The Army National Guard Readiness Center Addition
AE Senior Thesis 2011

Ian Herron | Lighting Electrical | April 13, 2011

Presentation Outline:

Lighting Depth
- Open Office | Work Space
- Auditorium | Multipurpose Space
  - Acoustical Breadth
  - Mechanical Breadth
- Prefunction Area | Circulation
- Plaza | Outdoor

Electrical Depth
- SKM Power Tools Analysis
- Transformer Consolidation

Conclusion
Acknowledgements

Building Information

Location | Arlington VA
Building Occupant | The Army National Guard
Function | Administrative Office Building
Size | 251,444 SF
Number of Stories | 8
Dates of Construction | 12/2008 to 01/2011
Overall Project Cost | $100,000,000

Project Team

Owner | Army National Guard
General Contractor | Tompkins Builders Inc.
Architect | CH2M Hill
Engineering Firm | AECOM

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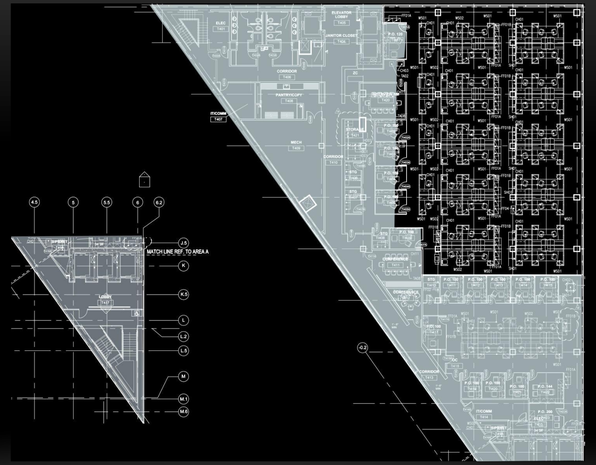
Open Office – Floor Plan



Key Features

- **Exterior Glass Façade**
- **Double Height Ceiling**
- **Rigid Cubicle Layout**

Material		Manufacturer	Style/Color	Reflectance
Modular Carpet	CP-2	Constantine	Narrow/ R252200	0.2
Gypsum Wall Board	CLG1	-	Bright White	0.76
Acoustical Ceiling Tile	ACT1	-	2'x2'/White Finish	0.8
Wood Base	WB1	Sherwin Williams	2.5" high/ Alabaster	0.3
Vision Glass	G6	-	Tempered Monolithic	0.25
Gypsum Wall Board	GWB1		Eggshell Sheen	0.5

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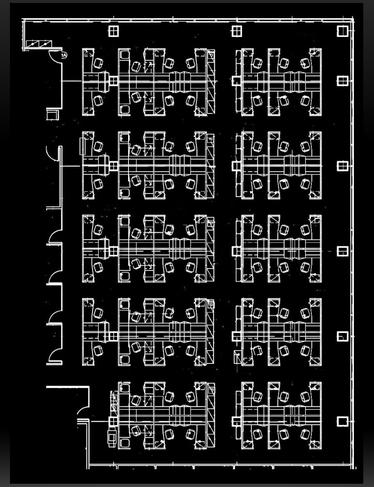


Design Goals

•30 fc on work plane

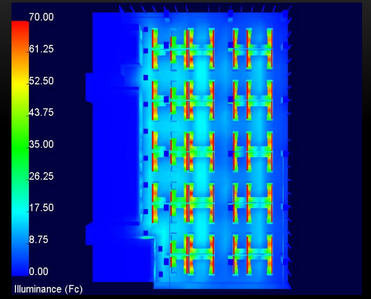
•10 fc on circulation

•Uniformity on task plane

•Reduction of glare

•Separate areas with light

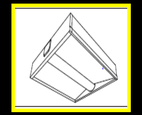
Calculations

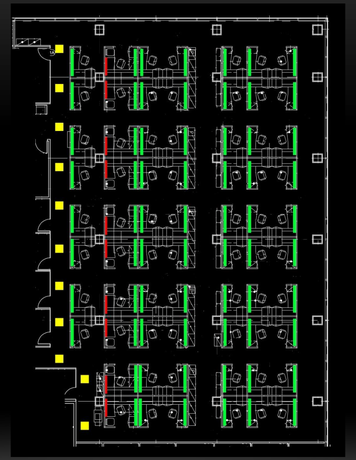


Illuminance Values (fc)		
	Average	IESNA
Workplane	37	30
Circulation Center	10.57	10
Circulation Left	22.6	10

Power Density		
ASHRAE 90.1	Actual	Difference
1.1W/ft^2	0.73W/ft^2	-0.37W/ft^2

Open Office – Lighting Plan





Renderings

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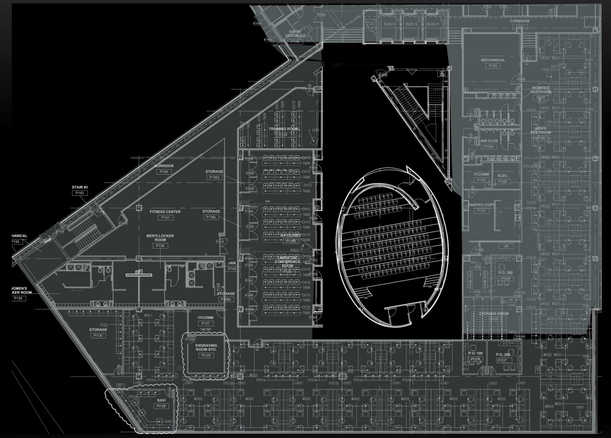
Auditorium – Floor Plan



Key Features

- **Three distinct areas**
  - Seating
  - Aisles
  - Stage
- **Multiple wall materials**
- **Non-linear surfaces**

Material		Manufacturer	Style/Color	Reflectance
Modular Carpet	CPT-5	Constantine	Broad loom/ R204850	0.08
Wood Floor	WF-1	Robins	Northern Hard Maple	0.08
Gypsum Wallboard	CLG1	-	Bright White/ Flat Sheen	0.76
Wood Veneer	WD-1	-	Quartered Red gum	0.16
Upholstered Wall Panel	UPW2	-	029 Tonic	0.2
Paint	P1		Alabaster	0.5
Plastic Laminate	PL1		New White	0.6

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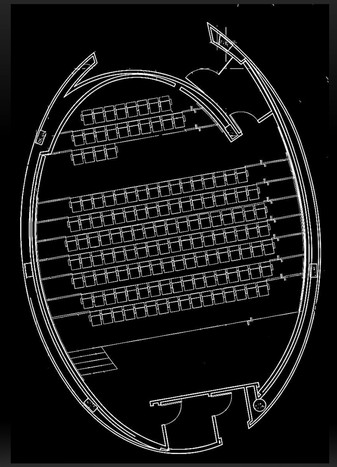


Design Goals

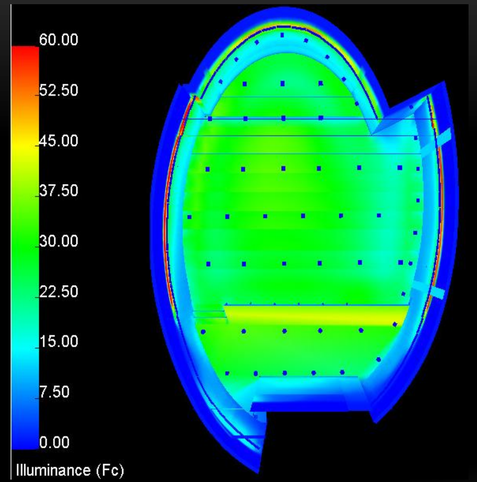
•Distinguish egress, seating, and point of interest (stage) with light.

•Provide system control and flexibility for different lighting scenes.

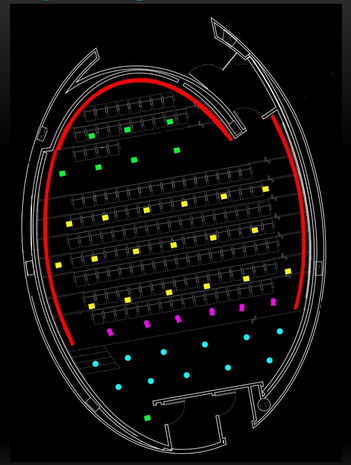
•Different functions for the stage.

•Modeling of faces.

Calculations

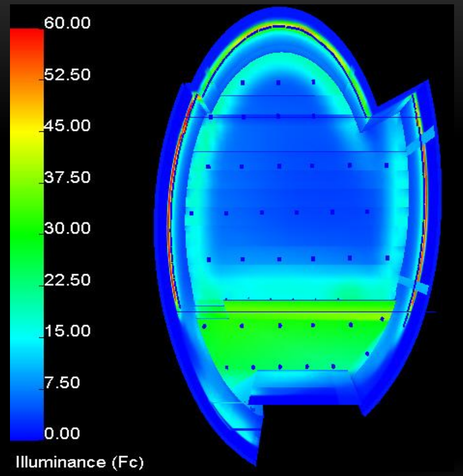


Auditorium – Lighting Plan

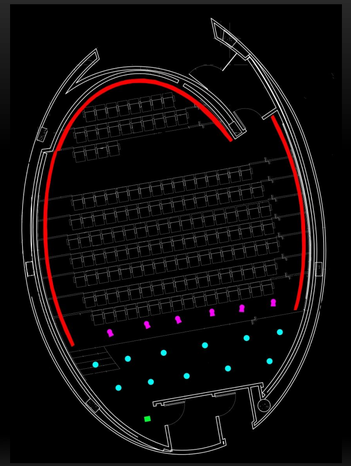


Renderings

Calculations



Auditorium – Lighting Plan



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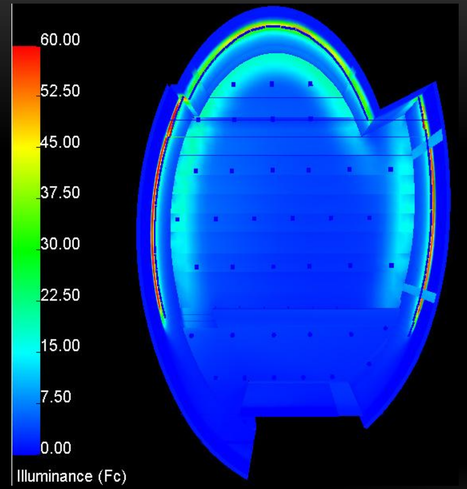
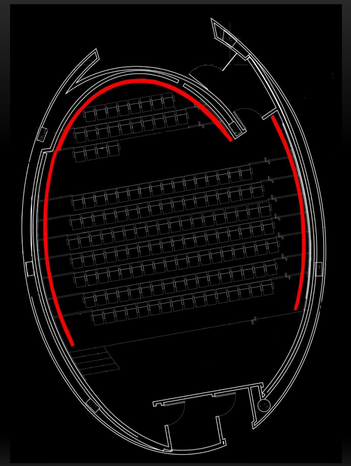


Auditorium – Lighting Plan



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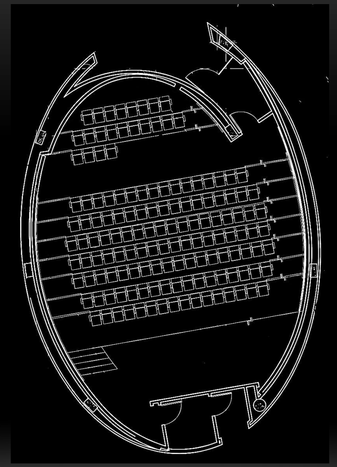
Acoustical Breadth



Design Goals

• Evaluate the existing acoustical conditions.

•Alter design and absorption value of space as needed

•Achieve a T60 reverberation time between 0.8s and 1.2s

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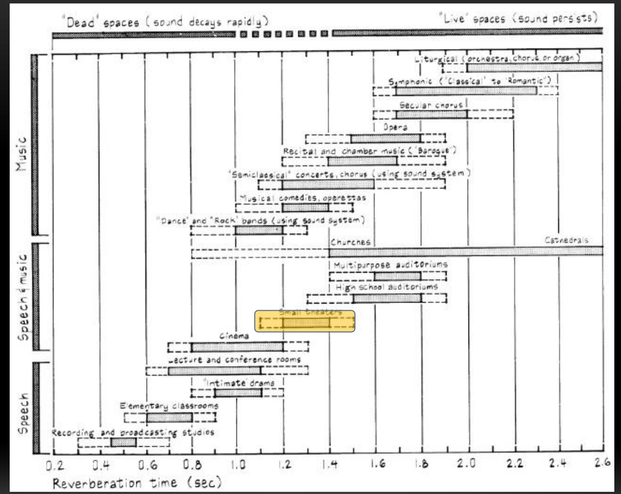
Acoustical Breadth - Existing



Calculation

Surface	Label	Description	Area (ft^2)	Absorption Coefficient	
				500Hz	1000Hz
Wall	P1	Paint on Gypsum	390	0.05	1.14
Wall	UPW2	Upholstered Wall Panel	1210	1.07	1.05
Wall	PL1	Plastic Laminate	154	0.1	0.09
Floor	WF-1	Wood Floor	345	0.2	0.17
Floor	CPT-5	Modular Carpet	735	0.14	0.35
Ceiling	CLG1	Gypsum Board	1706	0.05	0.04
Wall	WD1	Wood Veneer	370	0.2	0.17
Occupants	Audience	Audience	626	0.88	0.91

- Volume= 21545.4 ft^3
- $A = \alpha_{tot} S_{tot}$ ft^2 = 2225.3 @500Hz; 2336.6@1000Hz
- T60 = 0.161V/ (A + 4mV)s = 1.5s @500Hz; 1.4s @1000Hz

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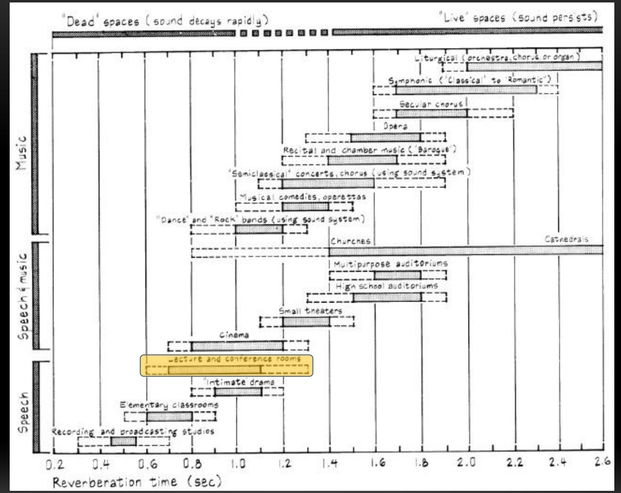
Acoustical Breadth - Revised



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Wall	PL1	Plastic Laminate	154	0.1	0.09
Floor	WF-1	Wood Floor	345	0.2	0.17
Floor	CPT-5	Modular Carpet	735	0.14	0.35
Ceiling	CLG1	Acoustic Plaster	1706	0.4	0.55
Wall	WD1	Wood Veneer	370	0.2	0.17
Occupants	Audience	Audience	626	0.88	0.91

- Volume= 21545.4 ft^3
- $A = \alpha_{tot} S_{tot}$ ft^2 = 2782 @500Hz; 3171 @1000Hz
- T60 = 0.161V/ (A + 4*m*V)s = 1.2s @500Hz; 1.1s @1000Hz

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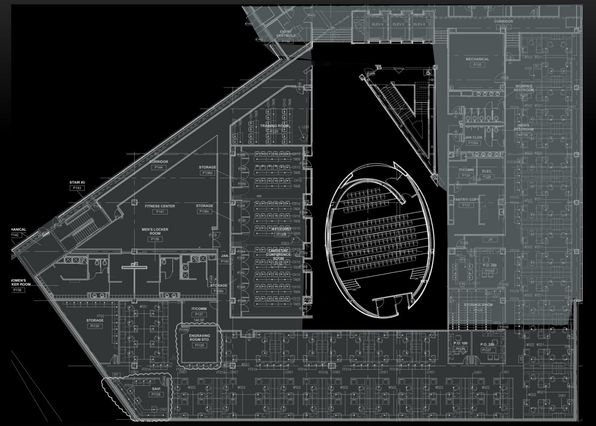
Prefunction Area – Floor Plan



Key Features

- **Glass enclosed stairwell.**
- **Auditorium within space.**
- **Elevator lobby to north.**

Material		Manufacturer	Style/Color	Reflectance
Stone Floor	ST-1	Alabama Stone Company	Honed/ Limestone	0.2
Flush Wood Base	WB3	-	6”high/Alabaster	0.2
Gypsum Wallboard	CLG1	-	Bright White/ Flat Sheen	0.76
Italian Plaster	SP1	Valley Craftsmen	Hand Applied	0.5
Gypsum wall board	GWB1	-	Alabaster sheen	0.5

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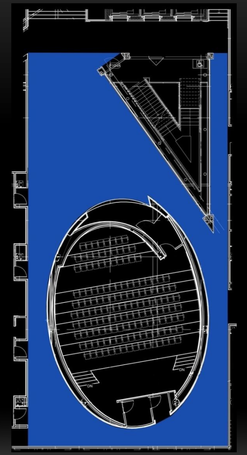
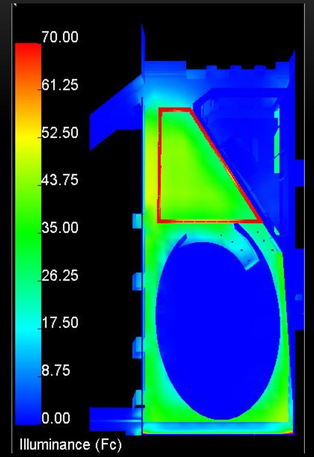


Design Goals

•30 fc uniformly

•Spacious psychological impression
- •Direct attention to perimeter
- •Direct attention toward ceiling

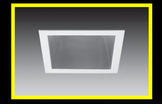
Calculations

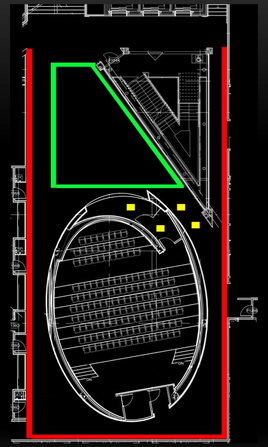


Illuminance Values (fc)		
	Average	IESNA
Floor	35.56	30

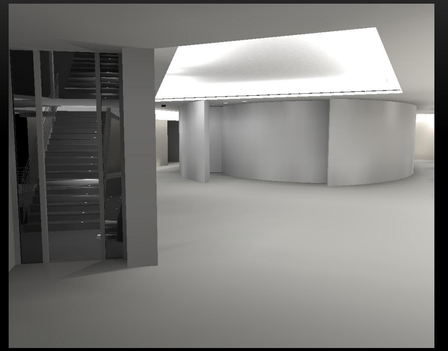
Power Density		
ASHRAE 90.1	Actual	Difference
1.3W/ft^2	1.29W/ft^2	-0.1W/ft^2

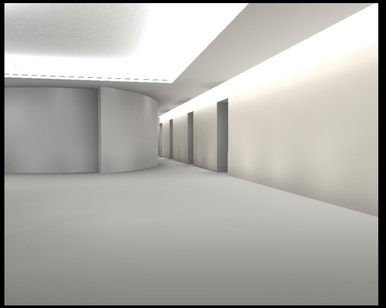
Prefunction Area – Lighitng Plan





Renderings





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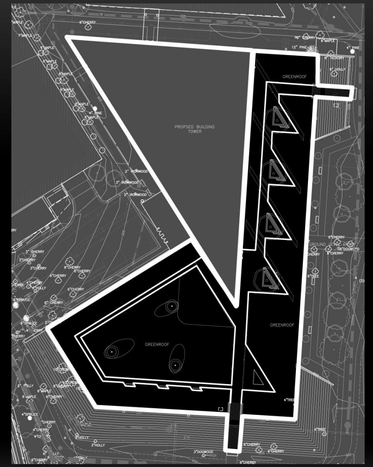
Plaza – Floor Plan



Key Features

•Stone paver paths

•Three foot tall concrete planters

•Stairs at east and west elevations

•Park benches

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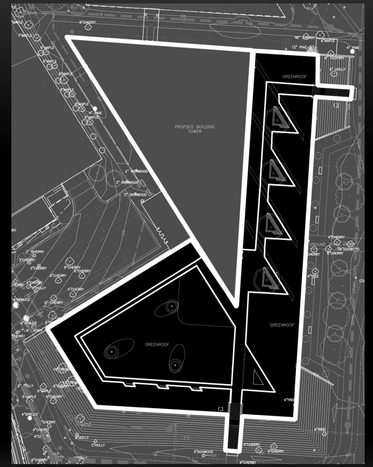
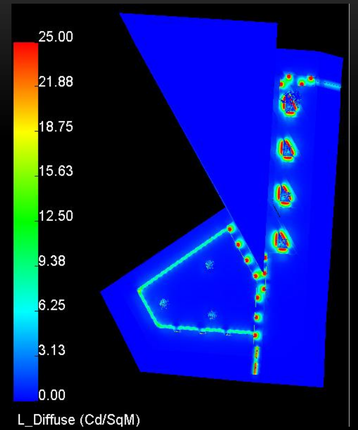


Design Goals

- 5 fc on all paths
- Provide visual clarity while maintaining a low profile
    - Not a public space
- Integrate luminaires with site
- Low mounting heights

Calculations

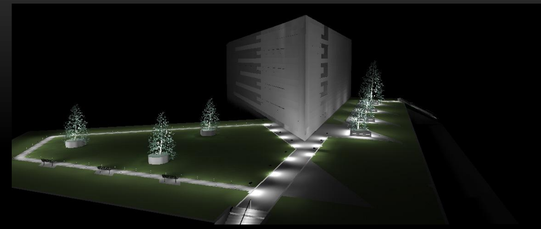


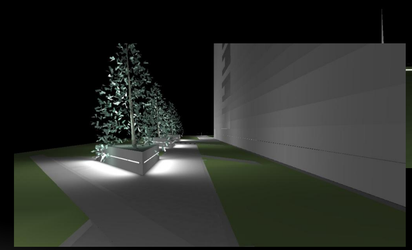
Illuminance Values (fc)		
	Average	IESNA
Large Path	5.93	5
Small Path	5.59	5

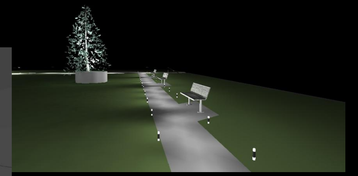
Power Density		
Large Path		
ASHRAE 90.1	Actual	Difference
1.1W/ft^2	0.73W/ft^2	-0.37W/ft^2
Small Path		
1.0W/ LF	0.5W/LF	-0.5W/LF

Plaza – Lighting Plan

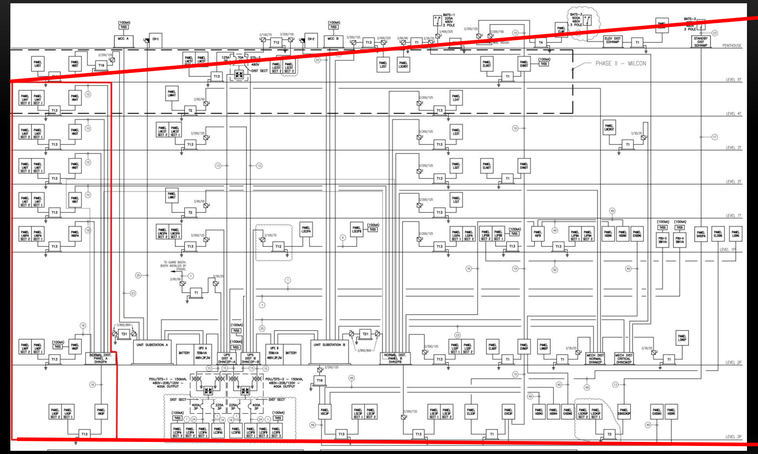
Renderings

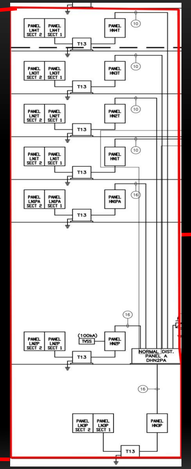


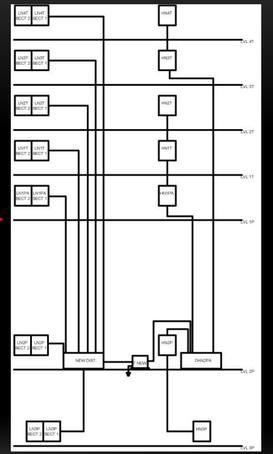




Electrical Depth – Transformer Consolidation Design Goals



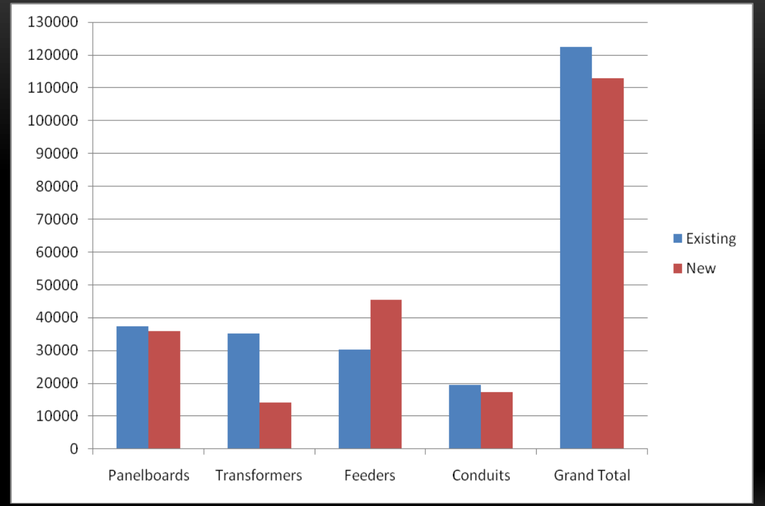


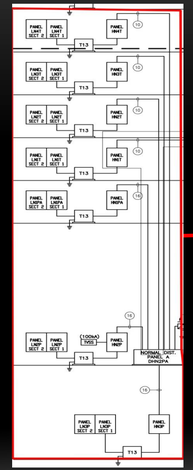


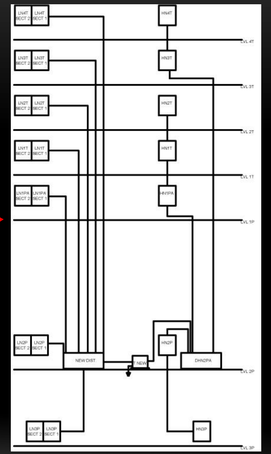
- To redesign a portion of the electrical distribution system by consolidating several smaller transformers into one larger one.

- Desired outcome is to develop a more cost efficient system

Electrical Depth – Transformer Consolidation Outcomes







- 480/277 V panel loads reduced significantly.
- Able to run several panelboards off of one feeder.
- Transformer cost reduced significantly.
- Length and size of feeders increased significantly.
- Overall $9687.67 net difference

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Conclusion

Lighting Depth
- Implemented unique design elements to for functional lighting designs.
- Met or exceeded all minimum light levels and power densities.

Acoustical Breadth
- Increased absorptivity of the room to decrease reverberation time and make space more suitable for speech.

Electrical Depth
- Consolidating transformers can lead to a more cost effective electrical distribution design.

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Dr. Richard Mistrick
Professor Ted Dannerth
Professor Robert Holland

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George VanSanford

Friends, Family, and my fellow AE students

Thank You
Questions?