



## Foundry Building

### Reuse Study

101 Rogers Street  
Cambridge, Massachusetts

June 18, 2013

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## Acknowledgements

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The Foundry Building at 101 Rogers Street was acquired by the city as the result of a real estate development proposal involving a number of parcels in an adjacent sector of the Kendall Square area. This report was commissioned to help determine the most appropriate use for the Foundry Building at 101 Rogers Street. With this report along with separate real estate market and management input, the city will be able to evaluate different options for short and long term use and ownership of the building.

Existing documentation on the Rogers Street property is limited. Alexandria and Hamilton Realty, both previous owners, have provided plans of the building. Assessors data as well as Google maps have been used in this report.

The report is the work of a study team led by HMFH architects and including Foley Buhl Roberts, structural engineers, Garcia Galuska DeSouza, MEP/FP engineers, and PM&C, cost consultants, along with code consultant R.W. Sullivan.



Image courtesy of Google maps

Aerial of 101 Rogers Street



The building was constructed in the 19th Century as a foundry and has historic interest but is not a listed property in the Historic Register. The building's original open, high bay design was modified at least as early as the 1980's by the addition of three structured floor levels within the building. At the same time, it appears that the ground floor was excavated to create the below grade level that accommodates parking as well as service and some additional rentable space.

The building consists of the lower parking level with approximately 4,000 SF of rentable area and 42 parking spaces. The first floor has approximately 23,000 SF of gross area and the second and third floors each have approximately 15,000 SF of gross area. A narrow open space to the east of the building is approximately 3,000 SF in area. The Rogers Street frontage includes the main entrance and 12 parking spaces. The total lot area is 37,500 SF. The parcel is abutted to the east by an open parking lot associated with the Worthington Place residential property to the south. The abutting parcel to the west contains a high rise and windowless structure that houses communications technology.

The City's acquisition of 101 Rogers Street included the stipulation that a minimum of 10,000 SF would be dedicated to community use. This report does not attempt to determine where or how much space will be made available for community use. It will identify options and locations for community use on the proposed plans. Cost for these options will not be included in the budget.

This report assumes that there will be no addition to the existing building, that any proposed uses will be allowed as of right or through a permitting process. The report also assumes that the current configuration of the building, open and below grade parking, most recent uses, etc., are legal and permitted.

The study methodology for this report consisted of walk-through inspections by the study team members; review of available plans and documents; visual assessment of building systems for current condition and life expectancy; conceptual level development of architectural and engineering upgrades, an integrated team session to review and develop possible reuse scenarios, and a conceptual level cost analysis of two redevelopment scenarios. Where possible, ceiling and wall openings were used to view existing structure but no destructive investigation or testing was done.

The impacts of the development of this property with regard to traffic congestion and noise during construction as well as impacts both positive and

negative of a full occupancy work force in this building were not considered by this study.

There are many possible scenarios for the reuse of this building. Most typical, and assumed for this study, is a “core and shell” development in which the building envelope and basic systems are all upgraded, barrier free access into and through the building is provided, and stairs, toilet facilities and exits are provided in accordance with code and standard occupancy loads. Each individual tenant would be responsible for fitting out the rented premises, extending building services, and making other interior modifications to meet its unique business needs.

This study is based on two development scenarios: a minimal investment to replace or upgrade the building’s envelope and operating systems and to meet code requirements for structure, energy and accessibility. In each scenario it has been assumed that the city remains the owner and this has two important impacts on the study findings. First, as a public entity the city is constrained to follow public design and construction procurement statutes, as it does for all other public facilities work. This results in a project cost premium over private development, which is identified in the project estimate. Second, as a municipality that has adopted exemplary policy positions with regard to building and environmental stewardship, energy use and conservation, sustainable operations, and green building standards, we have built into the two cost scenarios some assumptions that might be considered extra and optional by a private developer. For example Option A, the minimum scenario, includes replacement of windows that might otherwise be left intact. In Option B, the optimal scenario, we are planning for LEED Silver level certification, in line with the city’s policy. The options are described in more detail later in the report.



The original building at 101 Rogers Street is masonry veneer over a heavy timber frame structure. The main building was built in 1890 and side wings added in 1910. At this time the building was used as a foundry, all on one floor, at ground level. Historical usage is hard to determine, but in the 60s and 70s it was used as a taxi barn. In the 1980s the building was converted to office use by excavating down for a parking level and adding 3 floors for offices. The infill structure is steel frame with concrete decks. It has currently been vacant for over a year.

#### AREA:

• Garage Level	23,089 Sq. Ft.
• Rentable Area	4,000 Sq. Ft.
• First Level	23,089 Sq. Ft.
• Rentable Area	22,500 Sq. Ft.
• Second Level	14,969 Sq. Ft.
• Rentable Area	14,400 Sq. Ft.
• Third Level	14,969 Sq. Ft.
• Rentable Area	14,400 Sq. Ft.
Total Area	76,116 Sq. Ft.
Total Rentable Area	53,800 Sq. Ft.

#### FLOOR TO FLOOR HEIGHT:

- Garage to First Level – 10'-0"
- First to Second Level 0 10'-0" – at shed reaches to 17'-0"
- Second to Third Level – 10'-0"
- Third Level to roof deck – 10'-0" to 18'-0"

#### ZONING:

- District: IA-1
- Site Area: 37,500 Sq. Ft.
- Gross Area of Building: 56,525 Sq. Ft.
  
- Existing FAR: 1.51
- Allowable FAR: 1.25-1.50
  
- Existing Parking: 54 Spaces
- Required Parking (office): 71 Spaces

#### STRUCTURE:

- The building structure is compromised as regards lateral forces.
- See structural report for complete information

#### ENVELOPE:

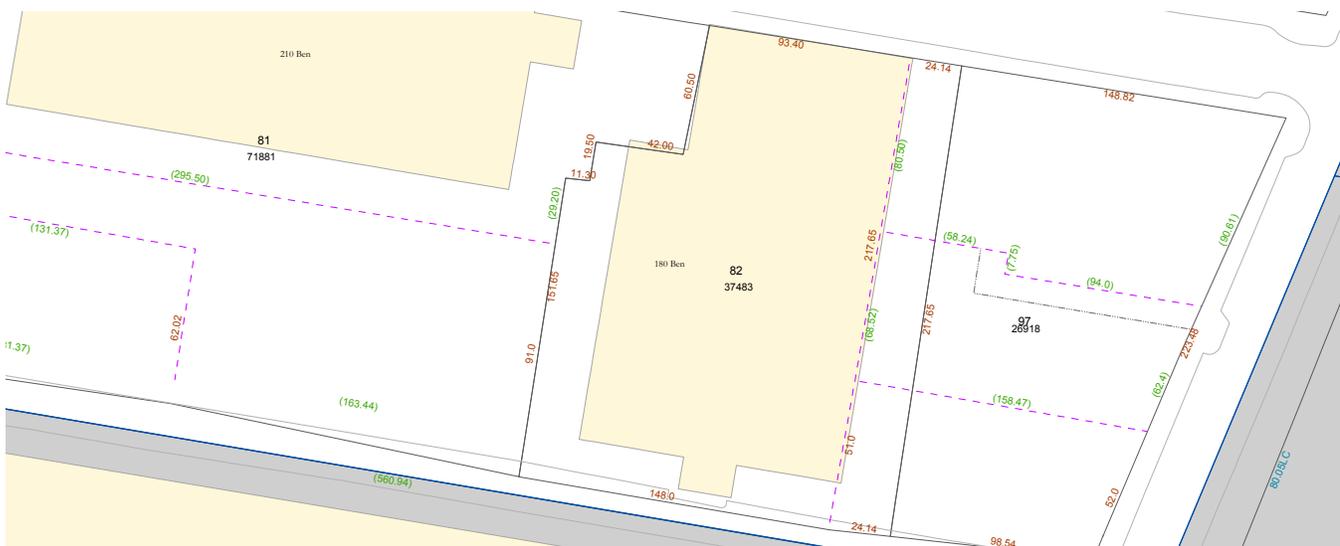
- Brick and stucco veneers need repair, clerestory siding needs to be replaced
- Windows, skylights and doors need to be replaced
- Roof is over 25 years old and while there is no evidence of recent leaks, it has reached the end of its lifespan

#### MECHANICAL, PLUMBING, ELECTRICAL, FIRE PROTECTION

- Most systems have reached the end of their life span
- Fire pump room requires a direct egress to the exterior
- There are areas in the building that require Fire protection
- Fire alarm system does not meet code
- Toilet rooms all need new fixtures, but plumbing infrastructure can remain
- See attached reports for complete information

#### ACCESSIBILITY

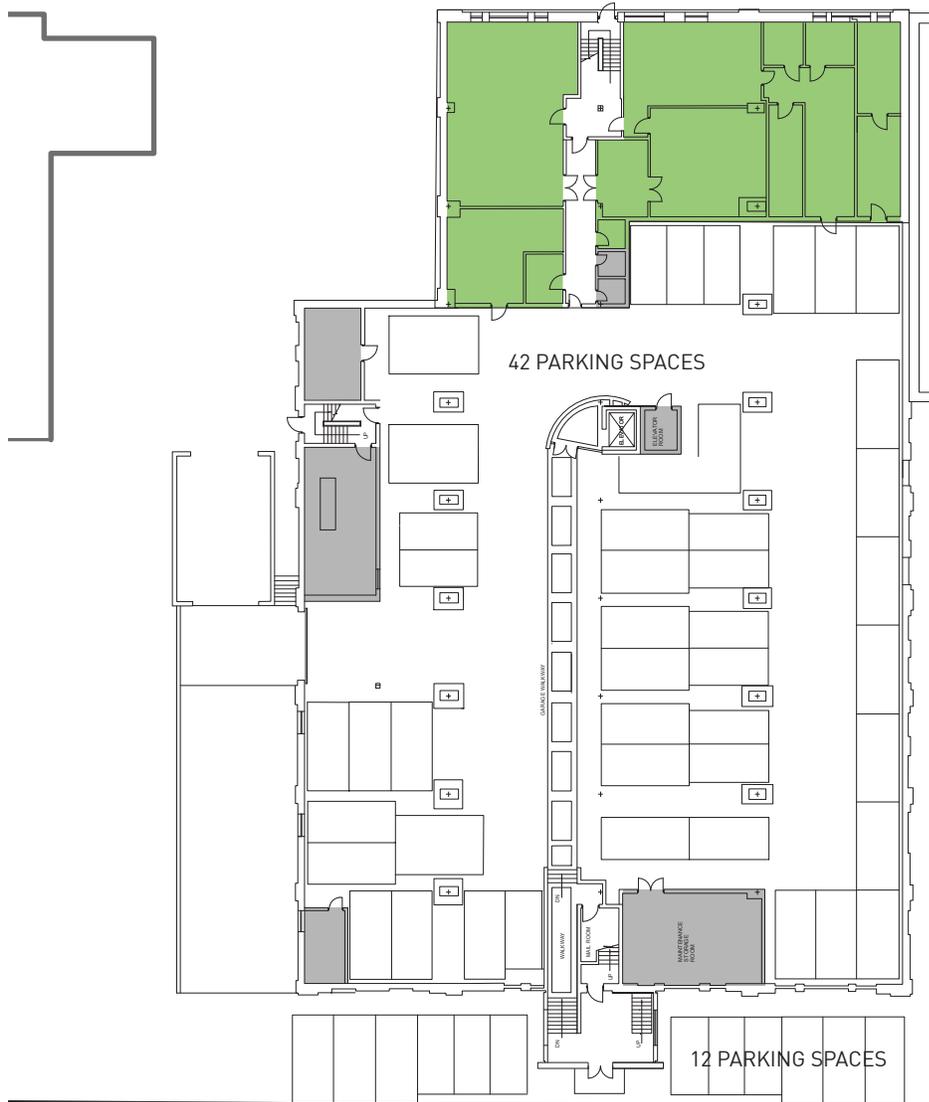
- There is no accessible access from the main lobby to the elevator
- Toilet rooms are non-conforming on all floors. Garage level needs new toilet rooms. Other toilet rooms can accommodate accessibility requirements.



Site Map 101 Rogers Street



BENT STREET



GARAGE LEVEL

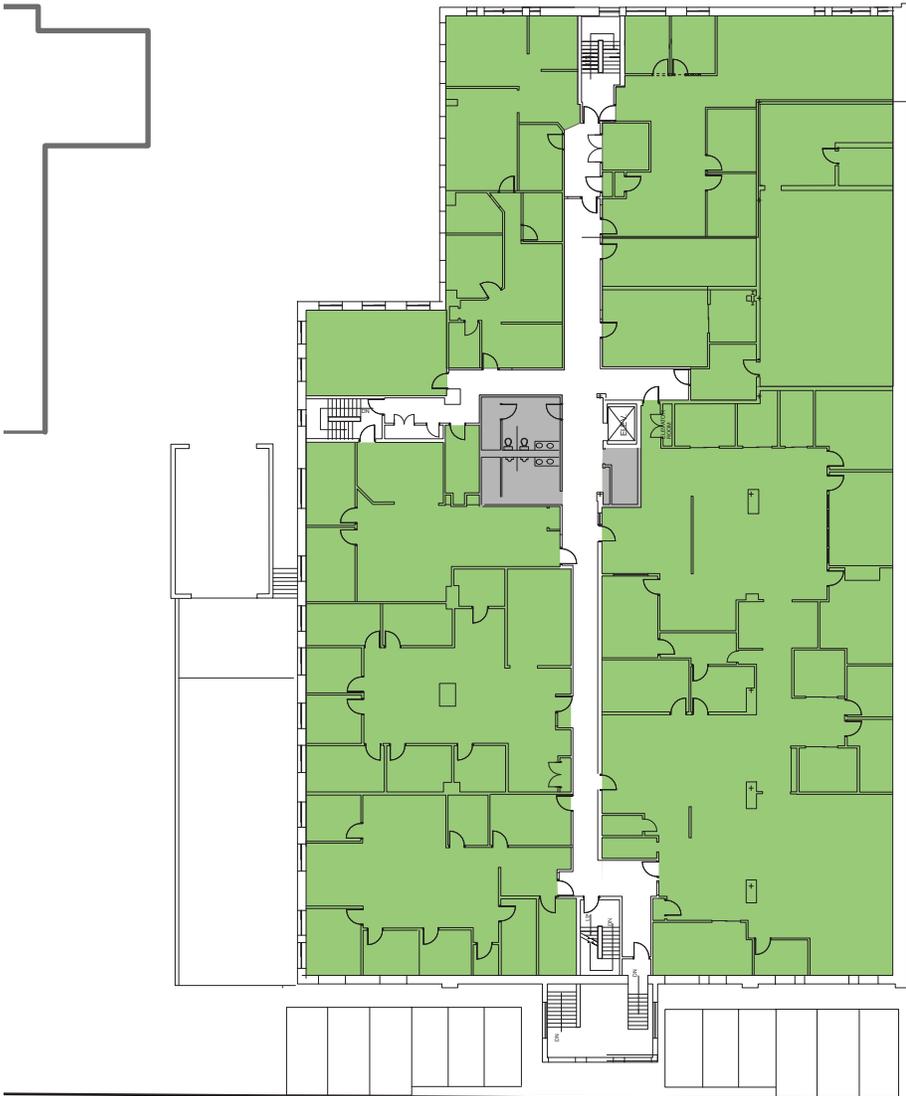
ROGERS STREET

Legend:

- EXISTING TENANT SPACE
- SUPPORT
- CIRCULATION

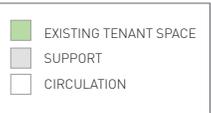


BENT STREET



FIRST LEVEL

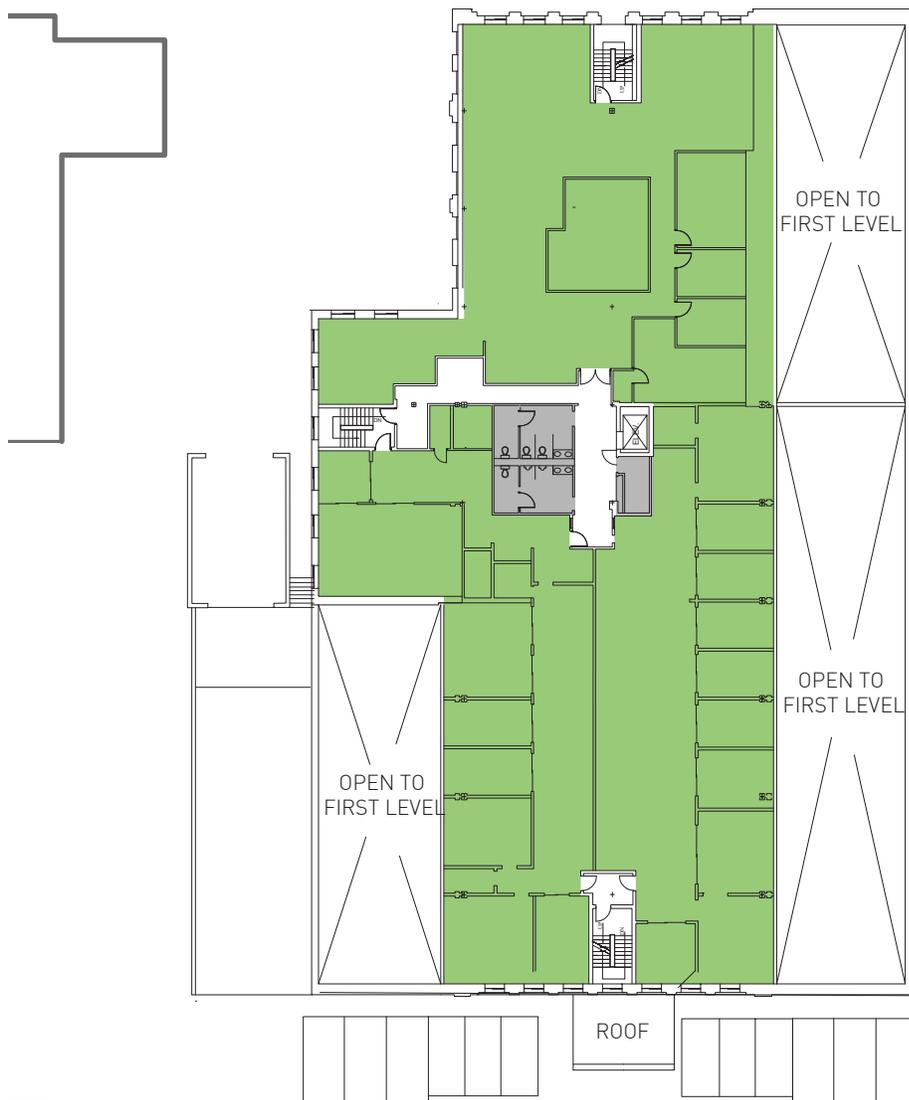
ROGERS STREET



# Section III

Existing Floor Plans continued

BENT STREET



SECOND LEVEL

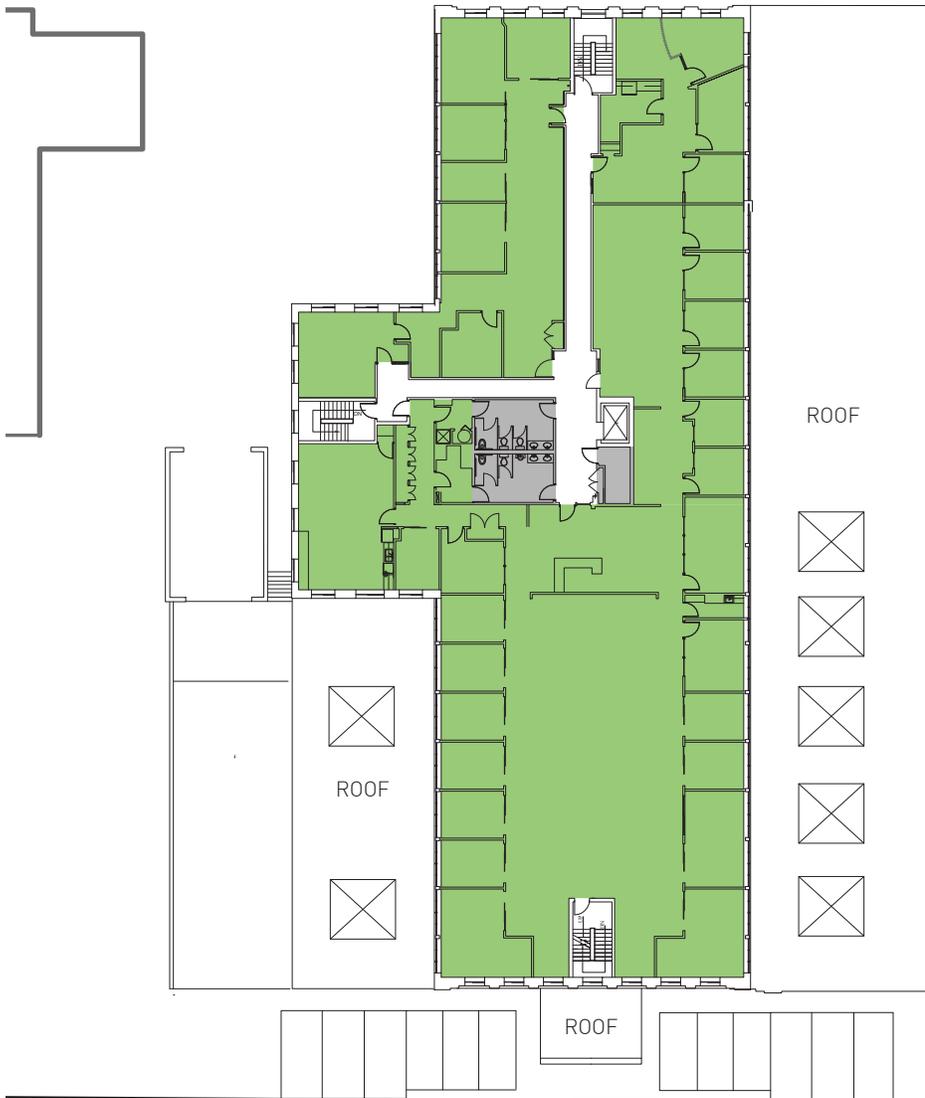


	EXISTING TENANT SPACE
	SUPPORT
	CIRCULATION

ROGERS STREET



BENT STREET



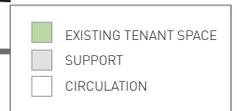
ROOF

ROOF

ROOF

THIRD LEVEL

ROGERS STREET



In any development of the Foundry, there will be a number of constraints – both external to the building as well as inherent - that will influence how this existing building is developed. Among these constraints are the following:

- Code compliance
  - Stretch code
  - Seismic requirements
  - Accessibility regulations
- Zoning requirements
- Historic building protections
- Cambridge public policy
- Public design and procurement statutes
- Use and occupancy

Code compliance is generally triggered when certain cost thresholds are exceeded or certain changes in use occur. In addition the replacement of certain building components, such as windows, must meet the energy-related performance requirements of the Stretch Code. Due to the age and structure of the Foundry building, seismic upgrades are required with a renovation of this level. However because the city will be the owner of the building, we have anticipated a higher level of compliance than for a private owner, who could more aggressively work to reduce compliance costs. For example in both option A and B, new structural bracing is added vertically through the building, in both axes of the building, from the foundation to the roof trusses.

Accessibility in a building occupied by uses which accommodate the public is more comprehensive than in an existing building occupied by businesses that are not “public” in character. Given that 10,000 square feet will be set aside for public or community use, it is advisable that full accessibility be achieved. Even then the two Options are differentiated. Option A achieves accessibility by a lift from the entrance to the first level, for access from there to the existing elevator that is upgraded. Option B plans for a new elevator and new entrance at Rogers Street that provides direct access to every level, and the existing elevator is removed.

Zoning considerations are expected to be minimal or absent, since the Foundry is not being expanded and is assumed to be otherwise legally occupied and permitted.

Historic considerations are related to the city's sense of stewardship. Renovations can be done with sympathy for the original buildings character, allowing for changes that are more appropriate to the original appearance of the building. Consultation with the Historic Commission is always advised and constructive. For a private developer, the use of historic tax credits might be available and attractive.

Cambridge public policy effects all development in some way, but more so for construction on publicly owned property. Public projects must be exemplary, from consideration of union construction labor to meeting the city's climate action and energy reduction scenarios. Option B has been planned for a high level of energy performance and in both options the construction costs include a factor for compliance with Cambridge's many regulations affecting construction and buildings, at least at this conceptual level.

Public construction procurement statutes also differentiate municipal from private development in important and cost-affected ways. Public construction bidding procedures are more cumbersome and prescriptive and construction generally takes longer. The City's local employment regulations also affect project cost. At a conceptual level, this premium is included in the cost analysis.

Use and occupancy is another consideration for any building redevelopment proposal. The Foundry's presumed approved occupancy is for office, categorized as Occupancy B. Other uses within that category are adult or general education (but not k-12 education), community health or medical offices, light fabrication or "dry" research and development, small assembly spaces under 300 people or technology and innovation office uses. Option B includes a higher level of code upgrades and in that regard accommodates some change in use and therefore more flexibility in the range of tenant. However in a core and shell development, the cost of extraordinary requirements attendant to a particular tenant use are usually part of the tenant's fit-out responsibility.



Option A is a basic upgrade meeting minimum code compliance for Core and Shell, Accessibility and Structural. Occupancy, type B, would not change.

Option B expands Option A to include LEED Silver 2009 Core & Shell compliance, provides a more elegant solution to accessibility and allows a fuller range of occupancy change.

The architectural changes in both option A & B are identical except for making the building accessible.

#### SITE IMPROVEMENTS A & B INCLUDE:

- A pocket park along the east side of the building.

#### EXTERIOR IMPROVEMENTS A & B INCLUDE:

- Roof: New membrane and roof decking. The skylights are replaced on the main roof, skylights on the shed roofs are covered over to provide a continuous diaphragm to resist lateral forces.
- Exterior veneer: stucco patched and brick repointed as required.
- Openings: All windows replaced, additional windows provided for the east shed walls (See axonometric). All doors replaced.

#### INTERIOR IMPROVEMENTS A & B INCLUDE:

- Toilet Rooms: Two (one) person toilet rooms added to the Garage Level. Toilet rooms on all other floors will receive new fixtures and finishes. Water fountains will be provided for each floor.
- New lighting and power on all floors.
- Exterior walls insulated and refinished on interior.
- New ceiling and floor finishes.

#### ACCESSIBILITY:

- OPTION A: Existing elevator to remain. In front lobby, stairs to first level replaced w/ a chair lift.
- OPTION B: Elevator and machine room removed. Front lobby is demolished and rebuilt to include new elevator, machine room and stairs to all levels.

## OCCUPANCY:

Option A keeps the building as currently occupied, Type B. This still allows for a variety of tenants:

- Office
- Research & Development
- Fabrication
- Education (post 12)
- Community Health/Medicine
- Health/Fitness

Option B allows for a greater mix of tenants resulting in more diverse uses which would encourage the continued vibrancy of the neighborhood and help to integrate the light industrial, office research & development and residential that is currently in the area. These uses include:

- Assembly
- Retail
- Day care (careful consideration necessary, but doable)
- Food/ Entertainment
- Market Hall

Adding certain use groups, such as assembly, retail or daycare will trigger other code requirements and additional building costs such as additional egress access and additional plumbing .

The major constraint which limits the flexibility of building use is the floor to floor height in the original building. The shed areas on the first level allow for greater clearance and the third level is open to structure. This could be marketed positively offering a variety of types of spaces within a historically significant building.

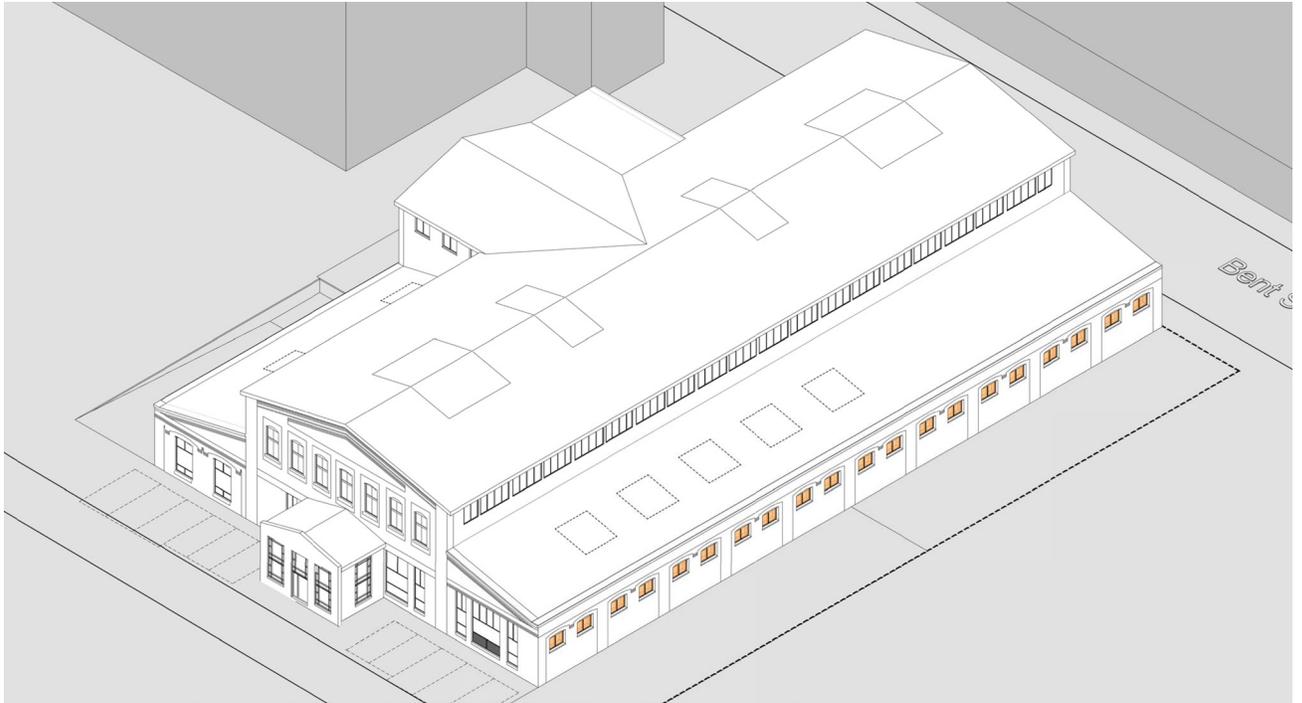
As uses are identified for the building, careful coordination with the building department will be necessary to assure conformance to the code.

This study attempts to provide an understanding of what will be required to bring the building into the 21st century and to provide a rentable space that could include neighborhood oriented uses not currently accommodated in the private real estate market.

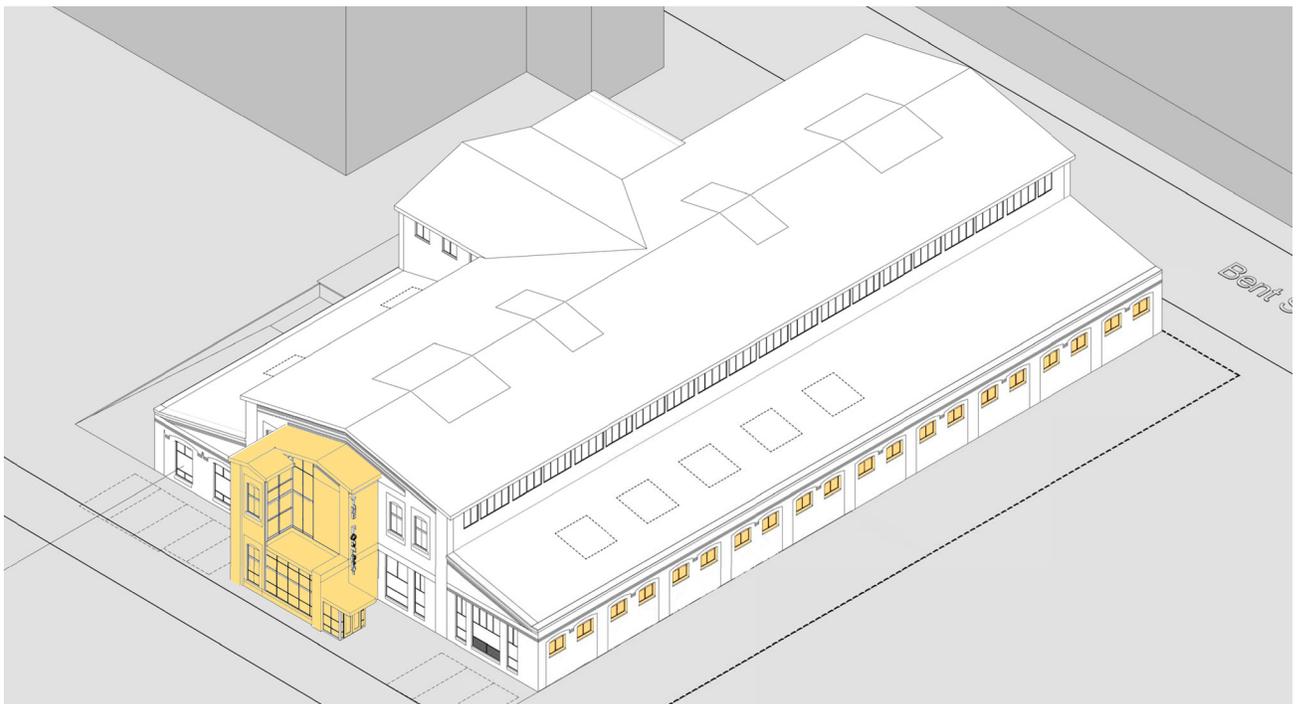


## Section V

Development Alternatives continued



Option A Axonometric



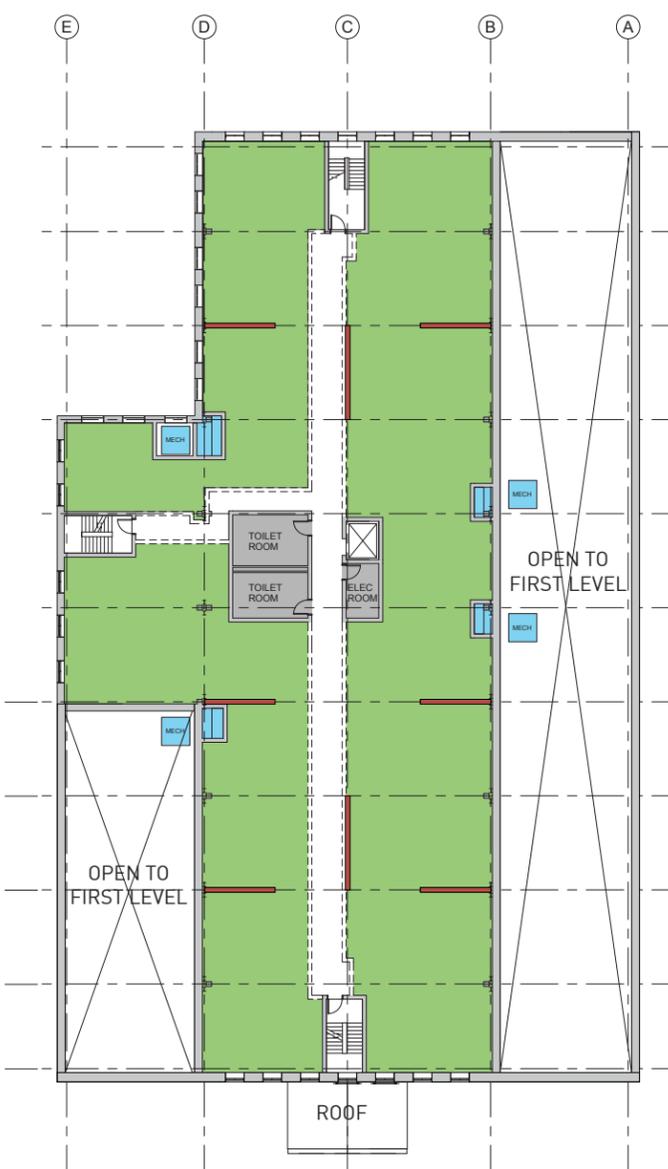
Option B Axonometric



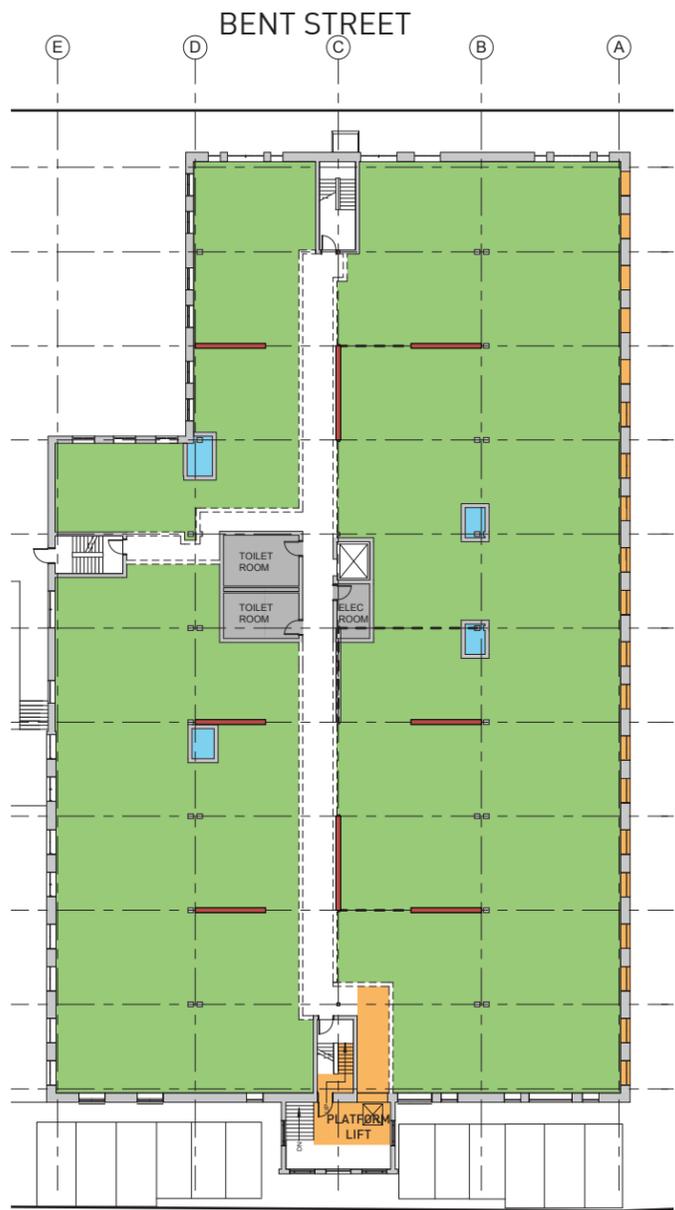
Section V  
Option A Floor Plans



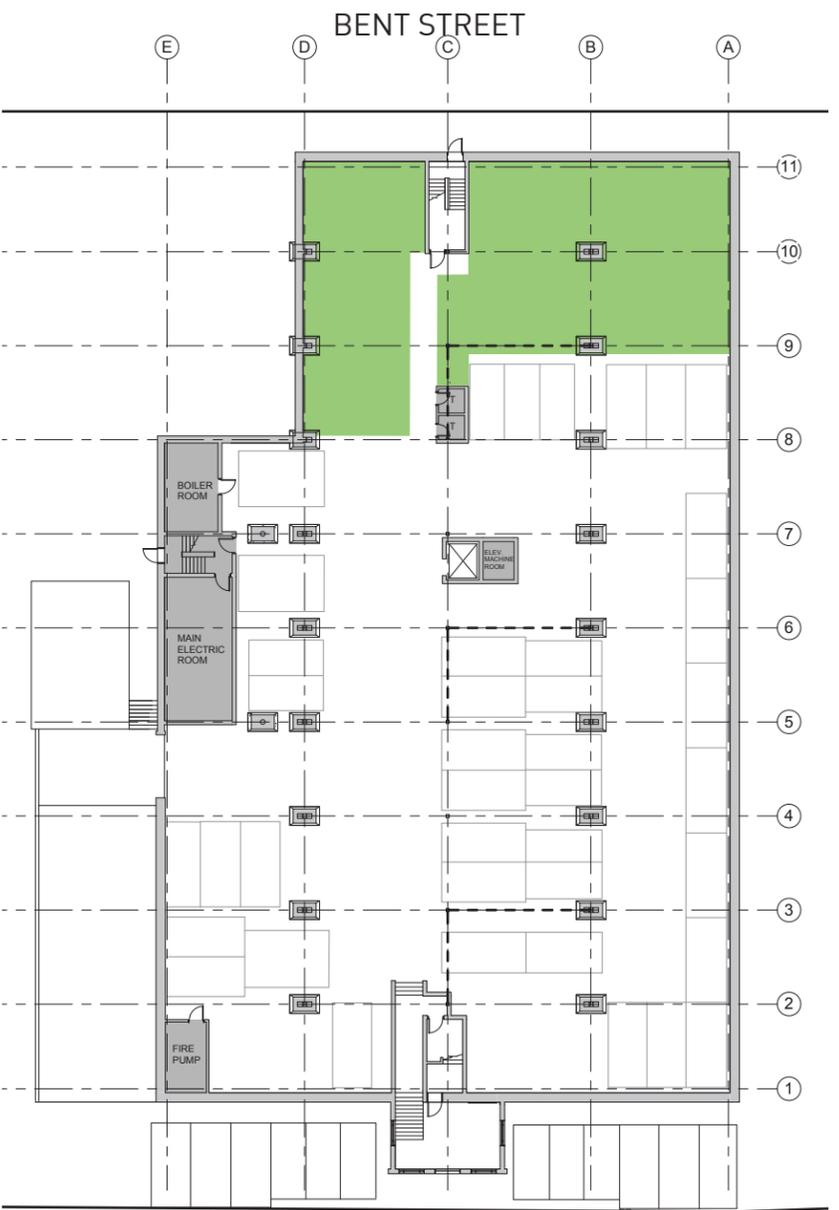
THIRD LEVEL



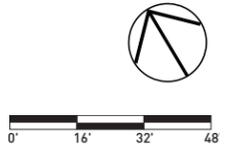
SECOND LEVEL



FIRST LEVEL

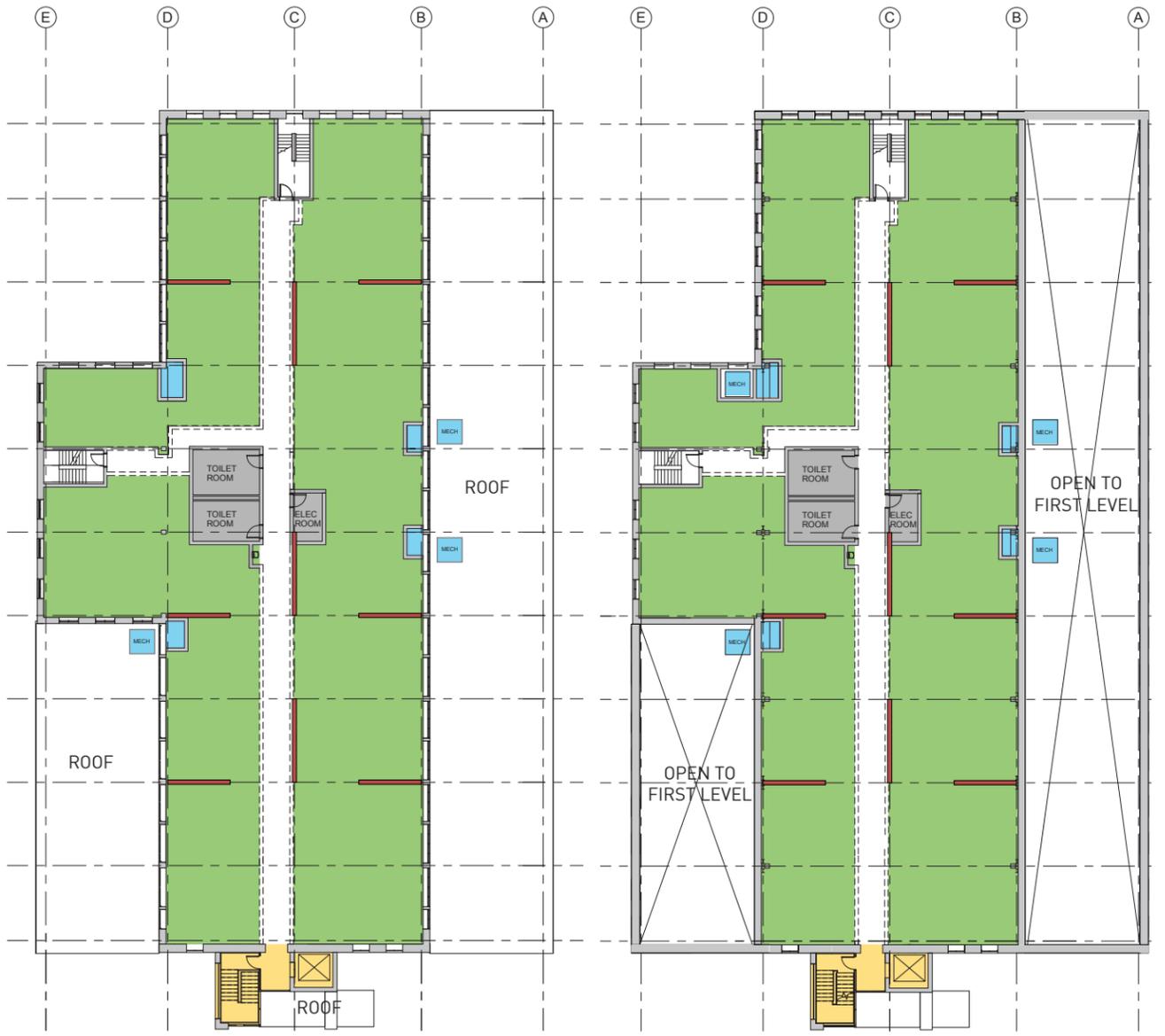


GARAGE LEVEL





Section V  
Option B Floor Plans

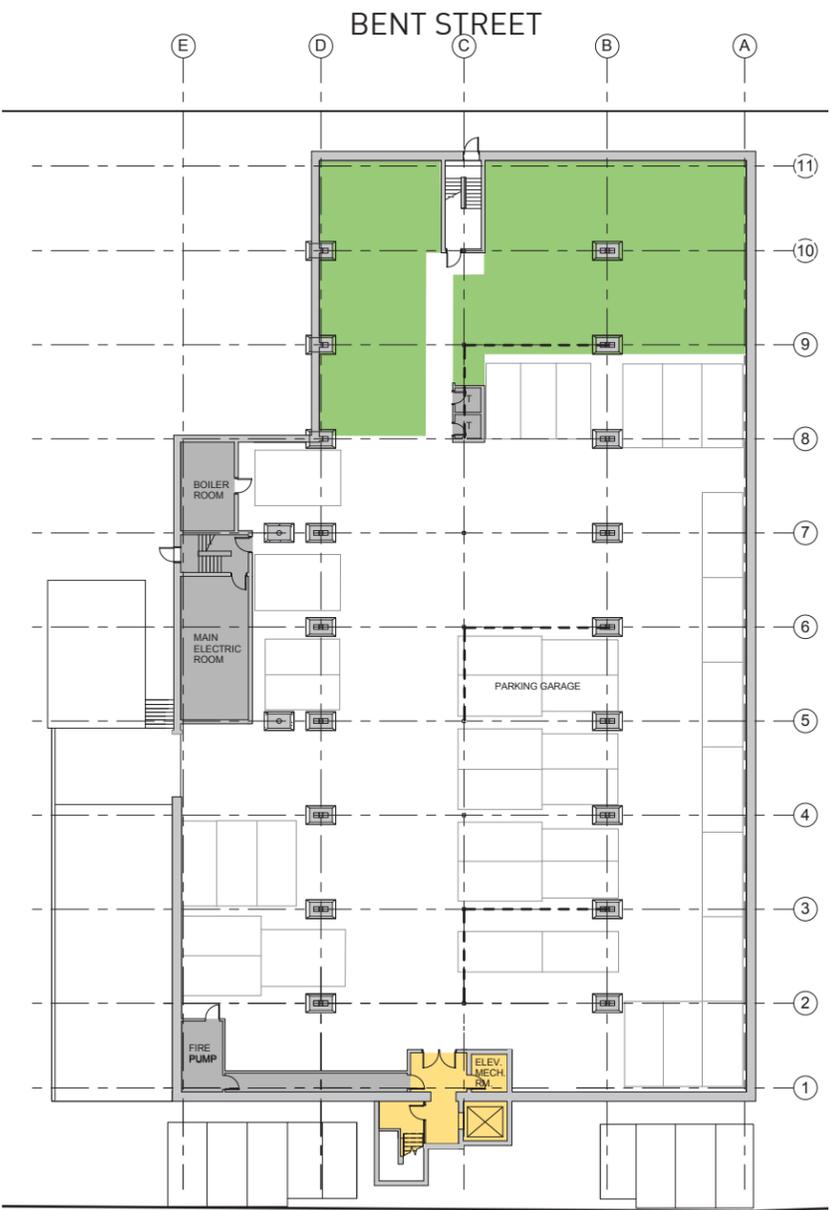


THIRD LEVEL

SECOND LEVEL



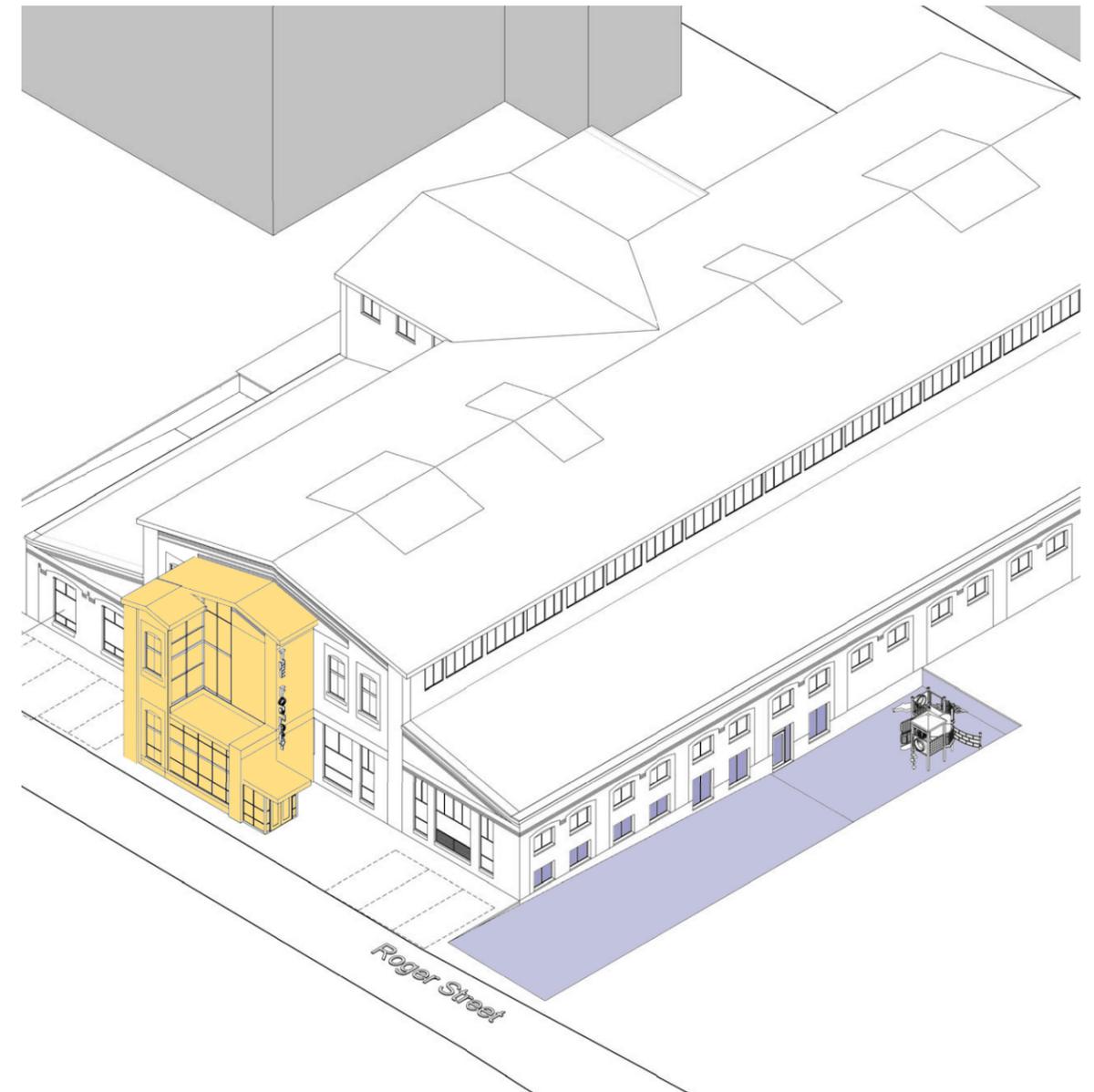
FIRST LEVEL



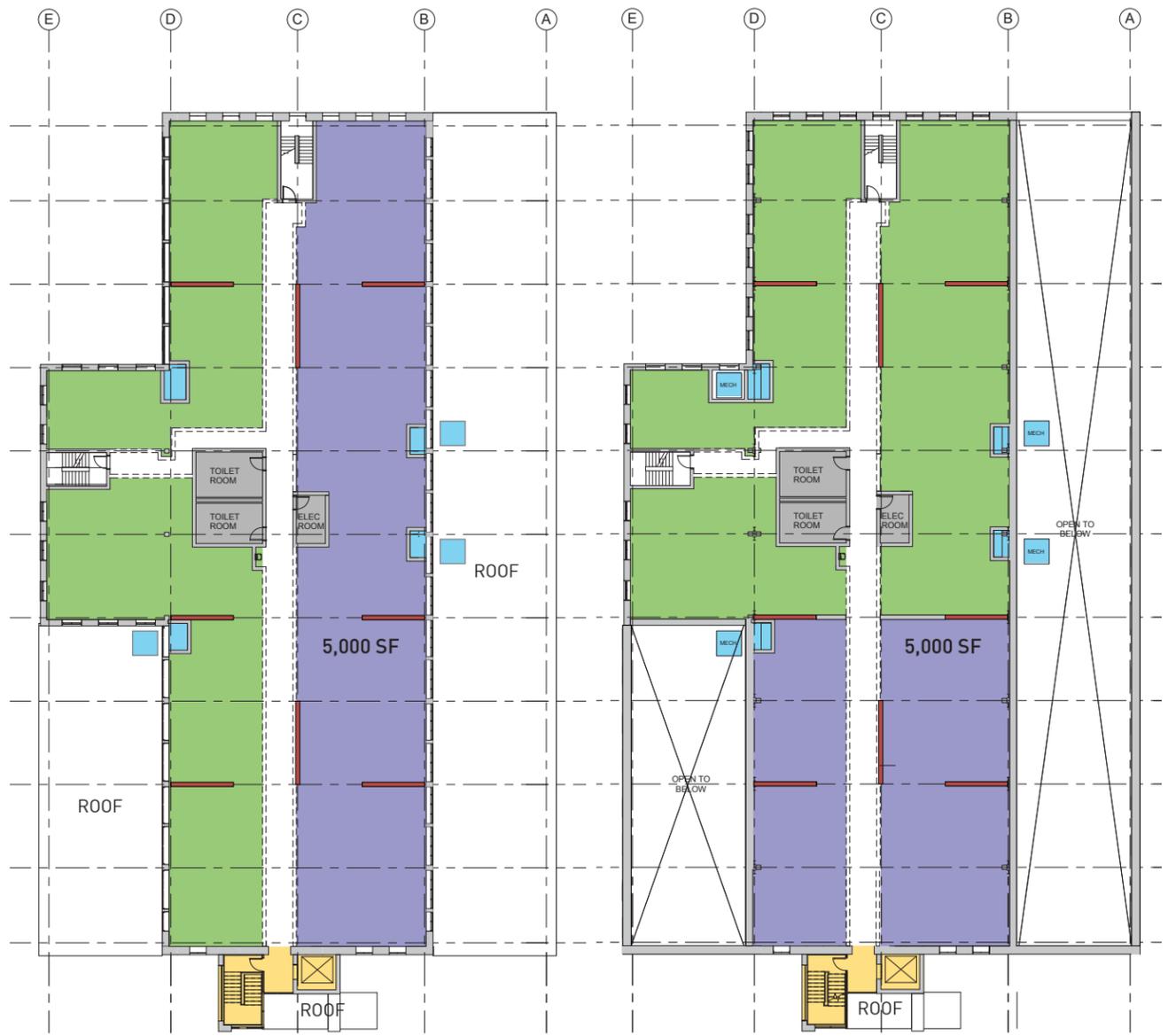
GARAGE LEVEL

<span style="color: green;">■</span> EXISTING TENANT SPACE	<span style="color: orange;">■</span> OPTION A
<span style="color: grey;">■</span> SUPPORT	<span style="color: yellow;">■</span> OPTION B
<span style="color: white;">■</span> CIRCULATION	<span style="color: blue;">■</span> COMMUNITY SPACE
<span style="color: cyan;">■</span> NEW MECH SPACE	<span style="color: lightblue;">■</span> EXTERIOR COMMUNITY SPACE

These plans identify how the 10,000 Sq. Ft. stipulated for to community use would fit in different configurations on the different levels. (See axonometric below) A 5,000 Sq. Ft. daycare facility is shown on the Garage Level.



Axonometric of Community Space Layout for Daycare with Outdoor Play Area

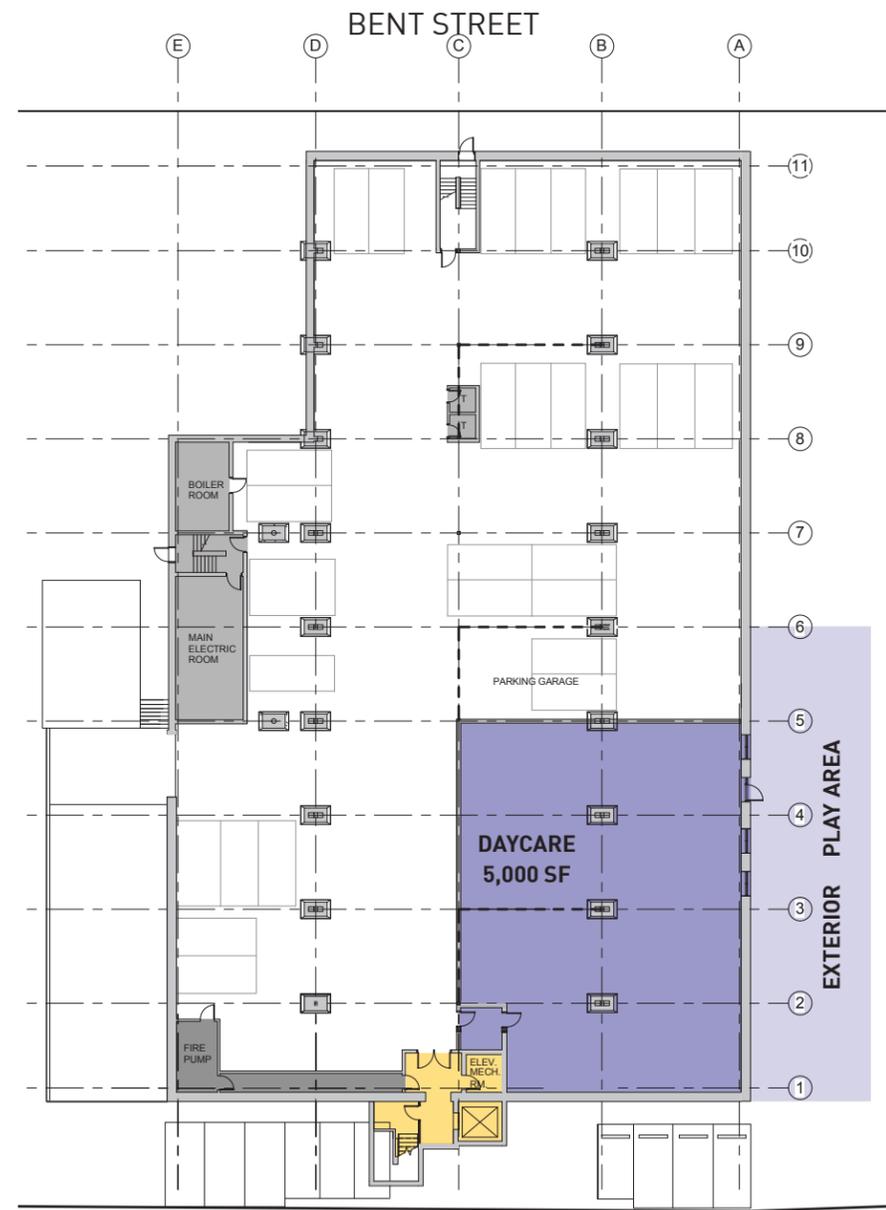


THIRD LEVEL

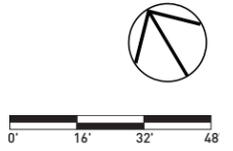
SECOND LEVEL



FIRST LEVEL



GARAGE LEVEL



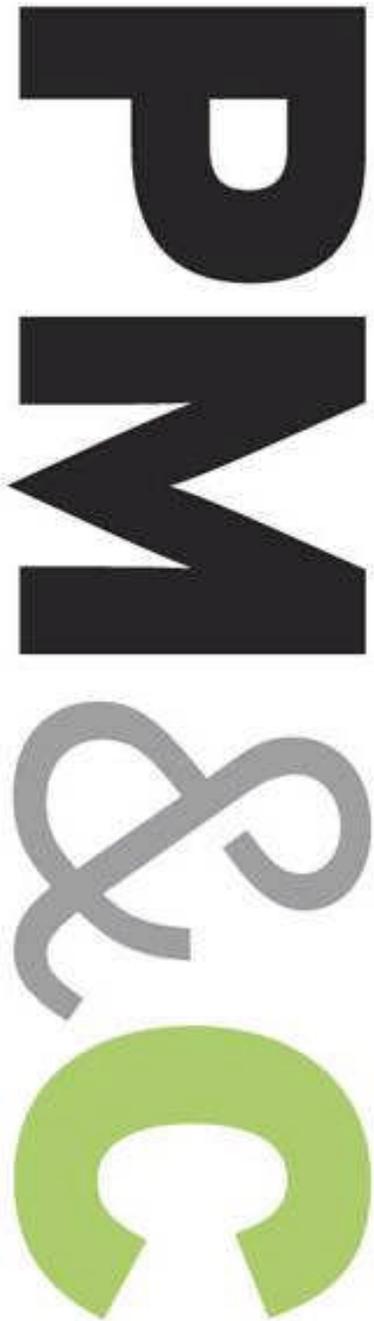


The estimates reflect costs for the work to be done publically and privately. The public cost includes a 10% premium for City of Cambridge, work requirements in addition to statutory requirements of MGL Chapter 149. Both detailed estimates are for construction only of the core and shell. Approximately 25% is added to include “soft” costs for design and engineering, testing, administrative and owner’s contingency. No cost is included for LEED certification or for tenant space fit-out. These are conceptual costs based on the analysis and assumptions outlined in the report, with the objective of developing reasonably comparable costs for the Options described. While the accompanying cost estimate breakdowns contain considerable detail they do not reflect detailed design or engineering efforts.

The costs can be summarized as follows:

OPTION A, minimum renovation	
Construction Cost	\$ 7,598,926
Soft Costs	\$ 1,899,732
TOTAL	\$ 9,498,658
Savings if bid privately	(\$1,899,732)
OPTION B, optimal renovation	
Construction Cost	\$ 8,982,790
Soft Costs	\$ 2,245,698
TOTAL	\$ 11,228,448
Savings if bid privately	(\$2,245,698)
Approximate cost for adjacent green space development	\$60,456





**Feasibility Submission**

**Cambridge Foundry Building  
Feasibility Design Options A and B**

Cambridge, MA

Prepared for:

**HMFH Architects, Inc.**



**Cambridge Foundry Building**  
 Feasibility Design Options A and B  
 Cambridge, MA

17-Jun-13

**Feasibility Submission**

**MAIN CONSTRUCTION COST SUMMARY**

	<b>Construction Start</b>	<b>Gross Floor Area</b>	<b>\$/sf</b>	<b>Estimated Construction Cost</b>
<b>OPTION A - RENOVATION</b>				
RENOVATE EXISTING BUILDING		50,155	\$103.02	\$5,167,137
REMOVE HAZARDOUS MATERIALS				NIC
EGRESS FROM FIRE PUMP ROOM - Allowance				\$25,000
SITework - New Pocket Park				\$60,456
<b>SUB-TOTAL</b>	Jun-14	50,155	\$104.73	\$5,252,593
DESIGN AND PRICING CONTINGENCY	15%			\$787,889
<b>SUB-TOTAL WITH CONTINGENCY</b>	Jun-14	50,155	\$120.44	\$6,040,482
GENERAL CONDITIONS	15.00%			\$906,072
BONDS	0.80%			\$48,324
INSURANCE	1.00%			\$60,405
PERMIT				NIC
OVERHEAD AND PROFIT	5%			\$302,024
ESCALATION TO START - June 2014 (assumed 4% PA)	4%			\$241,619
<b>TOTAL OF ALL CONSTRUCTION OPTION A</b>	Jun-14	50,155	\$151.51	<b>\$7,598,926</b>
Savings if Bid Privately				<b>(\$1,899,732)</b>





**Cambridge Foundry Building**  
Feasibility Design Options A and B  
Cambridge, MA

17-Jun-13

**Feasibility Submission****OPTION B - RENOVATION**

RENOVATE EXISTING BUILDING		50,155	\$122.10	\$6,123,703
REMOVE HAZARDOUS MATERIALS				NIC
EGRESS FROM FIRE PUMP ROOM - Allowance				\$25,000
SITework - New Pocket Park				\$60,456
SUB-TOTAL	Jun-14	50,155	\$123.80	\$6,209,159
DESIGN AND PRICING CONTINGENCY	15%			\$931,374
SUB-TOTAL WITH CONTINGENCY	Jun-14	50,155	\$142.37	\$7,140,533
GENERAL CONDITIONS	15.00%			\$1,071,080
BONDS	0.80%			\$57,124
INSURANCE	1.00%			\$71,405
PERMIT				NIC
OVERHEAD AND PROFIT	5%			\$357,027
ESCALATION TO START - June 2014 (assumed 4% PA)	4%			\$285,621
<b>TOTAL OF ALL CONSTRUCTION OPTION B</b>	Jun-14	50,155	\$179.10	<b>\$8,982,790</b>
Savings if Bid Privately				<b>(\$2,245,698)</b>
ALTERNATE				
Replace GWB and Insulation at Exterior Wall			ADD	<b>\$253,476</b>



**Cambridge Foundry Building**  
Feasibility Design Options A and B  
Cambridge, MA

17-Jun-13

**Feasibility Submission**

This Feasibility cost estimate was produced from preliminary drawings, outline specifications and other documentation prepared by HMFH Architects Inc. and their design team dated May 20th, 2013. Design and engineering changes occurring subsequent to the issue of these documents have not been incorporated in this estimate.

This estimate includes all direct construction costs, general contractor's overhead and profit and design contingency. Cost escalation assumes start dates indicated above.

We have assumed procurement will utilize a public bid under C.149 of the MGL with public bidding to pre-qualified General Contractors and subcontractors, open specifications for materials and manufactures. If 149a CM at risk procurement is selected costs will likely be greater than those included in this report.

The estimate is based on prevailing wage rates for construction in this market and represents a reasonable opinion of cost. It is not a prediction of the successful bid from a contractor as bids will vary due to fluctuating market conditions, errors and omissions, proprietary specifications, lack or surplus of bidders, perception of risk, etc. Consequently the estimate is expected to fall within the range of bids from a number of competitive contractors or subcontractors, however we do not warrant that bids or negotiated prices will not vary from the final construction cost estimate.

**ITEMS NOT CONSIDERED IN THIS ESTIMATE**

Items not included in this estimate are:

- Land acquisition, feasibility, and financing costs
- All professional fees and insurance
- Site or existing conditions surveys investigations costs, including to determine subsoil conditions
- All Furnishings, Fixtures and Equipment
- Items identified in the design as Not In Contract (NIC)
- Items identified in the design as by others
- Owner supplied and/or installed items as indicated in the estimate
- Utility company back charges, including work required off-site
- Work to City streets and sidewalks, (except as noted in this estimate)
- Construction contingency



## Section V



### Option A & B Cost Estimates

Cambridge Foundry Building  
Feasibility Design Options A and B  
Cambridge, MA

17-Jun-13

Feasibility Submission

GFA 50,155

<b>CONSTRUCTION COST SUMMARY</b>					
<i>BUILDING SYSTEM</i>		<i>SUB-TOTAL</i>	<i>TOTAL</i>	<i>\$/SF</i>	<i>%</i>
<b>OPTION A RENOVATION</b>					
<b>A10 FOUNDATIONS</b>					
A1010	Standard Foundations	\$34,018			
A1020	Special Foundations	\$0			
A1030	Lowest Floor Construction	\$155,088	<b>\$189,106</b>	\$3.77	3.7%
<b>A20 BASEMENT CONSTRUCTION</b>					
A2010	Basement Excavation	\$0			
A2020	Basement Walls	\$0	<b>\$0</b>	\$0.00	0.0%
<b>B10 SUPERSTRUCTURE</b>					
B1010	Upper Floor Construction	\$205,120			
B1020	Roof Construction	\$93,065	<b>\$298,185</b>	\$5.95	5.8%
<b>B20 EXTERIOR CLOSURE</b>					
B2010	Exterior Walls	\$267,725			
B2020	Windows	\$372,085			
B2030	Exterior Doors	\$18,718	<b>\$658,528</b>	\$13.13	12.7%
<b>B30 ROOFING</b>					
B3010	Roof Coverings	\$477,850			
B3020	Roof Openings	\$37,900	<b>\$515,750</b>	\$10.28	10.0%
<b>C10 INTERIOR CONSTRUCTION</b>					
C1010	Partitions	\$250,145			
C1020	Interior Doors	\$31,500			
C1030	Specialties/Millwork	\$97,166	<b>\$378,811</b>	\$7.55	7.3%
<b>C20 STAIRCASES</b>					
C2010	Stair Construction	\$72,000			
C2020	Stair Finishes	\$33,550	<b>\$105,550</b>	\$2.10	2.0%
<b>C30 INTERIOR FINISHES</b>					
C3010	Wall Finishes	\$64,422			
C3020	Floor Finishes	\$50,392			
C3030	Ceiling Finishes	\$47,115	<b>\$161,929</b>	\$3.23	3.1%
<b>D10 CONVEYING SYSTEMS</b>					
D1010	Elevator	\$50,000	<b>\$50,000</b>	\$1.00	1.0%
<b>D20 PLUMBING</b>					
D20	Plumbing	\$158,000	<b>\$158,000</b>	\$3.15	3.1%
<b>D30 HVAC</b>					
D30	HVAC	\$1,494,752	<b>\$1,494,752</b>	\$29.80	28.9%



Cambridge Foundry Building  
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GFA 50,155

<b>CONSTRUCTION COST SUMMARY</b>					
<i>BUILDING SYSTEM</i>		<i>SUB-TOTAL</i>	<i>TOTAL</i>	<i>\$/SF</i>	<i>%</i>
<b>OPTION A RENOVATION</b>					
<b>D40 FIRE PROTECTION</b>					
D40	Fire Protection	\$100,903	<b>\$100,903</b>	\$2.01	2.0%
<b>D50 ELECTRICAL</b>					
D5010	Complete System	\$497,538	<b>\$497,538</b>	\$9.92	9.6%
<b>E10 EQUIPMENT</b>					
E10	Equipment	\$0	<b>\$0</b>	\$0.00	0.0%
<b>E20 FURNISHINGS</b>					
E2010	Fixed Furnishings	\$4,500			
E2020	Movable Furnishings	NIC	<b>\$4,500</b>	\$0.09	0.1%
<b>F10 SPECIAL CONSTRUCTION</b>					
F10	Special Construction	\$0	<b>\$0</b>	\$0.00	0.0%
<b>F20 HAZMAT REMOVALS</b>					
F2010	Building Elements Demolition	\$553,585			
F2020	Hazardous Components Abatement	NIC	<b>\$553,585</b>	\$11.04	10.7%
<b>TOTAL DIRECT COST (Trade Costs)</b>			<b>\$5,167,137</b>	\$103.02	100.0%



# Section V

## Option A & B Cost Estimates



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GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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### OPTION A RENOVATION

#### GROSS FLOOR AREA CALCULATION

First Floor (Parking)	NIC
Second Floor	22,100
Third Floor	14,115
Fourth Floor	13,940

<b>TOTAL GROSS FLOOR AREA (GFA)</b>	<b>50,155</b>	<b>sf</b>
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#### A10 FOUNDATIONS

##### A1010 STANDARD FOUNDATIONS

###### Tie Beams, 18" x 24"

Excavation	122	cy	50.00	6,100
Remove off site	122	cy	30.00	3,660
Backfill with gravel	104	cy	45.00	4,680
Formwork	600	sf	15.00	9,000
Re-bar	2,160	lbs.	1.30	2,808
Concrete material; 4,000 psi	18	cy	115.00	2,070
Placing concrete	18	cy	150.00	2,700
Dowel into existing footings	12	loc	250.00	3,000
<b>SUBTOTAL</b>				<b>\$34,018</b>

##### A1020 SPECIAL FOUNDATIONS

No items in this section  
SUBTOTAL

##### A1030 LOWEST FLOOR CONSTRUCTION

Topping Slab to level floors	50,155	sf	2.50	125,388
<u>Cut and Patching</u>				
Saw cut for new tie-beams	360	lf	20.00	7,200
Remove and replace slabs for new tie-beams	750	sf	30.00	22,500
<b>SUBTOTAL</b>				<b>\$155,088</b>

<b>TOTAL - FOUNDATIONS</b>	<b>\$189,106</b>
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#### B10 SUPERSTRUCTURE

##### B1010 FLOOR CONSTRUCTION

New shear walls	3,660	sf	25.00	91,500
New W18 x 35	3	tns	5,000.00	15,000
Allowance to frame out around openings	1	ls	15,000.00	15,000
New angle at first floor perimeter	169	ea	140.00	23,660
A-Frame truss connections	34	ea	140.00	4,760
Heavy wood truss connections	34	ea	300.00	10,200
New diagonal bracing	4	tns	5,000.00	20,000
New penetrations to existing structure	1	ls	20,000.00	20,000
Fire stopping floors	1	ls	5,000.00	5,000
<b>SUBTOTAL</b>				<b>\$205,120</b>

##### B1020 ROOF CONSTRUCTION

5/8" plywood	25,630	sf	3.50	89,705
Infill roof where skylights removed	112	sf	30.00	3,360



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DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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**OPTION A RENOVATION**

SUBTOTAL

**\$93,065**

<b>TOTAL - SUPERSTRUCTURE</b>	<b>\$298,185</b>
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**B20 EXTERIOR CLOSURE**

**B2010 EXTERIOR WALLS**

25,263 sf

Interior skin

Existing to remain

NIC

Exterior skin

Patch/repair brick/stucco (20%)

**3,088** sf 25.00 77,200

New siding

**2,530** sf 30.00 75,900

Miscellaneous

Sawcut brick for new window openings

**340** lf 15.00 5,100

Remove existing brick

**355** sf 10.00 3,550

Cut in lintel at new window

**140** lf 250.00 35,000

Staging to exterior wall

**29,573** sf 2.40 70,975

SUBTOTAL

**\$267,725**

**B2020 WINDOWS/CURTAINWALL**

4,310 sf

New windows

**3,200** sf 80.00 256,000

New storefront

**1,060** sf 85.00 90,100

Louvers

**50** sf 70.00 3,500

Backer rod & double sealant

**2,998** lf 5.00 14,990

Wood blocking at openings

**2,998** lf 2.50 7,495

SUBTOTAL

**\$372,085**

**B2030 EXTERIOR DOORS**

Glazed entrance doors including frame and hardware; double door

**1** pr 7,500.00 7,500

HM doors, HM frames and hardware- Single

**2** ea 1,500.00 3,000

Overhead door, 14' x 8'

**1** ea 7,840.00 7,840

Backer rod & double sealant

**54** lf 4.00 216

Wood blocking at openings

**54** lf 3.00 162

SUBTOTAL

**\$18,718**

<b>TOTAL - EXTERIOR CLOSURE</b>	<b>\$658,528</b>
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**B30 ROOFING**

**B3010 ROOF COVERINGS**

Sloped roofing

Remove existing roof membrane

**25,630** sf 2.00 51,260

New sarnafil roof system, white

**25,630** sf 15.00 384,450

Miscellaneous Roofing

Roof edge

**980** lf 25.00 24,500

Roof edge blocking

**980** lf 18.00 17,640

SUBTOTAL

**\$477,850**

**B3020 ROOF OPENINGS**

New skylights

**330** sf 100.00 33,000

Roof hatch

**1** ea 2,500.00 2,500



# Section V

## Option A & B Cost Estimates



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GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	Roof ladders	2	ea	1,200.00	2,400		
	SUBTOTAL					<b>\$37,900</b>	
<b>TOTAL - ROOFING</b>							<b>\$515,750</b>
<b>C10 INTERIOR CONSTRUCTION</b>							
<b>C1010 PARTITIONS</b>							
	New interior partition	13,175	sf	15.00	197,625		
	Column furring	3,740	sf	6.00	22,440		
	Chase walls	1,880	sf	16.00	30,080		
	SUBTOTAL					<b>\$250,145</b>	
<b>C1020 INTERIOR DOORS</b>							
	Interior doors, frames and hardware	21	ea	1,500.00	31,500		
	SUBTOTAL					<b>\$31,500</b>	
<b>C1030 SPECIALTIES / MILLWORK</b>							
<i>Toilet Partitions</i>							
	Standard partition	6	ea	1,450.00	8,700		
	ADA partition	6	ea	1,750.00	10,500		
	Urinal screens	6	ea	600.00	3,600		
<i>Toilet Accessories</i>							
	Gang bathrooms	6	rm	3,000.00	18,000		
	Individual bathrooms, ADA	2	rm	900.00	1,800		
	Backer panels in electrical closets	1	ls	1,000.00	1,000		
	Fire extinguisher cabinets	17	ea	350.00	5,950		
	Miscellaneous metals throughout building	50,155	sf	0.75	37,616		
	Miscellaneous sealants throughout building	1	ls	10,000.00	10,000		
	SUBTOTAL					<b>\$97,166</b>	
<b>TOTAL - INTERIOR CONSTRUCTION</b>							<b>\$378,811</b>
<b>C20 STAIRCASES</b>							
<b>C2010 STAIR CONSTRUCTION</b>							
	ADA upgrades	9	flt	8,000.00	72,000		
	SUBTOTAL					<b>\$72,000</b>	
<b>C2020 STAIR FINISHES</b>							
	New rubber stair treads/risers	585	lf	30.00	17,550		
	Paint to stairs	8	flt	2,000.00	16,000		
	SUBTOTAL					<b>\$33,550</b>	
<b>TOTAL - STAIRCASES</b>							<b>\$105,550</b>
<b>C30 INTERIOR FINISHES</b>							
<b>C3010 WALL FINISHES</b>							
	Paint to stairwells, corridors	27,232	sf	1.20	32,678		
	Ceramic tile wainscot, full height wet wall	1,984	sf	16.00	31,744		



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GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	SUBTOTAL					<b>\$64,422</b>	
<b>C3020</b>	<b>FLOOR FINISHES</b>						
	Carpet	4,540	sf	5.00	22,700		
	Ceramic tile	1,130	sf	16.00	18,080		
	Resilient base	1,387	lf	2.50	3,468		
	Ceramic tile base	384	lf	16.00	6,144		
	SUBTOTAL					<b>50,392</b>	
<b>C3030</b>	<b>CEILING FINISHES</b>						
	GWB soffits for MEP	2,160	sf	10.00	21,600		
	ACT	5,670	sf	4.50	25,515		
	SUBTOTAL					<b>\$47,115</b>	
<b>TOTAL - INTERIOR FINISHES</b>							<b>\$161,929</b>

**D10 CONVEYING SYSTEMS**

	New wheelchair lift	1	ea	30,000.00	30,000		
	Upgrade to existing elevator controls	1	ea	20,000.00	20,000		
	SUBTOTAL					<b>\$50,000</b>	

**TOTAL - CONVEYING SYSTEMS \$50,000**

**D20 PLUMBING**

**D20 PLUMBING, GENERALLY**

<u>Equipment</u>							
	Electric point-of use water heater	21	ea	750.00	15,750		
	Elevator pit sump pump	1	ea	2,500.00	2,500		
	Water service and meter - existing			NIC			
	Connection to gas meter	1	ea	1,200.00	1,200		
<u>Plumbing Fixtures</u>							
	Water closet w/sensor flush valve	20	ea	1,400.00	28,000		
	Urinal w/sensor flush valve	3	ea	1,350.00	4,050		
	Lavatory w/sensor faucet	23	ea	1,000.00	23,000		
	Electric Water cooler	3	ea	3,600.00	10,800		
	Floor drain	6	ea	550.00	3,300		
	Roof drains - existing			NIC			
	Hose bibb	6	ea	150.00	900		
	Gas connection at boilers	2	ea	500.00	1,000		
<u>Domestic Water Piping</u>							
	Fixture rough-ins	55	ea	300.00	16,500		
<u>Sanitary Waste &amp; Vent Piping</u>							
	Fixture rough-ins	55	ea	350.00	19,250		
<u>Storm Drainage Piping</u>							
	Storm drain piping - existing			NIC			
<u>Gas Distribution Piping</u>							
	Gas piping to boilers	250	lf	45.00	11,250		
<u>Miscellaneous</u>							
	Coordination & management	1	ls	7,500.00	7,500		
	Coring, sleeves & firestopping	1	ls	3,500.00	3,500		



# Section V

## Option A & B Cost Estimates



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GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	Demolition	1	ls	5,000.00	5,000		
	Testing and sterilization	1	ls	3,000.00	3,000		
	Fees & permits	1	ls	1,500.00	1,500		
	<b>SUBTOTAL</b>					<b>\$158,000</b>	
<b>TOTAL - PLUMBING</b>							<b>\$158,000</b>

<b>D30 HVAC</b>
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**D30 HVAC, GENERALLY**

Equipment

500mbh gas-fired condensing boiler	2	ea	22,000.00	44,000
115 ton cooling tower - existing				NIC
Expansion tank	1	ea	2,000.00	2,000
Air separator	1	ea	1,200.00	1,200
Chemical treatment system	1	ls	4,500.00	4,500
Unit heater	2	ea	900.00	1,800
Cabinet unit heater	6	ea	1,750.00	10,500
Heating devices at garage - existing				NIC
Misc. heating devices	1	ls	15,000.00	15,000
Hot water pump, 415 gpm	2	ea	5,750.00	11,500
Condenser water pump, 345 gpm	1	ea	5,500.00	5,500
Variable frequency drive	2	ea	3,250.00	6,500
Air handling unit w/heat recovery, 5000 cfm	3	ea	37,500.00	112,500
Air handling unit w/heat recovery, 3000 cfm	1	ea	23,500.00	23,500
Air-cooled condensing unit, 20 ton	3	ea	17,500.00	52,500
Air-cooled condensing unit, 15 ton	1	ea	12,500.00	12,500
Water source heat pump, 3 ton (20 per floor)	60	ea	3,600.00	216,000
Ductless split system AC unit	1	ea	4,000.00	4,000
Exhaust fans	1	ls	10,000.00	10,000

Air Distribution

Galvanized steel ductwork	25,000	lbs.	10.00	250,000
Duct insulation	15,000	sf	4.00	60,000
Breeching & flue	1	ls	22,500.00	22,500
Miscellaneous RGDs	1	ls	3,000.00	3,000
Make-up air louver at garage	2	ea	3,250.00	6,500

Piping

Condenser water piping with valves & insulation	50,155	sf	2.50	125,388
Refrigerant piping with valves & insulation	1	ls	20,000.00	20,000

Condensate Drain Pipe

Condensate drain pipe with fittings & hangers	50,155	sf	0.50	25,078
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Piping Insulation

	50,155	sf	1.00	50,155
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Controls (DDC)

Automatic temperature controls at tenant floors	50,155	sf	3.00	150,465
Controls with CO monitoring at garage	23,700	sf	1.50	35,550

Balancing

System testing & balancing	50,155	sf	0.75	37,616
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Miscellaneous

Coordination & management	1	ls	75,000.00	75,000
Commissioning support	1	ls	15,000.00	15,000



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	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	Coring, sleeves & firestopping	1	ls	25,000.00	25,000		
	Demolition	1	ls	15,000.00	15,000		
	Equipment start-up and inspection	1	ls	10,000.00	10,000		
	Rigging & equipment rental	1	ls	15,000.00	15,000		
	Vibration & seismic restraints	1	ls	20,000.00	20,000		
	<b>SUBTOTAL</b>						<b>\$1,494,752</b>

<b>TOTAL - HVAC</b>	<b>\$1,494,752</b>
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**D40 FIRE PROTECTION**

**D40 FIRE PROTECTION, GENERALLY**

	Double check valve assembly - existing				ETR		
	Alarm check valve - existing				ETR		
	Fire pump - existing				ETR		
	Floor control valve stations - existing				ETR		
	Fire department standpipe valve	4	ea	900.00	3,600		
	Replace existing tenant heads with upright	42,365	sf	1.50	63,548		
	Adjust heads for new ceilings	5,670	sf	1.50	8,505		
	Sprinkler heads & distribution at garage - existing				ETR		
	Standpipe with fittings & hangers	175	lf	50.00	8,750		
	<u>Miscellaneous</u>						
	Coordination & management	1	ls	5,000.00	5,000		
	Hydraulic calculations	1	ls	2,000.00	2,000		
	Coring, sleeves & firestopping	1	ls	3,500.00	3,500		
	Commissioning of system	1	ls	5,000.00	5,000		
	Fees & permits	1	ls	1,000.00	1,000		
	<b>SUBTOTAL</b>						<b>\$100,903</b>

<b>TOTAL - FIRE PROTECTION</b>	<b>\$100,903</b>
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**D50 ELECTRICAL**

**D5010 SERVICE & DISTRIBUTION**

**Gear & Distribution**

Normal Power

	F&I 200A 3P circuit breaker in existing switchboard for fire pump	1	ea	2,500.00	2,500		
	F&I 400A 3P circuit breaker in existing switchboard						
	400A distribution panelboard with provision for (4) 200A meter sockets	4	ea	13,250.00	53,000		
	<u>Feeders</u>						
	400A feed (allow)	400	lf	102.00	40,800		
	Grounding & bonding	1	ls	3,500.00	3,500		
	<u>Emergency power</u>						
	Emergency power (NIC)				NIC		
	<u>Equipment Wiring</u>						
	ACCU unit feed and connection	4	ea	3,500.00	14,000		
	AHU feed and connection	4	ea	3,500.00	14,000		



# Section V

## Option A & B Cost Estimates



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	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	Boiler feed and connection	2	ea	1,500.00	3,000		
	Split unit feed and connection	1	ea	2,500.00	2,500		
	Elevator cab power 30A feed, connection & disconnect		ea		ETR		
	Elevator FSS, enclosed CB, feed and connection		ea		ETR		
	Lift FSS, feed and connection	1	ea	1,500.00	1,500		
	Exhaust fan feed and connection	1	ls	5,000.00	5,000		
	Pump feed and connection	3	ea	1,500.00	4,500		
	Heat pump feed and connection	60	ea	1,200.00	72,000		
	Metering for heat pumps	60	ea	500.00	30,000		
	UH/CUH feed and connection	8	ea	1,000.00	8,000		
	VFD's feed and connection	2	ea	850.00	1,700		
	Misc. equipment wiring	50,155	sf	0.50	25,078		
	<b>SUBTOTAL</b>						<b>\$281,078</b>
<b>D5020 LIGHTING &amp; POWER</b>							
	<u>Lighting &amp; Branch Power</u>						
	Type G	33	ea	350.00	11,550		
	Type G with emergency ballast	10	ea	450.00	4,500		
	Type FS1 with emergency ballast	12	ea	240.00	2,880		
	Type FS1	12	ea	140.00	1,680		
	Type SL4	2	ea	300.00	600		
	Type I4	3	ea	140.00	420		
	Exit sign	11	ea	220.00	2,420		
	<u>Lighting controls</u>						
	Single pole switch (allow)	4	ea	30.00	120		
	Occupancy sensor	6	ea	200.00	1,200		
	<u>Branch devices</u>						
	GFI duplex receptacle (allow)	16	ea	42.00	672		
	Device box	105	ea	30.00	3,150		
	3/4" conduit	2,500	lf	7.50	18,750		
	#12 THHN	10,000	lf	0.85	8,500		
	<b>SUBTOTAL</b>						<b>\$56,442</b>
<b>D5030 COMMUNICATION &amp; SECURITY SYSTEMS</b>							
	<u>Telephone/Data/CATV</u>						
	Devices and cabling (allow)	1	ls	2,500.00	2,500		
	MDF fit-out	1	ls	2,500.00	2,500		
	Closet grounding	1	ls	500.00	500		
	Backboard	1	ls	350.00	350		
	<u>Fire Alarm</u>						
	New control panel	1	ls	3,500.00	3,500		
	Initiating device	12	ea	100.00	1,200		
	Audio/visual device	16	ea	105.00	1,680		
	Control/monitor module	1	ea	200.00	200		
	Device box	6	ea	210.00	1,260		
	3/4" conduit	24	ea	30.00	720		
	FA cable	1,000	lf	7.50	7,500		
	Testing & programming	1,500	lf	1.25	1,875		
	<u>Security System</u>						
	Modify and upgrade existing head end	1	ls	1,500.00	1,500		
	Modify and upgrade existing head end	1	ls	3,500.00	3,500		
	Cameras, devices and cabling	50,155	sf	1.50	75,233		



Feasibility Submission

GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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**OPTION A RENOVATION**

SUBTOTAL **\$102,518**

**D5040 OTHER ELECTRICAL SYSTEMS**

Miscellaneous

Demolition work	1	ls	15,000.00	15,000		
Seismic restraints	1	ls	7,500.00	7,500		
Temp power and lights	1	ls	30,000.00	30,000		
Fees & Permits	1	ls	5,000.00	5,000		

SUBTOTAL **\$57,500**

<b>TOTAL - ELECTRICAL</b>	<b>\$497,538</b>
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**E10 EQUIPMENT**

**E10 EQUIPMENT, GENERALLY**

No items in this section

SUBTOTAL

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<b>TOTAL - EQUIPMENT</b>	
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**E20 FURNISHINGS**

**E2010 FIXED FURNISHINGS**

Entry mats & frames - recessed with carpet/rubber strips	100	sf	45.00	4,500		
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SUBTOTAL

**\$4,500**

**E2020 MOVABLE FURNISHINGS**

All movable furnishings to be provided and installed by owner

SUBTOTAL

NIC

<b>TOTAL - FURNISHINGS</b>	<b>\$4,500</b>
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**F10 SPECIAL CONSTRUCTION**

**F10 SPECIAL CONSTRUCTION**

No items in this section

SUBTOTAL

<b>TOTAL - SPECIAL CONSTRUCTION</b>	
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**F20 SELECTIVE BUILDING DEMOLITION**

**F2010 BUILDING ELEMENTS DEMOLITION**

Remove existing siding	2,530	sf	5.00	12,650		
Demolish ground floor bathrooms	2	rms	2,000.00	4,000		
Remove stairs	1	flt	3,000.00	3,000		
Remove skylights	7	ea	250.00	1,750		
Remove skylights at upper roof	330	ea	10.00	3,300		
Remove windows/storefront	3,905	sf	7.00	27,335		



# Section V

## Option A & B Cost Estimates



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 Feasibility Design Options A and B  
 Cambridge, MA

17-Jun-13

Feasibility Submission

GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION A RENOVATION</b>							
	Interior gut demolition	50,155	sf	10.00	501,550		
	SUBTOTAL					<b>\$553,585</b>	
<b>F2020 HAZARDOUS COMPONENTS ABATEMENT</b>							
	Abatement				NIC		
	SUBTOTAL						
<b>TOTAL - SELECTIVE BUILDING DEMOLITION</b>							<b>\$553,585</b>



<b>CONSTRUCTION COST SUMMARY</b>					
<i>BUILDING SYSTEM</i>		<i>SUB-TOTAL</i>	<i>TOTAL</i>	<i>\$/SF</i>	<i>%</i>
<b>OPTION B RENOVATION</b>					
<b>A10 FOUNDATIONS</b>					
A1010	Standard Foundations	\$124,570			
A1020	Special Foundations	\$0			
A1030	Lowest Floor Construction	\$173,748	<b>\$298,318</b>	\$5.95	4.9%
<b>A20 BASEMENT CONSTRUCTION</b>					
A2010	Basement Excavation	\$0			
A2020	Basement Walls	\$0	<b>\$0</b>	\$0.00	0.0%
<b>B10 SUPERSTRUCTURE</b>					
B1010	Upper Floor Construction	\$331,633			
B1020	Roof Construction	\$112,830	<b>\$444,463</b>	\$8.86	7.3%
<b>B20 EXTERIOR CLOSURE</b>					
B2010	Exterior Walls	\$385,772			
B2020	Windows	\$445,355			
B2030	Exterior Doors	\$18,718	<b>\$849,845</b>	\$16.94	13.9%
<b>B30 ROOFING</b>					
B3010	Roof Coverings	\$487,990			
B3020	Roof Openings	\$40,400	<b>\$528,390</b>	\$10.54	8.6%
<b>C10 INTERIOR CONSTRUCTION</b>					
C1010	Partitions	\$312,345			
C1020	Interior Doors	\$59,000			
C1030	Specialties/Millwork	\$97,166	<b>\$468,511</b>	\$9.34	7.7%
<b>C20 STAIRCASES</b>					
C2010	Stair Construction	\$132,000			
C2020	Stair Finishes	\$35,550	<b>\$167,550</b>	\$3.34	2.7%
<b>C30 INTERIOR FINISHES</b>					
C3010	Wall Finishes	\$64,422			
C3020	Floor Finishes	\$50,392			
C3030	Ceiling Finishes	\$47,115	<b>\$161,929</b>	\$3.23	2.6%
<b>D10 CONVEYING SYSTEMS</b>					
D1010	Elevator	\$161,600	<b>\$161,600</b>	\$3.22	2.6%



## Section V



### Option A & B Cost Estimates

Cambridge Foundry Building  
Feasibility Design Options A and B  
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GFA 50,155

<b>CONSTRUCTION COST SUMMARY</b>					
<i>BUILDING SYSTEM</i>		<i>SUB-TOTAL</i>	<i>TOTAL</i>	<i>\$/SF</i>	<i>%</i>
<b>OPTION B RENOVATION</b>					
<b>D20 PLUMBING</b>					
D20	Plumbing	\$157,000	<b>\$157,000</b>	\$3.13	2.6%
<b>D30 HVAC</b>					
D30	HVAC	\$1,783,301	<b>\$1,783,301</b>	\$35.56	29.1%
<b>D40 FIRE PROTECTION</b>					
D40	Fire Protection	\$100,903	<b>\$100,903</b>	\$2.01	1.6%
<b>D50 ELECTRICAL</b>					
D5010	Complete System	\$421,838	<b>\$421,838</b>	\$8.41	6.9%
<b>E10 EQUIPMENT</b>					
E10	Equipment	\$0	<b>\$0</b>	\$0.00	0.0%
<b>E20 FURNISHINGS</b>					
E2010	Fixed Furnishings	\$4,500			
E2020	Movable Furnishings	NIC	<b>\$4,500</b>	\$0.09	0.1%
<b>F10 SPECIAL CONSTRUCTION</b>					
F10	Special Construction	\$0	<b>\$0</b>	\$0.00	0.0%
<b>F20 HAZMAT REMOVALS</b>					
F2010	Building Elements Demolition	\$575,555			
F2020	Hazardous Components Abatement	NIC	<b>\$575,555</b>	\$11.48	9.4%
<b>TOTAL DIRECT COST (Trade Costs)</b>			<b>\$6,123,703</b>	\$122.10	100.0%



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	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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**OPTION B RENOVATION**

**GROSS FLOOR AREA CALCULATION**

First Floor (Parking)	NIC
Second Floor	22,100
Third Floor	14,115
Fourth Floor	13,940

<b>TOTAL GROSS FLOOR AREA (GFA)</b>	<b>50,155 sf</b>
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**A10 FOUNDATIONS**

**A1010 STANDARD FOUNDATIONS**

Tie Beams, 18" x 24"

Excavation	122	cy	50.00	6,100
Remove off site	122	cy	30.00	3,660
Backfill with gravel	104	cy	45.00	4,680
Formwork	600	sf	15.00	9,000
Re-bar	2,160	lbs.	1.30	2,808
Concrete material; 4,000 psi	18	cy	115.00	2,070
Placing concrete	18	cy	150.00	2,700
Dowel into existing footings	12	loc	250.00	3,000

Retaining wall footings for new vestibule

Excavation	74	cy	50.00	3,700
Remove off site	74	cy	30.00	2,220
Backfill with gravel	62	cy	45.00	2,790
Formwork	100	sf	15.00	1,500
Re-bar	1,440	lbs.	1.30	1,872
Concrete material; 4,000 psi	12	cy	115.00	1,380
Placing concrete	12	cy	150.00	1,800
Tie into existing footings	2	loc	250.00	500

Retaining walls at exterior - 12" thick with brick shelf

Formwork	1,300	sf	15.00	19,500
Re-bar	3,250	lbs.	1.30	4,225
Concrete material; 4,000 psi	25	cy	115.00	2,875
Placing concrete	25	cy	150.00	3,750
Waterproofing foundation wall and footing	650	sf	5.00	3,250
Insulation to foundation walls; 2" thick	200	sf	2.00	400

Strip footings for new vestibule

Excavation	41	cy	50.00	2,050
Remove off site	41	cy	30.00	1,230
Backfill with gravel	36	cy	45.00	1,620
Formwork	80	sf	15.00	1,200
Re-bar	600	lbs.	1.30	780
Concrete material; 4,000 psi	5	cy	115.00	575
Placing concrete	5	cy	150.00	750
Tie into existing footings	2	loc	250.00	500

Foundation walls at exterior - 12" thick with brick shelf

Formwork	280	sf	15.00	4,200
Re-bar	700	lbs.	1.30	910
Concrete material; 4,000 psi	5	cy	115.00	575
Placing concrete	5	cy	150.00	750
Waterproofing foundation wall and footing	140	sf	5.00	700



# Section V

## Option A & B Cost Estimates



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GFA

50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION B RENOVATION</b>							
	Insulation to foundation walls; 2" thick	160	sf	2.00	320		
	<u>Elevator Pit</u>						
	Excavation for elevator pit	84	cy	50.00	4,200		
	Remove off site	84	cy	30.00	2,520		
	Backfill with gravel	4	cy	45.00	180		
	Elevator pit walls						
	formwork	400	sf	15.00	6,000		
	reinforcement	800	lbs.	1.30	1,040		
	concrete material	5	cy	115.00	575		
	placing concrete	5	cy	150.00	750		
	Slab						
	formwork	150	sf	12.00	1,800		
	reinforcement	750	lbs.	1.30	975		
	concrete material in slab	6	cy	115.00	690		
	placing concrete	6	cy	150.00	900		
	Bentonite waterstops	1	ls	500.00	500		
	Cementitious waterproofing to elevator pit	300	sf	15.00	4,500		
	SUBTOTAL						<b>\$124,570</b>
	<b>A1020 SPECIAL FOUNDATIONS</b>						
	Underpinning						NIC
	SUBTOTAL						
	<b>A1030 LOWEST FLOOR CONSTRUCTION</b>						
	Topping Slab to level floors	50,155	sf	2.50	125,388		
	New SOG at vestibule and elevator machine room	590	sf	30.00	17,700		
	<u>Cut and Patching</u>						
	Saw cut for new tie-beams and elevator pit	408	lf	20.00	8,160		
	Remove and replace slabs for new tie-beams	750	sf	30.00	22,500		
	SUBTOTAL						<b>\$173,748</b>
<b>TOTAL - FOUNDATIONS</b>							<b>\$298,318</b>

### **B10 SUPERSTRUCTURE**

#### **B1010 FLOOR CONSTRUCTION**

	New shear walls	3,660	sf	25.00	91,500		
	New W18 x 35	3	tns	5,000.00	15,000		
	Allowance to frame out around openings	1	ls	15,000.00	15,000		
	New angle at first floor perimeter	169	ea	140.00	23,660		
	A-Frame truss connections	34	ea	140.00	4,760		
	Heavy wood truss connections	34	ea	300.00	10,200		
	New diagonal bracing	4	tns	5,000.00	20,000		
	New penetrations to existing structure	1	ls	20,000.00	20,000		
	Premium for Option B structural upgrades	1	ls	100,060.00	100,060		
	New structure, decking at elevator shaft	7	tns	3,500.00	24,500		
	Metal galvanized floor Deck; 3" 20 Ga. Deck	255	sf	2.50	638		
	WWF reinforcement	293	sf	0.70	205		
	Concrete Fill to metal deck; 5-1/2" thick; NW	5	cy	120.00	600		
	Place and finish concrete	255	sf	2.00	510		
	Fire stopping floors	1	ls	5,000.00	5,000		
	SUBTOTAL						<b>\$331,633</b>



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GFA

50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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**OPTION B RENOVATION**

**B1020 ROOF CONSTRUCTION**

New structure, decking at new vestibule	590	sf	30.00	17,700		
5/8" plywood	26,220	sf	3.50	91,770		
Infill roof where skylights removed	112	sf	30.00	3,360		
<b>SUBTOTAL</b>						<b>\$112,830</b>

<b>TOTAL - SUPERSTRUCTURE</b>						<b>\$444,463</b>
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**B20 EXTERIOR CLOSURE**

**B2010 EXTERIOR WALLS**

<u>Interior skin</u>	24,973	sf				
CMU backup to elevator shaft	701	sf	24.00	16,824		
MS backup	1,092	sf	9.00	9,828		
Sheathing	1,092	sf	3.00	3,276		
Insulation to exterior walls	1,793	sf	2.40	4,303		
A/V barrier at exterior walls	1,793	sf	6.00	10,758		
GWB to interior face	1,092	sf	2.50	2,730		
Replace existing GWB, insulation					ALT	
<u>Exterior skin</u>						
New brick at stairs/elevator, match existing	1,793	sf	40.00	71,720		
Patch/repair brick/stucco (20%)	3,088	sf	25.00	77,200		
New siding	2,530	sf	30.00	75,900		
<u>Miscellaneous</u>						
Sawcut brick for new window openings	340	lf	15.00	5,100		
Remove existing brick	355	sf	10.00	3,550		
Cut in lintel at new window	140	lf	250.00	35,000		
Staging to exterior wall	28,993	sf	2.40	69,583		
<b>SUBTOTAL</b>						<b>\$385,772</b>

**B2020 WINDOWS/CURTAINWALL**

	4,020	sf				
New windows	3,200	sf	80.00	256,000		
New storefront	770	sf	85.00	65,450		
Storefront at new vestibule	1,152	sf	85.00	97,920		
Louvers	50	sf	70.00	3,500		
Backer rod & double sealant	2,998	lf	5.00	14,990		
Wood blocking at openings	2,998	lf	2.50	7,495		
<b>SUBTOTAL</b>						<b>\$445,355</b>

**B2030 EXTERIOR DOORS**

Glazed entrance doors including frame and hardware; double door	1	pr	7,500.00	7,500		
HM doors, HM frames and hardware- Single	2	ea	1,500.00	3,000		
Overhead door, 14' x 8'	1	ea	7,840.00	7,840		
Backer rod & double sealant	54	lf	4.00	216		
Wood blocking at openings	54	lf	3.00	162		
<b>SUBTOTAL</b>						<b>\$18,718</b>

<b>TOTAL - EXTERIOR CLOSURE</b>						<b>\$849,845</b>
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# Section V

## Option A & B Cost Estimates



Cambridge Foundry Building  
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	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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### OPTION B RENOVATION

#### B30 ROOFING

##### B3010 ROOF COVERINGS

###### Sloped roofing

Remove existing roof membrane	25,630	sf	2.00	51,260
New sarnafil roof system, white	26,220	sf	15.00	393,300

###### Miscellaneous Roofing

Roof edge	1,010	lf	25.00	25,250
Roof edge blocking	1,010	lf	18.00	18,180

SUBTOTAL

**\$487,990**

##### B3020 ROOF OPENINGS

New skylights	330	sf	100.00	33,000
Elevator hatch	1	ea	2,500.00	2,500
Roof hatch	1	ea	2,500.00	2,500
Roof ladders	2	ea	1,200.00	2,400

SUBTOTAL

**\$40,400**

#### TOTAL - ROOFING

**\$528,390**

#### C10 INTERIOR CONSTRUCTION

##### C1010 PARTITIONS

New interior partition	13,175	sf	15.00	197,625
Column furring	3,740	sf	6.00	22,440
Chase walls	1,880	sf	16.00	30,080
Elevator shaft	550	sf	40.00	22,000
Glazing at new stairs/elevator	670	sf	60.00	40,200

SUBTOTAL

**\$312,345**

##### C1020 INTERIOR DOORS

Interior doors, frames and hardware	23	ea	1,500.00	34,500
Glazed aluminum doors at new stairs	7	ea	3,500.00	24,500

SUBTOTAL

**\$59,000**

##### C1030 SPECIALTIES / MILLWORK

###### *Toilet Partitions*

Standard partition	6	ea	1,450.00	8,700
ADA partition	6	ea	1,750.00	10,500
Urinal screens	6	ea	600.00	3,600

###### *Toilet Accessories*

Gang bathrooms	6	rm	3,000.00	18,000
Individual bathrooms, ADA	2	rm	900.00	1,800
Backer panels in electrical closets	1	ls	1,000.00	1,000
Fire extinguisher cabinets	17	ea	350.00	5,950

Miscellaneous metals throughout building	50,155	sf	0.75	37,616
Miscellaneous sealants throughout building	1	ls	10,000.00	10,000

SUBTOTAL

**\$97,166**

#### TOTAL - INTERIOR CONSTRUCTION

**\$468,511**



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**OPTION B RENOVATION**

**C20 STAIRCASES**

**C2010 STAIR CONSTRUCTION**

New stairs	3	flt	28,000.00	84,000		
ADA upgrades	6	flt	8,000.00	48,000		
<b>SUBTOTAL</b>						<b>\$132,000</b>

**C2020 STAIR FINISHES**

New rubber stair treads/risers	585	lf	30.00	17,550		
Paint to stairs	9	flt	2,000.00	18,000		
<b>SUBTOTAL</b>						<b>\$35,550</b>

**TOTAL - STAIRCASES**

**\$167,550**

**C30 INTERIOR FINISHES**

**C3010 WALL FINISHES**

Paint to stairwells, corridors	27,232	sf	1.20	32,678		
Ceramic tile wainscot, full height wet wall	1,984	sf	16.00	31,744		
<b>SUBTOTAL</b>						<b>\$64,422</b>

**C3020 FLOOR FINISHES**

Carpet	4,540	sf	5.00	22,700		
Ceramic tile	1,130	sf	16.00	18,080		
Resilient base	1,387	lf	2.50	3,468		
Ceramic tile base	384	lf	16.00	6,144		
<b>SUBTOTAL</b>						<b>50,392</b>

**C3030 CEILING FINISHES**

GWB soffits for MEP	2,160	sf	10.00	21,600		
ACT	5,670	sf	4.50	25,515		
<b>SUBTOTAL</b>						<b>\$47,115</b>

**TOTAL - INTERIOR FINISHES**

**\$161,929**

**D10 CONVEYING SYSTEMS**

New elevator, 4 stop, two-sided opening	1	ea	160,000.00	160,000		
Pit ladders	1	ea	1,000.00	1,000		
Sill angles	24	lf	25.00	600		
<b>SUBTOTAL</b>						<b>\$161,600</b>

**TOTAL - CONVEYING SYSTEMS**

**\$161,600**

**D20 PLUMBING**

**D20 PLUMBING, GENERALLY**

<u>Equipment</u>						
Electric point-of use water heater	21	ea	750.00	15,750		
Elevator pit sump pump	1	ea	2,500.00	2,500		
Water service and meter - existing					NIC	
Connection to gas meter	1	ea	1,200.00	1,200		



# Section V

## Option A & B Cost Estimates



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GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION B RENOVATION</b>							
	<u>Plumbing Fixtures</u>						
	Water closet w/sensor flush valve	20	ea	1,400.00	28,000		
	Urinal w/sensor flush valve	3	ea	1,350.00	4,050		
	Lavatory w/sensor faucet	23	ea	1,000.00	23,000		
	Electric Water cooler	3	ea	3,600.00	10,800		
	Floor drain	6	ea	550.00	3,300		
	Roof drains - existing				NIC		
	Hose bibb	6	ea	150.00	900		
	Gas connection at boilers	2	ea	500.00	1,000		
	<u>Domestic Water Piping</u>						
	Fixture rough-ins	55	ea	300.00	16,500		
	<u>Sanitary Waste &amp; Vent Piping</u>						
	Fixture rough-ins	55	ea	350.00	19,250		
	<u>Storm Drainage Piping</u>						
	Storm drain piping - existing				NIC		
	<u>Gas Distribution Piping</u>						
	Gas piping to boilers	250	lf	45.00	11,250		
	<u>Miscellaneous</u>						
	Coordination & management	1	ls	7,500.00	7,500		
	Coring, sleeves & firestopping	1	ls	3,500.00	3,500		
	Demolition	1	ls	4,000.00	4,000		
	Testing and sterilization	1	ls	3,000.00	3,000		
	Fees & permits	1	ls	1,500.00	1,500		
	<b>SUBTOTAL</b>					<b>\$157,000</b>	
<b>TOTAL - PLUMBING</b>							<b>\$157,000</b>

**D30 HVAC**

**D30 HVAC, GENERALLY**

Equipment

	1000mbh gas-fired condensing boiler	2	ea	27,500.00	55,000		
	Air-cooled chiller, 150 ton	1	ea	125,000.00	125,000		
	Expansion tank	2	ea	2,000.00	4,000		
	Air separator	2	ea	1,200.00	2,400		
	Chemical treatment system	1	ls	7,500.00	7,500		
	Unit heater	2	ea	900.00	1,800		
	Cabinet unit heater	6	ea	1,750.00	10,500		
	Heating devices at garage - existing				NIC		
	Misc. heating devices	1	ls	15,000.00	15,000		
	Hot water pump, 200 gpm	2	ea	4,500.00	9,000		
	Chilled water pump, 400 gpm	2	ea	5,750.00	11,500		
	Variable frequency drive	4	ea	3,250.00	13,000		
	Air handling unit w/heat recovery, 5000 cfm	3	ea	37,500.00	112,500		
	Air handling unit w/heat recovery, 3000 cfm	1	ea	23,500.00	23,500		
	Air-cooled condensing unit, 20 ton	3	ea	17,500.00	52,500		
	Air-cooled condensing unit, 15 ton	1	ea	12,500.00	12,500		
	Induction unit (40 per floor)	120	ea	1,850.00	222,000		
	Ductless split system AC unit	1	ea	4,000.00	4,000		
	Exhaust fans	1	ls	10,000.00	10,000		



Feasibility Submission

GFA

50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>OPTION B RENOVATION</b>							
	<u>Air Distribution</u>						
	Galvanized steel ductwork	25,000	lbs.	10.50	262,500		
	Duct insulation	15,000	sf	4.00	60,000		
	Breeching & flue	1	ls	22,500.00	22,500		
	Miscellaneous RGDs	1	ls	3,000.00	3,000		
	Make-up air louver at garage	2	ea	3,250.00	6,500		
	<u>Piping</u>						
	Hot water piping with valves & insulation	50,155	sf	2.00	100,310		
	Chilled water piping with valves & insulation	50,155	sf	2.25	112,849		
	Refrigerant piping with valves & insulation	1	ls	20,000.00	20,000		
	<u>Condensate Drain Pipe</u>						
	Condensate drain pipe with fittings & hangers	50,155	sf	0.50	25,078		
	<u>Piping Insulation</u>	50,155	sf	1.00	50,155		
	<u>Controls (DDC)</u>						
	Controls with metering at tenant floors	50,155	sf	3.50	175,543		
	Controls with CO monitoring at garage	23,700	sf	1.50	35,550		
	<u>Balancing</u>						
	System testing & balancing	50,155	sf	0.75	37,616		
	<u>Miscellaneous</u>						
	Coordination & management	1	ls	75,000.00	75,000		
	Commissioning support	1	ls	15,000.00	15,000		
	Coring, sleeves & firestopping	1	ls	25,000.00	25,000		
	Demolition (including cooling tower)	1	ls	20,000.00	20,000		
	Equipment start-up and inspection	1	ls	10,000.00	10,000		
	Rigging & equipment rental	1	ls	15,000.00	15,000		
	Vibration & seismic restraints	1	ls	20,000.00	20,000		
	SUBTOTAL						\$1,783,301
<b>TOTAL - HVAC</b>							<b>\$1,783,301</b>

**D40 FIRE PROTECTION**

**D40 FIRE PROTECTION, GENERALLY**

Double check valve assembly - existing					ETR
Alarm check valve - existing					ETR
Fire pump - existing					ETR
Floor control valve stations - existing					ETR
Fire department standpipe valve	4	ea	900.00	3,600	
Replace existing tenant heads with upright	42,365	sf	1.50	63,548	
Adjust heads for new ceilings	5,670	sf	1.50	8,505	
Sprinkler heads & distribution at garage - existing					ETR
Standpipe with fittings & hangers	175	lf	50.00	8,750	
<u>Miscellaneous</u>					
Coordination & management	1	ls	5,000.00	5,000	
Hydraulic calculations	1	ls	2,000.00	2,000	
Coring, sleeves & firestopping	1	ls	3,500.00	3,500	
Commissioning of system	1	ls	5,000.00	5,000	
Fees & permits	1	ls	1,000.00	1,000	
SUBTOTAL					\$100,903



# Section V

## Option A & B Cost Estimates



Cambridge Foundry Building  
Feasibility Design Options A and B  
Cambridge, MA

17-Jun-13

Feasibility Submission

GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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### OPTION B RENOVATION

<b>TOTAL - FIRE PROTECTION</b>	<b>\$100,903</b>
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### D50 ELECTRICAL

#### D5010 SERVICE & DISTRIBUTION

##### Gear & Distribution

##### Normal Power

F&I 200A 3P circuit breaker in existing switchboard for fire pump 1 ea 2,500.00 2,500

F&I 400A 3P circuit breaker in existing switchboard 400A distribution panelboard with provision for (4) 200A meter sockets 4 ea 13,250.00 53,000

##### Feeders

400A feed (allow) 400 lf 102.00 40,800

Grounding & bonding 1 ls 3,500.00 3,500

##### Emergency power

Emergency power (NIC) NIC

##### Equipment Wiring

ACCU unit feed and connection 4 ea 3,500.00 14,000

AHU feed and connection 4 ea 3,500.00 14,000

Boiler feed and connection 2 ea 1,500.00 3,000

Split unit feed and connection 1 ea 2,500.00 2,500

Chiller unit feed and connection 1 ea 8,500.00 8,500

CUH feed and connection ea

Elevator cab power 30A feed, connection & disconnect 1 ea 4,000.00 4,000

Elevator FSS, enclosed CB, feed and connection 1 ea 1,500.00 1,500

Exhaust fan feed and connection 1 ls 5,000.00 5,000

UH/CUH feed and connection 8 ea 1,000.00 8,000

Pump feed and connection 4 ea 1,500.00 6,000

VFD's feed and connection 4 ea 850.00 3,400

Misc. equipment wiring 50,155 sf 0.50 25,078

SUBTOTAL **\$194,778**

#### D5020 LIGHTING & POWER

##### Lighting & Branch Power

Type G (LED) 33 ea 450.00 14,850

Type G (LED) with emergency ballast 10 ea 550.00 5,500

Type FS1 with emergency ballast 12 ea 240.00 2,880

Type FS1 12 ea 140.00 1,680

Type SL4 2 ea 300.00 600

Type I4 3 ea 140.00 420

New lighting fixture for bathrooms 6 ea 250.00 1,500

Decorative pendant lobby lighting with daylight dimming 2 ea 600.00 1,200

Decorative pendant lobby lighting with daylight dimming (Emergency) 3 ea 700.00 2,100

Exit sign 11 ea 220.00 2,420

Lighting controls

Single pole switch (allow) 4 ea 30.00 120

Occupancy sensor 6 ea 200.00 1,200



Feasibility Submission

GFA

50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
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**OPTION B RENOVATION**

Branch devices

GFI duplex receptacle (allow)	16	ea	42.00	672		
Device box	105	ea	30.00	3,150		
3/4" conduit	2,500	lf	7.50	18,750		
#12 THHN	10,000	lf	0.85	8,500		
<b>SUBTOTAL</b>						<b>\$65,542</b>

**D5030 COMMUNICATION & SECURITY SYSTEMS**

Telephone/Data/CATV

Devices and cabling (allow)	1	ls	2,500.00	2,500		
MDF fit-out	1	ls	2,500.00	2,500		
Closet grounding	1	ls	500.00	500		
Backboard	1	ls	350.00	350		

Fire Alarm

New control panel	1	ls	3,500.00	3,500		
Initiating device	12	ea	100.00	1,200		
Audio/visual device	16	ea	105.00	1,680		
Elevator recall connection	1	ea	200.00	200		
Control/monitor module	6	ea	210.00	1,260		
Device box	24	ea	30.00	720		
3/4" conduit	1,000	lf	7.50	7,500		
FA cable	1,500	lf	1.25	1,875		
Testing & programming	1	ls	1,500.00	1,500		

Security System

Modify and upgrade existing head end	1	ls	3,500.00	3,500		
Cameras, devices and cabling	50,155	sf	1.50	75,233		
<b>SUBTOTAL</b>						<b>\$104,018</b>

**D5040 OTHER ELECTRICAL SYSTEMS**

Miscellaneous

Demolition work	1	ls	15,000.00	15,000		
Seismic restraints	1	ls	7,500.00	7,500		
Temp power and lights	1	ls	30,000.00	30,000		
Fees & Permits	1	ls	5,000.00	5,000		
<b>SUBTOTAL</b>						<b>\$57,500</b>

<b>TOTAL - ELECTRICAL</b>	<b>\$421,838</b>
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**E10 EQUIPMENT**

**E10 EQUIPMENT, GENERALLY**

No items in this section

SUBTOTAL

-

<b>TOTAL - EQUIPMENT</b>	
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**E20 FURNISHINGS**

**E2010 FIXED FURNISHINGS**

Entry mats & frames - recessed with carpet/rubber strips	100	sf	45.00	4,500		
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# Section V

## Option A & B Cost Estimates



Cambridge Foundry Building  
Feasibility Design Options A and B  
Cambridge, MA

17-Jun-13

Feasibility Submission GFA 50,155

	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
--	-------------	-----	------	-----------	------------	-----------	------------

**OPTION B RENOVATION**

SUBTOTAL **\$4,500**

**E2020 MOVABLE FURNISHINGS**

All movable furnishings to be provided and installed by owner

SUBTOTAL NIC

<b>TOTAL - FURNISHINGS</b>	<b>\$4,500</b>
----------------------------	----------------

<b>F10 SPECIAL CONSTRUCTION</b>
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**F10 SPECIAL CONSTRUCTION**

No items in this section

SUBTOTAL

<b>TOTAL - SPECIAL CONSTRUCTION</b>
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<b>F20 SELECTIVE BUILDING DEMOLITION</b>
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**F2010 BUILDING ELEMENTS DEMOLITION**

Remove existing siding	2,530	sf	5.00	12,650	
Demolish ground floor bathrooms	2	rms	2,000.00	4,000	
Openings in existing exterior wall for elevator	4	loc	2,500.00	10,000	
Demolish vestibule structure and foundations	100	sf	20.00	2,000	
Remove stairs	5	flt	3,000.00	15,000	
Remove skylights	7	ea	250.00	1,750	
Remove skylights at upper roof	330	ea	10.00	3,300	
Remove windows/storefront	3,615	sf	7.00	25,305	
Interior gut demolition	50,155	sf	10.00	501,550	
SUBTOTAL					<b>\$575,555</b>

**F2020 HAZARDOUS COMPONENTS ABATEMENT**

Abatement

NIC

SUBTOTAL

<b>TOTAL - SELECTIVE BUILDING DEMOLITION</b>	<b>\$575,555</b>
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Cambridge Foundry Building  
 Feasibility Design Options A and B  
 Cambridge, MA

17-Jun-13

Feasibility Submission

CSI CODE	DESCRIPTION	QTY	UNIT	UNIT COST	EST'D COST	SUB TOTAL	TOTAL COST
<b>NEW POCKET PARK</b>							
<b>G SITEWORK</b>							
<b>G10</b>	<b>SITE PREPARATION &amp; DEMOLITION</b>						
	Site construction fence/barricades				NIC		
	Miscellaneous demolition	1	ls	2,000	2,000		
	<u>Site Earthwork</u>						
	Strip topsoil, remove off site	74	cy	14.00	1,036		
	Cut / Fill / grading	1	ls	2,500.00	2,500		
	<u>Hazardous Waste Remediation</u>						
	Dispose/treat contaminated soils/water				NIC		
	SUBTOTAL						\$5,536
<b>G20</b>	<b>SITE IMPROVEMENTS</b>						
	<u>Hardscape; 50% of area</u>						
	gravel base; 8" thick	56	cy	30.00	1,680		
	concrete; 4" thick	2,000	sf	7.00	14,000		
	<u>Site Amenities</u>						
	Benches	1	ls	5,000.00	5,000		
	Add gates to existing CLF	2	loc	1,200.00	2,400		
	<u>Landscaping</u>						
	Soil mix; 6" thick	74	cy	35.00	2,590		
	Seeding	1,200	sf	0.50	600		
	Trees	12	ea	1,500.00	18,000		
	Plantings - shrubs	1,600	sf	6.00	9,600		
	Mulch	30	cy	35.00	1,050		
	Irrigation				NIC		
	SUBTOTAL						54,920
<b>G30</b>	<b>CIVIL MECHANICAL UTILITIES</b>						
	Existing to remain				NIC		
	SUBTOTAL						\$0
<b>G40</b>	<b>ELECTRICAL UTILITIES</b>						
	Existing to remain				NIC		
	SUBTOTAL						-
<b>TOTAL NEW POCKET PARK</b>							<b>\$60,456</b>







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### MEMORANDUM

**TO:** **HMFH Architects, Inc.**  
Attn: George R. Metzger, AIA

Foley Buhl Roberts & Associates, Inc. (FBRA)  
H. W. Hagen. P.E., SECB

**REFERENCE:** **Cambridge Foundry Building - 101 Rogers Street, Cambridge, MA**  
**Building Evaluation**

**SUBJECT:** Structural Narrative

**DATE:** 23 May 2013

---

#### A. General

1. A possible re-use of this building, originally built in 1890, is under consideration by the City of Cambridge, the current owner of the property. As such, the building may prove viable for several occupancy types depending upon a wide range of project variables.
2. A major renovation was undertaken in 1982 to accommodate a business use group, specifically for offices and so-called dry or light research and development spaces. This involved the addition of three new infill floors, a new below-grade parking garage, and a new main entry structure.
3. Two broad scope options are considered in this building evaluation: Option A Renovation - a minimum level of upgrade; and Option B Renovation - an optimum level of upgrade.
4. The scope of this building evaluation is limited in that it does not include any detailed structural calculations or material testing of any of the existing structural elements in the building. The evaluation is based solely on the following: site visit observations; a review of available drawings; collaboration with the other project team disciplines; and an assumption that the structural design of the 1982 renovation complied with the provisions of the building code applicable in 1982.
5. Two broad scope options are considered in this building evaluation: Option A - a minimum level of upgrade; and Option B - an optimum level of upgrade.

#### B. Site Visits

1. FBRA conducted two on-site, walk-around visits: Monday, 29 April 2013 - Bill Hagen and Bob Berard; and Monday, 13 May 2013 - Bill Hagen.
2. The purpose of the site visits was to observe the general structural condition of the exterior and accessible interior spaces of the building. Prior to FBRA's site visits some access holes through the ceilings had already been made by others which facilitated observation of the primary structure and taking of a few measurements of some representative structural elements.

3. Albeit that the site visits were limited in scope, from a structural point of view the building generally appears to be in a reasonably good and serviceable condition. However, there appears to be some structural deficiencies with regard to the lateral-force resisting system.

C. Available Drawings

1. Drawings of the original 1890 building are not available.
2. Drawings of the 1982 renovation are not available.
3. Four drawings showing tenant fit-ups in 1994 by Carroll Designs and one in 2002 by The Hamilton Company were made available.

D. Building Codes

1. At the time of the 1982 renovation the applicable building code was the Massachusetts State Building Code, Third Edition (MSBC-3rd-1979) which became effective on 1 June 1979.
2. MSBC-3rd-1979, Section 705.2 states that "When an existing building is altered by an extension in height or area, all existing structural parts affected by the addition shall be strengthened where necessary, and all structural parts shall be designed to meet the requirements for buildings hereafter erected."
3. MSBC-3rd-1979 does not include any specific requirements for upgrading any existing lateral-force-resisting system due to earthquake considerations. Aside from schools, State earthquake requirements for existing buildings did not appear until the Massachusetts State Building Code, Sixth Edition was promulgated in 2001.
4. In principle, certain parts of the primary framing system of the existing building function as a lateral-force-resisting system.
5. Any new renovation at this time would be governed by the Massachusetts State Building Code, Eighth Edition (MSBC-8th), which includes the 2009 International Building code, the 2009 International Existing Building Code (2009 IEBC), as well as so-called front-end Massachusetts Amendments.

E. Building Description

1. The original building was built circa 1890 to house foundry works and renovated in 1982 for occupancies that included spaces for offices and dry, or light, research and development laboratories.
2. The 1982 renovation reportedly included the removal of an original foundry floor slab on grade located at or near grade, excavation to accommodate a new Garage Level, and new framing for three infill floors.
3. The existing building is comprised of four major Sections.
4. Center Section: Located in the middle of the building with an approximate footprint at grade measuring 61 ft. (east-west direction) by 200 ft. (north-south direction) - ten bays long; a high space measuring approximately 38 ft. from grade to the top of gable-shaped High Roof, and about 30 ft. to the underside of the gabled-shaped timber roof trusses.
  - a. Gable-shaped timber roof trusses, approximately 8 ft. deep at mid-span, spanning in the east-west direction and spaced at 10 ft. on center, with wood and steel rod web

George R. Metzger, AIA  
 Cambridge Foundry Building - 101 Rogers Street, Cambridge, MA  
 Building Evaluation - Structural Narrative

23 May 2013  
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- members, supporting wood roof planking. These trusses are supported at the High Roof eaves by wood beams and A-frame trusses (outboard trusses).
- b. Clerestory windows along the east and west sides, above the adjacent one-story East and West Side Sections.
  - c. A-frame wood trusses (outboard trusses), located along the east and west sides, extend down to approximately the bottom chord of the wood mono-trusses in the East and West Side Sections.
  - d. A-frame trusses are supported by heavy timber columns (outboard columns) which extend from interior foundation piers up to the High Roof eave.
  - e. Heavy timber trusses (inboard trusses), approximately 10 ft. deep and spaced at 20 ft. on center, are located along the east and west sides. The bottom chords align approximately with the bottom chords of the wood mono-trusses in the East and West Sections. The Third Floor infill floor framing from the 1982 renovation is supported on the top chord of these trusses.
  - f. Heavy timber trusses (inboard trusses) are supported by heavy timber columns (inboard columns) which extend from interior foundation piers to the top chord of these trusses.
  - g. The inboard and outboard heavy timber columns, plus perhaps some concrete-encased vertical steel elements from the 1982 renovation, are all supported on large foundation piers. Many of these piers are exposed concrete, but others not visible since they are covered by parged wire mesh.
  - h. A row of hollow structural tube columns (7" square), spaced at approximately 20 ft. o.c. in the north-south direction, support the 1982 infill floor framing. These columns are in turn supported by 24" round concrete piers which are visible in the Garage.
  - i. Brick walls with openings for windows are located at the north and south ends of the building. Foundations for these walls appear to be large stone blocks which generally appeared to be grouted.
5. East Side Section: A one-story structure, located contiguous to the Center Section, with a footprint at grade of approximately 31 ft. (east-west direction) by 200 ft. (north-south direction) - ten bays long.
    - a. Mono-shaped heavy timber roof trusses, approximately 7 ft. deep at one end, spanning in the east-west direction and spaced at 10 ft. on center, with wood and steel rod web members, supporting wood roof planking. These trusses are supported on the west side by the Heavy Timber Trusses and on the east side by an exterior brick wall which may once have had window openings.
  6. West Side Section: A one-story structure, located contiguous to the Center Section, with a footprint at grade of approximately 31 ft. (east-west direction) by 80 ft. (north-south direction). This section extends for only four bays, between the south end of the building and the south side of the West Wing Section. Structural framing is similar or identical to that in the East Side Section.
  7. West Wing Section: Possibly a multi-story structure originally, extending some 30 ft. from grade level to slightly above the eave of the High Roof. The roof is a low-pitched gable. Exterior walls on three sides appear to be brick, but the original interior framing of this portion of the building is unknown.
  8. 1982 Infill Floor Framing
    - a. First Level: Concrete/formdeck slab on 20" steel joists at 30" o.c. spanning in the east-west direction and supported by either steel joist girders or brick walls.
    - b. Second Level: 6" concrete slab on composite steel joists at 48" o.c. spanning in the east-west direction and supported by either steel joist girders or brick walls.
    - c. Third Level: 6" concrete slab on composite steel joists at 48" o.c. spanning in the east-west direction and supported by either steel joist girders or on the top chord of the heavy timber trusses.

9. Building Areas: According to the Assessor's Office the existing building is comprised of the following areas:
    - a. Basement/Garage Level 23,089 sf.
    - b. First Level 23,089 sf.
    - c. Second Level 14,969 sf.
    - d. Third Level 14,969 sf.
- F. Structural Design Loads per MSBC-3 rd-1979
1. Section 706.0 - Uniformly Distributed Live Loads.
    - a. Offices 50 psf
    - b. Lobbies 100 psf
    - c. Corridors, above 1st Floor 80 psf
  2. Section 704.3 - Partition Load.
    - a. Partition allowance 20 psf
  3. Section 711.0 - Snow Load.
    - a. Snow Load Zone 2 (Cambridge): 30 psf on unobstructed flat roofs with slope less than 30 degrees, with adjustments for sloped roofs steeper than 30 degrees, plus allowance for snow drifts.
  4. Section 712 - Wind Load.
    - a. Wind Zone 3 (Cambridge): Exposure B - 21 psf up to 100 ft. above grade.
  5. Section 716 - Earthquake Load.
    - a. There are no specific earthquake requirements for existing buildings.
  6. Note: No structural documents of the 1982 renovation are available. Consequently, for the purpose of this preliminary building evaluation, it has been assumed that the structural design loads (live loads, snow loads, and wind loads) as required by MSBC-3rd-1979 for an office occupancy were incorporated into the structural design of the 1982 renovation.
- G. Option A Renovation
1. Although several occupancy types are being considered, however, it has been assumed that the Option A Renovation only involves ones with no change of occupancy.
  2. The Prescriptive Compliance Method, per 2009 IEBC Chapter 3, Section 303 - Alterations, has been selected for the purpose of this building evaluation.
  3. Before renovation, or currently, the existing building falls under Use Group B - Business and Occupancy Category II.
  4. After renovation, it has been assumed that both the Use Group and Occupancy Category remain the same as before renovation.
  5. The proposed renovation could be considered under 2009-IEBC, Section 303 - Alterations.
    - a. If a proposed new occupancy has a live load requirement greater than the combination of a 50 psf live load plus a dead load partition allowance of 20 psf, then the existing structural framing would likely have to be reinforced or supplemented.
    - b. Alterations will likely not increase design lateral loads beyond 10% of those which are associated with the existing conditions. As such, no seismic upgrade of the lateral-force resisting system would be required. However, based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the



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Building Evaluation - Structural Narrative

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existing lateral-force resisting system. Therefore, some improvement in the existing system is recommended (for details refer to the section below on proposed improvements).

6. If the existing building qualifies as an historic building, the proposed renovation could be considered under 2009 IEBC, Section 308 - Historic Buildings.
  - a. Provisions of 2009 IEBC relating to the construction, repair, alteration, addition, restoration, and change of occupancy are not mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard.
  - b. Based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the existing lateral-force resisting system. Therefore, some improvement in the existing system is recommended (for details refer to the section below on proposed improvements).

#### H. Option B Renovation

1. Since several occupancy types are being considered, it has been assumed that Option B may also involve a change of occupancy.
2. The Prescriptive Compliance Method, per 2009 IEBC Chapter 3, Section 303 - Alterations, has been selected for the purpose of this building evaluation.
3. Before renovation, or currently, the existing building falls under Use Group B - Business and Occupancy Category II.
4. After renovation, it has been assumed that either the Use Group or Occupancy Category, or both, may change. For example, the Occupancy Category may change from I to II, a more hazardous classification.
5. The proposed renovation could be considered under either 2009-IEBC, Section 303 - Alterations or Section 307 - Change of Occupancy.
  - a. If a proposed new occupancy has a live load requirement greater than the combination of a 50 psf live load plus a dead load partition allowance of 20 psf, then the existing structural framing would likely have to be reinforced or supplemented.
  - b. Alterations will likely not increase design lateral loads beyond 10% of those which are associated with the existing conditions. Whereas no seismic upgrade of the lateral-force resisting system would be required Section 303 - Alterations, Section 307 - Change of Occupancy might require and upgrade unless an exception becomes applicable. In any case, based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the existing lateral-force resisting system. Therefore, some improvement in the existing system is recommended (for details refer to the section below on proposed improvements).
6. If the existing building qualifies as an historic building, the proposed renovation could be considered under 2009 IEBC, Section 308 - Historic Buildings.
  - a. Provisions of 2009 IEBC relating to the construction, repair, alteration, addition, restoration, and change of occupancy are not mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard.
  - b. Based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the existing lateral-force resisting system. Therefore, some improvement in the existing system is recommended (for details refer to the section below on proposed improvements).

- I. Option A Renovation - Proposed Improvements to Existing Lateral-Force Resisting System. The following structural information is for cost estimating purposes only. Refer to diagrams for location of structural elements. (E) = Existing (N) = New
1. Roofs: Use for transfer of lateral loads at roofs: Center Section (High Roof); West Wing Section; East Side and West Side Sections (Low Roofs); and West Wing Section.
    - a. Provide (N) 5/8" plywood diaphragm over entire roof areas.
  2. Wood Shear Wall (SW): Use for transfer of lateral loads at High Roof, 3rd Floor, 2nd Floor, and 1st Floor.
    - a. Provide (N) 2x4 Studs @ 16" o.c. w/ 2 - 2x4 plates at Top & Bot, with 1/2" plywood both sides.
    - b. Connect w/ 1/2" Expansion Bolts @ 16" o.c. Top & Bot w/ 3" embedment into (E) conc. slabs.
    - c. For East-West Direction: SW Length = 15 ft.
      - (1) 6 (N) SW betw 1st FL & 2nd FL.
      - (2) 6 (N) SW betw 2nd FL & 3rd FL.
      - (3) 6 (N) SW betw 3rd FL & bot chord of (E) High Roof Truss.
      - (4) 6 (N) W18x35 under 1st Floor.
    - d. For North-South Direction: SW Length = 20 ft.
      - (1) 3 (N) SW betw 1st FL and 2nd FL.
      - (2) 3 (N) W18x35 under 1st Floor.
  3. Existing A-Frame Wood Truss: Use for transfer of lateral loads from High Roof to 3rd Floor - (E) Wood diagonals extend from 2nd Floor to High Roof.
    - a. Provide (N) 1/4"x6"x12"x12" steel bent PL at each diagonal w/ 2 - 3/4" bolts into diagonal and 2 - 1/2" Expansion Bolts into 3rd Floor concrete slab.  
(Total number connections = 2 per bay x 17 bays = 34)
  4. Existing Heavy Wood Truss: Use for transfer of lateral loads from 3rd Floor to 2nd Floor. (E) Heavy Wood truss extends from below 2nd Floor to below underside of 3rd Floor. Provide connection betw underside of 3rd Floor concrete slab and top chord of Heavy Wood Truss.
    - a. (N) Diagonal L 3x3x1/4 x 4 ft. long diagonal welded to 6"x14"x3/8" PL Top and Bot.
    - b. (N) 2 - 1/2" Expansion Bolts into 3rd Floor concrete slab and (N) 3 - 3/4" Lag Screws w/ 3" embedment.  
(Total number steel diagonals = 2 per bay x 17 bays = 34)
  5. Diagonal Bracing System (BR): Use for transfer of lateral loads from 1st Floor to Garage Level/Foundation.
    - a. Provide structural steel V-bracing (2 - HSS 6x6x3/8 diagonals per bay) connected at top to (E) column and at bottom to (N) reinforced concrete tie-beam.
    - b. Provide (N) 18" x 24" reinforced concrete (3000 psi) tie-beam - 120#/CY of reinforcing steel.
    - c. Top of tie-beam to be located 12" below top of (E) concrete slab in Garage.
    - d. Tie-beam to be epoxy doweled into (E) concrete foundation piers.
    - e. For East-West Direction Bracing.
      - (1) 30 ft. bay - 3 (N) bracing configurations between Garage and 1st Floor.
    - f. For North-South Direction Bracing.
      - (1) 20 ft. bay - 3 (N) bracing configurations between Garage and 1st Floor.
  6. First Floor Slab Connection.
    - a. (N) L4x4x1/4 @ 4'-0" o.c. with 2- 1/2" Adhesive Anchors into (E) brick walls around perimeter and 2-1/2" Expansion Anchors into (E) First Floor concrete floor slab.

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 Cambridge Foundry Building - 101 Rogers Street, Cambridge, MA  
 Building Evaluation - Structural Narrative

23 May 2013  
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- J. Option B Renovation - Proposed Improvements to Existing Lateral-Force Resisting System.
1. For preliminary cost estimating purposes, set the cost of the Option B Renovation equal to an adjustment factor of 1.5 times the cost of all structural items under the Option A Renovation, with the exception that an adjustment factor of 1.0 shall be applied to the cost of the (N) 5/8" plywood on all of the roofs.
- K. Structural Items To Be Considered As This Project Progresses
1. In order to establish the structural capacity of the existing structural members it is recommended that the following items be considered:
    - a. A more detailed field investigation of the existing structural members.
    - b. Engagement of a wood science specialist to provide information regarding the species and grade of the wood utilized in the building. Once this information is in hand, more accurate allowable stress limits could be established.
    - c. The extent of structural upgrades that may be required by 2009 IEBC will depend, in part, on the definition of the following: before and after designations of the Use Group and Occupancy Category, and the final selection of a compliance method option. These design parameters will be verified with the design team in conjunction with the owner.
- L. Summary
1. This structural narrative addresses two broad scope options that are being considered in this building evaluation: Option A Renovation - a minimum level of upgrade; and Option B Renovation - an optimum level of upgrade.
  2. A re-use of this building, originally built in 1890, with a major floor-infill renovation in 1982, is under consideration by the City of Cambridge. A range of occupancy types may be viable.
  3. Based on limited site observations, from a structural point of view the building generally appears to be in a reasonably good and serviceable condition. However, there appears to be some structural deficiencies with regard to the lateral-force resisting system.
  4. Aside from some recent fit-up drawings, no structural drawings are available for neither the original 1890 building nor the 1982 renovation.
  5. At the time of the 1982 renovation the applicable building code was the Massachusetts State Building Code, Third Edition (MSBC-3rd-1979). Any new renovation at this time would be governed by the Massachusetts State Building Code, Eighth Edition (MSBC-8th).
  6. For a detailed description of the building refer to Item E above.
  7. This building evaluation is based in part on the assumption that the structural design of the 1982 renovation complied with the provisions of the building code applicable in 1982, including the use of the structural design live loads specified for office buildings (50 psf for office occupancy and a partition allowance of 20 psf).
  8. The Prescriptive Compliance Method, per 2009 IEBC Chapter 3 has been selected for the purpose of this building evaluation.
  9. Option A Renovation considers several occupancy types, but assumes that there would no change of occupancy and no change in the occupancy category.
  10. Option A or Option B Renovation - Floor Load Capacity: If a proposed new occupancy has a live load requirement greater than the combination of a 50 psf live load plus a dead load

partition allowance of 20 psf, then the existing structural framing would likely have to be reinforced or supplemented.

11. Option A Renovation: Lateral-Force Resisting System: Since the alterations will likely not increase design lateral loads beyond the code specified limit, no seismic upgrade of the lateral-force resisting system would be required. However, Based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the existing lateral-force resisting system. Therefore, some improvement in the existing lateral-force resisting system is recommended.
12. Option B Renovation - Lateral-Force Resisting System: Since the proposed alterations would be subject to the requirements of the Massachusetts State Building Code, Eighth Edition, an upgrade of the existing lateral-force resisting system would be required.
13. Option A or Option B Renovation - Historic Building: If the existing building qualifies as a historic building, the provisions of 2009 IEBC relating to the alteration, addition, and change of occupancy are not mandatory where such buildings are judged by the building official to not constitute a distinct life safety hazard. However, based on our current knowledge of the existing building, it is our opinion that some life safety issues may exist with regard to the existing lateral-force resisting system. Therefore, some improvement in the existing system is recommended.
14. Option A and Option Renovation - Cost of Upgrades: A list of structural items was provided for cost estimating by others.
15. Structural Items for Consideration as Project Progresses: A more detailed field investigation of the existing structural members; engagement of a wood science specialist to provide information regarding the species and grade of the wood utilized in the building.

**END OF MEMORANDUM**







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### **PLUMBING**

#### **Executive Summary:**

Presently, the Plumbing Systems serving the building are cold water, hot water, sanitary, waste and vent system, and natural gas. Municipal sewer and municipal water service the Building.

The majority of the plumbing systems are original to the building and its additions. Portions of the systems have been updated as part of building renovation projects.

The plumbing fixtures are in fair to poor condition. Attempts have been made to make bathroom fixtures accessible, however, the majority of fixtures do not meet current accessibility codes. In general, the fixtures appear to have served their useful life. Current Access Code requires accessible fixtures wherever plumbing is provided. In terms of the water conservation fixtures, their use is governed by the provisions of the Plumbing and Building Code. Essentially, the code does not require these fixtures to be upgraded, but where new fixtures are installed, as may be required by other codes or concerns, the new fixtures need to be water conserving type fixtures. All new fixtures are recommended.

Cast iron is used for sanitary drainage. Where visible, the cast iron pipe appears to be in fair condition. Smaller pipe sizes appear to be copper. In general, the drainage piping can be reused where adequately sized for the intended new use. The sloped roof is collected by gutters and downspouts. They appear to generally discharge to grade.

#### **Fixtures:**

- The water closets are predominately floor mounted tank type vitreous china.
- Urinals are wall hung vitreous china with manually operated flush valves.
- Lavatories are either wall hung or counter mounted vitreous china. The lavatories are fitted with hot and cold water handle faucets. There are no sensor or metering type faucets on lavatories.



*Typical bathroom fixtures*



*Typical lavatory fixtures*

- Service sinks are laundry type floor mounted basins. Faucets are deck mounted and are not equipped with vacuum breakers.
- Some office suites contain stainless steel counter mounted kitchenette sinks with deck mounted faucets.
- One office suite is contains a non-accessible shower.
- There are no drinking fountains.



*Kitchenette sink*



*Service sink*

**Water Systems:**

- Domestic water piping, where exposed, appears to be copper with sweat joints. The majority of the piping exposed is not insulated.
- Domestic hot water in the building suites and core toilets are generated through electric tank type water heaters. The hot water systems are not recirculated. The heaters are not equipped thermostatic mixing valves to prevent scalding. The electric water heaters vary in size and age.

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- The heating boilers system is supplied with make-up water from the domestic system. Make-up water connection is protected with a reduced pressure backflow preventer.



*Backflow preventer on make-up water*



*Electric water heater above ceiling  
Core Toilet area*



*Electric water heater*

### Gas:

- The building is supplied with natural gas. The gas meter is located in the basement area, on the north side of the building. Service appears to enter from Bent Street. Gas meter is a model AL-1000.
- Gas piping is black steel with threaded joints and fittings. Gas supplies three heating boilers located in the Basement mechanical room.



*Building gas meter*



*Gas supply to heating boiler*

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**Drainage Systems:**

- Cast iron is used for sanitary drainage. Where visible, the cast iron pipe appears to be in fair condition. Smaller pipe sizes appear to be copper. The garage area has a trench drain adjacent to entrance door. Trench drain is routed through an oil/gas separator. Vent piping from separator is run on the exterior of the building.
- In general, the cast iron drainage piping can be reused even in a major renovation where adequately sized for the intended new use.

**RECOMMENDATIONS**

- Provide new high efficiency, low flow, plumbing fixtures throughout.
- Provide accessible drinking fountain on every floor.
- replace existing tank type electric water heaters with tankless gas fired units or electric tankless point-of-use heaters.



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**PLUMBING SYSTEMS**

**NARRATIVE REPORT - OPTION A**

The following is the Plumbing System Narrative which defines the scope of work and capacities of the Plumbing System as well as the Basis of Design.

1. CODES
  - A. All work installed under Section 220000 shall comply with the MA Building Code, IBC 2009, MA Plumbing Code and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.
2. DESIGN INTENT
  - A. The work of Section 220000 is shown on the drawings and specifications. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Plumbing work and all items incidental thereto, including commissioning and testing.
3. GENERAL
  - A. The plumbing systems that will serve the project are cold water, sanitary waste and vent system, garage waste system, and natural gas system.
  - B. The building is serviced by a municipal water and sewer service.
  - C. All new plumbing in the building will conform to accessibility codes and to water conserving sections of the plumbing code.
  - D. Installation of all work is to be coordinated with the phasing plans for the project.
4. DRAINAGE SYSTEM
  - A. Existing soil, waste, and vent piping system is existing to remain.
  - B. Garage waste and vent system, and gas interceptor, are existing to remain.
5. WATER SYSTEM
  - A. Existing domestic water service shall remain.
  - B. Cold and hot water distribution piping to plumbing fixtures is existing to remain.
  - C. Domestic hot water heating will be provided by tankless point-of-use electric water heaters.

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- D. New domestic water piping will be type 'L' copper with wrought copper sweat fittings, silver solder. All piping will be insulated with 1 in. thick high density fiberglass.
6. NATURAL GAS SYSTEM
- A. Natural gas service is existing to remain. Gas piping will be modified in the existing mechanical room to connect to the proposed two heating boilers.
  - B. Gas piping will be Schedule 40 black steel pipe with threaded gas pattern malleable fittings for 2 in. and under and butt welded fittings for 2½ in. and larger.
7. FIXTURES
- A. Existing fixtures in the core toilet area shall remain.
8. DRAINS
- A. Existing floor drains shall remain.
9. VALVES
- A. Locate all new valves so as to isolate all parts of the system. Shutoff valves 3 in. and smaller shall be ball valves, solder end or screwed, Apollo, or equal.
10. INSULATION
- A. All new water piping shall be insulated with snap-on fiberglass insulation Type ASJ-SSL, equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system.
11. CLEANOUTS
- A. Cleanouts shall be full size up to 4 in. threaded bronze plugs located as indicated on the drawings and/or where required in soil and waste pipes.
12. ACCESS DOORS
- A. Furnish access doors for access to all concealed parts of the plumbing system that require accessibility. Coordinate types and locations with the Architect.
13. WATER HEATER
- A. Point-of-use electric water heaters.



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### PLUMBING SYSTEMS

#### NARRATIVE REPORT - OPTION B

The following is the Plumbing System Narrative which defines the scope of work and capacities of the Plumbing System as well as the Basis of Design. The Plumbing Systems shall be designed and constructed for **LEED 2009 Core and Shell**.

1. CODES
  - A. All work installed under Section 220000 shall comply with the MA Building Code, IBC 2009, MA Plumbing Code and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.
2. DESIGN INTENT
  - A. The work of Section 220000 is shown on the drawings and specifications. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Plumbing work and all items incidental thereto, including commissioning and testing.
3. GENERAL
  - A. The plumbing systems that will serve the project are cold water, sanitary waste and vent system, garage waste system, and natural gas system.
  - B. The building is serviced by municipal water and sewer.
  - C. All new plumbing in the building will conform to accessibility codes and to water conserving sections of the plumbing code.
  - D. Installation of all work is to be coordinated with the phasing plans for the project.
4. DRAINAGE SYSTEM
  - A. Soil, waste, and vent piping system is provided to connect to all fixtures and equipment. System shall connect to existing.
  - B. Garage waste and vent system, and gas interceptor, are existing to remain.
  - C. Drainage systems piping will be service weight cast iron piping; no hub with gaskets, bands and clamps for above grade 2 in. and larger. Waste and vent piping 1-1/2 in. and smaller will be type 'L' copper.

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5. WATER SYSTEM

- A. Existing domestic water service shall remain.
- B. Cold and hot water distribution piping will be provided to new fixtures as required. Piping will connect to existing water risers in core toilet pipe chases.
- C. Domestic hot water heating will be provided by tankless point-of-use electric water heaters.
- D. New domestic water piping will be type 'L' copper with wrought copper sweat fittings, silver solder. All piping will be insulated with 1 in. thick high density fiberglass.

6. NATURAL GAS SYSTEM

- A. New natural gas service will be provided for the building and will serve the proposed heating boilers. The new gas service will be located in similar location as existing.
- B. Gas piping will be Schedule 40 black steel pipe with threaded gas pattern malleable fittings for 2 in. and under and butt welded fittings for 2½ in. and larger.

7. FIXTURES

- A. Furnish and install all new fixtures in the core toilet area, including supports, connections, fittings, and any incidentals to make a complete installation.
- B. Fixtures shall be the manufacturer's guaranteed label trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.
- C. Vitreous china and acid resisting enameled fixtures, including stops, supplies and traps shall be of one manufacturer by Kohler, American Standard, Eljer, or equal. Supports shall be Zurn, Smith, Josam or equal. All fixtures shall be white. Faucets shall be Speakman, Chicago, or equal.
- D. Fixtures shall be as scheduled on drawings.
  - 1. Water Closet: Sloan High efficiency toilet, 1.28 gallon per flush, wall hung, vitreous china, siphon jet, manually operated 1.28 gallon per flush-flush valve.
  - 2. Urinal: Sloan manually operated .13 gallon flush valve urinal, wall hung, and vitreous china.
  - 3. Lavatory: Wall hung/countertop ADA lavatory. Infra-red, sensor mixing faucet.

8. DRAINS

- A. Existing floor drains shall remain.



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9. VALVES

- A. Locate all new valves so as to isolate all parts of the system. Shutoff valves 3 in. and smaller shall be ball valves, solder end or screwed, Apollo, or equal.

10. INSULATION

- A. All new water piping shall be insulated with snap-on fiberglass insulation Type ASJ-SSL, equal to Johns Manville Micro-Lok HP, 850 degrees snap-on system.

11. CLEANOUTS

- A. Cleanouts shall be full size up to 4 in. threaded bronze plugs located as indicated on the drawings and/or where required in soil and waste pipes.

12. ACCESS DOORS

- A. Furnish access doors for access to all concealed parts of the plumbing system that require accessibility. Coordinate types and locations with the Architect.

13. WATER HEATER

- A. Point-of-use electric water heaters.



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**FIRE PROTECTION**

**Executive Summary**

Portions of the building are protected by a combined standpipe/automatic sprinkler system, the building is not fully sprinklered. There is inadequate coverage in some portions of the building. The sprinkler systems is supplied by municipal water and includes an electric driven fire pump.

**Existing Conditions:**

- The 8" fire service enters the basement Fire Pump Room from Rogers Street. The service includes an 8" Ames model 2000 backflow preventer. Systems includes a 4" dry alarm valve and a 6" wet alarm valve. Piping for dry and wet type systems are black steel.
- Fire pump is inline pump, 30 HP, 480 volt, 3 phase. Fire pump is showing signs of corrosion. Fire pump test header is located in the room. Fire pump room is only accessible from Garage area. Per State Building Code fire pump room shall be accessed directly from an exterior door at grade or through a fire resistance rated enclosure. As the building is provided with an automatic sprinkler system the enclosure would be required to be 1-hour rated.
- System includes a 4" Storz fire department connection. Fire department connection is located on the south side of the building facing Rogers street.



*Fire pump*



*Typical pendant sprinkler*



*Dry type alarm valve*

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- Standpipes are located in the south and north stair towers.
- Standpipes are equipped with 2-1/2" valves. Standpipes are exposed in the stair tower.
- Basement garage level is protected with a dry type sprinkler system. Sprinkler heads in Basement are typically upright type in non-ceiling areas and pendent type in ceiling areas. Sprinklers in Basement are solder type.
- Office spaces on upper levels are protected with a wet type system. Sprinkler heads are typically upright type or sidewall type in non-ceiling areas and pendent type in ceiling areas. Sprinklers vary from standard response and quick response. Newer renovated areas are equipped with quick response sprinkler heads.



*Fire department connection*



*Floor sprinkler control valve assembly  
at combined standpipe*



*Fire department valve*

## **RECOMMENDATIONS**

- Provide sprinkler protection in un-protected building areas.
- Replace existing solder type and standard response sprinklers with quick response type sprinklers.
- Provide standpipe in west stair tower.
- Provide 1-hour rated access enclosure to fire pump room.

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**FIRE PROTECTION SYSTEMS**

**NARRATIVE REPORT - OPTION A**

The following is the Fire Protection System Narrative, which defines the scope of work and capacities of the Fire Protection System as well as the Basis of Design.

1. CODES
  - A. All work installed under Section 210000 shall comply with the MA Building Code, IBC 2009 and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.
2. DESIGN INTENT
  - A. All new work consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Fire Protection work and all items incidental thereto, including commissioning and testing.
3. DESCRIPTION
  - A. The existing building is protected with a combined standpipe/sprinkler system supplied by an electric fire pump. The existing fire service and pump are to remain.
  - B. Existing sprinkler control valve assemblies consist of a supervised shutoff valve, check valve, flow switch and test connection with drain. All control valves shall remain.
  - C. Existing Standpipes are to remain. Install new standpipe in west stair.
  - D. In core areas existing pendent sprinklers shall remain.
  - E. In renovated tenant spaces, all pendent sprinkler heads shall be removed and new upright type sprinklers installed to protect space. In tenant areas sprinklers shall be spaced, at a minimum, according to Light Hazard occupancy.
  - E. All new sprinkler heads will be quick response, pendent and/or sidewall in hung ceiling areas and upright in unfinished areas.
  - F. All Fire Protection Systems are designed in accordance with NFPA 13-2007, NFPA 14-2007 and NFPA 72-2007.
5. BASIS OF DESIGN
  - A. The mechanical rooms and storage rooms are considered Ordinary Hazard Group 1; all other areas are considered light hazard.

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B. Required Design Densities:

Light Hazard Areas	0.10 GPM over 1,500 s.f.
Ordinary Hazard Group 1	0.15 GPM over 1,500 s.f.
Ordinary Hazard Group 2	0.20 GPM over 1,500 s.f.

C. Sprinkler spacing (max.):

Light Hazard Areas:	225 s.f.
Ordinary Hazard Areas:	130 s.f.

D. Installation of all work is to be coordinated with the phasing plans for the project.

6. PIPING

- A. Sprinkler piping 1-1/2 in. and smaller shall be ASTM A-53, Schedule 40 black steel pipe. Sprinkler piping 2 in. and larger shall be ASTM A-135, Schedule 10 black steel pipe.

7. FITTINGS

- A. Fittings on fire service piping, 2 in. and larger, shall be Victaulic Fire Lock Ductile Iron Fittings conforming to ASTM A-536 with integral grooved shoulder and back stop lugs and grooved ends for use with Style 009-EZ or Style 005 couplings. Branch line fittings shall be welded or shall be Victaulic 920/920N Mechanical Tees. Schedule 10 pipe shall be roll grooved. Schedule 40 pipe, where used with mechanical couplings, shall be roll grooved and shall be threaded where used with screwed fittings. Fittings for threaded piping shall be malleable iron screwed sprinkler fittings.

8. JOINTS

- A. Threaded pipe joints shall have an approved thread compound applied on male threads only. Teflon tape shall be used for threads on sprinkler heads. Joints on piping, 2 in. and larger, shall be made up with Victaulic, or equal, Fire Lock Style 005, rigid coupling of ductile iron and pressure responsive gasket system for wet sprinkler system as recommended by manufacturer.



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**FIRE PROTECTION SYSTEMS**

**NARRATIVE REPORT - OPTION B**

The following is the Fire Protection System Narrative, which defines the scope of work and capacities of the Fire Protection System as well as the Basis of Design.

1. CODES
  - A. All work installed under Section 210000 shall comply with the MA Building Code, IBC 2009 and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.
2. DESIGN INTENT
  - A. All new work consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Fire Protection work and all items incidental thereto, including commissioning and testing.
3. DESCRIPTION
  - A. The existing building is protected will a combined standpipe/sprinkler system supplied by an electric fire pump. The existing fire service and pump are to remain.
  - B. Existing sprinkler control valve assemblies consist of a supervised shutoff valve, check valve, flow switch and test connection with drain. All control valves shall remain.
  - C. Existing Standpipes are to remain. Install new standpipe in west stair.
  - D. In core areas existing pendent sprinklers shall remain.
  - E. In renovated tenant spaces, all pendent sprinkler heads shall be removed and new upright type sprinklers installed to protect space. In tenant areas sprinklers shall be spaced, at a minimum, according to Light Hazard occupancy.
  - E. All new sprinkler heads will be quick response, pendent and/or sidewall in hung ceiling areas and upright in unfinished areas.
  - F. All Fire Protection Systems are designed in accordance with NFPA 13-2007, NFPA 14-2007 and NFPA 72-2007.
5. BASIS OF DESIGN
  - A. The mechanical rooms and storage rooms are considered Ordinary Hazard Group 1; all other areas are considered light hazard.

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B. Required Design Densities:

Light Hazard Areas	0.10 GPM over 1,500 s.f.
Ordinary Hazard Group 1	0.15 GPM over 1,500 s.f.
Ordinary Hazard Group 2	0.20 GPM over 1,500 s.f.

C. Sprinkler spacing (max.):

Light Hazard Areas:	225 s.f.
Ordinary Hazard Areas:	130 s.f.

D. Installation of all work is to be coordinated with the phasing plans for the project.

6. PIPING

- A. Sprinkler piping 1-1/2 in. and smaller shall be ASTM A-53, Schedule 40 black steel pipe. Sprinkler piping 2 in. and larger shall be ASTM A-135, Schedule 10 black steel pipe.

7. FITTINGS

- A. Fittings on fire service piping, 2 in. and larger, shall be Victaulic Fire Lock Ductile Iron Fittings conforming to ASTM A-536 with integral grooved shoulder and back stop lugs and grooved ends for use with Style 009-EZ or Style 005 couplings. Branch line fittings shall be welded or shall be Victaulic 920/920N Mechanical Tees. Schedule 10 pipe shall be roll grooved. Schedule 40 pipe, where used with mechanical couplings, shall be roll grooved and shall be threaded where used with screwed fittings. Fittings for threaded piping shall be malleable iron screwed sprinkler fittings.

8. JOINTS

- A. Threaded pipe joints shall have an approved thread compound applied on male threads only. Teflon tape shall be used for threads on sprinkler heads. Joints on piping, 2 in. and larger, shall be made up with Victaulic, or equal, Fire Lock Style 005, rigid coupling of ductile iron and pressure responsive gasket system for wet sprinkler system as recommended by manufacturer.

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**ELECTRICAL**

**Electrical Distribution System:**

- A utility company pad mounted transformer feeds the existing electrical service equipment located in the basement main electrical room. The electrical service equipment is rated at 1200 amps, 277/480 volt, 3 phase, 4 wire. The equipment is manufactured by Square D. It appears that the service equipment has been updated within the last 20-25 years. The service equipment is in fair condition. The service equipment does have 3 ½ ft. clearance in front as is required by the electrical code but only has one entrance and does not have panic hardware.



*Tenant Metering*



*Main Switchboard*



*Tenant Electrical Panels*



*Fire Pump Service*

- The building is on multiple meters located in the main electrical room and also at each level in common area electrical closets. The main switchboard is setup with a house metered section and an unmetered tenant distribution section. Both house and tenant sections are rated at 800 amperes.
- The continuous service capacity (80 percent of rated capacity) is 960 amperes or 797.8 kVA. The service capacity yields approximately 10.5 watts per square foot which includes the basement/garage level.
- Existing lighting and power panels are circuit breaker type. The existing panels are in fair condition. Tenant panels have been updated as tenant spaces were constructed.
- Remote panels are circuit breaker type and are manufactured by various manufacturers.
- Each tenant space and house loads are metered separately, utility meters are located in the main electrical room and at each electrical closet on each floor level.

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- There is a fire pump service present. The service is not code compliant due to size. The breaker is rated at 150 amperes and should be rated at 200 amperes, so as to hold the locked rotor current of the fire pump. The fire pump is rated at 30 HP, 31 full load amps.

**Interior Lighting System:**

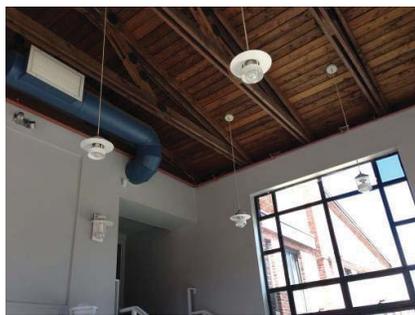
- Existing common area lighting generally consists of down lights with CFL lamps. The basement area is used as a garage and has high pressure sodium fixtures.



*Garage Lighting*



*Tenant Lighting*



*Common Area Incandescent Lighting*



*Tenant Linear Fixtures*

- Lighting in tenant spaces consists of parabolics, indirect fluorescent and linear fixtures and surface mounted toffers. There does not appear to be any building standards for tenant spaces.
- Incandescent fixtures are present in the main lobby area. The light level appears low.

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#### Emergency Lighting System:

- The emergency lighting system consists of battery type fixtures with self contained heads. The exit signs are illuminated.



*Battery Type Fixture at Garage*



*Exit Sign*

- Several updated emergency battery units have been installed for emergency lighting. The units were not tested for connection to area lighting circuit as required by code.

#### Wiring Devices:

- The existing receptacles are grounding type. The present quantity of outlets are adequate for office spaces as presently configured.

#### Fire Alarm System:

- There is an automatic fire alarm system present in the building.
- The fire alarm system is manufactured by Fire Lite. The system is obsolete and not ADA compliant. The control panel has eight zones and is Model Sensi Scan 1000.



*Tenant Horn/Strobe*

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- There is a local energy gamewell master box present. The master box can be re-used and is located at the main entrance.
- Smoke detectors are present for elevator recall.

**Feeders/Branch Circuits:**

- The existing branch circuits consist of armored cable and Electrical Metallic Tubing (EMT). The wiring appears to have been updated when the tenant spaces were constructed. No evidence of Romex or knob and tube wiring is present.

**TEL/DATA Security:**

- The existing telephone demarc is in the main electrical room. The telephone closets are located on each floor.



*Communications Closet in Common Area*



*Tenant Communications Closet*

- There is an existing security system in the building. The system consists of motion sensors and door contacts. There is a keypad located in the main lobby.



*Security Key Pad*

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### **RECOMMENDATIONS**

#### **Electrical Distribution System:**

- The existing service still has 50 percent of its life expectancy and has adequate capacity for office type tenant use. We recommend that the existing service remain at 1200 amps, 277/480 volt, 3 phase, 4 wire. The existing service feeders should remain. The service capacity is adequate for the desired tenant use with the exception of high level lab space required refrigeration.
- The electrical closets should be modified for two hour rating on each level. The existing panels should be replaced/upgraded as areas are being renovated. This should be part of tenant improvements.

#### **Interior Lighting System:**

- The existing interior lighting system is in fair condition for most areas. It may not be advantageous to replace existing lighting without changes to ceilings or finishes in the spaces. We do recommend that more efficient common area lighting such as LED be installed.
- The tenant space lighting should be replaced/upgraded as areas are being renovated. This should be part of tenant improvements.

#### **Emergency Lighting System:**

- The existing emergency lighting system should be upgraded for life safety code compliance. A new emergency battery system should be provided with sufficient capacity to serve emergency lighting and exit signs. The existing exit signs should be removed and new exit signs with LED lamps installed.
- New emergency light fixtures should be installed in all egress areas such as corridors, intervening spaces, toilets and above exterior doors. The present system does appear to be adequate, however battery type systems only have a life expectancy of 7 years.

#### **Wiring Device/Branch Circuits:**

- New receptacles and switches should be installed as areas are renovated. A new centralized lighting control system integrated with the Building Management System should be installed for common area.

#### **Fire Alarm System:**

- A new addressable fire alarm panel should be installed. The new system should be ADA compliant. Horn/strobe appliances should be installed per code requirements. Toilet rooms must be provided with fire alarm strobe lights for ADA compliance.



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**ELECTRICAL SYSTEMS****NARRATIVE REPORT – OPTION A**

The following is the Electrical system narrative, which defines the scope of work and capacities of the Power and Lighting system as well as the Basis of Design.

**1. CODES**

All work installed under Division 26 shall comply with the Massachusetts State Building Code and all local, county, and federal codes, laws, statutes, and authorities having jurisdiction.

**2. DESIGN INTENT**

The work of Division 26 is as described in this Narrative. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Electrical work and all items incidental thereto, including commissioning and testing.

**3. SEQUENCE OF OPERATIONS AND INTERACTIONS**

- A. Toilet rooms, lobby, garage and corridor lighting will be controlled via “relay panels”. The control of the space shall be by time of day. The system will be interfaced with the DDC control system for schedule functions. Occupancy sensors shall be provided in toilet rooms.
- B. Exterior lighting will be controlled by photocell “on” and “relay panel” for “off” operation. The area lighting will be controlled by “zones” and have dual level control. The relay panel will control exterior lights.
- C. Emergency and exit lighting will be battery unit type. Exit signs will have internal battery backup. Exit signs shall be located every 50 ft. intervals and above each exit door.

**4. DESCRIPTION OF THE SYSTEMS****A. Electrical Distribution System:**

- 1. The existing service capacity is 1600 amperes at 277/408 volt, 3Ø, 4wire. Existing lighting and power panels shall remain serving house loads.
- 2. Provide a 400A, 277/408 volt, 3Ø, 4wire. Meter bank on each floor for tenant metering. Provide (4) 200A sockets with circuit breaker at each level.

**B. Interior Lighting System:**

- 1. Lighting fixtures consist of surface mounted indirect fluorescent luminaries with T5HO lamps and electronic ballasts.

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2. Toilet room lighting fixtures will consist of perimeter mounted recessed fluorescent luminaries with T5HO lamps and electronic ballasts.

In general lighting power density will be 20% less than IECC 2009.

3. Main lobby shall be provided with pendant mounted decorative fluorescent fixtures with daylight dimming. Lighting levels will be approximately 10-15 foot candles in common areas.
4. Corridor lighting will be linear fluorescent fixtures. The corridor light level will be designed for approximately 15 foot candles. Corridor lighting will be on time clock control and only "ON" during occupied hours.
5. The entire space will be controlled with an automatic lighting control system using the DDC control system for programming lights on & off.

C. Emergency Lighting System:

1. Emergency ballast within the fixtures will be provided with for emergency lighting.
2. Exit signs will be provided with integral battery units.

D. Wiring Devices:

1. Corridors will have a cleaning receptacle at approximately 25 foot intervals.

E. Fire Alarm System:

1. An addressable fire alarm and detection system will be provided with battery back-up. The system will be a replacement of existing. Provide a new addressable fire alarm control panel and devices throughout.
2. Audio/visual will be provided in open areas, corridors and other egress ways.
3. The sprinkler system will be supervised for water flow and tampering with valves.
4. Audio/Visual will be provided in egress ways, tenant spaces. Strobe only units will be provided in single toilets.
5. Manual pull stations will be provided at exit discharge doors and at each egress stairwell not located at grade level.
6. The system will be remotely connected to automatically report alarms to fire department via an approved method by the fire department.

5. TESTING REQUIREMENTS



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- Lighting and power panels for correct phase balance.
- Lighting control system.
- Fire alarm system.
- Security system (existing to remain).

Testing reports shall be submitted to the engineer for review and approval before providing to the Owner.

#### 6. OPERATION MANUALS AND MAINTENANCE MANUALS

When the project is completed, the Electrical Contractor shall provide operation and maintenance manuals to the Owner.

#### 7. RECORD DRAWINGS AND CONTROL DOCUMENTS

When the project is completed, an as-built set of drawings, showing all lighting and power requirements from contract and addendum items, will be provided to the Owner.

#### 8. INTRUSION SYSTEM

An intrusion system presently on site will remain. Additional devices will be provided in the new space.



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### ELECTRICAL SYSTEMS

#### NARRATIVE REPORT – OPTION B

The following is the Electrical system narrative, which defines the scope of work and capacities of the Power and Lighting system as well as the Basis of Design. The electrical systems shall be designed and constructed in accordance with **LEED 2009 Core and Shell**.

#### 1. CODES

All work installed under Division 26 shall comply with the Massachusetts State Building Code and all local, county, and federal codes, laws, statutes, and authorities having jurisdiction.

#### 2. DESIGN INTENT

The work of Division 26 is as described in this Narrative. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Electrical work and all items incidental thereto, including commissioning and testing.

#### 3. SEQUENCE OF OPERATIONS AND INTERACTIONS

- A. Toilet rooms, lobby, garage and corridor lighting will be controlled via “relay panels”. The control of the space shall be by time of day. The system will be interfaced with the DDC control system for schedule functions. Occupancy sensors shall be provided in toilet rooms.
- B. Exterior lighting will be controlled by photocell “on” and “relay panel” for “off” operation. The area lighting will be controlled by “zones” and have dual level control. The relay panel will control exterior lights.
- C. Emergency and exit lighting will be battery unit type. Exit signs will have internal battery backup. Exit signs shall be located every 50 ft. intervals and above each exit door.
- D. Refer to HVAC narrative report for plug load metering required.

#### 4. DESCRIPTION OF THE SYSTEMS

##### A. Electrical Distribution System:

- 1. The existing service capacity is 1600 amperes at 277/408 volt, 3Ø, 4wire. Existing lighting and power panels shall remain serving house loads.
- 2. Provide a 400A, 277/408 volt, 3Ø, 4wire. Meter bank on each floor for tenant metering. Provide (4) 200A sockets with circuit breaker at each level.

##### B. Interior Lighting System:

- 1. Lighting fixtures consist of surface mounted indirect fluorescent luminaries with T5HO lamps and electronic ballasts.

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2. Toilet room lighting fixtures will consist of perimeter mounted recessed fluorescent luminaires with T5HO lamps and electronic ballasts.  
  
In general lighting power density will be 20% less than IECC 2009.
  3. Main lobby shall be provided with pendant mounted decorative fluorescent fixtures with daylight dimming. Lighting levels will be approximately 10-15 foot candles in common areas.
  4. Corridor lighting will be linear fluorescent fixtures. The corridor light level will be designed for approximately 15 foot candles. Corridor lighting will be on time clock control and only "ON" during occupied hours.
  5. The entire space will be controlled with an automatic lighting control system using the DDC control system for programming lights on & off.
  6. The lobby shall have new pendant fixtures with dimming ballasts for daylighting controls.
  7. Garage shall be provided with LED industrial fixtures.
- C. Emergency Lighting System:
1. Emergency ballast within the fixtures will be provided with for emergency lighting.
  2. Exit signs will be provided with integral battery units.
- D. Wiring Devices:
1. Corridors will have a cleaning receptacle at approximately 25 foot intervals.
- E. Fire Alarm System:
1. An addressable fire alarm and detection system will be provided with battery back-up. The system will be a replacement of existing. Provide a new addressable fire alarm control panel and devices throughout.
  2. Audio/visual will be provided in open areas, corridors and other egress ways.
  3. The sprinkler system will be supervised for water flow and tampering with valves.
  4. Audio/Visual will be provided in egress ways, tenant spaces. Strobe only units will be provided in single toilets.
  5. Manual pull stations will be provided at exit discharge doors and at each egress stairwell not located at grade level.
  6. The system will be remotely connected to automatically report alarms to fire department via an approved method by the fire department.



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### 5. TESTING REQUIREMENTS

The Electrical Contractor shall provide testing of the following systems with the Owner and Owner's representative present:

- Lighting and power panels for correct phase balance.
- Lighting control system.
- Fire alarm system.
- Security system (existing to remain).

Testing reports shall be submitted to the engineer for review and approval before providing to the Owner.

### 6. OPERATION MANUALS AND MAINTENANCE MANUALS

When the project is completed, the Electrical Contractor shall provide operation and maintenance manuals to the Owner.

### 7. RECORD DRAWINGS AND CONTROL DOCUMENTS

When the project is completed, an as-built set of drawings, showing all lighting and power requirements from contract and addendum items, will be provided to the Owner.

### 8. INTRUSION SYSTEM

An intrusion system presently on site will remain. Additional devices will be provided in the new space.



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### **HVAC**

#### **Executive Summary:**

Currently the existing system appears to be in fair shape. The main system components appear to be functional and providing satisfactory operating conditions. The overall maintenance on the building and the major pieces of equipment appear to be adequate however, at the time of the visit the existing cooling tower was not functional. The maintenance personal was aware of the situation and providing the necessary modifications/repairs required.

The individual spaces/tenant areas had also been maintained in a satisfactorily manner, in some cases it appeared that the units had been recently replaced. However, there were some units which appeared to have reached the end of their serviceable life. The condenser water piping was not insulated and in some cases appeared to be PVC while in other areas it appeared to be schedule 40 black steel. Overall the individual systems appeared functional and maintaining the desired space temperature.

#### **Heating Plant:**

- Three gas fired HydroTherm non-condensing fire tube boilers, model R-300B-PV, Input of 300 MBH and an output of 240 MBH.



*Existing Hot Water Boilers*

- Breeching for the boilers was provided through the use of a galvanized sheet metal system which exited the building and traveled up the side of the building façade. Combustion air for the boilers appeared to be provided through two wall mounted louvers. This is not code compliant and should be addressed.

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*Boiler Breeching*

- Two end suction base mounted pumps of the Amstrong manufacture with 15 HP motors at 415 GPM each, 75 feet of head at 1750 RPM. These pumps were utilized as the buildings system pumps which circulated tempered water throughout the building.



*End Suction Pumps*

- Horizontal style expansion tank, full capacity no bladder.



*Horizontal Expansion Tank*

- Schedule 40 black steel piping for hot water injection system.
- Three way bypass valve for mixing and maintaining set point water temperature.

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*Three Way Bypass Valve*

- These boilers are utilized in the winter when water temperatures are too cold for the water source heat pumps to operate properly. These boilers generate hot water which is injected into the piping system as needed through the use of three way control valve located within the boiler room.

#### Cooling Tower Plant:

- One closed circuit cooling tower of the Evapco manufacture, approximately 115 tons of cooling.



*Evapco Cooling Tower*



*Evapco Label*

- One Inline pump mounted on the discharge spray side of the cooling tower which was rated for 345 GPM and utilized a 2 HP TEFC motor.

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*Inline Cooling Tower Pump*

- Piping appeared to be PVC and was not insulated.
- This cooling tower for majority of the year produces the desired water temperature required for the water source heat pumps to function properly.

**Tenant Space/Areas:**

- Typical tenant spaces are provided with several water source heat pump units, depending on the size of the space and its heating/cooling demand. Heat pump manufactures varied from Climate Master to Carrier and some unit manufactures were unknown. Some heat pump units were ducted with galvanized sheet metal ductwork. These distribution systems were not insulated.



*Antiquated Heat Pump*



*New Heat Pump*

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- Some of the piping associated with these units was schedule 40 black steel, some were PVC and some were braided steel hoses. None of the pipes were insulated.
- The controls for these units appeared to be electronic standalone type with no interface into a building management system. Thermostat manufacturers varied from Honeywell, Carrier, Water Master and McQuay. All of which appeared to be functioning and maintaining the desired space set point however, some thermostats appeared too antiquated and in need of replacement.



*New Stand Alone Thermostat*



*Antiquated Stand Alone Thermostat*

- Some spaces were equipped with wall mounted electric baseboard. The controls associated with these units were unit mounted.



*Wall Mounted Electric Baseboard*

- There is no mechanical ventilation air provided for the entire building. It appears that operable windows are the main source for outside air. Currently, operable windows are an acceptable solution to providing code required ventilation air however, determinations must be made to ensure that the proper requirements are being achieved. The IMC (International Mechanical Code) requires that the operable portion of the window must be at least 4% of the floor area for which the window is serving. Therefore, spaces located in the center of the building that have no operable windows are currently not meeting ventilation code requirements. These ventilation requirements must be verified and documented prior to occupancy of the building.

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- There was a roof mounted packaged air conditioning unit located on the low roof however, its intended use or space being serviced was unknown. It's possible that it is utilized for cooling of one of the tenant spaces. There did not appear to be any gas piping associated with it therefore it could potentially be electric heat or a cooling only unit. It appeared to be in fair condition however it was unknown at the time of the visit if it was operational.



*Rooftop Unit and Condensers*

- Located throughout some of the tenant spaces there were split direct expansion cooling units with indoor units and associated outdoor condensing units. These mini systems appeared to be utilized for data closets or IDF rooms. Their associated condensers were located on the low roofs and at grade. Whether these units are operational or not is unknown, they were not operating at the time of the visit.



*Indoor Mini Split System*

**Parking Garage Area:**

- Currently the parking garage area is equipped with several wall mounted propeller exhaust fans. The activation method for these fans was unknown at the time of the visit.

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*Wall Mounted Propeller Fans*

**Building Control System:**

- Currently the building's hot water boilers, pumps and cooling tower are controlled through the use of an EnerCon Control System which is manufactured by AAF Co. This system basically operates as the building's time clock. It also appears to be controlling the three way valve position to allow the proper water temperature to be distributed to the water source heat pumps. This system appears to be operating however, its efficiency and accuracy is questionable. The system appears antiquated and reaching the end of its serviceable life.



*Existing Building Control System*

**RECOMMENDATIONS**

- Provide new high efficiency, condensing hot water boilers. These will operate at 95% or better efficiencies and provide energy savings.
- Provide new premium efficiency pumps with inverted duty motors and variable frequency drives for variable flow control. This will provide energy savings at low load conditions.

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- Provide new condenser fan motors on the cooling tower to help reduce energy when only partial demand/load is required.
- Provide insulation on all condenser water and hot water piping to ensure the proper water temperature drop is maintained throughout the system loop.
- Provide new higher efficiency water source heat pumps for areas to be renovated.
- Provide new standalone electronic thermostat controls where antiquated styles are currently installed. This will ensure proper operation and maintain set points more accurately.
- Provide 1 -1/2" flexible fiber glass insulation on sheet metal ductwork located within ceiling cavities and chases. This will prevent condensation forming on the outside of the ductwork which could lead to water damage.
- Provide carbon monoxide detectors in the parking garage area to activate the local exhaust fans.
- Confirm and provide ventilation air within the building, areas where operable windows are provided should be confirmed and verified to ensure code requirements are met. Other areas should be provided with mechanical ventilation per current code requirements.
- Provide combustion air for the boiler room as required by code.

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**HVAC SYSTEMS**

**NARRATIVE REPORT – OPTION A**

The following is the HVAC system narrative, which defines the scope of work and capacities of the HVAC system as well as the Basis Of Design.

1. CODES

All work installed under Section 23 00 00 shall comply with the Massachusetts Building Code and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.

2. DESIGN INTENT

The work of Section 23 00 00 is shown on the drawings and specifications. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Heating, Ventilating and Air Conditioning work and all items incidental thereto, including commissioning and testing.

A. Capacities of systems and equipment are specified as follows:

1. Boiler: Two (2) new high efficiency gas fired condensing boilers with power burners each sized at approximately 500 MBH each.
2. System Pumps: Two (2) new end suction pumps for heating system, each pump sized at one hundred percent (100%) of total system capacity of approximately 415 gpm each. One (1) pump shall be stand-by. A variable speed drive will also be provided to modulate the hot water flowrate to account for changes in the building heating load.
3. Hydronic specialties including air separator, expansion tanks and associated equipment is provided and sized corresponding to the associated power plant.
4. Tenant Heating and Air Conditioning Units:
  - a. New Horizontal Water Source Heat Pump units with supply fan, filters and controls. Units will be piped to an existing closed circuit central cooling tower system. Each unit is approximately three tons in capacity.
5. Central Cooling Plant:
  - a. The existing central cooling plant consists of a Central Cooling Tower system including closed cell cooling tower, inline condenser water pump, condenser water piping distribution piping and associated controls. The Cooling Tower has an approximate capacity of 115 tons.
6. Central Ventilation System:
  - a. This system will consist of four (4) new central indoor air handling units. Three units will be sized at 5000CFM, 20 tons of DX cooling with associated

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outdoor air cooled condenser, 170MBH hot water coils, energy recovery wheel, supply and return fans and MERV 10 filtration media. One unit will be sized at 3000CFM, 15 tons of DX cooling with associated outdoor air cooled condenser, 100MBH hot water coil, energy recovery wheel, supply and return fans and MERV 10 filtration media. A galvanized sheetmetal duct distribution system associated with each unit will provide a constant supply of air to the entire space. Energy recovery unit will extract heat from the exhaust air stream during heating periods and preheat outside air ventilation therefore, saving energy.

7. Toilet, Electric Room, and Mechanical Room exhaust with miscellaneous duct systems and fans.
8. Supply, return and exhaust ductwork including Grilles, registers and diffusers.
9. Hot water, condenser water supply and return, drain and vent piping.
10. Ductwork and piping insulation.
11. Vibration isolation and seismic restraints.
12. Water treatment system.
13. Testing and balancing of systems.
14. DDC temperature control systems and energy management and metering/monitoring system.

3. BASIS OF DESIGN: (MASS CODE)

Massachusetts Code values are listed herein based on the City of Boston values as determined from ASHRAE Weather Data.

Outside: Winter 7°F, Summer 87°F DB 74°F WB

Inside: 70°F for heating +1- 2°F, 78°F (50% RH) for cooling (where space is air conditioned). Unoccupied temperature setback will be provided.

Load Calculations: HVAC system load calculations shall be in accordance with performed ASHRAE fundamentals 2009 guidelines.

Ventilation: Generally outside air is provided at the rate of approximately 10 cfm/person for office spaces. In all cases ASHRAE Standard 62-2007 and IBC 2009 mechanical code will be met as a minimum.

Filtration for central ventilation systems shall be MERV-10 rated in accordance with ASHRAE Standard 52.

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**4. SYSTEM DESCRIPTION****A. Primary Heating/Cooling System:**

1. The main heating and cooling plant is a combination of the cooling tower and the hot water boilers. Both assist in maintaining the proper condenser water temperature for the tenant heat pumps to operate. The balance of injecting hot water versus cold water is maintained with the use of a three way valve which allows hot water into the loop if the water temp is too cold and cold water if its too hot.
1. Heating and air conditioning will be provided to individual tenants by terminal heating and cooling console type heat pumps. Ventilation supply and exhaust duct systems will be provided to distribute air to and from each space. Heating and cooling shall be controlled through an individual wall mounted thermostat.
2. Condenser water shall be distributed to the building by two (2) end suction pumps, each sized at 100% of the total load. One (1) pump shall be standby. A variable speed drive will be provided to excess system pressure as control valves modulate throughout the system.
3. The main condenser distribution system piping upfeeds and downfeeds to the building heat pump equipment.

**B. Ventilation System:****1. Tenant Spaces:**

This system will consist of (4) central indoor air handling units. Each unit will be provided with a supply and return galvanized sheetmetal duct distribution system. Each unit will provide ventilation air to a section of the building for all three floors through a horizontal ducted system which will be fed from a vertical riser. Each floor will be fed from the top or bottom of the horizontal duct system. Each unit will provide a constant supply of air at a constant temperature. The main feeds of supply and return ductwork will be installed partially into the tenant space and from there it will be the tenant's responsibility to connect and distribute the ventilation air to where it is required based on their floor plan and occupant load.

**5. Miscellaneous Systems:**

- A. In-line or roof exhaust fans shall be provided to serve the areas of the building that require separate dedicated exhaust systems utilizing exhaust air fans, ductwork and associated controls, i.e. Janitors closets, Electric rooms, etc.
- B. All exterior stairways, entrances and vestibules will be provided with hot water cabinet unit heaters.
- C. Ancillary spaces will be heated by fin tube radiation, radiant heating panels and/or convectors.

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D. All corridors will be ventilated by the central ventilation system that serves the building. Ventilation will be provided to ensure sufficient outdoor ventilation and make-up air is provided to offset the building exhaust air to maintain proper building pressurization.

E. Unit heaters will be provided to serve mechanical rooms.

### 6. Automatic Temperature Controls, Building Energy Management System

A direct digital control (DDC) automatic temperature control and building energy management system will be provided for the building. The system shall include capabilities for system control, monitoring, feedback, thermostat controls, and start/stop functions of the mechanical systems described above. A front end workstation computer with web-enabled software capable of communicating with a town wide energy management system will be located in a basement office adjacent to the mechanical room.

### 7. TESTING REQUIREMENTS

The mechanical contractor shall provide testing of the following systems with the Owner and Owner's representative present:

- Boiler plant and Cooling Plant systems
- Air handling unit systems including all indoor air handling systems and exhaust air systems
- Terminal heating and cooling devices
- Automatic temperature control and building energy management system

Testing reports shall be submitted to the engineer for review and approval before providing to the Owner.

### 8. OPERATION MANUALS AND MAINTENANCE MANUALS:

When the project is completed, the Mechanical Contractor shall provide operation and maintenance manuals to the Owner.

### 9. RECORD DRAWINGS AND CONTROL DOCUMENTS:

When the project is completed, an as-built set of drawings, showing all mechanical system requirements from contract and addendum items, will be provided to the Owner.

### 10. COMMISSIONING

The project's HVAC systems shall be fully commissioned in accordance with project Commissioning specifications.



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**HVAC SYSTEMS****NARRATIVE REPORT – OPTION B**

The following is the Electrical system narrative, which defines the scope of work and capacities of the Power and Lighting system as well as the Basis of Design. The electrical systems shall be designed and constructed in accordance with **LEED 2009 Core and Shell**.

**1. CODES**

All work installed under Section 23 00 00 shall comply with the Massachusetts Building Code and all state, county, and federal codes, laws, statutes, and authorities having jurisdiction.

**2. DESIGN INTENT**

The work of Section 23 00 00 is shown on the drawings and specifications. All work is new and consists of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Heating, Ventilating and Air Conditioning work and all items incidental thereto, including commissioning and testing.

**A. Capacities of systems and equipment are specified as follows:**

1. Boiler: Two (2) new high efficiency gas fired condensing boilers with power burners each sized at approximately 1000 MBH each.
2. Hot Water System Pumps: Two (2) new end suction pumps for heating system, each pump sized at one hundred percent (100%) of total system capacity of approximately 200 gpm each. One (1) pump shall be stand-by. A variable speed drive will also be provided to modulate the hot water flowrate to account for changes in the building heating load.
3. Chilled Water System Pumps: Two (2) new end suction pumps for cooling system, each pump sized at one hundred percent (100%) of total system capacity of approximately 400 gpm each. One (1) pump shall be stand-by. A variable speed drive will also be provided to modulate the hot water flowrate to account for changes in the building heating load.
4. Hydronic specialties including air separator, expansion tanks and associated equipment is provided and sized corresponding to the associated power plant.
5. Tenant Heating and Air Conditioning Units:
  - a. The tenant areas will be supplied with ventilation air thru the ventilation units which is of the 100% outside air design. Supply air ventilation will be provided to each space which will satisfy building code requirements based on population. It is proposed that spatial heating and air-conditioning will utilize induction units which will receive primary ventilation air from the associated air handling ventilation units and have a three to one ratio which will allow primary air into the unit and through the induction process deliver three times that primary air to the actual space. These induction units will be

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provided with hot water and chilled water coils. The coils are fed from the individual hot water and chilled water central recirculation piping system communicating with the boiler and chilled water power plants. These spaces will be heated, ventilated and air conditioned through the use of these induction units.

6. Central Cooling Plant:
  - a. A chilled water powerplant will be provided which will include a single grade mounted outside air cooled liquid chiller of approximately 150 tons capacity. It is proposed that the chiller will be of the high-efficiency oil-less turbo core digital scroll compressor design and will distribute 45°F chilled water to all areas of the building provided with induction unit distribution systems such as the tenant spaces and corridors. The chilled water distribution piping will be of the fiberglass insulated schedule 40 type and will be completely separate from the hot water distribution piping system.
7. Central Ventilation System:
  - a. This system will consist of four (4) new central indoor air handling units. Three units will be sized at 5000CFM, 20 tons of DX cooling with associated outdoor air cooled condenser, 170MBH hot water coils, energy recovery wheel, supply and return fans and MERV 10 filtration media. One unit will be sized at 3000CFM, 15 tons of DX cooling with associated outdoor air cooled condenser, 100MBH hot water coil, energy recovery wheel, supply and return fans and MERV 10 filtration media. A galvanized sheetmetal duct distribution system associated with each unit will provides a constant supply of air to the entire space. Energy recovery unit will extract heat from the exhaust air stream during heating periods and preheat outside air ventilation therefore, saving energy.
8. Toilet, Electric Room, and Mechanical Room exhaust with miscellaneous duct systems and fans.
9. Supply, return and exhaust ductwork including Grilles, registers and diffusers.
10. Hot water, condenser water supply and return, drain and vent piping.
11. Ductwork and piping insulation.
12. Vibration isolation and seismic restraints.
13. Water treatment system.
14. Testing and balancing of systems.
15. DDC temperature control systems and energy management and metering/monitoring system.



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3. BASIS OF DESIGN: (MASS CODE)

Massachusetts Code values are listed herein based on the City of Boston values as determined from ASHRAE Weather Data.

Outside: Winter 7°F, Summer 87°F DB 74°F WB

Inside: 70°F for heating +1- 2°F, 78°F (50% RH) for cooling (where space is air conditioned). Unoccupied temperature setback will be provided.

Load Calculations: HVAC system load calculations shall be in accordance with performed ASHRAE fundamentals 2009 guidelines.

Ventilation: Generally outside air is provided at the rate of approximately 10 cfm/person for office spaces. In all cases ASHRAE Standard 62-2007 and IBC 2009 mechanical code will be met as a minimum.

Filtration for central ventilation systems shall be MERV-10 rated in accordance with ASHRAE Standard 52.

4. SYSTEM DESCRIPTION

A. Primary Heating/Cooling System:

1. Heating for the entire building will be through the use of 2 gas fired boilers operating at a maximum supply water temperature of 150°F and supplying hot water to all heating apparatus throughout the entire building through a two-pipe fiberglass insulated schedule 40 black steel piping system. The boilers will have an estimated output capacity of 1,000 MBH each. The supply water temperature will be adjusted downward based on outside temperature to improve overall operating efficiency of the powerplant. It is anticipated that this boiler will shut down when outside temperatures are consistently above 65°F. Primary and standby end suction base mounted pumps with a capacity of 200 gpm each will be provided with variable frequency drives to distribute heating hot water to the building via a variable flow distribution system. Combustion air for each boiler will be distributed directly to each boiler through a ducted distribution system. Breeching from each boiler shall be through separate double wall stainless steel (AL294C) design chimneys each discharging approximately 15 feet above the roof level.
2. A chilled water powerplant will be provided which will include a single grade mounted outside air cooled liquid chiller of approximately 150 tons capacity and supplying chilled water to all cooling apparatus throughout the entire building through a two-pipe fiberglass insulated schedule 40 black steel piping system. Primary and standby base mounted end suction pumps at 400 GPM each with a variable frequency drive (which will control down to maintain a minimum flow to the chiller) will be provided for overall water system distribution.

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3. Tenant heating, ventilation and cooling will be provided through the use of the induction units. The tenants will be required to provide the correct number of units and determine the exact location based on their floor plan, occupant load, cooling and heating load. Through the new building management system, the hot water and chilled water control valves associated with the each induction unit will be monitored for each tenant to allow the owner to determine proper energy usage for billing purposes. The monitoring system will be programmed to provide the owner with real time system use based on valve position, timed position intervals, flow and water temperature.
4. The main chilled water and hot water distribution system piping upfeeds and downfeeds to the building's equipment.

B. Ventilation System:

1. Tenant Spaces:

This system will consist of (4) central indoor air handling units. Each unit will be provided with a supply and return galvanized sheetmetal duct distribution system. Each unit will provide ventilation air to a section of the building for all three floors through a horizontal ducted system which will be fed from a vertical riser. Each floor will be fed from the top or bottom of the horizontal duct system. Each unit will provides a constant supply of air at a constant temperature. The main feeds of supply and return ductwork will be installed partially into the tenant space and from there it will be the tenant's responsibility to connect and distribute the ventilation air to where it is required based on their floor plan and occupant load.

5. Miscellaneous Systems:

- A. In-line or roof exhaust fans shall be provided to serve the areas of the building that require separate dedicated exhaust systems utilizing exhaust air fans, ductwork and associated controls, i.e. Janitors closets, Electric rooms, etc.
- B. All exterior stairways, entrances and vestibules will be provided with hot water cabinet unit heaters.
- C. Ancillary spaces will be heated by fin tube radiation, radiant heating panels and/or convectors.
- D. All corridors will be ventilated by the central ventilation system that serves the building. Ventilation will be provided to ensure sufficient outdoor ventilation and make-up air is provided to offset the building exhaust air to maintain proper building pressurization.
- E. Unit heaters will be provided to serve mechanical rooms.

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6. Automatic Temperature Controls, Building Energy Management System

A direct digital control (DDC) automatic temperature control and building energy management system will be provided for the building. The system shall include capabilities for system control, monitoring, feedback, thermostat controls, and start/stop functions of the mechanical systems described above. A front end workstation computer with web-enabled software capable of communicating with a town wide energy management system will be located in a basement office adjacent to the mechanical room.

Through the new direct digital building management system, the hot water and chilled water control valves associated with the each induction unit will be monitored for each tenant to allow the owner to determine proper energy usage for billing purposes. The monitoring system will be programmed to provide the owner with real time system use based on valve position, timed position intervals, flow and water temperature.

7. TESTING REQUIREMENTS

The mechanical contractor shall provide testing of the following systems with the Owner and Owner's representative present:

- Boiler plant and Cooling Plant systems
- Air handling unit systems including all indoor air handling systems and exhaust air systems
- Terminal heating and cooling devices
- Automatic temperature control and building energy management system

Testing reports shall be submitted to the engineer for review and approval before providing to the Owner.

8. OPERATION MANUALS AND MAINTENANCE MANUALS:

When the project is completed, the Mechanical Contractor shall provide operation and maintenance manuals to the Owner.

9. RECORD DRAWINGS AND CONTROL DOCUMENTS:

When the project is completed, an as-built set of drawings, showing all mechanical system requirements from contract and addendum items, will be provided to the Owner.

10. COMMISSIONING

The project's HVAC systems shall be fully commissioned in accordance with project Commissioning specifications.

