cap-1 Maneuver	210	231	700	219	236	451	1210	-	-	928	-	_
Mov Cap-2 Maneuver	210	231	-	219	236	_	-	-	-	-	-	-
Stage 1	658	621	-	459	463	-	-	-	-	-	-	_
Stage 2	442	455	-	658	621	-	-	-	-	-	_	-
- · · g												
Approach	EB			WB			NB			SB		
HCM Control Delay, s	10.2			18			0			0.1		
HCM LOS	В			С								
Minor Lane/Major Mvm	nt _	NBL	NBT	NBR	EBLn1V	VBLn1	SBL	SBT	SBR			
Capacity (veh/h)		1210	-	-	700	301	928	-	-			
HCM Lane V/C Ratio		-	-	-	0.006	0.08	0.006	-	-			
HCM Control Delay (s)		0	-	-	10.2	18	8.9	0				
HCM Lane LOS		Α	-	-	В	С	Α	Α	-			
HCM 95th %tile Q(veh)	)	0	-	-	0	0.3	0	-	-			

	۶	<b>→</b>	•	•	+	•	•	<b>†</b>	<b>/</b>	<b>/</b>	<b>↓</b>	✓
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	ĵ»		ሻ	f)			4			4	
Traffic Volume (vph)	160	216	47	63	145	56	24	359	49	31	456	74
Future Volume (vph)	160	216	47	63	145	56	24	359	49	31	456	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	175		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25		, in the second	25			25			25		
Satd. Flow (prot)	1752	1849	0	1805	1785	0	0	1841	0	0	1802	0
Flt Permitted	0.307		, in the second	0.576				0.950			0.959	
Satd. Flow (perm)	566	1849	0	1094	1785	0	0	1755	0	0	1733	0
Right Turn on Red			No			No		.,,,	No		., 00	No
Satd. Flow (RTOR)			110			110			110			110
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		180			604			813			295	
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)		7.1			13.7			10.5			0.7	
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.86	0.86	0.86	0.89	0.89	0.89	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	0%	0%	0%	2%	2%	9%	1%	0%	0%	3%	6%
Bus Blockages (#/hr)	0	070	0	0	0	0	0	0	0	0	0	070
Parking (#/hr)	U	U	U	U	U	U	U	U	U	U	U	U
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)		070			070			070			070	
Lane Group Flow (vph)	184	302	0	73	234	0	0	485	0	0	603	0
Turn Type	pm+pt	NA	0	Perm	NA	- U	Perm	NA	0	Perm	NA	
Protected Phases	5	2		1 01111	6		1 OIIII	8		1 01111	4	
Permitted Phases	2			6			8			4	'	
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase	<u> </u>			0	U		0	0		7	7	
Minimum Initial (s)	6.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	
Total Split (s)	13.0	43.0		30.0	30.0		47.0	47.0		47.0	47.0	
Total Split (%)	11.6%	38.4%		26.8%	26.8%		42.0%	42.0%		42.0%	42.0%	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		1.0	0.0		1.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lead/Lag	Lead	3.0		Lag	Lag			5.0			5.0	
Lead-Lag Optimize?	Yes			Yes	Yes							
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	32.1	32.1		18.2	18.2		IVIIII	38.4		IVIIII	38.4	
Actuated g/C Ratio	0.33	0.33		0.19	0.19			0.40			0.40	
v/c Ratio	0.53	0.33		0.19	0.19			0.40			0.40	
Control Delay	39.4	32.2		43.0	51.4			33.3			45.7	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	39.4	32.2		43.0	51.4			33.3			45.7	
Tulai Delay	39.4	32.2		43.0	31.4			აა.ა			43.7	

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	22.0
Total Split (s)	22.0
Total Split (%)	20%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	

	•	-	•	•	•	•	1	<b>†</b>	/	-	<b>↓</b>	4
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С		D	D			С			D	
Approach Delay		34.9			49.4			33.3			45.7	
Approach LOS		С			D			С			D	
Queue Length 50th (ft)	97	170		44	152			270			373	
Queue Length 95th (ft)	151	244		84	223			420			#636	
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								
Base Capacity (vph)	291	773		301	491			811			801	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			0	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.63	0.39		0.24	0.48			0.60			0.75	

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 97.1

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.88

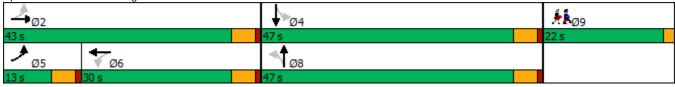
Intersection Signal Delay: 40.3 Intersection LOS: D
Intersection Capacity Utilization 70.9% ICU Level of Service C

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection												
Int Delay, s/veh	9.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	6	250	18	94	210	22	11	63	143	16	57	6
Future Vol, veh/h	6	250	18	94	210	22	11	63	143	16	57	6
Conflicting Peds, #/hr	5	0	4	4	0	5	2	0	2	2	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	85	85	85	84	84	84	88	88	88
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	7	301	22	111	247	26	13	75	170	18	65	7
Major/Minor N	1ajor1		_	Major2		N	Minor1		N	/linor2		
Conflicting Flow All	278	0	0	327	0	0	850	830	318	938	828	267
Stage 1	-	-	-	-	-	-	330	330	-	487	487	-
Stage 2	_	_	-	_	_	_	520	500	-	451	341	-
Critical Hdwy	4.1	_	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	_	-	-	_	_	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	_	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1296	-	-	1244	-	-	283	308	727	247	309	777
Stage 1	-	-	-	-	-	-	687	649	-	566	554	-
Stage 2	-	-	-	-	-	-	543	546	-	592	642	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1290	-	-	1239	-	-	209	271	723	135	272	772
Mov Cap-2 Maneuver	-	-	-	-	-	-	209	271	-	135	272	-
Stage 1	-	-	-	-	-	-	679	642	-	559	493	-
Stage 2	-	-	-	-	-	-	417	486	-	396	635	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			2.4			23.3			29.5		
HCM LOS	JIL						C			D		
Minor Lane/Major Mvmt		NBLn1	EBL	EBT	EBR	WBL	WBT	WBR:	SBI n1			
Capacity (veh/h)		449	1290		LDIK	1239	,,,,,	11.01(	235			
HCM Lane V/C Ratio		0.575		-	-	0.089	-		0.382			
HCM Control Delay (s)		23.3	7.8	0		8.2	0	-	29.5			
HCM Lane LOS		23.3 C	7.6 A	A	-	0.2 A	A	-	29.5 D			
HCM 95th %tile Q(veh)		3.5	0	-	_	0.3	-	-	1.7			
HOW 75HT 70HIC Q(VCH)		5.5	U			0.5		_	1.7			

Intersection												
Int Delay, s/veh	1.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		ĵ.			र्स			4			4	
Traffic Vol, veh/h	0	409	0	0	243	0	1	0	0	14	0	82
Future Vol, veh/h	0	409	0	0	243	0	1	0	0	14	0	82
Conflicting Peds, #/hr	0	0	2	2	0	0	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	79	79	79	25	25	25	82	82	82
Heavy Vehicles, %	2	1	2	2	4	2	0	2	2	0	2	0
Mvmt Flow	0	470	0	0	308	0	4	0	0	17	0	100
Major/Minor M	1ajor1		N	Major2		N	/linor1		N	Minor2		
Conflicting Flow All	- -	0	0	472	0	0	830	780	473	779	780	308
Stage 1	-	-	-		-	-	472	472	-	308	308	-
Stage 2	_		_	_	_		358	308	_	471	472	_
Critical Hdwy	-	_	-	4.12	-	_	7.1	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	_	_	_	-	_	_	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.5	4.018	3.318	3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	_	1090	_	0	292	327	591	316	327	737
Stage 1	0		-	-	-	0	576	559	-	706	660	-
Stage 2	0	-	-	-	-	0	664	660	-	577	559	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	-	-	-	1088	-	-	252	326	589	316	326	737
Mov Cap-2 Maneuver	-	-	-	-	-	-	252	326	-	316	326	-
Stage 1	-	-	-	-	-	-	576	558	-	706	660	-
Stage 2	-	-	-	-	-	-	574	660	-	576	558	-
<u> </u>												
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			19.5			12.2		
HCM LOS	U			U			17.5 C			12.2 B		
TOW LOO										U		
Minor Long/Major M.		IDI ~1	EDT	EDD	WDI	WDT	`DI ~1					
Minor Lane/Major Mvmt	.	VBLn1	EBT	EBR	WBL	WBT S						
Capacity (veh/h)		252	-	-	1088	-	617					
HCM Lane V/C Ratio		0.016	-	-	-	-	0.19					
HCM Control Delay (s)		19.5	-	-	0	-	12.2					
HCM Lane LOS		С	-	-	A	-	В					
HCM 95th %tile Q(veh)		0	-	-	0	-	0.7					

Intersection	0.5											
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	0	0	0	6	1	9	1	396	24	17	547	2
Future Vol, veh/h	0	0	0	6	1	9	1	396	24	17	547	2
Conflicting Peds, #/hr	4	0	0	0	0	4	5	0	16	16	0	5
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	e,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	71	71	71	78	78	78	89	89	89
Heavy Vehicles, %	2	2	2	0	0	0	0	1	0	6	1	0
Mvmt Flow	0	0	0	8	1	13	1	508	31	19	615	2
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	1196	1216	621	1196	1202	544	622	0	0	555	0	0
Stage 1	659	659	- 021	542	542	J44 -	- 022	-	-	-	-	-
Stage 2	537	557	_	654	660	_	_	_	_	_	_	_
Critical Hdwy	7.12	6.52	6.22	7.1	6.5	6.2	4.1	_	_	4.16	_	_
Critical Hdwy Stg 1	6.12	5.52	- 0.22	6.1	5.5	- 0.2	-	_	_		_	_
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.5	_	_	_	_	_	_	_
Follow-up Hdwy	3.518	4.018		3.5	4	3.3	2.2	_	_	2.254	_	_
Pot Cap-1 Maneuver	163	181	487	164	186	543	969	_	-	996	_	_
Stage 1	453	461	-	528	523	- 010	- ,0,	_	_	- , , , ,	_	_
Stage 2	528	512	-	459	463	-	_	-	-	-	-	-
Platoon blocked, %	320	J12		.07	.00			-	-		-	-
Mov Cap-1 Maneuver	153	172	485	158	177	533	964	-	-	981	-	-
Mov Cap-2 Maneuver	153	172	-	158	177	-	-	-	-	-	-	-
Stage 1	450	445	-	520	515	-	_	-	-	-	-	-
Stage 2	512	504	-	446	447	-	-	_	-	-	_	-
J -												
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			19.9			0			0.3		
HCM LOS	A			19.9 C			U			0.5		
TIOWI LOG	A											
		Mari		NIES		VDI 1	05:	057	055			
Minor Lane/Major Mvn	nt	NBL	NBT	NRK F	EBLn1V		SBL	SBT	SBR			
Capacity (veh/h)		964	-	-	-	264	981	-	-			
HCM Lane V/C Ratio		0.001	-	-		0.085		-	-			
HCM Control Delay (s)		8.7	0	-	0	19.9	8.7	0	-			
HCM Lane LOS	,	A	Α	-	Α	С	A	Α	-			
HCM 95th %tile Q(veh	)	0	-	-	-	0.3	0.1	-	-			

# APPENDIX G

2026 No Build Capacity/Level-of-Service Analysis

	٠	<b>→</b>	•	•	<b>←</b>	•	•	<b>†</b>	~	<b>\</b>	<del> </del>	-√
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	*	<b>1</b>	2011	ሻ	<b>1</b>		.,,,,	4		002	4	7
Traffic Volume (vph)	211	219	31	39	188	57	31	461	58	26	284	95
Future Volume (vph)	211	219	31	39	188	57	31	461	58	26	284	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	12	0%	12	12	0%	12	12	0%	12	12	0%	12
Storage Length (ft)	0	070	0	175	070	0	0	070	0	0	070	130
Storage Lanes	1		0	1/3		0	0		0	0		130
Taper Length (ft)	25		U	25		U	25		U	25		
Satd. Flow (prot)	1736	1809	0	1805	1820	0	0	1803	0	0	1825	1524
Flt Permitted	0.233	1007	U	0.599	1020	U	U	0.965	U	U	0.918	1324
Satd. Flow (perm)	426	1809	0	1138	1820	0	0	1745	0	0	1682	1524
Right Turn on Red	420	1009	No	1130	1020	No	U	1743	No	U	1002	No
			INO			INU			INO			INO
Satd. Flow (RTOR)		30			20			20			20	
Link Speed (mph)					30			30			30	
Link Distance (ft)		180			604			813			295	
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00	0.05	0.05	0.05
Peak Hour Factor	0.96	0.96	0.96	0.87	0.87	0.87	0.88	0.88	0.88	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	3%	4%	0%	1%	0%	4%	4%	0%	0%	4%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	220	260	0	45	282	0	0	625	0	0	326	100
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	5.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	5.0
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	11.0
Total Split (s)	15.0	45.0		30.0	30.0		45.0	45.0		45.0	45.0	15.0
Total Split (%)	13.4%	40.2%		26.8%	26.8%		40.2%	40.2%		40.2%	40.2%	13.4%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	None		None	None		Min	Min		Min	Min	None
Act Effct Green (s)	35.6	35.6		20.2	20.2			40.0			40.0	51.7
Actuated g/C Ratio	0.35	0.35		0.20	0.20			0.39			0.39	0.51
v/c Ratio	0.79	0.41		0.20	0.79			0.92			0.50	0.13
Control Delay	48.9	29.1		38.4	56.4			52.5			29.5	9.4
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Delay	48.9	29.1		38.4	56.4			52.5			29.5	9.4
Total Delay	40.9	Z7. I		ათ.4	30.4			02.5			29.0	7.4

01/14/2021 McMahon Associates

Lane Group	Ø9
LaneConfigurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr) Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	7
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	22.0
Total Split (s)	22.0
	20%
Total Split (%) Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize? Recall Mode	None
	None
Act Effet Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	

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		•	•	•			,	'	′		•	
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С		D	Е			D			С	Α
Approach Delay		38.2			53.9			52.5			24.8	
Approach LOS		D			D			D			С	
Queue Length 50th (ft)	116	139		26	188			426			177	19
Queue Length 95th (ft)	#193	213		58	272			#665			278	40
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								130
Base Capacity (vph)	279	726		285	456			700			674	769
Starvation Cap Reductn	0	0		0	0			0			0	0
Spillback Cap Reductn	0	0		0	0			0			0	0
Storage Cap Reductn	0	0		0	0			0			0	0
Reduced v/c Ratio	0.79	0.36		0.16	0.62			0.89			0.48	0.13

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 102.3

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.92

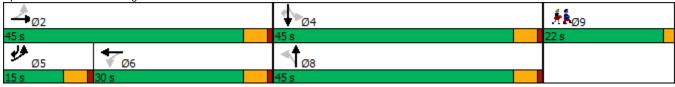
Intersection Signal Delay: 42.7 Intersection LOS: D
Intersection Capacity Utilization 87.6% ICU Level of Service E

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection												
Int Delay, s/veh	26											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	13	332	24	152	238	31	21	69	104	10	73	18
Future Vol, veh/h	13	332	24	152	238	31	21	69	104	10	73	18
Conflicting Peds, #/hr	5	0	5	5	0	5	2	0	0	0	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	93	93	93	92	92	92	66	66	66
Heavy Vehicles, %	0	4	0	0	3	0	23	0	0	0	0	9
Mvmt Flow	16	405	29	163	256	33	23	75	113	15	111	27
Major/Minor N	1ajor1			Major2			Minor1		N	/linor2		
Conflicting Flow All	294	0	0	439	0	0	1127	1077	425	1150	1075	280
Stage 1		-	-	-	-	-	457	457	-	604	604	-
Stage 2	-	-	-	-	-	-	670	620	-	546	471	-
Critical Hdwy	4.1	_	-	4.1	-	-	7.33	6.5	6.2	7.1	6.5	6.29
Critical Hdwy Stg 1	-	-	-	-	-	-	6.33	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.33	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.707	4	3.3	3.5		3.381
Pot Cap-1 Maneuver	1279	-	-	1132	-	-	165	221	634	177	221	742
Stage 1	-	-	-	-	-	-	545	571	-	489	491	-
Stage 2	-	-	-	-	-	-	414	483	-	526	563	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1273	-	-	1127	-	-	69	178	631	84	178	737
Mov Cap-2 Maneuver	-	-	-	-	-	-	69	178	-	84	178	-
Stage 1	-	-	-	-	-	-	533	558	-	478	404	-
Stage 2	-	-	-	-	-	-	239	398	-	367	551	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			3.2			89			82.6		
HCM LOS							F			F		
Minor Lane/Major Mvmt		VBLn1	EBL	EBT	EBR	WBL	WBT	WBR S	SBI n1			
Capacity (veh/h)		226	1273			1127		-	182			
HCM Lane V/C Ratio			0.012	_	_	0.145	-	_	0.841			
HCM Control Delay (s)		89	7.9	0	_	8.7	0	-	82.6			
HCM Lane LOS		F	Α	A	_	Α	A	_	02.0 F			
HCM 95th %tile Q(veh)		8	0	-	_	0.5	-	-	6			
						3.0						

Intersection												
Int Delay, s/veh	2.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		₽			4			4			4	
Traffic Vol, veh/h	0	446	0	1	313	0	2	0	0	15	0	106
Future Vol, veh/h	0	446	0	1	313	0	2	0	0	15	0	106
Conflicting Peds, #/hr	0	0	3	3	0	0	4	0	0	0	0	4
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	82	82	82	50	50	50	75	75	75
Heavy Vehicles, %	2	4	2	0	3	2	0	2	2	0	2	0
Mvmt Flow	0	469	0	1	382	0	4	0	0	20	0	141
Major/Minor N	Najor1		1	Major2		N	/linor1		N	/linor2		
Conflicting Flow All	-	0	0	472	0	0	931	856	472	853	856	386
Stage 1	-	-	-	-	-	-	472	472	-	384	384	-
Stage 2	-	-	-	-	-	-	459	384	-	469	472	-
Critical Hdwy	-	-	-	4.1	-	-	7.1	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	-	-	-	2.2	-	-	3.5	4.018	3.318	3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	-	1100	-	0	249	295	592	281	295	666
Stage 1	0	-	-	-	-	0	576	559	-	643	611	-
Stage 2	0	-	-	-	-	0	586	611	-	579	559	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	-	-	-	1097	-	-	194	294	590	281	294	663
Mov Cap-2 Maneuver	-	-	-	-	-	-	194	294	-	281	294	-
Stage 1	-	-	-	-	-	-	576	557	-	643	610	-
Stage 2	-	-	-	-	-	-	459	610	-	579	557	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			23.9			13.9		
HCM LOS							С			В		
Minor Lane/Major Mvm	t ſ	NBLn1	EBT	EBR	WBL	WBT S	SBLn1					
Capacity (veh/h)		194	_	_	1097	-	567					
HCM Lane V/C Ratio		0.021	-	-	0.001	_	0.285					
HCM Control Delay (s)		23.9	-	-	8.3	0	13.9					
HCM Lane LOS		С	-	-	A	A	В					
HCM 95th %tile Q(veh)		0.1	-	-	0	-	1.2					

Intersection												
Int Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	0	0	1	9	0	10	0	528	29	5	327	0
Future Vol, veh/h	0	0	1	9	0	10	0	528	29	5	327	0
Conflicting Peds, #/hr	0	0	0	0	0	0	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	e,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	25	25	25	71	71	71	78	78	78	89	89	89
Heavy Vehicles, %	2	2	0	0	2	11	2	3	0	0	4	2
Mvmt Flow	0	0	4	13	0	14	0	677	37	6	367	0
Major/Minor	Minor2		N	Minor1			Major1		N	/lajor2		
Conflicting Flow All	1086	1100	371	1080	1082	699	371	0	0	717	0	0
Stage 1	383	383	-	699	699	-	-	-	-		-	-
Stage 2	703	717	-	381	383	_	_	-	_	_	_	-
Critical Hdwy	7.12	6.52	6.2	7.1	6.52	6.31	4.12	-	-	4.1	-	_
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.3		4.018	3.399	2.218	-	-	2.2	-	-
Pot Cap-1 Maneuver	194	212	679	197	217	425	1188	-	-	893	-	-
Stage 1	640	612	-	434	442	-	-	-	-	-	-	-
Stage 2	428	434	-	645	612	-	-	-		-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	186	209	676	194	214	424	1183	-	-	890	-	-
Mov Cap-2 Maneuver	186	209	-	194	214	-	-	-	-	-	-	-
Stage 1	637	605	-	433	441	-	-	-	-	-	-	-
Stage 2	414	433	-	636	605	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	10.4			19.7			0			0.1		
HCM LOS	В			С								
Minor Lane/Major Mvm	nt	NBL	NBT	NBR	EBLn1V	WBLn1	SBL	SBT	SBR			
Capacity (veh/h)		1183	_	_	676	272	890	_				
HCM Lane V/C Ratio		-	_	_		0.098		_	_			
HCM Control Delay (s)		0	-	-	10.4	19.7	9.1	0	-			
HCM Lane LOS		A	_	-	В	C	A	A	_			
HCM 95th %tile Q(veh	)	0	-	-	0	0.3	0	-	-			
	1					0.0						

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	f)		ሻ	f)			4			ર્ન	7
Traffic Volume (vph)	172	232	50	68	155	60	26	385	53	33	489	79
Future Volume (vph)	172	232	50	68	155	60	26	385	53	33	489	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%		'-	0%			0%			0%	, _
Storage Length (ft)	0	070	0	175	070	0	0	0,0	0	0	0,70	130
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25		· ·	25			25			25		•
Satd. Flow (prot)	1752	1851	0	1805	1785	0	0	1840	0	0	1842	1524
Flt Permitted	0.266	1001	O .	0.564	1700	U	U	0.805	U	U	0.949	1021
Satd. Flow (perm)	491	1851	0	1072	1785	0	0	1485	0	0	1754	1524
Right Turn on Red	771	1001	No	1072	1700	No	U	1403	No	U	1754	No
Satd. Flow (RTOR)			NO			NO			NO			140
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		180			604			813			295	
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)		4.1			13.7			10.5			0.7	
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.86	0.86	0.86	0.89	0.89	0.89	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	3%	0%	0%	0%	2%	2%	9%	100%	0%	0%	3%	6%
Heavy Vehicles (%)					2%				0%		3%	0%
Bus Blockages (#/hr)	0	0	0	0	U	0	0	0	U	0	U	U
Parking (#/hr)		0%			0%			0%			0%	
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)	100	224	0	70	250	0	0	F22	0	0	Г/1	OΓ
Lane Group Flow (vph)	198	324	0	79		0	0	522	U	O Dorm	561	85
Turn Type Protected Phases	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
	5 2	2		,	6		0	8		1	4	5
Permitted Phases		2		6	,		8	0		4	4	4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase	ГО	/ 0		/ 0	/ 0		10.0	10.0		10.0	10.0	ГО
Minimum Initial (s)	5.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	5.0
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	11.0
Total Split (s)	13.0	43.0		30.0	30.0		47.0	47.0		47.0	47.0	13.0
Total Split (%)	11.6%	38.4%		26.8%	26.8%		42.0%	42.0%		42.0%	42.0%	11.6%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	None		None	None		Min	Min		Min	Min	None
Act Effct Green (s)	32.2	32.2		18.9	18.9			42.9			42.9	52.4
Actuated g/C Ratio	0.32	0.32		0.19	0.19			0.42			0.42	0.51
v/c Ratio	0.77	0.55		0.40	0.76			0.84			0.76	0.11
Control Delay	50.9	34.0		44.3	55.2			43.3			36.3	9.0
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Delay	50.9	34.0		44.3	55.2			43.3			36.3	9.0

Lane® Configurations   Traite Volume (opt)	Lane Group	Ø9
Future Volume (vph) Ideal Flow (vphpl) Lane Width (ft) Grade (%) Storage Length (ft) Storage Lanes Taper Length (ft) Satd. Flow (prot) Fit Permitted Satd. Flow (pem) Right Turn on Red Satd. Flow (pem) Right Turn on Red Satd. Flow (pem) Ink Speed (mph) Link Distance (ft) Travel Time (s) Confil. Peds. (#hr) Peak Hour Factor Heavy Vehicles (%) Bus Blockapes (#hr) Parking (#hr) Mid-Block Traffic (%) Lane Group Flow (vph) Lurn Type Protected Phases 9 Permitted Phases 9 Permitted Phases Switch Phase Minimum Inital (s) 7, 0 Minimum Spiti (s) Cool All Red Time (s) Lost Time (s) Lead-Lag Optimize? Recall Mode None Act Effic Green (s) Actuated g'C Ratio vice Ratio	LaneConfigurations	
Ideal Flow (yphp)		
Lane Width (ft)  Storage Lengh (ft)  Storage Lengh (ft)  Storage Lengh (ft)  Storage Lanes  Taper Lengh (ft)  Satd, Flow (prot)  FI Permitted  Satd, Flow (perm)  Right Turn on Red  Satd, Flow (RTOR)  Link Distance (ft)  Link Speed (mph)  Link Distance (ft)  Travel Time (s)  Confl. Bites (#hr)  Peak Hour Factor  Growth Factor  Growth Factor  Heavy Vehicles (%)  Bus Blockages (#hr)  Parking (#hr)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Shared Lane Traffic (%)  Shared Lane From (Ft)  Turn Type  Protected Phases  Detector Phase  Minimum Initial (s)  7.0  Minimum Split (s)  2.0  Total Split (s)  2.0  All-Red Time (s)  Load Lang  Lead-Lang  Lead-Lan	Future Volume (vph)	
Lane Width (ft)  Storage Lengh (ft)  Storage Lengh (ft)  Storage Lengh (ft)  Storage Lanes  Taper Lengh (ft)  Satd, Flow (prot)  FI Permitted  Satd, Flow (perm)  Right Turn on Red  Satd, Flow (RTOR)  Link Distance (ft)  Link Speed (mph)  Link Distance (ft)  Travel Time (s)  Confl. Bites (#hr)  Peak Hour Factor  Growth Factor  Growth Factor  Heavy Vehicles (%)  Bus Blockages (#hr)  Parking (#hr)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Shared Lane Traffic (%)  Shared Lane From (Ft)  Turn Type  Protected Phases  Detector Phase  Minimum Initial (s)  7.0  Minimum Split (s)  2.0  Total Split (s)  2.0  All-Red Time (s)  Load Lang  Lead-Lang  Lead-Lan	Ideal Flow (vphpl)	
Grade (%)  Storage Length (ft)  Static Flow (prot)  Fit Permitted  Said. Flow (prot)  Fit Permitted  Flow (prot)  Flow		
Storage Length (ft)		
Storage Lanes   Taper Length (ft)		
Satd. Flow (perm) Right Turn on Red Satd. Flow (RTOR) Link Speed (mph) Link Distance (ft) Travel Time (s) Confl. Peds. (#/hr) Confl. Rikes (#/hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Shared Lane Traffic (%) Shared Lane Traffic (%) Lane Group Flow (uph) Turn Type Protected Phases Detector Phase Switch Phase Minimum Initial (s) Minimum Spit (s) 2.2.0 Total Spit (%) Yellow Time (s) 2.0 All-Red Time (s) Load/Lag Lead-Lag Optimize? Recall Mode Act Effic Green (s) Actuated giv Ratio Vic Ratio Control Delay Use Lead (s) Vic Ratio Control Delay Use Lead (s) Use Lead (s) Vic Ratio Control Delay Use Lead (s) Vic Ratio		
FIL Permitted Satd. Flow (RTOR) Right Turn on Red Satd. Flow (RTOR) Link Distance (ft) Travel Time (s) Confil. Peds. (#/hr) Confil. Bikes (#/hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Shared Lane Traffic (%) Forum Flow (ph) Turn Type Protected Phases Permitted Phases Detector Phase Switch Phase Minimum Initial (s) Ninimum Split (s) 2.0 Total Split (%) 2.0 All Red Time (s) Lead-Lag Lead-Lag Optimize? Recal Mode Act Effet Green (s) Act Leift Act Leift Green (s) Act Leift Act Leift Act Leift Act Leift Act Leift	Taper Length (ft)	
Satd. Flow (perm)         Right Turn on Red           Satd. Flow (RTOR)         Ink Speed (mph)           Link Distance (tt)         Travel Time (s)           Confl. Peds. (#/hr)         Confl. Diskes (#/hr)           Peak Hour Factor         Flow (#/hr)           Heavy Vehicles (%)         Bus Blockages (#/hr)           Parking (#/hr)         Mid-Block Traffic (%)           Shared Lane Traffic (%)         Shared Lane Traffic (%)           Lane Group Flow (vph)         Turn Type           Protected Phases         9           Permitted Phases         9           Detector Phase         Switch Phase           Minimum Inital (s)         7.0           Minimum Spitt (s)         22.0           Total Spitt (%)         20%           Yellow Time (s)         2.0           All-Red Time (s)         0.0           Lost Time Adjust (s)         Total Spitt (s)           Total Lost Time (s)         Lead/Lag           Lead/Lag Optimize?         Recall Mode           Recal Mode         None           Act Letted Green (s)         Actuated g/C Ratio           Vic Ratio         Control Delay           Queue Delay	Satd. Flow (prot)	
Right Turn on Red Satd. Flow (RTOR) Link Distance (ft) Travel Time (s) Confi. Peds. (#hr) Confi. Blkes (#hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#hr) Parking (#hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases Permitted Phases Detector Phase Switch Phase Minimum Initial (s) Minimum Split (s) Total Split (s) 2.0 Total Split (%) 2.0 All-Red Time (s) Lost Time (s) Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode Act Effet Green (s) Actuated g/C Ratio Vic Ratio Control Delay Queue Delay	Flt Permitted	
Said. Flow (RTOR)  Link Speed (mph)  Link Distance (ft)  Travel Time (s)  Confl. Peds. (#hn)  Confl. Bikes (#hn)  Peak Hour Factor  Growth Factor  Growth Factor  How Blockages (#hn)  Parking (#hn)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Lane Group Flow (vph)  Turn Type  Protected Phases  Detector Phase  Switch Phase  Minimum Initial (s)  7.0  Minimum Spitt (s)  22.0  Total Spitt (s)  22.0  Total Spitt (s)  22.0  Total Spitt (s)  20.0  All-Red Time (s)  0.0  Lost Time (s)  Lost Time (s)  Lost Time (s)  Load/Lag  Lead-Lag Optimize?  Recall Mode  None  Act Effct Green (s)  Actuated g/C Ratio  Vic Ratio  Control Delay  Queue Delay	Satd. Flow (perm)	
Link Speed (mph) Link Distance (ft) Travel Time (s) Confi. Peds. (#/hr) Confi. Bikes (#/hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases Detector Phase Switch Phase Minimum Initial (s) Minimum Spit (s) 12.2 0 Total Spit (%) 20% Yellow Time (s) Lead Time (s) Lead Lag Qulimize? Recall Mode None Act Effet Green (s) Actuated g/C Ratio Vic Ratio Control Delay Queue Delay User Hour Factor  Growth Factor  Growth Factor  Heavy Vehicles (%)  Done  Heavy Vehicles (%)  Done Heavy Vehicles (%	Right Turn on Red	
Link Distance (ft) Travel Time (s) Confl. Peks. (#/hr) Confl. Bikes (#/hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio Vic Ratio Control Delay Queue Delay	Satd. Flow (RTOR)	
Travel Time (s)  Confl. Peds. (#hr)  Confl. Bikes (#hr)  Peak Hour Factor  Growth Factor  Heavy Vehicles (%)  Bus Blockages (#hr)  Parking (#/hr)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Lane Group Flow (vph)  Turn Type  Protected Phases  Detector Phases  Detector Phase  Switch Phase  Minimum Initial (s)  Total Split (s)  22.0  Total Split (s)  22.0  All-Red Time (s)  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode  None  Act Effct Green (s)  Actuated g/C Ralio  Wc Ratio  Control Delay  Queue Delay  Unime (s)  Confl. Delay  Queue Delay		
Confl. Peds. (#/hr)  Confl. Bikes (#/hr)  Peak Hour Factor  Growth Factor  Heavy Vehicles (%)  Bus Blockages (#/hr)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Lane Group Flow (vph)  Turn Type  Protected Phases  Detector Phase  Switch Phase  Minimum Initial (s)  Minimum Spilt (s)  Total Spilt (%)  22.0  Total Spilt (%)  22.0  Total Spilt (%)  20.0  All-Red Time (s)  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode  Act Effct Green (s)  Actuated g/C Ratio  Vic Ratio  Control Delay  Queue Delay  Queue Delay	Link Distance (ft)	
Confl. Bikes (#/hr) Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effet Green (s) Actuated g/C Ratio Wic Ratio Control Delay Queue Delay	Travel Time (s)	
Peak Hour Factor Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Confl. Peds. (#/hr)	
Growth Factor Heavy Vehicles (%) Bus Blockages (#/hr) Burking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Confl. Bikes (#/hr)	
Heavy Vehicles (%) Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases Permitted Phases Detector Phase Switch Phase Minimum Initial (s) Minimum Split (s) 22.0 Total Split (s) 22.0 Total Split (%) 22.0 Total Split (%) 20% Yellow Time (s) All-Red Time (s) Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Peak Hour Factor	
Bus Blockages (#/hr) Parking (#/hr) Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Spit (s) 22.0 Total Spit (s) 22.0 Total Spit (s) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio V/C Ratio Control Delay Queue Delay	Growth Factor	
Parking (#/nr)  Mid-Block Traffic (%)  Shared Lane Traffic (%)  Lane Group Flow (vph)  Turn Type  Protected Phases 9  Permitted Phases  Detector Phase  Switch Phase  Minimum Initial (s) 7.0  Minimum Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio  v/C Ratio  Control Delay  Queue Delay	Heavy Vehicles (%)	
Mid-Block Traffic (%) Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effet Green (s) Actuated g/C Ratio V/C Ratio Control Delay Queue Delay	Bus Blockages (#/hr)	
Shared Lane Traffic (%) Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Parking (#/hr)	
Lane Group Flow (vph) Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Mid-Block Traffic (%)	
Turn Type Protected Phases 9 Permitted Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio y/c Ratio Control Delay Queue Delay	Shared Lane Traffic (%)	
Protected Phases Detector Phase Switch Phase Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effet Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Lane Group Flow (vph)	
Permitted Phases Detector Phase  Switch Phase  Minimum Initial (s) 7.0  Minimum Split (s) 22.0  Total Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio v/c Ratio  Control Delay  Queue Delay	Turn Type	
Detector Phase  Switch Phase  Minimum Initial (s) 7.0  Minimum Split (s) 22.0  Total Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio v/c Ratio  Control Delay  Queue Delay	Protected Phases	9
Switch Phase  Minimum Initial (s) 7.0  Minimum Split (s) 22.0  Total Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio  v/c Ratio  Control Delay  Queue Delay	Permitted Phases	
Minimum Initial (s) 7.0 Minimum Split (s) 22.0 Total Split (s) 22.0 Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay	Detector Phase	
Minimum Split (s) 22.0  Total Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio  v/c Ratio  Control Delay  Queue Delay		
Total Split (s) 22.0  Total Split (%) 20%  Yellow Time (s) 2.0  All-Red Time (s) 0.0  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio  v/c Ratio  Control Delay  Queue Delay		
Total Split (%) 20% Yellow Time (s) 2.0 All-Red Time (s) 0.0 Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Yellow Time (s)  All-Red Time (s)  Lost Time Adjust (s)  Total Lost Time (s)  Lead/Lag  Lead-Lag Optimize?  Recall Mode  Act Effct Green (s)  Actuated g/C Ratio  v/c Ratio  Control Delay  Queue Delay		
All-Red Time (s) Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Lost Time Adjust (s) Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Total Lost Time (s) Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		0.0
Lead/Lag Lead-Lag Optimize? Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Lead-Lag Optimize?  Recall Mode None  Act Effct Green (s)  Actuated g/C Ratio  v/c Ratio  Control Delay  Queue Delay		
Recall Mode None Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Act Effct Green (s) Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		
Actuated g/C Ratio v/c Ratio Control Delay Queue Delay		None
v/c Ratio Control Delay Queue Delay	, ,	
Control Delay Queue Delay		
Queue Delay		
Total Delay		
	Total Delay	

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			•				,	'	<u>'</u>		•	
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С		D	Е			D			D	Α
Approach Delay		40.4			52.6			43.3			32.7	
Approach LOS		D			D			D			С	
Queue Length 50th (ft)	106	186		48	164			330			338	15
Queue Length 95th (ft)	#187	263		90	237			#564			#563	35
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								130
Base Capacity (vph)	256	705		268	447			625			738	783
Starvation Cap Reductn	0	0		0	0			0			0	0
Spillback Cap Reductn	0	0		0	0			0			0	0
Storage Cap Reductn	0	0		0	0			0			0	0
Reduced v/c Ratio	0.77	0.46		0.29	0.56			0.84			0.76	0.11

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 101.8

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

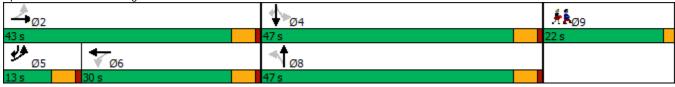
Intersection Signal Delay: 40.7 Intersection LOS: D
Intersection Capacity Utilization 78.9% ICU Level of Service D

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection												
Int Delay, s/veh	11.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	6	268	19	101	225	23	12	68	154	17	61	6
Future Vol, veh/h	6	268	19	101	225	23	12	68	154	17	61	6
Conflicting Peds, #/hr	5	0	4	4	0	5	2	0	2	2	0	2
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	85	85	85	84	84	84	88	88	88
Heavy Vehicles, %	0	1	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	7	323	23	119	265	27	14	81	183	19	69	7
Major/Minor M	lajor1			Major2			Minor1		N	/linor2		
Conflicting Flow All	297	0	0	350	0	0	910	888	341	1005	886	286
Stage 1	-	-	-	-	-	-	353	353	-	522	522	-
Stage 2	-	-	-	-	-	-	557	535	-	483	364	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1276	-	-	1220	-	-	258	285	706	222	286	758
Stage 1	-	-	-	-	-	-	668	634	-	542	534	-
Stage 2	-	-	-	-	-	-	518	527	-	569	627	-
Platoon blocked, %		-	-		-	-						
	1270	-	-	1215	-	-	182	248	702	111	249	753
Mov Cap-2 Maneuver	-	-	-	-	-	-	182	248	-	111	249	-
Stage 1	-	-	-	-	-	-	661	627	-	535	469	-
Stage 2	-	-	-	-	-	-	386	463	-	363	620	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			2.4			29.2			36.5		
HCM LOS							D			E		
										_		
Minor Lane/Major Mvmt		NBLn1	EBL	EBT	EBR	WBL	WBT	WBR S	SRI n1			
	. 1											
Capacity (veh/h) HCM Lane V/C Ratio		418 0.666	1270	-	-	1215 0.098	-	-	207 0.461			
		29.2	7.9	0		8.3	0	-	36.5			
HCM Control Delay (s) HCM Lane LOS		29.2 D			-		A	-	30.5 E			
HCM 95th %tile Q(veh)		4.7	A 0	A -	-	0.3	A -	-	2.2			
HOW FOUT FOUND Q(VEH)		4.7	U	-	-	0.3	-	-	Z.Z			

Intersection												
Int Delay, s/veh	1.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		ĵ.			4			4			4	
Traffic Vol, veh/h	0	439	0	0	260	0	1	0	0	15	0	88
Future Vol, veh/h	0	439	0	0	260	0	1	0	0	15	0	88
Conflicting Peds, #/hr	0	0	2	2	0	0	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	79	79	79	25	25	25	82	82	82
Heavy Vehicles, %	2	1	2	2	4	2	0	2	2	0	2	0
Mvmt Flow	0	505	0	0	329	0	4	0	0	18	0	107
Major/Minor N	/lajor1		1	Major2		N	/linor1		<b>N</b>	/linor2		
Conflicting Flow All	-	0	0	507	0	0	890	836	508	835	836	329
Stage 1	-	-	-	-	-	-	507	507	-	329	329	-
Stage 2	-	-	-	-	-	-	383	329	-	506	507	-
Critical Hdwy	-	-	-	4.12	-	-	7.1	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.52	-	6.1	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.5	4.018	3.318	3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	-	1058	-	0	266	303	565	289	303	717
Stage 1	0	-	-	-	-	0	552	539	-	688	646	-
Stage 2	0	-	-	-	-	0	644	646	-	552	539	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	-	-	-	1056	-	-	226	302	563	289	302	717
Mov Cap-2 Maneuver	-	-	-	-	-	-	226	302	-	289	302	-
Stage 1		-	-	-	-	-	552	538	-	688	646	-
Stage 2	-	-	-	-	-	-	548	646	-	551	538	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			21.2			12.7		
HCM LOS							С			В		
Minor Lane/Major Mvm	t N	NBLn1	EBT	EBR	WBL	WBT S	SBLn1					
Capacity (veh/h)		226	-	-	1056		590					
HCM Lane V/C Ratio		0.018	-	-	-	-	0.213					
HCM Control Delay (s)		21.2	-	-	0	-	12.7					
HCM Lane LOS		С	-	-	A	-	В					
HCM 95th %tile Q(veh)		0.1	-	-	0	-	0.8					

Movement	Intersection												
Lane Configurations	Int Delay, s/veh	0.6											
Lane Configurations	Movement	FBI	FBT	FBR	WBI	WBT	WBR	NBI	NBT	NBR	SBI	SBT	SBR
Traffic Vol, veh/h  0 0 0 6 1 10 1 427 26 18 587 2 Future Vol, veh/h  0 0 0 6 1 10 1 427 26 18 587 2 Future Vol, veh/h  0 0 0 0 6 1 10 1 427 26 18 587 2 Future Vol, veh/h  4 0 0 0 0 0 4 5 5 0 16 16 0 0 5 Sign Control Stop Stop Stop Stop Stop Free Free Free Free Free Free Free Fre											001		0011
Future Vol, veh/h		0		0	6		10	1		26	18		2
Conflicting Peds, #/hr						1		1					
Sign Control         Stop RT Channelized         Stop None         Stop None         Stop None         Stop None         Free RT Channelized         Free RT Channelized         Free RT Channelized         RT Channelized         None         None         RT Channelized         None         N	·					0							
RT Channelized		Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
Veh in Median Storage, # - 0	RT Channelized	•	-		-	-		-	-	None	-	-	None
Grade, %	Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Peak Hour Factor	Veh in Median Storage	e,# -	0	-	-	0	-	-	0	-	-	0	-
Heavy Vehicles, %   2   2   2   2   0   0   0   0   1   0   6   1   0   0   0   0   0   0   0   0   0					-								
Mymt Flow         0         0         0         8         1         14         1         547         33         20         660         2           Major/Minor         Minor2         Minor1         Major1         Major2           Conflicting Flow All         1283         1304         666         1283         1289         584         667         0         0         596         0         0           Stage 1         706         706         -         582         582         -				25	71	71	71	78	78	78	89	89	
Major/Minor         Minor2         Minor1         Major1         Major2           Conflicting Flow All         1283         1304         666         1283         1289         584         667         0         0         596         0         0           Stage 1         706         706         -         582         582         -													
Conflicting Flow All   1283   1304   666   1283   1289   584   667   0   0   596   0   0     Stage 1   706   706   - 582   582         Stage 2   577   598   - 701   707         Critical Hdwy   7.12   6.52   6.22   7.1   6.5   6.2   4.1   -   4.16   -     Critical Hdwy Stg 1   6.12   5.52   - 6.1   5.5     -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -     Critical Hdwy Stg 2   6.12   5.52   -   6.1   5.5   -   -   -     Critical Hdwy Stg 2   6.12   5.52   -   6.1   5.5   -   -   -     Critical Hdwy Stg 2   6.12   5.52   -   6.1   5.5   -   -   -     Critical Hdwy Stg 3   6.12   5.52   -   6.1   5.5   -   -   -     Critical Hdwy Stg 4   6.12   5.52   -     Critical Hdwy Stg 5   6.12   5.52   -     Critical Hdwy Stg 7   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   5.52   6.12   6.12   5.52   6.12   6.12   5.52   6.1	Mvmt Flow	0	0	0	8	1	14	1	547	33	20	660	2
Conflicting Flow All   1283   1304   666   1283   1289   584   667   0   0   596   0   0     Stage 1   706   706   - 582   582         Stage 2   577   598   - 701   707         Critical Hdwy   7.12   6.52   6.22   7.1   6.5   6.2   4.1   -   4.16   -     Critical Hdwy Stg 1   6.12   5.52   - 6.1   5.5     -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 2   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 3   6.12   5.52   - 6.1   5.5   -   -   -   -     Critical Hdwy Stg 4   6.12   5.52   - 6.1   5.5   -   -   -     Critical Hdwy Stg 5   6.12   5.52   -   6.1   5.5   -   -   -     Critical Hdwy Stg 7   6.12   5.52   -     Critical Hdwy Stg 9   6.12   5.5   -   -   -     Critical Hdwy Stg 9   6.12   5.5   -   -   -     Critical Hdwy Stg 9   6.12   5.52   -     Critical Hdwy Stg 9   6.2   5.52   6.1   5.5   -   -     Critical Hdwy Stg 9   6.2   5.52   6.1   5.5   -     Critical Hdwy Stg 9   6.2   5.52   6.1   5.5   -   -     Critical Hdwy Stg 9   6.2   5.52   6.12   5.52   6.12   5.52   6.12     Critical Hdwy Stg 9   6.2   5.52   6.1													
Stage 1         706         706         -         582         582         -	Major/Minor I	Minor2		ı	Minor1		ľ	Major1		ľ	Major2		
Stage 2   577   598   - 701   707   -   -   -   -   -   -   -   -   -	Conflicting Flow All	1283	1304	666	1283	1289	584	667	0	0	596	0	0
Critical Hdwy       7.12       6.52       6.22       7.1       6.5       6.2       4.1       - 4.16       2.16       2.16         Critical Hdwy Stg 1       6.12       5.52       - 6.1       5.5	Stage 1	706	706	-	582	582	-	-	-	-	-	-	-
Critical Hdwy Stg 1       6.12       5.52       -       6.1       5.5       - <t< td=""><td>Stage 2</td><td>577</td><td>598</td><td>-</td><td>701</td><td>707</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></t<>	Stage 2	577	598	-	701	707	-	-	-	-	-	-	-
Critical Hdwy Stg 2         6.12         5.52         -         6.1         5.5         -	<b>3</b>			6.22			6.2	4.1	-	-	4.16	-	-
Follow-up Hdwy 3.518 4.018 3.318 3.5 4 3.3 2.2 - 2.254 Pot Cap-1 Maneuver 142 160 459 143 165 515 932 - 961 Stage 1 427 439 - 502 502				-			-	-	-	-	-	-	-
Pot Cap-1 Maneuver	3 0								-	-	-	-	-
Stage 1									-	-		-	-
Stage 2         502         491         - 433         441	•			459			515	932	-	-	961	-	-
Platoon blocked, %				-			-	-	-	-	-	-	-
Mov Cap-1 Maneuver         132         151         457         137         156         505         928         -         -         946         -         -           Mov Cap-2 Maneuver         132         151         -         137         156         -		502	491	-	433	441	-	-	-	-	-	-	-
Mov Cap-2 Maneuver         132         151         -         137         156         - </td <td></td> <td>100</td> <td>454</td> <td>457</td> <td>107</td> <td>15/</td> <td>FAF</td> <td>000</td> <td>-</td> <td>-</td> <td>0.47</td> <td>-</td> <td>-</td>		100	454	457	107	15/	FAF	000	-	-	0.47	-	-
Stage 1         424         422         - 493         493								928	-	-	946	-	-
Stage 2         484         483         -         419         424         -							-	-	-	-	-	-	-
Approach         EB         WB         NB         SB           HCM Control Delay, s         0         21.4         0         0.3           HCM LOS         A         C         C             Minor Lane/Major Mvmt         NBL         NBT         NBR EBLn1WBLn1         SBL         SBT         SBR           Capacity (veh/h)         928         -         -         243         946         -         -           HCM Lane V/C Ratio         0.001         -         -         0.099         0.021         -         -           HCM Control Delay (s)         8.9         0         -         0         21.4         8.9         0         -           HCM Lane LOS         A         A         -         A         C         A         A         -	9						-	-	-	-	-	-	-
HCM Control Delay, s         0         21.4         0         0.3           HCM LOS         A         C         C           Minor Lane/Major Mvmt         NBL         NBT         NBR EBLn1WBLn1         SBL         SBT         SBR           Capacity (veh/h)         928         -         -         -         243         946         -         -           HCM Lane V/C Ratio         0.001         -         -         -         0.099         0.021         -         -           HCM Control Delay (s)         8.9         0         -         0         21.4         8.9         0         -           HCM Lane LOS         A         A         -         A         C         A         A         -	Staye 2	484	483	-	419	424	-	-	-	-	-	-	-
HCM Control Delay, s         0         21.4         0         0.3           HCM LOS         A         C         C             Minor Lane/Major Mvmt         NBL         NBT         NBR EBLn1WBLn1         SBL         SBT         SBR           Capacity (veh/h)         928         -         -         -         243         946         -         -           HCM Lane V/C Ratio         0.001         -         -         -         0.099         0.021         -         -           HCM Control Delay (s)         8.9         0         -         0         21.4         8.9         0         -           HCM Lane LOS         A         A         -         A         C         A         A         -													
Minor Lane/Major Mvmt         NBL         NBT         NBR EBLn1WBLn1         SBL         SBT         SBR           Capacity (veh/h)         928         -         -         -         243         946         -         -           HCM Lane V/C Ratio         0.001         -         -         -         0.099         0.021         -         -           HCM Control Delay (s)         8.9         0         -         0         21.4         8.9         0         -           HCM Lane LOS         A         A         -         A         C         A         A         -													
Minor Lane/Major Mvmt         NBL         NBT         NBR EBLn1WBLn1         SBL         SBT         SBR           Capacity (veh/h)         928         -         -         -         243         946         -         -           HCM Lane V/C Ratio         0.001         -         -         -         0.099         0.021         -         -           HCM Control Delay (s)         8.9         0         -         0         21.4         8.9         0         -           HCM Lane LOS         A         A         -         A         C         A         A         -								0			0.3		
Capacity (veh/h) 928 243 946 HCM Lane V/C Ratio 0.001 0.099 0.021 HCM Control Delay (s) 8.9 0 - 0 21.4 8.9 0 - HCM Lane LOS A A - A C A A -	HCM LOS	Α			С								
Capacity (veh/h) 928 243 946 HCM Lane V/C Ratio 0.001 0.099 0.021 HCM Control Delay (s) 8.9 0 - 0 21.4 8.9 0 - HCM Lane LOS A A - A C A A -													
HCM Lane V/C Ratio       0.001       -       -       -       0.099       0.021       -       -         HCM Control Delay (s)       8.9       0       -       0       21.4       8.9       0       -         HCM Lane LOS       A       A       -       A       C       A       A       -	Minor Lane/Major Mvm	nt	NBL	NBT	NBR I	EBLn1V	WBLn1	SBL	SBT	SBR			
HCM Control Delay (s) 8.9 0 - 0 21.4 8.9 0 - HCM Lane LOS A A - A C A A -	Capacity (veh/h)		928	-	-	-	243	946	-	-			
HCM Lane LOS A A - A C A A -	HCM Lane V/C Ratio		0.001	-	-	-	0.099	0.021	-	-			
	HCM Control Delay (s)		8.9	0	-	0	21.4	8.9	0	-			
HCM 95th %tile Q(veh) 0 0.3 0.1				Α	-	Α			Α	-			
	HCM 95th %tile Q(veh)	)	0	-	-	-	0.3	0.1	-	-			

## APPENDIX H

2026 Build Capacity/Level-of-Service Analysis

	۶	<b>→</b>	•	€	<b>+</b>	•	•	<b>†</b>	~	<b>/</b>	<b>+</b>	✓
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	*	f)		ሻ	f.			4			ર્ન	7
Traffic Volume (vph)	214	221	31	40	190	57	31	463	59	26	286	98
Future Volume (vph)	214	221	31	40	190	57	31	463	59	26	286	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)	12	0%	12	12	0%	12	12	0%	12	12	0%	12
Storage Length (ft)	0	070	0	175	070	0	0	070	0	0	070	130
Storage Lanes	1		0	1/3		0	0		0	0		1
Taper Length (ft)	25		U	25		U	25		U	25		•
Satd. Flow (prot)	1736	1809	0	1805	1820	0	0	1803	0	0	1825	1524
Flt Permitted	0.229	1007	U	0.597	1020	U	U	0.965	U	U	0.918	1324
Satd. Flow (perm)	418	1809	0	1134	1820	0	0	1745	0	0	1682	1524
Right Turn on Red	410	1009	No	1134	1020	No	U	1745	No	U	1002	No
Satd. Flow (RTOR)			NO			NO			INU			INO
Link Speed (mph)		30			30			30			30	
Link Speed (mpn) Link Distance (ft)		180			604						295	
· ,								813				
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00	0.05	0.05	0.05
Peak Hour Factor	0.96	0.96	0.96	0.87	0.87	0.87	0.88	0.88	0.88	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	4%	3%	4%	0%	1%	0%	4%	4%	0%	0%	4%	6%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	262	0	46	284	0	0	628	0	0	328	103
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	pm+ov
Protected Phases	5	2			6			8			4	5
Permitted Phases	2			6			8			4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase												
Minimum Initial (s)	5.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	5.0
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	11.0
Total Split (s)	15.0	45.0		30.0	30.0		45.0	45.0		45.0	45.0	15.0
Total Split (%)	13.4%	40.2%		26.8%	26.8%		40.2%	40.2%		40.2%	40.2%	13.4%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	5.0
Lead/Lag	Lead			Lag	Lag							Lead
Lead-Lag Optimize?	Yes			Yes	Yes							Yes
Recall Mode	None	None		None	None		Min	Min		Min	Min	None
Act Effct Green (s)	35.6	35.6		20.3	20.3			40.3			40.3	52.0
Actuated g/C Ratio	0.35	0.35		0.20	0.20			0.39			0.39	0.51
v/c Ratio	0.81	0.42		0.21	0.79			0.92			0.50	0.13
Control Delay	51.4	29.2		38.5	56.9			52.6			29.6	9.4
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Delay	51.4	29.2		38.5	56.9			52.6			29.6	9.4
	J 1.4	Z7.Z		30.5	JU.7			JZ.U			27.0	7.4

Lane Group	Ø9
LaneConfigurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr) Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	7
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	22.0
Total Split (s)	22.0
	20%
Total Split (%) Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize? Recall Mode	None
	None
Act Effet Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	

	•	<b>→</b>	•	•	•	•	•	<b>†</b>	/	-	Į.	4
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С	LDIX	D	E	WDIX	NDL	D	NDIX	JDL	С	A
Approach Delay		39.4			54.4			52.6			24.8	
Approach LOS		D			D			D			С	
Queue Length 50th (ft)	117	140		27	189			429			178	20
Queue Length 95th (ft)	#202	215		58	274			#671			279	41
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								130
Base Capacity (vph)	276	722		283	454			696			671	771
Starvation Cap Reductn	0	0		0	0			0			0	0
Spillback Cap Reductn	0	0		0	0			0			0	0
Storage Cap Reductn	0	0		0	0			0			0	0
Reduced v/c Ratio	0.81	0.36		0.16	0.63			0.90			0.49	0.13

## **Intersection Summary**

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 102.7

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.92

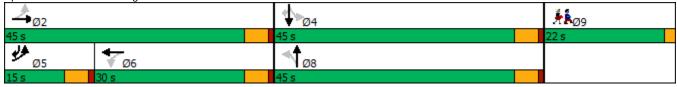
Intersection Signal Delay: 43.1 Intersection LOS: D
Intersection Capacity Utilization 88.1% ICU Level of Service E

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection												
Int Delay, s/veh	27.4											
		EDT	EDD	WDI	WDT	WDD	NDI	NDT	NDD	CDI	CDT	CDD
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	40	4	0.4	450	4	0.0	01	4	405	44	4	10
Traffic Vol, veh/h	13	334	24	153	240	32	21	69	105	11	73	18
Future Vol, veh/h	13	334	24	153	240	32	21	69	105	11	73	18
Conflicting Peds, #/hr	5	0	5	5	0	5	2 Cton	O Cton	O Ctop	O Cton	0	2 Cton
Sign Control RT Channelized	Free	Free	Free None	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
		-	None	-	-	None	-	-	None	-	-	None
Storage Length Veh in Median Storage,	- # -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	# -	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	82	82	82	93	93	93	92	92	92	66	66	66
Heavy Vehicles, %	0	4	02	0	3	0	23	0	0	0	0	9
Mvmt Flow	16	407	29	165	258	34	23	75	114	17	111	27
WWITHER	10	TU1	21	100	230	JT	23	75	117	17	111	21
Major/Minor	010-1			Aniero			lin c 1			Aine 2		
	ajor1			Major2			Minor1	1001		/linor2	1000	000
Conflicting Flow All	297	0	0	441	0	0	1135	1086	427	1158	1083	282
Stage 1	-	-	-	-	-	-	459	459	-	610	610	-
Stage 2	-	-	-	- 11	-	-	676	627	- / 2	548	473	- / 20
Critical Hdwy	4.1	-	-	4.1	-	-	7.33	6.5	6.2	7.1	6.5 5.5	6.29
Critical Hdwy Stg 1	-	-	-	-	-	-	6.33	5.5 5.5	-	6.1	5.5	-
Critical Hdwy Stg 2 Follow-up Hdwy	2.2		-	2.2	-	-	3.707	5.5	3.3	3.5	5.5	3.381
	1276	-	-	1130	-	-	163	218	632	175	219	740
Stage 1	1270		_	1130	_	_	544	570	032	485	488	740
Stage 2	_	-	-	-	-		411	479	-	524	562	-
Platoon blocked, %					-		711	7/7		JZH	302	
	1270		_	1125	_	_	68	175	629	82	176	735
Mov Cap-2 Maneuver	-	_	_	-	_	_	68	175	- 027	82	176	-
Stage 1	_	_	-	_	-	-	532	557	-	474	400	-
Stage 2	-	-	-	-	_	-	235	393	-	365	550	-
							_55	2.0			200	
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			3.1			92.6			89.3		
HCM LOS	0.3			J. I			92.0 F			09.3 F		
TIOWI LOG							<u> </u>			I		
N. 41		IDI. 1	ED!	EDT	EDD	14/51	MOT	MES	201 4			
Minor Lane/Major Mvmt	ſ	VBLn1	EBL	EBT	EBR	WBL	WBT	WBR S				
Capacity (veh/h)			1270	-		1125	-	-				
HCM Lane V/C Ratio			0.012	-	-	0.146	-		0.868			
HCM Control Delay (s)		92.6	7.9	0	-	8.7	0	-	07.0			
HCM Lane LOS		F	A	Α	-	A	Α	-	F			
HCM 95th %tile Q(veh)		8.2	0	-	-	0.5	-	-	6.3			

Intersection												
Int Delay, s/veh	2.5											
	EBL	EBT	EDD	WDI	WDT	WDD	MDI	NDT	NDD	CDI	CDT	CDD
Movement	EBL		EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	0	f)	4	,	4	0	,	4	_	15	4	10/
Traffic Vol, veh/h	0	446	4	6	313	0	6	0	5	15	0	106
Future Vol, veh/h	0	446	4	6	313	0	6	0	5	15	0	106
Conflicting Peds, #/hr	0	0	3	3	0	0	4	0	0	0	0	4
	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,		0	-	-	0	-	-	0	-	-	0	-
Grade, %	- 0F	0	- 0F	-	0	-	-	0	-	- 7F	0	- 75
Peak Hour Factor	95	95	95	82	82	82	92	92	92	75	75	75
Heavy Vehicles, %	2	4	2	2	3	2	2	2	2	0	2	0
Mvmt Flow	0	469	4	7	382	0	7	0	5	20	0	141
Major/Minor Ma	ajor1		I	Major2		<u> </u>	Vinor1		Λ	/linor2		
Conflicting Flow All	<u> </u>	0	0	476	0	0	945	870	474	870	872	386
Stage 1	-	-	-	-	-	-	474	474	-	396	396	-
Stage 2	-	-	-	-	-	-	471	396	-	474	476	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	-	1086	-	0	242	290	590	274	289	666
Stage 1	0	-	-	-	-	0	571	558	-	633	604	-
Stage 2	0	-	-	-	-	0	573	604	-	575	557	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	-	-	-	1083	-	-	188	287	588	270	286	663
Mov Cap-2 Maneuver	-	-	-	-	-	-	188	287	-	270	286	-
Stage 1	-	-	-	-	-	-	571	556	-	633	599	-
Stage 2	-	-	-	-	-	-	446	599	-	570	555	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.2			18.8			14		
HCM LOS	U			0.2			C			В		
							<u> </u>					
Minor Lang/Major Mumt	N	NBLn1	EBT	EBR	WBL	WBT S	CDI n1					
Minor Lane/Major Mvmt			EDI									
Capacity (veh/h)		272	-		1083	-	562					
HCM Control Polov (a)		0.044	-		0.007		0.20.					
HCM Control Delay (s)		18.8	-	-	8.3	0	14					
HCM Lane LOS		C	-	-	A	А	В					
HCM 95th %tile Q(veh)		0.1	-	-	0	-	1.2					

Intersection												
Int Delay, s/veh	0.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	3	0	5	9	0	10	4	528	29	5	327	3
Future Vol, veh/h	3	0	5	9	0	10	4	528	29	5	327	3
Conflicting Peds, #/hr	0	0	0	0	0	0	4	0	3	3	0	4
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	<u> </u>	<u> </u>	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	e,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	71	71	71	78	78	78	89	89	89
Heavy Vehicles, %	2	2	2	0	2	11	2	3	0	0	4	2
Mvmt Flow	3	0	5	13	0	14	5	677	37	6	367	3
Major/Minor I	Minor2		ľ	Minor1			Major1		N	/lajor2		
Conflicting Flow All	1098	1112	373	1092	1095	699	374	0	0	717	0	0
Stage 1	385	385	-	709	709	-	-	-	-	-	-	-
Stage 2	713	727	-	383	386	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.31	4.12	-	-	4.1	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318			3.399	2.218	-	-	2.2	-	-
Pot Cap-1 Maneuver	190	209	673	194	214	425	1184	-	-	893	-	-
Stage 1	638	611	-	428	437	-	-	-	-	-	-	-
Stage 2	423	429	-	644	610	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	181	204	670	190	209	424	1179	-	-	890	-	-
Mov Cap-2 Maneuver	181	204	-	190	209	-	-	-	-	-	-	-
Stage 1	631	604	-	424	433	-	-	-	-	-	-	-
Stage 2	406	425	-	634	603	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	16.1			19.9			0.1			0.1		
HCM LOS	С			С								
Minor Lane/Major Mvm	nt	NBL	NBT	NBR	EBLn1V	WBLn1	SBL	SBT	SBR			
Capacity (veh/h)		1179	-	-	333	268	890	-				
HCM Lane V/C Ratio		0.004	-	-	0.026		0.006	-	-			
HCM Control Delay (s)		8.1	0	-	16.1	19.9	9.1	0	-			
HCM Lane LOS		Α	A	-	С	С	Α	A	-			
HCM 95th %tile Q(veh)	)	0	-	-	0.1	0.3	0	-	-			

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ሻ	f)		ች	f)			4			4	7
Traffic Volume (vph)	177	234	50	69	157	60	26	389	54	33	492	83
Future Volume (vph)	177	234	50	69	157	60	26	389	54	33	492	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0	0,0	0	175	070	0	0	0,0	0	0	0,0	130
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25		· ·	25		J	25		· ·	25		•
Satd. Flow (prot)	1752	1851	0	1805	1785	0	0	1840	0	0	1842	1524
Flt Permitted	0.262	1001		0.563	1700	- U		0.799	· ·		0.949	1021
Satd. Flow (perm)	483	1851	0	1070	1785	0	0	1474	0	0	1754	1524
Right Turn on Red	100	1001	No	1070	1700	No	U	1 17 1	No	· ·	1701	No
Satd. Flow (RTOR)			110			110			140			140
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		180			604			813			295	
Travel Time (s)		4.1			13.7			18.5			6.7	
Confl. Peds. (#/hr)		7.1			13.7			10.5			0.7	
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.86	0.86	0.86	0.89	0.89	0.89	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	0%	0%	0%	2%	2%	9%	1%	0%	0%	3%	6%
Bus Blockages (#/hr)	0	0 / 0	0 / 0	0 %	0	0	970	0	0 /8	0.70	0	070
Parking (#/hr)	U	U	U	U	U	U	U	U	U	U	U	U
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)		070			070			070			070	
Lane Group Flow (vph)	203	326	0	80	253	0	0	527	0	0	564	89
Turn Type	pm+pt	NA	U	Perm	NA	U	Perm	NA	U	Perm	NA	pm+ov
Protected Phases	5	2		I CIIII	6		I CIIII	8		1 CIIII	4	5
Permitted Phases	2			6	U		8	U		4		4
Detector Phase	5	2		6	6		8	8		4	4	5
Switch Phase	J			U	U		U	U		4	4	J
Minimum Initial (s)	5.0	6.0		6.0	6.0		10.0	10.0		10.0	10.0	5.0
Minimum Split (s)	11.0	11.0		11.0	11.0		15.0	15.0		15.0	15.0	11.0
Total Split (s)	13.0	43.0		30.0	30.0		47.0	47.0		47.0	47.0	13.0
Total Split (%)	11.6%	38.4%		26.8%	26.8%		42.0%	42.0%		42.0%	42.0%	11.6%
Yellow Time (s)	4.0	4.0		4.0	4.0		42.070	4.0		42.070	42.070	4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		1.0	0.0		1.0	0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	5.0
Lead/Lag	Lead	5.0						5.0			5.0	Lead
Lead-Lag Optimize?	Yes			Lag Yes	Lag Yes							Yes
Recall Mode	None	None		None	None		Min	Min		Min	Min	None
Act Effct Green (s)	32.3	32.3		19.1	19.1		IVIIII	42.9		IVIIII	42.9	52.4
Actuated g/C Ratio	0.32	0.32		0.19	0.19			0.42			0.42	0.51
v/c Ratio	0.32	0.56		0.19	0.19			0.42			0.42	0.51
Control Delay	53.6	34.0		44.4	55.5			44.9			36.7	9.1
											0.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0				0.0
Total Delay	53.6	34.0		44.4	55.5			44.9			36.7	9.1

Lane Group	Ø9
LaneConfigurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr) Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	7
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	22.0
Total Split (s)	22.0
	20%
Total Split (%) Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	0.0
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize? Recall Mode	None
	None
Act Effet Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	

	•	<b>→</b>	•	•	←	•	•	<b>†</b>	/	<b>\</b>	Ţ	4
	=5.			*			'			051	•	0.5.5
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	С		D	Е			D			D	Α
Approach Delay		41.5			52.8			44.9			32.9	
Approach LOS		D			D			D			С	
Queue Length 50th (ft)	109	187		49	166			337			342	16
Queue Length 95th (ft)	#198	264		91	241			#574			#568	36
Internal Link Dist (ft)		100			524			733			215	
Turn Bay Length (ft)				175								130
Base Capacity (vph)	254	704		267	446			619			737	782
Starvation Cap Reductn	0	0		0	0			0			0	0
Spillback Cap Reductn	0	0		0	0			0			0	0
Storage Cap Reductn	0	0		0	0			0			0	0
Reduced v/c Ratio	0.80	0.46		0.30	0.57			0.85			0.77	0.11

## **Intersection Summary**

Area Type: Other

Cycle Length: 112

Actuated Cycle Length: 102

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.85

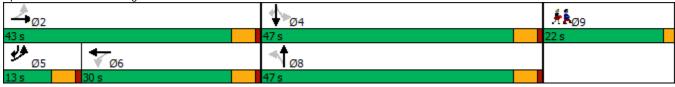
Intersection Signal Delay: 41.5 Intersection LOS: D
Intersection Capacity Utilization 79.6% ICU Level of Service D

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 3: Highland Avenue & West Street



Lane Group	Ø9
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Intersection												
Int Delay, s/veh	11.5											
		EBT	EDD	WDI	WDT	W/DD	MDI	NDT	NDD	CDI	SBT	CDD
Movement	EBL		EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL		SBR
Lane Configurations	/	<b>4</b>	10	100	220	24	10	4	155	10	4	/
Traffic Vol., veh/h	6	271	19	102	229	24	12	68 68	155	18	61	6
Future Vol, veh/h	6 5	271	19 4	102 4	229 0	24 5	12	08	155 2	18	61	6
Conflicting Peds, #/hr Sign Control		0 Free		Free								
RT Channelized	Free	riee	Free None	riee -	Free -	Free None	Stop -	Stop	Stop None	Stop -	Stop	Stop None
Storage Length	-	-	None -	_	-	None	-	-	None -	-	-	None
Veh in Median Storage,		0	-	-	0	-		0	-	-	0	-
Grade, %	.# -	0	_	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	85	85	85	84	84	84	88	88	88
Heavy Vehicles, %	0	1	03	0	1	0	0	0	0	0	0	0
Mymt Flow	7	327	23	120	269	28	14	81	185	20	69	7
IVIVIIIL I IOVV	,	321	23	120	207	20	14	01	103	20	07	,
	/lajor1			Major2			Minor1			/linor2		
Conflicting Flow All	302	0	0	354	0	0	920	899	345	1016	896	290
Stage 1	-	-	-	-	-	-	357	357	-	528	528	-
Stage 2	-	-	-	-	-	-	563	542	-	488	368	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1270	-	-	1216	-	-	254	281	702	218	282	754
Stage 1	-	-	-	-	-	-	665	632	-	538	531	-
Stage 2	-	-	-	-	-	-	514	523	-	565	625	-
Platoon blocked, %	10/4	-	-	1011	-	-	170	244	/00	100	244	7.40
Mov Cap-1 Maneuver	1264	-	-	1211	-	-	178	244	698	108	244	749
Mov Cap-2 Maneuver	-	-	-	-	-	-	178	244	-	108	244	-
Stage 1	-	-	-	-	-	-	658	625	-	532	466	-
Stage 2	-	-	-	-	-	-	381	459	-	359	618	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.2			2.4			30			38.7		
HCM LOS							D			Е		
Minor Lane/Major Mvmt	· .	VBLn1	EBL	EBT	EBR	WBL	WBT	WBR S	SRI n1			
	·	414		LDT		1211	-		200			
Capacity (veh/h) HCM Lane V/C Ratio		0.676	0.006	-		0.099	-	-	0.483			
HCM Control Delay (s)		30	7.9	0	-	8.3	0	-				
HCM Lane LOS		D	7.9 A	A	-	0.3 A	A	-	30. <i>1</i>			
HCM 95th %tile Q(veh)		4.8	0	- A	-	0.3	- A	-	2.4			
HOW FOUT FOUTE Q(VEH)		4.0	U			0.5	_		2.4			

Intersection												
Int Delay, s/veh	2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		f)			ર્ન			4			4	
Traffic Vol, veh/h	0	439	5	6	260	0	7	0	7	15	0	88
Future Vol, veh/h	0	439	5	6	260	0	7	0	7	15	0	88
Conflicting Peds, #/hr	0	0	2	2	0	0	0	0	1	1	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage,	,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	87	87	87	79	79	79	92	92	92	82	82	82
Heavy Vehicles, %	2	1	2	2	4	2	2	2	2	0	2	0
Mvmt Flow	0	505	6	8	329	0	8	0	8	18	0	107
Major/Minor N	/lajor1		N	Major2			Minor1		N	/linor2		
Conflicting Flow All	-	0	0	513	0	0	909	855	511	858	858	329
Stage 1	-	-	-	-	-	-	510	510	-	345	345	-
Stage 2	-	-	_	-	_	_	399	345	-	513	513	-
Critical Hdwy	-	-	-	4.12	-	-	7.12	6.52	6.22	7.1	6.52	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.1	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.1	5.52	-
Follow-up Hdwy	-	-	-	2.218	-	-	3.518	4.018	3.318	3.5	4.018	3.3
Pot Cap-1 Maneuver	0	-	-	1052	-	0	256	296	563	279	294	717
Stage 1	0	-	-	-	-	0	546	538	-	675	636	-
Stage 2	0	-	-	-	-	0	627	636	-	548	536	-
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	-	-	-	1050	-	-	216	293	561	273	291	717
Mov Cap-2 Maneuver	-	-	-	-	-	-	216	293	-	273	291	-
Stage 1	-	-	-	-	-	-	546	537	-	675	630	-
Stage 2	-	-	-	-	-	-	528	630	-	540	535	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.2			17.1			12.9		
HCM LOS				0.2			C			В		
Minor Lane/Major Mvm	t N	NBLn1	EBT	EBR	WBL	WBT :	SRI n1					
Capacity (veh/h)	r I	312	LDI	LDK -	1050	- 1001	580					
HCM Lane V/C Ratio		0.049	-		0.007		0.217					
HCM Control Delay (s)		17.1	-		8.5	0	12.9					
HCM Lane LOS		C	-	-	0.5 A	A	12.9 B					
HCM 95th %tile Q(veh)		0.2	-		0	- A	0.8					
1101V1 70111 70111C Q(VCII)		0.2					0.0					

Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4			4			4	
Traffic Vol, veh/h	5	0	6	6	1	10	6	427	26	18	587	6
Future Vol, veh/h	5	0	6	6	1	10	6	427	26	18	587	6
Conflicting Peds, #/hr	4	0	0	0	0	4	5	0	16	16	0	5
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	<u>.</u>	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage	e,# -	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	71	71	71	78	78	78	89	89	89
Heavy Vehicles, %	2	2	2	0	2	0	2	1	0	6	1	2
Mvmt Flow	5	0	7	8	1	14	8	547	33	20	660	7
Major/Minor	Minor2		1	Minor1		J	Major1		N	Major2		
Conflicting Flow All	1300	1321	669	1303	1308	584	672	0	0	596	0	0
Stage 1	709	709	-	596	596	-	-	-	-	-	-	-
Stage 2	591	612	-	707	712	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.1	6.52	6.2	4.12	-	-	4.16	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.5	4.018	3.3	2.218	-	-	2.254	-	-
Pot Cap-1 Maneuver	138	157	458	139	159	515	919	-	-	961	-	-
Stage 1	425	437	-	494	492	-	-	-	-	-	-	-
Stage 2	493	484	-	429	436	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	127	147	456	130	149	505	915	-	-	946	-	-
Mov Cap-2 Maneuver	127	147	-	130	149	-	-	-	-	-	-	-
Stage 1	417	420	-	480	478	-	-	-	-	-	-	-
Stage 2	470	470	-	408	419	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	23.3			22.1			0.1			0.3		
HCM LOS	С			С								
Minor Lane/Major Mvm	nt	NBL	NBT	NBR	EBLn1V	VBLn1	SBL	SBT	SBR			
Capacity (veh/h)		915		-	209	234	946	-	-			
HCM Lane V/C Ratio		0.008	-	-		0.102		-	-			
HCM Control Delay (s)		9	0	-	23.3	22.1	8.9	0	-			
HCM Lane LOS		Á	A	-	С	С	A	A	-			
HCM 95th %tile Q(veh	)	0	-	-	0.2	0.3	0.1	-	-			
	,											

## APPENDIX I

Capacity/Level-of-Service Analysis Summary

## **CAPACITY ANALYSIS SUMMARY**

## Weekday Morning Peak Hour The Residence at Carter Mill Needham, MA

				Existing		202	26 No Bui	ld	2	026 Build	
Intersection	Move	ement	LOS <sup>(1)</sup>	Delay <sup>(2)</sup>	$V/C^{(3)}$	LOS	Delay	V/C	LOS	Delay	V/C
West Street at	EB	L	D	39.0	0.67	D	48.9	0.79	D	51.4	0.81
Highland Avenue		TR	C	28.5	0.38	C	29.1	0.41	C	29.2	0.42
	WB	L	D	38.2	0.18	D	38.4	0.20	D	38.5	0.21
		TR	D	52.8	0.74	E	56.4	0.79	E	56.9	0.79
	NB	LTR	D	49.2	0.89	D	52.5	0.92	D	52.6	0.92
	SB	LT/R	C	33.2	0.64	C	29.5	0.50	C	29.6	0.50
		R	n/a	n/a	n/a	A	9.4	0.13	A	9.4	0.13
	O	verall	D	41.7	0.70	D	42.7	0.88	D	43.1	0.88
West Street at	EB	LTR	A	0.3	0.01	A	0.3	0.01	A	0.3	0.01
Hillside Avenue	WB	LTR	Α	3.1	0.13	A	3.2	0.15	A	3.1	0.15
	NB	LTR	E	49.5	0.74	F	89.0	0.93	F	92.6	0.95
	SB	LTR	F	52.1	0.68	F	82.6	0.84	F	89.3	0.87
West Street at	EB	TR	A	0.0	0.00	A	0.0	0.00	A	0.0	0.00
Site Driveway/Avery Square	WB	LT	A	0.0	0.00	A	0.0	0.00	A	0.2	0.01
	NB	LTR	C	21.7	0.02	C	23.9	0.02	C	18.8	0.04
	SB	LTR	В	13.1	0.25	В	13.9	0.29	В	14.0	0.29
Highland Avenue at	EB	LTR	В	10.2	0.01	В	10.4	0.01	С	16.1	0.03
Site Driveway/Morton Street	WB	LTR	C	18.0	0.01	C	10.4	0.01	C	19.9	0.03
Site Driveway/Morton Street	NB	LTR	A	0.0	0.00	A	0.0	0.10	A	0.1	0.10
	SB	LTR	A A	0.0	0.00	A	0.0	0.00	A A	0.1	0.00

<sup>(1)</sup> Level-of-Service

<sup>(2)</sup> Average vehicle delay in seconds

<sup>(3)</sup> Volume to capacity ratio

n/a Not Applicable

## **QUEUE SUMMARY**

Weekday Morning Peak Hour The Residence at Carter Mill Needham, MA

				sting	2026 N	o Build	2026 Build		
Intersection	Move	ment 50	th Queue <sup>(1)</sup>	95th Queue <sup>(2)</sup>	50th Queue	95th Queue	50th Queue	95th Queue	
West Street at	EB L	L	107	185	116	193	117	202	
Highland Avenue	Т	TR	129	198	139	213	140	215	
	WB L	L	24	54	26	58	27	58	
	Т	TR	172	251	188	272	189	274	
	NB L	LTR	374	600	426	665	429	671	
	SB L	LT/R	223	352	177	278	178	279	
	F	R	n/a	n/a	19	40	20	41	
West Street at	EB I	LTR	n/a	0	n/a	0	n/a	0	
Hillside Avenue	WB L	LTR	n/a	13	n/a	13	n/a	13	
	NB L	LTR	n/a	133	n/a	200	n/a	205	
	SB L	LTR	n/a	105	n/a	150	n/a	158	
West Street at	ЕВ Т	TR	n/a	0	n/a	0	n/a	0	
Site Driveway/Avery Square	WB L	LT	n/a	0	n/a	0	n/a	0	
	NB L	LR	n/a	3	n/a	3	n/a	3	
	SB I	LTR	n/a	25	n/a	30	n/a	30	
Highland Avenue at		LTR	n/a	0	n/a	0	n/a	3	
Site Driveway/Morton Street		LTR	n/a	8	n/a	8	n/a	8	
		LTR	n/a	0	n/a	0	n/a	0	
	SB L	LTR	n/a	0	n/a	0	n/a	0	

<sup>(1) 50</sup>th Percentile Queue Length (ft) (2) 95th Percentile Queue Length (ft) n/a Not Applicable

## **CAPACITY ANALYSIS SUMMARY**

## Weekday Afternoon Peak Hour The Residence at Carter Mill Needham, MA

				Existing		202	26 No Bui	ld	2	026 Build	
Intersection	Move	ment	LOS <sup>(1)</sup>	Delay <sup>(2)</sup>	$V/C^{(3)}$	LOS	Delay	V/C	LOS	Delay	V/C
West Street at	EB	L	D	39.4	0.63	D	50.9	0.77	D	53.6	0.80
Highland Avenue		TR	C	32.2	0.49	C	34.0	0.55	C	34.0	0.56
	WB	L	D	43.0	0.36	D	44.3	0.40	D	44.4	0.40
		TR	D	51.4	0.70	E	55.2	0.76	E	55.5	0.76
	NB	LTR	C	33.3	0.70	D	43.3	0.84	D	44.9	0.85
	SB	LT/R	D	45.7	0.88	D	36.3	0.76	D	36.7	0.77
		R	n/a	n/a	n/a	A	9.0	0.11	Α	9.1	0.11
	Ove	erall	D	40.3	0.71	D	40.7	0.79	D	41.5	0.80
West Street at	EB	LTR	A	0.2	0.01	A	0.2	0.01	A	0.2	0.01
Hillside Avenue	WB	LTR	Α	2.4	0.09	A	2.4	0.10	Α	2.4	0.10
	NB	LTR	C	23.3	0.58	D	29.2	0.67	D	30.0	0.68
	SB	LTR	D	29.5	0.38	E	36.5	0.46	E	38.7	0.48
West Street at	EB	TR	A	0.0	0.00	A	0.0	0.00	A	0.0	0.00
Site Driveway/Avery Square	WB	LT	Α	0.0	0.00	A	0.0	0.00	Α	0.2	0.01
	NB	LR	C	19.5	0.02	C	21.2	0.02	C	17.1	0.05
	SB	LTR	В	12.2	0.19	В	12.7	0.21	В	12.9	0.22
Highland Avenue at	EB	LTR	Α	0.0	0.00	Α	0.0	0.00	C	23.3	0.06
Site Driveway/Morton Street	WB	LTR	C	19.9	0.09	C	21.4	0.10	C	22.1	0.10
	NB	LTR	A	0.0	0.00	A	0.0	0.00	A	0.1	0.01
	SB	LTR	Α	0.3	0.02	A	0.3	0.02	Α	0.3	0.02

<sup>(1)</sup> Level-of-Service

<sup>(2)</sup> Average vehicle delay in seconds

<sup>(3)</sup> Volume to capacity ratio

n/a Not Applicable

## **QUEUE SUMMARY**

Weekday Afternoon Peak Hour The Residence at Carter Mill Needham, MA

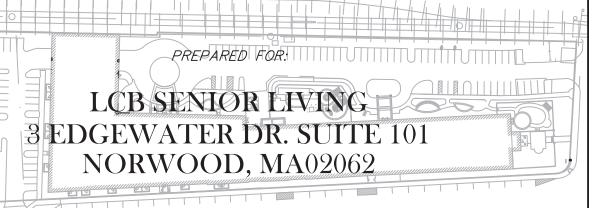
			Exis	ting	2026 N	o Build	ld 2026 Build	
Intersection	Move	ement	50th Queue <sup>(1)</sup>	95th Queue <sup>(2)</sup>	50th Queue	95th Queue	50th Queue	95th Queue
West Street at	EB	L	97	151	106	187	109	198
Highland Avenue		TR	170	244	186	263	187	264
	WB	L	44	84	48	90	49	91
		TR	152	223	164	237	166	241
	NB	LTR	270	420	330	564	337	574
	SB	LT/R	373	636	338	563	342	568
		R	n/a	n/a	15	35	16	36
West Street at	EB	LTR	n/a	0	n/a	0	n/a	0
Hillside Avenue	WB	LTR	n/a	8	n/a	8	n/a	8
	NB	LTR	n/a	88	n/a	118	n/a	120
	SB	LTR	n/a	43	n/a	55	n/a	60
West Street at	EB	TR	n/a	0	n/a	0	n/a	0
Site Driveway/Avery Square	WB	LT	n/a	0	n/a	0	n/a	0
	NB	LR	n/a	0	n/a	3	n/a	5
	SB	LTR	n/a	18	n/a	20	n/a	20
						_		_
Highland Avenue at	EB	LTR	n/a	0	n/a	0	n/a	5
Site Driveway/Morton Street	WB	LTR	n/a	8	n/a	8	n/a	8
	NB	LTR	n/a	0	n/a	0	n/a	0
	SB	LTR	n/a	3	n/a	3	n/a	3

<sup>(1) 50</sup>th Percentile Queue Length (ft) (2) 95th Percentile Queue Length (ft)

n/a Not Applicable

## STORMWATER MANAGEMENT REPORT 02/25/2021

## THE RESIDENCE AT CARTER MILL 100-110 WEST STREET NEEDHAM, MA



## PREPARED BY:



## **KELLY ENGINEERING GROUP**

civil engineering consultants O Campanelli Drive, Braintree, MA 02184 Phone: 781-843-4333 www.kellyengineeringgroup.com

## TABLE OF CONTENTS

Stormwater Letter

Stormwater Maintenance System Operation and Maintenance Plan & Long Term Pollution Prevention Plan

NPDES Requirements for Public Outreach Letter



February 25, 2021

Town of Needham Planning Board 500 Dedham Ave. Needham MA 02492 Attn: Lee Newman

Cc: Lee Bloom – LCB Senior Living

Anthony DelGaizo – Department of Public Works

Re: Stormwater

Special Permit & Site Plan Review The Residence at Carter Mill 100-110 West St. Needham, MA

Dear Members of the Board:

The existing site is serviced by a fully developed storm drainage system as shown on the existing conditions plan provided with this application. We have consulted with site maintenance personnel and town staff and are not aware of any drainage issues on the property. The applicant and our office has met with the Town of Needham Engineering Department and agreed the Needham Stormwater Bylaw Article 7 is not applicable to the proposed project. There is no increase to the existing building footprint. The renovations and floor areas in the garage and penthouse are not increasing the footprint of the building and are not considered an Addition. There is no change in impervious parking areas. The impervious area from the proposed 5 new parking spaces is balanced by removal of the existing garage entrance. There are 2,000 s.f. of additional sidewalks, patios, and other pedestrian areas which are not considered parking areas and therefore exempt from the Needham Stormwater Bylaw. Façade treatments, interior renovations, and less than 1,500 s.f. increase in parking area are exempt under section 7.4.2 of the Stormwater Bylaw.

As part of the Town of Needham DPW NPDES requirements, the applicant will comply with the Public Out Reach & Education and Public Participation & Involvement control measures. Attached is a letter to the DPW identifying the measures selected and dates by which the measures will be completed in order to incorporate it into the Planning Board's decision.

We look forward to presenting this project to you at your next scheduled meeting. If you have any questions or desire any additional information regarding this matter, please do not hesitate to call our office.

Sincerely,

KELLY ENGINEERING GROUP, INC.

DI DI Er er

Digitally signed by David Noel Kelly P.E. DN: cn=David Noel Kelly P.E., o=Kelly Engineering GRoup, Inc., ou, email=dkelly@kellyemgoineeringgroup.com, c=US Date: 2021.03.01 08:30:34 -05'00'

David N. Kelly, P.E. President

0 Campanelli Drive – Braintree – MA 02184 Phone 781 843 4333 <u>www.kellyengineeringgroup.com</u>

## THE RESIDENCE AT CARTER MILL 100-110 WEST STREET NEEDHAM, MA

# STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN & LONG-TERM POLLUTION PREVENTION PLAN

02/25/2021

## Prepared by:

## KELLY ENGINEERING GROUP, INC.

Zero Campanelli Drive Braintree, Massachusetts 02184

OWNER: Welltower Inc. 4500 Dorr St. Toldo, OH 43615

APPLICANT AND RESPONSIBLE PARTY:

LCB Senior Living 3 Edgewater Dr. Suite 101 Norwood, MA 02062

Lee Bloom

Note: If ownership of this property changes then the new owner becomes the responsible party. The Owner may assign responsibility to a tenant on the property.

## **Introduction**

The stormwater management system consists of a number of Best Management Practices (BMP's). These BMP's combine to ensure that storm runoff from the site will not damage the sensitive environmental resources surrounding the site. In order to ensure that these BMP's operate as designed it is very important that the procedures in this operation and maintenance plan be followed. Most of these operation procedures require observation and measurement; however, at certain times more extensive maintenance measures may be needed. The following is an itemization of each of these BMP's and their maintenance needs.

The party responsible for maintenance should contract with a maintenance organization capable of performing the more extensive measures such as pumping of catch basin sumps, etc.

## BMP No. 1 – Paved Road Surface:

- Regularly pick up and remove litter from the paved road surface and landscaped areas.
- The paved area is to be swept on a quarterly average, with sweeping scheduled primarily in spring and fall with a high efficiency vacuum sweeper or a regenerative air sweeper. If a mechanical sweeper is used, the paved area is to be swept on a monthly average.

## BMP No. 2 - Deep Sump Catch Basins:

- Basins are to be inspected 4 times per year.
  - 1. Verify that tees are secure and free-flowing.
  - 2. Measure depth of sediment below water line.
- Basins are to be cleaned whenever sediment and hydrocarbons are observed. Basins are to be cleaned a minimum of twice per year. One of these cleanings shall occur before April 15<sup>th</sup> of each year and one shall occur before September 15<sup>th</sup> of each year. Basins may be cleaned either using a clamshell or a vacuum pump.
- All liquid shall be pumped from the sump of each basin at least once per year.
- All sediments and hydrocarbons should be properly handled and disposed of, in accordance with local, state and federal guidelines and regulations.

Note: See catch basin detail for explanation of terms.

## Snow Removal:

- Road salts and de-icing materials shall be stored on impervious pads and covered to protect from wind and precipitation.
- There shall be no plowing or stock piling of snow within any resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- No de-icing materials shall be stored nor used within all resource areas and any area subject to the
  jurisdiction of local and state regulations without the prior written permission from state or local
  approving authority.

## Storage and Use of Chemicals:

- No pesticides, herbicides, nor insecticides shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Chemical storage on site shall be limited. Any chemicals that must be stored shall be stored in a secure area in accordance with Local and State regulations.

## Hazardous Waste:

- Containment In the event of a discharge or spill of oil or another hazardous material, outlets to stormwater management ponds shall be plugged so that hazardous material do not enter resource areas.
- Reporting In the event of a discharge or spill of oil or another hazardous material, responsible facility personnel, oil spill and/or hazardous material removal organizations, federal, state, and local regulatory agencies, the Town of Needham Department of Public Works, and the EPA National Response Center 1-800-424-8802 shall be rapidly notified.
- Hazardous Waste All hazardous waste materials will be disposed of in the manner specified by local, state and/or federal regulations and by the manufacturer of such products.
- There shall be no illicit discharges to the stormwater management system.

## Training for Long Term Pollution Prevention Plan:

All staff or personnel involved and responsible for implementing the Stormwater Management System
Operations and Maintenance Plan and the Long-Term Pollution Prevention Plan shall be properly
trained as required under the DEP Stormwater Management Regulations. Training shall be
documented with records kept with other stormwater maintenance records.

## Pet Waste Management:

- Pooper-scooper laws for pets shall be followed.
- Never dump pet waste into storm drains, catch basins, or the drainage system.
- Pet waste shall be scooped up and disposed of properly in the garbage.

## Lawn and Garden activities:

- No pesticides, herbicides, nor insecticides shall be stored nor used within any resource areas its buffers, and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Fertilizers and pesticides shall be applied properly, sparingly, and outside any resource areas and its buffers.

To reduce the impact of fertilizers, consider the following tips;

- Don't fertilize before a rain storm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Test soils before applying fertilizers. Some soils may not need fertilizers. A standard soil test costs \$9.00. (Call the UMass Extension Soil Testing Lab at 413-545-2311 or download a soil test order form at <a href="http://www.umass.edu/plsoils/soiltest/">http://www.umass.edu/plsoils/soiltest/</a>.)

February 25, 2021

Needham Planning Board Needham Town Hall 500 Dedham Avenue Needham, MA 02492 Attention: Lee Newman

RE: NPDES requirements

The Residence at Carter Mill 100-110 West St. Needham, MA

Dear Members of the Board,

As part of the NPDES requirement for Control Measure #1: Public Education and Outreach, the applicant will place an advertisement in the local newspaper to encourage environmental awareness. This advertisement will be published prior to occupancy of the building.

As part of the NPDES requirement for Control Measure #2: Public Participation and Involvement, the catch basins will include a plaque with the words "NO DUMPING - DRAINS TO RIVER" by Almetek. These plaques will be installed at prior to occupancy of the building.

If you	have an	y questi	ons, ple	ase con	itact me	٠.

Sincerely,		
Lee Bloom	 	 

Copy: Anthony DelGaizo, Town Engineer