

【Appendix-6】

Outline Design Drawings

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

THE PROJECT FOR IMPROVEMENT
OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

JUNE 2019

CTI ENGINEERING INTERNATIONAL CO.,LTD.

DRAWING LIST

No.	DRAWING TITLE	SHEET NO.	No. of Sheets	No.	DRAWING TITLE	SHEET NO.	No. of Sheets
1. GENERAL		GN - 01 ~ 09	9		DIRECTION SIGNS(1)-(7)	RA - 29 ~ 35	7
	GENERAL NOTES(1)-(3)	GN - 01 ~ 03	3		DETAIL OF NOSE(1)-(2)	RA - 36 ~ 37	2
	PROJECT LOCATION MAP	GN - 04	1	12.	TRAFFIC SIGNAL LIGHT(1)-(8)	SL - 01 ~ 08	8
	KEY PLAN	GN - 05	1	13.	ROAD LIGHT(1)-(18)	RL - 01 ~ 18	18
	ALIGNMENT LAYOUT(1)-(4)	GN - 06 ~ 09	4	14.	BRIDGE		29
2. PLAN(1)-(6)		PL - 01 ~ 06	6		GENERAL ARRANGEMENT OF BRIDGE	GB - 01	1
3. PROFILE(1)-(3)		PR - 01 ~ 03	3		GENERAL ARRANGEMENT OF SUPERSTRUCTURE(1)-(2)	SP - 01 ~ 02	2
4. TYPICAL CROSS SECTION		TP - 01	1		SECTIONAL FORCES AND PROPERTIES(1)-(12)	SF - 01 ~ 12	12
5. CROSS SECTION(1)-(36)		CR - 01 ~ 36	36		GENERAL ARRANGEMENT OF SUBSTRUCTURE(1)-(2)	SB - 01 ~ 02	2
6. PAVEMENT STRUCTURE		PS - 01	1		CROSS SECTION OF PIER 1	P1 - 01	1
7. INTERSECTION PLAN		IP - 01	1		CROSS SECTION OF CAISSON PILE OF PIER 1	P1 - 02	1
8. DRAINAGE PLAN(1)-(6)		DP - 01 ~ 06	6		CROSS SECTION OF PIER 2	P2 - 01	1
9. DETAIL OF DRAINAGE(1)-(5)		DR - 01 ~ 05	5		CROSS SECTION OF CAISSON PILE OF PIER 2	P2 - 02	1
	SIDE DITCH	DR - 01	1		CROSS SECTION OF ANCHOR FRAME	AF - 01	1
	CATCH BASIN	DR - 02 ~ 03	2		REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF PIER	PC - 01	1
	CROSS DRAINAGE	DR - 04	1		GENERAL ARRANGEMENT OF ABUTMENT 1	A1 - 01	1
	SCHEDULE OF DRAINAGE	DR - 05	1		REINFORCED REBAR ARRANGEMENT OF ABUTMENT 1	A1 - 02	1
10. REINFORCED EARTH WALL(1)-(9)		RE - 01 ~ 09	9		REINFORCED REBAR ARRANGEMENT OF COLUMN OF A1	A1 - 03	1
11. ROAD ANCILLARIES		RA - 01 ~ 37	37		REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF A1	A1 - 04	1
	ANCILLARY PLAN(1)-(6)	RA - 01 ~ 06	6		GENERAL ARRANGEMENT OF ABUTMENT 2	A2 - 01	1
	LAYOUT OF REFLECTOR(1)-(6)	RA - 07 ~ 12	6		REINFORCED REBAR ARRANGEMENT OF ABUTMENT 2	A2 - 02	1
	MEDIAN BLOCK, KERB AND EDGE BLOCK	RA - 13	1	15.	REFERENCE DRAWINGS	RD - 01 ~ 06	6
	CRASH BARRIER	RA - 14 ~ 15	2		STRUCTURE REMOVAL PLAN(1)-(6)	RD - 01 ~ 06	6
	REFLECTOR	RA - 16	1				
	LAYOUT OF PAVEMENT MARKINGS(1)-(8)	RA - 17 ~ 24	8				
	PAVEMENT MARKINGS(1)-(2)	RA - 25 ~ 26	2				
	TYPICAL TRAFFIC SIGNS(1)-(2)	RA - 27 ~ 28	2				
					<i>Total number of sheets</i>		175

GENERAL NOTES(1)

2. CONCRETE

CLASS	CHARACTERISTICS		MAXIMUM WATER/CEMENT CONCRETE		MINIMUM CEMENT CONCRETE (kg/m ³)
	CYLINDER STRENGTH (N/mm ²)	CUBE STRENGTH (N/mm ²)	A	B	
C20/25	20	25	0.70	0.60	260
C25/30	25	30	0.60	0.55	280
C30/37	30	37	0.55	0.50	300
C35/45	35	45	0.50	0.45	320
C40/50	40	50	0.45	0.40	340
C45/55	45	55	0.45	0.40	360
C50/60	50	60	0.45	0.40	360

NOTE: UNDER WATER/CEMENT RATIO COLUMN A APPLIES TO MODERATE AND INTERMEDIATE EXPOSURE, AND COLUMN B TO SEVERE EXPOSURE.

GENERAL

- SCALE
ATTENTION IS DIRECTED TO THE FACT THAT THE SCALES INDICATED IN THE DRAWINGS ARE FOR A1-SIZE. WHEN PRINTED ON OTHER SIZES, THE SCALES SHALL BE READ ACCORDINGLY.
- UNIT
ALL DIMENSIONS SHOWN IN THE DRAWINGS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
ALL ELEVATIONS SHOWN IN THE DRAWINGS ARE IN METERS, AND ARE LOCALLY ESTABLISHED BASED ON TEMPORARY BENCH MARK OF THIS PROJECT.
- COORDINATE SYSTEM
ALL COORDINATE VALUES IN THE DRAWINGS ARE CONFORMITY WITH "GHANA GRID" AND "WGS84 UTM ZONE 30N".
ALL COORDINATES AND LEVELS ARE GIVEN IN METRES.
- TECHNICAL STANDARDS
 - ROAD DESIGN GUIDE(GHA, 1991)
 - A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS (AASHTO,2011)
 - ROAD DESIGN ORDINANCES(JAPAN ROAD ASSOCIATION,2015)
 - GUIDE FOR DESIGN OF PAVEMENT STRUCTURES(AASHTO,1983)
 - PAVEMENT DESIGN MANUAL(MRH-GHA, 1998)
 - DESIGN GUIDELINE FOR CULVERT(JAPAN ROAD ASSOCIATION,2010)
 - DESIGN GUIDELINE FOR RETAINING WALL(JAPAN ROAD ASSOCIATION,2012)
 - HIGHWAY CAPACITY MANUAL(TRANSPORTATION RESEARCH BOARD,2010)
 - ROAD LIGHTNING INSTALLATION GUIDELINES AND EXPLANATION(JAPAN ROAD ASSOCIATION,2007)
 - LED ROAD AND LIGHTNING INSTALLATION(DRAFT)(MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM,2011)

- CLASS C20/25 CONCRETE - BLENDED CONCRETE, BASE CONCRETE OF BOX CULVERTS, PIPE BEDDING, AND ALL STRUCTURES WITHOUT REINFORCEMENT INCLUDING REINFORCEMENT STRUCTURES INDICATED IN THE BASIN, KERB STONE, MEDIAN STRIP BLOCK, TRAFFIC ISLAND BLOCK, EDGE BLOCK ETC.
- CLASS C25/30 CONCRETE - ALL MAJOR REINFORCED CONCRETE STRUCTURES INDICATED IN

5. SHOP DRAWING

- THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE CONSULTANT PRIOR TO COMMENCEMENT OF THE WORK.
- THE CONTRACTOR SHALL CONSTRUCT AND MAINTAIN DETOURS WHERE NECESSARY DURING CONSTRUCTION TO ACCOMMODATE EXISTING TRAFFIC. DETOURS SHALL BE DESIGNED BY THE CONTRACTOR SUBJECT TO APPROVAL BY THE CONSULTANT. CONSULTANT DESIGN IS ATTACHED FOR REFERENCE.
- ALL FALSE WORK AND TEMPORARY STRUCTURES SHALL BE DESIGNED BY THE CONTRACTOR AND SHALL BE SUBJECT TO THE APPROVAL BY THE CONSULTANT.

MATERIAL

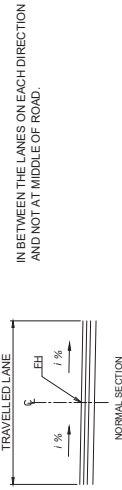
- REINFORCING BAR
 - REINFORCING STEEL SHALL BE DEFORMED HIGH YIELD BARS GRADE 60 IN COMPLIANCE WITH BS 4449 OR ASTM A615M OR EQUIVALENT.
 - REINFORCING FABRIC SHALL COMPLY WITH BS 8666.
 - ALL REINFORCING BARS SHALL HAVE DEFORMED SURFACES. REINFORCING STEEL SHALL BE FREE OF MILL SCALES, OR ANY SUBSTANCES WHICH WILL WEAKEN THE BOND WITH CONCRETE.

2. REINFORCED CONCRETE

- CONCRETE MIX AND PLACING
 - DESIGN OF CONCRETE MIX SHALL MEET THE DESIGN CONCRETE STRENGTH GIVEN IN THE SPECIFICATION.
CONCRETE SHALL BE DEPOSITED, VIBRATED AND CURED IN ACCORDANCE WITH THE SPECIFICATIONS
 - THE CONTRACTOR SHALL SUBMIT TO THE CONSULTANT FOR APPROVAL PLACING SEQUENCES FOR ALL CONCRETE WORK.
- BAR BENDING, SPlicing, AND PLACING
 - THE CONTRACTOR SHALL SUBMIT TO THE CONSULTANT FOR APPROVAL OF SHOP DRAWINGS INDICATING THE BENDING, CUTTING, SPlicing AND INSTALLATION OF ALL REINFORCING BARS.
BARS SHALL BE BENT COLD. BARS PARTIALLY EMBEDDED IN CONCRETE SHALL NOT BE FIELD BENT UNLESS PERMITTED BY THE CONSULTANT.
 - BAR SPlicing NOT INDICATED ON DRAWINGS SHALL BE SUBJECT TO THE APPROVAL OF THE CONSULTANT.
 - UNLESS OTHERWISE SHOWN ON DRAWINGS, THE CLEAR DISTANCE BETWEEN PARALLEL BARS IN LAYER SHALL BE MORE THAN 40mm OR 4/3 TIMES THE MAXIMUM SIZE OF COARSE AGGREGATE OR SHALL NOT BE LESS THAN 1.5 TIMES THE NOMINAL DIAMETER OF THE BAR.
- CONCRETE COVER TO THE SURFACE OF REINFORCEMENT
 - MINIMUM CONCRETE COVER TO THE SURFACE OF REINFORCEMENT SHALL BE 40mm IN THE ATMOSPHERE, 70mm UNDER EARTH UNLESS SHOWN OTHERWISE ON DRAWINGS.
- CONSTRUCTION JOINT
 - THE POSITION AND FORM OF ANY CONSTRUCTION JOINT SHALL BE AS INSTRUCTED BY THE CONSULTANT.
- FALSE WORK
 - ALL FALSE WORK SHALL BE DESIGNED BY THE CONTRACTOR SUBJECT TO PRIOR THE APPROVAL BY THE CONSULTANT.

ROAD

- FORMATION HEIGHT(FH)
DESIGN ELEVATION STIPULATED AS "FORMATION HEIGHT" IN THE DRAWINGS SHALL BE DEFINED BY FOLLOWING POINTS.



CONSTRUCTION

- CONSTRUCTION SHALL MEET THE SPECIFICATIONS UNDER ITEMS OF TECHNICAL STANDARDS.
- REINFORCED CONCRETE
 - THE SETTING OUT AND THE ELEVATIONS OF THE DIFFERENT COMPONENTS OF THE STRUCTURE SHALL BE APPROVED BY THE CONSULTANT PRIOR TO THE START OF ANY CONSTRUCTION WORK.

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
GENERAL NOTES(1)

SCALE (A1/100)

NONE

DRAWING NO.

GN-01

GENERAL NOTES(2)

BRIDGE

1. TECHNICAL STANDARDS
 - A GUIDE FOR BRIDGE DESIGN (GHANA HIGHWAY AUTHORITY, 1991)
 - DESIGN MANUAL FOR ROADS AND BRIDGES (BD 37/01, BS5400: PART2, 2001)
 - SPECIFICATIONS FOR HIGHWAY BRIDGES (JAPAN ROAD ASSOCIATION, 2012)

MATERIAL

1. STEEL
 - 4. RIGID STEEL FRAME STRUCTURE WITH STEEL PIERS
THE CONTRACTOR SHALL CONTROL THE AMOUNT OF VERTICAL DEFLECTION OCCURRING IN HORIZONTAL STEEL BEAM DURING CONSTRUCTION, NOT TO VIOLATE THE RANGE OF THE VERTICAL CLEARANCE, 5.5m, SPECIFIED IN THE DESIGN CRITERIA.
 - 5. ANCHOR FRAME INSTALLATION
THE CONTRACTOR SHALL CONTROL THE ACCURACY OF ANCHOR FRAME INSTALLATION, PAYING ATTENTION TO ANCHOR BOLT AND BEAM NOT TO BUCKLE IN CONCRETING CAISSON PILE FOUNDATION.

TYPE OF STEEL	STRUCTURAL MEMBERS	CLASS	STANDARD
STRUCTURAL STEEL	SUPER AND SUB STRUCTURE	SM570, SM520C, SM490Y, SM400	JIS G 3106
		SS400	JIS G 3101
REINFORCING BAR		SD345	JIS G 3112

2. CONCRETE

STRUCTURAL MEMBERS	28-DAY CYLINDER STRENGTH
DECK SLAB OF BRIDGE	24 (N/mm ²)
ABUTMENT, COLUMN, CAISSON PILE	24 (N/mm ²)
CAISSON PILE OF PIER	40 (N/mm ²)
BASE CONCRETE OF PIER	21 (N/mm ²)
LEVELING CONCRETE	18 (N/mm ²)

CONSTRUCTION

1. ERECTION
 - ALL DRAWINGS REGARDING THE GIRDER ERECTION FOR THE BRIDGE ARE FOR REFERENCE ONLY. THE CONTRACTOR SHALL PROPOSE THE MOST EFFECTIVE ERECTION METHOD TO MINIMIZE CONSTRUCTION PERIOD AND NEGATIVE IMPACT ON EXISTING TRAFFIC AND ENVIRONMENT.
2. BEARING CAPACITY TEST FOR FOUNDATION
 - THE CONTRACTOR SHALL CARRY OUT BEARING TESTS FOR CIP CONCRETE PILE FOUNDATION TO CONFIRM THE BEARING CAPACITY AT TWO LOCATIONS. PLAN AND SCHEDULE FOR THE TEST SHALL BE SUBMITTED BY THE CONTRACTOR TO BE APPROVED BY THE CONSULTANT PRIOR TO COMMENCEMENT OF THE TESTS.
 - THE BOTTOM OF CAISSON TYPE PILE FOUNDATION SHALL BE EMBEDDED INTO HARD STRATA WITH AN N-VALUE OF AT LEAST 50 CAPABLE OF DEVELOPING THE REQUIRED FACTORED BEARING RESISTANCE.
 - IF THE ABOVE CONDITION CANNOT BE MET DURING CONSTRUCTION, THE CONSULTANT SHALL BE NOTIFIED FOR ADJUSTMENT OF FOOTING DEPTH IF NECESSARY.
3. PAINTING
 - PAINTING SYSTEM C-5 WHICH IS STIPULATED IN "PAINTING MANUAL FOR STEEL HIGHWAY BRIDGES (JAPAN ROAD ASSOCIATION, 2005)", SHALL BE APPLIED TO STEEL MEMBER OF GIRDER AND PIERS.

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:

GENERAL NOTES(2)

SCALE (A1199)

NONE

DRAWING NO.

GN-02

GENERAL NOTES(3)

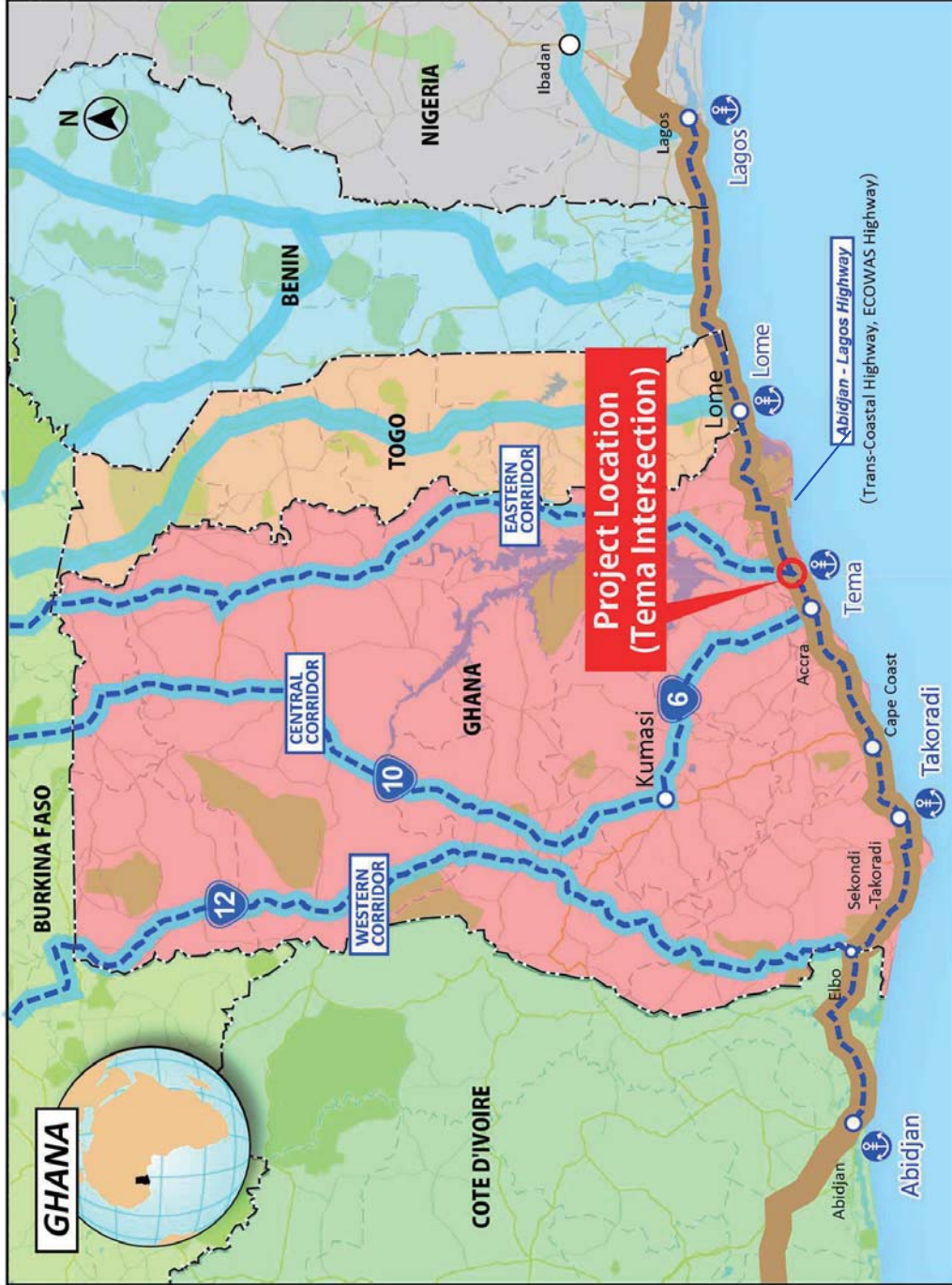
ABBREVIATION

ITEM	DESCRIPTION
BP	Beginning Point
EP	End Point
BC	Beginning of Curve
EC	End of Curve
IP	Intersection Point
IA	Angle of Intersection
TL	Tangent Length
SL	Secant Length
CL	Curve Length
DL	Datum Line
H	Height
V	Vertical
VCL	Vertical Curve Length
K	Rate of Vertical Curvature
BM	Bench Mark

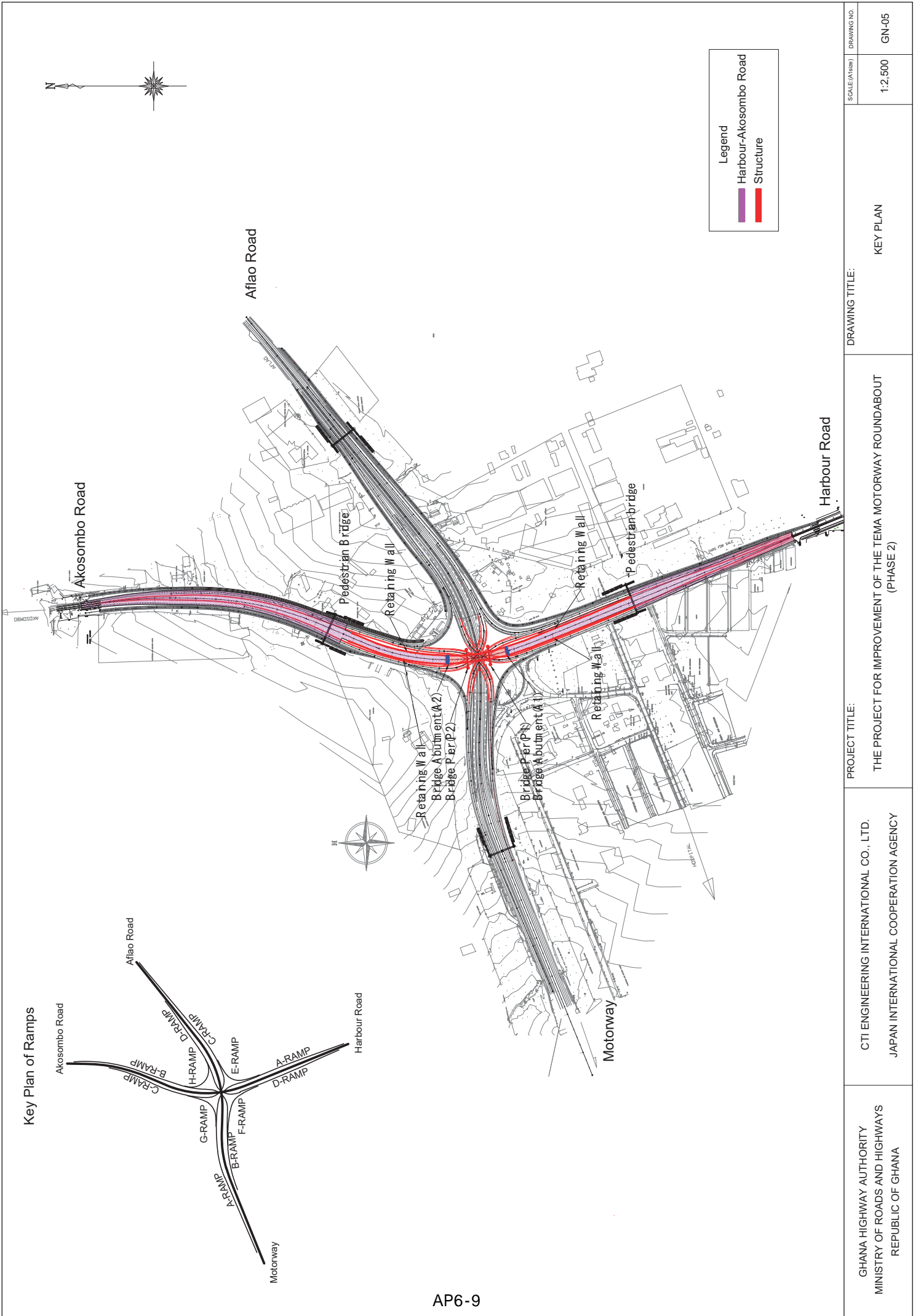
SYMBOLS

SYMBOL	DESCRIPTION
	Road
	Road Centerline
	Access Road
	North Direction Sign
	Tree
	Bench Mark
	Fence

ITEM	DESCRIPTION
STA.	Station
FH	Formation Height
GH	Ground Height
R	Radius of Curve
A	Relaxation curve length
L	Length
t	Thickness
i	Inclination
fb	Bending Stress of Concrete
∞	Straight
HWL	High Water Level



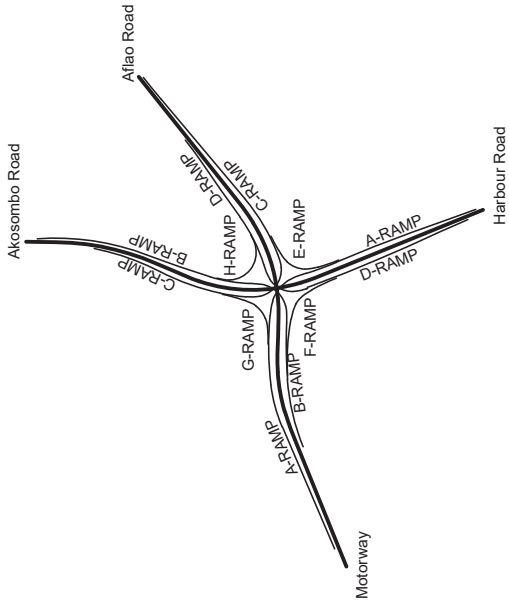
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: PROJECT LOCATION MAP	SCALE (A1199) 1:400,000	DRAWING NO. GN-04
--	---	--	--	----------------------------	----------------------



Legend

- Harbour-Akosombo Road
- Structure

Key Plan of Ramps

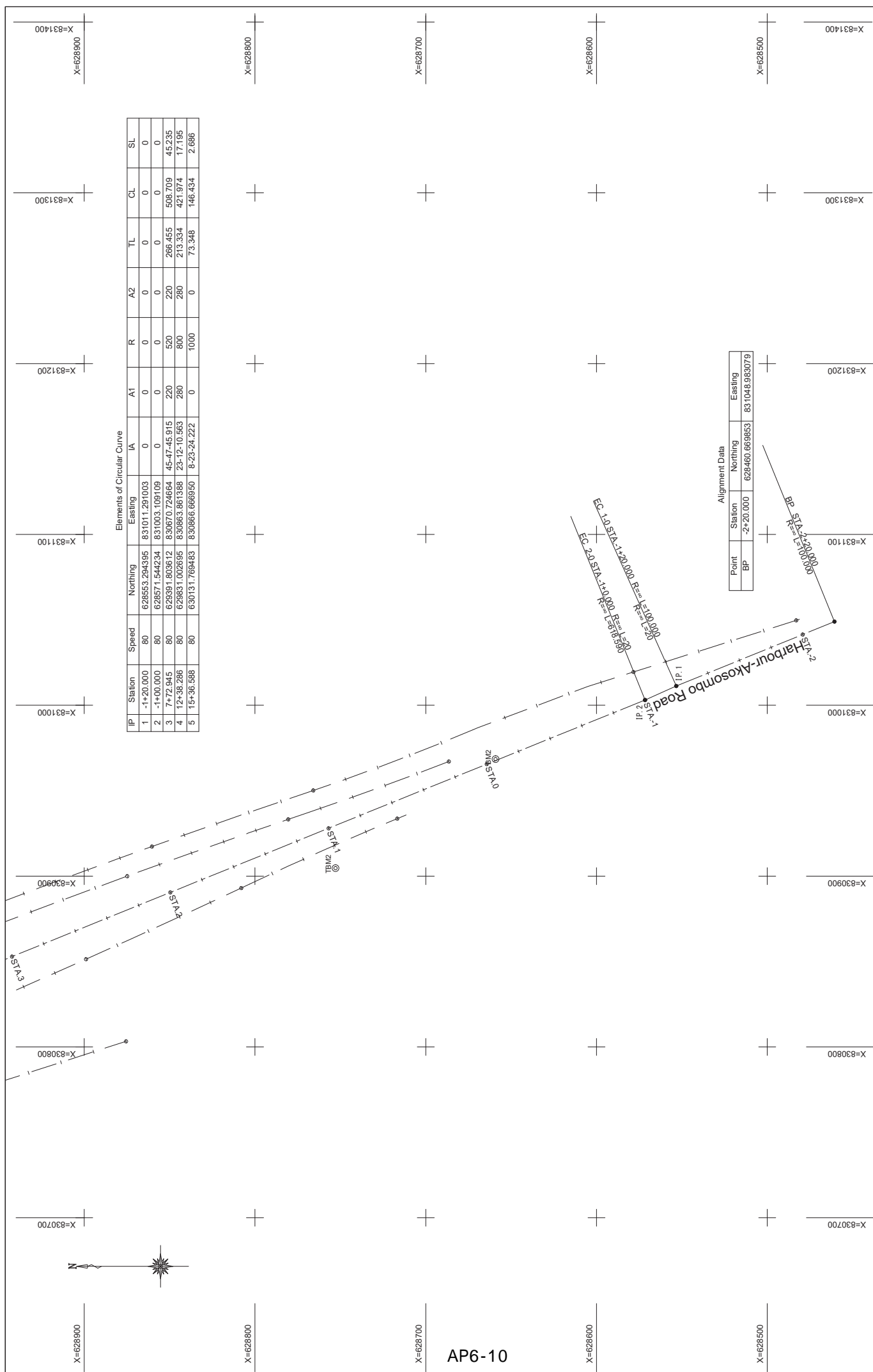


AP6-9

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO. GN-05
		SCALE (A1100) 1:2,500	DRAWING NO. GN-05

KEY PLAN

DRAWING TITLE:



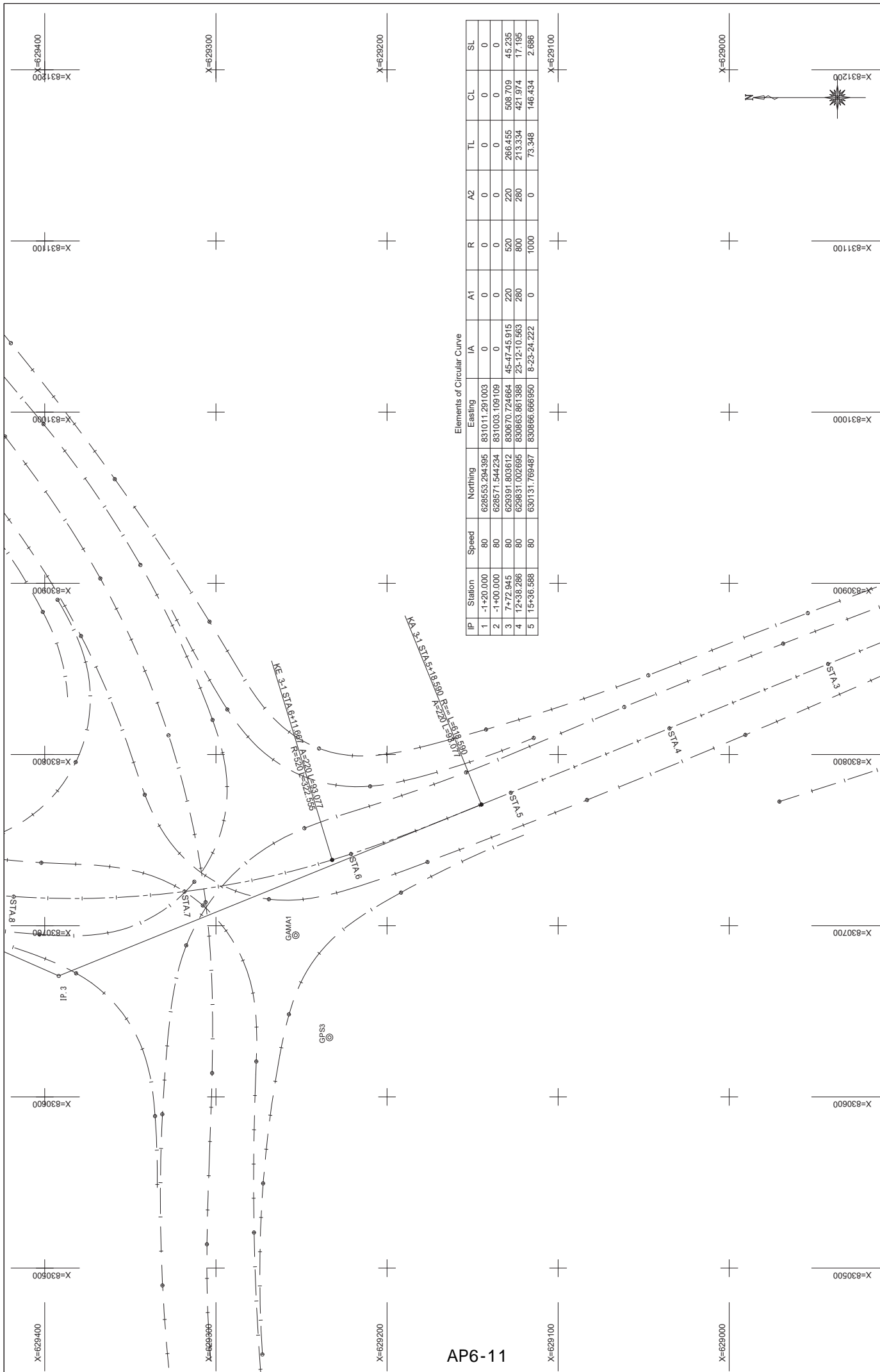
Elements of Circular Curve

IP	Station	Speed	Nothing	Easting	IA	A1	R	A2	TL	CL	SL
1	-1+20.000	80	628553.294395	831011.291003	0	0	0	0	0	0	0
2	-1+00.000	80	628571.544234	831003.109109	0	0	0	0	0	0	0
3	7+72.945	80	629391.803612	830670.724664	45-47-45.915	220	520	220	286.455	508.709	45.235
4	12+38.286	80	629831.002695	830863.861388	23-12-10.563	280	800	280	213.334	421.974	17.195
5	15+36.588	80	630131.764483	830866.666950	8-23-24.222	0	1000	0	73.348	148.434	2.686

Alignment Data

Point	Station	Nothing	Easting
BP	-2+20.000	628460.669563	831048.983079

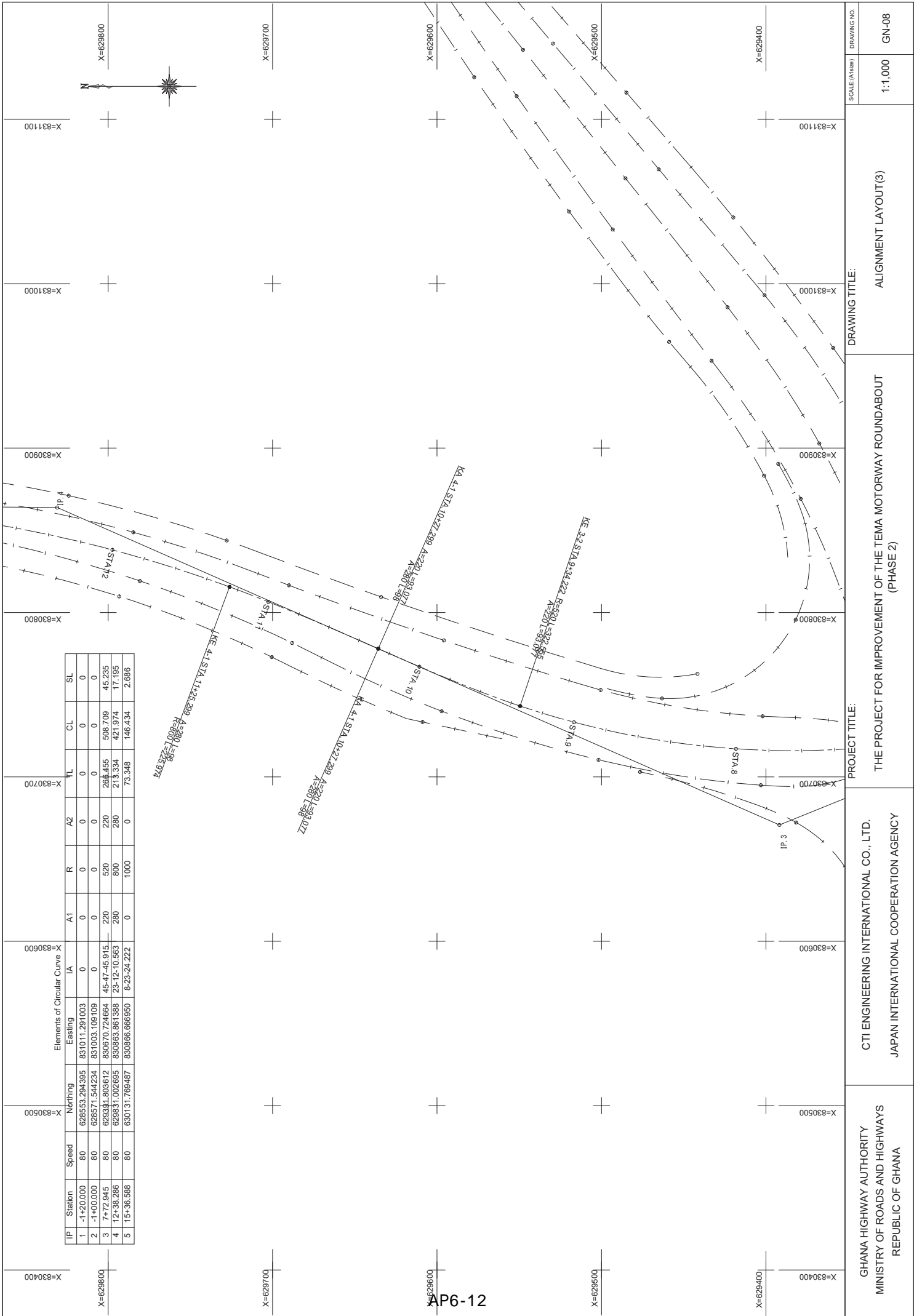
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
		DRAWING TITLE: ALIGNMENT LAYOUT (1)
		SCALE (A1:100) 1:1,000
		DRAWING NO. GN-06



Elements of Circular Curve

IP	Station	Speed	Northing	Easting	IA	A1	R	A2	TL	CL	SL
1	-1+20.000	80	628553.294395	831011.291003	0	0	0	0	0	0	0
2	-1+00.000	80	628571.544234	831003.109109	0	0	0	0	0	0	0
3	7+72.945	80	628391.803612	830870.724684	45-47-45.915	220	520	220	266.455	508.709	45.235
4	12+38.286	80	628631.002695	830863.861388	23-12-10.563	280	800	280	213.534	421.874	17.195
5	15+36.588	80	630131.769487	830866.866950	8-23-24.222	0	1000	0	73.348	146.434	2.686

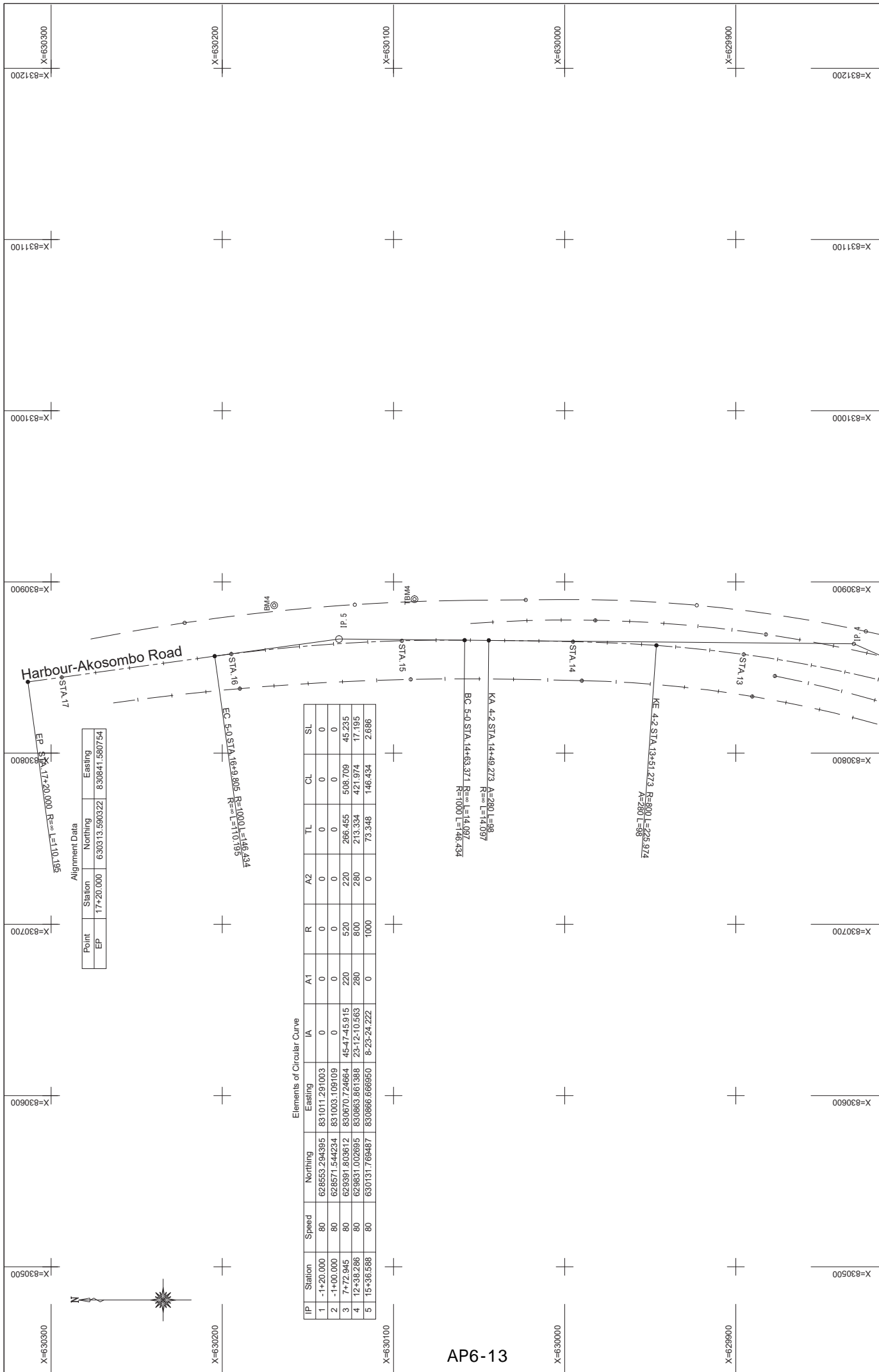
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ALIGNMENT LAYOUT(2)	SCALE (A1/100)	DRAWING NO.
				1:1,000	GN-07



Elements of Circular Curve X

IP	Station	Speed	Northing	Easting	IA	A1	R	A2	TL	CL	SL
1	-1+20.000	80	628553.294395	831011.291003	0	0	0	0	0	0	0
2	-1+00.000	80	628571.544234	831003.109109	0	0	0	0	0	0	0
3	7+72.945	80	629341.503612	830670.724864	45-47.45 615	220	520	220	650	509.709	45.235
4	12+35.286	80	629311.002695	830663.861388	23-12-10.863	280	800	280	650	421.974	17.195
5	15+36.588	80	630131.769487	830666.666950	8-23-24.222	0	1000	0	73.348	146.434	2.886

DRAWING NO. GN-08
 SCALE (A1:100) 1:1,000
 PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
 DRAWING TITLE: ALIGNMENT LAYOUT(3)
 CLIENT: GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA
 CONSULTANT: CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY



PROJECT TITLE: **ALIGNMENT LAYOUT(4)**

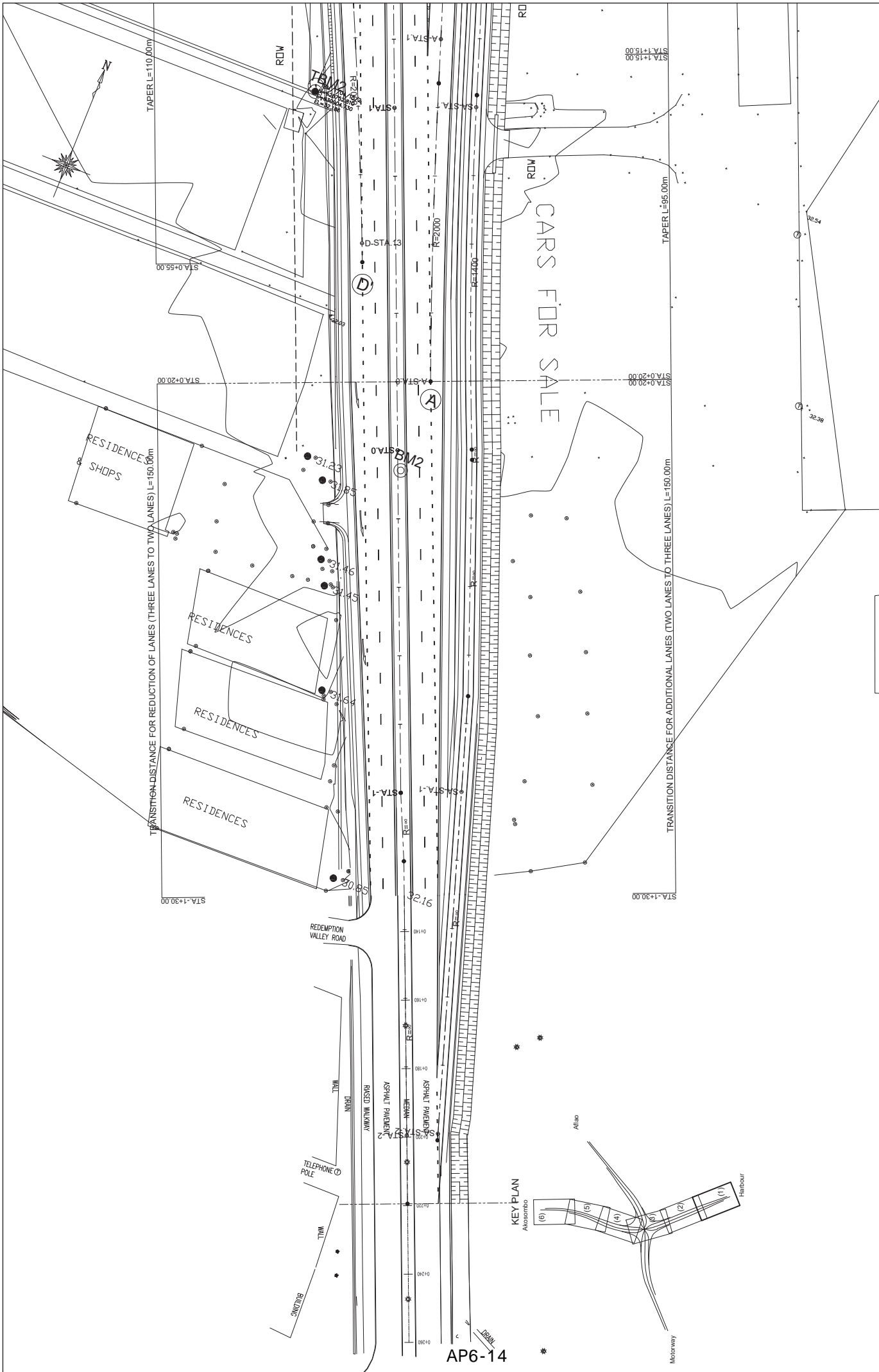
DRAWING NO: **GN-09**

SCALE (A1/100): **1:1,000**

PROJECT TITLE: **THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)**

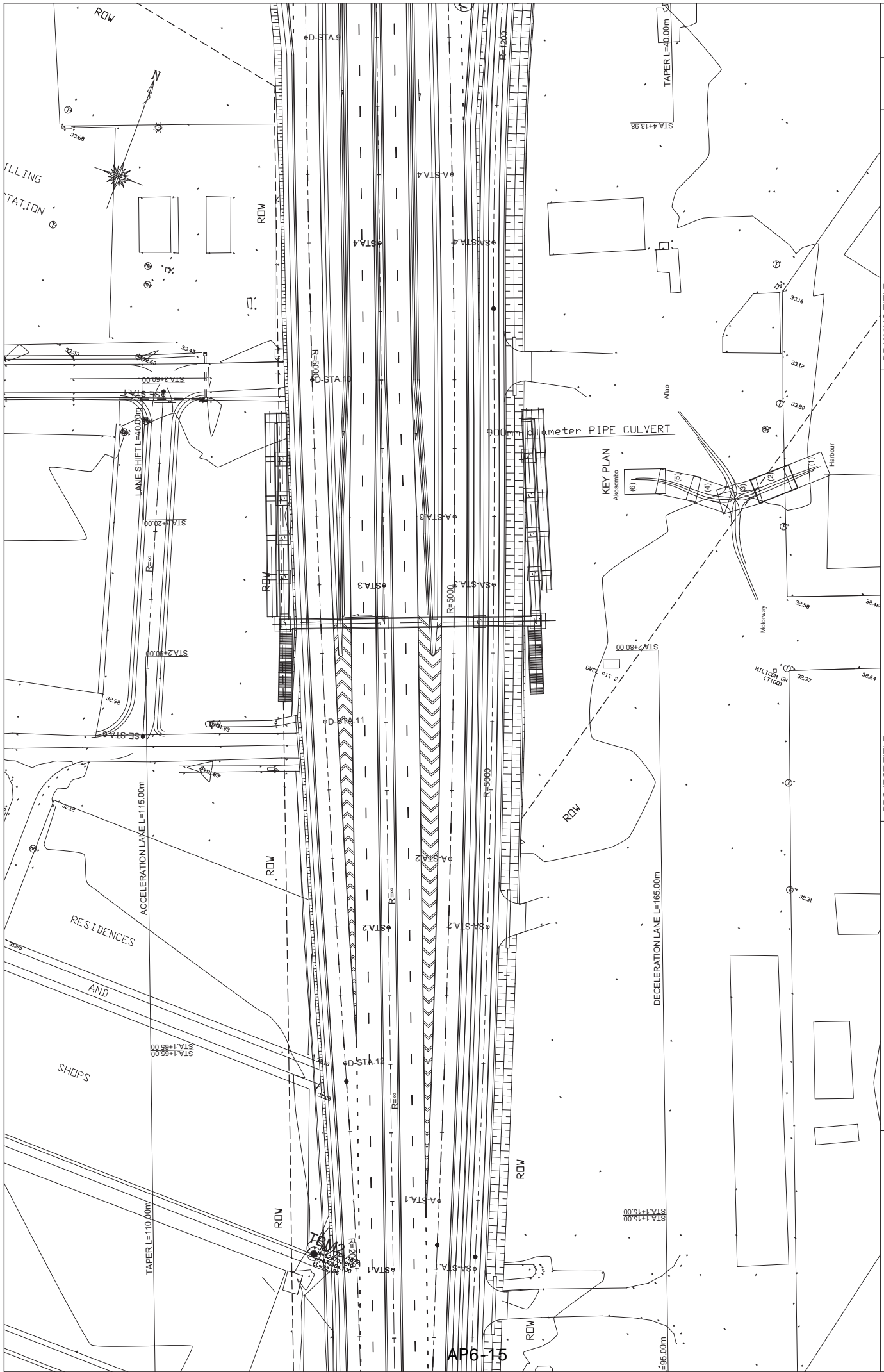
CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA



AP6-14

DRAWING NO.	SCALE (A 1:500)	PROJECT TITLE:	CITI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
PL-01	1:500	DRAWING TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	



SCALE (A base)

DRAWING TITLE:

PROJECT TITLE:

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

1:500

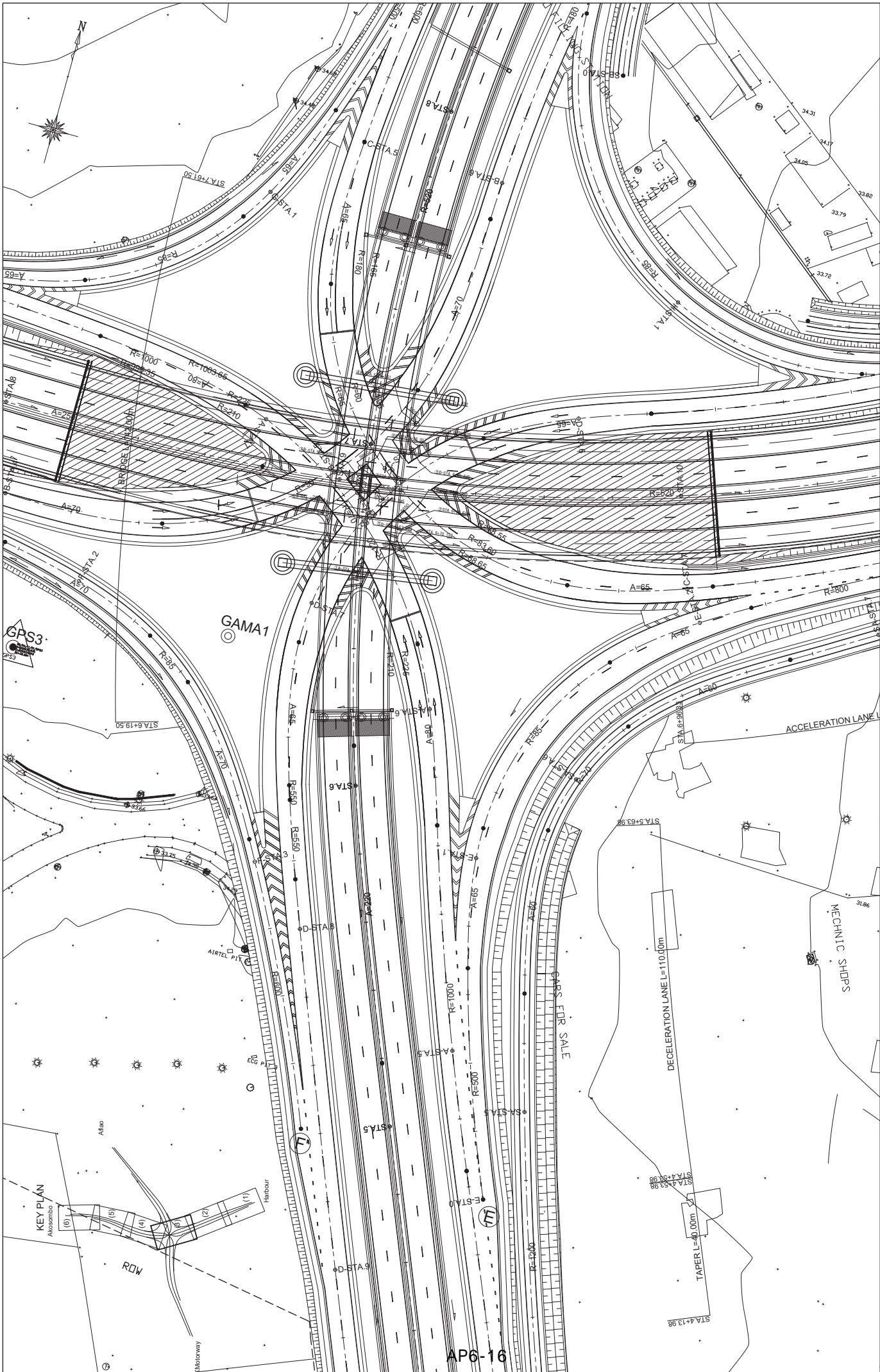
PLAN(2)

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

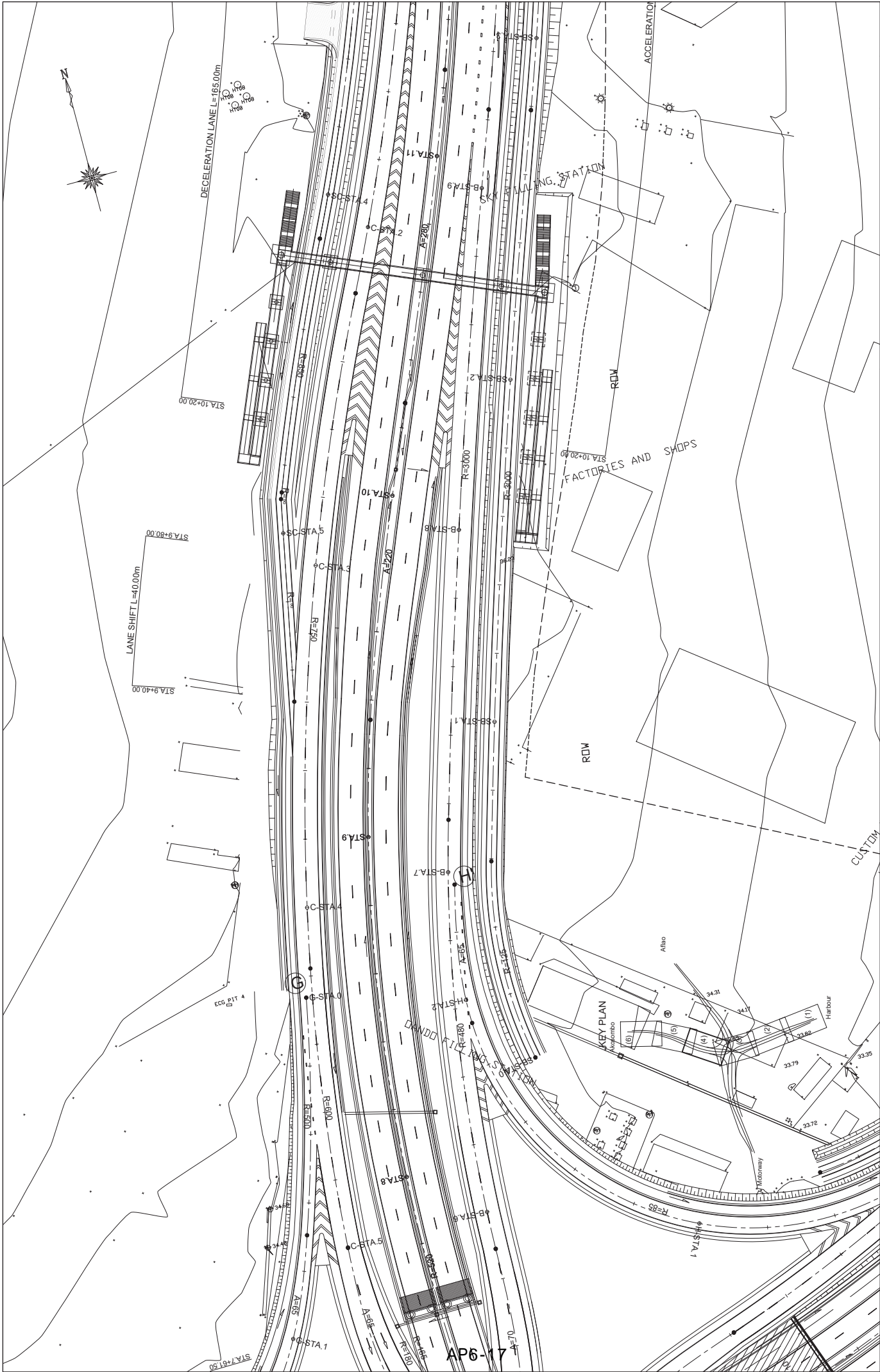
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

PL-02



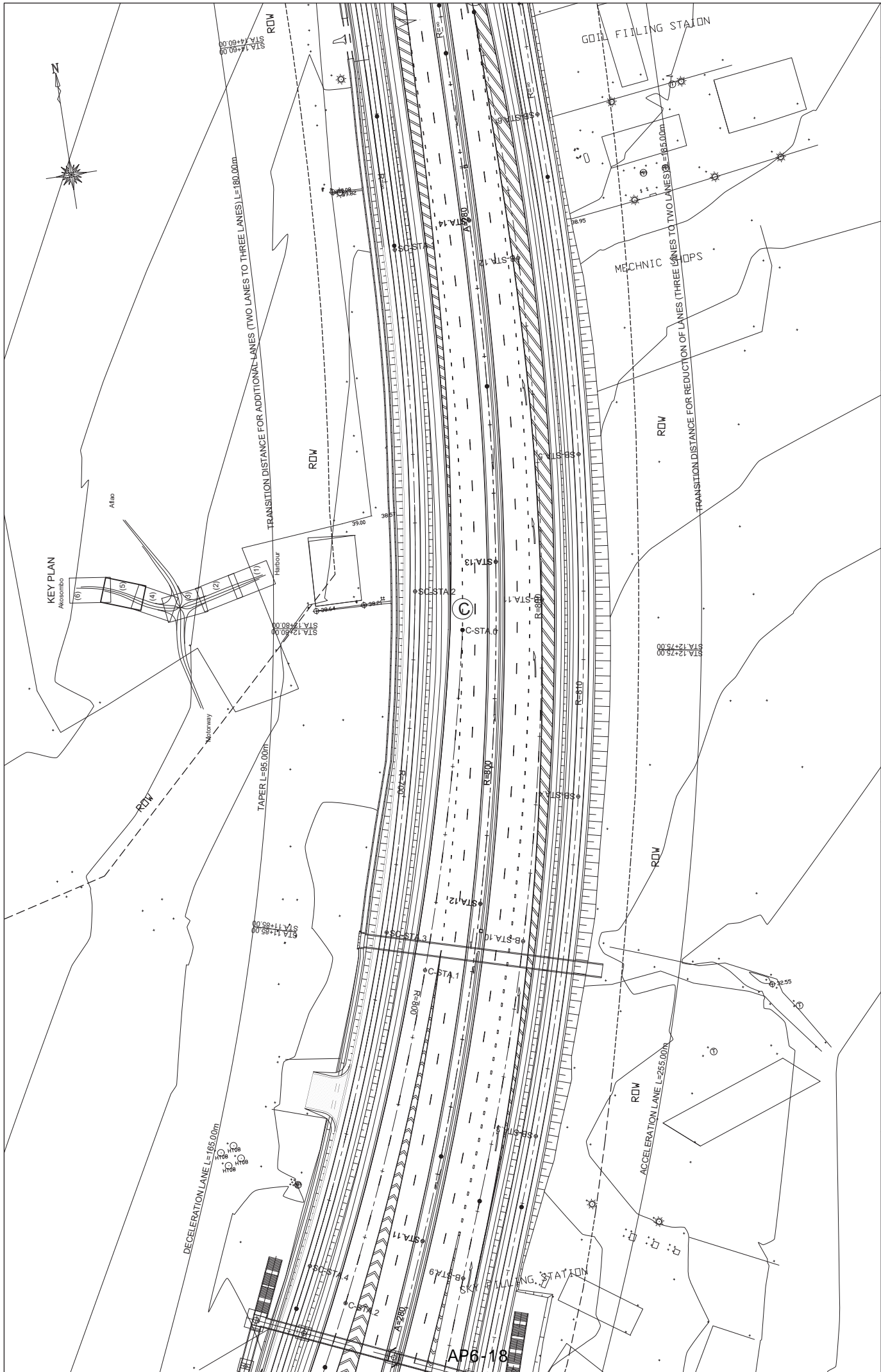
AP6-16

DRAWING NO.	PL-03
SCALE (A 1:500)	1:500
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	PLAN(3)
CLIENT:	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
DESIGNER:	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY

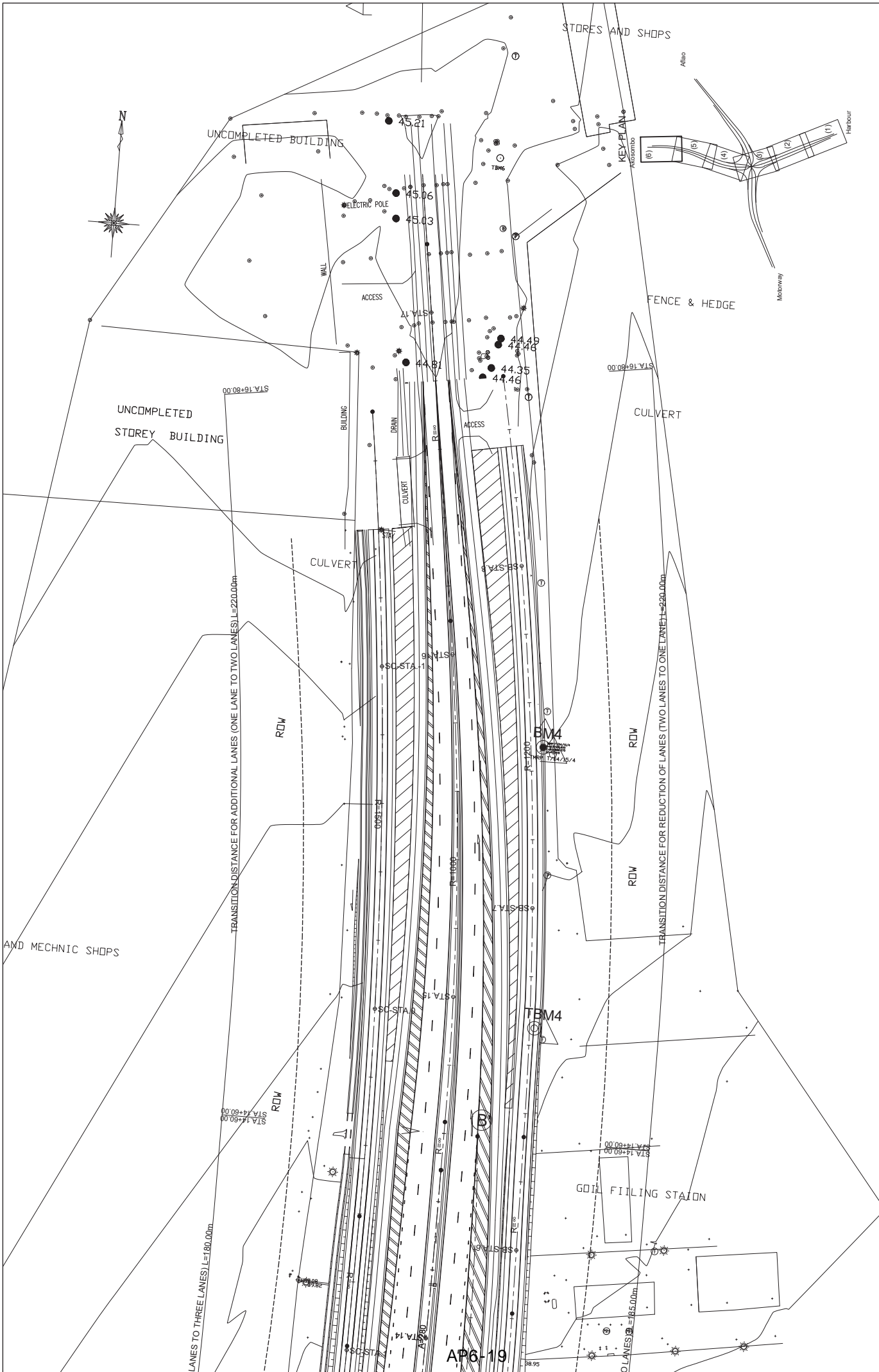


AP6-17

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: PLAN(4)	SCALE (A:BASE)	DRAWING NO.
			1:500	PL-04



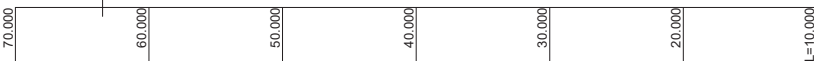
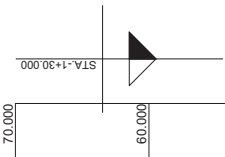
DRAWING NO.	PL-05
SCALE (A 1:500)	1:500
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	PLAN(5)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY



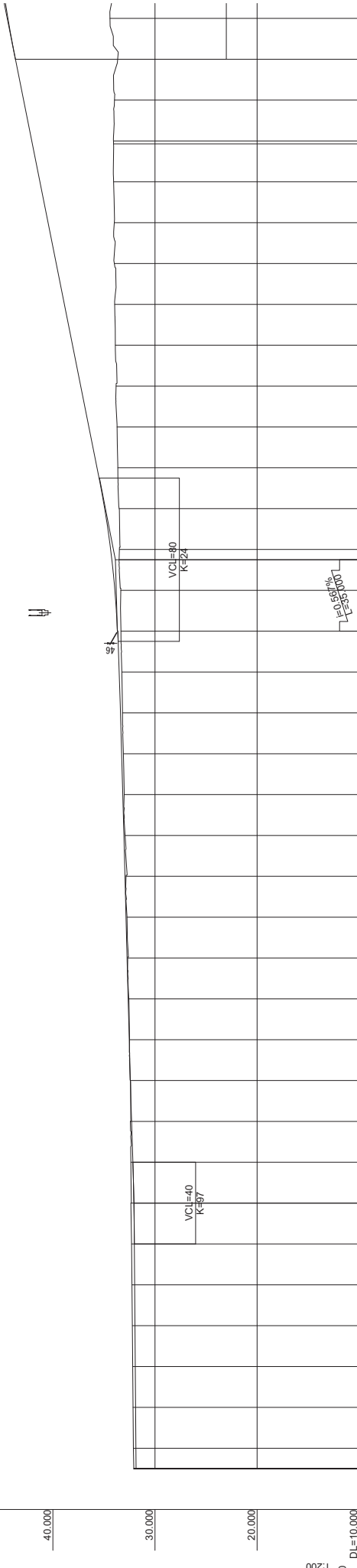
DRAWING NO.	PL-06
SCALE (A SIZE)	1:500
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	PLAN(6)
CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA

Harbour-Akosombo Road PROFILE 1

V=1:200
H=1:1000



AP6-20



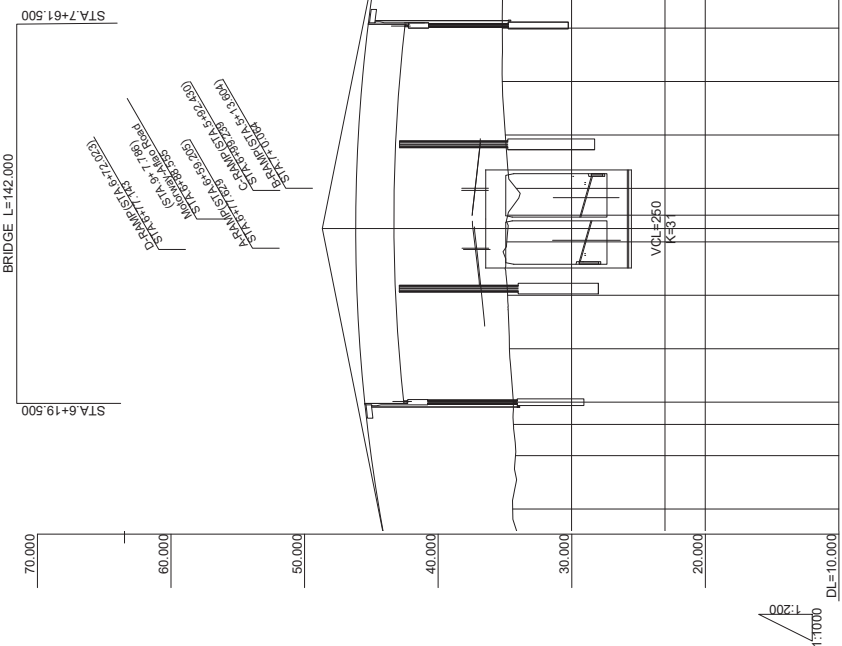
VERTICAL ALIGNMENT	FORMATION HEIGHT	GROUND HEIGHT	LENGTH	STATION	HORIZONTAL CURVATURE	SUPER ELEVATION	WIDENING
31.850	31.850	31.865		+20.000			
31.850	31.850	31.927		+80.000			
31.958	31.958	32.21		+60.000			
31.988	31.988	32.26		+40.000			
32.019	32.019	32.29		+20.000			
32.071	32.071	32.36		STA.0			
32.163	32.163	32.36		+20.000			
32.277	32.277	32.42		+40.000			
32.390	32.390	32.42		+60.000			
32.503	32.503	32.49		+80.000			
32.617	32.617	32.56		STA.1			
32.730	32.730	32.67		+20.000			
32.843	32.843	32.74		+40.000			
32.957	32.957	32.83		+60.000			
33.070	33.070	32.93		+80.000			
33.183	33.183	33.02		STA.2			
33.297	33.297	33.09		+20.000			
33.410	33.410	33.18		+40.000			
33.523	33.523	33.25		+60.000			
33.642	33.642	33.33		+80.000			
33.688	33.688	33.33		STA.3			
33.930	33.930	33.35		+20.000			
34.223	34.223	33.51		+15.000			
34.343	34.343	33.48		+20.000			
34.927	34.927	33.51		+40.000			
35.678	35.678	33.64		+60.000			
36.477	36.477	33.71		+80.000			
37.276	37.276	33.81		STA.4			
38.075	38.075	33.88		+20.000			
38.874	38.874	33.95		+40.000			
39.673	39.673	33.98		+60.000			
40.471	40.471	33.98		+80.000			
41.270	41.270	34.05		STA.5			
42.069	42.069	34.06		+20.000			
42.868	42.868	34.06		+40.000			
43.667	43.667	34.06		+60.000			
44.420	44.420	34.11		+80.000			

NOTE:FORMATION HEIGHT LOCATION REFERENCE POINT CHANGE FROM STA.2+80.00

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: Harbour-Akosombo Road PROFILE(1)	SCALE (A150): V=1:200 H=1:1000
			DRAWING NO: PR-01

Harbour-Akosombo Road PROFILE 2

V=1:200
H=1:1000



FORMATION HEIGHT	GROUND HEIGHT	LENGTH	STATION	HORIZONTAL CURVATURE	SUPER ELEVATION	WIDENING
48.660	34.86	5.000	20.000	7	0.000	
46.158	34.77	46.162	20.000		0.000	
46.063	34.79	20.000	20.000		0.000	
45.839	34.65	20.000	40.000		0.000	
45.304	34.37	8.333	+20.000	KE 1-1	11.667	
45.009	34.20	20.000	20.000	STA. 6		
44.402	34.41	20.000	40.000			
46.125	34.14	15.000	15.000	STA. 7		
45.965	34.97	20.000	20.000			
45.677	35.19	20.000	40.000			
45.260	35.19	20.000	60.000			
44.716	35.19	20.000	80.000	STA. 8		
44.044	35.27	20.000	100.000			
43.260	35.78	20.000	120.000			
42.460	36.02	20.000	140.000			
41.660	36.01	20.000	160.000			
40.860	36.17	20.000	180.000	STA. 9		
39.260	36.49	20.000	200.000	KE 1-2	14.222	
38.737	36.62	14.222	+40.000			
38.551	36.67	5.778	+40.000			
38.825	36.82	20.000	60.000			
37.830	36.87	10.000	70.000			
37.681	36.91	10.000	80.000			
37.520	37.04	20.000	100.000	STA. 10		
37.542	37.20	20.000	120.000	KA 2-1	7.299	
37.583	37.25	7.299	127.000			
37.325	37.32	37.325	140.000			
37.43	37.43	20.000	160.000			
37.58	37.58	20.000	180.000	STA. 11		
37.95	37.92	20.000	200.000	KE 2-1	5.299	
38.135	38.105	20.000	220.000			
38.218	38.03	14.701	+40.000			
38.331	38.13	20.000	60.000			
38.444	38.20	20.000	80.000	STA. 12		
38.556	38.36	20.000	100.000			
38.669	38.44	20.000	120.000			
38.782	38.53	20.000	140.000			
38.895	38.66	20.000	160.000			
39.007	38.75	20.000	180.000			

NOTE:FORMATION HEIGHT LOCATION REFERENCE POINT CHANGE FROM STA.2+80.00

DRAWING TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)

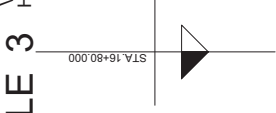
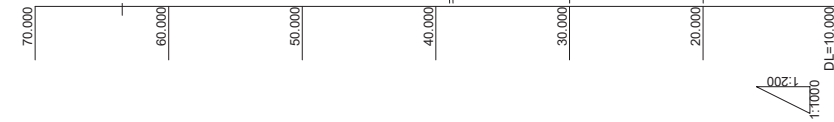
PROJECT TITLE:
CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

DRAWING NO:
SCALE (A150x)
V=1:200
H=1:1000
PR-02

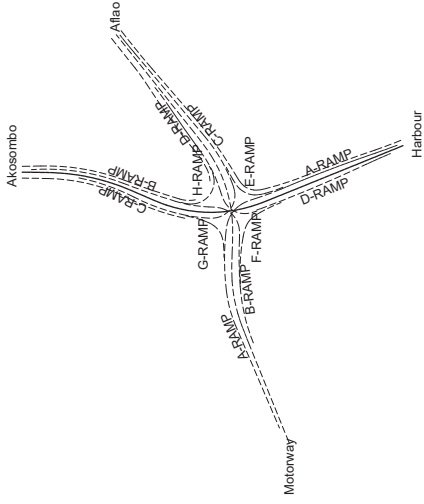
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

Harbour-Akosombo Road PROFILE 3

V=1:200
H=1:1000



KEY PLAN



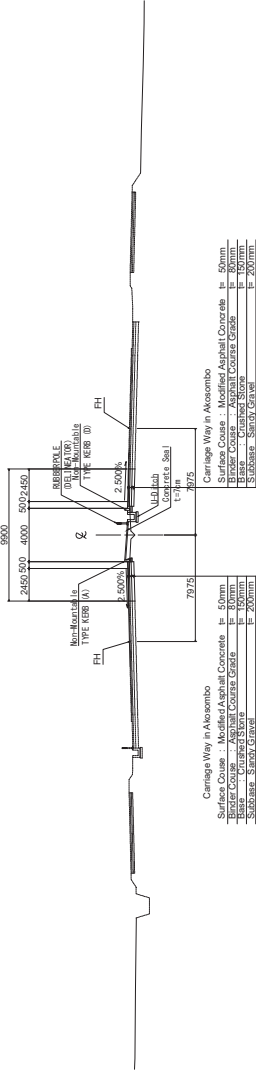
VERTICAL ALIGNMENT	FORMATION HEIGHT	GROUND HEIGHT	LENGTH	STATION
39.740	39.007	38.75	20.000	+80.000
	39.18	39.345	20.000	+40.000
	39.28	39.409	11.273	KE 2-2
	39.36	39.458	8.727	KA 2-2
	39.44	40.367	9.273	KA 2-2
	40.60	40.538	10.727	BC 3-0
	40.97	40.857	5.047	BC 3-0
	41.44	41.203	14.953	STA.15
	41.83	41.603	20.000	+20.000
	42.22	42.030	20.000	+40.000
	42.63	42.457	20.000	+60.000
	43.06	42.884	20.000	+80.000
	43.47	43.312	20.000	STA.16
	43.88	43.739	9.805	EC 5
	44.26	44.166	10.195	EC 5
	44.67	44.593	43.739	+20.000
	45.06	45.020	44.593	+60.000
	45.020	45.020	20.000	+80.000

NOTE:FORMATION HEIGHT LOCATION REFERENCE POINT CHANGE FROM STA.2+80.00

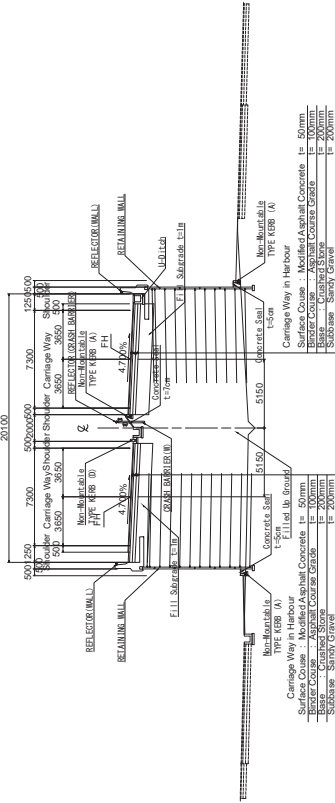
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	DRAWING TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	SCALE (A150x)	DRAWING NO.
			V=1:200 H=1:1000	PR-03

Harbour-Akosombo

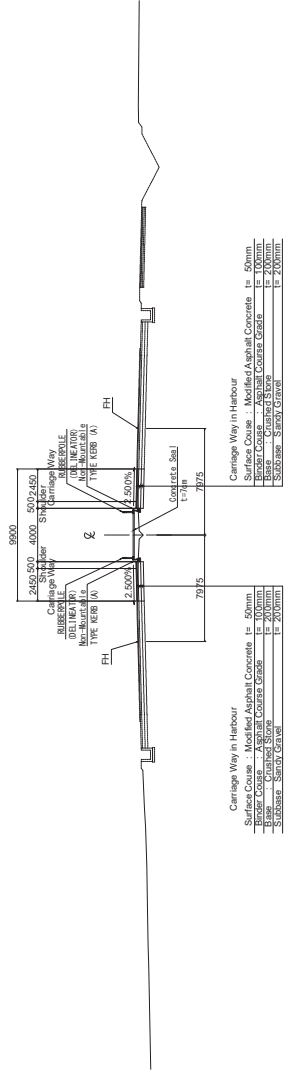
Akosombo Cross Section
STA.10+27.299 STA.16+80



Wall Cross Section
STA.2+80 STA.10+27.299



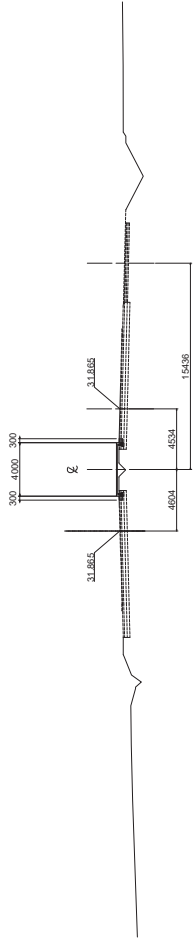
Harbour Cross Section
STA.1+30 STA.2+80



GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: TYPICAL CROSS SECTION SCALE (A1size) 1:200 DRAWING NO. TP-01
--	---	--

SA-STA-1+20.525
FH=31.526

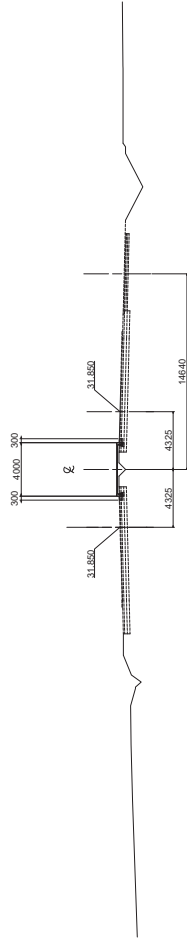
STA-1+20
GH=32.12
FH=31.265



DL=25.0

SA-STA-1+30.186
FH=31.539

STA-1+30
GH=32.12
FH=31.265



DL=25.0

DRAWING NO.

CR-01

SCALE (A1:1824)

1:200

DRAWING TITLE:

HARBOUR-AKOSOMBO ROAD
CROSS SECTION(1)

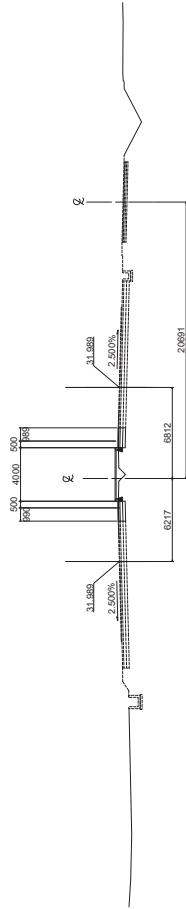
PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

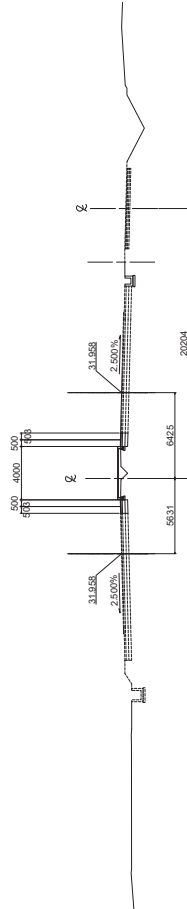
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

STA-0+40
 GH=32.26
 FH=31.989
 SA-STA-0+40.130
 FH=31.710



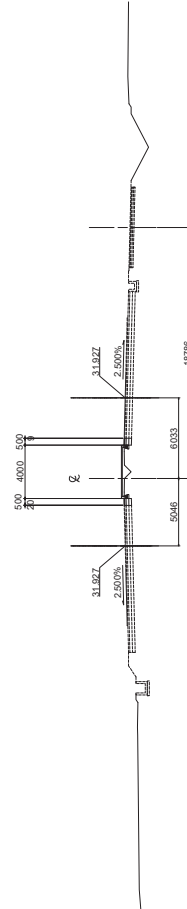
DL=25.0

STA-0+60
 GH=31.558
 FH=31.558
 SA-STA-0+60.019
 FH=31.640



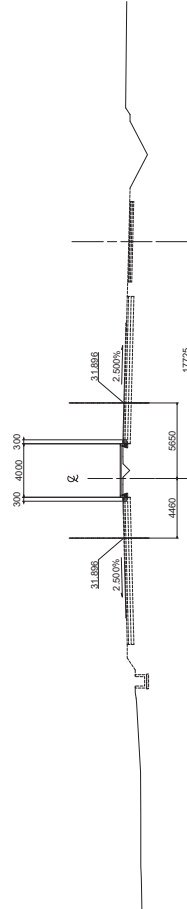
DL=25.0

STA-0+80
 GH=32.18
 FH=31.927
 SA-STA-0+80.047
 FH=31.570



DL=25.0

STA-1+00
 GH=31.896
 FH=31.896
 SA-STA-1+0.108
 FH=31.524



DL=25.0

DRAWING TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
 (PHASE 2)

HARBOUR-AKOSOMBO ROAD
 CROSS SECTION(2)

SCALE (A1:1924)

DRAWING NO.

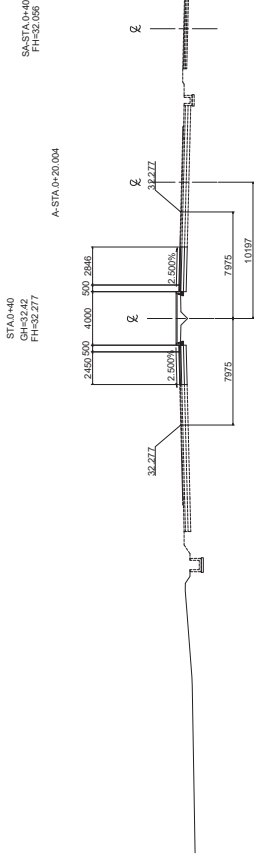
1:200

CR-02

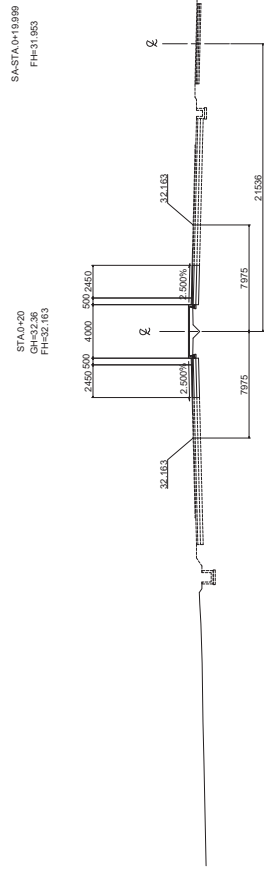
PROJECT TITLE:

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

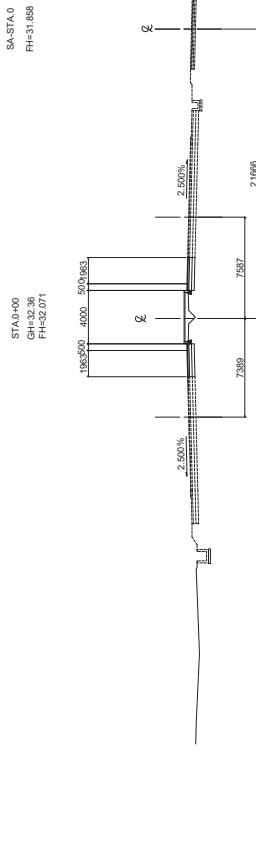
GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA



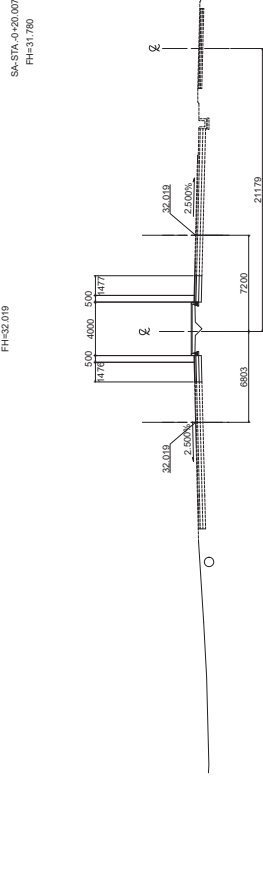
DL=25.0



DL=25.0



DL=25.0



DL=25.0

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

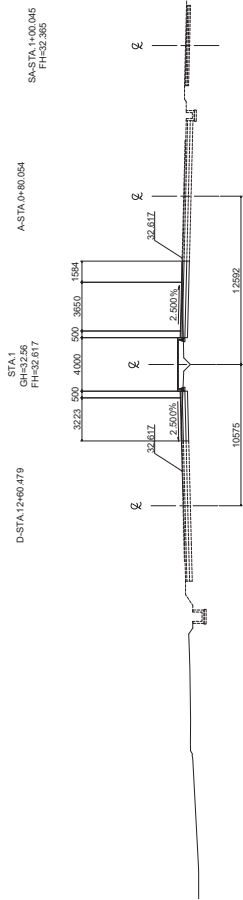
PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
HARBOUR-AKOSOMBO ROAD
CROSS SECTION(3)

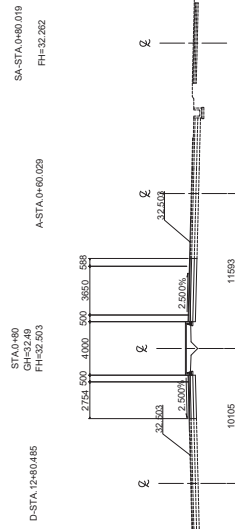
SCALE (A1/192)

DRAWING NO.
CR-03

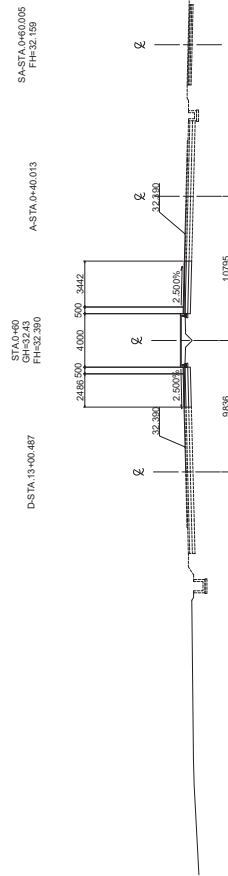
1:200



DL=25.0

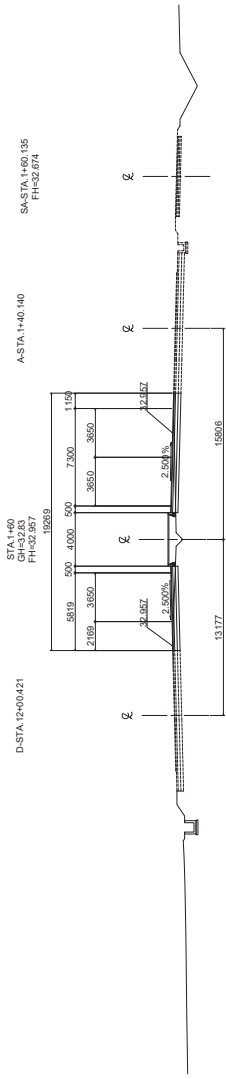


DL=25.0

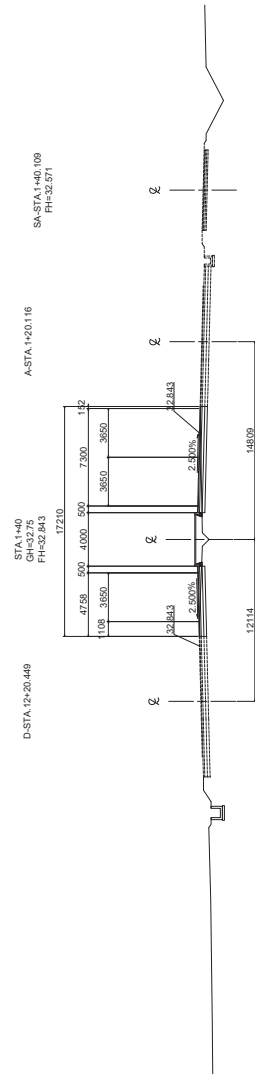


DL=25.0

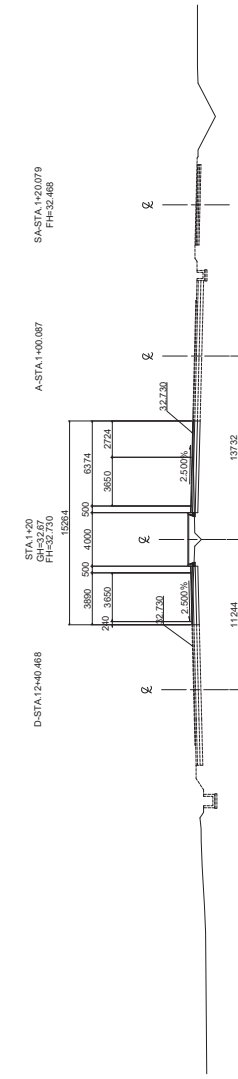
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(4)	SCALE (A1/200) 1:200	DRAWING NO. CR-04
--	---	--	---	-------------------------	----------------------



DL=25.0

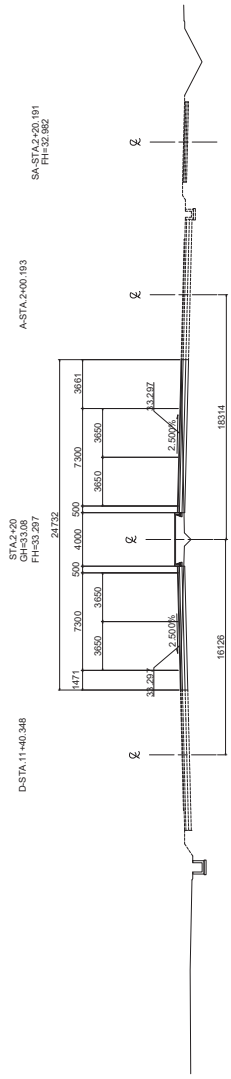


DL=25.0

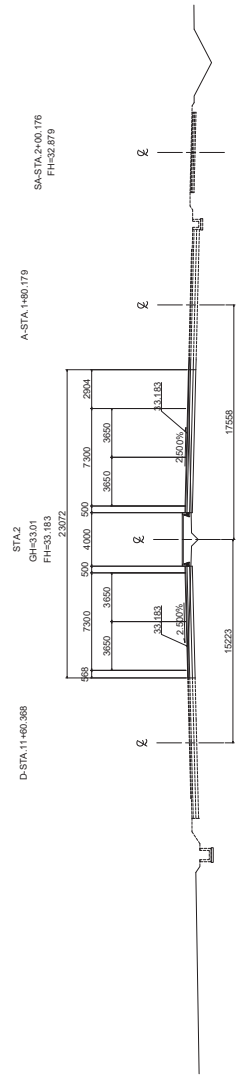


DL=25.0

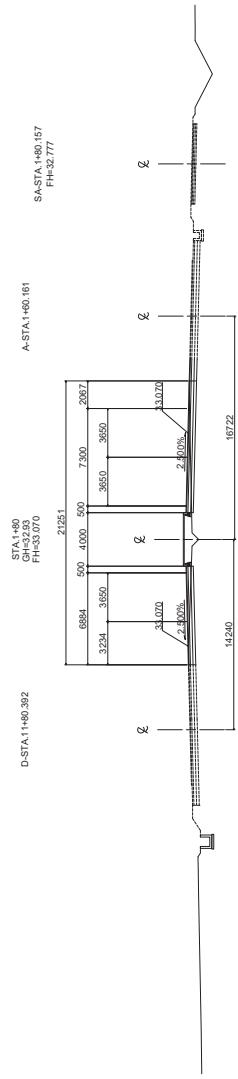
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(S)	SCALE (A1/200) 1:200	DRAWING NO. CR-05
--	---	--	---	-------------------------	----------------------



D.L.=25.0

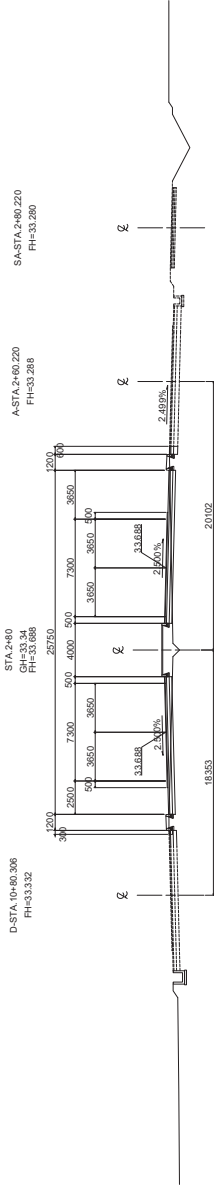


D.L.=25.0

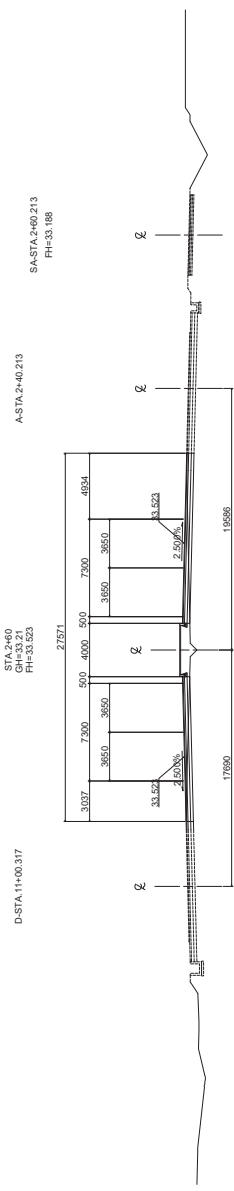


D.L.=25.0

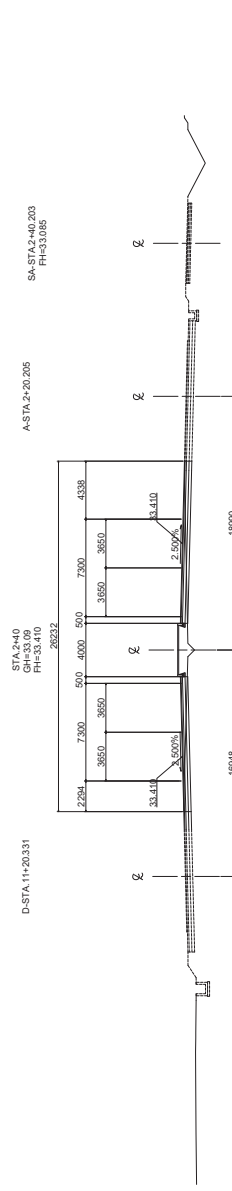
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(6)	SCALE (A1/1626) 1:200	DRAWING NO. CR-06
--	---	---	--------------------------	----------------------



DL=25.0

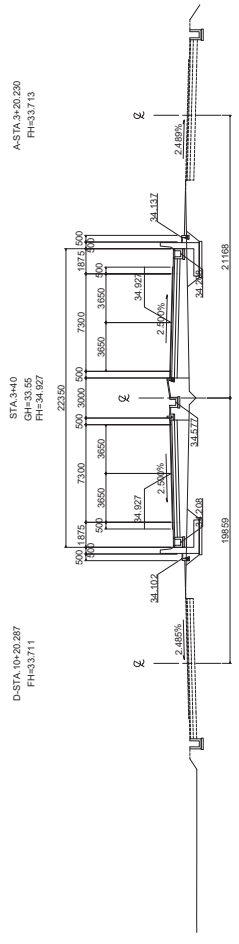


DL=25.0

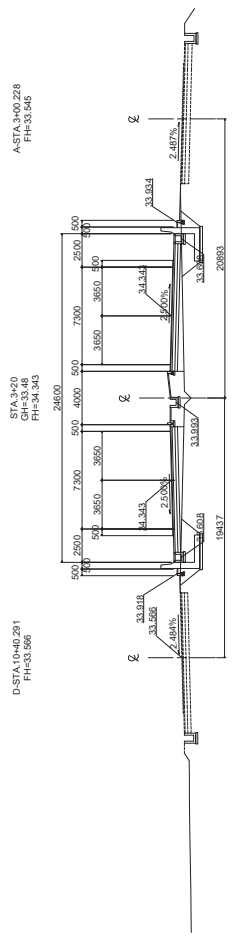


DL=25.0

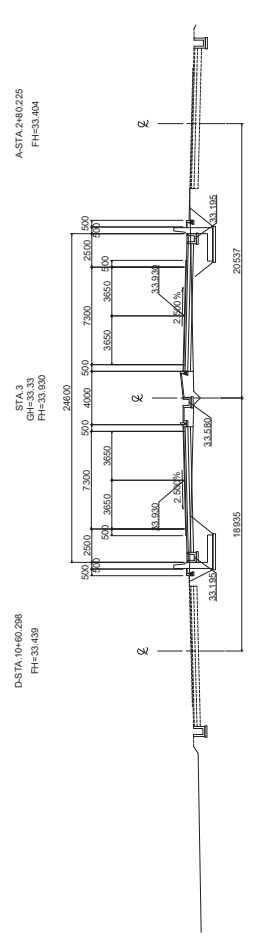
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(7)	SCALE (A1/1624) 1:200	DRAWING NO. CR-07
--	---	---	--------------------------	----------------------



DL=30.0

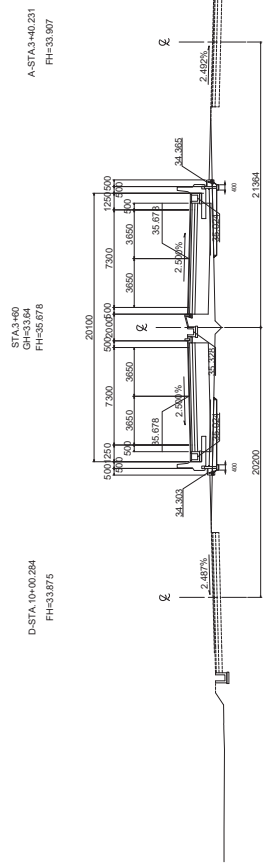
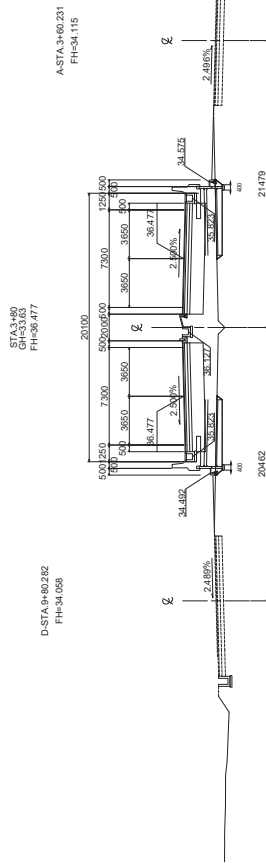
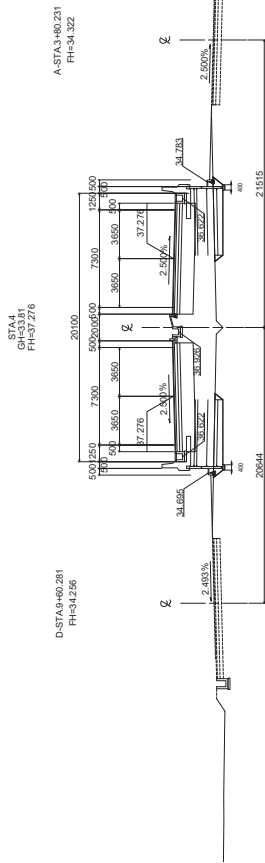


DL=25.0

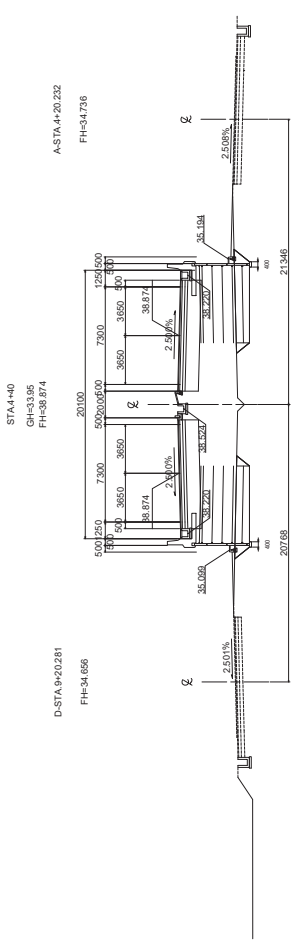


DL=25.0

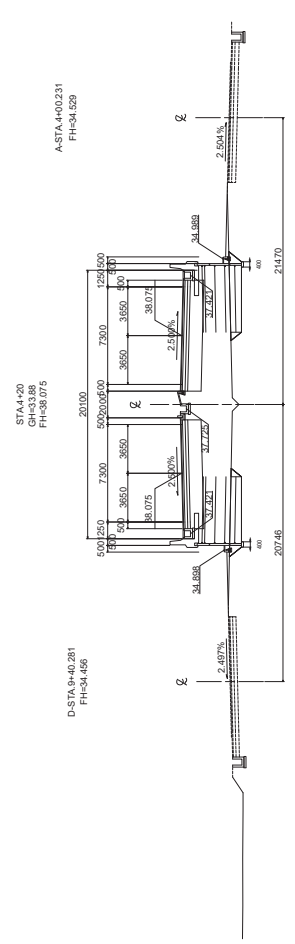
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(8)	SCALE (A1/192)	DRAWING NO.
			1:200	CR-08



GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(9)	SCALE (A1/100)	DRAWING NO. CR-09
--	---	--	---	----------------	----------------------

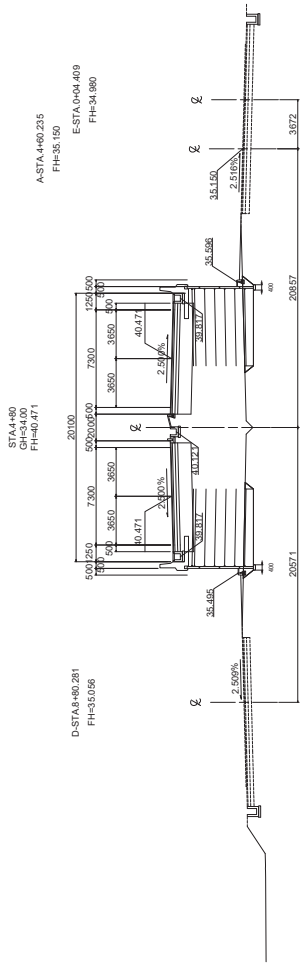


DL=+50.0

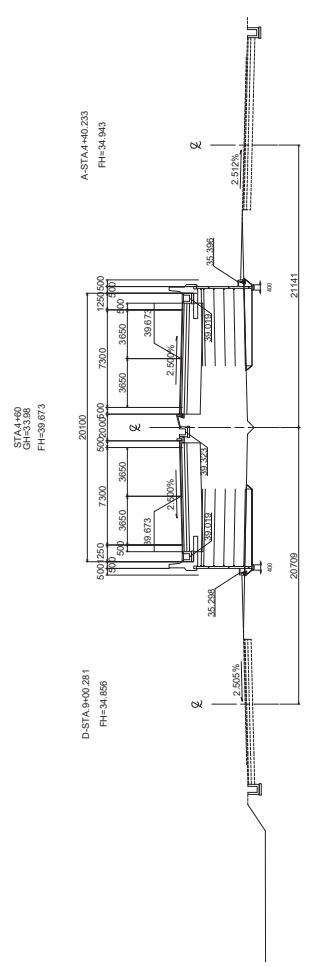


DL=+50.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(10)	SCALE (A1/1924) 1:200 DRAWING NO. CR-10
--	--	--	--



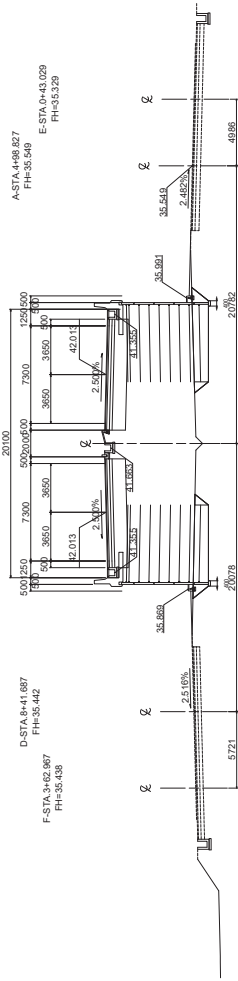
D.L.=30.0



D.L.=30.0

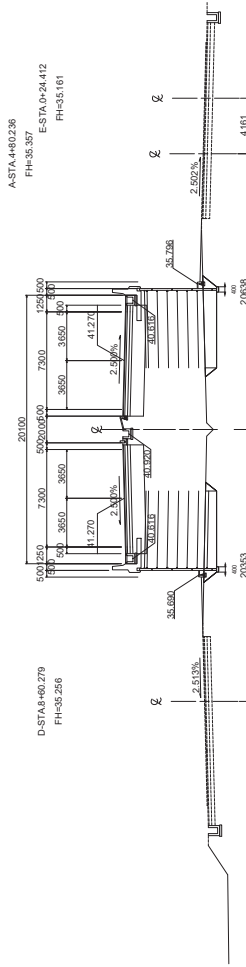
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HAFBOUR-AKOSOMBO ROAD CROSS SECTION(11)	SCALE (A1/100)	DRAWING NO.
				1:200	CR-11

KA 1-(STA 5+18.500)
GH-34.05
FH-42.013



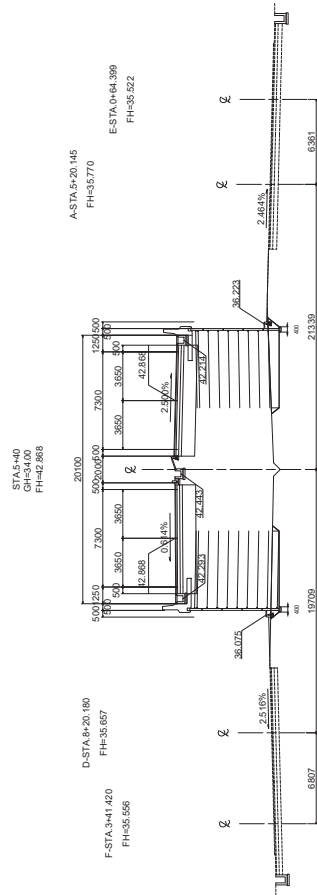
D.L.=30.0

STA 5
GH-34.05
FH-41.270

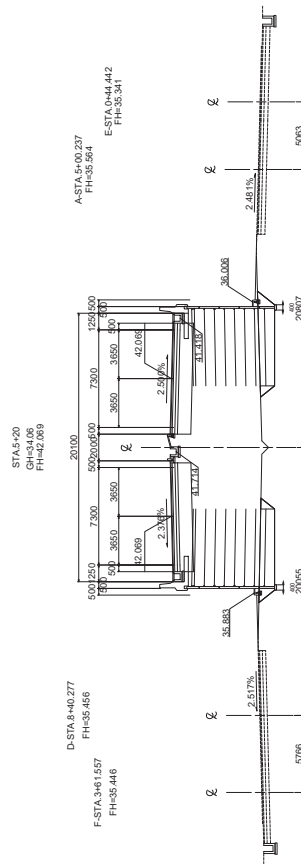


D.L.=30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(12)	SCALE (A1/100) 1:200	DRAWING NO. CR-12
--	---	--	--	-------------------------	----------------------



DL=+30.0



DL=+30.0

DRAWING TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

PROJECT TITLE:

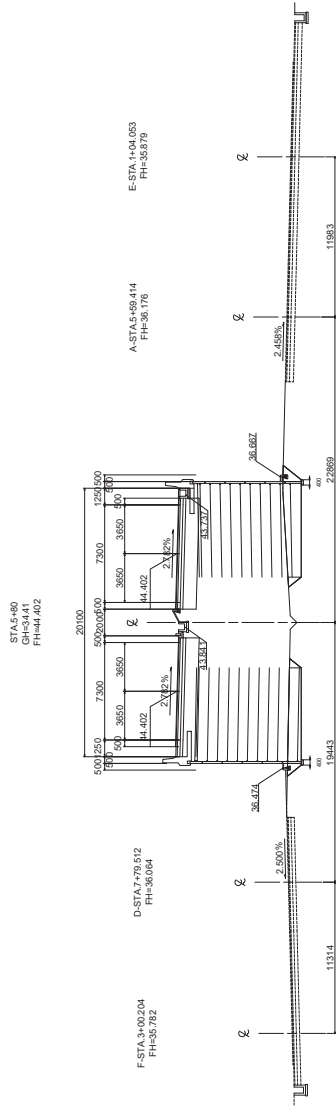
HARBOUR-AKOSOMBO ROAD
CROSS SECTION(13)

SCALE (A1/1924)

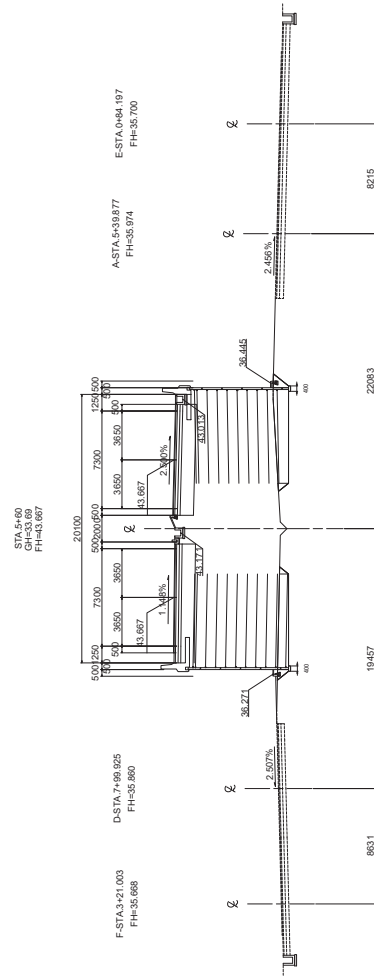
1:200

DRAWING NO.

CR-13



DL=30.0



DL=30.0

DRAWING TITLE:

HARBOUR-AKOSOMBO ROAD
CROSS SECTION(14)

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

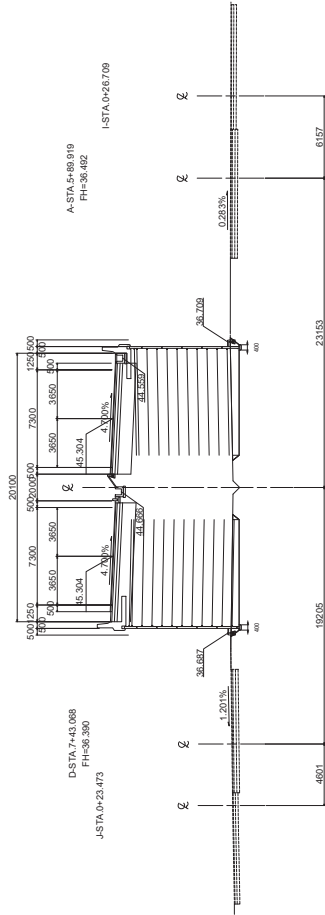
SCALE (A1/192)

1:200

DRAWING NO.

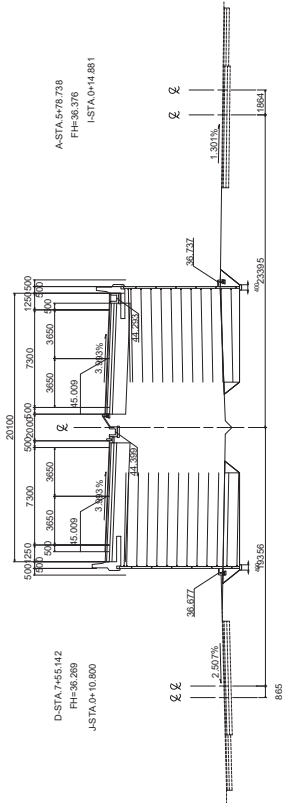
CR-14

KE 1-(STA.6+11.687)
 GH=43.36
 FH=38.34



DL=30.0

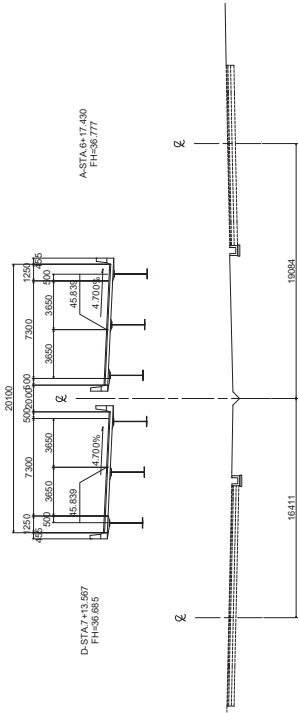
STA.6
 GH=54.17
 FH=49.69



DL=30.0

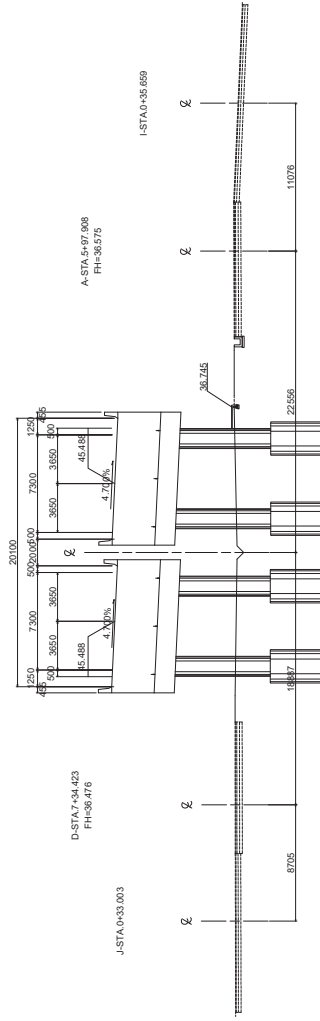
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(15) SCALE (A1/150) 1:200 DRAWING NO. CR-15
--	---	---

STA 6+40
GH=34.65
FH=40.839



DL=30.0

STA 6+20
GH=34.37
FH=40.488



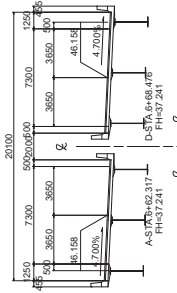
DL=30.0

<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)</p>	<p>DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(16)</p>	<p>SCALE (A1/1624) 1:200</p>	<p>DRAWING NO. CR-16</p>
---	---	---	---	----------------------------------	------------------------------

STA 6+00
GH=33.86
FH=46.158

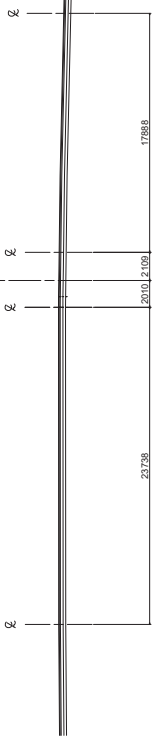
B-STA 4+50.472
FH=37.225

C-STA 6+20.041
FH=37.000



A-STA 6+62.317
FH=37.241

D-STA 6+68.416
FH=37.241

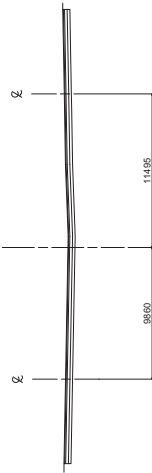
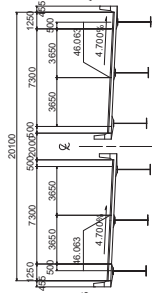


DL=30.0

STA 6+00
GH=34.79
FH=47.363

D-STA 6+91.985
FH=38.901

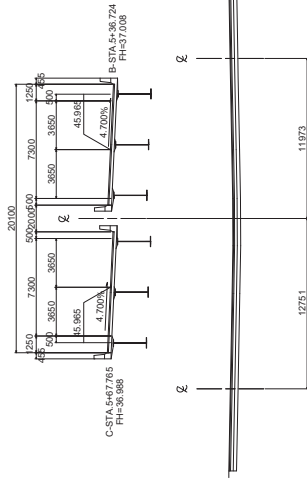
A-STA 6+98.208
FH=38.993



DL=30.0

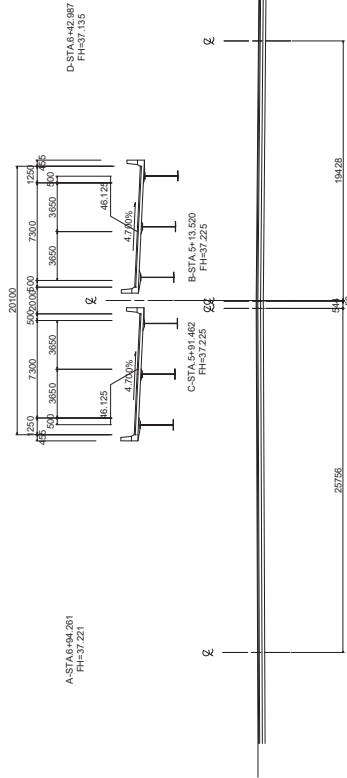
<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)</p>	<p>DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(17)</p>	<p>SCALE (A1/1626) 1:200</p>	<p>DRAWING NO. CR-17</p>
---	---	---	---	----------------------------------	------------------------------

STA 7+00
 CH=3.00
 FH=40.965



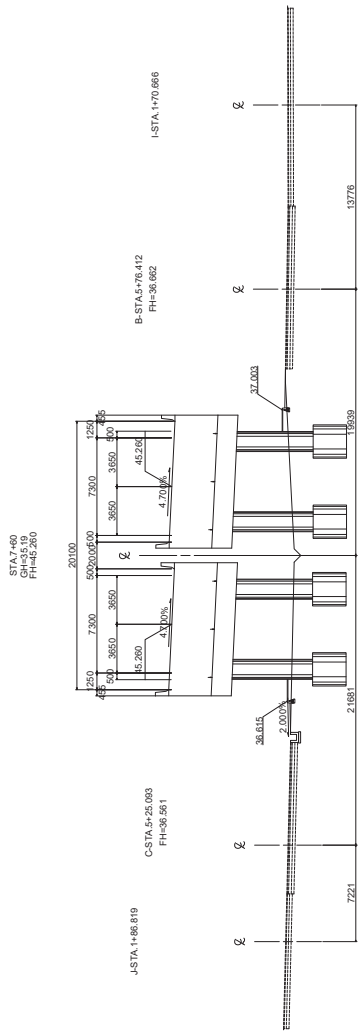
DL = -30.0

STA 7
 CH=3.00
 FH=40.125

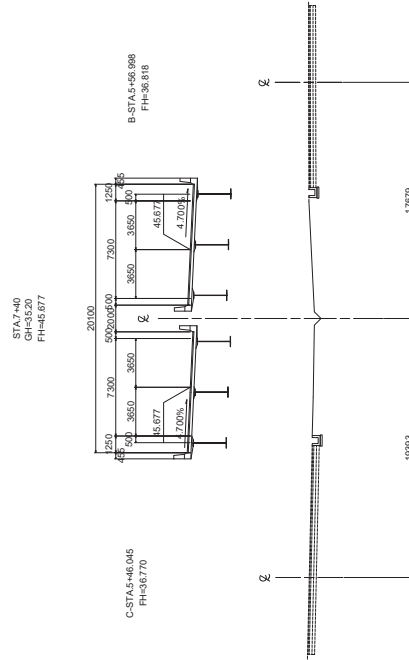


DL = -30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HAFBOUR-AKOSOMBO ROAD CROSS SECTION(18)	SCALE (A1/182) 1:200	DRAWING NO. CR-18
--	---	--	--	-------------------------	----------------------

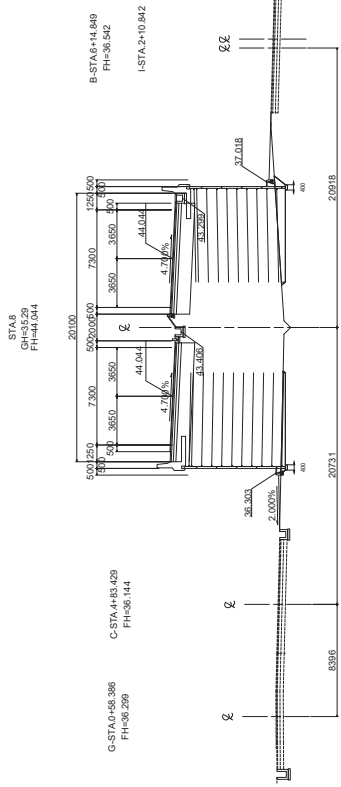


DL+30.0

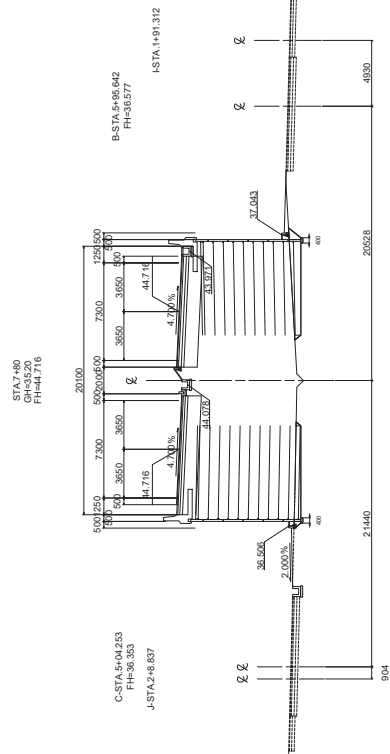


DL+30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HAFBOUR-AKOSOMBO ROAD CROSS SECTION(19)	SCALE (A1/1924) 1:200	DRAWING NO. CR-19
--	---	--	--	--------------------------	----------------------

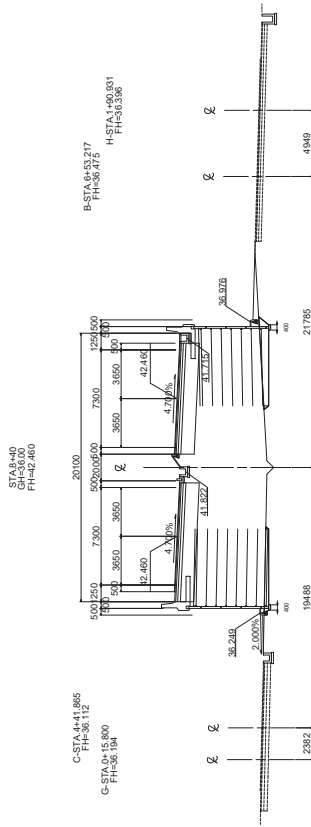


DL = +80.0

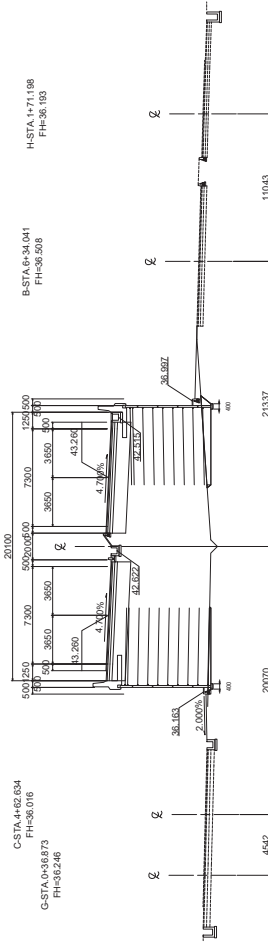


DL = +80.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(20)	SCALE (A1/100) 1:200	DRAWING NO. CR-20
--	---	--	--	-------------------------	----------------------

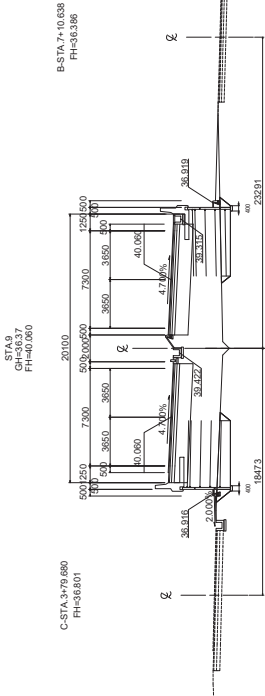


DL = -30.0

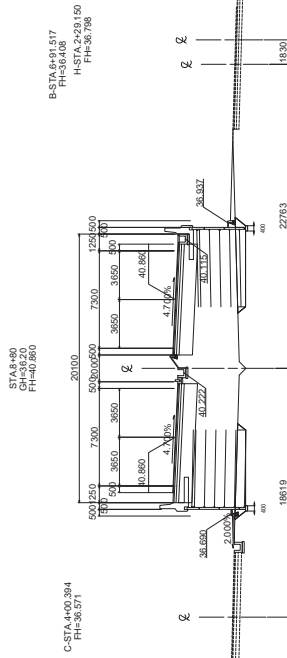


DL = -30.0

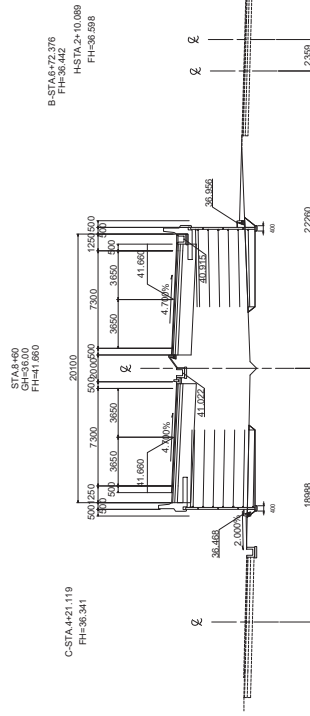
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(21)	SCALE (A1/192) 1:200	DRAWING NO. CR-21
--	---	--	--	-------------------------	----------------------



DL=30.0

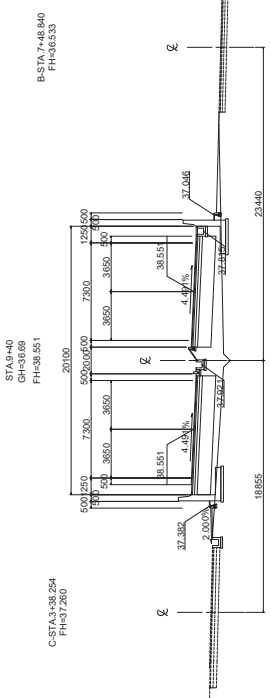


DL=30.0

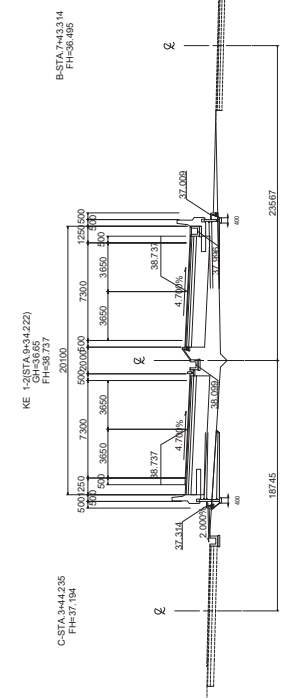


DL=30.0

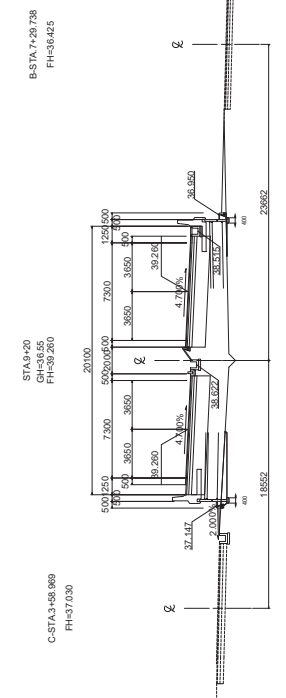
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(22)	SCALE (A1/1624) 1:200	DRAWING NO. CR-22
--	---	--	--	--------------------------	----------------------



DL=30.0

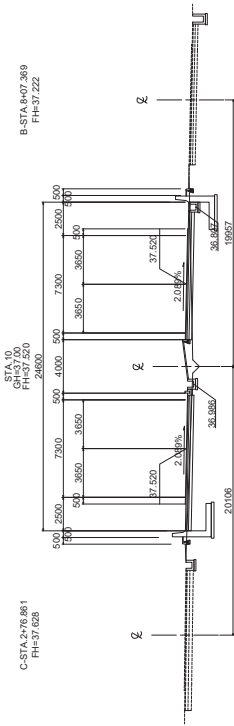


DL=30.0

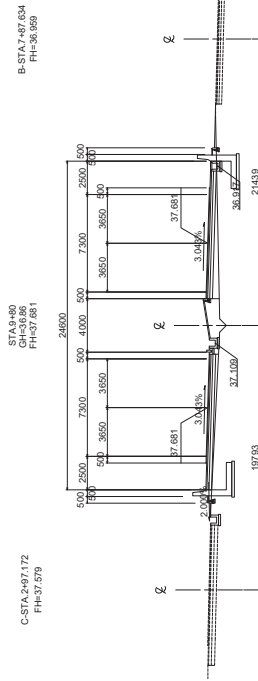


DL=30.0

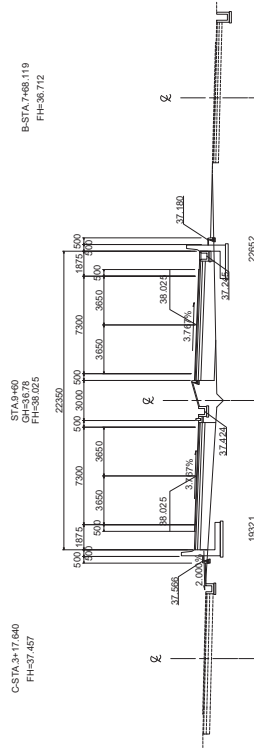
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(23)	SCALE (A1/1624) 1:200	DRAWING NO. CR-23
--	---	--	--	--------------------------	----------------------



DL=30.0



DL=30.0



DL=30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	DRAWING TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	SCALE (A1/1624) 1:200	DRAWING NO. CR-24
--	---	--	--------------------------	----------------------

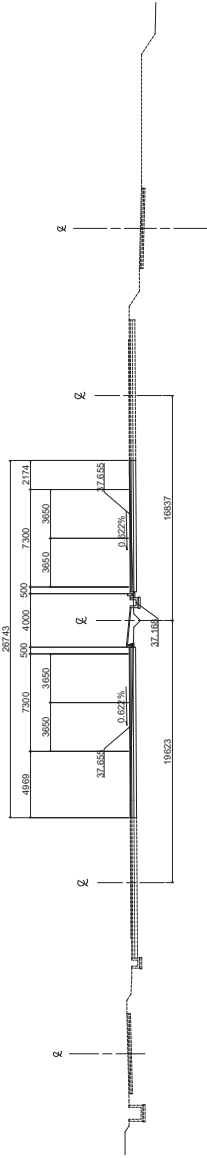
SB-STA.2+01.702
FH=38.650

B-STA.9+47.361

STA.10+40
GH=37.24
FH=37.655

C-STA.2+36.720

SC-STA.4+44.512
FH=37.798



DL=30.0

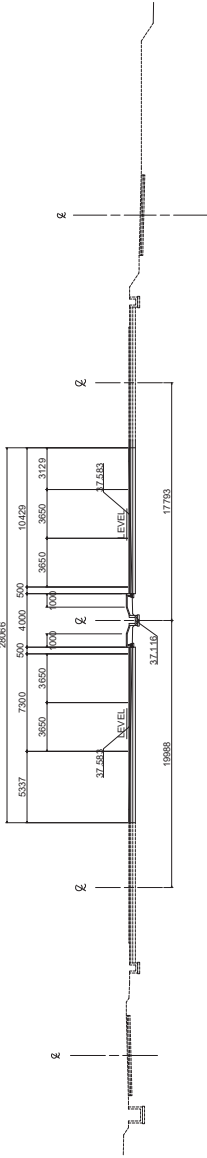
SB-STA.1+86.833
FH=35.744

B-STA.8+34.606

KA 2-1(STA.10+27.290)
GH=37.12
FH=37.563

C-STA.2+49.406

SC-STA.4+57.180
FH=37.705



DL=30.0

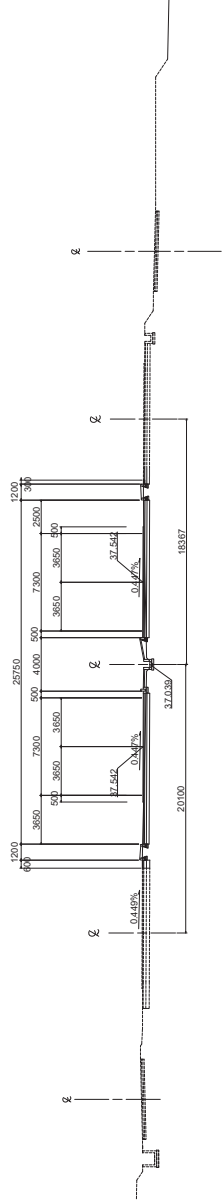
SB-STA.1+81.628
FH=36.684

B-STA.8+27.295
FH=37.487

STA.10+20
GH=37.05
FH=37.542

C-STA.2+56.717
FH=37.604

SC-STA.4+44.487
FH=37.656



DL=30.0

DRAWING TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

PROJECT TITLE:

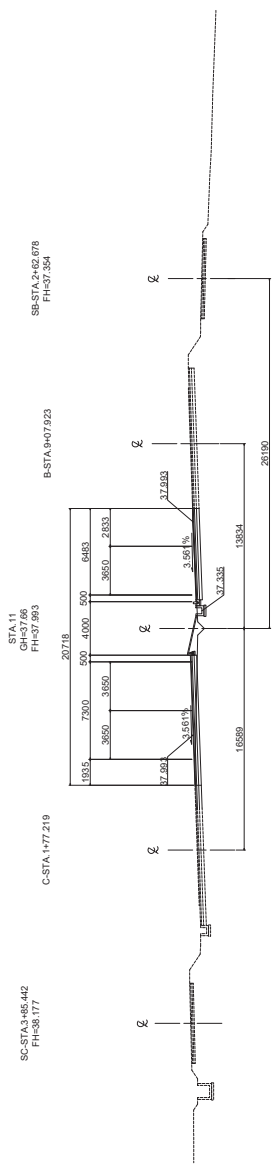
CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

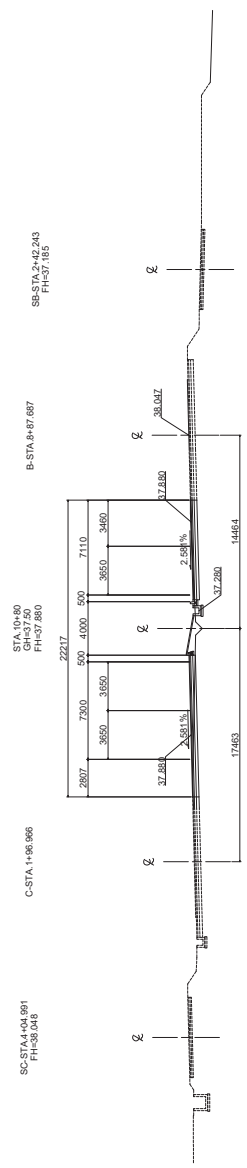
SCALE (A1:1924)

1:200

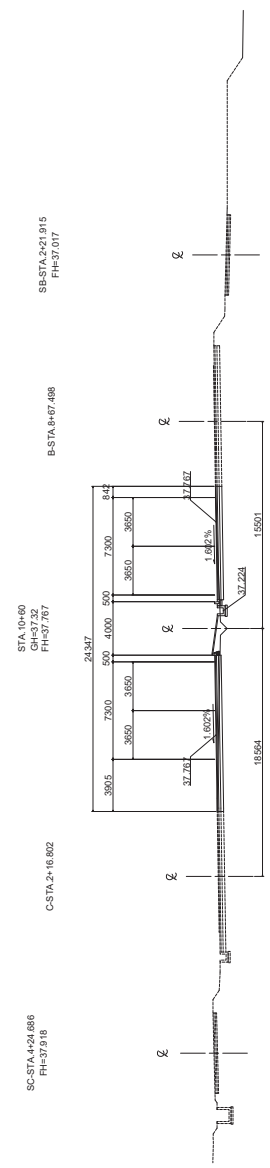
DRAWING NO.
CR-25



DL=30.0

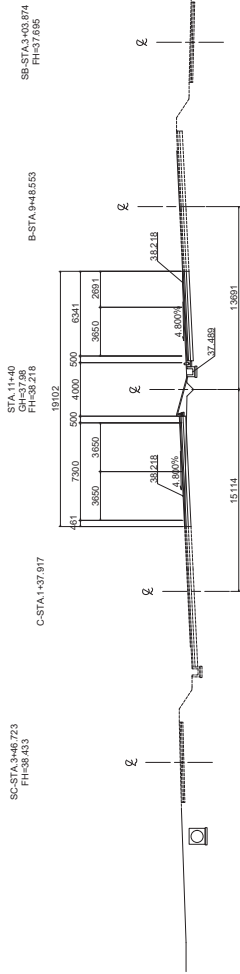


DL=30.0

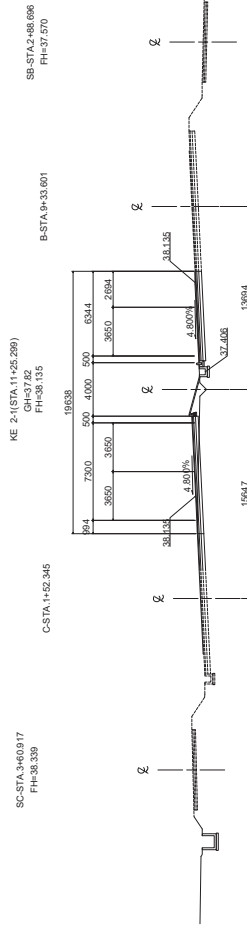


DL=30.0

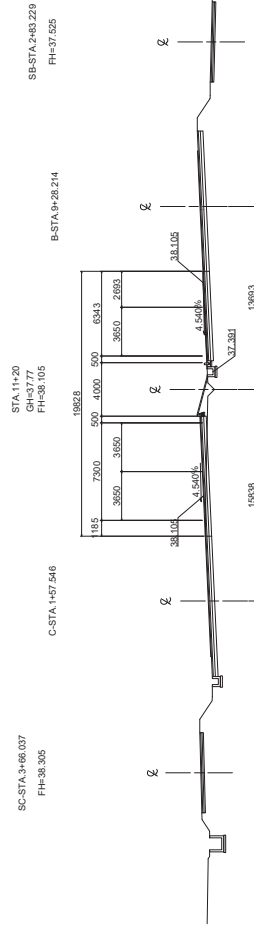
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(26)	SCALE (A1/1626) 1:200	DRAWING NO. CR-26
--	---	--	--	--------------------------	----------------------



DL=30.0



DL=30.0



DL=30.0

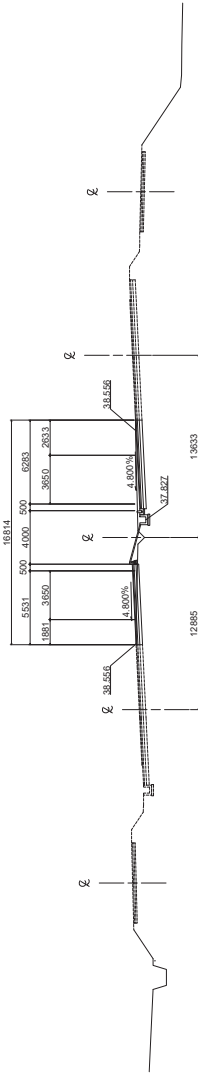
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(27)	SCALE (A1/1624) 1:200	DRAWING NO. CR-27
--	---	--	--------------------------	----------------------

SC-STA.2+487.701
FH=38.815

SB-STA.3+655.20
FH=38.208

C-STA.0+78.925

B-STA.10+09.579



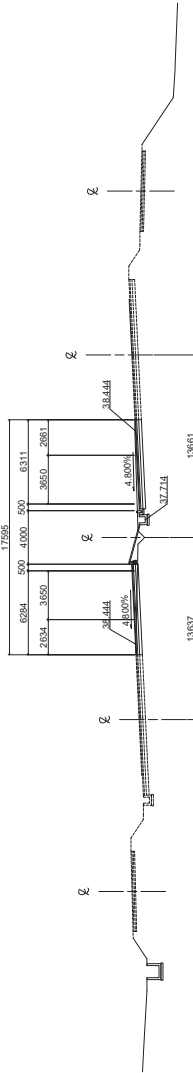
DL=50.0

SC-STA.3+08.057
FH=38.703

SB-STA.3+45.173
FH=38.037

C-STA.0+98.608

B-STA.9+89.237



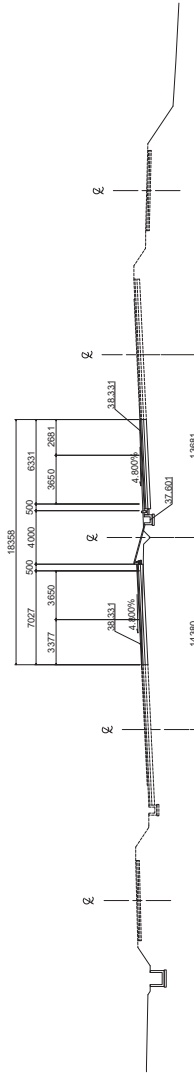
DL=50.0

SC-STA.3+27.398
FH=38.613

SB-STA.3+21.524
FH=37.866

C-STA.1+18.272

B-STA.9+68.896



DL=50.0

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
HARBOUR-AKOSOMBO ROAD
CROSS SECTION(28)

SCALE (A1/1626)

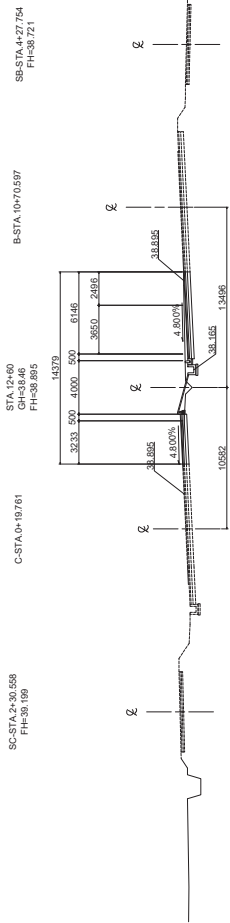
1:200

DRAWING NO.

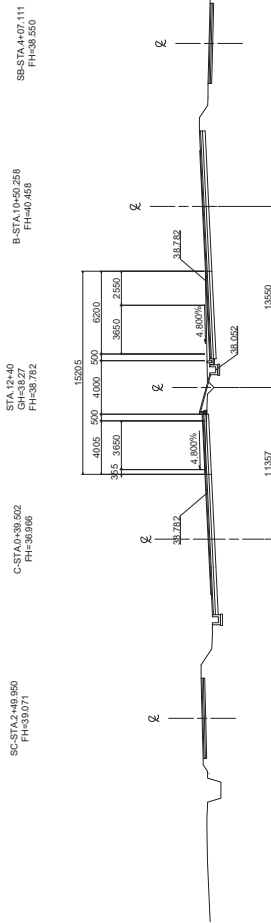
CR-28

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

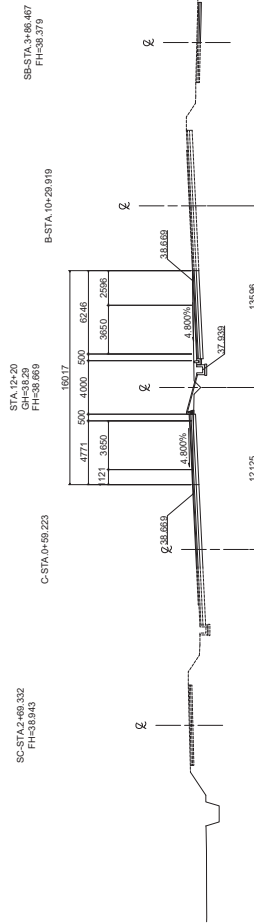
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA



DL=30.0

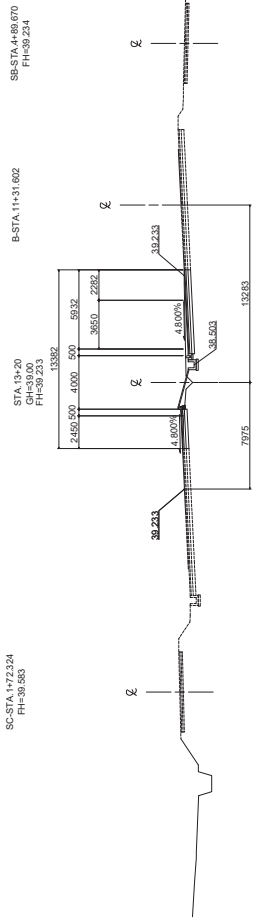


DL=30.0



DL=30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: HAFBOUR-AKOSOMBO ROAD CROSS SECTION(29)	SCALE (A1/1624) 1:200	DRAWING NO. CR-29
--	---	--	--------------------------	----------------------



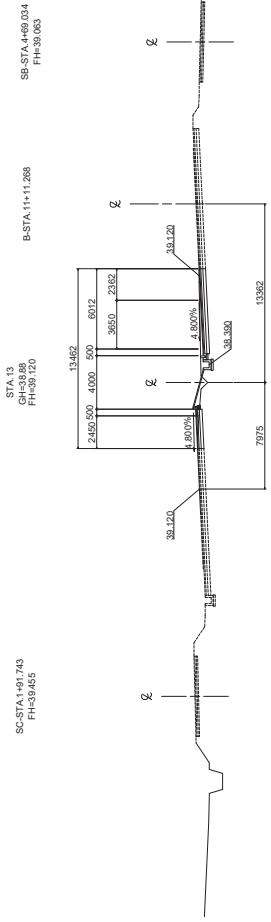
SC-STA.1+72.324
GH-38.983
FH-38.234

B-STA.11+31.602

STA.12+90
GH-38.983
FH-38.234

SB-STA.4+86.070
GH-38.983
FH-38.234

DL=30.0



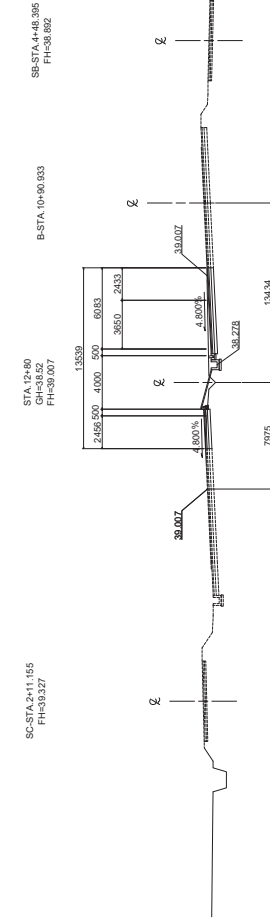
SC-STA.1+743
GH-38.983
FH-38.234

B-STA.11+11.268

STA.13
GH-38.983
FH-38.234

SB-STA.4+89.034
GH-38.983
FH-38.234

DL=30.0



SC-STA.2+11.955
GH-38.983
FH-38.234

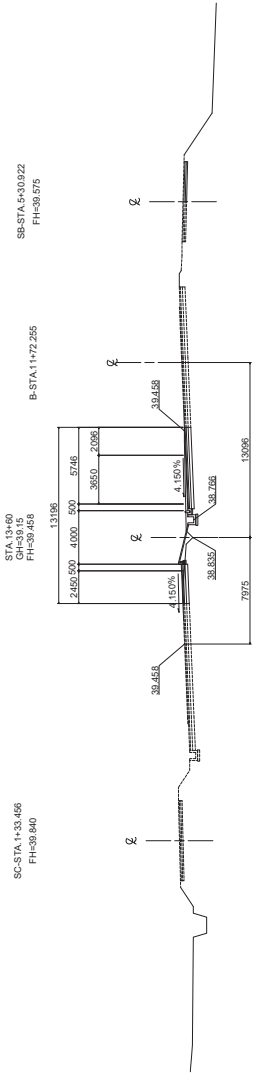
B-STA.10+90.933

STA.12+90
GH-38.983
FH-38.234

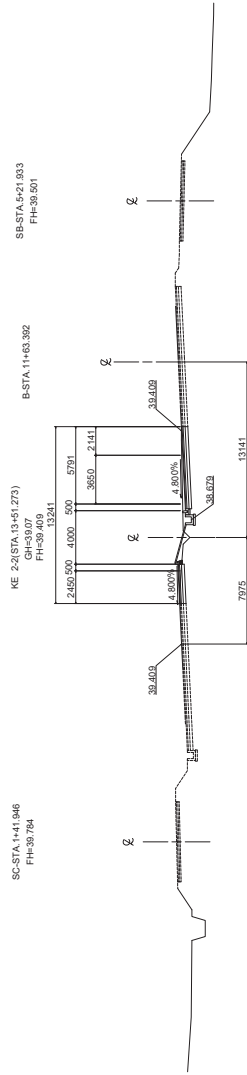
SB-STA.4+83.395
GH-38.983
FH-38.234

DL=30.0

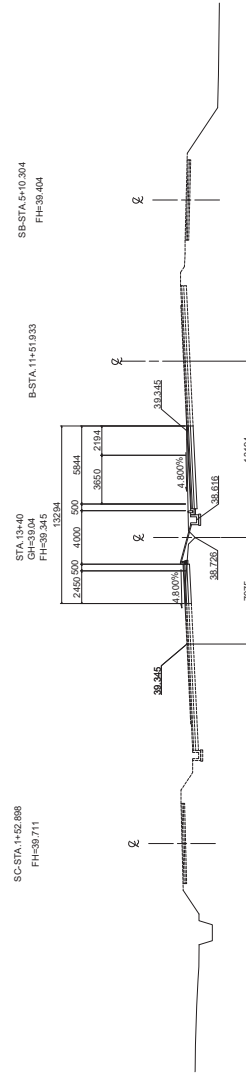
<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)</p>	<p>DRAWING TITLE: HAFBOUR-AKOSOMBO ROAD CROSS SECTION(30)</p>	<p>SCALE (A1/100)</p>	<p>DRAWING NO.</p>
				1:200	CR-30



DL=30.0

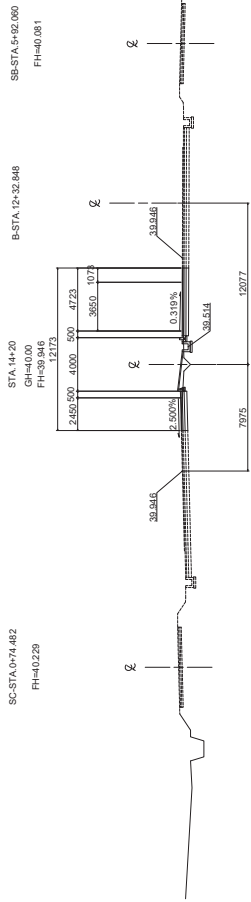


DL=30.0

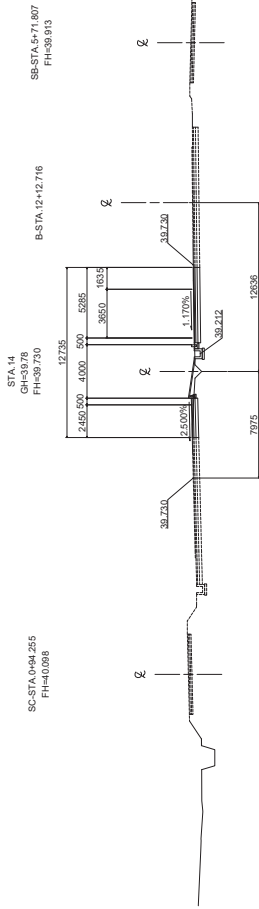


DL=30.0

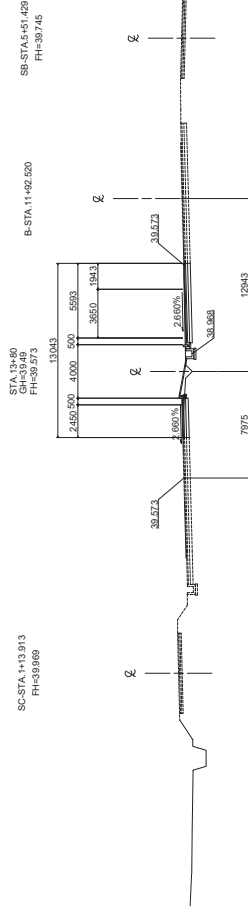
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(31)	SCALE (A1/200)	DRAWING NO.
				1:200	CR-31



DL=30.0



DL=30.0

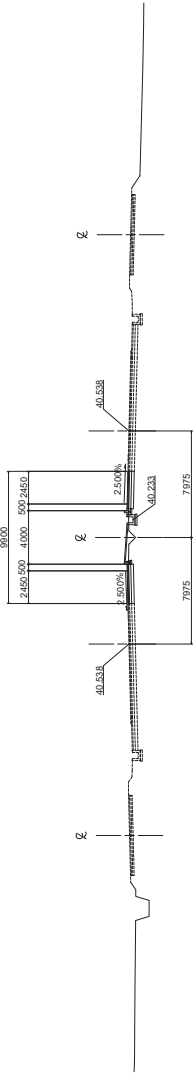


DL=30.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) JAPAN INTERNATIONAL COOPERATION AGENCY	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(32) SCALE (A1/1924) 1:200 DRAWING NO. CR-32
--	---	--

SC-STA 0+54.605
FH=40.492

SB-STA 6+32.213
FH=40.414



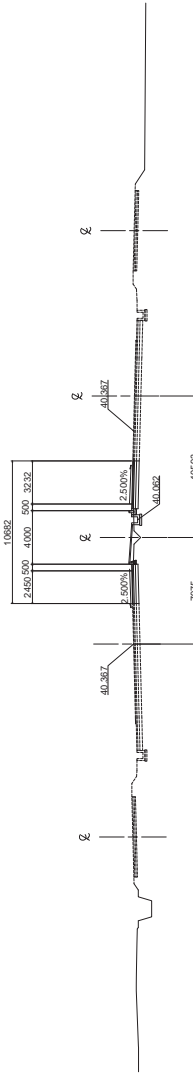
DL=35.0

SC-STA 0+45.332
FH=40.421

SB-STA 6+21.482
FH=40.325

B-STA 12+42.224

KA 2+2(STA 14+40.773)
GH=40.24
FH=40.367



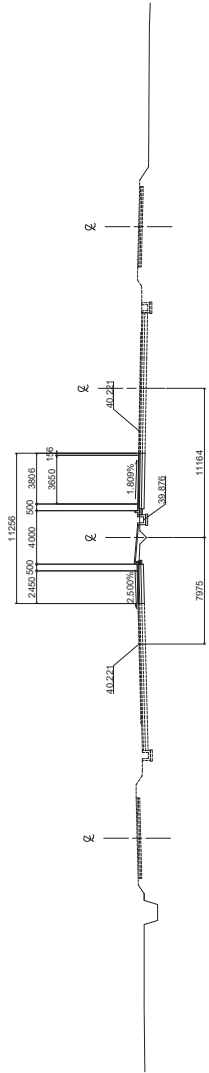
DL=35.0

SC-STA 0+54.593
FH=40.536

SB-STA 6+12.191
FH=40.248

B-STA 12+52.927

STA 14+40
GH=40.09
FH=40.221



DL=35.0

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
HARBOUR-AKOSOMBO ROAD
CROSS SECTION(33)

SCALE (A1/200)

DRAWING NO.

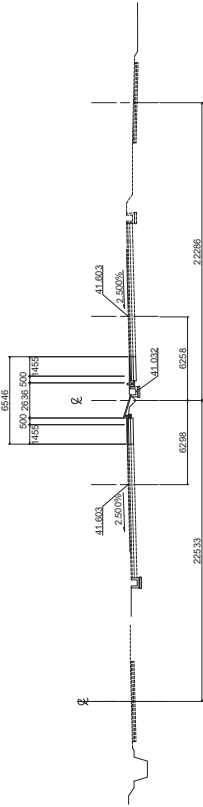
1:200

CR-33

SC-STA.0+24.114
FH=+1.586

STA. 15+20
GH=+1.83
FH=+1.603

SB-STA.6+95.489
FH=+1.213

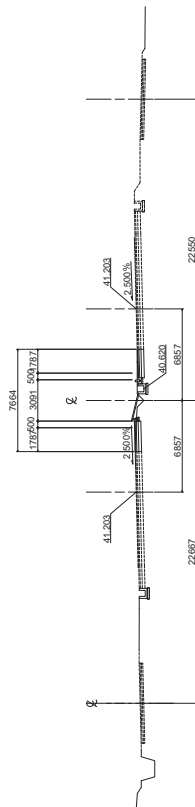


DL-35.0

SC-STA.0+4.586
FH=+0.803

STA. 15+00
GH=+1.44
FH=+1.203

SB-STA.6+73.039
FH=+0.834

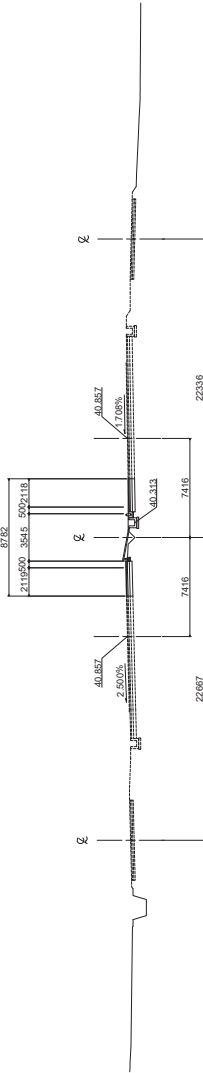


DL-35.0

SC-STA.0+14.981
FH=+0.828

STA. 14+80
GH=+0.95
FH=+0.857

SB-STA.6+52.489
FH=+0.883



DL-35.0

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
HARBOUR-AKOSOMBO ROAD
CROSS SECTION(34)

SCALE (A1/100)

1:200

DRAWING NO.

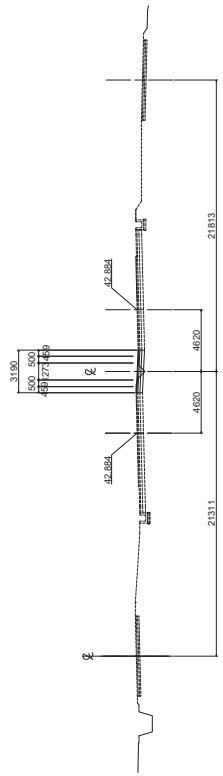
CR-34

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA
APPROVED: [Signature]

STA 16+80
 GH=43.06
 FH=42.884

SC STA 0+82.807
 FH=42.844

SB STA 7+54.811
 FH=42.486

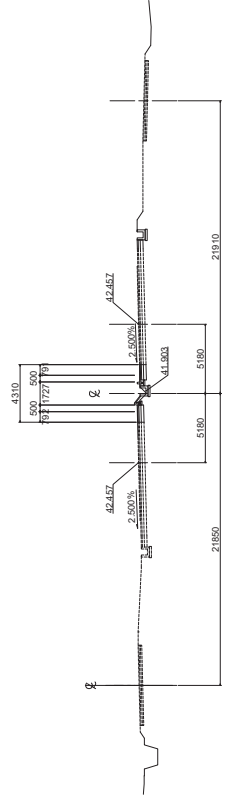


DL=35.0

STA 16+80
 GH=42.03
 FH=42.457

SC STA 0+83.231
 FH=42.418

SB STA 7+34.374
 FH=42.062

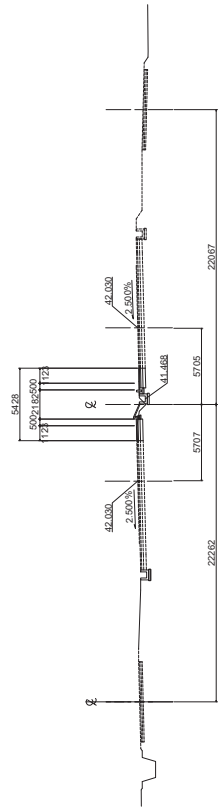


DL=35.0

STA 16+40
 GH=41.40
 FH=42.030

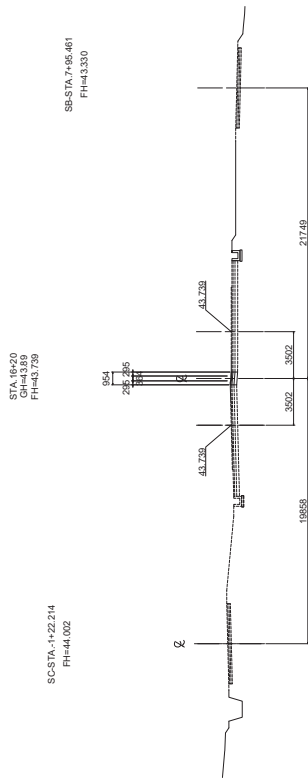
SC STA 0+43.689
 FH=41.893

SB STA 7+13.934
 FH=41.638

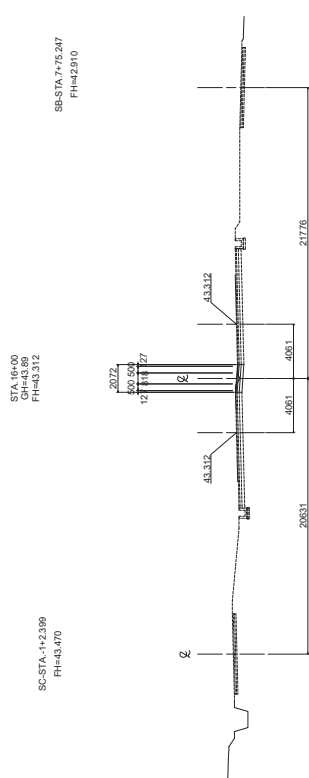


DL=35.0

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(35)	SCALE (A1 1924) 1:200	DRAWING NO. CR-35
--	---	--	--	--------------------------	----------------------



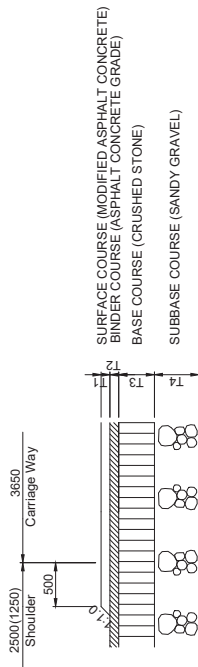
DL=40.0



DL=40.0

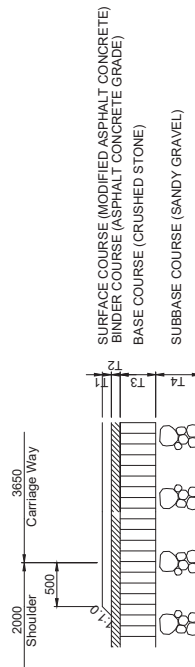
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: HARBOUR-AKOSOMBO ROAD CROSS SECTION(36)	SCALE (A1/1626) 1:200	DRAWING NO. CR-36
--	---	--	--	--------------------------	----------------------

MAIN ROAD PAVEMENT COMPOSITION (PHASE2) S=1:10



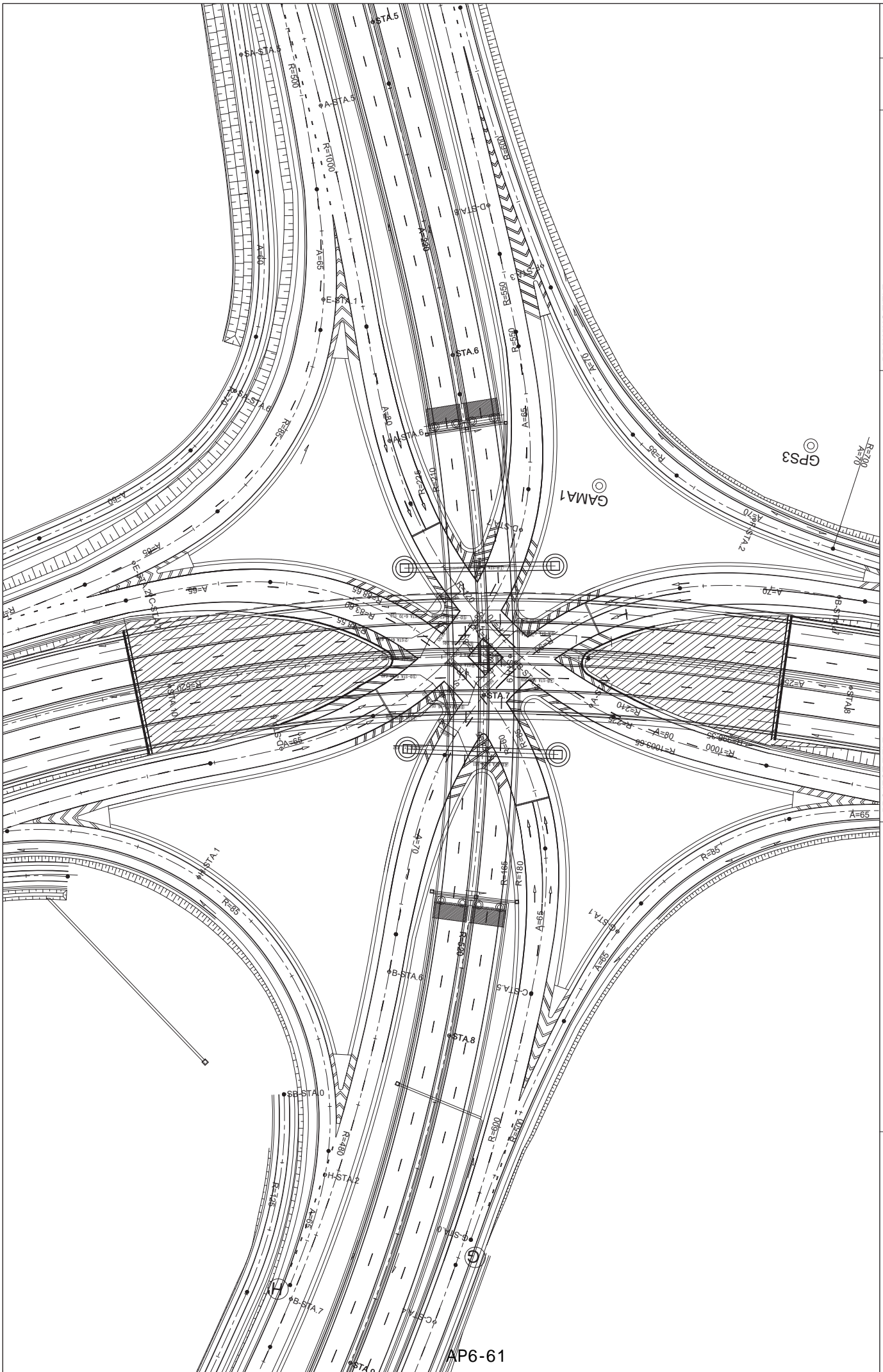
PAVEMENT COMPOSITION	SECTION		LENGTH COURSE	T1 SURFACE COURSE	T2 BINDER COURSE	T3 BASE COURSE	T4 SUBBASE COURSE
	FROM	TO					
HARBOUR ROAD	-1 + 30.0	6 + 14.0	744m	50	100	200	200
	6 + 14.0	6 + 19.0	5m	80	-	-	-
BRIDGE	6 + 19.5	7 + 61.5	142m	80	-	-	-
	7 + 62.0	7 + 67.0	5m	80	-	-	-
AKOSOMBO ROAD	7 + 67.0	16 + 80.0	913m	50	80	150	200

RAMP ROAD PAVEMENT COMPOSITION S=1:10



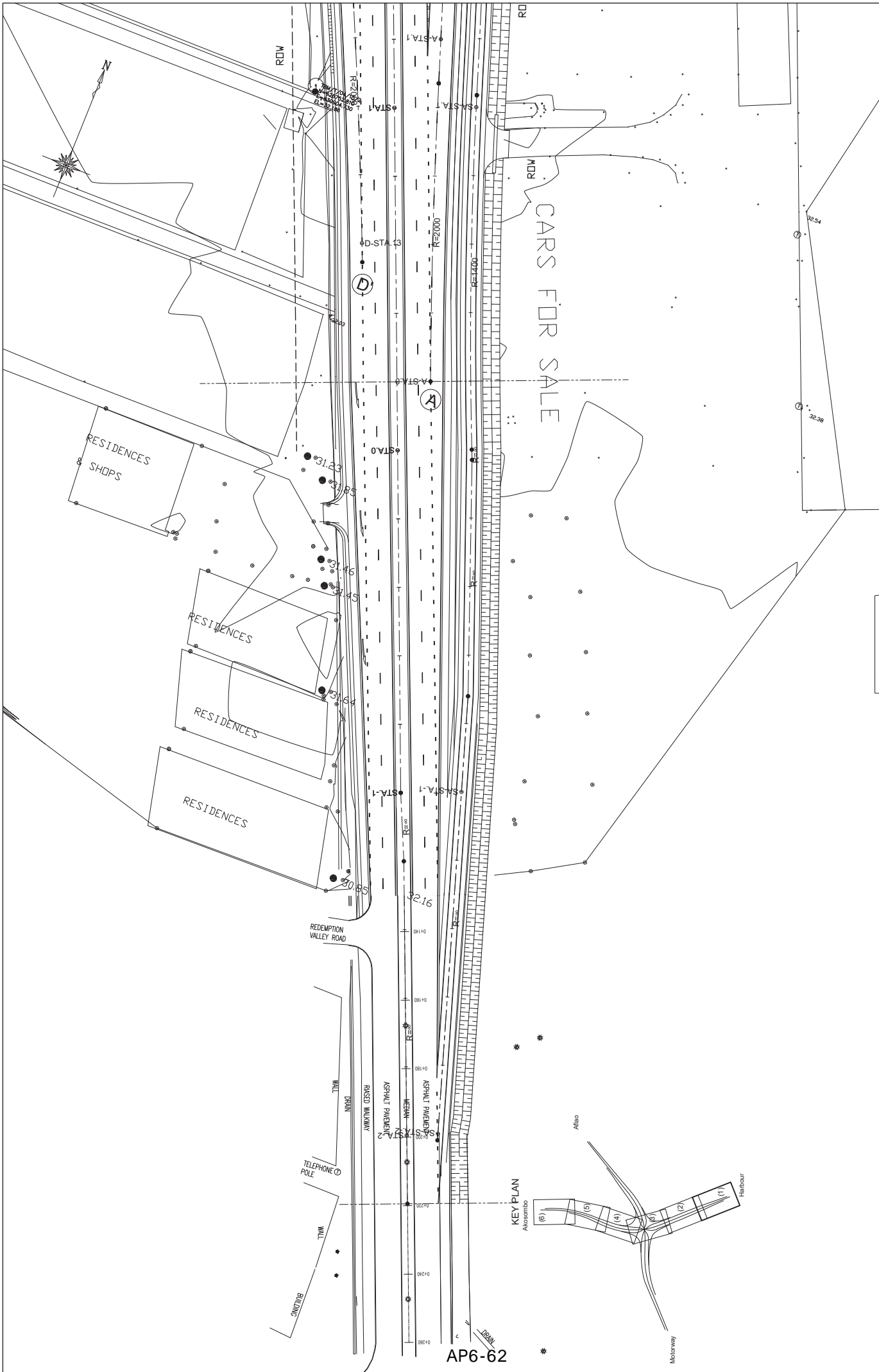
PAVEMENT COMPOSITION	SECTION	AREA COURSE Z	T1 SURFACE COURSE
INTERSECTION	A B C D-Ramp	8073m ²	30

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: PAVEMENT STRUCTURE	SCALE: (A1189) 1:10	DRAWING NO. PS-01
--	--	--------------------------------------	------------------------	----------------------



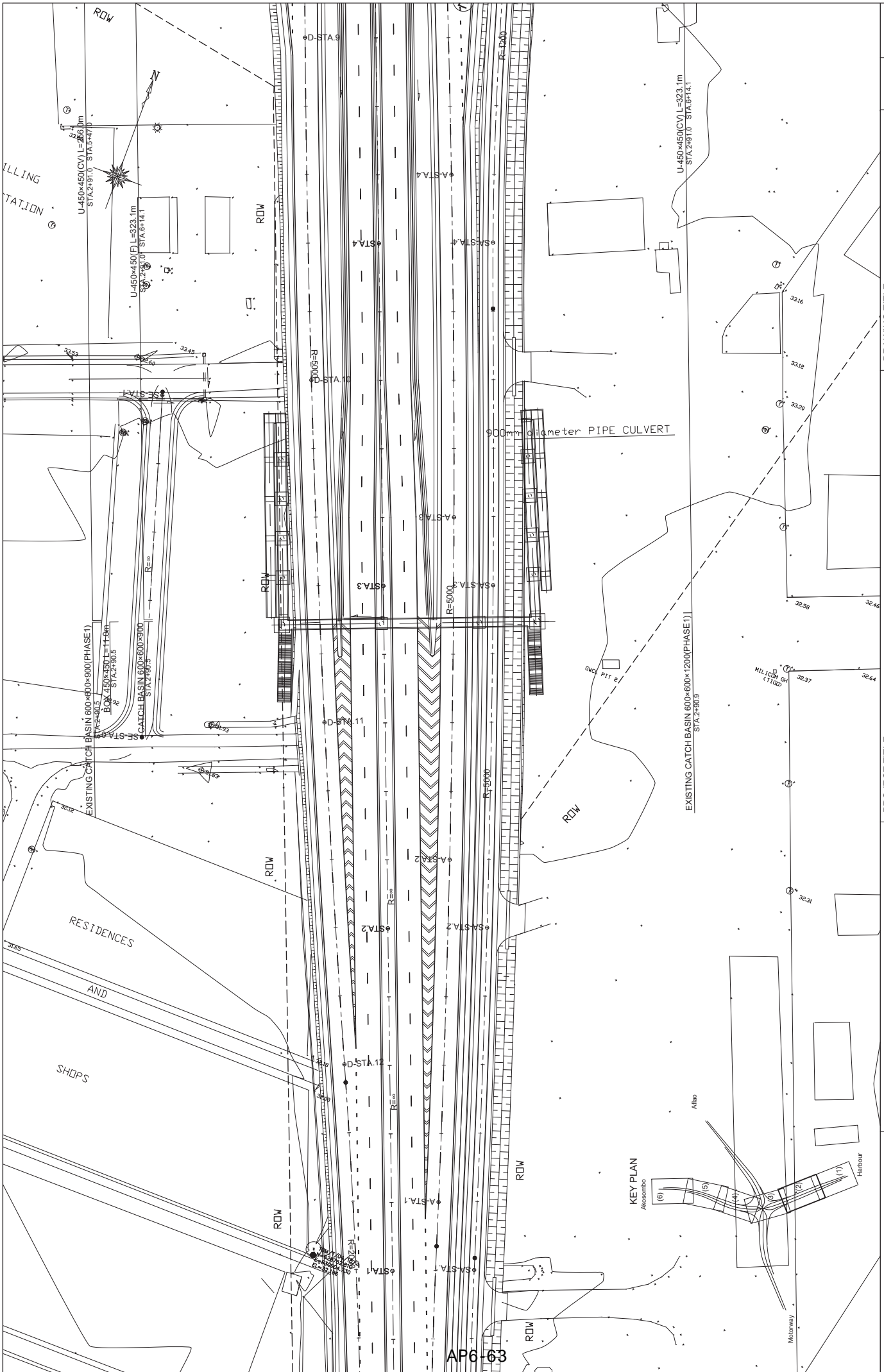
AP6-61

DRAWING NO.	INTERSECTION PLAN	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
SCALE (A:1:500)	1:500			
IP-01				

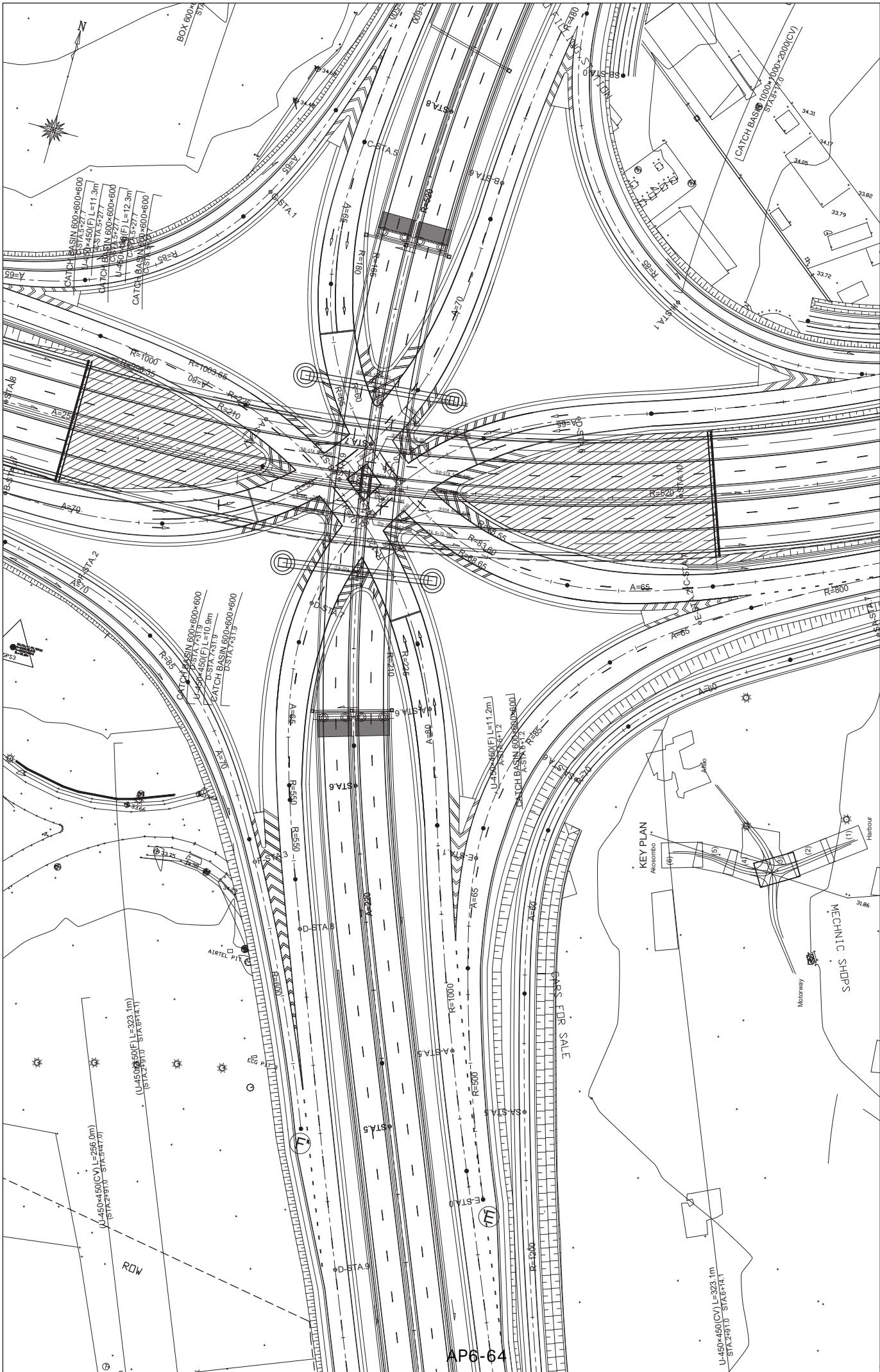


AP6-62

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DRAINAGE PLAN(1)	SCALE (A 1:500)	DRAWING NO. DP-01

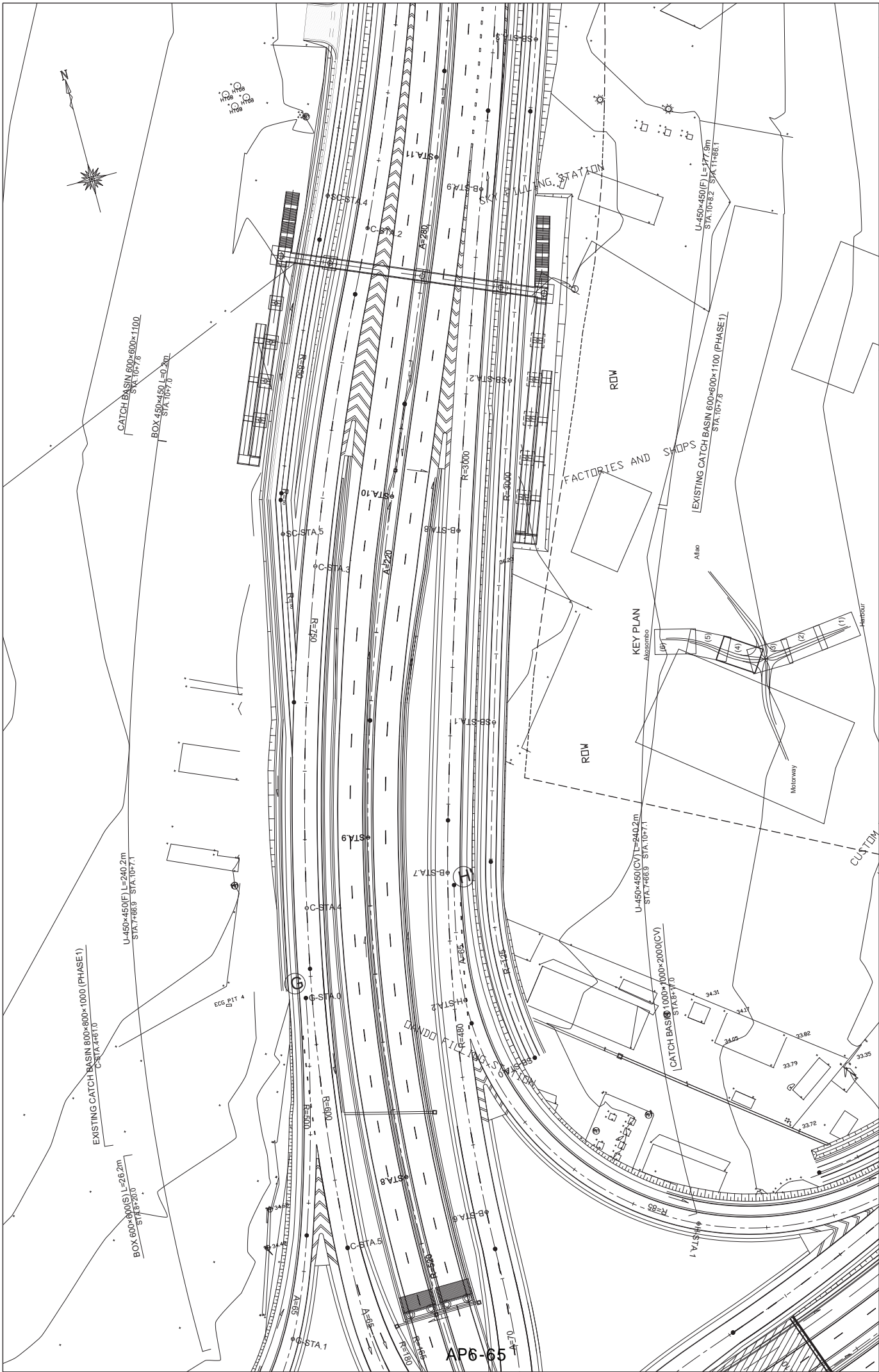


SCALE (A 1:500)	DRAWING NO.	PROJECT TITLE:	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
1:500	DP-02	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY
DRAWING TITLE:		DRAINAGE PLAN(2)	



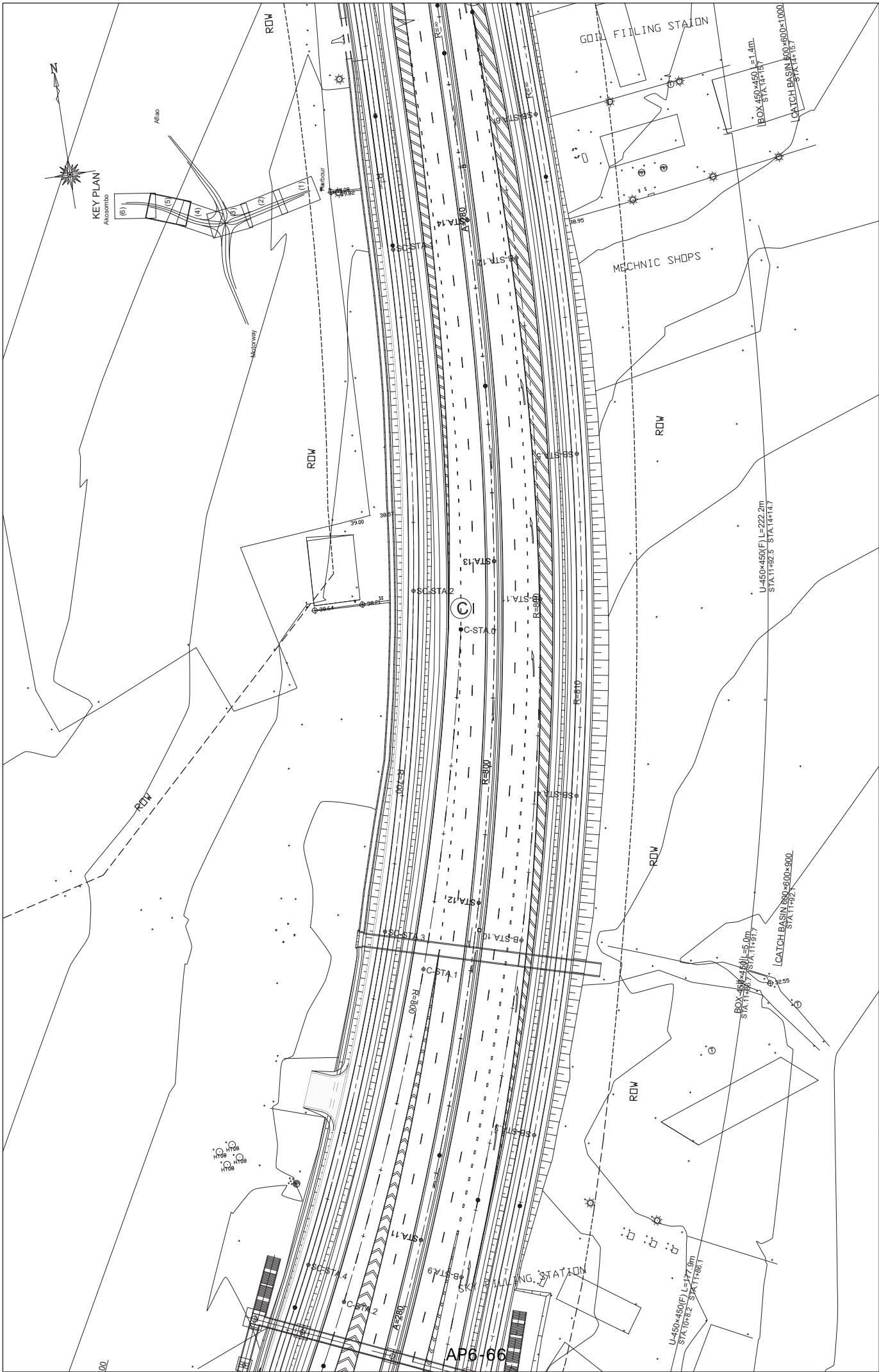
AP6-64

DRAWING NO.	DP-03
SCALE (A 1:500)	1:500
PROJECT TITLE:	DRAINAGE PLAN(3)
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY



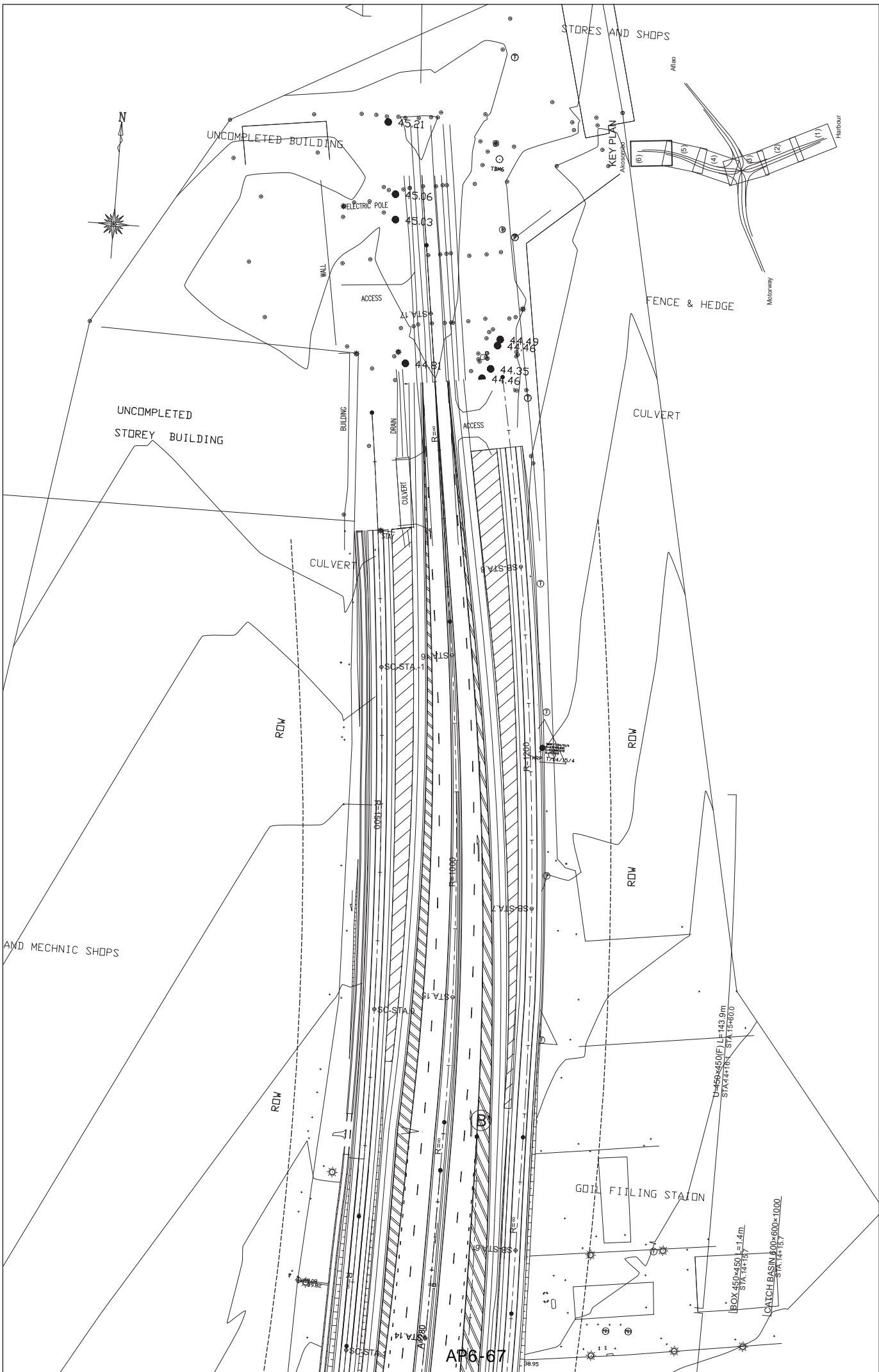
AP6-65

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		DRAWING NO. DP-04
	DRAWING TITLE: DRAINAGE PLAN(4)		SCALE (A 1:500)



DRAWING NO.	DRAINAGE PLAN(5)	PROJECT TITLE:	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
SCALE (A1 Base)	1:500	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		
DP-05				

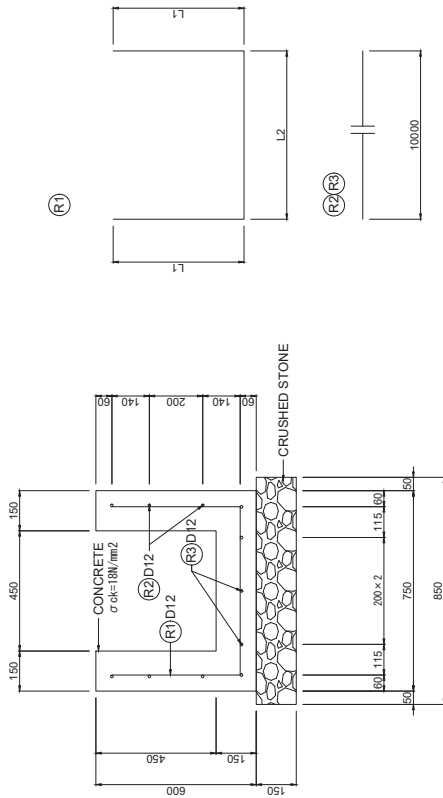
AP6-66



AP6-67

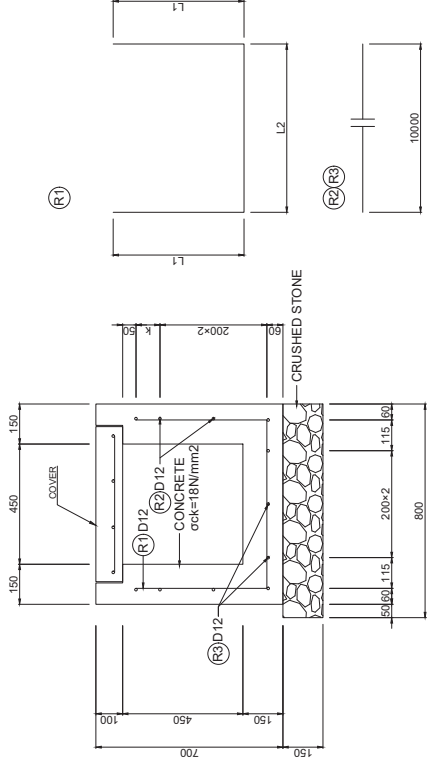
DRAWING NO.	DP-06
SCALE (A:base)	1:500
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	DRAINAGE PLAN(6)
CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA

DETAIL OF DRAINAGE(1)
SIDE DITCH



U-DITCH S=1:10
U-450x450(F)

LIST OF REINFORCEMENT		mm		PER 10.0m		
Type	L1	L2	(R1)	(R2)	(R3)	REMARKS
U-450x450(F)	480	630	50-D12x1590	6-D12x10000	5-D12x10000	(R1) etc.200



U-DITCH S=1:10
U-450x450(CV)

LIST OF REINFORCEMENT		mm		PER 10.0m		
Type	L1	L2	(R1)	(R2)	(R3)	REMARKS
U-450x450(CV)	50	490	630	50-D12x1610	6-D12x10000	5-D12x10000 (R1) etc.200

LIST OF REINFORCEMENT		mm		PER ONE	
Type	(R1)	(R2)	(R3)	REMARKS	
COVER-350x500	(4-D12x520)	(4-D12x400)			

NOTE :
U-BxH(F) indicates U-Ditch with foundation(crushed stone).

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

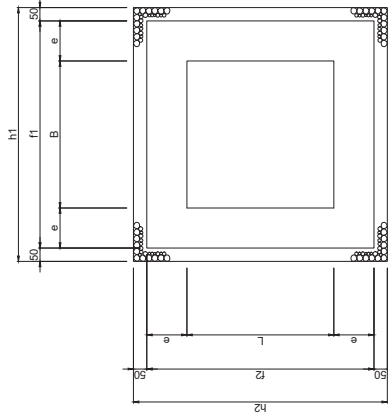
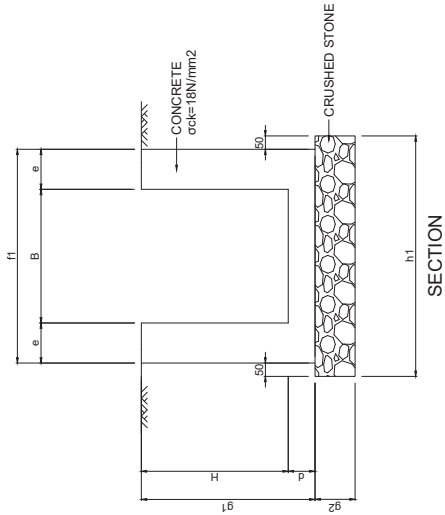
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

DRAWING TITLE:
DETAIL OF DRAINAGE(1)
SIDE DITCH

SCALE:(A1&A2)
1:10

DRAWING NO.
DR-01

DETAIL OF DRAINAGE(2) CATCH BASIN



PLAN

CATCH BASIN B×L×H S=1:10

DIMENSION TABLE

Type	B	L	H	d	e	f1	f2	g1	g2	h1	h2	REMARKS
600	600	600	600	150	150	900	900	750	150	1000	1000	
600	600	900	600	150	150	900	900	1050	150	1000	1000	
600	600	1000	600	1000	150	900	900	1150	150	1000	1000	
600	600	1100	600	1100	200	1000	1000	1300	200	1100	1100	

DRAWING TITLE:

DETAIL OF DRAINAGE(2)
CATCH BASIN

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

SCALE: (A1&A2)

1:10

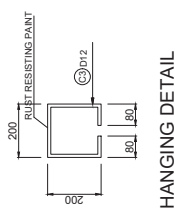
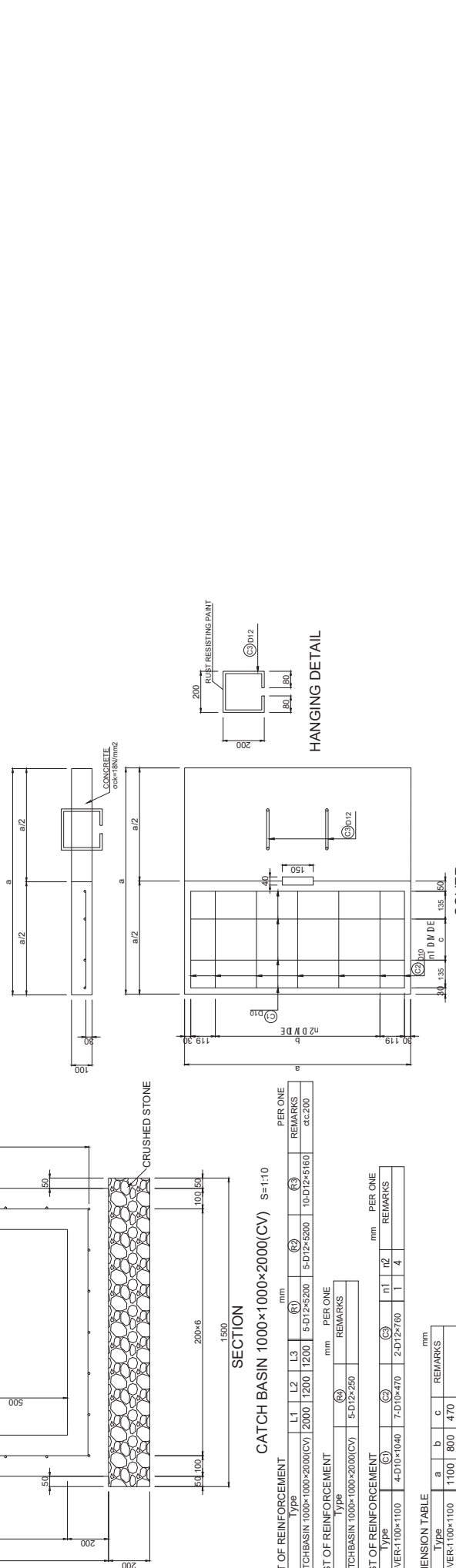
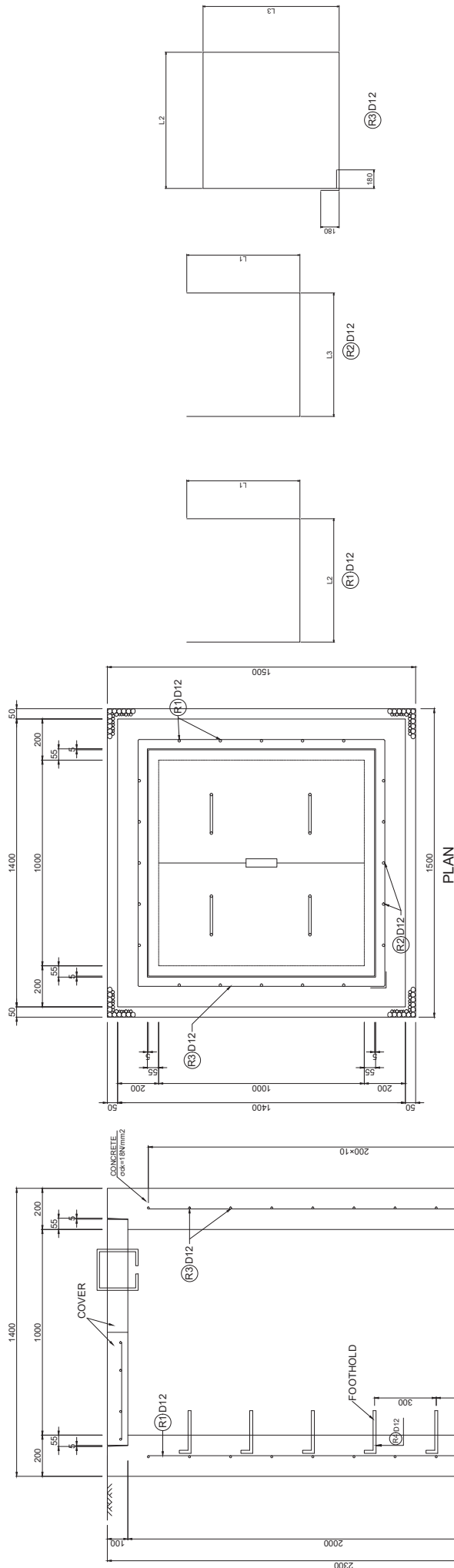
DRAWING NO.

DR-02

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

DETAIL OF DRAINAGE(3) CATCH BASIN(CV)



SECTION
CATCH BASIN 1000x1000x2000(CV) S=1:10

LIST OF REINFORCEMENT	Type	L1	L2	L3	(R1)	(R2)	(R3)	PER ONE
CATCHBASIN 1000x1000x2000(CV)	2000	1200	1200	1200	5-D12x5200	5-D12x5200	10-D12x5160	REMARKS
								at c.200

LIST OF REINFORCEMENT	Type	PER ONE	REMARKS
CATCHBASIN 1000x1000x2000(CV)	(R4)	5-D12x250	

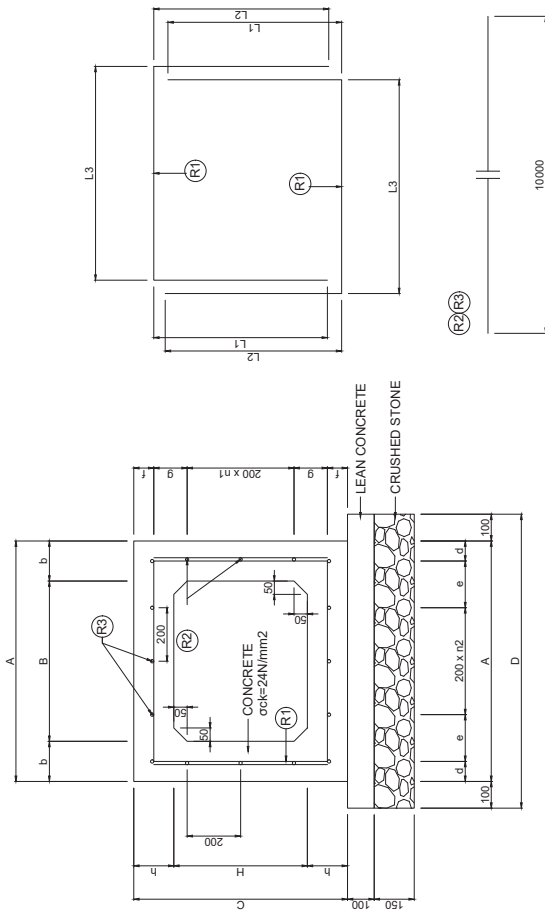
LIST OF REINFORCEMENT	Type	PER ONE	REMARKS
COVER-1000x1000	(C1)	4-D10x1040	7-D10x470
		n1	n2
		1	4

DIMENSION TABLE	a	b	c	REMARKS
COVER-1000x1000	1100	800	470	

AP6-70

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DETAIL OF DRAINAGE(3) CATCH BASIN(CV)
		SCALE: (A1822)	DRAWING NO.
		1:10	DR-03

DETAIL OF DRAINAGE(4) CROSS DRAINAGE



BOX CULVERT-BxH S=1:10

DIMENSION TABLE

Type	B	H	b	h	A	C	D	d	e	f	g	REMARKS
BOX 450x450	450	150	150	150	750	750	950	75	200	75	200	
BOX 600x600(S)	600	200	200	200	1000	1000	1200	100	200	100	200	

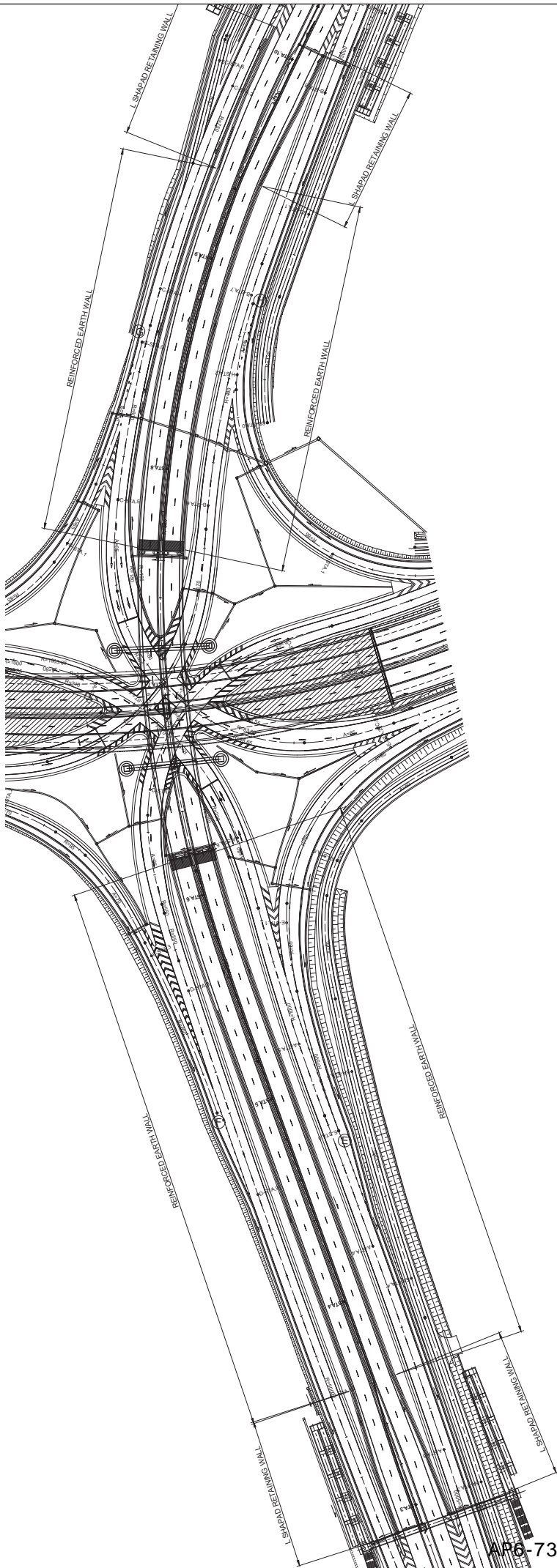
LIST OF REINFORCEMENT

Type	n1	n2	L1	L2	L3	PER 10.0m	REMARKS
BOX 450x450	1	1	600	600	600	90-D12x10000	4-D12x10000 (R) 8-D12x10000 (R) c/c.200
BOX 600x600(S)	2	2	800	800	800	90-D16x20000	6-D16x10000 (R) 10-D16x10000 (R) c/c.200

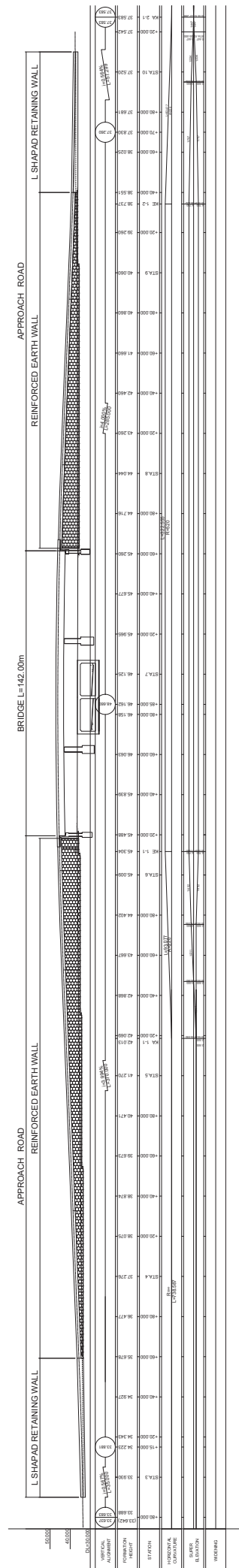
DETAIL OF DRAINAGE(5) SCHEDULE OF DRAINAGE

U-450x450(F)				CATCH BASIN 600x600x600				CATCH BASIN 1000x1000x200(CV)									
NO.	"STARTING STATION"	"ENDING STATION"	SIDE	LENGTH	REMARKS	NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤			
						Haibour-Akosombo Road											
1	2 + 91.0	6 + 14.1	LEFT	323.1		1	8 + 17.0	LEFT	1	BOX 600x600 Phase I Completed	34.907	34.907		34.907			
2	7 + 66.9	10 + 7.1	LEFT	240.2													
3	10 + 8.2	11 + 86.1	RIGHT	177.9													
4	11 + 92.5	14 + 14.7	RIGHT	222.2													
5	14 + 16.1	15 + 60.0	RIGHT	143.9													
A-RAMP																	
1	6 + 1.2		LEFT			1	6 + 1.2	LEFT	1	U-450x450(F)	36.225			36.075			
C-RAMP																	
1	5 + 27.7		LEFT			1	5 + 27.7	LEFT	1	U-450x450(F)	36.028			36.197			
2	5 + 27.7		LEFT			1	5 + 27.7	LEFT	1	U-450x450(F)	36.028			35.878			
D-RAMP																	
1	7 + 31.9		LEFT			1	7 + 31.9	LEFT	1	U-450x450(F) Phase I Completed	35.921	35.921		35.771			
D-RAMP																	
1	7 + 31.9		LEFT			1	7 + 31.9	LEFT	1	U-450x450(F)	36.192			36.042			
2	7 + 31.9		LEFT			1	7 + 31.9	LEFT	1	U-450x450(F) Phase I Completed	36.161	36.161		36.011			
U-450x450(CV)																	
NO.	"STARTING STATION"	"ENDING STATION"	SIDE	LENGTH	REMARKS												
Haibour-Akosombo Road																	
1	2 + 91.0	6 + 14.1	RIGHT	323.1													
2	2 + 91.0	5 + 47.0	LEFT	256.0													
3	7 + 66.9	10 + 7.1	RIGHT	240.2													
TOTAL						819.3											
BOX 450x450																	
NO.	"STARTING STATION"	"ENDING STATION"	SIDE	LENGTH	REMARKS												
Haibour-Akosombo Road																	
1	2 + 90.5		LEFT	11.0		1	2 + 90.5	LEFT	1	BOX 450x450	33.311			33.111			
2	10 + 7.0		LEFT	0.2		1	10 + 7.0	LEFT	1	U-450x450(F)	37.783			37.433			
3	11 + 86.7	11 + 91.7	RIGHT	5.0		1	11 + 86.7	RIGHT	1	BOX 450x450	37.583			37.433			
4	14 + 15.7		RIGHT	1.4		1	14 + 15.7	RIGHT	1	U-450x450(F)	39.115	39.115		38.904			
TOTAL						17.6											
BOX 600x600(S)																	
NO.	"STARTING STATION"	"ENDING STATION"	SIDE	LENGTH	REMARKS												
Haibour-Akosombo Road																	
1	8 + 20.0		LEFT	26.2		1	8 + 20.0	LEFT	1	BOX 600x600	35.164	35.164		34.994			
TOTAL						26.2											
EXISTING CATCH BASIN 600x600x900(PHASE I)																	
NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤									
Haibour-Akosombo Road																	
1	2 + 90.5	LEFT	1	BOX 450x450 Phase I Completed	36.466	36.466		36.305									
EXISTING CATCH BASIN 600x600x100(PHASE I)																	
NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤									
Haibour-Akosombo Road																	
1	10 + 7.6	RIGHT	1	BOX 450x450 Phase I Completed	36.466	36.466		36.785									
EXISTING CATCH BASIN 600x600x1200(PHASE I)																	
NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤									
Haibour-Akosombo Road																	
1	2 + 90.9	RIGHT	1	BOX 450x450 Phase I Completed	33.013	33.013		32.553									
EXISTING CATCH BASIN 800x800x1000(PHASE I)																	
NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤									
Haibour-Akosombo Road																	
1	4 + 61.0	LEFT	1	BOX 450x450 Phase I Completed	35.164	35.164		35.394									
EXISTING CATCH BASIN 800x800x1000(PHASE I)																	
NO.	STATION	SIDE	NUMBER	①	②	③	④	⑤									
Haibour-Akosombo Road																	
1	4 + 61.0	LEFT	1	BOX 450x450 Phase I Completed	35.164	35.164		35.394									

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DETAIL OF DRAINAGE(5) SCHEDULE OF DRAINAGE
	SCALE: (A1:1:2)	DRAWING NO. DR-05



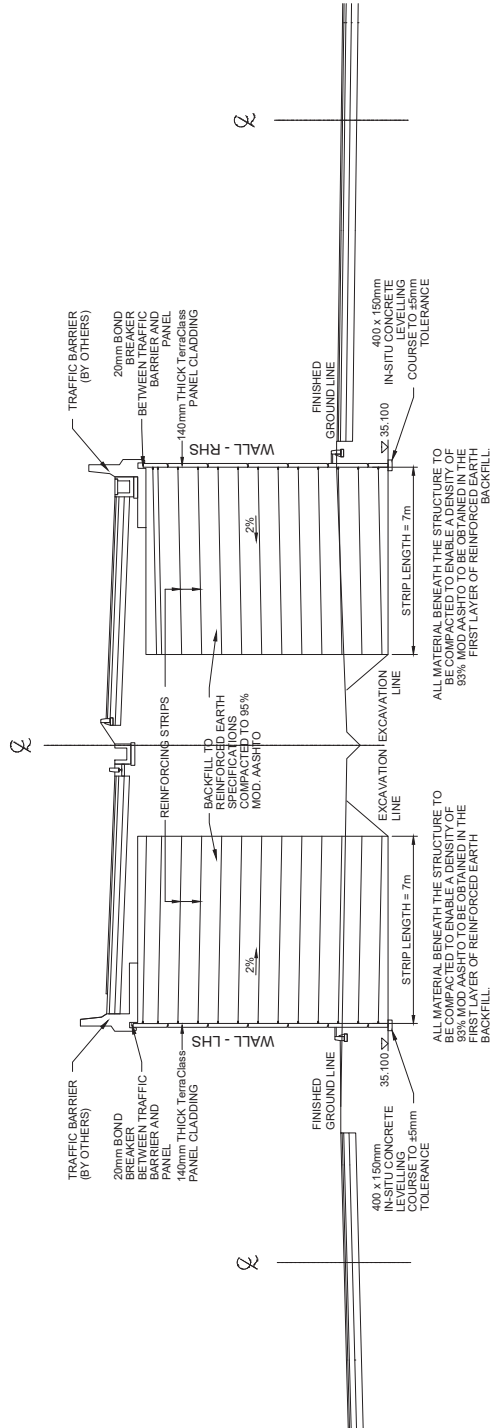
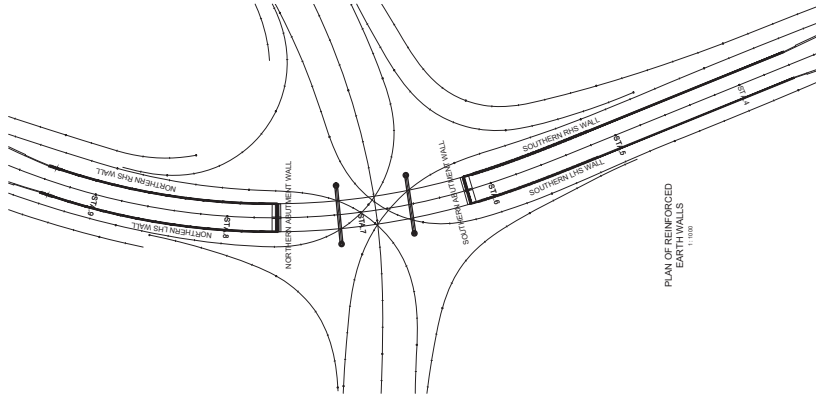
PLAN 1 : 200



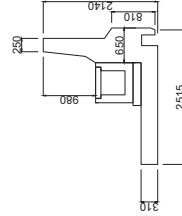
PROFILE 1 : 200

AP6-73

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)		DRAWING NO. RE-01
		DRAWING TITLE: REINFORCED EARTH WALL (1)		



TYPICAL SECTION 1:200

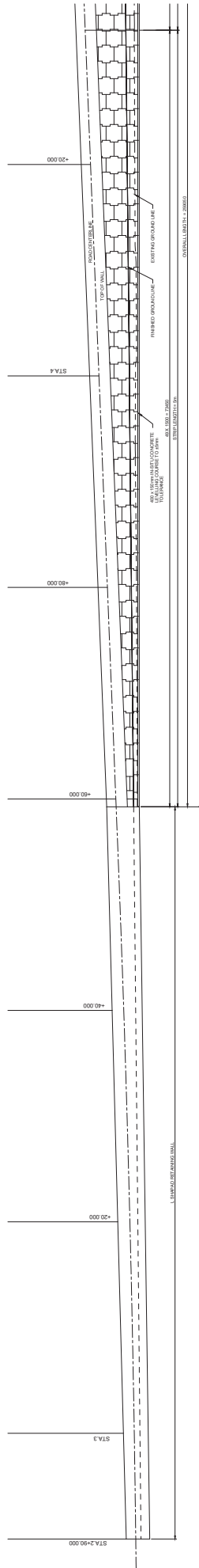


TRAFFIC BARRIER DETAIL 1:50

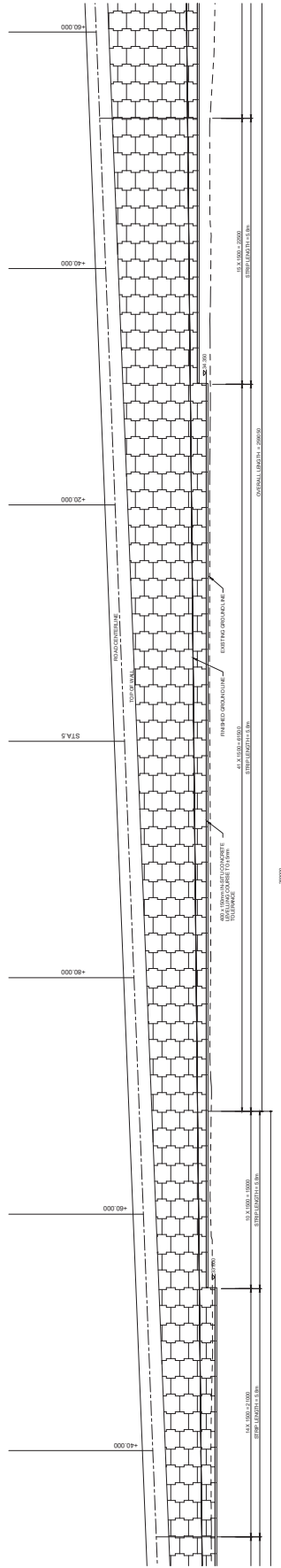
DL=30.0

AP6-74

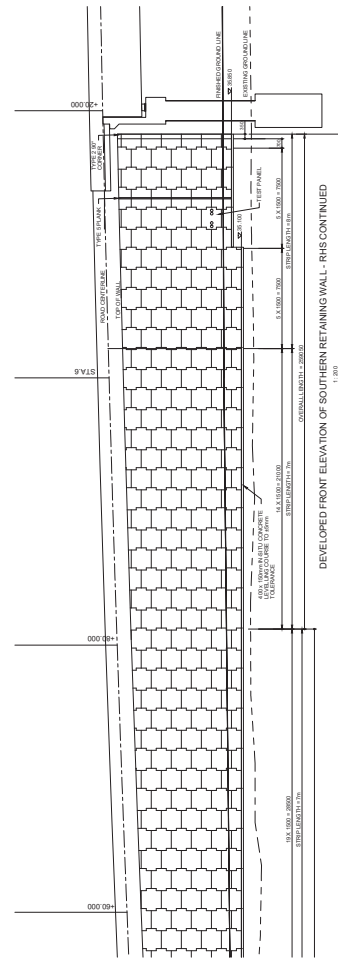
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING TITLE: REINFORCED EARTH WALL (2)	SCALE (A1100) AS SHOWN	DRAWING NO. RE-02
--	---	---	---	---------------------------	----------------------



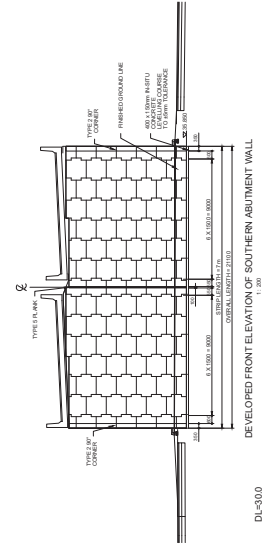
DEVELOPED FRONT ELEVATION OF SOUTHERN RETAINING WALL - RHS
1:200



DEVELOPED FRONT ELEVATION OF SOUTHERN RETAINING WALL - RHS CONTINUED
1:200



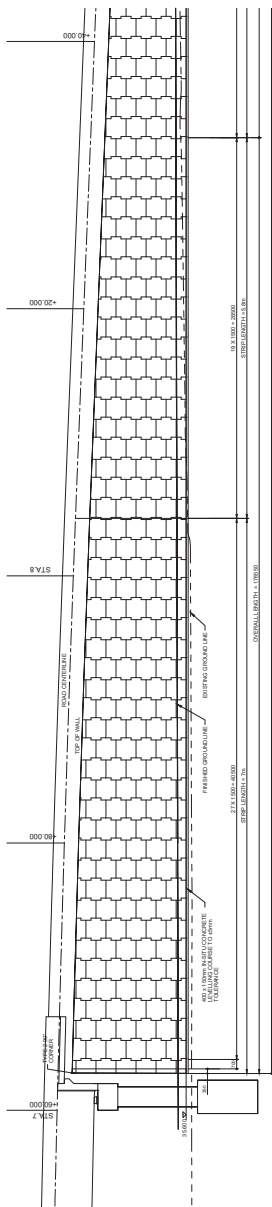
DEVELOPED FRONT ELEVATION OF SOUTHERN RETAINING WALL - RHS CONTINUED
1:200



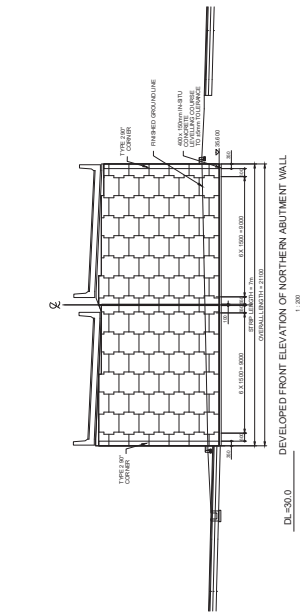
DEVELOPED FRONT ELEVATION OF SOUTHERN ABUTMENT WALL
1:200

DL-300

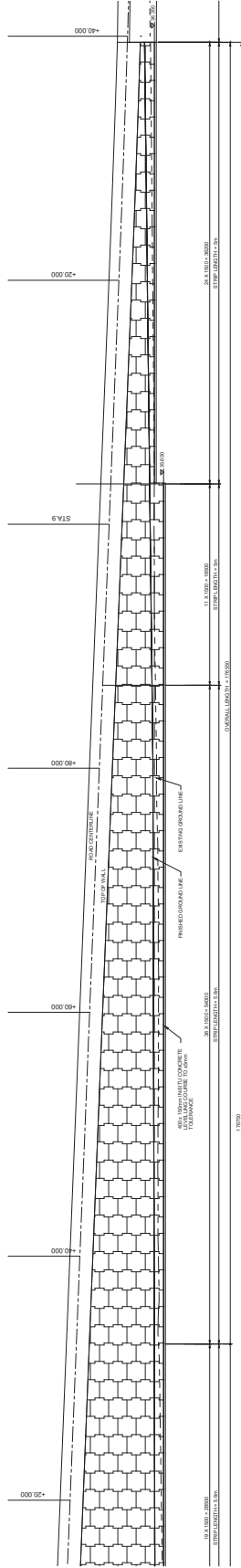
<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)</p>	<p>DRAWING TITLE: REINFORCED EARTH WALL (3)</p>	<p>SCALE (A1199) AS SHOWN</p>	<p>DRAWING NO. RE-03</p>
---	---	--	---	-----------------------------------	------------------------------



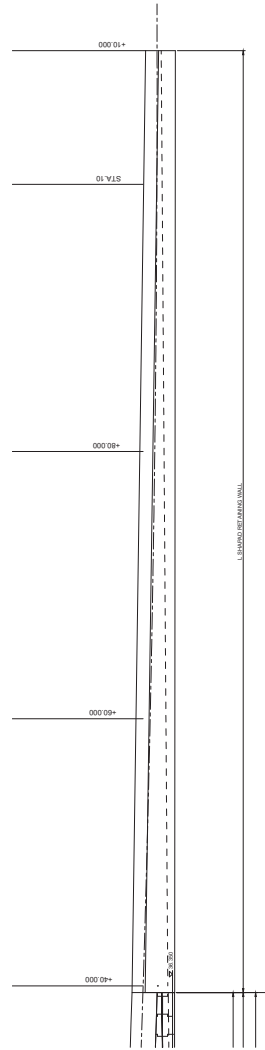
DEVELOPED FRONT ELEVATION OF NORTHERN RETAINING WALL - RHS



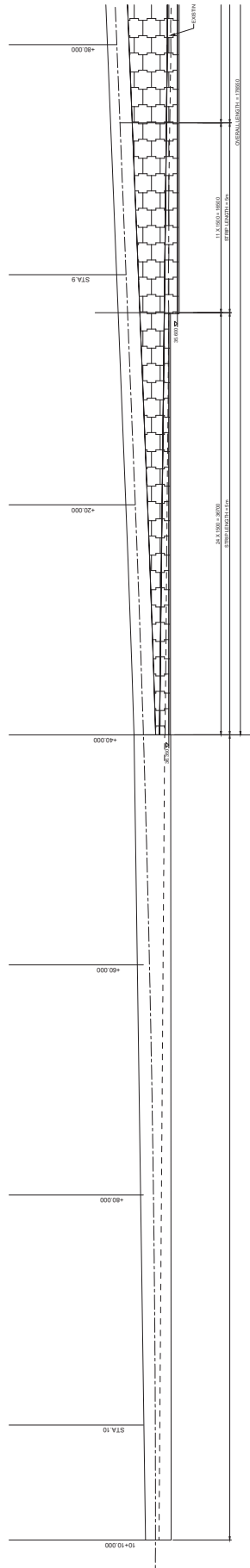
DEVELOPED FRONT ELEVATION OF NORTHERN ABUTMENT WALL



DEVELOPED FRONT ELEVATION OF NORTHERN RETAINING WALL - RHS CONTINUED

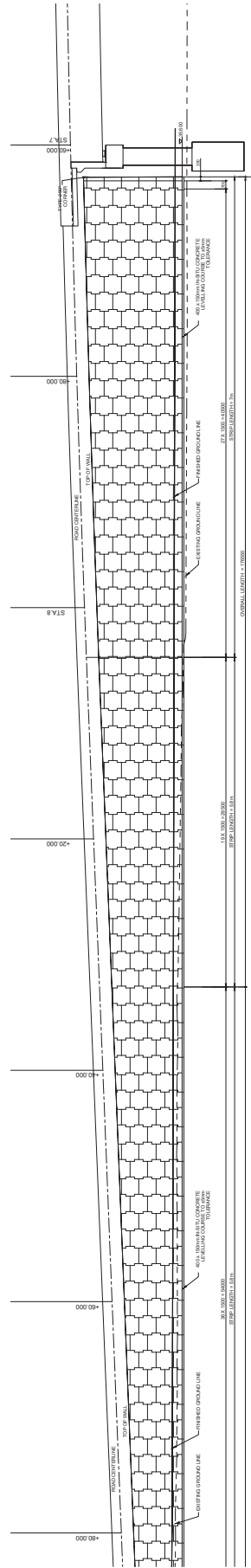


DRAWING NO.	RE-04
SCALE (A1189)	AS SHOWN
DRAWING TITLE:	REINFORCED EARTH WALL (4)
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY



DEVELOPED FRONT ELEVATION OF NORTHERN RETAINING WALL - RHS CONTINUED

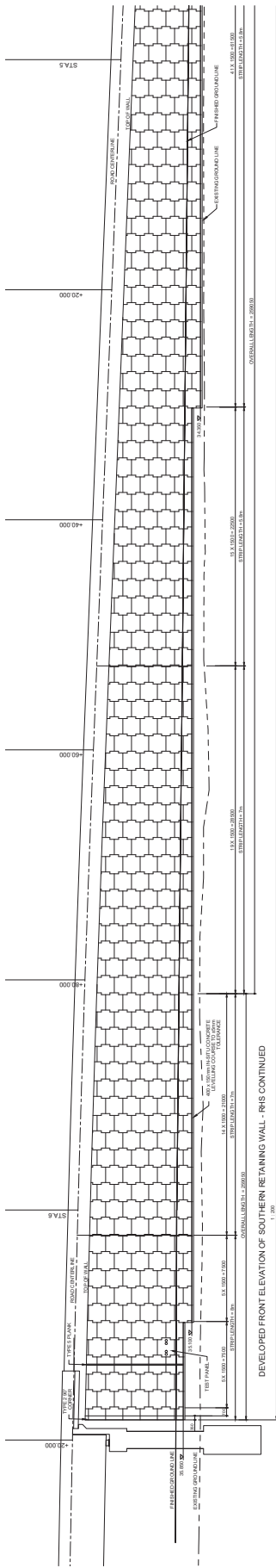
1:200



DEVELOPED FRONT ELEVATION OF NORTHERN RETAINING WALL - RHS

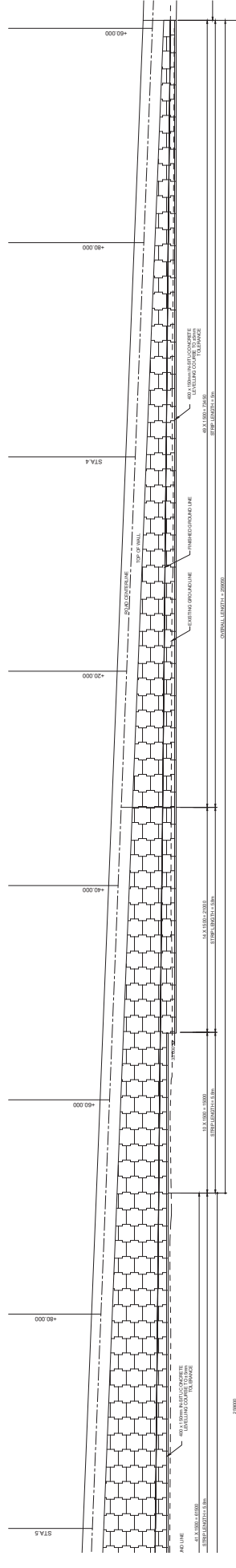
1:200

<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)</p>	<p>DRAWING TITLE: REINFORCED EARTH WALL (5)</p>	<p>SCALE (A1189) AS SHOWN</p>	<p>DRAWING NO. RE-05</p>
---	---	--	---	-----------------------------------	------------------------------



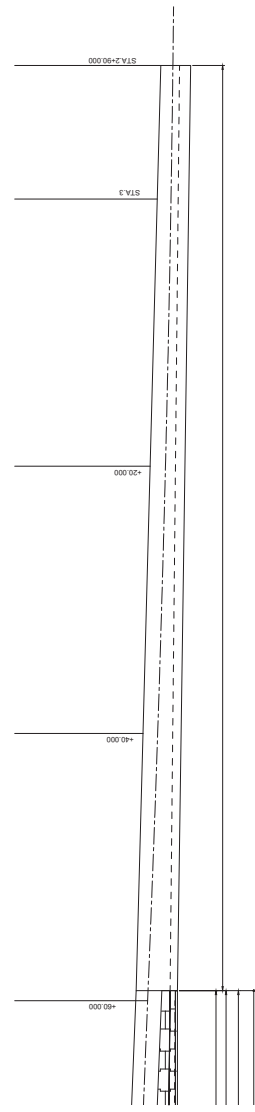
DEVELOPED FRONT ELEVATION OF SOUTHERN RETAINING WALL - RHS CONTINUED

1:200

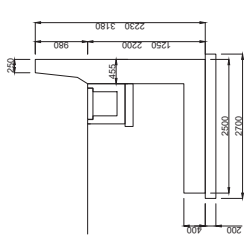


DEVELOPED FRONT ELEVATION OF SOUTHERN RETAINING WALL - RHS

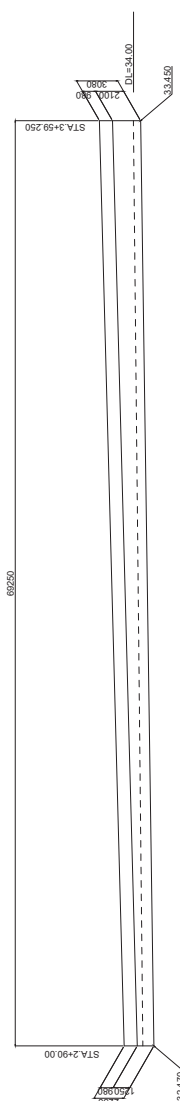
1:200



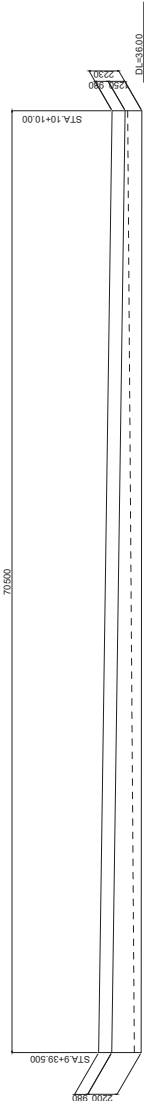
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: REINFORCED EARTH WALL (6)	SCALE (A1199) AS SHOWN	DRAWING NO. RE-06
--	---	--	---	---------------------------	----------------------



L SHAPAD RETAINING WALL
S=1/50



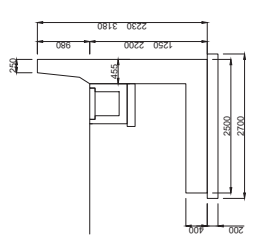
PROFILE S=1/100



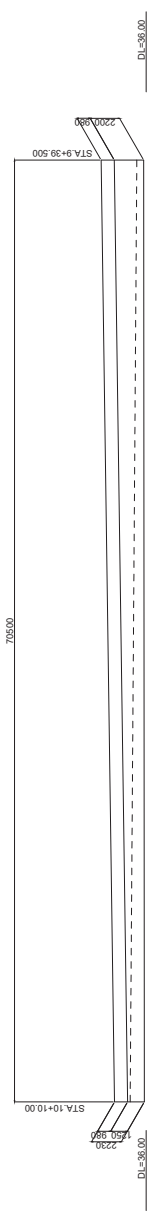
PROFILE S=1/100



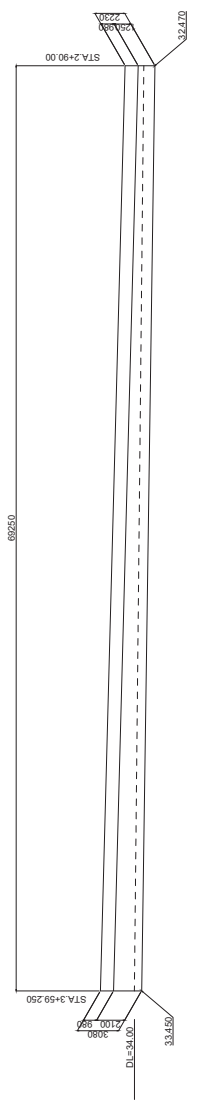
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING TITLE: REINFORCED EARTH WALL (7) L SHAPAD RETAINING WALL RIGHT	SCALE (A1189) AS SHOWN	DRAWING NO. RE-07
--	---	---	--	---------------------------	----------------------



L SHAPAD RETAINING WALL
S=1/50



PROFILE S=1/100



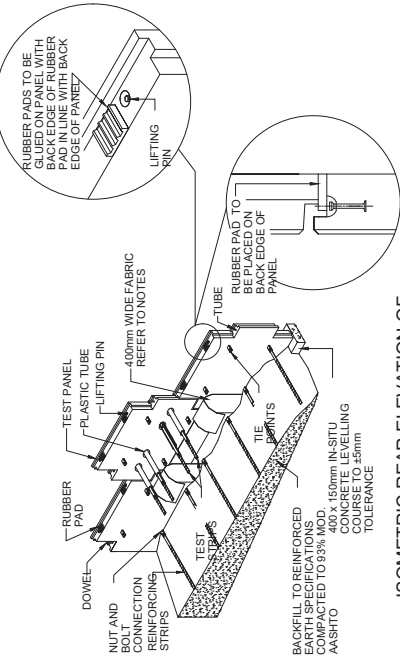
PROFILE S=1/100



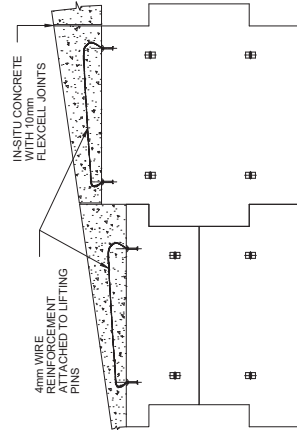
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING TITLE: REINFORCED EARTH WALL (8) L SHAPAD RETAINING WALL LEFT	SCALE (A1199) AS SHOWN	DRAWING NO. RE-08
--	---	---	---	---------------------------	----------------------

DESIGN NOTES (CONCRETE FACING)

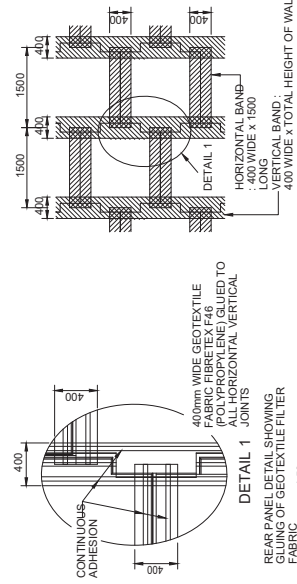
- STABILITY**
 - DESIGNED IN ACCORDANCE WITH RECOMMENDATIONS OF TERRE ARMEE INTERNATIONAL (STANDARD SECURITY)
 - LOAD FACTORS
 - 1.2.1 DEAD LOADS 1.35
 - 1.2.2 LIVE LOADS 1.60
 - FACTORS OF SAFETY
 - 1.3.1 INTERNAL STABILITY
 - 1.3.1 a) SLIPPAGE OF STRIPS 1.35
 - 1.3.1 b) REINFORCING STRIP RESISTANCE 1.5
 - EXTERNAL STABILITY
 - 1.3.2 a) OVERTURNING 1.5
 - 1.3.2 b) SLIDING ON THE BASE 1.60 (WORKING STRESS)
 - REINFORCED EARTH TAKES RESPONSIBILITY FOR INTERNAL STABILITY AND DESIGN OF REINFORCED EARTH STRUCTURE ONLY. STRUCTURES REMAIN THE CONSULTANT'S RESPONSIBILITY.
 - DESIGNED FOR A SERVICE LIFE OF 70 YEARS.
 - $P_0 = 1.50$ (COEFFICIENT OF FRICTION AT SURFACE)
 - DESIGNED FOR 12 kN/m^2 APPLIED AT TOP OF WALL (RETAINING WALLS).
- BACKFILL**
 - REINFORCED EARTH BACKFILL TO COMPLY TO TAI SPECIFICATIONS IN RESPECT OF MECHANICAL, CHEMICAL AND ELECTRO CHEMICAL PROPERTIES.
 - ALL REINFORCED EARTH BACKFILL MATERIAL TO BE TESTED FOR CHEMICAL AND MECHANICAL COMPLIANCE TO SPECIFICATIONS EVERY 300m^3 MAX.
 - REINFORCED EARTH BACKFILL DESIGN SPECIFICATIONS
 - DENSITY: MIN. 18 kN/m^3 MAX. 20 kN/m^3
 - COHESION = 0 kPa , $\phi = 30^\circ$ (MINIMUM ANGLE OF INT FRICTION).
 - FILL ABOVE AND BEHIND THE REINFORCED EARTH MASS.
 - DENSITY: MIN. 18 kN/m^3 MAX. 20 kN/m^3
 - COHESION = 0 kPa , $\phi = 30^\circ$ (MINIMUM ANGLE OF INT FRICTION).
 - FOUNDATION DESIGN SPECIFICATIONS
 - COHESION = 0 kPa , $\phi = 35^\circ$ (MINIMUM ANGLE OF INT FRICTION).
 - GENERAL FILL.
 - 2.6.1 TOE OF SPILL AROUND TO BE SET OUT BEFORE CONSTRUCTION.
 - 2.6.2 SPILL AROUND TO BE COMPACTED LAYERS AS FOR COMMON FILL.
 - 2.6.3 ADEQUATE EROSION PROTECTION AND SURFACE DRAINAGE MEASURES ARE REQUIRED. (AS DETERMINED BY THE ENGINEER)
- EXCAVATION**
 - EXCAVATION FOR REINFORCED EARTH WALL IS TO BE TO THE SAME LEVEL AS TOP OF FOOTING AND EXTEND TO THE SAME LENGTH AS STRIPS.
- REINFORCING STRIPS**
 - MEDIUM TENSILE TO S355L0 - SANS 50025 : 2009 / EN 10025 : 2004 $35 \times 4\text{mm}$ (A HIGH ADHERENCE)
 - GALVANISING TO SANS 121 : 2011 / ISO 1461: 2006 (MIN 85 μm)
- CONCRETE**
 - 400 x 150mm DEEP 15MPa IN SITU CONCRETE
 - LEVELLING COURSE TO $\pm 5\text{mm}$ TOLERANCE
 - CONCRETE PANELS TO BE MANUFACTURED WITH CONCRETE CLASS 30/19.
- JOINTS**
 - GEOTEXTILE FABRIC FIBRETEX F46 (POLYPROPYLENE) GLUED ONTO THE BACKFACE OF PANELS OVER ALL HORIZONTAL AND VERTICAL JOINTS



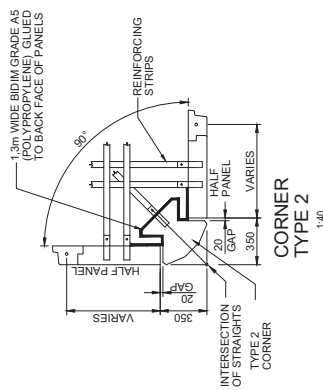
ISOMETRIC REAR ELEVATION OF PANELS



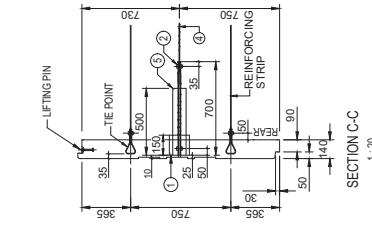
DETAIL OF IN-SITU CONCRETE ON TOP OF PANELS



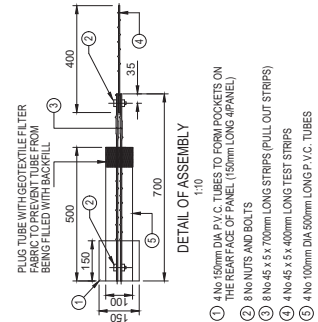
BACK ELEVATION OF GEOTEXTILE FILTER FABRIC OVER ALL VERTICAL AND HORIZONTAL JOINTS



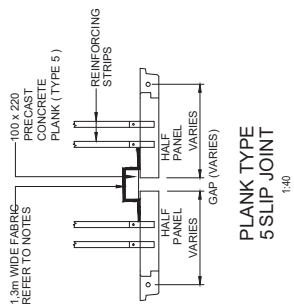
CORNER TYPE 2



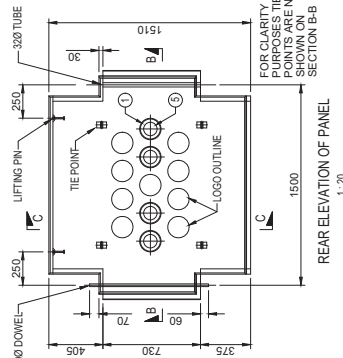
SECTION C-C



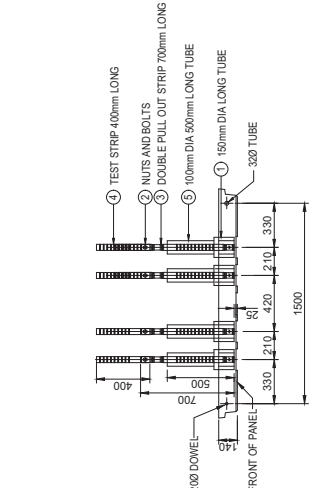
DETAIL OF ASSEMBLY



PLANK TYPE 5 SLIP JOINT



REAR ELEVATION OF PANEL



SECTION B-B

DETAILS OF TEST PANEL

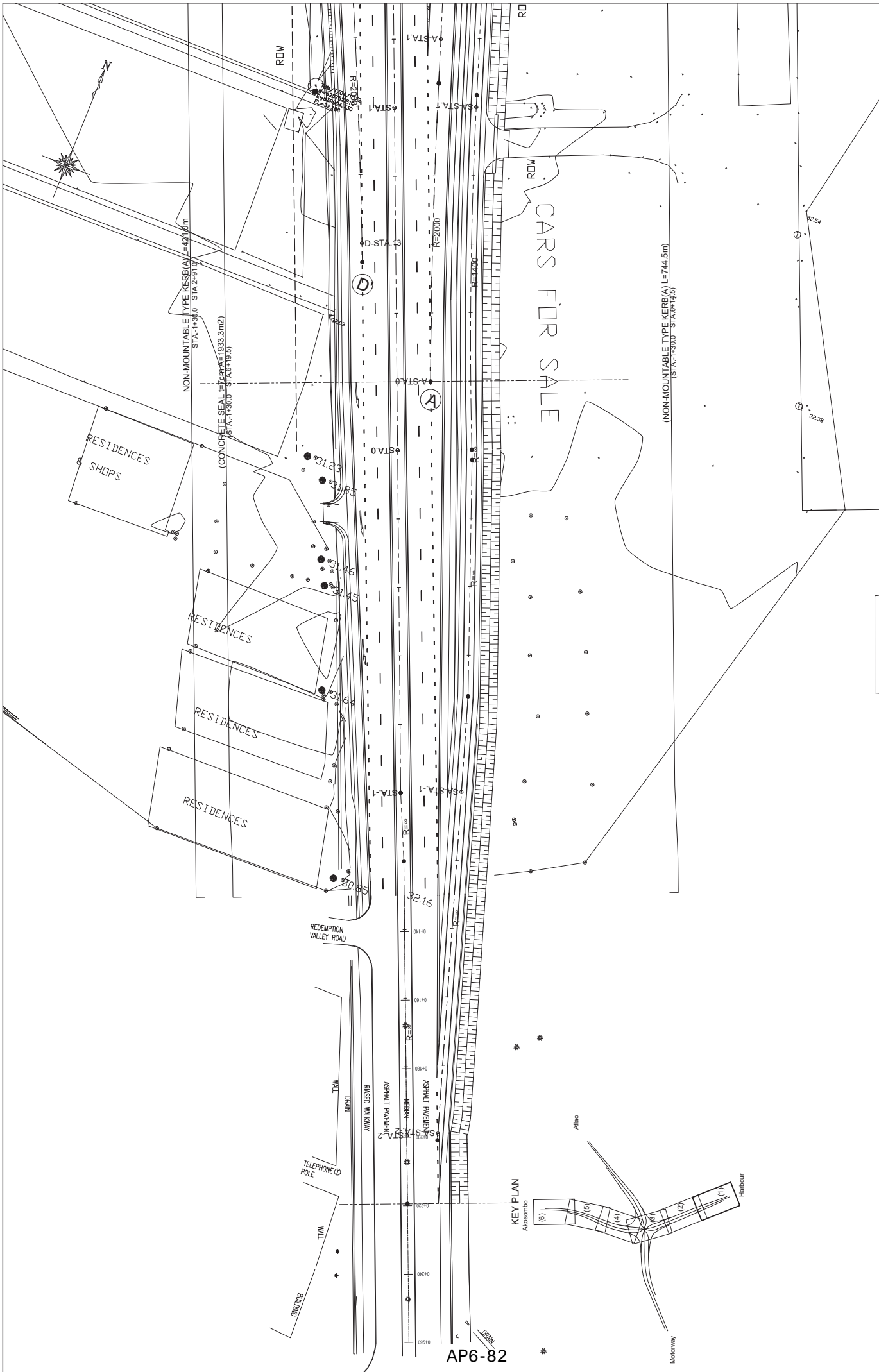
DETAILS OF FILTER FABRIC

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)

DETAILS OF FILTER FABRIC

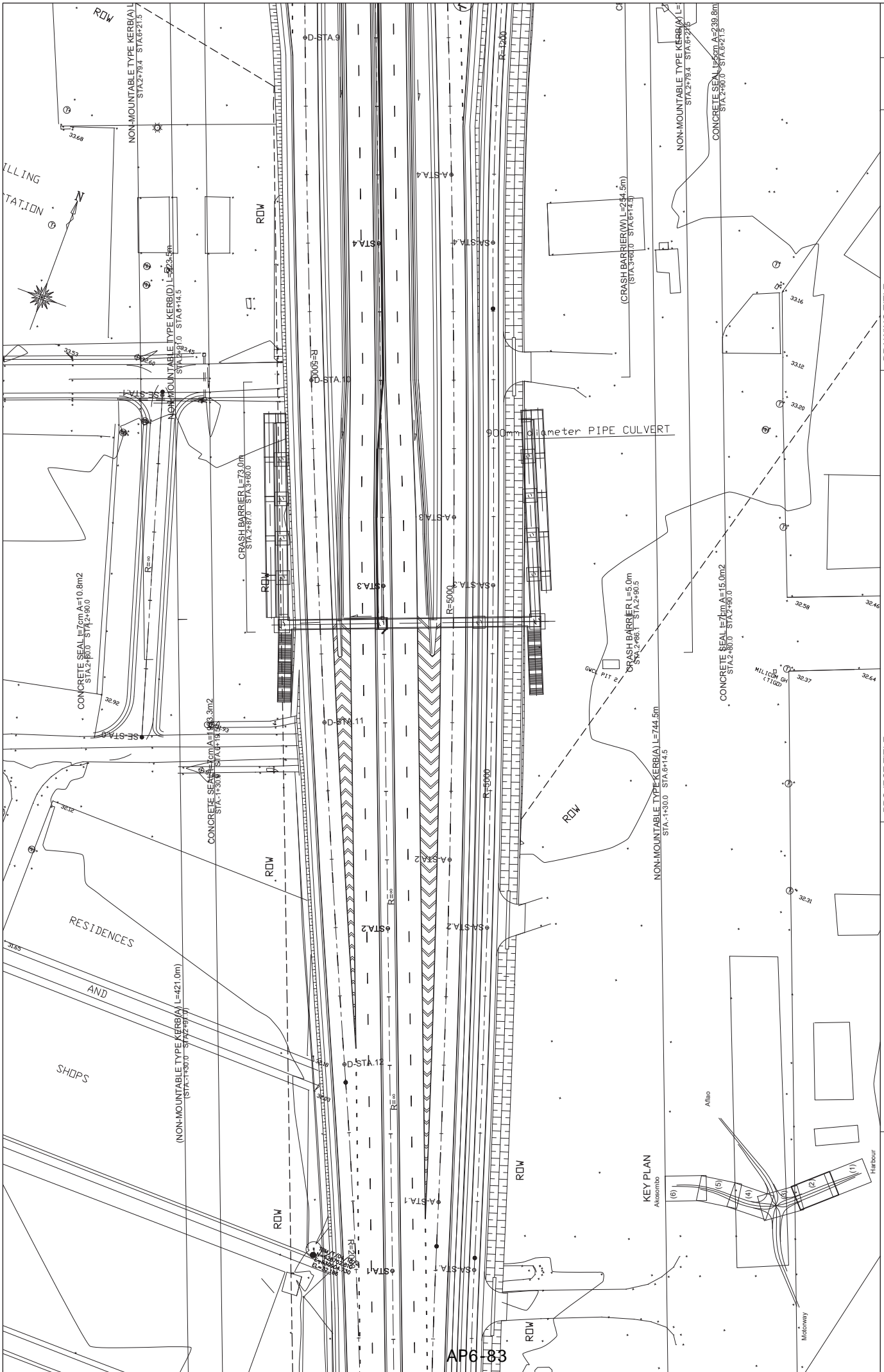
DRAWING TITLE:
REINFORCED EARTH WALL (9)

SCALE (A1/100)
AS SHOWN
DRAWING NO.
RE-09



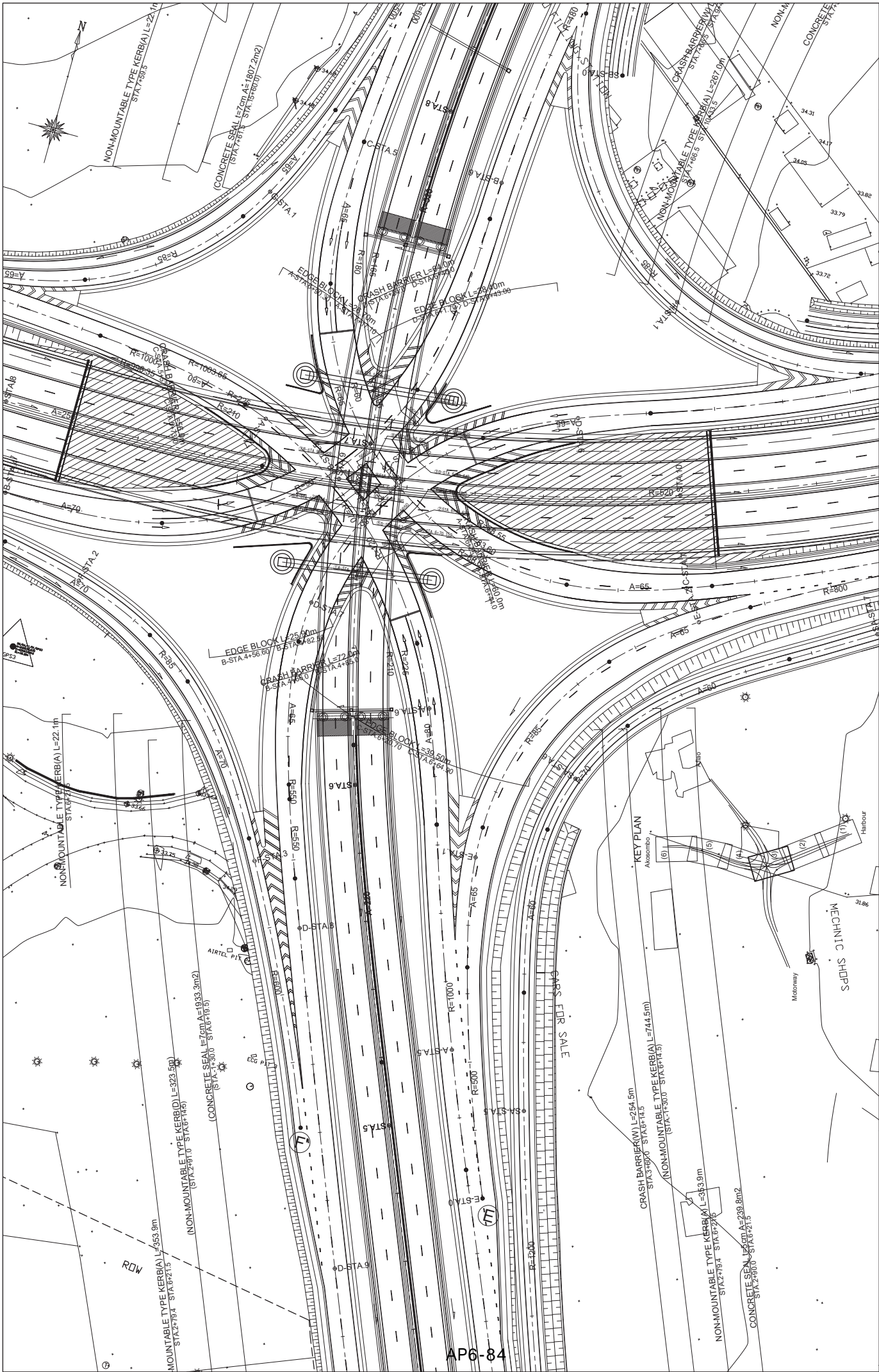
AP6-82

DRAWING NO.	SCALE (A 1:500)	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ANCILLARY PLAN(1)	DRAWING NO. RA-01
PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		CITI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	



AP6-83

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO. RA-02
		SCALE (A 1:500)



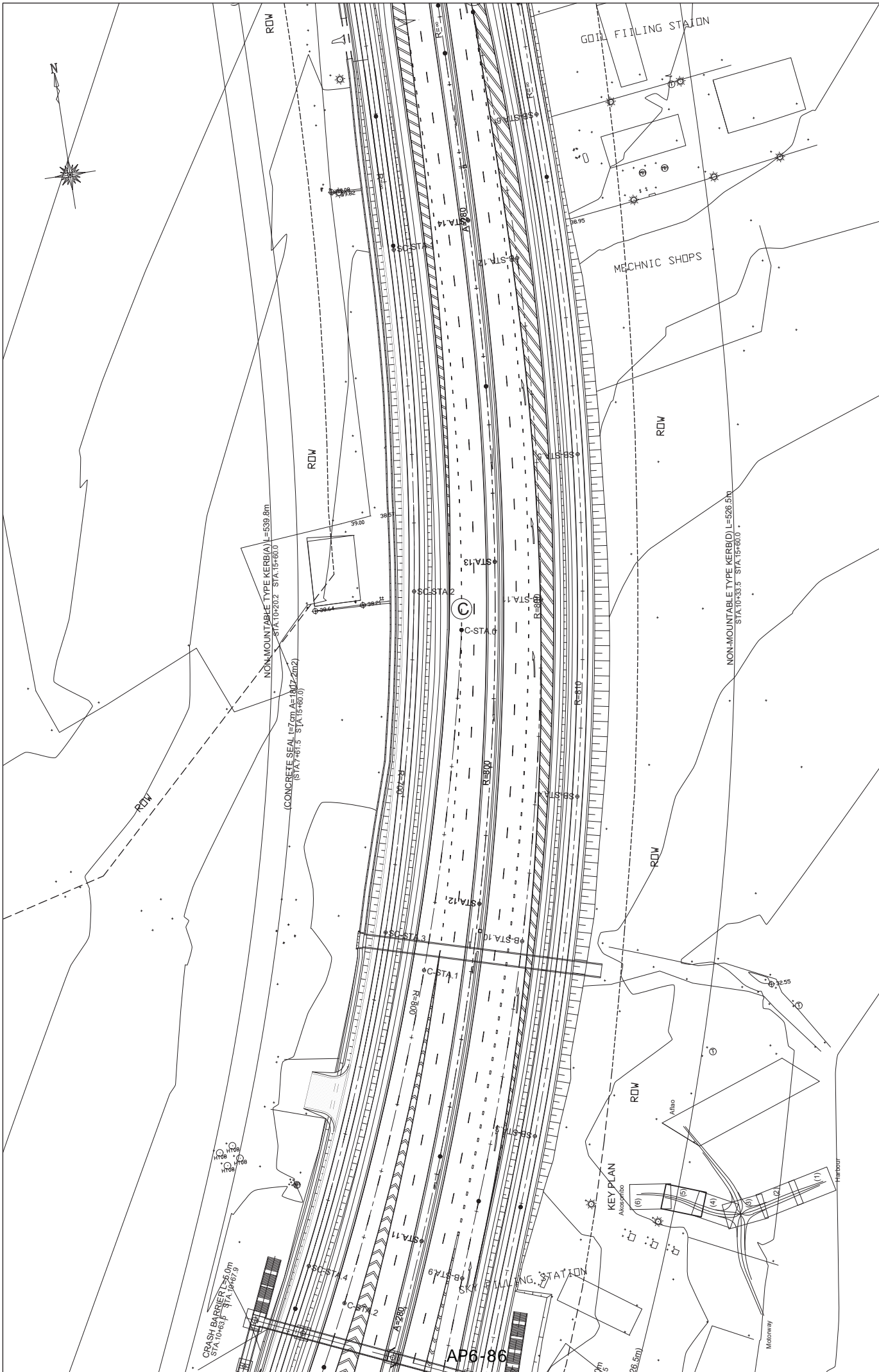
AP6-84

SCALE (A 1899)	DRAWING NO.
1:500	RA-03
PROJECT TITLE:	
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	
PROJECT TITLE:	
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CITI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY



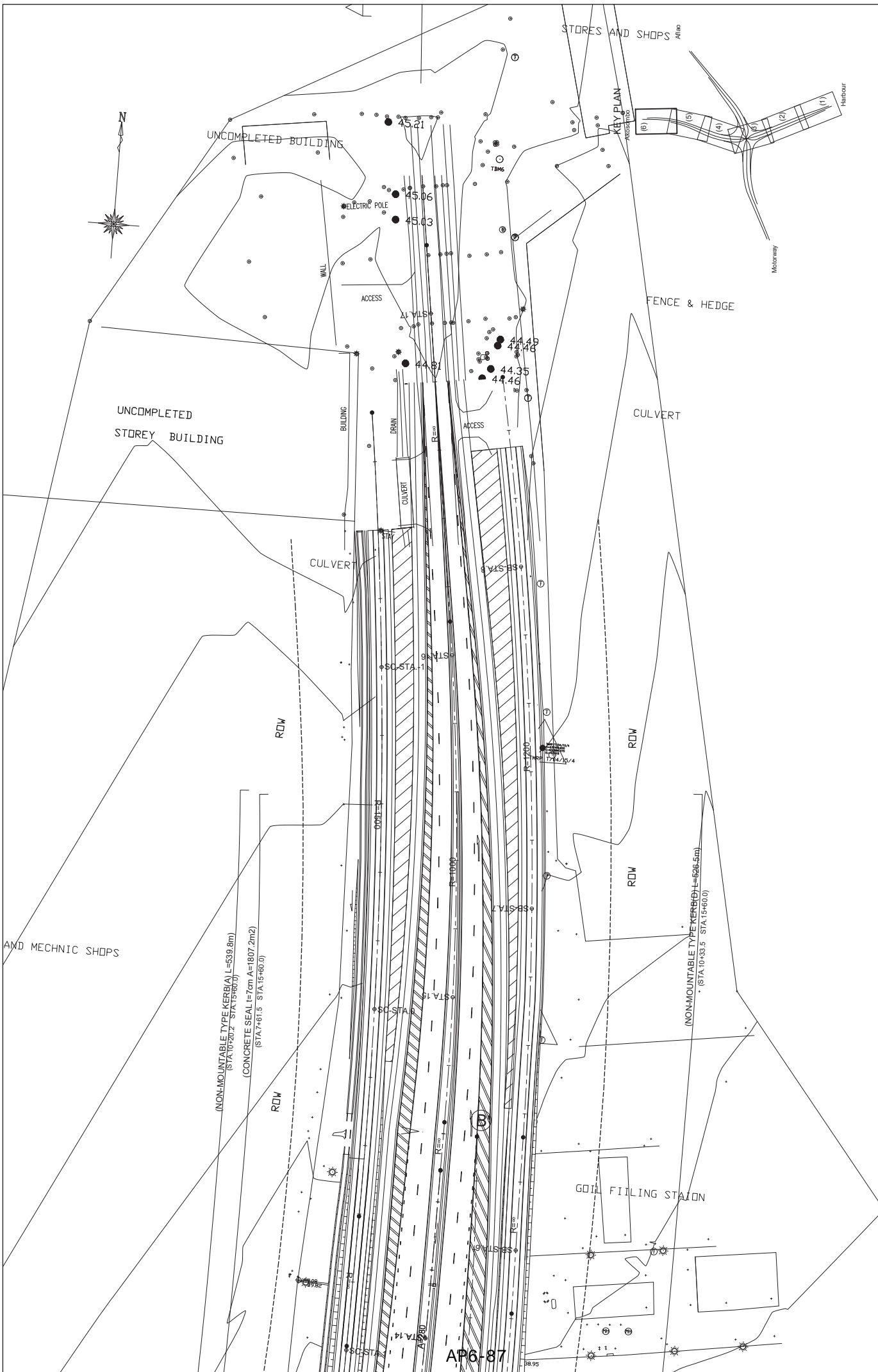
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ANCILLARY PLAN(4)	SCALE (A 1:500)	DRAWING NO. RA-04
			PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	

AP 6-85



AP6-86

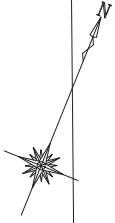
DRAWING NO.	SCALE (A 1:500)	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ANCILLARY PLAN(S)	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
1:500	RA-05	CITI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY		



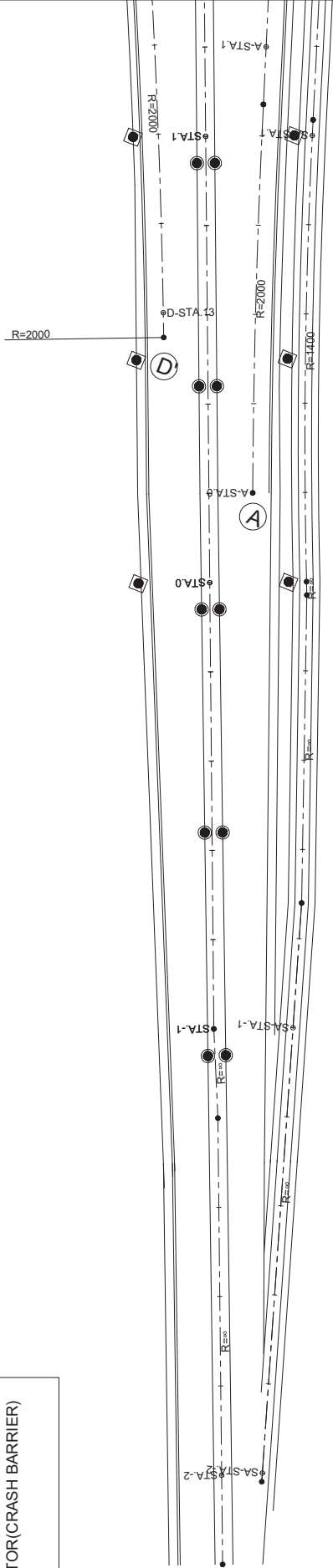
AP6-87

DRAWING NO.	RA-06
SCALE (A 1:500)	1:500
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	ANCILLARY PLAN(G)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY

RUBBER POLE c/c: 50.0m N=8.00
STA: 1+16.00 STA. 2+94.00

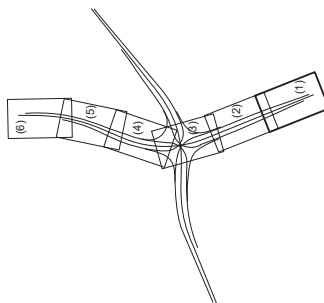


LEGEND	
	: RUBBER POLE (DELINERTOR)
	: REFLECTOR (WALL)
	: CUSHION DRUM
	: RUBBER POLE (DELINERTOR) (PHASE 1 COMPLETED)
	: REFLECTOR (CRASH BARRIER)



RUBBER POLE c/c: 50.0m N=9.00
STA: 1+16.00 STA. 2+94.00

KEY PLAN

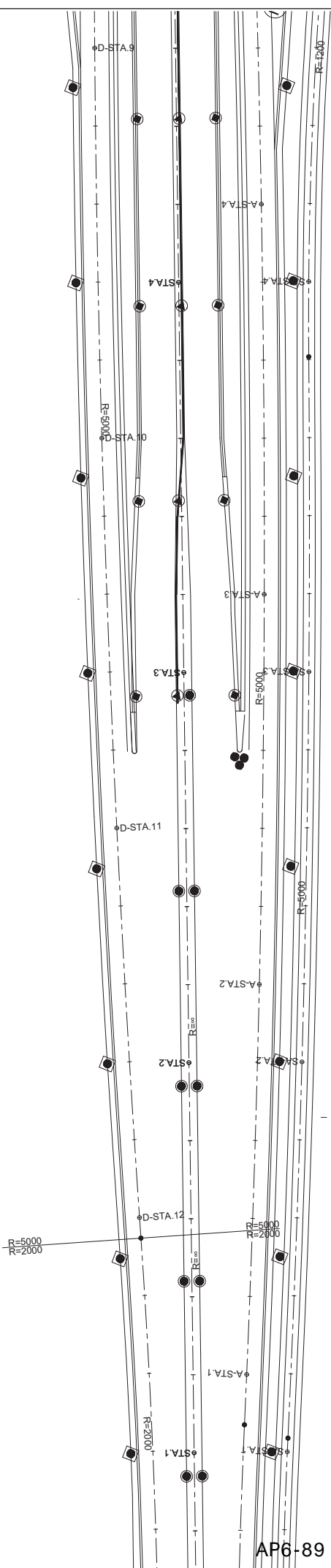


GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		SCALE (A 1829)	DRAWING NO.
		DRAWING TITLE: LAYOUT OF REFLECTOR(1)		1:500	RA-07

REFLECTOR(WALL) c/c:28.0 50.0m N=8.00
 STA.2+34.00 STA.6+22.00

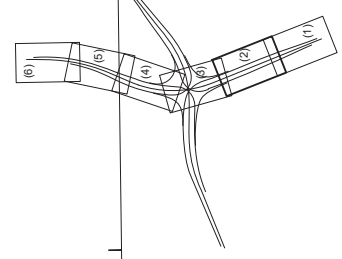
REFLECTOR(CRASH BARRIER) c/c:50.0m N=2.00
 STA.2+34.00 STA.3+44.00

(RUBBER POLE c/c:50.0m N=8.00)
 (STA.-1+6.00 STA.2+34.00)



AP6-89

KEY PLAN



REFLECTOR(CRASH BARRIER) c/c:32.0 50.0m N=6.00
 STA.3+44.00 STA.5+44.00

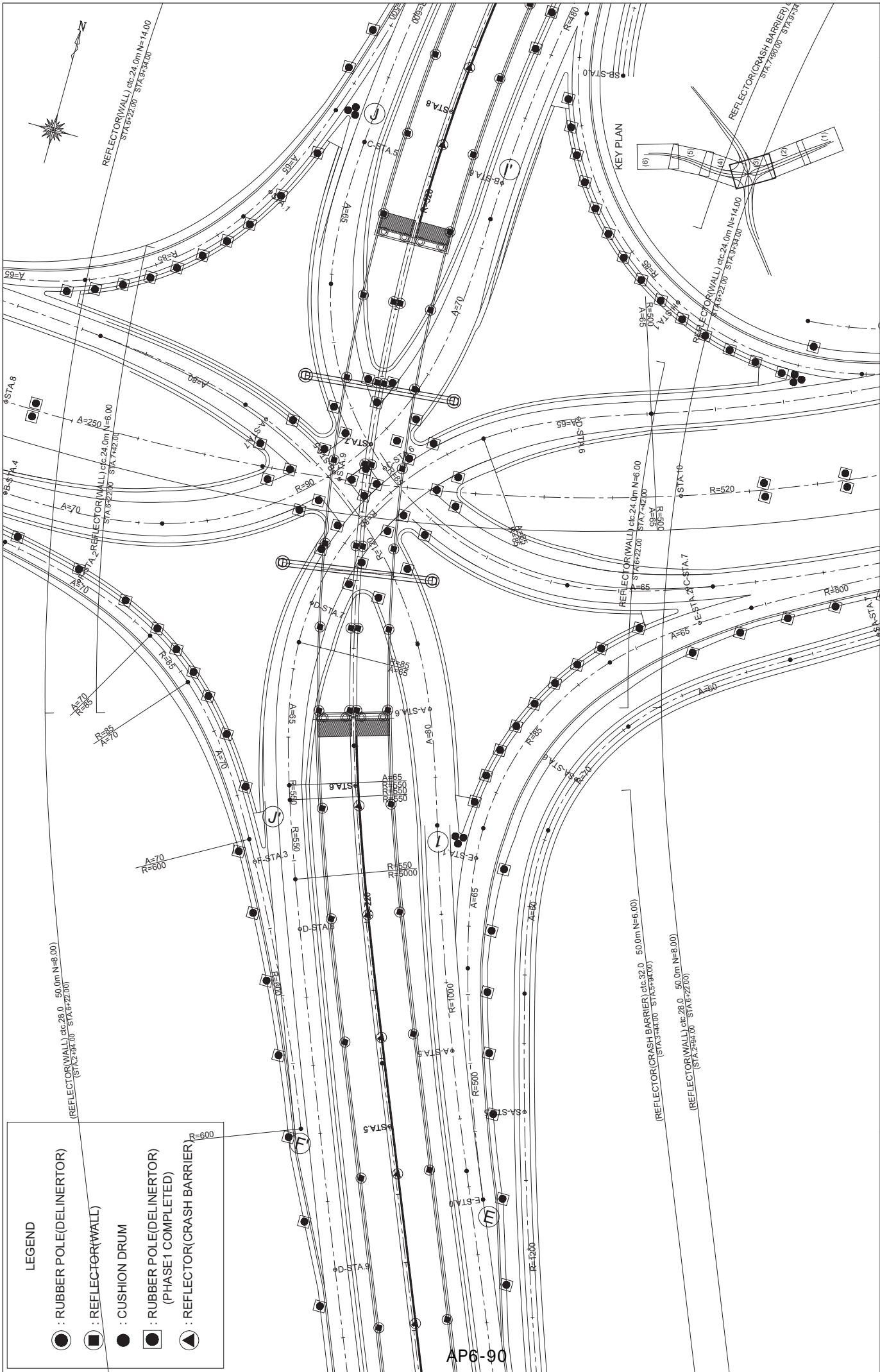
REFLECTOR(WALL) c/c:28.0 50.0m N=8.00
 STA.2+34.00 STA.6+22.00

CUSHION DRUM N=3.0
 STA.2+78.0

(RUBBER POLE c/c:50.0m N=9.00)
 (STA.-1+6.00 STA.2+34.00)

LEGEND	
	: RUBBER POLE(DELINERTOR)
	: REFLECTOR(WALL)
	: CUSHION DRUM
	: RUBBER POLE(DELINERTOR) (PHASE1 COMPLETED)
	: REFLECTOR(CRASH BARRIER)

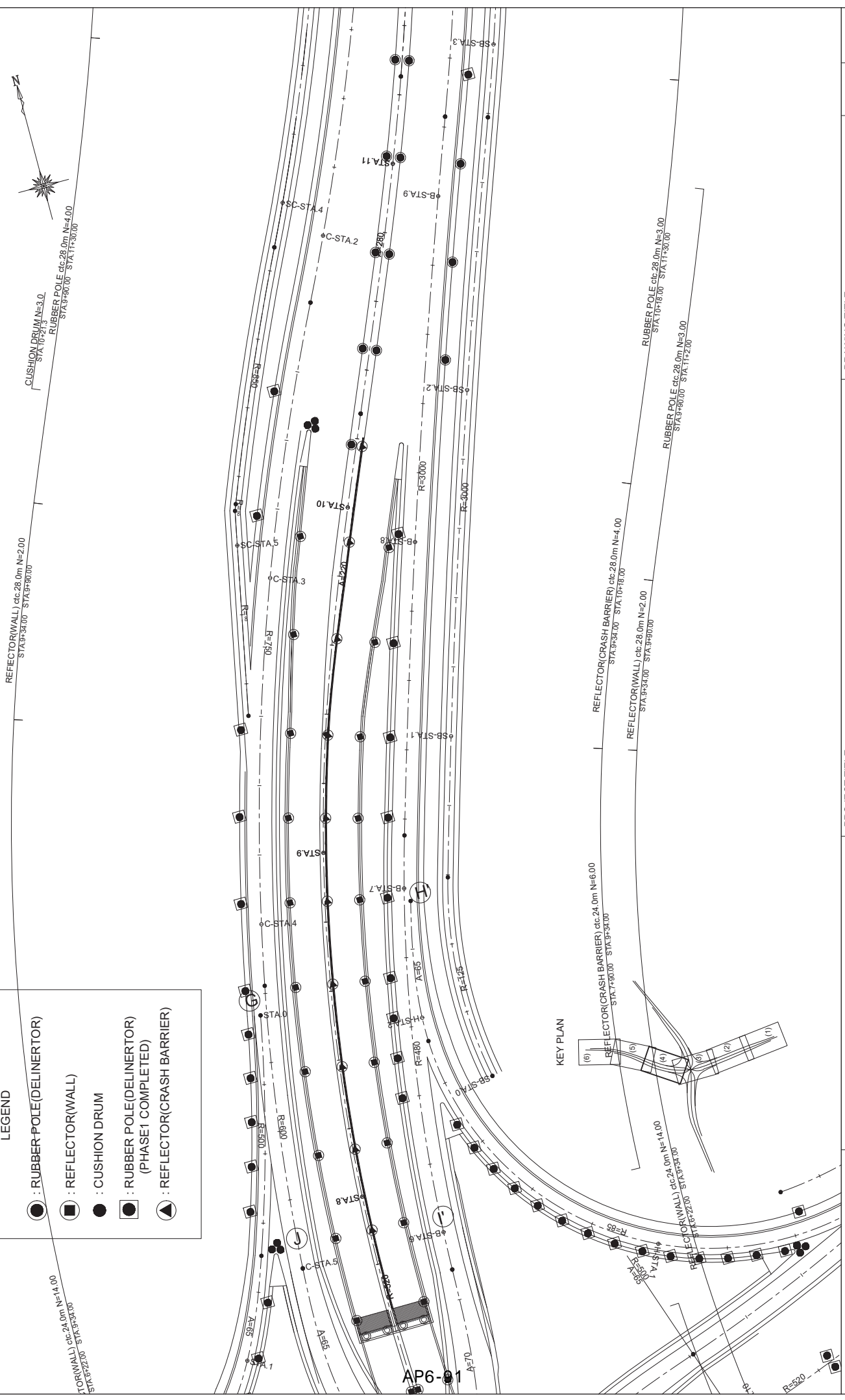
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		SCALE (A Size) 1:500	DRAWING NO. RA-08
		DRAWING TITLE: LAYOUT OF REFLECTOR(2)			



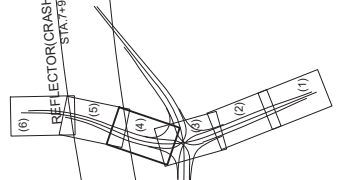
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO.	RA-09
			SCALE (A:1000)	1:500
		DRAWING TITLE:	LAYOUT OF REFLECTOR(3)	

LEGEND

- : RUBBER-POLE(DELINERTOR)
- : REFLECTOR(WALL)
- : CUSHION DRUM
- ⊙ : RUBBER POLE(DELINERTOR)
(PHASE1 COMPLETED)
- ▲ : REFLECTOR(CRASH BARRIER)

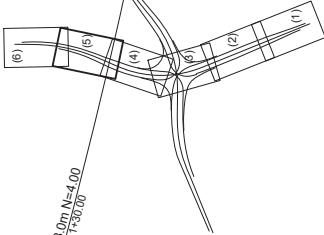


KEY PLAN



DRAWING NO.	RA-10
SCALE (A 1:500)	DRAWING TITLE: LAYOUT OF REFLECTOR(4)
PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: LAYOUT OF REFLECTOR(4)
CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA

KEY PLAN



DRUM N=3.0
RUBBER POLE c/c: 28.0m N=4.00
STA. 13*30.00 STA. 13*30.00

RUBBER POLE c/c: 40.0m N=3.00
STA. 13*30.00 STA. 13*70.00

RUBBER POLE c/c: 36.0m N=1.00
STA. 13*54.00 STA. 13*50.00

RUBBER POLE c/c: 32.0m N=7.00
STA. 13*30.00 STA. 13*54.00

RUBBER POLE c/c: 32.0m N=7.00
STA. 13*30.00 STA. 13*54.00

RUBBER POLE c/c: 36.0m N=1.00
STA. 13*54.00 STA. 13*50.00

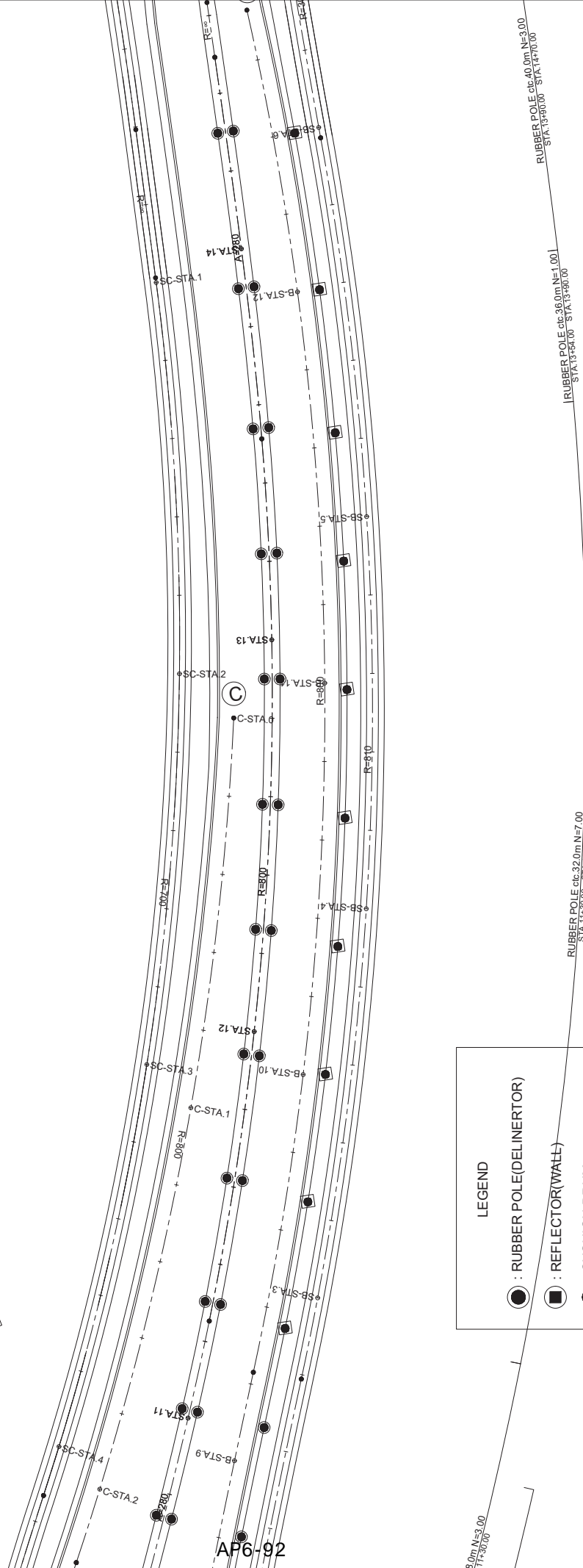
RUBBER POLE c/c: 40.0m N=3.00
STA. 13*30.00 STA. 13*70.00

8.0m N=3.00
13*30.00

AP6-92

LEGEND

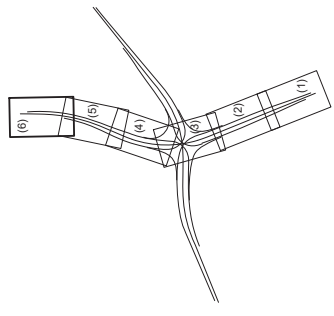
- : RUBBER POLE(DELINERTOR)
- : REFLECTOR(WALL)
- : CUSHION DRUM
- : RUBBER POLE(DELINERTOR)
(PHASE 1 COMPLETED)
- ▲ : REFLECTOR(CRASH BARRIER)



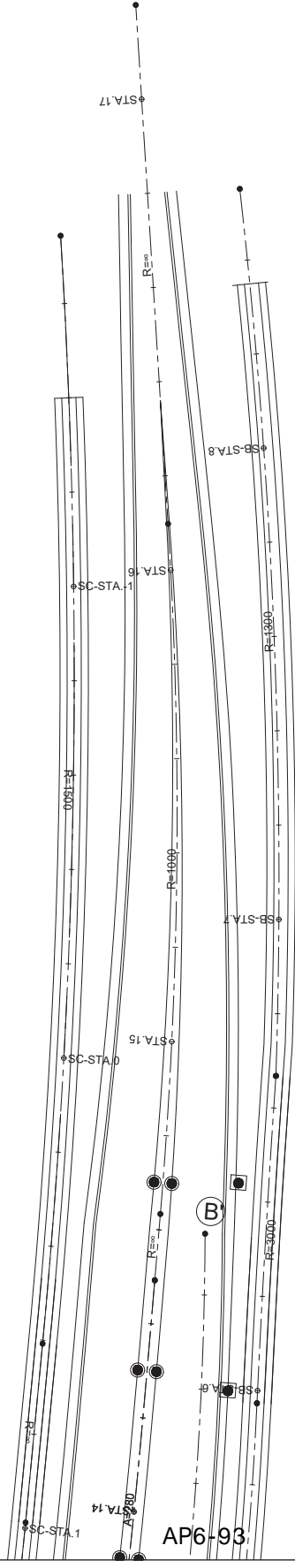
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	DRAWING TITLE: LAYOUT OF REFLECTOR(5)	
		SCALE (A 1:500)	DRAWING NO. RA-11



KEY PLAN



0m N=1.00
3=300.00
RUBBER POLE c/c 40.0m N=3.00
STA.13730.00 STA.14470.00



AP6-93

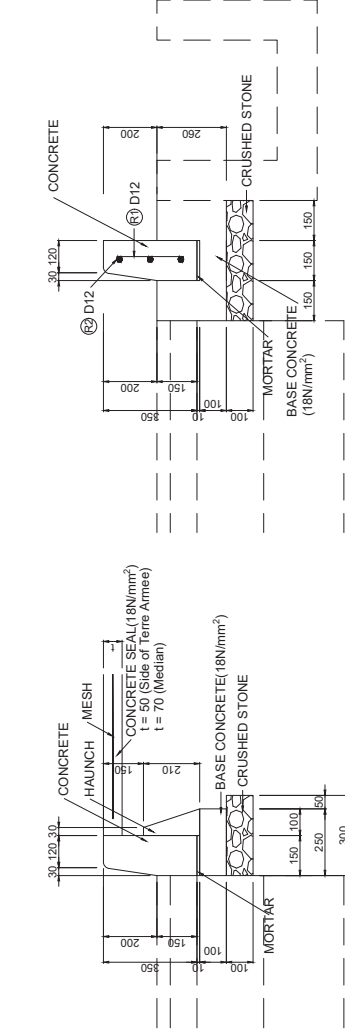
RUBBER POLE c/c 40.0m N=3.00
STA.13730.00 STA.14470.00

LEGEND

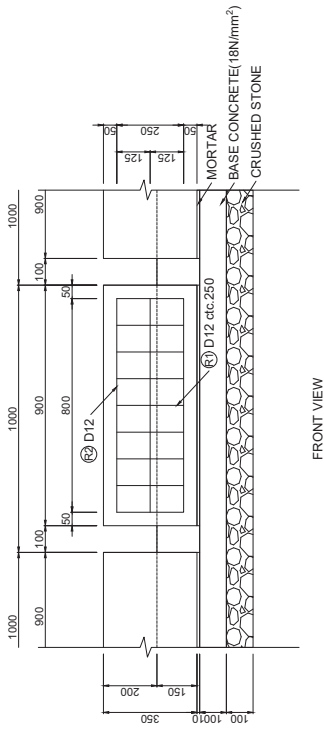
- : RUBBER POLE(DELINERTOR)
- : REFLECTOR(WALL)
- : CUSHION DRUM
- ◼ : RUBBER POLE(DELINERTOR) (PHASE1 COMPLETED)
- ▲ : REFLECTOR(CRASH BARRIER)

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		SCALE (A 1:500)	DRAWING NO.
		DRAWING TITLE: LAYOUT OF REFLECTOR(6)		1:500	RA-12

MEDIAN BLOCK, KERB AND EDGE BLOCK (FLUSH KERB)



NON-MOUNTABLE TYPE KERB (A)



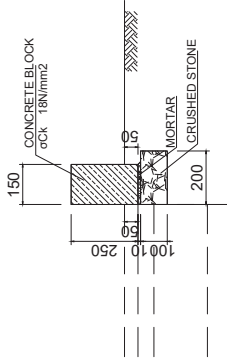
FRONT VIEW

NON-MOUNTABLE TYPE KERB (D)

SCHEDULE OF ROAD ANCILLARY NON-MOUNTABLE TYPE KERB, EDGE BLOCK, CONCRETE SEAL

NON-MOUNTABLE TYPE KERB(A)			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	-1 + 30.0	2 + 91.0	LEFT 421.0
2	-1 + 30.0	6 + 14.5	RIGHT 744.5
3	2 + 79.4	6 + 21.5	LEFT 363.9
4	2 + 79.4	6 + 21.5	RIGHT 363.9
5	6 + 21.5	-	22.1
6	7 + 59.5	-	22.1
7	7 + 59.5	10 + 20.6	LEFT 272.9
8	7 + 59.5	10 + 20.6	RIGHT 272.9
9	7 + 66.5	10 + 33.5	RIGHT 267.0
10	10 + 20.2	15 + 60.0	LEFT 598.8
TOTAL			3270.1

NON-MOUNTABLE TYPE KERB(D)			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	2 + 91.0	6 + 14.5	LEFT 323.5
2	7 + 66.5	10 + 20.2	LEFT 263.7
3	10 + 33.5	15 + 60.0	RIGHT 526.5
TOTAL			1103.7



EDGE BLOCK

EDGE BLOCK			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
A-RAMP			
1	6 + 90.3	7 + 17.1	LEFT 26.7
B-RAMP			
1	4 + 66.6	4 + 82.5	LEFT 25.9
C-RAMP			
1	6 + 20.7	6 + 64.9	LEFT 39.5
D-RAMP			
1	6 + 1.7	6 + 43.0	LEFT 38.4
TOTAL			130.5

CONCRETE SEAL 15cm			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	2 + 90.0	6 + 21.5	- 239.8
2	7 + 66.5	10 + 10.0	- 190.5
TOTAL			430.3

CONCRETE SEAL 17cm			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	-1 + 30.0	6 + 19.5	- 1933.3
2	7 + 61.5	15 + 60.0	- 1807.2
3	2 + 80.0	2 + 90.0	LEFT 10.8
4	2 + 80.0	2 + 90.0	RIGHT 15.0
5	10 + 10.0	10 + 20.0	LEFT 14.3
6	10 + 10.0	10 + 20.0	RIGHT 13.2
TOTAL			3793.8

Ghana Highway Authority
Ministry of Roads and Highways
Republic of Ghana

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
MEDIAN BLOCK, KERB AND EDGE BLOCK
(FLUSH KERB)

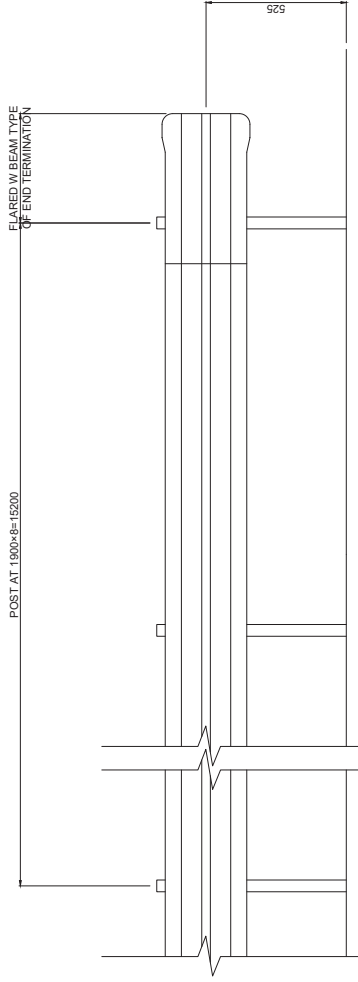
SCALE: (A1/100)
1:10
DRAWING NO.
RA-13

CRASH BARRIER

SCHEDULE OF ROAD ANCILLARY CRASH BARRIER

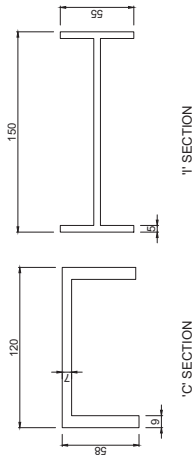
NO.	CRASH BARRIER		LENGTH	REMARKS
	"STARTING STATION"	"ENDING STATION"		
Harbour-Akesim to Road				
1	2 + 86.1	2 + 80.5	RIGHT	5.0
2	2 + 87.0	3 + 60.0	LEFT	73.0
3	9 + 40.0	10 + 20.0	RIGHT	80.0
4	10 + 62.1	10 + 66.5	RIGHT	5.0
5	10 + 63.5	10 + 67.9	LEFT	5.0
A-RAMP				
1	6 + 25.0	6 + 44.0	RIGHT	60.0
B-RAMP				
1	4 + 66.0	4 + 85.0	RIGHT	72.0
C-RAMP				
1	5 + 57.0	5 + 73.0	RIGHT	56.0
D-RAMP				
1	6 + 24.0	6 + 40.0	RIGHT	64.0
			TOTAL	420.0

CRASH BARRIER

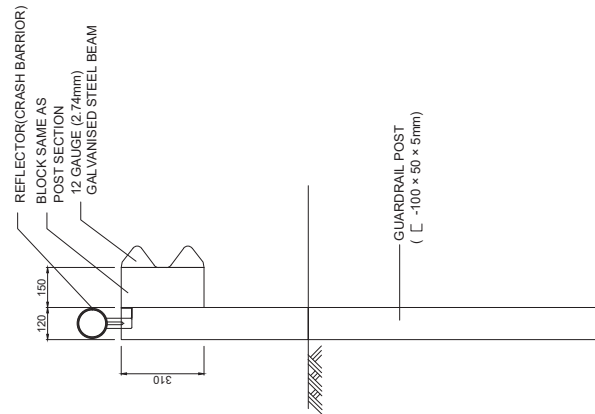


(ALL LAPS IN DIRECTION OF TRAFFIC)

FRONT VIEW
S=1:10

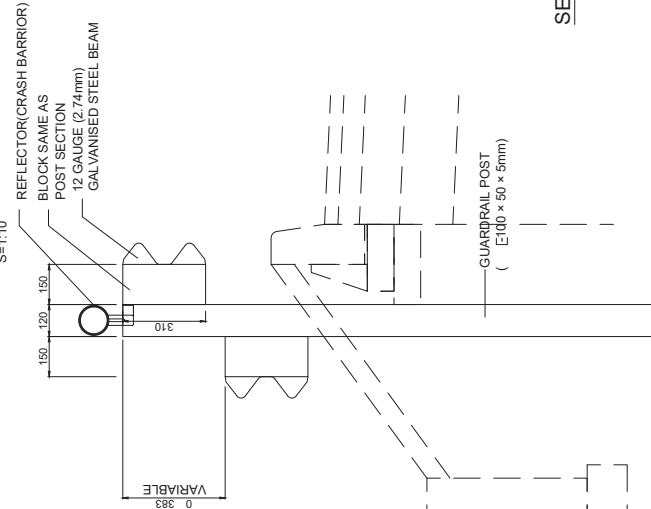


TYPICAL POST SECTION
S=1:2



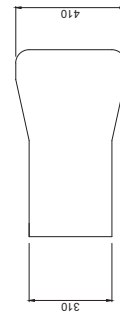
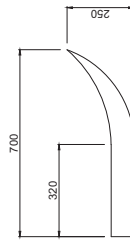
Beam On One side
CRASH BARRIER

TYPICAL POST DETAIL
S=1:10



SECTION THROUGH W-BEAM
S=1/5

NO.	CRASH BARRIER(W)		LENGTH	REMARKS
	"STARTING STATION"	"ENDING STATION"		
Harbour-Akesim to Road				
1	3 + 60.0	6 + 14.5	RIGHT	254.5
2	7 + 66.5	9 + 40.0	RIGHT	173.5
			TOTAL	428.0



W-BEAM TERMINAL SECTION
S=1:10

Beam On Both sides
CRASH BARRIER(W)

NOTE :
Crash Barrier at ends should be in accordance with the standards of Ghana.
or as instructed by the Engineer.

Ghana Highway Authority
Ministry of Roads and Highways
Republic of Ghana

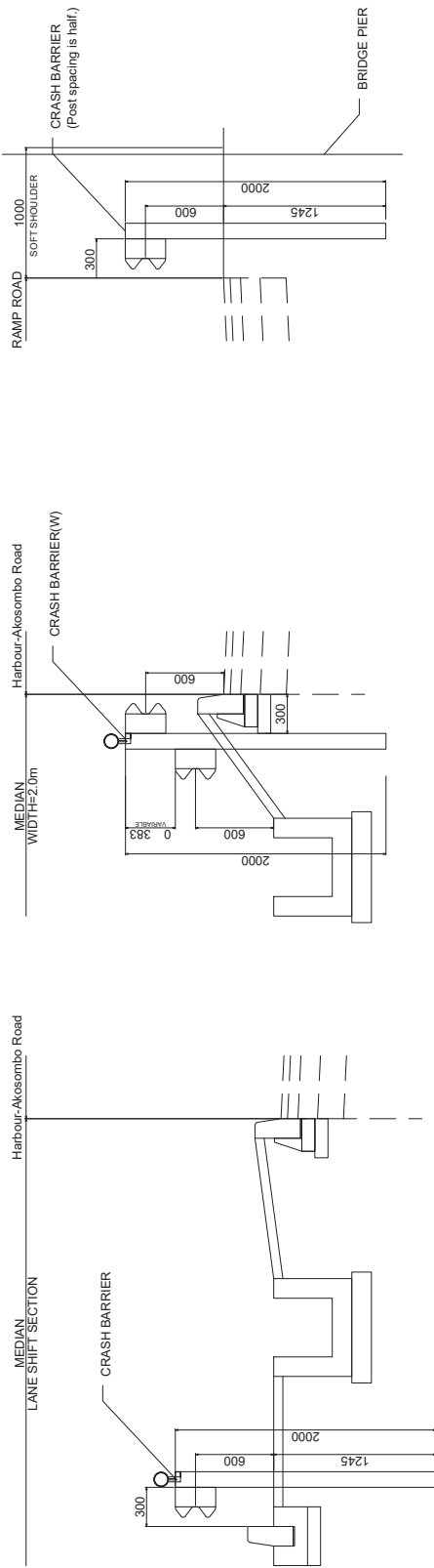
PROJECT TITLE:
CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

DRAWING TITLE:
CRASH BARRIER

SCALE (A/100)
1:10

DRAWING NO.
RA-14

DETAIL OF CRASH BARRIER



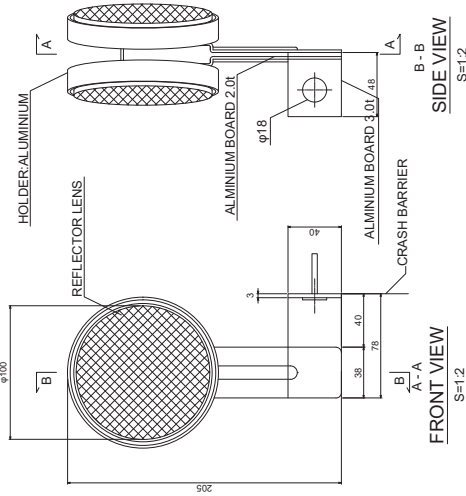
Harbour-Akosombo Road
LANE SHIFT SECTION

Harbour-Akosombo Road
MEDIAN WIDTH=2.0m SECTION

INTERSECTION
PROTECTION BRIDGE PIER SECTION

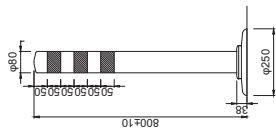
<p>G HANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)</p>	<p>DRAWING TITLE: DETAIL OF CRASH BARRIER</p>	<p>SCALE (A1/100)</p> <p>1:10</p>	<p>DRAWING NO.</p> <p>RA-15</p>
--	---	---	---	-----------------------------------	---------------------------------

REFLECTOR



FRONT VIEW
S=1:10

RUBBER POLE (DELINEATOR)



FRONT VIEW
S=1:10

SCHEDULE OF ROAD ANCILLARY RUBBER POLE (DELINEATOR), CUSHION DRUM

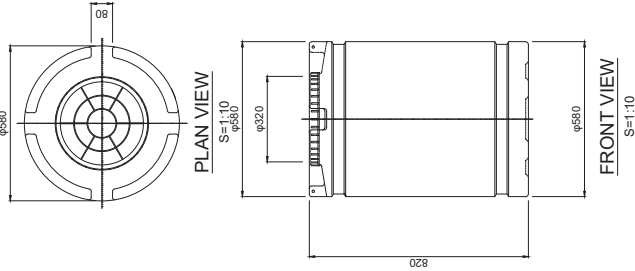
RUBBER POLE (DELINEATOR)			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	-1 + 6.0	2 + 94.0	LEFT 8.0
2	-1 + 6.0	2 + 94.0	RIGHT 9.0
3	9 + 90.0	11 + 30.0	LEFT 4.0
4	9 + 90.0	11 + 2.0	RIGHT 3.0
5	10 + 18.0	11 + 30.0	RIGHT 3.0
6	11 + 30.0	13 + 54.0	LEFT 7.0
7	11 + 30.0	13 + 54.0	RIGHT 7.0
8	13 + 54.0	13 + 90.0	LEFT 1.0
9	13 + 54.0	13 + 90.0	RIGHT 1.0
10	13 + 90.0	14 + 70.0	LEFT 3.0
11	13 + 90.0	14 + 70.0	RIGHT 3.0
TOTAL			49.0

REFLECTOR (WALL)			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	2 + 94.0	6 + 22.0	LEFT 8.0
2	2 + 94.0	6 + 22.0	RIGHT 8.0
3	6 + 22.0	9 + 34.0	LEFT 14.0
4	6 + 22.0	9 + 34.0	RIGHT 14.0
5	6 + 22.0	7 + 42.0	LEFT 6.0
6	6 + 22.0	7 + 42.0	RIGHT 6.0
7	9 + 34.0	9 + 90.0	LEFT 2.0
8	9 + 34.0	9 + 90.0	RIGHT 2.0
TOTAL			60.0

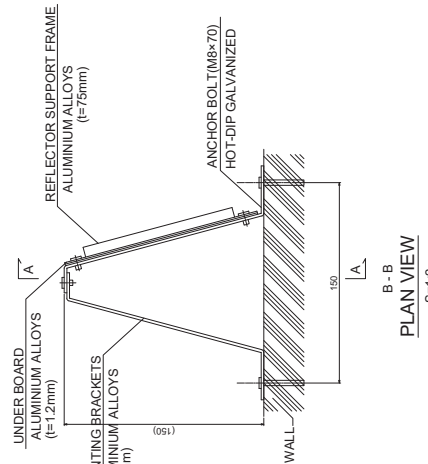
REFLECTOR (CRASH BARRIER)			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	2 + 94.0	3 + 44.0	LEFT 2.0
2	3 + 44.0	5 + 94.0	RIGHT 6.0
3	7 + 90.0	9 + 34.0	RIGHT 6.0
4	9 + 34.0	10 + 16.0	RIGHT 4.0
TOTAL			18.0

CUSHION DRUM			
NO.	"STARTING STATION"	"ENDING STATION"	REMARKS
Harbour-Akosombo Road			
1	2 + 78.0		RIGHT 3.0
2	10 + 21.3		LEFT 3.0
TOTAL			6.0

REFLECTOR (CRASH BARRIER)



CUSHION DRUM



FRONT VIEW (MAGNIFICATION)
S=1:2

REFLECTOR (WALL)

The orange reflector uses a special fluorescent prism lens
The anchor bolt uses a core rod drive type male screw anchor (drill diameter ϕ 8.5, depth 40 mm)

NOTE :
Exact installation location shall be as instructed/approved by the Engineer.
Replacement by other equivalent material may be acceptable upon approval by the Engineer

Ghana Highway Authority Ministry of Roads and Highways Republic of Ghana	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: REFLECTOR	SCALE: (A/100)	DRAWING NO.
			1:10	RA-16

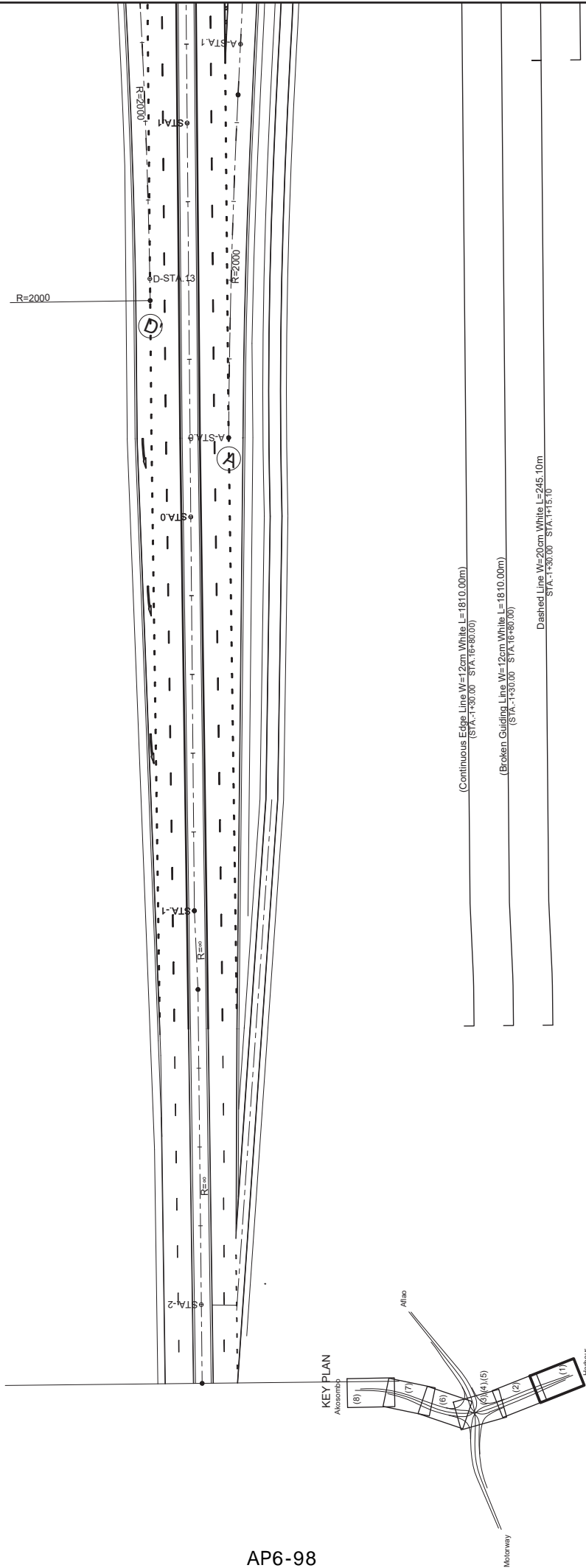


Deflecting Arrows L=7.5m White N=3.00
 STA: 1+30.00 STA: 20.00

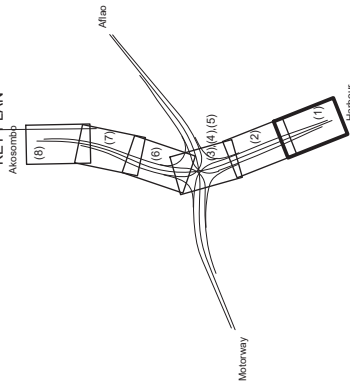
Dashed Line W=20cm White L=295.10m
 STA: 1+30.00 STA: 1+65.10

(Broken Guiding Line W=12cm White L=1810.00m)
 (STA: 1+30.00 STA: 16+80.00)

(Continuous Edge Line W=12cm White L=1810.00m)
 (STA: 1+30.00 STA: 16+80.00)

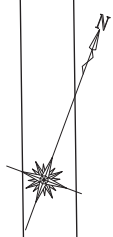


KEY PLAN



AP6-98

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO. RA-17	SCALE (A1100) 1:500	DRAWING TITLE: LAYOUT OF PAVEMENT MARKINGS(1)
--	---	--	----------------------	------------------------	---

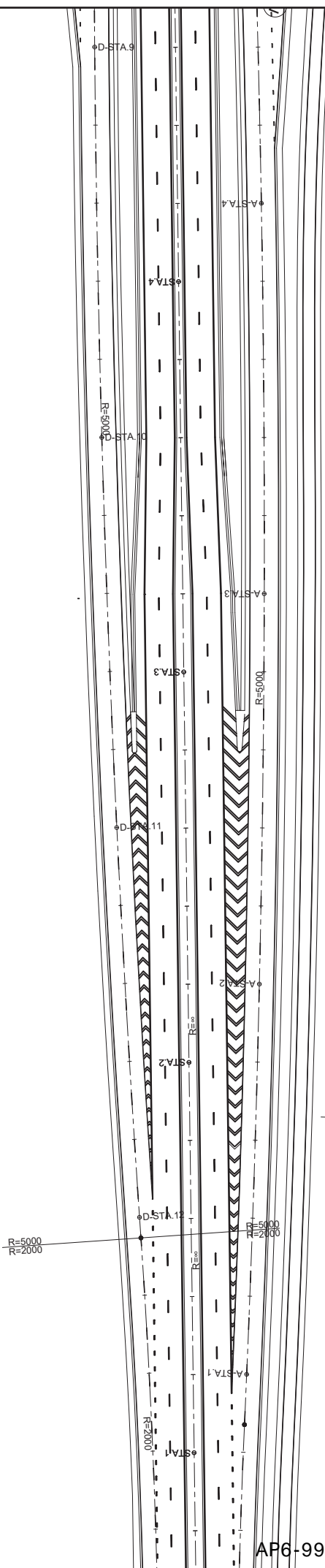


Chevrons W=45cm White A=328.40m²
 (STA.1+65.10 - STA.2+83.38)

(Continuous Edge Line W=12cm White L=1019.80m)
 (STA.1+65.10 - STA.1+84.30)

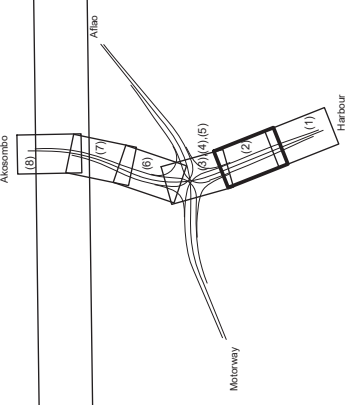
(Broken Guiding Line W=12cm White L=1810.00m)
 (STA.1+30.00 - STA.1+80.00)

(Continuous Edge Line W=12cm White L=1810.00m)
 (STA.1+30.00 - STA.1+80.00)



AP6-99

KEY PLAN
 Accombo



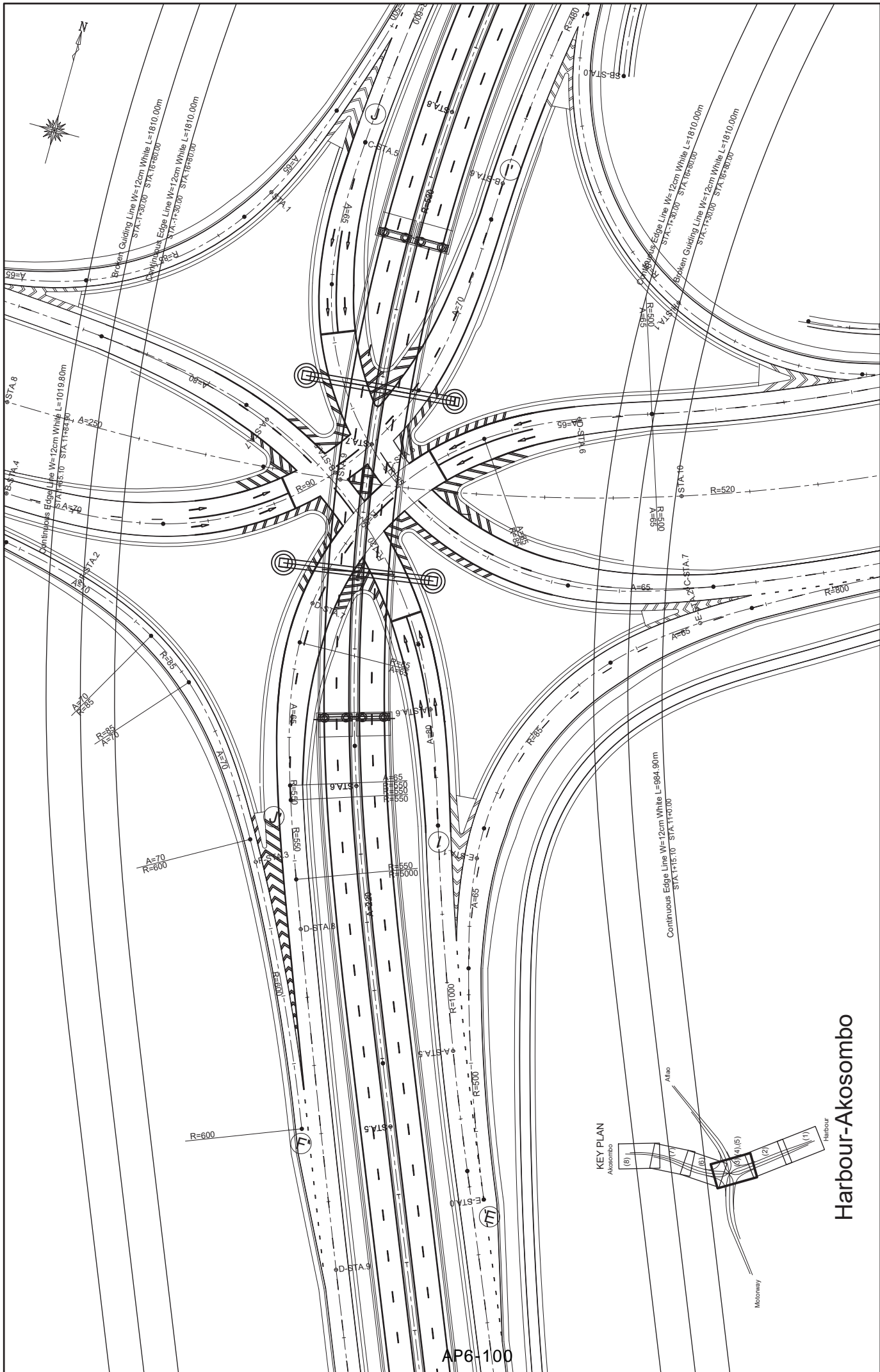
(Continuous Edge Line W=12cm White L=1810.00m)
 (STA.1+30.00 - STA.1+80.00)

(Broken Guiding Line W=12cm White L=1810.00m)
 (STA.1+30.00 - STA.1+80.00)

(Continuous Edge Line W=12cm White L=984.90m)
 (STA.1+15.10 - STA.1+40.00)

Chevrons W=45cm White A=651.40m²
 (STA.1+15.10 - STA.2+91.00)

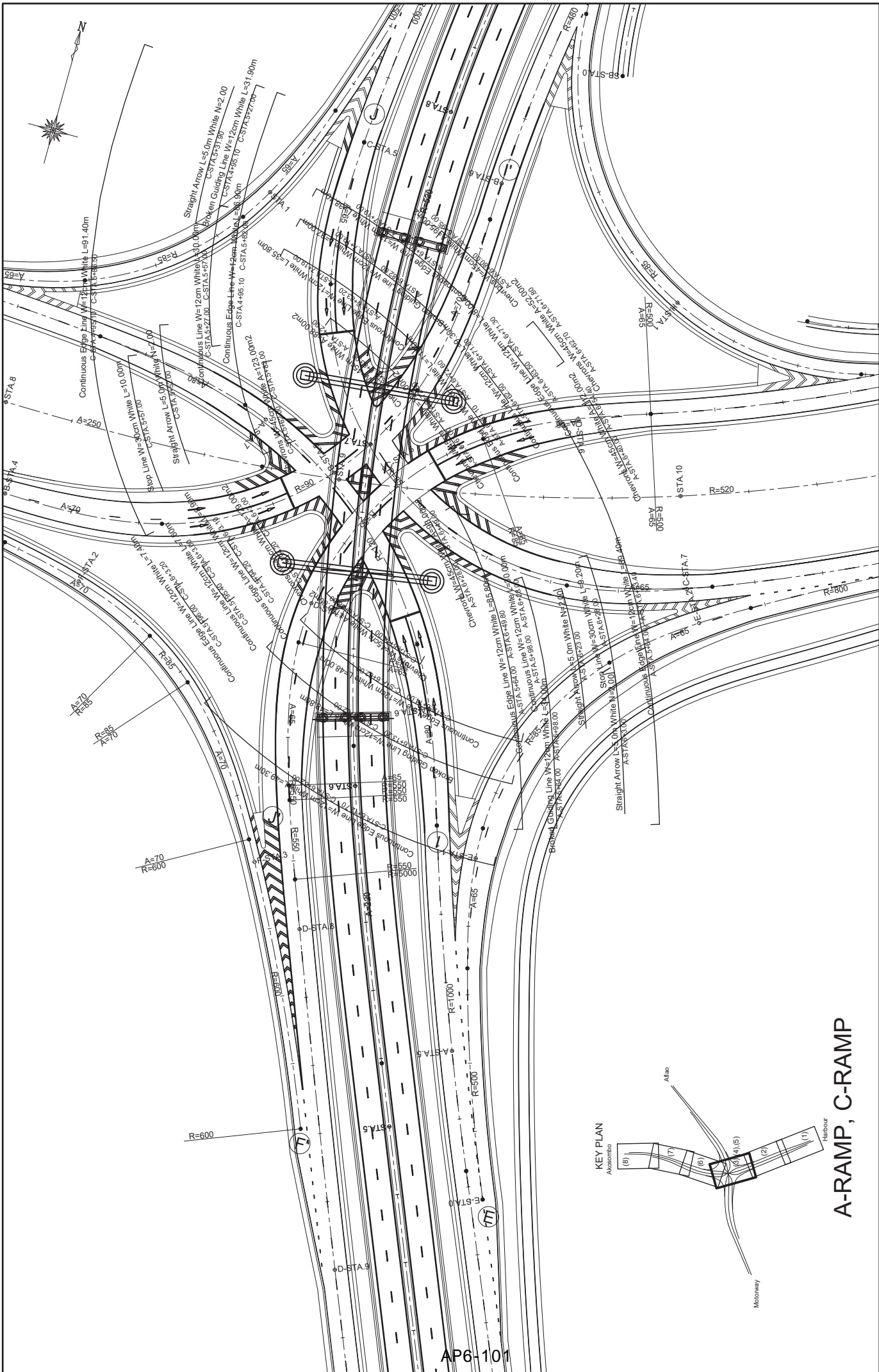
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: LAYOUT OF PAVEMENT MARKINGS(2)	SCALE (A1size) 1:500 DRAWING NO. RA-18
--	---	--	---	---



AP6-100

Harbour-Akosombo

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: LAYOUT OF PAVEMENT MARKINGS(3)	SCALE (A1189) 1:500	DRAWING NO. RA-19
--	---	--	---	------------------------	----------------------



A-RAMP, C-RAMP

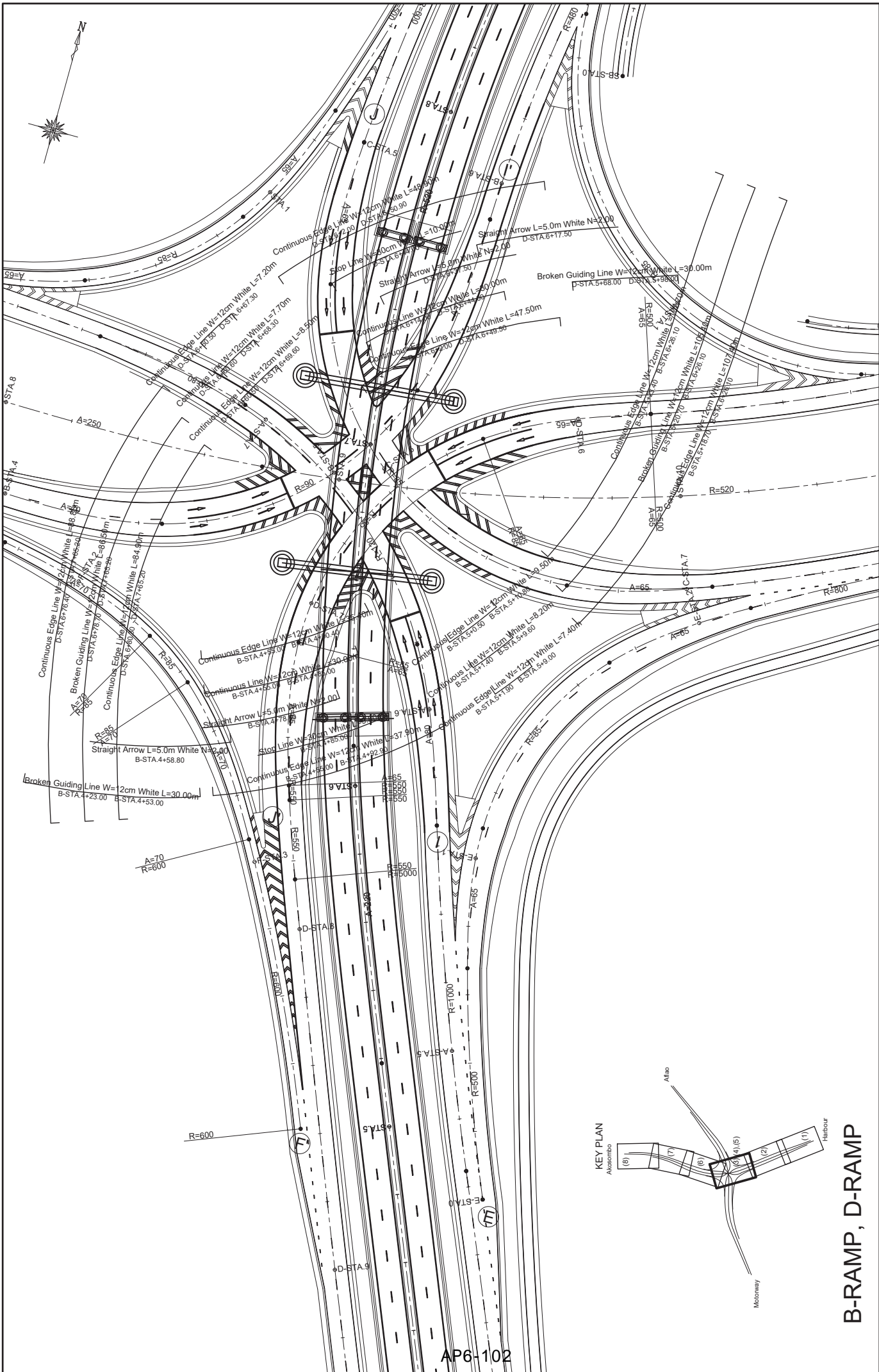
GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
 THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
 (PHASE 2)

DRAWING TITLE:
 LAYOUT OF
 PAVEMENT MARKINGS(4)

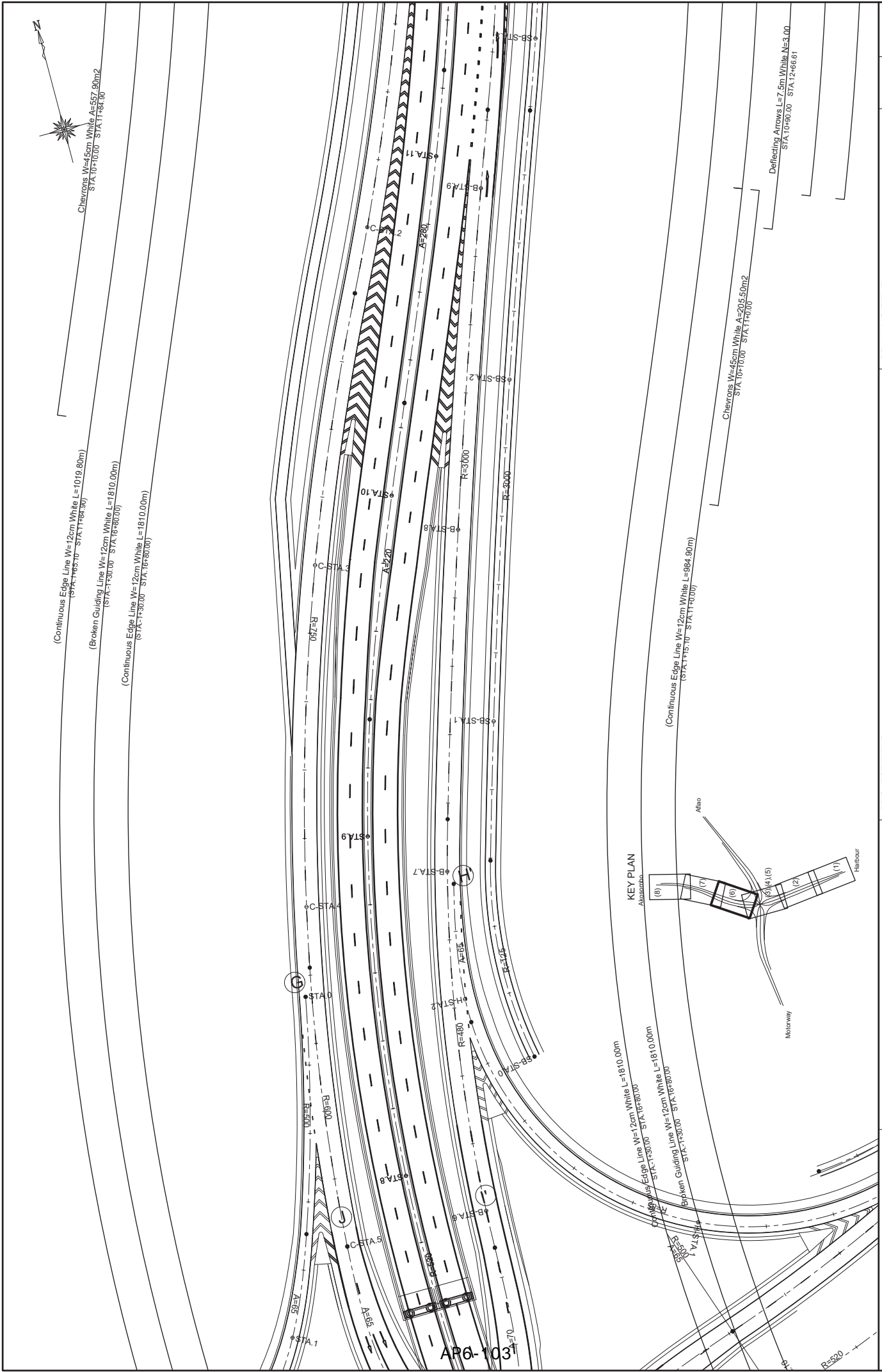
SCALE (A119) 1:500
 DRAWING NO. RA-20



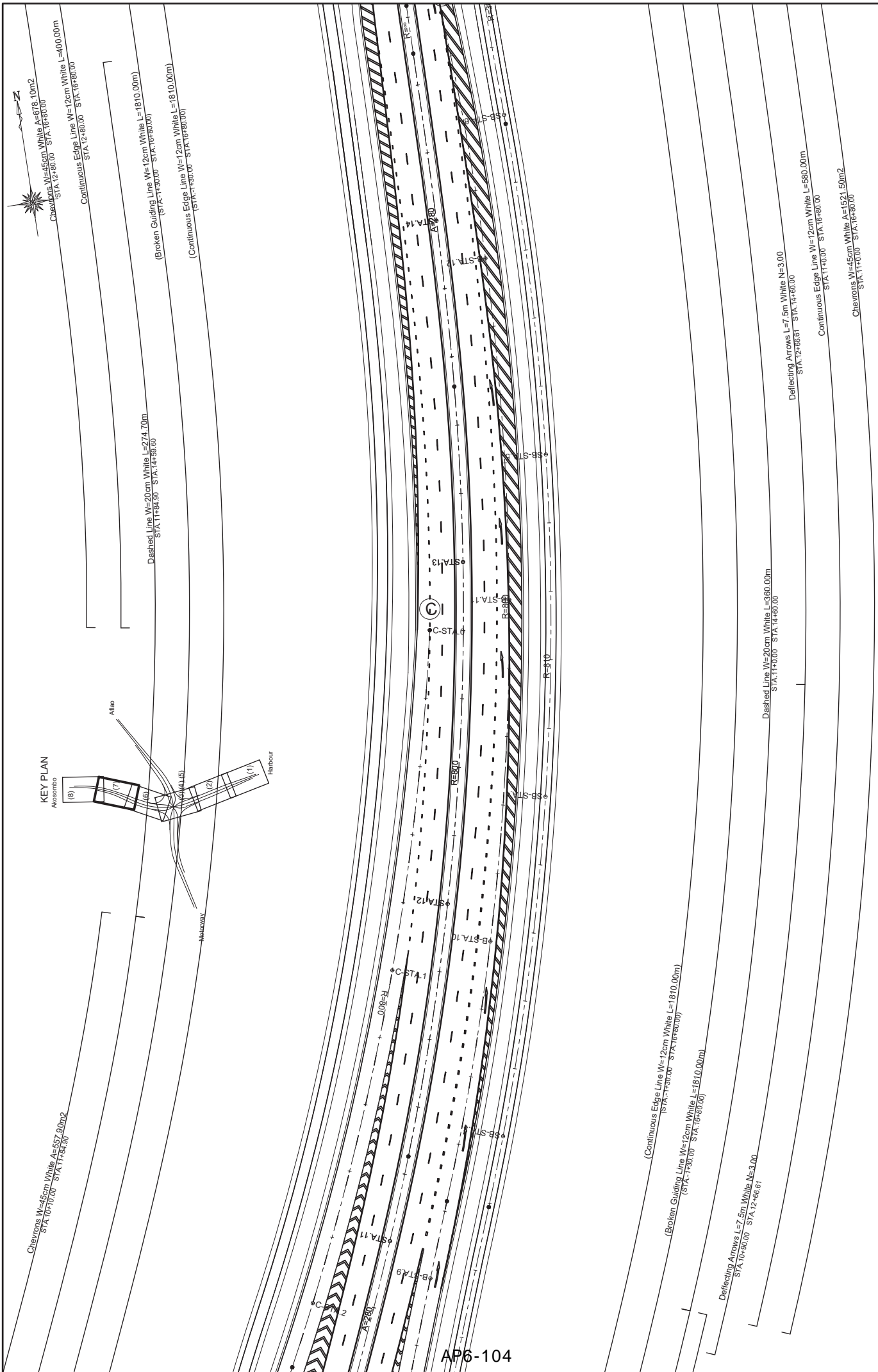
AP6-102

SCALE (A119)	DRAWING NO.	PROJECT TITLE:	DRAWING NO.
1:500	RA-21	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	LAYOUT OF PAVEMENT MARKINGS(S)
CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY		THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA

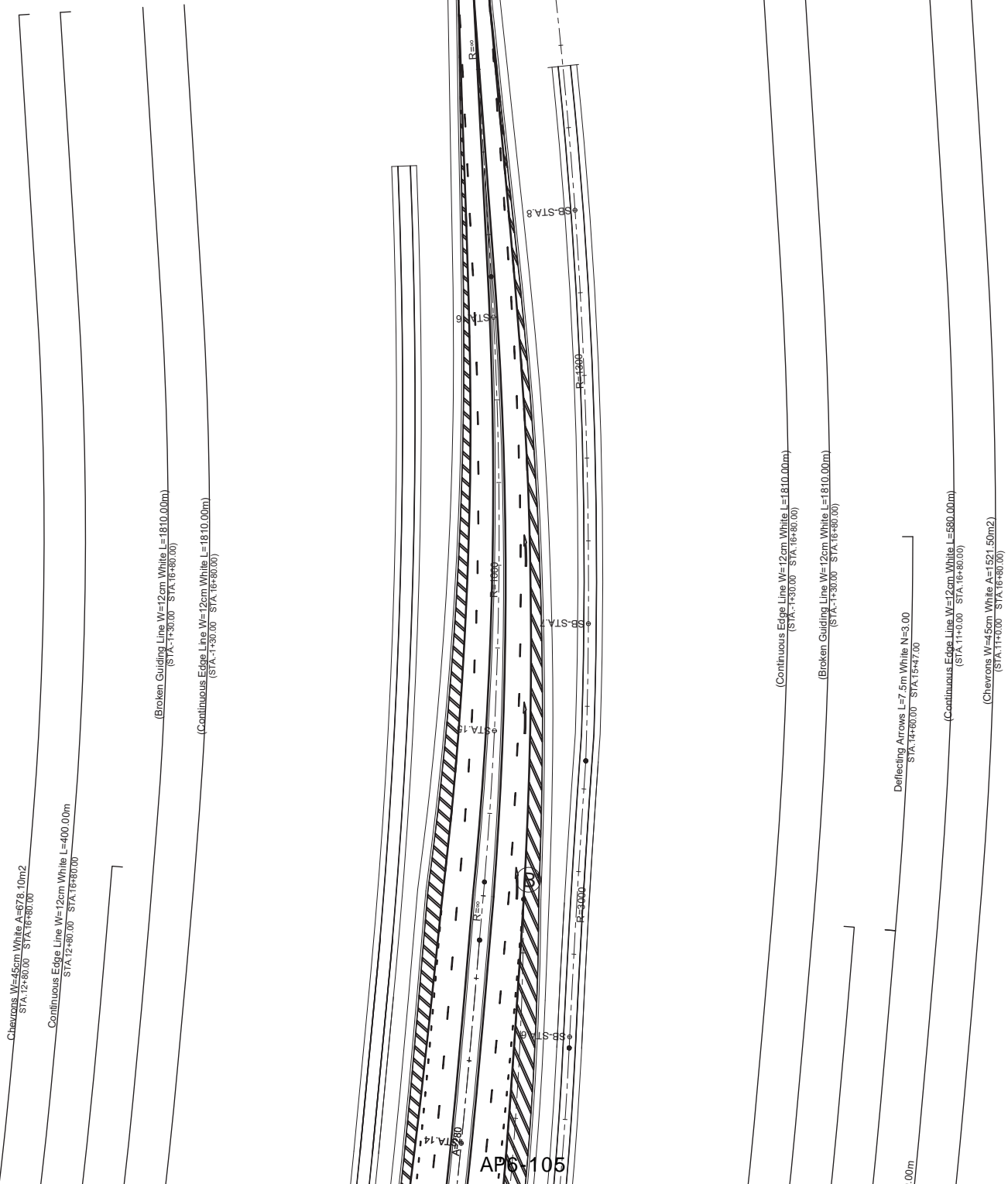
B-RAMP, D-RAMP



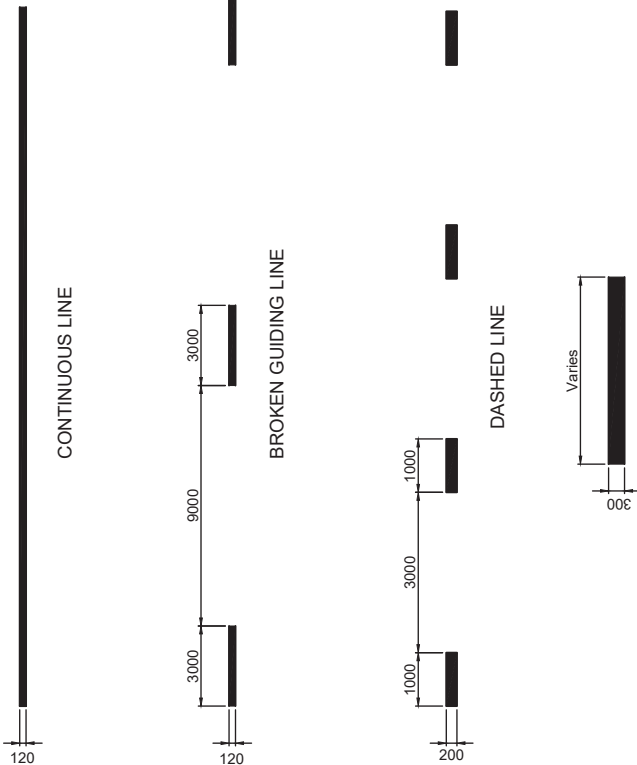
SCALE (A119)	DRAWING NO. RA-22
PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: LAYOUT OF PAVEMENT MARKINGS(6)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY



SCALE (A119)	DRAWING NO.	PROJECT TITLE:	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
1:500	RA-23	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	
DRAWING TITLE:		LAYOUT OF PAVEMENT MARKINGS(7)	



DRAWING NO.	RA-24
SCALE (At 1:500)	1:500
DRAWING TITLE:	LAYOUT OF PAVEMENT MARKINGS(8)
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
CLIENT:	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY
AUTHORITY:	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA



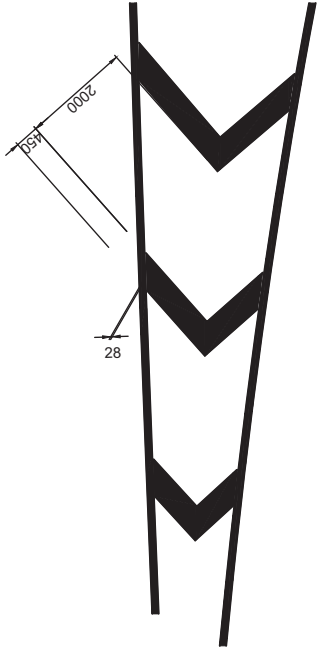
CONTINUOUS LINE

BROKEN GUIDING LINE

DASHED LINE

STOP LINE

AP6-106



CHEVRONS

SCHEDULE OF DRAINAGE

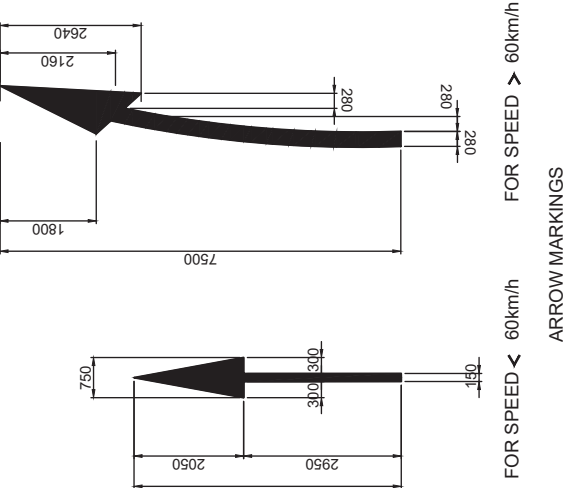
Continuous Line		Broken Guiding Line		Chevrans	
NO.	STARTING STATION	ENDING STATION	SIDE	LENGTH	REMARKS
A-Ramp					
1	6 + 11.7	6 + 41.7	-	30.0	
2	6 + 62.5	6 + 71.5	-	9.3	
B-Ramp					
1	4 + 55.0	4 + 85.0	-	30.0	
2	5 + 14	5 + 9.6	-	8.2	
C-Ramp					
1	5 + 43.0	5 + 73.0	-	30.0	
2	5 + 95.4	6 + 3.0	-	7.6	
D-Ramp					
1	6 + 14.0	6 + 44.0	-	30.0	
2	6 + 62.0	6 + 65.3	-	7.7	
TOTAL					
				152.8	

Broken Guiding Line		Chevrans		Dashed Line	
NO.	STARTING STATION	ENDING STATION	SIDE	LENGTH	REMARKS
Harbour-Akomba Road					
1	-1 + 30.0	16 + 80.0	RIGHT	1810.0	
2	-1 + 30.0	16 + 80.0	LEFT	1810.0	
A-Ramp					
1	5 + 64.0	6 + 11.7	-	47.7	
2	6 + 82.0	7 + 19.0	-	37.0	
B-Ramp					
1	6 + 20.7	6 + 20.1	-	105.4	
C-Ramp					
1	4 + 95.1	5 + 43.0	-	47.9	
2	6 + 13.2	6 + 62.0	-	46.8	
D-Ramp					
1	6 + 78.7	7 + 65.2	-	86.5	
TOTAL					
				3893.3	

Chevrans		Dashed Line		Step Line	
NO.	STARTING STATION	ENDING STATION	SIDE	LENGTH	REMARKS
Harbour-Akomba Road					
1	1 + 15.1	2 + 91.0	RIGHT	651.4	
2	1 + 65.1	2 + 90.0	LEFT	328.4	
3	10 + 10.0	11 + 84.9	LEFT	579.9	
4	10 + 10.0	11 + 80.0	RIGHT	205.5	
5	11 + 0.0	16 + 80.0	RIGHT	1521.5	
6	12 + 80.0	16 + 80.0	LEFT	678.1	
A-Ramp					
1	6 + 28.0	6 + 49.0	LEFT	93.0	
2	6 + 40.0	6 + 54.4	RIGHT	112.0	
3	6 + 61.0	6 + 72.0	LEFT	120.0	
4	6 + 62.7	6 + 71.8	RIGHT	52.0	
5	6 + 83.0	7 + 2.0	LEFT	86.0	
6	6 + 80.0	6 + 95.0	RIGHT	95.0	
C-Ramp					
1	5 + 62.0	6 + 82.0	LEFT	123.0	
2	5 + 94.2	6 + 3.0	LEFT	129.0	
3	6 + 14.0	6 + 38.0	LEFT	150.0	
TOTAL					
				4904.6	

Continuous Edge-Line		Dashed Line		Step Line	
NO.	STARTING STATION	ENDING STATION	SIDE	LENGTH	REMARKS
Harbour-Akomba Road					
1	-1 + 30.0	1 + 65.1	LEFT	285.1	
2	-1 + 30.0	1 + 15.1	RIGHT	245.1	
3	11 + 0.0	14 + 50.0	RIGHT	360.0	
4	11 + 84.9	14 + 59.6	LEFT	274.7	
TOTAL					
				1174.9	
A-Ramp					
1	6 + 41.7	-	-	9.2	
B-Ramp					
1	4 + 55.0	-	-	9.8	
C-Ramp					
1	6 + 83.2	7 + 19.0	LEFT	35.8	
D-Ramp					
1	4 + 95.0	4 + 90.4	LEFT	35.4	
2	4 + 95.0	4 + 92.9	RIGHT	37.9	
3	5 + 0.5	4 + 10.8	LEFT	6.5	
4	5 + 1.9	5 + 9.0	RIGHT	7.4	
5	5 + 23.4	6 + 26.1	LEFT	102.7	
6	5 + 18.7	6 + 28.1	RIGHT	107.4	
C-Ramp					
1	4 + 95.1	5 + 82.0	LEFT	86.9	
2	4 + 95.1	5 + 86.5	RIGHT	91.4	
3	5 + 94.2	6 + 3.1	LEFT	6.9	
4	5 + 98.0	6 + 3.2	RIGHT	7.4	
5	6 + 14.0	6 + 62.0	LEFT	48.0	
6	6 + 12.7	6 + 62.0	RIGHT	49.3	
D-Ramp					
1	6 + 2.0	6 + 49.5	LEFT	47.5	
2	6 + 2.0	6 + 50.9	RIGHT	48.9	
3	6 + 60.5	6 + 69.6	LEFT	8.5	
4	6 + 60.5	6 + 67.3	RIGHT	7.2	
5	6 + 80.3	7 + 65.2	LEFT	84.9	
6	6 + 78.4	7 + 65.2	RIGHT	88.8	
TOTAL					
				7750.8	

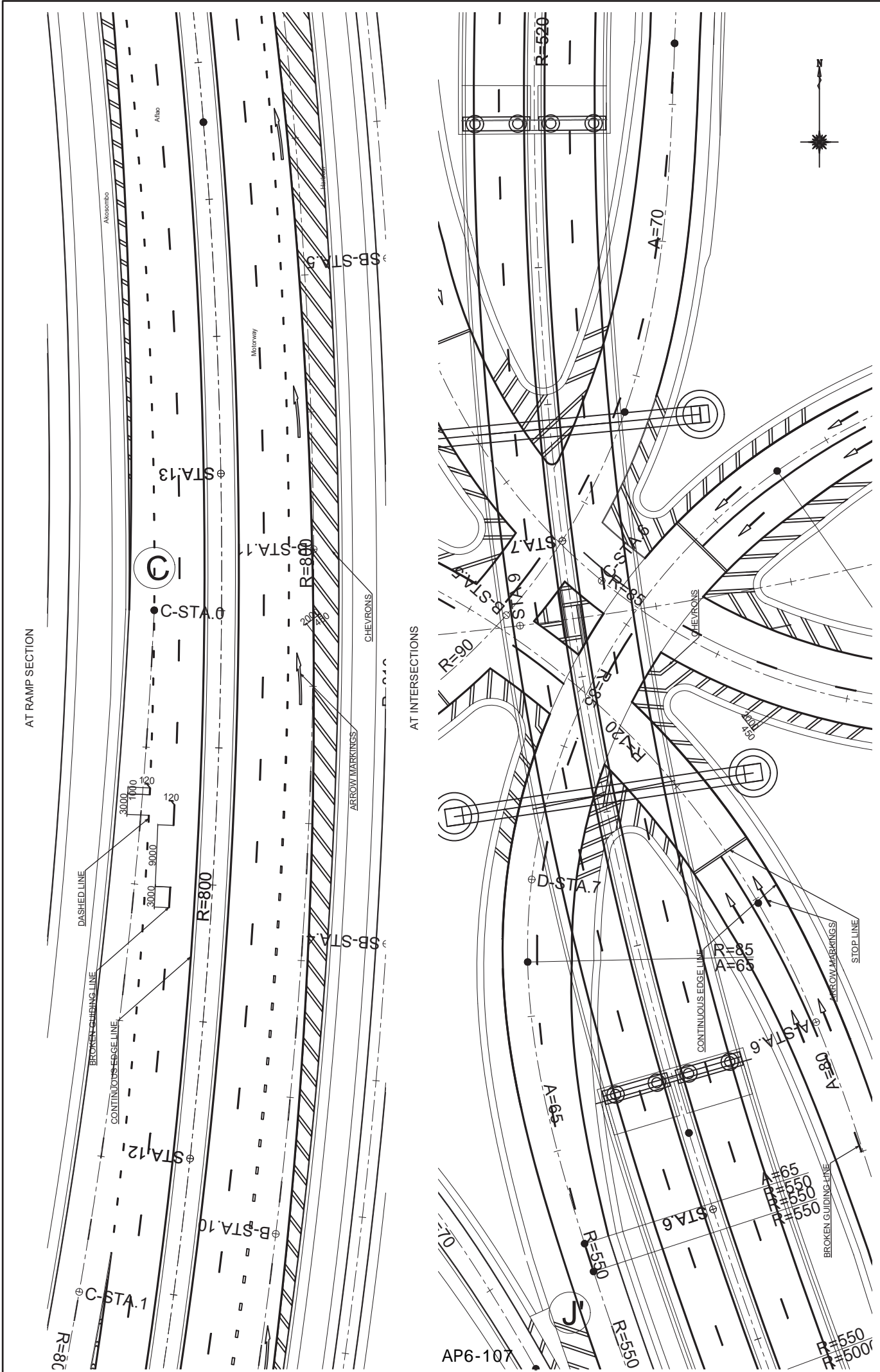
Continuous Edge-Line		Dashed Line		Step Line	
NO.	STARTING STATION	ENDING STATION	SIDE	LENGTH	REMARKS
Harbour-Akomba Road					
1	-1 + 30.0	1 + 65.1	LEFT	285.1	
2	-1 + 30.0	1 + 15.1	RIGHT	245.1	
3	11 + 0.0	14 + 50.0	RIGHT	360.0	
4	11 + 84.9	14 + 59.6	LEFT	274.7	
TOTAL					
				1174.9	
A-Ramp					
1	6 + 41.7	-	-	9.2	
B-Ramp					
1	4 + 55.0	-	-	9.8	
C-Ramp					
1	6 + 83.2	7 + 19.0	LEFT	35.8	
D-Ramp					
1	4 + 95.0	4 + 90.4	LEFT	35.4	
2	4 + 95.0	4 + 92.9	RIGHT	37.9	
3	5 + 0.5	4 + 10.8	LEFT	6.5	
4	5 + 1.9	5 + 9.0	RIGHT	7.4	
5	5 + 23.4	6 + 26.1	LEFT	102.7	
6	5 + 18.7	6 + 28.1	RIGHT	107.4	
C-Ramp					
1	4 + 95.1	5 + 82.0	LEFT	86.9	
2	4 + 95.1	5 + 86.5	RIGHT	91.4	
3	5 + 94.2	6 + 3.1	LEFT	6.9	
4	5 + 98.0	6 + 3.2	RIGHT	7.4	
5	6 + 14.0	6 + 62.0	LEFT	48.0	
6	6 + 12.7	6 + 62.0	RIGHT	49.3	
D-Ramp					
1	6 + 2.0	6 + 49.5	LEFT	47.5	
2	6 + 2.0	6 + 50.9	RIGHT	48.9	
3	6 + 60.5	6 + 69.6	LEFT	8.5	
4	6 + 60.5	6 + 67.3	RIGHT	7.2	
5	6 + 80.3	7 + 65.2	LEFT	84.9	
6	6 + 78.4	7 + 65.2	RIGHT	88.8	
TOTAL					
				7750.8	



FOR SPEED < 60km/h

FOR SPEED > 60km/h

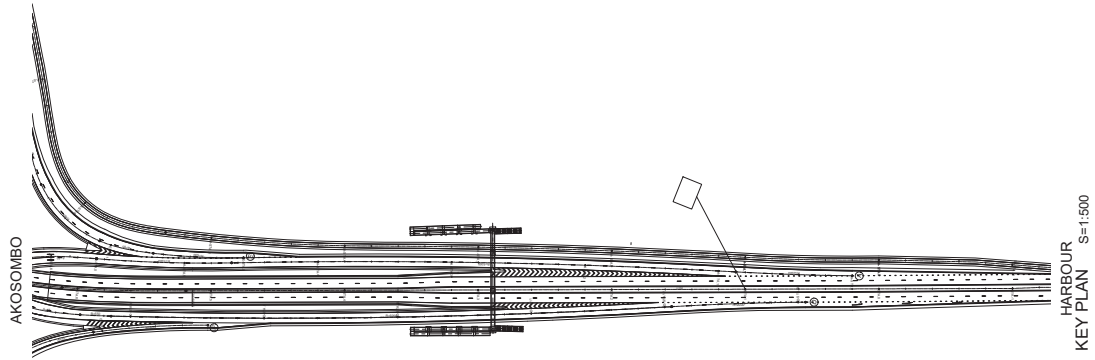
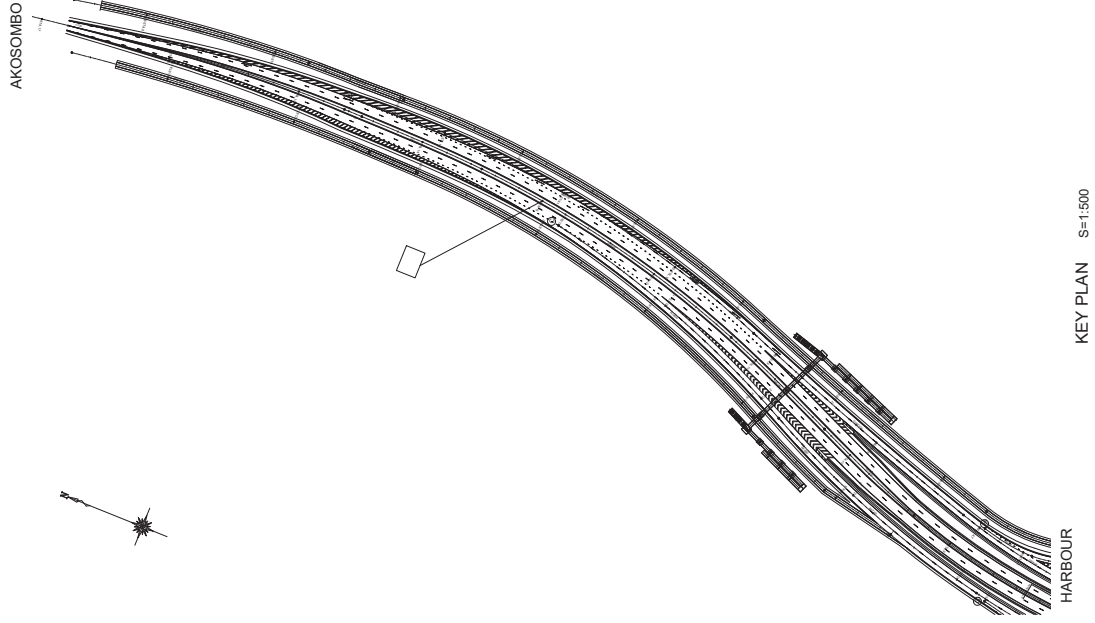
ARROW MARKINGS



AP6-107

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY		DRAWING NO. RA-26
	DRAWING TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) PAVEMENT MARKINGS(2)		SCALE (A1189) 1:250

TYPICAL TRAFFIC SIGNS(1)



DRAWING NO.	RA-27
SCALE (A1199)	1:500
DRAWING TITLE:	TYPICAL TRAFFIC SIGNS(1)
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY

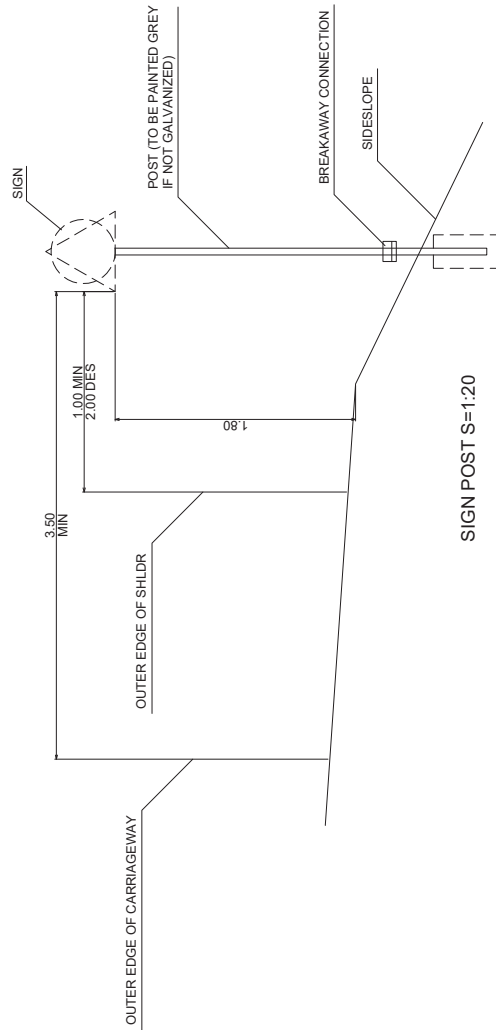
TYPICAL TRAFFIC SIGNS(2)



82

MAX SPEED LIMIT AS SHOWN

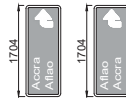
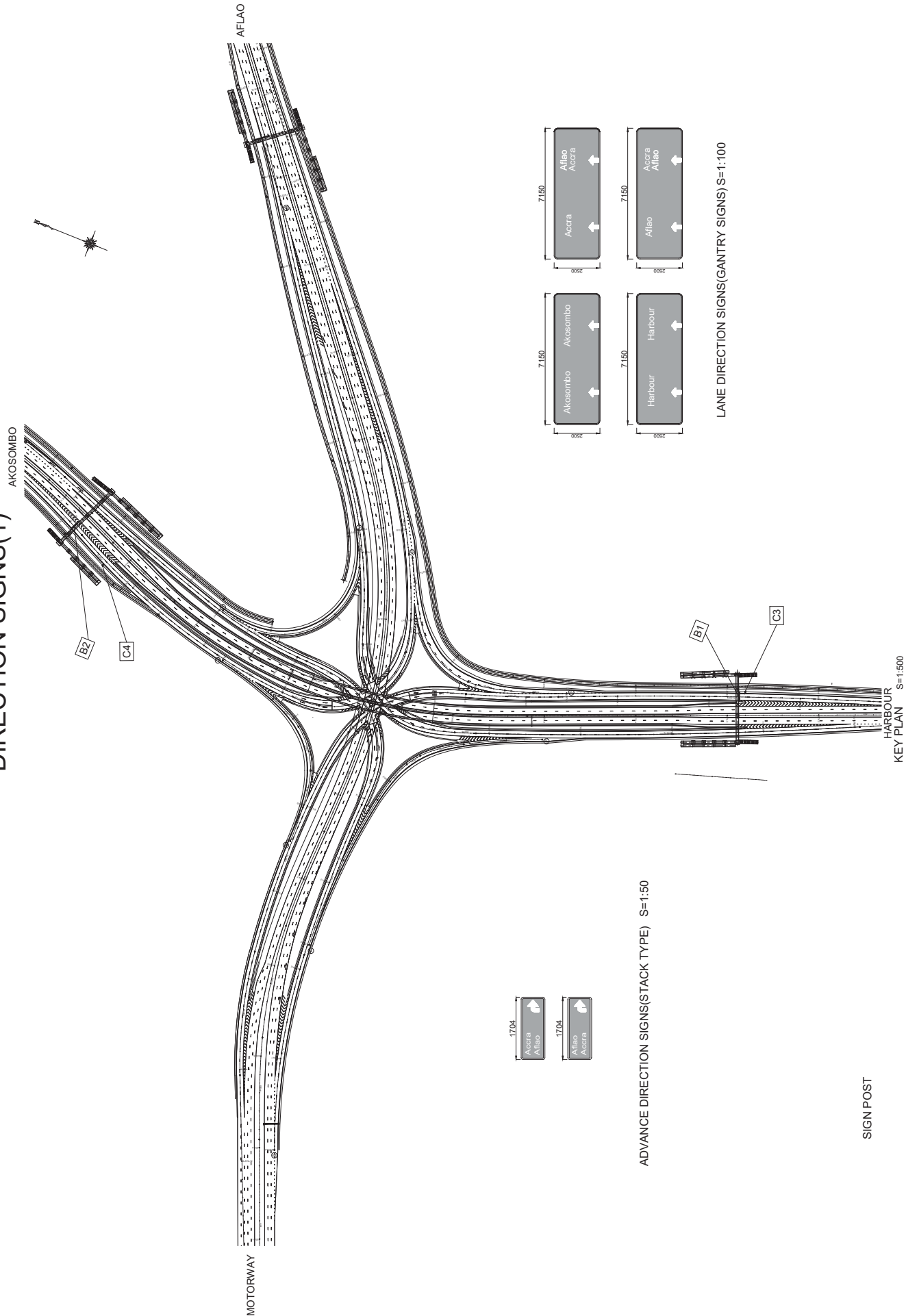
MAX SPEED LIMIT AS SHOWN(80km/h)			
NO.	STATION	SIDE	REMARKS
Harbour-Akosombo Road			
1	1 +	0.0	1.0
2	13 +	0.0	1.0
TOTAL			2.0



AP6-109

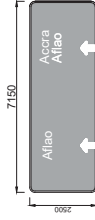
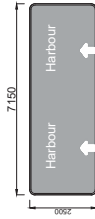
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: TYPICAL TRAFFIC SIGNS(2)	SCALE:(A1:100) AS SHOWN	DRAWING NO. RA-28
--	---	--	--	----------------------------	----------------------

DIRECTION SIGNS(1)



ADVANCE DIRECTION SIGNS(STACK TYPE) S=1:50

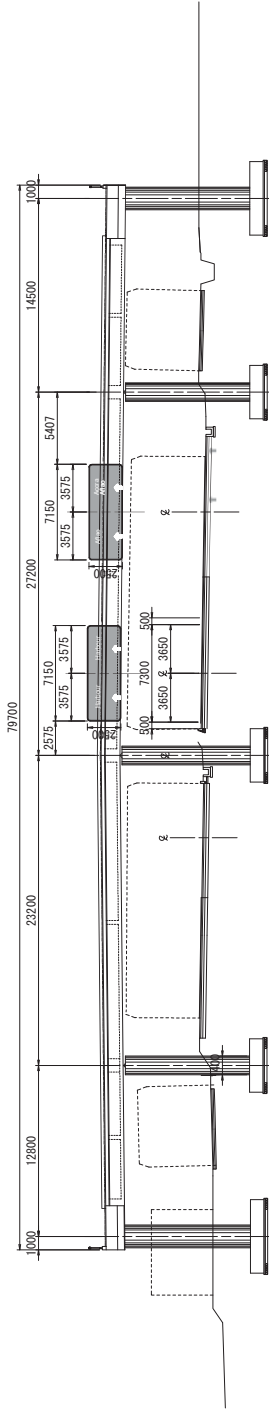
SIGN POST



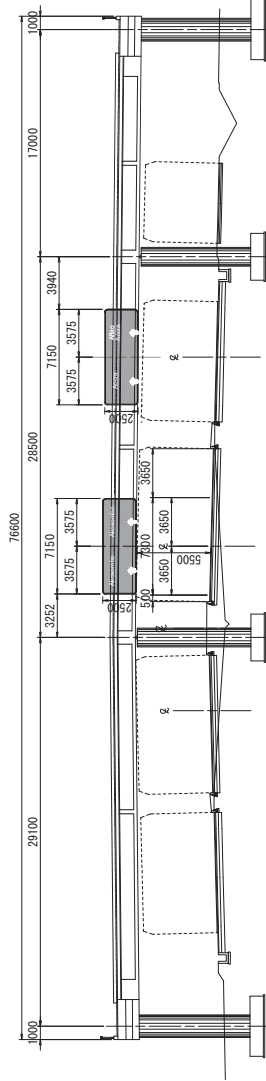
LANE DIRECTION SIGNS(GANTRY SIGNS) S=1:100

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO. RA-29
DRAWING TITLE: DIRECTION SIGNS(1)		SCALE(A1189) 1:500	

DIRECTION SIGNS(2)



Harbour-Akosombo_No.10+65 B2

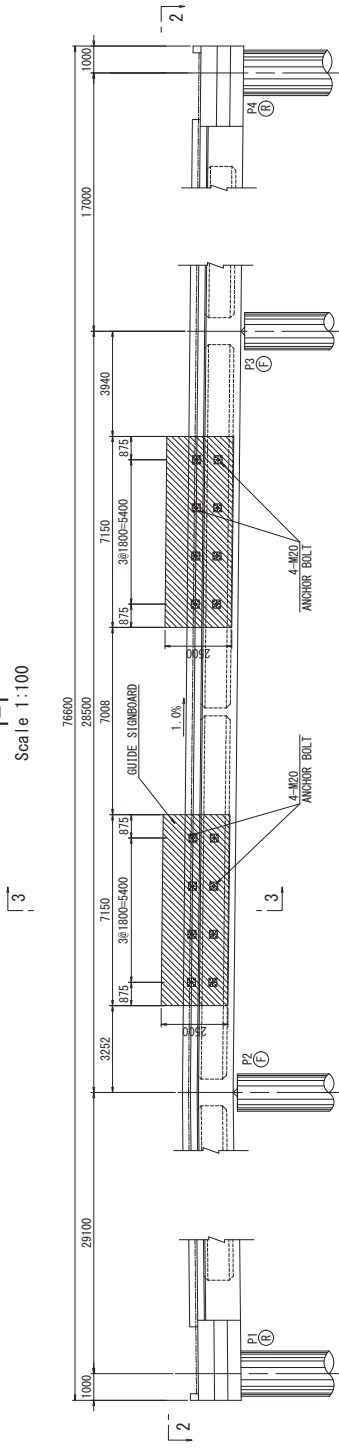


Harbour-Akosombo_No.2+89 B1

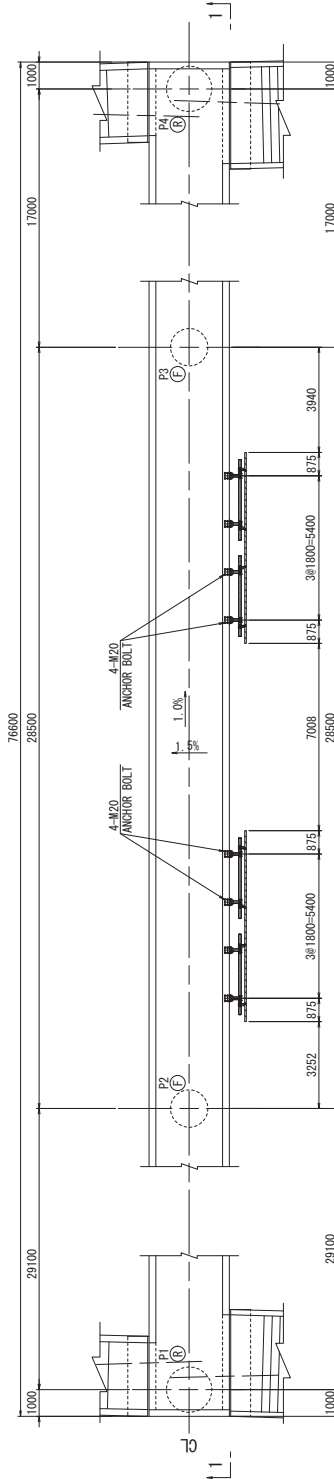
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DIRECTION SIGNS(2)	SCALE:(A1&A2) 1:200	DRAWING NO. RA-30
--	---	--	--------------------------------------	------------------------	----------------------

ANCHOR ARRANGEMENT OF GUIDE SIGN BOARD HARBOUR ROAD STA. 2+90.00

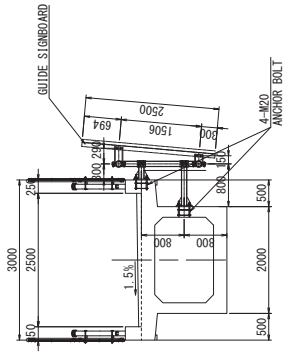
SIDE VIEW
1-1
Scale 1:100



PLAN
2-2
Scale 1:100



CROSS SECTION
3-3
Scale 1:50



MATERIAL LIST

KIND	DIMENSION (mm)	WEIGHT (kg)	NUMBER	TOTAL WEIGHT (kg)	NOTE
SS	M20 x 280 (L.W. 2M)		4		ANCHOR BOLT
SS	150 x 4.5 x 250	0.44	8	3.52	ANCHOR PLATE

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
DIRECTION SIGNS (3)
ANCHOR ARRANGEMENT
OF GUIDE SIGN BOARD
HARBOUR ROAD STA. 2+90.00

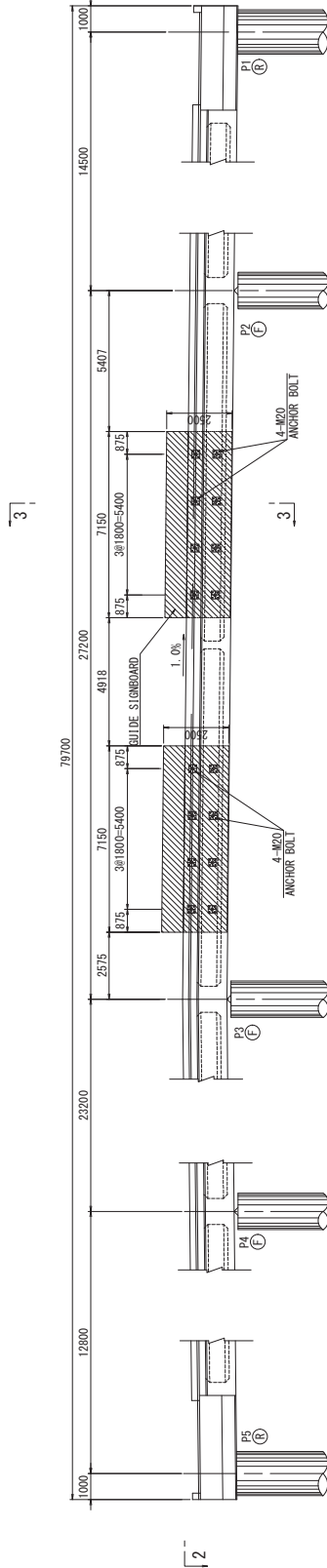
SCALE (A1199)

AS SHOWN

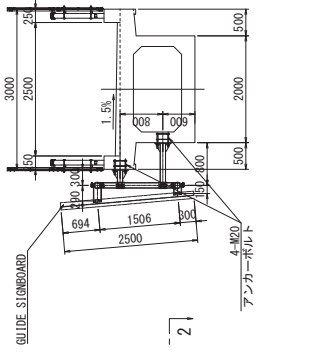
RA-31

ANCHOR ARRANGEMENT OF GUIDE SIGN BOARD AKOSOMBO ROAD STA. 10+65.00

SIDE VIEW
1-1
Scale 1:100



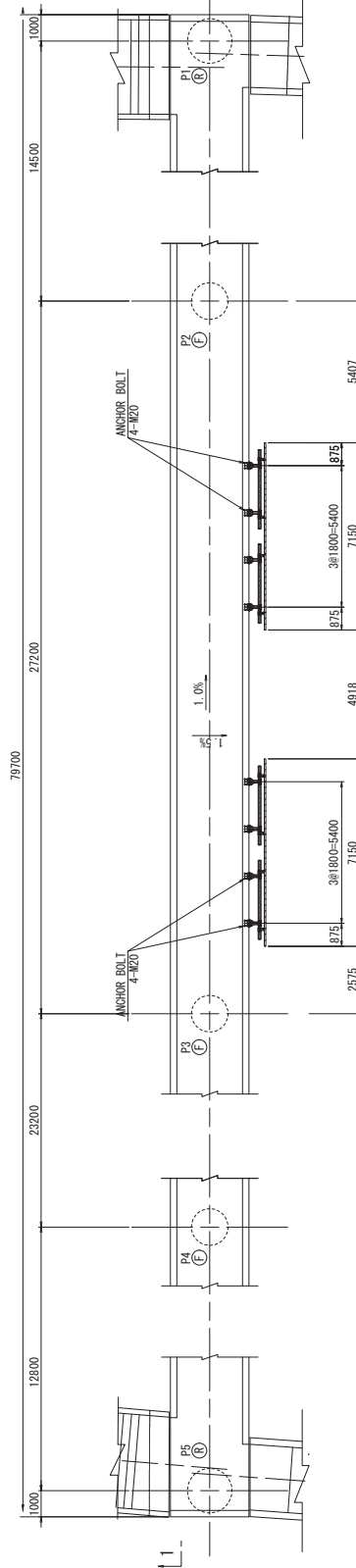
CROSS SECTION
3-3
Scale 1:50



MATERIAL LIST

KIND	DIMENSION (mm)	WEIGHT (kg)	NUMBER	TOTAL WEIGHT	PER SET
					NOTE
SS BOLT	M20 x 280 (1W, 2W)	—	4	—	ANCHOR BOLT
SS IFB	50 x 4.5 x 250	0.44	8	3.5	ANCHOR PLATE

PLAN
2-2
Scale 1:100

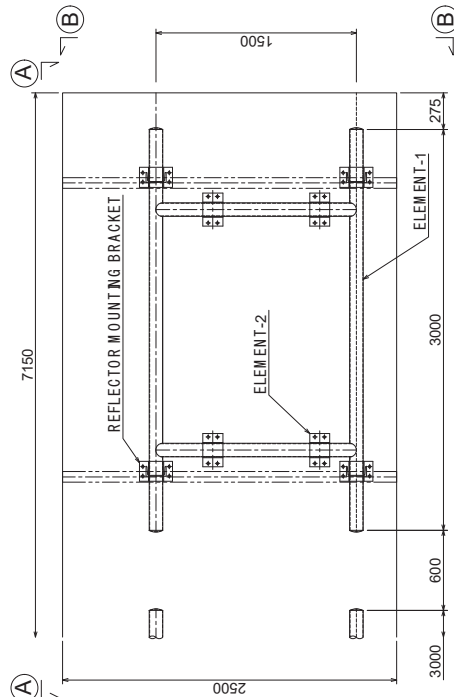


AP6-113

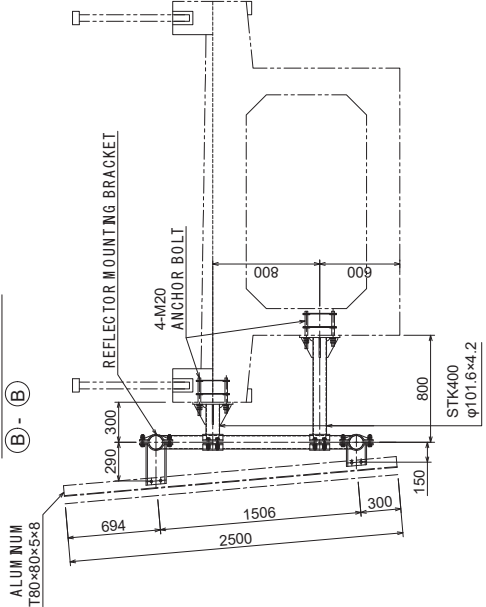
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DIRECTION SIGNS(4) ANCHOR ARRANGEMENT OF GUIDE SIGN BOARD AKOSOMBO ROAD STA.10+65.00
	SCALE (A1100)	DRAWING NO.
	AS SHOWN	RA-32

**OV SUPPORT TYPE GUIDE SIGN BOARD (REFLECTION TYPE)
STRUCTURAL DRAWING S=1:20
PEDESTRAIN BRIDGE ANCILLARIES**

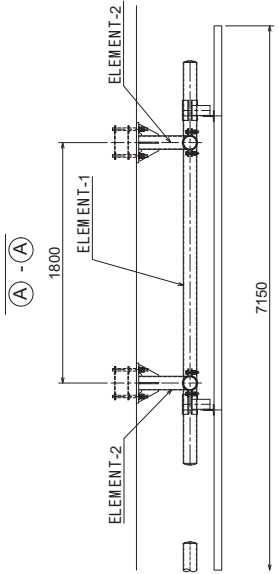
FRONT VIEW



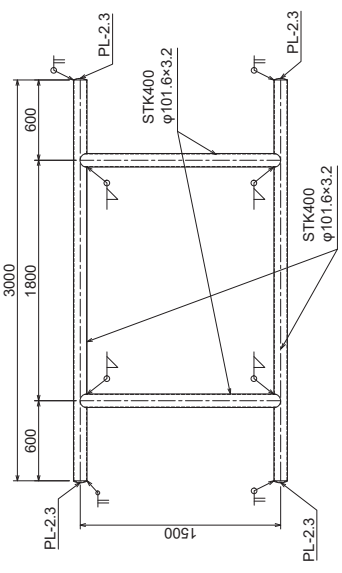
SIDE VIEW



PLAN

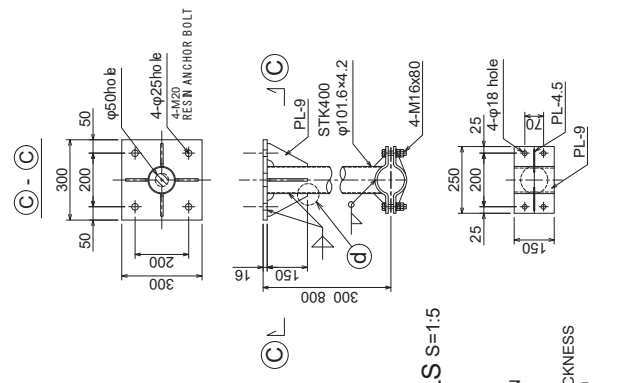


ELEMENT-1

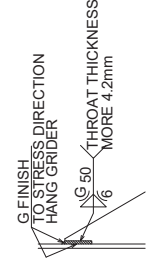


ELEMENT-2 DETAILS

S=1:10



SECTION DETAILS S=1:5



MATERIAL LIST

KIND	DIMENSION	WEIGHT	NUM	TOTAL	NOTE
	mm	kg			
STK	Pipe φ101.6x4.2x290	2.93	4	11.7	POST
STK	Pipe φ101.6x4.2x790	7.98	4	31.9	POST
SS	PL 300x16x300	11.30	8	90.4	BASE PL
SS	PL 85x9x150	0.90	32	28.8	RIB PL
SS	PL 150x9x340	3.60	16	57.6	BAND-A
SS	PL 40x4.5x40	0.06	32	1.9	RIB PL
STK	Pipe φ101.6x3.2x3000	23.28	4	93.1	BEAM
STK	Pipe φ101.6x3.2x1500	11.64	4	46.6	TIE BEAM
SS	PL φ105x2.3	0.16	8	1.3	CAP PL
SS	PL 150x9x340	3.60	16	57.6	BAND-B
SS	PL 40x4.5x40	0.06	32	1.9	RIB PL
SS	C 150x75x6.5x10x305	3.07	4	12.3	PIECE
SS	C 150x75x6.5x10x305	5.67	4	22.7	PIECE
	BOLT M16x80 2W,2N		32		BAND-A
	BOLT M16x80 2W,2N		32		BAND-B
	BOLT M16x60 2W,2N		16		PIECE
			TOTAL	457.8	

CAUTION
As a standard without special mention, steel pipe is STK400 steel plate and mold steel is SS400.
The surface treatment of the pillars is due to JIS H 864.1 hot plating.

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:

DIRECTION(S) SIGN(S)
OV SUPPORT TYPE GUIDE SIGN BOARD REFLECTION TYPE
STRUCTURAL DRAWING
PEDESTRAIN BRIDGE ANCILLARIES

SCALE (A1/100)

1:500

DRAWING NO.

RA-33

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

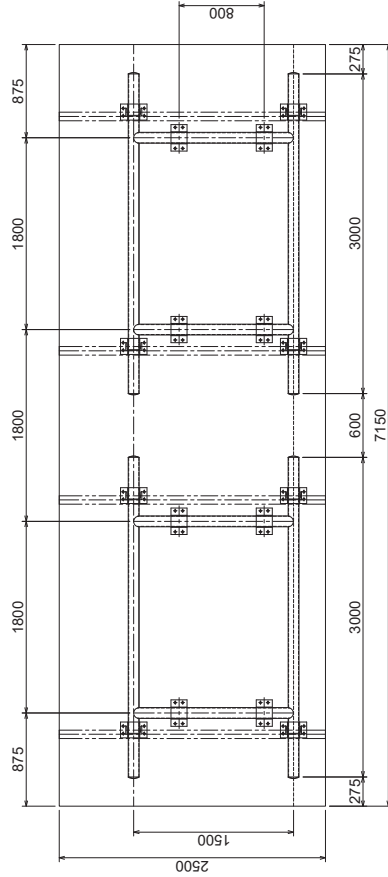
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

OV SUPPORT TYPE GUIDE SIGN BOARD (REFLECTION TYPE)
 MOUNTING BRACKET LAYOUT DRAWING
 PEDESTRAIN BRIDGE ANCILLARIES

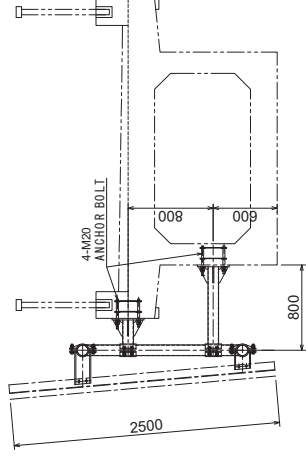
S=1:25

2500x7150

FRONT VIEW



SIDE VIEW



AP6-115

注册 縮尺 判 抜大時
 GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
 THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
 (PHASE 2)

DRAWING TITLE:
 DIRECTION SIGNS(6)
 OV SUPPORT TYPE GUIDE
 SIGN BOARD (REFLECTION TYPE)
 MOUNTING BRACKET LAYOUT DRAWING
 PEDESTRAIN BRIDGE ANCILLARIES

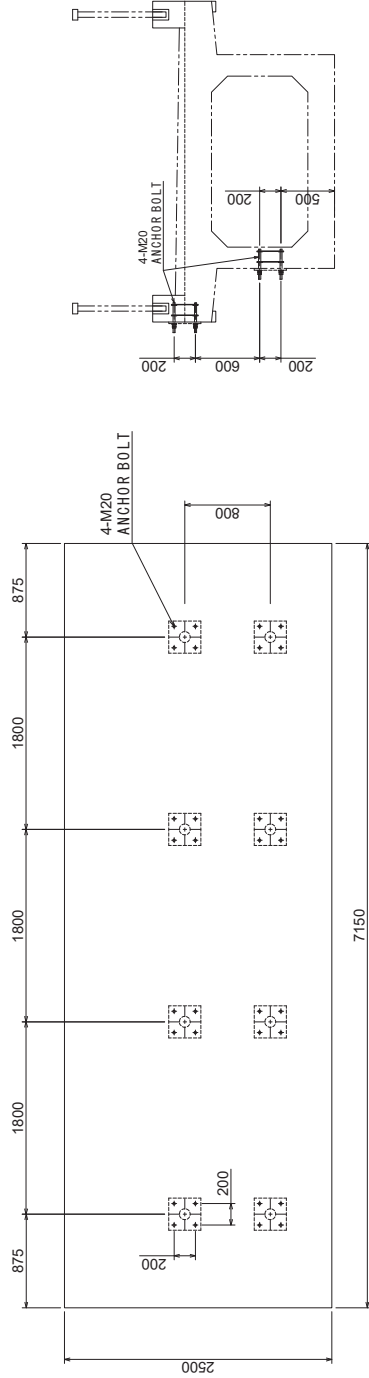
SCALE (A1199)
 AS SHOWN

DRAWING NO.
 RA-34

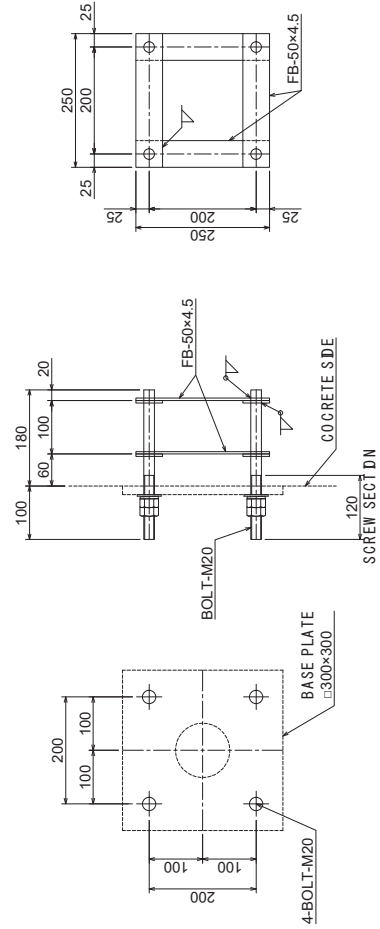
**OV SUPPORT TYPE GUIDE SIGN BOARD (REFLECTION TYPE)
ANCHOR BOLT LAYOUT DRAWING
PEDESTRAIN BRIDGE ANCILLARIES**

S=1:25

2500×7150



ANCHOR BOLT S=1:5



FOR 1 SET

KIND	DIMENSION mm	WEIGHT kg	NUMBER	TOTAL WEIGHT kg	NOTE
SS BOLT	M20×280-1W-2N	0.44	4	1.76	ANCHOR BOLT
SS FB	50×4.5×250	0.44	8	3.52	ANCHOR FLANGE

CAUTION
1 The surface treatment of the pillars is due to JIS H 8641 hot plating.

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
DIRECTION SIGNS(7)
OV SUPPORT TYPE GUIDE
SIGN BOARD (REFLECTION TYPE)
ANCHOR BOLT LAYOUT DRAWING
PEDESTRAIN BRIDGE ANCILLARIES

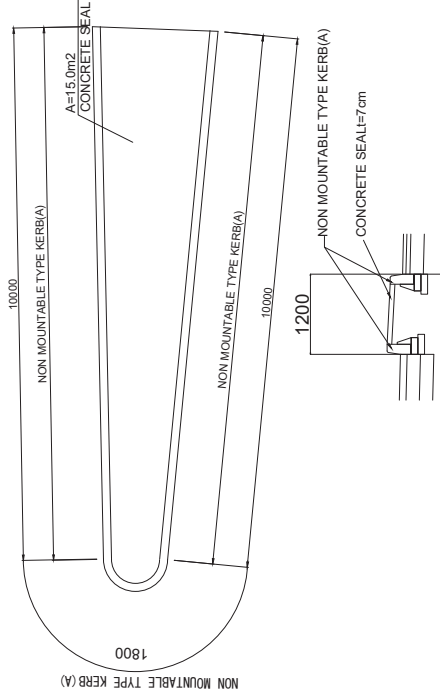
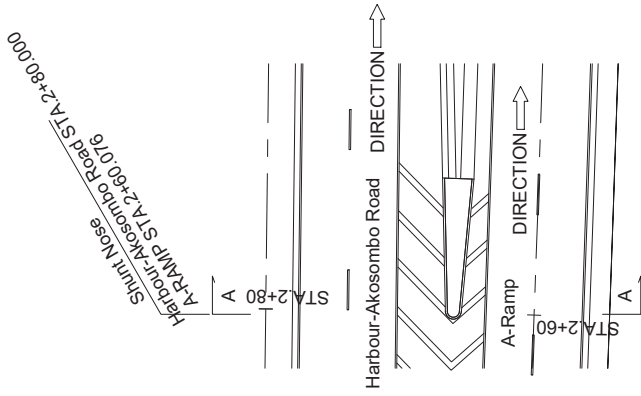
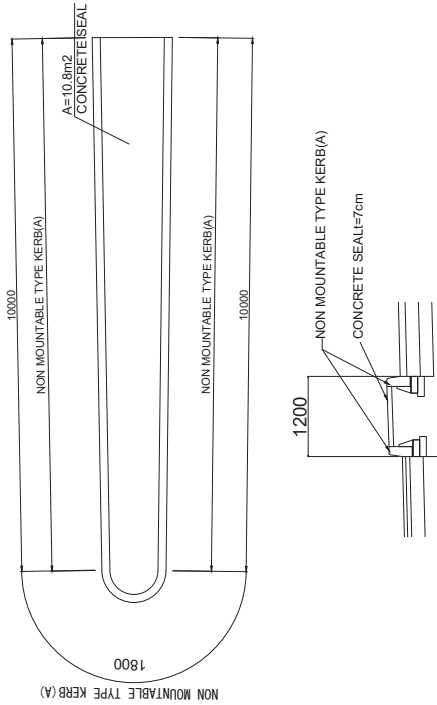
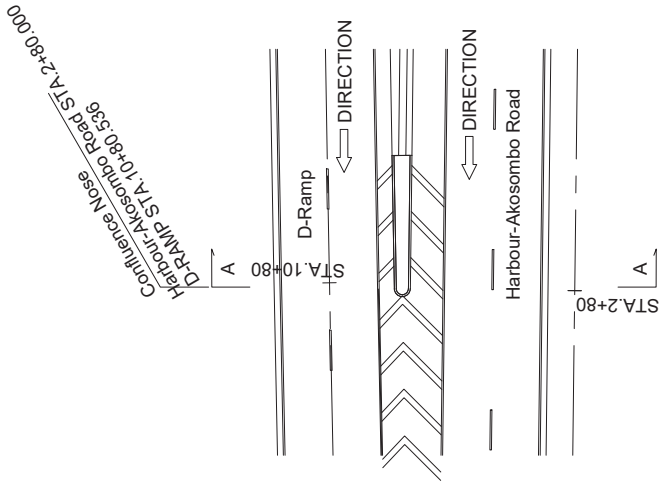
SCALE(A1199)

AS SHOWN

DRAWING NO.

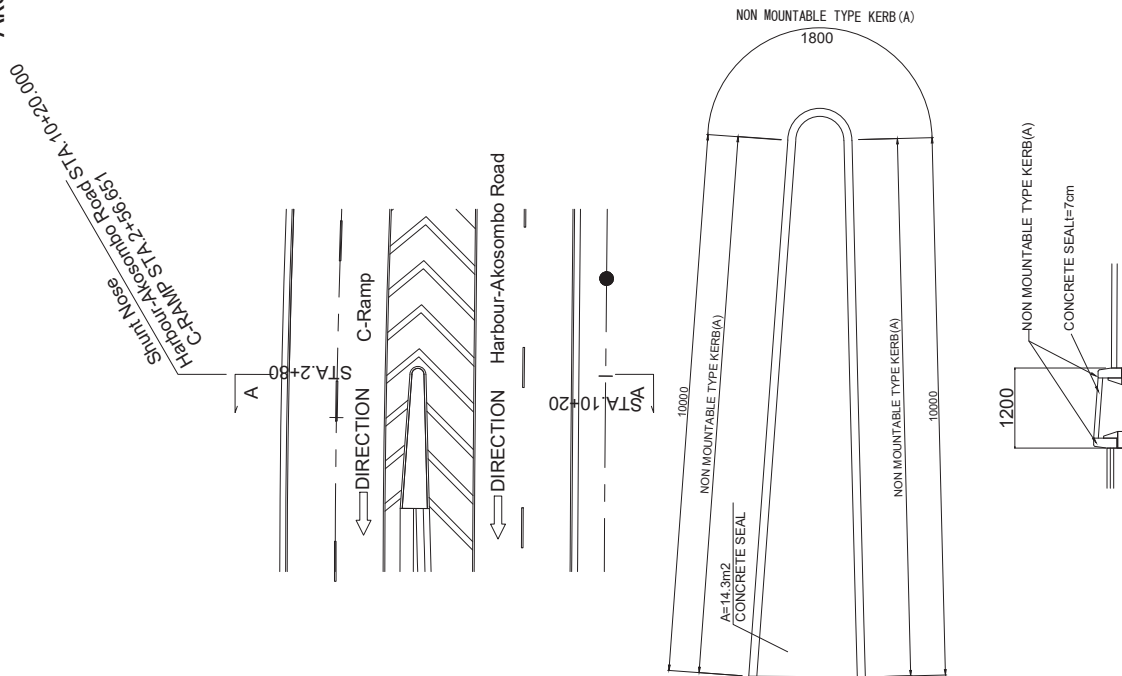
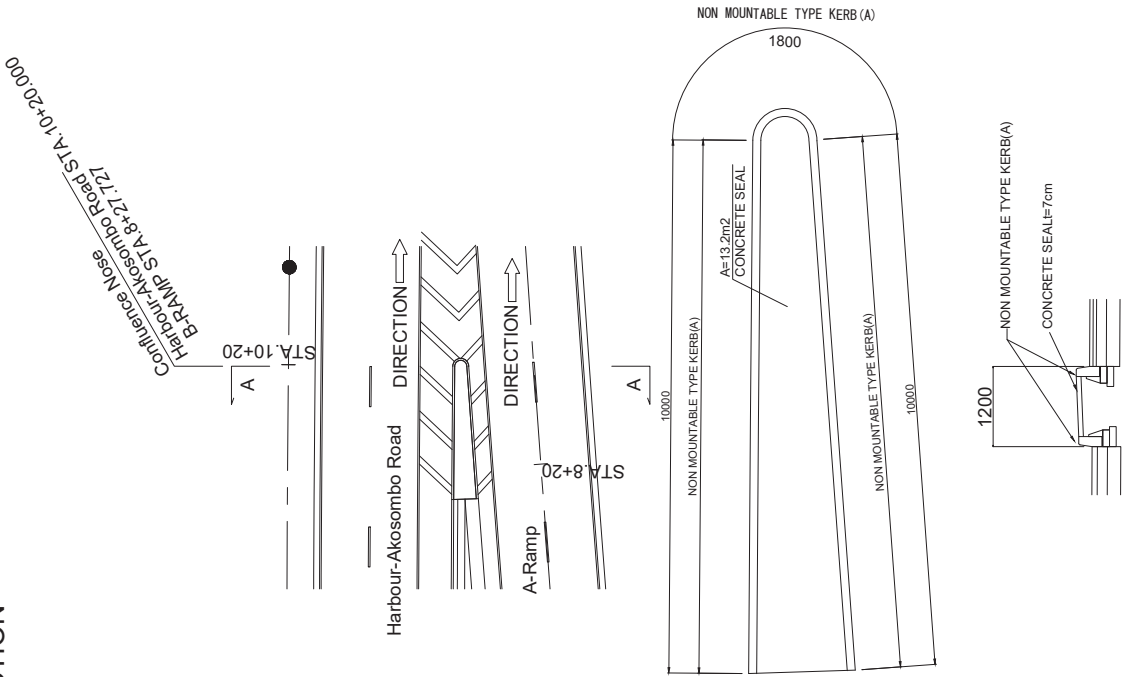
RA-35

DETAIL OF NOSE(1)
Harbour SECTION

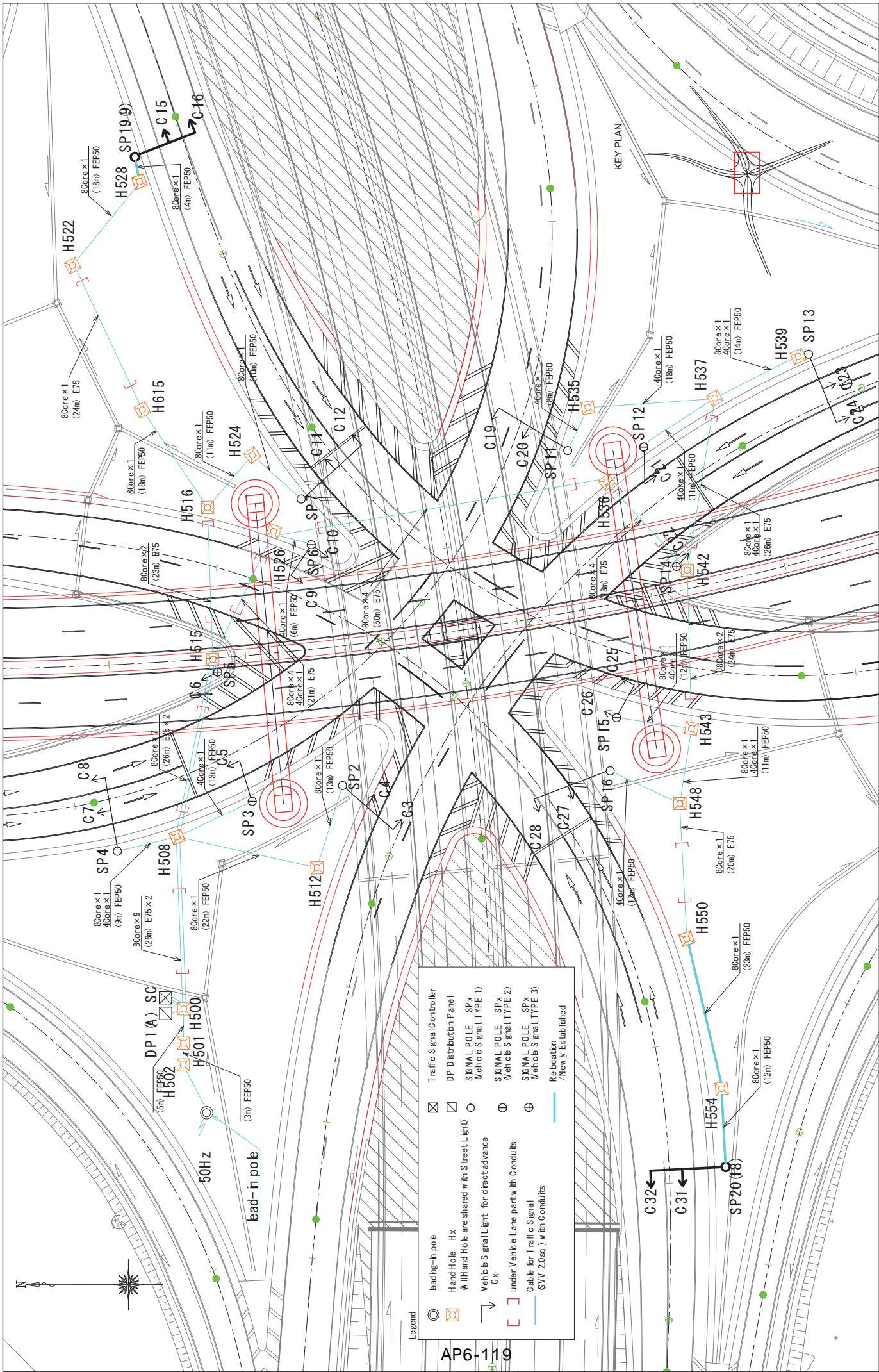


GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: DETAIL OF NOSE(1)	SCALE:(A1502) AS SHOWN	DRAWING NO. RA-36
--	---	---	---------------------------	----------------------

DETAIL OF NOSE(2)
Akosombo SECTION



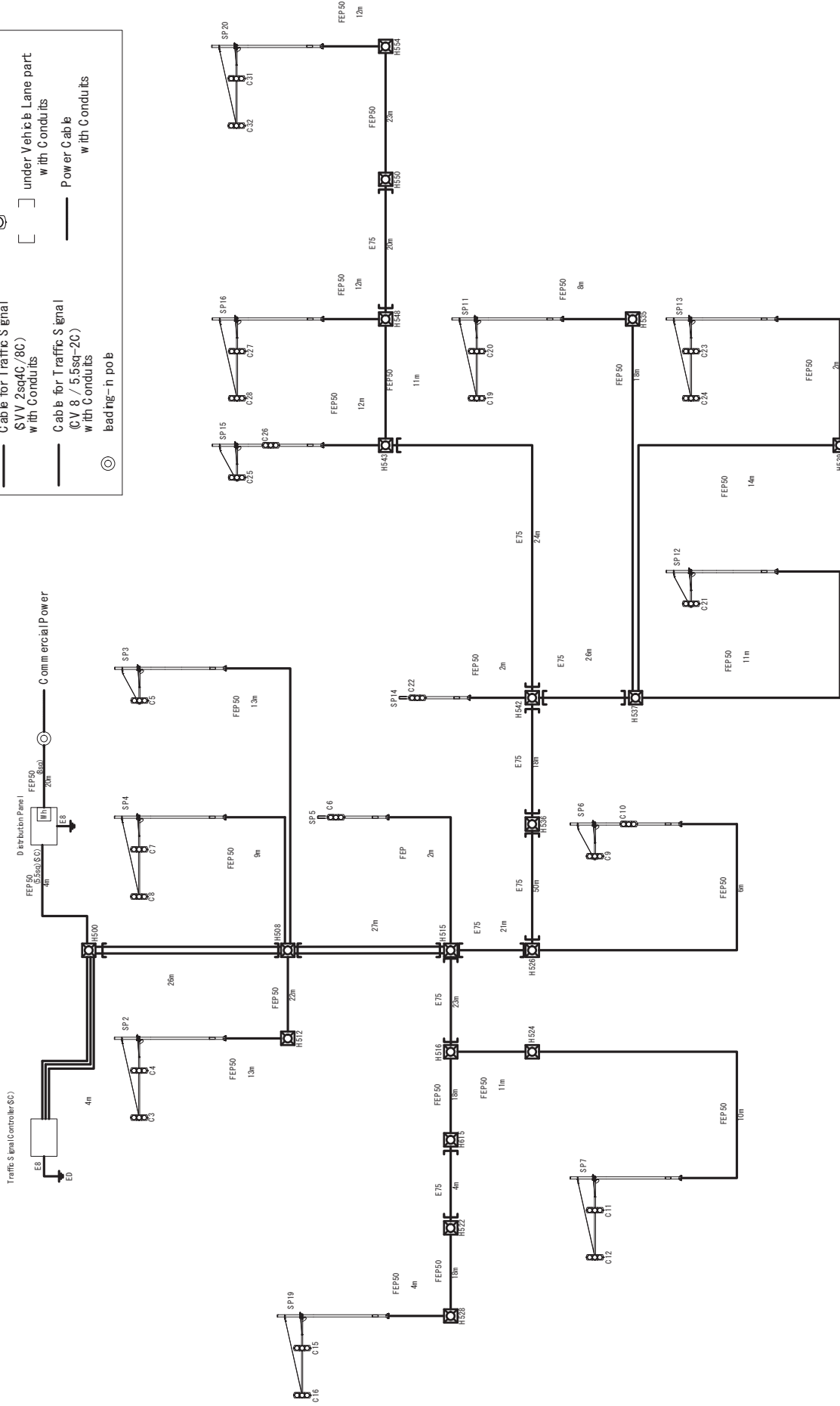
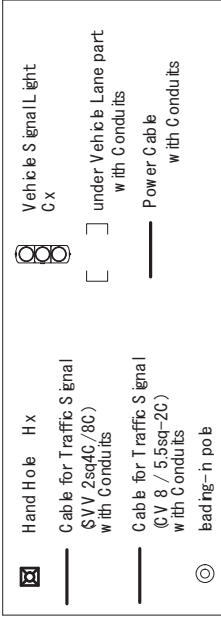
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: DETAIL OF NOSE(2)	SCALE: (A1822) AS SHOWN	DRAWING NO. RA-37

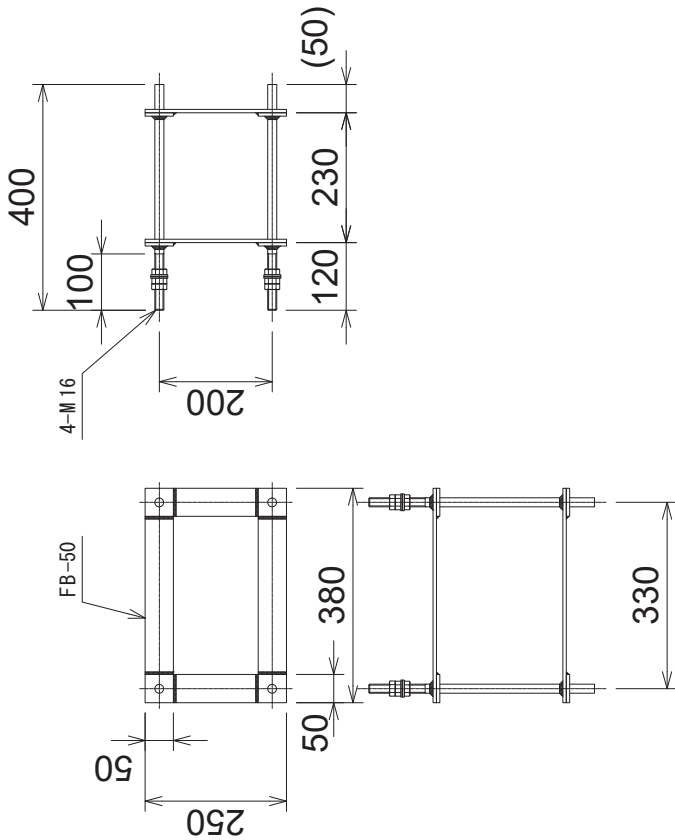
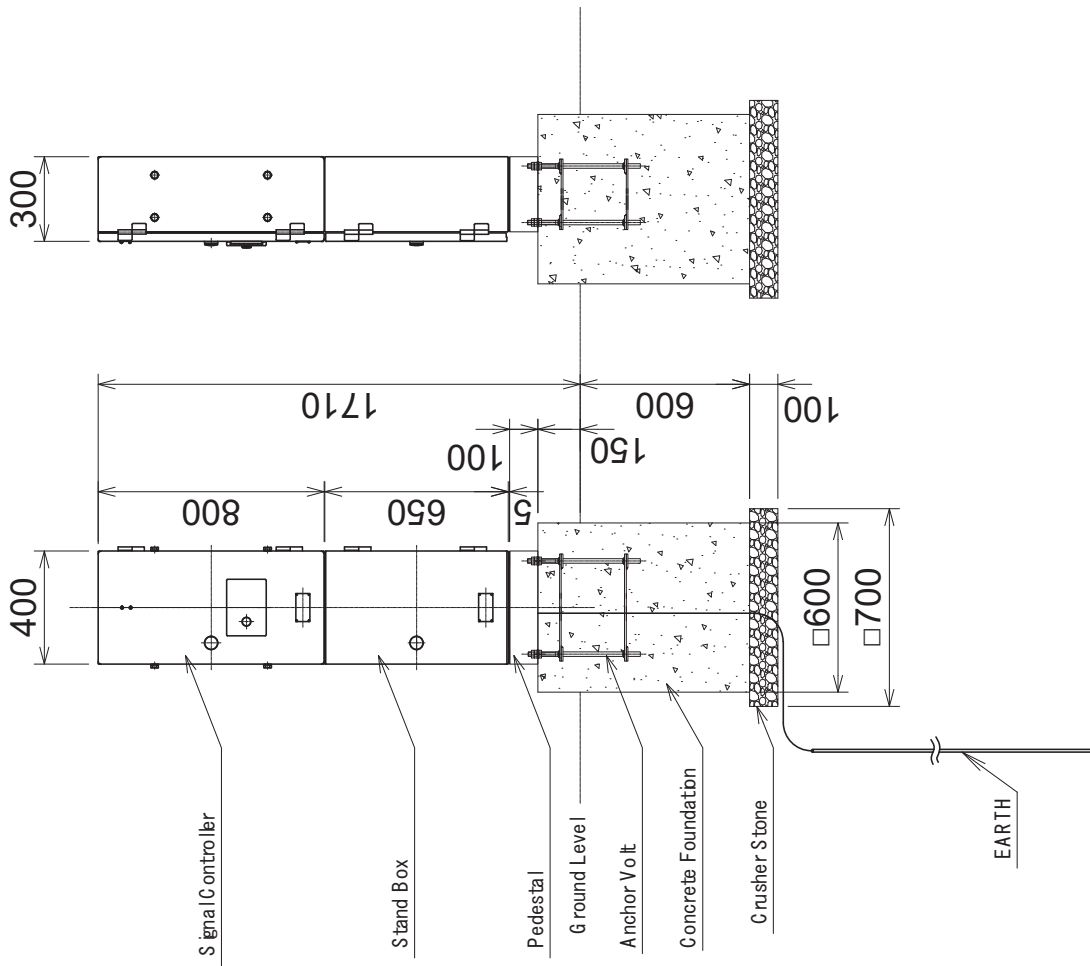


AP6-119

SCALE (A 1:500)	DRAWING NO. SL-01
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE:	TRAFFIC SIGNAL LIGHT(1) LAYOUT PLAN OF TRAFFIC SIGNAL LIGHT (PHASE 2)
PROJECT TITLE:	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY

Legend



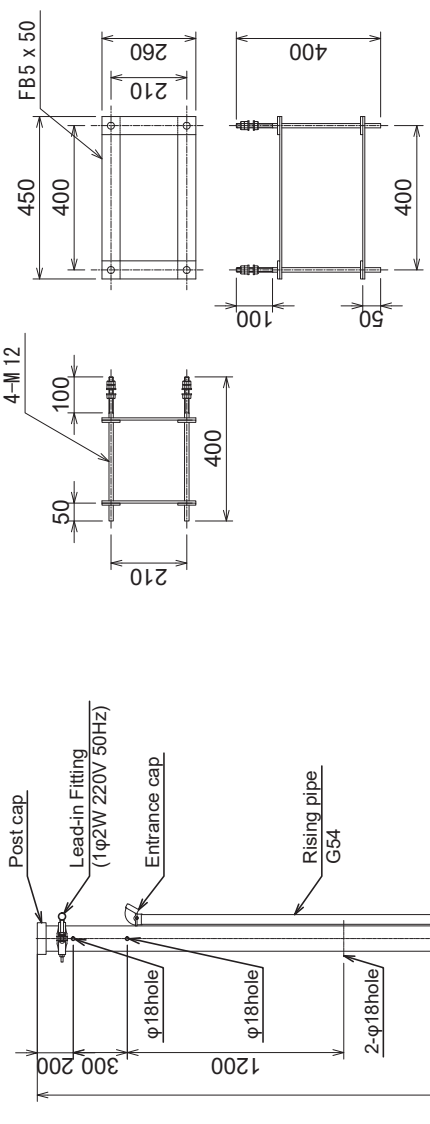


AP6-121

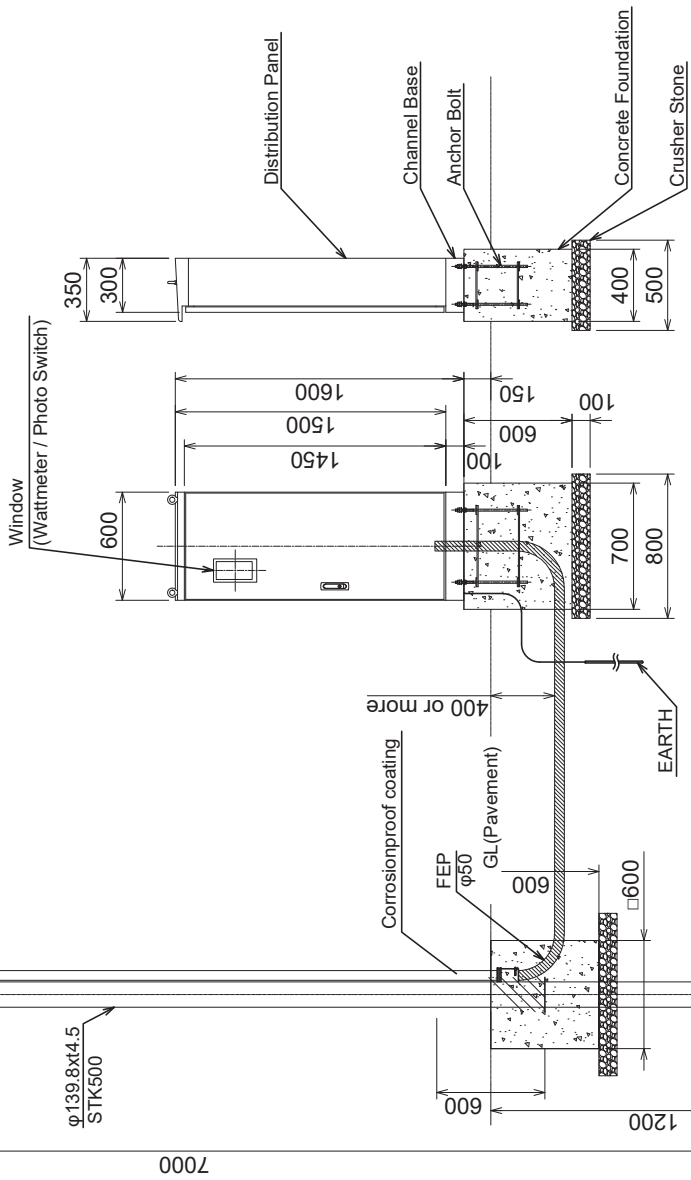
INSTALLATION DRAWING

DETAIL OF ANCHOR BOLTS

SCALE: (A1:100)	DRAWING TITLE: TRAFFIC SIGNAL LIGHT(3) INSTALLATION DRAWING OF TRAFFIC SIGNAL CONTROLLER	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA
DRAWING NO.				SL-03



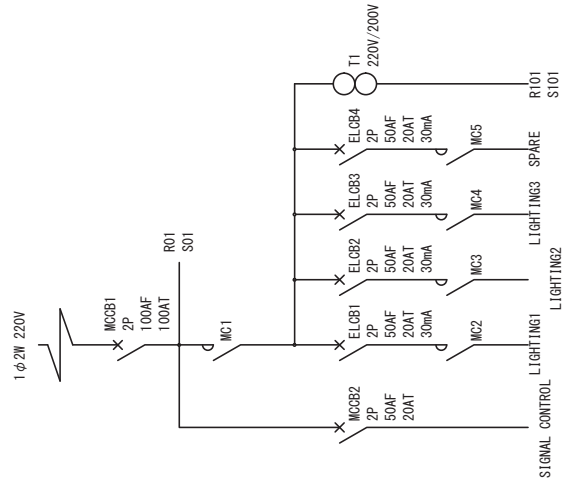
DETAIL OF ANCHOR BOLTS



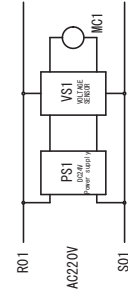
INSTALLATION DRAWING

Lead-in Pipe

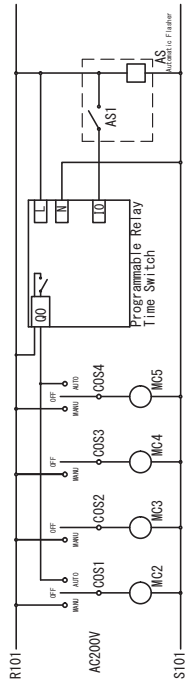
SINGLE CIRCUIT



VOLTAGE MONITOR CIRCUIT
(For Underpass)



CONTROL CIRCUIT



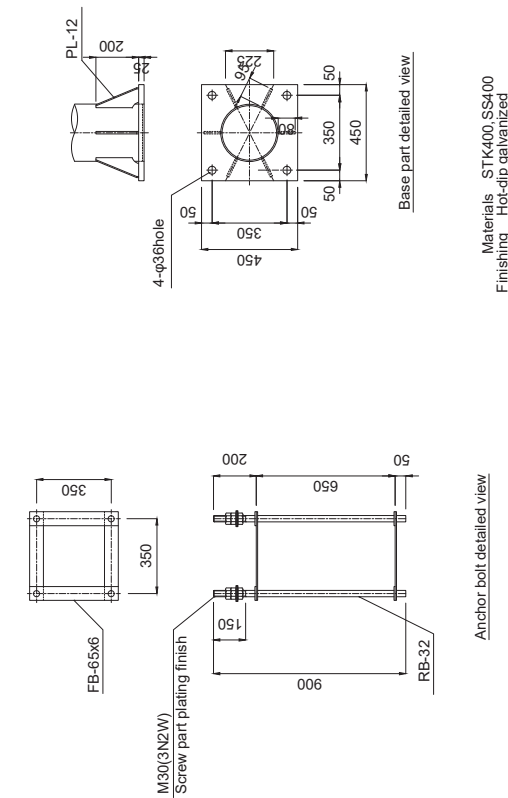
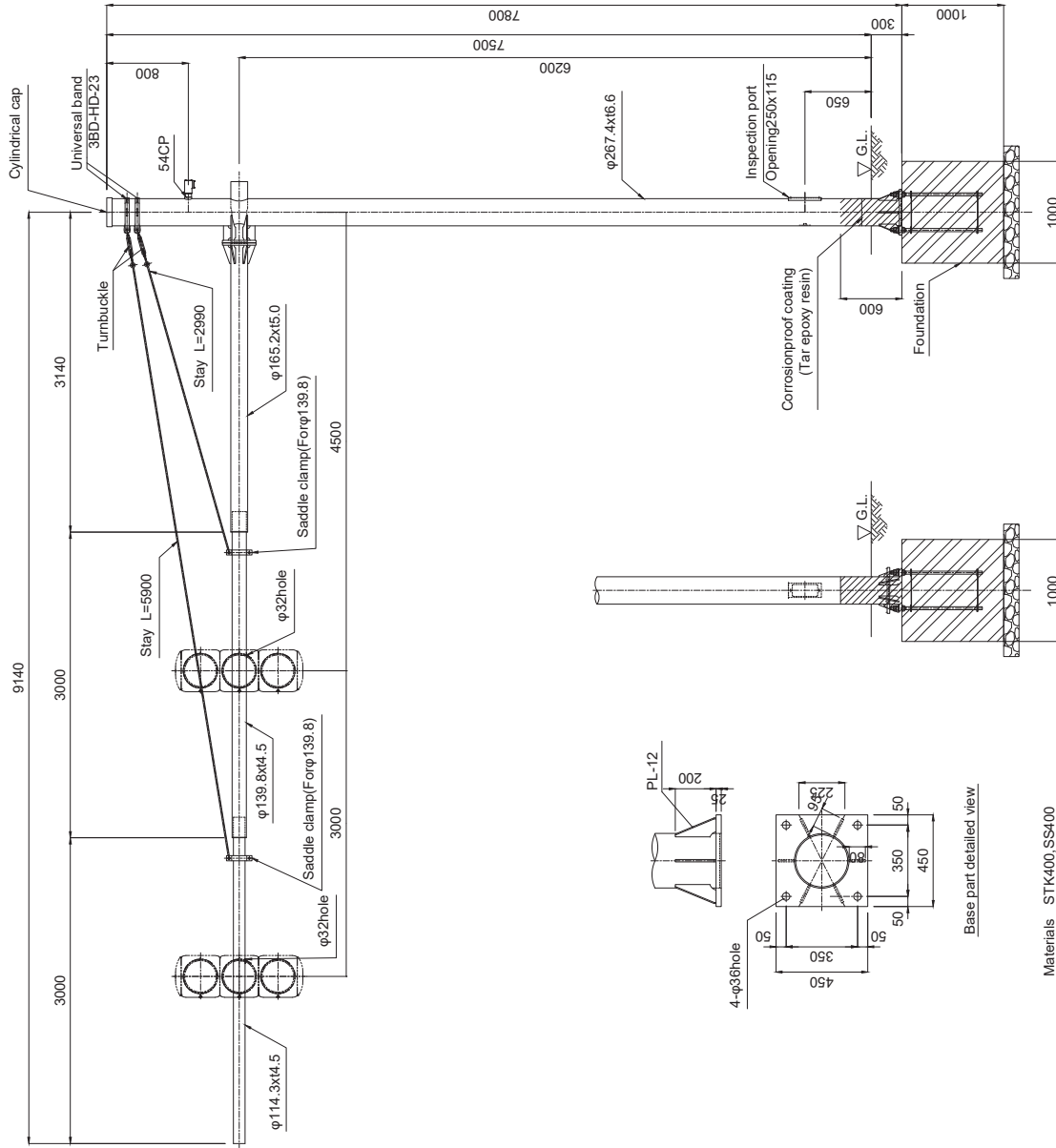
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

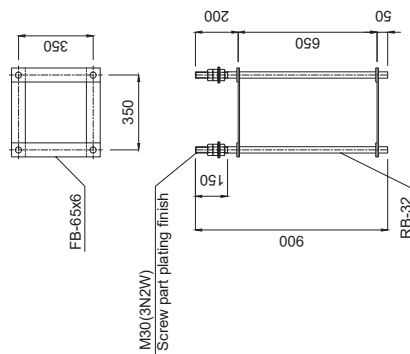
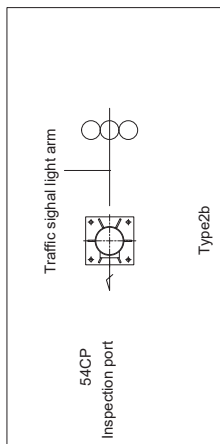
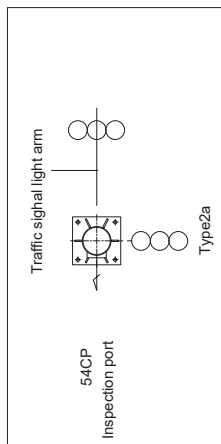
PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
TRAFFIC SIGNAL LIGHT(4)
INSTALLATION DRAWING OF
DISTRIBUTION PANEL

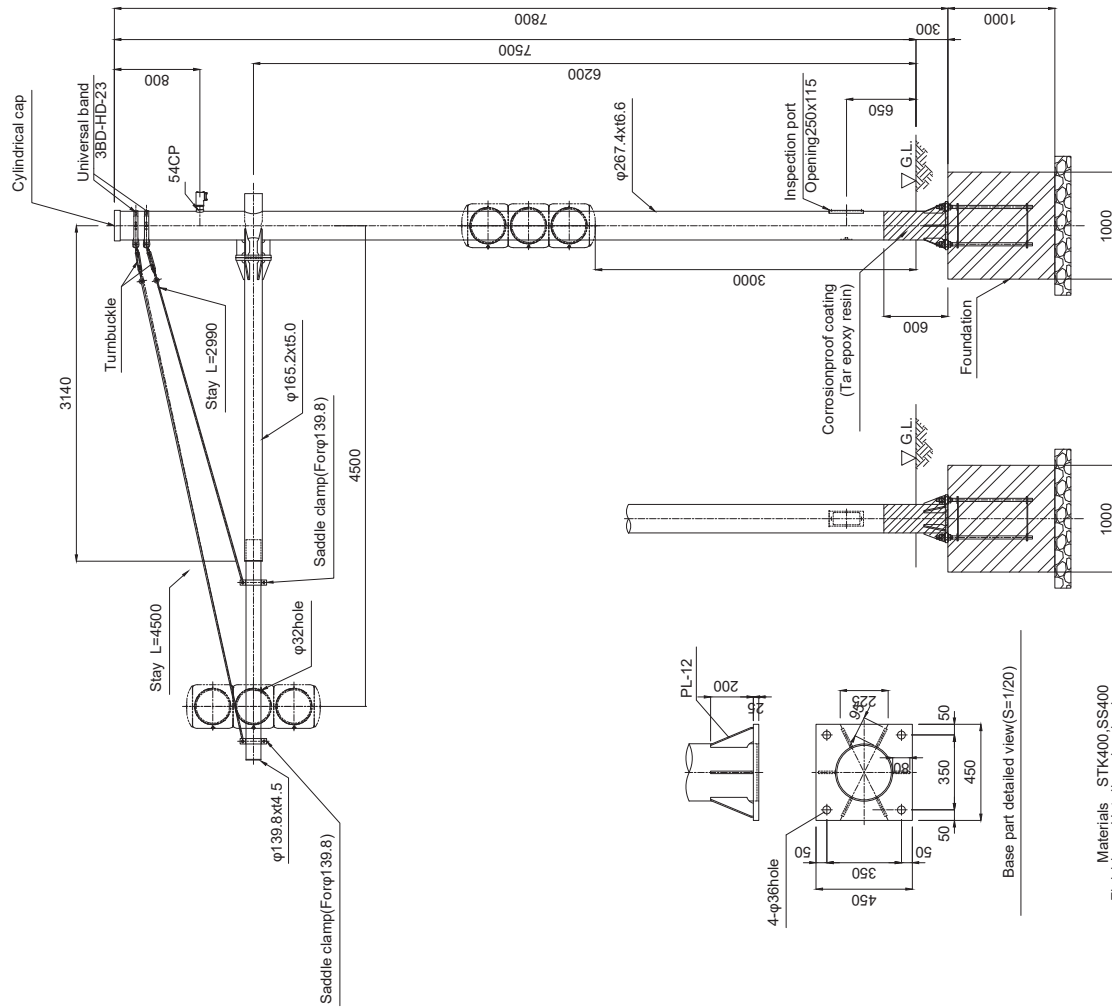
SCALE: (As Shown)
DRAWING NO.
SL-04



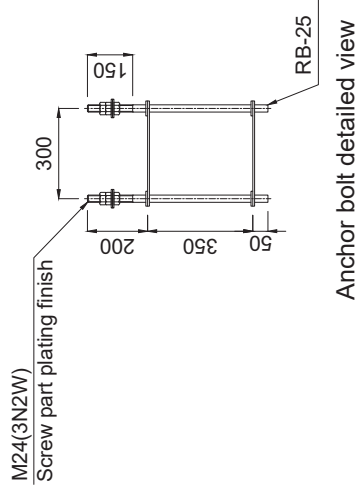
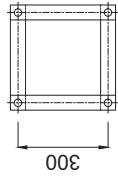
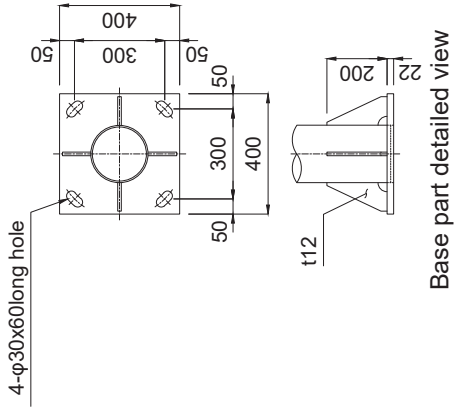
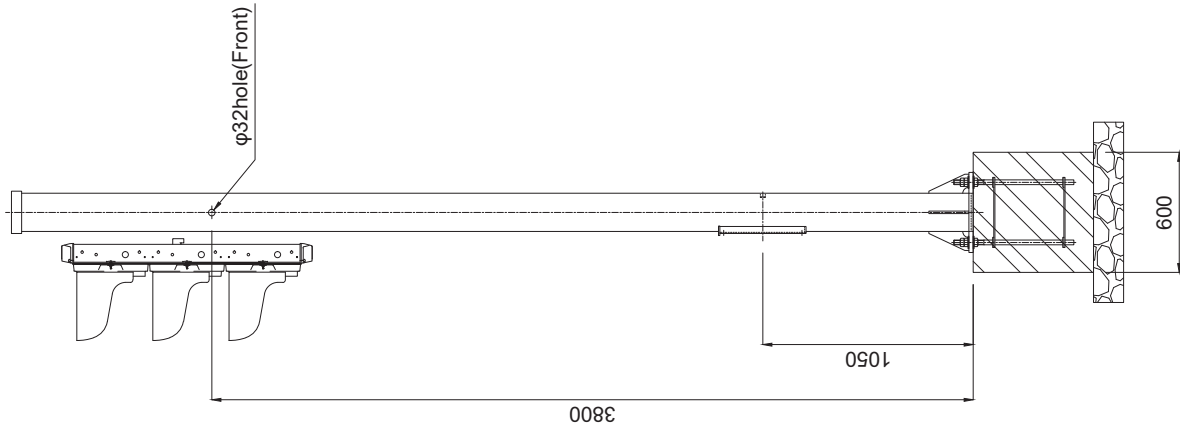
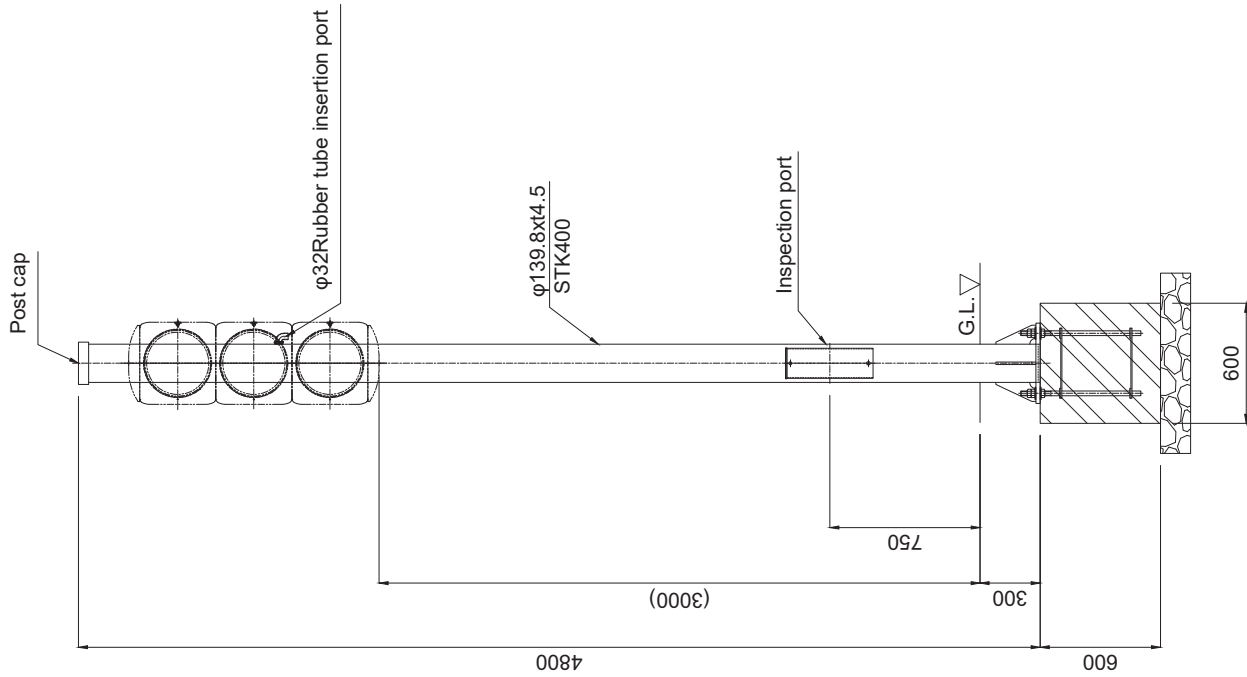
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: TRAFFIC SIGNAL LIGHT(5) INSTALLATION AND DETAIL DRAWING OF TRAFFIC SIGNAL LIGHT(TYPE 1)	SCALE:(A1=1/10)	DRAWING NO. SL-05
--	---	---	-----------------	----------------------



Anchor bolt detailed view(S=1/20)



GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: TRAFFIC SIGNAL LIGHT(6) INSTALLATION AND DETAIL DRAWING OF TRAFFIC SIGNAL LIGHT(TYPE 2)	SCALE:(A1/100)	DRAWING NO. SL-06
--	---	--	---	----------------	----------------------

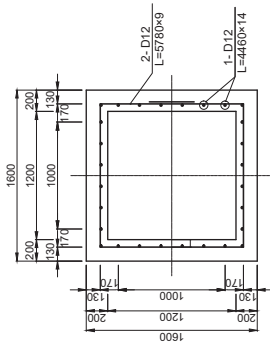


Materials STK400, SS400
Finishing Hot-dip galvanized

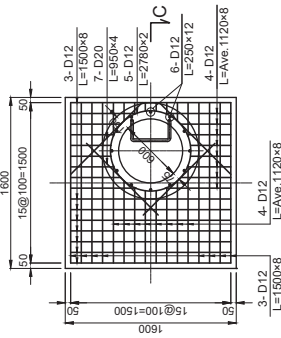
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING TITLE: TRAFFIC SIGNAL LIGHT(7) INSTALLATION AND DETAIL DRAWING OF TRAFFIC SIGNAL LIGHT(TYPE 3)	SCALE:(A1:100) DRAWING NO. SL-07
--	---	---	---	--

Hand Hole

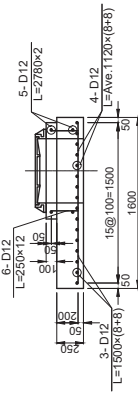
A-A Section



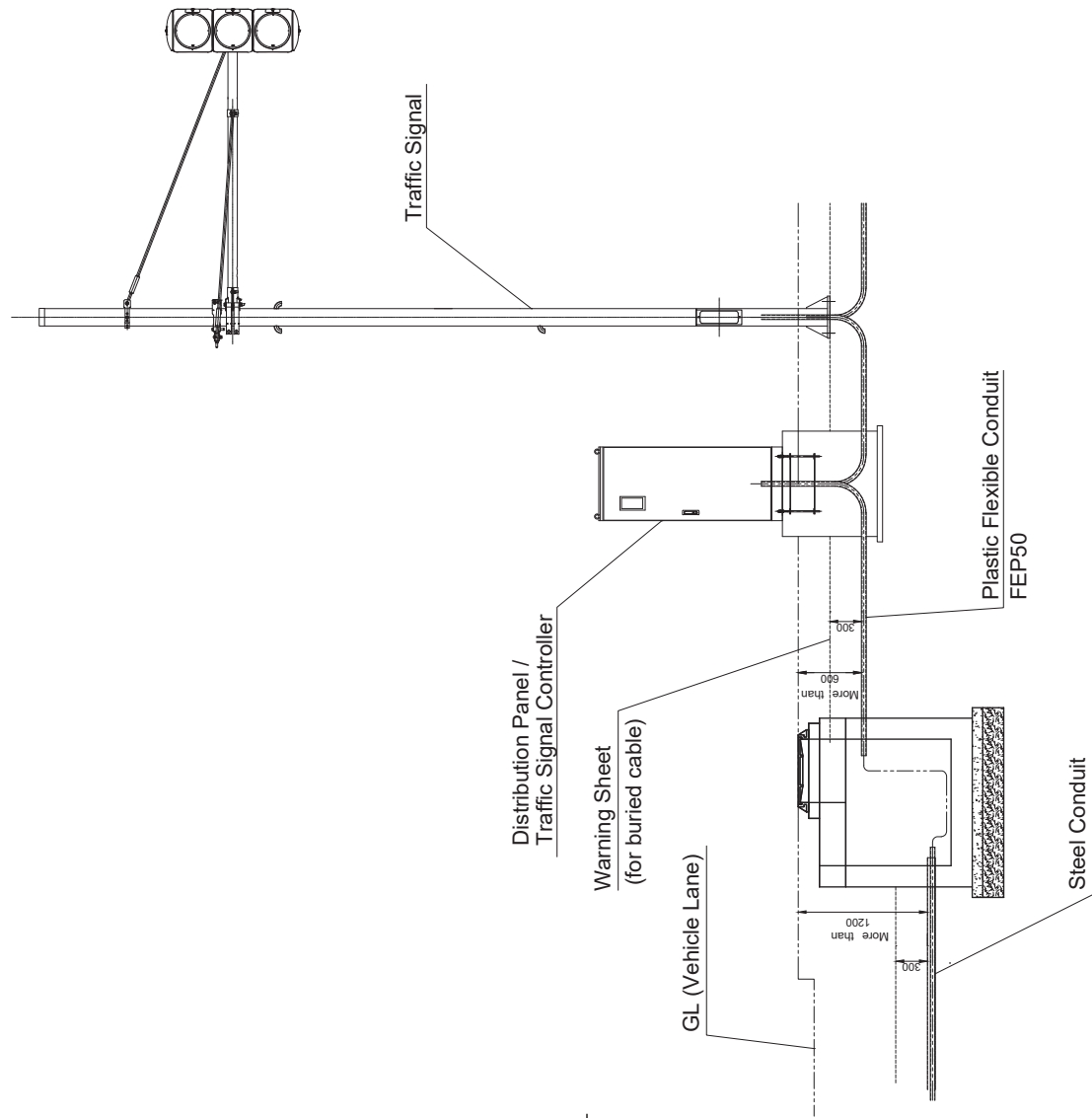
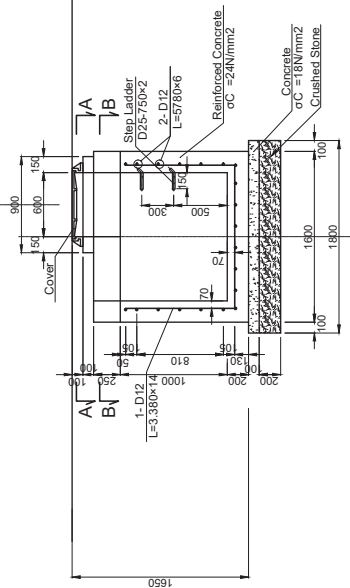
B-B Section



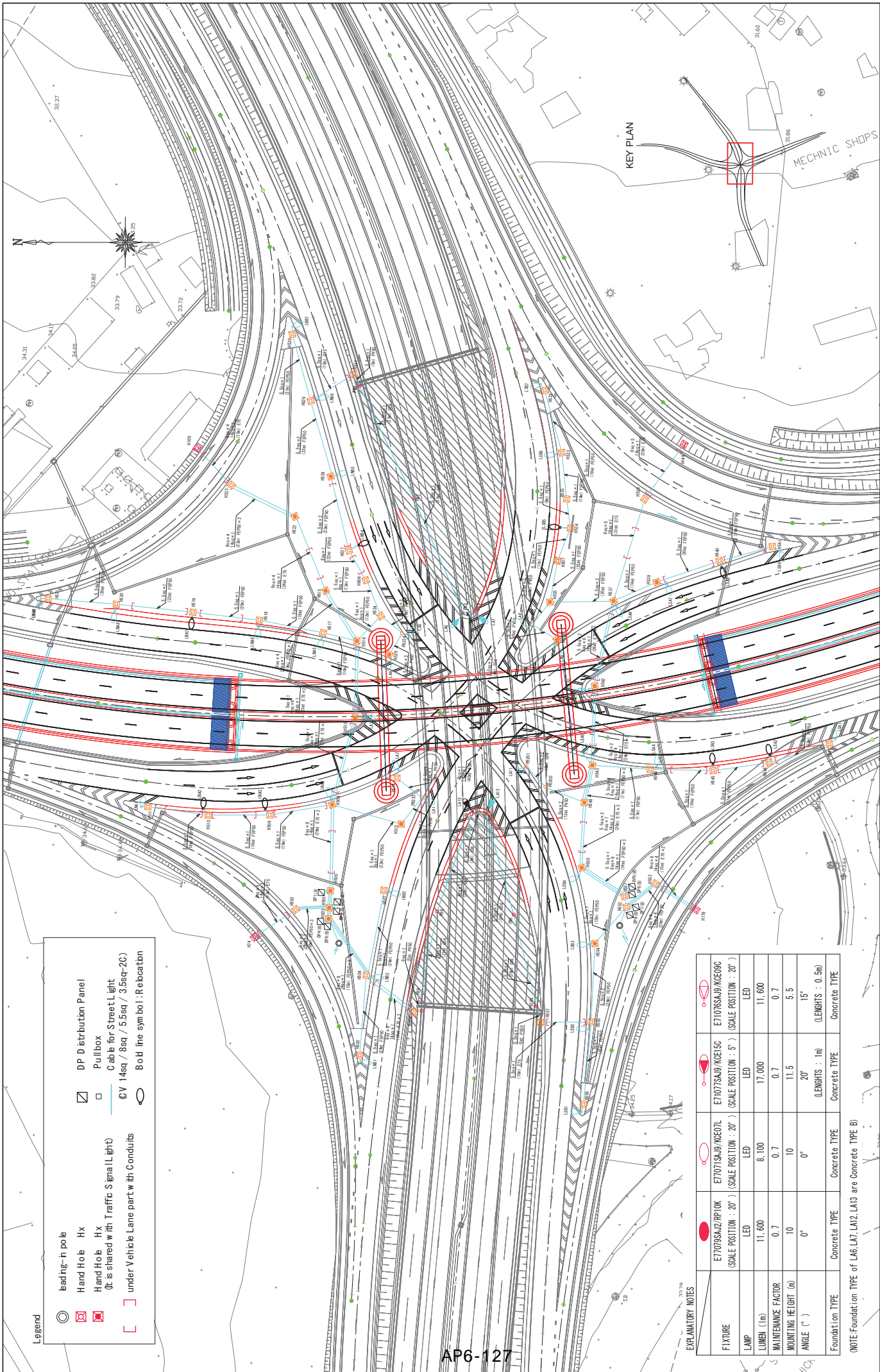
C-C Section



General Drawing



GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2) DRAWING TITLE: TRAFFIC SIGNAL LIGHT(8) INSTALLATION DRAWING OF CONDUIT PIPES AND CABLES	SCALE: (A119) DRAWING NO: SL-08
--	---	--	---------------------------------------



SCALE (A 1:800) DRAWING NO. RL-01

DRAWING TITLE: ROAD LIGHT(1) Layout Plan of Street Light (PHASE 2)

PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

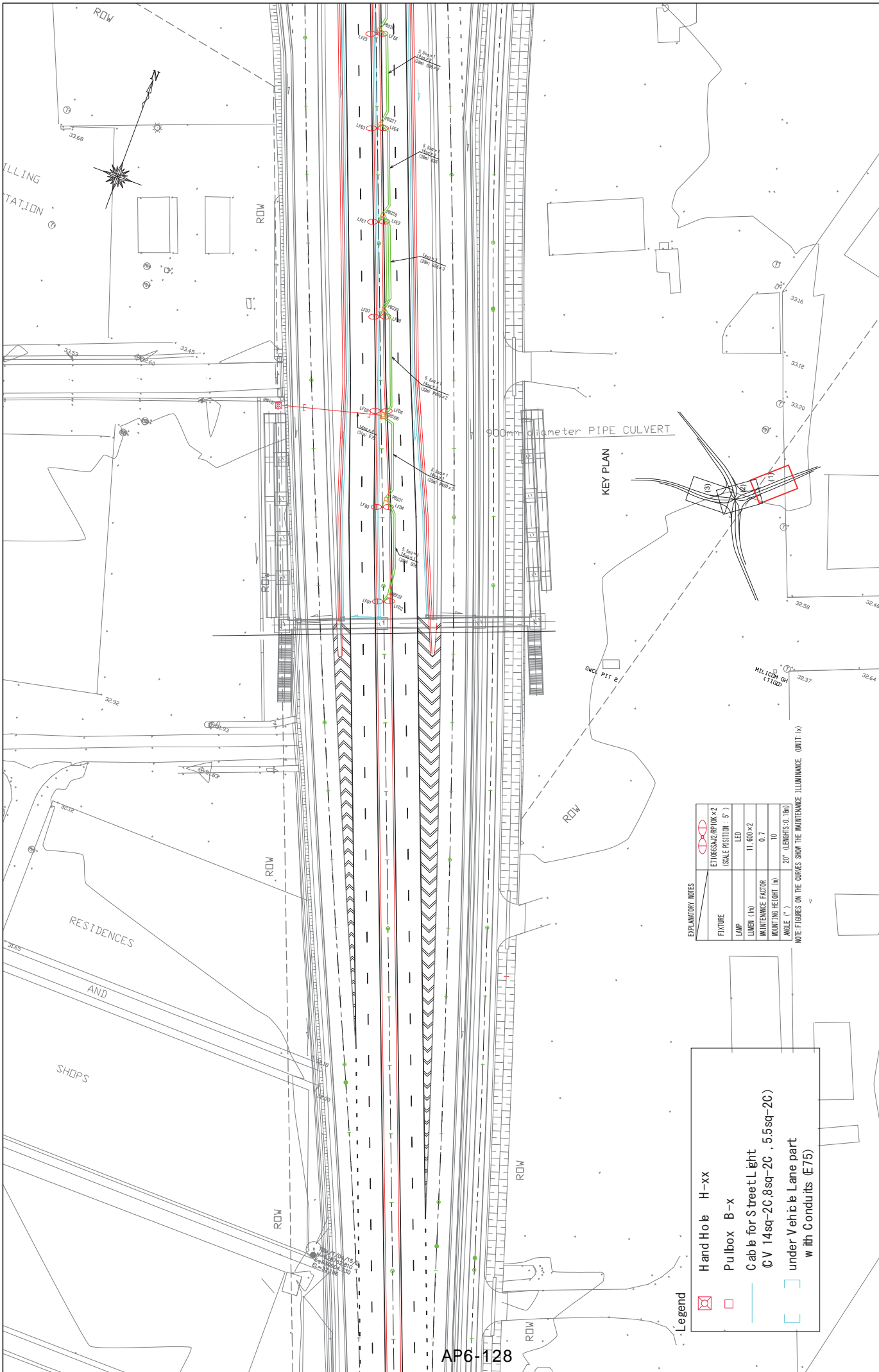
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

Legend

⊙	Lighting pole	⊗	DP Distribution Panel
⊠	Hand Hole	□	Pullbox
⊠	Hand Hole (It is shared with Traffic Signal)	—	Cable for Street Light (ØV 14sq / 8sq / 5.5sq / 3.5sq-2C)
⊠	Hand Hole (It is shared with Traffic Signal)	⊖	Boil line symbol - Relocation
[]	under Vehicle Lane part with Conduits		

EXPLANATORY NOTES

FIXTURE	LED	SCALE POSITION : 20'	SCALE POSITION : 5'	SCALE POSITION : 20'	SCALE POSITION : 20'
E7707SAI2/PT10K	LED	8,100	17,000	E7707SAI9/KCE15C	E7107SAI9/KCE09C
LUMEN (lm)	11,600	8,100	17,000	11,600	11,600
MAINTENANCE FACTOR	0.7	0.7	0.7	0.7	0.7
MOUNTING HEIGHT (m)	10	10	11.5	5.5	5.5
ANGLE (°)	0°	0°	20°	15°	15°
Foundation TYPE	Concrete TYPE	Concrete TYPE	Concrete TYPE	Concrete TYPE	Concrete TYPE
(NOTE: Foundation TYPE of LA6, LA7, LA12, LA13 are Concrete TYPE B)					



AP6-128

EXPLANATORY NOTES

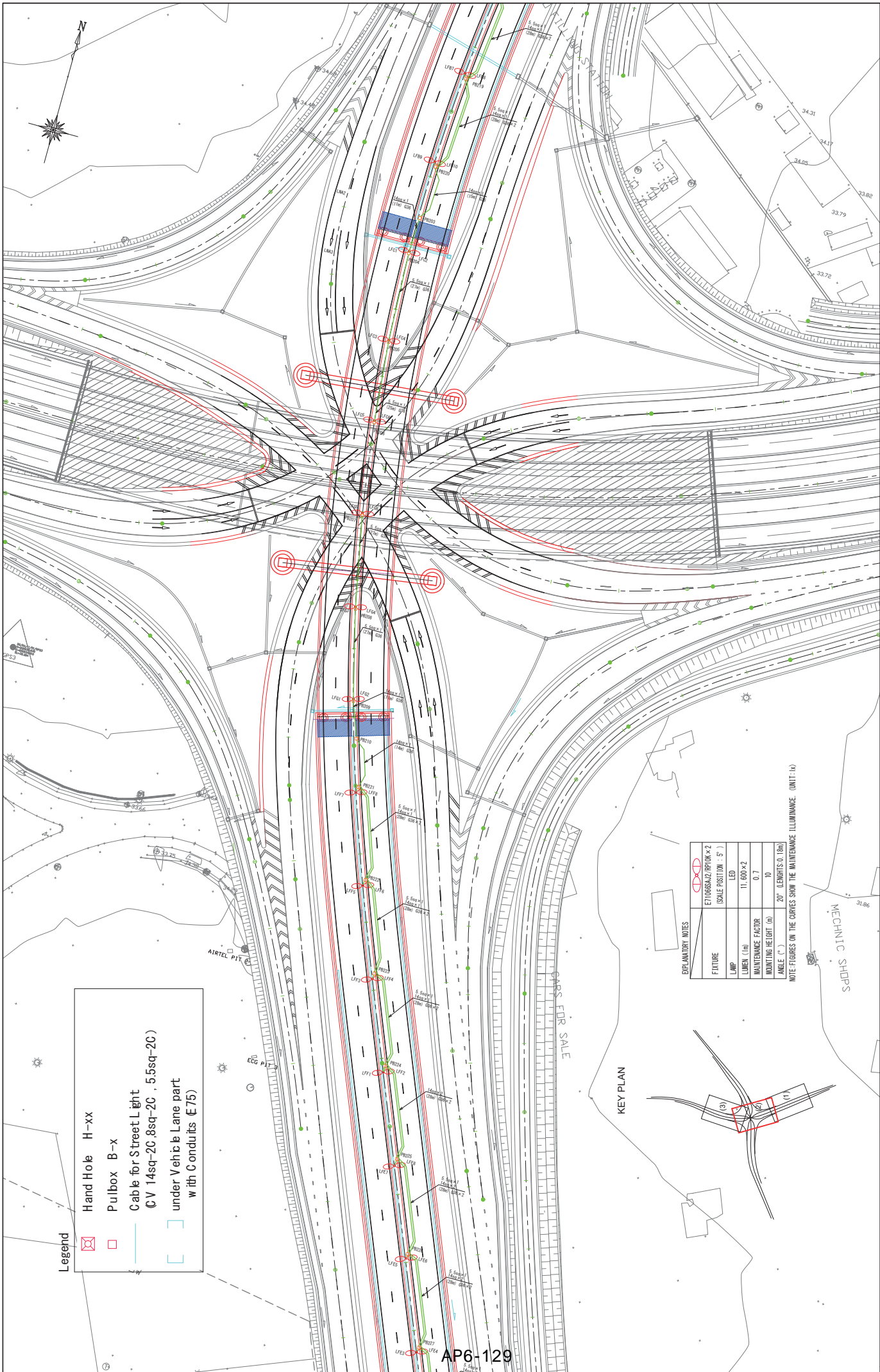
FIXTURE	E7108SKAZRFLXK-X2 (SCALE POSITION - 5')
LAMP	LED
LUMEN (lm)	11,600 x 2
MAINTENANCE FACTOR	0.7
MONITORING HEIGHT (m)	10
ANGLE (°)	20° (LENGTHS 0.18m)

NOTE: FIGURES ON THE CURVES SHOW THE MAINTENANCE ILLUMINANCE. (UNIT: lx)

Legend

- Hand Hold H-xx
- Pulbox B-x
- Cable for Street Light
(CV 14sq-2C, 8sq-2C, 5.5sq-2C)
- under Vehicle Lane part
with Conduits (E75)

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
DRAWING TITLE: ROAD LIGHT(2) Layout Plan of Street Light (Flyover) (1/3)		SCALE (A 1:800) DRAWING NO. RL-02



Legend

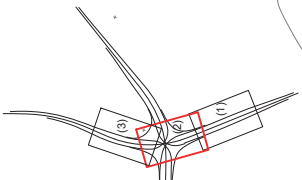
	Hand Hole	H-xx
	Pulbox	B-x
	Cable for Street Light	(CV 14sq-2C, 8sq-2C, 5.5sq-2C)
	Under Vehicle Lane part with Conduits	(E 75)

EXPLANATORY NOTES

FEATURE	ET10832A2, OPTIK x 2
LAMP	LED
LUMEN (lm)	11,600 x 2
MAINTENANCE FACTOR	0.7
MOUNTING HEIGHT (m)	10
ANGLE (°)	20° (LENGTHS: 0.10m)

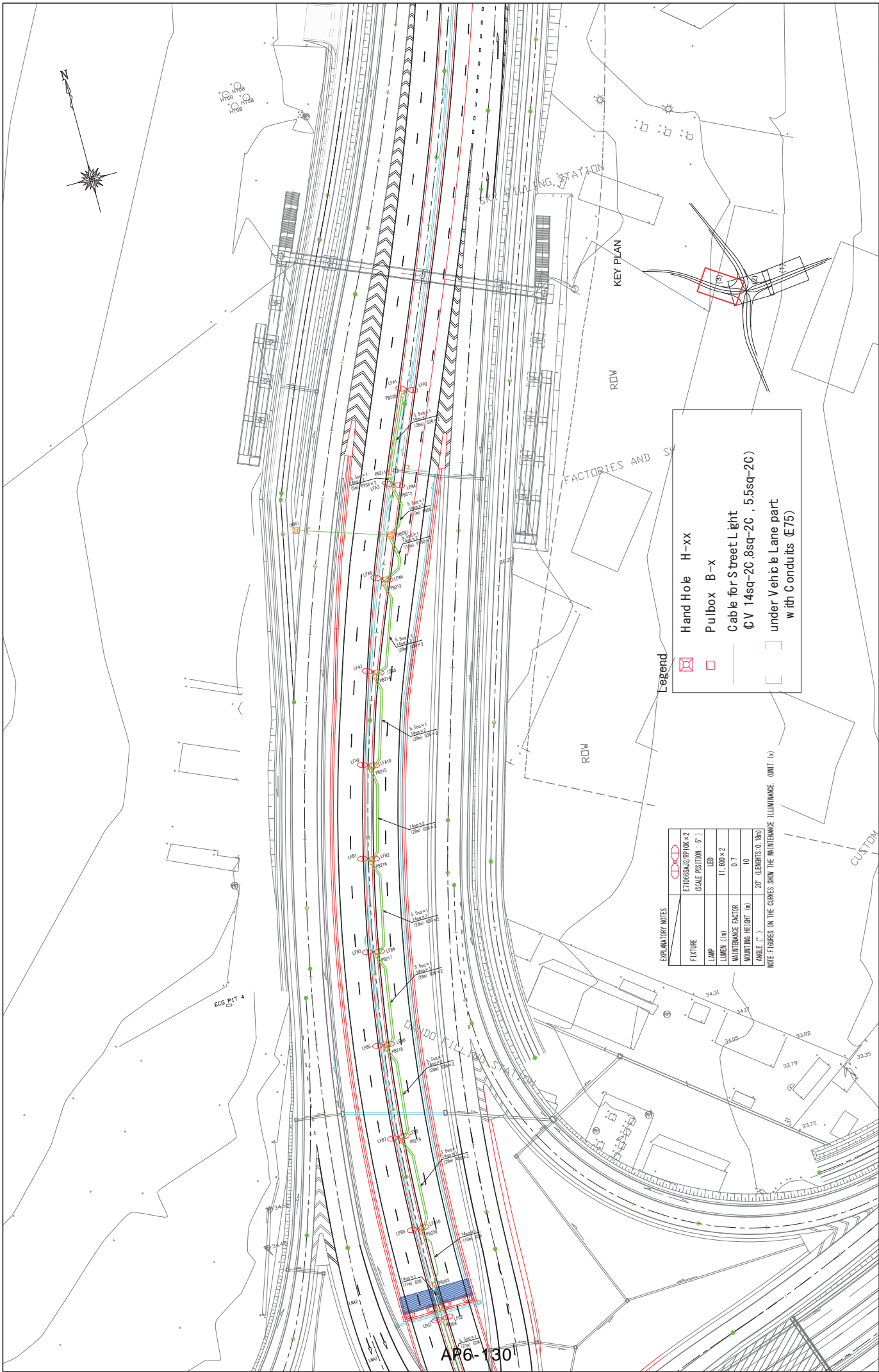
NOTE: FIGURES ON THE CURVES SHOW THE MAINTENANCE ILLUMINANCE. (UNIT: lx)

KEY PLAN



AP6-129

<p>PROJECT TITLE:</p> <p>THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)</p>	<p>DRAWING NO.</p> <p>RL-03</p>
	<p>SCALE (A 1:1000)</p>
<p>DRAWING TITLE:</p> <p>ROAD LIGHT(3)</p> <p>Layout Plan of Street Light (Flyover) (2/3)</p>	<p>CLIENT:</p> <p>GHANA HIGHWAY AUTHORITY</p> <p>MINISTRY OF ROADS AND HIGHWAYS</p> <p>REPUBLIC OF GHANA</p>
<p>DESIGNER:</p> <p>CTI ENGINEERING INTERNATIONAL CO., LTD.</p> <p>JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>DATE:</p>



EXPLANATORY NOTES

FIXTURE	ET1066SAJ2/PT10Kx2
LAMP	LED
LUMEN (lm)	11,000x2
MAINTENANCE FACTOR	0.7
MOUNTING HEIGHT (m)	10
ANGLE (°)	20° (LENGTHS: 0.18m)

NOTE: FIGURES ON THE CURVES SHOW THE MAINTENANCE ILLUMINANCE. (UNIT: lx)

Legend

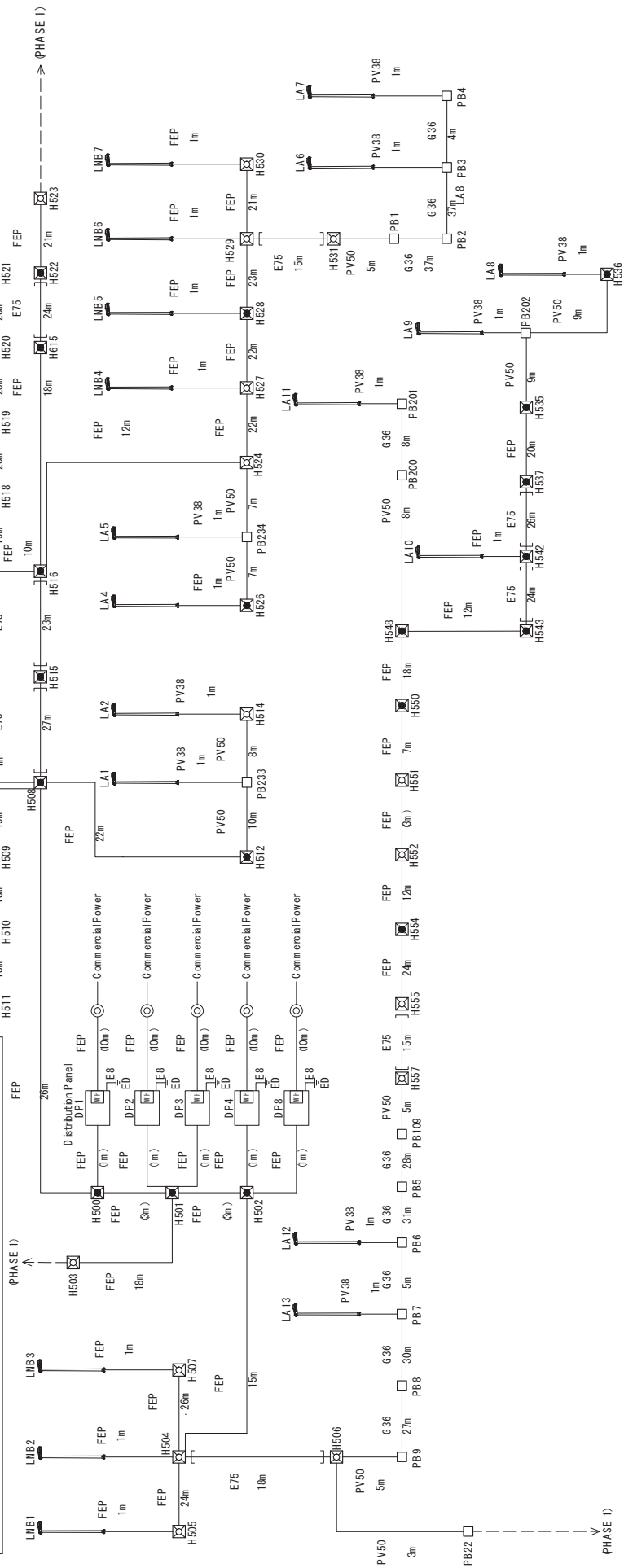
	Hand Hole H-xx
	Pulbox B-x
	Cable for Street Light (C V 14sq-2C, 8sq-2C, 5.5sq-2C)
	under Vehicle Lane part with Conduits (E75)

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ROAD LIGHT(4) Layout Plan of Street Light (Flyover) (3/3)	SCALE (A 1:500)	DRAWING NO. RL-04
		DRAWING NO.			

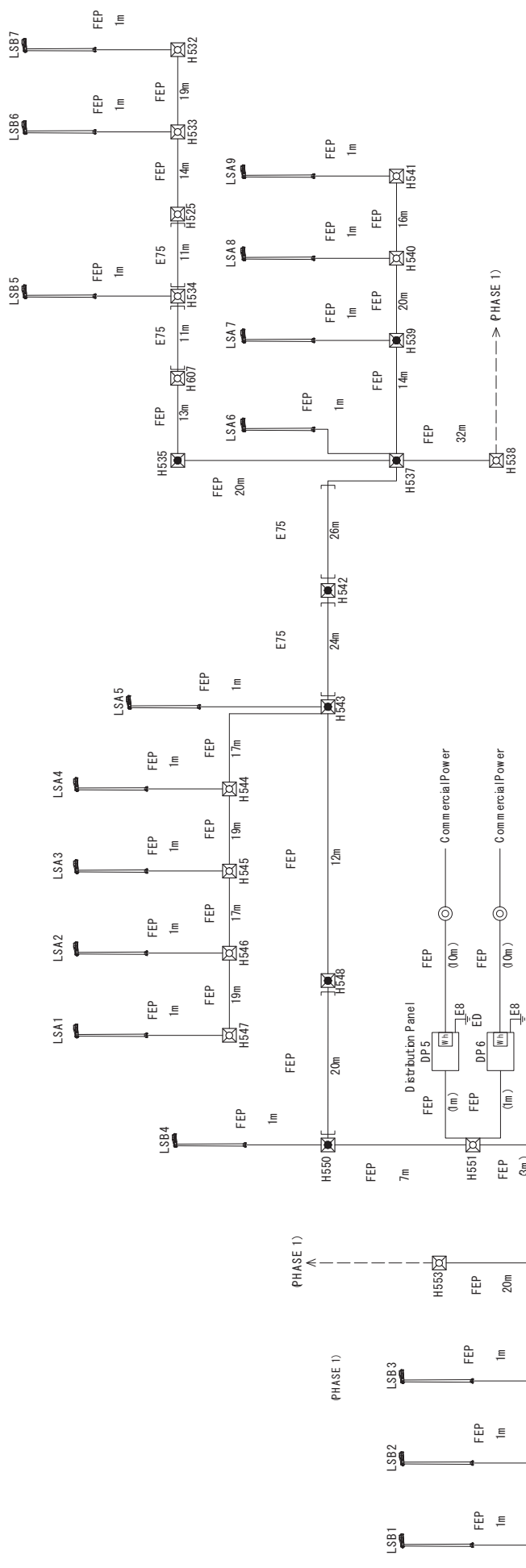
AP6-130

Legend

- Hand Hole H-xx
- Hand Hole H-xx
- Cable for Street Light (CV 14sq-2C, 8sq-2C, 5.5sq-2C) with Conduits (FEP50, G36, PV50, PV38)
- Pulbox B-x
- Cable for Traffic Signal (under Vehicle Lane part with Conduits (E75))
- Power Cable with Conduits (FEP50)



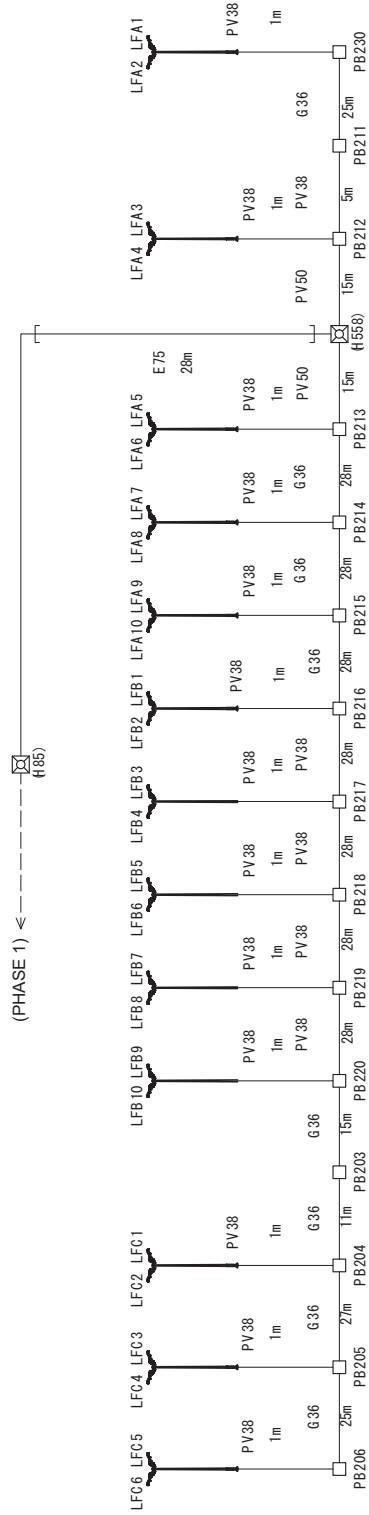
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ROAD LIGHT(5) Wiring Plan of Street Light (1/4) (PHASE 2)
SCALE: (As Shown)	DRAWING NO.	RL-05



Legend

- Hand Hole H-xx
- Pulbox B-x
- Street Light H-xx
- Traffic Signal H-xx
- Cable for Street Light
- Cable with Conduits (CV 14sq-2C, 8sq-2C, 5.5sq-2C)
- Power Cable with Conduits (FEP50, G36, PV50, PV38)

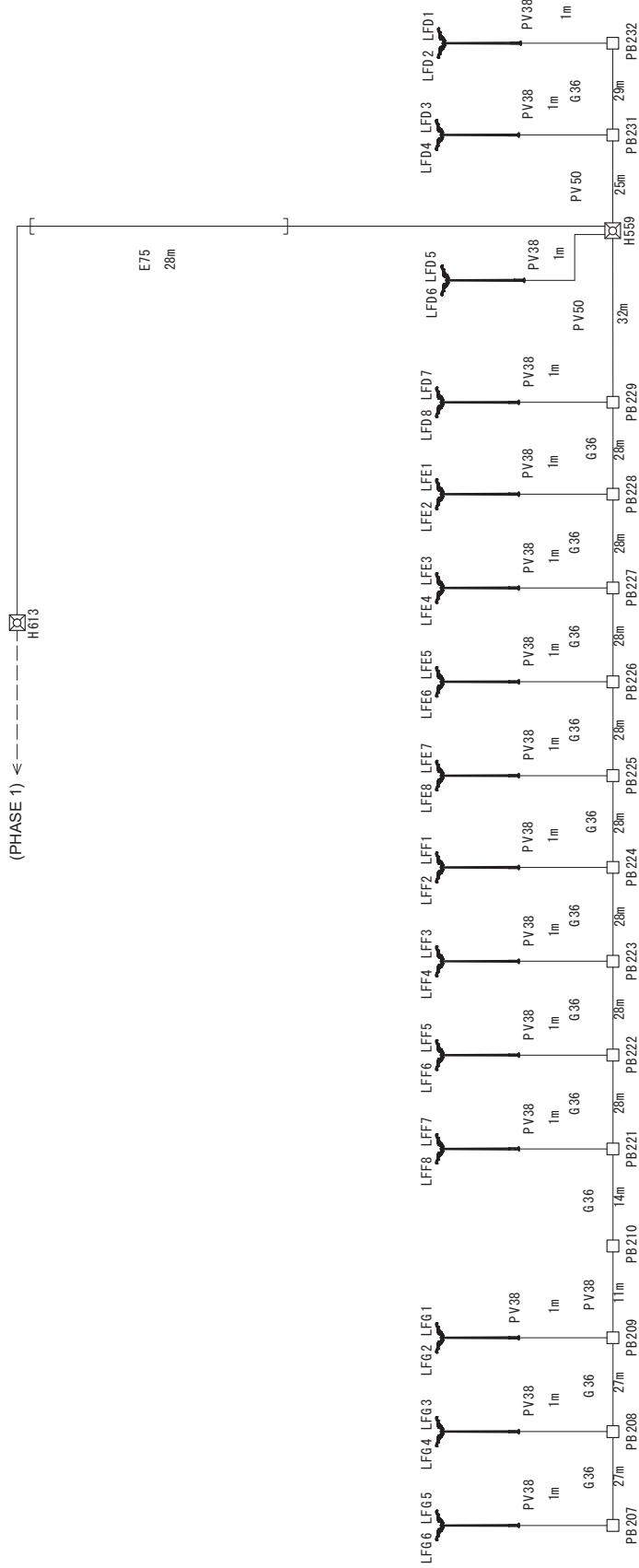
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	SCALE (A1/100)	DRAWING TITLE: ROAD LIGHT(6) Wiring Plan of Street Light (2/4) (PHASE 2)	DRAWING NO. RL-06
--	---	--	----------------	---	----------------------



Legend

- Hand Hole H-xx
- Pulbox B-x
- Cable for Street Light (V 8sq-2C . 5.5sq-2C) with Conduits (FEP50)
- Power Cable with Conduits (FEP50)
- under Vehicle Lane part with Conduits (E75)

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ROAD LIGHT(7) Wiring Plan of Street Light (3/4) (PHASE 2)	SCALE (A1/100) DRAWING NO. RL-07
--	---	--	---	--

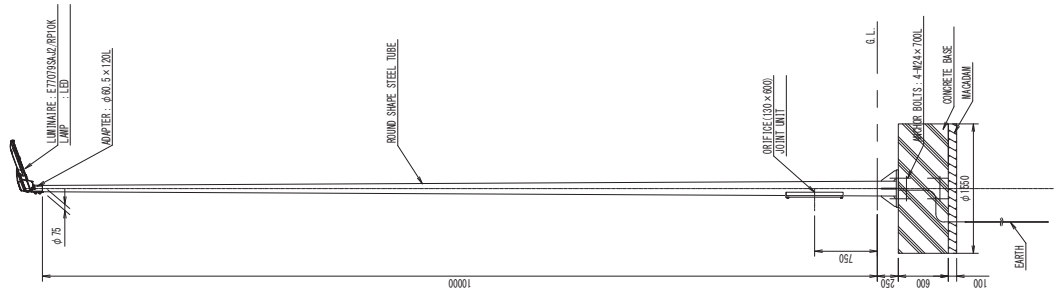


Legend

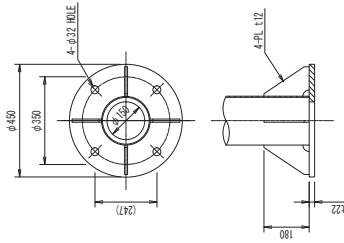
- Hand Hole H-xx
- Pulbox B-x
- Cable for Street Light (CV 8sq-2C, 5.5sq-2C) with Conduits (EP50)
- Power Cable with Conduits (EP50)
- under Vehicle Lane part with Conduits (E75)

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: ROAD LIGHT(8) Wiring Plan of Street Light (4/4) (PHASE 2)	SCALE:(A1/100) DRAWING NO. RL-08
--	---	--	---	--

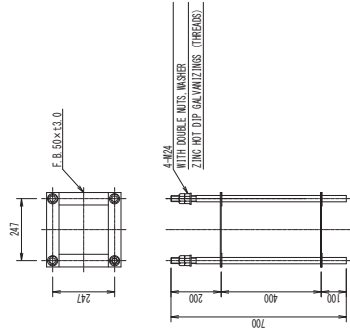
ELEVATION DIAGRAM OF LIGHTING



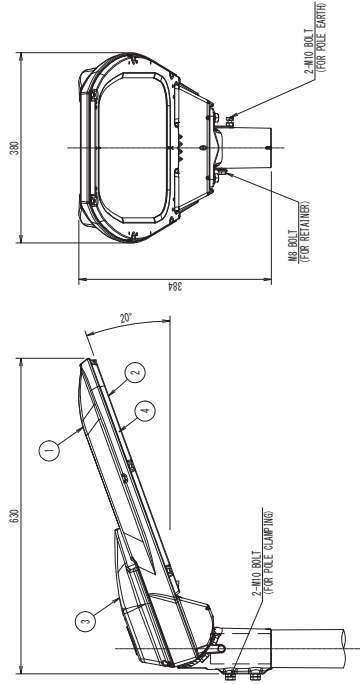
BASE-PLATE DETAIL



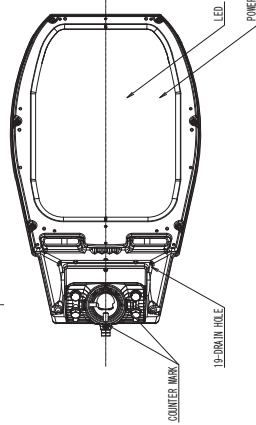
ANCHOR BOLTS DETAIL



LUMINAIRE DETAIL

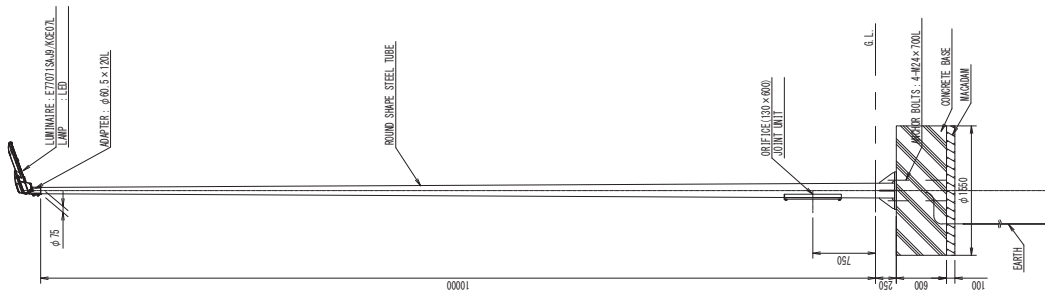


No.	PARTS	MATERIAL	QTY	SUMMARY
1	BODY	ALUMINIUM ALLOY DIE CASTING	1	
2	FRAME	ALUMINIUM ALLOY DIE CASTING	1	
3	COVER	ALUMINIUM ALLOY DIE CASTING	1	
4	FRONT GLASS	FIBERED GLASS 14	1	CLEAR

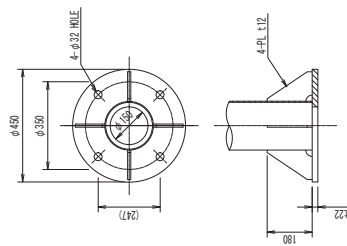


GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	DRAWING TITLE: ROAD LIGHT(9) Installation and Detail Drawing of Street Light (Type 1 Pole10m)	SCALE (A1199)	DRAWING NO.
				RL-09

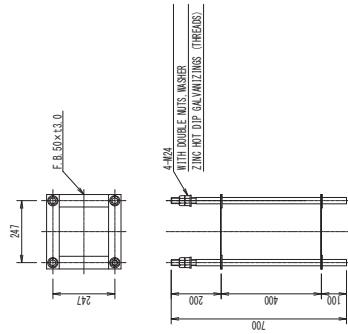
ELEVATION DIAGRAM OF LIGHTING S=1:30



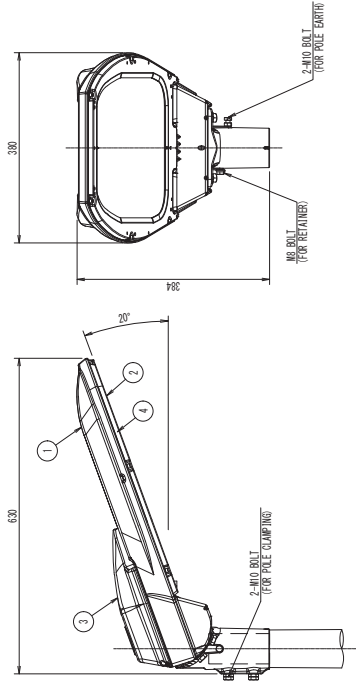
BASE-PLATE DETAIL S=1:10



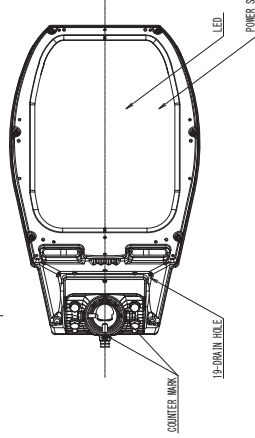
ANCHOR BOLTS DETAIL S=1:10



LUMINAIRE DETAIL S=1:5

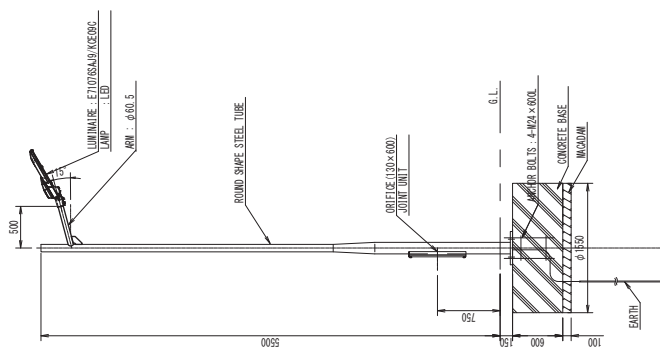


NO.	PARTS	MATERIAL	QTY	SUMMARY
1	BODY	ALUMINUM DIE CASTING	1	
2	FRAME	ALUMINUM DIE CASTING	1	
3	FRONT GLASS	ALUMINUM DIE CASTING	1	
4	FRONT GLASS	FIBERED GLASS 14	1	CLEAR

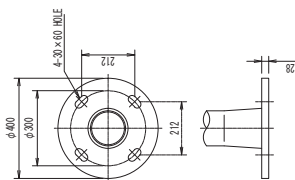


GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE:	DRAWING TITLE:	SCALE (A1199)	DRAWING NO.
		THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	ROAD LIGHT(10) Installation and Detail Drawing of Street Light (Type2 Pole10m)		RL-10

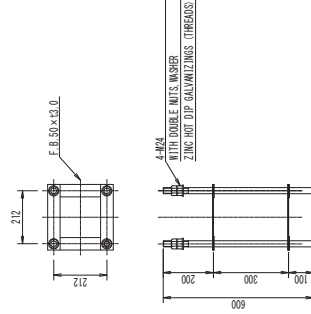
ELEVATION DIAGRAM OF LIGHTING S=1:30



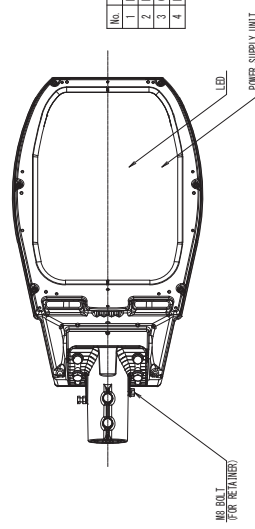
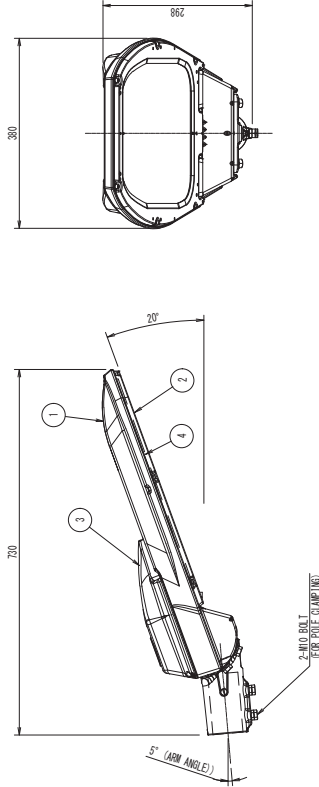
BASE-PLATE DETAIL S=1:10



ANCHOR BOLTS DETAIL S=1:10



LUMINAIRE DETAIL S=1:5



No.	PARTS	MATERIAL	Q T	SUMMARY
1	BODY	ALUMINUM ALLOY DIE CASTING	1	
2	FRAME	ALUMINUM ALLOY DIE CASTING	1	
3	COVER	ALUMINUM ALLOY DIE CASTING	1	
4	FRONT GLASS	TEMPERED GLASS 14	1	CLEAR

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

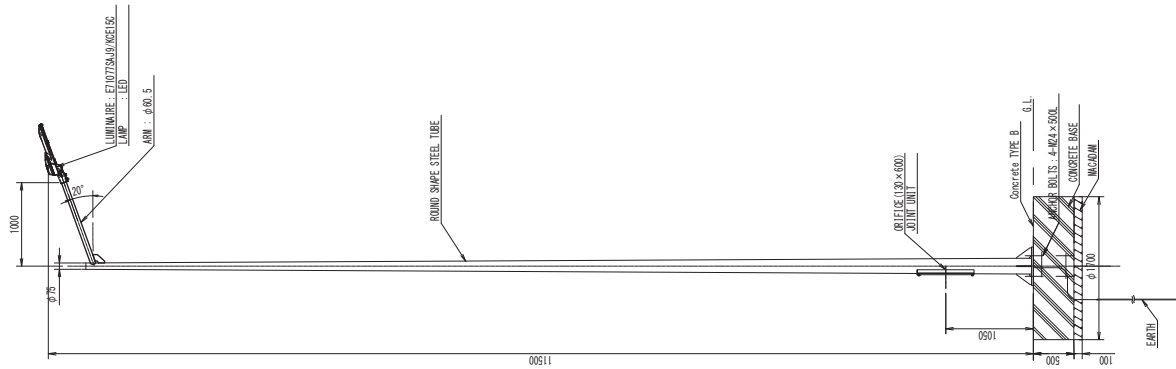
PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
PHASE 2)

DRAWING TITLE:
ROAD LIGHT(11)
Installation and Detail Drawing of Street Light
(Type3 Poles,5m Arm0.5m)

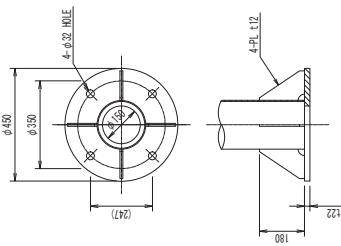
SCALE (A1100)

RL-11

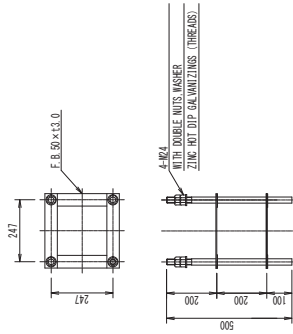
ELEVATION DIAGRAM OF LIGHTING



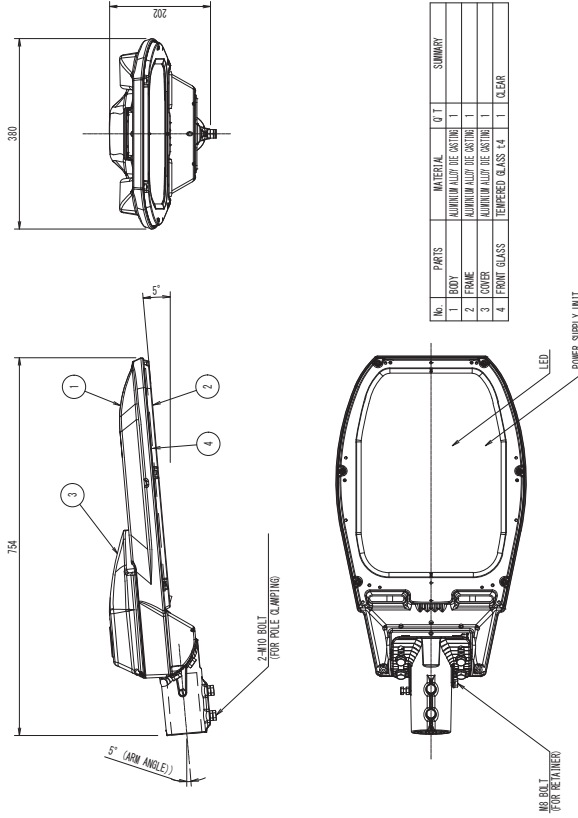
BASE-PLATE DETAIL



ANCHOR BOLTS DETAIL



LUMINAIRES DETAIL



SCALE (A1100)

DRAWING TITLE:
ROAD LIGHT(13)
Installation and Detail Drawing of Street Light
(Type5 Pole 11.5m Arm 1m, Concrete TYPE B)

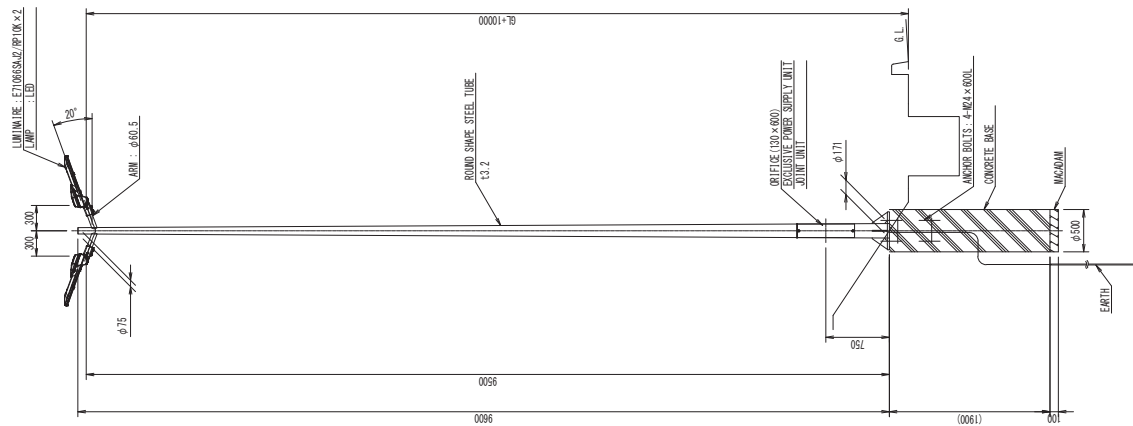
PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT
PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

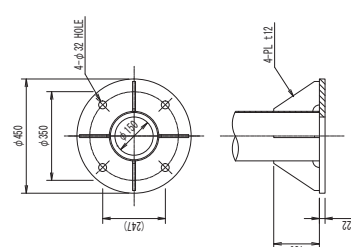
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

RL-13

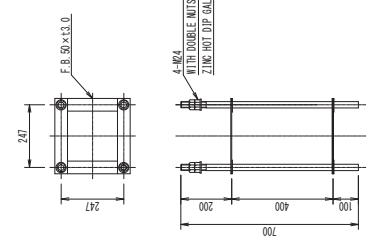
ELEVATION DIAGRAM OF LIGHTING S=1:30



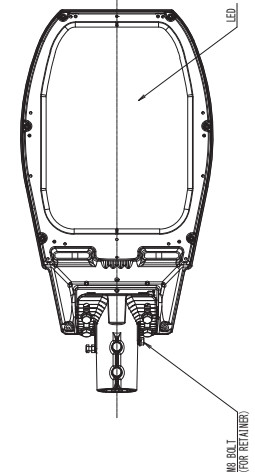
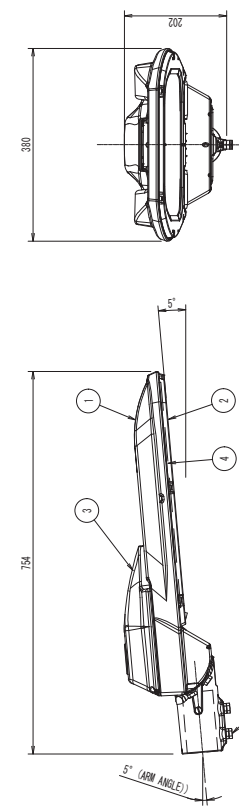
BASE-PLATE DETAIL S=1:10



ANCHOR BOLTS DETAIL S=1:10

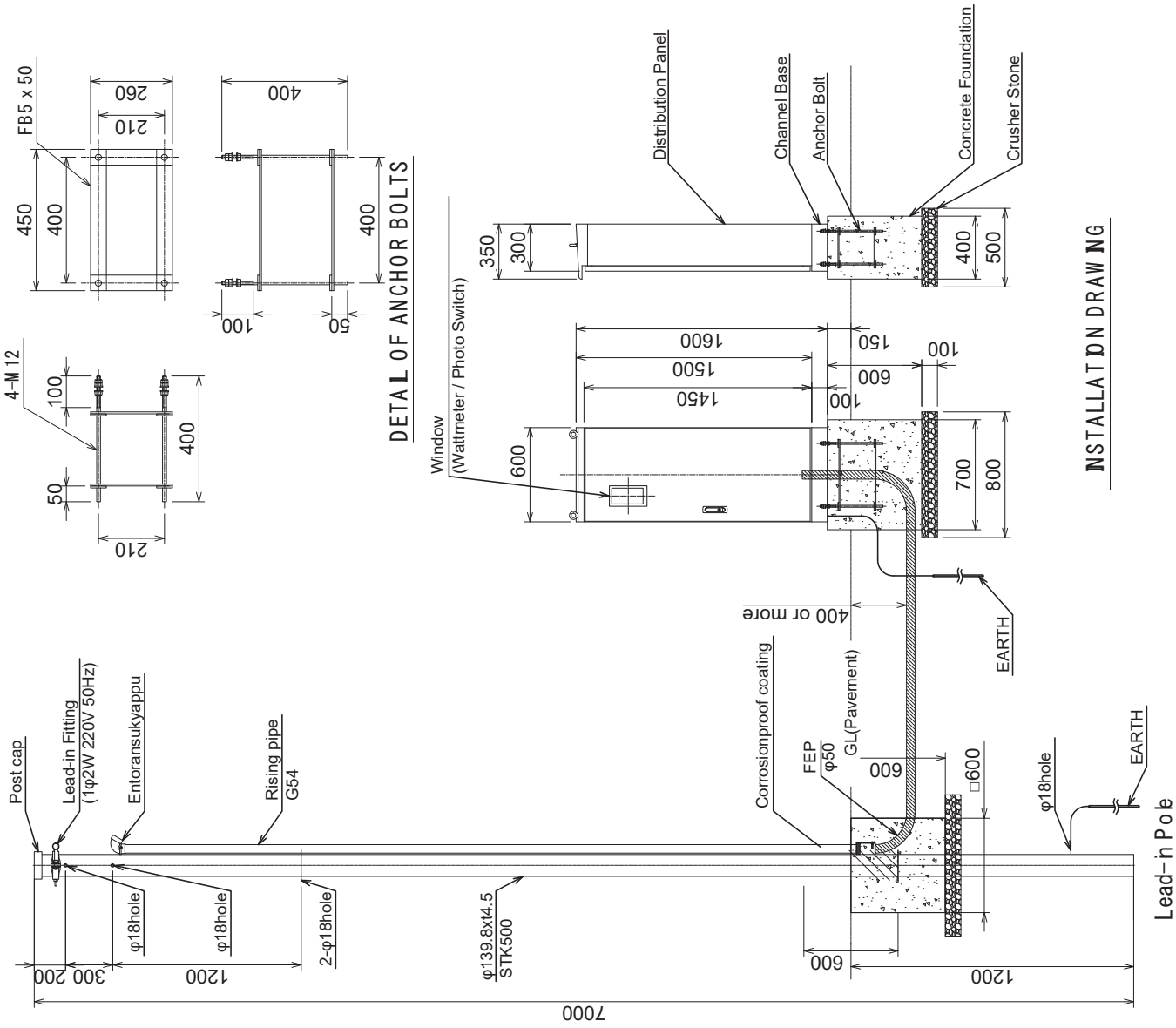


LUMINAIRES DETAIL S=1:5



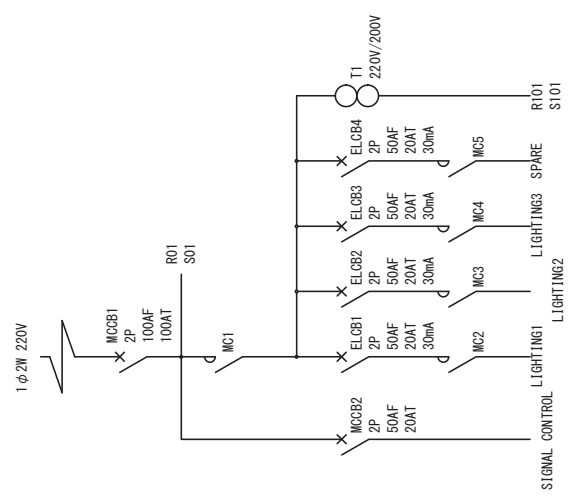
NO.	PARTS	MATERIAL	QTY	SUMMARY
1	BODY	ALUMINIUM ANODIZED CASTING	1	
2	FRAME	ALUMINIUM ANODIZED CASTING	1	
3	COVER	ALUMINIUM ANODIZED CASTING	1	
4	FRONT GLASS	TEMPERED GLASS 14	1	CLEAR

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2		SCALE (A1199)	DRAWING NO.
		DRAWING TITLE: ROAD LIGHT(14) Installation and Detail Drawing of Street Light (Type6)			RL-14

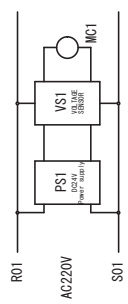


INSTALLATION DRAWING

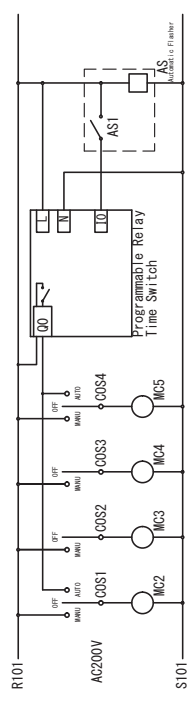
SINGLE CIRCUIT



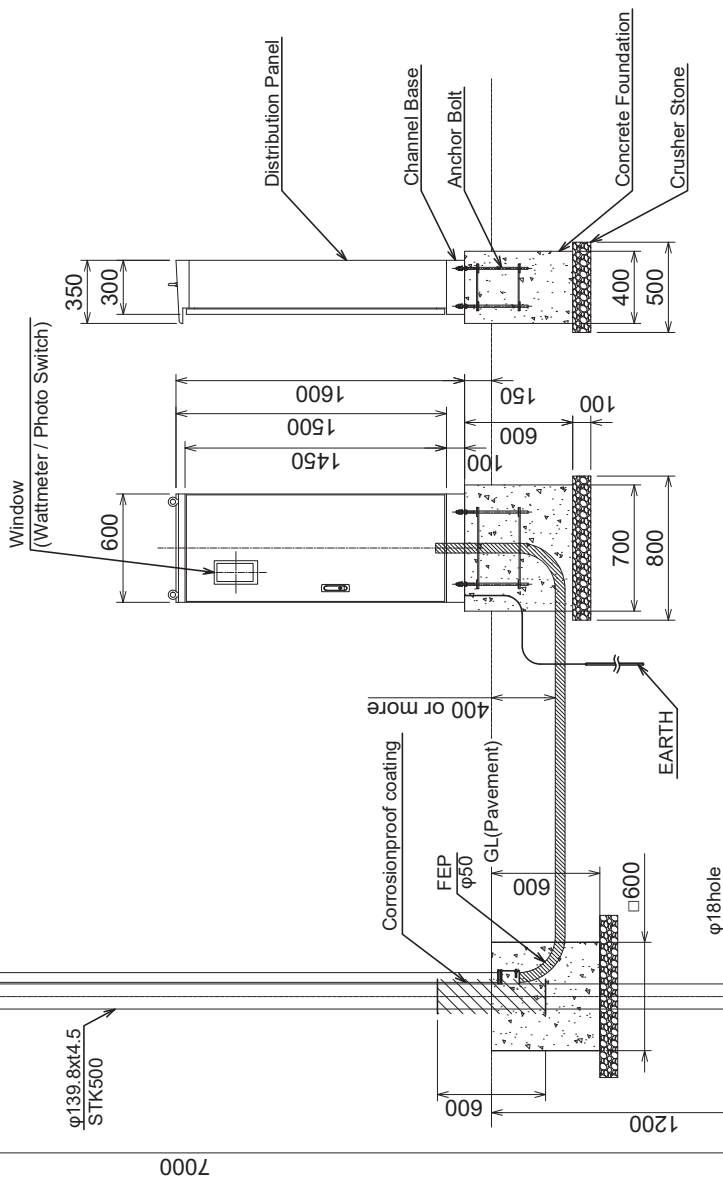
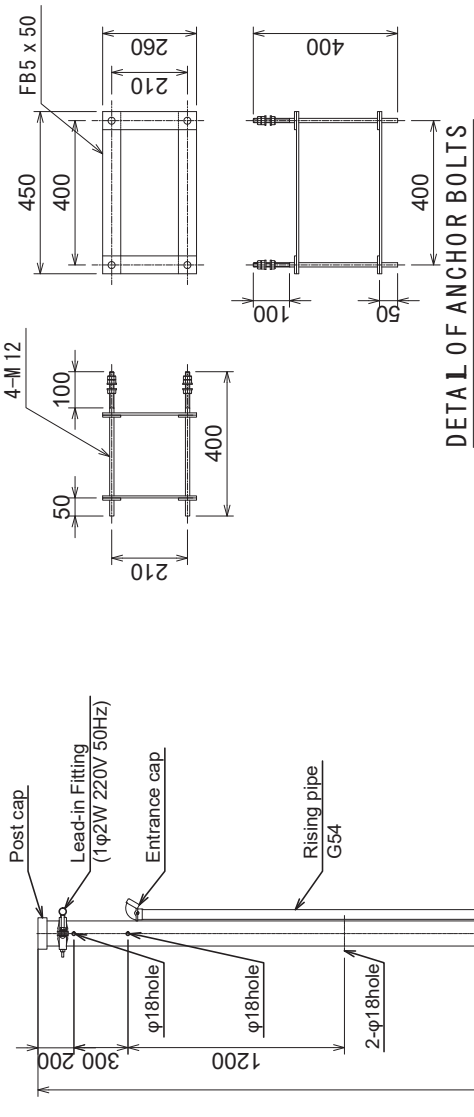
VOLTAGE MONITOR CIRCUIT
(For Underpass)



CONTROL CIRCUIT



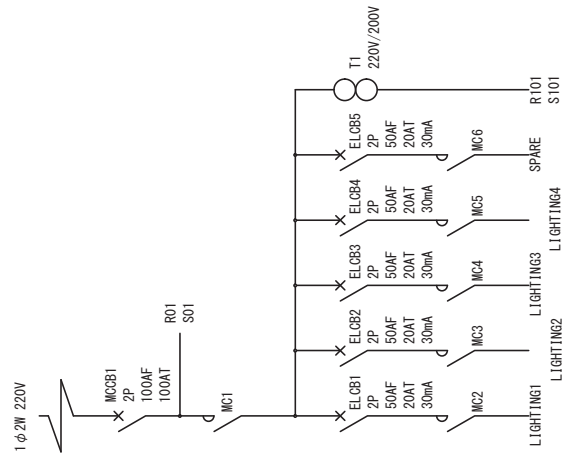
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2	DRAWING NO. RL-15
DRAWING TITLE: ROAD LIGHT(15) Installation Drawing of Distribution Panel (TypeA)		SCALE (A1/100)	



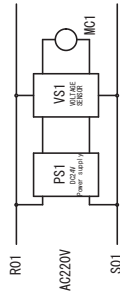
INSTALLATION DRAWING

Lead-in Pole

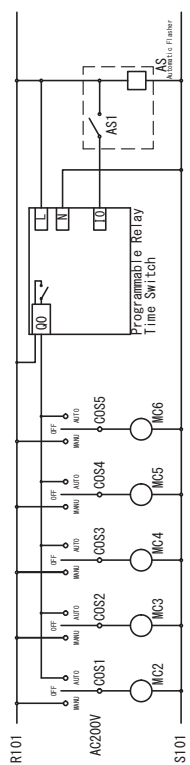
SINGLE CIRCUIT



VOLTAGE MONITOR CIRCUIT

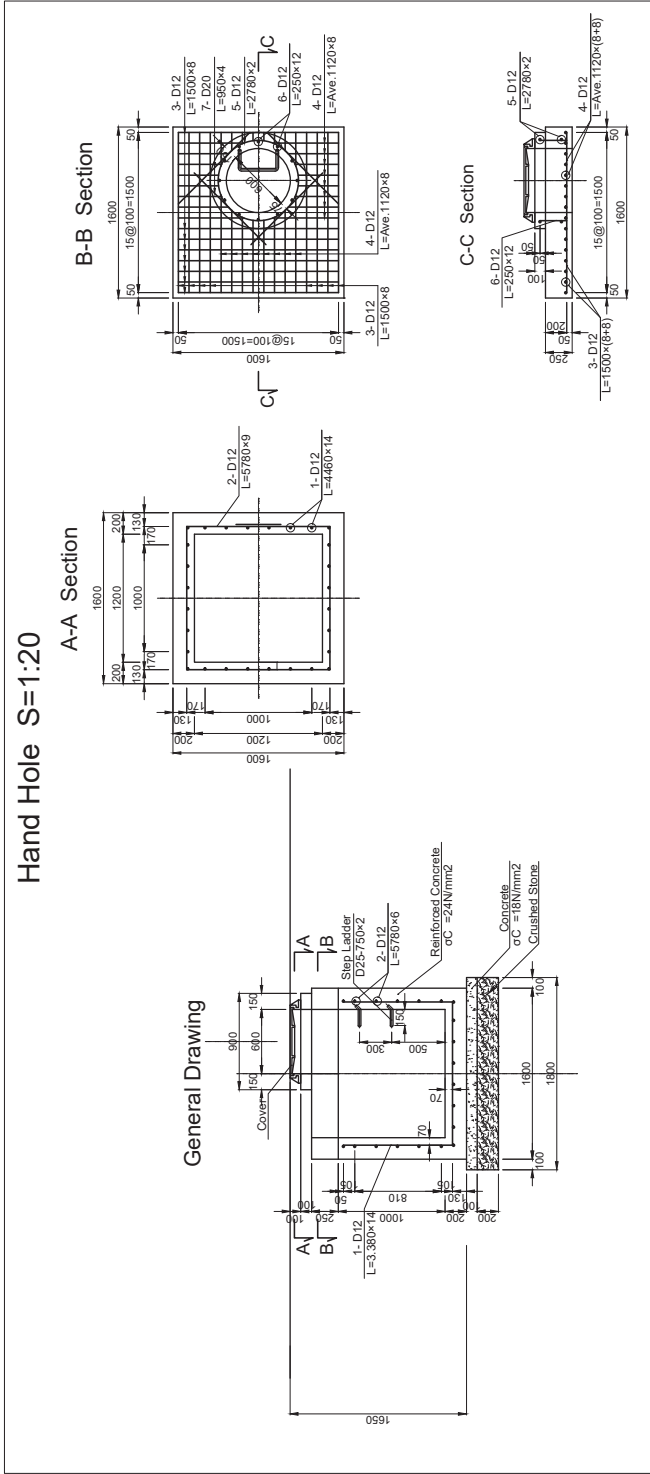


CONTROL CIRCUIT



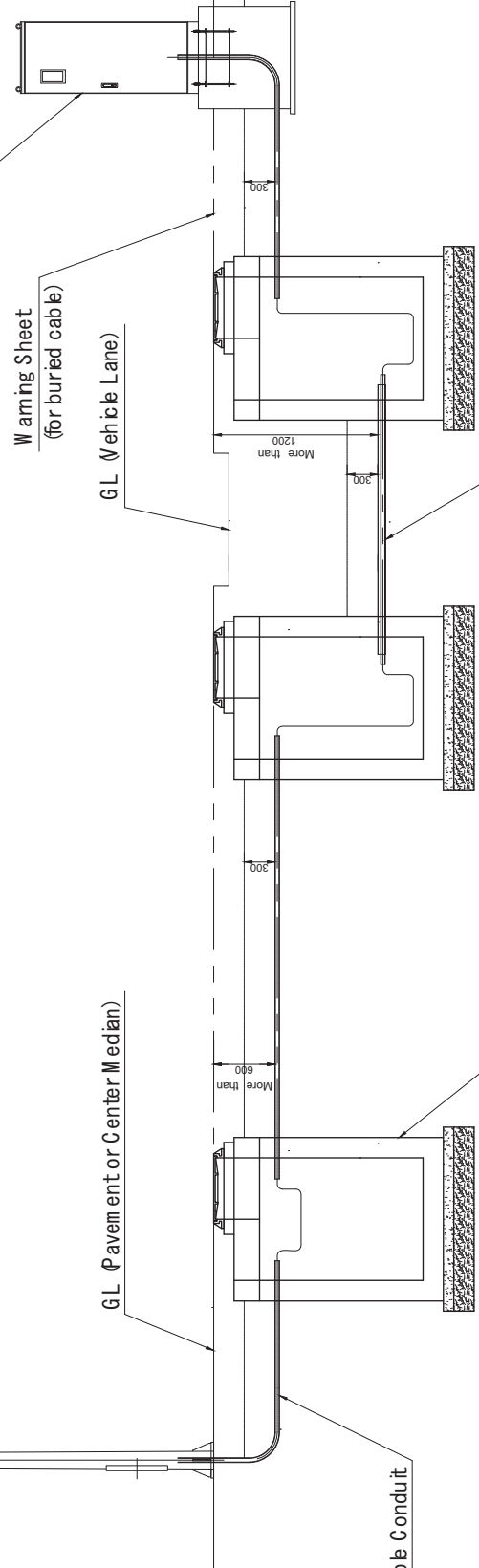
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING NO. RL-16
DRAWING TITLE: ROAD LIGHT(16) Installation Drawing of Distribution Panel (TypeB)		SCALE (A1/16)	

Hand Hole S=1:20



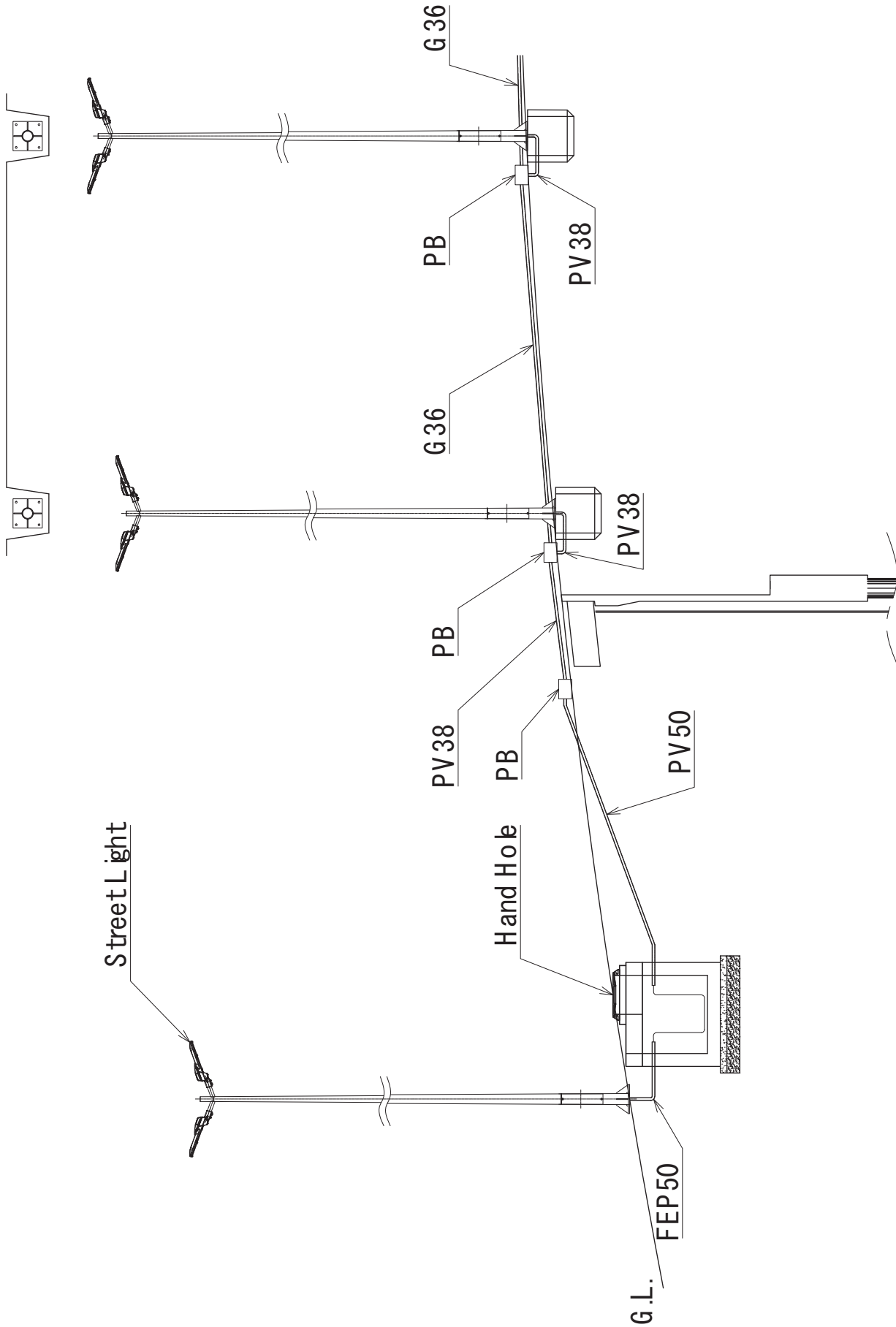
Street Light

Distribution Panel / Traffic Signal Controller



Plastic Flexible Conduit FEP50

<p>GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA</p>	<p>CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)</p>	<p>DRAWING TITLE: ROAD LIGHT(17) Installation Drawing of Conduit Pipes and Cables</p>	<p>SCALE (A119) DRAWING NO. RL-17</p>
---	---	--	---	---

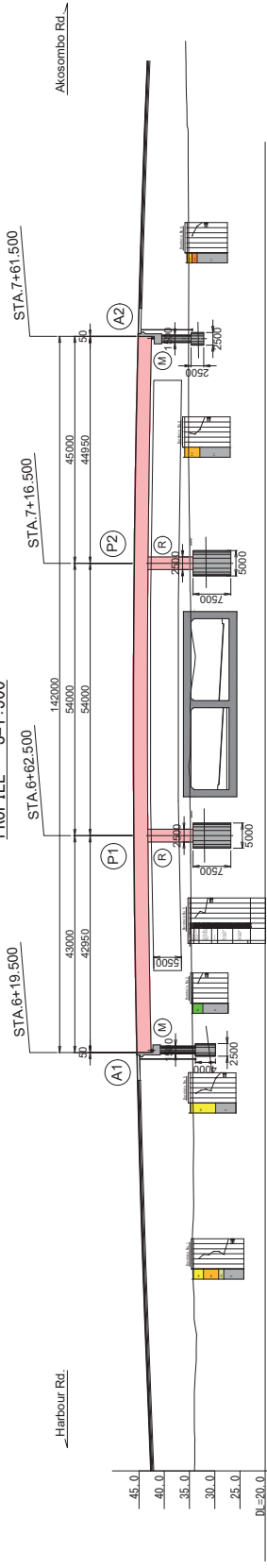


AP6-144

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT PHASE 2)	DRAWING TITLE: ROAD LIGHT(18) Installation Reference Drawing of Conduit Pipes and Cables (Flyover)	SCALE: (A1/100) DRAWING NO. RL-18
--	---	---	--	---

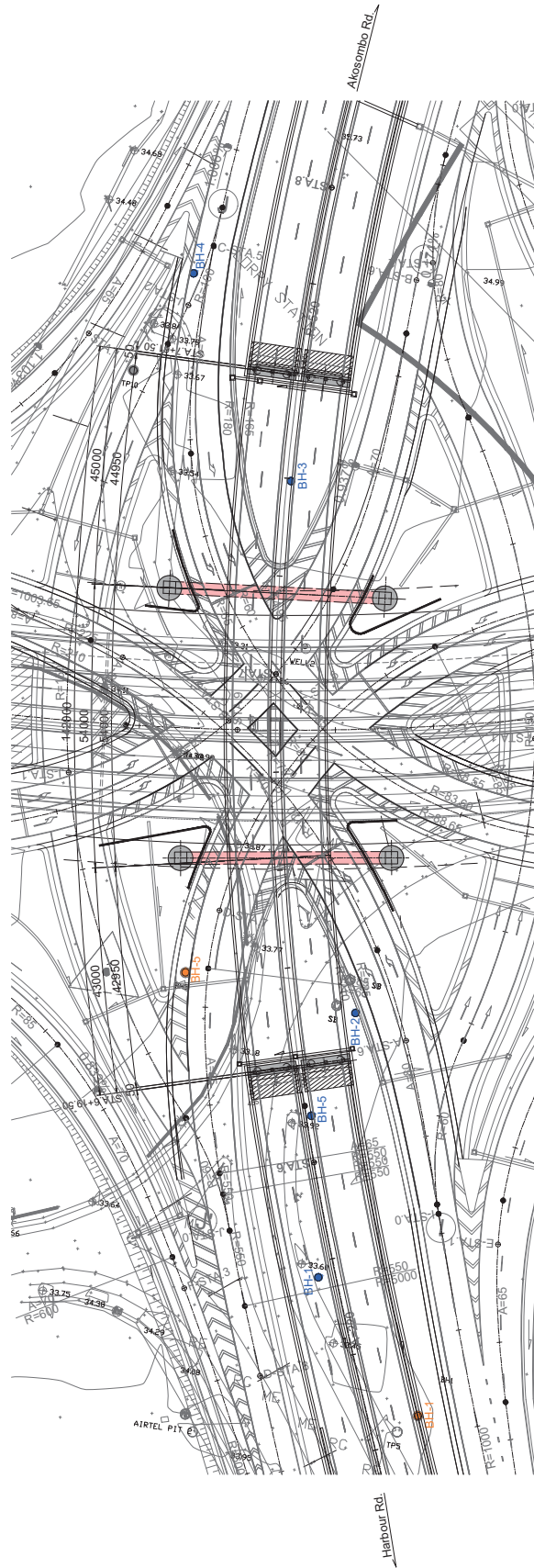
GENERAL ARRANGEMENT OF BRIDGE

PROFILE S=1:500



VERTICAL ALIGNMENT	FORMATION HEIGHT	GROUND HEIGHT	STATION	SUPER ELEVATION	HORIZONTAL CURVATURE	WIDENING
	44.402	34.41	80.000			
	45.009	34.20	20.000			
	45.304	34.36	11.667			
	45.488	34.37	8.333			
	45.839	34.65	20.000			
	46.063	34.79	20.000			
	46.158	34.86	5.000			
	46.162	34.77	10.000			
	46.162	34.78	10.000			
	46.125	34.14	10.000			
	45.965	34.97	20.000			
	45.677	35.19	20.000			
	44.716	35.19	20.000			
	44.044	35.27	20.000			

PLAN S=1:500



AP6-145

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
GENERAL ARRANGEMENT OF BRIDGE

SCALE (A1100)

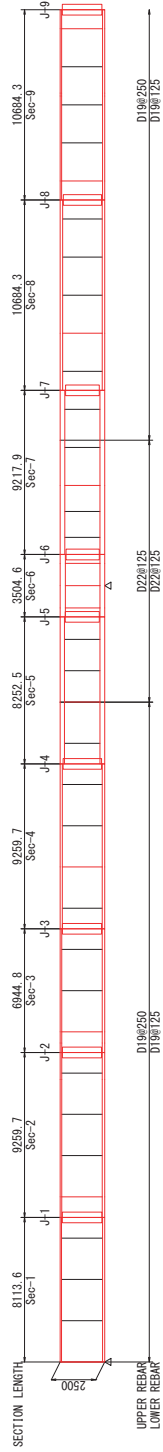
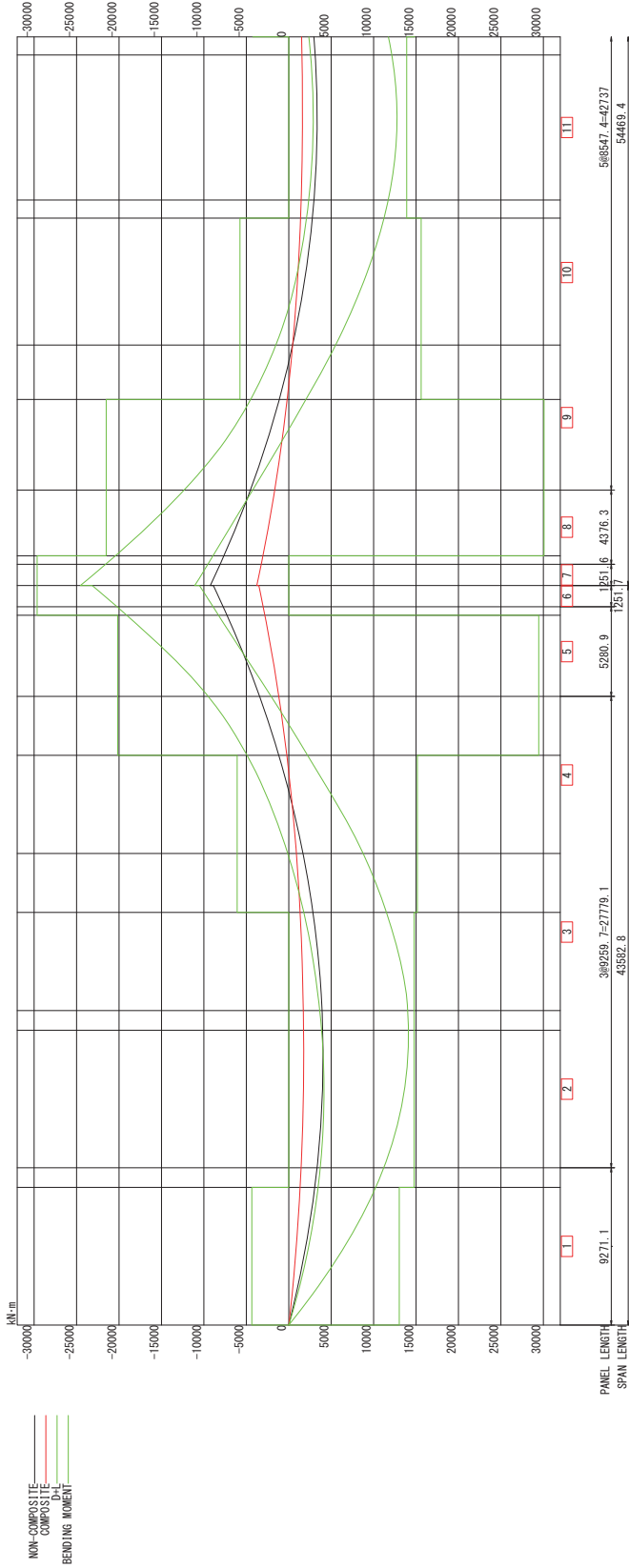
DRAWING NO.

AS SHOWN

GB-01

SECTIONAL FORCES AND PROPERTIES(1) S=1:150

SG1



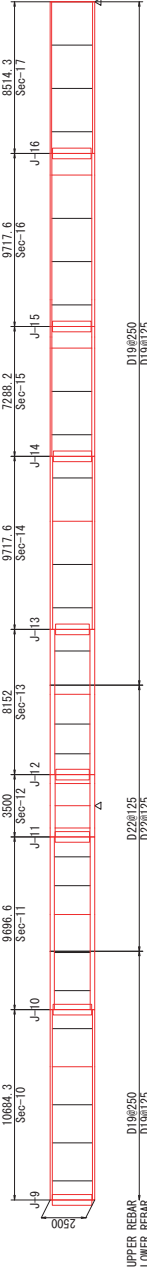
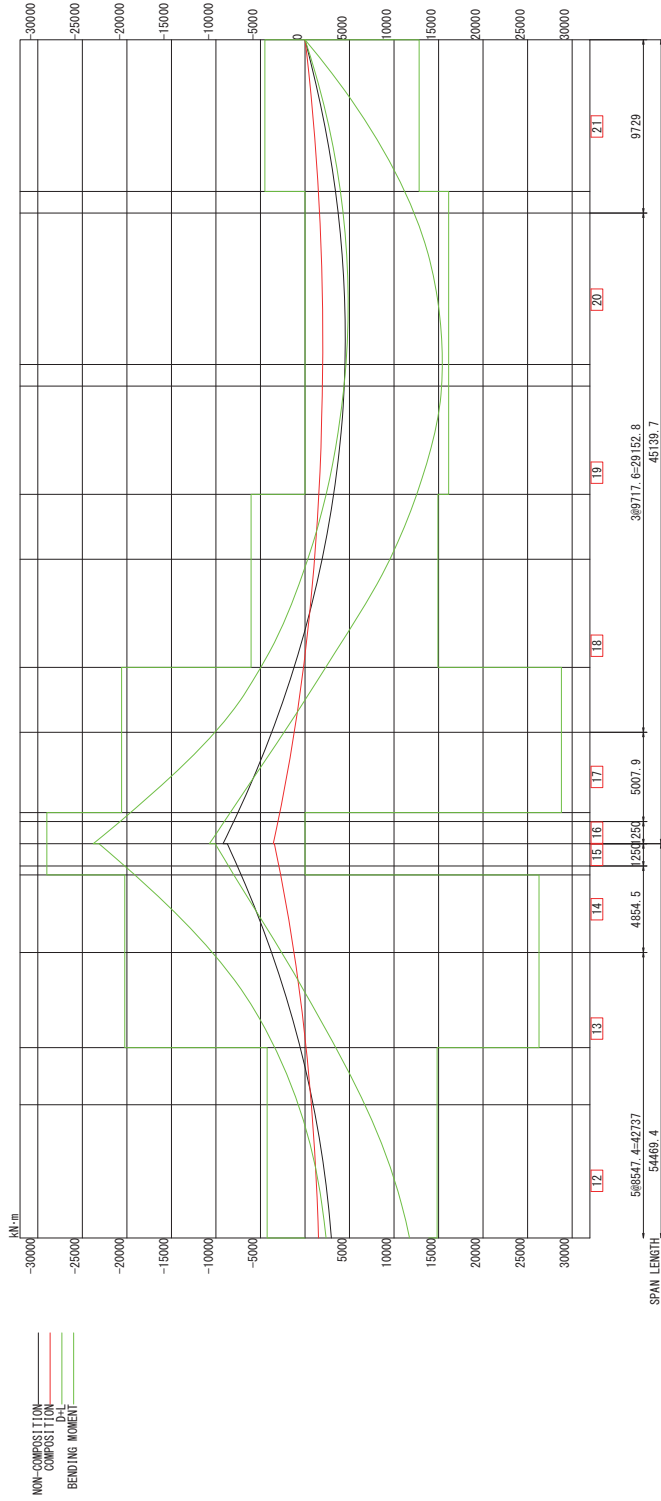
SECTION NAME	1	2	3	4	5	6	7	8	9
UPPER FLANGE	500	500	500	500	500	500	500	500	500
UPPER WEB	19(3)	19(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
LOWER FLANGE	20(3)	20(3)	20(3)	20(3)	20(3)	24(4)	20(3)	20(3)	20(3)
LOWER WEB	780	780	780	780	780	780	780	780	780
FLANGE THICKNESS	24(3)	28(3)	28(3)	28(3)	53(7)	53(6)	53(7)	24(3)	24(3)
UPPER FLANGE	103	-124	-123	-119	201	214	200	-103	-103
UPPER FLANGE	113	144	144	242	255	242	210	242	242
UPPER REBAR	5: GIRDER + REBAR	5: GIRDER + REBAR	5: GIRDER + REBAR	2: GIRDER + REBAR	2: STEEL	2: STEEL	2: STEEL	2: STEEL	2: STEEL
LOWER REBAR	10	20	21	123	9	41	10	137	24
UPPER REBAR	165	200	200	-116	-165	-211	-180	-112	193
LOWER REBAR	40	40	40	48	49	245	100	144	100
UPPER REBAR	46	46	46	58	58	78	78	78	78
LOWER REBAR	35	23	-20	-35	-51	45	52	36	19
UPPER FLANGE	0.65	0.92	0.92	0.60	1.09	0.80	1.10	0.54	0.85
LOWER FLANGE	198	209	197	87	206	210	210	75	206
UPPER FLANGE	D	B	B	E	A	A	A	E	B
LOWER FLANGE	D	A	A	E	B	B	B	E	D

MATERIALS (1): SM400
 (2): SM490
 (3): SM490Y
 (4): SM570
 (5): SM570Y
 (6): SM490-H
 (7): SM570-H
 (8): SM570-H
 CASE 1: D+L
 2: D+L+CR+SH
 3: D+L+CR+SH+STEEL
 4: D+L+CR+SH+CONCRETE
 5: ER (NON-COMPOSITION)
 STEEL GIRDER ALONE (NON-COMPOSITE)
 STEEL GIRDER-REBAR (COMPOSITE)
 STEEL GIRDER-CONCRETE SLAB (COMPOSITE)
 FACTOR A: TENSION
 B: COMPRESSION
 C: STRESS NET SECTION WITH BOLT HOLES
 D: MINIMUM THICKNESS
 E: THICKNESS DIFFERENCE
 F: STEEL BOX BEAM SECTION OF PIERS

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: SECTIONAL FORCES AND PROPERTIES(1)
	SCALE: (A1/100)	DRAWING NO.
	AS SHOWN	SF-01

SECTIONAL FORCES AND PROPERTIES (2) S=1:150

SG1



MATERIALS (1): SM400 (2): SM490 (3): SM490Y (4): SM570 (5): SM570H (6): SM490-H (7): SM570-H (8): SM570-H
 1-D+L
 2-D+L+CR+SH
 3-D+L+CR+SH+T (STEEL)
 4-D+L+CR+SH+T (CONCRETE)
 5-ER (NON-COMPOSITION)
 STEEL GIRDER ALONE (NON-COMPOSITE)
 STEEL GIRDER+REBAR (COMPOSITE)
 STEEL GIRDER-CONCRETE SLAB (COMPOSITE)
 A:TENSION B:COMPRESSION
 D:MINIMUM THICKNESS
 E:THICKNESS DIFFERENCE
 F:STEEL BOX BEAM SECTION OF PIERS

SECTION NAME	10	11	12	13	14	15	16	17
UPPER FLANGE	500	500	500	500	500	500	500	500
UPPER WEB	494(7)	494(7)	494(7)	494(7)	494(7)	494(7)	494(7)	494(7)
LOWER FLANGE	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)
LOWER WEB	780	780	780	780	780	780	780	780
UPPER FLANGE	26(3)	51(7)	53(3)	53(7)	28(3)	33(3)	33(3)	24(3)
UPPER WEB	-117	200	217	198	-127	-136	-137	-114
LOWER FLANGE	242	210	285	210	242	149	149	128
LOWER WEB	125	10	38	12	114	13	12	13
UPPER REBAR	2:COMPOSITE	2:STEEL	2:STEEL	2:STEEL	2:COMPOSITE	5: GIRDER + REBAR	5: GIRDER + REBAR	5: GIRDER + REBAR
LOWER REBAR	3:STEEL	2:STEEL	2:STEEL	2:STEEL	1:COMPOSITE	1:COMPOSITE	1:COMPOSITE	2:COMPOSITE
UPPER FLANGE	197	197	468	197	53	0	0	57
UPPER WEB	75	75	468	75	53	0	0	57
LOWER FLANGE	120	120	120	120	120	23	-21	-35
LOWER WEB	0.64	1.08	0.82	1.08	0.74	0.92	0.92	0.79
UPPER FLANGE	55	205	210	210	85	210	210	202
UPPER WEB	E	A	A	A	E	B	B	B
LOWER FLANGE	E	B	B	B	E	A	A	D

DRAWING TITLE:

PROJECT TITLE:
 THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

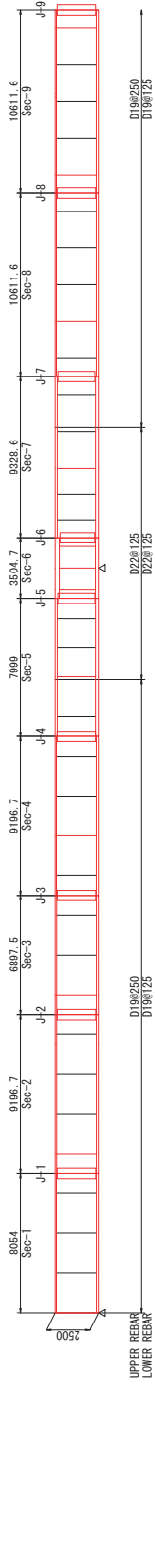
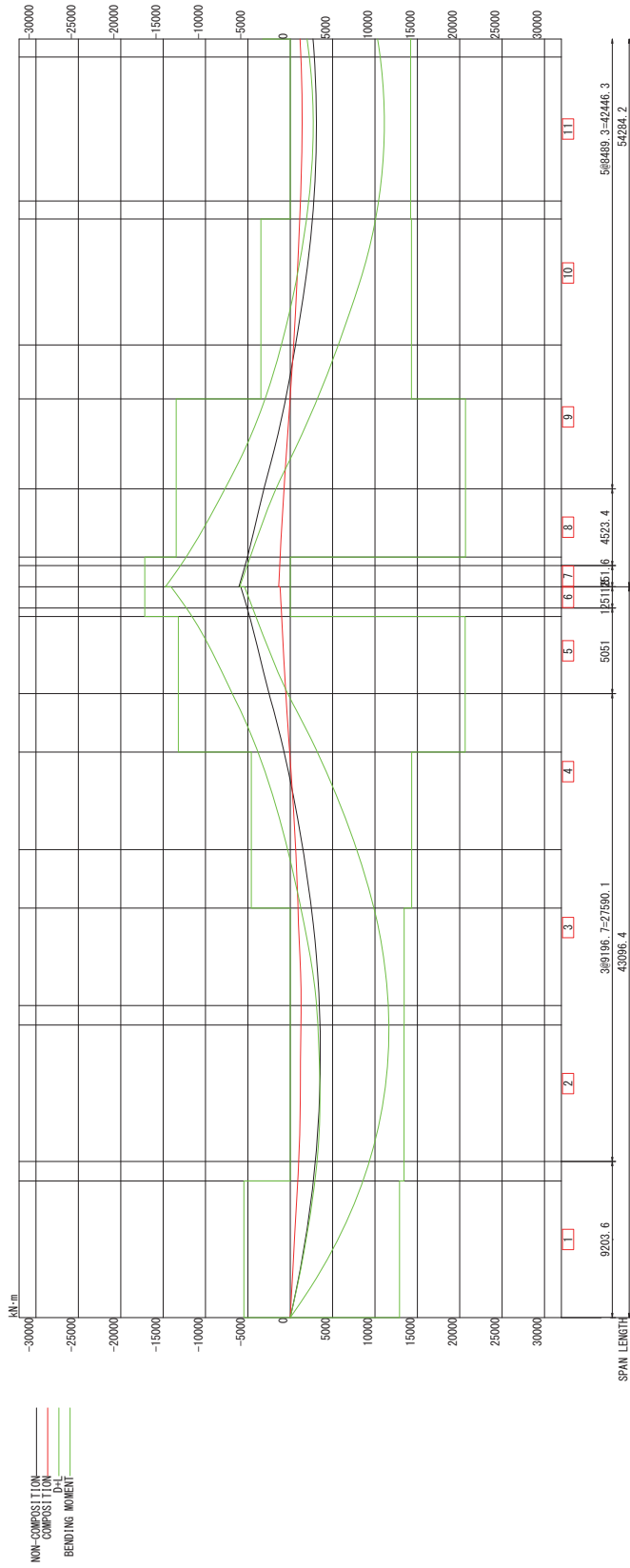
SCALE:(A150)
 AS SHOWN

SECTIONAL FORCES AND PROPERTIES(2)

DRAWING NO.
 SF-02

SECTIONAL FORCES AND PROPERTIES (3) S=1:150

SG2



SECTION NAME	1	2	3	4	5	6	7	8	9
UPPER FLANGE	140	140	140	140	140	140	140	140	140
UPPER WEB	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)
LOWER FLANGE	80	80	80	80	80	80	80	80	80
LOWER WEB	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
UPPER FLANGE	91	111	110	83	172	154	179	83	88
UPPER WEB	113	144	144	113	210	210	210	113	113
LOWER FLANGE	21	33	34	30	38	56	31	29	15
LOWER WEB	140	140	140	140	140	140	140	140	140
UPPER FLANGE	20	20	20	20	20	20	20	20	20
UPPER WEB	32	20	17	27	33	38	35	17	17
LOWER FLANGE	0.47	0.76	0.75	0.50	0.81	0.81	0.52	0.62	0.62
LOWER WEB	166	205	185	73	179	187	187	56	185
FACTOR	D	D	D	B	E	F	E	D	D
	D	D	D	B	E	F	E	D	D
	D	D	D	B	E	F	E	D	D

MATERIALS (1): SM400 (2): SM490 (3): SM490Y (4): SM570 (5): SM570H (6): SM490-H (7): SM520-H (8): SM570-H

CASE 1-D-H-L 2-D-H-L+QR+SH 3-D-H-L+QR+SH+ST(STEEL) 4-D-H-L+QR+SH+ST(CONCRETE) 5-ER (NON-COMPOSITION)

STEEL GIRDER ALONE (NON-COMPOSITE)
STEEL GIRDER+REBAR (COMPOSITE)
STEEL GIRDER+CONCRETE SLAB (COMPOSITE)

FACTOR A: TENSION B: COMPRESSION C: STRESS NET SECTION WITH BOLT HOLES D: MINIMUM THICKNESS E: THICKNESS F: STEEL BOX BEAM (SECTION OF PIERS)

UNIT : mm N/mm²

SCALE (A1:100)

DRAWING NO. SF-03

PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

DRAWING TITLE: SECTIONAL FORCES AND PROPERTIES (3)

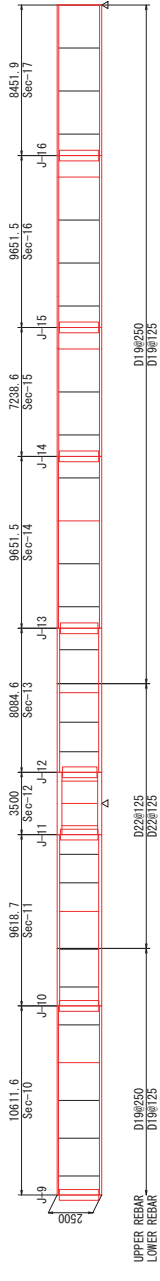
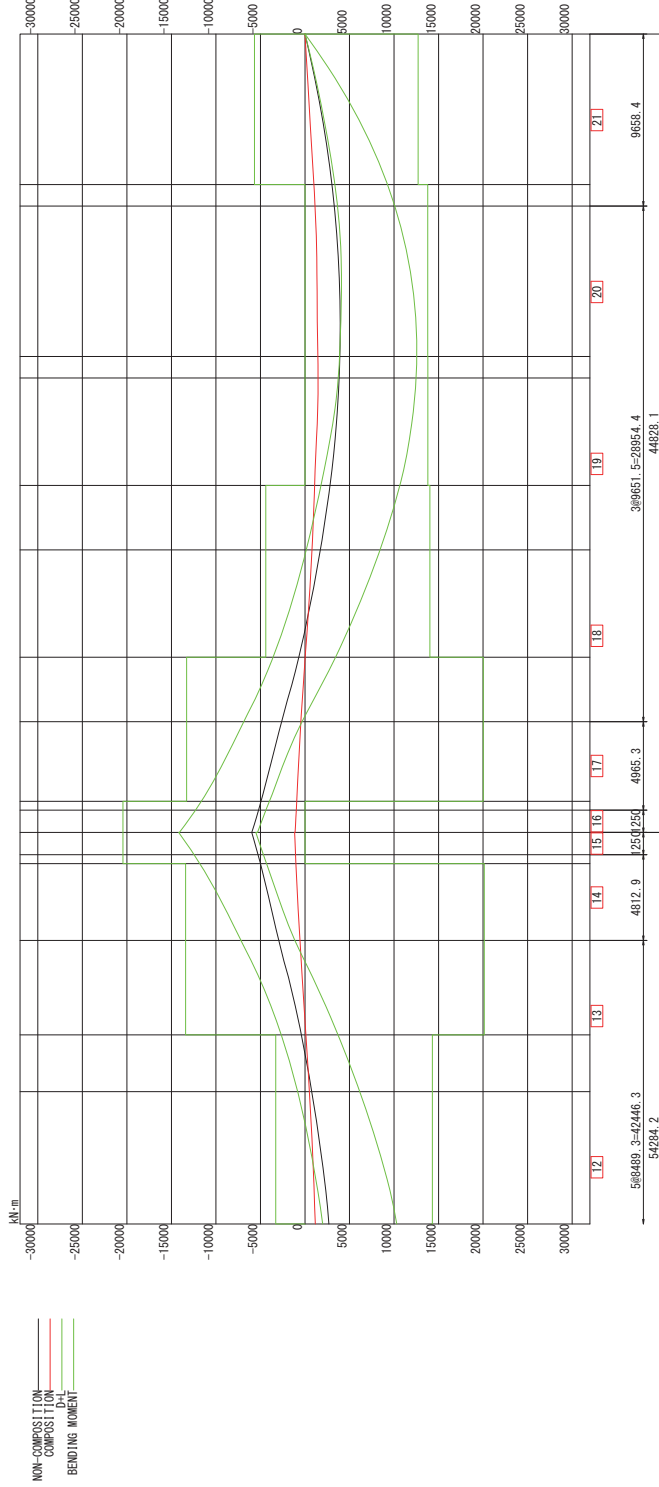
AS SHOWN

GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

SECTIONAL FORCES AND PROPERTIES (4) S=1:150

SG2



UNIT : mm N/mm²

MATERIALS (1) SM400
 (2) SM490
 (3) SM490Y
 (4) SM570
 (5) SM570H
 (6) SM490-H
 (7) SM620-H
 (8) SM570-H

1: D+L
 2: D+L+CR+SH
 3: D+L+CR+SH+1 (STEEL)
 4: D+L+CR+SH+1 (CONCRETE)
 5: ER (NON-COMPOSITION)

STEEL GIRDER ALONE (NON-COMPOSITE)
 STEEL GIRDER-REBAR (COMPOSITE)
 STEEL GIRDER-CONCRETE SLAB (COMPOSITE)

A: TENSION
 B: COMPRESSION
 C: STRESS/NET SECTION WITH BOLT HOLES
 D: MINIMUM THICKNESS
 E: THICKNESS DIFFERENCE
 F: STEEL BOX BEAM SECTION (OF PIERS)

SECTION NAME	WIDTH	FLANGE THICKNESS	FLANGE HELIX THICKNESS	LOWER FLANGE WIDTH	LOWER FLANGE THICKNESS	UPPER FLANGE THICKNESS	FLANGE σ	FLANGE σ	FLANGE σ	WEB τ	COMPOSITE	UPPER FLANGE	LOWER FLANGE	UPPER FLANGE	LOWER FLANGE
10 Sec-10	500	20	24.6	20	780	25	113	27	2.7	-33	3. STEEL	3. STEEL	3. STEEL	3. STEEL	3. STEEL
11 Sec-11	500	20	24.6	20	780	25	113	27	2.7	-33	2. STEEL	2. STEEL	2. STEEL	2. STEEL	2. STEEL
12 Sec-12	500	20	24.6	20	780	25	113	27	2.7	-33	2. STEEL	2. STEEL	2. STEEL	2. STEEL	2. STEEL
13 Sec-13	500	20	24.6	20	780	25	113	27	2.7	-33	2. STEEL	2. STEEL	2. STEEL	2. STEEL	2. STEEL
14 Sec-14	500	20	24.6	20	780	25	113	27	2.7	-33	5. GIRDER + REBAR	5. GIRDER + REBAR	5. GIRDER + REBAR	5. GIRDER + REBAR	5. GIRDER + REBAR
15 Sec-15	500	20	24.6	20	780	25	113	27	2.7	-33	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE
16 Sec-16	500	20	24.6	20	780	25	113	27	2.7	-33	3. STEEL	3. STEEL	3. STEEL	3. STEEL	3. STEEL
17 Sec-17	500	20	24.6	20	780	25	113	27	2.7	-33	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE	2. COMPOSITE
FACTOR															
											0.53	0.71	0.59	0.71	0.55
											199	195	199	195	182
											E	E	E	E	E
											D	D	D	D	D
											B	B	B	B	B
											E	E	E	E	E

GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

SECTIONAL FORCES AND PROPERTIES (4)

AS SHOWN

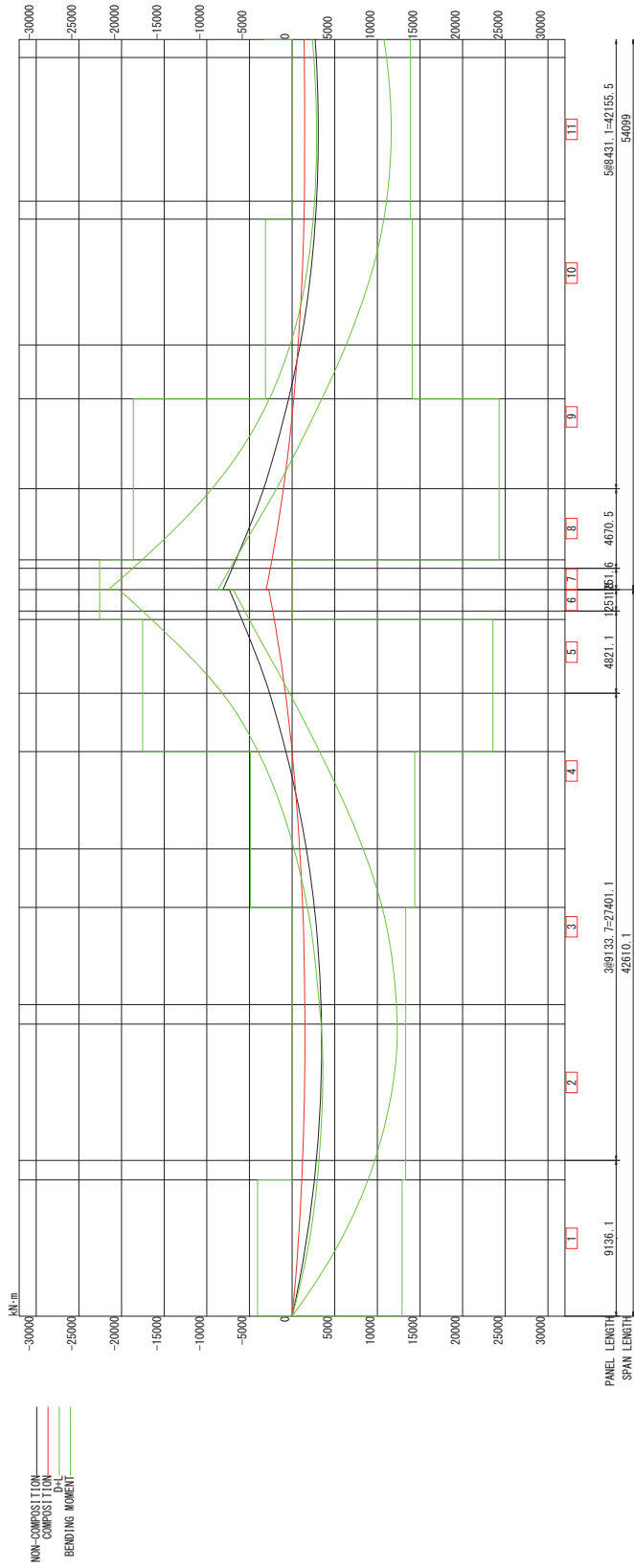
SF-04

SCALE (A150)

DRAWING NO.

SECTIONAL FORCES AND PROPERTIES (5) S=1:150

SG3



SECTION NAME	WIDTH	FLANGE	WEB	HEIGHT	FLANGE THICKNESS	WEB THICKNESS	WIDTH	FLANGE THICKNESS	WEIGHT	σ	σ _a	σ _{b-σ}	CASE	UNIT
1: Sec-1	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
2: Sec-2	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
3: Sec-3	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
4: Sec-4	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
5: Sec-5	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
6: Sec-6	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
7: Sec-7	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
8: Sec-8	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
9: Sec-9	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
10: Sec-10	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²
11: Sec-11	500	145	210	105	16	15	780	24(3)	184	128	43	5: GIRDER	1: D+L	N/mm ²

MATERIALS (1): SM400
 (2): SM490
 (3): SM490Y
 (4): SM570
 (5): SM570H
 (6): SM400-H
 (7): SM520-H
 (8): SM570-H

CASE
 1: D+L
 2: D+L+CR+SH
 3: D+L+CR+SH+(STEEL)
 4: D+L+CR+SH+(CONCRETE)
 5: ER (NON-COMPOSITION)

STEEL GIRDER ALONE (NON-COMPOSITE)
STEEL GIRDER-REAR (COMPOSITE)
STEEL GIRDER-CONCRETE SLAB (COMPOSITE)

FACTOR
 A: TENSION
 B: COMPRESSION
 C: STRESS (NET SECTION WITH BOLT HOLES)
 D: MINIMUM THICKNESS
 E: THICKNESS DIFFERENCE
 F: STEEL BOX BEAM (SECTION OF PIERS)

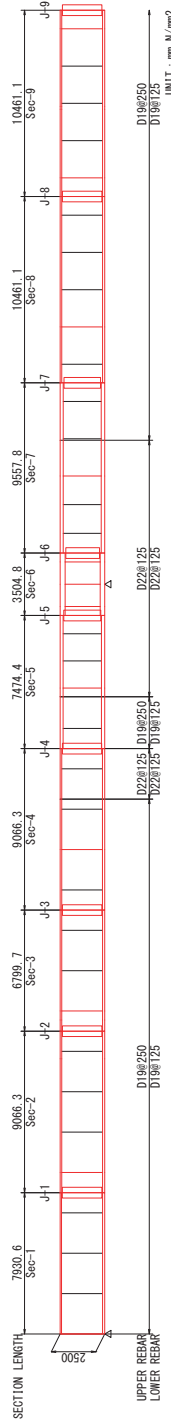
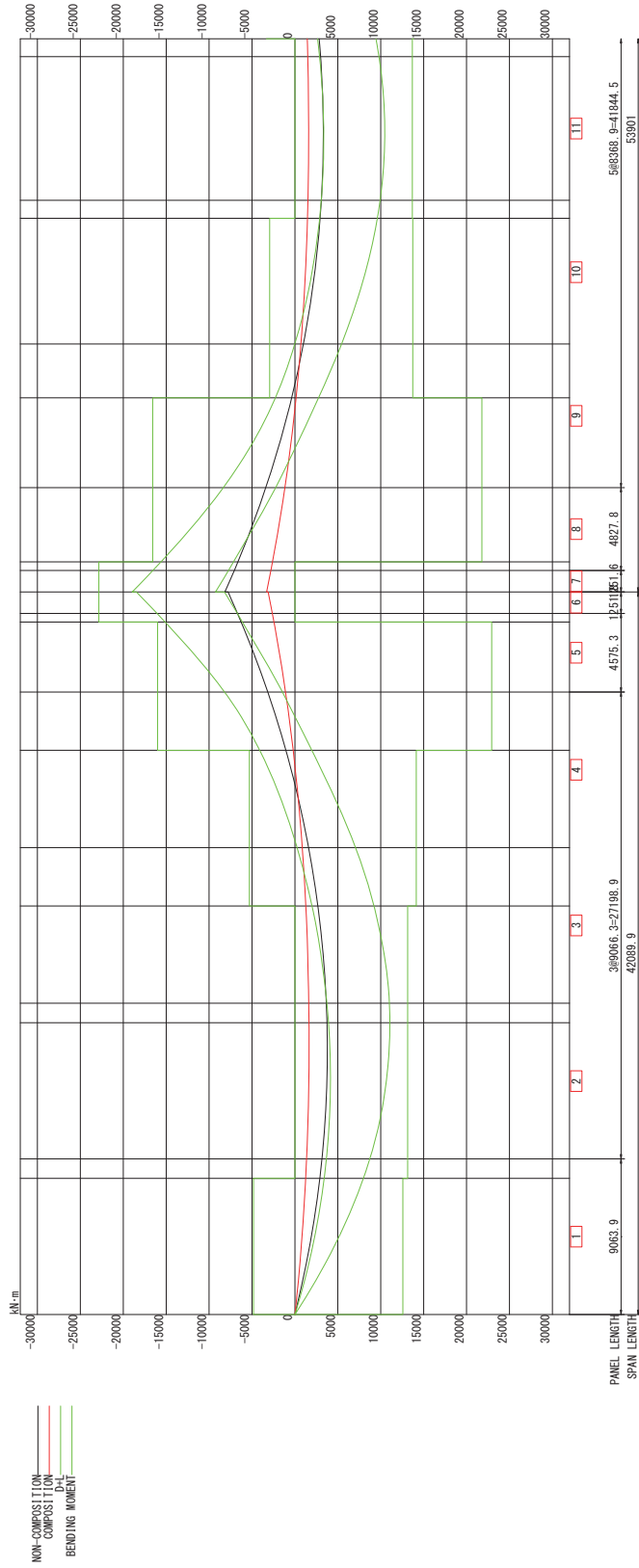
DRAWING TITLE:
 THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

SCALE (A1/100)
 AS SHOWN

DRAWING NO.
 SF-05

SECTIONAL FORCES AND PROPERTIES (7) S=1:150

NG1



SECTION NAME	Sec-1	Sec-2	Sec-3	Sec-4	Sec-5	Sec-6	Sec-7	Sec-8	Sec-9
UPPER FLANGE	133	177	177	96	189	189	189	106	181
UPPER WEB	210	210	210	124	119	119	119	24	210
UPPER REBAR	71	33	33	26	11	36	11	24	49
LOWER FLANGE	133	177	177	96	189	189	189	106	181
LOWER WEB	210	210	210	124	119	119	119	24	210
LOWER REBAR	71	33	33	26	11	36	11	24	49
UPPER FLANGE	133	177	177	96	189	189	189	106	181
UPPER WEB	210	210	210	124	119	119	119	24	210
UPPER REBAR	71	33	33	26	11	36	11	24	49
LOWER FLANGE	133	177	177	96	189	189	189	106	181
LOWER WEB	210	210	210	124	119	119	119	24	210
LOWER REBAR	71	33	33	26	11	36	11	24	49
UPPER FLANGE	133	177	177	96	189	189	189	106	181
UPPER WEB	210	210	210	124	119	119	119	24	210
UPPER REBAR	71	33	33	26	11	36	11	24	49
LOWER FLANGE	133	177	177	96	189	189	189	106	181
LOWER WEB	210	210	210	124	119	119	119	24	210
LOWER REBAR	71	33	33	26	11	36	11	24	49
UPPER FLANGE	133	177	177	96	189	189	189	106	181
UPPER WEB	210	210	210	124	119	119	119	24	210
UPPER REBAR	71	33	33	26	11	36	11	24	49
LOWER FLANGE	133	177	177	96	189	189	189	106	181
LOWER WEB	210	210	210	124	119	119	119	24	210
LOWER REBAR	71	33	33	26	11	36	11	24	49

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
SECTIONAL FORCES AND PROPERTIES (7)

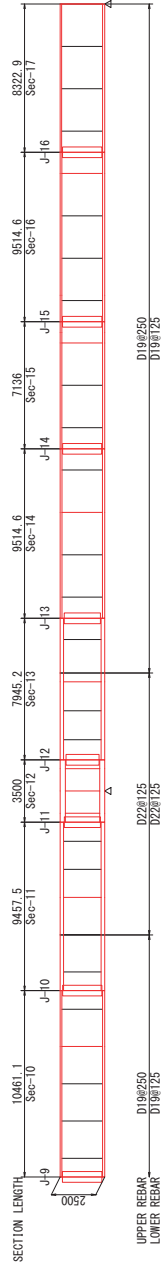
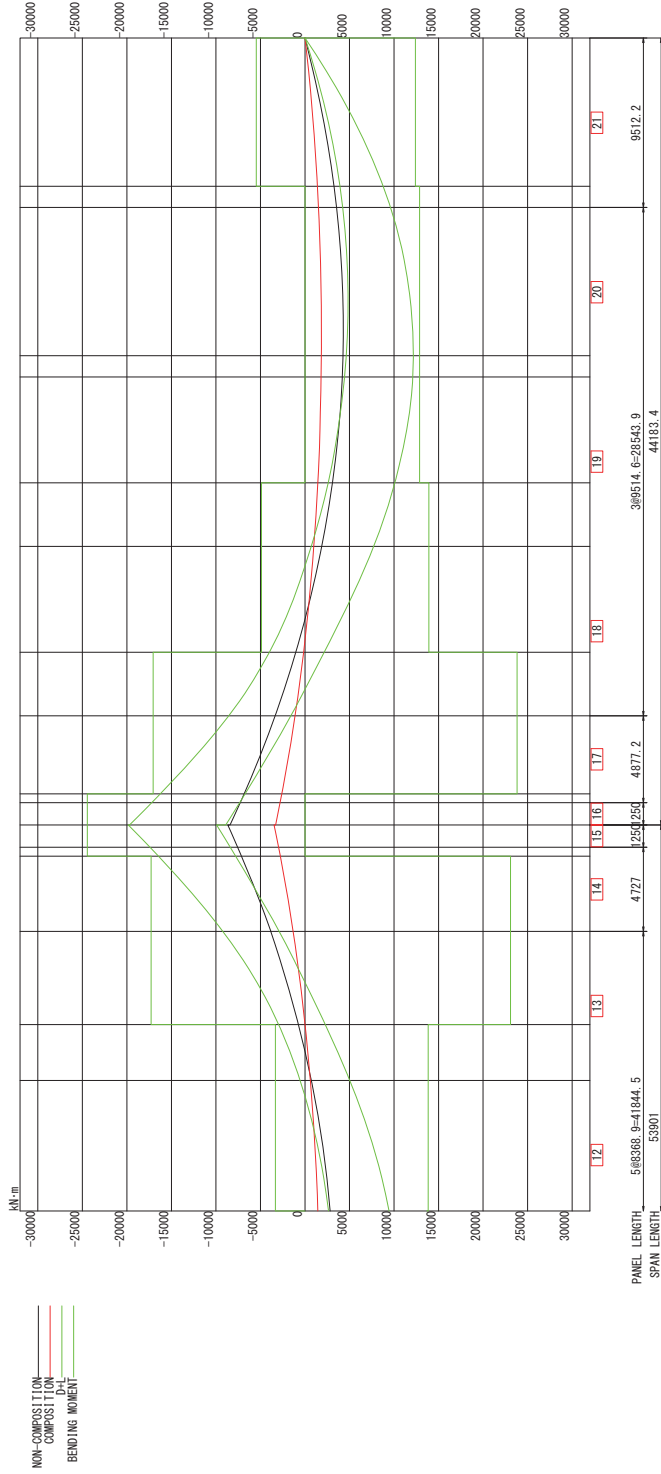
SCALE: (A199)

AS SHOWN

DRAWING NO.
SF-07

SECTIONAL FORCES AND PROPERTIES (8) S=1:150

NG1



SECTION NAME	10	11	12	13	14	15	16	17
UPPER FLANGE	500	500	500	500	500	500	500	500
WEB	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
LOWER FLANGE	780	780	780	780	780	780	780	780
UPPER FLANGE	24(3)	41(7)	56(7)	41(7)	24(3)	24(3)	24(3)	24(3)
UPPER FLANGE	-118	183	183	199	-90	-133	-134	-108
UPPER FLANGE	242	210	210	210	155	151	151	128
UPPER FLANGE	123	11	27	11	65	19	18	19
UPPER REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	5-GIRDER	5-GIRDER	5-GIRDER	5-GIRDER
LOWER REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	2-GIRDER + REBAR	3-GIRDER + REBAR	2-COMPOSITE	2-COMPOSITE	2-COMPOSITE
UPPER FLANGE	57	57	57	57	57	57	57	57
UPPER FLANGE	32	32	32	32	32	32	32	32
UPPER FLANGE	E	A	F	A	E	B	B	D
UPPER FLANGE	D	B	F	B	E	D	D	D
UPPER FLANGE	-28	-42	46	43	31	17	-18	-29
UPPER FLANGE	120	120	120	120	120	120	120	120
UPPER FLANGE	0.48	1.03	0.90	1.03	0.54	0.90	0.90	0.57
UPPER FLANGE	57	204	78	202	78	205	78	176
UPPER FLANGE	E	A	F	A	E	B	B	D
UPPER FLANGE	D	B	F	B	E	D	D	D

DRAWING TITLE:

SECTIONAL FORCES AND PROPERTIES (8)

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

SCALE (A150)

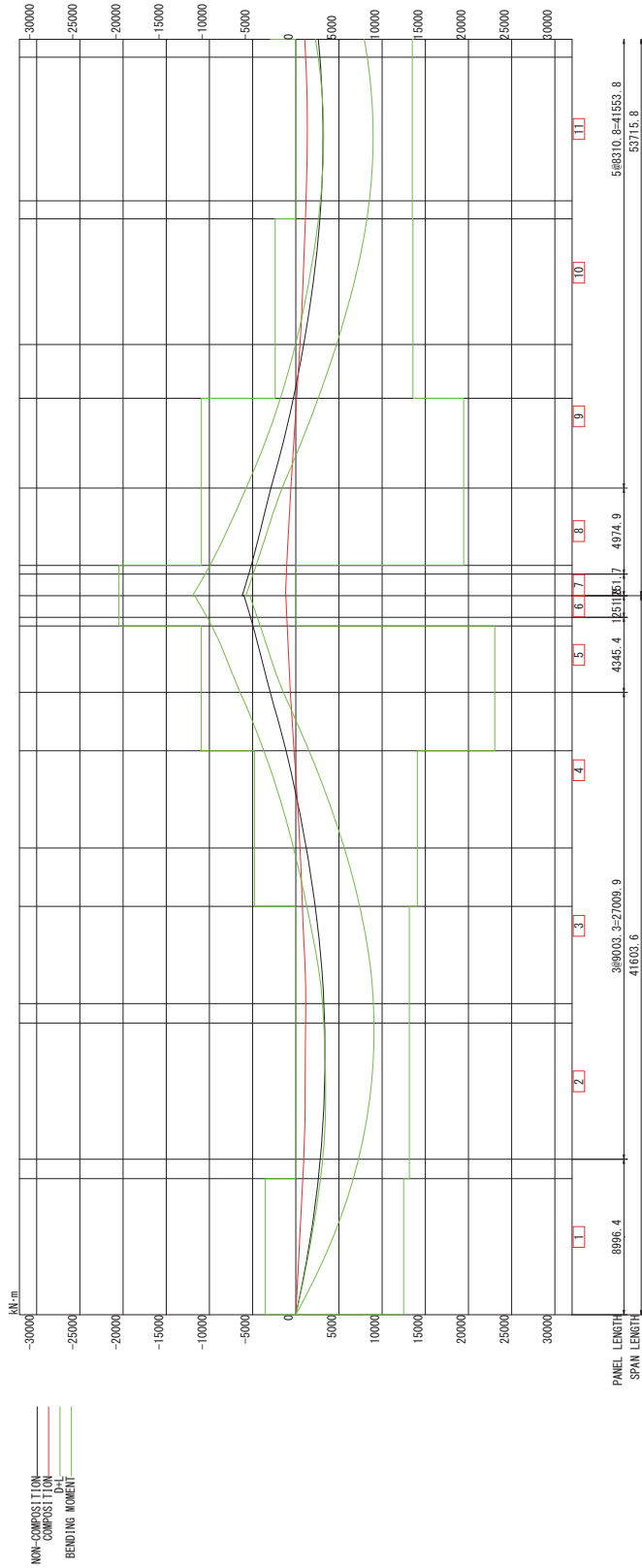
AS SHOWN

DRAWING NO.

SF-08

SECTIONAL FORCES AND PROPERTIES (9) S=1:150

NG2



SECTION NAME	1	2	3	4	5	6	7	8	9
UPPER FLANGE	500	500	500	500	500	500	500	500	500
UPPER FLANGE	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)
WEB	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
LOWER FLANGE	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)
LOWER FLANGE	780	780	780	780	780	780	780	780	780
UPPER FLANGE	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
UPPER FLANGE	-87	-105	-104	-74	171	145	154	-88	-100
UPPER FLANGE	113	144	113	113	242	210	210	113	113
UPPER FLANGE	26	39	40	38	71	97	56	24	12
LOWER FLANGE	5-GIRDER	5-GIRDER	5-GIRDER	5-GIRDER	4-GIRDER + REBAR	4-GIRDER + REBAR	2-GIRDER + REBAR	5-GIRDER	5-GIRDER
LOWER FLANGE	112	145	145	96	-167	-170	-170	-170	-170
LOWER FLANGE	210	210	210	124	187	187	187	108	108
LOWER FLANGE	65	65	65	26	21	87	17	27	71
WEB	2-COMPOSITE	2-COMPOSITE	1-COMPOSITE	3-GIRDER + REBAR	3-GIRDER + REBAR	2-GIRDER + REBAR	3-GIRDER + REBAR	3-GIRDER + REBAR	1-COMPOSITE
WEB	24	15	-15	-24	-28	30	28	22	-13
COMPOSITE	120	120	120	120	120	120	120	120	120
COMPOSITE	0.42	0.48	0.48	0.35	0.55	0.42	0.59	0.60	0.70
UPPER FLANGE	132	177	141	135	153	160	160	156	150
UPPER FLANGE	D	E	E	E	E	F	F	D	D
UPPER FLANGE	D	D	D	E	E	F	F	D	D
UPPER FLANGE	D	D	D	E	E	F	F	D	D

MATERIALS (1) : S2400
 (2) : S2400
 (3) : S2400
 (4) : S2400
 (5) : S2400
 (6) : S2400
 (7) : S2400
 (8) : S2400
 1-D+L
 2-D+L+CR+SH
 3-D+L+CR+SH+T(STEEL)
 4-D+L+CR+SH+T(CONCRETE)
 5-ER (NON-COMPOSITE)
 STEEL GIRDER ALONE (NON-COMPOSITE)
 STEEL GIRDER+REBAR (COMPOSITE)
 STEEL GIRDER+CONCRETE SLAB (COMPOSITE)
 A:TENSION
 B:COMPRESSION
 C:STRESS NET SECTION WITH BOLT HOLES
 D:MINIMUM THICKNESS
 E:THICKNESS DIFFERENCE
 F:STEEL BOX BEAM SECTION OF PIERS

UNIT : mm N/mm²

SECTION 1 : 7871 Sec-1
 SECTION 2 : 9003.3 Sec-2
 SECTION 3 : 6752.5 Sec-3
 SECTION 4 : 9003.3 Sec-4
 SECTION 5 : 7270.9 Sec-5
 SECTION 6 : 3504.9 Sec-6
 SECTION 7 : 9668.5 Sec-7
 SECTION 8 : 10388.4 Sec-8
 SECTION 9 : 10388.4 Sec-9

PANEL LENGTH : 8996.4
 SPAN LENGTH : 53715.8

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

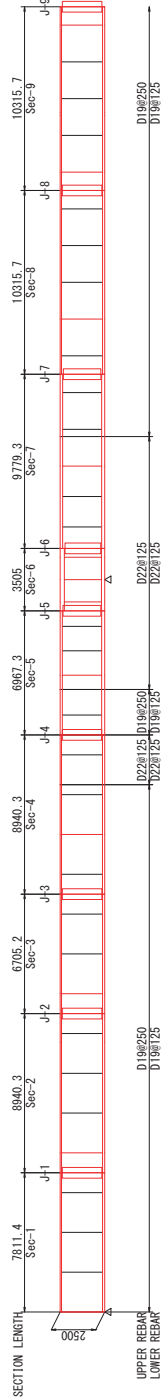
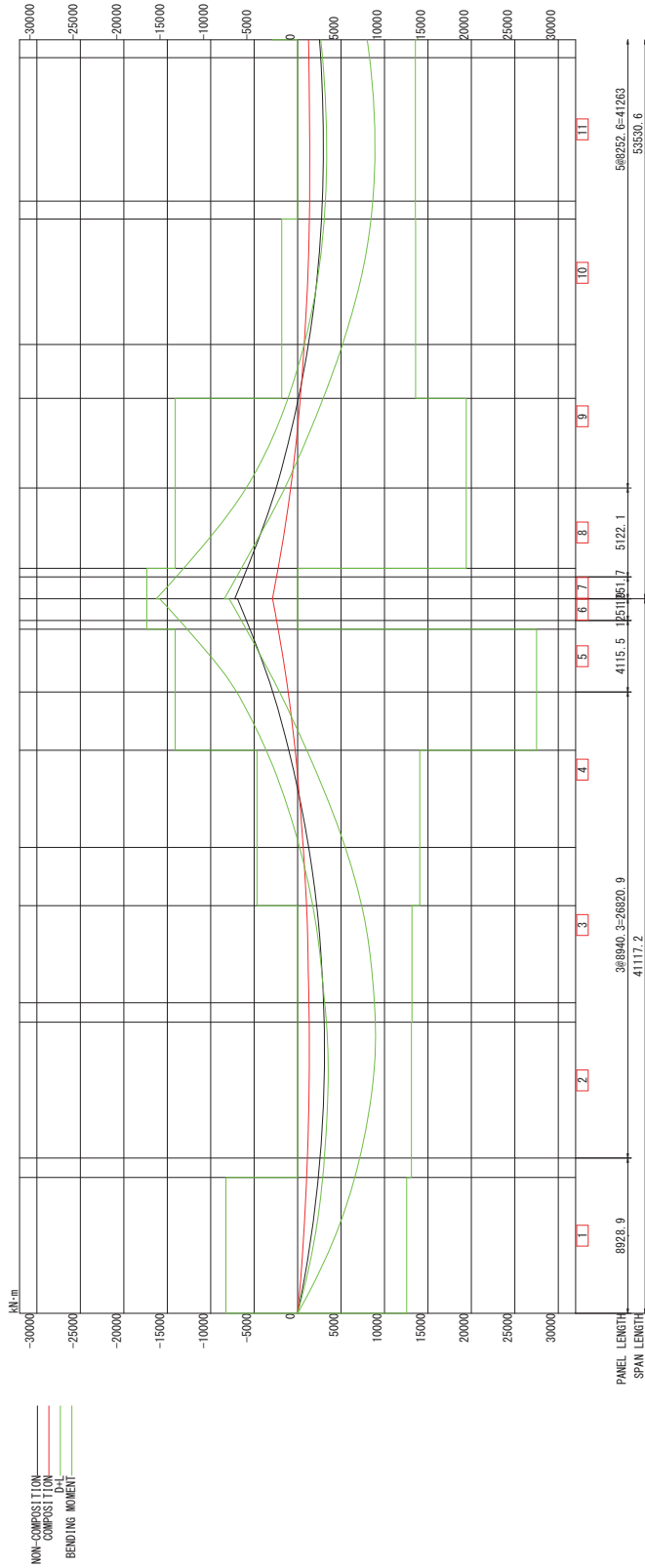
UPPER REBAR : D19@250
 LOWER REBAR : D19@250

UPPER REBAR : D22@125
 LOWER REBAR : D22@125

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: SECTIONAL FORCES AND PROPERTIES (9)
CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY		SCALE (A150) : AS SHOWN
		DRAWING NO. SF-09

SECTIONAL FORCES AND PROPERTIES (11) S=1:150

NG3



SECTION NAME	1	2	3	4	5	6	7	8	9
UPPER FLANGE	500	500	500	500	500	500	500	500	500
UPPER WEB	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)	19(3)
LOWER FLANGE	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)	20(3)
LOWER WEB	780	780	780	780	780	780	780	780	780
FLANGE THICKNESS	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)	24(3)
UPPER FLANGE	-79	-103	-101	-72	189	183	198	-217	-228
UPPER FLANGE	113	113	113	113	210	210	210	273	273
UPPER FLANGE	34	10	11	40	11	27	12	56	45
LOWER FLANGE	110	144	143	-86	-76	197	-101	131	138
LOWER FLANGE	210	210	210	124	106	210	106	210	210
LOWER FLANGE	100	66	67	28	19	13	14	70	72
WEB	24	13	-14	-27	-39	-42	39	23	-12
COMPOSITE	120	120	120	120	120	120	120	120	120
UPPER FLANGE	0.39	0.47	0.47	0.34	1.00	1.00	0.99	0.64	0.70
LOWER FLANGE	129	175	141	10	205	205	205	16	16
UPPER FLANGE	D	D	D	E	A	A	A	D	D
LOWER FLANGE	D	D	D	E	B	B	B	D	D

MATERIALS (1): SM400
 (2): SM490
 (3): SM490Y
 (4): SM570
 (5): SM570Y
 (6): SM490-H
 (7): SM570-H
 (8): SM570-H

CASE
 1: D+L
 2: D+L+CR+SH
 3: D+L+CR+SH+STEEL
 4: D+L+CR+SH+CONCRETE
 5: ER (NON-COMPOSITION)

STEEL GIRDER ALONE (NON-COMPOSITE)
 STEEL GIRDER+REBAR (COMPOSITE)
 STEEL GIRDER+CONCRETE SLAB (COMPOSITE)

A: TENSION
 B: COMPRESSION
 C: STRESS (NET SECTION WITH BOLT HOLES)
 D: MINIMUM THICKNESS
 E: THICKNESS DIFFERENCE
 F: STEEL BOX BEAM (SECTION OF PIERS)

GHANA HIGHWAY AUTHORITY
 MINISTRY OF ROADS AND HIGHWAYS
 REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
 JAPAN INTERNATIONAL COOPERATION AGENCY

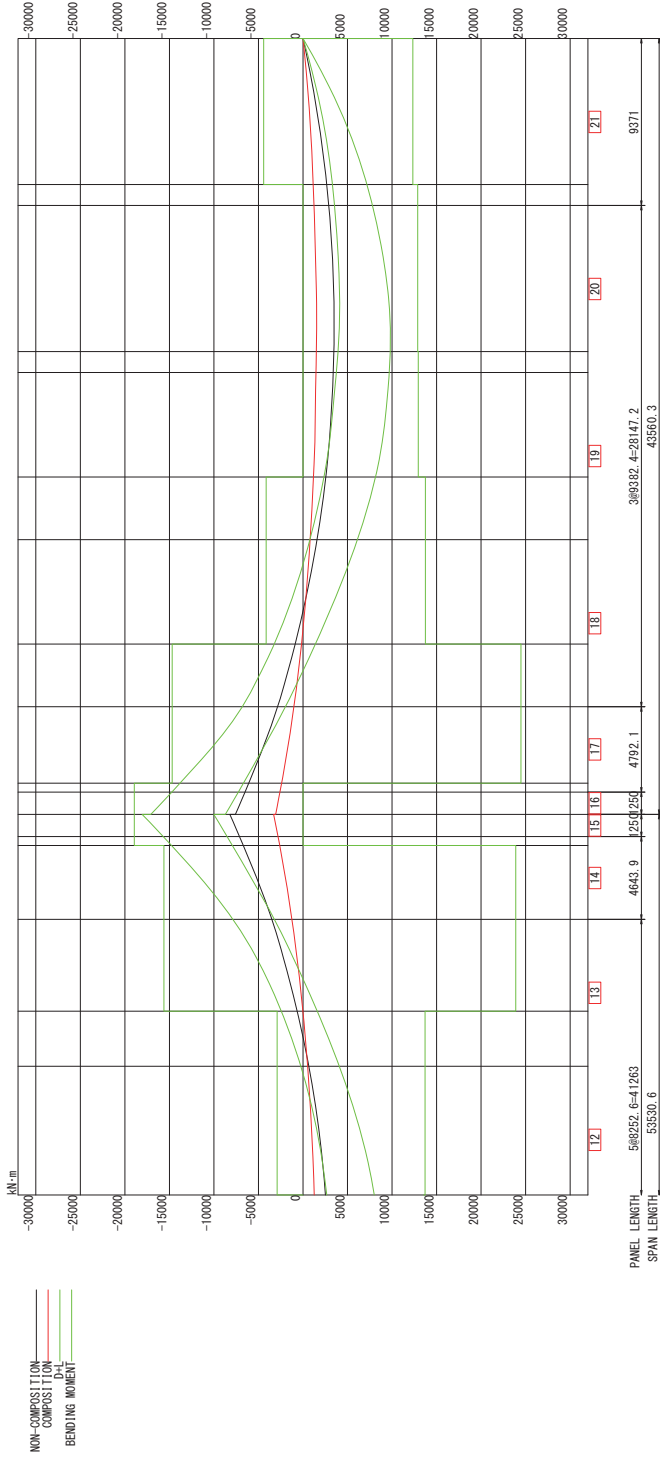
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
 (PHASE 2)

SECTIONAL FORCES AND PROPERTIES (11)
 AS SHOWN

SCALE: (A1199)
 DRAWING NO. SF-11

SECTIONAL FORCES AND PROPERTIES (12) S=1:150

NG3



SECTION NAME	WIDTH	FLANGE THICKNESS	WEB THICKNESS	FLANGE WIDTH	FLANGE THICKNESS	WEB THICKNESS	FLANGE WIDTH	FLANGE THICKNESS	WEB THICKNESS	FLANGE WIDTH
Sec-10	500	17	106	106	17	106	106	17	106	106
Sec-11	500	17	106	106	17	106	106	17	106	106
Sec-12	500	17	106	106	17	106	106	17	106	106
Sec-13	500	17	106	106	17	106	106	17	106	106
Sec-14	500	17	106	106	17	106	106	17	106	106
Sec-15	500	17	106	106	17	106	106	17	106	106
Sec-16	500	17	106	106	17	106	106	17	106	106
Sec-17	500	17	106	106	17	106	106	17	106	106

MATERIALS (1): SM400
 (2): SM490
 (3): SM570
 (4): SM670
 (5): SM400-H
 (6): SM490-H
 (7): SM570-H
 (8): SM670-H

CASE
 1: D+L
 2: D+L+CR+SH
 3: D+L+CR+SH+1 (STEEL)
 4: D+L+CR+SH+1 (CONCRETE)
 5: ER (NON-COMPOSITION)

STEEL GIRDER ALONE (NON-COMPOSITE)
STEEL GIRDER-REBAR (COMPOSITE)
STEEL GIRDER-CONCRETE SLAB (COMPOSITE)

FACTOR
 A: TENSION
 B: COMPRESSION
 C: STRESS (NET SECTION WITH BOLT HOLES)
 D: MINIMUM THICKNESS
 E: THICKNESS DIFFERENCE
 F: STEEL BOX BEAM (SECTION OF PIERS)

UNIT: mm N/mm²

DRAWING TITLE:
 SECTIONAL FORCES AND PROPERTIES (12)

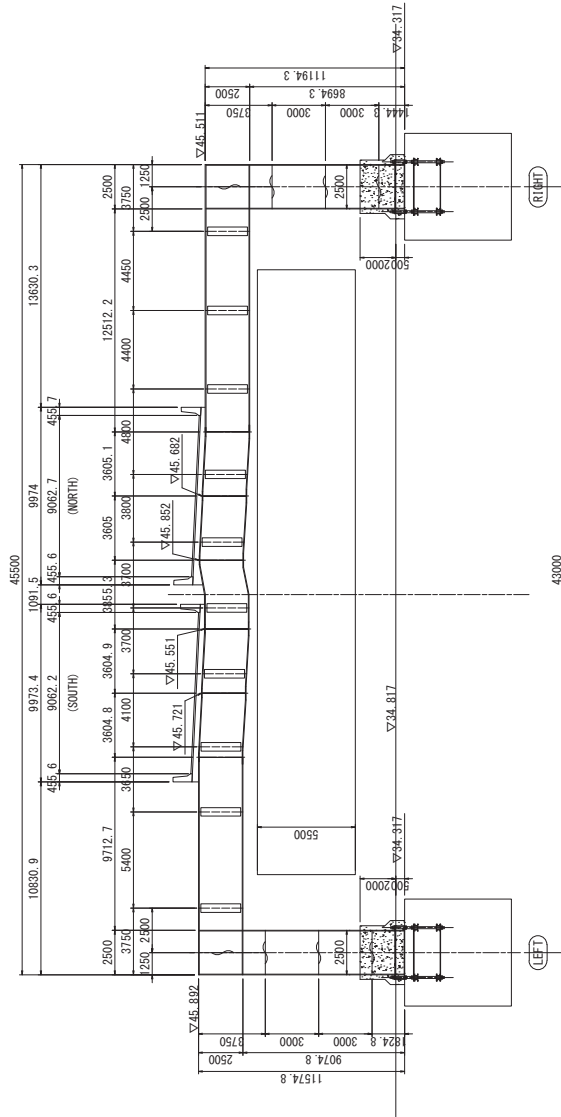
SCALE (A150):
 AS SHOWN

DRAWING NO.:
 SF-12

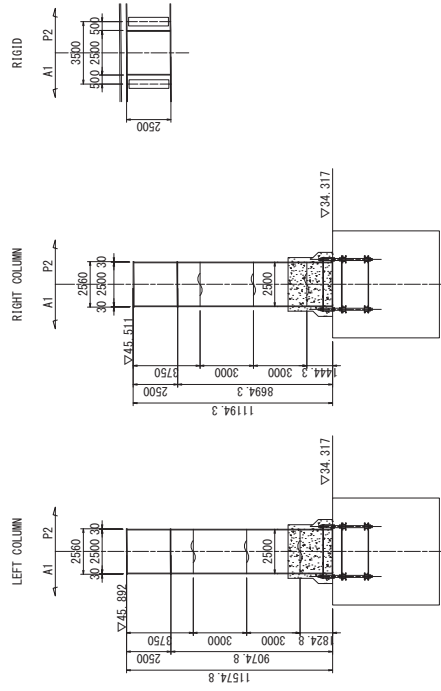
GENERAL ARRANGEMENT OF SUBSTRUCTURE (1) S=1:150

P1 PIER

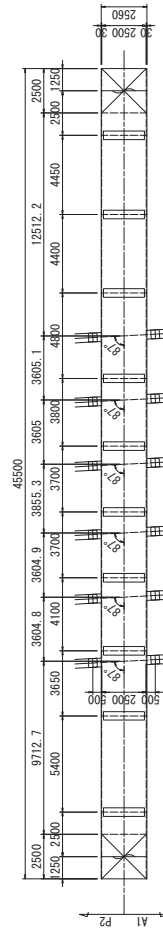
FRONT VIEW



SIDE VIEW



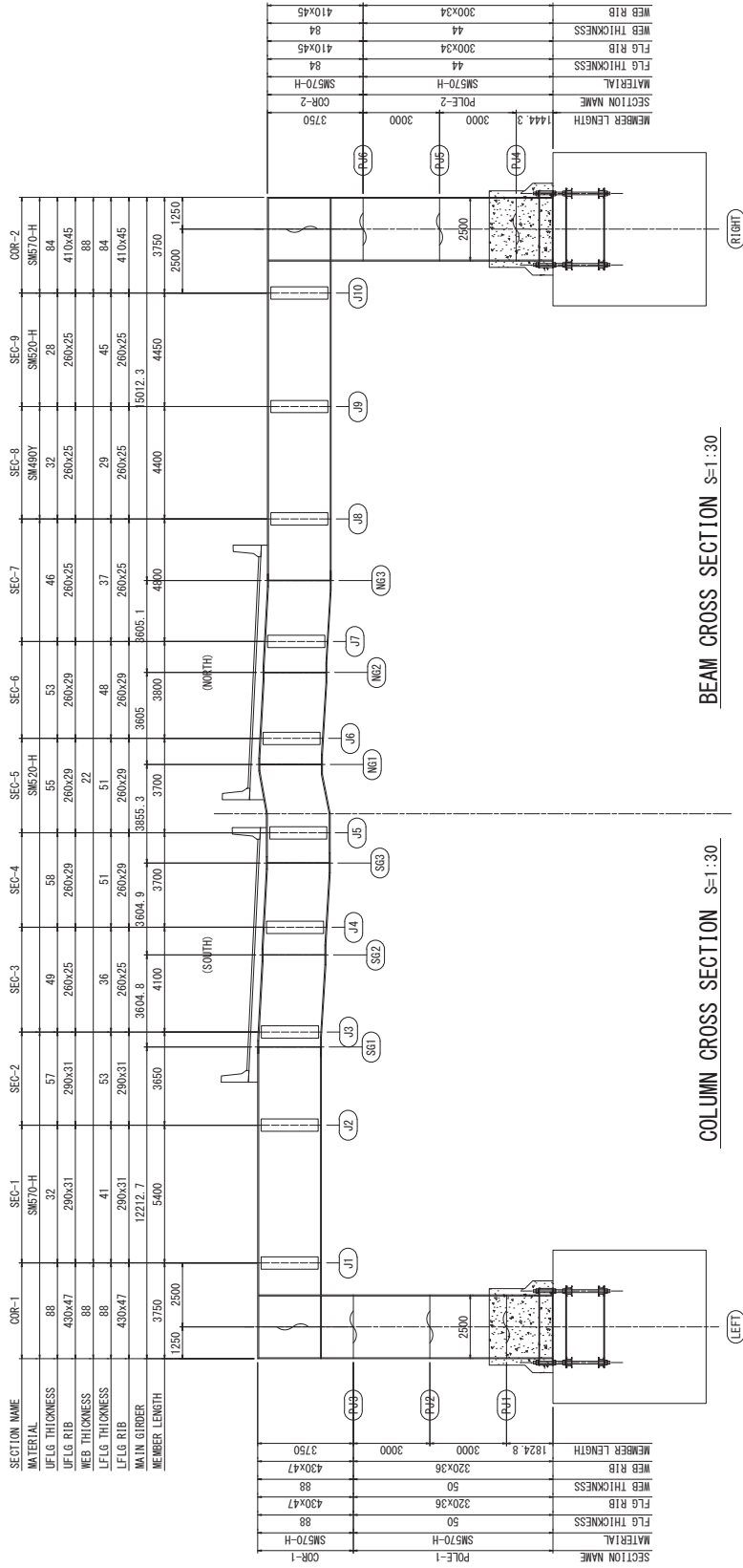
PLAN VIEW



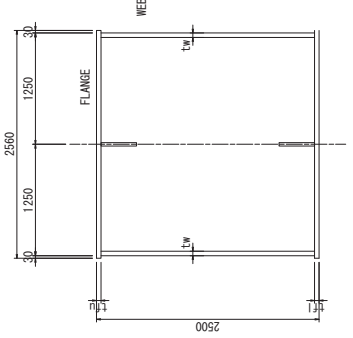
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: GENERAL ARRANGEMENT OF SUBSTRUCTURE(1)	SCALE:(A1100) AS SHOWN	DRAWING NO. SB-01
--	---	--	---	---------------------------	----------------------

CROSS SECTION OF PIER 1 S=1:100

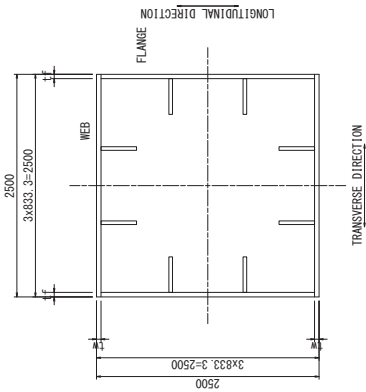
FRONT VIEW



BEAM CROSS SECTION S=1:30



COLUMN CROSS SECTION S=1:30



DRAWING TITLE:

CROSS SECTION OF PIER 1

PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

SCALE (A1100)

AS SHOWN

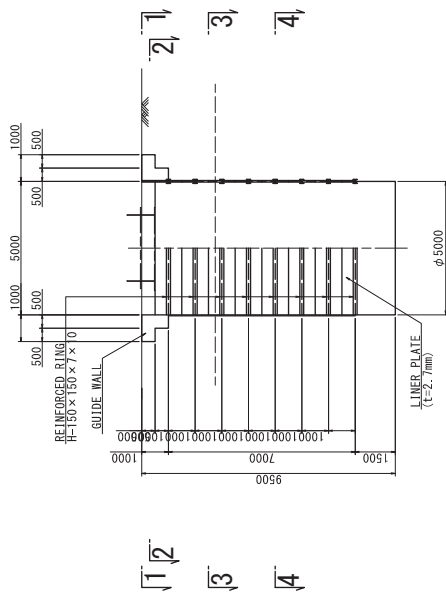
DRAWING NO.

P1-01

CROSS SECTION OF CAISSON PILE OF PIER 1 S=1:100

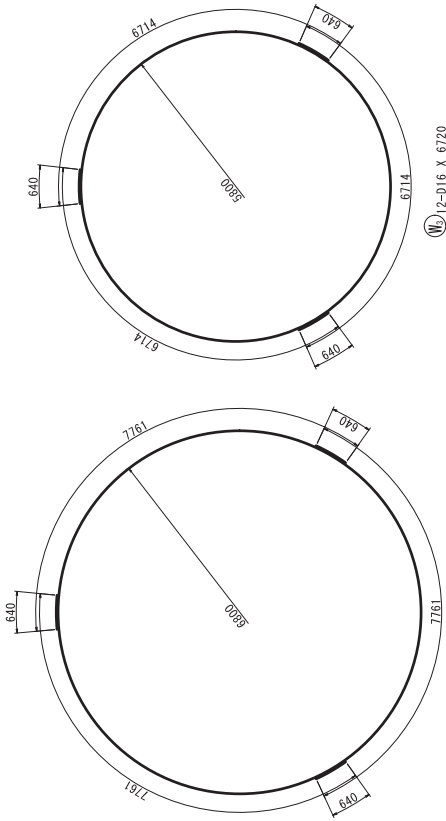
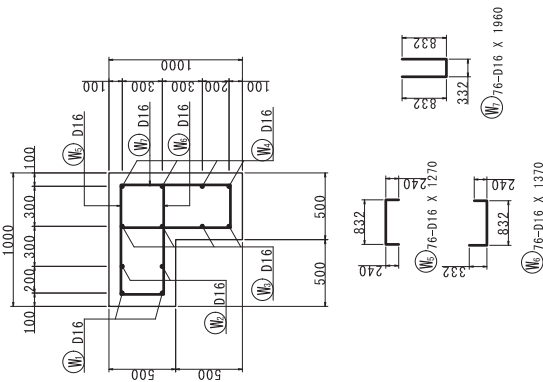
(REFERENCE)

SIDE VIEW

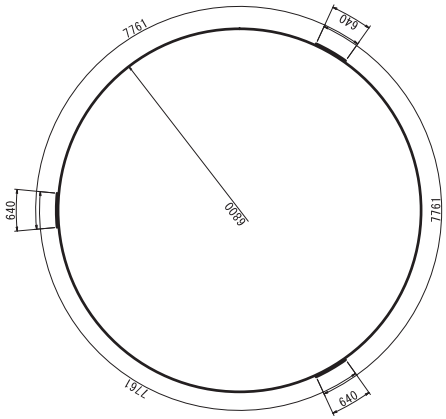


GUIDE WALL

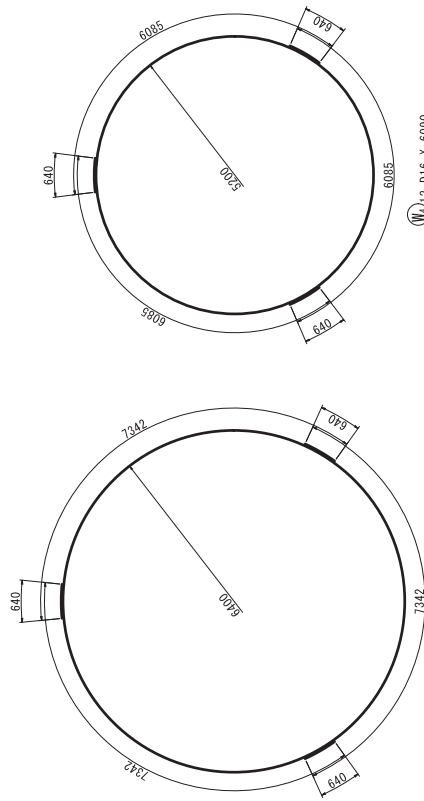
S=1:20



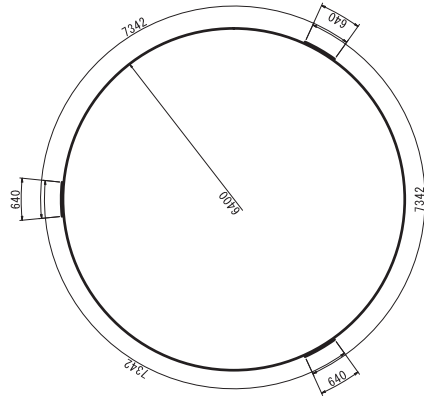
Ⓜ12-D16 X 6720



Ⓜ6-D16 X 7770



Ⓜ12-D16 X 6090



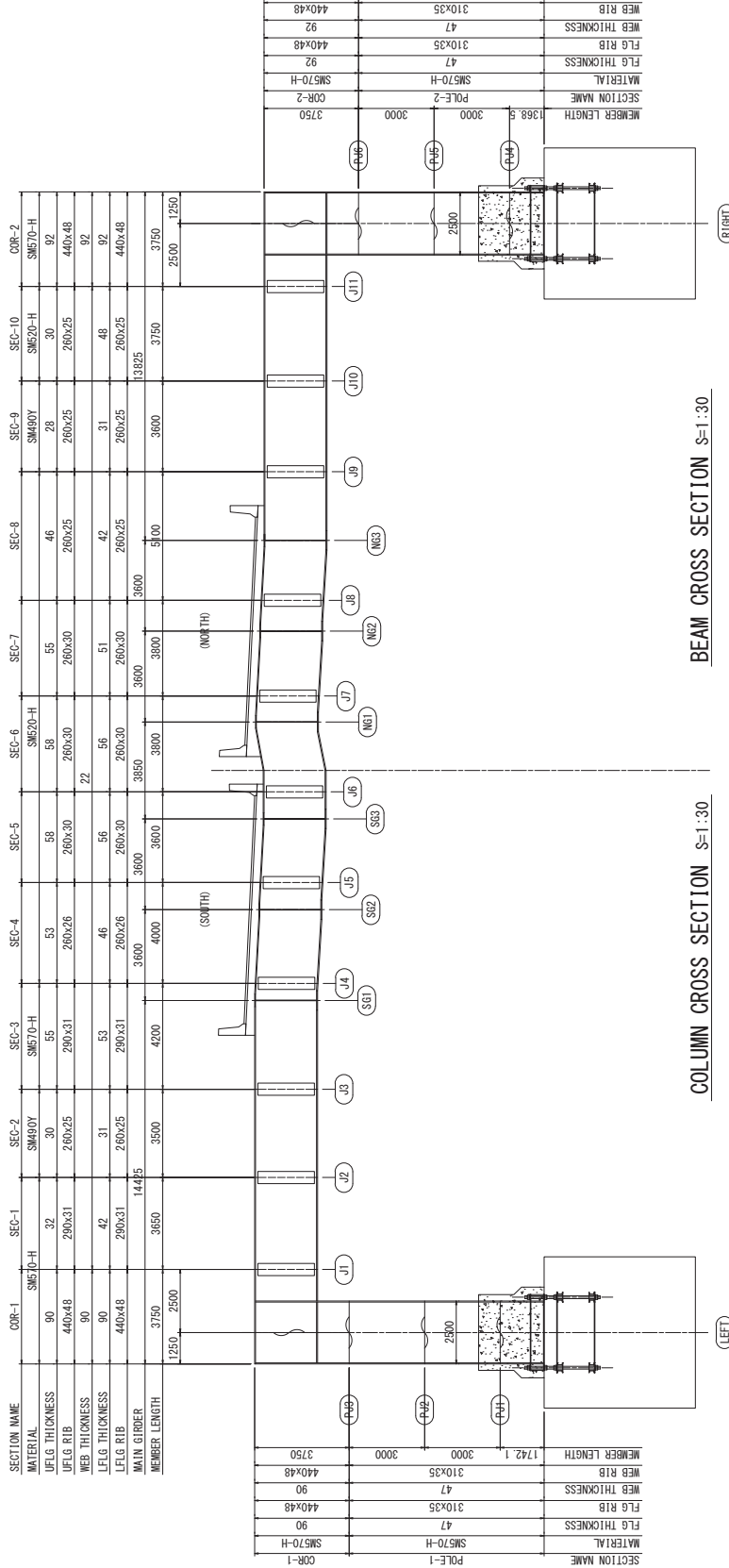
Ⓜ6-D16 X 7350

REBAR TABLE							PER PILE	
MARK	DIAMETER	LENGTH (mm)	NUMBER	UNIT WEIGHT (kg/m)	WEIGHT (kg)	WEIGHT (kg)	REMARKS	
W ₁	D16	7770	6	1.56	12.12	73	○	
W ₂	D16	7350	6	1.56	11.47	69	○	
W ₃	D16	6720	12	1.56	10.48	126	○	
W ₄	D16	6080	12	1.56	9.50	114	○	
W ₅	D16	1270	76	1.98	1.98	150	□	
W ₆	D16	1370	76	1.56	2.14	163	□	
W ₇	D16	1960	76	1.56	3.06	233	U	
SUM							D16	928
TOTAL WEIGHT								928 kg

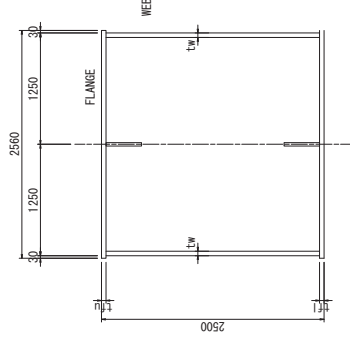
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: CROSS SECTION OF CAISSON PILE OF PIER 1	SCALE (A:100)	DRAWING NO.
			AS SHOWN	P1-02

CROSS SECTION OF PIER 2 S=1:100

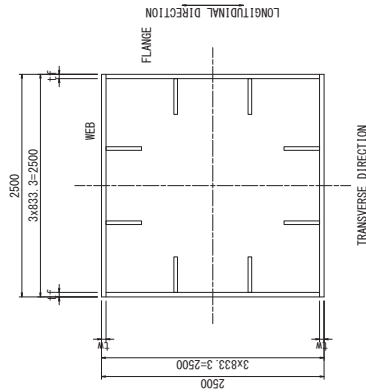
FRONT VIEW



BEAM CROSS SECTION S=1:30



COLUMN CROSS SECTION S=1:30



DRAWING TITLE:

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CROSS SECTION OF PIER 2

SCALE (A1100)

AS SHOWN

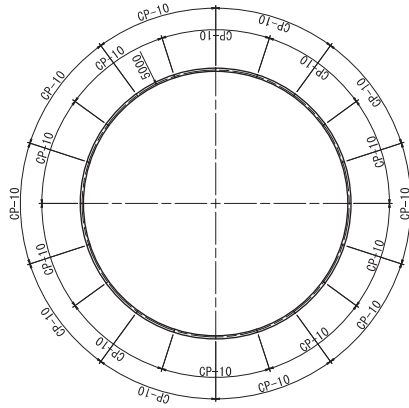
DRAWING NO.

P2-01

CROSS SECTION OF CAISSON PILE OF PIER 2 S=1:100

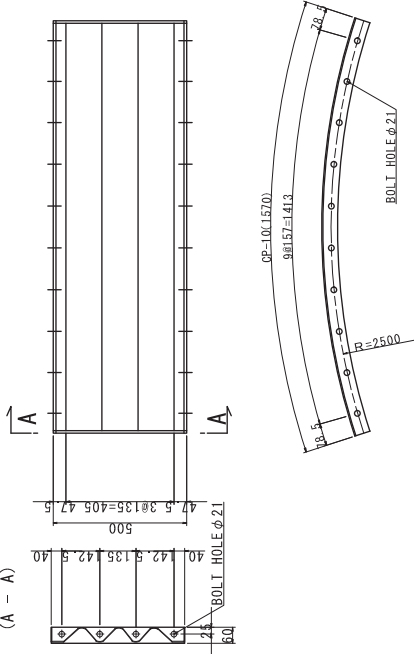
LINER PLATE S=1:50

PLAN

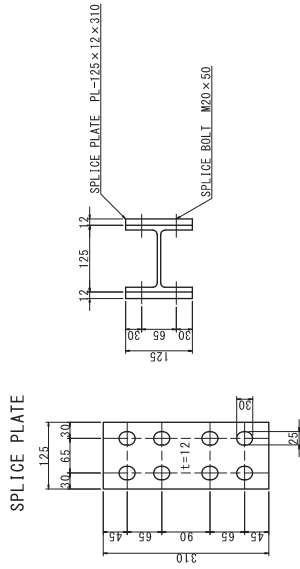


(REFERENCE)

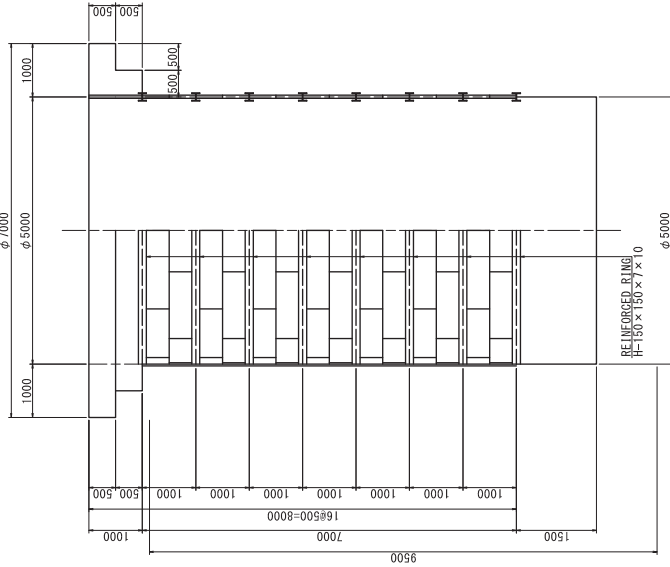
CROSS SECTION LINER PLATE S=1:10



REINFORCED-RING SPLICE S=1:5



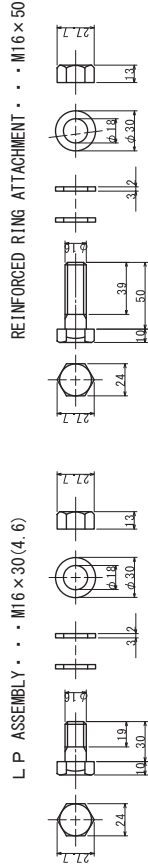
SIDE VIEW



REINFORCED RING TABLE

ITEM	SECTION	UNIT	NUMBER	REMARKS
REINFORCED RING	H=125 x 125 x 6.5 x 9	No.	80	LENGTH L=1.571m
	JOINT MATERIAL	t	2.966	W=23.6kg/m
	SUM WEIGHT	t	0.584	W=3.65kg 160 SHEETS
	BOLT NUT M20 x 50	PAIR	1280	(8.8)

BOLT - NUT - WASHER S=1:2



PER PILE

NAME	DIMENSION (mm)	UNIT WEIGHT(kg)	NUMBER	WEIGHT(kg)	REMARKS
LINER PLATE (t=2.7, H=8.000m)					
ASSEMBLY BOLTS (n-1 x 100 + n x 40)					
LINER PLATE	2.7 x 500 x 1570 (CP-10)	26.0	160	4160	BLACK FILM
ASSEMBLY BOLT	M16 x 30 (4.6 FOR LP)	0.137	1340	184	
ASSEMBLY BOLT	M16 x 50 (REINFORCED RING)	0.164	800	131	
PER			SUM	4475	(kg)

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

PROJECT TITLE:
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:
CROSS SECTION CAISSON
PILE OF PIER 2

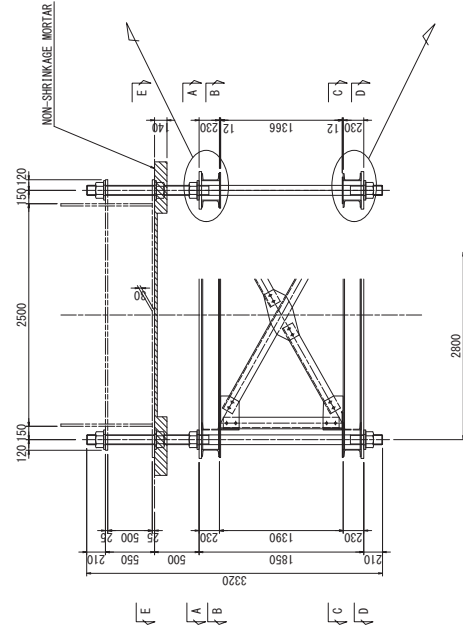
SCALE (A1199)
AS SHOWN

DRAWING NO.
P2-02

CROSS SECTION OF ANCHOR FRAME S=1:30

TRANSVERSE DIRECTION
(WEB OF PIER)

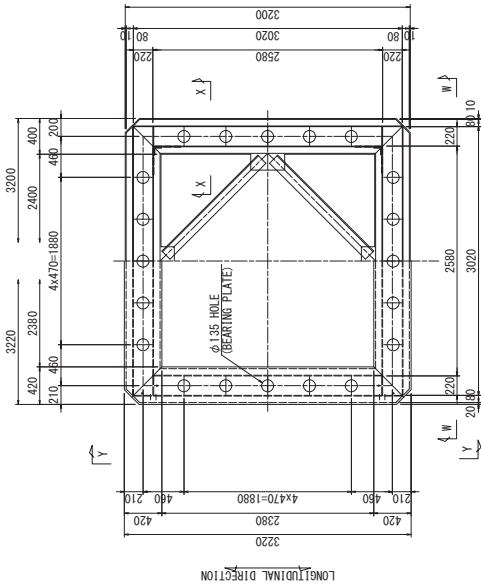
W - W X - X



UPPER FRAME

A - A B - B

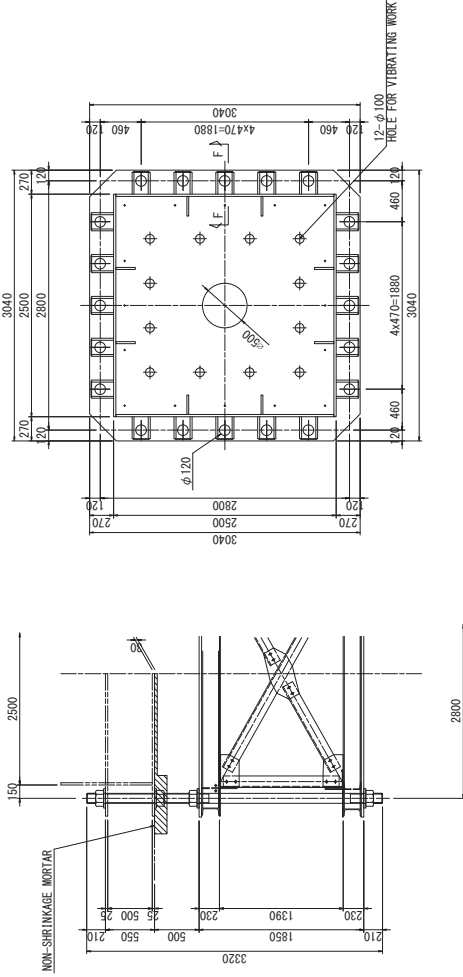
TRANSVERSE DIRECTION



LONGITUDINAL DIRECTION
(FLANGE OF PIER)

E - E

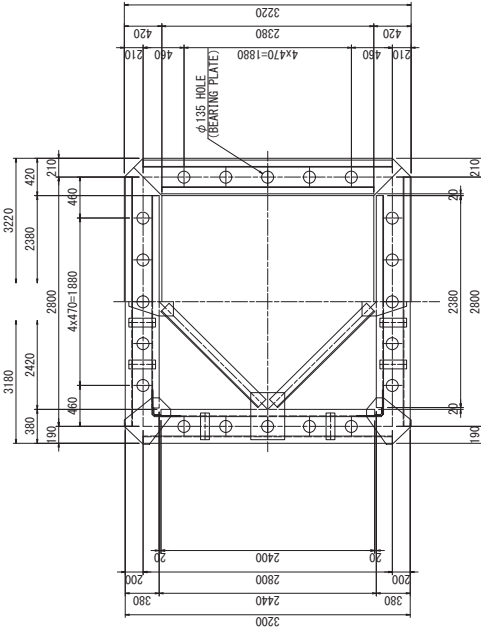
Y - Y



LOWER FRAME

C - C D - D

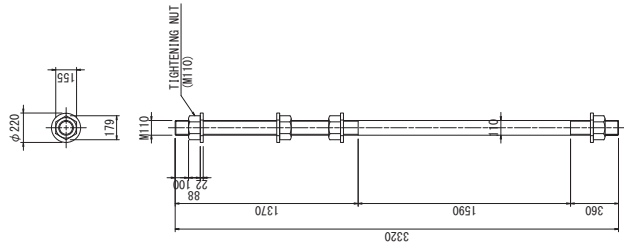
TRANSVERSE DIRECTION



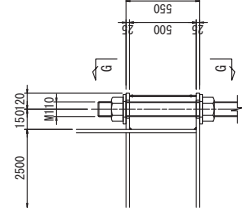
LONGITUDINAL DIRECTION

LONGITUDINAL DIRECTION

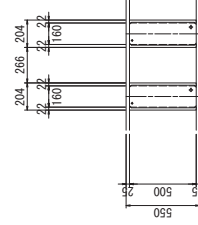
ANCHOR BOLT S=1:20



F - F S=1:20



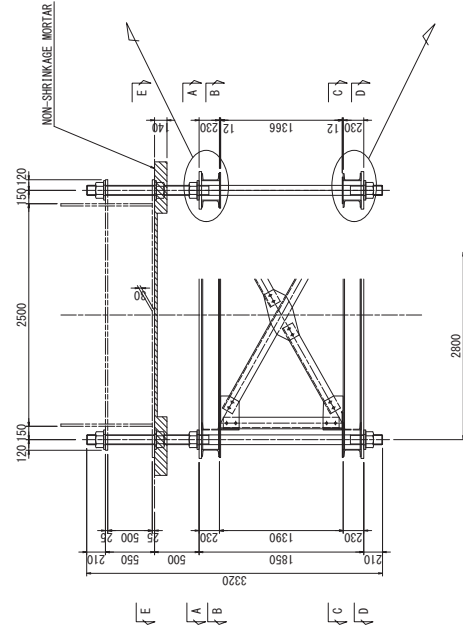
G - G S=1:20



CROSS SECTION OF ANCHOR FRAME S=1:30

TRANSVERSE DIRECTION
(WEB OF PIER)

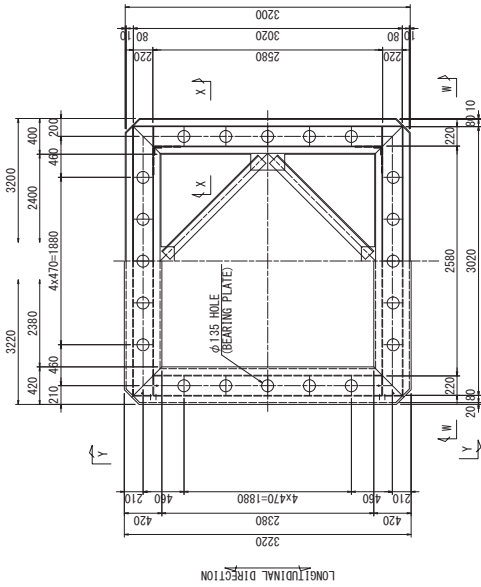
W - W X - X



UPPER FRAME

A - A B - B

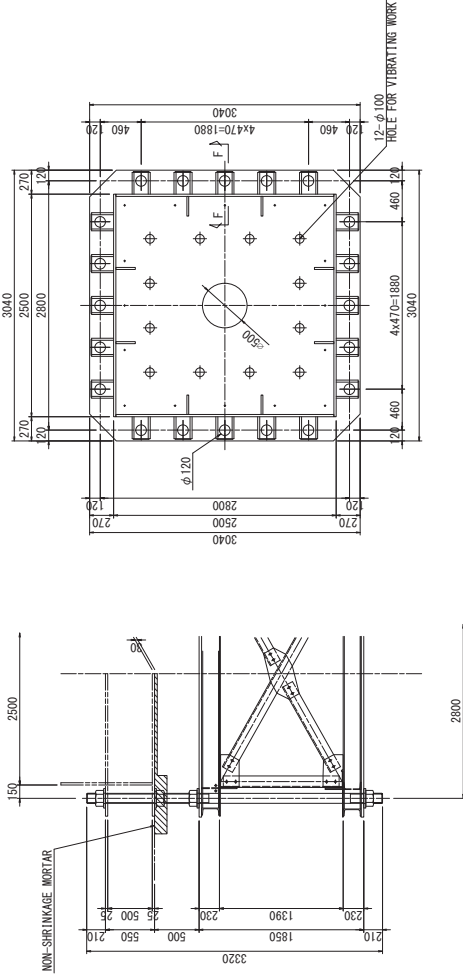
TRANSVERSE DIRECTION



LONGITUDINAL DIRECTION
(FLANGE OF PIER)

E - E

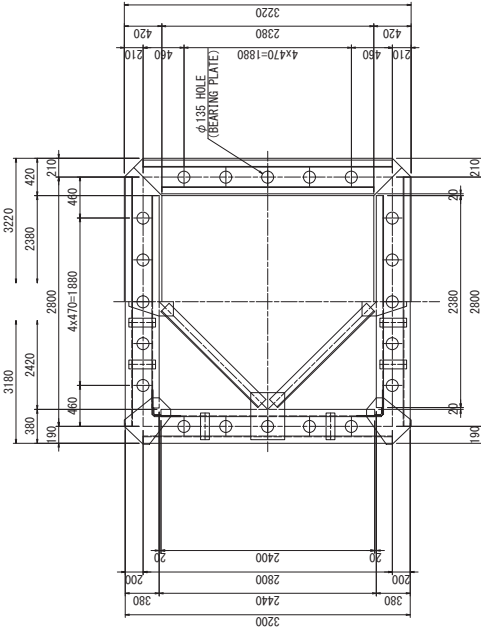
Y - Y



LOWER FRAME

C - C D - D

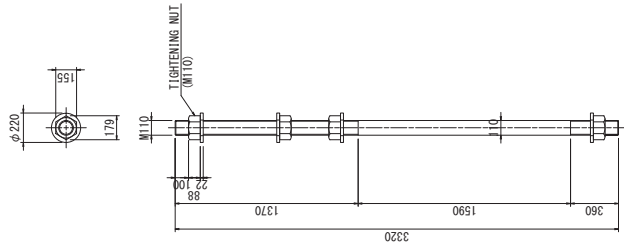
TRANSVERSE DIRECTION



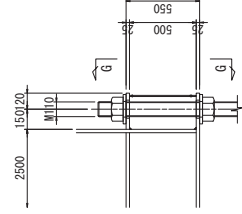
LONGITUDINAL DIRECTION

LONGITUDINAL DIRECTION

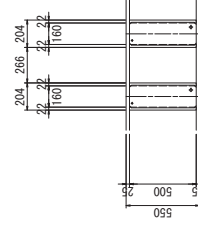
ANCHOR BOLT S=1:20



F - F S=1:20



G - G S=1:20



SCALE (A1:100)

DRAWING TITLE:

AF-01

CROSS SECTION OF ANCHOR FRAME

PROJECT TITLE:

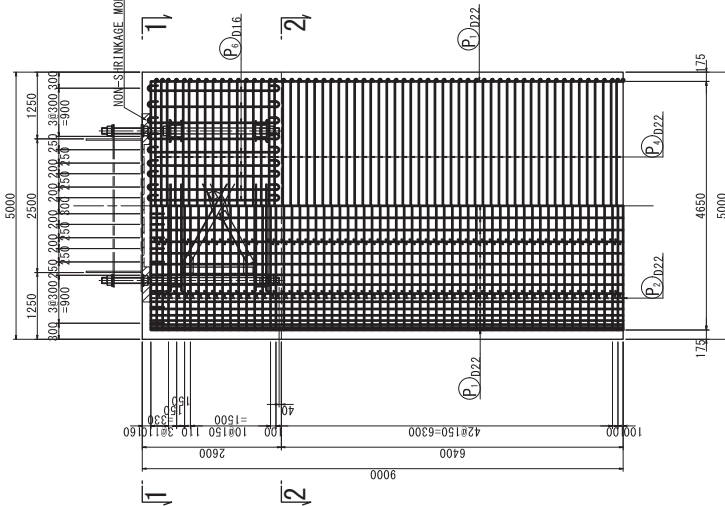
THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

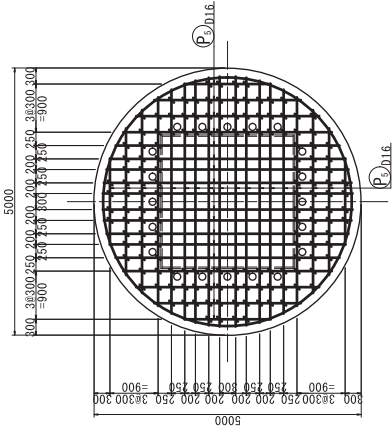
GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

REINFORCED REBAR ARRANGEMENT OF CAISSON OF PIER S=1:50 (REFERENCE)

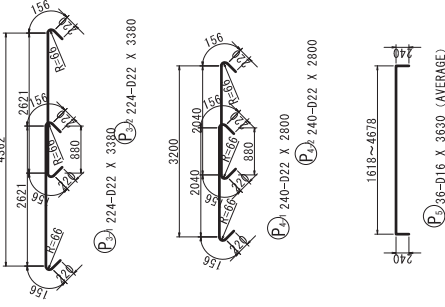
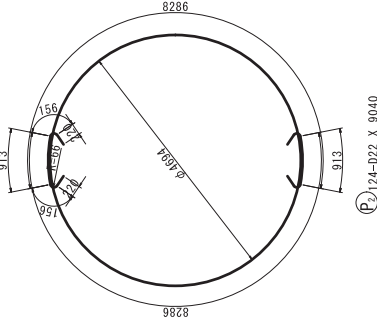
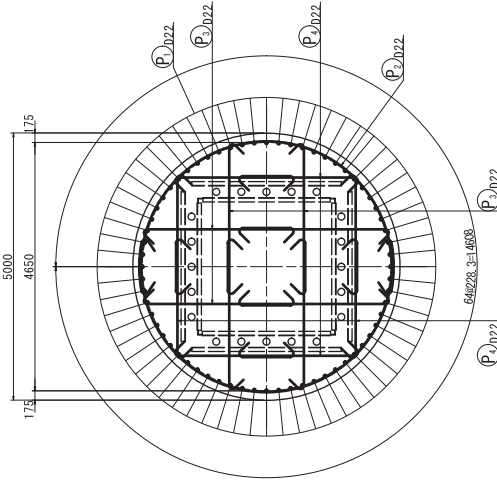
SIDE VIEW



1 - 1 PLAN



2 - 2 PLAN



AP6-167

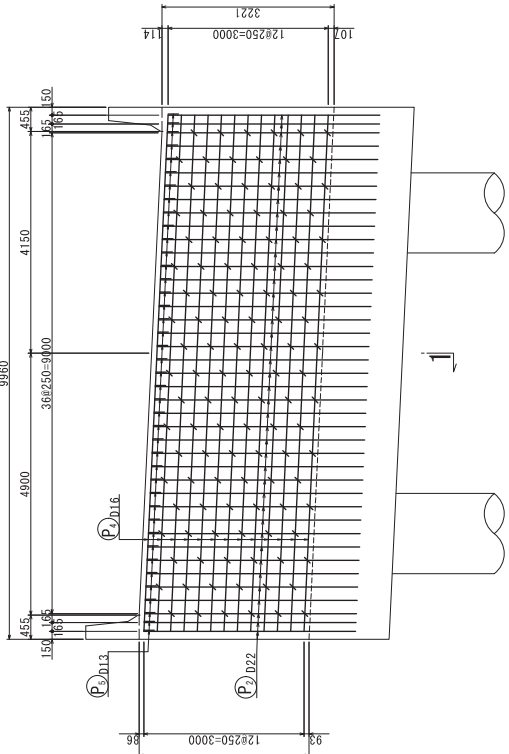
REBAR TABLE

MARK	DIAMETER	LENGTH (mm)	NUMBER	UNIT WEIGHT (kg/m)	PER WEIGHT (kg)	WEIGHT (kg)	REMARKS
P ₁	D22	8840	64	3.04	26.87	1720	I
P ₂	D22	9040	124	3.04	27.48	3408	O
P ₃₋₁	D22	3380	224	3.04	10.28	2303	←
P ₃₋₂	D22	3380	224	3.04	10.28	2303	←
P ₄₋₁	D22	2800	240	3.04	8.51	2042	←
P ₄₋₂	D22	2800	240	3.04	8.51	2042	←
P ₅	D16	3630	36	1.56	5.66	204	(AVERAGE)
P ₆	D16	2910	152	1.56	4.54	690	I
							14712
SUM				D22	13818	kg	
				D16	894	kg	
TOTAL WEIGHT					14712	kg	

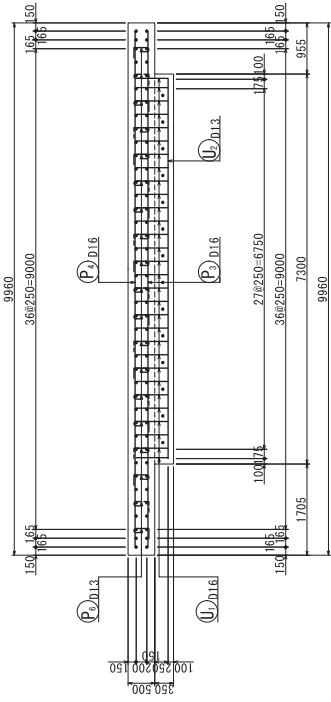
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF PIER
	SCALE: (A119)	DRAWING NO.
	AS SHOWN	PC-01

REINFORCED REBAR ARRANGEMENT OF ABUTMENT 1 S=1:50
(REFERENCE)

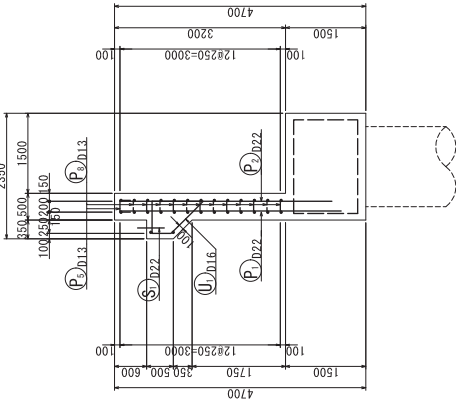
2 - 2



4 - 4

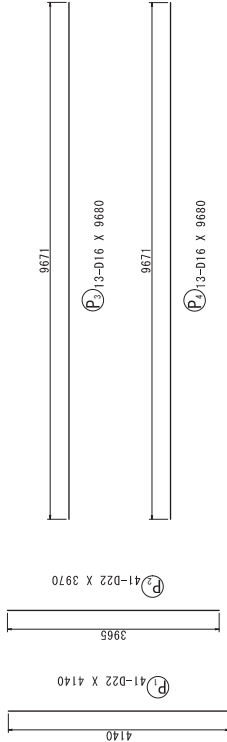
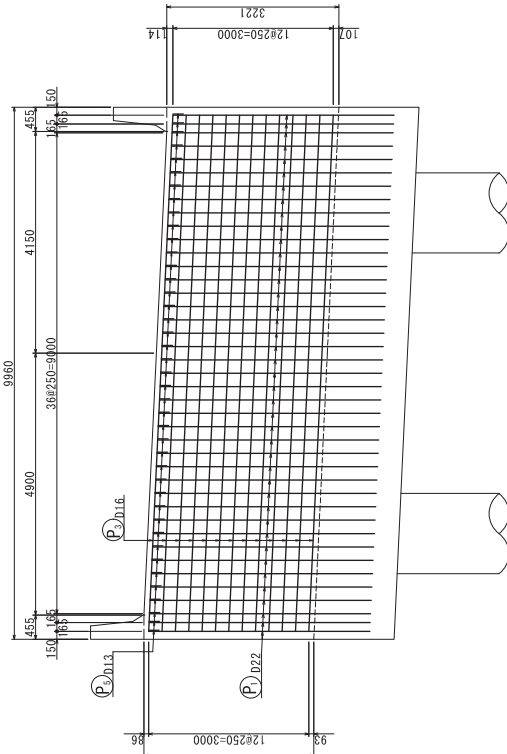


1 - 1

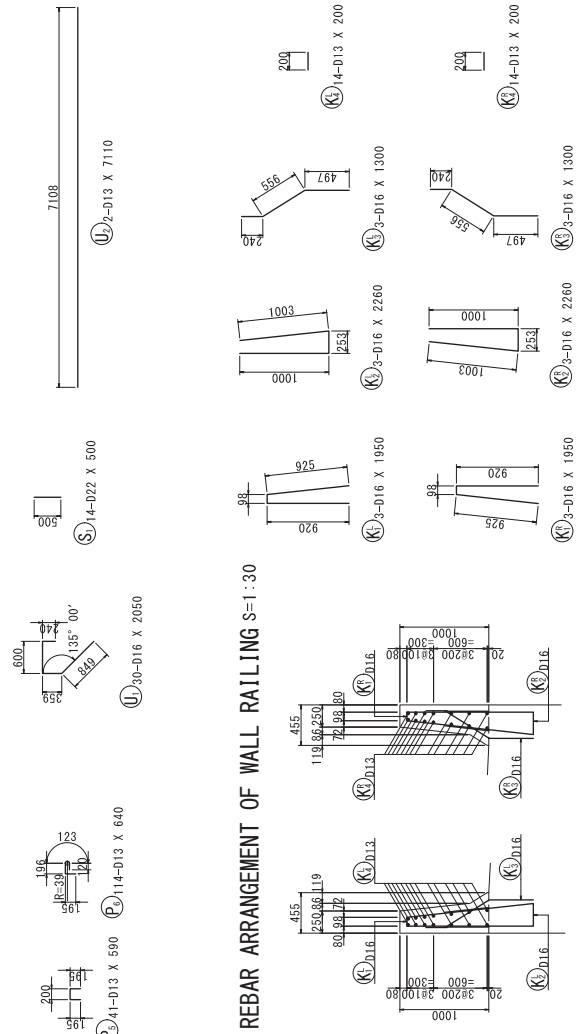


AP6-169

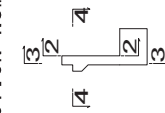
3 - 3



REBAR ARRANGEMENT OF WALL RAILING S=1:30



SECTION NUMBER



PROJECT TITLE:

THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT
(PHASE 2)

DRAWING TITLE:

REINFORCED REBAR ARRANGEMENT
OF ABUTMENT 1

SCALE (A1/100)

AS SHOWN

GHANA HIGHWAY AUTHORITY
MINISTRY OF ROADS AND HIGHWAYS
REPUBLIC OF GHANA

CTI ENGINEERING INTERNATIONAL CO., LTD.
JAPAN INTERNATIONAL COOPERATION AGENCY

DRAWING NO.

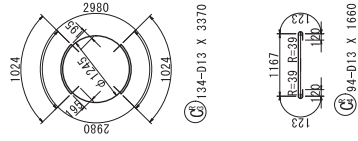
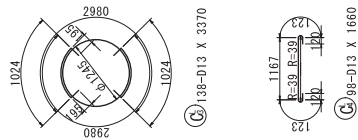
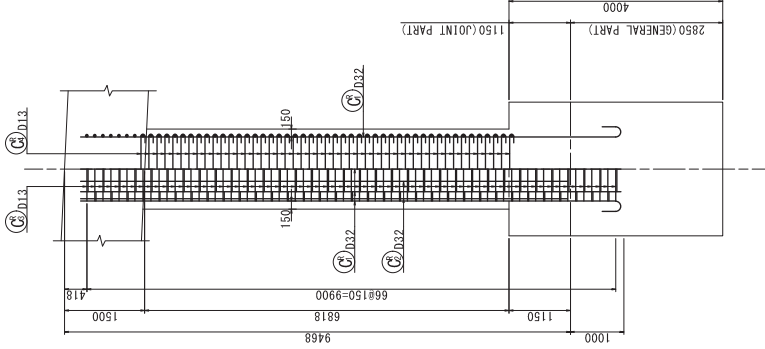
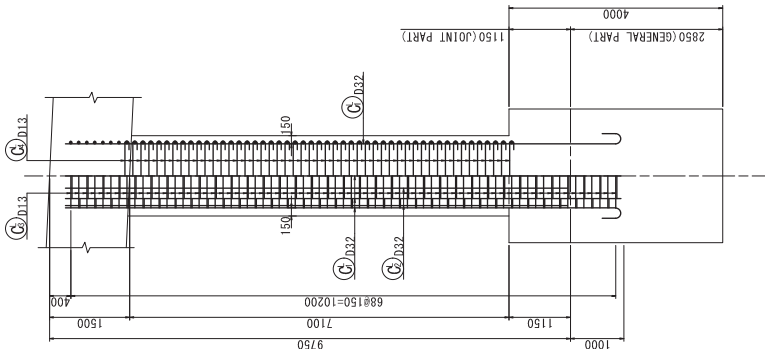
A1-02

REINFORCED REBAR ARRANGEMENT OF COLUMN OF A1 S=1:50

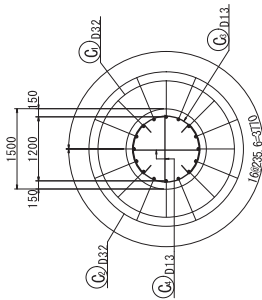
(REFERENCE)

LEFT SIDE

RIGHT SIDE



PLAN



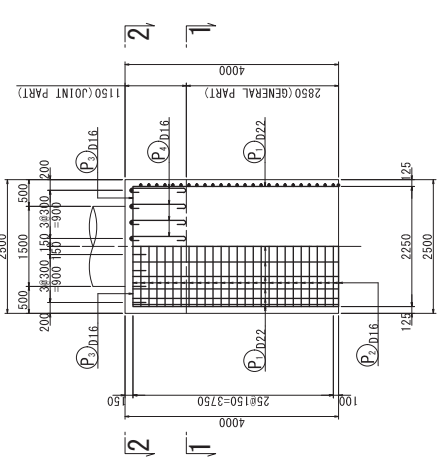
REBAR TABLE

MARK	DIAMETER	LENGTH (mm)	NUMBER	UNIT WEIGHT (kg/m)	PER WEIGHT (kg)	WEIGHT (kg)	REMARKS
C1	D32	10860	8	6.23	67.66	541	I
C2	D32	9860	8	6.23	61.43	491	I
C3	D13	3370	138	0.995	3.35	462	O
C4	D13	1660	98	0.995	1.65	162	I
							1656
C5	D32	10580	8	6.23	65.91	527	I
C6	D32	9580	8	6.23	59.68	477	I
C7	D13	3370	134	0.995	3.35	449	O
C8	D13	1660	94	0.995	1.65	155	I
							1608
SUM			D32	2036	kg		
			D13	1228	kg		
TOTAL WEIGHT				3264	kg		

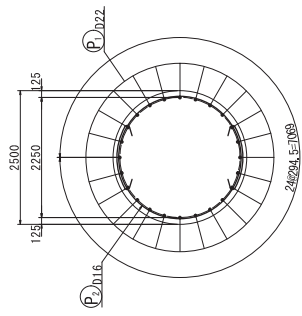
LEFT-SIDE COLUMN (h=7.100m)
W=1652kg / 7.100m = 232.7kg/m
RIGHT-SIDE COLUMN (h=6.818m)
W=1608kg / 6.818m = 235.8kg/m
AVERAGE W=(232.7+235.8)/1/2 =234.3 → 235kg/m

REINFORCED REBAR ARRANGEMENT OF CAISSON PILE OF A1 S=1:50
(REFERENCE)

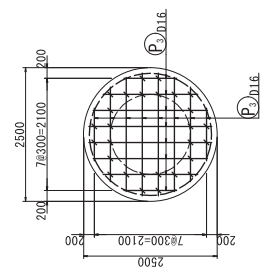
SIDE VIEW



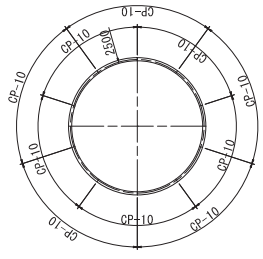
1 - 1 PLAN



2 - 2 PLAN

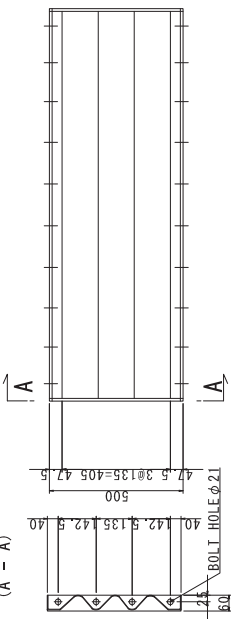


LINER PLATE PLAN

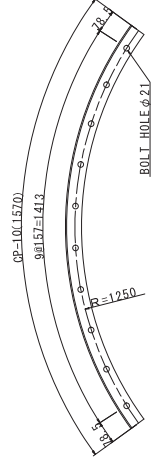


S=1:50

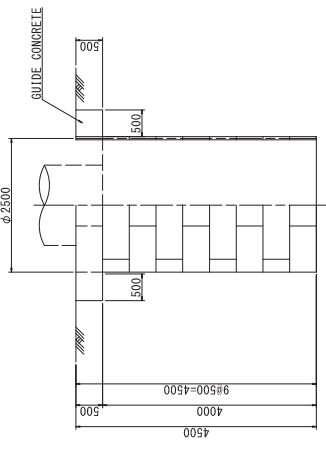
CROSS SECTION (A - A)



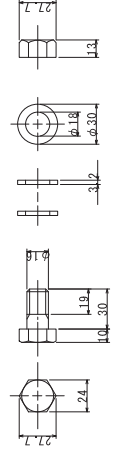
LINER PLATE S=1:10



SIDE VIEW



BOLT - NUT - WASHER S=1:2
LP ASSEMBLY . . . M16 x 30 (4, 6)



NAME	DIMENSION (mm)	UNIT WEIGHT (kg)	NUMBER	WEIGHT (kg)	REMARKS
LINER PLATE (t=2.7, H=4,500mm)					
ASSEMBLY BOLTS (n=1) x 50 + n x 20			n		LINER PLATE
LINER PLATE	2.7 x 500 x 1570 (CP-10)	26.0	45	1170	BLACK FILM
ASSEMBLY BOLT	M16 x 30 (4, 6, LP)	0.137	580	80	
		PER	SUM	1250	(kg)

REBAR TABLE

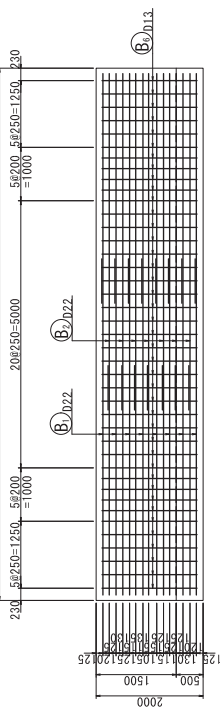
MARK	DIA(METER)	LENGTH(mm)	NUMBER	UNIT WEIGHT(kg/m)	PER WEIGHT(kg)	WEIGHT(kg)	REMARKS
P1	D22	3850	24	3.04	11.70	281	I
P2	D16	5340	54	1.56	8.33	450	O
P3	D16	2130	16	1.56	3.32	53	(AVERAGE)
P4	D16	1640	28	1.56	2.56	72	t
						856	
SUM	D22					281	kg
	D16					575	kg
	TOTAL WEIGHT					856	kg

$W = 856 / 4.0 = 214.0 \rightarrow 214 \text{ kg/m}$

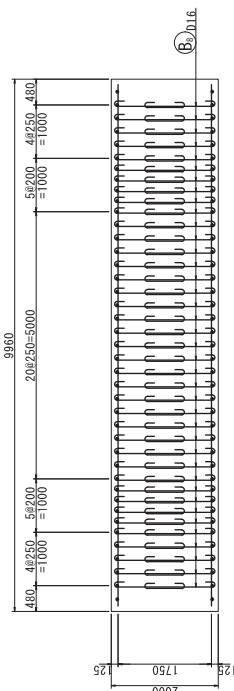
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING NO. A1-04
--	--	----------------------

**REINFORCED REBAR ARRANGEMENT OF ABUTMENT 2 S=1.50
(REFERENCE)**

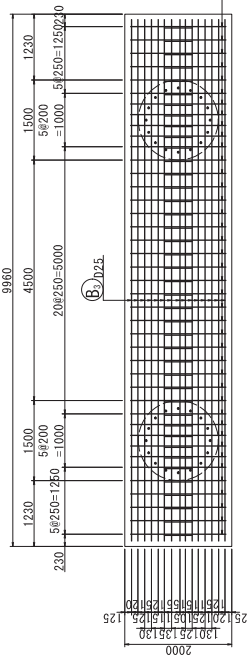
5 - 5



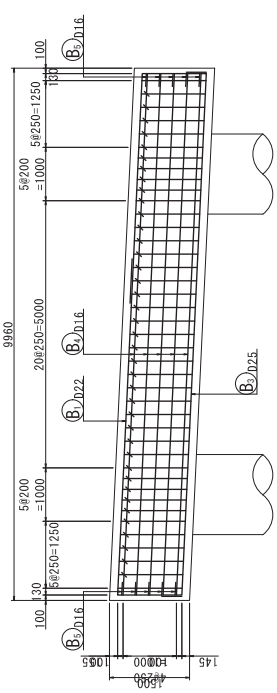
6 - 6



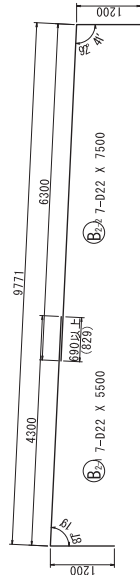
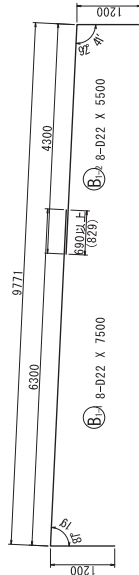
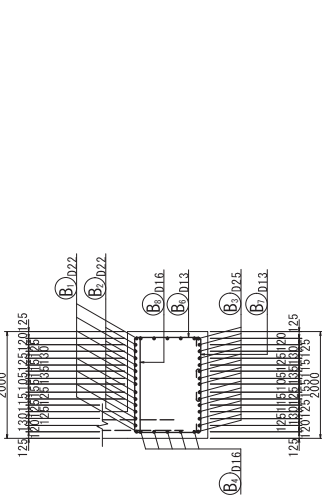
7 - 7



8 - 8

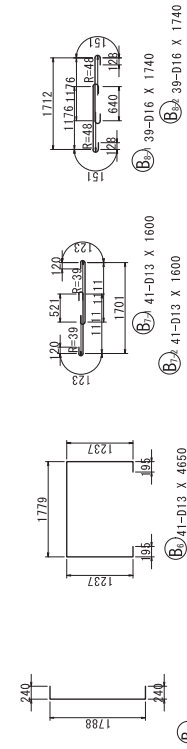


9 - 9

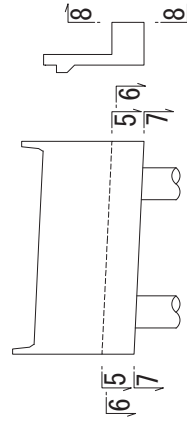


5#15-D25 X 10630

5#10-D16 X 9780



SECTION NUMBER



REBAR TABLE

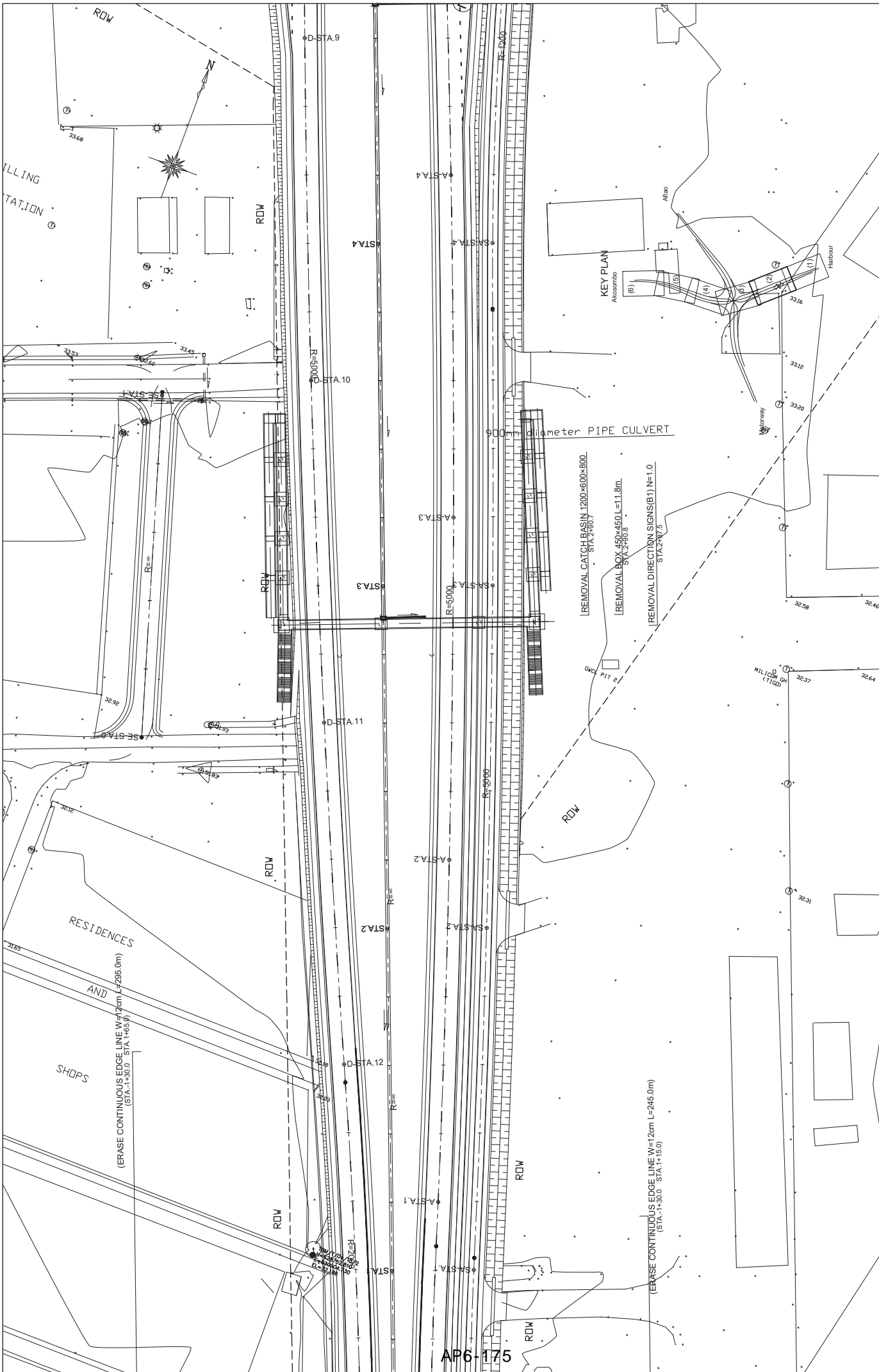
MARK	DIAMETER	LENGTH (mm)	NUMBER	UNIT WEIGHT (kg/m)	PER WEIGHT (kg)	WEIGHT	REMARKS
P ₁	D22	4140	41	3.04	12.59	516	I
P ₂	D22	3970	41	3.04	12.07	495	I
P ₃	D16	9680	13	1.56	15.10	196	—
P ₄	D16	9680	13	1.56	15.10	196	—
P ₅	D13	590	41	0.995	0.59	24	□
P ₆	D13	640	114	0.995	0.64	73	□
							1500
U ₁	D16	2050	30	1.56	3.20	96	□
U ₂	D13	7110	2	0.995	7.07	14	—
							110
S ₁	D22	500	14	3.04	1.92	21	I
							21
B ₁₋₁	D22	7500	8	3.04	22.80	182	—
B ₁₋₂	D22	5500	8	3.04	16.72	134	—
B ₂₋₁	D22	5500	7	3.04	16.72	117	—
B ₂₋₂	D22	7500	7	3.04	22.80	160	—
B ₃	D25	10630	15	3.98	41.91	629	—
B ₄	D16	9780	10	1.56	15.26	153	—
B ₅	D16	2270	10	1.56	3.54	35	I
B ₆	D13	4650	41	0.995	4.63	190	□
B ₇₋₁	D13	1600	41	0.995	1.59	65	—
B ₇₋₂	D13	1600	41	0.995	1.59	65	—
B ₈₋₁	D16	1740	39	1.56	2.71	106	—
B ₈₋₂	D16	1740	39	1.56	2.71	106	—
							1942
K ₁	D16	1950	3	1.56	3.04	9	I
K ₂	D16	2260	3	1.56	3.53	11	I
K ₃	D16	1300	3	1.56	2.03	6	I
K ₄	D13	200	14	0.995	0.20	3	—
							29
K ₅	D16	1950	3	1.56	3.04	9	I
K ₆	D16	2260	3	1.56	3.53	11	I
K ₇	D16	1300	3	1.56	2.03	6	I
K ₈	D13	200	14	0.995	0.20	3	—
							29
SUM				D25	629	kg	
				D22	1625	kg	
				D16	940	kg	
				D13	437	kg	
TOTAL WEIGHT					3631	kg	

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: REINFORCED REBAR ARRANGEMENT OF ABUTMENT 2	SCALE: (A:100)	DRAWING NO. A2-02
--	--	---	----------------	----------------------



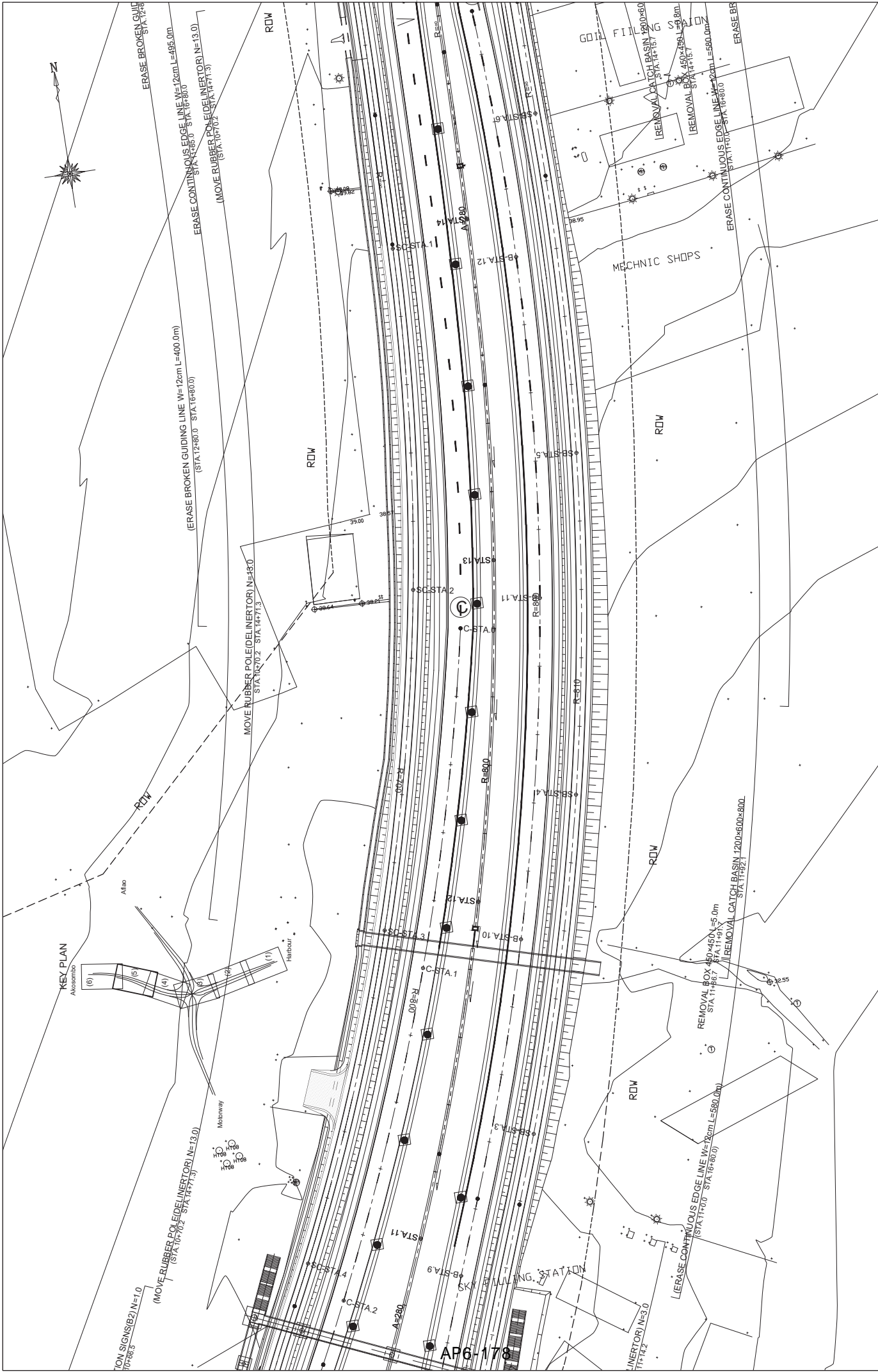
AP6-174

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)		DRAWING NO. RD-01
		DRAWING TITLE: STRUCTURE REMOVAL PLAN(1)		SCALE (A1100) 1:500



AP6-175

GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT TITLE: THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)	DRAWING TITLE: STRUCTURE REMOVAL PLAN(2)	SCALE (A1199) 1:500	DRAWING NO. RD-02



SCALE (A1189)	DRAWING NO.	DRAWING TITLE:	PROJECT TITLE:
1:500	RD-05	STRUCTURE REMOVAL PLAN(S)	THE PROJECT FOR IMPROVEMENT OF THE TEMA MOTORWAY ROUNDABOUT (PHASE 2)
GHANA HIGHWAY AUTHORITY MINISTRY OF ROADS AND HIGHWAYS REPUBLIC OF GHANA	CTI ENGINEERING INTERNATIONAL CO., LTD. JAPAN INTERNATIONAL COOPERATION AGENCY		

【Appendix-7】

Pavement Plan from the Final Report of Phase-1

2.2.2.4 Pavement Plan

(1) Condition of Existing Pavement

The existing pavement on the Motorway is a rigid type (concrete) pavement. Other roads have flexible

(asphaltic) pavement. Although partial deterioration on the pavement surface was found, most of the pavement is still under the good to fair condition.

As shown in **Figure 2.2.2-28**, existing pavement survey was conducted by soil compaction tester for the purpose to roughly evaluate existing pavement condition and to check if the laboratory test result is appropriate. In the survey, an average of 3 separately measured CBR values at a point was taken as the field CBR at that point. For pavement design, CBR obtained from laboratory test was used.








Figure 2.2.2-28 Existing Pavement Survey by Soil Compaction Tester










1) Accra- Tema Motorway

Thickness	Material	CBR Value	Photos
Surface Course t=20cm(Carriage way)	【Carriage way】 Cement Concrete	-	
t=5cm (Shoulder)	【Shoulder】 Asphalt concrete	-	
Base Course/ Sub-base Course t=35cm	CLAY with Gravel	188	
Subgrade	Clayey Sand	99 (Surface on subgrade) 23 (10cm down from surface)	

2) Tema-Hospital Road

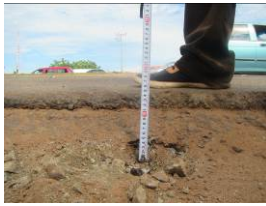




Thickness	Material	CBR Value	Photos
Surface Course t=8cm	【Carriage way】 Asphalt concrete	-	 
Base Course/ Sub-base Course t=25cm	【Shoulder】 Asphalt concrete	96 (Surface on base-course)	 
Subgrade	Clayey Sand	105 (Surface on subgrade)	

3) Tema-Harbour Road







Thickness	Material	CBR Value	Photos
Surface Course t=15cm(Carriage way)※1	【Carriage way】 Asphalt concrete	-	 
t=5cm(Shoulder)	【Shoulder】 Asphalt concrete	-	
Base Course/ Sub-base Course t=30cm	CLAY with Gravel	202 (Surface on base-course)	 
		145 (15cm down from surface)	 
		128 (25cm down from surface)	
Subgrade※3	CLAY with Gravel	39 (30cm down from subgrade)	 

- ※1. Height of pavement was assumed to be up to the height of the curb
 ※2. Existence of subgrade was not confirmed under 50 cm from the surface
 ※3. Unpaved section outside of carriage way was assumed to be subgrade.

4) Tema-Aflao Road

Thickness	Material	CBR Value	Photos
Surface Course t=15cm(Carriage way)	【Carriage way】 Asphalt concrete	-	
t=5cm(Shoulder)	【Shoulder】 Asphalt concrete	-	
Base Course/ Sub-base Course t=15cm	Crashed stone	N/A (Surface on base-course)	
		113 (5cm down from surface)	
Subgrade	Sandy CLAY with Gravel	99 (Surface on subgrade)	

5) Tema-Akosombo Road

Thickness	Material	CBR Value	Photos
Surface Course t=10cm(Carriage way)	【Carriage way】 Asphalt concrete	-	
t=10cm(Shoulder)	【Shoulder】 Asphalt concrete	-	
Base Course/ Sub-base Course t=10cm	Crashed stone	82 (Surface on base-course)	
		111 (Surface on subgrade)	
Subgrade	Sandy CLAY with Gravel	63 (10cm down from subgrade)	
		111 (Surface on subgrade)	

(2) Basic Policies

Basic policies for pavement design are as follows;

- Flexible pavement which is common in Ghana shall be applied.
- AASHTO Guide for Design of Pavement Structure, 1993 shall be adopted.
- Countermeasures for groundwater shall be considered.
- Minimum pavement thickness to be applied will be 10cm or more.
- The possible future increment of heavy traffic passing the objective intersection is anticipated.

At the intersection, drivers would have to negotiate curves at low driving speed. Against plastic deformation of wearing course of pavement, modified asphalt shall be applied to the wearing course. For the service roads and temporary detour, modified asphalt shall not be applied.

- As traffic volumes differ, pavement of main carriageway and ramp shall be designed separately.
- Pavement structure of temporary detour shall be designed for the year 2020 with an assumption that the project will be implemented in 2019 and complete by year 2020. Although pavement composition may vary due to difference of traffic volume and CBR values, the pavement structure that has the biggest layer values will be applied for all the roads.

(3) Pavement Design

1) Design Period

Design period shall be 15 years as stipulated in the Pavement Design Manual (GHA).

2) Design Parameters

Design parameters are summarized in **Table 2.2.2-23**. The Structural Number (SN) required for the asphalt pavement will be calculated from the following formula.

$$\text{Log}_{10}(W_{18}) = Z_R \times S_0 + 9.36 \times \text{Log}_{10}(\text{SN} + 1) - 0.20 + \frac{\text{Log}_{10}\left\{\frac{\Delta \text{PSI}}{(4.2 - 1.5)}\right\}}{0.40 + \left\{\frac{1094}{(\text{SN} + 1)^{5.19}}\right\}} + 2.32 \times \text{Log}_{10}(M_R) - 8.07$$

Table 2.2.2-22 Design Parameters (Inputs) of Pavement Design

Item	Description	Design Condition	Remarks
Design Period	The period of time that an initial pavement structure will last before it needs rehabilitation.	15 years (2020 – 2034)	
Traffic Load	The traffic load is expressed by cumulative number of 18-kip equivalent single axle load (ESAL) applications (w_{18}) during the performance period and is calculated based on the future traffic volume which is converted to 18-kip ESALs applying the axle load equivalency factors given in the AASHTO Guide.	Calculated by traffic demand forecast	
Reliability	Means of incorporating some degree of certainty into the design process.	<ul style="list-style-type: none"> • The level of reliability (R)=90% • Standard normal deviate corresponding to level of reliability (Z_R) = -1.282 • Combined standard error of the traffic prediction and performance prediction (S_0) = 0.44 	
Performance Criteria	The Present Serviceability Index (PSI) is used to represent pavement performance. The total change in PSI (Δ PSI) is defined as the difference between initial serviceability index (p_0 : value immediately after construction) and terminal serviceability index (p_t : lowest index that will tolerate before rehabilitation, resurfacing or reconstruction)	$p_0 = 4.2$ $p_t = 2.5$	$p_0=4.2$ $p_t=2.5$ $\Delta \text{PSI}=1.7$
Roadbed Soil	The resilient modulus (M_R) is used. The AASHTO Guide introduces the equation	CBR=9.6~20	$M_R=14,400\text{psi} \sim 30,000$

Item	Description	Design Condition	Remarks
Property	estimating M_R from CBR as $M_R = 1,500 \times \text{CBR}$ (CBR is regarded as 20 in case of CBR more than 20)	(calculated based on CBR investigation)	
Pavement Layer Material Properties	The pavement strength is expressed by the structural number (SN) which is calculated as : $SN = a_1D_1 + a_2D_2m_2 + a_3D_3m_3$ where $a_i=i^{\text{th}}$ layer coefficient $D_i=i^{\text{th}}$ layer thickness (inches) $m_i=i^{\text{th}}$ layer drainage coefficient	<ul style="list-style-type: none"> Asphalt concrete wearing course : $a_1=0.41$ ($E_{AC}=425,000$ psi) Asphalt concrete binder course : $a_2=0.39$ ($E_{AC}=425,000$ psi) Base : $a_4=0.14$ Subbase : $a_5=0.11$ 	
Drainage Condition	The factor to modify the SN considering the effects of drainage.	$m_4=m_5=1.0$ (water removed within 1 week, and pavement structure is exposed to moisture levels approaching saturation during 5% of the year)	

3) Design Traffic Volume

Table 2.2.2-23 shows design traffic volumes calculated using traffic survey data conducted in April 2015.

Table 2.2.2-23 Design Traffic Volume

Road	Design Traffic Volume (vehicle / day)					
	Car, Taxi, Minibus	Bus	Light Truck	Heavy Truck	Trailer	Others
Motorway	16,528	177	2,393	1,218	1,158	403
Akosombo Road	23,691	607	1,369	951	484	173
Aflao Road	27,254	329	1,705	993	1,037	320
Harbour Road	21,101	983	1,232	1,256	1,387	485

Design traffic volume for ramps was calculated based on the directional traffic volume during peak hours.

Table 2.2.2-24 Design Traffic Volume

Road	Section	Conversion factor	Traffic Volume by Deirection (Vehicle/day)					
			Car, Taxi, Minibus	Bus	Light Truck	Heavy Truck	Trailer	Others
Motorway	Right turn lane	45.2%	7,471	80	1,082	551	523	182
	Left turn lane	25.4%	4,198	45	608	309	294	102
	Common section	70.6%	11,669	125	1,689	860	818	285
Akosombo Road	Right turn lane	47.6%	11,277	289	652	453	230	82
	Left turn lane	11.0%	2,606	67	151	105	53	19
	Common section	58.6%	13,883	356	802	557	284	101
Aflao Road	Right turn lane	11.4%	3,107	38	194	113	118	36
	Left turn lane	55.8%	15,208	184	951	554	579	179
	Common section	67.2%	18,315	221	1,146	667	697	215
Harbour Road	Right turn lane	32.8%	6,921	322	404	412	455	159
	Left turn lane	24.5%	5,170	241	302	308	340	119
	Common section	56.3%	11,880	553	694	707	781	273

Accurate forecasting of traffic volume on service roads from the traffic volume obtained from the traffic count survey is virtually not possible as presently there are no service roads in the project area. Therefore, the volume is determined assuming 3% of the total traffic will use the service road. The assumed traffic volumes are as shown in Table 2.2.2-25.

Table 2.2.2-25 Design Traffic Volume

Road	Design Traffic Volume (vehicle / day)			Remarks
	Car, Taxi, Minibus	Bus	Truck	
Motorway	496	5	72	No service road
Akosombo	711	18	41	
Aflao	818	10	51	
Harbour	633	20	37	

Source: JICA Survey Team

4) Growth Rates of Traffic Volumes

Growth rates of traffic volumes were determined subject to the result of future traffic demand.

5) CBR of Subbases

Figure 2.2.2-29 illustrates locations of the field CBR tests, and Table 2.2.2-26 shows the results of laboratory CBR tests. In pavement design, CBR obtained from laboratory test was applied.



Figure 2.2.2-29 Location of Field CBR Test

Table 2.2.2-26 Laboratory Test Result

SAMPLE ID	CHAINAGE (KM)	REFERENCE	SOIL CLASSIFICATION	NATURAL MOISTURE CONTENT (%)	SPECIFIC GRAVITY	PLASTICITY INDEX (%)	COMPACTION		CBR		IN-SITU CBR %
							MDD (g/cm ³)	OMC (%)	95% MDD	98% MDD	
M1C Lay.1	1 - 0+580	Shoulder	GM	2.90	2.62	10.1	2.26	4.8	75	84	95
M1C Lay.2			GW	3.50	2.598	18.1	2.26	6.5	45	54	46
M1C Lay.3			GP	3.40	2.669	9.2	2.175	6.0	35	42	44
M2L Lay.1	2 - 0+700	Subgrade	SW	4.00	2.685	NP	2.025	6.2	64	72	96
M2L Lay.2			SM	4.60	2.61	NP	N.A	N.A	N.A	N.A	129
M2L Lay.3			CH	5.20	2.664	31.5	2045	13.5	7	10	28
H1R Lay.1	3 - 0+135	Shoulder	GW	4.40	2.85	non-plastic	2.335	7.2	65	93	75
H1R Lay.2			GM	6.10	2.685	7	2.227	7.8	52	70	73
H1R Lay.3			GC	8.60	2.672	12.8	1.871	13.2	21	26	40
HH1R Lay.1	4 - 0+160	Shoulder	GW	2.50	2.753	NP	2.398	5.0	89	112	132
HH1R Lay.2			GM	3.40	2.638	3.5	2.25	7.0	45	54	56
HH1R Lay.3			GM	4.00	2.698	NP	2.32	5.0	28	35	32
TH2L Lay.1	5 - 0+200	Shoulder	GM	2.50	2.653	9.5	2.198	7.4	75	90	153
TH1L Lay.1			GM	6.00	2.618	10.6	2.19	6.5	55	75	280
TH1L Lay.2			GC	5.50	2.637	10.5	2.2	6.7	50	65	47
A1R Lay.1	7 - 0+100	Shoulder	GM	5.00	2.58	11.5	2.21	8.5	42	53	151
A1R Lay.2			GW	3.60	2.658	3.2	2.378	5.2	85	109	111
A2L Lay.1			GM	3.50	2.653	11.8	2.21	7.2	55	65	96
A2L Lay.2	8 - 0+315	Shoulder	GM	3.60	2.605	10.5	2.195	7.5	60	72	191
A2L Lay.2			GW	2.30	2.712	NP	2.39	5.5	78	103	211
A2L Lay.3			GM	3.00	2.615	9.5	2.26	7.5	67	78	94
AS1R Lay.1	9 - 0+720	Shoulder	GW	1.40	2.69	NP	2.39	5	88	112	85
AS1R Lay.2			GM	2.80	2.593	9.5	2.205	7.5	63	87	101
AS1R Lay.3			GM	2.40	2.614	9.3	2.25	7.3	67	87	49
AS2L Lay.1	10 - 0+885	Subgrade	SW	3.20	2.658	4.2	2.253	6.2	60	73	702
AS2L Lay.2			GM	3.50	2.668	8.3	2.23	7	62	79	97
AS2L Lay.3			GM	4.20	2.605	9.1	2.2	8.2	72	84	21

MDD - Maximum Dry Density

OMC - Optimum Moisture Content

CBR - California Bearing Ratio

From the above result, all CBR values were high, except for one point on the Motorway. In pavement design of AASHTO, an equation to obtain Resilient Modulus (MR) on the subbase is taken as 20% even if the actual value is bigger than that.

6) Result

Pavement structures (calculation results) of main carriageways, ramps and service roads are shown in **Table 2.2.2-27**.

Table 2.2.2-27 Pavement Structure

Pavement Composition (Material)	Station	Surface Course	Binder Course	Base Course		Subbase Course		Total Thickness (mm)	Remarks
		Asphalt		Bitumin treated	Crushed Stone	Sandy Gravel	Sand		
Motorway (Standard Section)	00+00 ~ 06+40	50	100	-	250	300	-	700	Subgrade replacement t=350mm
High Gr. Water Section	06+40 ~ 12+00	50	100	270	-	-	-	420	
Inside Box	08+20 ~ 10+10	50	100	170	-	-	-	220-700	Leveling layer 50-400mm, Drainage Layer t=100mm
Aflao (Standard Section)	12+00 ~ 17+05	50	80	-	200	200	-		
Akosombo Road	8+65 (7+06.090) ~ 14+95	50	80	-	150	200	-	480	Inside parenthesis is for Phase-1 (from box edge)
Harbour Road	00+00 ~ 4+65 (6+70.197)	50	100	-	200	200	-	550	Inside parenthesis is for Phase-1 (to box edge)
Flyover	4+65 ~ 8+65	80	-	-	-	-	-	80	Including 40mm leveling layer
Motorway-Akosombo		50	60	-	200	250	-	560	
Intersection		50	50	-	200	250	-	550	ボックス上の舗装。橋梁同様8cm(表層+レベリング)
Service Road		70		-	100	100	-	270	

(4) Application of Modified Asphalt Concrete

1) Outline

Modified asphalt concrete is asphalt having high fluidity and abrasion produced by mixing straight asphalt with a polymer or rubber. In Japan, its commercial use begun in 1963.

In Ghana, PG 76 and PG 82 have been used recently. PG stands for Performance Grade, which is a standard defined by Superpave (Superior Performance Pavement) and proposed in SHRP (Strategic Highway Research Program). PG 76 means that maximum surface temperature to assure flexibility and stress-relaxation is 76 degrees Centigrade regardless of area or season.

2) Application in the Project

Modified asphalt concrete is planned to be provided on the wearing course at main carriageway and ramps including the intersection. However, this will not be provided on service roads.


3) Justification for Application of Modified Asphalt Concrete

A) Application at Intersection

Since the objective intersection is located on the international corridor, the intersection is expected to see significant rise in the number of heavy vehicles in the future. With the on-going expansion project at Tema Port, it is expected that freight vehicle to and from the port will also increase. The pavements on existing roads are seen to be in a deteriorated state even under the present traffic volume. Typical deteriorations found on the roads in an around Tema Roundabout are shown in **Table 2.2.2-28**. Major causes of these defects are rapid

acceleration/deceleration and curved path of heavy traffic at low speed.

Table 2.2.2-28 Typical Defects

		
Alligator Crack	Deformation	Pothole

Also, all the left-turning ramps and through lanes on north-south direction meet at the intersection which is located on top of the box culvert at the depressed section (east-west direction). As such, the pavement here is anticipated to experience distress, which could have adverse effect on the box culvert (top slab).

B) Application on Main Carriageway and Ramps

Due to improvement of the intersection, driving speed on Motorway – Aflao Road will drastically rise (it is high even at present). However, driving speed could occasionally reduce depending on the traffic conditions. Slow movement of vehicles inflicts bigger damages to the pavement surface possibly leading into rutting. Rutting can pose immense danger to vehicles driving at high speeds, especially, since the horizontal alignment of the depressed and underpass has a combination of opposite curves (S-shaped curve). Bad visibility in association with deformations caused by partial load applied due to superelevation could be adverse factors that affect traffic safety. Also, stagnation of rainfall water at rutted portions might also cause severe traffic accidents.

On the other hand, ramps are sections where rapid acceleration/deceleration is repeated and its horizontal curve radius is relatively small. In the curve section, deformation and rutting caused by partial load applied on the surface is likely to occur. Also, traffic congestions on ramps can easily occur because of its smaller width and could potentially become bottle necks. On the main carriageway also, there is the possibility of traffic accidents to occur due to rutting.

4) Availability and Applicability of Modified Asphalt Concrete

A) Production

For the application of modified asphalt concrete in this project, an admixture, which will be procured in Japan and transported to the site, is planned to be used for modifying the asphalt. The hearings conducted with the manufacturers regarding applicability have revealed the followings;

- Local asphalt plants have experience of producing modified asphalt concrete.
- Local plants apply batch type plant (use of admixture for plant mix type is possible).

- The nearest plant is in a distance of around 8kilometers from the project site.

B) Performance

Modified asphalt concrete types commonly used in Japan are classified into Performance Grade 64 (PG64) and PG 70. The figures indicate the maximum surface temperature where performance ability of the material is endorsed. The surface temperatures on the existing roads the Survey Team had measured are shown in **Table 2.2.2-29**. The temperatures measured are all below 64 degrees Centigrade and is favorable for application of modified asphalt concrete.

Table 2.2.2-29 Surface Temperature Survey Result

Time	Motorway		Aflao Road		Harbour Road		Akosombo Road	
	Concrete (Roundabout)	Concrete (Standard)	Concrete (Roundabout)	Asphalt	Concrete (Roundabout)	Asphalt	Concrete (Roundabout)	Asphalt
10:00-10:30	46.8°C	47.4°C	49.3°C	49.3°C	48.8°C	49.9°C	48.4°C	48.2°C
12:00-12:30	55.2°C	55.2°C	53.1°C	53.9°C	54.1°C	56.1°C	52.6°C	56.0°C
14:00-14:30	52.4°C	53.0°C	53.4°C	53.2°C	52.0°C	56.0°C	51.0°C	53.1°C
16:00-16:30	47.3°C	46.3°C	47.2°C	48.4°C	48.6°C	48.5°C	45.3°C	46.4°C

C) Quality Control Test

According to the information gathered from hearings conducted, there are no organizations or companies which are capable of doing a quality control test. Thus, the tests such as wheel tracking test for modified asphalt concrete is conducted in Denmark or South Africa by exporting asphaltic material. Since it is possible to transport the material overseas, the test can be done in Japan also.

5) Countermeasures to Groundwater

6) Outline

Groundwater can have adverse effects on the pavement in the depressed and underpass section. Although the pavement has a less chance of being affected by the groundwater from behind the retaining walls, risk of damages from the water infiltrating into the pavement due to piping phenomenon caused by the head water difference is relatively high. This issue should be properly addressed in order to mitigate or prevent the deterioration of the pavement.

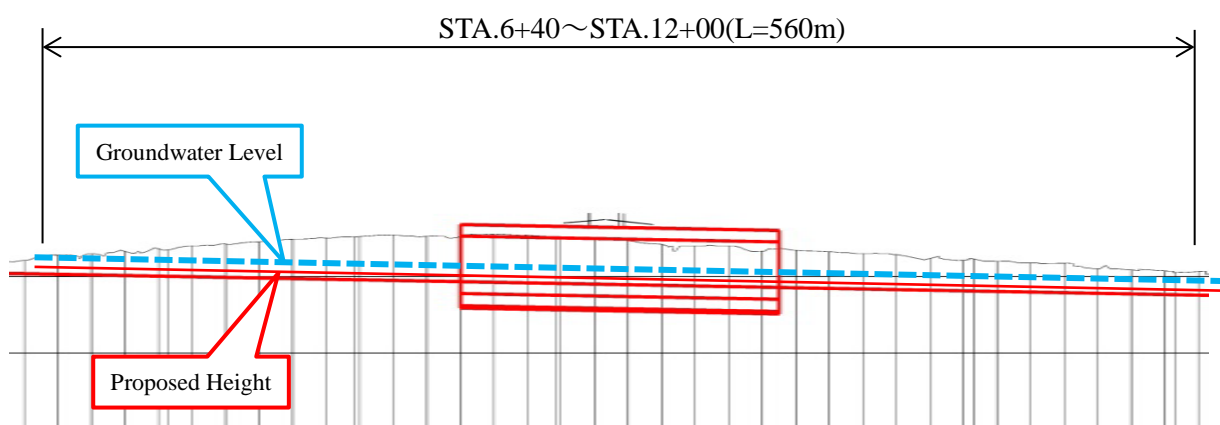


Figure 2.2.2-30 Area to be Considered Countermeasures

7) Countermeasure Plan

A) Provision of Underground Drainage Pipe

In order to adequately drain the water seeping under the pavement due to pressurization caused by water head difference, underground drainage facility with perforated drain pipes having a diameter of 200mm and surrounded by crushed stones and non-woven fabrics as shown in **Figure 2.2.2-31** shall be provided. The locations to be provided are shown in **Figure 2.2.2-32** and **Figure 2.2.2-33**.

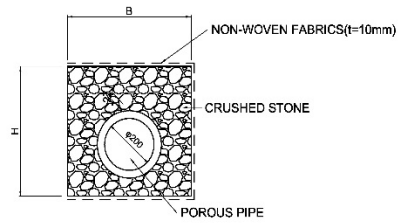


Figure 2.2.2-31 Underground Drainage Pipe

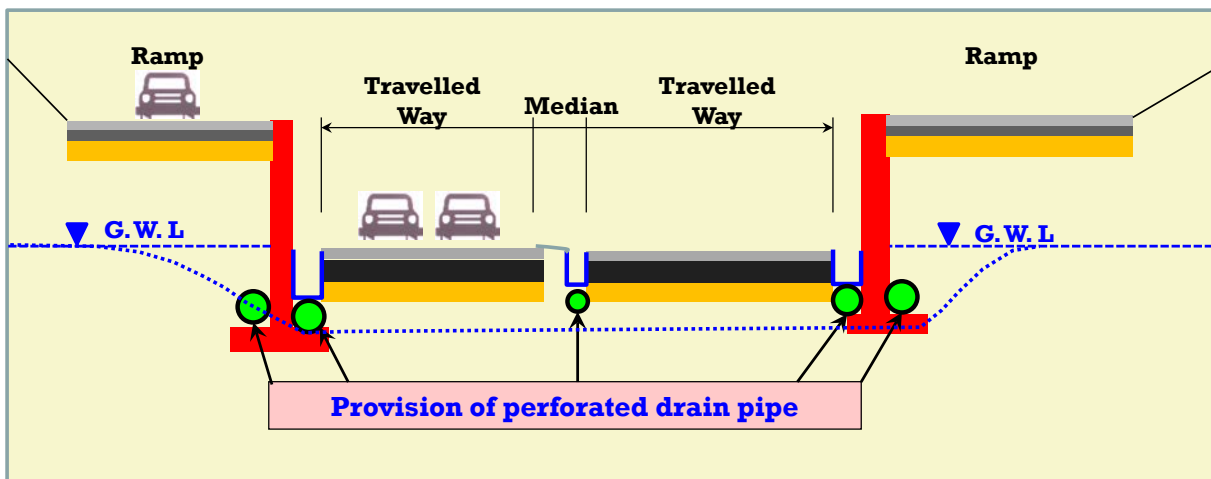


Figure 2.2.2-32 Underground Drainage Pipe Layout in Depressed Section

B) Application of Asphalt Stabilized Material

To prevent damage to the base course of the pavement from piping, asphalt stabilized material having high resistivity and perforated pipes will be applied. The locations where the perforated drain pipes are planned to be provided is shown in **Figure 2.2.2-33** or **Figure 2.2.2-35**.

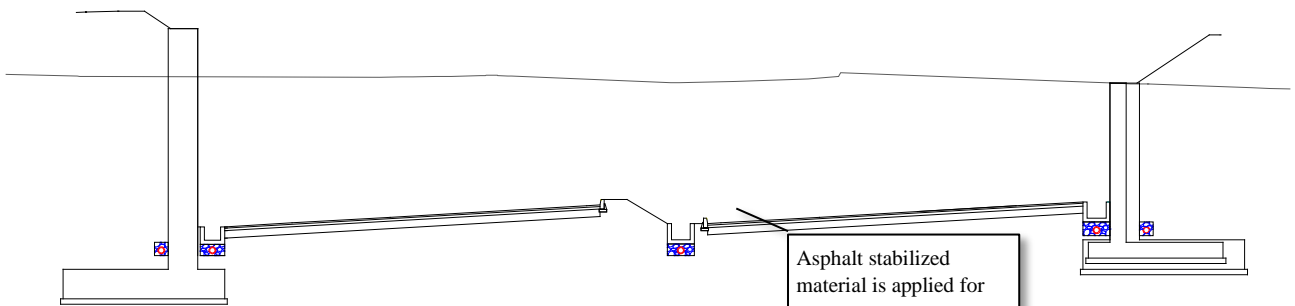


Figure 2.2.2-33 Typical Cross Section in Depressed Section

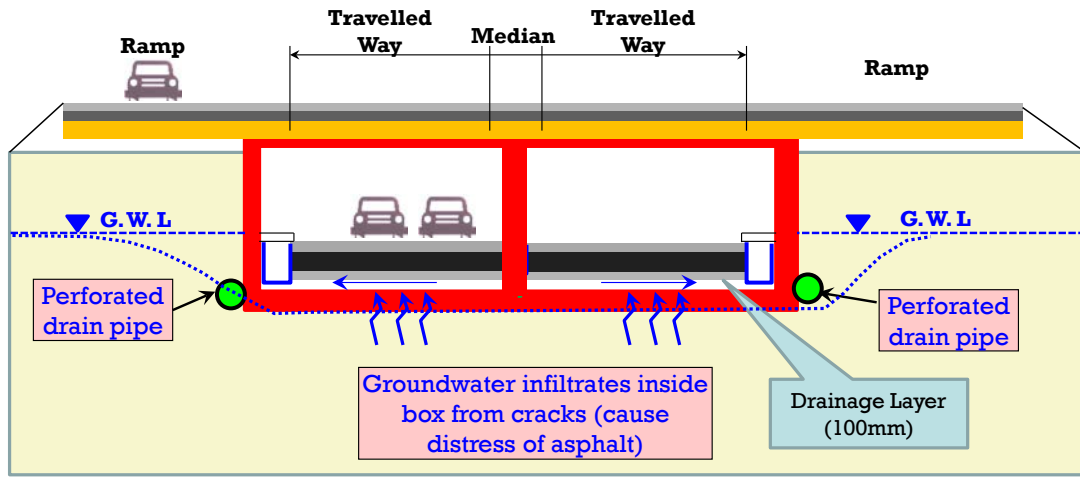


Figure 2.2.2-34 Underground Drainage Pipe Layout in BOX Culvert Section

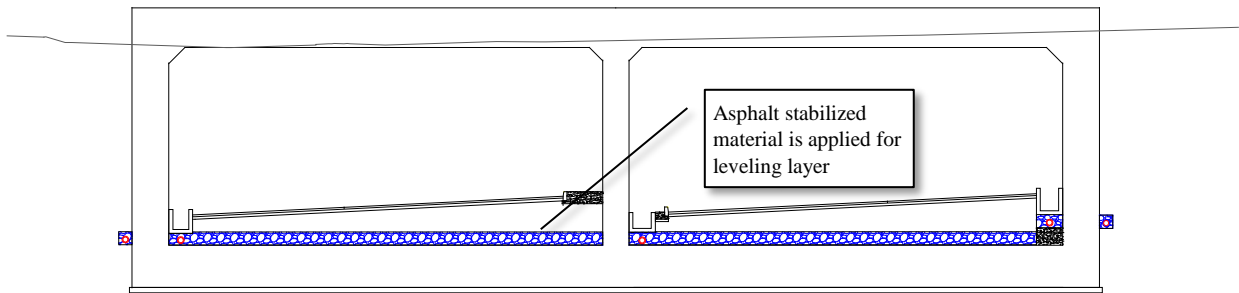


Figure 2.2.2-35 Typical Cross Section in Depressed Section