भारतीय राष्ट्रीय राजमार्ग प्राधिकरण
(सड़क परिवहन और राजमार्ग मंत्रालय, भारत सरकार)
NATIONAL HIGHWAYS AUTHORITY OF INDIA
(Ministry of Road Transport and Highways, Govt. of India)
क्षेत्रीय कार्यालय / **REGIONAL OFFICE**
ई-2/167, अरेरा कॉलोनी, हबीबगंज रेल्वे स्टेशन के पास, भोपाल (म.प्र.) 462016
E-2/167, Arera Colony, Near Habibganj Railway Station, Bhopal (M.P.) 462016
दूरभाष/Phone : 0755-2426638, फैक्स /Fax : 0755-2426698, ई-मेल/E-mail : robhopal@nhai.org
भारतमाला
प्रगति के पथ पर अग्रसर
BHARATMALA
ROAD TO PROSPERITY

NHAI/RO-MP/JBP/Canal Crossing/2021/44132

Date: 08.09.2021

Invitation of Public Comments

Sub: Request for ROW Permission for Execution of the Sleemanabad Carrier Canal Tunnel (Bargi Right Bank Canal) of Bargi Diversion project from RD 104 Km to RD 129 Km on Turn-Key Basis commissioning and testing of the canal system through TBM.

Ref: 1. PD, PIU-Jabalpur letter no. NHAI/PIU-JBP/NH-30/**P-2/Canal Permission**/ND Devision-05/17693 dated 06.09.2021
2. Executive Engineer, ND Division No.5 Katni letter No. 894 dated 06-09-2021-
3. PIU office letter No. NHAI/PIU/JBP/NH-30/P-12/Slimnabad Canal Crossing/2021/16213 dated 12.01.2021
4. PIU office letter No. NHAI/PIU/Katni/NH-7/P-2/File L&T/2019 /2665 dated 07.03.2020.
5. Executive Engineer, NDD Katni, ज्ञाप क्र.179/कार्य-3/रेल-एन.एच /क-5 दिनांक 28-01-2018
6. MoRT&H Circular No. RW/NH-33044/29/2015/S&R (R), dated 22.11.2016.

The Project Director, PIU-Jabalpur NHAI vide their letter dated 06.09.2021 has submitted the Proposal for ROW Permission for Execution of the Sleemanabad Carrier Canal Tunnel (Bargi Right Bank Canal) of Bargi Diversion project from RD 104 Km to RD 129 Km on Turn-Key Basis commissioning and testing of the canal system through TBM.

2. As per Ministry vide OM No. RW/NH-33044/29/2015/S&R (R) dated 22.11.2016, the Highways Administrator will make available the proposal seeking permission for utility laying for public comments for **30 days** on ground of public interest.

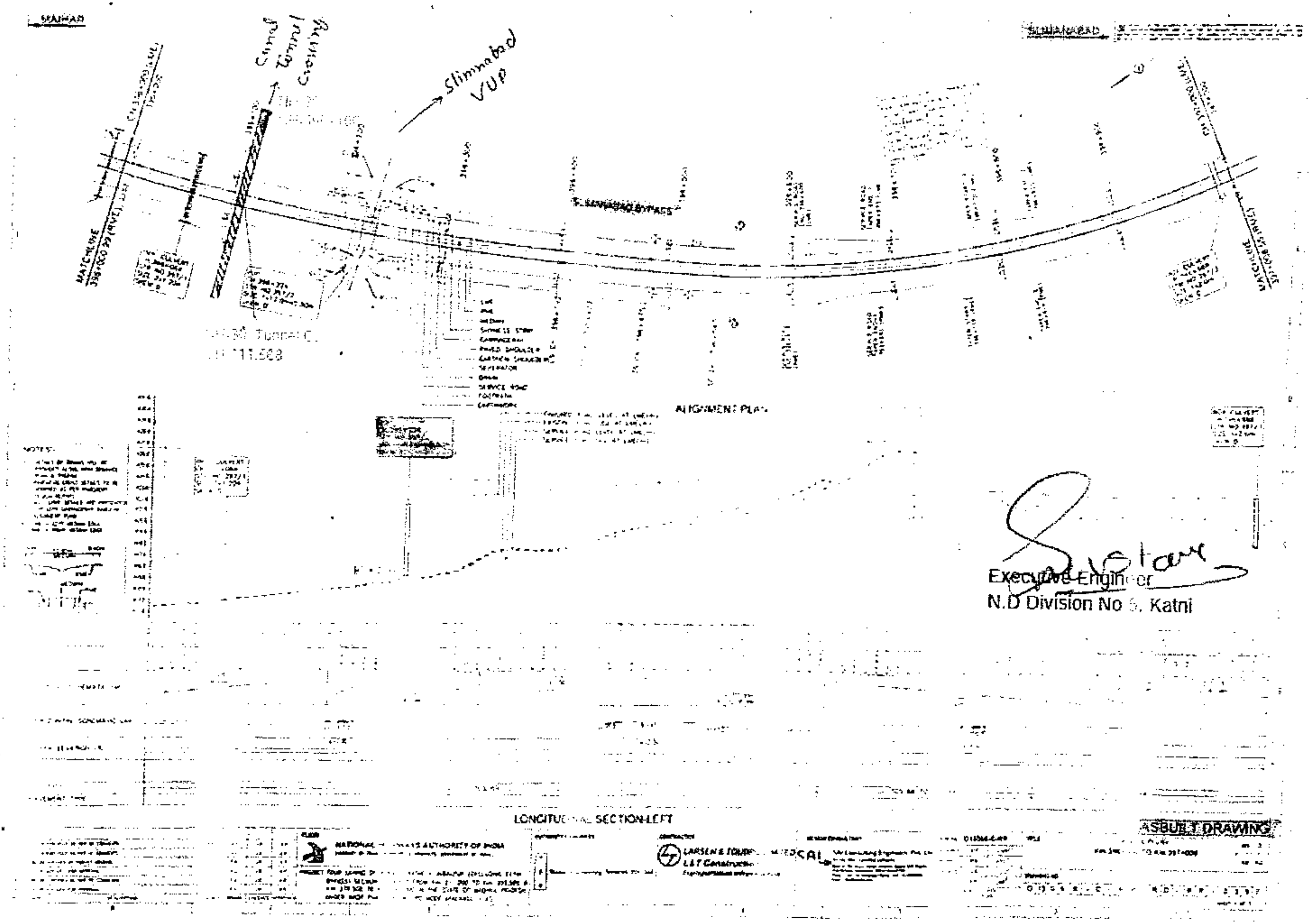
3. In view of the above the comments of public are invited on captioned proposal (copy of application is enclosed) and the same should reach to below mentioned address till **07.10.2021** beyond which no comments will be considered.

The Highway Administrator
O/o Regional Officer,
National Highways Authority of India
E-2/167, Arera Colony,
Near Habibganj Railway Station,
Bhopal (MP)-462016
E-mail ID:robhopal@nhai.org

4. This issues with the approval of Highways Administrator Cum Regional Officer, NHAI, Bhopal (MP).

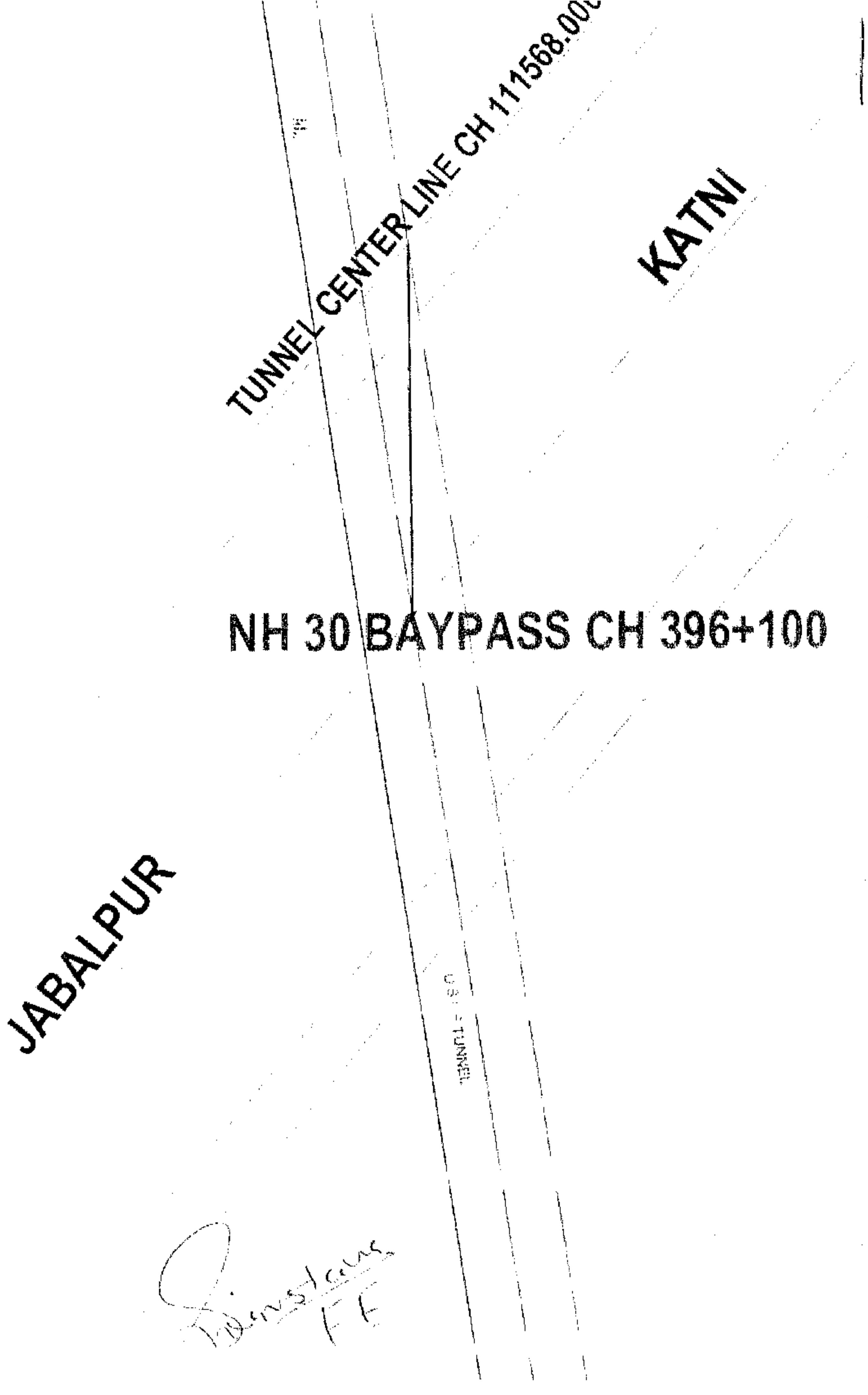
(Anand Prasad)
Manager (T)

Copy to:
(i) Web-Admin, nhai.org@gmail.com, NHAI-HQ for uploading on NHAI website.
(ii)The Senior Technical Director, NIC, Transport Bhawan, New Delhi-110001 for uploading on Ministry's Website.
(iii) The Project Director, PIU-Jabalpur (MP) for information please.
(iv)The, Executive Enginner, N.D. Division No. 5 Katni (M.P) for kind information.



Executive Engineer
N.D Division No 5, Katni


NH-30 CH-396+100
Tunnel CL
CH-111.568


TUNNEL CENTER LINE CH 111568.00
KATNI
NH 30 BAYPASS CH 396+100
JABALPUR
TUNNEL

[redacted]

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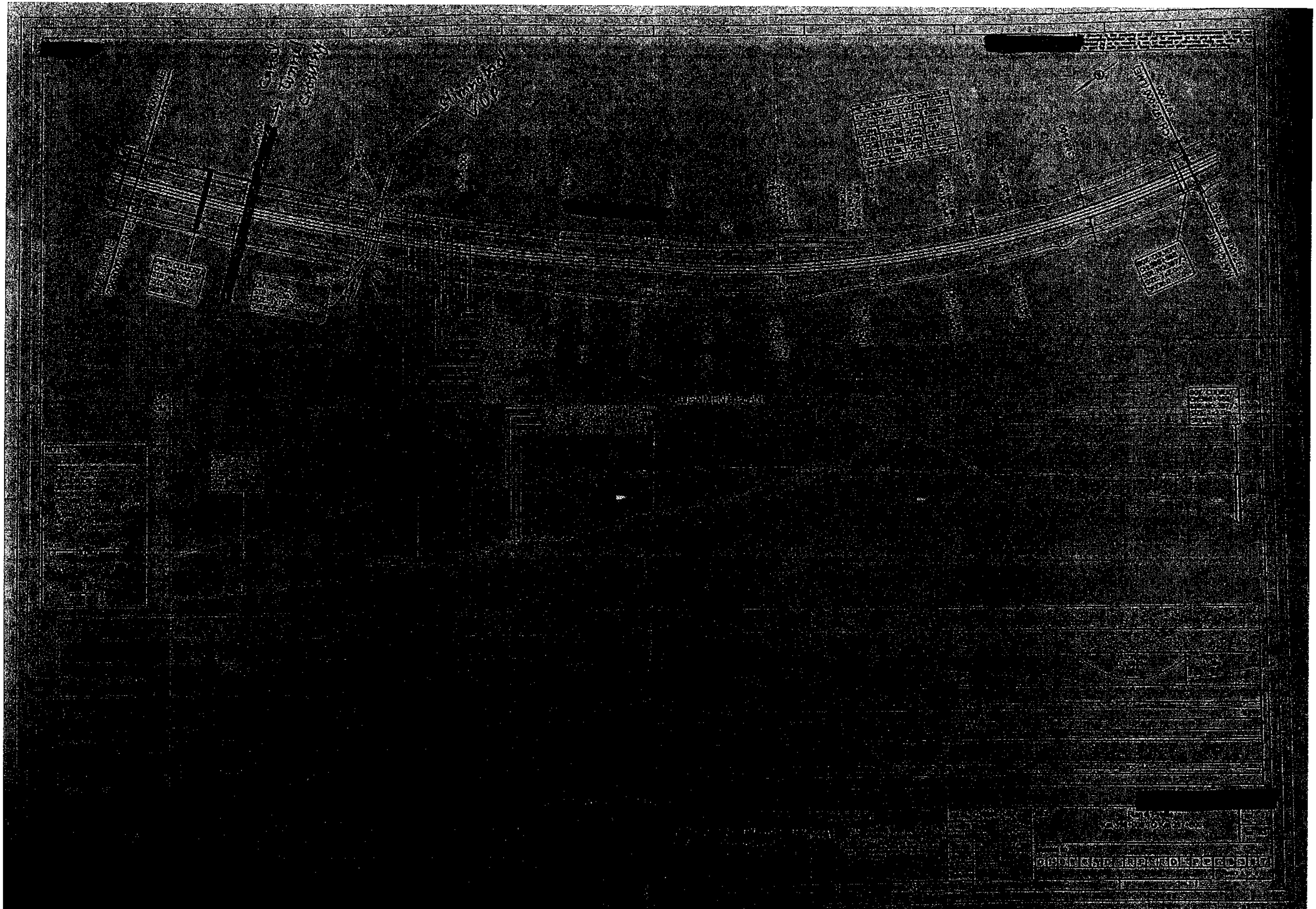

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Methodology of the Geotechnical Instrumentation and Monitoring for NH-30 Crossing.

PROJECT	SLEEMNABAD CARRIER CANAL PROJECT
EMPLOYER	NARMADA VALLEY DEVELOPMENT AUTHORITHY
CONTRACTOR	PATEL - SEW - JOINT VENTURE

PROJECT-: Execution of Sleemnabad Carrier Canal (Bargi Right Bank Canal) of Bargi Diversion from RD 104.00 to RD 129.00 KM on Turnkey Basis.

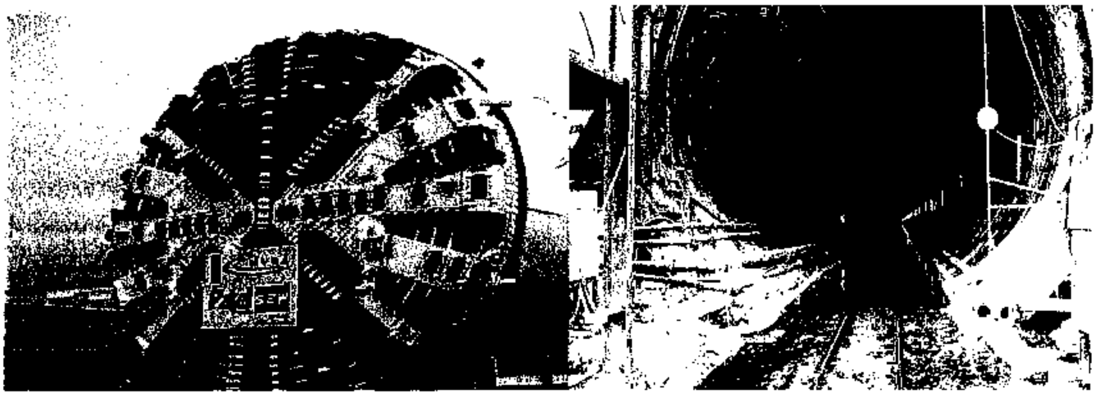


Table of Contents

1. INTRODUCTION: -

Geotechnical Instrumentation and Monitoring (I&M) plan is required to be undertaken before during and after the construction of Sleemnabad Carrier Canal Tunnel Project of NVDA for the protection of all assets including NH-30 Crossing, structures, Buildings, and utilities within the influence zone of the project. The performance of the ground support, the stability of the tunnel excavation and the surrounding ground should be monitored at each stage of construction.

NVDA has proposed a tunnel of about 12 km length and 10 meter dia to cross of the ridge portion between R.D.104.00 to 116.00km, existing railway line & NH-7& NH-30. Tunneling we are doing by **EARTH PRESSURE BALLANCED TUNNEL BORING MACHINE (EPB TBM).** Our TBM will go from 18.50m below ground level in NH-30. In this zone, TBM will go into full EPB mode.

2. PURPOSE:-

Safety of Roads, Highways, Bridges, & buildings

To provide early warning through regular or continuous monitoring for any Surface/ ground and underground movements affecting the adjoining premises, roads, Bridge structure and utilities like power lines, water lines etc. within the zone of influence of construction. This implementation of preventive remedial actions well within time.

3. METHODOLOGY

A. Settlement Monitoring Point

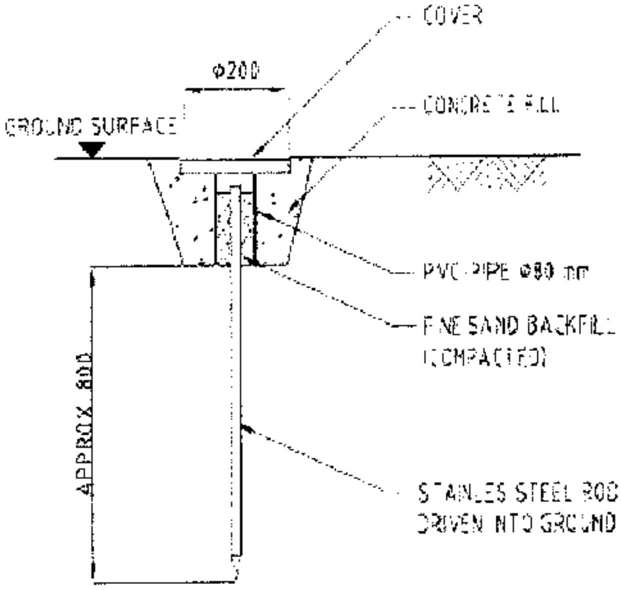
Surface settlement monitoring points (SMP) shall be installed around the excavations and above the tunnel alignments to monitor ground surface settlements induced due to construction activities.

Two types of SMP shall be used depending on the ground conditions.

One for hard pavement and another for soil.

➢ Settlement Monitoring Point for Soil :-

Settlement monitoring point for soil comprises of a steel survey pin having a hemi-spherical top with a red colored cross mark, MS extension rod approx. 1 m long 16 mm dia., an outer protective PVC pipe having 48 mm o.d. and 37 mm i.d and a MS grouting plate (150 mm dia. x 5 mm). A cover is supplied with each point to protect the top.



Settlement monitoring point for soil installation scheme

Installation

- Make a pit 1075 mm deep and 500 mm x 500 mm square at the top. In case hard rock is encountered at a shallower depth than 1 m, installation depth can be reduced accordingly.
- Pour a little concrete (1:2:4; cement: sand: gravel) at the bottom of the pit to make a resting pad for the grouting plate. Place the assembly comprising of, extension rod, outer PVC pipe and SS survey pin with grouting plate at the bottom of the pit.

- Backfill the void around the outer pipe and pit with excavated material. Compact while backfilling.
- Fill the annular space between the extension rod and outer PVC pipe with dry sand.
- Use necessary shuttering to make a 75 mm deep niche at the top. Grout 250 mm x 250 mm lockable cover on top of the niche to protect the installation. Keep the cover locked when not in use.

Taking Reading

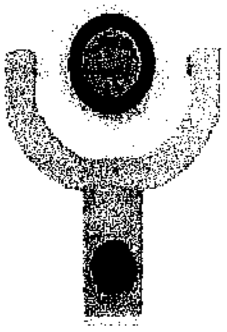
- Unlock hinged protective cover (In case of settlement marker in soil) with the special key provided. Clean survey pin.
- Elevation of the settlement points will be measured using a digital level optical survey team.
- Precise levelling survey method will be used. Permanent approved benchmarks for the survey works will used for reference. Temporary benchmarks closer to site will be established by survey team.
- Base reading/ initial reading will be established after taking 3 initial readings consecutively.
- To determine settlement, compare subsequent readings with base reading as reference.

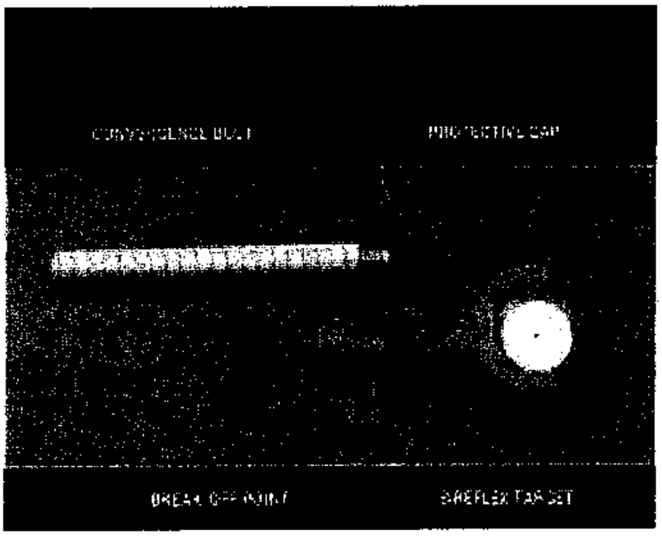
➢ Bi-reflex Target: -

General Description:-

Bireflex target consists of reflector mounted on a robust frame. The target has reflectors on both the sides and is mounted on a universal joint such that it can be oriented in any direction as required. The target has a small center hole to allow precise targeting. The target interchangeable is made of high performance materials and precise manufacturing processes.

The target components include convergence bolts with protective cap and adaptor with reference break-off point. The break-off point adaptor is required to mount the target on the convergence bolts.





Installation and Readings

Install the 12 mm diameter, 150 mm convergence bolt perpendicular to the surface of the structure by means of drilling and grouting or by grouting only as suitable. Ensure that the red PVC protective cap is secure over the threaded end of the bolt which remains outside. Ensure that sufficient clearance is there between the capped threaded end and the surrounding material to enable easy mounting of bireflex target

- After the stud is set, remove the PVC protective cap and install the break off point. Finally, install the bireflex target over the breakoff point and secure in its final position by means of tightening of the clamp screw.
- Take initial reading with a total station, establish base reading after taking 3 initial Readings consecutively.

PATEL SEW JOINT VENTURE

- To determine deformation, compare subsequent readings with base reading as reference.

➢ Crack Meter :-

Crack meter shall be used to monitor change in width of existing cracks in critical buildings, located within zone of influence of Sleemnabad Project. Locations of crack meters will be decided after visual inspection of cracks. Crack meter consists of a graduated scale with a resolution of 0.5 mm and a transparent acrylic plate with a hairline cursor mark. The graduated scale and the transparent acrylic plate are assembled across the crack with impact anchor in 5 mm diameter holes drilled to a depth of 30 mm .As the crack opens or closes, the graduated scale and the cursor move relative to each other representing the amount of movement occurring. The reading of the marking is initially noted and is taken as a base. Subsequent readings are then compared with the initial reading to determine the change in the width of the crack.

NOTE: In case crack width is larger, a crack gage with 100 mm marking instead of 50 mm marking will be used.

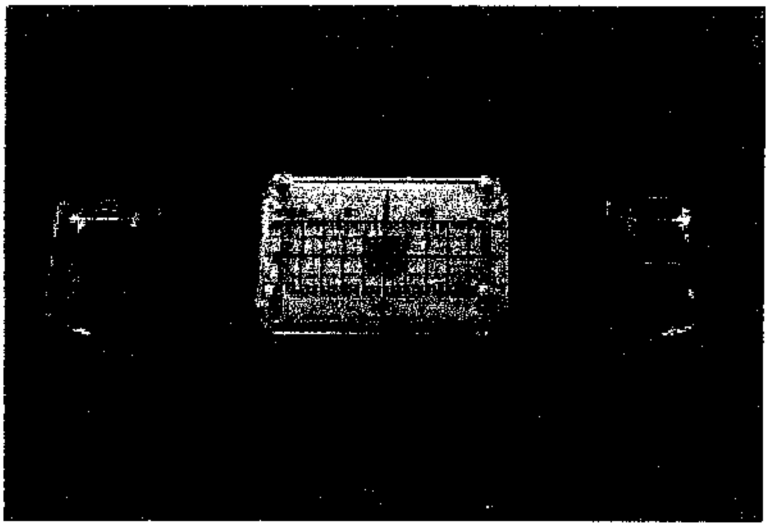
Installation

- Drill two 5 mm diameter, 30 mm deep holes on each side of the crack along a line perpendicular to the direction of crack, using drilling template Take care that the holes are drilled perpendicular to the surface of the wall. Clean the holes with a handheld air pump.

- Insert the expandable anchors through the holes provided in the graduated scale.
- Now push the expandable anchors inside the respective drilled holes upto the end.
- Place the screw over the expandable anchors and manually tighten them with the help suitable screwdriver.
- Insert the expandable anchors through the holes provided in the transparent acrylic plate. Now push the expandable anchors inside the respective drilled holes up to the end. Place the screw over the expandable anchor and manually tighten with the help of suitable screwdriver.

Taking Reading

- Note the initial reading as shown by the marker on the acrylic plate. This reading is taken as the base. Also note the ambient temperature.
- Subsequent readings are then compared with the initial reading to determine the change in the width of the crack.



Crack Monitor

4. SAFETY

- All risks are evaluated prior to any works commencing, utilizing the matrices to Determine the level of significance in terms of likelihood of occurrence and severity of Hazard based on the allocated numerical values.

Personal Protective Equipment (PPE) Requirements

All personnel involved in any of the JV's operations are to wear the following PPE:

- Safety Vest
- Safety Helmet
- Safety Footwear
- Eye Protection
- Safety Gloves (Task Dependent)
- Ear Protection (Where Necessary)
- Dust Mask

PATEL SEW JOINT VENTURE

First Aid Facilities

A trained first aider will be available at each station location and will be made known to all associated with the project through the site induction. A first aid kit and eye wash station will be available on site and will be placed within the welfare facility and will be clearly marked.

Thank You

Assistant [illegible]
N.D. Division [illegible]
KATNI (M.P.)

Executive Engineer
N.D. Division No.-5, Katni

Chief Engineer,
Upper Narmada Zone.
Jabalpur. (M. P.)

30.60	0.81	-30.60	0.81
30.70	0.79	-30.70	0.79
30.80	0.77	-30.80	0.77
30.90	0.76	-30.90	0.76
31.00	0.74	-31.00	0.74
31.10	0.72	-31.10	0.72
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31.30	0.69	-31.30	0.69
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32.00	0.58	-32.00	0.58
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46.00	0.01	-46.00	0.01
47.00	0.01	-47.00	0.01
48.00	0.00	-48.00	0.00

Assista [illegible] (F-13)
N.D. Division No. 5
KATNI (M.P.)

Executive Engineer
N.D. Division No.-5, Katni

Chief Engineer,
Upper Narmada Zone,
Jabalpur, (M. P.)

30.60	0.81	-30.60	0.81
30.70	0.79	-30.70	0.79
30.80	0.77	-30.80	0.77
30.90	0.76	-30.90	0.76
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46.00	0.01	-46.00	0.01
47.00	0.01	-47.00	0.01
48.00	0.00	-48.00	0.00

Assista (F-13)
N.D. Division No. 5
KATNI (M.P.)

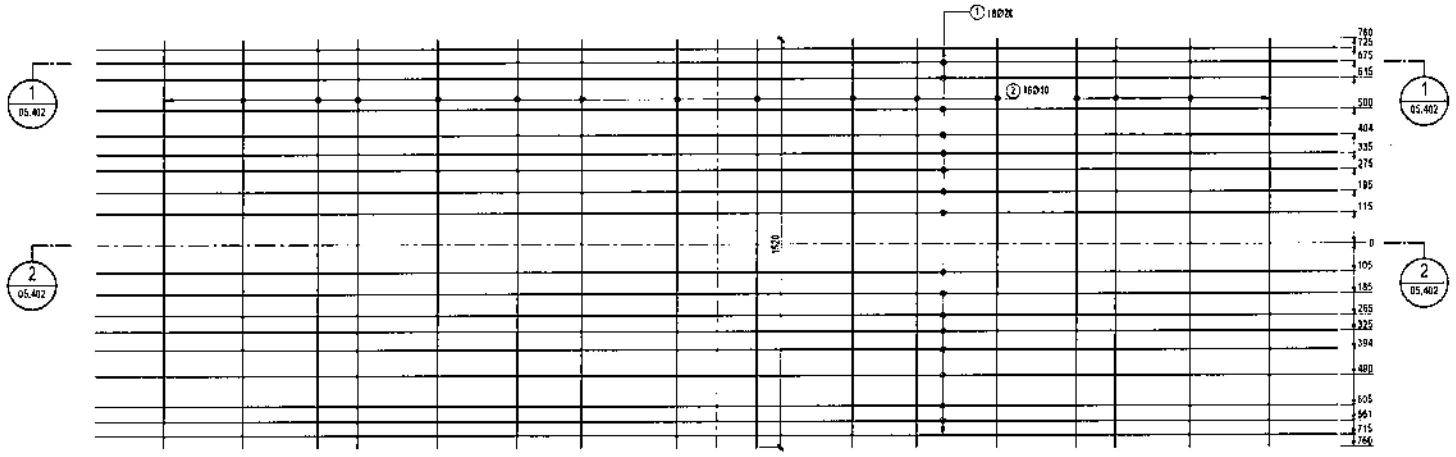
Executive Engineer
N.D. Division No.-5, Katni

Chief Engineer,
Upper Narmada Zone,
Jabalpur, (M. P.)

64

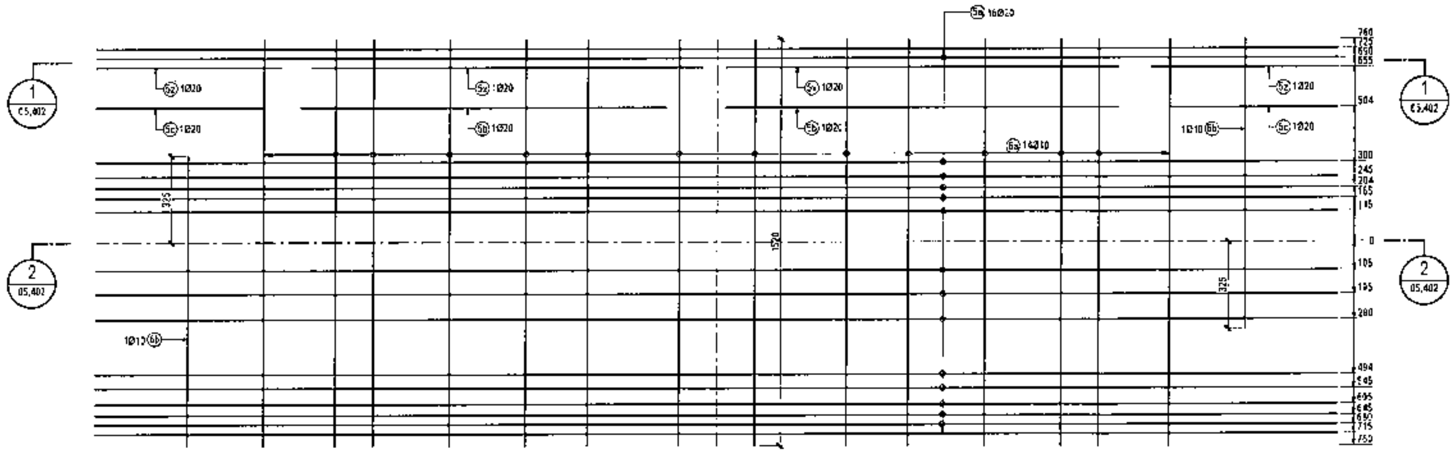
TOP VIEW
MAIN REINFORCEMENT LAYER EXTRADOS

0 0.25 0.5 m

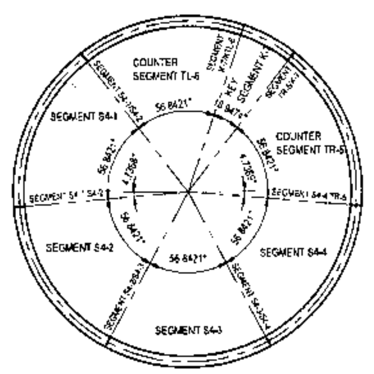


TOP VIEW
MAIN REINFORCEMENT LAYER INTRADOS

0 0.25 0.5 m



KEY PLAN
0 1.5 3 m



REFERENCE DRAWINGS :

S.NO.	DRG. NO.	DRAWING NAME
01	08-013/WC/010	SEGMENT S4-1,S4-2,S4-3,S4-4 REINFORCEMENT
02	08-010/WC/010	SEGMENT TR-6
03	08-010/WC/010	SEGMENT TL-6
04	08-013/WC/010	SEGMENT K-7
05	08-013/WC/010	PRECAST CONCRETE LINING
06	08-013/WC/010	PRECAST CONCRETE LINING
07	08-013/WC/010	PRECAST CONCRETE LINING
08	08-013/WC/010	PRECAST CONCRETE LINING

IMPORTANT NOTES :

1. THIS DRAWING IS APPLICABLE FROM CHAINAGE 111,535 (U/S OF NH30) TO CHAINAGE 111,600 (D/S OF NH 30) OF THE TUNNEL.
2. DURING EXECUTION OF TUNNEL BENEATH THE HIGHWAY & ONE MONTH THEREAFTER, REAL TIME MONITORING OF DEFORMATION OF THE HIGHWAY SHALL BE CARRIED OUT. DEFORMATION MONITORING INSTRUMENTS SHALL BE KEPT ON EACH SIDE OF THE ROAD @5mc/c ALTERNATIVELY AT LEAST UP TO 30m ON EACH SIDE OF TUNNEL. HIGHWAY SHALL IMMEDIATELY BE RESTORED TO ORIGINAL POSITION IF OBSERVED DEFORMATION IS MORE THAN 10mm. IF REQUIRED ADEQUATE GROUND IMPROVEMENT MEASURES SHALL BE IMPLEMENTED ON RECOMMENDATION FROM GEOLOGIST AND ENGINEER-IN-CHARGE IN CASE DEFORMATION IS MORE THAN 10mm.

NOTES :

1. REINFORCEMENT NOTATION

① 1Ø20
BAR DIAMETER
NUMBER OF BAR
BAR MARK

2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. CONCRETE SHALL BE OF GRADE M50 A20 CONFIRMING TO (IS 456 2000)
4. REINFORCEMENT SHALL BE OF GRADE FE500 CONFIRMING TO (IS 1786).
5. ALL OTHER NOTES MENTIONED IN EARLIER GOOD FOR CONSTRUCTION DRAWING (SEE REFERENCE DRAWING) SHALL BE VALID FOR THIS DRAWING.

REV.No.	REVISION DESCRIPTION	DRAWN	CHKED	APP'D	DATE

○ PREFEASIBILITY STUDY ☐ CONCEPT & BASIC DESIGN ● CONSTRUCTION DESIGN
○ FEASIBILITY STUDY ☐ TENDER DESIGN ○ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
SEGMENT S4-1, S4-2, S4-3, S4-4
REINFORCEMENT
TOP VIEW, (SHEET 1 OF 4)

26-08-2023
Dr. Bappaditya Manna
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016 India

ISSUED FOR CONSTRUCTION

AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHA	SCALE 1:10 (1:20)	FORMAT A1 (A3)
DRAWN	MEP	DRAWING No.	REV. No.
CHECKED	TSA	AFRY.4686.05.401	0
APPROVED	SSE		
DATE	25.08.21		

SECTION 1-1

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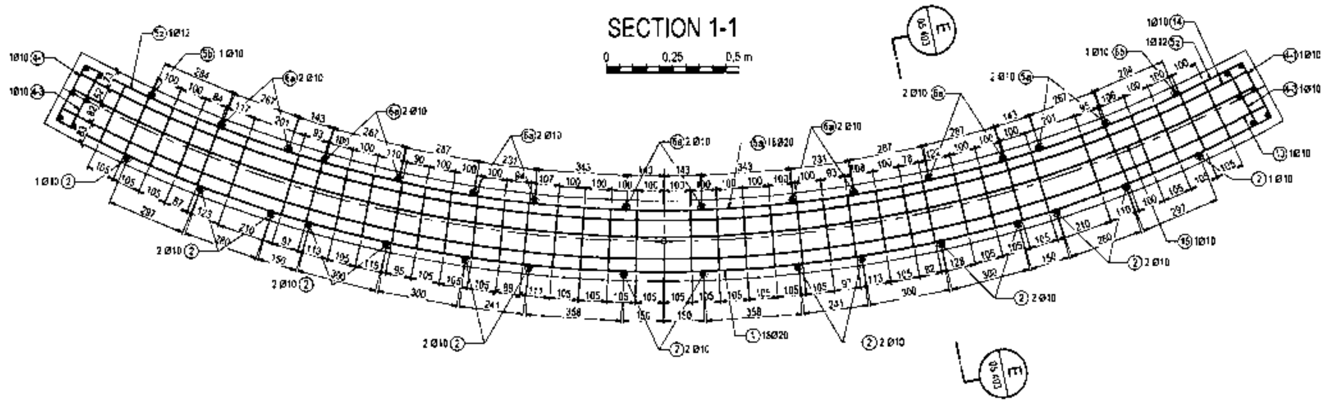

SECTION 2-2

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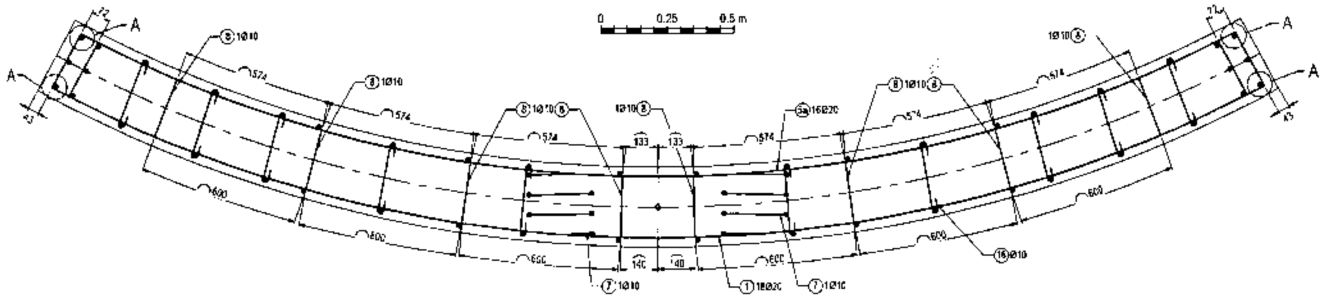


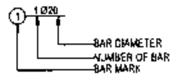
DETAIL- A

(TYP. DETAIL OF LADDER BAR)

0 0.025 0.05 m

NOTES .

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.401.

REV.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PREFEASIBILITY STUDY ☐ CONCEPT & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
SEGMENT S4-1, S4-2, S4-3, S4-4
REINFORCEMENT
SECTION 1-1 & 2-2 (SHEET 2 OF 4)

AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHA	SCALE 1:10 1:5	FORMAT A1
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CHECKED	[illegible]	DRAWING No	REV. No
APPROVED	[illegible]	AFRY.4686.05.402	0
DATE	[illegible]		

Bappaditya Manna
25-08-2021

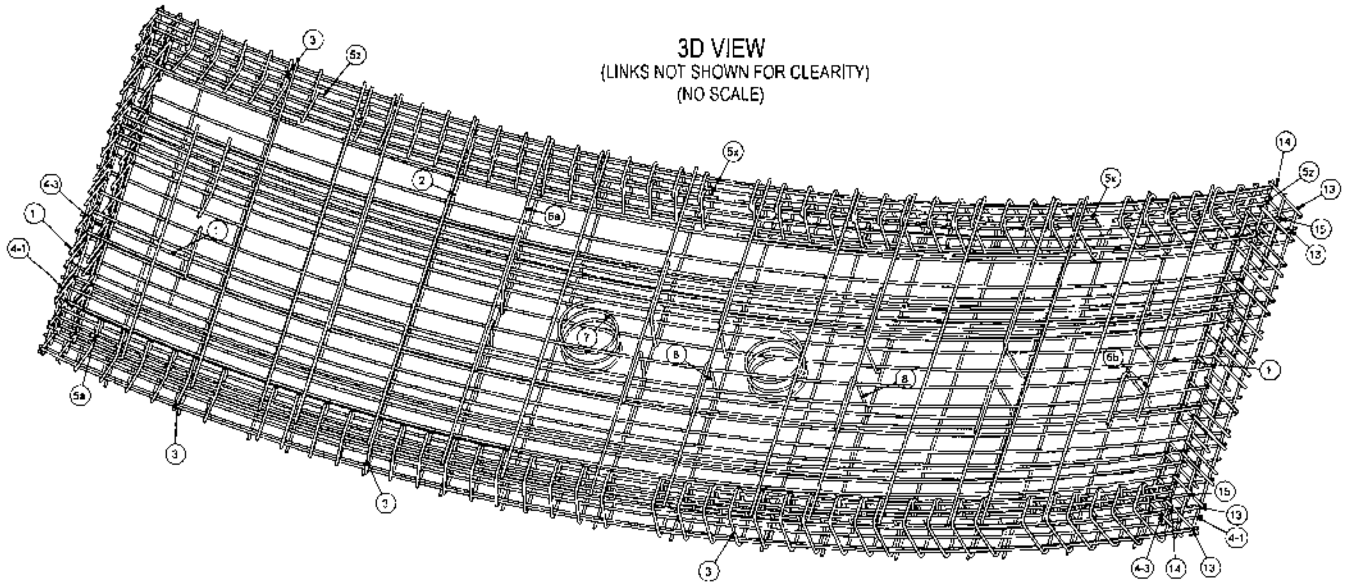
Dr. Bappaditya Manna
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016 India

ISSUED FOR CONSTRUCTION

PATEL SEW JOINT VENTURE

3D VIEW

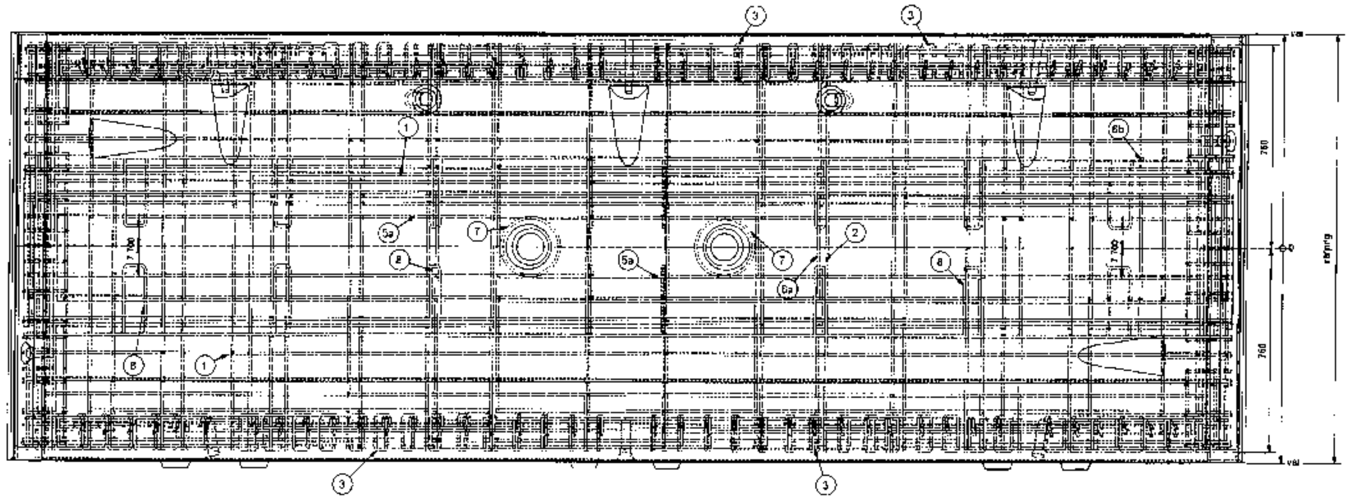
(LINKS NOT SHOWN FOR CLEARITY)
(NO SCALE)



TOP VIEW

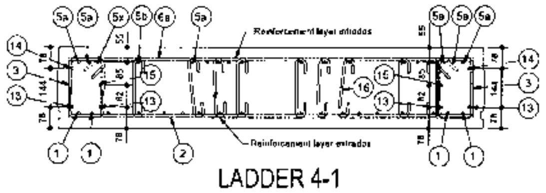
(LINKS NOT SHOWN FOR CLEARITY)

0 0.25 0.5 m



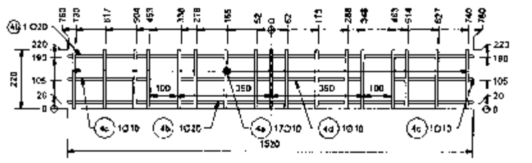
SECTION E-E

0 0.25 0.5 m



LADDER 4-1

0 0.25 0.5 m



LADDER 4-3

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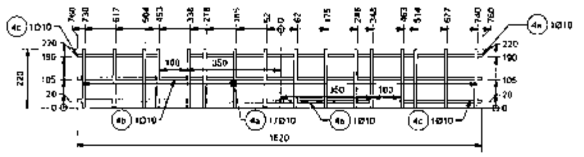

NOTES :

1. REINFORCEMENT NOTATION

2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.401.

Bappaditya Manna
26-08-2023

Dr. Bappaditya Manna
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ISSUED FOR CONSTRUCTION

REV. No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD.	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD CARRIER CANAL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
SEGMENT S4-1, S4-2, S4-3, S4-4
REINFORCEMENT
3D VIEW & SECTIONS (SHEET 3 OF 4)

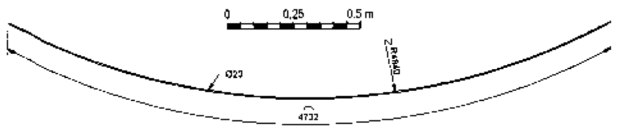
AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHR	SCALE 1:10 (1:20)	FORMAT A1 (A3)
DRAWN	USR		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.403	0
DATE	25.08.21		

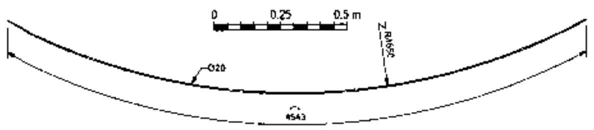
PATEL SEW JOINT VENTURE

3

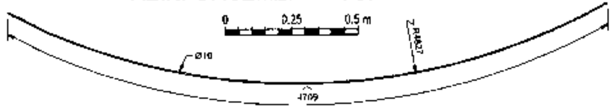
REINFORCEMENT POSITION 1



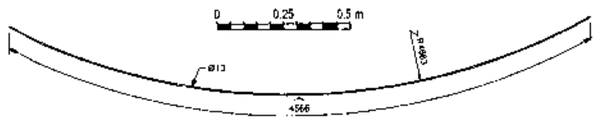
REINFORCEMENT POSITION 5a



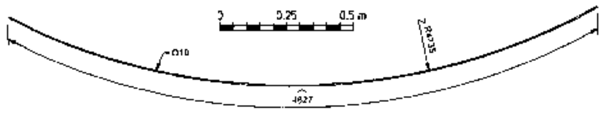
REINFORCEMENT POSITION 13



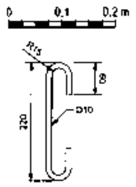
REINFORCEMENT POSITION 14



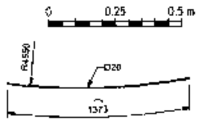
REINFORCEMENT POSITION 15



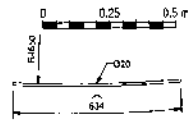
REINFORCEMENT POSITION 16



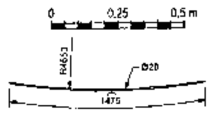
REINFORCEMENT POSITION 5b



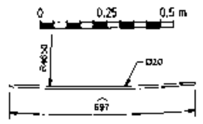
REINFORCEMENT POSITION 5c



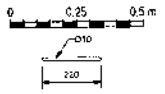
REINFORCEMENT POSITION 5x



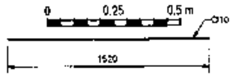
REINFORCEMENT POSITION 5z



REINFORCEMENT POSITION 4a



REINFORCEMENT POSITION 4b



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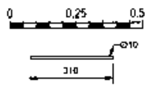
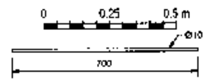
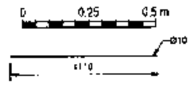


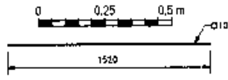
REINFORCEMENT POSITION 4d



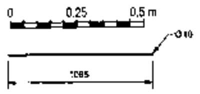
REINFORCEMENT POSITION 4e



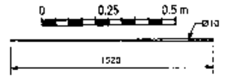
REINFORCEMENT POSITION 6a



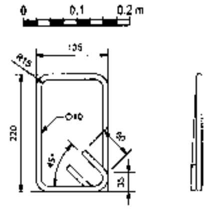
REINFORCEMENT POSITION 6b



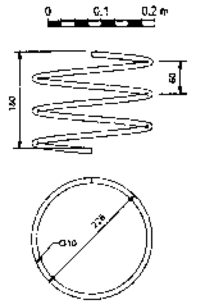
REINFORCEMENT POSITION 2



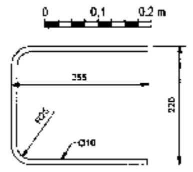
REINFORCEMENT POSITION 3



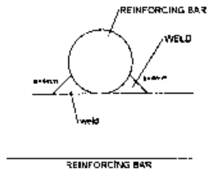
REINFORCEMENT POSITION 7



REINFORCEMENT POSITION 8



WELDING REQUIREMENTS



Following reinforcement positions MUST be welded together:
POS 1 with POS 2
POS 5a- 5c, 5x, 5z with POS 6a- 6b
POS 4a with POS 4b– 4e
POS 1, POS 5a and POS 5c with Ladder 4-1 and Ladder 4-3
Pos 3 with Pos 13, Pos 14 and Pos 15

26-08-2022

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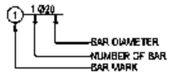
REINFORCEMENT LIST :

POS	NO.	DIA (mm)	Length (m)	Total Length (m)	Weight (Kg)
POS.1	18	20	4,732	85.16	210.44
POS.2	16	10	1.520	24.32	14.993
POS.3	80	10	0.900	72.00	44.388
POS.4a	68	10	0.220	14.96	9.223
POS.4b	6	10	1.520	9.12	5.622
POS.4c	8	10	0,310	2.48	1.529
POS.4d	2	10	0.700	1.40	0,863
POS.4e	4	10	1.110	4.44	2.737
POS.5a	16	20	4.543	72.69	179.249
POS.5b	2	20	1.373	2.75	6,772
POS.5c	2	20	0.634	1.27	3.127
POS. 5x	2	20	1,475	2.95	7.275
POS.5z	2	20	0.697	1.39	3.438
POS.6a	14	10	1.520	21.28	13.119
POS.6b	2	10	1,085	2.17	1.338
POS.7	2	10	2.130	4.26	2.626
POS.8	20	10	0.730	14.60	9.001
POS.13	4	10	4.709	18.84	11.612
POS.14	2	10	4.566	9.13	5.630
POS.15	2	10	4.627	9.25	5.705
POS.16	80	10	0.340	27.20	16,789
				TOTAL	555.060
				TOTAL FOR 4 SEGMENTS	2220.24

Min. cube strength [N/mm²]	50	
Max. grain size [mm]	32	
Concrete cover [mm]	40	
Segment Volume [m³]	2.25	
Reinforcement quality	Fe500	IS 1786 2008
Min. tensile strength [N/mm²]	500	
Minimum bending radius [mm]	15	
Reinforcement weight [kg]	555,060	
Reinforcement weight [kg/m³]	246.70	

NOTES :

1. REINFORCEMENT NOTATION



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3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.401.

REV.No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PRE FEASIBILITY STUDY ☐ CONCEPT & BASIC DESIGN ● CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD CARRIER CANAL PROJECT

PATEL-SEW JOINT VENTURE

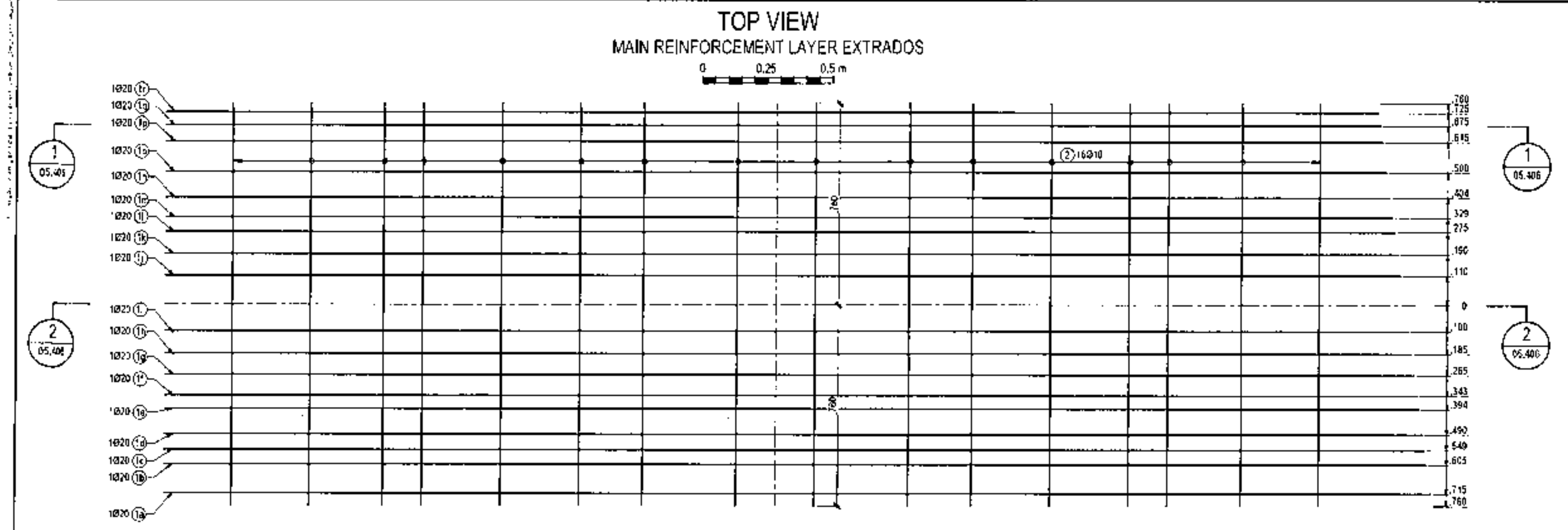
TUNNEL LINING PASSING UNDER NH 30
SEGMENT S4-1, S4-2, S4-3, S4-4
REINFORCEMENT
BARS DETAILS (SHEET 4 OF 4)

AFRY
AFRY India Pvt. Ltd.

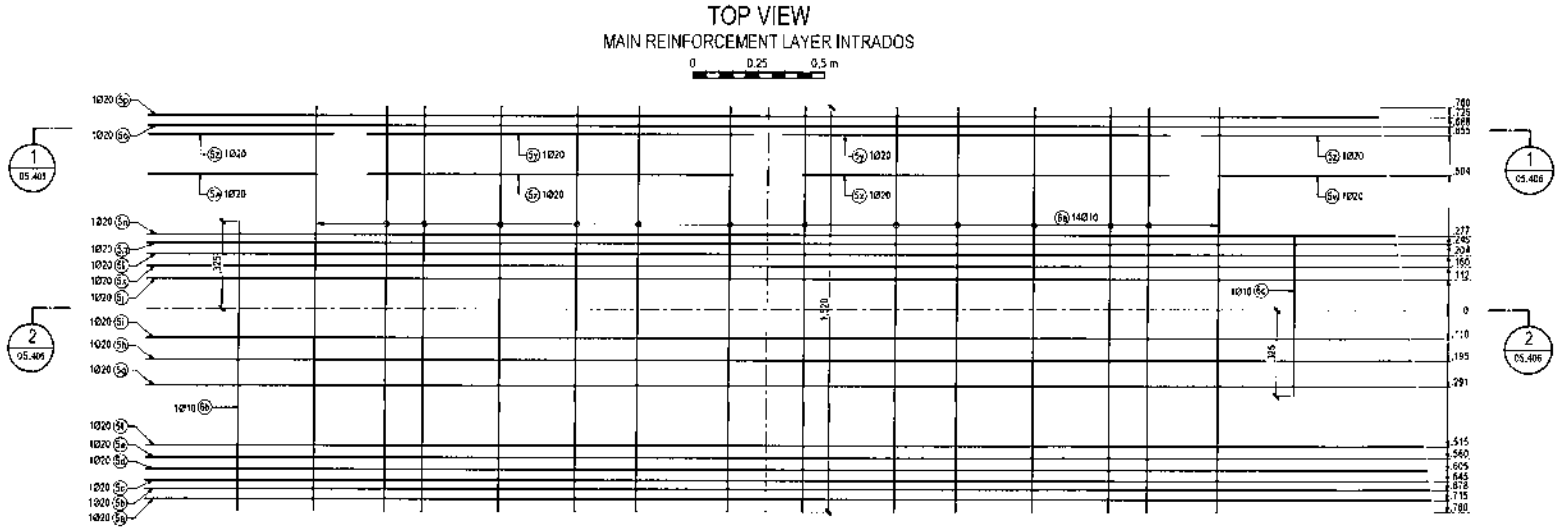
DESIGNED	CHA	SCALE N.T.S	FORMAT A1 [A3]
DRAWN	MEH		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.404	0
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

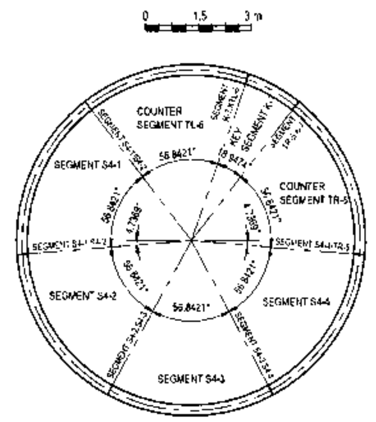
TOP VIEW
MAIN REINFORCEMENT LAYER EXTRADOS



TOP VIEW
MAIN REINFORCEMENT LAYER INTRADOS



KEY PLAN



REFERENCE DRAWINGS :

S.NO.	DRG. NO.	DRAWING NAME
01	08-010/VC/010	SEGMENT S4-1,S4-2,S4-3,S4-4 REINFORCEMENT
02	08-010/VC/010	SEGMENT TR-5
03	08-010/VC/010	SEGMENT TL-6
04	08-010/VC/010	SEGMENT K-7
05	08-010/VC/010	PRECAST CONCRETE LINING
06	08-010/VC/010	PRECAST CONCRETE LINING
07	08-010/VC/010	PRECAST CONCRETE LINING
08	08-010/VC/010	PRECAST CONCRETE LINING

IMPORTANT NOTES :

1. THIS DRAWING IS APPLICABLE FROM CHAINAGE 111.535 (U/S OF NH-30) TO CHAINAGE 111.600 (D/S OF NH 30) OF THE TUNNEL.
2. DURING EXECUTION OF TUNNEL BENEATH THE HIGHWAY & ONE MONTH THEREAFTER, REAL TIME MONITORING OF DEFORMATION OF THE HIGHWAY SHALL BE CARRIED OUT. DEFORMATION MONITORING INSTRUMENTS SHALL BE KEPT ON EACH SIDE OF THE ROAD @5mc/c ALTERNATIVELY AT LEAST UP TO 30m ON EACH SIDE OF TUNNEL. HIGHWAY SHALL IMMEDIATELY BE RESTORED TO ORIGINAL POSITION IF OBSERVED DEFORMATION IS MORE THAN 10mm. IF REQUIRED ADEQUATE GROUND IMPROVEMENT MEASURES SHALL BE IMPLEMENTED ON RECOMMENDATION FROM GEOLOGIST AND ENGINEER-IN-CHARGE IN CASE DEFORMATION IS MORE THAN 10mm.

NOTES :

1. REINFORCEMENT NOTATION

① 1 Ø20
- BAR DIAMETER
- NUMBER OF BAR
- BAR MARK

2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. CONCRETE SHALL BE OF GRADE M50 A20 CONFIRMING TO (IS 456-2000).
4. REINFORCEMENT SHALL BE OF GRADE FE500 CONFIRMING TO (IS 1786).
5. ALL OTHER NOTES MENTIONED IN EARLIER GOOD FOR CONSTRUCTION DRAWING (SEE REFERENCE DRAWING) SHALL BE VALID FOR THIS DRAWING.

REV.No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TR5
REINFORCEMENT
TOP VIEW, (SHEET 1 OF 4)

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ISSUED FOR CONSTRUCTION

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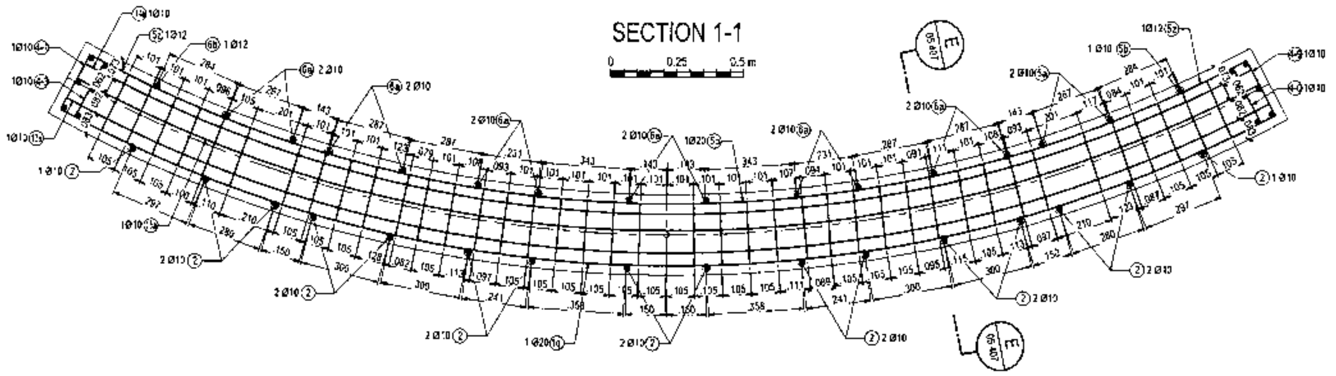
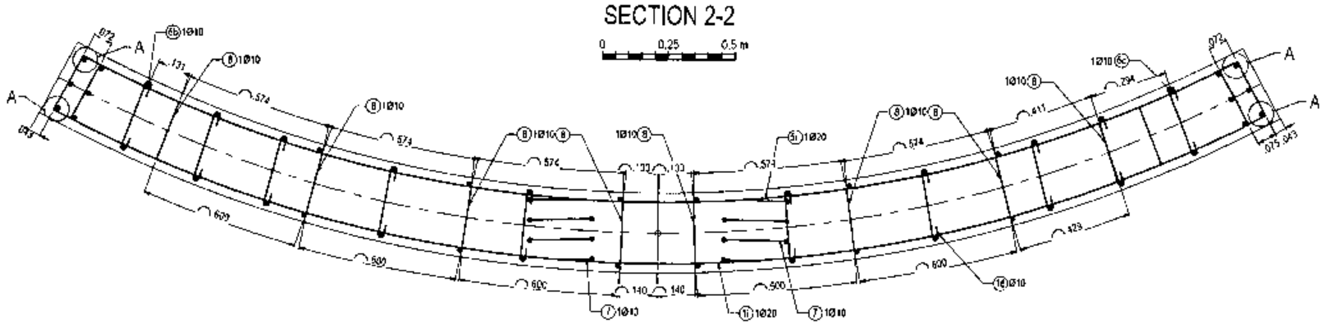
DESIGNED	DHA	SCALE 1:10 (1:20)	FORMAT A1 (A0)
DRAWN	MEH		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.405	0
DATE	25.03.21		

SECTION 1-1

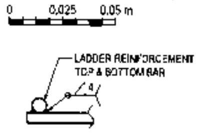


SECTION 2-2



DETAIL- A

(TYP. DETAIL OF LADDER BAR)



NOTES :

1. REINFORCEMENT NOTATION

(1) 1Ø20 — BAR DIAMETER — NUMBER OF BAR — BAR MARK

2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
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26-08-2021

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REV.No	REVISION DESCRIPTION	DRAWN	CHKED	APP'D	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ○ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TR5
REINFORCEMENT
SECTION 1-1 & 2-2 (SHEET 2 OF 4)

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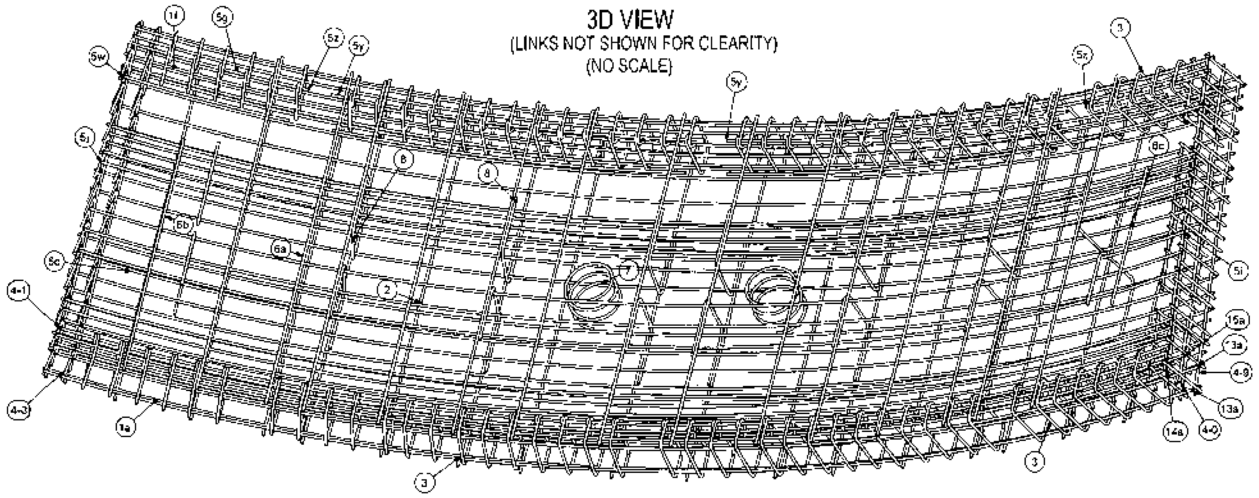
AF POYRY
AFRY India Pvt. Ltd.

DESIGNED	CKA	SCALE 1:10 (1:20 1:10)	FORMAT A1 (A3)
DRAWN	MEH		
CHECKED	TSK	DRAWING No.	REV No.
APPROVED	SSE	AFRY.4686.05.406	0
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

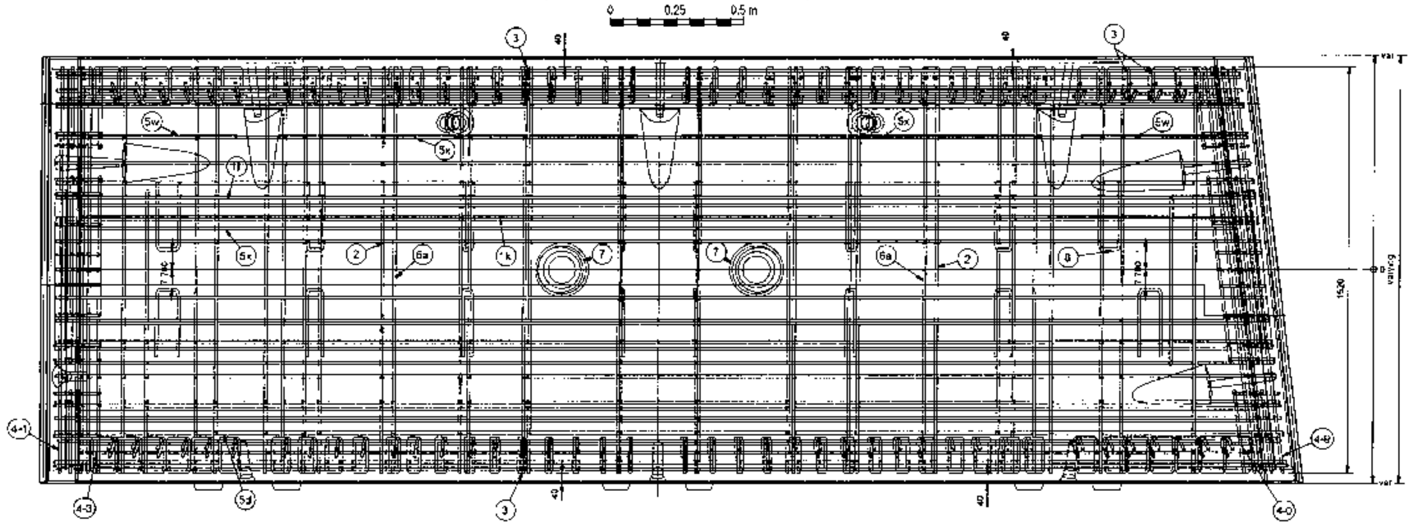
3D VIEW

(LINKS NOT SHOWN FOR CLEARITY)
(NO SCALE)

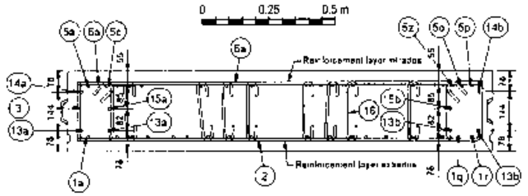


TOP VIEW

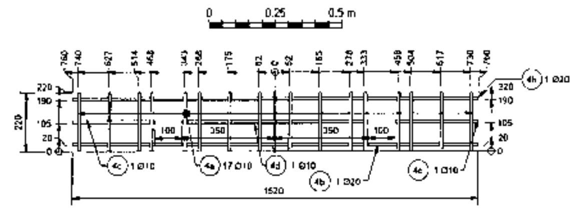
(LINKS NOT SHOWN FOR CLEARITY)



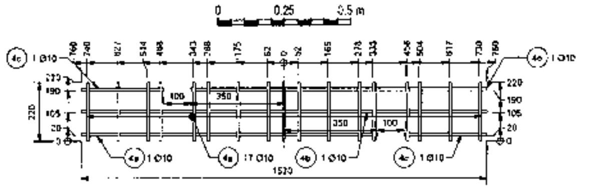
SECTION E-E



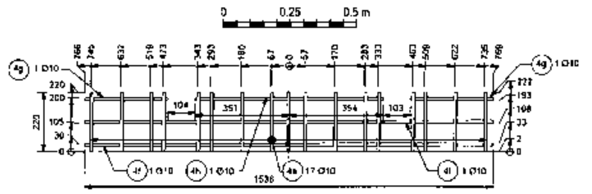
LADDER 4-1



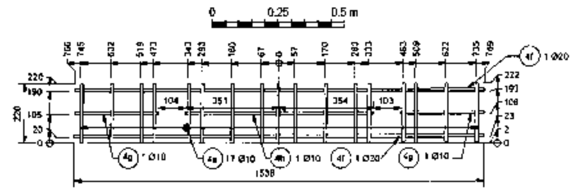
LADDER 4-3



LADDER 4-0



LADDER 4-9



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NOTES :

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- BAR MARK

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REV. №	REVISION DESCRIPTION	DRAWN	CHK'ED	APP'D	DATE

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☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

PATEL-SEW JOINT VENTURE

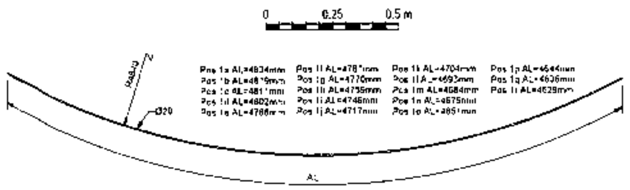
TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TR5
REINFORCEMENT
3D VIEW & SECTIONS (SHEET 3 OF 4)

AFRY
AFRY India Pvt. Ltd.

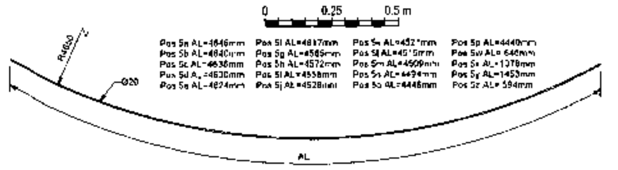
DESIGNED	CHA	SCALE 1:10 (1:20)	FORMAT A1 (A3)
DRAWN	MEP		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.407	0
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

REINFORCEMENT POSITION 1A - 1R

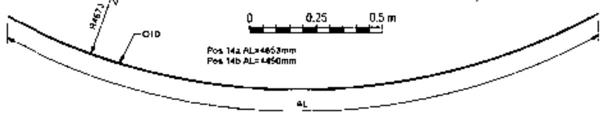


REINFORCEMENT POSITION 5A - 5P, 5W - 5Z



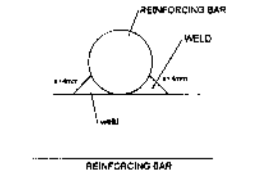
REINFORCEMENT POSITION 13A,B

REINFORCEMENT POSITION 14A,B



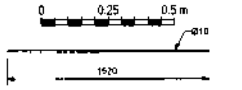
REINFORCEMENT POSITION 15A,B

WELDING REQUIREMENTS

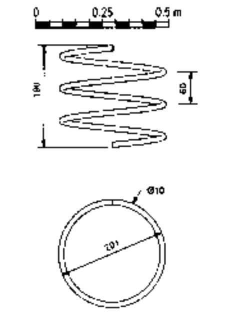


Following reinforcement positions MUST be welded together:
POS 1a- 1r with POS 2
POS 5a- 5p, 5w- 5z with POS 6a- 6c
POS 4a with POS 4b- 4h
Pos 1a-1r and POS 5a-5p, 5w- 5z with Ladder 4-1, Ladder 4-3, Ladder 4-0 and Ladder 4-9
POS 3 with POS 13a,b and Pos 14a,b and Pos 15a,b

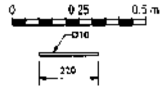
REINFORCEMENT POSITION 2



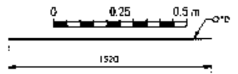
REINFORCEMENT POSITION 7



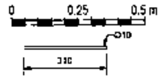
REINFORCEMENT POSITION 4a



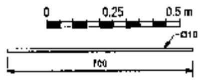
REINFORCEMENT POSITION 4b



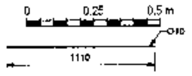
REINFORCEMENT POSITION 4c



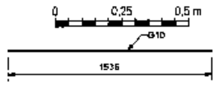
REINFORCEMENT POSITION 4d



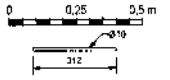
REINFORCEMENT POSITION 4e



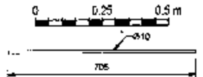
REINFORCEMENT POSITION 4f



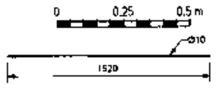
REINFORCEMENT POSITION 4g



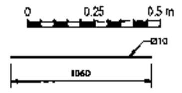
REINFORCEMENT POSITION 4h



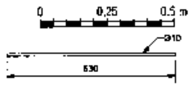
REINFORCEMENT POSITION 6a



REINFORCEMENT POSITION 6b



REINFORCEMENT POSITION 6c



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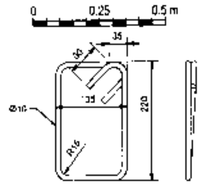
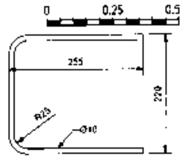
REINFORCEMENT LIST :

POS	NO.	DIA (mm)	Length (m)	Total Length (m)	Weight (Kg)
POS.1a	1	20	4.834	4.83	11.921
POS.1b	1	20	4.819	4.82	11.884
POS.1c	1	20	4.811	4.81	11.864
POS.1d	1	20	4.802	4.80	11.842
POS.1e	1	20	4.788	4.79	11.807
POS.1f	1	20	4.781	4.78	11.793
POS.1g	1	20	4.770	4.77	11.763
POS.1h	1	20	4.755	4.76	11.736
POS.1i	1	20	4.746	4.75	11.704
POS.1j	1	20	4.717	4.72	11.632
POS.1k	1	20	4.704	4.70	11.600
POS.1l	1	20	4.693	4.69	11.573
POS.1m	1	20	4.684	4.68	11.551
POS.1n	1	20	4.675	4.68	11.529
POS.1o	1	20	4.651	4.65	11.469
POS.1p	1	20	4.644	4.64	11.452
POS.1q	1	20	4.636	4.64	11.432
POS.1r	1	20	4.629	4.63	11.415
POS.2	16	10	1.520	24.32	14.993
POS.3	79	10	0.90	71.10	43.833
POS.4a	68	10	0.22	14.95	9.223
POS.4b	3	10	1.52	4.56	2.811
POS.4c	4	10	0.31	1.24	0.764
POS.4d	1	10	0.70	0.70	0.432
POS.4e	2	10	1.11	2.22	1.369
POS.4f	4	10	1.536	6.14	3.788
POS.4g	4	10	0.312	1.25	0.769
POS.4h	2	10	0.705	1.41	0.869
POS.5a	1	20	4.646	4.65	11.457
POS.5b	1	20	4.640	4.64	11.442
POS.5c	1	20	4.636	4.64	11.432
POS.5d	1	20	4.630	4.63	11.418
POS.5e	1	20	4.624	4.62	11.403
POS.5f	1	20	4.617	4.62	11.385
POS.5g	1	20	4.585	4.59	11.307
POS.5h	1	20	4.572	4.57	11.275
POS.5i	1	20	4.558	4.56	11.240
POS.5j	1	20	4.528	4.53	11.166
POS.5k	1	20	4.521	4.52	11.149
POS.5l	1	20	4.515	4.52	11.134
POS.5m	1	20	4.509	4.51	11.119
POS.5n	1	20	4.494	4.49	11.082
POS.5o	1	20	4.446	4.45	10.964
POS.5p	1	20	4.440	4.44	10.949
POS.5w	2	20	0.646	1.29	3.186
POS.5x	2	20	1.378	2.76	6.798
POS.5y	2	20	1.453	2.91	7.166
POS.5z	2	20	0.594	1.19	2.930
POS.6a	14	10	1.520	21.28	13.119
POS.6b	1	10	1.060	1.06	0.653
POS.6c	1	10	0.630	0.63	0.388
POS.7	2	10	2.2481	4.50	2.772
POS.8	16	10	0.730	11.68	7.201
POS.13a	2	10	4.7980	9.60	5.916
POS.13b	2	10	4.602	9.20	5.674
POS.14a	1	10	4.653	4.65	2.869
POS.14b	1	10	4.450	4.45	2.743
POS.15a	1	10	4.715	4.72	2.907
POS.15b	1	10	4.536	4.54	2.796
POS.16	80	10	0.340	27.20	16.769
				TOTAL	552.622

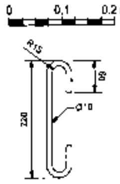
REINFORCEMENT POSITION 3



REINFORCEMENT POSITION 8



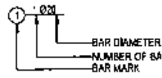
REINFORCEMENT POSITION 16



Min. cube strength [N/mm²]	50	
Max. grain size [mm]	32	
Concrete cover [mm]	40	
Segment Volume [m³]	2,25	
Reinforcement quality	Fe500	IS 1786: 2008
Min. tensile strength [N/mm²]	500	
Minimum bending radius [mm]	15	
Reinforcement weight [kg]	552,622	
Reinforcement weight [kg/m³]	245,609	

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.405.

REV No	REVISION DESCRIPTION	DRAWN	CHKED	APP'D	DATE

○ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
○ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

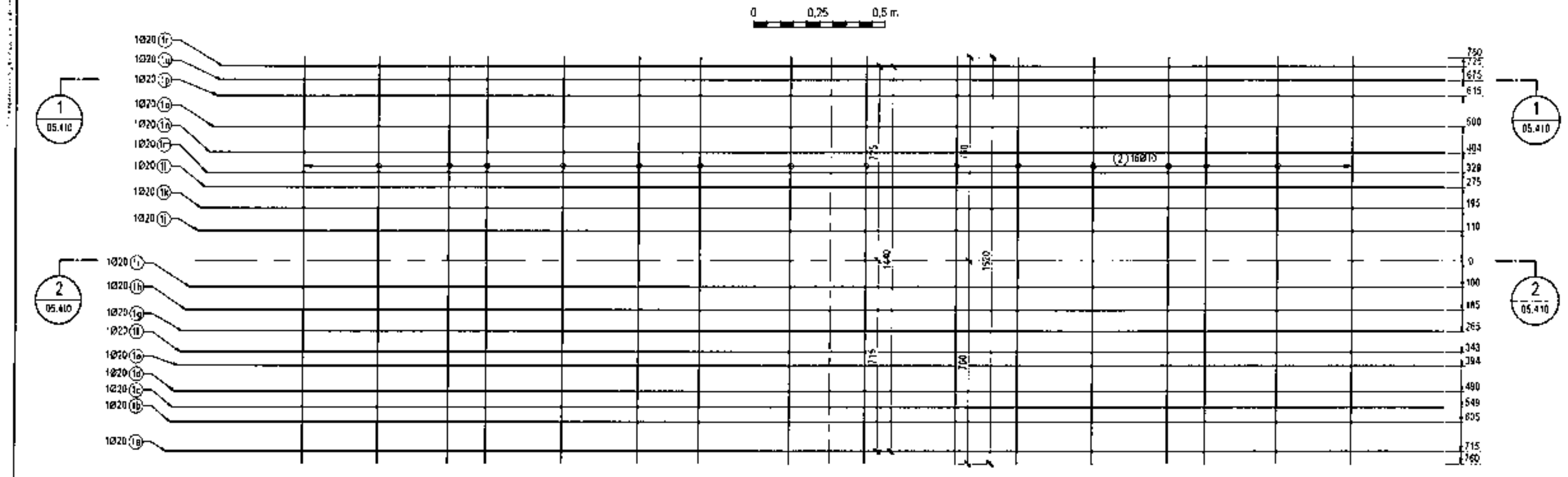
TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TR5
REINFORCEMENT
BARS DETAILS (SHEET 4 OF 4)

AFRY
AFRY India Pvt. Ltd.

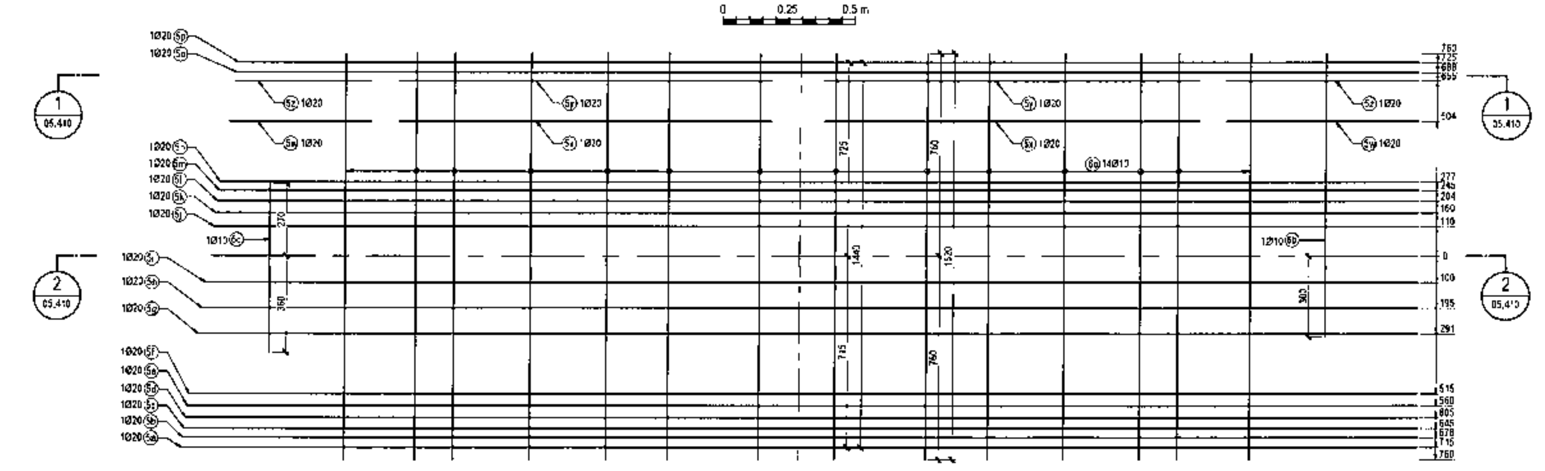
DESIGNED	CHA	SCALE NTS	FORMAT A1 (A3)
DRAWN	MBP		
CHECKED	TSK	DRAWING No.	REV. No
APPROVED	SSE	AFRY.4686.05.408	0
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

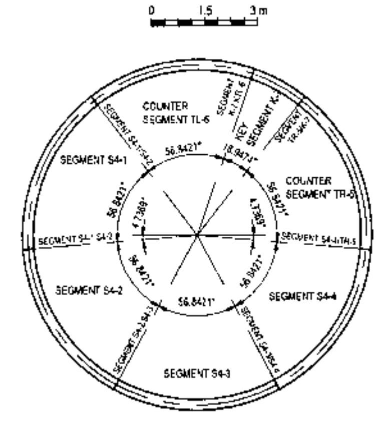
TOP VIEW
MAIN REINFORCEMENT LAYER EXTRADOS



TOP VIEW
MAIN REINFORCEMENT LAYER INTRADOS



KEY PLAN



REFERENCE DRAWINGS :

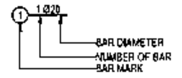
S.NO.	DRG. NO.	DRAWING NAME
01	08-010/WC/010	SEGMENT S4-1,S4-2,S4-3,S4-4 REINFORCEMENT
02	08-010/WC/010	SEGMENT TR-5
03	08-010/WC/010	SEGMENT TL-6
04	08-010/WC/010	SEGMENT K-7
05	08-010/WC/010	PRECAST CONCRETE LINING
06	08-010/WC/010	PRECAST CONCRETE LINING
07	08-010/WC/010	PRECAST CONCRETE LINING
08	08-010/WC/010	PRECAST CONCRETE LINING

IMPORTANT NOTES :

1. THIS DRAWING IS APPLICABLE FROM CHAINAGE 111.535 (U/S OF NH30) TO CHAINAGE 111.600 (D/S OF NH 30) OF THE TUNNEL.
2. DURING EXECUTION OF TUNNEL BENEATH THE HIGHWAY & ONE MONTH THEREAFTER, REAL TIME MONITORING OF DEFORMATION OF THE HIGHWAY SHALL BE CARRIED OUT. DEFORMATION MONITORING INSTRUMENTS SHALL BE KEPT ON EACH SIDE OF THE ROAD @5mc/c ALTERNATIVELY AT LEAST UP TO 30m ON EACH SIDE OF TUNNEL HIGHWAY SHALL IMMEDIATELY BE RESTORED TO ORIGINAL POSITION IF OBSERVED DEFORMATION IS MORE THAN 10mm. IF REQUIRED ADEQUATE GROUND IMPROVEMENT MEASURES SHALL BE IMPLEMENTED ON RECOMMENDATION FROM GEOLOGIST AND ENGINEER-IN-CHARGE IN CASE DEFORMATION IS MORE THAN 10mm.

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. CONCRETE SHALL BE OF GRADE M50 A20 CONFIRMING TO (IS 456 2000).
4. REINFORCEMENT SHALL BE OF GRADE FE500 CONFIRMING TO (IS 1786).
5. ALL OTHER NOTES MENTIONED IN EARLIER GOOD FOR CONSTRUCTION DRAWING (SEE REFERENCE DRAWING) SHALL BE VALID FOR THIS DRAWING.

REV.No.	REVISION DESCRIPTION	DRAWN	CH.KED	APP'D	DATE

☐ PREFEASIBILITY STUDY ☐ NCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TL-6
REINFORCEMENT
TOP VIEW (SHEET 1 OF 4)

AFRY India Pvt. Ltd.

DESIGNED	CHA	SCALE 1:10 (1:20)	FORMAT A1 (A3)
DRAWN	SCJ		
CHECKED	TSK	DRAWING No. AFRY.4686.05.409	REV No. 0
APPROVED	SSE		
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

Bappaditya Manna
25-08-2021

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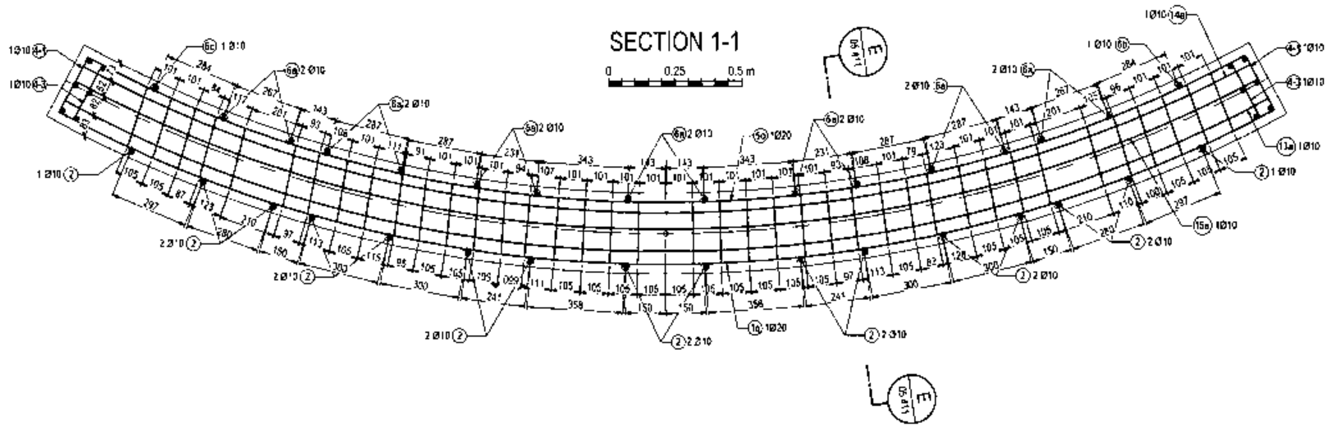
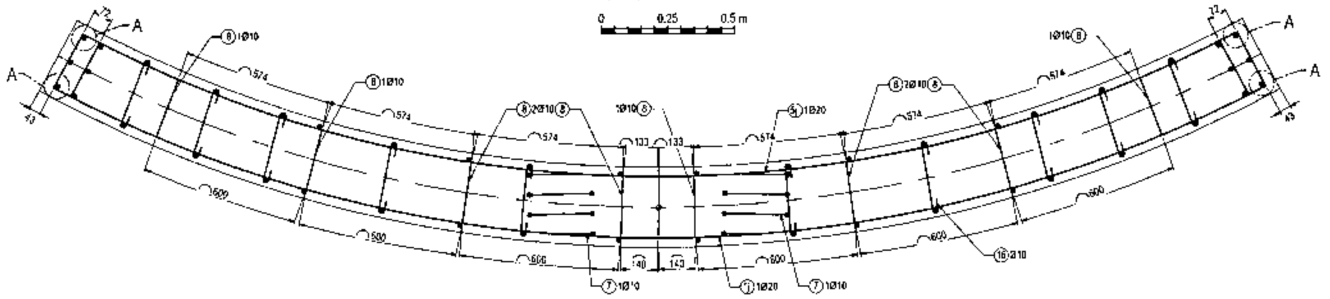
SECTION 1-1

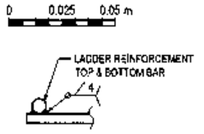


SECTION 2-2



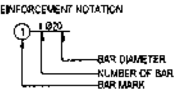
DETAIL- A

(TYP. DETAIL OF LADDER BAR)



NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.409.

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26-08-2021

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ISSUED FOR CONSTRUCTION

REV.No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PRE-FEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMANABAD WATER TUNNEL PROJECT

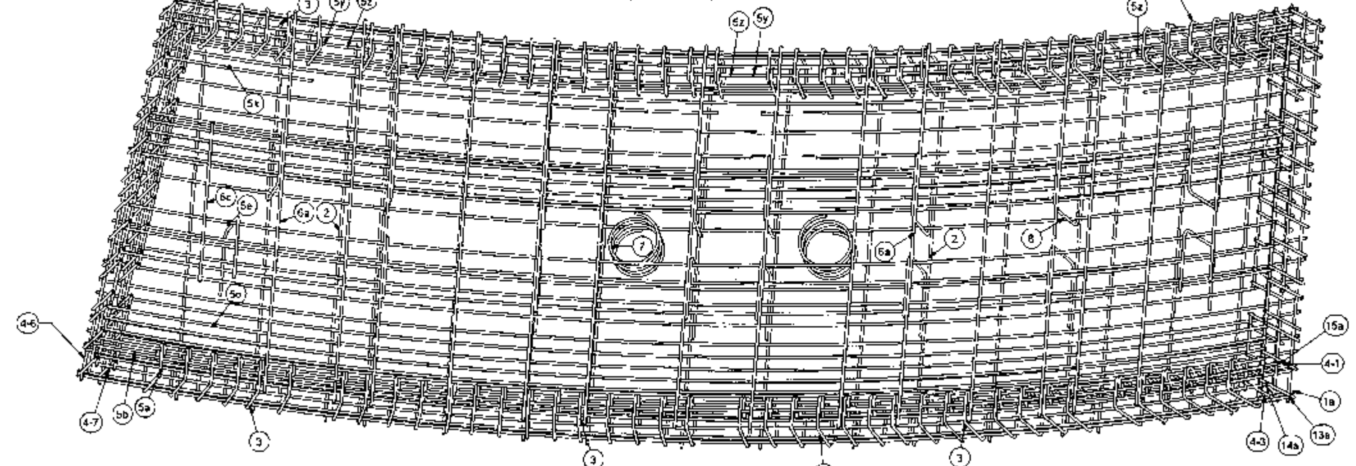
Patel PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TL-6
REINFORCEMENT
SECTION 1-1 & 2-2 (SHEET 2 OF 4)

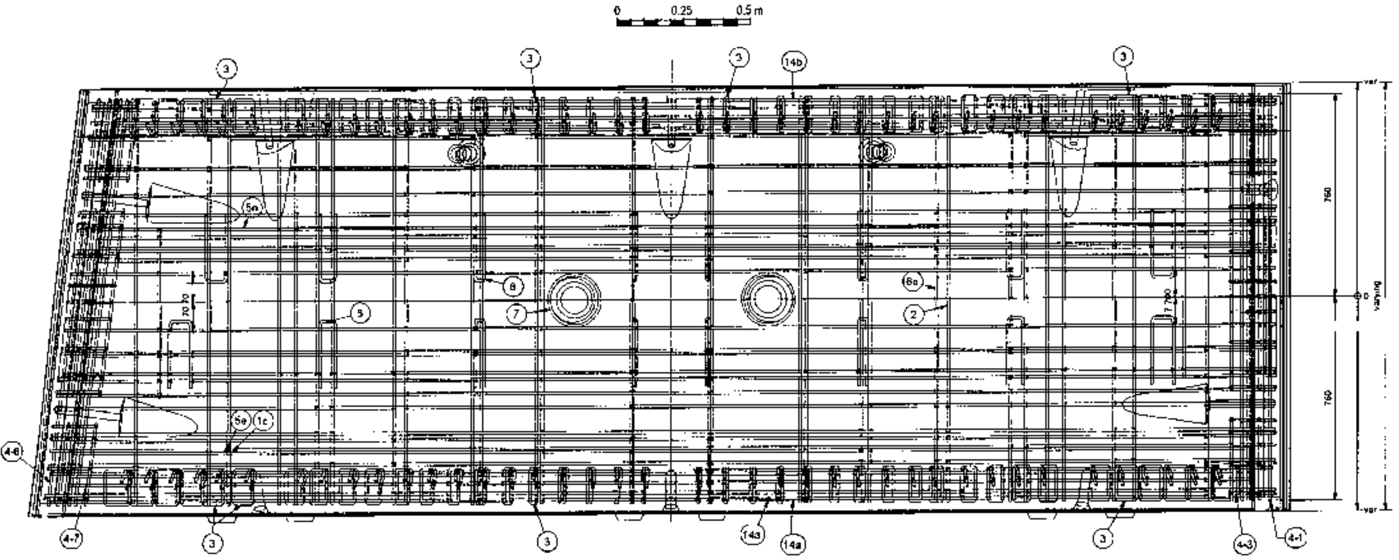
AFRY
AFRY India Pvt. Ltd.

DESIGNED CHA	SCALE 1:10 / 1:5 (1:20, 1:10)	FORMAT A1 (A3)	
DRAWN SGL			
CHECKED TSK	DRAWING No.		REV. No.
APPROVED SSE	AFRY.4686.05.410		0
DATE 25.08.21			

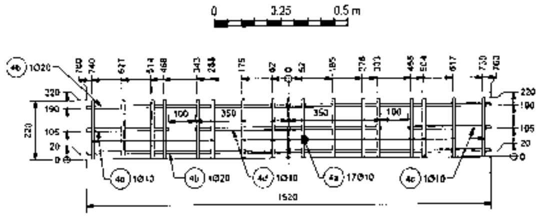
3D VIEW
(LINKS NOT SHOWN FOR CLEARITY)
(NO SCALE)



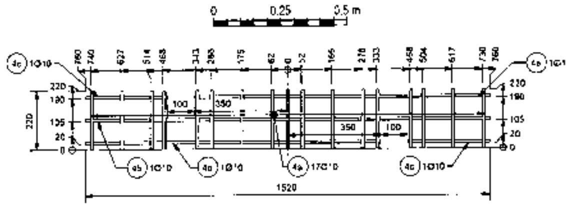
TOP VIEW
(LINKS NOT SHOWN FOR CLEARITY)



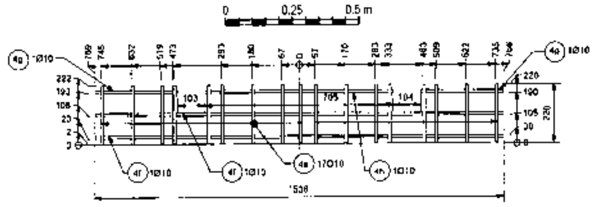
LADDER 4-1



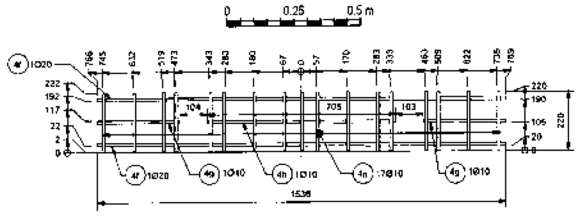
LADDER 4-3

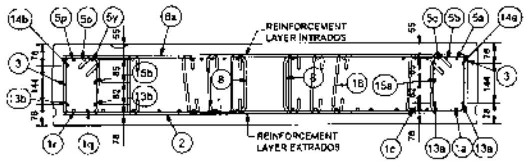


LADDER 4-7



LADDER 4-6





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26-08-2021

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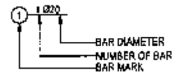
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi 110016 (India)

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.409.

ISSUED FOR CONSTRUCTION

REV.No.	REVISION DESCRIPTION	DRAWN	CH'KED	APP'D	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

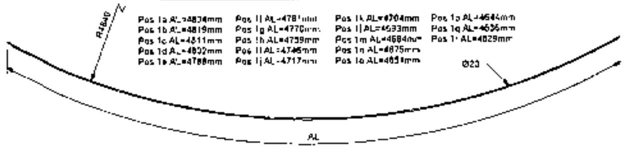
Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TL-6
REINFORCEMENT
3D VIEW & SECTIONS (SHEET 3 OF 4)

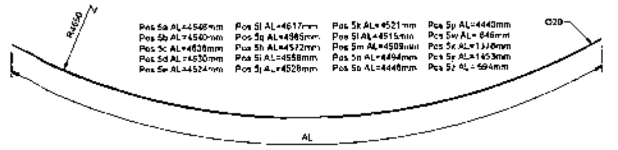
AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHV	SCALE 1:10 (1:20)	FORMAT A1 (A3)
DRAWN	SGJ		
CHECKED	TSK	DRAWING No.	REV. No
APPROVED	SSE	AFRY.4686.05.411	0
DATE	25.08.21		

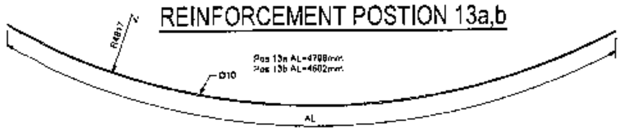
REINFORCEMENT POSTION 1a - 1r



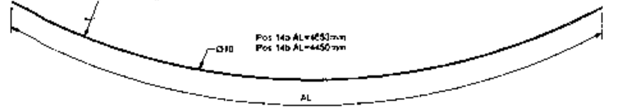
REINFORCEMENT POSTION 5a - 5p, 5w - 5z



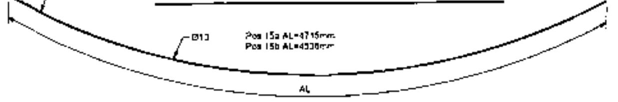
REINFORCEMENT POSTION 13a,b



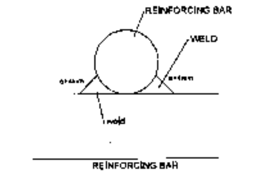
REINFORCEMENT POSTION 14a,b



REINFORCEMENT POSTION 15a,b

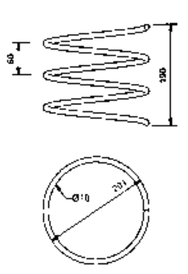


WELDING REQUIREMENTS

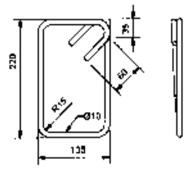


Following reinforcement positions MUST be welded together:
POS 1a- 1r with POS 2
POS 5a- 5p and Pos 5w- 5z with POS 6a- 6c
POS 4a with POS 4b- 4h
POS 1a- 1r, POS 5a- 5r with Ladder 4-1, Ladder 4-3, Ladder 4-7, Ladder 4-6
POS 3 with POS 13a,b and POS 14a,b and POS 15a,b

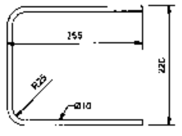
REINFORCEMENT POSTION 7



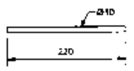
REINFORCEMENT POSTION 3



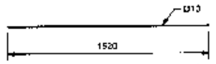
REINFORCEMENT POSTION 8



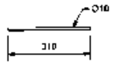
REINFORCEMENT POSTION 4a



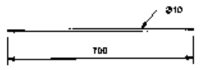
REINFORCEMENT POSTION 4b



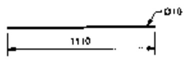
REINFORCEMENT POSTION 4c



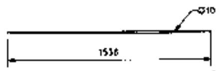
REINFORCEMENT POSTION 4d



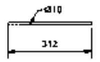
REINFORCEMENT POSTION 4e



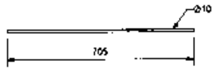
REINFORCEMENT POSTION 4f



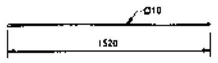
REINFORCEMENT POSTION 4g



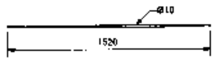
REINFORCEMENT POSTION 4h



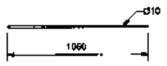
REINFORCEMENT POSTION 2



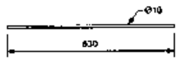
REINFORCEMENT POSTION 6a



REINFORCEMENT POSTION 6b



REINFORCEMENT POSTION 6c

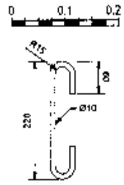


REINFORCEMENT LIST :

POS	NO.	DIA (mm)	LENGTH (m)	TOTAL LENGTH (m)	WEIGHT (Kg)
POS.1a	1	20	4.834	4.834	11.921
POS.1b	1	20	4.819	4.819	11.884
POS.1c	1	20	4.811	4.811	11.864
POS.1d	1	20	4.802	4.802	11.842
POS.1e	1	20	4.788	4.788	11.807
POS.1f	1	20	4.781	4.781	11.790
POS.1g	1	20	4.770	4.770	11.763
POS.1h	1	20	4.759	4.759	11.736
POS.1i	1	20	4.748	4.748	11.709
POS.1j	1	20	4.717	4.717	11.632
POS.1k	1	20	4.704	4.704	11.600
POS.1l	1	20	4.693	4.693	11.573
POS.1m	1	20	4.684	4.684	11.551
POS.1n	1	20	4.675	4.675	11.528
POS.1o	1	20	4.651	4.651	11.469
POS.1p	1	20	4.644	4.644	11.452
POS.1q	1	20	4.636	4.636	11.432
POS.1r	1	20	4.629	4.629	11.415
POS.2	16	10	1.520	24.320	14.993
POS.3	79	10	0.900	71.100	43.833
POS.4a	188	10	0.220	41.360	25.498
POS.4b	3	10	1.520	4.56	2.811
POS.4c	4	10	0.310	1.24	0.764
POS.4d	1	10	0.700	0.700	0.432
POS.4e	2	10	1.110	2.220	1.369
POS.4f	4	10	1.536	6.144	3.788
POS.4g	4	10	0.312	1.248	0.769
POS.4h	2	10	0.705	1.410	0.869
POS.5a	1	20	0.646	0.646	1.593
POS.5b	1	20	4.640	4.640	11.442
POS.5c	1	20	4.636	4.635	11.432
POS.5d	1	20	4.630	4.630	11.418
POS.5e	1	20	4.624	4.524	11.403
POS.5f	1	20	4.617	4.517	11.385
POS.5g	1	20	4.585	4.585	11.307
POS.5h	1	20	4.572	4.572	11.275
POS.5i	1	20	4.558	4.558	11.240
POS.5j	1	20	4.529	4.528	11.168
POS.5k	1	20	4.521	4.521	11.149
POS.5l	1	20	4.515	4.515	11.134
POS.5m	1	20	4.509	4.509	11.119
POS.5n	1	20	4.494	4.494	11.082
POS.5o	1	20	4.446	4.448	10.964
POS.5p	1	20	4.440	4.440	10.949
POS.5w	2	20	0.646	1.292	3.156
POS.5x	2	20	1.378	2.756	6.796
POS.5y	2	20	1.453	2.906	7.156
POS.5z	2	20	0.594	1.188	2.930
POS.6a	14	10	1.520	21,280	13.119
POS.6b	1	10	0.060	0.060	0.037
POS.6c	1	10	0.630	0.630	0.388
POS.7	2	10	2.248	4.496	2.772
POS.8	20	10	0.730	14.600	9.001
POS.13a	2	10	4.789	9.596	5.916
POS.13b	2	10	4.602	9.204	5.674
POS.14a	1	10	4.653	4.653	2.869
POS.14b	1	10	4.450	4.450	2.743
POS.15a	1	10	4.715	4.715	2.907
POS.15b	1	10	5.536	5.536	3.413
POS.16	80	10	0.340	27.20	16.769
				TOTAL	560.839

Min. cube strength (N/mm²)	50	
Max. grain size (mm)	32	
Concrete cover (mm)	40	
Segment Volume (m³)	2.25	
Reinforcement quality	Fe500	IS 1786: 2008
Min. tensile strength (N/mm²)	500	
Minimum bending radius (mm)	15	
Reinforcement weight (kg)	560.839	
Reinforcement weight (kg/m³)	249.261	

REINFORCEMENT POSITION 16

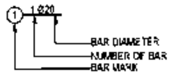


Bappaditya Manna
26-08-2021

Dr. Bappaditya Manna
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016 (India)

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.409.

REV. No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW
PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
COUNTER SEGMENT TL-6
REINFORCEMENT
BAR DETAILS (SHEET 4 OF 4)

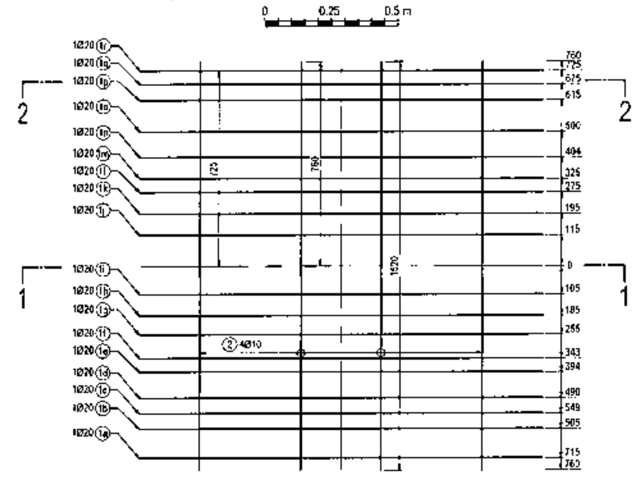
AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHA	SCALE N.T.S	FORMAT A1 (A3)
DRAWN	SCJ		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.412	0
DATE	23.08.21		

ISSUED FOR CONSTRUCTION

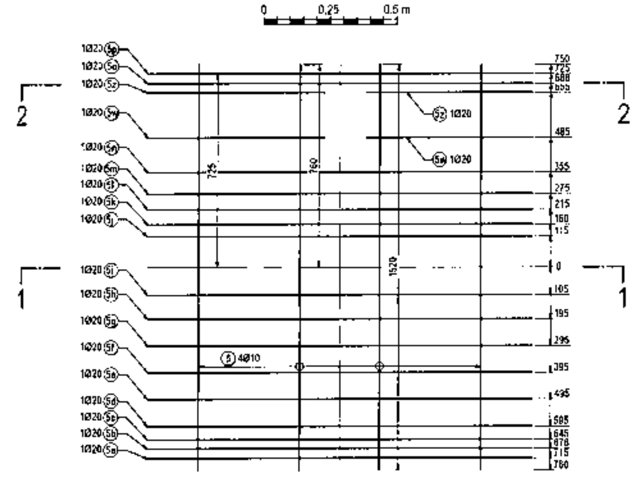
TOP VIEW

(MAIN REINFORCEMENT LAYER EXTRADOS)

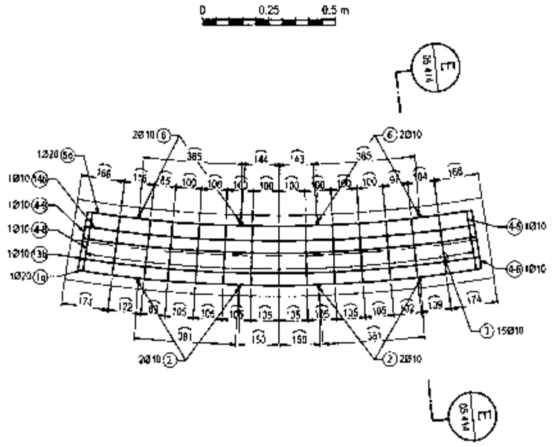


TOP VIEW

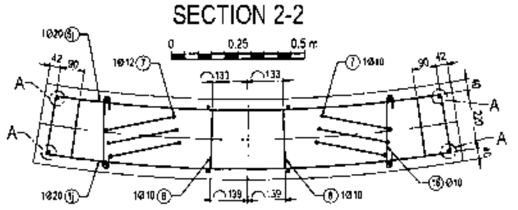
(MAIN REINFORCEMENT LAYER INTRADOS)



SECTION 1-1

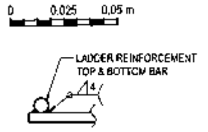


SECTION 2-2

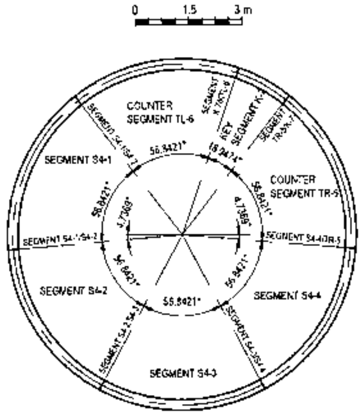


DETAIL- A

(TYP. DETAIL OF LADDER BAR)



KEY PLAN



REFERENCE DRAWINGS :

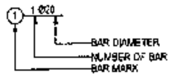
S.NO.	DRG. NO.	DRAWING NAME
01	C6-010/VC/010	SEGMENT S4-1,S4-2 S4-3,S4-4 REINFORCEMENT
02	C6-010/VC/010	SEGMENT TR-6
03	C6-010/VC/010	SEGMENT TL-6
04	C6-010/VC/010	SEGMENT K-7
05	C6-010/VC/010	PRECAST CONCRETE LINING
06	C6-010/VC/010	PRECAST CONCRETE LINING
07	C6-010/VC/010	PRECAST CONCRETE LINING
08	C6-010/VC/010	PRECAST CONCRETE LINING

IMPORTANT NOTES :

1. THIS DRAWING IS APPLICABLE FROM CHAINAGE 111.535 (U/S OF NH30) TO CHAINAGE 111.600 (D/S OF NH 30) OF THE TUNNEL.
2. DURING EXECUTION OF TUNNEL BENEATH THE HIGHWAY & ONE MONTH THEREAFTER, REAL TIME MONITORING OF DEFORMATION OF THE HIGHWAY SHALL BE CARRIED OUT. DEFORMATION MONITORING INSTRUMENTS SHALL BE KEPT ON EACH SIDE OF THE ROAD @5m c/c ALTERNATIVELY AT LEAST UP TO 30m ON EACH SIDE OF TUNNEL. HIGHWAY SHALL IMMEDIATELY BE RESTORED TO ORIGINAL POSITION IF OBSERVED DEFORMATION IS MORE THAN 10mm. IF REQUIRED ADEQUATE GROUND IMPROVEMENT MEASURES SHALL BE IMPLEMENTED ON RECOMMENDATION FROM GEOLOGIST AND ENGINEER-IN-CHARGE IN CASE DEFORMATION IS MORE THAN 10mm.

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. CONCRETE SHALL BE OF GRADE M50 A20 CONFIRMING TO (IS 456-2000).
4. REINFORCEMENT SHALL BE OF GRADE FE500 CONFIRMING TO (IS 1786).
5. ALL OTHER NOTES MENTIONED IN EARLIER GOOD FOR CONSTRUCTION DRAWING (SEE REFERENCE DRAWING) SHALL BE VALID FOR THIS DRAWING.

REV. No	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PRE-FEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ☒ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
KEY SEGMENT K-7
REINFORCEMENT
TOP VIEW, SECTION 1-1 & 2-2 (SHEET 1 OF 3)

AFRY
AFRY India Pvt. Ltd.

DESIGNED	CHA	SCALE 1:10 (1:5	FORMAT A1
DRAWN	SCJ	1:20 (1:10)	(A3)
CHECKED	FSK	DRAWING No.	REV. No
APPROVED	SSE	AFRY.4686.05.413	0
DATE	25.08.21		

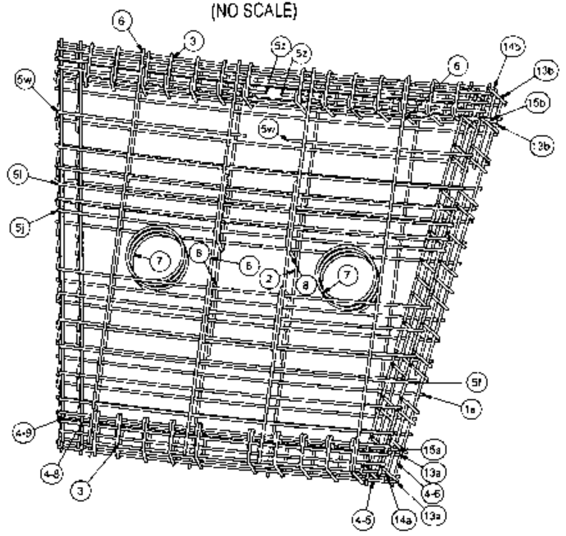
ISSUED FOR CONSTRUCTION

Bappaditya Manna
25-08-2021

Dr. Bappaditya Manna
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016 (India)

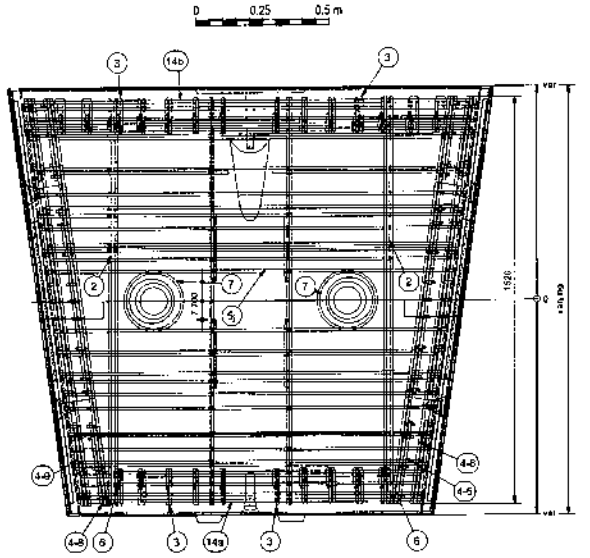
3D VIEW

(LINKS NOT SHOWN FOR CLEARITY)
(NO SCALE)

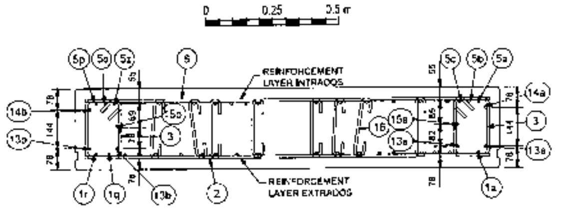


TOP VIEW

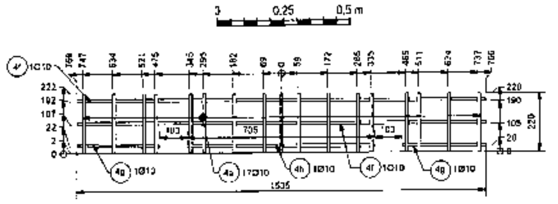
(LINKS NOT SHOWN FOR CLEARITY)



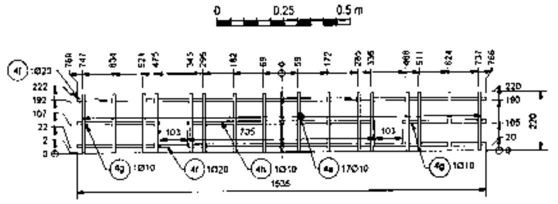
SECTION E-E



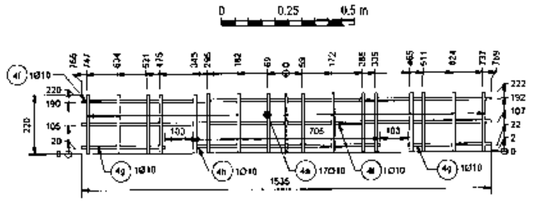
LADDER 4-5



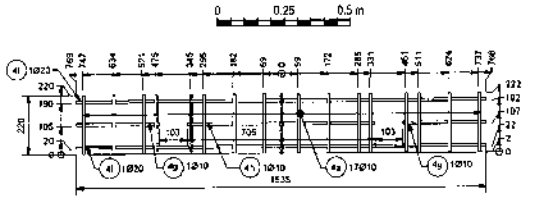
LADDER 4-6



LADDER 4-8



LADDER 4-9



26-08-2022

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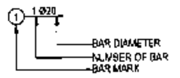
Hauz Khas, New Delhi-110016 (India)

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.413.

REV. No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PREFEASIBILITY STUDY ☐ INCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

PATEL-SEW JOINT VENTURE

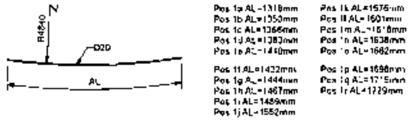
TUNNEL LINING PASSING UNDER NH 30
KEY SEGMENT K-7
REINFORCEMENT
3D VIEW & SECTIONS (SHEET 2 OF 3)

AFRY
AFRY India Pvt. Ltd.

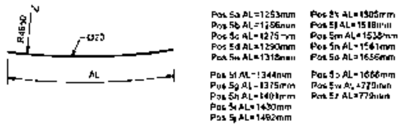
DESIGNED	CHA	SCALE 1:10	FORMAT	A1
DRAWN	SCJ	1:20		(A3)
CHECKED	TSK	DRAWING No.	REV. No.	
APPROVED	SSE	AFRY.4686.05.414	0	
DATE	25.08.21			

ISSUED FOR CONSTRUCTION

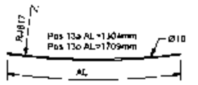
REINFORCEMENT POSTION 1a - 1r



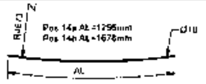
REINFORCEMENT POSTION 5a - 5p, 5w - 5z



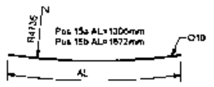
REINFORCEMENT POSTION 13a,b



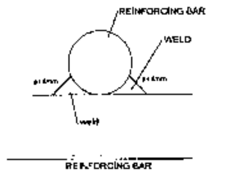
REINFORCEMENT POSTION 14a,b



REINFORCEMENT POSTION 15a,b



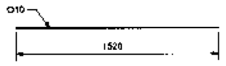
WELDING REQUIREMENTS



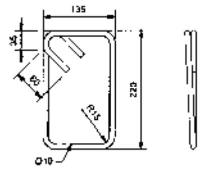
Following reinforcement positions
MUST be welded together:
POS 1a- 1j, 1n- 1r with POS 2
POS 5a- 5p, 5w, 5z with POS 6
POS 4a with POS 4f- 4h
POS 1a- 1r and POS 5a- 5p, 5w, 5z with Ladder 4-5, Ladder 4-6, Ladder 4-8, Ladder 4-9
Pos 3 with Pos 13a,b, Pos 14a,b and Pos 15a,b

Min. cube strength [N/mm²]	50	
Max. grain size [mm]	32	
Concrete cover [mm]	40	
Segment Volume [m³]	0.75	
Reinforcement quality	Fe500	IS 1786-2008
Min. tensile strength [N/mm²]	500	
Minimum bending radius [mm]	15	
Reinforcement weight [kg]	184.243	
Reinforcement weight [kg/m³]	245.657	

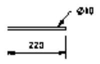
REINFORCEMENT POSTION 2



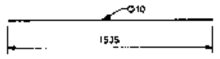
REINFORCEMENT POSTION 3



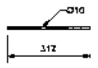
REINFORCEMENT POSTION 4a



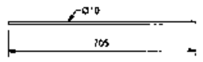
REINFORCEMENT POSTION 4f



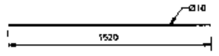
REINFORCEMENT POSTION 4g



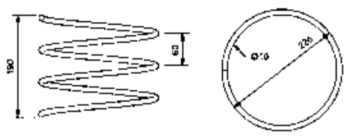
REINFORCEMENT POSTION 4h



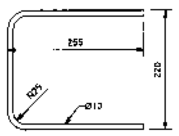
REINFORCEMENT POSTION 6



REINFORCEMENT POSTION 7



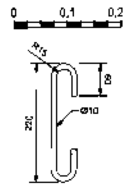
REINFORCEMENT POSTION 8



REINFORCEMENT LIST :

PCS	NO.	DIA (mm)	LENGTH (m)	TOTAL LENGTH (m)	WEIGHT (Kg)
POS.1a	1	20	1.318	1.318	3.250
POS.1b	1	20	1,350	1,350	3.329
POS.1c	1	20	1,366	1.366	3.369
POS.1d	1	20	1.383	1.383	3,410
POS.1e	1	20	1.410	1.410	3,477
POS.1f	1	20	1.422	1,422	3.507
POS.1g	1	20	1,444	1.444	3.561
POS.1h	1	20	1.467	1.467	3.618
POS.1i	1	20	1.489	1.489	3.672
POS.1j	1	20	1.552	1.552	3.827
POS.1k	1	20	1,576	1.576	3.886
POS.1l	1	20	1,601	1.601	3.948
POS.1m	1	20	1,618	1.618	3.990
POS.1n	1	20	1.636	1.636	4.034
POS.1o	1	20	1.662	1.662	4.098
POS.1p	1	20	1.698	1.698	4.187
POS.1q	1	20	1.715	1.715	4.229
POS.1r	1	20	1.729	1.729	4.264
POS.2	4	10	1,520	6,080	3.748
POS.3	15	10	0.900	12.600	7.768
POS.4a	58	10	0.220	14.960	9.223
POS.4f	8	10	1,535	12.280	7.571
POS.4g	8	10	0,312	2,496	1.539
POS.4h	4	10	0.705	2.820	1.739
POS.5a	1	20	1.253	1.253	3.090
POS.5b	1	20	1.266	1.266	3.122
POS.5c	1	20	1.275	1.275	3.144
POS.5d	1	20	1.290	1.290	3.181
POS.5e	1	20	1,318	1.318	3.250
POS.5f	1	20	1.344	1,344	3.314
POS.5g	1	20	1,375	1.375	3.391
POS.5h	1	20	1.401	1.401	3.455
POS.5i	1	20	1.430	1,430	3,526
POS.5j	1	20	1,492	1,492	3.679
POS.5k	1	20	1.505	1.505	3.711
POS.5l	1	20	1.518	1,518	3,743
POS.5m	1	20	1.538	1.538	3.793
POS.5n	1	20	1.561	1.561	3.849
POS.5o	1	20	1.656	1.656	4.084
POS.5p	1	20	1.666	1.666	4.108
POS.5w	2	20	0.729	1.458	3.595
POS.5z	2	20	0,779	1.558	3.842
POS.6	4	10	1,520	6.080	3.748
POS.7	2	10	2.248	4.496	2,772
POS.8	4	10	0,730	2,920	1.800
POS.13a	2	10	1.304	2.608	1.608
POS.13b	2	10	1.708	3.416	2.107
POS.14a	1	10	1,256	1,256	0.774
POS.14b	1	10	1,678	1.678	1.034
POS.15a	1	10	1.306	1.306	0.805
POS.15b	1	10	1,672	1,672	1,031
POS.16	80	10	0,340	27.20	16.769
				TOTAL	184.243

REINFORCEMENT POSITION 16

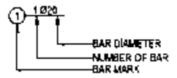


Bappaditya Manna
26-08-2021

Dr. Bappaditya Manna
Professor
Department of Civil Engineering
Indian Institute of Technology Delhi
Hauz Khas, New Delhi-110016 (India)

NOTES :

1. REINFORCEMENT NOTATION



2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
3. FOR OTHER NOTES AND REFERENCES REFER DWG. NO. AFRY.4686.05.413.

REV.No.	REVISION DESCRIPTION	DRAWN	CHKED	APPD	DATE

☐ PREFEASIBILITY STUDY ☐ CONCEPT. & BASIC DESIGN ■ CONSTRUCTION DESIGN
☐ FEASIBILITY STUDY ☐ TENDER DESIGN ☐ AS-BUILT DRAWINGS

SLEEMNABAD WATER TUNNEL PROJECT

Patel SEW
PATEL-SEW JOINT VENTURE

TUNNEL LINING PASSING UNDER NH 30
KEY SEGMENT K-7
REINFORCEMENT
BAR DETAILS (SHEET 3 OF 3)

AFRY
AFRY India Pvt. Ltd.

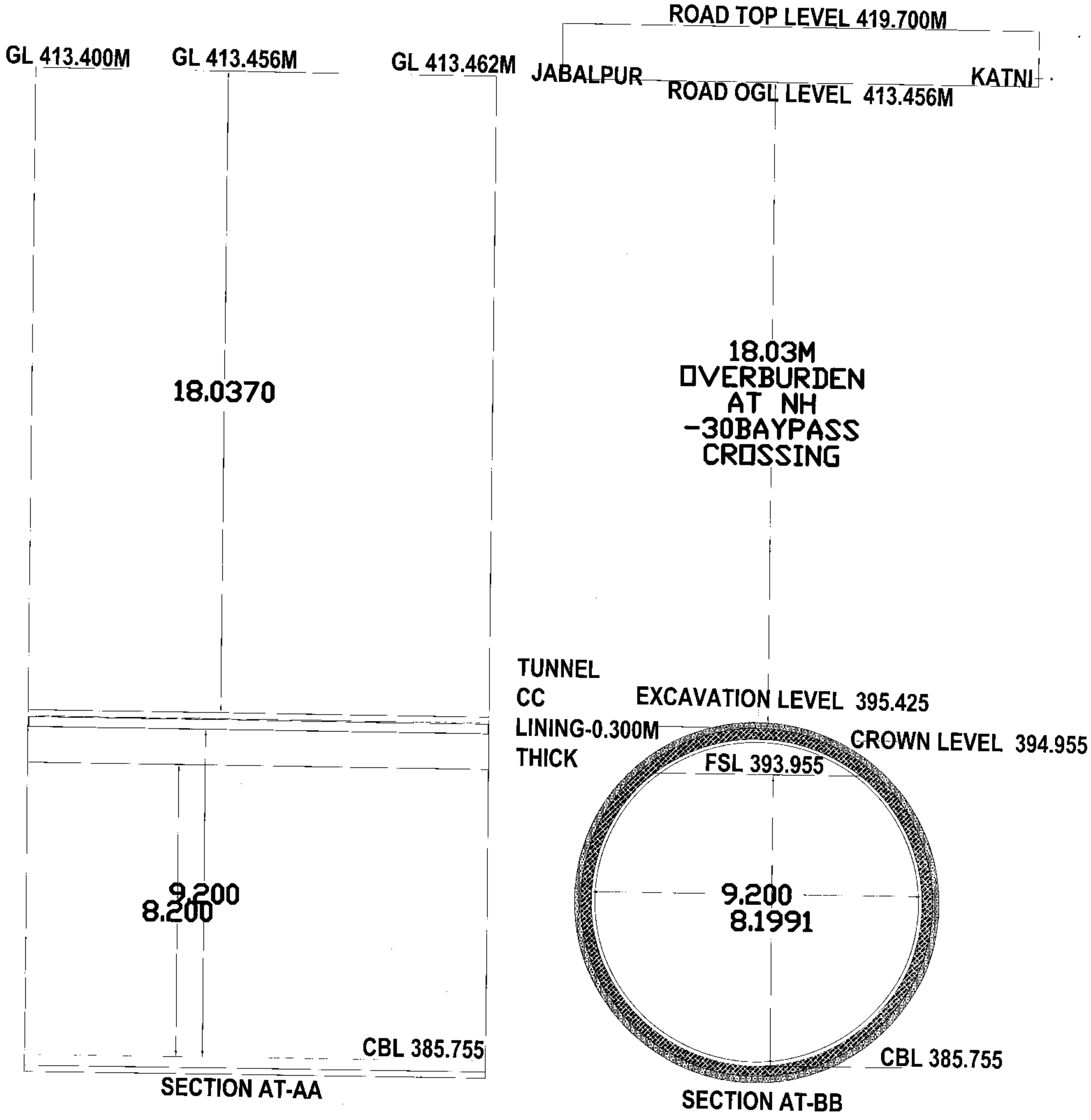
DESIGNED	CHA	SCALE N.T.S (1:20)	FORMAT A1 (A3)
DRAWN	SCU		
CHECKED	TSK	DRAWING No.	REV. No.
APPROVED	SSE	AFRY.4686.05.415	0
DATE	25.08.21		

ISSUED FOR CONSTRUCTION

Assistant Engineer (F-13)
N.D. Division No. 5
KATNI (M.P.)

Executive Engineer
N.D. Division No.-5, Katni

Chief Engineer,
Upper Narmada Zone,
Jabalpur, (M. P.)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GL 413.456M
GL 413.462M
18.0370
9.200
8.200
CBL 385.755
SECTION AT-AA
ROAD TOP LEVEL 419.700M
JABALPUR
ROAD OGL LEVEL 413.456M
KATNI
18.03M OVERBURDEN AT NH -30BAYPASS CROSSING
TUNNEL
CC
LINING-0.300M
THICK
EXCAVATION LEVEL 395.425
CROWN LEVEL 394.955
FSL 393.955
9.200
8.1991
CBL 385.755
SECTION AT-BB