Army National Guard Readiness Center

Revised Thesis Proposal 2

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3/25/2011

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Executive Summary

The following proposal contains a summary of work to be completed during the Spring 2011 semester for AE 482. Two depth and two breadth topics are required to be researched. A MAE focus will also be completed for the spring semester. The first depth deals with lighting design and covers a redesign of the lighting and controls of four different spaces within the Army National Guard Readiness Center Addition. The second depth focuses on electrical design. It will include a protective device coordination study, calculations for short circuiting, and two depth studies. The depth studies chosen are panel consolidation and a comprehensive short circuit analysis using SKM software.

Architectural and acoustical studies will be completed to satisfy the breadth topic requirements. For the architectural breadth, a study on lowering the ceiling heights and its effect on the installation of mechanical equipment within the plenum space will be conducted. The acoustical breadth will focus on the effects on the acoustics of lowering the ceiling heights in the auditorium.

Background Information

The Army National Guard Readiness Center Addition is a 251,444 ft^2 office building that will function as a stand-alone building. Its contract value is $100 million and is a Design-Bid-Build

with Tompkins Builders Inc. with the general contractor holding lump sum contracts with all subcontractors. This new addition will have three levels below grade consisting of open office space, an auditorium, fitness facilities, locker rooms, and a telecommunication center. Above grade, there is a five story triangular tower of smaller footprint that consists of open office space, a library, and mechanical penthouse. Where the below grade levels transition to the tower, there is an outdoor plaza consisting of seating and walkways and doubles as a green roof. A unique architectural feature of the building is the steel tricorn that is meant to represent an eyebrow.

The Army National Guard Readiness Center houses administrative and resource functions that provide support o the National Guard. The 2005 Base Realignment and Closure Act (BRAC) required the realignment of Jefferson Plaza 1 in Crystal City by relocating National Guard Bureau Headquarters and Air Force Headquarters to the Army National Guard Readiness Center in Arlington Virginia and to Andrews Air Force Base, in Maryland. Over 1,200 National Guard Bureau Joint Staff and Army National Guard Bureau Joint Staff and Army National Guard Staff were required to relocate to the Readiness Center. A need for additional space was created.

Lighting Depth

Problem Statement

The Army National Guard is a large office building with the majority of the lighting design comprising of either recessed or pendant mounted fluorescent fixtures. This ensures uniform lighting at efficient energy costs. However, a more aesthetic and interesting lighting scheme can be implemented that is still appropriate for the function of the building. The scope of the lighting depth is to redesign three indoor spaces and one outdoor. These include an open office, prefunction area, auditorium, and outdoor plaza. A preliminary schematic design for each space was completed in the Tech 3 report. The designs were presented in front of a panel of professional lighting designers on December 8th, 2010 and their comments will be taken into consideration in the revisions for the spring semester.

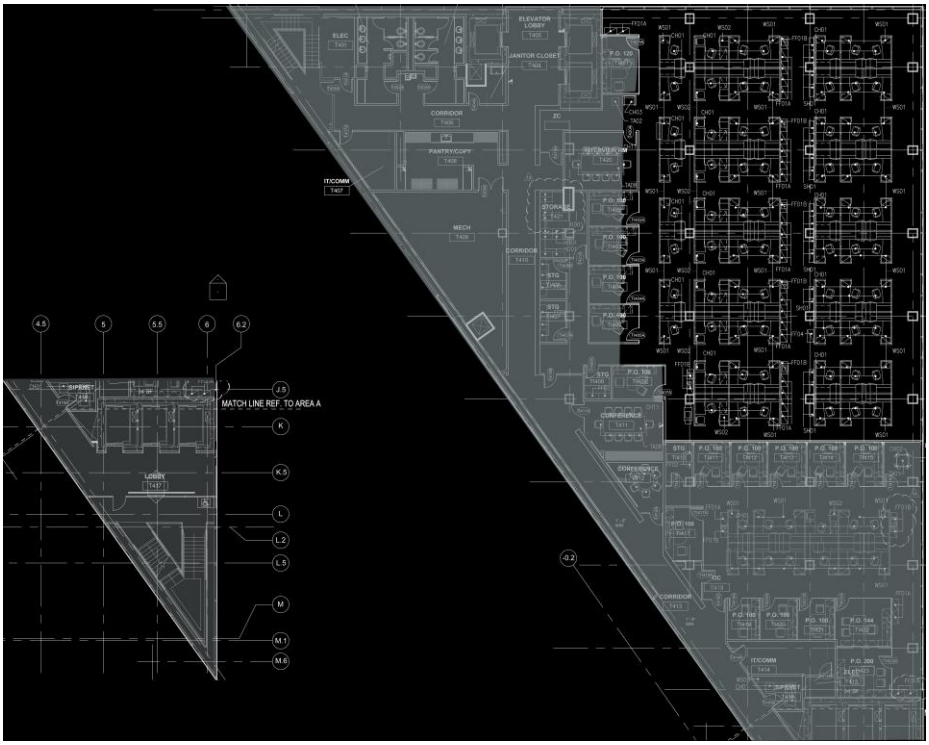


Figure 1: Open Office Floor Plan

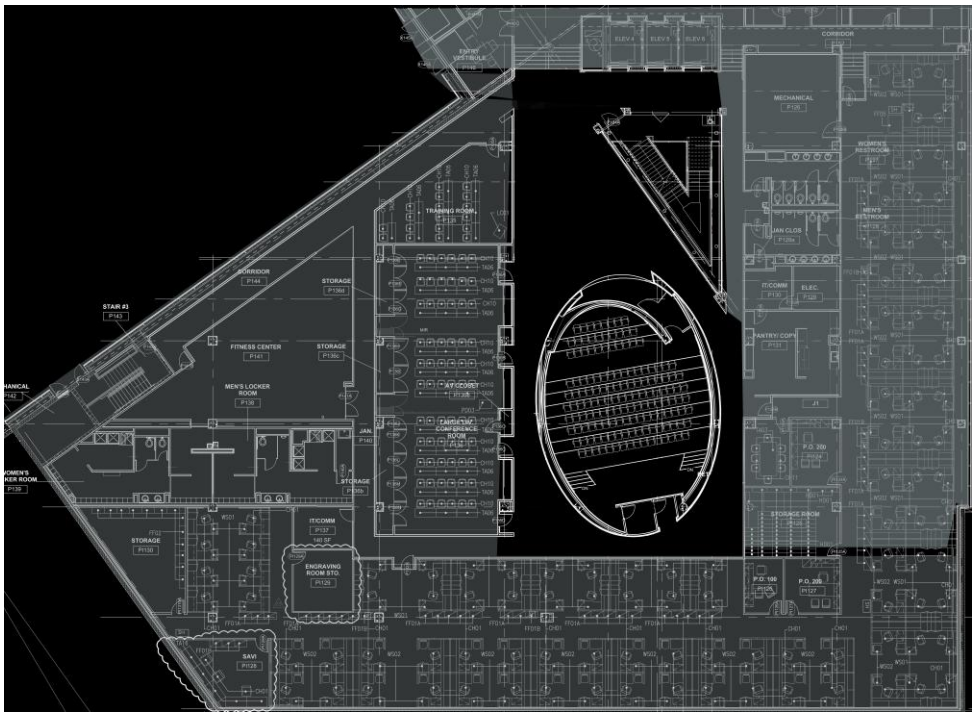


Figure 2: Prefunction Area Floor Plan

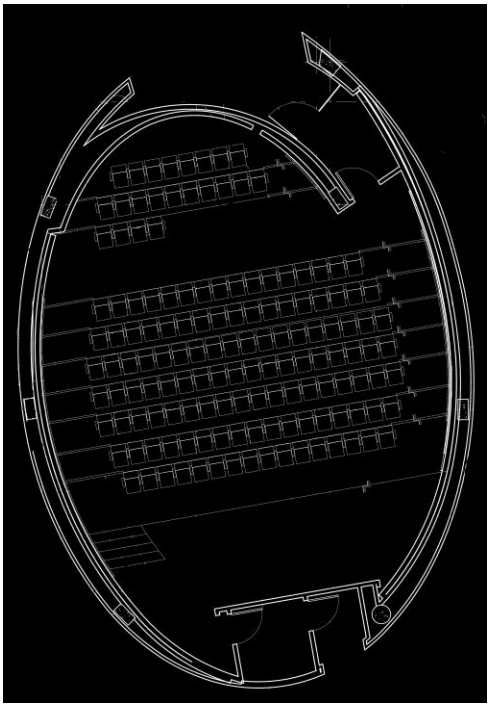


Figure 3: Auditorium Floor Plan

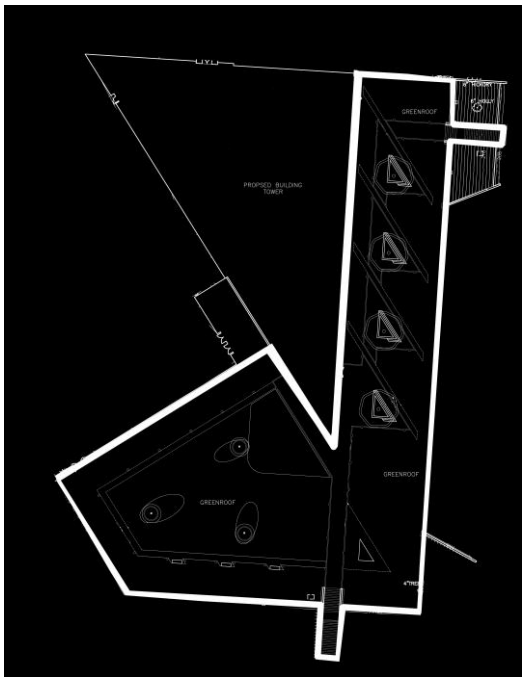


Figure 4: Plaza Plan

Proposed Solutions

Open Office

The open office is a space where employees will be spending much of the day working with VDT's in cubicles. There is a double height ceiling, which is 10.5' above the work space and 9' above the perimeter of the space where circulation occurs. Use of indirect light with a direct component will be utilized to provide high ambient light while provide some contrast and modeling of objects. This will be done with linear fluorescent pendant fixtures over the work are. Where the ceiling is lower around the perimeter, the linear theme with the fixtures will be carried over. Wall washing will also be a technique considered around the perimeter of the space.

Prefunction Area

The prefunction area serves as a place for gathering before events that may take place in the adjacent auditorium or conference rooms. Techniques to make the space feel more spacious will be utilized, which focus on illuminating the perimeter and ceiling. Because the space is a circulation space, the way light will be used to direct the occupants. Either random or guided circulation can be encouraged through the lighting design. The proposed design will implement guided circulation.

Auditorium

The auditorium is an oval shape room that will be used for presentation and training purposes. At the southern end of the room is a stage that lies before a retractable projector screen. The lighting within the space will try to highlight three distinct areas within the space: seating, egress, and the stage. Because the room is shaped in an odd oval shape, the design will focus on complementing this architectural feature, making it unique for this space. Lighting for the stage should be the most flexible within the space to accommodate for either single speaker, use of projector screen, or panel discussion. Track lighting can be utilized to focus light on a single speaker or directional downlights can uniformly illuminate stage for other uses. Flexibility of lighting control will also be incorporated into the design. Different light levels will be required for different tasks that will take place.

Outdoor Plaza

The plaza is a large outdoor area that provides seating and circulation around the exterior of the building. Because it is a government building, it is not desirable to draw public attention onto the site of the Army National Guard Readiness Center. Therefore the lighting design will be low

profile while providing adequate illumination for the employees to move about. In order to keep the space private, all the luminaires will be integrated within the site. The pathways will be illuminated by in-grade luminaires and luminaires integrated within the triangular planters. The stairs will be illuminated by LED handrails. To reinforce the idea of integrating the luminaires with the site, the trees within the planters will also be uplight. This will give the impression that the planters themselves are the light sources that light the paths.

Solution Method

The comments made by the panel of lighting professionals from the Tech 3 presentation will be taken into account when finalizing the design solutions. Computer software will be utilized to provide lighting calculations and renderings of each of the proposed spaces.

Tasks and Tools

1. Revise and Complete Schematic Design
   Review and improve previously mentioned design concepts based around past semester's critiques.

2. Model Spaces
   Computer programs such as AutoCAD, Revit Architecture, and AGI will be used to model each of the five spaces. Renderings and lighting calculations will be obtained from use of these programs.

3. Equipment Selection
   Lamps, luminaires, and ballasts will be specified from manufactures' catalogues and be implemented into the lighting design.

4. Electric Lighting Calculations
   Import 3D models of spaces into AGI and place selected luminaires within the model. Fill out all appropriate data. Run lighting calculations within program.

5. Renderings
   Create accurate 3D renderings of spaces with the use of AGI, Revit, or 3D Studio Max.

Electrical

Overview

The scope of the Electrical Depth includes a redesign of the branch circuit distribution for the four spaces that are being relighted, a protective device coordination study that addresses a single path through the distributions system, and two electrical depth topics. The depth topics that will be researched are panel consolidation and a short circuit analysis using SKM software.

Re-Lighted Spaces

1. Open Office (Northeast area of the 7th floor)

The open office is a large area containing several cubicles, each containing its own computer. The lighting for both the existing and proposed lighting design consists of indirect and direct fluorescent fixtures running on 277 volts.

2. Prefunction Area (Center of the lower section of the third floor)

The prefunction area will be a place for gathering before events taking place within the adjacent auditorium and conference rooms. The existing and proposed lighting loads consist of recessed and wallwash fluorescent luminaires at 277 volts.

3. Auditorium (located with the foot print of the prefunction area)

The auditorium is a large, oval shaped room used for presentations and training purposes. The existing lighting design is consists mostly of recessed halogen luminaires with some cold cathode lighting around the perimeter. The proposed lighting design will attempt to use more energy efficient luminaires.

4. Outdoor Plaza

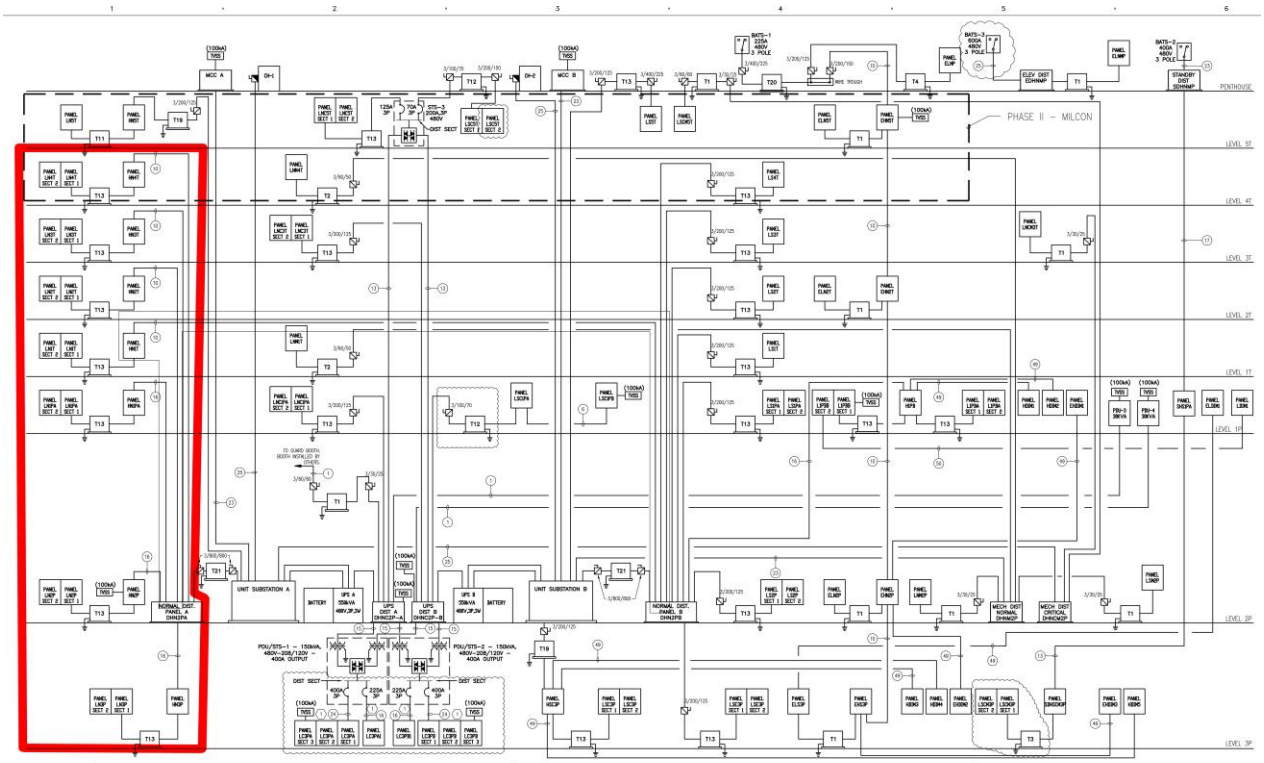
The outdoor plaza doubles as a green roof for the below grade levels. The existing lighting design uses halogen light sources to illuminate the pathways. The proposed design will try to utilize more efficient light sources.

Short Circuit Analysis

A short circuit analysis study will be conducted that addresses a single-path through the distribution system. The source will be from the utility transformer and the path will extend through the main switchgear MVS-1 to Unit Substation A, through feeder 23 to the motor control center MCC A.

Electrical Depth Topic 1 – Transformer Consolidation

A portion of the distribution system will be redesigned to consolidate several 75 kVA 480-208/120V transformers into one larger transformer. The current transformers feed individual 208/120V panelboards. The new design will have one transformer feeding into a new distribution panel that will feed into the individual panelboards. After the system has been redesigned, a cost analysis will be performed to determine the more economical system.



LEGEND OF FEEDER SIZES–COPPER CONDUCTORS

FEEDER SYMBOL	CONDUCTORS (3 PHASE, 3 WIRE) WITH GROUND	RACEWAY SIZE	CONDUCTORS (3 PHASE, 4 WIRE) WITH GROUND	RACEWAY SIZE	NOMINAL AMPERE RATING
(1)	3#6 & 1#10 GND.	3/4"			
(2)			4#6 & 1#10 GND.	1"	65
(3)	3#4 & 1#8 GND.	1"			
(4)			4#4 & 1#8 GND.	1 1/4"	85
(5)	3#2 & 1#6 GND.	1 1/4"			
(6)			4#2 & 1#8 GND.	1 1/4"	115
(7)	3#1 & 1#6 GND.	1 1/2"			
(8)			4#1 & 1#6 GND.	1 1/2"	130
(9)	3#1/0 & 1#6 GND.	1 1/2"			
(10)			4#1/0 & 1#6 GND.	2"	150
(11)	3#2/0 & 1#6 GND.	2"			
(12)			4#2/0 & 1#6 GND.	2"	175
(13)	3#3/0 & 1#6 GND.	2"			
(14)			4#3/0 & 1#6 GND.	2"	200
(15)	3#4/0 & 1#4 GND.	2"			
(16)			4#4/0 & 1#4 GND.	2 1/2"	230
(17)	3–250 KCMIL & 1#4 GND.	2 1/2"	4–250 KCMIL & 1#4 GND.	3"	255
(18)					
(19)	3–350 KCMIL & 1#4 GND.	3"			
(20)			4–350 KCMIL & 1#4 GND.	3"	310
(21)	3–500 KCMIL & 1#3 GND.	3"			
(22)			4–500 KCMIL & 1#3 GND.	3 1/2"	380
(23)	(2) 3–3/0 & (2)1#4 GND.	2–2"			
(24)			(2) 4–3/0 & (2)1#4 GND.	2–2"	400

NOTE: NOT ALL SIZES INDICATED IN SCHEDULE ARE USED.

LEGEND OF FEEDER SIZES–COPPER CONDUCTORS

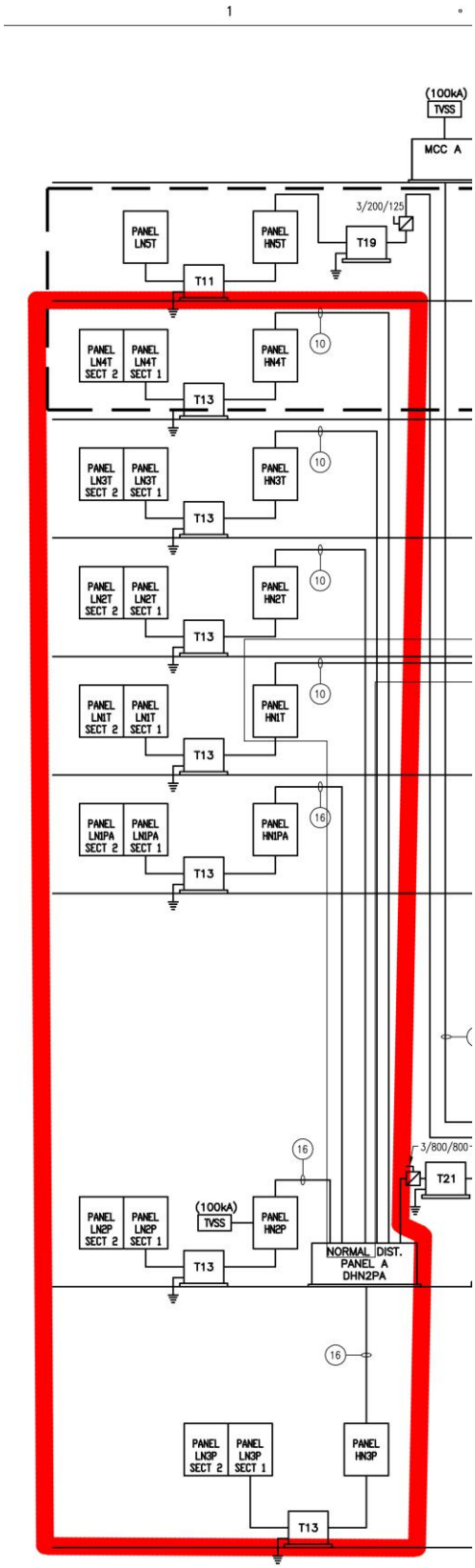
FEEDER SYMBOL	CONDUCTORS (3 PHASE, 3 WIRE) WITH GROUND	RACEWAY SIZE	CONDUCTORS (3 PHASE, 4 WIRE) WITH GROUND	RACEWAY SIZE	NOMINAL AMPERE RATING
(25)	(2)3–250 KCMIL & (2)1#2 GND.	2–3"			
(26)			(2)4–250 KCMIL & (2)1#2 GND.	2–3"	500
(27)	(2)3–350 KCMIL & (2)1#1 GND.	2–3"			
(28)			(2)4–350 KCMIL & (2)1#1 GND.	2–3"	600
(29)	(2)3–300 KCMIL & (2)1#1/0 GND.	3–2 1/2"			
(30)			(2)4–300 KCMIL & (2)1#1/0 GND.	3–3"	800
(31)	(2)3–400 KCMIL & (2)1#2/0 GND.	3–3"			
(32)			(2)4–400 KCMIL & (2)1#2/0 GND.	3–3"	1000
(33)	(4)3–350 KCMIL & (4)1#3/0 GND.	4–2 1/2"			
(34)			(4)4–350 KCMIL & (4)1#3/0 GND.	4–3"	1200
(46)	(4)3–500 KCMIL & (4)1#4/0 GND.	4–3"			
(35)			(4)4–500 KCMIL & (4)1#4/0 GND.	4–3 1/2"	1350
(36)	(5)3–400 KCMIL & (5)1#4/0 GND.	5–2 1/2"			
(37)			(5)4–400 KCMIL & (5)1#4/0 GND.	5–3"	1600
(38)	(6)3–400 KCMIL & (6)1–250 KCMIL GND	6–2 1/2"			
(39)			(6)4–400 KCMIL & (6)1–250 KCMIL GND	6–3"	2000
(40)	(7)3–500 KCMIL & (7)1–350 KCMIL GND	7–3"			
(41)			(7)4–500 KCMIL & (7)1–350 KCMIL GND	7–3"	2500
(42)	(8)3–500 KCMIL & (8)1–400 KCMIL GND	8–3"			
(43)			(8)4–500 KCMIL & (8)1–400 KCMIL GND	8–3 1/2"	3000
(44)	(9)3–500 KCMIL & (9)1–500 KCMIL GND	9–3"			
(45)			(9)4–500 KCMIL & (9)1–500 KCMIL GND	9–3 1/2"	3200
(47)	(10)3–500 KCMIL & (10)1–500 KCMIL GND	10–3"			
(48)			(10)4–500 KCMIL & (10)1–500 KCMIL GND	10–3 1/2"	3500
(49)	(11)3–500 KCMIL & (11)1–500 KCMIL GND	11–3"			
(50)			(11)4–500 KCMIL & (11)1–500 KCMIL GND	11–3 1/2"	4000
(51)			4#12 AWG AND 1#12 AWG GND	3/4"	20
(52)			4#8 AWG AND 1#10 AWG GND	3/4"	40

GENERAL NOTES:

1. REFER TO THE ONE LINE DIAGRAM FOR CONNECTIONS TO SUBSTATIONS, PANELBOARDS, LOADS, UPS, AND ATS SWITCHES.
2. TRANSFORMER GROUND ELECTRODE SIZES AND PRIMARY AND SECONDARY FEEDER SIZES ARE LOCATED ON THE TRANSFORMER SCHEDULE ON E601.
3. SOME TRANSFORMERS ARE SUSPENDED FROM STRUCTURE ABOVE, REFER TO E401, E402, AND E403 FOR DETAILS.
4. ALL OF THE INTERNAL CIRCUIT BREAKERS WITHIN THE STATIC SWITCHES AND PDUS ARE NOT INDICATED HERE. PROVIDE ONLY THE MAIN AND BRANCH CIRCUIT BREAKERS AS INDICATED IN THE SPECIFICATIONS.
5. REFER TO BID OPTION 11 FOR REMOVAL OF REDUNDANCY TO THE DISTRIBUTION SYSTEM.

KEYED NOTES:

1. PROVIDE WITH TWO NEUTRAL CONDUCTORS PER THE SCHEDULE FOR A 200% NEUTRAL RATING.


(100kA)
TVSS
MCC A
3/200/125
T19
PANEL LN5T
PANEL HN5T
T11
PANEL LN4T SECT 2
PANEL LN4T SECT 1
PANEL HN4T
T13
PANEL LN3T SECT 2
PANEL LN3T SECT 1
PANEL HN3T
PANEL LN2T SECT 2
PANEL LN2T SECT 1
PANEL HN2T
PANEL LN1T SECT 2
PANEL LN1T SECT 1
PANEL HN1T
PANEL LN1PA SECT 2
PANEL LN1PA SECT 1
PANEL HN1PA
3/800/800
T21
PANEL LN2P SECT 2
PANEL LN2P SECT 1
(100kA)
TVSS
PANEL HN2P
NORMAL DIST. PANEL A DHN2PA
PANEL LN3P SECT 2
PANEL LN3P SECT 1
PANEL HN3P

Electrical Depth Topic 2 – SKM Short Circuit Analysis

A comprehensive short circuit analysis, coordination study and arc fault study will be conducted using SKM software. Spreadsheets will be used to list each piece of equipment in the system along with the actual AIC rating and the available SCC from SKM.

Breadth 1 – Mechanical

The first breath will be a comparison of the heat load produced by incandescent luminaires vs. compact fluorescents within the auditorium. The original lighting design for the space primarily uses recessed incandescent luminaires, which tend to produce more heat than other lamps. My new design for the space replaces many of these incandescent with compact fluorescents. With the change in lamp type, a change in heating load within the space should occur. Therefore, an analysis will be run through Trane Trace to determine the difference in heating load.

Breadth 2 – Acoustical

For the Acoustical Breath, an analysis of the acoustics will be conducted and evaluated within the auditorium and changes will be made if necessary to improve acoustics.