

NYAWOLUHLE SUSPENDED BRIDGE

GPS COORDINATES 26°43'55.3"S, 31°5'9.5"E
 COUNTRY ESWATINI
 REGION MANZINI
 INKHUNDLA NGWEMPHISI
 COMMUNITY NGCOSENI AND VELEZIZWENI
 SPAN 122.1 METERS

DESIGN DATA:

ENGINEERS IN ACTION, 2022 BRIDGE BINDER VOLUME 2.

DESIGN LOADS:

DEAD LOAD = 0.79 kN/m²
 LIVE LOAD_{PRIMARY} = 3.14 kN/m²
 LIVE LOAD_{SECONDARY} = 4.07 kN/m²
 WIND LOAD = 0.49 kN/m

MATERIAL PROPERTIES:

CONCRETE f_c = 10 MPa (1450 psi)
 REINFORCING F_y = 275 MPa (40 ksi)
 TIMBER F_b = 3.96 MPa (574 psi)
 TIMBER F_v = 1.44 MPa (210 psi)
 SOIL q_a = 144 kPa (3000 psf)
 FRICTION ANGLE ϕ = 30 degrees
 CABLE P_n = 768.6 kN (173 kips)
 CROSSBEAM STEEL F_y = 240 MPa (35 ksi)

UNIT WEIGHTS:

STEEL = 7850 kg/m³ (490 lb/ft³)
 CONCRETE = 2400 kg/m³ (150 lb/ft³)
 TIMBER = 900 kg/m³ (56 lb/ft³)
 BROKEN ROCK = 2000 kg/m³ (125 lb/ft³)
 MASONRY = 2100 kg/m³ (131 lb/ft³)
 SOIL = 1800 kg/m³ (112 lb/ft³)

FACTOR OF SAFETY FOR SLIDING AND UPLIFT = 1.5
 FACTOR OF SAFETY FOR CABLE CAPACITY = 3.0

DECK SHALL CLEAR FREEBOARD ENVELOPE WITH A MINIMUM FREEBOARD OF 2.00METERS.

PROVIDE 7 DROP FORGED CABLE CLAMPS SPACED AT 16 cm OC. MAX TORQUE TO 360 ft-lb. PER HANDRAIL CABLE AT EACH ANCHOR.
 PROVIDE 7 DROP FORGED CABLE CLAMPS SPACED AT 16 cm OC. MAX TORQUE TO 360 ft-lb. FOR THE WALKWAY CABLE AT EACH ANCHOR.

INDEX:

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- 5 MODIFIED A3 ANCHOR DETAILS
- 6 T1 TOWER DETAILS
- 7 W3E WALKWAY DETAILS W/ NAILER
- 8 C5E CROSSBEAM DETAILS
- 9 F2E FENCE DETAILS

GENERAL NOTES:

BRIDGE CONSTRUCTION SHALL BE EXECUTED BY THE MEANS AND METHODS STATED IN THE ENGINEERS IN ACTION, 2022 BRIDGE BINDER VOLUME 3.

CONCRETE:

PORTLAND CEMENT (ASTM C150, TYPE I OR TYPE II) SHALL BE USED. CEMENT MUST BE USED WITHIN 60 DAYS OF PURCHASE.
 WATER SHALL BE CLEAN, CLEAR, AND FREE OF HARMFUL MATERIAL.
 COARSE AGGREGATE SHALL BE COMPRISED OF GRAVEL (CRUSHED LIMESTONE, GRANITE, OR GRAVEL), NO GREATER THAN 2.5 cm IN DIAMETER. MATERIAL SHALL BE CLEAN AND FREE OF DEBRIS.
 FINE AGGREGATE SHALL BE CLEAN, DRY SAND GRADED WITH A 4mm SIEVE BEFORE MIXING WITH CEMENT.

REINFORCEMENT:

ALL REINFORCEMENT SHALL BE MINIMUM GRADE 280 (GRADE 40) WITH A YIELD STRENGTH OF 275 MPa (40 ksi).
 RIBBED STEEL SHALL BE USED FOR ALL REINFORCING BARS INCLUDING SUSPENDERS.
 ALL REINFORCEMENT SHALL BE SUPPORTED BY CONCRETE BLOCKS OR STEEL CHAIRS TO AVOID CONTACT WITH GROUND OR FORMS.

MASONRY:

BLOCKS SHALL BE FREE OF CRACKS AND CHIPS. THERE SHALL BE NO DEFORMATIONS. USED BLOCK IS NOT PERMITTED.
 MASONRY UNITS SHALL BE WET BEFORE APPLYING MORTAR.
 MAINTAIN A CONSISTENT JOINT THICKNESS OF 15mm +/- 5mm. JOINTS BETWEEN BLOCKS SHALL BE COMPLETELY FILLED.
 STAGGER BLOCKS IN RUNNING BOND PATTERN.

CABLE:

CABLE IN PERMANENT CONTACT WITH THE GROUND SHALL BE COVERED WITH PLASTIC PIPE AND FILLED WITH GROUT OR COATED WITH TAR.
 CLAMPS SHALL BE DROP FORGED AND NOT MALLEABLE.

TIMBER:

TIMBER SHALL BE FREE OF KNOTS, HOLES, AND SPLITS.
 WOOD SCREWS AND NAILS SHALL BE GALVANIZED.

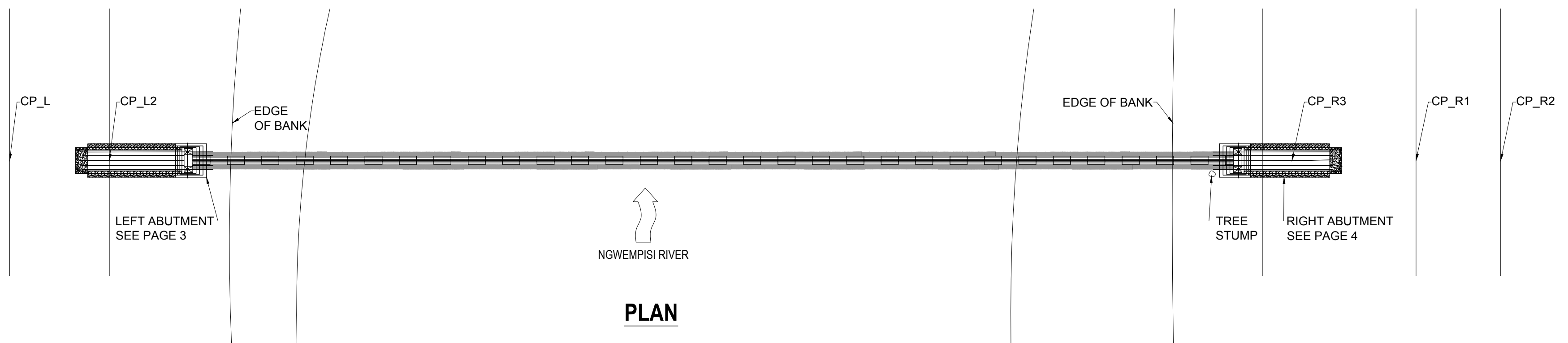
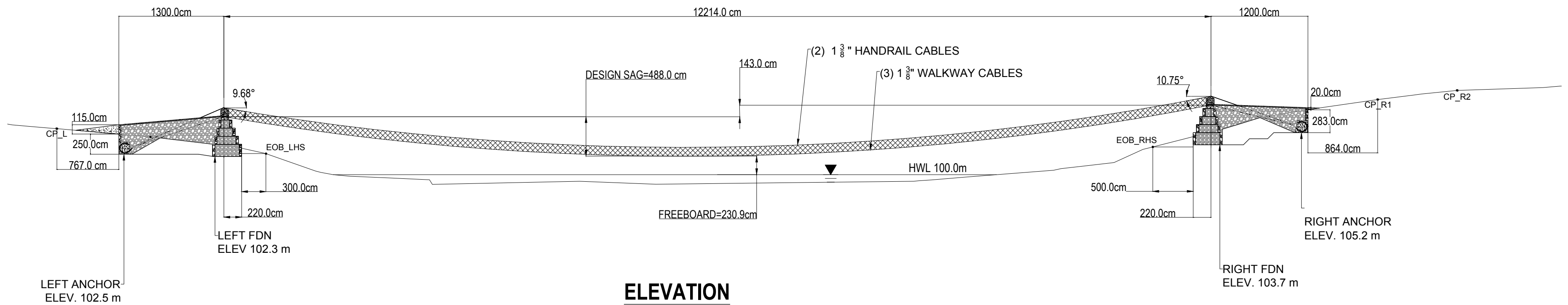


REV.	DESCRIPTION	DATE	ISSUED BY	DISCLAIMER:
A	ISSUED FOR RC 1	20/01/2023	ERH	THESE DRAWINGS ARE PRODUCED FOR THE STATED BRIDGE PROJECT. ANY CONDITIONS THAT REQUIRE CHANGES FROM THE PLANS MUST BE COMMUNICATED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. ANYONE USING THIS PLAN SHOULD VERIFY THE CALCULATIONS ACCORDING TO SITE SPECIFIC CONDITIONS AND LOCAL STANDARDS. USE OF THESE PLANS FOR ANY OTHER PURPOSE SHALL NOT BE ATTRIBUTABLE TO ENGINEERS IN ACTION AND USERS AGREE TO HOLD ENGINEERS IN ACTION HARMLESS TO ANY AND ALL LIABILITY.
B	ISSUED FOR RC2	12/03/2023	ERH	
C	RC2 EDITS	29/03/2023	ERH	

COUNTRY: ESWATINI
 REGION: MANZINI
 INKHUNDLA: NGWEMPHISI

PROJECT: NYAWOLUHLE
 PROGRAM MANAGER: BRITTANY MARGRITZ

ENGINEERING RECORD		NYAWOLUHLE SUSPENDED BRIDGE	
DATE: 29/03/2023			
DRAWN BY: ERH		PROJECT NUMBER	DRAWING NUMBER
CHECKED BY: BCB		BP026	1
APPROVED BY: BCB			
REVIEWED BY: XXX			



NOTES:

1. CONSTRUCTION SAG: 3.66m (3%)
 $f_{LEFT} = 2.98\text{ m}$ $f_{RIGHT} = 4.41\text{ m}$
2. HOISTING SAG: 4.69m (3.84%)
 $f_{LEFT} = 4.00\text{ m}$ $f_{RIGHT} = 5.43\text{ m}$
3. DESIGN SAG: 5.56m (4.55%)
 $f_{LEFT} = 4.88\text{ m}$ $f_{RIGHT} = 6.30\text{ m}$
4. LIVE SAG: 7.11m (5.83%)
5. SURVEY INFORMATION PROVIDED BY SAM QUICK ON 09/09/2022.
6. LANDMARKS INCLUDED IN PLAN VIEW ARE FOR INFORMATION ONLY, ARE NOT DRAWN TO SCALE, AND IN APPROXIMATE LOCATIONS.



REV.	DESCRIPTION	DATE	ISSUED BY
A	ISSUED FOR RC 1	20/01/2023	ERH
B	ISSUED FOR RC 2	12/03/2023	ERH
C	RC2 EDITS	26/03/2023	ERH

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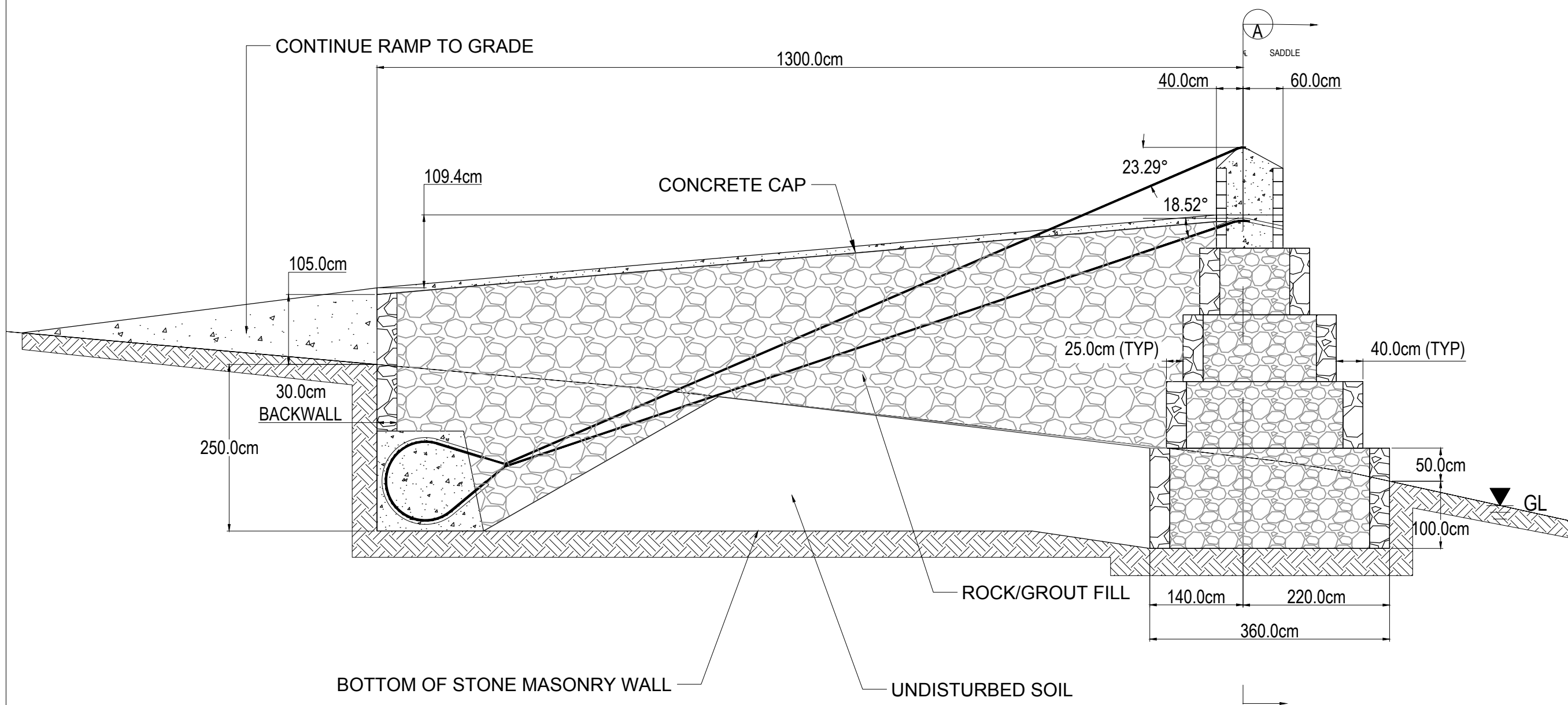
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COUNTRY: ESWATINI
 REGION: MANZINI
 INKHUNDLA: NGWEMPHISI

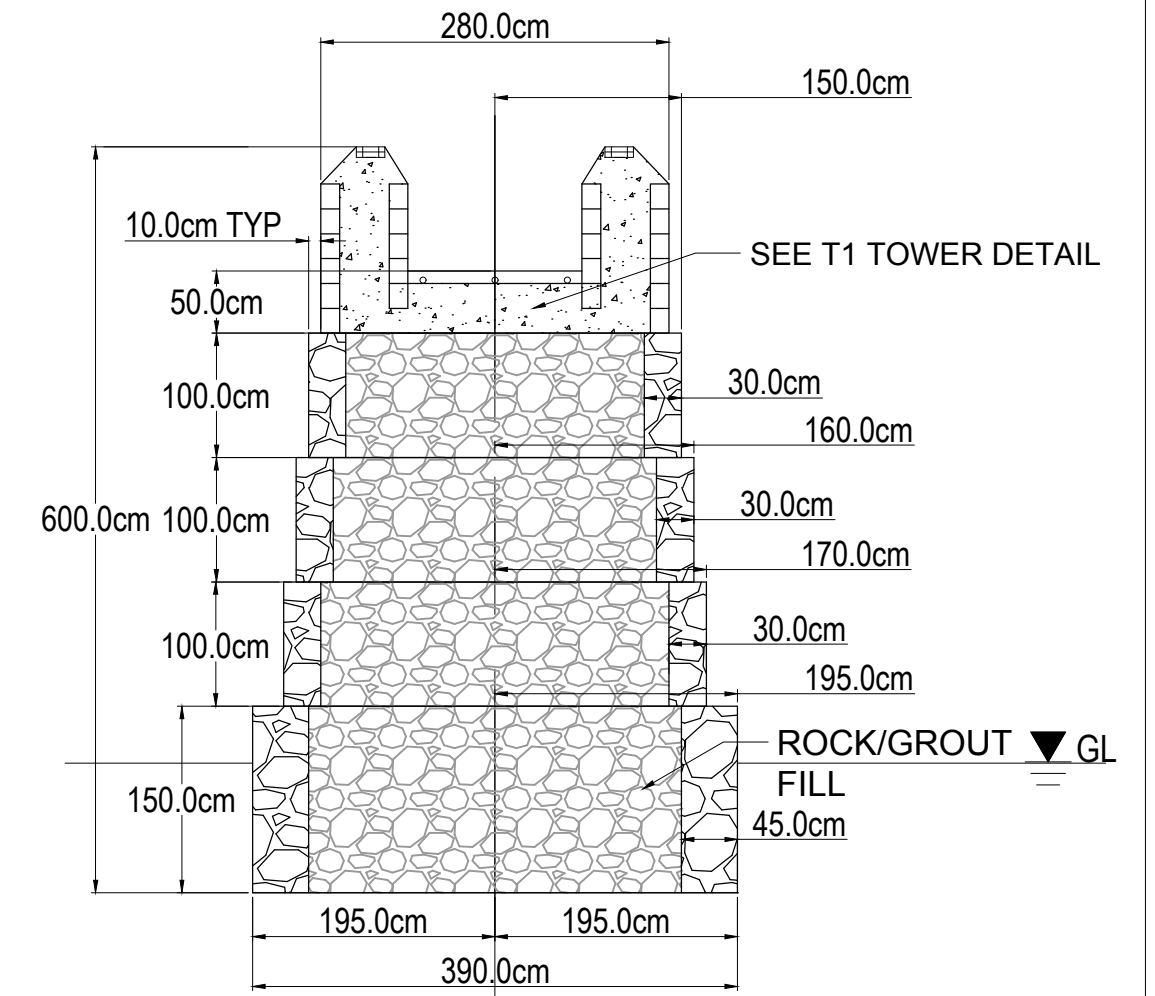
PROJECT: NYAWOLUHLE
 PROGRAM MANAGER: BRITTANY MARGRITZ

ENGINEERING RECORD
 DATE: 29/03/2023
 DRAWN BY: ERH
 CHECKED BY: BCB
 APPROVED BY: BCB
 REVIEWED BY: XXX

NYAWOLUHLE SUSPENDED BRIDGE LAYOUT	
PROJECT NUMBER	DRAWING NUMBER
BP026	2

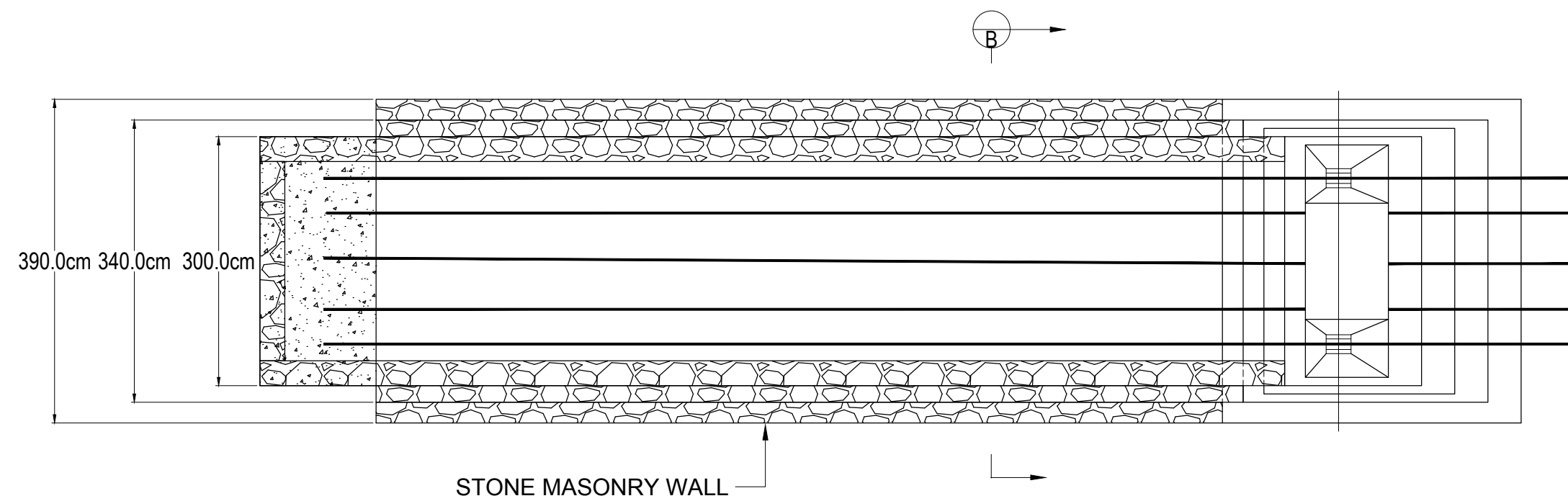


ELEVATION

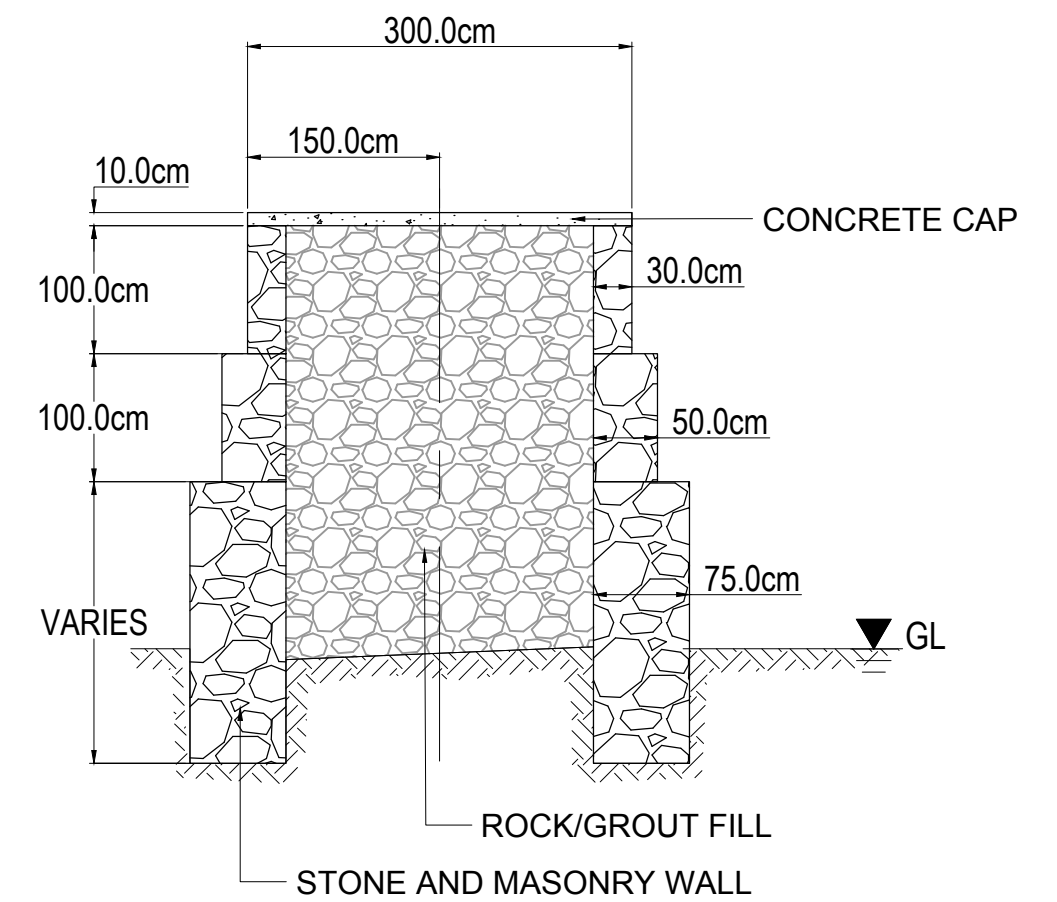


SECTION A

CONSTRUCTION NOTE: ANY REMOVED SOIL SHOULD BE FILLED WITH CONCRETE FILL--DO NOT USE SOIL AS BACKFILL



PLAN



SECTION B



EIA



REV.	DESCRIPTION	DATE	ISSUED BY
A	ISSUED FOR RC1	20/01/2023	FYL
B	ISSUED FOR RC2	12/03/2023	FYL
C	RC2 EDITS	29/03/2023	ERH

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COUNTRY:
ESWATINI

REGION:
MANZINI

INKHUNDLA:
NGWEMPHISI

PROJECT:
NYAWOLUHLE

PROGRAM MANAGER:
BRITTANY MARGRITZ

ENGINEERING RECORD

DATE: 29/03/2023

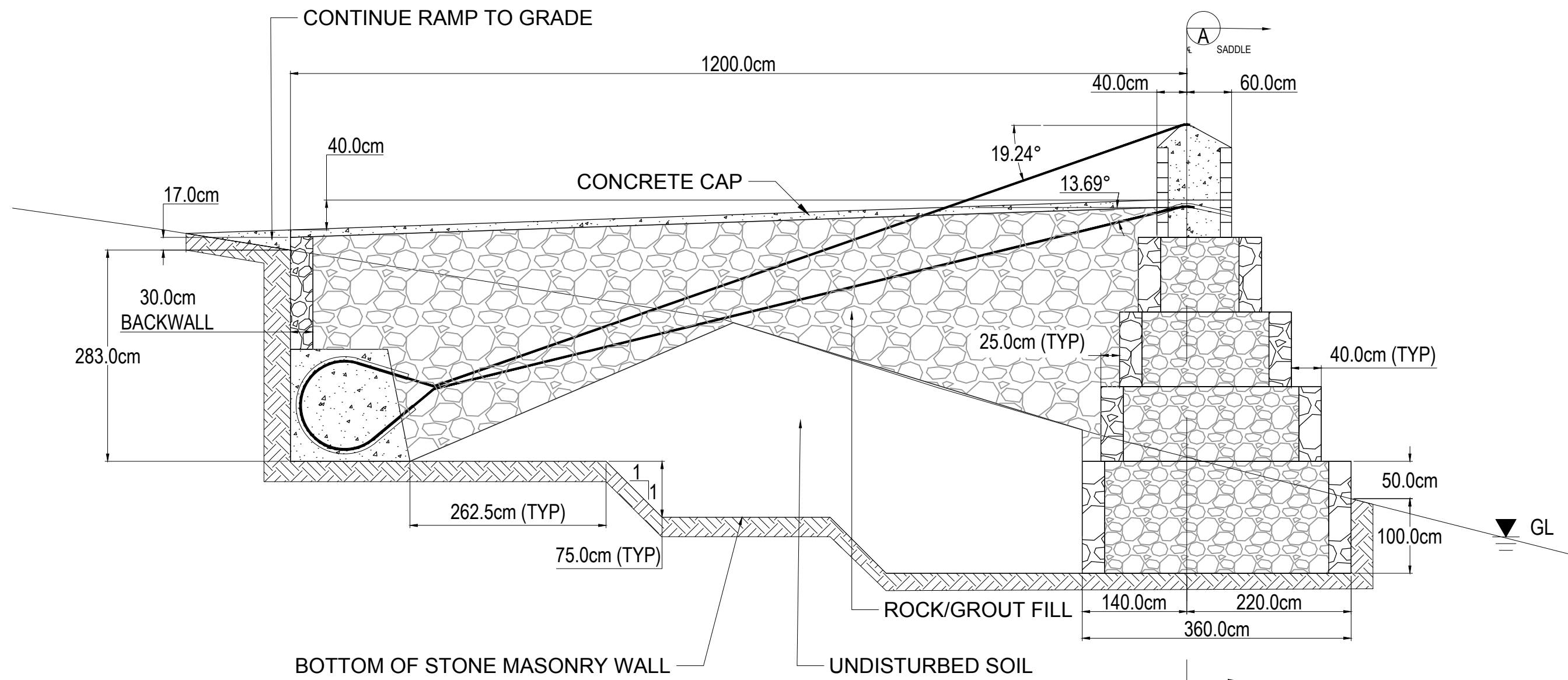
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CHECKED BY: BCB

APPROVED BY: BCB

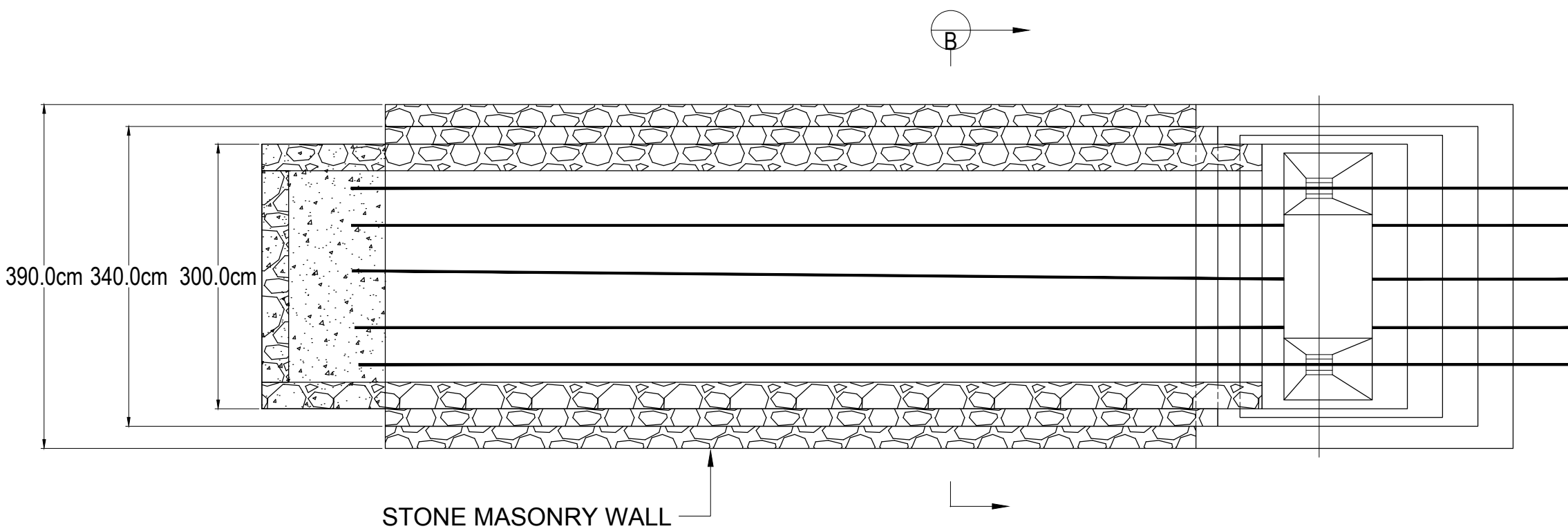
REVIEWED BY: XXX

NYAWOLUHLE SUSPENDED BRIDGE LEFT ABUTMENT	
PROJECT NUMBER	DRAWING NUMBER
BP026	3

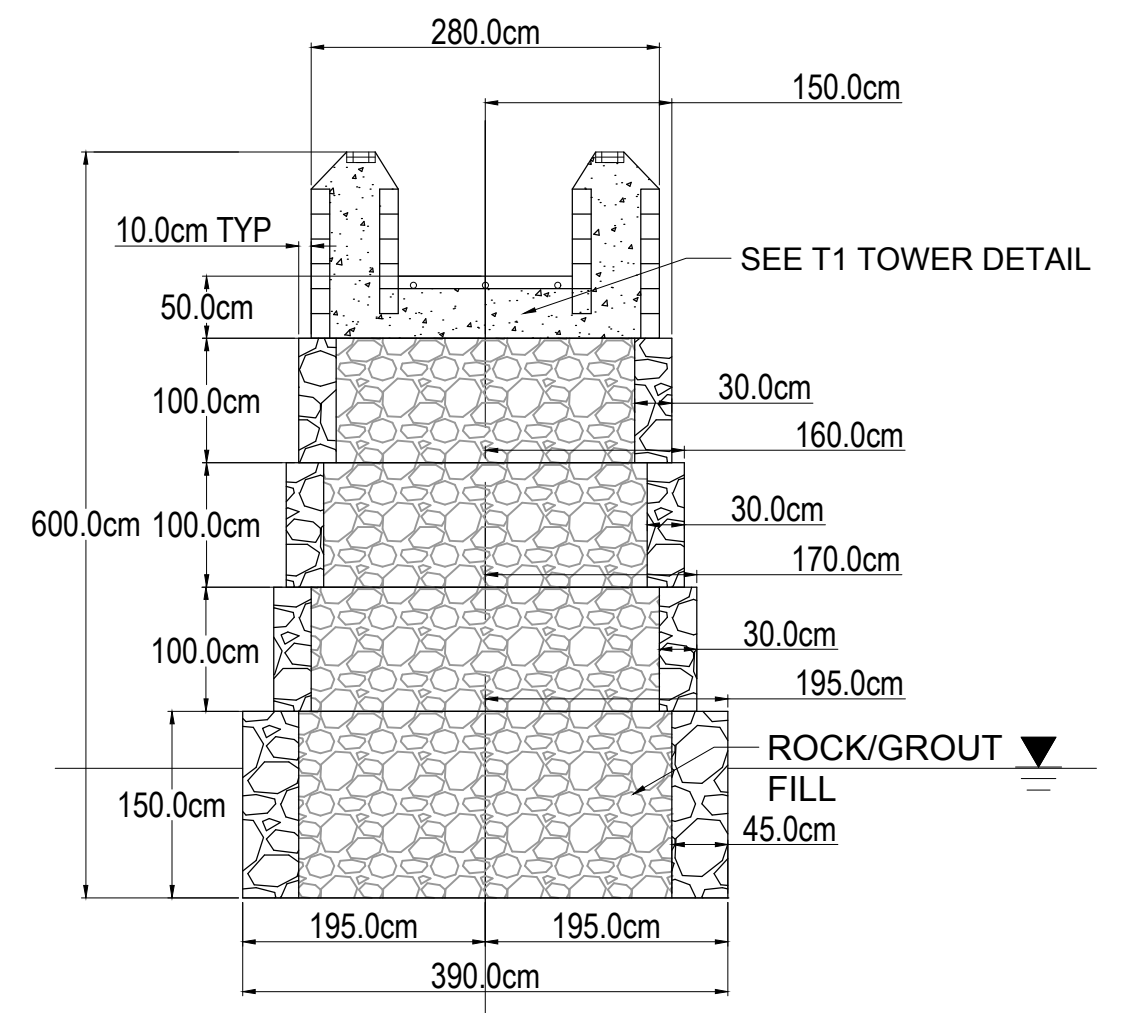


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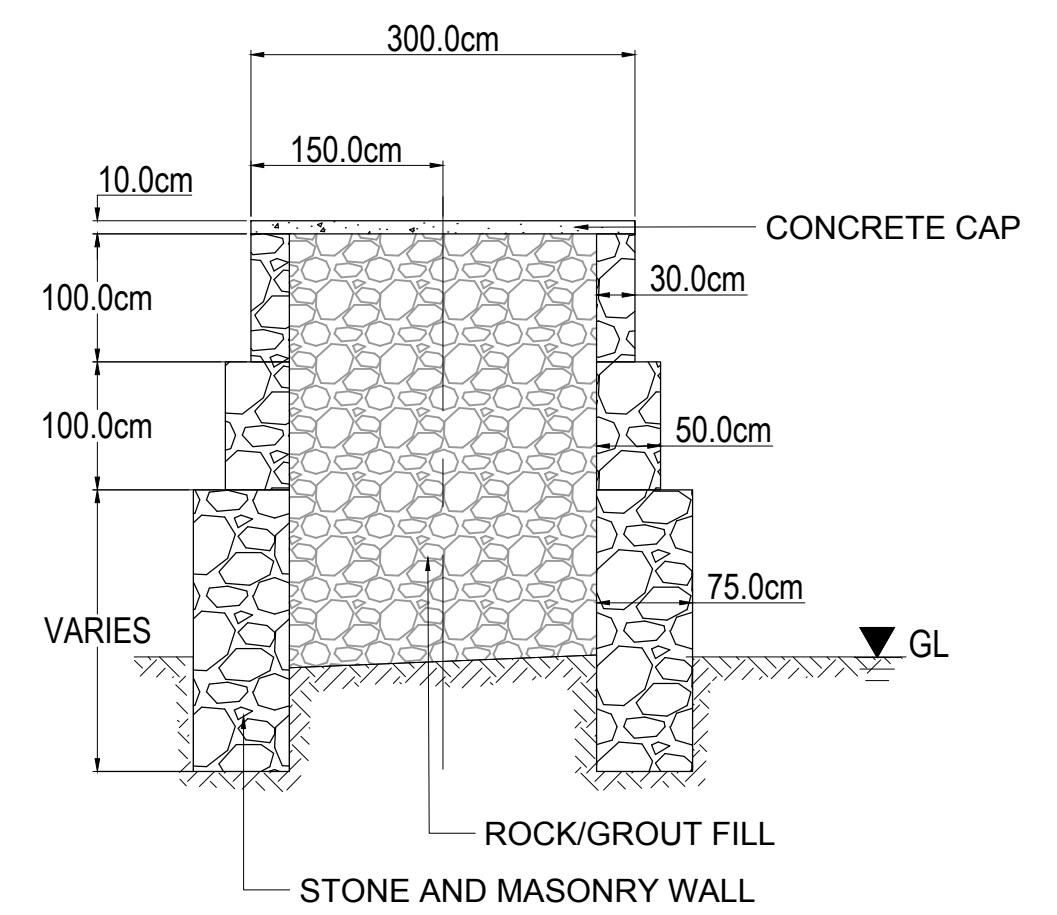
CONSTRUCTION NOTE: ANY REMOVED SOIL SHOULD BE FILLED WITH CONCRETE FILL—DO NOT USE SOIL AS BACKFILL



PLAN



SECTION A



SECTION B



REV.	DESCRIPTION	DATE	ISSUED BY
A	ISSUED FOR RC1	20/01/2023	ERH
B	ISSUED FOR RC2	12/03/2023	ERH
C	RC2 EDITS	29/03/2023	ERH

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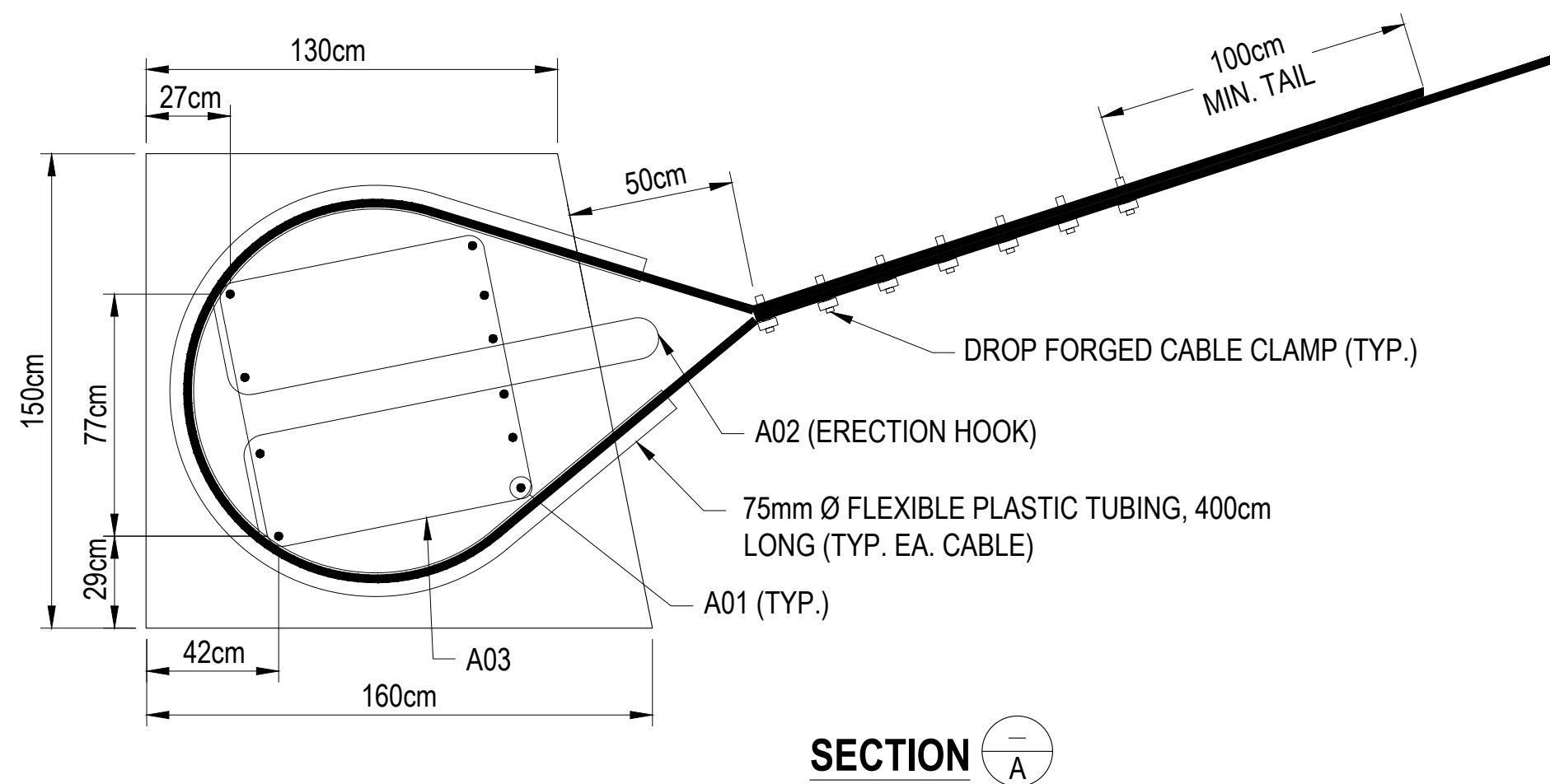
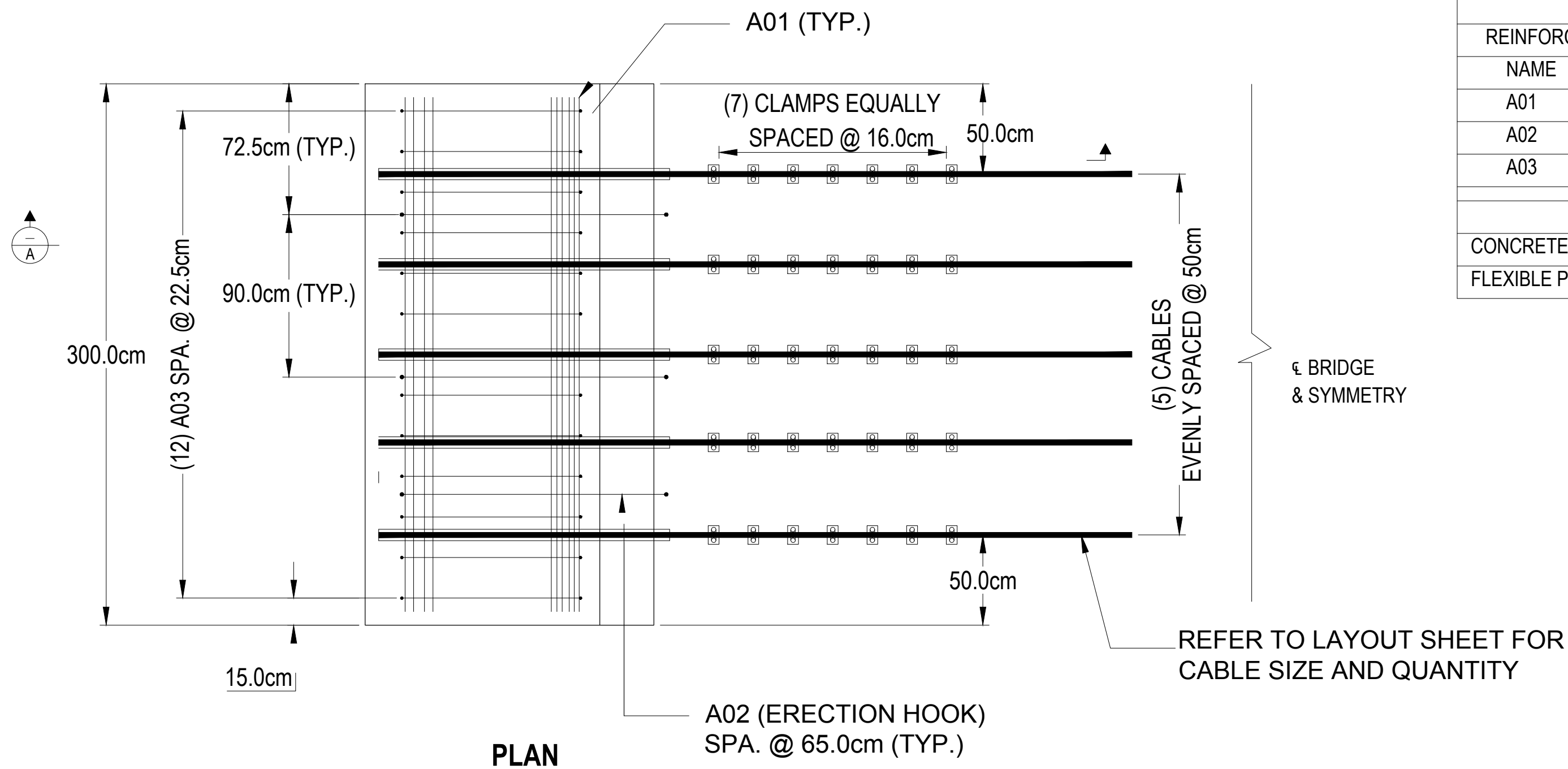
COUNTRY: ESWATINI
REGION: MANZINI
INKHUNDLA: NGWEMPHISI

PROJECT: NYAWOLUHLE
PROGRAM MANAGER: BRITTANY MARGRITZ

ENGINEERING RECORD
DATE: 29/03/2023
DRAWN BY: ERH
CHECKED BY: BCB
APPROVED BY: BCB
REVIEWED BY: XXX

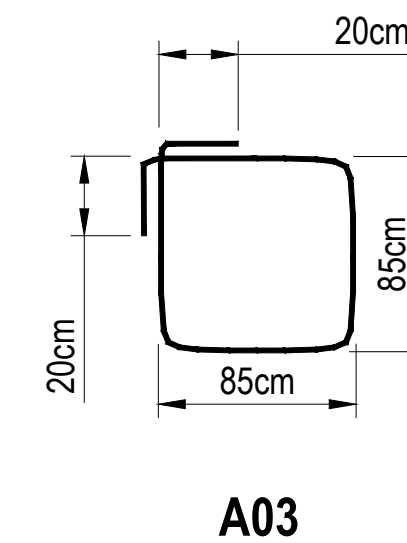
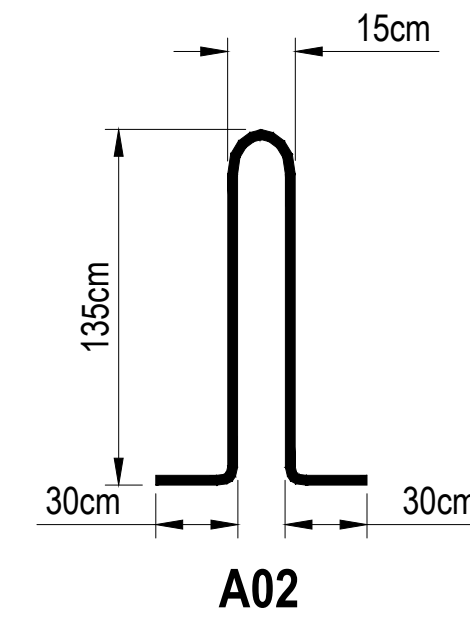
NYAWOLUHLE SUSPENDED BRIDGE RIGHT ABUTMENT	
PROJECT NUMBER	DRAWING NUMBER
BP026	4

NON-STANDARD ANCHOR



BILL OF MATERIALS

REINFORCING BARS (PER ANCHOR)				
NAME	BAR SIZE (mm)	LENGTH (cm)	QUANTITY	LENGTH (m)
A01	19 (#6)	285	10	28.5
A02	16 (#5)	326	3	9.8
A03	13 (#4)	365	12	43.8
ITEM			QUANTITY	
CONCRETE			6.53m ³	
FLEXIBLE PLASTIC TUBING x 400cm			VARIES	



NOTES:

- SEE ENGINEERS IN ACTION BRIDGE BINDER FOR CONSTRUCTION GUIDELINES.
- 7.5cm CLEAR COVER SHALL BE PROVIDED FOR ALL REINFORCING AND PLASTIC TUBING.
- ERECTION HOOK AND TUBING OPTIONAL FOR ANCHOR DETERMINED TO BE NON-ADJUSTABLE OR FIXED.
- REINFORCING BAR DIMENSIONS ARE TAKEN TO OUTSIDE OF BAR.

REV.	DESCRIPTION	DATE	ISSUED BY	DISCLAIMER:
A	RC2 EDITS	29/03/2023	ERH	THESE DRAWINGS ARE PRODUCED FOR THE STATED BRIDGE PROJECT. ANY CONDITIONS THAT REQUIRE CHANGES FROM THE PLANS MUST BE COMMUNICATED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. ANYONE USING THIS PLAN SHOULD VERIFY THE CALCULATIONS ACCORDING TO SITE SPECIFIC CONDITIONS AND LOCAL STANDARDS.
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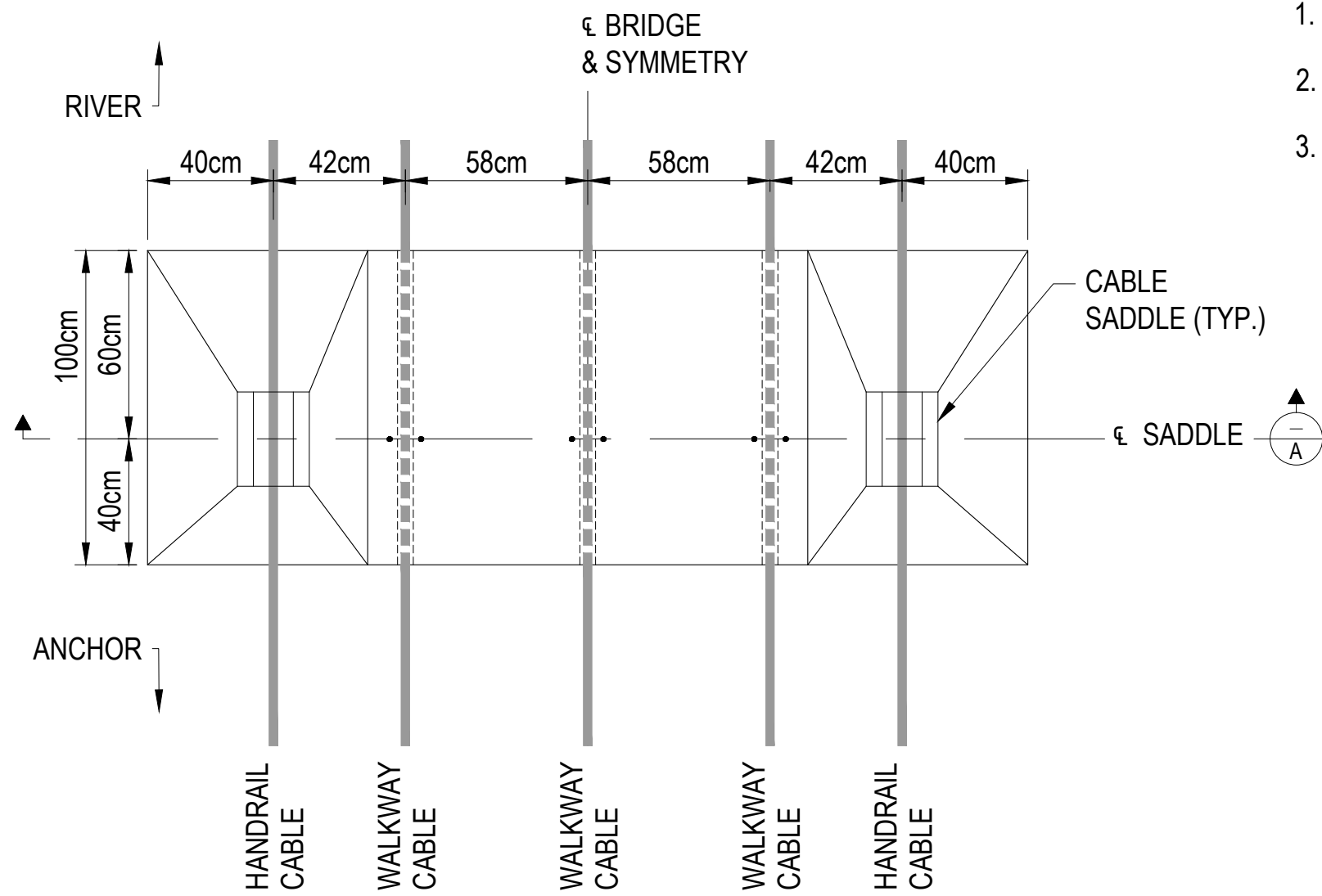
ENGINEERING RECORD		ANCHOR DETAILS NON-STANDARD 3 WALKWAY CABLES	
DATE: 29/03/2023		PROJECT NUMBER	DRAWING NUMBER
DRAWN BY: ERH		BP026	A3
CHECKED BY: BCB			
APPROVED BY: BCB			
REVIEWED BY:			

BILL OF MATERIALS

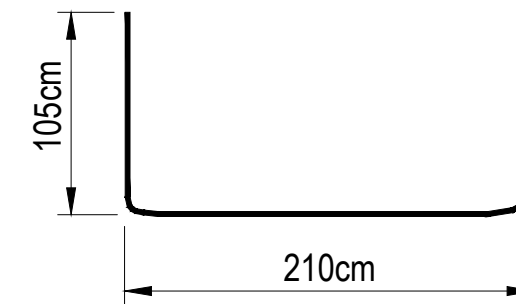
REINFORCING BARS (PER TOWER)				
NAME	BAR SIZE (mm)	LENGTH (cm)	QUANTITY	LENGTH (m)
T01	16 (#5)	413	4	16.5
T02	10 (#3)	170	8	13.6
T03	10 (#3)	15	6	0.9
ITEM			QUANTITY	
CONCRETE			1.08m ³	
FLEXIBLE PLASTIC TUBING x 110cm			3	

NOTES:

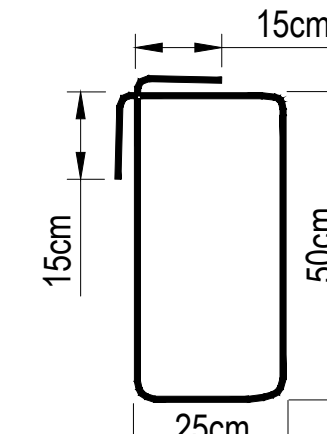
- SEE ENGINEERS IN ACTION BRIDGE BINDER FOR CONSTRUCTION GUIDELINES.
- 7.5cm CLEAR COVER SHALL BE PROVIDED FOR ALL REINFORCING AND PLASTIC TUBING.
- CONSTRUCTION STAGES:
 STAGE 1 - BASE LEVEL MASONRY PERIMETER FILLED WITH CONCRETE.
 STAGE 2 - CONSTRUCT TOWERS IN LIFTS OF 20-40cm.
 STAGE 3 - CAST WALKWAY HUMP AND STAB T03 CABLE GUIDE BARS.
 STAGE 4 - CAST WALKWAY TOPPING SLAB OVER SLEEVED CABLES.



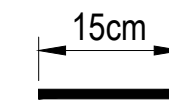
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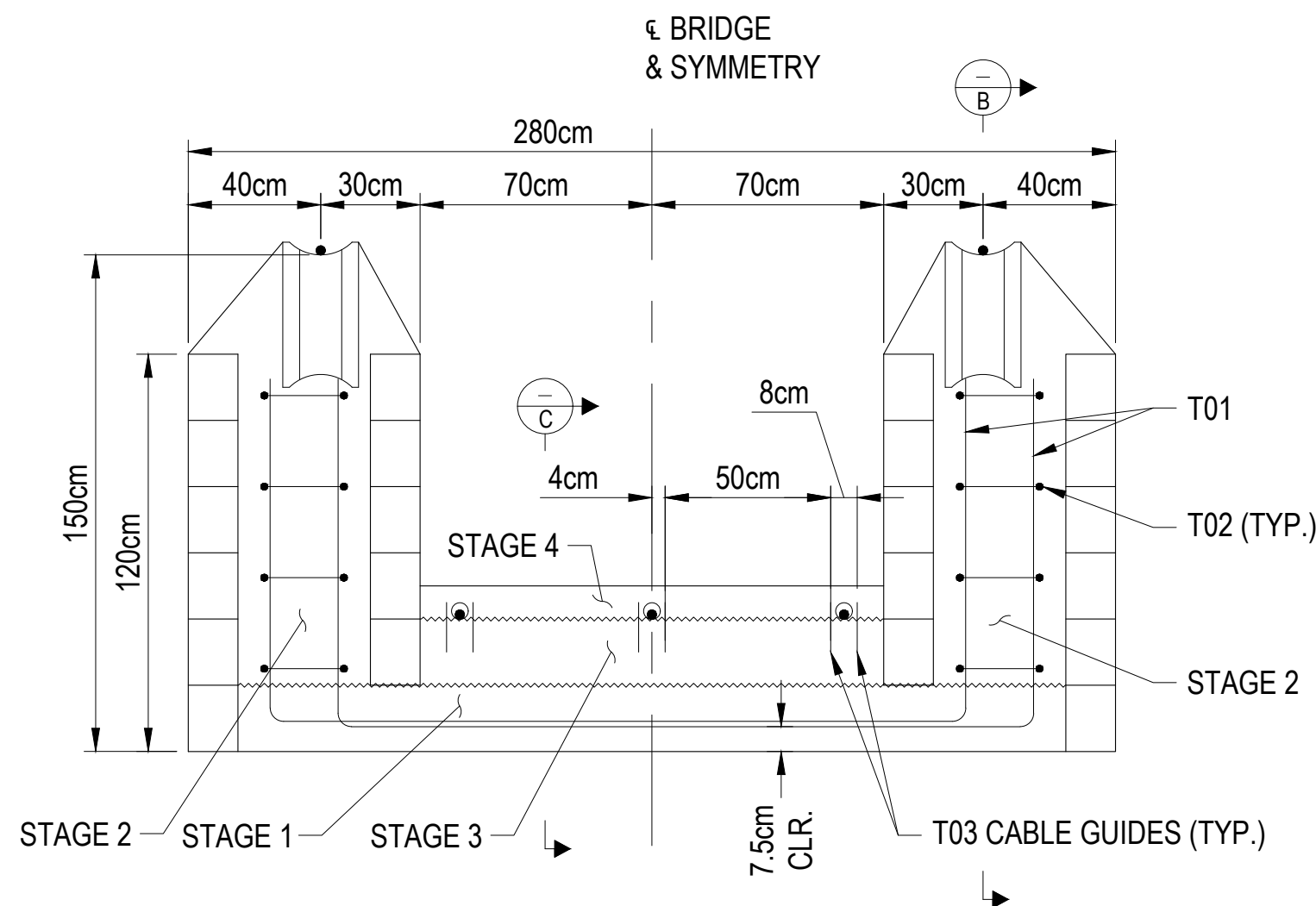
T01



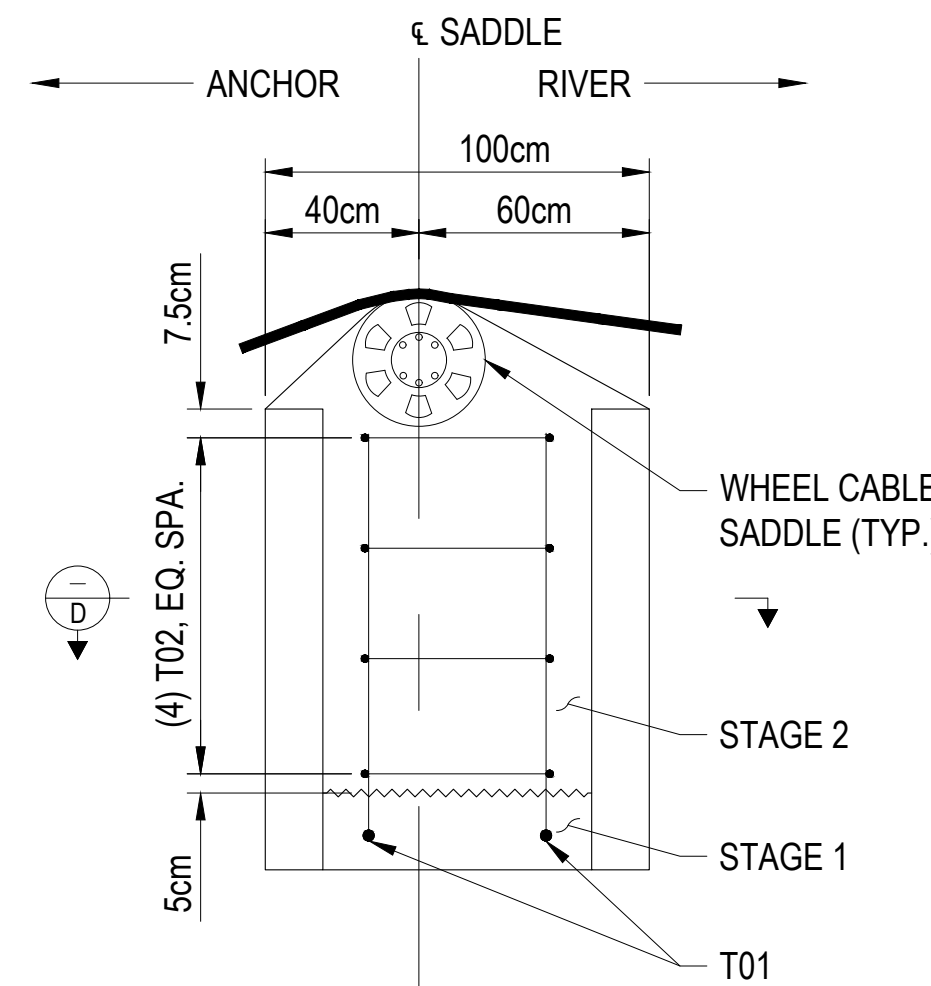
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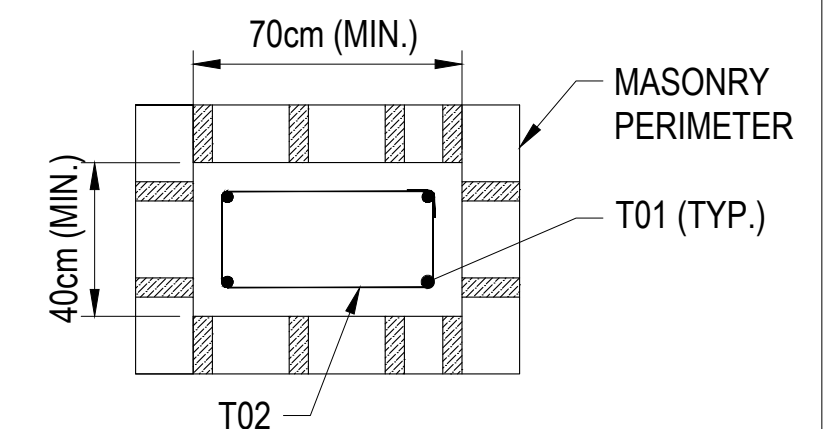
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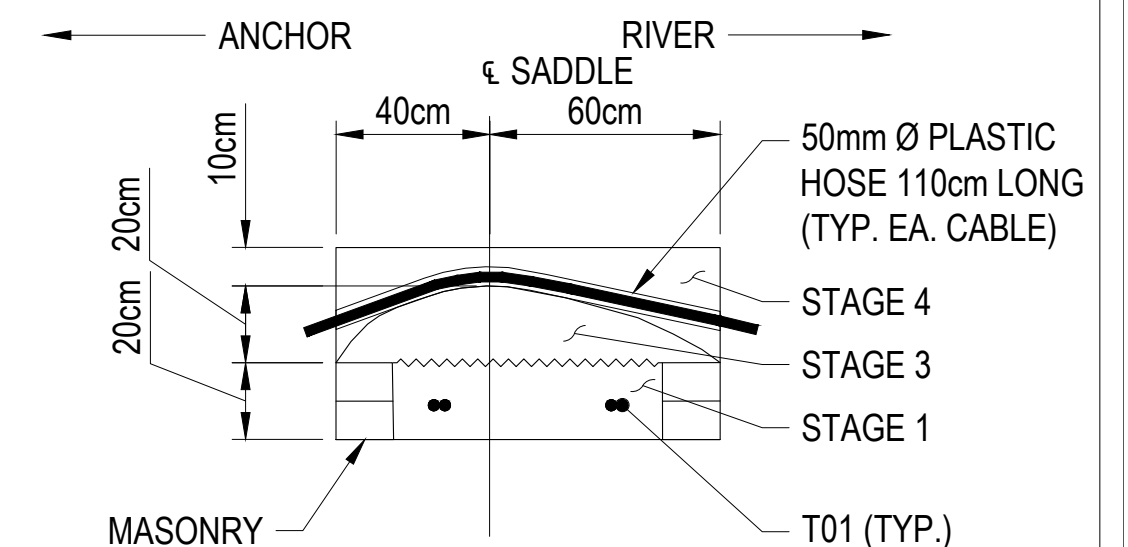
SECTION A



SECTION B



SECTION D



SECTION C

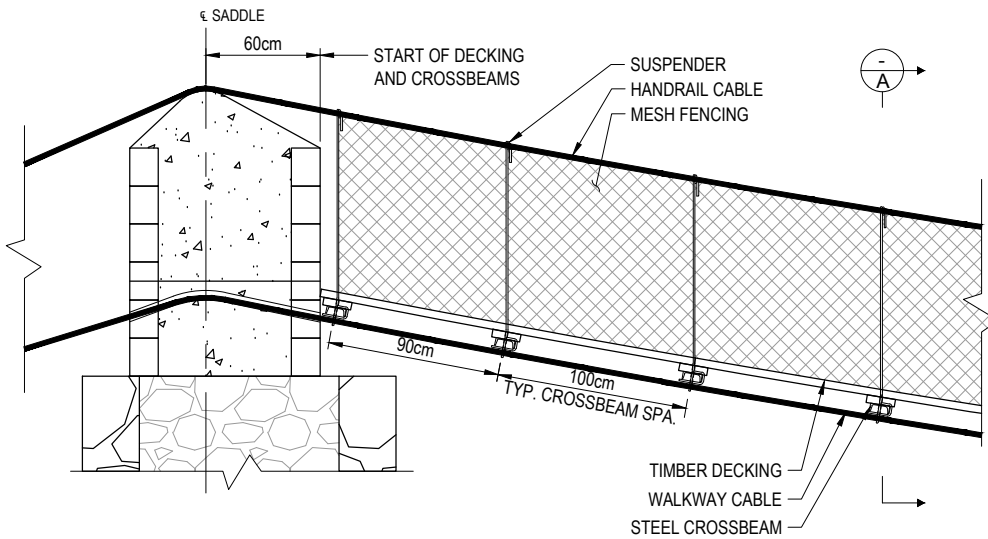
REV.	DESCRIPTION	DATE	ISSUED BY
0	ISSUED FOR CONSTRUCTION	04/11/2022	BKK

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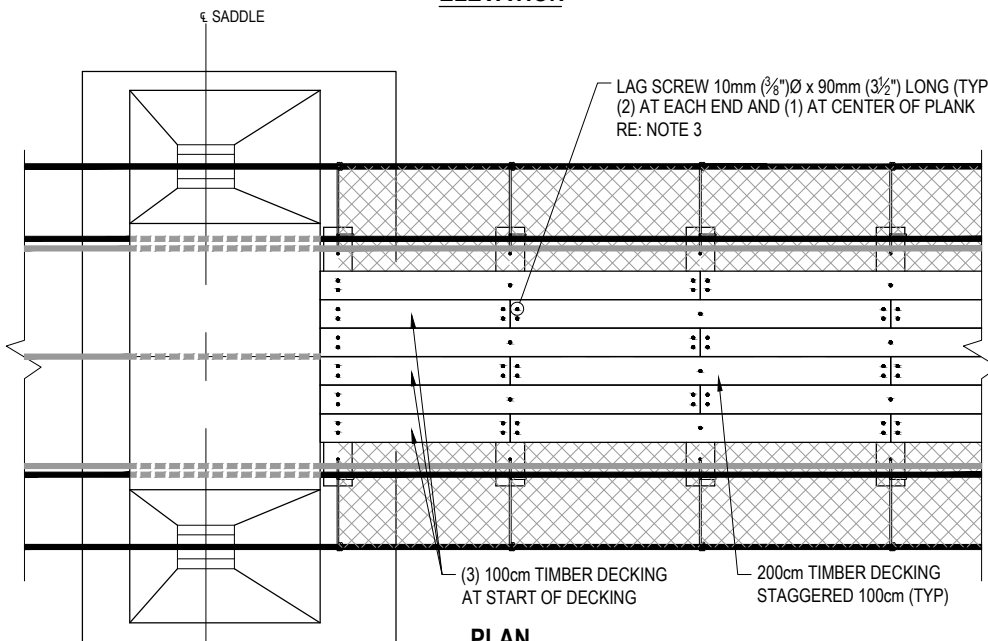
ENGINEERING RECORD
 DATE: 04/11/2022
 DRAWN BY: BKK
 CHECKED BY:
 APPROVED BY:
 REVIEWED BY:

TOWER DETAILS THREE WALKWAY CABLES

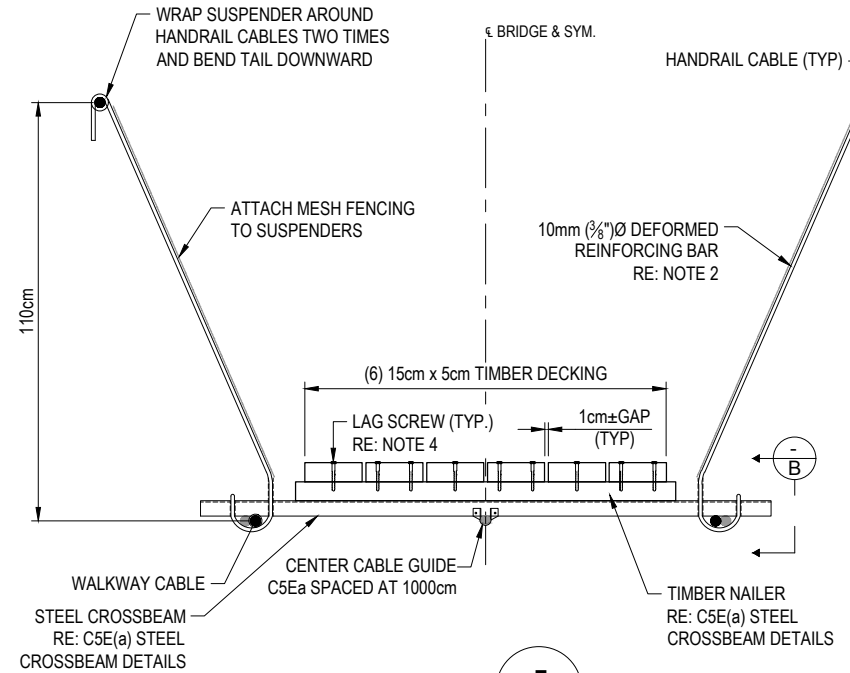
DRAWING NUMBER
T1



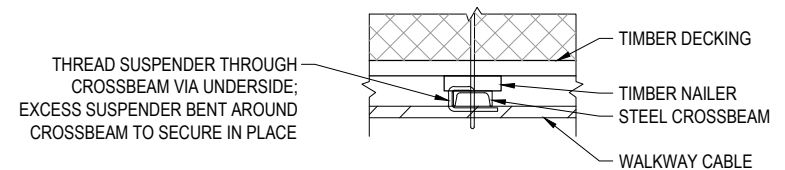
ELEVATION



PLAN



SECTION A



SECTION B

NOTES:

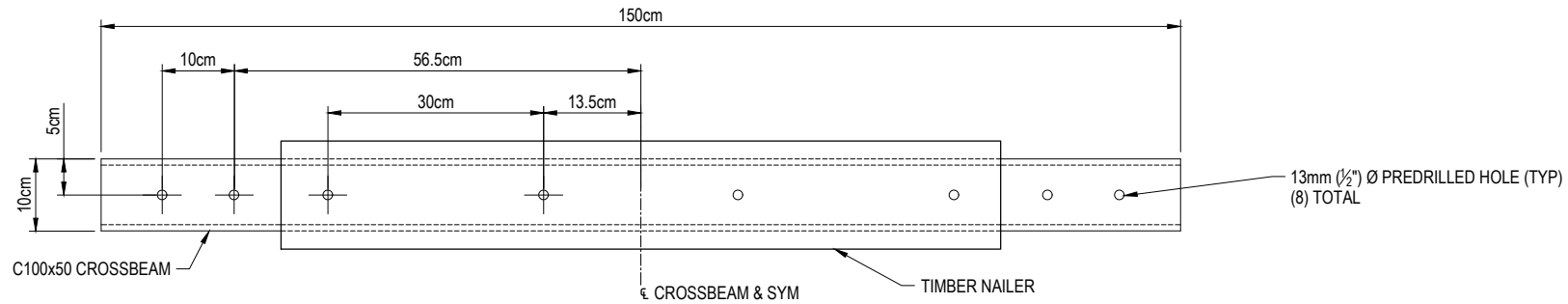
1. SEE ENGINEERS IN ACTION BRIDGE BINDER FOR CONSTRUCTION GUIDELINES.
2. CUT REBAR TO 200cm. BEND IN U TO FIT CROSSBEAM AT 40cm SO THAT STRAIGHT LEG IS 160cm
3. USE 8mm (5/16") PILOT HOLE IN NAILER AND 10mm (3/8") PILOT HOLE IN DECKING.
4. LEAVE LAG SCREW HEAD PARTIALLY EXPOSED FOR REPLACEMENT AND MOISTURE ISSUES.



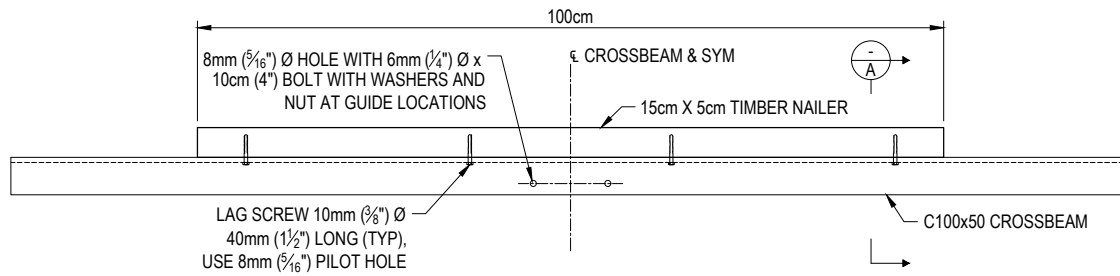
REV.	DESCRIPTION	DATE	ISSUED BY	DISCLAIMER:
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ENGINEERING RECORD
DATE: 22/11/2022
DRAWN BY: KNW
CHECKED BY: KNW
APPROVED BY: KNW
REVIEWED BY: KNW

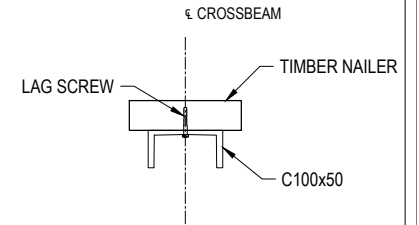
WALKWAY DETAILS	
STEEL CROSSBEAMS - ESWATINI PROJECTS - 6 BOARDS W/ NAILER	
PROJECT NUMBER	DRAWING NUMBER
	W3E



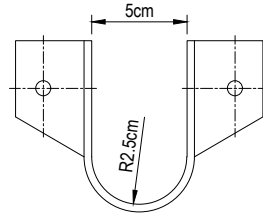
PLAN



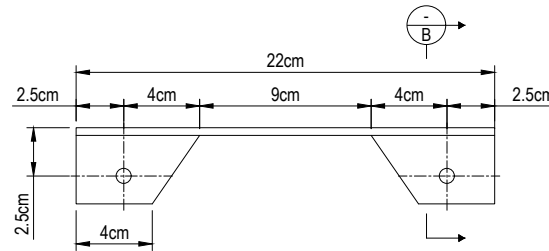
ELEVATION



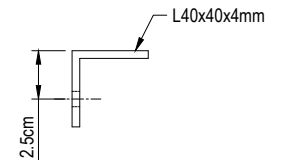
SECTION A-A



CENTER CABLE GUIDE



PRE-BEND GUIDE DETAILS



SECTION B-B



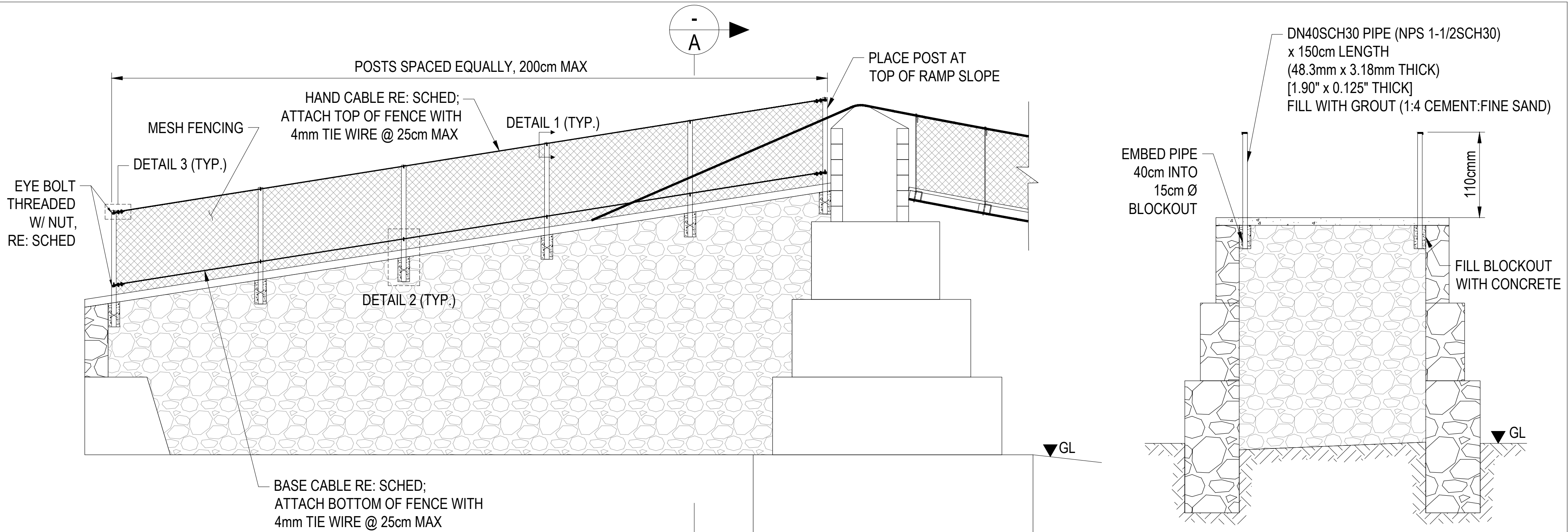
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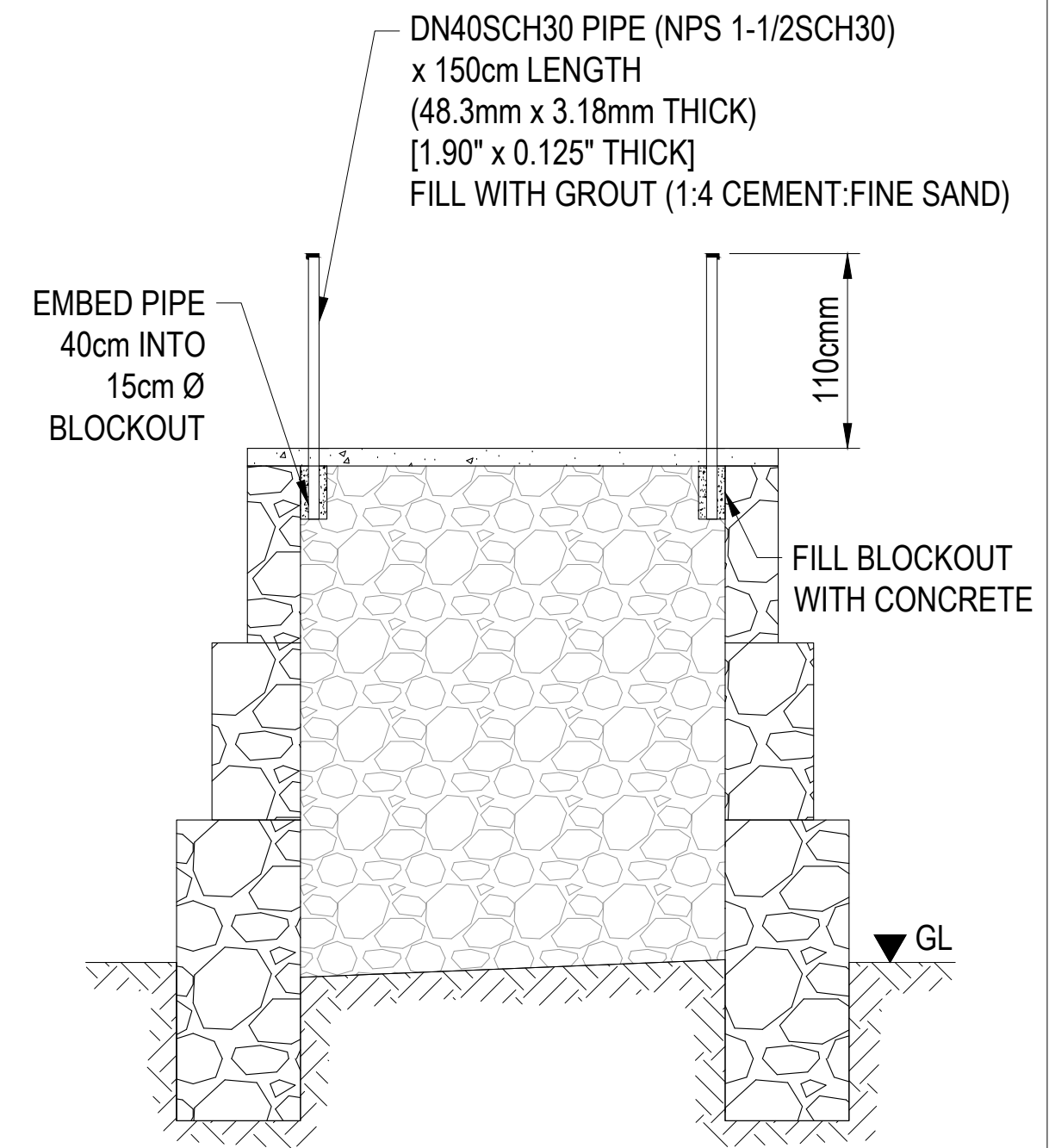
REV.	DESCRIPTION	DATE	ISSUED BY	DISCLAIMER:
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DATE: 22/11/2022
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CHECKED BY: KNW
APPROVED BY: KNW
REVIEWED BY: KNW

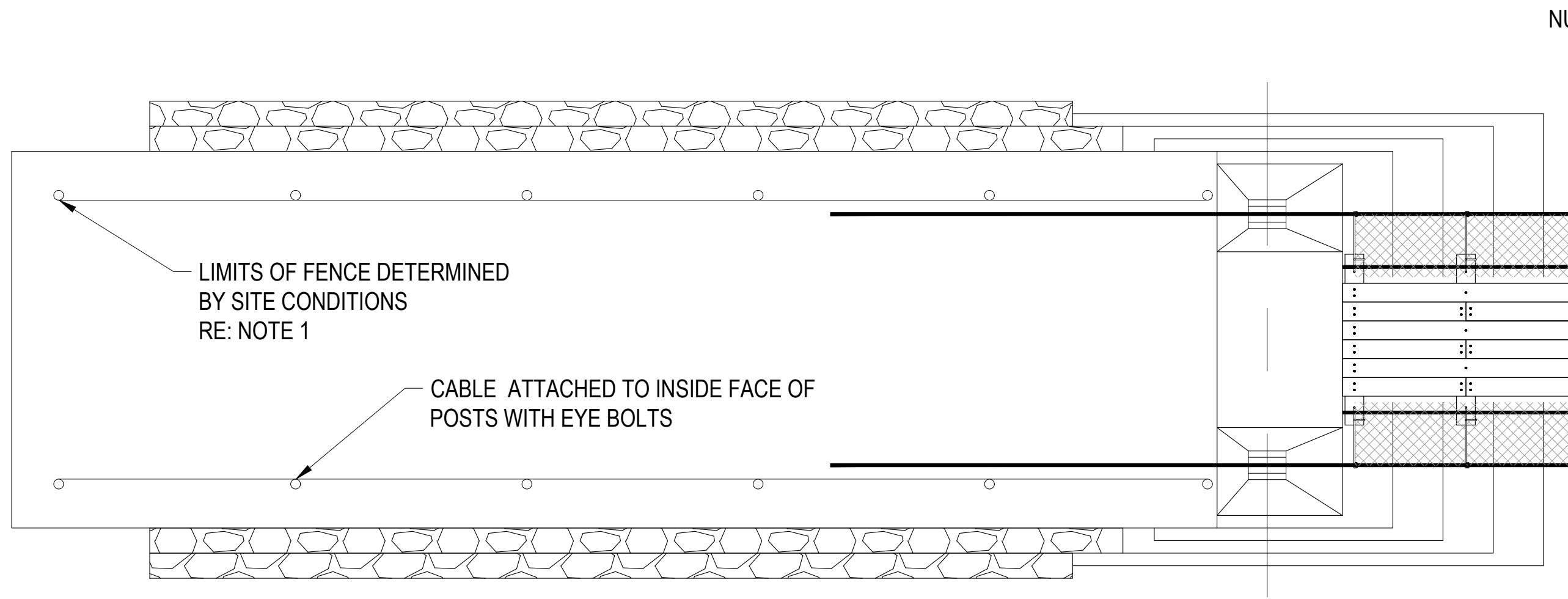
STEEL CROSSBEAM DETAILS C100x50 - ESWATINI PROJECTS W/ CENTER CABLE GUIDE	
PROJECT NUMBER	DRAWING NUMBER
	C5Ea



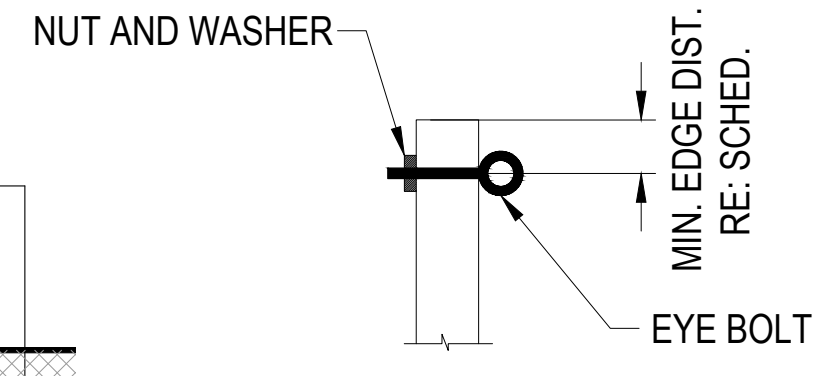
ELEVATION



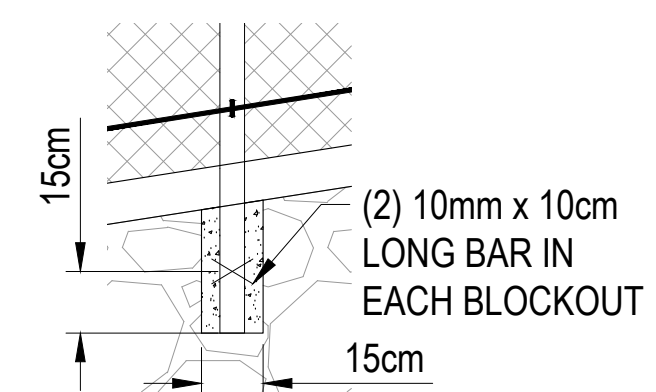
SECTION



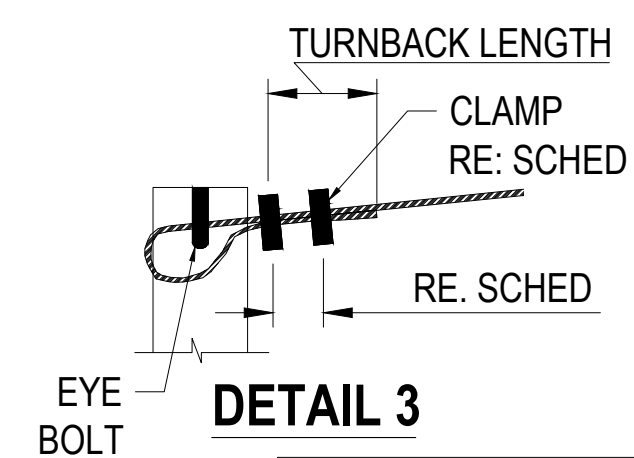
PLAN



DETAIL 1



DETAIL 2



DETAIL 3

EYE BOLT SCHEDULE	
d - SHANK DIAMETER (mm)	MIN. EDGE DISTANCE (mm)
UNDER 13	1.5d
13	20
16	22
20	26
22	28
24	30
27	34
30	38
36	46
OVER 36	1.25d

CABLE & CLAMP SCHEDULE				
CABLE & CLAMP SIZE (mm)	CABLE TURNBACK (mm)	CABLE TENSILE STRENGTH (kN)	CLAMP TORQUE (ft-lbs)	MIN CLAMP SPACING (mm)
6	121	25.7	15	61
8	134	39.9	30	67
10	165	57.1	45	83
11	178	77.1	65	89
13	292	101	65	97

NOTES:

1. PROVIDE APPROACH RAMP FENCE WHEN THE DISTANCE FROM GRADE TO THE TOP OF THE RAMP CAP EXCEEDS 1.8m (6ft). FENCE IS NOT REQUIRED WHERE THE VERTICAL DISTANCE IS LESS THAN 1.8m, SUBJECT TO THE PREFERENCE OF COUNTRY MANAGER AND/OR COMMUNITY.
2. PAINT EYE BOLT HARDWARE WITH SIMILAR, ANTICORROSIVE PAINT.
3. SEE EIA BRIDGE BINDER FOR CONSTRUCTION GUIDELINES.



REV.	DESCRIPTION	DATE	ISSUED BY
0	ISSUED FOR CONSTRUCTION	18/03/2022	KNW

DISCLAIMER: THESE DRAWINGS ARE PRODUCED FOR THE STATED BRIDGE PROJECT. ANY CONDITIONS THAT REQUIRE CHANGES FROM THE PLANS MUST BE COMMUNICATED TO THE ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION. ANYONE USING THIS PLAN SHOULD VERIFY THE CALCULATIONS ACCORDING TO SITE SPECIFIC CONDITIONS AND LOCAL STANDARDS.

USE OF THESE PLANS FOR ANY OTHER PURPOSE SHALL NOT BE ATTRIBUTABLE TO ENGINEERS IN ACTION AND USERS AGREE TO HOLD ENGINEERS IN ACTION HARMLESS TO ANY AND ALL LIABILITY.

ENGINEERING RECORD
 DATE: 18/03/2022
 DRAWN BY: BKK
 CHECKED BY: KNW
 APPROVED BY: KNW
 REVIEWED BY: KNW

APPROACH RAMP DETAILS
 CHAIN LINK FENCE
 ESWATINI PROJECTS

PROJECT NUMBER	DRAWING NUMBER
	F2E