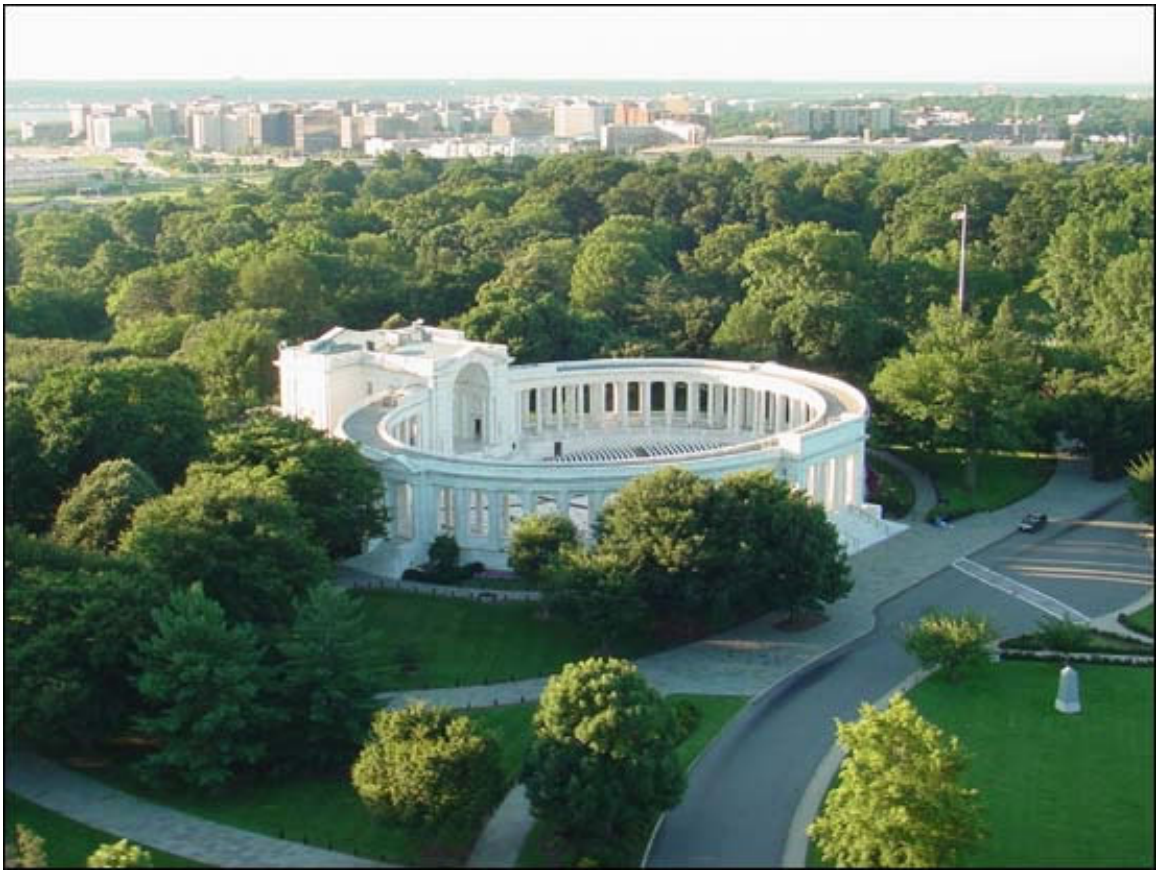
The Memorial Reception Building
Arlington National Cemetery



Existing Electrical Systems

Jennifer Sanborn
October 27, 2006

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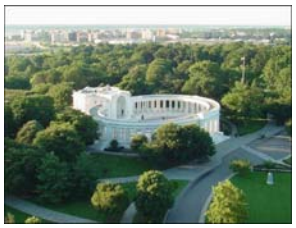
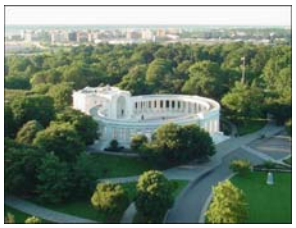
Arlington National Cemetery



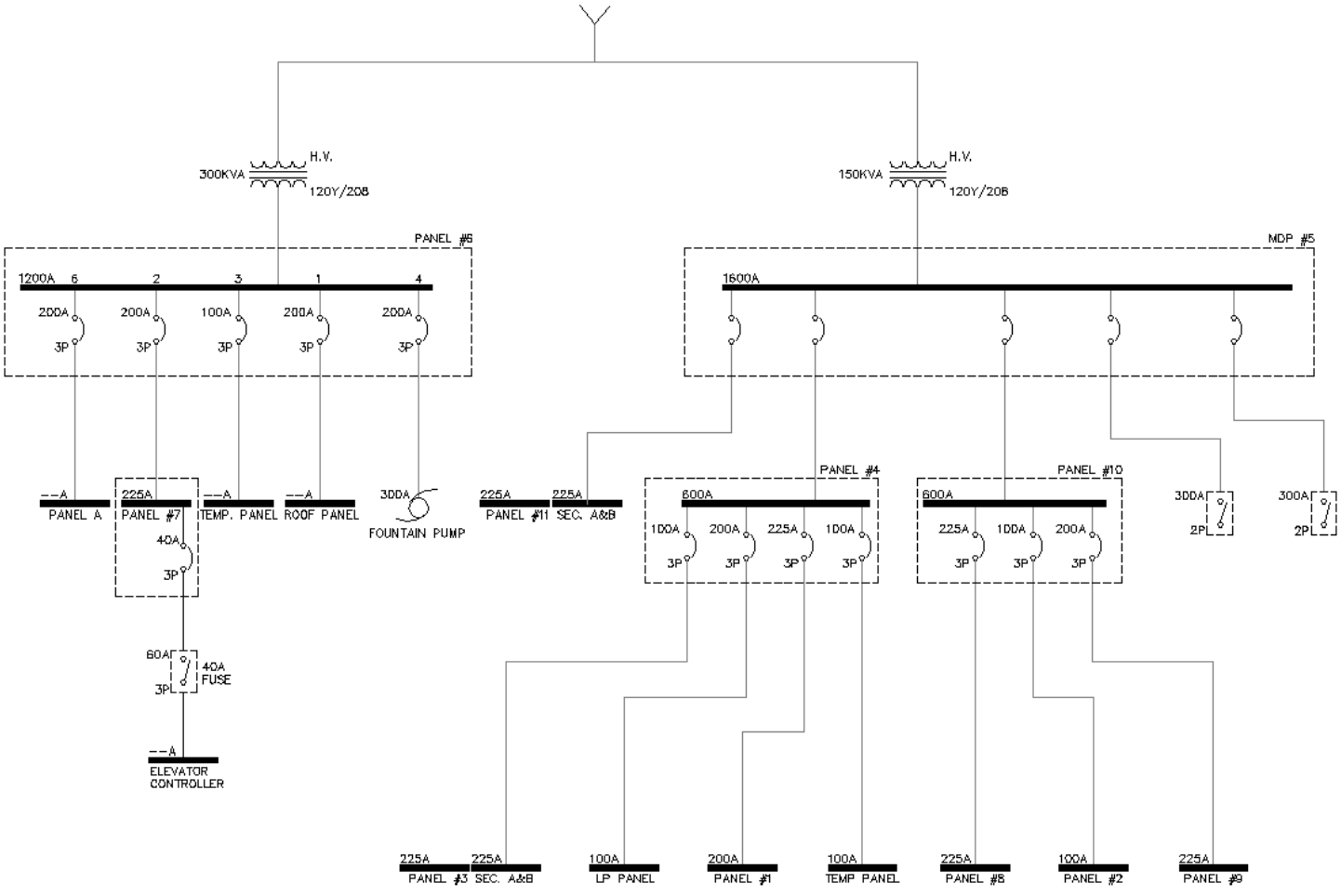
Executive Summary

The Memorial Reception Building at Arlington National cemetery is powered by a 15 kilo volt 3 phase service connected to the buildings high voltage switch board which is then distributed between two transformers. The secondary voltage on both of these transformers is 208Y/120 which means the entire building works off of 208Y/120 voltage. These two transformers are both 3 phase 4 wire and are rated for 150 and 300 kilo volt amps respectively. The load is then dispersed through out the building from two main distribution panel boards rated for 1200 amps and 1600 amps respectively.



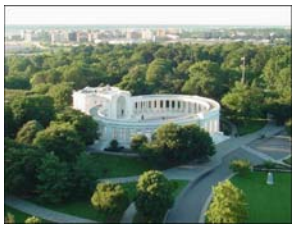
Power Distribution Systems

Single Line Diagram



NOTES:

1. INFORMATION FOR THE MDP #5, ROOF, AND "A" PANELS ARE UNKNOWN. THESE PANELS WERE NOT SURVEYED BY THE ELECTRICAL ENGINEER FOR THE RENOVATION AND THE EXISTING ORIGINAL DRAWINGS DO NOT SHOW ANY PANEL BOARD SCHEDULES. LOADS COULD NOT BE APPROXIMATED FROM WIRE OR PROTECTION DEVICE SIZING SINCE THEY WERE SPECIFIED ONLY AS "EXISTING WIRING AND CONDUIT" ON DRAWINGS.
2. NO INFORMATION WAS AVAILABLE FOR EITHER TEMPORARY PANEL BOARDS DUE TO



System Narrative

Distribution Type and Utility Entrance

The building's distribution system is a radial type system where the utility is entering the building at only one point and then disbursed through out. The location at which the service enters the building and begins to be the owner's responsibility is in the electrical room on the basement level. The system enters through an exterior wall on the East side of this electrical room.

Voltage Systems

The voltage coming into the building on the primary side of the transformers is 15,000 volts and the voltage on the secondary side of the transformers is 208Y/120 volts. This voltage is used through out the whole building for all the lighting and mechanical systems.

Transformers

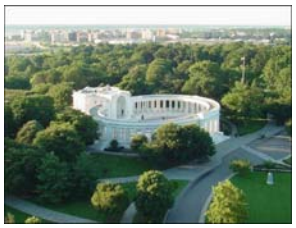
Transformer information is at the end of this report in the appendix section labeled Table 1.

Emergency Power

All interior emergency light fixtures and exit signs are equipped with emergency battery packs. There are no emergency lighting fixtures outside the building or in the amphitheater since the building and cemetery grounds are closed to the public after dusk.

Over current Devices and Location of Switch Gear

After the utility comes in through the electrical room wall, it is fed through a high voltage box, then through a high voltage service equipment center, and then finally through another high voltage box where it splits to each transformer, all of which are located in the electrical room on the basement level. After the voltage is brought down to a usable level for the building, in this case 208Y/120, it is then brought to two main distribution panels, one rated for 1200 amps and the other at 1600 amps. From their the service is distributed through out the building to other panel boards located in the basement's: corridor, mechanical room, electrical room, South Catacomb, mechanical room corridor, tomb guards quarters; and the first floor's electrical closet. There are no motor control centers in this building.



Lighting System

Compact fluorescent and fluorescent sources are used in the majority of the building's basement level's general spaces except for some halogen track lighting fixtures used in the tomb guard's practice room. Incandescent, halogen, and low voltage lamps are used in the crypt chapel which is also located on the basement level. The first floor is equipped with incandescent candelabra or incandescent globe lamps in the sconces and chandeliers. All of the second floor lighting consists of halogen track lighting. All lighting in building is operating off of 120V.

ASHRAE/IESNA 90.1

The ASHRAE 90.1 version that was used for this renovation was the 1999 version. Although the building is not open to the public after dusk, this building has no time-of-day operated control devices or occupancy sensors. Since the building is occupied by Tomb Guard Soldiers 24 hours a day, seven days a week and in some areas in considered living quarters, this building is exempt from this requirement from following the 9.2.1.1 Automatic Lighting Shut Off Requirement stating "interior lighting in buildings larger than 5000 square feet shall be controlled with an automatic control device to shut off building lighting in all spaces".

Power Factor Correction

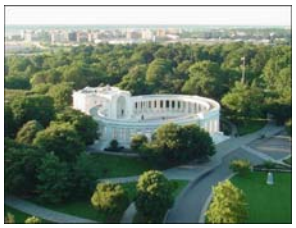
There are no power factor corrections required for this building.

Voltage Drop Considerations

There is no need for voltage drop consideration since the building foot print is so small. All feeder length and branch circuit length is so short that the voltage drop would be under the 2% and 3% max allowed.

Design Requirements

Since the Memorial Reception Building is a historical building, there were many requirements that needed to be followed when redesigning the mechanical, electrical, and lighting systems as well as updating the fire protection system. The architect as well as the rest of the design engineers needed to design a system that was the most efficient and durable while keeping the architecture and look of the historical features in the spaces. A couple examples of this are: the architect needed to make sure the new paint matched the original color as well as the marble that was being replaced match the rest of the marble in the building, and the lighting designer needed to choose fixtures that would compliment the architecture in the building as well as choose lamps that would create the



feel the space was originally designed for. There are also many rules and steps that need to be followed while renovating a historical building. For many renovations, a crew of trained professionals come in and take over the process to make sure the original pieces of the building aren't destroyed or the look of the building isn't replaced with a more modern one. One issue the MEP firm ran into was placing minimal amount of fire protection devices around each space, such as strobes, as to not distract from the architecture while keeping the system up to code.

Primary Lamps and Ballast

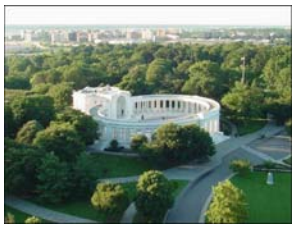
Tables for the primary lamp and ballast information is located in the appendix section at the end of this report labeled Table 2. All ballasts were taken from the advance transformer web site and were chosen keeping the type of ballast specified in each of the cut sheets in mind. Starting characteristics were not given for any of the ballast, so the starting characteristics and the operating characteristics were assumed to be the same.

Mechanical Equipment

Tables for the mechanical equipment are also located in the appendix section at the end of this report labeled Table 3. Power factors were not given, so they were based on the following rules of thumb for motors: three phase motors have a power factor of 0.90, and single phase motors equaling or above 0.1 horsepower have a power factor of 0.85, while ones below 0.1 have a power factor of 0.80.

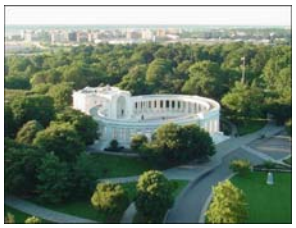
NEC Building Design Load

The NEC building design load calculation is located in a table at the end of this report in the appendix section labeled Table 4. The combined transformer load capability is 450 kilo volt amps. The total building power load is about 370 kilo volt amps, with future expansion included. The transformer load capability is greatly higher than my building load, this will allow for even more expansion throughout the years. The two main distribution panels are rated for 1200 amps and 1600 amps respectively. The total current required to run this system, including future expansion, is about 1770 amps. With this load being greatly smaller than the allotted amount, this shows my main distribution panels are sized correctly and are allowing for a large expansion if needed. Feeder information was omitted from renovation drawings on all existing wiring including feeders fed from the main distribution panels. No analysis can be made at this time, but a recommendation can be made for each feeder. For the feeder coming out of the MDP #6, which is rated for 1200A, the wire size should be 4#350AWG + 1#3/0G. For the feeder coming out of the MDP #5, which is rated for1600 amps, the wire size should be 5#600AWG + 1#4/0G. These wires are assumed to be of material type copper and rated for a temperature of 75 degrees Celsius.



Utility Rate Structure

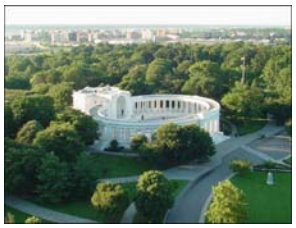
Utility information could not be obtained at this moment. The MEP firm believes the information from the utility bills would not be relevant due to the building may be on the same meter as the rest of the cemetery grounds, which contain other buildings.



Communication Systems

The communication system in this building consists of telephones, data, and security cameras. The security system is made up of fiber optic cabling connected to two site cameras, four cameras located around the amphitheater, and one camera located on the roof. The terminal cabinet for the security cameras is located in the telephone room, while the fiber optic termination by Arlington National Cemetery is located in the LAN closet, and the TV that is used to view these security cameras in located in the Sergeant of Guard's office. All three of which are located on the basement level.

The telephone systems is a typical system where the telephone cable; which is a category 3, 4 pair telephone cable; is distributed throughout the building from a 66 clip connecting block located in the telephone closet on the basement level. Eleven cables service the basement level, while three cables service the first floor level. The data system is also a typical system where the data cable; which is a category 5e, 4 pair data cable; is distributed through the building from the LAN terminal, which is a 16 port category 5 patch panel, located in the LAN closet on the basement level. Nine cables service the basement level, while four cables service the first floor level.



Appendix

Individual Transformer Schedule								
TAG	PRIMARY VOLTAGE	SECONDARY VOLTAGE	SIZE	TYPE	TEMP. RISE	TAPS	MOUNTING	REMARKS
T-1	15,000 V	208Y/120V,3PH,4W	300 KVA	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	
T-2	15,000 V	208Y/120V,3PH,4W	150 KVA	DRY TYPE	150 DEGREE C	(6) 2.5%	PAD MOUNTED ON FLOOR	
NOTES: 1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS								

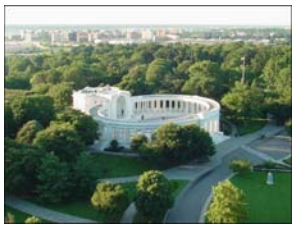
Table1

Lighting Load										
	Lamps			Ballast						
Type	Number/Type	Watts	Voltage	Input Watts	Operating Voltage	Input Current	Operating Current	Starting PF	Operating PF	BF
32T8U6	2	31.2	120	73	120	0.64	0.64	0.97	0.97	0.94
26CF	2	26	120	68	120	0.3	0.3	0.98	0.98	0.98
32T8	1	32	120	30	120	0.25	0.25	0.98	0.98	0.98
	2	32	120	59	120	0.5	0.5	0.99	0.99	0.88
T5	1	39	120	40	120	0.3	0.3	0.90	0.90	0.98
	1	24	120	27	120	0.2	0.2	0.98	0.98	1.02
PAR30L/HAL	1	75	120	-	-	-	-	1.0	1.0	1.0
60B10 1/2 14M	12	760	120	-	-	-	-	1.0	1.0	1.0
40G16 1/2 C/4M	4	160	120	-	-	-	-	1.0	1.0	1.0
250Q/CL/DC	1	250	120	-	-	-	-	1.0	1.0	1.0
50MRC16/CC/NFL24°	1	50	120	-	-	-	-	1.0	1.0	1.0

Table 2

Mechanical Equipment							
Designation	Equipment Type	Phase	Voltage	HP	FLA	PF	KW
EVAP-1/CU-1	Condensing Unit	3	208	2, 3	15.40	0.9	4.99
CU-2	Condensing Unit	3	208	1/2	2.10	0.9	0.68
EVAP-2	Evaporator	3	208	1.5	4.80	0.9	1.56
EF-1	Exhaust Fan	1	120	1/20	0.90	0.8	0.09
EF-2	Exhaust Fan	1	120	1/10	1.40	0.85	0.14
EF-3	Exhaust Fan	1	120	1/2	7.50	0.85	0.77
EF-4	Exhaust Fan	1	120	1/2	9.80	0.85	1.00
EF-5	Exhaust Fan	1	120	1/20	1.00	0.8	0.10
PF-1	Propeller Fan	1	120	1/30	0.72	0.8	0.07
P-1	Pump	3	208	2	7.50	0.9	2.43
P-2	Pump	3	208	2	7.50	0.9	2.43
SUP-1	Sump Pump	1	115	1/2	9.80	0.85	0.96
WH-1	Water Heater	3	208				0.00
CP-1	Circulation Pump	1	115	1/20	0.98	0.8	0.09
EWC	Electric Water Cooler	1	120	1/20	0.98	0.8	0.09
EWC	Electric Water Cooler	1	120	1/2	9.80	0.85	1.00

Table 3



Building Load						
Type of Load	Existing Load to Remain (kva)	New Load (kva)	Total Building Load (kva)		Correction Factor	Demand Load (kva)
Lighting	12.1	23.6	35.7		125%	44.6
Receptacles	7.2	29.7	36.9	first 10 kva	50%	5
	-	-	-	26.9 kva	100%	26.9
Mechanical	54	37.7	91.7		100%	91.7
Elevators	-	10.0	10.0		100%	10
Motors	-	11.5	11.5		100%	11.5
Other	85.5	19.1	104.6		100%	104.6
					Total	294.3
					x125% (Future)	367.9

Table 4