Technical Assignment #2

Electrical Systems Existing Conditions & Building Load Summary

William H. Gates Hall
Seattle, WA

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Lighting/Electrical Option

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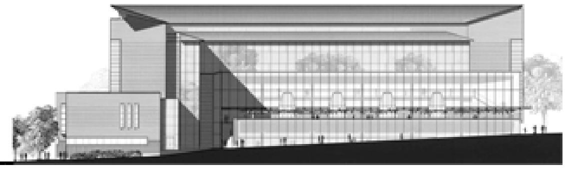

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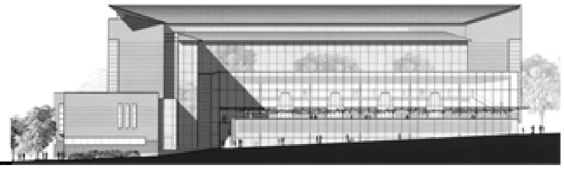


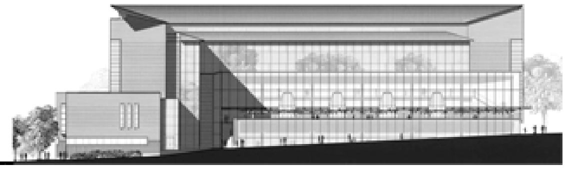
Executive Summary

The following Electrical Systems Existing Conditions and Building Load Summary report explores the existing electrical system design used in William H. Gates Hall. The report analyzes all areas and components used within this system, as well as actual electric consumption as calculated per the National Electric Code (NEC) 2005. An overall comprehensive analysis was completed on all electrical systems within the building, including but not limited to the power distribution system, lighting system, communication system, fire alarm system and security system. Documentation, design drawings and the specifications were used in order to fully understand and evaluate these existing building systems. Tools such as the single line diagram are included to help further understand the distribution system provided in William H. Gates Hall. In addition to looking at the distribution system as a whole, other specific topics such as ASHRAE shutoff requirements, overcurrent protection and transformer configuration are explored as well. Taking into consideration special issues pertaining to this particular building, important design considerations are also addressed.

In order to completely analyze the existing power distribution system within William H. Gates Hall, complete building load calculations were completed with guidance of NEC 2005. These calculations verify the main switchboard and transformer are sized appropriately to handle all loads within the building. These calculations included load summaries of lighting receptacle, motor (mechanical), elevator, and equipment loads. All necessary demand factors are included in the calculations per NEC requirements. In addition to this, NEC calculations were completed for distribution panels and their feeders to verify code compliance.

Upon completion of all load calculations, it is apparent that the electrical distribution system in William H. Gates hall is sized appropriately for all loads. The switchboard and primary transformer are both sized correctly for all connected and demand loads. Likewise, the overcurrent protection for these devices is appropriate for proper equipment protection. The majority of the equipment is sized to account for the recommended 125% oversize factor for future expansion of loads and panels. In addition, calculations of distribution panels and verification of properly sized feeders show that all distribution panels and their respective feeders are sized appropriately for their connected loads. This verification also extends to overcurrent protection devices of the distribution panels and their individual loads.

Specific information referenced within the report can be found in appendices, located at the end of the report. This includes the one-line diagram, feeder schedule for one-line and panel reference and the utility rate schedule.



Power Distribution Systems

Distribution System Type

William H. Gates Hall utilizes a radial system, in which the service is brought to the building through two 13.8 kV primary feeders tapped from the main campus distribution system. These two feeders enter the building in the Main Electric Room on level L2 and are connected to the three-bay primary switchgear. This then feeds a single-ended interior substation and the primary switch, which is rated at 15KV, 600 amperes, 500MVA short circuit duty, serves a 2500/3333 KVA fan cooled, dry type transformer. The secondary serving voltage for the building is a 480Y/277 volts, 3 phase, 4 wire grounded Wye system. The majority of the building's mechanical system and lighting loads are served at these voltages, and 120 and 208 volt loads are served through additional step-down transformers. The 4000 ampere bus in the main power center is protected by a 4000 ampere main circuit breaker. This power center further feeds two 215 KW chillers, a 400 A automatic transfer switch for emergency power, a 400 A elevator distribution panel, a 1600 A distribution panel, and five 480:208Y/120 volt dry type transformers.

To better understand the building power distribution system, refer to Appendix A: One-Line Diagram and Appendix B: Feeder Schedule for corresponding feeder sizes.

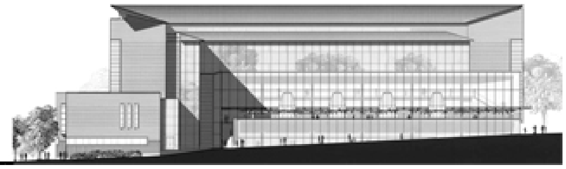
Utility to Owner Transfer Point

Electric service for this building is tapped from the campus system at Manhole NW-7 of the existing utility tunnel, located just to the east of the main entrance along Memorial Way. The two feeders tapped from this service then extend to the main electric room, via a new underground electrical duct bank.

Building Utilization Voltages

The secondary voltage system for the building is 480Y/277 volts, 3-phase, 4-wire. This system serves the majority of the mechanical systems and lighting loads. The main 480/277 volt bus also serves several distribution panels, elevator loads and the elevator panel, as well as the life safety distribution panel.

Achieved through several 480:208Y/120 volt dry type transformers, the 208/120 volt system primarily serves branch circuit panels in the building. The branch circuit panels provide for smaller mechanical loads, as well as receptacle loads. In addition to this, the building dimming racks are also fed from the 208/120 volt system.



Transformers

All the transformers in William H. Gates Hall are step-down transformers from a primary voltage of 480/277V to a secondary voltage of 208/120V, with exception of the main transformer in the main power center.

The following schedule outlines the relevant information for all transformers used within the building.

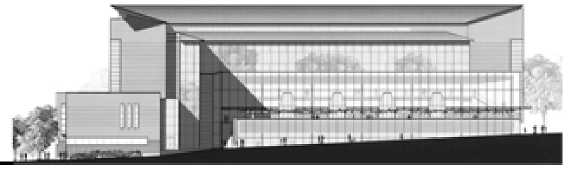
TRANSFORMER SCHEDULE								
TAG	**PRIMARY VOLTAGE**	**SECONDARY VOLTAGE**	**SIZE**	**TYPE**	**TEMP. RISE**	**TAPS**	**MOUNTING**	**REMARKS**
TR-NWB2-N01	13.8 KV,3PH,3W	480Y/277V,3PH,4W	2500	DRY TYPE	150 DEGREE C	(4) 2.5%	PAD MOUNTED ON FLOOR	K-4 RATED
TR-NWB2-N02	480V,3PH,3W.	208Y/120V,3PH,4W	500	DRY TYPE	150 DEGREE C	(4) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-NWB2-N03	480V,3PH,3W.	208Y/120V,3PH,4W	500	DRY TYPE	150 DEGREE C	(4) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-NWB2-N04	480V,3PH,3W.	208Y/120V,3PH,4W	225	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-NWB2-N05	480V,3PH,3W.	208Y/120V,3PH,4W	225	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-NWB2-N06	480V,3PH,3W.	208Y/120V,3PH,4W	45	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-SW01-N01	480V,3PH,3W.	208Y/120V,3PH,4W	112.5	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED
TR-NE04-N02	480V,3PH,3W.	208Y/120V,3PH,4W	75	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	K-13 RATED

Emergency Power Systems

Emergency Generator & Automatic Transfer Switch

Emergency power for William H. Gates Hall is provided from the existing campus 2.4 kV system, and is tapped from manhole NW-4 using a three-way linkbox. Campus emergency power is generated by means of diesel generators located at the university power plant. Within the building, transformation to a 480/277 V secondary power is achieved through the use of a dual winding 2.4/4.16 kV – 480/277 V transformer, rated at 225 KVA. This power is distributed through a 65,000 AIC Emergency Unit Substation, which feeds an 800A bus.

Upon loss of power, an automatic transfer switch, rated at 400 A, will transfer from the normal power source to emergency power. A life safety distribution panel and



transformer provide required power for life safety loads. Due to the load restrictions of the existing campus emergency power system, emergency power is used only for life safety loads and elevators

Emergency Lighting

Emergency lighting is provided throughout William H. Gates Hall, primarily in circulation, stairwell, and lobby areas to help provide ease of egress. Emergency lighting is also provided in library and stacks area and by LED exit signs with battery back-up. All emergency light fixtures are circuited separately to a life safety panel and remain on at all times of the day.

Overcurrent Protection Devices

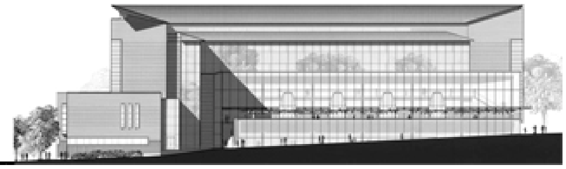
Overcurrent protection in William H. Gates Hall varies with location and equipment. The main switchboard is protected at the feeder entrance by two 600 A circuit breakers. Within the main switchgear, the feeder serving the secondary switchgear is protected by 600A circuit breaker and 600A fused switch. The secondary switchgear is protected by a 100KAIC circuit breaker. Within this switchgear, the bus duct is connected and protected with a combination 4000A circuit breaker and 4000A fuse. Each additional distribution panel fed from this main bus duct is protected with a breaker sized appropriately for the individual distribution panel. The majority of branch circuit panels are protected with individual circuit breakers, allowing for redundant entrance protection.

The majority of the mechanical equipment within the building is equipped with disconnect switches of varying ampere ratings for current protection. These fusible disconnect switches are fed from panels or are directly connected to the bus duct. Other mechanical equipment requiring smaller electrical loads are connected and protected through typical shunt-trip circuit breakers within individual panels.

General Location of Electrical Equipment

Electrical service enters the building through the new electrical underground duct bank and into the Main Electric Room located on Level L2. It is here that power is fed into the main power center and through the main switchgear and transformer. Located, on the northern edge of the building, the main electric room houses the majority of the buildings electrical distribution equipment. In this room, the following can be found:

- 100,000 AIC Secondary Switchgear supplying (1) 4000 A bus.
- (3) Distribution Panels, each providing 1600 A bus
- (4) Dry Type Transformers, (2) at 500 KVA and (2) at 225 KVA
- Harmonic Filter
- Elevator Distribution Panel



- (2) Automatic Lighting Control Panels
- Exterior Lighting Bypass Controller
- (5) Panels: PCD-NWB2-N02, PCD-NWB2-N08, PCB-NWB2-N04, PCB-NWB2-N05, PCB-NWB2-N08

Adjacent to the main electric room is the Equipment Room, which houses:

- 65,000 AIC Emergency Unit Substation supplying (1) 800 A bus.
- 400 A Automatic Transfer Switch
- Fire Alarm Control Panel
- (1) Emergency Transformer, 45 KVA
- Life Safety Distribution Panel, PCD-NWB2-E02
- (2) Life Safety Panels: PCB-NWB2-E01, PCB-NWB2-E04

Two bus duct risers run the height of the building delivering power to panels located in one of two electrical rooms on each floor. One of these electrical rooms is located at the northwest end of the building, and the other at the northeast. Each vertically aligned electrical room on each floor contains the same branch circuit panels, respective to floor. The following can be found in the electrical rooms on each region of the building:

Northwest Electrical Room

- Automatic Lighting Control Panel
- (6) Panels: PCB-NWXX-N01, PCB-NWXX-N02, PCB-NWXX-N03, PCB-NWXX-E01, PCB-NWXX-E02, PCB-NWXX-E05

Northeast Electrical Room

- (4) Panels: PCB-NEXX-N01, PCB-NEXX-N03, PCB-NEXX-N04, PCB-NEXX-N05,

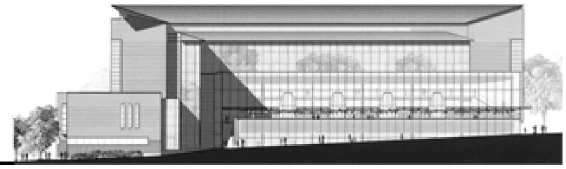
Note: Depending on floor location, the “XX” in panel names is replaced with the respective floor number

In addition to the two electrical rooms, Level 01 has a third electrical room. This electrical closet is located in the southwest region on the building and houses:

- (1) Dry type transformer, 112.5 KVA
- (3) Panels: PCD-SW01-N05, PCB-SW01-N01, PCB-SW01-N02

Typical Lighting Systems

The lighting system throughout William H. Gates Hall primarily utilizes fluorescent lighting. Classrooms and seminar rooms make use of suspended indirect/direct fluorescent luminaires, as do the majority of the office spaces, while the courtroom spaces use primarily compact fluorescent downlighting. The circulation corridors also take advantage of compact fluorescent downlighting, as well as linear fluorescent wall washers. Several areas make use of metal halide luminaires, primarily in the form of track fixtures and downlights. The lighting system is run off of 277 V, with the exception of a few spaces such as the conference/reception room, which are powered at 120 V. All ballasts used within the



building are high power factor, with power factors greater than 90%. In addition, dimming ballasts have a total harmonic distortion of 20% or less.

The current lighting design of William H. Gates Hall incorporates several different methods of control devices throughout the building. Office areas are controlled by means of a low voltage relay system, which is controlled by the building management system. Courtrooms and lecture spaces provide multi-level control of fluorescent lamps, and dimming capabilities for incandescent lighting. Throughout the entire building, occupancy sensors are utilized in all of the low use areas.

ASHRAE/IESNA 90.1 Shutoff Requirements

Shutoff Requirements outlined in ASHRAE 90.1 are fulfilled through the use of a timer and low-voltage relay system. Exterior and terrace lighting for the building are controlled by means of a timer and automatically shut off during day light hours. Office areas and the library are controlled by means of a low voltage relay system, which is controlled by the building management system. Also, throughout the entire building, occupancy sensors are utilized in all of the low use areas.

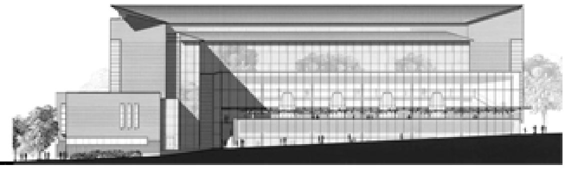
Power Factor Correction

Per the specifications, power factor correction capacitors are provided for all motors 20 horsepower and above, and are sized based on recommendations of motor manufacturer to bring the power factor to 0.95 lagging.

Important Design Considerations & Requirements

Electrical design considerations and requirements important to William H. Gates Hall are generally those typical to most buildings: voltage drop, surge suppression, power conservation, and emergency supply power. Due to the function of the building as an educational building, quality power systems are necessary to optimize the learning environment and for sophisticated computer equipment. In designing the electrical systems for this building the ultimate goal is to provide systems that work for both students and staff while remaining within budget limitations.

Due to the location of the electrical equipment in the electrical room on Level L2, voltage drop becomes a concern in designing and sizing feeders and branch circuits. In order to minimize the effects or voltage drop within the building, branch circuits exceeding 75 feet of run are increased to the next conductor size and 20 ampere branch circuits are loaded to a maximum of 1200 VA.



In the event of unexpected voltage surges, it is necessary to protect certain equipment and take surge suppression into account when designing an electrical system. In order to prevent unexpected surges within William H. Gates Hall, surge suppressed receptacles are provided for surge producing office equipment. In addition to this, surge protection is provided at select panel boards and loads.

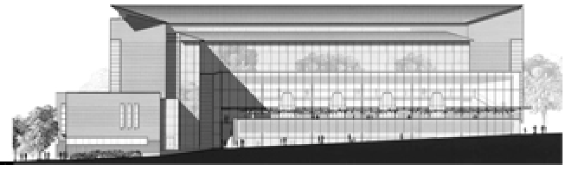
Emergency power is important in a building in order to provide necessary loads in the case of an emergency or power loss. However, due to the nature of the University of Washington electrical distribution system and emergency power distribution, loads which can be placed on the emergency power source are limited. The campus wide emergency power system does not have the capacity to accept large loads, and thus limits emergency power for life safety and elevators.

Lastly, designing for seismic loads is an important factor to take into consideration in the building. Due to the location of the building in Seattle, WA, code requires for consideration of seismic activity.

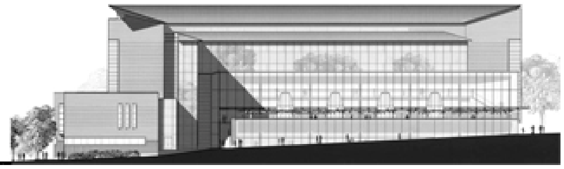
Primary Lamps & Ballast

Throughout the entire building there is a wide array of luminaire types utilized to maximize the building lighting design. This results in the use of a wide range of lamps and ballast, each of which have unique electrical characteristics. The following table outlines the lamp, ballast, and corresponding power requirements for start-up and operating conditions for each luminaire used throughout the building.

Luminaire Type	Lamps			Ballast				Voltage	Notes
	Number	Type	Total Watts	Ballast Watts	PF	BF	Input Current (A)		
A1	1	100A19/IF	100	N/A	N/A	N/A	N/A	120	--
A2	1	100PAR/FL/ HIR	100	N/A	N/A	N/A	N/A	120	--
A3	1	100PAR/SFL/ HIR	100	N/A	N/A	N/A	N/A	120	--
F1	1	F32T8	32	34	0.98	0.90	0.13	277	--
F2	2	F32T8	64	59	0.98	0.88	0.22	277	--
F4	3	F32T8	96	85	0.97	0.88	0.31	277	--
F4A	3	F32T8	96	85	0.97	0.88	0.31	277	--
F6	1	CFTR32W	32	34	0.99	1.0	0.13	277	--
F6A	1	CFTR32W	32	9/34	0.99	0.03/1.00	0.13	277	DIMMING
F7	1	F32T8	32	34	0.98	0.90	0.13	277	--
F7A	2	F32T8	64	59	0.98	0.88	0.22	277	--
F8	2	F32T8	64	59	0.98	0.88	0.22	277	--
F8	2	F32T8	64	59	0.98	0.88	0.22	277	--
F9	1	CFT13W	13	16	0.98	1.0	0.08	277	--
F10	1	CFQ13W	13	16	0.96	1.0	0.06	277	--



F11	1	CFQ26W	26	29	0.98	1.0	0.1	277	--
F12	2	F32T8	64	59	0.98	0.88	0.22	277	--
F13	1	F32T8	32	34	0.98	0.90	0.13	277	--
F15	1	F32T8	32	34	0.98	0.90	0.13	277	--
F15A	1	F32T8	32	34	0.98	0.90	0.13	277	--
F15B	2	F32T8	64	59	0.98	0.88	0.22	277	--
F18	1	F32T8	32	34	0.98	0.90	0.13	277	--
F22	1	F32T8	32	34	0.98	0.90	0.13	277	--
F22A	1	F32T8	32	9.0/35	0.99	0.05/1.00	0.13	277	DIMMING
F23	2	CFTR32W	64	19/75	0.99	0.03/1.00	0.21	277	DIMMING
F24	1	CFTR32W	32	34	0.99	1.0	0.13	277	--
F24A	1	CFTR32W	32	9.0/34	0.99	0.03/1.00	0.13	277	DIMMING
F25	2	CFQ26W	52	54	0.99	1.0	0.2	277	--
F26	1	F54T5/HO	54	62	0.98	1.0	0.24	277	--
F26A	1	F54T5/HO	54	13/63	0.98	0.03/1.00	0.23	277	DIMMING
F27	1	F28T5	28	30	0.99	1.0	0.11	277	--
F28	2	CFTR32W	64	75	0.99	1.0	0.21	277	--
F29	1	F32T8	32	34	0.98	0.90	0.13	277	--
F30	1	F32T8	32	34	0.98	0.90	0.13	277	--
F31	1	CFQ26W	26	54	0.99	1.0	0.2	277	--
F32	1	F32T8	32	9.0/35	0.99	0.05/1.00	0.13	277	DIMMING
F32A	1	F25T8	25	7.0/27	0.99	0.05/0.98	0.1	277	DIMMING
F32B	1	F17T8	17	7.0/27	0.99	0.05/0.94	0.07	277	DIMMING
F32C	1	F32T8	32	34	0.98	0.90	0.13	277	--
F32E	1	F32T8	32	34	0.98	0.90	0.13	277	--
F33	1	F54T5/HO	54	62	0.98	1.0	0.24	277	--
F34	1	F32T8	32	34	0.98	0.90	0.13	277	--
F35	1	CFTR42W	42	46	0.99	1.0	0.17	277	--
F35A	1	CFTR42W	42	9.0/46	0.99	0.03/1.00	0.17	277	DIMMING
H1	1	LU70 (HPS)	89	125	0.9	1.0	0.45	277	--
M1	1	CDM100/PAR38	100	110	0.9	1.0	0.4	277	--
M1A	1	CDM100/PAR38	100	110	0.9	1.0	0.4	277	--
M1B	1	CDM100/PAR38	100	110	0.9	1.0	0.4	277	--
M2	1	CDM70/PAR38	70	79	0.9	1.0	0.4	277	--
M4	1	CDM39/PAR20	39	45	0.95	1.0	0.3	277	--
M6	1	CDM35/TC/830	39	45	0.95	1.0	0.18	277	--
M7	1	CDM100/PAR38 FL	100	110	0.9	1.0	0.4	277	--
M10	1	CDM150/TD	150	166	0.9	1.0	0.6	277	--

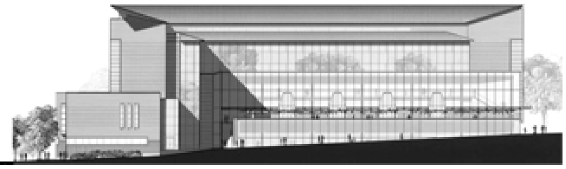


Mechanical Equipment (Motor) Schedule

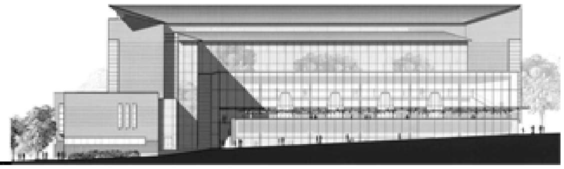
Various pieces of mechanical equipment throughout the building utilize motors and require electrical power in order to operate. The following schedule outlines such equipment and their corresponding load requirements. In addition, total motor loads used in the entire building are calculated at the conclusion of this table.

Note: Power factors listed here for mechanical equipment are assumed. All motors larger than 5 horsepower are assumed to have a power factor of 0.95. All motors less than 5 horsepower are assumed to have a power factor of 0.85.

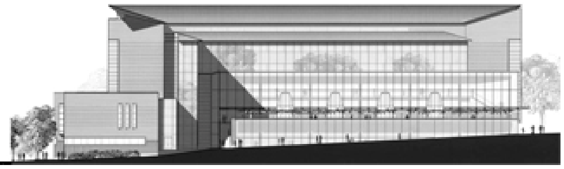
AIR HANDLING UNITS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
AHU-1	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	40 HP	52	0.95	100W	52.23
	AIR HANDLING UNIT RETURN FAN MOTOR			10 HP	14	0.95		
AHU-2	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	40 HP	52	0.95	100W	52.23
	AIR HANDLING UNIT RETURN FAN MOTOR			10 HP	14	0.95		
AHU-3	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	40 HP	52	0.95	100W	57.76
	AIR HANDLING UNIT RETURN FAN MOTOR			15 HP	21	0.95		
AHU-4	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	20 HP	27	0.95	100W	30.11
	AIR HANDLING UNIT RETURN FAN MOTOR			7.5 HP	11	0.95		
AHU-5	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	30 HP	40	0.95	100W	42.75
	AIR HANDLING UNIT RETURN FAN MOTOR			10 HP	14	0.95		
AHU-6	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	50 HP	65	0.95	100W	68.02
	AIR HANDLING UNIT RETURN FAN MOTOR			15 HP	21	0.95		
AHU-7	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	50 HP	65	0.95	100W	68.02
	AIR HANDLING UNIT RETURN FAN MOTOR			15 HP	21	0.95		



AHU-8	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	40 HP	52	0.95	100W	57.76
	AIR HANDLING UNIT RETURN FAN MOTOR			15 HP	21	0.95		
AHU-9	AIR HANDLING UNIT SUPPLY FAN MOTOR	3	480	30 HP	40	0.95	100W	42.75
	AIR HANDLING UNIT RETURN FAN MOTOR			10 HP	14	0.95		
COOLING TOWERS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Pan Heaters	Load (KW)
CT-1	COOLING TOWER	3	480	50 HP	65	0.95	5.0 W	51.34
CT-2	COOLING TOWER	3	480	50 HP	65	0.95	5.0 W	51.34
PUMPS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
CHP-1	CHILLED WATER PUMP	3	480	10 HP	14	0.95	-	11.06
CHP-2	CHILLED WATER PUMP	3	480	10 HP	14	0.95	-	11.06
CHP-3	CHILLED WATER PUMP	3	480	40 HP	52	0.95	-	41.07
CHP-4	CHILLED WATER PUMP	3	480	40 HP	52	0.95	-	41.07
CWP-1	CONDENSER WATER PUMP	3	480	20 HP	27	0.95	-	21.33
CWP-2	CONDENSER WATER PUMP	3	480	20 HP	27	0.95	-	21.33
HWP-1	HOT WATER PUMP	3	480	15 HP	21	0.95	-	16.59
HWP-2	HOT WATER PUMP	3	480	15 HP	21	0.95	-	16.59
EXHAUST FANS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
EF-1	EXHUAST FAN	1	120	1 1/2 HP	20	0.85	-	2.04
EF-2	EXHUAST FAN	1	120	3 HP	34	0.85	-	3.47
EF-3	EXHUAST FAN	1	120	3 HP	34	0.85	-	3.47
CHILLERS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
CH-1	CHILLER	3	480	160 KW	-	0.95	200W	152.2
CH-2	CHILLER	3	480	160 KW	-	0.95	200W	152.2
FANS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
FF-1	FAN	1	277	3/4 HP	6.9	0.85	-	1.62



FF-2	FAN	1	277	1/2 HP	4.9	0.85	-	1.15
MUA-1	FAN	3	480	2 HP	3.4	0.85	-	2.40
FAN COIL UNITS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Controls	Load (KW)
FC-1	FAN COIL UNIT	1	277	320W/ 0.24 HP	2.9	0.85	-	0.68
FC-2	FAN COIL UNIT	1	277	133W / 0.13 HP	2.2	0.85	-	0.52
FC-3	FAN COIL UNIT	1	277	320W/ 0.24 HP	2.9	0.85	-	0.68
FC-4	FAN COIL UNIT	1	277	239W / 0.12 HP	2.2	0.85	-	0.52
FC-5	FAN COIL UNIT	1	277	1 HP	8	0.85	-	1.88
FC-6	FAN COIL UNIT	1	277	133W / 0.13 HP	2.2	0.85	-	0.52
FC-7	FAN COIL UNIT	1	277	133W / 0.13 HP	2.2	0.85	-	0.52
FC-8	FAN COIL UNIT	1	277	320W / 0.24 HP	2.2	0.85	-	0.52
FC-9	FAN COIL UNIT	1	277	145W / 0.03 HP	2.2	0.85	-	0.52
FC-10	FAN COIL UNIT	1	277	210W / 0.05 HP	2.2	0.85	-	0.52
FC-11	FAN COIL UNIT	3	480	2 HP	3.4	0.85	-	2.40
FC-12	FAN COIL UNIT	3	480	2 HP	3.4	0.85	-	2.40
FC-13	FAN COIL UNIT	1	120	1/12 HP	4.4	0.85	-	0.45
FAN TERMINAL UNITS								
Designation	Equipment Type	Phase (Φ)	Voltage	Power	FLA	Power Factor	Quantity	Load (KW)
FTU X-XX	FAN TERMINAL BOX	1	277	1/6 HP	2.2	0.85	28	14.50
FTU X-XX	FAN TERMINAL BOX	1	277	1/4 HP	2.9	0.85	51	34.82
FTU X-XX	FAN TERMINAL BOX	1	277	1/3 HP	3.6	0.85	40	33.90
FTU X-XX	FAN TERMINAL BOX	1	277	3/4 HP	6.9	0.85	28	45.49
FTU X-XX	FAN TERMINAL BOX	1	277	1 HP	8	0.85	25	47.09
						TOTAL LOAD (KW)		**1260.89**



NEC Building Design Load Calculations

The following load calculations are performed according to the National Electric Code (NEC) 2005. The calculations include loads for all lighting, receptacle, equipment, motor and elevator loads. All relevant information and demand factors applied are outlined throughout each part of the calculation.

Lighting Loads

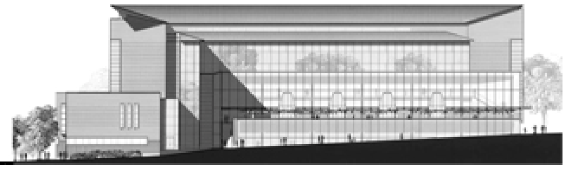
NEC LIGHTING CALCULATIONS			
NEC 2005 Table 220.12 General Lighting Loads by Occupancy			
OCCUPANCY TYPE	AREA (sq ft.)	UNIT LOAD (VA/sq ft)	TOTAL LOAD (KVA)
SCHOOL	197,176	3	591.53
		TOTAL LOAD (KVA)	591.53

NEC LIGHTING DEMAND FACTORS			
NEC 2005 Table 220.12 General Lighting Loads by Occupancy			
OCCUPANCY TYPE	LOAD (KVA)	DEMAND FACTOR	TOTAL LOAD (KVA)
SCHOOL (OTHER)	591.53	1.0	591.53
		TOTAL LOAD (KVA)	**591.53**

Receptacle Loads

NEC RECEPTACLE LOAD CALCULATIONS		
Assume 180 VA per Receptacle		
FLOOR	# OF RECEPTACLES	KVA
L2	248	44.64
L1	1192	214.56
1	274	49.32
2	293	52.74
3	338	60.84
4	288	51.84
	TOTAL	473.94

NEC RECEPTACLE DEMAND FACTORS	
NEC 2005 Table 220.44 Demand Factors for Receptacle Load	
FIRST 10 KVA: 1.0	10
REMAINDER > 10 KVA : 0.5	231.97
TOTAL KVA W/ DEMAND FACTORS	**241.97**



Mechanical Loads (Refer to Mechanical Equipment Schedule for more detailed calculations)

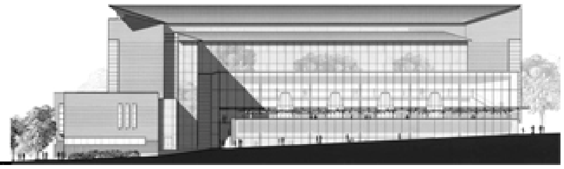
NEC MECHANICAL LOAD CALCULATIONS	
EQUIPMENT	LOAD (KVA)
AIR HANDLING UNITS	471.63
COOLING TOWERS	102.68
PUMPS	180.08
EXHAUST FANS	8.98
CHILLERS	304.4
FANS	5.18
FAN COIL UNITS	12.13
FAN TERMINAL UNITS	175.81
TOTAL LOAD (KVA)	**1260.89**

Equipment Loads

NEC EQUIPMENT LOAD CALCULATIONS	
Includes all Comm. & A/V Equip. etc.	
FLOOR	LOAD (KVA)
L2	94.5
L1	83.4
1	330.8
2	121.7
3	19.5
4	23.6
TOTAL LOAD (KVA)	**673.5**
NO DEMAND FACTORS APPLY	

Elevator Loads

NEC ELEVATOR LOAD CALCULATIONS	
ELEVATOR	LOAD (KVA)
ELEVATOR #1 - 30HP	33.3
ELEVATOR #2 - 73 FLA	60.6
ELEVATOR #3 - 73 FLA	60.6
ELEVATOR #4 - 73 FLA	60.6
TOTAL LOAD (KVA)	**215.1**
NO DEMAND FACTORS APPLY	



Load Summary

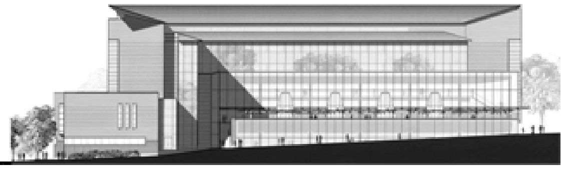
NEC LOAD SUMMARY	
DESCRIPTION	LOAD (KVA)
LIGHTING	591.53
RECEPTACLE	241.97
MECHANICAL	1260.89
EQUIPMENT	673.5
ELEVATOR	215.1
TOTAL LOAD (KVA)	**2982.99**
TOTAL CURRENT (A)	**3587.98**

The main switchboard and transformer are sized at 4000A. According to the NEC Calculations performed, the equipment is size correctly.

Distribution Panel Calculations

Note: Feeder sizes are listed according to their designation on the one-line diagram. Refer to Appendix B: Feeder Schedule for feeder sizes.

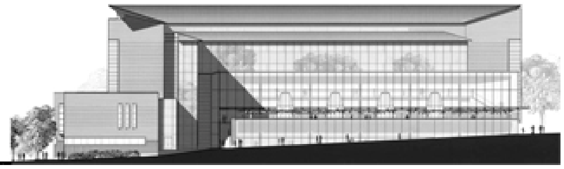
MAIN DISTRIBUTION PANEL PCM-NWB2-N01 480/277V, 3PH, 4W, 4000A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PNL PCD-NWB2-N04	800D	302.7	251.7	350	OK	OK
2	PNL RSCA-NW-N01	350D	189.1	157.2	400	OK	OK
3	MECH CHILLER	400D	258.6	215.0	400	OK	OK
4	MECH CHILLER	400D	484.9	403.1	800	OK	OK
5	PNL PCD-NWB2-N03	-	0.0	0.0	0	-	-
6	SPACE (1600AF)	-	0.0	0.0	0	-	-
7	SPACE (800AF)	-	0.0	0.0	0	-	-
8	SPACE (800AF)	-	0.0	0.0	0	-	-
9	SPACE (800AF)	-	0.0	0.0	0	-	-
10	SPACE (400AF)	-	0.0	0.0	0	-	-
11	PNL PCD-NWB2-E02	400Y	113.3	94.2	350	OK	OK
12	PNL PCD-NWB2-N02	1600Y	882.7	733.9	1600	OK	OK
13	PNL PCD-NWB2-N05	400D	258.7	215.1	400	OK	OK
14	PNL RSCA-NE-N05	350D	54.6	45.4	350	OK	OK
15	PNL RSCA-SW-N06	400D	88.2	73.3	350	OK	OK
16	PNL RSCA-NE-N02	1200D	877.9	729.9	1200	OK	OK
		TOTAL	3510.8	2918.8			



MAIN EMERGENCY DISTRIBUTION PANEL PCM-NWB2-E01, 480/277V, 3PH, 4W, 800A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PNL PCD-NWB2-E02	400Y	113.3	94.2	350	OK	OK
2	SPARE	-	0.0	0.0	100	-	OK
3	SPARE	-	0.0	0.0	100	-	OK
4	SPACE (225 AF)	-	0.0	0.0	0	-	-
		TOTAL	113.3	94.2			

DISTRIBUTION PANEL PCD-NE04-N02, 480/277V, 3PH, 4W, 1200A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PANEL PCB-NE04-N02	150D	7.2	6.0	125	OK	OK
2	MECH AHU-1	150Y	136.0	113.1	150	OK	OK
3	MECH AHU-2	100Y	84.8	70.5	90	OK	OK
4	MECH AHU-3	150Y	136.0	113.1	150	OK	OK
5	MECH AHU-4	50Y	45.2	37.6	50	OK	OK
6	MECH AHU-5	100Y	84.8	70.5	90	OK	OK
7	MECH AHU-6	70Y	71.3	59.3	80	OK	OK
8	MECH AHU-7	150Y	136.0	113.1	150	OK	OK
9	MECH AHU-8	100Y	84.8	70.5	90	OK	OK
10	MECH AHU-9	70Y	74.6	62.0	80	OK	OK
11	MECH TEF-1	50Y	7.3	6.1	20	OK	OK
12	MECH TEF-2	50Y	7.3	6.1	20	OK	OK
13	SPARE	-	0.0	0.0	20	-	OK
14	SPARE	-	0.0	0.0	60	-	OK
15	SPARE	-	0.0	0.0	100	-	OK
16	SPACE (100AF)	-	0.0	0.0	0	-	-
17	SPACE (100AF)	-	0.0	0.0	0	-	-
18	SPACE (100AF)	-	0.0	0.0	0	-	-
19	SPACE (100AF)	-	0.0	0.0	0	-	-
20	SPACE (100AF)	-	0.0	0.0	0	-	-
21	SPACE (100AF)	-	0.0	0.0	0	-	-
		TOTAL	875.5	727.9			

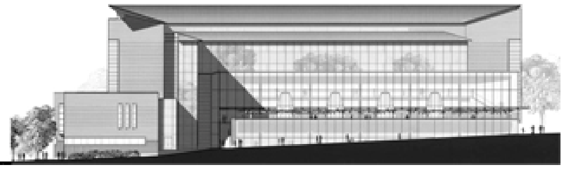
DISTRIBUTION PANEL PCD-NWB2-E02, 480/277V, 3PH, 4W, 400A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PANEL RSCA-NW-E01	70D	90.3	75.1	100	OK	OK
2	PANEL RSCA-NW-E02	225Y	23.0	19.1	225	OK	OK
3	SPARE	-	0.0	0.0	100	-	OK
4	SPARE	-	0.0	0.0	100	-	OK
5	SPARE	-	0.0	0.0	100	-	OK
6	SPACE(100AF)	-	0.0	0.0	0	-	-
7	SPACE(100AF)	-	0.0	0.0	0	-	-
		TOTAL	113.3	94.2			



DISTRIBUTION PANEL PCD-NWB2-N02, 480/277V, 3PH, 4W, 1600A MLO							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PANEL RSCA NW-NO2	400Y	210.9	175.3	400	OK	OK
2	SPARE	-	0.0	0.0	400	-	OK
3	PANEL PCD-NWB2-N06	400D	141.9	118.0	600	OK	OK
4	PANEL PCB-NWB2-N03	600Y	311.4	258.9	600	OK	OK
5	SPACE (400AF)	-	0.0	0.0	0	-	-
6	PANEL RSCA-NE-N04	400Y	176.2	146.5	400	OK	OK
7	PANEL PCB-NWB2-N08	400Y	42.2	35.1	400	OK	OK
		TOTAL	882.6	733.8			

DISTRIBUTION PANEL PCD-NWB2-N03. 208/120V, 3PH, 4W, 1600A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PANEL RSCA-NW-N03	600C	237.9	197.8	600	OK	OK
2	PANEL RSCA-NW-N04	600C	126.8	105.4	600	OK	OK
3	PANEL PCB-SWB2-N01	400C	33.2	27.6	400	OK	OK
4	PANEL RSCA-SW-N05	400C	28.6	23.8	400	OK	OK
5	PANEL RSCA-NW-N05	400C	58.2	48.4	400	OK	OK
6	SPARE	-	0.0	0.0	225	-	OK
7	SPARE	-	0.0	0.0	400	-	OK
8	SPACE	-	0.0	0.0	0	-	-
9	SPACE	-	0.0	0.0	0	-	-
10	SPACE	-	0.0	0.0	0	-	-
11	SPACE	-	0.0	0.0	0	-	-
12	SPACE	-	0.0	0.0	0	-	-
		TOTAL	484.7	403.0			

DISTRIBUTION PANEL PCD-NWB2-N04, 208/120V, 3PH, 4W, 1600A MCB							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	PANEL RSCA-NE-N01	6OOC	208.9	173.7	600	OK	OK
2	PANEL RSCA-NE-N03	400C	53.2	44.2	400	OK	OK
3	PANEL PCB-NWB2-N04	400C	35.5	29.5	400	OK	OK
4	PANEL RSCA-NE-N06	225C	5.2	4.3	225	OK	OK
5	SPACE (225AF)	-	0.0	0.0	0	-	-
		TOTAL	302.7	251.7			



DISTRIBUTION PANEL PCD-NWB2-N06, 480/277V, 3PH, 3W, 400A LUGS							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	MECH COOLING TWR CT-1	70Y	65.0	54.0	125	OK	OK
2	MECH COOLING TWR CT-2	70Y	65.0	54.0	125	OK	OK
3	MECH PAN HEATER	50Y	6.0	5.0	20	OK	OK
4	MECH PAN HEATER	50Y	6.0	5.0	20	OK	OK
5	SPARE	-	0.0	0.0	20	-	OK
6	SPARE	-	0.0	0.0	60	-	OK
		TOTAL	141.9	118.0			

DISTRIBUTION PANEL PCD-SW01-N05, 280/120V, 3PH, 4W, 400A MLO							
#	DESCRIPTION	FEEDER SIZE	CURRENT	KVA	BREAKER SIZE	FEEDER SIZE	BREAKER SIZE
1	DIMMER RACK D1	100C	16.1	13.4	100		OK
2	DIMMER RACK D2	100C	12.6	10.5	100		OK
3	FUTURE DIMMER	-	0.0	0.0	100	-	OK
4	SPARE	-	0.0	0.0	150	-	OK
		TOTAL	28.7	23.9			

Utility Rate Structure

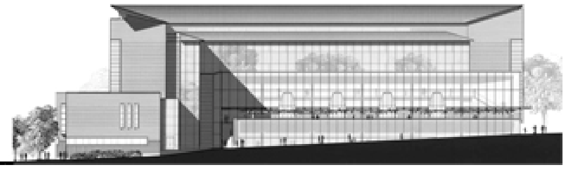
Electric utility service is provided to the University of Washington by Seattle City Light. The university follows the rate schedule for High Demand General Service (HDC Schedule) in the city of Seattle.

Refer to Appendix C for the utility rate structure breakdown provided by Seattle City Light.

The following is a monthly breakdown of the building power consumption throughout the last year in kilowatt-hours. Note that data for some months is not available due to metering problems within the building. Information regarding actual demand loads was unable to be obtained.

	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
BUILDING LOAD DATA FOR 2006 (IN KWH)	295,720	260,475	287,248	303,060	328,724	NOT AVAIL.	NOT AVAIL.	328,705	NOT AVAIL.	-	-	-

While specific data concerning power factor of the building is not kept, the current power factor of the building is known to be 0.88 and varies minimally from this value.



Communications Systems

Communications/Data Systems

A complete voice, data, and multimedia communications infrastructure system is provided throughout William H. Gates Hall, which supports such building networks. This infrastructure is integral to the building and is designated into two separate components, a university system and a college system.

Communications service enters the building on Level L2 via the utility duct bank tunnel into the main electrical room. The optical fiber service entrance cable also enters through this room. The optical fiber backbone is located in data closets near large classrooms, where station cabling is then run to desktops. Communications rooms are vertically stacked and connected to the one above and below with conduit sleeves through the floors and ceilings

Throughout the building, student seating areas in classrooms are provided with underfloor raceway stub-ups and connections to multi-outlet assemblies for future use. In addition to this, flush floor junction boxes are placed at selected locations in the floor for access from podiums and future fixed arrangements.

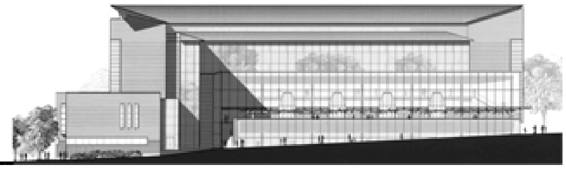
There are various communications systems and related equipment located throughout the building. These include, but are not limited to: wireless access points mounted in the ceilings of all classrooms, seminar rooms and court rooms; communications receptacle outlets all throughout the building for phone and data connections; several cable television outlets; and data/video projector and recorder outlets.

Access Control (Security) System

Security and access systems utilizing electronic card access, automatic door openers and door monitors are used in William H. Gates Hall via a raceway infrastructure. Located in the Northwest Electrical Room on each floor, the security equipment backboards feed security devices on the relative floors, and are interconnected through a security terminal cabinet on each floor. The security system is also connected to the main fire alarm control panel to control functions of the security devices in case of a fire.

Fire Alarm System

William H. Gates Hall is fully sprinklered and utilizes a multiplexed, analog addressable, annunciate, electrically supervised fire alarm system. Complying with University of Washington Facility Design Information Standards, as well as the Seattle Fire Code and ADA, the building contains all necessary fire alarm equipment and controls.



Connected to the Campus Loop through the main utility tunnel, the main fire alarm control panel is located on Level L2 in the main electrical room. From here, all fire alarm devices are served, as well as the fire alarm annunciator panel on Level L1 and the fire alarm terminal cabinets on each floor. The fire alarm system is zoned by floor and wing, and remote annunciation is provided on the main level (Level 1).

Smoke detection is provided in corridors, student computer labs, restrooms, student lounges, library stacks and electrical, communication and storage rooms. In addition to this, all supply and return plenums of HVAC systems greater than 2000 CFM are equipped with smoke detectors.

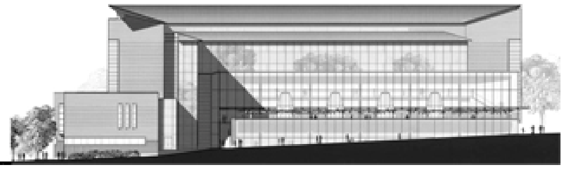
Manual pull stations are provided throughout the building per code requirements, including on each floor at exit stair entry and throughout the corridors. All corridors, public spaces, classrooms, mechanical, electrical, and communication rooms make use of wall-mounted, combination speaker/visible fire alarm devices, and visual fire alarm devices are provided in all labs, offices and administrative areas.

Other fire alarm control devices utilized throughout the building include door releases, sprinkler system flow switches, and fan shutdown circuitry.

Audio Visual System

An extensive audio/visual system is provided throughout William H. Gates Hall. The technical systems included within the building require equipment to amplify, process and distribute video and control signals within a classroom and between classrooms or control locations. This includes microphones, cameras, video monitors, shade screen controls, loud speakers, video projectors and assistive listening devices. The building audio visual system includes all of the following capabilities:

- Speech Reinforcement: Amplification is provided within classrooms and seminar rooms to allow for better hearing of the instructor. The amplification signal can also be used for assistive learning systems, as well as audio and video recorders.
- Program Amplification: All classrooms are equipped with amplification of audio signals from cassette tape, CD, DVD, VHS and live satellite.
- Video Presentation: Video presentation capabilities are included in many spaces for presentation of video signals from VHS, DVD, 35mm slides, film, computer, satellite, or other video conferencing equipment.
- Video Conferencing: All necessary equipment for video conferencing is provided in all spaces designed for this purpose. Camera control is provided in all video conferencing areas.
- Audio and Video Recording: Recording capabilities are provided through the use of dedicated cameras and microphones to enable "for the record" recording," which allows for recording and later review by students.

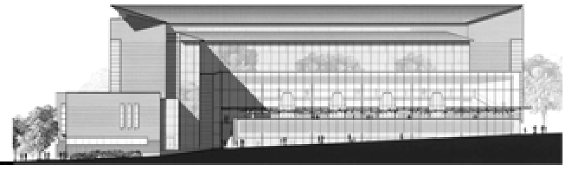


- AV System Control: All spaces which utilize any of the above audio/visual systems are equipped with local control. This includes transport control (PLAY, STOP, FF, RW, etc), volume control, lighting control, shade and projection screen control, and camera control.

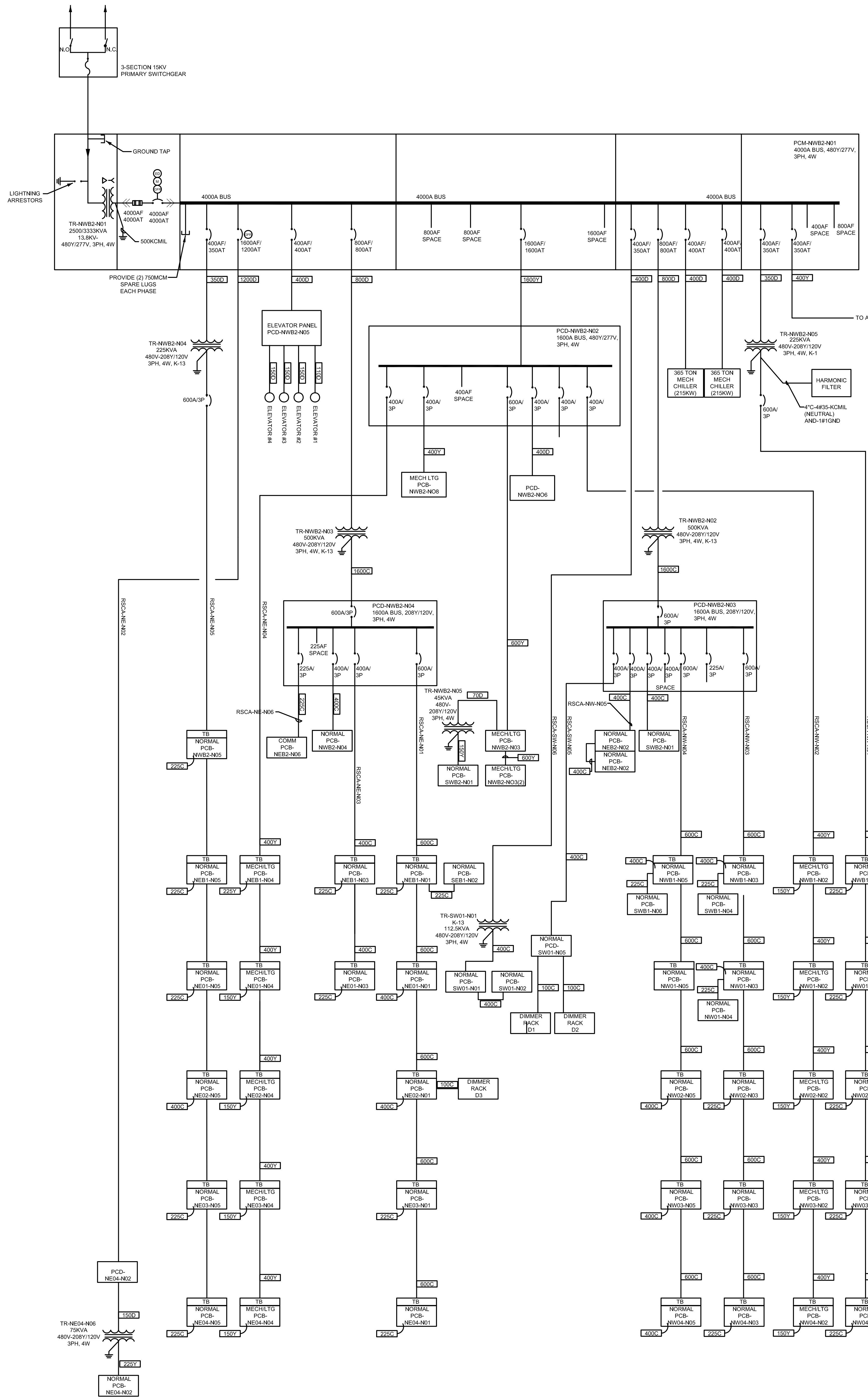
All of the above systems are found in the mock courtrooms in order to help simulate a courtroom environment as well as maximize the learning experience.

Clock System

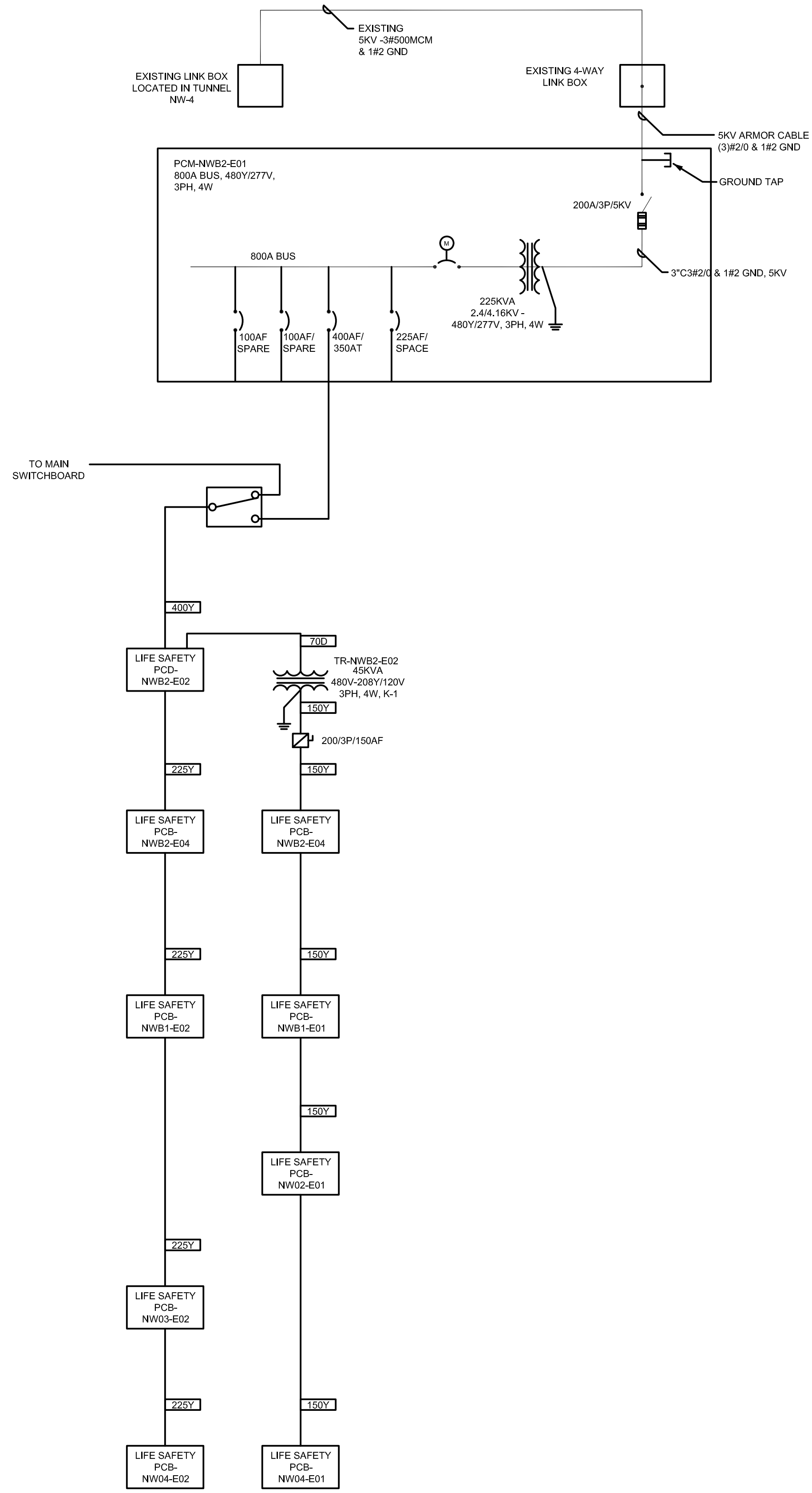
Analog and digital clocks connected to the campus system are provided in corridors, lounges, classrooms, public spaces, and multi-occupancy spaces together with program bells. The building clock system is controlled though a local control panel in the main electric room on Level L2. This control panel is connected to the campus loop and clock system through a pull box connection in the utility tunnel. From the main electric room, the local control panel serves clock junction boxes on each floor, which feed clocks and buzzers on the relative floors.

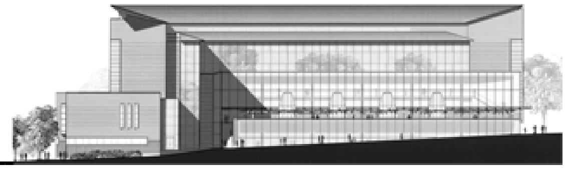


Appendices



N.O
N.C
3-SECTION 15KV PRIMARY SWITCHGEAR
GROUND TAP
LIGHTNING ARRESTORS
TR-NWB2-N01
2500/3333KVA
13.8KV-480Y/277V, 3PH, 4W
500KCMIL
4000AF 4000AT
4000AF 4000AT
PROVIDE (2) 750MCM SPARE LUGS EACH PHASE
4000A BUS
PCM-NWB2-N01
4000A BUS, 480Y/277V, 3PH, 4W
400AF/350AT
1600AF/1200AT
400AF/400AT
800AF/800AT
800AF SPACE
800AF SPACE
1600AF/1600AT
1600AF SPACE
400AF/350AT
800AF/800AT
400AF/400AT
400AF/400AT
400AF/350AT
400AF/350AT
400AF SPACE
800AF SPACE
350D
1200D
400D
800D
1600Y
400D
800D
400D
400D
350D
400Y
TO ATS
TR-NWB2-N04
225KVA
480V-208Y/120V
3PH, 4W, K-13
600A/3P
ELEVATOR PANEL
PCD-NWB2-N05
150D
150D
150D
110D
ELEVATOR #4
ELEVATOR #3
ELEVATOR #2
ELEVATOR #1
PCD-NWB2-N02
1600A BUS, 480Y/277V, 3PH, 4W
400A/3P
400A/3P
400AF SPACE
600A/3P
400A/3P
400A/3P
400A/3P
400Y
MECH LTG PCB-NWB2-N08
400D
PCD-NWB2-NO6
365 TON MECH CHILLER (215KW)
365 TON MECH CHILLER (215KW)
TR-NWB2-N05
225KVA
480V-208Y/120V
3PH, 4W, K-1
HARMONIC FILTER
4"C-4#35-KCMIL (NEUTRAL) AND-1#1GND
600A/3P
TR-NWB2-N03
500KVA
480V-208Y/120V
3PH, 4W, K-13
1600C
TR-NWB2-N02
500KVA
480V-208Y/120V
3PH, 4W, K-13
1600C
RSCA-NE-N02
RSCA-NE-N05
RSCA-NE-N04
PCD-NWB2-N04
1600A BUS, 208Y/120V, 3PH, 4W
600A/3P
225AF SPACE
225A/3P
400A/3P
400A/3P
600A/3P
PCD-NWB2-N03
1600A BUS, 208Y/120V, 3PH, 4W
600A/3P
400A/3P
400A/3P
400A/3P
400A/3P
600A/3P
225A/3P
600A/3P
SPACE
600Y
RSCA-NE-N06
225C
400C
COMM PCB-NEB2-N06
NORMAL PCB-NWB2-N04
RSCA-NE-N01
RSCA-NE-N03
TR-NWB2-N05
45KVA
480V-208Y/120V
3PH, 4W
70D
150Y
MECH/LTG PCB-NWB2-N03
600Y
NORMAL PCB-SWB2-N01
MECH/LTG PCB-NWB2-NO3(2)
RSCA-SW-N06
RSCA-SW-N05
RSCA-NW-N05
400C
400C
NORMAL PCB-NEB2-N02
NORMAL PCB-SWB2-N01
NORMAL PCB-NEB2-N02
400C
RSCA-NW-N04
RSCA-NW-N03
RSCA-NW-N02
RSCA-NW-N01
TB NORMAL PCB-NWB2-N05
225C
400Y
400C
600C
TB NORMAL PCB-NEB1-N05
TB MECH/LTG PCB-NEB1-N04
TB NORMAL PCB-NEB1-N03
TB NORMAL PCB-NEB1-N01
NORMAL PCB-SEB1-N02
225C
225Y
225C
225C
225C
TR-SW01-N01
K-13
112.5KVA
480V-208Y/120V
3PH, 4W
400C
NORMAL PCD-SW01-N05
NORMAL PCB-SW01-N01
NORMAL PCB-SW01-N02
400C
100C
100C
DIMMER RACK D1
DIMMER RACK D2
600C
600C
400Y
600C
400C
400C
TB NORMAL PCB-NWB1-N05
TB NORMAL PCB-NWB1-N03
TB MECH/LTG PCB-NWB1-N02
TB NORMAL PCB-NWB1-N01
225C
225C
NORMAL PCB-SWB1-N06
NORMAL PCB-SWB1-N04
150Y
225C
400Y
400C
600C
TB NORMAL PCB-NE01-N05
TB MECH/LTG PCB-NE01-N04
TB NORMAL PCB-NE01-N03
TB NORMAL PCB-NE01-N01
225C
150Y
225C
400C
TB NORMAL PCB-NW01-N05
TB NORMAL PCB-NW01-N03
400C
225C
NORMAL PCB-NW01-N04
TB MECH/LTG PCB-NW01-N02
TB NORMAL PCB-NW01-N01
150Y
225C
TB NORMAL PCB-NE02-N05
TB MECH/LTG PCB-NE02-N04
TB NORMAL PCB-NE02-N01
100C
DIMMER RACK D3
400C
150Y
400C
TB NORMAL PCB-NW02-N05
TB NORMAL PCB-NW02-N03
TB MECH/LTG PCB-NW02-N02
TB NORMAL PCB-NW02-N01
400C
225C
150Y
225C
TB NORMAL PCB-NE03-N05
TB MECH/LTG PCB-NE03-N04
TB NORMAL PCB-NE03-N01
225C
150Y
225C
TB NORMAL PCB-NW03-N05
TB NORMAL PCB-NW03-N03
TB MECH/LTG PCB-NW03-N02
TB NORMAL PCB-NW03-N01
400C
225C
150Y
225C
PCD-NE04-N02
150D
TR-NE04-N06
75KVA
480V-208Y/120V
3PH, 4W
225Y
NORMAL PCB-NE04-N02
TB NORMAL PCB-NE04-N05
TB MECH/LTG PCB-NE04-N04
TB NORMAL PCB-NE04-N01
225C
150Y
225C
TB NORMAL PCB-NW04-N05
TB NORMAL PCB-NW04-N03
TB MECH/LTG PCB-NW04-N02
TB NORMAL PCB-NW04-N01
400C
225C
150Y
225C


EXISTING
5KV -3#500MCM
& 1#2 GND
EXISTING LINK BOX
LOCATED IN TUNNEL
NW-4
EXISTING 4-WAY
LINK BOX
5KV ARMOR CABLE
(3)#2/0 & 1#2 GND
PCM-NWB2-E01
800A BUS, 480Y/277V,
3PH, 4W
GROUND TAP
200A/3P/5KV
800A BUS
M
3"C3#2/0 & 1#2 GND, 5KV
225KVA
2.4/4.16KV -
480Y/277V, 3PH, 4W
100AF
SPARE
100AF/
SPARE
400AF/
350AT
225AF/
SPACE
TO MAIN
SWITCHBOARD
400Y
70D
LIFE SAFETY
PCD-
NWB2-E02
TR-NWB2-E02
45KVA
480V-208Y/120V
3PH, 4W, K-1
150Y
200/3P/150AF
150Y
225Y
LIFE SAFETY
PCB-
NWB2-E04
LIFE SAFETY
PCB-
NWB2-E04
225Y
150Y
LIFE SAFETY
PCB-
NWB1-E02
LIFE SAFETY
PCB-
NWB1-E01
150Y
LIFE SAFETY
PCB-
NW02-E01
225Y
LIFE SAFETY
PCB-
NW03-E02
225Y
150Y
LIFE SAFETY
PCB-
NW04-E02
LIFE SAFETY
PCB-
NW04-E01



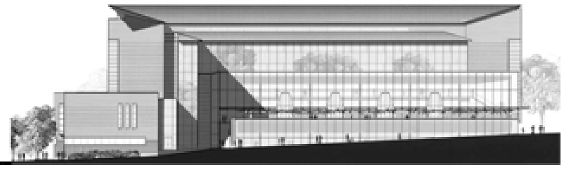
Appendix B: Feeder Schedule

FEEDER SCHEDULE

FEEDER NUMBER	NO. OF RACEWAYS	RACEWAY SIZE	CONDUCTORS (PER RACEWAY) PHASE	NEUTRAL	GROUND
3 PHASE, 3 WIRE, WITH GROUND - SERIES D:					
25D	1	3/4"	3#10	-	1#10
50D	1	1"	3#6	-	1#10
75D	1	1-1/4"	3#4	-	1#8
110D	1	1-1/2"	3#1	-	1#6
150D	1	1-1/2"	3# 1/0	-	1#6
175D	1	2"	3# 2/0	-	1#6
225D	1	2"	3# 4/0	-	1#4
250D	1	2-1/2"	3#250KCMIL	-	1#4
350D	1	4"	3#250KCMIL	-	1#2
400D	2	2"	3# 3/0	-	1#2
600D	2	3"	3#350KCMIL	-	1#1
800D	3	2-1/2"	3#300KCMIL	-	1#1/0
1200D	4	3"	3#350KCMIL	-	1#3/0
400D	2	2"	3# 3/0	-	1#2
800D	3	2-1/2"	3#300KCMIL	-	1#1/0
1200D	4	3"	3#350KCMIL	-	1#3/0
1600D	5	4"	3#500KCMIL	-	1#4/0

FEEDER NUMBER	NO. OF RACEWAYS	RACEWAY SIZE	CONDUCTORS (PER RACEWAY) PHASE	NEUTRAL	GROUND
3 PHASE,4 WIRE, WITH GROUND - SERIES Y:					
50Y	1	1-1/4"	3#6	1#6	1#10
70Y	1	1-1/4"	3#4	1#4	1#8
100Y	1	2"	3#1	1#1	1#8
150Y	1	2"	3#1/0	1#1/0	1#6
225Y	1	2-1/2"	3#4/0	1#4/0	1#4
400Y	2	2-1/2"	3#3/0	1#3/0	1#2
600Y	2	3"	3#350KCMIL	1#350KCMIL	1#1
800Y	3	3"	3#300KCMIL	1#300KCMIL	1#1/0
1200Y	4	3"	3#350KCMIL	1#350KCMIL	1#3/0
1600Y	5	3-1/2"	3#500KCMIL	1#500KCMIL	1#4/0
2000Y	6	3-1/2"	3#500KCMIL	1#500KCMIL	1#250KCMIL

FEEDER NUMBER	NO. OF RACEWAYS	RACEWAY SIZE	CONDUCTORS (PER RACEWAY) PHASE	NEUTRAL	GROUND
3 PHASE, 4 WIRE, DOUBLE NEUT, GRD & ISOL GRD - SERIES C:					
100C	1	2"	3#1	2#1	2#8
150C	1	2-1/2"	3#1/0	2#1/0	2#6
225C	1	2-1/2"	3#4/0	2#4/0	2#4
250C	1	3"	3#250KCMIL	2#250KCMIL	2#4
400C	2	3"	3#4/0	2#4/0	2#2
500C	2	3"	3#250KCMIL	2#250KCMIL	2#2
600C	2	3-1/2"	3#350KCMIL	2#350KCMIL	2#1
1600C	5	5"	3#600KCMIL	2#600KCMIL	2#4/0



Appendix C: Utility Rate Structure

SCHEDULE HDC

HIGH DEMAND GENERAL SERVICE: CITY

SCHEDULE HDC is for standard general service provided to city customers whose monthly demand is equal to or greater than 10,000 kW and who have not signed an agreement to be served under Schedule VRC. Energy charges shown below reflect a change in the pass-through of power rates charged by the Bonneville Power Administration (BPA) as required by Ordinance 121098 (passed by the City Council May 29, 2001) to pass these savings on to customers. The adjustment for non-residential classes is a decrease in energy charges of $.0014 per kWh.

Summer Billing Cycles (April - September)	Winter Billing Cycles (October - March)
ENERGY CHARGES:	
Peak: Energy used between 6 am and 10 pm, Monday through Saturday, excluding major holidays*, at 5.53¢ per kWh **Off-Peak** Energy used at all times other than the peak period at 4.77¢ per kWh	**Peak:** Energy used between 6 am and 10 pm, Monday through Saturday, excluding major holidays*, at 5.53¢ per kWh **Off-Peak** Energy used at all times other than the peak period at 4.77¢ per kWh
DEMAND CHARGES:	
Peak: All kW of maximum demand between 6 am and 10 pm, Monday through Saturday, excluding major holidays*, at $0.40 per kW **Off-Peak** All kW of maximum demand in excess of peak maximum demand, at all times other than the peak period, at $0.17 per kW	**Peak:** All kW of maximum demand between 6 am and 10 pm, Monday through Saturday, excluding major holidays*, at $0.40 per kW **Off-Peak** All kW of maximum demand in excess of peak maximum demand, at all times other than the peak period, at $0.17 per kW
Minimum Charge: $122.00 per meter per day	
Discounts:	
Transformer losses in kWh -- 1756 + .53285 x kW + .00002 x kW^2 + .00527 x kWh	
Transformer investment -- $0.17 per kW of monthly maximum demand	

* Major holidays excluded from the peak period are New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

Section 21.49.058

A. High demand general service is standard general service provided to customers who have in the previous calendar year half or more than half of the normal billings at 10,000 kW of maximum demand or greater. Classification of new customers will be based on Seattle City Light's estimate of maximum demand in the current year.

B. For customers metered on the primary side of a transformer, Seattle City Light will either program the meter to deduct computed transformer losses or provide a discount for transformer losses by reducing the monthly kWh billed by the number of kWh computed in Section 21.49.058,Subsection A.

C. For customers who provide their own transformation from City Light's standard distribution system voltage of 4 kV, 13 kV, or 26 kV to a utilization voltage, a discount for transformer investment will be provided in the amount stated in Section 21.49.058, Subsection A. Existing customers served by City Light's 34.5 kV system as of January 1, 1995 shall be considered as receiving standard distribution voltage for the purpose of this section. This 34.5 kV voltage will not be offered as a standard distribution system voltage for any new customers.

D. Customers must provide hourly load schedules each day for the following day. If the customer's load follows a regular pattern, City Light may, at its discretion, waive this requirement and request only to be informed of temporary or permanent changes to the pattern.

E. City Light may request voluntary load interruption during an emergency. If interruption occurs, the demand charge will be waived for the billing period in which the interruption occurs.