- academic campus of Lyceum of the Philippines
- Bray, Makiling, Calamba,

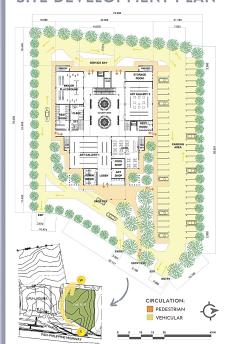
 A mixed-use building that provides openness for an indoor-outdoor connection needed by various agendas: food production training, art learning, health and recreation, while catering to some of the needs of LPU-Laguna

- Create a lighting environment suitable for the purpose of each space while providing visual comfort and adapting to modern lighting technologies.
- Identify the visual task and light levels for each task, then consider other factors that may require a higher or lower level of illumination to provide adequate lighting.
- · Arrange fixtures in such a way that they are unobtrusive but still complement the architecture.
- Lighting must have proper quality.
- Conserve energy, environmental resources and money by integrating daylighting and choosing energy efficient light sources and optically efficient fixtures.

- . Building Orientation: Elongated at East-West axis to reduce direct sun exposure.
- . The layout of the building, especially the presence of courtyard, provides natural, indirect light into the spaces, reducing the need for artificial lighting during the day.
- . Windows facing North and South are dominant.
- Tall trees are placed at the West Side to block direct harsh sunlight while providing natural sunshade.
- Horizontal sun shading at south side while vertical fins at east side to reduce sun exposure.
- · Side lighting such as windows of different sizes cater the lighting needs of areas such
- Reflective elements like white paint and glossy materials are utilized to spread out the natural light coming from the outside.



SITE DEVELOPMENT PLAN



- · Located at the third floor
- · Has south and north-facing windows Dimensions: 12.0m x 14.0 m

A B C D E E F G

H

0

(0)

POCH 1

3

SCULPTURE ETILORO

account.

TRANSIS ROOM 3

LIGHTING DESIGN

APPROACH

Select light-emitting diode (LED) for

· This will also allow immediate full

For woodshop lighting, provide no

glare and more of a daylight effect.

Use 5000K CCT which is a cool white,

· Calculate the number of fixtures needed

by the woodshop using Lumen

Method for higher accuracy.

brightness when turned on.

lower energy consumption, i.e., greater

- Area: 168.0 sq.m.
- Height: 2.9m · Work plane Height: 0.88m

Изтивси

- · Based on the Illuminating Energy Society of North America (IESNA) Lighting Design Guide, the recommended illuminance on the task plane for manual crafting which includes engraving, carving, pressing, polishing and woodworking at a "fine" level is 1000 lux.
- . This is under Category F of Illuminance, specifically for performance of visual tasks of low contrast and small size
- The Color Appearance (and Color Contrast), Direct Glare, Intrinsic Material Characteristics, Reflected Glare, Shadows and Source/Task/ Eye Geometry are very important.

TCP LED IB SERIES HIGH BAY

FEATURES & BENEFITS

- Up to 70% less energy than HID
- Instant energy savings · Long 50,000 hours rated life
- Minimizes replacements &
- maintenance costs Very low heat generation
- Less energy wasted as heat 0-10V dimming driver (standard) High impact, frosted white
- acrylic lens comes standard to protect the LEDs and minimize
- Delivers bright, white light and excellent uniformity



				23.6		
ō		0	- 1	۰	0	0
è		0				
		HIII	1-	lo ob	111111	111111
	ш	$\Pi\Pi$	1	00	HIII	11111
÷						
E						

LIGHTING SPECIFICATIONS



- Initial reflectances: 80% ceiling, 50% wall, 20% floor Mounting Height: 2.7m.
- LLD = 0.70, LDD = 0.94, BF 1.0 (for LED products)



50% 30% 10% 50% 30% 10%

20% 20%

CALCULATION USING LUMEN METHOD

ZONAL CAVITY HEIGHTS hCC - 2.9m - 2.7m - 0.2m

- hRC = 2.9m 0.2m 0.88m = 1.82m
- hFC = 0.88m

cost savings.

daylight lighting.

CAVITY RATIOS

- RCR = [5 x hRC (L+W)] / (LxW) RCR = [5 x 1.82 (12+14)] / (12x14)
- RCR = 1.41 CCR = [5 x hCC (L+W)] / (LxW)
- CCR = [5 x 0.2 (12+14)] / (12x14) o CCR - 0.15
- FCR = [5 × hFC (L+W)] / (L×W) FCR = [5 x 0.88 (12+14)] / (12x14)
- FCR = 0.68

30 % Wall reflectance Cavity ratio 80 20 50 30 50 30 10 50 30 10

EFFECTIVE REFLECTANCES

1 1 1 1 1 1 1 1 1

- pCC (pC = 80%, pW = 50%, CCR = 0.15) oCC = 77% or 0.77
- ρFC (ρF = 20%, ρW = 50%, FCR = 0.68) ρFC = (28+11)/2
- ρFC = 19.5% or 0.195 (Given: 20%)

COEFFICIENT OF UTILIZATION

- RCR = 1.41, ρW = 50%, ρCC = 77%
- CU = [((1.05+0.92)/2) + ((1.02+0.90)/2)] / 2
- . CII = 0 9725

LIGHT LOSS FACTOR

- LLF = $0.70 \times 0.94 \times 1.0$
- LLF = 0.658

NUMBER OF FIXTURES

- N = (E x A) / (n x LL x LLF x CU) N = (1000 x 168) / (1 x
- 13500 x 0.658 x 0.9725) OTHER TRIALS: • N = 19.45
- · N = 20 lighting
- fixtures led strip) with 7275 lumens = 39
 - led strip) with 7275 lumens : lighting fixtures needed Same fixture but surface-mox (no celling cavity) = same nu of lighting fixtures (20)

ESTIMATE OF COSTS

OPTION 1: 4' FSS FLUXSTREAM LED STRIP, 4130 LUMENS

- Number of Fixtures: 68
- · Cost per Fixture: \$147.07
- Total Cost: \$10.000.76

OPTION 1: 4' FSS FLUXSTREAM LED STRIP, 7275 LUMENS

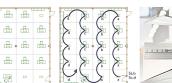
- Number of Fixtures: 39
- · Cost per Fixture: Unavailable
- · Total Cost: Could be much less than Option 1

OPTION 3: TCP LED IB SERIES HIGH BAY, 13500 LUMENS

- Number of Fixtures: 20
- · Cost per Fixture: \$112.02
- Total Cost: \$2,240,40

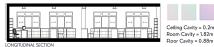






LIGHTING LAYOUT The woodshop needs 20 lighting fixtures (TCP LED IB Series High Bay) to achieve the recommended illuminance of 1000 lux. The plan is divided equally into 4x5 to properly space the fixtures. The lights located near the windows can be switched off









DAYLIGHTING

- Applying the correct daylighting strategies is important because this can help in determining the lighting and switching layout, and increase the efficiency of the lighting design.
- · Elongating the building along the East-West axis reduces direct sun exposure and provides better side lighting from the north and south windows.

INTERIOR SPACE: WOODSHOP

- . Proper woodshop lighting is very important to avoid strain in the eyes and give accuracy to wood cuts and marks.
- It should be considered to perceive the right colors, preventing glares and for safety purposes.
- · Based on the calculations using Lumen Method, it was found out that lighting fixtures with lower lumens increased the number of fixtures needed. Thus, it is better to choose fixtures with higher lumens to reduce the number of fixtures and
- o The first trial used 4' FSS FluxStream led strip with 4130 lumens and the result was 68 fivtures
- The next one used this same fixture but with higher lumens, 7275 and resulted to lower number of fixtures which is 39.
- The last option has the highest lumens and only required 20 fixtures, so it was the most cost-efficient.
- · Out of all trials, TCP LED IB Series High Bay proved to be the best option for the woodshop lighting as it provides the recommended illuminance of 1000 lux for fine woodworking using only 20 lighting fixtures, with 13500 lumens
- The TCP LED IB Series High Bay also minimizes glare and gives a cool white, daylight effect, while providing energy savings and less replacements & maintenance costs, making it the best lighting option for the woodshop.

DAYLIGHTING

indirect natural daylight.

. Study the site and building to be able to maximize daylighting through proper orientation and apply different daylighting strategies.

ARTIFICIAL LIGHTING

- · When planning for woodshop lighting, choose the ones that will provide no glare and more of a daylight effect.
- · For woodworking, it is recommended to use 5000K CCT which is a cool white, daylight
- Use light-emitting diode (LED) for lower
- energy consumption, i.e., greater cost savings.
- · It is recommended to consider different options and carefully assess the required number of fixtures and the cost estimates to know the best lighting for a space.