REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

REGION XI

DAVAO DEL NORTE

2ND DISTRICT ENGINEERING OFFICE

TAGUM CITY

C.Y. 2025 PROJECT

DETAILED ENGINEERING DESIGN PLAN FOR

BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460

SECTION	:	BABAK-SAMAL-KAPUTIAN ROAD
LOCATION	:	IGACOS, DAVAO DEL NORTE
STATION LIMITS	:	K 1507+633.00 - K 1510+460.00
NET LENGTH	:	2,762.00 LN.M ASPHALT OVERLAY/5.524 LANE.KM
ROAD SECTION I.D	:	S00095MN

SUBMITTED:

JEZABEL E. TULING, MPA
CHIEF,PLANNING & DESIGN SECTION

DATE:

RECOMMENDED:

GARRY E. VERANO
OFFICER-IN-CHARGE
OFFICE OF ASSISTANT DISTRICT ENGINEER

DATE:

APPROVED:

ARTURO P. LONGYAPON
DISTRICT ENGINEER

DATE:

PROJECT LIMITS :

ROAD ASPHALT OVERLAY:

K 1507 + 633 - K 1510 + 460 = 2,762.00 LN.M.

NET LENGTH = 2,762.00 LN.M.

RBIA LENGTH:

K 1507 + 000 - K 1508 + 000 = 1007.00 LN.M
K 1508 + 000 - K 1509 + 000 = 927.00 LN.M
K 1509 + 000 - K 15010 + 000 = 1001.00 LN.M
K 15010 + 000 - K 15011 + 000 = 979.00 LN.M

INDEX OF DRAWINGS

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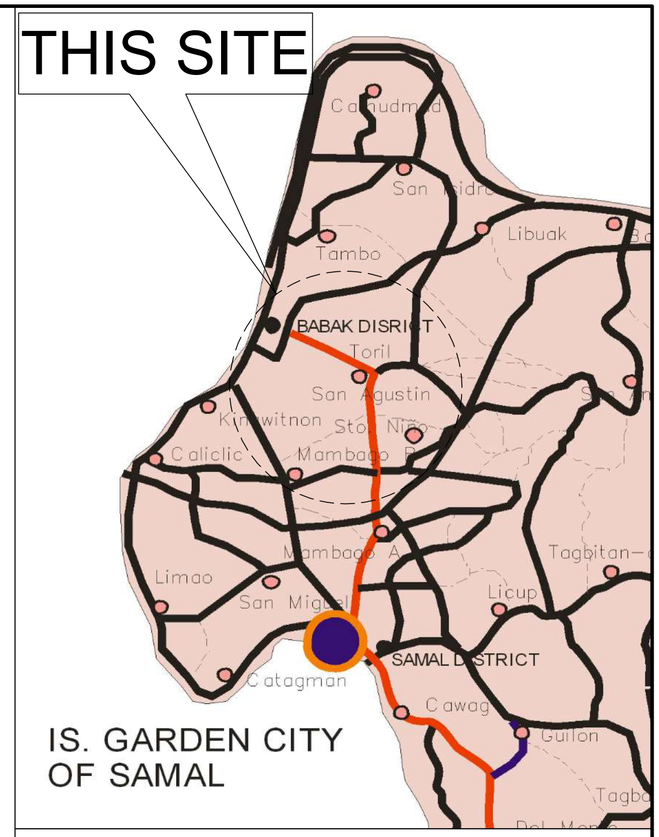
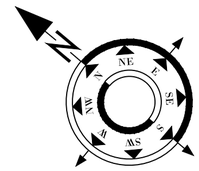
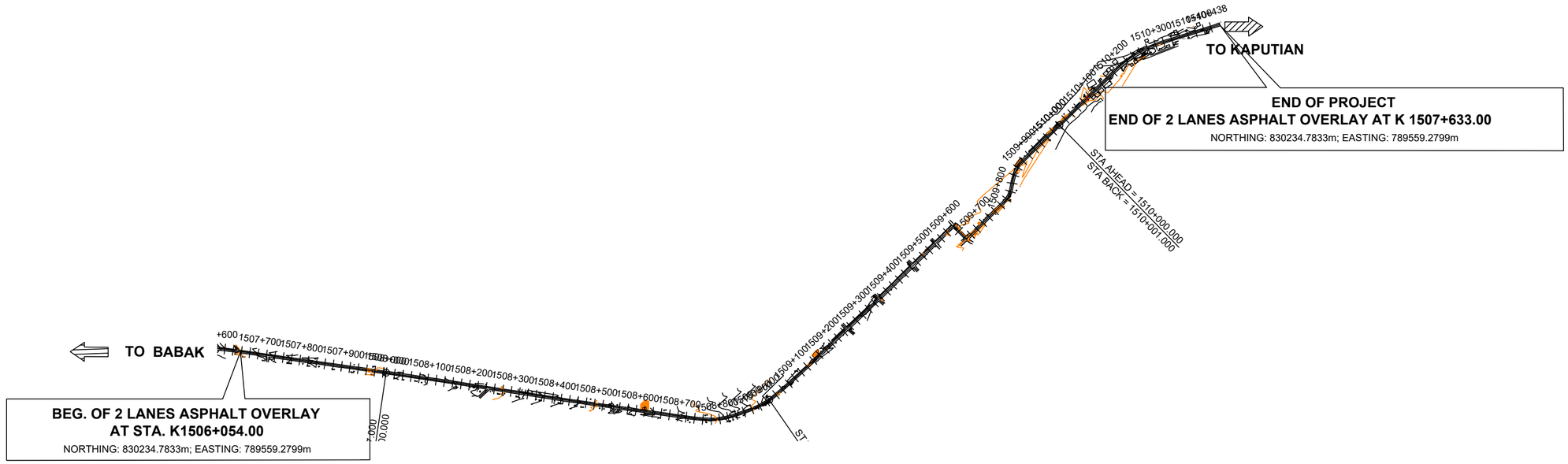
17-22	SOLAR STREET LIGHTS DETAILS AND SCHEDULE
23-28	PLAN AND PROFILE
29-52	CROSS SECTION



LOCATION MAP
DRAWN NOT TO SCALE



VICINITY PLAN
SCALE 1:5000 MTS.



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	INDEX OF DRAWINGS, PROJECT LIMITS, VICINITY PLAN, LOCATION MAP	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. SERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	A 1 | 1	1 52

G E N E R A L N O T E S

SPECIFICATIONS

1. All works shall comply with the "DPWH STANDARD SPECIFICATION VOLUME II, HIGHWAYS, BRIDGES AND AIRPORTS 2013", special provision and supplemental specifications pertaining to this project.

DIMENSIONS

1. Distance between the horizontal control points including reference points are measured and expressed in meters.
2. Unless otherwise specified, dimensions of pipes, box culverts, bridges and other structures are measured and expressed in millimeters.
3. All other dimensions are expressed in meters.

SURVEY SPECIFICATIONS

1. All project control points are projected in PRS '92 Grid Coordinate System (Zone 5)
2. Survey Instrument used, Stonex S9111 Plus STNS95321007 (Base), Stonex S9111 Plus STNS95491002 (Rover)
3. Date surveyed: January 15 - 16, 2024
4. Project Control Points, Refer to Plan and Profile

ELEVATIONS AND GRADES

1. Finished grade elevation shown on plan and profile sheets refers to finished pavement level as indicated in the typical roadway section.
2. Ground grade shown on the plan and profile sheets refers to the elevation of the original ground along the centerline of the project road.

OTHER GENERAL REQUIREMENTS

1. Alignment and grades are subject to adjustments to suit actual field conditions.
2. Distances and elevations are in meter unless otherwise indicated.
3. Grades shown are top of finished pavement.
4. All works shall comply with the Standard Specifications for Highways and Bridges, Revised 2004 and "A Policy on Geometric Design", AASHTO 2011.
5. Where no detours are available, traffic shall be handled in accordance to the provisions of Clause 75 of the DPWH Standard Specifications, Volume 1, Requirements and Conditions of Contract (1988).
6. The contractor shall continuously keep the road undergoing improvement and the section detours in such condition satisfactory to the Engineer that traffic will be accommodated during the entire contract period without any inconvenience to the traveling public in accordance to Clause 38 of the DPWH Standards Specifications, Volume 1, Requirements and Conditions of Contract (1988). The contractor shall bear all expenses for constructing, reconstructing if necessary and maintaining such road detours, approaches, including run-around temporary bridges without compensation.
7. The apparent silence of specifications, plans, special provisions and supplementary specifications, as to any detail or the apparent omission from them of a detailed description concerning any point shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of first class quality are to be used.
8. Roads closed to traffic shall be protected by effective barricades, and obstructions shall be illuminated at night. Suitable warning signs, illuminated at night by lanterns of flares, shall be provided. All lights for this purpose shall be kept burning from sunset to sunrise.
9. The contractor will be required to erect warning signs outside of, and 150m from, each end of the project, and 150m in advance at any place on the project where operations interfere with the use of the road by traffic, and at all intermediate points where the new work crosses or coincides with an existing road.
10. Before the start of actual construction, the As-Staked Plan should be submitted to the Davao del Norte Sub-District Engineering Office in order that immediate steps may be taken to correct or adjust whatever appreciable deviation there may be from the original plan.
11. Quarry site for Item 200 is located at Mabuhay, Carmen (29.28 km. from the project site). Disposal site is one (1) km. away from project limit.
12. Design was based on survey data submitted by the Survey and Investigation Section of the Planning and Design Section of the DPWH-Davao del Norte Engineering Sub-District Office.

SUBBASE AND BASE COURSE

1. Re-preparation and compaction of the existing base/subbase to the required density shall be done prior to gravel resurfacing in accordance with DPWH Standard Specifications, Volume II, 2004, using vibrating rollers and pneumatic tire rollers. In areas where the said equipment cannot be used, a portable mechanical compactor shall be used.

SURFACE COURSE

1. Use steel forms for item 311- Portland Cement Concrete Pavement
2. When concrete is to be placed adjoining a previously constructed lane and mechanical equipment will be operated upon the existing lane, that previously constructed lane shall have attained the strength of fourteen (14) day concrete. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.
3. At transverse construction joints, holes of 60mm dia. and spaced at 300mm (for 230mm and 280mm thick concrete pavement) shall be drilled at one-half (1/2) of the existing concrete pavement thickness so as to permit the load transfer device (28mm dia. plain dowel bars for 230mm thick PCCP; 36mm dia plain dowel bars for 280mm thick PCCP; 36mm dia. for 300mm thick PCCP) to be inserted at one-half (1/2) of its length. The said device shall be installed firmly at the holes and shall be held in position parallel to the surface of the slab. The dowel bars shall be painted with red lead and the surface of one-half (1/2) of the length to be inserted shall be coated with concrete epoxy while the other half shall be coated with approved bituminous materials.
-DO 54, s.2012
4. If reinforcing steel bars are used, mortar blocks of approved dimension shall be installed at specific intervals to maintain uniform clearance from the base.
5. Transverse contraction joint shall be cut using a concrete saw to the required depth (one-fourth to one-third of the concrete pavement thickness) and width as shown in the approved plans.
6. All joints shall be sufficiently sealed with asphalt sealant prior to opening to vehicular traffic.
7. The use of type III portland cement meeting the requirements of AASHTO M-85 for high-early strength mix or type I portland cement with accelerating admixtures conforming to the requrements of AASHTO M-194 shall be used.
8. The entire surface of the newly placed concrete shall be cured with either one of the curing materials specified in ITEM 708.1 of the DPWH Standard Specificationsm Volume II, 1995.

FOR ASPHALT OVERLAY

1. Item 310 shall consist of constructing a bituminous concrete surface course composed of aggregates, mineral filler, and bituminous material mixed in a central plant, constructed and laid hot on the prepared base in accordance with this specification and in conformity with lanes, grades, thickness and typical cross-section shown on the plans.
2. Bituminous material shall be either medium curing (MC) cut-back asphalt cement, whichever is called for in the bill of quantities. It shall conform to the requirements of ITEM 702, Bituminous Materials. The penetration grade, type and grade of bituminous material shall be specified in the special provisions.
3. Aggregates shall conform to the requirements of ITEM 307, Bituminous Plant Mix Surface.
4. The proportion of bituminous material on the basis of total dry aggregate shall be from 5.0 to 0.8 mass percent. The exact percentage to be used shall be fixed by the engineer in accordance with the job-mix formula and the other quality control requirements.
5. During the mixing operation, one half to one (0.50 to 1.0) mass percent of hydrated lime, dry aggregate basis shall be added to the mixture. The lower percentage limit is applicable to aggregate which are predominantly calcareous.
6. The construction requirements shall be in accordance whenever applicable with SECTION 307.3.
7. All deteriorated transverse and longitudinal joints shall be sealed with asphalt prior to laying of asphalt mix.
8. All cracks shall be sealed using machine pressurized epoxy injection. Spacing of copper tubes used in epoxy injection shall have a minimum and maximum spacing of 100 mm and 150 mm respectively depending on the extent of the cracks.
9. The contractor shall be responsible for handling materials and performing all parts of the work shall be approved by the engineer as to design, capacity and mechanical condition. The equipment shall be at the jobsite sufficiently ahead of the start of construction operations to be examined thoroughly and approved.
10. The Asphalt Overlay must attain an IRI of 3m/km.

EARTHWORK

1. All concrete pavement, base course, sidewalks, curbs, gutters, etc., designated for removal shall be broken into pieces, the size of which shall not exceed 300mm (12in) in any dimension and stockpiled at designated locations on the project or as directed by the Engineer.
2. All excavations shall be finished to reasonably smooth and uniform surfaces. No materials shall be wasted without authority of the Engineer. Excavation operations shall be conducted so that material outside of the limit of slopes will not be disturbed.
3. Spoils from demolished/ excavated materials shall not be allowed to be stockpiled at the shoulder or part of the traveled roadway and shall be removed immediately to prevent obstruction. Spoils removed shall be disposed off in designated areas approved by the Engineer.

MISCELLANEOUS STRUCTURES

1. The application of paint for pavement markings shall be preferably carried out by a machine specially made for this propose but where brushed are used, only round or oval brushes not exceeding 100mm in width will be permitted. The paint shall be so applied as to produce a uniform, even coating in close contact with the surface being painted.

REFERENCES:

1. Revised DPWH Manual on Highway Safety Design Standards,May 2012 Edition
   - For road safety planning and design activities as well as road safety maintenance activities such as the proper way of installing ,applying road signs,road safety devices and pavement markings - D.O. 41,s. 2012
2. Labor Code of the Philippines and its Implementing Rules and Regulations DOLE DO No. 13,s. 1998, Occupational Safety and Health Standards and its Procedural Guidelines.
   - For monitoring, enforcement and implementation of construction safety and health - D.O. 56,s. 2005
3. Design References
   - DPWH Design Guidelines, Criteria & Standards (DGCS), 2015 Edition
   - Guidelines for the preparation of cost estimates for traffic management and safety & health requirements for the construction and maintenance of roads, bridges and safety & health requirements for school buildings, 2018
   - AASHTO a policy on geometric design standard of highways and streets, 2011 6th Edition
   - AASHTO guide on pavement design, 1993 Edition
   - Highway Safety Design Standards: Part 1 - Road Safety Design, and Part 2 - Road Signs and Pavement Markings, 2012 Edition

This is to certify that the detailed engineering surveys and designs have been conducted according to the prescribed agency standards and specifications in conformance with the provisions of Annex"A" of the Revised Implementing Rules and Regulations of RA 9184,and that the detailed engineering outputs are adequate for the procurement at hand.

WARREN S. PIÑEZ
Head, Survey and Investigation Unit

LEGEND

SYMBOLS	DESCRIPTION	SYMBOLS	DESCRIPTION
CH	CONCRETE HOUSE		BENCH MARK
P	PUROK	CEP	CONCRETE ELECTRIC POST
WH	WOODEN HOUSE	WEP	WOODEN ELECTRIC POST
	EXISTING RCC PIPE		CENTERLINE
	SIDE SHOT REMARK		EDGELINE
	JUNCTION ROAD		SHOULDER LINE
	VARIOUS TREES		RROW LINE
RP-2 RP-2	REFERENCE POINTS		GRAVEL
	WATER FLOW DIRECTION		ASPHALT OVERLAY
	WATERWAY		REBLOCKING
	RCC PIPE PROFILE		CYLINDRICAL MONUMENT
	FENCE	PI	POINT OF INTERSECTION
	HEADWALL		BARBWIRE FENCE
	TURNING POINTS		REMOVAL OF EXISTING ASPHALT

REPUBLIC OF THE PHILIPPINES
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DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**

SHEET CONTENTS: GENERAL NOTES AND LEGENDS

DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II
PREPARED: **WARREN S. PIÑEZ** ENGINEER II

REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:

SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:

RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:

APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:

SET NO. B 1 1

SHEET NO. 2 52

SUMMARY OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	REMARKS
Part A	**Facilities for the Engineer**			
A.1.1 (3)	Provision of 4x4 Pickup Service Vehicles for the Engineer on Bare Rental Basis	vehicle - month	3.84	
A.1.2 (5)	Operation and Maintenance of 4x4 Pickup Type Service Vehicle for the Engineer	vehicle - month	3.84	
Part B	**Other General Requirement**			
B.4 (1)	Construction Survey and Staking	km	2.76	
B.5	Project Billboard/Signboard	ea	4.00	COA & DPWH Billboard
B.7 (2)	Occupational Safety and Health Program	ls	1.00	
B.8 (2)	Traffic Management	ls	1.00	
B.9	Mobilization and Demobilization	ls	1.00	
Part C	**Earthworks**			
101 (1)	Removal of Structures and Obstruction	ls	1.00	SEE SCHEDULE
101 (2)	Removal of Actual Structures/Obstruction	ea	614.00	SEE SCHEDULE
101 (10)	Removal of Existing Road Signages	ea	2.00	SEE SCHEDULE
101 (3)b3	Removal of Actual Structures/Obstruction (0.23m thk. PCCP-Unreinforced)	sq.m.	1,200.00	SEE SCHEDULE
102 (1)	Unsuitable Excavation	cu.m	300.00	
103 (1)b	Structure Excavation (Soft Rock)	cu.m	2,069.00	
103 (3)	Foundation Fill	cu.m	25.00	
105 (1)e	Subgrade Preparation (Soft Rock Material)	sq.m.	1,200.18	
Part C	**Subbase and Base Course**			
200 (1)	Aggregate Subbase Course	cu.m	240.00	
Part E	**Surface Course**			
300 (1)	Gravel Surface Course	cu.m	732.00	
302 (2)	Emulsified Asphalt	sq.m.	33,726.90	
310 (1)b	Bituminous Concrete Surface Wearing Course, Hot Laid (40 mm. thk.)	sq.m.	17,077.04	
310 (2)b	Bituminous Concrete Surface Binder Course, Hot Laid (40 mm. thk.)	sq.m.	13,578.74	
311 (1)e1	PCC Pavement (Unreinforced), 0.28m thk. 14 days	sq.m.	1,200.18	
Part G	Drainage and Slope Protection Structures			
404 (1)a	Reinforcing Steel (Grade 40)	kg	7,780.93	
404 (1)b	Reinforcing Steel (Grade 60)	kg	8,731.48	
405 (1)a2	Structural Concrete, Class "A", 14days	cu.m	216.00	
1718 (1)	Pipe Culverts, 910mm dia., Class IV, RCPC	l.m.	296.00	SEE DETAILS AND SCHEDULE
502 (1)a3	Manholes; Thickness/Sizes=910mm dia., Class=Concrete	ea.	16.00	
Part H	**Miscellaneous Structures**			
600 (7)	Curb & Gutter (Precast)	pc	268.00	
605 (1)I2	Warning Signs; 600mm-W2-6B (Intersection and Junction Signs Side Road Junction L or R)	ea.	3.00	SEE DETAILS AND SCHEDULE
605 (1)ai1	Warning Signs; 600mm x 600mm; W6-1B (Pedestrian and School Sign Pedestrian Crossing Ahead)	ea.	6.00	SEE DETAILS AND SCHEDULE
605 (2)aj2	Regulatory Sign; 600mm thick (R6-9B) Miscellaneous Signs School Children Crossing	ea.	4.00	SEE DETAILS AND SCHEDULE
607 (3)a1	Internally Illuminated (Solar) Pavement Levelled Marker/Stud Flush Type (Mono-directional)	ea.	307.00	SEE DETAILS AND SCHEDULE
612 (1)	Reflectorized Thermoplastic Pavement Markings (White)	sq.m.	786.82	SEE DETAILS AND SCHEDULE
612 (2)	Reflectiorized Thermoplastic Pavement Marking (Yellow)	sq.m	103.65	SEE DETAILS AND SCHEDULE
613 (1)	Concrete Joint Sealant (Hot-Poured Elastic Type)	kg	145.83	SEE DETAILS AND SCHEDULE
624 (9)b2	Single arm solar LED roadway lighting; 8M-pole-80W-125W	ea.	99.00	SEE DETAILS AND SCHEDULE

NOTE: THE QUANTITIES OF ALL WORK ITEMS INVOLVED ARE SUBJECT TO INCREASE/ DECREASE AS PER ACTUAL FIELD REQUIREMENTS.

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TAGUM CITY

PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**

SHEET CONTENTS: SUMMARY OF QUANTITIES

DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II

PREPARED: **WARREN S. PIÑEZ** ENGINEER II

REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:

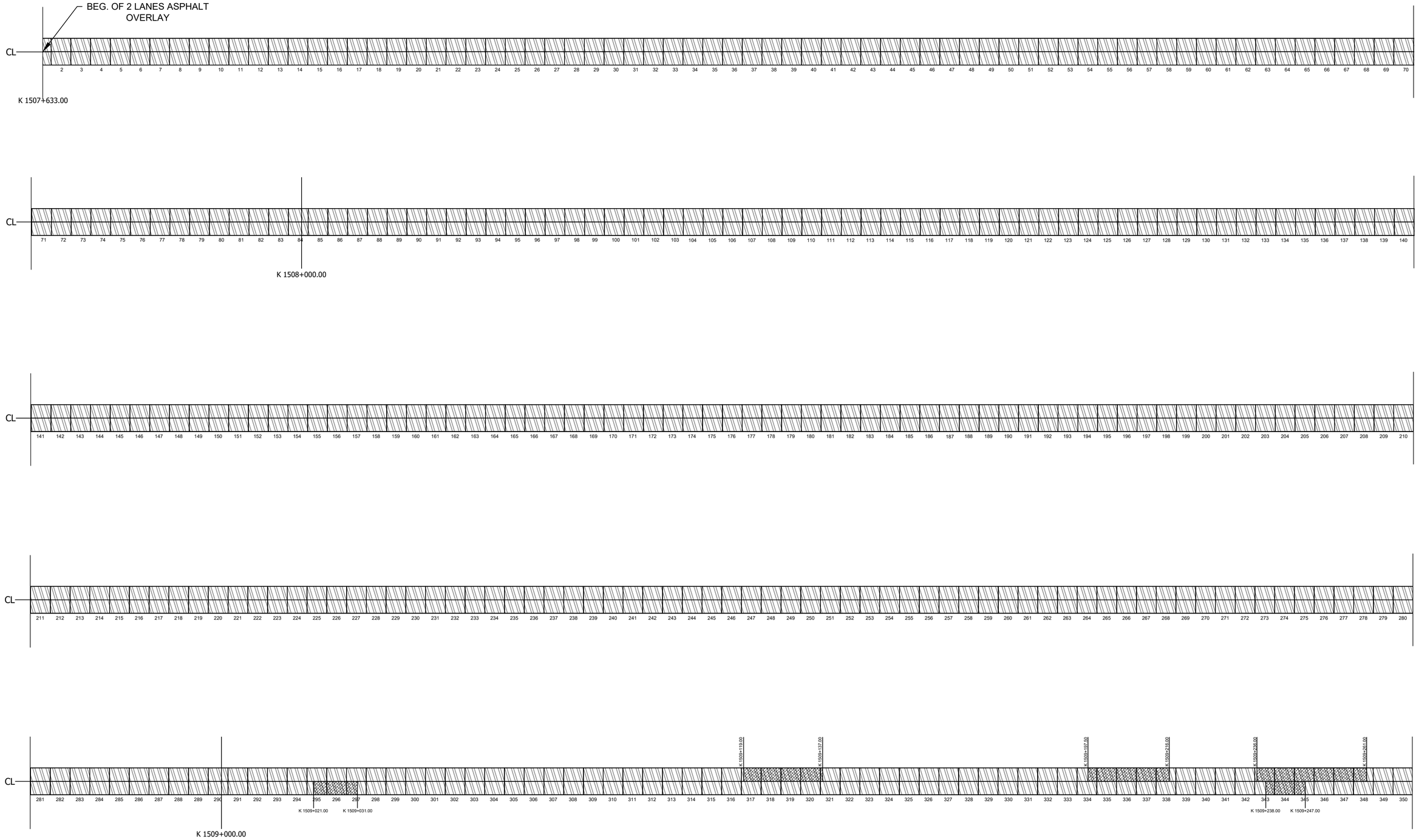
SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:

RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:

APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:

SET NO. C 1 1

SHEET NO. 3 52



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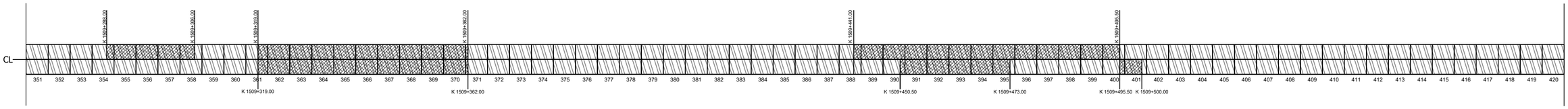
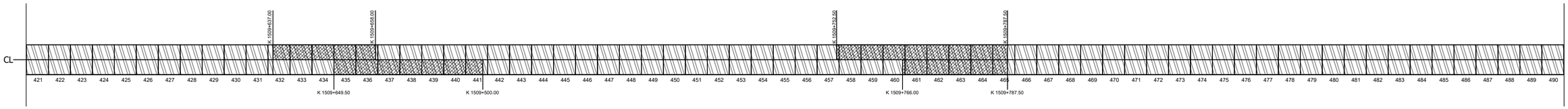
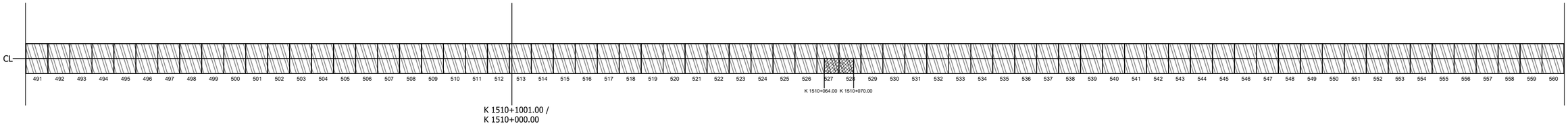
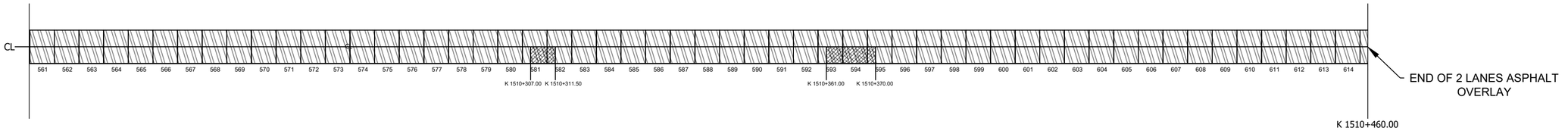
PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	STRAIGHT LINE DIAGRAM, REMOVAL OF EXISTING ASPHALT SCHEDULE, AND SCHEDULE OF ASPHALT OVERLAY	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	D 1 | 2	4 52









SCHEDULE OF REBLOCKING

STATION	LENGTH (m)	WIDTH (m)	BLOCKS	AREA (sq.m.)	REMARKS
K 1509+021 - K 1509+031.00	10.00	3.05	2	30.500	R/S
K 1509+119.00 - K 1509+137.00	18.00	3.05	4	54.900	L/S
K 1509+197.50 - K 1509+216.00	18.50	3.05	4	56.430	L/S
K 1509+236.00 - K 1509+261.00	25.00	3.05	6	76.250	L/S
K 1509+238.00 - K 1509+247.00	9.00	3.05	2	27.450	R/S
K 1509+288.00 - K 1509+306.00	18.00	3.05	4	54.900	L/S
K 1509+319.00 - K 1509+362.00	43.00	3.05	10	131.150	L/S
K 1509+319.00 - K1509+362.00	43.00	3.05	10	131.150	R/S
K 1509+441.00 - K 1509+495.00	54.50	3.05	12	166.230	L/S
K 1509+450.50 - K 1509+473.00	22.50	3.05	5	68.630	R/S
K 1509+495.50 - K 1509+500.00	4.50	3.05	1	13.730	R/S
K 1509+637.00 - K 1509+658.00	21.00	3.05	5	64.050	L/S
K 1509+649.50 - K 1509+680.00	30.50	3.05	7	93.030	R/S
K 1509+752.50 - K 1509+787.50	35.00	3.05	8	106.750	L/S
K 1509+766.00 - K 1509+787.50	21.50	3.05	5	65.580	R/S
K 1510+064.00 - K 1510+070.00	6.00	3.05	1	18.300	R/S
K 1510+307.00 - K 1510+311.50	4.500	3.05	1	13.730	R/S
K 1510+361.00 - K 1510+370.00	9.00	3.05	2	27.450	R/S
	393.500	TOTAL=	89	1200.000	

STRAIGHT LINE DIAGRAM
SCALE 1:600

LEGEND:
- FOR NEW ASPHALT OVERLAY
- FOR REBLOCKING/RECONSTRUCTION

SCHEDULE OF ASPHALT OVERLAY

ITEM 302(2) - Emulsified Asphalt

STATION	LENGTH (m)	AREA (sq.m.)	REMARKS
K1507+633.00 - K1510+460.00	2762.00	33,726.90	2 LANES
TOTAL	2762.00	33,726.90	

SCHEDULE OF ASPHALT OVERLAY

ITEM 310(2)b - Bituminous Concrete Surface Binder Course, Hot Laid (40 mm. thk.) - 1st Layer

STATION	LENGTH (m)	AREA (sq.m.)	REMARKS
K 1507+633.00 - K 1510+460.00	2762.00	13,578.74	2 LANES
TOTAL		13,578.74	

SCHEDULE OF ASPHALT OVERLAY

ITEM 310(1)b - Bituminous Concrete Surface Wearing Course, Hot Laid (40 mm. thk.) - 2nd Layer

STATION	LENGTH (m)	AREA (sq.m.)	REMARKS
K 1507+633.00 - K 1510+460.00	2762.00	17,077.04	2 LANES
TOTAL		17,077.04	

ITEM 101(1) REMOVAL OF STRUCTURES AND OBSTRUCTION

DESCRIPTION	STATION	LENGHT/NO.
RAISED STUDS		263.00
SOLAR STUDS		263.00

REMOVAL AND RELOCATION OF UTILITIES

STATION	DESCRIPTION	UNIT	LENGHT (m)	AREA (SQ.M.)	LOCATION
K1510+104.00	1 STOREY CONCRETE HOUSE	1.00		110.00	R/S
K1510+115.00	1 STOREY CONCRETE HOUSE	1.00		125.00	R/S
K1510+110.00	CONCRETE FENCE		38.00		L/S
K1510+120.00	CONCRETE SLAB	1.00		264.85	L/S
K1510+120.00	1 STOREY CONCRETE STORE	1.00		141.00	R/S
K1510+129.00	1 STOREY WOODEN STORE	1.00		145.00	R/S
K1510+140.00	1 STOREY WOODEN STORE	1.00		136.00	L/S
K1510+146.00	WOODEN PUROK	1.00		77.00	L/S
K1510+148.00	1 STOREY CONCRETE HOUSE	1.00		122.00	R/S
K1510+148.00	CONCRETE FENCE		37.00		R/S
K1510+159.00	WOODEN ELECTRICAL POST	1.00			L/S
K1510+164.00	1 STOREY CONCRETE HOUSE	1.00		144.00	R/S
K1510+174.60	1 STOREY WOODEN HOUSE	1.00		120.00	L/S
K1510+177.00	CONCRETE FENCE	1.00	39.00		R/S
K1510+183.00	1 STOREY WOODEN STORE	1.00		146.75	L/S
K1510+197.00	1 STOREY CONCRETE HOUSE	1.00		96.00	L/S
	TOTAL		111.00	1627.60	

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460

SHEET CONTENTS:
STRAIGHT LINE DIAGRAM, REMOVAL OF EXISTING ASPHALT SCHEDULE, AND SCHEDULE OF ASPHALT OVERLAY

DRAFTED:
HERWIN EVAN J. HABABAG
ENGINEER II

PREPARED:
WARREN S. PIÑEZ
ENGINEER II

REVIEWED:
BENILDA S. PACQUIAO
ENGINEER III
DATE:

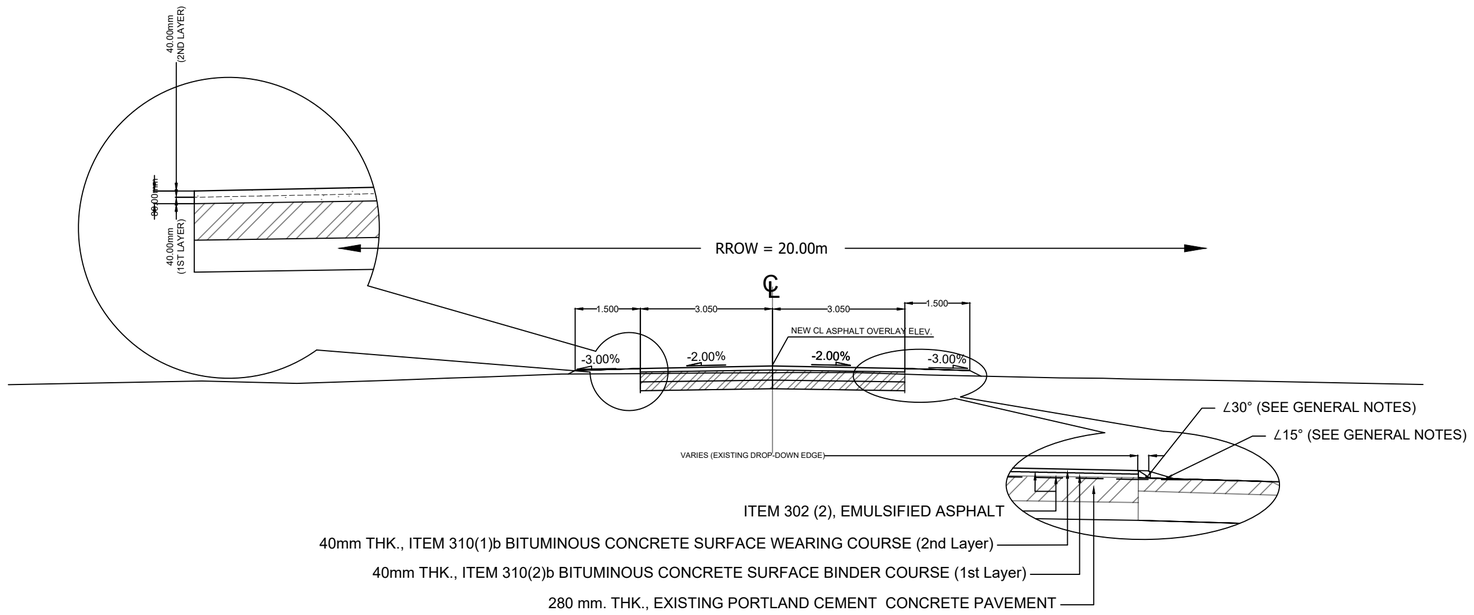
SUBMITTED:
JEZABEL E. TULING, MPA
CHIEF, PLANNING AND DESIGN SECTION
DATE:

RECOMMENDED:
GARRY E. VERANO
OFFICER-IN-CHARGE
OFFICE OF THE ASSISTANT DISTRICT ENGINEER
DATE:

APPROVED:
ARTURO R. LONGYAPON
DISTRICT ENGINEER
DATE:

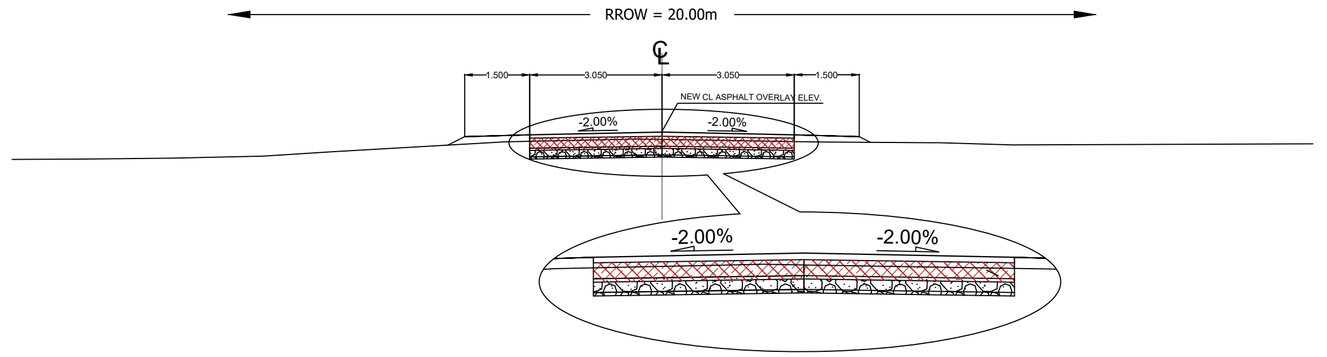
SET NO. D 2 2

SHEET NO. 5 52



TYPICAL ROADWAY SECTION SHOWING TWO (2) LANES ASPHALT OVERLAY - 80mm. thk.

SCALE 1 : 100 M.



EXISITNG 0.23 M THK., DAMAGED PCCP (UNREINFORCED) TO BE REMOVED

EXISITNG 0.20 M THK., ITEM 200 - AGGREGATE SUBBASE COURSE TO BE REMOVED

NEW 0.28 M THK., ITEM 311(1)e1 - PORTLAND CEMENT CONCRETE PAVEMENT (UNREINFORCED)

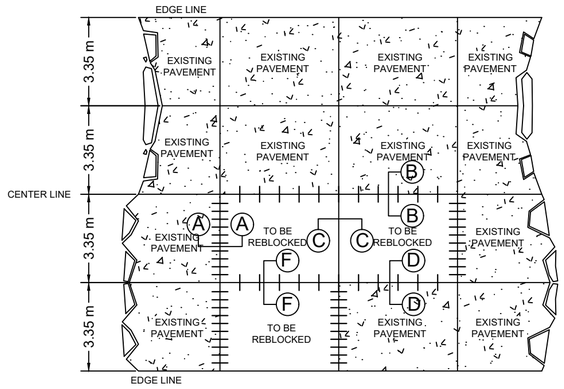
NEW 0.20 M THK., ITEM 200 - AGGREGATE SUBBASE COURSE

TYPICAL ROADWAY SECTION OF TWO (2) LANES FOR ASPHALT OVERLAY WITH REBLOCKING ON BOTH LANES

SCALE 1 : 100 M.

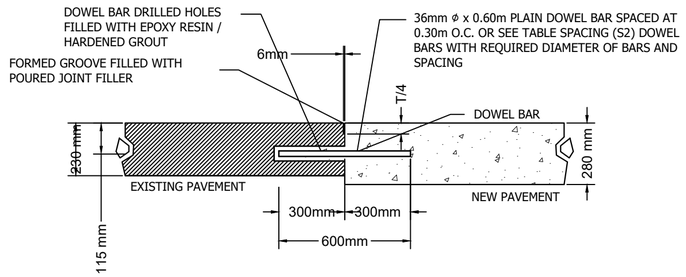
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	TYPICAL ROADWAY SECTION	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	E 1 1	6 52



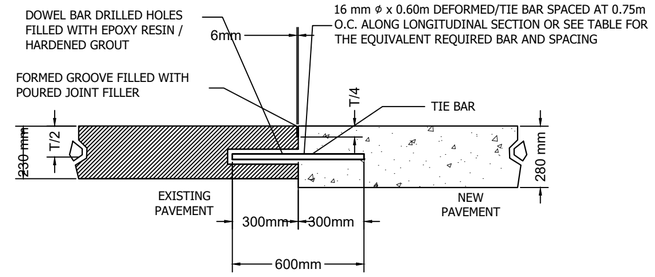
TYPICAL PLAN OF PCCP (4 LANES) - FOR REBLOCKING

SCALE NTS



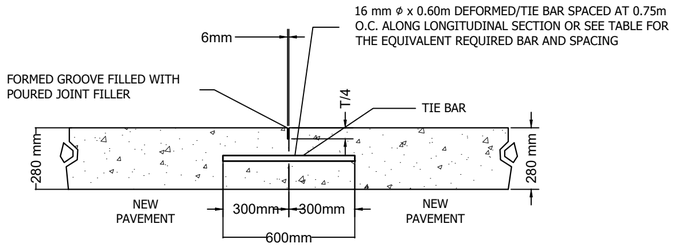
(TO BE USED FOR CONNECTIONS WITH EXISTING PAVEMENT AND NEW PAVEMENT WITH DIFFERENT THICKNESS)

A TRANSVERSE CONSTRUCTION JOINT (SECTION A - A)
(NEW AND EXISTING PAVEMENT)

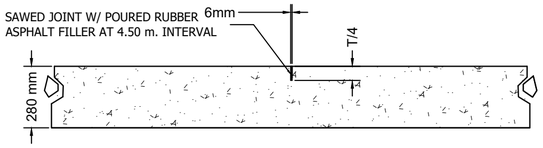


(TO BE USED FOR CONNECTIONS WITH EXISTING PAVEMENT AND NEW PAVEMENT WITH DIFFERENT THICKNESS)

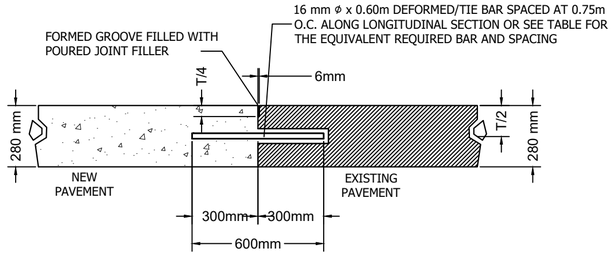
B LONGITUDINAL CONSTRUCTION JOINT (SECTION B - B)
(NEW AND EXISTING PAVEMENT)



F LONGITUDINAL CONSTRUCTION JOINT (SECTION F - F)



C TRANSVERSE CONTRACTION JOINT (SECTION C-C)



(TO BE USED FOR CONNECTIONS WITH EXISTING PAVEMENT AND NEW PAVEMENT WITH SAME THICKNESS)

D LONGITUDINAL CONSTRUCTION JOINT (SECTION D - D)
(NEW AND EXISTING PAVEMENT)

TABLE SPACING OF TIE BARS (L=600 mm)		
SLAB THICKNESS (mm)	SPACING S1 (mm)	
	12 mm dia.	16 mm dia.
230	600	750
240	600	750
250	600	750
260	500	750
270	500	750
280	500	750
290	500	750
300	500	750
310	400	750
320	400	750
330	400	750
340	400	750

BASED ON AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES 1993.
NOTE: THE BAR SPACING WILL BE BASED FROM THICKNESS OF THE NEW PAVEMENT

N O T E:

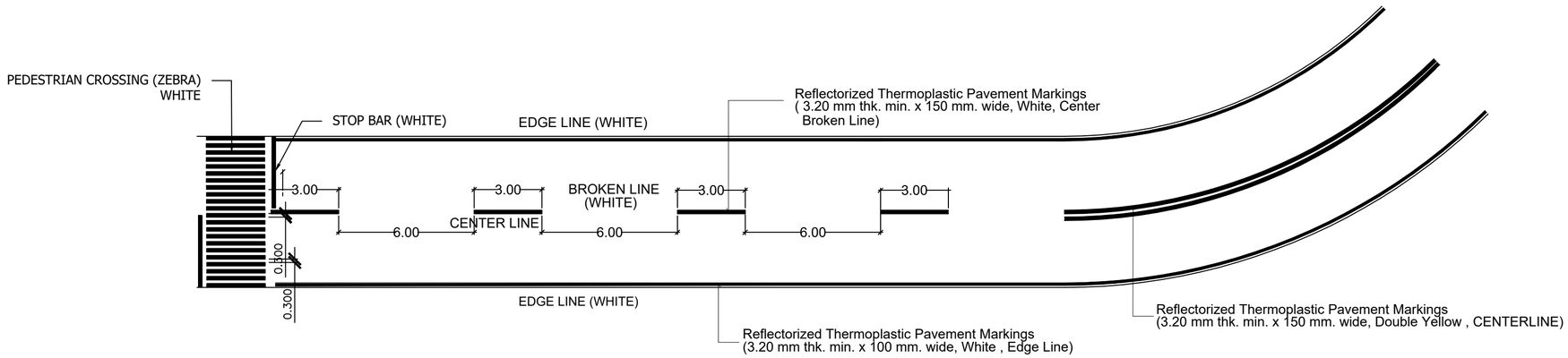
1. Materials and workmanship shall conform with the DPWH Standard Specification for Highways, Bridges and Airport, 2013
2. Contraction joints are formed when concrete on one side of the joint is poured ahead and allowed to set before pouring on the other side, No construction joint shall be placed within 1.50 m. from the weakened plane joint.
3. At construction joint (longitudinal or transverse) care should be taken that no concrete from the last slab placed overhangs any portion of the first slab.
4. Tie bars should be deformed steel bars. All dowel bars shall be smooth round steel bar free from rust and other defects which might restrict their movement.
5. Type of weakened plane joint to be used shall be as specified in the plans and only one type should be used for the whole project.
6. Material for the metal side form shall be brand new sheet metal Gauge no. 15 of black iron free from rust and links.
7. At least six (6) successive doweled butt joints at normal joint spacing shall be provided before or after an expansion joint.
8. The groove or cracks above joints (longitudinal or transverse) shall be sealed with 30-50 penetration asphalt seal or cold applied liquid rubber compound after the concrete had been cured and before opening pavement to traffic. Asphalt sealed should be poured in such manner that spalling shall be prevented/eliminated, thus, provide a smooth leveling/ riding surface.
9. All transverse joints except construction joint shall be continuous from edge to edge.
10. All longitudinal joints shall meet at intersections with no gaps or offset.
11. All dimensions are in millimeters unless otherwise specified.
12. Avoid stoppage of formworks along curves.
13. Construct expansion joint at every 90 meters and/or every adjacent existing structures.

TABLE SPACING (S2) OF DOWEL BARS (L=600mm)				
SLAB DEPTH, (T) (mm)	SPACING FOR 36mm. dia, DOWEL BAR (mm)	SPACING FOR 32mm. dia, DOWEL BAR (mm)	SPACING FOR 28mm. dia, DOWEL BAR (mm)	SPACING FOR 25mm. dia, DOWEL BAR (mm)
280	300	250	190	160
290	290	230	170	140
300	270	210	160	130
310	250	200	150	120
320	230	190	140	110
330	220	180	130	110
340	200	170	130	100

BASED ON AASHTO GUIDE FOR DESIGN OF PAVEMENT STRUCTURES 1993.
NOTE: THE BAR SPACING WILL BE BASED FROM THICKNESS OF THE NEW PAVEMENT

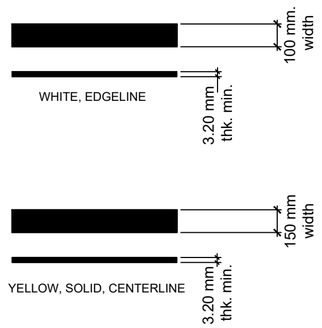
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	STANDARD PORTLAND CEMENT CONCRETE PAVEMENT JOINTS	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	F 1 1	7 52



PLAN AT CURVE

SCALE NTS



REFLECTORIZED THERMOPLASTIC
PAVEMENT MARKINGS DETAIL

GENERAL NOTES:

1. THE MATERIALS, DIMENSIONS, SHAPE, COLOR, SIZE OF NUMERALS, LETTERS, AND INSTALLATION CONFORMED IN ACCORDANCE WITH SPECIFICATIONS OF DPWH MANUAL ON PAVEMENT MARKINGS.

2. REFLECTORIZED THERMOPLASTIC PAVEMENT STRIPPING MATERIAL CONFORMED TO AASHTO M249, IN WHICH THE ROAD HAD BEEN APPLIED IN A MOLTEN STATE BY MECHANICAL MEANS WITH SURFACE APPLICATION OF GLASS BEADS AT A RATE OF NOT LESS THAN 350 G/L OF GLASS BEADS HAVING A SIZE RANGE OF DROP-IN TYPE AND PRODUCED AN ADHERENT REFLECTORIZED STRIPE OF SPECIFIED THICKNESS AND WIDTH CAPABLE OF RESISTING DEFORMATION BY TRAFFIC.

REFLECTORIZED THERMOPLASTIC PAVEMENT
MARKINGS DETAIL

REFLECTORIZED THERMOPLASTIC PAVEMENT MARKINGS SCHEDULE

STATION	EDGELINE		BROKEN LINES (W=0.15m, L=3.00m)		WHITE SOLID LINE (STOP BAR)		PEDESTRIAN LANE (L=6.10m, W=0.30m)		AREA, SQ.M. ITEM 612(1)	AREA, SQ.M. ITEM 612(2)	DESCRIPTION
	LENGTH	WIDTH	LENGTH	NO. OF STRIPS	LENGTH	WIDTH	LENGTH	NO. OF STRIPS			
K1507+633.00 - K1510+460.00 (2 LANES)	2767.00	0.10							553.40		WHITE ,EDGE LINE (BOTHSIDES)
K1507+633.00 - K1510+460.00 (2 LANES)			2421.50	269.00					242.10		WHITE ,CENTERLINE (BROKEN LINE)
K1507+845 K1507+910 K1508+565 K1508+680 K1509+010 K1509+060					6.10 x 3	0.30	4.00 x 3	10.00 x 3	905.12		WHITE SOLID LINE, PEDESTRIAN LANE WITH STOP BAR
K1508+750.00 - K1509+010.00 K1509+780.00 - K1509+920.00 K1509+183.50 - K1509+202.00										103.65	DOUBLE YELLOW LINE (CENTERLINE)
TOTAL=									1700.62	103.65	

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**

SHEET CONTENTS: REF. THERMOPLASTIC PAVEMENT MARKINGS DETAILS

DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II
PREPARED: **WARREN S. PIÑEZ** ENGINEER II

REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:

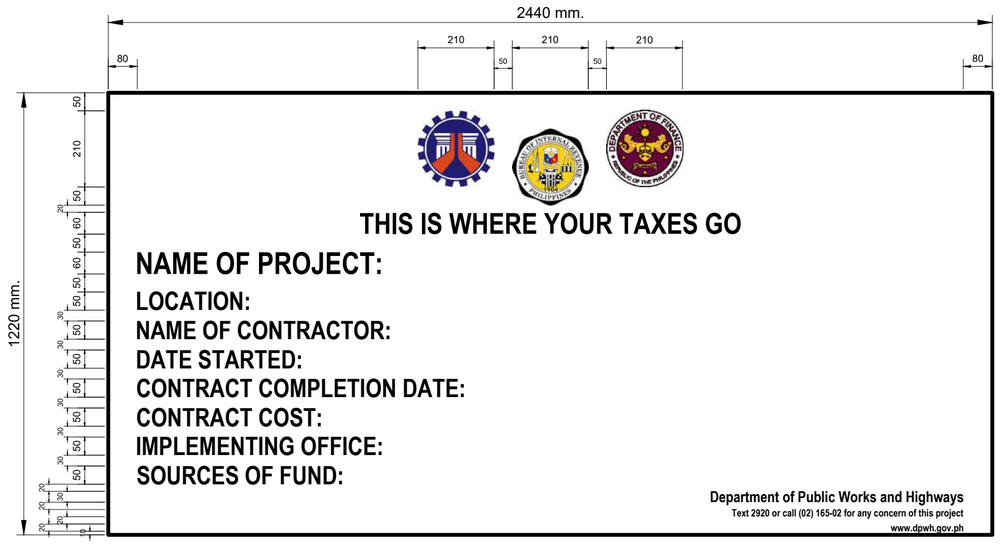
SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:

RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:

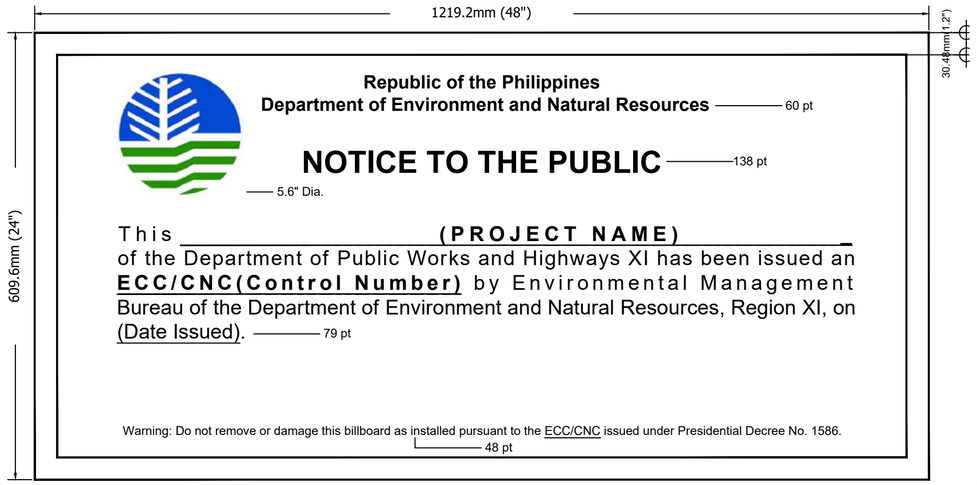
APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:

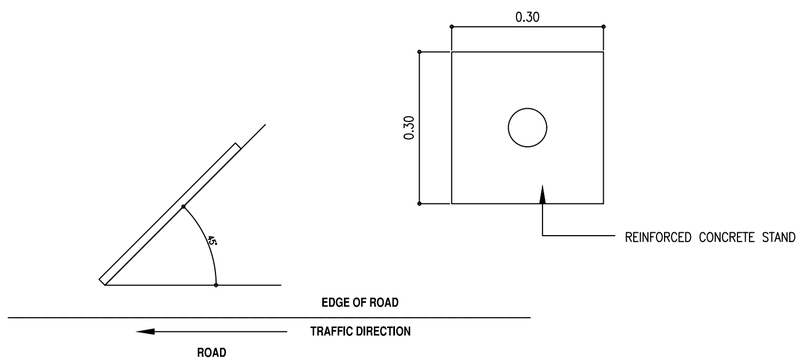
SET NO. G 1 1

SHEET NO. 8 52



DPWH STANDARD PROJECT BILLBOARD





BILLBOARD FRAME DETAIL

COA BILLBOARD

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
DISTRICT ENGINEERING OFFICE
TAGUM CITY

Project:_____ Cost:_____
Location:_____ Fund Source/s:_____
Implementing Agency/ies:_____
Development Partner/s:_____
Contractor/Supplier:_____
Brief Description of Project:_____

Project Details:

PROJECT DATE			PROJECT STATUS				REMARKS
Duration	Started	Target Date of Completion	Percentage of Completion	As of (Date)	Cost Incurred to Date	Date Completed	

For particulars or complain about this project, please contact the Regional Office or Cluster which has audit jurisdiction on this project:

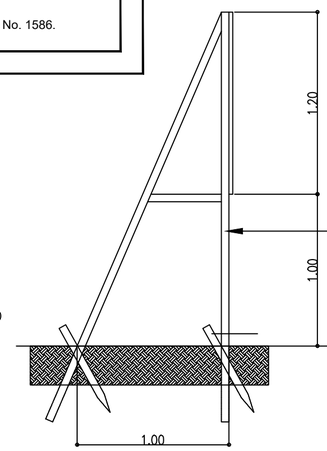
COA Regional Office No./Cluster:_____
Address:_____
Contact No.:_____or Text COA Citizen's Desk at 0915-5391957

2440 mm. (8 ft.)

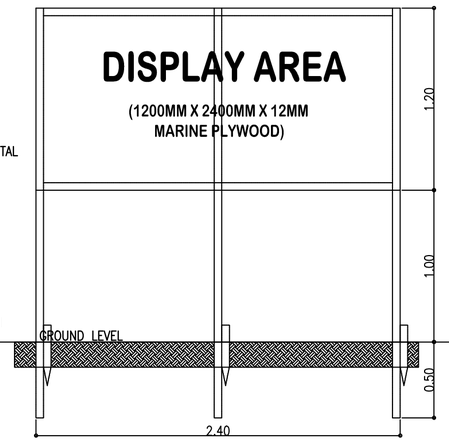
WHITE BACKGROUND

2440 mm. (8 ft.)

NOTE :
* INSTALLATION OF BILLBOARD SHALL BE ONE(1) AT THE BEGINNING & ONE(1) AT THE END OF THE PROJECT.
* NAMES OR PICTURES OF ANY PERSONAGES SHOULD NOT APPEAR IN THE BILLBOARD.
* NO POLITICAL BILLBOARD SHALL BE ALLOWED TO BE INSTALLED 100m BEFORE & 100m AFTER ALL DPWH PROJECTS & IN BETWEEN THE PROJECT LIMITS OR WITHIN THE ROAD-RIGHT-OF-WAY.
* DPWH CONTRACTORS SHALL NOT BE ALLOWED TO PLACE NAMES OF POLITICIANS ON THEIR EQUIPMENT OR CARRY POLITICAL BILLBOARD ON THEIR EQUIPMENT.

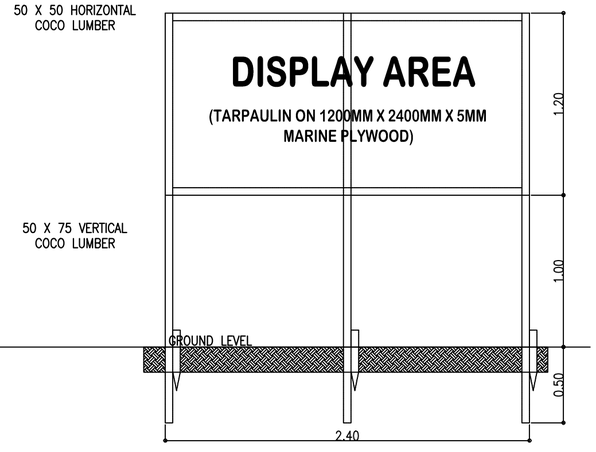


ELEVATION



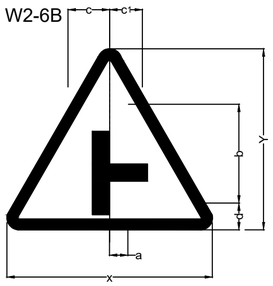
FRONT ELEVATION
(OPTION 1)

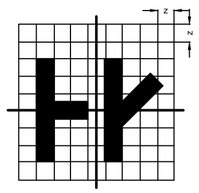
ORIENTATION



FRONT ELEVATION
(OPTION 2)

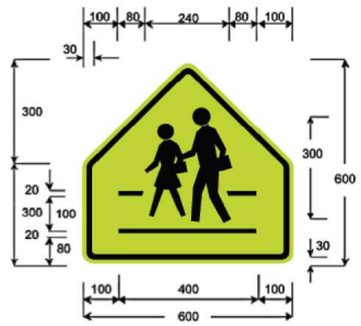
REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: DPWH AND COA BILLBOARD DETAILS	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. H 1 1	SHEET NO. 9 52

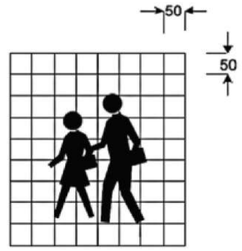




X	600
Y	520
a	50
b	300
c	150
d	50
Z	50

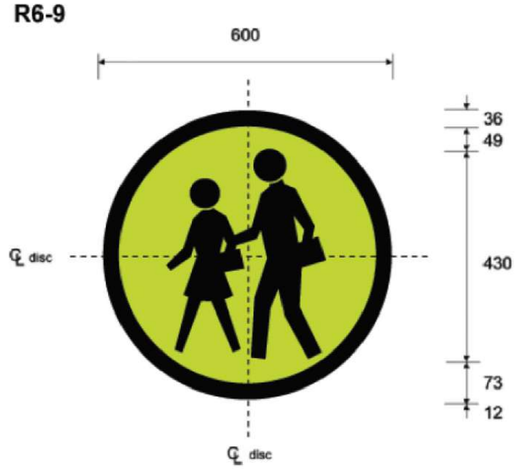
W6-2 (B size illustrated)





Black symbol and border on fluorescent yellow green background

R6-9



Black symbol and border on retro-reflective fluorescent yellow-green background.

ROAD SIGN SCHEDULE

TYPE	QUANTITY	LOCATION / STATION
W2 - 6B	3	K 1507+650 @ LEFT SIDE K 1508+020 @ LEFT SIDE K 1508+200 @ RIGHT SIDE
W6 - 1B	6	K 1508+210 @ RIGHT SIDE K 1508+880 @ RIGHT SIDE K 1509+100 @ LEFT SIDE K 1509+780 @ RIGHT SIDE K 1510+000 @ RIGHT SIDE K 1510+240 @ LEFT SIDE
R6 - 9B	4	K 1509+010.00 @ BOTH SIDE K 1509+060.00 @ BOTH SIDE

ITEM 605(2)aj2 - REMOVAL

R6 - 9B	1 1	K 1509+040.00 K 1509+080.00

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: ROAD SIGNS DETAILS AND SCHEDULE	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. I 1 | 2	SHEET NO. 10 52

GENERAL NOTES FOR WARNING SIGNS

1. ALL POST SHALL BE THOROUGHLY CLEANED, FREE FROM GREASE, SCALE AND RUSTS BE GIVEN ONE COAT OF RUST-INHIBITING PRIMING PAINT AND TWO COATS OF INTERNATIONAL ORANGE IN ACCORDANCE WITH ITEM 411, PAINT DPWH STANDARD SPECIFICATION.

2. ALL DETAILS SHALL COMPLY WITH THE DPWH STANDARD SPECIFICATIONS FOR ROAD SIGN, DO. 158, S. 2015

DESIGN

3. IN GENERAL, WARNING SIGNS ARE TRIANGULAR IN SHAPE (WITH ONE ANGLE VERTICAL), WITH A BLACK SYMBOL, REFLECTORIZED RED BORDER ON A RETRO-REFLECTIVE WHITE, OR FLUORESCENT YELLOW GREEN BACKGROUND.

4. THE SIDE OF ONE SIDE OF EQUILATERAL TRIANGULAR SHAPED SIGNS SHALL NOT BE LESS THAN 600 mm. FOR HIGH-SPEED EXPRESSWAYS, LARGER SIGNS (UP TO 1200 mm) ARE USUALLY ADOPTED.

LOCATION

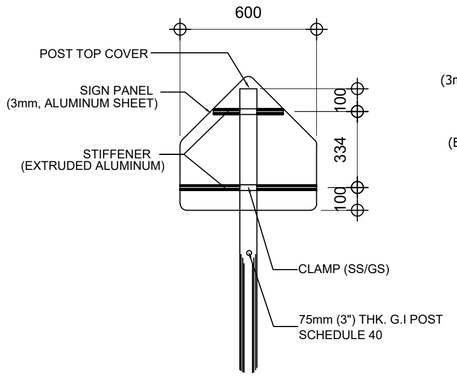
5. AS WARNING SIGNS ARE PLACED PRIMARILY FOR THE PROTECTIONOF THE DRIVER WHO IS NOT FAMILIAR WITH THE ROAD, IT IS VERY IMPORTANT THAT THEIR LOCATION AND INSTALLATION MUST BE UNDERTAKEN WITH CARE.

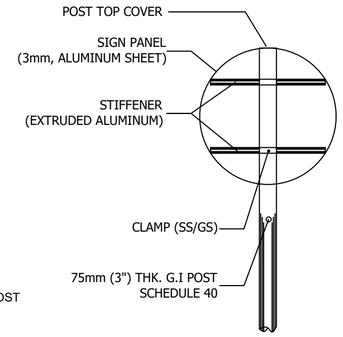
5.1 TEST RUNS SHOULD BE MADE BY DAY AND BY NIGHT FROM BOTH DIRECTIONS TO CHECK THE LOCATION AND MOUNTING OF EACH INSTALLATION.

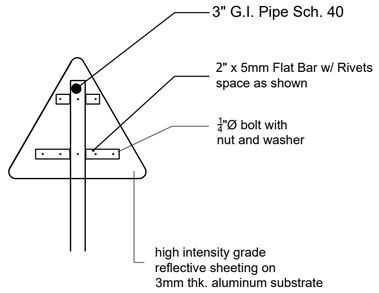
5.2 A WARNING SIGN SHOULD BE GENERALLY BE INSTALLED ON THE RIGHT SIDE OF THE ROAD AND BE POSITIONED SO THAT IT WILL CONVEY ITS MESSAGE WITHOUT RESTRICTING LATERAL CLEARANCE OR SIGHT DISTANCE.

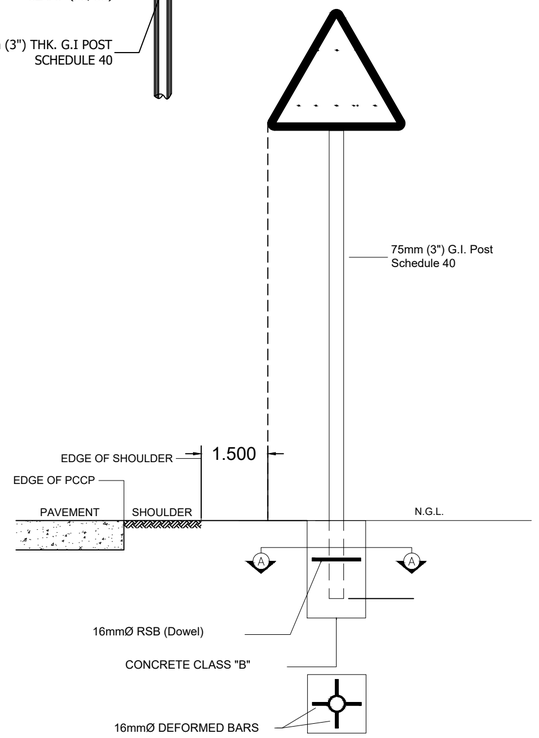
5.3 IN URBAN AREAS, ADVANCE WARNING SIGN SHOULD BE PLACED AT NOT LESS THAN 30.0 m. IN ADVANCE OF THE HAZARDOUS AREA.

5.4 EXACT LOACTION OF ALL WARNING SIGNS TO BE INSTALLED SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER.

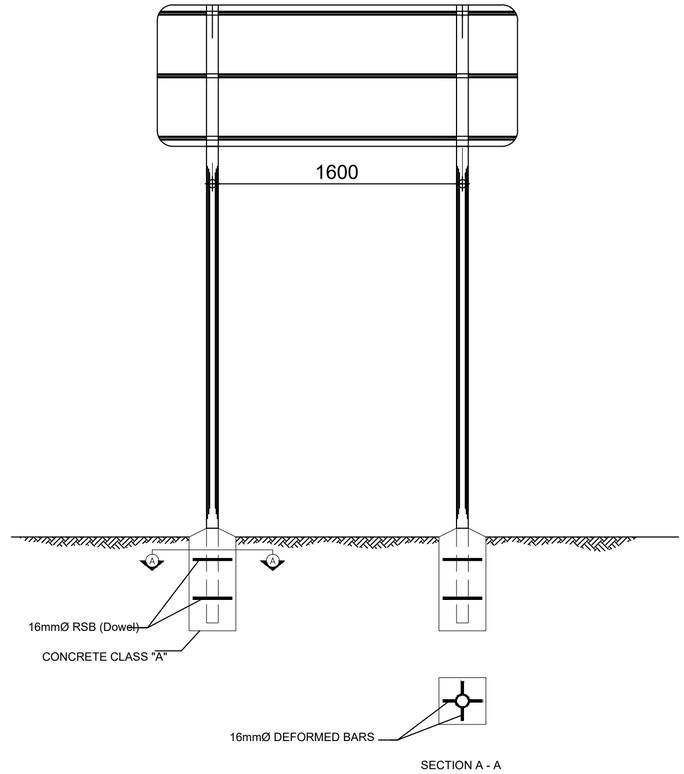




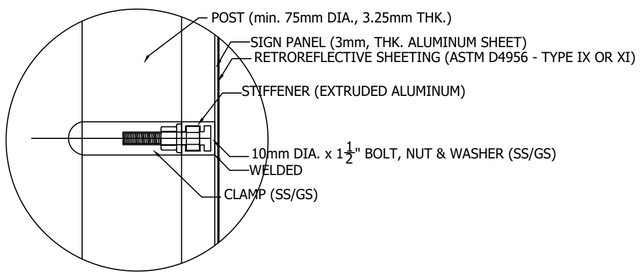




SECTION A - A

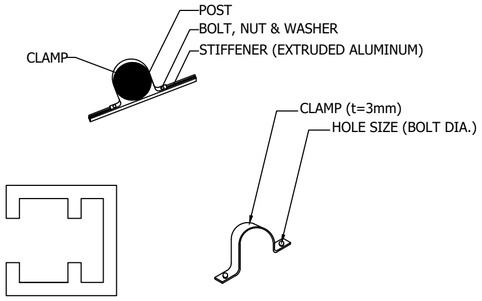


SECTION A - A



MOUNTING DETAILS

SCALE NTS

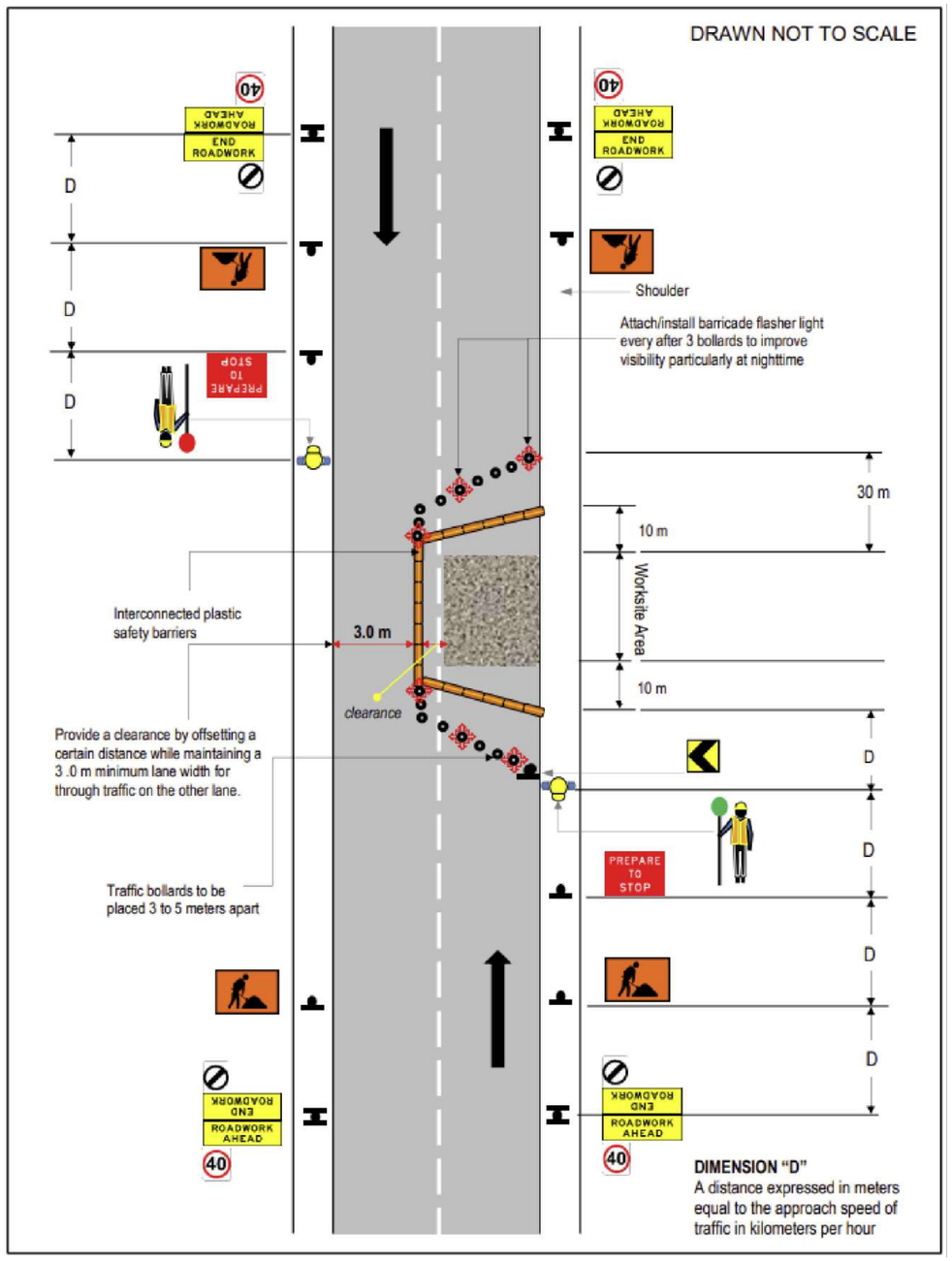


STIFFENER AND CLAMP DETAILS

SCALE NTS

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: ROAD SIGNS DETAILS AND SCHEDULE	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. I 2 2	SHEET NO. 11 52

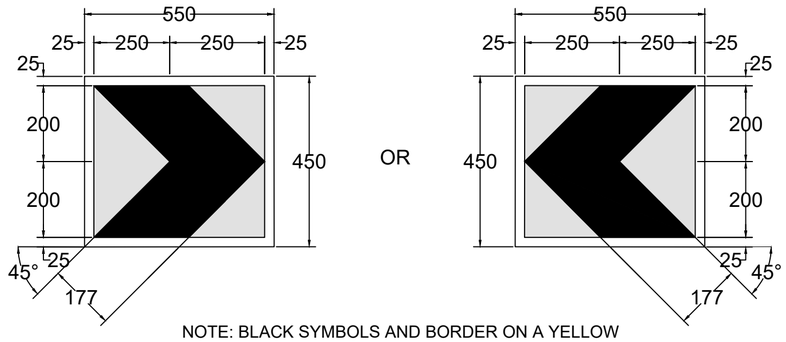
TRAFFIC MANAGEMENT LAY-OUT (LAY-OUT 7 - CASE 1 - PART LANE CLOSURE - 2 LANE, 2 WAY ROAD, LONG TERM)



ROAD & BRIDGE WORK SITE TEMPORARY SIGNAGE		SIGN No.	SIZE (mm) (WidthxHeight)
LEGEND:			
40	SPEED RESTRICTION	R4-10	600X800
ROADWORK AHEAD	ROADWORK AHEAD	T1-1	1800x600
END ROADWORK	END ROADWORK	T2-16	1800x600
	END SPEED RESTRICTION	R4-2	600x800
	WORKMEN AHEAD (SYMBOLIC)	T1-5	900x600
PREPARE TO STOP	PREPARE TO STOP	T1-18	900x600
	TEMPORARY HAZARD MARKER	T5-5	550x450
	TEMPORARY BOLLARDS		
	TEMPORARY BOLLARDS WITH FLASHER		

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	TRAFFIC MANAGEMENT PLAN AND DETAILS	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	J 1 3	12 52



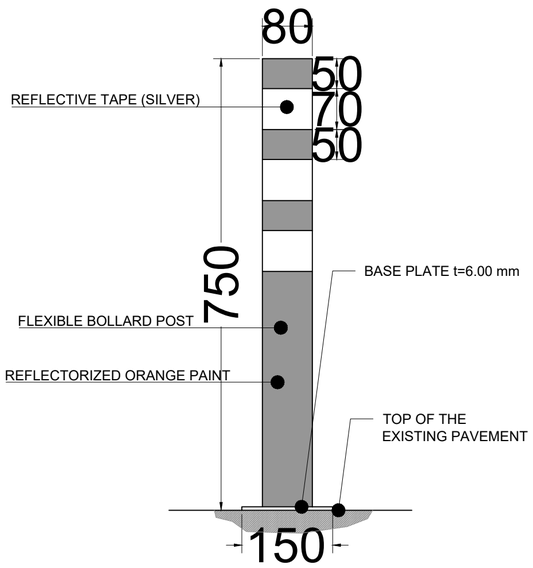
NOTE: BLACK SYMBOLS AND BORDER ON A YELLOW RETRO-REFLECTIVE BACKGROUND

NOTE: BLACK NUMERALS ON A WHITE RETRO-REFLECTIVE BACKGROUND AND RED REFLECTORIZED CIRCLE

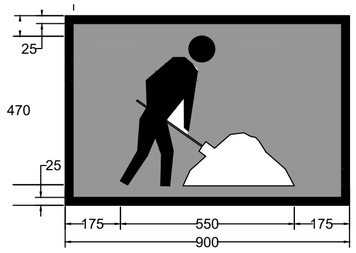
SPEED RESTRICTION

NOTE: SYMBOL 600 DIA BLACK ON A WHITE RETRO-REFLECTORIZED BACKGROUND

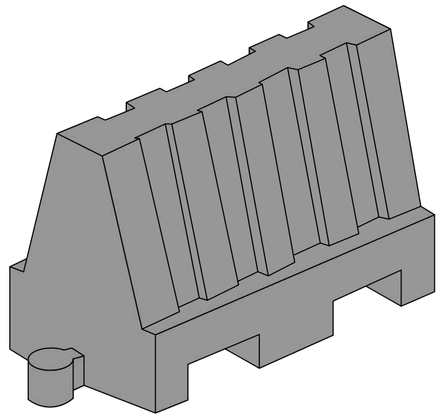
END SPEED RESTRICTION



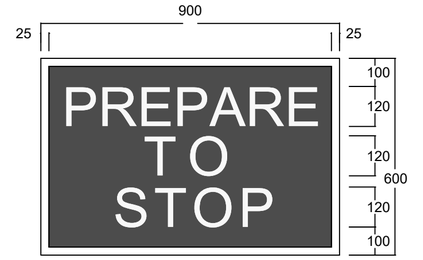
ELEVATION OF FLEXIBLE BOLLARD POST



NOTE:
BLACK SYMBOLS AND BORDER
- RED/ORANGE FLOURESCENT BACKGROUND FOR DAYTIME USE (SHORT TERM)
- RED/ORANGE RETRO-REFLECTIVE BACKGROUND FOR NIGHTTIME USE (LONG TERM)

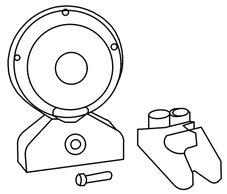


PLASTIC SAFETY BARRIER



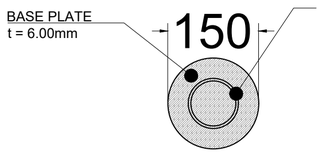
NOTE: WHITE LETTERS ON A RED RETRO-REFLECTIVE BACKGROUND

PREPARE TO STOP DETAIL



NOTE: FLASHER LIGHT 3 VOLTS, BATTERY OPERATED, AMBER COLOR W/ LIFESPAN CONSIDERATION OF 6 MONTHS

FLASHER LIGHT



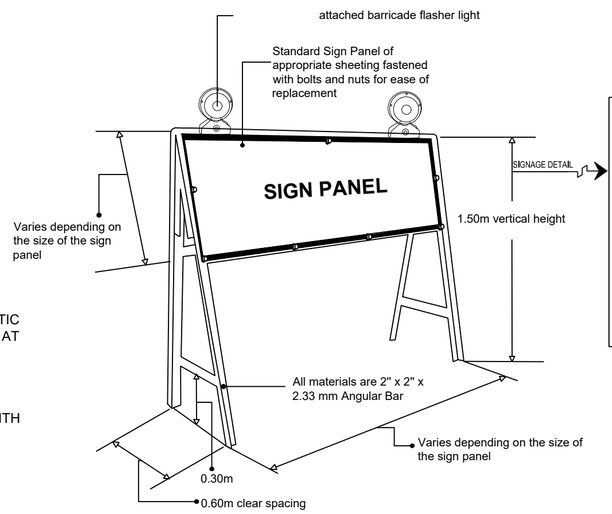
PLAN VIEW OF FLEXIBLE BOLLARD POST

NOTE :
FLEXIBLE BOLLARD POST WITH REFLECTORIZED YELLOW PAINT

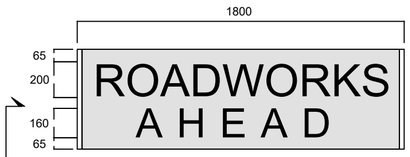
1. TEMPORARY BOLLARD SHALL BE FLUORESCENT RED OR ORANGE PLASTIC THAT IS RESILIENT TO IMPACT & WILL NOT DAMAGE VEHICLES WHEN HIT AT LOW SPEED.

2. THE HEIGHT OF BOLLARDS IS UP TO 1 METER.

3. FOR NIGHT TIME OPERATION THE BOLLARDS MUST BE FITTED WITH REFLECTIVE TAPE WITH A MINIMUM BANDWIDTH OF 250mm.
(See Lay-out Plan for the Standard Spacing)

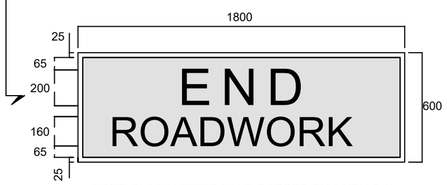


DETAILS OF THE TWO SIDED SIGN FRAMES



NOTE: BLACK LETTERS AND BORDER ON A YELLOW RETRO-REFLECTIVE BACKGROUND

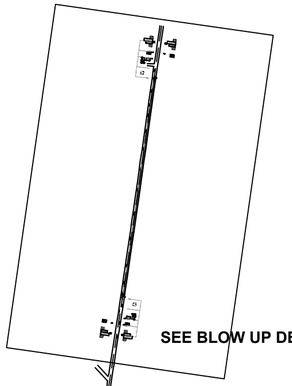
ROAD WORK AHEAD DETAIL



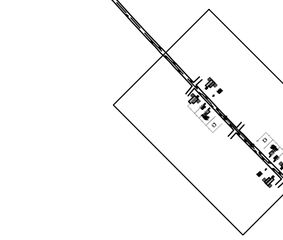
NOTE: BLACK LETTERS AND BORDER ON A YELLOW RETRO-REFLECTIVE BACKGROUND

END ROADWORK DETAIL

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: TRAFFIC MANAGEMENT PLANS AND DETAILS	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. J 2 3	SHEET NO. 13 52

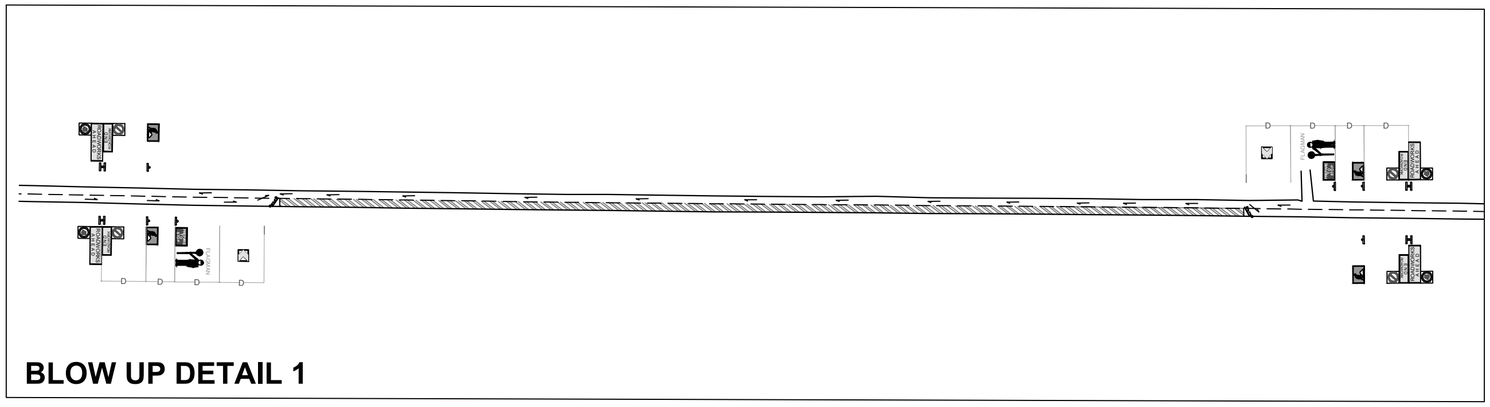


SEE BLOW UP DETAIL 1

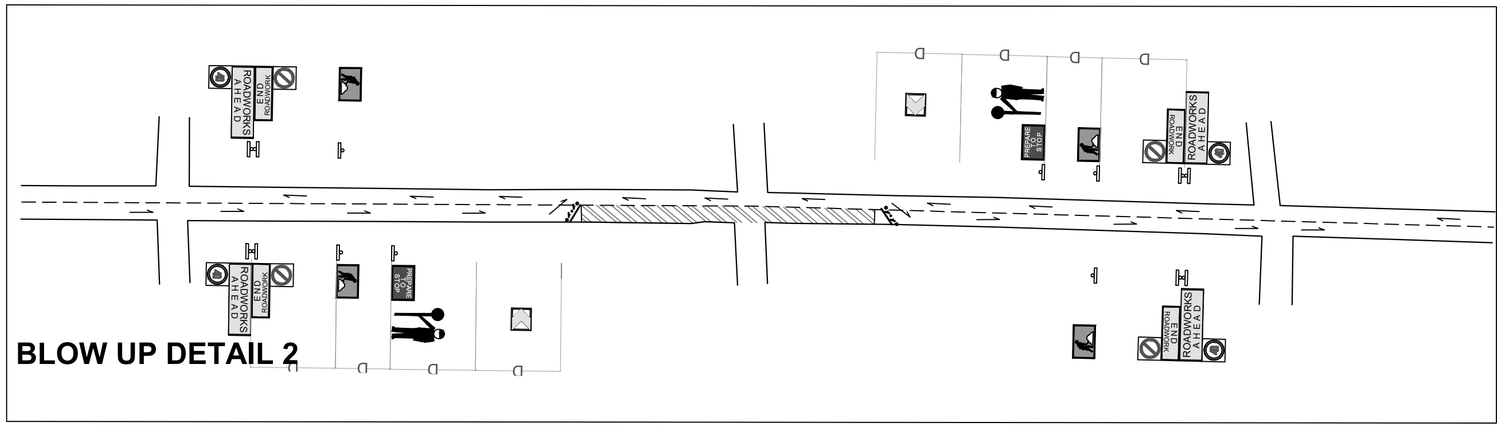


SEE BLOW UP DETAIL 2

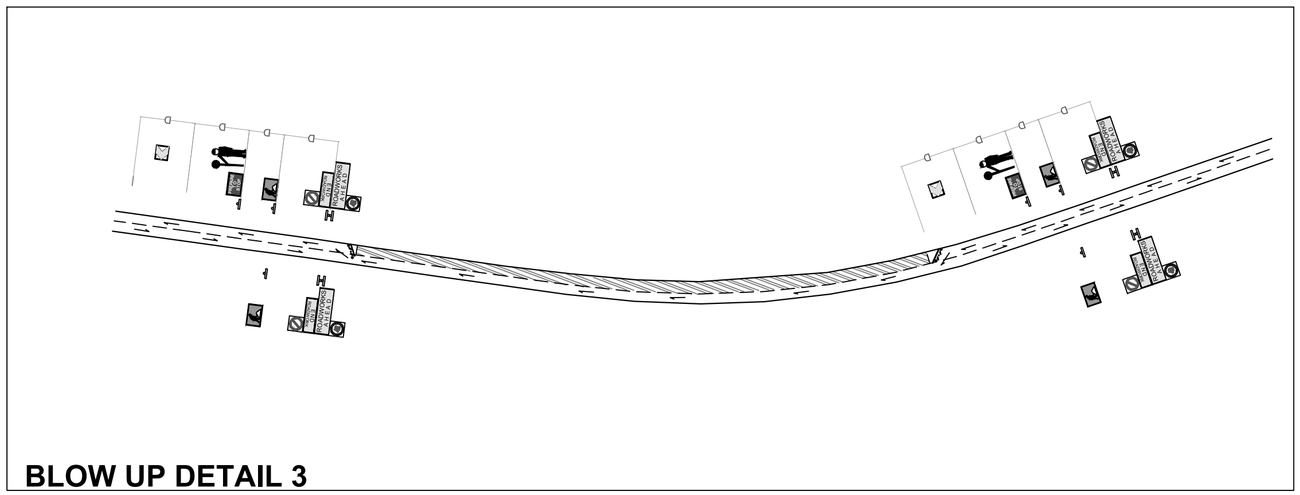
SEE BLOW UP DETAIL 3



BLOW UP DETAIL 1



BLOW UP DETAIL 2

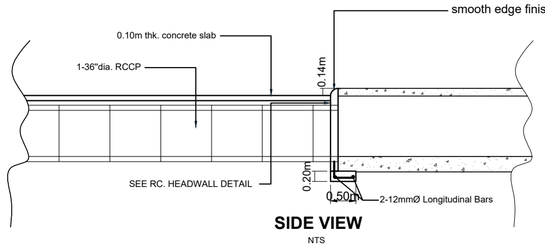


BLOW UP DETAIL 3

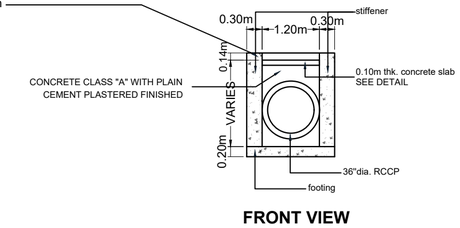
TRAFFIC MANAGEMENT PLAN

NOT TO SCALE

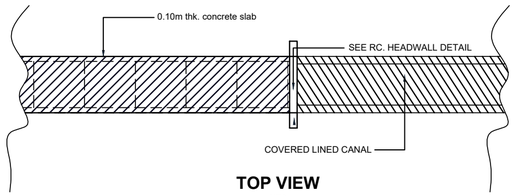
REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: TRAFFIC MANAGEMENT PLAN AND DETAILS	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. J 3 3	SHEET NO. 14 52



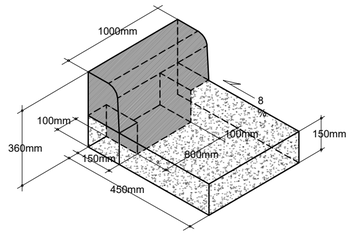
SIDE VIEW
NTS



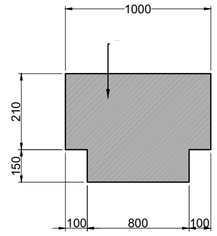
FRONT VIEW
NTS



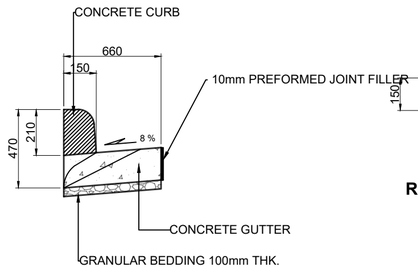
TOP VIEW
NTS



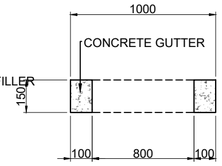
ISOMETRIC VIEW
NTS



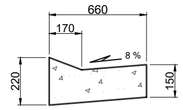
REAR ELEV. OF CURB
SCALE NTS



CONC. CURB & GUTTER DETAIL
SCALE NTS



REAR ELEV. OF GUTTER
SCALE NTS



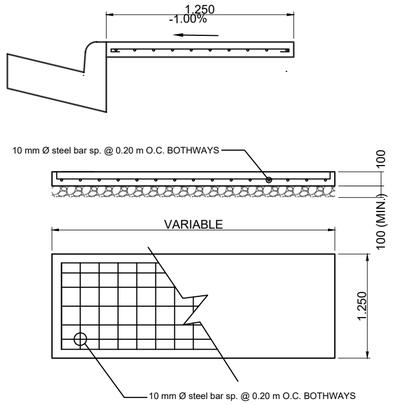
DROP CURB DETAIL
SCALE NTS

DROP CURBS WILL BE USE @ RAMPS OF SIDEWALK & DRIVEWAYS

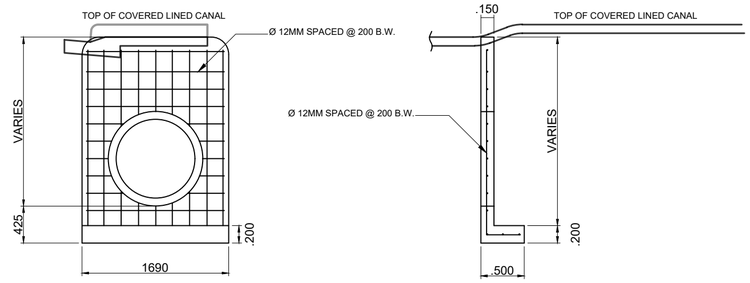
NOTES :

1. CONCRETE CURB AND GUTTER SHALL BE CONSIDERED IN THE DESIGN OF PAVED ROADS IF THE FUNCTION IS TO FACILITATE THE CHANNELING OF SURFACE WATER RUN-OFF THUS PREVENTING THE EROSION OF SHOULDERS AND SLOPE.

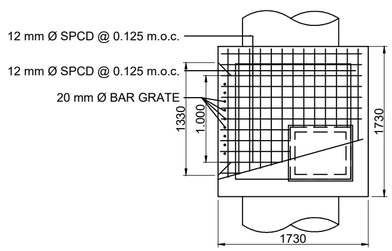
2. MINIMUM CURB INLET INTERVAL IS 5 meters.



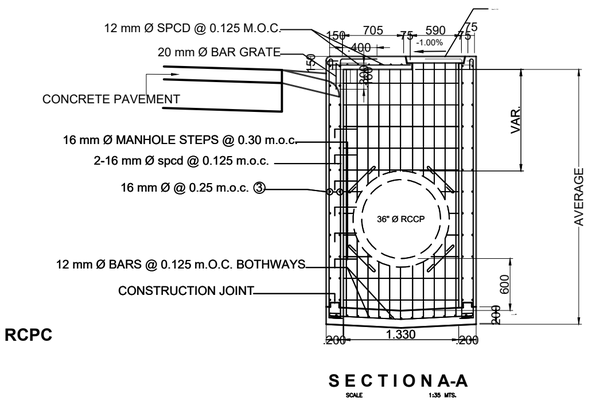
REINFORCED CONCRETE SLAB DETAIL (SIDEWALK)
NTS



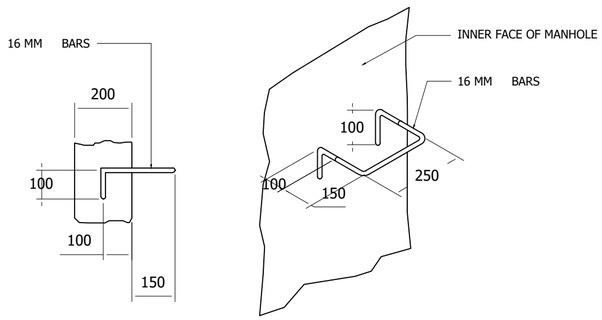
REINFORCED CONCRETE HEADWALL DETAIL
NTS



REINFORCED CONCRETE MANHOLE for 36 " Ø RCPC
SCALE 1:35 MTS.

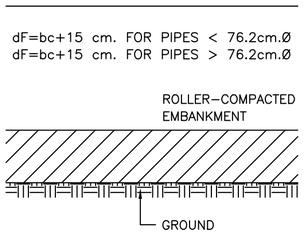


S E C T I O N A-A
SCALE 1:35 MTS.

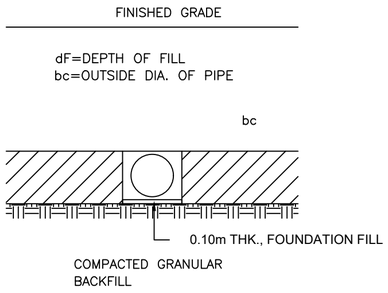


CATCH BASIN STEPS
SCALE NTS

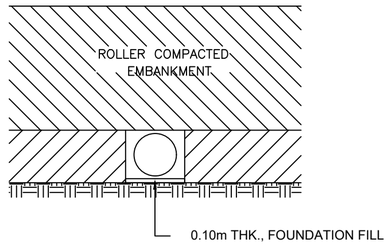
REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: CONCRETE SIDEWALKS DETAILS, CURB AND GUTTER DETAIL, DROPPED CURB AND DETAIL, AND MANHOLE DETAILS	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. K 1 | 1	SHEET NO. 15 52



STEP –1–CONSTRUCT COMPACTED EMBANKMENT TO AN ELEVATION ABOVE TOP OF PROPOSED PIPE

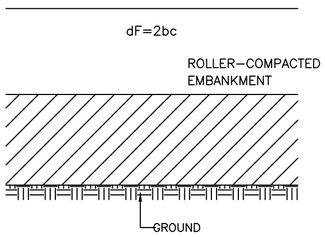


STEP –2–TRENCH THROUGH THIS COMPACTED EMBANKMENT AND INSTALL PIPE BACKFILL WITH COMPACTED GRANULAR MATERIAL

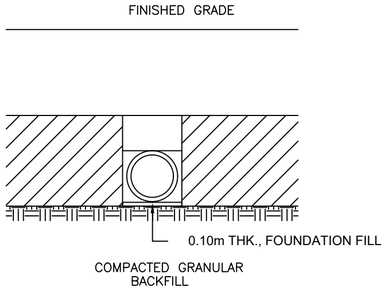


STEP –3–COMPLETE EMBANKMENT IN USUAL MANNER

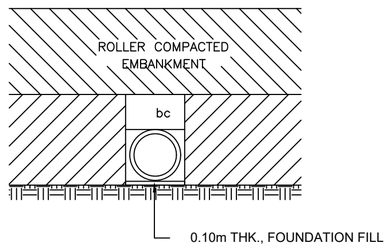
CALIFORNIA METHOD A



STEP –1–CONSTRUCT COMPACTED EMBANKMENT TO A TOTAL DEPTH EQUAL TO TWICE THE OUTSIDE DIA. OF THE PIPE.



STEP –2–TRENCH THROUGH THIS COMPACTED EMBANKMENT AND INSTALL PIPE BACKFILL WITH COMPACTED GRANULAR MATERIAL TO TOP OF PIPE

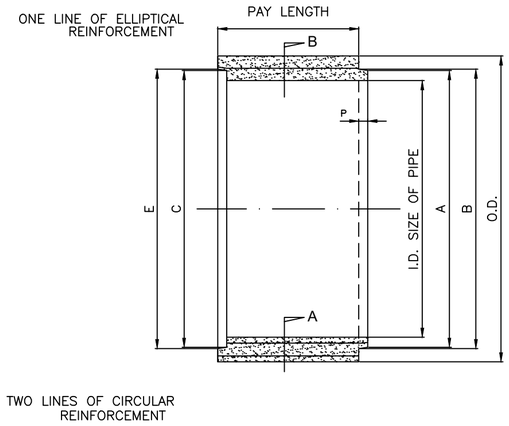


STEP –3–FILL REMAINDER OF TRENCH WITH BACKFILL PLACE IN LOOSEST POSSIBLE CONDITION. COMPLETE EMBANKMENT IN NORMAL MANNER.

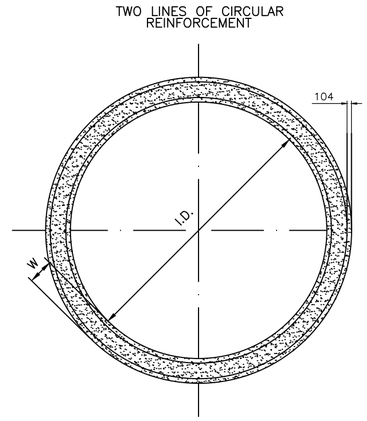
CALIFORNIA METHOD B

METHODS OF PIPE INSTALLATION

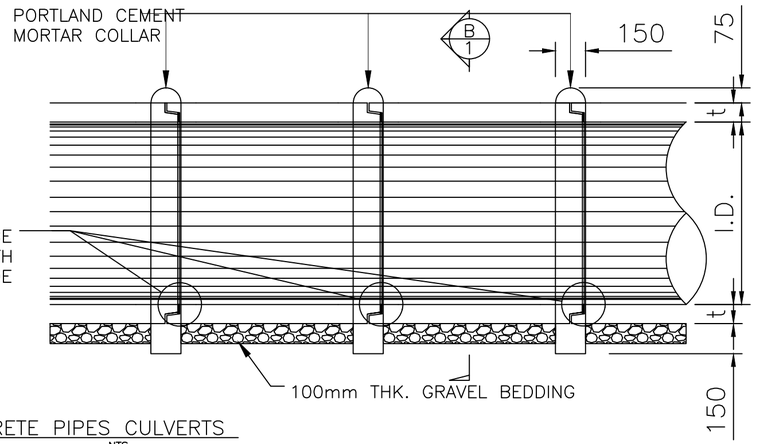
SIZE OF PIPE		CONCRETE 317 KG./SQ. CM. (4,500 LB/SQ.IN.)						
IN.	M.	WALL THICKNESS (M)	TONGUE (M)		GROOVE (M)		DEPTH (M)	MINIMUM REINFORCEMENT SQ.CM./M. OF PIPE *
		W	A	B	C	E	P	CIRCULAR REINFORCEMENT
36"	0.910	0.086	0.988	1.007	0.994	1.013	0.064	2 LINE EACH 4.66



LONGITUDINAL SECTION
SCALE NTS



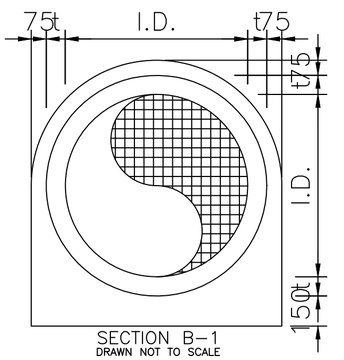
SECTION A
SCALE NTS



DESIGN REQUIREMENTS OF REINFORCED CONCRETE PIPES CULVERTS
SCALE NTS

- THE DISTANCE FORM CENTERLINE OF THE REINFORCEMENT TO THE NEAREST SURFACE OF THE CONCRETE HAS BEEN ASSUMED AS 0.032 M. FOR PIPES WITH A SHELL THICKNESS OF 0.064 M. OR MORE.

NOTE:
DESIGN REQUIREMENTS ARE BASED ON THE SPECIFICATIONS FOR MATERIALS OF AASHTO M-170.



SECTION B–1
DRAWN NOT TO SCALE

DETAIL OF RCPC JOINT

DRAINAGE SCHEDULE

Station	Description	103(1)b	404(1)a	405(1)a2	1718(1)	502(3)a3	DRAINAGE PARAMETERS		
		cu.m	kg	cu.m.	l.m.	ea.	Q	A	V
K1510+090.00 - K1510+249.00	BLIND DRAINAGE 1-36" Ø SERVICE HOLE IN EVERY 20.00m WITH CURB AND GUTTER	2040.00	7778.56	152.00	318.00	17.00			
	TOTAL	2040.00	7778.56	152.00	318.00	17.00			

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**

SHEET CONTENTS: METHODS OF PIPE INSTALLATION, DETAILS OF RCPC JOINTS

DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II
PREPARED: **WARREN S. PIÑEZ** ENGINEER II

REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:

SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:

RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:

APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:

SET NO. L 1 1

SHEET NO. 16 52

GENERAL NOTES

1. ALL ELECTRICAL WORKS SHALL BE DONE IN ACCORDANCE WITH THE PROVISION OF THE LATEST EDITION OF THE PHILIPPINE ELECTRICAL CODE PART I AND II. THE LAWS AND ORDINANCES OF THE LOCAL CODE ENFORCING AUTHORITIES AND THE REQUIREMENTS OF THE LOCAL POWER COMPANY.
2. THE ELECTRICAL WORK SHALL BE DONE UNDER THE DIRECT AND IMMEDIATE SUPERVISION OF A DULY REGISTERED ELECTRICAL ENGINEER.
3. PERFORMANCE OF THE ROAD LIGHT SUCH AS ILLUMINANCE LEVEL SHALL COMPLY WITH THE REQUIREMENTS OF THE SPECIFICATION.
4. THE ELECTRICAL CONTRACTOR SHALL SECURE ALL PERMITS AND PAY ALL FEES REQUIRED FOR THE WORK AND FURNISH THE OWNER THROUGH THE ENGINEERS FINAL CERTIFICATE OF ELECTRICAL INSPECTION AND APPROVAL FROM PROPER GOVERNMENT AUTHORITIES FOR COMPLETE WORK.
5. THE ELECTRICAL MATERIALS TO BE USED AND EQUIPMENT TO BE INSTALLED SHALL BE BRAND NEW AND SHALL BE OF THE APPROVED TYPES FOR THE PARTICULAR LOCATION AND PURPOSE INTENDED.
6. ALL ROAD LIGHTS AND WARNING LIGHTS SHALL BE POWERED FROM SOLAR PHOTOVOLTAIC (PV) SYSTEM WITH STORAGE BATTERY.
7. ALL BOXES SHALL BE OF STEEL AND ZINC CHROMATED PROTECTED.
8. ALL UNDERGROUND CONDUIT PIPES AND CONDUIT RUN EMBEDDED IN CONCRETE SHALL BE UNPLASTICIZED POLYVINYL CHLORIDE CONDUIT (uPVC).
9. UNDERGROUND CONDUIT RUNS SHALL BE BURIED AT A MINIMUM OF 600mm BELOW GROUND LEVEL CONDUIT RUN CROSSING STREET SHALL BE ENCASED IN CONCRETE WITH STEEL BAR REINFORCED, 2500psi CONCRETE WITH MINIMUM 75mm (3 INCHES) COVER ALL AROUND.
10. UNPROTECTED CONDUIT RISERS AND EXPOSED CONDUIT RUNS SHALL BE INTERMEDIATE METAL CONDUITS. (IMC)
11. ALL STREET LUMINAIRE ASSEMBLY INCLUDES LED LUMINAIRE, PV POWER SUPPLY EQUIPMENT, CONTROL AND BATTERY PANEL, AND FOUNDATION SHALL WITHSTAND UP TO 340KPH PER HOUR GUSTING WINDS WITHOUT PERMANENT DEFORMATION.
12. ALL SPARE PIPES INCLUDING PULL BOXES EMBEDDED IN THE STRUCTURE WALL SHOWN ON THE STRUCTURE DRAWINGS WILL BE USED AS CONDUIT. IN CASE THAT THE ROAD LIGHT IS POWERED FROM ELECTRIC UTILITY COMPANY (EC) IN FUTURE OR EMERGENCY, THE SPARE PIPES, PULL WIRE AND PULL BOXES SHALL BE INSTALLED BY THE ELECTRICAL WORKS.
13. FOR EXISTING CABLE RUNS WHICH WILL BE REPLACED BEFORE REMOVING THE CABLE SHALL BE TESTED IF FREE FROM GROUND AND CAN STILL BE RE-USED. IF FOUND GROUNDED, THESE CABLES SHALL BE REMOVED AND TURN-OVER TO THE CLIENT.

DESIGN GUIDELINES FOR ROADWAY LIGHTING

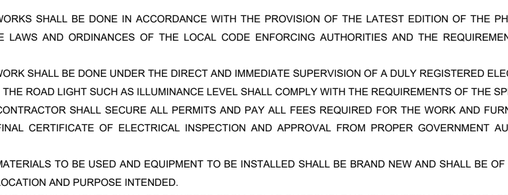
SECTION 1 OBJECTIVE

THESE GUIDELINES SET OUT FACTORS THAT NEED TO BE TAKEN INTO ACCOUNT IN DESIGNING ROADWAY LIGHTING SOLAR-POWERED SYSTEMS USED TO ILLUMINATE ROADWAYS SUCH AS PRIMARY, SECONDARY, AND TERTIARY ROADS AS WELL AS ROADS THAT IS MODIFIED, EXTENDED, EXPANDED, OR ADDED TO EXISTING ROADWAY INSTALLATIONS.

SECTION 2 MINIMUM TECHNICAL REQUIREMENTS

SECTION 2.1 ELECTRICAL SYSTEM (SOLAR-POWERED)

1. THE ILLUMINATION SHALL BE UNIFORM WITHOUT DARK BANDS OR ABRUPT VARIATIONS, AND SHOULD BE SOOTHING TO THE EYE. THE LIGHT OUTPUT FROM THE WHITE LIGHT-EMITTING DIODE (LED) LIGHT SOURCE SHOULD BE ALMOST CONSTANT AND HIGHER LIGHT OUTPUT WILL BE PREFERRED. THE ACCEPTABLE LEVELS OF LUMINANCE SHALL BE ACHIEVED UNDER NORMAL OPERATIONS.
2. COLOR TEMPERATURE FOR LED CAN VARY BETWEEN "WARM WHITE" AND "WARM YELLOW" THE USED OF LEDS WHICH EMITS ULTRAVIOLET LIGHT SHALL NOT BE PERMITTED.
3. THE LAMPS SHALL BE HOUSED IN AN ASSEMBLY SUITABLE FOR OUTDOOR USE AND SHALL BE RATED AS IP 65 RATED PER IEC WITH A REFLECTOR ON ITS BACK. THE LED HOUSING SHALL BE MADE OF CORROSION-RESISTANT PRESSURE DIE-CAST ALUMINUM WITH A POWDER COATED FINISH OF A NEUTRAL COLOR HAVING A SUFFICIENT AREA FOR HEAT DISSIPATION AND HEAT RESISTANT TOUGHENED CLEAR GLASS / HIGH-QUALITY POLYCARBONATE FITTED WITH PRESSURIZED DIE-CAST ALUMINUM FRAME WITH SCREWS. THE TEMPERATURE OF THE HEAT SINK SHOULD NOT INCREASE MORE THAN 30°C ABOVE AMBIENT TEMPERATURE EVEN AFTER 48 HOURS OF CONTINUOUS OPERATION. THE DUTY CYCLE OF THE LED SHOULD COMPLY WITH THE DUSK TO DAWN OPERATION OF THE LAMPS WHILE THE BATTERY OPERATES AT ANY VOLTAGE BETWEEN THE LOAD DISCONNECT AND CHARGE REGULATION SET POINT. LEDS SHALL BE PROCURED FROM A MANUFACTURER WHO HAS TEST REPORTS FROM IESNA LM80-08 AND TM-21-11 QUALIFIED FOR RELEVANT LED PRODUCT TESTING, PARTICULARLY FOR ROADWAY LIGHTING.
4. THE ELECTRIC CABLE SHALL BE TWIN CORE PVC INSULATED WATER AND UV RESISTANT COPPER CABLE OF 1.5 MM DIAMETER MINIMUM SIZE.
5. THE CHARGE CONTROLLER SHALL HAVE AN AUTOMATIC DUSK UNTIL DAWN CIRCUIT BASED ON A SOLAR PHOTOVOLTAIC MODULE AS A SENSOR FOR SWITCHING ON/OFF THE STREET LIGHT WITHOUT MANUAL INTERVENTION AND AS SPECIFIED OPERATION PROFILE DURING PROJECT ANALYSIS. ALL THIS CONTROL SHOULD KEEP THE SYSTEM OPERATING AT PEAK PERFORMANCE SHALL INCREASE THE SYSTEM'S LIFESPAN, AND SHOULD OPERATE AS ILLUSTRATED IN THE FIGURE BELOW.



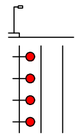
6. THE PHOTOELECTRIC CONTROL'S OPERATING CONDITION SHALL TURN ON AT A NOMINAL LIGHT LEVEL SETTING OF 10.76 LUX WHICH IS WITHIN THE LIMITS OF 5.38LUX TO 21.52LUX AT RATED VOLTAGE OF 240VOLTS, 60HERTZ. THE RATIO OF THE TURN-OFF TO THE TURN-ON LIGHT LEVEL SHALL BE DESIGNED WITH A FAIL-ON FAILURE MODE AND SHALL BE INSTALLED AT EACH LIGHTING POST FOR INDIVIDUAL LAMP CONTROL. THE EYE OF THE CELL SHOULD BE ORIENTED TO FACE NORTH, CONTROL CONDUCTOR AND THE NECESSARY CONNECTION SHALL BE MADE FOR COMPLETE SATISFACTORY OPERATION OF THE STREET LUMINAIRE.
7. THE BATTERY SHALL BE LITHIUM-ION OR DEEP CYCLE, LEAD-ACID TYPE ELECTROLYTE PLATE LEAD ACID WITH LOW ANTIMONY LEAD ALLOY PLATES, AND CERAMIC VENT PLUGS AND SHALL BE CATEGORIZED BY LOW MAINTENANCE REQUIREMENTS, LONG SERVICE LIFE, AND EXCELLENT CAPACITY PERFORMANCE EVEN IN HIGH-TEMPERATURE.
8. THE SOLAR PHOTO VOLTAIC MODULE MUST BE MADE OF CRYSTALLINE HIGH POWER/EFFICIENCY CELLS AND SHALL BE USED AND MUST BE WARRANTED FOR OUTPUT WATTAGE, WHICH MUST BE GREATER THAN 90% AFTER 10 YEARS AND LESS THAN 80% AFTER 25 YEARS. THE PROJECT WILL ONLY USE INDIGENOUS MODULES FROM REPUTABLE BRANDS.
   THE TERMINAL BOX ON THE MODULE MUST BE DESIGNED FOR LONG-TERM OUTDOOR OPERATION IN HARSH ENVIRONMENTS, WITH AN OPENING FOR REPLACING THE CABLE IF NECESSARY. HENCE, PROTECTIVE DEVICES AGAINST SURGES AT THE PV MODULE SHALL BE PROVIDED.
9. THE GROUNDING SYSTEM SHALL HAVE LOW RESISTANCE AND LOW IMPEDANCE ATTRIBUTE TO PROTECT SOLAR STREET LIGHTS FROM EXTENSIVE LIGHTING DAMAGE. AFTER ESTABLISHING THE STABLE GROUNDING SYSTEM, A SURGE PROTECTION DEVICE (SPD) SYSTEM SHOULD BE INSTALLED.
10. AUTOMATIC SELF-CLEANING MECHANISM SHALL HAVE A BRUSH WITH THICK AND SOFT BRISTLES IDEAL FOR CLEANING HEAVY DUST PARTICLES WITH FLAT FITTING ON THE SOLAR PANEL SHALL BE DESIGNED FOR AREAS WHERE SEA SPRAY, DUST AND DIRT THAT MAY COVER THE PANEL PREVENTING THE BATTERY FROM BEING FULLY CHARGED. THE BRUSH SHOULD BE AUTOMATED TO ALLOW THOROUGH CLEANING EVERY FOUR HOURS AND SHALL ROUTINELY RETURN TO ITS INITIAL POSITION TO PREVENT FROM BEING JAMMED WHEN ENCOUNTERING LARGE OBSTACLES THAT MAY CAUSE MOTOR DAMAGE. THE CASING SHALL BE MADE OF ALUMINUM ALLOY FOR INCREASED DURABILITY.
11. THE MOTION SENSOR FEATURE SHALL HAVE DIFFERENT POWER CONTROL DEPENDING ON THE PERIOD WITH AN 8-METER RADIUS AND SHALL SET AND LOWER BRIGHTNESS IN A REDUCED PEDESTRIAN AFTER MIDNIGHT TO SAVE ENERGY AND IMPROVE PRACTICALITY.

SECTION 2.2 STRUCTURAL SYSTEM

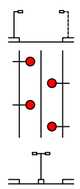
1. THE POLE SHALL BE CONSTRUCTED OF ROUND TAPERED HOT-DIP GALVANIZED STEEL GI PIPE OF 3 MM MINIMUM THICKNESS, A MINIMUM LOWER AND UPPER DIAMETER OF 200 MM AND 75 MM DIAMETER AND ITS SURFACE MUST BE PAINTED WITH REFLECTORIZED WHITE ENAMEL COATING. THE POLE SHOULD HAVE THE PROVISIONS TO HOLD THE WEATHERPROOF LAMP HOUSING INDIVIDUALLY PER CASE, THE BATTERY BOX AT AN APPROPRIATE HEIGHT, AND THE SOLAR PHOTOVOLTAIC PANEL, THAT SHALL BE MOUNTED ON TOP OF THE POLE.
   STANDARD LIGHT POLES TO BE UTILIZED WITH SOLAR SHOULD HAVE LARGER BASES AND MORE SUBSTANTIAL FOUNDATIONS DUE TO THE WEIGHT OF THE SOLAR POWER ASSEMBLY AND SHOULD HAVE AN EFFECTIVE PROJECTED AREA (EPA) CAPACITY THAT COULD WITHSTAND SEVERAL WIND VELOCITIES UP TO 340 KPH IN ACCORDANCE WITH AASHTO LTS-6, AS STANDARD POLES ARE TOO WEAK TO HANDLE THE WEIGHT OF THE SYSTEM AND CAN QUICKLY FAIL. POLES SHOULD BE MANUFACTURED EXCLUSIVELY FOR THE PROJECT WITH APPROPRIATE HEIGHT AS IT INFLUENCES THE INTENSITY, UNIFORMITY, AND AREA OF ILLUMINATION.
2. SOLAR FIXTURE BRACKET SHOULD DIRECT THE PV SOLAR FACING SOUTH (OR TOWARDS THE EQUATOR) AND SHOULD ALLOW THE FIXTURE INSTALLATION TO FACE THE CORRECT DIRECTION IF IT IS ATTACHED TO THE PANEL. SHALL BE DESIGNED TO MEET THE STRENGTH REQUIREMENTS OF THE LATEST EDITION OF THE NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (NSCP) AND SHOULD BE PROVIDED WITH A MOUNTING PLATE AND STIFFENER TO INCREASE ITS LOAD-BEARING CAPACITY.
   HARDWARE SUCH AS HINGES, LATCHES, SPRINGS, NUTS, SCREWS, WASHERS, PINS, AMONG OTHERS, SHALL BE MADE OF MATERIALS COMPATIBLE TO THE HOUSING MATERIAL AND SHALL BE INHERENTLY CORROSION PROOF OR HAVE BEEN PROTECTED BY FINISHES APPROVED FOR CORROSION RESISTANCE. HOWEVER, THOSE EXPOSED TO THE ELEMENTS SHALL BE MADE OF HIGH-GRADES STAINLESS STEEL.
3. STREET LIGHTING POST CONCRETE FOOTING SHALL BE CLASS A AND SHALL CONFORM WITH SUBSECTION 405.2, MATERIAL REQUIREMENTS OF ITEM 405, STRUCTURAL CONCRETE.
   ALL ELECTRICAL LIGHTING POST FOOTINGS WITH DIMENSIONS INDICATED IN THE PLANS SHALL BE REINFORCED CONCRETE AND SHALL CONFORM WITH THE REQUIREMENTS FOR CONCRETE STRUCTURES OF THIS SPECIFICATION. EXCAVATION AND BACK FILL FOR FOUNDATION INCLUDING DISPOSAL OF SURPLUS MATERIALS SHALL BE PROVIDED. EXCAVATED HOLES FOR CONCRETE FOOTINGS SHALL BE NEAT OR PROPERLY FORMED AND FREE FROM LOOSE MATERIALS WHEN THE CONCRETE IS PLACED.
   CONCRETE FOUNDATION SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL STRUCTURAL CODE OF THE PHILIPPINES (NSCP) TO RESIST WIND VELOCITY AND VIBRATIONS INHERENT IN THE AREA WHERE THE POLES WILL BE CONSTRUCTED AND LOCATED TO PROVIDE ADEQUATE SUPPORT FOR THE LUMINAIRE AND POLE STRUCTURE.

SECTION 3 ROADWAY LIGHTING SECTION AND CONFIGURATION

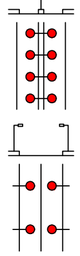
SECTION 3.1 LIGHTING ARRANGEMENT



IN SINGLE-SIDED POLE ARRANGEMENT, ALL LUMINAIRES ARE LOCATED ON ONE SIDE OF THE ROAD. THIS SHALL BE USED WHEN THE ROAD WIDTH IS LESS THAN OR EQUAL TO THE MOUNTING HEIGHT.



IN STAGGERED ARRANGEMENT, ALL LUMINAIRES ARE ALTERNATELY PLACED ON EACH SIDE OF THE ROAD. THIS SHALL BE USED WHEN THE ROAD WIDTH IS EQUALT TO 1 TO 1.5 TIMES THE MOUNTING HEIGHT.



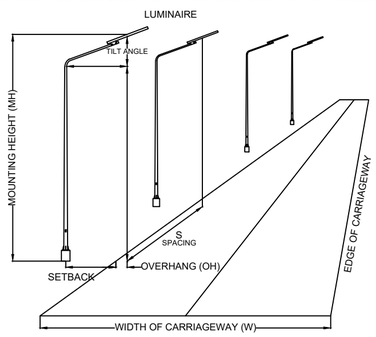
IN AXIAL ARRANGEMENT, ALL LUMINAIRES ARE MOUNTED ON CENTRAL TWIN MASTS IN THE MIDDLE OF THE ISLAND. THIS SHALL BE USED WHEN THE ROAD WIDTH IS LESS THAN OR EQUAL TO THE MOUNTING HEIGHT.

IN OPPOSITE ARRANGEMENT, ALL LUMINAIRES ARE POSITIONED DIRECTLY OPPOSITE AND FACING EACH OTHER. THIS SHALL BE USED WHEN THE ROAD WIDTH IS GREATER THAN 1.5 TIMES THE MOUNTING HEIGHT.

ARRANGEMENTS SUCH AS OPPOSITE, STAGGERED, AND ONE-SIDED ARE TYPICALLY INSTALLED 30 TO 40 METERS APART WHEN DESIGNING PRIMARY AND SECONDARY ROADS. IF AXIAL AND OPPOSITE ARRANGEMENTS LACK THE REQUIRED ILLUMINATION, THE CAN BE COMBINED WITH SINGLE-SIDED ARRANGEMENTS.

SECTION 3.2 MOUNTING HEIGHT, SPACING, MAST ARM, AND OVERHANG

THE STREET LIGHTING GEOMETRY IS SHOWN BELOW TO FURTHER ILLUSTRATE THE FOLLOWING DESIGN PARAMETERS:



MOUNTING HEIGHT
THE MOUNTING HEIGHT SHALL BE THE PERPENDICULAR DISTANCE FROM THE CENTER OF THE LAMP TO THE GROUND SURFACE. IN GENERAL, THE MINIMUM MOUNTING HEIGHT SHALL BE GENERALLY 8 METERS AND A LUMINAIRE THAT DOES NOT OVERHANG THE ROADWAY SHALL HAVE A MINIMUM MAST ARM LENGTH OF 1.5 METERS. 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 PHILIPPINE ELECTRICAL CODE (PEC) 2. TABLE 2. ROADWAY LIGHTING STATIONING AND PARAMETERS SHOULD BE CONSIDERED AS IT SPECIFIES THE SUITABLE MOUNTING HEIGHT FOR THE ENTIRETY OF ROADWAY LIGHTING.

SPACING
SPACING SHALL BE DEFINED AS THE HORIZONTAL DISTANCE BETWEEN SUCCESSIVE LUMINAIRES IN AN INSTALLATION. TO PRESERVE LONGITUDINAL UNIFORMITY, THE SPACE-HEIGHT RATIO SHOULD GENERALLY BE GREATER THAN 3. MINIMUM AND MAXIMUM ALLOWABLE SPACING SHALL BE FOLLOWING THE VALUES ESTABLISHED IN TABLE 2. ROADWAY LIGHTING STATIONING AND PARAMETERS.

POLE SPACING IS ALSO SPECIFIED DEPENDING ON THE ILLUMINATION LEVEL OF THE AREA. INTERSECTIONS AND OTHER MERGING SECTION OF THE ROADWAY SHOULD HAVE A HIGHER LEVEL OF ILLUMINATION.

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

POLE ARM
THE USE OF AN ARM BRINGS THE LIGHT SOURCE CLOSER TO THE TRAVELED 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 AND/OR DOUBLE DAVITY OR MAST ARMS AND LOCATED AT THE UPPER MOST PART OF THE POLE.

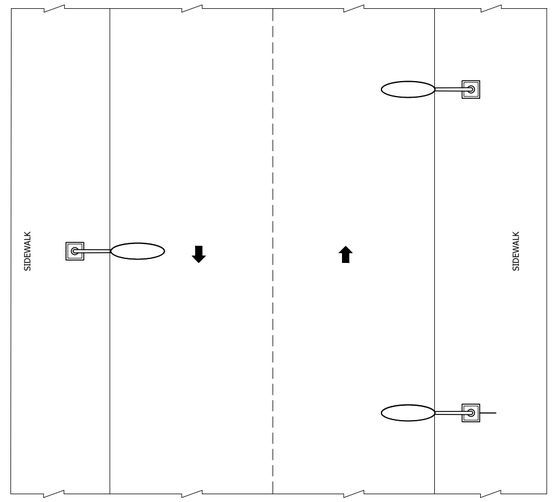
THE POLE ARM'S ANGLE OF TILT SHALL BE KEPT FROM 15° TO 30°, OTHERWISE STRONG LIGHT SHALL AFFECT THE DRIVER'S EYES BY CAUSING DISCOMFORT GLARE. THE TILT GETS LARGER AS THE UNIFORMITY RATIO INCREASE.

SETBACK
THE SETBACK IS THE HORIZONTAL DISTANCE BETWEEN THE FACE OF A LIGHT POLE AND THE EDGE OF THE TRAVELED 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.

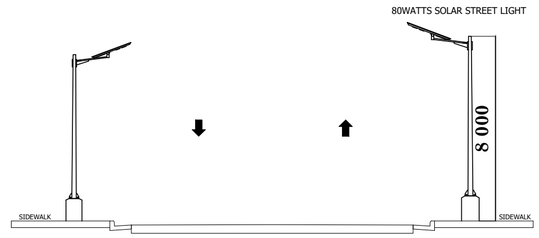
THE TABLE BELOW SHALL BE CONSIDERED IN DESIGNING THE LUMINARE SETBACK BASE ON VEHICULAR SPEED ON A PARTICULAR ROADWAY AND EQUIVALENT.

DESIGN SPEED FOR THE ROADWAY (KPH)	POLE SETBACKS (M)
50	0.80
80	1.00
100	1.50
120	1.50

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



LIGHTING LAYOUT



STREET LIGHT TYPICAL CROSS SECTION

STAGGERED SOLAR STREET LIGHTING ARRANGEMENT
NOT TO SCALE

REPUBLIC OF THE PHILIPPINES **DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS** REGION XI DAVAO DEL NORTE 2ND DISTRICT ENGINEERING OFFICE TAGUM CITY	PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**	SHEET CONTENTS: SOLAR STREET LIGHTS DETAILS AND SCHEDULE	DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:	SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	APPROVED: **ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	SET NO. M 1 6	SHEET NO. 17 52

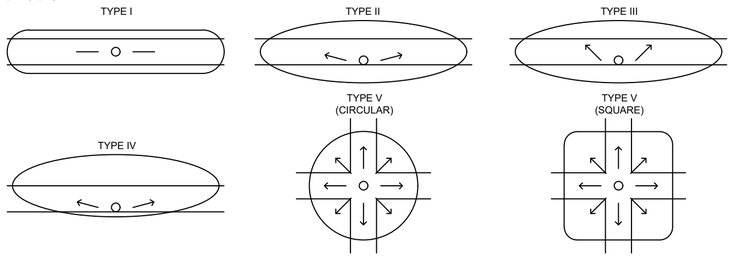
OUTREACH
THE OUTREACH OR HORIZONTAL DISTANCE BETWEEN THE LUMINAIRE'S CENTER AND THE COLUMN'S CENTER IS TYPICALLY ESTABLISHED IN ACCORDANCE WITH THE ARCHITECTURAL AESTHETIC CONDITIONS.

ROAD CLASSIFICATION	LIGHTING ARRANGEMENT	ROAD WIDTH (meter)	POLE PLACING (meter)	MOUNTING HEIGHT (meter)	LAMP WATTAGE (watt)		MAST ARM LENGTH (meter)
					HPS	LED	
PRIMARY	SINGLE	6.70	10 - 25	10	150 - 250	80 - 125	1.50
		13.40	15 - 35	12	150 - 250	80 - 125	3.00
	AXIAL	13.40	20 - 35	10	150 - 250	80 - 125	1.50
		20.10	20 - 40	12	150 - 250	80 - 125	3.00
		26.80	20 - 45	12	300 - 400	200 - 300	3.00
	OPPOSITE	6.70	20 - 35	10	70 - 120	50 - 80	1.50
		13.40	20 - 35	12	150 - 250	80 - 125	1.50
		20.10	20 - 40	12	300 - 400	200 - 300	1.50
		26.80	20 - 45	12	300 - 400	200 - 300	1.50
	STAGGERED	6.70	10 - 25	8	70 - 120	50 - 80	1.50
		13.40	10 - 25	10	150 - 250	80 - 125	1.50
		20.10	15 - 25	12	300 - 400	200 - 300	3.00
		26.80	15 - 25	12	300 - 400	200 - 30	3.00
SECONDARY	SINGLE	6.70	15 - 35	10	150 - 250	80 - 125	1.50
	OPPOSITE	6.70	20 - 40	8	150 - 250	80 - 125	1.50
	STAGGERED	6.70	15 - 35	8	150 - 250	80 - 125	1.50
TERTIARY	SINGLE	5.00	10 - 25	8	70 - 120	50 - 80	1.50
		6.10	10 - 25	8	70 - 120	50 - 80	1.50
	STAGGERED	5.00	10 - 25	8	70 - 120	50 - 80	1.50
		6.10	10 - 25	8	70 - 120	50 - 80	1.50

TABLE 2. ROADWAY LIGHTING STATIONING AND PARAMETERS

SECTION 3.3 PHOTOMETRIC REQUIREMENTS AND COMPUTATIONS

ON OF THE MOST IMPORTANT ASPECTS OF OUTDOOR AREA LIGHTING IS THE PROPER DISTRIBUTION OF LIGHT FLUX FROM LUMINAIRES. THE LIGHT EMITTED BY THE LUMINAIRES IS DIRECTED AND PROPORTIONED ACCORDING TO THE REQUIREMENTS FOR SEEING AND VISIBILITY. LIGHT DISTRIBUTION IS TYPICALLY DESIGNED FOR A TYPICAL RANGE OF CONDITIONS SUCH AS LUMINAIRE MOUNTING HEIGHT, TRANSVERSE (OVERHANG) LOCATION OF THE LUMINAIRES, LONGITUDINAL SPACING, WIDTHS OF AREAS TO BE EFFECTIVELY LIGHTED, LUMINAIRE ARRANGEMENT, AND MAINTAINED SYSTEM EFFICIENCY.



LUMINAIRE'S TRANSVERSE (PROJECTION) CAN BE CONSIDERED AS TYPES I, II, III, IV, AND V, AS SHOWN IN THE FIGURE ABOVE. CHARACTERISTICS THAT SHOW THE MAXIMUM INTENSITY OF THE LIGHT IS ABOVE 180° AND 90° TO EVADE GLARE AND SPILL LIGHT, IT IS CLASSIFIED AS FULL CUTOFF, CUTOFF, SEMI-CUTOFF, AND NON-CUTOFF.

ON A TWO-LANE ROADWAY, ADDING LIGHT TO ONE SIDE AND USING A TYPE 2 WILL ALLOW THE LIGHT TO FOCUS ALONG THE ROADWAY. ALLOCATING A TYPE 5 OR TWO (2) TYPE 3 LIGHTS BACK-TO-BACK IS PREFERRED WHEN DESIGNING A FOUR-LANE HIGHWAY WITH A MEDIAN SHALL ENHANCE THE ILLUMINATION OF THE AREA. ADDITIONAL TYPE 2 OR 3 ON THE OUTSIDE EDGES OF THE ROADS COULD ALSO EVENLY ILLUMINATE THE AREA.

GENERAL EQUATION

FOR ILLUMINANCE

$$E_{WP} = \frac{(\Theta_{TOTAL})(CU)(LLF)}{A_{WP}}$$

E_{WP} = Average Maintained Illuminance on the Work Plane
Θ_{TOTAL} = Total System Lamp Lumen Output
CU = coefficient of utilization
A_{WP} = Area of the Work Plane

FOR STREETLIGHT SPACING

$$S = \frac{(LL)(MF)(CU)}{(fc)(W)}$$

S = Spacing
LL = Lamp Lumen
MF = Maintenance Factor
CU = Coefficient of Utilization
fc = Foot Candle
W = Width of Road

NOTE: ILLUMINATION CALCULATION CAN ALSO BE ATTAINED USING DIGITAL SOFTWARE FOR THE LAMP WATTAGE RATING.

EACH LUMINAIRE HAS ITS OWN COEFFICIENT OF UTILIZATION AND CAN BE OBTAINED FROM THE REPUTABLE MANUFACTURER'S DATA, SPECIFIC TO ITS LIGHT DISTRIBUTION AND EFFICIENCY.

THE TABLE BELOW ILLUSTRATES HOW THE DESIGN VARIES DEPENDING ON THE STANDARD VALUES LISTED FOR DIFFERENT SURFACE REFLECTANCE CONTINGENT ON THE PAVEMENT TYPE TO BE LIGHTED WHETHER CONCRETE OR ASPHALT.

ILLUMINANCE METHOD - RECOMMENDED VALUES						
ROADWAY & PEDESTRIAN CONFLICT AREA		PAVEMENT CLASSIFICATION			UNIFORMITY RATIO EAVA/EMIN	VEILING LUMINANCE RATIO LMAX/LAVG
ROAD	PEDESTRIAN CONFLICT AREA	R1 LUX/FC	R2 & R3 LUX/FC	R4 LUX/FC		
FREEWAY CLASS A		6.0 / 6.0	9.0 / 0.9	8.0 / 0.8	3	0.3
FREEWAY CLASS B		4.0 / 4.0	6.0 / 0.6	5.0 / 0.5	3	0.3
EXPRESSWAY	HIGH	10.0 / 1.0	14.0 / 1.4	13.0 / 1.3	3	0.3
	MEDIUM	8.0 / 0.8	12.0 / 1.2	10.0 / 1.0	3	0.3
	LOW	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3	0.3
MAJOR PRIMARY	HIGH	12.0 / 1.2	17.0 / 1.7	15.0 / 1.5	3	0.3
	MEDIUM	9.0 / 0.9	13.0 / 0.3	11.0 / 1.1	3	0.3
	LOW	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	3	0.3
COLLECTOR SECONDARY	HIGH	8.0 / 0.8	12.0 / 1.2	10.0 / 0.1	4	0.4
	MEDIUM	6.0 / 0.6	9.0 / 0.9	8.0 / 0.8	4	0.4
	LOW	4.0 / 0.4	12.0 / 1.2	5.0 / 0.5	4	0.4
LOCAL TERTIARY	HIGH	6.0 / 0.6	0.9 / 9.0	8.0 / 0.8	6	0.4
	MEDIUM	5.0 / 0.5	7.0 / 0.7	6.0 / 0.6	6	0.4
	LOW	3.0 / 0.3	4.0 / 0.4	4.0 / 0.4	6	0.4

TABLE 3. IESNA RECOMMENDED MAINTAINED AVERAGE HORIZONTAL ILLUMINANCE LEVELS (LUX) FOR DIFFERENT TYPES OF ROADS, PAVEMENTS, AND PEDESTRIAN CONDITIONS.
(EXCERPT FROM IESNA 2000)

*ACCORDING TO NATIONAL ROAD CLASSIFICATIONS

SECTION 4 DESIGN CONSIDERATIONS

SURFACE LUMINANCE AND SOURCE LUMINANCE ARE THE TWO MOST IMPORTANT FACTORS TO BE CONSIDERED IN DESIGNING ROADWAY LIGHTING SYSTEMS. SURFACE LUMINANCE ADDS INTEREST AND DEPTH TO AN OUTDOOR SCENE AND CAN BE NECESSARY FOR GOOD VISIBILITY, ESPECIALLY FOR THE SAFETY OF THE DRIVERS.

FACTORS IN DESIGNING ROADWAY LIGHTING SYSTEM

THE EXPERTISE REQUIRED FOR LIGHTING DESIGNS INCLUDES:
- LAMP TYPES AND CHARACTERISTICS, INCLUDING DEPRECIATION FACTORS
- BALLAST AND DRIVER TYPES AND CHARACTERISTICS
- FIXTURE MECHANICAL CHARACTERISTICS
- LENS TYPES
- PHOTOMETRIC PERFORMANCE OF LUMINAIRES AND FACTORS IMPACTING SUCH PERFORMANCE
- FIXTURE MOUNTING TYPES
- POLE MECHANICAL AND ELECTRICAL CHARACTERISTICS
- BREAKAWAY DEVICE OPTIONS AND WHEN APPROPRIATE TO USE
- CLEAR ZONE CRITERIA
- POLE TYPES, MOUNTING OPTIONS, AND LOADING CONSIDERATIONS
- FOUNDATION AND SUPPORT DETAILS
- PAVEMENT REFLECTION FACTORS
- MOUNTING HEIGHT AND SPACING OPTIONS
- LIGHT TRESPASS AND SKY GLOW ISSUES INCLUDING LAWS AND ORDINANCES
- LIGHTING QUALITY REQUIREMENTS, SUCH AS ILLUMINANCE, VEILING, VISIBILITY
- ENERGY AND LIFE-CYCLE COSTS

MASTER LIGHTING PLAN

A MASTER LIGHTING PLAN IS A FORMAL ARRANGEMENT BETWEEN RELEVANT GOVERNMENT AGENCIES AND OTHER ENTITIES WITHIN A REGIONAL AREA TO COORDINATE AND STANDARDIZE THE DESIGN, OPERATION, MAINTENANCE OF PUBLIC LIGHTING. BASIC BENEFITS OF LIGHTING INCLUDE SAFETY, BEAUTIFICATION, AND SECURITY FOR PEOPLE AND PROPERTY.

ILLUMINANCE CONSIDERATIONS

ILLUMINANCE ON ROADWAY LIGHTING IS A MEASURE OF THE LIGHT INCIDENT ON THE PAVEMENT SURFACE MEASURED IN FOOT-CANDLES (LUX). THE ILLUMINANCE AT ANY CERTAIN POINT WILL BE THE SUM OF ILLUMINANCE FROM ONE OR SEVERAL CONTRIBUTING SOURCES.

LUMINANCE IN ROADWAY LIGHTING IS A MEASURE OF THE REFLECTED LIGHT INCIDENT ON THE PAVEMENT SURFACE THAT IS VISIBLE TO THE MOTORIST'S EYE. DIFFERENT ROAD SURFACE MATERIAL, SUCH AS PORTLAND CEMENT CONCRETE OR ASPHALT HAVE DIFFERENT LUMINANCE COEFFICIENT. FOR A SECTION OF ROADWAY, LUMINANCE UNIFORMITY IS CALCULATED BOTH AS THE RATIO OF AVERAGE LEVEL TO MINIMUM POINT. THE EVALUATION OF GLARE FROM THE FIXED LIGHTING SYSTEM IS ALSO RELEVANT AND INCLUDED WITH THE LUMINANCE CRITERIA.

DESIGN CRITERIA

1. DPWH DESIGN GUIDELINES, CRITERIA AND STANDARDS (DGCS) 2015 EDITION
2. NATIONAL STRUCTURAL CODE OF THE PHILIPPINES
3. PHILIPPINE ELECTRICAL CODE, PART 2, 2017
4. ROADWAY LIGHTING DESIGN GUIDE, 7TH EDITION, 2018
5. ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA) LIGHTING HANDBOOK, 9TH EDITION, 2000

PEDESTRIAN	VEHICULAR TRAFFIC CLASSIFICATION			
	VERY LIGHT	LIGHT	MEDIUM	HEAVY TO HEAVIEST
TRAFFIC	UNDER 150	150 - 500	500 - 1200	1200 AND UP
HEAVY	9.68	12.91	16.14	21.52
MEDIUM	6.46	8.61	10.26	12.91
LIGHT	2.15	4.30	6.46	9.68

TABLE 4. RECOMMENDED AVERAGE HORIZONTAL ILLUMINATION LEVEL LUX
(ELECTRICAL LAYOUT AND ESTIMATE, 2000)

ROAD CLASSIFICATION	PEDESTRIAN CONFLICT	POLE HEIGHT (M)				
		1 LANE ONE SIDE	2 LANES ONE SIDE	3 LANES ONE SIDE	4 LANES OPPOSITE	5 LANES OPPOSITE
FREEWAY CLASS A		12 (40')	12 (40')	12 (40')	15 (49')	15 (49')
FREEWAY CLASS B		12 (40')	12 (40')	12 (40')	15 (49')	15 (49')
EXPRESSWAY	HIGH		12 (40')	12 (40')	12 (40')	12 (40')
	MEDIUM		12 (40')	12 (40')	12 (40')	12 (40')
	LOW		12 (40')	12 (40')	12 (40')	12 (40')
MAJOR PRIMARY	HIGH		12 (40')	12 (40')	12 (40')	12 (40')
	MEDIUM		12 (40')	12 (40')	12 (40')	12 (40')
	LOW		12 (40')	12 (40')	12 (40')	12 (40')
COLLECTOR SECONDARY	HIGH		10 (33')	10 (33')	10 (33')	12 (40')
	MEDIUM		10 (33')	10 (33')	10 (33')	12 (40')
	LOW		10 (33')	10 (33')	10 (33')	12 (40')
LOCAL TERTIARY	HIGH	7 (23')	7 (23')	10 (33')		
	MEDIUM	7 (23')	7 (23')	10 (33')		
	LOW	7 (23')	7 (23')	10 (33')		

TABLE 5. POLE HEIGHT BY ROADWAY CONFIGURATION (IESNA RP-8-05)

MASTER LIGHTING PLAN

LIGHTING BENEFITS MOTORISTS BY IMPROVING THEIR ABILITY TO SEE ROADWAY GEOMETRY AND OTHER VEHICLES AT EXTENDED DISTANCE AHEAD THIS RESULTS IN GREATER DRIVER CONFIDENCE AND IMPROVED SAFETY, WHICH IN TURN IMPROVES HIGHWAY CAPACITY, PEDESTRIAN SAFETY, PUBLIC SAFETY, SECURITY AND CONVENIENCE.

WARRANTS FOR CONTINUOUS EXPRESSWAY LIGHTING, COMPLETE INTERCHANGE LIGHTING, AND PARTIAL INTERCHANGE LIGHTING ARE PROVIDED IN TABLE 4. COMPLETE INTERCHANGE LIGHTING IS DEFINED AS A LIGHTING SYSTEM THAT PROVIDES RELATIVELY UNIFORM LIGHTING WITHIN THE LIMITS OF THE INTERCHANGE, LANES, RAMP TERMINALS, CROSSROAD INTERSECTIONS.

CASE	WARRANTING CONDITIONS
CEL-1	SECTIONS IN AND NEAR CITIES WHERE THE CURRENT AVERAGE DAILY TRAFFIC (ADT) IS 30,000 OR GREATER
CEL-2	SECTIONS WHERE THREE OR MORE SUCCESSIVE INTERCHANGES ARE LOCATED WITH AN AVERAGE SPACING OF 2.3KM OR LESS, AND ADJACENT AREAS OUTSIDE THE RIGHT-OF-WAY ARE SUBSTANTIALLY URBAN IN CHARACTER.
CEL-3	SECTIONS OF 3 KM OR MORE PASSING THROUGH SUBSTANTIALLY DEVELOPED URBAN OR SUBURBAN AREAS IN WHICH ONE OR MORE OF THE FOLLOWING CONDITIONS EXIST: LOCAL TRAFFIC OPERATES ON A COMPLETE STREET GRID HAVING SOME FORM OF STREET LIGHTING, PARTS OF WHICH ARE VISIBLE FROM THE EXPRESSWAY, THE EXPRESSWAY PASSES THROUGH A SERIES OF DEVELOPMENTS - SUCH AS RESIDENTIAL, COMMERCIAL, INDUSTRIAL, AND CIVIC AREAS, COLLEGES, PARKS, TERMINALS, ETC., THAT INCLUDE LIGHTED ROADS, STREETS, PARKING AREAS, YARDS, ETC., THAT ARE LIGHTED AS PART OF THE LOCAL STREET SYSTEM THE EXPRESSWAY CROSS SECTION ELEMENTS, SUCH AS MEDIAN AND BORDERS, ARE SUBSTANTIALLY REDUCED IN WIDTH BELOW DESIRABLE SECTIONS USED IN RELATIVELY OPEN COUNTRY.
CEL-4	SECTIONS WHERE THE RATION OF NIGHT TO DAY CRASH RATES IS AT LEAST 2.0 TIMES THE REGION AVERAGE FOR ALL UNLIGHTED SIMILAR SECTION, AND A STUDY INDICATES THAT LIGHTING MAY BE EXPECTED TO RESULT IN A SIGNIFICANT REDUCTION IN THE NIGHT CRASH RATE. WHERE CRASH RATE DATA IS NOT AVAILABLE, RATE COMPARISON MAY BE USED AS A GENERAL GUIDELINES FOR CRASH SEVERITY.

TABLE 6. WARRANTING CONDITIONS FOR CONTINUOUS EXPRESSWAY LIGHTING
(AASHTO 2005, ROADWAY LIGHTING DESIGN GUIDE)

CASE	WARRANTING CONDITIONS
CIL-1	WHERE THE TOTAL CURRENT ADT RAMP TRAFFIC ENTERING AND LEAVING EXPRESSWAY WITHIN THE INTERCHANGE AREAS EXCEEDS 10,000 FOR URBAN CONDITIONS, 8,000 FOR SUBURBAN CONDITIONS, OR 5,000 FOR RURAL CONDITIONS.
CIL-2	WHERE THE CURRENT ADT ON THE CROSSROAD EXCEEDS 10,000 FOR URBAN CONDITIONS, 8,000 FOR SUBURBAN CONDITIONS, OR 5,000 FOR RURAL CONDITIONS.
CIL-3	WHERE EXISTING SUBSTANTIAL COMMERCIAL OR INDUSTRIAL DEVELOPMENT THAT IT LIGHTED DURING HOURS OF DARKNESS IS LOCATED IN THE IMMEDIATE VICINITY OF THE INTERCHANGE, OR WHERE THE CROSS ROAD APPROACH LEGS ARE LIGHTED FOR 0.75 KM OR MORE EACH SIDE OF THE INTERCHANGE.
CIL-4	WHERE THE RATIO OF NIGHT TO DA CRASH RATE WITHIN THE INTERCHANGE AREA IS AT LEAST 1.5 TIMES THE REGION AVERAGE FOR ALL UNLIGHTED SIMILAR SECTIONS, AND A STUDY INDICATES THAT LIGHTING MAY BE EXPECTED TO RESULT IN A SIGNIFICANT REDUCTION IN THE NIGHT CRASH RATE. WHERE CRASH DATA IS NOT AVAILABLE, RATE COMPARISON MAY BE USED AS A GENERAL GUIDELINE FOR CRASH SEVERITY.

TABLE 7. WARRANTING CONDITIONS FOR COMPLETE INTERCHANGE LIGHTING
(AASHTO 2005, ROADWAY LIGHTING DESIGN GUIDE)

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION: **BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460**

SHEET CONTENTS: SOLAR STREET LIGHTS DETAILS AND SCHEDULE

DRAFTED: **HERWIN EVAN J. HABABAG** ENGINEER II
PREPARED: **WARREN S. PIÑEZ** ENGINEER II

REVIEWED: **BENILDA S. PACQUIAO** ENGINEER III DATE:

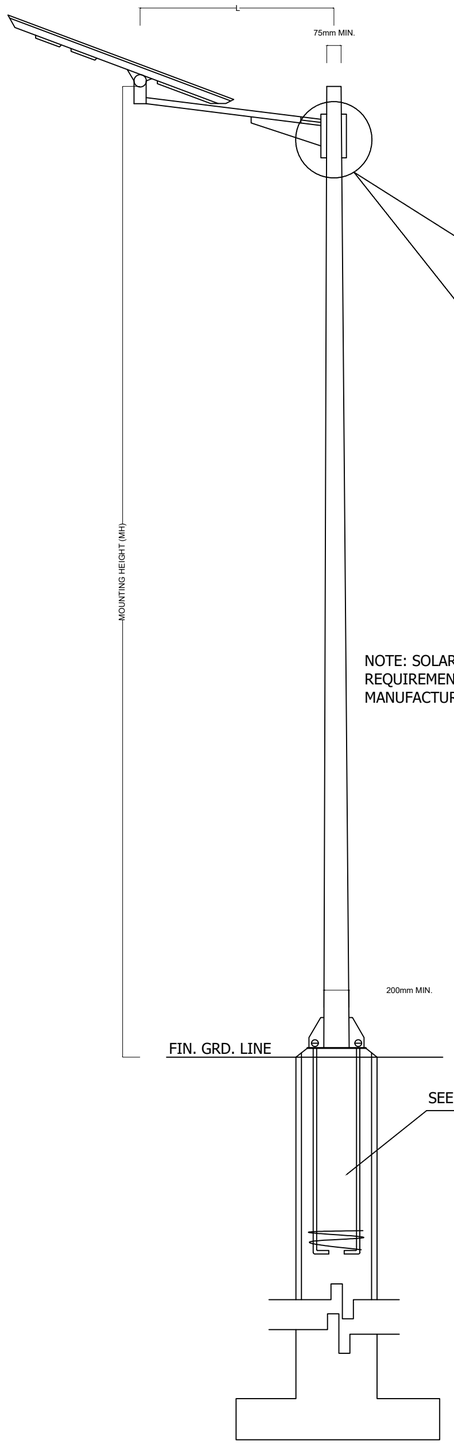
SUBMITTED: **JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:

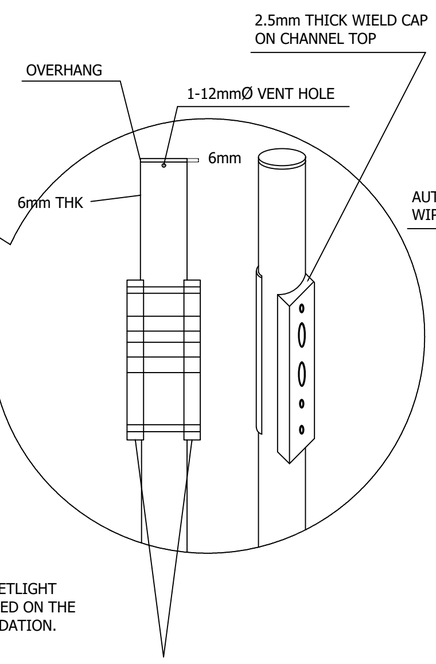
RECOMMENDED: **GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:

APPROVED: **ARTURO P. LONGYAPON** DISTRICT ENGINEER DATE:

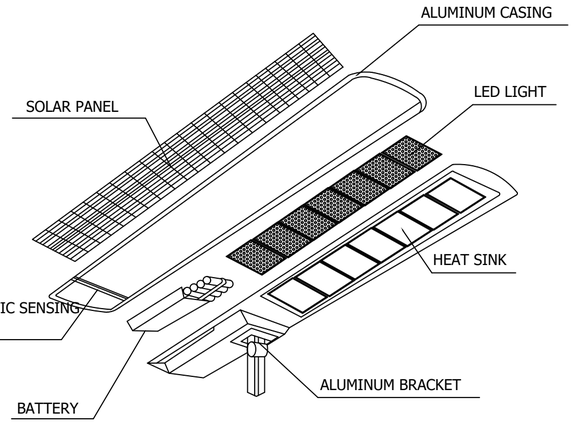
SET NO. M 2 6

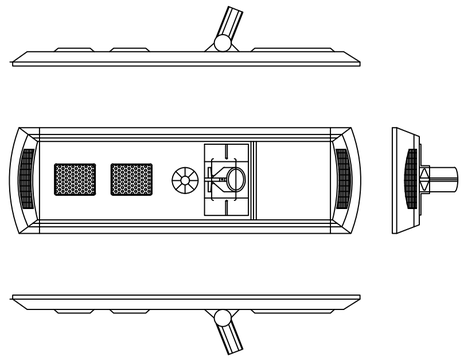
SHEET NO. 18 52

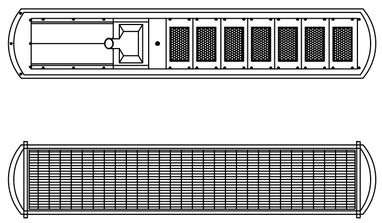


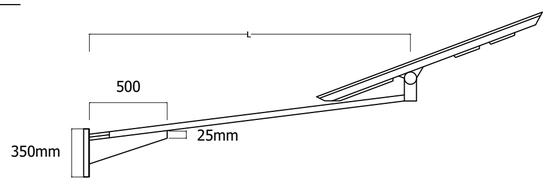


NOTE: SOLAR-POWERED STREETLIGHT REQUIREMENTS SHALL BE BASED ON THE MANUFACTURER'S RECOMMENDATION.









NOTE:
1. INCLUDE ADDITIONAL DETAILS FOR DESIRED LAMP POST TO BE USED AND REFER AND VERIFY TO LOCAL ELECTRIC POWER DISTRIBUTION COMPANY STANDARDS
2. REFER TO DPWH ELECTRICAL TECHNICAL SPECS FOR LAMP POST WATTAGE RATING, MOUNTING HEIGHT, AND SPACING EQUIVALENT.

INITIAL LUMEN OF HIGH PRESSURE LAMPS		
TYPES OF LAMPS	WATTAGE	INITIAL LUMEN
HIGH PRESSURE SODIUM (HPS)	100	9500
	150	16000
	250	26000
	450	50000

INTEGRATED SOLAR STREETLIGHT TECHNICAL PARAMETERS		
SOLAR PHOTOVOLTAIC PANEL	OPERATING VOLTAGE AND POWER	12V - 36V
		60 - 310 W
		(SHOULD BE GREATER THAN 90% AFTER 10 YEARS AND LESS THAN 80% AFTER 25 YEARS)
	LIFETIME	>25 YEARS
	MATERIAL	MONOCRYSTALLINE/POLYCRYSTALLINE SILICON
	WEIGHT	<25KG
	ALLOWABLE AMBIENT TEMPERATURE RANGE	-40° TO +60°C
BATTERY	INPUT VOLTAGE	12.8V
	TYPE	LITHIUM-ION OR LEAD-ACID TYPE ELECTROLYTE PLATE LEAD ACID WITH LOW ANTIMONY LEAD ALLOY PLATES AND CERAMIC VENT PLUGS
	LIFETIME	6 - 8 YEARS
	CHARGING AND DISCHARGING CYCLES	2000
	CHARGING TIME	7 HOURS
	WORKING TIME UNDER RAINY DAYS	10 DAYS
CHARGE CONTROLLER	INTELLIGENT CONTROL FOR CIRCUIT PROTECTION	
	FEATURE	TIMING, DIMMING, AND SENSOR
LIGHT-EMITTING DIODE (LED) LAMP	LIGHT OUTPUT	50W TO 300W
	SYSTEM FLUX	6000 - 30,000 LM
	COLOR TEMPERATURE	2,500K - 3,500K (WARM WHITE) 3,000K - 4,500K (COOL WHITE) 5,500K - 6,500K (DAYLIGHT)
	OPTICAL COVER/LENS TYPE	UV STABILIZED
		POLYCARBONATE COVER
	DRIVER	DIMMABLE AND DESIGNED TO OPERATE MAINTENANCE FREE FOR 50,000 HOURS WITH A COMPATIBILITY TO WIRELESS LIGHTING CONTROL PROTOCOLS
	LIFETIME	>50,000 HOURS
	PHOTO CONTROLLER	INDIVIDUAL OR GROUP
	HOUSING	HIGH PRESSURE DIE-CAST ALUMINUM WITH HEAT MANAGEMENT SYSTEM AND RUST RESISTANT
ALLOWABLE AMBIENT TEMPERATURE	RANGE	-40°C TO +60°C
	RANGE FOR CHARGING	0°C TO +45°C
	RANGE FOR DISCHARGING	-20°C TO +35°C
CHARGE TIME	7 HOURS UNDER DIRECT AND STRONG SUNLIGHT	
IP RATING	IP 65	
WARRANTY PERIOD	6 YEARS MINIMUM	

REPUBLIC OF THE PHILIPPINES
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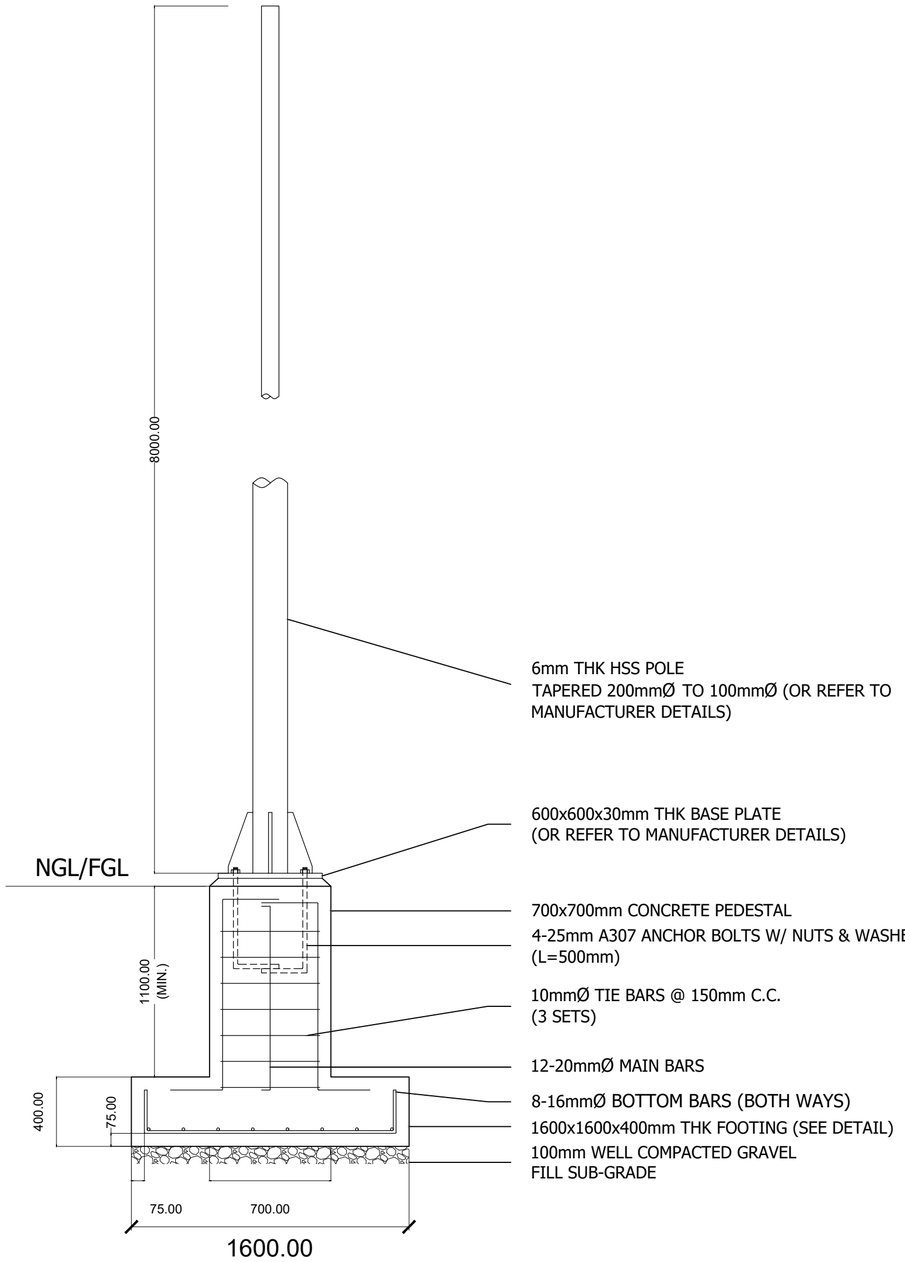
CHIEF, PLANNING AND DESIGN SECTION
DATE:

RECOMMENDED:
GARRY E. VERANO
OFFICER-IN-CHARGE
OFFICE OF THE ASSISTANT DISTRICT ENGINEER
DATE:

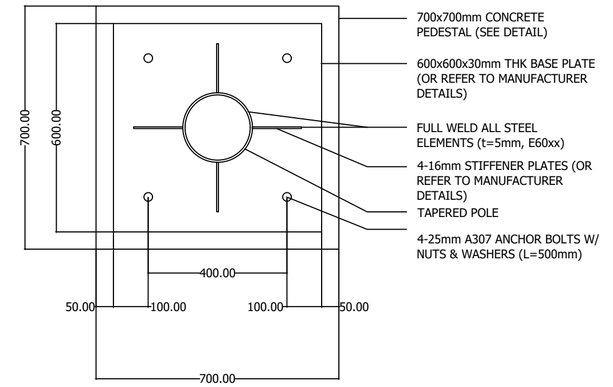
APPROVED:
ARTURO R. LONGYAPON
DISTRICT ENGINEER
DATE:

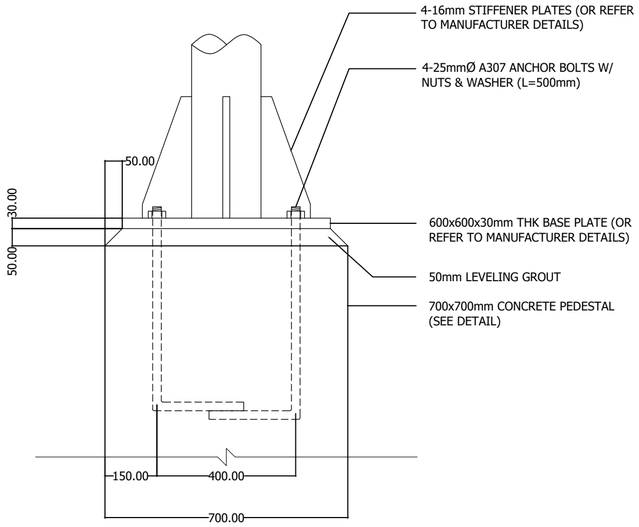
SET NO.: M 3 6

SHEET NO.: 19 52

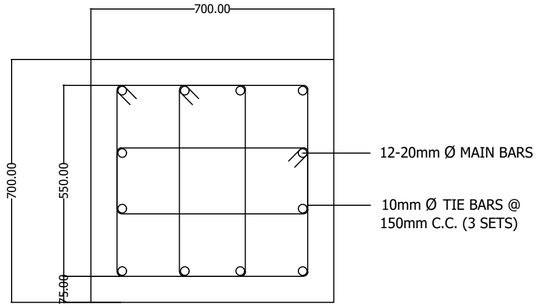


FOUNDATION ELEVATION
NOT TO SCALE





BASE PLATE DETAIL FOR 8.0 MTS. 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/m^3
  - ii. STEEL — 77 kN/m^3
  - iii. SOIL — 18 kN/m^3
  - iv. POLE ATTACHMENTS — 50 kg
- b. WIND LOAD
  - i. WIND SPEED — 340 kph
  - ii. EXPOSURE CATEGORY — D
  - iii. DIRECTIONALITY FACTOR — 0.85
  - iv. OCCUPANCY CATEGORY — V (MISCELLANEOUS STRUCTURES)

C. MATERIALS
- a. NORMAL WEIGHT CONCRETE — F_c = 28 MPa (4000 psi)
- b. REINFORCING STEEL
  - i. 12mmØ AND BELOW — F_y = 276 MPa (GRADE 40)
  - ii. 16mm Ø AND BELOW — F_y = 414 MPa (GRADE 60)
- c. STRUCTURAL STEEL
  - i. STEEL POLE — F_y= 240 MPa (A53 GRADE B); F_u = 415 MPa
  - ii. BASE PLATE & STIFFENER — F_y = 248 MPa (A36); F_u = 400 MPa
- d. STRUCTURAL BOLTS AND FASTENER — F_{nt} = 310 MPa (A307); F_{nv} = 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

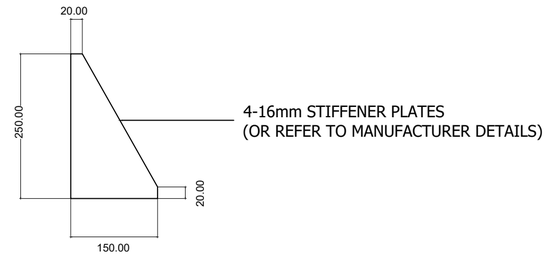
a. THE FOUNDATION IS DESIGNED FOR AN ASSUMED ALLOWABLE SOIL BEARING CAPACITY (SBC) OF 96 kPa (2000 psf). IF THE LOCATION IS KNOWN OR FOUND OUT TO HAVE AN SBC OF LESS THAN THE ASSUMED, THE FOOTING DESIGN SHALL BE REVISED ACCORDINGLY.

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 LOADS AND MATERIAL STRENGTHS PROVIDED IN THE ITEMS ABOVE.

b. DESIGN CALCULATIONS/SPECIFICATIONS OF THE PRE-ASSEMBLED STEEL POST MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR INSTALLATION.



STIFFENER DETAIL
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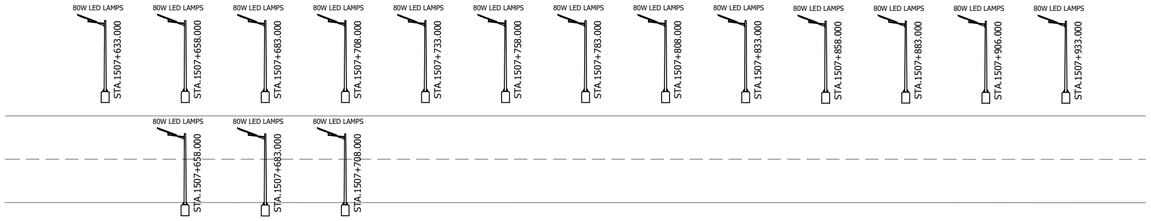
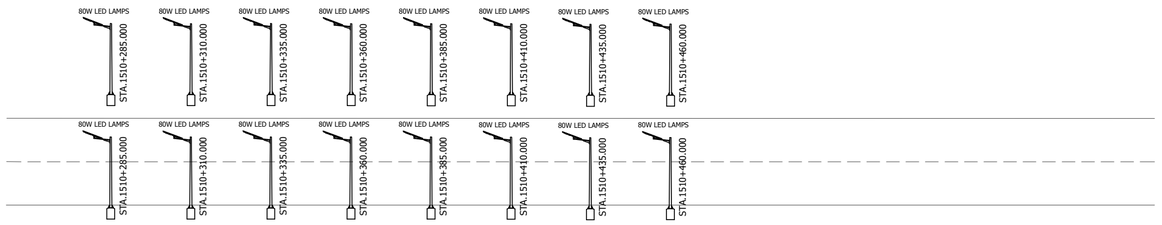
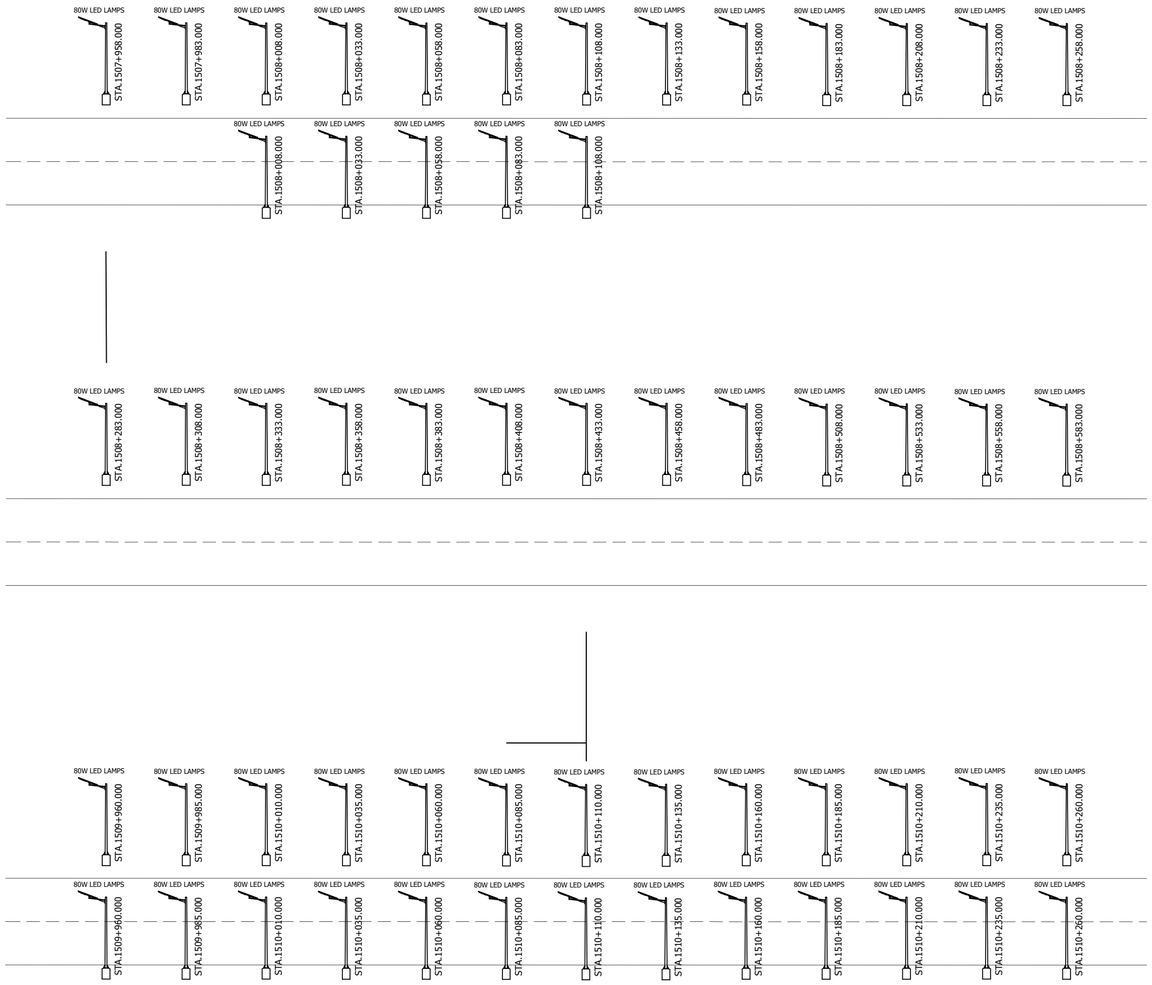
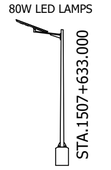
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REGION XI
DAVAO DEL NORTE
2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:	SHEET CONTENTS:	DRAFTED:	REVIEWED:	SUBMITTED:	RECOMMENDED:	APPROVED:	SET NO.	SHEET NO.
BABAK-SAMAL-KAPUTIAN RD - K1507+633 - K1510+460	SOLAR STREET LIGHTS DETAILS AND SCHEDULE	**HERWIN EVAN J. HABABAG** ENGINEER II PREPARED: **WARREN S. PIÑEZ** ENGINEER II	**BENILDA S. PACQUIAO** ENGINEER III DATE:	**JEZABEL E. TULING, MPA** CHIEF, PLANNING AND DESIGN SECTION DATE:	**GARRY E. VERANO** OFFICER-IN-CHARGE OFFICE OF THE ASSISTANT DISTRICT ENGINEER DATE:	**ARTURO R. LONGYAPON** DISTRICT ENGINEER DATE:	M 4 6	20 52







	SOLAR STREET LED LIGHTS (PLAN)
	SOLAR STREET LED LIGHTS (SECTION)

DRAWING LEGENDS
NOT TO SCALE

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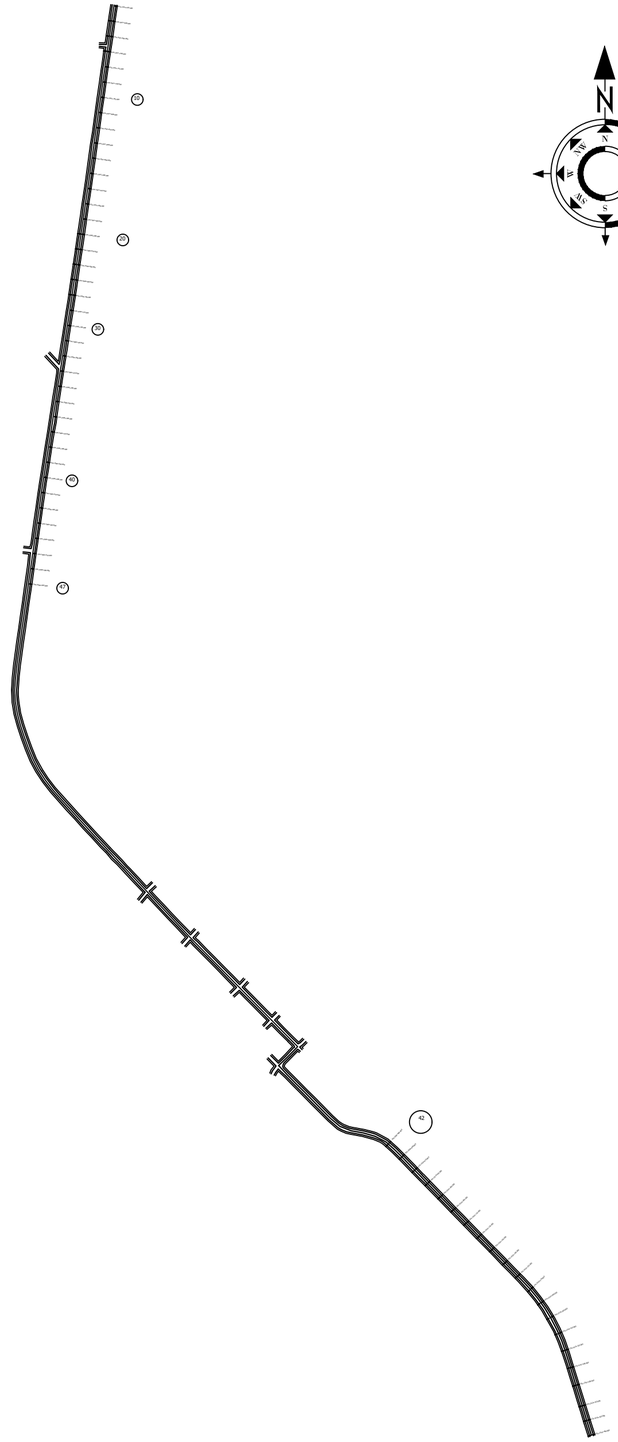
SCHEDULE OF SOLAR STREET LIGHTS

80-125W SOLAR LED STREET LIGHT

STATION	QTY	SPACING(m)	REMARKS	STATION	QTY	SPACING(m)	REMARKS
K1507+633.00	1.00	25.00	LS	K1508+633.00	1.00	25.00	LS
K1507+658.00	2.00	25.000	BOTH SIDE	K1508.658.00	1.00	25.00	LS
K1507+683.00	2.00	25.00	BOTH SIDE	K1508+683.00	1.00	25.00	LS
K1507+708.00	2.00	25.00	BOTH SIDE	K1508+708.00	1.00	25.00	LS
K1507+733.00	1.00	25.00	LS	K1508+733.00	1.00	25.00	LS
K1507+758.00	1.00	25.00	LS	K1508+758.00	2.00	25.00	BOTH SIDE
K1507+783.00	1.00	25.00	LS	K1508+783.00	2.00	25.00	BOTH SIDE
K1507+808.00	1.00	25.00	LS	K1508+808.00	2.00	25.00	BOTH SIDE
K1507+833.00	1.00	25.00	LS	K1508+833.00	2.00	25.00	BOTH SIDE
K1507+858.00	1.00	25.00	LS	K1508+858.00	2.00	25.00	BOTH SIDE
K1507+883.00	1.00	25.00	LS	K1508+883.00	2.00	25.00	BOTH SIDE
K1507+908.00	1.00	25.00	LS	K1508+908.00	2.00	25.00	BOTH SIDE
K1507+933.00	1.00	25.00	LS	K1508+933.00	2.00	25.00	BOTH SIDE
K1507+958.00	1.00	25.00	LS	K1508+958.00	1.00	25.00	LS
K1507+983.00	1.00	25.00	LS	K1509+680.00	1.00	25.00	RS
K1508+008.00	2.00	25.00	BOTH SIDE	K1509+705.00	1.00	25.00	RS
K1508+033.00	2.00	25.00	BOTH SIDE	K1509+730.00	1.00	25.00	RS
K1508+058.00	2.00	25.00	BOTH SIDE	K1509+755.00	1.00	25.00	RS
K1508+083.00	2.00	25.00	BOTH SIDE	K1509+780.00	1.00	25.00	RS
K1508+108.00	2.00	25.00	BOTH SIDE	K1510+960.00	2.00	25.00	BOTH SIDE
K1508+133.00	1.00	25.00	LS	K1509+985.00	2.00	25.00	BOTH SIDE
K1508+158.00	1.00	25.00	LS	K1510+010.00	2.00	25.00	BOTH SIDE
K1508+183.00	1.00	25.00	LS	K1510+035.00	2.00	25.00	BOTH SIDE
K1508+208.00	1.00	25.00	LS	K1510+060.00	2.00	25.00	BOTH SIDE
K1508+233.00	1.00	25.00	LS	K1510+085.00	2.00	25.00	BOTH SIDE
K1508+258.00	1.00	25.00	LS	K1510+110.00	2.00	25.00	BOTH SIDE
K1508+283.00	1.00	25.00	LS	K1510+135.00	2.00	25.00	BOTH SIDE
K1508+308.00	1.00	25.00	LS	K1510+160.00	2.00	25.00	BOTH SIDE
K1508+333.00	1.00	25.00	LS	K1510+185.00	2.00	25.00	BOTH SIDE
K1508+358.00	1.00	25.00	LS	K1510+210.00	2.00	25.00	BOTH SIDE
K1508+383.00	1.00	25.00	LS	K1510+235.00	2.00	25.00	BOTH SIDE
K1508+408.00	1.00	25.00	LS	K1510+260.00	2.00	25.00	BOTH SIDE
K1508+433.00	1.00	25.00	LS	K1510+285.00	2.00	25.00	BOTH SIDE
K1508+458.00	1.00	25.00	LS	K1510+310.00	2.00	25.00	BOTH SIDE
K1508+483.00	1.00	25.00	LS	K1510+335.00	2.00	25.00	BOTH SIDE
K1508+508.00	1.00	25.00	LS	K1510+360.00	2.00	25.00	BOTH SIDE
K1508+533.00	1.00	25.00	LS	K1510+385.00	2.00	25.00	BOTH SIDE
K1508+558.00	1.00	25.00	LS	K1510+410.00	2.00	25.00	BOTH SIDE
K1508+583.00	1.00	25.00	LS	K1510+435.00	2.00	25.00	BOTH SIDE
K1508+608.00	1.00	25.00	LS	K1510+460.00	2.00	25.00	BOTH SIDE



STREET LIGHTS STATIONING
NOT TO SCALE

ROADWAY LIGHTING PLAN
NOT TO SCALE

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2ND DISTRICT ENGINEERING OFFICE
TAGUM CITY

PROJECT NAME AND LOCATION:
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SHEET CONTENTS:
SOLAR STREET LIGHTS DETAILS AND SCHEDULE

DRAFTED:
HERWIN EVAN J. HABABAG
ENGINEER II

PREPARED:
WARREN S. PIÑEZ
ENGINEER II

REVIEWED:
BENILDA S. PACQUIAO
ENGINEER III
DATE:

SUBMITTED:
JEZABEL B. TULING, MPA
CHIEF, PLANNING AND DESIGN SECTION
DATE:

RECOMMENDED:
GARRY E. VERANO
OFFICER-IN-CHARGE
OFFICE OF THE ASSISTANT DISTRICT ENGINEER
DATE:

APPROVED:
ARTURO P. LONGYAPON
DISTRICT ENGINEER
DATE:

SET NO.: M 6 6

SHEET NO.: 22 52