MIT Stephen A. Schwarzman College of Computing (Volume III)

Cambridge, Massachusetts

SUBMITTED TO **Cambridge Community Development Department**
City Hall Annex
344 Broadway
Cambridge, MA

PROPONENT **Massachusetts Institute of Technology**
77 Massachusetts Avenue NW 23-100
Cambridge MA, 02139

PREPARED BY **VHB**
99 High Street, 10th Floor
Boston, MA 02110

In association with:
Skidmore, Owings & Merrill LLP
REED Hilderbrand Landscape Architects
Nitsch Engineering, Inc.
ARUP

December 8, 2020

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APPENDIX A: Tree Study

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Massachusetts Institute of Technology
Department of Facilities
Building NW23
77 Massachusetts Avenue
Cambridge, Massachusetts
02139–4307

Memorandum

To: David Lefcourt, City of Cambridge Arborist/Tree Warden

From: Travis Wanat, Senior Project Manager, Campus Construction

CC: Sonia Richards, Director of Capital Projects, Campus Construction
Sarah Gallop, Co-Director, Office of Government & Community Relations
Kelley Brown, Senior Campus Planner, Office of Campus Planning
Laura Tenny, Senior Campus Planner, Office of Campus Planning

Date: October 23, 2023

Re: Tree Study for Proposed MIT Stephen A. Schwarzman College of Computing (Building 45)

The Massachusetts Institute of Technology (MIT) retained a landscaping consultant, Reed Hilderbrand Landscape Architects, in association with an arborist, to prepare a tree study and mitigation plans consistent with the requirements of the Cambridge Tree Protection Ordinance, Section 8.66 of the Cambridge Zoning Ordinance.

The Applicant submitted the tree study to DPW and the City Arborist on July 1, 2020. Consistent with the requirements of Section 19.20 of the Cambridge Zoning Ordinance, the Tree Study is also provided as a component of the Article 19 Project Review Special Permit Application for the MIT Stephen A. Schwarzman College of Computing (the “SCC” or the “College”) on the MIT campus in Cambridge MA.

The Tree Study includes the following exhibits:

- Zoning Lot Locus Plan;
- Pre-Construction Plan;
- Proposed Landscape Plan;
- Tree Survey and Protection Plan Schedule and Graphic Plans;
- Mitigation Plan;
- Estimate for the cost of purchasing, planting, watering and maintain the replacement trees; and
- Certification from a Certified Arborist.

We look forward to discussing the details of the Tree Study, and answering any questions you may have.

Thank you,

Travis Wanat

TREE STUDY

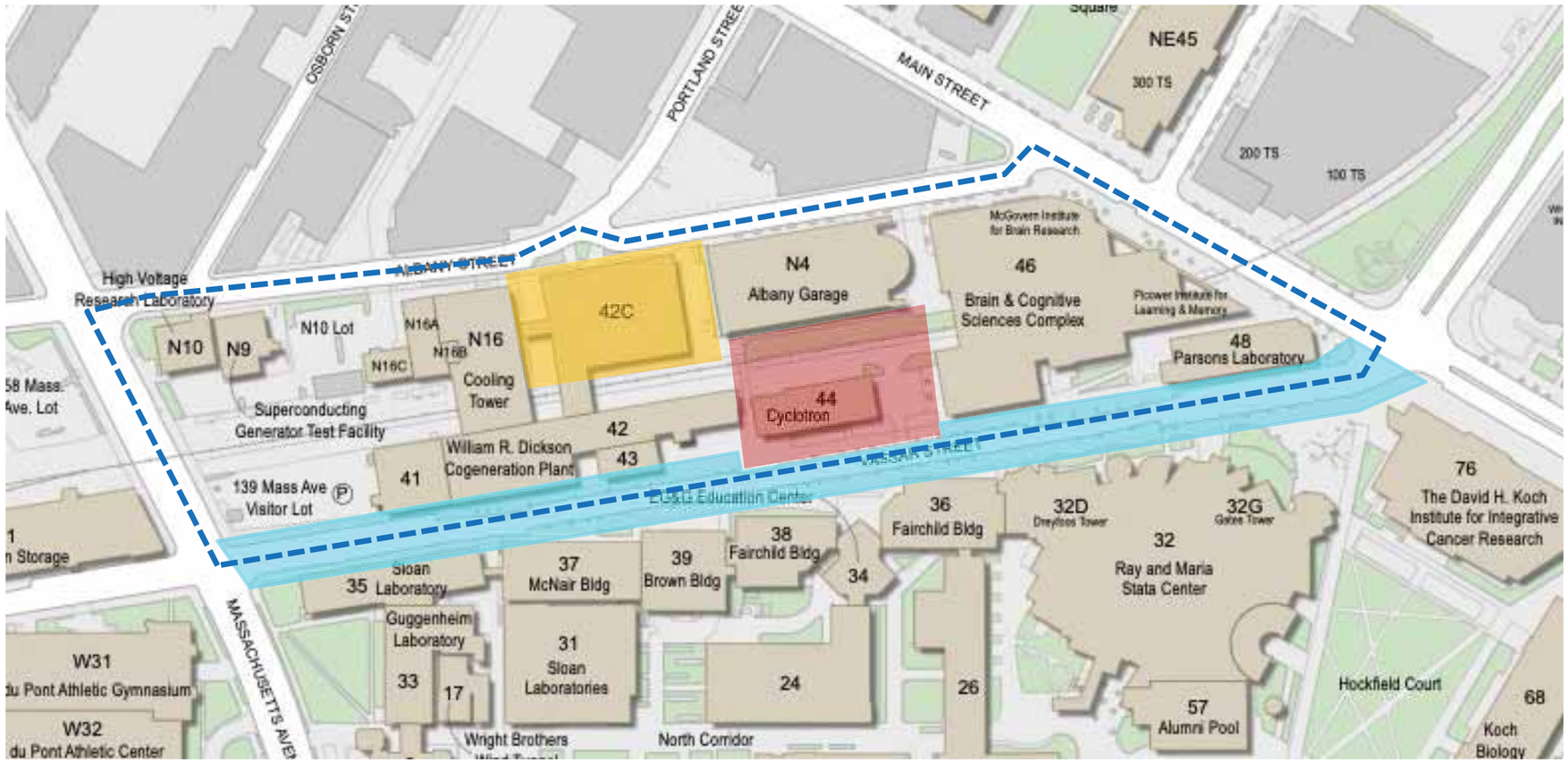
MIT Projects Within the Zoning Lot

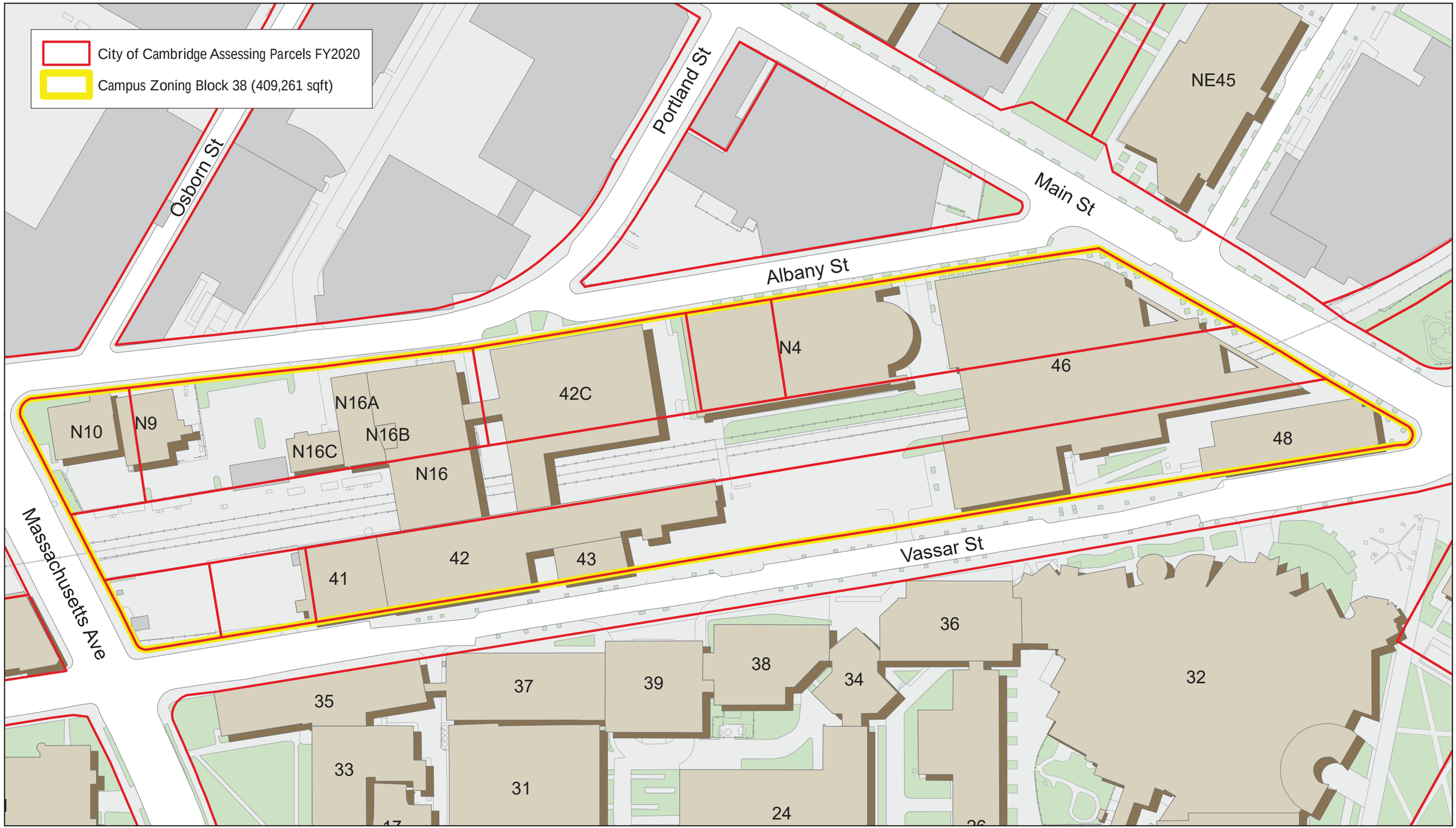
Stephen A. Schwarzman College of Computing project
Completion: Fall 2023
Project scope to include Vassar Street Tree Replanting work in front of building

Central Utility Plant project
Completion: Summer 2020

Vassar Street Tree Replanting project
Completion: Fall 2020

Extent of zoning lot





100 Feet

Campus Parcel 38 & City of Cambridge Assessors Tax Parcels

Source:
Basemap: Facility Information Systems (2020)

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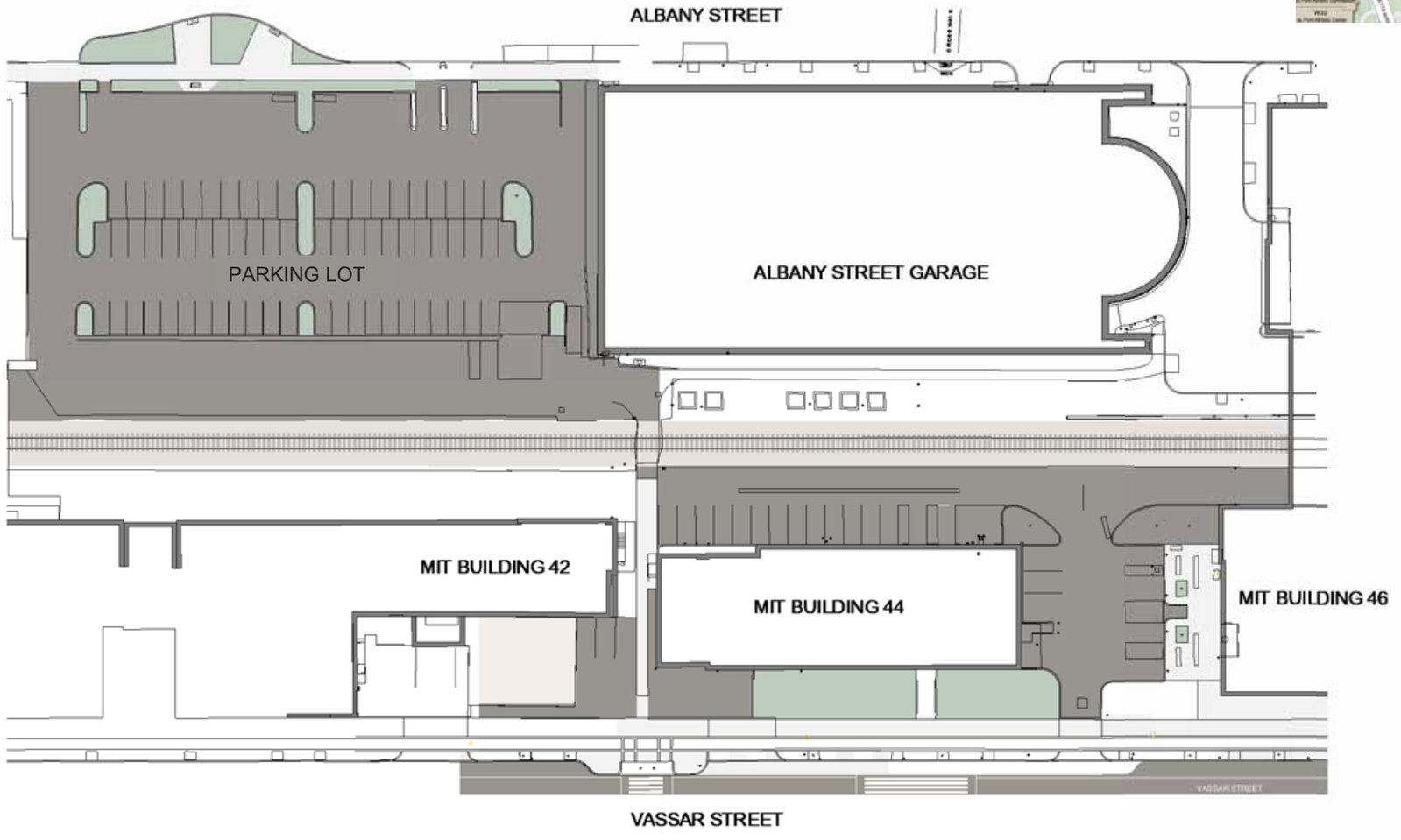
TREE STUDY

Pre-Construction Plan

LOCUS PLAN



MIT SCHWARZMAN COLLEGE OF COMPUTING

SKIDMORE, OWINGS & MERRILL LLP

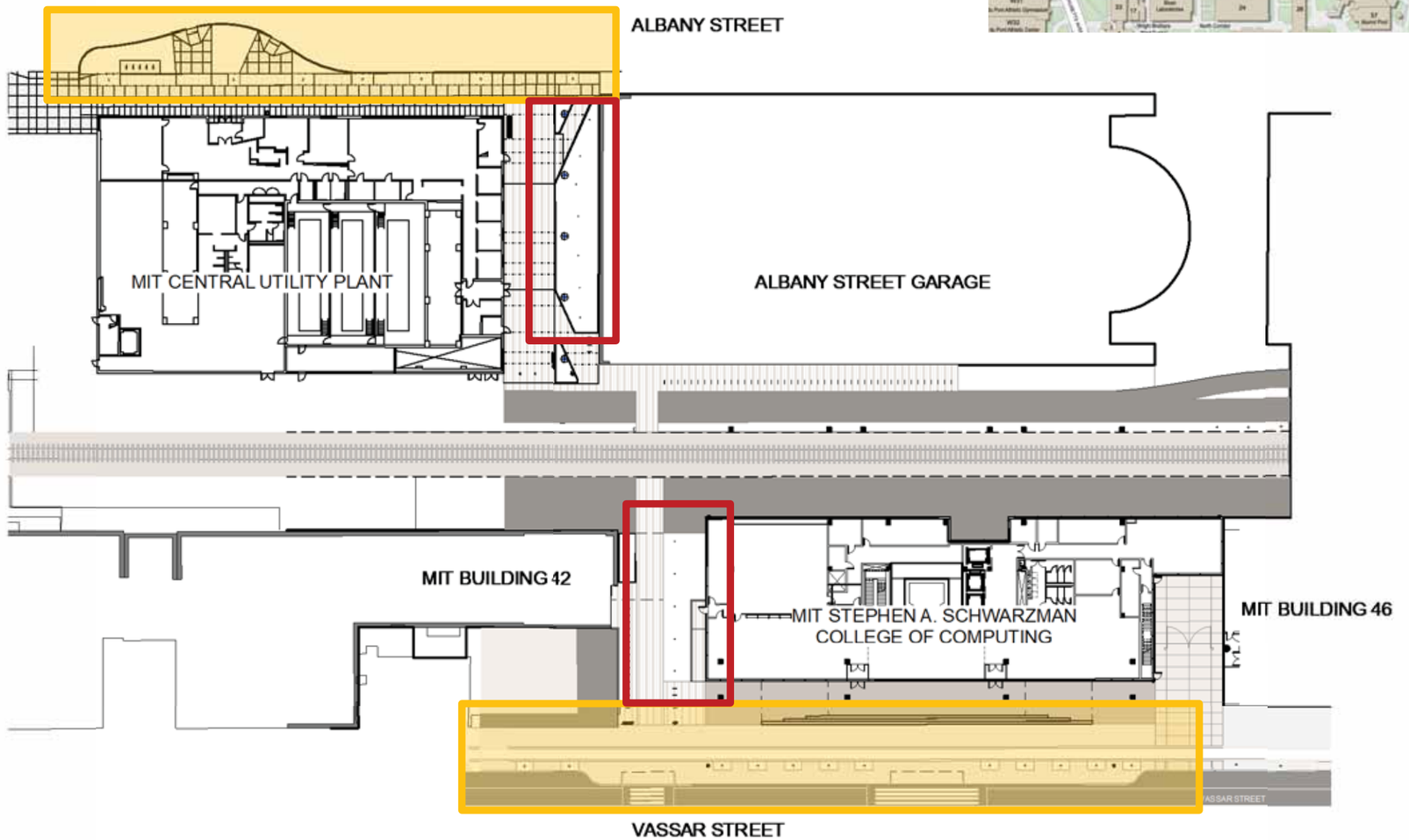
TREE STUDY
Proposed Landscape Plan

LOCUS PLAN

Street tree planting in R.O.W.
along Albany Street: 7 trees.
Tree species: American Elm
Pre-construction quantity: 0 trees

Street tree planting in R.O.W.
along Vassar Street: 12 trees.
Tree species: TBD
Pre-construction quantity: 9 trees

Replacement Trees
see Mitigation Plan



TREE STUDY

Tree Survey and Protection Plan Schedule

(E) TREE SCHEDULE

MIT TAG #	SIZE	BOTANICAL NAME	COMMON NAME	CONDITION	HEIGHT	SIGNIFICANT TREE	STATUS	REASON FOR REMOVAL OF SIGNIFICANT TREE
1187	8" DBH	CARYA SPP.	HICKORY	DEAD	24'	NO	REMOVE	DEAD
1196	7" DBH	CARPINUS BETULUS	EUROPEAN HORNBEAM	GOOD	24'	NO	PROTECT	NOT SIGNIFICANT
1197	6" DBH	CARPINUS BETULUS	EUROPEAN HORNBEAM	FAIR	22'	NO	PROTECT	NOT SIGNIFICANT
1198	6" DBH	CARPINUS BETULUS	EUROPEAN HORNBEAM	GOOD	22'	NO	PROTECT	NOT SIGNIFICANT
1241	8.2" DBH	GLEDITSIA TRIACANTHOS INERMIS	THORNLESS HONEYLOCUST	GOOD	23'	YES	REMOVE	WITHIN AREA OF PROPOSED LOADING DOCK
1242	8.0" DBH	GLEDITSIA TRIACANTHOS INERMIS	THORNLESS HONEYLOCUST	GOOD	25'	YES	REMOVE	WITHIN AREA OF PROPOSED LOADING DOCK
1243	9.5" DBH	TILIA CORDATA	LITTLELEAF LINDEN	GOOD	25'	YES	REMOVE	WITHIN FOOTPRINT OF PROPOSED BUILDING
1244	7.5" DBH	TILIA CORDATA	LITTLELEAF LINDEN	GOOD	25'	NO	REMOVE	NOT SIGNIFICANT
1245	8.5" DBH	TILIA CORDATA	LITTLELEAF LINDEN	FAIR	24'	YES	REMOVE	WITHIN FOOTPRINT OF PROPOSED BUILDING

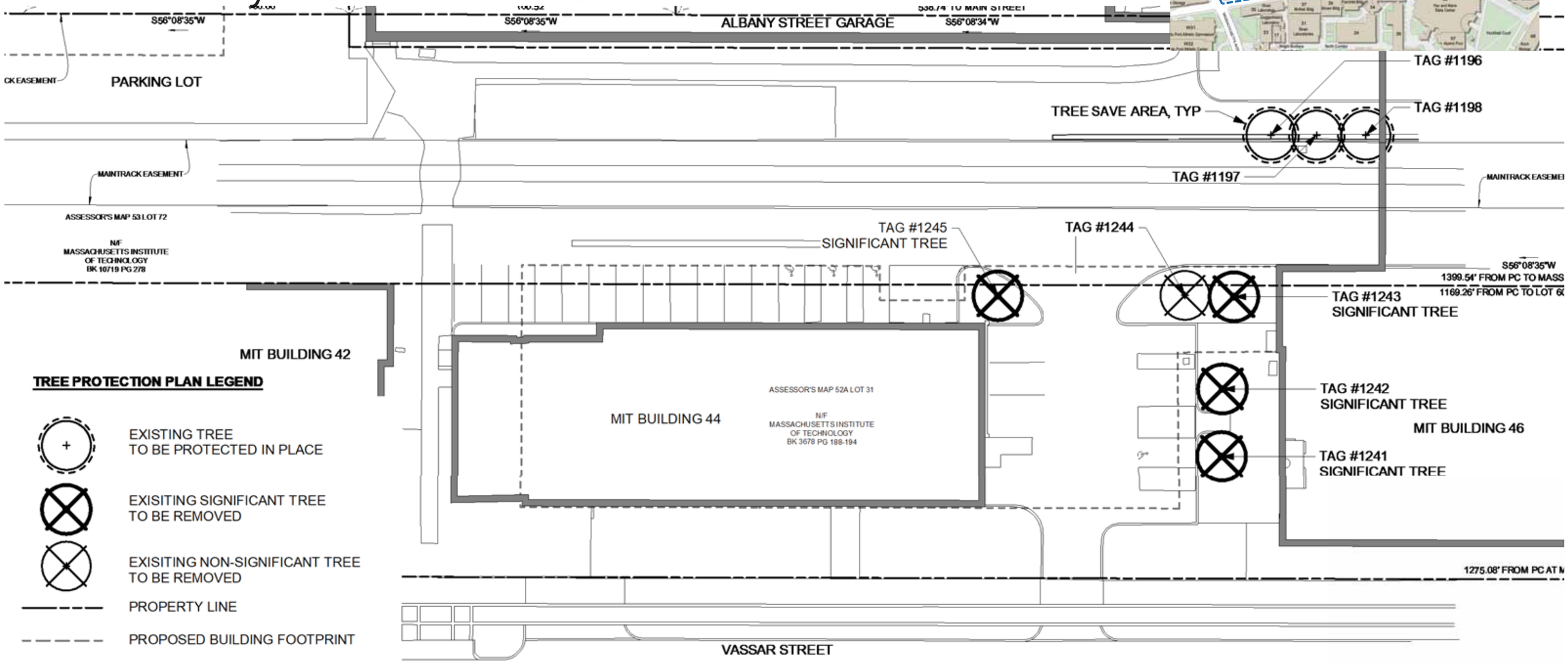
TOTAL QUANTITY OF SIGNIFICANT TREES TO REMOVE (TREES 8" DBH AND LARGER): 4

TOTAL CALIPER INCHES OF SIGNIFICANT TREES TO REMOVE: 34.2 CALIPER INCHES

TREE STUDY

Tree Survey and Protection Plan

LOCUS PLAN



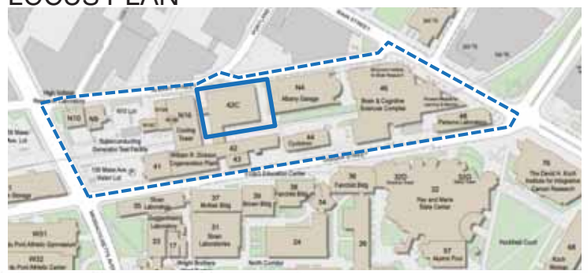
TREE PROTECTION PLAN LEGEND

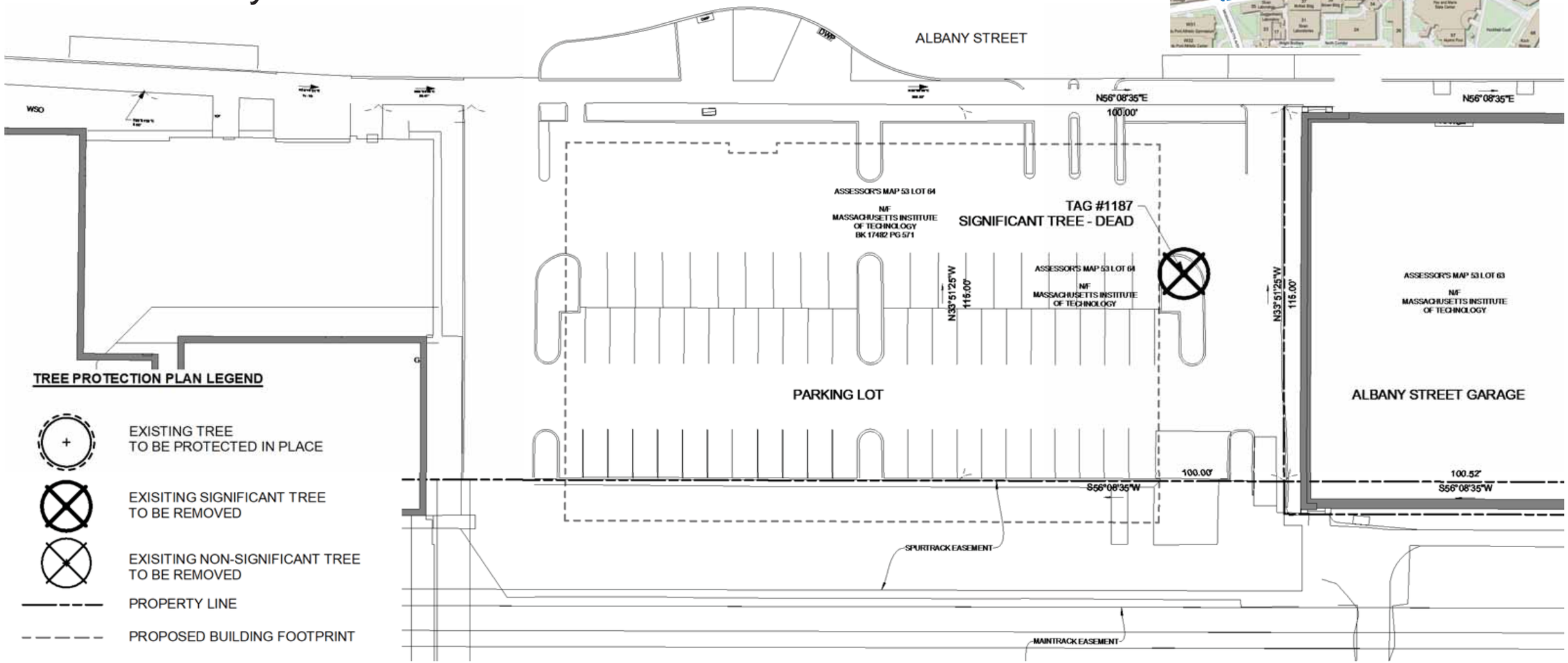
- EXISTING TREE TO BE PROTECTED IN PLACE
- EXISITING SIGNIFICANT TREE TO BE REMOVED
- EXISITING NON-SIGNIFICANT TREE TO BE REMOVED
- PROPERTY LINE
- PROPOSED BUILDING FOOTPRINT

TREE STUDY

Tree Survey and Protection Plan

LOCUS PLAN





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- PROPERTY LINE
- PROPOSED BUILDING FOOTPRINT

TREE STUDY

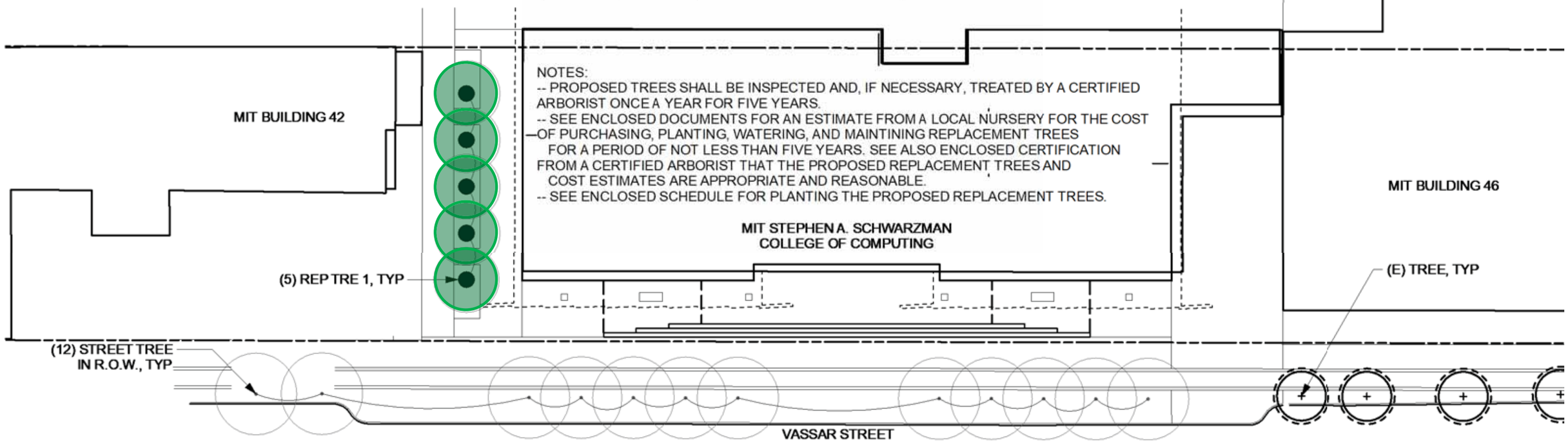
Mitigation Plan

LOCUS PLAN

LEGEND

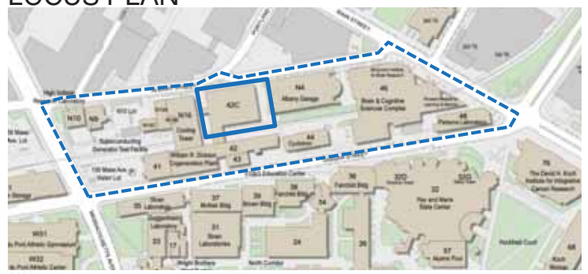
——— — — ———	PROPERTY LINE
	EXISTING TREE TO PROTECT IN PLACE. SEE TREE PROTECTION PLAN

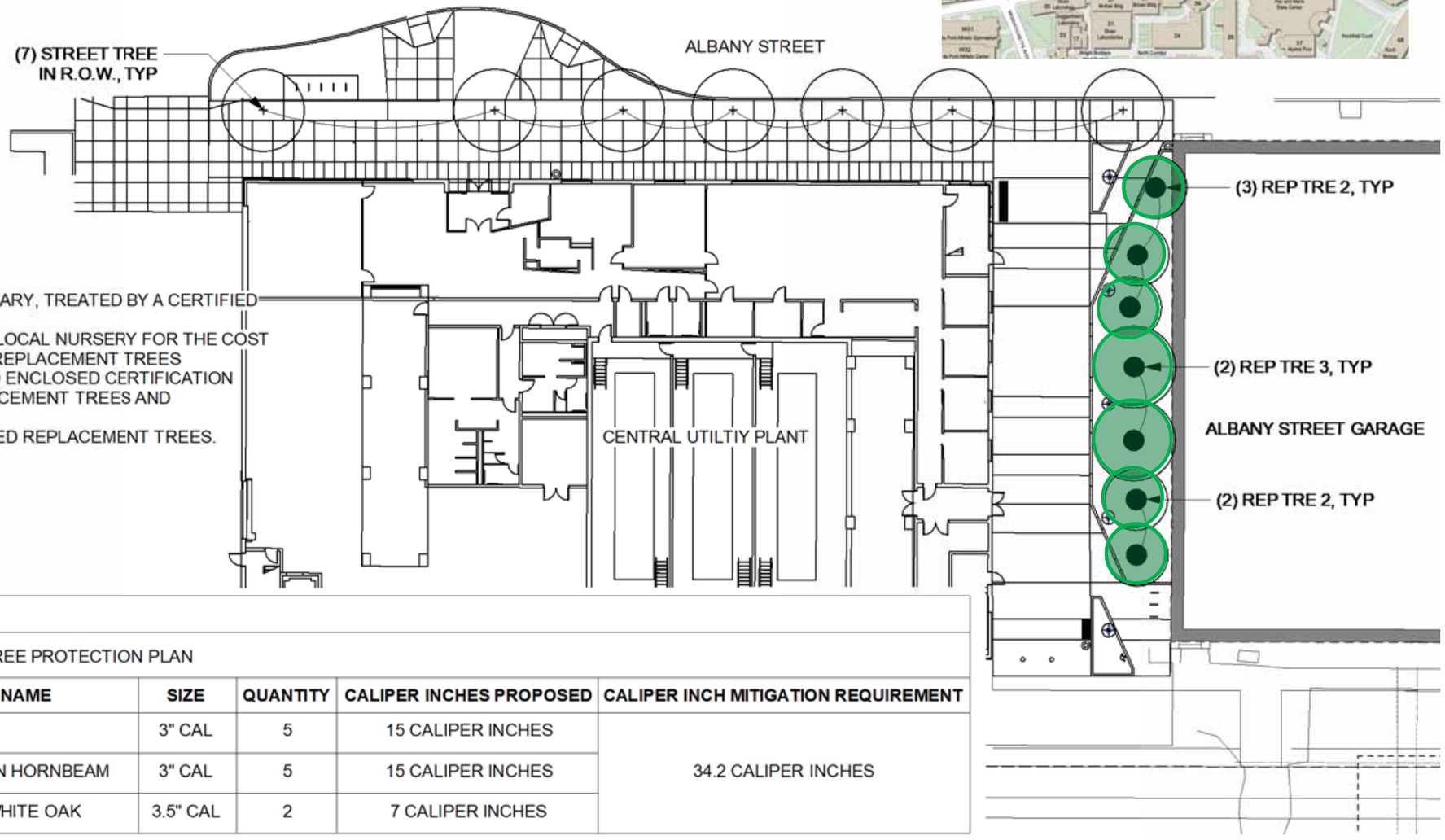
SYMBOL	KEYNOTE	BOTANICAL NAME	COMMON NAME	SIZE	QUANTITY	CALIPER INCHES PROPOSED	CALIPER INCH MITIGATION REQUIREMENT
	REP TRE 1	TBD	TBD	3" CAL	5	15 CALIPER INCHES	34.2 CALIPER INCHES
	REP TRE 2	CARPINUS CAROLINIANA	AMERICAN HORNBEAM	3" CAL	5	15 CALIPER INCHES	
	REP TRE 3	QUERCUS BICOLOR	SWAMP WHITE OAK	3.5" CAL	2	7 CALIPER INCHES	



TREE STUDY
Mitigation Plan

LOCUS PLAN





NOTES:
-- PROPOSED TREES SHALL BE INSPECTED AND, IF NECESSARY, TREATED BY A CERTIFIED ARBORIST ONCE A YEAR FOR FIVE YEARS.
-- SEE ENCLOSED DOCUMENTS FOR AN ESTIMATE FROM A LOCAL NURSERY FOR THE COST OF PURCHASING, PLANTING, WATERING, AND MAINTINING REPLACEMENT TREES FOR A PERIOD OF NOT LESS THAN FIVE YEARS. SEE ALSO ENCLOSED CERTIFICATION FROM A CERTIFIED ARBORIST THAT THE PROPOSED REPLACEMENT TREES AND COST ESTIMATES ARE APPROPRIATE AND REASONABLE.
-- SEE ENCLOSED SCHEDULE FOR PLANTING THE PROPOSED REPLACEMENT TREES.

LEGEND

————	PROPERTY LINE
	EXISTING TREE TO PROTECT IN PLACE. SEE TREE PROTECTION PLAN

SYMBOL	KEYNOTE	BOTANICAL NAME	COMMON NAME	SIZE	QUANTITY	CALIPER INCHES PROPOSED	CALIPER INCH MITIGATION REQUIREMENT
	REP TRE 1	TBD	TBD	3" CAL	5	15 CALIPER INCHES	34.2 CALIPER INCHES
	REP TRE 2	CARPINUS CAROLINIANA	AMERICAN HORNBEAM	3" CAL	5	15 CALIPER INCHES	
	REP TRE 3	QUERCUS BICOLOR	SWAMP WHITE OAK	3.5" CAL	2	7 CALIPER INCHES	

BARTLETT TREE EXPERTS

50 BEAR HILL ROAD, WALTHAM, MA 02451 • (781) 622-5980 • FAX (781) 622-5984

June 29, 2020

Travis Wanat
Capital Projects
Department of Facilities
Massachusetts Institute of Technology
77 Ma. Ave
Cambridge, MA 02139

RE: Tree Study.

Mr. Wanat,
I have reviewed the updated tree planting recommendations of June 16, 2020. I am agreement with estimate provided by Suffolk construction to the plan to increase the tree size as well as species.
I will be available to review and evaluated the health of the selected trees throughout the scheduled project.

Please advise.

Jack Kelly
ISA, MCA Certified Arborist
ASCA Consulting Arborist
TRAQ Qualified.

MIT Schwartzman
Project ROMs

Item	Date	Item	Qty	Unit Cost	TOTAL
1	6/16/2020	Provide 5 replacement trees CEL OCC 3" CAL	5	1700	$ 8,500
		Maintenance 5years	5	1200	$ 6,000
		Certified Arborist - included in Maintenance period			
		Subtotal			**$ 14,500**
		Indirect Costs – GCs/GRs, Construction Contingency, Subguard, CCIP, GLI, Fee	14%	14%	$ 2,030
		Total Add / Deduct			**$ 16,530**

APPENDIX B: Green Building Report

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Green Building Requirements

51 Vassar Street Green Building Report – Comments on Special Permit Stage

Status: On **9/21/2020,** per Section 22.25.1 of the Zoning Ordinance, the Community Development Department (CDD) received the Green Building Report for the Special Permit stage for 51 Vassar Street, an institutional building at MIT campus for the Schwarzman College of Computing (SCC) containing office, research laboratory, academic, event, and meeting spaces and a café. MIT's SCC, the 'project', consist of gross floor area (GFA) of 173,000 SF. CDD staff have reviewed the project's GBR report and offer the following Determination, Summary of Compliance and Advisory Comments on its green building and net zero attributes.

CDD Determination: The documentation provided by the Applicant is complete and demonstrates compliance with the Green Building Requirements of Section 22.24 at the special permit stage of review. A revised submission with additional documentation will be required at the building permit stage.

LEED Project Summary: This project is subject to the City's Green Building Requirements (Section 22.20, Zoning Ordinance). The Project is currently meeting the minimum requirement with 71 credit points, targeting LEED Gold, under LEED v4 BD+C – New Construction. Additional 12 points have been designated as possible points. The Green Building Report for this project is anticipated to be complete and meets Article 22 requirements.

LEED Rating System: LEED v4 BD+C – New Construction and Major Renovation

Summary of Compliance and Comments:

Green Building Professional Affidavit Certification

- Hilary Williams of Arup USA Inc. has been identified as the Green Building Professional for the project. The affidavit states that this professional has reviewed all relevant documents for this project and confirm to the best of his/her knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.
- A copy of the professional's credential from Green Building Rating Program has been provided.

Rating System Checklist, Rating System Narrative and Net Zero Narrative

- The project is pursuing Integrative Process credit.
- The project is pursuing Enhanced Commissioning credit using Path 1 in Option 1 and Option 2, which includes commissioning process for various building systems and assemblies as well as building's thermal envelope.
- The project is pursuing Optimize Energy Performance credit by targeting a 53% improvement in energy cost savings over the baseline building performance standard. The proposed building site energy use intensity (EUI) will be approximately 36 kBtu/sf-yr.
- The project is pursuing Innovation credit using Option 3, which includes comprehensive composting as pilot performance strategy, construction and demolition waste management as exemplary strategy, and design for active occupants, Green Building education, and purchasing low or no mercury lamps as innovation strategies.

  - LEED-credit points summary:
  - Integrative Process – 1 point
  - Location and Transportation – 13 points
  - Sustainable Sites – 3 points
  - Water Efficiency – 5 points
  - Energy and Atmosphere – 25 points
  - Materials and Resources – 7 points
  - Indoor Environmental Quality – 10 points
  - Innovation – 6 points
  - Regional Priority – 1 points

- Anticipated building envelope performance including roof, foundation, walls and window assemblies, and window-to-wall ratio:
  - Building envelope performance comparison between latest edition Massachusetts Stretch Energy Code baseline and proposed design indicates the proposed design performance is on par with regard to window and wall assemblies and roof system.
- Anticipated energy loads, baseline energy simulation tool assumptions, and proposed energy targets as currently modelled in this design phase:
  - Proposed site energy use intensity (EUI) will be 40% below baseline with a targeted EUI of approximately 36 kBtu/sf-yr.
  - Proposed GHG emissions will be 42% reduction from baseline with targeted GHG emission of 370 MT CO2e.
- Description of building energy performance integrated into the project's planning, design, and engineering, massing, envelope systems, building mechanical systems, on-site and off-site renewable energy systems, and district-wide energy systems:
  - High performance glazing with double layer curtain wall on south-east facade.
  - Low Window to Wall Ratio at 40%.
  - Heat pump chillers utilizing grid chilled water network for supplemental heating and cooling with no cooling towers.
  - High efficiency plumbing system to reduce water and energy use.
  - LED lighting.
  - Building connected to central plant infrastructure for chilled water, electricity, and Medium Temperature Hot Water for domestic hot water.
  - Low flow plumbing fixtures.
  - Extensive green roof system for 68% of the roof area.
- Description of technical framework for transitioning project to net zero emission in the future, including future net zero emission options for building envelope, HVAC systems, domestic hot water, interior lighting, and on-site and off-site renewable energy sources:

    - Install 138 kW photovoltaic panel array on the solar-ready roof with annual generation capacity of 179 MWh/yr.
    - HVAC system transitioning to net-zero carbon source.
- Description of programs offered by local utility companies that are being considered to improve building performance:
    - Eversource utility rate incentives
    - Mass Save Programs for Integrated Design Path for Large Buildings

Advisory Comments by CDD Staff:

The City's goal is to promote environmentally sustainable and energy-efficient design and development practices in new construction and renovation of existing buildings. Recommended practices include the reuse of existing buildings and materials, the conservation of natural resources and reduction of toxins in building materials and construction methods, and the reduction in energy use in construction and daily operations. Other design strategies that would foster pedestrian, bicycle, and public transit use in the city include compact arrangement of buildings and permitted mix of land uses . CDD staff would encourage the Project Team to pursue the highest level of sustainable and energy-efficient design possible and recommend pursuing the following:

- Additional (3) point for Rainwater Management credit in Sustainable Sites category.
- Additional (1) point for Cooling Tower Water Use credit in Water Efficiency category.
- Additional (2) points for Green Power and Carbon Offsets credit in Energy and Atmosphere category.
- Additional points, (1) for Building Life-Cycle Impact Reduction credit and (1) for BPDO-Material Ingredients credit in Materials and Resources category.
- Additional points, (1) for Low-Emitting Materials credit, (1) for Daylight credit, and (1) for Quality Views in Indoor Environmental Quality category.
- Additional point (1) for Rainwater Management in Regional Priority category.

Staff urge the design team to keep pursuing additional points especially from impactful categories such as energy and atmosphere, indoor environmental quality and materials and resources. As the project design proceeds, kindly provide more details on the closed cavity facade. In addition, staff would appreciate if more information can be provided regarding the pursued green building incentive program and Memorandum of Understanding with Eversource.

The project will be subject to review prior to receiving its Building Permit and Certificate of Occupancy. CDD Staff is available to work with the Applicant through continuing design review and looks forward to receiving updates on the project's Net Zero Narrative and modeled energy savings as the design moves forward.

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Massachusetts Institute of Technology

Stephen A. Schwarzman College of Computing

Article 22 Submission

Issue | September 18, 2020 updated October 20, 2020

Job number 271619-00

Arup USA, Inc
60 State Street
Boston MA 02109
United States of America
www.arup.com

ARUP

Contents

1 Project Introduction

The Stephen A. Schwarzman College of Computing will be a mixed-use building containing office, research laboratory, academic, event, a café, and collaboration and meeting spaces. In total, the building will comprise approximately 174,000 Gross Floor Area (GFA) distributed over eight (8) above-grade floors and a basement level. Public programs are located on floors 1 and 2, while the academic and research programs are located on floors 3-7, with the event space on floor 8. The basement will contain shell space for future use.

Project Rendering: Vassar Street Façade image: SOM

Table 1. Summary of building development characteristics

Site area:	18,300 ft^2
Existing land use(s) and gross floor area, by use:	Institutional/Academic: 16,119 GFA
Proposed land use(s) and gross floor area, by use:	Institutional/Academic: 170,900 GFA Café: 3,100 GFA Total: 174,000 GFA
Proposed building height(s):	118 ft 9 stories (8 above-grade)
Proposed parking spaces:	0 off street
Proposed bicycle parking spaces (Long-term and short-term):	71 short-term[1] & 44 long-term

[1] Bicycle parking required by Article 6.1 has been updated since the Green Building Report was certified on October 15, 2020 to reflect the final building gross floor area, 174,000 GFA not 173,000 GFA as previously stated.

1.1 Project team

Owner: Massachusetts Institute of Technology

The Stephen A. Schwarzman College of Computing design team includes:

- Architect & Structural Engineer: Skidmore, Owings & Merrill LLP
- MEP/FP Engineering: Arup
- Civil Engineering: Nitsch
- Landscape Architect: Reed Hildebrand
- Environmental Engineering: Haley & Aldrich
- Cost Estimating: AECOM
- Lighting Design: HLB
- Sustainability Consulting: Arup
- Acoustics Consulting: Arup
- Code Consulting: Arup
- AV, IT & Security Consulting: Vantage TCG
- Vertical Transportation: Lerch Bates
- Waterproofing consultant: Vidaris
- Lab Planning Consultant: RFD
- Signage and Wayfinding Consultant: Isometric Studio

Green Building Project Checklist

Green Building
Project Location: 51 Vassar Street, Cambridge MA 02142

Applicant

Name: Travis Wanat - Massachusetts Institute of Technology
Address: 195 Albany Street Cambridge MA 02139
Contact Information
Email Address: twanat@mit.edu
Telephone #: 617-756-2858

Project Information (select all that apply):

- ☒ New Construction – GFA: 174,000
- ☐ Addition – GFA of Addition: _____
- ☐ Rehabilitation of Existing Building – GFA of Rehabilitated Area: _____
  - ☐ Existing Use(s) of Rehabilitated Area: _____
  - ☐ Proposed Use(s) of Rehabilitated Area: _____
- ☒ Requires Planning Board Special Permit approval
- ☐ Subject to Section 19.50 Building and Site Plan Requirements
- ☐ Site was previously subject to Green Building Requirements

Green Building Rating Program/System:

- ☒ Leadership in Energy and Environmental Design (LEED) – Version: 4 New Construction
  - ☐ Building Design + Construction (BD+C) – Subcategory: _____
  - ☐ Residential BD+C – Subcategory: _____
  - ☐ Interior Design + Construction (ID+C) – Subcategory: _____
  - ☐ Other: _____
- ☐ Passive House – Version: _____
  - ☐ PHIUS+
  - ☐ Passivhaus Institut (PHI)
  - ☐ Other: _____
- ☐ Enterprise Green Communities – Version: _____

Project Phase

☐ **SPECIAL PERMIT**

Before applying for a building permit, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

☒ Rating system checklist

☒ Rating system narrative

☒ Net zero narrative (see example template for guidance)

☒ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit)

Affidavit Form for Green Building Professional
Special Permit

Green Building
Project Location: 51 Vassar Street, Cambridge MA 02142

Green Building Professional

Name: Hilary Williams PE LEED AP BD+C

☐ Architect
☑ Engineer

Mass. License Number: 55379
Company: Arup USA Inc.
Address: 60 State Street,Boston MA 02109
Contact Information
Email Address: Hilary.Williams@arup
Telephone Number: 617 864 2987

I, Hilary Williams PE LEED AP BD+C , as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

9/18/2020

(Signature) *(Date)*

Attach either:

☑ Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.

☐ If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.

LEED AP BD+C

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

Hilary Williams

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED green building program.

10658894-AP-BD+C

CREDENTIAL ID

01 DEC 2011

ISSUED

28 NOV 2021

VALID THROUGH

MAHESH RAMANUJAN
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.

Massachusetts Institute of Technology

Stephen A. Schwarzman College of Computing

Article 22: Green Building Narrative

Issue | September 18, 2020 updated October 20, 2020

Job number 271619-00

Arup USA, Inc
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United States of America
www.arup.com

ARUP

Contents

Appendices

1 LEED v4 New Construction Scorecard Summary

The table below summarizes the LEEDv4 New Construction credit summary for the proposed building design. The project is pursuing points for LEED Gold certification at a high level. Gold certification requires achievement of at least 60 points, 60-79 points. The project is targeting 71 points. The LEED Credit Scorecard can be found in Appendix A.

Table 1. LEED points planned for Gold v4 certification pathway

Category	Points planned (YES)	Maybe Points
IP: Integrative Process	1	-
LT: Location and Transportation	13	-
SS: Sustainable Sites	3	3
WE: Water Efficiency	5	1
EA: Energy and Atmosphere	25	2
MR: Materials and Resources	7	2
EQ: Indoor Environmental Quality	10	3
ID: Innovation in Design	6	-
RP: Regional Priority	1	1
Total	**71**	**12**

A detailed credit by credit narrative is included in the following narrative.

2 LEED Credit Narrative

This section provides a detailed narrative for each LEED credit being pursued, with some credits being indicated as "maybe" for evaluation for their cost benefit using life cycle cost analysis.

The project will meet all three (3) minimum program requirements to (1) be in a permanent location on existing land, (2) use a reasonable LEED boundary and (3) comply with size requirements of at least 1,000 square feet of gross floor area.

Additionally, the project will achieve each of the twelve (12) prerequisites which are discussed under each credit category below.

2.1 Integrative Process

2.1.1 Integrative Process 1 point

The project is pursuing 1 point from this credit with the intention of supporting high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems. Early analyses for energy-related systems and water-related systems were completed and will be used to inform the basis of design (BOD), design documents, and construction documents. "Simple box" energy modeling was performed during Concept Design phase to evaluate the importance of building envelope attributes including double skin façade systems, and assessment different HVAC alternatives. Water consumption calculations were performed to estimate the project's indoor and outdoor water demand and set reduction targets. A series of sustainability focused charrettes have been held to define project goals, set targets for energy and water use reduction and review analysis of energy and water related reduction strategies.

2.2 Location and Transportation

LTc2 Sensitive Land Protection 1 point

The project will achieve this credit by being located on land that has been previously developed.

LTc4 Surrounding Density and Diverse Uses 5 points

The project will achieve the full 3 available points under the Surrounding Density criteria, and an additional 2 points for Diverse Uses criteria, for a total of 5 points. The table below includes a calculation of surrounding density, demonstrating exceedance of the LEED threshold of 35,000 square feet per acre of buildable land. The calculations have accounted for the full ¼ mile radius of surrounding area and shows the minimum density threshold is comfortably exceeded.

Table 2. Surrounding density calculations. Data from MIT Space Accounting Database.

Total building area (MIT campus buildings only):	6,737,560 ft^2
Total radius area (including non-buildable land):	0.20 mi^2
	5,473,833 ft^2
	125.7 acres
Combined density:	536,156 ft^2/acre
Non-residential density:	1.16 FAR
Residential density:	4.9 dwelling unit/acre

The project targets an additional 2 points for Diverse Uses, having a main entrance within a ½ mile walking distance of the main entrance for eight (8) or more existing and publicly available diverse uses, as summarized below.

Table 3. Diverse uses by category and use type within 0.5 miles walking distance of project site

Location name	Category	Use type	Distance to site (miles)
Forbes Family Café	Services	Café	0.2
Cambridge Trust	Services	Bank	0.2
455 Main Street	Community anchor	Office	0.2
LaVerde's Market	Food retail	Grocery	0.3
USPS Post Office	Civic & community facilities	Post office	0.3
7-Eleven	Community-serving retail	Convenience store	0.3
Clover Food Lab	Services	Restaurant	0.3
List Visual Arts Center	Civic & community facilities	Museum	0.3
Revela Salon	Services	Hair care	0.4

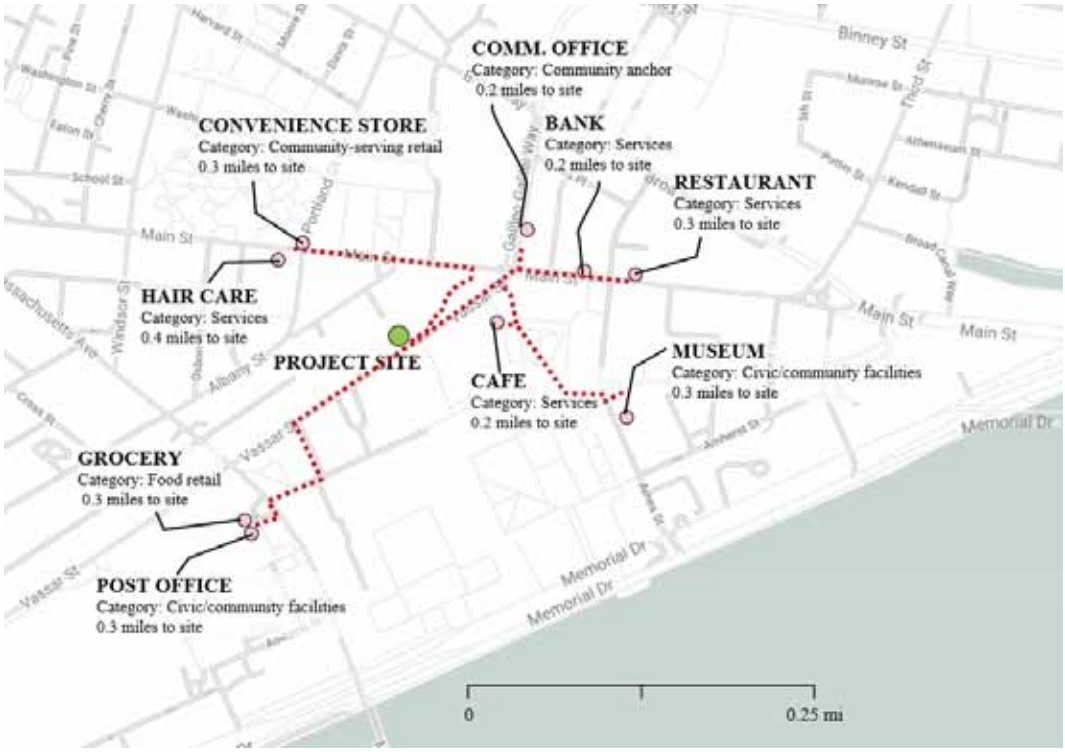

Figure 1. Map of Diverse Uses located within 0.5 miles walking distance of project site.

LTc5 Access to Quality Transit (v4.1) 5 points

The project will achieve 5 points for LTc5 Access to Quality Transit by having a functional entry for the project within a ¼-mile walking distance of existing bus stops and a ½-mile walking distance from the MBTA "T" system. A calculation of frequency of service that fulfill the credit criteria are included in the table below.

Table 4. Transit options in fulfillment of Quality Transit credit

Route	Stop	Distance to site (miles)	Weekday trips	Weekend trips
EZ-Ride	Main/Vassar Street	0.2	77	0
MBTA Red Line	Kendall	0.4	200	157
MBTA 1 Bus	77 Massachusetts Ave	0.2	127	100
		Total:	**404**	**257**
		LEED 5-point threshold:	360	216

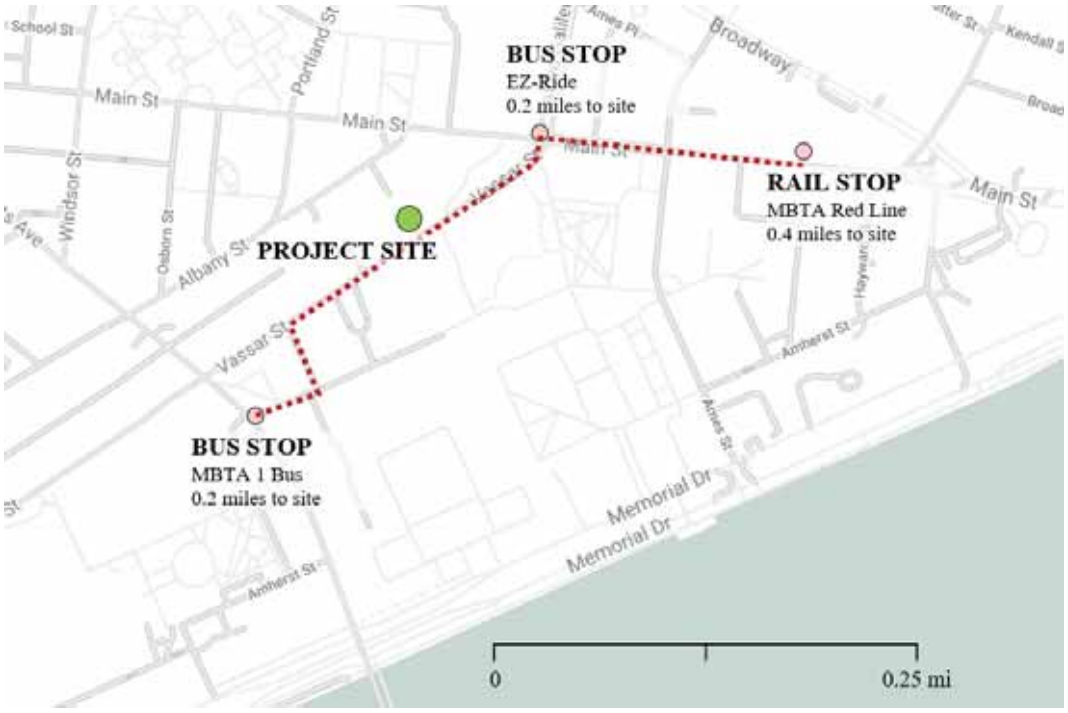

Figure 2. Transit options within ¼ mile walking distance (bus stops) or ½-mile walking distance (rail stop).

LTc6 Bicycle Facilities (v4.1) 1 point

The project will achieve 1 point for providing bike parking and shower and changing facilities per LEED requirements and meet the City of Cambridge Article 6.100, bike parking spaces. Refer to the table below. The City of Cambridge Article 6.100 requirements are more stringent for short-term parking, while LEED is more stringent for long-term parking and requires shower and changing facilities.

Building metrics:

- 174,000[1] GFA
- 850 full-time occupants (FTE)
- 1,100 peak visitors

Table 5. Bicycle parking and showers/changing rooms counts

	Short-term		Long-term		Showers / Changing Rooms	
	Criteria	Result	Criteria	Result	Criteria	Result
Cambridge Article 6.100	0.4 spaces per 1,000 SF	**71**	0.2 spaces per 1,000 SF	**36**	n/a	n/a

[1] Bicycle parking required by Article 6.1 has been updated since the Green Building Report was certified on October 15, 2020 to reflect the final building gross floor area, 174,000 GFA not 173,000 GFA as previously stated.

LEED LTc6	2.5% of peak visitors	**28**	5% of FTE	**44**	1 for first 100 FTE +1 for each 150 after	**9**

The project site is connected to a bicycle network that extends throughout the MIT campus and from Cambridge into Boston and connects to at least 10 diverse uses per LEED requirements.

LTc7 Reduced Parking Footprint (v4.1) 1 point

The project achieves 1 point for this credit under LEED v4.1 criteria, Option 1, by including no offstreet parking.

2.3 Sustainable Sites

SS Prerequisite 1: Construction Activity Pollution Prevention

The project will meet this prerequisite by creating and implementing an erosion and sedimentation control plan for all construction activities associated with the project. The plan will conform to the municipal erosion and sedimentation requirements for the City of Cambridge.

SSc4 Rainwater Management 3 points (maybe)

The project is studying the feasibility for achievement of 3 points under this credit. The project's stormwater reduction strategies include a vegetative roof such as the "Purple Roof" technology which maximizes stormwater retention and plant health, as well as supplemental rainwater retention chambers. Achievement of the credit involves retaining on-site rainwater from the 90th percentile storm event.

SSc5 Heat Island Reduction 2 points

The project has targeted 2 points for achievement under SSc5 Option 1 (Nonroof and Roof). The Nonroof measures that support credit achievement include landscape areas with planting and trees to provide shade. The hardscape materials will incorporate light-colored granite and pre-cast concrete. The roof membrane is a combination of light-colored sand, mortar, and grout with an extensive green roof system.

SSc6 Light Pollution Reduction 1 point

The project will pursue 1 point under this credit using Option 1: BUG Rating Method. Exterior lighting priorities include providing a safe nighttime lighting environment that meets LEED criteria per BUG methodology and to minimize light spill from the building to Vassar Street. Per the Illuminating Engineering

Society Model Lighting Ordinance, the project lies in a Lighting Zone 3 (LZ-3) corresponding to a moderately high lighting level in commercial mixed-use areas.

2.4 Water Efficiency Credits

WE Prerequisite 1: Outdoor Water Use Reduction

The project will fulfill this prerequisite by reducing irrigation water demand by at least 30% from the calculated baseline for the site's peak water month, achieved through plant species selection and irrigation system efficiency, as calculated by the Environmental Protection Agency (EPA) WaterSense Water Budget Tool.

WE Prerequisite 2: Indoor Water Use Reduction

The project will fulfill this prerequisite by installing fittings and fixtures that reduce aggregate water consumption by at least 20% from the baseline as specified in the LEED v4 Reference Guide and will be Water Sense labelled. Applicable water fixtures include toilets, lavatory faucets, kitchen faucets, and showerheads. In addition, appliances such as dishwashers and ice machines will meet the ENERGY STAR or equivalent performance.

WE Prerequisite 3: Building-Level Water Metering

The project will fulfill this prerequisite by installing a whole building water meter to measure the total potable water use for the building and associated grounds, compiled into monthly and annual summaries. The project commits to sharing with USGBC the resulting whole-project water usage data for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first.

WEc1 Outdoor Water Use Reduction 1 of 2 points

The landscape design will demonstrate at least a 50% reduction in potable water demand for outdoor water use through specification of native species with low water demand and efficient irrigation systems. This will achieve 1 point.

WEc2 Indoor Water Use Reduction 3 of 6 points

The project will achieve three (3) points or a 36.7% reduction in indoor potable water use by specifying low-flow water fixtures per MIT design standards. Restrooms will all be gender neutral and no urinals will be installed on the project.

Water fixture flow rates have been defined as follows and will be water sense labelled per LEED requirements:

	Design flow rate	Max. Allowable Flow Rate

• Toilets:	1.0 gpf	1.6 gpf
• Lavatories:	0.35 gpm	0.5 gpm
• Showers:	1.5 gpm	2.5 gpm
• Kitchen sinks:	0.5 gpm	2.0 gpm

WEc3 Cooling Tower Water Use 1 point (maybe)

The project is exploring achievement of 1 point under this credit and confirming compliance with the Central Utility Plant for potable water analysis measuring, Ca (as $CaCO_3$), total alkalinity, SiO_2, Cl^-, and conductivity against the maximum levels prescribed in the LEED v4 Reference Guide. In accordance with LEED criteria, cooling tower cycles will be measured to verify whether the maximum number of cycles are achieved without exceeding any filtration levels or affecting operation of condenser water system (up to a maximum of 10 cycles).

WEc4 Water Metering 1 point

Water sub-metering will be implemented on the project to sub-meter water use for two (2) end uses, (1) landscape irrigation and (2) the cafeteria/food service area.

2.5 Energy and Atmosphere Credits

EA Prerequisite 1: Fundamental Commissioning and Verification

In fulfillment of this prerequisite, the project will engage commissioning (Cx) agents for mechanical, electrical, plumbing, and renewable energy systems and assemblies in accordance with ASHRAE Guideline O-2005 and ASHRAE Guideline 1.1-2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability. In addition, a building enclosure commissioning (BECx) agent has been engaged for the project. The Cx and BECx agents will complete all steps outlined in LEED v4 Reference Guide.

EA Prerequisite 2: Minimum Energy Performance

In fulfillment of this prerequisite, the project will follow Option 1: Whole Building Energy Simulation to demonstrate an improvement of at least 5% in the proposed building performance rating compared with an ASHRAE 90.1-2010 Appendix G baseline building. Refer to the description of credit EAc2: Optimize Energy Performance below for detailed energy model results.

EA Prerequisite 3: Building-Level Energy Metering

In fulfillment of this prerequisite, the project will install building-level energy meters and submeters that can be aggregated to provide building-level data representing total building energy consumption. The project commits to sharing with USGBC the resulting energy consumption data for a five-year period beginning on the date the project accepts LEED certification. At a minimum, energy consumption must be tracked at one-month intervals.

EA Prerequisite 4: Building-Level Energy Metering

In fulfillment of this prerequisite, the project commits to not using chlorofluorocarbon (CFC)-based refrigerants throughout major HVAC&R systems.

EAc1 Enhanced Commissioning 6 points

The project will pursue all points under Enhanced Commissioning for Options 1 and 2. The process will exceed the Article 22 Green Commissioning requirements, which require the engagement of a Green Commissioning Authority as defined in Article 2.000 who completes the activities outlined in Section 22.24.2. The commissioning plan includes Option 1 Path 2: Enhanced and Monitoring-Based Commissioning. A commissioning agent will be engaged prior to the end of design development phase with a scope of work aligned with LEED criteria. It is understood that MIT uses KGS Building's Clockworks system as its monitoring-based commissioning platform and that this will be implemented on the project.

Option 2: Envelope commissioning will also be pursued. MIT has engaged Wiss Janney, Elstner Associates (WJE) as the building envelope commissioning agent and they have already been engaged with the project team and informing the curtain wall design.

EAc2 Optimize Energy Performance 18 of 18 points

The building will be connected to the MIT Central Utility Plant and will be served by electricity and campus chilled water. Accordingly, the design team has focused on demand reduction since thermal energy generation is outside of the project scope of work. Preliminary energy modelling was completed aligned with Option 1 Whole-building energy simulation to determine the proposed design performance against a LEED baseline which references ASHRAE 90.1-2010. The analysis utilized LEED guidance for district energy systems, Option 2. **The results indicate the proposed project design would achieve all 18 points available EAc2 Optimize Energy Performance by achieving a 53.7% energy cost savings as compared to an ASHRAE 90.1-2010 baseline.**

It is important to note that the Central Utility Plant (CUP) is undergoing an expansion project that will be fully complete and operational prior to this building

being complete. The cost analysis has used MIT's DES Calculator which is populated with FY2019 utility data and a projection for the future 40MW CUP.

The proposed design includes an energy efficient building envelope and energy-efficient lighting. HVAC systems include a heat pump chiller utilizing campus chilled water as a heat sink/source, dedicated outdoor air system (DOAS) air handling unit with V8 dynamic filters and energy recovery at 80% efficiency. The auditorium will be served by a displacement ventilation system, while the ground-floor café and circulation areas will be served by radiant slab heating and cooling system. Fan coil units with high efficiency motors controlled by demand control ventilation sensors are provided throughout occupied spaces . A full description of the energy efficiency strategies, model inputs and assumptions are provided in the Net Zero Narrative.

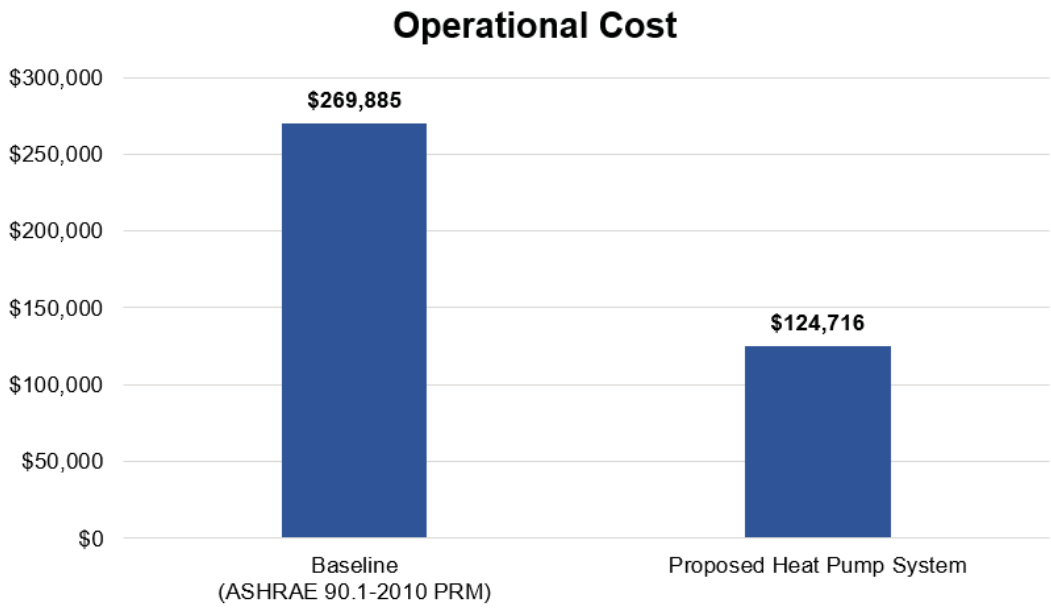

Figure 3. Energy cost of the LEED baseline and proposed design (heat pump system)

Table 6. Summary of Proposed design and LEED baseline results

	Energy Cost ($/year)	LEED points
LEED v4 Baseline	$269,885	-
Proposed Design	$124,716	18

EAc3 Advanced Energy Metering 1 point

The project is pursuing 1 point under this credit by installing advanced energy metering for all whole-building energy sources and individual energy end uses

that represent 10% or more of the total annual building energy consumption. The metering will meet the prescribed characteristics listed in the LEED v4 Reference Guide for this credit, including having meters that are permanently installed, record both consumption and demand at intervals of one hour or less (and capable of reporting hourly, daily, monthly, and annual energy use), transmit data to a remote location that is remotely accessible. The metering system will be capable of storing all meter data for at least 36 months.

EAc7 Green Power and Carbon Offsets 2 points (maybe)

MIT is currently engaged in a power purchase agreement (PPA) as a part of its campus-wide renewable energy strategy. The project is evaluating the feasibility and alignment with wider Campus goals for renewables and carbon offsets to achieve 2 points under this credit by acquiring 100% of the total project's energy demand by renewable energy certificates (RECs) and/or carbon offsets, for a period of at least 5 years.

2.6 Materials and Resources Credits

MR Prerequisite 1: Storage and Collection of Recyclables

In fulfillment of this prerequisite, the project will provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Materials to be collected include mixed paper, corrugated cardboard, glass, plastics, and metals, with appropriate measures being taken for the safe collection of batteries, mercury-containing lamps, and electronic waste.

MR Prerequisite 2: Construction and Demolition Waste Management Planning

In fulfillment of this prerequisite, the project will develop and implement a construction and demolition waste management plan adhering to LEED v4 Reference Guide criteria. Requirements will be integrated into section 017419 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT AND DISPOSAL.

MRc1 Building Life-Cycle Impact Reduction 2 of 5 points (+ 1 point maybe)

The project has committed to track and measure scope 3 emissions for embodied carbon related to construction materials and will pursue Option 4: Whole Building Life Cycle Assessment (LCA). In addition to conducting an LCA, the project has targeted achievement of a 5% reduction in embodied carbon to achieve 2 points.

An additional point is included as a 'maybe' if the project is able to demonstrate a 10% reduction.

MRc2 Building Product Disclosure and Optimization (BPDO) Environmental Product Declarations (v4.1) 1 of 2 points

The project will achieve Option 1: Environmental Product Declaration (EPD) for achievement of 1 point under version 4.1 by specifying at least 20 different permanently installed products sourced from at least five different manufacturers that have compliant EPDs. An emphasis will be placed on product specific EPDs and will support achievement of MRc1 and conducting the LCA. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

MRc3: BPDO: Sourcing of Raw Materials (v4.1) 1 of 2 points

The project has targeted achievement of 1 point using LEED v4.1 by specifying products sourced from at least three different manufacturers that meet at least one of the responsible sourcing and extraction criteria for at least 20%, by cost, of the total value of permanently installed building products. It is anticipated the credit will be met through specifying FSC-certified wood, recycled content and regional materials. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

MRc4 BPDO: Material Ingredients (v4.1) 1 of 2 points (+ 1 point maybe)

The project is pursuing this credit under Option 1: Material Ingredient Reporting, specifying at least 20 different permanently installed products from at least five different manufacturers that demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm). In accordance with the project's Sustainable Design Requirements, these inventories will conform to one of the following types:

1. A "Declare" product label indicating Red List Free or Declared.
2. Manufacturer inventory (a complete content inventory for the product)
3. Health Products Declaration
4. Cradle to Cradle Certification
5. ANSI/BIFMA e3 Furniture Sustainability Standard
6. UL Product Lens Certification
7. PACTS – NSF/ANSI 226: Sustainability Assessment for Commercial Furnishings Fabric at any certification level
8. Other USGBC-approved program

An emphasis will be placed on specifying Red List Free products as available to reduce chemicals of concern in the interior environment. Requirements will be

integrated into section 018113 SUSTAIANABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

As a part of the project stretch goal, Option 2 (Material Ingredient Optimization) is being considered for 1 additional point. Under this strategy, project material selection would include over 10 Red List-free materials.

MRc5 Construction and Demolition Waste Management (v4.1) 2 points

The project has targeted 2 points for achievement using version 4.1 under Option 1: Diversion which requires at least a 75% diversion rate plus Path 3 or 4. For an additional innovation credit, the project is also targeting achievement of Option 2: Reduction of Total Waste Material which requires not generating more than 7.5 lbs/sf from new construction activities and diverting at least 75% of demolition waste. Requirements will be integrated into section 017419 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT AND DISPOSAL.

2.7 Indoor Environmental Quality Credits

IEQ Prerequisite 1: Minimum Indoor Air Quality Performance

In fulfillment of this prerequisite, the project will meet ventilation requirements by providing minimum outdoor air in accordance with ASHRAE Standard 62.1-2010.

IEQ Prerequisite 2: Environmental Tobacco Smoke Control

In fulfillment of this prerequisite, the project will prohibit smoking inside the building, outside the building except in designated areas located at least 25 feet from all entries, outdoor air intakes, and operable windows. The project will abide by MIT's existing Campus Smoking Policy which prohibits smoking in all spaces of all MIT buildings.

EQc1 Enhanced Indoor Air Quality Strategies 2 points

The project will achieve 2 points under Option 1 Enhanced IAQ Strategies and Option 2 Additional enhanced IAQ Strategies. For Option 1, strategies A and C will be achieved by installing permanent entryway systems at least 10 feet long in the primary direction of travel to capture dirt and particulates and will install MERV-13 or higher filters at all AHUs supplying outdoor air to occupied spaces. For Option 2, Option C will be achieved by installing CO2 monitoring in densely occupied spaces.

EQc2 Low-Emitting Materials (v4.1) 2 of 4 points (+ 1 point maybe)

The project will pursue 2 points under this credit by specifying three (3) product categories that meet the low-emitting criteria for VOC content and general emissions evaluation. Flooring, Paints and Coatings, and Furniture have been initially identified for compliance. An additional 1 point has been identified as maybe point if a fourth product category is achieved. Composite wood has been initially identified for achievement. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

EQc3 Construction Indoor Air Quality Management Plan 1 point

The project will achieve 1 point by requiring the Contractor to develop and implement an indoor air quality (IAQ) management plan for the construction. The plan will meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3. Additional measures will be implemented to protect absorptive materials stored on-site and installed from moisture damage. Requirements will be integrated into section 018120 CONSTRUCION INDOOR AIR QUALITY MANAGEMENT.

EQc4 Indoor Air Quality Assessment 2 points

The project will achieve 2 points by requiring the Contractor to pursue Option 2: Air Testing. IAQ testing using LEED-specified methods will be carried out after construction ends and prior to occupancy. Requirements will be integrated into section 018120 CONSTRUCION INDOOR AIR QUALITY MANAGEMENT and 018113 SUSTAIANABLE DESIGN REQUIREMENTS.

EQc5 Thermal Comfort 1 point

The project will achieve 1 point using Option 1, by designing to meet the requirements of ASHRAE Standard 55-2010, Thermal Comfort Conditions for Human Occupancy and providing at least 50% of individual occupant spaces with thermal comfort controls. Additionally, thermal comfort controls will be provided for all shared multi-occupant spaces.

EQc6 Interior Lighting 2 points

The project is pursuing 2 points from this credit using both Option 1: Lighting Control and Option 2: Lighting Quality. In accordance with LEED criteria, at least

90% of individual occupant spaces will contain individual lighting controls, and multi-occupant spaces will contain multizone control systems, separate controls for presentation- or projection- focused lighting, and switches or manual controls located in the same space as the controlled luminaires. At least four of the eight lighting control strategies prescribed in the LEED v4 Reference Guide will be incorporated.

EQc7 Daylight (v4.1) 1 of 3 points (maybe)

The project is tentatively pursuing 1 point under this credit and is conducting daylight analysis to confirm if the credit thresholds are met. Under this strategy, manual or automatic glare-control devices would be installed in all regularly-occupied spaces, and 1 point would be targeted under Option 1: Simulation – Spatial Daylight Autonomy and Annual Sunlight Exposure, demonstrating an average sDA300/50% value for the regularly occupied floor area of at least 40%.

EQc8 Quality Views 1 point (maybe)

The project is tentatively pursuing 1 point under this credit by establishing a direct line of sight to the outdoors via vision glazing for 75% of all regularly occupied floor area, and at least 75% of all regularly occupied floor area having at least two of the four kinds of views listed under this credit description in the LEED v4 Reference Guide. This credit will be confirmed later in the design phase when furniture and office layouts are developed.

2.8 Innovation Credits

IDc1 Pilot Credit: Comprehensive Composting 1 point

The project is pursuing 1 point from this credit using Option 1: Regular compost collection and offsite processing. The design will integrate organic waste receptacles and regular organic waste collection in accordance with the LEED v4 Pilot credit criteria.

IDc2 Innovation – MRc5 C&D Waste 1 point

The project is pursuing 1 point as exemplary performance to achieve both Options under MRc5: Construction and Demolition Waste Management Plan. In addition to achievement of Option 1: Diversion, the project will track Option 2: Reduction of Total C&D Waste material using version 4.1 criteria. This require new construction to not generate more than 7.5 lbs/sf of waste and at least 75% of demolition is salvaged or recycled.

IDc3 Innovation – Design for Active Occupants 1 point

The project is pursuing 1 point from this Innovation credit, meeting the criteria outlined in the LEED v4 Innovation Catalog with the intention of improving the health of occupants through physical activity while reducing environmental impacts. The building has a primary main feature stair at the main entrance that enables occupants to travel between the building entrance floor, occupants' destination floors, and common use floors. In addition, the project will include 7 or more of the 11 features outlined in the LEED v4 Innovation Catalog for this credit. Features, 1, 2, 3, 4, 5, 6 and 8 have been initially identified for compliance.

IDc4 Innovation – Green Building Education 1 point

The project is pursuing 1 point from this Innovation credit, meeting the criteria outlined in the LEED v4 Innovation Catalog with the intention of providing public education focusing on green building strategies and solutions through installed signage. The green building education approach will be *actively* instructional, and incorporate:

1. A comprehensive signage program built into the building's spaces to educate occupants and visitors of the benefits of green buildings.
2. Development of a manual, guidelines, or case study to inform the design of other buildings based on this project's successes.

IDc5 Innovation – Purchasing (Lamps) 1 point

The project will pursue 1 point from this credit by establishing a toxic material source reduction program to reduce the amount of mercury brought onto the building site through purchases of lamps. The project will provide primarily an all-LED lighting design with potential for exceptions in select specialty lighting. Any non-LED lighting installed will be energy efficient and meet the mercury limits established in the LEED credit of an overall building average of 70 picograms of mercury per lumen-hour or less.

IDc6 LEED Accredited Professional 1 point

The project will achieve 1 point by having numerous members of the project team who are current LEED Accredited Professionals (APs) with a Building Design and Construction (BD+C) specialty. The Green Building Design Professional is the sustainability and LEED consultant on the project, Rebecca Hatchadorian of Arup, LEED BD+C credential ID #0010055526.

2.9 Regional Priority Credits

RP Credit – Rainwater Management 1 point (maybe)

The project is tentatively pursuing 1 Regional Priority Credit for exceeding the 2-point threshold for SS Credit 4: Rainwater Management.

RP Credit – Energy Performance 1 point

The project is pursuing 1 Regional Priority Credit for exceeding the 8-point threshold for EA Credit 2: Optimize Energy Performance.

Appendix A

LEED Checklist

LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: MIT Stephen A Schwarzman College of Computing
Date: 9/18/2020
Article 22 Green Building Narrative

Y	?	N				
Integrative Process						**1**
1			D	Credit	Integrative Process	1
Y	**?**	**N**				
13	**0**	**3**		**Location and Transportation**		**16**
			D	Credit 1	LEED for Neighborhood Development	16
1			D	Credit 2	Sensitive Land Protection (previously developed land)	1
		2	D	Credit 3	High Priority Site	2
5			D	Credit 4	Surrounding Density and Diverse Uses	5
5			D	Credit 5	4.1 Access to Quality Transit (T + bus frequency)	5
1			D	Credit 6	4.1 Bicycle Facilities (5% long term + 2.5% short term)	1
1			D	Credit 7	4.1 Reduced Parking Footprint (option 1 no off street)	1
		1	D	Credit 8	4.1 Green Vehicles (2% or 2 spaces EV charging)	1
Y	**?**	**N**				
3	**3**	**4**		**Sustainable Sites**		**10**
Y			C	Prereq	Construction Activity Pollution Prevention	Required
		1	D	Credit 1	Site Assessment	1
		2	D	Credit 2	Site Development - Restore Habitat (25% site area)	2
		1	D	Credit 3	4.1 Open Space (30% total site area)	1
	3		D	Credit 4	4.1 Rainwater Management	3
2			C	Credit 5	Heat Island Reduction (Option 1)	2
1			D	Credit 6	Light Pollution Reduction	1
Y	**?**	**N**				
5	**1**	**5**		**Water Efficiency**		**11**
Y			D	Prereq	Outdoor Water Use Reduction	Required
Y			D	Prereq	Indoor Water Use Reduction	Required
Y			D	Prereq	Building-Level Water Metering	Required
1		1	D	Credit 1	Outdoor Water Use Reduction (50% reduction)	2
3		3	D	Credit 2	Indoor Water Use Reduction (35% reduction)	6
	1	1	D	Credit 3	Cooling Tower Water Use	2
1			D	Credit 4	Water Metering (2 end uses: irrigation + cafe)	1
Y	**?**	**N**				
25	**2**	**6**		**Energy and Atmosphere**		**33**
Y			C	Prereq	Fundamental Commissioning and Verification	Required
Y			D	Prereq	Minimum Energy Performance	Required
Y			D	Prereq	Building-Level Energy Metering	Required
Y			D	Prereq	Fundamental Refrigerant Management	Required
6			C	Credit 1	Enhanced Commissioning (+BECx + MBCx)	6
18			D	Credit 2	Optimize Energy Performance (38% = 15 pts)	18
1			D	Credit 3	Advanced Energy Metering	1
		2	C	Credit 4	Demand Response	2
		3	D	Credit 5	Renewable Energy (2pts = 5% RP)	3
		1	D	Credit 6	Enhanced Refrigerant Management	1
	2		C	Credit 7	Green Power and Carbon Offsets	2

D = Design submission & C = Construction Submission

Y	?	N				
7	**2**	**4**		**Materials and Resources**		**13**
Y			D	Prereq	Storage and Collection of Recyclables (+ compost)	Required
Y			C	Prereq	Construction and Demolition Waste Management Planning	Required
2	1	2	C	Credit 1	Building Life-Cycle Impact Reduction (5% reduction, 10% or 20%)	5
1		1	C	Credit 2	4.1 BPDO - Environmental Product Declarations (Option 1: 20	2
1		1	C	Credit 3	4.1 BPDO - Sourcing of Raw Materials (20% + 40% cost)	2
1	1		C	Credit 4	4.1 BPDO - Material Ingredients (Option 1: 20 Materials w/HPD)	2
2			C	Credit 5	4.1 C&D Waste Management (Options 1 + 2)	2
Y	**?**	**N**				
10	**3**	**3**		**Indoor Environmental Quality**		**16**
Y			D	Prereq	Minimum Indoor Air Quality Performance	Required
Y			D	Prereq	Environmental Tobacco Smoke Control	Required
2			D	Credit 1	Enhanced Indoor Air Quality Strategies	2
2	1		C	Credit 2	4.1 Low-Emitting Materials (3 or 4 product categories)	3
1			C	Credit 3	Construction Indoor Air Quality Management Plan	1
2			C	Credit 4	Indoor Air Quality Assessment	2
1			D	Credit 5	Thermal Comfort (ASHRAE 55 + 50% occupants have control)	1
2			D	Credit 6	Interior Lighting (option 1: control + quality)	2
	1	2	D	Credit 7	4.1 Daylight	3
	1		D	Credit 8	Quality Views	1
		1	D	Credit 9	Acoustic Performance	1
Y	**?**	**N**				
6	**0**	**0**		**Innovation**		**6**
1			D	Credit 1	Pilot - Comprehensive Composting	1
1			D	Credit 2	Innovation - C&D Waste Management Option 2	1
1			D	Credit 3	Innovation - Design for Active Occupants	1
1			D	Credit 4	Innovation - Green Building Education	1
1			D	Credit 5	Innovation - Purchasing- lamps (Low Mercury Lighting)	1
1			D	Credit 6	LEED Accredited Professional	1
Y	**?**	**N**				
1	**1**	**2**		**Regional Priority**		**4**
	1		D	Credit 1	Regional Priority: SS 4 Rainwater Management (2 points)	1
1			D	Credit 2	Regional Priority: EA 2 Energy Performance (8pt)	1
		1	D	Credit 3	Regional Priority: WE 2 Indoor Water Use (4pt = 40%)	1
		1	D	Credit 4	Regional Priority: EA 5 Renewable Energy	1
Y	**?**	**N**				
71	**12**	**27**		**TOTALS**	Possible Points:	**110**

Massachusetts Institute of Technology

Stephen A. Schwarzman College of Computing

Article 22: Net Zero Narrative

Issue | September 18, 2020 updated October 20. 2020

Job number 271619-00

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Contents

Appendices

1 Project Profile

1.1 Development Characteristics

Table 1. Summary of building development characteristics

Site area:	18,300 ft^2
Existing land use(s) and gross floor area, by use:	Institutional/Academic: 16,119 GFA
Proposed land use(s) and gross floor area, by use:	Institutional/Academic: 170,900 GFA Café: 3,100 GFA Total: 174,000 GFA
Proposed building height(s):	118 ft 9 stories (8 above-grade)
Proposed parking spaces:	0 off street
Proposed bicycle parking spaces (Long and short-term):	71 short-term[1] & 44 long-term

1.2 Green Building Rating System

Table 2. LEED rating system details

Rating system and version:	LEED for Building Design and Construction, New Construction and Major Renovation rating system LEED-BC+C NC v4
Seeking certification?	YES
Rating level:	Gold (60-79 points)
Points targeted:	71

The project is already formally registered with GBCI for certification with the title: MIT Schwarzman College of Computing, project #1000130425. Refer to the Green Building Narrative for full details on LEED certification approach.

[1] Bicycle parking required by Article 6.1 has been updated since the Green Building Report was certified on October 15, 2020 to reflect the final building gross floor area, 174,000 GFA not 173,000 GFA as previously stated.

2 Proposed Design Characteristic

2.1 Building Envelope

2.1.1 Description

Table 3. Envelope assembly descriptions

Roof:	Fluid-applied membrane roof with extensive green roof representing 68% roof area.
Exterior walls/glazing:	Southeast face: Closed cavity façade system with shadowbox Specialty glass curtain wall Other faces: Unitized aluminum-framed curtain wall system
Below-grade walls:	Cast-in-place, reinforced concrete
Below-grade floor:	Framed structural hydrostatic slab
Window-to-Wall ratio:	North façade - 11 % East façade - 30 % South façade - 71% West façade - 45% Whole building - 40%

2.1.2 Thermal Performance

Estimates of the thermal transmittance (U-value) for the building envelope compared to the Massachusetts Stretch Energy Code 780 CMR Chapter 13 amended February 7, 2020 are summarized in the table below. Note that these values represent the performance-based pathway baseline per the results presented later in this report.

The building envelope is a high-performance design that in aggregate exceeds the prescriptive performance of a code compliant baseline. The largest contributors are a window to wall ratio of 40% and high-performance glazing including a double skin south-east façade with low-U-values in excess of code minimums.

Table 4. Envelope thermal performance, Proposed Design vs. Prescriptive Code

	Proposed			Baseline[1]		
	Description (per table above)	**Area (ft2)**	**U-value**	**Description**	**Area (ft2)**	**U-value**
Glazing	Exterior glazing	30,775	SE Façade U-0.20 All other orientations U-0.36	Non-operable glazing	30,596	U-0.42
Roof	Roof	24,000	U-0.032	Insulation entirely above roof deck	24,000	U-0.032
Wall	Above-grade wall	45,715	U-0.055 (R-10 continuous + R-13 cavity)	Steel Framed	45,894	U-0.055
	Below-grade wall	8,800	C-0.119	Below-grade wall	8,800	C-0.119

[1] baseline values are per ASHRAE 90.1-2013 per the energy modeling results later in this report.

2.1.3 Envelope Commissioning Process

MIT has engaged Wiss Janney, Elstner Associates (WJE) as the building envelope commissioning agent. WJE have already been engaged with the project team and informing the curtain wall design. WJE will conduct testing and commissioning of the envelope components and report the results in alignment with LEED v4 criteria for credit EAc1 Enhanced Commissioning Option 2. Details on the BECx process are described in Appendix A.

2.2 Building Systems

The proposed design mechanical and electrical systems are summarized in the table below.

Table 5. Mechanical and electrical system descriptions

Space heating/cooling:	• Use of heat pump chillers at the building utilizing the campus chilled water as a heat sink/source to provide supplemental heating or cooling to the building. • Fan Coil Units (FCUs) provide space heating and cooling for regularly-occupied spaces • Stair unit heaters • Supplemental perimeter heating (Along entire south perimeter on first floor, and along central indented portion of perimeter on upper floors)

	• Electrical and IT room cooling is provided from split-type DX computer room air-conditioning (CRAC) units with roof mounted air-cooled condensing units
Heat rejection:	• The building will be connected to the campus chilled water network for heat rejection & extraction. No cooling towers will be installed at the building. • Cooling supply/return 42°F/58°F Summer, 50°F/60°F Winter • Heating supply/return temperatures 150°F/120°F
Pumps & auxiliary:	• No distribution pumps required for chilled water systems in the building.
Ventilation:	• 30,000 CFM DOAS Air Handling Unit • 8,000 CFM Laboratory Exhaust Fan for damp lab spaces • 2,000 CFM Exhaust Fan system for restrooms, janitors' closets, copy rooms, break rooms, and pantry areas • Stairway pressurization between 0.1-0.35 in-water per 780 CMR 909.20.5 • Transfer air ventilation for circulation spaces
Domestic Hot Water:	• Domestic Hot Water (DHW) heating sourced from campus MTHW loop using duplex MTHW heat exchangers. DHW generated at 140°F. • Master thermostatic mixing value and re-circulation piping system with circulating pumps and balancing vales provided to maintain minimum supply water temperature.
Interior lighting:	• Lighting designed to meet or exceed the efficiency requirements prescribed by Massachusetts Stretch Energy Code 780 CMR Chapter 13 and MIT Design Standards • Lutron ESN networked lighting system for building-wide lighting controls and connected to central system that communicates with MIT's central Quantam system
Exterior lighting:	• Priority to provide safe nighttime lighting environment that meets LEED criteria per BUG methodology and to minimize light spill from the building to Vassar Street. • Exterior lighting to be time clock controlled • Current design includes 6 light poles for pedestrian passageways, 7 light poles along Vassar Street, 96 recessed stair riser lights • LED lighting.
Other equipment:	• Backup power provided by 800 kW air-cooled diesel generator located at roof level in weatherproof enclosure • PV-ready rooftop. Conduit and interconnection breakers will be provided in main electrical switchgear.

2.3 MIT Central Utility Plant

MIT is committed to reducing their carbon footprint in support of the City of Cambridge's Net Zero Action Plan. Given our current understanding of available technologies, one potential path for Schwarzman College of Computing (SCC) to achieve net zero would be a de-carbonization of the ISO New England electrical grid and deployment of technologies that can take advantage of grid improvements. MIT has begun to explore ways of decarbonizing the electrical grid which can be seen by MIT's recent alliance with Boston Medical Center and Post Office Square Redevelopment Corporation in a 25-year power purchase agreement (PPA) enabling the construction of a 60-megawatt solar farm (occupying roughly 650 acres) that otherwise would not have been built. MIT will purchase carbon-free electricity, equating to 40% of our current campus electric use.

As noted above, SCC will be connected to MIT's central plant infrastructure to obtain chilled water, electricity and MTHW only for domestic hot water demand, not for space heating. There are no technical barriers to the building accepting utilities from a de-carbonized or net-zero carbon source.

MIT will continue to explore opportunities to de-carbonize the central plant. MIT is completing a significant central plant upgrade that will reduce emissions across all campus buildings served by the plant. Coupled with an electric grid that decarbonizes in the future, additional GHG emissions savings will be realized.

There is potential for MIT to further de-carbonize the campus through the deployment of alternate technologies (e.g. heat generated electrically to then produce hot water or steam). MIT will explore these options based on changes in low carbon fuel options and the electrical grid's carbon intensity. As the grid and technology evolves and improves over time, the strategies for MIT to upgrade their central plant will evolve and will use the latest available technology, which may not currently be understood, to support making a transition that is economically feasible, reliable, and decarbonized.

2.4 Building Systems Commissioning Process

Details on the Cx process are described in Appendix B per MIT Design Standards. The project is pursuing LEED EAc1 Enhanced Commissioning Option 1 Path 2 and will engage a Commissioning agent in design development phase. Additionally, the project is pursuing and will install monitoring-based commissioning using KGS Clockworks system.

3 Anticipated Energy Loads and Greenhouse Gas Emissions

3.1 Assumptions

Early phase energy modeling was performed for the proposed design, as well as a baseline building prescribed by the Massachusetts Stretch Energy Code, 780 CMR Chapter 13 amended February 7, 2020. Modeling was performed using the DOE-approved Integrated Environmental Solutions Virtual Environment (IES-VE) software, version 2019. Energy modeling outcomes for both the baseline model and proposed design are subject to change as the architectural and mechanical design and input assumptions and schedules are refined in the subsequent design phases. Additionally, energy modeling is not exact and is used to compare relative performance between alternatives rather than predicting precise energy consumption, cost, and GHG emissions.

A summary of energy model inputs and more detailed results are provided in Appendix C.

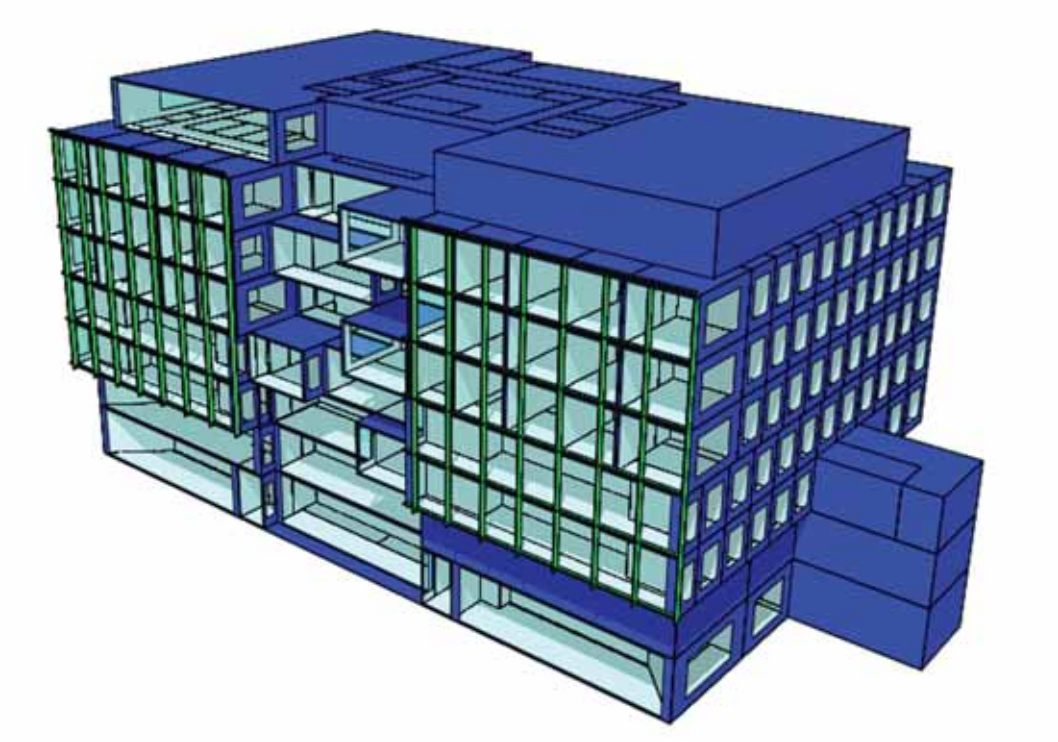


Figure 1. Image of the multizone whole-building energy model in IES-VE software

The proposed building will be supplied by the MIT central utility plant (CUP) for chilled water, electricity and MTHW only for domestic hot water. Energy cost and greenhouse gas (GHG) emissions calculations used the conversion factors from the

anticipated CUP plant upgrade; these are summarized in the table below. Note, steam cost and GHG emissions conversion factors have been used for DHW in lieu of MTHW rates which are currently not available.

Table 6. MIT campus utility data per 40MW anticipated values

	Cost	Emissions
Electric	$0.12 / kWh	0.571 lbs / kWh
Steam	$4.10 / MMBtu	144.35 lbs / MMBtu
Campus CHW	$4.74 / MMBtu	66.29 lbs / MMBtu

3.2 Annual Projected Energy Consumption and GHG Emissions

Preliminary energy modelling was completed to determine the proposed design performance against the Stretch Energy Code, 780 CMR, Ninth Edition, Chapter 13: Energy Efficiency Amendments as of 8/7/2020 . In accordance with the requirements, the baseline building incorporates the following three (3) energy conservation measures (ECMs):

1. Reduced lighting power density system in accordance with section C406.3
2. Enhanced lighting controls in accordance with section C406.4
3. High-efficiency service water heating in accordance with section C406.7 (assumes on-site renewable energy service water-heating systems)

The energy model results for annual energy use intensity (EUI) and emissions comparing the baseline and proposed design (BOD) are summarized below.

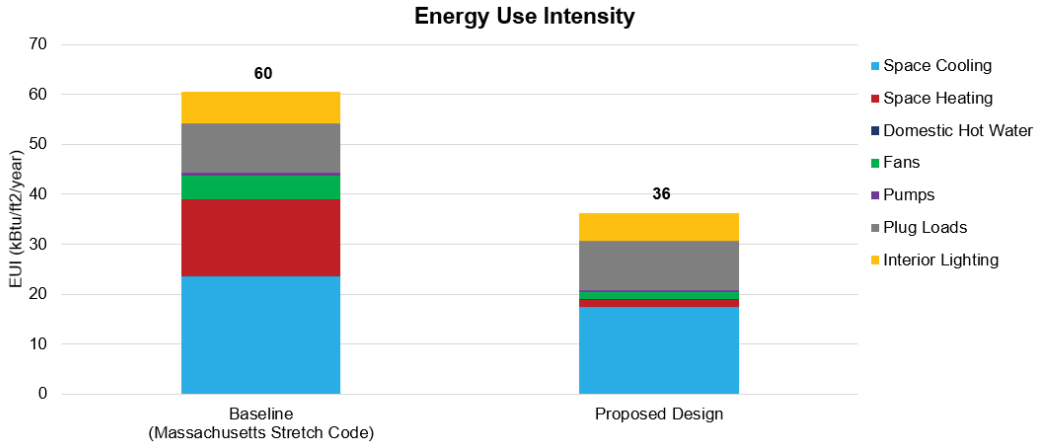


Figure 2. Energy Use Intensity (kBtu/sf/year) of Stretch code baseline and proposed design.

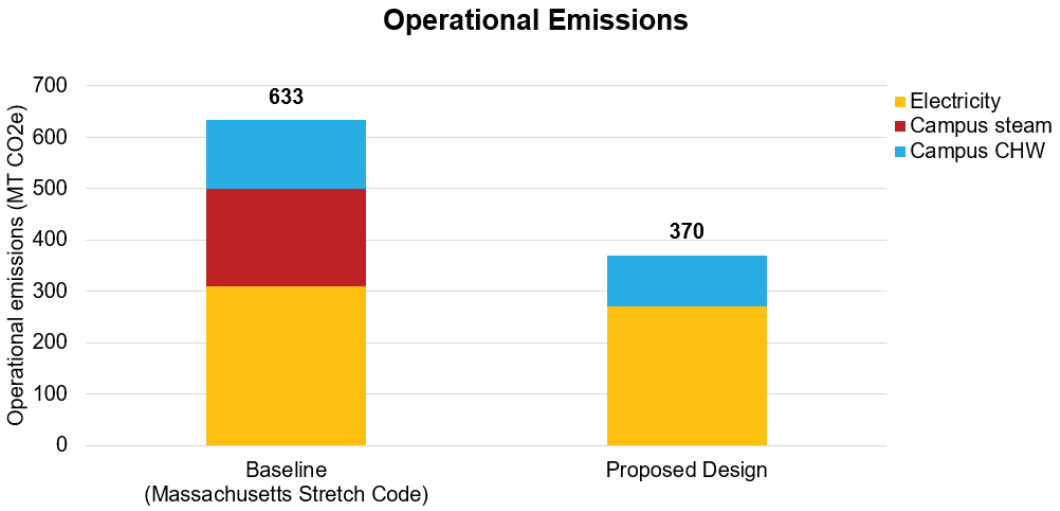


Figure 3. GHG emissions of Stretch energy code baseline and proposed design .

In comparison to the Stretch Energy Code baseline, the proposed design achieves a 40% reduction in energy and a 42% reduction in operational GHG emissions. This far exceeds the minimum Stretch Energy Code requirement for a 10% reduction in energy.

Table 7. Energy model energy and emissions summary[2]

	Baseline		Proposed		Future Scenario[3]	
	Energy (MWh)	% of total	Energy (MWh)	% of total	Energy (MWh)	% of total
Space Heating	850	25%	74	4%	74	4%
Space Cooling	1307	39%	963	48%	963	48%
Heat Rejection	-	0%	-	0%	-	0%
Pumps & Aux	32	1%	22	1%	22	1%
Ventilation	271	8%	79	4%	79	4%
Domestic HW	-	0%	18	1%	18	1%
Int. Lighting	348	10%	310	15%	310	15%
Ext. Lighting	-	0%	-	0%	-	0%
Misc. Equipment	542	16%	542	27%	542	27%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% reduction from baseline	$US, kBTU, kBTU/SF	% reduction from baseline
Total energy cost ($ US)	$176,192		$141,089	20%	$141,089	20%
Total energy use (kBtu)	11,428,338		6,854,965	40%	6,854,965	40%
Site EUI (kBtu/SF)	60		36	40%	36	40%
	MWH	% total energy	MWH	% total energy	MWH	% total energy
On-site renewable energy (MWh)	0	0	0	0	0	0
Off-site renewable energy (MWh)	0	0	0	0	0	0
	Metric tons CO_2[/SF]		Metric tons CO_2[/SF]	%reduction from baseline	Metric tons CO_2[/SF]	% reduction from baseline
GHG emissions (mtCO2e)	633		370	42%	370	42%
GHG emissions (mtCO2e/SF)	0.0034		0.0020	42%	0.0020	42%

The improvement of the proposed design over the Stretch Code baseline is derived from significant heating and cooling energy savings. These savings are a result of the highly efficient heat pump heating and cooling system, the energy

[2] Assumes utility cost and emission rates from the anticipated 40MW CUP upgrade
[3] Refer to section 3.3 for a discussion of the MIT CUP and section 6 for details.

recovery wheel (up to 80% efficient), and the decoupling of space conditioning requirements met by efficient fan coil units and outdoor air requirements met by the central DOAS system with demand control ventilation.

The energy model results incorporate direct consumption of campus chilled water and steam on an energy basis, and don't consider coefficients of performance (COPs) of the campus central utility plant.

4 Building Energy Performance Measures

4.1 Overview

The table below summarizes the ways in which building energy performance has been integrated throughout aspects of the project's planning and design, engineering, and commissioning.

Table 8. Energy performance measures incorporated throughout design

Land uses:	• Adjacency to bicycle paths which connect to the existing Cambridge bicycle network, including 76 short-term and 44 long-term bicycle parking spaces meeting both City of Cambridge and LEED requirements. • Surrounding mixed use density including academic, commercial, and residential space (see LEED LT c3 Surrounding Density and Diverse Uses credit narrative) • Walking distance of public transit options (see LEED LT c4 Access to quality transit credit narrative) • Reduction in impervious surfaces from the existing condition
Building orientation and massing:	• The building massing and orientation is driven primarily by existing conditions with the only street frontage along Vassar Street, and buildings adjacent on both sides. Solar radiation analysis showed that the slight orientation of the south façade to the south east, helps to mitigate solar gains as opposed to a fully south facing façade. • Enhanced double-skin glazing performance on Southeast-facing façade • Regularly occupied spaces and convening spaces have been primarily programmed at the building perimeter for maximum daylighting and quality views for occupants. The central circulation core and with increased glazing on Southeast façade, allows increased daylighting deeper into core spaces of the floor plate.
Envelope systems:	• The Southeast façade incorporates a double skin façade for enhanced thermal performance and thermal comfort of occupants. Shading within the double skin is being assessed for its feasibility and cost benefit. • Concept Phase parametric façade analysis identified sensitivities and drivers of energy performance. • Building envelope commissioning to be completed.

Table 8 (continued)

Mechanical systems:	• High-efficiency heat pump chillers utilizing campus chilled water as a heat sink/source • High-efficiency DOAS system with dynamic v8 filtration and demand-control ventilation. • High-efficiency (up to 80%) energy recovery system on exhaust air to minimize heating and cooling energy consumption. • 4-pipe fan coil units serving regularly occupied spaces • Energy saving measures being explored for lab exhaust systems include customized nozzles to reduce flow rate and reducing or eliminating the need for makeup air, or varying nozzle velocity to reduce flow according to localized wind measurements from an on-site anemometer
Renewable energy systems:	• PV-ready rooftop. Conduit and interconnection breakers will be provided in main electrical switchgear. • Solar PV analysis was conducted for the roof indicating a 138 kW maximum array, capable of producing 179 MWh of carbon-free electricity annually offsetting 46 mtCO2e per MIT's campus electricity emissions factor. An extensive green roof is included in the proposed design.
District-wide energy systems:	• Connection to Central Utility Plant (CUP) providing medium-temperature hot water, chilled water and electricity. • The CUP is currently being expanded to a new high-efficiency, 40 MW system resulting in a reduction of regulated pollutant emissions of approximately 25%. • The chilled water system operates on reset system during winter

4.2 Integrative Design Process

A series of four (4) sustainability focused workshops were held in Programming & Concept Phase, and an additional four (4) in Schematic Design Phase, to collectively refine and review the analysis to support the sustainability and resilience goals and priorities defined in Concept Phase to support a healthy, low carbon building design. Arup has worked collaboratively with MIT, SOM, Reed Hildebrand, and Nitsch Engineering to progress and provide analysis on a range of sustainability strategies so informed decisions could be made.

Through these workshops, the sustainability goals and priorities or project were defined and refined, aligning with the Owner's Project Requirements (OPR) document. These include the following:

- LEED BD+C v4 Gold certification. Refer to the LEED checklist (included with the Green Building Narrative)

- Design the building and project site to be resilient to 2070 flood and heat impacts as defined by MIT and the City of Cambridge Vulnerability Assessment.
- Reduce the existing impervious area within our project boundary and manage stormwater on site as feasible.
- Develop a carbon neutral pathway and set energy and GHG emissions targets for energy use intensity and GHG intensity.
- Track and report on embodied carbon and construction GHG emissions.
- Develop circular economy principles for the project.
- Develop a healthy materials class-based avoidance approach to avoid chemicals of concern and build on the ILFI's Red-List free procurement MIT has already undertaken.

Through design team workshops, the project team established an energy use intensity performance target of 63.8 kBtu/ft2/year, based on a weighted average of the three principle space use types (i.e. office, university and laboratory), area percentages at the time and target EUIs for each, i.e. 45, 75 and 200 kBtu/sf/yr respectively.

4.3 Solar-Ready Roof Assessment

A rooftop solar photovoltaic (PV) analysis was conducted and details are included in Appendix D. The analysis used Helioscope software and assumed high efficiency 340W panels. While the PV system is not incorporated in the proposed project design due to cost feasibility and high payback period, the roof will be designed as solar-ready, meaning that the structural capacity, conduit runs and interconnection breakers will be provided in the main electrical switchgear. An extensive green roof is currently part proposed design. Details related to the project's PV-readiness are summarized in the table below.

Table 9. Solar-ready roof details

Total Roof Area:	24,000 ft2 total roof area 16,486 ft2 extensive green roof area
Modeled Roof Area for PV array:	18,700 ft2
Structural support:	Roof to be rated for between 10 – 40 psf with consideration for future PV installations
Electrical infrastructure:	Conduit and interconnection breakers to be provided in main electrical switchgear.
Capacity of solar array:	138.4 kW module DC nameplate 110.8 kW inverter AC nameplate 179.0 MWh annual production

Financial incentives:	As a non-profit, MIT is not eligible for the Federal Tax Incentive. The SMART program was not assessed as MIT would want to retain the renewable attribute of the solar PV electricity generated.

4.4 Green Building Incentive Program Assistance

The project will involve utility rate incentives through a Memorandum of Understanding (MOU) with Eversource. MIT has engaged Eversource at concept design to begin the Technical Analysis process. The Integrated Design Path for Large Buildings is provided by the Mass Save Program Administrators (Eversource) for projects greater than 100,000 square feet. Eversource and MIT have hired a third-party Engineer to evaluate potential energy saving measures through energy modeling compared to the state energy code baseline. Eversource will be part of the integrative design process through design development. The results of the energy model and pricing exercise will be used to determine utility incentives as well as aid in system decision making.

5 Net Zero Scenario Transition

In October 2015, MIT committed to reduce its GHG emissions a minimum of 32% by 2030 from a 2014 baseline. In the fall of 2016, MIT advanced its climate change mitigation efforts by joining with two local partners, Boston Medical Center and Post Office Square Redevelopment Corporation in a 25-year power purchase agreement (PPA) with Dominion Resources, a Virginia-based utility. The PPA enabled the construction of Summit Farms, a roughly 650-acre, 60-megawatt solar farm that otherwise would not have been built. At the time, it was the largest aggregated renewable-energy purchase by such an alliance of organizations in the U.S.

The impact of this initial PPA on MIT's carbon footprint is equivalent to more than half (17%) of the 32% emissions reductions MIT committed to in its Plan for Action on Climate Change, announced on Oct. 21, 2015

As of 2019, net emissions are 18% below the 2014 baseline.

The table below summarizes the technical framework by which the proposed project can be transitioned to net zero greenhouse gas emissions in the future, including the future condition and process of transitioning from the proposed design to the future condition.

It is important note that the current upgrade and expansion of MIT's CUP will reduce the emissions associated with campus utilities. A comparison of the FY19 utility emissions factors with the anticipated 40MW utility emissions factors are provided below.

Campus Utilities carbon emissions		FY19	40MW anticipated	% reduction
Campus CHW	lbs CO2e /MMBtu	80.05	66.29	17%
Campus Steam	lbs CO2e /MMBtu	150.59	144.35	4%
Campus Electricity	lbs CO2e /kWh	0.639	0.571	11%

As such, the project at initial opening will benefit from this significant investment in the CUP and GHG emissions reduction.

Table 10. Details for net-zero scenario transition

	Net zero condition	Transition process
Building envelope:	The proposed design incorporates a high-performance façade that exceeds prescriptive code compliance to minimize thermal loads and reduce the demands for heating and cooling systems. A 40% window to wall ratio, double skin south east façade and green roof all contribute to the high-performance enclosure. The façade has been designed for a 50-year life and will be commissioned.	The building is being designed with a high-performance envelope that will be maintained throughout its useful life. It is not anticipated that the building envelope will play a significant role in transitioning to Net Zero.
HVAC systems:	The proposed design will be connected to the campus CUP chilled water network. The CUP currently utilizes natural gas and electricity energy sources to generate thermal energy and electricity for the campus. An upgrade and expansion project is underway to expand the CUP to 40MW and reduce GHG emission associated with campus utilities. The project has therefore focused on demand reduction and as demonstrated above is a highly energy efficient building design, exceeding the new Stretch Energy Code by 40%. As equipment reaches its end of life, opportunities for further efficiency will be evaluated but it is anticipated the building will remain connected to the CUP into the future. Therefore, the building's Net Zero approach will significantly rely on the CUP transitioning away from natural gas and procurement of off-site renewables.	Refer to section below on the MIT CUP transition. There are no technical barriers to the building accepting utilities from a de-carbonized or net-zero carbon source.
Domestic hot water:	The proposed system will be connected to campus MTHW utility.	DHW will continue to be provided by the campus MTHW utility. As the CUP decarbonizes over time, this end use will also decarbonize.

Lighting:	High-efficiency lighting with occupant controls. Lighting will utilize LED and low lighting power densities by space type.	It is not anticipated that significant additional energy savings will be realized through lighting. As lighting relies on electricity, the transition to Net Zero relies on off-site renewable electricity supply.
Renewable energy systems:	The roof is being designed to be PV-ready roof. PV analysis identified that a maximum 138 kW system could be installed using 340W panels which is a small percentage of the predicted annual energy consumption of the highly energy efficient building.	MIT will assess the cost benefit of on-site versus off-site renewable energy procurement to transition to Net Zero. Without significant advancement in PV panel efficiency, on-site solar PV will only contribute a very small amount to a Net Zero transition. As such, the project will rely on off-site renewable energy to achieve Net Zero. It is anticipated that off-site renewable energy contracts will be a key component of the transition to Net Zero at MIT, potentially also including carbon offset. These decisions will be made on at a campus level and not particular to one (1) building project.

Appendix A

Building Envelope
Commissioning Plan

A1 Building Envelope Commissioning

The BECx process is summarized below, as outlined in the MIT BECx Project Commissioning Manual (PCM). The components to be tested and the corresponding test criteria include:

- Waterproofing of below-grade construction including foundations, basements, and slab-on-grade that functions as part of the exterior enclosure system.
- Superstructure floor and roof construction that functions as part of the exterior enclosure system.
- Exterior enclosure construction, above grade, including exterior opaque walls, windows, and doors including sheathing, framing, and insulation, and interior finish materials attached to the exterior wall.
- Roofing, including roofing system, roofing insulation, and skylights, hatches, and other roof openings.

Table 11. Envelope components and BECx test criteria

Component	Test Criteria
Fenestration & Curtain Wall	Any significant leakage identified will be assessed to determine if a specific cause can be identified and addressed to prevent during full-scale installation.
	Maximum air leakage of 0.10 cfm/ft at an air pressure differential of 6.24 psf.
	No uncontrolled water leakage when tested under a pressure difference of 8.0 lbf/sq. ft.
Air Barrier Assemblies	No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s). Pass/fail criteria shall be no bubbles observed in the leak detection liquid at 1.57 psf.
Sealant	Sealant pull testing shall be performed on sealant joints installed through the building enclosure. Pass/fail criteria shall require all sealants fail cohesively within themselves at or above the minimum manufacturer's anticipated elongation percentage.
Dynamic Water	575 Pa (12.0 psf). Failure Criteria will need to be determined prior to testing.
Dynamic Water	Water infiltration
Whole Building Performance	LEED Homes Mid Rise Testing

Appendix B

HVAC Systems Commissioning Plan

B1 HVAC Systems Commissioning Plan

The HVAC commissioning process will cover the following components and phases, with all pre-functional testing, functional testing, and reporting to be carried out by a dedicated commissioning agent (CxA) and as outlined in the MIT Project Commissioning Manual (PCM).

A CxA will be engaged in design development phase for a scope of work that meets MIT Standards and LEED v4 EAc1 Enhanced Commissioning requirements.

Table 12. Building systems commissioning scope of work

Component / Phase	Scope
Recirculating air handling units	• Chilled water system • Controls • Associated supply, transfer, return and exhaust fans • Terminal units
100% outside air and exhaust air handling units	• Chilled water system • Steam system • Associated supply and exhaust fan systems • Supply and exhaust terminal units • Controls
Supply and exhaust fans	• Controls • Terminal equipment
Terminal units	• Constant volume and VAV boxes w/and w/o reheat coils (supply and exhaust) • Laboratory supply and exhaust flow controls • Fan coil units (FCU, FCW, FCH, FCA) • Radiation (FTR) • Chilled Beams • Unit heaters (UH, CUH, RR, PR) • In duct heating coils (RHC) • Return air systems • Heat Exchanger and Pumps (HW)
Chilled water systems	• Chilled water • Chilled Beam active and passive systems • Chilled Beam water/pumps • Distribution Equipment (AHU, AC, FCU, FCW, FCH, FCA)

Hot water systems	• Lab heating • Radiation heating • Heat exchangers • Pumps, AD, ET • VFD • Distribution Equipment (UH, CUH, RR, PR, RHC)
Fuel oil system	• Emergency generator fuel oil day tank transfer systems. • Storage tank and FOP 1&2 pumping transfer systems
Control systems	• Building automation system (BAS) • Fume hood control & laboratory control • HVAC and Exhaust systems • Atrium smoke management • Pneumatic air system • AHU and conference room CO2 sensing and control • Energy meters • Spectroscopy complete lab control sequences
Testing and balancing (TAB) phase	• TAB water-side • TAB air-side • TAB equipment and systems • TAB electrical

Appendix C

Energy Model Detailed Assumptions and Results

Appendix C. Energy modeling detailed inputs and results

Input
Calculation
Notes

MIT Stephen A. Schwarzman College of Computing
271619-00

ZONE TYPES

Name	Conditioned (Y/N)	Thermostat Schedule	Heating SP (°F)	Heating Setback (°F)	Cooling SP (°F)	Cooling Setback (°F)	Zone Level DCV (Y/N)	DCV SP (ppm)	Source/Comments
Auditorium	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Café	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Circulation	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Classroom	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Conference	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
IT	Y	24/7	70.0	65.0	74.0	80.0	N		
Elevators	N		N/A	N/A	N/A	N/A	N		
Laboratory - Dry	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Lobby	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
MEP	N		70.0	65.0	74.0	80.0	N		
Office - Open	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Office - Private	Y	7 days, 8am - 10pm	70.0	65.0	74.0	80.0	Y	800	Setpoints and schedules per OPR dated 2020-03-25
Restroom	N		70.0	65.0	74.0	80.0	N		
Stairwells	N		70.0	65.0	74.0	80.0	N		
Storage	N		N/A	N/A	N/A	N/A	N		

Input
Calculation
Notes

Internal Gains

MIT Stephen A. Schwarzman College of Computing
271619-00

Zone Types

Name	Occ. Density (ft²/person)	Occ. Schedules	Equipment Power Density (W/ft²)	Equipment Schedules	Lighting Power Density (Baseline) (W/ft²)	Lighting Power Density (Proposed) (W/ft²)	Lighting Schedules	Infiltration (cfm/ft² facade)	Source/Comments
Auditorium	50	Occupancy_Classroom	0.25	Equipment_Classroom	0.71	0.61	Lighting_Classroom	0.08 cfm/ft2 façade	
Café	100	Occupancy_Cafe	0.1	Equipment_Cafe	0.86	0.4	Lighting_Cafe	0.08 cfm/ft2 façade	
Circulation	75	Occupancy_Office	0.5	Equipment_Office	0.41	0.41	Lighting_Office	0.08 cfm/ft2 façade	
Classroom	75	Occupancy_Classroom	0.5	Equipment_Classroom	0.71	0.71	Lighting_Classroom	0.08 cfm/ft2 façade	
Conference	75	Occupancy_Office	0.75	Equipment_Office	0.97	0.97	Lighting_Office	0.08 cfm/ft2 façade	
IT	N/A		25		0.43	0.94		0.08 cfm/ft2 façade	
Elevators	N/A		N/A		0.84	0.84		0.08 cfm/ft2 façade	
Laboratory - Dry	75	Occupancy_Lab	3	Equipment_Lab	1.11	1.11	Lighting_Lab	0.08 cfm/ft2 façade	
Lobby	75	Occupancy_Lobby	0.25	Equipment_Lobby	0.84	0.84	Lighting_Lobby	0.08 cfm/ft2 façade	
MEP	N/A		1		0.43	0.43		0.08 cfm/ft2 façade	
Office - Open	275	Occupancy_Office	0.75	Equipment_Office	0.61	0.61	Lighting_Office	0.08 cfm/ft2 façade	
Office - Private	275	Occupancy_Office	0.75	Equipment_Office	0.74	0.74	Lighting_Office	0.08 cfm/ft2 façade	
Restroom	275		N/A		0.98	0.63		0.08 cfm/ft2 façade	
Stairwells	N/A		N/A		0.49	0.49		0.08 cfm/ft2 façade	
Storage	N/A		N/A		0.51	0.51		0.08 cfm/ft2 façade	

Input
Calculation
Notes

Envelope

MIT Stephen A. Schwarzman College of Computing
271619-00

	Units	Baseline	BOD	Source/Comments
OPAQUE ENVELOPE				
Wall type/name		Exterior wall assembly - Steel-framed	Proposed exterior wall assembly	
Wall conduction	hr-ft²-F/Btu (R-Value)	18.18	18.18	
Roof type/name		Roof assembly - Insulation entirely above roof deck	Proposed roof assembly	
Roof conduction	hr-ft²-F/Btu (R-Value)	31.25	31.25	
Slab type/name		Slab	Slab	
Slab conduction	Btu/hr-ft-F (F-factor)	0.73	0.73	
Infiltration	(cfm/ft² facade)	0.08	0.08	Inputs at standard pressure
GLAZING (VERTICAL)				
Window type/name		Non-operable metal-frame glazing	Exterior glazing assembly	
WWR	%	22% overall (Applied to each face in same proportion as BOD)	North façade - 11 % East façade - 30 % South façade - 71 % West façade - 45 % Whole building - 40%	
Window conduction	Btu/hr-ft²-F (U-Value)	U-0.42	SE double skin: U-0.2 All other glazing: U-0.36	
Window SHGC	SHGC	0.4	SE double skin: U-0.39 All other glazing: U-0.38	
Window VLT	%	0.76	0.73	
SKYLIGHTS				
Skylight type/name		N/A	N/A	
Skylight-to-Roof ratio	%	N/A	N/A	
Skylight conduction	Btu/hr-ft²-F (U-Value)	N/A	N/A	
Window SHGC	SHGC	N/A	N/A	
Window VLT	%	N/A	N/A	

Energy Model Input Summary

Input
Calculation
Notes: Baseline per 90.1 2016

Detailed HVAC Information

	Units	Baseline	Proposed Design	Source/Comments
HVAC Airside				
System Type		Occupied zones: ASHRAE 90.1-2013 PRM System 7 VAV (1 per floor) IT rooms: ASHRAE 90.1-2013 PRM System 3 Packaged single-zone AC	DOAS / FCU Auditorium displacement ventilation Radiant heating/cooling at ground level café/circulation	
Total Cooling Capacity	kBtu/h	Autosized	Autosized	
Total Heating Capacity	kBtu/h	Autosized	Autosized	
Supply Airflow	cfm	Autosized	Autosized	
Outdoor Airflow	cfm	Autosized	Autosized	
Demand Controlled Ventilation	(Y/N)	N	Y	
Economizer High Limit Shutoff	(°F)	70	70	
Supply Air Temperature Reset	(°F)	See "Space Types' tab	See "Space Types' tab	
Energy Recovery	(Y/N)	Yes, for baseline VAV systems qualifying for exhaust air energy recovery per ASHRAE 90.1-2013 Section 6.5.6.1	Y	
Energy Recovery Effectiveness	%	50	82	
Supply fan power	kW	Autosized	Autosized	
Return or relief fan power	kW	Autosized	Autosized	
Exhaust fan power	kW	Autosized	Autosized	
System Minimum Turndown	%	0	10	
HVAC Waterside - Cooling System				
Cooling type		Campus CHW	Heat Pump Chiller connected to Campus CHW network	
Number and type of chillers (and capacity per chiller if more than one type or size of chiller)		Campus CHW	1 heat pump chiller	
Total cooling capacity	Tons	Autosized	Autosized	
Chilled water (CHW) supply temp	(°F)	44	44	
CHW ΔT	(°F)	16	16	
Distribution Heat Loss (if applicable)		5%	5%	
HVAC Waterside - Heating System				
Heating type		Campus steam	Heat pump chiller extracting heat from campus CHW network	
Total heating capacity	kBtu/h	Autosized	Autosized	
HHW Return	(°F)	105	105	
HHW Supply	(°F)	140	140	

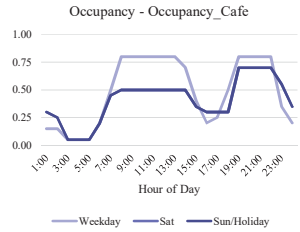
Input
Calculation
Notes

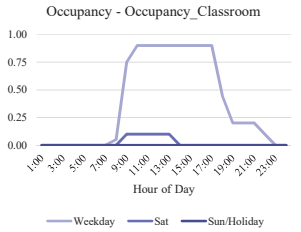
Schedules

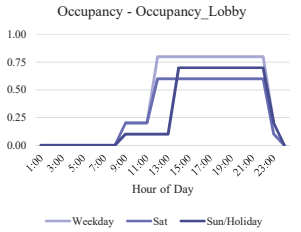
MIT Stephen A. Schwarzman College of Computing
271619-00

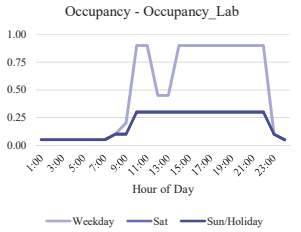
Occupancy

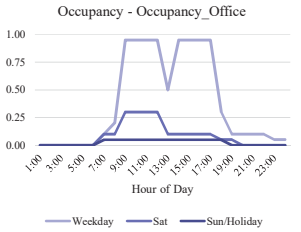
Schedule	Day of Week	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00	Source/Comments
Occupancy - Occupancy_Cafe	Occupancy_Cafe	Weekday	0.15	0.15	0.05	0.05	0.05	0.20	0.50	0.80	0.80	0.80	0.80	0.80	0.80	0.70	0.40	0.20	0.25	0.50	0.80	0.80	0.80	0.80	0.35	0.20	Schedule applied for cafe space Based on ASHRAE 90.1-2016 User's Manual restaurant schedules Morning hours adjusted to reflect building schedule
		Sat	0.30	0.25	0.05	0.05	0.05	0.20	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.35	0.30	0.30	0.30	0.70	0.70	0.70	0.70	0.55	0.35	
		Sun/Holiday	0.30	0.25	0.05	0.05	0.05	0.20	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.35	0.30	0.30	0.30	0.70	0.70	0.70	0.70	0.55	0.35	
Occupancy - Occupancy_Classroom	Occupancy_Classroom	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.75	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.45	0.20	0.20	0.20	0.10	0.00	0.00	Schedule applied for classroom and auditorium spaces Based on ASHRAE 90.1-2016 User's Manual school schedules Afternoon and evening schedule adjusted to reflect MIT class schedule
		Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Occupancy - Occupancy_Lobby	Occupancy_Lobby	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.20	0.00	Schedule applied for lobby spaces Based on ASHRAE 90.1-2016 User's Manual assembly schedules Evening hours adjusted to reflect building schedule
		Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.20	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.10	0.00	
		Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.20	0.00	
Occupancy - Occupancy_Lab	Occupancy_Lab	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.20	0.90	0.90	0.45	0.45	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.10	0.05	Schedule applied for lab spaces Based on ASHRAE 90.1-2016 User's Manual laboratory schedules Evening hours adjusted to reflect building schedule
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.10	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.10	0.05	
Occupancy - Occupancy_Office	Occupancy_Office	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.95	0.95	0.95	0.95	0.50	0.95	0.95	0.95	0.95	0.30	0.10	0.10	0.10	0.10	0.05	0.05	Schedule applied for office, conference, and corridor spaces Based on ASHRAE 90.1-2016 User's Manual office schedules
		Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.30	0.30	0.30	0.30	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.00	0.00	0.00	0.00	0.00	
		Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	



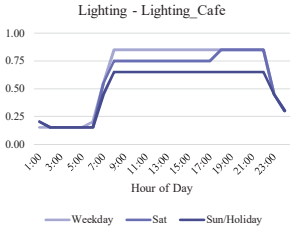


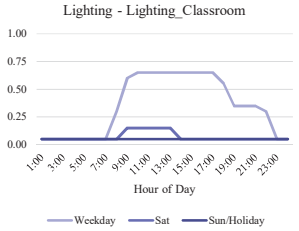


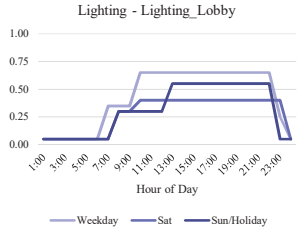


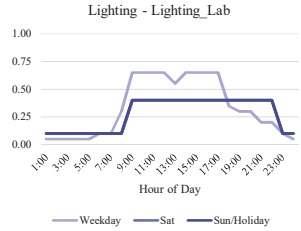


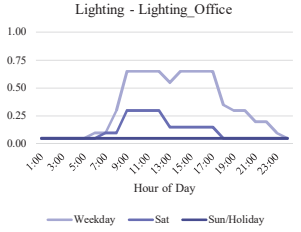
Lighting																												Source/Comments
	Schedule	Day of Week	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00	
Lighting - Lighting_Cafe	Lighting_Cafe	Weekday	0.15	0.15	0.15	0.15	0.15	0.20	0.55	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.45	0.30	Schedule applied for cafe space Based on ASHRAE 90.1-2016 User's Manual restaurant schedules Morning hours adjusted to reflect building schedule
		Sat	0.20	0.15	0.15	0.15	0.15	0.15	0.55	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.85	0.85	0.85	0.85	0.85	0.45	0.30	
		Sun/Holiday	0.20	0.15	0.15	0.15	0.15	0.15	0.45	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.45	0.30	
Lighting - Lighting_Classroom	Lighting_Classroom	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.60	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.55	0.35	0.35	0.35	0.30	0.05	0.05	Schedule applied for classroom and auditorium spaces Based on ASHRAE 90.1-2016 User's Manual school schedules Weekdays adjusted to reflect MIT class schedule
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Lighting - Lighting_Lobby	Lighting_Lobby	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.35	0.35	0.35	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.25	0.05	Schedule applied for lobby spaces Based on ASHRAE 90.1-2016 User's Manual assembly schedules Evening hours adjusted to reflect building schedule
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.30	0.30	0.30	0.30	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.05	0.05	
Lighting - Lighting_Lab	Lighting_Lab	Weekday	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.30	0.20	Schedule applied for lab spaces Based on ASHRAE 90.1-2016 User's Manual laboratory schedules Evening hours adjusted to reflect building schedule
		Sat	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	
		Sun/Holiday	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	
Lighting - Lighting_Office	Lighting_Office	Weekday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.65	0.65	0.65	0.65	0.55	0.65	0.65	0.65	0.65	0.35	0.30	0.30	0.20	0.20	0.10	0.05	Schedule applied for office, conference, and corridor spaces Based on ASHRAE 90.1-2016 User's Manual office schedules
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	



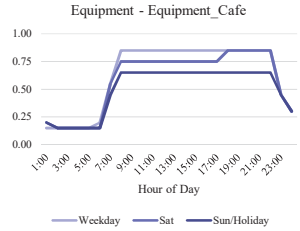


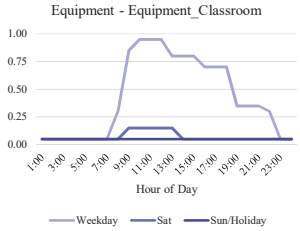


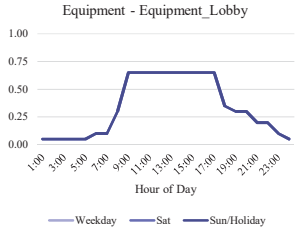


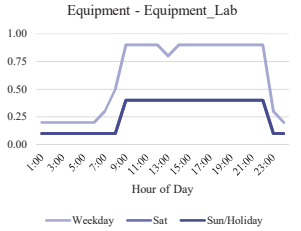


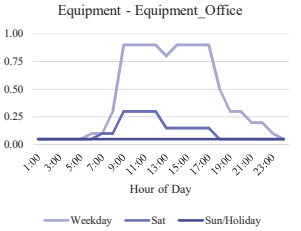
Equipment	Schedule	Day of Week	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	0:00	Source/Comments
Equipment - Equipment_Cafe	Equipment_Cafe	Weekday	0.15	0.15	0.15	0.15	0.15	0.20	0.55	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.45	0.30	Schedule applied for cafe space Based on ASHRAE 90.1-2016 User's Manual restaurant schedules Morning hours adjusted to reflect building schedule
		Sat	0.20	0.15	0.15	0.15	0.15	0.15	0.55	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.85	0.85	0.85	0.85	0.85	0.45	0.30	
		Sun/Holiday	0.20	0.15	0.15	0.15	0.15	0.15	0.45	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.45	0.30	
Equipment - Equipment_Classroom	Equipment_Classroom	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.30	0.85	0.95	0.95	0.95	0.80	0.80	0.80	0.70	0.70	0.70	0.35	0.35	0.35	0.30	0.05	0.05	Schedule applied for classroom and auditorium spaces Based on ASHRAE 90.1-2016 User's Manual school schedules Weekdays adjusted to reflect MIT class schedule
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Equipment - Equipment_Lobby	Equipment_Lobby	Weekday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.35	0.30	0.30	0.20	0.20	0.10	0.05	Schedule applied for lobby spaces Based on ASHRAE 90.1-2016 User's Manual office schedules Evening and weekend hours adjusted to reflect building schedule
		Sat	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.35	0.30	0.30	0.20	0.20	0.10	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.35	0.30	0.30	0.20	0.20	0.10	0.05	
Equipment - Equipment_Lab	Equipment_Lab	Weekday	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.50	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.30	0.20	Schedule applied for lab spaces Based on ASHRAE 90.1-2016 User's Manual laboratory schedules Evening hours adjusted to reflect building schedule
		Sat	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	
		Sun/Holiday	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.10	
Equipment - Equipment_Office	Equipment_Office	Weekday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.20	0.20	0.10	0.05	Schedule applied for office, conference, and corridor spaces Based on ASHRAE 90.1-2016 User's Manual office schedules
		Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
		Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	











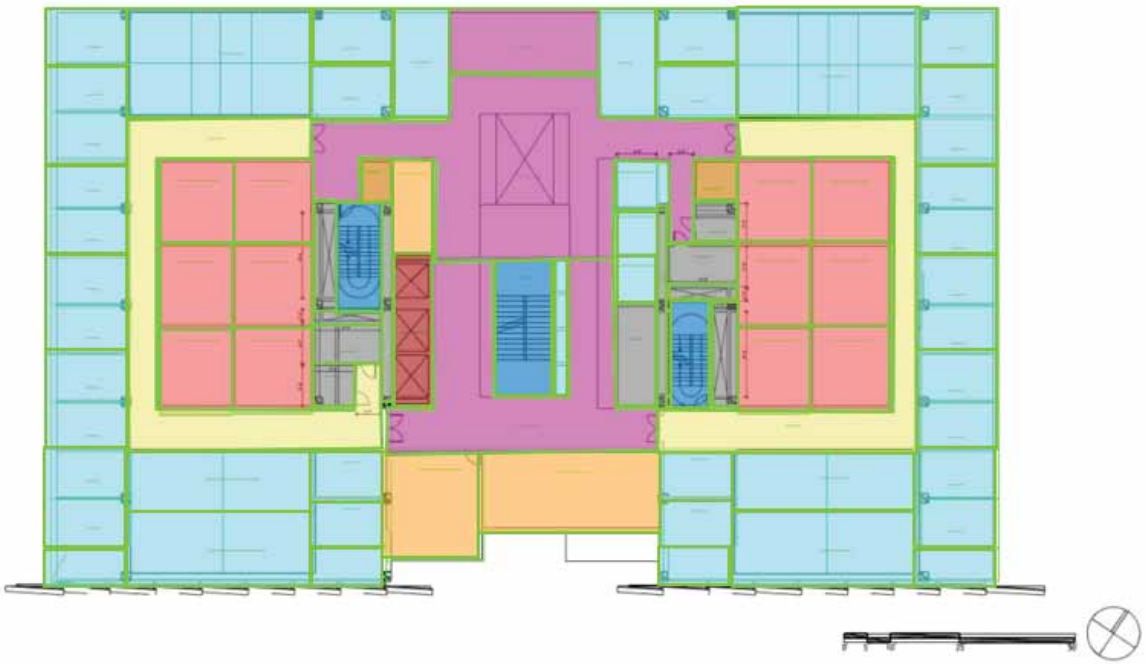
Energy model

Thermal Zoning – Level 1

- Cafe
- Circulation
- Classroom
- Conference / Meeting
- Elevator
- Event Space
- IT
- Laboratory (Dry)
- Lobby
- MEP
- Office
- Restroom
- Stairwell
- Storage

Energy model

Thermal Zoning– Typical Levels 4-7



- Cafe
- Circulation
- Classroom
- Conference / Meeting
- Elevator
- Event Space
- IT
- Laboratory (Dry)
- Lobby
- MEP
- Office
- Restroom
- Stairwell
- Storage

RESULTS (MWh)
Baseline (Massachusetts Stretch Energy Code)

Date	Interior Lighting	Receptacle Equipment	Space Heating	Service Water Heating	Space Cooling	Heat Rejection	Interior Central Fans	Exhaust Fans	Pumps
Jan	30.15	47.19	140.17	0.00	17.41	0.00	23.47	0.00	2.18
Feb	26.68	41.55	103.81	0.00	15.34	0.00	21.12	0.00	1.74
Mar	28.71	44.42	86.82	0.00	23.40	0.00	22.85	0.00	1.75
Apr	28.99	45.31	61.89	0.00	35.16	0.00	22.52	0.00	1.80
May	29.49	45.88	45.54	0.00	121.66	0.00	21.90	0.00	2.72
Jun	28.21	43.85	44.01	0.00	190.66	0.00	21.36	0.00	3.44
Jul	30.15	47.19	43.41	0.00	307.13	0.00	24.75	0.00	4.65
Aug	28.71	44.42	43.65	0.00	290.90	0.00	22.81	0.00	4.53
Sep	28.99	45.31	38.14	0.00	178.39	0.00	21.98	0.00	3.11
Oct	30.15	47.19	54.49	0.00	78.55	0.00	23.31	0.00	2.28
Nov	27.55	42.54	79.71	0.00	27.64	0.00	21.69	0.00	1.82
Dec	30.15	47.19	108.05	0.00	20.42	0.00	23.41	0.00	1.92
Summed total	347.95	542.05	849.68	0.00	1306.67	0.00	271.16	0.00	31.95

RESULTS (MWh)
Proposed Design

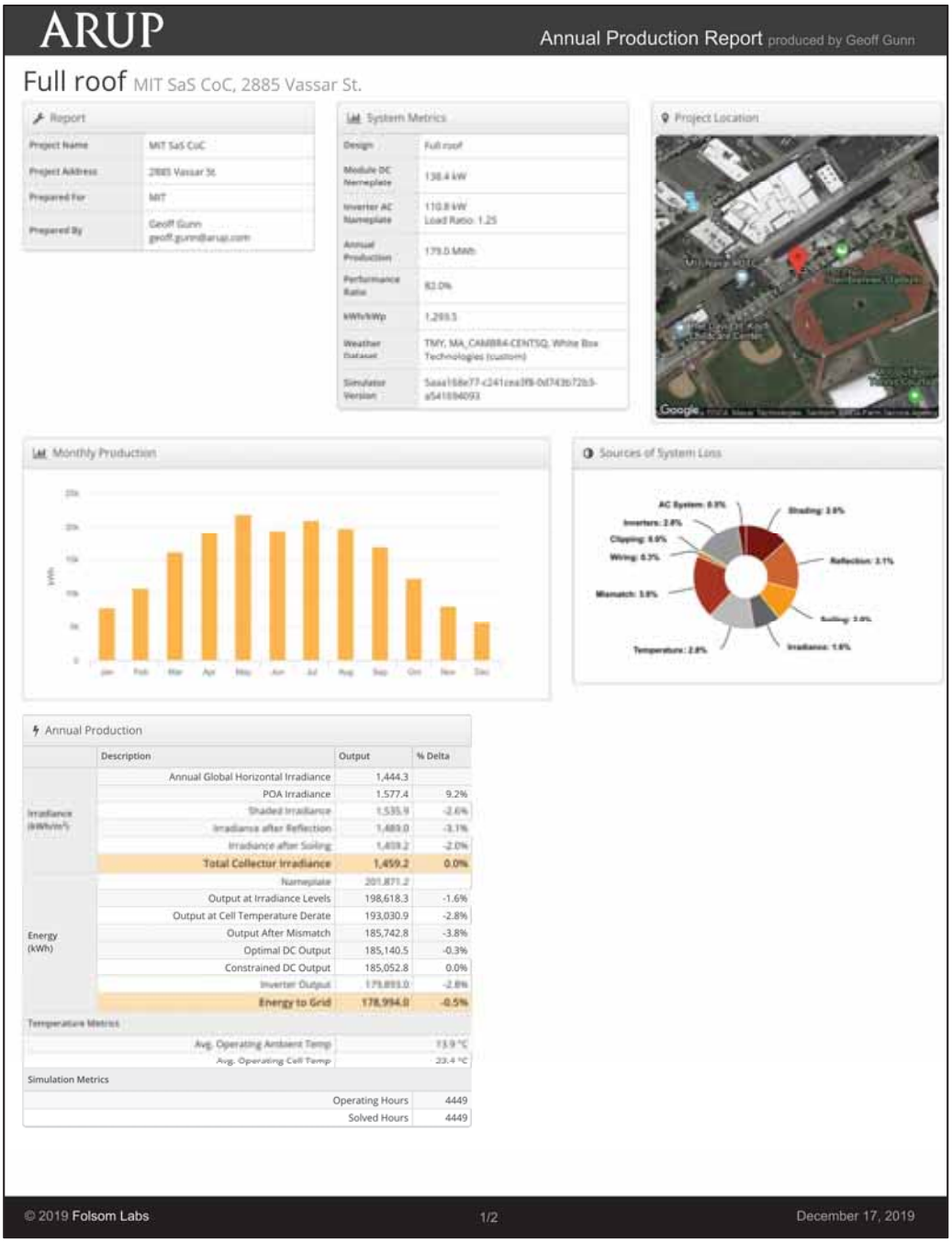
Date	Interior Lighting	Receptacle Equipment	Space Heating	Service Water Heating	Space Cooling	Heat Rejection	Interior Central Fans	Interior Local Fans	Exhaust Fans	Pumps
Jan	28.49	47.19	20.84	1.57	24.23	0.00	5.45	1.82	0.08	2.62
Feb	24.25	41.55	14.52	1.40	25.33	0.00	4.81	1.38	0.07	2.13
Mar	25.60	44.42	10.16	1.52	34.62	0.00	5.16	1.19	0.07	1.98
Apr	25.25	45.31	4.04	1.51	50.94	0.00	5.19	0.92	0.07	1.49
May	25.24	45.88	0.87	1.55	93.83	0.00	5.25	1.13	0.07	1.42
Jun	23.66	43.85	0.24	1.48	123.27	0.00	5.05	1.35	0.07	1.65
Jul	25.22	47.19	0.06	1.57	183.78	0.00	5.37	1.96	0.08	2.38
Aug	24.59	44.42	0.05	1.52	163.20	0.00	5.12	1.66	0.07	2.05
Sep	25.47	45.31	0.16	1.51	119.29	0.00	5.18	1.35	0.07	1.46
Oct	27.38	47.19	2.06	1.57	74.12	0.00	5.39	1.04	0.08	1.46
Nov	25.80	42.54	7.67	1.46	39.60	0.00	4.94	1.05	0.07	1.71
Dec	28.73	47.19	13.39	1.57	30.94	0.00	5.42	1.37	0.08	2.22
Summed total	309.68	542.05	74.07	18.24	963.14	0.00	62.34	16.21	0.88	22.48

Appendix D

Rooftop Solar PV Analysis

D1 Rooftop Solar PV Analysis

The following report details the rooftop solar PV analysis and results that was completed for the project via Helioscope software.



ARUP

Annual Production Report produced by Geoff Gunn

Full roof MIT SaS CoC, 2885 Vassar St.

Report

Project Name	MIT SaS CoC
Project Address	2885 Vassar St
Prepared For	MIT
Prepared By	Geoff Gunn geoff.gunn@arup.com

System Metrics

Design	Full roof
Module DC Nameplate	138.4 kW
Inverter AC Nameplate	110.8 kW Load Ratio: 1.25
Annual Production	179.0 MWh
Performance Ratio	82.0%
kWh/kWp	1,293.5
Weather Dataset	TMY, MA_CAMBR4-CENTSQ, White Box Technologies (custom)
Simulator Version	5aaa168e77-c241cea3f8-0d743b72b3-a541094093

Project Location

Monthly Production

Sources of System Loss

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,444.3	
	POA Irradiance	1,577.4	9.2%
	Shaded Irradiance	1,535.9	-2.6%
	Irradiance after Reflection	1,489.0	-3.1%
	Irradiance after Soiling	1,459.2	-2.0%
	Total Collector Irradiance	**1,459.2**	**0.0%**
Energy (kWh)	Nameplate	201,871.2	
	Output at Irradiance Levels	198,618.3	-1.6%
	Output at Cell Temperature Derate	193,030.9	-2.8%
	Output After Mismatch	185,742.8	-3.8%
	Optimal DC Output	185,140.5	-0.3%
	Constrained DC Output	185,052.8	0.0%
	Inverter Output	179,893.0	-2.8%
	Energy to Grid	**178,994.0**	**-0.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		13.9 °C
	Avg. Operating Cell Temp		23.4 °C
Simulation Metrics			
	Operating Hours		4449
	Solved Hours		4449

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December 17, 2019

ARUP

Annual Production Report produced by Geoff Gunn

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, MA_CAMBR4-CENTSQ, White Box Technologies (custom)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters	Rack Type	a	b	Temperature Delta
	Fixed Tilt	-3.56	-0.075	3°C
	Flush Mount	-2.81	-0.0455	0°C
	East-West	-3.56	-0.075	3°C
	Carport	-3.56	-0.075	3°C

Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	0.50%

Module Characterizations	Module	Uploaded By	Characterization
	Q.PEAK DUO-G7 340 (Hanwha Q Cells)	Folsom Labs	Qcells_Q.PEAK DUO-G7_340_Rev3.PAN, PAN

Component Characterizations	Device	Uploaded By	Characterization
	SunnyBoy 10KW (SMA)	Folsom Labs	Default Characterization

Components

Component	Name	Count
Inverters	SunnyBoy 10KW (SMA)	11 (110.8 kW)
Strings	10 AWG (Copper)	33 (3,826.4 ft)
Module	Hanwha Q Cells, Q.PEAK DUO-G7 340 (340W)	407 (138.4 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	9-13	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	15°	147°	1.6 ft	1x1	415	407	138.4 kW

Detailed Layout

2/2

December 17, 2019

APPENDIX C: Circulation and Access Study

Contents

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Circulation and Access Study

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Transportation Access & Circulation Plan

MIT Stephen A. Schwarzman School of Computing

Transportation Access & Circulation Plan

PREPARED FOR

Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139
617-253-1000

PREPARED BY

99 High Street
10th Floor
Boston, MA 02210

December 8, 2020

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1

Introduction and Project Overview

On behalf of Massachusetts Institute of Technology (MIT), Vanasse Hangen Brustlin, Inc. (VHB) has conducted a Transportation Access and Circulation Study (the "Study") for the proposed redevelopment of the existing MIT Cyclotron site located at 51 Vassar Street in Cambridge, MA (known as Building 44). The existing building will be replaced by a new mixed-use building that includes institutional and academic uses in support of the Schwartzman College of Computing ("SCC" or the "College") program.

The new proposed SCC will sit in a centralized location that promises to unite the many MIT departments, centers, and labs that integrate computing into their work. The proposed building will serve as an interdisciplinary hub for research and innovation in computer science, artificial intelligence (AI), data science, and related fields that deal with computing advances, including how new computing methods can both address and pose societal challenges.

The proposed academic building will house a total population of approximately 850 faculty/staff/students on an average day, the majority of whom are already on the MIT campus. Therefore, the pedestrian and bicycle activity projected for the proposed Project reflects a shift in existing pedestrian and bicycle trips from existing departments rather than new pedestrian and bicycle trips to the area.

This document is developed based on the proposed scope shared with the City of Cambridge Traffic, Parking & Transportation (TP&T) Department on August 21, 2020. A copy of the proposed scope can be found in the Appendix.

1.1 Project Description

The Proposed Project will include approximately 171,000 GFA of academic use and approximately 3,000 GFA of café space. The Project is described more fully below and illustrated in the relevant figures.

- Figure 1 presents a site location map and study area intersections
- Figure 2 presents the existing conditions site plan
- Figure 3 presents the proposed site plan
- Figure 3a presents the bicycle storage room located in the basement level

As illustrated in Figure 1, the Project is located along the north side of Vassar Street on the current MIT Cyclotron Site. The Project is adjacent to the Brain and Cognitive Sciences Building (Building 46) and across from the EG&G Education Center (Building 34).

The Project contains academic and retail components, as described below.

Academic Space

The Project will include the construction of a mix of institutional and academic uses that will support SCC program requirements, including office space, research laboratory space, academic space, function/event space, collaboration and meeting space, convening space, and publicly accessible café space totaling approximately 174,000 gross floor area (GFA), or approximately 157,800 net-new GFA.

The proposed academic building will house a total population of approximately 850 faculty/staff/students on an average day, the majority of whom are already on the MIT campus. The net new occupants to the site will include approximately 160 faculty/staff and approximately 280 students.

Accessory Café/Retail Space

The approximately 3,000 GFA accessory café space will be open to the public but is not considered to be a destination retail location that would draw regional traffic. There will be no off-street parking provided on-site.

Table 1 summarizes the existing and proposed programming for the building.

Table 1 Existing and Proposed Program

Program Component	Existing	Proposed	Net-New
Building Programing			
Institutional/Academic Uses	16,200 SF	171,000 SF	+154,800 SF
Retail/Café	0 SF	3,000 SF	+3,000 SF
Total	**16,200 SF**	**174,000 SF**	**+157,800 SF**
Population			
Faculty/Staff[1]	129	288	+159
Students[2]	281	562	+281
Total	**410**	**850**	**+440**
Parking			
Vehicle Parking	22	0	-22
Bicycle Parking (Long Term)[3]	-	Min. 36 required	
Bicycle Parking (Short Term)[3]	-	Min. 71 required	

[1]MIT's faculty and staff employment is largely based on the needs and strategies developed at the department, laboratory, and center unit level, rather than through a central Institute-wide planning process. The number of faculty members has been growing 0.4% annually since 2010. In the 2019 MIT Town Gown, the Schwarzman College of Computing was expected to increase the faculty head count by 50 over the next several years.

[2]As stated in the 2019 Town Gown, the enrollment of graduate students and the number of post-doctoral employees, fluctuates depending on the independent decisions of academic departments. With the opening of the Schwarzman College of Computing, MIT expects its student population to increase over the next decade, matching the expanded teaching and research facilities and faculty to serve them.

[3]Bicycle parking meets Zoning Article 6 requirement for uses E2 (Collage of University Facilities) and N4 (Retail) calculated using GFA

The study area for the Proposed Project is illustrated in Figure 1, and includes the following study locations:

- Vassar Street/Galileo Galilei Way at Main Street
- Vassar Street at Massachusetts Avenue
- Vassar Street at Mid-block Crossing

1.2 Study Methodology

Through discussions with the City of Cambridge it was determined that while a certified Transportation Impact Study (TIS) was not needed, transportation related impacts would be analyzed through a Transportation Access and Circulation Study. This document is developed based on the proposed scope shared with the City of Cambridge Traffic, Parking & Transportation (TP&T) Department on August 21, 2020. A copy of the proposed scope can be found in the Appendix.

The study comprises of the following components:

- Existing Conditions – inventory of roadways, parking, bikeshare, transit, crash data, counts (vehicles, bikes and pedestrians)
- Future Condition – project trip generation, site access, service/delivery, vehicle and bicycle parking projections, transit and pedestrian evaluations
- Transportation Demand Management and Mitigation

Supplementary data and analysis worksheets are provided in the Appendix.

1.3 Summary of Key Findings

As described in the following sections, the study has established that the Proposed Project will have negligible impacts to the surrounding transportation network. The Project will provide ample benefits to the MIT community and create a more vibrant urban landscape along Vassar Street.

Key transportation findings include:

- The Project is estimated to generate 18 net-new vehicle trips during the morning peak hour and 20 net-new vehicle trips during the evening peak hour. Since no parking will be provided on-site, these vehicle trips are expected to be drop-off/pick-up trips or trips that park in a nearby MIT parking facility.
- The existing 22 vehicle parking spaces that are currently on-site will be relocated to the future Music Building Garage.
- As reported in the 2019 MIT Town Gown Report, 77 percent of students will either walk, bike, or take public transit to get to campus.
- The Project will generate approximately 23 net-new walking trips and 22 net-new bicycle trips during the morning peak hour, and 26 net-new walking trips and 28 net-new bicycle trips during the evening peak hour.
- The Project is proposing to improve the existing pedestrian crossing along Vassar Street to the southwest of the Project Site.
- The Project is providing 36 long-term bike parking spaces and 71 short-term bicycle parking spaces).
- An enhanced path between Vassar Street and the Grand Junction will be provided adjacent to the southwest side of the building

2

Transportation Access and Circulation Study

This Study for the proposed MIT SCC describes existing and future transportation conditions in the study area. The study area includes two signalized intersections and one pedestrian crossing, as illustrated in Figure 1.

This section includes inventories of physical and operational conditions in the study area including roadways, intersections, crosswalks, sidewalks, on-street and off-street parking, and transit facilities in the study area. Transportation data including intersection turning movement counts, pedestrian and bicycle counts, vehicle crash data, and transit service data that were compiled and are presented in this document.

2.1 Existing Conditions

This section describes the existing transportation conditions, including an overview of roadway and intersection geometry, peak period traffic conditions, available public and private transit options, pedestrian and bicycle facilities, vehicular crash data and existing parking conditions. Each of these elements is described below in detail.

Roadways

The Project Site is bounded by Vassar Street to the southeast. To the west/southwest, the Project Site is bounded by the MIT Central Utilities Plant (the "MIT CUP"), and an existing multimodal path that connects MIT's Campus south of Vassar Street to Albany Street. To the west/northwest, the Project Site is bounded by active railroad lines, a fire lane which could become a future second railway line, and the MIT Albany Street Garage. The right of way for the future Grand Junction Multi-Use Path is also located west/northwest of the Project parallel the railroad tracks, which when completed will connect the Boston University Bridge to Somerville. To the northeast, the Project Site is bounded by the MIT Brain and Cognitive Sciences Building (Building 46).

Vassar Street is a 1.1-mile-long, two lane roadway that runs from Memorial Drive in the southwest to Main Street in Kendall Square to the northeast. Between Memorial Drive and Audrey Street, Vassar Street provides on-street un-buffered bike lanes in each direction adjacent to on-street parking. Between Audrey Street and Main Street (including in front of the Project Site), Vassar Street provides a raised separated bike lane in each direction, except for the intersection of Massachusetts Avenue where cyclists are accommodated on a street-level unprotected bike lane. Crosswalks are provided at all major intersections, as well as several mid-block crossings.

Grand Junction Corridor is an 8.5-mile section of railroad that travels from the vicinity of the BU Bridge to the Twin City Plaza near McGrath Highway in Somerville. The track has been

historically used only to enable transfer of trains between the north rail and the south rail, to allow for Amtrak to move Downeaster equipment from the north side to the maintenance facility in South Bay in Dorchester[1].

Plans for the Grand Junction Multi-Use Path are discussed in Section 2.3.

Study Intersections

The Project study area includes the following three study area intersections which are presented in Figure 1 and individually illustrated in Figures 4a – 4c.

1. Vassar Street/Galileo Galilei Way at Main Street
2. Vassar Street at Massachusetts Avenue
3. Vassar Street at Mid-block Crossing

Parking

There are currently 22 total vehicular parking spaces on-site. The parking spaces are provided in a surface level lot that is accessed via a curb-cut along Vassar Street. The surface parking wraps around the northeast façade of the building and continues along the back, adjacent to the Grand Junction tracks. There are three (3) accessible parking spaces and two (2) EV Charging stations, the remaining 17 spaces are standard parking spaces.

Figure 5 presents existing on-street parking regulations along Vassar Street. Vassar Street provides two-hour metered parking spaces along the northwest side between Massachusetts Avenue and Main Street.

Existing Bike Share Stations

There are four BlueBikes stations currently available within a quarter mile of the Project:

- MIT Stata Center at Vassar Street / Main Street (35 docks) – This is the closest BlueBikes station to the Project Site, located approximately 500-feet to the northeast.
- Ames Street at Main Street (19 docks) – An approximately 5-minute walk from the Project Site. Typically, this station also features a valet service between 7:00 AM and 7:00 PM, Monday through Fridays.
- Massachusetts Avenue at Albany Street (19 docks) – An approximately 5-minute walk from the Project Site.
- MIT at Massachusetts Avenue / Amherst Street (27 docks) – An approximately 6-minute walk from the Project Site.

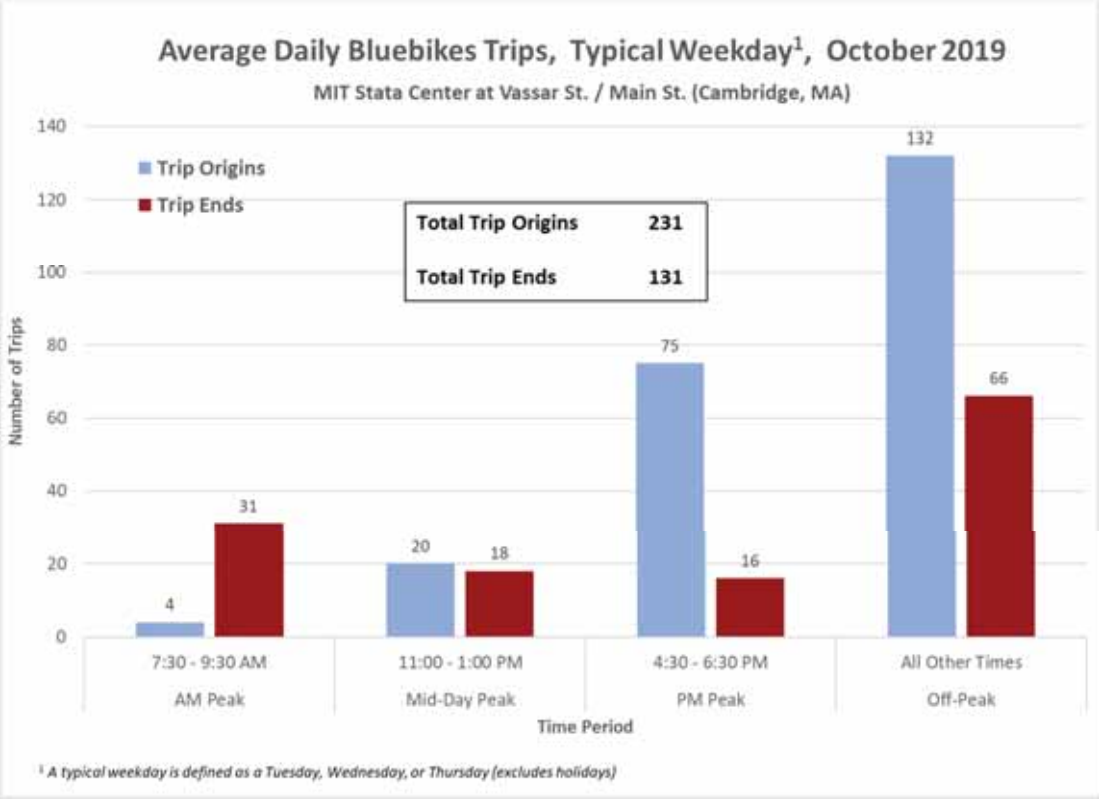
Figure 6 shows the existing BlueBikes stations and the existing and proposed bicycle infrastructure in the area.

[1] Kleinfelder. Grand Junction Community Path and MIT Property Feasibility Study. Oct. 2014, www.cambridgema.gov/-/media/Files/CDD/Transportation/Projects/GrandJunction/Historical_Documents/mitpropertyfeasibilitystudyoctober2014.pdf.

BlueBikes Utilization – MIT Stata Center

BlueBikes publishes trip history data for every station in their system. This data includes trip duration, start/stop time and date, start/end station, bike ID, and information about the user. VHB compiled bikeshare data for the 23-dock MIT Stata Center at Vassar Street / Main Street station.

During the month of October 2019, there were a total of 5,612 trips originating at the station, and 3,633 trips ending at the station. During a typical weekday, an average of 231 trips start and 131 trips end at this station, with approximately 10 percent of trips occurring during the morning peak hour and approximately 25 percent of trips occurring during the evening peak hour. The graph below shows the average daily BlueBikes trips during a typical weekday in October 2019.



Transit Services

The Project Site is accessible to the Massachusetts Bay Transportation Authority's (MBTA) Red Line, as well as several MBTA Bus lines and private shuttle services.

A graphical illustration of study area transit lines is presented in Figure 7 (Public Transit Services) and Figure 8 (Private Shuttle Services) and is described in more detail below.

Public Transit Services

MBTA Red Line

The Project Site is located a half mile (or 10-minute walk) from the Kendall/MIT MBTA Red Line Station and one mile (or 20-minute walk) from the Central Square MBTA Red Line Station. Both stations are served by the Red Line, which runs between Alewife Station to the north and Braintree/Ashmont Stations to the south. The Red Line connects with the Green Line at Park Street and the Orange Line and Silver Line at Downtown Crossing. Connection to all southern commuter rail lines and the Silver Line (to South Boston, Chelsea, and Logan Airport) are made at South Station. In addition, the Fitchburg commuter rail line connects with the Red Line at Porter Square.

The Red Line runs on 9-minute headways during peak hours on each branch, which results in a combined headway service of 4.5 minutes at Kendall/MIT Station. Service from Alewife Station is provided between 5:16 AM to 12:27 AM. Service from Braintree is provided between 5:08 AM (5:09 AM on Saturdays) to 12:17 AM, and Ashmont Service is available from 5:16 AM to 12:30 AM.

Route 1: Harvard Square to Nubian Square via Massachusetts Avenue

The Route 1 bus travels from Cambridge, Harvard Square Station to Nubian Square in Roxbury, via Massachusetts Avenue. The Route 1 bus is a key bus route that experiences some of the largest MBTA ridership. Two stops are located approximately 0.2 miles (an approximately 5-minute walk) from the Project site at the intersection of Massachusetts Avenue at Albany Street and at 77 Massachusetts Avenue. Service on the Route 1 bus is provided between 4:37 AM and 1:41 AM and runs on 8-minute headways during peak hours. Saturday service is provided from 4:40 AM to 1:41 AM. Sunday service is provided from 5:55 AM to 1:34 AM.

Route CT2: Sullivan Square Station to Ruggles Station

Bus Route CT2 is a limited stop, cross-town route that operates between Sullivan Square in Charlestown and Ruggles Station in Roxbury. This bus route travels adjacent to the Project Site with a stop approximately 600-feet from the site at the corner of Vassar Street at Massachusetts Avenue. Service on this bus route runs on 20 to 30-minute headways and is provided only on weekdays from 5:55 AM to 7:59 PM.

Private Transit Service

Charles River TMA EZRide Shuttle

The Charles River Transportation Management Association (TMA) operates the EZRide shuttle service between Kendall Square, East Cambridge, MIT and Cambridgeport. This shuttle provides connections to the Green Line at Lechmere Station and the MBTA commuter rail services from the north, as well as the Green Line and Orange Line, at North Station. The route traverses Vassar Street during its morning loop to North Station. For the evening service, the route uses Albany Street just north of the Project Site. Typically, service on the EZRide is provided at 7 to 10-minute headways during typical commuter peak period

in each direction between 6:20 AM and 7:58 PM on weekdays. EZRide shuttles do not run on weekends.

MIT Tech Shuttle

MIT operates the Tech Shuttle which provides students, faculty, and staff with a free shuttle around campus starting at Kendall Square and looping around Memorial Drive and Amherst Alley turning onto Vassar Street and later to Main Street where it again reaches Kendall Square. The shuttles operate Monday through Friday from 6:15 AM to 11:00 PM. Headways are 10 minutes during the AM and PM commuter peak periods and 20 minutes all other times. No weekend service is provided.

MIT Boston Daytime Shuttle

MIT operates a shuttle between 84 Massachusetts Avenue and Commonwealth Avenue in Boston every 30 minutes between the hours of 8:00 AM to 6:00 PM on weekdays during the school year (September through May). No weekend service is provided.

MIT Campus Shuttle - Lincoln Laboratory

Lincoln Laboratory's Facilities Services Department operates a weekday shuttle service between the MIT campus (Building E23 and E39) and the main Laboratory site in Lexington. Service runs from MIT every two hours starting at 7:00 AM with the last shuttle departing from MIT at 6:00 PM.

MIT Weekend - Grocery Shuttle

The Weekend Shuttle, also called the Grocery Shuttle, is operated by MIT and it transports MIT students to and from Trader Joe's, the Whole Foods Market, Kendall Square, and Central Square. The service operates Sundays from 11:30 AM to 4:30 PM during the school year. MIT operates an additional shuttle for students to and from Costco and Target in Everett. This service operates from 11:00 AM to 3:05 PM on select Sundays throughout the school year. No service is provided on weekdays or Saturdays for either shuttle.

MIT SafeRide Shuttle

MIT operates a safety shuttle service, known as SafeRide, providing students with safe transportation at night within and around the MIT campus and Boston neighborhoods. Service runs on a fixed route from 6:00 PM to 11:00 PM daily and then on an On-Demand mode (where students can request a ride online or through an app) from 11:00 PM to 2:30 AM Sunday to Wednesday and 11:00 PM to 3:30 PM Thursday to Saturday. The last call for the On-Demand shuttle is half an hour before the end of service.

MIT Exchange Bus - Wellesley

The Wellesley-MIT Exchange operates between Wellesley College and MIT from 7:00 AM until 12:40 PM on weekdays. No service is provided on weekends. This service is available for Wellesley and MIT staff and students.

Table 2 summarizes existing MBTA services, the CRTMA EZ Ride, and private MIT Shuttle services within the study area.

Table 2 Transit Services

Transit Service	Origin/Destination	Hours of Operation	Peak Hour Headways	Weekday Daily Ridership
MBTA Subway Red Line	Alewife/Ashmont or Braintree	Mon-Fri: 5:08 AM – 12:30 AM Sat: 5:16 AM – 12:30 AM Sun: 6:00 AM – 12:30 AM	4.5 minutes	350,900
MBTA Bus Route 1	Harvard Square – Nubian Square via Mass. Ave.	Mon-Fri: 4:37 AM – 1:41 AM Sat: 4:40 AM – 1:41 AM Sun: 5:55 AM – 1:34 AM	8 minutes	11,900
MBTA Bus Route Crosstown 2 (CT2)	Sullivan Square - Ruggles Station	Mon-Fri: 5:55 AM – 7:59 PM No Weekend Service	20-30 minutes	1,800
CRTMA EZRide Shuttle	North Station – Cambridgeport/Brookline St	Mon-Fri: 6:20 AM – 7:58 PM No Weekend Service	7-10 minutes	2,000[b]
MIT Tech Shuttle	Kendall Square loop via Vassar Street and Amherst Alley	Mon-Fri: 6:15 AM – 11:00 PM No Weekend Service	10 minutes	N/A
MIT Boston Daytime Shuttle	84 Massachusetts Avenue and Commonwealth Avenue	Mon-Fri: 8:00 AM – 6:00 PM No Weekend Service	30 minutes	N/A
Lincoln Library – MIT Campus Shuttle	MIT Campus – main laboratory site, Lexington	Mon-Fri: 7:00 AM – 6:00 PM No Weekend Service	2 hours	N/A
MIT Weekend / Grocery Shuttle	MIT Campus – local supermarkets: Costco and Target in Everett / Whole Foods and Trader Joe's / Star Market	Every other Sunday: 11:00 AM – 4:30 PM / Sundays: 1130 AM – 4:30 PM / Saturdays: 12:00 PM – 4:30 PM	75 minutes / 43 minutes / 20 minutes	N/A
MIT Exchange Bus – Wellesley	MIT Campus – Wellesley College Campus	Weekday: 7:00 AM – 12:40 AM	1 hour	N/A

Sources: MBTA Bus Routes – MBTA FY 2018 Data, Red Line – MBTA Spring 2018 Data, Schedules from Fall 2020 b CRTMA EZRide Feasibility Study March 2014

Crash Analysis

VHB obtained crash records from the Cambridge Police Department for the most recent three-year period available (January 2015 through December 2017) (Table 3). VHB also supplemented the CPD crash records with data from Massachusetts Department of Transportation (MassDOT). The summary table includes the calculated crash rates (number of reported crashes per million entering vehicles based on the evening peak traffic volumes). A detailed summary by crash type is presented in the Appendix.

Table 3 Crash Analysis Summary (2015-2017)

	Main Street at Vassar Street	Massachusetts Avenue at Vassar Street	Mid-Block Crossing
Total Crashes	15	26	8
Crashes with non-fatal injuries reported	6	10	1
Crashes involving a non-motorist (bike, ped)	6	14	4
Calculated MassDOT Crash Rate	0.68	1.11	0.64
Crash Rate Above MassDOT Threshold?	No	Yes	Yes

Source: City of Cambridge Police Department and MassDOT

Cambridge falls within the District 6 area of Massachusetts where the average crash rate is 0.71 crashes per million entering vehicles for a signalized intersection and 0.52 crashes per million entering vehicles for an unsignalized intersection. As presented in Table 3, the intersections of Massachusetts Avenue at Vassar Street and Vassar Street at the existing mid-block crossing are above the MassDOT Crash Rate thresholds for signalized and unsignalized intersections. The intersection of Massachusetts Avenue at Vassar Street had a total of 26 crashes during the three-year period starting in 2015 with 14 of them involving a non-motorist. The existing mid-block crossing on Vassar Street experienced eight (8) crashes during the same three-year period, half of them involving a non-motorist.

In 2012, Congress established the Highway Safety Improvement Program (HSIP) to provide funding for eligible improvements that reduce fatalities and serious injuries on public roads. The intersection of Massachusetts Avenue at Vassar Street and the intersection of Main Street at Vassar Street are both identified by MassDOT as a 2015-2017 HSIP Cluster. Additionally, Vassar Street between Main Street and Massachusetts Avenue has been identified as a 2008-2017 HSIP Bicycle Cluster. With this designation, the intersection is eligible for federal HSIP funding to help improve safety at these locations.

2.2 Data Collection

Due to COVID-19, VHB was unable to conduct counts or observations at the study area intersections, during the development of this study. The count data presented in this section has been sourced from publicly accessible data and from the City of Cambridge TP&T Department.

Existing Turning Movement Counts

Conducting new traffic counts during the time this study was developed was not feasible due to the COVID-19. Therefore, published traffic studies in the area and historic counts from the City of Cambridge have been reviewed by VHB. Turning movement counts (TMCs) for these sources are grown to the existing year (2020) using MassDOT Yearly Growth Rate published by in May 2020.

Table 4 summarizes the sources of the existing count data for each of the study area intersections, and applicable growth factor that was applied per MassDOT guidance.

Table 4 Available Turning Movement Counts

Intersection	Data Source	Growth Rate Multiplier[2]
Vassar Street/Galileo Galilei Way at Main Street	KSURP 2016[1]	1.02
Vassar Street at Massachusetts Avenue	Vassar Street Residences, 2017	1.02
Vassar Street at Mid-block Crossing	CRA Monitoring, 2015	1.09

[1]KSURP study based on 2016 Theoretical existing
[2]MassDOT Yearly Growth Rate published by in May 2020

Figure 9a and Figure 9b show the existing turning movement counts during the morning and evening peak hours, respectively.

Existing Bicycle Counts

Existing bicycle counts were collected at the intersection of Massachusetts Avenue at Vassar Street on September 11, 2019 by the City of Cambridge. The data shows that a total of 813 cyclists passed through the intersection during the morning peak hour and 816 cyclists passed through during the evening peak hour. Figure 10a and Figure 10b show the existing bicycle counts during the morning and evening peak hours, respectively.

2.3 Future Conditions

Project Trip Generation

To estimate the impacts of the Project, it is necessary to determine the pedestrian, transit, bicycle, and vehicle volumes expected to be generated by the Project. This section presents the unadjusted vehicle trip generation and the adjusted pedestrian, transit, bicycle, and vehicle trip generation

Net-New Unadjusted Trip Generation

Trip estimates were based on standard rates from the ITE Trip Generation, 10th Edition. Trip generation for the proposed academic and retail uses were estimated based on the ITE Land Use Codes as demonstrated in Table 5. While a summary of the unadjusted trip generation for the Project is demonstrated in Table 6.

Table 5 Trip Generation Land Use Codes

Land Use	ITE Land Use Code (LUC)	Project Program
Academic	LUC 550 – College/University	160 employees
Retail	LUC 820 – Shopping Center	3,000 SF

Source: Trip Generation Manual, 10th Edition, Institute of Transportation Engineers; Washington DC (2017)

Table 6 Unadjusted Project-Generated Vehicle Trips

		Academic	Retail	Total
Daily	In	771	57	828
	Out	771	57	828
	Total	**1,422**	**114**	**1,656**
Morning Peak Hour	In	91	2	93
	Out	29	1	30
	Total	**120**	**3**	**123**
Evening Peak Hour	In	42	5	47
	Out	65	6	71
	Total	**127**	**11**	**118**

Source: Trip Generation Manual, 10th Edition, Institute of Transportation Engineers; Washington DC (2017)

Adjusted Trip Generation

The trip generation estimates demonstrated in Table 6 do not include any adjustments to reflect existing land uses, vehicle occupancy rates, public transit, walking trips, or bicycle trips that are characteristic of an urban downtown location.

To account for alternative modes of transportation, mode shares for the area, based on the K2C2 and MIT Town Gown were applied to the Project generated person trips. Mode shares and vehicle occupancy rates are demonstrated in Table 7.

Once the mode shares and VORs from Table 7 are applied to the unadjusted vehicle trip generation, the resulting trip generation by mode is presented in Table 8.

Table 7 Mode Shares

Mode	Academic[1]	Retail[2]
Drive Alone (SOV)[5]	18%	26%
Carpool (HOV)[6]	5%	5%
Transit	43%	30%
Bike	16%	8%
Walk	15%	29%
Other	3%	0%
VOR	2.00[3]	1.82[4]

[1] Mode shares based on MIT Town Gown (2019)
[2] Mode Shares based on K2C2 Study; Combined HOV+SOV provided, for analysis we are assuming 5% HOV and remainder is SOV
[3] VOR applied to carpool vehicles
[4] VOR applied to all vehicles
[5] SOV – single occupancy vehicle
[6] HOV – high occupancy vehicle

Table 8 Project-Generated Trips by Mode

	Transit (Person)	Walk (Person)	Bicycle (Person)	Vehicle
		Daily		
Enter	392	156	142	190
Exit	392	156	142	190
Total	**784**	**312**	**284**	**380**
		Weekday AM Peak Hour		
Enter	47	17	17	14
Exit	16	6	5	4
Total	**63**	**23**	**22**	**18**
		Weekday PM Peak		
Enter	24	9	10	7
Exit	46	17	18	13
Total	**70**	**26**	**28**	**20**

As summarized in Table 8, there are 18 total net-new vehicle trips during the morning peak hour and 20 net-new vehicle trips during the evening peak hour. Once these trips are distributed throughout the roadway network, it is expected that the impact to the surrounding roadways will be negligible.

Site Access

Primary building access will be from two entry points along the Vassar street frontage. Broad, sloped walkways (less than five percent grade) are proposed to facilitate direct,

universal access, and are designed to align with the anticipated significant flow of pedestrian traffic coming from the east and west along the Vassar Street sidewalk.

Along the building's southwest façade, a dedicated entrance will provide access to long-term bicycle parking.

No vehicle parking will be provided on-site. A designated space for Transportation Network Companies (TNCs) is proposed on-street, where two existing two-hour parking spaces could be converting into a passenger loading (drop-off/pick-up) zone. MIT will coordinate with the City's TP&T Department on appropriate location and signage for such spaces.

Service and Deliveries

The Proposed Project allows access for service and delivery vehicles at the northeast side of the site via a curb cut to a loading dock.

As summarized in Table 9, the Project is estimated to generated approximately 11 service and delivery trips daily with most of these trips typically occurring during off-peak hours. MIT will manage larger deliveries such as equipment and food services to reduce impacts to the surrounding transportation systems. Loading estimates were developed from NCHRP Synthesis 298 - Truck Trip Generation Data.

Table 9 Estimated Truck Trip Generation

Land Use	SF	Loading Dock Deliveries per KSF	# of Deliveries per Day	Other Short-term Deliveries per KSF[1]	# of Deliveries per Day	Combined
Academic	171,000	0.015	3	0.022[2]	4	7
Retail	3,000	0.494	2	0.714	2	4
Total	**174,000**	**-**	**5**	**-**	**6**	**11**

[1] Short term deliveries include mail delivery services like USPS and FedEx and can be handled curbside
[2]Short term delivery estimates for academic uses limited to loading dock deliveries – short term deliveries estimated using the office land use.
Source: NCHRP Synchesis 298 Truck Trip Generation

A truck turning movement analysis was completed and is presented in Figure 11.

A sightline analysis for the loading dock is presented in Figure 12.

Emergency vehicles can reach the Project Site from Vassar Street, or via a fire lane behind the building.

Vehicle Parking

The Project will seek to reduce dependence on auto travel and will implement a comprehensive package of transportation demand management (TDM) strategies to reduce auto trip and parking demand. The Project is not proposing to construct any vehicle parking on-site, and any parking demand that is potentially generated by the new building occupants is expected to be accommodated in a MIT parking facility. Figure 13 shows a map of existing MIT parking facilities.

Furthermore, as part of the Special Permit for this Project, MIT is requesting to eliminate the minimum parking zoning requirement.

The following sections outline MIT's existing parking supply and utilization, MIT's proposed parking demand for the Project and a review of future parking conditions with other planned developments over the next several years.

1. MIT's Existing Parking Supply and Utilization

A parking utilization study was conducted for MIT garages and lots based on data from October 2019 and is summarized in Table 10.

Specifically, parking occupancy data for Tuesday October 22, Wednesday October 23, and Thursday October 24, 2019 was reviewed at 9am, 12pm/noon and 5pm. Additionally, a daily peak occupancy was recorded for each lot and summarized in Table 10, as was the parking facility supply.

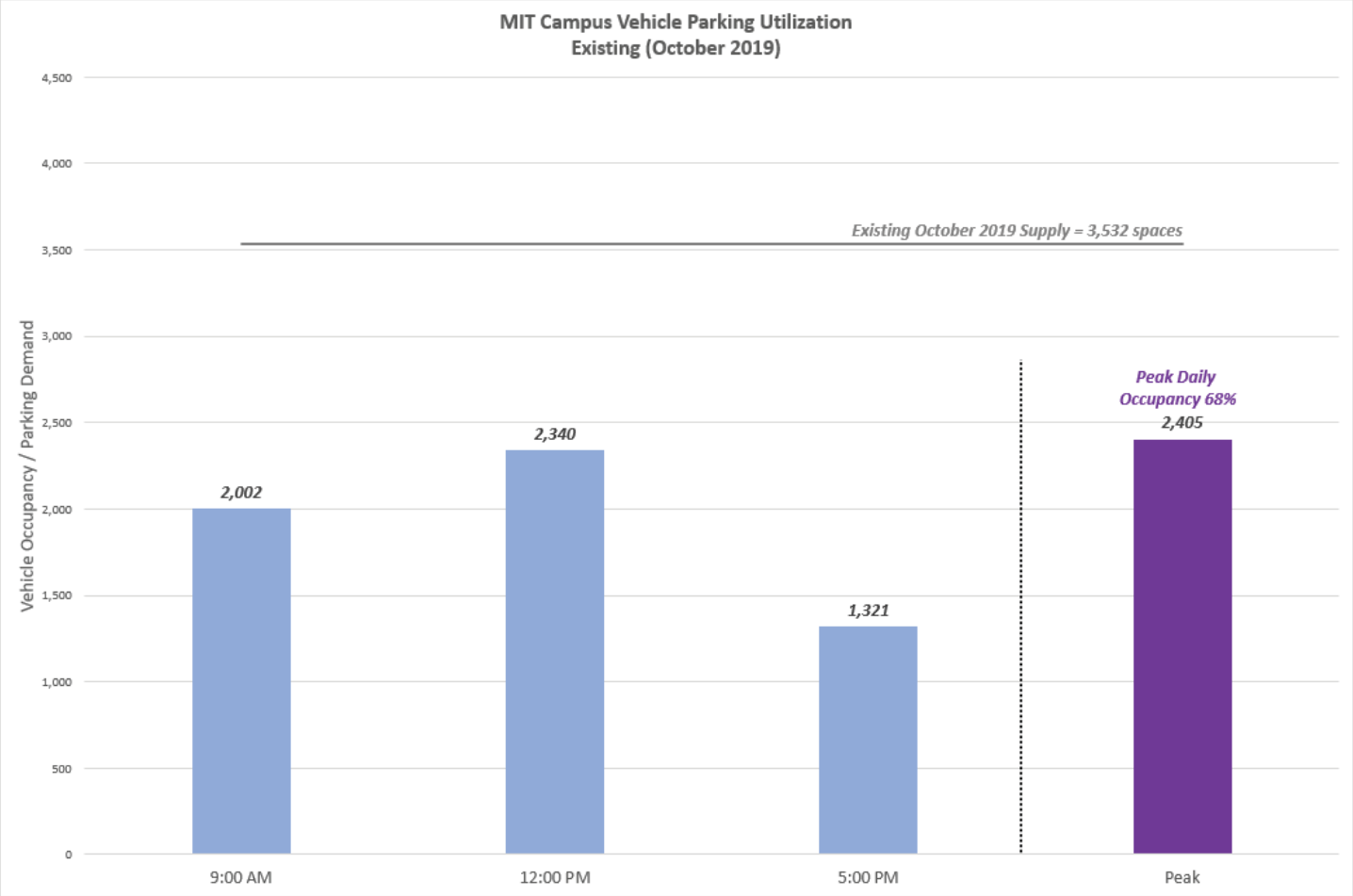
Table 10 MIT Campus Existing Vehicle Parking Utilization (October 2019)

Garage/Lot	*Supply/*	*Tuesday 10/22/2018*				*Wednesday 10/23/2019*				*Thursday 10/24/2019*				*Average*			
	Capacity	9:00 AM	Noon	5:00 PM	Peak	9:00 AM	Noon	5:00 PM	Peak	9:00 AM	Noon	5:00 PM	Peak	9:00 AM	Noon	5:00 PM	Peak
Amherst Alley + Dormitories + Danforth	**94**	20	52	67	67	34	21	34	34	35	18	35	35	30	30	45	45
Sloan Lot	**49**	15	15	26	26	21	12	21	21	12	12	12	12	16	13	20	20
E51 Lot / Amherst lot	**60**	27	27	60	60	60	41	60	60	60	38	38	38	49	35	53	53
Kresge Lot	**94**	79	94	94	94	72	94	94	94	70	86	94	94	74	91	94	94
Main Lot	**20**	20	5	9	20	7	4	7	7	7	5	7	7	11	5	8	11
N52 Lot	**7**	1	1	1	1	7	7	7	7	7	7	7	7	5	5	5	5
Albany Garage	**420**	246	297	55	297	243	293	67	293	241	299	69	299	243	296	64	296
68 Koch	**4**	3	3	4	4	4	4	4	4	4	2	4	4	4	3	4	4
Stata Garage + Lot + Valet	**829**	345	469	180	469	314	461	159	461	332	468	181	468	330	466	173	466
158 Mass Ave	**51**	45	46	15	46	42	42	11	43	43	41	13	43	43	43	13	44
Plasma Fusion Center	**29**	16	29	29	29	7	24	24	24	16	16	29	29	13	23	27	27
NW23 Lot/22	**84**	66	66	11	69	67	64	4	67	67	66	10	67	67	65	8	68
NW35 Lot	**8**	4	8	8	8	4	7	7	7	4	7	7	7	4	7	7	7
65 Waverly	**55**	9	17	17	17	6	16	16	16	10	20	20	20	8	18	18	18
NW86 Lot	**77**	62	69	7	71	62	75	19	75	74	79	13	77	66	74	13	74
Cross Street	**11**	11	11	11	11	8	8	11	11	10	2	10	10	10	7	11	11
Nuclear Reactor Lot	**23**	5	8	2	9	6	8	2	8	6	8	3	8	6	8	2	8
Koch Lot TCC	**19**	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
West Lot	**136**	79	80	12	80	89	93	20	93	79	77	12	83	82	83	15	85
Westgate Lowrise + lot economy	**387**	109	139	37	139	92	123	35	123	96	116	34	116	99	126	35	126
W15	**35**	19	35	35	35	21	35	35	35	25	35	35	35	22	35	35	35
W98	**66**	66	66	66	66	42	66	66	66	35	58	58	58	48	63	63	63
W91 lot + 92 lot	**77**	77	77	77	77	49	77	77	77	62	77	77	77	63	77	77	77
W92 Garage	**54**	17	22	4	25	13	23	4	23	17	20	1	20	16	22	3	23
East Garage	**424**	261	315	91	315	249	304	95	304	256	302	85	302	255	307	90	307
President's House	**8**	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Hermann Garage	**22**	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
East Campus	**5**	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Medical Lot / Hayward lot	**61**	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Ford Lot	**22**	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Student Center	**4**	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Visitor Lot	**54**	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
NW86 Garage	**130**	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130	130
Cruiser Lot - W31	**3**	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
nw32 lot	**23**	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
44/46 lots	**32**	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
N10	**55**	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Total	**3,532**												**Total**	**2,002**	**2,340**	**1,321**	**2,405**
													% Utilization of Total Supply	**57%**	**66%**	**37%**	**68%**

Note: MIT Parking Data October 2019; facilities with no data were assumed to be fully occupied for conservative approach

The data from Table 10 (average of three days of data) was translated into Chart 1 for visual representation of capacity and utilization. As illustrated in Chart 1 the peak utilization of all garages/lots reaches 68 percent (or 2,405 spaces) with 32 percent (or 1,127 spaces) remaining as unoccupied.

Chart 1 MIT Campus Existing Vehicle Parking Utilization (October 2019 Average)



2. Estimated Project Parking Demand

As noted previously, the Project will not provide any vehicle parking on-site, and any parking demand that is generated by the new building occupants, is expected to be accommodated in a nearby MIT parking facility.

To support the Special Permit, a detailed parking analysis was conducted using different demand methodologies, including a.) ITE (Institute of Transportation Engineers), b.) Employee Density and c.) calculations based on MIT parking data from October 2019.

a. Parking Demand Estimate based on ITE

One way to estimate parking demand is to follow the ITE parking generation methodology. ITE provides standard parking demand rates for different land uses that are based on a national data sample. For the purposes of providing a complete review of possible parking demand alternatives for the Project, the ITE land use codes 550 (University/College) and 820 (Shopping/Retail) were consulted.

Table 11 presents the resulting parking demand estimate for the Project based on ITE methodology, at 29 to 48 parking spaces.

Table 11 Parking Demand Estimate based on ITE

Land Use	Net New SF	Parking Spaces per KSF	Estimated Parking Demand
Academic	159,000	0.16 - 0.28#	26 - 45
Retail	3,000	0.975##	3
Total	**162,000**	**-**	**29 to 48**

The parking rate is shown as a range because ITE LUC 550 has a parking rate of 0.16 for city core college/university and parking rate 0.28 for general urban college/university.

Parking rate is for LUC 820 – shopping/retail is assumed to be a high estimate for this location, but is consistent with the ITE LUC 820 for trip generation; rate covers parking for employees and visitors of the retail space, discount by 50% to capture parking for employees only

b. Parking Demand Estimate based on Employee Density and Student Permits

A second parameter used to evaluate demand for parking at a site is based on population density. The calculation involves multiplying the expected population numbers by the single occupancy vehicle (SOV) mode share plus ½ high occupancy vehicle (HOV) mode.

The Project expects an employee population of 159 net-new faculty/staff and approximately 3 retail employees (to service the 3,000 SF of ground floor café).

Table 12 presents the resulting parking demand estimate for the Project based on the Employee Density methodology, at 30 parking spaces.

Table 12 Parking Demand Estimate based on Employee Density

Land Use	Approximated Population	90% of Population#	Vehicle Mode Share %*	Estimated Parking Demand
Academic	160	144	20.5%	29
Retail	3**	3	28.5%	1
Total				**30**

#10% of estimated population is assumed to be absent due to off-site meeting, vacation, sick, jury duty etc.; results rounded
*SOV% + ½ of HOV% sourced from MIT Town Gown (Academic) and City's K2C2 Study (Retail)
**Assumes 1 retail employee per 1,000 SF of retail land use

The employee density calculation does not include parking demand for students. A supplemental review of parking permits was conducted by MIT to develop a parking rate estimate for this population group. Based on MIT parking data from 2019, the permit per student ratio is 0.050. With an expected new-net student population of 281 for the proposed Project, we are estimating the student parking demand at 14 parking spaces.

c. Parking Demand Estimate based on 2019 Parking Demand Rate

The third methodology used to estimate parking demand for the Project is based on existing parking usage patterns. The calculation involves development of a parking rate for academic/service land uses, based on October 2019 collected parking utilization data, that is then projected to the proposed square footage for the Project.

MIT provided building data (Table 1: Building Data and Zoning Parking Requirements, from MIT Institutional Zoning Parking requirements and Allocation Plan 2019-2020 as submitted to the City on October 26, 2020 and copy included in the appendix to this report), indicate that approximately 7.7 Mill SF are dedicated to academic/service land uses campus wide. Cross referencing the parking usage data from October 2019 with MIT's parking allocation plan (Table 10 in section above supplemented by Table 2: Parking Allocation Data, from MIT Institutional Zoning Parking Requirements and Allocation Plan 2019-2020), we estimate that approximately 2,000 parking spaces are utilized by primarily academic/services uses during the peak occupancy period. This calculates to a parking demand rate of approximately 3,850 square feet per 1 parking space, or 0.3 parking spaces per 1,000 square feet of academic/service land use, based on conservative estimates and allocations of parking.

Table 13 presents the resulting parking demand estimate for the Project based on MIT's October 2019 parking demand rate methodology, at 49 parking spaces.

Table 13 Parking Demand Estimate based on October 2019 Parking Demand Rate

Land Use	Net New SF	Parking Spaces per KSF[1]	Estimated Parking Demand
Academic	159,000	0.3	48
Retail	3,000	0.3	1
Total	**162,000**	**-**	**49**

[1] Parking rate calculated based on existing academic/service square footage (gross floor area) and parking utilization data from October 2019;

3. Project Parking Supply Zoning Requirement

The minimum and maximum vehicle parking requirements based on the Zoning Ordinance is summarized in Table 14.

Table 14 Parking Requirements based on Zoning

Land Use	Program	Minimum Ratio	Maximum Ratio	Minimum Parking	Maximum Parking
Academic[1]	171,000 SF	1 space per 1,800 SF	1 space per 1,200 SF	95	143
Retail[2]	3,000 SF	1 space per 900 SF	1 space per 600 SF	3	5
Total	**174,000 SF**			**98**	**148**

Source: City of Cambridge Zoning Ordinance Article 6 for Zoning District C-3B
[1]Land Use Category 6.36.3-b (Table on Page 6-14 of the Zoning Ordinance)
[2]Land Use Category 6.36.5-a2 (Table on Page 6-19 of the Zoning Ordinance)

4. Request for Parking Supply Reduction

MIT is requesting for the minimum parking supply requirement to be eliminated, thereby allowing no parking minimum for the proposed Project. Any parking demand that is generated form the Project is expected to be accommodated within the existing parking supply. As outlined in previous sections, the existing MIT campus parking supply can absorb the projected parking demand from the Project.

Existing parking supply shows availability of more than 1,100 parking spaces, and the projected demand for the Project will range between approximately 30 to 50 spaces, depending on methodology.

5. Future MIT Parking Supply and Demand

Over the next five years, in addition to the proposed SCC Building, MIT is also expecting to develop the West Campus Graduate Dormitory, the Music Building and the Met Warehouse. Each of these three buildings will go through the appropriate permitting process with the City, however for the purposes of providing a more complete view of MIT's expected future parking conditions, the team has developed a future parking scenario that accounts for these additional three developments.

Table 15 summarizes parking demand projections for the additional three developments that are based on zoning minimum parking ratios, as a conservative approach. Once each project goes through their individual permitting/review, they will develop parking estimates that are more reflective of expected demand levels.

Table 15 Future Parking Demand Projections (5+ years) based on min. Zoning Ratios

Project	Land Use	Approximate Program	Parking Ratio*	Estimated Parking Demand
West Campus Graduate Dormitory	Dormitory	690 beds	1 space / 12 beds	58
Music Building	Academic	34,000 SF	1 space / 1,800 SF	19
Met Warehouse Project	Academic	214,000 SF	1 space / 1,800 SF	119
			Sub-Total	196
			+ SCC Project	98
			Total	**294**

*parking rate assumed to be zoning minimum

As outlined in Table 15, the total estimated parking demand from the four identified projects that are expected to be developed by MIT over the next five years, calculate to approximately 300 parking spaces (rounded from 294 spaces).

In addition to parking demand that will be added to the MIT campus, parking supply is also projected to increase. Table 16 summarizes the additional parking spaces that are planned to become available over the next several years, estimated at +412 spaces.

Table 16 Future Parking Supply Projections (5+ years)

	Change in Supply	Total Supply
Existing 2019 Supply		**3,532 spaces**
Kendall Square Garage	+509 spaces	
Lot 44/46	-22 spaces	
Kresge Lot	-94 spaces	
West Lot	-136 spaces	
Music Garage	155 spaces	
Total	+412 spaces	
Future Supply		**3,944 spaces**

Source: MIT Institutional Zoning Parking requirements and Allocation Plan 2019-2020, as submitted to the City on October 26, 2020 and copy included in the appendix to this report

The addition of 412 parking spaces to the MIT campus parking supply will bring the total from 3,532 spaces (October 2019 inventory) to 3,944 spaces in the future.

Similarly, the additional parking demand of approximately 300 spaces gets layered into the existing parking utilization data, to develop a snapshot of parking conditions in the future.

Table 17 summarizes the resulting future parking demand, supply and utilization at 9am, 12pm/noon and 5pm. The table also highlights the daily peak occupancy/utilization.

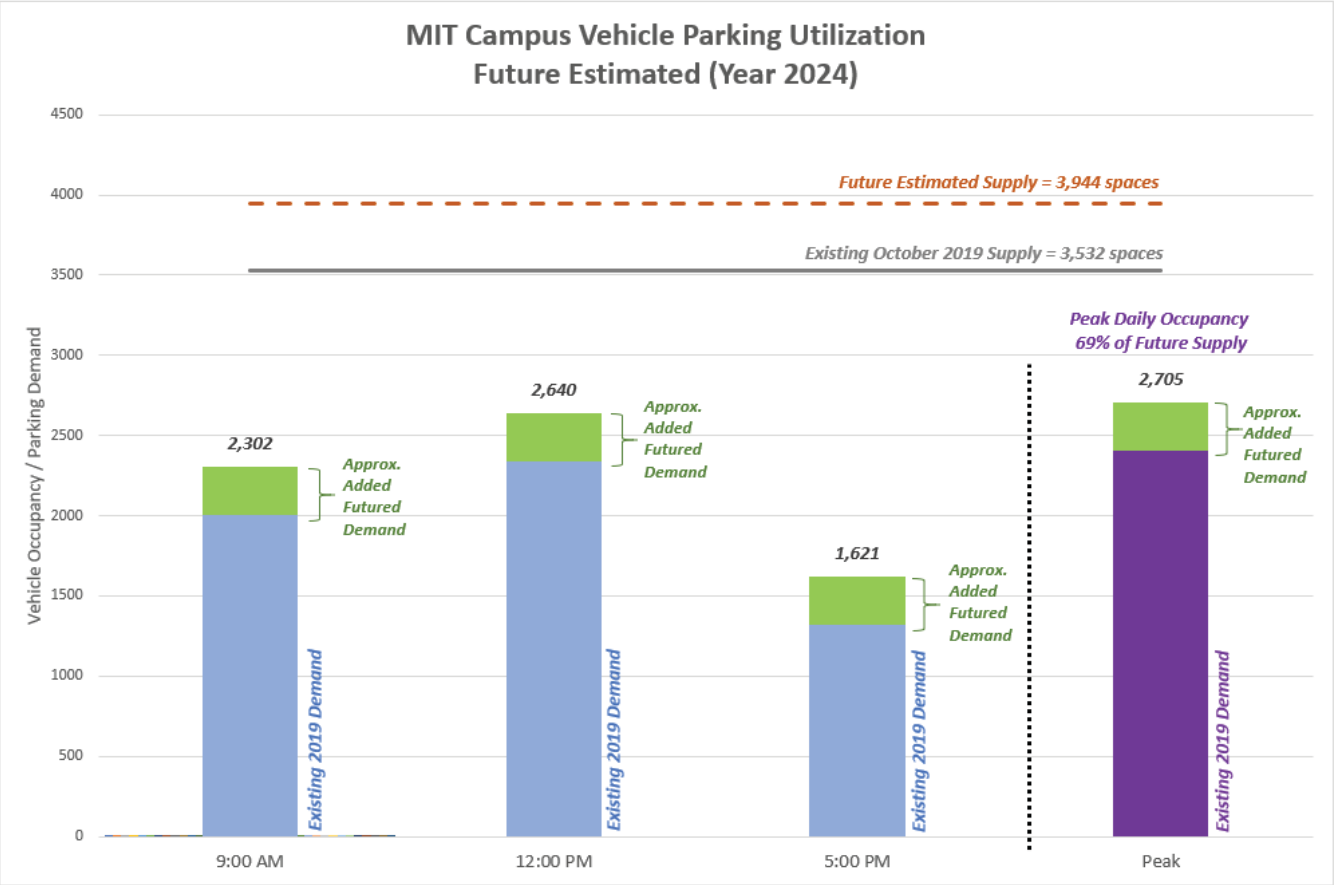
Table 17 MIT Campus Future Estimated Vehicle Parking Utilization

	9am	12pm	5pm	Peak
Total Existing Demand*	2,002	2,340	1,321	2,405
Added Demand	300	300	300	300
Total Future Demand	**2,302**	**2,640**	**1,621**	**2,705**
Existing Supply	3,532	3,532	3,532	3,532
Added Supply	+412	+412	+412	+412
Total Future Supply	**3,944**	**3,944**	**3,944**	**3,944**
% Utilization	**58%**	**67%**	**41%**	**69%**

*Average parking utilization from October 2019, MIT

The data form Table 17 was translated into Chart 2 for a visual representation of capacity and utilization. As illustrated in Chart 2 the peak utilization of garages/lots is expected to reach just below 70 percent in the future.

Chart 2 MIT Campus Future Estimated Vehicle Parking Utilization



Bicycle Access and Parking

The Project will retain the existing cycle track along Vassar Street and the path between the cycle track and the proposed Grand Junction Multi-Use Path through the southwest edge of the Project Site. The path connecting the Vassar Street cycle track and the Grand Junction Multi-Use Path will include a 12-foot wide clear space, a landscape area with trees, benches, and bike racks.

The Site will provide short-term and long-term parking per the City of Cambridge Bicycle Parking guidelines. The minimum ratios by land use are summarized in Table 10.

Table 10 Bike Parking Minimum Requirements Based on Zoning

Land Use	Program	Long Term Bike Parking Rate	Long Term Bike Parking Spaces	Short Term Bike Parking Rate	Short Term Bike Parking Spaces
Academic[1]	171,000 SF	0.2 spaces per 1,000 SF	35	0.40 spaces per 1,000 SF	69
Retail[2]	3,000 SF	0.10 spaces per 1,000 SF	1	0.60 spaces per 1,000 SF	2
Total	**174,000 SF**		**36**		**71**

[1]Land Use E2
[2]Land Use N4

The City of Cambridge zoning requires that a minimum of 36 long-term and 71 short-term bicycle parking spaces be provided on site.

Long-term bike parking will be accommodated on site in a bike room that is accessed via elevators leading to the lobby. As currently envisioned, short term bike parking spaces will be provided in a combination of spaces along the southwest side of the building and along the northern edge of the Grand Junction Multi-Use Path to meet the required short-term bike parking spaces.

Transit

Several existing departments will be relocated to the proposed SCC building. Two of the departments are currently located in Building 32 along Vassar Street and the commuting patterns of those relocated students and staff members are not expected to change. The commuting patterns for students and staff of The Institute for Data, Systems, and Society, located in Building E18 on Ames Street will also remain similar, where they will continue using the Main Street at Vassar Street shuttle stop. Commuting patterns for students and staff of The Electrical Engineering and Computer Science located in Building 38, are expected to change slightly. Students taking the MIT Tech Shuttle from West Campus are expected to use the Vassar St at Mass Ave Stop instead of the Main Street at Vassar Street stop.

Students and staff that are currently utilizing the MBTA Red Line are not expected to change which stop they use.

The 63 (47 inbound / 16 outbound) and 70 (24 inbound / 46 outbound) net-new transit trips to/from the Site during the morning and evening peak hours, respectively, are expected to be dispersed to one of the many existing transit options presented in Section 2.1.

Pedestrian Analysis

Most trips generated by the Project will be walking trips, since the transit, walking, and vehicle trips ultimately arrive to the Project Site as pedestrians.

The study area provides sidewalks along all the study area roadways and crosswalks are provided at all the study area intersection approaches.

The proposed building is intended to serve as an interdisciplinary hub for research and innovation in computer science because of its proximity to a cluster of computing and AI focused departments, centers, and labs. SCC will work closely with students and staff that are in other MIT biological engineering, nanotechnology, and biophysics labs. This collaboration will help activate pedestrian activity on Vassar Street.

The main access to the building will be provided off Vassar Street. The Project proposes enhancements to the existing multimodal path and existing pedestrian crossing between the Project and the MIT CUP and extends across Vassar Street. The Project will create a new 12-foot-wide multimodal path (an increase from nine feet in existing conditions) that will include new unit pavers, trees, bike racks, trash receptacles, benches, improved lighting and wayfinding, and installation of safety measures over the existing railroad tracks. The enhanced multimodal path will serve as a critical connection between MIT's main campus, south of Vassar Street, the Project Site, the future Grand Junction Multi-Use Path, and Albany Street.

Grand Junction Path

The Grand Junction Multi-Use Path is a proposed pedestrian/bicycle path that is planned to be built adjacent to the railroad tracks in the Grand Junction corridor, from the Boston University Bridge, through MIT and towards the Twin City Plaza. The path is currently in design with 25 percent design documents expected to be released later in 2020 and construction commencing in the Fall of 2021[2].

MIT, in conjunction with other consultants, prepared the *Grand Junction Community Path and MIT Property Feasibility Study* exploring the potential impacts of the pathway to the MIT campus. The study focused on the Grand Junction MIT owned segments and identified potential designs and identified potential conflicts with current, planned, and future projects as well as how to mitigate these impacts and divert users of the path during construction. Based on continued planning, collaboration and cooperation with all stakeholders, the study

[2] Cambridge, City of. "Grand Junction Multi-Use Path." *Grand Junction Multi-Use Path - CDD - City of Cambridge, Massachusetts*, www.cambridgema.gov/CDD/Projects/Transportation/GrandJunctionPathway.

provided a positive outlook on the Grand Junction Community Path and MITs ability to participate in the planning, design, and construction of the Multi-Use path.

As part of the Kendall Square Mobility Task Force, a feasibility study looking at potential passenger rail service on the corridor was conducted. The study identified varying service types relating to frequency of the service and the physical infrastructure and land needs associated with each service type. A range of Right-of-Way (ROW) requirements were estimated from the current single track with a multi-use path at 33-37 feet to a 60-65-foot ROW to support a two-way transitway, the single track, and a multi-use path. The City concluded that the preferred alternative was a double track with a multi-use path; this would require approximately 47-51 feet of total ROW. The study placed the multi-use path to the north of the existing tracks as did the City's 2004 Feasibility Study and the 2014 Study.

As part of the Volpe re-zoning process (PUD-7 Zoning), MIT agreed to work with the City to advance the implementation of the Grand Junction Multi-Use Path which included an agreement to memorialize a commitment by MIT to, convey to the City the easement necessary for the Grand Junction Multi-Use Path and make a $8,500,000 contribution to the City for the development of the design and construction of the Grand Junction Multi-Use Path.

Through MIT's campus, between Massachusetts Avenue and Main Street, the future Grand Junction Multi-Use Path is expected to be constructed within the 78.5-foot right-of-way to the northwest of the Project Site. This section of the Grand Junction Multi-Use Path is expected to include 36-feet for the double train tracks and a 14-foot multi-use path with 2-foot shoulders on each side.

As illustrated in Figure 3, the Project is maintaining access to the Grand Junction through a multimodal path to the southwest of the building. Additionally, on Levels 3-8, the building bridges over the railroad tracks north of the Project Site and creates an overhang above the railroad tracks. The design of the column grid is being closely coordinated with the City of Cambridge in order to not affect the design of the Grand Junction Multi-Use Path.

2.4 TDM and Mitigation

Transportation Demand Management

MIT is committed to reducing single-occupancy vehicles traveling to MIT and has a strong transportation demand management (TDM) program to encourage sustainable modes including carpool/vanpool, public transportation, walking and biking.

All MIT students, faculty and staff, including the MIT community using the Project, have access to the following TDM measures:

- On-Site Transportation Coordinator
- Charles River Transportation Management Association
  - EZRide Shuttle Service
  - Ride-matching and guaranteed ride home programs

- TMA promotional events and support services

› Transit
  - No-cost transit pass embedded in employee's ID cards with Free, unrestricted sue of the MBTA buses and subways
  - 60% commuter rail subsidy
  - 50% subsidy for parking at MBTA stations (up to $100 per month)

› Bicycle
  - Bicycle parking facilities, short- and long-term
  - Lockers and showers
  - BlueBikes discount membership program

› Pedestrian
  - Pedestrian pathways and streetscape
  - Lighting for pedestrian pathways
  - Enhanced pedestrian connections

› Marketing and Promotion
  - Website
  - Transportation Fairs/Events

› Shift from annual to daily pay-per-day parking

Mitigation

In addition to the list of TDM measures proposed in this report, the Proponent has also committed to several other mitigation measures, for different development projects, which will benefit the broader MIT campus.

Special Permit #302 (NoMa) mitigation commitments:

› Redesign and construction of a raised cycle track on Third Street and Main Street adjacent to the One Broadway site.

› Financing and installation of (1) BlueBike (formerly Hubway) station along Broad Canal Way.

› Addition of new bikes to the existing BlueBike station at Kendall on Main Street.

› Payment of annual operations and maintenance fees to the City for the BlueBike station.

› Implementation of a Residential Transportation Demand Management Plan that aims to reduce reliance on single occupancy vehicles.

› Provision of a bike station at 165 Main Street prior to obtaining the Certification of Occupancy in 2022.

Special Permit #303 (SoMa) mitigation commitments:

› Redesign and reconstruction of Ames Street between Main Street and Memorial Drive, including an at-grade cycle track on the east side of the street.

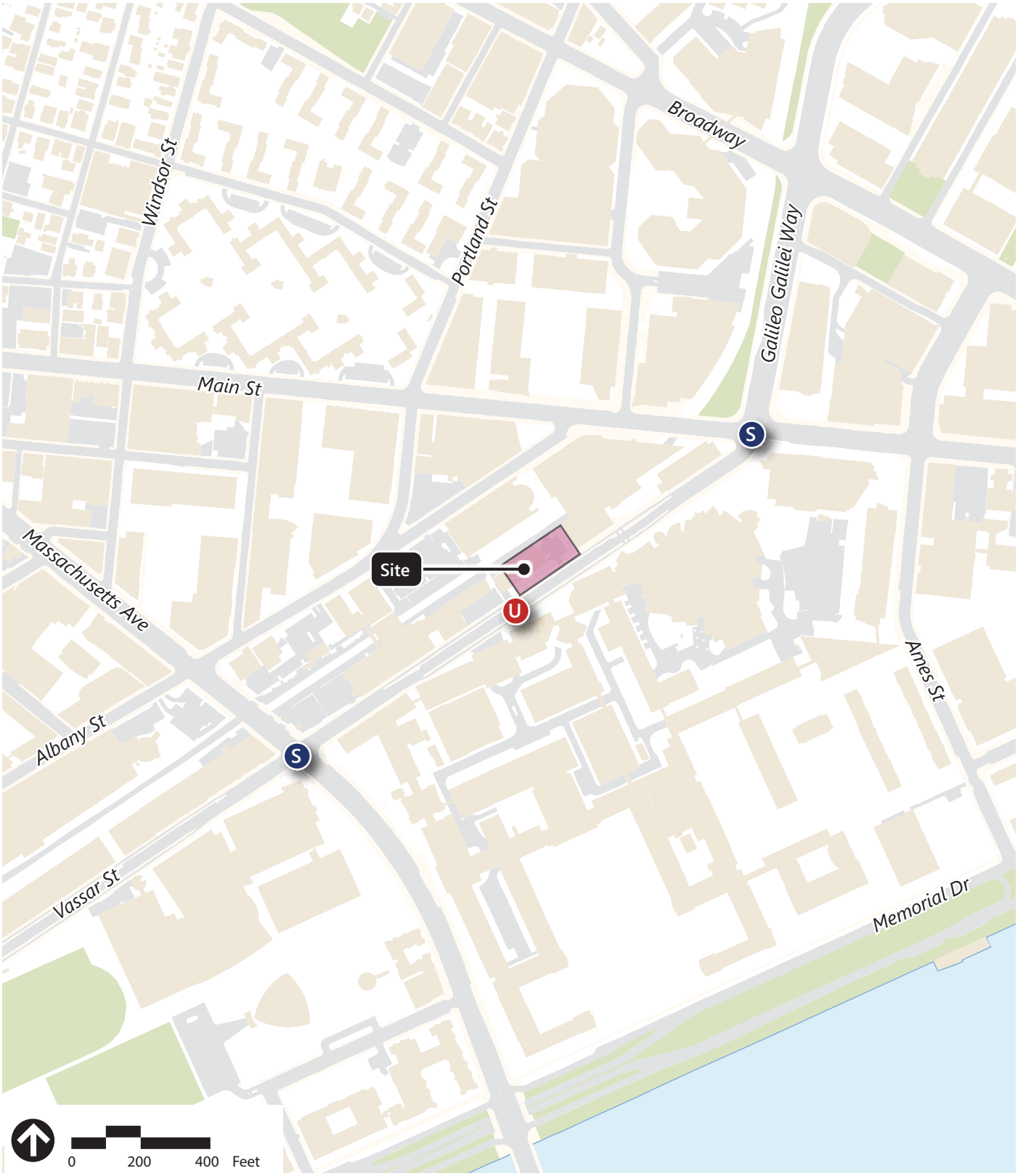
- Redesign and construction of a crossing at Memorial Drive and Ames Street to accommodate pedestrians and cyclists.
- Update of traffic signal equipment at Ames Street and Main Street to accommodate the new cycle track.
- Finance installation of two (2) BlueBike (formerly Hubway) Stations, to be located at the intersections of Amherst Street and Carleton Street, and Amherst Street and Hayward Street.
- Pay ongoing annual operations and maintenance fees to the City for the (2) BlueBike stations.
- Contribution of $175,000 to the City for Transit and Mobility Studies in Kendall Square.
- Contribution of $75,000 to the City to advance the design of the Grand Junction Multi-Use Path.
- Contribution of $250,000 to the City for transit investments, such as contributions to shuttle or MBTA bus capacity or operations in Kendall Square, bus priority signals, signal changes that could shorten train headways, or other MBTA or publicly accessible private transit capital improvements that support transit.
- Reconstruction of Amherst Street between Ames Street and Wadsworth Street.
- Reconstruction of Wadsworth Street between Main Street and Amherst Street with widened sidewalks, raised crosswalk and pavement marking.
- Improvements to Memorial Drive Crossing at Wadsworth Street, subject to DCR approval.
- Commitment to a transportation monitoring program for the SoMa development sites.
- Design and construction of a cycle track extension along Vassar Street to Main Street.
- Contribution of $250,000 to the City for future traffic signal improvements at the intersection of Main Street/Vassar Street/Galileo Way to allow for flexibility, and coordination of future streetscape redesign, as planned by the City – this amended mitigation item was approved by the Planning Board on June 16, 2020.

PUD-7 Zoning

- Following adoption of the PUD-7 Zoning, MIT is contributing $500,000 to the City for the development of the design for the Grand Junction Multi-Use Path.
- Within 30 days of the completion of the design of the Grand Junction Multi-Use Path MIT will either deliver to the City $8,000,000 for the design and construction of the Grand Junction Multi-Use Path or commence construction of the portion of the Grand Junction Multi-Use Path located on the MIT Property.
- MIT agrees that it shall include or cause to be included a covenant that the unit tenants shall not apply to the City of Cambridge Traffic, Parking & Transportation Department for a Residential Parking Permit in 30 of the residential leases for the residential innovation housing.

In addition to the above outlined mitigation, the Proponent is committing to the following transportation mitigation to support the development of the Project:

- Enhancements to the existing mid-block crosswalk, in the form of striping and improved signage.
- The Project will create a new 12-foot-wide multimodal path (an increase from nine feet in existing conditions) that will include new unit pavers, trees, bike racks, trash receptacles, benches, improved lighting and wayfinding, and installation of safety measures over the existing railroad tracks.
- Enhance the railroad crossing at the Grand Junction Multi-Use Path.



Source: MassGIS

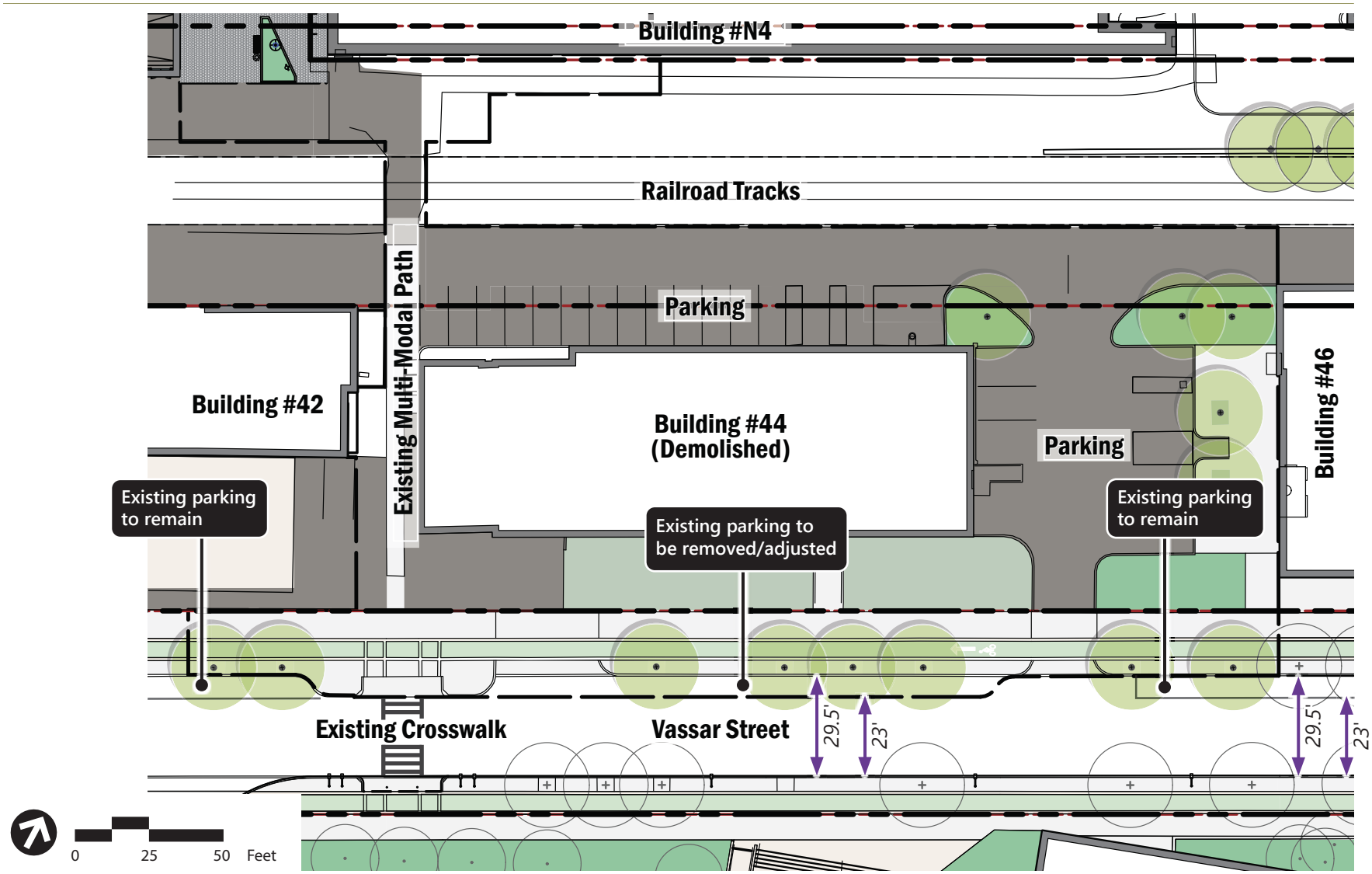
S Signalized Intersection

U Unsignalized Intersection

Figure 1

Study Area Map

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Base provided by SOM

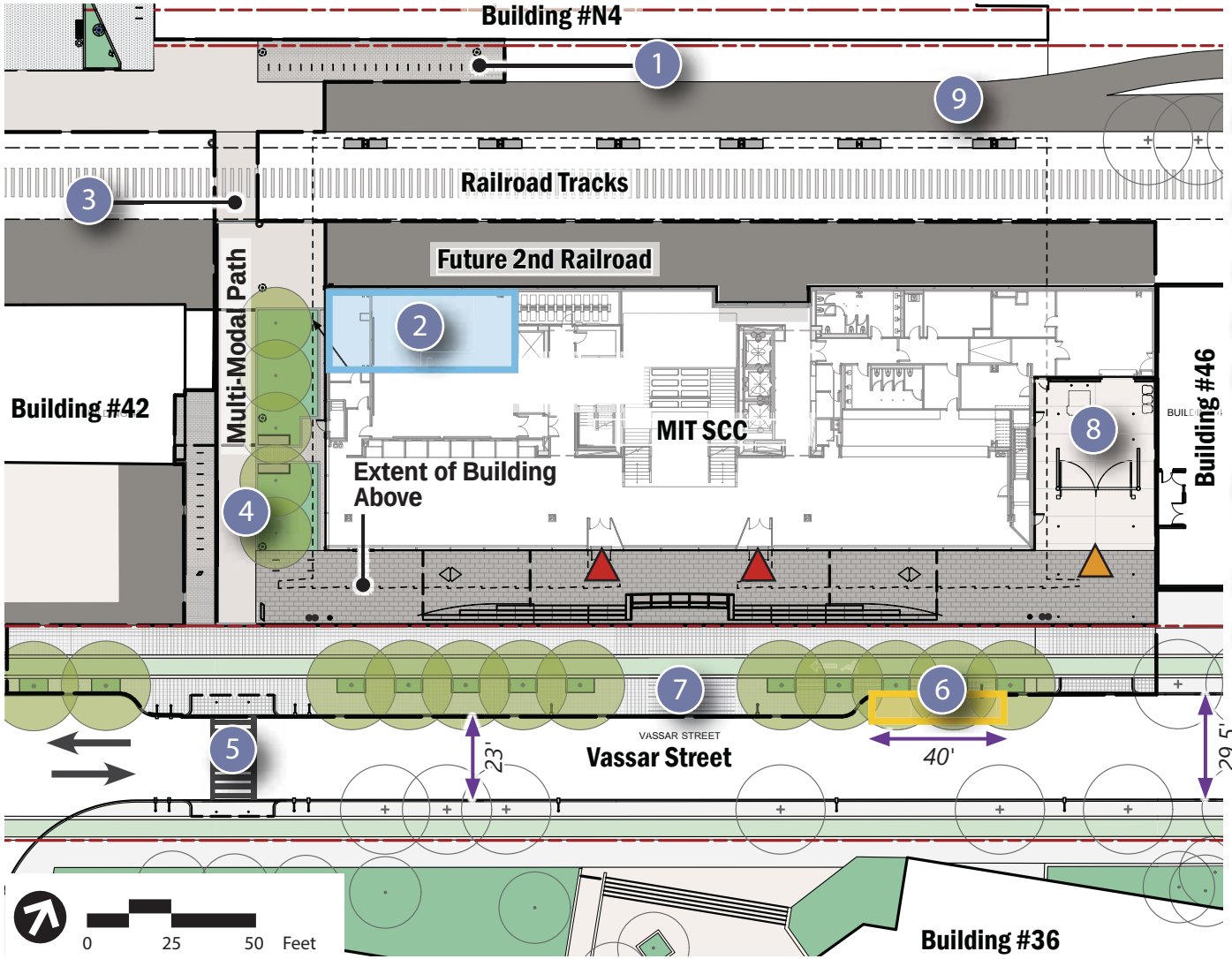
Property Line

Project Limit of Work

Figure 2

Existing Conditions Plan

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Site Planning Accomodations

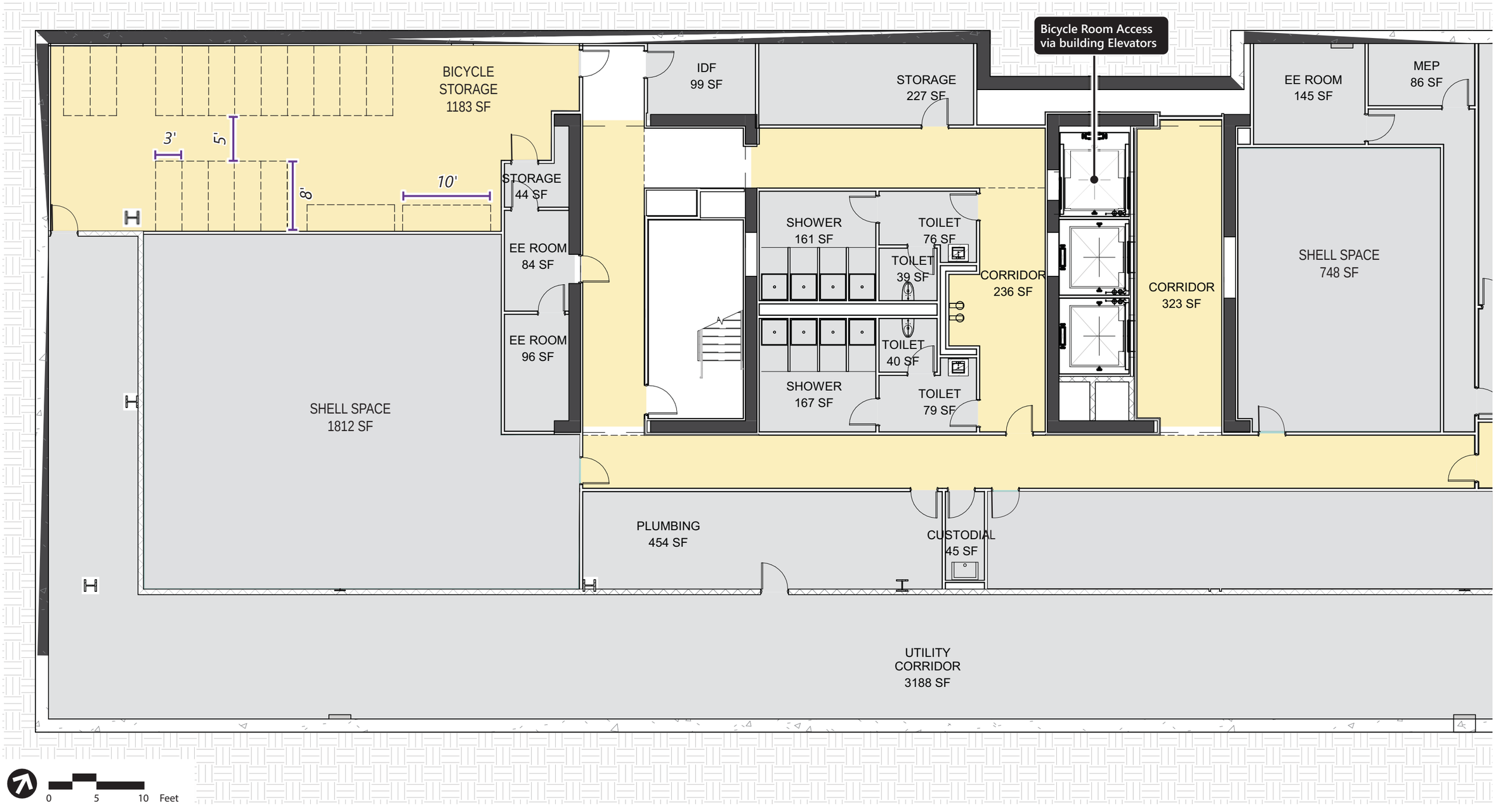
1. Short-term bike parking spaces area 1
2. Bike parking room located in the basement level.
3. Retain crossing and future connections to the Grand Junction Multi-use Path.
4. Short-term bike parking spaces area 2
5. Existing crosswalk to remain.
6. Two 2-hour metered parking spaces to be re-assigned as a 15-minute loading zone (passenger pick-up/drop-off).
7. Curb Extension to replace three 2-hour metered parking spaces and existing curb cut.
8. Proposed Loading Dock
9. Future Grand Junction Multi-use Path

Base provided by SOM

Pedestrian Access
Loading Dock
Property Line
Line of Work

Figure 3
Site Plan

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

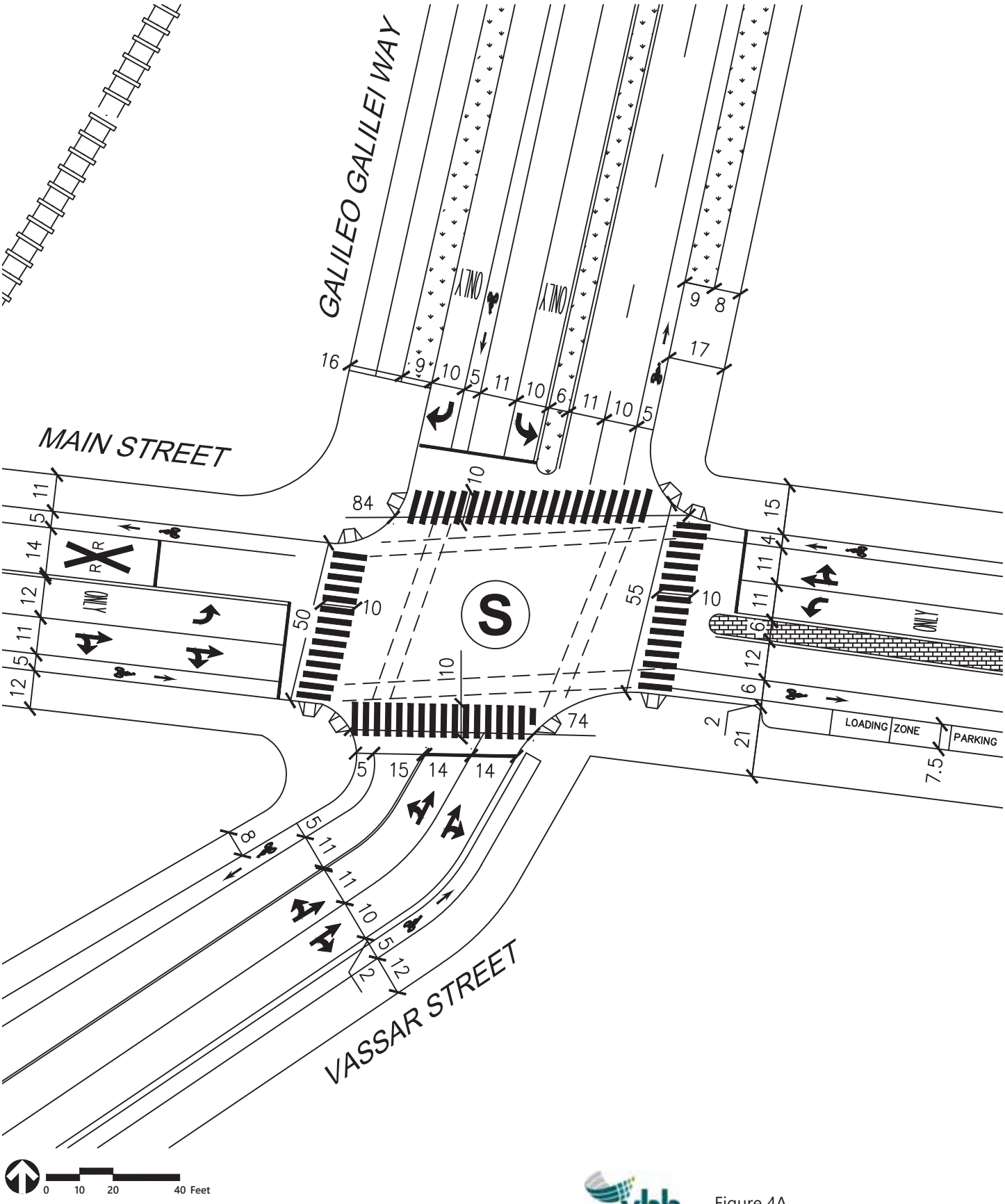


Base provided by SOM

Figure 3a

Bicycle Storage Room Plan

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

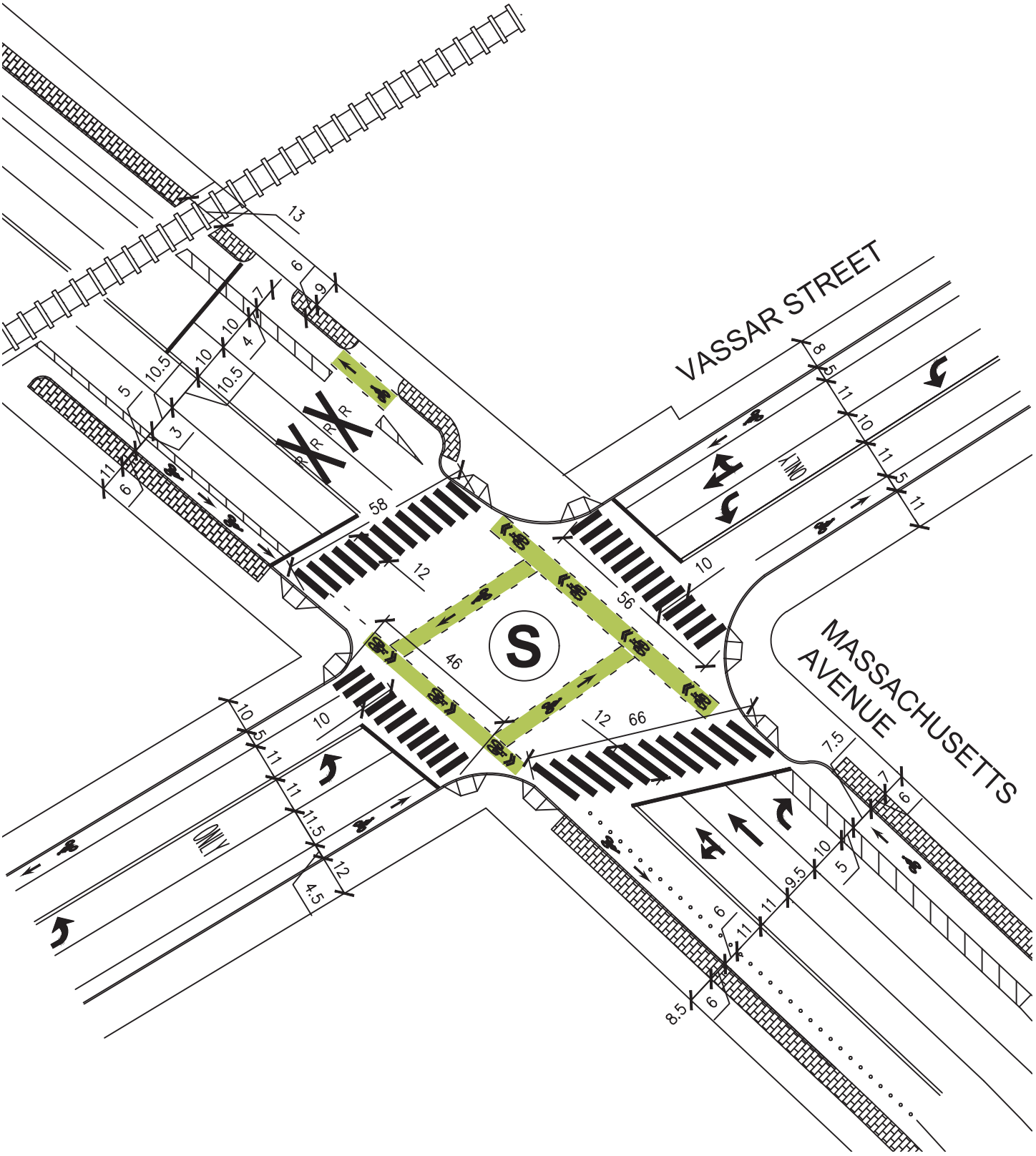


0 10 20 40 Feet

Date of Field Condition:
August 13, 2020

Figure 4A

Existing Condition Intersection Sketch
Main Street at Galileo Galilei Way and Vassar Street
MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

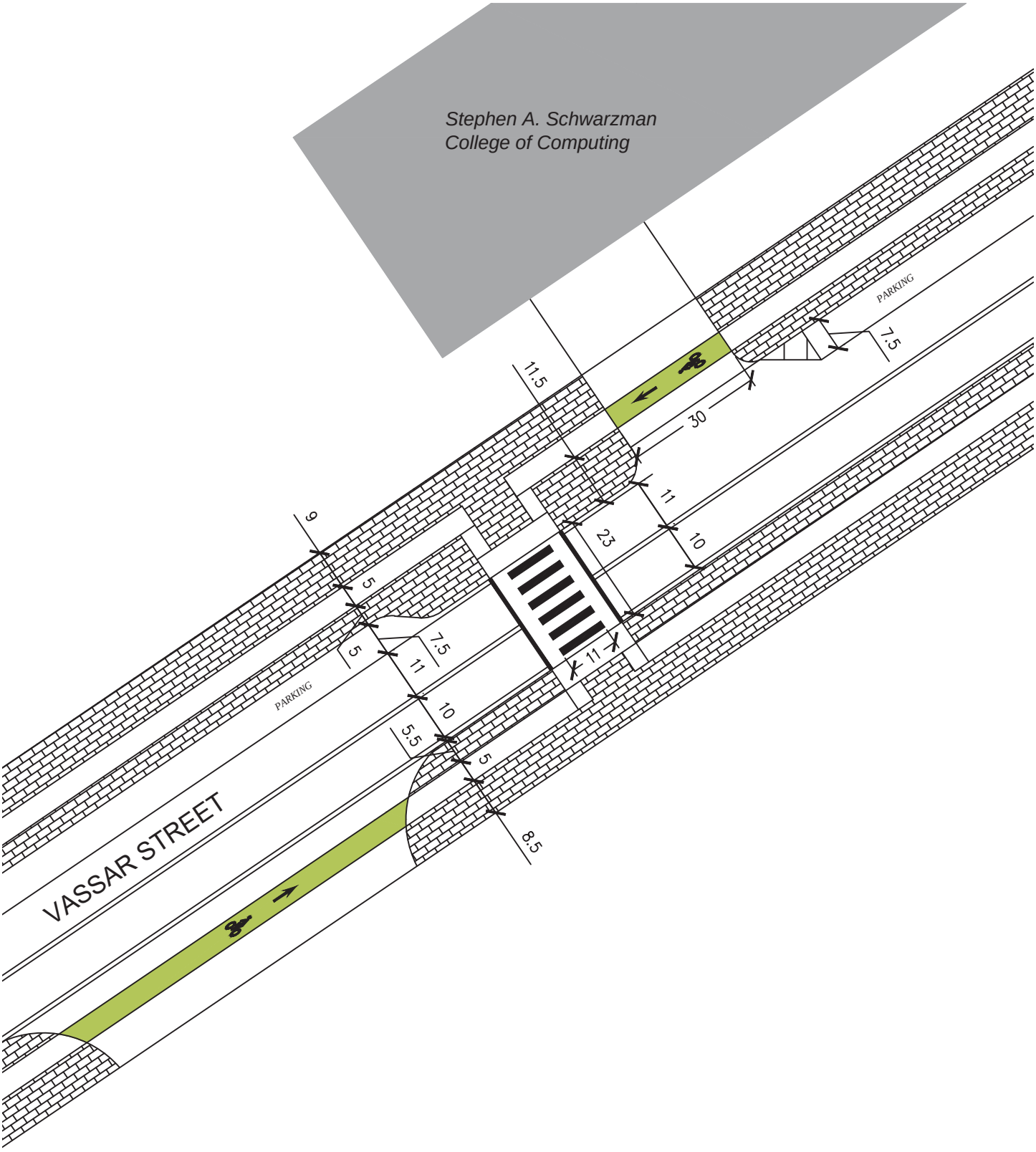


0 10 20 40 Feet

Date of Field Condition:
August 13, 2020

Figure 4B

Existing Condition Intersection Sketch
Massachusetts Avenue and Vassar Street
MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



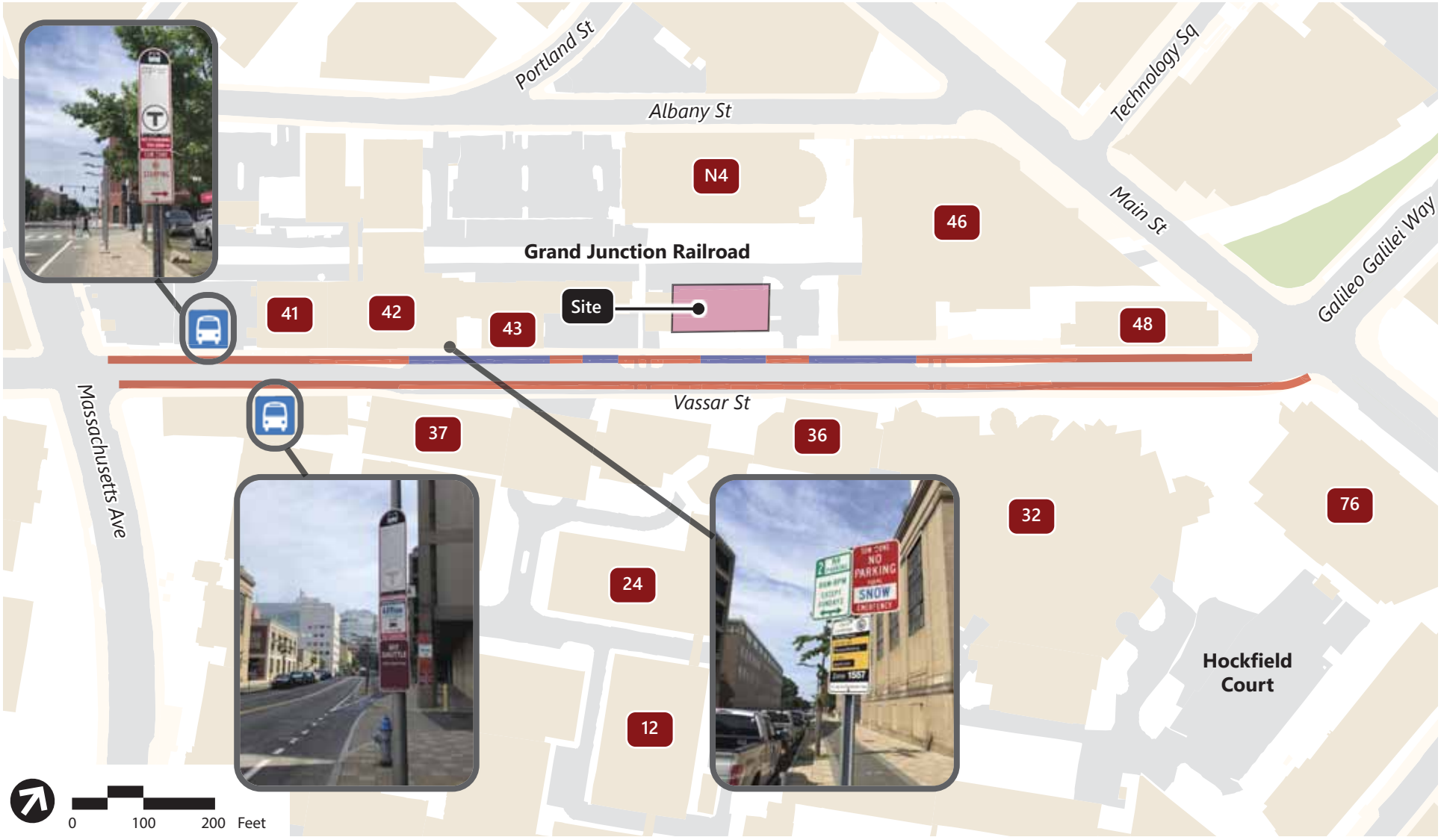
0 7.5 15 30 Feet

Date of Field Condition:
August 13, 2020

Figure 4C

Existing Condition Intersection Sketch
Vassar Street and Mid-Block Crossing

MIT Stephen A. Schwarzman
College of Computing
Cambridge, Massachusetts



Date of Field Condition and Photos: August 13, 2020

No Parking

2-Hour Metered Parking

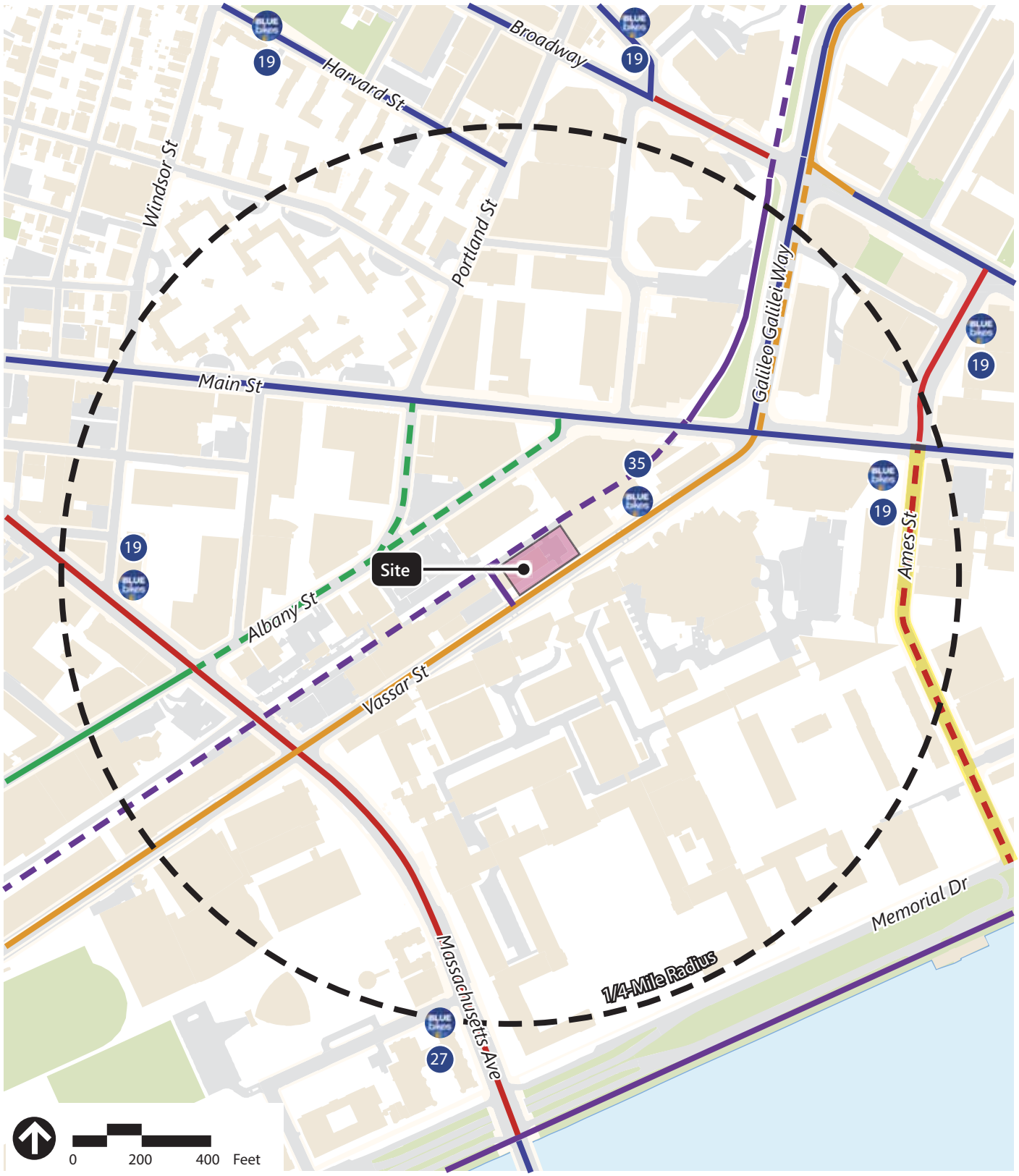
Shuttle Bus Stop

MIT Building No.

Figure 5

Existing Curb Use - Vassar Street

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



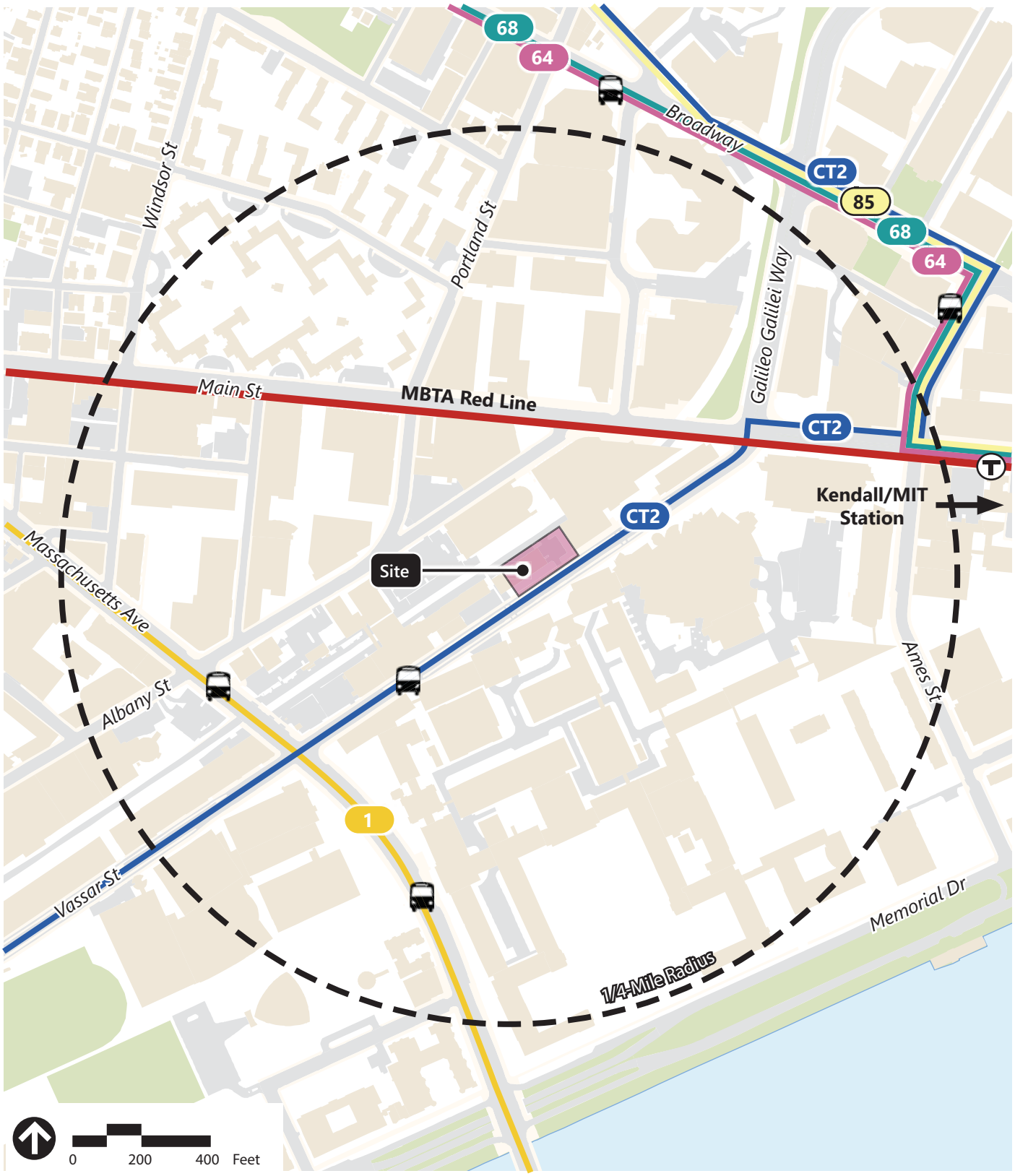
Source: City of Cambridge 2015 Bike Plan

- Bike Lane
- Planned Bike Lane
- Bike Path/Multi-Use Path
- Planned Bike Path/Multi-Use Path
- Protected Bike Lane
- Planned Protected Bike Lane
- Shared Lane Pavement Marking
- Planned Shared Lane Pavement Marking
- Cycle Track
- Planned Cycle Track
- Under Construction
- Bluebikes Station
- (#) Number of Docks

Figure 6

Existing Bikeshare Locations and Bicycle Facilities

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

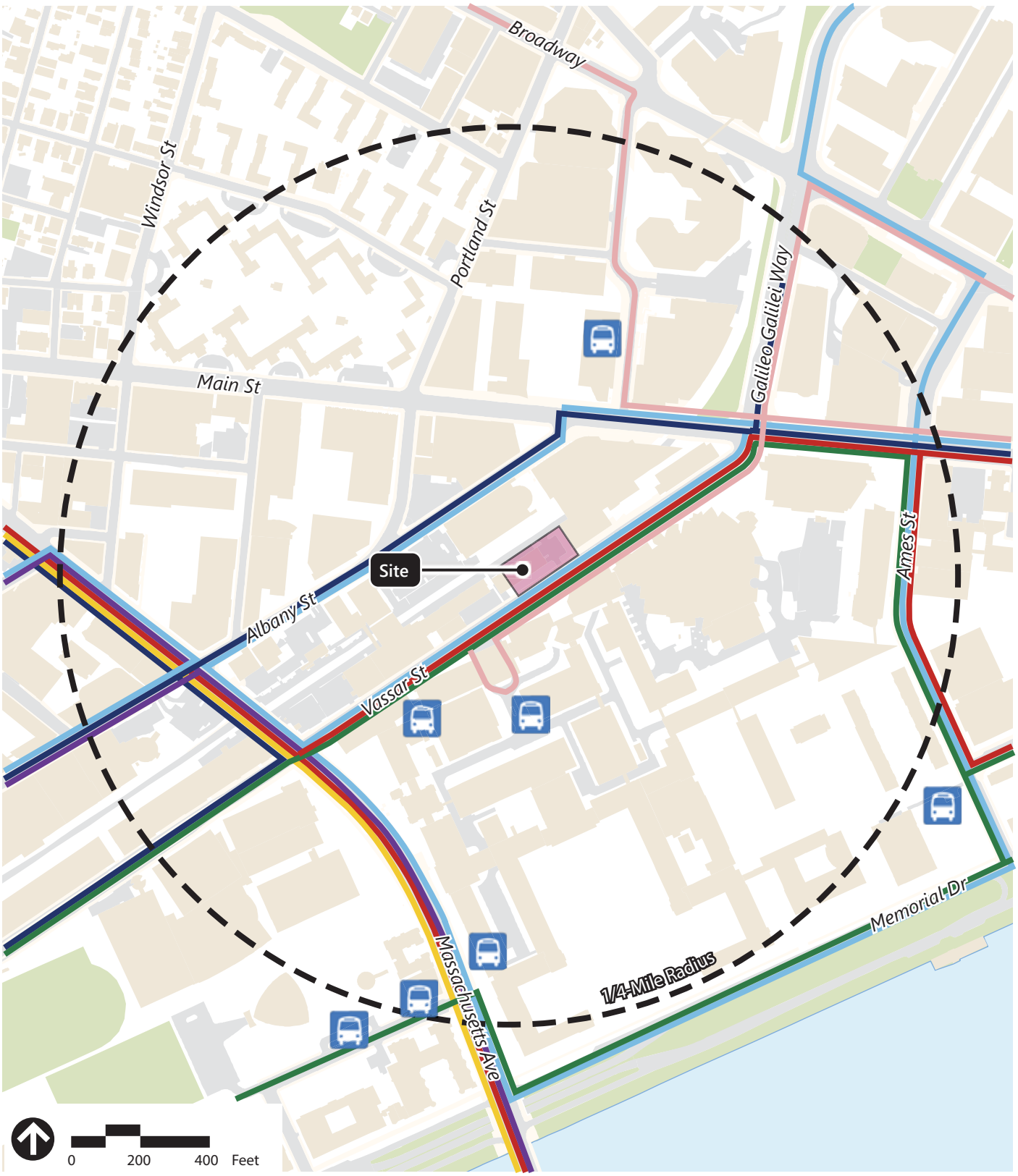


Source: MassGIS

- # Existing MBTA Bus Route
- Existing Red Line
- Existing MBTA Station
- Existing MBTA Bus Stop

Figure 7
Existing Public Transportation

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



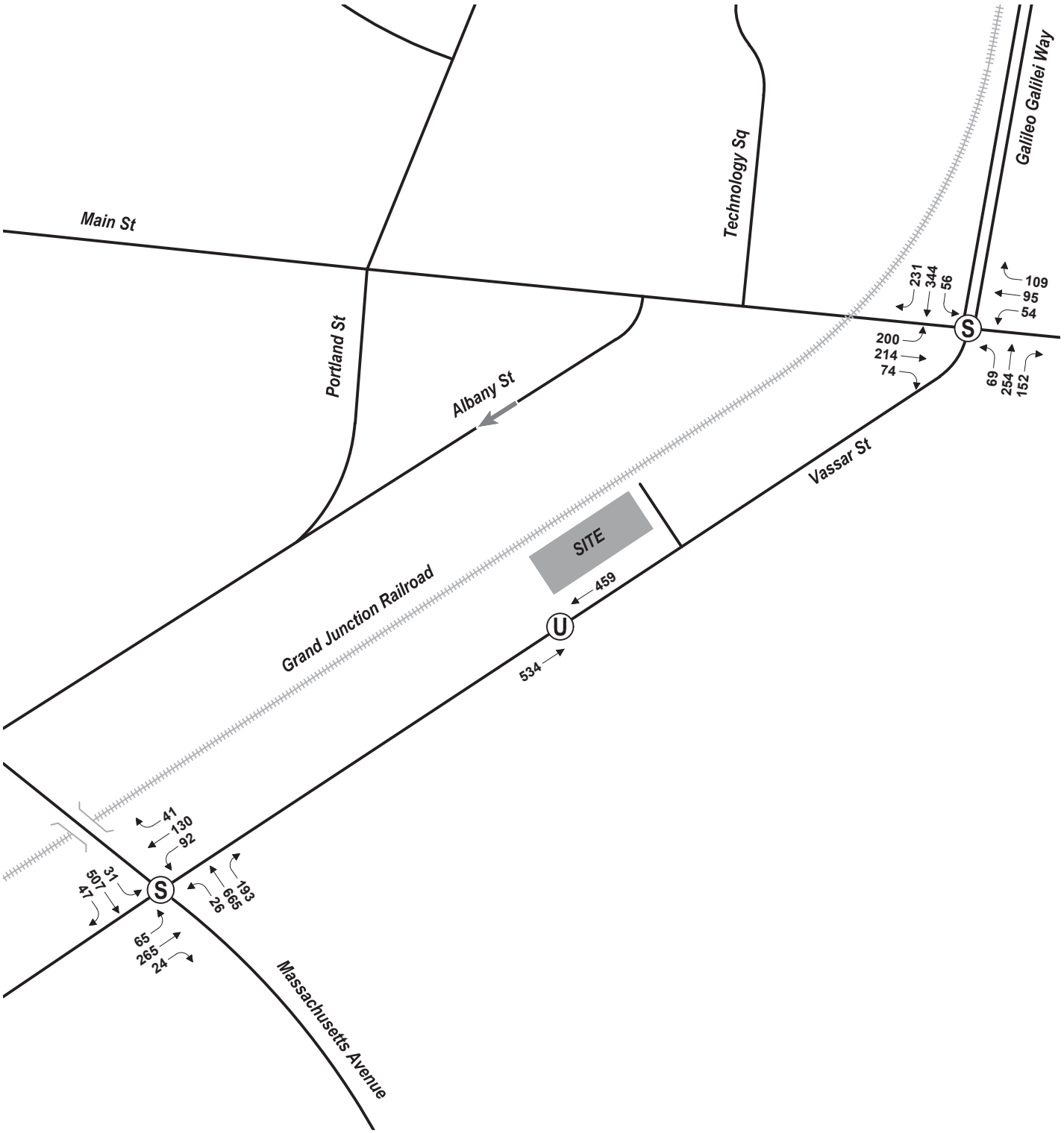
Source: MassGIS

- MIT TECH Shuttle
- MIT Boston Daytime
- MIT Weekend Shuttle
- MIT Lincoln Lab Shuttle
- MASCO M2 Shuttle
- Charles River TMA EZ Ride Shuttle
- Wellesley-MIT Exchange Bus
- Shuttle Bus Stop

Figure 8

Existing Private Shuttle Service

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Date of Counts:

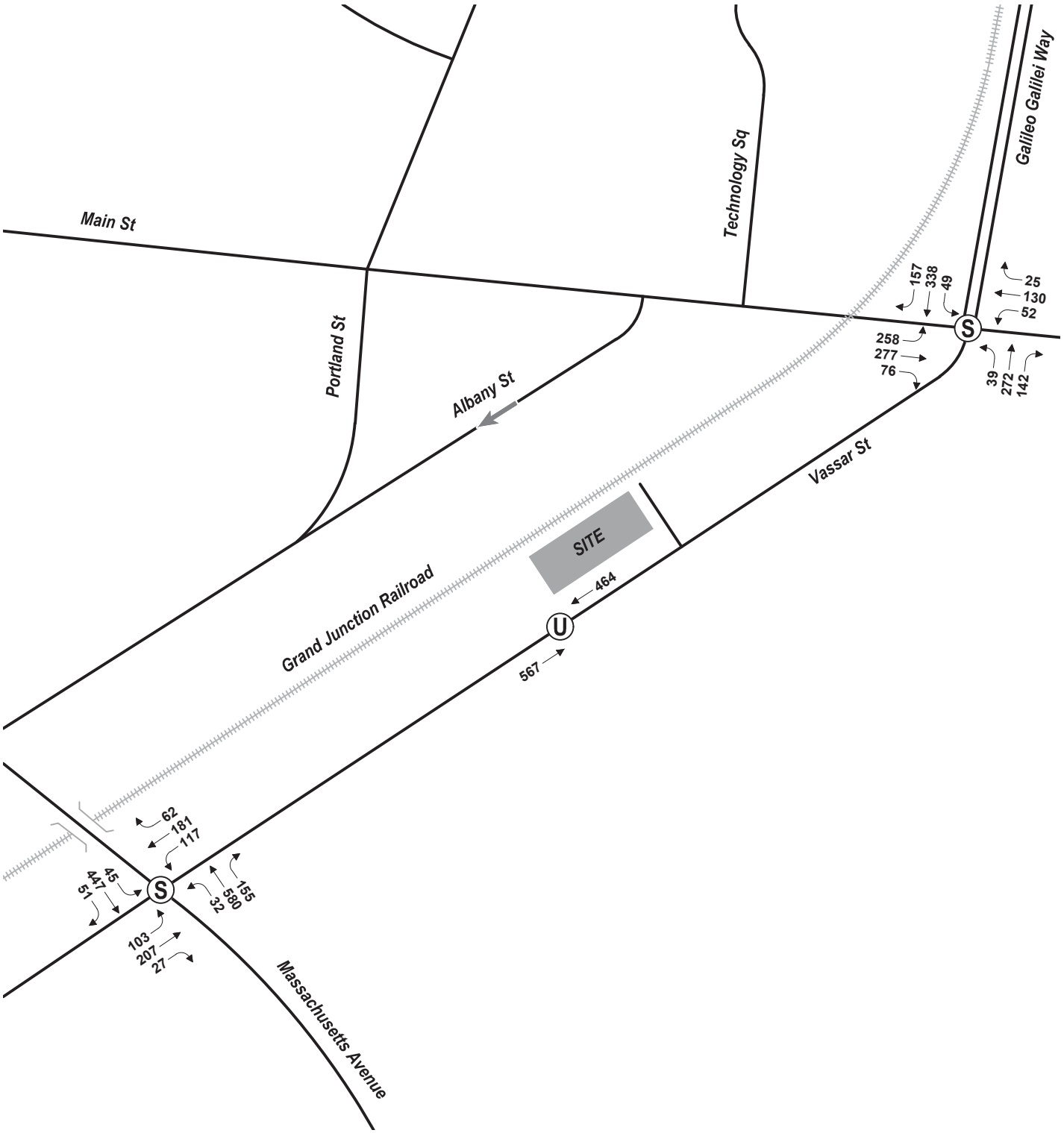
Massachusetts Ave. at Vassar St. - 9/14/2017
Vassar St. South of Main St. - 5/14/2015
Vassar St. at Main St. - 5/13/2013

Note - Turning Movement Counts (TMCs) were grown to reflect 2019 conditions using MassDOT Guidelines.

Figure 9a

Morning Peak Hour
Existing Condition Vehicle Volumes

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Date of Counts:

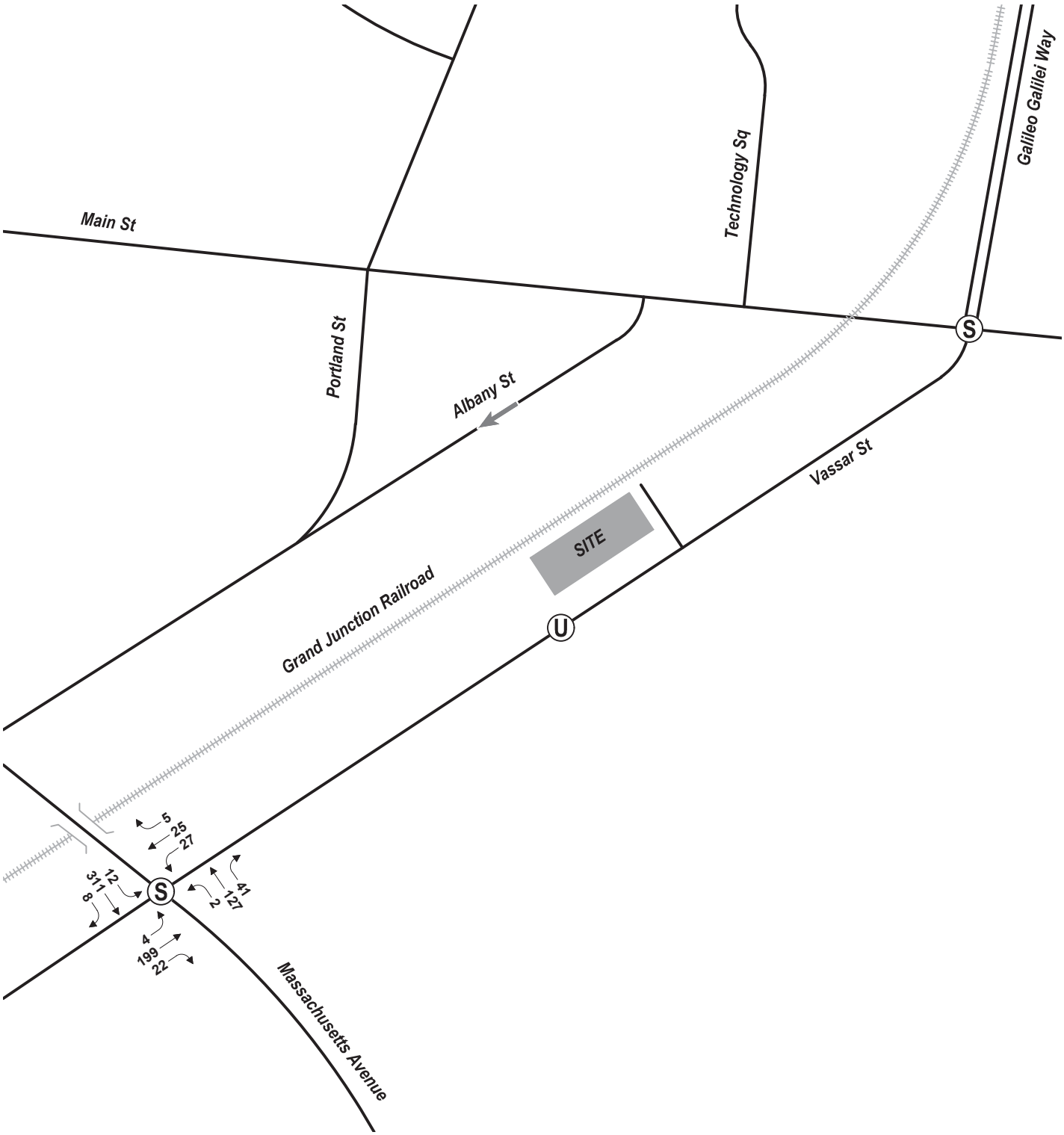
Massachusetts Ave. at Vassar St. - 9/14/2017
Vassar St. South of Main St. - 5/14/2015
Vassar St. at Main St. - 5/13/2013

Note - Turning Movement Counts (TMCs) were grown to reflect 2019 conditions using MassDOT Guidelines.

Figure 9b

Evening Peak Hour
Existing Condition Vehicle Volumes

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

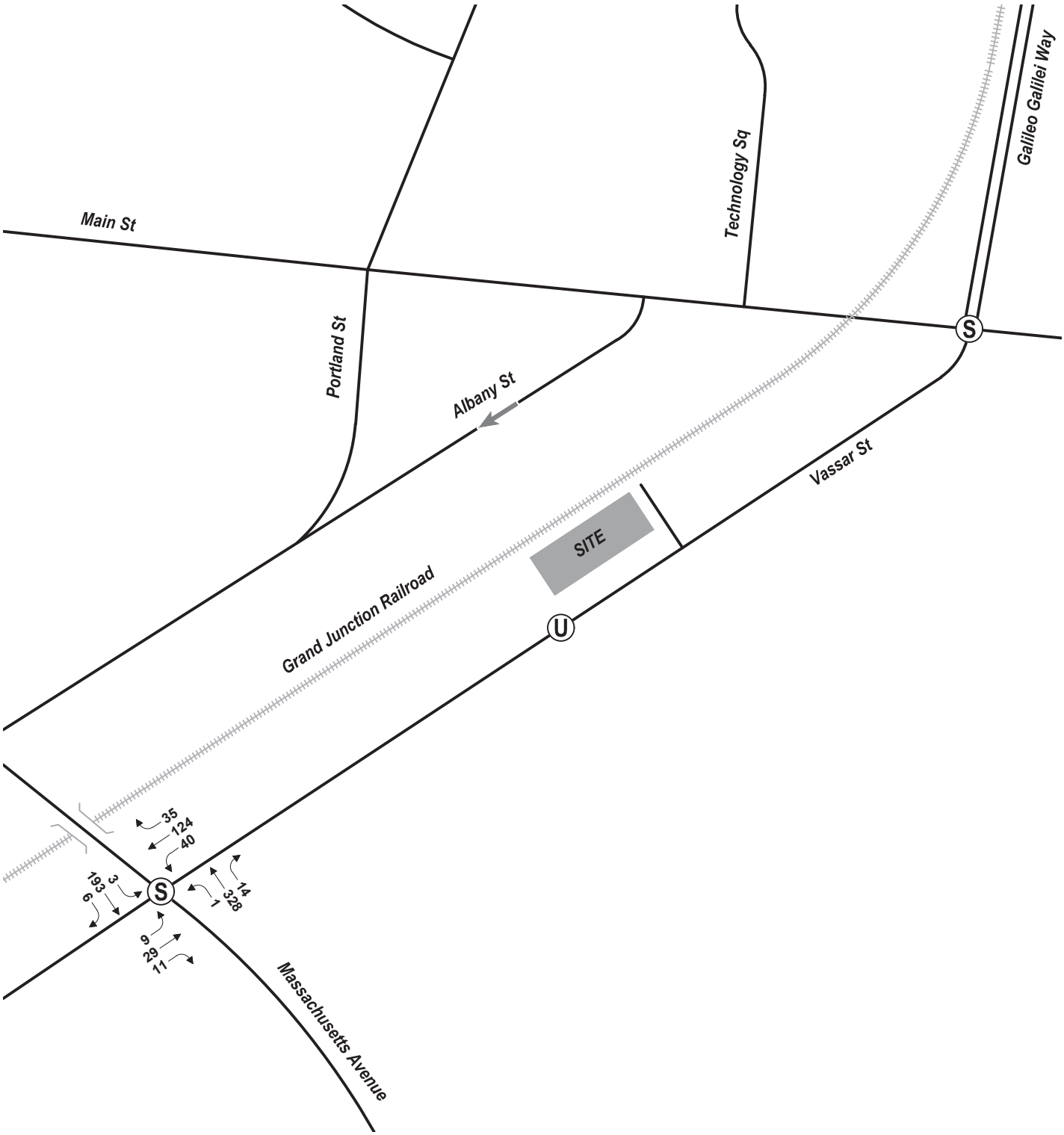


Date of Counts: September 11, 2019

Figure 10a

Morning Peak Hour
Existing Condition Bicycle Volumes

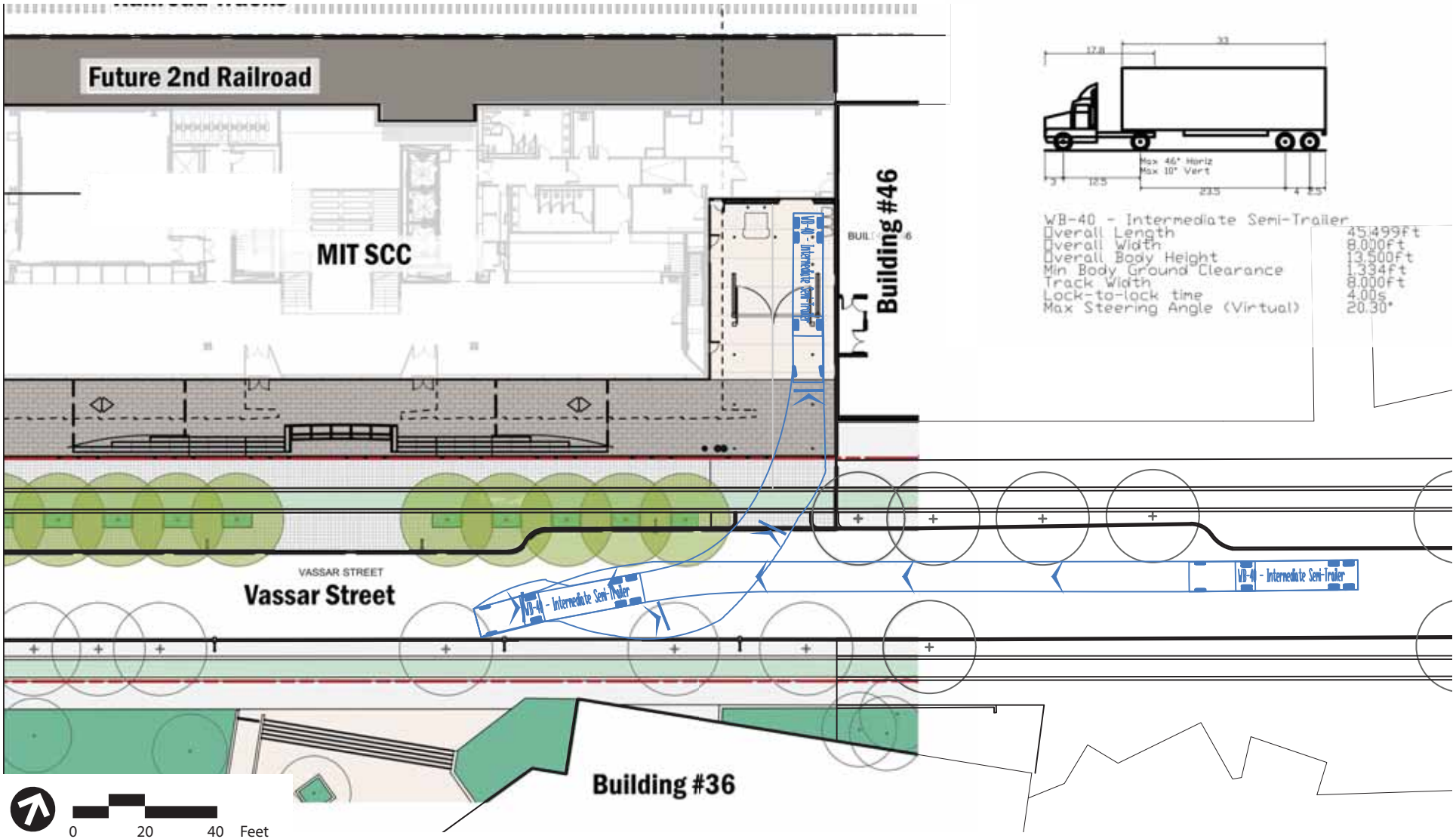
MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Date of Counts: September 11, 2019

Figure 10b
Evening Peak Hour
Existing Condition Bicycle Volumes

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

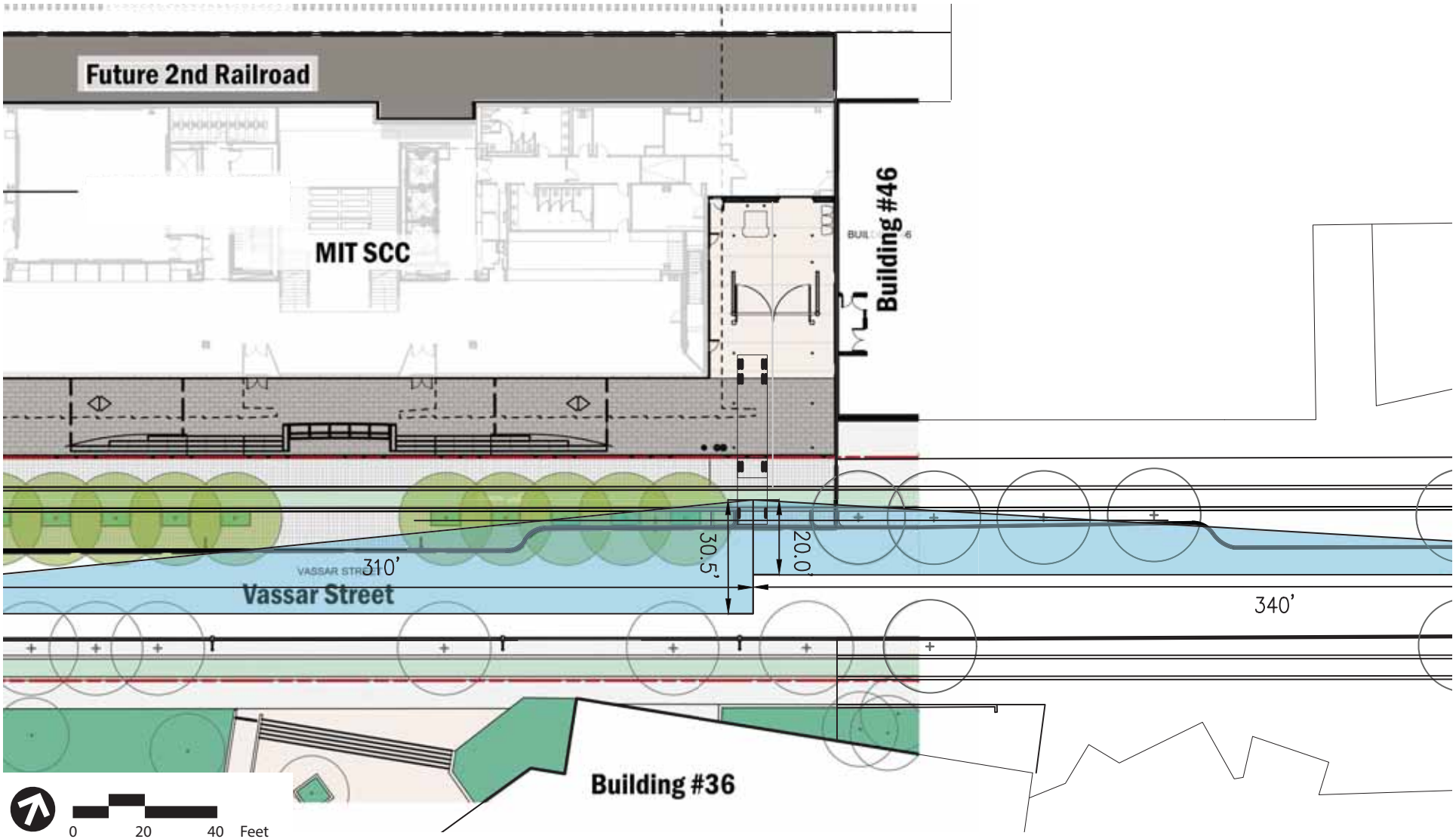


Base provided by SOM

Figure 11

Turning Movement Diagram: WB-40

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts



Base provided by SOM

Figure 12

Intersection Sight Distance

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

RESERVED SPACE CODES						
	AB	AMBULANCE BAY	HP	HANDICAP	PH	PRESIDENT'S HOUSE
	AF	ALTERNATE FUEL VEHICLE	HV	HANDICAP - VAN ACCESSIBLE	R	RESERVED
	C	COMPACT	IS&T	INFO. SERVICES TECH	ROTC	RESERVED OFFICER TRAINING CORP
	CD	CAMPUS DINING	L1	LOADING - 15 MIN.	SV	SERVICE VEHICLES
	CL	CAR POOL	L2	LOADING - 20 MIN.	TC	TEMPORARY CONSTRUCTION
	CP	CAMPUS POLICE	L3	LOADING - 30 MIN.	TCC	TECH. CHILD CARE - 30 MIN.
	ER	EAST GATE RESIDENTS	MC	MOTORCYCLES	V	VISITOR
	EV	ELECTRIC VEHICLE CHARGING	ML	MAGNET LAB	VL	VAN POOL
	F	FACULTY	MM	MIT MUSEUM	VP	SENIOR ADMINISTRATION
	FV	FACILITIES	MR	MEDICAL RESERVE	Z	ZIP CAR
	H	HEAD OF HOUSE	PF	PLASMA FUSION		

Sources:
Basemap: Facility Information Systems (2020)

MIT Parking Inventory 2019 - 2020

500 Feet

Figure 13

MIT Parking Facilities

MIT Stephen A. Schwarzman College of Computing
Cambridge, Massachusetts

PROPOSED STUDY SCOPE – 8/20/2020

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Memorandum

To: Joseph Barr
Adam Shulman
City of Cambridge
Traffic, Parking and Transportation
Department

Date: August 20, 2020

Project #: 14926.00

From: Selma Mandzo-Preldzic, PE
Adriana Santiago

Re: MIT Stephen A. Schwarzman College of Computing
Proposed Scope for Transportation Access & Circulation Study

Introduction and Project Overview

Massachusetts Institute of Technology (MIT) is proposing to redevelop the existing MIT Cyclotron site (known as Building 44) with a new academic and institutional building, the MIT Stephen A. Schwarzman College of Computing (the Project), located at 51 Vassar Street in Cambridge, MA (the Site). The existing approximately 16,200 gross floor area (GFA) building will be demolished, and a new mixed-use building will be constructed that includes institutional and academic uses in support the SCC College program requirements, including office space, research laboratory space, academic space, event space, collaboration and meeting space, and café space totaling approximately 173,000 GFA, or approximately 156,800 net new GFA. The approximately 3,000 GFA café space will be open to the public but is not considered to be a destination retail location that would draw regional traffic.

The proposed academic building will house a population of 850 faculty/staff/students on an average day, the majority of whom are already on the MIT campus. The net new occupants to the site will include approximately 160 faculty/staff and approximately 280 students.

Vehicle parking will not be available on-site. Building occupants who drive and park on-campus, will be able to do so in an existing MIT parking facility. No additional parking spaces will be added to the MIT parking supply, the expectation is for the net new occupants who drive and park on-campus to use MIT's existing vehicle parking supply.

It was determined that a Transportation Impact Study, certified by the City of Cambridge Traffic, Parking, and Transportation (TP&T) Department is not required for this Project. Instead a "Transportation Access & Circulation Study" (the "Study") will be developed for TP&T review. The study will review the circulation and access needs of the project, consider the effects of such circulation and access, and explore any necessary changes in building plans or mitigation needed.

This document serves as the proposed scope that VHB intends to complete as part of the Transportation Access & Circulation Study. While TP&T's approval of the scope is not required, VHB would like to solicit feedback and input on the study outline below.

Figure 1 shows the existing site location, while Figure 2 illustrates the proposed site plan.

99 High Street
10th Floor
Boston, MA 02110-2354
P 617.728.7777

Memorandum

Study Area

The study will focus on the following intersections

- Vassar Street at Main Street
- Vassar Street at Massachusetts Avenue
- Mid-block crossing on Vassar Street, adjacent to Project site

The study will include a description for each location, field inventory layout with dimensions, and graphics that show the existing pedestrian, bicycle, and vehicle volumes.

No new counts or queue observations will be conducted, instead VHB will rely on historic data available from the City's TP&T and CDD staff from permanent count stations, and other City sources.

Program and Trip Generation

A trip generation analysis will be conducted to estimate the number of pedestrian, bicycle, and vehicle traffic that will be generated by the proposed Project. Table 1 shows the proposed program and land use code assumptions.

Table 1 Proposed Trip Generation Assumptions

Project Component	Program (Net-New)	ITE Land Use Code	Mode Share Rate Sources
Academic	153,800 sf (160 faculty/staff and 280 students)	LUC 550 – University/College	2019 MIT Town Gown
Retail	3,000 sf	LUC 820 – Retail/Shopping Center	K2C2/PTDM Data
Total	156,800 sf		

No vehicle capacity analysis will be conducted as part of this study. The vehicle trip generation will be presented for informational purposes only.

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Memorandum

Pedestrian Analysis

The pedestrian analysis will focus on:

- Pedestrian access to/from the site
- Consistency with future Grand Junction plans
- VHB will review the desire lines and safety issues related to mid-block crosswalk locations and develop a pros/cons list for installing a second crosswalk directly in front of the front door of the site.

Bike Analysis

The bicycle analysis will focus on:

- Bike access to the site and building
- Connection with the cycle track on Vassar Street and with the Grand Junction crossing
- Number of indoor/long-term bicycle parking spaces and outdoor/short-term bicycle parking spaces
- Review of the existing BlueBikes usage at nearby stations

Transit Analysis

The transit analysis will focus on:

- MBTA Bus Routes CT2, 1, EZ Ride and MIT Shuttles
- The transit analysis will describe current bus route stops, and if the re-located students and staff will change which bus stop they use.

Crash Analysis

The crash analysis will present the latest 3 years of crash data available from the City of Cambridge Police Department, supplemented with MassDOT data. Bicycle and pedestrian crash rates will be listed separately. Crash rates will be compared to district and statewide averages.

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Parking Analysis

The existing 22 parking spaces that are currently on-site will be relocated off-site. The parking analysis will focus on:

- A parking supply calculation using zoning ratios
- A parking demand calculation for the Proposed program, using population/density
- A description of the current MIT campus wide parking supply and a description of where the existing 22 spaces will be relocated to.

Loading/Service Access

The loading/servicing analysis will focus on:

- The proposed loading off Vassar Street
- A turning movement analysis for an SU truck using the loading dock
- A sightline analysis
- Calculation of expected truck activity levels
- TNC drop-off/pick-up locations

TDM and Mitigation

The study will include a summary of MIT's TDM programs for students and employees and a summary of the transportation impacts of the Project and the proposed mitigation.

Please do not hesitate to contact Adriana Santiago or Selma Mandzo-Preldzic if you have any questions or need additional information. We look forward to your input on the proposed scope.

Thank you for your assistance.

CC: Kelley Brown, MIT; Emma Corbalan, MIT; Travis Wanat, MIT

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Source: Google Earth

Study Area Intersections:

1. Vassar Street at Main Street/Galileo Galilei Way
2. Vassar Street at Massachusetts Avenue
3. Mid-block crossing on Vassar Street, adjacent to Project Site

Site Location

Signalized Intersection

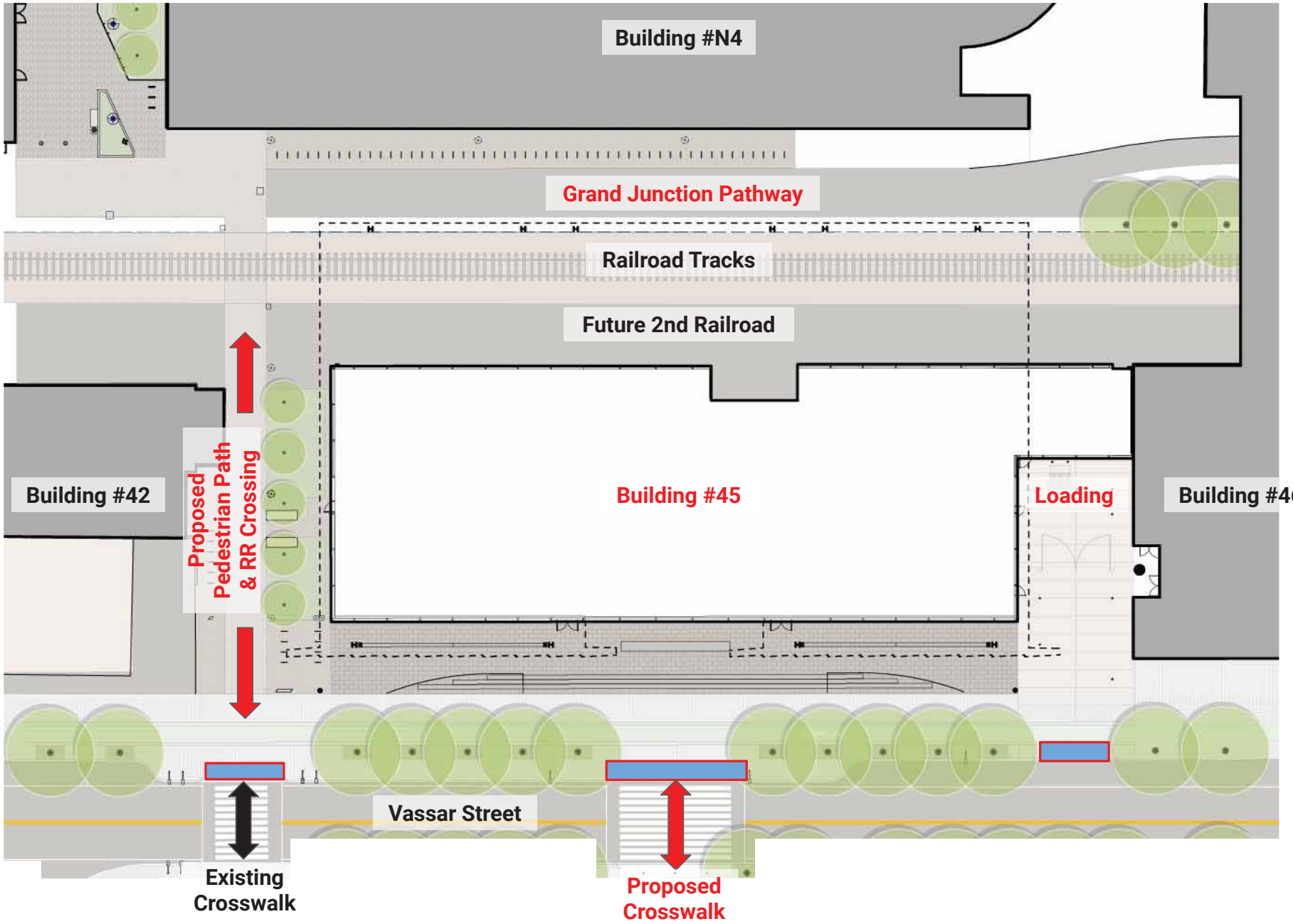
Un-signalized Intersection

vhb

Existing Site Location

Figure 1

MIT Schwarzman College of Computing
Cambridge, MA



Not to Scale

Proposed Site Plan

Figure 2

MIT Schwarzman College of Computing
Cambridge, MA

EXISTING BLUBIKES DATA

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MIT SCC
Project # 14926.00

Trips originating at MIT Stata Center
October 2019

Date	Trip Starts	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	AM Peak	PM Peak	Mid-Day Peak	Off-Peak
10/1/2019	282			282					6	91	16	169
10/2/2019	210				210				5	47	25	133
10/3/2019	256					256			5	89	19	143
10/4/2019	194						194		4	26	32	132
10/5/2019	89							89	1	22	8	58
10/6/2019	108	108							1	29	12	66
10/7/2019	241		241						3	88	20	130
10/8/2019	280			280					5	90	17	168
10/9/2019	181				181				3	37	15	126
10/10/2019	221					221			3	66	23	129
10/11/2019	102						102		4	19	28	51
10/12/2019	89							89	2	27	7	53
10/13/2019	104	104							0	22	11	71
10/14/2019	157		157						7	36	7	107
10/15/2019	235			235					2	67	23	143
10/16/2019	240				240				4	83	25	128
10/17/2019	215					215			3	74	18	120
10/18/2019	167						167		1	29	29	108
10/19/2019	72							72	2	18	7	45
10/20/2019	94	94							1	26	11	56
10/21/2019	241		241						6	70	13	152
10/22/2019	262			262					4	92	24	142
10/23/2019	236				236				2	72	22	140
10/24/2019	246					246			4	72	19	151
10/25/2019	163						163		4	16	30	113
10/26/2019	93							93	2	19	11	61
10/27/2019	33	33							0	6	4	23
10/28/2019	208		208						4	56	14	134
10/29/2019	218			218					3	81	25	109
10/30/2019	198				198				7	70	16	105
10/31/2019	177					177			1	91	10	75
TOTAL	**5612**	**339**	**847**	**1277**	**1065**	**1115**	**626**	**343**	**99**	**1631**	**541**	**3341**
AVERAGE	**181**	**85**	**212**	**255**	**213**	**223**	**157**	**86**	**3**	**53**	**17**	**108**
								5612				**5612**

	Tues. - Thurs.	Mon., Fri.	Weekend
	3457	1473	682
(check)	3457	1473	682
	230	**184**	**85**

	AM Peak 7:30 - 9:30 AM	Mid-Day Peak 11:00 - 1:00 PM	PM Peak 4:30 - 6:30 PM	Off-Peak All Other Times
T-Th	57	297	1122	1981
M, F	33	173	340	927
Wknd.	9	71	169	433
	4	**20**	**75**	**132**

MIT SCC
Project # 14926.00

Trips ending at MIT Stata Center
October 2019

Date	Trip Ends	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	AM Peak	Mid-Day Peak	PM Peak	Off-Peak
10/1/2019	140			140					35	21	17	67
10/2/2019	135				135				33	8	26	68
10/3/2019	164					164			30	21	15	98
10/4/2019	165						165		42	12	32	79
10/5/2019	90							90	9	17	18	46
10/6/2019	104	104							8	13	19	64
10/7/2019	159		159						27	17	26	89
10/8/2019	149			149					36	16	19	78
10/9/2019	112				112				33	6	11	62
10/10/2019	136					136			31	18	23	64
10/11/2019	89						89		34	2	23	30
10/12/2019	68							68	1	7	14	46
10/13/2019	84	84							12	15	20	37
10/14/2019	113		113						27	18	18	50
10/15/2019	160			160					31	13	20	96
10/16/2019	112				112				31	12	10	59
10/17/2019	131					131			30	8	25	68
10/18/2019	127						127		29	18	22	58
10/19/2019	62							62	2	10	14	36
10/20/2019	94	94							5	21	7	61
10/21/2019	131		131						35	14	14	68
10/22/2019	141			141					30	22	21	68
10/23/2019	134				134				29	29	22	54
10/24/2019	119					119			29	16	16	58
10/25/2019	141						141		32	14	26	69
10/26/2019	85							85	8	15	13	49
10/27/2019	27	27							5	4	5	13
10/28/2019	132		132						47	12	16	57
10/29/2019	131			131					32	17	25	57
10/30/2019	111				111				32	17	16	46
10/31/2019	87					87			28	10	8	41
TOTAL	**3633**	**309**	**535**	**721**	**604**	**637**	**522**	**305**	**793**	**443**	**561**	**1836**
AVERAGE	**117**	**77**	**134**	**144**	**121**	**127**	**131**	**76**	**26**	**14**	**18**	**59**
								3633				**3633**

	Tues. - Thurs.	Mon., Fri.	Weekend
	1962	1057	614
(check)	1962	1057	614
	131	**132**	**77**

	AM Peak	Mid-Day Peak	PM Peak	Off-Peak
T-Th	470	274	234	984
M, F	273	177	107	500
Wknd.	50	110	102	352
	31	**18**	**16**	**66**

CRASH DATA

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INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Cambridge COUNT DATE : XX-XX

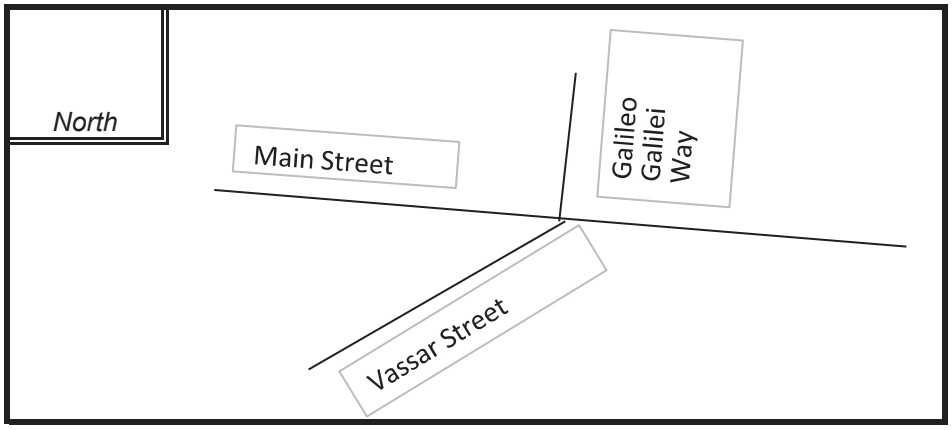
DISTRICT : 6 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Main Street

MINOR STREET(S) : Vassar Street

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	SB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	453	611	544	207		**1,815**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **20,167**

TOTAL # OF CRASHES : 15

OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **5.00**

CRASH RATE CALCULATION : **0.68**

RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : PM Peak Hour Vehicle Volumes

Project Title & Date: MIT Schwarzman College of Computing - Transportation Access and Circulation St

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Cambridge COUNT DATE : XX-XX

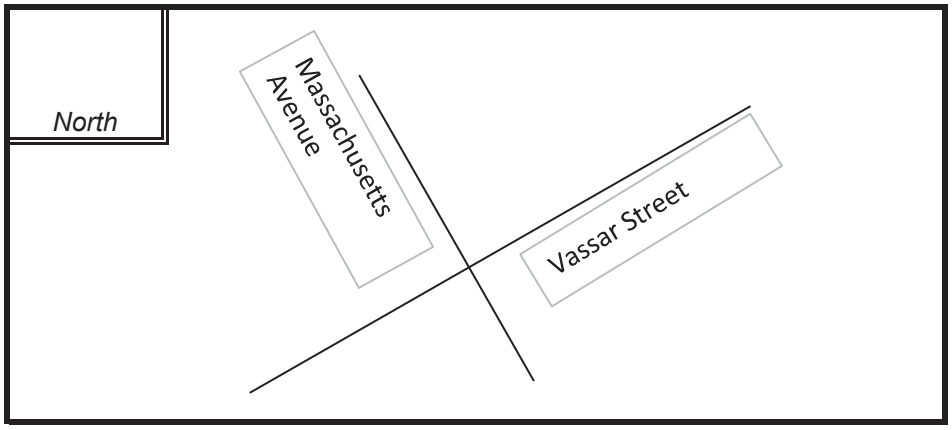
DISTRICT : 6 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Massachusetts Avenue

MINOR STREET(S) : Vassar Street

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	SB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	767	337	543	360		**2,007**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **22,300**

TOTAL # OF CRASHES : 27 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **9.00**

CRASH RATE CALCULATION : **1.11** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : PM Peak Hour Vehicle Volumes

Project Title & Date: MIT Schwarzman College of Computing - Transportation Access and Circulation St

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Cambridge COUNT DATE : XX-XX

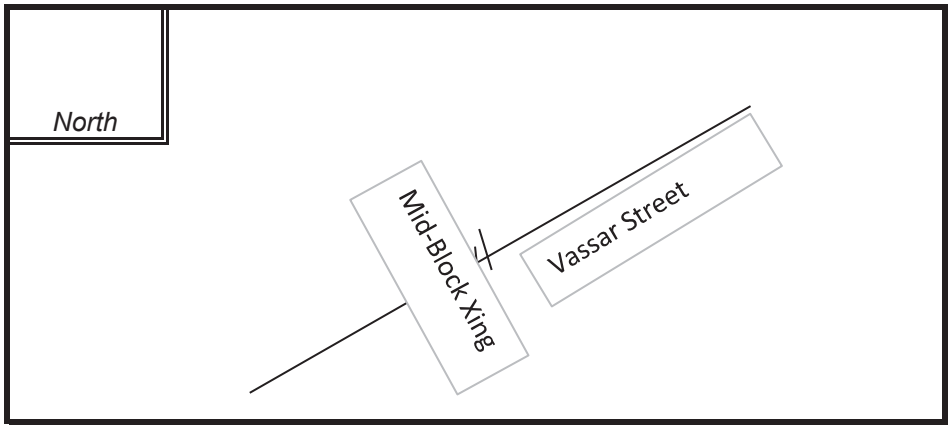
DISTRICT : 6 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Vassar Street

MINOR STREET(S) : Mid-Block Crossing

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	EB	SB	WB		
PEAK HOURLY VOLUMES (AM/PM) :	567		464			**1,031**

" K " FACTOR : **0.090** INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **11,456**

TOTAL # OF CRASHES : 8 # OF YEARS : 3 AVERAGE # OF CRASHES PER YEAR (**A**) : **2.67**

CRASH RATE CALCULATION : **0.64** RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : PM Peak Hour Vehicle Volumes

Project Title & Date: MIT Schwarzman College of Computing - Transportation Access and Circulation St

Intersection	Object ID	Date	Time	Day of Week	Object 1	Object 2	Street Name	Cross Street	Near Street	May involve cyclist	May Involve Pedestrian	Manner of Collision	Ambient Light	Weather Condition 1	Road Surface Condition	Work Zone	Street or Intersection
1	29	4/23/2015	7:20 AM	Thursday	PASSENGER CAR		MAIN ST	GALILEO WAY		1		REAR-END	DAYLIGHT	CLEAR			
1	1303	8/31/2015	3:54 PM	Monday	LIGHT TRUCK(VAN, MIN	TRACTOR / SEMI-TRIALE	MAIN STREET	VASSAR STREET				SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
1	1436	10/3/2015	11:28 AM	Saturday	SINGLE UNIT TRUCK (3 OR MORE AXLES)		VASSAR STRE	MAIN STREET		1		SIDESWIPE, S	DAYLIGHT	SLEET, HAIL,	WET	NO	INTERSECTIO
1	1658	12/17/2015	4:31 PM	Thursday	PASSENGER CAR		MAIN ST	GALELEIO WAY			1	SINGLE VEHI	DARK - LIGHT	RAIN	WET	NO	INTERSECTIO
1	3011	10/9/2016	9:04 PM	Sunday	PASSENGER CAR		VASSAR STRE	MAIN STREET			1	SINGLE VEHI	DARK - LIGHT	RAIN	WET	NO	INTERSECTIO
1	3515	5/4/2017	12:40 PM	Thursday	PASSENGER CAR		MAIN ST	GALILEO GALILEI WAY			1	ANGLE	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
1	3968	8/8/2017	12:10 PM	Tuesday	PASSENGER CAR	BUS SEATS MORE THAN	VASSAR ST	MAIN ST				SIDESWIPE, S	DAYLIGHT	CLOUDY	DRY	NO	INTERSECTIO
1	4060	8/3/2017	8:54 PM	Thursday	LIGHT TRUCK(VAN, MINI	VAN, PICK-UP, SPORT	MAIN ST	GALILEO GALILEI WAY			1	HEAD ON	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
1	4191	7/26/2017	11:26 PM	Wednesday	PASSENGER CAR	PASSENGER CAR	MAIN STREET	VASSAR STREET				ANGLE	DARK - LIGHT	CLEAR	DRY	NO	INTERSECTIO
2	72	2/18/2016	9:00 AM	Thursday	PASSENGER CAR		MASS AVE	VASSAR ST		1		ANGLE	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	475	2/27/2015	4:49 PM	Friday	LIGHT TRUCK(VAN, MINI	VAN, PICK-UP, SPORT	MASS AV	VASSAR ST		1		REAR-END	DAYLIGHT	CLEAR	SNOW	NO	INTERSECTIO
2	940	5/6/2015	8:31 PM	Wednesday	PASSENGER CAR	BUS SEATS MORE THAN	MASSACHUS	VASSER STREET				REAR-END	DUSK	CLEAR	DRY	NO	INTERSECTIO
2	1075	7/9/2015	10:15 AM	Thursday	PASSENGER CAR	BUS SEATS MORE THAN	MASS AVE	VASSAR ST				ANGLE	DAYLIGHT	CLOUDY	DRY	NO	INTERSECTIO
2	1634	10/23/2015	7:10 AM	Friday	OTHER		MASS AVE	VASSAR ST			1	ANGLE	DAYLIGHT	CLOUDY	DRY	NO	INTERSECTIO
2	1887	1/31/2016	1:09 PM	Sunday	PASSENGER CAR		MASS AVE	VASSAR STREET		1		SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	2494	6/8/2016	2:15 PM	Wednesday	PASSENGER CAR		MASS AVE	VASSAR ST		1		ANGLE	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	2885	8/21/2016	3:05 PM	Sunday			MASS AVE	VASSAR STREET		1		SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	2995	8/28/2016	9:26 PM	Sunday	PASSENGER CAR		MASSACHUS	VASSAR ST.				SIDESWIPE, S	DARK - LIGHT	CLEAR	DRY	YES	INTERSECTIO
2	3101	11/4/2016	9:18 AM	Friday	LIGHT TRUCK(VAN, MINI	VAN, PICK-UP, SPORT	MASS.AVE	VASSAR STREET			1	SINGLE VEHI	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	3226	11/10/2016	10:16 AM	Thursday	PASSENGER CAR		MASSACHUS	VASSAR STREET		1		SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	3332	11/16/2016	9:42 AM	Wednesday	PASSENGER CAR		MASS AVE	VASSAR ST		1		SIDESWIPE, C	DAYLIGHT	CLOUDY	WET	NO	INTERSECTIO
2	3516	4/2/2017	6:18 PM	Sunday	LIGHT TRUCK(VAN, MINI	VAN, PICK-UP, SPORT	MASSACHUS	VASSAR ST		1		SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	3600	4/29/2017	9:33 PM	Saturday	PASSENGER CAR		VASSAR STRE	MASSACHUSETTS AVE			1	HEAD ON	DARK - LIGHT	CLEAR	DRY	NO	INTERSECTIO
2	3948	6/17/2017	2:30 PM	Saturday	TRACTOR / SEMI-TRIALER		MASSACHUS	VASSAR ST		1		SIDESWIPE, S	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
2	4309	9/13/2017	4:46 PM	Wednesday	LIGHT TRUCK(VAN, MIN	PASSENGER CAR	MASS AVE	VASSAR				REAR-END	DARK - LIGHT	CLEAR	DRY	NO	INTERSECTIO
2	4557	8/12/2017	5:10 PM	Saturday	PASSENGER CAR		MASS AVE	VASSAR ST.				UNKNOWN	DAYLIGHT	CLEAR	DRY	NO	INTERSECTIO
3	2889	9/9/2016	8:57 PM	Friday	PASSENGER CAR		VASSAR STREET				1						NON INTERSE
3	4335	10/25/2017	11:25 AM	Wednesday	LIGHT TRUCK(VAN, MIN	PASSENGER CAR	VASSAR ST					REAR-END	DAYLIGHT	RAIN	WET	NO	NON INTERSE
3	4641	12/15/2017	11:50 AM	Friday	UNKNOWN HEAVY TRU	LIGHT TRUCK(VAN, MIN	VASSAR STREET					SIDESWIPE, S	DAYLIGHT	CLOUDY	DRY	NO	NON INTERSE
3	1874	3/3/2016	11:40 AM	Thursday	UNKNOWN HEAVY TRU	PASSENGER CAR	VASSAR ST	0	0	0	0	SAME	DAYLIGHT	CLEAR	DRY		
3	3141	12/22/2016	10:21 AM	Thursday	LIGHT TRUCK(VAN, MIN	TRACTOR / SEMI-TRIALE	VASSAR ST	0	0	0	0	SAME	DAYLIGHT	CLOUDY	DRY		
3	4065	6/1/2017	8:30 AM	Thursday	SINGLE UNIT TRUCK (2	12:00 AM	VASSAR ST	0	0	1	0	ANGLE	DAYLIGHT	CLOUDY	DRY		
3	4641	12/15/2017	11:50 AM	Friday	UNKNOWN HEAVY TRU	LIGHT TRUCK(VAN, MIN	VASSAR STRE	0	0	0	0	SAME	DAYLIGHT	CLOUDY	DRY		
3	4335	10/25/2017	11:25 AM	Wednesday	LIGHT TRUCK(VAN, MIN	PASSENGER CAR	VASSAR ST	0	0	0	0	REAR-END	DAYLIGHT	RAIN	WET		
3	4435	11/8/2017	4:56 PM	Wednesday	LIGHT TRUCK(VAN, MIN	12:00 AM	VASSAR STRE	0	0	0	1	ANGLE	DUSK	CLOUDY	DRY		

Intersection	Crash Number	City Town	Crash Date	Crash Time	Crash Severity	Object1	Object2	StreetName	CrossStreet	Pedestrian	MannerCollis	AmbientLigh	Weather	RoadSurface
1	4022494	CAMBRIDGE	1/20/2015	11:10 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MAIN STREET			Sideswipe, sa	Daylight	Clear	Dry
1	4067825	CAMBRIDGE	4/23/2015	7:20 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MAIN STREET / GALILEO		P2: Cyclist	Rear-end	Daylight	Clear	Dry
1	4102477	CAMBRIDGE	10/3/2015	11:28 AM	Non-fatal injury	V1:(Single-unit truc	V1:(Collision wit	VASSAR STREET / MAIN		P2: Cyclist	Sideswipe, sa	Daylight	Sleet, hail (fre	Wet
1	4112354	CAMBRIDGE	8/31/2015	3:54 PM	Not Reported	V1:(Light truck(van	V1:(Collision wit	MAIN STREET / VASSAR			Sideswipe, sa	Daylight	Clear	Dry
1	4157213	CAMBRIDGE	12/17/2015	4:31 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MAIN STREET / GALILEO		P2: Pedestrian	Single vehicle	Dark - lighted	Rain/Rain	Wet
1	4159023	CAMBRIDGE	3/3/2016	9:30 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	VASSAR ST	MAIN ST		Angle	Daylight	Clear	Dry
1	4175163	CAMBRIDGE	1/17/2016	9:36 PM	Not Reported	V1:(Passenger car)	V1:(Collision wit	MAIN STREET / VASSAR			Single vehicle	Dark - lighted	Snow	Snow
1	4260385	CAMBRIDGE	10/9/2016	9:04 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	VASSAR STREET / MAIN		P2: Pedestrian	Single vehicle	Dark - lighted	Rain/Rain	Wet
1	4333104	CAMBRIDGE	2/28/2017	10:59 PM	Not Reported			MAIN STREET	VASSAR STREET		Single vehicle	Dark - lighted	Clear	Dry
1	4359794	CAMBRIDGE	5/4/2017	12:40 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MAIN ST / GALILEO GAL		P2: Pedestrian	Angle	Daylight	Clear	Dry
1	4399007	CAMBRIDGE	7/26/2017	11:26 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MAIN STREET / VASSAR			Angle	Dark - lighted	Clear	Dry
1	4404529	CAMBRIDGE	8/3/2017	8:54 PM	Non-fatal injury	V1:(Light truck(van	V1:(Collision wit	MAIN ST / GALILEO GAL		P2: Pedestrian	Head-on	Daylight	Clear	Dry
1	4407171	CAMBRIDGE	8/8/2017	12:10 PM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	VASSAR STREET / MAIN			Sideswipe, sa	Daylight	Cloudy	Dry
1	4444036	CAMBRIDGE	10/24/2017	11:12 AM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	VASSAR STREET / MAIN			Sideswipe, op	Daylight	Cloudy/Cloud	Wet
1	4487318	CAMBRIDGE	8/17/2016	8:51 AM	Unknown	V1:(Passenger car)	V1:(Collision wit	GALILEO GALILEI WAY	MAIN STREET		Sideswipe, sa	Daylight	Clear	Dry
2	4041191	CAMBRIDGE	5/6/2015	8:31 PM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN			Rear-end	Dusk	Clear/Clear	Dry
2	4065674	CAMBRIDGE	2/27/2015	4:49 PM	Non-fatal injury	V1:(Light truck(van	V1:(Collision wit	MASS AVENUE / VASSA		P2: Cyclist	Rear-end	Daylight	Clear	Snow
2	4079439	CAMBRIDGE	7/9/2015	10:15 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MASS AVENUE / VASSA			Angle	Daylight	Cloudy	Dry
2	4114682	CAMBRIDGE	10/23/2015	7:10 AM	Non-fatal injury	V1:(Unknown heav	V1:(Collision wit	MASS AVENUE / VASSA		P2: Pedestrian	Angle	Daylight	Cloudy	Dry
2	4133945	CAMBRIDGE	9/17/2015	12:22 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MASS AVENUE	VASSAR STREET	P3: Pedestrian	Sideswipe, sa	Daylight	Clear/Clear	Dry
2	4181129	CAMBRIDGE	1/31/2016	1:09 PM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	MASS AVENUE / VASSA		P2: Cyclist / P3: Cyclist	Sideswipe, sa	Daylight	Clear	Dry
2	4181575	CAMBRIDGE	2/18/2016	9:00 AM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN		P2: Cyclist	Angle	Daylight	Clear	Dry
2	4182763	CAMBRIDGE	4/26/2016	1:45 PM	Property damage only (none injured)	V2:(Passenger car)	V2:(Collision wit	MASSACHUSETTS AVEN	VASSAR STREET		Sideswipe, sa	Daylight	Rain/Cloudy	Wet
2	4203087	CAMBRIDGE	6/8/2016	2:15 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN		P2: Cyclist	Angle	Daylight	Clear	Dry
2	4217300	CAMBRIDGE	7/6/2016	6:00 PM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	MASSACHUSETTS AVEN	VASSAR STREET		Angle	Daylight	Clear	Dry
2	4224254	CAMBRIDGE	7/26/2016	6:07 PM	Unknown	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVE	VASSAR STREET		Angle	Daylight	Clear	Dry
2	4241670	CAMBRIDGE	8/28/2016	9:26 PM	Unknown	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVE F			Sideswipe, sa	Dark - lighted	Clear/Clear	Dry
2	4260383	CAMBRIDGE	10/8/2016	2:23 PM	Unknown	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN	VASSAR STREET		Unknown	Daylight	Cloudy	Dry
2	4277467	CAMBRIDGE	11/4/2016	9:18 AM	Non-fatal injury	V1:(Light truck(van	V1:(Collision wit	MASSACHUSETTS AVEN		P2: Pedestrian	Single vehicle	Daylight	Clear	Dry
2	4284511	CAMBRIDGE	11/10/2016	10:16 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN			Sideswipe, sa	Daylight	Clear	Dry
2	4334170	CAMBRIDGE	3/4/2017	10:19 PM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	VASSAR STREET	MASSACHUSETTS AVEN		Rear-end	Dark - lighted	Clear	Dry
2	4348582	CAMBRIDGE	4/2/2017	6:18 PM	Non-fatal injury	V1:(Light truck(van	V1:(Collision wit	MASSACHUSETTS AVEN		P2: Cyclist	Sideswipe, sa	Daylight	Clear	Dry
2	4355670	CAMBRIDGE	4/24/2017	11:00 AM	Non-fatal injury	V1:(Light truck(van	V1:(Collision wit	MASSACHUSETTS AVEN	VASSAR ST		Rear-end	Daylight	Cloudy	Dry
2	4357612	CAMBRIDGE	4/29/2017	9:33 PM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	VASSAR STREET / MASS			Head-on	Dark - lighted	Clear	Dry
2	4370073	CAMBRIDGE	11/16/2016	9:42 AM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN		P2: Cyclist	Sideswipe, op	Daylight	Cloudy	Wet
2	4380054	CAMBRIDGE	6/17/2017	2:30 PM	Property damage only (none injured)	V1:(Tractor/semi-tr	V1:(Collision wit	MASSACHUSETTS AVEN			Sideswipe, sa	Daylight	Clear/Clear	Dry
2	4389349	CAMBRIDGE	7/12/2017	5:37 PM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	MASSACHUSETTS AVE	VASSAR STREET	P2: Cyclist	Angle	Daylight	Cloudy	Dry
2	4407514	CAMBRIDGE	8/12/2017	5:10 PM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN			Unknown	Daylight	Clear/Clear	Dry
2	4422964	CAMBRIDGE	9/13/2017	4:46 PM	Property damage only (none injured)	V1:(Light truck(van	V1:(Collision wit	VASSAR STREET / MASS			Rear-end	Dark - lighted	Clear/Clear	Dry
2	4440214	CAMBRIDGE	10/13/2017	10:35 AM	Property damage only (none injured)	V1:(Passenger car)	V1:(Collision wit	MASSACHUSETTS AVEN	VASSAR STREET		Sideswipe, sa	Daylight	Clear	Dry
3	4331454	CAMBRIDGE	2/23/2017	11:00 AM	Non-fatal injury	V1:(Passenger car)	V1:(Collision wit	VASSAR ST		P3: Cyclist	Head-on	Daylight	Clear	Dry

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EXISTING VEHICLE COUNTS

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start Time	14-May-15 Thu	NB Morning	NB Afternoon	Hour Totals Morning	Hour Totals Afternoon	SB Morning	SB Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		27	77			11	75				
12:15		13	90			15	81				
12:30		21	104			13	75				
12:45		7	65	68	336	7	93	46	324	114	660
01:00		7	94			5	64				
01:15		13	87			8	76				
01:30		9	94			6	78				
01:45		11	82	40	357	3	84	22	302	62	659
02:00		16	87			8	87				
02:15		4	98			6	96				
02:30		4	101			4	77				
02:45		6	96	30	382	3	67	21	327	51	709
03:00		5	103			4	106				
03:15		8	91			4	111				
03:30		4	110			4	107				
03:45		9	105	26	409	5	94	17	418	43	827
04:00		3	105			12	116				
04:15		2	130			9	89				
04:30		11	127			10	127				
04:45		13	99	29	461	16	121	47	453	76	914
05:00		19	123			11	97				
05:15		23	120			30	101				
05:30		30	147			49	113				
05:45		67	132	139	522	55	116	145	427	284	949
06:00		71	136			60	96				
06:15		70	135			61	103				
06:30		79	127			73	98				
06:45		86	114	306	512	80	78	274	375	580	887
07:00		119	83			107	92				
07:15		116	67			88	68				
07:30		109	68			115	62				
07:45		132	78	476	296	103	60	413	282	889	578
08:00		120	57			105	65				
08:15		127	50			121	30				
08:30		130	56			82	41				
08:45		115	50	492	213	115	39	423	175	915	388
09:00		116	59			123	43				
09:15		125	49			96	35				
09:30		134	54			98	36				
09:45		104	54	479	216	111	41	428	155	907	371
10:00		108	48			91	35				
10:15		103	38			71	60				
10:30		86	34			79	49				
10:45		94	34	391	154	85	36	326	180	717	334
11:00		100	35			77	23				
11:15		94	36			73	18				
11:30		99	30			81	28				
11:45		91	24	384	125	81	19	312	88	696	213
Total		2860	3983			2474	3506			5334	7489
Percent		41.8%	58.2%			41.4%	58.6%			41.6%	58.4%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start Time	15-May-15 Fri	NB Morning	NB Afternoon	Hour Totals Morning	Hour Totals Afternoon	SB Morning	SB Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		50	77			10	56				
12:15		20	63			15	54				
12:30		16	67			5	79				
12:45		14	58	100	265	13	69	43	258	143	523
01:00		13	84			7	72				
01:15		14	79			3	76				
01:30		17	93			5	86				
01:45		14	73	58	329	13	87	28	321	86	650
02:00		33	79			5	97				
02:15		10	69			9	83				
02:30		8	70			4	92				
02:45		8	70	59	288	7	89	25	361	84	649
03:00		5	104			4	89				
03:15		12	74			8	103				
03:30		8	73			2	107				
03:45		2	81	27	332	5	79	19	378	46	710
04:00		4	94			6	92				
04:15		2	75			8	119				
04:30		8	94			6	97				
04:45		19	89	33	352	11	88	31	396	64	748
05:00		13	70			16	100				
05:15		21	92			31	73				
05:30		42	72			42	76				
05:45		56	67	132	301	56	69	145	318	277	619
06:00		55	76			63	75				
06:15		72	72			68	52				
06:30		69	65			81	63				
06:45		81	79	277	292	74	66	286	256	563	548
07:00		127	61			69	58				
07:15		86	48			84	76				
07:30		98	45			93	54				
07:45		111	54	422	208	88	50	334	238	756	446
08:00		127	33			63	42				
08:15		126	30			78	29				
08:30		132	40			73	29				
08:45		117	36	502	139	93	37	307	137	809	276
09:00		107	39			78	44				
09:15		106	40			100	41				
09:30		115	41			84	40				
09:45		101	43	429	163	84	20	346	145	775	308
10:00		106	43			61	27				
10:15		100	29			68	44				
10:30		85	33			69	41				
10:45		94	37	385	142	69	14	267	126	652	268
11:00		81	34			74	19				
11:15		81	24			71	34				
11:30		79	30			58	29				
11:45		71	26	312	114	69	22	272	104	584	218
Total		2736	2925			2103	3038			4839	5963
Percent		48.3%	51.7%			40.9%	59.1%			44.8%	55.2%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start	16-May-15	NB		Hour Totals		SB		Hour Totals		Combined Totals	
Time	Sat	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		37	48			16	44				
12:15		21	55			13	42				
12:30		22	50			9	37				
12:45		11	38	91	191	17	52	55	175	146	366
01:00		12	49			13	48				
01:15		16	41			15	45				
01:30		12	49			12	42				
01:45		10	43	50	182	5	36	45	171	95	353
02:00		30	50			10	60				
02:15		8	68			11	52				
02:30		9	57			2	50				
02:45		10	32	57	207	9	57	32	219	89	426
03:00		8	58			4	49				
03:15		3	48			4	38				
03:30		6	41			7	44				
03:45		5	44	22	191	6	27	21	158	43	349
04:00		4	41			2	28				
04:15		5	50			1	45				
04:30		5	41			5	43				
04:45		3	37	17	169	7	50	15	166	32	335
05:00		5	53			2	34				
05:15		13	47			13	37				
05:30		18	50			15	34				
05:45		22	55	58	205	16	42	46	147	104	352
06:00		27	47			24	42				
06:15		15	42			17	35				
06:30		14	25			22	44				
06:45		29	46	85	160	27	34	90	155	175	315
07:00		33	51			23	28				
07:15		21	50			17	31				
07:30		25	30			24	33				
07:45		30	29	109	160	28	21	92	113	201	273
08:00		18	35			26	24				
08:15		15	33			25	32				
08:30		44	40			21	27				
08:45		20	36	97	144	22	18	94	101	191	245
09:00		25	39			28	28				
09:15		45	36			31	35				
09:30		36	42			43	24				
09:45		42	26	148	143	36	23	138	110	286	253
10:00		38	37			43	19				
10:15		54	34			38	33				
10:30		37	38			37	24				
10:45		44	41	173	150	37	31	155	107	328	257
11:00		55	26			35	25				
11:15		38	19			24	24				
11:30		41	28			47	22				
11:45		66	17	200	90	43	25	149	96	349	186
Total		1107	1992			932	1718			2039	3710
Percent		35.7%	64.3%			35.2%	64.8%			35.5%	64.5%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start Time	17-May-15 Sun	NB Morning	NB Afternoon	Hour Totals Morning	Hour Totals Afternoon	SB Morning	SB Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		20	28			14	35				
12:15		17	36			13	35				
12:30		15	33			10	39				
12:45		15	58	67	155	11	59	48	168	115	323
01:00		14	53			19	43				
01:15		12	53			5	44				
01:30		14	53			12	38				
01:45		12	45	52	204	10	47	46	172	98	376
02:00		14	47			16	55				
02:15		10	49			15	46				
02:30		7	43			9	32				
02:45		8	50	39	189	6	52	46	185	85	374
03:00		14	43			5	39				
03:15		7	36			7	41				
03:30		1	47			4	54				
03:45		9	40	31	166	2	54	18	188	49	354
04:00		2	36			0	47				
04:15		6	49			1	52				
04:30		12	67			1	39				
04:45		5	41	25	193	2	58	4	196	29	389
05:00		0	73			2	43				
05:15		2	78			8	34				
05:30		10	45			11	50				
05:45		11	63	23	259	7	43	28	170	51	429
06:00		9	55			8	48				
06:15		3	41			8	35				
06:30		13	51			8	48				
06:45		10	56	35	203	11	33	35	164	70	367
07:00		10	69			7	45				
07:15		8	67			11	36				
07:30		17	41			14	33				
07:45		24	27	59	204	11	30	43	144	102	348
08:00		10	38			15	22				
08:15		12	34			15	16				
08:30		25	43			25	38				
08:45		36	41	83	156	27	21	82	97	165	253
09:00		11	30			24	32				
09:15		28	35			34	34				
09:30		24	29			39	22				
09:45		33	32	96	126	38	18	135	106	231	232
10:00		39	19			27	19				
10:15		43	21			47	20				
10:30		53	25			35	28				
10:45		55	33	190	98	36	18	145	85	335	183
11:00		37	9			33	25				
11:15		33	21			29	13				
11:30		42	13			33	7				
11:45		35	13	147	56	29	11	124	56	271	112
Total		847	2009			754	1731			1601	3740
Percent		29.7%	70.3%			30.3%	69.7%			30.0%	70.0%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start	18-May-15	NB		Hour Totals		SB		Hour Totals		Combined Totals	
Time	Mon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		26	86			10	50				
12:15		12	70			7	63				
12:30		8	90			6	61				
12:45		4	77	50	323	10	56	33	230	83	553
01:00		8	63			5	64				
01:15		9	82			4	64				
01:30		6	73			2	55				
01:45		8	98	31	316	1	62	12	245	43	561
02:00		2	71			4	71				
02:15		4	81			4	68				
02:30		7	79			6	81				
02:45		2	85	15	316	2	71	16	291	31	607
03:00		11	91			3	88				
03:15		4	88			5	98				
03:30		6	122			4	87				
03:45		3	114	24	415	7	81	19	354	43	769
04:00		6	113			7	100				
04:15		10	110			4	116				
04:30		7	112			8	88				
04:45		11	96	34	431	14	105	33	409	67	840
05:00		13	134			16	105				
05:15		36	128			24	119				
05:30		33	93			57	114				
05:45		59	104	141	459	59	101	156	439	297	898
06:00		65	103			58	76				
06:15		67	92			56	88				
06:30		83	95			72	74				
06:45		109	76	324	366	67	74	253	312	577	678
07:00		132	76			65	43				
07:15		114	66			68	62				
07:30		123	65			81	40				
07:45		143	56	512	263	86	41	300	186	812	449
08:00		127	47			91	51				
08:15		152	51			86	40				
08:30		120	50			89	40				
08:45		123	42	522	190	94	21	360	152	882	342
09:00		124	43			97	21				
09:15		148	44			85	31				
09:30		100	45			98	31				
09:45		108	34	480	166	88	17	368	100	848	266
10:00		99	28			59	24				
10:15		84	45			84	34				
10:30		92	27			76	30				
10:45		86	27	361	127	51	25	270	113	631	240
11:00		79	25			55	15				
11:15		85	26			62	11				
11:30		80	21			64	13				
11:45		73	17	317	89	64	16	245	55	562	144
Total		2811	3461			2065	2886			4876	6347
Percent		44.8%	55.2%			41.7%	58.3%			43.4%	56.6%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start Time	19-May-15 Tue	NB Morning	NB Afternoon	Hour Totals Morning	Hour Totals Afternoon	SB Morning	SB Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		37	67			11	75				
12:15		11	92			8	64				
12:30		10	74			8	62				
12:45		9	101	67	334	13	56	40	257	107	591
01:00		20	73			11	68				
01:15		7	107			5	41				
01:30		3	96			3	66				
01:45		8	86	38	362	10	62	29	237	67	599
02:00		16	94			3	74				
02:15		2	88			4	77				
02:30		2	84			0	79				
02:45		8	93	28	359	3	76	10	306	38	665
03:00		5	101			6	110				
03:15		3	84			1	98				
03:30		6	127			7	89				
03:45		8	108	22	420	2	92	16	389	38	809
04:00		4	91			3	112				
04:15		4	96			6	90				
04:30		5	118			12	116				
04:45		11	99	24	404	10	105	31	423	55	827
05:00		14	140			18	115				
05:15		23	126			29	126				
05:30		36	107			49	112				
05:45		49	111	122	484	53	83	149	436	271	920
06:00		45	133			71	84				
06:15		76	91			52	89				
06:30		78	101			86	77				
06:45		93	82	292	407	70	72	279	322	571	729
07:00		147	82			80	60				
07:15		129	50			63	46				
07:30		136	68			89	40				
07:45		120	79	532	279	103	47	335	193	867	472
08:00		123	45			93	40				
08:15		135	46			103	47				
08:30		122	37			95	45				
08:45		144	50	524	178	83	36	374	168	898	346
09:00		118	39			105	26				
09:15		105	51			91	44				
09:30		109	42			85	30				
09:45		127	27	459	159	100	30	381	130	840	289
10:00		98	34			75	21				
10:15		101	19			86	38				
10:30		96	40			79	26				
10:45		87	27	382	120	72	47	312	132	694	252
11:00		98	31			69	24				
11:15		84	21			79	11				
11:30		91	19			57	10				
11:45		88	17	361	88	66	13	271	58	632	146
Total		2851	3594			2227	3051			5078	6645
Percent		44.2%	55.8%			42.2%	57.8%			43.3%	56.7%

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start	20-May-15	NB		Hour Totals		SB		Hour Totals		Combined Totals	
Time	Wed	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		35	91			12	69				
12:15		20	87			17	77				
12:30		9	73			6	79				
12:45		11	91	75	342	11	77	46	302	121	644
01:00		11	91			9	60				
01:15		19	73			3	65				
01:30		5	97			6	70				
01:45		6	79	41	340	4	67	22	262	63	602
02:00		19	91			4	97				
02:15		7	84			5	85				
02:30		3	102			6	69				
02:45		5	99	34	376	1	74	16	325	50	701
03:00		4	91			1	84				
03:15		5	117			0	92				
03:30		0	117			3	83				
03:45		6	123	15	448	5	89	9	348	24	796
04:00		6	98			7	115				
04:15		5	105			4	117				
04:30		13	113			6	117				
04:45		18	113	42	429	15	120	32	469	74	898
05:00		18	128			19	98				
05:15		25	121			28	122				
05:30		52	121			53	113				
05:45		47	129	142	499	54	95	154	428	296	927
06:00		62	112			58	87				
06:15		73	109			50	93				
06:30		82	96			83	76				
06:45		89	73	306	390	88	73	279	329	585	719
07:00		157	96			68	65				
07:15		119	83			82	65				
07:30		124	61			96	54				
07:45		118	66	518	306	77	52	323	236	841	542
08:00		140	67			105	40				
08:15		130	55			101	39				
08:30		121	59			105	46				
08:45		147	58	538	239	117	26	428	151	966	390
09:00		124	58			71	36				
09:15		115	44			107	28				
09:30		125	61			89	38				
09:45		123	39	487	202	78	29	345	131	832	333
10:00		111	44			96	27				
10:15		100	46			74	36				
10:30		88	34			70	34				
10:45		110	38	409	162	76	33	316	130	725	292
11:00		106	25			74	16				
11:15		108	18			56	19				
11:30		73	24			82	15				
11:45		108	13	395	80	75	9	287	59	682	139
Total		3002	3813			2257	3170			5259	6983
Percent		44.0%	56.0%			41.6%	58.4%			43.0%	57.0%
Grand Total		16214	21777			12812	19100			29026	40877
Percent		42.7%	57.3%			40.1%	59.9%			41.5%	58.5%
ADT		ADT 10,230		AADT 10,230							

Accurate Counts

978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start	11-May-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM	*	*	*	*	*	*	68	46	100	43	91	55	67	48	82	48
01:00	*	*	*	*	*	*	40	22	58	28	50	45	52	46	50	35
02:00	*	*	*	*	*	*	30	21	59	25	57	32	39	46	46	31
03:00	*	*	*	*	*	*	26	17	27	19	22	21	31	18	26	19
04:00	*	*	*	*	*	*	29	47	33	31	17	15	25	4	26	24
05:00	*	*	*	*	*	*	139	145	132	145	58	46	23	28	88	91
06:00	*	*	*	*	*	*	306	274	277	286	85	90	35	35	176	171
07:00	*	*	*	*	*	*	476	413	422	334	109	92	59	43	266	220
08:00	*	*	*	*	*	*	**492**	423	**502**	307	97	94	83	82	**294**	226
09:00	*	*	*	*	*	*	479	**428**	429	**346**	148	138	96	135	288	**262**
10:00	*	*	*	*	*	*	391	326	385	267	173	**155**	**190**	**145**	285	223
11:00	*	*	*	*	*	*	384	312	312	272	**200**	149	147	124	261	214
12:00 PM	*	*	*	*	*	*	336	324	265	258	191	175	155	168	237	231
01:00	*	*	*	*	*	*	357	302	329	321	182	171	204	172	268	242
02:00	*	*	*	*	*	*	382	327	288	361	**207**	**219**	189	185	266	273
03:00	*	*	*	*	*	*	409	418	332	378	191	158	166	188	274	286
04:00	*	*	*	*	*	*	461	**453**	**352**	**396**	169	166	193	**196**	294	**303**
05:00	*	*	*	*	*	*	**522**	427	301	318	205	147	**259**	170	**322**	266
06:00	*	*	*	*	*	*	512	375	292	256	160	155	203	164	292	238
07:00	*	*	*	*	*	*	296	282	208	238	160	113	204	144	217	194
08:00	*	*	*	*	*	*	213	175	139	137	144	101	156	97	163	128
09:00	*	*	*	*	*	*	216	155	163	145	143	110	126	106	162	129
10:00	*	*	*	*	*	*	154	180	142	126	150	107	98	85	136	124
11:00	*	*	*	*	*	*	125	88	114	104	90	96	56	56	96	86
Lane	0	0	0	0	0	0	6843	5980	5661	5141	3099	2650	2856	2485	4615	4064
Day	0		0		0		12823		10802		5749		5341		8679	
AM Peak	-	-	-	-	-	-	08:00	09:00	08:00	09:00	11:00	10:00	10:00	10:00	08:00	09:00
Vol.	-	-	-	-	-	-	492	428	502	346	200	155	190	145	294	262
PM Peak	-	-	-	-	-	-	17:00	16:00	16:00	16:00	14:00	14:00	17:00	16:00	17:00	16:00
Vol.	-	-	-	-	-	-	522	453	352	396	207	219	259	196	322	303

Accurate Counts

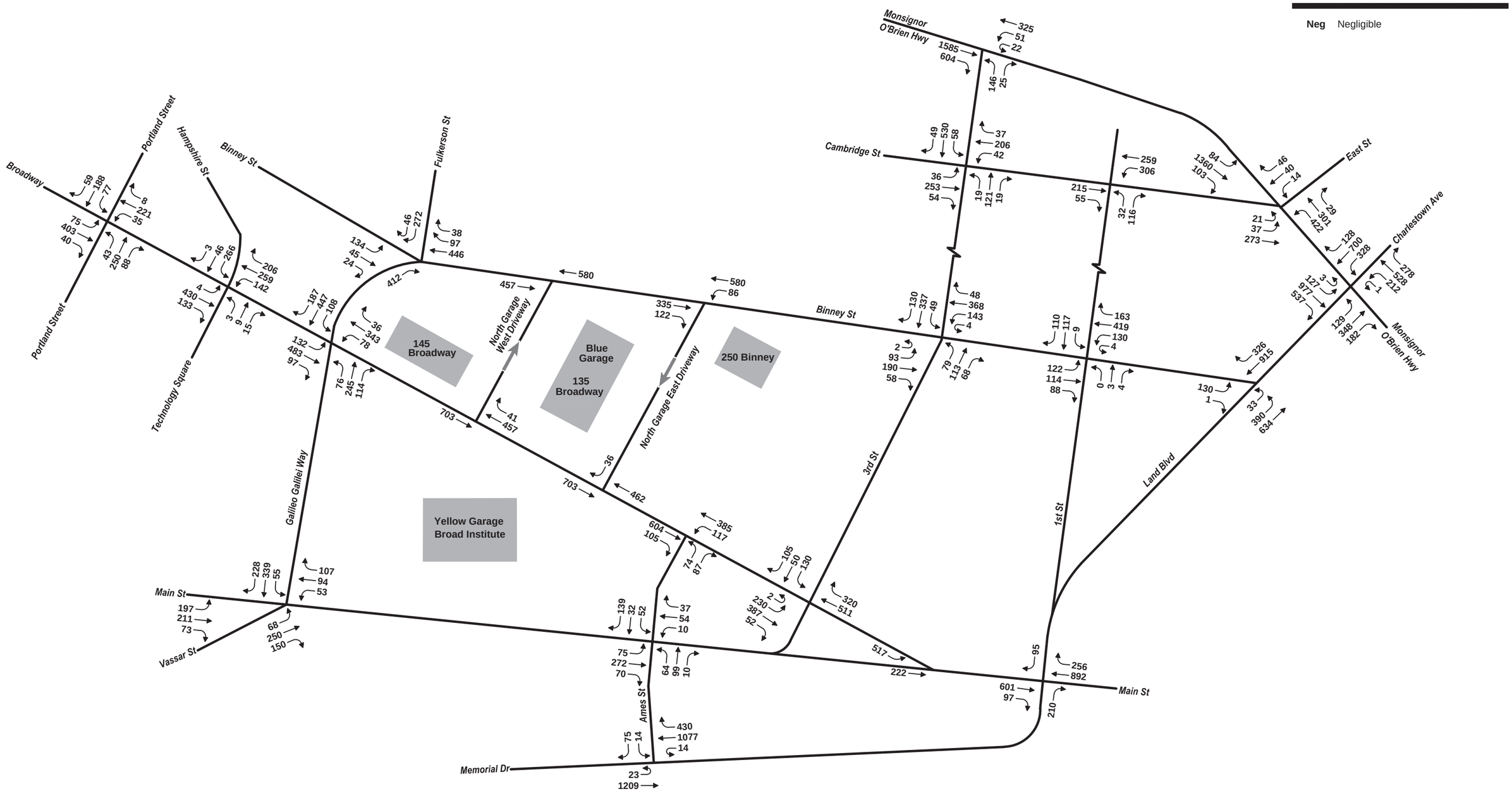
978-664-2565

Location : Vassar Street
Location : South of Main Street
City/State: Cambridge, MA

LG038C05

Start	18-May-15		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM	50	33	67	40	75	46	*	*	*	*	*	*	*	*	64	40
01:00	31	12	38	29	41	22	*	*	*	*	*	*	*	*	37	21
02:00	15	16	28	10	34	16	*	*	*	*	*	*	*	*	26	14
03:00	24	19	22	16	15	9	*	*	*	*	*	*	*	*	20	15
04:00	34	33	24	31	42	32	*	*	*	*	*	*	*	*	33	32
05:00	141	156	122	149	142	154	*	*	*	*	*	*	*	*	135	153
06:00	324	253	292	279	306	279	*	*	*	*	*	*	*	*	307	270
07:00	512	300	**532**	335	518	323	*	*	*	*	*	*	*	*	521	319
08:00	**522**	360	524	374	**538**	**428**	*	*	*	*	*	*	*	*	**528**	**387**
09:00	480	**368**	459	**381**	487	345	*	*	*	*	*	*	*	*	475	365
10:00	361	270	382	312	409	316	*	*	*	*	*	*	*	*	384	299
11:00	317	245	361	271	395	287	*	*	*	*	*	*	*	*	358	268
12:00 PM	323	230	334	257	342	302	*	*	*	*	*	*	*	*	333	263
01:00	316	245	362	237	340	262	*	*	*	*	*	*	*	*	339	248
02:00	316	291	359	306	376	325	*	*	*	*	*	*	*	*	350	307
03:00	415	354	420	389	448	348	*	*	*	*	*	*	*	*	428	364
04:00	431	409	404	423	429	**469**	*	*	*	*	*	*	*	*	421	**434**
05:00	**459**	**439**	**484**	**436**	**499**	428	*	*	*	*	*	*	*	*	**481**	434
06:00	366	312	407	322	390	329	*	*	*	*	*	*	*	*	388	321
07:00	263	186	279	193	306	236	*	*	*	*	*	*	*	*	283	205
08:00	190	152	178	168	239	151	*	*	*	*	*	*	*	*	202	157
09:00	166	100	159	130	202	131	*	*	*	*	*	*	*	*	176	120
10:00	127	113	120	132	162	130	*	*	*	*	*	*	*	*	136	125
11:00	89	55	88	58	80	59	*	*	*	*	*	*	*	*	86	57
Lane	6272	4951	6445	5278	6815	5427	0	0	0	0	0	0	0	0	6511	5218
Day	11223		11723		12242		0		0		0		0		11729	
AM Peak	08:00	09:00	07:00	09:00	08:00	08:00	-	-	-	-	-	-	-	-	08:00	08:00
Vol.	522	368	532	381	538	428	-	-	-	-	-	-	-	-	528	387
PM Peak	17:00	17:00	17:00	17:00	17:00	16:00	-	-	-	-	-	-	-	-	17:00	16:00
Vol.	459	439	484	436	499	469	-	-	-	-	-	-	-	-	481	434

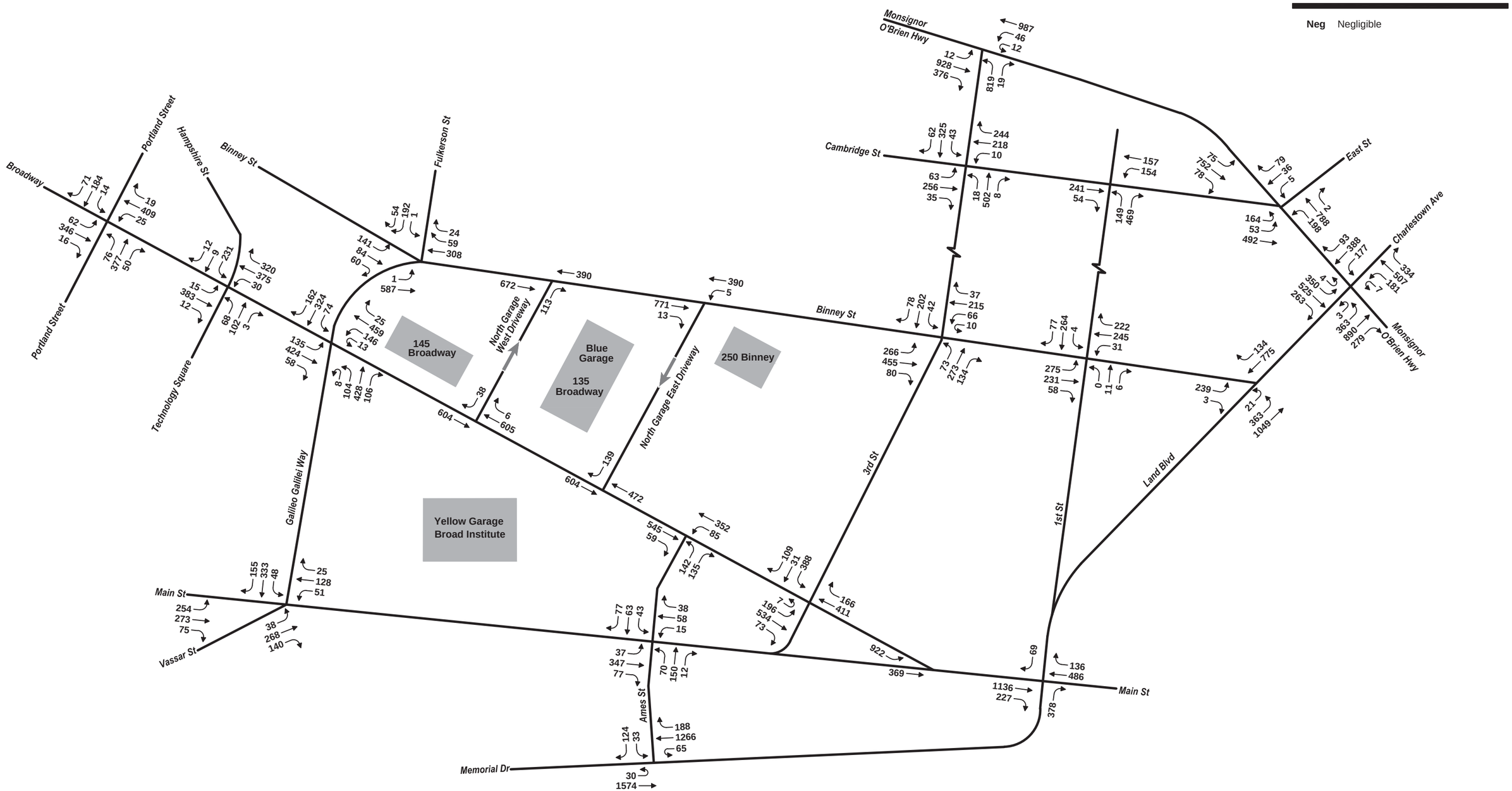
Comb. Total	11223	11723	12242	12823	10802	5749	5341	20408
ADT	ADT 10,230	AADT 10,230						



Note:
Volumes from May 22, 2013 counts presented in the MIT Kendall Square TIS. Vehicle volumes were grown by 0.5 percent per year for three years to estimate the 2016 theoretical existing conditions volumes.

Figure 2.c.1

2016 Theoretical Existing Condition Vehicle Volumes
Morning Peak Hour
Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, Ma



Note:
Volumes from May 22, 2013 counts presented in the MIT Kendall Square TIS. Vehicle volumes were grown by 0.5 percent per year for three years to estimate the 2016 theoretical existing conditions volumes.

Figure 2.c.2
2016 Theoretical Existing Condition Vehicle Volumes
Evening Peak Hour
Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, Ma