The City of Green Administration Building

City of Green, Ohio

Brian Koze Lighting & Electrical 4/13/2011

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Full Thesis Scope of Work

- **Lighting Redesign**
  - **Entrance Structure**
  - Main Lobby
  - Council Chambers
  - **Planning & Engineering Workspace**
- **Electrical Requirements**
  - Branch Circuit Redesign
  - **Depth 1: Addition of UPS System**
  - Depth 2: Panel Consolidation
- **Mechanical Breadth**
- Architectural Breadth

Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

Presentation Contents

- **Lighting Redesign**
  - **Entrance Structure**
  - **Planning & Engineering Workspace**
- **Electrical Depth**
  - **Addition of UPS System**
- **Mechanical Breadth**
  - **Water Loop Heat Pump vs. Variable Refrigerant Flow System**

Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Building Summary

- City of Green, Ohio
- 3 stories, 2 above grade
- 53,671 SF
- Occupied by various city employees

Outline

Introduction

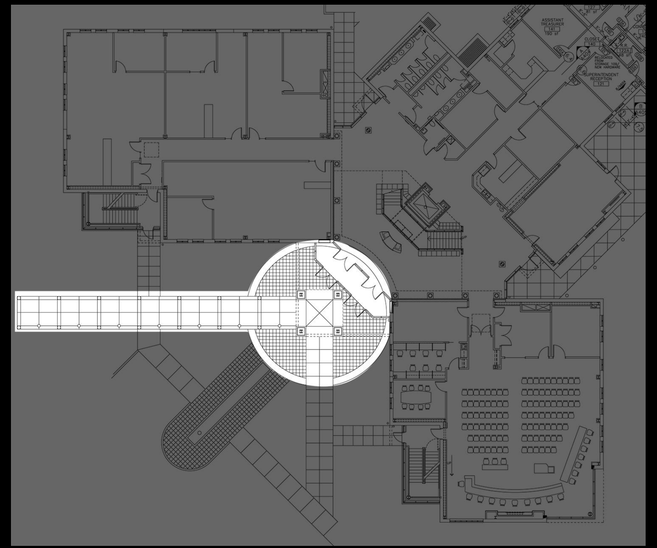
Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Building Summary



Location of Lighting Redesign Spaces

- **Entrance Structure**
  - **Outdoor Space**

- Planning & Engineering
  - Work Space

Outline

Introduction

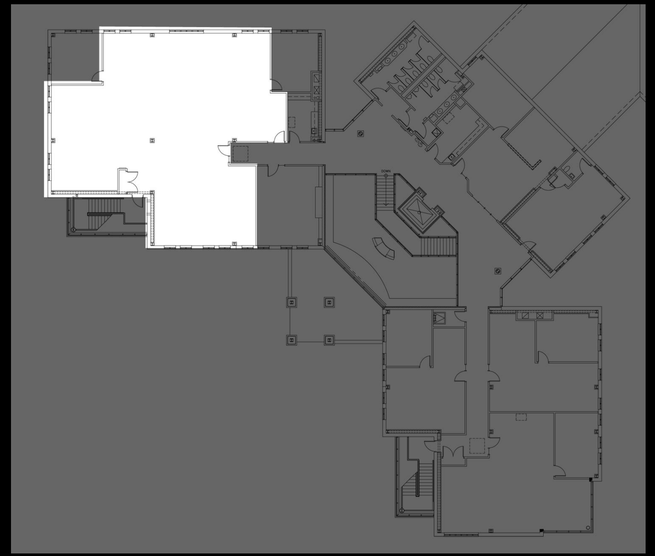
Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Building Summary



Location of Lighting Redesign Spaces

- Entrance Structure
  - Outdoor Space

- **Planning & Engineering**
  - **Work Space**

General Lighting Design Goals

Inspiration from building forms

Create visually interesting, yet professional atmosphere

Enhance **occupant experience**

Outline

Introduction

Lighting Redesign

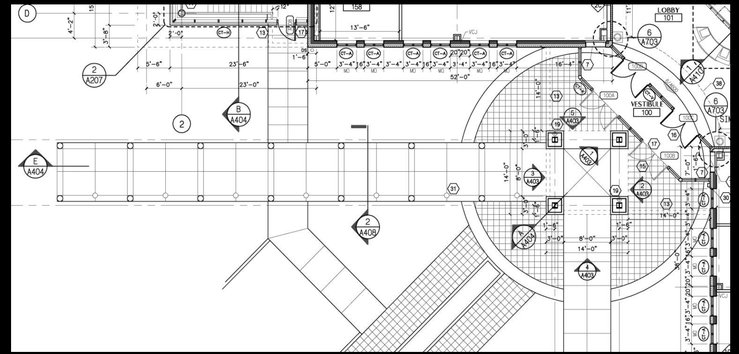
Electrical Depth

Mechanical Breadth

City of Green Administration Building

Entrance Structure

- 9’-6” covered walkway leading to clock tower
- 43’ tall at highest point
- Canopy ceiling height = 9’-4”



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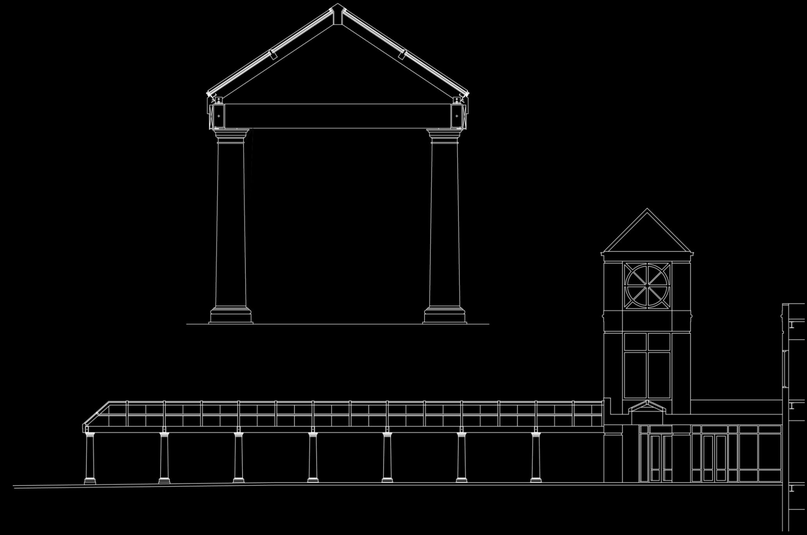

Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

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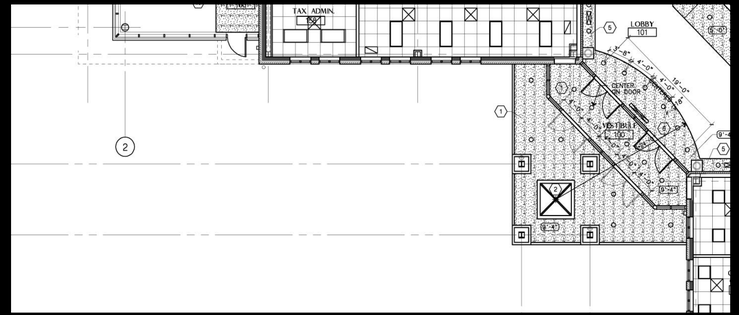

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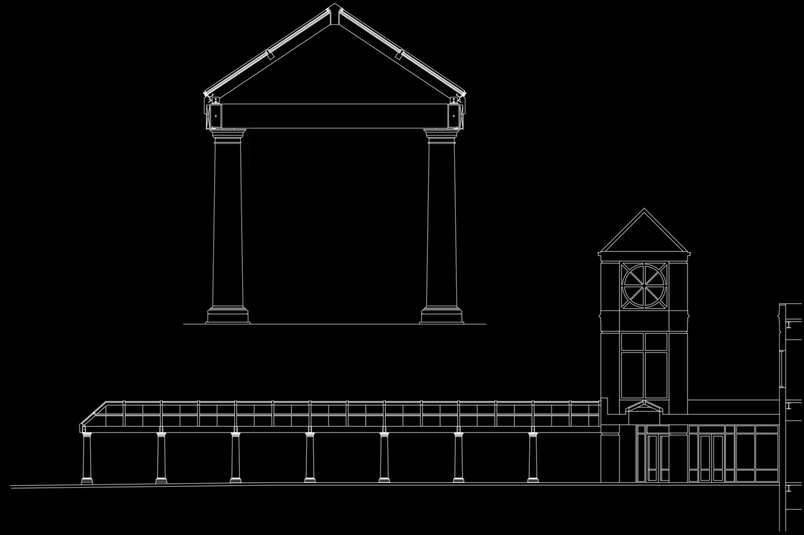


Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Entrance Structure

- Create **focal point** without visual clutter
- **Transition** to interior with increasing Illuminance
- Minimize **Light Pollution**
- Meet IESNA **Illuminance Values**
  - **5 fc Horizontal**
  - **3 fc Vertical**

Design Criteria

Outline

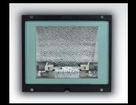
Introduction

Lighting Redesign

Electrical Depth

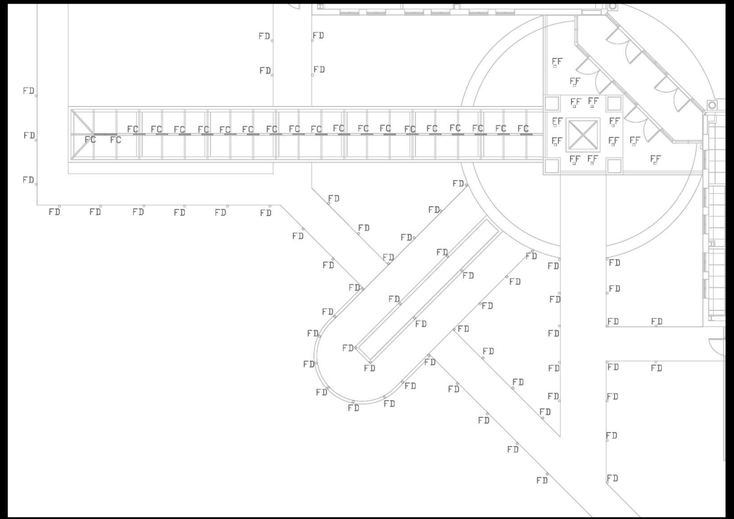
Mechanical Breadth

City of Green Administration Building



Entrance Structure

Lighting Solution



Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

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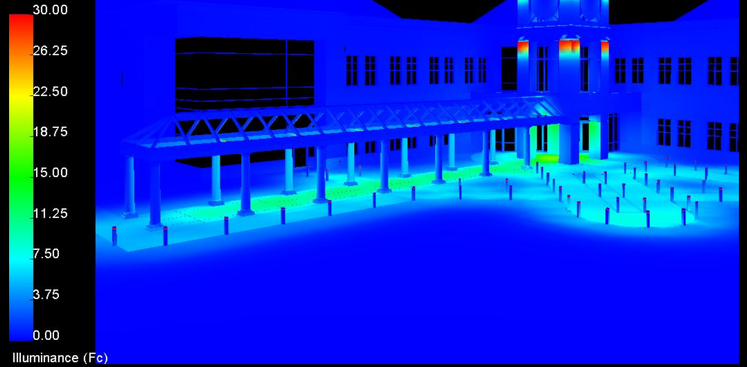
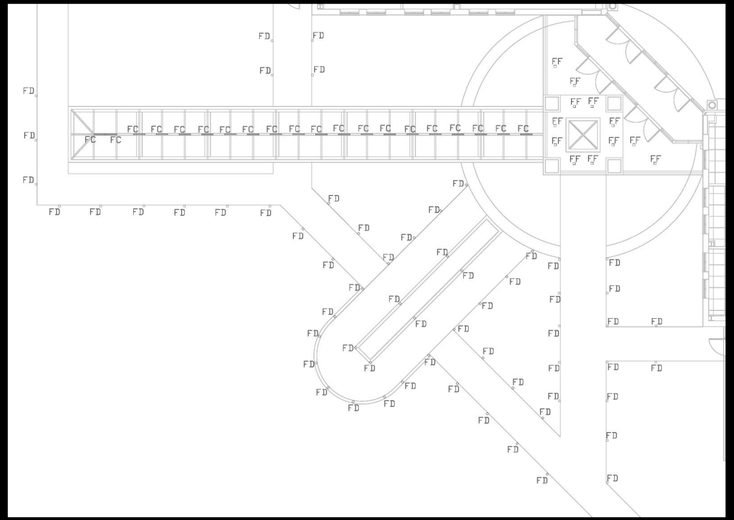


Lighting Solution



Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

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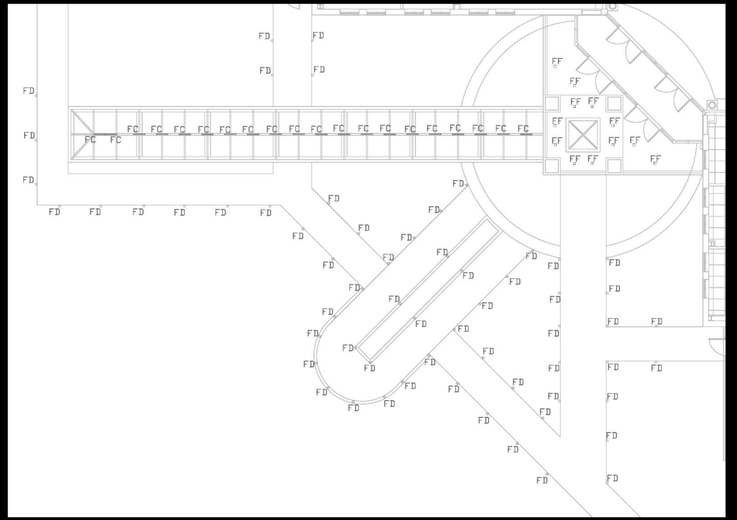


Outline

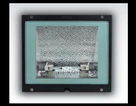
Introduction

Lighting Redesign

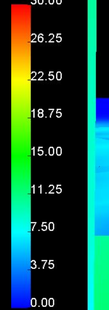
Electrical Depth

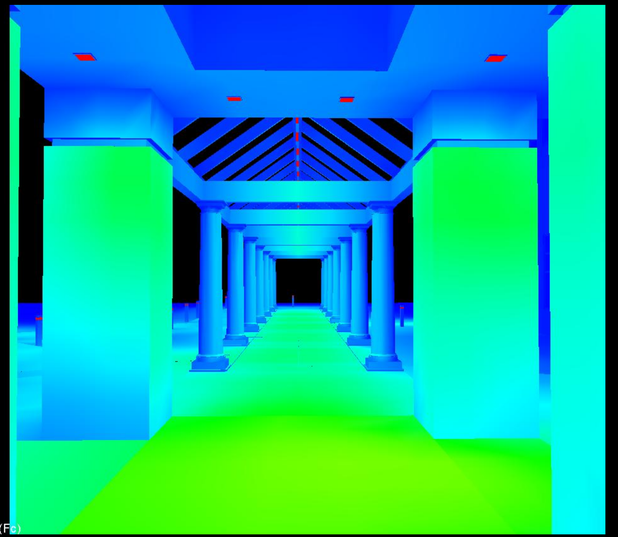
Mechanical Breadth

City of Green Administration Building



Entrance Structure





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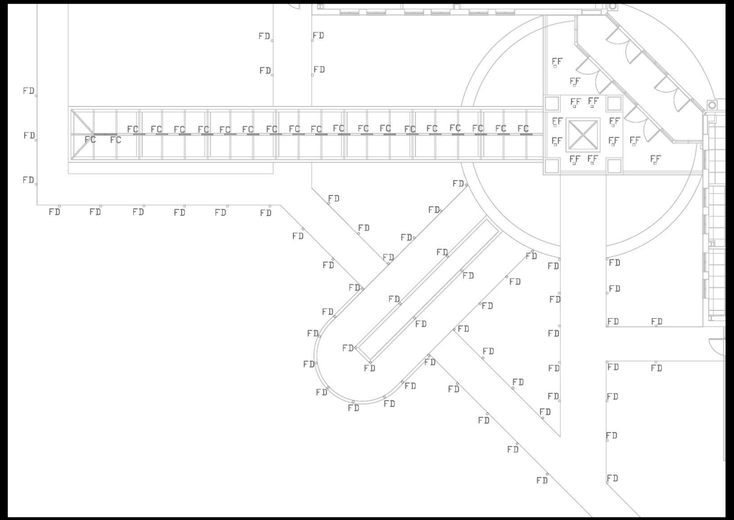


Outline

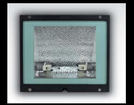
Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

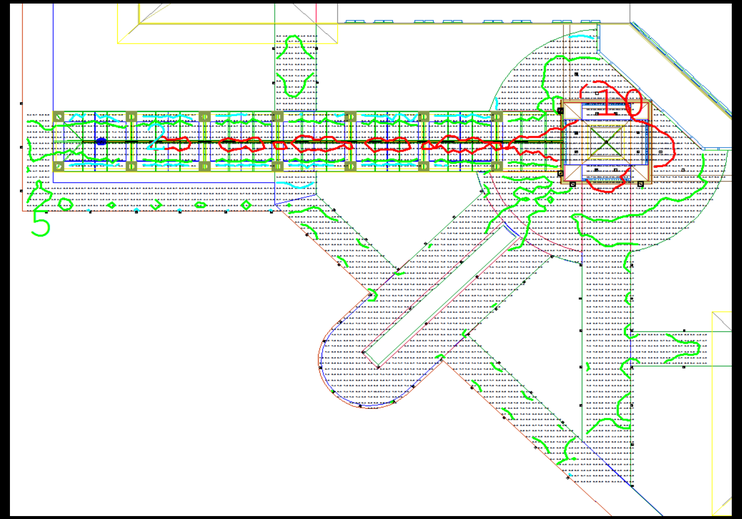
City of Green Administration Building



Entrance Structure

- UWLR = 0.016
- Average fc = 6.40

Lighting Solution



Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

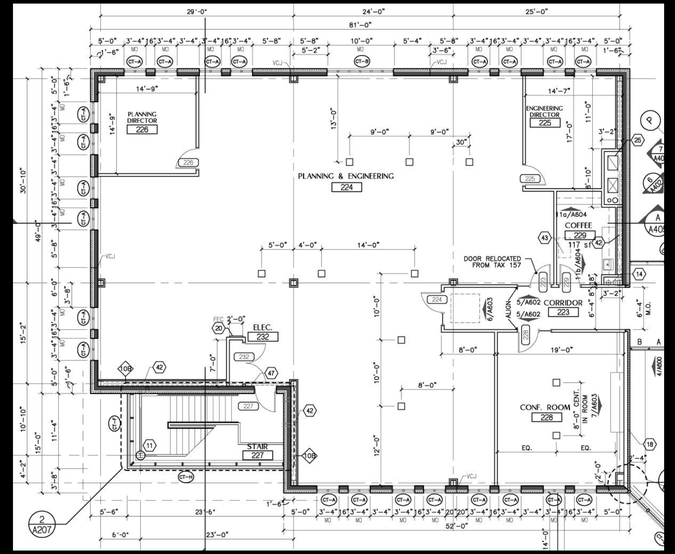
City of Green Administration Building

Planning & Engineering Workspace

- Ceiling height = 12 ft.
- Area = 3120

- Open office
- No permanent furniture

Spatial Description



City of Green Administration Building

Planning & Engineering Workspace

Design Criteria

- Achieve **balance** between space flexibility and existing furniture driven design
- Minimize Direct / Reflected Glare
- IESNA Illuminance Criteria
  - **40 fc on work plane**
  - **50 fc maximum**
- Add **Visual Interest** to the space

Outline

Introduction

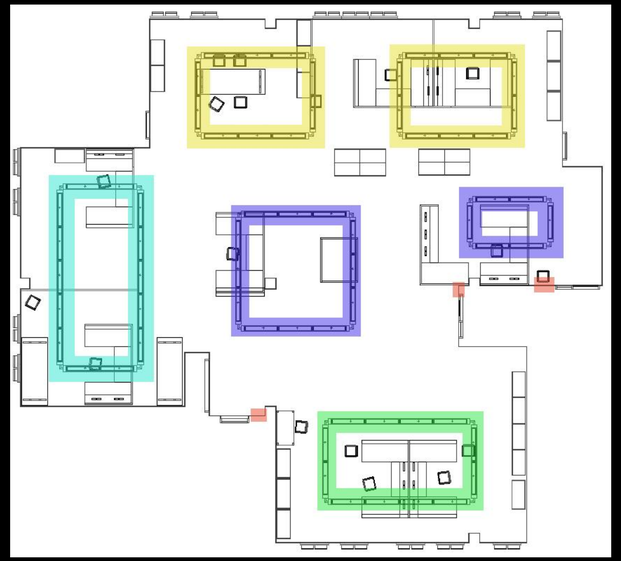
Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Planning & Engineering Workspace



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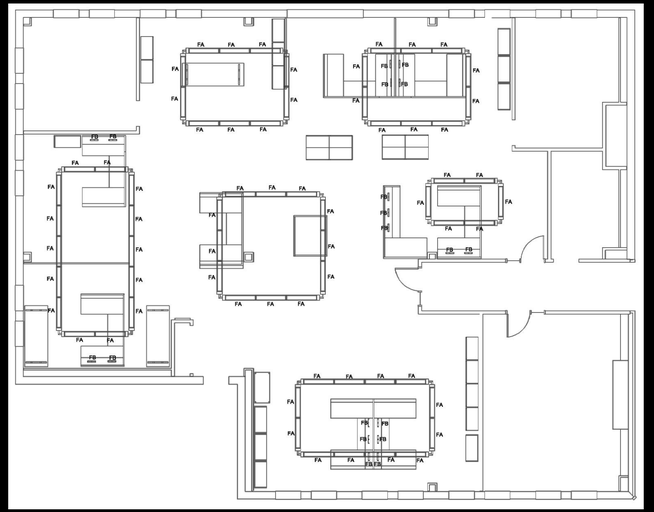


Outline

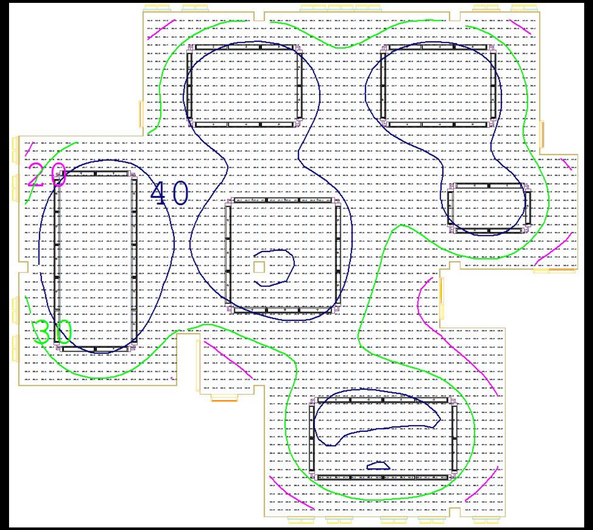
Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

- Average Work plane Illuminance = 35.80 fc
- Maximum Work plane Illuminance = 48.2 fc



Outline

Introduction

Lighting Redesign

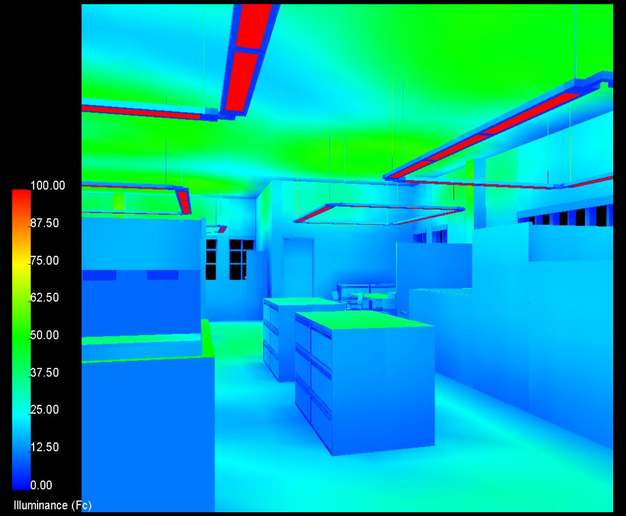
Electrical Depth

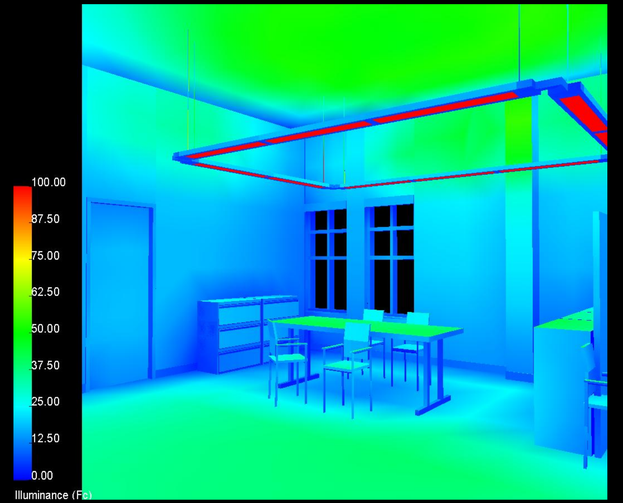
Mechanical Breadth

City of Green Administration Building

Planning & Engineering Workspace

Lighting Solution





Outline

Introduction

Lighting Redesign

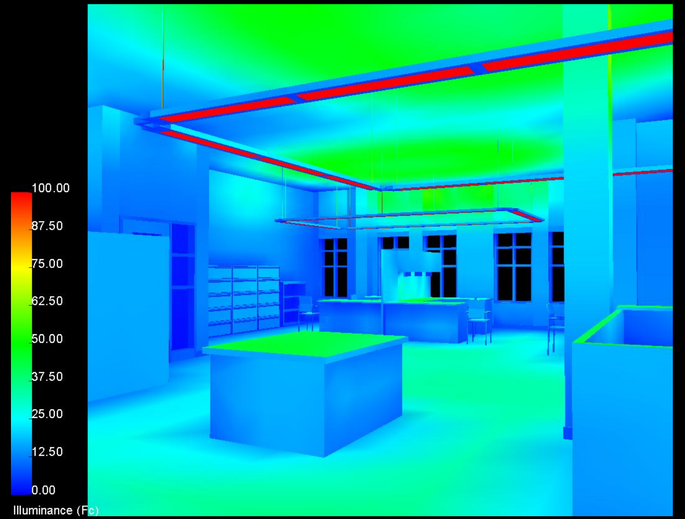
Electrical Depth

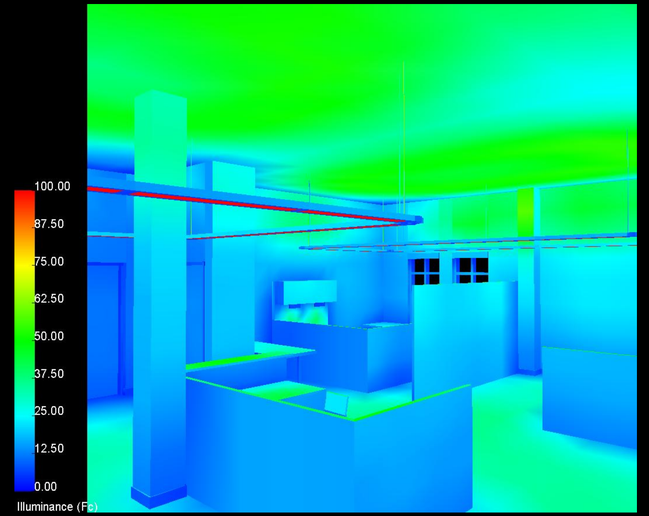
Mechanical Breadth

City of Green Administration Building

Planning & Engineering Workspace

Lighting Solution





Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

City of Green Administration Building

Planning & Engineering Workspace

Lighting Solution

Introduction

Lighting Redesign

Electrical Depth

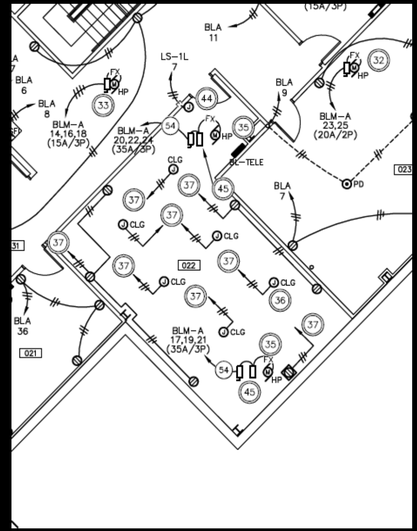
Mechanical Breadth

City of Green Administration Building

Electrical Depth

Addition of UPS System

- Incorporate UPS system to protect important computer systems and servers
- 30 second generator start up time
- Locate in large basement server room
- Smaller ground level server room serviced through panelboard



Outline

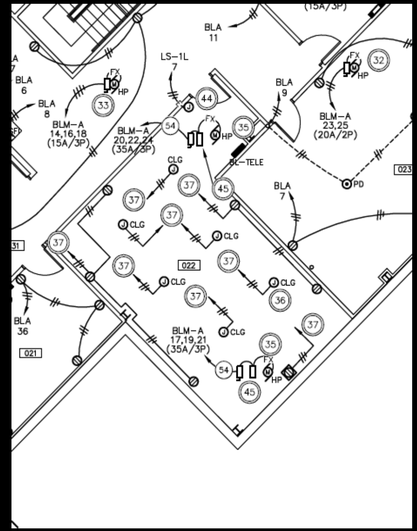
Introduction

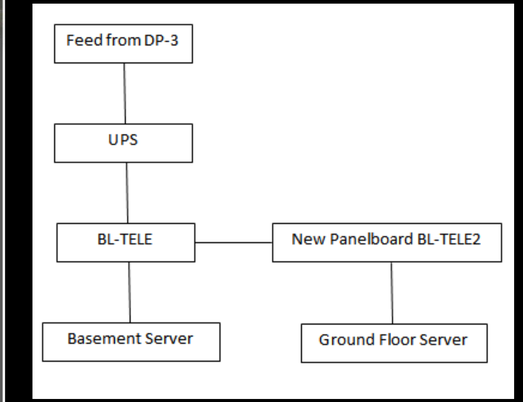
Lighting Redesign

Electrical Depth

Mechanical Breadth

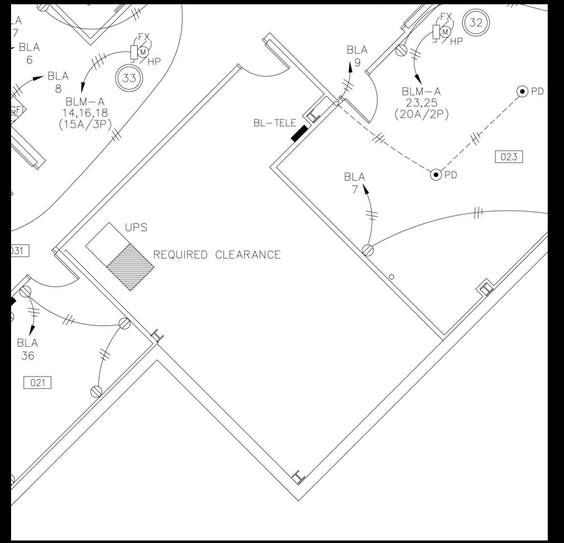
- Sized based on 200 W/SF estimate server farm load
- Total Area = 374.7 SF
- Estimated electrical load = 74.94 kW





- Eaton 9390 UPS (20 – 160 kVA rating)
- Meet required clearances

Table B. UPS Cabinet Clearances	
From Top of Cabinet	Minimum clearance over the UPS cabinet is 457.2 mm (18 in.) for ventilation
From Front of Cabinet	914.4 mm (36 inches) working space
From Back of Cabinet	None required
From Right Side of Cabinet	None required
From Left Side of Cabinet	None required



Outline

Introduction

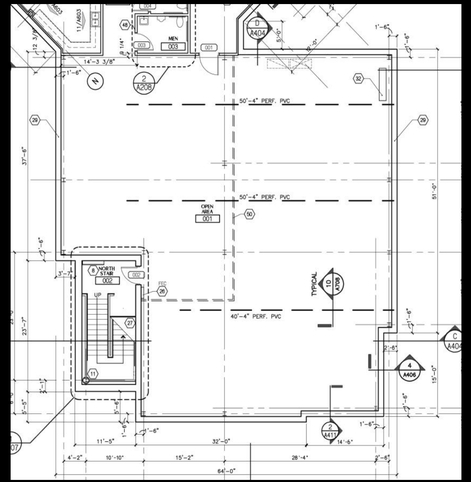
Lighting Redesign

Electrical Depth

Mechanical Breadth

- Change existing Water Loop Heat Pump to a Variable Refrigerant Flow System (VRF)
- Increased efficiency
- Energy Savings

- Assumptions
  - Existing Load Calculations are correct
  - New system can be designed based on listed cooling and heating capacity of existing equipment



- Numerous unitary heat pumps throughout building
- New system uses localized heat pumps with central compressors
- Locate where noise will not be an issue

- Assumptions
  - Existing Load Calculations are correct
  - New system can be designed based on listed cooling and heating capacity of existing equipment

- Total Cooling Capacity
  - 1,501,300 BTU / hr Total Cooling Capacity (125 tons)

- Energy comparison estimate using typical design values for the area and building type

Description	% Total Capacity	Capacity (BTU / hr)	# Hours	BTU
Occupied Cooling	100	1,501,300	328.5	493,177,050
Occupied Cooling	75	1,125,975	438	493,177,050
Occupied Cooling	50	750,650	657	493,177,050
Occupied Cooling	25	375,325	766.5	287,686,612.5
Unoccupied Cooling	33.33	500,383	328.5	164,375,815.5
Unoccupied Cooling	25	375,325	438	164,392,350
Unoccupied Cooling	16.6	249,216	657	163,734,912
Unoccupied Cooling	8.3	124,608	766.5	95,512,032
Occupied Heating	100	750,000	328.5	246,375,000
Occupied Heating	75	562,500	438	246,375,000
Occupied Heating	50	375,000	657	246,375,000
Occupied Heating	25	187,500	766.5	143,718,750
Unoccupied Heating	66.67	500,025	328.5	500,353.5
Unoccupied Heating	50	375,000	438	164,250,000
Unoccupied Heating	33.3	249,750	657	164,085,750
Unoccupied Heating	16.6	124,500	766.5	95,429,250
Totals			1 Year	3,662,341,975

Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

Total Electricity Cost per Year New System = $ 19,435.86

Total Electricity Cost per Year Old system = $25,153.98

Total Savings per Year = $ 5718.12

Outline

Introduction

Lighting Redesign

Electrical Depth

Mechanical Breadth

Questions?