THE ECO DEPOT

Ramirez-Lam, K. | Arch 143 | R. Flores-Bernardo | UPCA AY 2021-2022

The generation of plastic waste and its eventual disposal has been one of our generation's most prominent environmental problems. While plastic has become a versatile, necessary, and essential product to people in the modern world, it has led to harmful effects. An industrial-reliant city such as Mandaue found in Metro Cebu in the Philippines suffers from poor plastic waste management leading the Mactan Channel beside the city polluted. This has interfered with the local marine ecosystem making the waters less habitable. It has also impacted the low-income community situated beside the Mactan Channel lowering their standard of living and creating health problems.

Mandaue earned its title, "the furniture capital of the Philippines", because of its strength in the furniture and construction industry extending nationwide. With this, there is a continuous need to find sources of material for furniture craft. This has led to timber shortage and its connected problems such as illegal or overlogging of wood.

THE ECO DEPOT will bring in a relatively new technology of plastic extrusion in Mandaue which allows plastic waste to be upcycled into lumber. This allows the development to tackle both the plastic waste management and lumber shortage problems faced by the city while providing new opportunities of work for the nearby low-income community and new businesses for the furniture industry.

"waste to worth"

Creating opportunities to utilize what is considered of waste or no use into something of worth while involving the community

DESIGN APPROACH

PROGRAMMATIC GOALS & OBJECTIVES

- function
- form
- time
- economy
- management
- organization

zero-waste design

DESIGN CONCEPT 01

- tropical design intervention STRATEGY
- sustainable eco-technology STRATEGY

industrial process

DESIGN CONCEPT 02

- production assembly STRATEGY
- specialized spaces STRATEGY

integrative design

DESIGN CONCEPT 03

- immediate use of product STRATEGY
- long-term development STRATEGY

LIGHTING DESIGN CONCEPTS

zero-waste design

The lighting design concepts would also reflect the general design concepts. With zero-waste design, the development will lean toward passive and tropical daylighting interventions. This leads to the abundance of open windows positioned above the workplane to let ambient light in while also having shade interventions to regulate heat in the form of louvres and surrounding the area with tall greenery. Translucent ETFE plastic panels are used for toplighting to diffuse it.

industrial process

As a development heavy on the industrial activities, most of the indoor artificial lighting designs mainly use a utilitarian approach. The development will be mostly using lamps designed for factories and warehouses such as the highbay lamps to create sufficient ambient lighting for the production systems. As for "specialized spaces" such as those to be found in the furniture showroom sets, many task lightings will be used to highlight these.

integrative design

The lighting design, particularly in exterior facade lighting, highlights the use of plastic lumber throughout the development. This allows viewers to see the application of the development's products while creating practical lighting design for navigation and safety. Additionally, the exterior lighting integrates the green softscapes to the facade in the form of playful shadows reflecting the environmental advocacy of the development.

SITE ELEVATION 1:2500 MTS

SITE ORIENTATION

The buildings of the development are located on the site's Northwest portion, having its frontage on the West side. It is adjacent to a creek on its North side, the Mactan Channel on its East side, and roads on its West and South sides.

The design influenced the development to be separated into four buildings instead of a single massive structure to allow more daylighting into each of the buildings. All of the sloping of the buildings have their high end towards the North where daylighting interventions are mostly designed for. This allows softer and more diffused light to be utilized throughout the building interior spaces.

DAYLIGHTING STRATEGIES

tree shading

The design uses many opening to increase natural lighting and ventilation. To offset the increased lighting, tree shading is used to soften daylight.

diffused toplight

ETFE plastic panels facing the North allows diffused toplight to enter the building interior. This allows light to access the deeper parts of the building.

high windows

Locating the windows very high allows the light to distribute more evenly inside which contributes to a better daylight factor calculation.

accent louvres & tint

Accent louvres which serve as shading fins limit daylight entering. Tint also helps regulate light and temperature received by the building.

PLASTIC LUMBER PRODUCTION FACILITY

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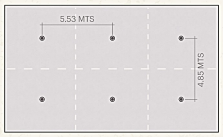
The Plastic Lumber Production Facility is one of the four buildings of the development which handles the processes of shredding and extruding plastic into plastic lumber.

The plastic shredding area has its own dedicated room walled off from the rest of the other areas in the building because it can generate micro-plastics in the air. It is a 16.6 m by 9.7 m room with a sloping ceiling beginning at 7.8 m and ending at 11.5 m. It houses six plastic shredding machines evenly spaced apart from one another.

BUILDING ELEVATION
1:1500 MTS

FLOOR PLAN 1:1500 MTS



REFLECTED CEILINGPLAN 1:1500 MTS

lighting design approach

Designing the lighting for the plastic shredding area takes on a practical approach of using lamps to evenly distribute light to the entire workplace. It is desired to have six luminaires to match the six shredding machines and mounting them all six meters from the ground.

illumination standards

Considering the lighting level recommendations given by IESNA and CIBSE, the room with heavy machinery will use a light level of 300 lux. For other relevant values to be used in calculation, the standards for the typical industrial typology will be used.

lighting specification

PHILIPS Lighting
Green Perform Highbay Elite
BY719P LED 150/CW PSU NB

Light Source Color: 865 cool daylight
Light Source Engine Type: LED
Initial Outputs: 15000 lm
Luminaire Efficacy: 145 lm / W
Useful Life: L70B50 75000 h

recommendations

There is no information on the chosen lamp if it immediately uses 15,000 lm upon start which may cause glare when turned on. An intervention to create a transition from no artificial light to maximum capacity should be used such as a dimmer.

ZONAL CAVITY / LUMEN METHOD

QUANTITY	SYMBOL	FORMULA	ANSWER	UNIT
GIVEN				
room length	l	designed	16.60	m
room width	w	designed	9.70	m
total room height	h_t	average height of designed	9.05	m
target illuminance	E	recommended lighting level	300.00	lx
work plane	WP	designed	2.00	m
ceiling reflectance	ρ_c	standard	0.50	percent/ratio
wall reflectance	ρ_w	standard	0.30	percent/ratio
floor reflectance	ρ_f	standard	0.20	percent/ratio
mounting height	MH	designed	6.00	m
# of lamps	n	according to lamp	1.00	units
initial output	LL	according to lamp	15,000.00	lm
ZONAL CAVITY HEIGHTS				
ceiling cavity height	h_{cc}	h-MH	3.05	m
room cavity height	h_{rc}	MH-WP	4.00	m
floor cavity height	h_{fc}	WP	2.00	m
CAVITY RATIOS				
room area	A	l*w	161.02	m^2
ceiling cavity ratio	CCR	[5*h_{cc}*(l+w)]/A	2.08	percent/ratio
room cavity ratio	RCR	[5*h_{rc}*(l+w)]/A	3.27	percent/ratio
floor cavity ratio	FCR	[5*h_{fc}*(l+w)]/A	1.63	percent/ratio
EFFECTIVE REFLECTANCES				
ceiling effective reflectance	ρ_{cc}	check table	0.225	percent/ratio
floor effective reflectance	ρ_{fc}	check table	0.126	percent/ratio
COEFFICIENT OF UTILIZATION				
coefficient of utilization	CU	standard	0.55	percent/ratio
LIGHT LOSS FACTOR				
lamp lumen depreciation	LLD	according to lamp	0.79	percent/ratio
luminaire dirt depreciation	LDD	check table	0.91	percent/ratio
ballast factor	BF	according to lamp	1.00	percent/ratio
light loss factor	LLF	LLDxLDDxBF	0.66	percent/ratio
NUMBER OF FIXTURES				
# of fixtures	N	N*A/(n*LL*LLF*CU)	6	units

COSTING / ESTIMATE

ITEM	PRICE	QTY	AMOUNT
BY719P Green Perform Highbay Elite	12,250.00	6	73,500.00
30% Labor Installation Cost			22,050.00
TOTAL COST ESTIMATE			95,550.00

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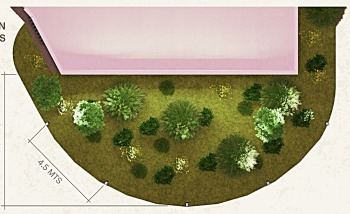
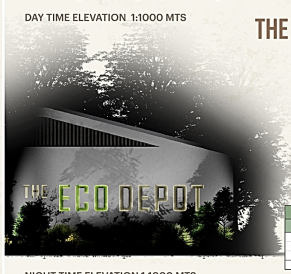
FLOOR PLAN
1:1000 MTS



DAY TIME ELEVATION 1:1000 MTS



NIGHT TIME ELEVATION 1:1000 MTS

THE ECO DEPOT FRONT SIGNAGE

A signage of the development is made on the showroom and retail center building which welcomes all the guests. It is embedded on the concrete wall and has a backwall made of the plastic lumber which demonstates an application of the development's product material. The signage is also framed with minor landscape to add to its aesthetic value while giving an ecological feel.

COSTING / ESTIMATE

ITEM	PRICE	QTY	AMOUNT
Omni LED Strip Light 6W 12V	1,995.75	11	21,957.25
Omni LED Weatherproof Spotlight 10W	500.00	5	2,500.00
30% Labor Installation Cost			7,349.18
TOTAL COST ESTIMATE			31,846.43

lighting design approach

Designing the lighting for the front signage takes on a more artistic approach. Strip lights are used to outline the letters illuminating the plastic lumber behind revealing its color. Landscape spotlights are used to cast foliage shadows which will surround the signage.

illumination standards

A light level below 100 lux is to be observed in the lighting design as no particular task is necessary asides from viewing the signage. It is important to only achieve a low light level to reduce skyglow. A warm tone will be used to create a calmer atmosphere.

lighting specifications

Omni LED Strip Light 6W 12V LSDC-8W-WW

Light Source Color: warm white
Light Source Engine Type: LED
Useful Life: 20000 h
Mounting Location: outline of letters resulting to 55 M

Omni LED Weatherproof Spotlight PAR Lamp 10W

Light Source Color: warm white
Light Source Engine Type: LED
Useful Life: 20000 h
Mounting Height: 0.15 M; 30° angle
Spacing: 4.5 M

recommendations

Finer landscaping can be applied to show a more intentional design to how the shadows are casted to the signage. With this, the landscape spotlights can be located in much more strategic and uneven locations to produce more dynamics to the design.

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SITE DEVELOPMENT

The site development, as well as the buildings, are designed to maximize daylighting as a passive lighting design is ideal for a industrial development. It is done by creating separation in between the buildings to let light in as well as utilizing daylight from the North direction to acquire softer lighting.

SITE DEVELOPMENT PLAN 1:15000 MTS

SHREDDING AREA DAY TIME PERSPECTIVE

SHREDDING AREA NIGHT TIME PERSPECTIVE

OVERALL EFFECT

The lighting design of the whole development focuses on natural daylighting but is supplemented by artificial lighting when necessary especially during night time.

A contrast has been made when it comes to the interior and exterior spaces of the development. The interior lighting design for most of the buildings adapt a practical and work-conducive environment while the exterior lighting design focuses on being relaxing and attractive.

INTERIOR LIGHTING DESIGN

The design only utilizes necessary lighting for the task of plastic shredding. Instead of targetted task lighting, the design opts for ambient and distributed lighting. The light level is designed for the task with a slight cool tone.

practical · productive · ambient

plastic shredding area

EXTERIOR LIGHTING DESIGN

Contrary to the interior lighting design, the exterior design opts for a more artistic and creative approach to capture the viewers' attention in the form of play of brilliance. This is supplemented by accent lighting for visual interest. The light level is low with a warm tone to calm the viewers.

creative · relaxing · accented

THE ECO DEPOT front signage

FRONT SIGNAGE DAY TIME PERSPECTIVE

FRONT SIGNAGE NIGHT TIME PERSPECTIVE