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Lighting + Electrical

City of Green Administration Building

City of Green, Ohio

[Link to thesis portfolio](#)

Final Thesis Report

Date of Submission

Faculty Consultant: Dr. Mistrick

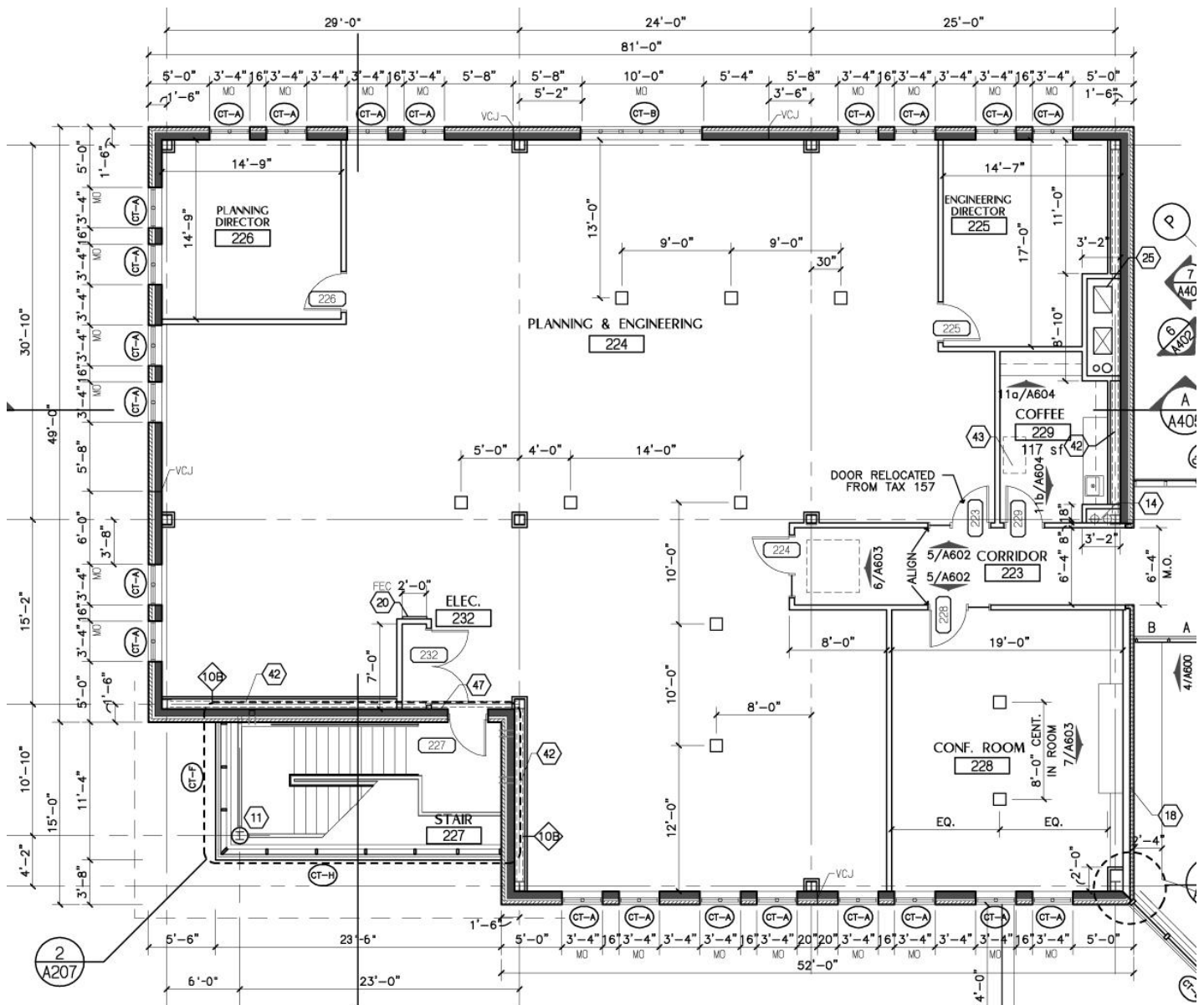
# Lighting Design: Planning & Engineering Large Work Space

## Spatial Description

The Planning and Engineering department of the City of Green is a relatively simple space with few distinguishing features. The space is an open office and contains cubicle style work stations, drafting tables, filing cabinets. These elements are spread out with a lot of space in between them in an inconsistent pattern.

Area: 3120 SF      Ceiling Height = 9 ft.

## Floor plan



**Finishes (Materials)**

Material	Location	Reflectance
Armstrong acoustical ceiling tile "Dune Second Look II." Appears as a 24" by 24" tile because of additional scoring. Is actually 48" by 24." Fine texture.	Ceiling	0.84
Carpet, Bolyu / On the Edge Color	Floor	0.2
Painted GWB, "waterbury cream" color	Walls	0.79
Painted GWB, "barrington green" color	Walls	0.49
Painted Door and Window Frames	Frames	0.79
Wood Doors	Doors	0.22
Painted wood baseboard	Bottom 4" of Walls	0.14
Glazing	Windows	.44 Transmittance

**Furnishings**

The space contains cubical style workstations, drafting tables, shelving units, chairs, and partitions. The layout was estimated from photographs of the space. All of this furniture is easily moved or reconfigured; therefore the lighting design must match the flexibility of the space.



## Visual Tasks

The visual tasks for the space are consistent with typical engineering tasks. This means heavy VDT use when using modeling software as well as the viewing of printed out drawings and plans. Every cubicle style workspace has a computer station and a lot of table space for laying out full sized drawings. Typical reading, writing, and filing tasks are also commonplace.

## Design Criteria

### Space Type in IESNA Lighting Guide

Open plan office with intensive VDT use

### Illuminance Values Based on IESNA Lighting Guide

Horizontal Illuminance: 30 fc

Vertical Illuminance: 5 fc

Because of the heavy VDT use in the space, the Illuminance should not pass 50 fc on the work plane at any point.

### Power Allowances: ASHRAE Standard 90.1

Using the Space-by-Space method for an open office plan and Table 9.6.1, the power allowance is equal to 1.1 W/SF.

Area = 3102 SF

$(3120 \text{ SF}) * (1.1 \text{ W/SF}) = 3432 \text{ W Lighting Power Allowance}$

### Luminance of Room Surfaces

Reducing luminance contrast between surfaces while still maintaining a slightly higher luminance on the work plane or task will help with dark and light adaption and disability glare. The following luminance ratios should not be exceeded:

Between paper task and adjacent VDT screen: 3:1 or 1:3

Between task and adjacent dark surroundings: 3:1 or 1:3

Between task and remote surfaces: 10:1 or 1:10

[IESNA 11-3]

Overall, the ceiling luminance should not exceed 850 cd/m<sup>2</sup> as well as the 10:1 ratio.

### Direct Glare

Direct glare from the luminaires needs to be avoided by choosing proper fixtures for the application. This type of glare would be very distracting for the employees.

### Reflected Glare (Source – Task – Eye Geometry)

Surface reflectance's and furniture layout need to be considered when laying out luminaires to ensure there is no possibility for reflected glare.

### **Uniformity of Light Distribution on Task Plane**

The light on work surfaces such as desks and drafting tables must be very uniform to allow the occupants to perform the visual tasks of reading and writing without difficulty.

### **Appearance of Space and Luminaires**

The overall appearance of the office should be uniform, but contain elements that make the space an enjoyable place to work by adding visual interest.

### **Daylight Control**

All windows in the space are equipped with MechoShade "Mecho 5" chain driven roller shades. The one larger window has the same type of roller shade, but is motor controlled via a switch.

## **Lighting Solution Overview**

Schematic design for this space began with the idea to use indirect pendants to achieve a uniform distribution of light throughout the space and meet the design criteria. Overall, the solution as it currently exists does not meet all design criteria and needs to be improved upon. The direct/indirect style of luminaire successfully limits direct and indirect glare, and provides adequate illumination to the work plane in most cases. The illumination value does not go above 50 anywhere on the work plane. The issues have to do with low illumination values on some parts of the cubicle desks due to shadows caused by the overhead shelving units. This can be fixed with a variety of options including task lighting, and will be investigated further.

## **Luminaire Schedule (will be in chart form for final submission)**

Type: FA

Image:



Description: Lightolier Lytecel linear fluorescent direct/indirect Pendant, 48" modular length, low iridescence semi-specular aluminum parabolic

Catalog Number: LL4MF8LX154120PG

Lamp Type: Philips 28W T5

Ballast: Universal B254PUNV-D

Input Watts: 32W

Volts: 120V

Quantity:

## Control System

### Requirements: ASHRAE Standard 90.1

Standard 90.1 requires automatic lighting shutoff for interior lighting in buildings larger than 5000 SF

### Space Control Scheme

## Performance Summary

### Light Loss Factors

Luminaire Dirt Depreciation

$$LLD = .94$$

- Found via new method for finding luminaire dirt depreciation, Case "X"

Lamp Lumen Depreciation

$$LLD = \text{Mean Lumens} / \text{Initial Lumens} = 4450 / 5000 = .89$$

Ballast Factor = 1.0

Total LLF = .84

## Renderings and AGI Calculations

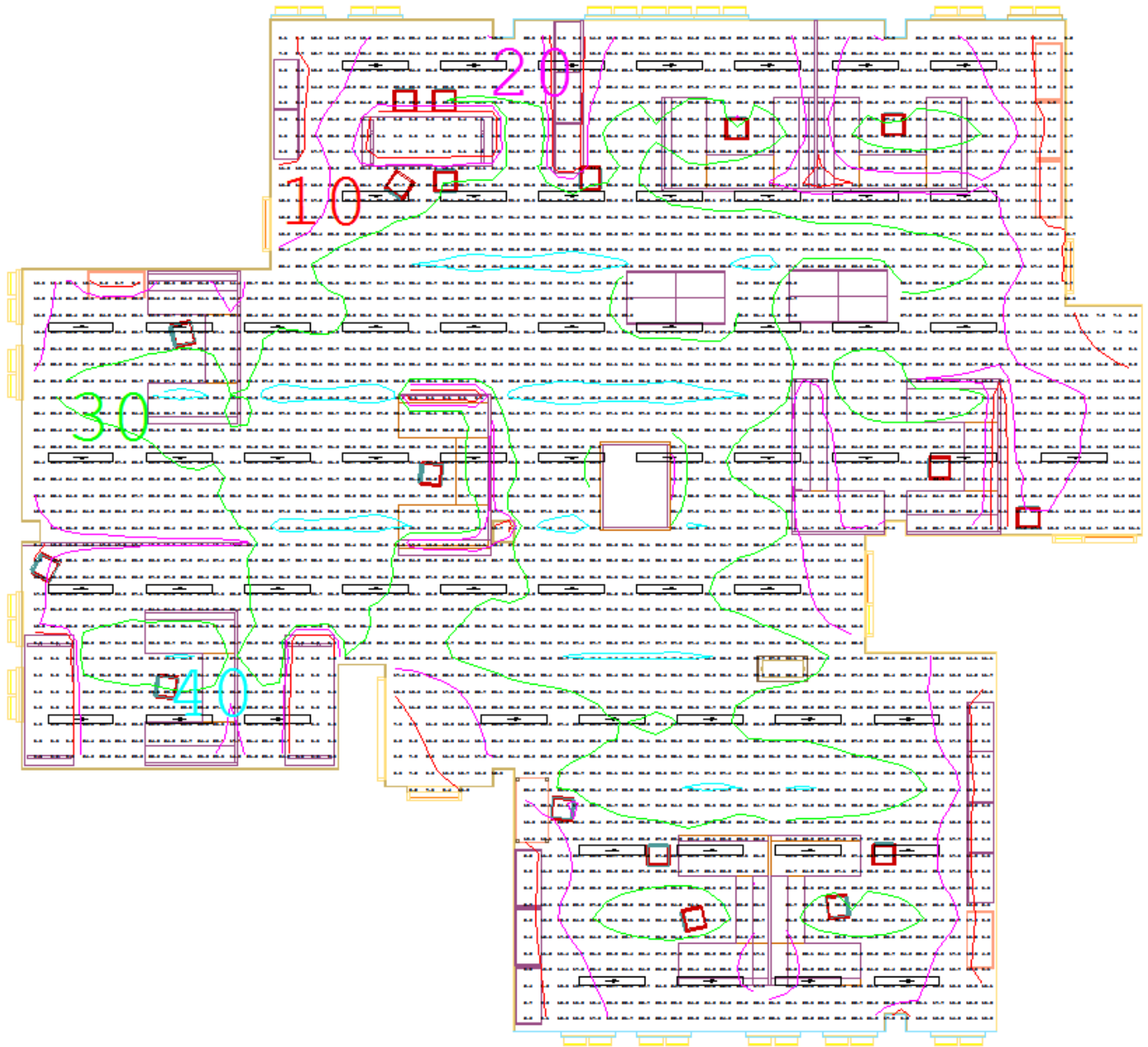
### Renderings







### AGI Calculations



### Workplane Illuminance

Average = 26.28

Maximum = 43.1

