

# 3AMFisher

321 Ashland Pl, Brooklyn NY

## TECH REPORT TWO

MFGANgrant

Lighting | Electrical

Advisor—Dr. Kevin Houser

October 21st, 2015



### Electrical Systems Existing Conditions and Building Load Summary Report

## EXECUTIVE SUMMARY

The Brooklyn Academy of Music's BAM Fisher building is an addition to the prestigious higher education program. The following technical report focuses on the Fisher building, analyzing existing conditions of the space. In addition, this report will provide in depth analysis of existing lighting conditions and provide design criteria and considers of a new lighting design.

This building is truly unique as it was the first theater in the Manhattan area to achieve a LEED gold rating in new construction. The building also celebrates history by preserving the façade of the salvation army building that existed on the site from 1927. BAM is a program committed to allowing college students to grow and express themselves freely. This space provides performance and rehearsal spaces such as the Judith and Alan Fisherman Space Black-box Theater, Rita K. Hillman Dance Studio, and Max Leavitt Theater Workshop. The building is also home to several offices and classrooms.

The following report concentrates on the electrical design criteria and existing electrical system. Part one of this report is all design criteria and code analysis for the building occupancy type and function using the NEC 2011 and the IBC 2012. Part two includes the actual electrical system design including load values and equipment specifics from the construction drawings and specifications. The third part compares the designed system to the criteria.

Overall, the building electrical system performs well and complies with the codes studied. Through redesign, additional steps will be taken to try to further reduce energy load and losses.

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## References

The following links are available on the Technical Reports page of the CPEP site

Electrical Drawings | One-Line on page 21

International Building Code 2012

ConEdison Tariff

# BUILDING OVERVIEW

<b>Building Name</b>	BAM Fisher
<b>Location and Site</b>	321 Ashland Place, Brooklyn NY
<b>Building Occupant</b>	Brooklyn Academy of Music
<b>Occupancy/Function</b>	Theater (A-1), Offices (B), Classroom (B), Dance Studio (A-1)
<b>Size</b>	40,000SF
<b>Number of Stories</b>	1 below ground, 7 above ground
<b>Construction Dates</b>	10/1/2010-5/1/2012
<b>Cost Info</b>	Construction Cost \$25.2 million   Total Project Cost \$52 million
<b>Project Delivery Method</b>	Design Build with CM at Risk with a GMP

## Key Players in Electrical Design

Architect | H3 Hardy Collaboration [www.h3hc.com](http://www.h3hc.com)

Lighting Designer | Cline Bettridge Bernstein Lighting Design [www.cbld.com](http://www.cbld.com)

MEPF Engineers | ICOR Associates, LLC [www.icorassociates.com](http://www.icorassociates.com)

Environmental Consultant | Ambrosino DePinto Schmieder [www.adsce.com](http://www.adsce.com)

Code Consultant | Milrose Consultants, Inc [www.milrose.com](http://www.milrose.com)

Theater Consultant | Auerbach Pollack Friedlander [www.auerbachconsultants.com](http://www.auerbachconsultants.com)

## PART 1 | ELECTRICAL SYSTEMS CRITERIA & SCOPE OF WORK

### Preliminary Load Calculation

The BAM Fisher Building is a 40,000 SF building with type A-1 Occupancy. The following primary load calculation is found using NEC 2011 Article 220 and using reasonable estimations.

<b>Table 1.1   Primary Load Calculation</b>				
Load Type	VA/SF	Demand Factor	Area (SF)	Allowable Load (kVA)
Lighting	1	1	40000	40
Receptacle				
First 10kVA	1	1	10000	10
Remainder	1	0.5	30000	15
Mechanical	5	1	40000	200
Elevator	1.275	1	40000	51
Fire Pump	1.275	1	40000	51
			<b>Total</b>	<b>367</b>

*\*Elevator VA/SF based off 50HP system. Fire pump VA/SF is based off 140A pump (50HP)*

### Utility Company Information

Con Edison provides electrical service to Brooklyn where the BAM Fisher Theater is located. Con Edison serves the majority of the New York City area. The following table shows the current rates for this standard service from electricity provider for standard and low tension service for general large (>10kW) building applications.

Table 1.2   ConEd Tariff		
Demand Deliver Charges, per kW of maximum demand		
Jun-Sept		
First 5kW (or less)	\$140.86 per month	
Over 5kW	\$21.82 per kW	
Oct-May		
First 5kW (or less)	\$112.51 per month	
Over 5kW	\$17.22 per kW	
Energy Delivery Charge, per kWhr		
All months	\$0.0236 per kWhr	
Charges for Metering Services		
Meter Ownership Charge	\$1.68 per month	
Meter Service Provider Charge	\$2.63 per month	
Maximum Rate		
All months through Dec 2015	\$0.8943 per kWhr	

# PART 1 | ELECTRICAL SYSTEMS CRITERIA & SCOPE OF WORK

## Building Utilization Voltage

The building utilization voltage is 3 phase 120/208V which enters the building via an underground sidewalk transfer vault located on Ashland avenue.

Lighting—120V

Receptacle—120V

Mechanical—208V 3Φ

Special Equipment

Elevator—208V 3Φ

Theatrical Lighting—120V

IT—120V

Audio Visual—120V

## Emergency Power Requirements

The BAM Fisher Building is classified as a Type A-1 Occupancy. According to the 2012 International Building Code the following emergency power requirements should be implemented.

**2702.1 Installation** | Emergency and standby power systems required by this code or the *International Fire Code* shall be installed in accordance with IBC 2012, NFPA 110 and 111.

**2702.1.1 Stationary generators** | Stationary emergency and standby power generators required by this code shall be *listed* in accordance with UL 2200.

**2702.2.1 Group A occupancies** | Emergency power shall be provided for emergency voice/alarm communication systems in Group A occupancies

**2702.2.2 & 909.11 Smoke control systems** | Standby power shall be provided for smoke control systems and shall be supplied with two sources of power. Standby power source and transfer switches shall be in a room separate from the normal power transformer and switch gears. Said room must be ventilated directly to and from the exterior and have at least a 1hr fire rating wall system. The transfer to full standby power shall be automatic and within 60 seconds of failure of the primary power.

**2702.2.3 & 1011.6.3 Exit signs** | Emergency power shall be provided for *exit* signs and shall be illuminated at all times. Signs shall be connected to batteries, unit equipment, or on-site generator to ensure illumination for a duration not less than 90 min.

**2702.2.4 & 1006.3 Means of egress illumination** | Emergency power shall be provided for *means of egress* illumination. The power supply for *means of egress* illumination shall normally be provided by the premises' electrical supply. In the event of power supply failure, an emergency electrical system shall automatically illuminate aisles, corridors, stairways/ramps, egress, exit discharges, exterior discharge landings/doorways. For exterior landings and doorways the power should last not less than 90 minutes and contain backup batteries, unit equipment, or an on-site generator.

**2702.2.5 & 1007.4 Accessible Means of Egress Elevators** | Standby power shall be provided for elevators that are part of an accessible means of egress. Elevator shall comply with the emergency operation and signaling device requirements of Section 2.27 of ASME A17.1. The elevator shall be accessed from either an area of refuge or a horizontal exit.

PART 1 | ELECTRICAL SYSTEMS CRITERA & SCOPE OF WORK

Emergency Power Requirements Continued

**2702.2.15 High-Rise Buildings** | Emergency and standby power shall be provided in high-rise buildings in accordance with the following requirements.

**403.4.8 Standby power** | A standby power system shall be provided for standby power loads specified in IBC 403.4.8.2. Where elevators are provided in a *high-rise building for accessible means of egress*, fire service access or occupant self-evacuation, the standby power system shall also comply with the emergency operation and signaling device requirements of Section 2.27 of ASME A17.1 and every floor of the building shall be served by a fire service access elevator.

**403.4.9 Emergency power systems.**  
An emergency power system shall be provided for emergency power loads: exit signs and means of egress illumination, elevator car lighting, emergency voice/alarm communication systems, automatic fire detection systems, fire alarm system and electrically powered fire pumps.

**2702.3 Maintenance** | Emergency and standby power systems shall be maintained and tested in accordance with the *International Fire Code*

Emergency Power Estimation of Loads

The generator used for emergency power will use 120/208V 3Φ as that is the only service entering the building. As it is high rise construction, the elevator shall be on emergency power and can be estimated at 50HP which is approximately 51 kVA. The firepump must also run on emergency power. At an estimated 800A at 120V, the pump is assumed to be 96kVA. It is assumed 10% of all lighting loads will be connected to emergency power. From the preliminary load calculation for lighting we can estimate an emergency power load of 4 kVA.

Special Occupancy Requirements

NEC Article 520 states special occupancy requirements for buildings with a portion of the building dedicated for the use of presentation, dramatic, musical, motion picture projects, or similar purposes. This requirements article would need to be implemented in design.

The IBC also contains Occupancy Requirements. Section 403 for high-rise building would apply in this case. In addition, section 410 for stages, platforms and technical production areas would be applicable.

Priority Assessment

The following list shows the priority of power characteristics based on a high/medium/low rating for this specific building use.

High	Medium	Low
Low life cycle cost	Low first cost	Flexibility
Power Quality	Reliability	Redundancy

## PART 1 | ELECTRICAL SYSTEMS CRITERIA & SCOPE OF WORK

### Optional Back-Up Power

As the building does not include any designated critical operation equipment, it is not highly critical to have optional back-up power. However, for ease of use in case of power failure, it may be desirable to have several loads connected to back up power. For short term power loss, an uninterrupted power supply or generator could connect to security systems, computers and other IT equipment, elevators, any loads considered life safety that are not required. It may also be desirable to connect theatrical loads to back-up power as to not interrupt a performance due to power loss.

### Low Voltage/Communication Systems

The following list contains communication systems that may be used in the BAM Fisher Building

Telephone/Data

Access Control

Video Surveillance

Low Voltage Lighting Systems

Fire Alarm

For new buildings and structures, an approved fire alarm system shall be installed in accordance with the provisions of the IBC and NFPA 72. In addition, a minimum of one manual fire alarm box shall be provided in an approved location to initial a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices. If sprinklers are present, a single fire alarm box can be installed. For group A occupancy types the following additional alarm system requirements are necessary:

**907.2.1 Group A** | A manual fire alarm system that activates the occupant notification system shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more. Group A occupancies not separated from one another shall be considered as a single occupancy.

**907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more** | Activation of the fire alarm in Group A occupancies with an *occupant load* of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system.

### Major Equipment

Both mechanical and electrical equipment take up floor space in buildings. Below is a preliminary list of equipment that will require floor space.

#### Electrical

Panelboards  
Switchboards  
Transformers  
Generators  
UPS  
Metering Devices

#### Mechanical

Air Handling Units  
Rooftop Units  
Air Cooled Chillers  
Fire Pump  
Motors

#### Fire Protection

Fire rating of walls (thickness)  
Fire-rated insulated doors  
Fire partitions



# PART 2 | EXISTING ELECTRICAL SYSTEMS

## Actual Connected Building Load

Panel	Lighting/ Electrical	Theatrical Lighting and equipment	Receptacle	Mechanical	Other	Transferrable Loads
MS-A						1180
MDP						991
DP-C	10			16		224
DP-5		15		47		140
DP-EM6				18		78
PP-6				60		70
DP-7				213		15
DP-AV						28
PP-6A				10		
TLD-1		0				
TLD-2		135				81
PP-Elev	0.6		2	8.9	62	
TLG-1		94				18
TLG-2		20				
TLG-3		8				
TMG-1		42			17.7	
TRP-1		18				
APL-CA			3.8	17.2	37	
APL-CB	4.6		44		22.4	
APL-1	1.5		11.2	8.9	11.7	
APL-2	0.9		14.2	1.6	7	
APL-3	1		8	10.8	1.2	
APL-4	2		6.4	9.3	52.3	
APL-5	3		11.6	4		
APL-6	3		20.2	7.3	4.8	
APL-7	2		5.4	25.6	2.8	
APL-EM-C	2.8			7.4	2.4	12
APL-EM2	1.2					
APL-EM3	1.9				24	3
APL-EM5	4.4			0.9	6.7	
APL-GEN	2		3	15		
APL-W-C			5.2		9.8	
RPC						12
RP6						5
RPCEM						8
RP6EM						1
IT-5			2		24	
AV-X2			14			
<b>Total Per Category (kVA)</b>	<b>40.9</b>	<b>332</b>	<b>151</b>	<b>480.9</b>	<b>285.8</b>	<b>N/A</b>
<b>Total (kVA)</b>	<b>1290.6</b>					

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Utility Company Information

Con Edison provides 120/208V 3 $\Phi$  electrical (standard) service to the BAM Fisher theater. Con Edison serves the majority of the New York City area. The following table shows the current rates for this electricity provider for standard and low tension service for general large (>10kW) building applications.

Table 2.2   ConEd Tariff		
Demand Deliver Charges, per kW of maximum demand		
Jun-Sept	First 5kW (or less)	\$140.86 per month
	Over 5kW	\$21.82 per kW
Oct-May	First 5kW (or less)	\$112.51 per month
	Over 5kW	\$17.22 per kW
Energy Delivery Charge, per kWhr		
All months		\$0.0236 per kWhr
Charges for Metering Services		
Meter Ownership Charge		\$1.68 per month
Meter Service Provider Charge		\$2.63 per month
Maximum Rate		
All months through Dec 2015		\$0.8943 per kWhr

### Building Utilization Voltage

The building utilization voltage is 3 phase 120/208V which enters the building via an underground sidewalk transfer vault located on Ashland avenue.

Lighting—120V

Receptacle—120V

Mechanical—208V 3 $\Phi$

Special Equipment

Elevator—208V 3 $\Phi$

Theatrical Lighting—120V

IT—120V

Audio Visual—120V

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Emergency Power Loads

Table 2.3   Emergency Power Load (kVA)						
Panel	Lighting/ Electrical	Theatrical Lighting and equipment	Receptacle	Mechanical	Other	Transferrable Loads
DP-EM6				18		78
PP-Elev	0.6		2	8.9	62	
APL-EM-C	2.8			7.4	2.4	12
APL-EM2	1.2					
APL-EM3	1.9				24	3
APL-EM5	4.4			0.9	6.7	
APL-GEN	2		3	15		
RPCEM	8					
RP6EM	1					
<b>Total Per Category (kVA)</b>	<b>21.9</b>	<b>0</b>	<b>5</b>	<b>50.2</b>	<b>95.1</b>	<b>N/A</b>
<b>Total (kVA)</b>	<b>172.2</b>					

The emergency power is provided by a 150kW generator on the roof. The generator is sound attenuated in a NEMA 4 enclosure. The generator has 4 emergency feeds that are connected to 4 transfer switches. A 300A feed feeds the 50 HP elevator and a 200A feed is connected to the 50HP fire pump. From the preliminary calculations we can assume the elevator and fire pump both have a 51kVA load. A 200A feed and 30A feed services the emergency lighting and life safety equipment.

### Special Occupancy Requirements

**High Rise Building** | The elevator is connect to emergency power as required for high rise buildings.

**Assembly** | The theater and dance studio can hold more than 50 persons, and thus is equipped with emergency lighting and exit signs.

**Stages** | Without stage construction details, it is assumed the stage was constructed to comply with the standards set by the IBC.

### Special Equipment

The following equipment is used in the building and corresponds to certain sections of NEC chapter 6.

Office Furnishing | 605

Elevator | 620

Audio Signal Processing, Amplification, & Reproduction Equipment | 640

Information Technology Equipment | 645

Fire Pumps | 695

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Panelboards

Table 2.4   Panelboards				
Panel	Voltage	Phase	Bus Rating (A)	Main Type
MS-A	208/120V	3Φ	4000	-
MDP	208/120V	3Φ	3000	MLO
DP-C	208/120V	3Φ	600	500A MCB
DP-5	208/120V	3Φ	400	400A MCB
DP-EM6	208/120V	3Φ	200	200A MCB
PP-6	208/120V	3Φ	400	400A MCB
DP-7	208/120V	3Φ	800	800A MCB
DP-AV	208/120V	3Φ	400	250A MCB
PP-6A	208/120V	3Φ	100	MLO
TLD-1	208/120V	3Φ	1600	1600A MCB
TLD-2	208/120V	3Φ	600	600A MCB
PP-Elev	208/120V	3Φ	400	300A MCB (Non-Automatic)
TLG-1	208/120V	3Φ	100	100A MCB (Non-Automatic)
TLG-2	208/120V	3Φ	100	100A MCB
TLG-3	208/120V	3Φ	100	60A MCB (Non-Automatic)
TMG-1	208/120V	3Φ	225	200A MCB
TRP-1	208/120V	3Φ	100	50A MCB (Non-Automatic)
APL-CA	208/120V	3Φ	200	200A MCB (Non-Automatic)
APL-CB	208/120V	3Φ	200	200A MCB (Non-Automatic)
APL-1	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-2	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-3	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-4	208/120V	3Φ	225	200A MCB (Non-Automatic)
APL-5	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-6	208/120V	3Φ	225	150A MCB
APL-7	208/120V	3Φ	225	125A MCB
APL-EM-C	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-EM2	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-EM3	208/120V	3Φ	200	150A MCB (Non-Automatic)
APL-EM5	208/120V	3Φ	100	100A MCB (Non-Automatic)
APL-GEN	208/120V	3Φ	100	100A MCB
APL-W-C	208/120V	3Φ	100	40A MCB (Non-Automatic)
RPC	208/120V	3Φ	100	-
RP6	208/120V	3Φ	100	-
RPCEM	208/120V	3Φ	100	100A MCB (Non-Automatic)
RP6EM	208/120V	3Φ	100	100A MCB (Non-Automatic)
IT-5	208/120V	3Φ	100	100A MCB (Non-Automatic)
AV-X2	208/120V	3Φ	100	60A MCB

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Transformers

Both transformers are located on the 2nd fl in the theatrical dimmer room. The transformers clean up the power to be supplied to the theatrical dimming panels and other support equipment.

Table 2.5   Transformer Schedule				
Tag	Rating	Primary	Secondary	K-Rating
TLD	500kVA	208V Delta	208/120Y	K-13
TAV	74VA	208V Delta	208/120Y	K-13

### Main Risers/Feeders

As the building is served with only one voltage, all the feeders come from the Main Distribution Panel and are distributed throughout the building. The wire sizes varies based on load. See below for specifics of conductors and conduit or the riser diagram found under references.

### Conductors

All conductors are copper complying with NEMA 1; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger. All wiring shall be copper. The conductor insulation are types THHN-THWN XHHW complying with NEMA 2. For multiconductor cable is armored cable, type AC metal-clad cable with ground wire. The plenum-rated cables are used in all spaces which by definition established in applicable codes qualify as such. Feeder and branch circuits are all single conductors in raceway. Fire alarm circuits are in rigid conduit raceway and approved fire alarm cable and are all run in ceiling and wall voids as allowed by code.

### Conduit

The conduit is all rigid galvanized steel varying between 3/4" to 4" diameter. All wiring is run through conduit, there are no busways. Conduit that is 1" or larger in diameter is wrapped with a 1/2" thick elastomeric closed cell neoprene insulation with metal pipe sleeve around the insulation. Conduit less than 1" in diameter is wrapped with 1/2" thick closed cell neoprene insulation and the drywall is installed right to the neoprene wrap. Fire alarm circuits type THHN-THWN are in rigid conduit raceway. All electrical conduit connections to vibration isolated equipment is looped or installed with flexible conduit to allow free motion of isolated equipment. Conduit at the first three supports on both sides of any acoustical isolation joint will be resiliently mounted, either floor supported or ceiling hung so the conduit is isolated from the building structure.

Rigid Steel Conduit | ANSI C80.1

Aluminum Rigid Conduit | ANSIC80.5

Plastic-Coated Steel Conduit | NEMA RN 1

LFMC | Flexible Steel conduit in PVC jacket

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Receptacles

There are several types of receptacles in the BAM Fisher building. The finish will be steel with white baked enamel (able to be field painted) in finished spaces and smooth, high-impact thermoplastic in unfinished spaces. Wet locations will use a thermoplastic with a spring-loaded life cover listed and labeled for wet-location use.

Straight-Blade Type Receptacles and locking receptacles | Heavy-Duty grade

Straight-Blade Receptacles | Hospital grade

GFCI Receptacles | Straight-blade, Heavy-Duty grade with integral NEMA WD 6, 5-20R configuration, duplex receptacle

Isolated-Ground Receptacle | Straight-blade, Heavy-Duty grade duplex receptacle with equipment grounding contacts with inherent electrical isolation from mounting strap.

TVSS Receptacles | Straight-blade, NEMA WD 6, Configuration 5-20R with integral TVSS in line to ground, line to neutral, neutral to ground.

### Switches

Single and Double-Pole Switches | Comply with DSCC W-C-896F and UL 20

Snap Switches | Heavy-Duty grade, quiet type

Combination Switch and Receptacle | Both devices in a single gang unit with plaster ears and removable tab connector.

Dimmer Switches | Modular, full-wave, solid-state units with integral, quiet on/pff switches and audible frequency and EMI/RFI filters

### Motor Starters

The BAM Fisher building does not have a motor control center; all devices requiring motors have individual motor starters.

### UPS Systems

There is no UPS system for the BAM Fisher Building.

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Optional Back-Up Power

The BAM Fisher building is not designed to include any optional back-up power systems.

### Low Voltage/Communication Systems

**Fire Alarm** | The fire alarm system operates as an automatic system. It includes duct mounted smoke detectors, fire smoke dampers, stair smoke vents, fan shutdown function, manual pull stations, sprinklers, and audio visual alert systems located throughout the building. The fire pump is located on the 6th floor in the large mechanical space.

**Telephone & Data** | The telecommunication line comes from the Peter Jay Sharp Opera House, another BAM facility located adjacent to the Fisher Building. The conduit run is approximately 300' from the existing computer room in the Sharp Opera House to where it enters the Fisher Building. The Fisher Building has 3 wall mounted cabinets for telecommunications located on the cellar, 2nd, and 6th floors.

**Security-Video Surveillance** | The security system in the building consists of an access control system, alarm point monitoring, communication system, and video surveillance. The access control system is card readers and electromagnetic locks. The alarm point monitoring is duress buttons, motion detectors, leak/damage protectors and tamper switches. The communication system involves video intercom stations and is powered over Ethernet. Video Surveillance includes cameras and monitors.

**AV** | The AV systems contains a 120/208V k13 transformer and is primarily located in the A/V Rack room on the third floor. The system serves the entire building.

**General Lighting Control** | General lighting in common space is controlled by a Lutron XP Softswitch system which works using lighting zones and scene control. The lobby, rooftop terrace, stairwells, and corridors are all on this system. The XP panels are located in the mechanical room on the 6th floor

**Theatrical DMX Lighting Control** | The theatrical lighting is all DMX controlled and it served by the TLG-2 panel board, TRP-1 relay panel, and 4 dimming panels located dimming room on the second floor.

## PART 2 | EXISTING ELECTRICAL SYSTEMS

### Electrical and Telecommunication Floor Space

Below is a list of areas dedicated to electrical or AV equipment in the building with corresponding square footage. The overall building square footage is 40,000SF.

Main Switchboard C22   138 SF	MEP 3 303   37 SF
Electric 01 C17   84 SF	MEP 3 405   39 SF
MEP 115   29 SF	MEP 2 416   195 SF
MEP 108   21 SF	MEP 6 418   37 SF
MEP 6 111   49 SF	Lighting Controls 420   77 SF
MEP 2 208   156 SF	MEP 3 503   39 SF
MEP 6 210   37 SF	MEP 6 508   37 SF
EP 3 207   37 SF	Server 507   158 SF
MEP 6 307   37 SF	MEP 3 603   39 SF
MEP 2 305   190 SF	Elec 622   21 SF
A/V Rack 301   141 SF	Elec 710   17 SF
	Elev Control 709   31 SF

The total area used by electrical or telecommunication space in the building is **4.03%** of the total building area.

### Energy Reduction Methods

The BAM Fisher building does not implement any renewable energy generation systems, such as a PV array. However, it was the first theater in the Manhattan area to achieve a LEED gold rating in new construction. Through the efforts of the designers to create a sustainable space, the building achieves a 40% reduction water usage and a 22% reduction in greenhouse gas emissions. The project team also used low emitting material in all building interior finishes and according to BAM Director of Capital Projects Jonathan Jones approximately 97% of the construction waste was recycled. Another design feature included in the BAM Fisher building is the incorporation of a rooftop terrace. The terrace not only provides a beautiful exterior space for events, the use of white high albedo roofing materials reduce the heat island effect. This lessens the load on the mechanical system and thus reduces the energy needed to run the equipment.



## PART 3 | COMPARISON OF DESIGNED SYSTEMS AND CRITERIA

### Building Loads

There is a large discrepancy in preliminary building load and actual connected load. We found the preliminary load to be approximately 400kVA where the actual load is 1290.6kVA. The lighting load, was calculated to be very similar. The preliminary estimate was 40kVAS and the actual was 40.9kVA, which doesn't include reductions for accent lighting. Conversely, the mechanical load was very different. The preliminary calculation yielded a 200kVA load estimation whereas the actual was over 480kVA. In addition, the preliminary calculation didn't account for theatrical equipment, dedicated receptacles, or other miscellaneous loads.

### Utility Rate Schedule

The rate schedule is ideal for this type of building. Serving the building with only one load, allows for simplicity in electrical design. In addition, it eliminates the extra cost of supplying transformers to change the voltage within the building. Since the building does not house large equipment that require higher voltages, the traditional 120/208V 3 phase service works for all loads. In addition, ConEd is the main supplier for the area, and isn't feasible to use a different electrical supplier.

### Building Utilization Voltage

With only one voltage serving the building, the building utilization voltages for items were as expected. If another voltage supply was introduced into the building, the larger loads could switch to the higher voltage.

### Electrical Equipment

The electrical system is designed well for the space and function. The panel boards are placed close to the loads they service which reduces energy losses and voltage drop in transport, but the means there are many electrical and MEP rooms. The building may benefit from a more collective layout with all panels in one location for maintenance ease.

### Emergency Power System

The emergency power system meets all the code requirements for type A-1 occupancies and high rise structures. The generator being on the roof lessens the amount of electrical space needed in the usable floor space of the building.

### Optional Back-Up Power

The building does not have any optional back-up power system. It may be beneficial to have an optional back-up power system to provide power to the theatrical equipment as to not interrupt a performance in the case of a loss of power. However, the additional cost of adding an optional back-up power system is likely unreasonable for an educational facility.

### Energy Reduction Strategies

BAM Fisher implemented many energy saving strategies into design in order to achieve a high LEED rating. However, more can still be done to further improve the efficiency of the building. The more extensive lighting control system could be implemented. For example, occupancy sensors could be placed in all rooms, rather than just public and transitional spaces. In addition, a renewable energy source could be utilized. There is not a lot of space on the roof for a PV array, but it could be implemented into the building architecture and façade.