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MITI Kendall Square Initiative
Sustainability Design Review Narrative – Building 4
07 October 2016

Introduction
MIT's Kendall Square Initiative is designed to be a leader in urban sustainability revitalization and renewal. MIT has made sustainability an integral part of the project and Building 4's design process. MIT is committed to developing buildings that are sustainably designed, energy efficient, environmentally conscious and healthy for the occupants and visitors that enhance the community.

The Building 4 project team has embraced an integrated design process and includes technical experts who are actively engaged with the design process of both the site and overall SoMa District. This comprehensive view allows the development to incorporate sustainability best practices in design and operation, stormwater capture and reuse, transportation and landscape strategies.

Sustainability Design Review Overview
This memo provides an overview of the sustainability efforts and decisions related to the Building 4 project.

In working with the City of Cambridge to shape the PUD-5 Zoning Requirements, MIT established a minimum commitment to Leadership in Energy and Environmental Design (LEED) Gold. The project will therefore achieve a LEED Gold Rating under the v4 system. The team's efforts have been in developing buildings that are sustainably designed, energy efficient, environmentally conscious, and healthy for the occupants, visitors, and community and committed to earn the buildings at least 60 credit points under the more stringent LEED v4 system, for LEED Gold ratings. MIT's Kendall Square Initiative will be one of the largest LEED v4 collections of projects on the east coast that incorporates the latest energy standards and new sustainability initiatives such as material content disclosure to encourage healthy buildings and indoor environments.

In addition to achieving the LEED project goals, the Building 4 design team has addressed the City of Cambridge's Sustainability requirements and guidelines throughout the design process, as detailed in the following.

- Chapter 1: Consistency with Zoning Requirements
- Chapter 2: Consistency with Sustainability Guidelines
- Chapter 3: LEED Benchmarking

Chapter 1: Consistency with Zoning Requirements
The Building 4 project incorporates best practices for Energy and Emissions, Urban Site and Landscaping, Healthy Living & Working, Transportation, Promotion of Sustainability Awareness, Cool Roofs, and Monitoring. The team has achieved this through the following integrated design measures to enhance the project's environmental performance.

Energy + Emissions
The Building 4 design team recognizes that an important driver in mitigating climate change caused by building operations is to reduce the buildings energy consumption. The reduction in energy and its associated emissions is critical in effective environmental design.

As part of the design process, MIT is exploring the opportunities to improve energy efficiency and reduce greenhouse gas emissions. An integral part of this process is the study of the projected energy demands of the future building and how to best meet them. First and foremost, the design team is focused on reducing the energy demand of the buildings through the integration of high performance facades, efficient building systems, reduced lighting power consumption, advanced controls, efficient equipment, and occupant education programs. The mechanical systems are designed to minimize energy use and maximize flexibility by utilizing high efficiency equipment and a next generation approach to building conditioning.

In tandem with exploring opportunities for building level efficiency improvements for Building 4, the district team performed a comprehensive district energy study that evaluated a wide range of options against multiple criteria, including energy use, emissions, space requirements, regulatory context, market drivers, phasing, and cost. The options evaluated included steam, chilled water, gas, and electricity sourced from on-site district energy plants, MIT's central utility plant, local district steam providers, building by building plants, the local energy utility, and combinations of those different sources. While the design for many of the SoMa buildings is still ongoing, the current results of the study provide a clear direction for further development. Based on the analysis of all criteria, a hybrid approach to the SoMa buildings results in the optimum overall performance including greenhouse gas emissions. The Building 4 design now includes district connections to the MIT CUP for Building 4 as well as the existing buildings at 292 Main St and 290 Main St, E38 and E39 respectively. This allows the project to benefit from emissions reduction strategies, both currently in place and any future improvements taking place at MIT's CUP.

In accordance with LEED v4, the design team has modeled the building based on ASHRAE 90.1-2010 appendix G and the LEED Whole-Building Energy Simulation methodology including the CHP Modeling Guidance. The project is tracking to obtain a 10-20% energy cost savings compared to the baseline building. In addition, through MIT's Energy Consumption Reduction MOU agreement with Eversource, the design team has engaged with Eversource and has further developed energy savings strategies specifically aimed to help reduce the site consumption of the building.

In order to conserve energy and reduce greenhouse gas emissions, Building 4 team has prioritized systems that benefit occupant comfort and energy efficiency while providing reliability and ease of maintenance for units. The greatest savings demonstrated in the building energy model currently come from:

- Variable frequency drives for the hot and chilled water loops
- Valance units within the residential units
- Heat recovery devices in the dedicated outside air units serving the residences
- Enhanced heat recovery effectiveness for air handling units serving non-residential areas
- Enhanced lighting power density and lighting controls
    - Daylight harvesting controls within the offices and common areas of the podium
    - Reduced lighting power density – goal of 20% reduction over ASHRAE90.1-2013 allowance

  Low flow shower heads for residential and non-residential areas. This measure not only reduces the water consumption, but also reduces the demand on the Domestic Hot Water service which will result in energy savings.

As an active and engaged member in City committees and initiatives such as the Net Zero working group, MIT is committed to exceeding local energy standards by incorporating a whole system, integrated approach and to continually revise and re-evaluate design strategies to stay at the forefront of technical developments and improve environmental performance. Energy efficiency and resource conservation are at the heart of the sustainability framework developed for Kendall Square, and will remain a focus for the entire team as the project develops.

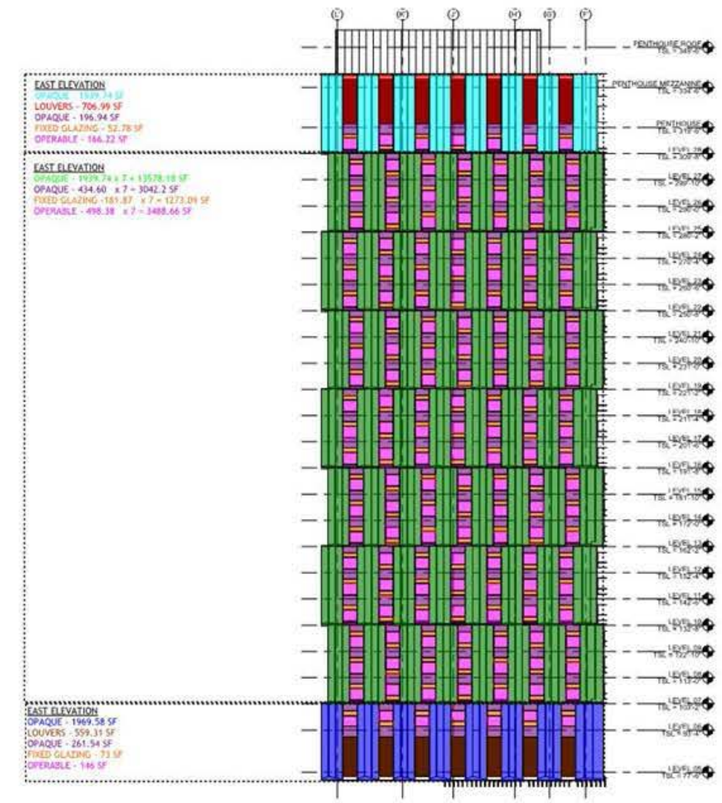
Urban Site + Landscaping – Water Management

As part of the overall development, the design of Building 4 will achieve sustainability in water management and site landscaping strategies while managing domestic potable water consumption. The current design incorporates potable water use reductions, stormwater capture and connection to SoMA open space areas. MIT's housing department has undergone an extensive study of low-flow and flush fixtures to find the most efficient fixtures that will meet operational requirements.

The design team is targeting a minimum reduction of 35% for potable water consumption from efficient fixtures alone, and the current design anticipates over 45% savings from efficient fixtures that have been selected. Academic office spaces and retail spaces will be held to tenant guidelines that will set limits on installed fixtures to align with base building potable water conservation goals.

Healthy Living + Working

Providing healthy living and working environments is a further defining factor of high performance buildings. The Building 4 project incorporates envelope design that maximizes access to daylight and views while providing insulated facades that manage occupant thermal comfort and energy use. The team has balanced increasing insulated panelized facade areas with fenestration that provides views and connections to the outdoors for residents. In addition, the design process for existing building envelope retrofits have included a careful analysis of adding insulation to masonry walls for energy and thermal comfort performance.

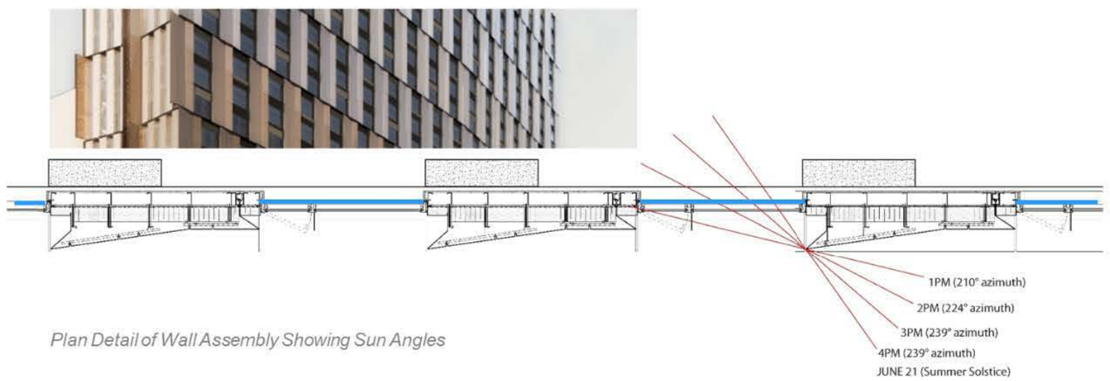


Orientation	AVG SF	Units	Total SF
Southeast/Southwest			
Opaque southeast/southwest level 05-07	246.20	16	3939.16
Opaque southeast/southwest level 07 - 28	242.47	112	27156.36
Opaque southeast/southwest level 28-penthouse roof	242.47	16	3879.48
Louvers southeast/southwest level 05	79.90	14	1118.62
Louvers southeast/southwest level 28-penthouse roof	100.99	14	1413.80
Spandrel southeast/southwest level 06-28	15.63	448	7001.36
Operable glazing southeast/southwest level 06-28	23.61	322	7601.76
Fixed glazing southeast/southwest level 06-28	8.69	322	2797.74

From all areas of the building, direct views through the glazing provides connection to the outdoors for occupants, including quality views to the site open space, neighboring streetscapes, and the Charles River and Boston beyond.

In contrast, external shading has been designed with recessed windows to have limited impact on views while shading the glazing from solar gain and occupants from excessive direct solar glare. This shading will improve thermal comfort for occupants near glazed areas to reduce glare from direct sunlight. In residential spaces, interior shades can further reduce any glare and can be controlled by each residential unit individually.

The diagram below shows the effective shading hours achieved by the external shading to reduce heat gain and glare potential, to improve occupant comfort while maximizing views.



Plan Detail of Wall Assembly Showing Sun Angles

Transportation

MIT continues to encourage alternative transportation through various commuter initiatives, providing commuting options, reduced fare benefits, and alternative transportation infrastructure. The team has considered the types of users for the building and has provided the most beneficial alternative transportation strategies.

This building will connect into the Kendall bicycle transportation network and include site-level bike racks for visitors and transient occupants while the below grade garage will include secure bike racks dedicated to building full time employees and residents.

Moreover, residents of this building can participate in all MIT campus programs, including (web.mit.edu/facilities/transportation):

- Subsidized MBTA passes for busses and trains that pass through campus
- Discounted campus carpool parking program
- Emergency rides home for personal emergencies or late work schedules
- Vanpool subsidy benefits
- Shuttle services

Retail tenants and visitors will have access to street level bicycle parking and connectivity to the surrounding community via public transit.

Promotion of Sustainability Awareness

One of the Innovation Credits the project is considering is Green building education. MIT is evaluating including: educational building dashboards, an informational website, building tours of selected key areas, and signage for sustainable features for residents and visitors.

Initiatives geared at educating new building occupants and users on installed green features is helpful to encourage behaviors and engagement with the environment. This building can also serve as a living lab as part of greater campus wide sustainability programs. MIT has multiple programs that offer research and innovation opportunities as well as a living lab initiative here on campus. These sustainability related groups not only focus on energy reduction, but also agriculture, urban design and planning, global climate change, exploring opportunities to bring technologies to disadvantage social classes, environmental policy, impacts of aviation, and alternative fuels.

Cool Roofs

All roof areas will install high-albedo materials to reflect heat and reduce urban heat island effects. The Solar Reflective Index of the roof material will be an SRI of at least 78. For areas of the childcare program on the podium roof where playground materials are used that do not meet the SRI requirements, the team is committed to providing shading via canopies or landscaped features.

Monitoring

Monitoring building energy data and sharing with the City allows for not only accountability in energy performance but consistency internally in building operations and ongoing identification of operational deficiencies. The project will comply with the City of Cambridge's Building Energy Use Disclosure Ordinance and will be submitted with the rest of the MIT campus buildings. MIT will commit to sharing building energy data annually under this ordinance that supersedes the Zoning Requirements.

MIT and the design team understand the importance of metering building energy data to evaluate whether the building is being operated as efficiently as designed. Building meters will be installed to measure water and energy consumption in line with the LEED v4 requirements. Additional metering of building performance data is likely for tenant spaces and building systems. Having sufficient meters in place will allow building operation to be continuously evaluated over time, evolving to improve performance, increase efficiency, and reduce emissions.

Building meters may also be paired with lobby score board features to display energy performance real-time for residents and/or occupants, going beyond the City's Building Energy Use Disclosure Ordinance, while building awareness for energy conservation.

Chapter 2: Consistency with Sustainability Guidelines

This section outlines the design team's considerations, strategies, and benchmarks with respect to MIT's Kendall Square Initiative Sustainability Guidelines.

The Building 4 design process included integrated design efforts to incorporate proposed strategies from the Net-Zero Action Plan and likely climate conditions as described in the Cambridge Climate Vulnerability Assessment, while considering how such environmental design measures may evolve over time with the changing climate.

A detailed breakdown of the decision making process is outlined below for the primary sustainability guidelines, including how the design investigated and incorporated strategies or where the investigation demonstrated a more efficient or feasible opportunity.

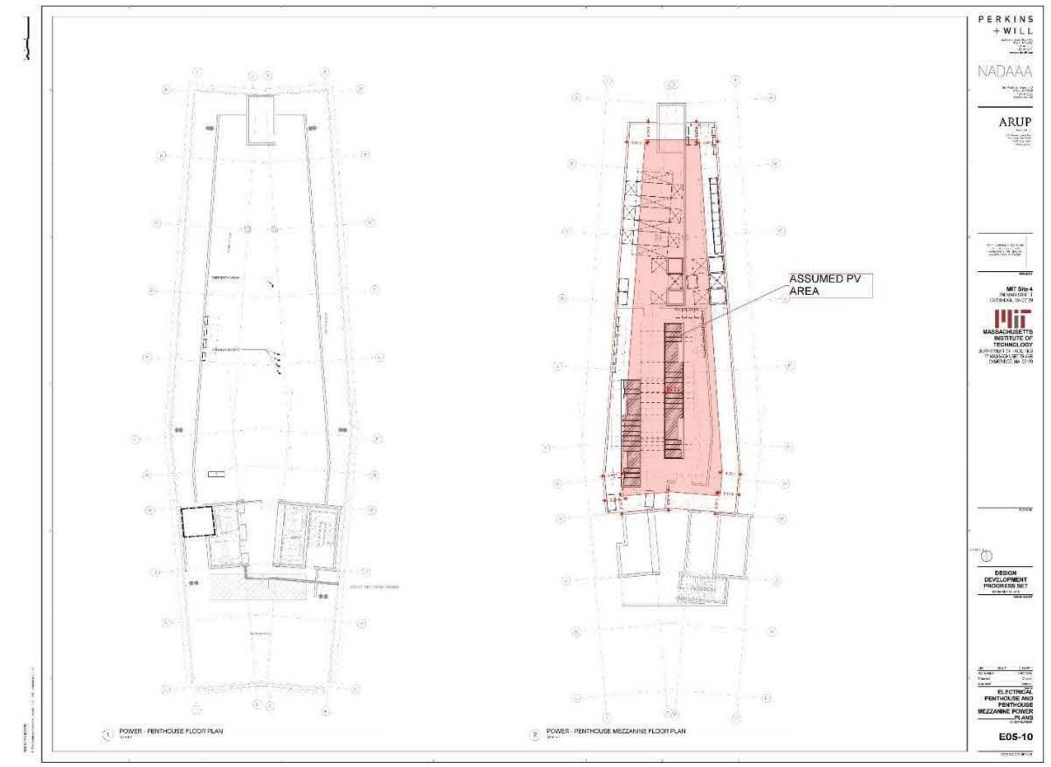
Energy Performance

Building 4 has established a minimum of 10-20% target for reduction in energy cost from the more stringent ASHRAE 90.1-2010/LEED v4 Baseline. The design team will continue to evaluate additional energy efficiency measures as are described in the above section *Design Response to Zoning Requirements: Energy + Emissions*. Moreover, the team is collaborating with Eversource to determine the numerous possibilities where the design can best maximize energy and emissions reductions.

Energy Supply

To date, the design has considered alternative sources of energy, such as solar renewables, district steam, and geothermal heating and cooling.

The design team evaluated opportunities to include PVs on open roof areas; the roof area is small and the majority of it is occupied by mechanical equipment and low roof areas are occupied by the childcare program. In addition, the lower roof areas would be overshadowed by the taller massing which would limit their potential for generating energy.



The design team's evaluation included performance of a test fit for solar renewables to determine if solar energy generation would be viable. The study concluded the potential energy generation of rooftop renewables in the limited square footage available was not viable and the resources required for such generation would be better applied elsewhere for more effective energy efficiency measures on the project. Rooftop renewables could likely only provide up to 2% of the building's annual energy consumption. The team recognizes that as the efficiency of solar panels and energy storage improves future installation could provide not only educational opportunities, but could be contributing power generators to the building.

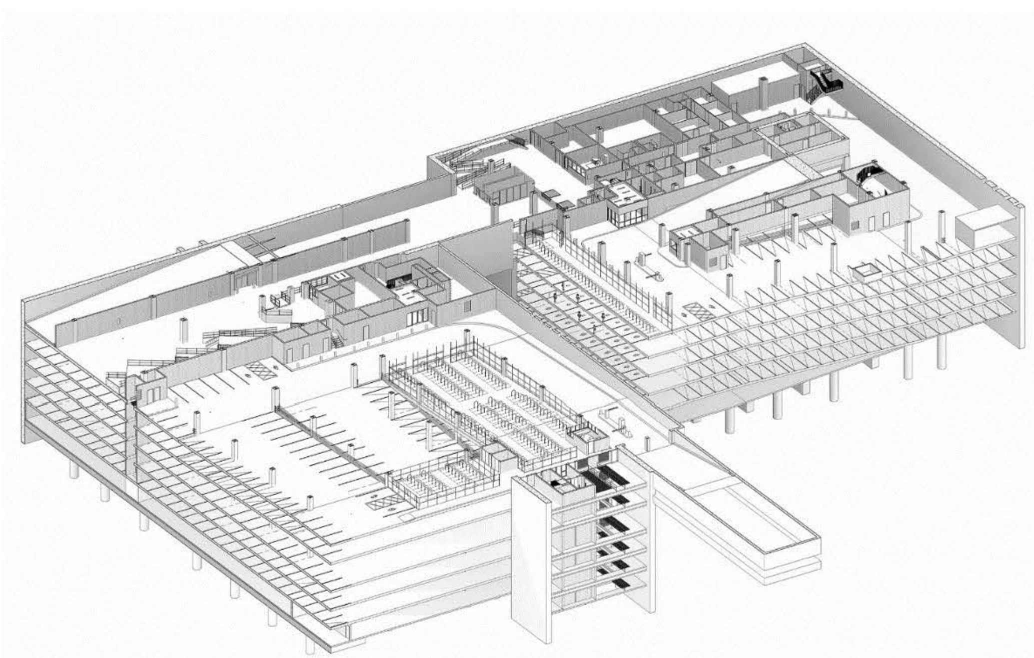
The building façade module is optimized for thermal performance and solar shading. Building integrated renewables were not feasible for the project due to their low efficiencies and high cost.

The design team also considered wind renewables. The consideration was determined to not be viable, as it would generate a small amount of energy and would conflict with other mechanical systems that are located on the roof.

The team performed a comprehensive analysis of potential district steam connections, as outlined in the above section *Consistency with Zoning Requirements: Energy + Emissions*. Building 4 will connect to MIT's Central plant as well as to the existing buildings at 292 Main St and 290 Main St, E38 and E39 respectively..

Lastly, the district SoMa team investigated opportunities for geothermal, or ground source heat pumps, during the early design phases of the project. Ground source heat pumps allow buildings to reject heat to the ground when in cooling and remove heat from the ground for heating during cooler months. Wells are drilled vertically into the ground and require a significant spacing to avoid any interaction between wells underground to maintain efficiency. The site area that would be required to install ground source heat pumps to meet a significant portion of the building's heating and cooling load is greater than the area of the SoMa district.

Comparatively, the near zero lot line of the Building 4 project restricts the access to potential wells which would need to be installed through the below grade garage. The SoMa design team investigated installing a limited number of wells as a demonstration project; however, the below grade garage would limit access to well heads, significantly complicate future maintenance on such a system, and limit future flexibility in use of the garage space.



Ultimately, the building team determined the best course of action was to connect to the MIT cogeneration plant and consider building level investments for energy reductions.

Energy Storage
Energy storage is not feasible for the building due to space considerations. Similarly, the building will connect to the MIT central plant for energy, and any future thermal storage may likely be installed on a campus-wide scale for the central plant network and would benefit this project. The team will continue to consider future opportunities for energy storage.

Commissioning
MIT has adopted the Enhanced Commissioning standards as outlined in LEED. Through ongoing operation, MIT will consider opportunities for recommissioning of building systems to maintain performance and ensure maximum energy savings and emissions reductions.

The Building 4 team has engaged the commissioning agent during the schematic design phase and has included envelope commissioning on the project. The Building 4 team will continue to coordinate with a commissioning agent to meet the requirements. This project will follow MIT's new capital project standard of following a continuous commissioning process. Likewise, MIT has chosen to pursue enhanced envelope commissioning for the project which will provide enhanced verification of the façade from an energy, infiltration, and construction quality perspective to ensure energy requirements and thermal comfort aspirations are met.

Transitioning to Net Zero
The high density building presents a challenge for achieving net-zero energy on a dense urban site. The proposed design reflects new construction being built to the best of currently available technology and efficiency, and embraces new trends in reducing unit size to maximize density to reduce the urban footprint (allowing for maximum open site area) while increasing provided shared communal spaces for community building. The design team continues to evaluate opportunities to reduce energy consumption and the resulting greenhouse gas emissions.

As a result of the campus energy studies, the team has brainstormed pathways for potential emissions reductions, including speculation about future technologies, future greening of the grid, and what it would take to fully electrify our buildings. Additionally, utility scale strategies are continually being considered by the MIT central plant to improve reliability of campus energy services while reducing operational costs and emissions.

Additional savings are likely to be seen in advancement of building controls and active personalization of your environment in spaces. New technologies have the opportunity to be tested and incorporated as tenant turnover happens to bring spaces up to the most current integrated systems. Beyond improvements at the MIT plant, the biggest reduction potential within the building in energy consumption and greenhouse gas emissions for residential buildings will likely be in equipment performance and plug load management.

The team discussed where it sees energy supply and decarbonization in the future, particularly with improvements from the grid electricity sources. However, this building is connected to MIT's Central Utility Plant, and will primarily benefit from future plant improvements in emissions associated with energy generation and distribution.

Resilience
Building 4's design will locate critical equipment above the flood elevation, above Cambridge elevation 26 feet.

In addition, the high performance envelope is well insulated to reduce heat loss and gain and maintain comfortable temperatures during severe weather events, prolonged extreme temperatures and potential power outages. An optional stand-by generation system is being provided for the residential component of the project. The system will provide the residents the opportunity, when applicable, to remain in their dwellings during times of power interruptions.

Building equipment capacities are being designed to account for future temperature changes that will be able to accommodate rising temperatures and increasing average building cooling loads.

Evolving Standards

As the design has progressed, the design team has continued to evaluate the building performance against new guidelines and standards. Mainly, the team has continued to model the building against the LEED v4 ASHRAE 90.1 baseline. This information can be translated to greenhouse gas emissions in addition to energy consumption and cost (as is referenced by LEED) to be in line with any potential future City benchmarks.

MIT and the design team members continue to be engaged with City initiatives and are prepared to respond to new environmental design expectations for the design and operation of the building. MIT and the design teams look forward to continued collaboration with the City and Cambridge Community to develop a sustainable destination in Kendall Square.

Chapter 3: LEED Benchmarking

MIT is committed to LEED Gold projects, suggesting a more stringent benchmark above the City of Cambridge's standard requirement for minimum LEED Silver performance. Reinforcing their commitment, the Kendall Square Initiative projects will achieve LEED Gold. Given the project timeline, the team has decided to pursue LEED version 4 which is more stringent than the previous version of LEED, LEED v3 (2009).

MIT will register an overall LEED Master Site for the Kendall Square Initiatives buildings south of Main Street that will take advantage of combined site, landscape, and transportation strategies. Then, the individual project will achieve the remaining credits required for a Gold rating under the LEED v4 for New Construction system (for Site 4).

The project will be registered with the USGBC and target several credits which span the nine LEED version 4 categories (Integrative Process, Location & Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation in Design Process and the additional Regional Priority Credits) to enable the project to meet the zoning requirements as outlined in the Appendix.

All points below are being pursued unless noted as a maybe/possible credit, if it is determined that some of the credits under consideration will not be attainable.

All LEED Minimum Program Requirements and Prerequisites will be met.

A building specific credit summary unique to Building 4 below outlines the credits IN ADDITION TO Master Site credits that will be pursued at the site level. In total, the Building 4 project is currently projected to earn 65 LEED points, for a LEED Gold Rating commitment.

LEED CREDIT SUMMARY – BUILDING SPECIFIC CREDITS

Building 4 will connect to the Master Site south of Main. The following LEED commitments are made beyond the base Master Site credits to achieve a LEED Gold rating for Building 4.

58 points high probability targeted, +19 medium probability points and 16 low probability points to be studied further for at least 60 points. This totals a current projection of 65 points. (Note, not all Master Site credits will apply for Building 4 due to MIT Parking policies)

Integrative Process

<u>Integrative Process</u>

The design team has completed a preliminary energy model and water budget before the completion of SD and both will be documented in the OPR & BOD.

Location & Transportation

The project site, part of a LEED Master Site, is located on a previously developed site in urban Cambridge, close to several public transportation services including a Massachusetts Bay Transportation Authority subway stop, and public bus services. Occupants shall have access to bicycle racks and showers, as well as preferred parking for hybrid and/or low-emitting vehicles via the Master Site and building facilities.

Credit 7 Reduced Parking Footprint ()
The top level of the garage will provide preferred parking for carpools for 5% of all Master Site full time occupants. The team continues to investigate possible Parking credits.

Credit 8 Green Vehicles
The team continues to evaluate electric charging stations or other low-emitting vehicle priority related to SoMa garage parking.

Sustainable Sites
The team is taking a comprehensive approach to site, landscape, habitat creation, stormwater management, and human use.

Credit 7 Tenant Design and Construction Guidelines (For Core and Shell Retail)
Design requirements for tenant fitouts will be utilized for Core and Shell areas, such as retail and potentially Childcare, to commit future tenants to the principles pursued by the project as a whole for sustainability.

Water Efficiency
Outdoor and process water use reduction will be a primary driver on the project. The project will specify low-flow and low-flush plumbing fixtures to achieve Water Efficiency. The team shall also consider other water strategies to reduce potable water use.

Prerequisite 1 Outdoor Water Use Reduction, 30% Reduction
Through the use of native and adapted vegetation and efficient irrigation systems, the project will reduce the demand for irrigation by 30%. The design will achieve at least 50% reduction in potable water via native species and drip irrigation. The remaining 50% of irrigation demand will be met by non-potable stormwater reuse.

Prerequisite 2 Indoor Water Use Reduction, 20% Reduction
Through specifying efficient fixtures and equipment, the project will achieve at least a 20% reduction in potable water use inside the building.

Prerequisite 3 Building Level Water Metering
New in LEED v4, the project will install meters for building and any roof landscape to measure and ongoing reevaluate water consumption for each building.

Credit 2 Water Use Reduction 25/30/35/40/45/50%
The project will install efficient flow and flush fixtures as well as compliant equipment to reduce building potable water consumption. The residential building's water reduction target is a 30-35% reduction, given current MIT standard efficient fixtures and lack of urinals in residential program spaces.

Through the use of low-flow and low-flush plumbing fixtures in the building, as outlined in the project basis of design, the project shall implement water use reduction strategies that use at least 30% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

Credit 4 Water Metering *MAYBE*

Beyond the whole building and site water metering, the project will study installing permanent water meters for two or more water subsystems. This credit is under consideration but not yet anticipated.

Energy and Atmosphere
The building systems shall be designed to optimize energy performance and will not use refrigerants that are harmful to the environment. MIT will engage a third party Commissioning Agent to confirm the building systems are installed and function as intended and designed.

Prerequisite 1 Fundamental Commissioning and Verification
Building will engage a commissioning agent and develop and perform fundamental commissioning.

Prerequisite 2 Minimum Energy Performance
SD energy models show the current design will meet this prerequisite. Further study and energy modeling in subsequent project phases will confirm compliance.

Prerequisite 3 Building-Level Energy Metering
Meters must be installed to provide data on total energy consumption. This LEED requirement is in line with City of Cambridge energy data reporting guidelines.

Prerequisite 4 Fundamental Refrigerant Management
The specifications for refrigerants used in the building HVAC systems will not use of CFC based refrigerants. The MIT Plant already is participating in a LEED compliant CDC phase-out plan.

Credit 1 Enhanced Commissioning
The Commissioning agent will perform a review of the CD documents and provide any comments to the team for design revision. In addition, the Cx agent will perform post-occupancy reviews and draft a recommissioning manual and develop monitoring procedures for ongoing operations and maintenance. Additional points are awarded for envelope commissioning, which is currently anticipated in the scope of the Cx agent for Building 4.

Credit 2 Optimize Energy Performance (6%-50%, up to 18 points)
The design is targeting at least a 20% cost savings through the design of an efficient building envelope, high performance lighting and energy-saving HVAC systems. Energy modeling in the SD phase will establish the energy target for this project, but a 20% cost savings has been initially targeted.

In addition, the project will be connected to the MIT Central Plant for a district energy connection that will further improve the overall efficiency savings of the project.

Credit 4 Demand Response *NOT LIKELY*

Credit requires designing building and equipment for participation in demand response programs through load shedding or shifting. This credit will not be pursued, as no demand response systems are currently offered in this area of Cambridge by Eversource. In addition, Building 4 is to be connected to MIT Central Plant with no demand response program.

Credit 5 Renewable Energy Production (1%, 5%, 10%) *MAYBE*

Currently, the team is exploring opportunities to incorporate renewables in the projects. The density of the development and potential for renewables may only achieve the 1% threshold if pursued. Credit is not likely.

Credit 7 Green Power and Carbon Offsets

A primary strategy for this project will be reduction in energy consumption. However, MIT is committed to meeting the requirements of this credit on all new construction projects. Green-e certified power contracts would be written into tenant guidelines as required for retail and childcare spaces if this credit is pursued.

Materials and Resources

Throughout the construction phase of the project, the contractor shall endeavor to divert construction and demolition waste from area landfills and procure materials that have recycled content and/or are manufactured locally.

Prerequisite 1 Storage and Collection of Recyclables

Storage of collected recyclables shall be accommodated throughout the building. At least 500 square feet has been allocated for recycling storage total, with some distributed on individual floors as well lower level collection, sorting, and bundling for pick-up. A recycling plan will be developed.

Prerequisite 2 Construction and Demolition Waste Management Planning

Projects will follow construction and demolition waste management best practices. The construction manager will draft Construction and Demo Waste Management Plans to maximize waste diverted from landfill.

Credit 1 Building Life-Cycle Impact Reduction *MAYBE*

Project will conduct a life-cycle assessment that demonstrates a minimum of 10% reduction in at least three of the six impact measures.

- Global warming potential (greenhouse gasses), in CO_2e
- Depletion of the stratospheric ozone layer, in kg CFC-11
- Acidification of land and water sources, in moles $H+$ or kg SO_2
- Eutrophication, in kg nitrogen or kg phosphate
- Formation of tropospheric ozone, in kg NO_2 or kg ethane
- Depletion of nonrenewable energy resources, in MJ

Credit 2 Building Product Disclosure & Optimization: Enviro. Product Declarations *MAYBE*

Team will specify 20 products sourced from five different manufacturers that meet the disclosure criteria and use products that exhibit optimized performance on those disclosures for 50% by cost.

Credit 3 Building Product Disclosure & Optimization: Sourcing of Raw Materials *MAYBE*

Team will use 20 products sourced from five different manufacturers that have publicly released a report from their raw material suppliers and those reports demonstrate products meet responsible extraction criteria (25% material cost).

Credit 4 Building Product Disclosure & Optimization: Material Ingredients *MAYBE*

Team will use 20 products sourced from five different manufacturers that demonstrate the chemical inventory of the products and document their material ingredient optimization (25% by material cost).

Credit 5 Construction & Demolition Waste Management (50/75%)

The project will pursue optimized waste diversion from landfill to achieve 75% reduction in 4 material streams OR generate less than 2.5 lbs of waste/sf.

Indoor Environmental Quality

The air quality shall be monitored during the construction phase of the project and likely prior to occupancy. Low emitting materials will be used throughout construction to maintain and improve air quality. The building occupants will be able to maintain a comfortable environment through access to thermal and lighting controls.

Prerequisite 1 Minimum IAQ Performance

The building mechanical systems will be designed to meet or exceed the requirements of ASHRAE Standard 62.1-2010 sections 4 through 7 and/or applicable building codes.

Prerequisite 2 Environmental Tobacco Smoke (ETS) Control

Smoking will be prohibited inside the building and within 25 feet of the building, especially any entryways or air intakes or interior and exterior spaces adjacent to the childcare program.

Credit 1 Enhanced Air Quality Strategies

Project will provide entryway systems to avoid contamination from exterior particulates and prevent interior cross contamination. In addition, MERV 13 filters will be specified. In addition, project will either provide increased ventilation or monitor CO_2, depending on the program type for which compliance path is most energy efficient.

Credit 2 Low-Emitting Materials

The team will target achieving threshold level of compliance for VOC content in at least 4 categories. Enhanced performance will target 5 categories.

- Interior paints and coatings
- Interior adhesives and sealants applied on-site (including flooring)
- Flooring
- Composite wood
- Ceilings, walls, thermal, and acoustic insulation
- (Furniture not applicable)

Credit 3 Construction IAQ Management Plan

A Construction IAQ Management Plan will be drafted and implemented on all projects during construction and pre-occupancy according to the SMACNA Guidelines.

Credit 4 Indoor Air Quality Assessment
In addition to managing air quality during construction and pre-occupancy, a building flush-out or air quality testing will be performed before each building is occupied.

Credit 5 Daylight (55%/75%) *MAYBE*
Project will design for adequate daylighting and visual comfort where possible. Building enclosures will be designed to mitigate heat gains and temper interior daylighting levels. In addition, daylight dimming will be studied for perimeter building zones. This credit will be calculated in later design phases.

Credit 6 Quality Views *MAYBE*
Direct views will be provided to the outside for 75% of regularly occupied spaces, which meet 2 of 4 LEED criteria.

- Multiple lines of sight to vision glazing in different directions at least 90 degrees apart
- Views that include at least 2 of the following (1) flora, fauna, or sky; (2) movement; and (3) objects at least 25 feet from the exterior of the glazing
- Unobstructed views located within the distance of three times the head height of the vision glazing
- Views with a view factor of 3 or greater, as defined in :"windows and Offices, A Study of Office Worker Performance and the Indoor Environment"

Innovation & Design Processes
The project team has identified several possible ID credits which are listed below, limited to 5 ID credits total. Throughout the design process these along with other potential innovation and design process credits will be evaluated.

Credit 1.1 Green Building Education
Green building education is a recommended best practice. MIT will consider educational programs for the project, as well as collective green educational features connected to the Master Site. Green education options include educational building dashboards, informational website, building tours, or signage for sustainable features for residents and visitors.

Credit 1.2 Green Housekeeping *MAYBE*
Green housekeeping is a recommended best practice. The team will discuss developing and implementing a plan for occupants.

Credit 1.3 Exemplary Performance, Low Mercury Lighting *MAYBE*
This innovation credit can be earned by specifying low-mercury lighting which reduces the toxicity of waste streams.

Credit 1.4 Innovation in Design, Organic Landscape Management
Site may choose to pursue organic landscape management, to enhance the quality of the site and reduce chemicals and pesticides used on site areas. This will improve the quality of stormwater runoff and green spaces that occupants and visitors may come in contact with.

Credit 1.5 Innovation in Design, Integrated Pest Management
Team will explore alternative ID credits; however, an integrated pest management approach that meets LEED EBOM standards will help improve indoor air quality for occupants, and can be included as a requirement in the Tenant Guidelines.

Credit 2 LEED Accredited Professional
Atelier Ten, a group of LEED accredited professionals, is overseeing the overall sustainability of the Kendall Square development. They are also serving as the sustainability lead on the Site 4 design team. In addition, many other design team members have LEED accredited professionals working on the projects.

Regional Priority Credits
Regional Priority Credits (RPC) are established LEED credits designated by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. Up to four RPCs can be achieved on a project. The following RPCs are applicable to the Kendall Square Development area in LEED v4:

Credits to be Pursued
Optimize Energy Performance (8 pts required, up to 18 points)
High Priority Site (2 pts required, 2 possible)
Rainwater Management (2 pts required, up to 3 points)
Indoor Water Use Reduction (4 pts required, up to 6 points)

Credits Not Pursued
Renewable Energy Production (5% required, up to 3 points)

LEED v4 for New Construction - Kendall Square Building 4
last updated: June 27, 2016

Achievability				
hi	med	low	NP	
58	19	16	17	**65 Projected Points**

Certified 40 to 49 points **Silver** 50 to 59 points **Gold** 60 to 79 points **Platinum** 80 or more points
Achievability rating: **Hi** = 90%, **Med** = 60%, **Low** = 10%, **NP** = not possible.

hi	med	low	NP		Prerequisites	Standard	Tenant Guidelines	Comments	Responsible
Y				SS Prereq 1	**Construction Activity Pollution Prevention**	Create and implement erosion control plan that meets the 2003 EPA Construction General Permit.		Atelier Ten completed overall Master Site water budget. Arup completed building level water budget and energy model.	Nitsch
Y				WE Prereq 1	**Outdoor Water Use Reduction:** 30%	Reduce outdoor water use by 30% over the baseline specified in LEED.		MIT confirmed they will not be irrigating past establishment for the project. Arup confirmed irrigation meters required if only for establishment.	-
Y				WE Prereq 2	**Indoor Water Use Reduction:** 20%	Reduce indoor water use by 20% over the baseline specified in LEED and meet requirements for process water use.	T	Arup cnfirmed prerequisite will be met.	Arup
Y				WE Prereq 3	**Building-Level Water Metering**	Install permanent water meters for building and grounds	T	Arup cnfirmed prerequisite will be met.	Arup
Y				EA Prereq 1	**Fundamental Commissioning and Verification**	Engage commissioning agent, and develop and execute a commissioning plan. Prepare O&M plan for current facilities.		MIT has brought a Cx agent on board.	MIT, Cx
Y				EA Prereq 2	**Minimum Energy Performance**	Reduce energy cost by 5%, compared to ASHRAE 90.1-2010, Appendix G; meet mandatory provisions of ASHRAE 90.1-2010.	T	Arup's DD energy model confirms design exceeds minimum energy cost savings.	Arup
Y				EA Prereq 3	**Building-Level Energy Metering**	Install meters to provide data on total energy consumption AND commit to share data with the USGBC for 5 years	T	Arup cnfirmed prerequisite will be met with buliding level energy meter. MIT to confirm that information will be shared with the USGBC.	Arup, MIT
Y				EA Prereq 4	**Fundamental Refrigerant Management**	Eliminate CFCs in building HVAC&R.		Arup confirmed that building level systems will comply with the prerequisite. MIT to confirm campus central plant meets requirements.	Arup, MIT
Y				MR Prereq 1	**Storage & Collection of Recyclables**	Provide space for the collection and storage of paper, cardboard, glass, plastic, and metals.	T	MIT to provide narrative on campus waste and recycle handling.	MIT
Y				MR Prereq 2	**Construction and Demolition Waste Management Planning**	Develop and implement a construction and demolition waste management plan		-	-
Y				IEQ Prereq 1	**Minimum IAQ Performance**	Meet sections 4 through 7 of ASHRAE 62.1-2010.		Arup confirmed that design will comply with this prerequisite.	Arup
Y				IEQ Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Prohibit smoking inside building, and locate exterior smoking areas at least 25 feet away from building.	T	Campus policy will prohibit smoking near building entryways and air intakes.	-
1	**0**	**0**	**0**		**Integrative Process**	**Standard**			
1				IP Credit 1	**Integrative Process**	Perform preliminary energy model and water budget before the completion of SD and document in OPR & BOD.		Atelier Ten completed overall Master Site water budget. Arup completed building level water budget and energy model.	Arup
11	**3**	**2**	**0**		**Location & Transportation**	**Standard**			
			16	LT Credit 1	**LEED for Neighborhood Development Location**	Locate the project in within a development certified under LEED for Neighborhood Development		-	
1				LT Credit 2	**Sensitive Land Protection**	Locate the development footprint on land that has been previously developed.		Credit likely met, project on previously developed site.	A10
		2		LT Credit 3	**High Priority Site**	Locate the project on a site where contaminated soil/groundwater remediation is required or in historic district/building.		Team to confirm if site contamination and remediation is necessary.	P+W, MIT
5				LT Credit 4	**Surrounding Density and Diverse Uses**	Locate on a site with an existing density of 22,000sf/acre - 35,000 sf/acre and within 1/2 mile of 4-8 basic services.		Credit likely met by Kendall Square services and buildings.	A10
5				LT Credit 5	**Access to Quality Transit**	Locate project within 1/2 mile of a rail station or ferry terminal or 1/4 mile of bus, streetcar or rideshare.		Credit likely met by Kendall Square services and buildings.	A10
	1			LT Credit 6	**Bicycle Facilities**	Access to bicycle network. Short term (2.5% peak visitors) and long term (5% all occupants) bike parking and FTE showers	T	P+W calculated showers and bike racks required. Showers will meet requirements and most bike storage confirmed. Credit requires additional bike racks for FTE residents for achievement. P+W to test additional bicycle storage further from entryway as Special Circumstances.	P+W
	1			LT Credit 7	**Reduced Parking Footprint**	Preferred parking for carpools for 5% of the total parking spaces		P+W to comment on number of spaces provided in garage for E38/39 + Site 4 building.	P+W, A10, MIT
	1			LT Credit 8	**Green Vehicles**	Preferred parking for Green Vehicles: 5% of all parking spaces and electric vehicle charging or alternative fuel facility for 2%		Team to discuss if credit is to be pursued.	P+W, A10, MIT
6	**3**	**0**	**1**		**Sustainable Sites**	**Standard**			
1				SS Credit 1	**Site Assessment**	Complete comprehensive site survey; topography, hydrology, climate, vegetation, soils, human use and human health effects.		Hargreaves, Nitsch, and Atelier Ten to determine compliance, potentially on master site level.	Hargreaves, Nitsch and A10
	1		1	SS Credit 2	**Site Development:** Protect or Restore Habitat	Protect 40% of greenfield and restore 30% of previously developed site (2pts) or provide $0.40/sf to accredited land trust (1pt).		Significant habitat not likely created by shade trees. MIT confirmed that credit could be purchased if needed to get over credit rating threshold.	P+W
	1			SS Credit 3	**Open Space**	Provide outdoor space greater than or equal to 30% of the total site area (including building footprint).		Credit to be determined by Master Site open space calculation. A10 to coordinate.	A10
3				SS Credit 4	**Rainwater Management**	Manage runoff for the 95th percentile (2pt), 98th percentile (+1pt) with low-impact development (LID) and green infrastructure.		Nitsch to comment on compliance in CD phase.	Nitsch
2				SS Credit 5	**Heat Island Reduction**	Meet high albedo requirements for roof and site OR place a minimum of 75% parking under cover (1pt).		P+W to calculate compliance of the roof areas, concern over playscape area meeting SRI. Team to consider if shade trees and canopies can achieve intent of shaded roof areas.	P+W, A10, MIT
	1			SS Credit 6	**Light Pollution Reduction**	Meet uplight and light trespass requirements and do not exceed exterior signage luminance requirements.		Arup to comment on compliance in CD phase.	Arup
7	**0**	**1**	**3**		**Water Efficiency**	**Standard**			
1				WE Credit 1	**Outdoor Water Use Reduction:** 50% Reduction	Reduce potable water used for irrigation by 50%.		Irrigation not likely past establishment period for planters and trees. P+W and Arup to confirm, as Arup commented that irrigation water meters are to be installed. P+W clarified no irrigation in design.	P+W, Arup
1				WE Credit 1	**Outdoor Water Use Reduction:** No Potable Water	No potable water use for irrigation.			
3				WE Credit 2	**Water Use Reduction:** 25% / 30% / 35%	Reduce building water use over LEED baseline .	T	Arup's calculations show 46.7% savings based on the DD documents. Arup to confirm that different showerhead fixtures are to be used in the innovation areas vs the residential areas (2.0 gpm vs 1.5). Confirm all fixtures have WaterSense	Arup
2			1	WE Credit 2	**Water Use Reduction:** 40% / 45% / 50%	Reduce building water use over LEED baseline .			
			2	WE Credit 3	**Cooling Tower Water Use**	Conduct a water analysis to optimize cooling tower cycles. Maximizing cycles (1pt), >10 cycled or 20% non-potable water use (2pts).		Building will connect to MIT's central plant and will not have local cooling towers.	-
		1		WE Credit 4	**Water Metering**	Install permanent water meters for two or more water subsystems.	T	Arup confirmed irrigation and building water meters are included, but additional meters would have to be added to comply with credit.	Arup, MIT, P+W

This letter presents the outdoor equipment sound evaluation for the MITIMCo Site 4 project in Cambridge, MA. This project site needs to comply with the City of Cambridge noise regulation as well as the Massachusetts state regulation. A more detailed evaluation of the entire South of Main (SOMA) sound impact to the neighborhood was conducted in 2015 and included in the Article 19 submission (dated July 13, 2015). This report confirms some earlier assumptions and provides updated evaluations for Site 4.

APPLICABLE NOISE REGULATION

Massachusetts

The Massachusetts Department of Environmental Noise Policy (MassDEP) defines noise pollution by the condition resulting when:

- The equipment increases broadband sound level by more than 10 dB(A) above ambient, or
- The equipment with tonal sound - when any octave band center frequency sound pressure level exceeds the two adjacent bands by 3 dBA or more

For this project, we confirmed the existing background sound levels are high enough in the project area that the meeting the City of Cambridge Noise Regulation would be the more stringent. We will need to comply with the MassDEP regulation for the emergency generators.

City of Cambridge

The City of Cambridge Noise Regulation has fixed sound emissions level limits for daytime and nighttime hours. There are different limits based on the zoning district. Based on the City of Cambridge Zoning Map, the equipment of our project should meet the Residential Zoning District at the closest residential building and hotel. The rest of the building should meet the Business Zoning District.

Daytime is defined by the City as the period between the hours of 7AM and 6PM except Sunday and holidays.

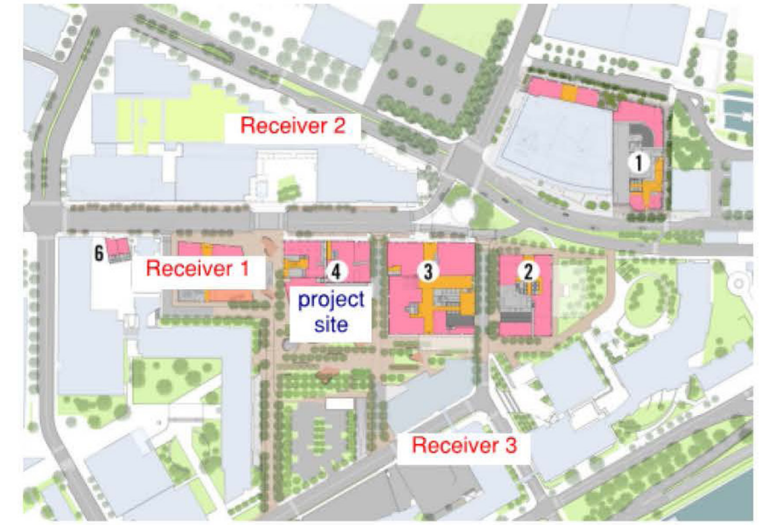
PREDICTED SOUND EMISSION LEVELS

Your engineer has provided us with some of the outdoor equipment and emergency generator sound data. We have predicted the sound emission levels of the future equipment to the property lines. We have assumed that for <u>nighttime conditions</u>, all mechanical equipment will operate at full capacity in the worst-case scenario. For worst-case <u>daytime condition</u>, the same rooftop equipment will be operating, as well as the emergency generator (per testing).

The list below shows equipment used in our acoustic analysis.

- Five custom indoor air handling units (Ventrol or equal) located in the fifth floor mechanical room of the tower of varying sizes with sound attenuators provided on the air intake and exhaust openings
- Two custom outdoor air handling units (Ventrol or equal) located on the lower roof on the 4th level with sound attenuators provided on the air intake and exhaust openings.
- Two custom indoor energy recovery units (Ventrol or equal) located on the penthouse level of the tower with sound attenuators provided on the air discharge side.
- 10 general supply and exhaust fans (similar to Greenheck) located within the building as well as on the lower roof levels with sound attenuators provided for sound control to the exterior
- Various outdoor split system condensers on the lower and upper roof, similar to Mitsubishi PUHY series.
- Four indoor 500 kW diesel emergency generators with sound attenuators provided at the air intake and discharge openings to the exterior and exhaust muffler provided to each generator that achieves an average of 65 dB(A) overall sound levels at 50 ft. The generators will only be tested during the daytime hours.

The figure below shows the project location and the closest adjacent commercial and residential/ hotel receivers:



Tone Evaluation

Based on the equipment sound data and the predicted sound levels to the closest receivers, we do not anticipate the equipment to emit tonal sound as defined by the state of Massachusetts.

Predicted Equipment Sound Levels

Based on the equipment sound data and the sound control measures described above, we predicted the rooftop equipment sound emission levels to the closest receivers (Table 1). Receiver 1 is a commercial building while Receivers 2 and 3 are the closest residential buildings. These are the sound levels without the existing background sound level.

Receiver Location	Overall daytime and nighttime sound emission levels excluding the emergency generator (dBA)	Sound Limits (dBA)
1	52 dBA	65 dBA (anytime)
2	46 dBA	60 dBA (day) 50 dBA (night)
3	38 dBA	

Table 1. Predicted sound pressure levels to the receivers with all noise control measured provided as described in this report.

The predicted A-weighted levels with the noise control described above will be within the allowable daytime and nighttime sound limits.

Table 2 shows the predicted sound levels with the one emergency generator turned on. It is assumed that only one generator will be tested at a time.

Receiver Location	Overall daytime sound emission levels including the emergency generator (dBA)	Sound Limits (dBA)
1	59 dBA	65 dBA (anytime)
2	57 dBA	60 dBA (day)
3	44 dBA	

Table 2. Predicted sound pressure levels to the receivers with all noise control measured provided as described in this report.

CONCLUSION

Based on our evaluation of the mechanical equipment and emergency generators proposed for SOMA MITIMCo Site 4 project, the equipment sound emission to the community are within the acceptable sound limits and will not produce any tonal sound.

PUD-5 SoMa Wind Update

November 1, 2016

INTRODUCTION

During the PUD Special Permit process, RWDI, an international engineering firm that specializes in testing and analysis of wind conditions, evaluated approximately 170 locations in and around PUD-5 on behalf of MIT. The wind study showed that there are many locations outside of the PUD that have existing wind conditions that the MIT Kendall project neither improves nor worsens. The study further demonstrated that the project improves wind conditions at several wind locations both within and outside of the PUD that are deemed “uncomfortable” in the existing (no build) condition. At the time of the granting of the Special Permit, all locations within the SoMa PUD, with the exception of eight, were “comfortable for sitting, standing or walking” with the remaining eight identified as areas for continued focus.

While projected conditions in these areas of focus are not dangerous and are consistent with urban wind conditions existing in Kendall Square and throughout the region, MIT, the design and engineering teams and RWDI have continued to evaluate strategies to further improve conditions at these locations. This memo serves as an update regarding the work the teams have been undertaking to improve conditions at these areas of focus.

OVERVIEW

The SoMa areas of focus are shown on the attached graphic and can be viewed in two main groups – those in the Gateway/ MBTA stations area influenced by design around Building 5 and those along Hayward Street between Buildings 3 and 4 and influenced by design around Building 4. (The area around sensor 56 will be addressed in future Building 2 design.)

Between September 2015 and October 2016, RWDI conducted multiple pedestrian wind tunnel tests, as well as area specific sensitivity studies, to determine strategies for improving conditions in these areas. Members of the MIT and the design teams associated with the proposed Kendall Square buildings participated in the wind tunnel testing at RWDI’s labs in Guelph Ontario. The results of the most recent test, October 2016, are presented and discussed below.

Gateway/MBTA Station

Given wind direction along Main Street, MIT evaluated a range of additional design elements and strategic landscape around Building 5 to improve the areas of focus around the MBTA station and the Gateway (sensors 136, 133, 126 and 124/128). As tested in the October 2016 test, these strategies can result in all areas around the T station achieving a level comfortable for sitting, standing or walking. As some of these design elements are integral to Building 5 design, MIT will present these elements in more detail as part of the Building 5 design review process.-

Hayward Street

MIT has also focused on the area on Hayward Street between Buildings 4 and 3 (sensors 92 and 94). The October 2016 test resulted in significantly improved conditions at sensor 94. However, it did not improve conditions at sensor 92. Focusing on this area, the team then tested the impact of inserting a 60’ x 35’ wall between the Building 4 tower cantilever and the ground. Although that did bring the wind comfort to Comfortable for Walking (19 mph) it was deemed undesirable from an urban design standpoint, as it prevents both views and pedestrians from passing through the area in question. Additionally, the relatively minimal decrease in wind speed (3 mph difference from the Special Permit test), did not seem worth the trade off.

Although the initial attempt at strategic planting studied in the October 2016 test resulted in higher wind speeds than in the April 2016 test, the design and engineering teams believe that strategic planting in this area can result in conditions similar to the April 2016 test. This is particularly true because all of the adjacent sensors are not only comfortable for walking but also for sitting or standing. Although this area may still be in the uncomfortable range it will be at the low end of wind speed, closer to “comfortable for walking”. These conditions are similar to existing conditions at several locations along Main Street and Third Street and in Point Park.

WIND STUDY RESULTS

Below are descriptions and results for the SoMa areas of focus for the major tests conducted.

1. **Existing Conditions Test:**
   - Assumptions
     - i. Existing Conditions (no new construction)

2. **April 2016 PUD Special Permit Test:**
   - Assumptions
     - i. New Construction
     - ii. New planting: mix of evergreen and deciduous trees, as well as low planting
   - Results:
     - i. All points within the SoMa PUD were comfortable for sitting, standing or walking with the exception of eight "areas of focus" which were uncomfortable
     - ii. Point 92 result: 22 mph = Uncomfortable (area of focus)

3. **October 2016 Updated Landscape Plan and Strategic Planting:**
   - Assumptions
     - i. New Construction
     - ii. Landscape Plan reflective of current design (October 2016)
     - iii. Revised planting: mix of deciduous and evergreen trees altered to test wind impact
   - Results
     - i. General result: reduced wind speeds by 1-10 mph in areas of focus; did not result in any new areas of focus
     - ii. Point 92 result: 25 mph = Uncomfortable
     - iii. Also, a low (10'x10') wall at SE corner of Site 4 corner: wall had no measurable no impact

Sensor	Building Area	Existing Conditions	April 2016 Special Permit	October 2016 Revised Landscape and Strategic Planting
56	2	16 mph	21 mph	16 mph
83	5	16 mph	21 mph	17 mph
92	4	11 mph	22 mph	25 mph
94	4	11 mph	20 mph	10 mph
124/128	5	17mph/15 mph	21mph/19 mph	19 mph/21 mph
126	5	10 mph	20 mph	17 mph
133	5	12 mph	20 mph	20 mph
136	5	12 mph	21 mph	19 mph

The comfort levels have been defined as follows. The range of standard deviation is +/- 3 mph.

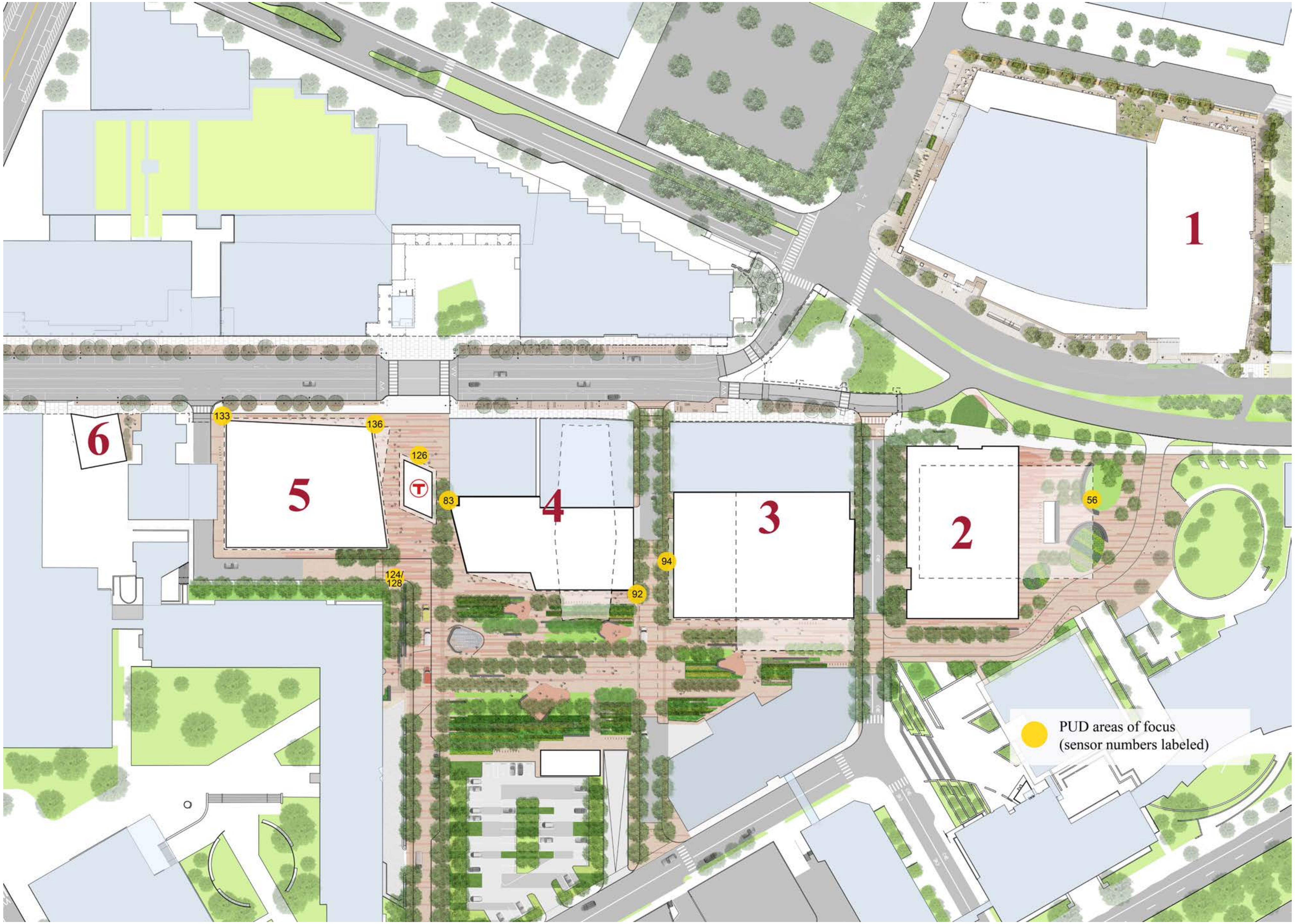
Comfortable for Sitting: Annual average wind speeds of 12 mph or less at least for 80% of the time

Comfortable for Standing: Annual average wind speeds of 13-15 mph or less at least for 80% of the time

Comfortable for Walking: Annual average wind speeds of 16-19 mph or less at least for 80% of the time

Uncomfortable: Annual average wind speeds of 20-27 mph at least for 80% of the time.

Dangerous: Annual average wind speeds of 28 mph or greater at least for 80% of the time.



November 2, 2016

WIND PLAN