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Project Description and Concept

The design used for this project is taken from the studio assignment in ARC 452. The class was asked to design an ecology center for Southern Illinois. Located on the Mississippi River in Chester, IL, the site is one of the most challenging features of the design. The steep hillside provides great views of the Mississippi and unique opportunities for the building.

The design focuses on the interaction between organisms and their environment. The buildings move down the site, reaching into the landscape, and bringing some of it inside. This project will focus on a power and light plan located in the upper public building. As the building moves out from the hill, outcroppings are formed on the exterior facades to allow for daylighting, cross ventilation from southeast to northwest, and views out to the landscape. The interior features a large quantity of natural light to support the plant life in the atrium and the green wall. The green wall also serves as a sound absorption strategy in the atrium and adjacent spaces.

The portion selected to calculate is a classroom and laboratory on the first sub level. Both areas include a lot of natural light with overhangs to block direct sun during the summer months and light shelves to bounce light further into the room for the rest of the year. Lighting was selected to create a pleasant learning environment as well as highlight the green wall in the classroom.
Legend
1. Entry
2. Meeting Room
3. Greenhouse
4. Office
5. Lounge

Ground Level: Floor Plan | Scale: 1" = 20'-0"
Sub Level 1: Floor Plan  |  Scale: 1" = 20'-0"

Legend
1. Toilet
2. Lab
3. Classroom
4. Greenhouse
5. Meeting Room
Legend
1. Storage
2. Auditorium Lobby
3. Cafe
4. Greenhouse
5. Toilet

Sub Level 3: Floor Plan  Scale: 1" = 20'-0"
Calculations - Classroom

1. Average maintained illumination for a classroom : 50 fc or approximately 500 lux
   Daylight was not factored into calculation. However, the lighting was zoned to account for daylight on sunny days

2. Number of luminaires = \( \frac{\text{footcandles desired} \times \text{room area}}{\text{CU} \times \text{LLF} \times \text{lamps/luminaire} \times \text{lumens/lamp}} \)
   \( \text{fc} = 50 \)
   Area = 1034 sq ft.
   CU = 62 - found on Metalux specification sheet using the following data
   -rc = 80%
   -rw = 50%
   rcr = 5
   LLF = 1-Metalux specification
   1 lamp / luminaire
   4520 lumens / lamp - Metalux Specification
   \( \frac{50 \times 1034}{4520} = 18.45 = 19 \text{ Luminaries} \)

16 - Metalux Encounter 2 x 4 Modular LED & 3 - 23XR Wall Washer Direct-Indirect (3068 lumens/lamp)

3. Average footcandles = \( \frac{\text{lumens} / \text{lamps} / \text{luminaire} \times \text{CU} \times \text{LLF}}{\text{Area of room}} \)
   \( = \frac{4520 \times 1 \times 62 \times 1}{1034} = 2.71 \)

4. Power Density = \( \frac{\text{footcandles desired}}{\text{source efficacy} \times \text{CU} \times \text{LLF}} \)
   \( = \frac{50}{118.9 \times 62 \times 1} = .678 \text{ watts / sq ft} \)
   Maximum for classroom = 1.2 watts/sq ft

5. These calculations were double checked using the calculator from the manufacturer Cooper Industries

Calculations - Laboratory

1. Average maintained illumination for laboratory : 50 fc or approximately 500 lux

2. Number of luminaires = \( \frac{\text{footcandles desired} \times \text{room area}}{\text{CU} \times \text{LLF} \times \text{lamps/luminaire} \times \text{lumens/lamp}} \)
   \( \text{fc} = 50 \)
   Area = 2095 sq ft.
   CU = 62 - found on Metalux specification sheet using the following data
   -rc = 80%
   -rw = 50%
   -rcr = 5
   LLF = 1-Metalux specification
   1 lamp / luminaire
   4520 lumens / lamp - Metalux Specification
   \( \frac{50 \times 1034}{4520} = 37.37 = 37 \text{ Luminaries} \)

3. Average footcandles = \( \frac{\text{lumens} / \text{lamps} / \text{luminaire} \times \text{CU} \times \text{LLF}}{\text{Area of room}} \)
   \( = \frac{4520 \times 1 \times 62 \times 1}{2095} = 1.33 \)

4. Power Density = \( \frac{\text{footcandles desired}}{\text{source efficacy} \times \text{CU} \times \text{LLF}} \)
   \( = \frac{50}{118.9 \times 62 \times 1} = .678 \text{ watts / sq ft} \)

5. These calculations were double checked using the calculator from the manufacturer Cooper Industries

Building Power Density

Maximum Lighting Power Density = Area of building x 1.2 watts/ sq ft = 28,000 x 1.2 =33,600 max watts

Luminaire Schedule

<table>
<thead>
<tr>
<th>Mark</th>
<th>Manufacturer &amp; Description</th>
<th>Lamps</th>
<th>Finish</th>
<th>Mounting</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cooper Industries Metalux Encounter 2 x 4 Troffer</td>
<td>LED</td>
<td>High reflectance baked matte white enamel finish</td>
<td>Ceiling</td>
<td>Can be equipped with automatic daylighting and occupancy controls</td>
</tr>
<tr>
<td></td>
<td>Cooper Industries 23XR Wall Washer Direct-Indirect</td>
<td>Fluorescent</td>
<td>Durable, low-gloss white</td>
<td>Ceiling</td>
<td>Can have different finishes 1'-3' mounting distance from vertical surface</td>
</tr>
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Distribution Curves

Metalux Encounter 23XR Wall Wash

References
