REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

REGIONAL OFFICE NO.1

ILOCOS SUR 2ND DISTRICT ENGINEERING OFFICE

CALAOA-AN, CANDON CITY, ILOCOS SUR

DETAILED ENGINEERING DESIGN FOR

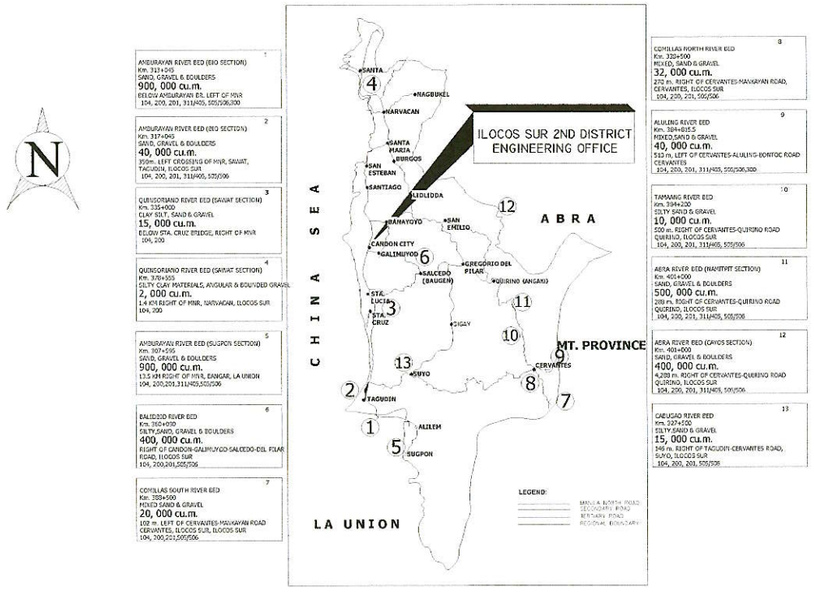
SUPPLY AND INSTALLATION OF SOLAR LIGHTS, REFLECTIVE THERMOPLASTIC PAINT, AND DELINEATORS FOR USE IN ILOCOS SUR 2ND DISTRICT AND REPLACEMENT OF CONCRETE PAVEMENT ALONG JCT. CANDON-SALCEDO-DELPILAR ROAD, K0346+000

ILOCOS SUR 2ND DISTRICT

S000149LZ

SUBMITTED:	CHECKED:	RECOMMENDED:	APPROVED:
MARK ANTHONY F. TANAGON	**PIO R. PERILLA**	**ARNEL H. GABUAT**	**GLENN V. REYES**
CHIEF, MAINTENANCE SECTION	CHIEF, PLANNING AND DESIGN SECTION	OIC - ASSISTANT DISTRICT ENGINEER	DISTRICT ENGINEER
DATE:	DATE:	DATE:	DATE:

INDEX OF SHEETS



LOCATION MAP

Summary of Quantities

Materials	QTY	Unit	Remarks
Reflective Delineator, 3mm thick GI Sheet (100mm x 200mm) with complete accessories	440.00	set	
Solar LED Street Lights (120 Watts) Solar Panel: Monocrystalline Silicon atleast 36W/160W Battery: Grade A Life PO4 battery, atleast 48Ah/25.6V Led Light: High Lumen Chips Rated power of 150W Luminous flux: not less than 20,000 lumens Charge Time: 6-	33.00	ea.	
Single Arm Pole Material: Hot Dipped Glavanized Iron, atleast 4mm thick Type: Tapered Single Arm 150kgs weight with anchor bolts and base plate	33.00	set	
Reinforcing Steel, Grade 40	4,125.00	kg.	
Reinforcing Steel, Grade 60	2,838.00	kg.	
Portland Cement	495.00	bag	
Sand	33.00	cu.m.	
Gravel, G3/4	66.00	cu.m.	
Lumber, Good - 4 uses	1,155.00	bd-ft	
Plywood Marine, 1/2"thk x 4' x 8' - 4 uses	66.00	pc.	
Assorted CWN (1kg/100bd-ft of Lumber)	33.00	kg.	
Tie Wire #16 (2% of RSB)	165.00	kg.	
Ready Mix Concrete, 4000 psi	5.72	cu.m.	
Reinforcing Steel Bar	11.00	kg.	
Asphalt Sealant	4.00	L	
Steel Forms (Rental)	9.95	m.	
Concrete Saw (Diamond Blade 14" dia)	1.00	pc	
Pipe Sleeve 2"	1.00	m.	
Grease/Tar	0.17	L	
Curing Compound	6.28	L	
Thermoplastic Powder (Yellow)	20.00	bags	
Glass Beads (Pre-Mix)	3.00	bags	
Paint Roller (101mm)	2.00	pcs.	
Thermoplastic Sealer	16.00	Liter	
Calsumine	1.00	kgs.	

SUMMARY OF QUANTITIES

REPUBLIC OF THE PHILIPPINES
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CALACA-AN, CANDON CITY, ILOCOS SUR

PROJECT NAME AND LOCATION:
SUPPLY AND INSTALLATION OF SOLAR LIGHTS, REFLECTIVE THERMOPLASTIC PAINT, AND DELINEATORS FOR USE IN ILOCOS SUR 2ND DISTRICT AND REPLACEMENT OF CONCRETE PAVEMENT ALONG JCT SANDON-SALCEDO-DELPILAR ROAD, K0346+000

SHEET CONTENT:
INDEX OF SHEET
VICINITY MAP
SUMMARY OF QUANTITIES
LOCATION MAP

DRAFTED BY:
CHANTEL FAYE B. GACUSAN
ENGINEER I

PREPARED BY:
SIERWINN D. DE CASTRO
ENGINEER II

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MARK ANTHONY P. TANAGON
CHIEF, MAINTENANCE SECTION
DATE:

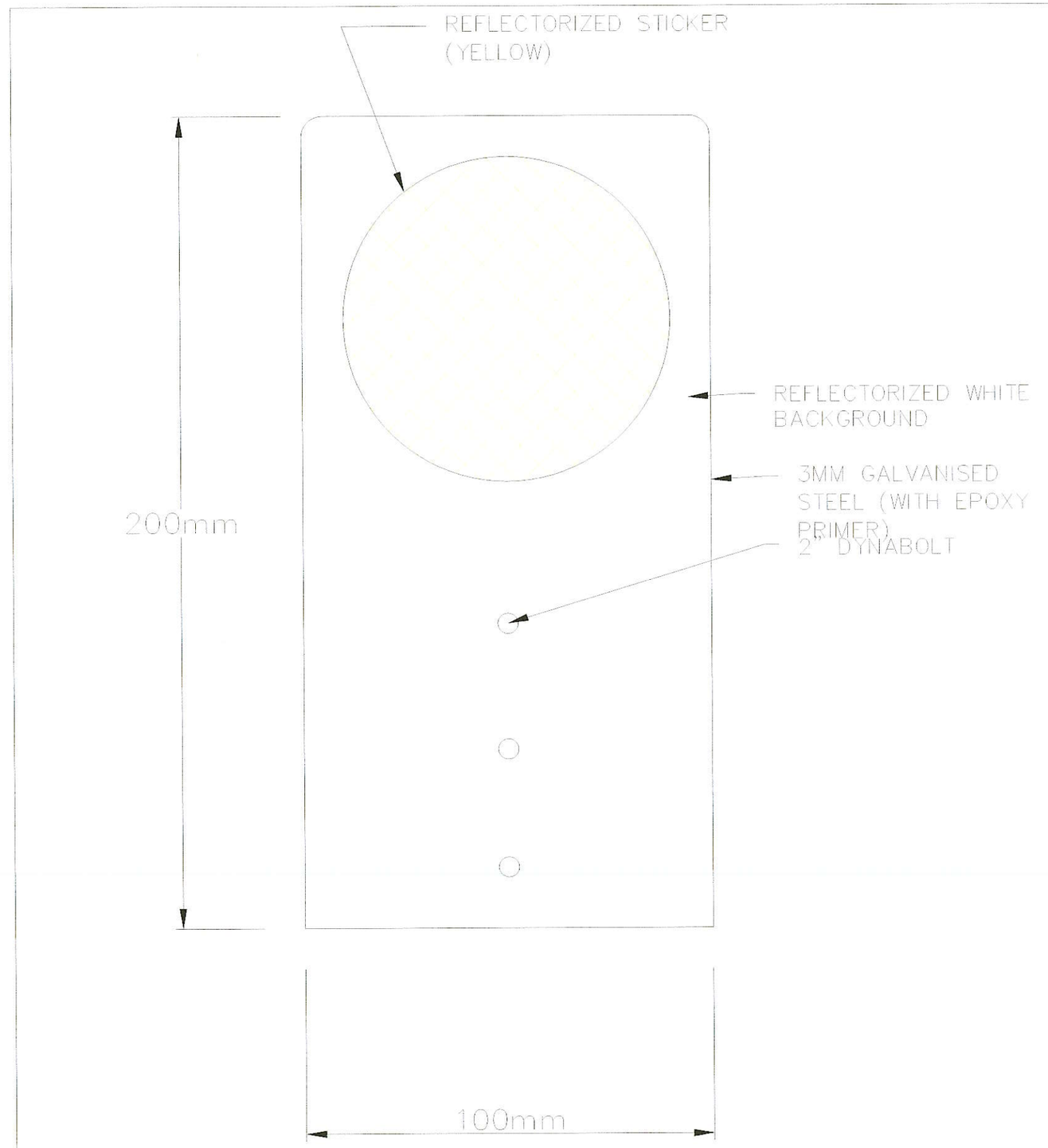
SUBMITTED:
PIO R. PERILLA
CHIEF, PLANNING AND DESIGN SECTION
DATE:

RECOMMENDED:
ARNEL H. GABUAT
OIC - ASSISTANT DISTRICT ENGINEER
DATE:

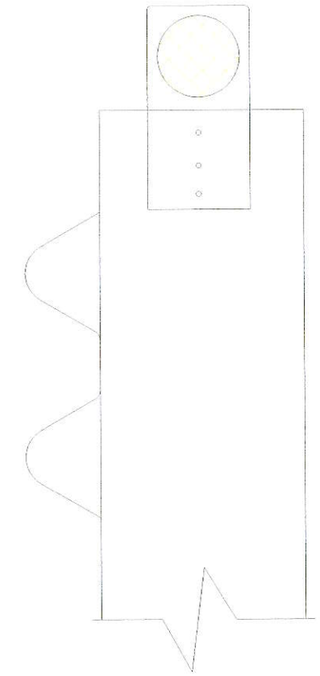
APPROVED:
GLENN V. REYES
DISTRICT ENGINEER
DATE:

SET NO. 1

SHEET NO. 2 / 6

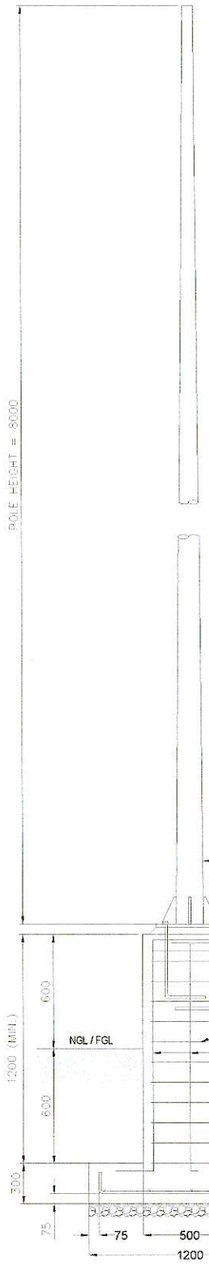


DELINEATOR DETAIL

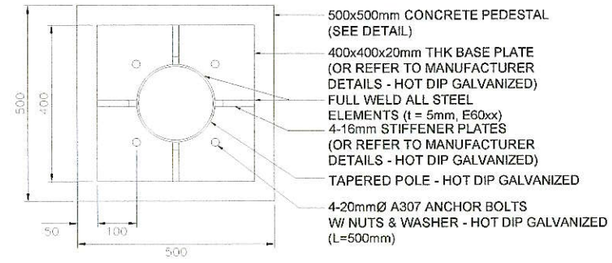


PLACEMENT OF DELINEATOR ON GUARD FENCE

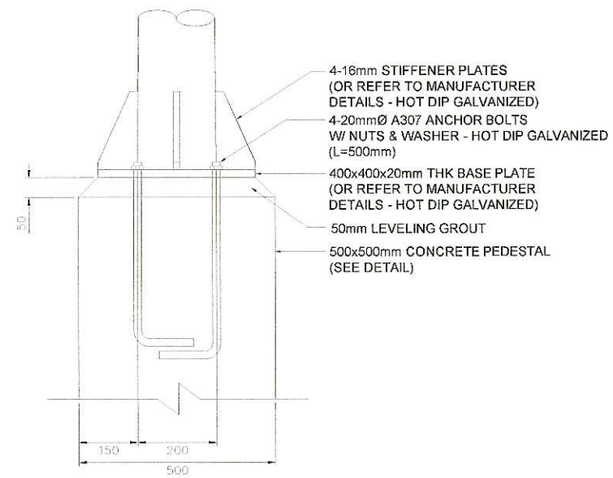
REPUBLIC OF THE PHILIPPINES DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS REGIONAL OFFICE NO.1 ILOCOS SUR 2ND DISTRICT ENGINEERING OFFICE CALAOA-AN, CANDON CITY, ILOCOS SUR	PROJECT NAME AND LOCATION: SUPPLY AND INSTALLATION OF SOLAR LIGHTS, REFLECTIVE THERMOPLASTIC PAINT, AND DELINEATORS FOR USE IN ILOCOS SUR 2ND DISTRICT AND REPLACEMENT OF CONCRETE PAVEMENT ALONG JCT SANDON-SALCEDO-DELPILAR ROAD, K0346+000	SHEET CONTENT: DELINEATOR DETAILS	DRAFTED BY: CHANTAL FAYE B. GACUSAN ENGINEER I PREPARED BY: SIERVINN D. DE CASTRO ENGINEER II	REVIEWED: MARK ANTHONY F. TANAGON CHIEF, MAINTENANCE SECTION DATE:	SUBMITTED: PIO R. PERILLA CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: ARNEL H. GABUAT OIC - ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: GLENN V. REYES DISTRICT ENGINEER DATE:	SET NO.	SHEET NO. 3 6



FOUNDATION ELEVATION
NOT TO SCALE

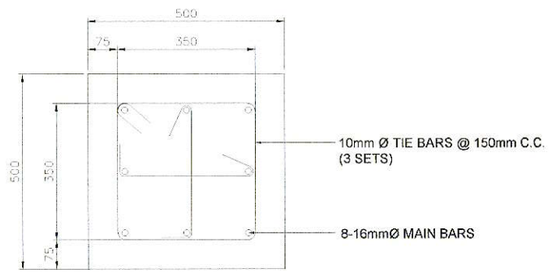


TOP VIEW



FRONT VIEW

BASE PLATE DETAIL FOR 8M POLE
NOT TO SCALE



PEDESTAL DETAIL
NOT TO SCALE

DESIGN CRITERIA

A. REFERENCES

a. NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (NSCP). 7TH EDITION (2015)
b. AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) 360
c. AMERICAN CONCRETE INSTITUTE (ACI) 318
d. AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) 360

B. DESIGN LOADS

a. DEAD LOAD	
i. CONCRETE	24 kN/m3
ii. STEEL	77 kN/m3
iii. SOIL	18 kN/m3
iv. POLE ATTACHMENTS	50 kg
b. WIND LOAD	
i. WIND SPEED	250 kph
ii. EXPOSURE CATEGORY	D
iii. DIRECTIONALITY FACTOR	0.85
iv. OCCUPANCY CATEGORY	V (MISCELLANEOUS STRUCTURES)

C. MATERIALS

a. NORMAL WEIGHT CONCRETE	Fc' = 28 MPa (4000 psi)
b. REINFORCING STEEL	
i. 12MM Ø AND BELOW	Fy = 276 MPa (Grade 40)
ii. 16MM Ø AND ABOVE	Fy = 414 MPa (Grade 60)
c. STRUCTURAL STEEL	
i. STEEL POLE	Fy = 240 MPa (A53 GRADE B) Fu = 415 MPa
ii. BASE PLATE & STIFFENER	Fy = 276 MPa (A36) Fu = 400 MPa
d. STRUCTURAL BOLTS & FASTENERS	Fnt = 310 MPa (A307) Fnv = 165 MPa
e. WELDS	E60xx ELECTRODE

D. DESIGN APPROACH

a. LOAD AND RESISTANCE FACTORED DESIGN (LRFD) IS USED TO DESIGN THE STEEL ELEMENTS.
b. ULTIMATE STRENGTH DESIGN (USD) IS USED TO DESIGN THE CONCRETE ELEMENTS.
c. WORKING STRESS DESIGN (WSD) IS USED TO PARTIALLY DESIGN THE FOUNDATION.
d. LOAD COMBINATIONS CORRESPONDING TO THE DESIGN PHILOSOPHIES MENTIONED ABOVE ARE UTILIZED WHICH ARE BASED ON THE NSCP 2015.

E. NOTES ON DESIGN LOADS

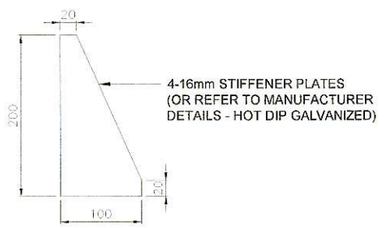
a. IF THE ASSUMED DESIGN LOADS IS NOT APPLICABLE FOR THE REQUIRED DESIGN, THE DESIGN SHALL BE REVISED ACCORDINGLY.

F. NOTES ON FOUNDATION

a. THE FOUNDATION IS DESIGNED FOR AN ASSUMED ALLOWABLE SOIL BEARING CAPACITY (SBC) OF 96 kPa (2000 psf). IF THE LOCATION IS KNOWN OR FOUND OUT TO HAVE AN SBC OF LESS THAN THE ASSUMED, THE FOOTING DESIGN SHALL BE REVISED ACCORDINGLY.
b. NO FOOTING SHALL REST ON FILL. PROVIDE 100mm THICK PROPERLY WELL COMPACTED GRAVEL BED BEFORE CASTING.

G. NOTES ON ASSEMBLY

a. MANUFACTURER MAY SUPPLY A PRE-ASSEMBLED STEEL POST WITH ACCESSORIES (MAST ARM, STIFFENERS, AND/OR BASE PLATE) PROVIDED THAT ITS DESIGN IS SUFFICIENT FOR THE DESIGN LOAD AND MATERIALS STRENGTHS PROVIDED IN THE ITEMS ABOVE.
b. DESIGN CALCULATION/SPECIFICATIONS OF THE PRE-ASSEMBLED STEEL POST MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR INSTALLATION.



STIFFENER DETAIL
NOT TO SCALE

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SHEET CONTENT:
SOLAR LIGHTS

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GLENN V. REYES
DISTRICT ENGINEER
DATE:

SET NO.

SHEET NO.
4
6

GENERAL NOTES

OPPOSITE ARRANGEMENT - IN WHICH THE LUMINARIES ARE PLACED DIRECTLY OPPOSITE AND FACING EACH OTHER ALONG THE ROAD, SHALL BE USED WHEN THE ROAD WIDTH IS MORE THAN 1.5 TIMES THE MOUNTING HEIGHT.

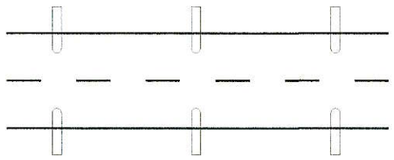


FIGURE 3:OPPOSITE LIGHTING ARRANGEMENT

TWIN CENTRAL ARRANGEMENT - IN WHICH THE LUMINARIES ARE MOUNTED ON A T-SHAPED LIKE MASTS IN THE MIDDLE OF THE CENTER ISLAND OF THE ROAD, SHALL BE USED WHEN THE ROAD WIDTH IS LESS THAN OR EQUAL TO THE MOUNTING HEIGHT.

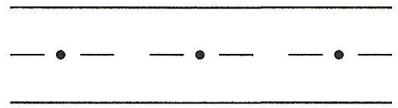


FIGURE 4: TWIN CENTRAL LIGHTING ARRANGEMENT

FOR EXISTING CONDITION, TWIN CENTRAL IN COMBINATION WITH OPPOSITE ARRANGEMENT, IN CERTAIN APPLICATION WHERE ADEQUATE ILLUMINATION CANNOT BE MET, A SINGLE SIDED ARRANGEMENT IS INTEGRATED WITH TWIN CENTRAL ARRANGEMENT, OR IF POSSIBLE AN OPPOSITE OR STAGGERED ARRANGEMENT.

TYPICALLY, STREET LIGHTS FOR MAJOR THOROUGHFARES ARE INSTALLED ON SINGLE SIDED, OPPOSITE AND STAGGERED OF THE ROADWAY. POLE MOUNTED STREET LIGHTING ARE TYPICALLY INSTALLED 30 TO 40 METERS APART AND ALMOST 100 METERS APART FOR HIGH MAST IN SECONDARY STREETS AND MAJOR THOROUGHFARES.

PHYSICAL ROADSIDE CONDITIONS MAY REQUIRE ADJUSTMENT OF THE POLE SPACING DETERMINED FROM THE BASE LEVELS OF ILLUMINATION, AS INDICATED IN THE GUIDELINES. HIGHER LEVELS OF ILLUMINATION ARE JUSTIFIED WHEN OVERHEAD STRUCTURES, SAFETY, AND OBJECT CLEARANCES RESTRICT THE PLACEMENT OF POLES. IT IS ADVISABLE TO PROVIDE HIGHER ILLUMINATION LEVELS AT DIVERGING AND MERGING AREAS.

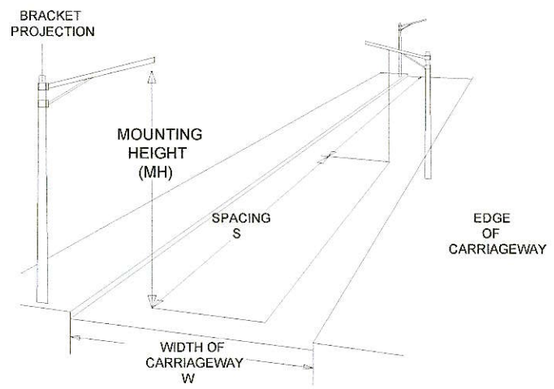
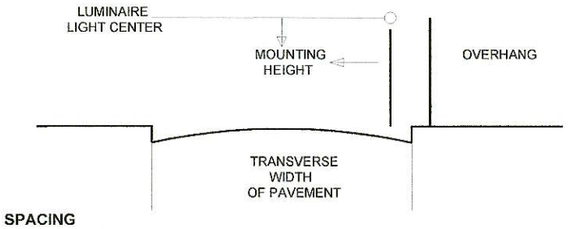


FIGURE 5: STREET LIGHTING PARAMETERS

MOUNTING HEIGHT

MOUNTING HEIGHT- SHALL BE THE PERPENDICULAR DISTANCE FROM THE CENTER OF THE LAMP TO THE GROUND SURFACE.

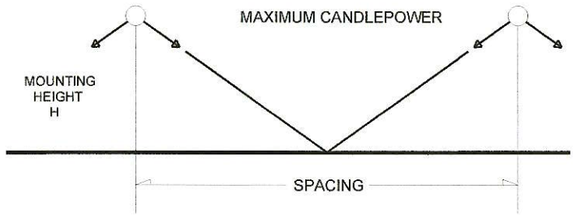
WHERE THE LUMINAIRE OVERHANGS THE ROAD SURFACE, THE MINIMUM MOUNTING HEIGHT SHALL BE GENERALLY 8.0 M-10M. HOWEVER, A LUMINAIRE THAT DOES NOT OVERHANG THE ROADWAY MAY HAVE A MINIMUM MOUNTING HEIGHT OF 3.0 M PROVIDED THAT THE INSTALLED LUMINAIRE USED WOULD NOT RESULT INTO DISABILITY GLARE TO THE MOTORIST AND THE POLE IS INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF PEC 2 AND NSCP.



SPACING

SPACING- SHALL BE DEFINED AS THE HORIZONTAL DISTANCE BETWEEN POLES SUPPORTING THE LUMINAIRE.

THE SPACING OF LUMINAIRES FOR A CURVED ROAD SHALL BE REDUCED BY 25% TO 50% FOR A SIMILAR STRETCH OF A STRAIGHT ROAD. A CURVED ROAD THAT HAS A RADIUS OF 1000M AND ABOVE MAY BE TREATED AS A STRAIGHT ROAD.



OVERHANG

THE HORIZONTAL DISTANCE BETWEEN THE CENTER OF THE LUMINAIRE MOUNTED ON A BRACKET AND THE ADJACENT EDGE OF A CARRIAGEWAY IS DEFINED AS OVERHANG. TO AVOID REDUCED VISIBILITY OF CURBS AND OBSTACLES, SHOULD NOT EXCEED ONE-FOURTH OF THE MOUNTING HEIGHT.

POLE ARM

THE USE OF AN ARM BRINGS THE LIGHT SOURCE CLOSER TO THE TRAVELLED PATH WHILE ALLOWING THE POLE TO BE PLACED FURTHER AWAY FROM THE EDGE OF THE PATH'S EDGE. DEPENDING ON THE APPLICATION, POLEARMS CAN BE SINGLE / OR DOUBLE DAVIT OR MAST ARMS AND LOCATED AT THE UPPERMOST PART OF THE POLE.

THE POLE ARM'S ANGLE OF TILT SHALL KEPT FROM 15° TO 30°, OTHERWISE STRONG LIGHT SHALL AFFECT THE DRIVER'S CAUSING DISCOMFORT GLARE. THE TILT GETS LARGER AS THE UNIFORMITY RATIO INCREASE.

SETBACK

THE SETBACK IS THE HORIZONTAL DISTANCE BETWEEN THE FACE OF A LIGHT POLE AND THE EDGE OF THE TRAVELLED WAY. THE MINIMUM ALLOWED VALUE IS SET AT 0.80 TO 1.5 METERS SINCE EXTREMELY SHORT SETBACK GRAZES THE SURFACE AND ENHANCES ITS TEXTURE AND LONG SETBACKS CAUSE SHADOWS AT LOW LEVELS.

THE TABLE BELOW SHALL BE CONSIDERED IN DESIGNING THE LUMINAIRE SETBACK BASED ON VEHICULAR SPEED ON A PARTICULAR ROADWAY AND EQUIVALENT.

DESIGN SPEED FOR THE ROADWAY (KPH)	POLE SETBACKS (M)
50	0.8
80	1.0
100	1.5
120	1.5

TABLE 1. DESIGNATED ALLOWABLE SETBACK VALUES WITH A ROADWAY DESIGNED SPEED EQUIVALENT.

OUTREACH

THE OUTREACH OR HORIZONTAL DISTANCE BETWEEN THE LUMINAIRE'S CENTER AND THE COLUMN'S CENTER IS TYPICALLY ESTABLISHED IN ACCORDANCE WITH THE ARCHITECTURAL AESTHETICS CONDITIONS.

TABLE 2. ROADWAY LIGHTING STATIONING AND PARAMETERS

ROAD CLASSIFICATION	LIGHTING ARRANGEMENT	ROAD WIDTH (meter)	POLE PLACING (meter)	MOUNTING HEIGHT (meter)	LAMP WATTAGE (watt)		MAST ARM (meter)
					HPS	LED	
PRIMARY	SINGLE	6.7	10-25	10	150-250	80-125	1.5
		13.4	15-35	12	150-250	80-125	3.0
	AXIAL	13.4	20-35	10	150-250	80-125	1.5
		20.1	20-40	12	150-250	80-125	3.0
		26.8	20-45	12	300-400	200-300	3.0
	OPPOSITE	6.7	20-35	10	70-120	50-80	1.5
		13.4	20-35	12	150-250	80-125	1.5
		20.1	20-40	12	300-400	200-300	1.5
		26.8	20-45	12	300-400	200-300	1.5
	STAGGERED	6.7	10-25	8	70-120	50-80	1.5
		13.4	10-25	10	150-250	80-125	1.5
		20.1	15-25	12	300-400	200-300	3.0
		26.8	15-25	12	300-400	200-300	3.0
SECONDARY	SINGLE	6.7	15-35	10	150-250	80-125	1.5
	OPPOSITE	6.7	20-40	8	150-250	80-125	1.5
	STAGGERED	6.7	15-35	8	150-250	80-125	1.5
TERTIARY	SINGLE	5.0	10-25	8	70-120	50-80	1.5
		6.1	10-25	8	70-120	50-80	1.5
	STAGGERED	5.0	10-25	8	70-120	50-80	1.5
		6.1	10-25	8	70-120	50-80	1.5

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SHEET CONTENT:
GENERAL NOTES

DRAFTED BY:
CHANTAL FAYE B. GACUSAN
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	Quantity			Unit
Reflective Delineator, 3mm thick GI Sheet (100mm x 200mm) with complete accessories	440.00			set
Solar LED Street Lights (120 Watts) Solar Panel: Monocrystalline Silicon atleast 36V/16			33.00	ea
Single Arm PoleMaterial: Hot Dipped Glavanized Iron, atleast 4mm thickType: Tapered			33.00	set
For Footing and Pedestal	*Quantity per Solar Light*	*Quantity of LED Street Light*		
Reinforcing Steel, Grade 40	125.00	33.00	4,125.00	kg.
Reinforcing Steel, Grade 60	86.00	33.00	2,838.00	kg.
Portland Cement	15.00	33.00	495.00	bag
Sand	1.00	33.00	33.00	cu.m.
Gravel, G3/4	2.00	33.00	66.00	cu.m.
Lumber, Good - 4 uses	35.00	33.00	1,155.00	bd-ft
Plywood Marine, 1/2"thk x 4' x 8' - 4 uses	2.00	33.00	66.00	pc.
Assorted CWN (1kg/100bd-ft of Lumber)	1.00	33.00	33.00	kg.
Tie Wire #16 (2% of RSB)	5.00	33.00	165.00	kg.

Reblocking:	**Length, m**	**Width, m**	**Thickness**	**Area (sq.m)**	**Volume (cu.m)**
JCT. Candon - Salcedo - Del Pilar Road K0346+000	4.95	3.66	0.28	18.12	5.07
	1.30	1.21	0.28	1.57	0.44
	0.90	0.82	0.28	0.74	0.21
				20.43	**5.72**
Ready Mix Concrete, 4000 psi		1 sqm = 0.28 cu.m	0.28	5.720	cu.m.
Reinforcing Steel Bar		1 sqm = 0.50 kg.	0.50	11.000	kg.
Asphalt Sealant		1 sqm = 0.17 L	0.17	4.000	L
Steel Forms (Rental)		1 sqm = 0.46 m.	0.46	9.397	m.
Concrete Saw (Diamond Blade 14'" dia)		1 sqm = 0.003 pc	0.00015	1.000	pc
Pipe Sleeve 2"		1 sqm = 0.0078 m.	0.0078	1.000	m.
Grease/Tar		1 sqm = 0.0078 L.	0.0078	1.000	L
Curing Compound		1 sqm = 0.29 L	0.2900	5.924	L

For Reflectorized Traffic Paint	*Quantity per Thermo as per DUPA*			
Thermoplastic Powder (Yellow)	1.00	20.00	20.00	bags
Glass Beads (Pre-Mix)	0.10	20.00	3.00	bags
Paint Roller (101mm)	0.06	20.00	2.00	pcs.
Thermoplastic Sealer	0.56	20.00	16.00	Liter
Calsumine	0.02	20.00	1.00	kgs.

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SUPPLY AND INSTALLATION OF SOLAR LIGHTS, REFLECTIVE THERMOPLASTIC PAINT, AND DELINEATORS FOR USE IN ILOCOS SUR 2ND DISTRICT AND REPLACEMENT OF CONCRETE PAVEMENT ALONG JCT SANDON-SALCEDO-DELPILAR ROAD, K0346+000

SHEET CONTENT:
DETAILED QUANTITY CALCULATION

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