

**Section VII-11: Tender Drawings and Documents**

**A- Tender Drawings**

**B- Tender Documents**

## Section VII-11

### A: Tender Drawings

#### List of Drawings



- Black colour shows Tender drawings which have not been revised



- Blue colour shows Tender drawings which have been revised



- Red colour shows New Additional Tender drawings

S. No	TITLE	REVISED/NEW DRAWING NO.
<b>1 ALIGNMENT PLAN &amp; L-SECTION:</b>		
1.	Plan and longitudinal section (55.0KM to 60.0KM)	GC-HRIDC-C2-DRW-ALN-P&P-01001_A1
2.	Plan connectivity towards Patli	GC-HRIDC-C2-DRW-ALN-P&P-03001_A1
3.	Plan connectivity towards Sultanpur	GC-HRIDC-C2-DRW-ALN-P&P-04001_A1
4.	Plan connectivity towards Badsa	GC-HRIDC-C2-DRW-ALN-P&P-05001_A0
<b>2 ESP/YARD PLAN</b>		
1.	ESP of Patli Station	GC-HRIDC-C2-DRW-STN-ESP-PAT01_A1
2.	Engineering scale plan New Patli Junction CH:58135.513 f/Prithala	GC-HRIDC-C2-DRW-STN-ESP-NPA01_A1
3.	Engineering scale plan sultanpur kaliawas junction CH: 3674.74m f/Badsa KM:6/375	GC-HRIDC-C2-DRW-STN-ESP-SUL01_A1
4.	Engineering scale plan Manesar junction CH: 3674.74m f/badsa KM:6/375	GC-HRIDC-C1-DRW-STN-ESP-MAN01_A0
<b>3 STATION BUILDING</b>		
1.	Conceptual general arrangement drawing - New Patli station	GC-HRIDC-C2-DRW-STN-SAD-NPA01_A1 (Sheet No 1 of 2)
2.	Conceptual general arrangement drawing - New Patli station	GC-HRIDC-C2-DRW-STN-SAD-NPA01_A1 (Sheet No 2 of 2)
3.	Conceptual general arrangement drawing -Sultanpur station	GC-HRIDC-C2-DRW-STN-SAD-SUL01_A1
<b>4 BRIDGES</b>		
<b>4.1 MINOR BRIDGES</b>		
<b>4.1.1 MAIN LINE</b>		
1.	Conceptual general arrangement drawing for balancing culvert bridge no. 137, 1x5x4 RCC box at CH:56117.426	GC-HRIDC-C2-DRW-BRD-GAD-01137_A1

## Section VII-11: Employers' Requirements-Tender Drawings and Documents

<b>S. No</b>	<b>TITLE</b>	<b>REVISED/NEW DRAWING NO.</b>
2.	Conceptual general arrangement drawing for road under bridge no. 138, 1x5x4 RCC box at CH:56290.652	GC-HRIDC-C2-DRW-BRD-GAD-01138_A1
3.	Conceptual general arrangement drawing for balancing culvert bridge no. 139, 1x5x4 RCC box at CH: 56465.029	GC-HRIDC-C2-DRW-BRD-GAD-01139_A1
4.	Conceptual general arrangement drawing for balancing culvert bridge no. 140, 1x5x4 RCC box at CH: 56755.035	GC-HRIDC-C2-DRW-BRD-GAD-01140_A1
5.	Conceptual general arrangement drawing for road + balancing culvert bridge no. 141, 1x5x4+ 1x2x2 RCC box at CH: 57167.991	GC-HRIDC-C2-DRW-BRD-GAD-01141_A1
6.	Conceptual general arrangement drawing for balancing culvert bridge no. 142, 1x5x4 RCC box at CH: 57546.023	GC-HRIDC-C2-DRW-BRD-GAD-01142_A1
7.	Conceptual general arrangement drawing for road under bridge no. 143, 2x7x5.25 RCC box at CH: 57670.809	GC-HRIDC-C2-DRW-BRD-GAD-01143_A1
8.	Conceptual general arrangement drawing for road balancing culvert bridge no. 144, 1x2x2 RCC box at CH: 57987.046	GC-HRIDC-C2-DRW-BRD-GAD-01144_A1
9.	Conceptual general arrangement drawing for road under bridge no. 145, 1x5x3 RCC box at CH: 58203.149	GC-HRIDC-C2-DRW-BRD-GAD-01145_A1
10.	Conceptual general arrangement drawing for balancing culvert bridge no. 146, 1x2x2 RCC box at CH: 58564.993	GC-HRIDC-C2-DRW-BRD-GAD-01146_A1
11.	Conceptual general arrangement drawing for road under bridge no. 148, 2x5x5.25 RCC box at CH: 59884.954	GC-HRIDC-C2-DRW-BRD-GAD-01148_A1
12.	Conceptual general arrangement drawing for road + balancing culvert bridge no. 149, 1x5x3 + 1x2x2 RCC box at CH:60161.343	GC-HRIDC-C2-DRW-BRD-GAD-01149_A1
13.	Conceptual general arrangement drawing for balancing culvert bridge no. 154, 1x2x2 RCC box at CH: 61163.504	GC-HRIDC-C2-DRW-BRD-GAD-01154_A1
<b>4.1.2 CONNECTING LINE</b>		
<b>A. NEW PATLI TO PATLI</b>		
1.	Conceptual general arrangement drawing for road under bridge no. 1,	GC-HRIDC-C2-DRW-BRD-GAD-03001_A1

## Section VII-11: Employers' Requirements-Tender Drawings and Documents

S. No	TITLE	REVISED/NEW DRAWING NO.
	1x5x3.25 RCC box at CH: 1046.562 (connecting line New Patli to Patli)	
2.	Conceptual general arrangement drawing for balancing culvert bridge no. 2, 1x2x2 RCC box at CH: 1277.958 (connecting line New Patli to Patli)	GC-HRIDC-C2-DRW-BRD-GAD-03002_A1
3.	Conceptual general arrangement drawing for road under bridge no. 3, 1x4x3.25 RCC box at CH: 1986.847 (connecting line New Patli to Patli)	GC-HRIDC-C2-DRW-BRD-GAD-03003_A1
4.	Conceptual general arrangement drawing for road under bridge no. 4, 1x5x5.25 RCC box at CH: 2518.489 (connecting line New Patli to Patli)	GC-HRIDC-C2-DRW-BRD-GAD-03004_A1
5.	Conceptual general arrangement drawing for balancing culvert bridge no. 5, 1x2.5x3 RCC box at CH: 2687.006 (connecting line New Patli to Patli)	GC-HRIDC-C2-DRW-BRD-GAD-03005_A1
<b>B. NEW PATLI TO SULTANPUR</b>		
1.	Conceptual general arrangement drawing for balancing culvert bridge no. 2, 1x2x2 RCC box at CH: 1548.996 (connecting line New Patli to Sultanpur)	GC-HRIDC-C2-DRW-BRD-GAD-04002_A1
2.	Conceptual general arrangement drawing for balancing culvert bridge no.4, 1x2x2 RCC box at CH: 2189.831 (connecting line New Patli to Sultanpur)	GC-HRIDC-C2-DRW-BRD-GAD-04004_A1
3.	Conceptual general arrangement drawing for road under bridge no. 5, 1x5x4.25 RCC box at CH: 2823.679 (connecting line New Patli to Sultanpur)	GC-HRIDC-C2-DRW-BRD-GAD-04005_A1
<b>4.2 MAJOR BRIDGES</b>		
<b>4.2.1 MAIN LINE</b>		
1.	Conceptual general arrangement drawing for proposed major ROR bridge no. 136, 18.3+76.2+18.3 CG + Open Web Girder at CH: 55724.752	GC-HRIDC-C2-DRW-BRD-GAD-01136_A1
2.	Conceptual general arrangement drawing for proposed major RUB no. 147, 1x45.7 Open Web Girder at CH: 59106.085	GC-HRIDC-C2-DRW-BRD-GAD-01147_A1
3.	Conceptual general arrangement drawing for proposed major RUB no.	GC-HRIDC-C2-DRW-BRD-GAD-01150_A1

## Section VII-11: Employers' Requirements-Tender Drawings and Documents

<b>S. No</b>	<b>TITLE</b>	<b>REVISED/NEW DRAWING NO.</b>
	150, 1x30.5 Composite Girder at CH: 60457.614	
4.	Conceptual general arrangement drawing for proposed major RUB no. 151, 1x24.4 Composite Girder at CH: 60563.367	GC-HRIDC-C2-DRW-BRD-GAD-01151_A1
5.	Conceptual general arrangement drawing for proposed major RUB no. 152, 1x24.4 Composite Girder at CH: 60642.669	GC-HRIDC-C2-DRW-BRD-GAD-01152_A1
6.	Conceptual general arrangement drawing for proposed major RUB no. 153, 1x30.5 Composite Girder at CH: 60754.591	GC-HRIDC-C2-DRW-BRD-GAD-01153_A1
<b>4.2.2 CONNECTING LINE</b>		
<b>A. NEW PATLI TO SULTANPUR</b>		
1.	Conceptual general arrangement drawing for proposed major RUB no. 1, 1x45.7 Open Web Girder at CH: 951.499 (connecting line New Patli to Sultanpur)	GC-HRIDC-C2-DRW-BRD-GAD-04001_A1
2.	Conceptual general arrangement drawing for proposed major RUB no. 3, 1x12.2 PSC U Slab at CH: 1767.989 (connecting line New Patli to Sultanpur)	GC-HRIDC-C2-DRW-BRD-GAD_04003_A1
<b>5 MISCELLANEOUS DRAWINGS (CONCEPTUAL PLAN)</b>		
1.	Typical embankment/cutting profile	GC-HRIDC-SK-GEN-001
2.	S&T hut	GC-HRIDC-SK-GEN-002
3.	Mini platform shelter	GC-HRIDC-SK-GEN-003
4.	R.C. pre-cast fencing for end platform	GC-HRIDC-SK-GEN-004
5.	Station name board (M.S. steel board)	GC-HRIDC-SK-GEN-005
6.	Proposed toilet block on island platforms	GC-HRIDC-SK-GEN-006
7.	Proposed toilet block on main platforms	GC-HRIDC-SK-GEN-007
8.	Drains for formation	GC-HRIDC-SK-GEN-008
9.	Steel barricade	GC-HRIDC-SK-GEN-009
10.	Water booth with one side taps arrangement (end platform)	GC-HRIDC-SK-GEN-010
11.	Water booth with both side taps arrangement (island platform)	GC-HRIDC-SK-GEN-011

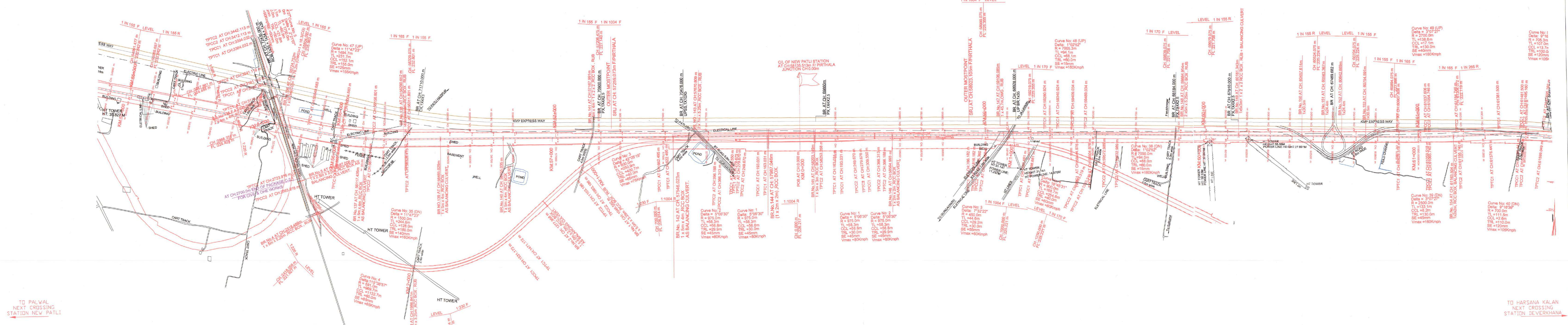
## Section VII-11: Employers' Requirements-Tender Drawings and Documents

S. No	TITLE	REVISED/NEW DRAWING NO.
12.	Interfacing location bank benching	GC-HRIDC-SK-GEN-012
13.	Ticket counter	GC-HRIDC-SK-GEN-013
14.	Typical details of protection work	GC-HRIDC-SK-GEN-015
15.	Drainage arrangement (New Patli)	GC-HRIDC-C2-SK-CIVIL-002
16.	Drainage arrangement (Sultanpur)	GC-HRIDC-C2-SK-CIVIL-003
17.	Circulating area – New Patli	GC-HRIDC-C2-SK-CIVIL-004
18.	Plan showing earmarked area for contractor's facilities and site office	GC-HRIDC- SK-C2-001
19.	Type plan powder toilet for divyangs	N.R.H.Q.E PLAN NO. HQ/20/11-2021
20.	Barbed wire fencing	RDSO/WKS/2019/2
21.	Bridge Plaque	Annexure 11/7 of IRBM
22.	Bridge No. Tablet	Annexure 2/1 of IRBM
<b>6 SIGNALLING</b>		
1.	Cable marker	NR/S&T/CON/1.5/97A
2.	Earth electrode (G.I. pipe)	NR/S&T/Proj/16.1/2015
3.	CC enclosure earth electrode and handle	NR/S&T/Proj/16.2/2015
4.	Track circuit connection jumper wire & bond wire fixing in track lead JN. box	NR/S&T/CON/3.1/97
5.	Cable termination arrangement in track lead JN. box	NR/S&T/CON/3.2/97
6.	Cable trench	NR/S&T/CON/1.1/97A
7.	RCC pipe under track crossing	NR/S&T/CON/1.2/97
8.	Foundation for App. Case Single	NR/S&T/CON/2.7/97
9.	Foundation for App. Case Half	NR/S&T/CON/2.8/97
10.	Signal foundation	NR/S&T/CON/2.1/97
11.	Shunt Signal foundation	NR/S&T/CON/2.1/97A
12.	G.I. pipe on culvert	NR/S&T/CON/1.4/97
13.	'P' marker non illuminated	NR/S&T/CON/6.2/97
14.	Foundation for Block section limit board, Shunting limit board and Sighting board	NR/S&T/CON/7.4/97
15.	Signalling concept plan-Patli IR	GC-HRIDC-C2-DRW-ALN-SIP-001_A0

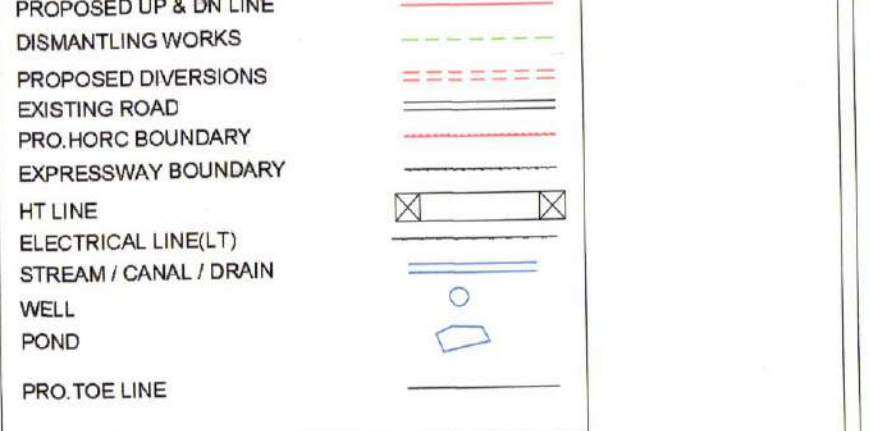
Section VII-11: Employers' Requirements-Tender Drawings and Documents

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<b>S. No</b>	<b>TITLE</b>	<b>REVISED/NEW DRAWING NO.</b>
16.	Signalling concept plan-Sultanpur	GC-HRIDC-C2-DRW-STN-SIP-SUL01_A1
17.	Signalling concept plan-New Patli	GC-HRIDC-C2-DRW-STN-SIP-NPA01_A1
18.	Signalling concept plan-Manesar	GC-HRIDC-C2-DRW-STN-SIP-MAN-01_A0



CHANGES	HORIZONTAL ALIGNMENT		VERTICAL ALIGNMENT		DEPTH OF CUTTING (-) HEIGHT OF BANKING (+)	PROPOSED RAIL LEVEL	PROPOSED FORMATION LEVEL	GROUND LEVELS
	Stationing	Level	Stationing	Level				
50000.0	L=1783.413m	1 IN 155 F	50000.0	270.000	0.00	270.000	270.000	270.000
50000.1	L=2989.123m	1 IN 1004 F	50000.1	271.000	0.00	271.000	271.000	271.000
50000.2	L=2000.07m	1 IN 155 F	50000.2	272.000	0.00	272.000	272.000	272.000
50000.3	L=400.07m	1 IN 155 F	50000.3	273.000	0.00	273.000	273.000	273.000
50000.4	L=29.808m	1 IN 155 F	50000.4	274.000	0.00	274.000	274.000	274.000
50000.5	L=208.598m	1 IN 155 F	50000.5	275.000	0.00	275.000	275.000	275.000
50000.6	L=247.43m	1 IN 155 F	50000.6	276.000	0.00	276.000	276.000	276.000
50000.7	L=502.837m	1 IN 155 F	50000.7	277.000	0.00	277.000	277.000	277.000
50000.8	L=297.900m	1 IN 155 F	50000.8	278.000	0.00	278.000	278.000	278.000
50000.9	L=148.80m	1 IN 155 F	50000.9	279.000	0.00	279.000	279.000	279.000
50001.0	L=2.822m	1 IN 155 F	50001.0	280.000	0.00	280.000	280.000	280.000
50001.1	L=1771.888m	1 IN 1004 F	50001.1	281.000	0.00	281.000	281.000	281.000
50001.2	L=29.000m	1 IN 1004 F	50001.2	282.000	0.00	282.000	282.000	282.000
50001.3	L=188.235m	1 IN 1004 F	50001.3	283.000	0.00	283.000	283.000	283.000
50001.4	L=29.327m	1 IN 1004 F	50001.4	284.000	0.00	284.000	284.000	284.000
50001.5	L=598.47m	1 IN 155 F	50001.5	285.000	0.00	285.000	285.000	285.000
50001.6	L=43.533m	1 IN 155 F	50001.6	286.000	0.00	286.000	286.000	286.000
50001.7	L=115.333m	1 IN 155 F	50001.7	287.000	0.00	287.000	287.000	287.000
50001.8	L=40.000m	1 IN 155 F	50001.8	288.000	0.00	288.000	288.000	288.000
50001.9	L=10.500m	1 IN 255 R	50001.9	289.000	0.00	289.000	289.000	289.000
50002.0	L=270.200	1 IN 155 R	50002.0	290.000	0.00	290.000	290.000	290.000
50002.1	L=111.613	1 IN 155 R	50002.1	291.000	0.00	291.000	291.000	291.000
50002.2	L=222.326	1 IN 155 R	50002.2	292.000	0.00	292.000	292.000	292.000
50002.3	L=111.613	1 IN 155 R	50002.3	293.000	0.00	293.000	293.000	293.000
50002.4	L=222.326	1 IN 155 R	50002.4	294.000	0.00	294.000	294.000	294.000
50002.5	L=111.613	1 IN 155 R	50002.5	295.000	0.00	295.000	295.000	295.000
50002.6	L=222.326	1 IN 155 R	50002.6	296.000	0.00	296.000	296.000	296.000
50002.7	L=111.613	1 IN 155 R	50002.7	297.000	0.00	297.000	297.000	297.000
50002.8	L=222.326	1 IN 155 R	50002.8	298.000	0.00	298.000	298.000	298.000
50002.9	L=111.613	1 IN 155 R	50002.9	299.000	0.00	299.000	299.000	299.000
50003.0	L=222.326	1 IN 155 R	50003.0	300.000	0.00	300.000	300.000	300.000



NOTE:  
 1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED  
 2. ALL THE LEVELS ARE WITH RESPECT TO MEAN SEA LEVEL  
 3. TRACK CENTRE BETWEEN MAIN LINES OF HORC HAS BEEN KEPT AS MIN 5.0m  
 4. PUBLIC UTILITIES HT/LT LINES OF CABLES WATER/SEWER LINES ETC INTERFERING WITH DFC TRACKS SHALL BE RELOCATED  
 5. ARRANGEMENT & SIZE OF THE BRIDGE SHOWN IN THE DRAWING IS TENTATIVE AND MAY CHANGE AS PER THE APPROVED GAD. VERTICAL CLEARANCE FROM LOWEST CONDUCTOR OF HT POWER LINE TO PROPOSED RAIL LEVEL ARE SHOWN

PROPOSED TRACK STRUCTURE (TO SUIT FOR 25T AXLE LOAD)  
 L FOR RAIL CORRIDOR: 1600KMPH Speed  
 TRACK = 60KG RAILS  
 SLEEPER DENSITY: PAC SLEEPERS = 1660 No S PER KM  
 BALLAST CUSHION: 350mm  
 ALL TURNOUTS ARE 1:112 UNLESS OTHERWISE SPECIFIED

ABBREVIATIONS:  
 1. BVC - BEGIN OF VERTICAL CURVE  
 2. PVI - POINT OF VERTICAL INTERSECTION  
 3. EVC - END OF VERTICAL CURVE

LEGEND FOR PROFILE:  
 PROPOSED RAIL PROFILE  
 PROPOSED FORMATION PROFILE  
 GROUND PROFILE

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHHATEY RAM PD	<i>[Signature]</i>	SHY OM DWEDI	<i>[Signature]</i>
SUDHIR AGRAWAL SPO-CHE	<i>[Signature]</i>	UMA MRNG DOMICHERET	<i>[Signature]</i>
WISHAN CHAND SANSI CRE-CLERK	<i>[Signature]</i>		

PROJECT: HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONPAT BYPASSING DELHI AREA BY LINKING ASOTI-PATLI-SULTANPUR-ASAUJAH BY NEW ELECTRIFIED BG DOUBLE LINE

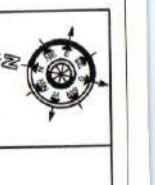
CLIENT: HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

GENERAL CONSULTANT: AARVEE ASSOCIATES  
 HARYANA ORBITAL RAIL CORRIDOR  
 RTES Limited in consortium with SMEC International Pty. Ltd.

DRG NO.: GC-HRDC-C2-DRW-ALN-P&P-01001\_A1  
 TITLE: PLAN & LONGITUDINAL SECTION (85.0 KM TO 81.5 KM)

CONSULTANTS: AARVEE ASSOCIATES, TANMAY (AN CAD) G PRASAD (M) N. J. RAO (M)  
 SCALE: H = 1:5000 V = 1:500 | ISSUED Dt: 26.11.2019 | REV Dt: 23-07-2022





**LEGEND**

EXISTING RAILWAY TRACK	————
PROPOSED UP & DN LINE	————
DEMANTLING WORKS	=====
PROPOSED DIVERSIONS	————
EXISTING ROAD	————
PRO-HORC BOUNDARY	————
KMP EXPRESSWAY	————
KMP EXPRESSWAY BOUNDARY	————
EXISTING RAILWAY BOUNDARY	————
HT LINE	————
ELECTRICAL LINE(LT)	————
STREAM / CANAL / DRAIN	————
WELL	⊗
POND	⊕

**NOTE:**

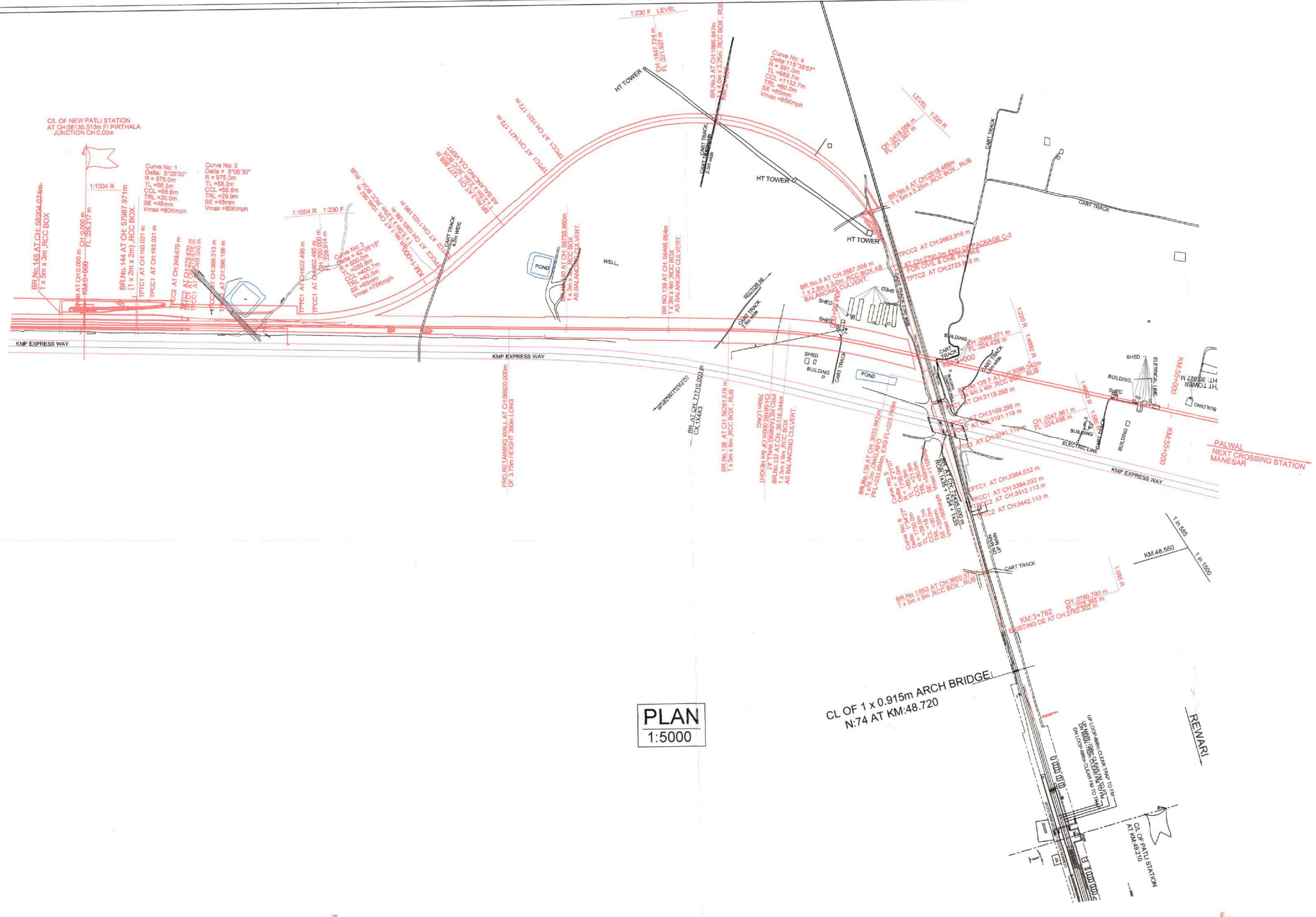
- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED
- CH:0.00 FOR CONNECTIVITY LINE IS RECKONED FROM NEW PATLI STATION
- ALL THE LEVELS ARE WITH RESPECT TO MEAN SEA LEVEL
- TRACK CENTER BETWEEN MAIN LINES OF HORC HAS BEEN KEPT AS MIN 5.301
- ARRANGEMENT & SIZE OF THE BRIDGE SHOWN IN THE DRAWING IS TENTATIVE AND MAY CHANGE AS PER THE APPROVED GAD.

**PROPOSED TRACK STRUCTURE (TO SUIT FOR 26T AXLE LOAD)**

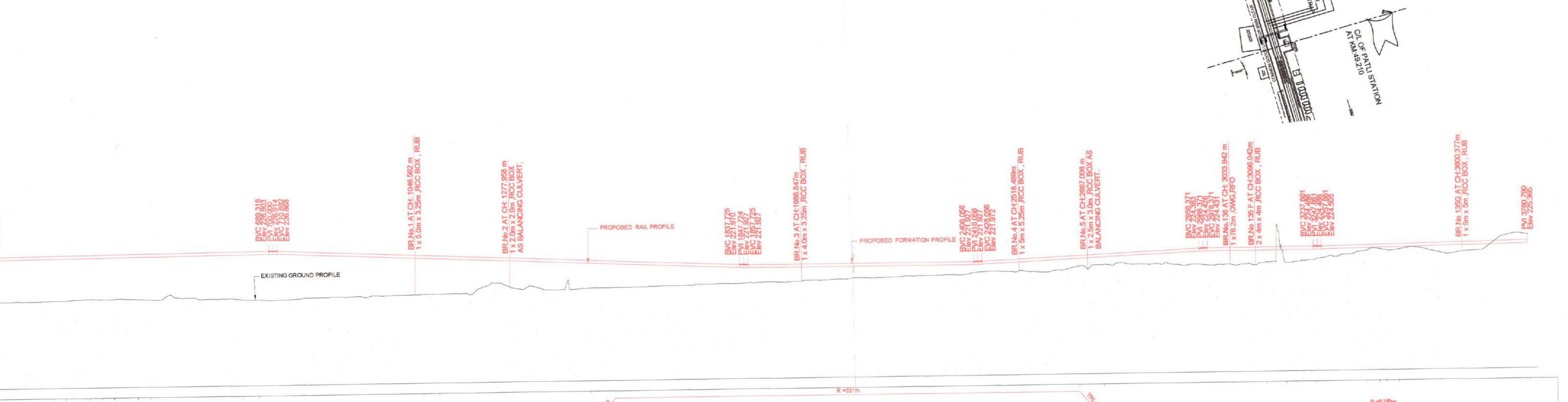
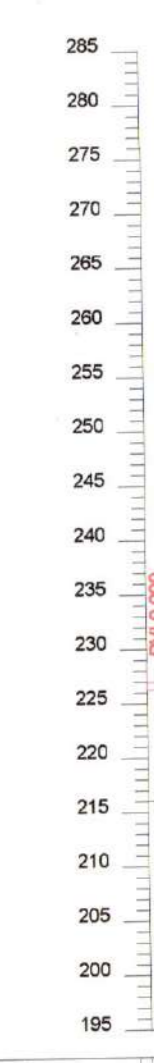
- FOR RAIL CORRIDOR: 160KMPH Speed
- TRACK = 600G RAILS
- SLEEPER DENSITY = RSC SLEEPERS = 1800 No & PER KM
- BALLAST CUSHION = 350mm
- ALL TURNS ARE 1 in 12 UNLESS OTHERWISE SPECIFIED.

**ABBREVIATIONS:**

- BVC - BEGIN OF VERTICAL CURVE
- PVI - POINT OF VERTICAL INTERSECTION
- EVC - END OF VERTICAL CURVE



**PLAN**  
1:5000



LONGITUDINAL PROFILE  
2500:1:5000 H.M.M. VERTICAL CURVE

GCHORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAUHATY RAM ROY	[Signature]	SHIV OM DAVIED	[Signature]
SUDHAR AGRAWAL	[Signature]	UMA M RAO	[Signature]
DR.DR. VIKAS KUMAR	[Signature]	DGM/C&WT	[Signature]
KRISHAN CHAND SANI	[Signature]		
CIVIL			

PROJECT: HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SIKRI BYPASSING DELHI AREA BY LINKING ANANTPURI-SIKRI-PALWAL-BALAHNA BY NEW ELECTRICISED 850KV LINE

CLIENT: HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**GENERAL CONSULTANT:**

GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
SITES Located in Gurgaon: M/S SMIEC International Pvt. Ltd.



CC-DRG-NO: GCHORC-G-DRW-A/4-N-RAP-2001\_A1

TITLE: **PLAN CONNECTIVITY TOWARDS PATLI**

CONSULTANTS: **AARVEE ASSOCIATES**

SCALE: 1:1000  
ISSUED: 26.11.2019  
REV. CD: 28-07-2022







**LEGEND**

EXISTING LINE	---
PROPOSED LINE	---
DESTROY LINE TO BE DESTROYED	---
NEW BOUNDARY	---
LEVEL	---
PROPOSED STRUCTURE	---
EXISTING STRUCTURE	---
WIRE FENCE	---
DRIVE	---
LAND USE	---
WALL	---
ROAD	---
RAILROAD	---
CONSTRUCTION	---

**NOTES**

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL CURVES ARE TO BE OPEN TO THE RIGHT UNLESS OTHERWISE SPECIFIED.
3. ALL TRACKS ARE TO BE LAYED OUT AS PER THE HORIZONTAL ALIGNMENT.
4. ALL TRACKS ARE TO BE LAYED OUT AS PER THE VERTICAL ALIGNMENT.
5. ALL TRACKS ARE TO BE LAYED OUT AS PER THE CROSS SECTION.
6. ALL TRACKS ARE TO BE LAYED OUT AS PER THE STATIONING.
7. ALL TRACKS ARE TO BE LAYED OUT AS PER THE SLOPE.
8. ALL TRACKS ARE TO BE LAYED OUT AS PER THE CLEARANCE.
9. ALL TRACKS ARE TO BE LAYED OUT AS PER THE OBSTRUCTION.
10. ALL TRACKS ARE TO BE LAYED OUT AS PER THE ADJACENT PROPERTY.
11. ALL TRACKS ARE TO BE LAYED OUT AS PER THE EXISTING INFRASTRUCTURE.
12. ALL TRACKS ARE TO BE LAYED OUT AS PER THE ENVIRONMENTAL CONSTRAINTS.
13. ALL TRACKS ARE TO BE LAYED OUT AS PER THE SAFETY REQUIREMENTS.
14. ALL TRACKS ARE TO BE LAYED OUT AS PER THE OPERATIONAL REQUIREMENTS.
15. ALL TRACKS ARE TO BE LAYED OUT AS PER THE MAINTENANCE REQUIREMENTS.
16. ALL TRACKS ARE TO BE LAYED OUT AS PER THE CONSTRUCTION REQUIREMENTS.
17. ALL TRACKS ARE TO BE LAYED OUT AS PER THE OPERATIONAL REQUIREMENTS.
18. ALL TRACKS ARE TO BE LAYED OUT AS PER THE MAINTENANCE REQUIREMENTS.
19. ALL TRACKS ARE TO BE LAYED OUT AS PER THE CONSTRUCTION REQUIREMENTS.
20. ALL TRACKS ARE TO BE LAYED OUT AS PER THE OPERATIONAL REQUIREMENTS.

**Signature book**

CEP&D	SANJAY KUMAR SRIVASTAVA	Digitally signed by SANJAY KUMAR SRIVASTAVA	Date: 2022.07.13 12:38:45 +05'30'
CTPM	SANJAY BAJPAL	Digitally signed by SANJAY BAJPAL	Date: 2022.07.13 11:31:11 +05'30'
DRM-DLI	DIMPY GARG	Digitally signed by DIMPY GARG	Date: 2022.06.14 07:38:41 +05'30'
ADRM-PR&D	ANUPUM SINGH	Digitally signed by ANUPUM SINGH	Date: 2022.06.14 06:33:20 +05'30'
SREN-CD-DLI	AMIT KUMAR	Digitally signed by AMIT KUMAR	Date: 2022.06.14 02:54:17 +05'30'
SROOM-DLI	RAJNEESH KUMAR ERVASTAVA	Digitally signed by RAJNEESH KUMAR ERVASTAVA	Date: 2022.06.10 02:39:58 +05'30'
SROOM-DLI	Banshi Kumar	Digitally signed by Banshi Kumar	Date: 2022.07.01 03:48:38 +05'30'
SROSTE-DLI	ANURAG ANAND	Digitally signed by ANURAG ANAND	Date: 2022.07.01 05:08:33 +05'30'
SROME-CH&D	ANANT KUMAR	Digitally signed by ANANT KUMAR	Date: 2022.07.01 05:08:33 +05'30'
SROE-TR&D	ATAMJEET SINGH	Digitally signed by ATAMJEET SINGH	Date: 2022.06.13 02:07:10 +05'30'
SREN-S-DLI	SUMAN BALHARA	Digitally signed by SUMAN BALHARA	Date: 2022.06.13 01:12:33 +05'30'
ADEN-DEE	JORA SINGH	Digitally signed by JORA SINGH	Date: 2022.06.10 01:24:20 +05'30'

**NORTHERN RAILWAY**

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
CONVERTING RAILWAY TO ELECTRIC FEED AREA BY LINKING ANAPATI-LALPUR-AJALGARH BY NEW ELECTRIC FEED DOUBLE LINE

**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

**GENERAL CONSULTANT:** GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
BITES Limited in consortium with SMEC (Pvt.) Ltd.

**DATE:** 13.07.2022

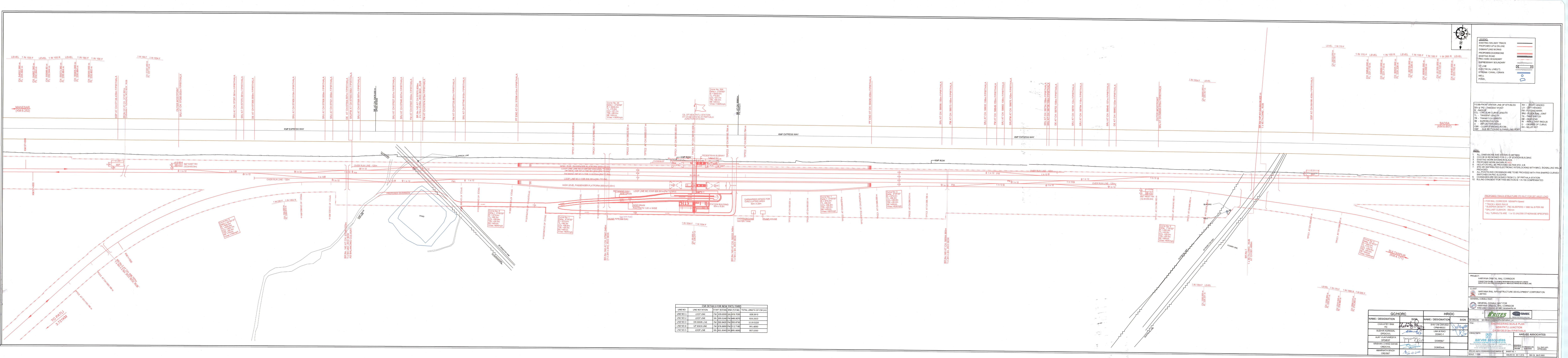
**SCALE:** 1:1000

**DRAWING NO.:** ESP OF PATLI STATION

GCHORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHATEY RAM	-SD	SHY DU SHVEDI	-SD
SUDHAR KUMAR	-SD	UMA M RAO	-SD
AJAY KUMAR SINGH	-SD	DOMEST	-SD
KRISHAN CHAND SINGH	-SD	DOMEST	-SD
AMARJIT SINGH	-SD		

**ADJACENT TRACKS**

TRACK NO.	TRACK WIDTH	TRACK CENTER	LENGTH OF STRAIGHT	DISTANCE	DISTANCE TO THE	LENGTH OF COVER
1	1.812	1.812	4.814	18.8	23.37	17.83
2	1.812	4.78	0.94	17.85	17.85	18.89



**LEGEND**

- EXISTING HALWAY TRACK
- PROPOSED UP & DN LINE
- DIMANTLING WORKS
- PROPOSED OVERBONS
- EXISTING ROAD
- PRO HORC BOUNDARY
- EXPRESSWAY BOUNDARY
- IN LINE
- ELECTRICAL LINE
- STREAM / CANAL / DRAIN
- POUND

**NOTES**

1. ALL DIMENSIONS ARE SHOWN IN METRES
2. CH 0.00 IS RECKONED FOR C.O.P. OF STATION BUILDING
3. EXISTING WORK SHOWN IN BLACK
4. PROPOSED WORK SHOWN IN RED
5. SECTION WALLS ARE PROVIDED AS PER STD. I.R.
6. STD. I.R. DISTRIBUTED ELECTRONIC INTERLOCKING WITH MAEL SIGNALING WILL BE PROVIDED
7. ALL POINTS AND CROSSINGS ARE TO BE PROVIDED WITH FAN SHAPED CURVED
8. CHANGES ARE RECKONED FROM C.I. OF PIRITHALA STATION
9. CHANGES ARE RECKONED FROM C.I. OF PIRITHALA STATION
10. RULING GRADIENT FOR THIS SECTION IS 1 IN 150 COMPENSATED

**PROPOSED TRACK STRUCTURE TO SUIT FOR 2MT AXLE LOAD**

- 1. TRACK WIDTH: 1600mm
- 2. TRACK & S&G RAILS
- 3. SLEEPER DENSITY: 1300 SLEEPERS PER KM
- 4. BALLAST CUSHION: 350mm
- 5. ALL TURNOUTS ARE 1 IN 12 UNLESS OTHERWISE SPECIFIED

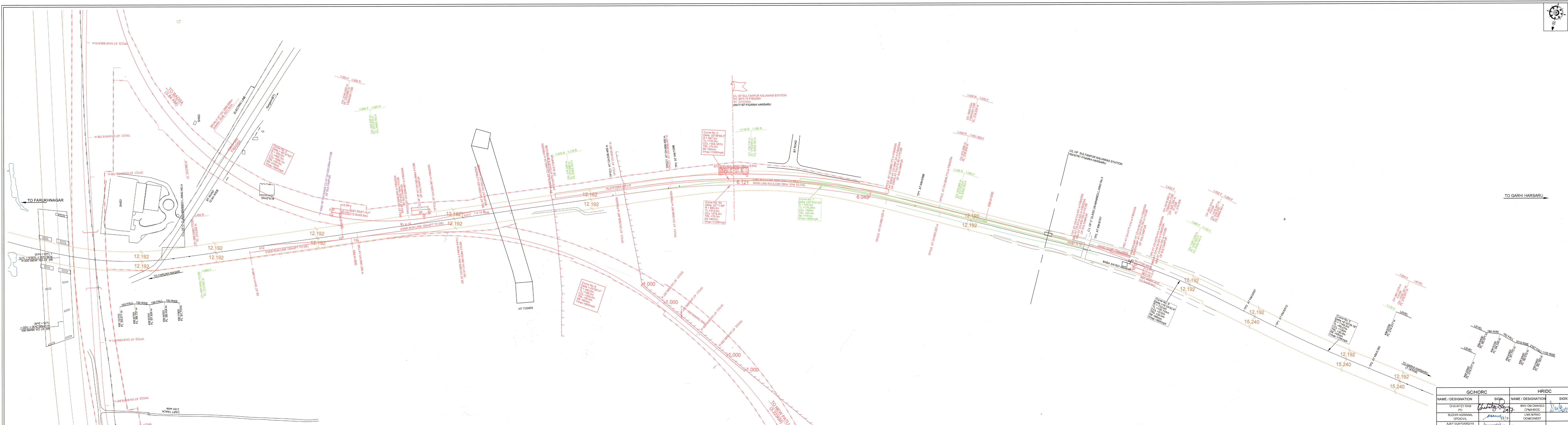
**CSR DETAILS FOR NEW PATLI YARD**

LINE NO.	LINE NOTATION	START (PC/CS)	END (PC/CS)	TOTAL LENGTH OF CSR (M)
LINE NO-1	LOOP LINE	FM 428.8000	SM 419.7030	828.2610
LINE NO-2	LOOP LINE	SM 189.5240	FM 448.9070	826.2610
LINE NO-3	DN MAIN LINE	FM 560.8420	FM 550.8730	1119.5220
LINE NO-4	UP MAIN LINE	FM 478.8800	FM 512.7180	991.6050
LINE NO-5	LOOP LINE	SM 441.8640	SM 495.6690	957.5390

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED  
**GENERAL CONSULTANT:** AARVEE ASSOCIATES  
**ENGINEERING SCALE PLAN:** NEW PATLI JUNCTION CH 58135.513m PIRITHALA

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHAYEY RAM PD	<i>[Signature]</i>	SHYAM DAVIED CPM-ROCC	<i>[Signature]</i>
SUDHAR AGRAWAL DPCVCL	<i>[Signature]</i>	UMA M RAO DOMC-1	<i>[Signature]</i>
AJAY VIJAYVARGYA DPCIBET	<i>[Signature]</i>	DOMSAT	<i>[Signature]</i>
KRISHNA GRANDHANI CRECVCL	<i>[Signature]</i>	DOMENCL	<i>[Signature]</i>
AMARNATH SINGH CREIBT	<i>[Signature]</i>		

SCALE: 1:1000  
 SHEET NO. 1  
 REV. ON: 28-07-2022



**LEGEND**

EXISTING RAILWAY TRACK	---
PROPOSED UP & DN LINE	---
EXISTING OVERBRIDGE	---
PROPOSED OVERBRIDGE	---
EXISTING ROAD	---
PROPOSED ROAD	---
PROPOSED BOUNDARY	---
EXISTING BOUNDARY	---
HT LINE	---
ELECTRICAL LINE (L)	---
STREAM / CANAL / DRAIN	---
WELL	---
POND	---
RAIL PIPELINE	---

**NOTE**

- ALL DIMENSIONS ARE SHOWN IN METRES.
- CH/D/S IS RECORDED FROM C/L OF STATION BUILDING.
- EXISTING WORK SHOWN IN BLACK.
- PROPOSED WORK SHOWN IN RED.
- ISOLATION WILL BE PROVIDED AS PER STD IJR.
- STD IJR DISTRIBUTED ELECTRONIC INTERLOCKING WITH MAQSI SIGNALLING WILL BE PROVIDED.
- ALL POINTS AND CROSSINGS ARE TO BE PROVIDED WITH FAN SHAPED CURVED SWITCHES ON CONCRETE SLEEPER.
- CHANGES ARE RECORDED FROM C/L OF PITHALA STATION.
- RULING GRADIENT FOR THIS SECTION IS 1 IN 150 COMPENSATED.
- TRACK RULING GRADIENT (TO SUIT CSR 25T AXLE LOAD)

FOR RAIL CORRIDOR: 160KMPH Speed  
 TRACK = 60KG RAILS  
 SLEEPER DENSITY = 1800 No. S PER KM  
 BALLAST CLASS: 300mm  
 ALL TURNOUTS ARE 1 IN 12 UNLESS OTHERWISE SPECIFIED.

**NORTHERN RAILWAY**

DRM-DLI
ADRM-INFRA-DLI
SRDEN-CO-DLI
SRDOM-DLI
SRDSTE-DLI
SRDDE-TRD-DLI
SRDEN-5-DLI
ADEN-DEE
SSE-PWAY-GGN
SSE-W-GGN

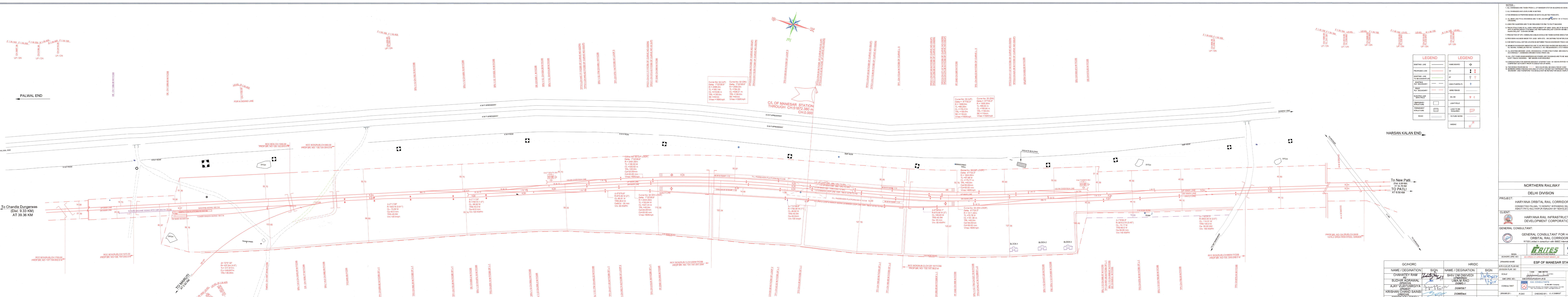
NR CIVIL FILE NO. \_\_\_\_\_  
 NR CIVIL PLAN NO. \_\_\_\_\_  
 NRHQ CASE NO. \_\_\_\_\_  
 NRHQ PLAN NO. \_\_\_\_\_

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED  
**GENERAL CONSULTANT:** ARVEE ASSOCIATES  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR:** ARVEE ASSOCIATES

<b>GC/HORC</b>	<b>HRDC</b>
NAME / DESIGNATION	NAME / DESIGNATION
GHANATEY RAM PO	SHIV OM DWIVEDI CPM/HRDC
SUCHIR AGRAWAL DPDC/DL	UMA RAO DSM/HRDC
AJAY VIJAYVARGIYA DPDEST	AMSBT
KRISHAN CHAND SAINI CRS/CIVIL	DGM/HRDC
AMARNATH SINGH CRS/SST	

**CSR DETAILS FOR SULTANPUR KALAWAS YARD**

LINE NO	LINE NOTATION	START (FCSB)	END (FCSB)	TOTAL LENGTH OF CSR (m)
LINE NO-1	LOOP LINE	SRJ 320.217	SRJ 439.783	780.000
LINE NO-2	MAIN LINE	FM 320.217	FM 439.783	760.000



C/L OF MANESAR STATION THROUGH CH:51672.380 m CH:0.000

Curve No: 32 (UP) Date: 7/22/28  
 R = 2881.00 m  
 TL = 180.53 m  
 CL = 150.82 m  
 TRL = 100.00 m  
 SE = 45.00 m  
 Vmax = 80 kmph

Curve No: 33 (DN) Date: 8/7/28  
 R = 1600.00 m  
 TL = 180.50 m  
 CL = 176.41 m  
 TRL = 100.00 m  
 SE = 110.00 m  
 Vmax = 80 kmph

LEGEND		LEGEND	
EXISTING LINE	—	NAME BOARD	⊠
PROPOSED LINE	- - -	TP	⊠
EXISTING LINE TO BE OBTAINED	---	PT	⊠
EXISTING RLY BOUNDARY	- - -	HAND PUMP/PL	⊠
PROP. RLY BOUNDARY	- - -	WIRE FENCE	⊠
ELECTRIC LINE WITH POLE	---	DS SE	⊠
TEMPORARY STRUCTURE	⊠	LIGHT POLE	⊠
PERMANENT STRUCTURE	⊠	LAND TO BE ACQUIRED	⊠
ROAD	---	FUTURE WORK	---
		NSIC	⊠

- NOTES:
1. ALL DIMENSIONS AND LEVELS ARE IN METRES.
  2. THE DRAWING IS PREPARED BASED ON DATA COLLECTED FROM SITE.
  3. ALL MAIN LINE P/S & CROSSINGS ARE TO BE LAID WITH 1 IN 12 THICKNESS WITH WELDED CORN CROSSING.
  4. DOWNING SLEEPERS ARE TO BE PROVIDED FOR P/C TO P/B BY MACHINE.
  5. TRACK STRUCTURE OF ALL NEW REPLACEMENT OF LINES SHALL BE OF 60 KG RAILS ON 60 KG SLEEPERS AND WITH TRACK CENTER TO TRACK CENTER AS PER THE TRACK CENTER TO TRACK CENTER SYSTEM.
  6. THE TRACK CENTER SHALL NOT BE LOCATED IN BETWEEN TRACKS WHERE TRACK CENTER IS LESS THAN 5.0 M.
  7. PRELIMINARY OF THE TRACKING CALLS SHALL BE MADE DURING EXECUTION OF WORK.
  8. PROVISION HAS BEEN MADE FOR CROSSING WITH 10% CLEARANCE TO BE MAINTAINED FROM THE TRACK CENTER TO TRACK CENTER.
  9. ALL EXISTING BRIDGE LEVEL CROSSINGS & OTHER STRUCTURES ARE EXACTLY AS PER FIELD SURVEY & ACCORDING TO CHANGES IN THE TRACK CENTER.
  10. ALL LINES UNDER HEADUNDERSTANDING POWER LINE CROSSINGS ARE TO BE WOODED AS PER THE REGULATION FOR COMPETENT AUTHORITY PRIOR TO EXECUTION OF WORK.
  11. THE WORK SHALL BE DONE IN SUCH A MANNER THAT THE TRACK CENTER SHALL BE MAINTAINED AS PER THE TRACK CENTER TO TRACK CENTER SYSTEM.
  12. ALL LINES UNDER HEADUNDERSTANDING POWER LINE CROSSINGS ARE TO BE WOODED AS PER THE REGULATION FOR COMPETENT AUTHORITY PRIOR TO EXECUTION OF WORK.
  13. THE WORK SHALL BE DONE IN SUCH A MANNER THAT THE TRACK CENTER SHALL BE MAINTAINED AS PER THE TRACK CENTER TO TRACK CENTER SYSTEM.
  14. BARRIERS SHALL BE PROVIDED AT THE SITE AS PER THE REGULATIONS FOR RAILWAY LAND ACQUISITION AND THEREAFTER THIS DRAWING WILL BE USED FOR CONSTRUCTION.

**NORTHERN RAILWAY**

**DELHI DIVISION**

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONPAT BYPASSING DELHI AREA BY LINKING ASHOTI-PATLI SULTANPUR ASHADI BY NEW ELECTRIFIED BG DOUBLE LINE

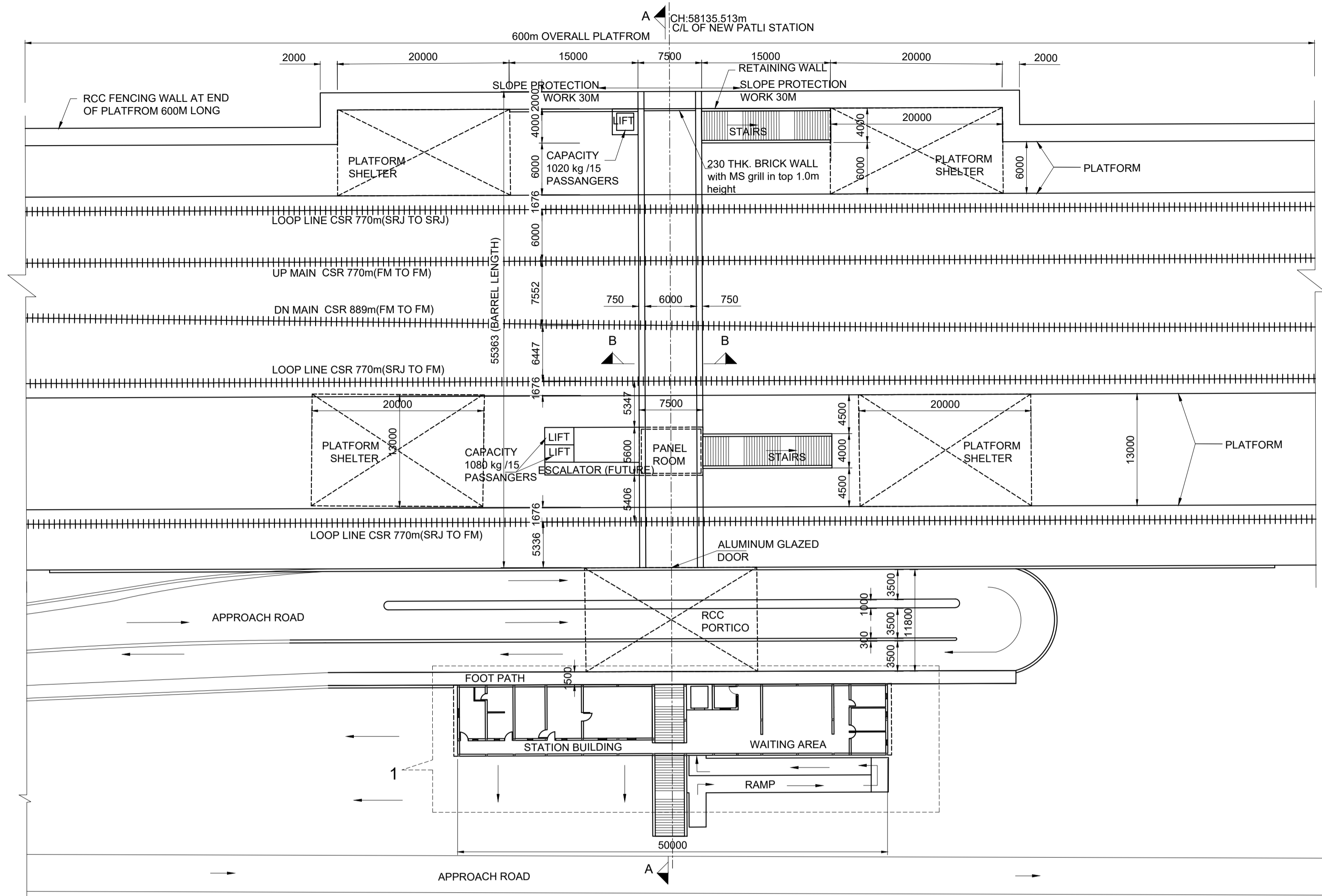
**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**GENERAL CONSULTANT:** GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pvt. Ltd.

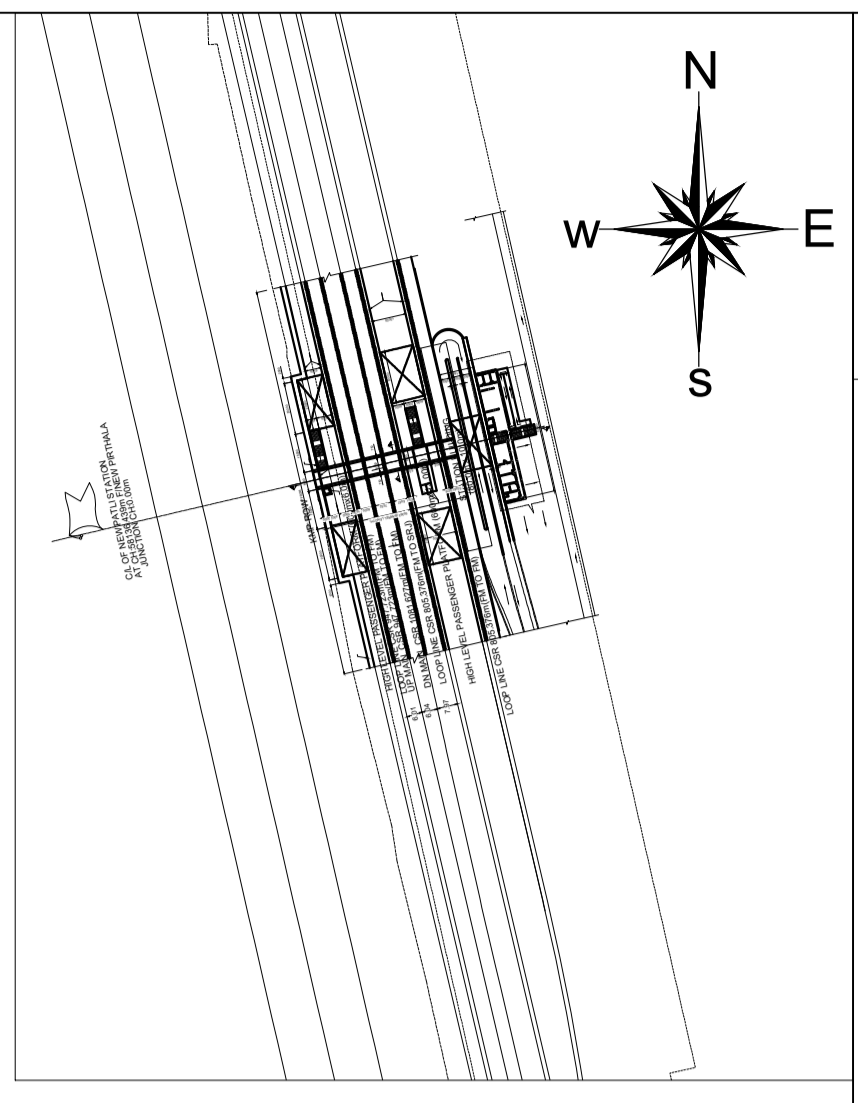
**SIGN:** [Signature]

**DRAWING NAME:** ESP OF MANESAR STATION

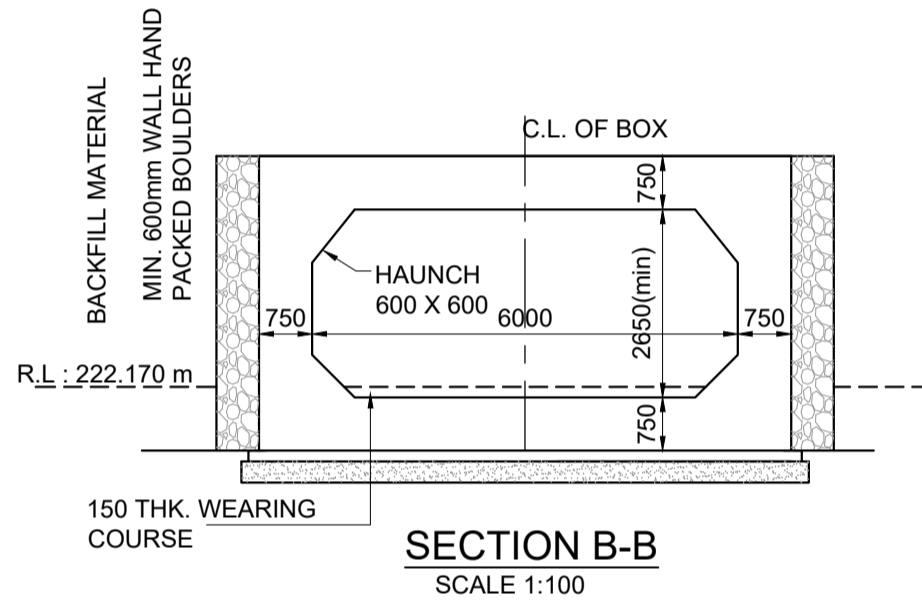
GC/HORC	HRDC
NAME/DEGNATION	NAME/DEGNATION
CHHATEY RAM	SHIVOM DIVEDI
SUDHIR AGRAWAL	UMA M RAO
ALAY VIJAYVARGIYA	DGM/S&T
KRISHAN CHAND SAINI	DGM/S&T
AMARNATH SINGH	



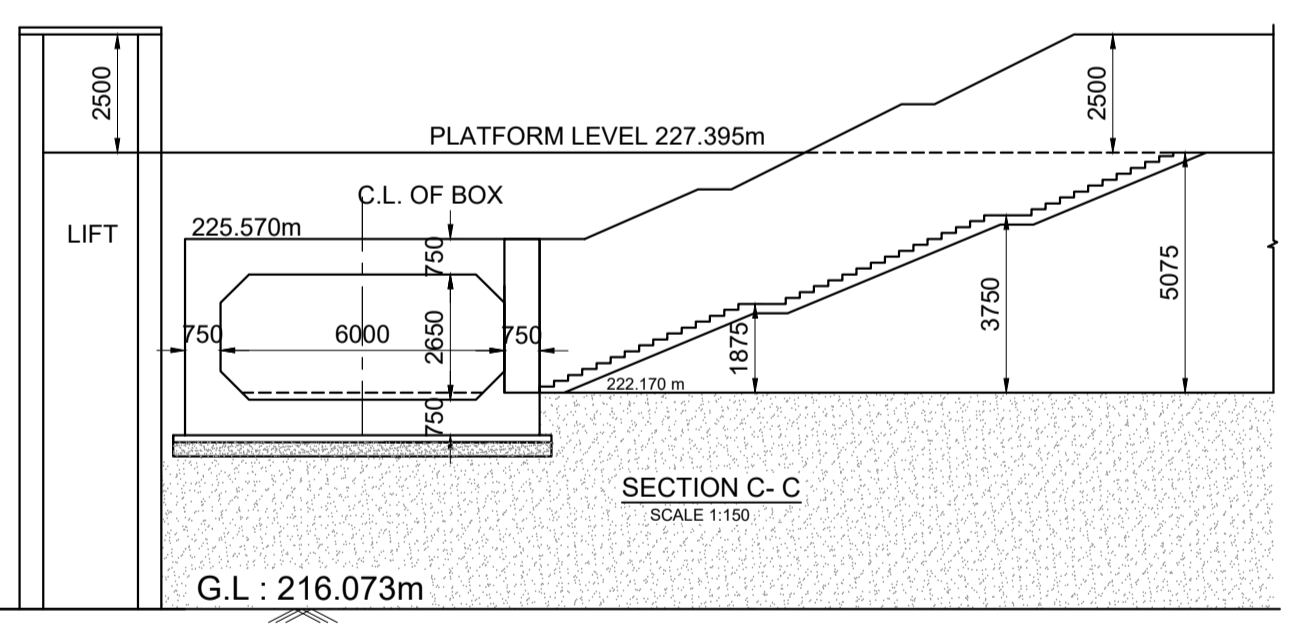
**NEW PATLI STATION PLAN**  
(SCALE 1:350)



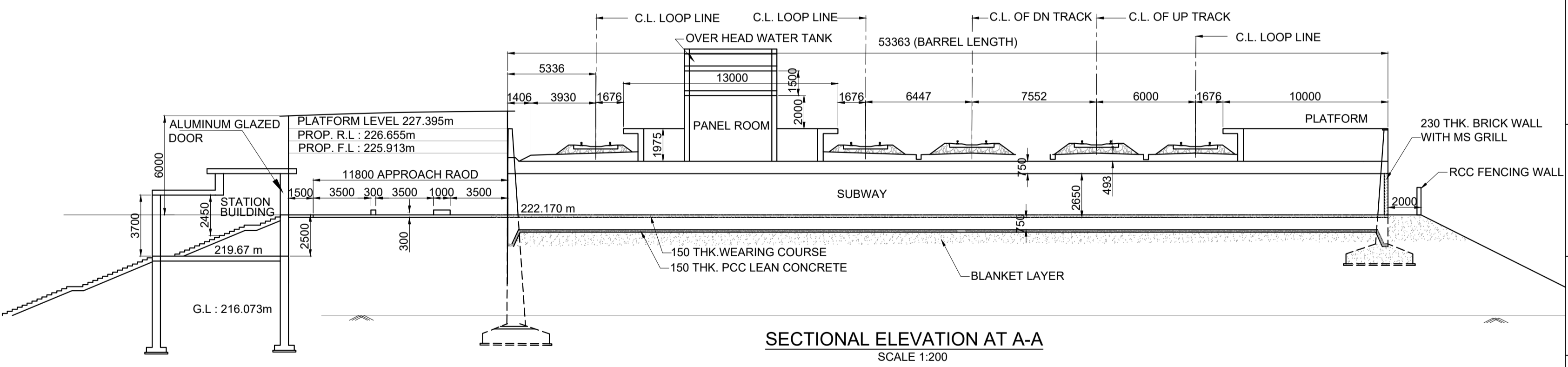
**KEY PLAN**  
SCALE 1:NTS



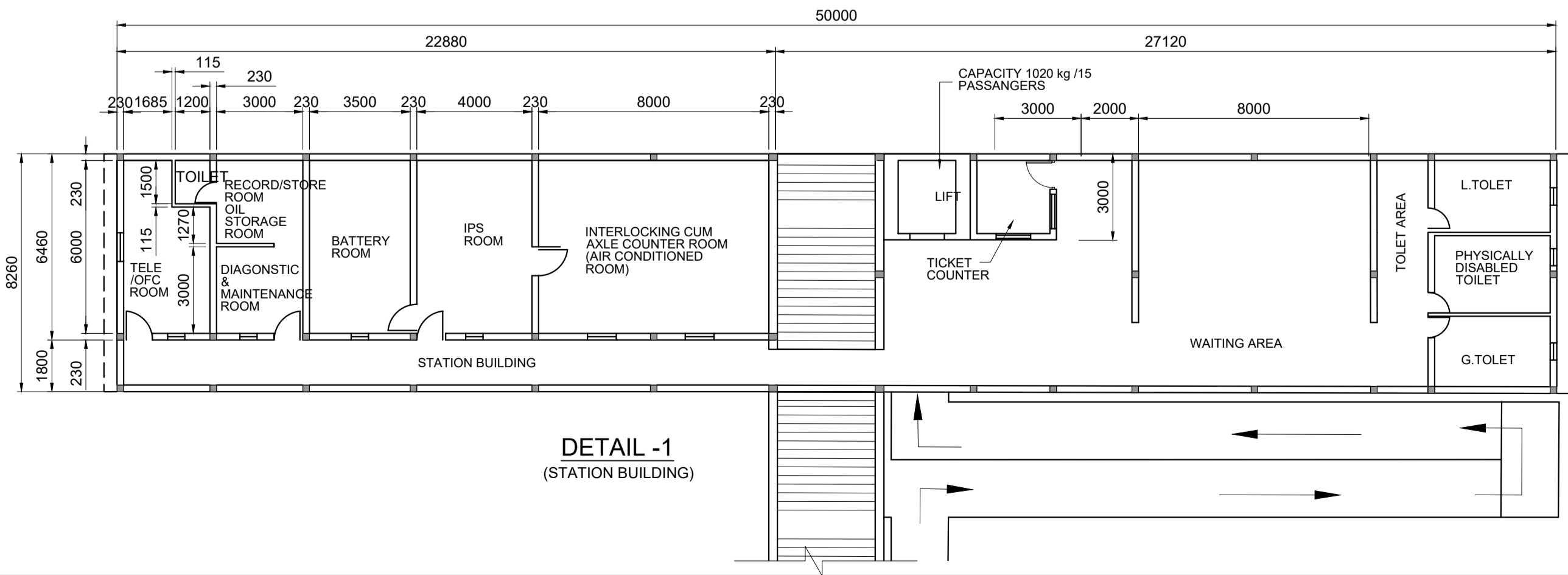
**SECTION B-B**  
SCALE 1:100



**SECTION C-C**  
SCALE 1:150



**SECTIONAL ELEVATION AT A-A**  
SCALE 1:200



**DETAIL -1**  
(STATION BUILDING)

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA.M.RAO DGMIC-1	<i>Uma M Rao</i>
AJAY VIJAYVARGIYA DPD/EST	<i>Ajay Vijayvargiya</i>	DGM/S&T	
KRISHAN CHAND SAINI CRE/CIVIL	<i>Krishan Chand Saini</i>	DGM/Elect.	
AMARNATH SINGH CRE/S&T	<i>Amarnath Singh</i>		

- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. ALL LEVEL ARE IN METERS.
  3. SUBWAY AND LIFT-WELL SHALL BE PLACED AT FIRM BED/ STRATA / PILE FOUNDATION.
  4. PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF SUBWAY SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  5. BEARING CAPACITY SHALL BE ENSURED AT TOP OF FILL BY PLATE LOAD TEST (MINIMUM TWO LOCATION) BEFORE CASTING OF SUBWAY.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

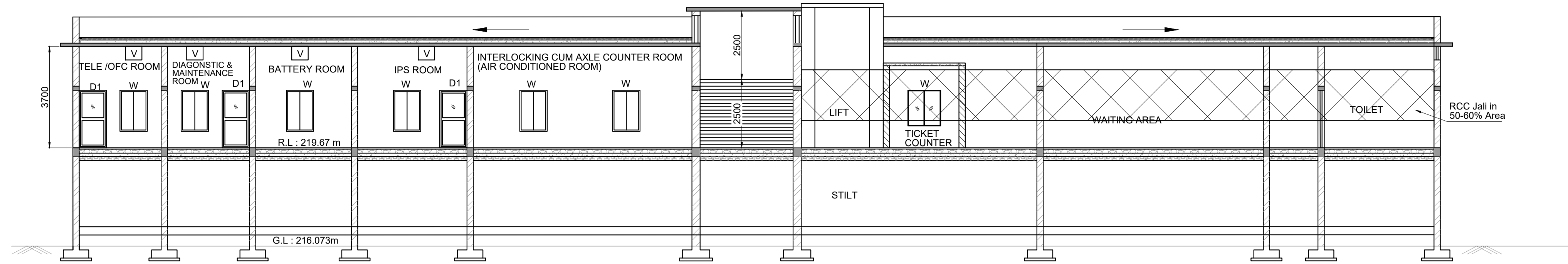


**TITLE:-**  
CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
NEW PATLI STATION

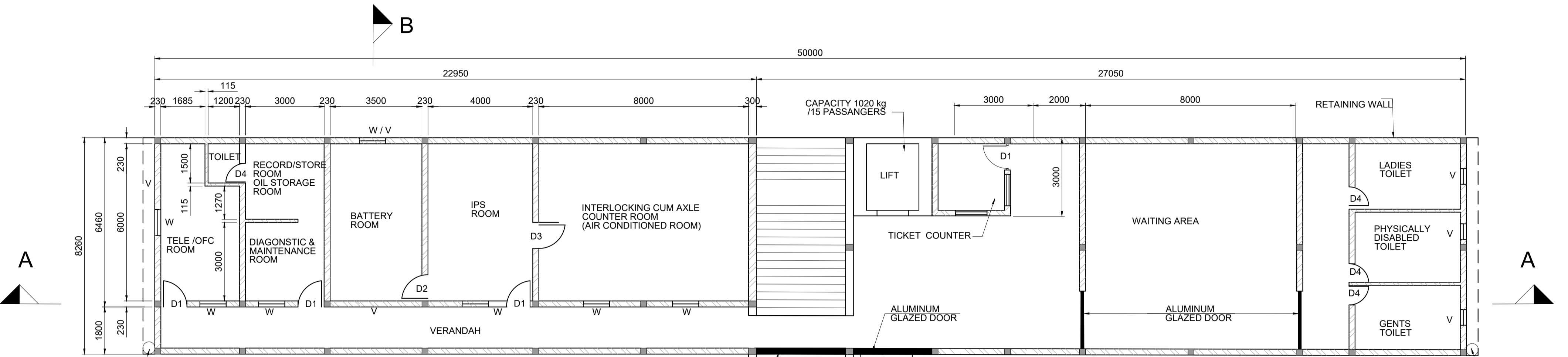
**DRG. NO.** GC-HRIDC-C2-DRW-STN-SAD-NPA01\_A1 **SHEET NO.** 1 OF 2

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

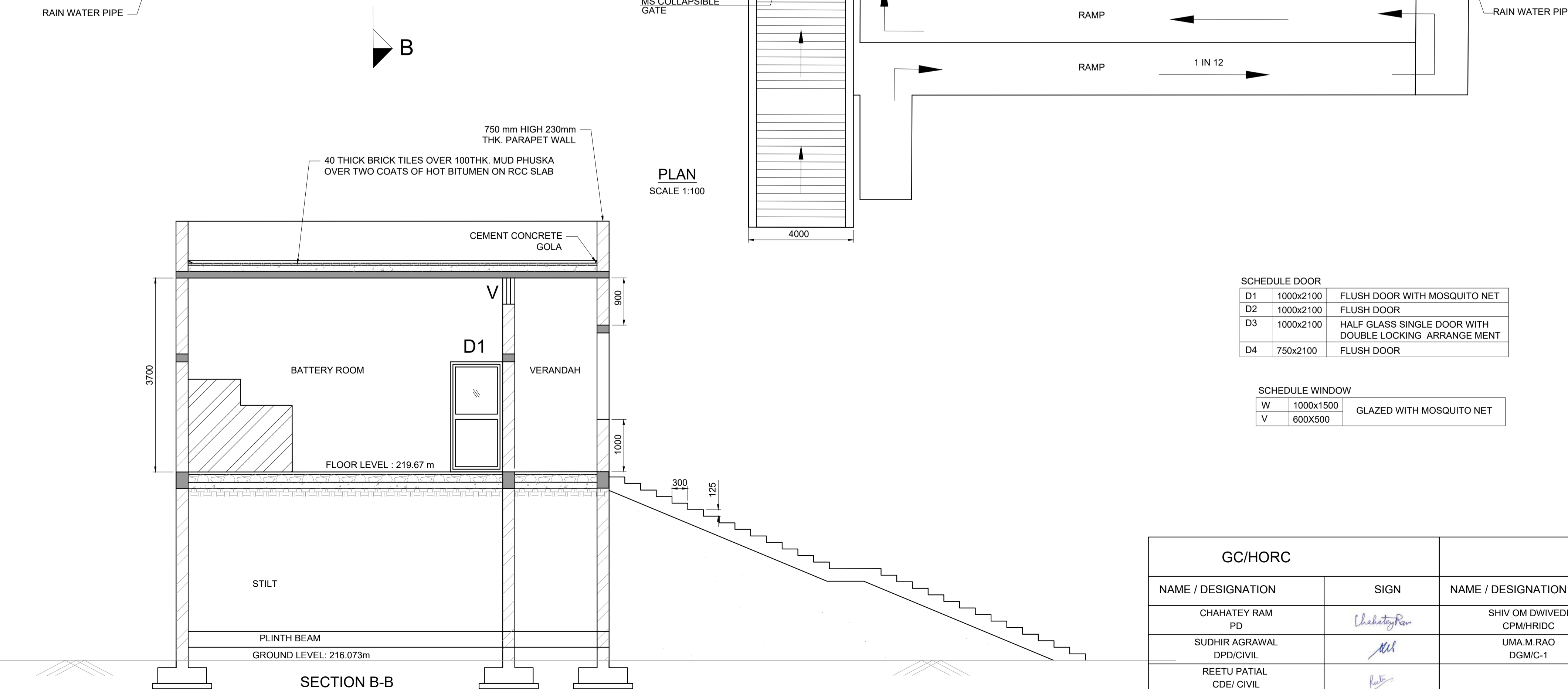




SECTION A-A  
SCALE 1:100



PLAN  
SCALE 1:100



SECTION B-B  
SCALE 1:50

SCHEDULE DOOR

D1	1000x2100	FLUSH DOOR WITH MOSQUITO NET
D2	1000x2100	FLUSH DOOR
D3	1000x2100	HALF GLASS SINGLE DOOR WITH DOUBLE LOCKING ARRANGE MENT
D4	750x2100	FLUSH DOOR

SCHEDULE WINDOW

W	1000x1500	GLAZED WITH MOSQUITO NET
V	600x500	

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA M.RAO DGM/C-1	<i>Uma M. Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS.
  - ALL WALLS ARE OF 230MM THICK & PARTITION WALLS ARE OF 115MM.
  - ALL INTERNAL & EXTERNAL WALLS SHOULD BE PLASTERED AS PER TECHNICAL SPECIFICATIONS.
  - THE PROPOSED BUILDING PLAN IS BASED OF RDSO DRAWING NO. "SDQ/S&T SERVICE BUILDING/001 AMDIT 1".
  - THE LOCATION OF THE BUILDING SHALL BE AS CLOSE TO CENTER OF YARD AS POSSIBLE. THE EXACT LOCATION OF THE BUILDING SHALL BE DECIDED BY CONCERNED ENGINEER.
  - THE FLOOR LEVEL SHALL BE AT LEAST 500 MM ABOVE THE LEVEL OF THE PLATFORM OF THE STATION.
  - THE FLOOR SHALL BE PROVIDED WITH VITRIFIED TILES IN ALL THE ROOMS AND VERANDAH UNLESS OTHERWISE SPECIFIED.
  - THE INTERIOR WALLS AND CEILING SHALL BE COATED WITH PREMIUM ENAMEL PAINT WITH A GLOSSY, DURABLE AND WASHABLE FINISH AS PER CONSTRUCTION SPECIFICATION.
  - FOUNDATIONS TO BE DESIGNED FOR G+1 FLOORS.
  - ASSUME BEARING CAPACITY OF SOIL: 10T/SQ.M.
  - R.C.C. PLINTH BAND & LINTEL BAND TO BE PROVIDED IN ALL WALLS.
  - FOR ANY FURTHER DETAIL OF S&T SERVICE BUILDING REFER NR TYPE PLAN NO. O-99/2021 SHEET NO. 1 TO 5.
  - FOR PHYSICALLY HANDICAPPED TOILET REFER DRAWING NO. O-104/2021 SHEET 1 OF 1.
  - SUITABLE ARRANGEMENT FOR SEPTIC TANK & SOAK PIT TO BE PROVIDED FOR DRAINAGE DISCHARGE AND FOR EFFLUENT DISCHARGE REFER SEPARATE DRAINAGE PLAN.
  - TICKET COUNTER REFER DRAWING NO. GC-HRIDC-C2-DRG-SAD-GMD-013\_A0 SHEET 1 OF 1.
  - ANY DETAIL WHICH IS NOT COVERED UNDER THE DRAWING REFER THE TECHNICAL SPECIFICATION/ DECIDED BY ENGINEER.

PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

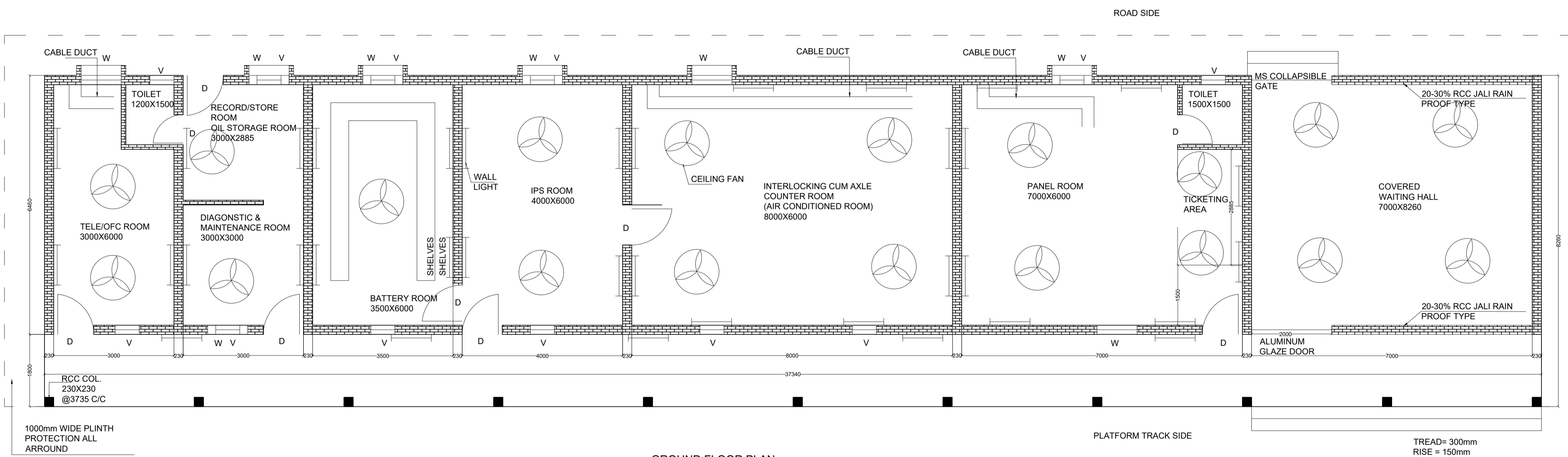


TITLE:-  
CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
NEW PATLI STATION

DRG. NO. GC-HRIDC-C2-DRW-STN-SAD-NPA01\_A1 SHEET NO. 2 OF 2

SCALE : AS SHOWN ISSUE DATE 23-06-2022 REVISED DATE 29-07-2022

- NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. FOR OTHER DETAIL REFER NORTHERN RAILWAY DRAWING S & T SERVICE BUILDING DWG.NO N.R.H.Q.E.PLAN NO.HQ/02/02-2021. SH. 1 OF 5 TO 5 OF 5.




GROUND FLOOR PLAN  
(STATION BUILDING)

LEGEND

D-	PANELED DOOR
W-	WINDOW
V-	VENTILATOR

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 **HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
 **GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

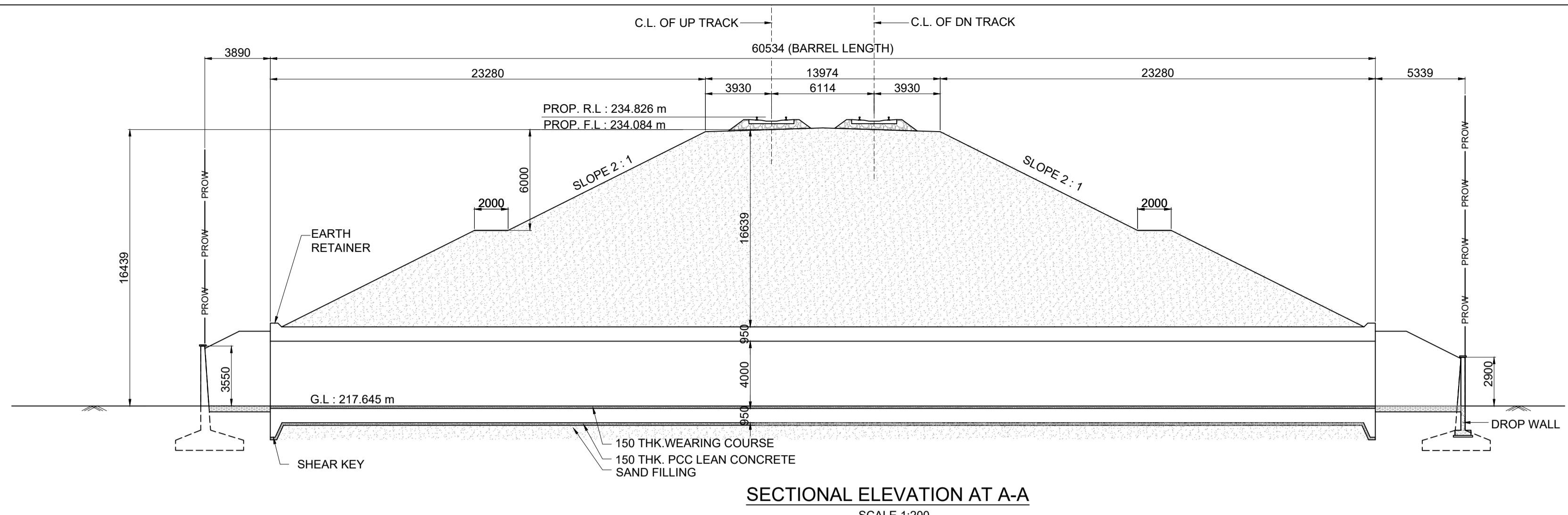


GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
AJAY VIJAYVARGIYA DPD/EST		DGM/S&T	
KRISHAN CHAND SAINI CRE/CIVIL	<i>KC</i>	DGM/Elect.	
AMARNATH SINGH CRE/S&T	<i>Amarnath Singh</i>		

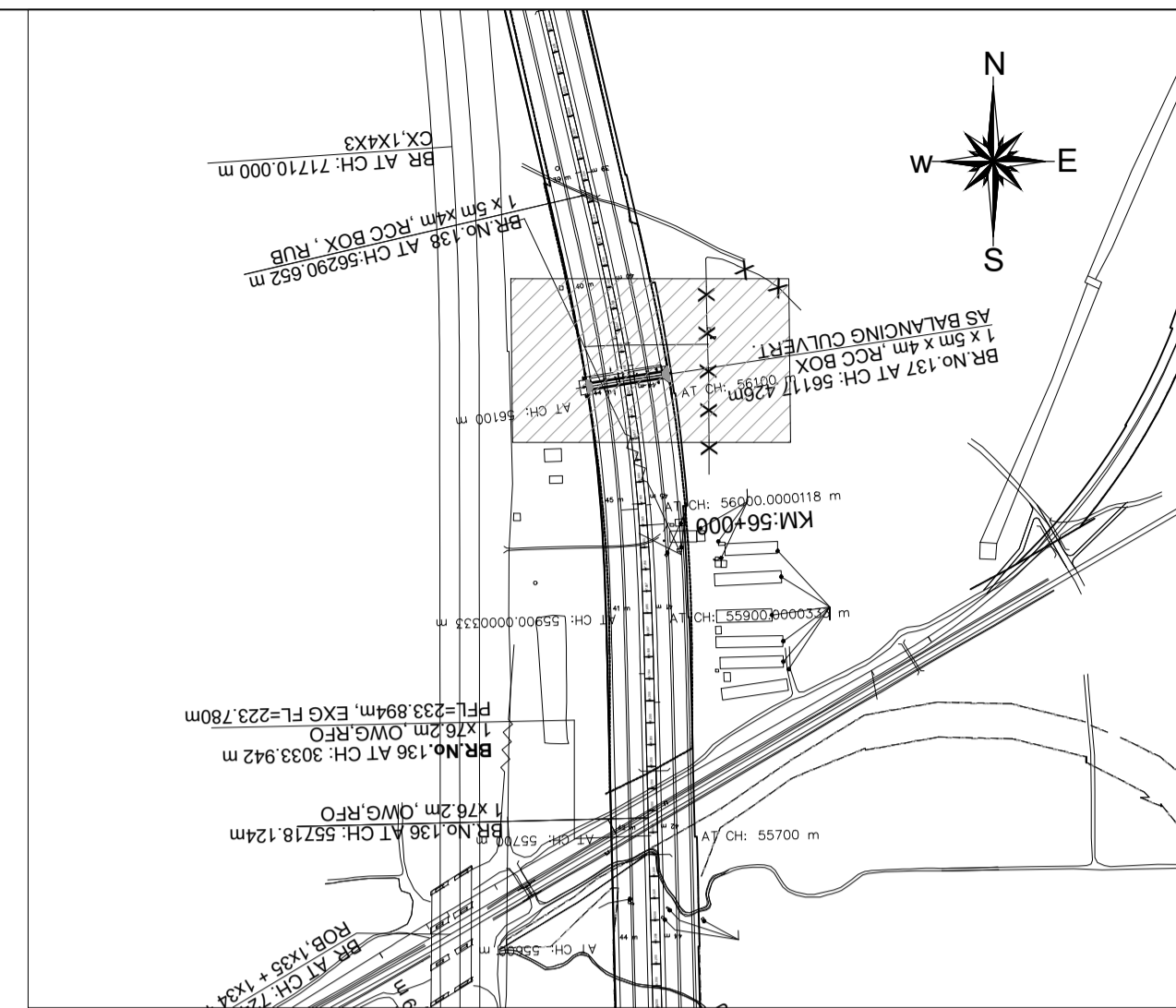
TITLE:-  
 CONCEPTUAL GENERAL ARRANGEMENT DRAWING OF  
**SULTANPUR STATION BUILDING**

DRG. NO. GC-HRIDC-C2-DRW-STN-SAD-SUL01\_A1 SHEET NO. 1 OF 2

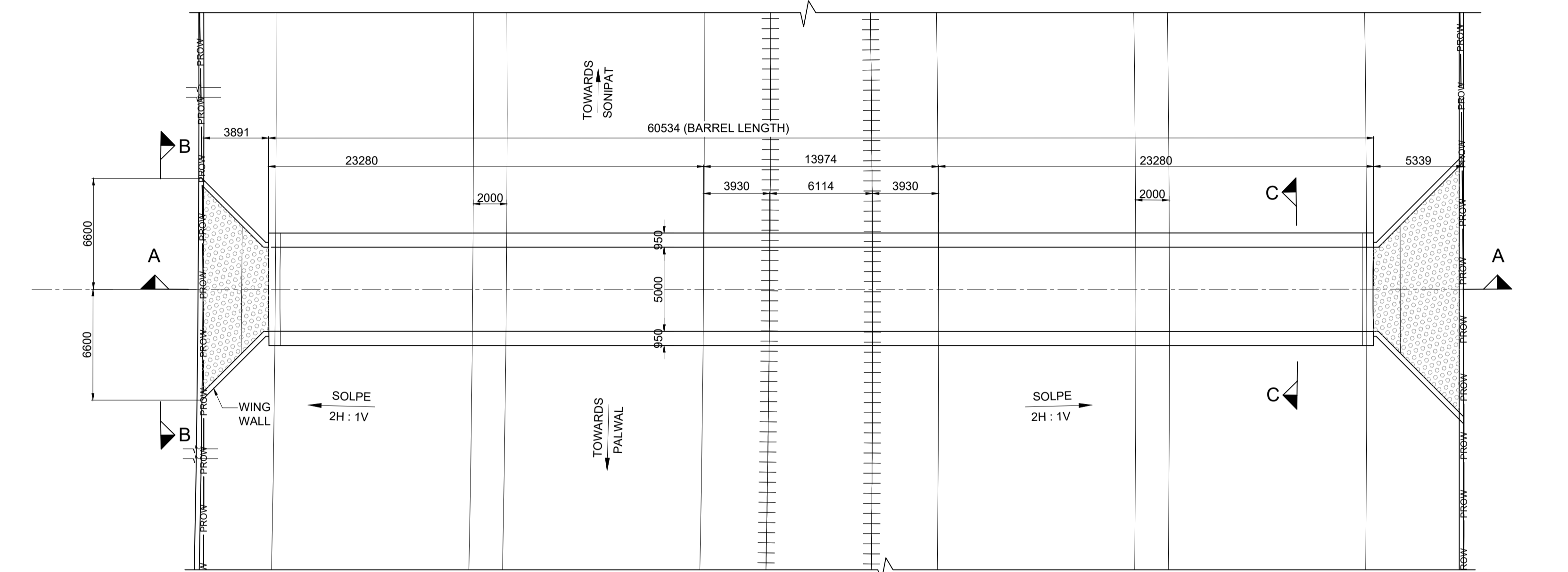
SCALE : AS SHOWN ISSUE DATE 23-06-2022 REVISED DATE 29-07-2022



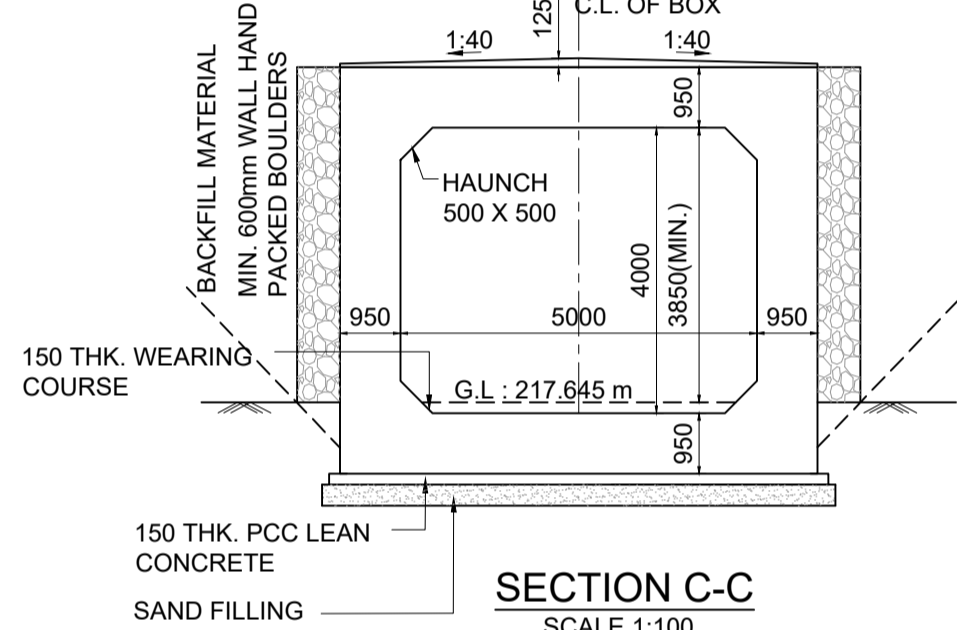
SECTIONAL ELEVATION AT A-A  
SCALE 1:200



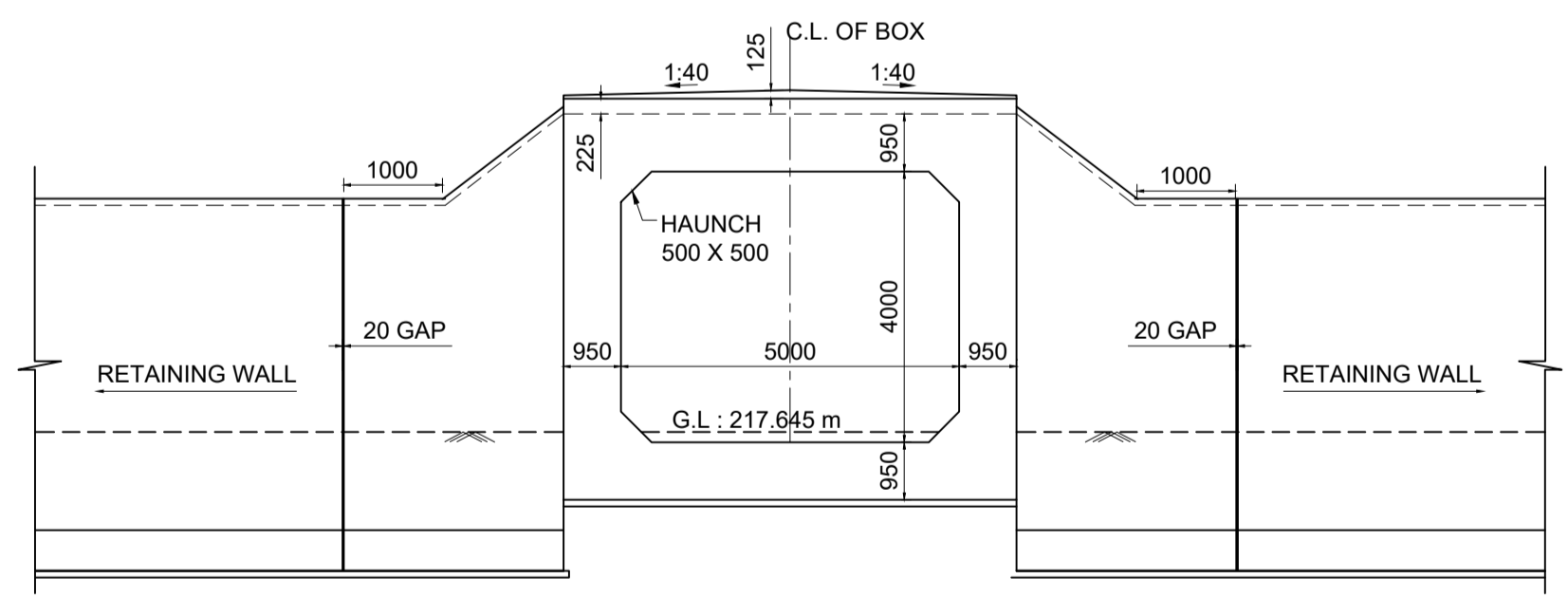
KEY PLAN  
SCALE 1:NTS



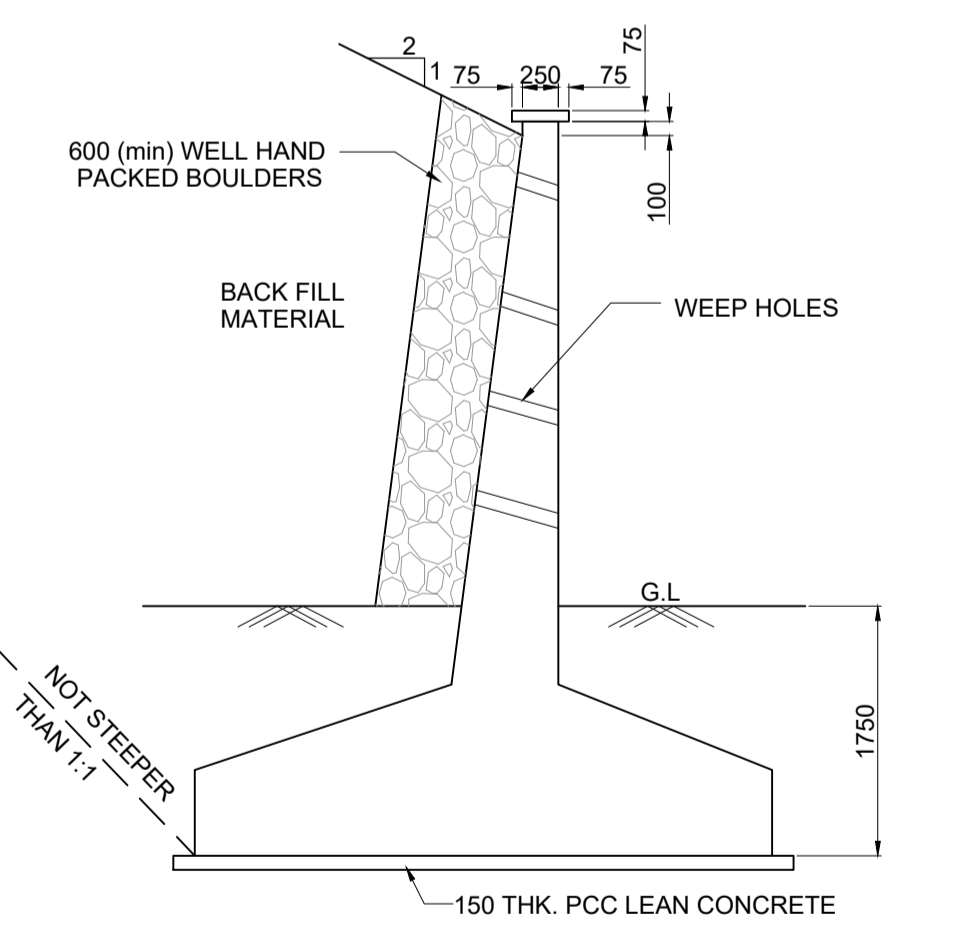
PLAN AT TOP  
SCALE 1:200



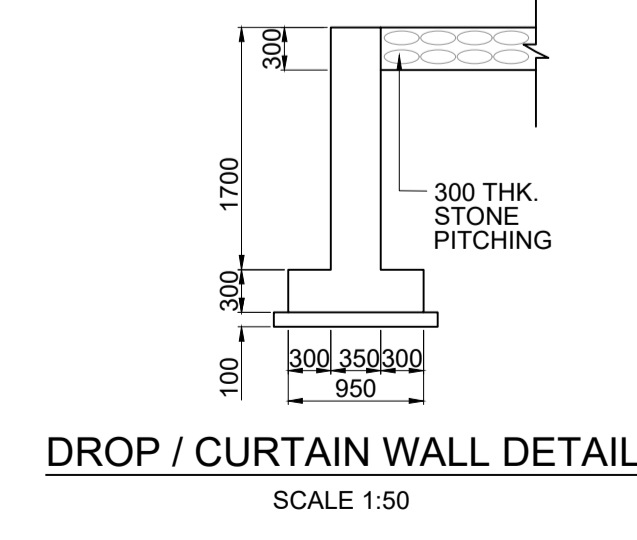
SECTION C-C  
SCALE 1:100



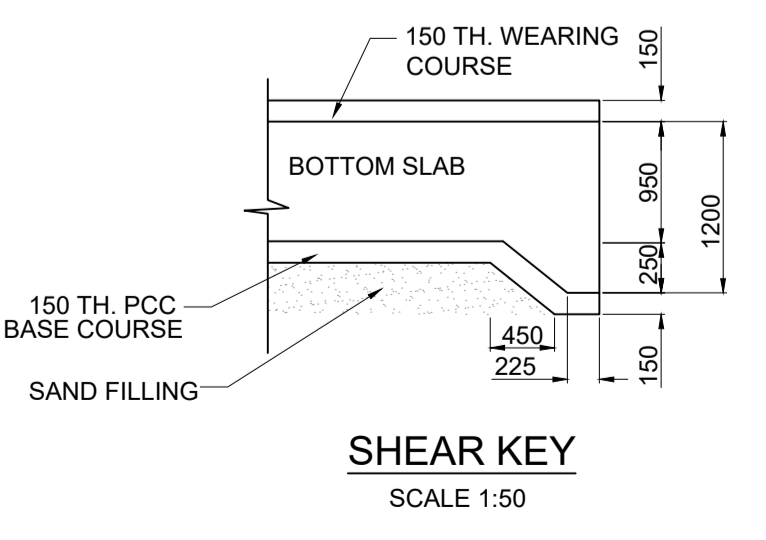
VIEW AT B-B  
SCALE 1:100



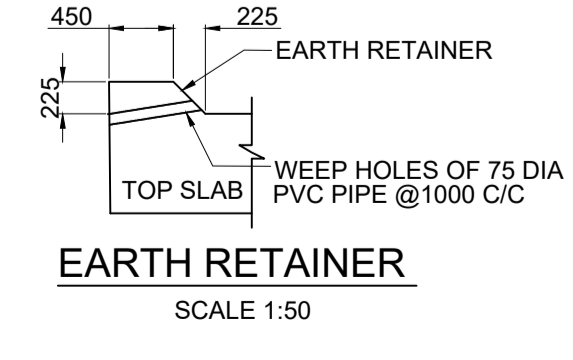
TYPICAL DETAIL OF RETURN WALL / WING WALL  
SCALE 1:50



DROP / CURTAIN WALL DETAILS  
SCALE 1:50



SHEAR KEY  
SCALE 1:50



EARTH RETAINER  
SCALE 1:50

**NOTES :**

**A) GENERAL NOTES**

- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
- THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
- FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
- BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
- THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
- ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
- SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
- ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
- THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HRIDC.
- DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
- THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

**B) TECHNICAL NOTES :**

- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
- FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
- ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
- PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
- DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
- DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
  - IRS BRIDGE RULE
  - IRS CONCRETE BRIDGE CODE
  - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
- SEISMIC ZONE- IV
- EXPOSURE CONDITION- MODERATE.
- DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
- THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
- ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
- REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
- FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.

**GRADE OF CONCRETE :**

- ALL RCC = M.35/DETAILED DESIGN DRG.
- WEARING COURSE = M.20/DETAILED DESIGN DRG.
- LEVELING COURSE/LEAN CONCRETE = M.20/DETAILED DESIGN DRG.

- BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
- FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
- ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.


**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

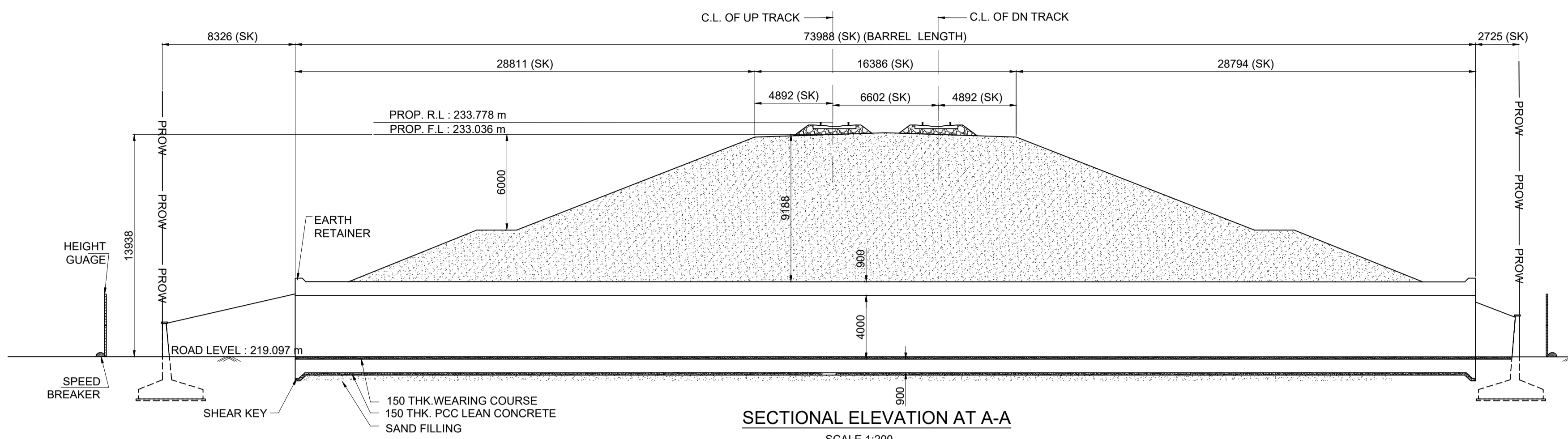


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 137 SPAN 1.0X5.0X4.0 RCC BOX AT CH: 56117.426

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01137\_A1 **SHEET NO.** 1 OF 1

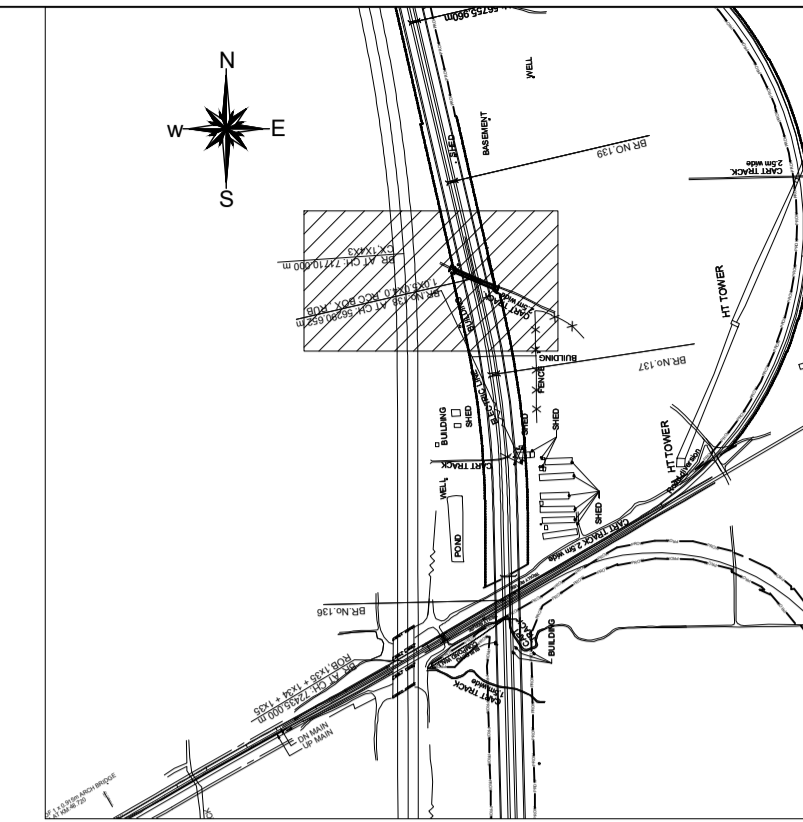
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



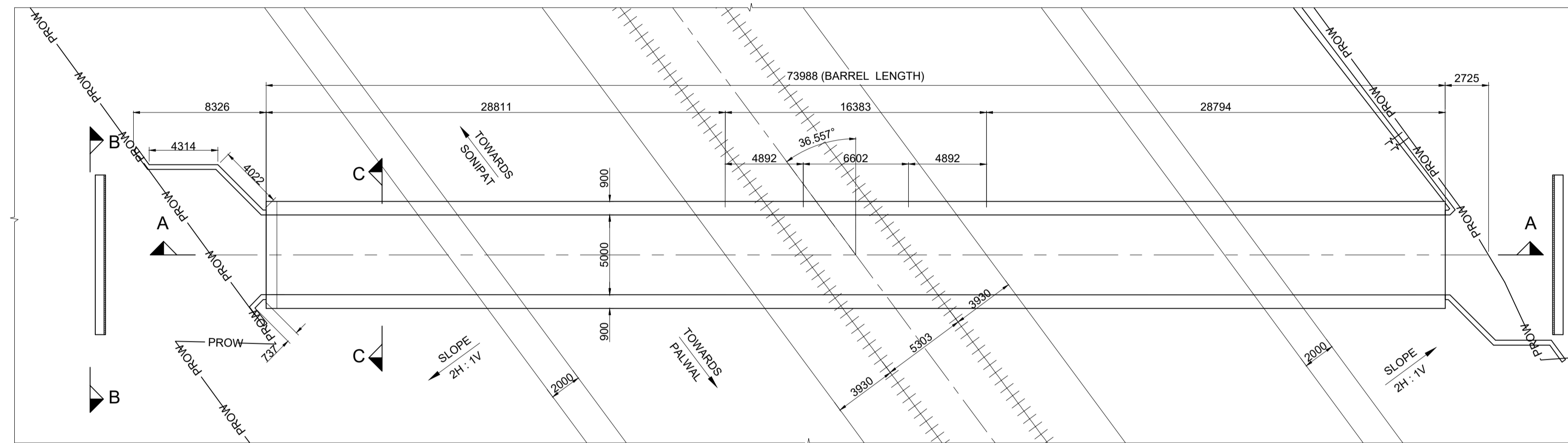
SECTIONAL ELEVATION AT A-A

SCALE 1:200



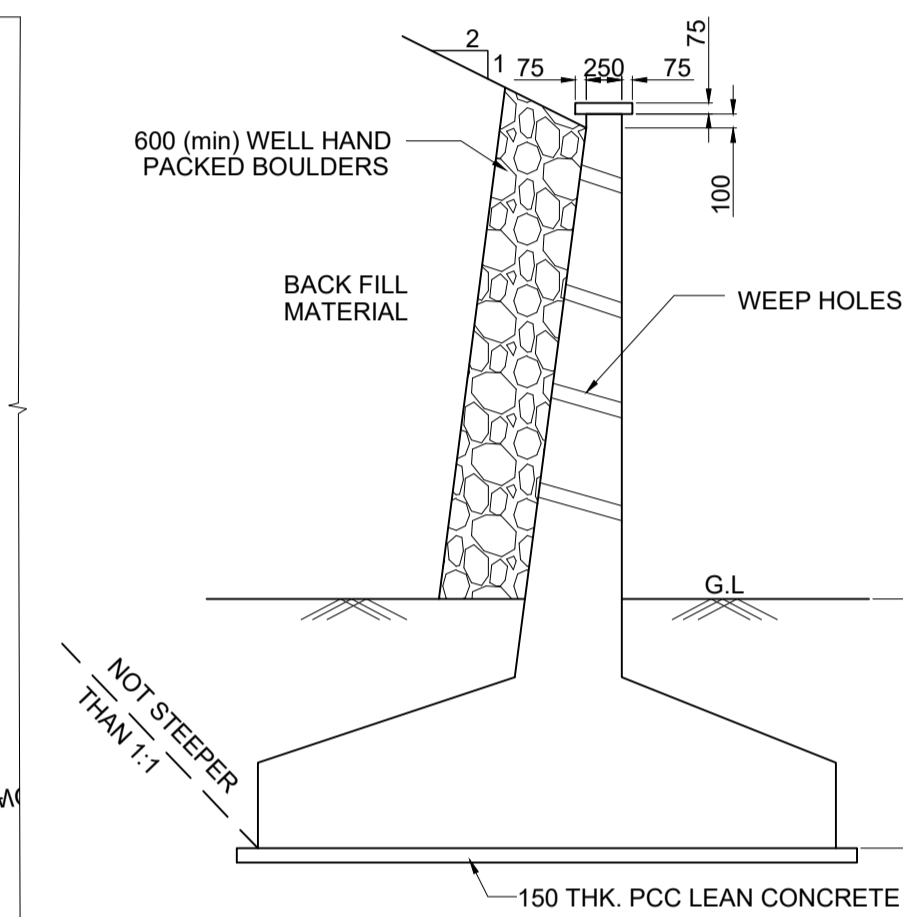
KEY PLAN

SCALE 1:NTS



PLAN AT TOP

SCALE 1:200



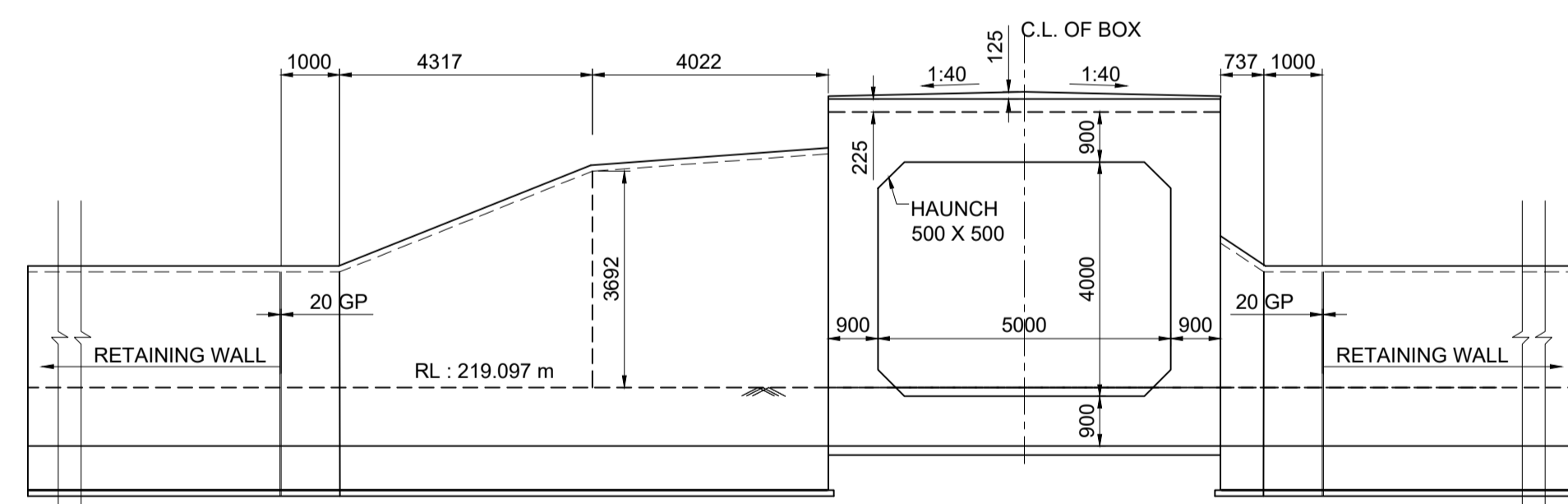
TYPICAL DETAIL OF RETURN WALL / WING WALL

SCALE 1:50

NOTES :

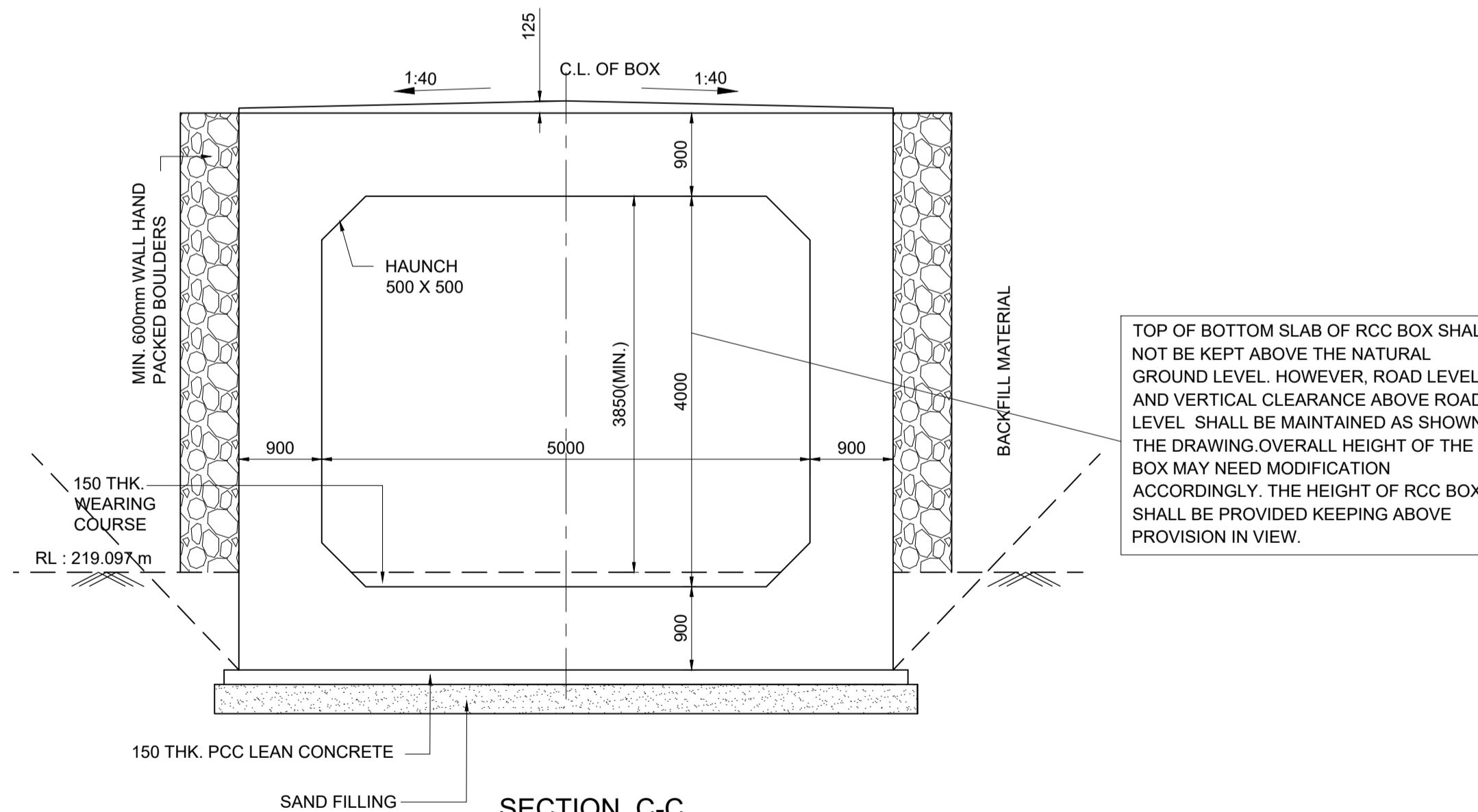
- A) GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  2. THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  4. BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  5. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  6. ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL, FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  9. THIS DRAWING IS THE PROPERTY OF HRDC AND FOR EXCLUSIVE USE OF HORC.
  10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRDC-SK-GEN-015.
  2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  3. ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  5. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES  
(i) IRS BRIDGE RULE  
(ii) IRS CONCRETE BRIDGE CODE  
(iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  6. SEISMIC ZONE - IV
  7. EXPOSURE CONDITION - MODERATE.
  8. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  9. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  10. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  11. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  12. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.  
GRADE OF CONCRETE :  
(i) ALL RCC =M:35/DETAILED DESIGN DRG.  
(ii) WEARING COURSE =M:20/DETAILED DESIGN DRG.  
(iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  13. BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  14. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  15. HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



VIEW AT B-B

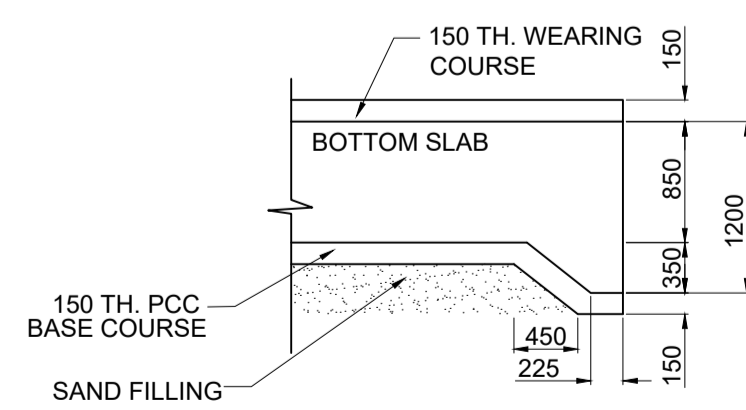
SCALE 1:50



SECTION C-C

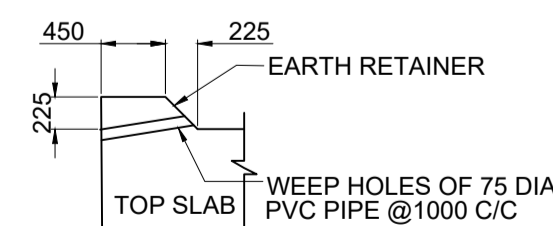
SCALE 1:50

TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



SHEAR KEY

SCALE 1:50



EARTH RETAINER

SCALE 1:50

LEGEND

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

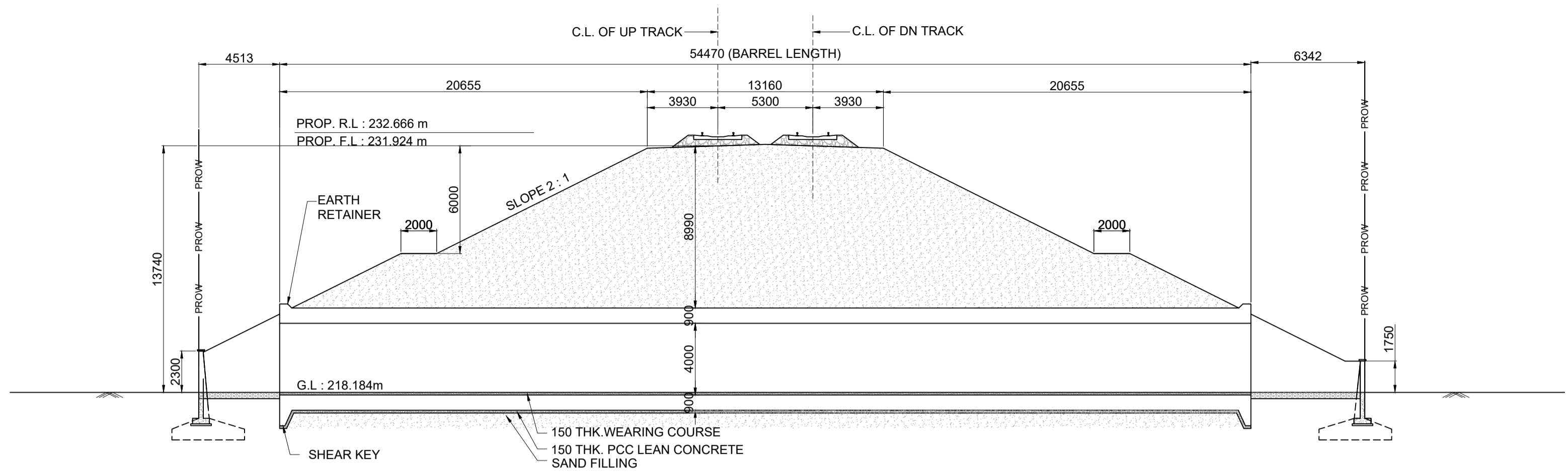
**CONSULTANT:**  
 GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



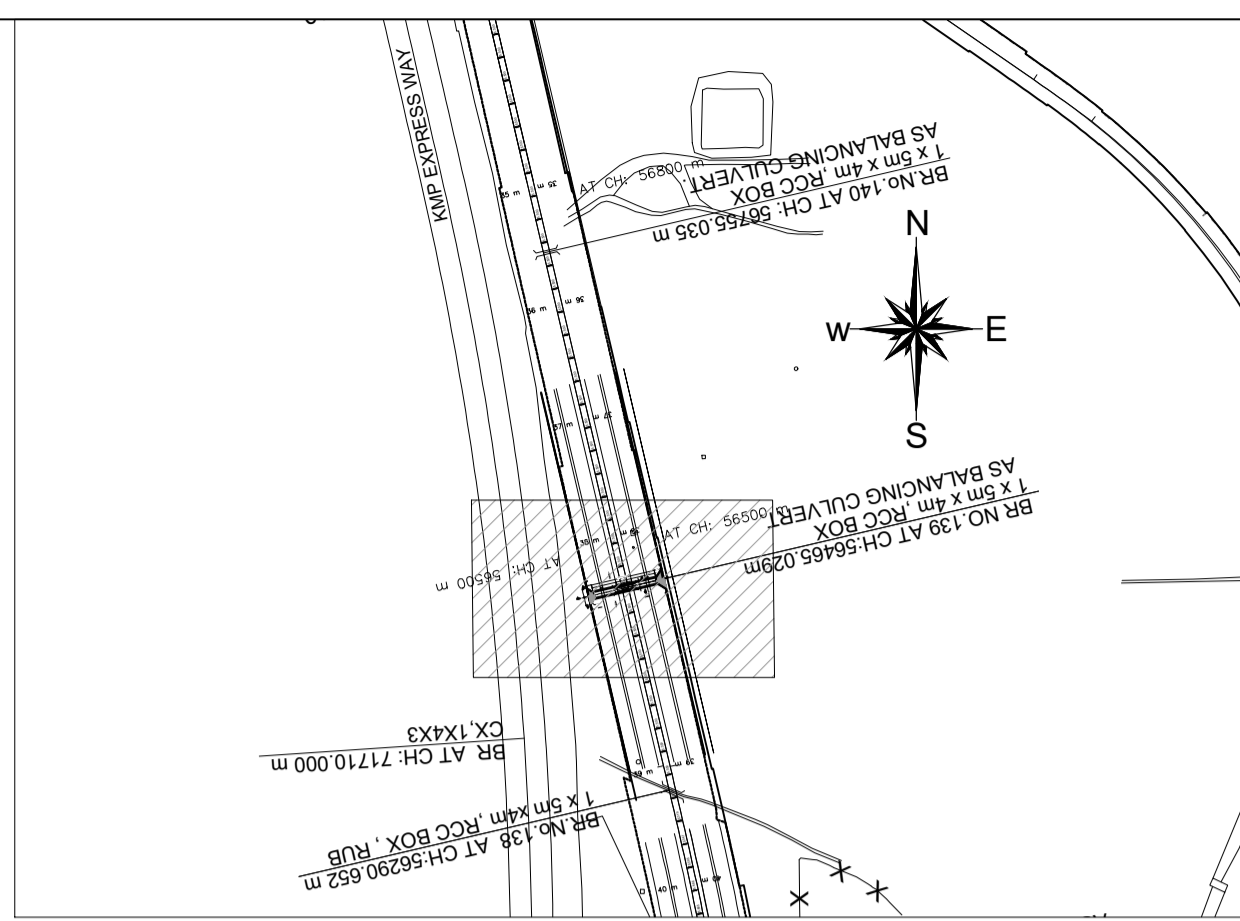
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO 138 SPAN 1.0X5.0X4.0 RCC BOX AT CH: 56290.652

**DRG. NO.** GC-HRDC-C2-DRW-BRD-GAD-01138\_A1 **SHEET NO.** 1 OF 1

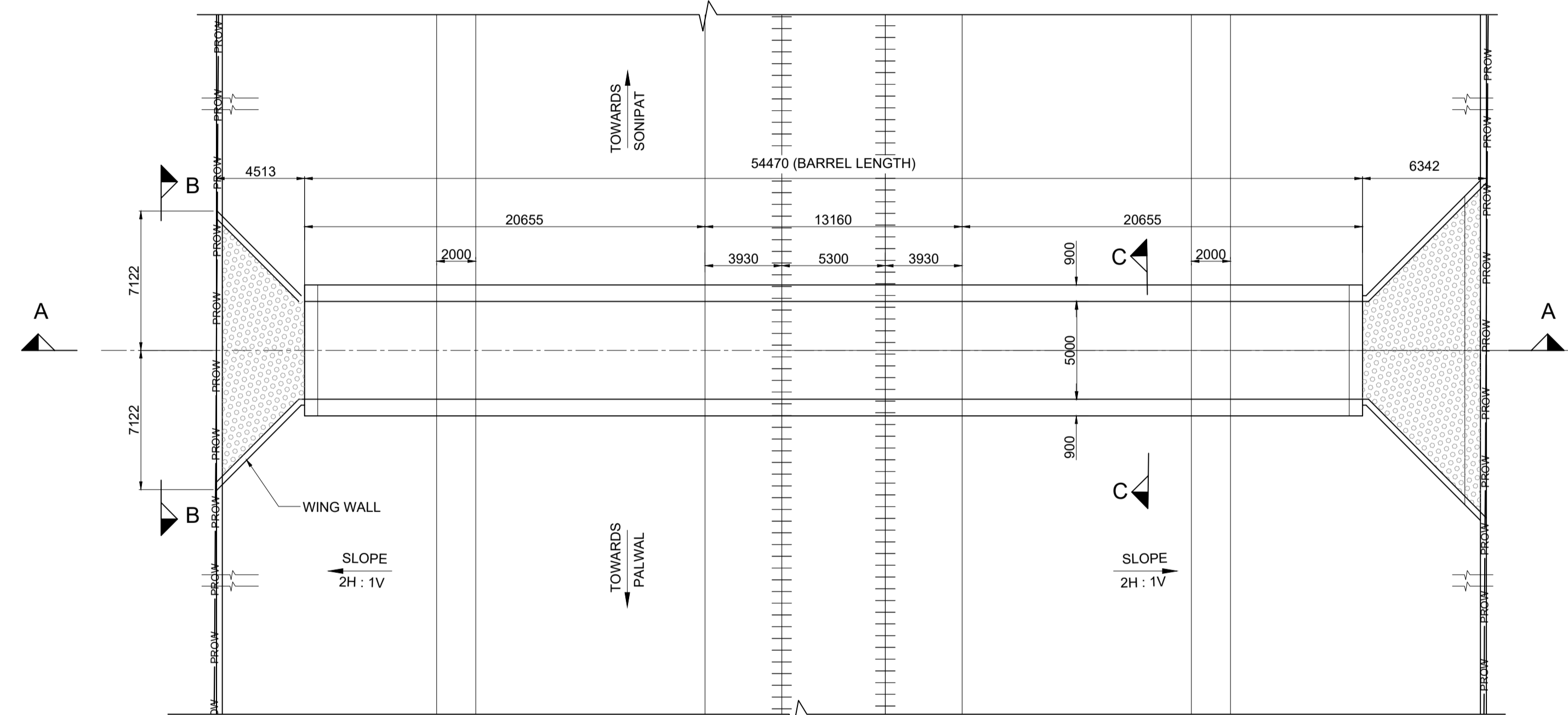
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



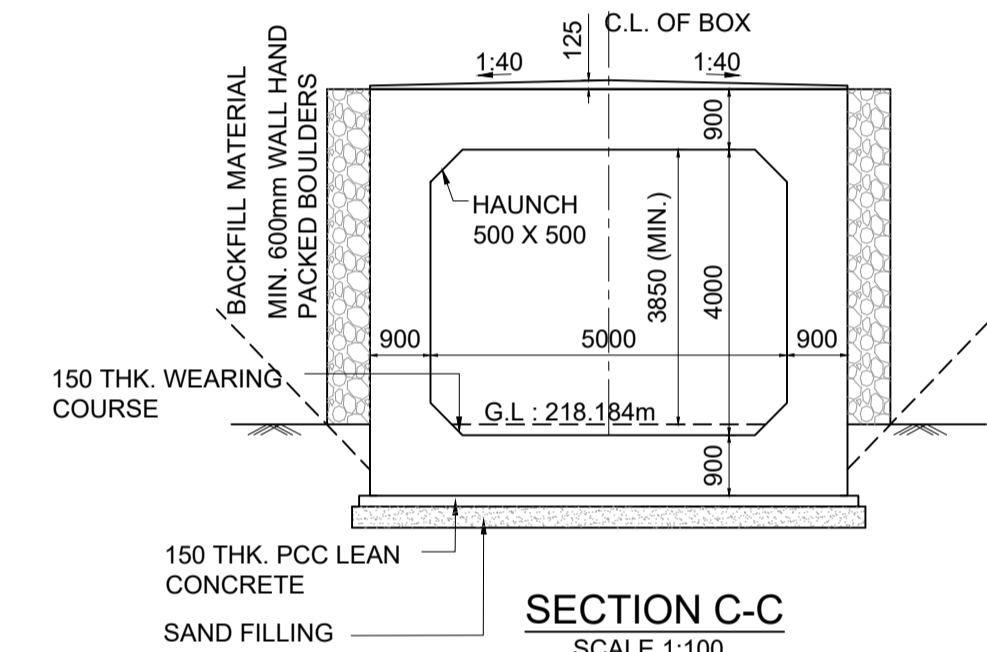
**SECTIONAL ELEVATION AT A-A**  
SCALE 1:200



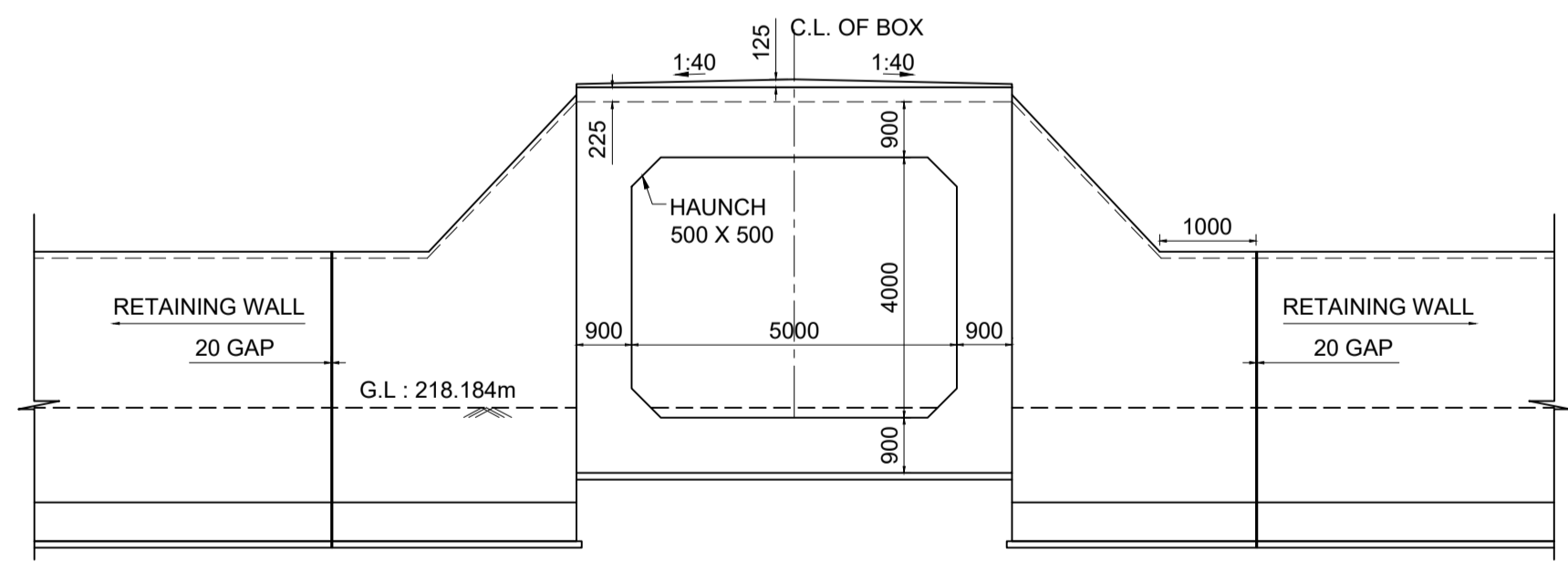
**KEY PLAN**  
SCALE 1:NTS



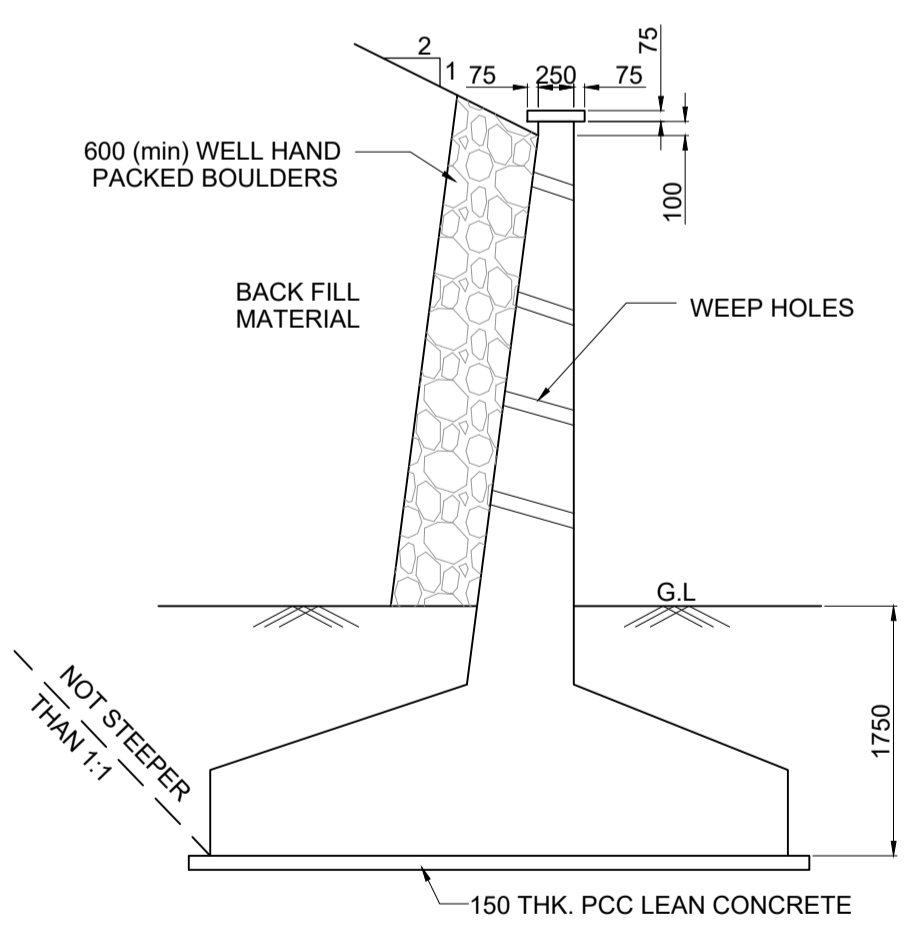
**PLAN AT TOP**  
SCALE 1:200



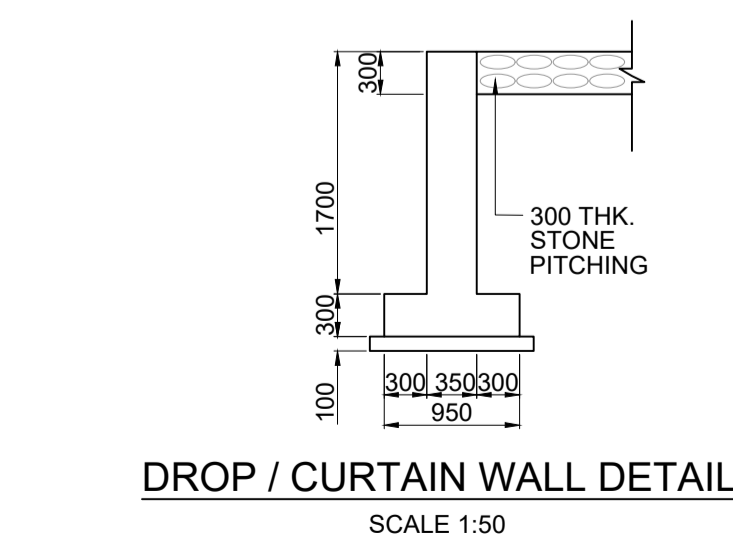
**SECTION C-C**  
SCALE 1:100



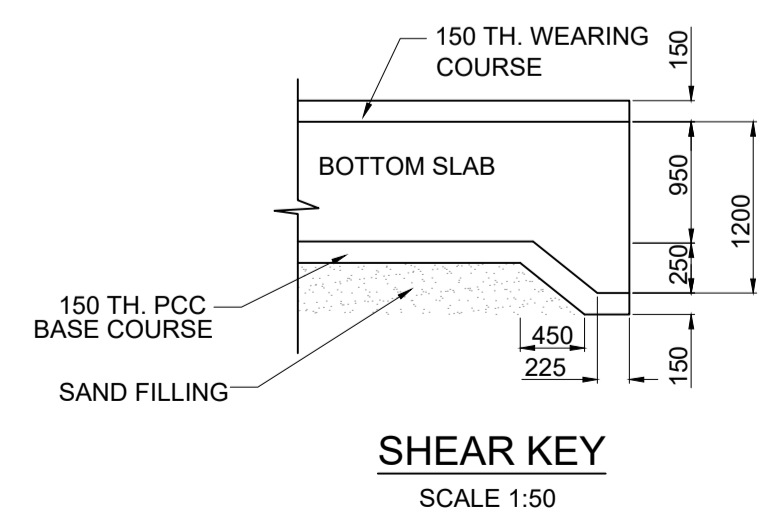
**VIEW AT B-B**  
SCALE 1:100



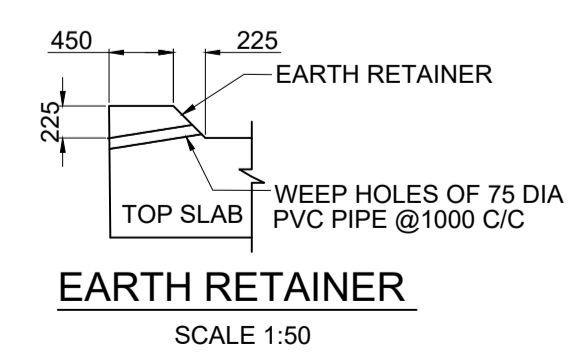
**TYPICAL DETAIL OF RETURN WALL / WING WALL**  
SCALE 1:50



**DROP / CURTAIN WALL DETAILS**  
SCALE 1:50



**SHEAR KEY**  
SCALE 1:50



**EARTH RETAINER**  
SCALE 1:50

**NOTES :**

**A) GENERAL NOTES :**

- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
- THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
- FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
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- ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
- THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HRIDC.
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- PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
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  - IRS CONCRETE BRIDGE CODE
  - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
- SEISMIC ZONE- IV
- EXPOSURE CONDITION- MODERATE.
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- THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
- ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
- REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
- FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

(i) ALL RCC	=M.35/DETAILED DESIGN DRG.
(ii) WEARING COURSE	=M.20/DETAILED DESIGN DRG.
(iii) LEVELING COURSE/LEAN CONCRETE	=M.20/DETAILED DESIGN DRG.
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- ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  
  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

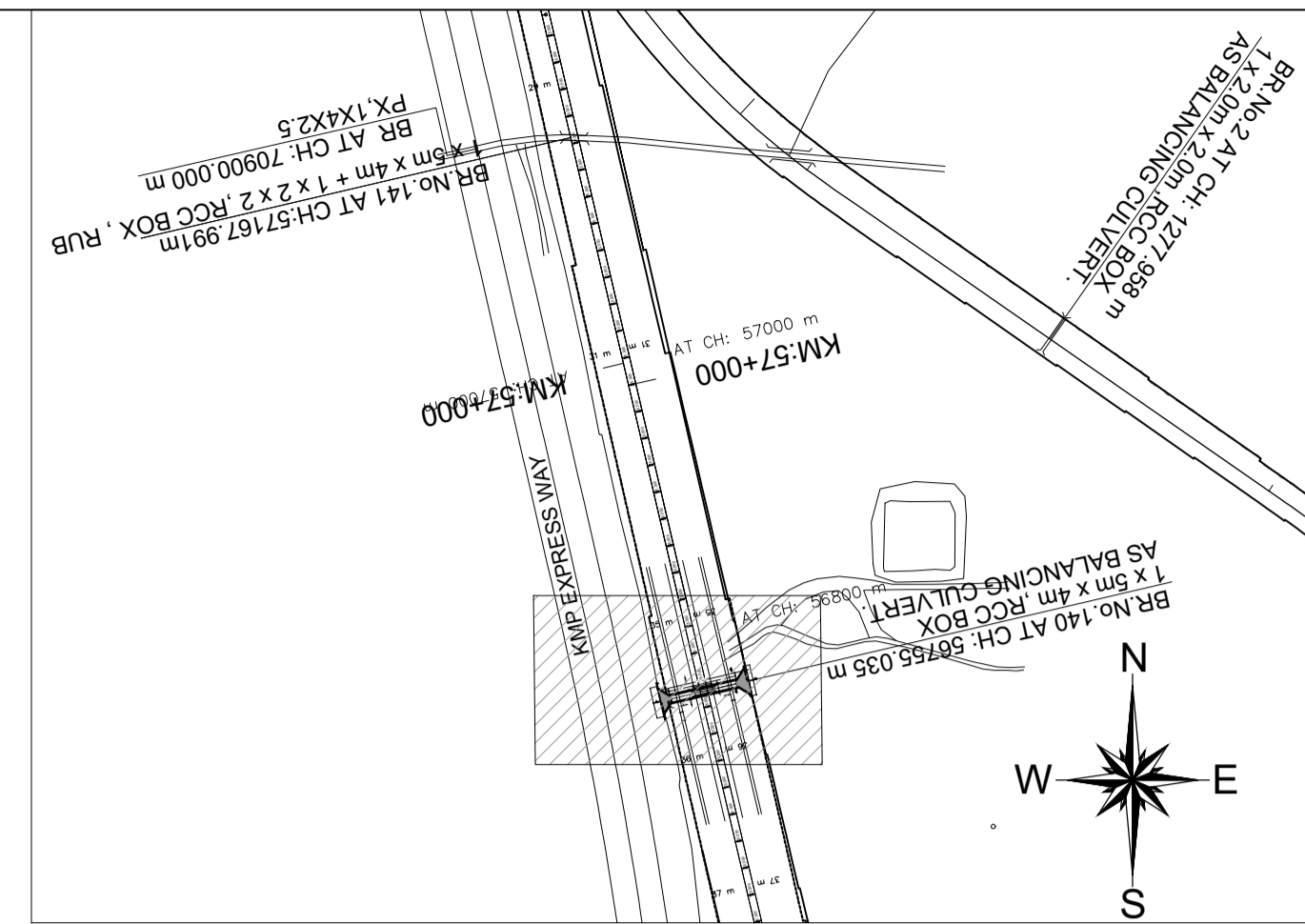
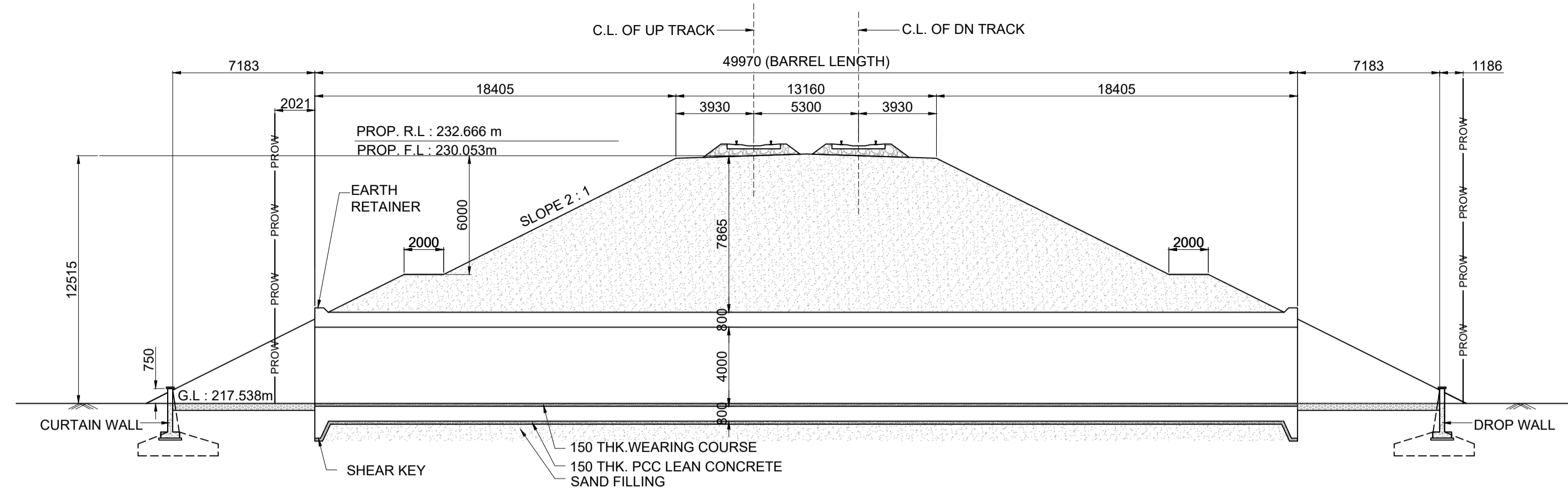


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 139 SPAN 1.0X5.0X4.0 RCC BOX AT CH: 56465.029

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01139\_A1 **SHEET NO.** 1 OF 1

<b>SCALE :</b>	<b>ISSUE DATE</b>	<b>REVISED DATE</b>
AS SHOWN	23-06-2022	29-07-2022

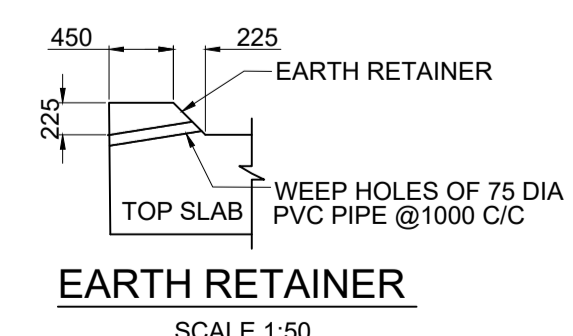
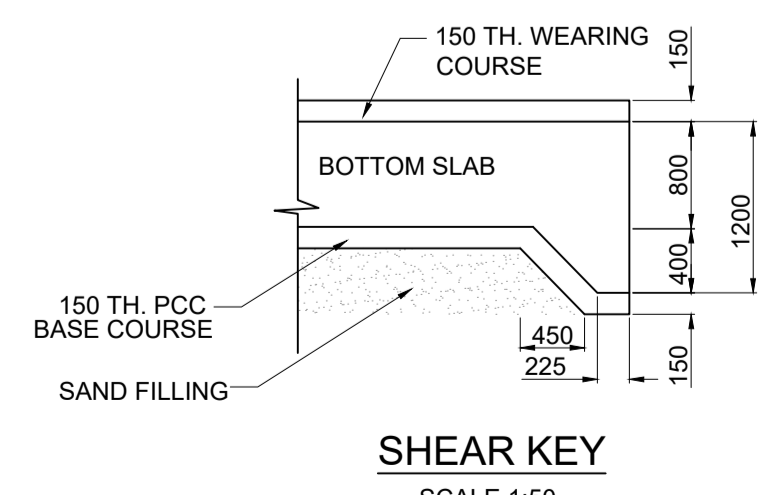
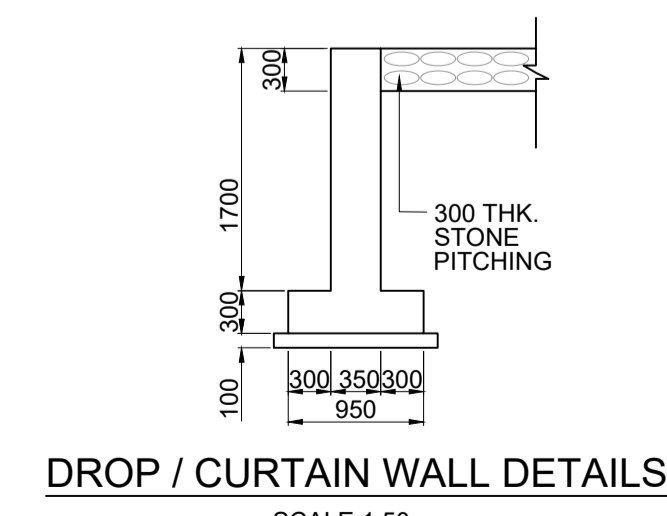
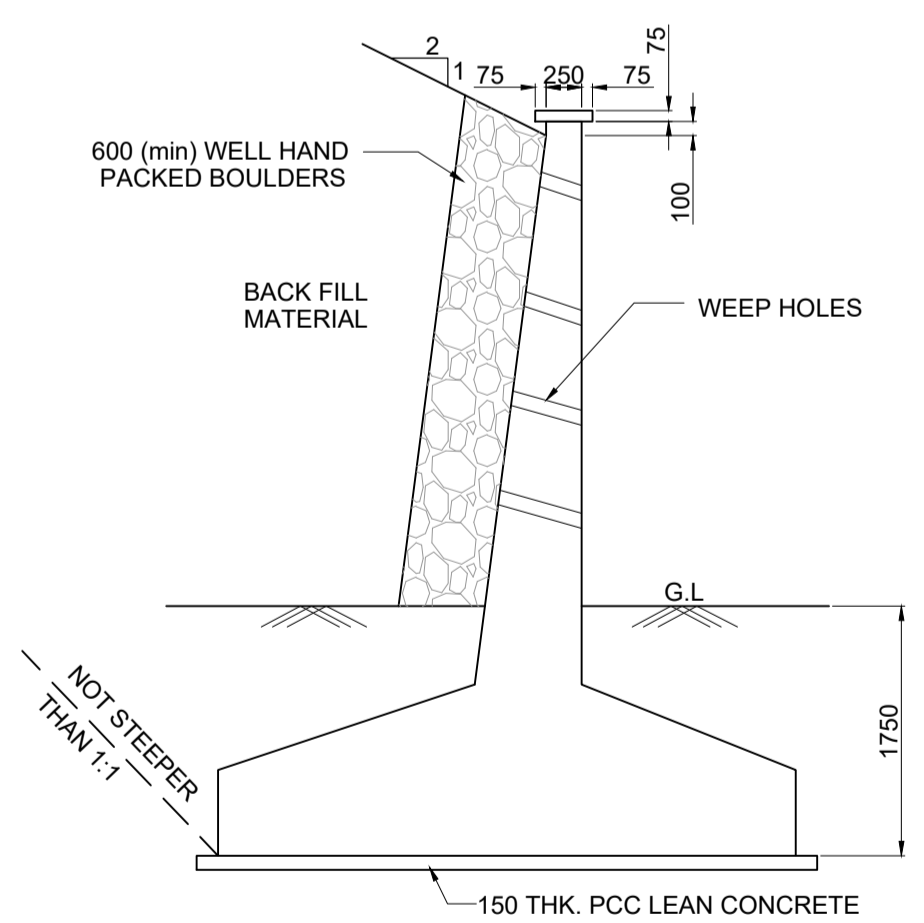
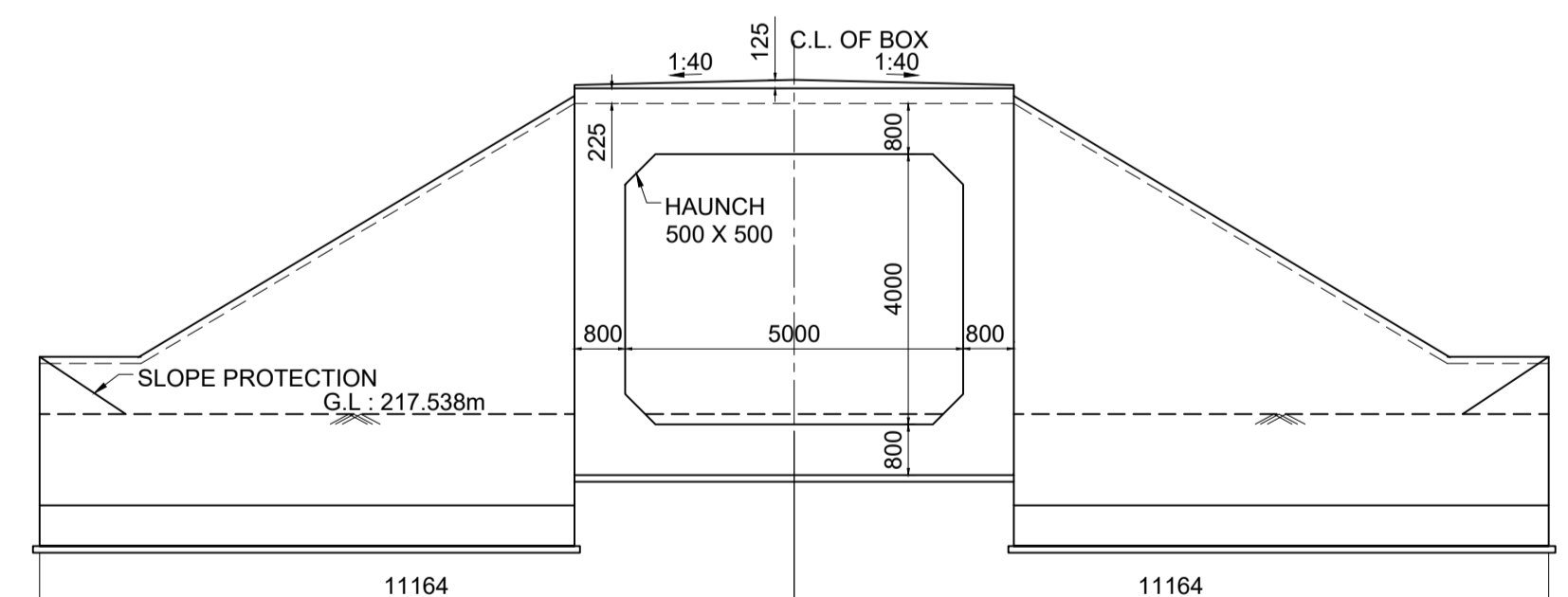
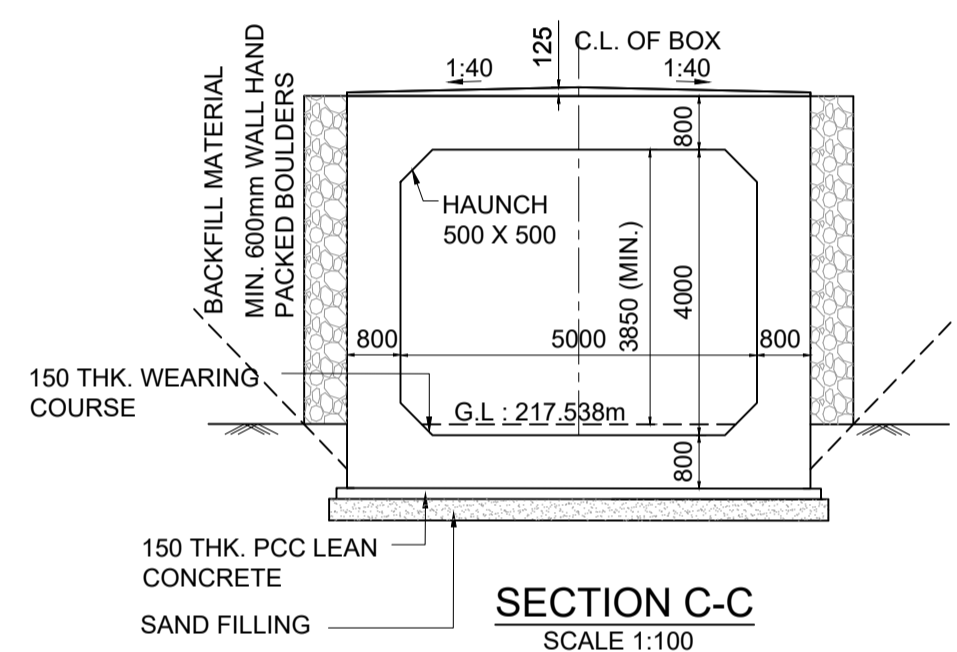
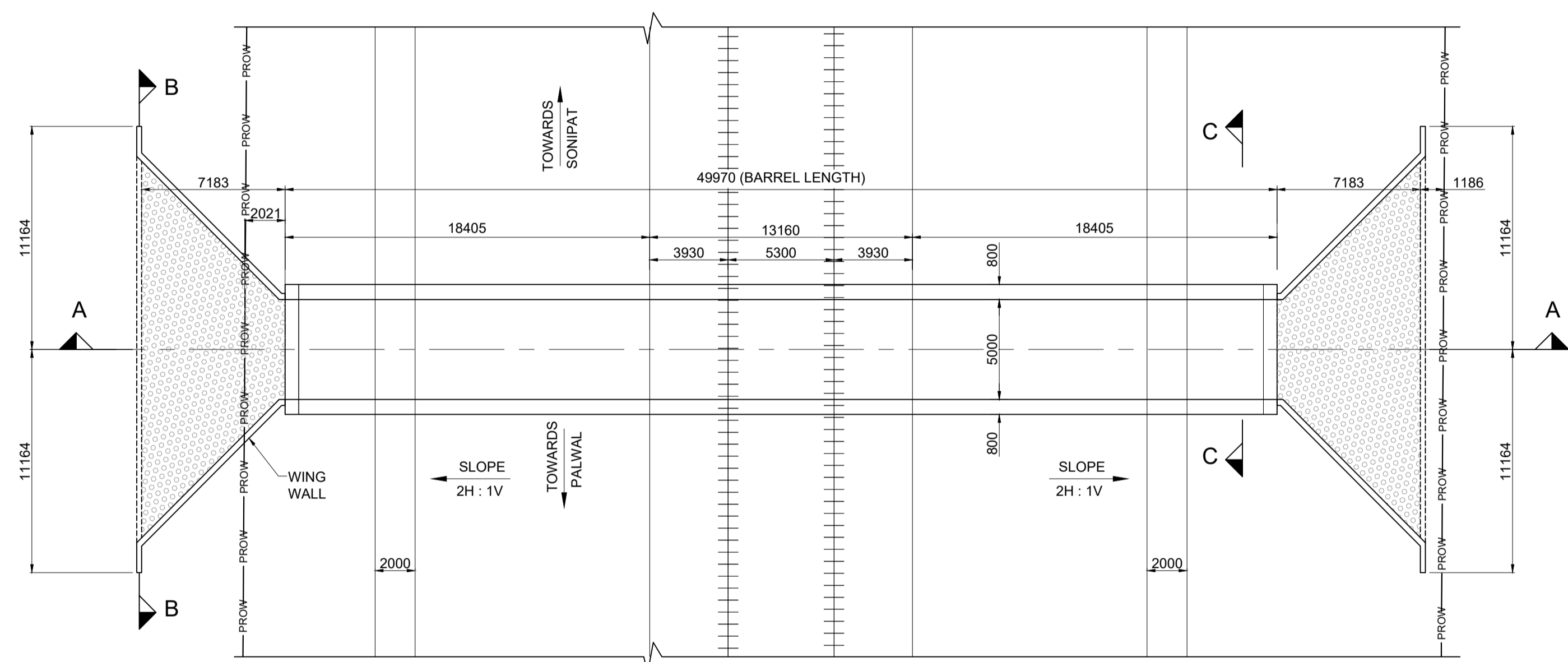
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA.M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			



- NOTES :**
- A) GENERAL NOTES :**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HRIDC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

(i) ALL RCC	=M.35/DETAILED DESIGN DRG.
(ii) WEARING COURSE	=M.20/DETAILED DESIGN DRG.
(iii) LEVELING COURSE/LEAN CONCRETE	=M.20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

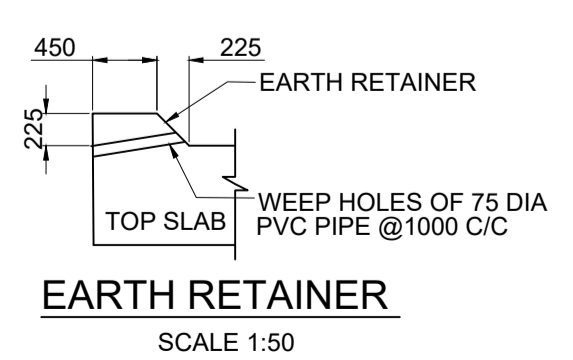
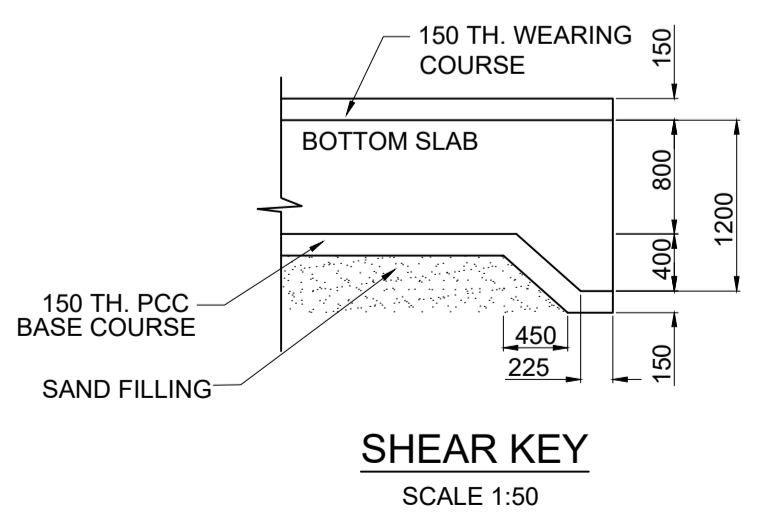
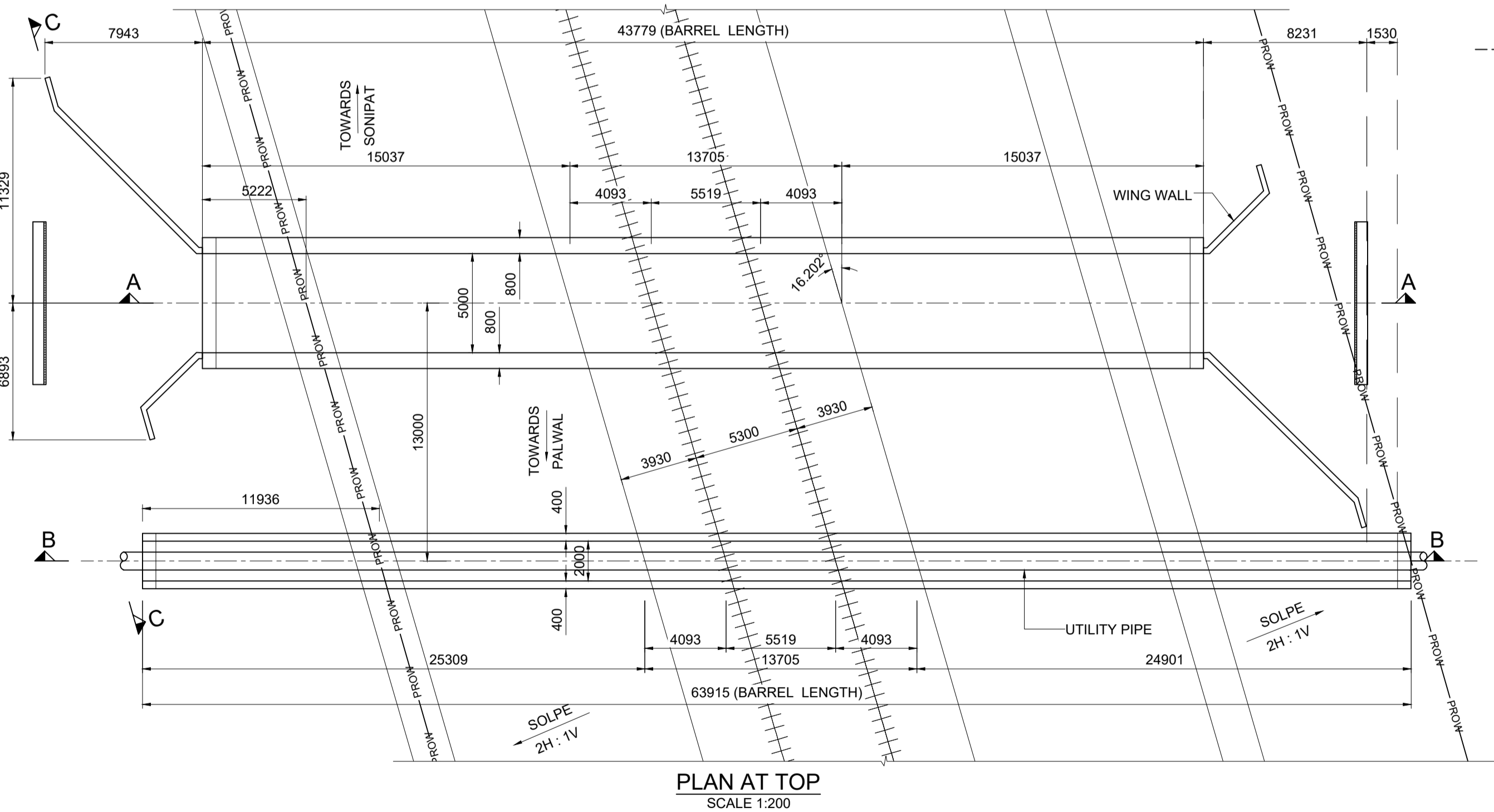
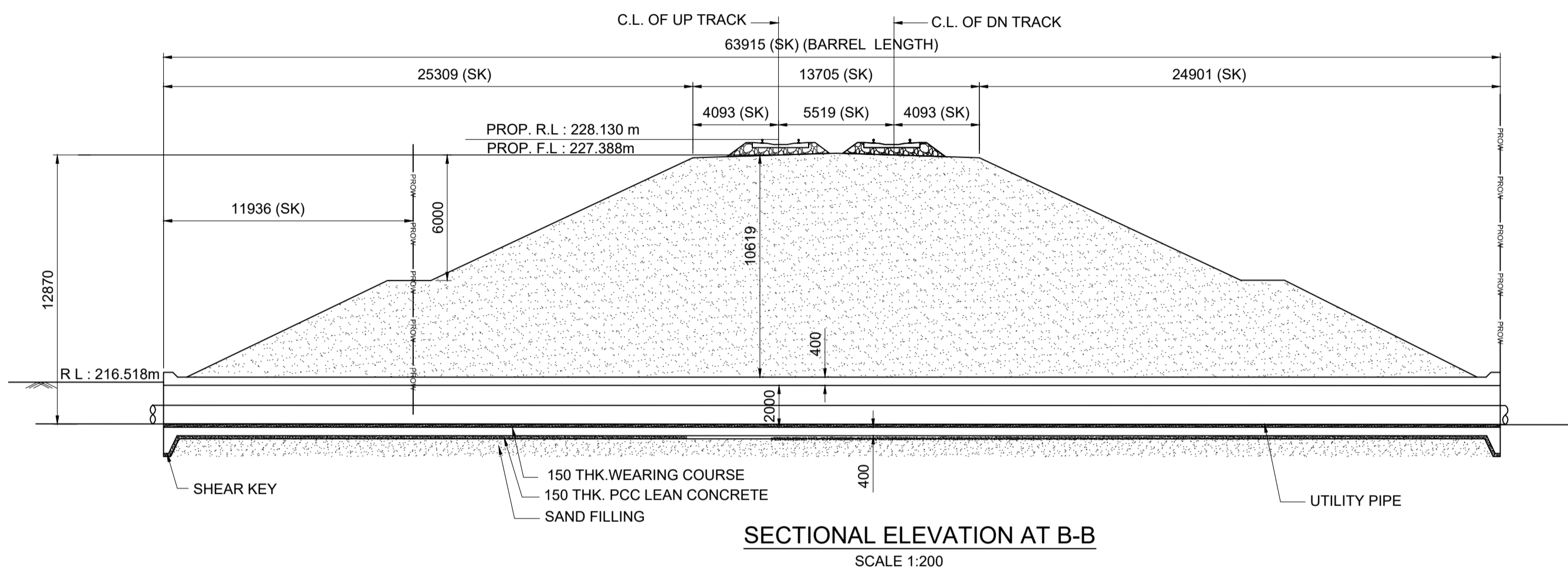
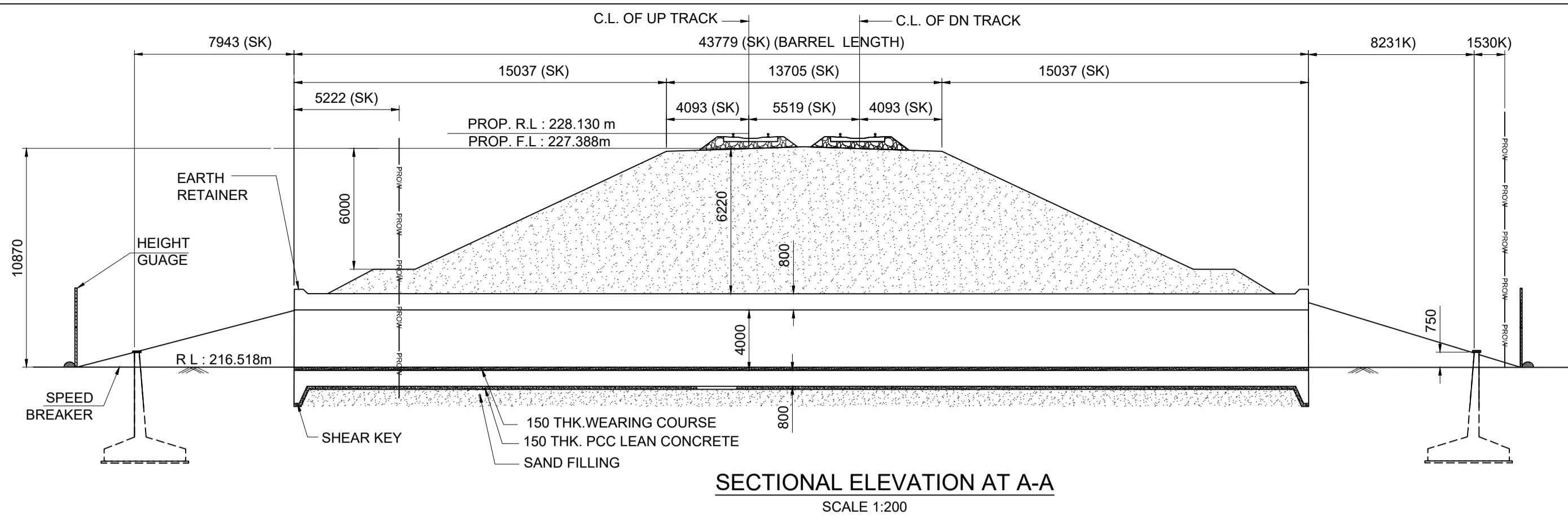


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 140 SPAN 1.0X5.0X4.0 RCC BOX AT CH: 56755.035

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01140\_A1 **SHEET NO.** 1 OF 1

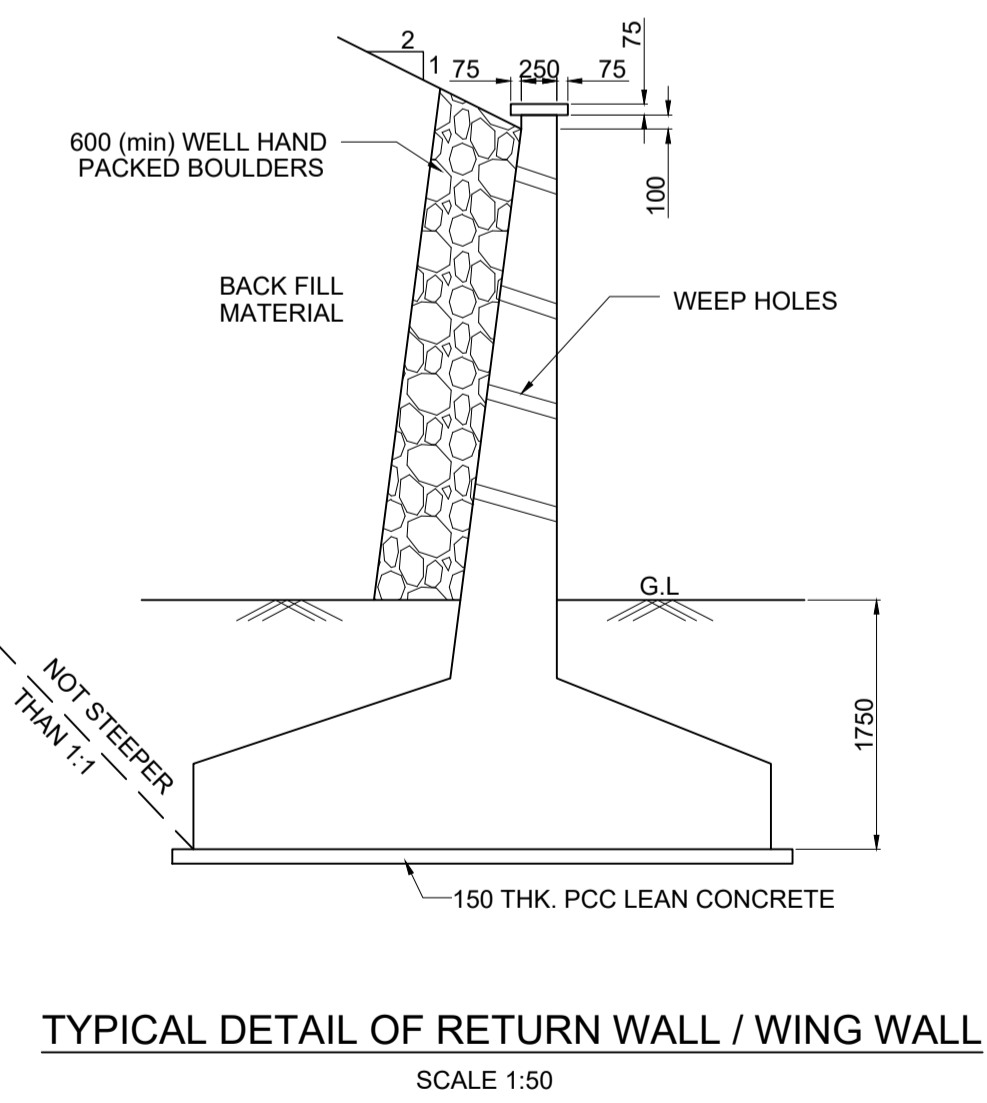
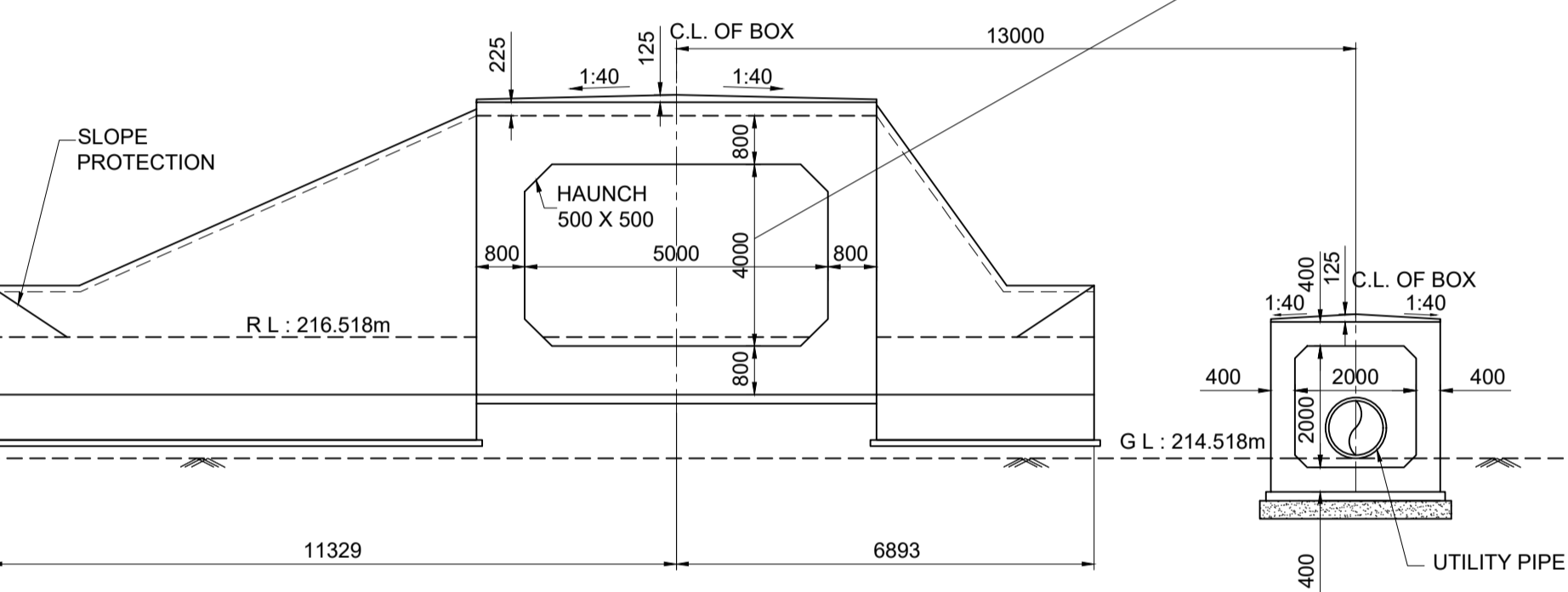
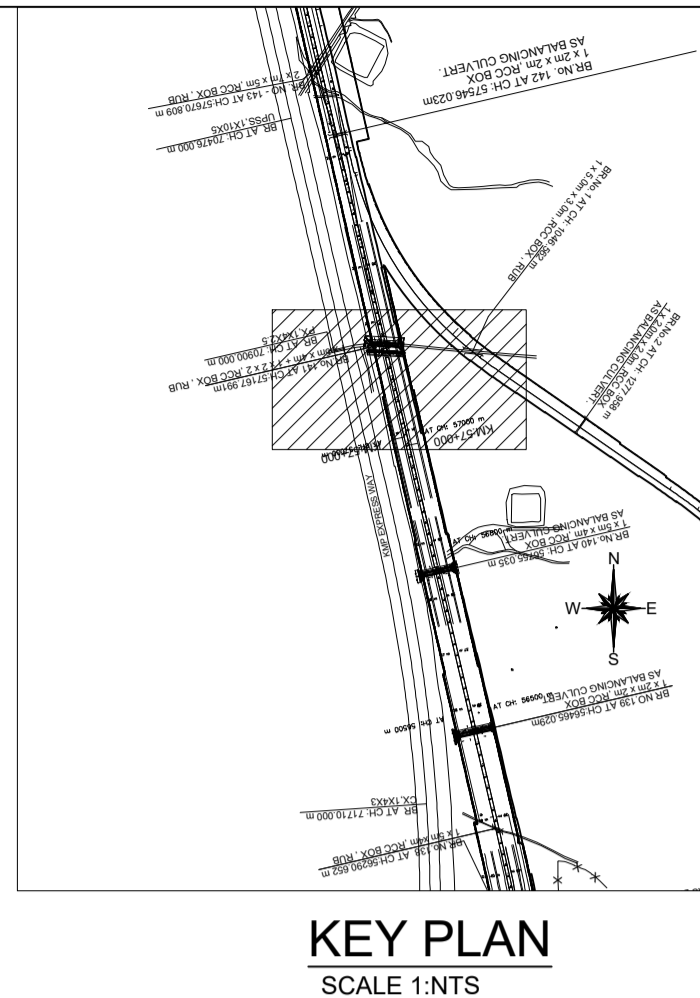
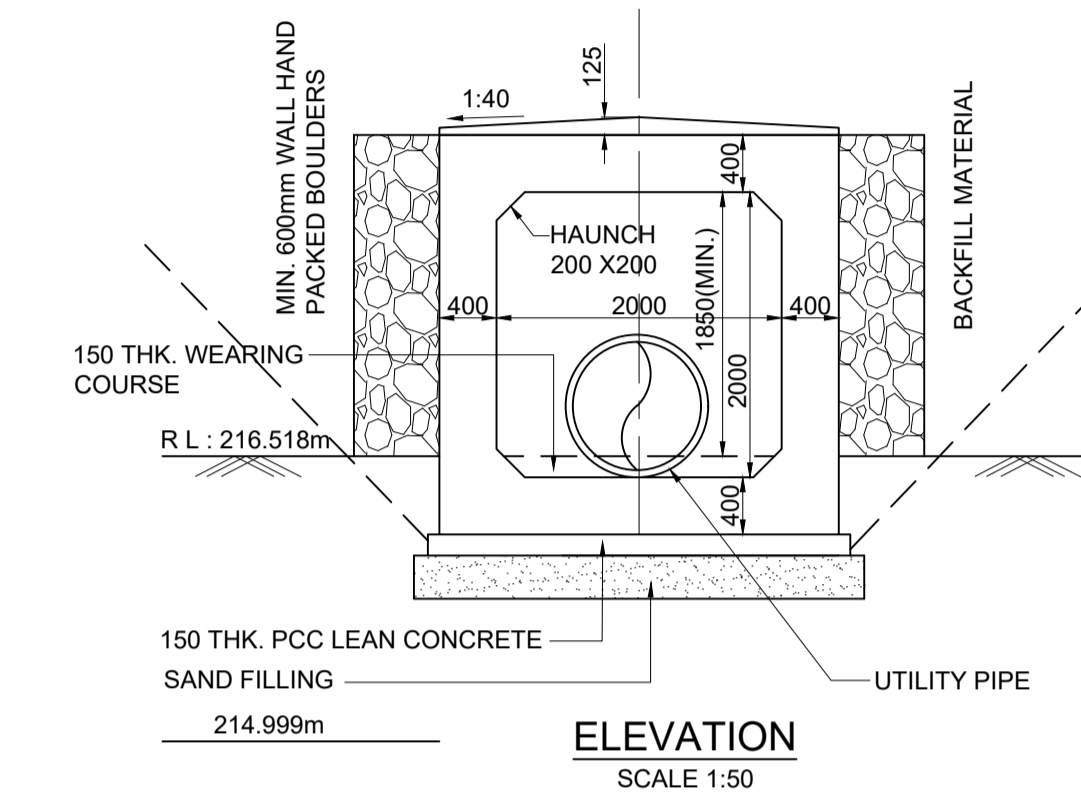
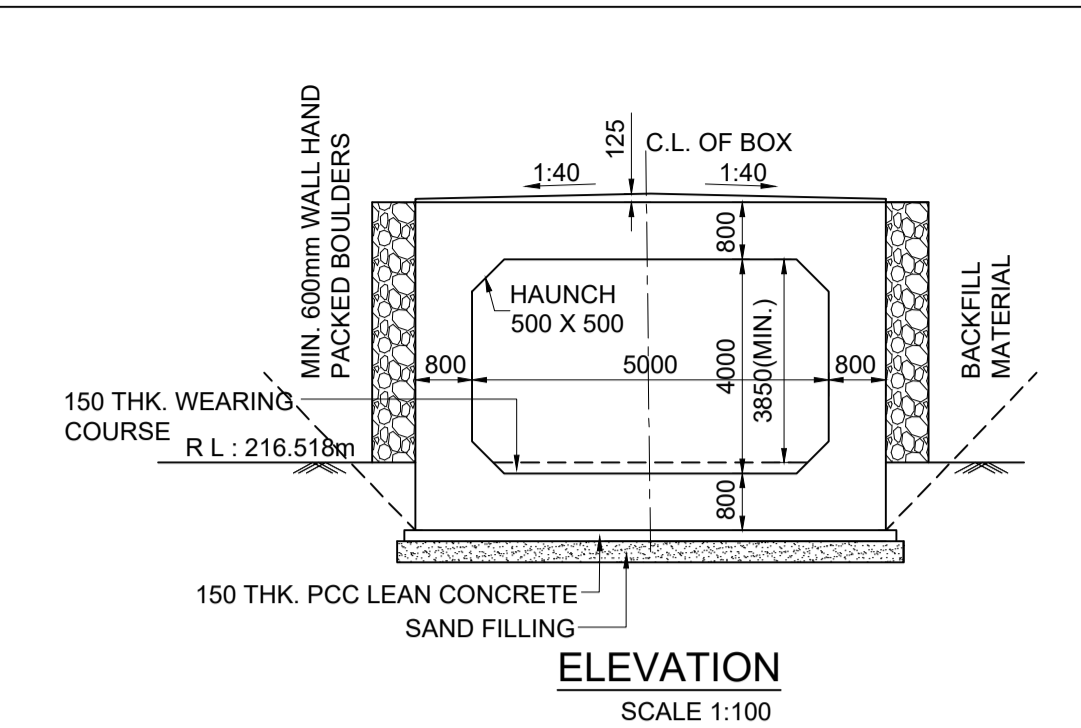
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL



TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL, FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE OF C/DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE. GRADE OF CONCRETE :
    - ALL RCC =M:35/DETAILED DESIGN DRG.
    - WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.
- IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

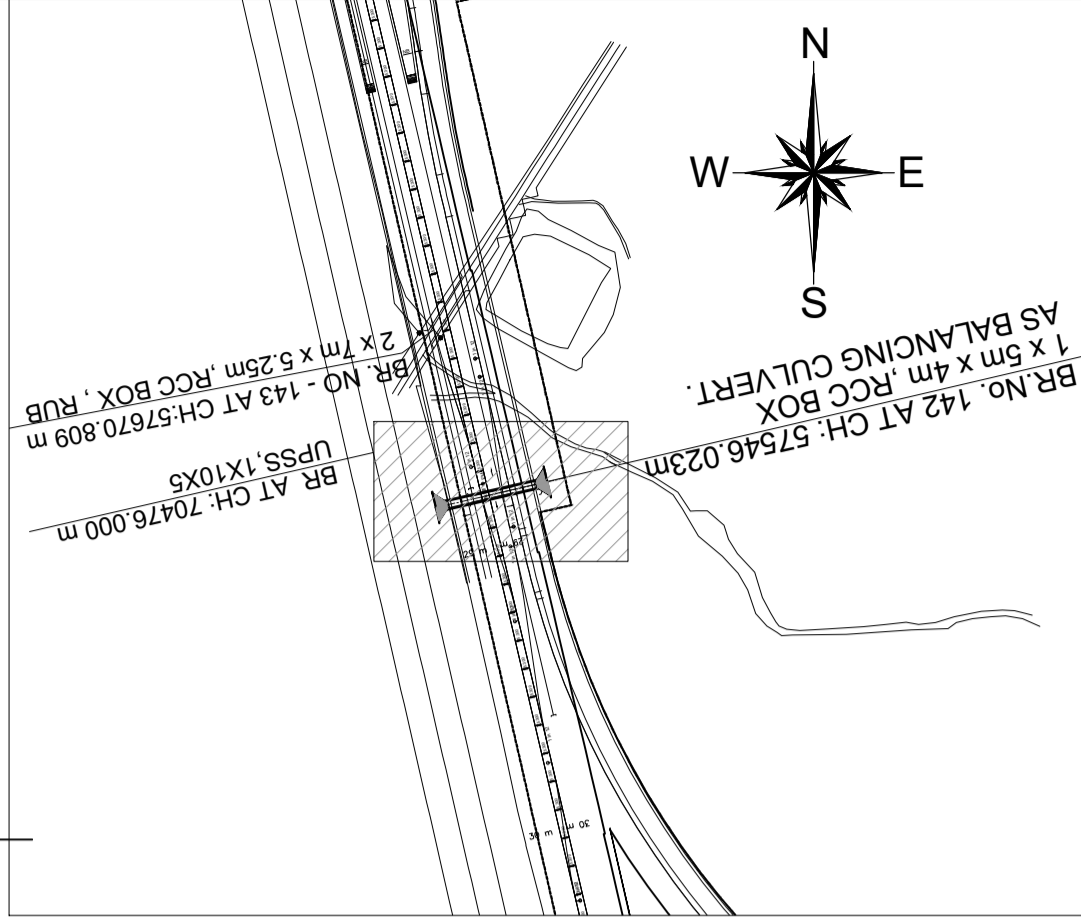
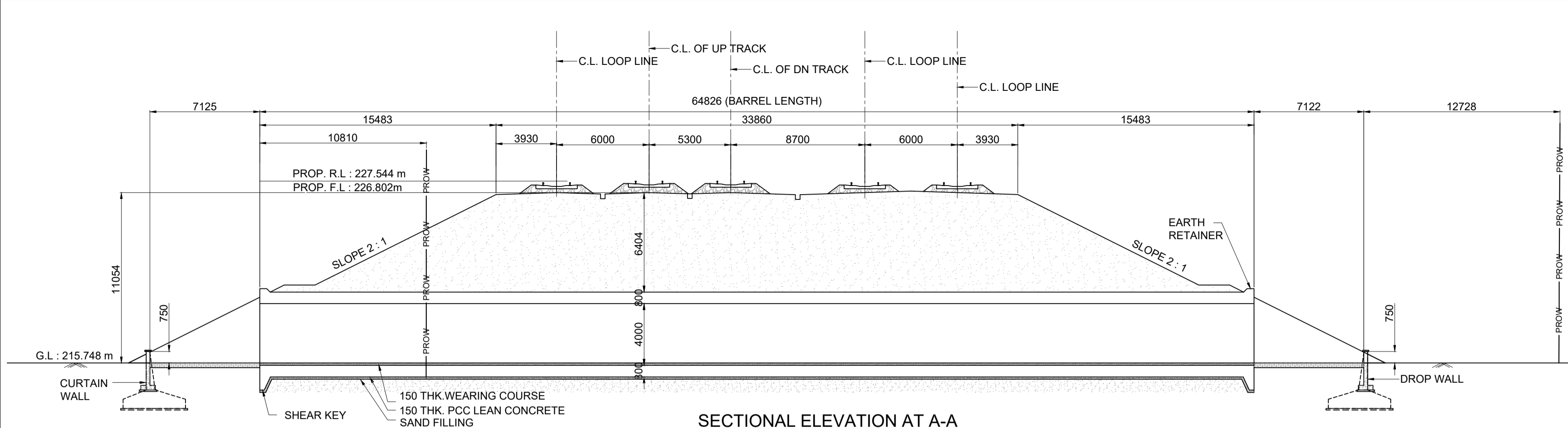


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO 141 SPAN 1x5x4 +1x2x2RCC BOX AT CH: 57167.991

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01141\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

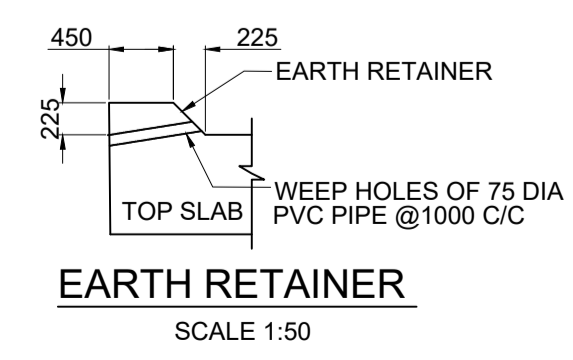
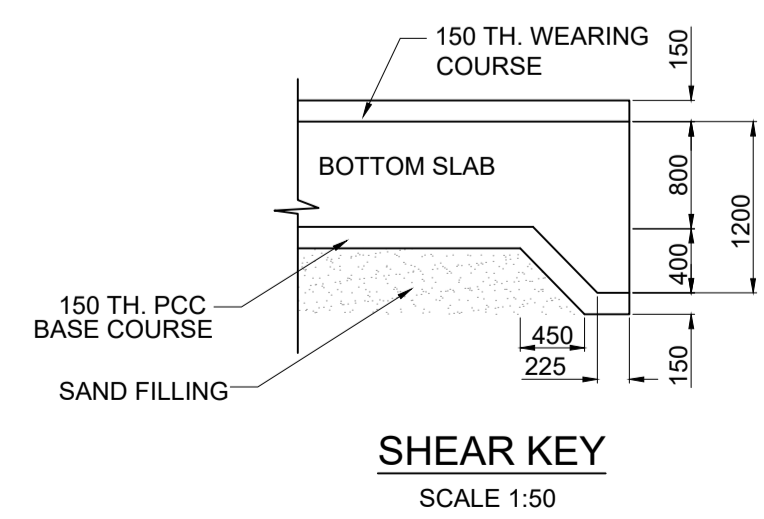
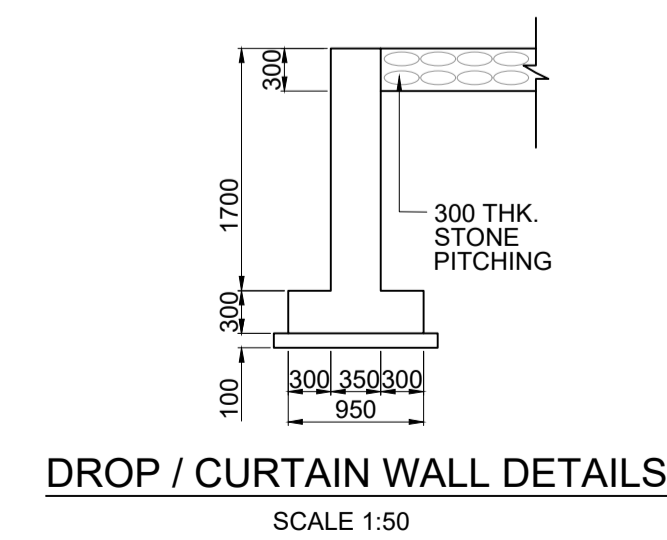
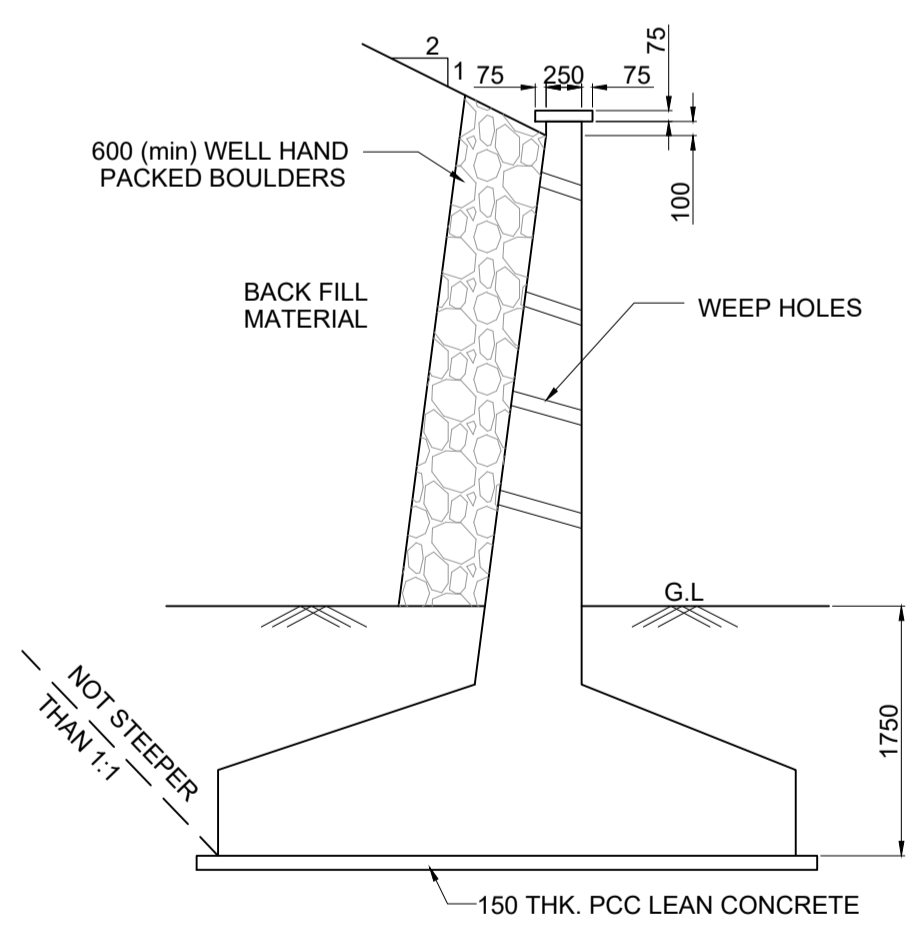
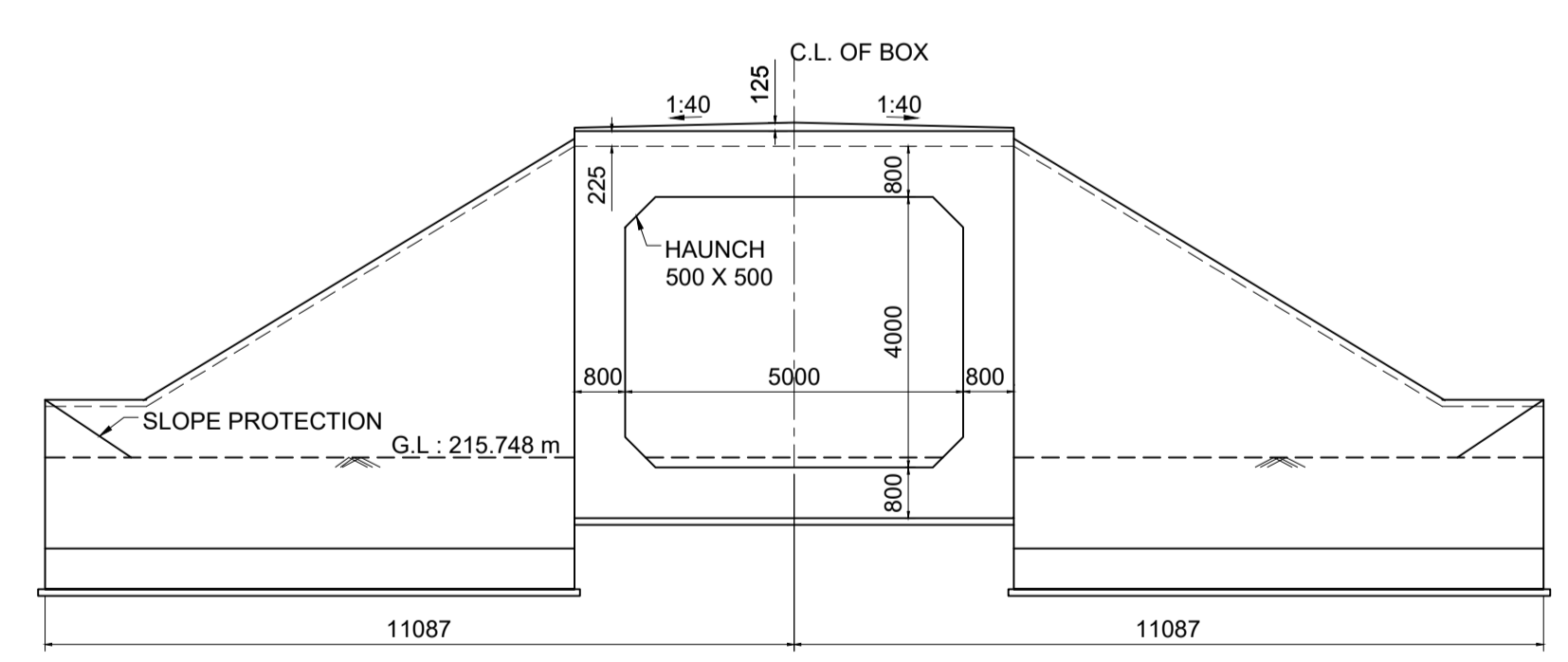
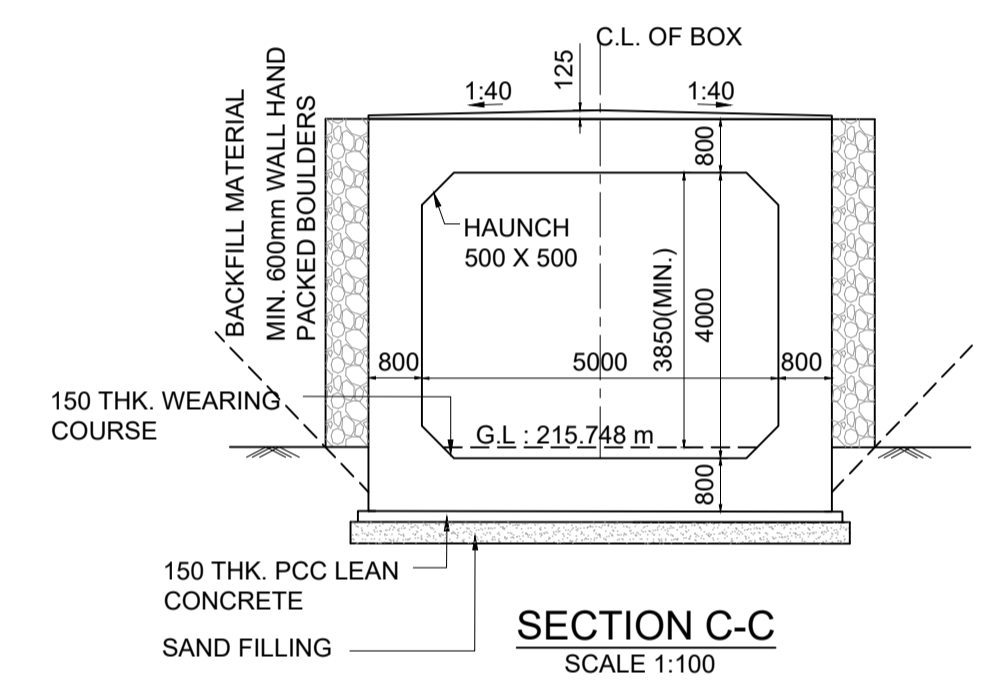
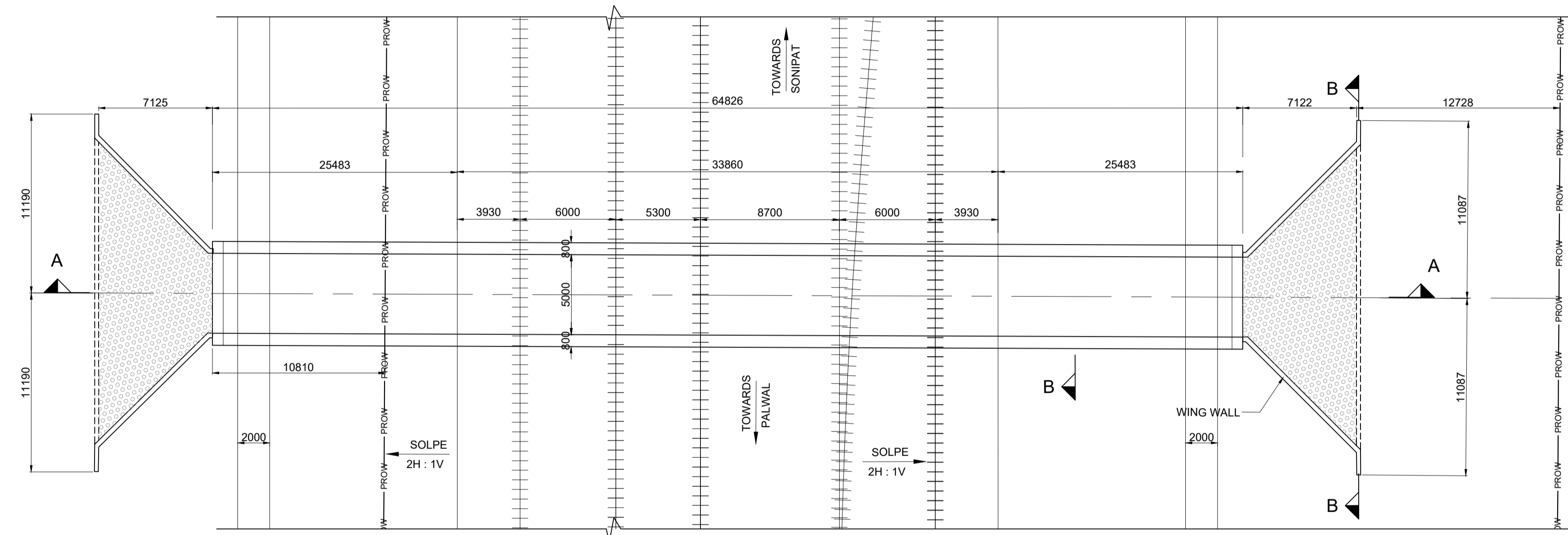
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HRIDC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

    - ALL RCC = M.35/DETAILED DESIGN DRG.
    - WEARING COURSE = M.20/DETAILED DESIGN DRG.
    - LEVELING COURSE/LEAN CONCRETE = M.20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



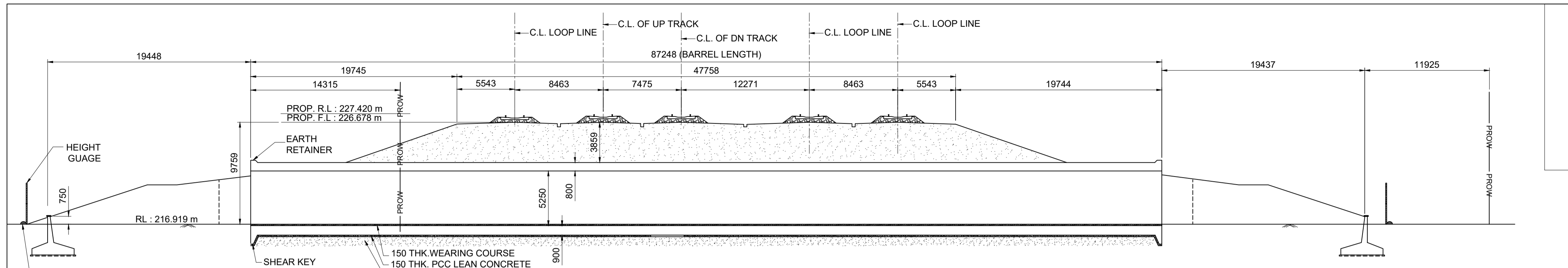
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 142 SPAN 1.0X5.0X4.0 RCC BOX AT CH: 57546.023

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01142\_A1 **SHEET NO.** 1 OF 1

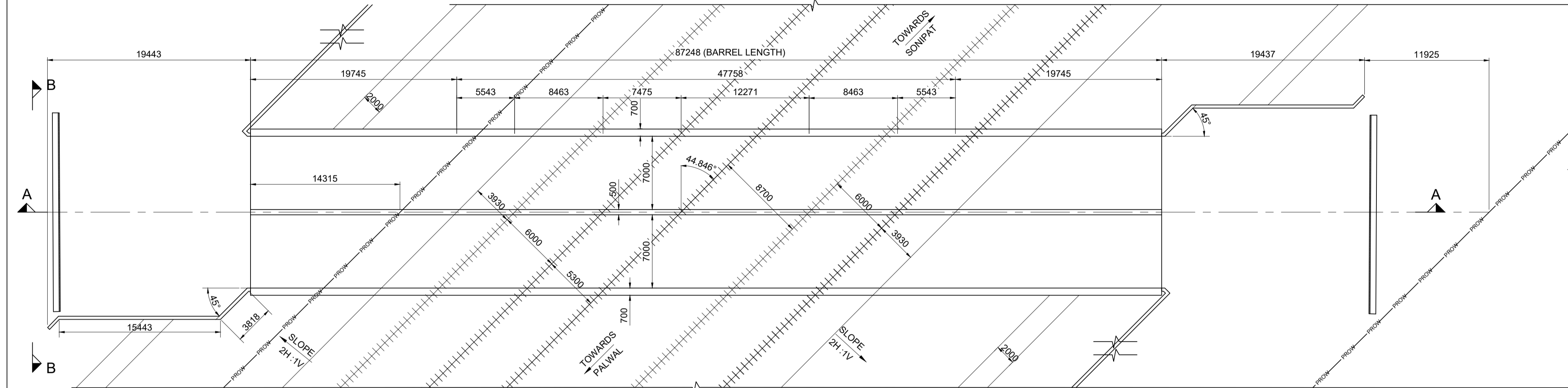
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

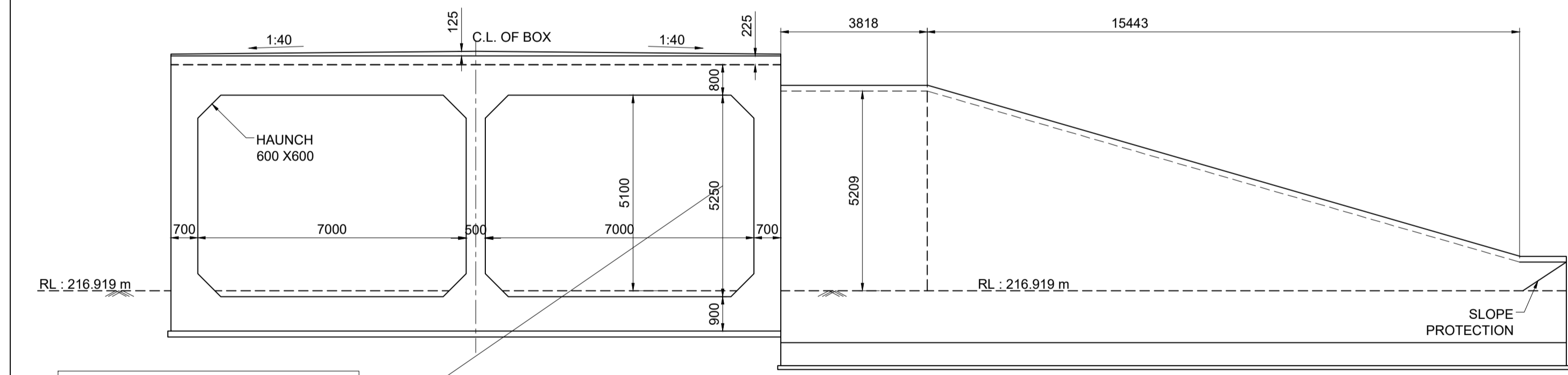




**SECTIONAL ELEVATION AT A-A**  
SCALE 1:250

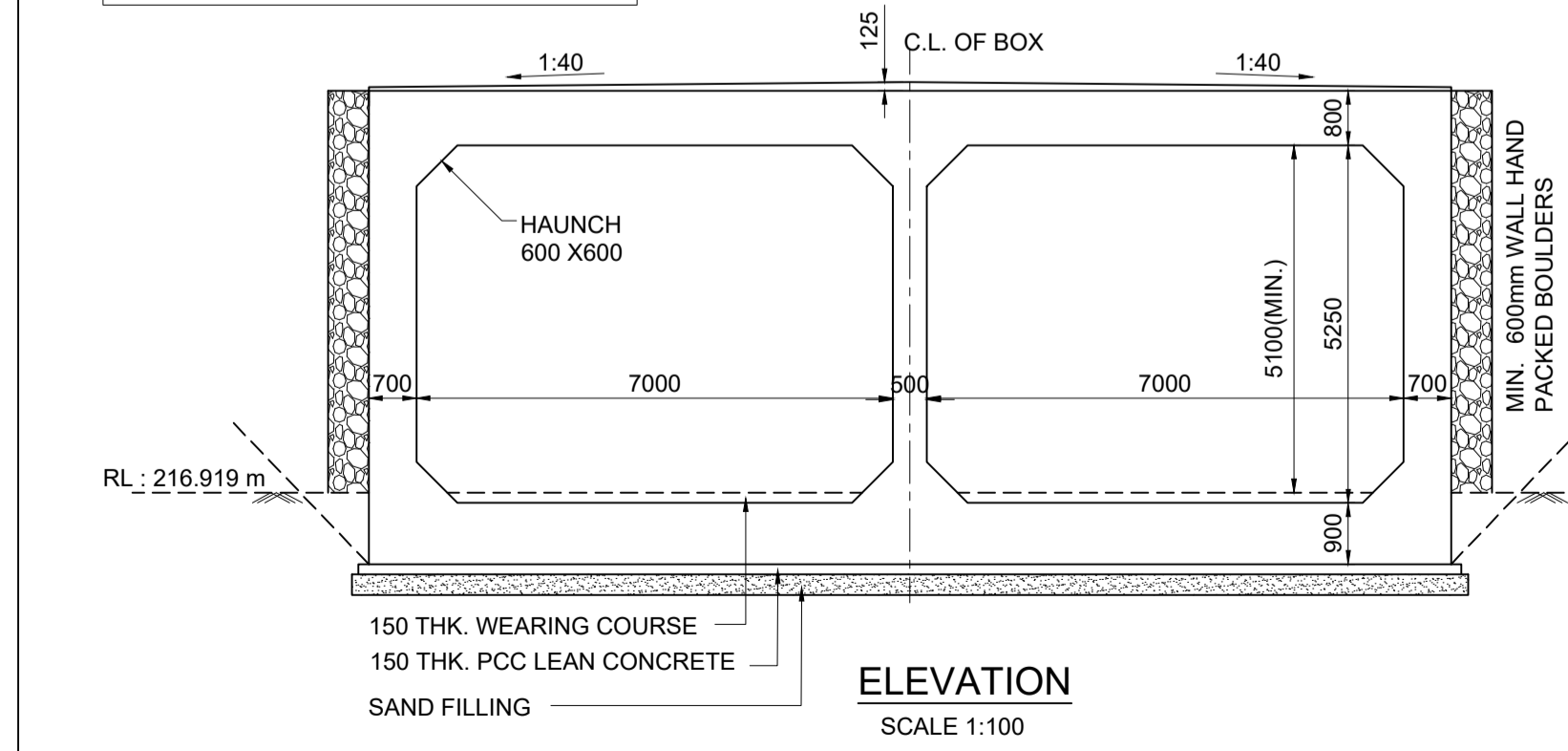


**PLAN AT TOP**  
SCALE 1:250

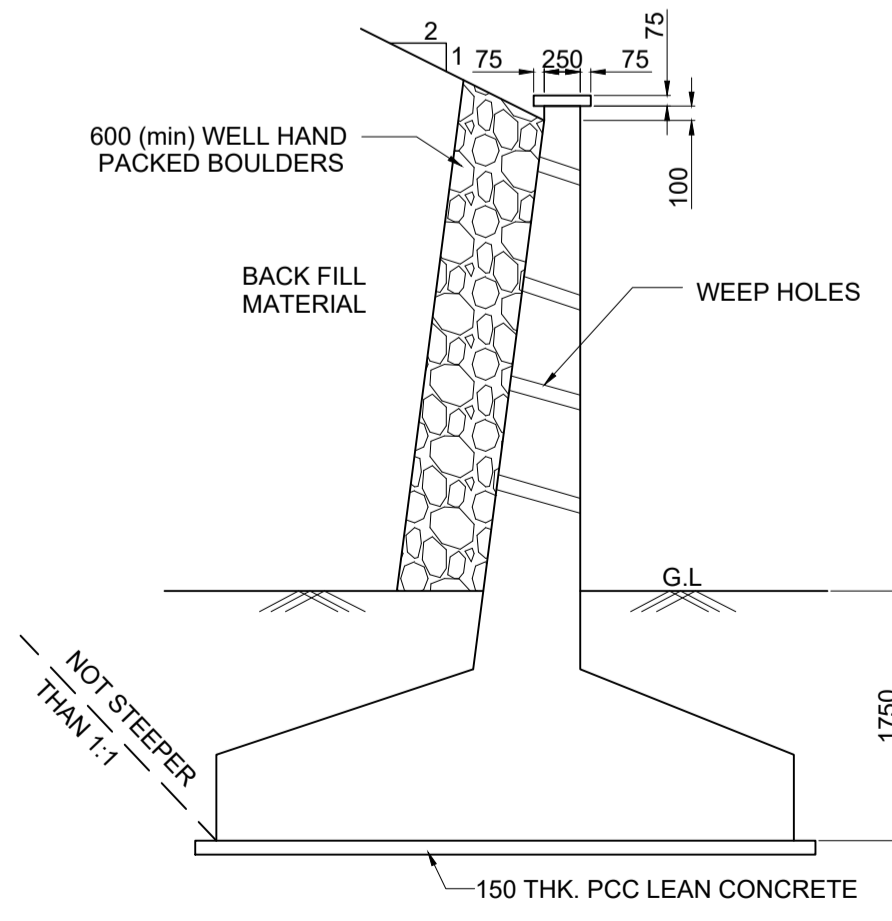


**SECTION B-B**  
SCALE 1:100

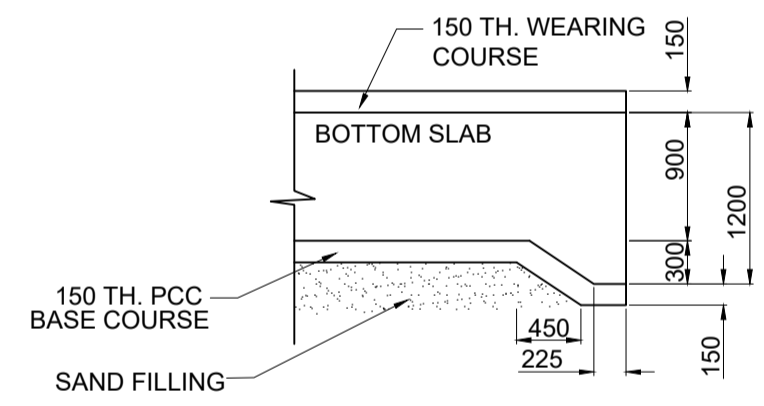
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



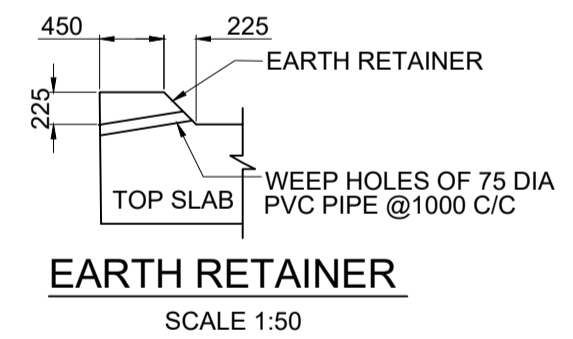
**ELEVATION**  
SCALE 1:100



**TYPICAL DETAIL OF RETURN WALL / WING WALL**  
SCALE 1:50



**SHEAR KEY**  
SCALE 1:50



**EARTH RETAINER**  
SCALE 1:50

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE - IV
  - EXPOSURE CONDITION - MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
    - GRADE OF CONCRETE :
      - (i) ALL RCC =M:35/DETAILED DESIGN DRG.
      - (ii) WEARING COURSE =M:20/DETAILED DESIGN DRG.
      - (iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

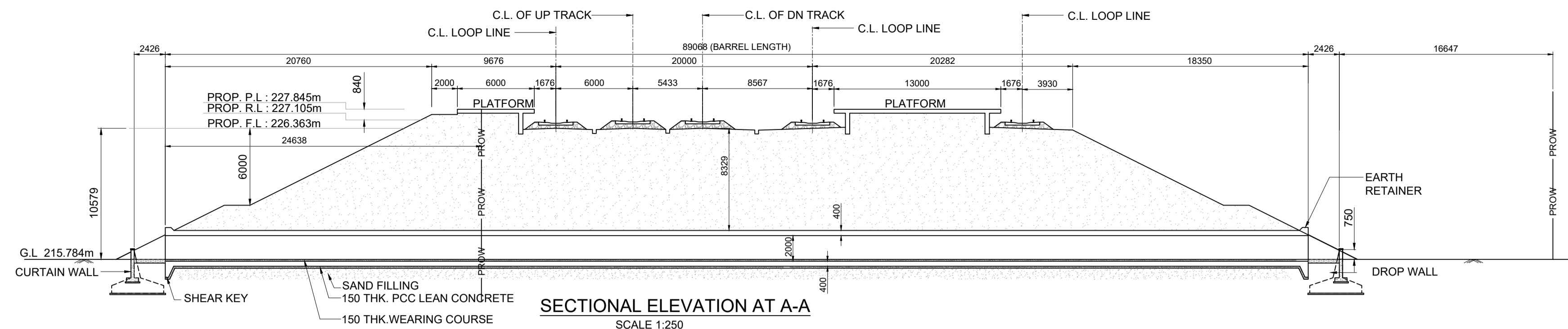
**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



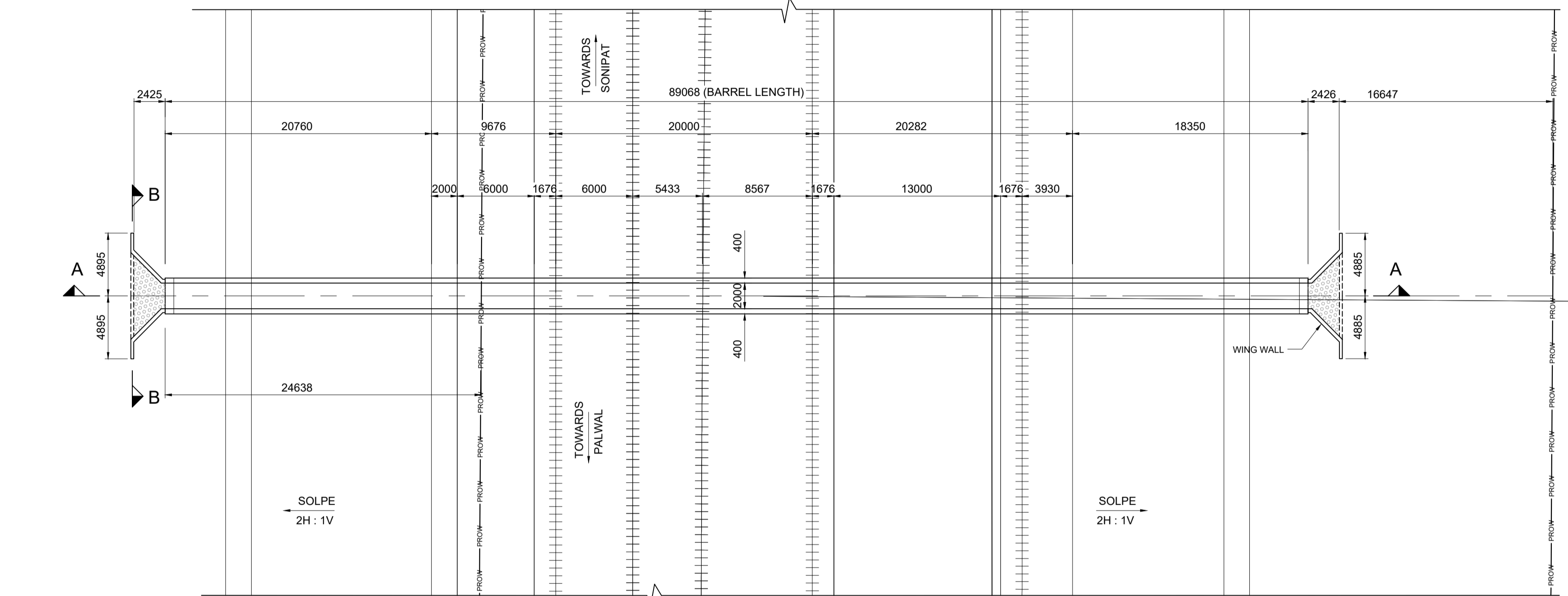
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO 143 SPAN 2.0X7.0X5.25 RCC BOX AT CH: 57670.809

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01143\_A1 **SHEET NO.** 1 OF 1

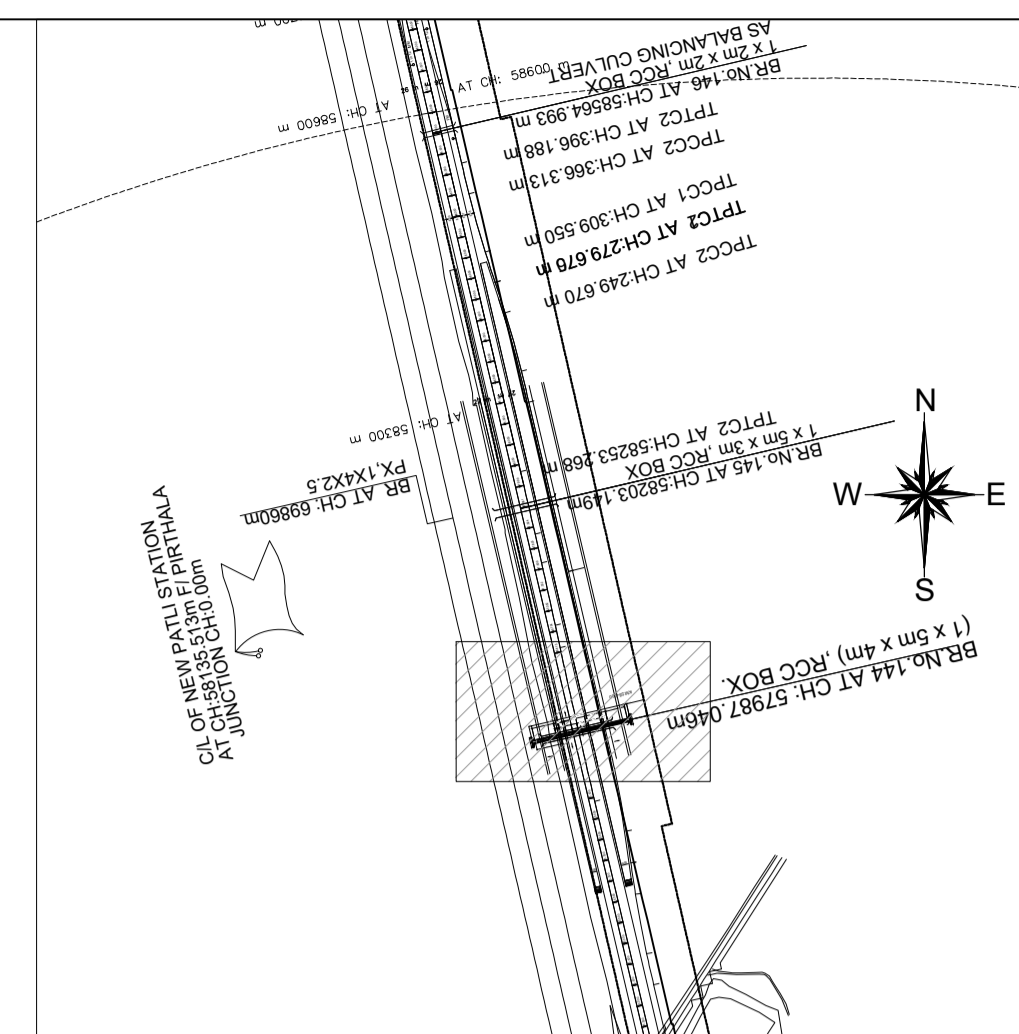
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



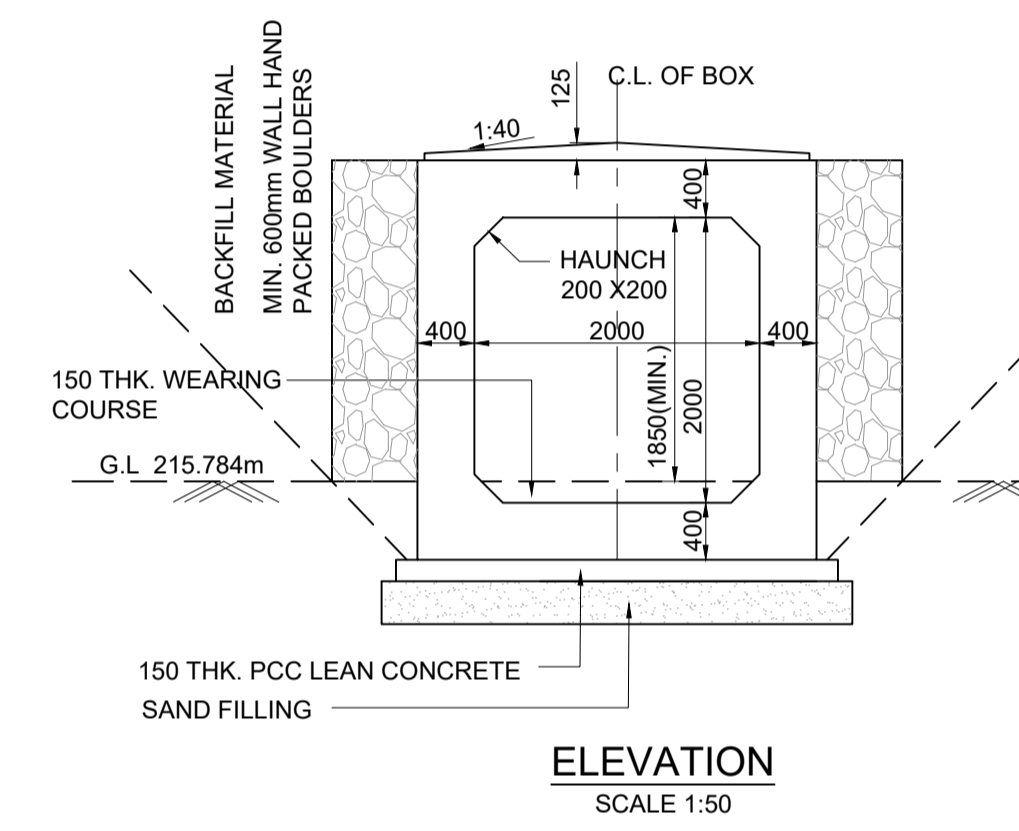
SECTIONAL ELEVATION AT A-A  
SCALE 1:250



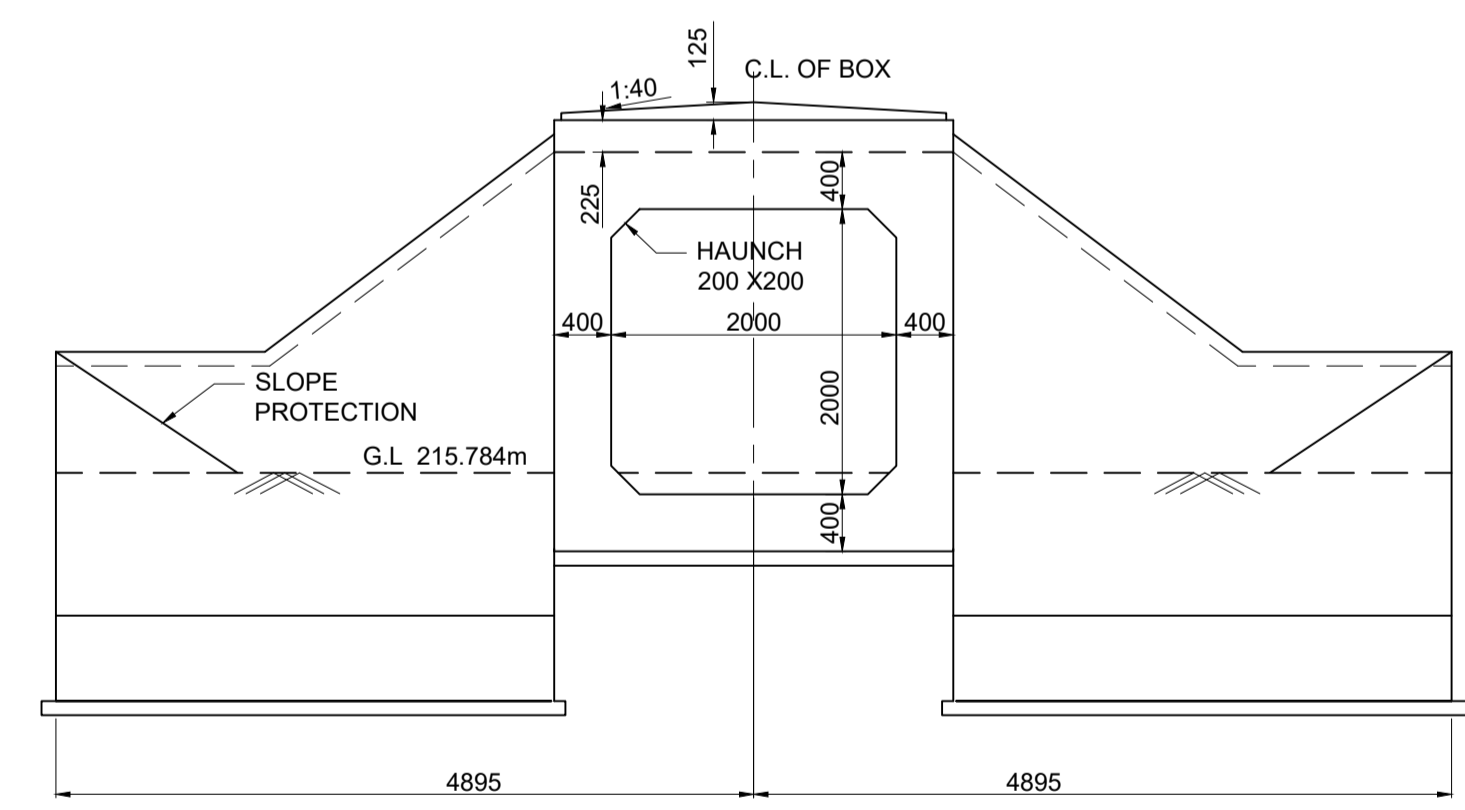
PLAN AT TOP  
SCALE 1:250



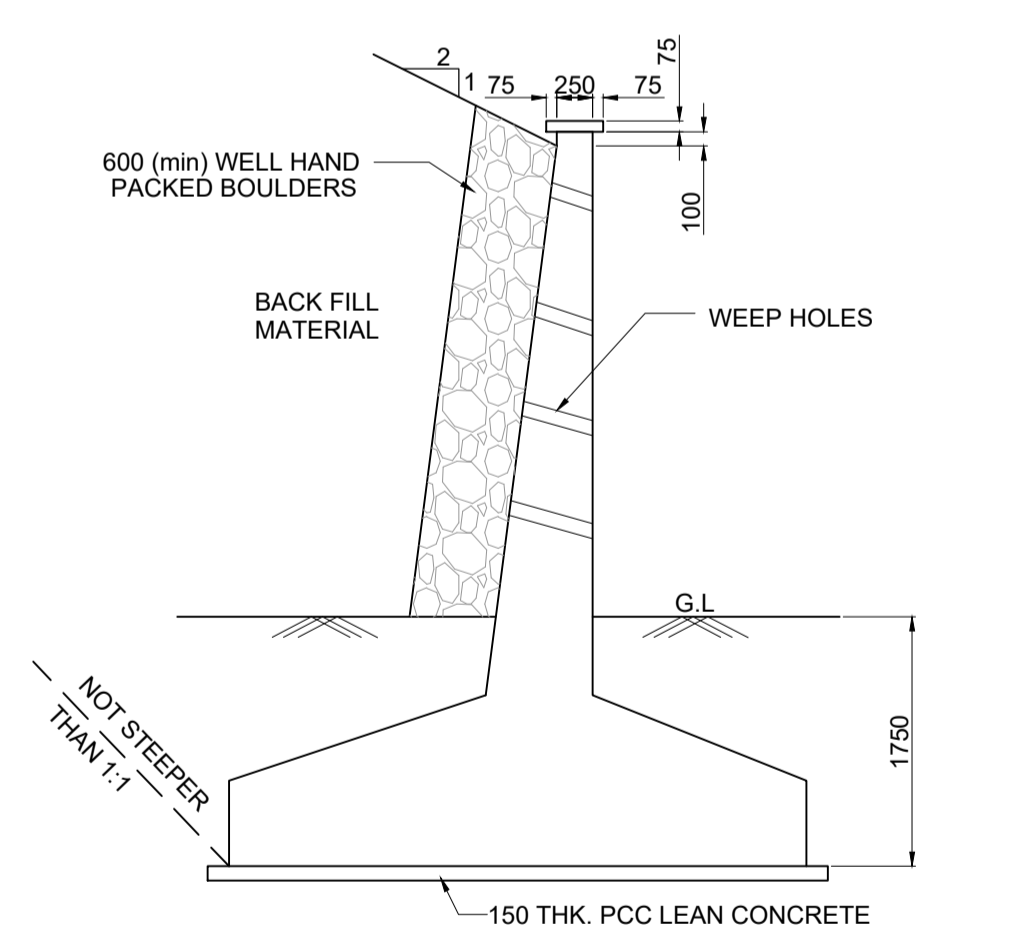
KEY PLAN  
SCALE 1:NTS



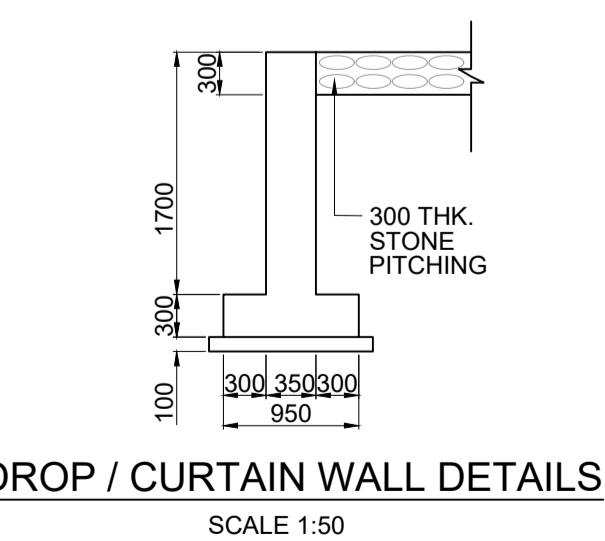
ELEVATION  
SCALE 1:50



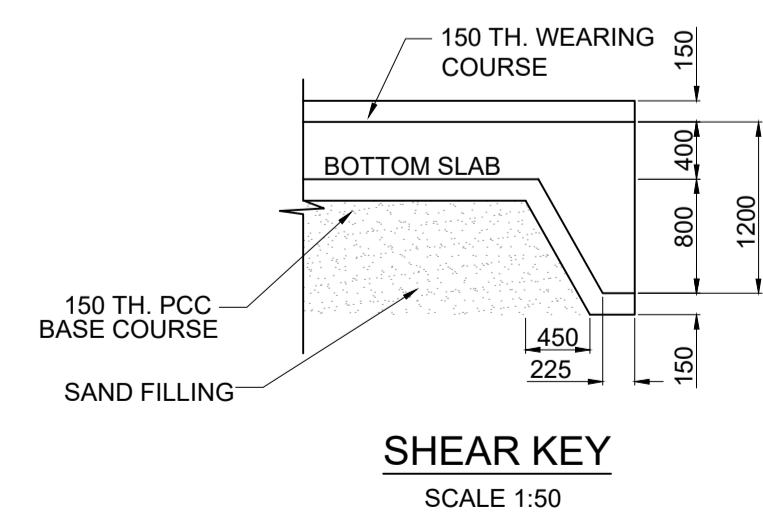
VIEW AT B-B  
SCALE 1:50



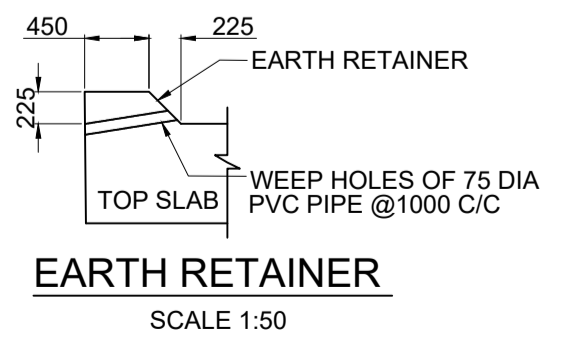
WING WALL (TO BE DESIGN AS PER SITE CONDITION)  
TYPICAL DETAIL OF RETURN WALL / WING WALL  
SCALE 1:50



DROP / CURTAIN WALL DETAILS  
SCALE 1:50



SHEAR KEY  
SCALE 1:50



EARTH RETAINER  
SCALE 1:50

NOTES :

A) GENERAL NOTES :

- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
- THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
- FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
- BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
- THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
- ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
- SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
- ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
- THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
- DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
- THE SIZE OF BOX & SLABS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

B) TECHNICAL NOTES :

- RETURN WALL AND OTHER PROTECTION WORK SUCH AS PITCHING ETC SHALL BE DONE AS SHOWN IN DRG. NO GC-HRIDC-C2-DRG-BRD-GMD-015\_A0.
- FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
- ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
- PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE AND DRAINAGE.
- DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT.
- DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
  - (i) IRS BRIDGE RULE
  - (ii) IRS CONCRETE BRIDGE CODE
  - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
- SEISMIC ZONE- IV
- EXPOSURE CONDITION- MODERATE.
- DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
- THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
- ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQ.M.
- REINFORCEMENT SHALL BE F<sub>y</sub> 500D (TMT) CONFORMING TO IS 1786
- FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
  - GRADE OF CONCRETE :
    - (i) ALL RCC =M.35/DETAILED DESIGN DRG.
    - (ii) WEARING COURSE =M.20/DETAILED DESIGN DRG.
    - (iii) LEVELING COURSE/LEAN CONCRETE =M.20/DETAILED DESIGN DRG.
- FOR SAFE BEARING CAPACITY OF SOIL PLEASE REFER GT REPORT. IF BEARING CAPACITY AT SITE IS INADEQUATE SUITABLE GROUND IMPROVEMENT MAY BE ADOPTED AS PER DETAILED DESIGN DRAWING.
- FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.

LEGEND

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

PROJECT:

**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

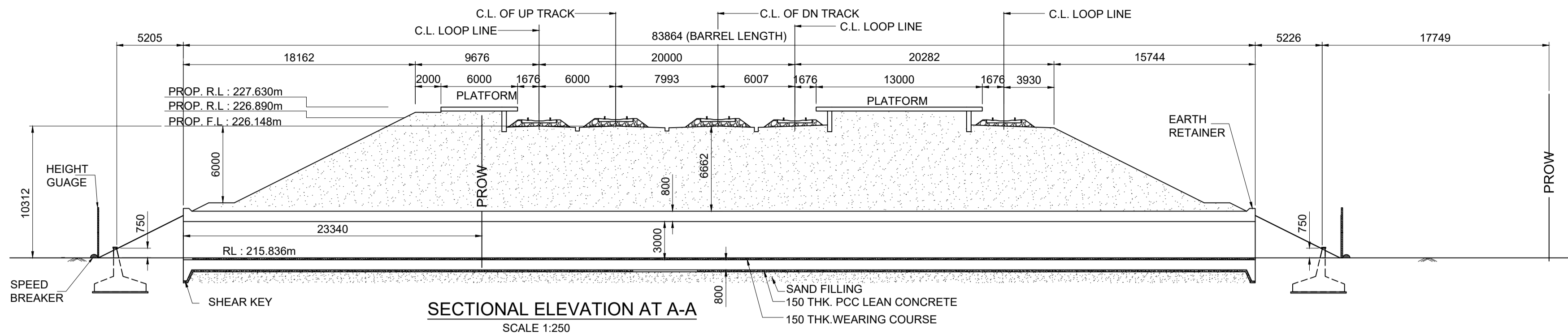


TITLE:- CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
FOR BALANCING CULVERT BRIDGE NO 144  
SPAN 1.0X5.0X4.0 RCC BOX AT CH: 57987.046

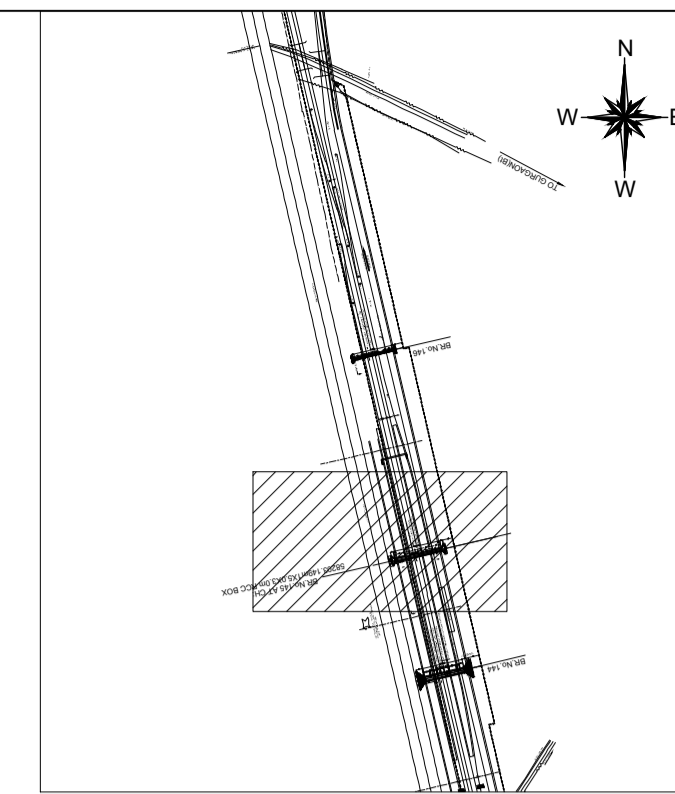
DRG. NO. GC-HRIDC-C2-DRW-BRD-GAD\_01144\_A1 SHEET NO. 1 OF 1

SCALE :	ISSUE DATE	REVISED DATE
AS SHOWN	23-06-2022	29-07-2022

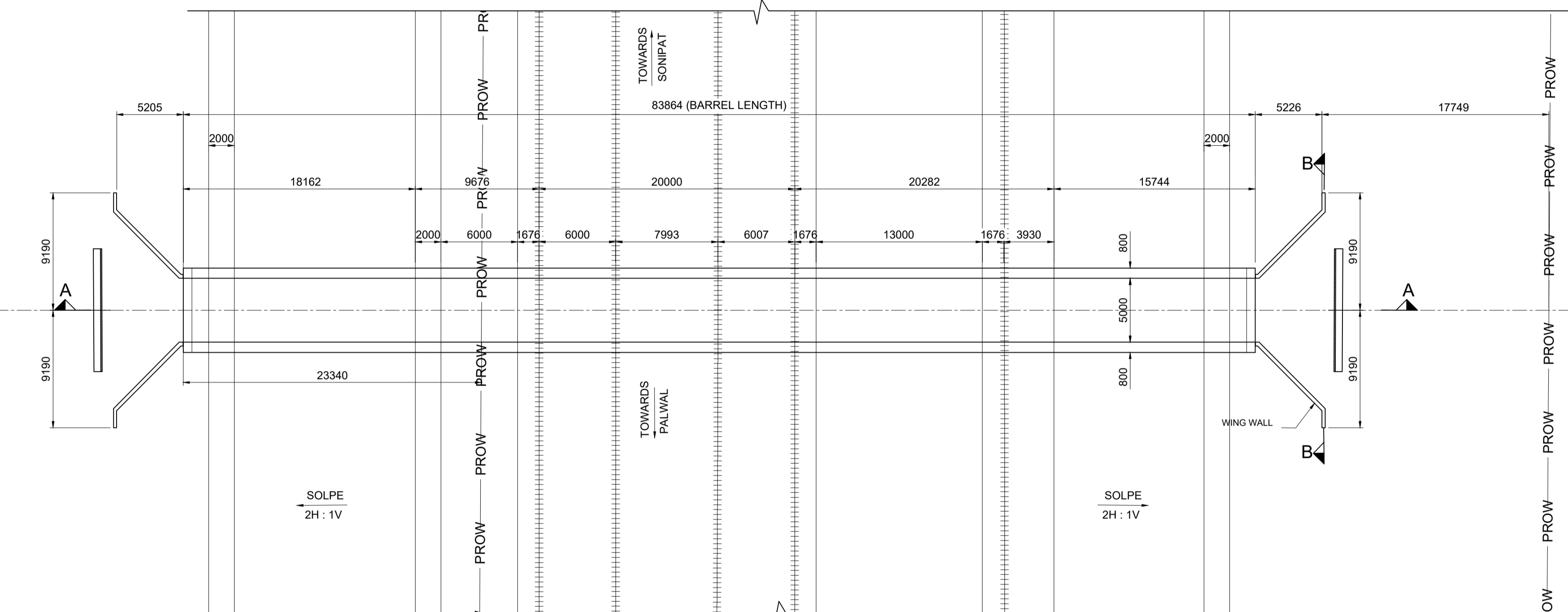
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Retu</i>		



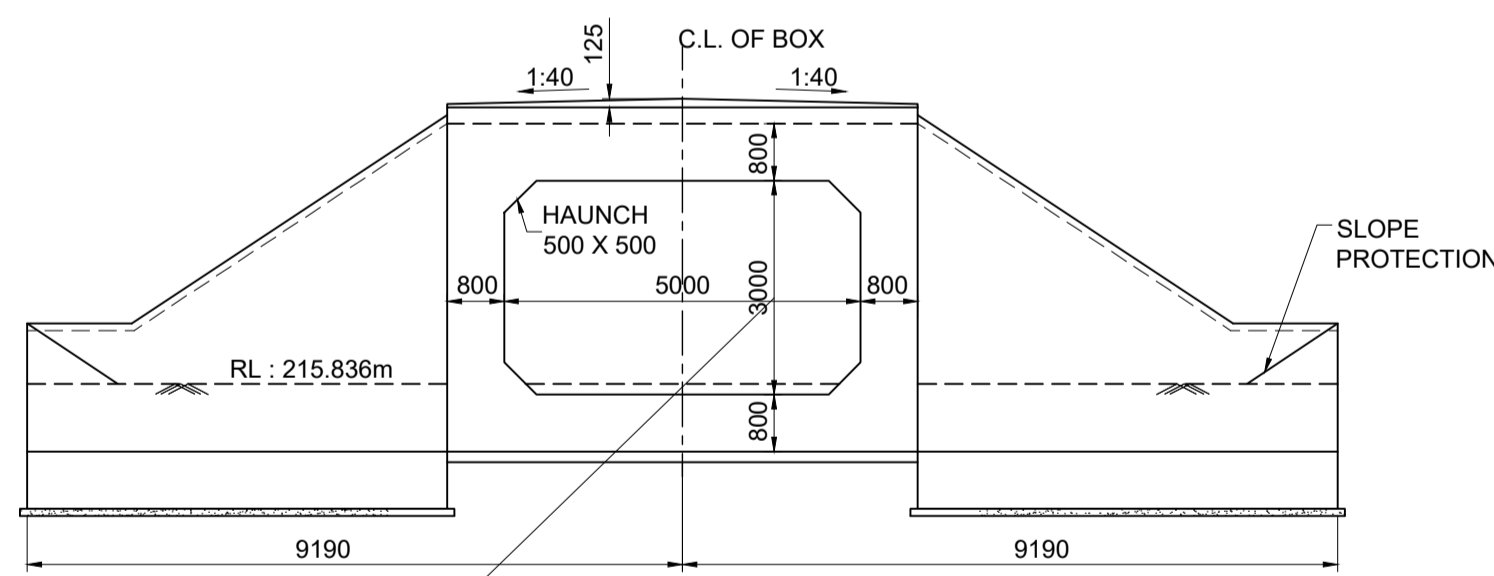
SECTIONAL ELEVATION AT A-A  
SCALE 1:250



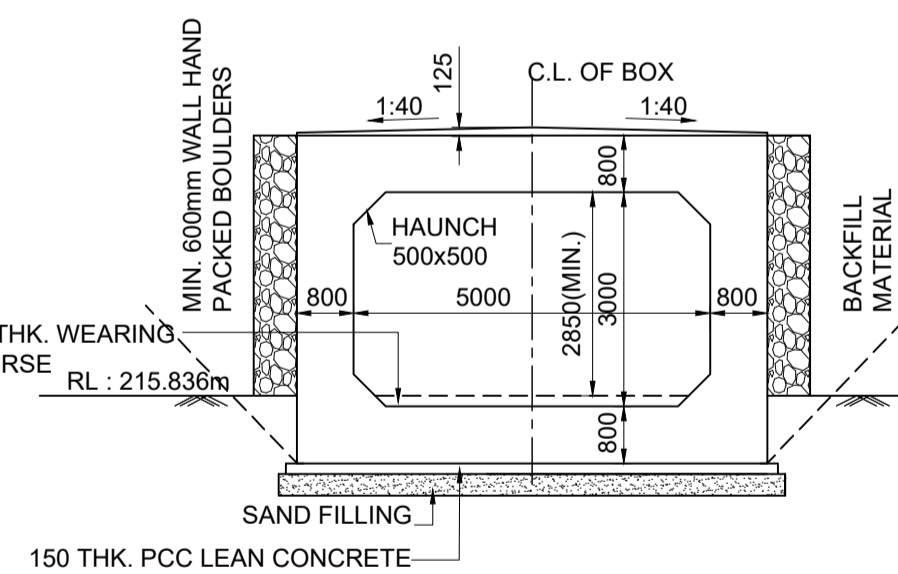
KEY PLAN  
SCALE 1:NTS



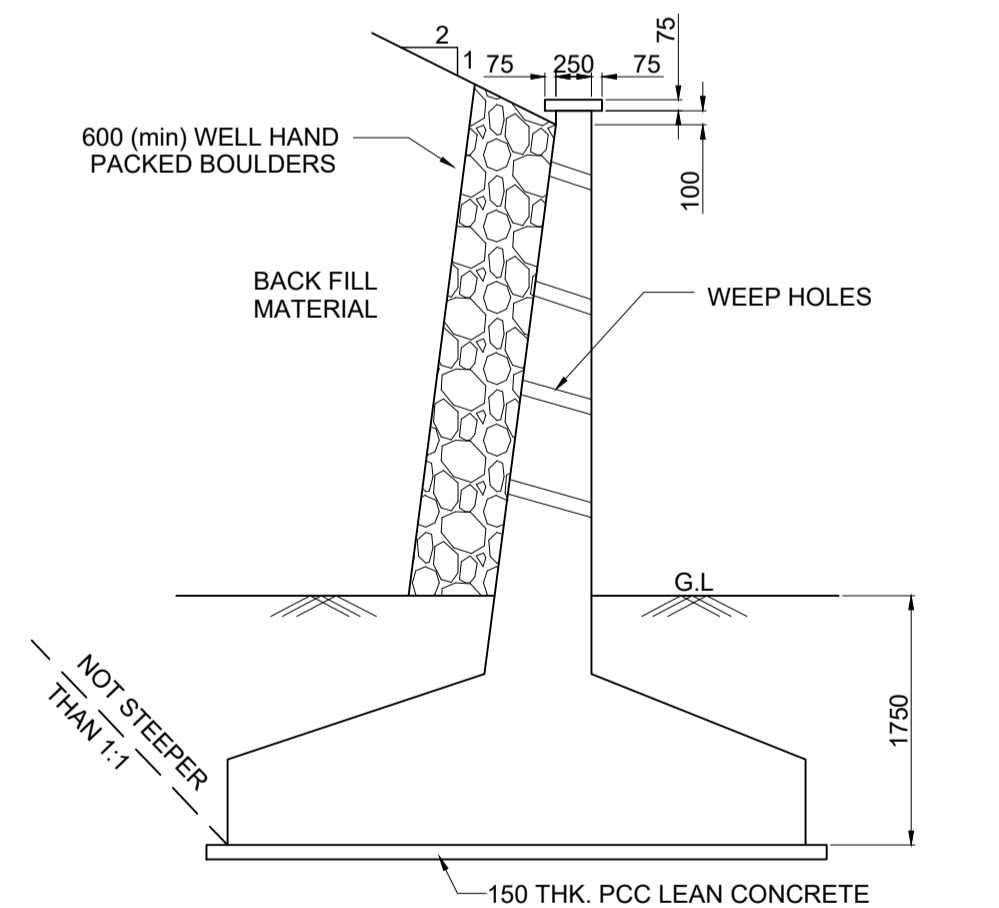
PLAN AT TOP  
SCALE 1:250



SECTION B-B  
SCALE 1:100

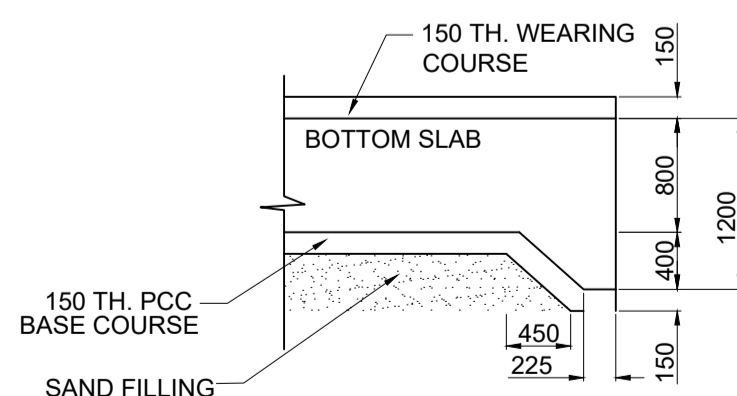


ELEVATION  
SCALE 1:100

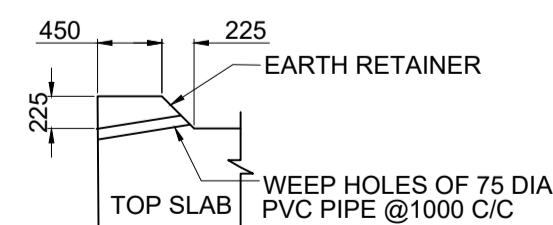


TYPICAL DETAIL OF RETURN WALL / WING WALL  
SCALE 1:50

TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



SHEAR KEY  
SCALE 1:50



EARTH RETAINER  
SCALE 1:50

LEGEND

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M. BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
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    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
    - (i) ALL RCC =M:35/DETAILED DESIGN DRG.
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    - (iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDED AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
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**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

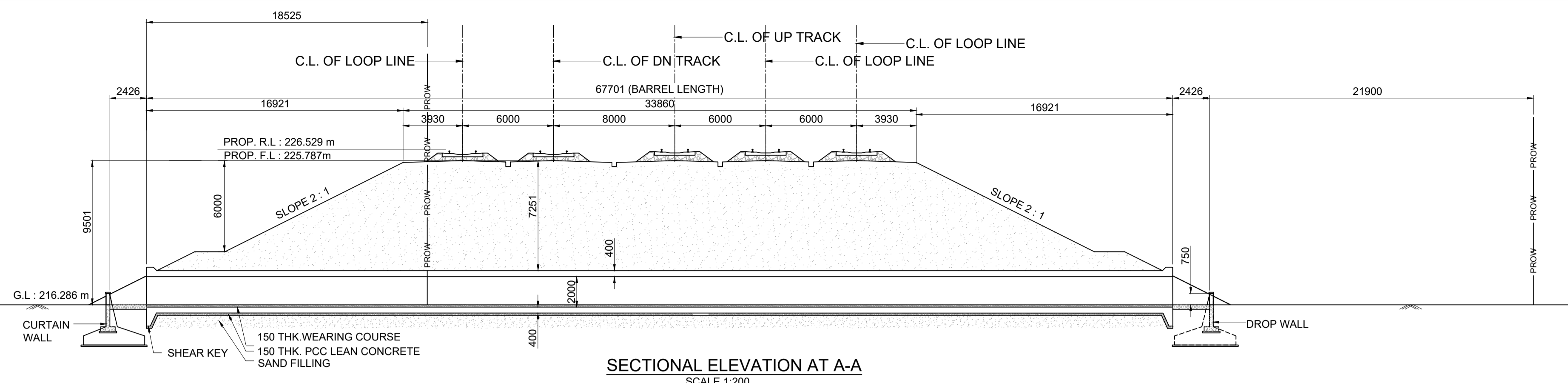


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO 145 1X5.0X3.0m RCC BOX AT CH. 58203.149m

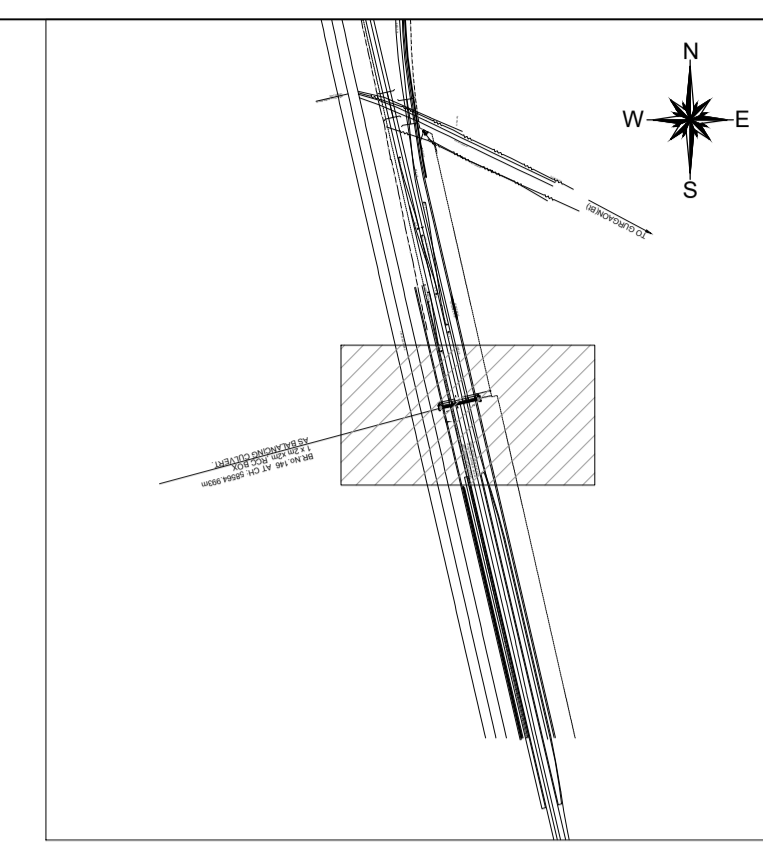
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01145\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

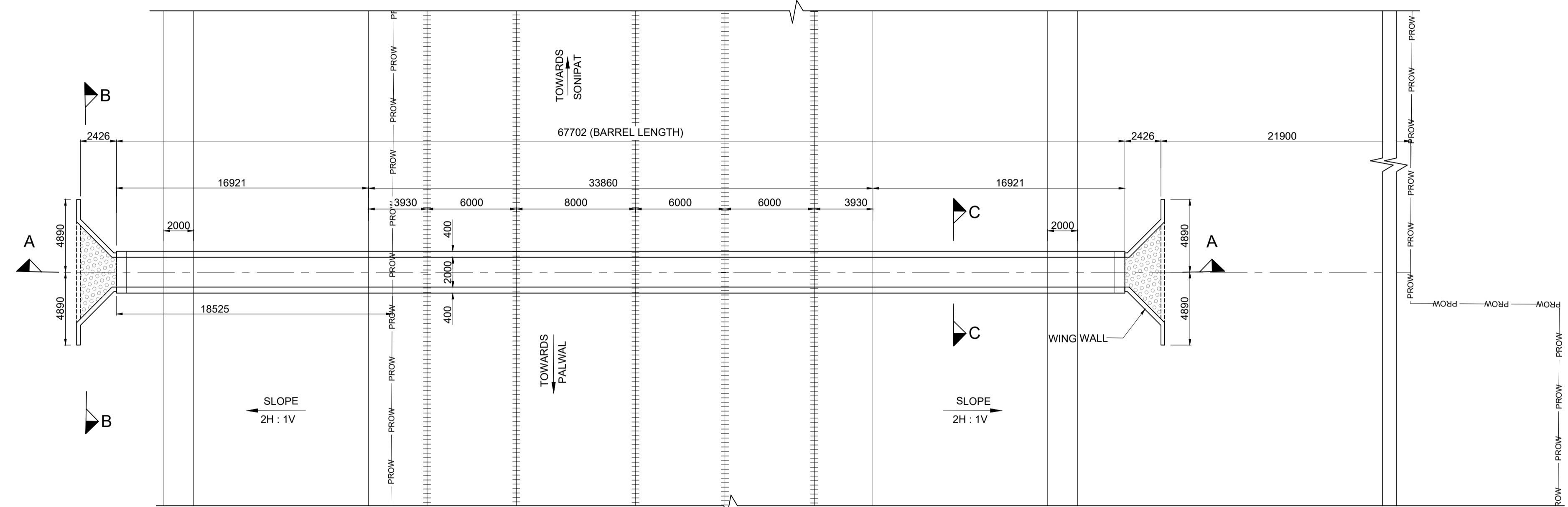


SECTIONAL ELEVATION AT A-A  
SCALE 1:200

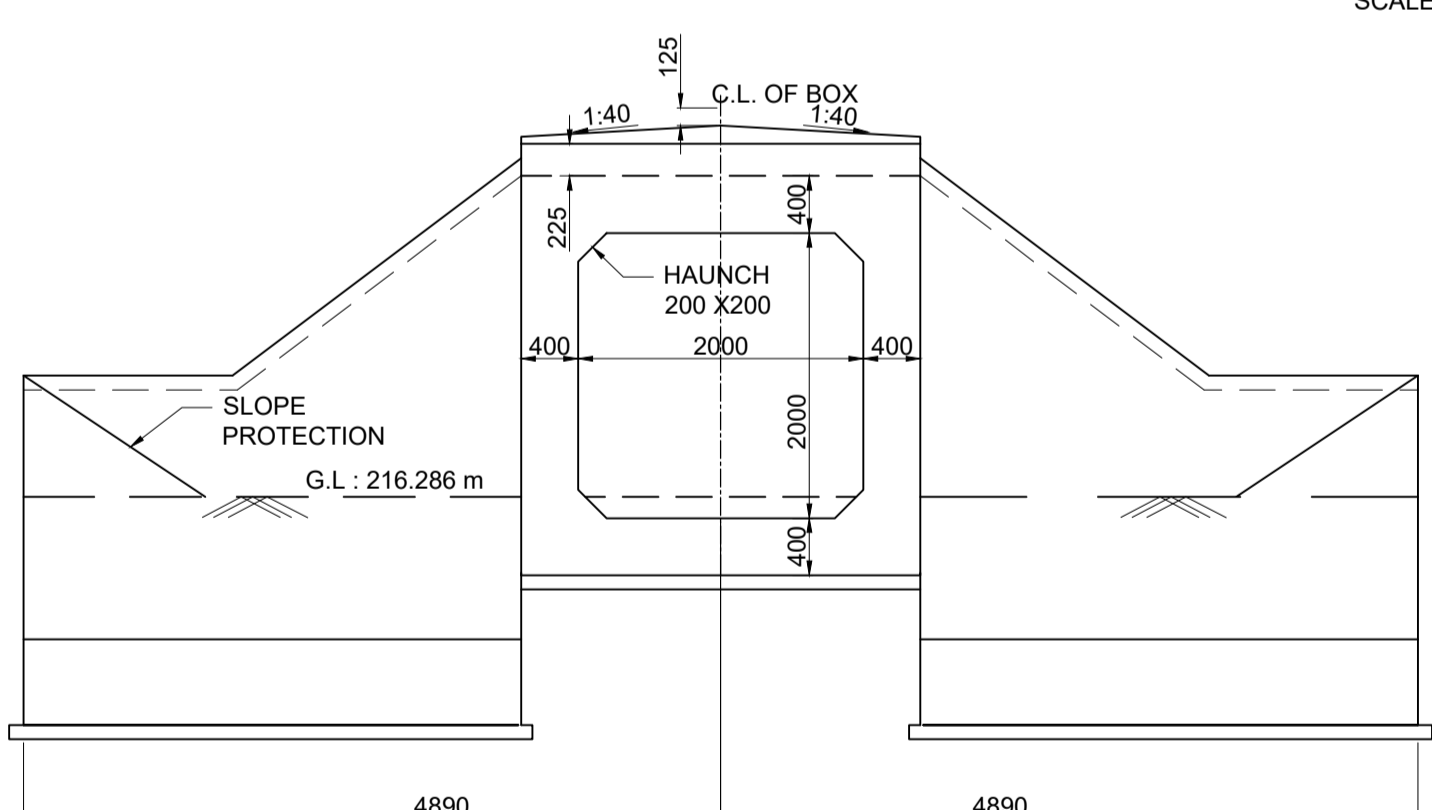


KEY PLAN  
SCALE 1:NTS

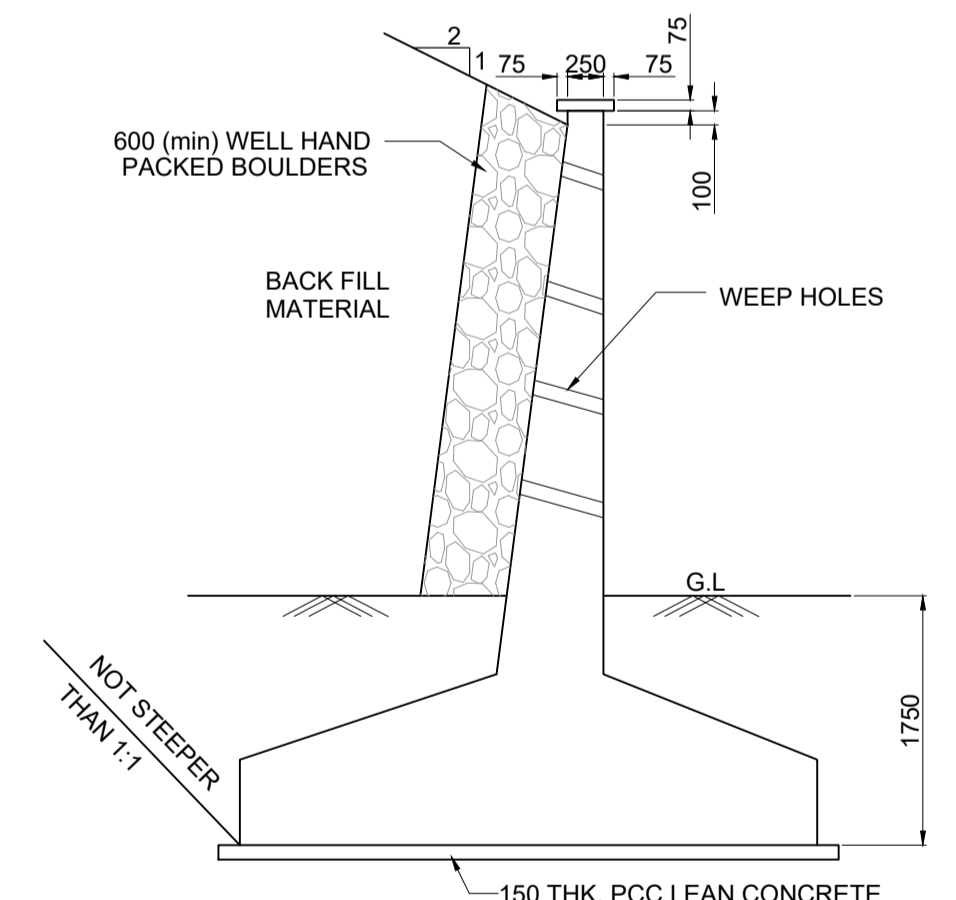
- NOTES :**
- A) GENERAL NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  2. THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
  3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  4. BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  5. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  6. ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  9. THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HRIC.
  10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  3. ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  5. DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
  6. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  7. SEISMIC ZONE- IV
  8. EXPOSURE CONDITION- MODERATE.
  9. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  10. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
  11. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  12. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  13. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
    - GRADE OF CONCRETE :
      - (i) ALL RCC =M.35/DETAILED DESIGN DRG.
      - (ii) WEARING COURSE =M.20/DETAILED DESIGN DRG.
      - (iii) LEVELING COURSE/LEAN CONCRETE =M.20/DETAILED DESIGN DRG.
  14. BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  15. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  16. ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.



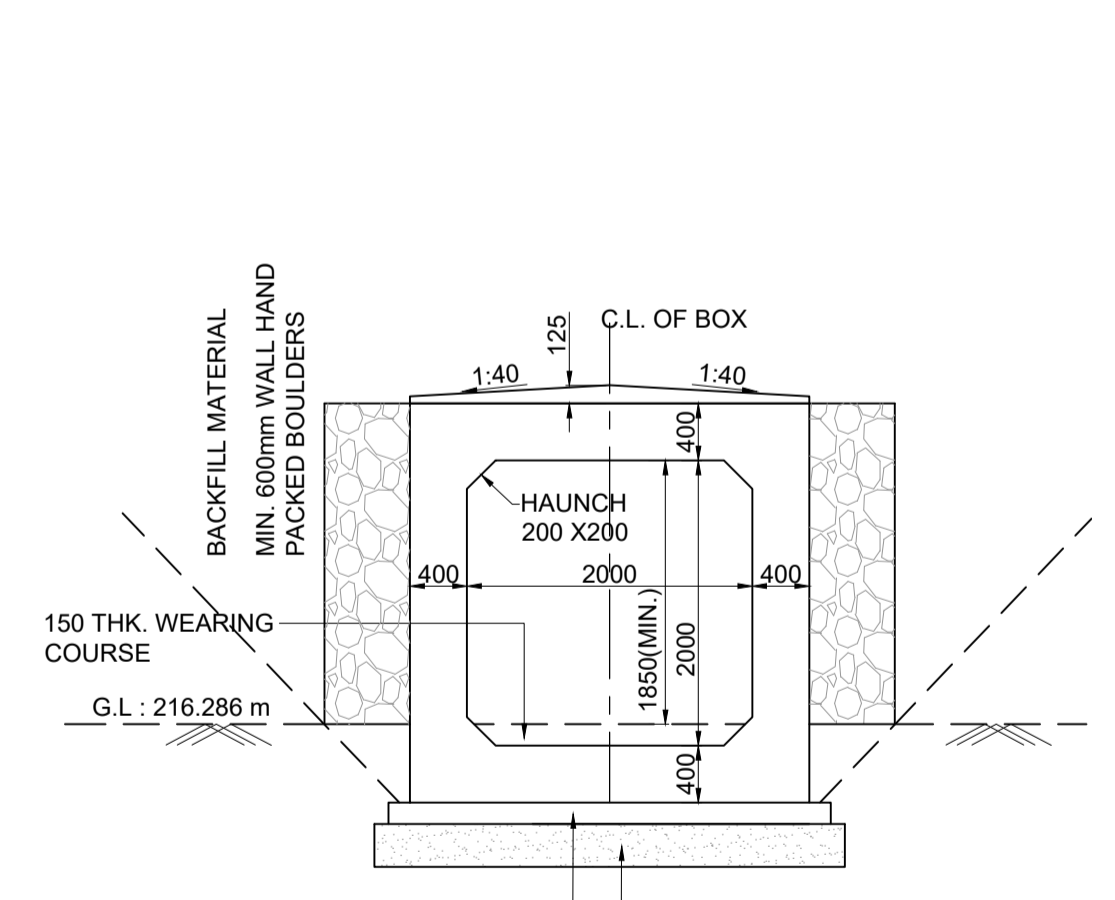
PLAN AT TOP  
SCALE 1:200



VIEW AT B-B  
SCALE 1:50



TYPICAL DETAIL OF RETURN WALL / WING WALL  
SCALE 1:50



SECTION  
SCALE 1:50

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

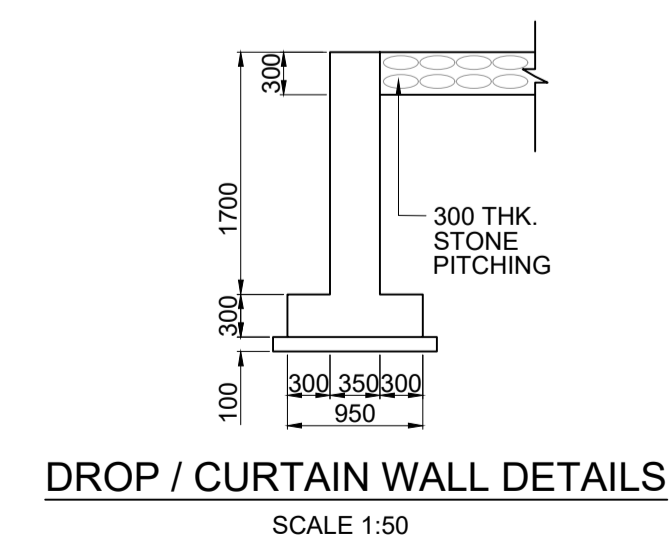


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 146 1X2.0X2.0m RCC BOX AT CH. 58564.993m

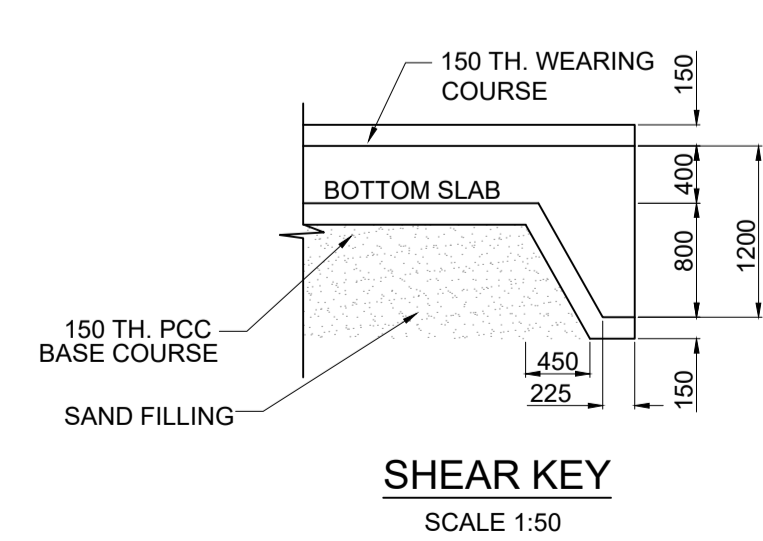
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01146\_A1  
**SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN  
**ISSUE DATE** 23-06-2022  
**REVISED DATE** 29-07-2022

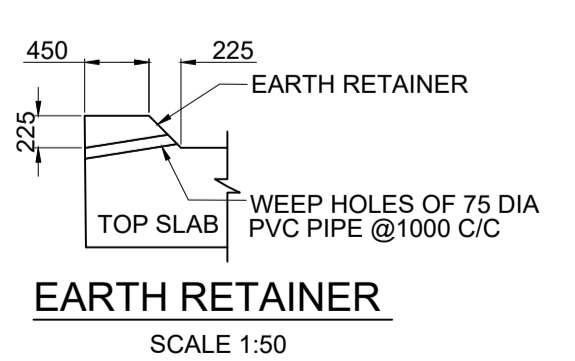
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



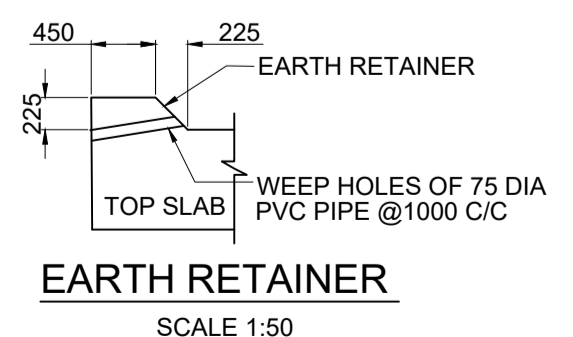
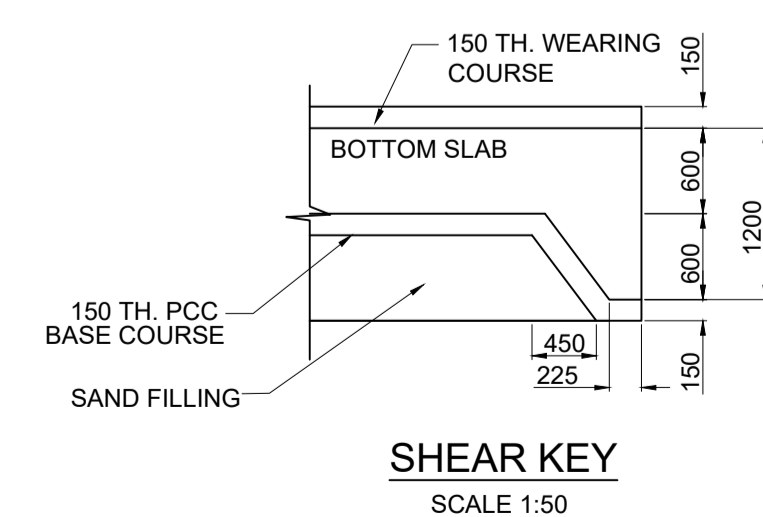
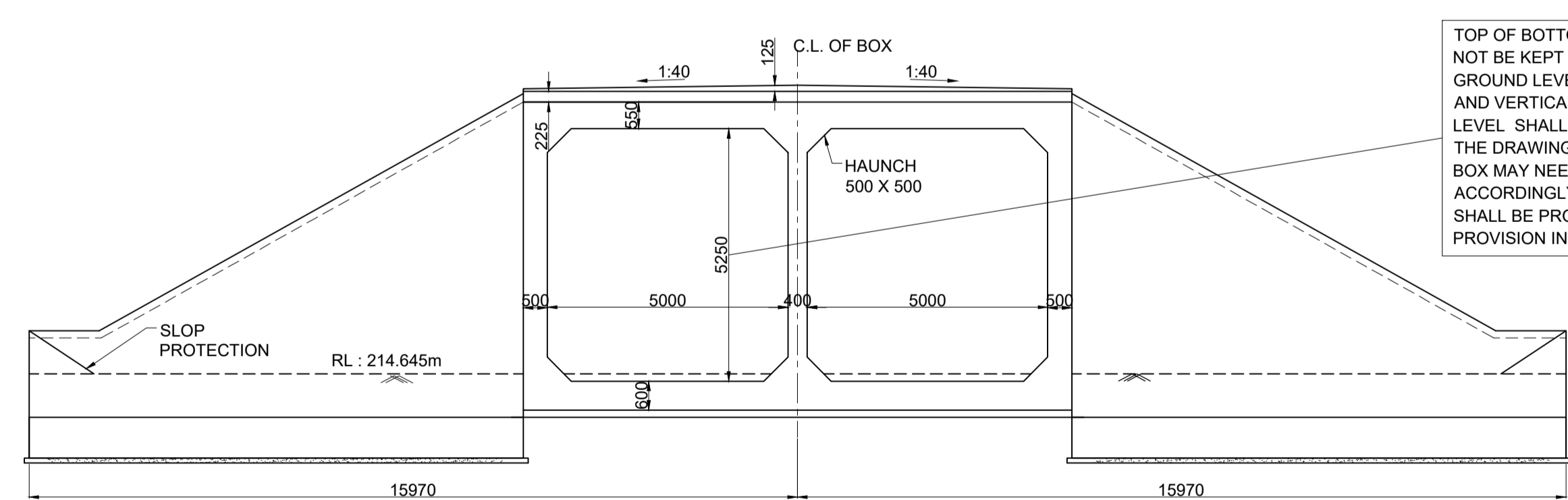
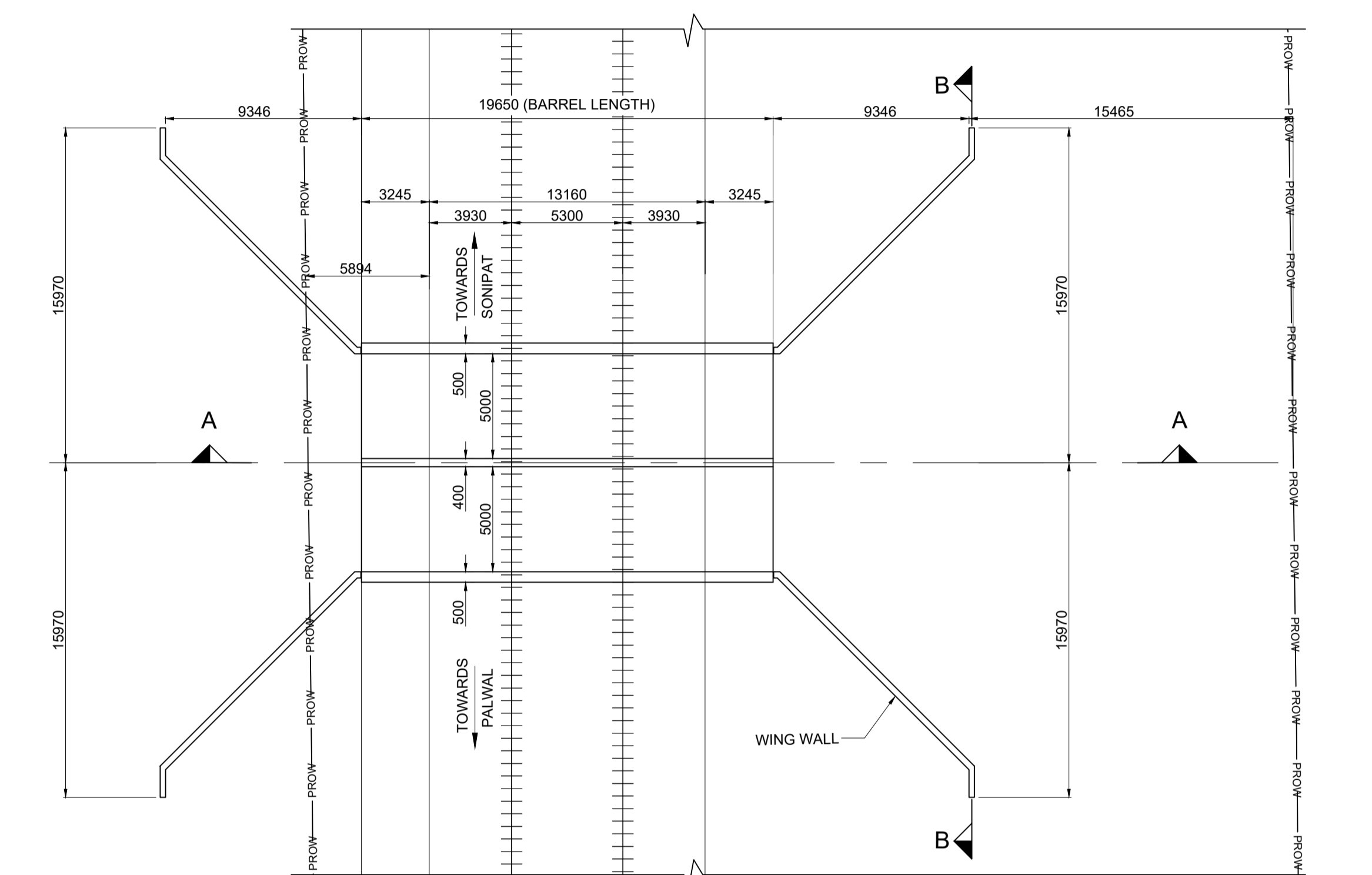
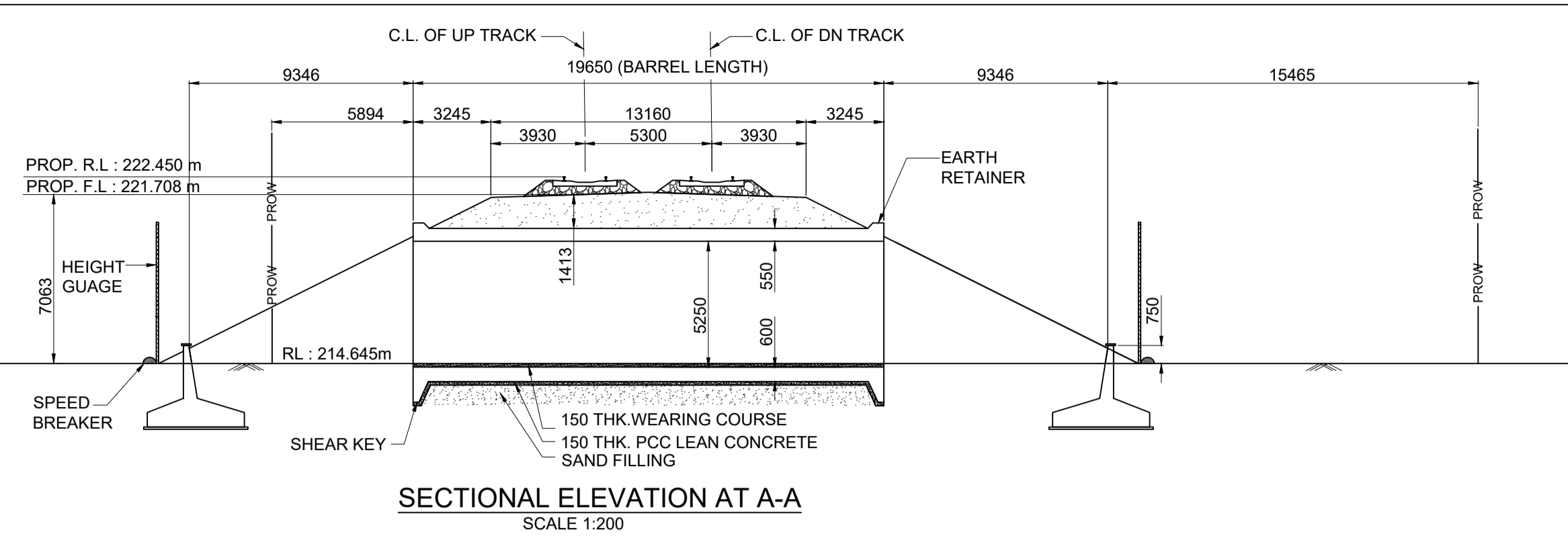
DROP / CURTAIN WALL DETAILS  
SCALE 1:50



SHEAR KEY  
SCALE 1:50

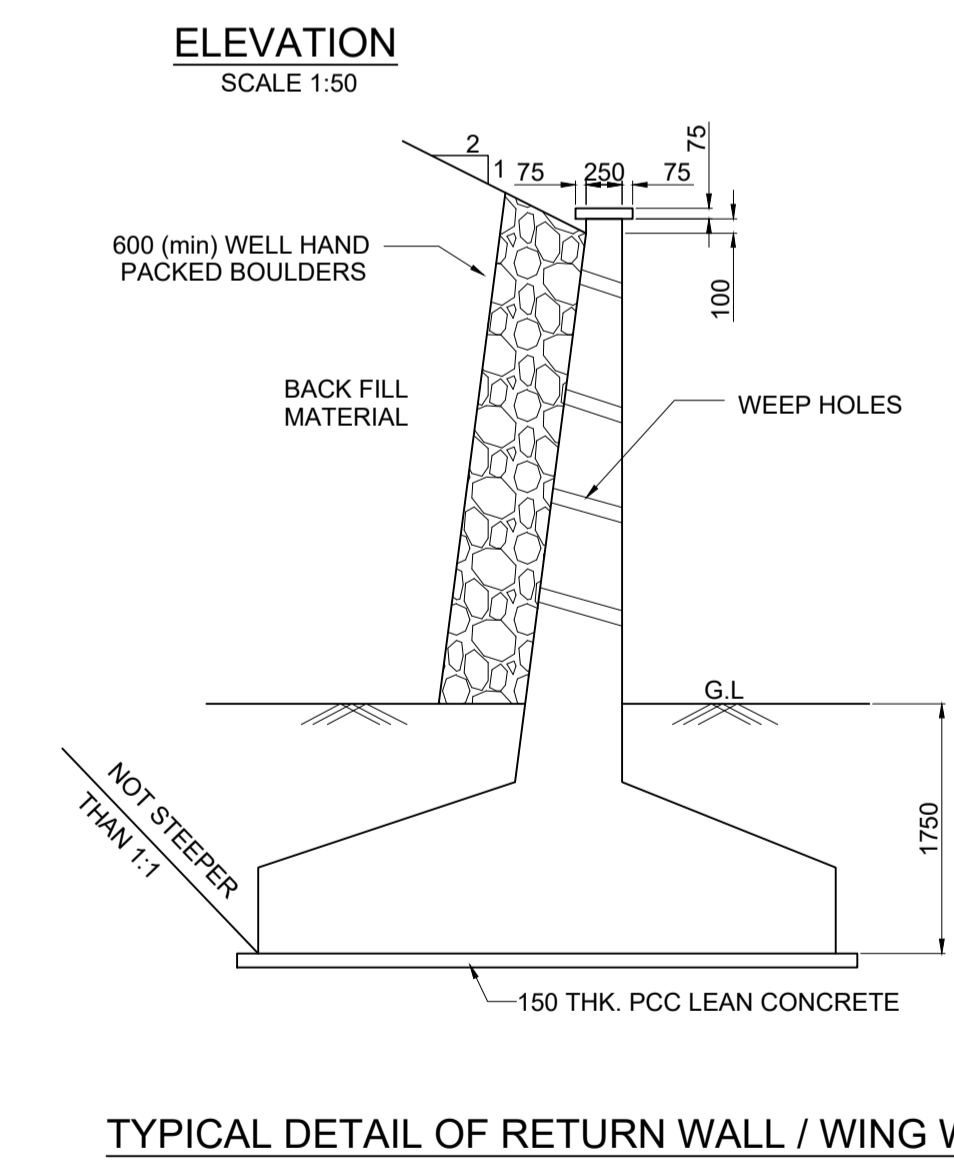
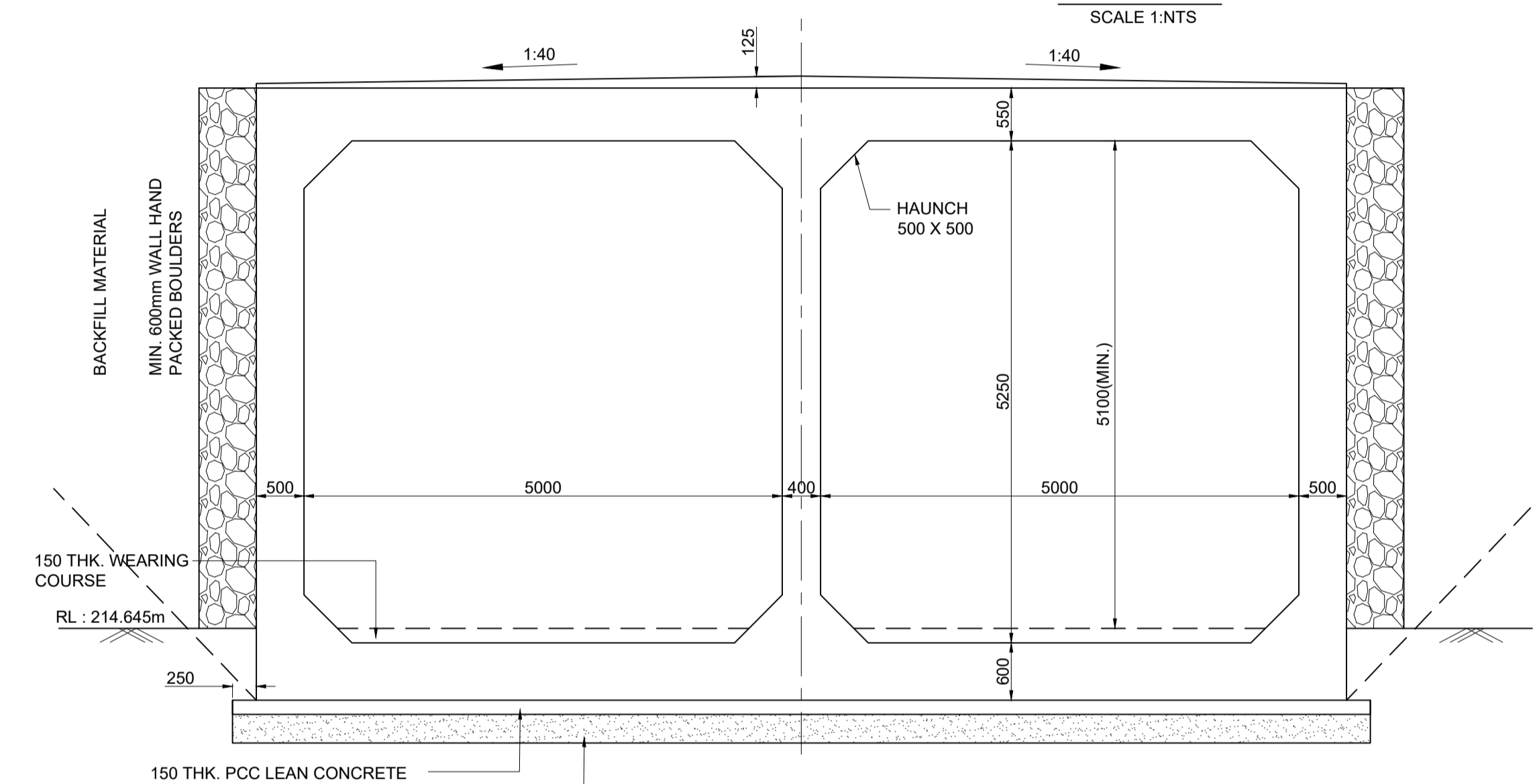
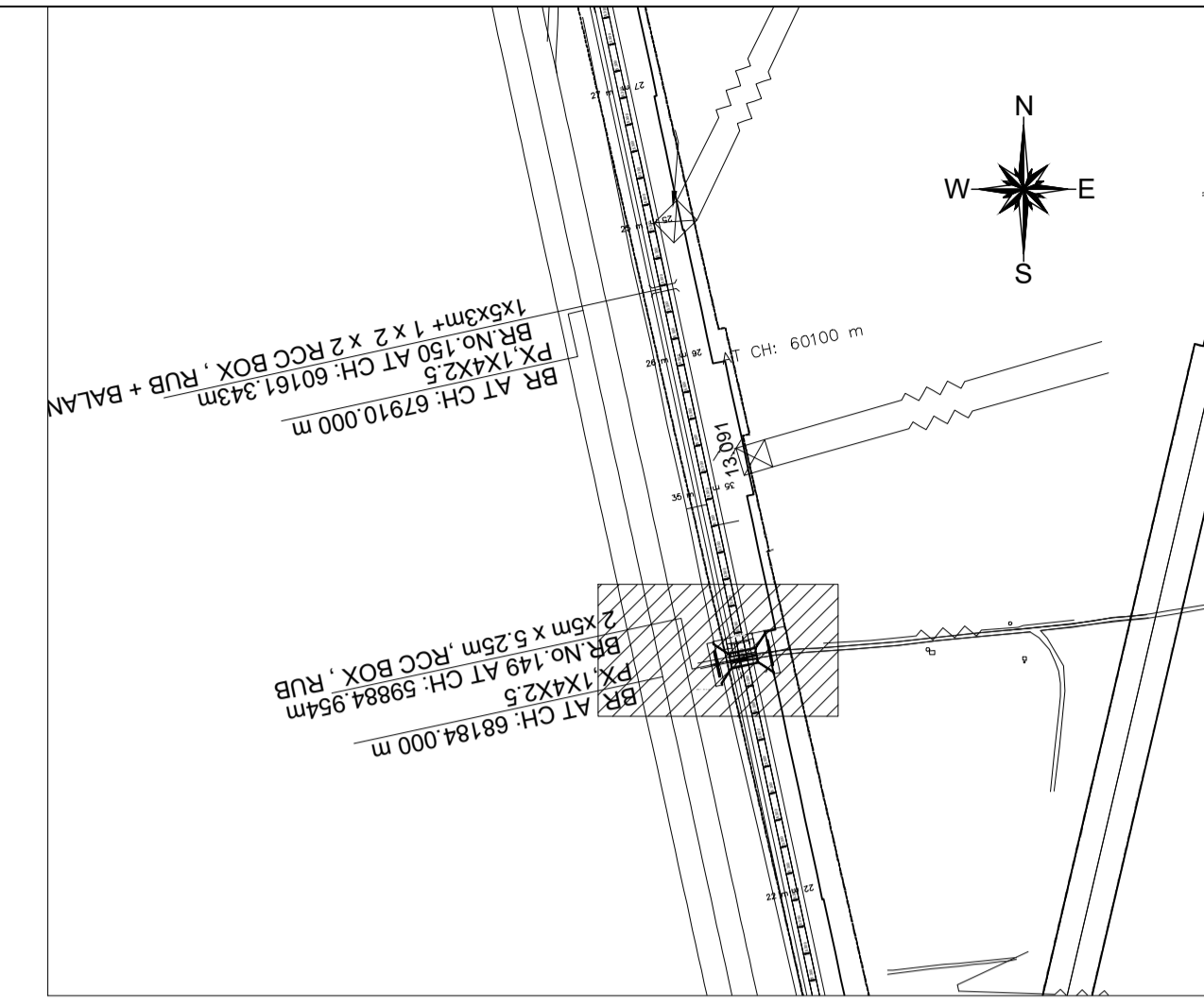


EARTH RETAINER  
SCALE 1:50



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL



- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER I-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER STRUCTURAL DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHYDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

    - ALL RCC =M:35/DETAILED DESIGN DRG.
    - WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDED AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHA BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 **HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  
 **GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

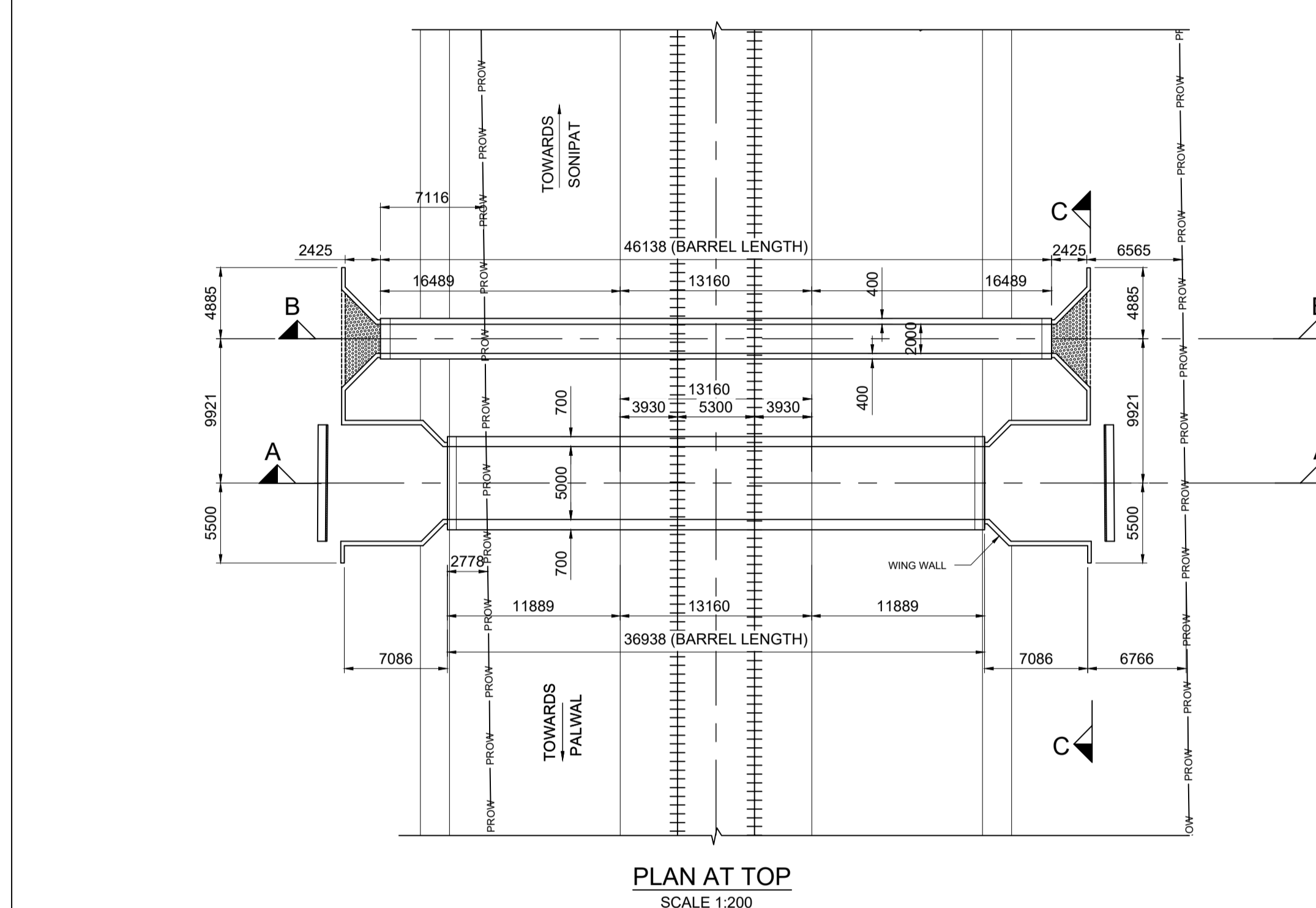
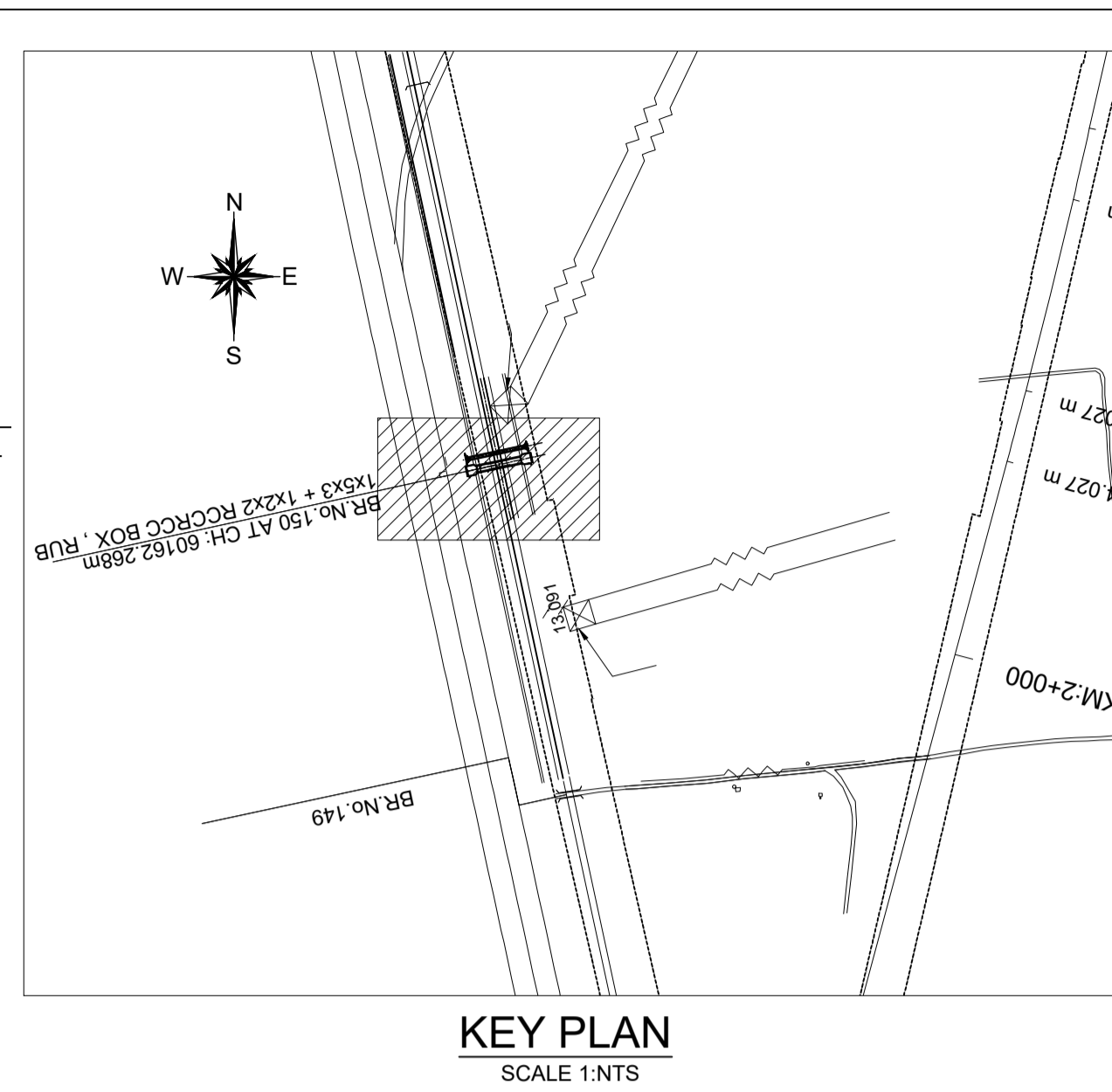
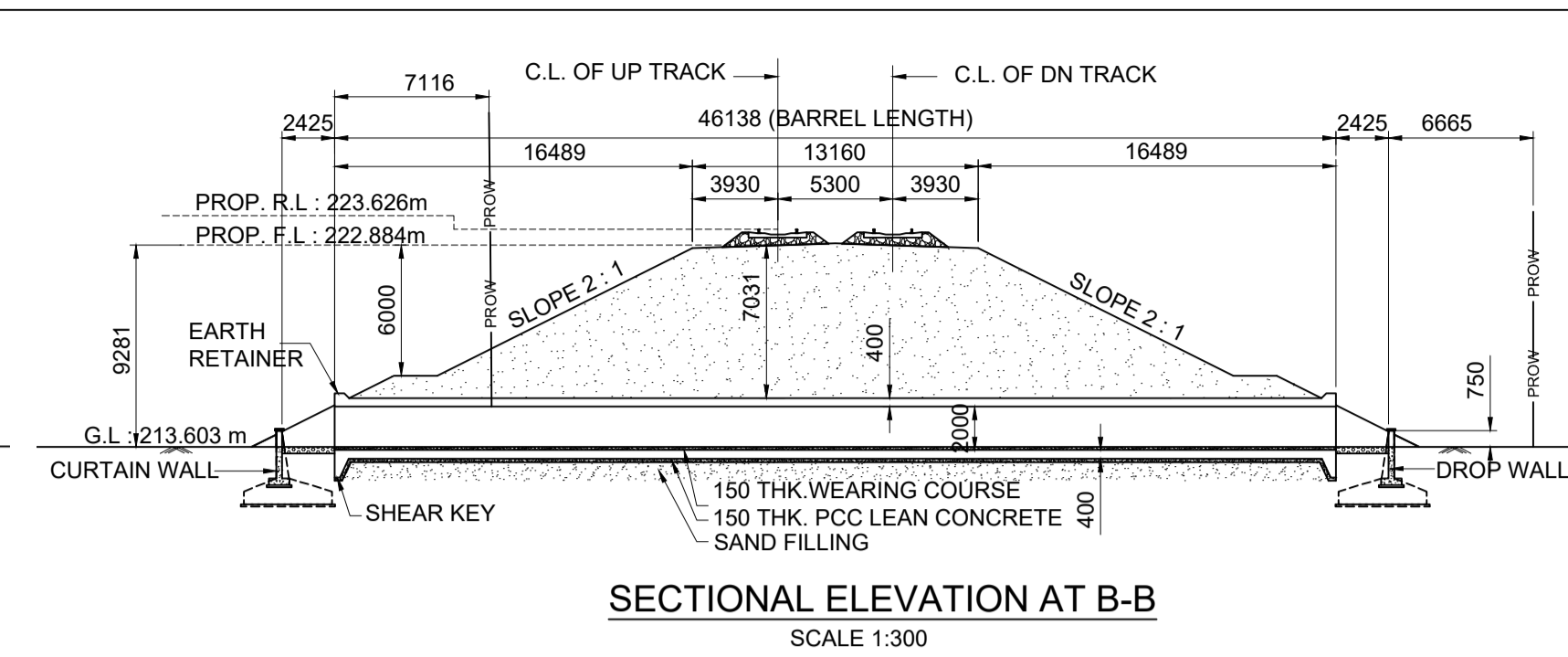
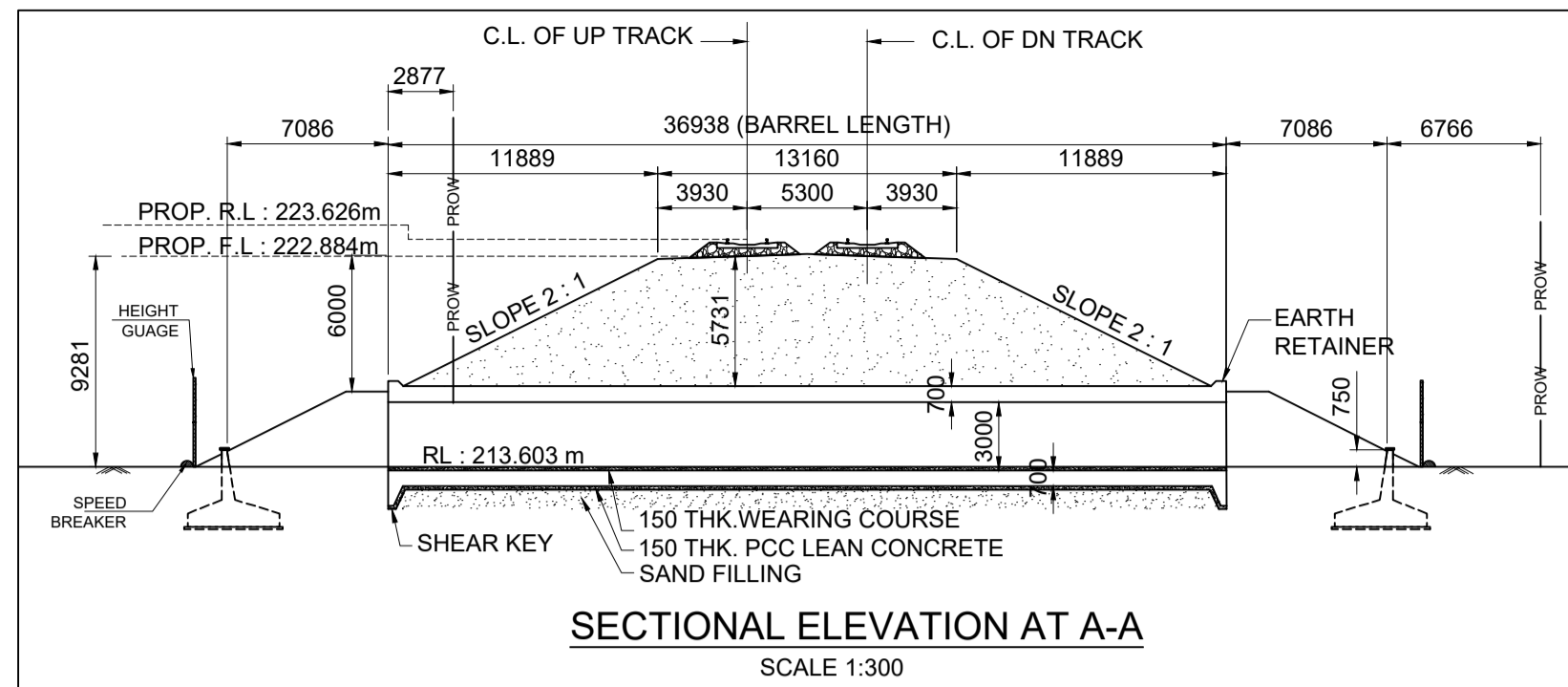


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
FOR ROAD UNDER BRIDGE NO 148 SPAN  
2.0X5.0X5.25 RCC BOX AT CH.59884.954

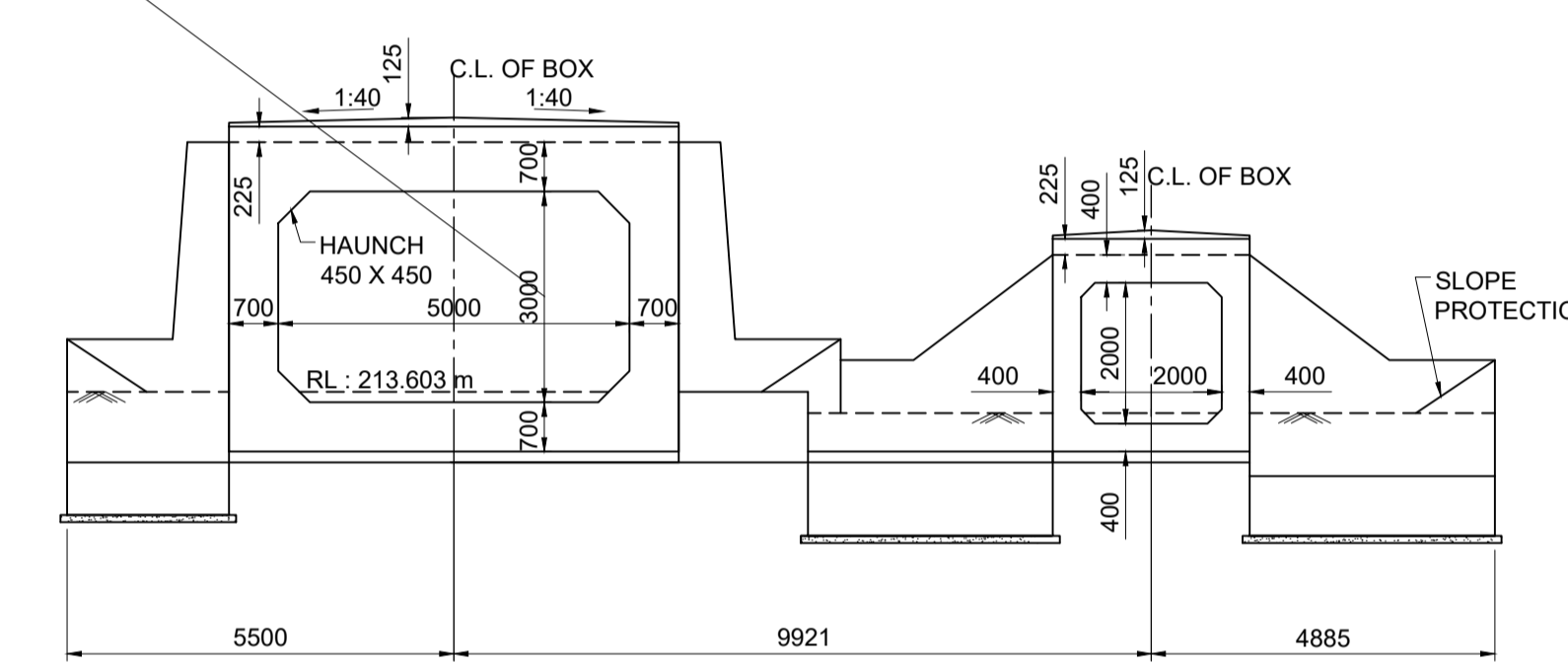
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01148\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/I OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
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  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
- GRADE OF CONCRETE :**
- (i) ALL RCC =M-35/DETAILED DESIGN DRG.
  - (ii) WEARING COURSE =M-20/DETAILED DESIGN DRG.
  - (iii) LEVELING COURSE/LEAN CONCRETE =M-20/DETAILED DESIGN DRG.
- BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

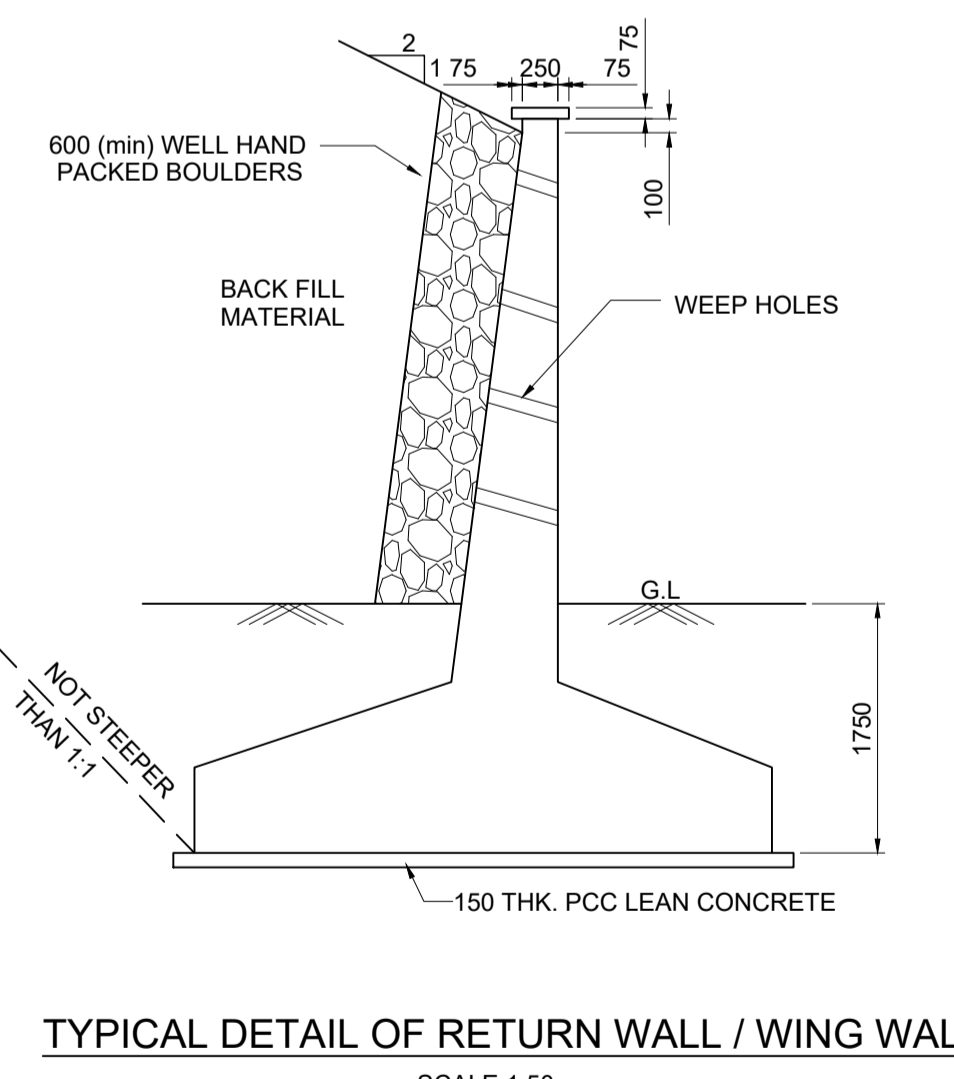
**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD+BALANCING CULVERT BRIDGE NO 149 1x5x3 + 1x2x2 RCC BOX AT CH. 60161.343m

**DRG. NO.** GC-HRDC-C2-DRW-BRD-GAD-01149\_A1 **SHEET NO.** 1 OF 1

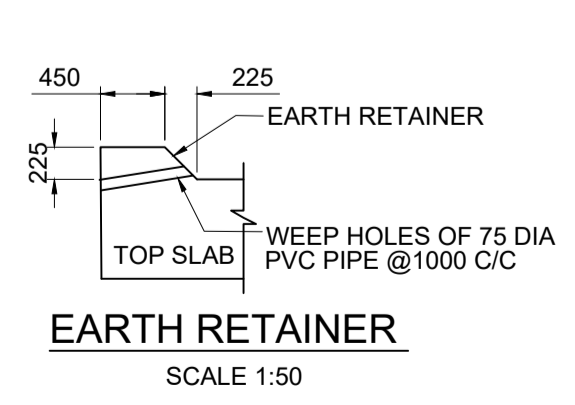
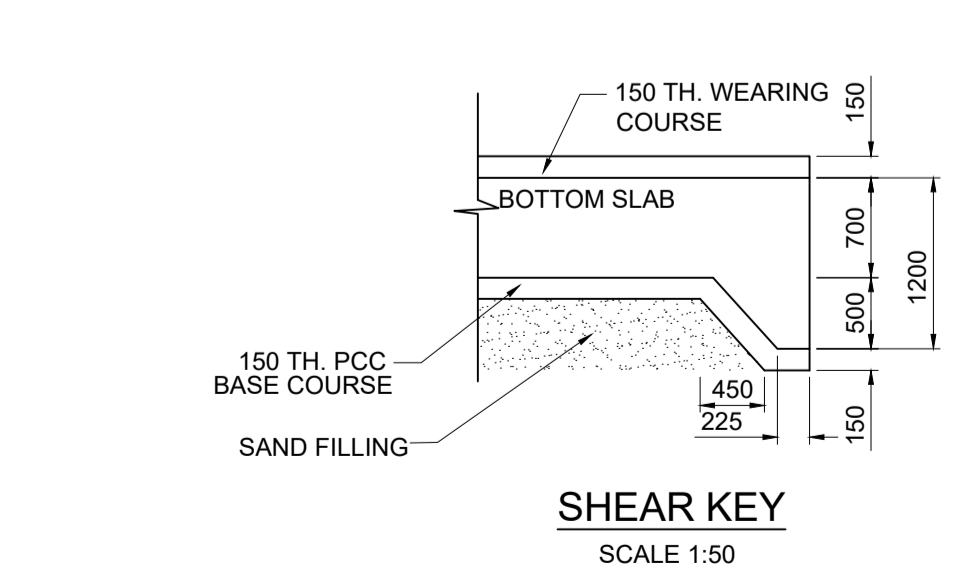
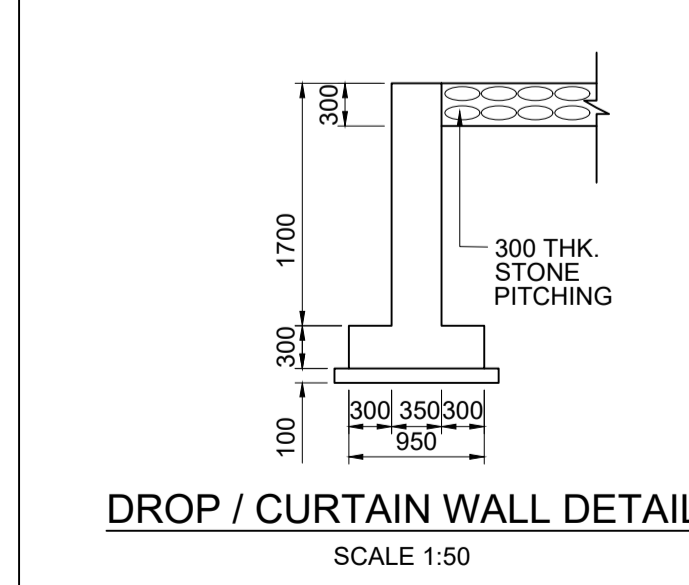
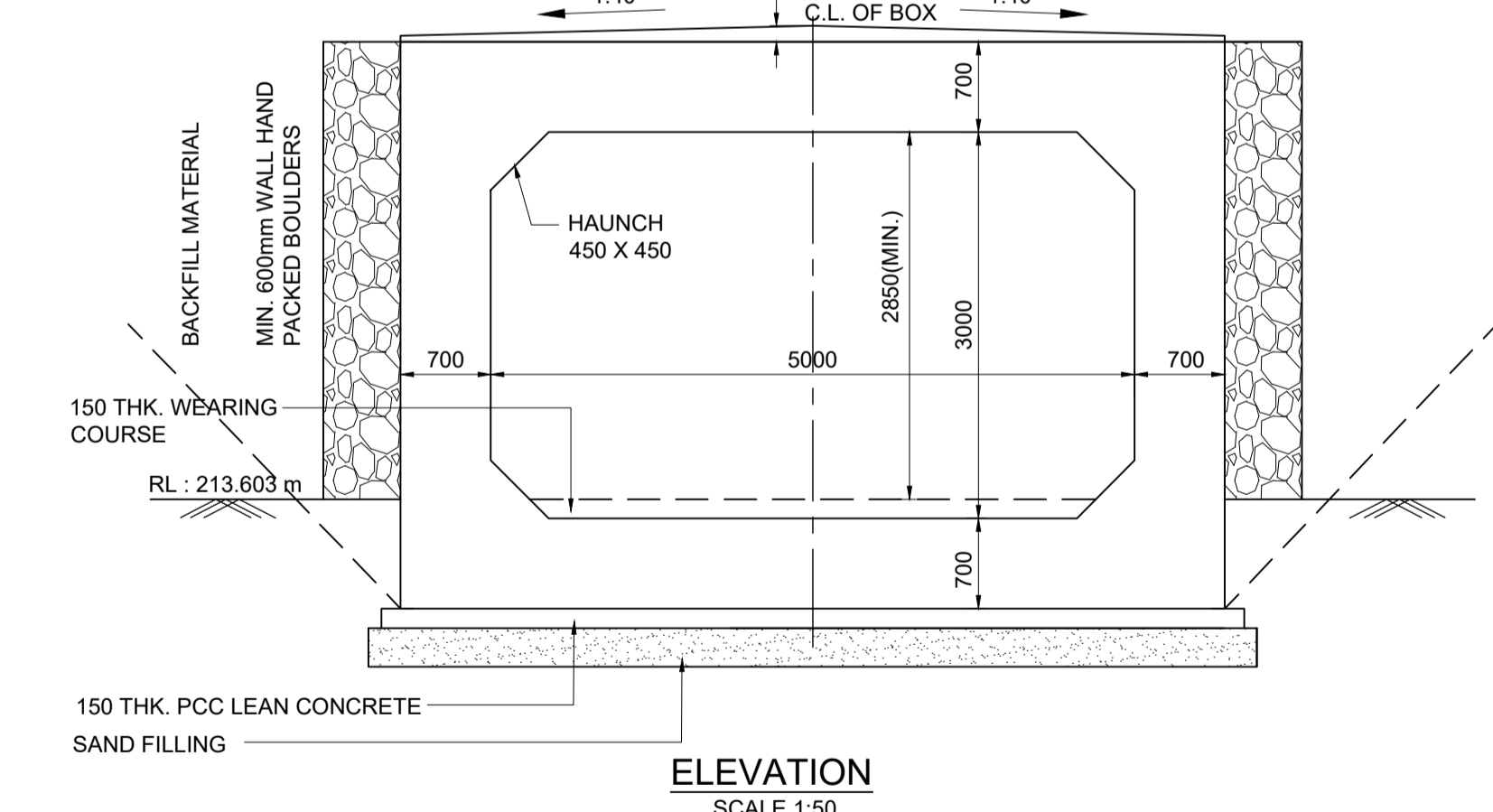
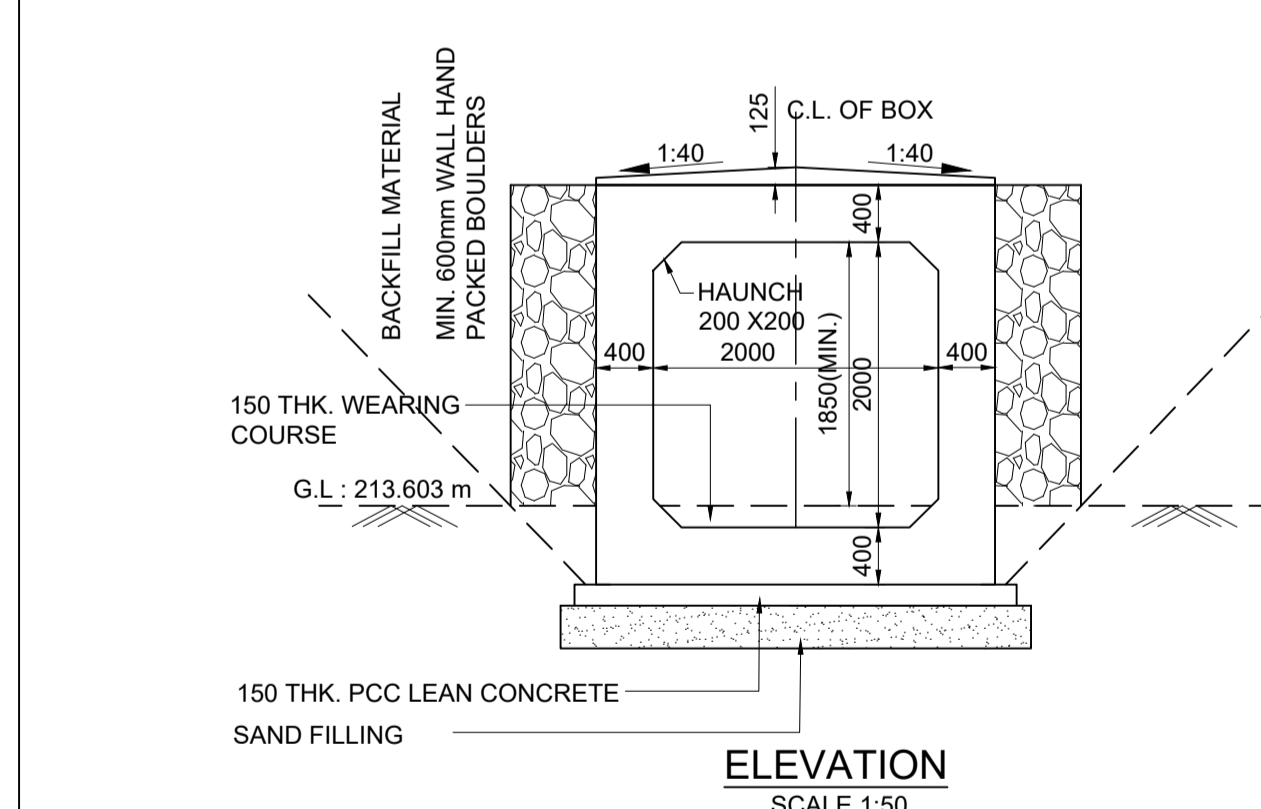
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

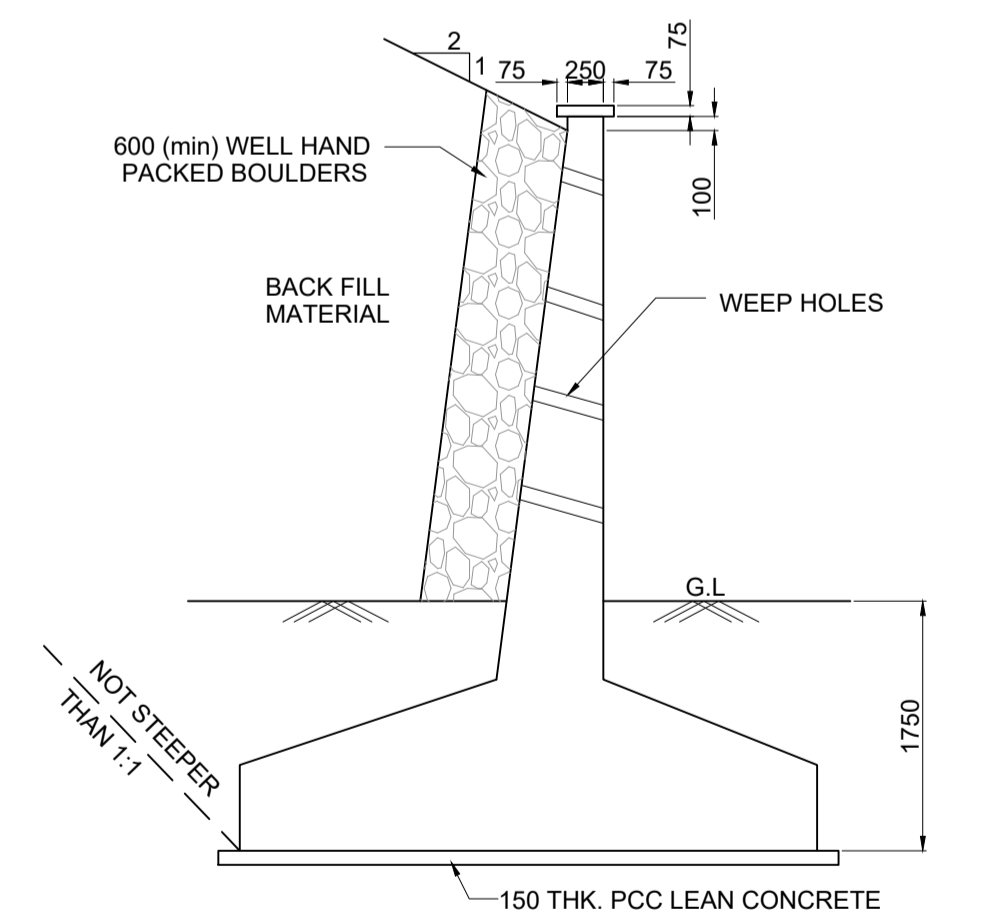
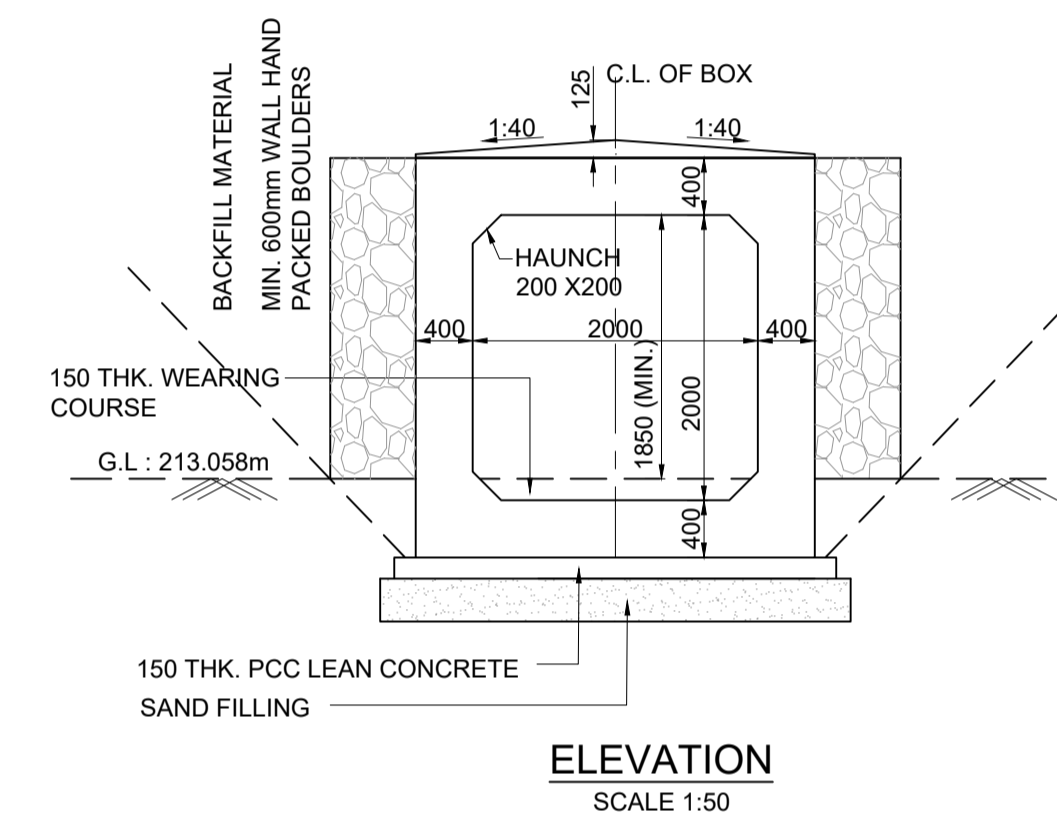
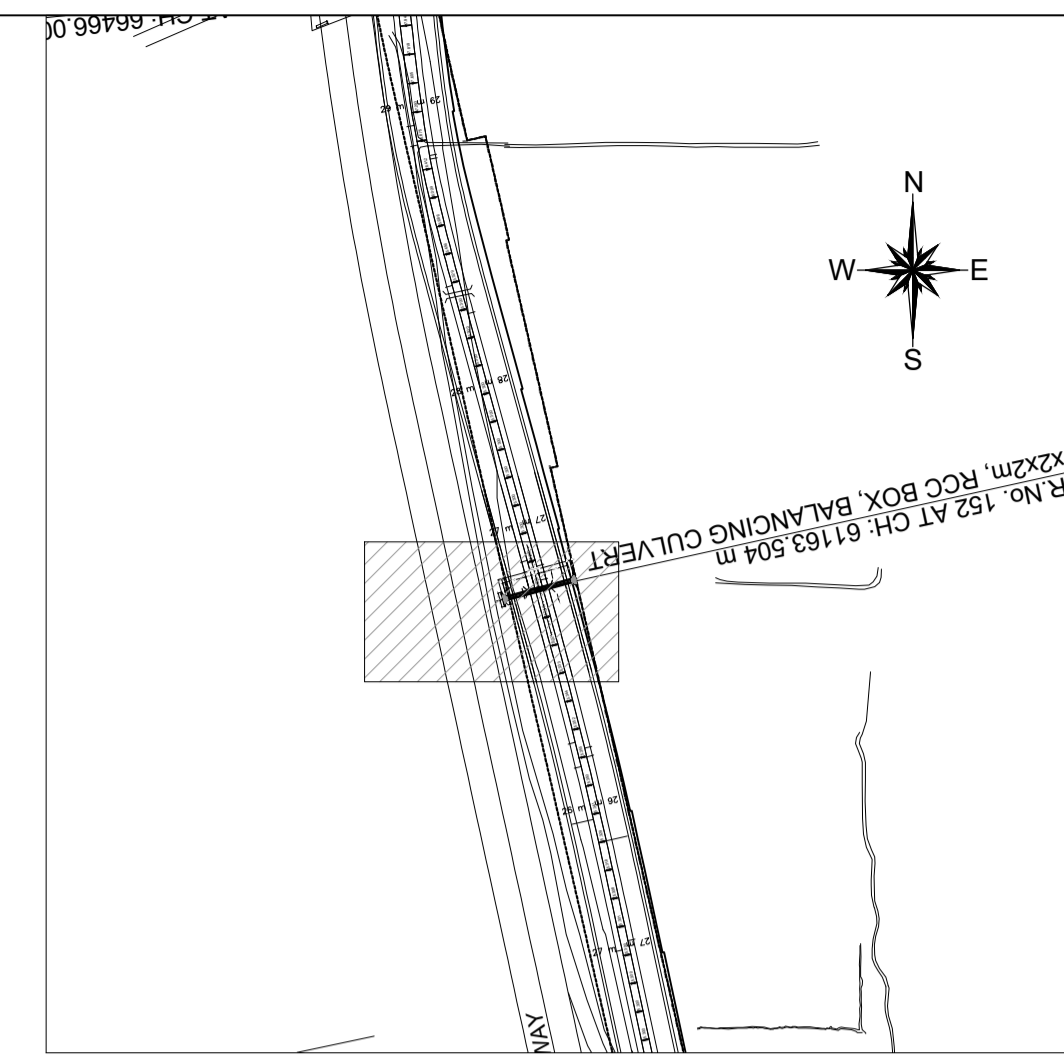
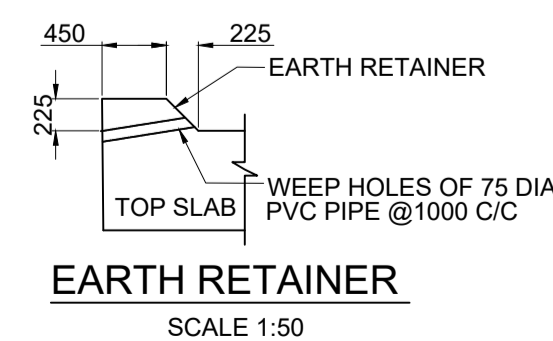
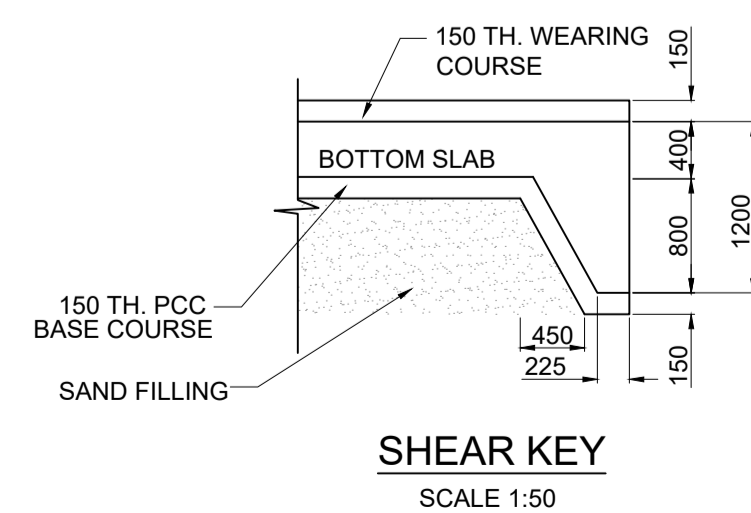
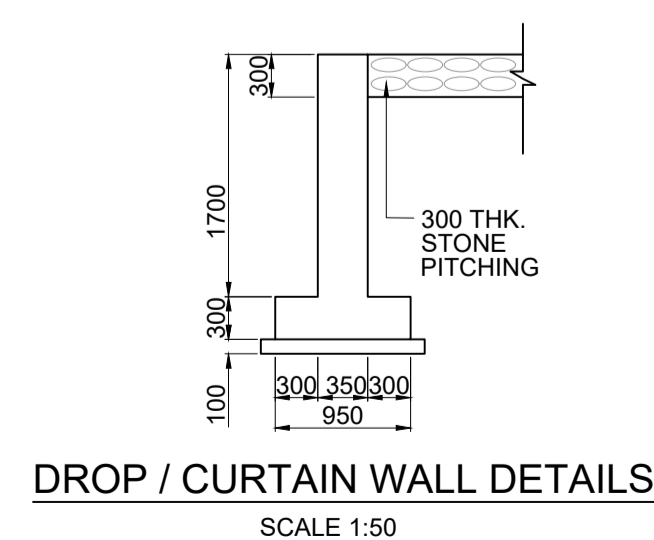
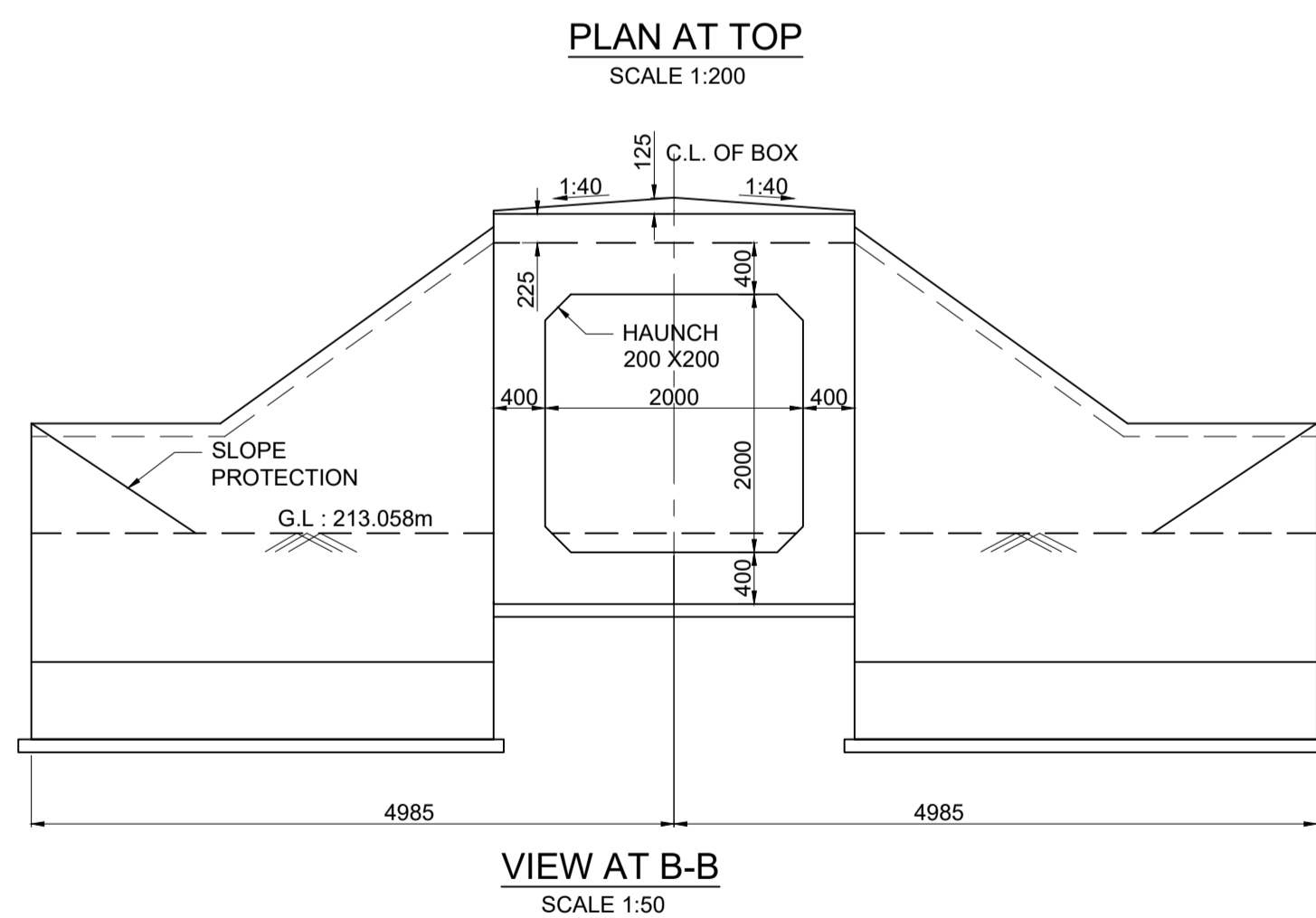
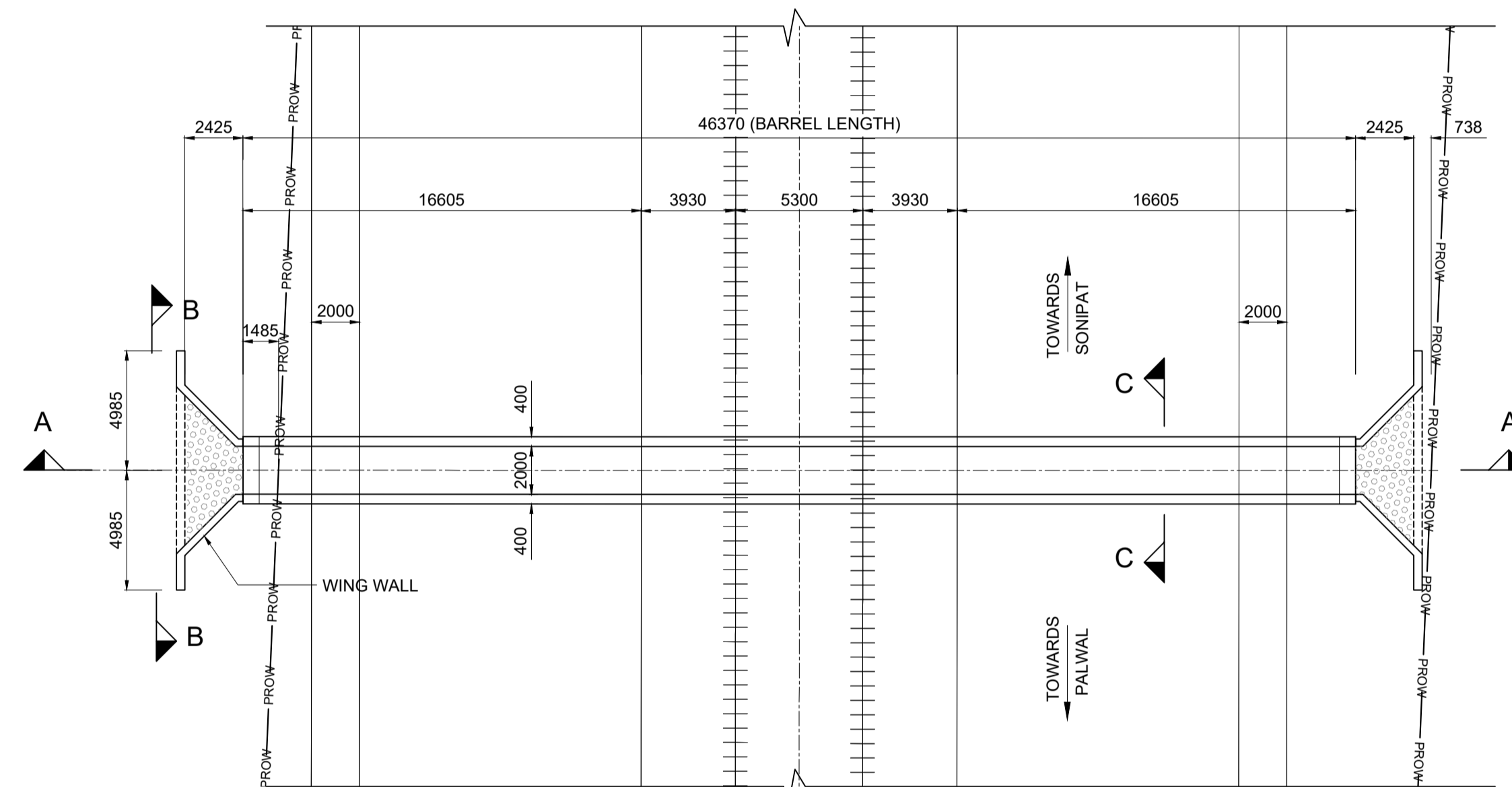
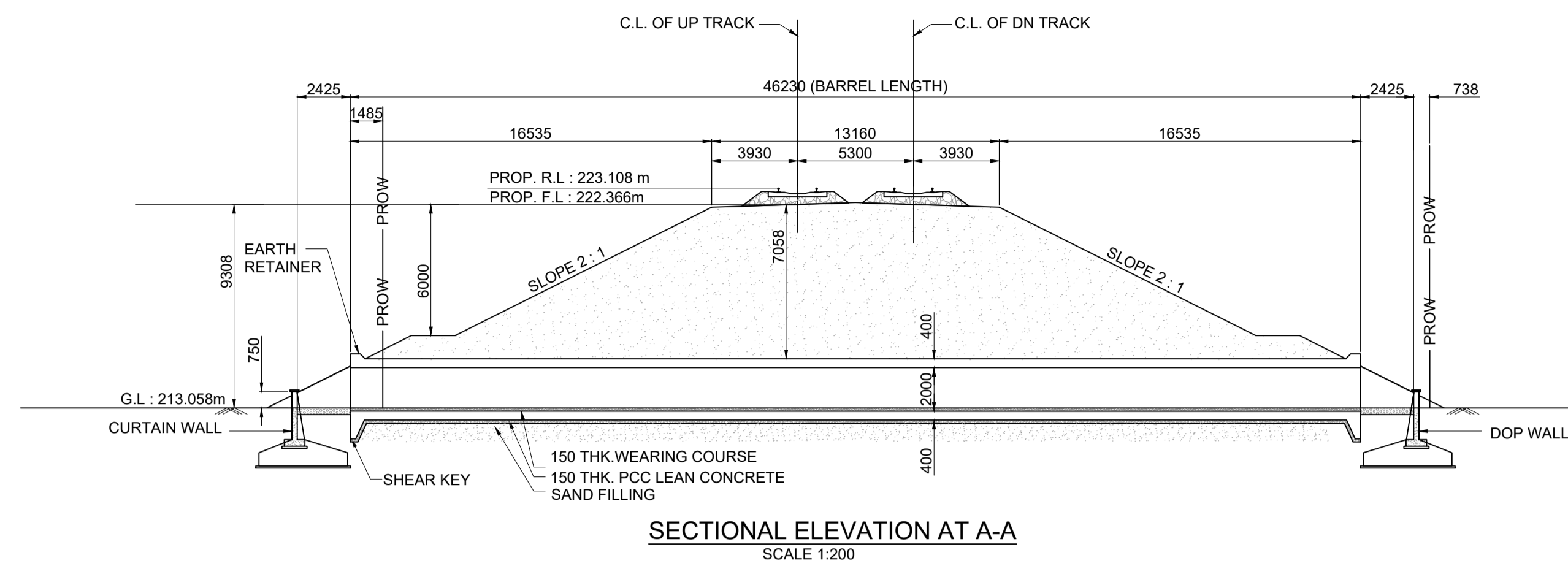


**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		





GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sh</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

**NOTES :**

**A) GENERAL NOTES**

- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
- THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
- FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
- BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
- THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONSTRUCTOR BEFORE EXECUTION.
- ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
- SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
- ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
- THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
- DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
- THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

**B) TECHNICAL NOTES :**

- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
- FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
- ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
- PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
- DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
- DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
  - IRS BRIDGE RULE
  - IRS CONCRETE BRIDGE CODE
  - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
- SEISMIC ZONE- IV
- EXPOSURE CONDITION- MODERATE.
- DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
- THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
- ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
- REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
- FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

  - ALL RCC =M.35/DETAILED DESIGN DRG.
  - WEARING COURSE =M.20/DETAILED DESIGN DRG.
  - LEVELING COURSE/LEAN CONCRETE =M.20/DETAILED DESIGN DRG.
- BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
- FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
- ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**

**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**

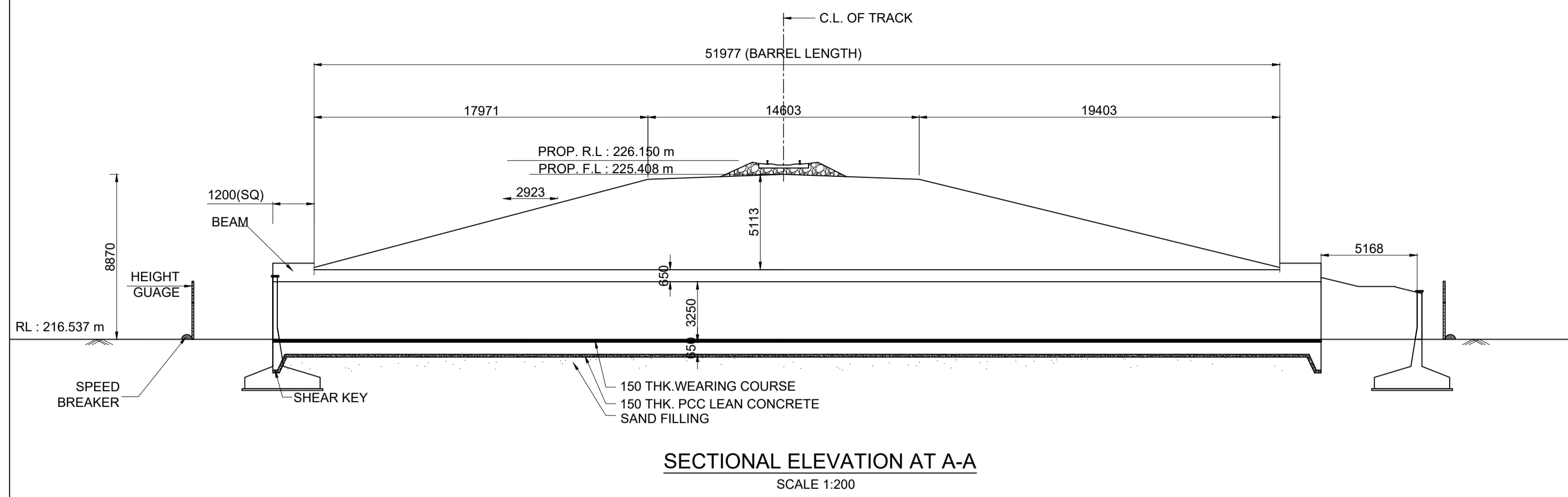
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.



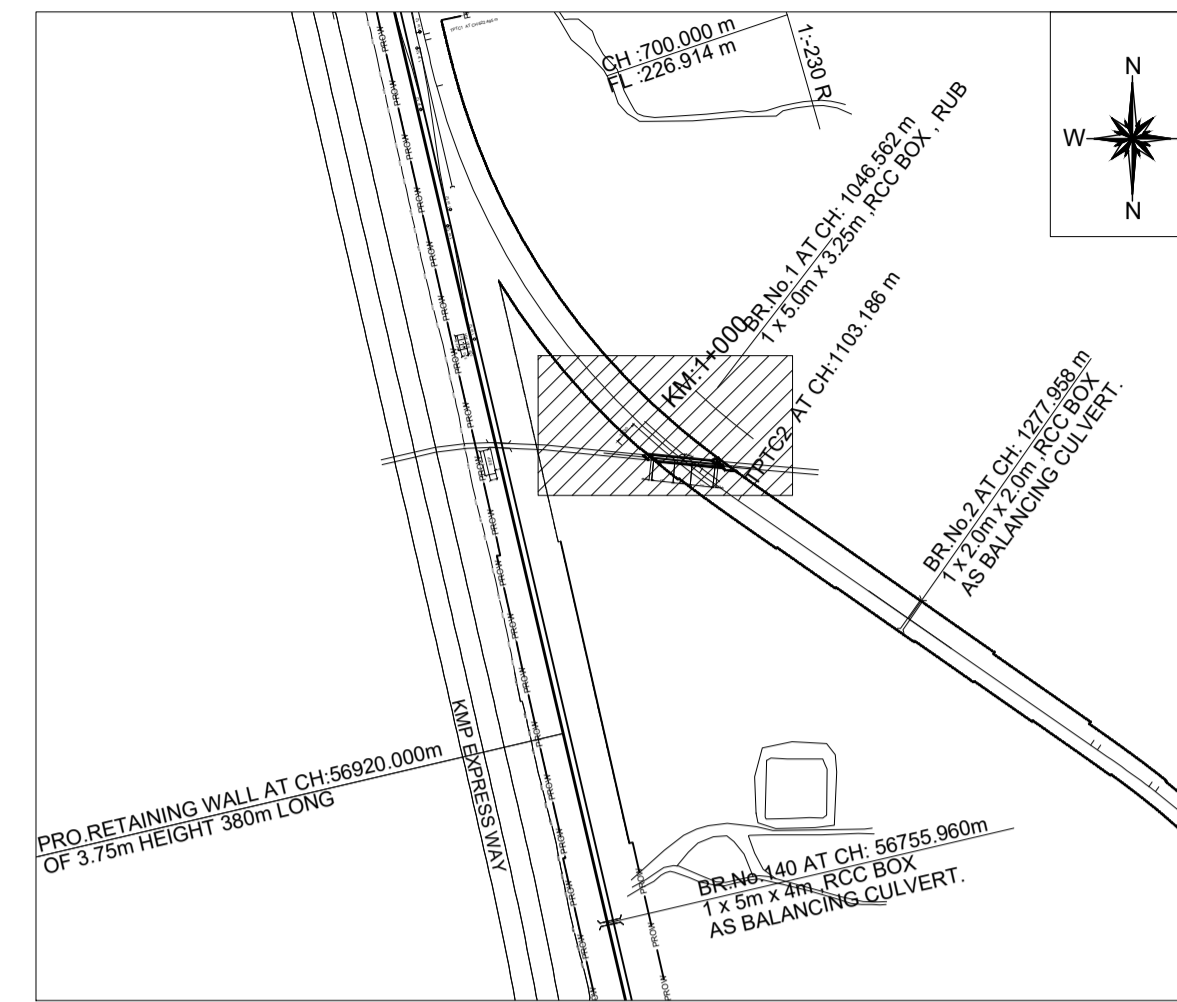
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO 154 SPAN 1.0X2.0X2.0 RCC BOX AT CH.61163.504

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01154\_A1 **SHEET NO.** 1 OF 1

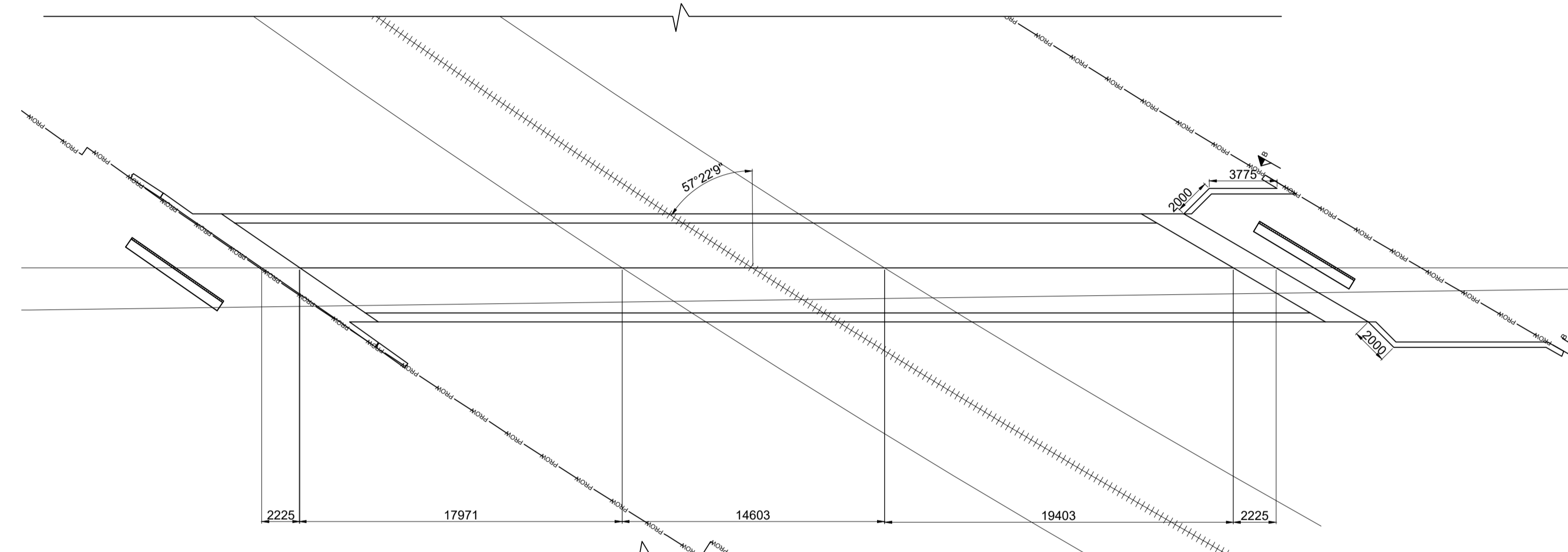
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



SECTIONAL ELEVATION AT A-A  
SCALE 1:200

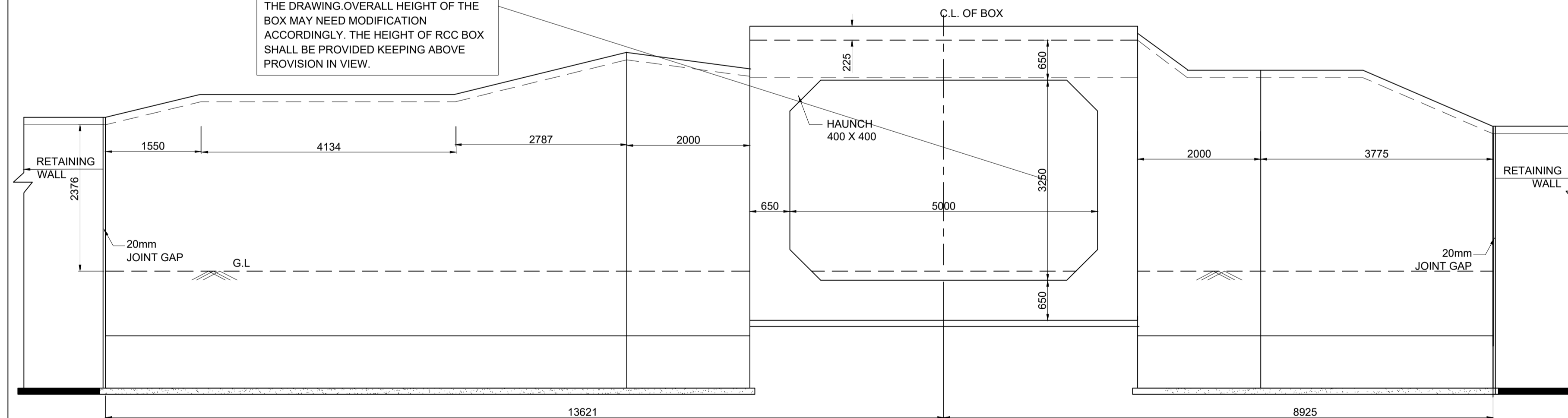


KEY PLAN  
SCALE 1:NTS

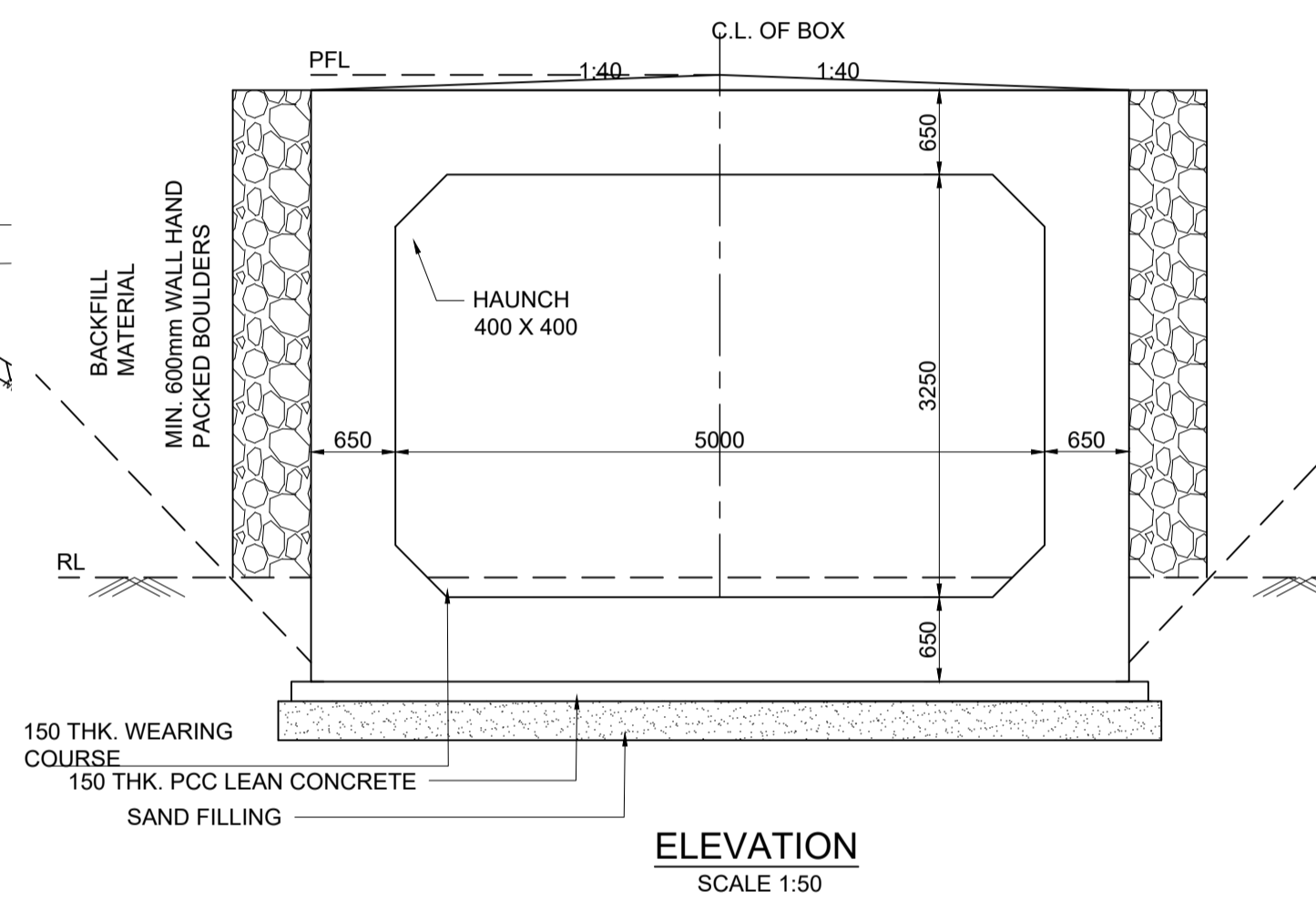


PLAN AT TOP  
SCALE 1:200

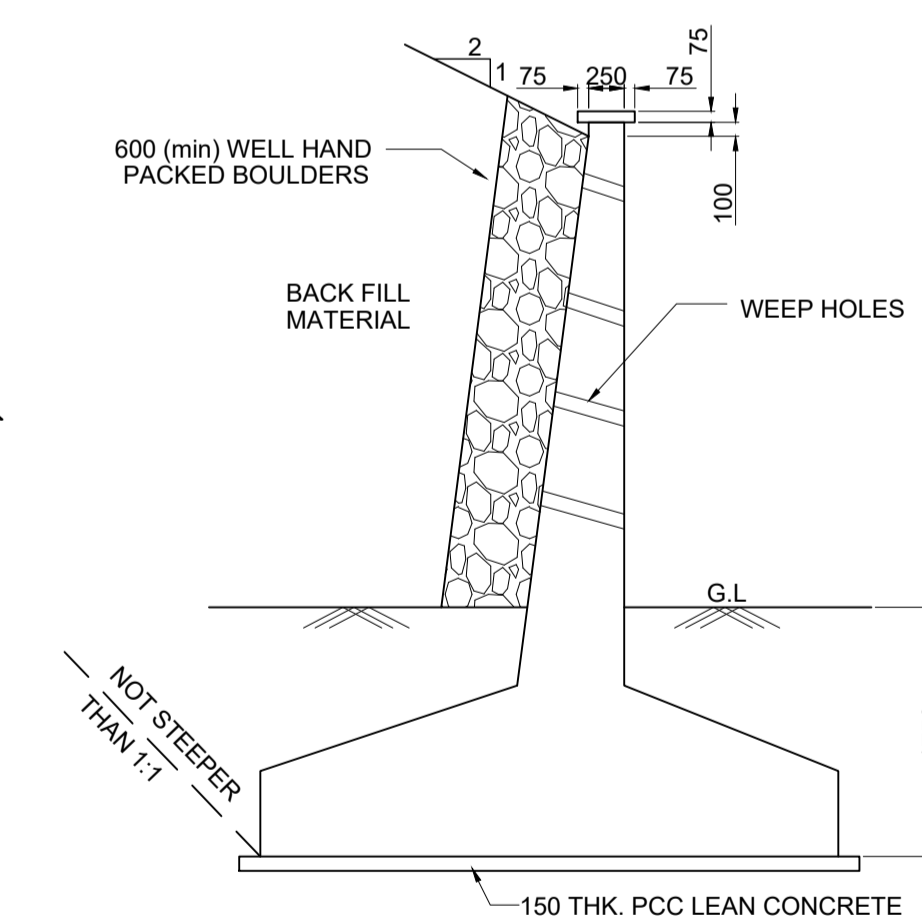
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



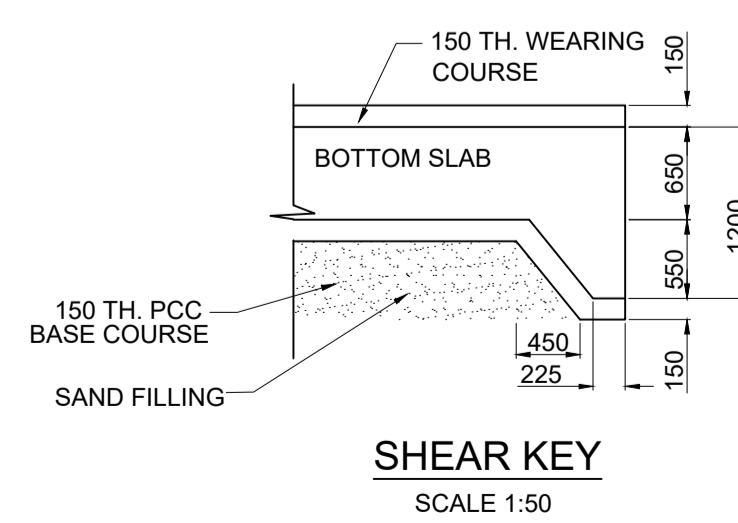
VIEW AT B-B  
SCALE 1:50



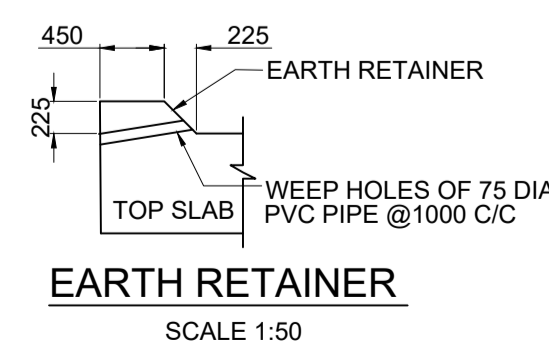
ELEVATION  
SCALE 1:50



TYPICAL DETAIL OF RETURN WALL / WING WALL  
SCALE 1:50



SHEAR KEY  
SCALE 1:50



EARTH RETAINER  
SCALE 1:50

LEGEND

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA M. RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/ARTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE. GRADE OF CONCRETE :
    - ALL RCC =M:35/DETAILED DESIGN DRG.
    - WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.
- IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

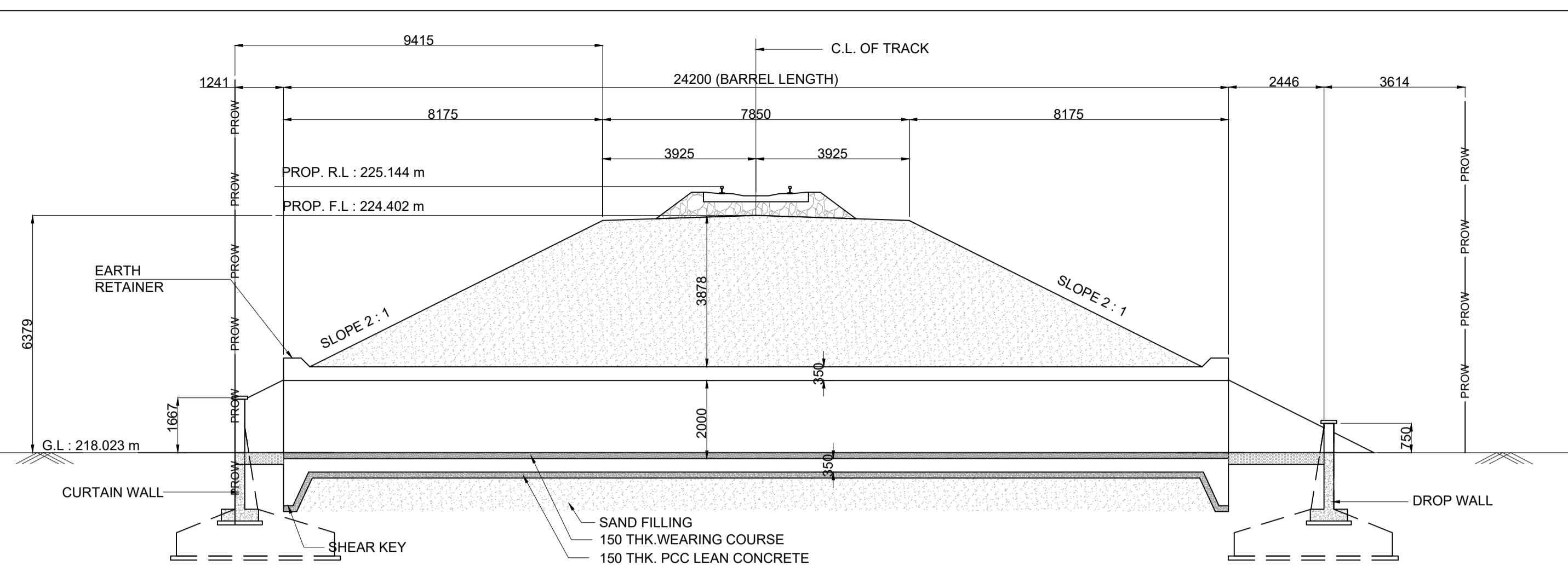


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO.1 - 1X5.0X3.25m RCC BOX AT CH. 1046.562m (CONNECTING LINE NEW PATLI TO PATLI)

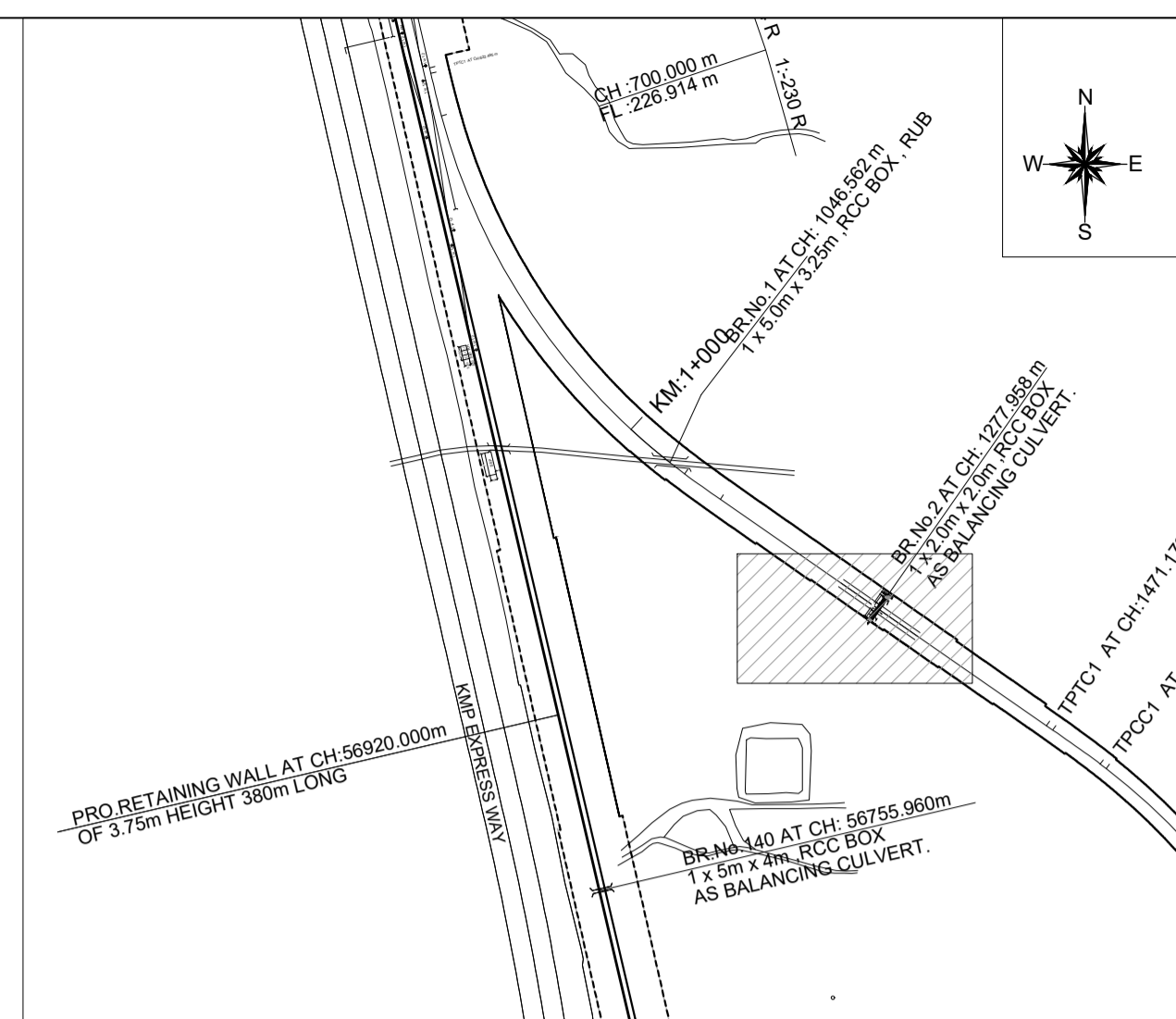
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-03001\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

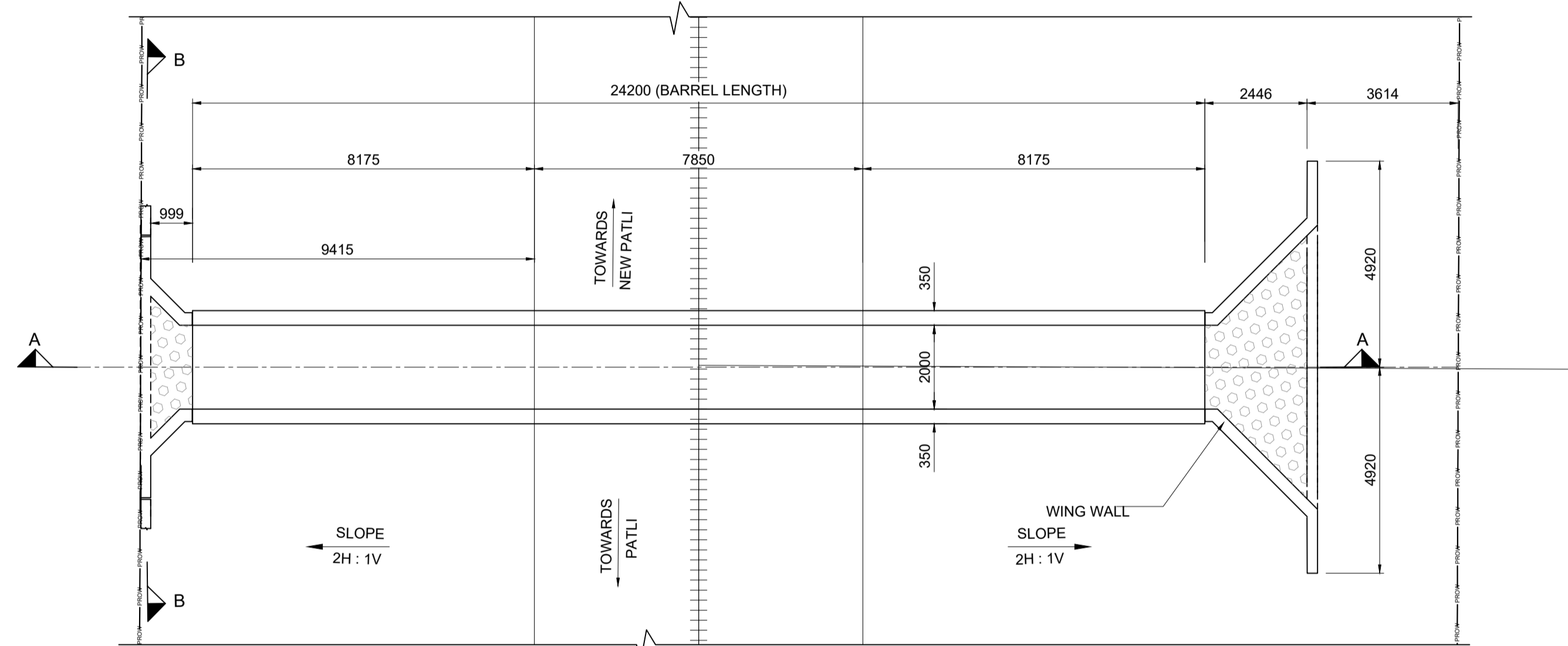




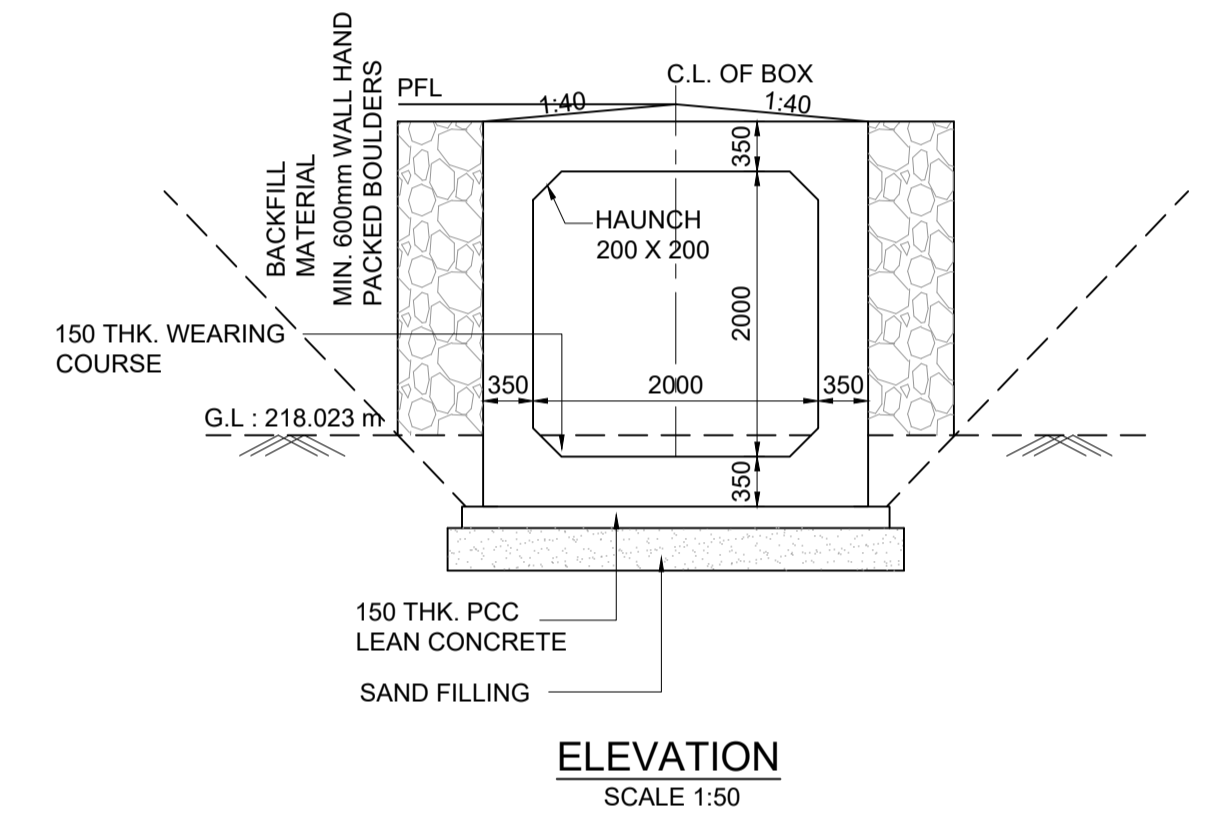
**SECTIONAL ELEVATION AT A-A**  
SCALE 1:100



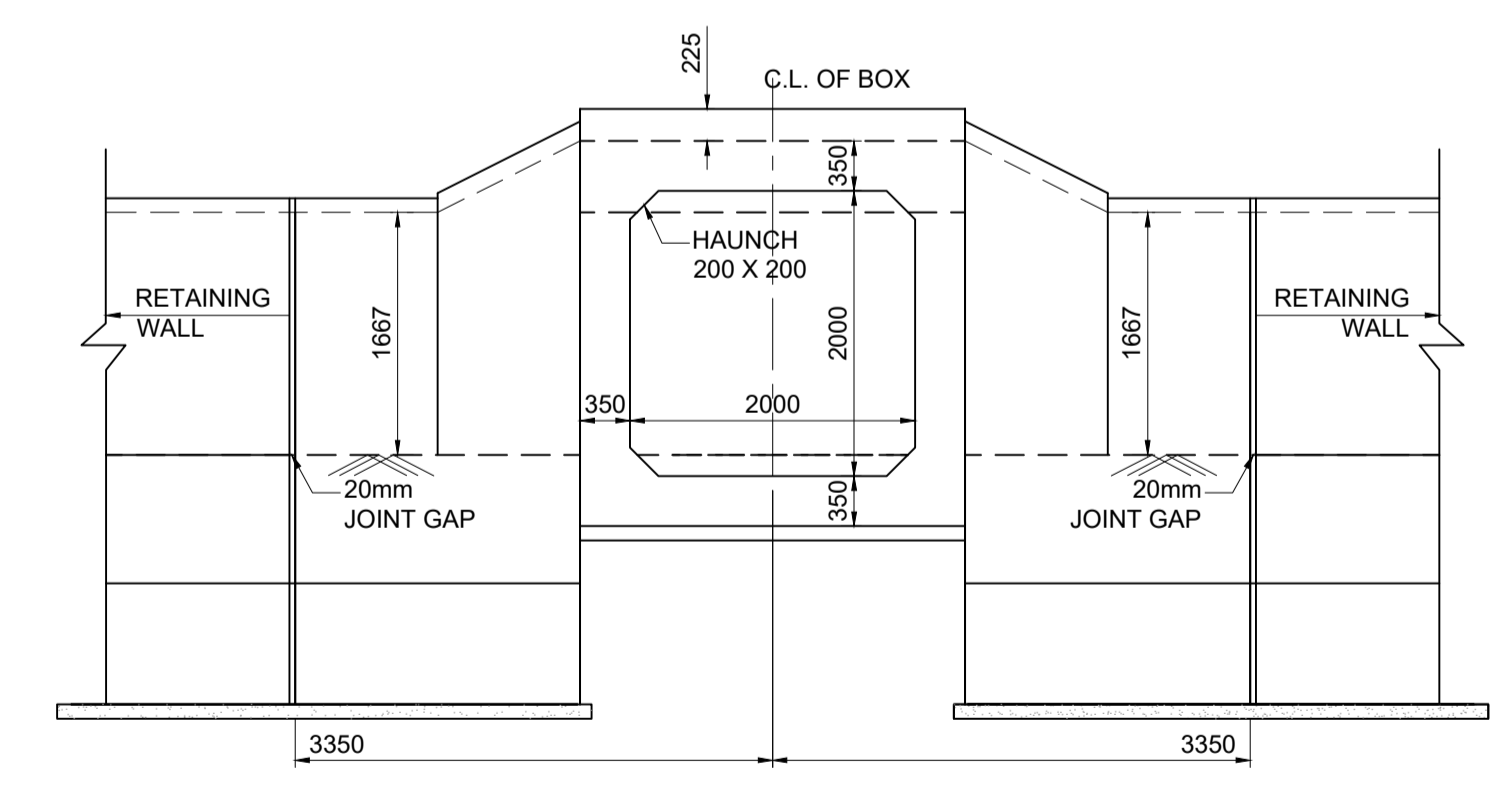
**KEY PLAN**  
SCALE 1:NTS



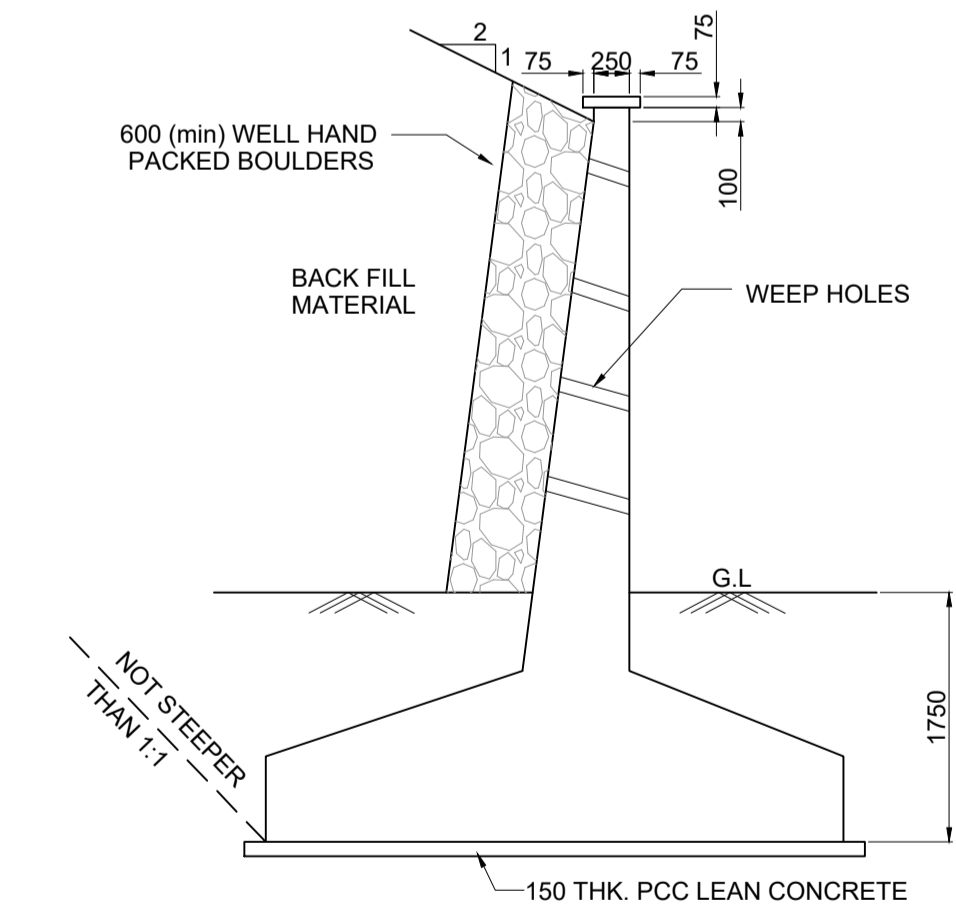
**PLAN AT TOP**  
SCALE 1:100



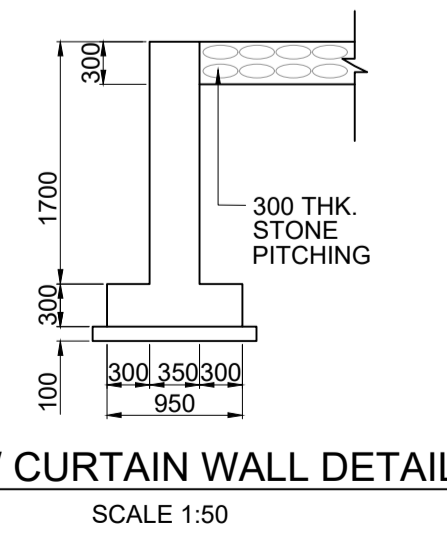
**ELEVATION**  
SCALE 1:50



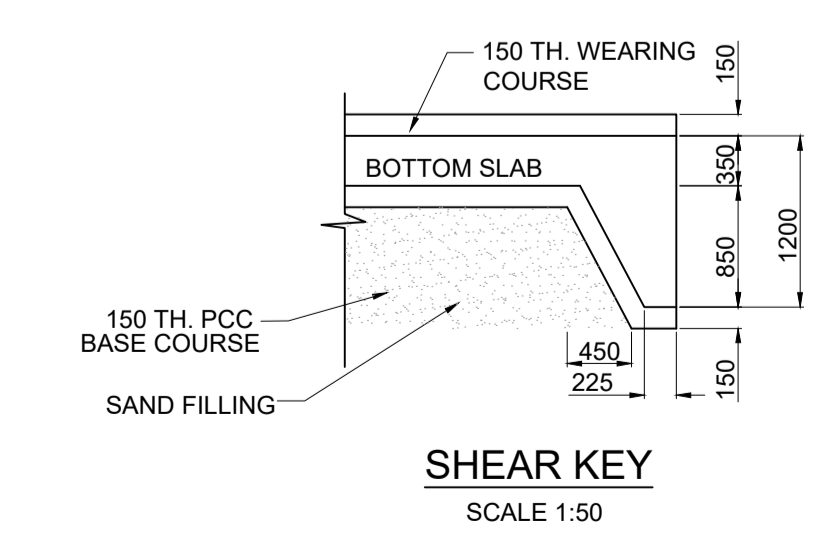
**VIEW B-B**  
SCALE 1:50



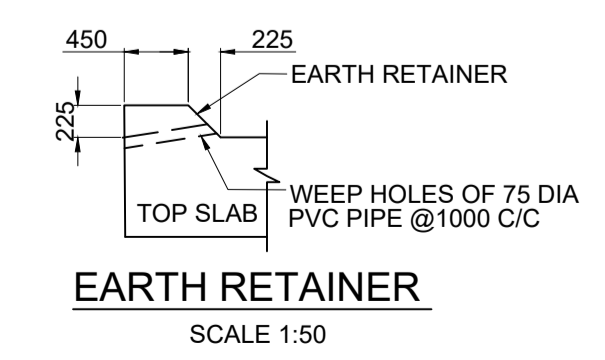
**TYPICAL DETAIL OF RETURN WALL / WING WALL**  
SCALE 1:50



**DROP / CURTAIN WALL DETAILS**  
SCALE 1:50



**SHEAR KEY**  
SCALE 1:50



**EARTH RETAINER**  
SCALE 1:50

**NOTES :**

**A) GENERAL NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
2. THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
4. BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
5. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
6. ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
9. THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

**B) TECHNICAL NOTES :**

1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
3. ALL CLEAN EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
5. DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
6. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
  - (i) IRS BRIDGE RULE
  - (ii) IRS CONCRETE BRIDGE CODE
  - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
7. SEISMIC ZONE- IV
8. EXPOSURE CONDITION- MODERATE.
9. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
10. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB-STRUCTURE AND FOUNDATION CODE.
11. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
12. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
13. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
  - GRADE OF CONCRETE :
    - (i) ALL RCC = M-35/DETAILED DESIGN DRG.
    - (ii) WEARING COURSE = M-20/DETAILED DESIGN DRG.
    - (iii) LEVELING COURSE/LEAN CONCRETE = M-20/DETAILED DESIGN DRG.
14. BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
15. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
16. ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**

**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

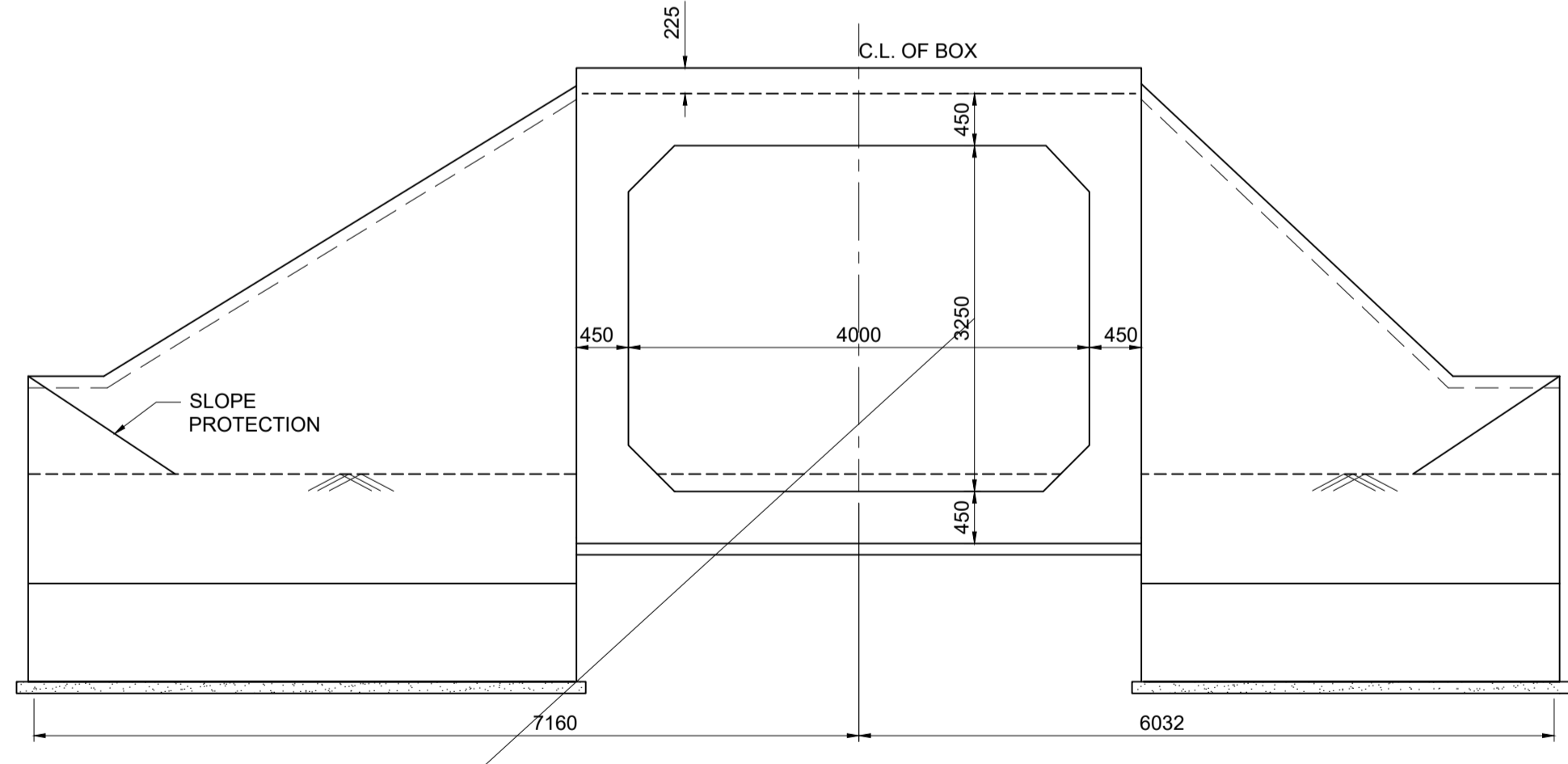
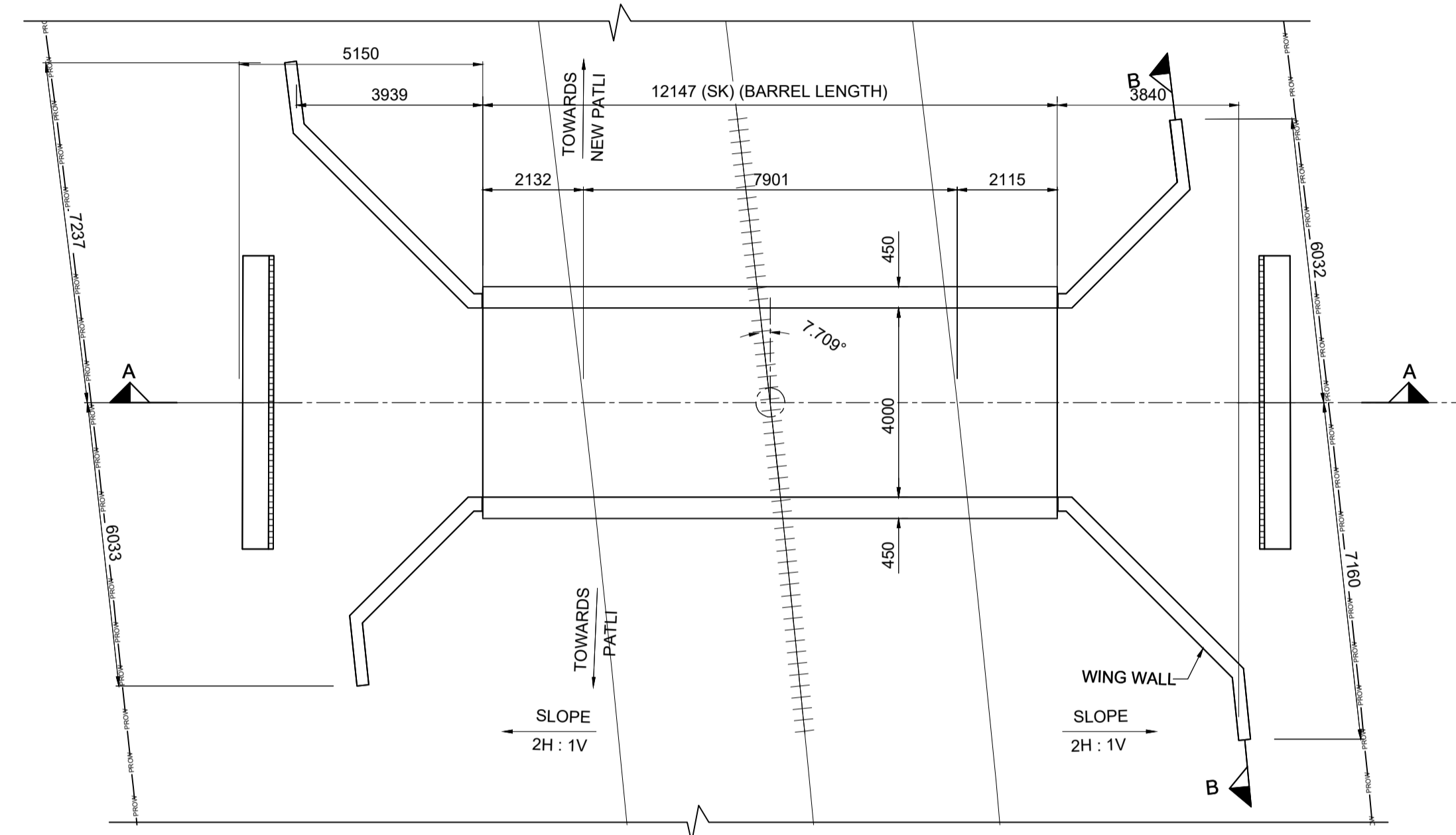
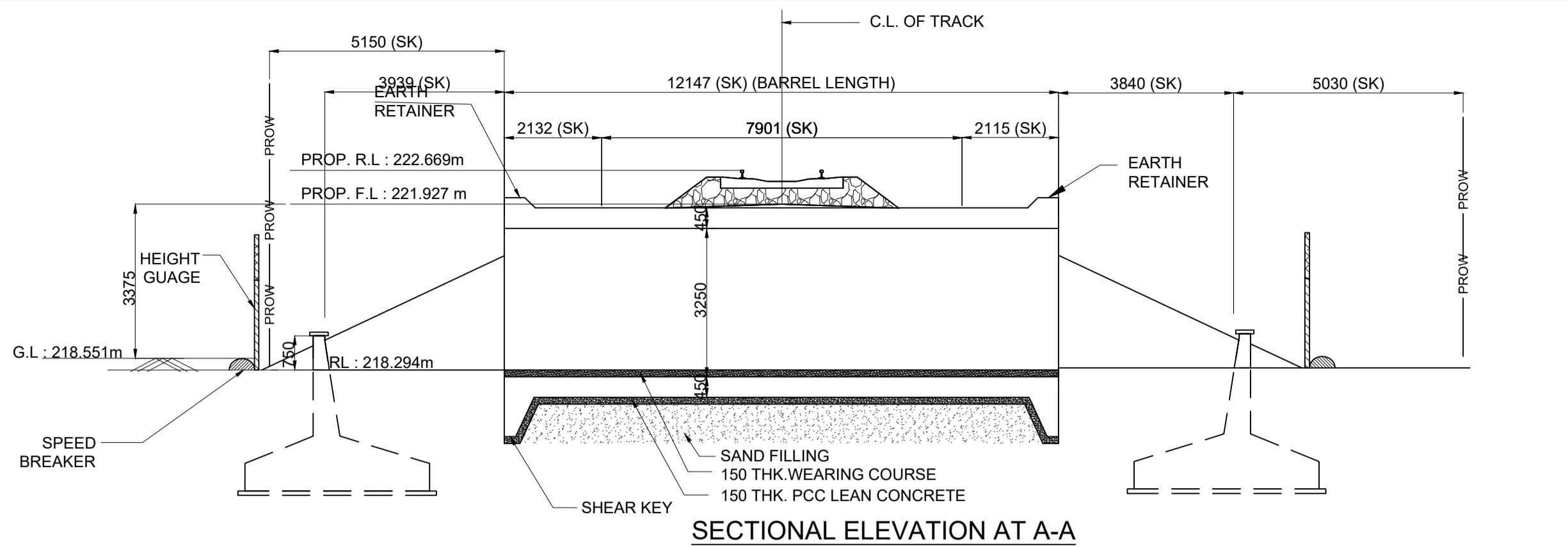


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT NO.2 -1X2.0X2.0m RCC BOX AT CH. 1277.958m (CONNECTING LINE NEW PATLI TO PATLI)

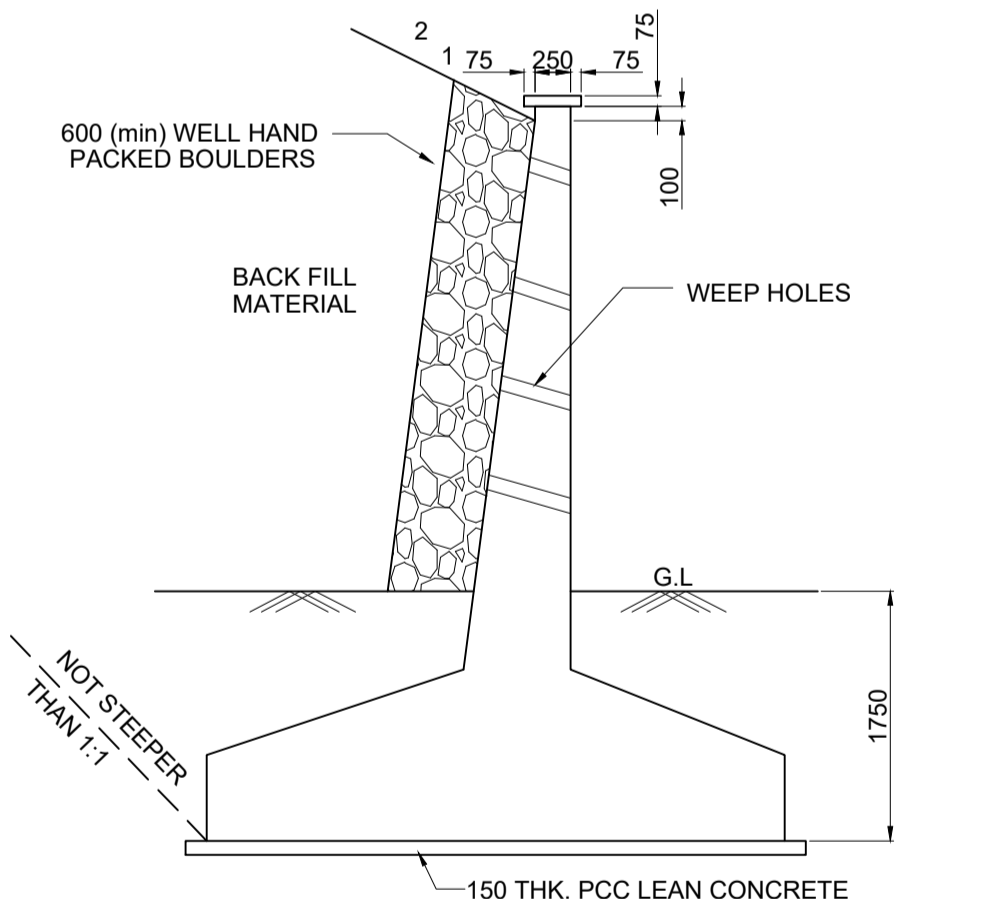
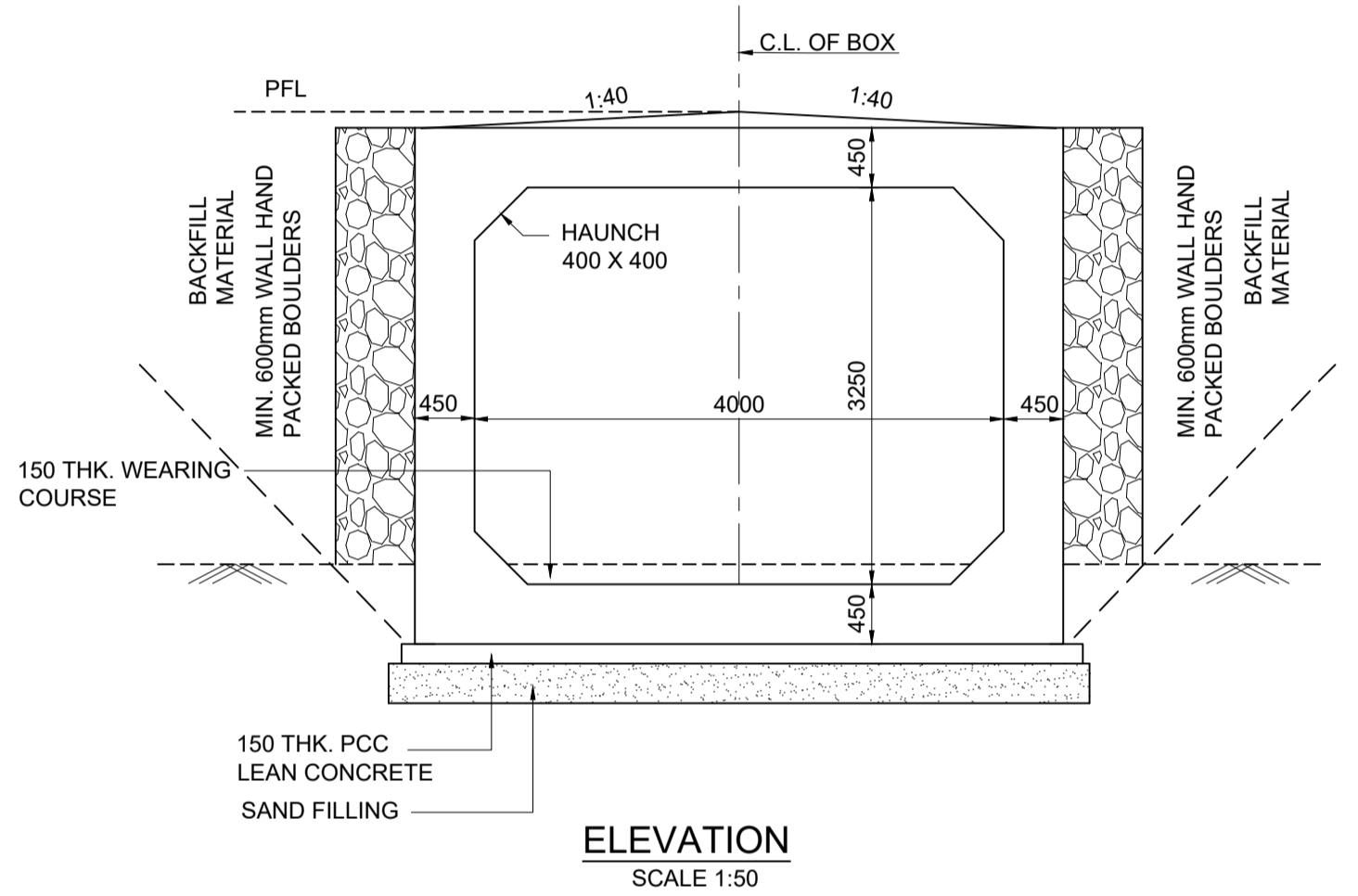
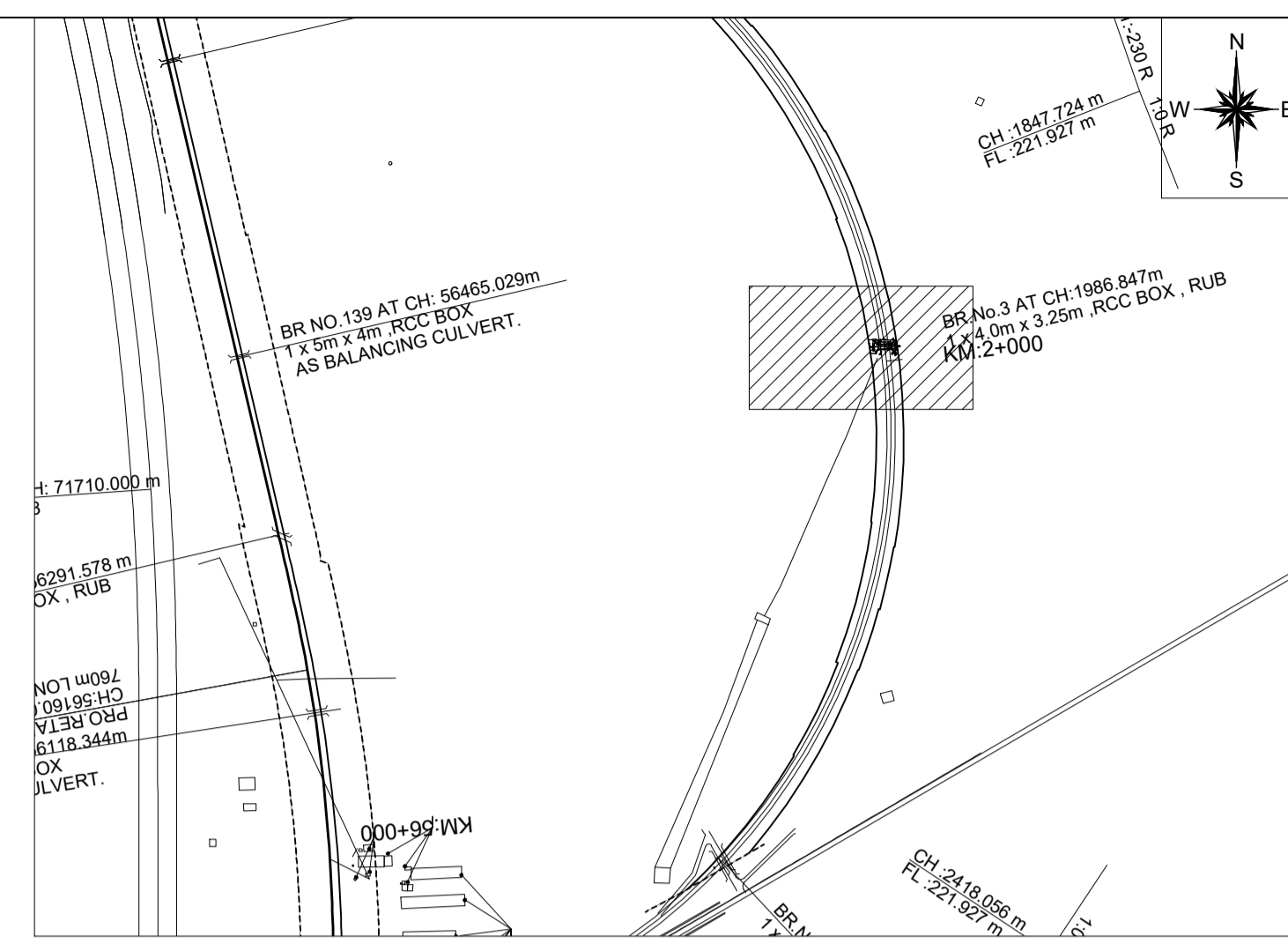
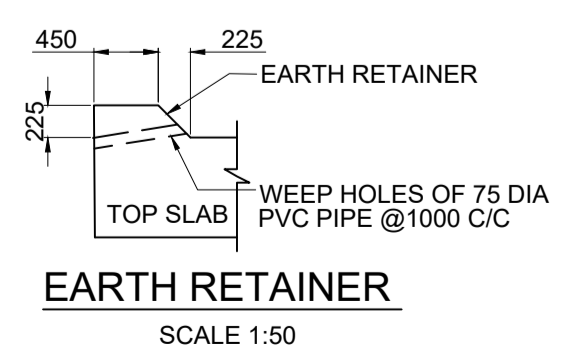
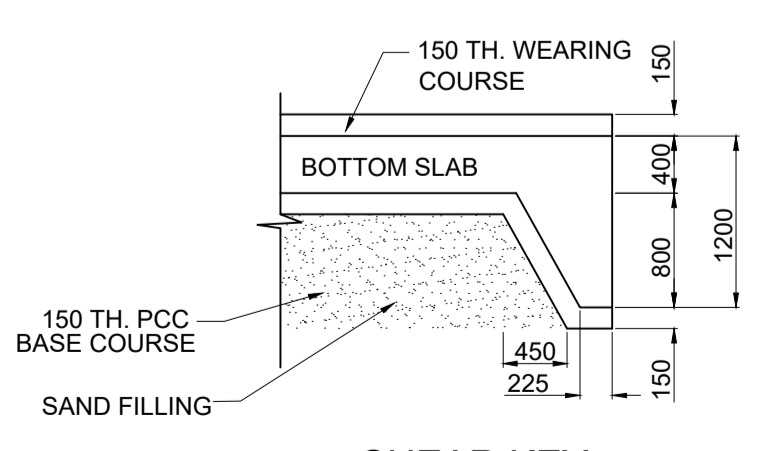
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD\_03002\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/CIVIL	<i>Reetu</i>		



TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

- NOTES :**
- A) GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  2. THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  4. BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  5. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  6. ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL, FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  9. THIS DRAWING IS THE PROPERTY OF HRDC AND FOR EXCLUSIVE USE OF HORC.
  10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRDC-SK-GEN-015.
  2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  3. ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  5. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  6. SEISMIC ZONE- IV
  7. EXPOSURE CONDITION- MODERATE.
  8. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST
  9. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  10. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  11. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  12. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE. GRADE OF CONCRETE :
    - (i) ALL RCC =M:35/DETAILED DESIGN DRG.
    - (ii) WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - (iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  13. BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  14. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  15. HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.
- IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

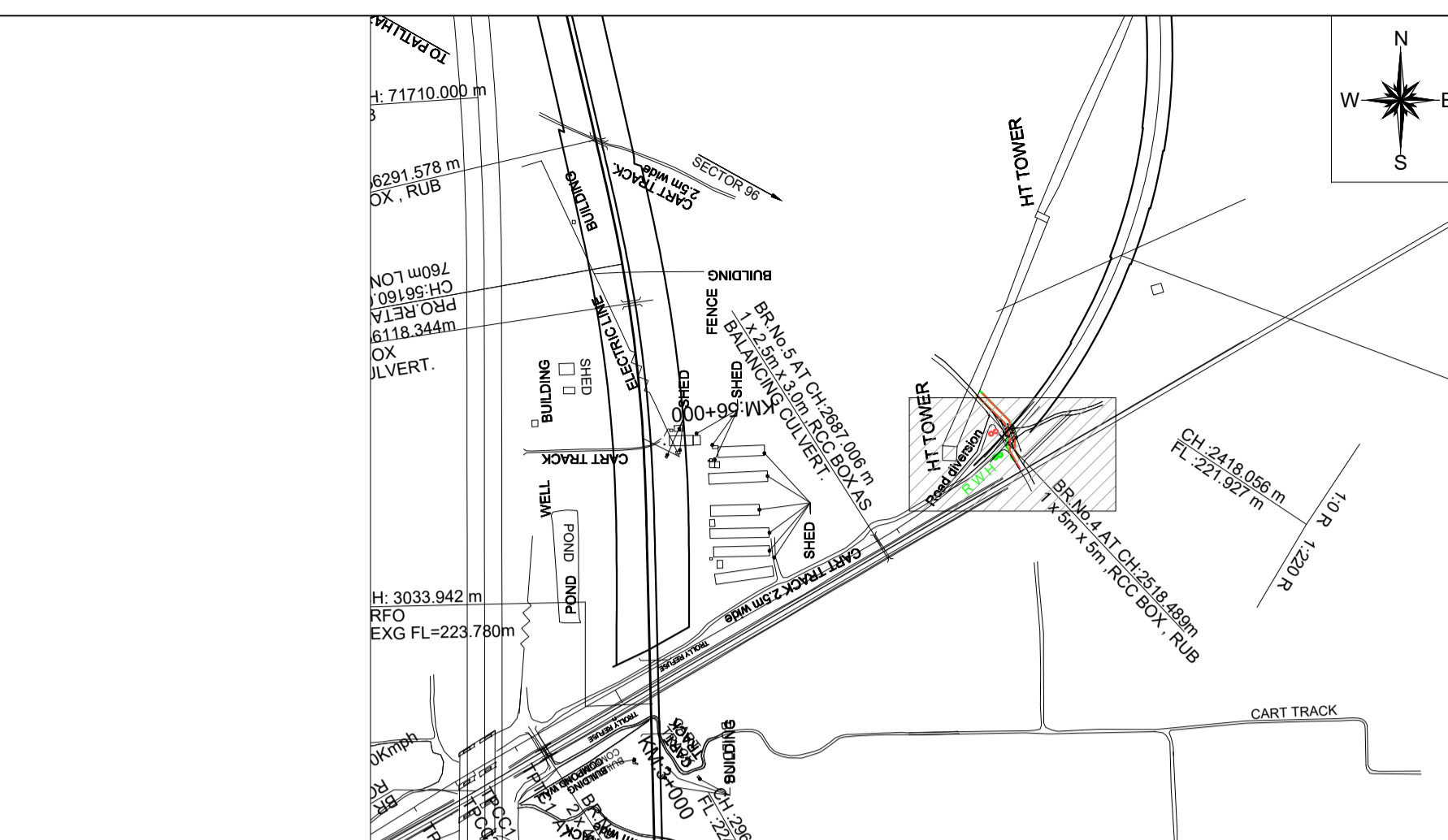
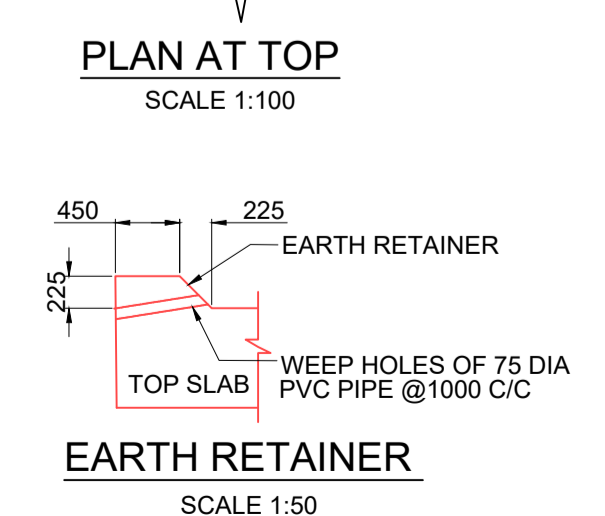
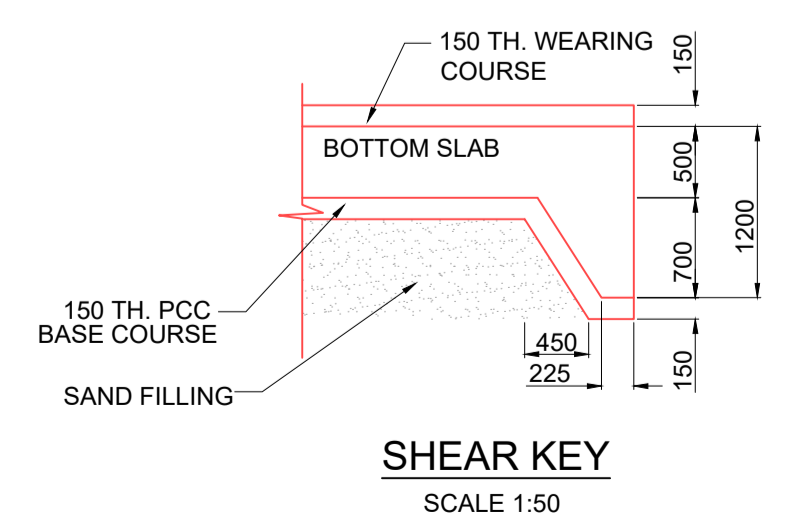
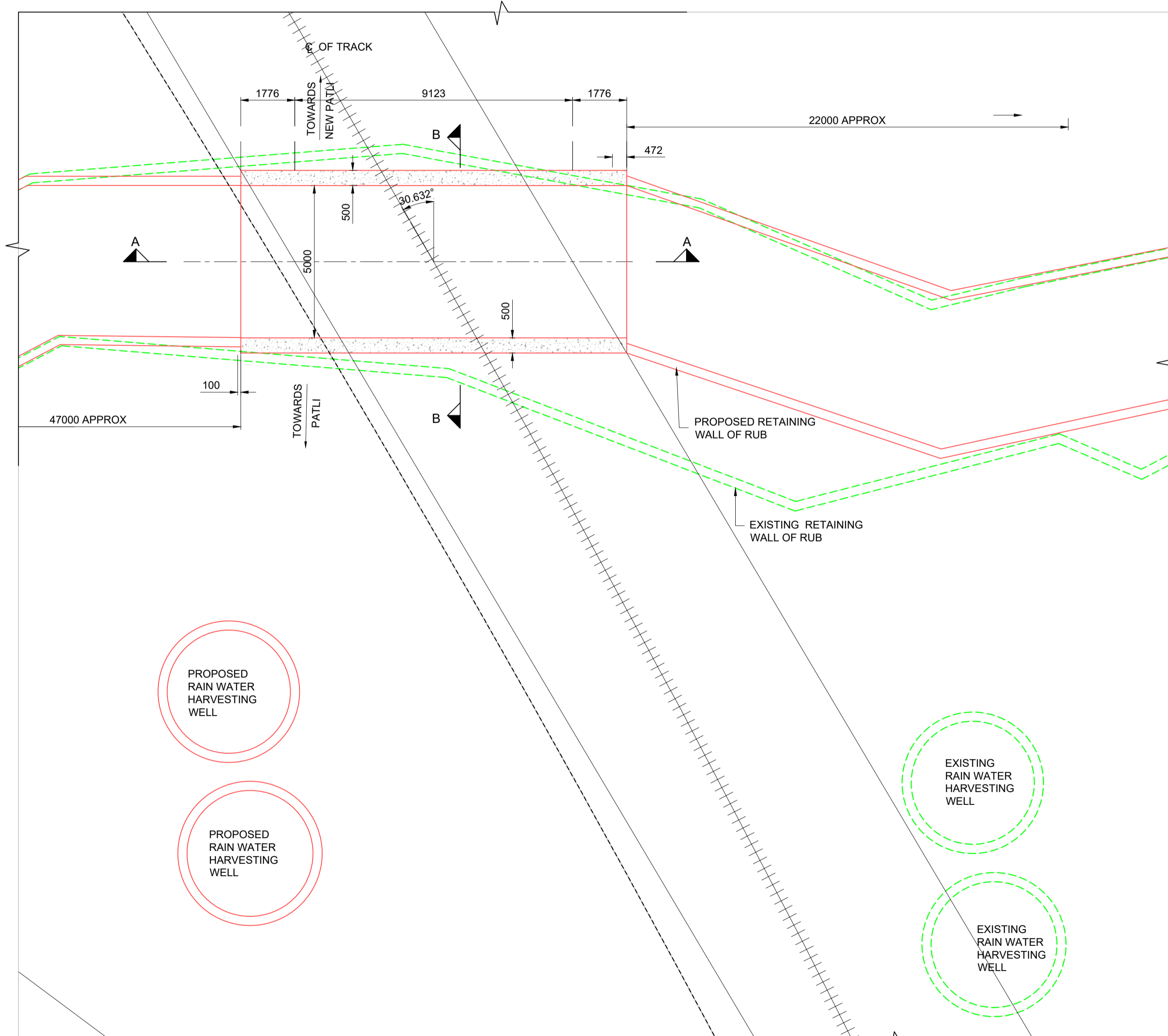
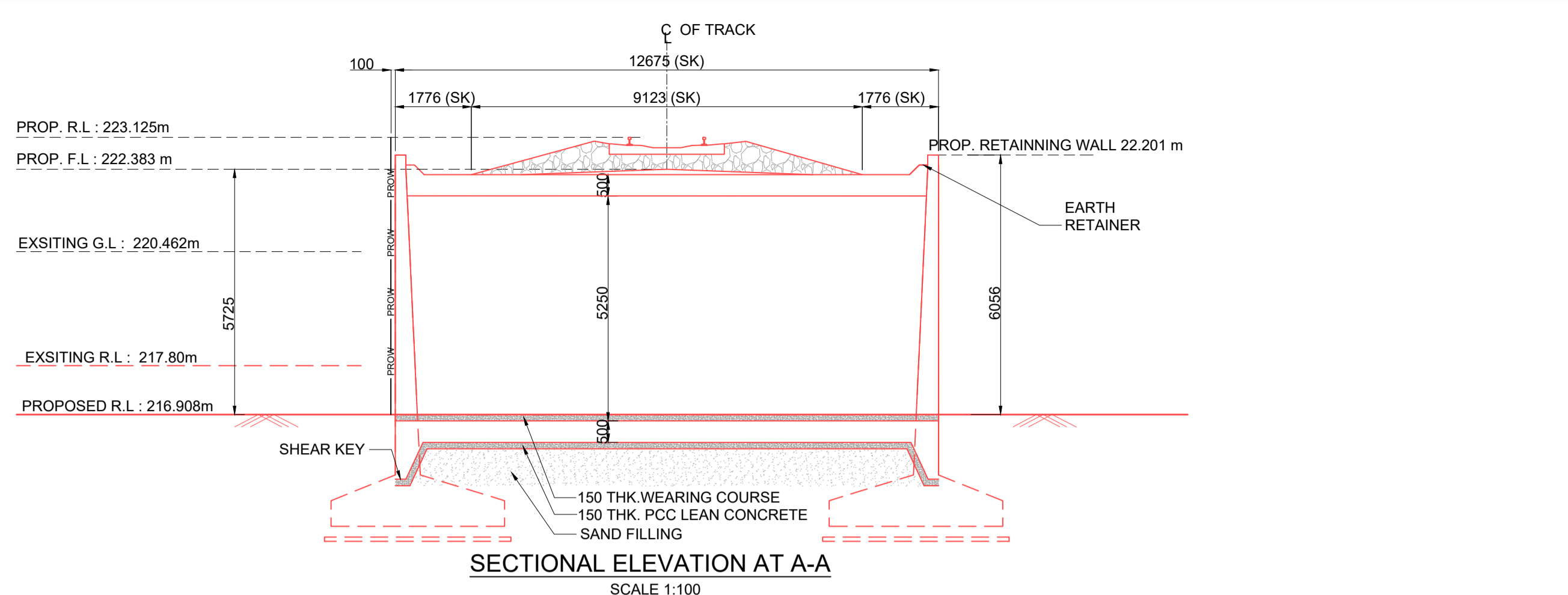


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO. 3 - 1X4.0X3.25m RCC BOX AT CH. 1986.847m (CONNECTING LINE NEW PATLI TO PATLI)

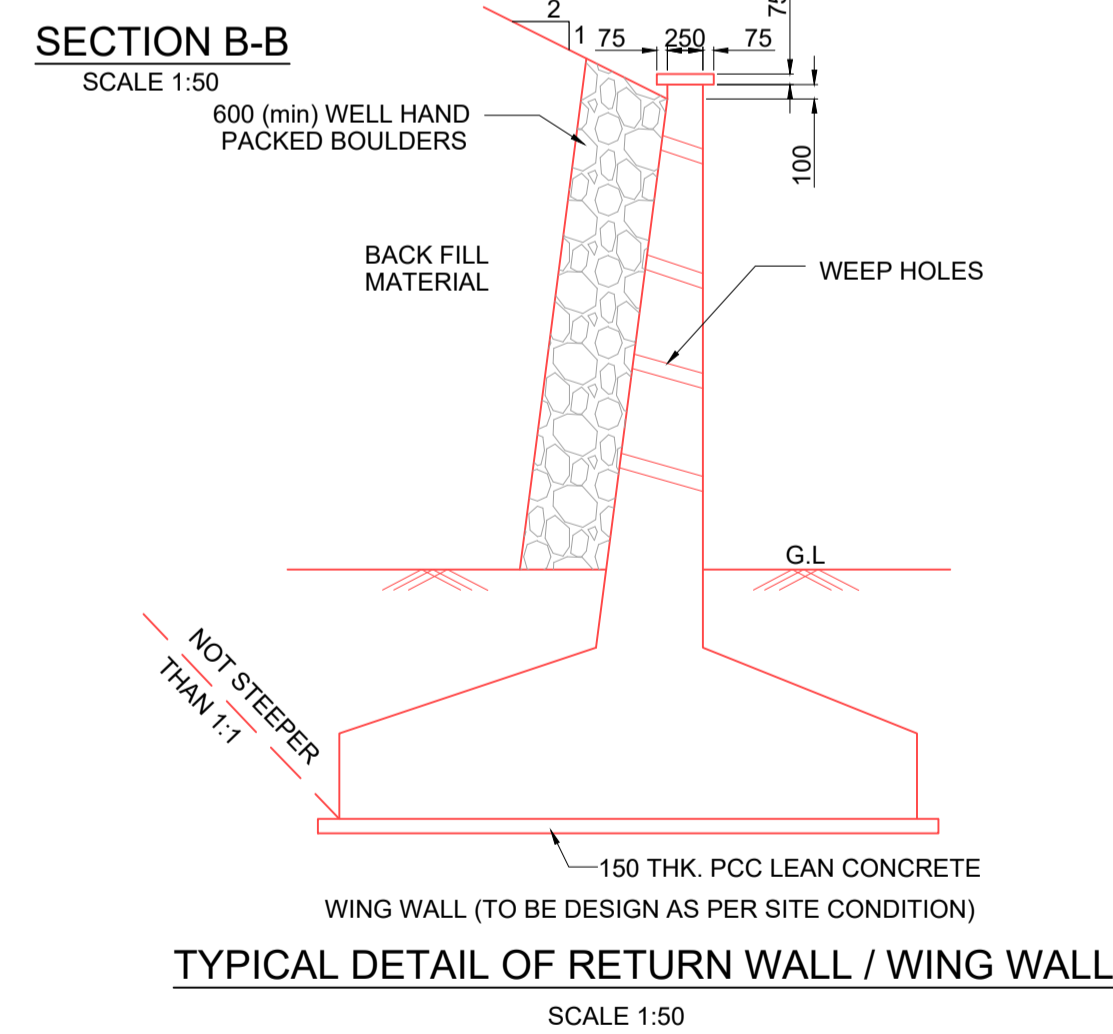
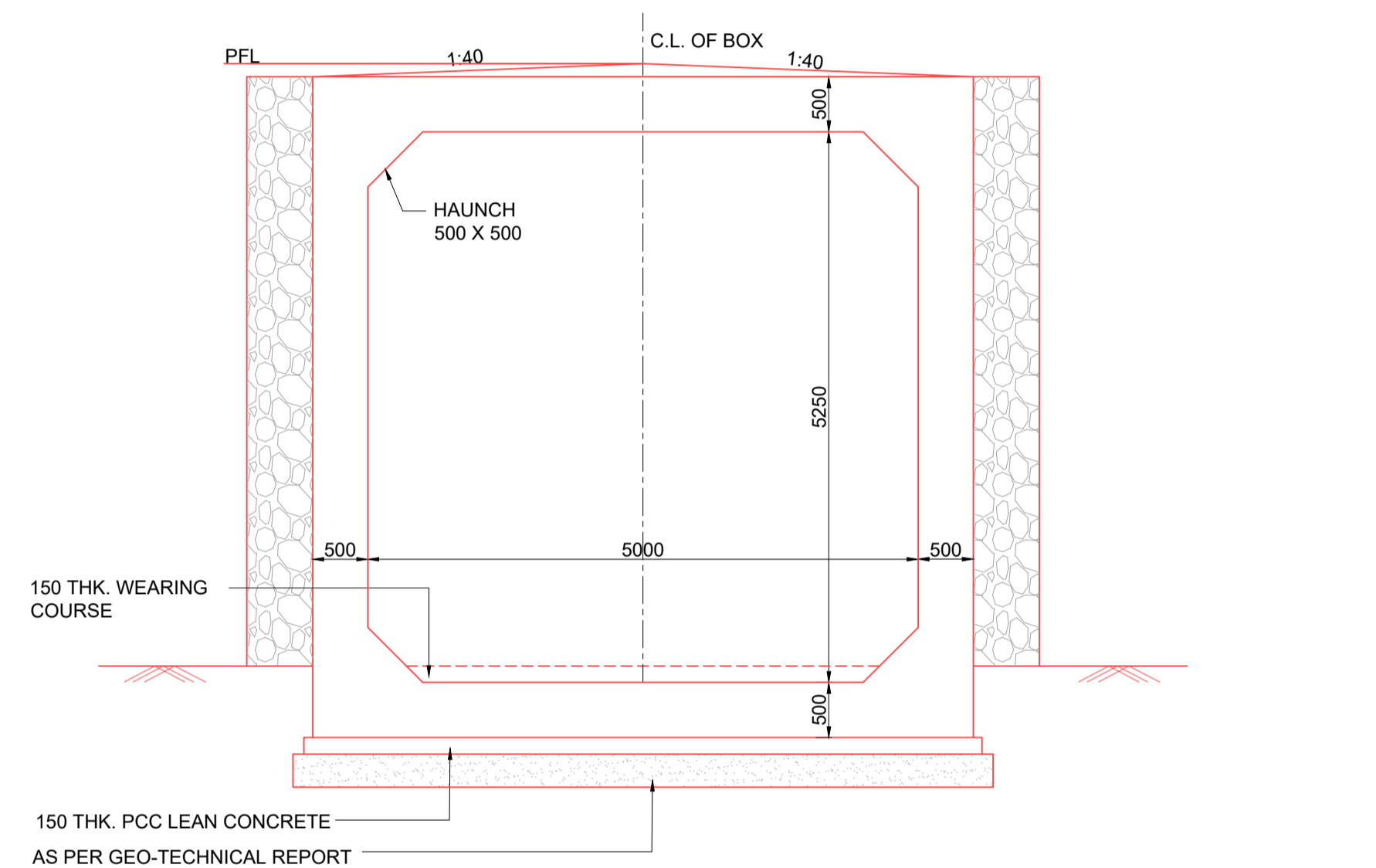
**DRG. NO.** GC-HRDC-C2-DRW-BRD-GAD-03003\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 22/06/2022 **REVISED DATE** 29/07/2022

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



- NOTES :**
- A) GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  2. THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  4. BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  5. THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  6. ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  9. THIS DRAWING IS THE PROPERTY OF HRDC AND FOR EXCLUSIVE USE OF HORC.
  10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRDC-SK-GEN-015.
  2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  3. ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  5. DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
  6. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - (i) IRS BRIDGE RULE
    - (ii) IRS CONCRETE BRIDGE CODE
    - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  7. SEISMIC ZONE- IV
  8. EXPOSURE CONDITION- MODERATE.
  9. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  10. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  11. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K G/SQM.
  12. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  13. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE. GRADE OF CONCRETE :
    - (i) ALL RCC =M:35/DETAILED DESIGN DRG.
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    - (iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
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  15. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  16. HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001



- LEGEND**
- |       |                          |
|-------|--------------------------|
| PRL   | PROPOSED RAIL LEVEL      |
| PFL   | PROPOSED FORMATION LEVEL |
| HFL   | HIGHEST FLOOD LEVEL      |
| GL    | GROUND LEVEL             |
| —     | PROPOSED                 |
| - - - | DISMANTEL                |
- PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE
- CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.
- CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

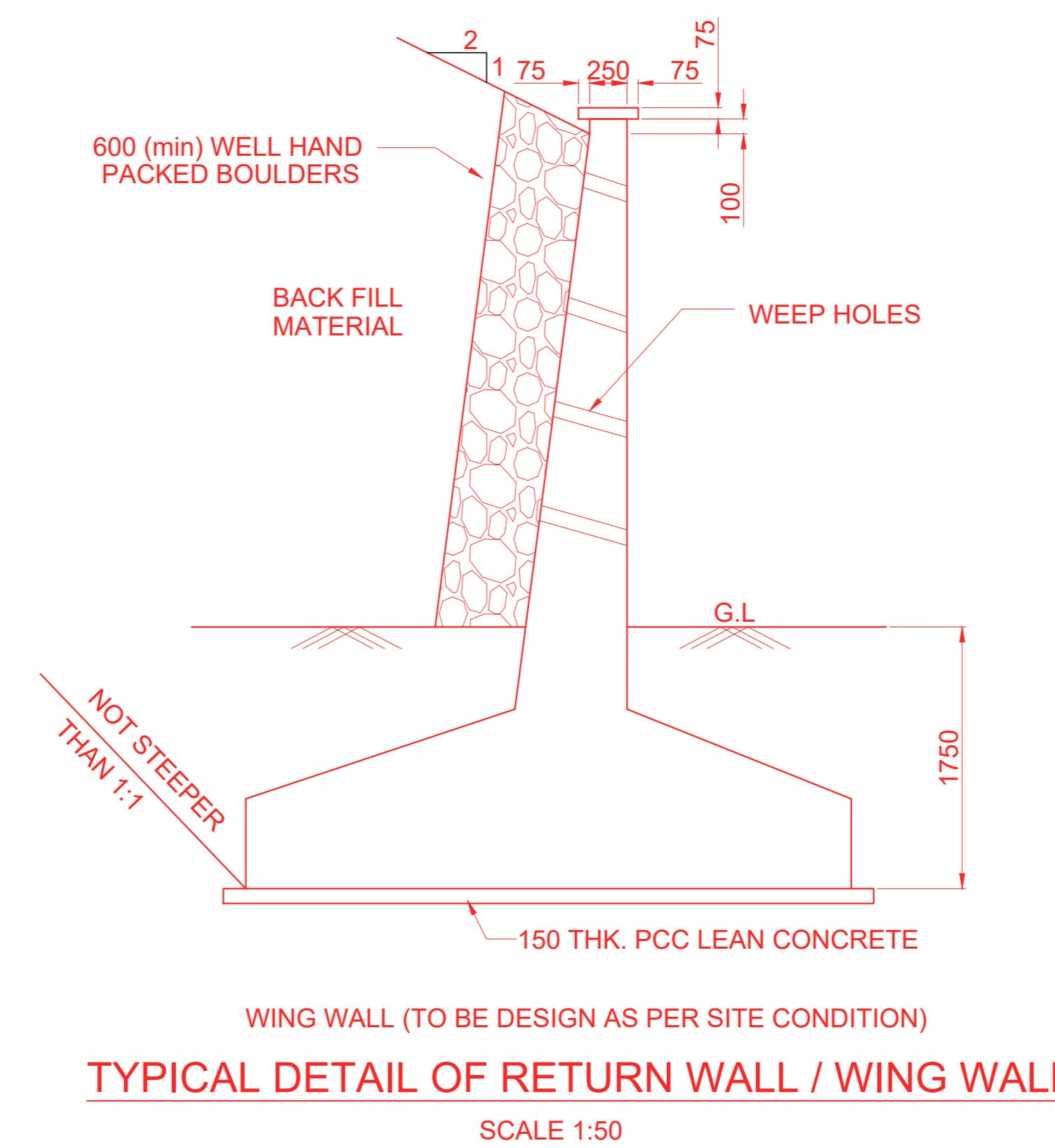
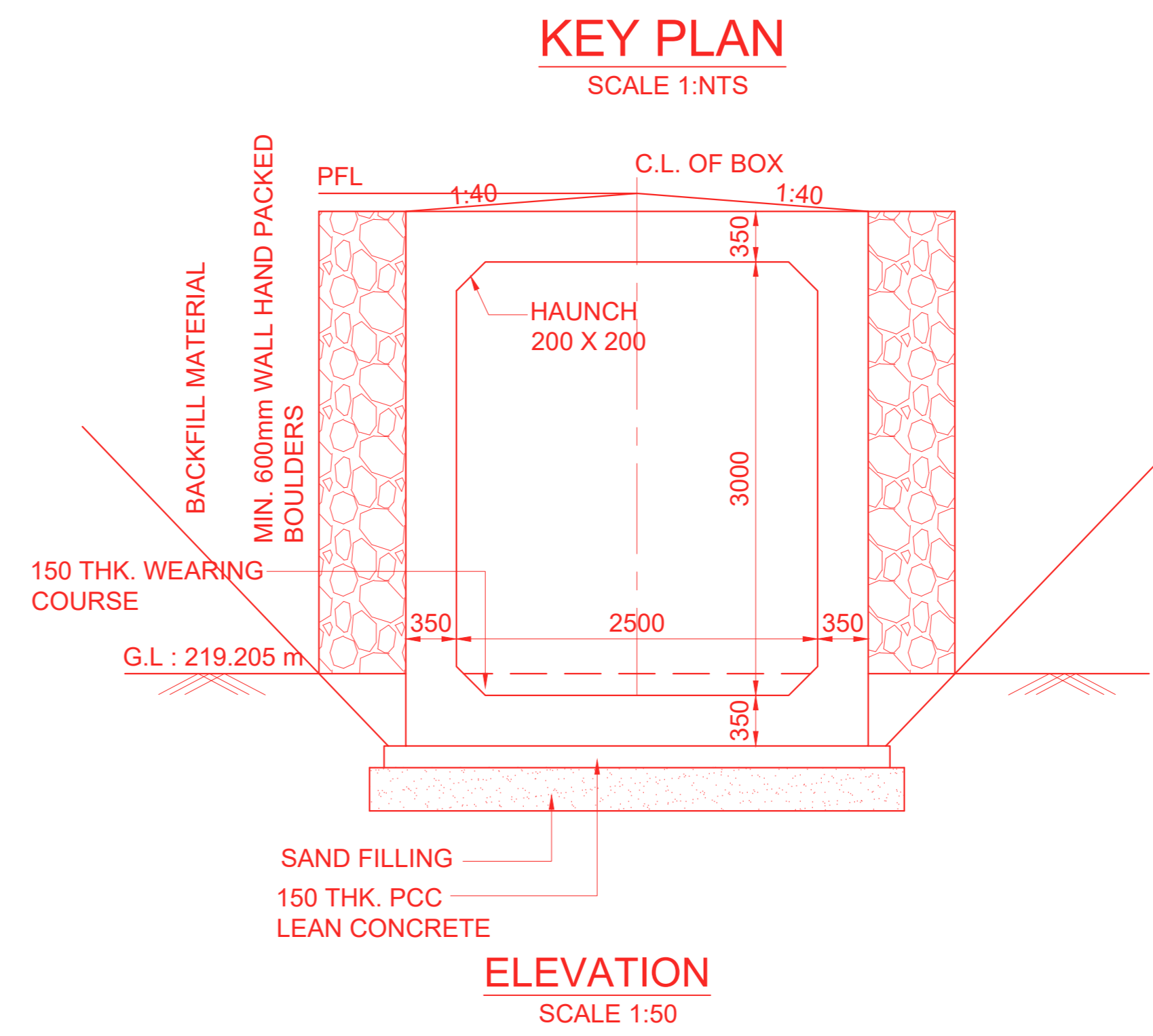
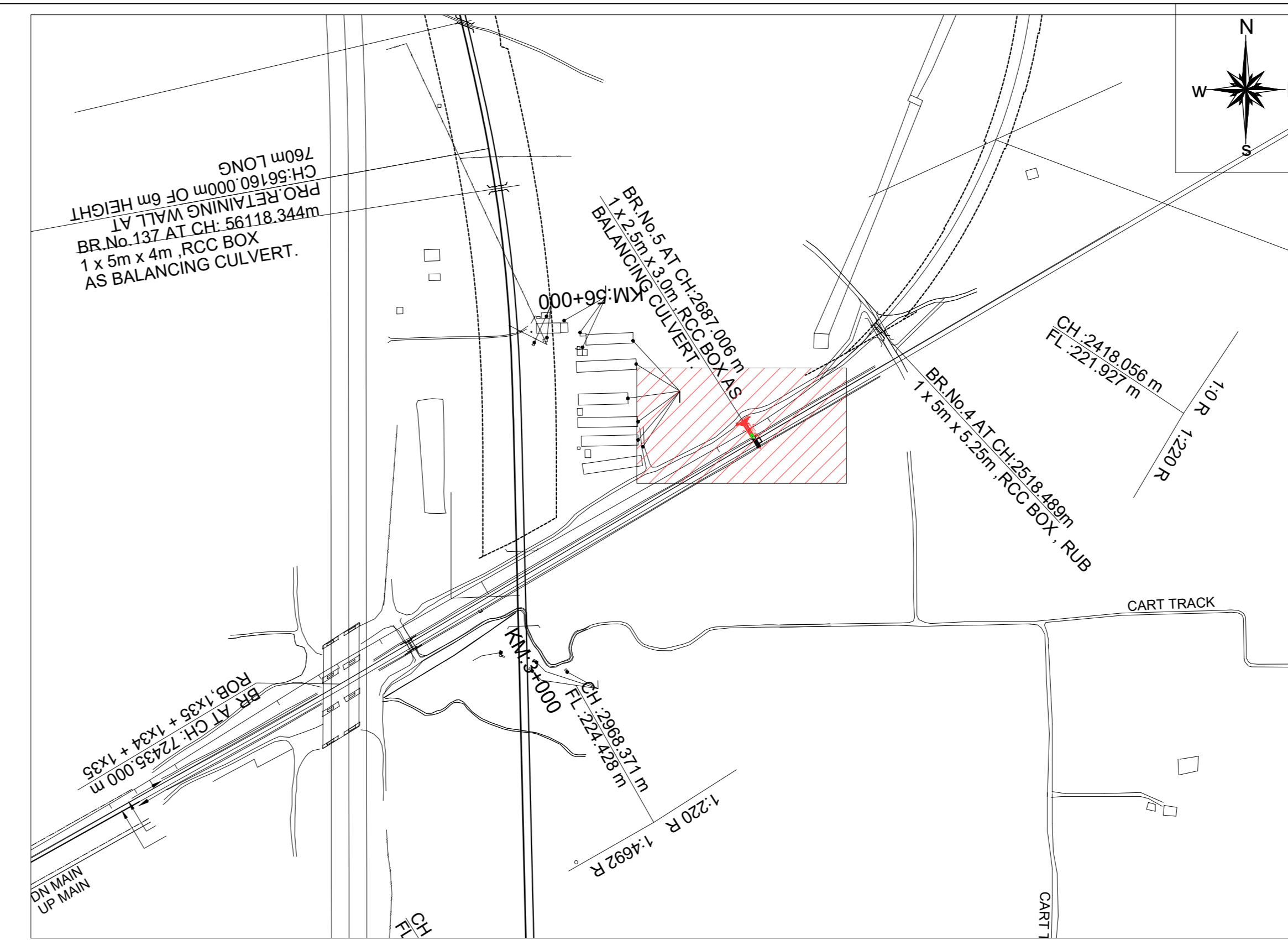
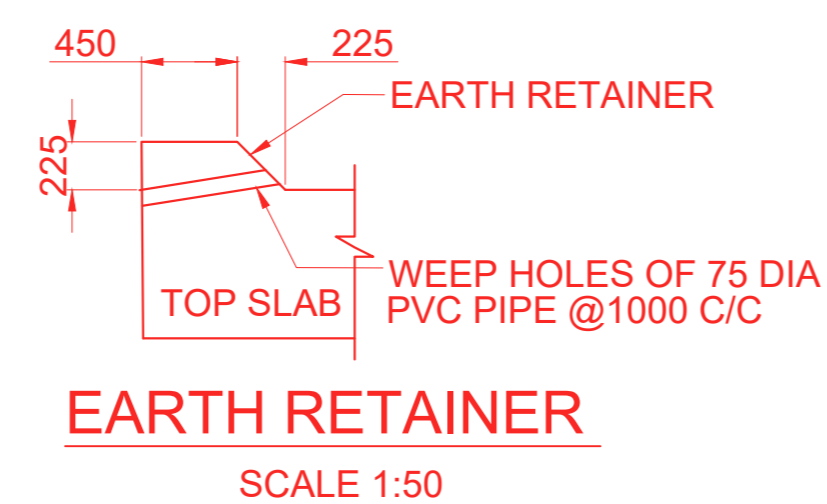
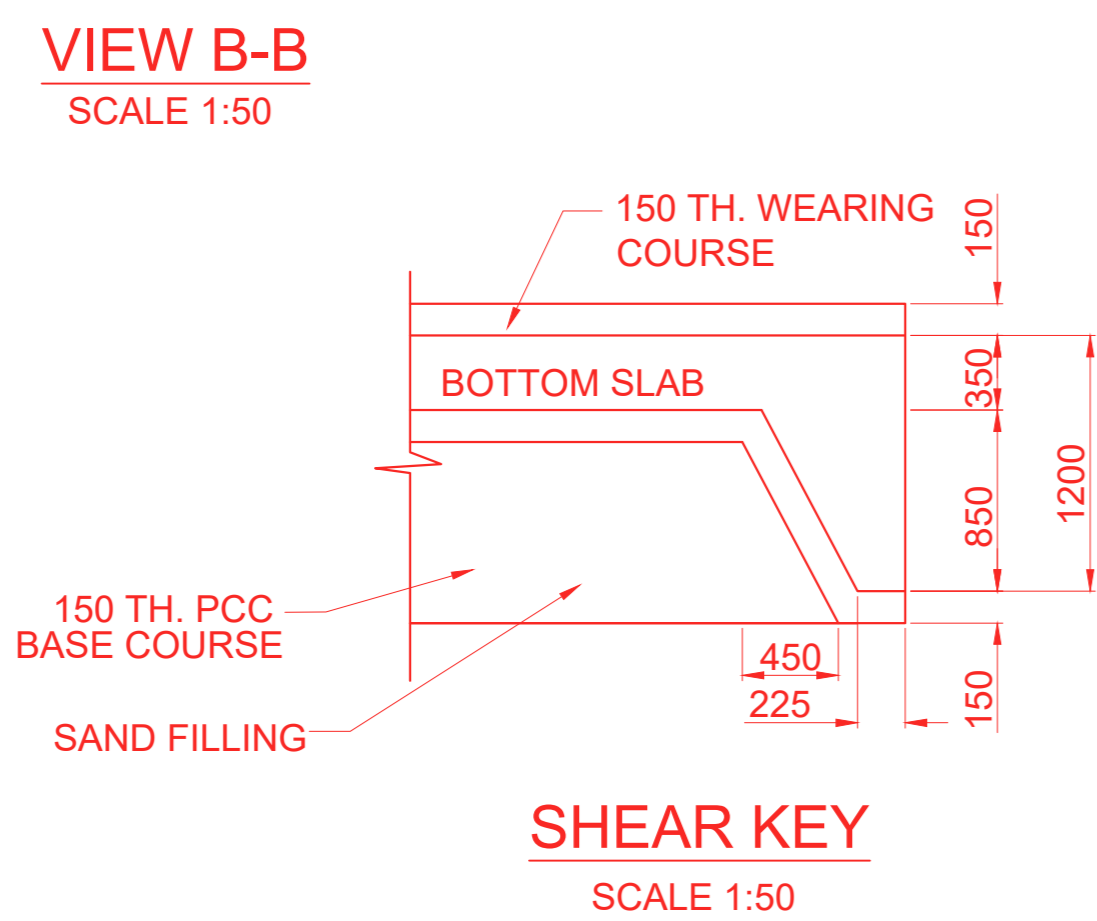
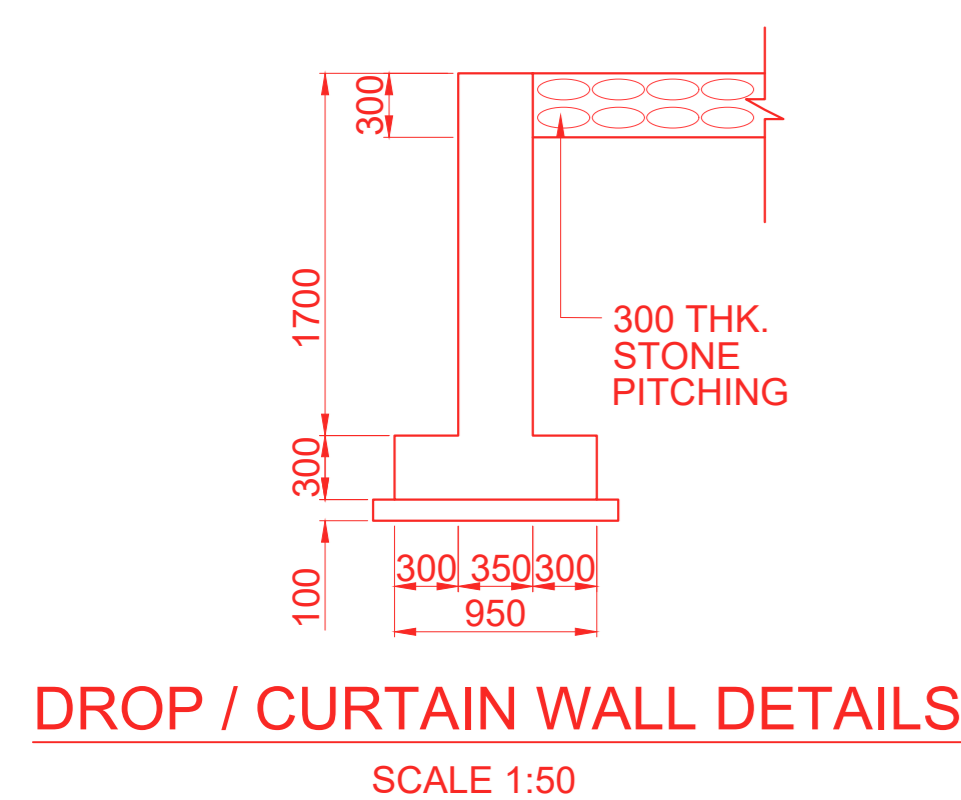
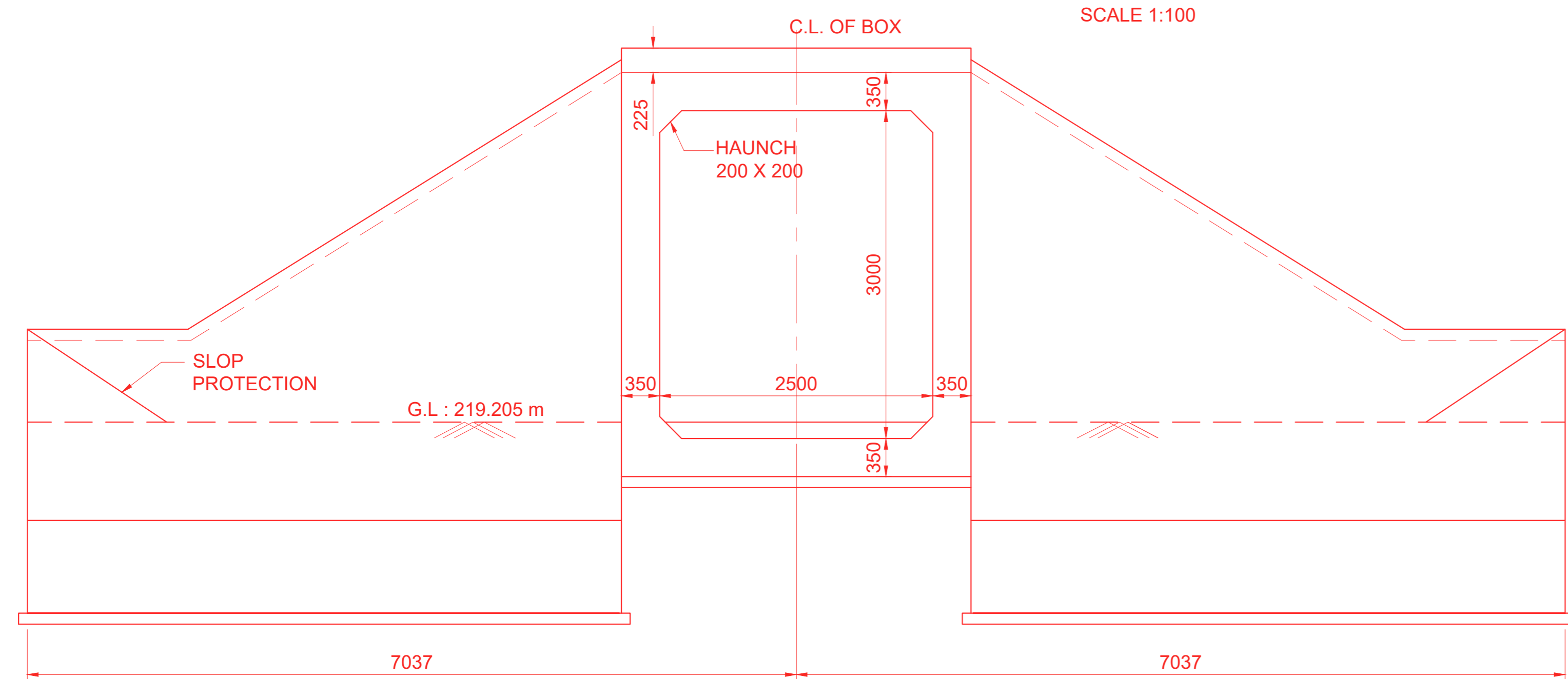
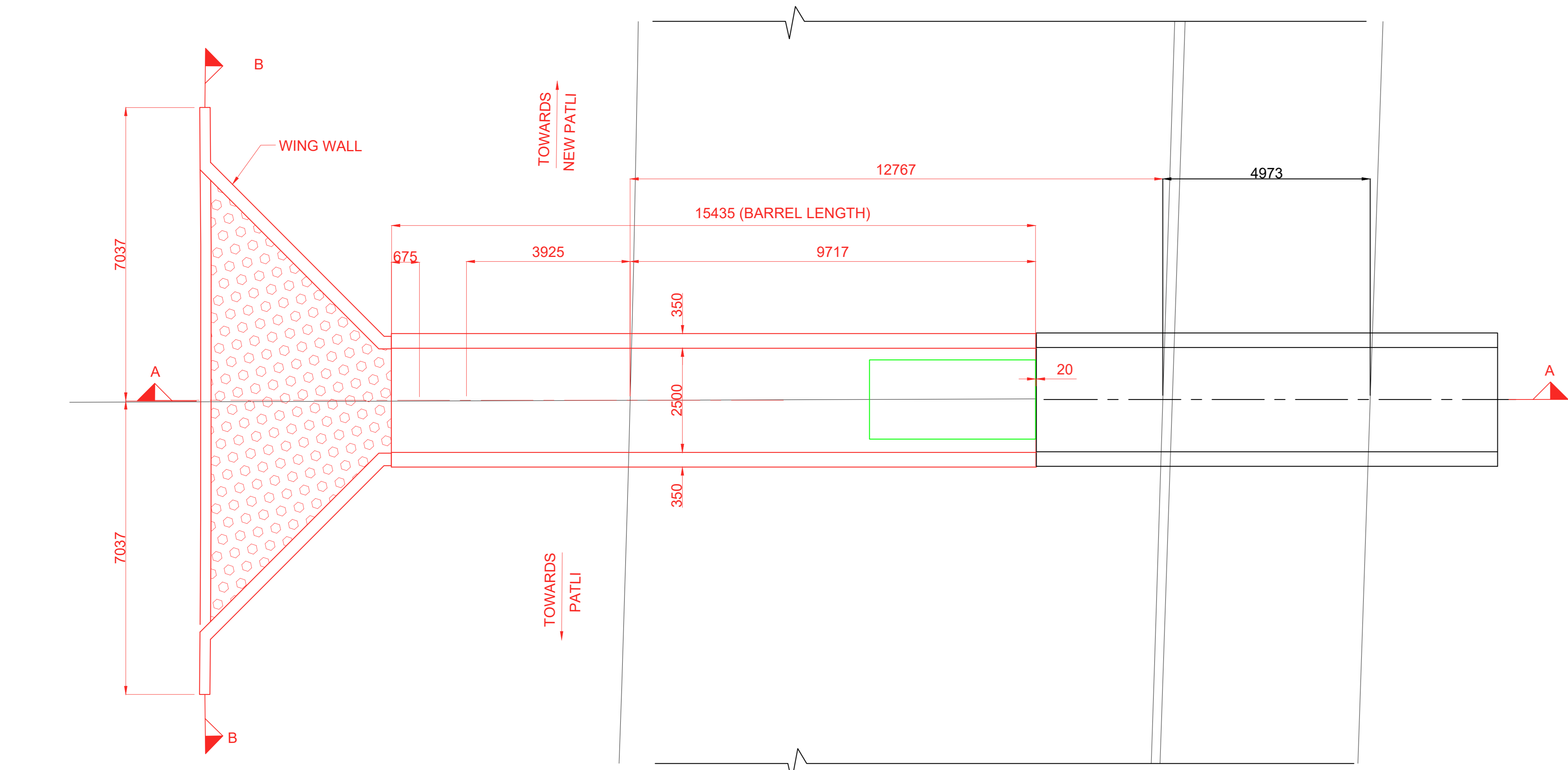
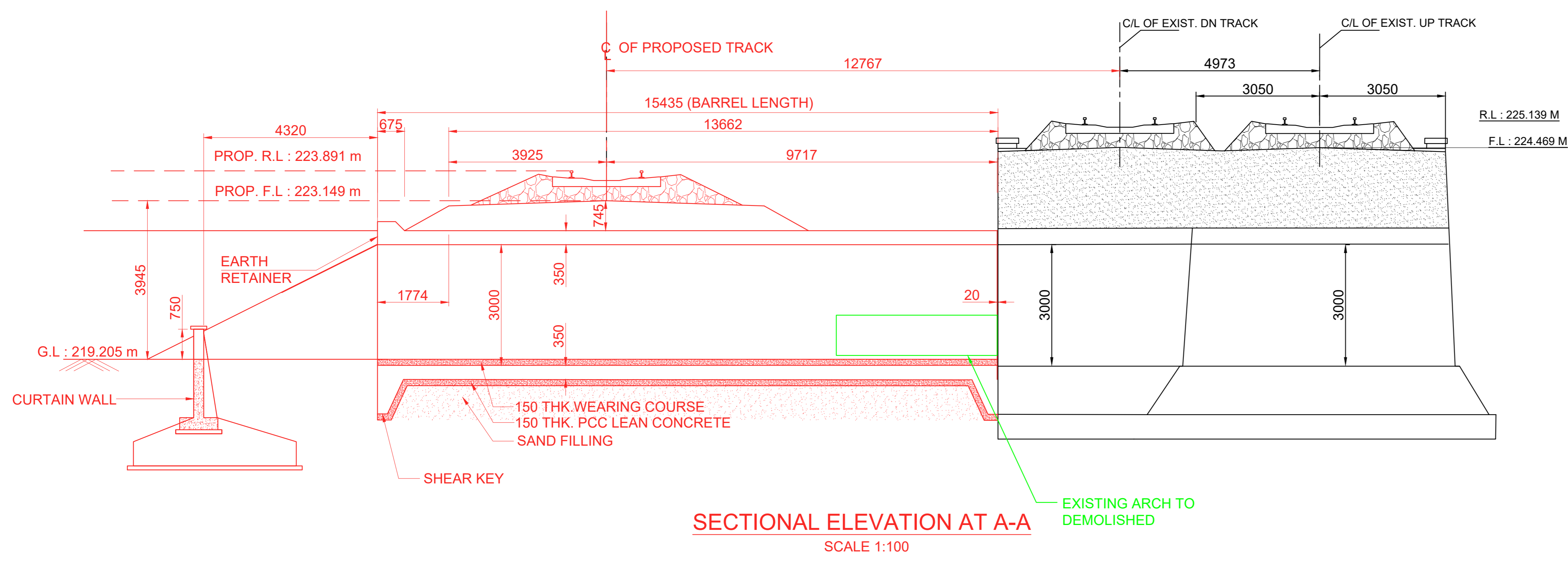
**LOGOS:**  
RITES THE INFRASTRUCTURE PEOPLE, SMEC Member of the Surlana Jurong Group

GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO.4 - 1X5.0X5.25m RCC BOX AT CH. 2518.489m (CONNECTING LINE NEW PATLI TO PATLI)

**DRG. NO.** GC-HRDC-C2-DRW-BRD-GAD\_03004\_A1 **SHEET NO.** 1 OF 1

SCALE :	ISSUE DATE	REVISED DATE
AS SHOWN	23-06-2022	29-07-2022



- NOTES :**
- A) GENERAL NOTES:**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE ANATURAL GROUND PROFILE.
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    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE. GRADE OF CONCRETE :
    - ALL RCC =M:35/DETAILED DESIGN DRG.
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    - LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.


**LEGEND**

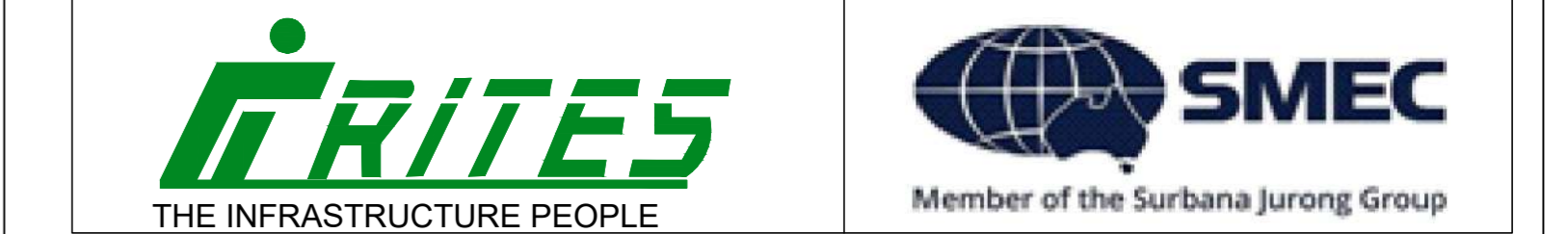
PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
(-)	PROPOSED
(-)	DISMANTEL

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED DB DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

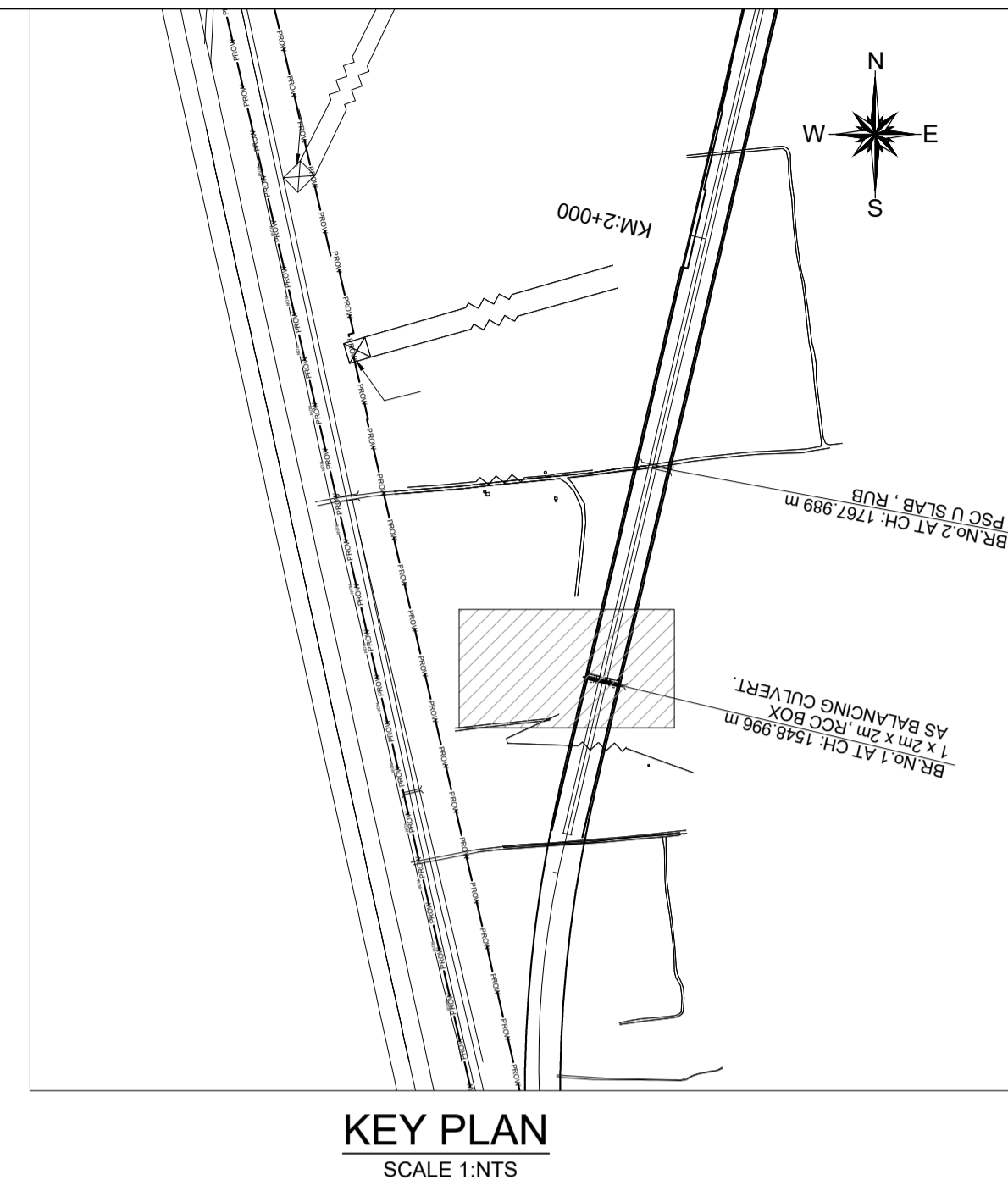
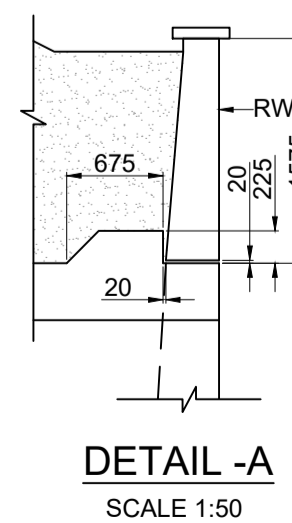
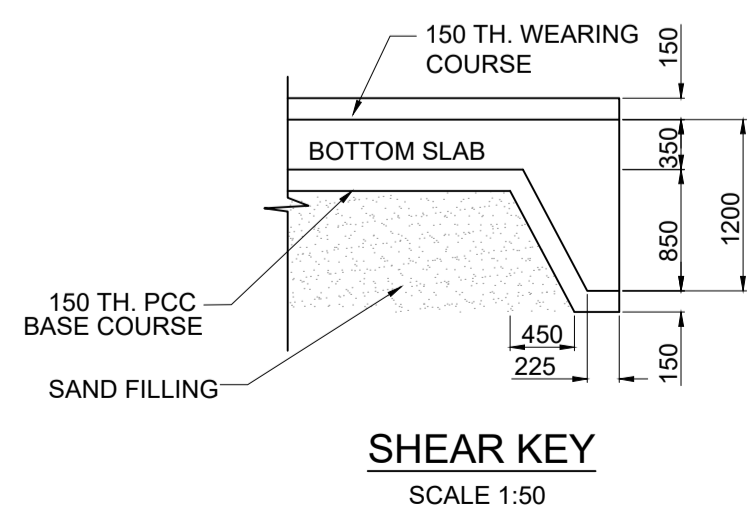
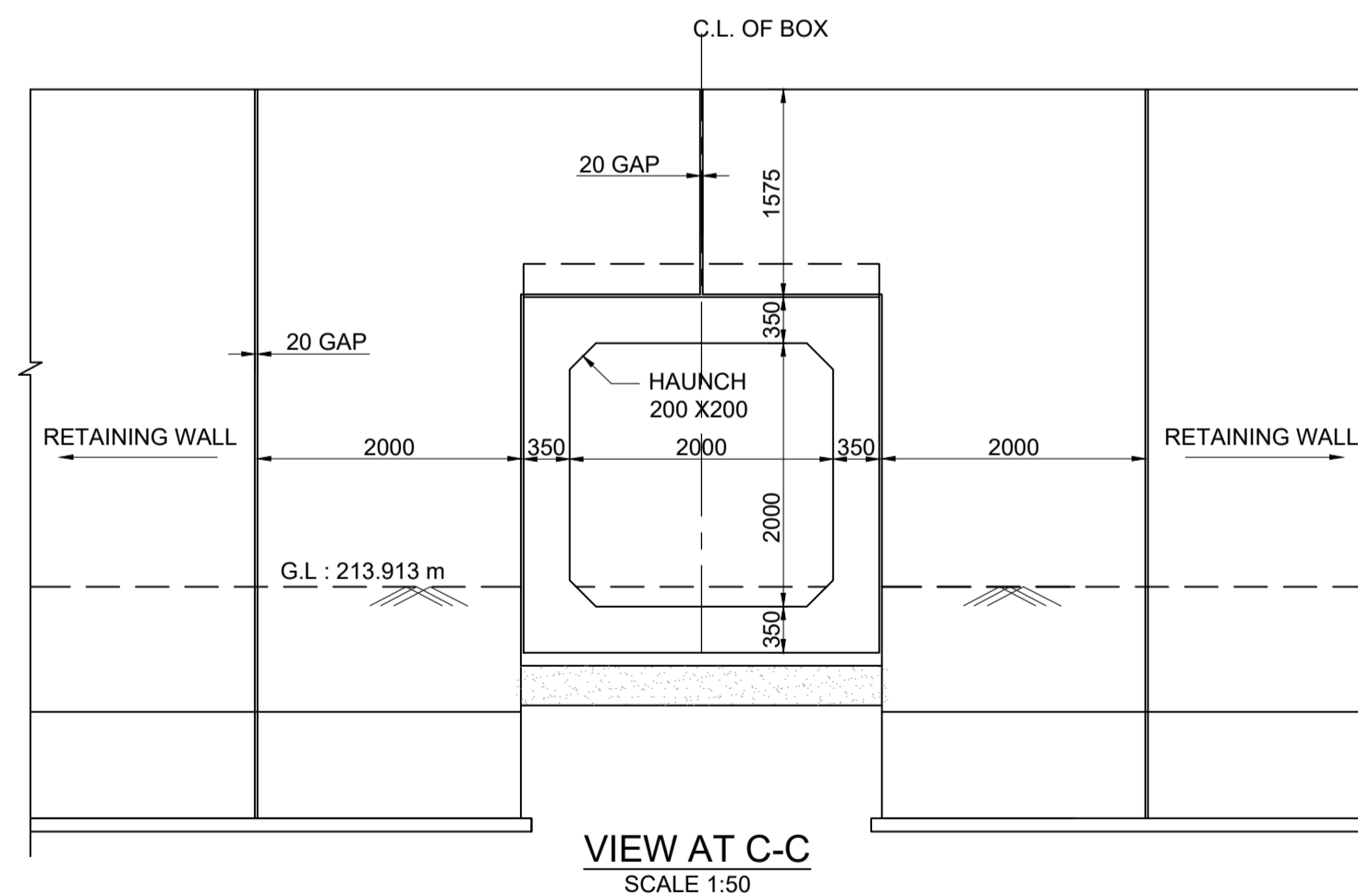
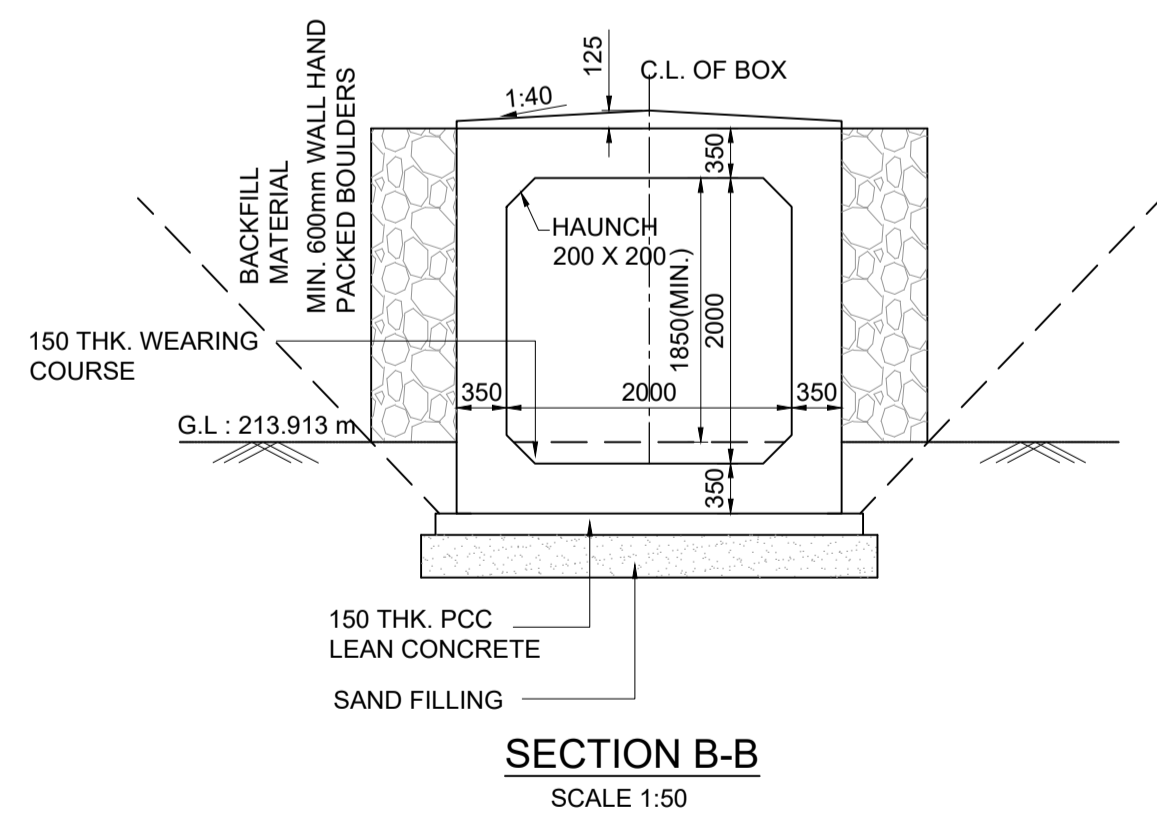
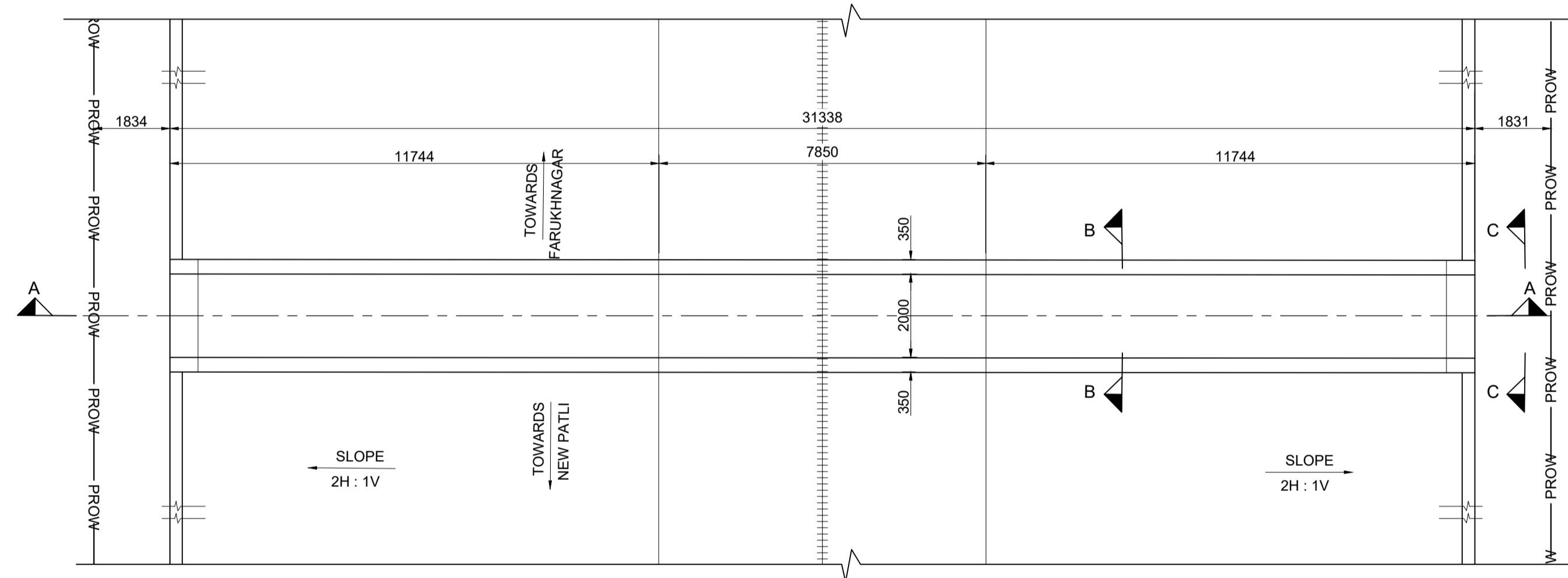
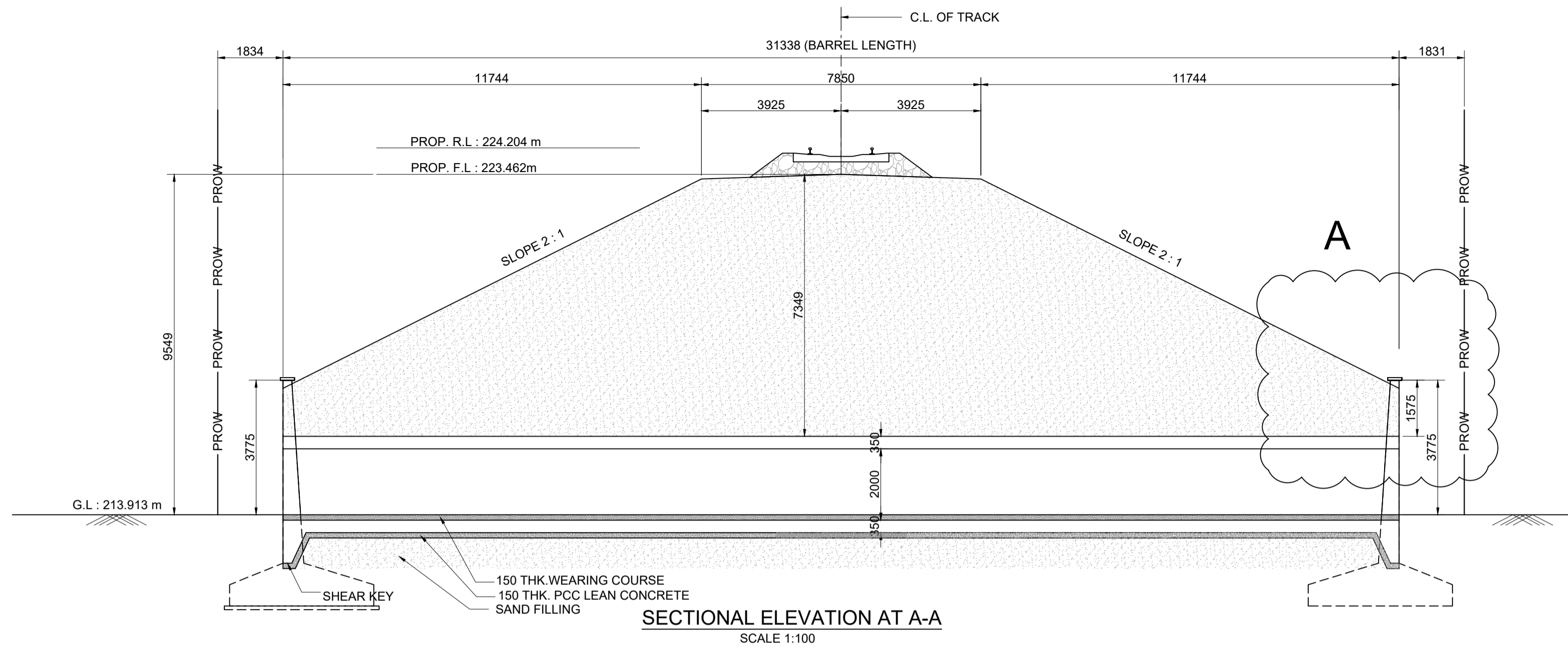


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT NO.5 - 1X2.5X3.0m RCC BOX AT CH. 2687.006 AND EXIST BOX. SIZE- 1X2.5X3.0 (CONNECTING LINE NEW PATLI TO PATLI)

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD\_03005\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA.M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			



**NOTES :**

**A) GENERAL NOTES**

1. ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
2. THE CHANGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
3. FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
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6. ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
7. SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
8. ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
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10. DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
11. THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.

**B) TECHNICAL NOTES :**

1. PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
2. FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
3. ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
4. PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
5. DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
6. DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
  - (i) IRS BRIDGE RULE
  - (ii) IRS CONCRETE BRIDGE CODE
  - (iii) IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
7. SEISMIC ZONE- IV
8. EXPOSURE CONDITION- MODERATE
9. DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST
10. THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
11. ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G./SQM.
12. REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
13. FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
  - GRADE OF CONCRETE :
    - (i) ALL RCC =M:35/DETAILED DESIGN DRG.
    - (ii) WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - (iii) LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
14. BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
15. FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
16. ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**

**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

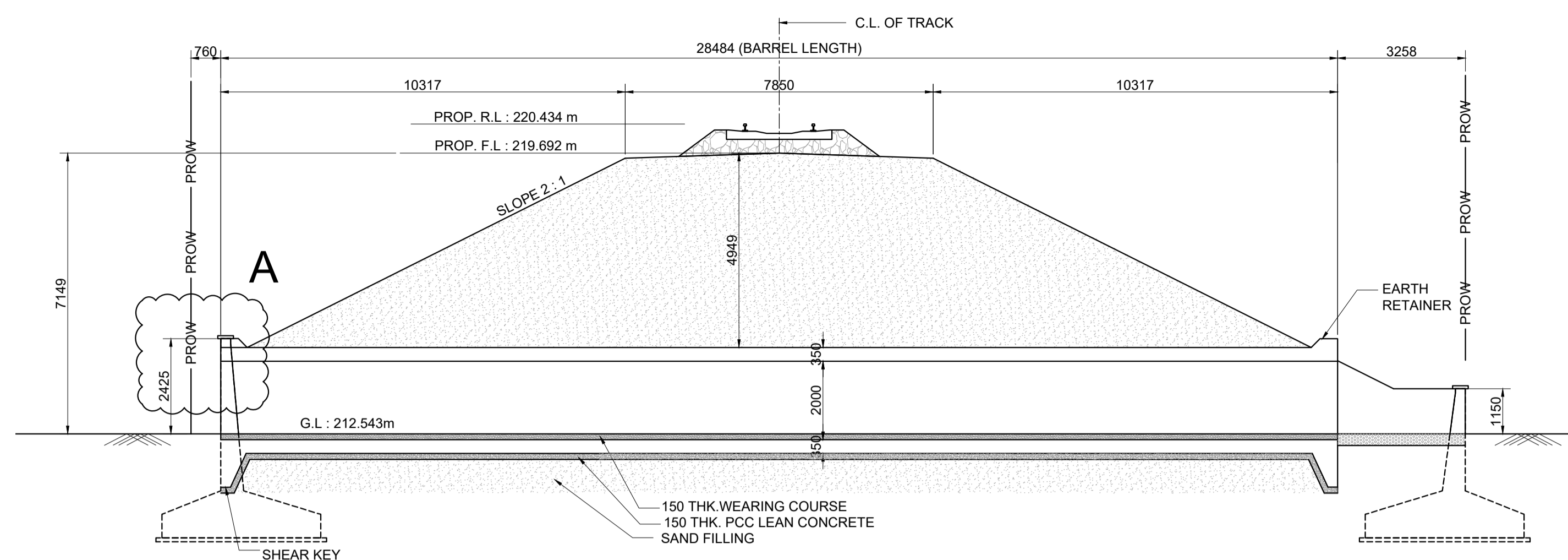


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO.2 - 1X2.0X2.0m RCC BOX AT CH.1548.996 (CONNECTING LINE NEW PATLI TO SULTANPUR)

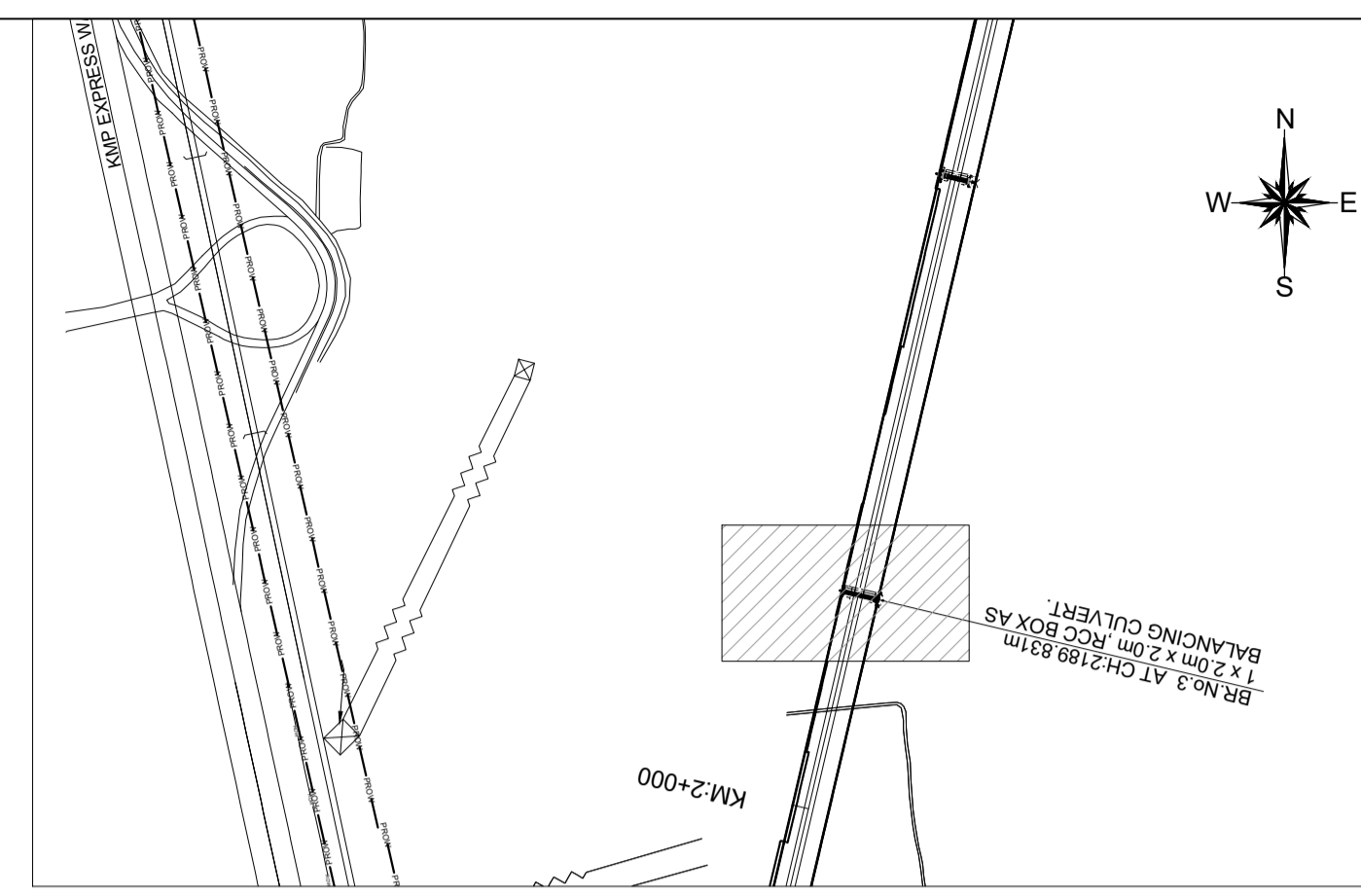
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-04002\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

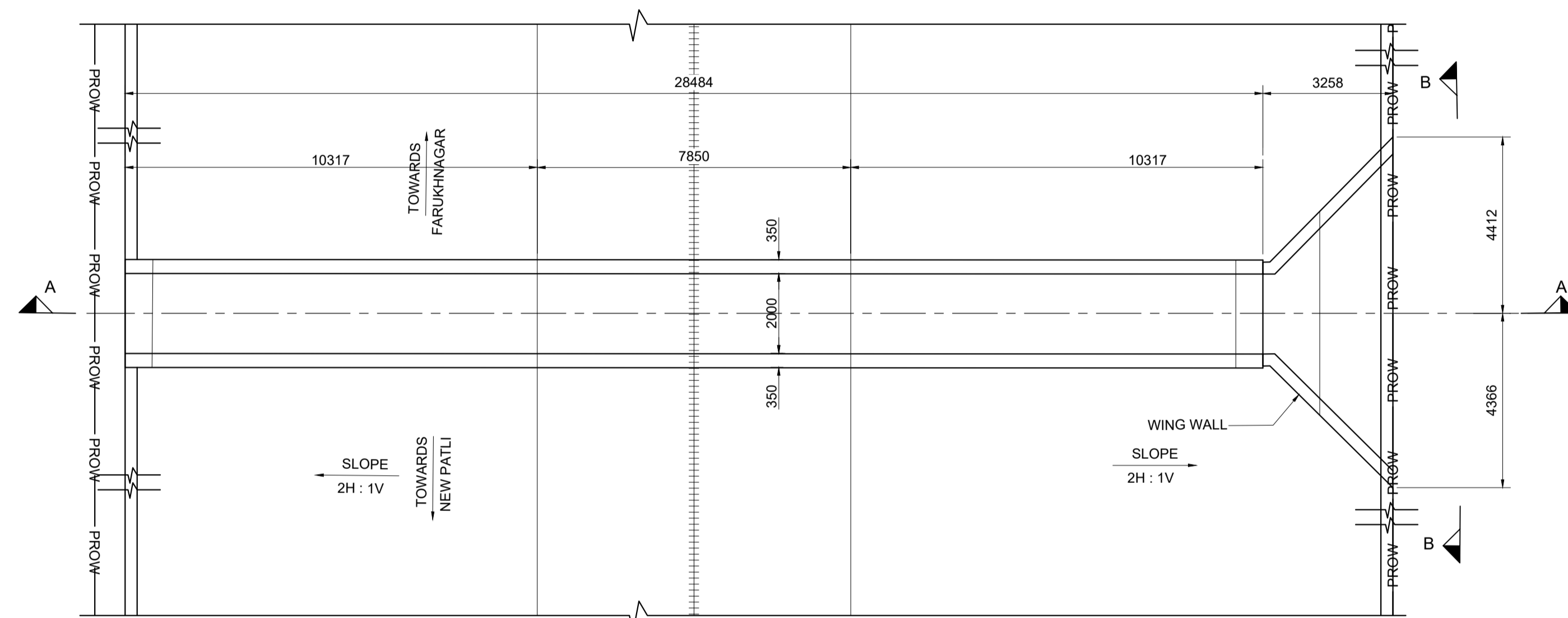
GC/HORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



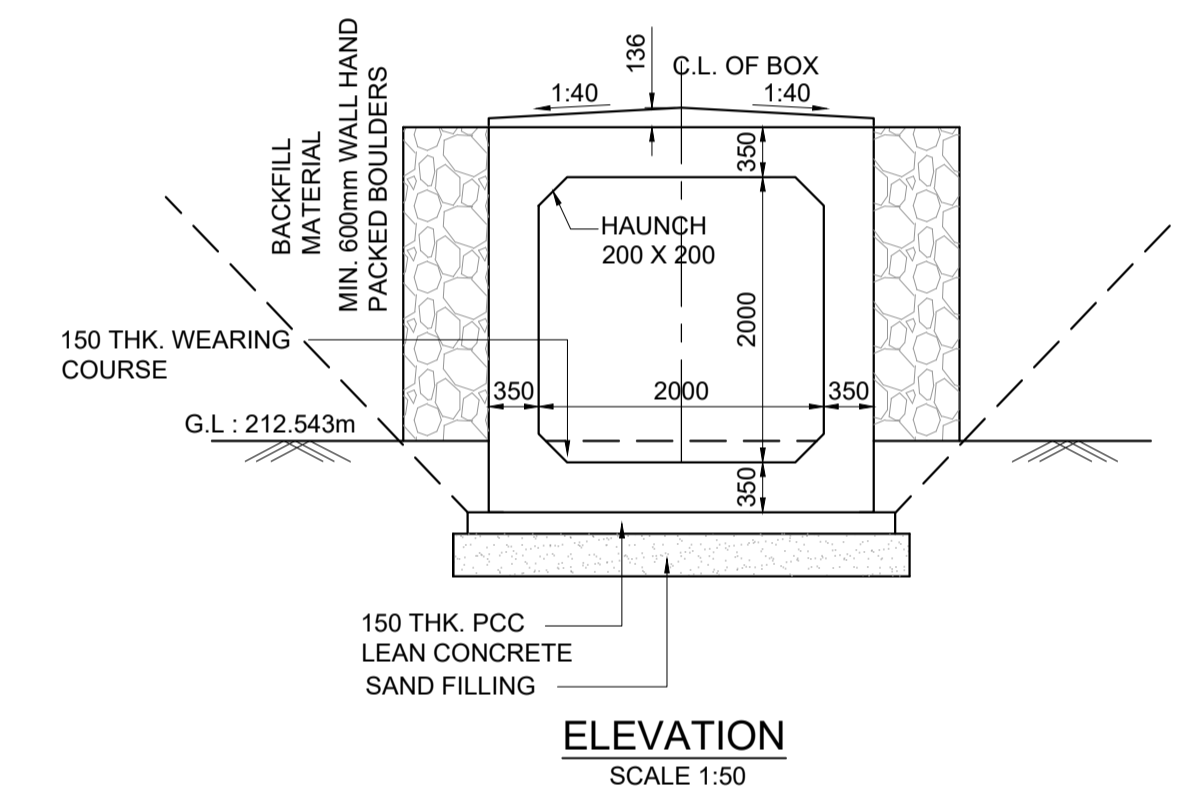
**SECTIONAL ELEVATION AT A-A**  
SCALE 1:100



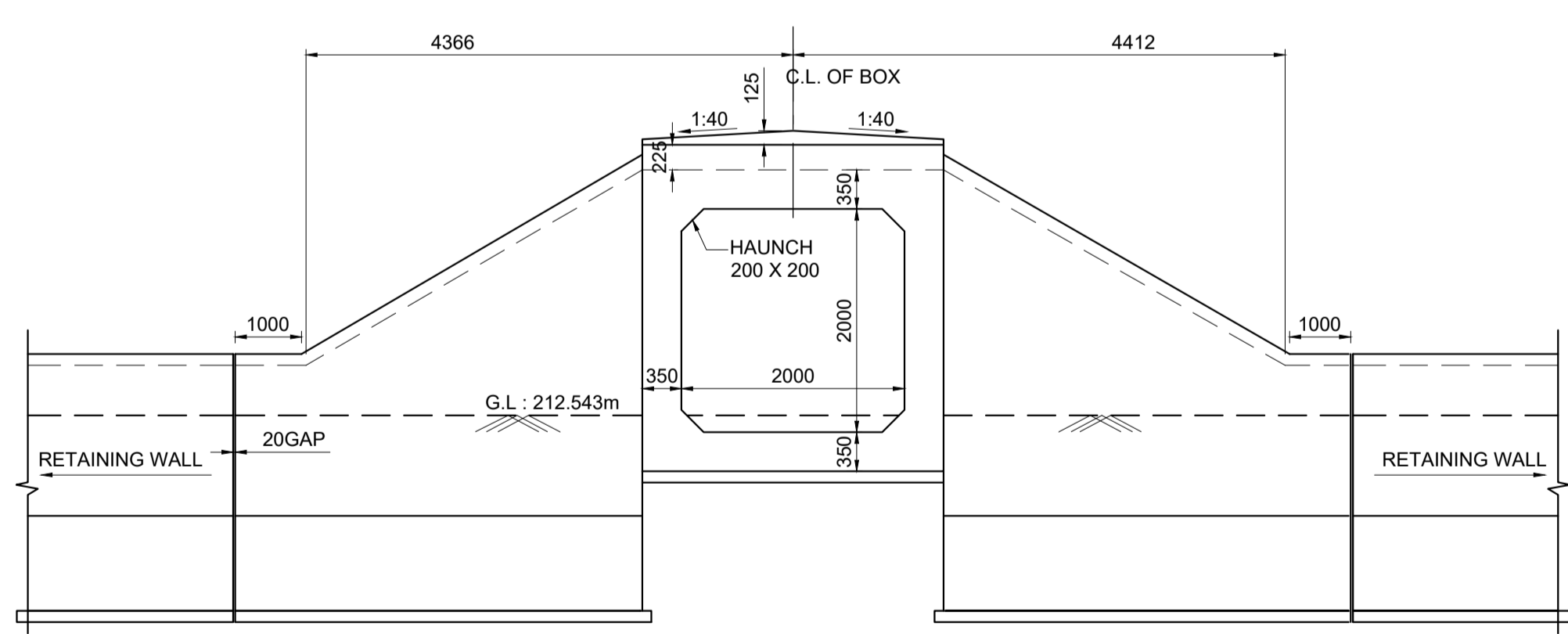
**KEY PLAN**  
SCALE 1:NTS



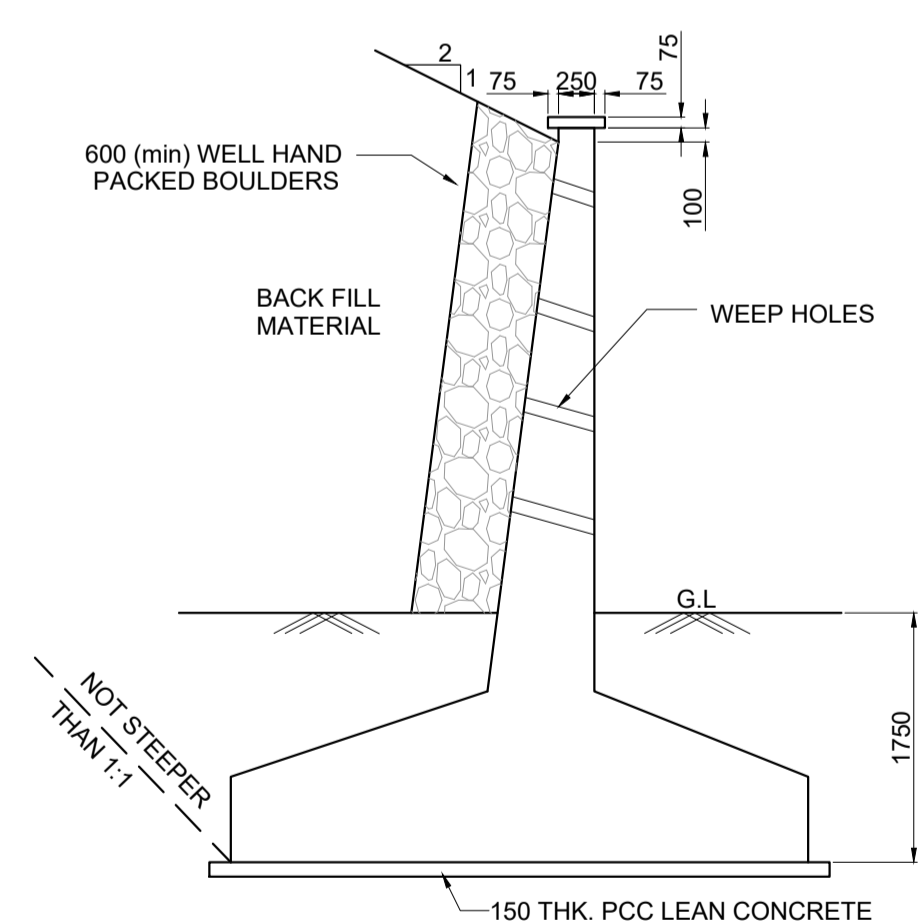
**PLAN AT TOP**  
SCALE 1:100



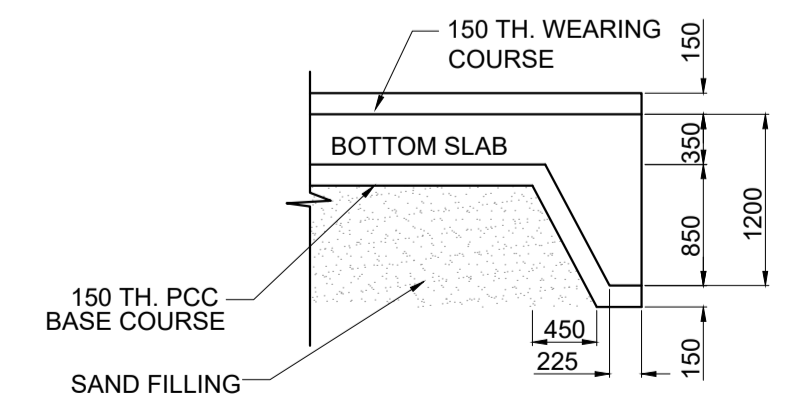
**ELEVATION**  
SCALE 1:50



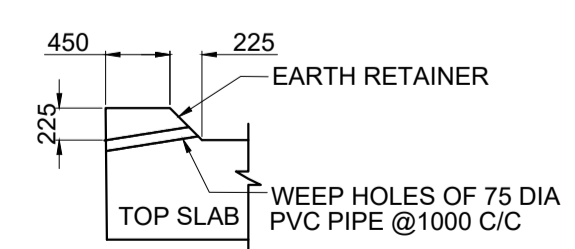
**VIEW B-B**  
SCALE 1:50



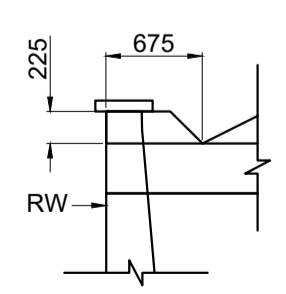
**TYPICAL DETAIL OF RETURN WALL / WING WALL**  
SCALE 1:50



**SHEAR KEY**  
SCALE 1:50



**EARTH RETAINER**  
SCALE 1:50



**DETAIL -A**  
SCALE 1:50

**NOTES :**

- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M. WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/ SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DIMENSION OF THE BOX MAY BE SUITABLY MODIFIED AS PER SITE REQUIREMENT. HEIGHT OF BOX SHOWN INCLUDES MINIMUM REQUIRED CLEAR OPENING HEIGHT AND WEARING COARSE. OVERALL HEIGHT OF BOX OPENING MAY VARY AS PER SITE REQUIREMENT AND ACTUAL ROAD/GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :

    - ALL RCC =M:35/DETAILED DESIGN DRG.
    - WEARING COURSE =M:20/DETAILED DESIGN DRG.
    - LEVELING COURSE/LEAN CONCRETE =M:20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - ADEQUATE SLOPE IN BOTTOM SLAB OF RCC BOX TOWARDS DIRECTION OF FLOW SHALL BE PROVIDED.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

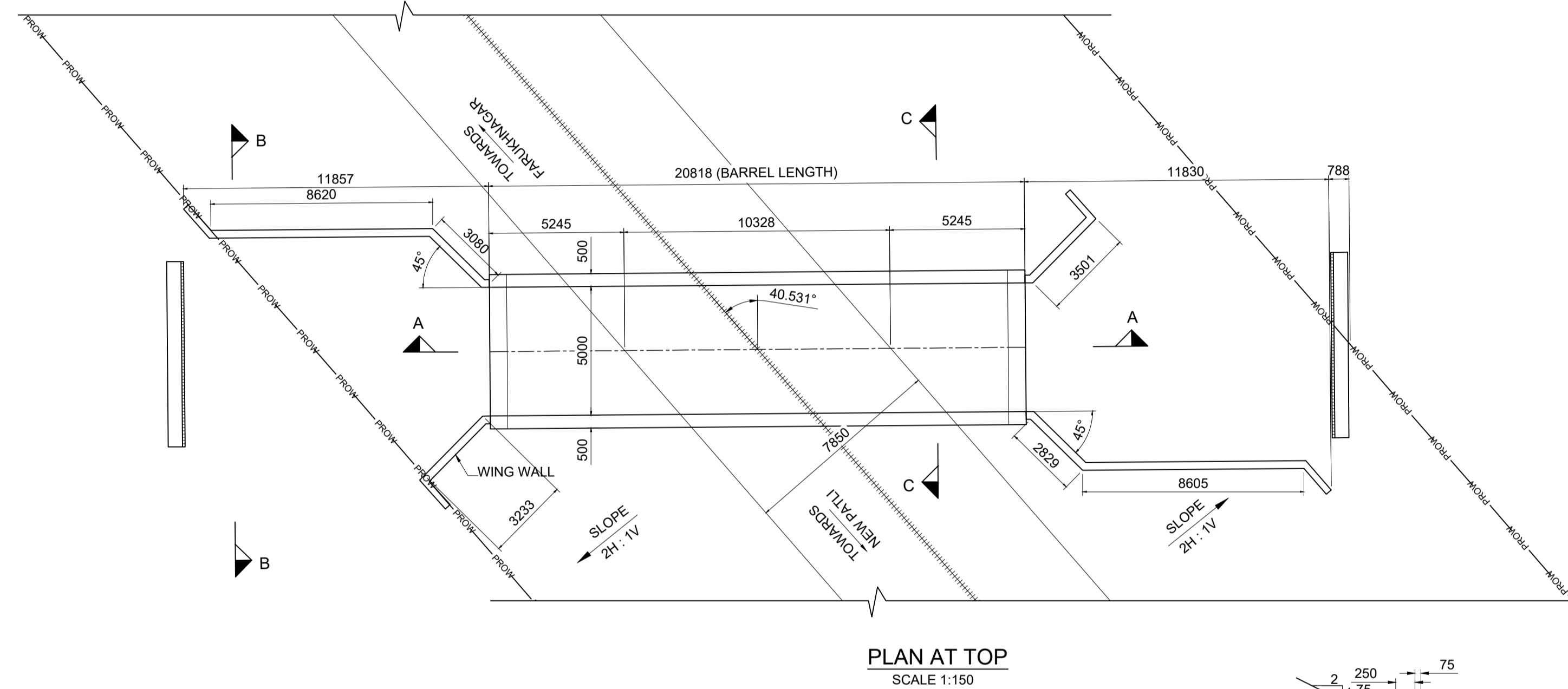
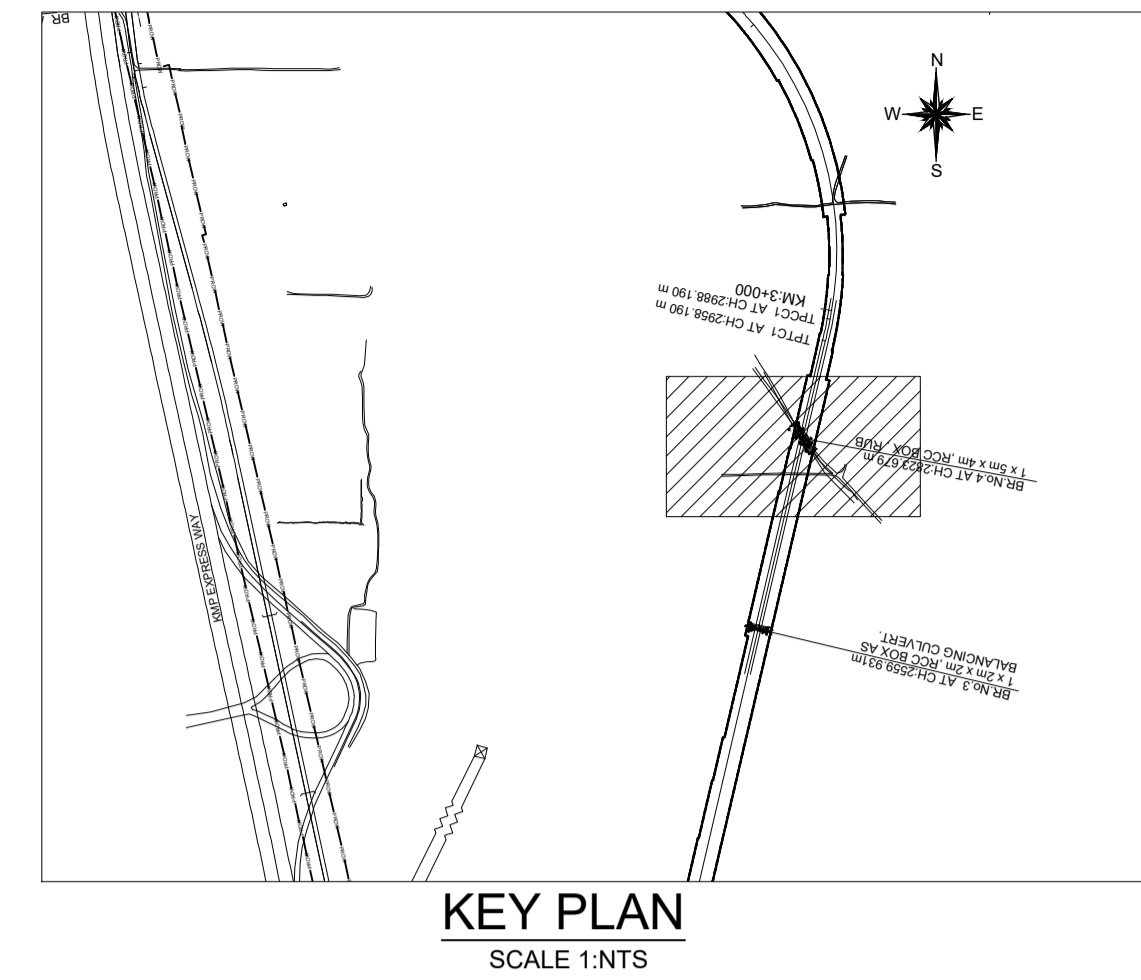
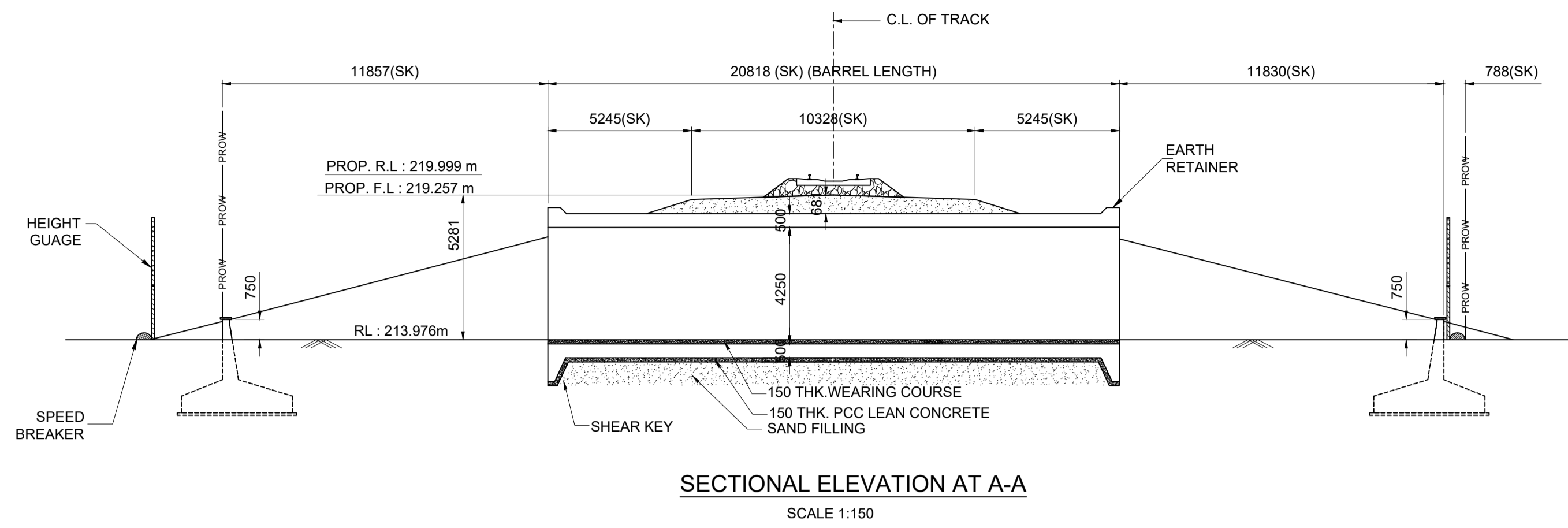


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR BALANCING CULVERT BRIDGE NO.4 - 1X2.0X2.0m RCC BOX AT CH. 2189.831m (CONNECTING LINE NEW PATLI TO SULTANPUR)

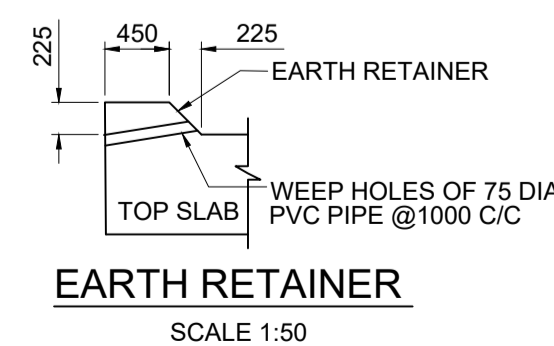
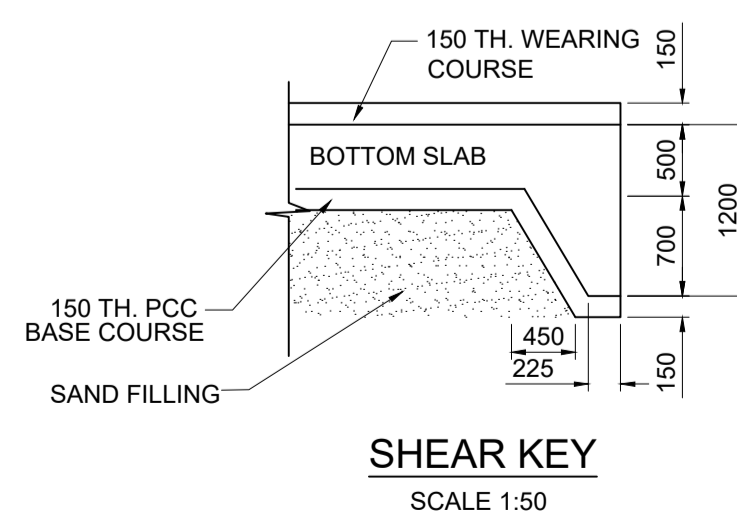
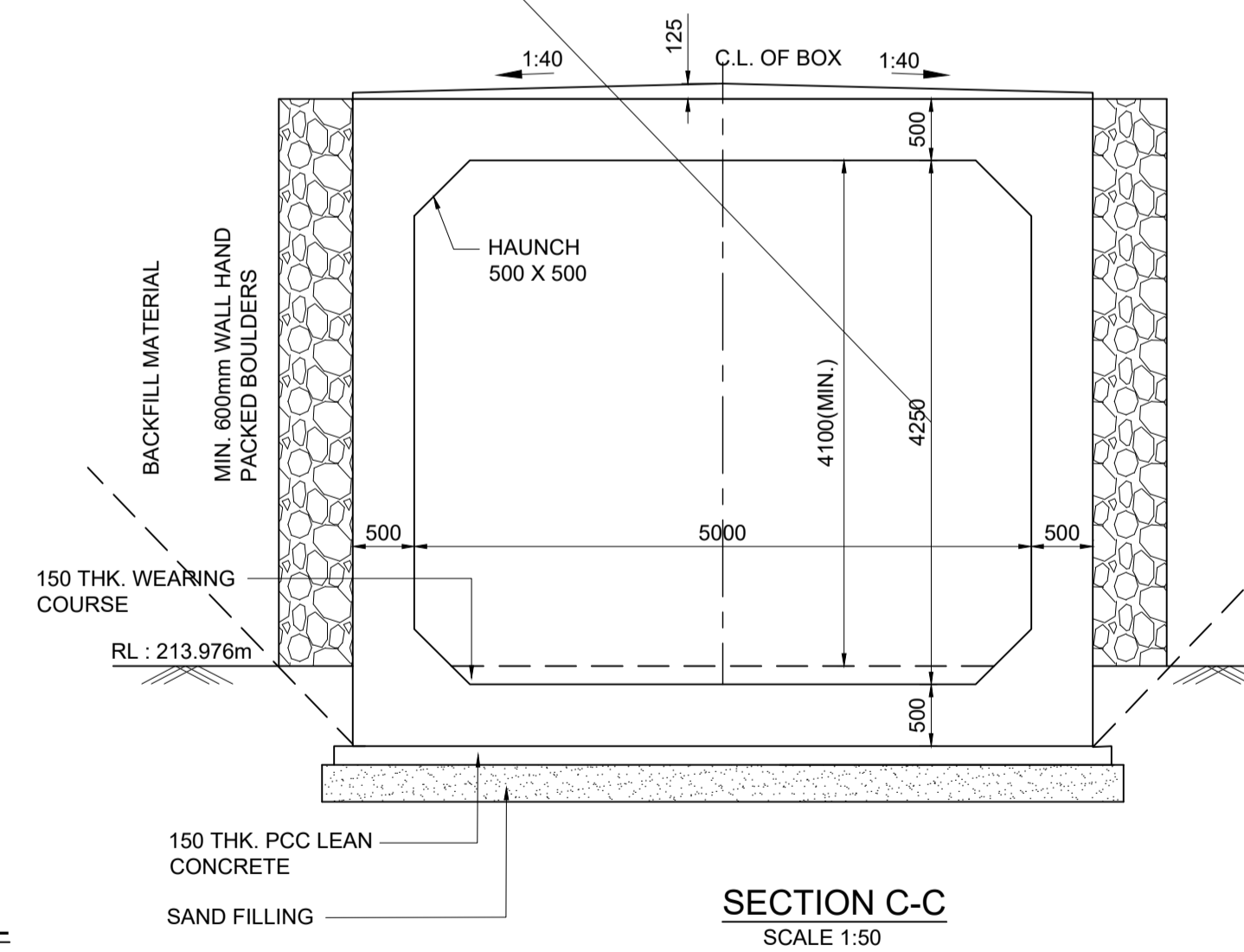
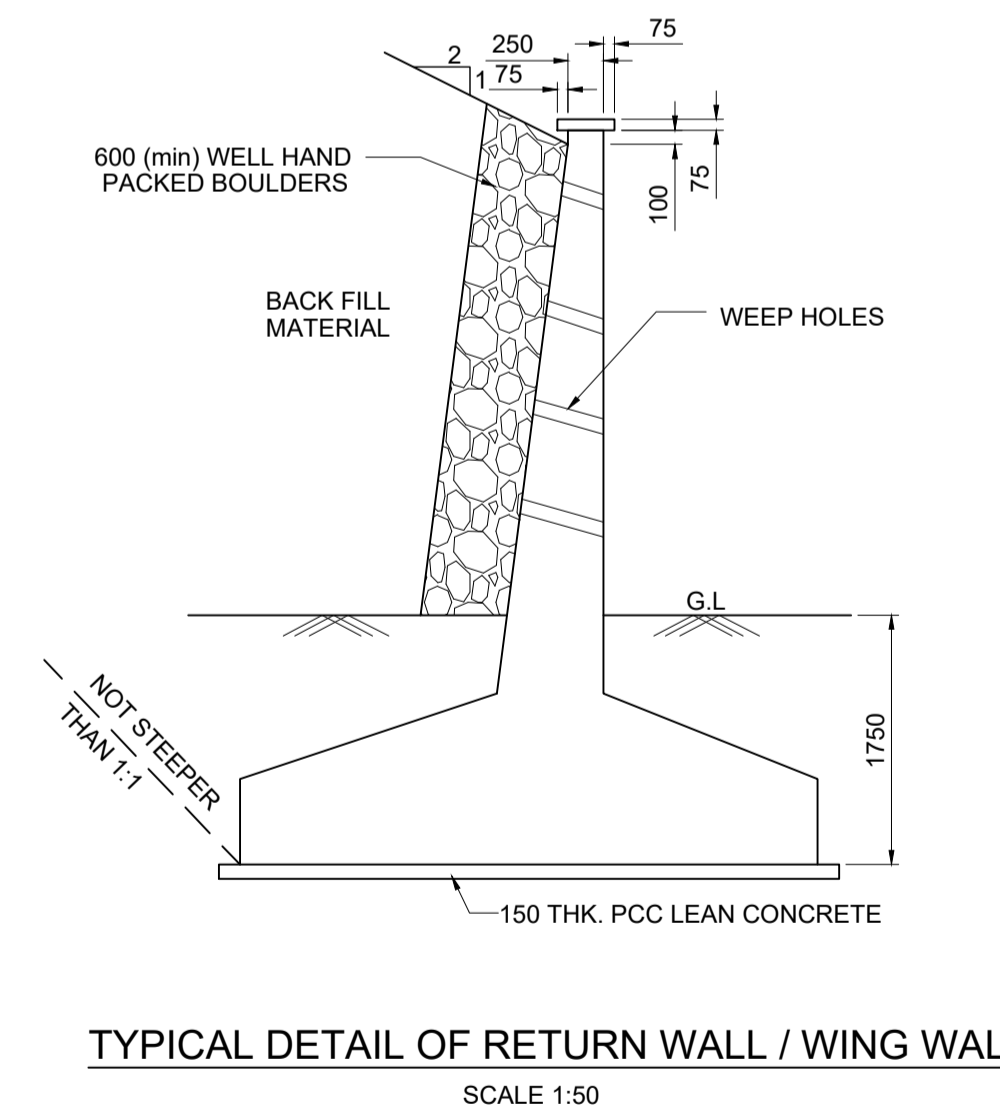
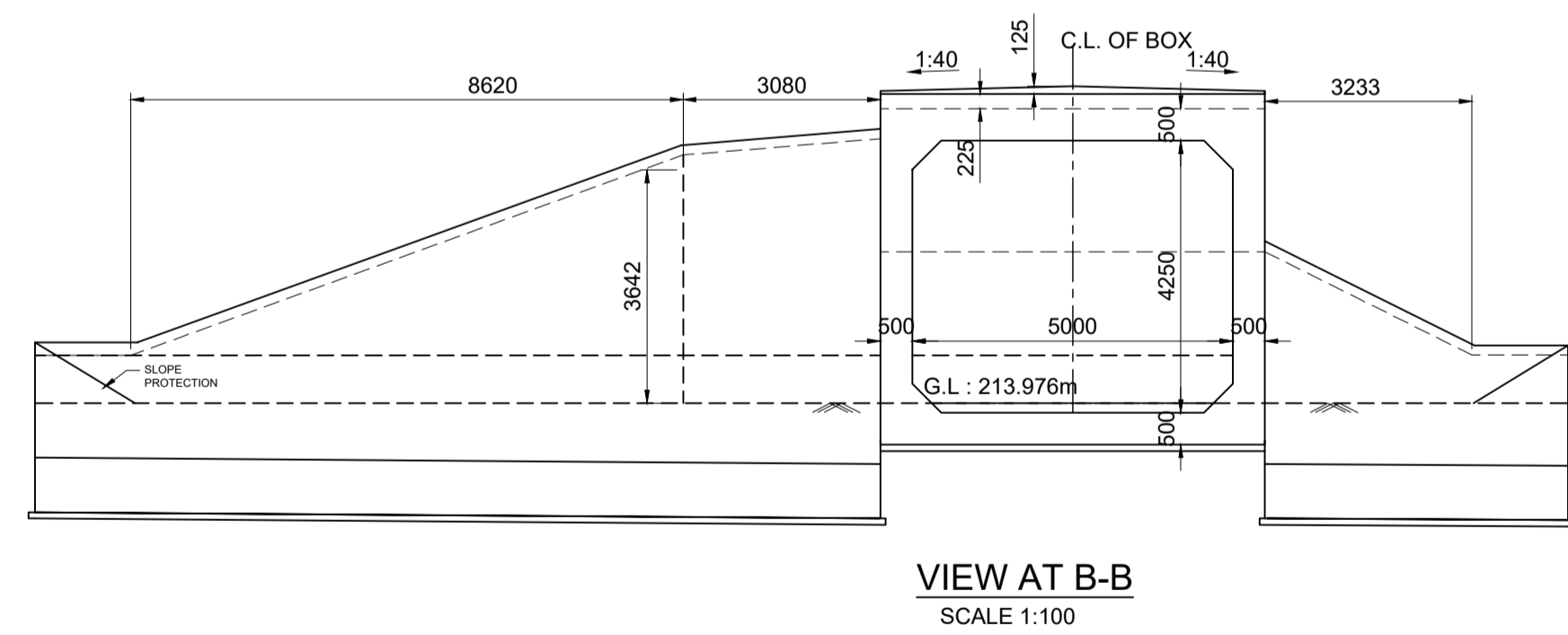
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-04004\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>MS</i>	UMA.M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.



**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
RL	ROAD LEVEL

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

- NOTES :**
- A) GENERAL NOTES**
- ALL DIMENSIONS ARE IN MILLIMETERS EXCEPT LEVELS WHICH ARE IN METER, UNLESS OTHERWISE MENTIONED.
  - THE CHAINAGES SHOWN ARE RECKONED FROM C/L OF PRITHALA STATION BUILDING TAKEN AS 0.00 M, WITH RESPECT TO UP MAIN LINE.
  - FOR RAIL LEVELS, FORMATION LEVEL, GRADES ETC. REFER L-SECTION.
  - BOX BRIDGE IS TO BE DESIGNED FOR 32.5 T LOADING AS APPLICABLE.
  - THE EXISTING DETAILS ARE AS PER SITE SURVEY AND SHALL BE VERIFIED BY THE CONTRACTOR BEFORE EXECUTION.
  - ENGINEER IN CHARGE/SITE ENGINEER SHOULD VERIFY THE RAIL LEVEL, FORMATION LEVEL, BED LEVEL & TRACK CENTER AT SITE BEFORE COMMENCEMENT OF WORK.
  - SUITABLE BED SLOPE SHALL BE PROVIDED AND ADJUSTED AS PER SITE CONDITIONS.
  - ENGINEER IN CHARGE/SITE ENGINEER SHALL ENSURE THE SAFETY OF TRACK/ROAD AT ALL THE TIME AND SHALL TAKE NECESSARY PRECAUTIONS TO PREVENT DAMAGE OF S&T CABLE /OFC DURING EXECUTION OF WORK CONCERNED DEPT. SUCH AS BSNL/AIRTEL/SSE/SIG/ADSTE ETC. SHALL BE INFORMED WELL IN ADVANCE BEFORE EXECUTION OF WORK.
  - THIS DRAWING IS THE PROPERTY OF HRIDC AND FOR EXCLUSIVE USE OF HORC.
  - DETAILED DESIGN DRAWING WILL BE PREPARED BASED ON THIS CONCEPTUAL APPROVED GAD.
  - THICKNESS OF STRUCTURAL MEMBERS ARE TENTATIVE AND WILL BE FINALISED AFTER DETAILED DESIGN.
- B) TECHNICAL NOTES :**
- PROTECTION WORK ON SLOPES OF BANK UP TO 15M. BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - FOR PROPER DRAINAGE OF WATER, 50mm PCC M-20 WITH SUITABLE SLOPE TO BE USED ON TOP OF BOX SLAB.
  - ALL CLEAN/ EXPANSION JOINTS SHALL BE FILLED WITH BITUMINOUS BOARDS / POLYSULPHIDE SEALANT FILLING.
  - PLACEMENT LEVEL OF BOX AS SHOWN IN THIS GAD IS INDICATIVE AND MAY BE SUITABLY LOWERED/ELEVATED BASED UPON THE REQUIREMENT OF CLEARANCE, DRAINAGE & NATURAL GROUND PROFILE.
  - DESIGN CRITERIA SHALL BE BASED ON FOLLOWING IRS CODES
    - IRS BRIDGE RULE
    - IRS CONCRETE BRIDGE CODE
    - IRS BRIDGE SUB-STRUCTURE & FOUNDATION CODE
  - SEISMIC ZONE- IV
  - EXPOSURE CONDITION- MODERATE.
  - DURING CONSTRUCTION, IF REQUIRED, ROAD CLOSURE TO BE OBTAINED FROM CONCERNED ROAD/CIVIL AUTHORITIES. DIVERSION OF ROAD IF ANY, REQUIRED IS TO BE DONE BY CONTRACTOR AT HIS COST.
  - THE BACK FILL MATERIAL SHALL BE CONFORMING TO CLAUSE 7.5 OF IRS SUB- STRUCTURE AND FOUNDATION CODE.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 K.G/SQM.
  - REINFORCEMENT SHALL BE Fe 500D (TMT) CONFORMING TO IS 1786
  - FOR CONCRETE SPECIFICATION REFER IRS CONCRETE BRIDGE CODE.
 

GRADE OF CONCRETE :	
(i) ALL RCC	=M-35/DETAILED DESIGN DRG.
(ii) WEARING COURSE	=M-20/DETAILED DESIGN DRG.
(iii) LEVELING COURSE/LEAN CONCRETE	=M-20/DETAILED DESIGN DRG.
  - BEARING CAPACITY OF SOIL SHALL BE ENSURED AS PER DETAILED DESIGN REQUIREMENT. IF REQUIRED GROUND IMPROVEMENT MAY BE CARRIED OUT AND CONFIRMED THROUGH FIELD TESTING.
  - FOUNDATION LEVEL SHOWN IN DRAWING IS TENTATIVE. DETAILED DESIGN DRAWING SHALL BE FOLLOWED FOR FOUNDATION LEVEL DURING EXECUTION.
  - HEIGHT GAUGE SHALL BE PROVIDE AS PER RDSO STANDARD DRAWING NO. RDSO/M0001.

**IMPORTANT NOTE:**  
TOP OF BOTTOM SLAB OF RCC BOX SHALL NOT BE KEPT ABOVE THE NATURAL GROUND LEVEL. HOWEVER, ROAD LEVEL AND VERTICAL CLEARANCE ABOVE ROAD LEVEL SHALL BE MAINTAINED AS SHOWN IN THE DRAWING. OVERALL HEIGHT OF THE BOX MAY NEED MODIFICATION ACCORDINGLY. THE HEIGHT OF RCC BOX SHALL BE PROVIDED KEEPING ABOVE PROVISION IN VIEW.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASADAHAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

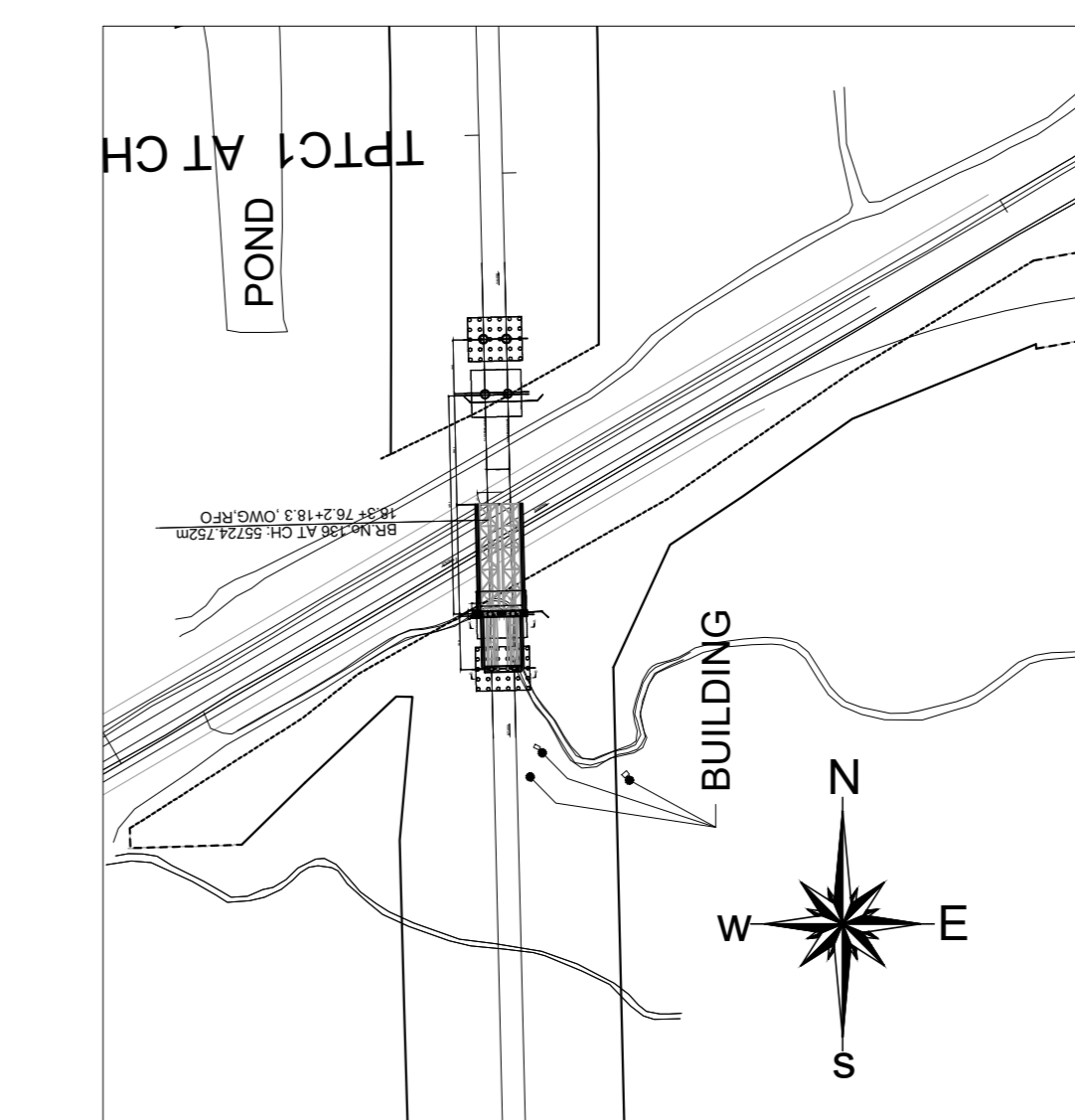
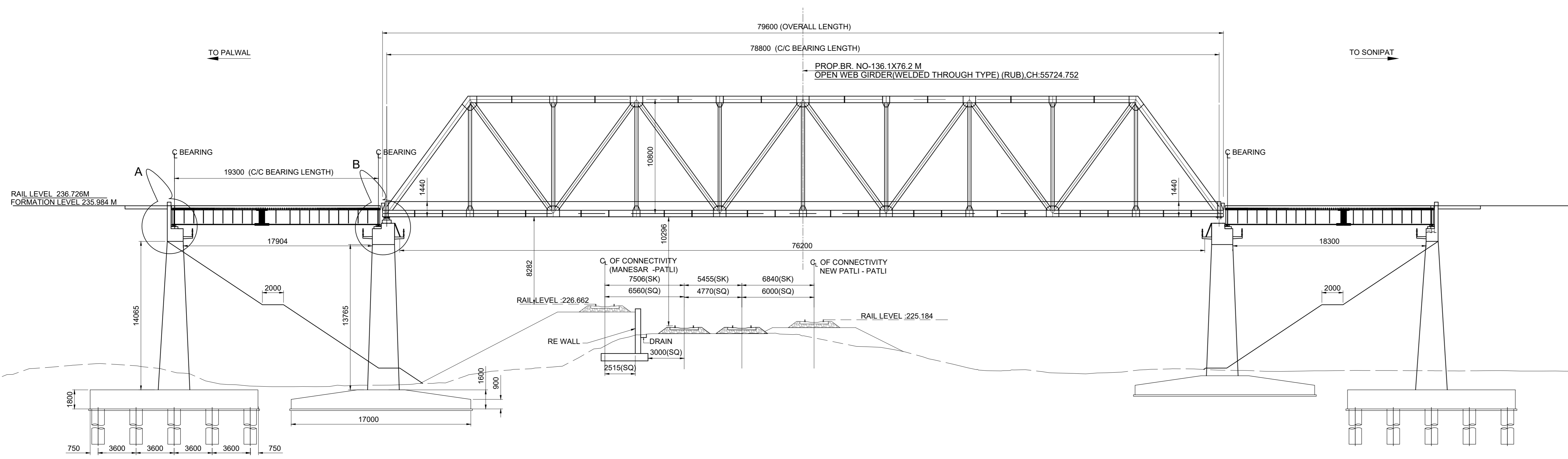
**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



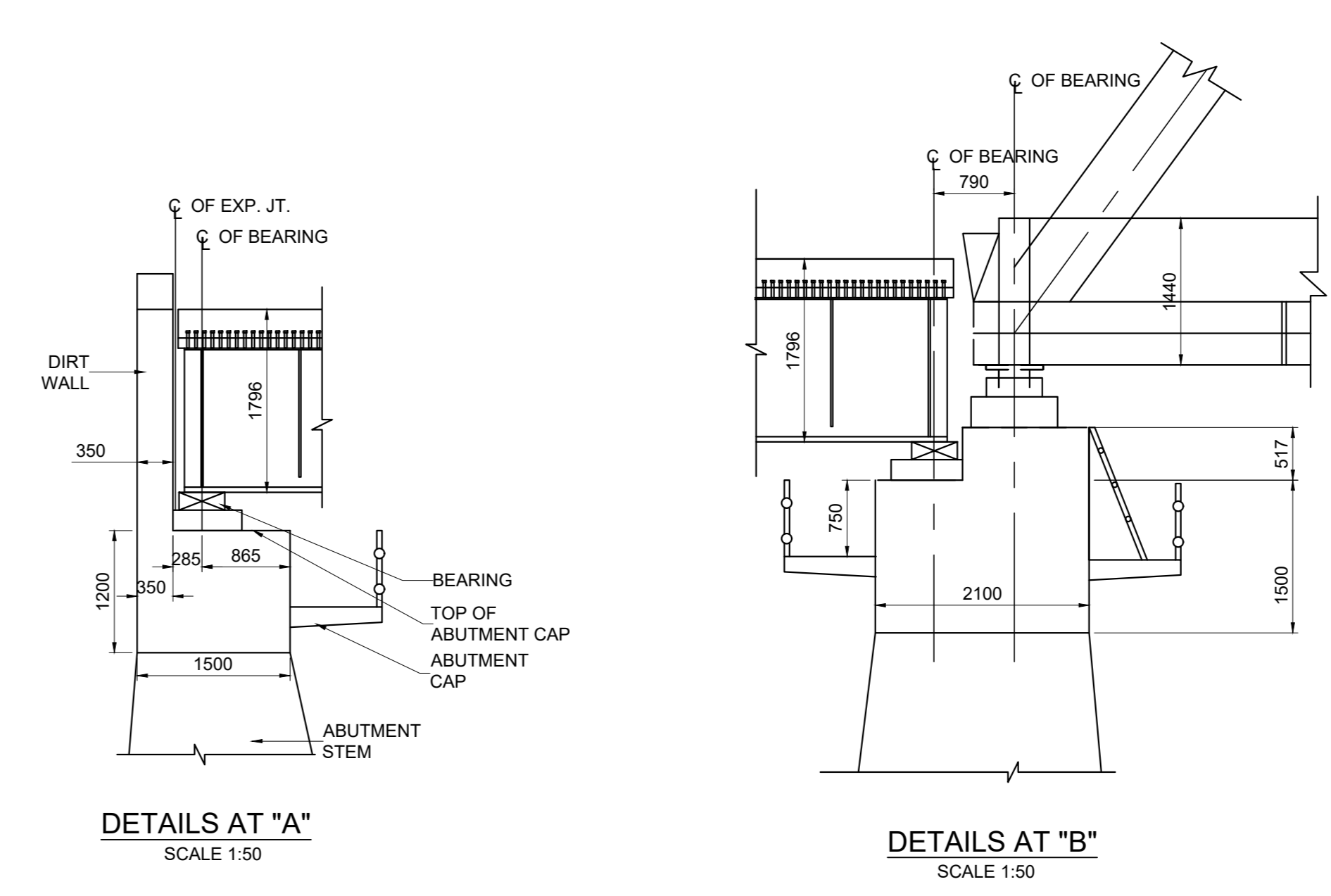
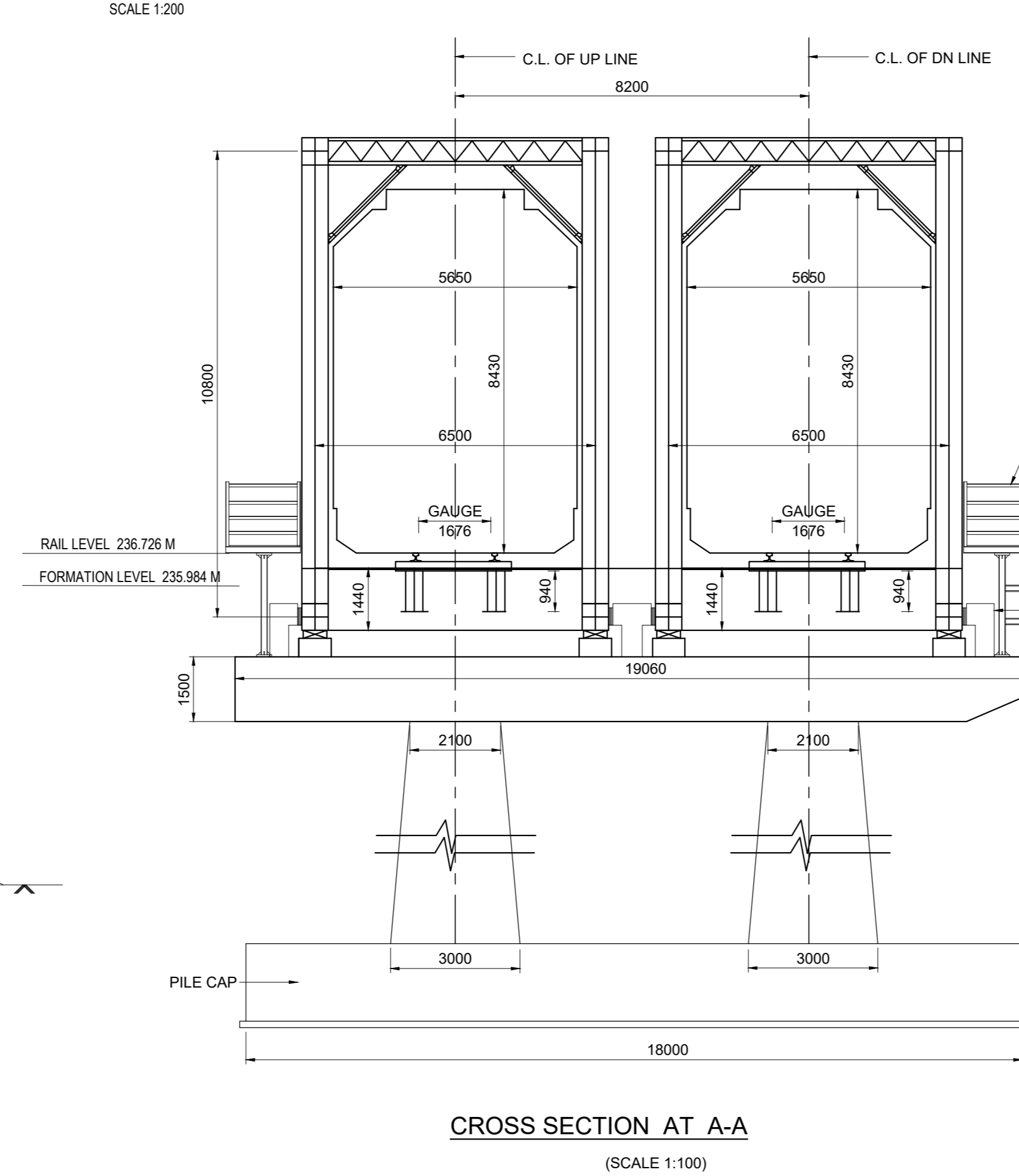
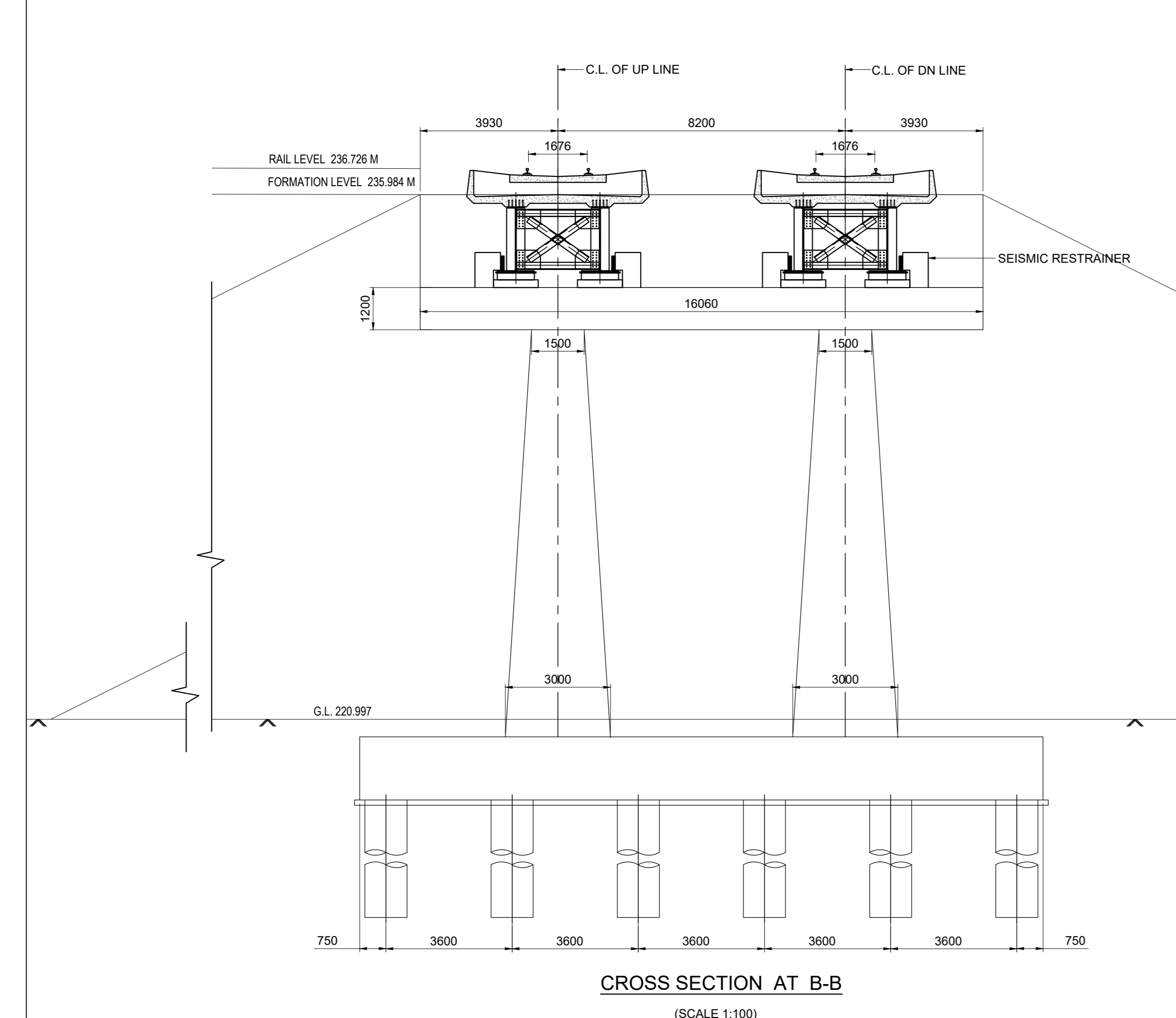
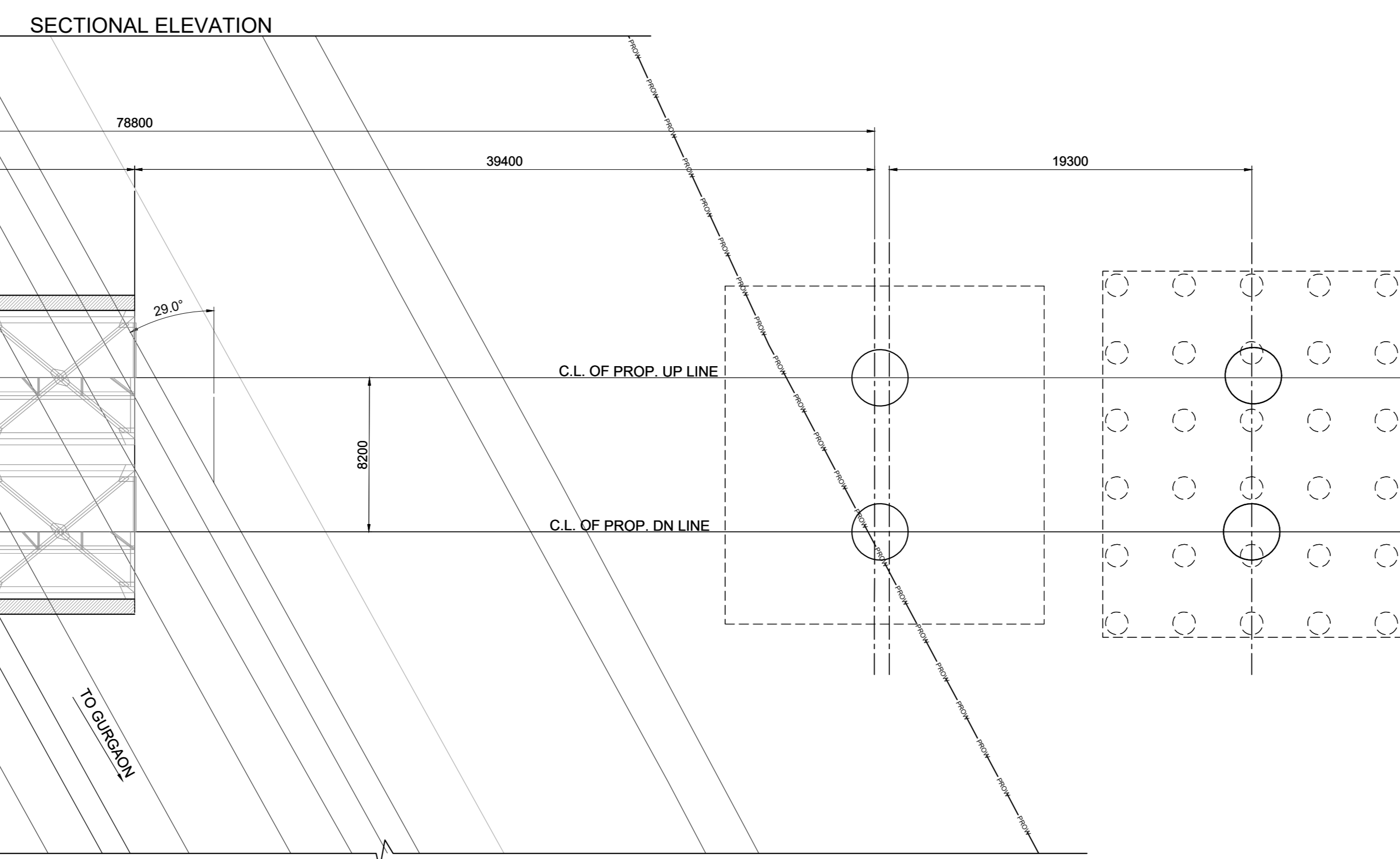
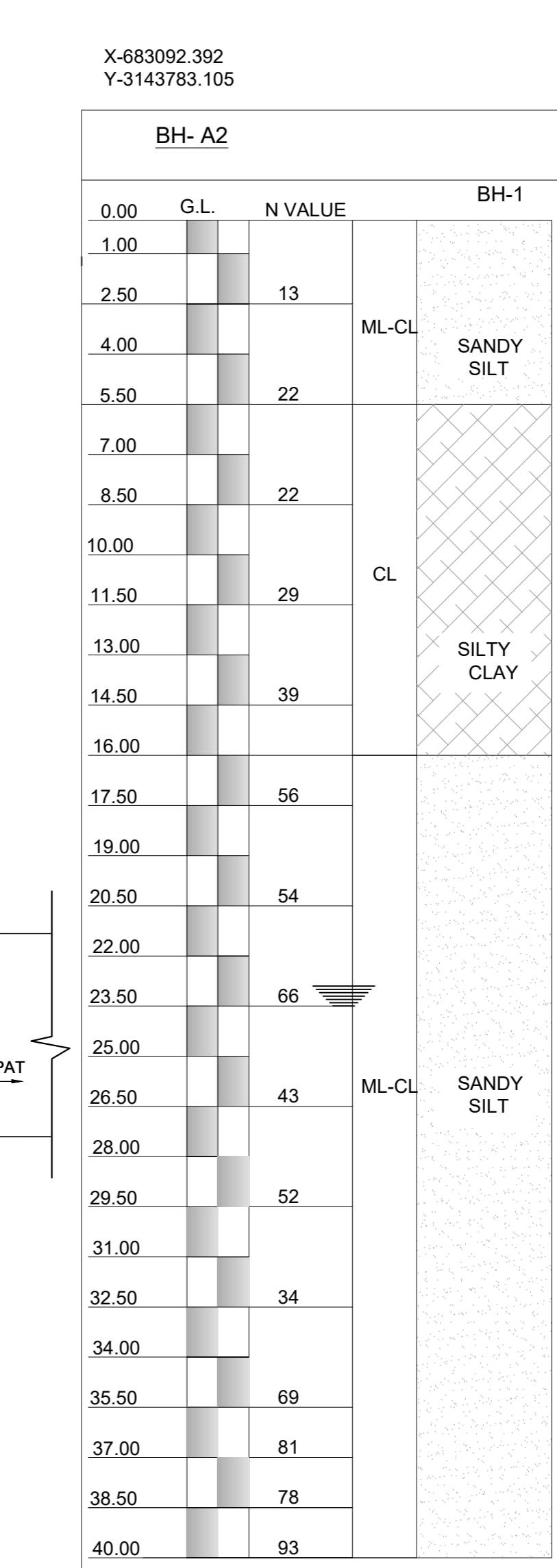
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR ROAD UNDER BRIDGE NO 5 - 1X5.0X425m RCC BOX AT CH. 2823.679 m (CONNECTING LINE NEW PATLI TO SULTANPUR)

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-04005\_A1 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



DATUM - 205.00					
FORMATION LEVEL	235.984	235.984	235.984	235.984	235.984
GROUND LEVEL	220.218	218.994	220.413	220.362	220.362
CHAINAGE	55666.052	55685.352	55724.752	55764.152	55783.452



- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2811 PART-1 SECTION-2
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING - SUPER STRUCTURE-32.5T (RDSO STANDARD O/WG), SUPER STRUCTURE-25T (RDSO STANDARD CG) & SUB STRUCTURE-32.5T-2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT DIRT & RETURN WALL - M35
    - FOR FOUNDATION - M35
    - FOR LEVELING COURSE - M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE F8-500D CONFORMING TO IS: 1786-2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPWM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE OPEN WEB GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG NO'S - RDSO B-17101 TO 17118 AND COMPOSITE GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG NO'S - RDSO B-11753/1R1 TO 11753/7R1.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - FOR PILE FOUNDATION THE RELEVANT CODE FOR PILE FOUNDATION AND TESTING WILL BE FOLLOWED.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE - DL, INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - ARRANGEMENT FOR PATHWAY SHALL BE PROVIDED AS PER RDSO DWG. NO. CBS-0045/FOR O/WG & CBS-0046 (FOR CC).
  - TROLLEY REFUGE SHALL BE PROVIDED ON OPPOSITE SIDES OF EACH CENTRAL PIER.
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.

DESCRIPTION OF BRIDGE

1. CHAINAGE	55724.752
2. RAIL LEVEL	236.726 M
3. FORMATION LEVEL	235.984 M
4. VERTICAL ALIGNMENT	LEVEL
4. HORIZONTAL ALIGNMENT	STRAIGHT
5. SOFFIT LEVEL	234.944 M
6. ROAD LEVEL	223.893 M
7. OVERALL SPAN	79800 MM
8. EFFECTIVE SPAN	78800 MM
9. CLEAR SPAN	76200 MM
10. TYPE OF CROSSING	ROAD
11. VERTICAL CLEARANCE	11051 MM

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWA TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

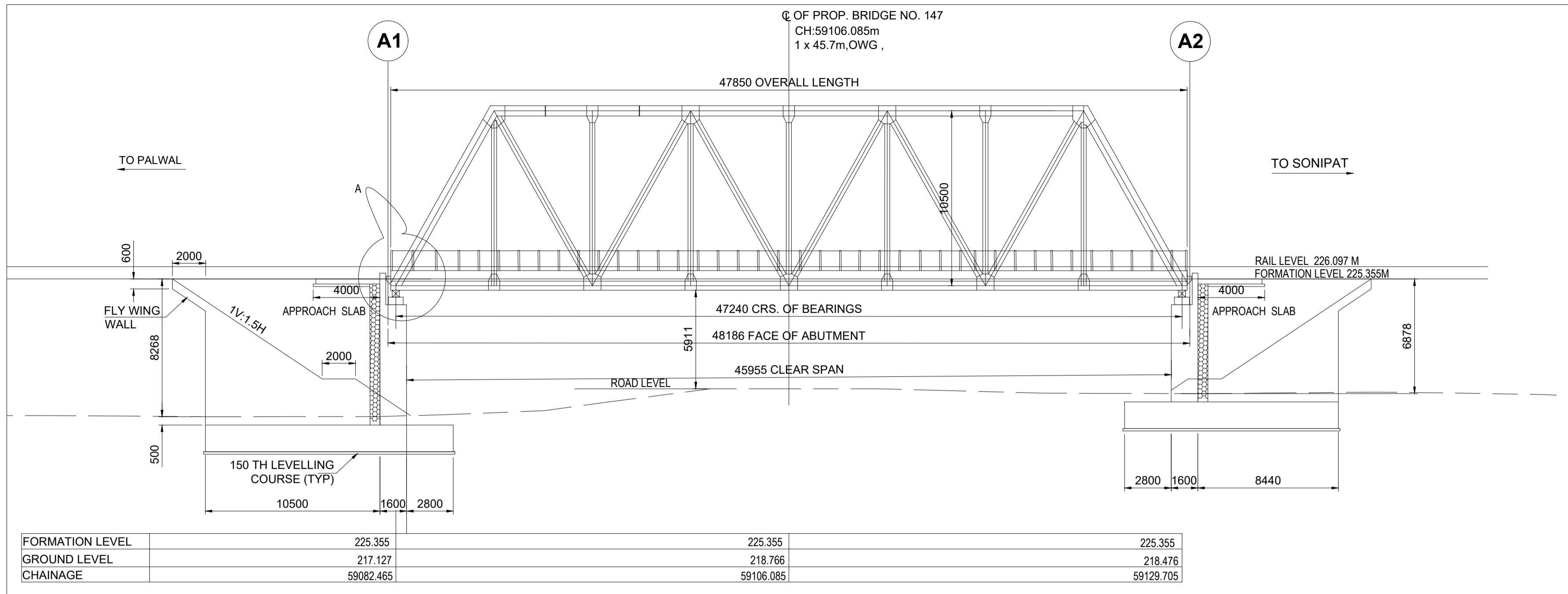
CONSULTANT:  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

TITLE:- **CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR PROPOSED MAJOR ROR BRIDGE NO.136, 18.3+76.2+18.3 CG + OWG AT CH: 55724.752m**

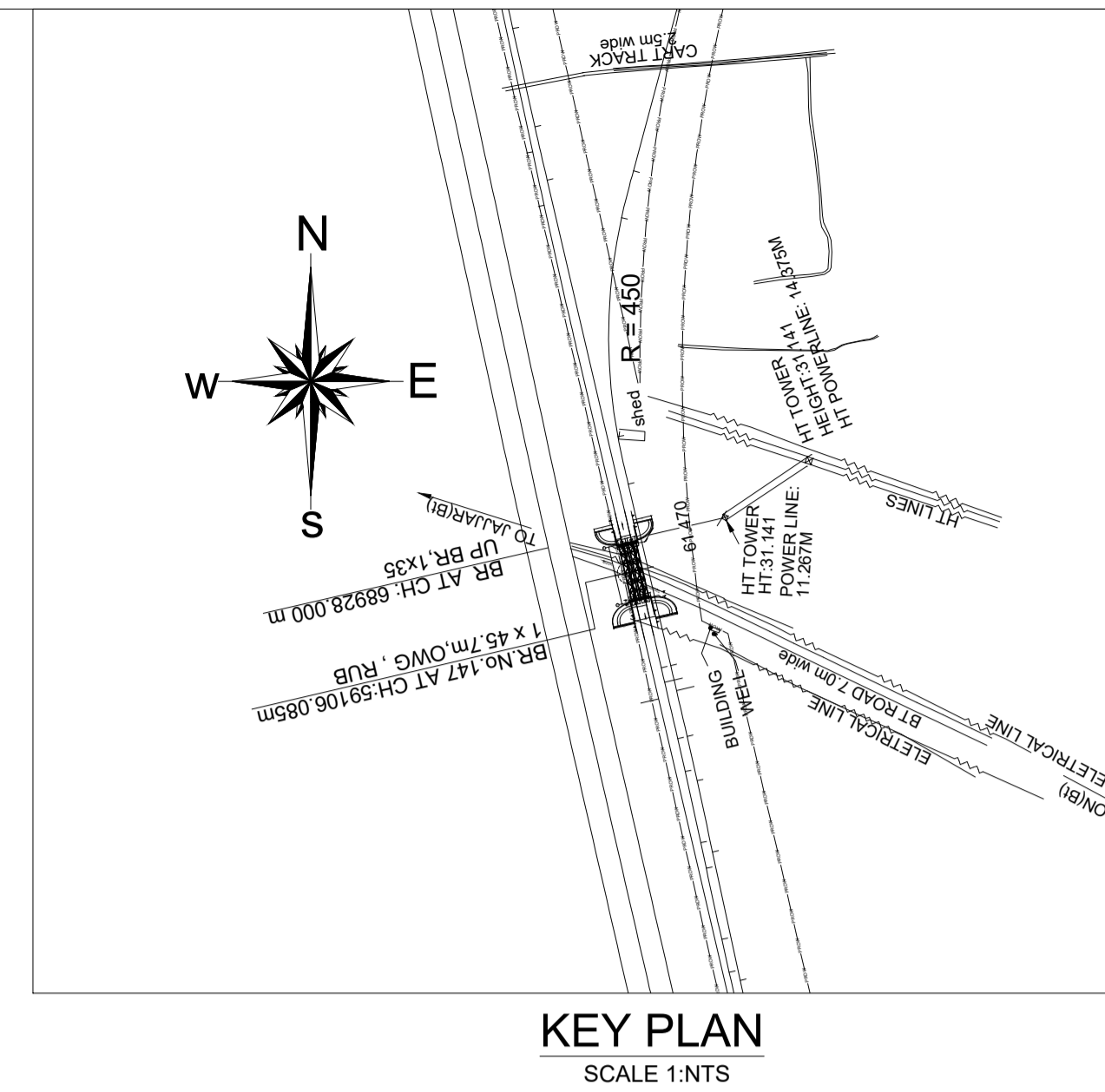
DRG. NO.	GC-HRIDC-C2-DRW-BRD-GAD-01136_A1	SHEET NO.	1 OF 1
SCALE :	AS SHOWN	ISSUE DATE	23-06-2022
		REVISED DATE	29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

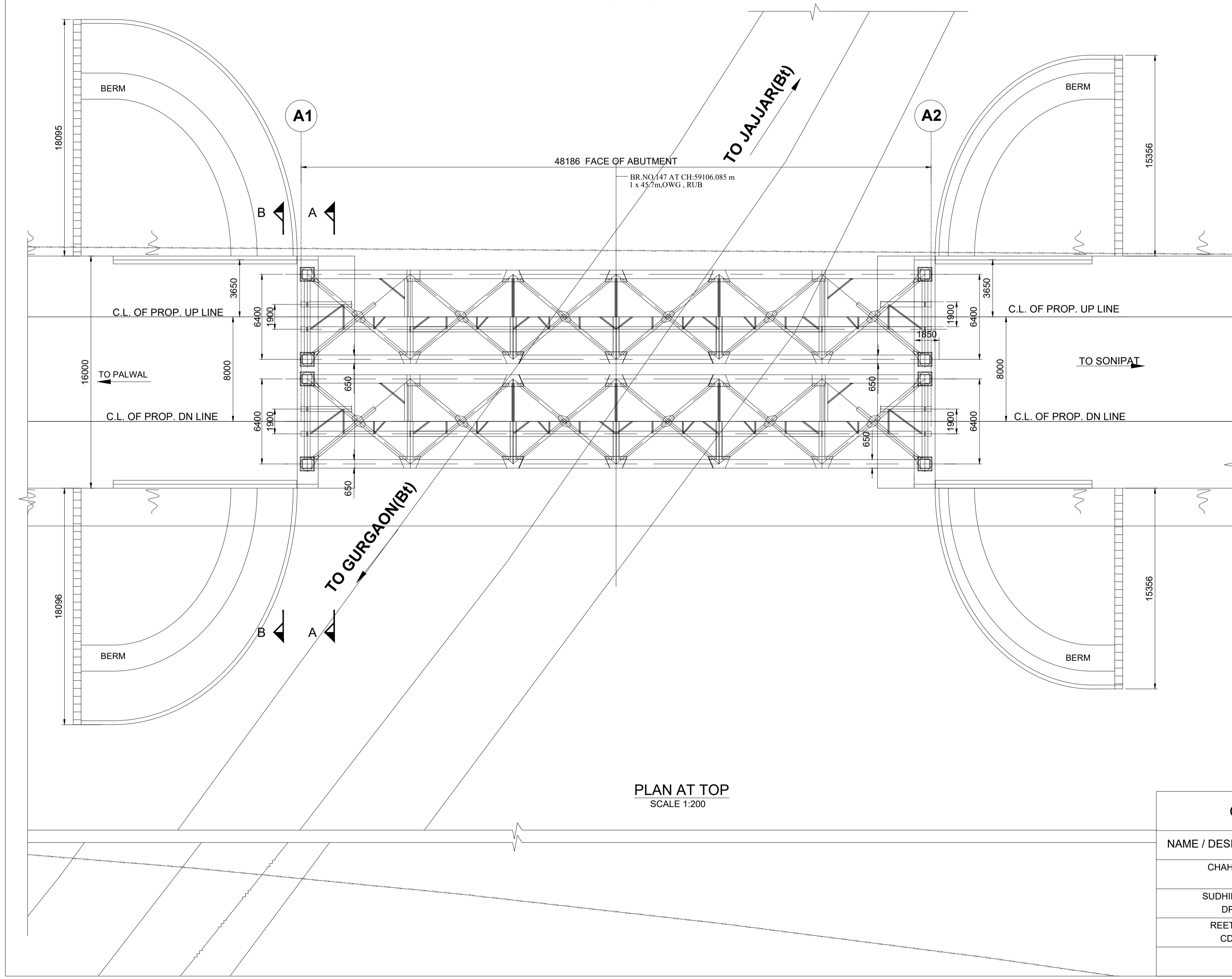




FORMATION LEVEL	225.355	225.355	225.355
GROUND LEVEL	217.127	218.766	218.476
CHAINAGE	59082.465	59106.085	59129.705



- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING :- SUPER STRUCTURE-32.5T (RDSO STANDARD OWG), SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL-----M35
    - FOR FOUNDATION-----M35
    - FOR LEVELING COURSE-----M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe-500D CONFORMING TO IS: 1786- 2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL.7.5.2.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPMM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE OPEN WEB GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG. NO'S : RDSO/B-17081 TO 17098
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE , DL, INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - ARRANGEMENT FOR PATHWAY SHALL BE PROVIDED AS PER RDSO DWG. NO. CBS-0045 (FOR OWG).
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.



GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

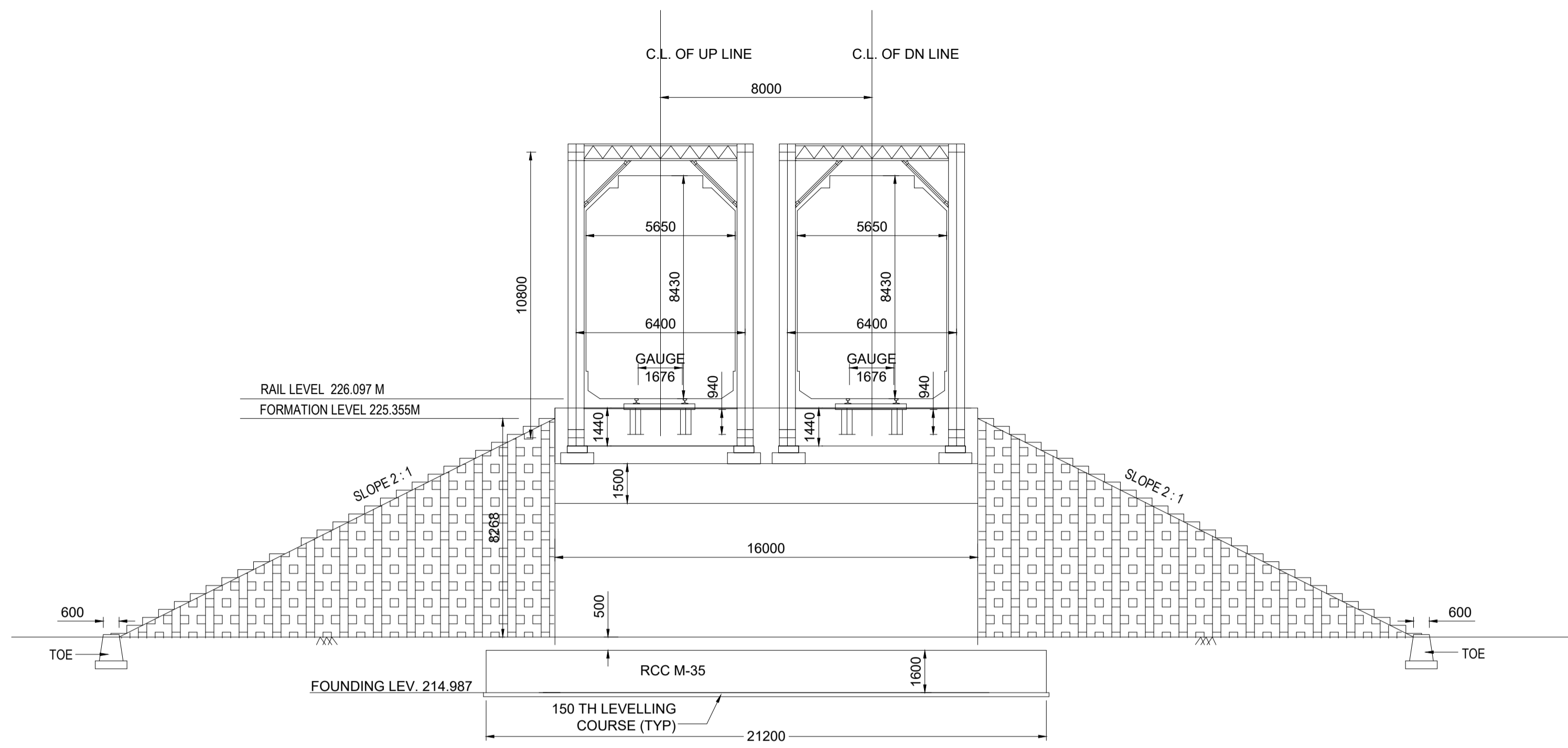
CONSULTANT:  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

TITLE:- CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR PROPOSED MAJOR RUB NO.147 AT CH:59106.085m 1 x 45.7m, OPEN WEB GIRDER

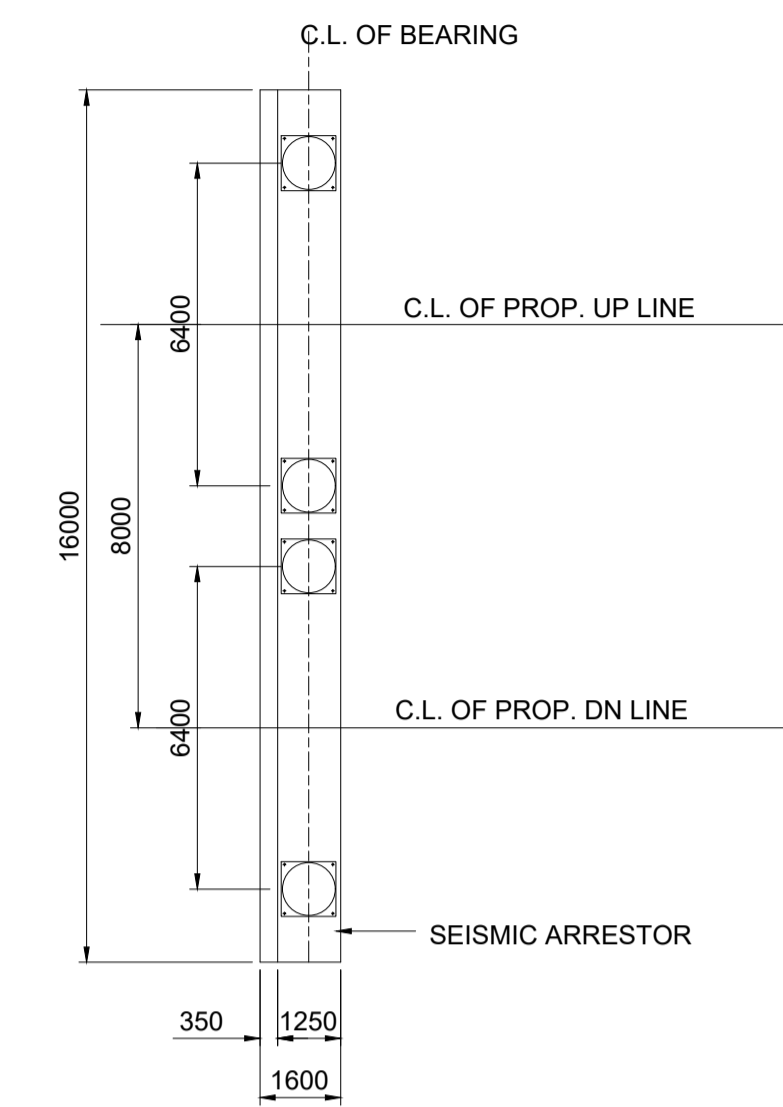
DRG. NO. GC-HRIDC-C2-DRW-BRD-GAD-01147\_A1 SHEET NO. 1 OF 2

SCALE : AS SHOWN ISSUE DATE 23-06-2022 REVISED DATE 29-07-2022

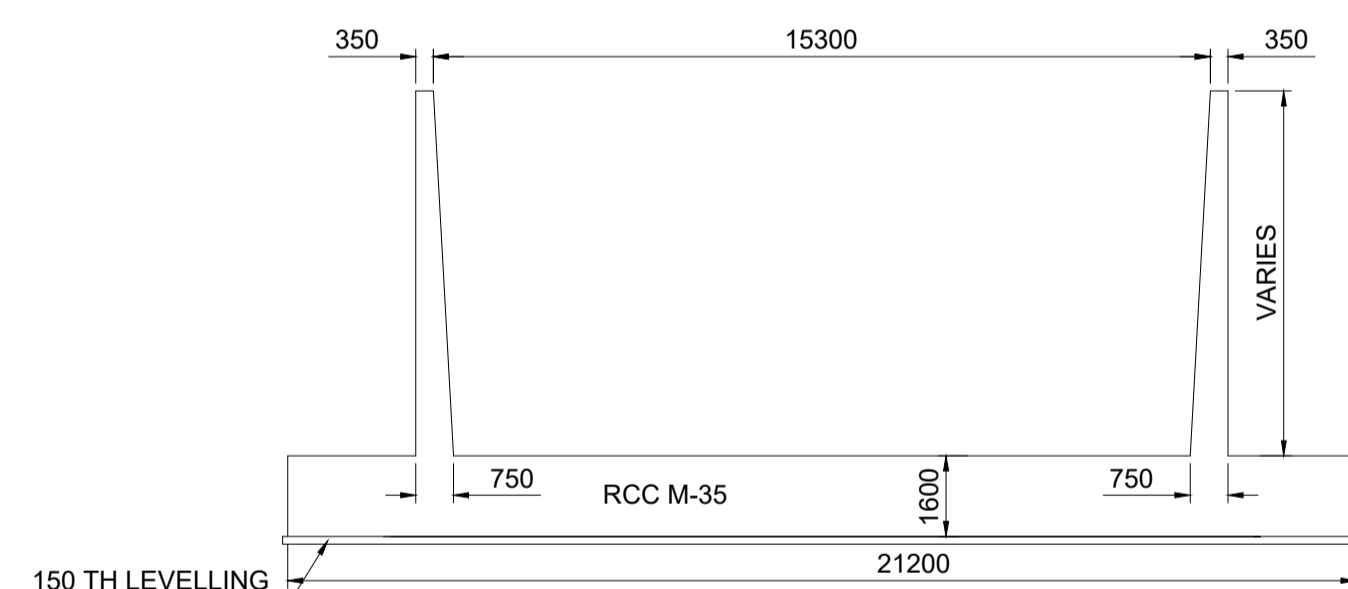




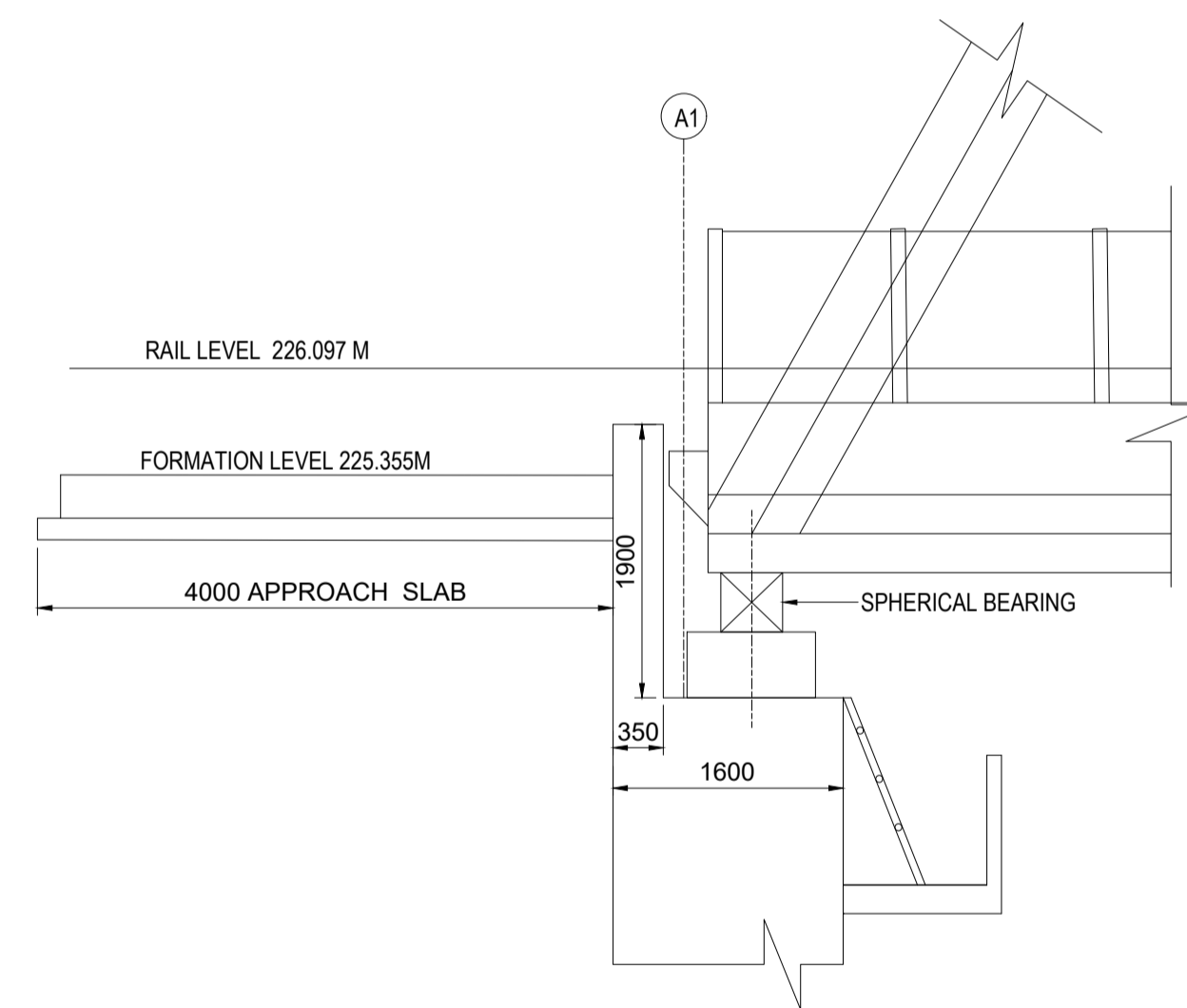
CROSS SECTION AT A-A (ABUTMENT)  
SCALE 1:150



TYPICAL DETAILS OF ABUTMENT CAP  
SCALE 1:150



CROSS SECTION AT B-B  
SCALE 1:150



DETAILS AT "A"  
SCALE 1:50

NOTES:  
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER.  
2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED.

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAO TI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

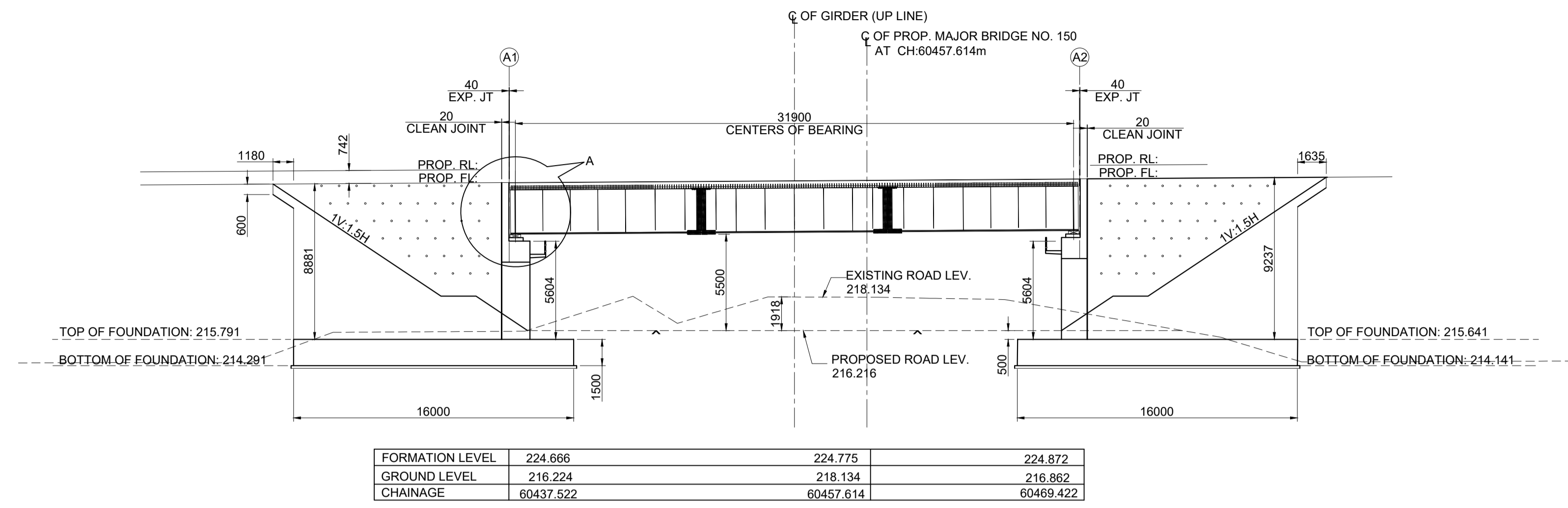


TITLE:- **CONCEPTUAL GENERAL ARRANGEMENT DRAWING**  
FOR PROPOSED MAJOR RUB NO.147 AT 59106.085 m 1 x 45.7m, OPEN WEB GIRDER

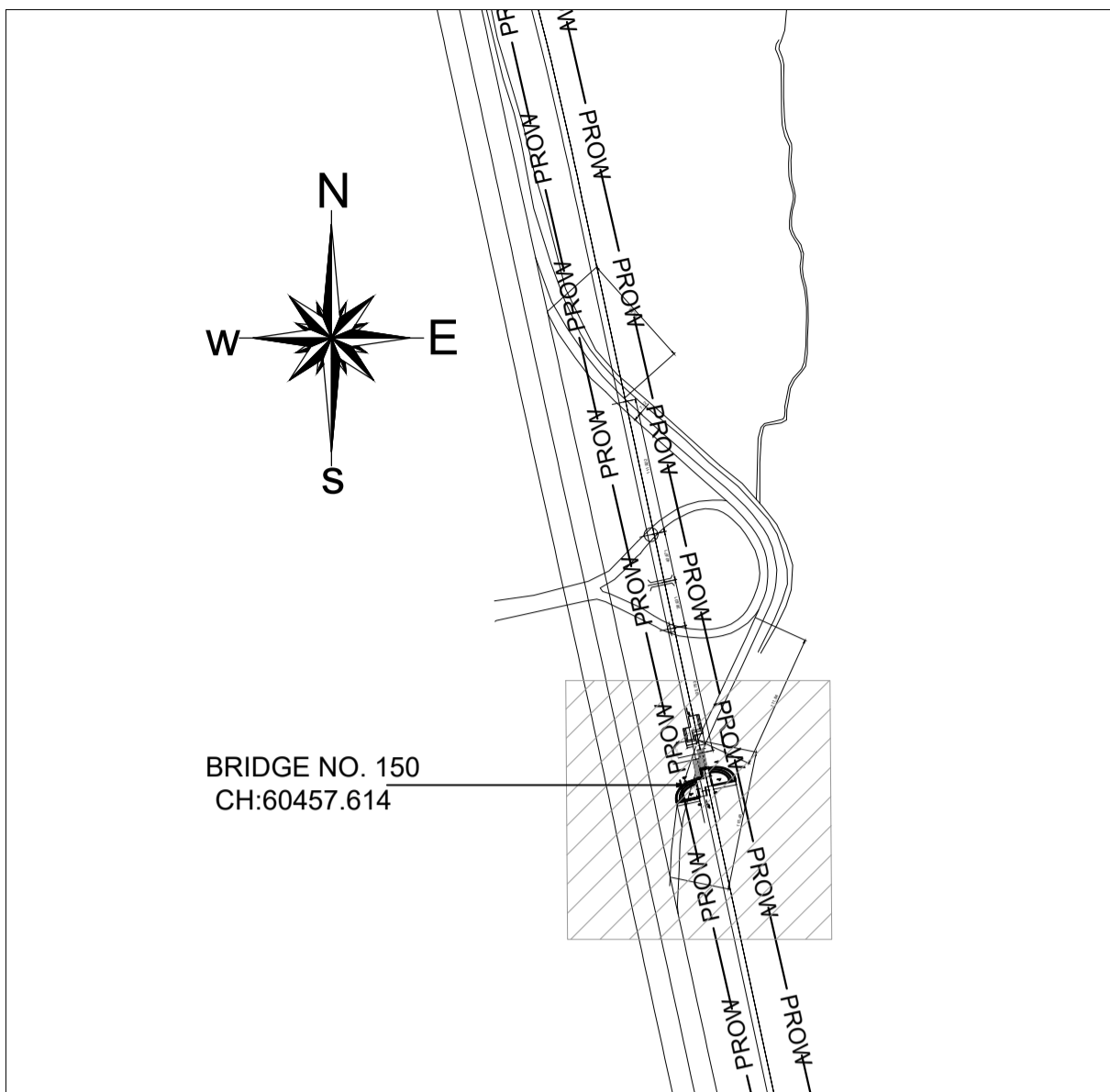
DRG. NO. **GC-HRIDC-C2-DRW-BRD-GAD-01147\_A1** SHEET NO. **2 OF 2**

SCALE : **AS SHOWN** ISSUE DATE **23-06-2022** REVISED DATE **29-07-2022**

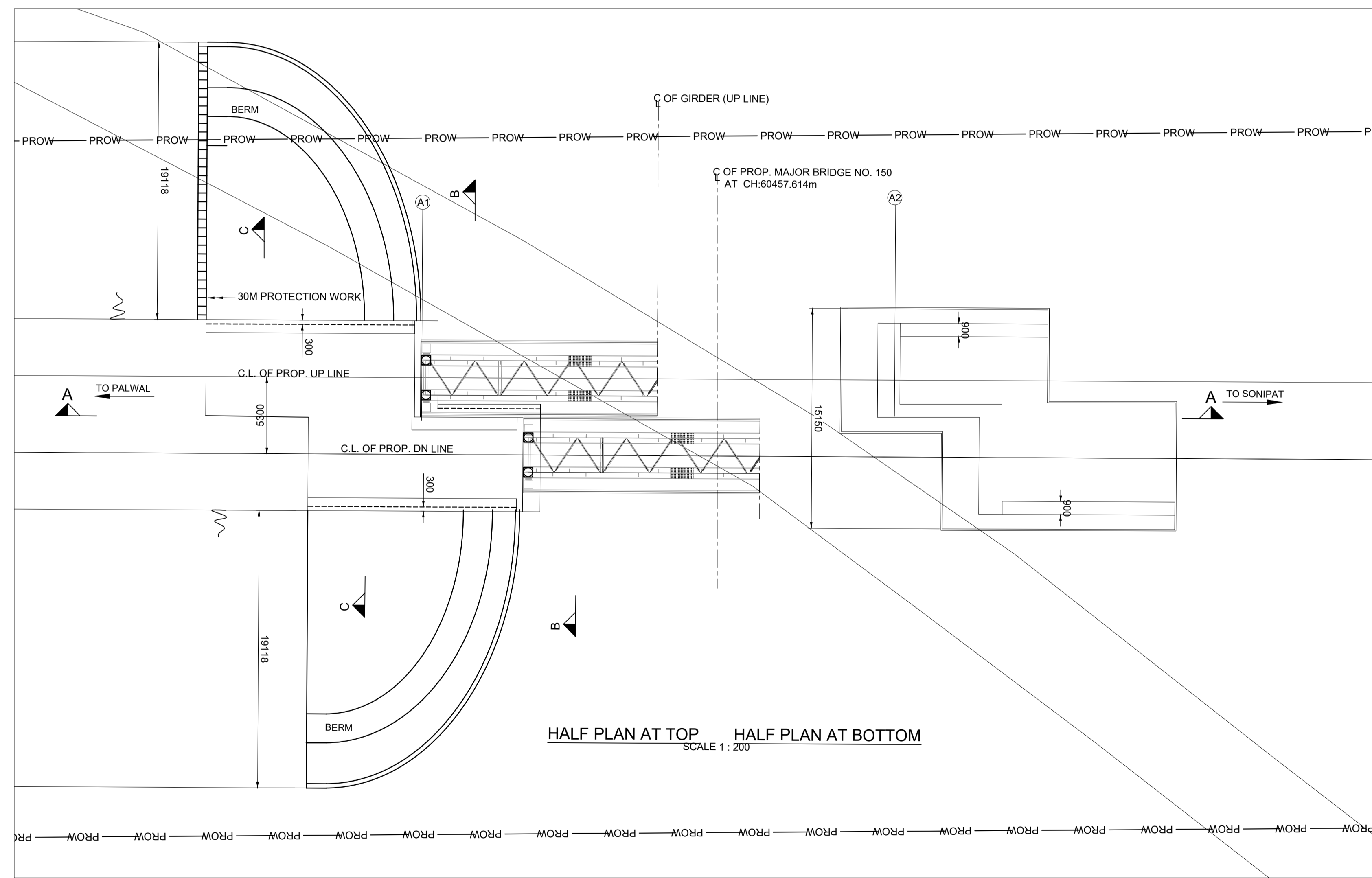
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



SECTIONAL ELEVATION  
SCALE 1:200




KEY PLAN  
SCALE 1:NTS




HALF PLAN AT TOP    HALF PLAN AT BOTTOM  
SCALE 1 : 200

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING - SUPER STRUCTURE-25T, SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL.....M35
    - FOR FOUNDATION .....M35
    - FOR LEVELING COURSE.....M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE F<sub>y</sub>-500D CONFORMING TO IS: 1798- 2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL. 7.5.2
  - BACK FILL SHALL BE AS PER CL. 7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPVM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE COMPOSITE GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG. NO'S : RDSO/B-11754/R2 TO 11754/6.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - ARRANGEMENT FOR PATHWAY SHALL BE PROVIDED AS PER RDSO DWG. NO. CBS-0046 (FOR CG).
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.
  - EXISTING ROAD SHALL BE FIRST DIVERTED TEMPORARILY TO THE EXSITING ROAD STANDARDS.
  - THEREAFTER EXISTING ROAD SHALL BE LOWERED AS SHOWN IN THE DRAWING. L-SECTION OF LOWERED ROAD SHALL BE GOT APPROVED FROM THE ENGINEER BEFORE START OF WORK.
  - PROTECTIVE BARRIERS FOR ABUTMENTS SHALL BE PROVIDED AS APPROVED BY THE ENGINEER.

PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
 GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



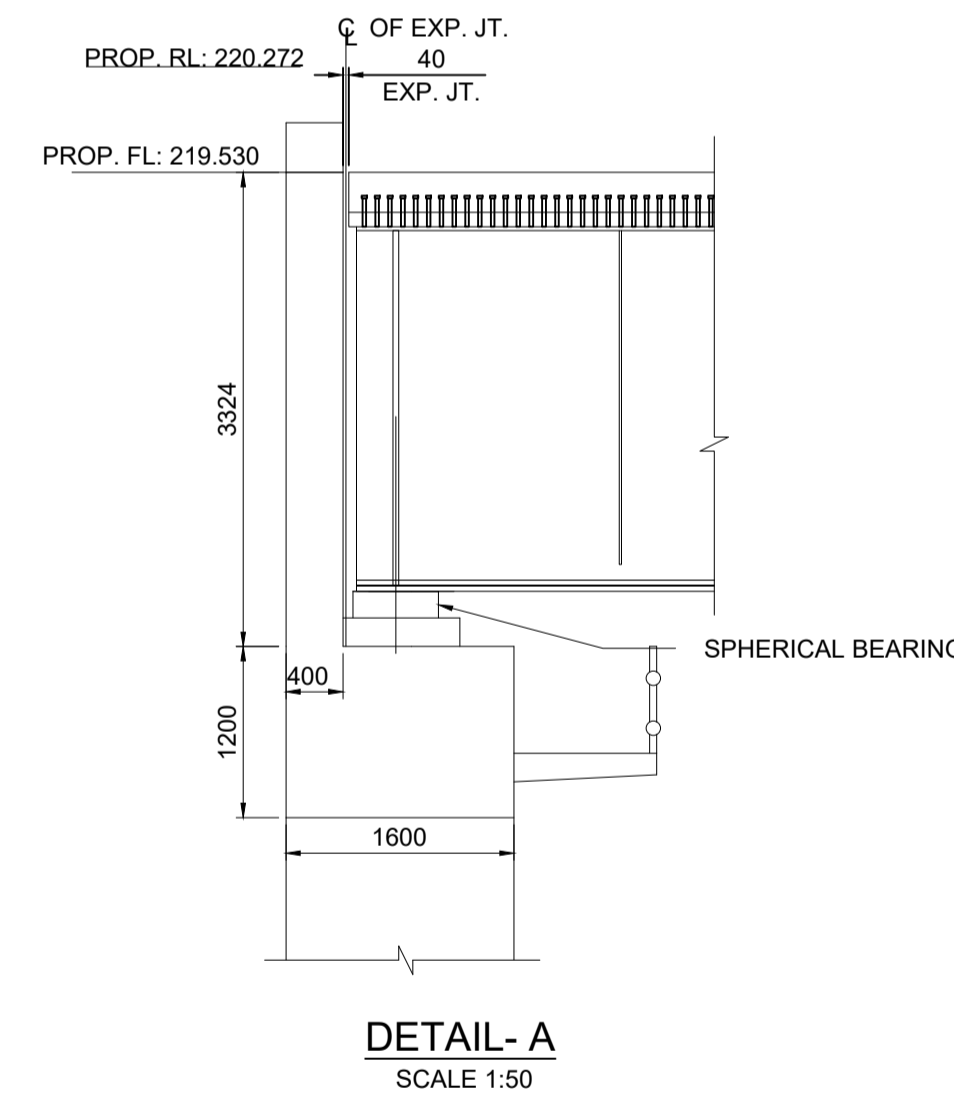
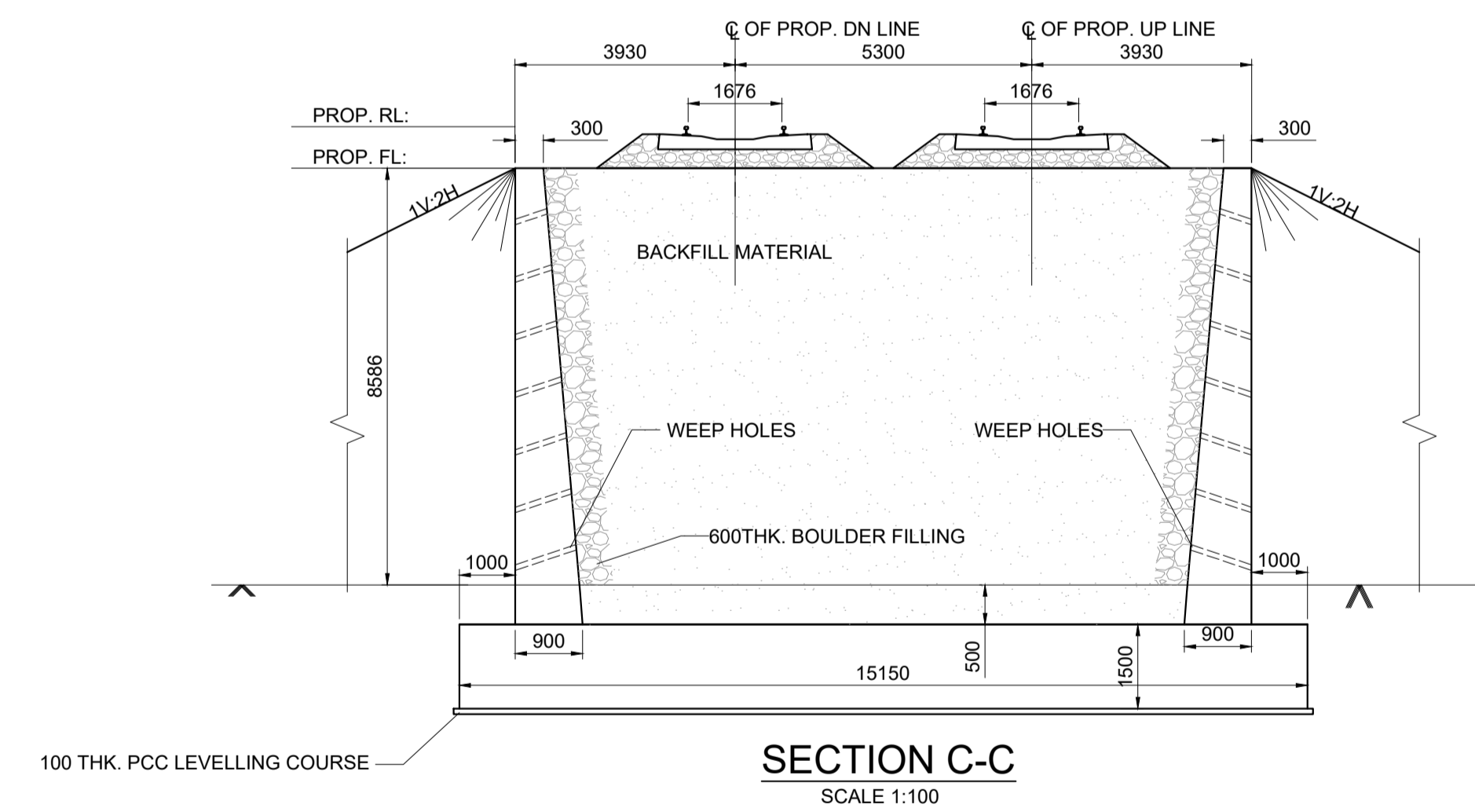
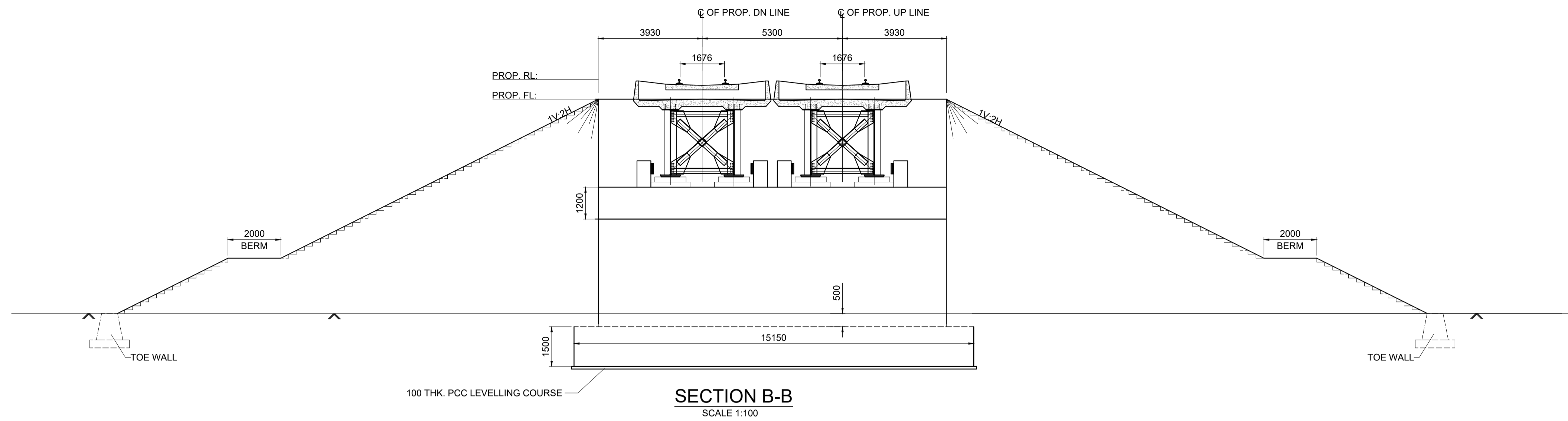
TITLE:- CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
FOR PROPOSED MAJOR RUB NO.150,  
1 x 30.5m COMPOSITE GIRDER AT CH: 60457.614m

DRG. NO. GC-HRIDC-C2-DRW-BRD-GAD-01150\_A1    SHEET NO. 1 OF 2

SCALE : AS SHOWN    ISSUE DATE 23-06-2022    REVISED DATE 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

- NOTES:  
 1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER  
 2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED



PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 **HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
 **GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

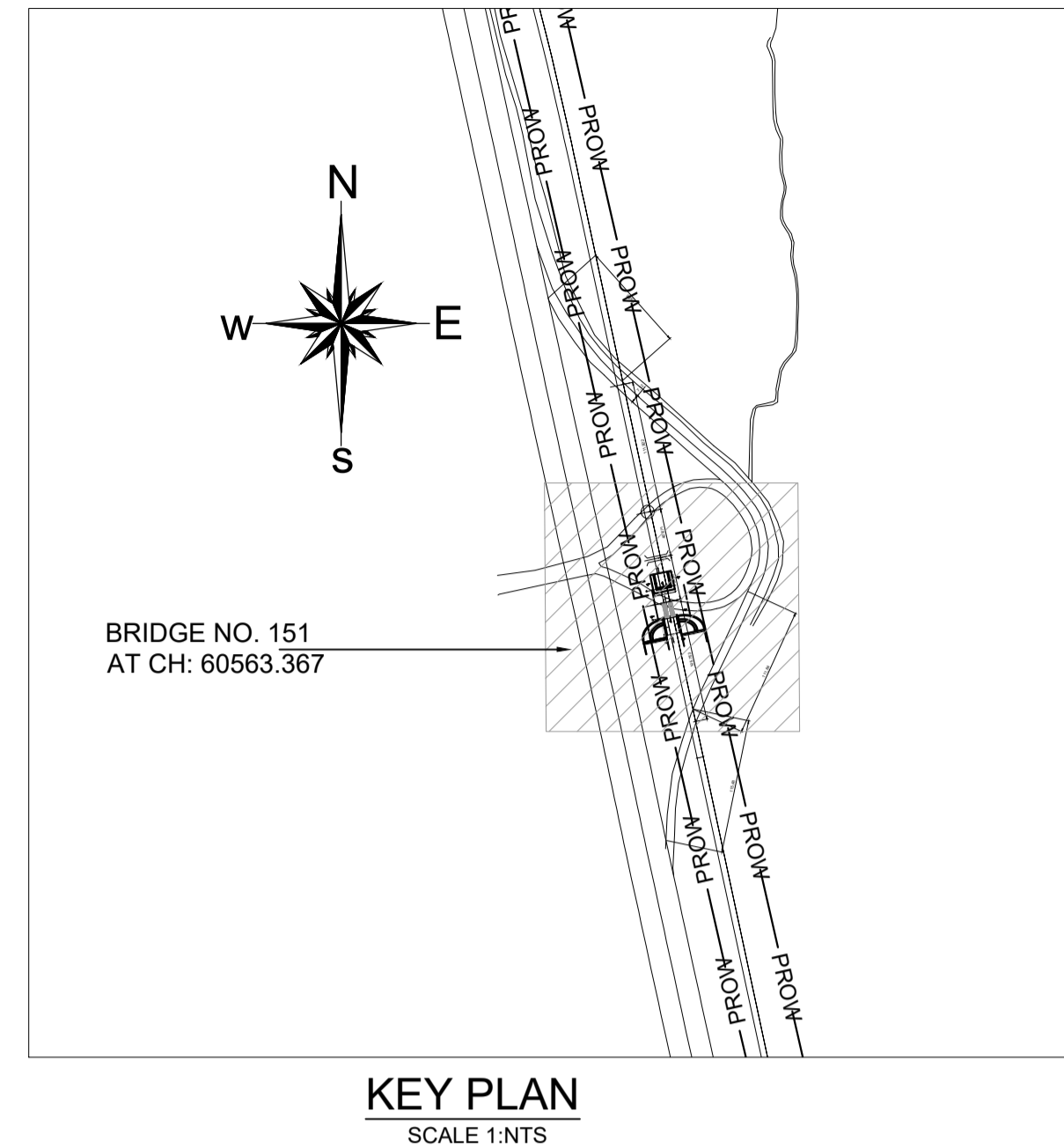
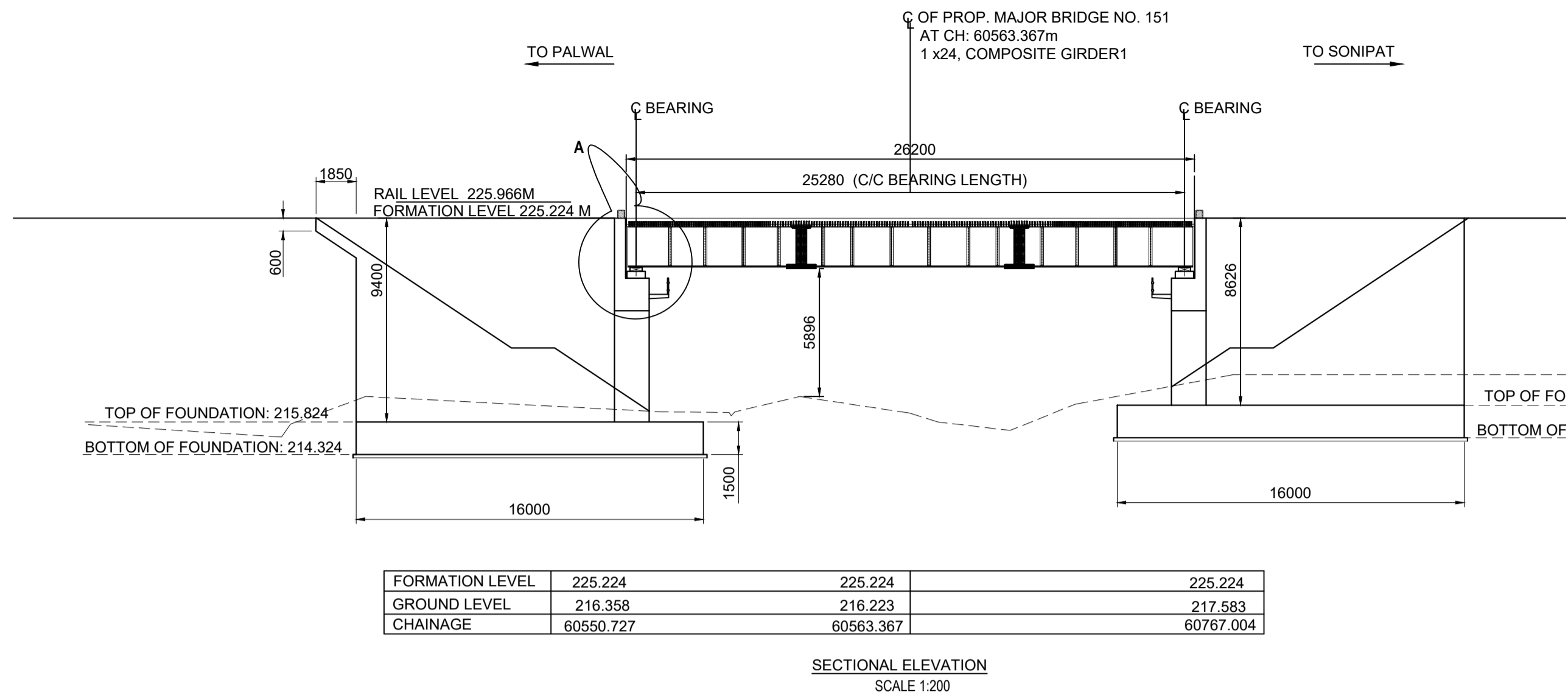


TITLE:- **CONCEPTUAL GENERAL ARRANGEMENT DRAWING**  
 FOR PROPOSED MAJOR RUB NO.150,  
 1 x 30.5m COMPOSITE GIRDER AT CH: 60457.614m

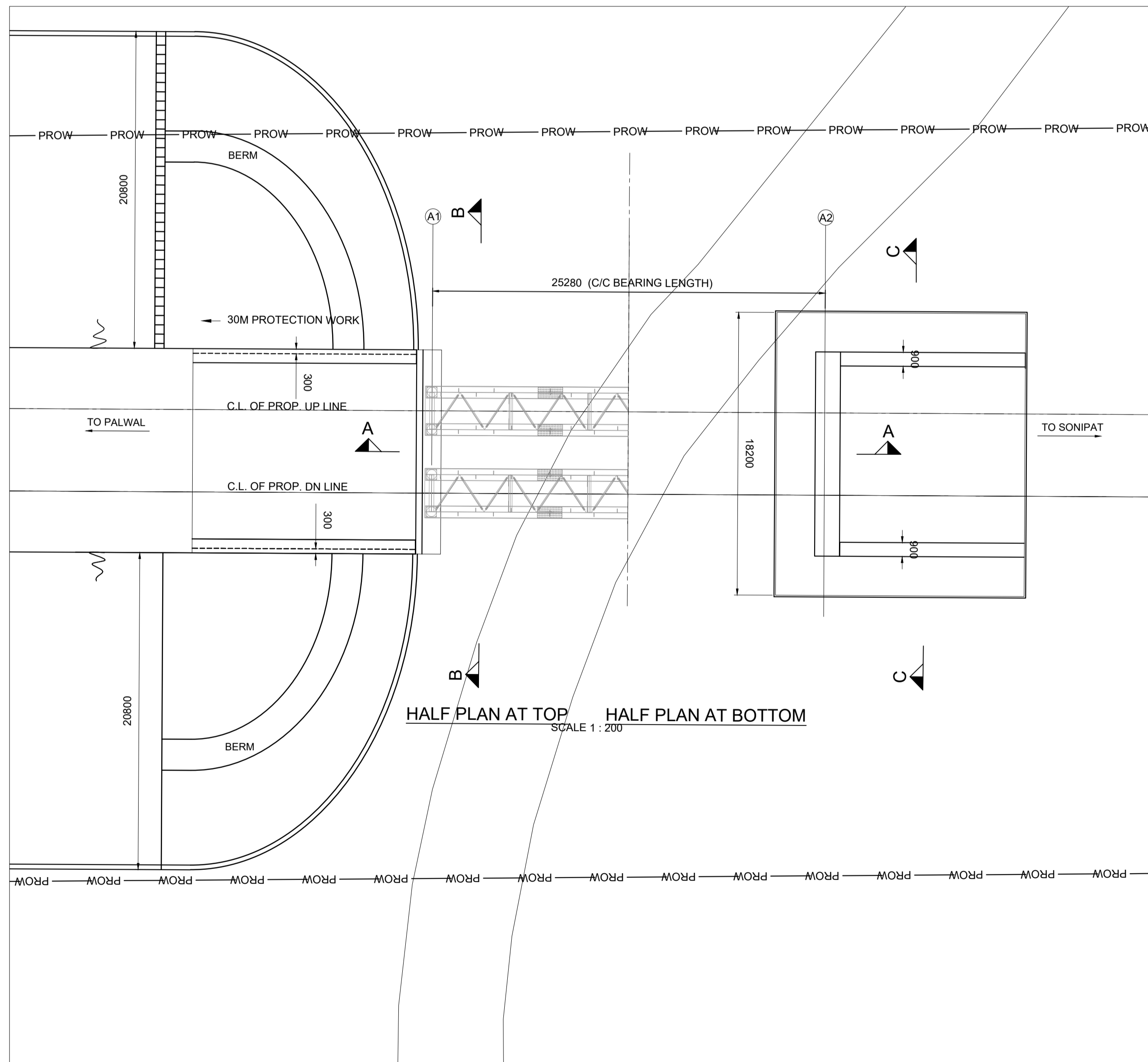
DRG. NO. **GC-HRIDC-C2-DRW-BRD-GAD-01150\_A1** SHEET NO. **2 OF 2**

SCALE : **AS SHOWN** ISSUE DATE **23-06-2022** REVISED DATE **29-07-2022**

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		




- NOTES:**
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING :- SUPER STRUCTURE-25T, SUB STRUCTURE-32.5T-2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT DIRT & RETURN WALL-----M35
    - FOR FOUNDATION -----M35
    - FOR LEVELING COURSE-----M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe-500D CONFORMING TO IS: 1786-2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL.7.5.2.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPVM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE COMPOSITE GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG.NO'S : RDSO/B-11751/R1 TO 11751/8.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION
  - BRIDGE DETAILS LIKE INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - PATHWAY SHALL BE PROVIDED ON OUTER SIDE OF CG. RDSO DWG. NO. CBS-0046 (FOR CG.) SHALL BE FOLLOWED FOR ARRANGEMENT OF PATHWAY.
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.



**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 **HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  
 **GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

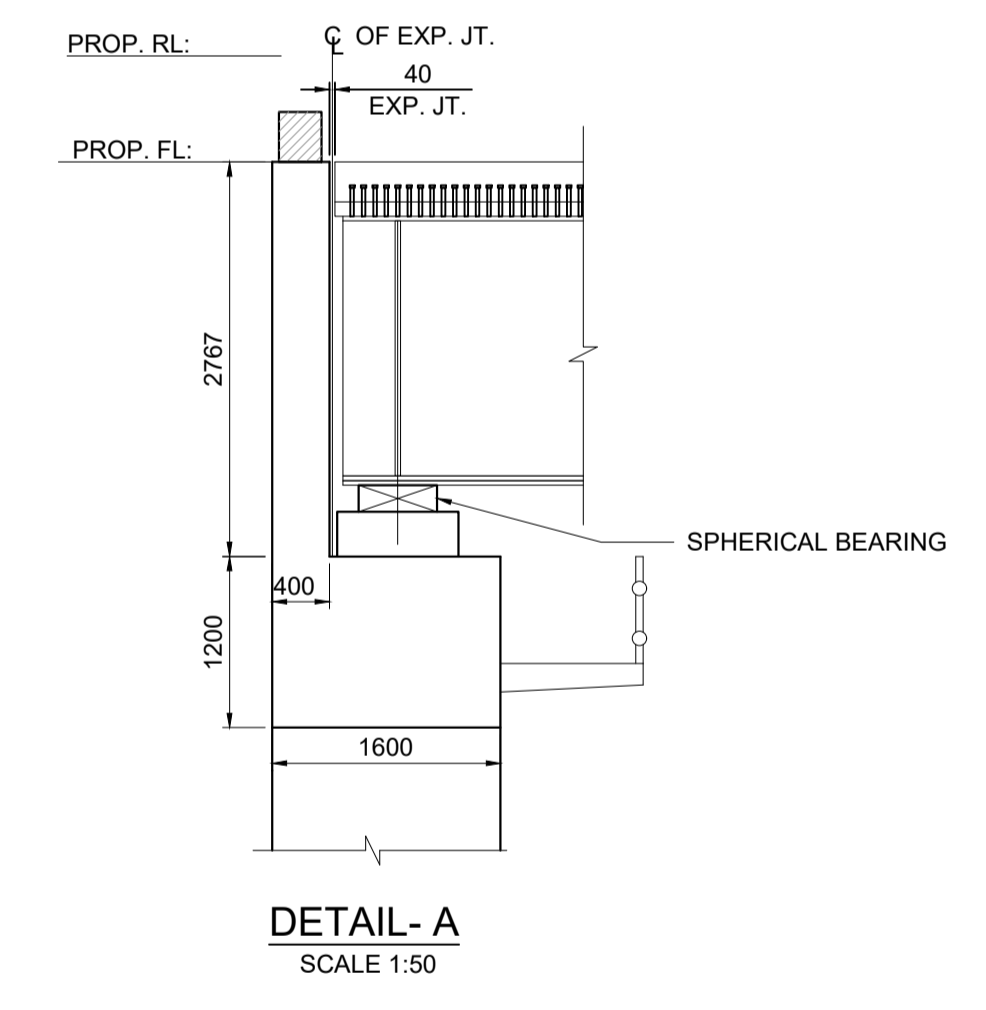
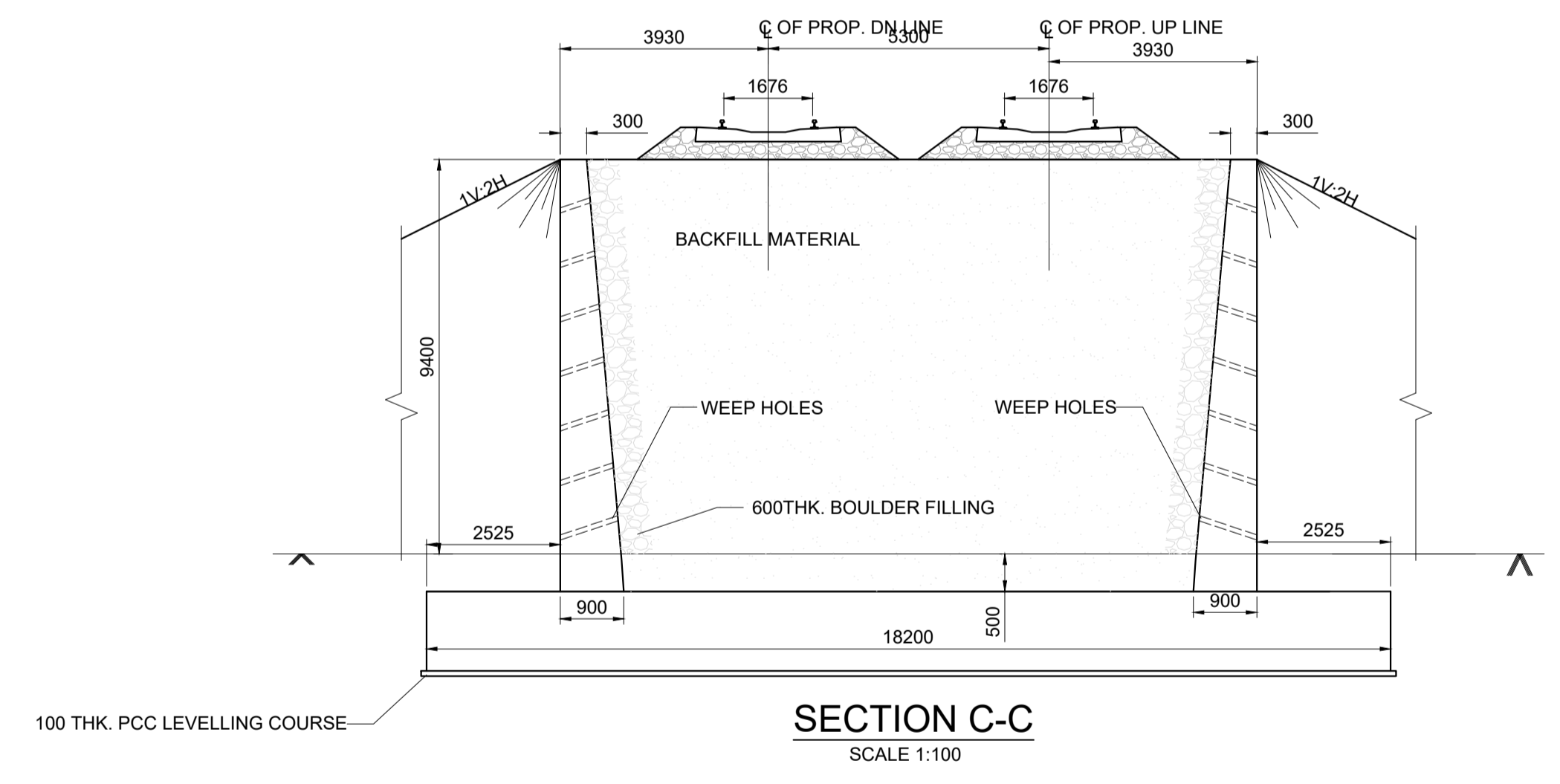
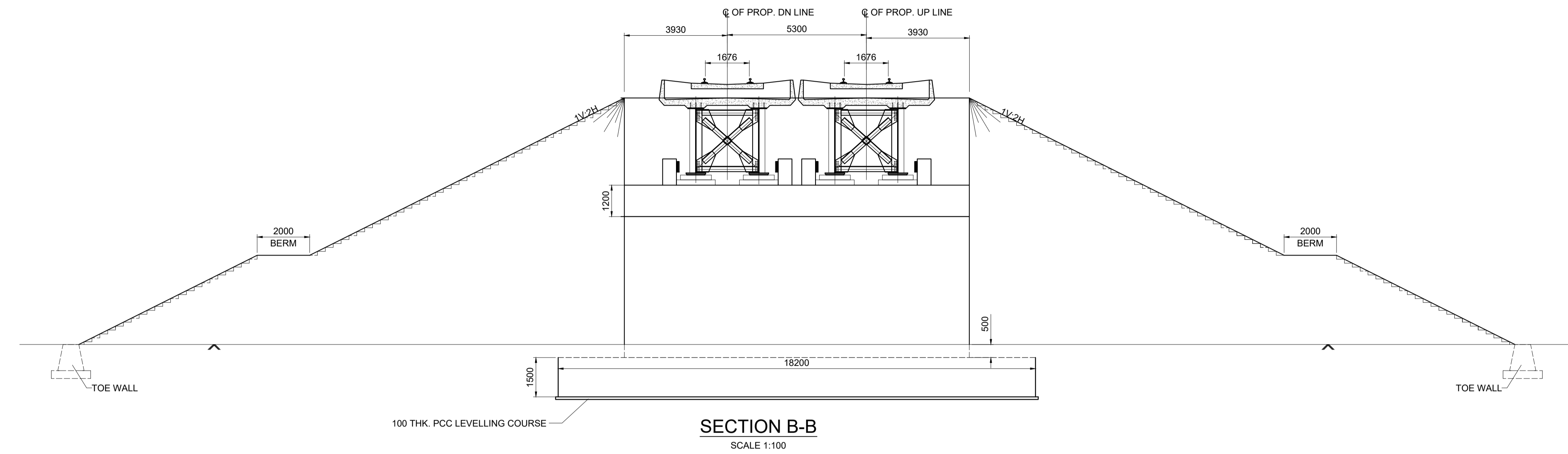


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO.151,  
 1 x 24.4m COMPOSITE GIRDER AT CH: 60563.367m

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

<b>DRG. NO.</b> GC-HRIDC-C2-DRW-BRD-GAD-01151_A1	<b>SHEET NO.</b> 1 OF 2
<b>SCALE :</b> AS SHOWN	<b>ISSUE DATE</b> 23-06-2022
	<b>REVISED DATE</b> 29-07-2022

NOTES:  
 1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER  
 2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED



**PROJECT:**  
 HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pty. Ltd.

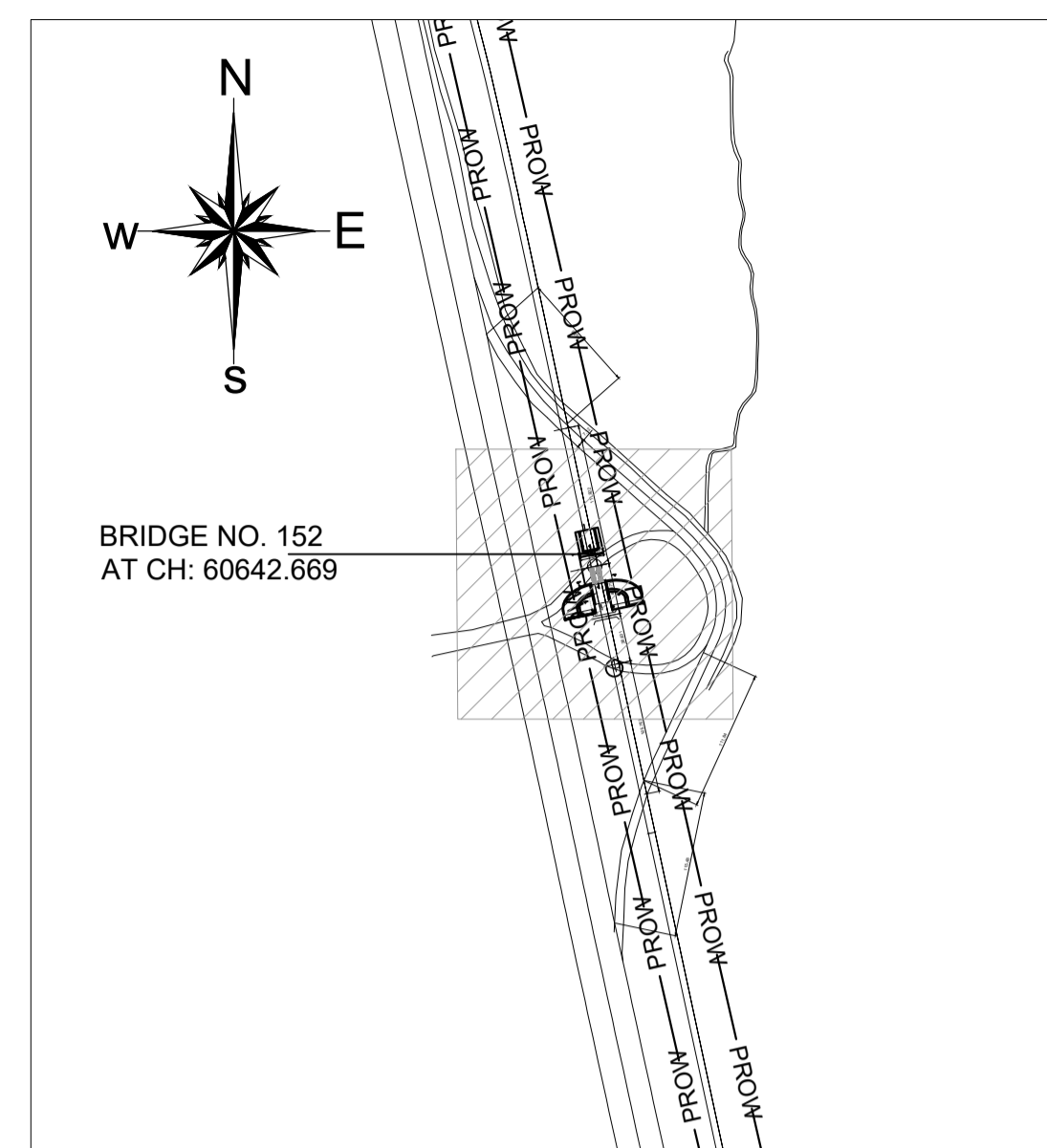
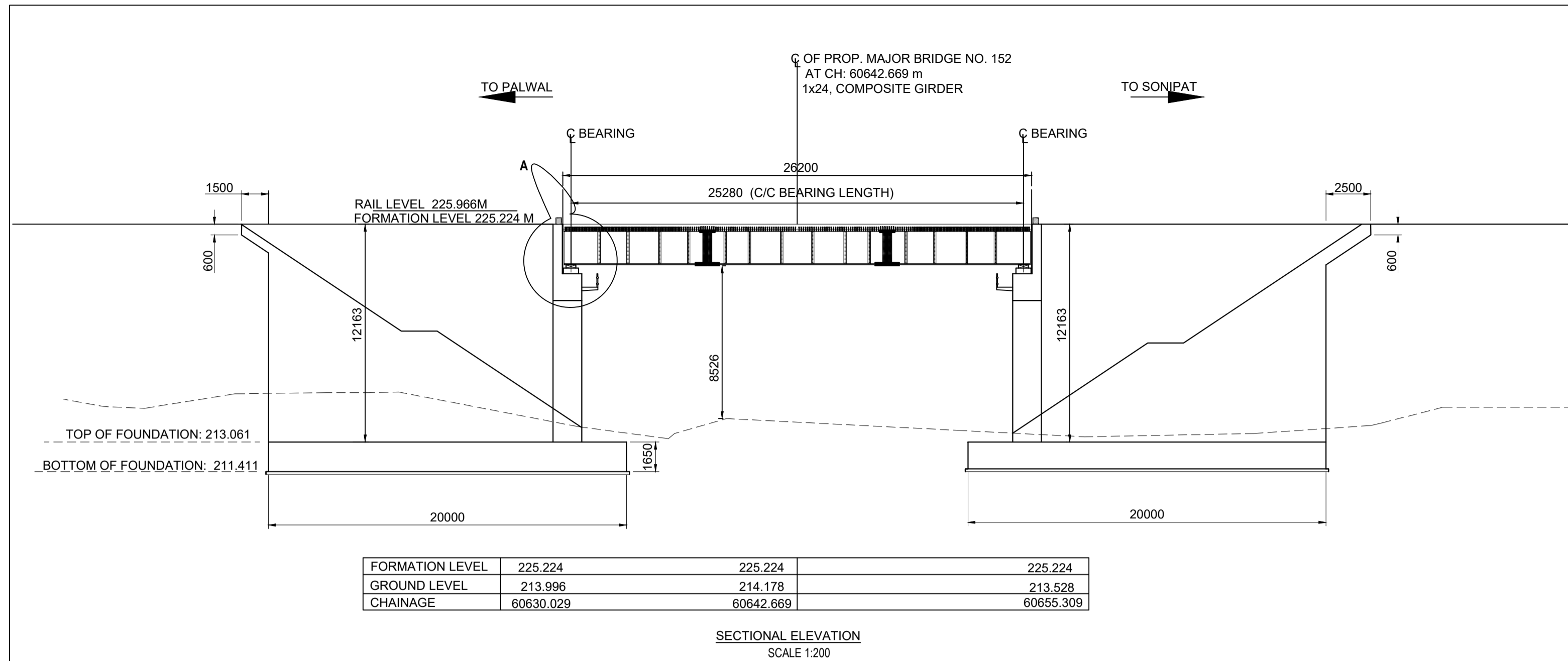


GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO.151,  
 1 x 24.4m COMPOSITE GIRDER AT CH: 60563.367m

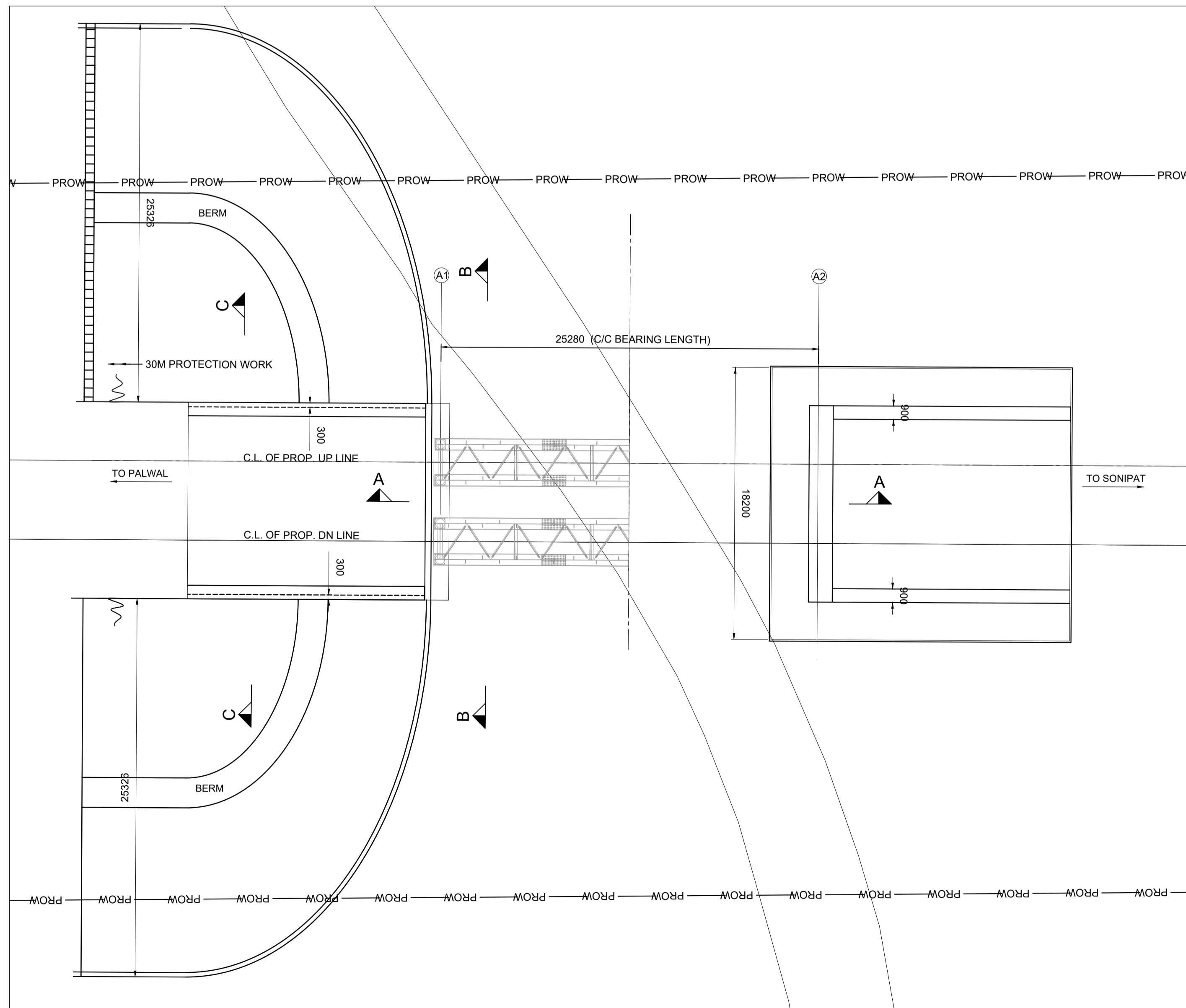
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01151\_A1 **SHEET NO.** 2 OF 2

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



KEY PLAN  
SCALE - N.T.S

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING :- SUPER STRUCTURE-25T, SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL-----M35
    - FOR FOUNDATION -----M35
    - FOR LEVELING COURSE-----M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe-500D CONFORMING TO IS: 1786- 2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL.7.5.2.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRP/M WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE COMPOSITE GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG.NO'S : RDSO/B-11751/R1 TO 11751/8.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE , INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - PATHWAY SHALL BE PROVIDED ON OUTER SIDE OF CG. RDSO DWG. NO. CBS-0046 (FOR CG.) SHALL BE FOLLOWED FOR ARRANGEMENT OF PATHWAY.
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.



PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
 GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



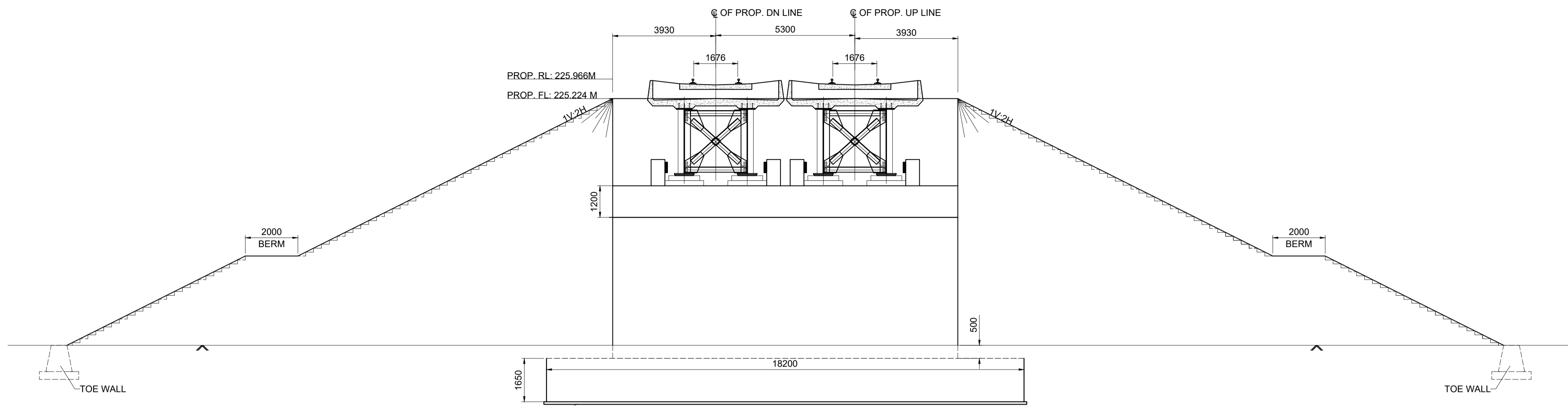
TITLE:- CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
FOR PROPOSED MAJOR RUB NO.152,  
1 x 24.4m COMPOSITE GIRDER AT CH: 60642.669 m

DRG. NO. GC-HRIDC-C2-DRW-BRD-GAD-01152\_A1 SHEET NO. 1 OF 2

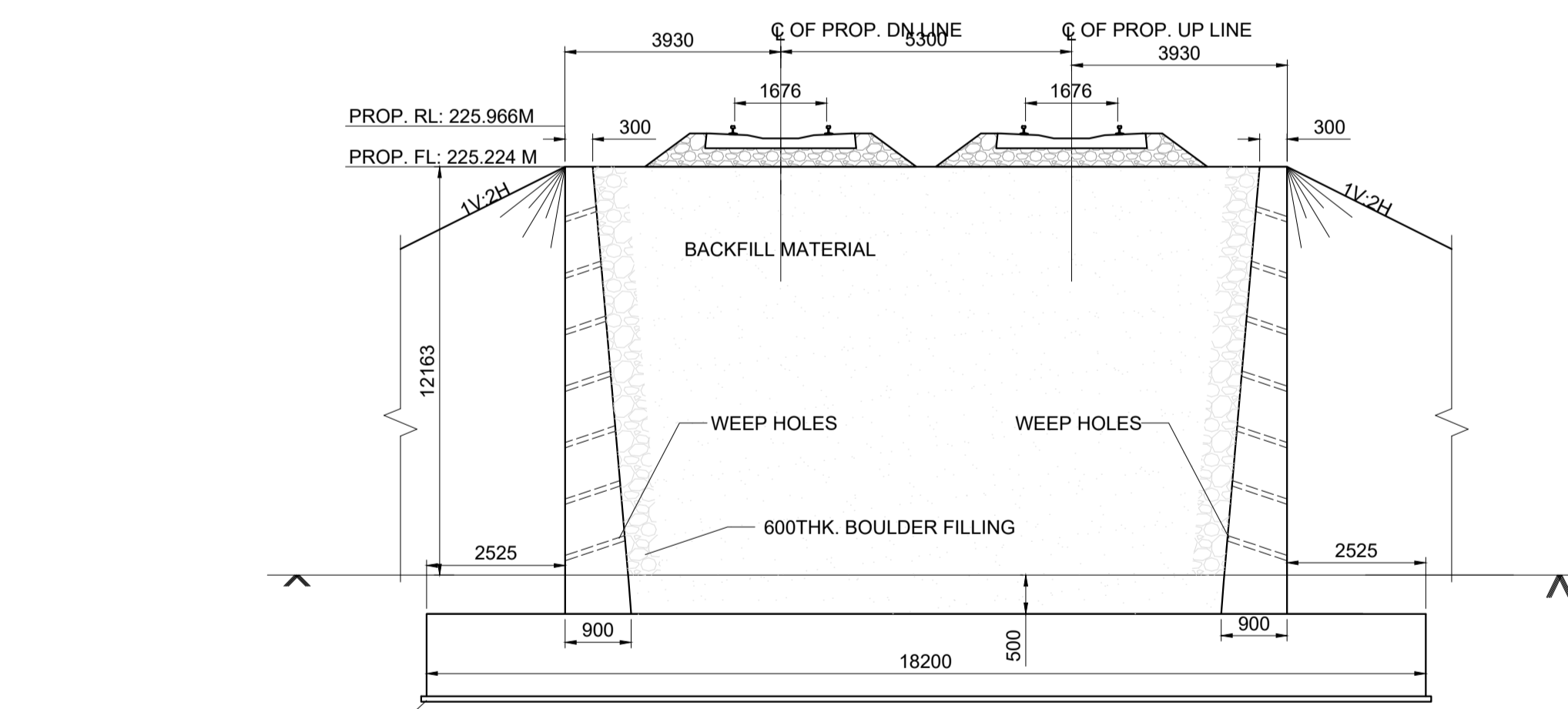
SCALE : AS SHOWN ISSUE DATE 23-06-2022 REVISED DATE 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

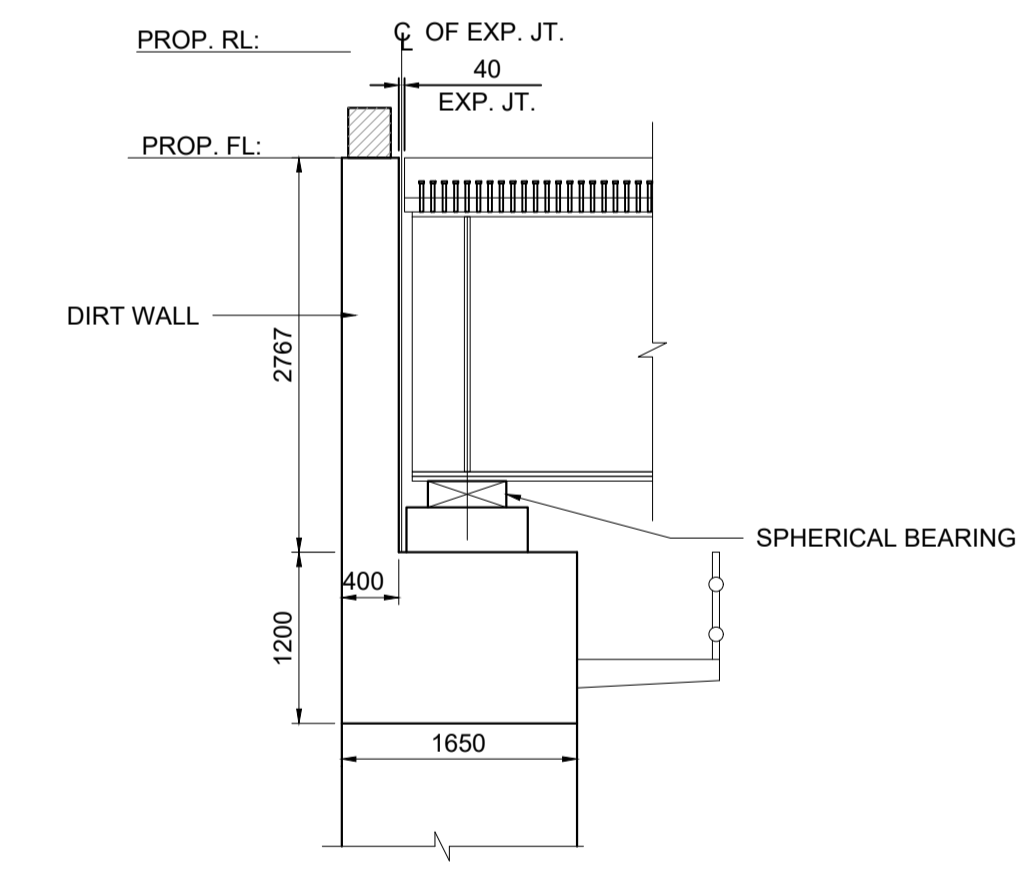
- NOTES:  
 1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER  
 2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED



**SECTION B-B**  
SCALE 1:100



**SECTION C-C**  
SCALE 1:100



**DETAIL-A**  
SCALE 1:50

**PROJECT:**  
 HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pty. Ltd.



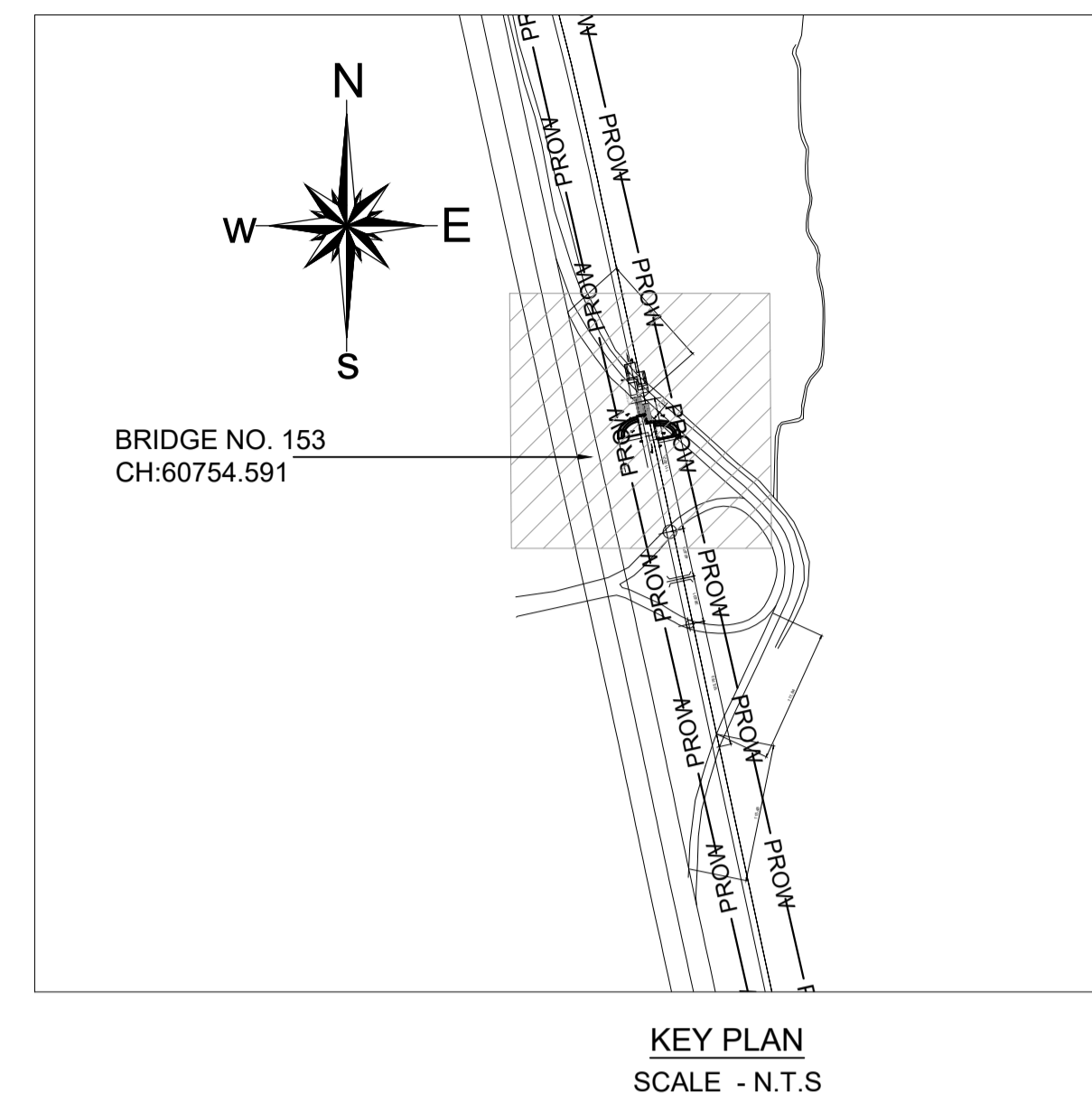
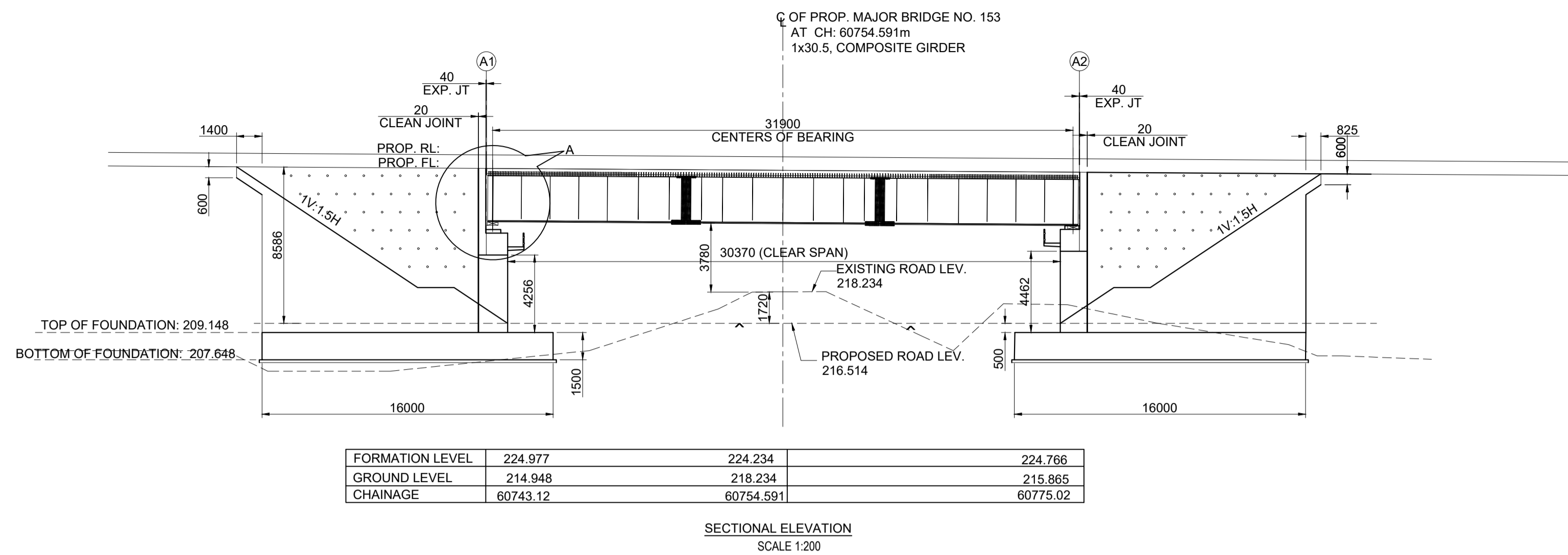
**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO.152,  
 1 x 24.4m COMPOSITE GIRDER AT CH: 60642.669 m

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01152\_A1 **SHEET NO.** 2 OF 2

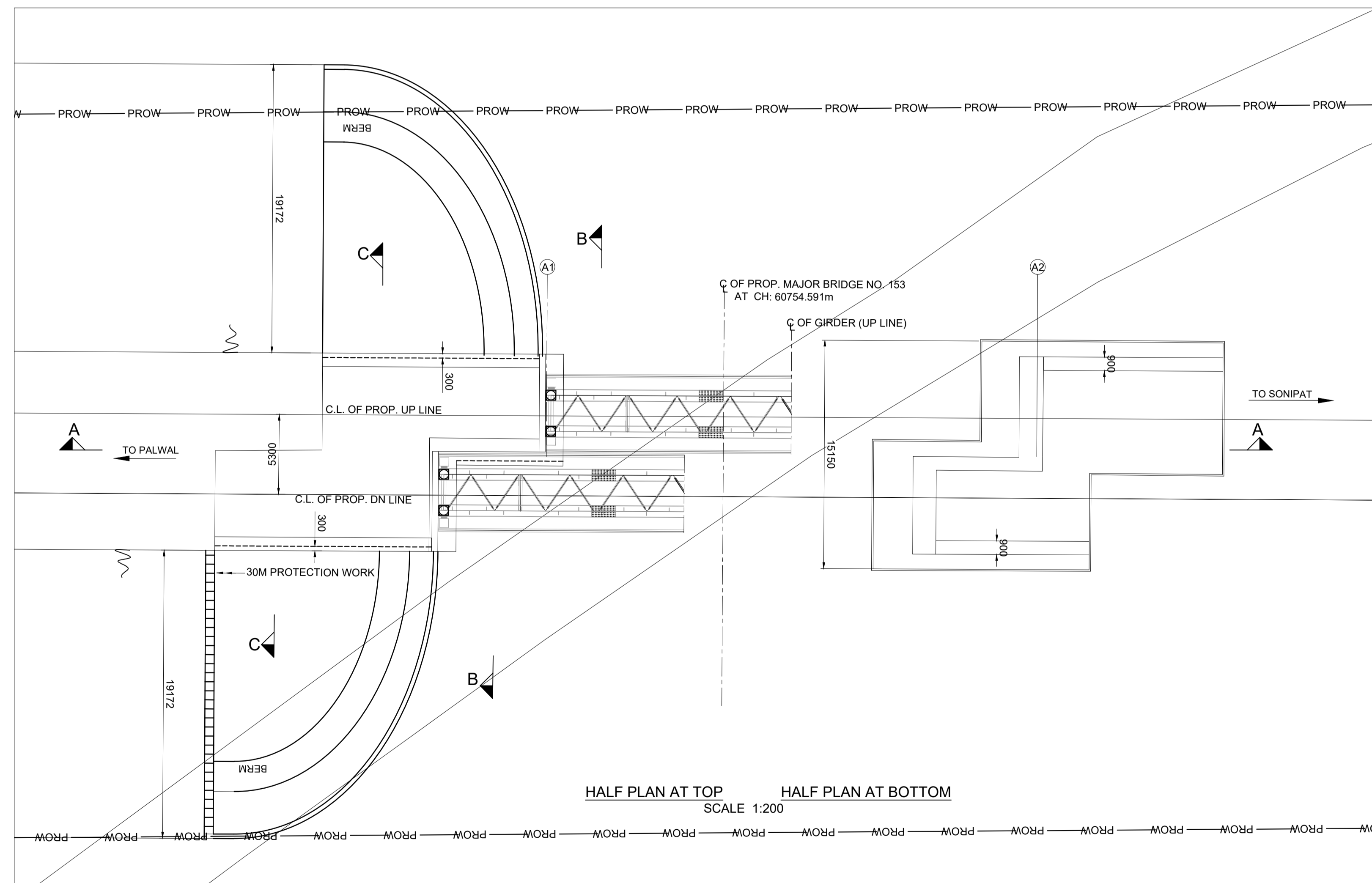
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		





- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING - SUPER STRUCTURE-25T, SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL.....M35
    - FOR FOUNDATION .....M35
    - FOR LEVELING COURSE.....M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE F<sub>y</sub>-500D CONFORMING TO IS: 1786- 2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL. 7.5.2
  - BACK FILL SHALL BE AS PER CL. 7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPVM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE COMPOSITE GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG. NO'S : RDSO/B-11754/R2 TO 11754/6.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - ARRANGEMENT FOR PATHWAY SHALL BE PROVIDED AS PER RDSO DWG. NO. CBS-0046 (FOR CG).
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.
  - EXISTING ROAD SHALL BE FIRST DIVERTED TEMPORARILY TO THE EXSITING ROAD STANDARDS.
  - THEREAFTER EXISTING ROAD SHALL BE LOWERED AS SHOWN IN THE DRAWING. L-SECTION OF LOWERED ROAD SHALL BE GOT APPROVED FROM THE ENGINEER BEFORE START OF WORK.
  - PROTECTIVE BARRIERS FOR ABUTMENTS SHALL BE PROVIDED AS APPROVED BY THE ENGINEER.



**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 **HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  
 **GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

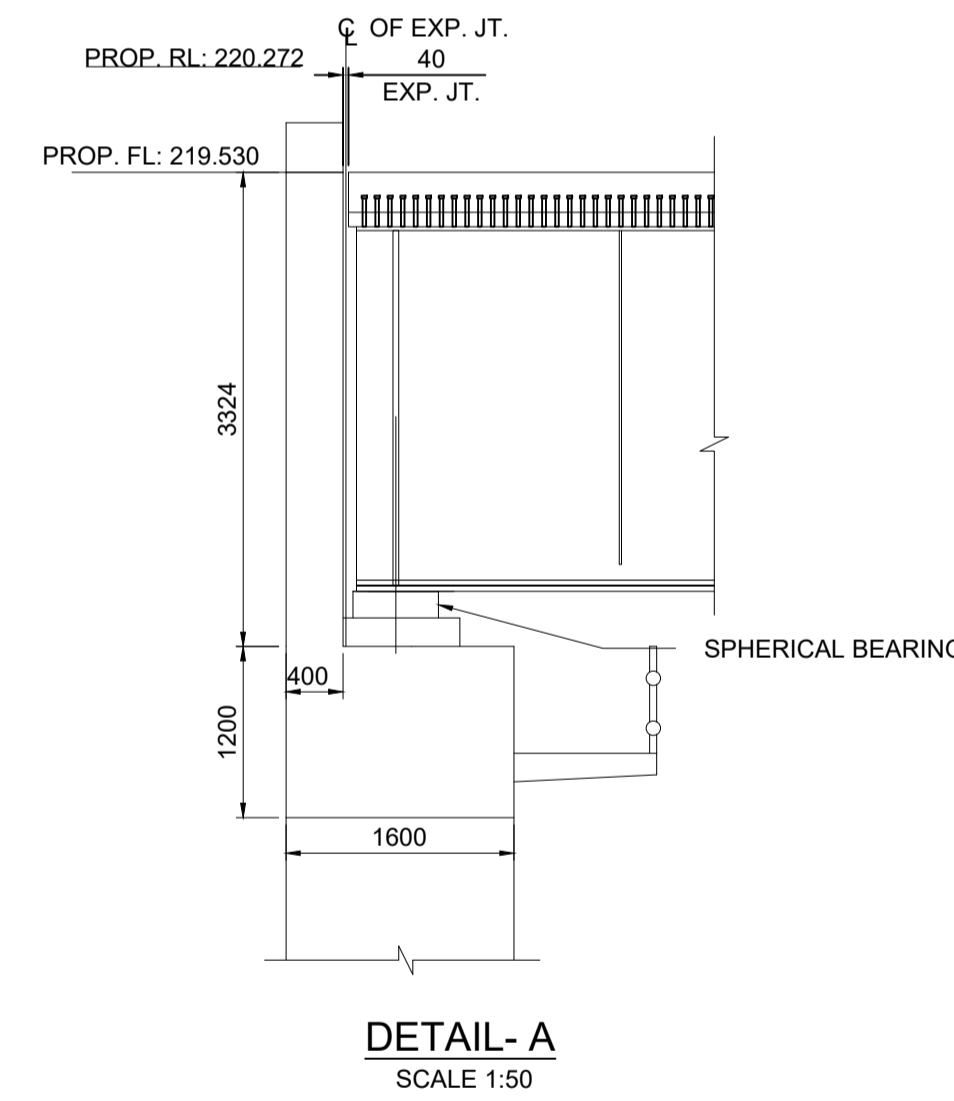
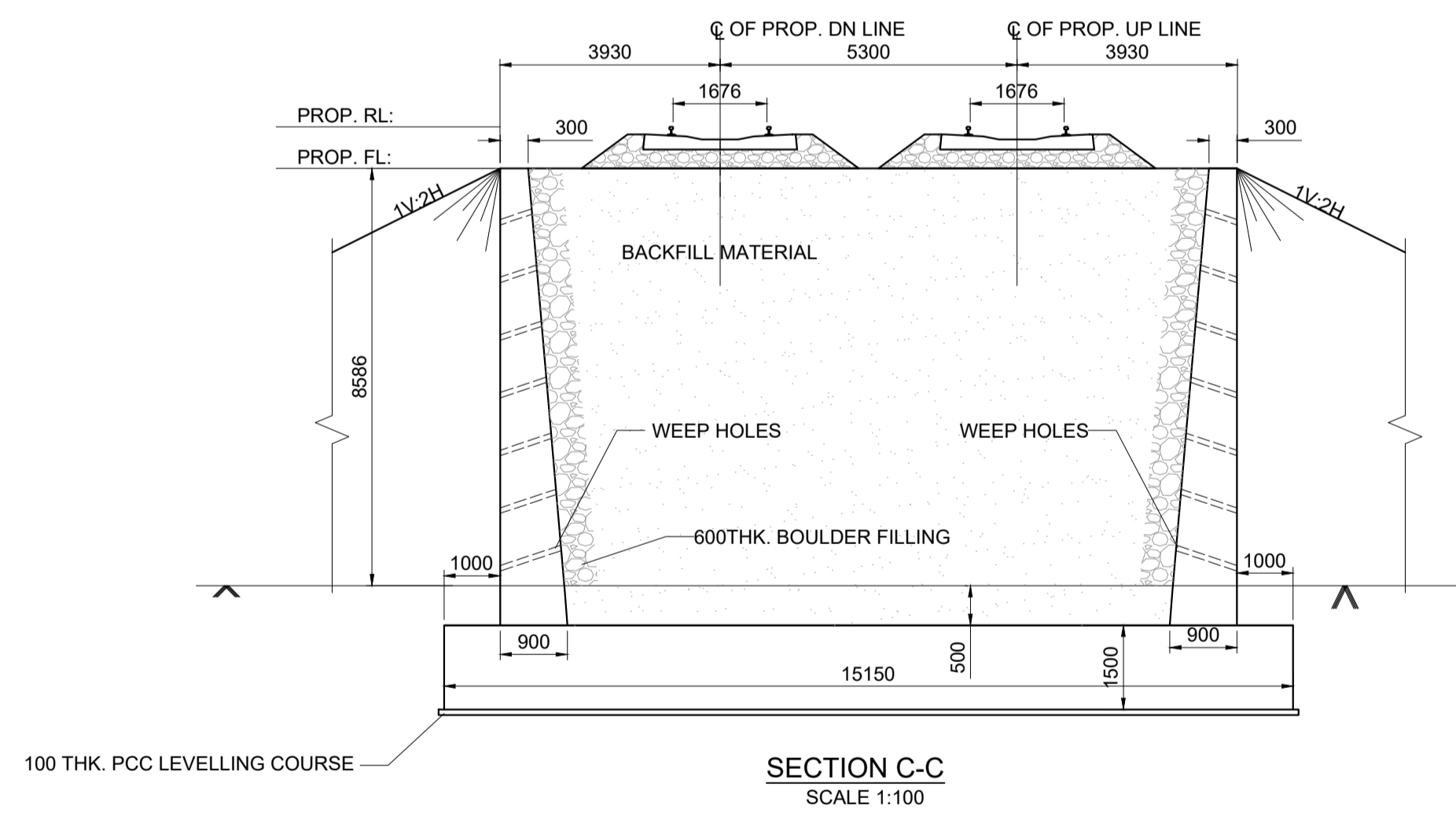
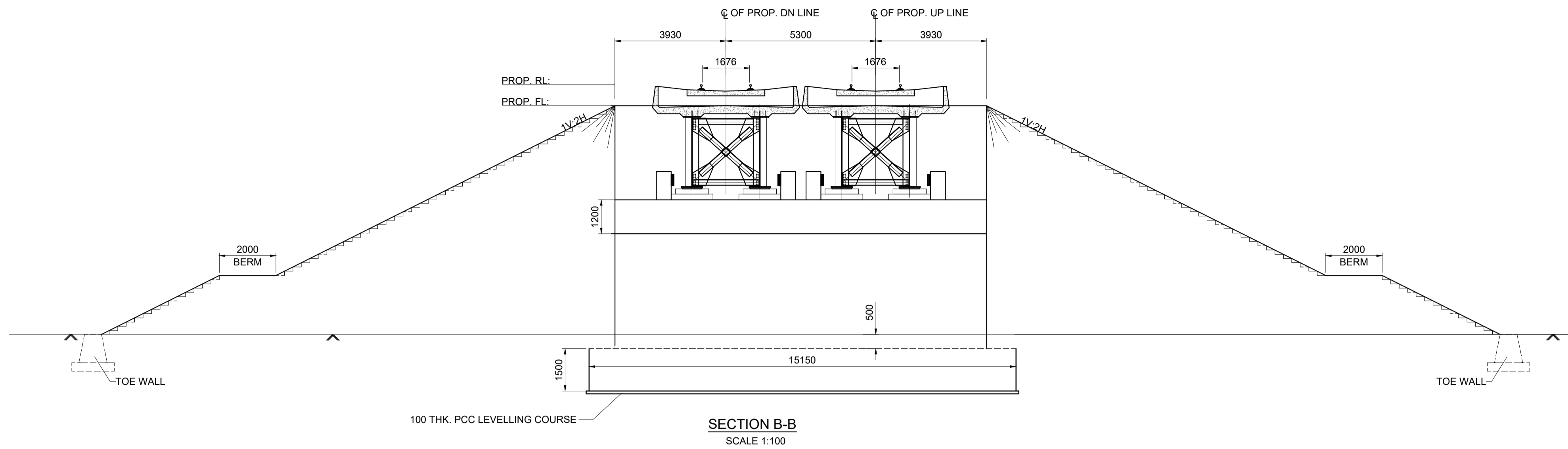
 

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA.M.RAO DGM/C-1	<i>Uma M. Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO.153,  
 1 x 30.5 m COMPOSITE GIRDER AT 60754.591m

<b>DRG. NO.</b> GC-HRIDC-C2-DRW-BRD-GAD-01153_A1	<b>SHEET NO.</b> 1 OF 2
<b>SCALE :</b> AS SHOWN	<b>ISSUE DATE</b> 23-06-2022
	<b>REVISED DATE</b> 29-07-2022

- NOTES:  
 1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER  
 2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED



**PROJECT:**  
 HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pty. Ltd.

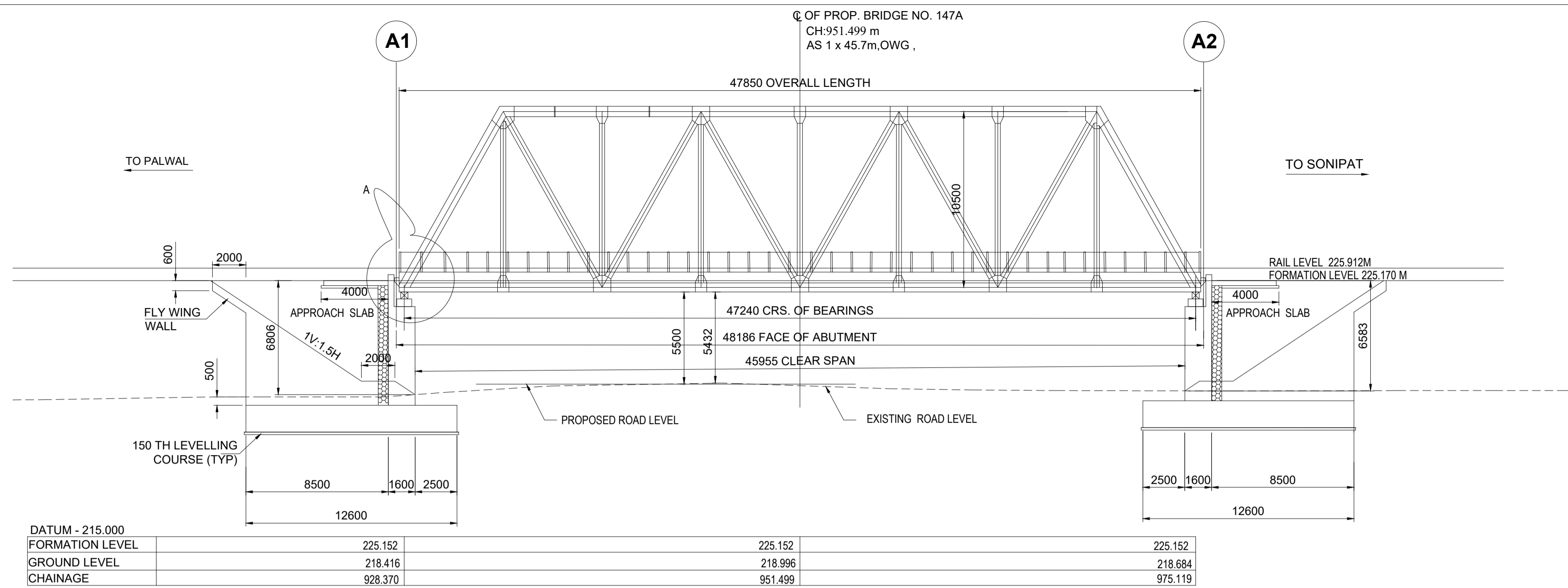


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO.153,  
 1 x 30.5 m COMPOSITE GIRDER AT 60754.591m

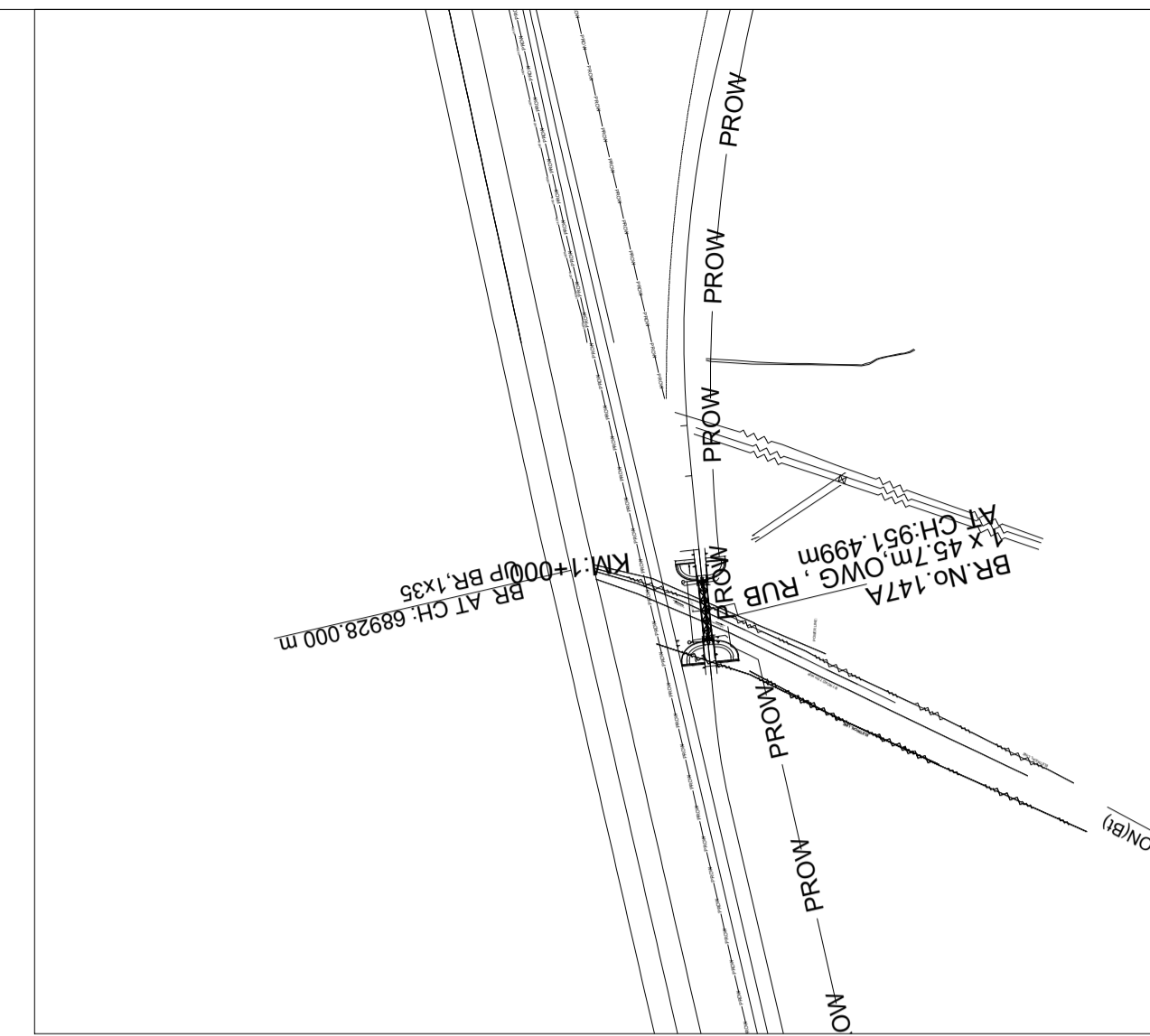
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-01153\_A1 **SHEET NO.** 2 OF 2

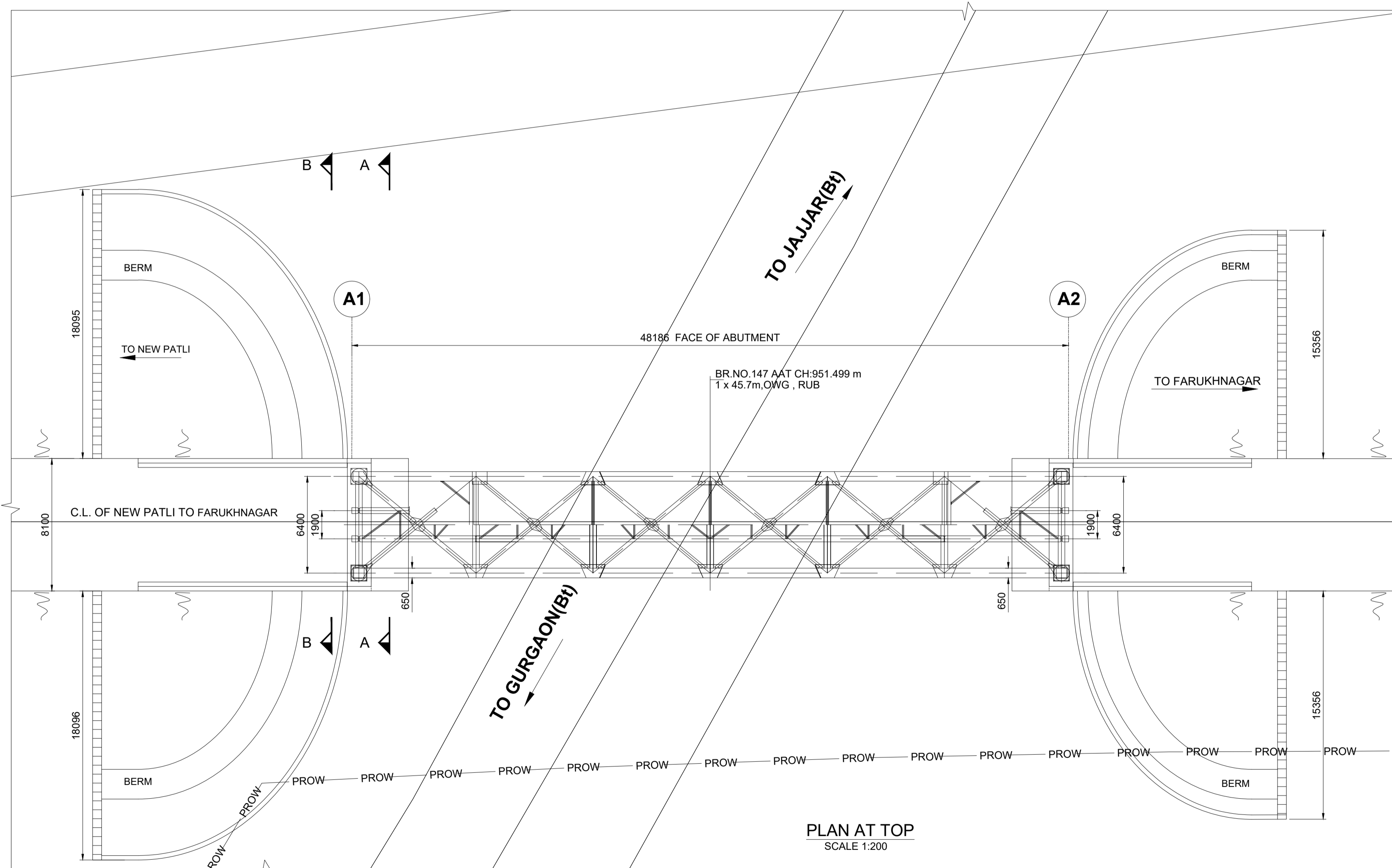
**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022



SECTIONAL ELEVATION  
SCALE 1:200



KEY PLAN  
SCALE 1:NTS



PLAN AT TOP  
SCALE 1:200

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER
  - DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING :- SUPER STRUCTURE-32.5T (RDSO STANDARD OWG), SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE AND TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL-----M35
    - FOR FOUNDATION-----M35
    - FOR LEVELING COURSE-----M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED.
  - MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe-500D CONFORMING TO IS: 1786- 2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL.7.5.2.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM.
  - CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPMM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE OPEN WEB GIRDER SHALL BE IN ACCORDANCE WITH RDSO DRG.NO'S : RDSO/B-17081 TO 17098
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE , DL, INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.
  - ARRANGEMENT FOR PATHWAY SHALL BE PROVIDED AS PER RDSO DWG. NO. CBS-0045 (FOR OWG).
  - SEISMIC ARRESTOR SHALL BE PROVIDED ON THE PIER/ABUTMENT CAP.

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.



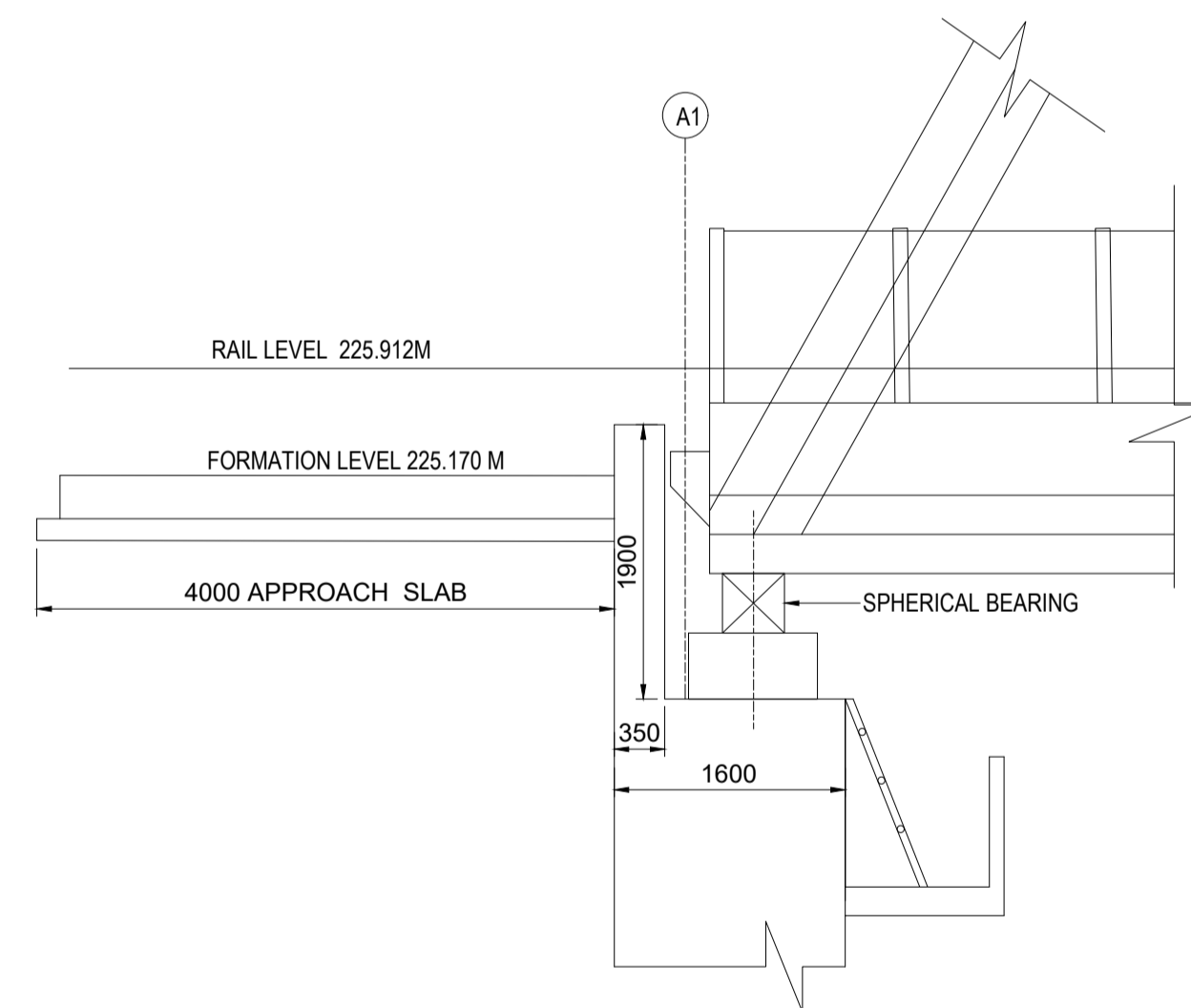
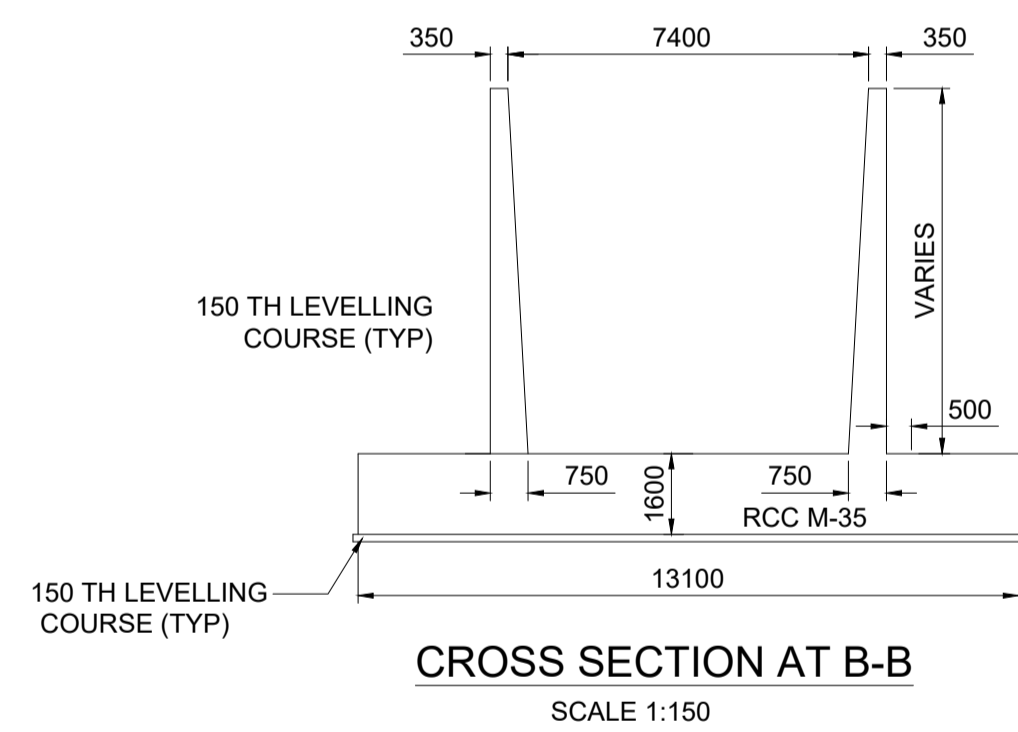
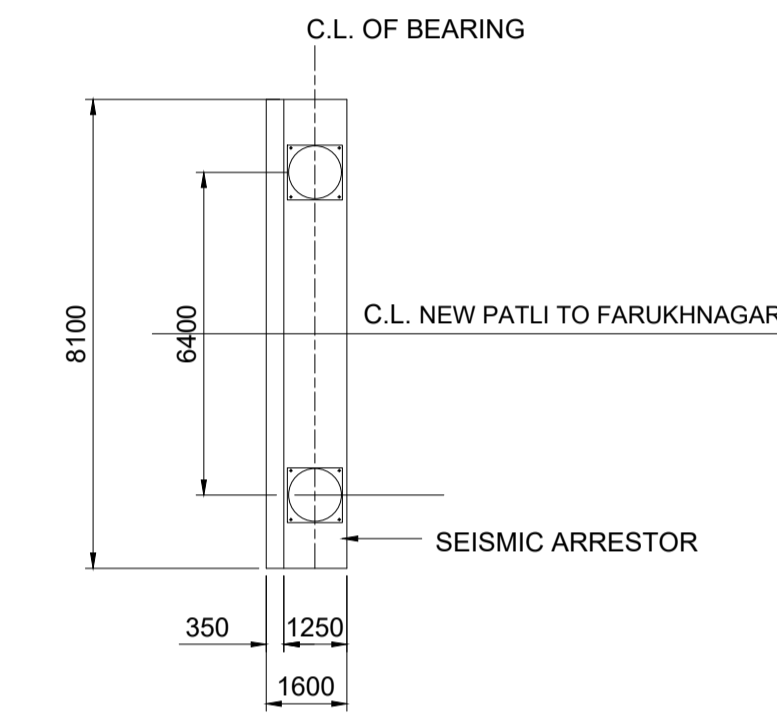
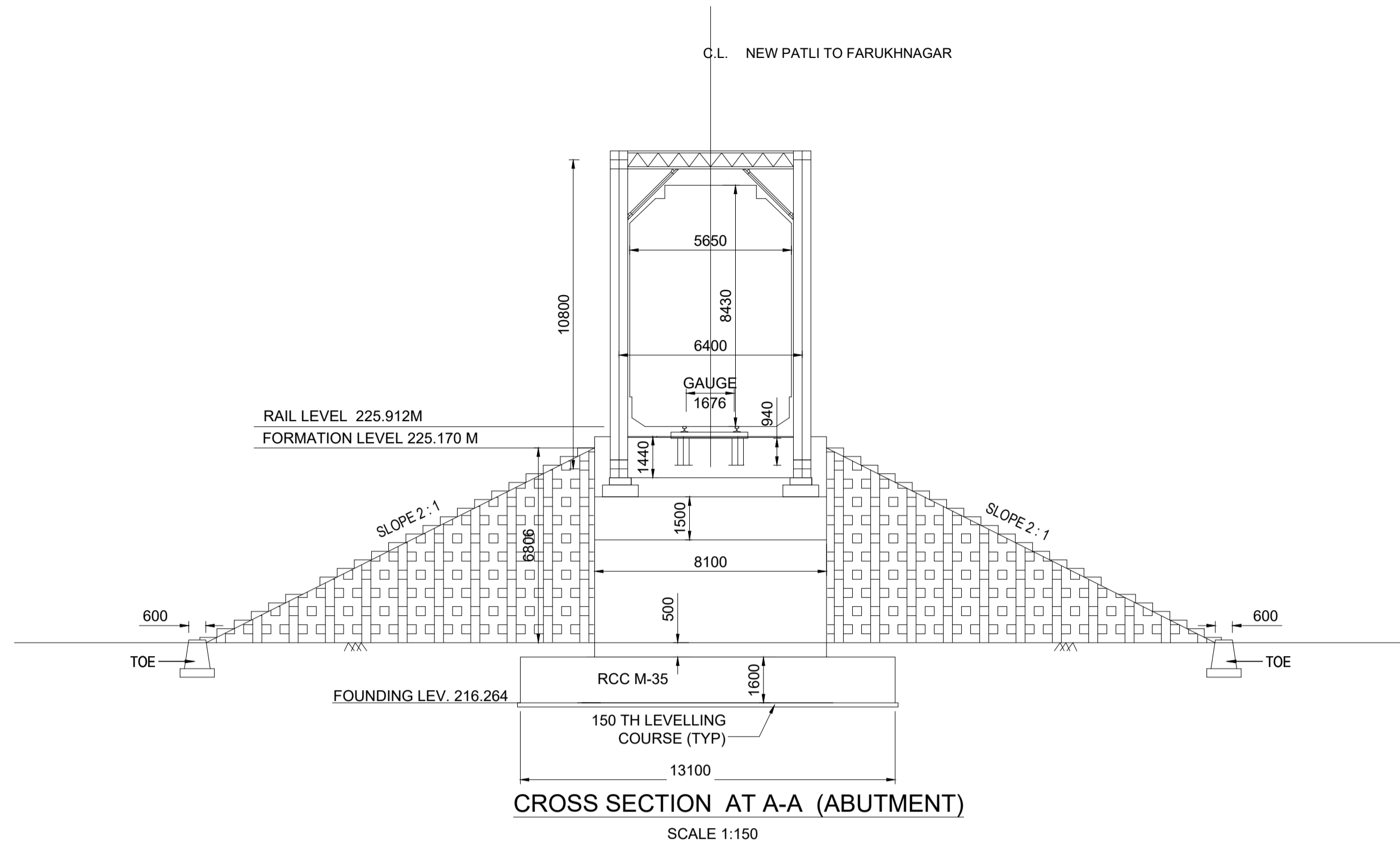
TITLE:- **CONCEPTUAL GENERAL ARRANGEMENT DRAWING FOR PROPOSED MAJOR RUB NO. 1 AT CH:951.499 m x 45.7m, OPEN WEB GIRDER (CONNECTING LINE NEW PATLI TO SULTANPUR)**

DRG. NO. **GC-HRIDC-C2-DRW-BRD-GAD-04001\_A1** SHEET NO. **1 OF 2**

SCALE : **AS SHOWN** ISSUE DATE **23-06-2022** REVISED DATE **29-07-2022**


GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

- NOTES:  
 1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER  
 2. DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED



**PROJECT:**  
 HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pty. Ltd.

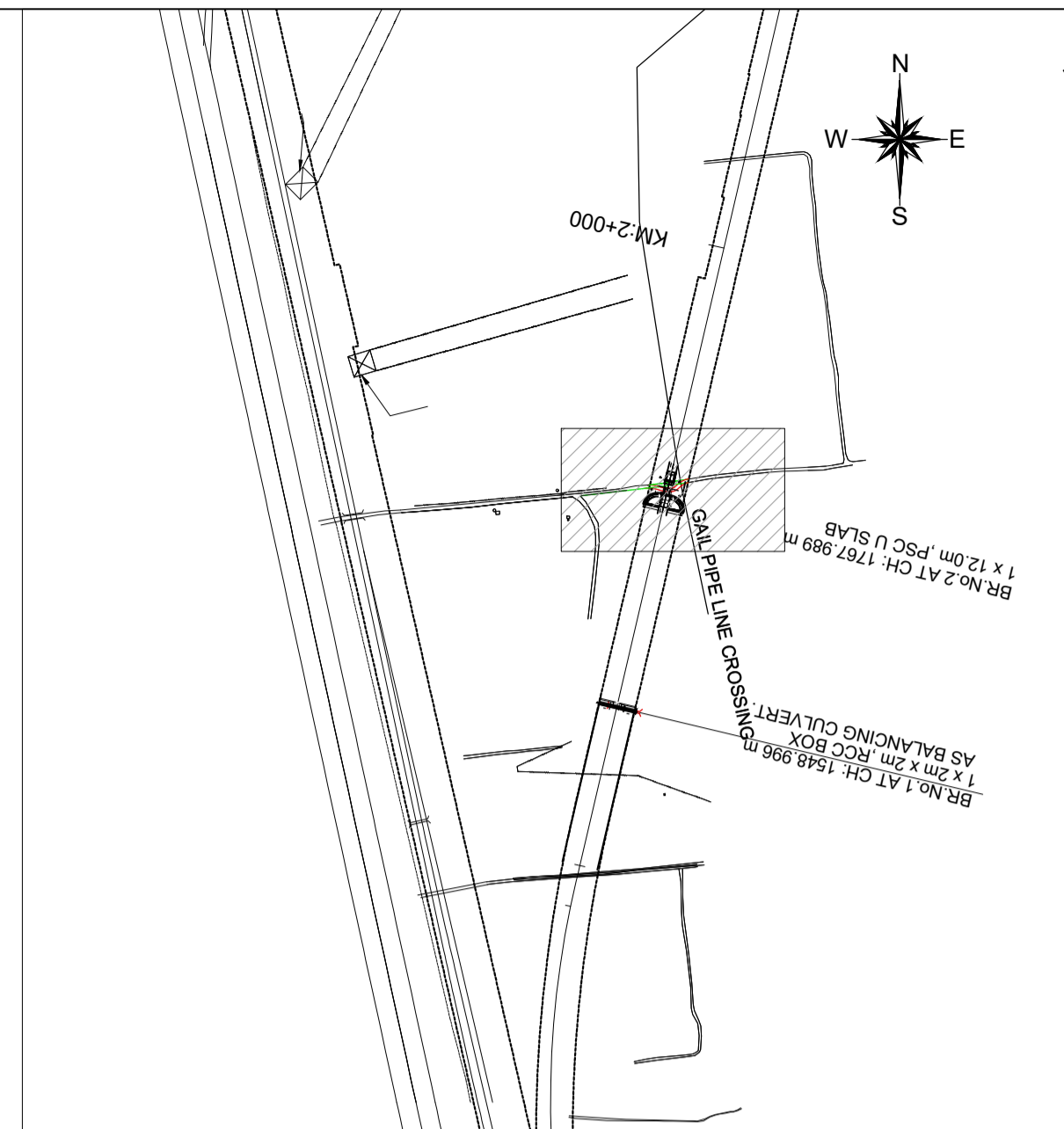
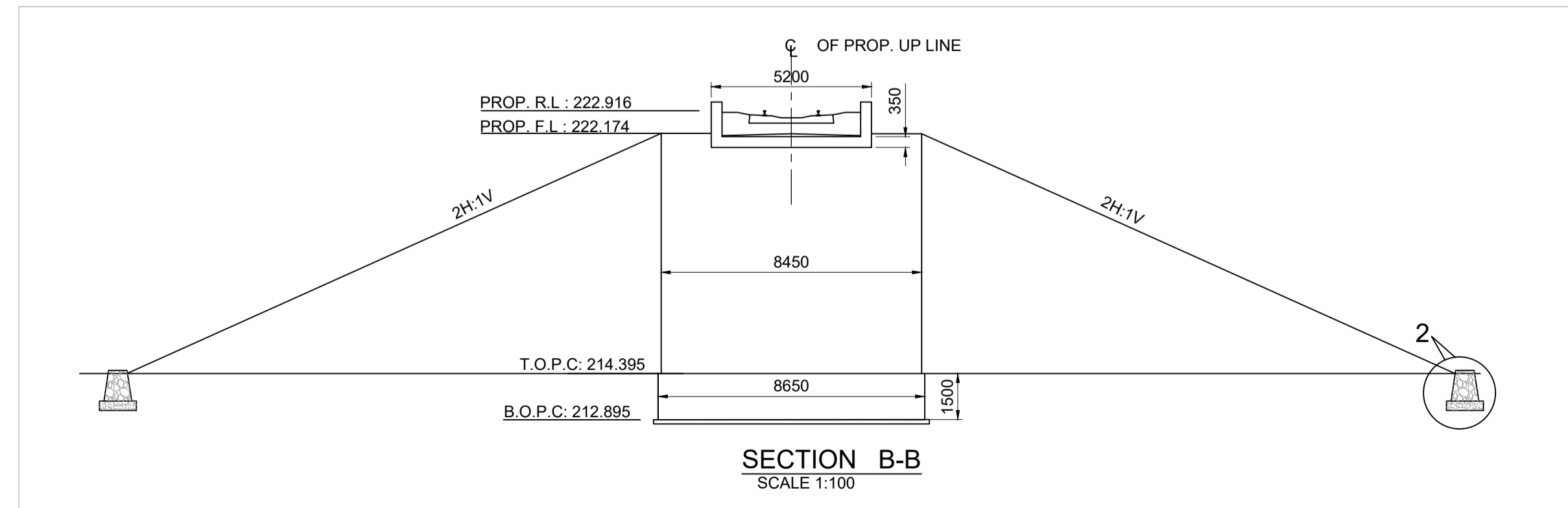
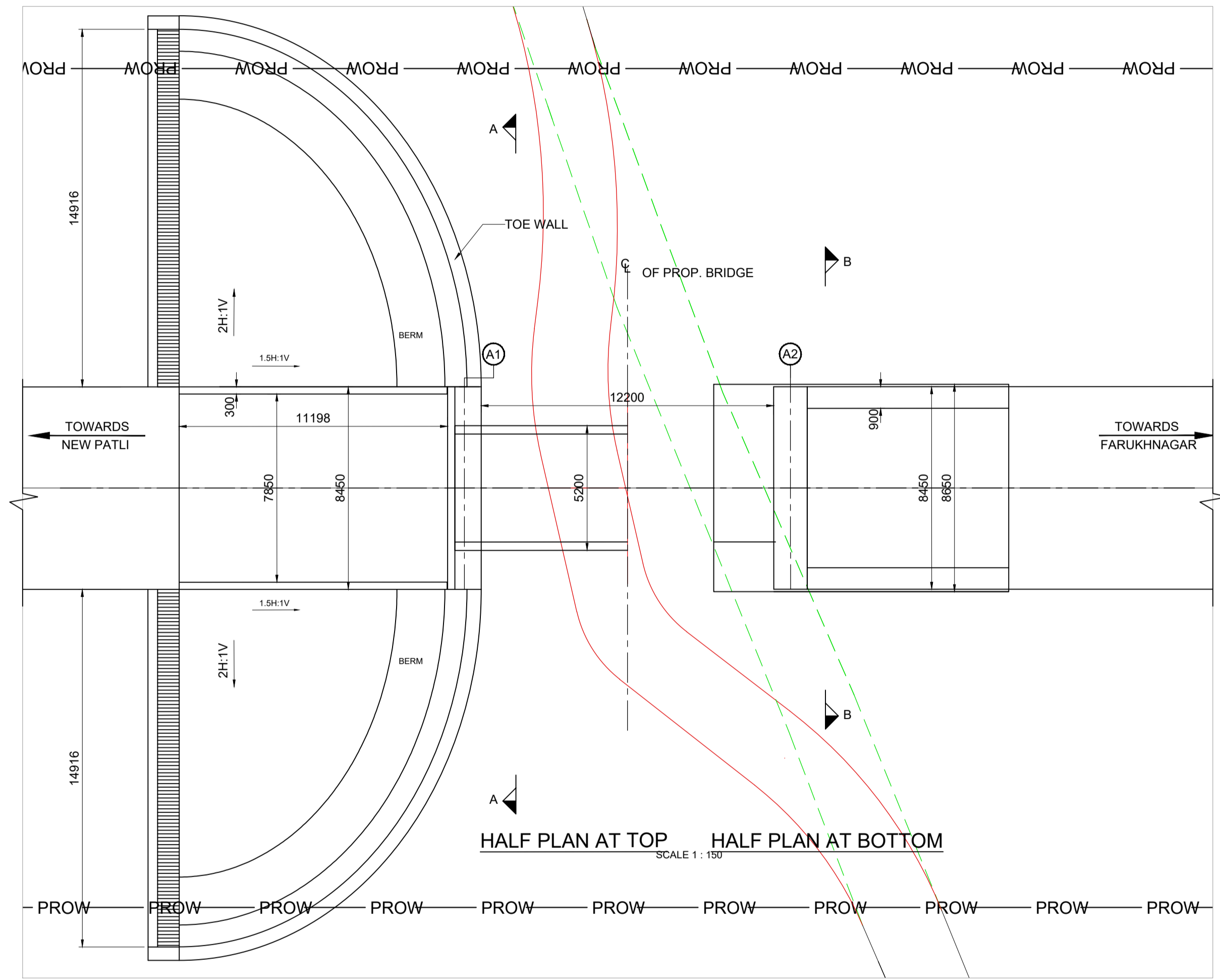
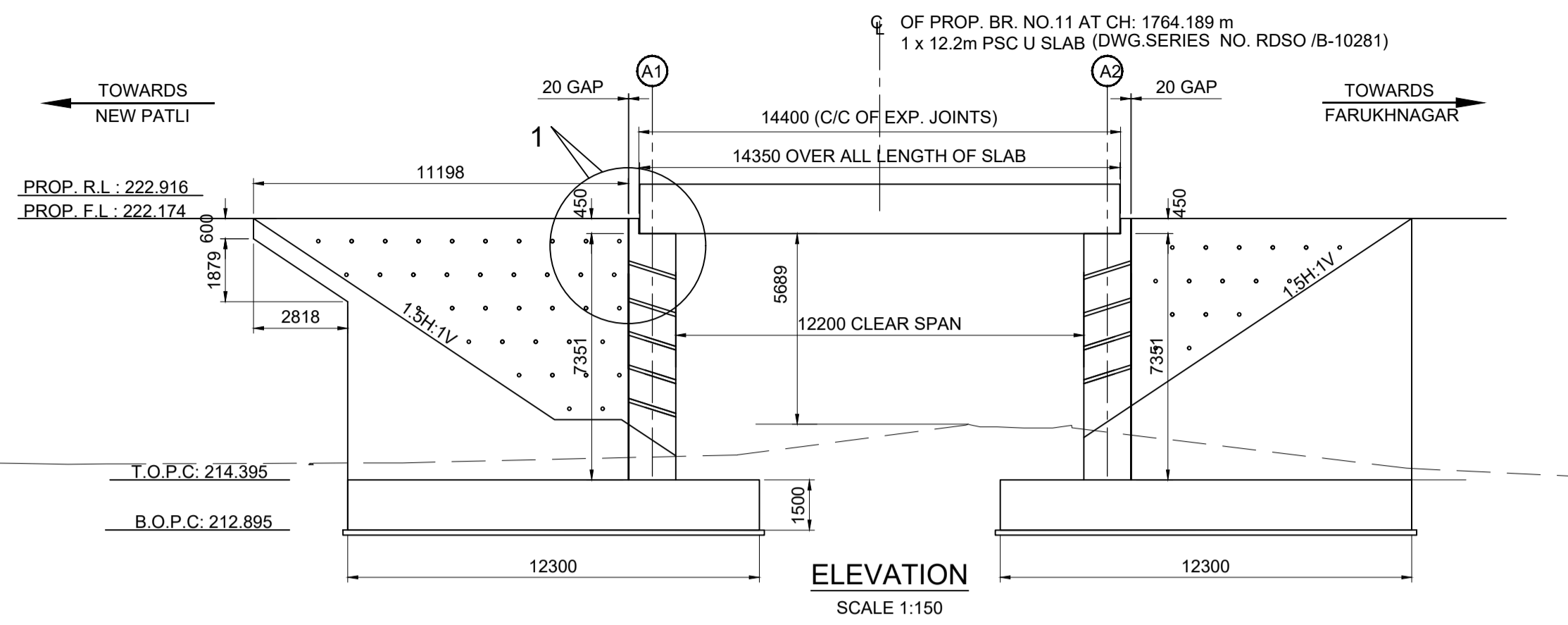


**TITLE:-** CONCEPTUAL GENERAL ARRANGEMENT DRAWING  
 FOR PROPOSED MAJOR RUB NO. 1 AT CH:951.499 m 1 x  
 45.7m, OPEN WEB GIRDER(CONNECTING LINE NEW PATLI  
 TO SULTANPUR)

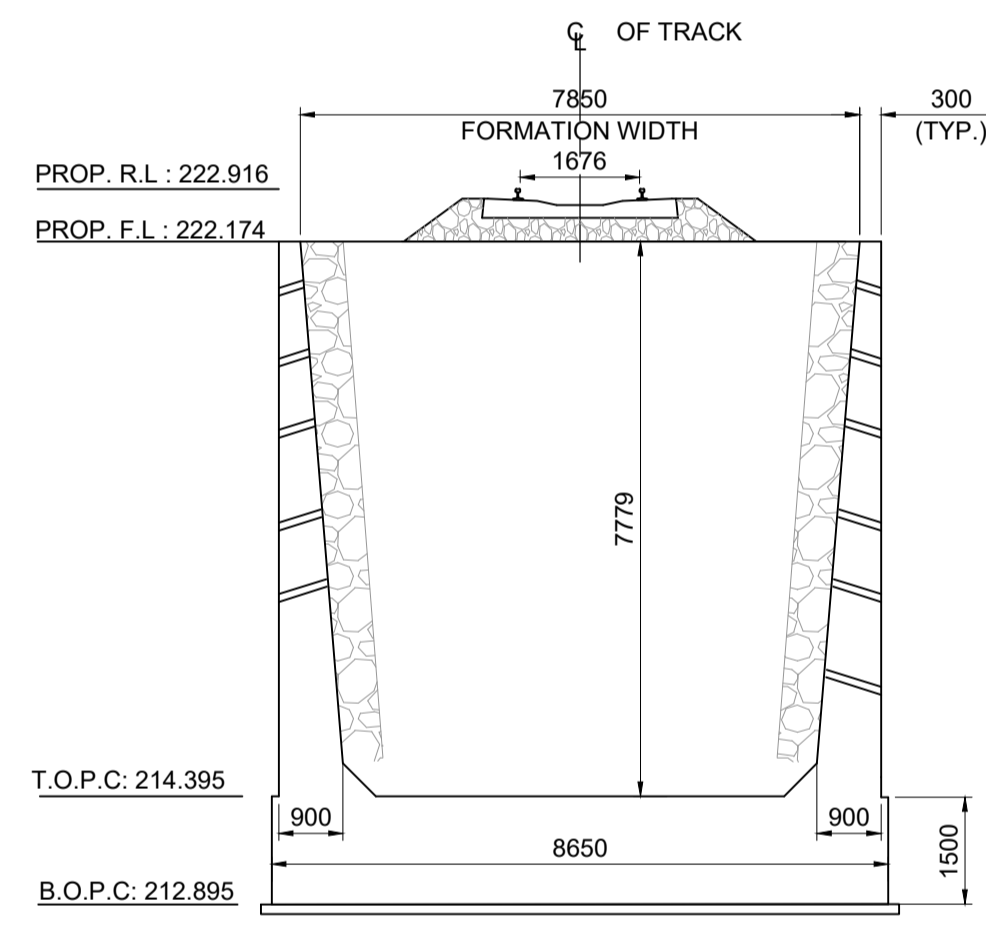
**DRG. NO.** GC-HRIDC-C2-DRW-BRD-GAD-04001\_A1 **SHEET NO.** 2 OF 2

**SCALE :** AS SHOWN **ISSUE DATE** 23-06-2022 **REVISED DATE** 29-07-2022

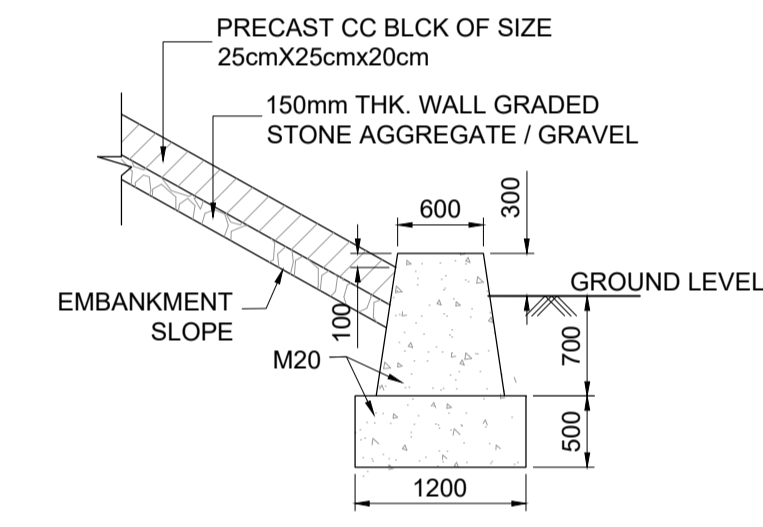
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA M. RAO DGM/C-1	<i>Uma M. Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		



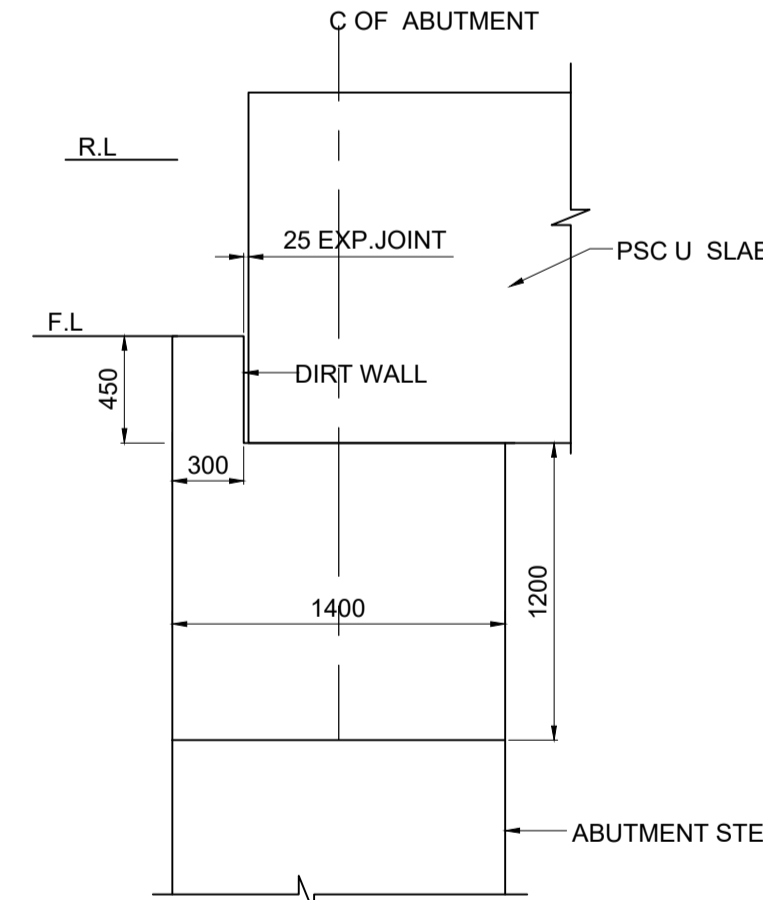
KEY PLAN  
SCALE 1:NTS



SECTION A-A  
SCALE 1:100



DETAIL -2  
SCALE 1:50  
TOE WALL AND PITCHING



DETAIL -1  
SCALE 1:30

- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METER DIMENSIONS ARE NOT TO BE SCALED ONLY WRITTEN DIMENSIONS TO BE FOLLOWED
  - DESIGN CRITERIA
    - IRS BRIDGE SUBSTRUCTURE AND FOUNDATION CODE 2013.
    - IRS CONCRETE BRIDGE CODE 2014.
    - IRS BRIDGE RULES 2014.
    - IS 2911 PART-1 SECTION-2.
    - EXPOSURE CONDITION - MODERATE.
    - SEISMIC ZONE - IV
    - STANDARD OF LOADING :- SUPER STRUCTURE-25T (RDSO STANDARD) & SUB STRUCTURE-32.5T- 2008 LOADING.
  - THE STRUCTURAL DIMENSIONS AND SIZES ARE INDICATIVE AND THESE MAY VARY DURING DETAIL DESIGN.
  - SIZE & TYPE OF FOUNDATION SHOWN IS TENTATIVE AND MAY CHANGE DURING DETAILED DESIGN.
  - ALL RCC AND CC WORKS SHALL BE DONE IN ACCORDANCE WITH SPECIFICATION LAID DOWN IN IRS CONCRETE BRIDGE CODE.
  - THE GRADE OF CONCRETE
    - FOR ABUTMENT, DIRT & RETURN WALL-----M35
    - FOR FOUNDATION-----M35
    - FOR LEVELING COURSE-----M20
  - ALL CONCRETE WORK SHALL BE MECHANICALLY MIXED AND VIBRATED. MIX DESIGN SHALL BE APPROVED BY ENGINEER - IN CHARGE.
  - HIGH YIELD STRENGTH DEFORMED BARS OF GRADE Fe-500D CONFORMING TO IS: 1786-2008 SHALL BE USED AS REINFORCEMENT.
  - BED LEVEL & ROAD LEVEL, FORMATION LEVEL AND RAIL LEVEL & ALIGNMENT SHALL BE VERIFIED BY THE ENGINEER AT SITE BEFORE EXECUTION OF WORK.
  - ANGLE OF INTERNAL FRICTION OF BACK FILL SHALL NOT BE LESS THAN 35.
  - PROTECTION WORK ON SLOPES OF BANK UP TO 30M, BOTH SIDES ON APPROACHES OF BRIDGE SHALL BE DONE AS PER SKETCH NO. GC-HRIDC-SK-GEN-015.
  - BOULDER FILLING & BOULDER PACKING BEHIND ABUTMENT TO BE DONE AS PER IRS FOUNDATION & SUBSTRUCTURE CODE CL.7.5.2.
  - BACK FILL SHALL BE AS PER CL.7.5 OF IRS BRIDGE SUBSTRUCTURE & FOUNDATION CODE 2013.
  - 75mm DIA WEEP HOLES TO BE PROVIDED @1000 C/C HORZ. AND 1000 MM C/C VERTICALLY ABOVE LOWEST WATER LEVEL IN RETURN WALL AS PER IRS SUB STRUCTURE CODE CLAUSE 7.6.
  - ALL RCC SURFACES COMING IN CONTACT WITH SOIL SHOULD BE PAINTED WITH BITUMEN OR COAL TAR OF APPROVED QUALITY @ 1.464 KG/SQM. CURING SHALL BE DONE AS PER CLAUSE NO 8.4 OF IRS CONCRETE BRIDGE CODE.
  - SAFETY & PROTECTION OF THE PROPOSED WORK IS TO BE ENSURED BY THE CONTRACTOR AS PER PARA 826 OF IRPVM WITH UPDATED CORRECTION SLIPS OF 2011-12.
  - THE SPECIFICATIONS FOR THE PSC U SLAB SHALL BE IN ACCORDANCE WITH RDSO DRG NO'S : RDSO 10281/1 AND 10281/2.
  - CONCRETING SHALL BE DONE IN ACCORDANCE WITH IRS CONCRETE BRIDGE CODE WITH 20MM MAXIMUM SIZE AGGREGATE.
  - ALL DIMENSIONS AND LEVELS SHOULD BE VERIFIED AT SITE BEFORE EXECUTION.
  - BRIDGE DETAILS LIKE , DL, INSPECTION STEPS PAINTINGS ETC SHOULD BE FOLLOWED AS PER BRIDGE MANUAL, DURING CONSTRUCTION.
  - THIS DRAWING IS PROPERTY OF HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED (HRIDC) AND EXCLUSIVE USE OF HRIDC.

LEGEND

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL
—	PROPOSED
- - -	DISMANTEL

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
RITES Limited in consortium with SMEC International Pty. Ltd.

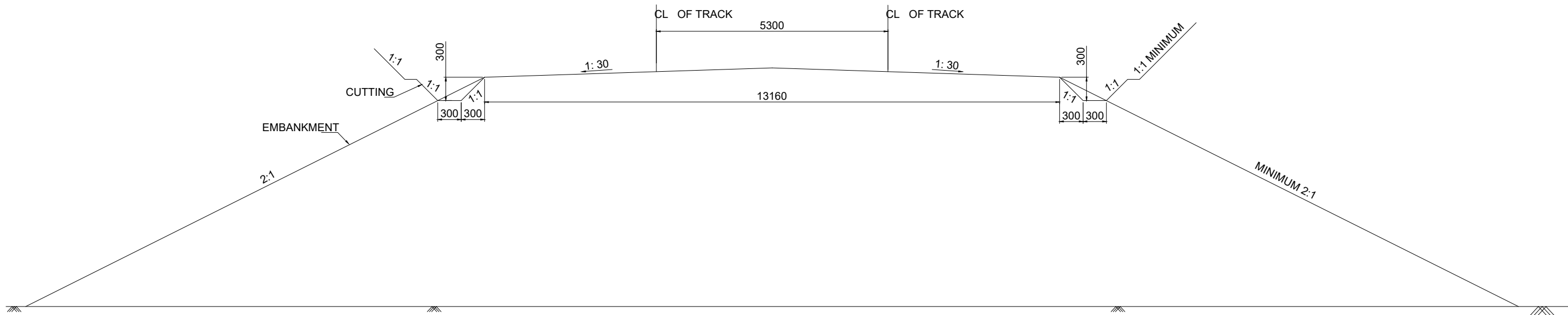


TITLE:- **CONCEPTUAL GENERAL ARRANGEMENT DRAWING**  
FOR PROPOSED MAJOR RUB NO. 3, 1 x 12.2m PSC U SLAB AT CH.1767.989 (CONNECTING LINE NEW PATLI TO SULTANPUR)

DRG. NO. **GC-HRIDC-C2-DRW-BRD-GAD-04003\_A1** SHEET NO. **1 OF 1**

SCALE : **AS SHOWN** ISSUE DATE **23-06-2022** REVISED DATE **29-07-2022**

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		



**TYPICAL EMBANKMENT/CUTTING PROFILE**

**NOTE**  
 1. ALL DIMENSION ARE IN MM.  
 2. CROSS SLOPE OF 1 IN 30 SHALL BE PROVIDED.  
 3. MINIMUM FORMATION WIDTH OF 13160 MM SHALL BE ENSURED IN BOTH EMBANKMENT AND IN CUTTING (EXCLUDING SIDE DRAIN)  
 4. ON CURVES CENTER TO CENTER DISTANCE BETWEEN TWO TRACK SHALL BE INCREASED AS PER IRSOD.

**PROJECT:**  
 HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
 RITES Limited in consortium with SMEC International Pty. Ltd.

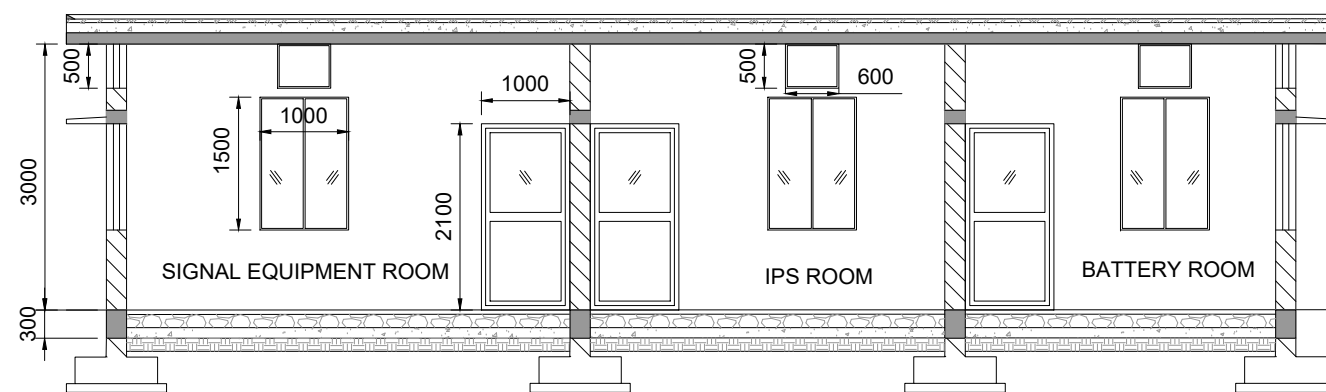
 THE INFRASTRUCTURE PEOPLE  Member of the Surline Jurong Group

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA M.RAO DGM/C-1	<i>U</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

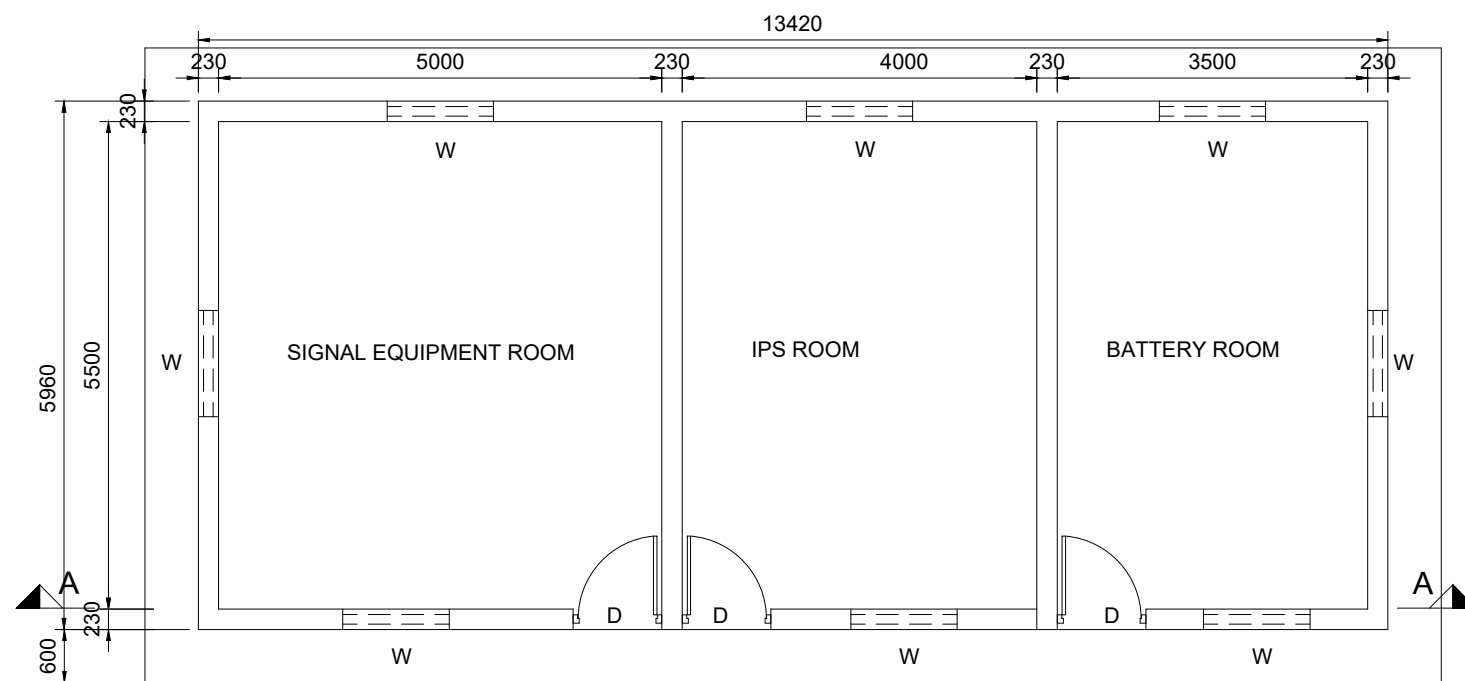
**TITLE:-** CONCEPTUAL PLAN  
 TYPICAL EMBANKMENT/CUTTING PROFILE

**SKETCH NO.** GC-HRIDC-SK-GEN-001 **SHEET NO.** 1OF1

**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022



**SECTIONAL ELEVATION A-A**  
(SCALE 1:100)




**PLAN**  
(SCALE 1:100)


**SCHEDULE**

DOOR	2100x1000
WINDOW	1000x1500
TILATOR	600x500

**NOTES:**  
1. ALL DIMENSIONS ARE IN MILLIMETERS.






**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:-** CONCEPTUAL PLAN  
S & T HUT

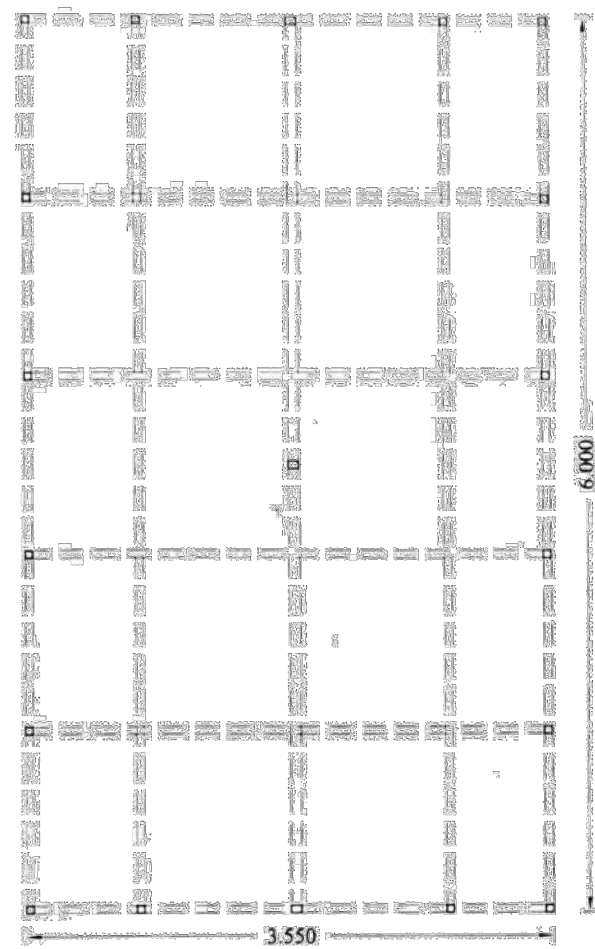
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NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			

**SKETCH NO.**  
GC-HRIDC--SK-GEN-002

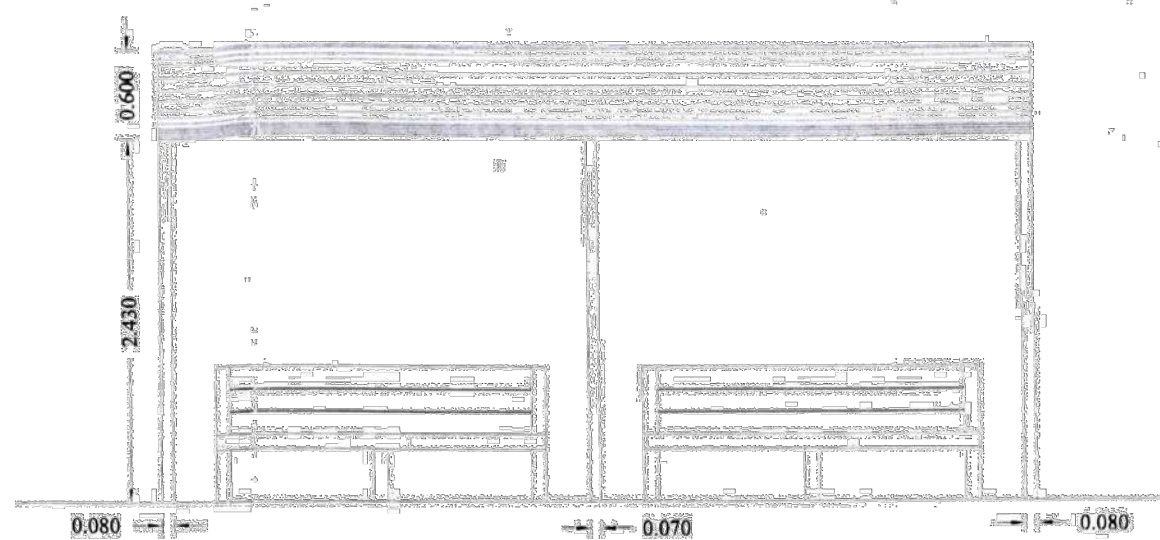
**SHEET NO.**  
1OF1

**SCALE :** AS SHOWN

<b>ISSUE DATE</b> 23.06.2022	<b>REVISED DATE</b> 29.07.2022
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PLAN



FRONT VIEW


Note:-

- 1- All dimensions are in meter unless otherwise mentioned in the drawing.
- 2- 6mm thick Multi-wall Translucent Polycarbonate sheet both side UV Protected and in curved shape including Aluminum top and bottom profile with EPDM gasket, their fixing with M.S. Pipe purlins self tapping screw etc. on structure roof of shelter
- 3- This sketch is only for architectural purpose. Hollow Circular/ square/ rectangular sections of M.S. shall be used. Size mentioned in the drawing are tentative and shall be as per detailed design.

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  

**HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

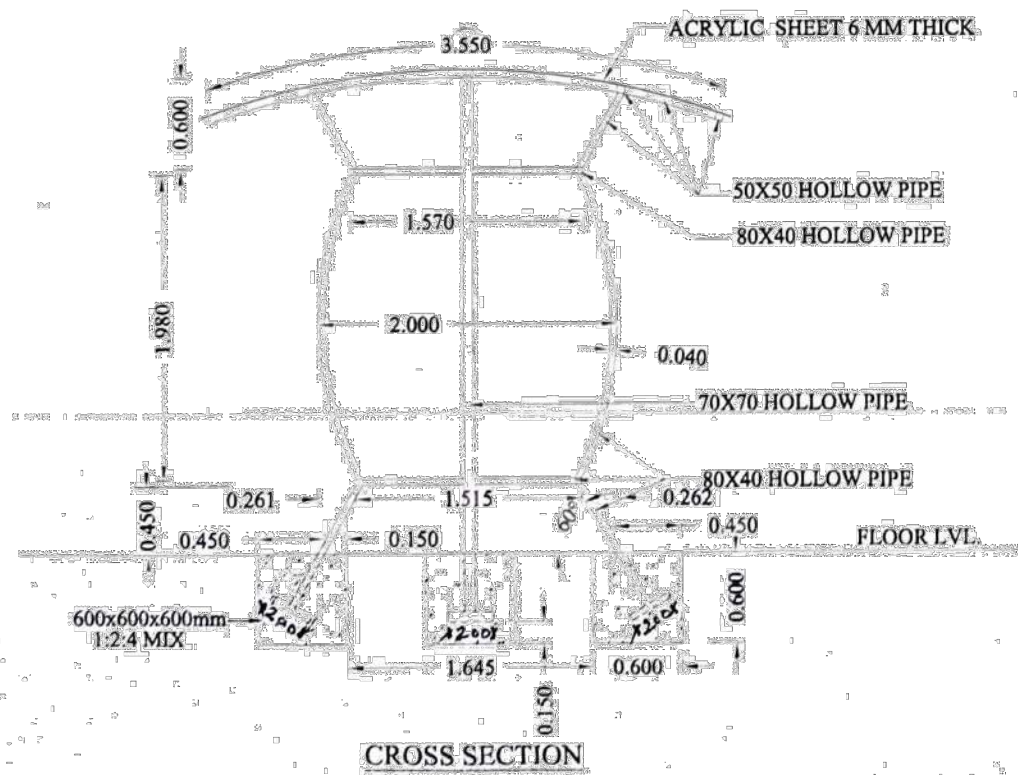
CONSULTANT:  

**GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.



TITLE:- **CONCEPTUAL PLAN  
 MINI PLATFORM SHELTER**

SKETCH NO. **GC-HRIDC-SK-GEN-003** SHEET NO. **1 OF 1**

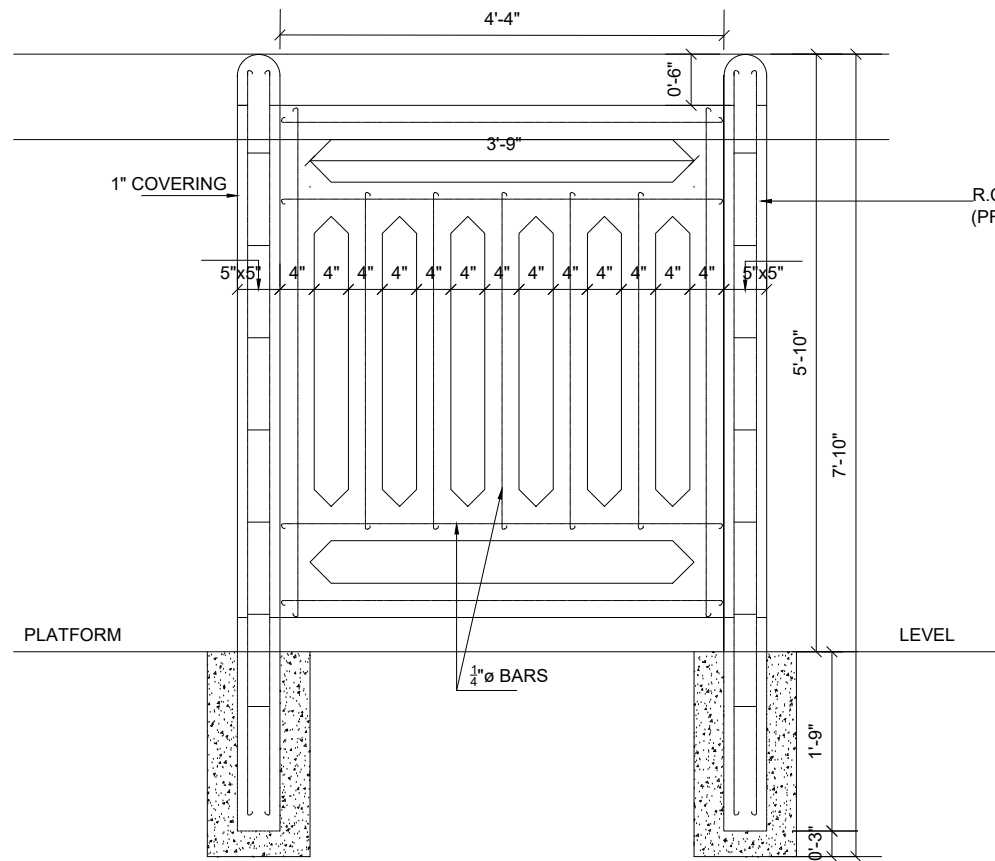
SCALE : **AS SHOWN** ISSUE DATE **23.06.2022** REVISED DATE **29.07.2022**



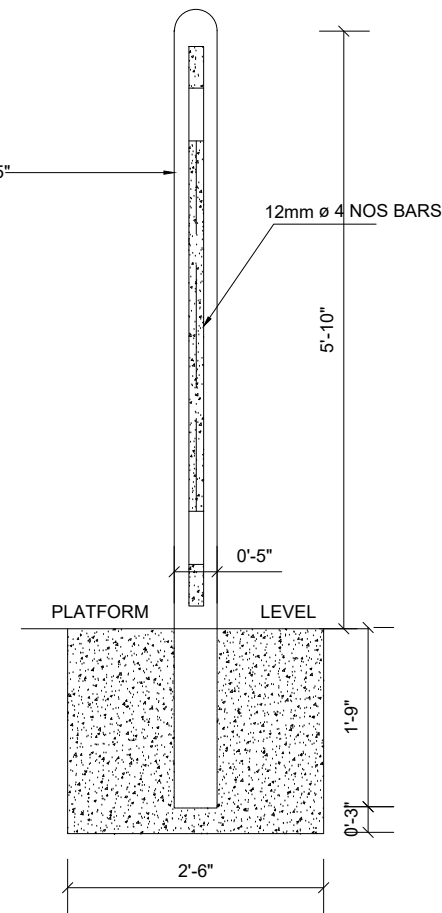
CROSS SECTION

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA M.RAO DGM/C-1	<i>Uma M. Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

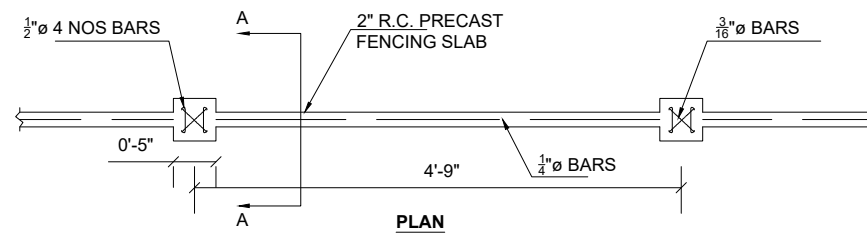




**ELEVATION**



**SECTION AT A-A**



**PLAN**

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
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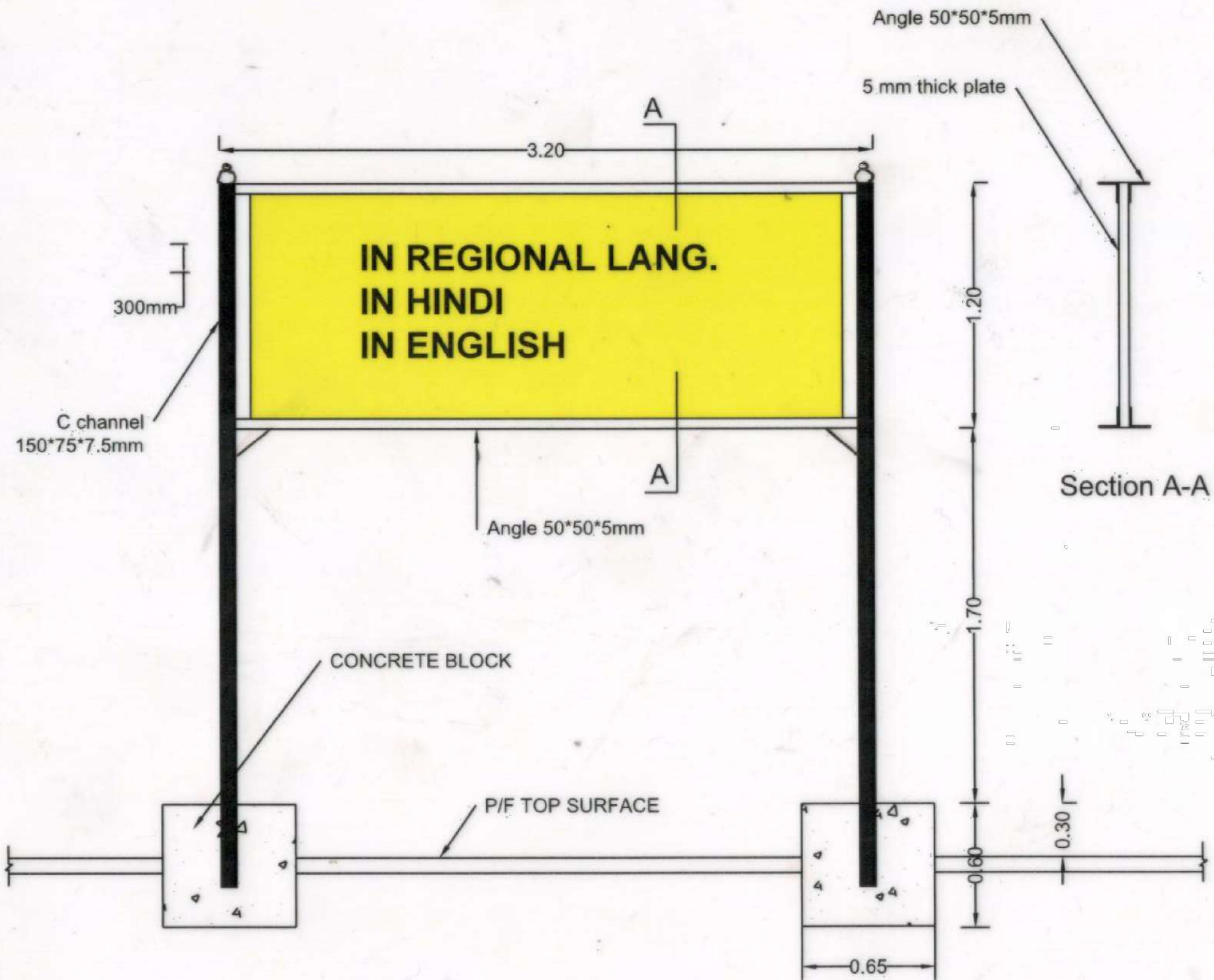


**TITLE:-** CONCEPTUAL PLAN  
 R.C.PRE-CAST FENCING FOR END PLATFORM

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

**SKETCH NO.** GC-HRIDC-SK-GEN-004 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022




- Notes:
1. THE PRINCIPAL NAME BOARDS PAINTED ON BOTH FACES SHOULD BE FIXED AT BOTH THE ENDS OF THE PLATFORM AND GENERALLY ORIENTED AT RIGHT ANGLE TO THE TRACK.
  2. THE ACTUAL ANGEL AT WHICH THE NAME BOARD ARE FACED SHOULD BE DETERMINED BY THE SITE CONDITIONS ENSURING THE CRITERIA THAT THE NAME BOARDS ARE CLEARLY VISIBLE FROM APPROACHING TRAINS.
  3. BOARD TO BE PAINTED YELLOW WITH BLACK LETTERS.
  4. THE STATION NAME SHALL BE EXHIBITED IN THE FOLLOWING ORDER: REGIONAL LANGUAGE, HINDI AND ENGLISH.
  5. HEIGHT OF LETTERS SHALL BE 300 MM, THICKNESS IN PROPORTIONS TO THE STYLE OF THE SCRIPT.
  6. THE LOWER EDGE OF THE PRINCIPAL BOARD SHOULD BE 2M ABOVE THE PLATFORM.
  7. THE PAINTING WORK SHALL BE COMMENCE ONLY AFTER THE SATISFACTORY SURFACE PREPARATION INSPECTED AND APPROVED BY THE ENGINEER.
  8. 2 COATS OF APPROVED BRAND YELLOW PAINT SHALL BE APPLIED OVER THE ONE COAT OF PRIMER.
  9. THE APPLIED COAT OF PAINT SHALL BE UNIFORM AND FREE FROM BRUSH MARKS, SACK MARKS, BLEMISHES ETC.

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

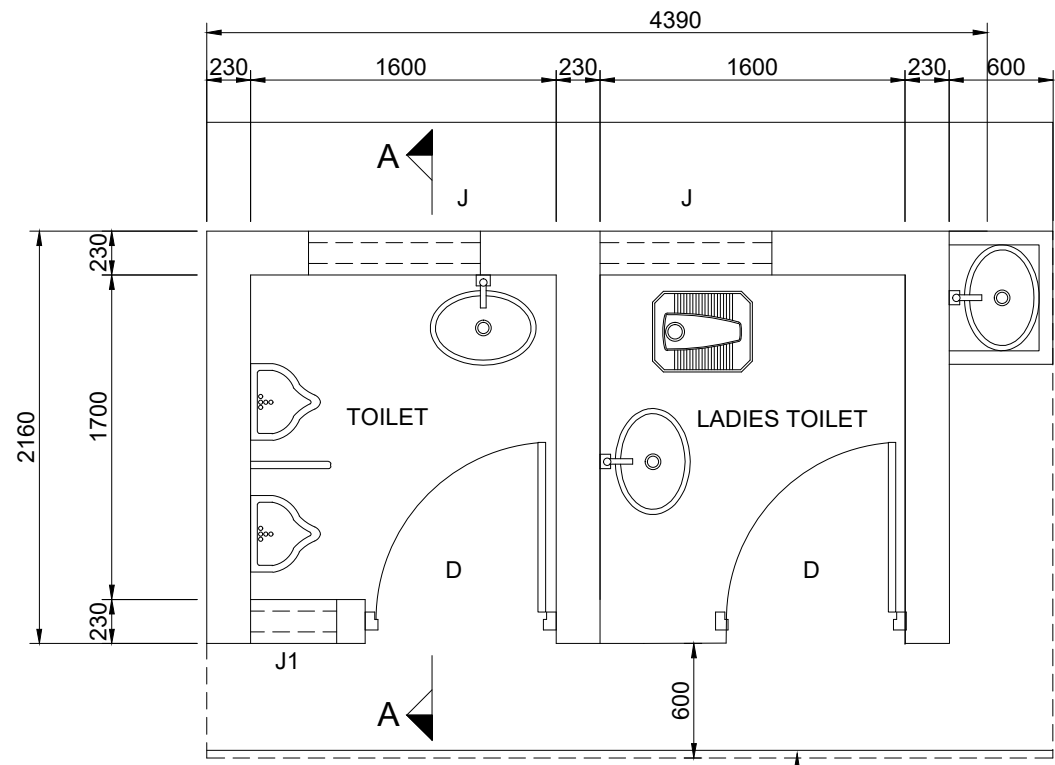


TITLE:- **CONCEPTUAL PLAN STATION NAME BOARD (M.S. STEEL BOARD)**

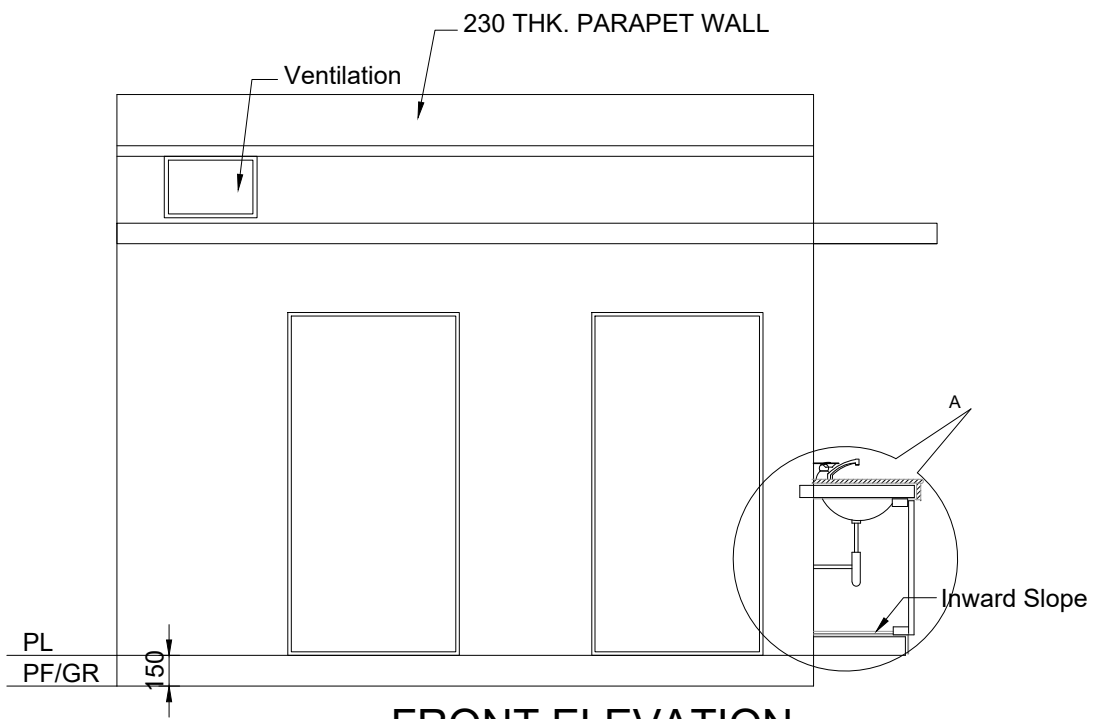
GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir</i>	UMA M.RAO DGM/C-1	<i>Uma</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu</i>		

SKETCH NO. **GC-HRIDC-SK-GEN-005** SHEET NO. **1 OF 1**

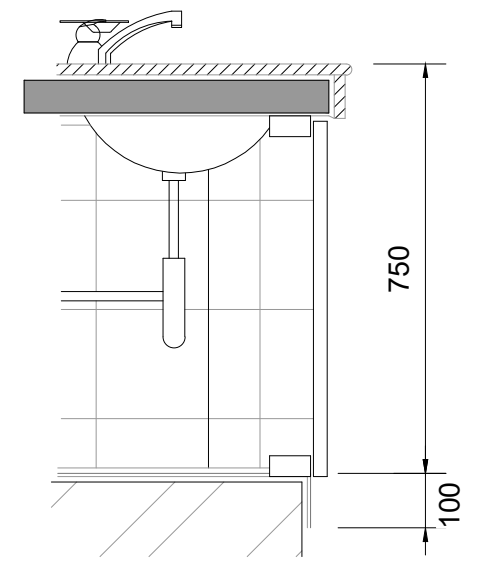
SCALE : **AS SHOWN** ISSUE DATE **23.06.2022** REVISED DATE **29.07.2022**



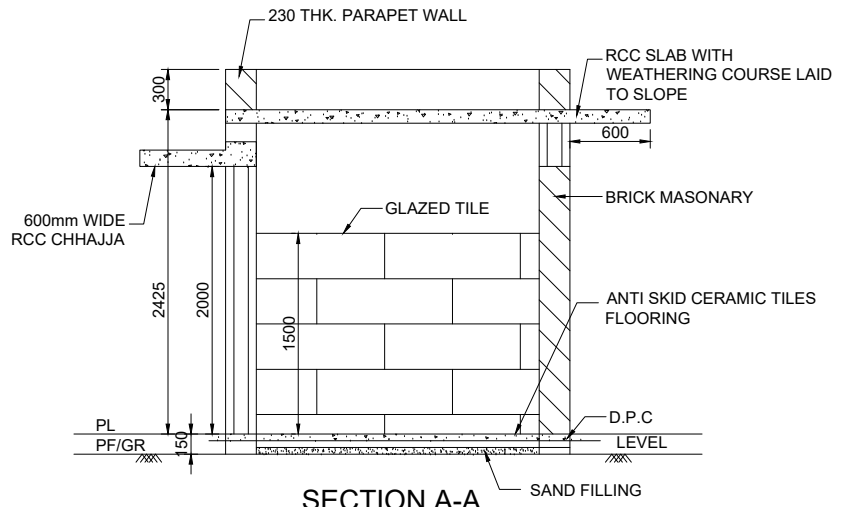
**PLAN**  
(SCALE 1:50)



**FRONT ELEVATION**  
(SCALE 1:50)



**DETAIL 'A'**



**SECTION A-A**  
(SCALE 1:50)

- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. FLOORING WITH CERAMIC TILES TO BE PROVIDED.
  3. DADO WITH GLAZED TILES OF APPROVED QUALITY FOR A HEIGHT OF 1500MM TO BE PROVIDED INSIDE WC & URINAL.
  4. THE FLOOR FOR URINAL SHOULD BE AT THE SAME LEVEL.
  5. WHITE GLAZED FLAT BLACK LIPPED URINAL 43X260X350MM SIZE.
  6. WHITE GLAZED SQUATTING TYPE URINAL OF SIZE 450X350XMM TO CONFORM IS 771-1963 TO BE PROVIDED.
  7. FLUSHING TANK TO BE PROVIDED AS UNDER  
(A) 1. NO. 10 LITER CAPACITY FOR 2/3 URINAL -AUTOMATIC PVC/PORCELAIN TYPE.
  8. PLUMBING TO BE CONCEALED.
  9. OVERHEAD TANK OF SUITABLE CAPACITY SHALL BE PROVIDED TO ENSURE UNINTERRUPTED WATER SUPPLY.
  10. DRAINAGE IS TO BE CONNECTED TO SOAK PIT OF SUITABLE CAPACITY.
  11. EFFLUENT TO BE DISCHARGE IN DRAINAGE SYSTEM (REFER SEPARATE DRAINAGE PLAN FOR DRAINAGE SYSTEM).
  12. THIS PLAN TO BE ADOPTED FOR OTHER THAN A-1 CLASS STATION.

**PROJECT:**  
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AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



**SCHEDULE OF JOINERY**

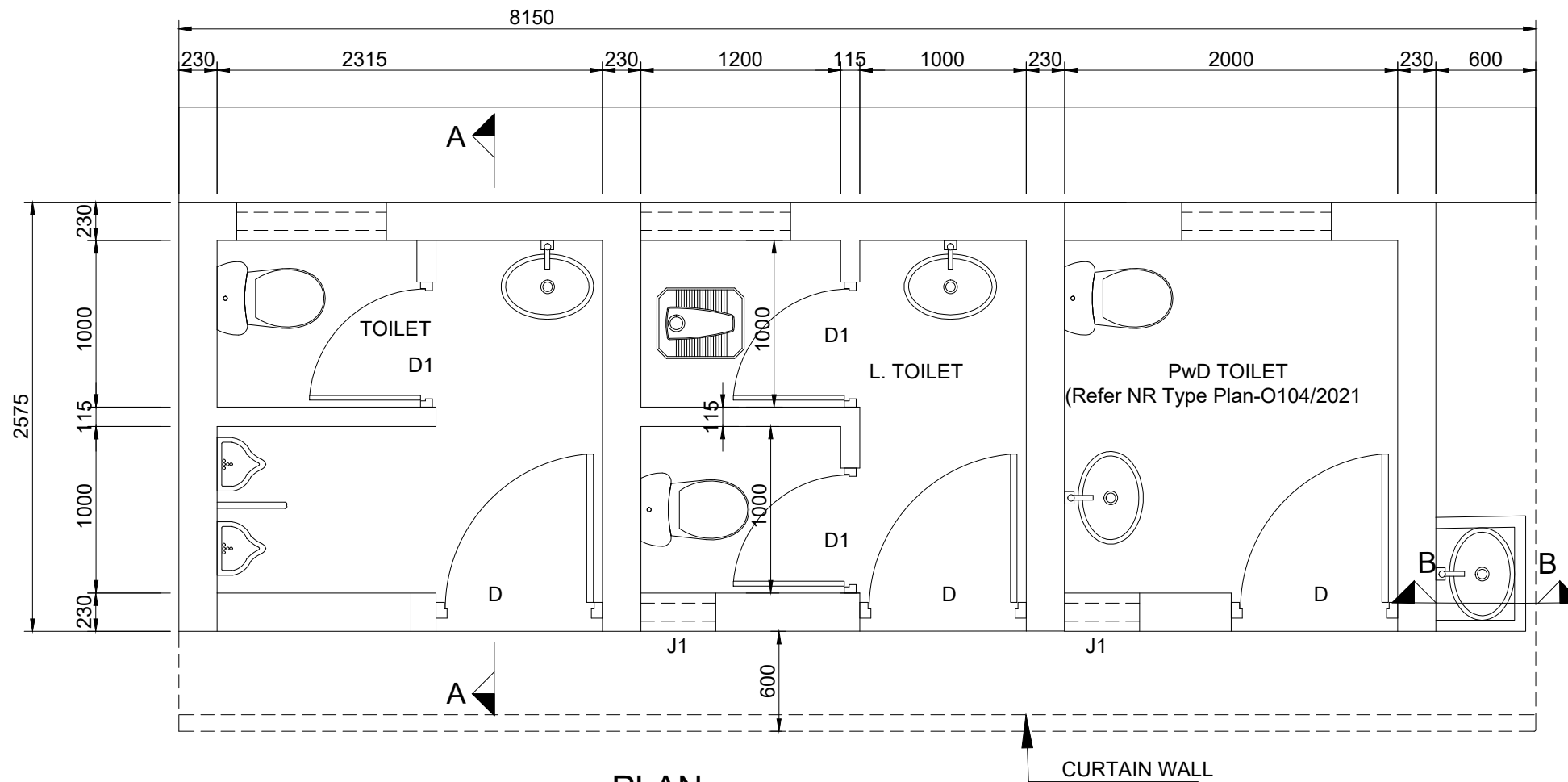
REF.	DESCRIPTION	SIZE
D	PVC DOOR	900x2000
J	RCC JALI (RAIN PROOF TYPE)	900x600
J1	RCC JALI (RAIN PROOF TYPE)	450x300

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA.M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

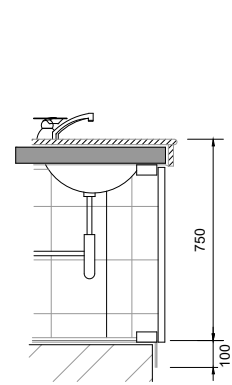
**TITLE:-** CONCEPTUAL PLAN  
PROPOSED TOILET BLOCK ON  
ISLAND PLATFORMS

**SKETCH NO.** GC-HRIDC-SK-GEN-006 **SHEET NO.** 1 OF 1

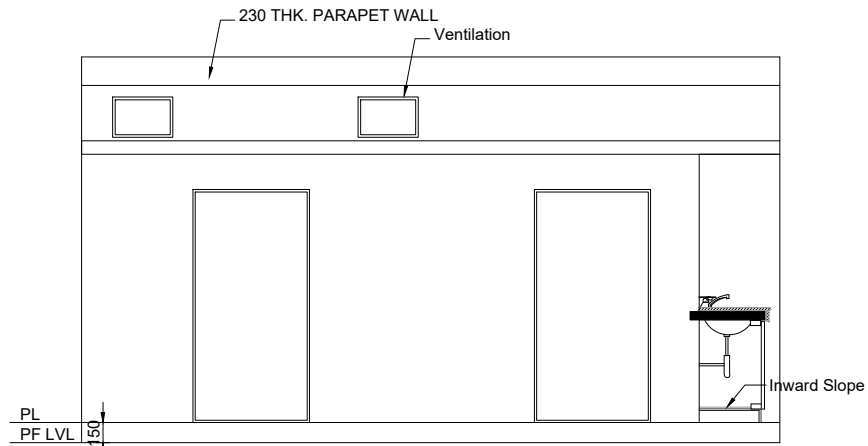
**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022



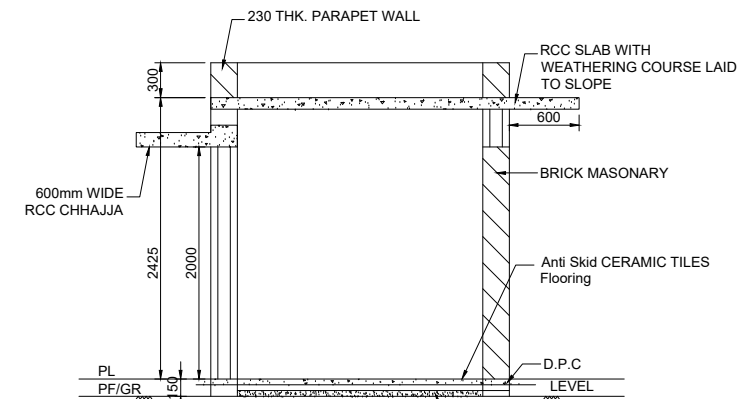
**PLAN**  
(SCALE 1:50)



**SECTION B-B**



**FRONT ELEVATION**  
(SCALE 1:50)



**SECTION A-A**  
(SCALE 1:50)

- NOTES :**
- ALL DIMENSIONS ARE IN MILLIMETERS.
  - FLOORING WITH CERAMIC TILES TO BE PROVIDED.
  - DADO WITH GLAZED TILES OF APPROVED QUALITY FOR A HEIGHT OF 1500MM TO BE PROVIDED IN SIDE WC & URINAL.
  - THE FLOOR FOR WC & URINAL SHOULD AT THE SAME LEVEL.
  - WHITE GLAZED INDIAN TYPE WATER CLOSET (ORISSA PATTERN) OF SIZE 580MM AND 'P' TRAP TO BE PROVIDED.
  - WHITE GLAZED FLAT BLACK LIPPED URINAL 43X260X350MM SIZE TO BE PROVIDED.
  - WHITE GLAZED SQUATTING TYPE URINAL OF SIZE 450X350XMM TO CONFORM IS 771-1963 TO BE PROVIDED.
  - FLUSHING TANK TO BE PROVIDED AS UNDER  
(A) -1 NO. 1250 LITER CAPACITY FOR EACH WATER CLOSET - SUM PVC/PORCELAIN TYPE.  
(B) 1 NO. 10 LITER CAPACITY FOR 2/3 URINAL -AUTOMATIC PVC/PORCELAIN TYPE.
  - PLUMBING TO BE CONCEALED.
  - OVERHEAD TANK OF SUITABLE CAPACITY SHALL BE PROVIDED TO ENSURE UNINTERRUPTED WATER SUPPLY
  - DRAINAGE IS TO BE CONNECTED TO SEPTIC TANK / SOAK PIT SUITABLE CAPACITY.
  - EFFLUENT TO BE DISCHARGE IN DRAINAGE SYSTEM (REFER SEPARATE DRAINAGE PLAN FOR DRAINAGE SYSTEM).
  - THIS PLAN TO BE ADOPTED FOR OTHER THAN A-1 CLASS STATION.

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
 HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

**CONSULTANT:**  
 GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:-** CONCEPTUAL PLAN  
PROPOSED TOILET BLOCK ON  
MAIN PLATFORMS

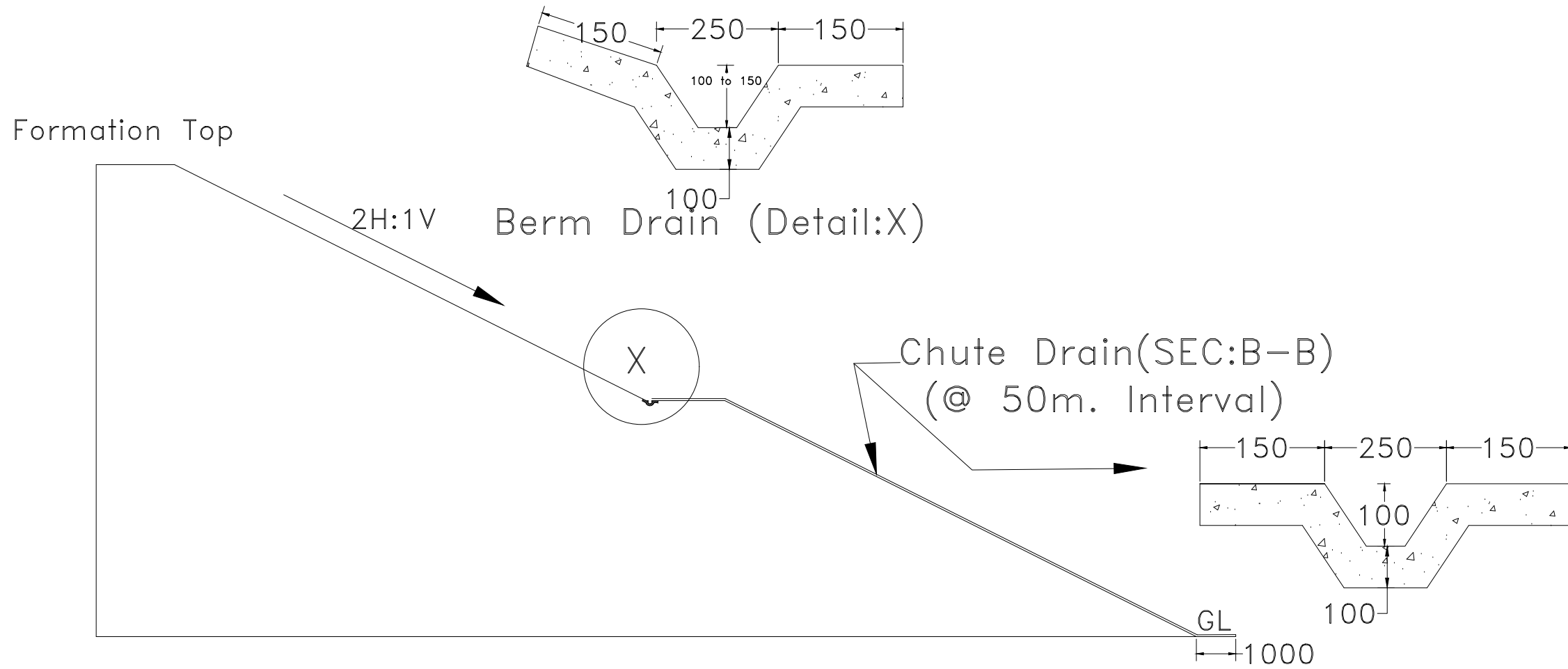
**SKETCH NO.** GC-HRIDC-SK-GEN-007 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022

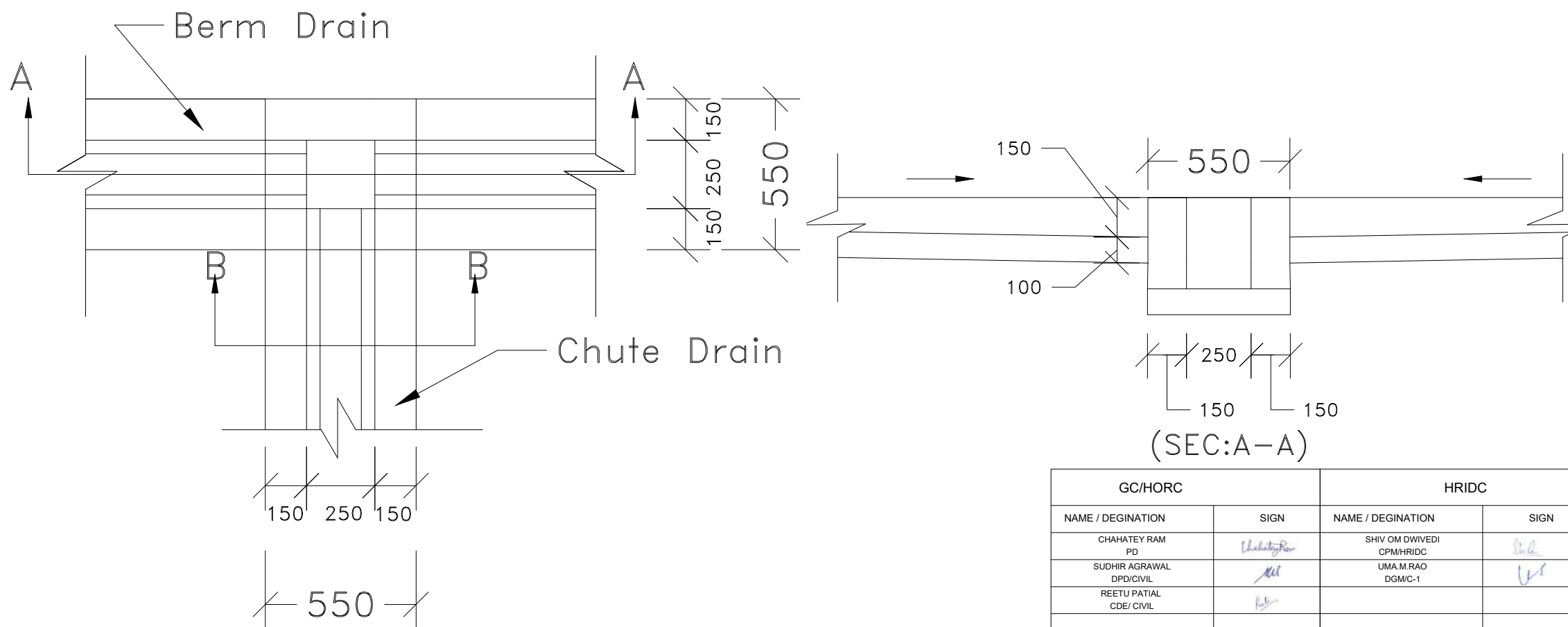
**SCHEDULE OF JOINERY**

REF.	DESCRIPTION	SIZE
D	PVC DOOR	900x2000
J	RCC JALI (RAIN PROOF TYPE)	900x600
J1	RCC JALI (RAIN PROOF TYPE)	450x300

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA.M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			



Note:-  
1. All dimension are in mm unless otherwise specified.



PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



TITLE:- CONCEPTUAL PLAN  
DRAINS FOR FORMATION

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA.M.RAO DGMIC-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

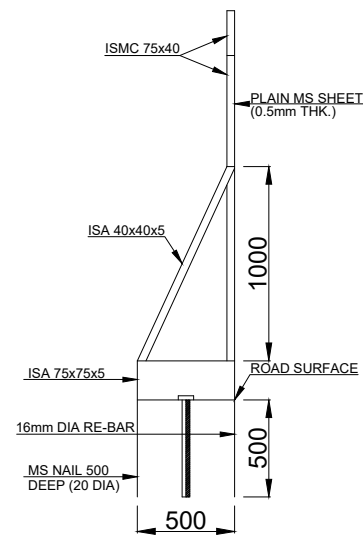
SKETCH NO. GC-HRIDC-SK-GEN-008

SHEET NO. 1 OF 1

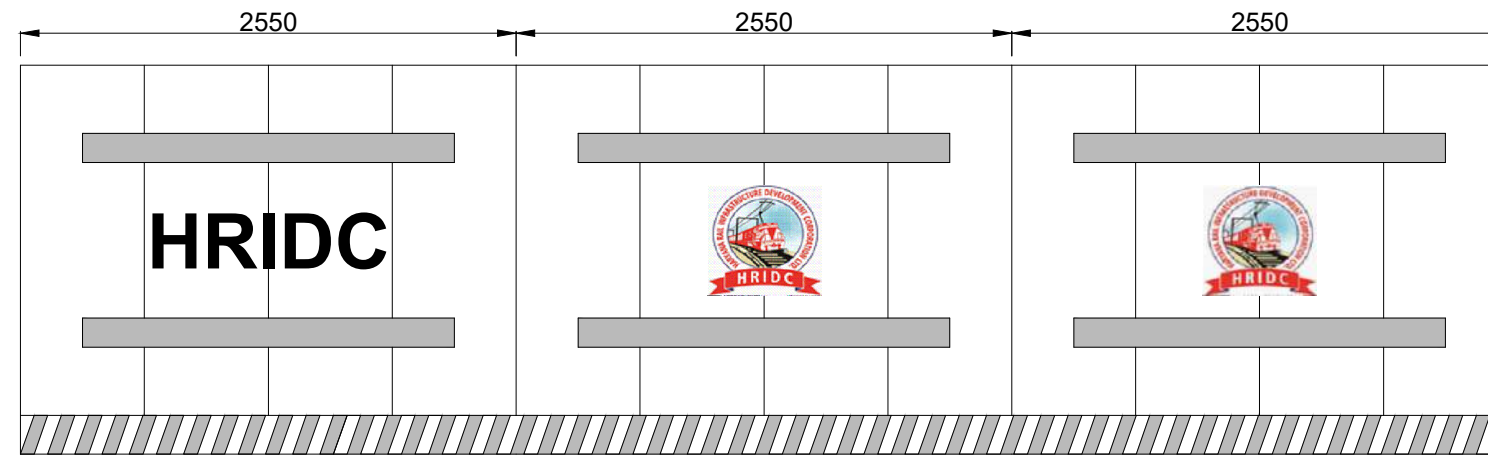
SCALE : AS SHOWN

ISSUE DATE: 23.06.2022

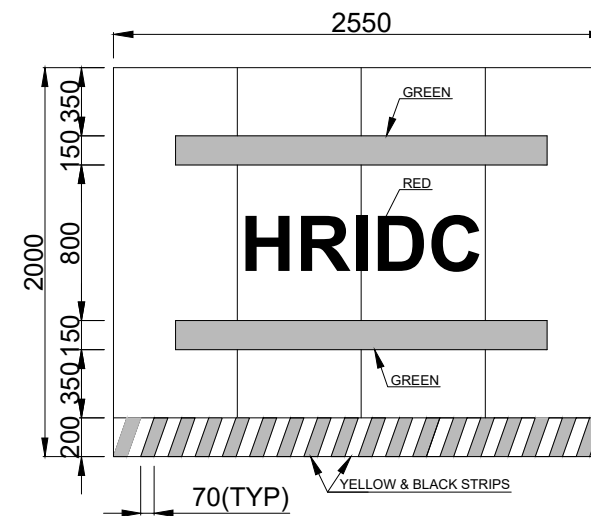
REVISED DATE: 29.07.2022



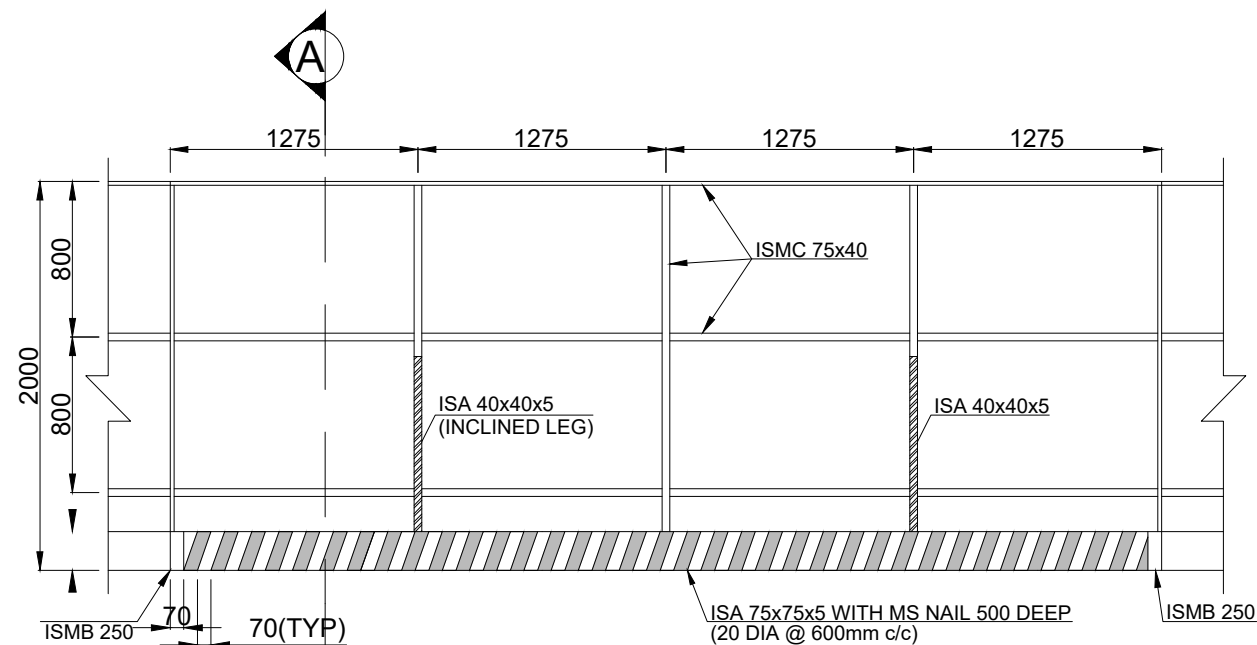
**SECTION A-A**



**ELEVATION OF ONE UNIT OF TEMPORARY BARRICADING**



**ELEVATION OF ONE SET OF TEMPORARY BARRICADING**




**DETAIL OF TEMPORARY BARRICADING**

- NOTES:
1. ALL DIMENSIONS SHOWN ARE IN MILLIMETERS, UNLESS OTHERWISE MENTIONED.
  2. THIS BARRICADING SHALL BE USED AT LOCATION OF ROAD AND PEDESTRIAN TRAFFIC.

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 **HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
 **GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

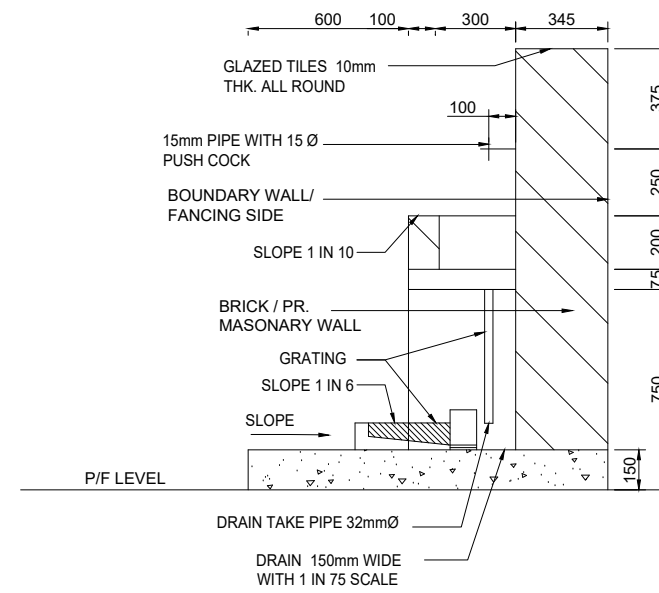
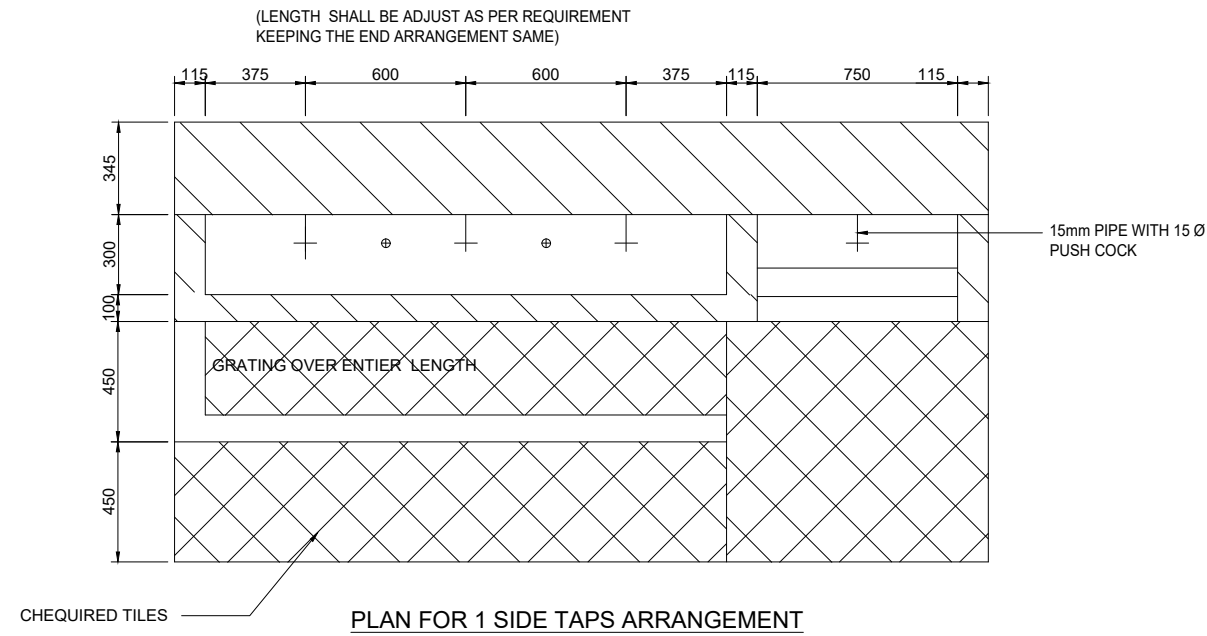


TITLE:- **CONCEPTUAL PLAN STEEL BARRICADE**

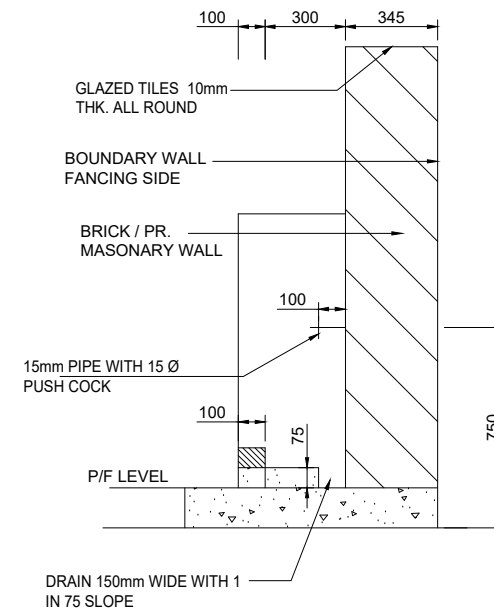
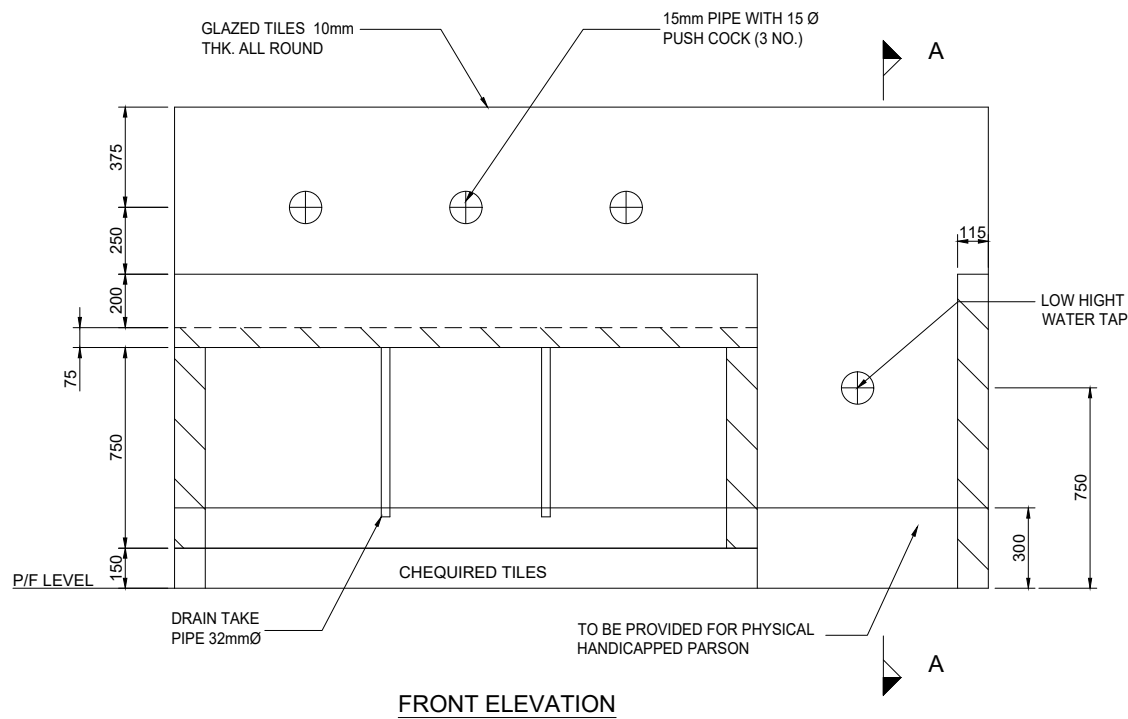
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

SKETCH NO. GC-HRIDC-SK-GEN-009 SHEET NO. 1 OF 1

SCALE : AS SHOWN ISSUE DATE 23.06.2022 REVISED DATE 29.07.2022



**SECTION FOR ONE SIDE TAPS**




**SECTION AT A-A**

- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETER
  2. LENGTH SHALL BE ADJUSTED AS PER REQUIREMENT KEEPING THE END ARRANGEMENT SAME.
  3. ALL EXPOSED SURFACES SHALL BE PROVIDE WITH GRANITE CLADDING.
  4. PUSH COCK SHALL BE CP BRASS WITH ANTY SABOTAGE FITTINGS.
  5. LOW HEIGHT WATER TAP TO BE PROVIDED FOR PHYSICALLY HANDICAPPED PERSONS.
  6. ALL DIMENSIONS ARE TENTATIVE AND MAY VARY AS PER THE REQUIREMENT.

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

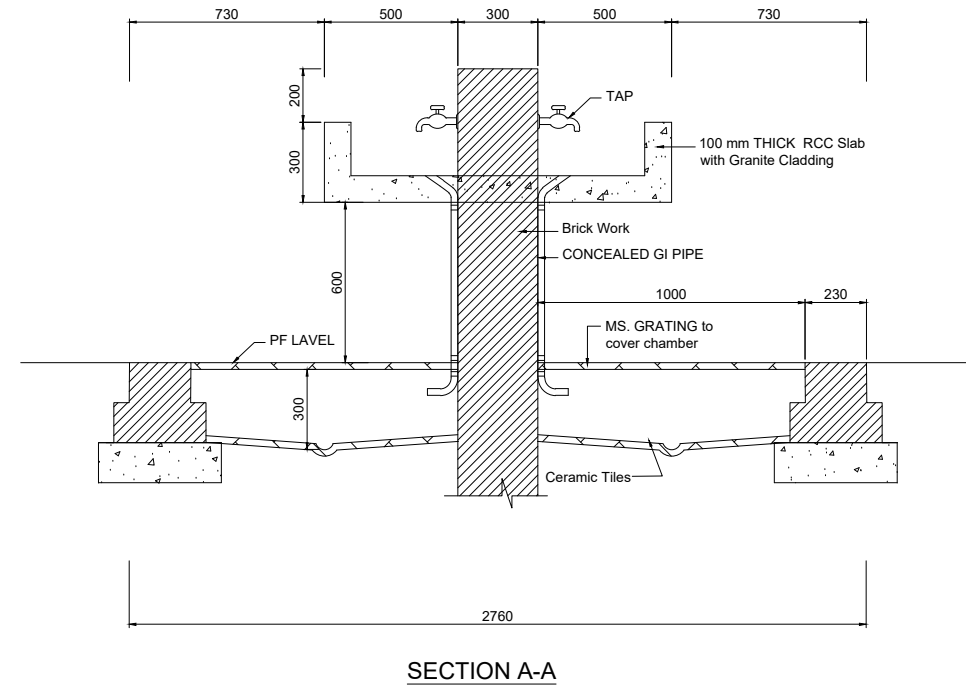
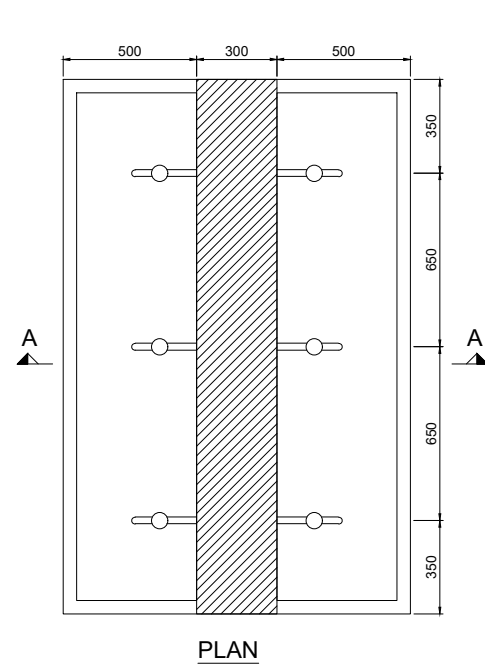


GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA.M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

**TITLE:- CONCEPTUAL PLAN WATER BOOTH WITH ONE SIDE TAPS ARRANGEMENT (END PLATFORM)**

**SKETCH NO.** GC-HRIDC-SK-GEN-010 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022



**NOTES :**

1. ALL DIMENSIONS ARE IN MM .
2. ALL EXPOSED SURFACE SHALL BE OF GRANITE CLADDING
3. PUSH COCK SHALL BE CP BRASS WITH ANTY SABOTAGE FITTINGS.
4. SEPARATE DRAINAGE PLAN SHALL BE REFERRED FOR EFFLUENT DISCHARGE etc.
5. ALL DIMENSIONS ARE TENTATIVE AND MAY VARY AS PER THE REQUIREMENT.

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.



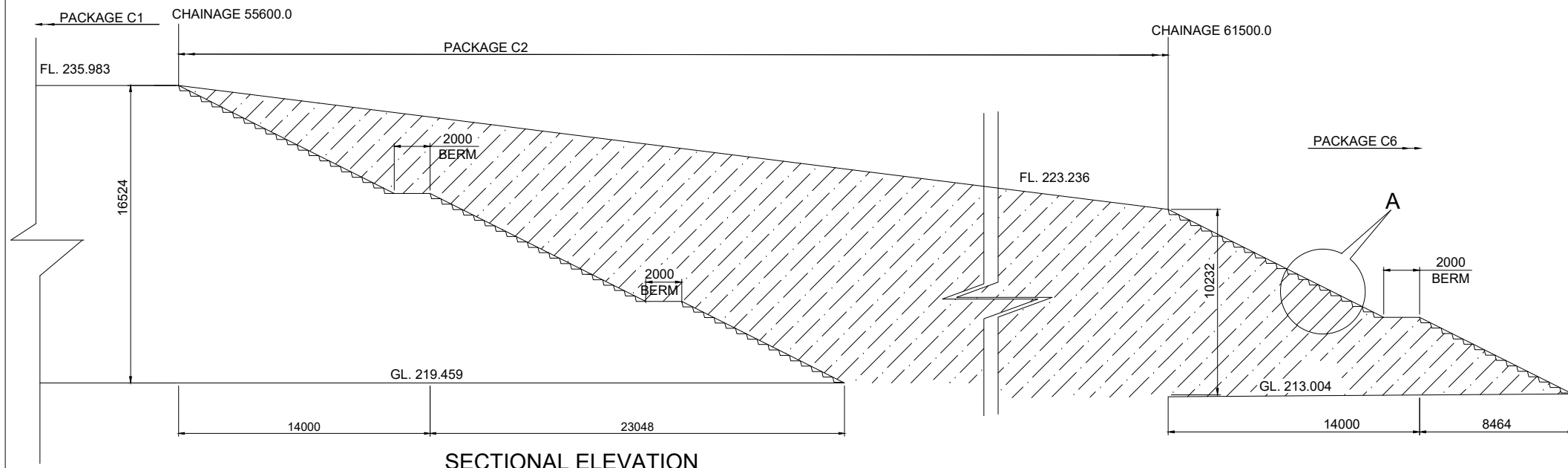
GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA.M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

**TITLE:- CONCEPTUAL PLAN WATER BOOTH WITH BOTH SIDE TAPS ARRANGEMENT (ISLAND PLATFORM)**

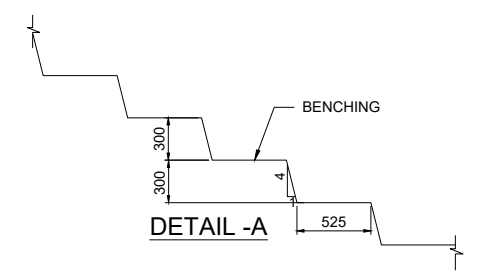
**SKETCH NO.** GC-HRIDC-SK-GEN-011 **SHEET NO.** 1 OF 1

**SCALE :** AS SHOWN **ISSUE DATE** 23.06.2022 **REVISED DATE** 29.07.2022






**SECTIONAL ELEVATION**




**DETAIL -A**

- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETERS.
  2. FOR OTHER DETAILS REFER RDSO SPECIFICATION NO. RDSO/2020/GE:IRS-004 SEPTEMBER 2020 "COMPREHENSIVE GUIDELINES AND SPECIFICATIONS FOR RAILWAY FORMATION".
  3. HATCHED AREA IS IN THE SCOPE OF C-2.

**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.**

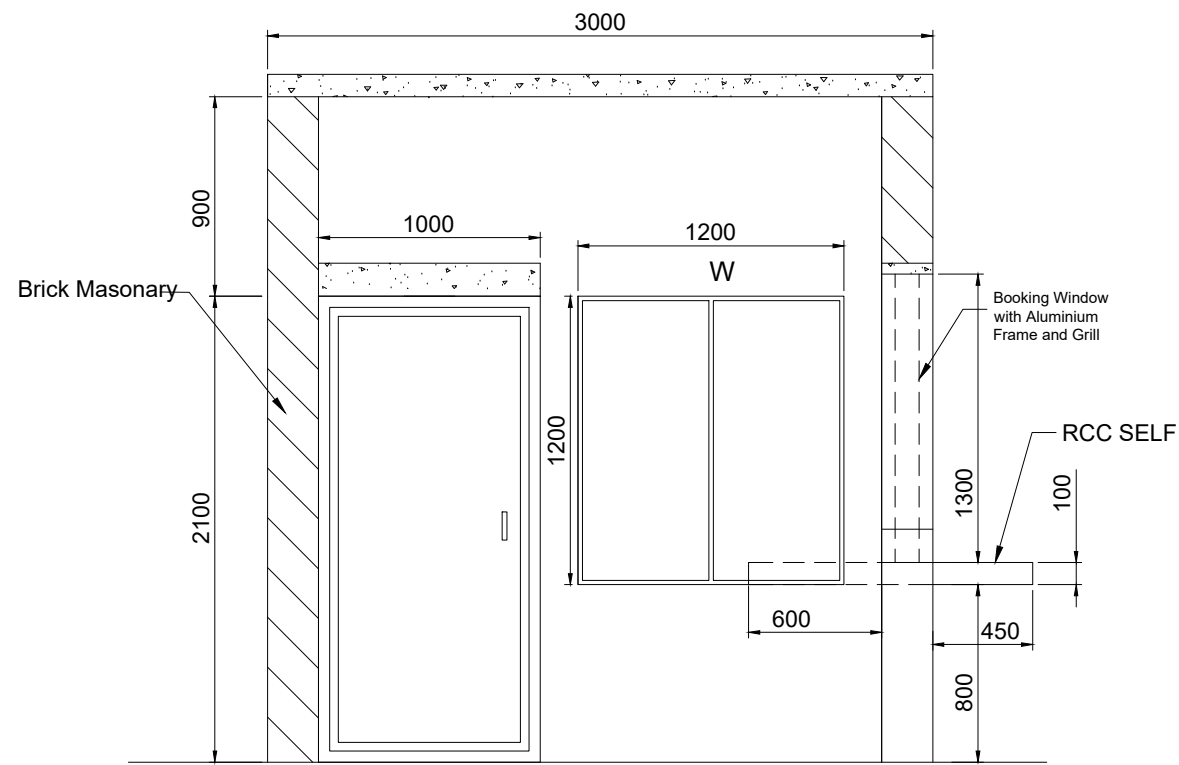
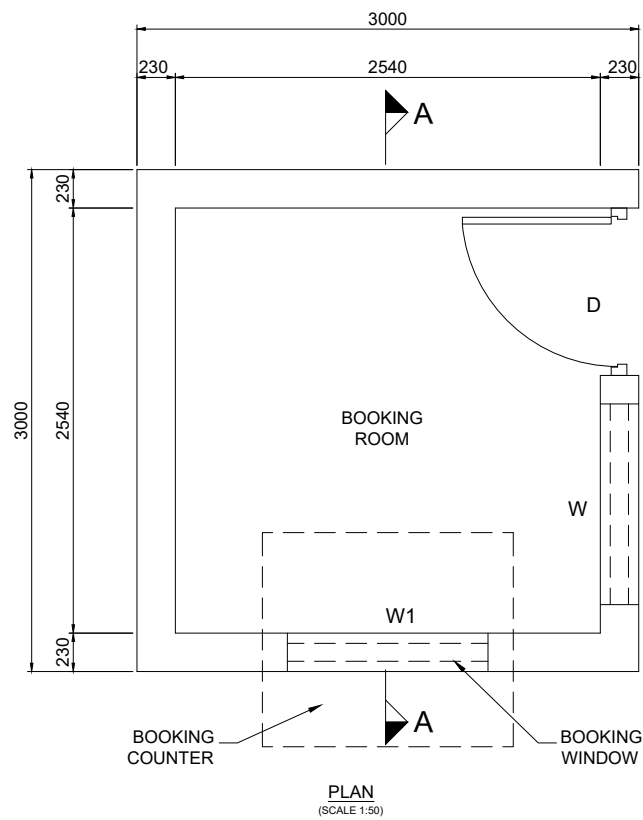
**CONSULTANT:**  

**GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:- CONCEPTUAL PLAN**  
**INTERFACING LOCATION BANK BENCHING**

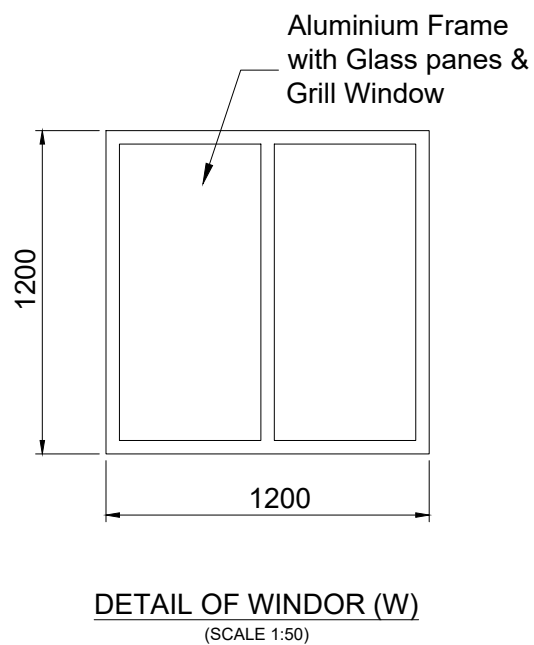
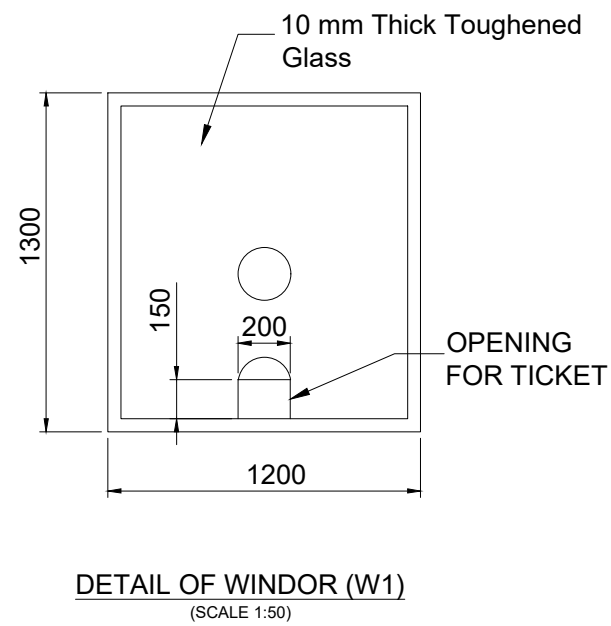
GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>Chahatey Ram</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>Shiv Om Dwivedi</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>Sudhir Agrawal</i>	UMA.M.RAO DGM/C-1	<i>Uma M Rao</i>
REETU PATIAL CDE/ CIVIL	<i>Reetu Patial</i>		

SKETCH NO. GC-HRIDC-SK-GEN-012	SHEET NO. 1 OF 1
SCALE : AS SHOWN	ISSUE DATE 23.06.2022
	REVISED DATE 29.07.2022





**NOTES :**

1. ALL DIMENSIONS ARE IN MILIMETERS.
2. DEEPTH OF FOUNDATION TO BE DECIDED AS PER SITE CONDITION.
3. RCC SELF WITH GRANITE TOP TO BE PROVIDING FOR BOOKING COUNTER.








**PROJECT:**  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  

**HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

**CONSULTANT:**  

**GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:- CONCEPTUAL PLAN  
 TICKET COUNTER**

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA.M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			

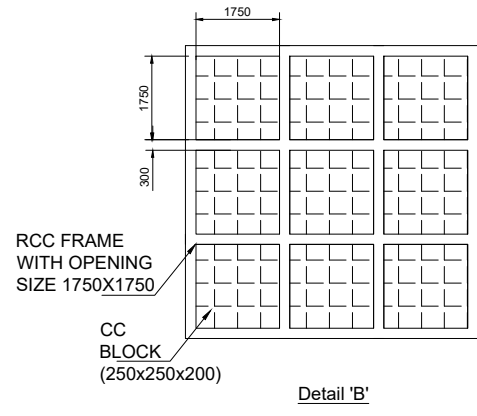
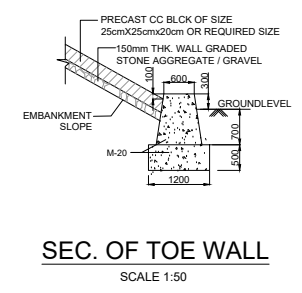
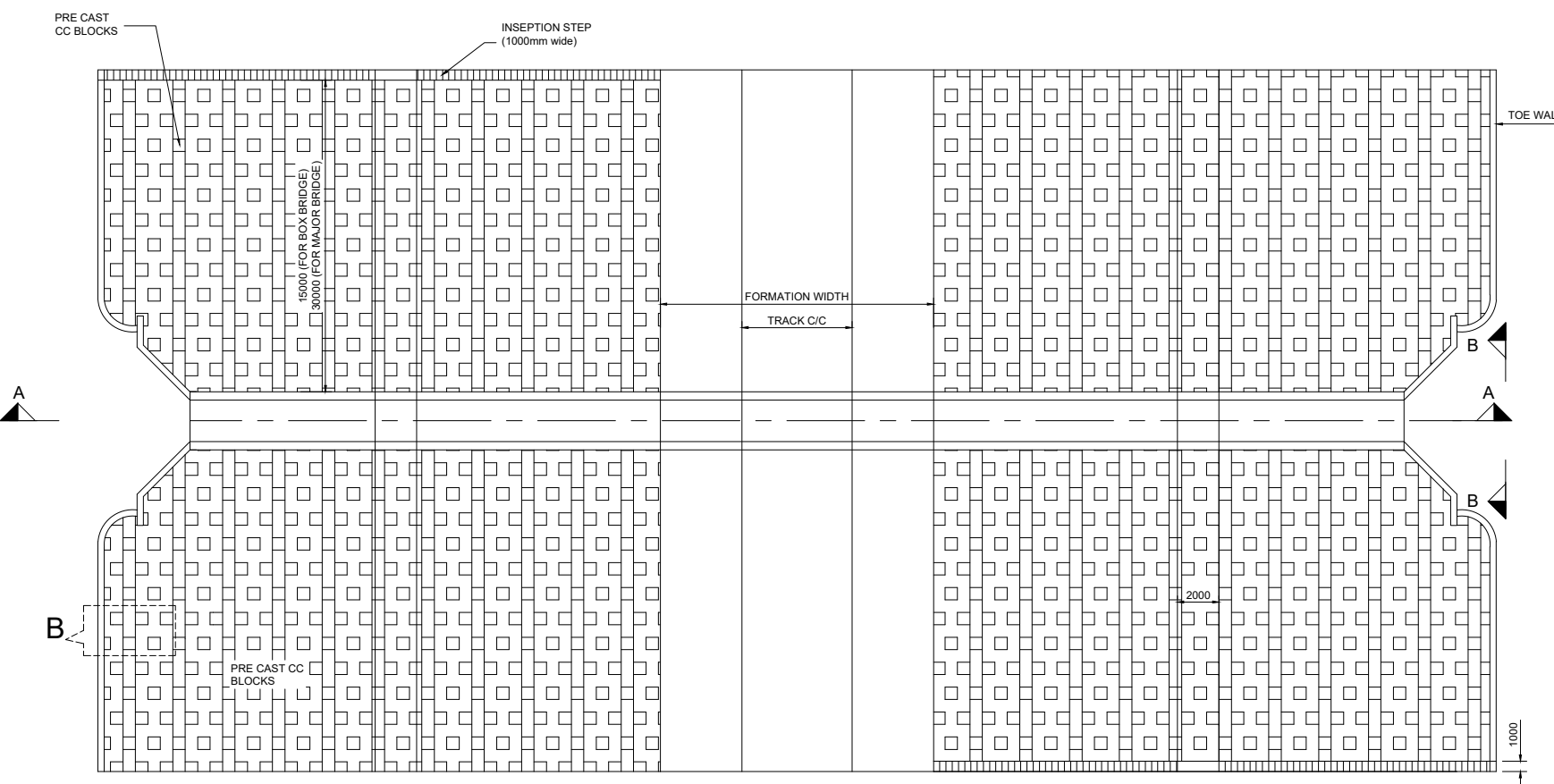
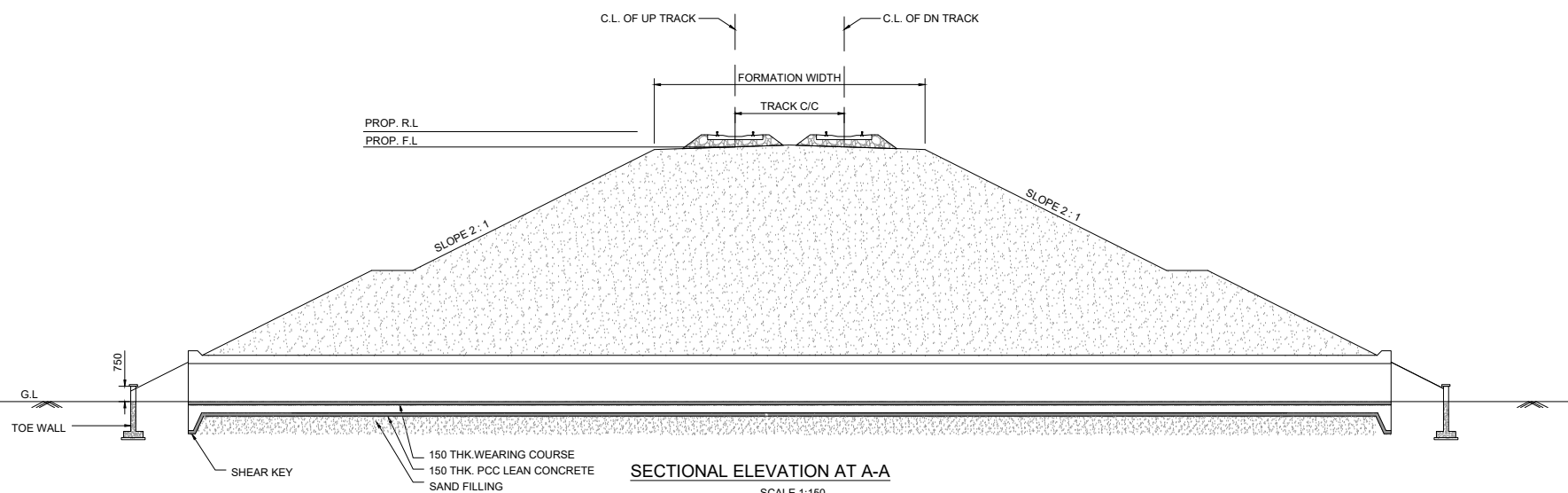
**SKETCH NO.**  
 GC-HRIDC-SK-GEN-013

**SHEET NO.**  
 1 OF 1

**SCALE :** AS SHOWN

**ISSUE DATE** 23.06.2022

**REVISED DATE** 29.07.2022



- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE MENTIONED.
  2. PROTECTION WORK WITH PRECAST CC BLOCK ON BOTH SIDES OF BRIDGES SHALL BE DONE FOR 15m LENGTH AND 30m LENGTH FOR MINOR BRIDGES & MAJOR BRIDGES RESPECTIVELY.
  3. THIS DRAWING IS VALID FOR SINGLE/MULTIPLE NO. OF TRACKS. TRACKS SHOWN IN DRAWING ARE SYMBOLIC PRESENTATION ONLY.

**LEGEND**

PRL	PROPOSED RAIL LEVEL
PFL	PROPOSED FORMATION LEVEL
HFL	HIGHEST FLOOD LEVEL
GL	GROUND LEVEL

**PROJECT:**  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY NEW ELECTRIFIED BG DOUBLE LINE

**CLIENT:**  
HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

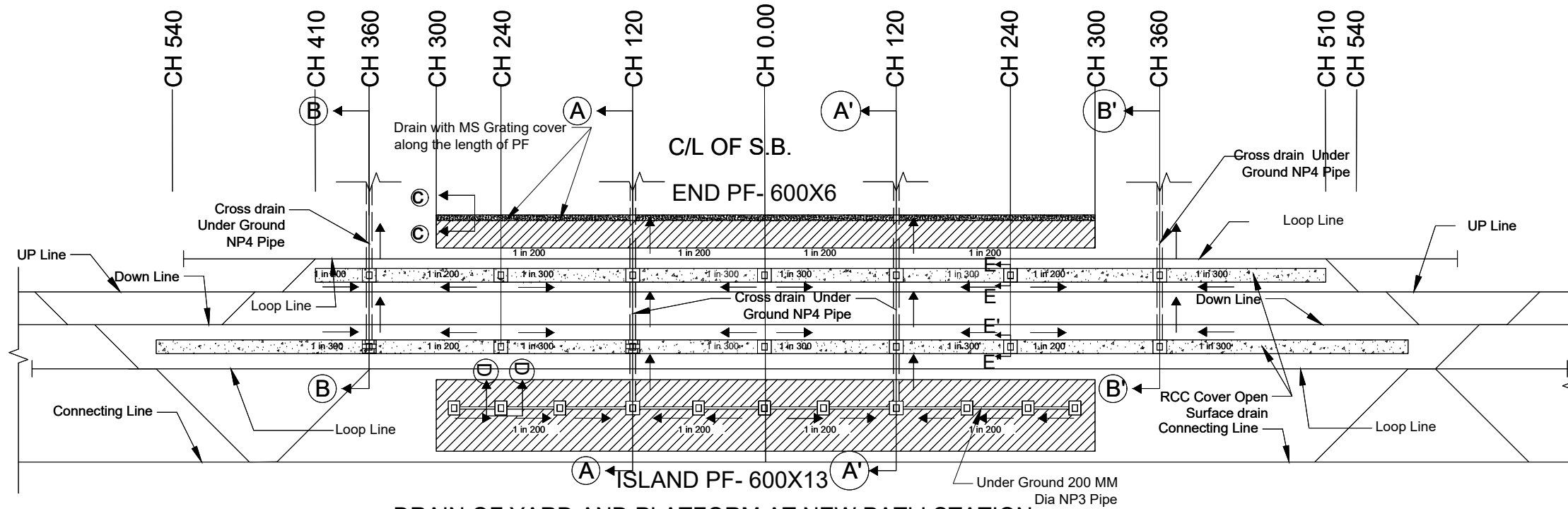
**CONSULTANT:**  
GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



**TITLE:-** CONCEPTUAL PLAN  
TYPICAL DETAILS OF PROTECTION WORK

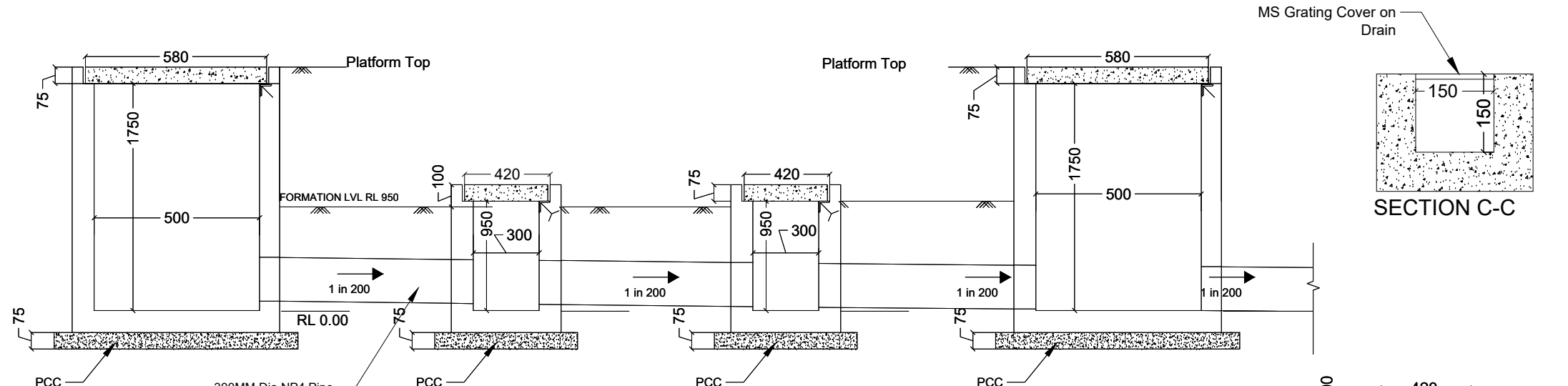
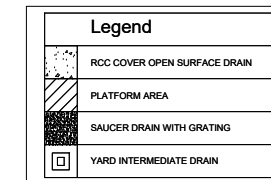
GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA M. RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

SKETCH NO. GC-HRIDC-SK-GEN-015	SHEET NO. 1 OF 1
SCALE : AS SHOWN	ISSUE DATE 23.06.2022
	REVISED DATE 29.07.2022

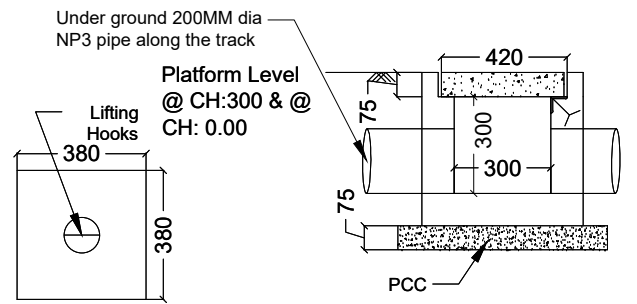


DRAIN OF YARD AND PLATFORM AT NEW PATLI STATION

- Note:-
- All dimension are in mm unless otherwise specified.
  - Precast RCC Cover to be provided as per drawing.
  - Drain to be provided in slope as specified in the drawing.
  - Drain to be made of RCC.

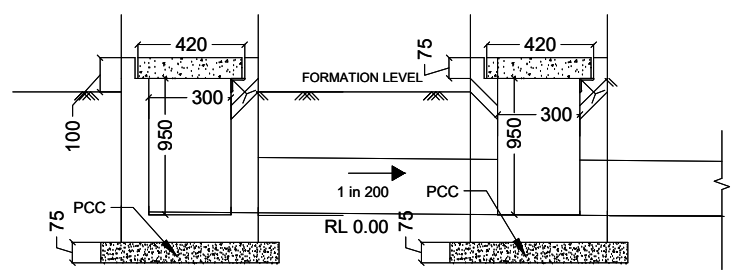


SECTION A-A & A'-A'

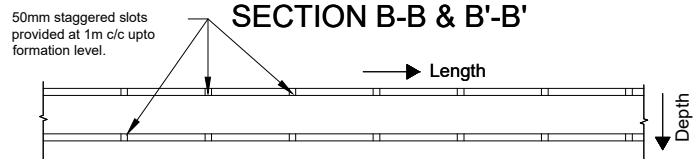


TYP. RCC Cover of Platform Drain

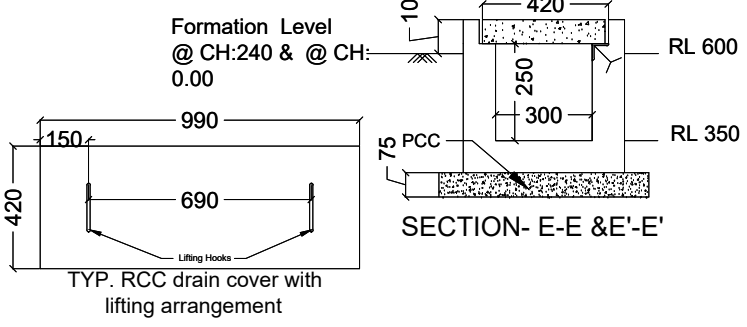
Platform Intermediate Drain Chamber SECTION D-D



SECTION B-B & B'-B'



SECTION D-D



SECTION- E-E & E'-E'

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA.M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
 HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
 GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.



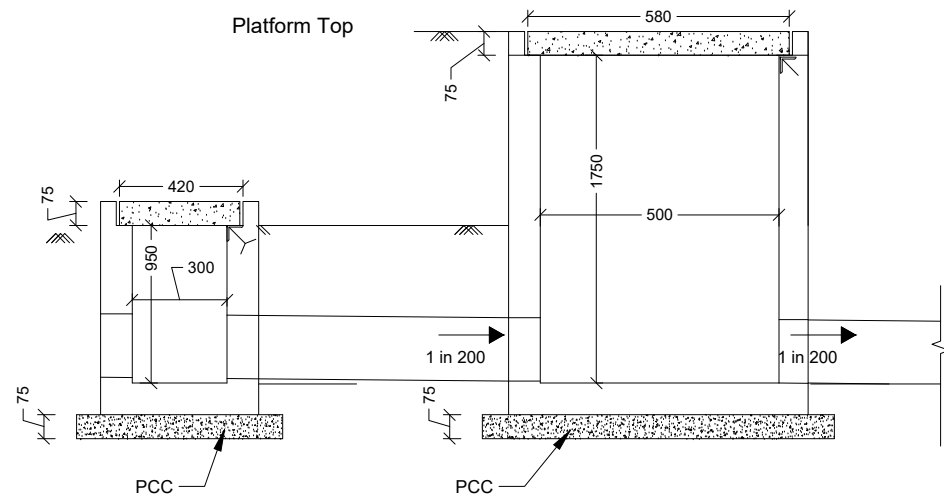
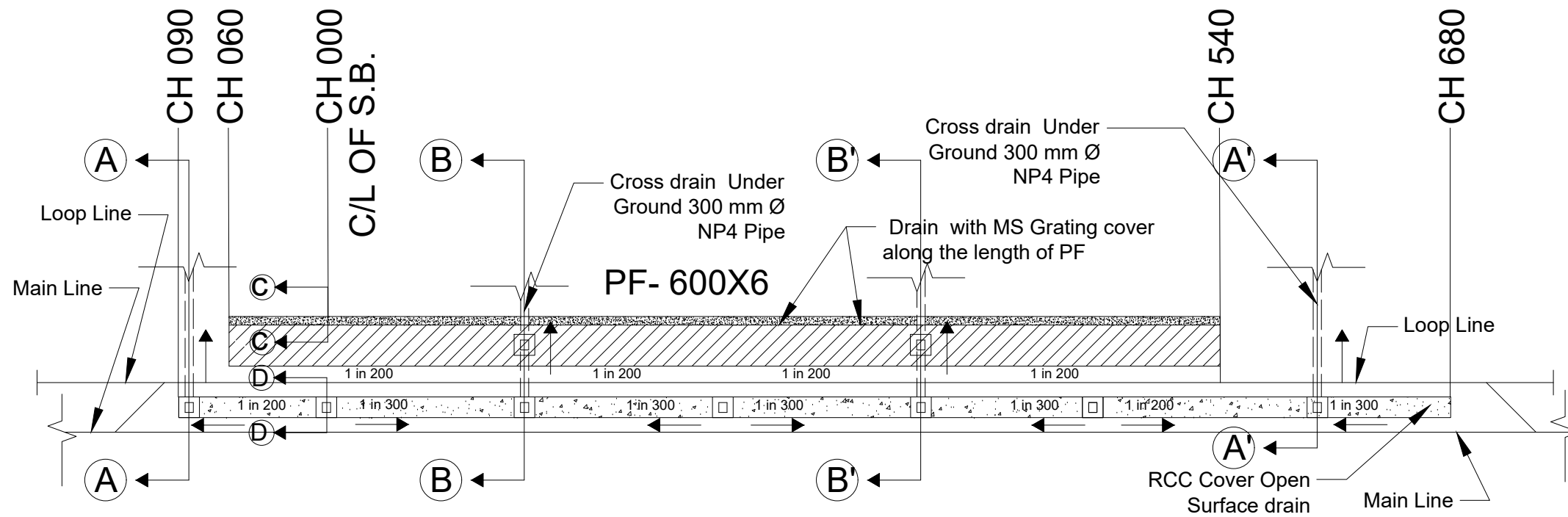
TITLE:- CONCEPTUAL PLAN  
DRAINAGE ARRANGEMENT (NEW PATLI)

SKETCH NO. GC-HRIDC-C2-SK-CIVIL-002 SHEET NO. 1 OF 1

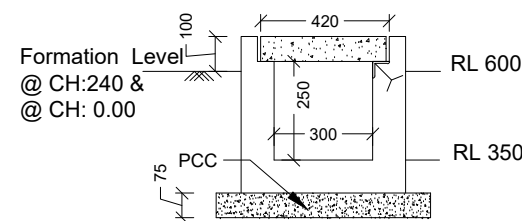
SCALE : AS SHOWN ISSUE DATE 23.06.2022 REVISED DATE 29.07.2022

# DRAIN OF YARD AND PLATFORM AT SULTANPUR STATION

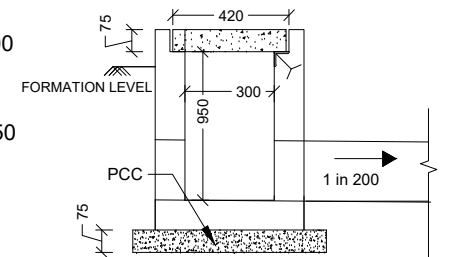
- Note:-
1. All dimension are in mm unless otherwise specified.
  2. Precast RCC Cover to be provided as per drawing.
  3. Drain to be provided in slope as specified in the drawing.
  4. Drain to be made of RCC.



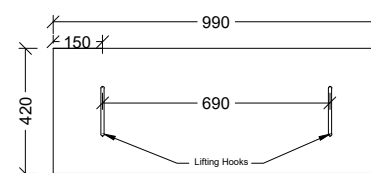
SECTION B-B & B'-B'



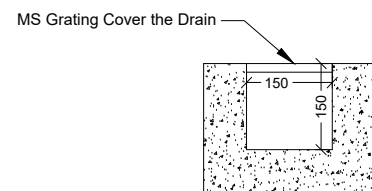
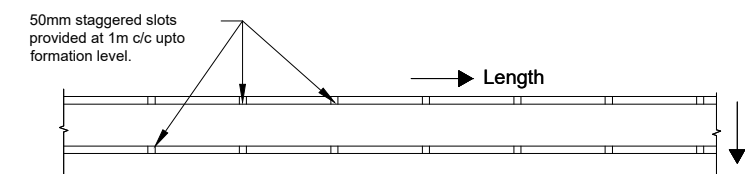
Yard Intermediate Drain SECTION- D-D



SECTION A-A & A'-A'



TYP. RCC drain cover lifting arrangement



SECTION C-C

Legend	
	RCC COVER OPEN SURFACE DRAIN
	PLATFORM AREA
	SAUCER DRAIN WITH GRATING
	YARD INTERMEDIATE DRAIN

PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
**HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  
**GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.

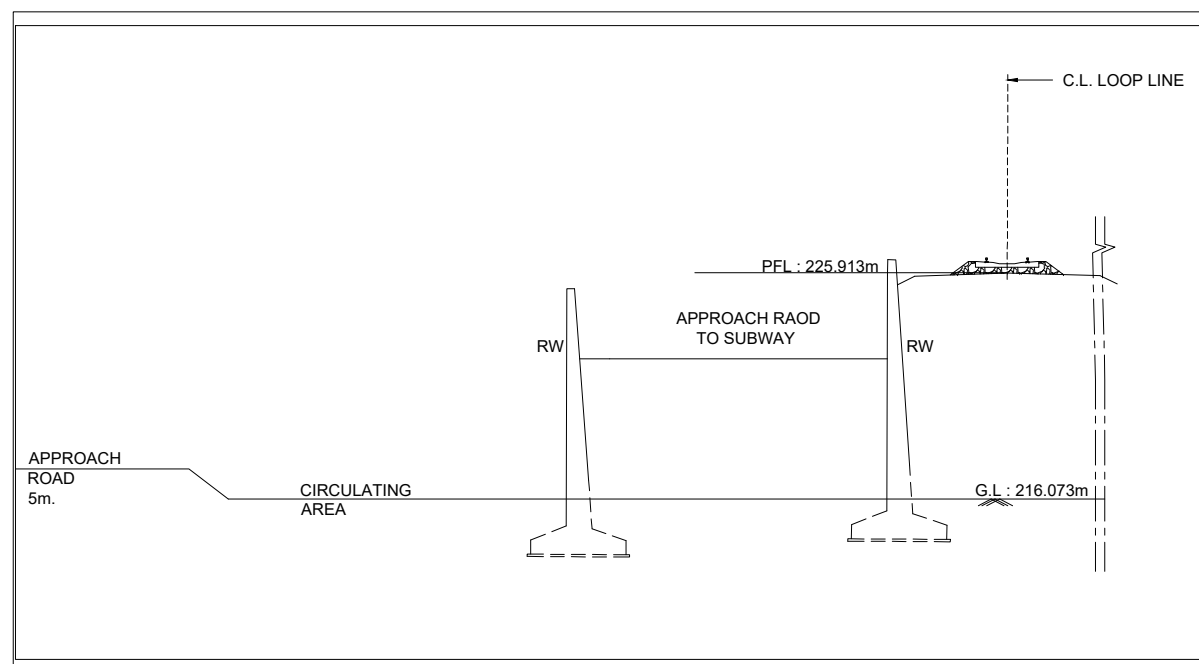
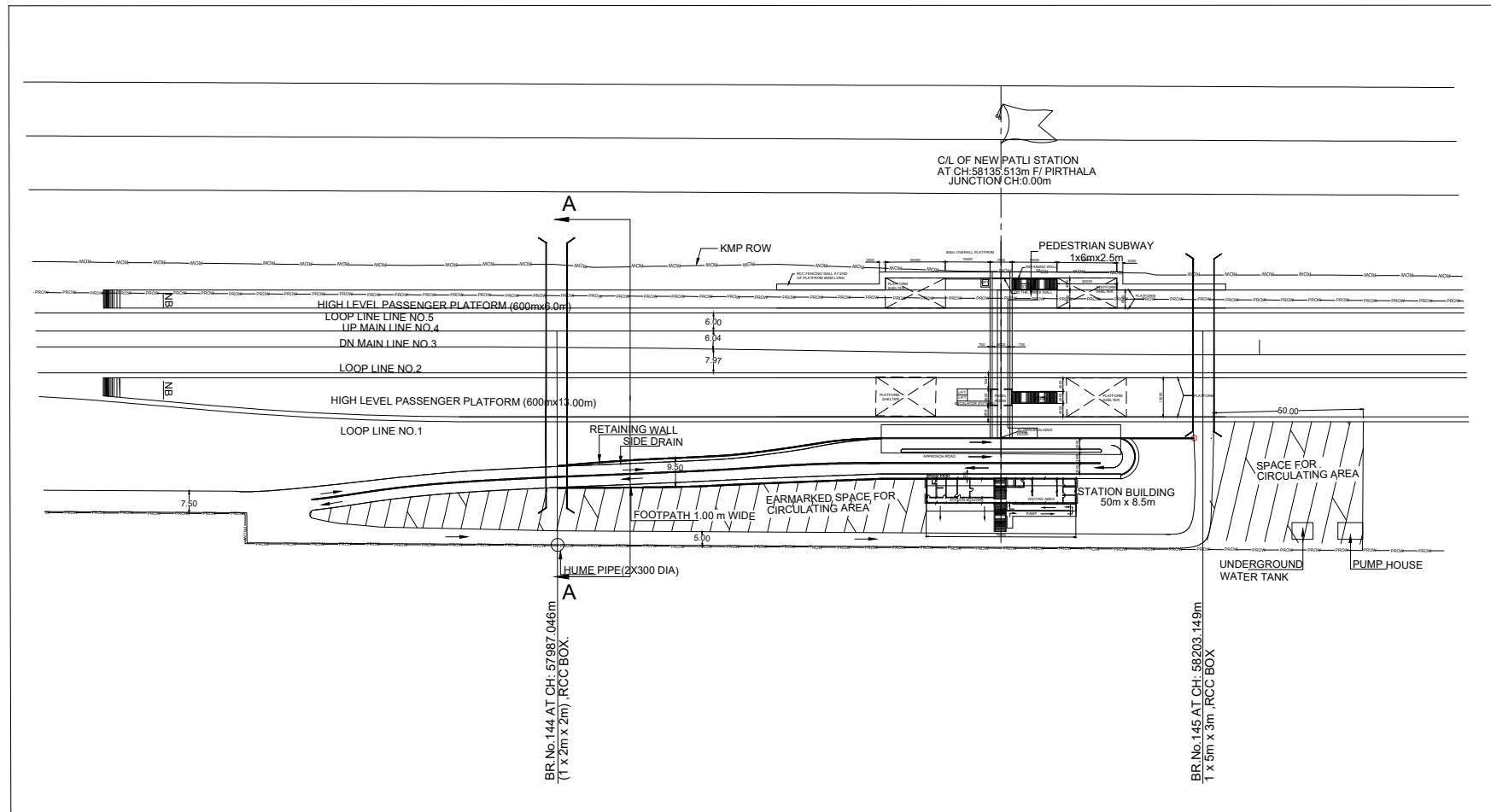


TITLE:- **CONCEPTUAL PLAN  
 DRAINAGE ARRANGEMENT (SULTANPUR)**

SKETCH NO. **GC-HRIDC-C2-SK-CIVIL-003** SHEET NO. **1 OF 1**

SCALE : **AS SHOWN** ISSUE DATE **23.06.2022** REVISED DATE **29.07.2022**

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD		SHIV OM DWIVEDI CPM/HRIDC	
SUDHIR AGRAWAL DPD/CIVIL		UMA M.RAO DGM/C-1	
REETU PATIAL CDE/ CIVIL			



SECTION A-A

PROJECT:  
HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  
HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LIMITED.

CONSULTANT:  
GENERAL CONSULTANT FOR  
HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with SMEC International Pty. Ltd.

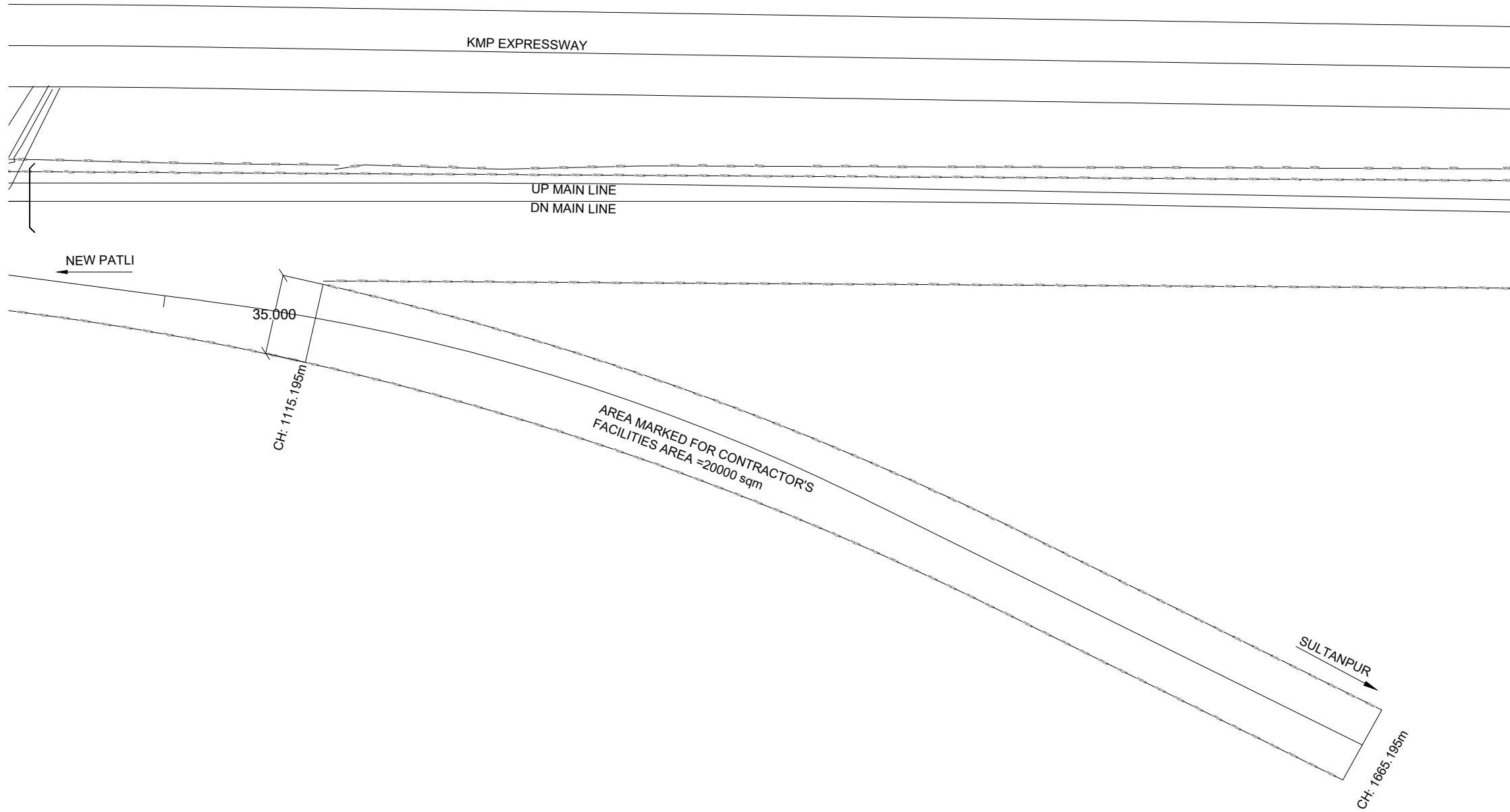


TITLE:- CIRCULATING AREA  
NEW PATLI

GC/HORC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

DRG. NO. GC-HRIDC-C2-SK-CIVIL-004 SHEET NO. 1OF1

SCALE : AS SHOWN ISSUE DATE 29.07.2022 REVISED DATE



PROJECT:  
**HARYANA ORBITAL RAIL CORRIDOR**  
 CONNECTING PALWAL TO SONIPAT BYPASSING DELHI  
 AREA BY LINKING ASAOTI-PATLI-SULTANPUR-ASAUDAH BY  
 NEW ELECTRIFIED BG DOUBLE LINE

CLIENT:  

**HARYANA RAIL INFRASTRUCTURE  
 DEVELOPMENT CORPORATION LIMITED.**

CONSULTANT:  

**GENERAL CONSULTANT FOR  
 HARYANA ORBITAL RAIL CORRIDOR**  
 RITES Limited in consortium with SMEC International Pty. Ltd.



TITLE:- **PLAN SHOWING EARMARKED AREA  
 FOR CONTRACTOR'S FACILITIES &  
 SITE OFFICE**

GC/HORC		HRIDC	
NAME / DEGINATION	SIGN	NAME / DEGINATION	SIGN
CHAHATEY RAM PD	<i>[Signature]</i>	SHIV OM DWIVEDI CPM/HRIDC	<i>[Signature]</i>
SUDHIR AGRAWAL DPD/CIVIL	<i>[Signature]</i>	UMA M.RAO DGM/C-1	<i>[Signature]</i>
REETU PATIAL CDE/ CIVIL	<i>[Signature]</i>		

SKETCH NO. GC-HRIDC-SK-C2-001 SHEET NO. 1 OF 1

SCALE : AS SHOWN ISSUE DATE REVISED DATE 29.07.2022

**Northern Railway**

Headquarters Office,  
Baroda House,  
New Delhi.

No. SD/TP/2021

Date: 22/11/2021

C.A.O./Const.  
Northern Railway,  
Kashmere Gate, Delhi.

C.A.O.-II/Const.,  
Northern Railway,  
Kashmere Gate, Delhi.

C.A.O./C/USBRL,  
Northern Railway,  
Jammu Tawi.

Divisional Railway Manager,  
Northern Railway,  
DLI, FZR, LKO, MB & UMB.

Sr. Divisional Engineer/Co-ord.,  
Northern Railway,  
DLI, FZR, LKO, MB & UMB.

**Type Plan No. O-104/2021**

**Sub: Standard Type Plan of "Powder Toilet for Divyangjans"**


In spite of the enabling policies and guidelines at national and state level regarding divyang toilet, there have been challenges faced by implementers and service providers because of lack of skills to deal with Divyang toilet due to in-adequate information.

In order to satiate the desire of Divyang Toilet, a Type Plan No. P-45/2019 (NRHQE Plan No. HQ/05/07-2019) of "Toilet & Ramp for Divyangs" has been already circulated earlier. In that, toilet enclosed both Water Closet & bathing facilities. A new Type Plan of "Powder Toilet for Divyangs" has been prepared, wherever, space is constrained. It encloses Water Closet with wash basin only. The layout plan conforms "Harmonised Guidelines and Space Standards for Barrier Free Built Environment for Person with Disability and Elderly Person (2016)" issued by MoUD, Govt. of India.

This Type Plan No. **O-104/2021** (NRHQE No. HQ/20/11-2021) regarding "Powder Toilet for Divyangs" has been uploaded on Northern Railway website <https://nr.indianrailways.gov.in/> and can be downloaded. This may be circulated to all concerned for implementation of instructions contained therein.

If any discrepancy found in above Type Plan, kindly inform this office. You may also send your comments/remarks/suggestions, if any to this office so that necessary improvements/corrections may be incorporated.

Encl. - as above

  
Name: (K.K. SHARMA)  
Dy. Chief Engineer/ Stn.Dev.  
For General Manager/Engg.



N.R.H.Q.E. PLAN NO. : HQ/20/11-2021

TYPE PLAN NO. : O-104/2021

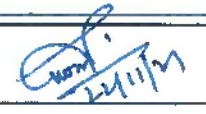


CANCEL TYPE PLAN NO. : .....

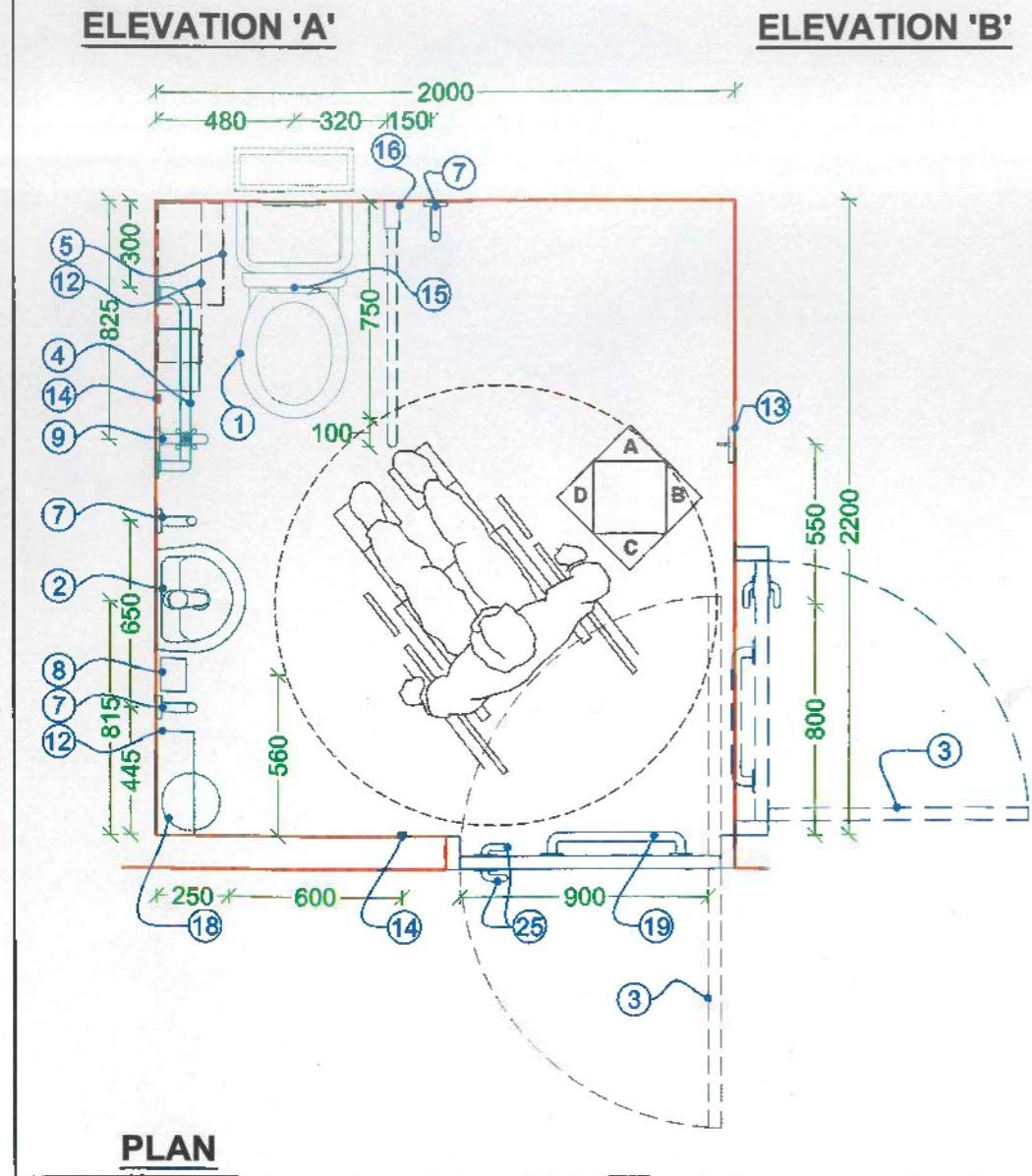
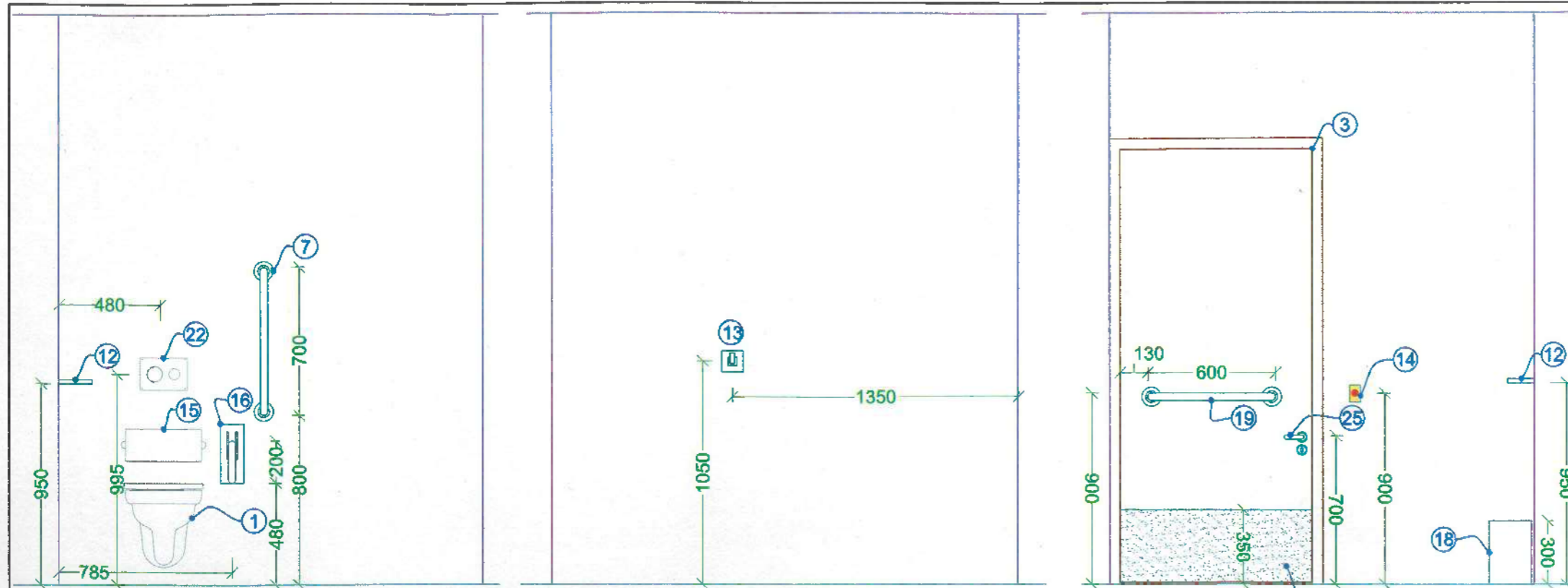
**NOTE:-**

- DO NOT SCALE THIS DRAWING.
- THIS DRAWING IS TO BE READ WITH ALL RELATED INFORMATION.
- ALL DIMENSIONS TO BE VERIFIED ON SITE BY MAIN CONTRACTOR BEFORE THE COMMENCEMENT OF ANY DRAWING OR WORK WHATSOEVER.
- ALL DIMENSIONS ARE IN MILLIMETER UNLESS SHOWN OTHERWISE.
- ALL GRAB RAIL SHOULD BE PROPERLY FIXED TO HANDLE THE MINIMUM LOAD OF 45 kg (100 lbs).
- ANTI-SKID OR SLIP RESISTANT TILES SHOULD BE USED ON FLOORING.
- MIRROR SHOULD BE TILTED AT AN ANGLE OF 30° FOR BETTER VISIBILITY OF WHEELCHAIR USER.
- VENTILATOR (600mm x 600mm) TO BE PROVIDED ACCORDING TO SITE OPENING.
- ACCESSIBLE TOILET SHOULD HAVE THE INTERNATIONAL SYMBOL OF ACCESSIBILITY (WITH BRAILLE SIGNAGE) DISPLAYED OUTSIDE FOR WHEELCHAIR ACCESS (Figure 1).
- THERE SHOULD BE ADEQUATE COLOUR & TONAL CONTRAST BETWEEN THE FIXTURES, WALLS & FLOORING. THIS IS TO ENABLE EASY RECOGNITION BY PERSONS WITH VISUAL IMPAIRMENTS.
- TOILET LEVEL SHOULD BE KEPT SAME AS LEVEL OF PLATFORM SO AS TO AVOID REQUIREMENT OF RAMP.
- THIS DRAWING IS BASED ON RAILWAY BOARD'S LETTER NO. 2019/Str.Dev.-I/03/06/Policy/PwDs dated 12.02.2020.

**LEGENDS:-**

ITEM NO.	PARTICULARS/ DESCRIPTION OF ITEM
1	WALL HUNG COMMODE
2	WASH BASIN
3	DOUBLE SWING DOOR POSITIONS
4	STAINLESS STEEL WALL MOUNTED L-SHAPE GRAB RAIL
5	STAINLESS STEEL SANITARY NAPKIN DISPOSAL
6	STAINLESS STEEL TISSUE HOLDER
7	STAINLESS STEEL VERTICAL GRAB RAIL
8	SOAP DISPENSER
9	TWO WAY BIB COCK
10	LEVER HANDLE TAP (Figure 2)
11	MIRROR
12	STAINLESS STEEL SHELF
13	SINGLE POST CLOTH HOOK
14	ALARM SWITCH
15	BACK REST (Figure 3)
16	STAINLESS STEEL DROP DOWN RAIL
17	SANITARY DISPOSAL UNIT
18	STAINLESS STEEL DISPOSAL BIN
19	STAINLESS STEEL PULL RAIL
20	ALARM RESET BUTTON
21	HAND JET SPRAY
22	FULL & HALF FLUSH BUTTON
23	KICK PLATE
24	ALARM RESET BUTTON
25	D-LEVER HANDLE

MONA SRIVASTAVA (CE/STN. DEV.)	
K.K. SHARMA (DY.CE/STN. DEV.)	
MOHD. SHARIF (PREPARED BY: SSE/ARCH.)	
<b>NORTHERN RAILWAY</b>	
<b>TYPE PLAN</b>	
<b>POWDER TOILET FOR DIVYANGS</b>	
CASE NO. SD/TP/2021	CANCEL PLAN NO. : NIL
SCALE : 1:25@A3	SHEET NO.: 01 OF 01
N.R.H.Q.E. PLAN NO. : HQ/20/11-2021	



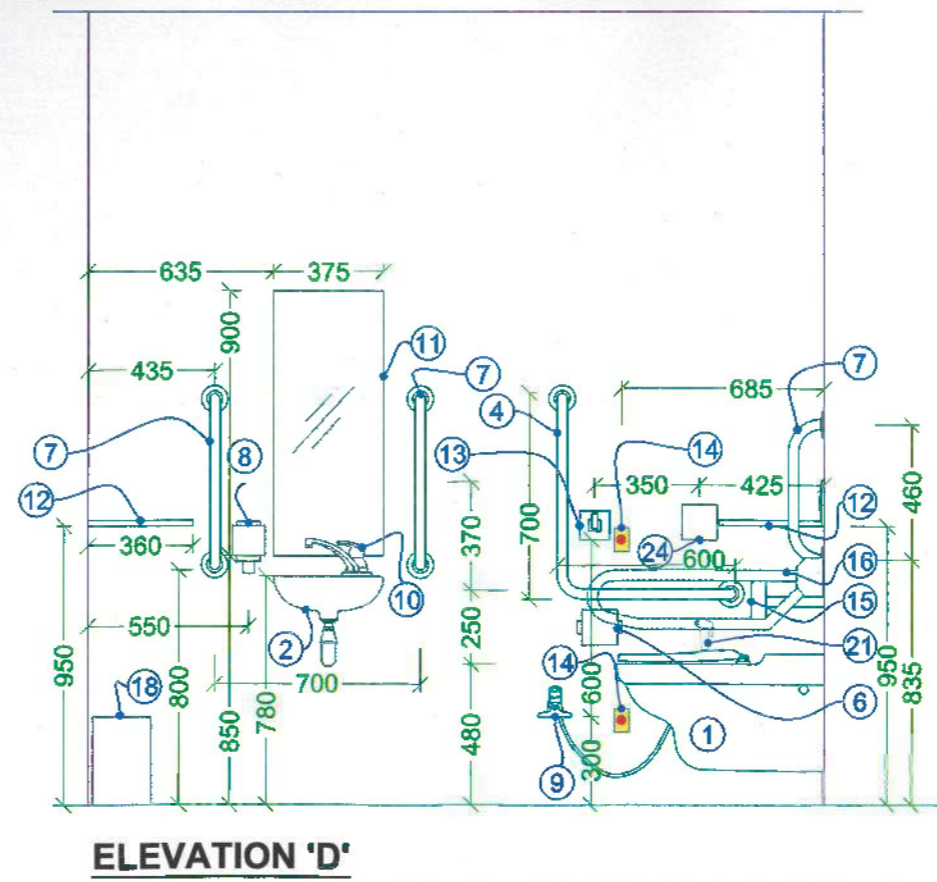
**Figure 1**

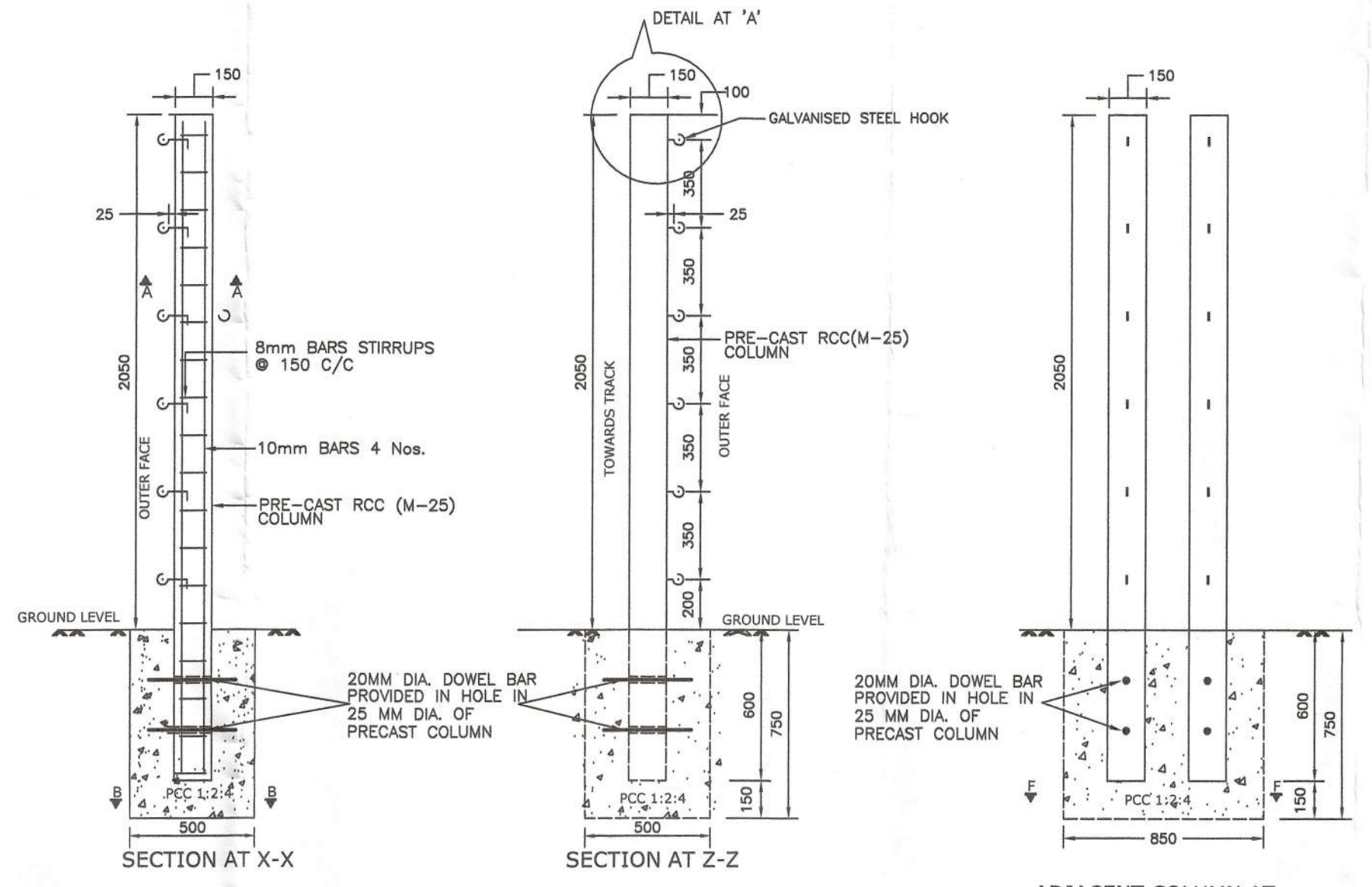
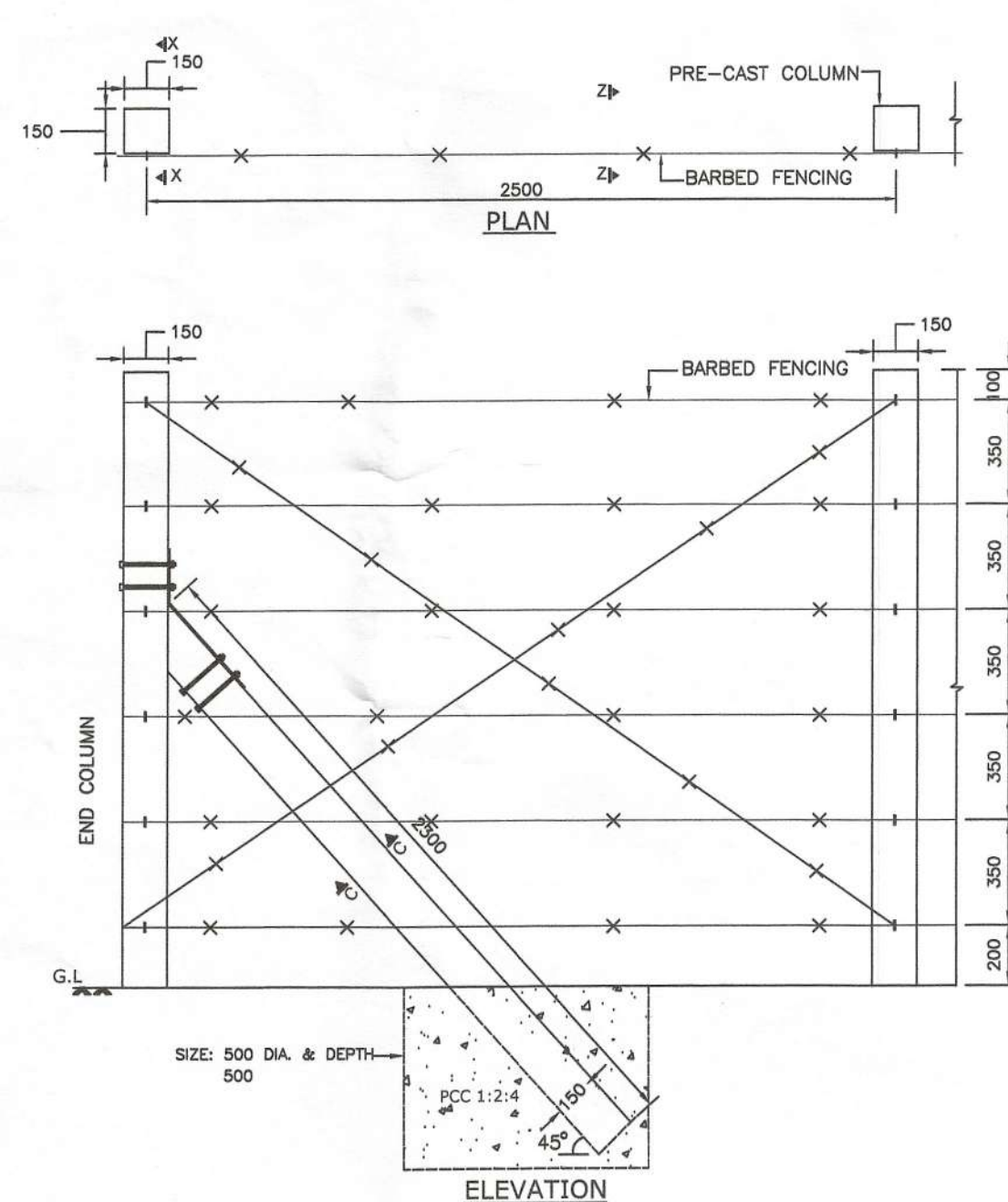


**Figure 2**



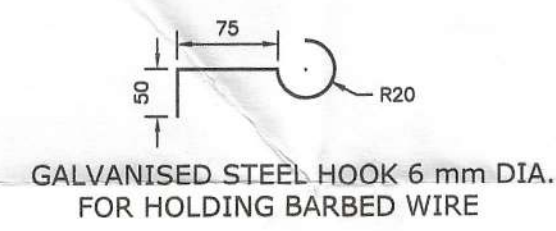
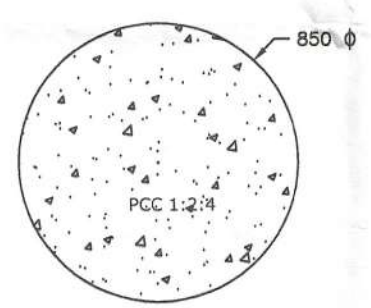
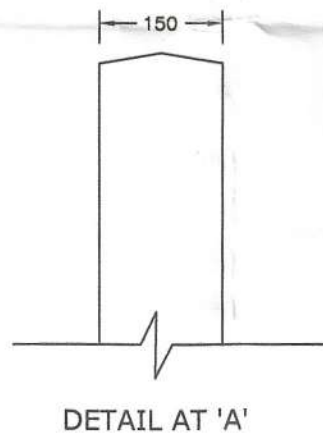
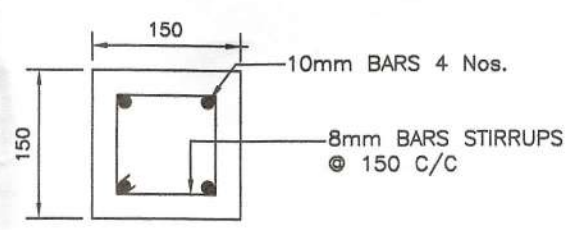
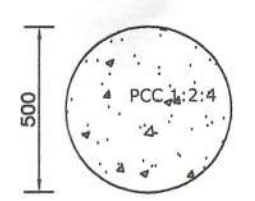
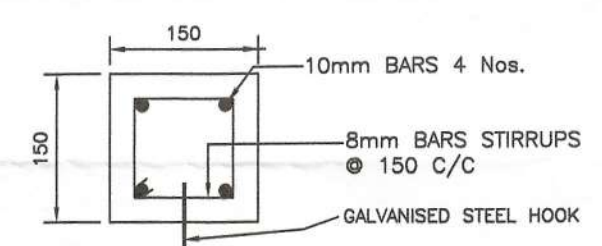
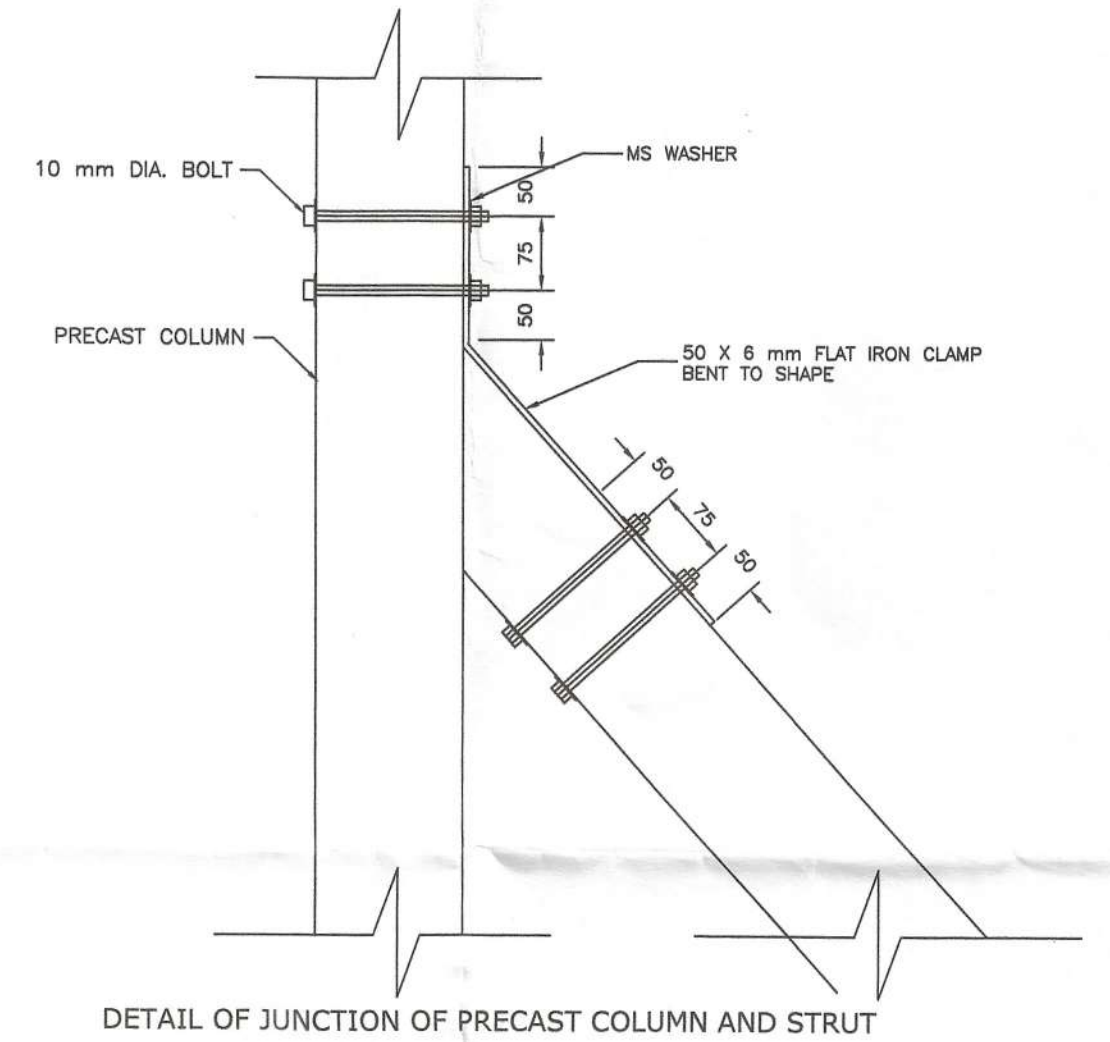
**Figure 3**





**NOTES:**

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. BARBED FENCING SHALL BE MADE OF G.I. BARBED WIRES CONFIRMING TO IS: 278. THE WEIGHT OF G.I. BARBED WIRE SHALL BE AS PER SOR.
3. THE G.I. BARBED WIRES SHALL BE FIXED TO THE COLUMNS WITH HOOKS MADE OF 6 mm DIA. GALVANIZED STEEL. ANOTHER END OF GALVANIZED STEEL HOOK SHALL BE PLACED BEHIND STIRRUPS AND TIED WITH STIRRUPS AS PER DRAWING TO PROVIDE STRENGTH.
4. FOR ERECTION OF WIRE FENCING, RECOMMENDATIONS GIVEN IN IS:4996-1984 SHALL BE FOLLOWED. FENCING WIRE SHALL BE TIED TO GALVANISED STEEL HOOKS WITH SHORT PIECE OF LIGHT WIRE.
5. M-25 GRADE CONCRETE SHALL BE USED IN PRECAST COLUMN/ STRUT. COLUMN/ STRUT SHALL BE CAST AT CENTRALIZED DEPOT UNDER CONTROLLED CONDITION AS PER IS :456-2000.
6. TMT BARS OF GRADE FE 415/ 500 OF SPECIFIED DIA. SHALL BE USED. TMT BAR SHALL BE CONFIRMING TO IS:1786 (LATEST).
7. ZONAL RAILWAY MAY PAINT THEIR INITIALS (SUCH AS NR, SER etc.) ON COLUMN AND STRUT.
8. STRUT OR BRACE SHALL BE FIXED WITH END RCC COLUMN BY SUITABLE ARRANGEMENT AS DETAILED IN DRAWING. 50 X 6 mm MS FLAT SHALL BE USED TO CONNECT STRUT/BRACE TO RCC COLUMN. 10 mm DIA. MS BOLT BLACK HEXAGONAL HEAD ROUND NECK WITH HEXAGONAL NUTS AND TWO WASHER SHALL BE USED. AFTER TIGHTING NUT, END OF BOLT SHALL BE HAMMERED TO MAKE ANTITHEFT.
9. SUPPORTING STRUT SHALL BE PROVIDED AT FIRST / END COLUMN OR CHANGE OF DIRECTION.
10. 1:20 SLOPE SHALL BE PROVIDED ON TOP OF COLUMN AT THE TIME OF CASTING.
11. AT EVERY 30 METRE TWO COLUMN SHALL BE GROUTED SIDE BY SIDE.
12. IN UNDULATING AREA, COLUMN SHALL BE PLACED ACCORDINGLY SO THAT BARBED WIRE ARE ALIGNED HORIZONTAL. VERTICALITY OF COLUMN SHALL BE CHECKED DURING ERECTION.
13. FOUNDATION SHALL BE DUG USING AUGAR/ MECHANICAL BORING EARTH SHALL BE RAMMED PROPERLY AND 50 MM SAND SHALL BE PLACED BEFORE FOUNDATION CASTING. FOUNDATION SHALL BE CURED PROPERLY.
14. THIS CATLE FENCE SHALL BE PROVIDED AT RAILWAY BOUNDARY.



ED/WORKS	Jd 08/05/19
Jr. DIR/WORKS	08/05/19
ADE/WORKS	08/05/19

**BARBED WIRE CATTLE FENCE  
ALONG THE TRACK  
WITH PRECAST COLUMN**

SCALE - N.T.S DATE - 08.05.19

DRG. NO. - RDSO/WKS/2019/2

WORKS DIRECTORATE / R.D.S.O.

MPK 8-5-19			
DRAWN BY	ALT	DESCRIPTION	DATE

---

**Annexure 11/7**

**Para 1103.4**

**INSCRIPTION PLAQUES ON BRIDGES SHOWING  
NATURE AND DEPTH OF FOUNDATIONS.**

On all bridges of 3 m (10 ft.) span or over, particulars of the nature and depth of foundations should be inscribed on a CC or stone slab fixed on each pier and abutment.

1. The information to be recorded should be :

- a) Nature of foundation e.g. wells, piles and open,
- b) Nature of strata passed through and reached,
- c) Depth from rail level to the bottom of foundations and top of foundations.

2. The following abbreviations should be used in the inscriptions:

WL	Well foundation
ON	Open foundation
SP	Screw Pile foundation
TP	Timber pile foundation
CP	Concrete pile foundation
IC	Iron cylinder
SC	Steel cylinder
CN	Concrete
CCN	Cement Concrete
PSC	Prestressed concrete
BF	Bottom of foundation
TF	Top of foundation
TA	Top of apron
TI	Top of invert
BD	Bottom of drop wall
RL	Rail level
RL-BF	Depth from rail level to bottom of foundation
RL-TF	Depth from rail level to top of foundation
S	Sand
C	Clay
G	Gravel or shingle

---

Title:  
Bridge Plaque (sheet 1of2)  
(Annexure-11/7 of IRBM)

---

M	Moorum
R	rock
BC	Black cotton soil
K	Kunker
A	Alluvium

3. Other symbols may be used if required such as :

WW	Wing wall
US	Up stream
DS	Down stream
TP	Top of pitching
BP	Bottom of pitching
WN	Wire netting
CW	Crib work

4. For example a plaque inscribed thus and built on top of pier :

WL	
RL - BF	74
RL - TF	34
S	25
C	15

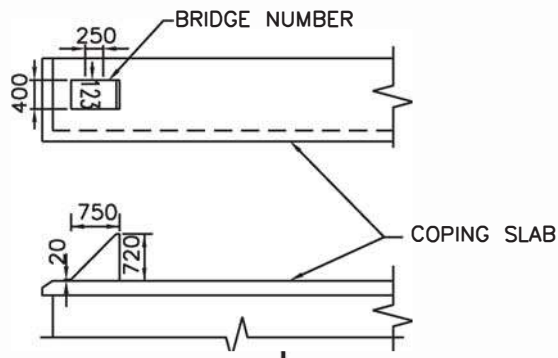
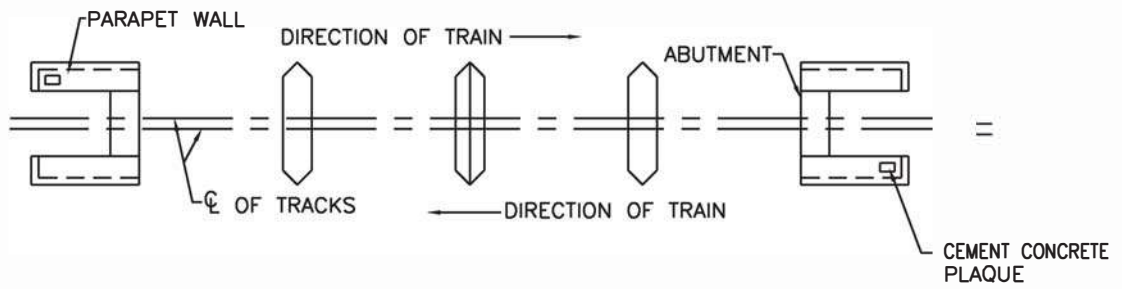
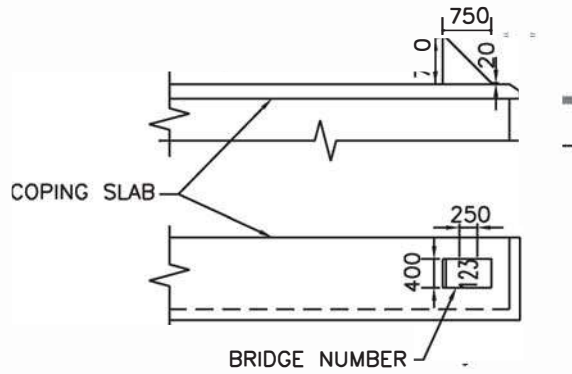
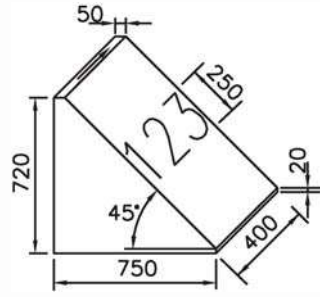
Will indicate that the pier is founded on a well, the bottom of which is at 74 ft below rail level and top 34 ft below rail level and that 25 ft of sand and 15 ft of clay were passed through and the well rested on clay. If the inscriptions had been made after the metric measurements came into force, the numbers on the inscription will indicate the depths in metres and to distinguish from FPS units, letter "m" should be added e.g. RL-BF 20m.

5. On bridges already built it may be impossible to give so much details, in that case a simple inscription such as

RL - BF 69  
R  
will suffice

This will indicate that the foundation is on rock at a level of 69 ft below rail level.

Note : Most of the existing bridges contain plaques with inscriptions in FPS Units. On new bridges, plaque inscriptions in MKS Units should be adopted.



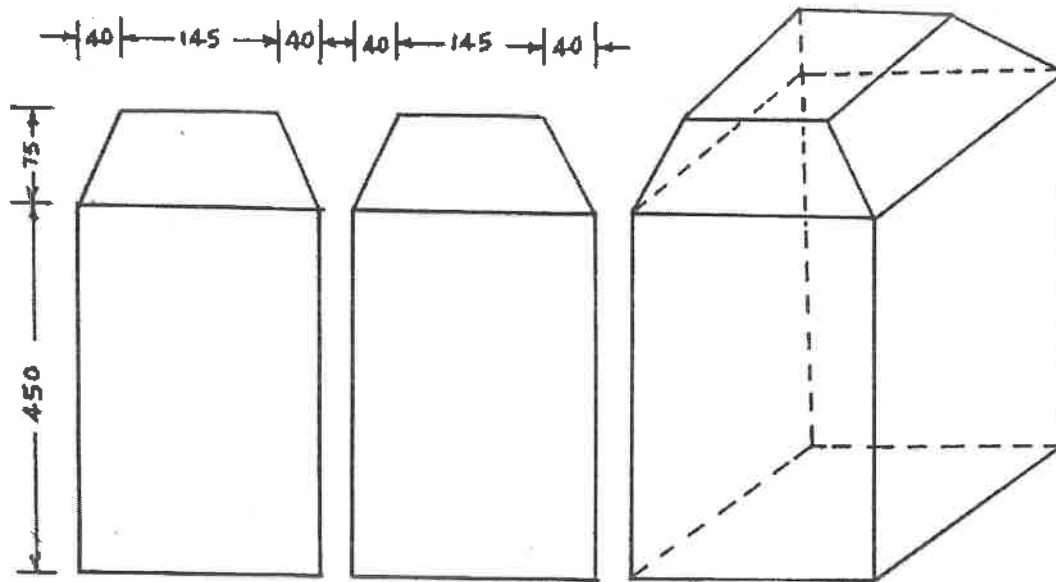
मुंडेर दीवार पर पुल संख्या की व्यवस्था  
दर्शाने वाला रेखाचित्र

SKETCH SHOWING PROVISION OF  
BRIDGE NUMBER ON PARAPET WALL

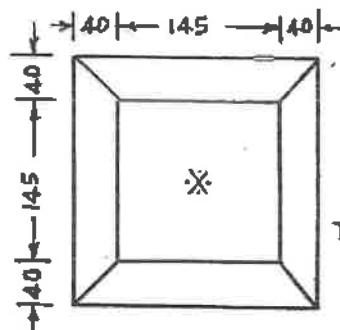
NOTE:-  
ALL DIMENSIONS ARE IN MILLIMETRES ONLY.

Title:  
Bridge No. Tablet  
(Annexure- 2/1 of IRBM)

6







FRONT ELEVATION    SIDE ELEVATION    3-DIMENSION VIEW

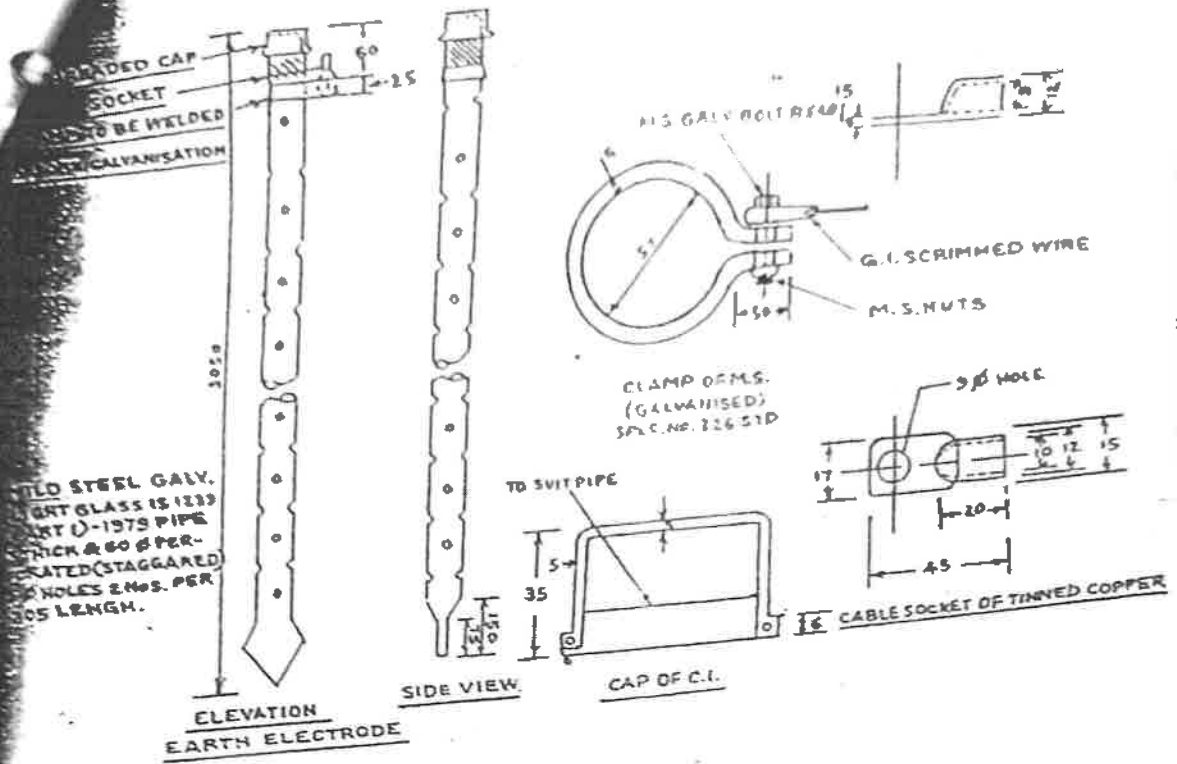


✱  
SIG: CABLE  
OR  
TELECOM: CABLE

**NOTE:-**

- 1 DIMENSIONS ARE IN MILLIMETERS.
- 2 CABLE MARKER IS TO BE MADE FROM 1:3:6 CEMENT, SAND, COARSE & CONCRETE MIXTURE.
- 3 ENGRAVATION IS TO BE MADE AS PER THE TYPE OF CABLE AT SITE.

		 S.E/D&D/LDH			
N. R.	CABLE MARKER FOR SIG. & TELECOM: CABLE	 N. Mohd	 J. P. Datta	 Tan	N: NR/S&T/CON/1-5/97-A
	NOT TO SCALE	DRN.	S.E/C	ASTE/SPL	

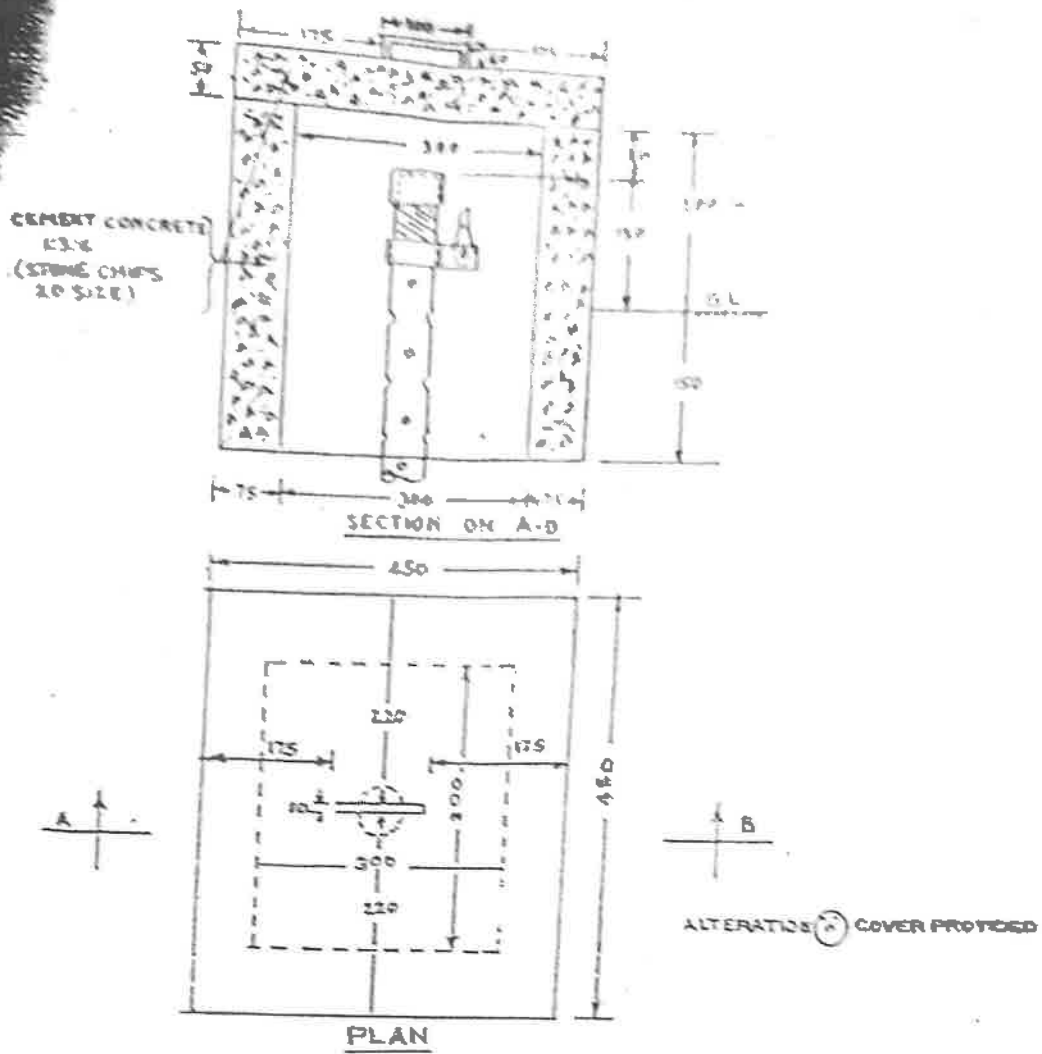


MILD STEEL GALV.  
PORT GLASS IS 1233  
RT D-1975 PIPE  
THICK & 60  $\phi$  PER-  
FORATED (STAGGERED)  
HOLES 2 NOS. PER  
105 LENGH.

- NOTE :-
- 1 ALL DIMENSIONS IN MM.
  - 2 NOT TO SCALE
  - 3 LOWER END OF PIPE TO BE SHAPPED AS SHOWN BY SQUIZZING  $\phi$  IF NECESSARY BY CUTTING OF DEFORMED MATERIAL.
  - 4 EARTH ELECTRODE PIPE TO BE GALVANISED AFTER DRILLING AND FABRICATION.
  - 5 EACH ELECTRODE SHOULD BE SUPPLIED WITH A GALVANISED HEX-HEAD IRON BOLT TO SPEC. NO. I.S. 1821-1961 (8  $\phi$ , 40 LENGTH WITH 25 THREADED PORTION) AND TWO ROUND FLAT WASHERS AND A NUT TO SUIT FOR FIXING THE SOCKET TO PIPE CLAMP.

*[Signature]*  
S.E./D&D/LOH


		<i>[Signature]</i> S.E./D&D/LOH		
N.R.	EARTH ELECTRODE (G.I. PIPE)	<i>[Signature]</i>	Yes	N <sup>o</sup> NR/S&T/CON/6-3/97 & NR/S&T/Project/16.1/2015
FOUND	ELECTRICAL	DRN.	S.E.K	ASTE/SPL



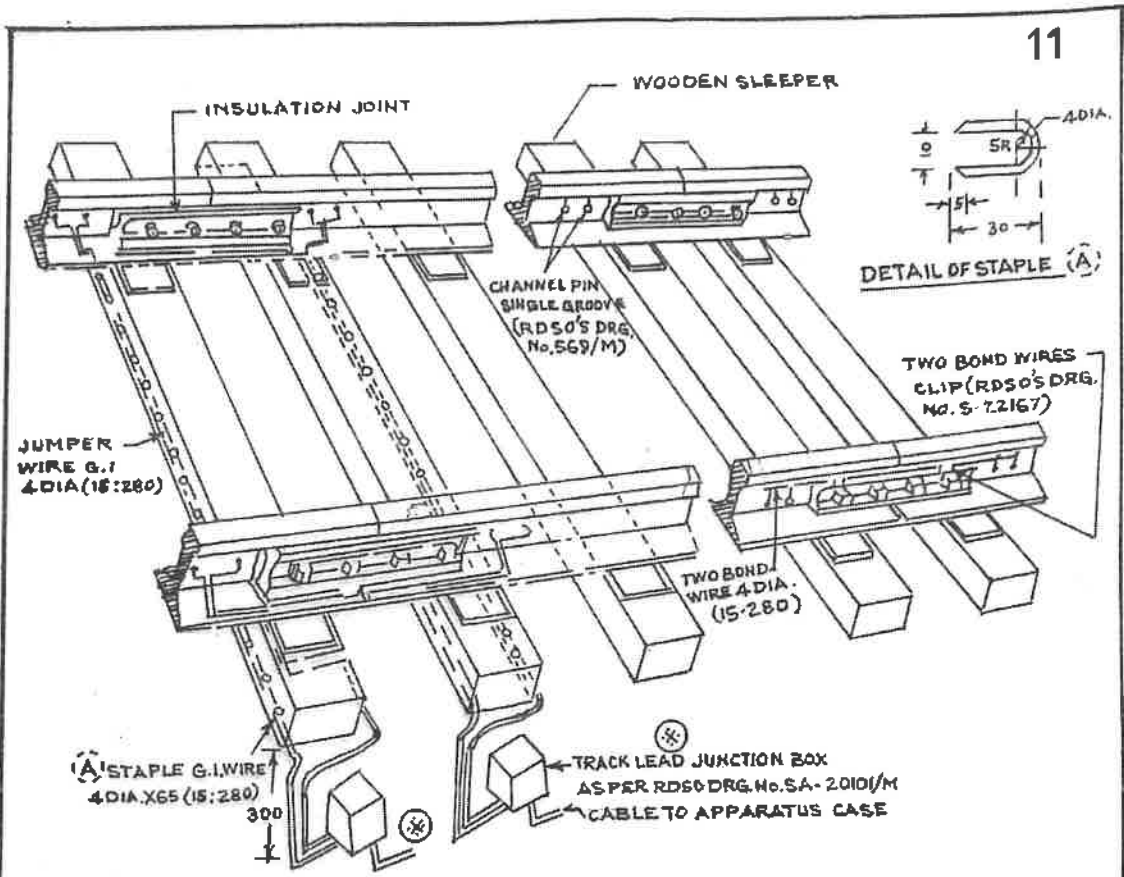
**NOTE:-**

1. OUTER SURFACE ABOVE GROUND LEVEL SHOULD BE PLASTERED WITH 1:4 CEMENT SAND.
2. ALL DIMENSIONS IN MM.

*R*




		 SE/D&D/LOH	
C.C. ENCLOSURE EARTH ELECTRODE AND HANDLE		<i>N. N. N.</i> CEMENT	No NR/S&T/CON/6-4/97 NR/S&T/PROP/162/2015
NOT TO SCALE		DRM. SE/C	ASTE/SPL



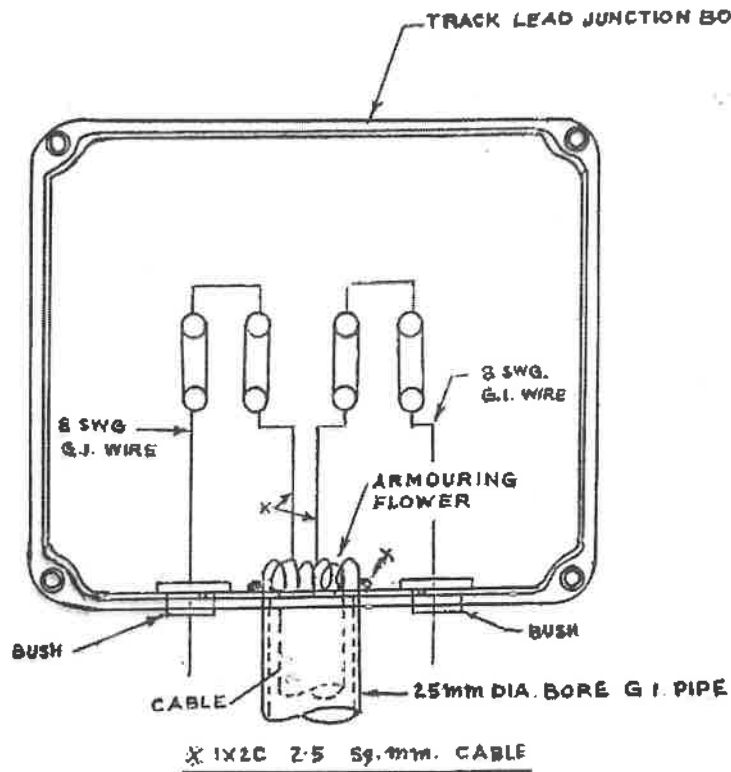


**NOTE:-**

- 1 JUMPER WIRES WILL BE TAKEN THROUGH TRANSPARENT PVC PIPE OF GOOD QUALITY TO AVOID EARTHING OF POSITIVE RAIL.
- 2 THE G.I. JUMPER WIRE WILL BE TAKEN TO TRACK LEAD JUNCTION BOX THROUGH INSULATED NYLON BUSH PROVIDED IN TRACK LEAD. JUNCTION BOX SEPARATELY FOR +VE AND NEGATIVE RAIL.
- 3 THE TRACK LEAD J.B. SHOULD BE PROVIDED AT A LEVEL SUITING G.I. JUMPER WIRE AND AVOID INFRINGEMENT. THE J.B. SHOULD CLOSE TO SLEEPER TO AVOID DAMAGE.
- 4 STAPLES SHOULD BE PROVIDED FOR SUPPORTING THE WIRE WITH WOODEN SLEEPERS AT SUITABLE DISTANCE.
- 5 INVARIABLY BOND WIRE CLIPS MUST BE PROVIDED FOR THROUGH BOND WIRE.
- 6 JUMPER WIRE SHOULD BE SECURED BY TWO NOS. OF CHANNEL PIN AT INSULATED JOINTS FOR BETTER CONTACT.
- 7 CABLE SHOULD BE PROPERLY SECURED IN TRACK LEAD JUNCTION BOX BY PROVIDING FLOWER MADE OF CABLE ARMOURING.



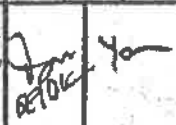
		 6E/D&D/LDH		
N R	TRACK CIRCUIT CONNECTION JUMPER WIRE & BOND WIRE FIXING IN TRACK LEAD JN: BOX ON WOODEN SLEEPER	 N. N. N.	 J. J. J.	N: NR/S&T/CON/ 3-1/97
NOT TO SCALE		DRN.	SE/C	ASTE/SPL

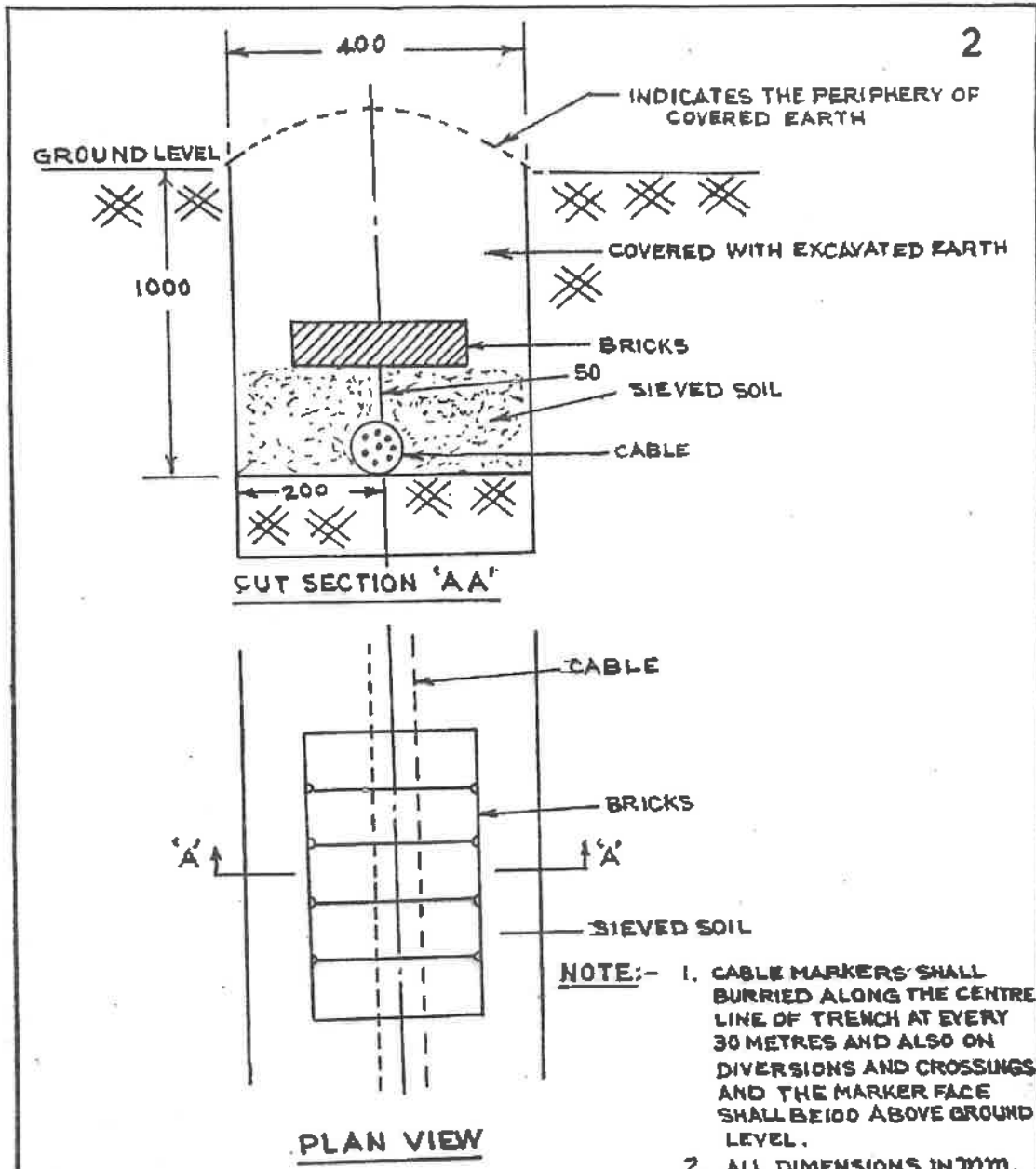
12




**NOTE :-**

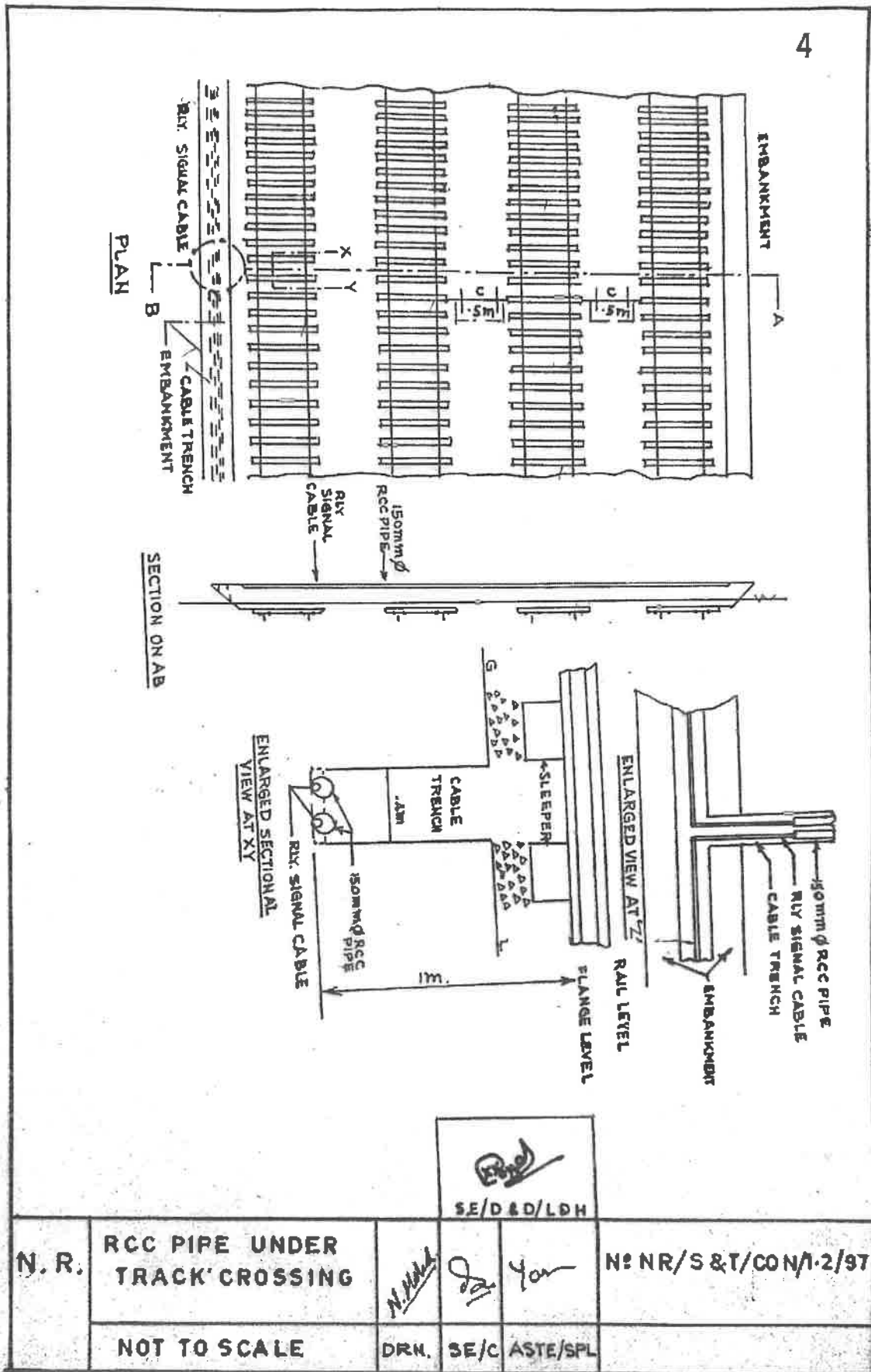
- 1 ALL DIMENSIONS IN MM.
- 2 ARMOURING FLOWER PROVIDED FOR PREVENTING THE PULLING OUT OF THE CABLE FROM TRACK LEAD JUNCTION BOX.
- 3 NYLON BUSH TO BE PROVIDED TO PREVENT EARTHING OF G.I. JUMPER WIRE.
- X 4 HEXAGON BACK NUT M.S. FOR 25 DIA. ANNOIDISED BORE.

		 S.E/D&D/LDH		
N. R.	CABLE TERMINATION ARRANGEMENT IN TRACK LEAD JUNCTION BOX	 N. K. K.	 J. M. Y.	NR/S&T/CON/32/57
NOT TO SCALE		DRN	SE/C	ASTE/SPL



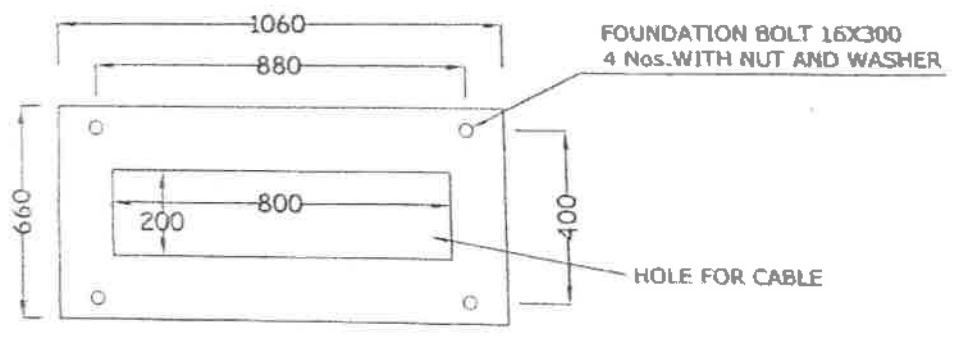
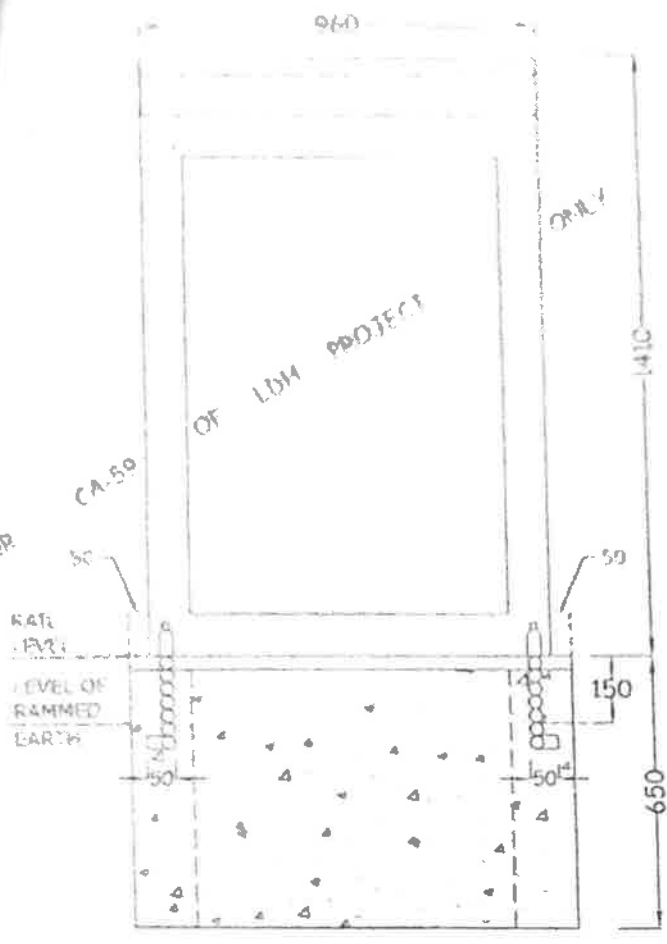
		 SED & L DH		
N. R.	CABLE TRENCH	<i>N. R.</i>	<i>J. Y.</i>	№ NR/S&T/CON/1-1/97-A
	NOT TO SCALE	DRN.	SE/C	ASTE/SPL

7



NOTE

- 1 FOUNDATION SHOULD BE CAST USING FORMWORK AND PREPARING TEMPLATE FOR THE FOUNDATION BOLTS
- 2 OUTER SURFACE SHOULD BE PLASTERED WITH 1:4 CEMENT SAND UP TO 300 FROM THE TOP OF THE SURFACE
- 3 ON ALL SIDES EARTH SHOULD BE RAMMED UP TO THE LEVEL SHOWN IN THE SKETCH
- 4 FOUNDATION WITH MIXTURE OF CEMENT, SAND AND STONE CHIPS SIZE 20(1:3:6)
- 5 ALL DIMENSIONS ARE IN MM.

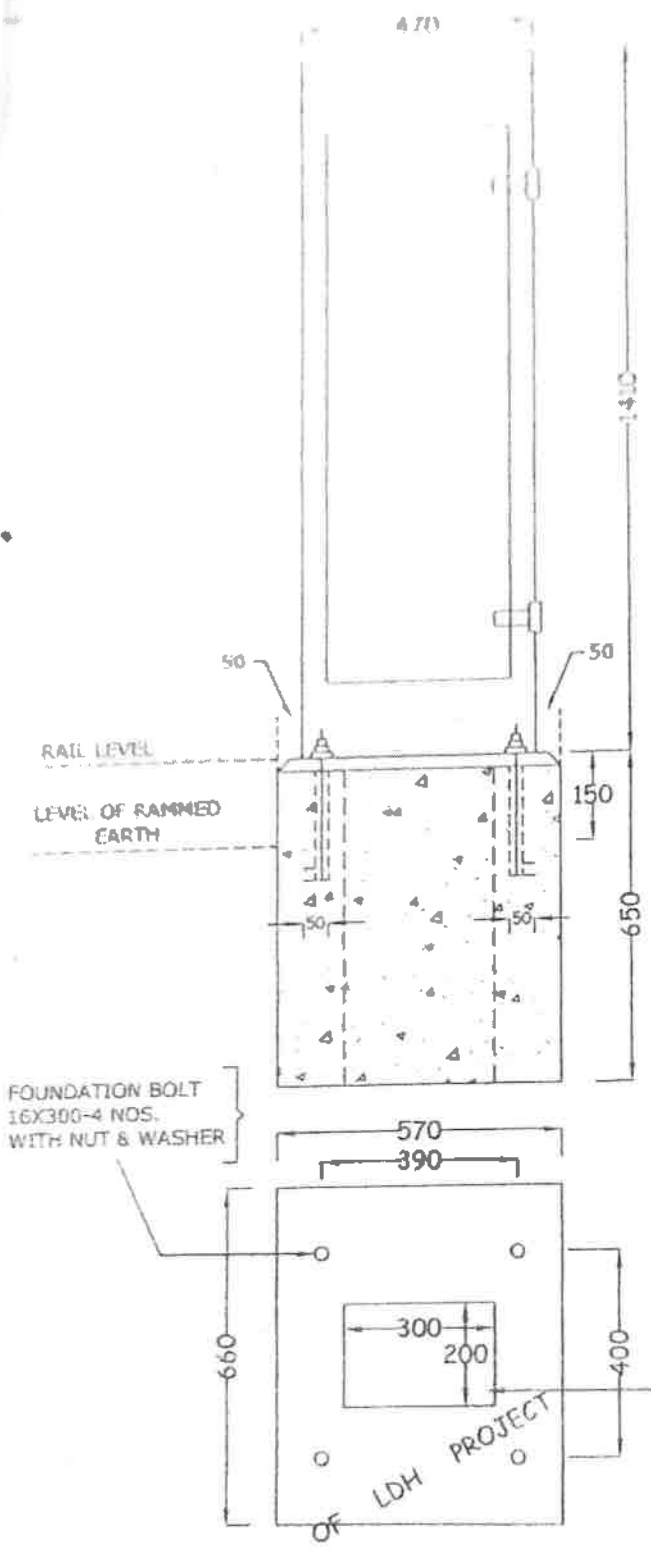


N.R.	FOUNDATION FOR APP. CASE SINGLE	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	N/NR/S&T/CON/2.7/97
	NOT TO SCALE	SSR/080/ALM	AESTY/WLDH	DI ESTE/WLDH	

N.Riy.

NOTE

- 1 ALL DIMENSIONS ARE IN MM.
- 2 FOUNDATION SHOULD BE CAST PREPARING TEMPLATE FOR THE FOUNDATION BOLTS.
- 3 OUTER SURFACE SHOULD BE PLASTERED WITH 1:4 CEMENT SAND UP TO 100 FROM THE TOP OF THE SURFACE.
- 4 ON ALL SIDES EARTH SHOULD BE RAMMED UP TO THE LEVEL SHOWN IN THE SKETCH.
- 5 FOUNDATION WITH MIXTURE OF CEMENT, SAND AND STONE CHIPS (SIZ. 20(1:3:6))



FOUNDATION BOLT  
16X300-4 NOS.  
WITH NUT & WASHER

RAIL LEVEL

LEVEL OF RAMMED  
EARTH

ONLY

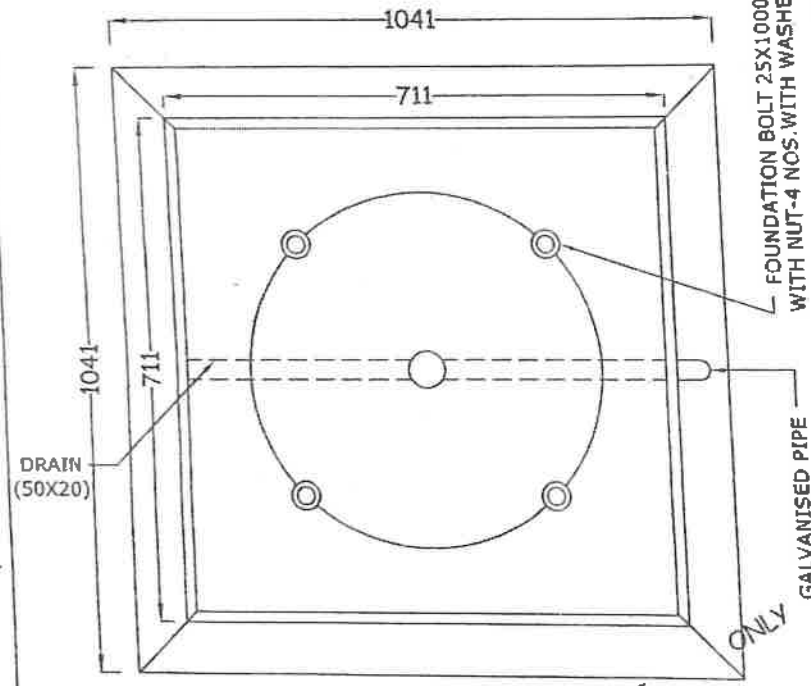
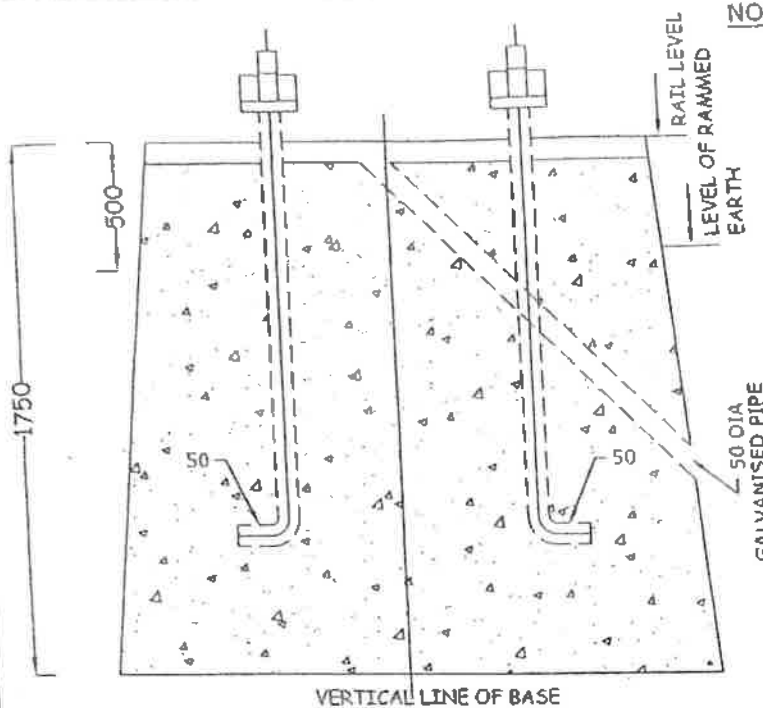
HOLE FOR CABLE

LDH PROJECT

FOR

CA-59

N.R.	FOUNDATION FOR APP. CASE HALF	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	NR/S&T/CON/2.8/97
	NOT TO SCALE	DATE/DATE	DATE/DATE	DATE/DATE	



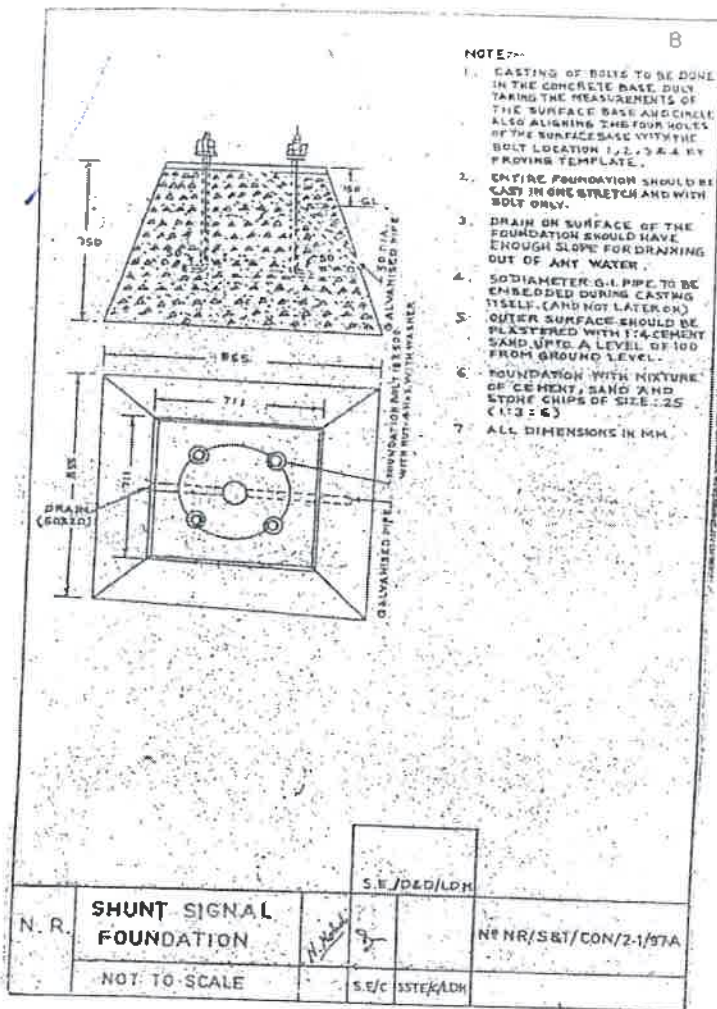
**NOTE:-**

- 1 CASTING OF BOLTS TO BE DONE IN THE CONCRETE BASE DULY TAKING THE MEASUREMENTS OF THE SURFACE BASE AND CIRCLE ALSO ALIGNING THE FOUR HOLES OF THE SURFACE BASE WITH THE BOLT LOCATION 1,2,3 & 4 BY PROVING TEMPLATE.
- 2 ENTIRE FOUNDATION SHOULD BE CAST IN ONE STRETCH AND WITH BOLT ONLY.
- 3 DRAIN ON SURFACE OF THE FOUNDATION SHOULD HAVE ENOUGH SLOPE FOR DRAINING OUT OF ANY WATER.
- 4 50 DIAMETER G.I. PIPE TO BE EMBEDDED DURING CASTING IT SELF. (AND NOT LATER ON)
- 5 AFTER CASTING OF BASE AND CURING OF THE SAME IS OVER THE FOUR SIDES OF THE BASE TO BE CLEARED OF ALL LEFT OVER CONCRETE AND SIDES DULY RAMMED WITH EARTH UP TO 500 BELOW THE TOP OF THE BASE.
- 6 WHERE REQUIRED PITCHING ON THE RELEVANT SIDES OF THE RAMMED SURFACE WITH 225 TO 300 SIZE BOULDERS SHALL BE DONE & FILLING THE CREVICES WITH 1:6:12 CONCRETE WITH FINE 20 STONE CHIPS PITCHING WILL BE TO THE FULL HEIGHT OF THE RAMMED EARTH.
- 7 OUTER SURFACE SHOULD BE PLASTERED FROM TOP OF FOUNDATION WITH 1:2 CEMENT SAND UP TO A LEVEL OF 50 BELOW.
- 8 FOUNDATION WITH MIXTURE OF CEMENT, SAND AND STONE CHIPS SIZE-25 (1:3:6)
- 9 ALL DIMENSIONS ARE IN MM.

OF LDH PROJECT

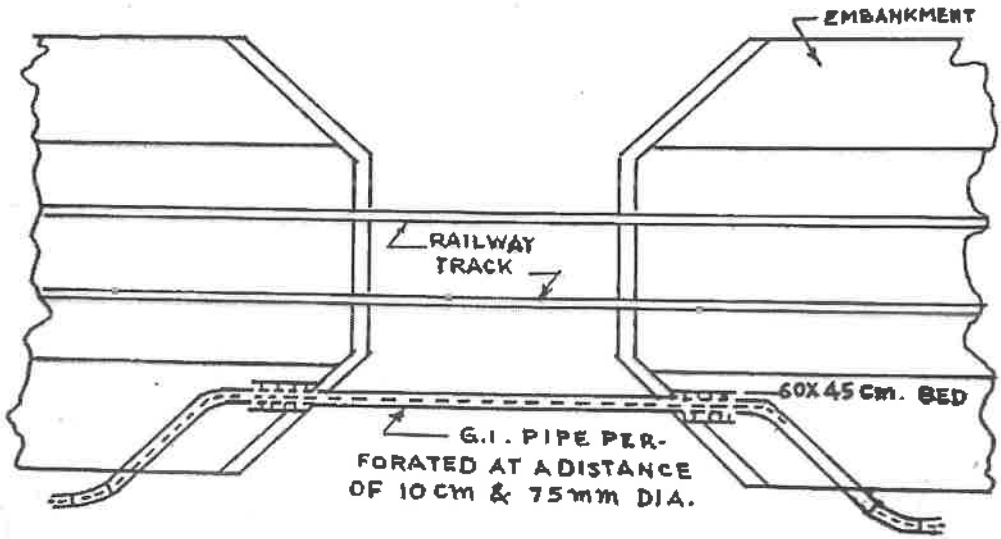
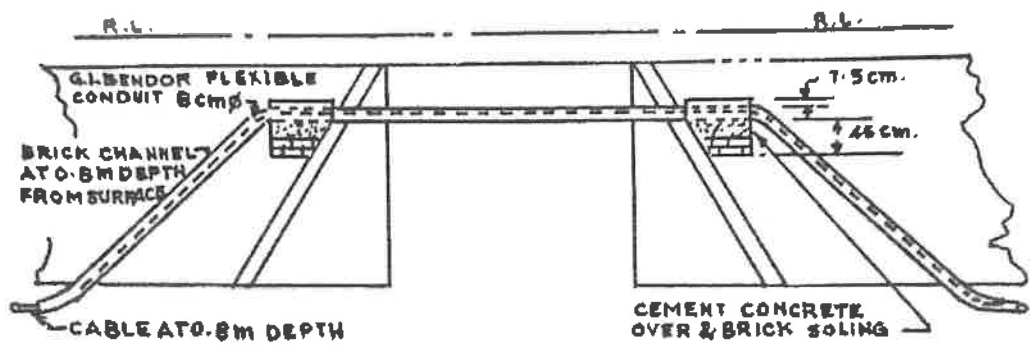
NOT TO SCALE

<b>NR</b>	CA-59	 S.S.E./DSD/LDH 19/02/19	 A.E.S.T.E./W/LDH 19/2/19	 O.Y.C.S.T.E./W/LDH 19/2/19	Drawing No. NR/S&T/CON/2.1/97
	SIGNAL FOUNDATION FOR				



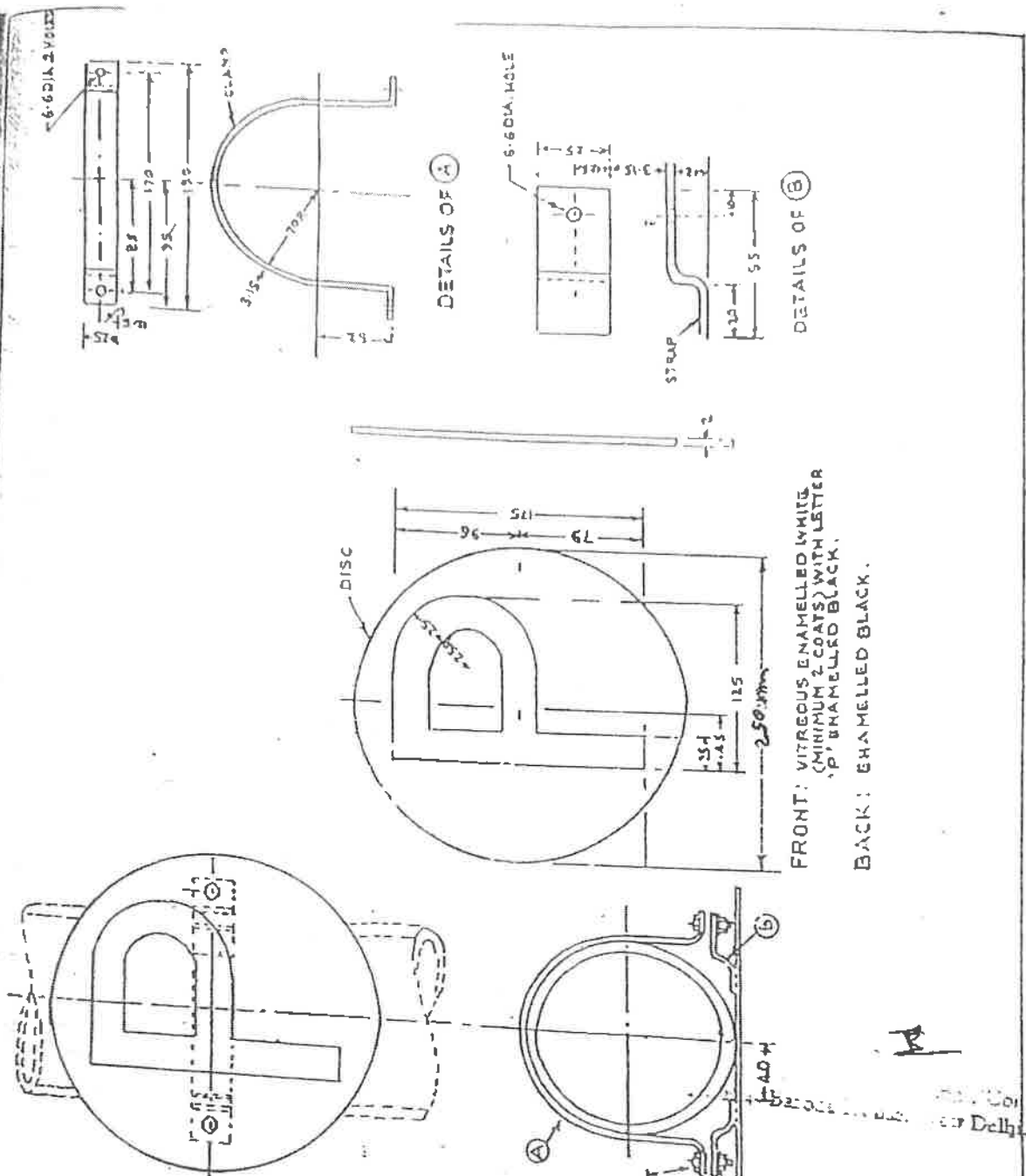


5



*[Signature]*  
SE/DAD/LOH

N. R.	G.I. PIPE ON CULVERT	<i>N.H.A.</i>	<i>[Signature]</i>	<i>Yam</i>	N: NR/S&T/CON/1.4/57
NOT TO SCALE		DRN.	SE/C	ASTE/SPL	



NOTE:-

- 1 ALL DIMENSIONS IN MILLIMETRES.
- 2 ALL DIMENSIONS SHALL BE WITHIN  $\pm 1.0$  UNLESS OTHERWISE SPECIFIED, DEPENDING UPON RELATED DIMENSIONS.
- 3 DISC SHALL BE ENAMELLED AFTER WELDING STRAP.
- 4 HOLE CENTRES SHALL NOT DEVIATE BY MORE THAN 0.5.
- 5 MATERIAL - STEEL SHEET.
- 6 STRAP AND CLAMP SHALL BE PAINTED WITH DEAD BLACK PAINT.
- 7 ALL PAINTING SHALL BE DONE AFTER WELDING THE STRAP.

BOLT M5 HEX. HD.  
6X20 WITH HEX. NUT

SPRING WASHER  
TYPE 'B' M-6

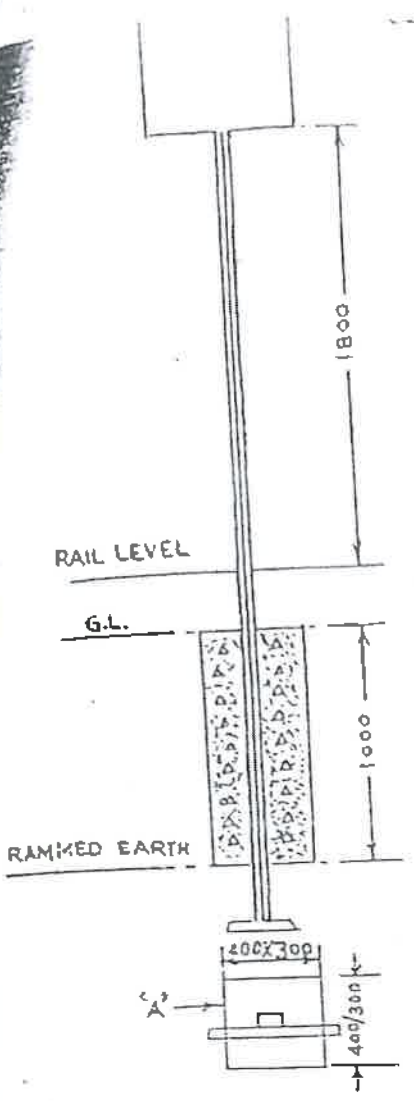
FRONT: VITREOUS ENAMELLED WHITE  
(MINIMUM 2 COATS) WITH LETTER  
'P' ENAMELLED BLACK.

BACK: ENAMELLED BLACK.

*[Signature]*  
S.E/D & D/LDH

N.R.	'P' MARKER NON ILLUMINATED		<i>N. Khandewal</i> 02/11/0	Yes	No. NR/S&T/CON/6-2/97
	NOT TO SCALE	DRN			

By KHANDREWAL ELECTRIC



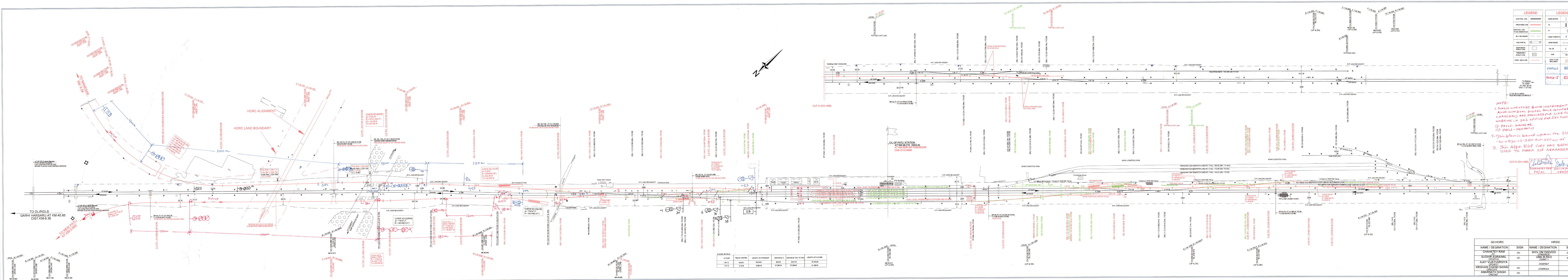
- NOTE :-
- 1 IN CASE CHANNEL POST IS USED THE DIMENSIONS OF 'A' WILL BE 300 AND IF RAIL POST IS USED THE DIMENSION OF 'A' WILL BE 400
  - 2 FOUNDATION WITH MIXTURE OF CEMENT, SAND AND STONE CHIPS SIZE - 20 (1:3:6)
  - 3 ALL DIMENSIONS IN MM.

Asst. Eng. / Const. P. J.

*(Signature)*  
SE/DSD/LDH

N. R.	FOUNDATION FOR BLOCK SECTION LIMIT BOARD SHUNTING LIMIT BOARD SIGHTING BOARD	<i>N. Mohan</i>	<i>For</i>	<i>For</i>	No NR/S&T/CON/ 7.4/97
	FOR CHANNEL WALL ELECTRICALS NOT TO SCALE	DRN.	SE/C	ASTE/SPL	

15/10/97



ROADS DETAIL

NO.	TRACK CENTRE	LENGTH OF STRAIGHT	DISTANCE X	DISTANCE Y	LENGTH OF A OVER
1	10.00	4.00	4.00	2.00	4.00
2	10.00	4.00	4.00	2.00	4.00

LEGEND

EXISTING LINE	---
PROPOSED LINE TO BE DEMOLISHED	---
EXISTING LINE TO BE MAINTAINED	---
NEW BOUNDARY	---
ONE PHASE	---
TEMPORARY STRUCTURE	---
PERMANENT STRUCTURE	---
WORK WALL LINE	---

LEGEND

NAME BAND	---
VI	---
PT	---
WAVE FENCE	---
ONE	---
ONE	---
LAND TO BE ACQUIRED	---
PHASE I	---
PHASE II	---

NOTE:  
 1. SINGLE LINE UPS & BLOCK INSTRUMENT ALONG WITH DUAL DIGITAL AXLE COUNTER CHASSIS & ARE PROVIDED FOR LINE CLEAR MARKING IN SHS OFFICE FOR SECTIONS.  
 2. PATI - HEMATI  
 3. This Appd. ESP COPY HAS BEEN USED TO MARK SITE ARRANGEMENT.

NOTES

CEP&D	SANJAY KUMAR SRIVASTAVA	Digitally signed by SANJAY KUMAR SRIVASTAVA	Date: 2022.07.13 12:38:48 +05'30'
CTPM	SANJAY BAJPAI	Digitally signed by SANJAY BAJPAI	Date: 2022.07.13 11:37:11 +05'30'
DRM-DLI	DIMPY CHAUDHARY	Digitally signed by DIMPY CHAUDHARY	Date: 2022.06.14 07:04:41 +05'30'
ADRM-FR&D	ANUPAM SINGH	Digitally signed by ANUPAM SINGH	Date: 2022.06.14 08:30:20 +05'30'
SRDM-CO-DLI	AMIT KUMAR	Digitally signed by AMIT KUMAR	Date: 2022.06.14 08:30:20 +05'30'
SRDM-DLI	ANURAG ANAND	Digitally signed by ANURAG ANAND	Date: 2022.06.10 08:00:09 +05'30'
SRDM-CO-DLI	ANANT KUMAR	Digitally signed by ANANT KUMAR	Date: 2022.07.01 08:38:38 +05'30'
SRDM-TRD-DLI	ATAMJEET SINGH	Digitally signed by ATAMJEET SINGH	Date: 2022.06.13 03:10:10 +05'30'
SRDM-S-DLI	SUMAN BALHARA	Digitally signed by SUMAN BALHARA	Date: 2022.06.13 01:21:29 +05'30'
ADEN-DEE	JORNA SINGH	Digitally signed by JORNA SINGH	Date: 2022.06.10 01:24:03 +05'30'

NORTHERN RAILWAY  
 DELHI DIVISION

PROJECT: HARYANA ORBITAL RAIL CORRIDOR  
 CONNECTING PATLI TO SONPAT BYPASSING DELHI AREA BY LINKING ASHOKA HILL WITH PATLI THROUGH BY NEW ELECTRICISED DOUBLE LINE

CLIENT: HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED.

GENERAL CONSULTANT: GENERAL CONSULTANT FOR HARYANA CREDITAL RAIL CORRIDOR SITES LIAISON IN CONSULTANT WITH ISEC International Pvt. Ltd.

DESIGNING NAME: SIGNALING CONCEPT PLAN OFF PATLI STATION CLASS - B

DESIGNING NO: 11/2022

DATE: 11/07/2022

SCALE: 1:1000

DATE: 11/07/2022

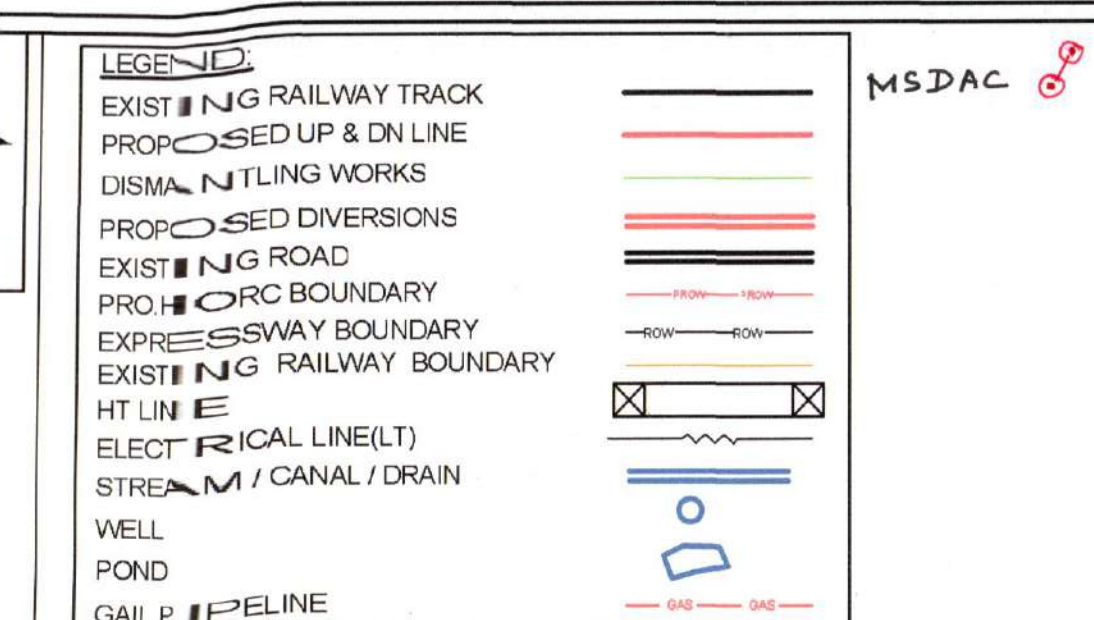
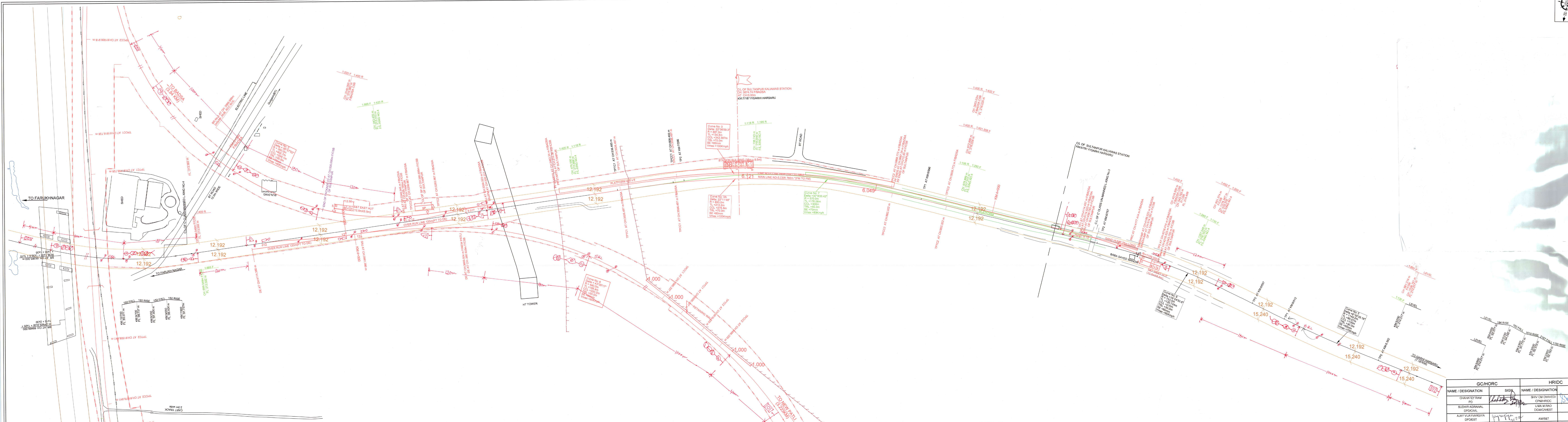
DESIGNED BY: A. SAMANT

CHECKED BY: A. SAMANT

APPROVED BY: A. SAMANT

DATE: 11/07/2022

NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHAYEY RAM	-SD-	SHIV OM DAWEDI	-SD-
SUDHIR AGRAWAL	-SD-	UMA W. RAO	-SD-
AJAY VIJAY VARGIYA	-SD-	COMSAT	-SD-
KRISHAN CHAND SAINI	-SD-	DGM&E	-SD-
AMAR SINGH	-SD-		-SD-



- NOTE:**
1. ALL DIMENSIONS ARE SHOWN IN METRES.
  2. CHORDS ARE RECKONED FROM CL OF STATION BUILDING.
  3. EXISTING J.G. WORK SHOWN IN BLACK.
  4. PROPOSED WORK SHOWN IN RED.
  5. SIGNALING WILL BE PROVIDED AS PER STD IIR.
  6. ALL TRACKS WILL BE PROVIDED WITH MAEL SIGNALING.
  7. ALL TRACKS WILL BE PROVIDED WITH MAEL SIGNALING.
  8. ALL POINTS AND CROSSINGS ARE TO BE PROVIDED WITH FAN SHAPED CURVED SWITCHES ON CONCRETE SLEEPERS.
  9. CHANGING GRADIENT FOR THIS SECTION IS IN NO COMPENSATED.
  10. PROPOSED TRACK RATES (TO SUIT FOR 25T AXLE LOAD)
- FOR RAIL CORRIDOR: 100KMPH Speed**
- TRACK = 600G RAILS
  - SLEEPER DENSITY = 1800 No. 6 PER KM
  - BALLAST CUSHION: 300mm
  - ALL TURNOUTS ARE 1 IN 12 UNLESS OTHERWISE SPECIFIED.

**NORTHERN RAILWAY**

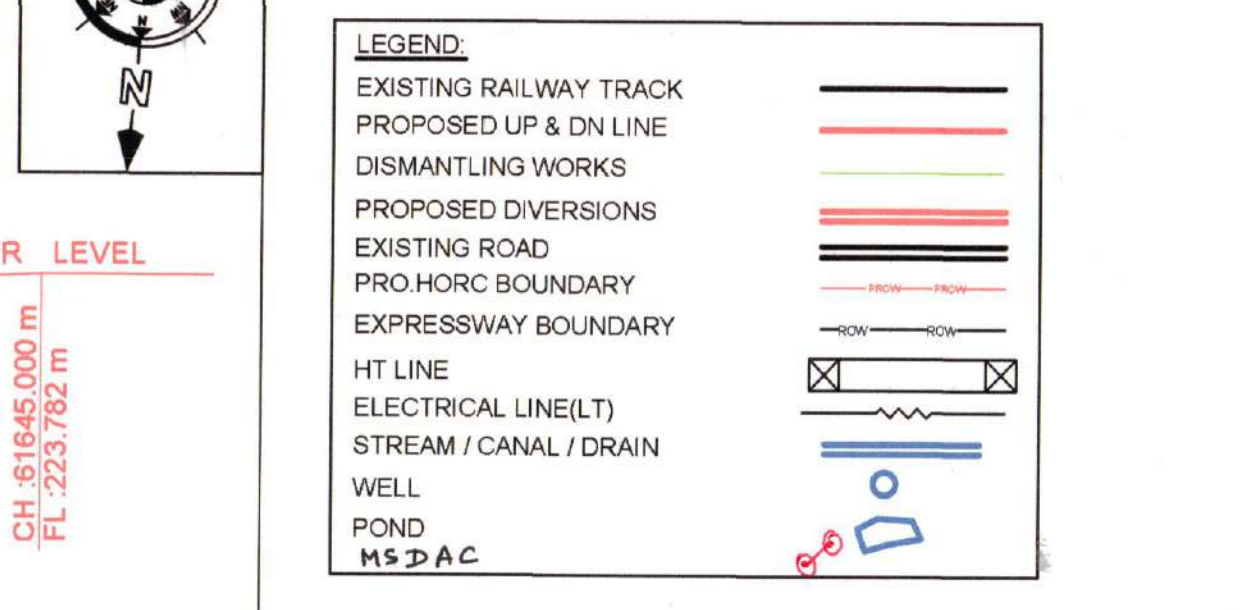
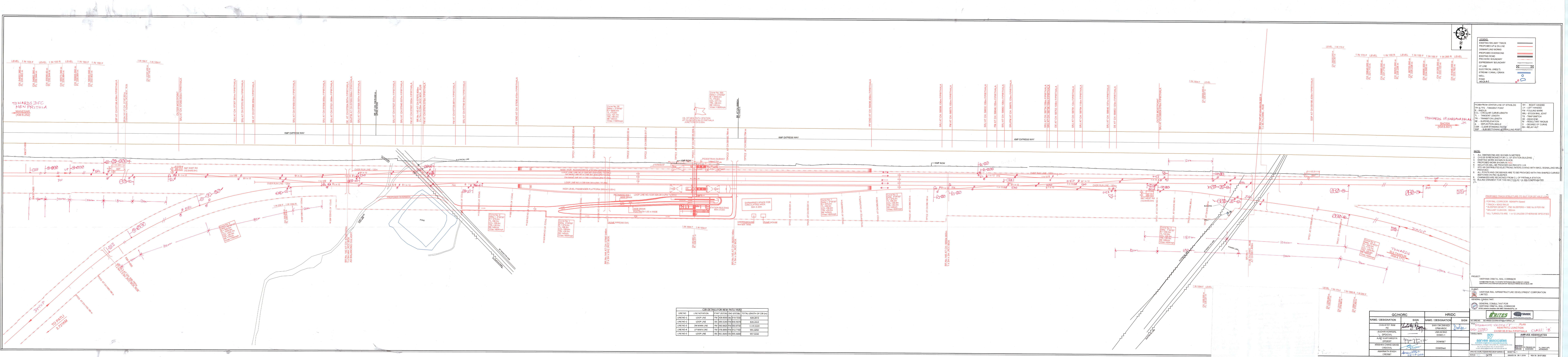
DRM-DLI
ADM-IND-DLI
SRDN-C-DLI
SRDN-D-DLI
SRDN-E-DLI
SRDN-F-D-DLI
SRDN-G-DLI
ADM-DEE
SSE-PAL-Y-GGN
SSE-W-GGN
TRD-VILL-NO
NR-DIV-LAN-NO
NRHC-CASE-NO
TRND-PLAN-NO

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION  
**GENERAL CONSULTANT:** GIE GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
**CONSULTANTS:** GORHC, HRIDC

GORHC		HRIDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAHATEY RAM PC	[Signature]	SHIV OM DAVEDI CHM/HRIDC	[Signature]
SUHR AGRAWAL DP/CIVIL	[Signature]	UMA M RAO DOM/CMST	[Signature]
AJAY VILAYARGIYA D/DEPT	[Signature]	AMISST	[Signature]
KRISHAN CHAND SAINI CR/CIVIL	[Signature]	DOM/DEPT	[Signature]
AMARNATH SINGH CR/SST	[Signature]		

**CSR DETAILS FOR SULTANPUR KALIAWAS YARD**

LINE NO	LINE NOTATION	START (P/CSB) AND (P/CSB)	TOTAL LENGTH OF CSR (M)
LINE NO-1	LOOP LINE	880+200.217 TO 880+285	760.000
LINE NO-2	LOOP LINE	880+200.217 TO 880+285	760.000



FROM CENTER LINE OF STN BLDG	RT - RIGHT HANDED
TP1 & TP2 - TANGENT POINT	LT - LEFT HANDED
R - RADIUS	FM - FOLLING MARK
CL - CIRCULAR CURVE LENGTH	SRU - STOCK RAIL JOINT
TL - TANGENT LENGTH	TS - TRAP SWITCH
TR - TRANSITION LENGTH	DE - DEAD END
SE - SUPERELEVATION	PR - RESULTANT RADIUS
Δ - DEFLECTION ANGLE	D - DEGREE OF CURVE
CSR - CLEAR STANDING ROOM	BR - RELAY HUT
SSP - SUBSECTIONING & PARALLING POST	

- NOTE**
1. ALL DIMENSIONS ARE SHOWN IN METRES.
  2. CHS IS RECKONED FOR C.L. OF STATION BUILDING.
  3. EXISTING WORK SHOWN IN BLACK.
  4. PROPOSED WORK SHOWN IN RED.
  5. LOCATION SHALL BE PROVIDED AS PER STD. IR.
  6. STD. IR DISTRIBUTED ELECTRONIC INTERLOCKING WITH MAEL SIGNALING WILL BE PROVIDED.
  7. ALL POINTS AND CROSSINGS ARE TO BE PROVIDED WITH FAN SHAPED CURVED CHANGES.
  8. ALL POINTS AND CROSSINGS ARE TO BE PROVIDED WITH FAN SHAPED CURVED CHANGES.
  9. CHANGES ARE RECKONED FROM C.L. OF PRITHLA STATION.
  10. ROLLING GRADIENT FOR THIS SECTION IS 1 IN 100 COMPENSATED.
  11. ALL TURNOUTS ARE 1 IN 12 UNLESS OTHERWISE SPECIFIED.

**PROPOSED TRACK STRUCTURE (TO SUIT FOR 2ST AXLE LOAD)**

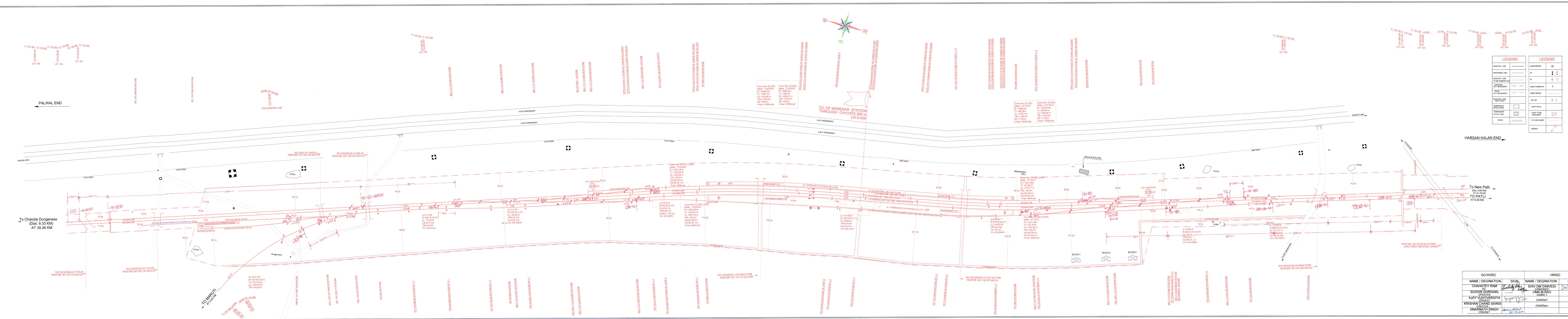
- FOR RAIL CORRIDOR: 1600MM Spaced
- TRACK: 800 RAILS
- SLEEPER DENSITY: 1800 No. S PER KM
- BALLAST CUSHION: 300mm
- ALL TURNOUTS ARE 1 IN 12 UNLESS OTHERWISE SPECIFIED

**CSR DETAILS FOR NEW PATLI YARD**

LINE NO.	LINE NOTATION	START (P/C/SR)	END (P/C/SR)	TOTAL LENGTH OF CSR (m)
LINE NO-1	LOOP LINE	FM 428.8000	SR 419.7500	826.2610
LINE NO-2	LOOP LINE	SR 186.5300	FM 809.8000	826.2610
LINE NO-3	DN MAIN LINE	FM 250.8400	FM 250.8700	1129.5200
LINE NO-4	UP MAIN LINE	FM 478.8800	FM 512.7100	991.9050
LINE NO-5	LOOP LINE	SR 481.8500	SR 495.6600	957.8300

GC/HORC		HR/DC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHAIATEY RAM PD	<i>[Signature]</i>	SHY CM DIV/DC	<i>[Signature]</i>
SUDHAR AGRAWAL	<i>[Signature]</i>	UMA M. RAO	<i>[Signature]</i>
ALAY VIJAYARGIA	<i>[Signature]</i>	DOMG-1	
PODDEBT	<i>[Signature]</i>	DOMG-2	
KRISHAN CHAND BANSI	<i>[Signature]</i>	DOMG-3	
CREK/IVL	<i>[Signature]</i>	DOMG-4	
AMARNATH BISHN	<i>[Signature]</i>	DOMG-5	
CREK/IVL	<i>[Signature]</i>		

PROJECT: HARYANA CRISTAL RAIL CORRIDOR  
 CLIENT: HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED  
 GENERAL CONSULTANT: AARVEE ASSOCIATES  
 PROJECT ENGINEER: AARVEE ASSOCIATES  
 SHEET NO: HRY/CR/PC/REC/001/REV-1  
 SHEET: 1  
 SCALE: 1:500  
 ISSUED ON: 26.11.2019  
 REV: 01



**LEGEND**

EXISTING LINE	---
PROPOSED LINE	---
EXISTING LINE TO BE DEMOLISHED	---
EXISTING RLY BOUNDARY	---
ROAD RLY BOUNDARY	---
ELECTRICITY PROFILE	---
TEMPORARY STRUCTURE	---
PERMANENT STRUCTURE	---
ROAD	---

**LEGEND**

NAME BOARD	---
TP	---
PT	---
HAND PAPER(S)	---
WIRE FENCE	---
DS DE	---
LIGHT POLE	---
LAND TO BE ACQUIRED	---
FUTURE WORK	---
MSDC	---

**NOTES**

1. ALL DIMENSIONS ARE TAKEN FROM CL OF MAIN STATION BUILDING UNLESS STATED.
2. ALL DIMENSIONS ARE IN METRES.
3. THIS DRAWING IS PREPARED BASED ON DATA COLLECTED FROM SITE.
4. ALL WORKS ARE TO BE DONE WITHIN THE BOUNDARY OF THE TRACKS.
5. ALL WORKS ARE TO BE DONE WITHIN THE BOUNDARY OF THE TRACKS.
6. TRACK BOUNDARY OF ALL TRACKS TO BE MAINTAINED AS PER THE TRACK BOUNDARY OF THE TRACKS.
7. TRACK BOUNDARY OF ALL TRACKS TO BE MAINTAINED AS PER THE TRACK BOUNDARY OF THE TRACKS.
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14. TRACK BOUNDARY OF ALL TRACKS TO BE MAINTAINED AS PER THE TRACK BOUNDARY OF THE TRACKS.

GCHORC		HRDC	
NAME / DESIGNATION	SIGN	NAME / DESIGNATION	SIGN
CHARAT RAM	<i>[Signature]</i>	SHIV OM DIMVEDI	<i>[Signature]</i>
SUDHIR AGRWAL	<i>[Signature]</i>	UMA M RAO	<i>[Signature]</i>
AJAY VIJAY VARGIYA	<i>[Signature]</i>	DGM/SAT	
KRISHAN CHAND SAINI	<i>[Signature]</i>	DGM/Elect	
AMARNATH SINGH	<i>[Signature]</i>		

**NORTHERN RAILWAY**  
DELHI DIVISION

**PROJECT:** HARYANA ORBITAL RAIL CORRIDOR  
CONNECTING PALWAL TO SONPAT BY PASSING DELHI AREA BY LINKING ANKAPATI PATLI SULTANPUR-BALAHN BY NEW ELECTRIFIED DOUBLE LINE

**CLIENT:** HARYANA RAIL INFRASTRUCTURE DEVELOPMENT CORPORATION LIMITED

**GENERAL CONSULTANT:** GENERAL CONSULTANT FOR HARYANA ORBITAL RAIL CORRIDOR  
RITES Limited in consortium with EMEC International Pvt. Ltd.

**SIGN:** *[Signature]*  
DRAWING NAME: **SIGNALING CODE PLAN OF MANESAR STATION** CLASS: 'B'

**SCALE:** 1:1000

**CONSULTANT:** *[Signature]*

**DRAWN BY:** R. DAS  
**CHECKED BY:** A. SAMANT  
**PROJECT CHECKER:** *[Signature]*

**RELEASER FOR:**  PRELIMINARY  FINAL APPROVAL  TENDER  CONSTRUCTION

## Section VII-11 B: Tender Documents

### List of Documents



-Black colour shows Tender documents which have not been revised



-Blue colour shows Tender documents which have been revised



- Red colour shows New Additional Tender documents

<b>List of tender Documents</b>		
<b>S. No.</b>	<b>EXISTING DOCUMENT TITLE</b>	<b>REVISED/NEW DOCUMENT TITLE</b>
1.	List of curve and gradient	List of curve and gradient (A1)
2.	-	List of Bridge Coordinates
3.	List of TBM	List of Control points
4.	List of Chartered Utilities	List of Chartered Utilities
4.1	List of EHT Crossings	List of EHT Crossings
4.2	-	List of Chartered Signalling Utilities at existing Patli Station of IR
5.	Geotechnical (GT) Reports	Geotechnical (GT) Reports
6.	List of approved Vendors	List of approved Vendors



## **1. LIST OF CURVE AND GRADIENT**

## Gradient Details PKG-C2(55.600-61.500)

28.07.2022

S.No.	Chainage KM		Length metre	Gradient 1 in	RISE/FALL	PFL		Remarks
	From	upto				From	To	
1	5559.574	55791.975	232.401		LEVEL	235.902	235.975	<b>Main Line</b>
2	55791.975	56319.075	527.1	165	F	235.984	232.856	
3	56319.075	57195.574	876.499	155	F	232.863	227.185	
4	57195.574	58989.075	1793.501	1004	F	226.619	225.335	
5	58989.075	59207.31	218.235		LEVEL	225.154	225.335	
6	59207.31	59827.31	620	170	F	225.152	221.723	
7	59827.31	59966.171	138.861		LEVEL	221.708	221.708	
8	59966.171	60511.172	545.001	155	R	221.708	225.188	
9	60511.172	60691.171	179.999		LEVEL	225.224	225.224	
10	60691.171	60884.075	192.904	155	F	225.224	223.998	
11	60684.075	61181.404	497.329	165	F	223.968	223.239	
12	61181.404	61634.046	452.642	265	R	222.178	223.761	
1	0	700	700	1004	R	226.217	226.914	<b>New Patli - Patli</b>
2	700	1847.724	1147.724	230	F	226.914	221.927	
3	1847.724	2418.056	570.332		LEVEL	221.927	221.927	
4	2418.056	2968.371	550.315	220	R	221.927	224.428	
5	2968.371	3247.861	279.49	4692	R	224.428	224.428	
6	3247.861	3760.79	512.929	585	R	224.428	225.365	
1	0	1000	1000	1004	F	226.217	225.221	<b>New Patli - Sultanpur</b>
2	1000	1250	250		LEVEL	225.221	225.221	
3	1250	2310.92	1060.92	170	F	225.221	218.98	
4	2310.92	2881.479	570.559	2106	R	218.98	219.251	
5	2881.479	3840.924	959.445	200	F	219.251	214.454	
6	3840.924	4114.38	273.456	400	F	214.454	213.77	

## Horizontal Curve Details

S.No.	Curve No.	SIDE	DEGREE	RADIUS	DEF.ANGLE (Delta)	CANT {SE} (mm)	TANGENT LENGTH	Circular Curve Length(CCL)	TRANSITION LENGTH	CH. TTP-1	CH. TTP-2	TOTAL LENGTH	
1	47	RHS	01° 10' 14.89"	1494.700	11°47'23"	125.000	231.700	152.100	155.000	55849.683	56311.801	462.118	<b>Main Line UP line</b>
2	48	RHS	00° 14' 59.31"	7005.300	1°02'52"	15.000	94.100	68.100	60.000	59280.924	59469.034	188.110	
3	49	LHS	00° 38' 53.33"	2700.000	3°07'27"	40.000	138.600	17.100	130.000	60907.606	61184.746	277.140	
4	50	LHS	02° 28' 52.36"	705.300	9°16'39"	120.000	107.000	13.700	100.000	61381.500	61595.160	213.660	
1	35	RHS	01° 10' 00.00"	1500.000	11°47'23"	140.000	246.600	128.000	180.000	56018.456	56326.415	307.959	<b>Main Line DN line</b>
2	38	RHS	00° 15' 00.00"	7000.000	1°02'52"	15.000	94.000	68.000	60.000	59444.976	59632.989	188.013	
3	39	LHS	00° 42' 00.00"	2500.000	3°07'27"	45.000	133.100	6.200	130.000	60929.518	61195.740	266.222	
4	40	LHS	02° 30' 00.00"	700.000	9°16'39"	120.000	111.500	2.600	110.000	61376.441	61599.049	222.608	
1	1	RHS	01° 47' 41.53"	975.000	5°05'30"	45.000	58.300	56.600	30.000	163.031	279.67	116.639	<b>New patli to patli</b>
2	2	RHS	01° 47' 41.53"	975.000	5°05'30"	45.000	58.300	56.800	29.900	279.675	396.188	116.513	
3	3	RHS	02° 55' 00.00"	600.000	42°05'15"	65.000	250.900	400.700	40.000	622.495	1103.186	480.691	
4	4	LHS	02° 57' 39.89"	591.000	115°38'57"	85.000	969.700	1132.700	60.000	1471.172	2723.916	1252.744	
5	5	RHS	01° 00' 00.00"	1750.000	2°21'07"	50.000	60.900	21.800	50.000	3119.295	3241.119	121.824	
6	6	RHS	01° 00' 00.00"	1750.000	1°34'27"	35.000	39.000	18.100	30.000	3364.032	3442.113	78.081	
1	1	RHS	01° 47' 41.53"	975.000	5°05'30"	45.000	58.300	56.600	30.000	163.031	279.676	116.645	<b>New patli to Sultanpur</b>
2	2	LHS	01° 47' 41.53"	975.000	5°05'30"	45.000	58.300	56.800	30.000	279.676	396.881	117.205	
3	3	LHS	03° 53' 19.99"	450.000	7°32'22"	55.000	44.600	29.200	30.000	786.182	875.36	89.178	
4	4	LHS	01° 56' 39.99"	900.000	18°45'31"	60.000	168.700	254.600	40.000	1058.681	1393.319	334.638	
5	5	RHS	03° 48' 15.65"	460.000	65°57'46"	55.000	313.600	499.500	30.000	2956.77	3516.32	559.55	
6	6	RHS	03° 58' 38.18"	440.000	43°00'17"	60.000	188.400	300.200	30.000	3550.337	3910.537	360.2	

Note - details are taking from L-Section received vide e-mail dated 28.07.2022.

### Gradiant Details PKG-C2(55.600-61.500)

06.06.2022

S.No.	Chainage KM		Length metre	Gradient 1 in	RISE/FALL	PFL		Remarks
	From	upto				From	To	
1	55580	55780	207.162		LEVEL	235.98	235.984	Main Line UP-line
2	55780	56320	502.878	165	F	235.984	232.863	
3	56320	57260	908.334	150	F	232.863	226.619	
4	57260	59000	1718.833	1200	F	226.619	225.154	
5	59000	59200	198.89		LEVEL	225.154	225.152	
6	59200	59860	597.781	180	F	225.152	221.708	
7	59860	59960	115.987		LEVEL	221.708	221.708	
8	59960	60540	519.195	155	R	221.708	225.224	
9	60540	60680	154.192		LEVEL	225.224	225.224	
10	60680	60900	167.095	155	F	225.224	223.968	
11	60900	61200	279.878	165	F	223.968	222.178	
12	61200	61640	409.877	250	R	222.178	223.857	
1	0	820	820	1200	F	225.982	225.249	New Patli -Patli
2	820	1580	760	300	F	225.249	222.709	
3	1580	1800	220	250	F	222.709	221.869	
4	1800	2400	600		LEVEL	221.869	221.869	
5	2400	2960	560	220	R	221.869	224.344	
6	2960	3300	340	1545	R	224.344	224.587	
7	3300	3636	336	585	R	224.587	225.128	
1	0	1000	1000	1200	F	225.982	225.149	New Patli -Sultanpur
2	1000	1260	260		LEVEL	225.149	225.149	
3	1260	2300	1040	165	F	225.149	218.811	
4	2300	3000	700	900	R	218.811	219.543	
5	3000	4000	1000	191	F	219.543	214.336	
6	4000	4132	132	505	F	214.336	214.066	

### Horizonatal Curve Details

S.No.	Curve No.	SIDE	DEGREE	RADIUS	DEF.ANGLE (Delta)	CANT (SE) (mm)	TANGENT LENGTH	Circular Curve Length(CCL)	TRANSITION LENGTH	CH. TTP-1	CH. TTP-2	TOTAL LENGTH	
1	35	RHS	01° 10' 00.00"	1500.000	11°47'23"	115.000	224.800	168.300	140.000	55830.580	56278.910	448.330	Main Line
2	36	LHS	00° 15' 00.00"	7000.000	1°02'52"	20.000	86.500	83.000	45.000	59424.816	59597.830	173.014	
3	37	RHS	00° 42' 00.00"	2500.000	3°07'27"	10.000	123.200	26.300	110.000	60911.842	61158.100	246.258	
4	38	LHS	02° 30' 00.00"	700.000	9°16'39"	100.000	96.700	33.100	80.000	61363.577	61556.641	193.064	
5	39	LHS	00° 52' 30.00"	2000.000	4°52'33"	10.000	110.100	120.200	50.000	61766.728	61986.918	220.190	
6	40	RHS	00° 47' 43.63"	2200.000	4°04'54"	65.000	143.300	26.600	130.000	62024.620	62311.222	286.602	
1	1	LHS	03° 53' 19.99"	450.000	42°05'15"	10.000	193.100	290.500	40.000	537.208	907.676	370.468	New patli to patli
2	2	RHS	02° 55' 00.00"	600.000	114°50'58"	130.000	992.300	1096.800	105.000	1316.539	2623.364	1306.825	
1	1	LHS	00° 19' 05.45"	5500.000	1°00'51"	25.000	78.700	37.300	60.000	598.212	755.556	157.344	New patli to Sultanpur
2	2	LHS	00° 19' 05.45"	5500.000	1°00'52"	25.000	78.700	37.400	60.000	863.812	1021.183	157.371	
3	3	LHS	03° 53' 19.99"	450.000	28°13'11"	10.000	133.100	181.600	40.000	1174.61	1436.162	261.552	
4	4	RHS	00° 19' 05.45"	5500.000	2°18'16"	25.000	140.600	161.200	60.000	2164.027	2445.231	281.204	
5	5	RHS	03° 34' 17.14"	490.000	113°10'52"	10.000	755.400	942.900	25.000	3107.419	4100.338	992.919	

## **2. LIST OF BRIDGE COORDINATES**

**BRDIGE COORDINATE**

<b>Bridge Coordinates for Package C-2(Contd.)</b>			
<b>S.No</b>	<b>Bridge No.</b>	<b>EASTING</b>	<b>NORTHING</b>
<b>1 MINOR BRIDGES</b>			
<b>1.1 MAIN LINE</b>			
1.	137	683069.3516	3144132.1123
2.	138	683034.9208	3144301.8405
3.	139	682995.2109	3144471.6348
4.	140	682929.1655	3144754.0206
5.	141	682835.1199	3145156.1253
6.	142	682749.0279	3145524.2085
7.	143	682715.8345	3145639.7985
8.	144	682648.5904	3145953.6570
9.	145	682599.3755	3146164.0821
10.	146	682516.9666	3146516.4322
11.	148	682225.4646	3147803.7382
12.	149	682167.4527	3148073.9695
13.	154	681950.8746	3149052.3403
<b>1.2 CONNECTING LINE</b>			
<b>1.2.1 NEW PATLI TO PATLI</b>			
1.	1	682993.3905	3145142.9874
2.	2	683182.7984	3145010.1007
3.	3	683614.1529	3144480.9837
4.	4	683458.6626	3143991.1736
5.	5	683327.1611	3143886.6961
<b>1.2.2 NEW PATLI TO SULTANPUR</b>			
1.	2	682479.9496	3147621.9981
2.	4	682625.5502	3148245.9988
3.	5	682769.5211	3148863.0147
<b>2 MAJOR BRIDGES</b>			
<b>2.1 MAIN LINE</b>			
1.	136	683091.4319	3143739.7333
2.	147	682393.7432	3147043.2907

<b>Bridge Coordinates for Package C-2(Contd.)</b>			
<b>S.No</b>	<b>Bridge No.</b>	<b>EASTING</b>	<b>NORTHING</b>
3.	150	682105.2673	3148363.6414
4.	151	682083.0704	3148467.0386
5.	152	682066.4255	3148544.5741
6.	153	682042.9338	3148654.0030
<b>2.2 CONNECTING LINE</b>			
<b>2.3 NEW PATLI TO SULTANPUR</b>			
1.	1	682433.3915	3147030.5468
2.	3	682528.8372	3147831.5159

### **3. LIST OF CONTROL POINTS**

CH 55.000 KM TO CH 70.000 KM GCP'S DETAIL'S					
GCP"S	WGS84 Latitude	WGS84 Longitude	Grid Northing (m)	Grid Easting (m)	Elevation
SCP-34	28°26'27.1660"N	76°53'03.9408"E	3147488.043	684540.453	215.911
SCP-35	28°25'30.7392"N	76°50'25.8913"E	3145684.543	680266.856	219.896
SCP-36	28°28'09.7293"N	76°52'43.6735"E	3150636.520	683939.677	213.146
SCP-37	28°27'18.7550"N	76°50'07.4498"E	3149001.770	679714.292	220.146
SCP-38	28°29'42.9174"N	76°52'07.7145"E	3153489.785	682916.938	214.025
SCP-39	28°28'50.9803"N	76°49'32.4323"E	3151826.102	678718.550	213.476
SCP-40	28°31'23.0046"N	76°51'19.5862"E	3156550.370	681560.510	215.268
SCP-41	28°30'47.1215"N	76°48'49.0457"E	3155383.233	677484.549	215.147
TCP-121	28°24'44.9666"N	76°52'05.2477"E	3144317.248	682992.383	219.192
TCP-122	28°24'43.9123"N	76°52'08.2088"E	3144286.044	683073.473	218.608
TCP-123	28°25'12.0360"N	76°51'58.2550"E	3145147.538	682789.158	216.629
TCP-124	28°25'12.2561"N	76°52'01.6202"E	3145155.733	682880.630	216.485
TCP-125	28°25'44.3761"N	76°51'51.2001"E	3146140.046	682581.747	215.537
TCP-126	28°25'44.5441"N	76°51'55.0849"E	3146146.859	682687.377	215.975
TCP-127	28°26'14.6158"N	76°51'43.6273"E	3147067.689	682361.278	217.239
TCP-128	28°26'12.3380"N	76°51'47.4057"E	3146999.166	682465.168	218.938
TCP-129	28°26'52.0371"N	76°51'34.8424"E	3148215.885	682104.440	214.765
TCP-130	28°26'53.6477"N	76°51'38.0460"E	3148266.810	682190.830	213.613
TCP-131	28°27'22.0923"N	76°51'27.8475"E	3149138.096	681899.839	213.026
TCP-132	28°27'23.6537"N	76°51'29.6618"E	3149186.920	681948.452	212.382
TCP-133	28°27'36.8392"N	76°51'38.4657"E	3149596.499	682181.669	213.633
TCP-134	28°27'37.9196"N	76°51'45.7131"E	3149632.812	682378.301	213.769
TCP-135	28°27'59.5240"N	76°51'23.4804"E	3150288.477	681763.240	212.754
TCP-136	28°27'58.2345"N	76°51'26.5012"E	3150250.052	681846.023	213.531
TCP-137	28°28'36.0083"N	76°51'16.7447"E	3151408.700	681562.683	212.211
TCP-138	28°28'35.7799"N	76°51'20.2138"E	3151403.127	681657.146	212.179
TCP-139	28°28'57.6830"N	76°51'05.8799"E	3152071.330	681256.893	212.880
TCP-140	28°28'57.1481"N	76°51'10.2363"E	3152056.693	681375.628	212.816
TCP-141	28°29'18.8721"N	76°50'53.4692"E	3152718.372	680909.323	212.975
TCP-142	28°29'19.3493"N	76°50'57.6049"E	3152734.791	681021.569	212.681
TCP-143	28°29'54.7526"N	76°50'31.4879"E	3153813.651	680294.586	214.680
TCP-144	28°29'57.1221"N	76°50'30.5123"E	3153886.183	680266.936	214.588
TCP-145	28°30'22.3772"N	76°50'20.6217"E	3154659.458	679986.076	214.211
TCP-146	28°30'22.6226"N	76°50'23.7880"E	3154668.329	680072.053	214.134
TCP-147	28°30'53.1741"N	76°50'08.1171"E	3155602.235	679631.563	213.177
TCP-148	28°30'54.2896"N	76°50'11.2711"E	3155637.887	679716.790	212.908
TCP-149	28°31'22.3387"N	76°49'56.0802"E	3156494.973	679290.586	213.433
TCP-150	28°31'25.2632"N	76°49'57.6593"E	3156585.651	679332.140	213.002
TCP-151	28°31'59.1200"N	76°49'43.5444"E	3157621.968	678932.518	212.454
TCP-152	28°31'59.1272"N	76°49'46.9756"E	3157623.614	679025.787	212.229



Pramod Rehpade  
Asst. Technical Manger



## **4. LIST OF CHARTED UTILITIES**

### **4.1 LIST OF EHT CROSSINGS**

### **4.2 LIST OF CHARTERED SIGNALLING UTILITIES AT EXISTING PATLI STATION OF IR**

### List of EHT Crossings

Sr. No.	Chainage	Capacity in kV	Feeder	Utility Owner
1	59180	66 KV (HVPNL)	Harsaru - farukhnagar Line	HVPNL
2	59270	220 KV (BBMB)	Dadri - Samaypur - Balabhgarh Line	BBMB
3	60216	400 KV (HVPNL)	Dhanonda - Daulatabad Line	HVPNL
4	1+860 (Patli-New Patli connecting Line)	220 KV (HVPNL)	Sec-95 - Mau Line	HVPNL

**List of Chartered utilities for Signalling at existing Patli station of IR**

**List of Charted utilities Signalling at existing Patli station of IR**

**For Phase 1 work**

A) Full Location Boxes/Single Apparatus cases:

- 1) L-12C,
- 2) L-12A,
- 3) B/Box,
- 4) L-12,
- 5) CH-2,
- 6) CH-1,
- 7) L-10,
- 8) L-10D,
- 9) B/Box,
- 10) L-10A,
- 11) L-7,
- 12) B/Box,
- 13) L-8,
- 14) L-8A,
- 15) L-8B,
- 16) Axl (Old),
- 17) L-3A,
- 18) L-3

B) Half Location Boxes/Half Apparatus cases:

- 1) L-12
- 2) L-8C
- 3) B/Box
- 4) B/Box

**For Phase-II work**

A) Full Location Boxes/Single Apparatus cases:

- 1) L-4
- 2) L-5
- 3) L-6 (Old)

B) Half Location Boxes/Half Apparatus cases:

- 1) Axl (Old)
- 2) 4TF Location box

## **5. GEOTECHNICAL (GT) REPORTS**

## CONTENTS

SN	<b>Geotechnical Investigation reports</b>	page
1	<b>Main Line</b> Chainage 55.6 to Chainage km 69.5	1-387
2	<b>Connecting lines:</b>	
	a. New Patli to Patli	1-44
	b. New Patli to Sultanpur	1-41

# Geotechnical Investigation Report

Ch. old 52+518 53+107 53+282 53+572 53+982 54+363 54+496 55+910 56+403  
Ch. new 55+719 56+291 56+466 56+756 57+169 57+547 57+672 59+107 59+587

Ch. old 56+701 56+978 57+400 58+191 58+497 58+837 59+071 59+206 59+270  
Ch. new 59+886 60+162 60+603 61+376 61+676 62+026 62+256 62+400 62+546

**SR NO. : 544\_21-22**

**CONDUCTING GEOTECHNICAL INVESTIGATION,  
PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING  
OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH  
CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR  
(HORC) PROJECT FROM PALWAL TO HARSANA KALAN  
INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN  
THE STATE OF HARYANA**

## CLIENT

**M/S. HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LTD. (HRIDCL)**

## PROGRAMME

**APRIL - 2022**

SR. No.	Report No.	Revision No.	Date
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/262_(44 BHs)	03	05.05.2022
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/97_(44 BHs)	02	18.04.2022
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544_21-22	CEGTH/HRIDCL/SR-544/2021-22/1544_(38 BHs)	00	22.03.2022



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CEGTH/HRIDCL/SR-544/2022-23/262

Date:- 05.05.2022

To,

**Haryana Rail Infrastructure Development**

**Corporation Ltd. (HRIDCL)**

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Subject :- Geotechnical investigation work for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan in the state of Haryana.

Dear Sir,

We are pleased to submit this report of the subject work based on 44 borehole carried out at Old Ch. 52+518 (New ch. 55+719) to Old ch. 59+270 (New ch. 62+546) for the proposed project site.

The accompanying report presents results of various field tests and laboratory tests conducted on selected soil samples and their interpretation.

Should there be any clarifications regarding the contents please contact us at your most convenient time.

We value the opportunity to participate in this project and look forward a pleasant association on future projects.

Very truly yours,  
CEG Test House & Research Centre Pvt. Ltd.

Prepared By:-



**Nehal Jain**  
**General Manager - Geotechnical**  
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**Sr. Manager – Geotech Services**

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**CONTENTS**

<b>S. NO.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>CHAPTER 1 GENERAL</b>		
1.0	INTRODUCTION	1
2.0	SITE LOCATION & GENERAL GEOLOGICAL HISTORY	1-2
3.0	SCOPE OF WORK	3-4
4.0	FIELD INVESTIGATION	4-7
5.0	LABORATORY INVESTIGATION	7-13
<b>CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION</b>		
6.0	STRATIFICATION	14-15
6.1	GROUND WATER TABLE DEPTH	15
6.2	RESULTS OF CHEMICAL ANALYSIS OF SOIL SAMPLES	15-16
6.3	COMPUTATION OF LIQUEFACTION POTENTIAL	16-18
6.4	INTERPRETATION OF LAB TEST RESULTS	18-19
<b>CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS</b>		
7.0	TYPE & DEPTH OF FOUNDATION	20
7.1	ANALYSIS OF SHALL FOUNDATION	20-23
7.2	ANALYSIS OF PILE FOUNDATION	23-30
<b>CHAPTER 4 RECOMMENDATIONS</b>		
8.0	FOUNDATION RECOMMENDATIONS	31-47
ABBREVIATIONS		48

**LIST OF FIGURES / TABLES**

<b>Appendix No.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>APPENDIX – A (FIELD DATA RESULTS)</b>		
A-1	LOCATION PLAN	50-53
A-2	FIELD BORE HOLE LOGS	54-177
A-3	SUB SOIL PROFILE DIAGRAM	178-185
<b>APPENDIX – B (LAB TEST RESULTS)</b>		
B-1	SOIL CHARACTERISTICS SHEETS	187-260
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES	261
B-3	RESULT OF CHEMICAL ANALYSIS OF WATER SAMPLES	262
B-4	GSD CURVES	263-306
B-5	SHEAR CURVE	307-366
B-6	CONSOLIDATION CURVE	367-372
<b>APPENDIX – C (ANALYSIS &amp; RECOMENDATION)</b>		
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION	374-376
C-2	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN COMPRESSION & UPLIFT	377-384
C-3	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN LATERAL	385-386

## CHAPTER 1 GENERAL

### 1.0 INTRODUCTION:

The work of conducting “**Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana**” was awarded to “**CEG Test House & Research Centre Pvt. Ltd., Jaipur**” by M/S. “**Haryana Rail Infrastructure Development Corporation Ltd. (HRIDCL)**” as per work order no. HRIDC/ HORC/ GT/ CEG/ 237/ 2021/ 577-M dated 29<sup>th</sup> July 2021.

Field work including drilling of boreholes, conducting field tests such as Electrical Resistivity Test, & Plate Load Test and sample collection was carried out in the presence of representative of Client. Laboratory tests were conducted on selected soil samples to determine the design parameters, confirming to relevant IS specifications and the guidelines received from time to time from representative of Client.

This report includes the details of Methodology of Investigation, collection of samples (soil/ rock), field test results, laboratory test results, analysis of results and recommendations for proposed structure carried out at Old Ch. 52+518 (New ch. 55+719) to Old ch. 59+270 (New ch. 62+546) based on soil sample collected from the locations of 44 boreholes.

### 2.0 SITE LOCATION & GENERAL GEOLOGICAL HISTORY:

The details of the site & test locations for the proposed project are shown in location plan attached vide **Appendix A-1**. The site of proposed project is located from Palwal to Harsana Kalan (Sonipat) in the State of Haryana falls in seismic zone – IV (Zone factor=0.24) of India.

Soil of the Haryana Sub-Region have been classified and described under the following major soil types as shown below:-

- Typic Ustochrepts : Soil of old alluvial plains
- Typic Ustipsamments : Soil of Aravali plains
- Typic Ustifluvents : Soil of recent alluvial plains and flood plains
- Typic Torripsamments : Soil of Aeofluvial plains
- Rocky Outcrops : Aravali rocky hills

The district wise details of soil characteristics are described below:-

**Panipat:** The soils are well drained, Sandy loam to clay loam/silty clay loam in plains and loam to clay loam/ silty/ loose clay loam in relic channels/depressions/basins.

**Sonipat:** The district comprises of recent flood plains, young meander plains, old meander plains and old alluvial plains. Recent flood plains occur along the Yamuna River and clearly show fluvial features. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface.

**Rohtak:** The district mainly comprises of old alluvial plains. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface. Old meander plains are almost flat with loamy sand to silty clay loam soils. Oldest among all the land forms are old alluvial plains, which cover major areas in the district. These soils are sand to loamy sand/sandy loam (surface) to silt loam/silty clay loam (sub-surface).

**Jhajjar:** The district mainly comprises of old alluvial plains and some parts of the district also have soil belonging to Aravali plains.

**Rewari:** The soils of the district fall under Entisols and Inceptisols orders. The surface soil texture varies from sand to fine loamy sand.

**Gurgaon:** The district comprises of sand dunes, sandy plains, alluvial plains, salt affected areas, low lands, lakes, hills and pediments. The soil varies from sand to loamy sand in sand dunes and sandy plain areas, sandy loam to clay loam / silty clay loam in alluvial plains, calcareous, loamy sand to loam in salt affected plains, silty loam to loam in low lands and calcareous, loamy sand to loam in hills.

**Mewat:** The soils of the area are generally sandy loam to loam. In parts of the low-lying areas, they are clayey and saline. The upper hills are mostly barren.

**Faridabad and Palwal:** The district comprises of recent Yamuna flood plains, low lying plains, depressions, sand dunes and hills. The texture of the soil is sand to loamy sand in recent Yamuna flood plains, sandy loam in plains, sandy loam to clay loam in alluvial plains, sandy loam to loam (surface), clay loam/silty clay (sub-surface) in low lying plains and depressions.

### **3.0 SCOPE OF WORK:**

The stipulated scope of work involved carrying out the following operations:-

- a) Mobilisation of necessary plant equipment, men and materials for the complete Geotechnical investigation work as per specifications, drawings and instructions of the Engineer and to complete the same within the stipulated time schedule and demobilisation after completion of field work.
- b) Shifting of Equipments from one structure location to another including Erection, installation of rigs at site and dismantling of the same after completion of field work. Shifting of setup for each borehole location and associated preparation for borehole under water
- c) Making 150 mm nominal diameter boreholes at various locations in all types of soils except hard rock and large boulders using suitable approved method of boring including chiselling, cleaning, providing casing pipe as required; performing Standard Penetration Test at every 3.0m interval and at change of strata; collection of water samples and disturbed soil samples, observation such as ground water, etc., collection of undisturbed soil samples at every 3.0 m interval and at change of strata; transportation of all the collected samples to the laboratory and back filling of boreholes on completion of the same, complete as per specification and instructions of the Engineer, for depths below natural ground level.
- d) Conducting Electrical resistivity tests at various locations all complete as per specification and directions of the Engineer.
- e) Conducting plate load test at various locations, all complete as per specification and directions of the Engineer.
- f) Drilling of Nx size boreholes (75mm dia.) in all types of hard rock, collection of core samples, maintaining continuous record of core recovery/ RQD, keeping the cores in wooden core boxes, transporting to laboratory, backfilling on completion of the same, all complete as per specification and instructions of the EIC.
- g) Conducting various laboratory tests on soil samples at an approved laboratory including preparation of soil samples to determine the following properties of soil, all complete as per specification.

#### **On soil Samples**

- Dry density test
- Bulk Density and Moisture Content.
- Sieve Analysis
- Hydrometer Analysis
- Liquid Limit and Plastic Limit
- Specific gravity
- Shrinkage Limit

- Free Swell Index
  - Direct Shear Test
  - Triaxial Shear Test
  - One Dimensional consolidation test
  - Chemical Analysis of soil samples (pH, chloride, Sulphate)
- h) Conducting laboratory tests on rock samples including preparation of the samples to determine the following properties, all complete as per specification

**On Rock Samples**

- Moisture content, porosity & Density
  - Specific gravity
  - Hardness
  - Unconfined compression test
  - Point load strength index
  - Modulus of Elasticity and Poission's Ratio
  - Abrasion Test
- i) Conducting chemical tests on water samples to determine the Sulphate, chloride and pH value all complete as per specification.
- j) Submitting draft report in soft copy including all field records and laboratory test results, graphs, etc., all complete as per specifications.
- k) Submitting final report in t0068ree hard copies in after the approval of the draft report including all field records and laboratory test results, graphs, etc., all complete as per specifications.

**4.0 FIELD INVESTIGATION IN SOIL STRATA:**

The investigation was planned to obtain the subsurface stratification in the proposed project site and collect soil / rock core samples for laboratory testing to determine the engineering properties such as shear strength, along with basic engineering classification of the subsurface stratum.

For geotechnical investigation work, required equipments along with rotary drilling rigs and manpower were mobilized at site to carry out various field activities as per the scope of work. These were shifted from one test location to another location during execution of field work and were demobilized on satisfactory completion of field work.

For conducting the field investigations the following practices were followed at site:

- The locations of 44 borehole carried out at Old Ch. 52+518 to ch. 59+270 (New ch. 55+719 to ch. 62+546) were marked at site at specified locations. These locations are shown in **Appendix A-1** attached subsequently.

The details of various boreholes along with their coordinates are provided herein below:

**Table 1.1: Details of Borehole Locations**

S. No.	Chainage Old	Chainage New	Structure	BH.No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)		(+ ) R.L. (m)
							E	N	
1.	52+518	55+719	MJB	BH-A1	22.80	40.00	683091.771	3143671.170	213.216
				BH-A2	23.50	40.00	683092.392	3143783.105	220.511
2.	53+107	56+291	MNB	BH-CL	NE	15.00	683034.675	3144302.971	218.950
3.	53+282	56+466	MNB	BH-CL	NE	10.00	682995.864	3144473.609	218.087
4.	53+572	56+756	MNB	BH-CL	NE	10.00	682931.500	3144756.380	217.532
5.	53+982	57+169	MNB	BH-CL	NE	10.00	682840.528	3145156.160	217.050
6.	54+363	57+547	MNB	BH-CL	NE	10.00	682755.991	3145527.663	216.014
7.	54+496	57+672	MNB	BH-CL	NE	15.00	682726.480	3145657.348	217.393
8.	55+910	59+107	MJB	BH-A1	16.00	40.00	682418.856	3147009.213	218.101
				BH-A2	15.60	40.00	682407.318	3147059.917	217.474
9.	56+403	59+587	MNB	BH-CL	NE	10.00	682303.349	3147516.813	215.389
10.	56+701	59+886	MNB	BH-CL	NE	15.00	682237.228	3147807.384	215.273
11.	56+978	60+162	MNB	BH-CL	NE	10.00	682175.767	3148077.480	212.389
12.	57+400	60+603	MJB	BH-A1	10.90	30.00	682111.171	3148361.347	217.941
				BH-P2	11.85	30.00	682104.781	3148389.429	213.893
				BH-P3	11.50	31.00	682101.808	3148402.495	214.414
				BH-P4	11.80	30.00	682098.835	3148415.561	214.498
				BH-P5	12.00	30.00	682095.861	3148428.627	214.548
				BH-P6	11.40	30.00	682092.888	3148441.693	214.417
				BH-P7	11.00	30.00	682089.915	3148454.759	214.599
				BH-P9	12.00	35.00	682083.968	3148480.891	214.330
				BH-P10	11.85	30.00	682080.995	3148493.957	214.021
				BH-P11	11.80	30.00	682078.022	3148507.023	213.946
				BH-P12	12.10	30.00	682075.049	3148520.089	214.402
				BH-P13	12.30	30.00	682072.075	3148533.155	214.579
				BH-P15	11.80	30.00	682066.129	3148559.287	213.460
				BH-P16	11.20	30.00	682063.156	3148572.353	212.949
				BH-P17	10.80	30.00	682060.182	3148585.419	213.184
				BH-P18	10.50	30.00	682057.209	3148598.485	213.517
BH-P19	11.50	30.00	682054.236	3148611.551	213.504				
BH-A2	10.90	35.00	682050.819	3148626.567	213.090				
13.	58+191	61+376	MNB	BH-CL	NE	10.00	681895.083	3149257.396	212.823
14.	58+497	61+676	MJB	BH-A1	11.50	40.00	681858.380	3149467.024	213.216
				BH-P1	11.60	40.00	681844.488	3149495.176	214.371
				BH-P2	10.70	40.00	681840.419	3149522.156	213.108
				BH-P3	11.00	40.00	681840.000	3149565.000	214.145
				BH-P4	11.90	40.00	681837.920	3149594.593	214.312
				BH-P5	12.00	40.00	681834.868	3149620.114	213.726
				BH-P6	11.00	40.00	681836.405	3149645.522	213.711
				BH-A2	12.00	40.00	681833.809	3149673.452	214.044
15.	58+837	62+026	MNB	BH-CL	NE	10.00	681823.952	3149897.982	213.610

S. No.	Chainage Old	Chainage New	Structure	BH.No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)		(+ R.L. (m))
							E	N	
16.	59+071	62+256	MNB	BH-CL	NE	10.00	681817.835	3150131.892	213.832
17.	59+206	62+400	MNB	BH-CL	12.65	15.00	681807.000	3150266.000	213.360
18.	59+270	62+546	MNB	BH-CL	NE	10.00	681801.000	3150330.000	212.593

**\*Not Encountered:-NE**

- In soil, boreholes of 150mm dia. were drilled as per the standard procedure laid in IS: 1892.
- Borehole was properly cleaned before taking any sample in soil.
- Casing was used as per the prevailing soil conditions, to stabilize the borehole.
- Standard Penetration Tests were conducted in bore holes at regular intervals or at every change of strata as per Technical specification.
- Undisturbed were collected wherever feasible as per the requirements and at specified depths. The same has been discussed in detail in soil characteristics sheets attached with the report.
- Water table was met at depths varying from 10.5m to 23.5m below EGL.

The detailed procedure adopted for conducting various field tests is given here in below:

**(i) Standard Penetration Test:**

The Standard Penetration Test was conducted in boreholes as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows 'N'.

Standard split spoon sampler was attached to an 'A' rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as 'N' value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective borelog.

SPT 'N' values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

**Table 1.2: Soil compactness as per SPT N values (cl. 9.7, table 9.3 & 9.4, page 330\_text book of V.N.S. Murthy)**

Correlation for Clay / Plastic silt		Correlation for Sand / Non-Plastic silt	
Consistency	SPT "N" Value	Compactness	SPT "N" Value
Very Soft	0 - 2	Very Loose	0 - 4
Soft	2 - 4	Loose	4 - 10
Medium	4 - 8	Medium	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very Stiff	15 - 30	Very Dense	> 50
Hard	> 30		

The field SPT N values obtained were further corrected as per the guidelines given in IS: 2131 as follows:

(a) **For overburden:** - The N value for cohesionless soil is corrected with the help of fig. 1 given in IS-2131.

(b) **Due to dilatancy** :- Wherever N values observed below water table in fine sand, silty sand or silt was greater than 15, then corrected N values were corrected as under:

$$N' = 15 + \frac{1}{2} (N-15)$$

**(ii) Undisturbed Sampling (Soil) in boreholes:**

Undisturbed samples were collected using MS tubes of suitable diameter and length with Area ratio as per clause 4.1.1 (c) of IS: 1892 (latest) fitted to an adopter with ball and socket arrangement. Before taking any sample, sampling tube was properly greased. Immediately after taking on undisturbed sample in a tube, the adopter head was removed along with the disturbed material. The visible ends of the sample were trimmed off any wet disturbed soil. The ends were coated alternately with four layers of just molten wax. More molten wax was added to give a total thickness of min. 25 mm. The samples were carefully labeled and transported to the laboratory for testing. Undisturbed samples wherever slipped during lifting were duly marked in the field logs as well as in the soil profile.

**(iii) Collection of Ground Water Samples from bore holes:**

Water table was met at depths varying from 10.5m to 23.5m below EGL.

**5.0 LABORATORY TESTS ON SOIL SAMPLES:**

The following laboratory tests were conducted on selected soil samples:

**Table 1.3: Description of Tests**

Description of Test	Reference	Undisturbed (UDS) Soil Samples	Disturbed (DS/SPT) Soil Samples
Grain Size Analysis / Hydrometer	IS: 2720 (Part - 4)	√	√
Natural Moisture Content / Bulk / Dry density	IS : 2720 (Part – 2)	√	-



Description of Test	Reference	Undisturbed (UDS) Soil Samples	Disturbed (DS/SPT) Soil Samples
Atterberg Limits <ul style="list-style-type: none"> <li>Liquid Limit</li> <li>Plastic Limit</li> </ul>	IS: 2720 (Part - 5) IS: 2720 (Part - 5)	√ √	√ √
Specific Gravity	IS : 2720 (Part – 3)	√	-
Direct Shear Test	IS : 2720 (Part – 13)	√	-
Triaxial compressive shear test	IS : 2720 (Part – 11 & 12)	√	-
Chemical Analysis of Soil Samples	IS : 2720 (Part – 26, 27)	√	-

**Note:-** The detailed procedure adopted for conducting various laboratory tests is described in the following paragraphs:

### 5.1.1 Dry density and Bulk density

For determination of bulk density and dry density, a sample of known volume ‘V’ was extracted from the undisturbed sampling tube and its bulk weight ‘W’ was noted down. Moisture content ‘Wn’ was determined by oven drying method.

The bulk density and dry density were determined by following equation-

$$\text{Bulk density } (\gamma_b) = W/V$$

$$\text{Dry density } (\gamma_d) = \gamma_b / (1+Wn)$$

### 5.1.2 Natural water content

For this test, the soil sample of known quantity (Wm) was taken in a container. The container with soil sample was placed into an oven for drying at 105-110°C temperature for 16-24 hours. After drying, the dry sample was again weighted to determine the dry weight of sample (Wd).

The natural water content was computed by the following equation-

$$Wn = (Wm-Wd)*100/Wd$$

### 5.1.3 Grain Size Analysis (IS: 2720- Part-4)

#### Wet sieve analysis:

For determination of particle sizes finer than 75 micron, wet sieve analysis test was conducted. For this test, oven dried sample of known quantity was taken in a container and soaked with dispersing agent. The soaked soil sample was washed thoroughly over 75 micron IS sieve until the water passing sieve was substantially clean.

Fraction retained on 75 micron IS sieve was carefully collected in a container without any loss in material and placed into oven for drying.

#### Dry sieve analysis:

For this test, the oven dried soil sample after wet sieving was sieved through the set of IS sieves 20 mm, 10 mm, 4.75 mm, 2.0 mm, 1.0 mm, 425 micron, 300 micron, 150 micron and 75 micron. The amounts of soil retained on each sieve were noted down. The % retained, cumulative % retained and % passing were computed accordingly. Wherever the soil sample % passing 75 micron sieve was significant, Hydrometer method was used to find the percentage of silt and clay fraction.

### **Grain size analysis for the fraction passing 75 micron IS Sieve (Hydrometer method)**

#### ***Calibration of Hydrometer***

Hydrometer was calibrated to determine a relationship (an equation) between the effective depth  $H_R$  and corresponding hydrometer reading  $R_h$  (obtained during test).

50 to 100 gm of soil sample passing through 75 micron IS Sieve was taken. It was mixed with 100 ml of sodium hexametaphosphate solution and the mixture was warmed for about 10 minutes. It was then transferred to the cup of the mechanical mixer and the soil suspension was stirred for 15 minutes. The soil suspension was transferred into 1000 ml measuring cylinder and distilled water was added to make 1000ml solution. This solution was mixed vigorously. The measuring cylinder was then allowed to stand and the stopwatch was started. Hydrometer was immersed in the solution and reading were taken after half, one, two and four minutes. The hydrometer was then removed slowly and kept in distilled water at the same temperature as the soil suspension. Readings were taken after the periods of 8, 15 and 30 minutes, and one, two and four hours. Hydrometer was removed, rinsed and placed in the distilled water after each reading. After 4 hours reading was taken once or twice within 24 hours. Finally a reading was taken at the end of 24 hours. The temperature of the suspension was observed and recorded.

#### ***Calculations***

*Diameter of the particles (D):*

$$D = \sqrt{\frac{30\mu}{980(G-1)}} \times \sqrt{\frac{H_R}{t}} = M \sqrt{\frac{H_R}{t}}$$

Where,

$D$  = diameter of particle in suspension, in mm;

$\mu$  = co-efficient of viscosity of water at the temperature of the suspension at the time of taking the hydrometer reading, in poise;

$G$  = specific gravity of the soil fraction used in the sedimentations analysis;

$H_R$  = effective depth corresponding to  $R_n$ , in cm.

$t$  = time elapsed between the beginning of sedimentation and taking of hydrometer reading in minutes

$M = \sqrt{\frac{30\mu}{980(G-1)}}$  = a constant factor for given values of  $\mu$  and  $G$  at the temperature of the suspension.

*Percentage finer than diameter D:*

The percentage by mass ( $w$ ) of particles smaller than corresponding equivalent particle diameters ( $D$ ) was calculated from the formula:

$$w = \frac{100G_s}{W_b(G_s - 1)} \times R_h$$

Where

$w$  = percentage finer

$G_s$  = specific gravity of soil particle

$W_b$  = weight of soil

$R_h$  = Hydrometer reading

#### 5.1.4 Specific Gravity (IS: 2720-Part-3 Sec-1)

The specific gravity of soil sample was determined by density bottle method. For this test 5-10g oven dried and cooled soil sample was taken in 50ml capacity density bottle and its weight was noted down as  $W_2$ . The soil was covered with distilled water and left for sufficient period for suitable soaking. The entrapped air was removed by vacuum. The bottle with soil was filled fully with water and its weight was noted down ( $W_3$ ). The mass of empty bottle and bottle filled with distilled water were noted down as  $W_1$  and  $W_4$  respectively.

The Specific Gravity was determined by using following equation :

$$G = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)}$$

#### 5.1.5 Liquid Limit (IS: 2720- Part-5)

##### By Cone Penetrometer Method

The 'Cone Penetrometer Apparatus' is a variant of the fall-cone and consists of a cone with a smooth polished surface and angle of  $30^\circ \pm 1/2^\circ$ . The weight of the cone, together with its associated shaft is  $80g \pm 0.5g$ . A support assembly with an automatic cone release mechanism and cone height adjustment mechanism used to hold the cone vertically. The angle and weight of the cone were calibrated at regular intervals, and the sharpness of the cone tip was checked daily.

Distilled water was added and thoroughly mixed with the soil sample to produce a homogeneous paste. The paste was then placed in a cup with a diameter of at least 55mm and a depth of at least 40mm. The surface of the soil was smoothed off level and parallel to the base. The support assembly was used to position the tip of the cone so that it was just touching the top surface of the soil, and the automatic tripping mechanism was released. The cone was allowed to penetrate into the soil for a period of 5 ( $\pm 1$ ) s, then the cone was locked off to stop further movement and the penetration was recorded. The cup was refilled and the test was repeated. The two recorded penetrations need to be within 0.5mm of each other, otherwise a third test is performed. when the three test vary by more than 1mm the test was repeated.

Further tests were conducted, at varying water contents, in order to produce a series of cone penetrations (usually 4) in the range 15mm to 25mm. The resulting cone penetrations were plotted verses the water content of the test specimens. The Liquid Limit ( $W_L$ ) was read off the graph, being the water content at which the line of best fit through the test points crosses 20mm penetration.

#### **5.1.6 Plastic Limit (IS: 2720-Part-5)**

For this test, soil sample was prepared in the same way as for liquid limit test. A ball of soil sample weighed about 5 gm was formed. The ball was rolled between the fingers of one hand and the glass plate with pressure sufficient to reduce the mass into a thread of about 3 mm in 5 to 10 complete forward and back movements. When a diameter of 3 mm was reached, soil was again remolded into a ball. The process of rolling and remolding was repeated until the thread started just crumbling at a diameter of 3 mm. The crumbled thread was immediately transferred to an airtight container for determination of its moisture content by oven drying method.

This water content has been termed as plastic limit. ( $W_P$ )

#### **5.1.7 Plasticity Index (IS: 2720-Part-5)**

The plasticity index  $I_p$  was given by

$$I_p = W_L - W_P \text{ (in percent)}$$

#### **5.1.8 Direct Shear Test (IS:2720-Part-13):**

For this test shear box test apparatus was used. The prepared specimen from remolded/undisturbed sample was placed carefully in the box. The plain grid was kept on top of the specimen with its directions at right angles to the direction of shear. The upper porous stone was placed on the grid and loading pad on the stone. The box with specimen was gently placed in the container (water jacket). The specimen was submerged with water. The container was mounted with the shear box and the specimen inside, on the shearing machine. The upper part of the box was so adjusted that it

touched the proving ring. The jack was brought forward to bear up against the box container. The proving ring dial gauge was set to read zero.

The steel ball was placed in the recess of the loading pad. The loading yoke was set in contact with the steel ball on the loading pad. Vertical displacement dial gauge to read zero in contact with the top of the yoke. The normal load was applied and any change in thickness of specimen was recorded. Shear displacement dial gauge was also set to read zero. The locking screw was now removed and two parts of the shear box were separated by advancing the spacing screws.

The specimen was sheared at constant rate of strain. The readings of the proving ring dial gauge were noted down every 15 seconds for the first one-minute and then every 30 seconds thereafter. The reading of change in the thickness dial gauge and shear displacement dial gauge were also recorded at the same time interval. The test was continued until the specimen fails. The specimen was assumed to fail when the proving ring dial gauge started receding or at shear displacement of approximately 15% of the length took place.

The soil was removed from the box and test was repeated on the identical specimen under increased normal load.

The rate of strain for conducting Direct Shear Test is kept as 0.25 mm/min as per codal/literature provision based on strata.

#### **5.1.9 Triaxial Shear Test\_UUT (IS: 2720-Part-11)**

For this test, Triaxial Shear Test apparatus was used. The plain disc was placed on the pedestal of the triaxial cell. The specimen was placed centrally on the disc. A correct size rubber membrane was fitted inside the stretcher with ends of membrane folded over those of the stretcher. Vacuum was applied to stretch the membrane to the inside surface of the stretcher which was carefully slipped around the specimen kept on the pedestal. The vacuum on the membrane was released. Its bottom part was rolled down into the pedestal. plain disc was placed on the top of the specimen and then loading pad was placed. The top part of membrane was rolled on to the loading pad. Then the stretcher was removed and ends were sealed with 'O' rings. With the properly sealed specimen placed centrally on the pedestal, the cell was assembled, keeping the loading piston initially clear of the loading pad of the specimen, the assembly was placed in the loading frame.

For unconsolidated undrained test, the bottom drainage value (BDV) and top drainage value (TDV) of cell, was closed and air release valve (ARV) was opened. The cell was filled with water through the cell water valve CWV. ARV was closed when water begins to escape through it. The cell pressure was raised to the desired value and kept constant till the end of the test.

When the cell pressure was applied, the load piston rises upward, the loading machine was operated at the anticipated rate to bring the load piston slightly above the loading pad of the specimen and the load measuring dial gauge on proving ring was set to zero.

The piston was brought just in contact with loading pad by hand operation of the machine. The

axial compression dial gauge was mounted and set to read zero.

The axial loading was started at 1.25 mm/min rate of strain. Simultaneous readings on the load and compression dial gauges were noted down. The test was continued until a recession of the axial load is observed or 20% of strain.

After failure, the specimen was unloaded by reversing the loading machine, cell pressure was reduced and cell water was drained out through BRV. The cell was dismantled and the specimen was taken out, rubber membrane was removed and weight of the failed sample and its water content was determined. The test was repeated on two more identical specimens with increasing cell pressure.

The rate of strain for conducting UUT is kept as 1.25 mm/min as per codal/literature provision based on strata.

#### **5.1.10 Chemical Testing**

Chemical Testing was generally performed in accordance with IS: 2720, but the different parts of method as described below:

##### **a) Total Sulphate Content Of Soil**

Samples were tested according to IS 2720 (Part 27). The dried soil was extracted with a 10% solution of hydrochloric acid. The extract was adjusted to slightly alkaline pH with ammonia, and then barium chloride solution was added to precipitate the sulphate. The barium sulphate precipitate was collected by filtration, and it was washed, dried and weighed. The mass of barium sulphate recovered was used to calculate the sulphate content of the original soil.

##### **b) pH Value**

Samples were tested according to IS: 2720 (Part 26). The soil sample ( $30 \pm 0.1$ g) was extracted with 75 ml of distilled water and the pH of the resulting suspension was measured with a calibrated (by means of Standard buffer solution) pH meter.

##### **c) Chloride Content**

For the water soluble content, soil samples were extracted with a volume of water equal to twice the mass of the soil. The extract was filtered and acidified with a small amount of nitric acid. Standardized silver nitrate solution was then added to precipitate the chloride as its silver salt. The amount of precipitated silver remaining in solution was then determined by titration.

An acid-soluble version of the test was also available, with the initial extraction being with nitric acid instead of water.

## CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION

### 6.0 STRATIFICATION

From the study of the 44 borehole carried out at Old Ch. 52+518 (New Ch.55+719) to Old ch. 592+70 (New ch. 62+546), it is revealed that:-

**At location of O.C. 52+518 & N.C. 55+719 :-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 53+107 & N.C. 56+291:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 53+282 & N.C. :-56+466**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 53+272 & N.C. :-56+756**

The sub strata mainly consist of Silty Clay of low plasticity (CL).

**At location of O.C. 53+982 & N.C. :-57+169**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 54+363 & N.C. :-57+547**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Clayey sand (SM-SC).

**At location of O.C. 54+496 & N.C. :-57+672**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 56+978 & N.C. :-60+162**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Clayey sand (SM-SC).

**At location of O.C. 55+910 & N.C. 59+107 :-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Silty sand (SM).

**At location of O.C. 56+403 & N.C. 59+587:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Silty sand (SM).

**At location of O.C. 56+701 & N.C. 59+886:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Silty sand (SM).

**At location of O.C. 57+400 & N.C. 60+603:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Silty sand (SM).

**At location of O.C. 58+191 & N.C. 61+376:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL).

**At location of O.C. 58+497 & N.C. 61+676:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ silty Clay of low plasticity (CL)/Clayey sand (SM-SC).

**At location of O.C. 58+837 & N.C. 62+026:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL)/ Silty sand (SM).

**At location of O.C. 59+071 & N.C. 62+256:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL).

**At location of O.C. 59+206 & N.C. 62+400:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL).

**At location of O.C. 59+270 & N.C. 62+546:-**

The sub strata mainly consist of sandy silt of low plasticity (ML-CL).

## **6.1 GROUND WATER TABLE DEPTH**

The Ground Water Table was met at depths varying from 10.5 m to 23.5m below EGL, it may rise up during heavy rains / rainy season. Therefore, for the analysis of various foundations, the water table has been considered to rise by about 3.0m at the locations of boreholes, however at the locations of 13 BHs water table was not encountered, for the analysis of foundation the water table has been considered well below the depth of influence zone.

## **6.2 RESULTS OF CHEMICAL ANALYSIS**

Results of chemical analysis of soil samples (as per **Appendix – B2**) indicates that the soil sample falls under Class I for sulphates and chlorides concentration (As per IS 456-2000 and CIRIA Sp. Publication No. 31). The results are summarized here in below :-



**Summary of chemical analysis of soil samples**

Chemical Property	Findings (Min. to Max.)	Remarks (Required limits as per IS 456-2000)
pH	8.06 to 9.87	> 6.0
Sulphite as SO <sub>3</sub> <sup>2-</sup> (%)	0.0017 (%) to 0.0025 (%)	< 0.2% (Class I)
Chlorides as Cl <sup>-</sup> (%)	0.0055 (%) to 0.0097 (%)	No limit specified in IS 456. However, a limit of 0.10% specified for class I in CIRIA Sp. Publication No. 31)

**Note :-** All the chemical contents are within permissible limit hence no special precautions are required.

**6.3 COMPUTATION OF LIQUEFACTION POTENTIAL**

Liquefaction is the sudden loss of shear strength of the sub soil strata due to earthquake-induced vibration under saturated conditions.

Assessment of liquefaction potential of foundation strata is made by simplified approach proposed as per IS: 1893 (Part-1)-2016, from the SPT data and peak ground acceleration likely to occur at the site. In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake (DBE) is first evaluated.

Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Unsaturated soils are not subjected to liquefaction because vibratory forces from earthquakes do not cause any increase in pore water pressure in such soils.

The area of site from Palwal to Harsana Kalan (Sonipat) in the State of Haryana falls in seismic zone – IV of India as per IS: 1893. Further as per the provisions of IS: 1893 in soil deposits consisting of submerged loose sands & soils falling under classification of SP with standard penetration N value less than 15, the shaking caused by earthquake ground motion may cause liquefaction or excessive total and differential settlements.

For the analysis of liquefaction potential, following constant parameters are considered:

EQ Zone	IV
Earthquake Magnitude (Mw)	7.0
Peak Horizontal Ground Acceleration (amax /g)	0.24

The ground water table was encountered at depths varying from 10.5 m to 23.50m below EGL at 31 boreholes locations and not encountered at 13 borehole locations. For the analysis of liquefaction potential, the water table has been considered to rise by about 3.0m at the location of

all boreholes. Since, water table is either very deep or not encountered, the boreholes are not likely to liquefy, as tabulated below below:-

**Table 2.1: Liquefaction Analysis**

S. No.	Chainage Old	Chainage New	Structure	BH.No.	Depth of Water Table below EGL (m)	Water Table Depth considered for analysis below EGL (m)	Liquefiable Depth (m)
1.	52+518	55+719	MJB	BH-A1	22.80	19.80	Non-Liquefiable
				BH-A2	23.50	20.50	Non-Liquefiable
2.	53+107	56+291	MNB	BH-CL	NE	-	Non-Liquefiable
3.	53+282	56+466	MNB	BH-CL	NE	-	Non-Liquefiable
4.	53+572	56+756	MNB	BH-CL	NE	-	Non-Liquefiable
5.	53+982	57+169	MNB	BH-CL	NE	-	Non-Liquefiable
6.	54+363	57+547	MNB	BH-CL	NE	-	Non-Liquefiable
7.	54+496	57+672	MNB	BH-CL	NE	-	Non-Liquefiable
8.	55+910	59+107	MJB	BH-A1	16.00	13.00	Non-Liquefiable
				BH-A2	15.60	12.60	Non-Liquefiable
9.	56+403	59+587	MNB	BH-CL	NE	-	Non-Liquefiable
10.	56+701	59+886	MNB	BH-CL	NE	-	Non-Liquefiable
11.	56+978	60+162	MNB	BH-CL	NE	-	Non-Liquefiable
12.	57+400	60+603	MJB	BH-A1	10.90	7.90	Non-Liquefiable
				BH-P2	11.85	8.85	Non-Liquefiable
				BH-P3	11.50	8.50	Non-Liquefiable
				BH-P4	11.80	8.80	Non-Liquefiable
				BH-P5	12.00	9.00	Non-Liquefiable
				BH-P6	11.40	8.40	Non-Liquefiable
				BH-P7	11.00	8.00	Non-Liquefiable
				BH-P9	12.00	9.00	Non-Liquefiable
				BH-P10	11.85	8.85	Non-Liquefiable
				BH-P11	11.80	8.80	Non-Liquefiable
				BH-P12	12.10	9.10	Non-Liquefiable
BH-P13	12.30	9.30	Non-Liquefiable				
BH-P15	11.80	8.80	Non-Liquefiable				
BH-	11.20	8.20	Non-Liquefiable				

S. No.	Chainage Old	Chainage New	Structure	BH.No.	Depth of Water Table below EGL (m)	Water Table Depth considered for analysis below EGL (m)	Liquefiable Depth (m)
				P16			
				BH-P17	10.80	7.80	Non-Liquefiable
				BH-P18	10.50	7.50	Non-Liquefiable
				BH-P19	11.50	8.50	Non-Liquefiable
				BH-A2	10.90	7.90	Non-Liquefiable
13.	58+191	61+376	MNB	BH-CL	NE	-	Non-Liquefiable
				BH-A1	11.50	8.60	Non-Liquefiable
				BH-P1	11.60	8.60	Non-Liquefiable
				BH-P2	10.70	7.70	Non-Liquefiable
				BH-P3	11.00	8.00	Non-Liquefiable
				BH-P4	11.90	8.90	Non-Liquefiable
				BH-P5	12.00	9.00	Non-Liquefiable
				BH-P6	11.00	8.00	Non-Liquefiable
				BH-A2	12.00	9.00	Non-Liquefiable
14.	58+497	61+676	MJB	BH-CL	NE	-	Non-Liquefiable
15.	58+837	62+026	MNB	BH-CL	NE	-	Non-Liquefiable
16.	59+071	62+256	MNB	BH-CL	NE	-	Non-Liquefiable
17.	59+206	62+400	MNB	BH-CL	12.65	9.65	Non-Liquefiable
18.	59+270	62+546	MNB	BH-CL	NE	-	Non-Liquefiable

\*Not Encountered:-NE

**Note:** To identify the Soil sheet, Shear curves and Log profiles, old chainages of respective bore holes are mentioned.

## 6.4 INTERPRETATION OF LAB TEST RESULTS

### Grain Size Analysis

- **Clay content:** It generally varies from 4 to 14%.
- **Silt content:** It generally varies from 15 to 59%.
- **Sand content:** It generally varies from 23 to 85%.
- **Gravel content:** It generally varies from 1 to 12%.

### Atterberg's Limit

- **Liquid limit:** The test results of liquid limit of the soil samples reveal that it generally varies from 26 to 28% in ML-CL type of soil, 30 to 34% in CL type of soil.

- **Plastic Limit:** The plastic limit of the soil sample varies from 19 to 21% in ML-CL type of soil, 20 to 23% in CL type of soil. However ML-CL type of soil is considered as non-plastic.
- **Plasticity index:** The plasticity index of the soil samples generally varies from 6 to 7% in ML-CL type of soil, 10 to 11% in CL type of soil whereas ML-CL and SM/ SM-SC/ SC type of soil are non-plastic.

### **Natural moisture content & Bulk density**

The bulk density of soil samples generally varies from 1.63gm/cc to 1.97gm/cc whereas natural moisture content varies from 10.21% to 18.26%.

#### **Direct shear tests:**

Direct shear test under drained condition have been conducted in sandy silty (ML-CL) / sandy stratum (SM/ SM-SC/ SC) type of soil.

For Sandy strata (SM/ SM-SC/ SC), the value of angle of internal friction varies from 25° to 32°, whereas cohesion varies from 0.00 kg/cm<sup>2</sup> to 0.11 kg/cm<sup>2</sup>.

For Silty strata (ML-CL), the value of angle of internal friction varies from 22° to 27°, whereas cohesion varies from 0.19 kg/cm<sup>2</sup> to 0.22 kg/cm<sup>2</sup>.

#### **Triaxial shear tests:**

Triaxial shear test under undrained condition have been conducted in silty clay (CL) type of soil.

For silty clay (CL) strata, the value of angle of internal friction varies from 4° to 5°, whereas cohesion varies from 1.42kg/cm<sup>2</sup> to 2.24kg/cm<sup>2</sup>.

## CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS

### 7.0 TYPE & DEPTH OF FOUNDATION:

Based on the nature & strength characteristics of the substrata and requirement of the project, the following type of foundation have been analyzed as given below:

**Table 3.1 : Shallow Foundation**

Type of foundation	Depth of Foundation below E.G.L. (m)	Size of Foundation (m x m)
Shallow Foundation	1.0,1.5,2.0	6.2 X 6.2 3.7 X 3.7 4.9 X 4.9 4.7 X 4.7 11.35 X 11.35 2.7 X 2.7 3.7 X 3.7 4.7 X 4.7 2.7 X 2.7
	2.0, 3.0, 4.0	7.2 X 7.2

**Table 3.2 : Pile Foundation**

Type of foundation	Length of Pile below E.G.L. (m)	Dia. of Pile (m)
Normal Bored Cast in-situ RCC Pile	16.0, 18.0, 20.0, 22.0, 24.0, 26.0, 28.0	1.0 & 1.2

The details of foundation analysis are given in the subsequent paragraph.

### 7.1 Analysis of SHALLOW foundation

#### 7.1.1 From Shear Failure Criteria

Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981, which is based on, modified Terzaghi's classical approach. The weighted average of shear strength parameters for various strata upto depth equal to  $0.5 \cdot B \cdot \tan(45 + \frac{\phi}{2})$  (where B = Width of the Foundation,  $\phi$  = Angle of internal friction ) is used in the analysis. A factor of safety of 2.5 to estimate the net safe bearing capacity from ultimate net bearing capacity.

For soils, containing both coarse grained (gravels & sands) and fine grained (clays), c and  $\phi$  are used to determine the soil strength. In case of predominantly fine grained soils, c and  $\phi$  are determined by the Triaxial Compression test as per IS: 2720 pt XI. For predominantly coarse

grained soils,  $c$  and  $\Phi$  are determined by Direct Shear test as per IS: 2720 pt XIII. These  $c$  and  $\Phi$  values were used for determining the SBC of soil as per shear failure criteria.

The ultimate net bearing capacity in case of general shear failure is given by following expression,

$$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$$

The ultimate net bearing capacity in case of local shear failure is given by following expression,

$$q'_d = (2/3) c N'_c s_c d_c i_c + q (N'_q - 1) s_q d_q i_q + (1/2) B \gamma N'_\gamma s_\gamma d_\gamma i_\gamma W'$$

Where,

$$d_c = 1 + 0.2 (D_f/B) \sqrt{N_\phi}$$

$$d_q = d_\gamma = 1 \text{ for } \phi < 10^\circ$$

$$d_q = d_\gamma = 1 + 0.1 (D_f/B) \sqrt{N_\phi} \text{ for } \phi > 10^\circ$$

$$N_\phi = \tan^2(\pi/4 + \phi/2)$$

$$\phi' \text{ for local shear failure} = \tan^{-1} (0.67 \tan \phi)$$

### 7.1.2 From Settlement Failure Criteria

Allowable Bearing Pressure from Settlement Failure consideration has been computed in accordance with IS: 8009 (Part-I). The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure.

The total permissible settlement in cohesion-less soil is estimated using SPT value as per IS: 8009 (Part-I). While using this approach, the N value was corrected, wherever applicable, below the footing base to at least 1.5B below the base to account for the effects of energy ratio, adopted bearing pressure, dilation for submerged silty fine sands / fine sands as well as that due to the overburden pressure.

Further for settlement Calculation in cohesive soil the following equation has been used.

$$S_t = \Delta P M_v H$$

Where,

$$M_v = \text{Coefficient of volume compressibility, cm}^2/\text{kg}$$

$$\Delta P = \text{Pressure increment, kg/cm}^2$$

$$H = \text{Thickness of layers}$$

**Note:** - Value of Coefficient of volume compressibility ( $M_v$ ) has been calculated by using the following co-relation [Ref. Stroud and Butler, 1975] :-

#### Coefficient of Volume Compressibility derived from SPT N-Value (after Stroud and Butler, 1975)

Plasticity Index (%)	Conversion Factor ( $f_2$ )	$m_v (10^{-3} \text{ kPa}^{-1})$ based on N-Value: $m_v = 1/(f_2 N)$				
		N=10	N=20	N=30	N=40	N=50
10	800	0.12	0.06	0.04	0.03	0.02
20	525	0.19	0.09	0.06	0.05	0.04

Plasticity Index (%)	Conversion Factor ( $f_2$ )	$m_v$ ( $10^{-3} \text{ kPa}^{-1}$ ) based on N-Value: $m_v = 1/(f_2 N)$				
		N=10	N=20	N=30	N=40	N=50
30	475	0.21	0.10	0.07	0.05	0.04
40	450	0.22	0.11	0.07	0.06	0.04

$$M_v = 1/(f_2 N_{\text{corr.}})$$

Where  $f_2$  = factor based on  $N_{\text{corr.}}$  Value & plasticity index of soil

$N_{\text{corr.}}$  = corrected SPT 'N' value

For analysis of shallow foundation the total permissible settlement has been considered as 25mm, & 50mm as per IS 1904.

Zone of influence below foundation has been considered up to 1.5 times the width of the foundation.

For the determination of the SBC from settlement criteria, the corrected SPT N values within the influence zone are given in the table below.

**NOTE:-**

- Lower of the two values obtained from settlement and shear criteria is used in arriving at allowable bearing capacity of the soil.
- Structural foundations are designed based on the minimum of Safe Bearing Capacity obtained from Shear Failure Criteria and Allowable Bearing Pressure corresponding to the permissible settlement. The permissible Settlement that can be allowed for the foundation depends on the strata at the location and type of foundation (whether Isolated or Raft).

Settlement occurs with the application of loads on foundations. It has two components, Immediate Settlement and Long Term Settlement. The immediate settlement takes place immediately as the loading is imposed on the structure and long term settlement arises due to the consolidation of the sub-soil with time under the load. Hence, the total settlement allowed for a foundation is the sum of the immediate and consolidation settlement that is expected to occur. The cohesionless strata (predominantly sandy) is primarily subjected to immediate settlement and cohesive strata (clayey) undergoes settlement in long time with the compression of the strata due to consolidation. Settlement of the foundation is determined from the relation provided in Indian standards (IS: 8009 (part-1) &/or various literatures (Bowles, BM Das, etc.).

From the Geotechnical investigation conducted on our site along with subsequent laboratory tests on soil samples, it is observed that predominantly the strata is silty with sand (SM/SC/SM-SC/ML-CL i.e. predominantly cohesionless) with the presence of small patches of silty clay of low plasticity (CL). Since the Settlement that takes place in cohesionless strata is mostly immediate, it

takes place immediately after the imposing of load, initially during construction with the application of Dead Load and further during Live Load. The live load usually is many times lesser than the dead load, and correspondingly the post construction settlement is very less for live loads. As an example, if dead load is three times that of live load, then the settlement corresponding to live load (i.e. the post construction settlement) will be one-third of the settlement due to dead load which is comparatively lesser than 25mm for permissible settlement of 50mm.

According to the IS 1904, the permissible settlement for concrete structure having raft foundation is allowed upto 75mm, and the permissible settlement is 25mm post construction as per IRS code (Code of Practice for The Design of Sub-Structures and Foundations of Bridges). As discussed above, the settlement post construction is directly proportional to the allowable settlement. Therefore, given the importance of structure to be constructed and considering mostly cohesionless strata encountered at site, it is recommended that the maximum permissible settlement shall be restricted to 50mm for the design purpose on conservative side so that the post construction settlement can be constraint to lesser than 25mm.

As per IS- 8009 part 1 clause 9.2.2.1, If the clay layer is sandwiched between cohesionless soil layers, the immediate settlement is zero. Hence, even though the immediate settlement has been calculated during analysis, however it is ignored in the calculation of total settlement.

The sample calculations for computation of allowable bearing capacity of sub-strata for shallow foundation vide **Appendix – C-1**.

## 7.2 Analysis of PILE foundation

### (A) Deep foundation

The safe Load Carrying Capacity of normal bored cast in-situ RCC pile is determined in compression, uplift and lateral as per IS: 2911 (Part-1/sec-2) – 2010. The axial capacity of a pile depends upon the soil skin friction along the shaft and end bearing at it's tip.

Thus Axial load = Skin Friction + End-bearing

#### a) For piles in granular soils (using the static formula)

$$Q_u = (0.5 \cdot D \cdot \gamma \cdot N_\gamma + P_D \cdot N_q) \cdot A_p + (\sum K_i \cdot P_{Di} \cdot \tan \delta_i) \cdot A_{si}$$

Where,

$Q_u$  = Ultimate load capacity of pile in KN

$D$  = dia. of pile shaft in m

$\gamma$  = effective unit weight of the soil at pile tip in  $\text{kN/m}^3$

$N_\gamma$  &  $N_q$  = bearing capacity factors depending upon the angle of internal friction  $\Phi$  at pile tip ( $N_\gamma$  from IS 6403 for general shear failure case &  $N_q$  from Fig. 1, IS 2911)



$P_D$  = effective overburden pressure at pile tip in  $\text{kN/m}^2$  limited to 15-17 times diameter of pile (as per the Phi value at end bearing)

$\Sigma$  = Summation for layers (1 to n) in which pile is installed and which contribute to (+ve) skin friction

$K_i$  = coefficient of earth pressure applicable for the  $i^{\text{th}}$  layer

$P_{Di}$  = effective overburden pressure for the  $i^{\text{th}}$  layer in  $\text{kN/m}^2$  limited to 15-17 times diameter of pile (as per the Phi value at end bearing)

$\delta_i$  = angle of wall friction between pile and soil for  $i^{\text{th}}$  layer, and

$A_{si}$  = surface area of pile shaft in the  $i^{\text{th}}$  layer in  $\text{m}^2$

**b) For piles in cohesive soils (using the static formula)**

$$Q_u = c_p * N_c * A_p + \Sigma \alpha_i * c_i * A_{si}$$

Where,

$Q_u$  = Ultimate load capacity of pile in KN

$A_p$  = cross-sectional area of pile tip in  $\text{m}^2$

$N_c$  = bearing capacity factor (= 9)

$\Sigma$  = Summation for layers (1 to n) in which pile is installed and which contribute to (+ve) skin friction

$\alpha_i$  = adhesion factor for the  $i^{\text{th}}$  layer depending on the consistency of soil

$c_i$  = average cohesion for  $i^{\text{th}}$  layer in  $\text{kN/m}^2$

$A_{si}$  = surface area for pile shaft in the  $i^{\text{th}}$  layer in  $\text{m}^2$

**c) For computation of safe load carrying capacity of pile in lateral, the following equation has been used:**

**i. Fixed Head Condition**

$$Q = (12 * E * I * Y) / (L_1 + L_f)^3$$

**ii. Free Head Condition**

$$Q = (3 * E * I * Y) / (L_1 + L_f)^3$$

Where,

$Q$  = Lateral Load (in kg)

$Y$  = Permissible lateral deflection taken as 5mm

$E$  = Modulus of Elasticity of concrete

$I$  = Moment of Inertia of the pile cross-section

$L_1$  = Length of pile above cut-off level

$L_f$  = Length of fixity

The effective length of the pile has been considered below the cut-off level taken as 2.0m below the EGL. Normal Bored cast in-situ RCC piles having stem diameter equal to 100cm & 120cm and of effective length varying from 16.0m to 28.0m were selected.

For the analysis of the pile foundations the soil parameters used for computation of safe load carrying capacity of pile is tabulated below:-

**Table 3.3 : Design Soil Parameter**

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
52+518	55+719	BH-A1	0.00	4.00	4.00	Sandy Silt	12	15	1.70	0.20	29
			4.00	7.00	3.00	Sandy Silt	22	22	1.76	0.21	29
			7.00	11.50	4.50	Silty Clay	36	36	1.85	1.22	4
			11.50	16.00	4.50	Sandy Silt	44	32	1.86	0.21	30
			16.00	40.00	24.00	Sandy Silt	83	34	1.92	0.15	30
		BH-A2	0.00	5.50	5.50	Sandy Silt	13	17	1.72	0.19	29
			5.50	13.00	7.50	Silty Clay	24	24	1.78	0.74	5
			13.00	16.00	3.00	Silty Clay	39	39	1.85	1.12	4
			16.00	25.00	9.00	Sandy Silt	59	34	1.87	0.21	30
			25.00	34.00	9.00	Sandy Silt	43	18	1.84	0.23	29
53+282	56+466	BH-CL	0.00	5.25	5.25	Sandy Silt	14	19	1.74	0.20	28
			5.25	8.25	3.00	Silty Clay	32	32	1.89	1.02	5
			8.25	10.00	1.75	Silty Clay	25	25	1.90	1.02	5
53+572	56+756	BH-CL	0.00	3.00	3.00	Silty Clay	9	9	1.68	0.26	5
			3.00	8.25	5.25	Silty Clay	32	32	1.91	1.09	4
			8.25	10.00	1.75	Silty Clay	47	47	1.97	1.65	4
53+982	57+169	BH-CL	0.00	2.25	2.25	Silty Clay	8	8	-	-	-
			2.25	5.25	3.00	Silty Clay	22	22	1.89	0.39	5
			5.25	7.50	2.25	Silty Clay	24	24	1.97	0.85	4
			7.50	10.00	2.50	Sandy Silt	32	25	1.90	0.20	28
54+363	57+547	BH-CL	0.00	5.25	5.25	Silty Sand	21	27	1.82	0.11	30
			5.25	8.25	3.00	Silty Clay	33	33	1.99	1.09	4
			8.25	10.00	1.75	Sandy Silt	38	28	1.90	0.20	30
54+496	57+672	BH-CL	0.00	5.25	5.25	Sandy Silt	15	19	1.79	0.21	28
			5.25	8.25	3.00	Silty Clay	32	32	1.98	1.09	5
			8.25	11.25	3.00	Silty Clay	37	37	1.99	1.26	4
			11.25	15.00	3.75	Silty Clay	44	44	2.00	1.42	4
+ 9	+ 1	BH-CL	0.00	2.25	2.25	Sandy Silt	14	20	-	-	-

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
			2.25	3.00	0.75	Sandy Silt	-	-	1.86	0.22	28
			3.00	10.00	7.00	Silty Clay	27	27	1.95	0.85	5
55+910	59+107	BH-A1	0.00	7.00	7.00	Silty Sand	13	14	1.68	0.00	30
			7.00	13.00	6.00	Silty Clay	28	28	1.81	0.85	4
			13.00	19.00	6.00	Sandy Silt	43	25	1.83	0.20	30
			19.00	25.00	6.00	Sandy Silt	53	24	1.85	0.18	30
			25.00	31.00	6.00	Sandy Silt	67	27	1.87	0.20	30
			31.00	40.00	9.00	Sandy Silt	85	30	1.89	0.18	30
		BH-A2	0.00	5.50	5.50	Silty Sand	19	24	1.75	0.00	32
			5.50	8.50	3.00	Silty Sand	26	24	1.76	0.00	32
			8.50	16.00	7.50	Silty Sand	36	27	1.77	0.00	32
			16.00	20.50	4.50	Silty Clay	39	39	1.99	1.34	4
			20.50	26.50	6.00	Sandy Silt	56	25	1.86	0.20	30
			26.50	40.00	13.50	Sandy Silt	73	28	1.95	0.16	30
57+400	60+603	BH-A1	0.00	8.50	8.50	Silty Sand	17	19	1.73	0.10	31
			8.50	13.00	4.50	Silty Clay	32	32	1.86	1.06	5
			13.00	17.50	4.50	Silty Sand	57	29	1.86	0.00	32
			17.50	30.00	12.50	Silty Clay	74	43	2.01	1.66	4
		BH-P2	0.00	5.50	5.50	Sandy Silt	20	26	1.78	0.21	30
			5.50	8.50	3.00	Silty Clay	32	32	1.83	1.10	4
			8.50	14.50	6.00	Sandy Silt	40	27	1.84	0.20	30
			14.50	20.50	6.00	Silty Clay	67	67	2.01	2.22	4
			20.50	26.50	6.00	Sandy Silt	90	35	1.90	0.21	30
		BH-P3	26.50	30.00	3.50	Sandy Silt	-	-	1.94	0.20	32
			0.00	4.00	4.00	Sandy Silt	12	15	1.71	0.16	29
			4.00	10.00	6.00	Sandy Silt	31	28	1.81	0.18	30
			10.00	19.00	9.00	Silty Sand	40	25	1.82	0.00	32
			19.00	25.00	6.00	Sandy Silt	53	25	1.88	0.21	30
			25.00	31.00	6.00	Sandy Silt	61	26	1.90	0.20	30
57+400	60+603	BH-P4	0.00	7.00	7.00	Silty Sand	16	20	1.73	0.00	31
			7.00	11.50	4.50	Sandy Silt	51	43	1.84	0.25	32
			11.50	17.50	6.00	Sandy Silt	59	29	1.90	0.21	30
			17.50	23.50	6.00	Sandy Silt	73	32	1.93	0.22	30
			23.50	30.00	6.50	Sandy Silt	80	32	1.94	0.19	30
		BH-P5	0.00	4.00	4.00	Silty Sand	11	14	1.69	0.00	31
			4.00	10.00	6.00	Silty Sand	26	24	1.75	0.00	32
			10.00	16.00	6.00	Sandy Silt	49	31	1.85	0.23	30

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
			57+400	60+603							
			16.00	22.00	6.00	Sandy Silt	65	30	1.88	0.22	30
			22.00	30.00	8.00	Sandy Silt	85	33	1.91	0.18	30
		BH-P6	0.00	5.50	5.50	Silty Sand	13	17	1.71	0.00	31
			5.50	8.50	3.00	Silty Sand	20	18	1.73	0.00	31
			8.50	11.50	3.00	Silty Clay	26	26	1.84	0.90	4
			11.50	14.50	3.00	Silty Clay	32	32	1.96	1.03	5
			14.50	20.50	6.00	Sandy Silt	52	26	1.90	0.19	30
			20.50	26.50	6.00	Sandy Silt	62	27	1.90	0.22	30
			26.50	30.00	3.50	Sandy Silt	73	30	1.92	0.24	30
			BH-P7	0.00	4.00	4.00	Silty Sand	14	18	1.71	0.00
		4.00		10.00	6.00	Silty Sand	26	24	1.74	0.00	32
		10.00		16.00	6.00	Silty Clay	38	38	1.99	1.15	4
		16.00		22.00	6.00	Sandy Silt	51	25	1.88	0.22	30
		22.00		25.00	3.00	Sandy Silt	63	28	1.91	0.20	30
		25.00		30.00	5.00	Sandy Silt	80	32	1.94	0.23	30
		BH-P9	0.00	5.50	5.50	Sandy Silt	16	20	1.74	0.22	29
			5.50	8.50	3.00	Sandy Silt	19	18	1.75	0.22	29
			8.50	11.50	3.00	Silty Clay	33	33	1.86	1.02	4
			11.50	14.50	3.00	Silty Clay	30	30	1.89	1.02	4
			14.50	17.50	3.00	Sandy Silt	66	31	1.88	0.20	30
			17.50	23.50	6.00	Silty Clay	45	45	1.98	1.42	4
			23.50	31.00	7.50	Sandy Silt	77	31	1.92	0.17	30
			31.00	35.00	4.00	Sandy Silt	97	35	1.95	0.16	30
		BH-P10	0.00	7.00	7.00	Silty Sand	26	30	1.78	0.00	32
			7.00	10.00	3.00	Silty Clay	27	27	1.83	0.92	5
			10.00	16.00	6.00	Sandy Silt	34	22	1.84	0.21	29
			16.00	22.00	6.00	Sandy Silt	46	23	1.88	0.18	29
			22.00	30.00	8.00	Sandy Silt	68	28	1.91	0.21	30
		BH-P11	0.00	5.50	5.50	Sandy Silt	14	17	1.72	0.16	29
			5.50	11.50	6.00	Sandy Silt	25	22	1.78	0.21	29
			11.50	23.50	12.00	Sandy Silt	27	17	1.83	0.21	28
			23.50	25.00	1.50	Silty Clay	45	45	1.97	1.47	4
			25.00	30.00	3.00	Sandy Silt	85	33	1.94	0.19	30
		BH-P12	0.00	7.00	7.00	Silty Sand	26	29	1.77	0.11	32
			7.00	13.00	6.00	Sandy Silt	31	25	1.81	0.22	30
			13.00	23.50	10.50	Sandy Silt	36	20	1.83	0.21	29
			23.50	30.00	6.50	Sandy Silt	53	24	1.87	0.22	29

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
57+400	60+603	BH-P13	0.00	4.00	4.00	Silty Sand	9	14	1.68	0.00	30
			4.00	11.50	7.50	Sandy Silt	38	36	1.82	0.21	31
			11.50	17.50	6.00	Sandy Silt	42	23	1.85	0.23	29
			17.50	20.50	3.00	Silty Clay	51	51	2.00	1.67	4
			20.50	30.00	9.50	Sandy Silt	64	27	1.93	0.22	30
		BH-P15	0.00	10.00	10.00	Silty Sand	19	22	1.76	0.09	31
			10.00	17.50	7.50	Sandy Silt	56	34	1.86	0.19	31
			17.50	25.00	7.50	Sandy Silt	63	29	1.87	0.22	30
			25.00	30.00	5.00	Sandy Silt	83	33	1.92	0.23	30
		BH-P16	0.00	4.00	4.00	Sandy Silt	16	20	1.75	0.21	29
			4.00	10.00	6.00	Sandy Silt	20	19	1.76	0.19	29
			10.00	16.00	6.00	Silty Sand	28	18	1.78	0.00	30
			16.00	19.00	3.00	Silty Sand	39	21	1.81	0.00	31
			19.00	26.50	7.50	Sandy Silt	77	34	1.94	0.17	30
			26.50	30.00	3.50	Silty Sand	-	-	1.94	0.17	33
		BH-P17	0.00	4.00	4.00	Silty Clay	5	5	1.66	0.20	4
			4.00	14.50	10.50	Sandy Silt	24	19	1.75	0.23	27
			14.50	17.50	3.00	Sandy Silt	36	21	1.83	0.20	28
			17.50	29.50	12.50	Sandy Silt	-	-	1.94	0.18	29
		BH-P18	0.00	4.00	4.00	Sandy Silt	15	19	1.74	0.21	29
			4.00	7.00	3.00	Sandy Silt	20	20	1.77	0.21	29
			7.00	10.00	3.00	Sandy Silt	26	22	1.80	0.19	29
			10.00	17.50	7.50	Silty Clay	32	32	1.93	1.07	30
			17.50	30.00	12.50	Sandy Silt	-	-	1.95	0.21	33
		BH-P19	0.00	8.50	8.50	Sandy Silt	15	17	1.72	0.22	29
			8.50	16.00	7.50	Sandy Silt	28	21	1.77	0.19	29
			16.00	20.50	4.50	Silty Clay	33	33	1.94	1.02	5
			20.50	30.00	9.50	Silty Sand	100	36	1.94	0.00	34
58+497	61+676	BH-A2	0.00	4.00	4.00	Sandy Silt	14	18	1.72	0.16	29
			4.00	7.00	3.00	Silty Clay	26	26	1.80	0.88	4
			7.00	10.00	3.00	Silty Clay	27	27	1.82	0.88	4
			10.00	13.00	3.00	Sandy Silt	30	19	1.80	0.20	29
			13.00	22.00	9.00	Sandy Silt	34	20	1.82	0.20	29
			22.00	35.00	13.00	Sandy Silt	88	31	1.95	0.19	29
58+497	61+676	BH-A1	0.00	5.50	5.50	Sandy Silt	21	27	1.76	0.19	29
			5.50	8.50	3.00	Sandy Silt	32	30	1.80	0.22	29

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
58+497	61+676	BH-P1	8.50	20.50	12.00	Silty Clay	48	48	1.86	1.52	5
			20.50	28.00	7.50	Sandy Silt	72	37	1.86	0.21	30
			28.00	40.00	12.00	Sandy Silt	78	36	1.89	0.17	30
		BH-P1	0.00	4.00	4.00	Sandy Silt	17	22	1.75	0.23	29
			4.00	7.00	3.00	Sandy Silt	30	30	1.81	0.19	29
			7.00	10.00	3.00	Silty Clay	40	40	1.86	1.34	5
			10.00	13.00	3.00	Silty Clay	45	45	1.91	1.48	4
			13.00	16.00	3.00	Silty Clay	49	49	1.97	1.65	5
			16.00	19.00	3.00	Silty Clay	54	54	2.02	1.80	4
			19.00	28.00	9.00	Sandy Silt	70	29	1.88	0.20	30
			28.00	40.00	12.00	Sandy Silt	82	30	1.91	0.16	30
		BH-P2	0.00	4.00	4.00	Silty Sand	19	30	1.74	0.09	30
			4.00	11.50	7.50	Silty Clay	28	28	1.81	0.93	4
			11.50	20.50	9.00	Sandy Silt	49	25	1.83	0.20	30
			20.50	26.50	6.00	Sandy Silt	61	28	1.88	0.21	30
			26.50	40.00	13.50	Sandy Silt	100	36	1.95	0.17	33
		BH-P3	0.00	7.00	7.00	Silty Sand	15	17	1.69	0.00	31
			7.00	13.00	6.00	Sandy Silt	36	26	1.80	0.21	30
			13.00	19.00	6.00	Sandy Silt	47	25	1.85	0.19	30
			19.00	28.00	9.00	Sandy Silt	88	36	1.89	0.22	30
			28.00	40.00	12.00	Sandy Silt	105	36	1.94	0.18	33
		BH-P4	0.00	5.50	5.50	Sandy Silt	22	29	1.77	0.18	30
			5.50	13.00	7.50	Sandy Silt	42	34	1.82	0.20	31
			13.00	26.50	13.50	Sandy Silt	62	28	1.84	0.19	30
			26.50	31.00	4.50	Sandy Silt	78	30	1.87	0.19	30
			31.00	40.00	9.00	Sandy Silt	82	30	1.91	0.22	30
		BH-P5	0.00	4.00	4.00	Silty Sand	8	13	1.66	0.00	31
			4.00	8.50	4.50	Silty Sand	28	29	1.76	0.00	32
			8.50	17.50	9.00	Silty Clay	37	37	1.92	1.26	4
		BH-P5	17.50	23.50	6.00	Sandy Silt	54	25	1.86	0.20	30
23.50	28.00		4.50	Sandy Silt	67	28	1.89	0.22	30		
28.00	40.00		12.00	Sandy Silt	96	33	1.96	0.17	31		
BH-P6	0.00	4.00	4.00	Sandy Silt	16	20	1.74	0.24	29		
	4.00	7.00	3.00	Sandy Silt	27	27	1.79	0.19	30		
	7.00	10.00	3.00	Silty Clay	36	36	1.87	1.22	5		
	10.00	13.00	3.00	Silty Clay	43	43	1.90	1.36	5		
	13.00	16.00	3.00	Silty Clay	51	51	1.99	1.65	4		

Chainage Old & New	Chainage New	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm <sup>2</sup> )	Angle of internal Friction (Φ) (°)
			From	To			Observed	Corrected			
			16.00	19.00	3.00	Silty Clay	54	54	2.02	1.79	4
			19.00	28.00	9.00	Sandy Silt	73	30	1.87	0.18	30
			28.00	40.00	12.00	Sandy Silt	100	36	1.95	0.20	32
		BH-A2	0.00	4.00	4.00	Sandy Silt	13	21	1.74	0.22	29
			4.00	11.50	7.50	Sandy Silt	29	28	1.80	0.20	30
			11.50	20.50	9.00	Sandy Silt	34	19	1.81	0.18	29
			20.50	32.50	12.00	Sandy Silt	57	25	1.87	0.19	30
			32.50	40.00	7.50	Sandy Silt	99	34	1.91	0.17	30

Design parameter have been obtained from the laboratory test results however various depth where the shear parameter seems on the lower side with respect to SPT 'N' values those shear parameter have been judicially improved based on the SPT 'N' for the analysis purpose.

The sample calculation for computation of safe load carrying capacity of normal bored cast-in-situ RCC pile in compression & uplift are attached vide **Appendix C-2**.

The sample calculation for computation of safe load carrying capacity of normal bored cast-in-situ RCC pile in lateral are attached vide **Appendix C-3**.

## CHAPTER 4 FOUNDATION RECOMMENDATIONS

### 8.0 FOUNDATION RECOMMENDATIONS

- Based on the nature & strength characteristics of the substrata and requirement of the project, shallow foundation and normal bored cast in-situ RCC pile foundation have been analyzed.
- Based on the method of analysis & design parameters given under Para 7.1 above, the recommended net allowable bearing capacity values are given in Table 4.1 to 4.4.

**Table 4.1: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 25mm**

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1.	52+518	55+719	BH-A1	2.0	7.2 X 7.2	32.9	20.1	20.1
				3.0		38.8	23.5	23.5
				4.0		44.9	28.1	28.1
			BH-A2	2.0	7.2 X 7.2	36.1	14.1	14.1
				3.0		42.6	15.4	15.4
				4.0		49.4	16.8	16.8
2.	53+107	56+291	BH-CL	1.0	6.2 X 6.2	23.9	18.4	18.4
				1.5		26.3	19.6	19.6
				2.0		28.8	21.1	21.1
3.	53+282	56+466	BH-CL	1.0	3.7 X 3.7	25.3	17.0	17.0
				1.5		28.8	18.5	18.5
				2.0		32.5	20.5	20.5
4.	53+572	56+756	BH-CL	1.0	3.7 X 3.7	6.3	7.5	6.3
				1.5		6.6	8.7	6.6
				2.0		6.9	10.4	6.9
5.	53+982	57+169	BH-CL	1.0	4.9 X 4.9	9.2	5.1	5.1
				1.5		9.5	5.7	5.7
				2.0		9.9	6.6	6.6
6.	54+363	57+547	BH-CL	1.0	4.7 X 4.7	34.0	23.2	23.2
				1.5		39.1	24.6	24.6
				2.0		44.4	26.5	26.5
7.	54+496	57+672	BH-CL	1.0	11.35 X 11.35	39.5	13.4	13.4
				1.5		42.6	13.5	13.5
				2.0		45.7	13.7	13.7



Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
8.	55+910	59+107	BH-A1	2.0	7.2 X 7.2	27.1	11.1	11.1
				3.0		33.8	12.5	12.5
				4.0		40.8	14.4	14.4
			BH-A2	2.0	7.2 X 7.2	63.4	23.4	23.4
				3.0		77.7	24.7	24.7
				4.0		92.6	26.1	26.1
9.	56+403	59+587	BH-CL	1.0	2.7 X 2.7	18.7	12.7	12.7
				1.5		22.2	16.6	16.6
				2.0		25.8	22.5	22.5
10.	56+701	59+886	BH-CL	1.0	11.35 X 11.35	18.1	9.4	9.4
				1.5		19.4	9.8	9.8
				2.0		20.9	10.2	10.2
11.	56+978	60+162	BH-CL	1.0	4.9 X 4.9	31.8	18.4	18.4
				1.5		35.7	20.1	20.1
				2.0		39.6	22.1	22.1
12.	57+400	60+603	BH-A1	2.0	7.2 X 7.2	43.6	15.8	15.8
				3.0		51.1	17.6	17.6
				4.0		58.8	19.7	19.7
			BH-P2	2.0	7.2 X 7.2	60.4	18.2	18.2
				3.0		69.3	18.4	18.4
				4.0		78.4	18.4	18.4
			BH-P3	2.0	7.2 X 7.2	30.4	23.5	23.5
				3.0		35.4	25.7	25.7
				4.0		40.6	28.3	28.3
			BH-P4	2.0	7.2 X 7.2	44.7	28.1	28.1
				3.0		53.3	29.6	29.6
				4.0		62.3	31.2	31.2
			BH-P5	2.0	7.2 X 7.2	33.6	25.7	25.7
				3.0		40.4	27.0	27.0
				4.0		47.4	28.6	28.6
			BH-P6	2.0	7.2 X 7.2	35.5	14.1	14.1
				3.0		42.6	15.0	15.0
				4.0		49.9	16.2	16.2
			BH-P7	2.0	7.2 X 7.2	37.4	18.2	18.2
				3.0		44.8	19.4	19.4
				4.0		52.5	21.0	21.0
			BH-P9	2.0	7.2 X 7.2	43.6	15.7	15.7
				3.0		50.1	16.7	16.7
				4.0		56.7	18.1	18.1

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )			
	57+400	60+603	BH-P10	2.0	7.2 X 7.2	61.4	23.6	23.6			
				3.0		72.8	24.8	24.8			
				4.0		84.7	25.5	25.5			
			BH-P11	2.0	7.2 X 7.2	30.6	15.0	15.0			
				3.0		35.6	15.9	15.9			
				4.0		40.8	16.8	16.8			
			BH-P12	2.0	7.2 X 7.2	69.4	27.8	27.8			
				3.0		80.6	28.4	28.4			
				4.0		92.1	27.8	27.8			
			BH-P13	2.0	7.2 X 7.2	27.0	18.4	18.4			
				3.0		32.6	22.6	22.6			
				4.0		38.4	28.4	28.4			
			BH-P15	2.0	7.2 X 7.2	39.5	21.2	21.2			
				3.0		46.3	23.6	23.6			
				4.0		53.3	26.5	26.5			
			BH-P16	2.0	7.2 X 7.2	45.1	21.2	21.2			
				3.0		37.7	19.4	19.4			
				4.0		58.7	26.5	26.5			
			BH-P17	2.0	7.2 X 7.2	19.8	5.4	5.4			
				3.0		22.9	7.9	7.9			
				4.0		26.0	17.7	17.7			
			BH-P18	2.0	7.2 X 7.2	39.2	15.7	15.7			
				3.0		45.1	16.5	16.5			
				4.0		51.2	17.5	17.5			
			BH-P19	2.0	7.2 X 7.2	22.1	15.9	15.9			
				3.0		25.2	16.8	16.8			
				4.0		28.5	17.7	17.7			
			BH-A2	2.0	7.2 X 7.2	34.1	16.7	16.7			
				3.0		39.6	18.1	18.1			
				4.0		45.3	19.0	19.0			
			13.	58+191	61+376	BH-CL	1.0	3.7 X 3.7	21.2	11.2	11.2
							1.5		24.1	12.1	12.1
							2.0		27.1	13.4	13.4
			14.	58+497	61+676	BH-A1	2.0	7.2 X 7.2	52.4	23.8	23.8
							3.0		60.3	25.3	25.3
							4.0		68.4	27.2	27.2
BH-P1	2.0	7.2 X 7.2				43.6	24.0	24.0			
	3.0					50.0	26.0	26.0			
	4.0					56.7	28.4	28.4			

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )			
	58+497	61+676	BH-P2	2.0	7.2 X 7.2	45.5	18.4	18.4			
				3.0		53.2	18.7	18.7			
				4.0		61.2	18.5	18.5			
			BH-P3	2.0	7.2 X 7.2	37.1	17.4	17.4			
				3.0		44.4	20.0	20.0			
				4.0		52.0	23.2	23.2			
			BH-P4	2.0	7.2 X 7.2	63.7	32.7	32.7			
				3.0		73.2	36.1	36.1			
				4.0		83.0	39.0	39.0			
			BH-P5	2.0	7.2 X 7.2	26.3	19.1	19.1			
				3.0		31.8	20.4	20.4			
				4.0		37.6	21.9	21.9			
			BH-P6	2.0	7.2 X 7.2	47.2	21.5	21.5			
				3.0		54.0	23.4	23.4			
				4.0		61.0	25.6	25.6			
			BH-A2	2.0	7.2 X 7.2	43.6	22.1	22.1			
				3.0		50.0	23.3	23.3			
				4.0		56.7	24.6	24.6			
			15.	58+837	62+026	BH-CL	1.0	4.9 X 4.9	39.1	9.3	9.3
							1.5		44.1	10.7	10.7
							2.0		49.3	12.6	12.6
			16.	59+071	62+256	BH-A1	1.0	2.7 X 2.7	26.0	27.8	26.0
							1.5		30.1	29.9	29.9
							2.0		34.3	31.9	31.9
17.	59+206	62+400	BH-CL	1.0	11.5 X 11.5	32.2	19.8	19.8			
				1.5		34.5	20.2	20.2			
				2.0		36.7	20.5	20.5			
18.	59+270	62+546	BH-CL	1.0	2.7 X 2.7	27.7	34.4	27.7			
				1.5		31.9	37.0	31.9			
				2.0		36.3	39.5	36.3			

\* The maximum value of recommended net allowable bearing capacity shall be restricted to 30 t/m<sup>2</sup>.

**Table 4.2: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 50mm**

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure ( $t/m^2$ )	Net Allowable Bearing Pressure from settlement failure ( $t/m^2$ )	*Recommended Net Allowable Bearing Capacity ( $t/m^2$ )
1.	52+518	55+719	BH-A1	2.0	7.2 X 7.2	32.9	40.2	32.9
				3.0		38.8		38.8
				4.0		44.9		44.9
			BH-A2	2.0	7.2 X 7.2	36.1	28.2	28.2
				3.0		42.6		30.7
				4.0		49.4		33.7
2.	53+107	56+291	BH-CL	1.0	6.2 X 6.2	23.9	36.8	23.9
				1.5		26.3		26.3
				2.0		28.8		28.8
3.	53+282	56+466	BH-CL	1.0	3.7 X 3.7	25.3	34.0	25.3
				1.5		28.8		28.8
				2.0		32.5		32.5
4.	53+572	56+756	BH-CL	1.0	3.7 X 3.7	6.3	15.0	6.3
				1.5		6.6		6.6
				2.0		6.9		6.9
5.	53+982	57+169	BH-CL	1.0	4.9 X 4.9	9.2	10.2	9.2
				1.5		9.5		9.5
				2.0		9.9		9.9
6.	54+363	57+547	BH-CL	1.0	4.7 X 4.7	34.0	46.5	34.0
				1.5		39.1		39.1
				2.0		44.4		44.4
7.	54+496	57+672	BH-CL	1.0	11.35 X 11.35	39.5	26.7	26.7
				1.5		42.6		27.0
				2.0		45.7		27.4
8.	55+910	59+107	BH-A1	2.0	7.2 X 7.2	27.1	22.3	22.3
				3.0		33.8		25.0
				4.0		40.8		28.7
			BH-A2	2.0	7.2 X 7.2	63.4	46.9	46.9
				3.0		77.7		49.4
				4.0		92.6		52.2
9.	56+403	59+587	BH-CL	1.0	2.7 X 2.7	18.7	25.5	18.7
				1.5		22.2		22.2
				2.0		25.8		25.8
10.	56+701	59+886	BH-CL	1.0	11.35 X 11.35	18.1	18.8	18.1
				1.5		19.4		19.4
				2.0		20.9		20.4

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
11.	56+978	60+162	BH-CL	1.0	4.9 X 4.9	31.8	36.7	31.8
				1.5		35.7	40.2	35.7
				2.0		39.6	44.2	39.6
12.	57+400	60+603	BH-A1	2.0	7.2 X 7.2	43.6	31.7	31.7
				3.0		51.1	35.2	35.2
				4.0		58.8	39.4	39.4
			BH-P2	2.0	7.2 X 7.2	60.4	36.5	36.5
				3.0		69.3	36.7	36.7
				4.0		78.4	36.8	36.8
			BH-P3	2.0	7.2 X 7.2	30.4	47.0	30.4
				3.0		35.4	51.5	35.4
				4.0		40.6	56.5	40.6
			BH-P4	2.0	7.2 X 7.2	44.7	56.1	44.7
				3.0		53.3	59.2	53.3
				4.0		62.3	62.5	62.3
			BH-P5	2.0	7.2 X 7.2	33.6	51.3	33.6
				3.0		40.4	54.1	40.4
				4.0		47.4	57.1	47.4
			BH-P6	2.0	7.2 X 7.2	35.5	28.1	28.1
				3.0		42.6	30.0	30.0
				4.0		49.9	32.5	32.5
			BH-P7	2.0	7.2 X 7.2	37.4	36.4	36.4
				3.0		44.8	38.8	38.8
				4.0		52.5	42.1	42.1
			BH-P9	2.0	7.2 X 7.2	43.6	31.4	31.4
				3.0		50.1	33.4	33.4
				4.0		56.7	36.2	36.2
			BH-P10	2.0	7.2 X 7.2	61.4	47.2	47.2
				3.0		72.8	49.6	49.6
				4.0		84.7	51.0	51.0
			BH-P11	2.0	7.2 X 7.2	30.6	30.1	30.1
				3.0		35.6	31.7	31.7
				4.0		40.8	33.5	33.5
			BH-P12	2.0	7.2 X 7.2	69.4	55.7	55.7
				3.0		80.6	56.7	56.7
				4.0		92.1	55.5	55.5
			BH-P13	2.0	7.2 X 7.2	27.0	36.8	27.0
				3.0		32.6	45.3	32.6
				4.0		38.4	56.7	38.4

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )			
	57+400	60+603	BH-P15	2.0	7.2 X 7.2	39.5	42.5	39.5			
				3.0		46.3	47.2	46.3			
				4.0		53.3	53.0	53.0			
			BH-P16	2.0	7.2 X 7.2	45.1	42.5	42.5			
				3.0		37.7	38.9	37.7			
				4.0		58.7	53.0	53.0			
			BH-P17	2.0	7.2 X 7.2	19.8	10.8	10.8			
				3.0		22.9	15.9	15.9			
				4.0		26.0	35.5	26.0			
			BH-P18	2.0	7.2 X 7.2	39.2	31.5	31.5			
				3.0		45.1	33.0	33.0			
				4.0		51.2	35.1	35.1			
			BH-P19	2.0	7.2 X 7.2	22.1	31.9	22.1			
				3.0		25.2	33.6	25.2			
				4.0		28.5	35.5	28.5			
			BH-A2	2.0	7.2 X 7.2	34.1	33.4	33.4			
				3.0		39.6	36.1	36.1			
				4.0		45.3	38.0	38.0			
			13.	58+191	61+376	BH-CL	1.0	3.7 X 3.7	21.2	22.5	21.2
							1.5		24.1	24.3	24.1
							2.0		27.1	26.8	26.8
			14.	58+497	61+676	BH-A1	2.0	7.2 X 7.2	52.4	47.7	47.7
							3.0		60.3	50.7	50.7
							4.0		68.4	54.3	54.3
BH-P1	2.0	7.2 X 7.2				43.6	47.9	43.6			
	3.0					50.0	52.1	50.0			
	4.0					56.7	56.9	56.7			
BH-P2	2.0	7.2 X 7.2				45.5	36.9	36.9			
	3.0					53.2	37.5	37.5			
	4.0					61.2	37.1	37.1			
BH-P3	2.0	7.2 X 7.2				37.1	34.9	34.9			
	3.0					44.4	40.0	40.0			
	4.0					52.0	46.4	46.4			
BH-P4	2.0	7.2 X 7.2				63.7	65.3	63.7			
	3.0					73.2	72.2	72.2			
	4.0					83.0	78.0	78.0			
BH-P5	2.0	7.2 X 7.2				26.3	38.3	26.3			
	3.0					31.8	40.8	31.8			
	4.0					37.6	43.8	37.6			

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
	58+497	61+676	BH-P6	2.0	7.2 X 7.2	47.2	43.1	43.1
				3.0		54.0	46.7	46.7
				4.0		61.0	51.1	51.1
			BH-A2	2.0	7.2 X 7.2	43.6	44.2	43.6
				3.0		50.0	46.6	46.6
				4.0		56.7	49.2	49.2
15.	58+837	62+026	BH-CL	1.0	4.9 X 4.9	39.1	18.6	18.6
				1.5		44.1	21.4	21.4
				2.0		49.3	25.2	25.2
16.	59+071	62+256	BH-A1	1.0	2.7 X 2.7	26.0	55.7	26.0
				1.5		30.1	59.9	30.1
				2.0		34.3	63.8	34.3
17.	59+206	62+400	BH-CL	1.0	11.5 X 11.5	32.2	39.6	32.2
				1.5		34.5	40.3	34.5
				2.0		36.7	41.1	36.7
18.	59+270	62+546	BH-CL	1.0	2.7 X 2.7	27.7	68.9	27.7
				1.5		31.9	74.1	31.9
				2.0		36.3	79.0	36.3

\* The maximum value of recommended net allowable bearing capacity shall be restricted to 30 t/m<sup>2</sup>.

Based on the method of analysis given under Para 7.2 above, The values of Safe Load Carrying Capacity of piles in compression, uplift and lateral under static conditions have been tabulated below:-

**Table 4.2: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 25mm (Replaced Soil)**

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from 25mm settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1.	53+572	56+756	BH-CL	1.0	3.7 X 3.7	32.1	26.6	26.6
				1.5		34.4	28.2	28.2
				2.0		36.8	34.6	30.0
2.	53+982	57+169	BH-CL	1.0	4.9 X 4.9	24.0	19.9	19.9
				1.5		26.5	21.1	21.1
				2.0		28.5	24.2	24.2

**Table 4.2: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 50mm (Replaced Soil)**

Sr. No.	Old Chainage	New Chainage	BH. No.	Depth of foundation below EGL (m)	Foundation Size (m x m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from 50 mm settlement failure (t/m <sup>2</sup> )	*Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1.	53+572	56+756	BH-CL	1.0	3.7 X 3.7	32.1	53.3	30.0
				1.5		34.4	56.5	30.0
				2.0		36.8	69.3	30.0
2.	53+982	57+169	BH-CL	1.0	4.9 X 4.9	24.0	39.8	24.0
				1.5		26.5	42.2	26.5
				2.0		28.5	48.3	28.5

**Note:-** The sub-strata at the location of Ch (Old) 53+572 & 53+982 consist of cohesive soil upto a depth of 10 m and 6 m below EGL, respectively. Therefore before laying the open foundation at 1.0, 1.5 m & 2.0m depth it is recommended to replace & compact the soil up to 1.5m depth below the foundation level.



As per the Morth guidelines the gradation of fill soil shall be as per following limits. The effective angle of friction not less than 30°. The gradation of fill soil shall be as per following limits.

<b>Sieve Size</b>	<b>Percentage Passing</b>
75 mm	100%
425 micron	0-60%
75 micron	less than 15 %
PI	≤6

- 1. The density of backfill soil should be more than 95% of proctor density. The replaced /compacted soil should be lay down layer wise for each 300mm.*
- 2. The design parameters considered for replaced/compacted Soil for calculating the SBC from shear criteria are as follows;*

*C=0, Phi = 32 degree, Sp. Gravity= 2.63 Moisture content= 8%, Dry density=1.58 t/m<sup>2</sup>, N = 25.*

**Table 4.3: Safe Load Carrying Capacity of normal bored cast in-situ RCC Pile in Soil**

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)
						In compression	In uplift	Fixed Head
1.	O.C._52+518 N.C._55+719	BH-A1	1.0	22.0	2.0	437.0	275.0	26.22
				24.0		480.0	315.0	
				26.0		523.0	355.0	
				28.0		565.0	394.0	
		1.2	22.0	2.0	644.0	370.0	35.10	
			24.0		706.0	427.0		
			26.0		766.0	483.0		
			28.0		827.0	540.0		
2.	O.C._52+518 N.C._55+719	BH-A2	1.0	22.0	2.0	437.0	275.0	26.22
				24.0		480.0	315.0	
				26.0		523.0	355.0	
				28.0		565.0	394.0	
		1.2	22.0	2.0	644.0	370.0	35.10	
			24.0		706.0	427.0		
			26.0		766.0	483.0		
			28.0		827.0	540.0		
3.	O.C._55+910 N.C._59+107	BH-A1	1.0	22.0	2.0	426.0	270.0	24.91
				24.0		463.0	305.0	
				26.0		501.0	340.0	
				28.0		538.0	375.0	
		1.2	22.0	2.0	589.0	349.0	33.35	
			24.0		638.0	395.0		
			26.0		688.0	442.0		
			28.0		736.0	488.0		
4.	O.C._55+910 N.C._59+107	BH-A2	1.0	22.0	2.0	419.0	263.0	28.10
				24.0		455.0	298.0	
				26.0		492.0	333.0	
				28.0		529.0	367.0	
		1.2	22.0	2.0	576.0	334.0	37.62	
			24.0		625.0	382.0		
			26.0		674.0	428.0		
			28.0		723.0	474.0		
BH-A1	1.0	2.0	16.0	214.0	163.0	23.56		
			18.0	228.0	179.0			
			20.0	243.0	195.0			
			22.0	258.0	205.0			

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)
						In compression	In uplift	Fixed Head
5.	O.C._57+400 N.C._60+603	BH-A1	1.2	16.0	2.0	274.0	226.0	31.54
				18.0		293.0	247.0	
				20.0		311.0	268.0	
				22.0		329.0	205.0	
		BH-P2	1.0	16.0	2.0	240.0	171.0	29.31
				18.0		258.0	190.0	
				20.0		288.0	219.0	
				22.0		393.0	252.0	
			1.2	16.0	2.0	307.0	213.0	39.23
				18.0		330.0	238.0	
				20.0		371.0	277.0	
				22.0		545.0	322.0	
6.	O.C._57+400 N.C._60+603	BH-P3	1.0	16.0	2.0	331.0	192.0	28.71
				18.0		363.0	223.0	
				20.0		397.0	255.0	
				22.0		431.0	287.0	
		1.2	16.0	2.0	458.0	241.0	38.43	
			18.0		501.0	283.0		
			20.0		546.0	326.0		
			22.0		591.0	369.0		
7.	O.C._57+400 N.C._60+603	BH-P4	1.0	16.0	2.0	343.0	201.0	25.57
				18.0		378.0	234.0	
				20.0		412.0	267.0	
				22.0		447.0	299.0	
		1.2	16.0	2.0	476.0	252.0	34.23	
			18.0		523.0	296.0		
			20.0		568.0	340.0		
			22.0		614.0	384.0		
8.	O.C._57+400 N.C._60+603	BH-P5	1.0	16.0	2.0	327.0	190.0	24.91
				18.0		359.0	222.0	
				20.0		393.0	254.0	
				22.0		426.0	285.0	
		1.2	16.0	2.0	453.0	238.0	33.35	
			18.0		497.0	282.0		
			20.0		542.0	325.0		
			22.0		586.0	367.0		
9.	O.C._57+400 N.C._60+603	BH-P6	1.0	16.0	2.0	284.0	153.0	23.56
				18.0		318.0	185.0	
				20.0		352.0	217.0	
				22.0		387.0	250.0	

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)
						In compression	In uplift	Fixed Head
10.	O.C._57+400 N.C._60+603	BH-P6	1.2	16.0	2.0	404.0	194.0	31.54
				18.0		449.0	237.0	
				20.0		495.0	281.0	
				22.0		542.0	325.0	
		BH-P7	1.0	16.0	2.0	282.0	148.0	25.57
				18.0		316.0	181.0	
				20.0		351.0	214.0	
				22.0		385.0	247.0	
		BH-P9	1.2	16.0	2.0	234.0	189.0	34.23
				18.0		448.0	233.0	
				20.0		495.0	278.0	
				22.0		541.0	322.0	
11.	O.C._57+400 N.C._60+603	BH-P9	1.0	20.0	2.0	235.0	194.0	24.91
				22.0		255.0	215.0	
				24.0		378.0	246.0	
				26.0		411.0	278.0	
		BH-P10	1.2	20.0	2.0	300.0	246.0	33.35
				22.0		325.0	272.0	
				24.0		523.0	315.0	
				26.0		568.0	358.0	
12.	O.C._57+400 N.C._60+603	BH-P10	1.0	16.0	2.0	299.0	179.0	28.10
				18.0		331.0	210.0	
				20.0		364.0	241.0	
				22.0		417.0	274.0	
		BH-P11	1.2	16.0	2.0	413.0	225.0	37.62
				18.0		456.0	267.0	
				20.0		499.0	309.0	
				22.0		545.0	353.0	
13.	O.C._57+400 N.C._60+603	BH-P11	1.0	16.0	2.0	298.0	193.0	24.91
				18.0		329.0	223.0	
				20.0		360.0	254.0	
				22.0		392.0	284.0	
		BH-P12	1.2	16.0	2.0	403.0	242.0	33.35
				18.0		445.0	283.0	
				20.0		487.0	323.0	
				22.0		529.0	364.0	
14.	O.C._57+400 N.C._60+603	BH-P12	1.0	16.0	2.0	325.0	201.0	28.10
				18.0		358.0	233.0	
				20.0		391.0	264.0	
				22.0		424.0	296.0	

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)
						In compression	In uplift	Fixed Head
15.	O.C._57+400 N.C._60+603	BH-P12	1.2	16.0	2.0	443.0	252.0	37.62
				18.0		487.0	294.0	
				20.0		530.0	336.0	
				22.0		574.0	379.0	
		BH-P13	1.0	16.0	2.0	256.0	198.0	31.06
				18.0		271.0	214.0	
				20.0		300.0	242.0	
				22.0		418.0	275.0	
			1.2	16.0	2.0	325.0	247.0	41.58
				18.0		343.0	268.0	
				20.0		382.0	306.0	
				22.0		571.0	350.0	
16.	O.C._57+400 N.C._60+603	BH-P15	1.0	16.0	2.0	341.0	200.0	24.91
				18.0		376.0	232.0	
				20.0		410.0	265.0	
				22.0		445.0	298.0	
		1.2	16.0	2.0	472.0	250.0	33.35	
			18.0		518.0	294.0		
			20.0		563.0	338.0		
			22.0		609.0	382.0		
17.	O.C._57+400 N.C._60+603	BH-P16	1.0	16.0	2.0	318.0	184.0	24.24
				18.0		349.0	214.0	
				20.0		381.0	245.0	
				22.0		414.0	276.0	
		1.2	16.0	2.0	433.0	231.0	32.45	
			18.0		482.0	271.0		
			20.0		525.0	313.0		
			22.0		569.0	355.0		
18.	O.C._57+400 N.C._60+603	BH-P17	1.0	16.0	2.0	308.0	192.0	22.86
				18.0		448.0	225.0	
				20.0		483.0	259.0	
				22.0		519.0	292.0	
		1.2	16.0	2.0	421.0	241.0	30.61	
			18.0		640.0	286.0		
			20.0		688.0	331.0		
			22.0		735.0	377.0		
19.	O.C._57+400 N.C._60+603	BH-P18	1.0	16.0	2.0	397.0	223.0	24.91
				18.0		505.0	259.0	
				20.0		543.0	295.0	
				22.0		582.0	331.0	

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)		
						In compression	In uplift	Fixed Head		
20.	O.C._57+400 N.C._60+603	BH-P18	1.2	16.0	2.0	547.0	279.0	33.35		
				18.0		718.0	328.0			
				20.0		770.0	376.0			
				22.0		821.0	425.0			
		BH-P19	1.0	16.0	2.0	219.0	182.0	24.24		
				18.0		234.0	198.0			
				20.0		262.0	226.0			
				22.0		515.0	257.0			
			1.2	16.0	2.0	274.0	226.0	32.45		
				18.0		294.0	248.0			
				20.0		332.0	285.0			
				22.0		743.0	328.0			
21.	O.C._58+497 N.C._61+676	BH-A2	1.0	22.0	2.0	392.0	270.0	23.56		
				24.0		424.0	300.0			
				26.0		456.0	331.0			
				28.0		489.0	362.0			
			1.2	22.0	2.0	535.0	347.0	31.54		
				24.0		578.0	388.0			
				26.0		621.0	430.0			
				28.0		664.0	471.0			
		22.	O.C._58+497 N.C._61+676	BH-A1	1.0	22.0	2.0	353.0	220.0	29.31
						24.0		386.0	253.0	
						26.0		421.0	285.0	
						28.0		454.0	317.0	
1.2	22.0				2.0	492.0	282.0	39.23		
	24.0					536.0	326.0			
	26.0					582.0	370.0			
	28.0					627.0	413.0			
23.	O.C._58+497 N.C._61+676	BH-P1	1.0	22.0	2.0	362.0	225.0	26.22		
				24.0		396.0	259.0			
				26.0		432.0	292.0			
				28.0		466.0	324.0			
			1.2	22.0	2.0	513.0	292.0	35.10		
				24.0		558.0	338.0			
				26.0		606.0	383.0			
				28.0		652.0	427.0			
24.	O.C._58+497 N.C._61+676	BH-P2	1.0	22.0	2.0	408.0	267	28.71		
				24.0		442.0	300			
				26.0		479.0	334			
				28.0		607.0	368			

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)				
						In compression	In uplift	Fixed Head				
25.	O.C._58+497 N.C._61+676	BH-P2	1.2	22.0	2.0	564.0	345	38.43				
				24.0		609.0	388					
				26.0		658.0	434					
				28.0		855.0	481					
		26.	O.C._58+497 N.C._61+676	BH-P3	1.0	22.0	2.0	428.0	286	26.22		
						24.0		461.0	318			
						26.0		495.0	350			
						28.0		620.0	384			
				27.	O.C._58+497 N.C._61+676	BH-P3	1.2	22.0	2.0	587.0	368	35.10
								24.0		632.0	411	
								26.0		677.0	454	
								28.0		725.0	500	
26.	O.C._58+497 N.C._61+676	BH-P4	1.0	22.0	2.0	452.0	304	29.31				
				24.0		486.0	336					
				26.0		520.0	368					
				28.0		554.0	400					
		27.	O.C._58+497 N.C._61+676	BH-P4	1.2	22.0	2.0	617.0	389	39.23		
						24.0		662.0	432			
						26.0		707.0	475			
						28.0		753.0	518			
27.	O.C._58+497 N.C._61+676	BH-P5	1.0	22.0	2.0	361.0	227	29.90				
				24.0		396.0	260					
				26.0		431.0	293					
				28.0		490.0	326					
		28.	O.C._58+497 N.C._61+676	BH-P5	1.2	22.0	2.0	508.0	296	40.03		
						24.0		556.0	341			
						26.0		602.0	385			
						28.0		648.0	429			
28.	O.C._58+497 N.C._61+676	BH-P6	1.0	22.0	2.0	360.0	224	27.48				
				24.0		395.0	257					
				26.0		429.0	290					
				28.0		525.0	325					
		29.	O.C._58+497 N.C._61+676	BH-P6	1.2	22.0	2.0	510.0	291	36.79		
						24.0		557.0	336			
						26.0		603.0	380			
						28.0		654.0	428			
29.	O.C._58+497 N.C._61+676	BH-A2	1.0	22.0	2.0	439.0	294	28.10				
				24.0		472.0	326					
				26.0		506.0	358					
				28.0		539.0	390					

Sr. no.	Old & New Chainage	BH No.	Diameter of Pile (m)	Length of piles below cut-off (m)	Cut-off level below EGL (m)	Safe load carrying capacity of single pile (T)		In Lateral (T)
						In compression	In uplift	Fixed Head
		BH-A2	1.2	22.0	2.0	599.0	376	37.62
				24.0		643.0	419	
				26.0		688.0	462	
				28.0		732.0	504	

**Notes :-**

1. Permissible lateral deflection has been taken as 5mm.
2. The self weight of the pile has been taken into account while computing the Safe Load Carrying Capacity of Pile in uplift only and not considered for vertical load capacity in compression.
3. The safe load carrying capacity of piles have been worked out on the basis of IS: 2911 (Part-1/sec-2) – 2010 as per provisions / assumptions provided therein & are only an assessment based on characteristics of the sub-strata obtained at the locations of the above BHs. The safe load carrying capacities as tabulated above will further depend substantially on the piling technique adopted and equipment used for making the piles in the field. However, for the final designs & constructions, the safe/allowable load carrying capacities of these piles should be taken by conducting actual initial load tests on these piles by casting them in the respective areas.
4. While erecting normal bored cast in-situ pile, utmost care should be taken while flushing/cleaning the bottom of pile particularly prior to start of pouring of concrete so as to rest the pile in virgin soil only for obtaining full point bearing as while computing safe load carrying capacity of pile no bottom softening during erection of pile has been considered.
5. Further the pile should have necessary structural strength to transmit / sustain the design load.

**Notes:-**

All The above recommendations are based on the field and laboratory tests conducted on selected soil/ rock core samples and our experience in this regard. If the actual substrata conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations.



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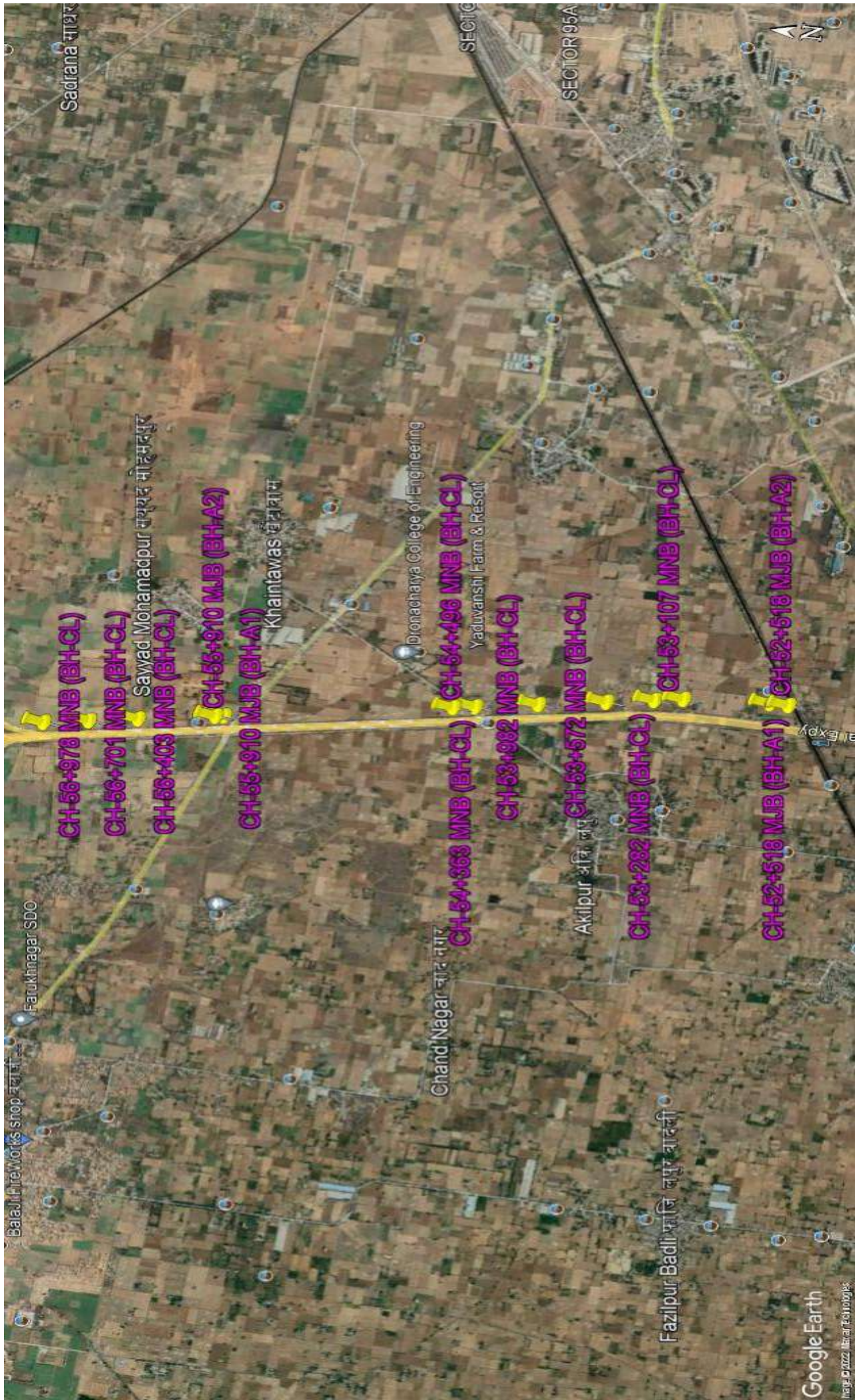
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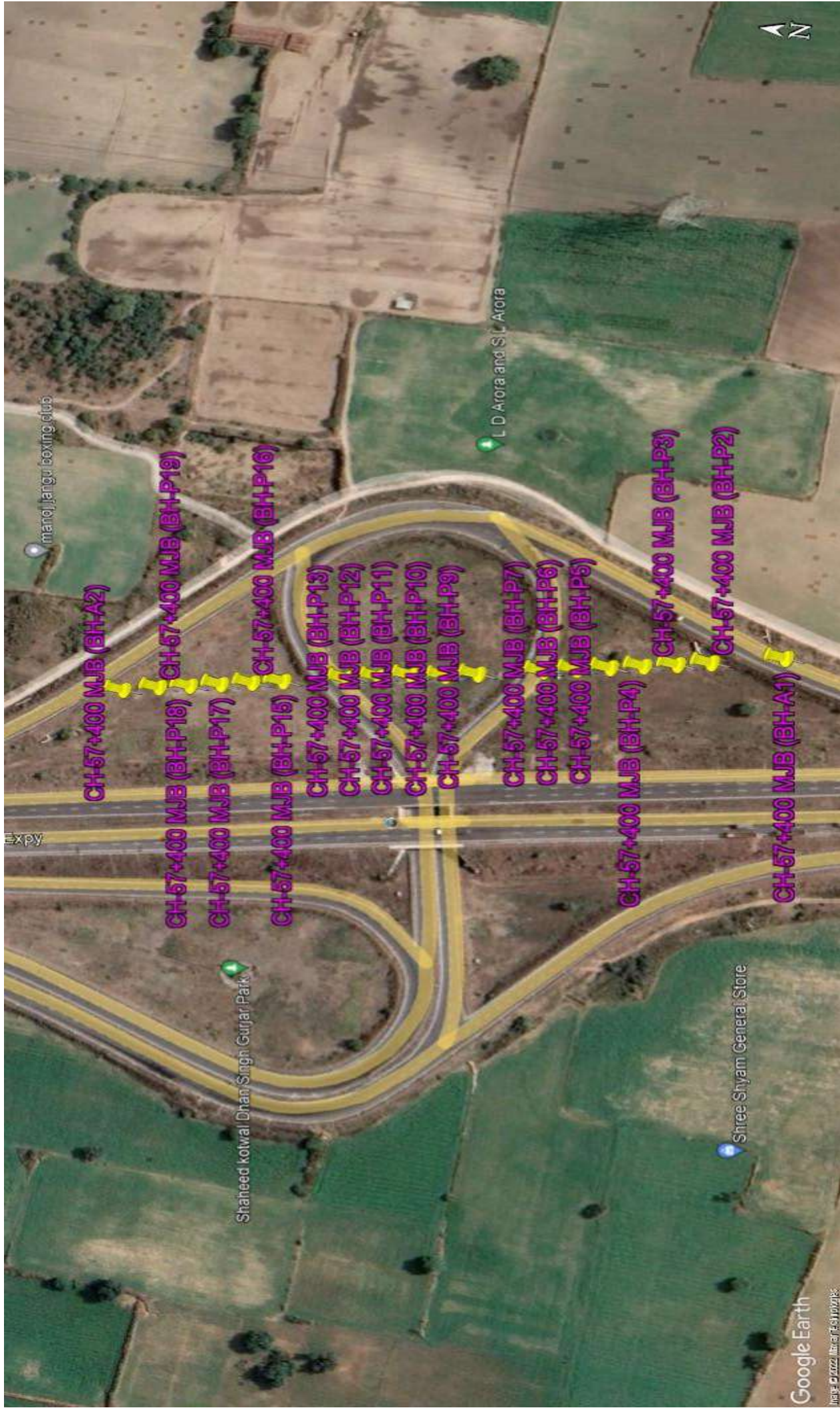
**Abbreviations**

BH	Borehole
ERT	Electrical Resistivity Test
EGL	Existing Ground Level
GWT	Ground Water Table
IS	Indian Standards
SPT	Standard Penetration Test
DS	Disturbed Soil
R.L.	Reduced Level
m	Metre
sp. gr.	Specific Gravity
%	Percentage
mg /l	Milligram per litre
mg /kg	Milligram per kilogram

## APPENDIX – A (FIELD DATA RESULTS)

Appendix No.	ITEMS
A-1	LOCATION PLAN
A-2	FIELD BORE HOLE LOGS
A-3	SUB SOIL PROFILE DIAGRAM











# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143671.17 m	Easting : 683091.771 m
Reduced Level (m): (+)213.216	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 22.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 20-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	3	5	7	12	Brown, Medium dense, Sandy silt of low plasticity ML-CL				
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	5	9	13	22					
6.0											
6.5											
7.0	7	UDS*					Brown, Hard, Silty clay of low plasticity CL				
7.5											
8.0											
8.5	8.5	SPT-3	7	15	21	36					
9.0											
9.5											
10.0	10	UDS-3									

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :52+518 km	Northing :3143671.17 m	Easting :683091.771 m
Reduced Level (m):(+)213.216	BH. No. :BH-A1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):22.80	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :20-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations			
			N1	N2	N3									
10.0														
10.5						Brown, Hard, Silty clay of low plasticity	CL	[Graphic Log]	[SPT N Value vs Depth Plot]					
11.0														
11.5	11.5	SPT-4	9	16	24	40								
12.0						Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL	[Graphic Log]	[SPT N Value vs Depth Plot]					
12.5														
13.0	13	UDS-4												
13.5														
14.0														
14.5	14.5	SPT-5	10	20	28					48				
15.0														
15.5														
16.0	16	UDS-5												
16.5														
17.0														
17.5	17.5	SPT-6	13	29	50	79								
18.0														
18.5														
19.0	19	SPT-7	15	32	60	92								
19.5														
20.0														

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143671.17 m	Easting : 683091.771 m
Reduced Level (m): (+)213.216	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 22.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 20-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-8	30	60	40 (8cm)	>100					
21.0											
21.5											
22.0	22	SPT-9	26	57	43 (7cm)	>100					
22.5											
23.0											
23.5	23.5	SPT-10	24	49	51 (5cm)	>100					
24.0											
24.5											
25.0	25	SPT-11	27	62	38 (3cm)	>100	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-12	28	48	52 (12cm)	>100					
27.0											
27.5											
28.0	28	SPT-13	25	43	56	99					
28.5											
29.0											
29.5	29.5	SPT-14	20	40	60 (13cm)	>100					
30.0											



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143671.17 m	Easting : 683091.771 m
Reduced Level (m): (+)213.216	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 22.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 20-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-15	26	44	56 (9cm)	>100					
31.5											
32.0											
32.5	32.5	SPT-16	17	29	41	70					
33.0											
33.5											
34.0	34	SPT-17	21	36	45	81					
34.5											
35.0							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-18	19	30	47	77					
36.0											
36.5											
37.0	37	SPT-19	20	38	44	82					
37.5											
38.0											
38.5	38.5	SPT-20	27	62	38 (9cm)	>100					
39.0											
39.5											
40.0	40	SPT-21	29	69	31 (8cm)	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143783.105 m	Easting : 683092.392 m
Reduced Level (m): (+)220.511	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 23.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 27-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	4	6	7	13	Brown, Medium dense, Sandy silt of low plasticity ML-CL				
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	7	9	13	22	Brown, Very stiff to hard, Silty clay of low plasticity CL				
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	6	8	14	22					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143783.105 m	Easting : 683092.392 m
Reduced Level (m):(+)220.511	BH. No. : BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):23.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	8	13	16	29	Brown, Very stiff to hard, Silty clay of low plasticity  CL				
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	12	17	22	39	Brown, Very dense, Sandy silt of low plasticity  ML-CL				
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	14	22	34	56	Brown, Very dense, Sandy silt of low plasticity  ML-CL				
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143783.105 m	Easting : 683092.392 m
Reduced Level (m): (+)220.511	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 23.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 27-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	12	21	33	54					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	13	29	37	66		▼ 23.50m			
24.0											
24.5											
25.0	25	UDS-9					Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-9	9	17	26	43					
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	11	19	33	52					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 52+518 km	Northing : 3143783.105 m	Easting : 683092.392 m
Reduced Level (m): (+)220.511	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 23.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	UDS-11									
31.5											
32.0											
32.5	32.5	SPT-11	9	13	21	34					
33.0											
33.5											
34.0	34	UDS-12									
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-12	19	30	39	69					
36.0											
36.5											
37.0	37	SPT-13	24	38	43	81					
37.5											
38.0											
38.5	38.5	SPT-14	29	35	43	78					
39.0											
39.5											
40.0	40	SPT-15	27	40	53	93					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :53+107 km	Northing :3144302.971 m	Easting :683034.675 m
Reduced Level (m):(+)218.950	BH. No. :BH-CL	BH Termination Depth (m):15
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :15-01-2022		Date of Completion :15-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1				15	Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
1.0											
1.5	1.5	SPT-2				15					
2.0											
2.5	2.25	UDS*									
3.0	3	SPT-3				13					
3.5											
4.0											
4.5	4.5	SPT-4				17					
5.0											
5.5	5.25	UDS-1									
6.0	6	SPT-5				40	Brown, Hard, Silty clay of low plasticity	CL			
6.5											
7.0											
7.5	7.5	SPT-6				45					
8.0											
8.5	8.25	UDS-2									
9.0	9	SPT-7				45					
9.5											
10.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 53+107 km	Northing : 3144302.971 m	Easting : 683034.675 m
Reduced Level (m):(+)218.950	BH. No. : BH-CL	BH Termination Depth (m):15
Proposed / Existing Structure : Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) :Not Used
Date of Start : 15-01-2022		Date of Completion : 15-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5	10.5	SPT-8				50	Brown, Hard, Silty clay of low plasticity	CL			
11.0	11.25	UDS-3					Brown, Very dense, Sandy silt of low plasticity	ML-CL			
11.5											
12.0	12	SPT-9				50					
12.5											
13.0											
13.5	13.5	SPT-10				51					
14.0											
14.5	14.25	UDS-4									
15.0	15	SPT-11				62					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 53+282 km	Northing : 3144473.609 m	Easting : 682995.864 m
Reduced Level (m):(+)218.087	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 14-01-2022		Date of Completion : 14-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	4	5	5	10	Brown, Medium dense, Sandy silt of low plasticity ML-CL				
1.5	1.5	SPT-2	5	6	7	13					
2.25	2.25	UDS*									
3.0	3	SPT-3	6	6	8	14					
4.5	4.5	SPT-4	7	8	11	19					
5.25	5.25	UDS-1									
6.0	6	SPT-5	11	13	16	29					
7.5	7.5	SPT-6	14	15	19	34	Brown, Very stiff to hard, Silty clay of low plasticity CL				
8.25	8.25	UDS-2									
9.0	9	SPT-7	10	11	14	25					
10.0	10	SPT-8	12	13	17	30					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :53+572 km	Northing :3144756.38 m	Easting :682931.5 m
Reduced Level (m):(+)217.532	BH. No. :BH-CL	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :14-01-2022		Date of Completion :14-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	2	3	3	6	Brown, Medium stiff to stiff, Silty clay of low plasticity	CL			
1.0											
1.5	1.5	SPT-2	3	4	7	11					
2.0											
2.25	2.25	UDS*									
2.5											
3.0	3	SPT-3	8	11	15	26	Brown, Very stiff to hard, Silty clay of low plasticity	CL			
3.5											
4.0											
4.5	4.5	SPT-4	11	13	16	29					
5.0											
5.25	5.25	UDS-1									
5.5											
6.0	6	SPT-5	13	15	19	34					
6.5											
7.0											
7.5	7.5	SPT-6	15	18	21	39					
8.0											
8.25	8.25	UDS-2									
8.5											
9.0	9	SPT-7	17	20	27	47					
9.5											
10.0	10	SPT-8	19	22	30	52					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 53+982 km	Northing : 3145156.16 m	Easting : 682840.528 m
Reduced Level (m):(+)217.050	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 12-01-2022		Date of Completion : 12-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	2	2	3	5	Brown, Medium stiff to very stiff, Silty clay of low plasticity  CL	CL			
1.5	1.5	SPT-2	5	5	6	11					
2.25	2.25	UDS-1									
3.0	3	SPT-3	7	8	9	17					
4.5	4.5	SPT-4	12	12	15	27					
5.25	5.25	UDS-2									
6.0	6	SPT-5	10	11	13	24					
7.5	7.5	SPT-6	13	15	17	32					
8.25	8.25	UDS-3					Brown, Medium dense to dense, Sandy silt of low plasticity  ML-CL	ML-CL			
9.0	9	SPT-7	15	18	24	42					
10.0	10	SPT-8	15	17	21	38					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 54+363 km	Northing : 3145527.663 m	Easting : 682755.991 m
Reduced Level (m):(+)216.014	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 11-01-2022		Date of Completion : 11-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	9	11	13	24	Brown, Medium dense, Silty sand with clay SM-SC				
1.0											
1.5	1.5	SPT-2	8	9	10	19					
2.0											
2.5	2.25	UDS*									
3.0	3	SPT-3	7	9	9	18					
3.5											
4.0											
4.5	4.5	SPT-4	8	10	12	22					
5.0											
5.5	5.25	UDS-1					Brown, Hard, Silty clay of low plasticity CL				
6.0	6	SPT-5	11	14	17	31					
6.5											
7.0											
7.5	7.5	SPT-6	13	15	19	34					
8.0											
8.5	8.25	UDS-2					Brown, Dense, Sandy silt of low plasticity ML-CL				
9.0	9	SPT-7	11	17	21	38					
9.5											
10.0	10	SPT-8	12	19	23	42					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 54+496 km	Northing : 3145657.348 m	Easting : 682726.48 m
Reduced Level (m):(+)217.393	BH. No. : BH-CL	BH Termination Depth (m): 15
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 12-01-2022		Date of Completion : 12-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	4	5	9	Brown, Loose to medium dense, Sandy silt of low plasticity	ML-CL			
1.5	1.5	SPT-2	5	6	7	13					
2.25	2.25	UDS*									
3.0	3.0	SPT-3	6	8	9	17					
4.5	4.5	SPT-4	7	9	11	20					
5.25	5.25	UDS-1					Brown, Hard, Silty clay of low plasticity with gravel	CL			
6.0	6.0	SPT-5	12	14	16	30					
7.5	7.5	SPT-6	13	15	19	34					
8.25	8.25	UDS-2									
9.0	9.0	SPT-7	12	16	19	35					
10.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :54+496 km	Northing :3145657.348 m	Easting :682726.48 m
Reduced Level (m):(+)217.393	BH. No. :BH-CL	BH Termination Depth (m):15
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :12-01-2022		Date of Completion :12-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5	10.5	SPT-8	15	17	21	38					
11.0											
11.5	11.25	UDS-3									
12.0	12	SPT-9	13	19	22	41					
12.5											
13.0											
13.5	13.5	SPT-10	15	21	25	46					
14.0											
14.5	14.25	UDS-4									
15.0	15	SPT-11	18	20	26	46					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 54+496 km	Northing : 3145657.348 m	Easting : 682726.48 m
Reduced Level (m):(+)217.393	BH. No. : BH-CL	BH Termination Depth (m): 15
Proposed / Existing Structure : Minor Bridge	Water Table (m): 1.36	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 12-01-2022		Date of Completion : 12-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5	10.5	SPT-8	15	17	21	38					
11.0											
11.5	11.25	UDS-3									
12.0	12	SPT-9	13	19	22	41					
12.5											
13.0											
13.5	13.5	SPT-10	15	21	25	46					
14.0											
14.5	14.25	UDS-4									
15.0	15	SPT-11	18	20	26	46					





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147009.213 m	Easting : 682418.856 m
Reduced Level (m): (+)218.101	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 16.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	2	4	5	9	Brown, loose to medium dense, Silty sand	SM			
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	4	7	9	16					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	7	10	14	24	Brown, Very stiff to Hard, Silty clay of low plasticity	CL			
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :55+910 km	Northing :3147009.213 m	Easting :682418.856 m
Reduced Level (m):(+)218.101	BH. No. :BH-A1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):16.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :23-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	12	15	17	32	Brown, Very stiff to Hard, Silty clay of low plasticity	CL			
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	15	18	21	39					
15.0											
15.5											
16.0	16	UDS-6									
16.5							Brown, Dense to Very dense, Sandy silt of low plasticity with gravel	ML-CL			
17.0											
17.5	17.5	SPT-6	17	22	24	46					
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147009.213 m	Easting : 682418.856 m
Reduced Level (m): (+)218.101	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 16.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	18	24	27	51					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	19	25	29	54					
24.0											
24.5											
25.0	25	UDS-9					Brown, Dense to Very dense, Sandy silt of low plasticity with gravel	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-9	21	28	37	65					
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	24	30	39	69					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147009.213 m	Easting : 682418.856 m
Reduced Level (m): (+)218.101	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 16.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	UDS-11									
31.5											
32.0											
32.5	32.5	SPT-11	27	38	47	85					
33.0											
33.5											
34.0	34	UDS-12									
34.5											
35.0							Brown, Dense to Very dense, Sandy silt of low plasticity with gravel	ML-CL			
35.5	35.5	SPT-12	37	48	54 (4cm)	>100					
36.0											
36.5											
37.0	37	SPT-13	39	50	50 (10cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-14	65	85	15 (12cm)	>100					
39.0											
39.5											
40.0	40	SPT-15	67	59	41 (7cm)	>100					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147059.917 m	Easting : 682407.318 m
Reduced Level (m): (+)217.474	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 15.60	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 21-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	5	7	8	15					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	7	10	12	22					
4.5											
5.0							Brown, Medium dense to dense, Silty sand	SM			
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	10	12	14	26					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	11	15	17	32					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :55+910 km	Northing :3147059.917 m	Easting :682407.318 m
Reduced Level (m):(+)217.474	BH. No. :BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):15.60	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :19-08-2021		Date of Completion :21-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0											
12.5											
13.0	13	SPT-5	14	18	21	39	Brown, Medium dense to dense, Silty sand	SM			
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	12	16	19	35					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0							Brown, Hard, Silty clay of low plasticity	CL			
18.5											
19.0	19	SPT-7	15	20	23	43					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147059.917 m	Easting : 682407.318 m
Reduced Level (m):(+)217.474	BH. No. : BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):15.60	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 21-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7					Brown, Hard, Silty clay of low plasticity	CL			
21.0											
21.5											
22.0	22	SPT-8	20	24	29	53					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5											
25.0	25	SPT-9	21	27	31	58	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-9									
27.0											
27.5											
28.0	28	SPT-10	24	32	41	73					
28.5											
29.0											
29.5	29.5	UDS*									
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 55+910 km	Northing : 3147059.917 m	Easting : 682407.318 m
Reduced Level (m):(+)217.474	BH. No. : BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):15.60	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 21-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	40	54	46 (4cm)	>100					
31.5											
32.0											
32.5	32.5	SPT-12	44	62	38 (3cm)	>100					
33.0											
33.5											
34.0	34	SPT-13	38	58	42 (5cm)	>100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
35.5	35.5	SPT-14	33	65	35 (6cm)	>100					
36.0											
36.5											
37.0	37	SPT-15	39	73	27 (3cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-16	42	69	31 (4cm)	>100					
39.0											
39.5											
40.0	40	SPT-17	48	70	30 (5cm)	>100					

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 56+403 km	Northing : 3147516.813 m	Easting : 682303.349 m
Reduced Level (m): (+)215.389	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 25-09-2021	Date of Completion : 25-09-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS							0 10 20 30 40 50 60 70 80 90 100		
0.5											
1.0	1	SPT-1	2	3	4	7	Brown, Loose, Silty sand	SM			
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	7	10	12	22	Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	8	11	14	25					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	11	15	27	42					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :56+701 km	Northing :3147807.384 m	Easting :682237.228 m
Reduced Level (m):(+)215.273	BH. No. :BH-CL	BH Termination Depth (m):15
Proposed / Existing Structure :Minor Bridge	Water Table (m):1.40	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :10-01-2022		Date of Completion :10-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	4	4	8	Brown, Loose to medium dense, Sandy silt of low plasticity ML-CL				
1.0											
1.5	1.5	SPT-2	5	7	9	16					
2.0											
2.25	2.25	UDS-1									
2.5											
3.0	3	SPT-3	4	6	8	14					
3.5											
4.0											
4.5	4.5	SPT-4	7	9	10	19					
5.0											
5.25	5.25	UDS-2									
5.5											
6.0	6	SPT-5	10	13	16	29	Brown, Medium dense to dense, Silty sand SP-SM				
6.5											
7.0											
7.5	7.5	SPT-6	11	14	19	33					
8.0											
8.25	8.25	UDS-3									
8.5											
9.0	9	SPT-7	12	15	20	35					
9.5											
10.0	10	SPT-8	10	13	16	29					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 56+701 km	Northing : 3147807.384 m	Easting : 682237.228 m
Reduced Level (m):(+)215.273	BH. No. : BH-CL	BH Termination Depth (m): 15
Proposed / Existing Structure : Minor Bridge	Water Table (m): 1.40	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 10-01-2022		Date of Completion : 10-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0	11.25	UDS*					Brown, Medium dense to dense, Silty sand	SP-SM			
11.5											
12.0	12	SPT-9	11	15	21	36					
12.5											
13.0											
13.5	13.5	SPT-10	14	19	22	41	Brown, Hard, Silty clay of low plasticity	CL			
14.0											
14.5	14.25	UDS*									
15.0	15	SPT-11	16	21	25	46					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 56+978 km	Northing : 3148077.48 m	Easting : 682175.767 m
Reduced Level (m): (+)212.389	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 10-01-2022		Date of Completion : 10-01-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	5	6	11	Brown, Medium dense, Sandy silt of low plasticity  ML-CL				
1.5	1.5	SPT-2	7	8	8	16					
2.25	2.25	UDS-1									
3.0	3	SPT-3	7	9	11	20	Brown, Very stiff to hard, Silty clay of low plasticity  CL				
4.5	4.5	SPT-4	8	10	12	22					
5.25	5.25	UDS-2									
6.0	6	SPT-5	9	12	14	26					
7.5	7.5	SPT-6	11	13	16	29					
8.25	8.25	UDS*									
9.0	9	SPT-7	9	11	19	30	Brown, Medium dense, Silty sand with clay  SM-SC				
10.0	10	SPT-8	13	15	22	37					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148361.347 m	Easting : 682111.171 m
Reduced Level (m): (+)217.941	BH. No. : BH-A1	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 10.90	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 27-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	3	5	7	12	Brown, Medium dense, Silty sand with clay	SM-SC			
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	5	7	9	16					
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	7	10	12	22					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0							Brown, Hard, Silty clay of low plasticity	CL			
9.5											
10.0	10	SPT-4	12	15	17	32					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148361.347 m	Easting :682111.171 m
Reduced Level (m):(+)217.941	BH. No. :BH-A1	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.90	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :27-08-2021	Date of Completion :27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4					Brown, Hard, Silty clay of low plasticity	CL			
12.0											
12.5											
13.0	13	SPT-5	18	23	29	52					
13.5											
14.0											
14.5	14.5	UDS-5					Brown, Very dense, Silty sand	SM			
15.0											
15.5											
16.0	16	SPT-6	23	28	34	62					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	16	24	27	51	Brown, Hard, Silty clay of low plasticity	CL			
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148361.347 m	Easting :682111.171 m
Reduced Level (m):(+)217.941	BH. No. :BH-A1	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.90	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :27-08-2021	Date of Completion :27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	21	28	32	60	Brown, Hard, Silty clay of low plasticity	CL			
22.5											
23.0											
23.5	23.5	SPT-9	27	34	41	75					
24.0											
24.5											
25.0	25	SPT-10	29	36	49	85					
25.5											
26.0											
26.5	26.5	SPT-11	34	48	51	99	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
27.0											
27.5											
28.0	28	SPT-12	40	55	45 (4cm)	>100					
28.5											
29.0											
29.5	29.5	SPT-13	46	66	34 (13cm)	>100					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148389.429 m	Easting : 682104.781 m
Reduced Level (m): (+)213.893	BH. No. : BH-P2	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.85	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	6	7	8	15					
1.5											
2.0											
2.5	2.5	UDS-1					Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
3.0											
3.5											
4.0	4	SPT-2	8	10	14	24					
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	10	14	18	32	Brown, Hard, Silty clay of low plasticity	CL			
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5							Brown, Dense, Sandy silt of low plasticity	ML-CL			
10.0	10	SPT-4	12	16	21	37					

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148389.429 m	Easting :682104.781 m
Reduced Level (m):(+)213.893	BH. No. :BH-P2	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):11.85	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :23-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0											
12.5											
13.0	13	SPT-5	10	19	23	42	Brown, Dense, Sandy silt of low plasticity	ML-CL			
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	18	26	38	64					
16.5											
17.0											
17.5	17.5	UDS-6					Brown, Hard, Silty clay of low plasticity	CL			
18.0											
18.5											
19.0	19	SPT-7	24	29	41	70					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148389.429 m	Easting : 682104.781 m
Reduced Level (m): (+)213.893	BH. No. : BH-P2	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.85	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7					Brown, Hard, Silty clay of low plasticity	CL			
21.0											
21.5											
22.0	22	SPT-8	27	36	48	84					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.0	25	SPT-9	26	38	58	96					
25.5											
26.0											
26.5	26.5	UDS-9									
27.0											
27.5											
28.0	28	SPT-10	32	58	42 (6cm)	>100					
28.5											
29.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
29.5	29.5	SPT-11	42	62	38 (7cm)	>100					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148402.495 m	Easting : 682101.808 m
Reduced Level (m): (+)214.414	BH. No. : BH-P3	BH Termination Depth (m): 31
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.50	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	2	5	7	12					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	SPT-2	7	11	15	26					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	13	16	19	35					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148402.495 m	Easting :682101.808 m
Reduced Level (m):(+)214.414	BH. No. :BH-P3	BH Termination Depth (m):31
Proposed / Existing Structure :Major Bridge	Water Table (m):11.50	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :23-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	15	17	20	37		▼ 11.50m	●		
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	16	18	21	39	Brown, Dense, Silty sand	SM	●		
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	17	20	24	44			●		
18.0											
18.5											
19.0	19	UDS-7									
19.5							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148402.495 m	Easting : 682101.808 m
Reduced Level (m):(+)214.414	BH. No. : BH-P3	BH Termination Depth (m):31
Proposed / Existing Structure : Major Bridge	Water Table (m):11.50	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	19	23	25	48	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	22	27	30	57					
24.0											
24.5											
25.0	25	UDS-9									
25.5											
26.0											
26.5	26.5	SPT-9	24	29	32	61					
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	31	37	42	79					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148402.495 m	Easting : 682101.808 m
Reduced Level (m): (+)214.414	BH. No. : BH-P3	BH Termination Depth (m): 31
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.50	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	UDS-11					Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148415.561 m	Easting : 682098.835 m
Reduced Level (m): (+)214.498	BH. No. : BH-P4	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations		
			N1	N2	N3								
0.0		DS											
0.5													
1.0	1	SPT-1	3	5	7	12	Brown, Medium dense, Silty sand	SM					
1.5													
2.0													
2.5	2.5	UDS-1											
3.0													
3.5													
4.0	4	SPT-2	5	8	11	19							
4.5													
5.0													
5.5	5.5	UDS-2											
6.0													
6.5													
7.0	7	SPT-3	10	15	32	47	Brown, Very dense, Sandy silt of low plasticity	ML-CL					
7.5													
8.0													
8.5	8.5	UDS-3											
9.0													
9.5													
10.0	10	SPT-4	11	17	37	54							

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148415.561 m	Easting :682098.835 m
Reduced Level (m):(+)214.498	BH. No. :BH-P4	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):11.80	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :24-08-2021		Date of Completion :25-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0											
12.5											
13.0	13	SPT-5	10	19	39	58					
13.5											
14.0											
14.5	14.5	UDS-5									
15.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	SPT-6	13	21	38	59					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	15	35	40	75					
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148415.561 m	Easting : 682098.835 m
Reduced Level (m): (+)214.498	BH. No. : BH-P4	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	17	29	42	71					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5											
25.0	25	SPT-9	20	31	45	76	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS*									
27.0											
27.5											
28.0	28	SPT-10	28	36	48	84					
28.5											
29.0											
29.5	29.5	UDS-9									
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148428.627 m	Easting : 682095.861 m
Reduced Level (m): (+)214.548	BH. No. : BH-P5	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	3	5	6	11					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense to dense, Silty sand	SM			
5.5	5.5	SPT-2	7	9	11	20					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	12	14	17	31					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148428.627 m	Easting :682095.861 m
Reduced Level (m):(+)214.548	BH. No. :BH-P5	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):12.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :24-08-2021	Date of Completion :25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	15	20	25	45					
12.0								▼ 12.00m			
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	18	24	29	53	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	22	28	33	61					
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148428.627 m	Easting : 682095.861 m
Reduced Level (m): (+)214.548	BH. No. : BH-P5	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	19	31	37	68	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	27	36	43	79					
24.0											
24.5											
25.0	25	UDS*									
25.5											
26.0											
26.5	26.5	SPT-9	28	43	47	90					
27.0											
27.5											
28.0	28	UDS-9					Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
28.5											
29.0											
29.5	29.5	SPT-10	26	45	59	94					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148441.693 m	Easting : 682092.888 m
Reduced Level (m): (+)214.417	BH. No. : BH-P6	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.40	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	2	4	6	10					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	4	7	9	16	Brown, Medium dense, Silty sand	SM			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	4	8	12	20					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0							Brown, Very stiff to hard, Silty clay of low plasticity	CL			
9.5											
10.0	10	SPT-4	6	10	16	26					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148441.693 m	Easting : 682092.888 m
Reduced Level (m):(+)214.417	BH. No. : BH-P6	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.40	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4						▼ 11.40m			
12.0						Brown, Very stiff to hard, Silty clay of low plasticity	CL				
12.5											
13.0	13	SPT-5	9	13	19	32					
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	15	21	29	50					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	14	22	31	53	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148441.693 m	Easting : 682092.888 m
Reduced Level (m): (+)214.417	BH. No. : BH-P6	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.40	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	16	25	35	60					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5											
25.0	25	SPT-9	17	26	37	63	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-9									
27.0											
27.5											
28.0	28	SPT-10	19	31	42	73					
28.5											
29.0											
29.5	29.5	UDS*									
30.0	30	-									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148454.759 m	Easting : 682089.915 m
Reduced Level (m): (+)214.599	BH. No. : BH-P7	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	4	6	8	14					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense, Silty sand	SM			
5.5	5.5	SPT-2	7	10	11	21					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	9	14	16	30					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148454.759 m	Easting : 682089.915 m
Reduced Level (m): (+)214.599	BH. No. : BH-P7	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0								▼ 11.00m			
11.5	11.5	SPT-4	13	19	23	42			●		
12.0											
12.5											
13.0	13	UDS-5					Brown, hard, Silty clay of low plasticity	CL			
13.5											
14.0											
14.5	14.5	SPT-5	12	15	18	33			●		
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	14	20	23	43			●		
18.0							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148454.759 m	Easting : 682089.915 m
Reduced Level (m): (+)214.599	BH. No. : BH-P7	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	25	27	32	59					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	24	29	34	63					
24.0											
24.5											
25.0	25	UDS-9					Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-9	27	35	45	80					
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	31	42	51	93					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148480.891 m	Easting : 682083.968 m
Reduced Level (m): (+)214.330	BH. No. : BH-P9	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 28.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	3	6	7	13					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	4	8	10	18	Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	6	9	10	19					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0							Brown, Hard, Silty clay of low plasticity	CL			
9.5											
10.0	10	SPT-4	9	14	19	33					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148480.891 m	Easting : 682083.968 m
Reduced Level (m): (+)214.330	BH. No. : BH-P9	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 28.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0								▼ 12.00m			
12.5							CL				
13.0	13	SPT-5	8	13	17	30					
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	16	30	36	66	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	12	17	25	42	Brown, Hard, Silty clay of low plasticity	CL			
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148480.891 m	Easting : 682083.968 m
Reduced Level (m): (+)214.330	BH. No. : BH-P9	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 28.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	13	20	28	48	Brown, Hard, Silty clay of low plasticity	CL			
22.5											
23.0											
23.5	23.5	SPT-9	18	24	36	60					
24.0											
24.5											
25.0	25	SPT-10	29	32	39	71					
25.5											
26.0											
26.5	26.5	SPT-11	30	36	41	77	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
27.0											
27.5											
28.0	28	SPT-12	35	40	48	88					
28.5											
29.0											
29.5	29.5	SPT-13	37	41	50	91					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148480.891 m	Easting : 682083.968 m
Reduced Level (m): (+)214.330	BH. No. : BH-P9	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 28.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-14	32	45	52	97					
31.5											
32.0											
32.5	32.5	SPT-15	29	52	48 (10cm)	>100	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
33.0											
33.5											
34.0	34	SPT-16	31	58	42 (8cm)	>100					
34.5											
35.0	35	SPT-17	33	67	33 (5cm)	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148493.957 m	Easting : 682080.995 m
Reduced Level (m):(+)214.021	BH. No. : BH-P10	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.85	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :27.00
Date of Start :23-08-2021		Date of Completion :24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	9	12	15	27	Brown, Medium dense, Silty sand	SM			
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	6	11	14	25					
6.0											
6.5											
7.0	7	UDS-3					Brown, Very stiff, Silty clay of low plasticity	CL			
7.5											
8.0											
8.5	8.5	SPT-3	8	11	16	27					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148493.957 m	Easting : 682080.995 m
Reduced Level (m):(+)214.021	BH. No. : BH-P10	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.85	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :27.00
Date of Start :23-08-2021		Date of Completion :24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	9	13	18	31					
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	10	15	22	37					
15.0							Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	13	18	25	43					
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148493.957 m	Easting : 682080.995 m
Reduced Level (m): (+)214.021	BH. No. : BH-P10	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.85	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 27.00
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	14	20	28	48					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	15	24	31	55					
24.0											
24.5											
25.0	25	SPT-9	16	28	32	60	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-10	14	23	33	56					
27.0											
27.5											
28.0	28	SPT-11	16	42	58	>100					
28.5											
29.0											
29.5	29.5	SPT-12	52	64	36 (4cm)	>100					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148507.023 m	Easting : 682078.022 m
Reduced Level (m): (+)213.946	BH. No. : BH-P11	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 27.50
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	2	4	5	9					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	5	8	10	18					
4.5											
5.0							Brown, Loose to medium dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	6	10	12	22					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	8	12	15	27					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148507.023 m	Easting : 682078.022 m
Reduced Level (m): (+)213.946	BH. No. : BH-P11	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 27.50
Date of Start : 24-08-2021		Date of Completion : 25-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0											
12.5											
13.0	13	SPT-5	10	14	16	30					
13.5											
14.0											
14.5	14.5	UDS-5									
15.0							Brown, Loose to medium dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	SPT-6	7	9	13	22					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	8	10	15	25					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148507.023 m	Easting : 682078.022 m
Reduced Level (m):(+)213.946	BH. No. : BH-P11	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :27.50
Date of Start :24-08-2021		Date of Completion :25-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	9	13	17	30	Brown, Loose to medium dense, Sandy silt of low plasticity	ML-CL			
22.5											
23.0											
23.5	23.5	SPT-9	11	25	20	45					
24.0											
24.5											
25.0	25	SPT-10	12	20	24	44	Brown, Hard, Silty clay of low plasticity	CL			
25.5											
26.0											
26.5	26.5	SPT-11	20	35	50	85					
27.0											
27.5											
28.0	28	SPT-12	21	50	50 (10cm)	>100	Brown, Very dense, Sandy silt of low plastic	ML-CL			
28.5											
29.0											
29.5	29.5	SPT-13	40	80	20 (3cm)	>100					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148520.089 m	Easting : 682075.049 m
Reduced Level (m): (+)214.402	BH. No. : BH-P12	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.10	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 26-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	8	11	14	25	Brown, Medium dense, Silty sand	SM-SC			
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	10	12	14	26					
6.0											
6.5											
7.0	7	UDS-3					Brown, Medium dense to very dense, Sandy silt of low plasticity	ML-CL			
7.5											
8.0											
8.5	8.5	SPT-3	12	13	16	29					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148520.089 m	Easting : 682075.049 m
Reduced Level (m): (+)214.402	BH. No. : BH-P12	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.10	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 26-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	13	15	18	33					
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	14	17	20	37					
15.0							Brown, Medium dense to very dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	12	16	19	35					
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148520.089 m	Easting :682075.049 m
Reduced Level (m):(+)214.402	BH. No. :BH-P12	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):12.10	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :26-08-2021		Date of Completion :27-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	11	13	19	32					
21.0											
21.5											
22.0	22	SPT-8	13	16	22	38					
22.5											
23.0											
23.5	23.5	SPT-9	15	20	31	51					
24.0											
24.5											
25.0	25	SPT-10	16	26	34	60	Brown, Medium dense to very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-11	17	22	27	49					
27.0											
27.5											
28.0	28	SPT-12	20	25	33	58					
28.5											
29.0											
29.5	29.5	SPT-13	38	70	30 (4cm)	>100					
30.0	30										



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148533.155 m	Easting : 682072.075 m
Reduced Level (m):(+)214.579	BH. No. : BH-P13	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):12.30	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 27-08-2021	Date of Completion : 28-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	3	4	5	9	Brown, Loose, Silty sand	SM			
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	10	15	19	34	Brown, Dense, Sandy silt of low plasticity	ML-CL			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	11	17	21						
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	12	19	23	42					

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148533.155 m	Easting :682072.075 m
Reduced Level (m):(+)214.579	BH. No. :BH-P13	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):12.30	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :27-08-2021	Date of Completion :28-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0											
12.5								▼ 12.30m			
13.0	13	SPT-5	14	21	25	46	Brown, Dense, Sandy silt of low plasticity ML-CL		●		
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	10	16	22	38			●		
16.5											
17.0											
17.5	17.5	UDS-6									
18.0							Brown, Hard, Silty clay of low plasticity CL				
18.5											
19.0	19	SPT-7	12	18	33	51				●	
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148533.155 m	Easting : 682072.075 m
Reduced Level (m): (+)214.579	BH. No. : BH-P13	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.30	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 27-08-2021		Date of Completion : 28-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7					Brown, Hard, Silty clay of low plasticity	CL			
21.0											
21.5											
22.0	22	SPT-8	15	33	40	73					
22.5											
23.0											
23.5	23.5	SPT-9	14	25	35	60					
24.0											
24.5											
25.0	25	SPT-10	15	27	40	67					
25.5							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
26.0											
26.5	26.5	SPT-11	14	25	35	60					
27.0											
27.5											
28.0	28	SPT-12	15	24	35	59					
28.5											
29.0											
29.5	29.5	SPT-13	19	28	34	62					
30.0	30										

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148559.287 m	Easting : 682066.129 m
Reduced Level (m): (+)213.460	BH. No. : BH-P15	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 25-08-2021	Date of Completion : 26-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	4	7	8	15					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	6	8	10	18					
4.5											
5.0							Brown, Medium dense, Silty sand	SM-SC			
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	8	11	14	25					
7.5											
8.0											
8.5	8.5	UDS*									
9.0											
9.5											
10.0	10	SPT-4	18	25	31	56					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148559.287 m	Easting :682066.129 m
Reduced Level (m):(+)213.460	BH. No. :BH-P15	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):11.80	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :25-08-2021		Date of Completion :26-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-3									
12.0											
12.5											
13.0	13	SPT-5	20	28	33	61					
13.5											
14.0											
14.5	14.5	UDS-4									
15.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	SPT-6	18	23	28	51					
16.5											
17.0											
17.5	17.5	UDS-5									
18.0											
18.5											
19.0	19	SPT-7	21	26	30	56					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148559.287 m	Easting : 682066.129 m
Reduced Level (m): (+)213.460	BH. No. : BH-P15	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.80	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 25-08-2021	Date of Completion : 26-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-8	24	29	35	64					
21.0											
21.5											
22.0	22	SPT-9	22	27	32	59					
22.5											
23.0											
23.5	23.5	SPT-10	28	35	39	74					
24.0											
24.5											
25.0	25	SPT-11	26	37	42	79	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-12	29	40	46	86					
27.0											
27.5											
28.0	28	SPT-13	32	38	43	81					
28.5											
29.0											
29.5	29.5	SPT-14	35	41	49	90					
30.0	30										



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148572.353 m	Easting : 682063.156 m
Reduced Level (m): (+)212.949	BH. No. : BH-P16	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.20	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 27-08-2021	Date of Completion : 28-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	5	7	9	16					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	SPT-2	6	8	11	19					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	7	9	12	21					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148572.353 m	Easting : 682063.156 m
Reduced Level (m): (+)212.949	BH. No. : BH-P16	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.20	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 27-08-2021	Date of Completion : 28-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	7	10	14	24		▼ 11.20m	●		
12.0											
12.5											
13.0	13	UDS*									
13.5											
14.0											
14.5	14.5	SPT-5	9	13	18	31	Brown, Medium dense to dense, Silty sand	SM	●		
15.0											
15.5											
16.0	16	UDS-5									
16.5											
17.0											
17.5	17.5	SPT-6	12	16	23	39			●		
18.0											
18.5											
19.0	19	SPT-7	22	34	43	77			●		
19.5							Brown, Very dense, Sandy silt of low plasticity	ML-CL	●		
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148572.353 m	Easting :682063.156 m
Reduced Level (m):(+)212.949	BH. No. :BH-P16	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):11.20	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :27-08-2021		Date of Completion :28-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-8	29	63	37 (9cm)	>100	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
21.0											
21.5											
22.0	22	SPT-9	31	65	35 (8cm)	>100					
22.5											
23.0											
23.5	23.5	SPT-10	30	67	33 (11cm)	>100					
24.0											
24.5											
25.0	25	SPT-11	27	55	45 (8cm)	>100					
25.5											
26.0											
26.5	26.5	SPT-12	38	62	38 (11cm)	>100	Brown, Very dense, Silty sand	SM			
27.0											
27.5											
28.0	28	SPT-13	33	60	40 (9cm)	>100					
28.5											
29.0											
29.5	29.5	SPT-14	33	46	44	90					
30.0	30										





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148585.419 m	Easting : 682060.182 m
Reduced Level (m): (+)213.184	BH. No. : BH-P17	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 10.80	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 26-08-2021	Date of Completion : 27-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	3	3	2	5	Brown, Medium stiff, Silty clay of low plasticity  CL	[Graphic Log]	●		
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	4	7	10	17	[Graphic Log]	●			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	6	8	12	20	[Graphic Log]	●			
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	8	10	14	24	[Graphic Log]	●			

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148585.419 m	Easting :682060.182 m
Reduced Level (m):(+)213.184	BH. No. :BH-P17	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.80	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :26-08-2021		Date of Completion :27-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-5	9	11	16	27	Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
12.0											
12.5											
13.0	13	SPT-6	9	13	18	31					
13.5											
14.0											
14.5	14.5	SPT-7	11	14	20	34					
15.0											
15.5											
16.0	16	SPT-8	12	15	21	36					
16.5											
17.0											
17.5	17.5	UDS-4					Brown, Very dense, Sandy silt of low plasticity	ML-CL			
18.0											
18.5											
19.0	19	SPT-9	43	68	32 (3cm)	>100					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148585.419 m	Easting :682060.182 m
Reduced Level (m):(+)213.184	BH. No. :BH-P17	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.80	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :26-08-2021		Date of Completion :27-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-10	35	55	45 (10cm)	>100					
21.0											
21.5											
22.0	22	SPT-11	33	53	47 (9cm)	>100					
22.5											
23.0											
23.5	23.5	SPT-12	36	62	38 (5cm)	>100					
24.0											
24.5											
25.0	25	SPT-13	38	65	35 (9cm)	>100	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-14	34	67	33 (9cm)	>100					
27.0											
27.5											
28.0	28	SPT-15	30	75	25 (5cm)	>100					
28.5											
29.0											
29.5	29.5	SPT-16	39	68	32 (3cm)	>100					
30.0	30										



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148598.485 m	Easting : 682057.209 m
Reduced Level (m): (+)213.517	BH. No. : BH-P18	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 10.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 27.50
Date of Start : 24-08-2021	Date of Completion : 25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	5	6	9	15					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	SPT-2	7	9	11	20					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	8	12	14	26					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148598.485 m	Easting :682057.209 m
Reduced Level (m):(+)213.517	BH. No. :BH-P18	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.50	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :27.50
Date of Start :24-08-2021	Date of Completion :25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0									0 10 20 30 40 50 60 70 80 90 100		
10.5								▼ 10.50m			
11.0											
11.5	11.5	SPT-4	10	14	16	30	Brown, Hard, Silty clay of low plasticity  CL				
12.0											
12.5											
13.0	13	SPT-5	8	13	17	30					
13.5											
14.0											
14.5	14.5	SPT-6	11	15	19	34					
15.0											
15.5											
16.0	16	SPT-7	9	14	20	34					
16.5											
17.0											
17.5	17.5	SPT-8	37	67	33 (5cm)	>100	Brown, Very dense, Sandy silt of low plasticity  ML-CL				
18.0											
18.5											
19.0	19	SPT-9	35	65	35 (7cm)	>100					
19.5											
20.0											



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148598.485 m	Easting :682057.209 m
Reduced Level (m):(+)213.517	BH. No. :BH-P18	BH Termination Depth (m):30
Proposed / Existing Structure :Major Bridge	Water Table (m):10.50	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :27.50
Date of Start :24-08-2021	Date of Completion :25-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0									0 10 20 30 40 50 60 70 80 90 100		
20.5	20.5	SPT-10	36	65	35 (3cm)	>100	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
21.0											
21.5											
22.0	22	SPT-11	36	66	34 (10cm)	>100					
22.5											
23.0											
23.5	23.5	SPT-12	38	68	32 (6cm)	>100					
24.0											
24.5											
25.0	25	SPT-13	31	59	41 (9cm)	>100					
25.5											
26.0											
26.5	26.5	SPT-14	39	59	44 (11cm)	>100					
27.0											
27.5											
28.0	28	SPT-15	32	58	42 (8cm)	>100					
28.5											
29.0											
29.5	29.5	SPT-16	48	69	31 (12cm)	>100					
30.0	30										



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148611.551 m	Easting : 682054.236 m
Reduced Level (m): (+)213.504	BH. No. : BH-P19	BH Termination Depth (m): 30
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 26.00
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	4	5	6	11					
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	7	7	7	14					
4.5											
5.0							Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	6	9	10	19					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	7	10	13	23					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148611.551 m	Easting : 682054.236 m
Reduced Level (m):(+)213.504	BH. No. : BH-P19	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :26.00
Date of Start :23-08-2021		Date of Completion :24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-5	8	11	20	31		▼ 11.50m			
12.0											
12.5											
13.0	13	SPT-6	9	13	18	31	Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
13.5											
14.0											
14.5	14.5	SPT-7	7	11	16	27					
15.0											
15.5											
16.0	16	SPT-8	8	12	19	31					
16.5											
17.0											
17.5	17.5	UDS-4									
18.0							Brown, Hard, Silty clay of medium plasticity	CL			
18.5											
19.0	19	SPT-9	11	14	21	35					
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148611.551 m	Easting : 682054.236 m
Reduced Level (m):(+)213.504	BH. No. : BH-P19	BH Termination Depth (m):30
Proposed / Existing Structure : Major Bridge	Water Table (m):11.50	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :26.00
Date of Start :23-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations	
			N1	N2	N3							
20.0												
20.5	20.5	SPT-10	64	36 (9cm)	-	>100	Brown, Hard, Silty clay of medium plasticity	CL				
21.0												
21.5												
22.0	22	SPT-11	56	44 (8cm)	-	>100	Brown, Very dense, Silty sand	SM				
22.5												
23.0												
23.5	23.5	SPT-12	59	41 (7cm)	-	>100						
24.0												
24.5												
25.0	25	SPT-13	54	46 (5cm)	-	>100						
25.5												
26.0												
26.5	26.5	SPT-14	22	56 (3cm)		>100						
27.0												
27.5												
28.0	28	SPT-15	24	51 (10cm)		>100						
28.5												
29.0												
29.5	29.5	SPT-16	33	64 (10cm)	-	>100						
30.0	30											



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148626.567 m	Easting : 682050.819 m
Reduced Level (m): (+)213.090	BH. No. : BH-A2	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 10.90	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 26.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1					Brown, Medium dense, Sandy silt of low plasticity ML-CL				
1.5											
2.0											
2.5	2.5	SPT-1	4	6	8	14					
3.0											
3.5											
4.0	4	UDS-2					Brown, Very stiff, Silty clay of low plasticity CL				
4.5											
5.0											
5.5	5.5	SPT-2	8	11	15	26					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	7	10	17	27					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :57+400 km	Northing :3148626.567 m	Easting :682050.819 m
Reduced Level (m):(+)213.090	BH. No. :BH-A2	BH Termination Depth (m):35
Proposed / Existing Structure :Major Bridge	Water Table (m):10.90	Inclination : Vertical
Boring type :Shell & Auger	Dia. of Boring :150 mm	Depth of Casing (m) :26.00
Date of Start :20-08-2021		Date of Completion :22-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0								▼ 10.90m			
11.5	11.5	SPT-4	8	11	19	30			●		
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	9	13	21	34			●		
15.0							Brown, Dense, Sandy silt of low plasticity with gravel	ML-CL			
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	11	14	19	33			●		
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148626.567 m	Easting : 682050.819 m
Reduced Level (m):(+)213.090	BH. No. : BH-A2	BH Termination Depth (m):35
Proposed / Existing Structure : Major Bridge	Water Table (m):10.90	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) :26.00
Date of Start :20-08-2021		Date of Completion :22-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	12	15	21	36	Brown, Dense, Sandy silt of low plasticity with gravel	ML-CL			
21.0											
21.5											
22.0	22	SPT-8	70	30 (9cm)	-	>100	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
22.5											
23.0											
23.5	23.5	SPT-9	66	34 (7cm)	-	>100					
24.0											
24.5											
25.0	25	SPT-10	19	25	29	54					
25.5											
26.0											
26.5	26.5	SPT-11	24	45	55 (13cm)	>100					
27.0											
27.5											
28.0	28	SPT-12	29	49	50	99					
28.5											
29.0											
29.5	29.5	SPT-13	25	79	21 (3cm)	>100					
30.0											



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 57+400 km	Northing : 3148626.567 m	Easting : 682050.819 m
Reduced Level (m): (+)213.090	BH. No. : BH-A2	BH Termination Depth (m): 35
Proposed / Existing Structure : Major Bridge	Water Table (m): 10.90	Inclination : Vertical
Boring type : Shell & Auger	Dia. of Boring : 150 mm	Depth of Casing (m) : 26.00
Date of Start : 20-08-2021	Date of Completion : 22-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-14	26	76	34 (5cm)	>100					
31.5											
32.0											
32.5	32.5	SPT-15	28	71	29 (4cm)	>100	Brown, Very dense, Sandy silt of low plasticity with gravel	ML-CL			
33.0											
33.5											
34.0	34	SPT-16	31	69	31 (7cm)	>100					
34.5											
35.0	35	SPT-17	37	76	34 (8cm)	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+191 km	Northing : 3149257.396 m	Easting : 681895.083 m
Reduced Level (m): (+)212.823	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-09-2021	Date of Completion : 24-09-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	2	3	3	6	Brown, Loose to medium dense, Sandy silt of low plasticity ML-CL				
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	5	7	9	16	Brown, Hard, Silty clay of low plasticity with gravel CL				
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	11	14	17	31	Brown, Hard, Silty clay of low plasticity with gravel CL				
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	13	20	26	46					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149467.024 m	Easting : 681858.38 m
Reduced Level (m):(+)213.216	BH. No. : BH-A1	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 100 mm	Depth of Casing (m) : Not Used
Date of Start : 14-08-2021	Date of Completion : 16-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
1.0	1	SPT-1	4	7	10	17	Brown, Medium dense TO DENSE, Sandy silt of low plasticity	ML-CL			
2.5	2.5	UDS-1									
4.0	4	SPT-2	8	11	13	24					
5.5	5.5	UDS-2									
7.0	7	SPT-3	10	14	18	32	Brown, Hard, Silty clay of low plasticity	CL			
8.5	8.5	UDS-3									
10.0	10	SPT-4	18	21	25	46					
10.0	10	SPT-4	18	21	25	46					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149467.024 m	Easting :681858.38 m
Reduced Level (m):(+)213.216	BH. No. :BH-A1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :100 mm	Depth of Casing (m) :Not Used
Date of Start :14-08-2021	Date of Completion :16-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS*									
12.0											
12.5											
13.0	13	SPT-5	17	22	26	48					
13.5											
14.0											
14.5	14.5	UDS-4									
15.0							Brown, Hard, Silty clay of low plasticity	CL			
15.5											
16.0	16	SPT-6	20	24	28	52					
16.5											
17.0											
17.5	17.5	UDS-5									
18.0											
18.5											
19.0	19	SPT-7	18	21	24	45					
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149467.024 m	Easting :681858.38 m
Reduced Level (m):(+)213.216	BH. No. :BH-A1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :100 mm	Depth of Casing (m) :Not Used
Date of Start :14-08-2021	Date of Completion :16-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-6					Brown, Hard, Silty clay of low plasticity	CL			
21.0											
21.5											
22.0	22	SPT-8	25	34	41	75					
22.5											
23.0											
23.5	23.5	UDS-7									
24.0											
24.5											
25.0	25	SPT-9	23	31	38	69	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-8									
27.0											
27.5											
28.0	28	SPT-10	21	34	41	75					
28.5											
29.0											
29.5	29.5	UDS-9									
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149467.024 m	Easting : 681858.38 m
Reduced Level (m): (+)213.216	BH. No. : BH-A1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 100 mm	Depth of Casing (m) : Not Used
Date of Start : 14-08-2021	Date of Completion : 16-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	24	35	45	80					
31.5											
32.0											
32.5	32.5	UDS-10									
33.0											
33.5											
34.0	34	SPT-12	34	55	45 (5cm)	>100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-13	30	64	36 (8cm)	>100					
36.0											
36.5											
37.0	37	SPT-14	38	70	30 (11cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-15	22	29	38	67					
39.0											
39.5											
40.0	40	UDS-11									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149495.176 m	Easting : 681844.488 m
Reduced Level (m):(+)214.371	BH. No. : BH-P1	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):11.60	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 16-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	5	8	9	17	Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	10	14	16	30					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	15	18	22	40	Brown, Hard, Silty clay of low plasticity	CL			
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149495.176 m	Easting :681844.488 m
Reduced Level (m):(+)214.371	BH. No. :BH-P1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.60	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :16-08-2021	Date of Completion :18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	17	21	24	45		▼ 11.60m	●		
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	19	23	26	49	Brown, Hard, Silty clay of low plasticity	CL	●		
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	18	25	29	54			●		
18.0											
18.5											
19.0	19	UDS-7									
19.5							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149495.176 m	Easting :681844.488 m
Reduced Level (m):(+)214.371	BH. No. :BH-P1	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.60	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :16-08-2021	Date of Completion :18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	15	28	33	61					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	20	30	38	68					
24.0											
24.5											
25.0	25	UDS*	28	39	42	81	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-10	23	32	37	69					
27.0											
27.5											
28.0	28	UDS-9									
28.5											
29.0											
29.5	29.5	SPT-11	27	36	41	77					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149495.176 m	Easting : 681844.488 m
Reduced Level (m): (+)214.371	BH. No. : BH-P1	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.60	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 16-08-2021	Date of Completion : 18-08-2021	

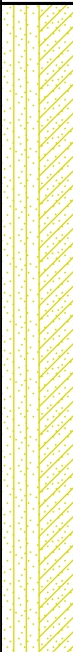
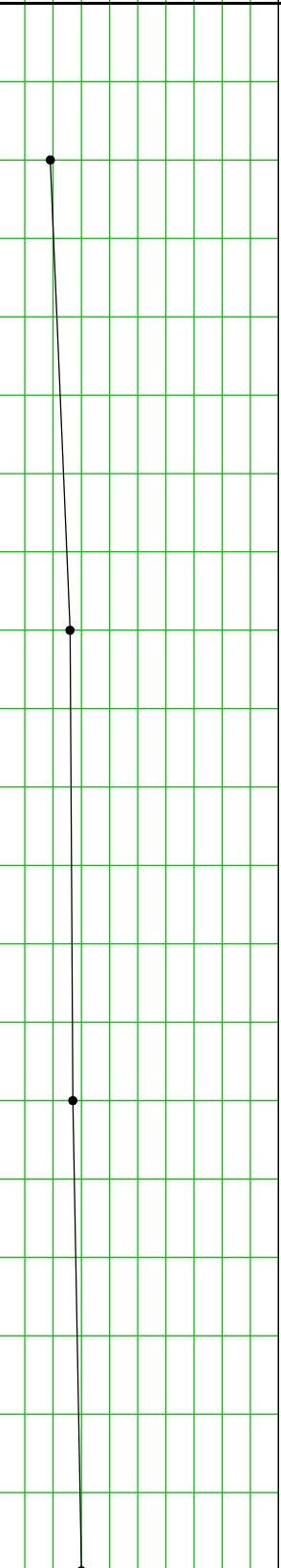
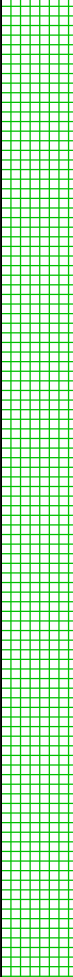
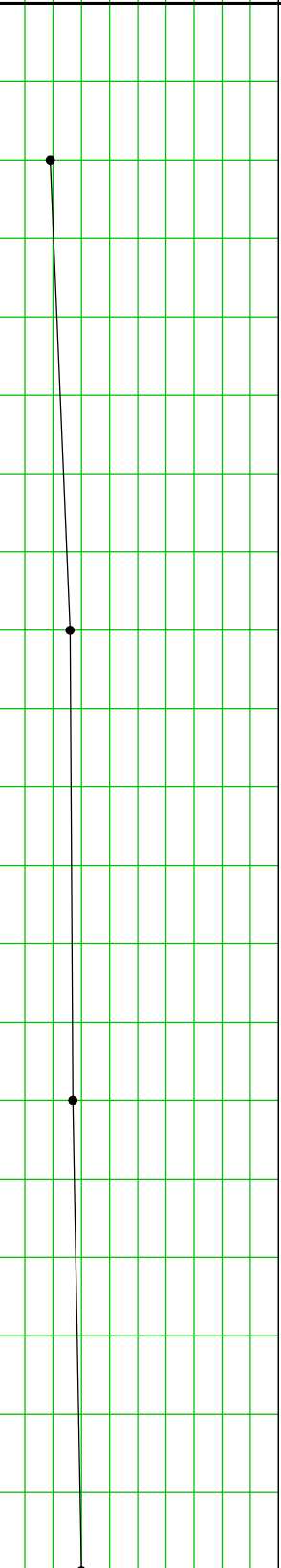
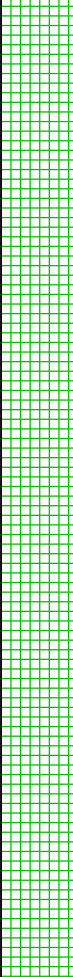
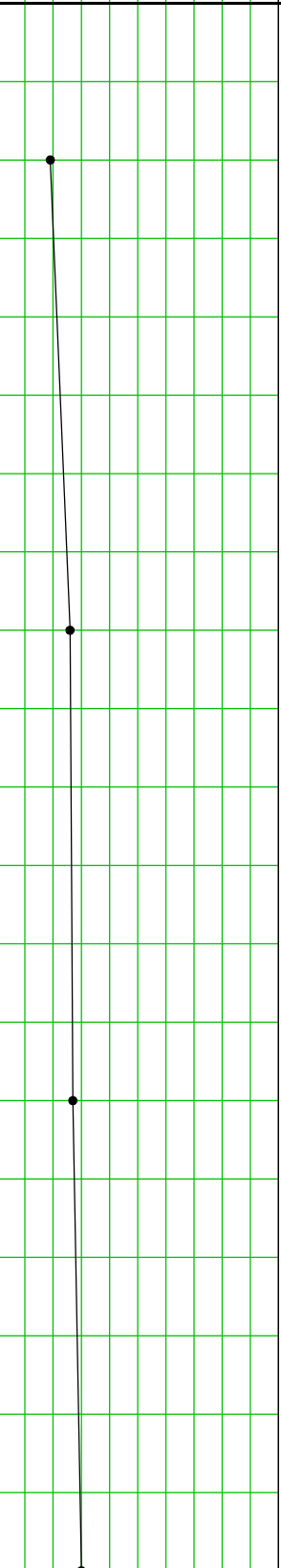
Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	UDS*	24	39	47	86					
31.5											
32.0											
32.5	32.5	SPT-13	34	51	49 (2cm)	>100					
33.0											
33.5											
34.0	34	UDS*	40	65	35 (10cm)	>100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	UDS*	31	72	28 (11cm)	>100					
36.0											
36.5											
37.0	37	UDS*	36	67	33 (10cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-14	23	32	41	73					
39.0											
39.5											
40.0	40	UDS-10									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149522.156 m	Easting : 681840.419 m
Reduced Level (m):(+)213.108	BH. No. : BH-P2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):10.70	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	5	8	11	19	Brown, Medium dense, Silty sand with clay  SM-SC				
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	6	10	16	26	Brown, Very stiff, Silty clay of low plasticity  CL				
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	8	12	15	27	Brown, Very stiff, Silty clay of low plasticity  CL				
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	7	13	17	30					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149522.156 m	Easting :681840.419 m
Reduced Level (m):(+)213.108	BH. No. :BH-P2	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):10.70	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :19-08-2021		Date of Completion :20-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5						Brown, Very stiff, Silty clay of low plasticity	CL				
11.0											
11.5	11.5	UDS-4									
12.0						Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL				
12.5											
13.0	13	SPT-5	8	16	22						38
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	12	19	26						45
16.5											
17.0											
17.5	17.5	UDS*									
18.0											
18.5											
19.0	19	SPT-7	20	27	36	63					
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149522.156 m	Easting : 681840.419 m
Reduced Level (m):(+)213.108	BH. No. : BH-P2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):10.70	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-6									
21.0											
21.5											
22.0	22	SPT-8	18	26	32	58					
22.5											
23.0											
23.5	23.5	UDS-7									
24.0											
24.5											
25.0	25	SPT-9	21	27	37	64	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-8									
27.0											
27.5											
28.0	28	SPT-10	80	20 (12cm)	-	>100					
28.5											
29.0											
29.5	29.5	SPT-11	42	62	38 (5cm)	>100					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149522.156 m	Easting : 681840.419 m
Reduced Level (m):(+)213.108	BH. No. : BH-P2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):10.70	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-12	70	30 (8cm)	-	>100					
31.5											
32.0											
32.5	32.5	SPT-13	48	72 (10cm)	28 (10cm)	>100					
33.0											
33.5											
34.0	34	SPT-14	36	52 (10cm)	48 (10cm)	>100					
34.5											
35.0							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-15	77	23 (9cm)	-	>100					
36.0											
36.5											
37.0	37	SPT-16	59	41 (12cm)	-	>100					
37.5											
38.0											
38.5	38.5	SPT-17	60	40 (8cm)	-	>100					
39.0											
39.5											
40.0	40	SPT-18	73	27 (6cm)	-	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149565 m	Easting : 681840 m
Reduced Level (m): (+)214.145	BH. No. : BH-P3	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	4	6	8	14	Brown, Medium dense, Silty sand	SM			
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	6	7	9	16					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	10	15	18	33	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149565 m	Easting :681840 m
Reduced Level (m):(+)214.145	BH. No. :BH-P3	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :23-08-2021	Date of Completion :24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	12	18	20	38					
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	13	19	21	40					
15.0							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	18	24	29	53					
18.0											
18.5											
19.0	19	UDS-7									
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149565 m	Easting : 681840 m
Reduced Level (m): (+)214.145	BH. No. : BH-P3	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021	Date of Completion : 24-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	26	38	42	80					
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	24	36	48	84					
24.0											
24.5											
25.0	25	UDS-9					Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	SPT-9	28	42	58	100					
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	36	68	32 (10cm)	>100					
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149565 m	Easting : 681840 m
Reduced Level (m): (+)214.145	BH. No. : BH-P3	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-08-2021		Date of Completion : 24-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	58	58	42 (8cm)	>100					
31.5											
32.0											
32.5	32.5	SPT-12	62	58	42 (10cm)	>100					
33.0											
33.5											
34.0	34	SPT-13	68	48	52 (5cm)	>100					
34.5											
35.0							Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-14	43	63	42	105					
36.0											
36.5											
37.0	37	SPT-15	39	72	35 (4cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-16	42	80	20 (8cm)	>100					
39.0											
39.5											
40.0	40	SPT-17	65	76	24 (10cm)	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149594.593 m	Easting : 681837.92 m
Reduced Level (m):(+)214.312	BH. No. : BH-P4	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):11.90	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 18-08-2021	Date of Completion : 19-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
1.0	1	SPT-1	6	8	11	19	Brown, Medium dense, Sandy silt of low plasticity	ML-CL			
2.5	2.5	UDS-1									
4.0	4	SPT-2	8	10	14	24					
5.5	5.5	UDS-2									
7.0	7	SPT-3	11	16	19	35	Brown, Dense, Sandy silt of low plasticity	ML-CL			
8.5	8.5	UDS-3									
10.0	10	SPT-4	17	20	23	43					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149594.593 m	Easting : 681837.92 m
Reduced Level (m):(+)214.312	BH. No. : BH-P4	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):11.90	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 18-08-2021		Date of Completion : 19-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-5	19	22	26	48	Brown, Dense, Sandy silt of low plasticity	ML-CL			
12.0											
12.5											
13.0	13	SPT-6	18	25	29	54					
13.5											
14.0											
14.5	14.5	UDS-4									
15.0											
15.5											
16.0	16	SPT-7	21	27	31	58	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
16.5											
17.0											
17.5	17.5	UDS-5									
18.0											
18.5											
19.0	19	SPT-8	14	24	29	53					
19.5											
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149594.593 m	Easting :681837.92 m
Reduced Level (m):(+)214.312	BH. No. :BH-P4	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.90	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :18-08-2021	Date of Completion :19-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-6									
21.0											
21.5											
22.0	22	SPT-9	26	30	36	66					
22.5											
23.0											
23.5	23.5	UDS*									
24.0											
24.5											
25.0	25	SPT-10	22	35	43	78	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-7									
27.0											
27.5											
28.0	28	SPT-11	24	38	40	78					
28.5											
29.0											
29.5	29.5	UDS-8									
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149594.593 m	Easting : 681837.92 m
Reduced Level (m):(+)214.312	BH. No. : BH-P4	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):11.90	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 18-08-2021	Date of Completion : 19-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-12	26	34	48	82					
31.5											
32.0											
32.5	32.5	UDS-9									
33.0											
33.5											
34.0	34	SPT-13	38	55	45 (9cm)	>100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-14	43	70	30 (4cm)	>100					
36.0											
36.5											
37.0	37	SPT-15	32	53	47 (11cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-16	30	58	42 (8cm)	>100					
39.0											
39.5											
40.0	40	SPT-17	26	41	48	89					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149620.114 m	Easting : 681834.868 m
Reduced Level (m): (+)213.726	BH. No. : BH-P5	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	2	3	5	8	Brown, Loose, Silty sand  SM				
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	4	10	15	25	Brown, Medium dense, Silty sand  SM				
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	9	13	18	31	Brown, Hard, Silty clay of low plasticity  CL				
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	12	18	21	39					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149620.114 m	Easting : 681834.868 m
Reduced Level (m): (+)213.726	BH. No. : BH-P5	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0								▼ 12.00m			
12.5											
13.0	13	SPT-5	14	17	20	37	Brown, Hard, Silty clay of low plasticity  CL				
13.5											
14.0											
14.5	14.5	UDS-5									
15.0											
15.5											
16.0	16	SPT-6	11	15	19	34					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0							Brown, Very dense, Sandy silt of low plasticity  ML-CL				
18.5											
19.0	19	SPT-7	17	24	27	51					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149620.114 m	Easting : 681834.868 m
Reduced Level (m):(+)213.726	BH. No. : BH-P5	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7									
21.0											
21.5											
22.0	22	SPT-8	20	26	30	56					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5											
25.0	25	SPT-9	28	31	36	67	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-9									
27.0											
27.5											
28.0	28	SPT-10	34	40	49	89					
28.5											
29.0											
29.5	29.5	UDS-10									
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149620.114 m	Easting : 681834.868 m
Reduced Level (m): (+)213.726	BH. No. : BH-P5	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 19-08-2021	Date of Completion : 20-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	42	52	48 (10cm)	>100					
31.5											
32.0											
32.5	32.5	SPT-12	40	54	46 (10cm)	>100					
33.0											
33.5											
34.0	34	SPT-13	36	47	53	100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-14	40	49	51	100					
36.0											
36.5											
37.0	37	SPT-15	42	45	55 (11cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-16	37	47	53 (9cm)	>100					
39.0											
39.5											
40.0	40	SPT-17	52	48 (10cm)	-	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149645.522 m	Easting : 681836.405 m
Reduced Level (m): (+)213.711	BH. No. : BH-P6	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 17-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	9	7	9	16	Brown, Medium dense, Sandy silt of low plasticity ML-CL				
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0											
5.5	5.5	SPT-2	9	11	16	27					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	14	17	19	36	Brown, Hard, Silty clay of low plasticity CL				
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149645.522 m	Easting :681836.405 m
Reduced Level (m):(+)213.711	BH. No. :BH-P6	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :17-08-2021	Date of Completion :18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0								▼ 11.00m			
11.5	11.5	SPT-4	16	19	24	43			●		
12.0											
12.5											
13.0	13	UDS-5									
13.5											
14.0											
14.5	14.5	SPT-5	19	24	27	51	Brown, Hard, Silty clay of low plasticity	CL		●	
15.0											
15.5											
16.0	16	UDS-6									
16.5											
17.0											
17.5	17.5	SPT-6	21	25	29	54				●	
18.0											
18.5											
19.0	19	UDS-7									
19.5							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
20.0											

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149645.522 m	Easting :681836.405 m
Reduced Level (m):(+)213.711	BH. No. :BH-P6	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):11.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :17-08-2021		Date of Completion :18-08-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	SPT-7	25	30	37	67	Brown, Very dense, Sandy silt of low plasticity	ML-CL	70		
21.0											
21.5											
22.0	22	UDS-8									
22.5											
23.0											
23.5	23.5	SPT-8	29	38	39	72					80
24.0											
24.5											
25.0	25	UDS-9									
25.5											
26.0											
26.5	26.5	SPT-9	30	35	45	80			90		
27.0											
27.5											
28.0	28	UDS-10									
28.5											
29.0											
29.5	29.5	SPT-10	54	46 (10cm)	-	>100			100		
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149645.522 m	Easting : 681836.405 m
Reduced Level (m): (+)213.711	BH. No. : BH-P6	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 11.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 17-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	58	42 (8cm)	-	>100					
31.5											
32.0											
32.5	32.5	SPT-12	50	50 (9cm)	-	>100					
33.0											
33.5											
34.0	34	SPT-13	54	46 (8cm)	-	>100					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-14	41	53 (10cm)		>100					
36.0											
36.5											
37.0	37	SPT-15	45	57 (7cm)		>100					
37.5											
38.0											
38.5	38.5	SPT-16	55	45 (10cm)	-	>100					
39.0											
39.5											
40.0	40	SPT-17	57	43 (9cm)	-	>100					



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149673.452 m	Easting : 681833.809 m
Reduced Level (m): (+)214.044	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 17-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	5	6	7	13	Brown, Medium dense, Sandy silt of low plasticity ML-CL				
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	8	12	14	26	Brown, Medium dense to dense, Sandy silt of low plasticity ML-CL				
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	9	13	18	31					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	8	12	19	31					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149673.452 m	Easting : 681833.809 m
Reduced Level (m): (+)214.044	BH. No. : BH-A2	BH Termination Depth (m): 40
Proposed / Existing Structure : Major Bridge	Water Table (m): 12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 17-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	UDS-4									
12.0								▼ 12.00m			
12.5											
13.0	13	SPT-5	7	14	18	32					
13.5											
14.0											
14.5	14.5	UDS-5									
15.0							Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
15.5											
16.0	16	SPT-6	9	11	17	28					
16.5											
17.0											
17.5	17.5	UDS-6									
18.0											
18.5											
19.0	19	SPT-7	12	18	23	41					
19.5											
20.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :58+497 km	Northing :3149673.452 m	Easting :681833.809 m
Reduced Level (m):(+)214.044	BH. No. :BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure :Major Bridge	Water Table (m):12.00	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :17-08-2021	Date of Completion :18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
20.0											
20.5	20.5	UDS-7					Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
21.0											
21.5											
22.0	22	SPT-8	17	21	29	50					
22.5											
23.0											
23.5	23.5	UDS-8									
24.0											
24.5											
25.0	25	SPT-9	20	24	31	55	Brown, Very dense, Sandy silt of low plasticity	ML-CL			
25.5											
26.0											
26.5	26.5	UDS-9									
27.0											
27.5											
28.0	28	SPT-10	21	24	34	58					
28.5											
29.0											
29.5	29.5	UDS-10									
30.0											

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+497 km	Northing : 3149673.452 m	Easting : 681833.809 m
Reduced Level (m):(+)214.044	BH. No. : BH-A2	BH Termination Depth (m):40
Proposed / Existing Structure : Major Bridge	Water Table (m):12.00	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 17-08-2021	Date of Completion : 18-08-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
30.0											
30.5											
31.0	31	SPT-11	22	27	38	65					
31.5											
32.0											
32.5	32.5	UDS-11									
33.0											
33.5											
34.0	34	SPT-12	27	48	51	99					
34.5											
35.0							Brown, Very dense, Sandy silt of low plasticity	ML-CL			
35.5	35.5	SPT-13	38	54	46 (6cm)	>100					
36.0											
36.5											
37.0	37	SPT-14	48	60	40 (8cm)	>100					
37.5											
38.0											
38.5	38.5	SPT-15	53	47 (11cm)	-	>100					
39.0											
39.5											
40.0	40	SPT-16	30 (3cm)	-	-	>100					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 58+837 km	Northing : 3149897.982 m	Easting : 681823.952 m
Reduced Level (m): (+)213.610	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-09-2021	Date of Completion : 24-09-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	SPT-1	2	2	4	6	Brown, Loose, Silty sand	SM			
1.5											
2.0											
2.5	2.5	UDS-1									
3.0											
3.5											
4.0	4	SPT-2	4	8	14	22	Brown, Medium dense to dense, Sandy silt of low plasticity with gravel	ML-CL			
4.5											
5.0											
5.5	5.5	UDS-2									
6.0											
6.5											
7.0	7	SPT-3	8	12	20	32					
7.5											
8.0											
8.5	8.5	UDS-3									
9.0											
9.5											
10.0	10	SPT-4	11	19	28	47					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 59+071 km	Northing : 3150131.892 m	Easting : 681817.835 m
Reduced Level (m): (+)213.832	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 24-09-2021	Date of Completion : 24-09-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	4	7	11	18					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense to dense, Sandy silt of low plasticity with gravel	ML-CL			
5.5	5.5	SPT-2	6	12	17	29					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	9	13	19	32					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 59+206 km	Northing : 3150266 m	Easting : 681807 m
Reduced Level (m):(+)213.360	BH. No. : BH-CL	BH Termination Depth (m): 15
Proposed / Existing Structure : Minor Bridge	Water Table (m): 12.65	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-09-2021		Date of Completion : 24-09-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5											
1.0	1	UDS-1									
1.5											
2.0											
2.5	2.5	SPT-1	5	8	12	20					
3.0											
3.5											
4.0	4	UDS-2									
4.5											
5.0							Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL			
5.5	5.5	SPT-2	7	12	14	26					
6.0											
6.5											
7.0	7	UDS-3									
7.5											
8.0											
8.5	8.5	SPT-3	8	10	14	24					
9.0											
9.5											
10.0	10	UDS-4									

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 59+206 km	Northing : 3150266 m	Easting : 681807 m
Reduced Level (m): (+)213.360	BH. No. : BH-CL	BH Termination Depth (m): 15
Proposed / Existing Structure : Minor Bridge	Water Table (m): 12.65	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-09-2021		Date of Completion : 24-09-2021

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
10.0											
10.5											
11.0											
11.5	11.5	SPT-4	12	15	18	33					
12.0											
12.5							Brown, Medium dense to dense, Sandy silt of low plasticity	ML-CL ▼ 12.65m			
13.0	13	UDS*									
13.5	13.5	SPT-5	12	14	16	30					
14.0											
14.5											
15.0	15	SPT-6	17	22	27	49					

UDS\*-UDS not recovered



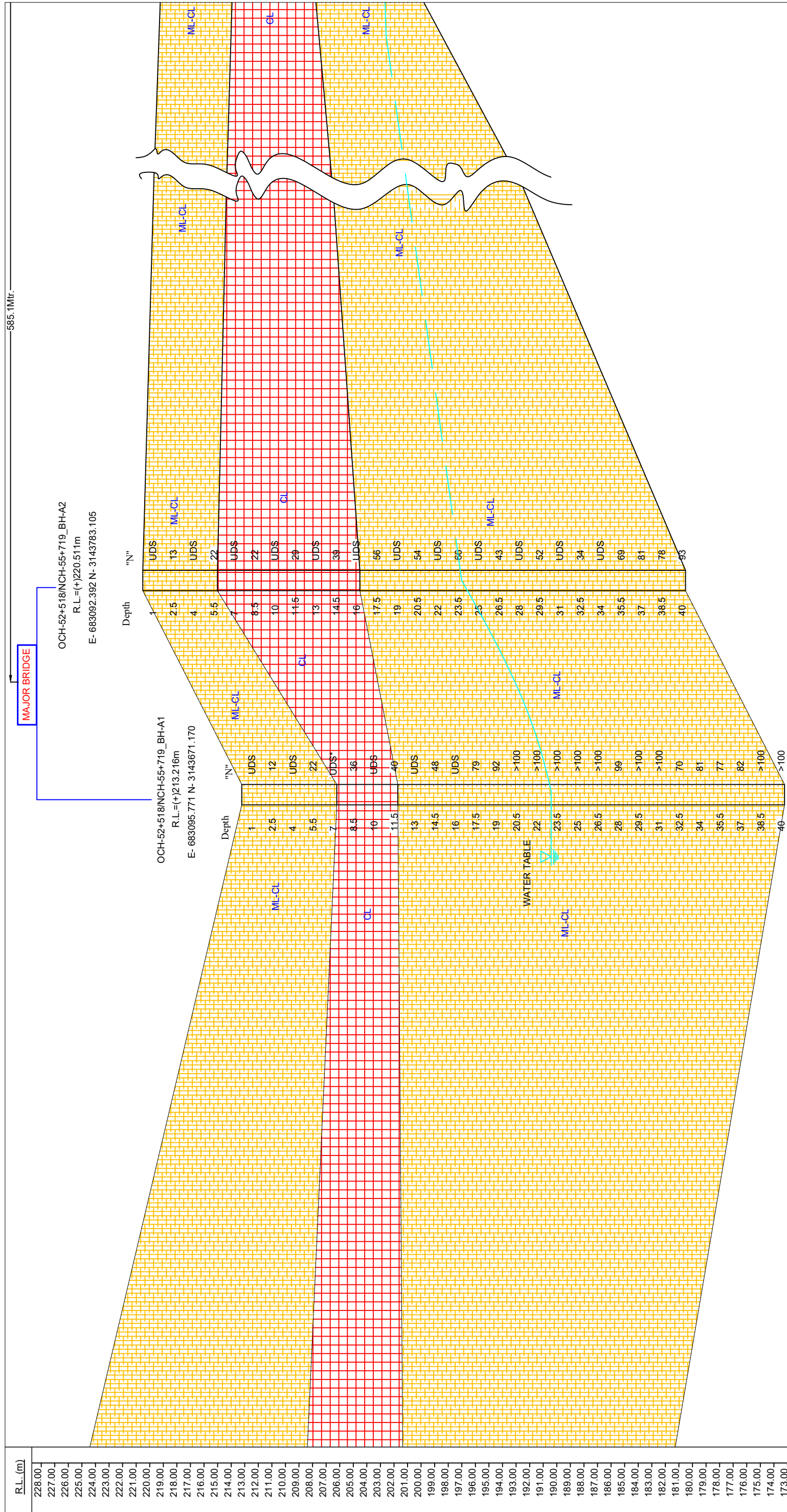
# FIELD BOREHOLE LOG

Project Name : GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client : HRIDCL
BH Location/Chainage : 59+270 km	Northing : 3150330 m	Easting : 681801 m
Reduced Level (m): (+)212.593	BH. No. : BH-CL	BH Termination Depth (m): 10
Proposed / Existing Structure : Minor Bridge	Water Table (m): Not Encountered	Inclination : Vertical
Boring type : Rotary	Dia. of Boring : 150 mm	Depth of Casing (m) : Not Used
Date of Start : 23-09-2021	Date of Completion : 23-09-2021	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
1.0	1	SPT-1	7	9	11	20					
2.5	2.5	UDS-1									
4.0	4	SPT-2	8	12	14	26					
5.5	5.5	UDS-2					Brown, Medium dense to dense, Sandy silt of low plasticity with gravel	ML-CL			
7.0	7	SPT-3	15	19	20	39					
8.5	8.5	UDS-3									
10.0	10	SPT-4	19	20	22	42					

UDS\*-UDS not recovered

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.

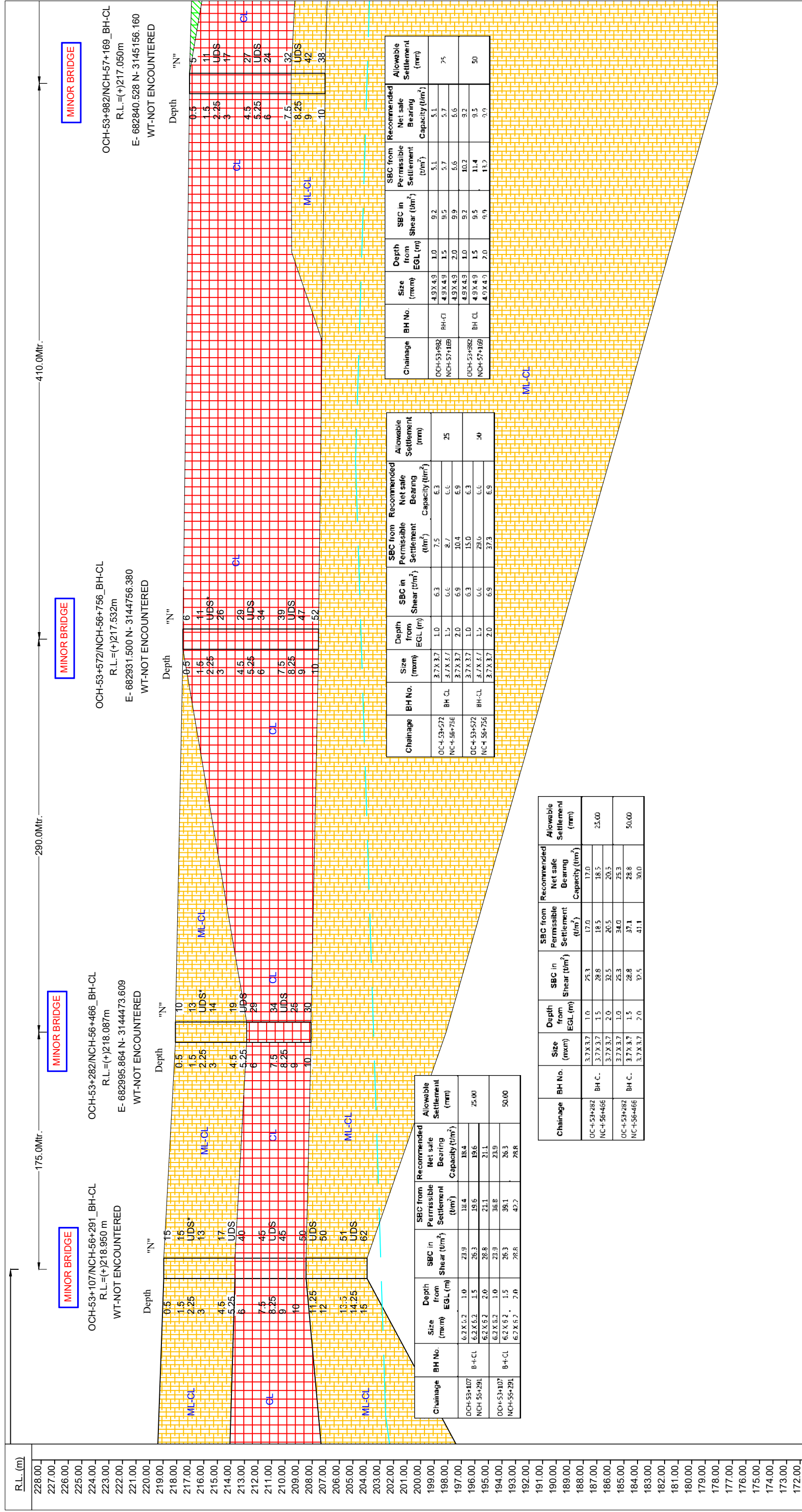


Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-52+518	BH-A1	7.2 X 7.2	2.0	32.9	20.1	20.1	75.00
NCH-55+719		7.2 X 7.2	3.0	38.8	23.5	23.5	
		7.2 X 7.2	4.0	44.9	28.1	28.1	
OCH-52+518	BH-A1	7.2 X 7.2	2.0	32.9	40.2	30.0	50.00
NCH-55+719		7.2 X 7.2	3.0	38.8	47.0	30.0	
		7.2 X 7.2	4.0	44.9	54.7	30.0	
OCH-52+518	BH-A2	7.2 X 7.2	0.7	25.5	50.1	25.5	25.00
NCH-55+719		7.2 X 7.2	1.0	27.2	51.6	27.2	
		7.2 X 7.2	1.5	30.0	54.5	30.0	
OCH-52+518	BH-A2	7.2 X 7.2	0.7	25.5	47.6	25.5	50.00
NCH-55+719		7.2 X 7.2	1.0	27.2	48.2	27.2	
		7.2 X 7.2	1.5	30.0	49.2	30.0	

SYMBOL	DESCRIPTION
	SM-Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC -Clayey Sand (Having fines Less Than 50% and in the hatched zone (4<PI<7))
	ML-CL -Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
	CL-Silty Clay of low plasticity (Above A-line, LL<35)
	CI- Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED
	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line= 73(wi<20) SCALE:- HOR:- 1:2850 VER:- 1:285

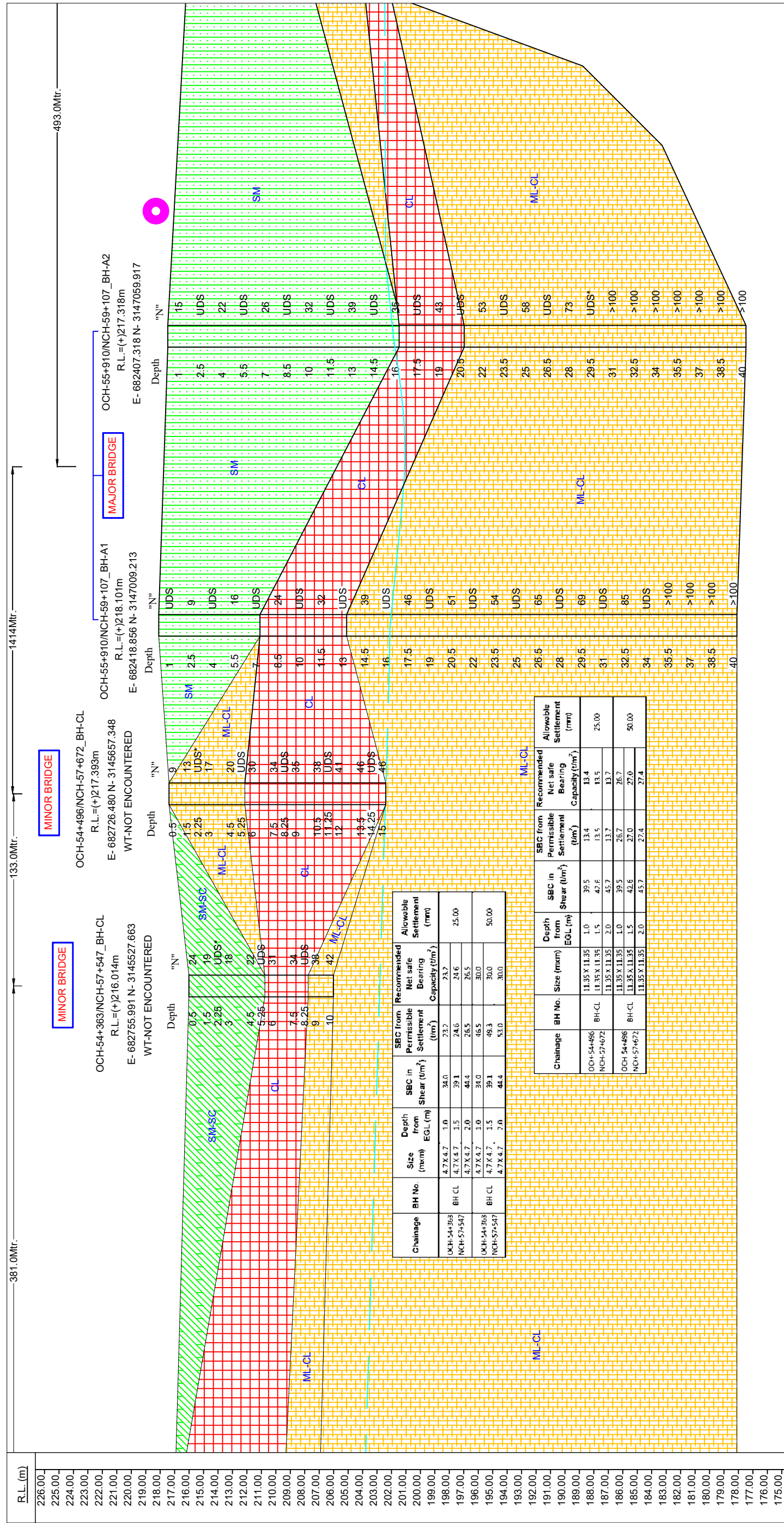
CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.



SYMBOL	DESCRIPTION
	SM-Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC-Clayey Sand (Having fines Less Than 50% and in the hatched zone (4-PI<7))
	ML-CL -Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
	CL-Silty Clay of low plasticity (Above A-line, LL<35)
	CI- Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED
	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line= 73(wi-20) SCALE:- HOR:- 1:2850 VER:- 1:285

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.



R.L. (m)	381.0Mtr.	133.0Mtr.	1414Mtr.	493.0Mtr.
226.00				
225.00				
224.00				
223.00				
222.00				
221.00				
220.00				
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183.00				
182.00				
181.00				
180.00				
179.00				
178.00				
177.00				
176.00				
175.00				

Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-54+496	BH-CL	4.7x4.7	1.0	34.0	73.2	73.7	25.00
NCH-57+547	BH-CL	4.7x4.7	1.5	39.1	24.6	24.6	25.00
OCH-54+496	BH-CL	4.7x4.7	2.0	44.4	26.5	26.5	50.00
NCH-57+547	BH-CL	4.7x4.7	1.0	34.0	48.5	30.0	50.00
OCH-54+496	BH-CL	4.7x4.7	1.5	39.1	49.3	30.0	50.00
NCH-57+547	BH-CL	4.7x4.7	2.0	44.4	52.0	30.0	50.00

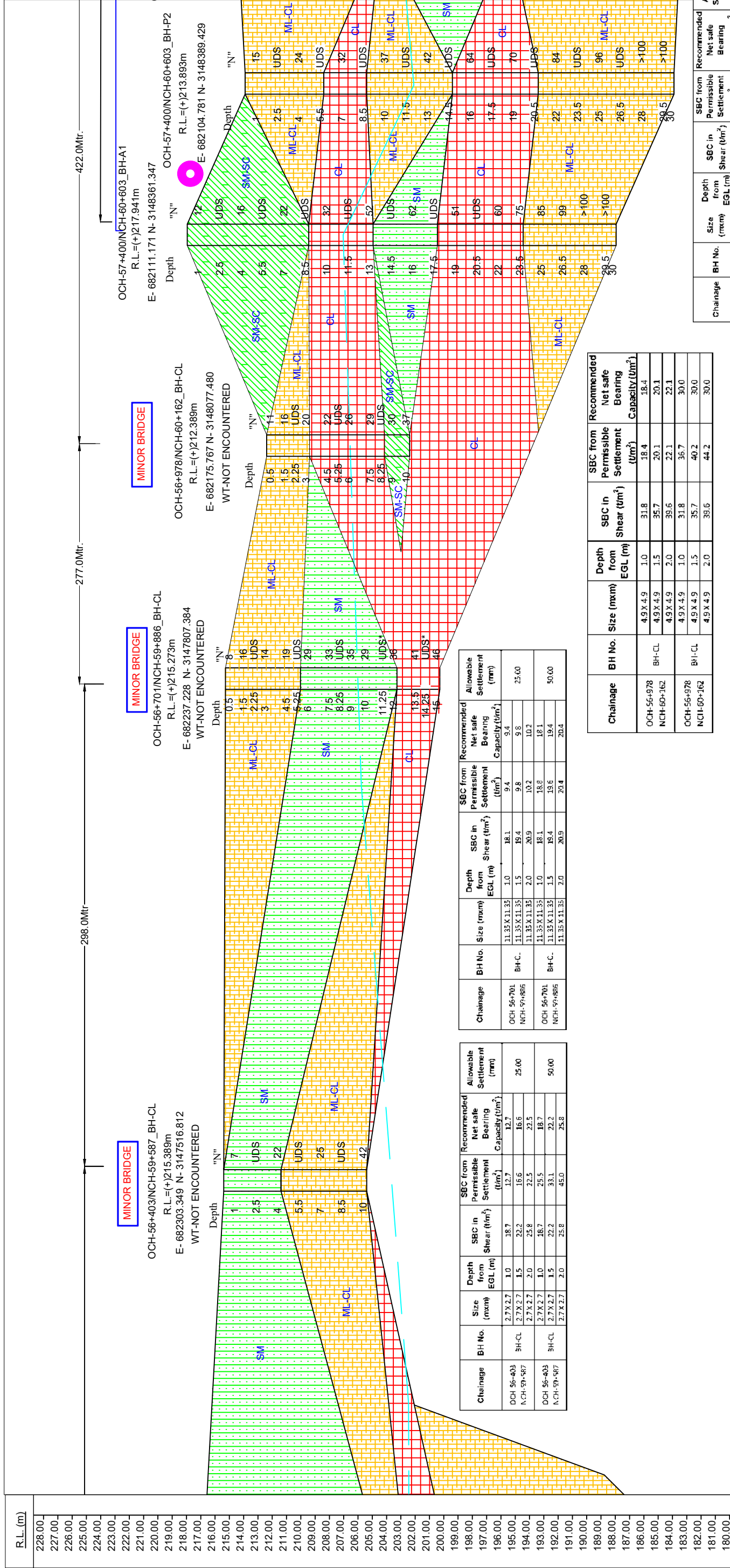
Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-54+496	BH-CL	11.35 x 11.35	1.0	39.5	13.4	13.4	25.00
NCH-57+547	BH-CL	11.35 x 11.35	1.5	42.6	13.5	13.5	25.00
OCH-54+496	BH-CL	11.35 x 11.35	2.0	45.7	13.7	13.7	50.00
NCH-57+547	BH-CL	11.35 x 11.35	1.5	39.5	26.7	26.7	50.00
OCH-54+496	BH-CL	11.35 x 11.35	2.0	42.6	27.0	27.0	50.00
NCH-57+547	BH-CL	11.35 x 11.35	2.0	45.7	27.4	27.4	50.00

Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-55+910	BH-A1	7.2x7.2	2.0	27.1	11.1	11.1	25.00
NCH-59+107	BH-A1	7.2x7.2	3.0	33.8	12.5	12.5	25.00
OCH-55+910	BH-A1	7.2x7.2	2.0	27.1	22.3	22.3	50.00
NCH-59+107	BH-A1	7.2x7.2	3.0	33.8	25.0	25.0	50.00
OCH-55+910	BH-A2	7.2x7.2	4.0	40.8	28.7	28.7	50.00
NCH-59+107	BH-A2	7.2x7.2	3.0	33.8	23.4	23.4	50.00
OCH-55+910	BH-A2	7.2x7.2	4.0	40.8	26.1	26.1	50.00
NCH-59+107	BH-A2	7.2x7.2	3.0	33.8	48.4	30.0	50.00
OCH-55+910	BH-A2	7.2x7.2	4.0	40.8	52.2	30.0	50.00

SYMBOL	DESCRIPTION
[Green Dotted Pattern]	SM-Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
[Green Hatched Pattern]	SM-SC -Clayey Sand (Having fines Less Than 50% and in the hatched zone (4<PI<7))
[Yellow Hatched Pattern]	ML-CL -Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
[Red Hatched Pattern]	CL-Silty Clay of low plasticity (Above A-line, LL<35)
[Red Dotted Pattern]	CI-Clay of medium plasticity (Above A-line, 35<LL<50)
[Pink Circle]	BOREHOLE REQUIRED
[Blue Arrow]	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line= 73(wl-20) SCALE:- HOR:- 1:2850 VER:- 1:285

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.



Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
DCH-57+403 N.CH-60+603	A1	7.2 X 7.2	2.0	43.6	15.8	15.8	25.00
	A1	7.2 X 7.2	3.0	51.1	17.6	17.6	25.00
DCH-57+403 N.CH-60+603	P1	7.2 X 7.2	4.0	58.8	19.7	19.7	50.00
	P2	7.2 X 7.2	3.0	60.4	18.2	18.2	75.00
DCH-57+403 N.CH-60+603	P1	7.2 X 7.2	4.0	69.3	18.4	18.4	50.00
	P2	7.2 X 7.2	3.0	78.4	36.7	36.7	50.00

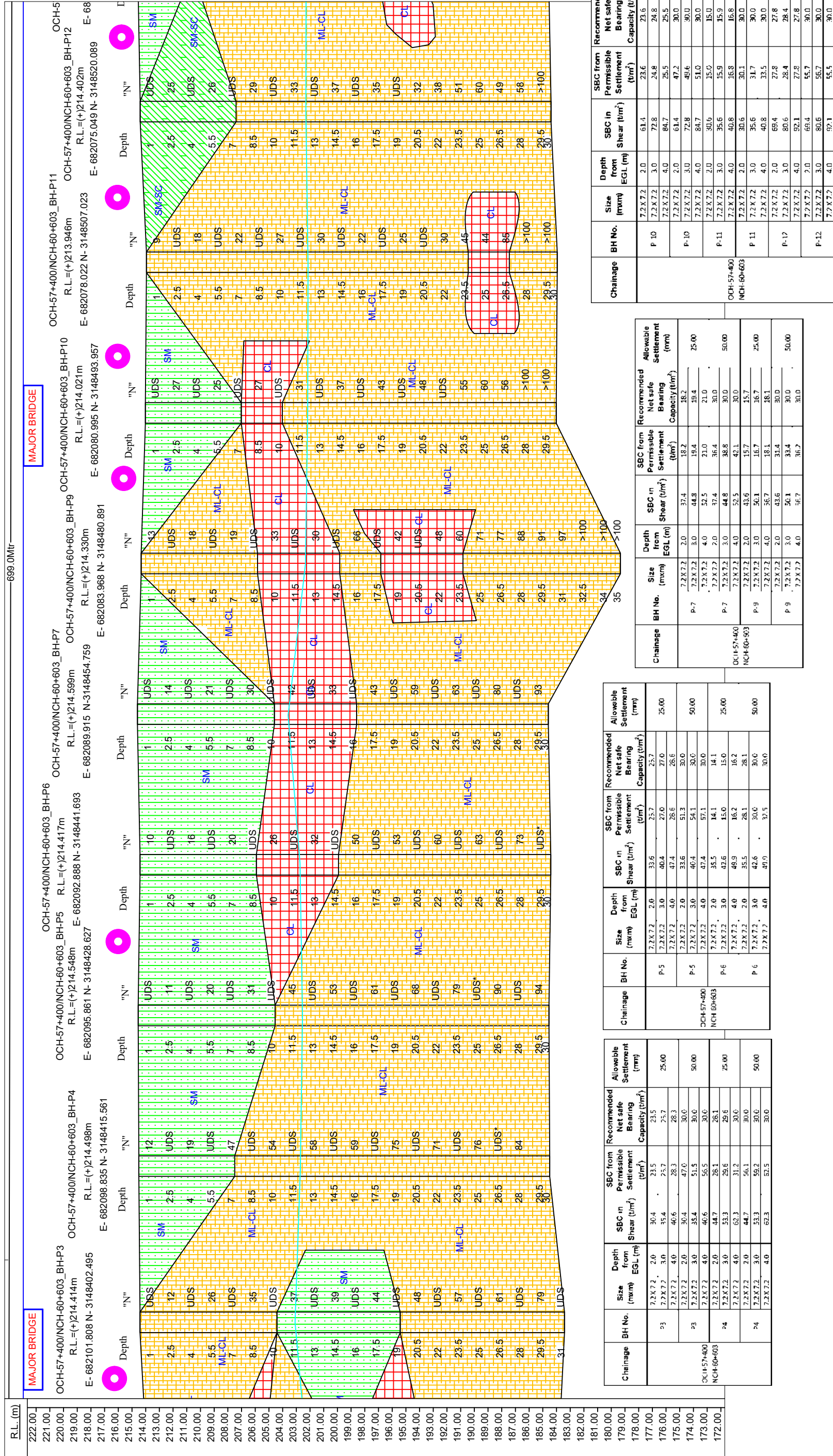
Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )
OCH-56+978 NCH-60+162	BH-CL	4.9 X 4.9	1.0	31.8	18.4	18.4
	BH-CL	4.9 X 4.9	1.5	35.7	20.1	20.1
OCH-56+978 NCH-60+162	BH-CL	4.9 X 4.9	2.0	39.6	22.1	22.1
	BH-CL	4.9 X 4.9	1.0	31.8	36.7	30.0
OCH-56+978 NCH-60+162	BH-CL	4.9 X 4.9	1.5	35.7	40.2	30.0
	BH-CL	4.9 X 4.9	2.0	39.6	44.2	30.0

Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-56+701 NCH-59+886	BH-C.	11.35 X 11.35	1.0	18.1	9.4	9.4	25.00
	BH-C.	11.35 X 11.35	1.5	19.4	9.6	9.6	25.00
OCH-56+701 NCH-59+886	BH-C.	11.35 X 11.35	2.0	20.9	10.2	10.2	50.00
	BH-C.	11.35 X 11.35	1.0	18.1	18.8	18.1	50.00
OCH-56+701 NCH-59+886	BH-C.	11.35 X 11.35	1.5	19.4	19.6	19.4	50.00
	BH-C.	11.35 X 11.35	2.0	20.9	23.8	20.1	50.00

SYMBOL	DESCRIPTION
	SM- Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC -Clayey Sand (Having fines Less Than 50% and in the hatched zone (4<PI<7))
	ML-CL -Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
	CL- Silty Clay of low plasticity (Above A-line, LL<35)
	CI- Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED
	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line=73(wi-20) SCALE:- HOR:- 1:2850 VER:- 1:285

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.



Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m²)	SBC from Permissible Settlement (t/m²)	Recommended Net safe Bearing Capacity (t/m²)	Allowable Settlement (mm)
P-3	P-3	7.2x7.2	2.0	30.4	23.5	23.5	25.00
		7.2x7.2	3.0	35.4	23.7	23.7	25.00
P-5	P-5	7.2x7.2	2.0	33.6	25.7	25.7	25.00
		7.2x7.2	3.0	40.4	27.0	27.0	25.00
P-7	P-7	7.2x7.2	2.0	37.4	18.2	18.2	25.00
		7.2x7.2	3.0	44.8	19.4	19.4	25.00
P-9	P-9	7.2x7.2	2.0	43.6	15.7	15.7	50.00
		7.2x7.2	3.0	50.1	16.7	16.7	50.00
P-11	P-11	7.2x7.2	2.0	40.8	16.3	16.3	25.00
		7.2x7.2	3.0	47.2	17.5	17.5	25.00
P-12	P-12	7.2x7.2	2.0	61.4	23.6	23.6	50.00
		7.2x7.2	3.0	72.8	24.8	24.8	50.00

SYMBOL	DESCRIPTION
	SM-Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC-Clayey Sand (Having fines Less Than 50% and in the hatched zone (4-PI<7))
	ML-CL-Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
	CL-Silty Clay of low plasticity (Above A-line, LL<35)
	CI-Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED

Note:- Fines= Percentage of Silty + Clay A-line=73(wi<20) SCALE:- HOR:- 1:2850 VER:- 1:285



CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.

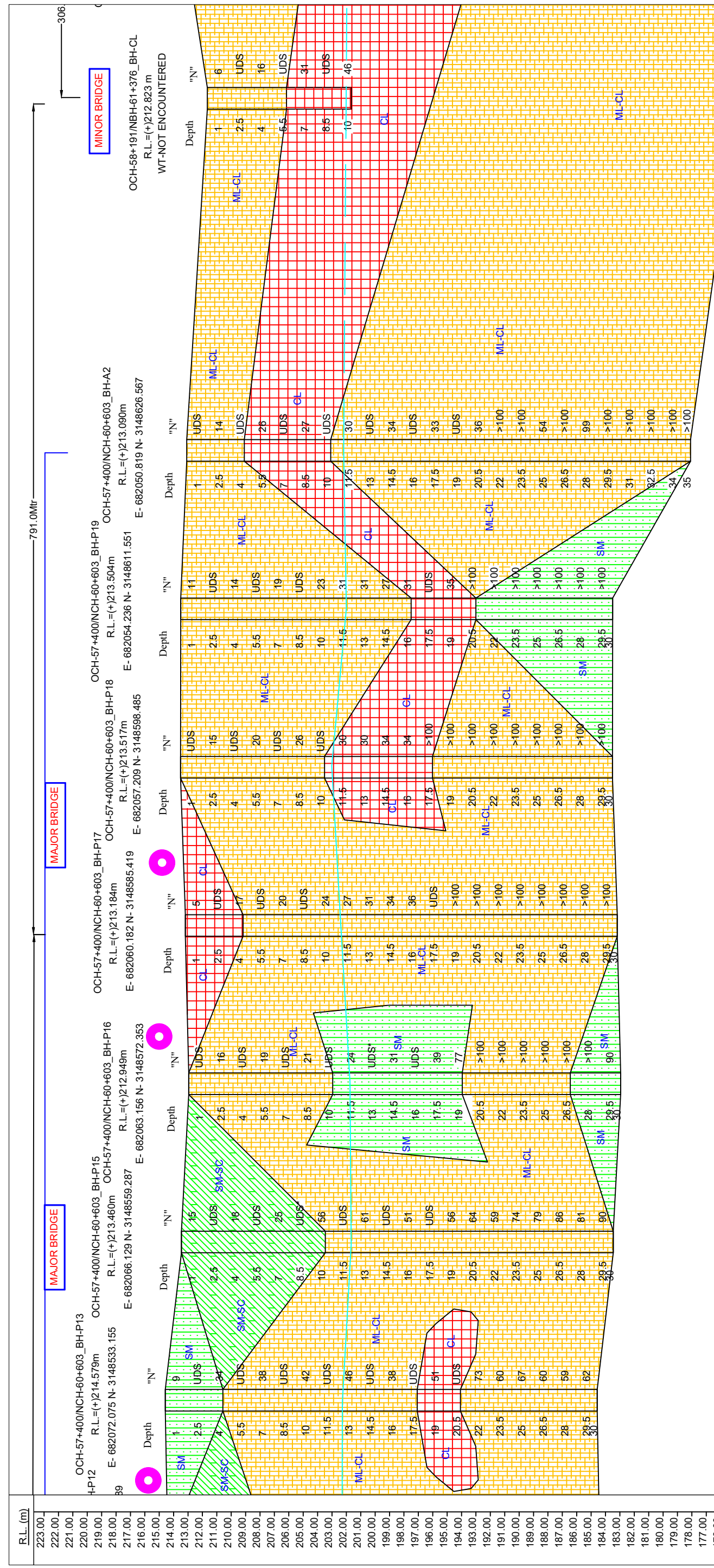
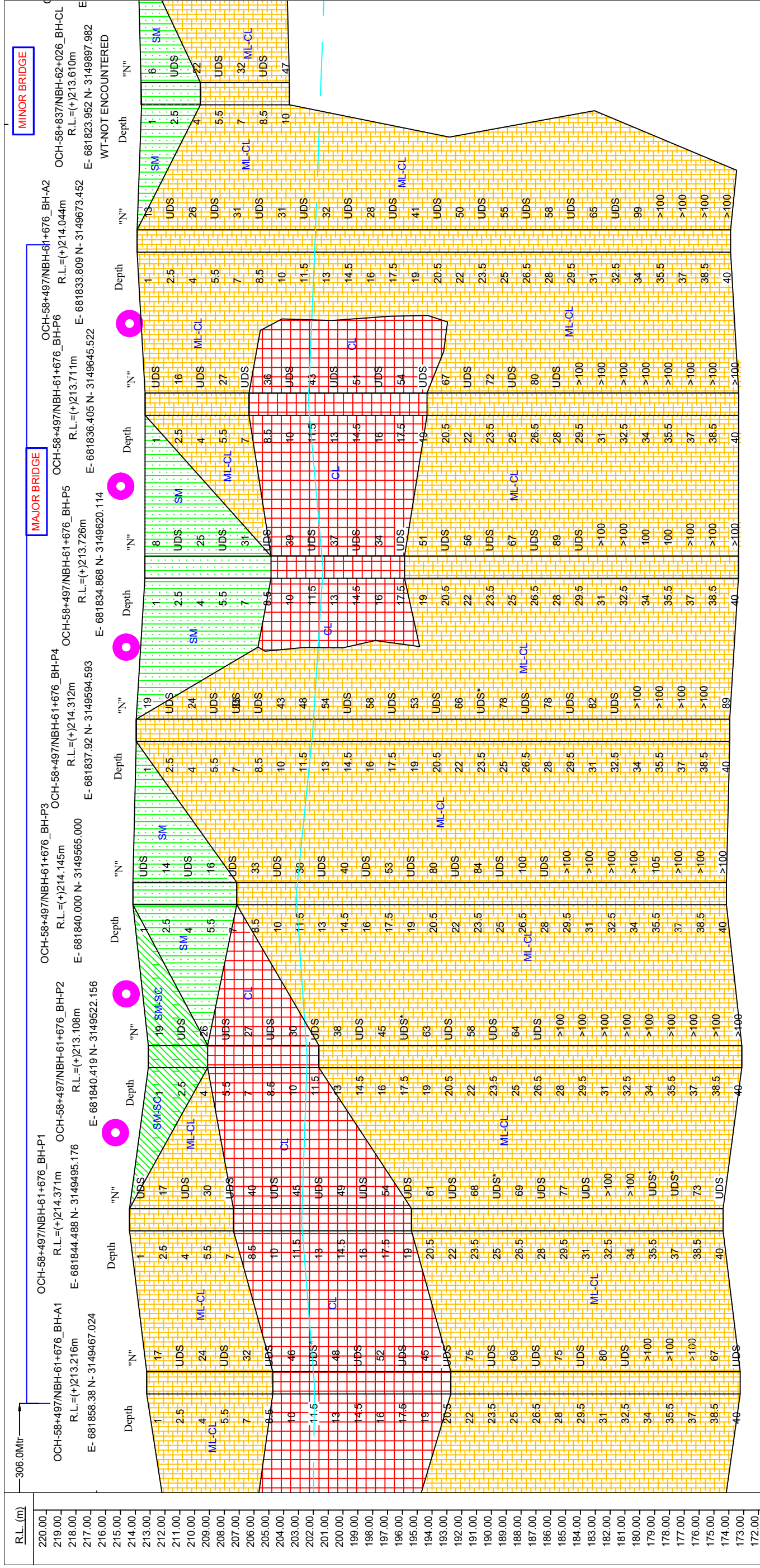


Table with columns: Chainage, BH No., Size (mm), Depth from EGL (m), SBC in Shear (tm²), SBC from Permissible Settlement (tm²), Recommended Net safe Bearing Capacity (tm²), Allowable Settlement (mm). It contains data for boreholes P-13 through P-20.

SYMBOL DESCRIPTION table with columns: SYMBOL, DESCRIPTION. It defines symbols for SM-Silly Sand, SM-SC-Clayey Sand, ML-CL-Sandy with clay, CL-Silty Clay, and CI-Clay of medium plasticity.

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.



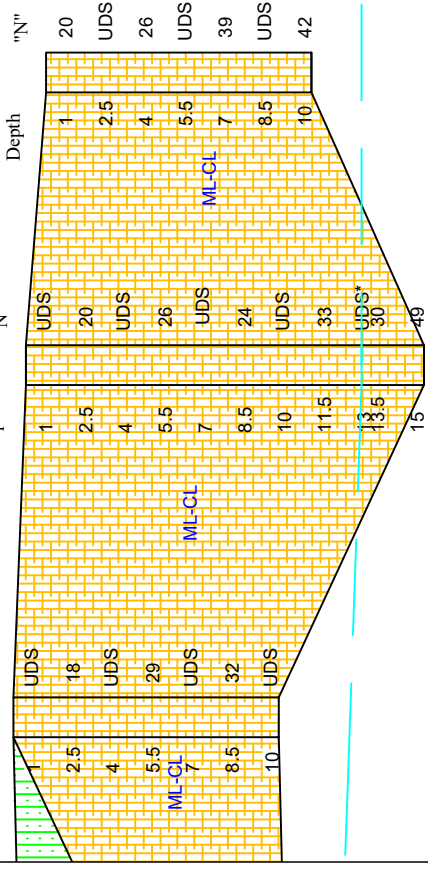
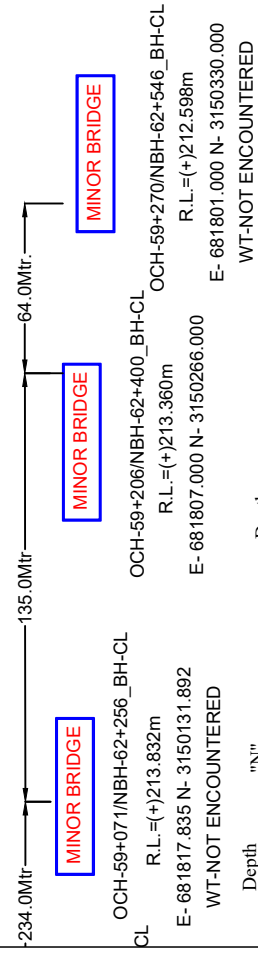
Change	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (tonf)	SBC from Permissible Settlement (tonf)	Recommended Net safe Bearing Capacity (tonf)	Allowable Settlement (mm)
A1	P2	7.2x7.2	2.0	52.4	23.5	23.5	25.00
		7.2x7.2	4.0	60.3	25.2	25.2	25.00
A1	P7	7.2x7.2	2.0	68.4	37.2	37.2	50.00
		7.2x7.2	4.0	60.3	35.2	35.2	50.00
P1	P4	7.2x7.2	2.0	43.6	24.0	24.0	25.00
		7.2x7.2	4.0	50.5	25.9	25.9	25.00
P1	P5	7.2x7.2	2.0	57.3	27.1	27.1	50.00
		7.2x7.2	4.0	65.2	29.1	29.1	50.00
P6	P8	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P9	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P10	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P11	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P12	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P13	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P14	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P15	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P16	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P17	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P18	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P19	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00
P6	P20	7.2x7.2	2.0	63.7	32.7	32.7	25.00
		7.2x7.2	4.0	73.2	35.0	35.0	25.00

SYMBOL	DESCRIPTION
	SM- Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC-Clayey Sand (Having fines Less Than 50% and in the hatched zone (4-PI<7))
	ML-CL- Silty clay with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4-PI<7))
	CL- Clay of low plasticity (Above A-line, LL<35)
	CI- Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED
	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line= 73(wt-20) SCALE:- HOR:- 1:2850 VER:- 1:285

CONDUCTING GEOTECHNICAL INVESTIGATION, PREPARATION OF GEOTECHNICAL REPORT FOR DESIGNING OF BRIDGES AND FOR EMBANKMENT IN CONNECTION WITH CONSTRUCTION OF HARYANA ORBITAL RAIL CORRIDOR (HORC) PROJECT FROM PALWAL TO HARSANA KALAN INCLUDING CONNECTIVITY TO EXISTING IR NETWORK IN THE STATE OF HARYANA.

R.L. (m)
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174.00
173.00



Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-59-071	BH-A1	2.7X2.7	1.0	26.0	27.8	26.0	25.00
NCH-62-256	BH-A1	2.7X2.7	1.5	30.1	29.9	29.9	30.0
OCH-59-071	BH-A1	2.7X2.7	2.0	34.3	31.9	30.0	30.0
OCH-59-071	BH-A1	2.7X2.7	1.0	26.0	55.7	26.0	50.00
NCH-62-256	BH-A1	2.7X2.7	1.5	30.1	59.9	30.0	30.0
NCH-62-256	BH-A1	2.7X2.7	2.0	34.3	63.8	30.0	30.0

Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-59-071	BH-C	2.7X2.7	1.0	27.7	34.4	27.7	25.00
NCH-62-546	BH-C	2.7X2.7	1.5	31.9	37.0	30.0	30.0
OCH-59-071	BH-C	2.7X2.7	2.0	36.3	39.5	30.0	30.0
OCH-59-071	BH-C	2.7X2.7	1.0	27.7	68.9	27.7	50.00
NCH-62-546	BH-C	2.7X2.7	1.5	31.9	74.1	30.0	30.0
NCH-62-546	BH-C	2.7X2.7	2.0	36.3	79.0	30.0	30.0

Chainage	BH No.	Size (mm)	Depth from EGL (m)	SBC in Shear (t/m <sup>2</sup> )	SBC from Permissible Settlement (t/m <sup>2</sup> )	Recommended Net safe Bearing Capacity (t/m <sup>2</sup> )	Allowable Settlement (mm)
OCH-59-206	BH-CL	11.5X11.5	1.0	32.2	19.8	19.8	25.00
NCH-62-400	BH-CL	11.5X11.5	1.5	34.5	20.2	20.2	30.0
OCH-59-206	BH-CL	11.5X11.5	2.0	36.7	20.5	20.5	30.0
NCH-62-400	BH-CL	11.5X11.5	1.0	32.2	39.6	30.0	50.00
NCH-62-400	BH-CL	11.5X11.5	1.5	34.5	40.3	30.0	30.0
NCH-62-400	BH-CL	11.5X11.5	2.0	36.7	41.1	30.0	30.0

SYMBOL	DESCRIPTION
	SM-Silty Sand (Having fines Less Than 50% and no plasticity or below A-line)
	SM-SC-Clayey Sand (Having fines Less Than 50% and in the hatched zone (4<PI<7))
	ML-CL-Sandy with clay (Having fines greater than 50% and in the hatched zone (LL<35 & 4<PI<7))
	CL-Silty Clay of low plasticity (Above A-line, LL<35)
	CI-Clay of medium plasticity (Above A-line, 35<LL<50)
	BOREHOLE REQUIRED
	WATER TABLE

Note:- Fines= Percentage of Silty + Clay A-line= 73(wt-20) SCALE:- HOR:- 1:2850 VER:- 1:285

## APPENDIX – B (LAB TEST RESULTS)

Appendix No.	ITEMS
B-1	SOIL CHARACTERISTICS SHEETS
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES
B-3	RESULT OF CHEMICAL ANALYSIS OF WATER SAMPLES
B-4	GSD CURVES
B-5	SAMPLE SHEAR CURVE
B-6	CONSOLIDATION CURVE



## SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.										Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.		Ref. Code												
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse			Fine	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )		Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )
SPT-13	28.00	99	32	Brown, Dense to very dense, Sandy silt of low plasticity	-																		-	-	-	-	-	-	-	-	-	-	-	-			
SPT-14	29.50	100 (28cm)	-		-																		-	-	-	-	-	-	-	-	-	-	-	-			
SPT-15	31.00	100 (24cm)	-		-																		-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-16	32.50	70	24		ML-CL																		-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-17	34.00	81	26		-																		-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-18	35.50	77	25		-																		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-19	37.00	82	26		ML-CL																		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-20	38.50	100 (24cm)	-		-																		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-21	40.00	100 (23cm)	-		-																		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code																						
															23-08-2021	to	27-08-2021	52+518	BH-A2	23.50 m	40.00 m	683092.392 m	3143783.105 m	(+220.511 m	SR-544_21-22											
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Depth of Water Table				Termination Depth		Coordinates (E,N)				R.L.				Ref. Code					
							Clay	Silt	Fine	Medium	Coarse	Fine	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )				
UDS-10	28.00	-	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL		6	57	26	2	0	9	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-10	29.50	52	20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-11	31.00	-	-		ML-CL		7	50	25	5	2	11	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-11	32.50	34	16		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-12	34.00	-	-		ML-CL		8	53	26	3	4	6	0	29	22	7	-	1.89	18.29	1.60	2.66	DST	0.17	27	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	35.50	69	23		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	37.00	81	26		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-14	38.50	78	25		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	40.00	93	29		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.										Ref. Code													
	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth			Coordinates (E,N)				R.L.										
	14-01-2022	to			14-01-2022	53+282	BH-CL	Not Encountered	Dry Density (g/cm <sup>3</sup> )	Specific Gravity		Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )		
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)									
							Clay	Silt	Fine	Medium	Coarse	Fine	Gravel	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit						
DS	0.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-1	0.50	10	18		ML-CL		7	49	37	4	2	1	0	27	20	7	-	-	-	-	-			
SPT-2	1.50	13	19	Brown, Medium dense, Sandy silt of low plasticity			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS*	2.25	-	-					8	47	34	6	3	2	0	28	21	7	-	-	-	-	-		
SPT-3	3.00	14	17		ML-CL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-4	4.50	19	21		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-1	5.25	-	-	Brown, Very stiff to hard, Silty clay of low plasticity	CL		11	50	28	3	4	4	0	31	20	11	18.23	1.89	1.60	2.67	UUT	5		
SPT-5	6.00	29	29			-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-6	7.50	34	34		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-2	8.25	-	-		CL		10	49	31	5	2	3	0	30	20	10	-	-	-	-	-	-	-	
SPT-7	9.00	25	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	10.00	30	30		CL		11	41	37	4	3	4	0	31	20	11	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



## SOIL CHARACTERISTICS

Project	Date of Boring						Chainage (km./Location)		B.H. No.			Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.		Ref. Code														
	12-01-2022		to		12-01-2022		53+982		BH-CL			0.60 m		10.00 m		682840.528 m		3145156.160 m		(+2)17.050 m		SR-544_21-22														
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>p</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Shear Strength			Consolidation Parameters														
Clay								Silt	Fine	Medium	Coarse	Liquid Limit	Plastic Limit	Plasticity Index					Shrinkage Limit	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>v</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )						
DS	0.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								
SPT-1	0.50	5	5		CL	-	12	56	25	5	2	0	0	33	22	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-2	1.50	11	11		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
UDS-1	2.25	-	-	Brown, Medium stiff to very stiff, Silty clay of low plasticity	CL	-	10	50	31	4	3	2	0	30	20	10	1.89	27.45	1.48	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-3	3.00	17	17		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-4	4.50	27	27		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-2	5.25	-	-		CL	-	-	11	51	27	6	2	3	0	31	20	11	1.97	24.74	1.58	2.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	6.00	24	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-6	7.50	32	25	ML-CL	-	-	7	45	38	3	2	5	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-3	8.25	-	-	ML-CL	-	-	8	43	36	6	1	6	0	28	21	7	1.90	19.74	1.59	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	9.00	42	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	10.00	38	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

SOIL CHARACTERISTICS

Project	Sample Type	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.		Ref. Code																							
		11-01-2022	to			11-01-2022	54+363	BH-CL	1.48 m	10.00 m	682755.991 m	3145527.663 m	(+2)16.014 m	SR-544_21-22																									
		Depth from G.L. (m)	Observed SPT Value (N)			Corrected SPT Value (N <sub>p</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>v</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )								
Clay	Silt			Fine	Medium					Coarse	Sand	Coarse	Fine	Gravel	Liquid Limit	Plastic Limit																Plasticity Index	Shrinkage Limit						
DS		0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
SPT-1		0.50	24	43		SM-SC																																	
SPT-2		1.50	19	23																																			
UDS*		2.25	-	-																																			
SPT-3		3.00	18	20		SM-SC																																	
SPT-4		4.50	22	22																																			
UDS-1		5.25	-	-		CL																																	
SPT-5		6.00	31	31																																			
SPT-6		7.50	34	34																																			
UDS-2		8.25	-	-		ML-CL																																	
SPT-7		9.00	38	28																																			
SPT-8		10.00	42	29		ML-CL																																	

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																										
	23-08-2021	to			24-08-2021	55+910		BH-A1	16.00 m	40.00 m	682418.856 m			3147009.213 m	(+2)18.101 m	SR-544_21-22																							
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Depth of Water Table				Termination Depth		Coordinates (E,N)				R.L.				Ref. Code								
							Clay	Silt	Fine	Medium	Coarse	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )					
UDS-10	28.00	-	-		ML-CL		6	53	30	3	4	0	4	0	27	21	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-10	29.50	69	27		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-11	31.00	-	-		ML-CL		7	50	26	5	2	1	9	27	20	7	18.06	1.89	1.60	2.67	DST	0.18	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-11	32.50	85	30		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-12	34.00	-	-	Brown, Dense to Very dense, Sandy silt of low plasticity with gravel	ML-CL		8	57	22	3	4	0	6	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	35.50 (19cm)	102	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	37.00 (25cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	38.50 (27cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	40.00 (22cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





**SOIL CHARACTERISTICS**

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)	B.H. No.	Depth of Water Table			Termination Depth		Coordinates (E,N)					R.L.	Ref. Code																													
							19-08-2021		to		21-08-2021				55+910		BH-A2	15.60 m	40.00 m	682407.318 m	3147059.917 m	(+2)17.474 m	SR-544_21-22																																
							Clay	Silt	Fine	Medium	Coarse	Grain Size Distribution % wt retained			Atterberg Limits %									Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )																	
Gravel	Fine	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit																																																		
SPT-10	28.00	73	28	Brown, Very dense, Sandy silt of low plasticity with gravel	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
UDS*	29.50	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
SPT-11	31.00	100 (19cm)	-		ML-CL	ML-CL										8	44	26	3	2	9	8	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	32.50	100 (18cm)	-		-	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	34.00	100 (20cm)	-		-	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-14	35.50	100 (21cm)	-		ML-CL	ML-CL										6	46	34	3	2	9	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	37.00	100 (18cm)	-		-	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	38.50	100 (19cm)	-		-	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	40.00	100 (20cm)	-		-	-										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

## SOIL CHARACTERISTICS

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained					Atterberg Limits %			Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code								
							Clay	Silt	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )			Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)
Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.																															
	Date of Boring	25-09-2021	to	25-09-2021	Chainage (km./Location)	56+403 km	B.H. No.	BH-C/L			Not encountered		10.00 m		682303,349 m		3147516,813 m															
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
SPT-1	1.00	7	11	Brown, Loose, Silty sand	SM	-	0	41	56	2	1	0	0	0	0	0	Nil	NP	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	2.50	-	-		SM	-	0	40	58	1	1	0	0	0	0	0	Nil	NP	1.65	10.64	1.49	2.62	DST	0.00	27	-	-	-	-	-	-	-
SPT-2	4.00	22	25		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	5.50	-	-		ML-CL	-	6	54	33	4	1	2	0	0	27	20	7	1.78	12.88	1.58	2.66	DST	0.21	24	-	-	-	-	-	-	-	-
SPT-3	7.00	25	24	Brown, Medium dense to dense, Sandy silt of low plasticity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	8.50	-	-		ML-CL	-	7	54	31	4	1	3	0	28	21	7	1.83	13.46	1.61	2.66	DST	0.19	26	-	-	-	-	-	-	-	-	-
SPT-4	10.00	42	34		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SOIL CHARACTERISTICS

Project	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)			B.H. No.			Depth of Water Table			Termination Depth		Coordinates (E,N)						R.L.		Ref. Code		
								10-01-2022		to		10-01-2022		56+701 Minor Bridge			BH-CL			1.40 m			15.00 m		682237.228 m			3147807.384 m			(+2)15.273				
								Clay	Silt	Grain Size Distribution % wt retained		Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )						
										Coarse	Medium	Fine	Liquid Limit	Plastic Limit																Shrinkage Limit					
	DS	0.00	-	-																															
	SPT-1	0.50	8	14		ML-CL																													
	SPT-2	1.50	16	20	Brown, Loose to medium dense, Sandy silt of low plasticity																														
	UDS-1	2.25	-	-		ML-CL																													
	SPT-3	3.00	14	17																															
	SPT-4	4.50	19	20																															
	UDS-2	5.25	-	-		SP-SM																													
	SPT-5	6.00	29	25																															
	SPT-6	7.50	33	26																															
	UDS-3	8.25	-	-	Brown, Medium dense to dense, Silty sand																														
	SPT-7	9.00	35	26																															
	SPT-8	10.00	29	23		SM																													
	UDS*	11.25	-	-																															
	SPT-9	12.00	36	36		CL																													
	SPT-10	13.50	41	41	Brown, Hard, Silty clay of low plasticity																														
	UDS*	14.25	-	-																															
	SPT-11	15.00	46	46		CL																													

# SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						IS Classification	IS Symbol	Soil Description	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Depth from G.L. (m)	Sample Type	Date of Boring	Chainage (km./Location)	B.H. No.	Depth of Water Table	Termination Depth	Coordinates (E,N)	R.L.	Ref. Code					
	10-01-2022	to	10-01-2022	56+978	BH-CL	1.36 m																10.00 m	682175.767 m	3148077.480 m	(+212.389 m)	SR-544_21-22
Sample Type	Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>v</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )	
DS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	7	46	38	5	2	2	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	8	44	35	7	4	2	28	21	7	-	1.86	19.74	1.55	2.66	DST	0.22	24	-	-	-	-	-	-	-	-	-
SPT-3	11	49	28	6	3	3	31	20	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	12	52	25	5	2	4	32	21	11	-	1.95	23.70	1.58	2.68	UUT	0.85	5	-	-	-	-	-	-	-	-	-
SPT-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	6	36	45	3	5	5	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



## SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.				Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																		
	Date of Boring		Atterberg Limits %				Shear Strength			Consolidation Parameters																							
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )		
SPT-12	28.00	100 (19cm)	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL		8	53	24	1	3	11	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	29.50	100 (27cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





## SOIL CHARACTERISTICS

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)		R.L.	Ref. Code																									
	23-08-2021	to			24-08-2021	57+400 Major Bridge		BH-P2	11.85 m			30.00 m	682104.781 m	3148389.429 m	(+2)13.893 m	SR-544_21-22																				
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained					Atterberg Limits %				Consolidation Parameters																				
							Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )				
SPT-10	28.00	100 (21cm)	-	Brown, Very dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-11	29.50 (22cm)	100	-		ML-CL			7	52	27	1	3	10	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-12	30.00	<100	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.







**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km.)/Location	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)		R.L.	Ref. Code																																						
	24-08-2021	to 25-08-2021			11.80 m	30.00 m		682098.835 m	3148415.561 m			(+)214.498 m	SR-544_21-22																																				
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %				Consolidation Parameters				Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )																				
-	28.00	84	32				Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )												Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Shear Strength		Swelling Pressure	Permeability	Void Ratio (e <sub>0</sub> )	Pressure	C <sub>v</sub> x 10 <sup>-4</sup>	M <sub>v</sub> x 10 <sup>-2</sup>	Compression Index (C <sub>p</sub> )								
SPT-10	28.00	84	32	Brown, Very dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
UDS-9	29.50	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	30.00	-	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





## SOIL CHARACTERISTICS

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)		R.L.	Ref. Code																							
												Grain Size Distribution % wt retained		Atterberg Limits %		Shear Strength		Consolidation Parameters																
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )			
UDS-9	28.00	-	-	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL		6	48	32	4	2	5	3	27	21	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-10	29.50	94	34		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DS-2	30.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Sample Type	Date of Boring				Chainage (km./Location)	B.H. No.	Depth of Water Table				Termination Depth		Coordinates (E,N)						R.L.				Ref. Code				
		23-08-2021		24-08-2021				57+400 Major Bridge		BH-P6		11.40 m		30.00 m		682092.888 m			3148441.693 m			(+2)14.417 m			SR-544_21-22			
Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.		Grain Size Distribution % wt retained					Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )				
Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit																			
Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description		IS Classification	IS Symbol																						
DS	-	-																										
SPT-1	10	16																										
UDS-1	-	-	0	22	72	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-2	16	18	Brown, Medium dense, Silty sand		SM																							
UDS-2	-	-	0	34	63	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-3	20	19																										
UDS-3	-	-	12	54	23	6	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-4	26	26	Brown, Very stiff to hard, Silty clay of low plasticity		CL																							
UDS-4	-	-	11	63	20	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-5	32	32																										
UDS-5	-	-	10	50	31	3	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-6	50	26																										
UDS-6	-	-	9	42	27	7	7	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-7	53	26																										
UDS-7	-	-	6	50	33	3	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-8	60	27																										
UDS-8	-	-	8	51	29	5	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-9	63	27																										
UDS-9	-	-	7	48	32	3	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.				IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code			
	23-08-2021	to	24-08-2021	57+400 Major Bridge			BH-P6	11.40 m	30.00 m	682092.888 m	3148441.693 m	(+2)14.417 m			SR-544_21-22											
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	Grain Size Distribution % wt retained			Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )	
				Clay	Silt	Fine	Medium	Coarse	Fine	Coarse																Liquid Limit
SPT-10	28.00	73	29	Brown, Very dense, Sandy silt of low plasticity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS*	29.50	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.								IS Classification	IS Symbol	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	Grain Size Distribution % wt retained			Atterberg Limits %			Depth of Water Table			Termination Depth	Coordinates (E,N)				R.L.	Ref. Code											
	Grain Size Distribution % wt retained			Atterberg Limits %			Depth of Water Table									Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)		M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>z</sub> )															
	23-08-2021	to	24-08-2021	Chainage (km.)/Location			B.H. No.			Depth of Water Table		Termination Depth		Coordinates (E,N)											R.L.			Ref. Code														
	23-08-2021	to	24-08-2021	57+400 Major Bridge			BH-P7			11.00 m		30.00 m		682089,915 m				(+)214.599 m		SR-544_21-22																						
				Clay			Liquid Limit			Plasticity Index			Bulk Density (g/cm <sup>3</sup> )		Natural Moisture Content (%)		Dry Density (g/cm <sup>3</sup> )		Specific Gravity		Type of Test		Cohesion C (kg/cm <sup>2</sup> )		Angle of Friction (φ)		Free Swell Index (%)		Swelling Pressure (kg/cm <sup>2</sup> )		Permeability (cm/sec)		Void Ratio (e <sub>0</sub> )		Pressure (kg/cm <sup>2</sup> )		C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)		M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)		Compression Index (C <sub>z</sub> )	
				Silt			Shrinkage Limit			Plastic Limit																																
				Fine			Plasticity Index			Liquid Limit																																
				Coarse																																						
				Medium																																						
				Fine																																						
				Coarse																																						

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+- Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						IS Classification	IS Symbol	Soil Description	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Sample Type	Depth from G.L. (m)	Termination Depth	B.H. No.	Depth of Water Table		Chainage (km./Location)	B.H. No.	Atterberg Limits %				Termination Depth	Coordinates (E,N)				R.L.	Ref. Code					
	Date of Boring		Grain Size Distribution % wt retained		Liquid Limit	Plastic Limit										Plasticity Index	Shrinkage Limit			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity		Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)			Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)
20-08-2021	to	22-08-2021	to	57+400 Major Bridge			BH-P9	12.00 m	35.00 m	682083.968 m	3148480.891 m	(+2)14.330 m	SR-544_21-22																						
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Fine	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )			
SPT-13	29.50	91	33	Brown, Very dense, Sandy silt of low plasticity with gravel	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-14	31.00	97	34		ML-CL			7	48	32	1	3	9	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-15	32.50	100	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	34.00	107	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	35.00	100	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



# SOIL CHARACTERISTICS

Project	Date of Boring		Chainage (km./Location)		B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code																			
	23-08-2021	to	24-08-2021	57+400 Major Bridge		BH-P10	11.85 m	30.00 m	682080,995 m	3148493,957 m	682080,995 m	(+2)14,021 m	SR-544_21-22																					
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Consolidation Parameters								
DS	0.00	-	-		-	-	Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index											Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	-	-	-	-
UDS-1	1.00	-	-	SM	SM	-	0	20	78	1	0	0	Nil	NP	-	-	1.58	12.35	1.58	2.63	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-1	2.50	27	#####	Brown, Medium dense, Silty sand	SM	-	0	30	67	1	1	0	Nil	NP	-	-	1.58	12.35	1.58	2.63	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-2	4.00	-	-	SM	SM	-	0	30	67	1	1	0	Nil	NP	-	-	1.58	12.35	1.58	2.63	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-2	5.50	25	#####	Brown, Very stiff, Silty clay of low plasticity	CL	-	-	-	-	-	-	-	-	-	-	-	1.58	15.63	1.58	2.68	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-3	7.00	-	-	CL	CL	-	9	57	16	6	4	0	20	10	6	-	1.83	15.63	1.58	2.68	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-3	8.50	27	27	Brown, Very stiff, Silty clay of low plasticity	-	-	-	-	-	-	-	-	-	-	-	-	1.84	17.20	1.57	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-4	10.00	-	-	ML-CL	ML-CL	-	6	61	25	4	1	0	20	6	6	-	1.84	17.20	1.57	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-4	11.50	31	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.88	18.79	1.58	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-5	13.00	-	-	ML-CL	ML-CL	-	7	58	26	3	2	0	19	7	7	-	1.88	18.79	1.58	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-5	14.50	37	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.88	18.79	1.58	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-6	16.00	-	-	ML-CL	ML-CL	-	7	55	30	1	2	0	20	7	7	-	1.88	18.79	1.58	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-6	17.50	43	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.88	18.79	1.58	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-7	19.00	-	-	ML-CL	ML-CL	-	6	57	29	3	1	0	20	7	7	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-7	20.50	48	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-8	22.00	-	-	ML-CL	ML-CL	-	8	54	26	4	2	0	21	7	7	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	23.50	55	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	25.00	60	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	26.50	56	#####	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	1.91	19.26	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.										IS Classification	IS Symbol																						
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	Grain Size Distribution % wt retained		Atterberg Limits %					Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code													
						Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )			
		23-08-2021	to	24-08-2021	57+400 Major Bridge	BH-P10	11.85 m	30.00 m	682080.995 m	3148493.957 m	(+2)14.021 m	SR-544_21-22																						
SPT-11	28.00	100	#####	ML-CL	Brown, Very dense, Sandy silt of low plasticity with gravel	7	53	25	5	4	6	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-12	29.50 (19cm)	100	-	-	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	30.00	<100	-	-	Brown, Very dense, Sandy silt of low plasticity with gravel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





### SOIL CHARACTERISTICS

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																								
														24-08-2021	to	57+400 Major Bridge	BH-P11	11.80 m	30.00 m	682078.022 m	3148507.023 m	(+2)13.946 m	SR-544_21-22														
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Consolidation Parameters																				
							Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )								
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse																															
SPT-11	26.50	85	33	Brown, Very dense, Sandy silt of low plastic	ML-CL		0	79	7	2	7	6	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-12	28.00	100 (25cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	29.50	100 (18cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



## SOIL CHARACTERISTICS

Project	Sample Type	Depth from G.L. (m)			Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)			B.H. No.			Depth of Water Table			Termination Depth		Coordinates (E,N)					R.L.				Ref. Code																				
		26-08-2021	to	27-08-2021						Grain Size Distribution % wt retained	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm³)	Natural Moisture Content (%)	Dry Density (g/cm³)	Specific Gravity	Type of Test	Cohesion C (kg/cm²)	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm²)	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm²)	C <sub>v</sub> x 10 <sup>-4</sup> (cm²/Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm²/Kg)	Compression Index (C <sub>p</sub> )																											
Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.	-	28.00	58	25	Brown, Medium dense to very dense, Sandy silt of low plasticity	ML-CL	-	-	-																					Clay	5	46	36	3	2	8	0	25	19	6	-	-	-	12.10 m	30.00 m	682075.049 m	3148520.089 m	(+)214.402 m	SR-544_21-22							
		29.50	100	-						Silt																																														

**SOIL CHARACTERISTICS**

Project	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring												Chainage (km.)/Location				B.H. No.			Depth of Water Table					Termination Depth		Coordinates (E,N)						R.L.				Ref. Code
								27-08-2021		to		28-08-2021		57+400		Major Bridge		BH-P13			12.30 m		30.00 m		682072.075 m			3148533.155 m			(+2)14.579 m		SR-544_21-22											
								Grain Size Distribution % wt retained				Atterberg Limits %		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )												
								Clay	Silt	Fine	Medium	Coarse	Sand																				Fine	Coarse	Gravel									
	DS	0.00	-	-	Brown, Loose, Silty sand	-																																						
	SPT-1	1.00	9	14		-																																						
	UDS-1	2.50	-	-		SM																																						
	SPT-2	4.00	34	39		-																																						
	UDS-2	5.50	-	-		ML-CL																																						
	SPT-3	7.00	38	36		-																																						
	UDS-3	8.50	-	-		ML-CL																																						
	SPT-4	10.00	42	34		-																																						
	UDS-4	11.50	-	-		ML-CL																																						
	SPT-5	13.00	46	25		-																																						
	UDS-5	14.50	-	-		ML-CL																																						
	SPT-6	16.00	38	21		-																																						
	UDS-6	17.50	-	-		CL																																						
	SPT-7	19.00	51	51		-																																						
	UDS-7	20.50	-	-		ML-CL																																						
	SPT-8	22.00	73	31		-																																						
	SPT-9	23.50	60	26		-																																						
	SPT-10	25.00	67	28		ML-CL																																						
	SPT-11	26.50	60	25		-																																						
	SPT-12	28.00	59	24		-																																						

SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.										IS Classification	IS Symbol														
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	Grain Size Distribution % wt retained		Atterberg Limits %					Depth of Water Table			Termination Depth	Coordinates (E,N)	R.L.	Ref. Code							
						Clay	Silt	Fine	Medium	Coarse			Sand	Fine	Coarse					Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )
SPT-13	29.50	62	25	Brown, Very dense, Sandy silt of low plasticity	8	54	28	2	1	7	0	28	21	7	-	12.30 m	30.00 m	682072.075 m	3148533.155 m	(+2)14.579 m	SR-544_21-22					
-	30.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					



**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)		R.L.	Ref. Code																							
	25-08-2021	to			26-08-2021	57+400 Major Bridge		BH-P15	11.80 m			30.00 m	682066.129 m	3148559.287 m	(+2)13.460 m	SR-544_21-22																		
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained					Atterberg Limits %				Shear Strength			Consolidation Parameters															
							Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )		
SPT-13	28.00	81	31	Brown, Very dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	29.50	90	33		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00	-	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.





## SOIL CHARACTERISTICS

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Project	Date of Boring		Chainage (km.)/Location	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code															
								27-08-2021	to 28-08-2021			57+400 Major Bridge	BH-P16		11.20 m	30.00 m	682063.156 m	3148572.353 m			(+2)12.949 m	SR-544_21-22													
								Grain Size Distribution % wt retained						Atterberg Limits %				Shear Strength				Consolidation Parameters													
								Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )					
Clay		Silt		Fine	Medium	Coarse	Fine	Coarse	Fine	Coarse																									
SPT-12	26.50	100 (26cm)	-	Brown, Very dense, Silty sand	SM		Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.	20	76	1	0	-	Nil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-13	28.00	100 (24cm)	-		-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-14	29.50	90	34		-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00	-	-		-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.				Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)			R.L.	Ref. Code		
	Date of Boring		10.80 m				682060.182 m	3148585.419 m		Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)			M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )
	26-08-2021 to 27-08-2021		Natural Moisture Content (%)													
	Grain Size Distribution % wt retained		Bulk Density (g/cm <sup>3</sup> )													
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>p</sub> )	Soil Description	IS Classification	IS Symbol	Atterberg Limits %		Type of Test				Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)		
	29.50	100 (18cm)	-	Brown, Very dense, Sandy silt of low plasticity	-	SH	Liquid Limit									
	30.00	-	-				Plastic Limit									
							Plasticity Index									
							Shrinkage Limit									
							Gravel									
							Fine									
							Coarse									
							Sand									
							Fine									
							Medium									
							Coarse									

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUUT-Unconsolidated Undrained Triaxial Shear Test, DSTJ+ - Direct Shear Test on Remoulded Sample, UUJ+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						Date of Boring		Chainage (km./Location)		B.H. No.		Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.		Ref. Code													
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %		Bulk Density (g/cm <sup>3</sup> )		Natural Moisture Content (%)		Dry Density (g/cm <sup>3</sup> )		Specific Gravity		Type of Test		Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )			
								Clay	Silt	Fine	Medium	Coarse	Sand	Fine	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )													Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-1	1.00	-	-	-	ML-CL	ML-CL		8	48	42	1	0	0	27	20	7	13.10	1.74	1.54	2.67	-	-	DST	0.21	24	-	-	-	-	-	-	-	-	-		
SPT-1	2.50	15	19	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-2	4.00	-	-	-	ML-CL	ML-CL		8	57	28	3	2	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-2	5.50	20	20	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-3	7.00	-	-	-	ML-CL	ML-CL		7	51	33	4	2	1	27	20	7	15.26	1.80	1.56	2.66	-	-	DST	0.19	25	-	-	-	-	-	-	-	-	-	-	-
SPT-3	8.50	26	23	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-4	10.00	-	-	-	CL	CL		12	61	18	4	2	0	34	22	12	20.65	1.93	1.60	2.68	-	-	UUT	1.07	4	-	-	-	-	-	-	-	-	-	-	-
SPT-4	11.50	30	30	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-5	13.00	30	30	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	14.50	34	34	-	CL	CL		11	65	12	6	2	4	33	22	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	16.00	34	34	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	17.50	100 (20cm)	-	-	ML-CL	ML-CL		7	52	27	5	2	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	19.00	100 (22cm)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	20.50	100 (18cm)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	22.00	100 (25cm)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-12	23.50	100 (21cm)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	25.00	100 (24cm)	-	-	ML-CL	ML-CL		6	54	24	2	3	11	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	26.50	103 (26cm)	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)			R.L.	Ref. Code																										
	24-08-2021	to			57+400 Major Bridge	BH-P18		10.50 m	30.00 m	682057.209 m			3148598.485 m	(+213.517 m	SR-544_21-22																							
																Grain Size Distribution % wt retained			Atterberg Limits %		Consolidation Parameters																	
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Fine	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )						
SPT-15	28.00	100 (23cm)	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-16	29.50 (27cm)	100 (27cm)	-				8	51	30	2	1	8	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	30.00	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

# SOIL CHARACTERISTICS

Project	Date of Boring					Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																				
	23-08-2021	to	24-08-2021	57+400 Major Bridge	BH-P19			11.50 m	30.00 m		682054,2.36 m	3148611,551 m	(+2)13.504 m	SR-544_21-22																						
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Shear Strength				Consolidation Parameters															
							Clay	Silt	Fine	Medium	Coarse	Sand	Clay	Plasticity Index	Plastic Limit	Liquid Limit	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>v</sub> )				
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
SPT-1	1.00	11	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
UDS-1	2.50	-	-	7	46	45	2	0	0	0	26	6	20	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
SPT-2	4.00	14	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
UDS-2	5.50	-	-	8	49	41	2	0	0	0	28	7	21	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
SPT-3	7.00	19	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-3	8.50	-	-	6	52	37	4	0	1	0	26	6	20	26	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
SPT-4	10.00	23	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-5	11.50	31	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-6	13.00	31	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-7	14.50	27	18	7	47	44	1	1	0	0	27	7	20	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
SPT-8	16.00	31	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	17.50	-	-	12	68	16	2	1	1	0	30	10	20	30	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-9	19.00	35	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	20.50	>100	-	0	20	48	20	2	10	0	Nil	NP	Nil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-11	22.00	>100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-12	23.50	>100	-	0	19	42	32	1	6	0	Nil	NP	Nil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SPT-13	25.00	>100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

## SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.										IS Classification	IS Symbol																
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description																							
Date of Boring	Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)	R.L.	Ref. Code	Grain Size Distribution % wt retained																		
			Clay	Silt	Fine	Medium				Coarse	Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit												
											Fine	Coarse																
			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity				Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )								
Atterberg Limits %																												
23-08-2021	to	24-08-2021	57+400 Major Bridge	BH-P19	11.50 m	30.00 m	682054,236 m	3148611,551 m	SR-544_21-22	Clay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
										Silt	0	22	77	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-
										SM																		
SPT-14	26.50	100 (18cm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	28.00	100 (25cm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	29.50	>100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	30.00	>100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-





**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						IS Classification	IS Symbol	Soil Description	Corrected SPT Value (N)	Observed SPT Value (N)	Depth from G.L. (m)	Sample Type	Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code		
	Date of Boring	Grain Size Distribution % wt retained		Atterberg Limits %												Shear Strength			Consolidation Parameters							
	20-08-2021	to	22-08-2021	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	35.00 m	682050.819 m	3148626.567 m	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )	
	Clay	Silt	Fine	Medium	Coarse	Fine	Coarse																			
SPT-12	-	-	-	-	-	-	-	-	-	-	99	28.00			BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-
SPT-13	-	-	-	-	-	-	-	-	-	100 (18cm)	100	29.50			BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-
SPT-14	6	48	36	2	1	7	0	26	20	6	-	31.00	Brown, Very dense, Sandy silt of low plasticity with gravel	BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-	
SPT-15	-	-	-	-	-	-	-	-	-	100 (19cm)	100	32.50			BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-
SPT-16	-	-	-	-	-	-	-	-	-	100 (22cm)	100	34.00			BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-
SPT-17	-	-	-	-	-	-	-	-	-	110 (23cm)	110	35.00			BH-A2	10.90 m	35.00 m	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



# SOIL CHARACTERISTICS

Project	Date of Boring				Chainage (km.)/Location	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																																																
	24-09-2021	to	24-09-2021	58+191			BH-CL	Not Encountered		10.00 m	681895.083 m	3149257.396 m	(+2)12.823 m			SR-544_21-22																																															
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained				Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )		Natural Moisture Content (%)		Dry Density (g/cm <sup>3</sup> )		Specific Gravity		Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )																															
							Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )												Specific Gravity																														
DS	0.00	-	-	Brown, Loose to medium dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																							
SPT-1	1.00	6	10		ML-CL			7	50	37	4	2	0	0	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																		
UDS-1	2.50	-	-		ML-CL			6	48	35	6	3	2	0	0	26	20	6	-	1.69	12.60	1.50	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-													
SPT-2	4.00	16	18		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-											
UDS-2	5.50	-	-	Brown, Hard, Silty clay of low plasticity with gravel	CL		11	49	28	5	2	5	0	0	31	20	11	-	1.84	15.24	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								
SPT-3	7.00	31	31		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
UDS-3	8.50	-	-		CL			10	53	24	4	3	6	0	0	30	20	10	-	1.90	16.49	1.63	2.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-4	10.00	46	46		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**SOIL CHARACTERISTICS**

Project	Date of Boring					Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)					R.L.	Ref. Code														
	14-08-2021		to					11.30 m			40.00 m		681858.380 m		3149467.024 m			Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )									
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description			IS Classification	IS Symbol		Grain Size Distribution % wt retained												Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)			
											Clay	Silt	Fine	Medium	Coarse														Gravel	Liquid Limit	Plastic Limit
Sand						Coarse	Coarse			Fine						Coarse	Gravel														
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
SPT-1	1.00	17	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-1	2.50	-	-	7	51	36	4	2	0	0	26	6	20	20	6	11.56	1.58	2.67	-												
SPT-2	4.00	24	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-2	5.50	-	-	8	56	32	3	1	0	0	27	7	20	20	7	12.31	1.60	2.67	-												
SPT-3	7.00	32	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-3	8.50	-	-	11	56	25	2	1	5	0	31	11	20	20	11	2.68	2.68	2.68	-												
SPT-4	10.00	46	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS*	11.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
SPT-5	13.00	48	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-4	14.50	-	-	13	58	20	3	2	3	1	33	22	22	11	11	-	-	-	-												
SPT-6	16.00	52	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-5	17.50	-	-	12	56	26	2	1	3	0	32	21	21	11	11	-	-	-	-												
SPT-7	19.00	45	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-6	20.50	-	-	8	58	27	2	1	4	0	28	7	21	7	7	15.06	1.62	2.66	-												
SPT-8	22.00	75	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-7	23.50	-	-	7	49	30	3	4	6	1	27	20	20	7	7	-	-	-	-												
SPT-9	25.00	69	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-												
UDS-8	26.50	-	-	8	53	27	5	2	5	0	26	19	19	7	7	-	-	-	-												

Abbreviations:-

DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



# SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.											Ref. Code																																
	Sample Type	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table			Termination Depth		Coordinates (E,N)				R.L.																													
		Depth from G.L. (m)	Observed SPT Value (N)			Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Clay	Silt		Fine	Medium		Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )								
SPT-10	28.00	75	27	Brown, Very dense, Sandy silt of low plasticity	-	ML-CL		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-										
UDS-9	29.50	-	-					6	46	36	2	2	0	27	-	7	-	-	2.66	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
SPT-11	31.00	80	26					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-10	32.50	-	-					6	49	37	3	1	0	26	6	20	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	34.00	100 (20cm)	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	35.50	100 (23cm)	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-14	37.00	100 (26cm)	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	38.50	67	23					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-11	40.00	-	-					7	47	32	3	2	0	26	19	7	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:- DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



### SOIL CHARACTERISTICS

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Depth of Water Table		Termination Depth		Coordinates (E,N)						R.L.		Ref. Code										
							Sand			Gravel			Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )		C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )							
							Clay	Silt	Fine	Medium	Coarse	Coarse																					Fine	Coarse					
DS	0.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-1	1.00	-	-	ML-CL	ML-CL		-	-	-	0	0	0	27	20	7	12.36	1.75	1.56	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-1	2.50	17	22	Brown, Medium dense, Sandy silt of low plasticity			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-2	4.00	-	-	ML-CL	ML-CL		-	-	-	0	0	0	28	21	7	12.86	1.81	1.60	2.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-2	5.50	30	30		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-3	7.00	-	-	CL	CL		13	63	18	3	2	32	21	11	15.10	1.86	1.62	2.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.655	7.05	1.84	1.230
SPT-3	8.50	40	40		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-4	10.00	-	-	CL	CL		12	63	15	3	4	33	22	11	17.22	1.91	1.63	2.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-4	11.50	45	45	Brown, Hard, Silty clay of low plasticity			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-5	13.00	-	-	CL	CL		14	53	19	4	4	34	23	11	20.34	1.97	1.64	2.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-5	14.50	49	49		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-6	16.00	-	-	CL	CL		14	71	12	1	2	33	22	11	22.29	2.02	1.65	2.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	17.50	54	54		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-7	19.00	-	-	ML-CL	ML-CL		6	55	30	3	2	26	20	6	17.25	1.88	1.60	2.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	20.50	61	27		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-8	22.00	-	-	ML-CL	ML-CL		8	52	28	5	2	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-8	23.50	68	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS*	25.00	81	32		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-10	26.50	69	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST\* - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code																								
	16-08-2021	to			18-08-2021	58+497	BH-P1	11.60 m	40.00 m	681844.488 m	3149495.176 m	(+2)14.371 m			SR-544_21-22																							
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Consolidation Parameters																					
							Clay	Silt	Fine	Medium	Coarse	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )				
UDS-9	28.00	-	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL		7	51	34	4	1	3	0	27	20	7	-	1.91	18.34	1.61	2.67	DST	0.16	28	-	-	-	-	-	-	-	-	-	-	-			
SPT-11	29.50	77	29		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS*	31.00	86	31		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-13	32.50	100 (17cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS*	34.00	100 (20cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS*	35.50	100 (24cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	37.00	100 (18cm)	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	38.50	73	25		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-10	40.00	-	-		ML-CL			8	51	30	1	1	9	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DSJ+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code															
															Grain Size Distribution % wt retained		Atterberg Limits %		Shear Strength		Consolidation Parameters								
									Clay	Silt	Fine	Medium			Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)
Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.	19-08-2021 to 20-08-2021		58+497	BH-P2	11.40 m		40.00 m		681840.419 m 3149522.156 m				(+2)13.108 m	SR-544_21-22															
	DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	SPT-1	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	UDS-1	2.50	6	33	55	2	3	1	0	25	19	6	-	1.74	11.34	1.56	2.65	DST	0.09	27	-	-	-	-	-	-	-		
	SPT-2	4.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	UDS-2	5.50	11	74	10	1	2	2	0	30	20	10	-	1.81	14.67	1.58	2.68	UUT	0.93	4	-	-	-	-	-	-	-		
	SPT-3	7.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	UDS-3	8.50	12	58	14	4	2	10	0	32	21	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	SPT-4	10.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	UDS-4	11.50	7	52	34	4	2	1	0	26	19	7	-	1.83	16.80	1.57	2.66	DST	0.20	25	-	-	-	-	-	-	-		
	SPT-5	13.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	UDS-5	14.50	6	50	38	4	1	1	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SPT-6	16.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	UDS*	17.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SPT-7	19.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-6	20.50	7	51	33	3	2	4	0	27	20	7	-	1.88	17.76	1.60	2.67	DST	0.21	26	-	-	-	-	-	-	-	-		
SPT-8	22.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-7	23.50	8	49	28	1	3	11	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-9	25.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-8	26.50	6	51	25	3	2	13	0	26	20	6	-	2.66	2.66	2.66	2.66	DST	0.17	28	-	-	-	-	-	-	-	-		





## SOIL CHARACTERISTICS

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)	B.H. No.				Depth of Water Table			Termination Depth		Coordinates (E,N)						R.L.				Ref. Code					
							Clay	Silt	Fine	Sand		Coarse		Atterberg Limits %				Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )						
										Medium	Coarse			Liquid Limit	Plasticity Index	Shrinkage Limit																						
							Grain Size Distribution % wt retained		Gravel																													
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-1	1.00	-	-	-	SM																																	
SPT-1	2.50	14	18	Brown, Medium dense, Silty sand																																		
UDS-2	4.00	-	-		SM																																	
SPT-2	5.50	16	16																																			
UDS-3	7.00	-	-		ML-CL																																	
SPT-3	8.50	33	29																																			
UDS-4	10.00	-	-		ML-CL																																	
SPT-4	11.50	38	23																																			
UDS-5	13.00	-	-		ML-CL																																	
SPT-5	14.50	40	23																																			
UDS-6	16.00	-	-		ML-CL																																	
SPT-6	17.50	53	26	Brown, Dense to very dense, Sandy silt of low plasticity																																		
UDS-7	19.00	-	-		ML-CL																																	
SPT-7	20.50	80	35																																			
UDS-8	22.00	-	-		ML-CL																																	
SPT-8	23.50	84	35																																			
UDS-9	25.00	-	-		ML-CL																																	
SPT-9	26.50	100	38																																			

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code																						
	23-08-2021	to			24-08-2021	58+497	BH-P3	11.00 m	40.00 m	681840.000 m	3149565.000 m	(+2)14.145 m			SR-544_21-22																					
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Consolidation Parameters																			
							Clay	Silt	Fine	Medium	Coarse	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )		
UDS-10	28.00	-	-	Brown, Dense to very dense, Sandy silt of low plasticity	ML-CL		7	51	35	1	1	5	0	26	19	7	-	1.94	18.10	1.64	2.66	DST	0.18	28	-	-	-	-	-	-	-	-	-	-	-	
SPT-10	29.50 (25cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-11	31.00 (23cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	32.50 (25cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	34.00 (20cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	35.50	105	36		ML-CL		8	55	25	3	1	8	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	37.00 (19cm)	107	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	38.50 (23cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	40.00 (25cm)	100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



SOIL CHARACTERISTICS

Project	Date of Boring						Chainage (km./Location)		B.H. No.		Depth of Water Table				Termination Depth		Coordinates (E,N)						R.L.				Ref. Code										
	18-08-2021 to 19-08-2021		58+497		BHP4		11.90 m		40.00 m		681837.920 m		3149594.593 m		(+2)14.312 m		SR-544_21-22		Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )		C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )							
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %		Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity																			
							Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit					Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity														
DS	0.00	-	-																																		
SPT-1	1.00	19	30	Brown, Medium dense, Sandy silt of low plasticity																																	
UDS-1	2.50	-	-		ML-CL																																
SPT-2	4.00	24	27																																		
UDS-2	5.50	-	-		ML-CL																																
SPT-3	7.00	35	32																																		
UDS-3	8.50	-	-	Brown, Dense, Sandy silt of low plasticity	ML-CL																																
SPT-4	10.00	43	33																																		
SPT-5	11.50	48	34																																		
SPT-6	13.00	54	26																																		
UDS-4	14.50	-	-		ML-CL																																
SPT-7	16.00	58	25																																		
UDS-5	17.50	-	-		ML-CL																																
SPT-8	19.00	53	22																																		
UDS-6	20.50	-	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL																																
SPT-9	22.00	66	25																																		
UDS*	23.50	-	-																																		
SPT-10	25.00	78	28																																		
UDS-7	26.50	-	-		ML-CL																																

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Date of Boring		Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																																									
	18-08-2021	to			19-08-2021	58+497		BH-P4	11.90 m	40.00 m	681837.920 m			3149594.593 m	(+2)14.312 m	SR-544_21-22																																						
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %				Shear Strength					Consolidation Parameters																																
							Clay	Silt	Fine	Medium	Coarse	Sand	Fine	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C <sub>u</sub> (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )																				
SPT-11	28.00	78	26	Brown, Very dense, Sandy silt of low plasticity	-		-	-	-	-	-																								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-8	29.50	-	-		ML-CL		7	61	27	3	2	0	0	27	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
SPT-12	31.00	82	26		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-9	32.50	-	-		ML-CL		8	65	24	2	1	0	0	28	-	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-13	34.00	100 (24cm)	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-14	35.50	100 (19cm)	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-15	37.00	100 (26cm)	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	38.50	100 (23cm)	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-17	40.00	89	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		





**SOIL CHARACTERISTICS**

Project	Date of Boring				Chainage (km./Location)		B.H. No.	Depth of Water Table			Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																															
	17-08-2021	to	18-08-2021		58+497			11.00 m	40.00 m	681836.405 m		3149645.522 m	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)			M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )																													
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained					Atterberg Limits %			Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)																												
		Clay	Silt				Fine	Medium	Coarse	Sand	Gravel	Liquid Limit	Plastic Limit	Plasticity Index							Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity																							
DS	0.00	-	-	Brown, Medium dense, Sandy silt of low plasticity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-																					
UDS-1	1.00	-	-		ML-CL	-	-	7	58	27	4	3	1	0	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-									
SPT-1	2.50	16	20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
UDS-2	4.00	-	-		ML-CL	-	-	9	58	24	5	2	2	0	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-						
SPT-2	5.50	27	27		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
UDS-3	7.00	-	-		CL	-	-	13	71	11	3	1	1	0	0	33	22	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-3	8.50	36	36		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
UDS-4	10.00	-	-		CL	-	-	12	66	15	3	2	2	0	0	32	21	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-4	11.50	43	43		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-5	13.00	-	-		CL	-	-	12	61	18	4	1	4	0	0	31	20	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-5	14.50	51	51		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-6	16.00	-	-		CL	-	-	13	57	16	5	3	5	1	1	33	22	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-6	17.50	54	54		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-7	19.00	-	-		ML-CL	-	-	8	58	28	2	1	3	0	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	20.50	67	29		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-8	22.00	-	-	ML-CL	-	-	6	52	32	3	1	6	0	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-8	23.50	72	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-9	25.00	-	-	ML-CL	-	-	7	62	21	4	1	5	0	0	26	19	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-9	26.50	80	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		



## SOIL CHARACTERISTICS

Project	Date of Boring						Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code																			
	17-08-2021		to		18-08-2021				58+497		BH-P6		11.00 m		40.00 m				681836.405 m		3149645.522 m																
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %			Shear Strength				Consolidation Parameters																	
							Sand			Gravel			Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )						
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Clay	Silt	Fine	Medium	Coarse																						
UDS-10	28.00	-	-	Brown, Very dense, Sandy silt of low plasticity	ML-CL		8	63	22	1	0	6	0	28	21	7	-	1.95	18.19	1.65	2.67	DST	0.20	28	-	-	-	-	-	-	-	-	-	-			
SPT-10	29.50	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
SPT-11	31.00	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-12	32.50	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	34.00	>100	-		-	ML-CL		7	59	26	7	1	0	0	27	20	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	35.50	100 (25cm)	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	37.00	100 (22cm)	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	38.50	>100	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	40.00	>100	-		-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring						Chainage (km./Location)	B.H. No.			Depth of Water Table		Termination Depth		Coordinates (E,N)						R.L.		Ref. Code			
							17-08-2021		18-08-2021		58+497			BH-A2			12.00 m		40.00 m		681833.809 m			3149673.452 m			(+2)14.044 m					
							Grain Size Distribution % wt retained							Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )		C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )
Clay	Silt	Fine	Medium	Coarse	Sand	Clay	Silt	Fine	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit																		
DS	0.00	-	-	Brown, Medium dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
SPT-1	1.00	13	21		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-1	2.50	-	-		ML-CL			7	54	34	4	1	0	0	0	27	20	7	-	1.74	12.36	1.55	2.67	DST	0.22	23	-	-	-	-	-	
SPT-2	4.00	26	29	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-2	5.50	-	-	ML-CL			9	51	33	6	1	0	0	29	22	7	-	1.80	13.21	1.59	2.66	DST	0.20	25	-	-	-	-	-	-		
SPT-3	7.00	31	29	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-3	8.50	-	-	ML-CL			8	50	35	3	3	1	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-4	10.00	31	25	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-4	11.50	-	-	ML-CL			7	57	31	2	0	3	0	26	19	7	-	1.81	16.63	1.55	2.67	DST	0.18	25	-	-	-	-	-	-	-	
SPT-5	13.00	32	19	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-5	14.50	-	-	ML-CL			6	55	33	3	2	1	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	16.00	28	17	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-6	17.50	-	-	ML-CL			9	59	24	2	2	4	0	29	22	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	19.00	41	21	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-7	20.50	-	-	ML-CL			7	52	29	3	4	5	0	27	20	7	-	1.87	18.10	1.58	2.66	DST	0.19	26	-	-	-	-	-	-	-	-
SPT-8	22.00	50	24	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-8	23.50	-	-	ML-CL			8	56	25	6	1	3	1	26	19	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	25.00	55	24	-			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-9	26.50	-	-	ML-CL			6	55	30	3	4	2	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

## SOIL CHARACTERISTICS

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.				Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth		Coordinates (E,N)				R.L.	Ref. Code				
	Date of Boring		Atterberg Limits %				Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )			Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol									Clay	Silt				
SPT-10	28.00	58	25	Brown, Very dense, Sandy silt of low plasticity	-		-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-10	29.50	-	-		ML-CL			7	67	26	0	0	0	26	20	6	-	-	-	-
SPT-11	31.00	65	26		-			-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-11	32.50	-	-		ML-CL			5	51	36	4	1	3	26	19	7	-	2.66	2.66	27
SPT-12	34.00	99	33		-			-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	35.50	100 (21cm)	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	37.00	100 (23cm)	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	38.50	>100	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	40.00	>100	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						Chainage (km./Location)	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code																			
	Date of Boring		Grain Size Distribution % wt retained		Atterberg Limits %				Shear Strength			Consolidation Parameters																								
Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )					
DS	0.00	-	-																																	
SPT-1	1.00	6	10	Brown, Loose, Silty sand	-																															
UDS-1	2.50	-	-		SM																															
SPT-2	4.00	22	25																																	
UDS-2	5.50	-	-		ML-CL																															
SPT-3	7.00	32	30	Brown, Medium dense to dense, Sandy silt of low plasticity with gravel																																
UDS-3	8.50	-	-		ML-CL																															
SPT-4	10.00	47	38																																	

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

**SOIL CHARACTERISTICS**

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Date of Boring					Chainage (km.)/Location	B.H. No.	Depth of Water Table		Termination Depth	Coordinates (E,N)					R.L.	Ref. Code									
							24-09-2021	to	24-09-2021	59+071 Minor Bridge	BH-CL			Not Encountered	10.00 m		681817.835 m	3150131.892 m	(+2)13.832 m	SR-544_21-22												
							Grain Size Distribution % wt retained					Atterberg Limits %			Consolidation Parameters																	
							Clay	Silt	Sand		Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )	
									Fine	Medium	Coarse	Fine																				Coarse
DS	0.00	-	-	Brown, Medium dense to dense, Sandy silt of low plasticity with gravel	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-1	1.00	-	-		ML-CL		7	51	33	5	1	3	0	27	20	7	-	1.79	14.60	1.56	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	2.50	18	23		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	4.00	-	-		ML-CL		6	54	30	4	2	4	0	26	20	6	-	1.85	15.41	1.60	-	-	-	-	-	-	-	-	-	-	-	-
SPT-2	5.50	29	29		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	7.00	-	-		ML-CL		8	51	28	6	1	6	0	28	21	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	8.50	32	27		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	10.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Date of Boring			Chainage (km.)/Location			B.H. No.			Depth of Water Table			Termination Depth			Coordinates (E,N)						R.L.		Ref. Code										
	23-09-2021		to	24-09-2021		to	59+206 Minor Bridge			BH-CL			12.65 m			15.00 m			681807.000 m			3150266.000 m			(+2)13.360 m		SR-544_21-22							
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained						Atterberg Limits %			Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )			
Clay								Silt	Fine	Medium	Coarse	Sand	Fine	Coarse	Gravel	Liquid Limit																Plastic Limit	Plasticity Index	Shrinkage Limit
DS	0.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
UDS-1	1.00	-	-		ML-CL		6	49	40	4	1	0	0	0	27	20	7	-	1.79	13.56	1.58	2.66	-	-	-	-	-	-	-	-	-	-	-	
SPT-1	2.50	20	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-2	4.00	-	-		ML-CL		7	53	33	3	2	2	0	26	19	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-2	5.50	26	26		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	7.00	-	-		ML-CL		8	57	28	5	1	1	0	28	21	7	-	1.80	14.80	1.57	2.66	DST	0.22	25	-	-	-	-	-	-	-	-	-	-
SPT-3	8.50	24	21		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	10.00	-	-		ML-CL		6	57	27	4	3	3	0	26	20	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-4	11.50	33	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	13.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	13.50	30	18		ML-CL		7	51	31	6	1	4	0	27	20	7	-	1.88	21.00	1.55	2.65	DST	0.19	26	-	-	-	-	-	-	-	-	-	-
SPT-6	15.00	49	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.						IS Classification	IS Symbol	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N <sub>c</sub> )	Soil Description	Atterberg Limits %						Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Termination Depth	Coordinates (E,N)				R.L.	Ref. Code							
	Date of Boring													Chainage (km./Location)		B.H. No.	Depth of Water Table		Grain Size Distribution % wt retained						Liquid Limit	Shrinkage Limit	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )			Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )	
	23-09-2021	to	23-09-2021	59+270	Minor Bridge	BH-CL								Not Encountered	10.00 m		681801.000 m	3150330.000 m	(+2)12.598 m																		SR-544_21-22
Sample Type	Clay	Silt	Fine	Medium	Coarse		Gravel	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>c</sub> )											
DS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
UDS-1	6	55	31	5	1	0	26	20	6	6	14.23	1.83	14.23	1.60	2.66	DST	0.20	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
UDS-2	8	53	28	6	1	0	28	21	7	7	15.10	1.85	15.10	1.61	2.65	DST	0.21	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
UDS-3	7	52	29	5	1	0	27	20	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SPT-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Abbreviations:-  
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+- Direct Shear Test on Remoulded Sample, UUT+- Unconsolidated Undrained Tri-axial Test on Remoulded Sample.



**RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES**

Sr. No	Chainage Old	Chainage New	BH No.	Depth of collected sample (m)	pH	Chlorides (Cl <sup>-</sup> )		Sulphate (SO <sub>4</sub> <sup>2-</sup> )	
						(mg/kg)	(%)	(mg/kg)	(%)
1.	52+518	55+719	BH-A1	1.0	8.79	76.23	0.0076	18.14	0.0018
			BH-A2	16.0	7.88	85.68	0.0086	29.30	0.0029
2.	55+910	59+107	BH-A1	13.0	7.14	56.12	0.0056	19.35	0.0019
			BH-A2	2.5	9.34	65.67	0.0066	24.26	0.0024
3.	57+400	60+603	BH-P3	13.0	8.74	74.54	0.0074	23.10	0.0023
			BH-P19	5.5	9.70	61.71	0.0062	29.20	0.0029
4.	58+497	61+676	BH-A1	2.5	8.90	80.43	0.0080	17.04	0.0017
			BH-A2	11.5	8.75	79.71	0.0080	22.40	0.0022

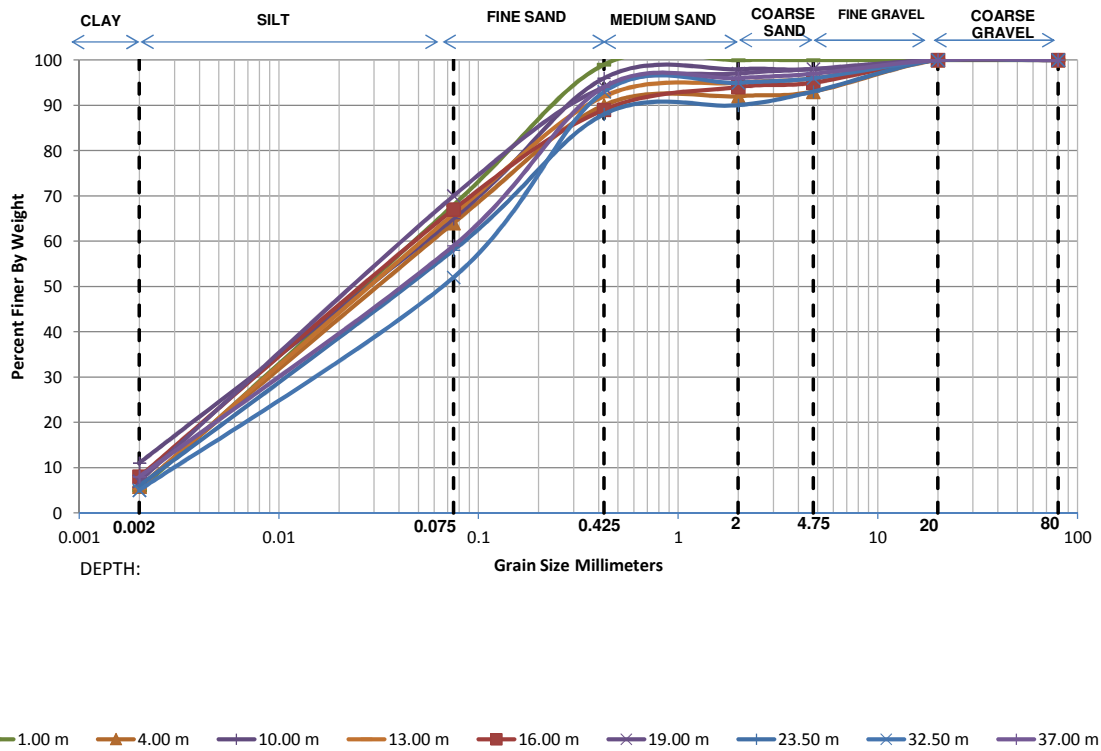
**RESULT OF CHEMICAL ANALYSIS OF WATER SAMPLE**

Sr. No	Chainage Old	Chainage New	BH No.	pH	Chlorides (Cl <sup>-</sup> )		Sulphate (SO <sub>4</sub> <sup>2-</sup> )	
					(mg/l)		(mg/l)	
1.	52+518	55+719	BH-A1	9.23	55.34		20.64	
2.	55+910	59+107	BH-A1	9.06	70.33		24.19	
3.	57+400	60+603	BH-A1	10.12	57.73		25.43	
4.	58+497	61+676	BH-A1	9.43	57.65		23.28	



### GRAIN SIZE DISTRIBUTION CURVES

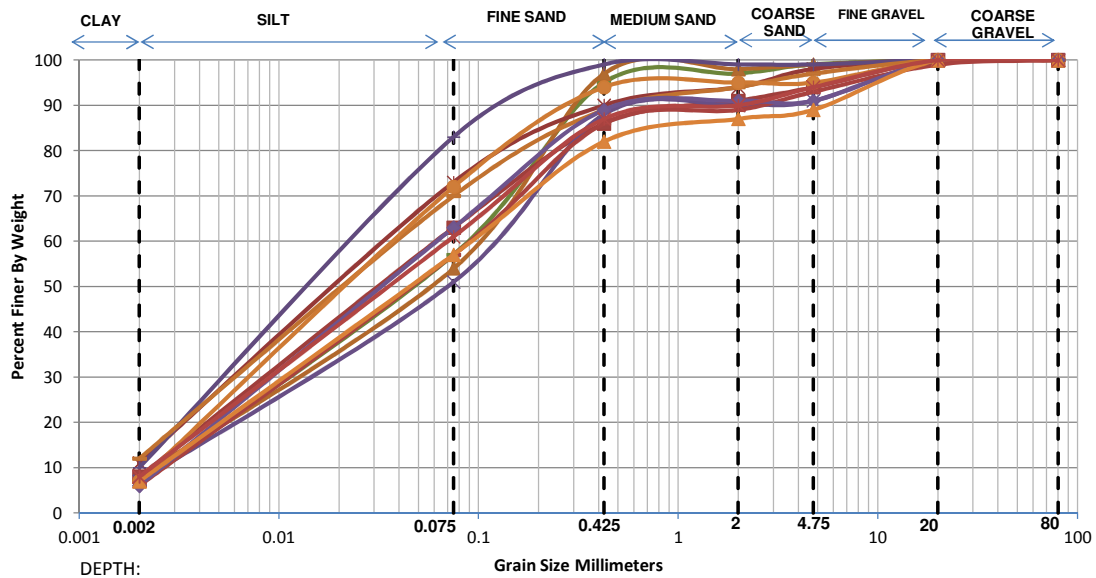
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	52+518 (Old Ch) & 55+719 (New Ch) Major Bridge
<b>B.H. No.</b>	BH-A1



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	5.00	63.00	31.00	1.00	0.00	0.00	0.00	0.0051	0.0202	0.0595	11.76	1.36
4.00 m	5.80	58.20	26.00	2.00	1.00	7.00	0.00	0.0044	0.0203	0.0662	15.06	1.42
10.00 m	11.00	54.00	31.00	2.00	0.00	2.00	0.00	-	0.0148	0.0634	-	-
13.00 m	5.60	60.40	26.00	3.00	1.00	4.00	0.00	0.0045	0.0199	0.0625	13.79	1.39
16.00 m	8.00	59.00	22.00	5.00	1.00	5.00	0.00	0.0029	0.0167	0.0600	20.88	1.61
19.00 m	7.00	63.00	24.00	3.00	1.00	2.00	0.00	0.0034	0.0169	0.0555	16.15	1.50
23.50 m	6.00	52.00	30.00	2.00	3.00	7.00	0.00	0.0044	0.0231	0.0810	18.60	1.51
32.50 m	5.00	47.00	41.00	2.00	1.00	4.00	0.00	0.0056	0.0291	0.1022	18.27	1.48
37.00 m	8.00	51.00	35.00	2.00	1.00	3.00	0.00	0.0029	0.0205	0.0777	26.55	1.86

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	52+518 (Old Ch) & 55+719 (New Ch) Major Bridge
<b>B.H. No.</b>	BH-A2

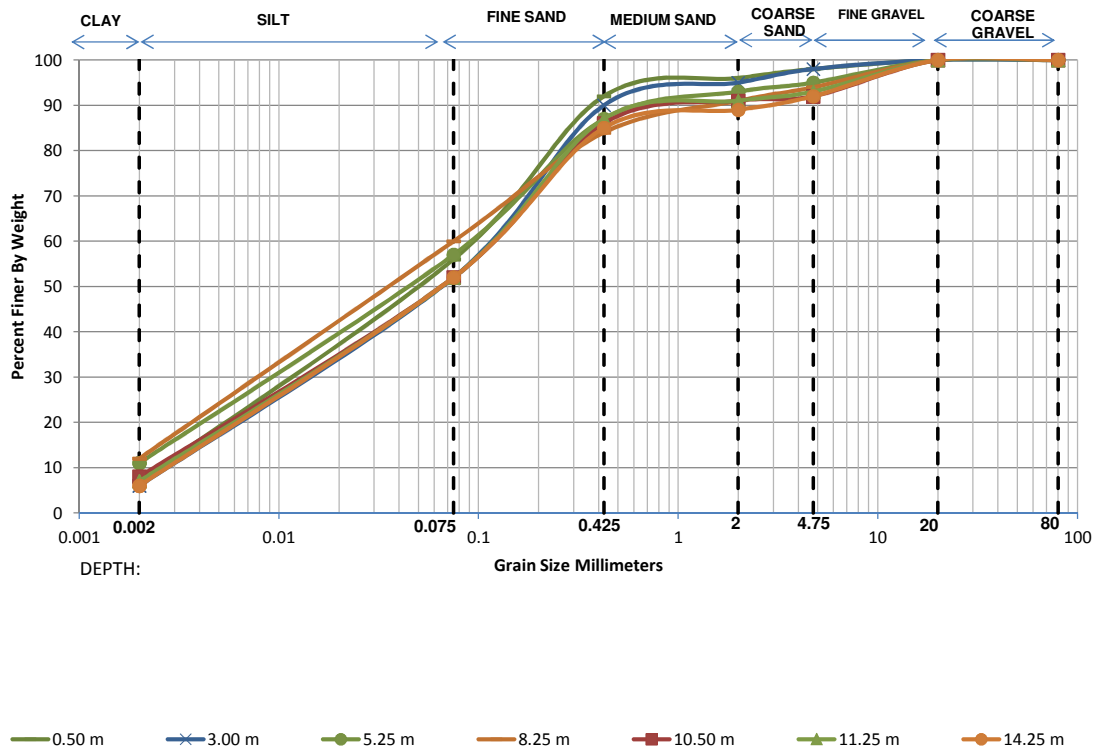


- |            |            |           |            |            |            |
|------------|------------|-----------|------------|------------|------------|
| — 1.00 m   | —▲ 4.00 m  | —* 7.00 m | —◆ 10.00 m | — 13.00 m  | —■ 16.00 m |
| —× 19.00 m | —● 22.00 m | — 25.00 m | —◆ 28.00 m | —▲ 31.00 m | —* 34.00 m |

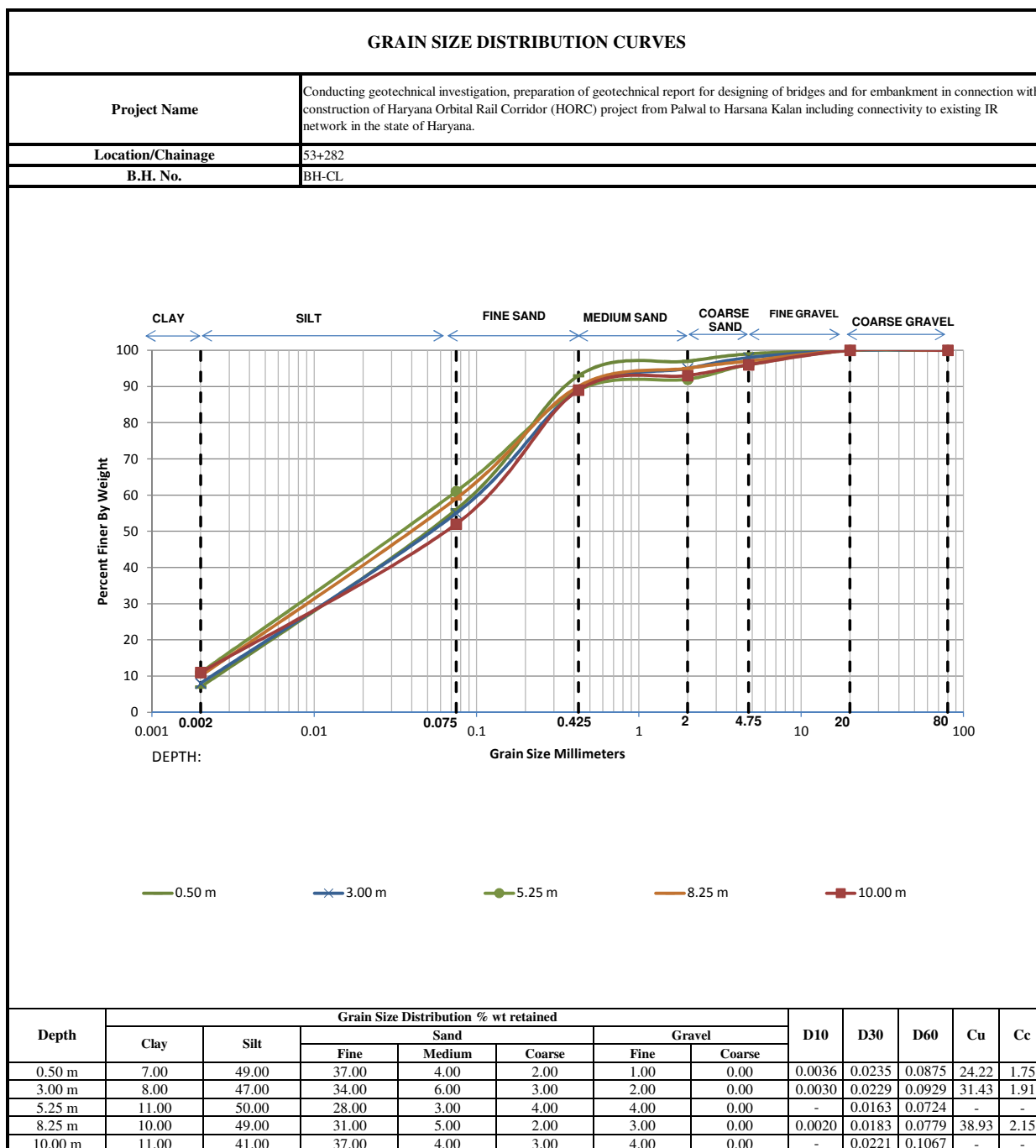
Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	7.00	50.00	38.00	2.00	2.00	1.00	0.00	0.0036	0.0229	0.0836	23.25	1.75
4.00 m	8.00	46.00	43.00	1.00	1.00	1.00	0.00	0.0030	0.0241	0.0937	31.52	2.09
7.00 m	11.00	62.00	17.00	4.00	4.00	2.00	0.00	-	0.0122	0.0493	-	-
10.00 m	10.00	73.00	16.00	0.00	0.00	1.00	0.00	0.0020	0.0113	0.0388	19.42	1.66
13.00 m	12.00	58.00	19.00	5.00	3.00	3.00	0.00	-	0.0122	0.0535	-	-
16.00 m	8.00	55.00	23.00	5.00	3.00	6.00	0.00	0.0029	0.0181	0.0679	23.47	1.67
19.00 m	7.00	44.00	37.00	2.00	1.00	9.00	0.00	0.0037	0.0273	0.1106	29.87	1.82
22.00 m	7.00	65.00	22.00	1.00	0.00	5.00	0.00	0.0034	0.0163	0.0525	15.37	1.48
25.00 m	6.00	51.00	29.00	3.00	4.00	6.00	1.00	0.0044	0.0236	0.0851	19.45	1.50
28.00 m	6.00	57.00	26.00	2.00	0.00	9.00	0.00	0.0042	0.0205	0.0682	16.06	1.45
31.00 m	7.00	50.00	25.00	5.00	2.00	11.00	0.00	0.0036	0.0222	0.0866	24.20	1.60
34.00 m	8.00	53.00	26.00	3.00	4.00	6.00	0.00	0.0029	0.0191	0.0725	24.96	1.74

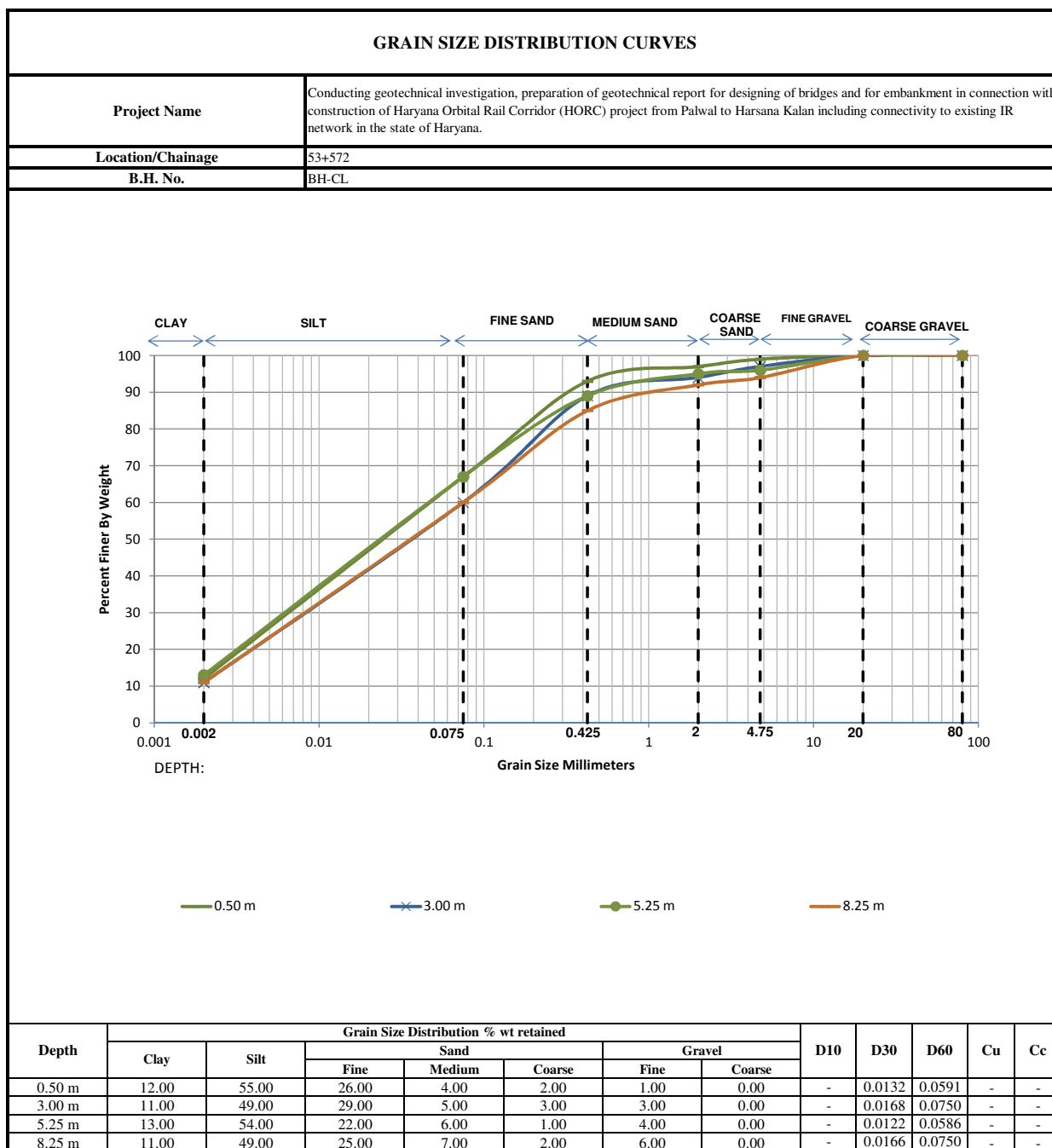
### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	53+107
<b>B.H. No.</b>	BH-CL

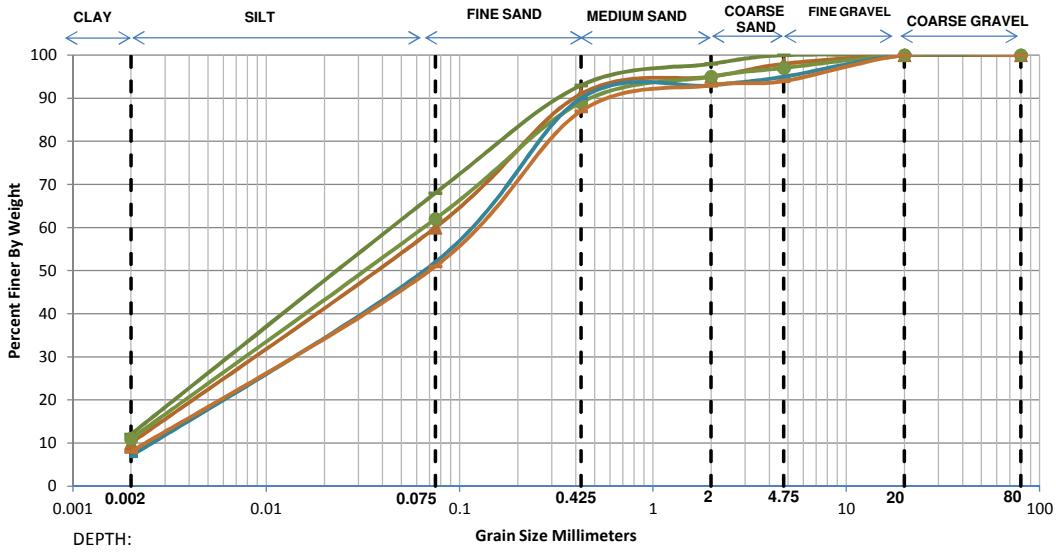


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	7.00	49.00	36.00	4.00	2.00	2.00	0.00	0.0036	0.0235	0.0877	24.29	1.74
3.00 m	6.00	46.00	38.00	5.00	3.00	2.00	0.00	0.0045	0.0277	0.1047	23.08	1.61
5.25 m	11.00	46.00	30.00	6.00	2.00	5.00	0.00	-	0.0183	0.0856	-	-
8.25 m	12.00	48.00	24.00	7.00	3.00	6.00	0.00	-	0.0156	0.0750	-	-
10.50 m	8.00	44.00	34.00	5.00	1.00	8.00	0.00	0.0030	0.0252	0.1087	36.44	1.95
11.25 m	7.00	45.00	35.00	4.00	2.00	7.00	0.00	0.0037	0.0263	0.1073	29.16	1.76
14.25 m	6.00	46.00	33.00	4.00	3.00	8.00	0.00	0.0045	0.0274	0.1091	24.13	1.52



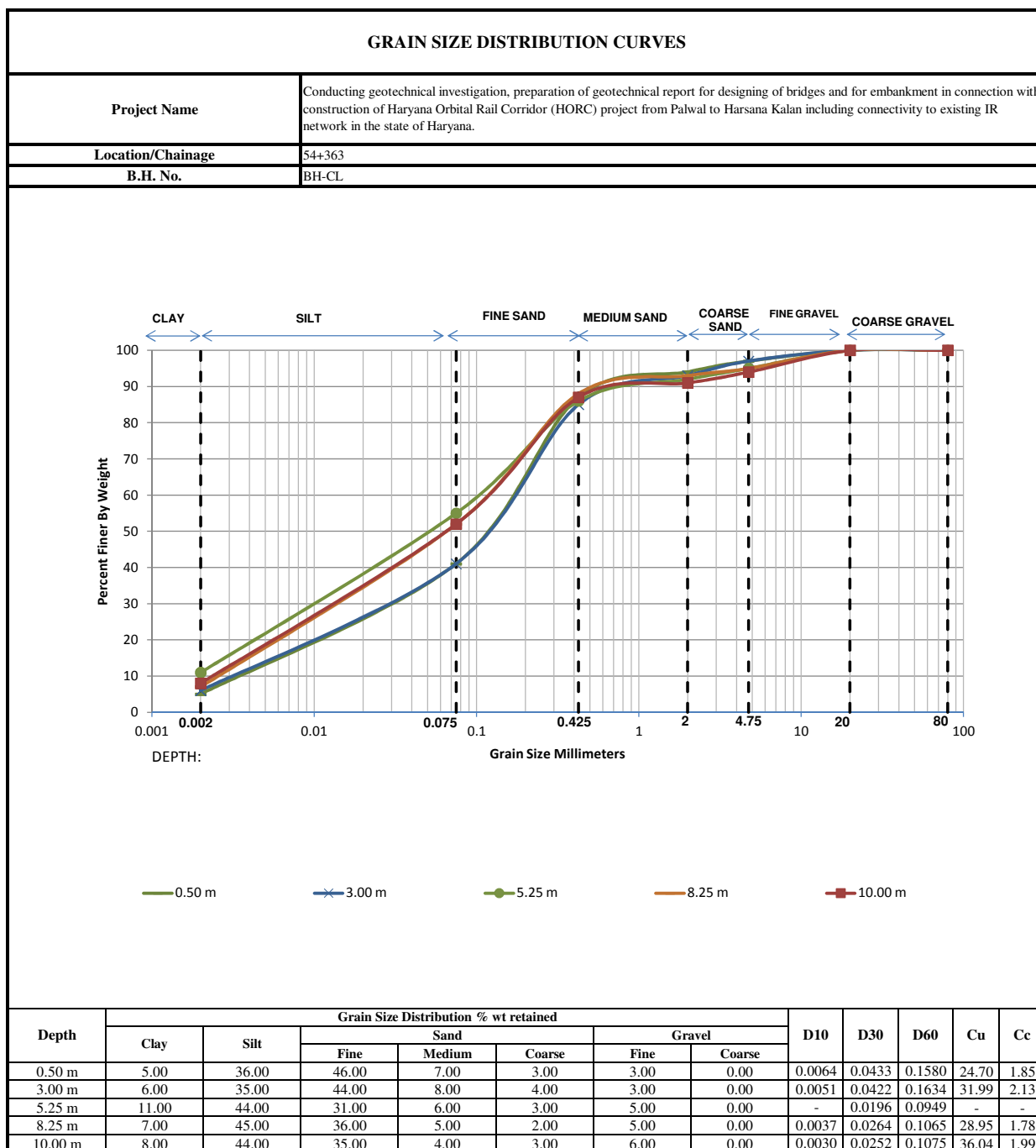


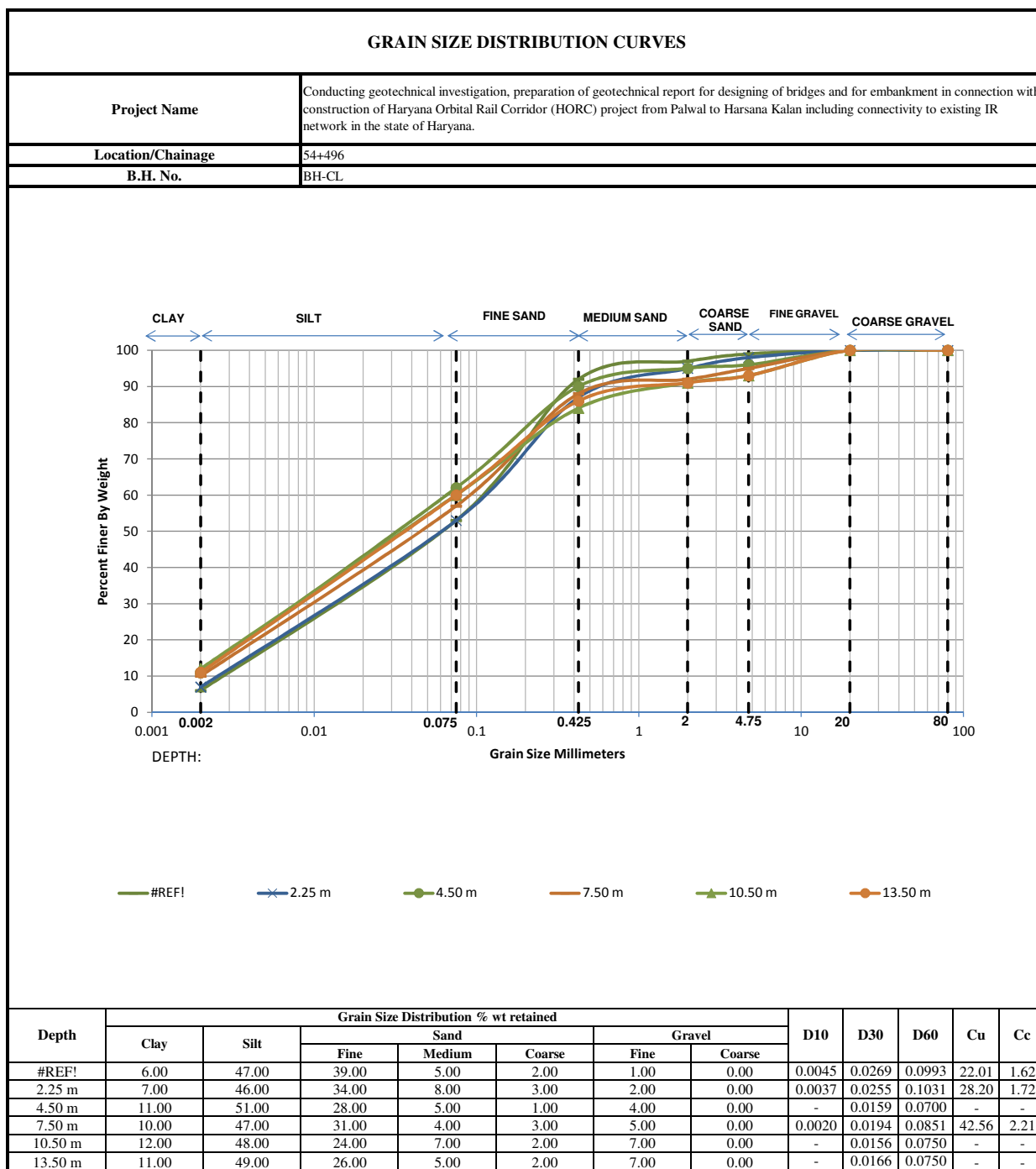
<b>GRAIN SIZE DISTRIBUTION CURVES</b>	
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	53+982
<b>B.H. No.</b>	BH-CL



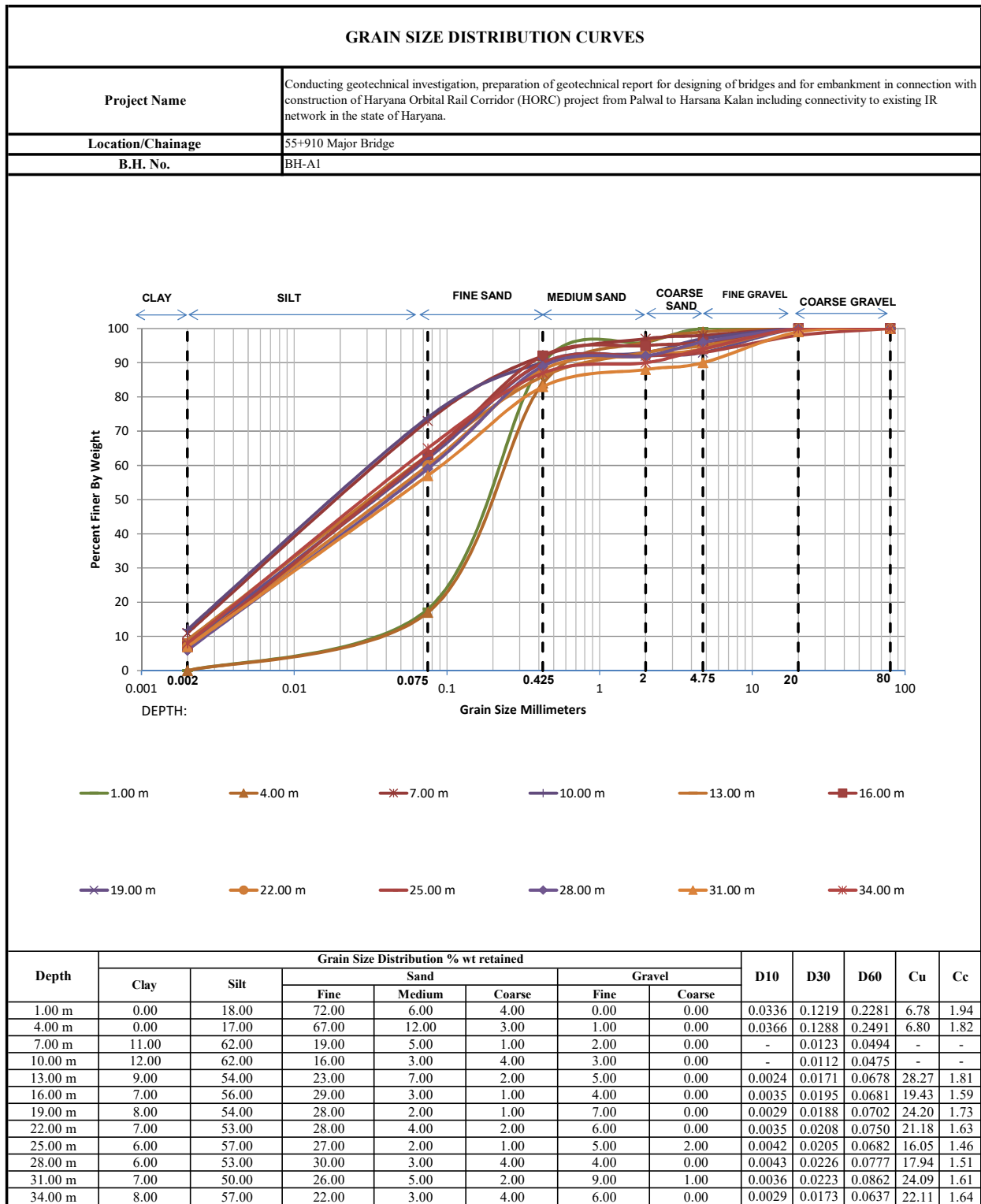
Legend for depths: 0.50 m (green line), 2.25 m (orange line with triangle), 5.25 m (green line with diamond), 7.50 m (blue line), 8.25 m (orange line)

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	12.00	56.00	25.00	5.00	2.00	0.00	0.00	-	0.0129	0.0572	-	-
2.25 m	10.00	50.00	31.00	4.00	3.00	2.00	0.00	0.0020	0.0178	0.0750	37.50	2.12
5.25 m	11.00	51.00	27.00	6.00	2.00	3.00	0.00	-	0.0158	0.0699	-	-
7.50 m	7.00	45.00	38.00	3.00	2.00	5.00	0.00	0.0037	0.0265	0.1047	28.41	1.82
8.25 m	8.00	43.00	36.00	6.00	1.00	6.00	0.00	0.0030	0.0262	0.1127	37.62	2.03

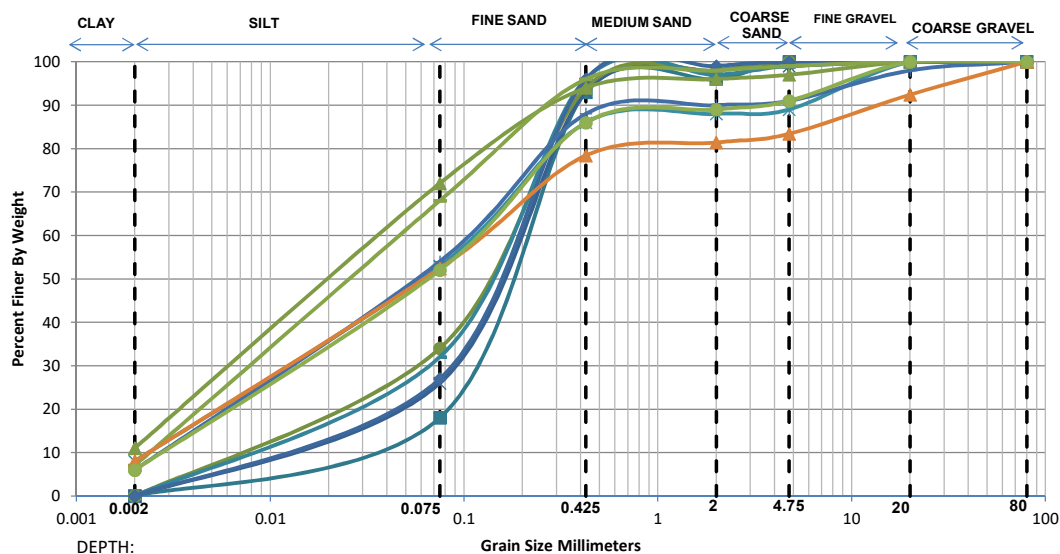








<b>GRAIN SIZE DISTRIBUTION CURVES</b>	
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	55+910 Major Bridge
<b>B.H. No.</b>	BH-A2

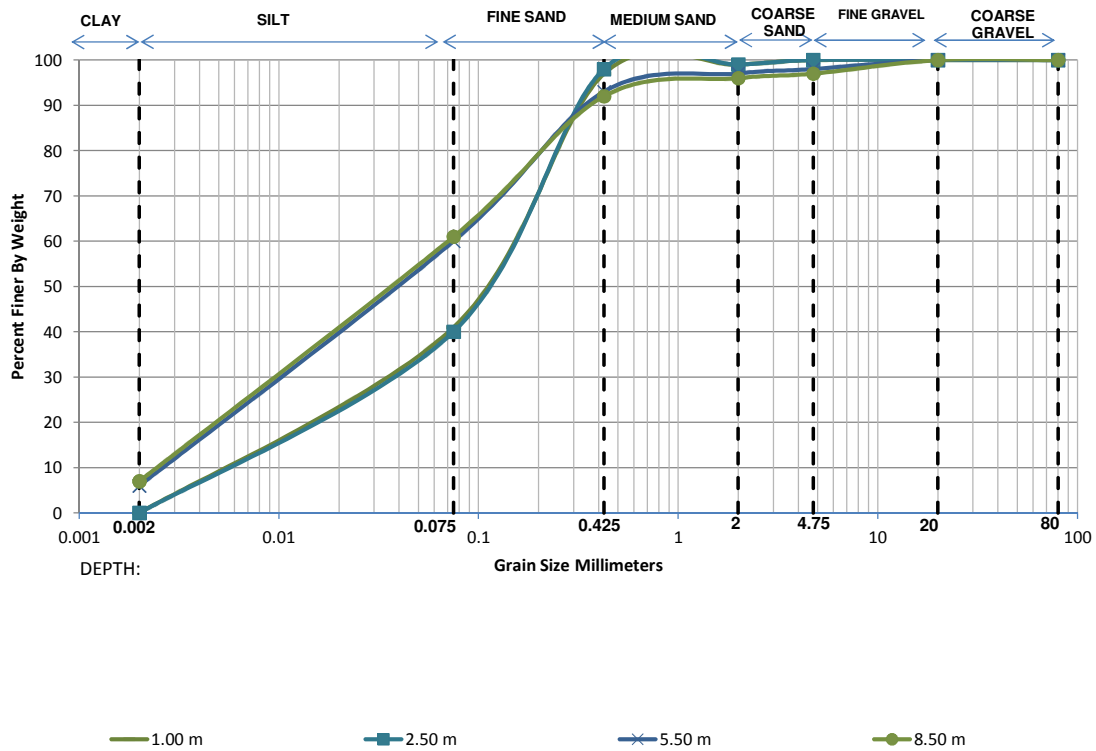


■ 2.50 m   
 × 5.50 m   
 ● 8.50 m   
 — 11.50 m   
 ◆ 14.50 m   
 ▲ 17.50 m   
 ✱ 20.50 m   
 — 23.50 m   
 — 26.50 m   
 ▲ 31.00 m   
 — 35.50 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	0.00	18.00	75.00	3.00	4.00	0.00	0.00	0.0338	0.1208	0.2209	6.53	1.95
5.50 m	0.00	26.00	67.00	5.00	1.00	1.00	0.00	0.0174	0.0892	0.1967	11.28	2.32
8.50 m	0.00	34.00	60.00	4.00	2.00	0.00	0.00	0.0107	0.0624	0.1680	15.68	2.17
11.50 m	0.00	32.00	64.00	1.00	2.00	1.00	0.00	0.0120	0.0685	0.1708	14.21	2.29
14.50 m	0.00	27.00	69.00	3.00	1.00	0.00	0.00	0.0164	0.0854	0.1875	11.44	2.37
17.50 m	11.00	61.00	22.00	2.00	1.00	3.00	0.00	-	0.0126	0.0510	-	-
20.50 m	8.00	45.00	33.00	2.00	1.00	11.00	0.00	0.0030	0.0243	0.1033	34.76	1.92
23.50 m	6.00	48.00	34.00	2.00	1.00	7.00	2.00	0.0045	0.0259	0.0969	21.71	1.55
26.50 m	7.00	61.00	28.00	2.00	1.00	1.00	0.00	0.0035	0.0176	0.0588	17.01	1.53
31.00 m	8.00	44.40	26.00	3.00	2.00	9.00	7.60	0.0030	0.0243	0.1171	39.43	1.70
35.50 m	6.00	46.00	34.00	3.00	2.00	9.00	0.00	0.0045	0.0274	0.1078	23.83	1.54

### GRAIN SIZE DISTRIBUTION CURVES

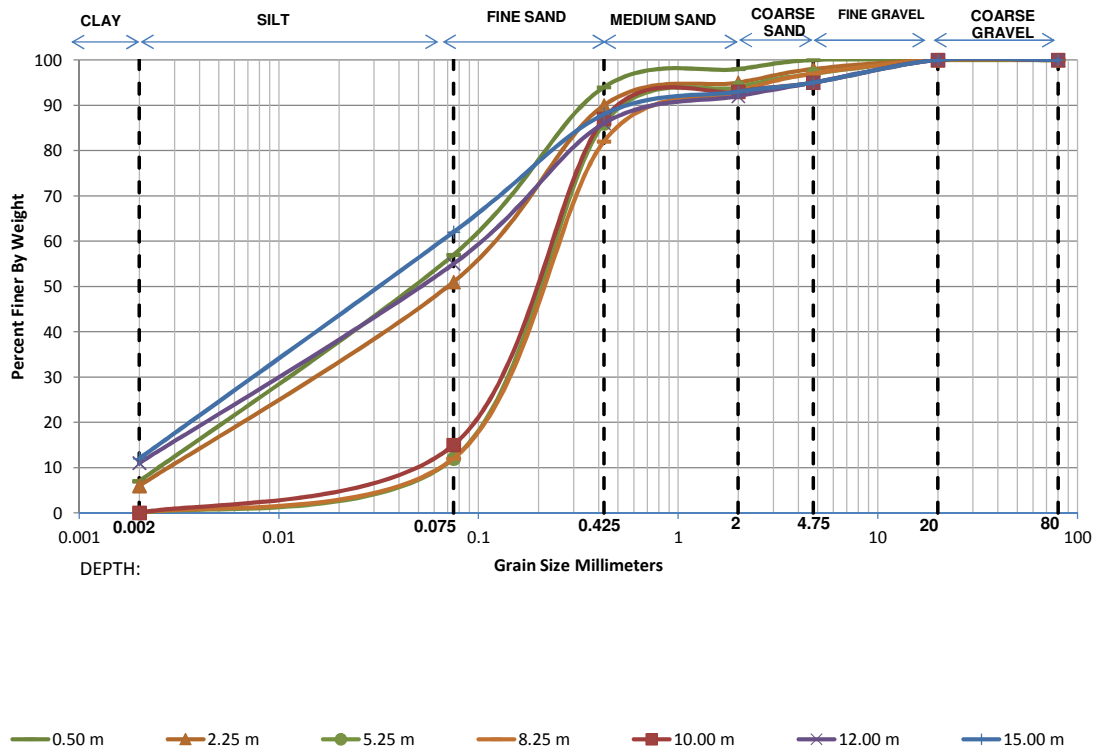
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	56+403 km
<b>B.H. No.</b>	BH-C/L



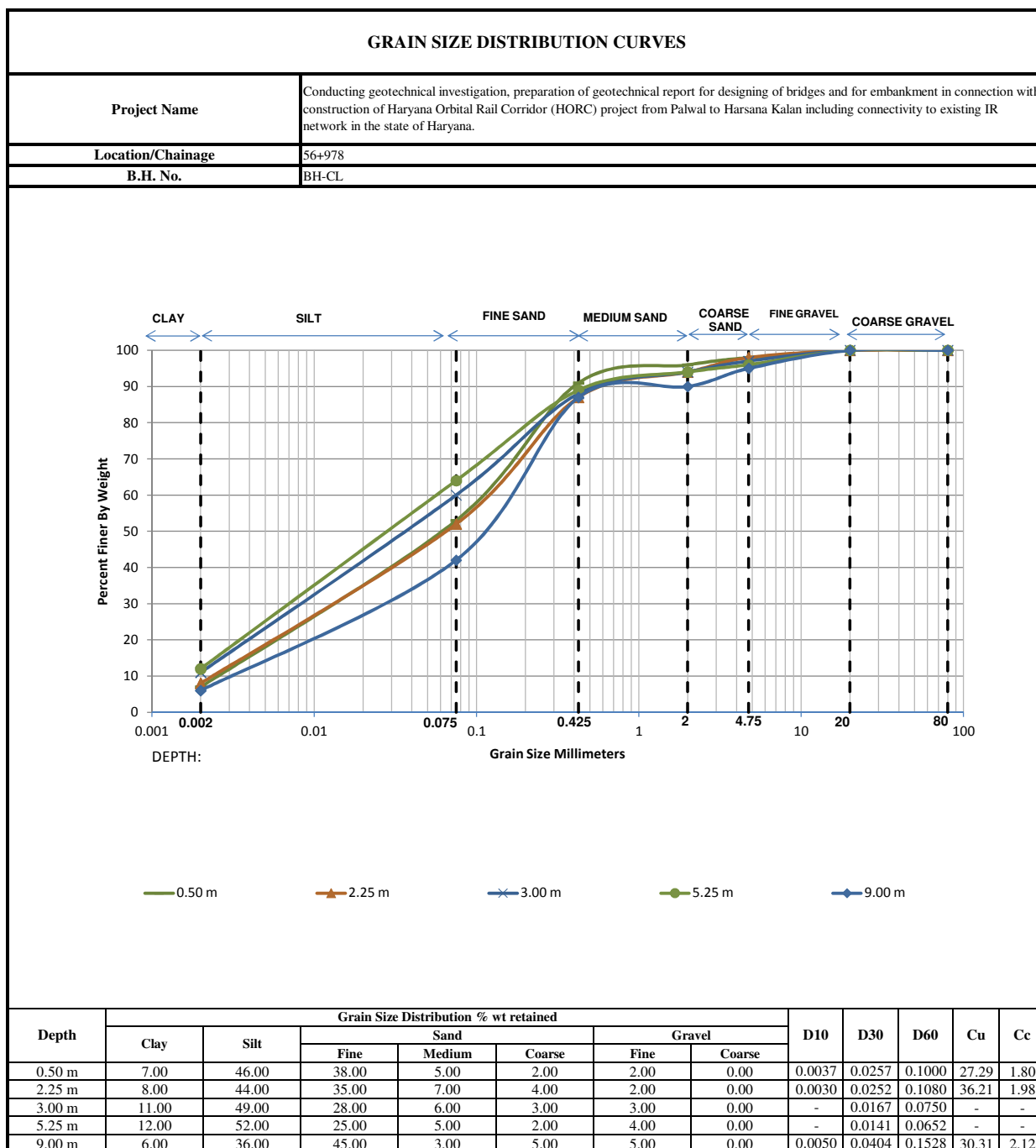
Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	41.00	56.00	2.00	1.00	0.00	0.00	0.0078	0.0457	0.1387	17.78	1.93
2.50 m	0.00	40.00	58.00	1.00	1.00	0.00	0.00	0.0082	0.0478	0.1409	17.28	1.99
5.50 m	6.00	54.00	33.00	4.00	1.00	2.00	0.00	0.0043	0.0222	0.0750	17.37	1.52
8.50 m	7.00	54.00	31.00	4.00	1.00	3.00	0.00	0.0035	0.0204	0.0726	20.55	1.63

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	56+701 Minor Bridge
<b>B.H. No.</b>	BH-CL

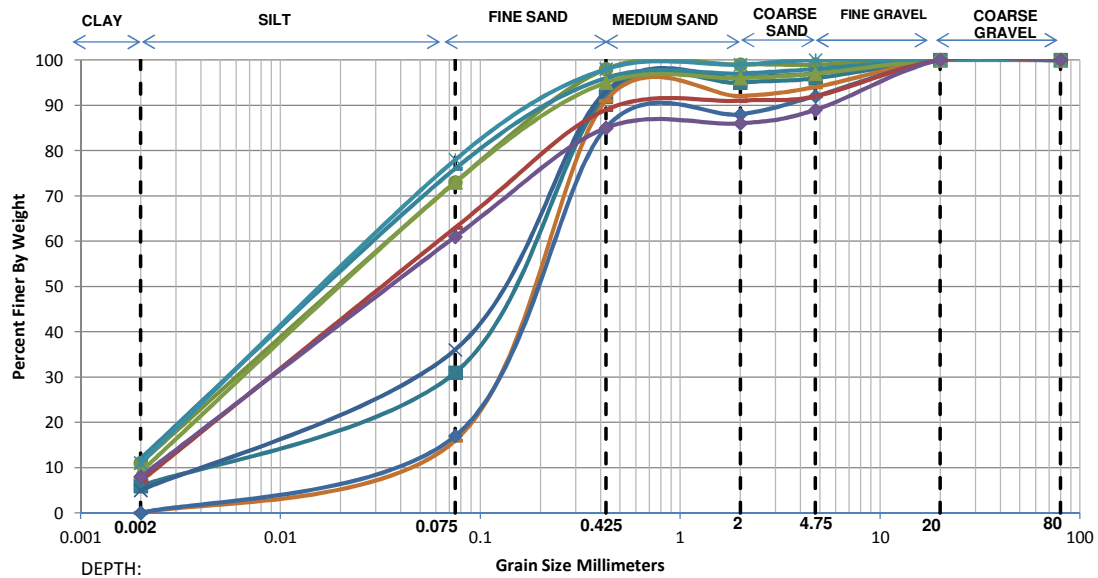


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	7.00	50.00	37.00	4.00	2.00	0.00	0.00	0.0036	0.0229	0.0838	23.31	1.74
2.25 m	6.00	45.00	39.00	5.00	3.00	2.00	0.00	0.0046	0.0286	0.1091	23.84	1.64
5.25 m	0.00	12.00	74.00	8.00	3.00	3.00	0.00	0.0622	0.1513	0.2562	4.12	1.44
8.25 m	0.00	12.00	70.00	11.00	4.00	3.00	0.00	0.0620	0.1538	0.2691	4.34	1.42
10.00 m	0.00	15.00	72.00	6.00	2.00	5.00	0.00	0.0453	0.1364	0.2444	5.40	1.68
12.00 m	11.00	44.00	31.00	6.00	3.00	5.00	0.00	-	0.0196	0.0949	-	-
15.00 m	12.00	50.00	26.00	5.00	2.00	5.00	0.00	-	0.0149	0.0698	-	-



### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-A1

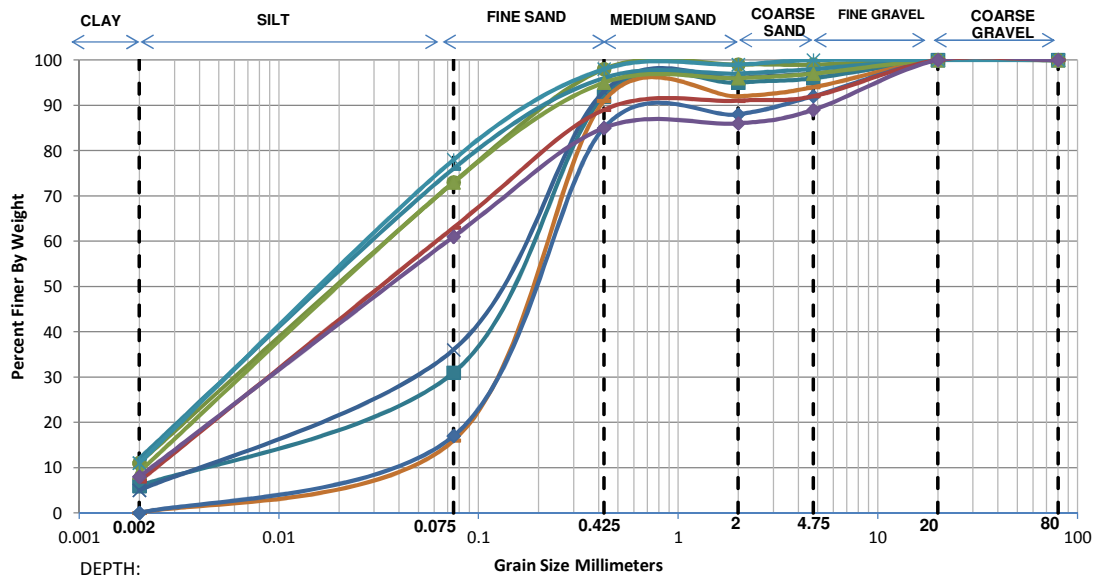


■ 2.50 m   
 × 5.50 m   
 ● 8.50 m   
 — 11.50 m   
 — 13.00 m   
 ◆ 14.50 m   
 ▲ 17.50 m   
 ✱ 20.50 m   
 — 25.00 m   
 ◆ 28.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	6.00	25.00	61.00	3.00	1.00	4.00	0.00	0.0066	0.0711	0.1859	28.09	4.11
5.50 m	5.00	31.00	57.00	3.00	1.00	3.00	0.00	0.0072	0.0552	0.1653	22.99	2.57
8.50 m	11.00	62.00	25.00	1.00	0.00	1.00	0.00	-	0.0125	0.0498	-	-
11.50 m	12.00	64.00	20.00	1.00	1.00	2.00	0.00	-	0.0110	0.0452	-	-
13.00 m	0.00	16.00	75.00	1.00	2.00	6.00	0.00	0.0411	0.1300	0.2304	5.61	1.78
14.50 m	0.00	17.00	68.00	3.00	4.00	8.00	0.00	0.0367	0.1278	0.2432	6.62	1.83
17.50 m	9.00	64.00	22.00	1.00	1.00	3.00	0.00	0.0024	0.0141	0.0504	21.17	1.66
20.50 m	11.00	67.00	20.00	1.00	1.00	0.00	0.00	-	0.0114	0.0434	-	-
25.00 m	7.00	56.00	26.00	2.00	1.00	8.00	0.00	0.0035	0.0193	0.0681	19.43	1.57
28.00 m	8.00	53.00	24.00	1.00	3.00	11.00	0.00	0.0029	0.0190	0.0725	24.96	1.72

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P2

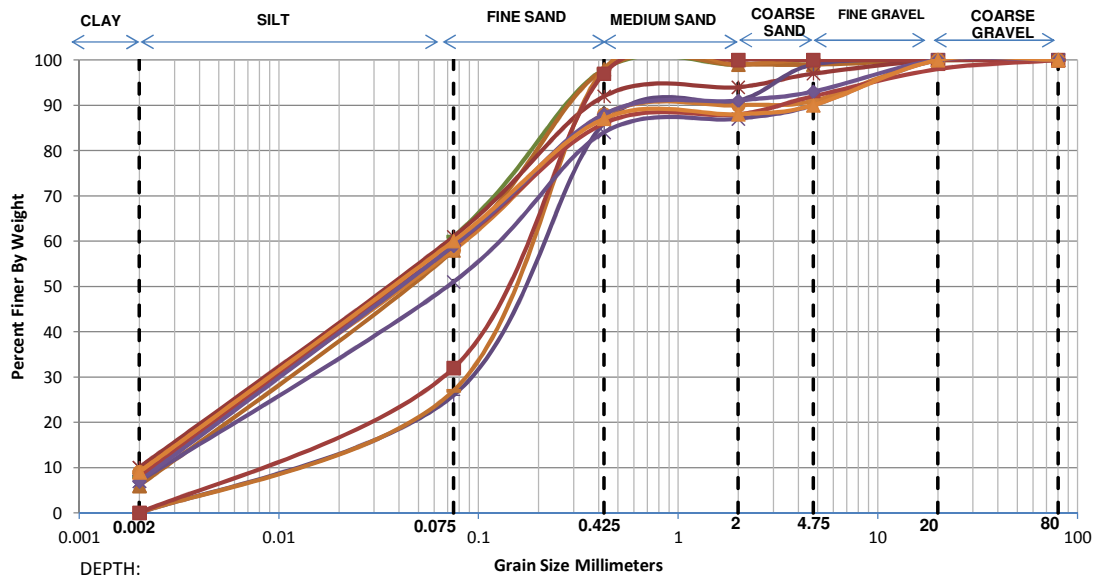


■ 2.50 m   
 × 5.50 m   
 ● 8.50 m   
 — 11.50 m   
 — 13.00 m   
 ◆ 14.50 m   
 ▲ 17.50 m   
 ✱ 20.50 m   
 — 25.00 m   
 ◆ 28.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	7.00	51.00	36.00	2.00	3.00	1.00	0.00	0.0036	0.0222	0.0806	22.51	1.72
5.50 m	9.00	67.00	11.00	4.00	3.00	6.00	0.00	0.0024	0.0132	0.0460	19.38	1.58
8.50 m	7.00	52.00	33.00	2.00	3.00	3.00	0.00	0.0036	0.0215	0.0777	21.81	1.68
11.50 m	8.00	56.00	30.00	1.00	1.00	4.00	0.00	0.0029	0.0180	0.0660	22.81	1.71
14.50 m	11.00	50.00	32.00	4.00	2.00	1.00	0.00	-	0.0164	0.0724	-	-
17.50 m	10.00	60.00	26.00	1.00	1.00	2.00	0.00	0.0020	0.0141	0.0546	27.29	1.81
20.50 m	6.00	56.00	33.00	1.00	2.00	2.00	0.00	0.0043	0.0212	0.0704	16.46	1.50
23.50 m	7.00	56.00	29.00	5.00	1.00	2.00	0.00	0.0035	0.0195	0.0681	19.43	1.59
26.50 m	9.00	62.00	25.00	2.00	0.00	2.00	0.00	0.0024	0.0147	0.0534	22.38	1.69
29.50 m	7.00	52.00	27.00	1.00	3.00	10.00	0.00	0.0036	0.0212	0.0778	21.91	1.63

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P3



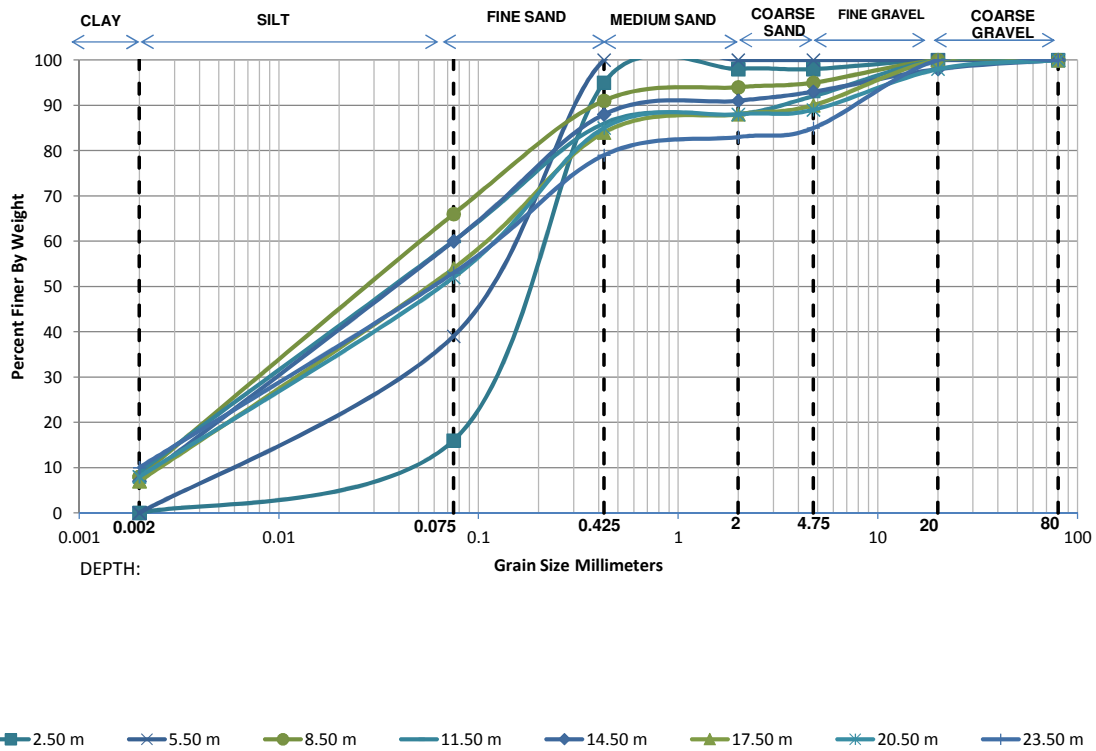
— 1.00 m  
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 — 7.00 m  
 — 10.00 m  
 — 13.00 m  
 — 16.00 m  
 — 19.00 m  
 — 22.00 m  
 — 25.00 m  
 — 28.00 m  
 — 31.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	8.00	53.00	37.00	1.00	1.00	0.00	0.00	0.0029	0.0196	0.0726	24.93	1.82
4.00 m	6.00	52.00	40.00	1.00	0.00	1.00	0.00	0.0044	0.0236	0.0803	18.33	1.59
7.00 m	10.00	51.00	31.00	2.00	3.00	3.00	0.00	0.0020	0.0174	0.0725	36.24	2.08
10.00 m	0.00	26.00	60.00	5.00	8.00	1.00	0.00	0.0171	0.0898	0.2134	12.46	2.21
13.00 m	0.00	27.00	71.00	1.00	1.00	0.00	0.00	0.0165	0.0852	0.1839	11.16	2.40
16.00 m	0.00	32.00	65.00	3.00	0.00	0.00	0.00	0.0120	0.0685	0.1698	14.09	2.30
19.00 m	7.00	44.00	33.00	3.00	3.00	10.00	0.00	0.0037	0.0271	0.1154	31.25	1.72
22.00 m	9.00	49.00	30.00	2.00	1.00	9.00	0.00	0.0024	0.0198	0.0812	33.72	2.00
25.00 m	8.00	51.00	27.00	2.00	4.00	6.00	2.00	0.0029	0.0201	0.0779	26.68	1.79
28.00 m	7.00	52.00	29.00	3.00	2.00	7.00	0.00	0.0036	0.0213	0.0778	21.88	1.65
31.00 m	9.00	51.00	27.00	1.00	2.00	10.00	0.00	0.0024	0.0186	0.0750	31.21	1.92



### GRAIN SIZE DISTRIBUTION CURVES

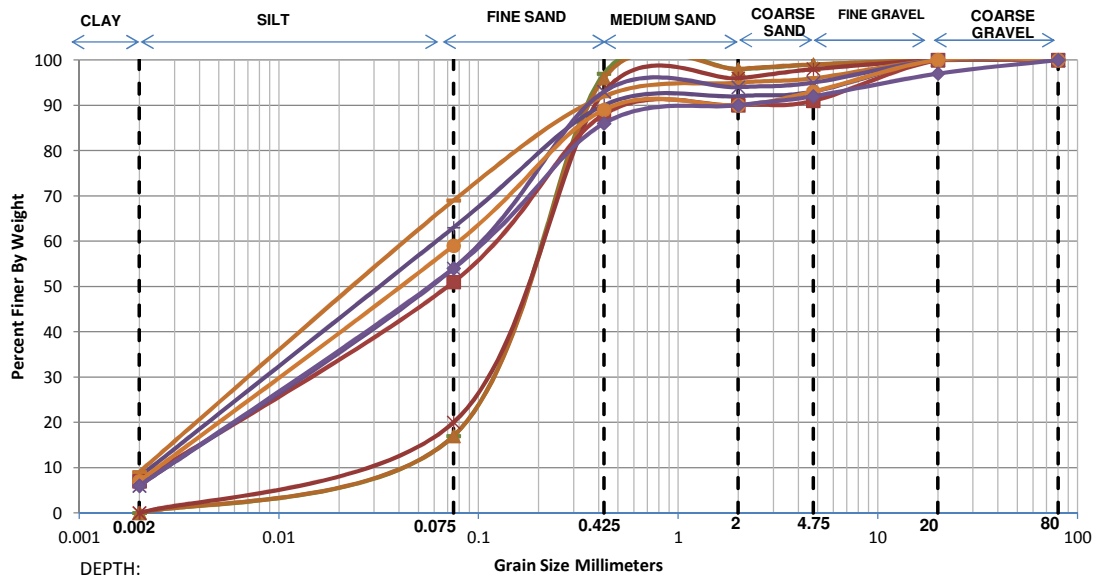
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P4



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	0.00	16.00	79.00	3.00	0.00	2.00	0.00	0.0414	0.1287	0.2232	5.40	1.80
5.50 m	0.00	39.00	61.00	0.00	0.00	0.00	0.00	0.0086	0.0501	0.1964	22.95	1.49
8.50 m	8.00	58.00	25.00	3.00	1.00	5.00	0.00	0.0029	0.0171	0.0619	21.51	1.64
11.50 m	9.00	51.00	26.00	2.00	4.00	8.00	0.00	0.0024	0.0186	0.0750	31.21	1.91
14.50 m	7.00	53.00	28.00	3.00	2.00	5.00	2.00	0.0035	0.0208	0.0750	21.18	1.63
17.50 m	7.00	47.00	30.00	4.00	2.00	10.00	0.00	0.0036	0.0245	0.1002	27.58	1.65
20.50 m	8.00	44.00	33.00	3.00	1.00	9.00	2.00	0.0030	0.0251	0.1094	36.68	1.93
23.50 m	10.00	43.00	26.00	4.00	2.00	15.00	0.00	0.0020	0.0217	0.1129	56.43	2.09

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P5

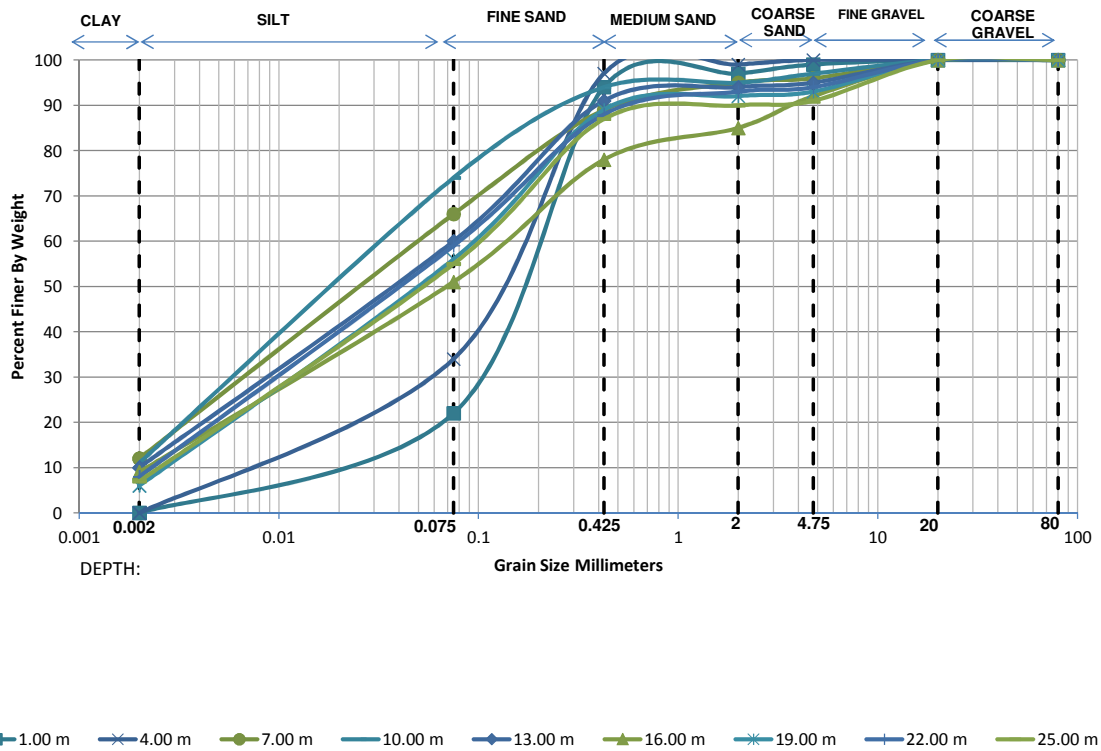


— 1.00 m   
 — 4.00 m   
 — 7.00 m   
 — 10.00 m   
 — 13.00 m   
 — 16.00 m   
 — 19.00 m   
 — 22.00 m   
 — 28.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	17.00	80.00	1.00	1.00	1.00	0.00	0.0376	0.1238	0.2162	5.76	1.89
4.00 m	0.00	17.00	79.00	2.00	1.00	1.00	0.00	0.0375	0.1241	0.2182	5.82	1.88
7.00 m	0.00	20.00	73.00	3.00	2.00	2.00	0.00	0.0281	0.1125	0.2148	7.63	2.10
10.00 m	8.00	55.00	27.00	2.00	1.00	7.00	0.00	0.0029	0.0183	0.0680	23.48	1.70
13.00 m	9.00	60.00	23.00	3.00	1.00	4.00	0.00	0.0024	0.0151	0.0563	23.61	1.70
16.00 m	7.00	44.00	37.00	2.00	1.00	9.00	0.00	0.0037	0.0273	0.1106	29.87	1.82
19.00 m	6.00	48.00	39.00	1.00	1.00	5.00	0.00	0.0045	0.0262	0.0945	21.10	1.62
22.00 m	7.00	52.00	30.00	1.00	3.00	7.00	0.00	0.0036	0.0214	0.0777	21.85	1.65
28.00 m	6.00	48.00	32.00	4.00	2.00	5.00	3.00	0.0045	0.0258	0.0984	22.08	1.51

### GRAIN SIZE DISTRIBUTION CURVES

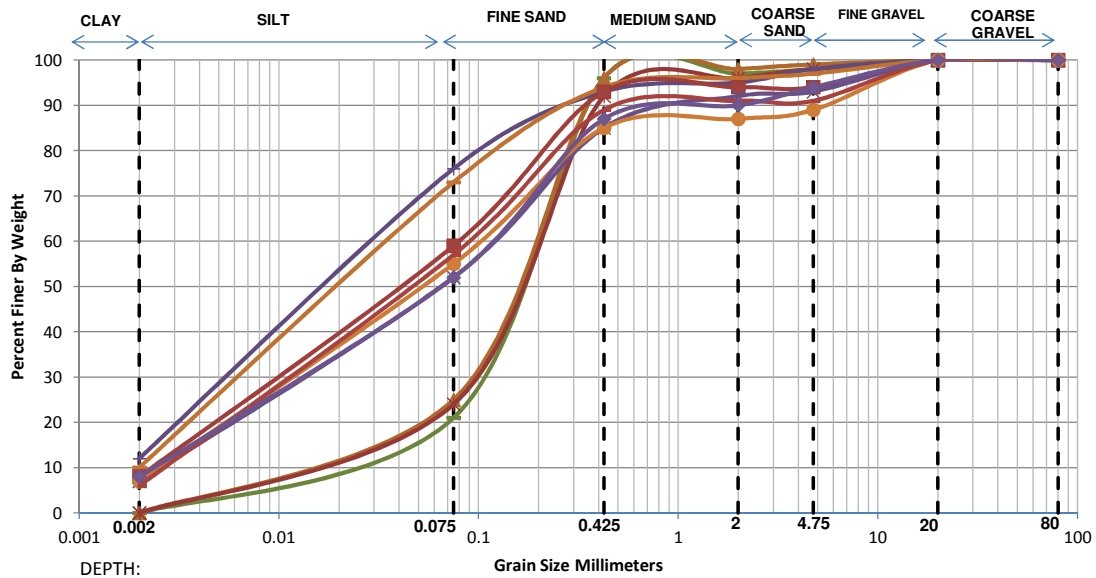
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P6



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	22.00	72.00	3.00	2.00	1.00	0.00	0.0238	0.1043	0.2068	8.70	2.22
4.00 m	0.00	34.00	63.00	2.00	1.00	0.00	0.00	0.0108	0.0626	0.1629	15.08	2.23
7.00 m	12.00	54.00	23.00	6.00	1.00	4.00	0.00	-	0.0134	0.0609	-	-
10.00 m	11.00	63.00	20.00	1.00	2.00	3.00	0.00	-	0.0121	0.0481	-	-
13.00 m	10.00	50.00	31.00	3.00	1.00	5.00	0.00	0.0020	0.0178	0.0750	37.50	2.12
16.00 m	9.00	42.00	27.00	7.00	7.00	8.00	0.00	0.0024	0.0245	0.1290	53.15	1.91
19.00 m	6.00	50.00	33.00	3.00	1.00	7.00	0.00	0.0044	0.0245	0.0882	20.02	1.54
22.00 m	8.00	51.00	29.00	5.00	1.00	6.00	0.00	0.0029	0.0202	0.0778	26.65	1.80
25.00 m	7.00	48.00	32.00	3.00	1.00	9.00	0.00	0.0036	0.0239	0.0933	25.79	1.69

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P7

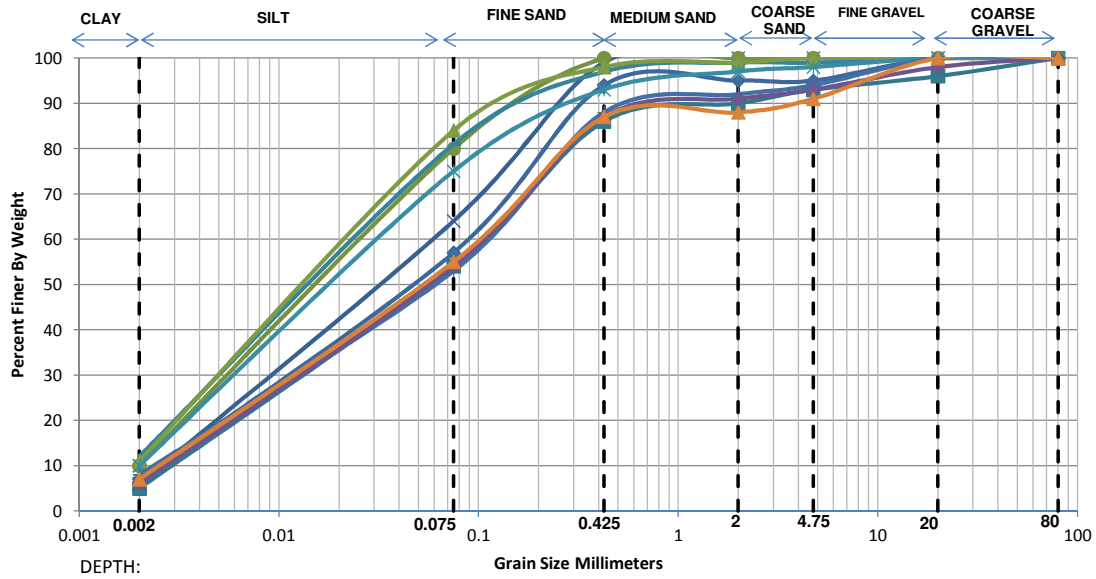


— 1.00 m   
 —▲— 4.00 m   
 —✖— 7.00 m   
 —✕— 10.00 m   
 —■— 13.00 m   
 —■— 16.00 m   
 —✕— 19.00 m   
 —●— 22.00 m   
 —■— 25.00 m   
 —●— 28.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	21.00	75.00	1.00	1.00	2.00	0.00	0.0260	0.1078	0.2057	7.93	2.18
4.00 m	0.00	25.00	71.00	2.00	1.00	1.00	0.00	0.0189	0.0926	0.1936	10.25	2.34
7.00 m	0.00	24.00	68.00	4.00	2.00	2.00	0.00	0.0202	0.0969	0.2048	10.15	2.27
10.00 m	12.00	64.00	17.00	2.00	3.00	2.00	0.00	-	0.0109	0.0450	-	-
13.00 m	10.00	63.00	21.00	2.00	1.00	3.00	0.00	0.0020	0.0132	0.0499	24.97	1.74
16.00 m	8.00	51.00	34.00	1.00	0.00	6.00	0.00	0.0029	0.0205	0.0777	26.56	1.85
19.00 m	7.00	45.00	33.00	7.00	1.00	7.00	0.00	0.0037	0.0262	0.1099	29.91	1.70
22.00 m	7.00	48.00	30.00	2.00	2.00	11.00	0.00	0.0036	0.0238	0.0943	26.08	1.66
25.00 m	6.00	51.00	32.00	2.00	0.00	9.00	0.00	0.0044	0.0238	0.0844	19.26	1.53
28.00 m	8.00	44.00	35.00	3.00	4.00	6.00	0.00	0.0030	0.0252	0.1074	35.98	1.99

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P9

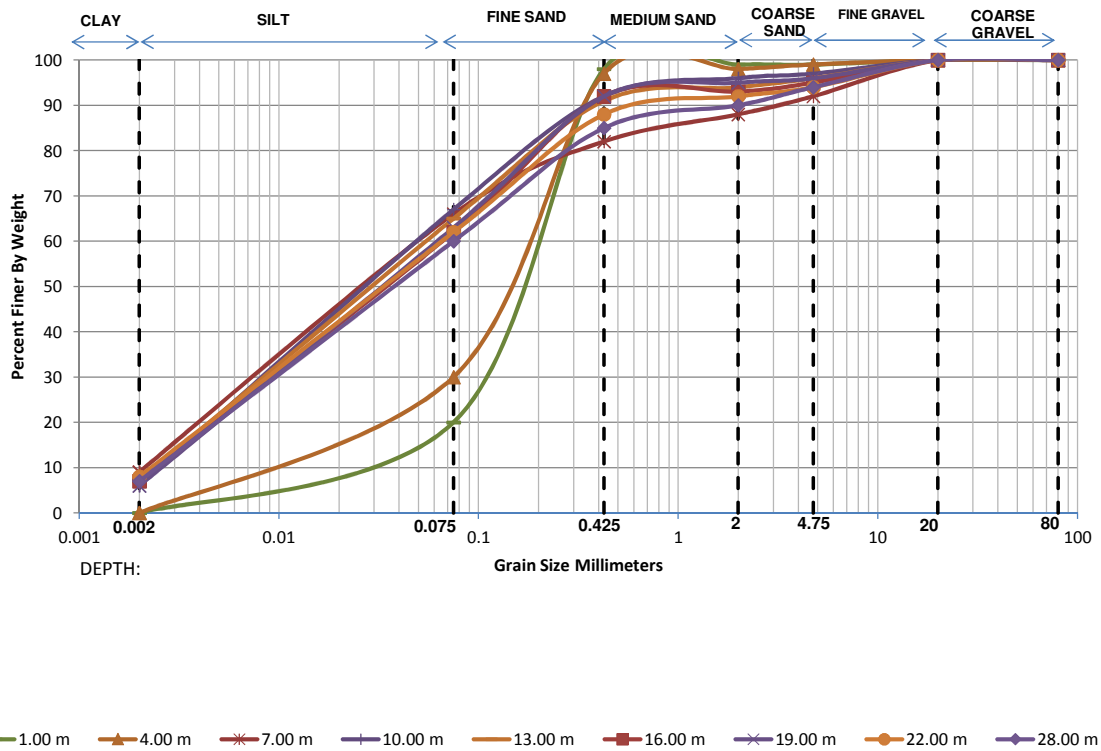


■ 2.50 m   
 × 5.50 m   
 ● 8.50 m   
 — 11.50 m   
 ◆ 14.50 m   
 ▲ 17.50 m   
 ✱ 20.50 m   
 + 23.50 m   
 ◆ 28.00 m   
 ▲ 31.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	5.00	49.00	32.00	4.00	3.00	3.00	4.00	0.0055	0.0270	0.0982	17.97	1.36
5.50 m	6.00	58.00	35.00	1.00	0.00	0.00	0.00	0.0042	0.0205	0.0664	15.63	1.49
8.50 m	10.00	70.00	20.00	0.00	0.00	0.00	0.00	0.0020	0.0119	0.0418	20.91	1.68
11.50 m	12.00	69.00	16.00	2.00	0.00	1.00	0.00	-	0.0101	0.0396	-	-
14.50 m	7.00	50.00	37.00	1.00	0.00	5.00	0.00	0.0036	0.0229	0.0837	23.29	1.74
17.50 m	11.00	73.00	14.00	1.00	1.00	0.00	0.00	-	0.0104	0.0374	-	-
20.50 m	10.00	65.00	18.00	4.00	1.00	2.00	0.00	0.0020	0.0127	0.0472	23.59	1.71
23.50 m	8.00	45.00	35.00	4.00	2.00	6.00	0.00	0.0030	0.0244	0.1021	34.32	1.97
28.00 m	6.00	48.00	33.00	4.00	2.00	5.00	2.00	0.0045	0.0258	0.0978	21.91	1.53
31.00 m	7.00	48.00	32.00	1.00	3.00	9.00	0.00	0.0036	0.0239	0.0931	25.74	1.69

### GRAIN SIZE DISTRIBUTION CURVES

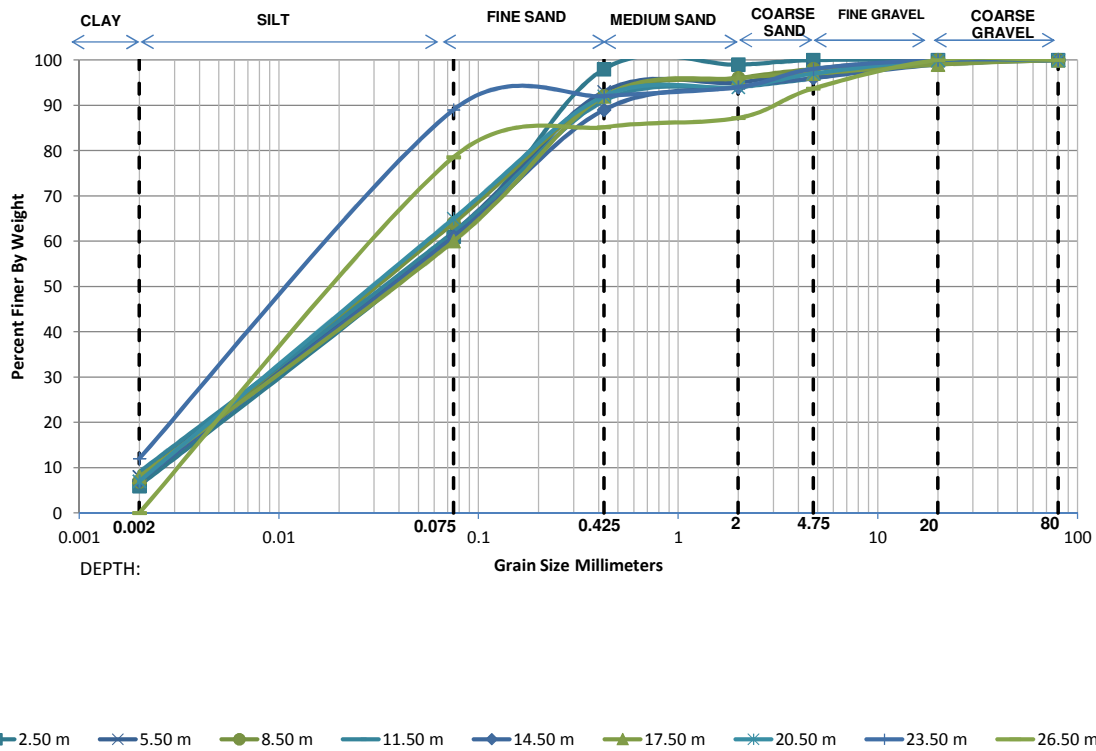
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P10



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	20.00	78.00	1.00	0.00	1.00	0.00	0.0284	0.1114	0.2055	7.23	2.12
4.00 m	0.00	30.00	67.00	1.00	1.00	1.00	0.00	0.0135	0.0750	0.1758	12.98	2.36
7.00 m	9.00	57.00	16.00	6.00	4.00	8.00	0.00	0.0024	0.0158	0.0613	25.66	1.70
10.00 m	6.00	61.00	25.00	4.00	1.00	3.00	0.00	0.0042	0.0190	0.0606	14.50	1.42
13.00 m	7.00	58.00	26.00	3.00	2.00	4.00	0.00	0.0035	0.0186	0.0640	18.38	1.55
16.00 m	7.00	55.00	30.00	1.00	2.00	5.00	0.00	0.0035	0.0199	0.0703	19.98	1.61
19.00 m	6.00	57.00	29.00	3.00	1.00	4.00	0.00	0.0043	0.0206	0.0683	16.05	1.47
22.00 m	8.00	54.00	26.00	4.00	2.00	6.00	0.00	0.0029	0.0187	0.0702	24.20	1.72
28.00 m	7.00	53.00	25.00	5.00	4.00	6.00	0.00	0.0035	0.0206	0.0750	21.20	1.60

### GRAIN SIZE DISTRIBUTION CURVES

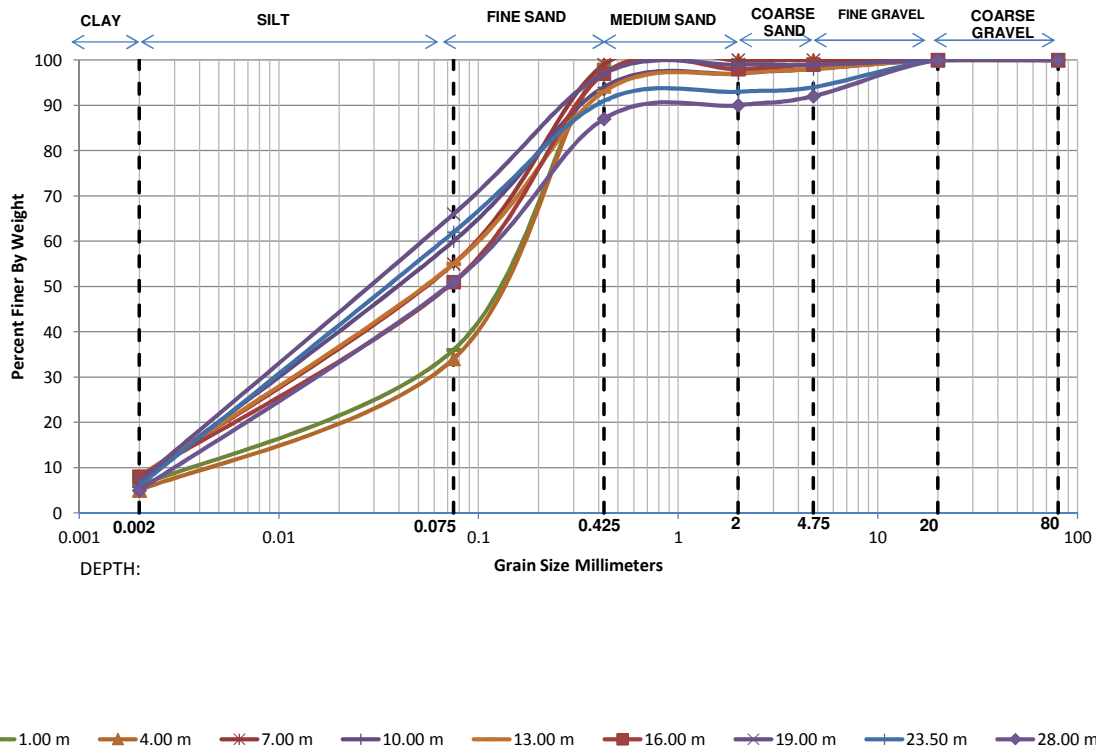
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P11



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	6.00	55.00	37.00	1.00	1.00	0.00	0.00	0.0043	0.0219	0.0727	16.88	1.53
5.50 m	8.00	54.00	31.00	2.00	3.00	2.00	0.00	0.0029	0.0189	0.0703	24.20	1.75
8.50 m	7.00	57.00	28.00	4.00	2.00	2.00	0.00	0.0035	0.0190	0.0661	18.90	1.57
11.50 m	9.00	53.00	29.00	3.00	2.00	4.00	0.00	0.0024	0.0178	0.0701	29.23	1.88
14.50 m	7.00	54.00	28.00	5.00	2.00	3.00	1.00	0.0035	0.0203	0.0726	20.57	1.61
17.50 m	8.00	52.00	32.00	4.00	1.00	2.00	1.00	0.0029	0.0199	0.0750	25.72	1.81
20.50 m	7.00	58.00	27.00	2.00	3.00	3.00	0.00	0.0035	0.0186	0.0641	18.39	1.55
23.50 m	12.00	77.00	3.00	2.00	4.00	2.00	0.00	-	0.0090	0.0325	-	-
26.50 m	0.00	78.55	6.60	2.05	6.50	6.30	0.00	0.0032	0.0129	0.0449	13.96	1.15

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P12

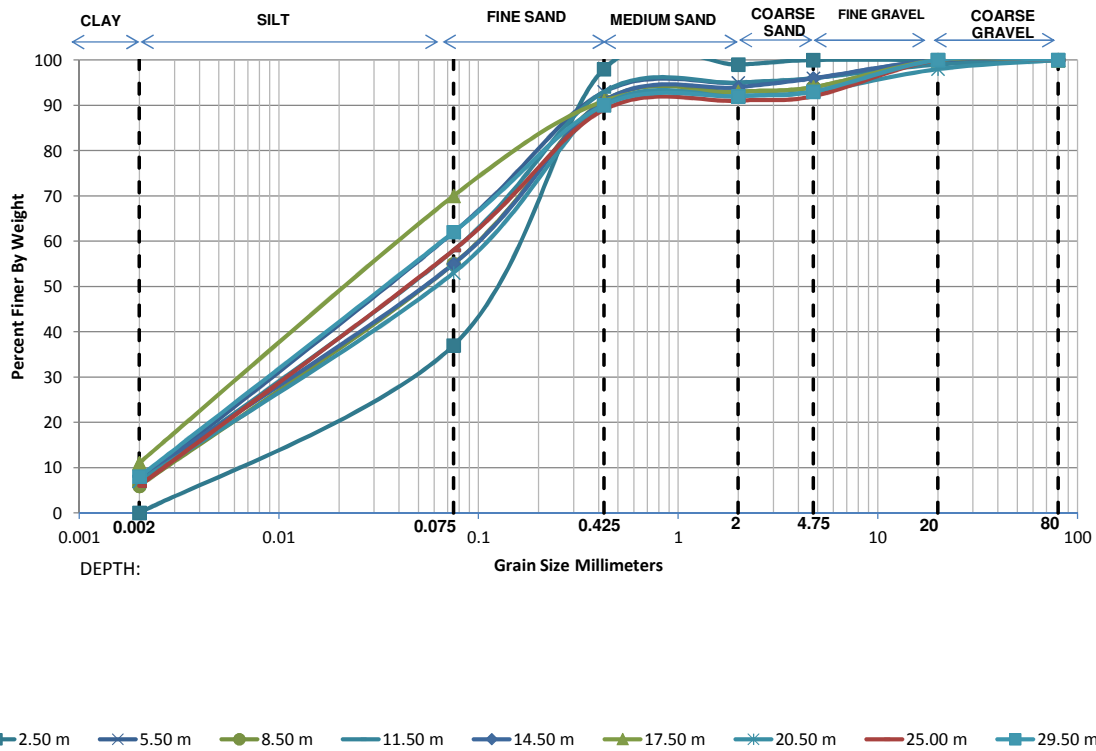


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	6.00	30.00	63.00	1.00	0.00	0.00	0.00	0.0057	0.0550	0.1571	27.35	3.35
4.00 m	5.00	29.00	65.00	1.00	0.00	0.00	0.00	0.0077	0.0613	0.1633	21.27	3.00
7.00 m	8.00	47.00	44.00	1.00	0.00	0.00	0.00	0.0030	0.0235	0.0898	30.30	2.07
10.00 m	7.00	53.00	34.00	3.00	1.00	2.00	0.00	0.0035	0.0211	0.0750	21.13	1.67
13.00 m	8.00	47.00	38.00	4.00	1.00	2.00	0.00	0.0030	0.0231	0.0913	30.87	1.98
16.00 m	8.00	43.00	46.00	1.00	1.00	1.00	0.00	0.0030	0.0268	0.1047	34.83	2.28
19.00 m	7.00	59.00	31.00	2.00	0.00	1.00	0.00	0.0035	0.0184	0.0623	17.92	1.56
23.50 m	6.00	56.00	29.00	2.00	1.00	6.00	0.00	0.0043	0.0211	0.0704	16.48	1.48
28.00 m	5.00	46.00	36.00	3.00	2.00	8.00	0.00	0.0056	0.0297	0.1113	19.81	1.41



### GRAIN SIZE DISTRIBUTION CURVES

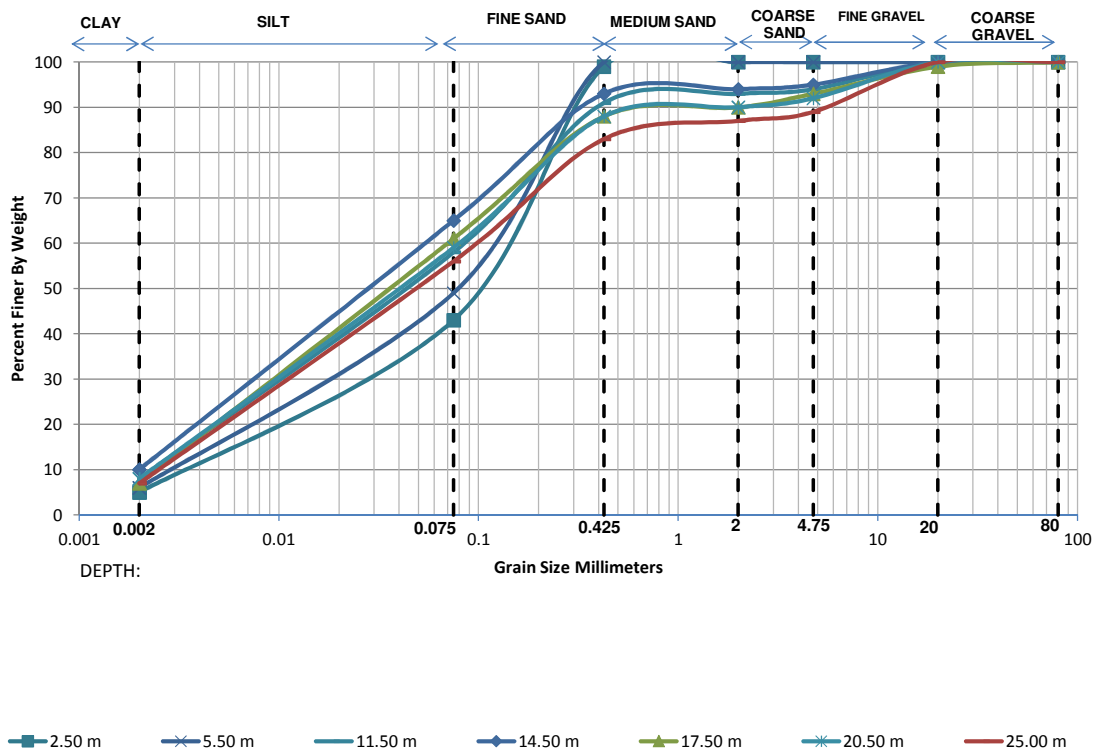
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P13



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	0.00	37.00	61.00	1.00	1.00	0.00	0.00	0.0093	0.0546	0.1512	16.22	2.12
5.50 m	7.00	55.00	31.00	2.00	1.00	4.00	0.00	0.0035	0.0200	0.0703	19.98	1.61
8.50 m	6.00	49.00	36.00	2.00	1.00	6.00	0.00	0.0044	0.0253	0.0915	20.59	1.57
11.50 m	7.00	51.00	35.00	2.00	1.00	3.00	1.00	0.0036	0.0222	0.0806	22.53	1.71
14.50 m	8.00	47.00	36.00	3.00	2.00	4.00	0.00	0.0030	0.0230	0.0919	31.08	1.95
17.50 m	11.00	59.00	21.00	2.00	1.00	6.00	0.00	-	0.0130	0.0540	-	-
20.50 m	7.00	46.00	37.00	2.00	1.00	5.00	2.00	0.0037	0.0257	0.1003	27.37	1.79
25.00 m	6.00	52.00	31.00	2.00	1.00	8.00	0.00	0.0044	0.0232	0.0809	18.56	1.52
29.50 m	8.00	54.00	28.00	2.00	1.00	7.00	0.00	0.0029	0.0188	0.0702	24.20	1.73

### GRAIN SIZE DISTRIBUTION CURVES

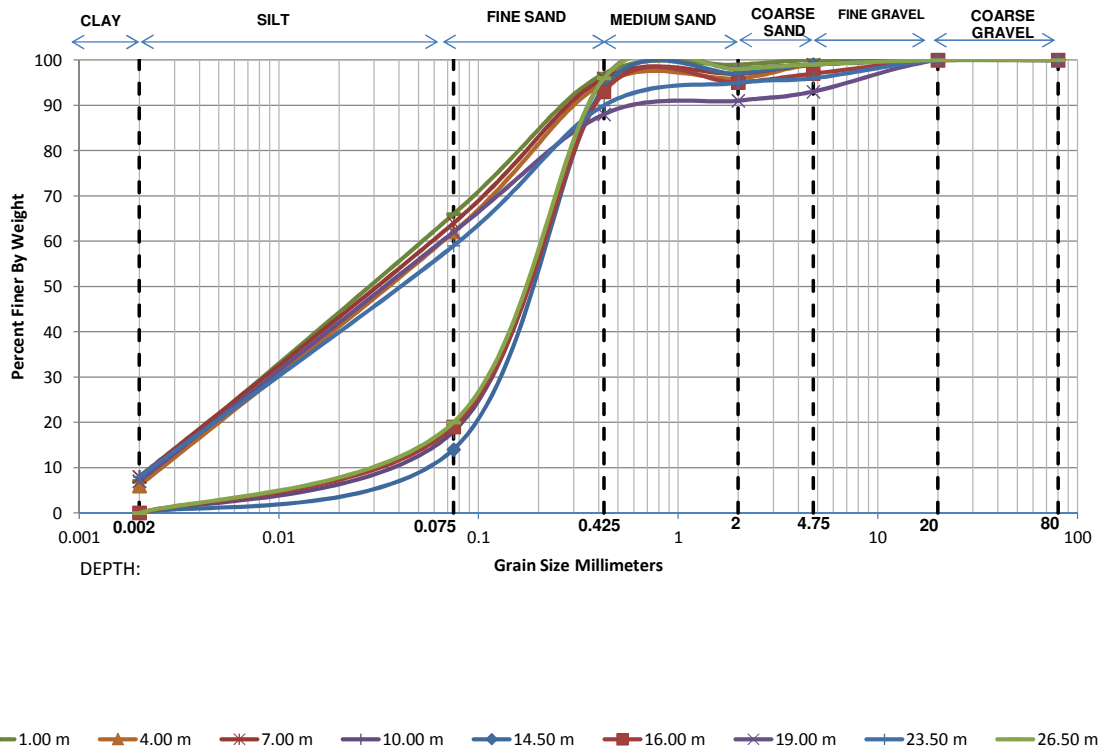
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P15



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	5.00	38.00	56.00	1.00	0.00	0.00	0.00	0.0063	0.0406	0.1317	20.98	2.00
5.50 m	6.00	43.00	51.00	0.00	0.00	0.00	0.00	0.0047	0.0313	0.1352	28.82	1.55
11.50 m	8.00	50.00	33.00	2.00	1.00	6.00	0.00	0.0029	0.0210	0.0808	27.59	1.86
14.50 m	10.00	55.00	28.00	1.00	1.00	5.00	0.00	0.0020	0.0156	0.0635	31.76	1.93
17.50 m	7.00	54.00	27.00	2.00	3.00	6.00	1.00	0.0035	0.0203	0.0726	20.57	1.60
20.50 m	8.00	51.00	29.00	2.00	2.00	8.00	0.00	0.0029	0.0202	0.0778	26.64	1.80
25.00 m	7.00	49.00	27.00	4.00	2.00	11.00	0.00	0.0036	0.0229	0.0909	25.28	1.61

### GRAIN SIZE DISTRIBUTION CURVES

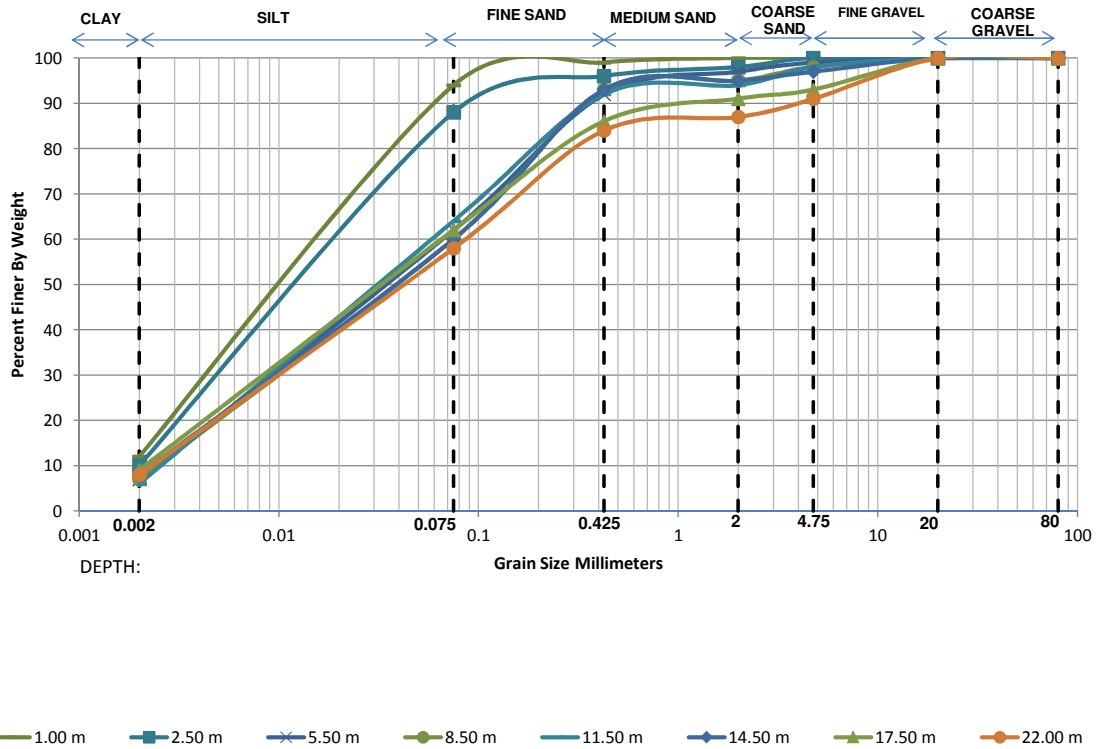
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P16



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	7.00	59.00	31.00	2.00	1.00	0.00	0.00	0.0035	0.0184	0.0623	17.92	1.56
4.00 m	6.00	56.00	33.00	1.00	3.00	1.00	0.00	0.0043	0.0212	0.0704	16.46	1.50
7.00 m	8.00	56.00	32.00	1.00	2.00	1.00	0.00	0.0029	0.0181	0.0660	22.82	1.72
10.00 m	0.00	18.00	78.00	2.00	1.00	1.00	0.00	0.0340	0.1200	0.2151	6.32	1.97
14.50 m	0.00	14.00	80.00	3.00	2.00	1.00	0.00	0.0508	0.1379	0.2311	4.55	1.62
16.00 m	0.00	19.00	74.00	2.00	2.00	3.00	0.00	0.0308	0.1166	0.2176	7.06	2.03
19.00 m	7.00	55.00	26.00	3.00	2.00	7.00	0.00	0.0035	0.0198	0.0703	19.99	1.58
23.50 m	8.00	51.00	31.00	5.00	1.00	4.00	0.00	0.0029	0.0204	0.0778	26.61	1.82
26.50 m	0.00	20.00	76.00	2.00	1.00	1.00	0.00	0.0283	0.1118	0.2090	7.38	2.11

### GRAIN SIZE DISTRIBUTION CURVES

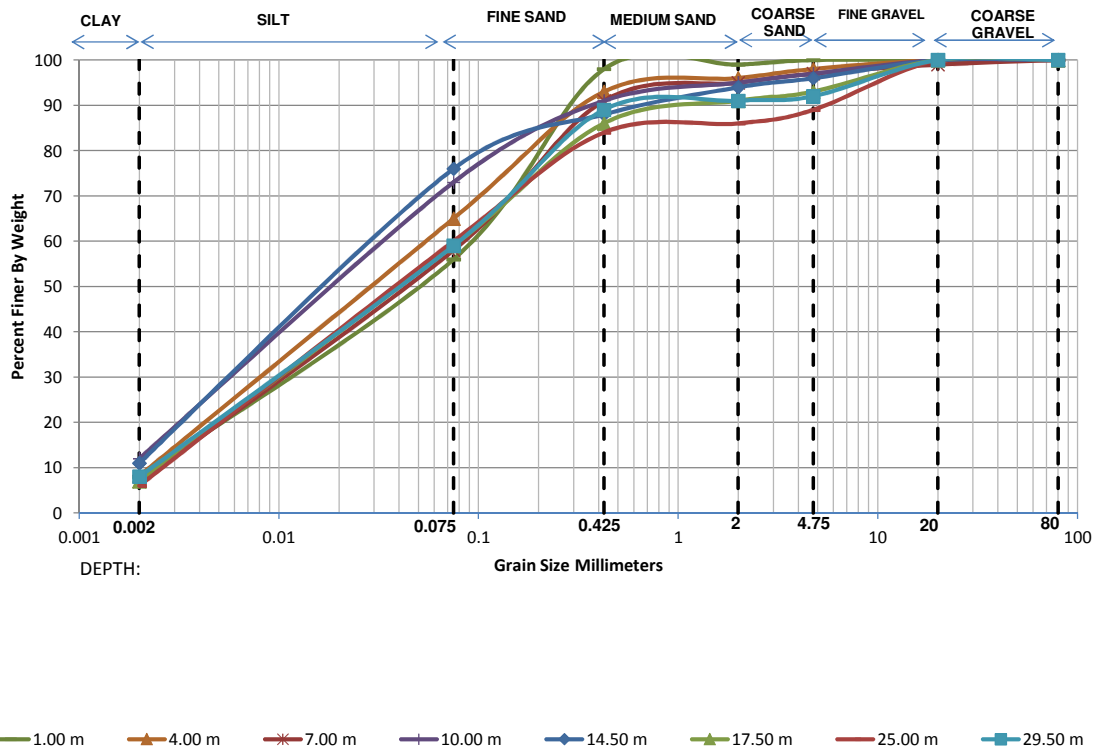
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P17



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	12.00	82.00	5.00	1.00	0.00	0.00	0.00	-	0.0087	0.0296	-	-
2.50 m	10.00	78.00	8.00	2.00	2.00	0.00	0.00	0.0020	0.0106	0.0346	17.29	1.62
5.50 m	7.00	55.00	30.00	5.00	2.00	1.00	0.00	0.0035	0.0199	0.0703	19.98	1.61
8.50 m	7.00	53.00	33.00	2.00	3.00	2.00	0.00	0.0035	0.0210	0.0750	21.14	1.66
11.50 m	6.00	58.00	28.00	2.00	4.00	2.00	0.00	0.0042	0.0202	0.0662	15.64	1.45
14.50 m	8.00	52.00	33.00	2.00	2.00	3.00	0.00	0.0029	0.0199	0.0750	25.71	1.82
17.50 m	9.00	53.00	24.00	5.00	2.00	7.00	0.00	0.0024	0.0176	0.0701	29.21	1.84
22.00 m	8.00	50.00	26.00	3.00	4.00	9.00	0.00	0.0029	0.0206	0.0817	27.91	1.78

### GRAIN SIZE DISTRIBUTION CURVES

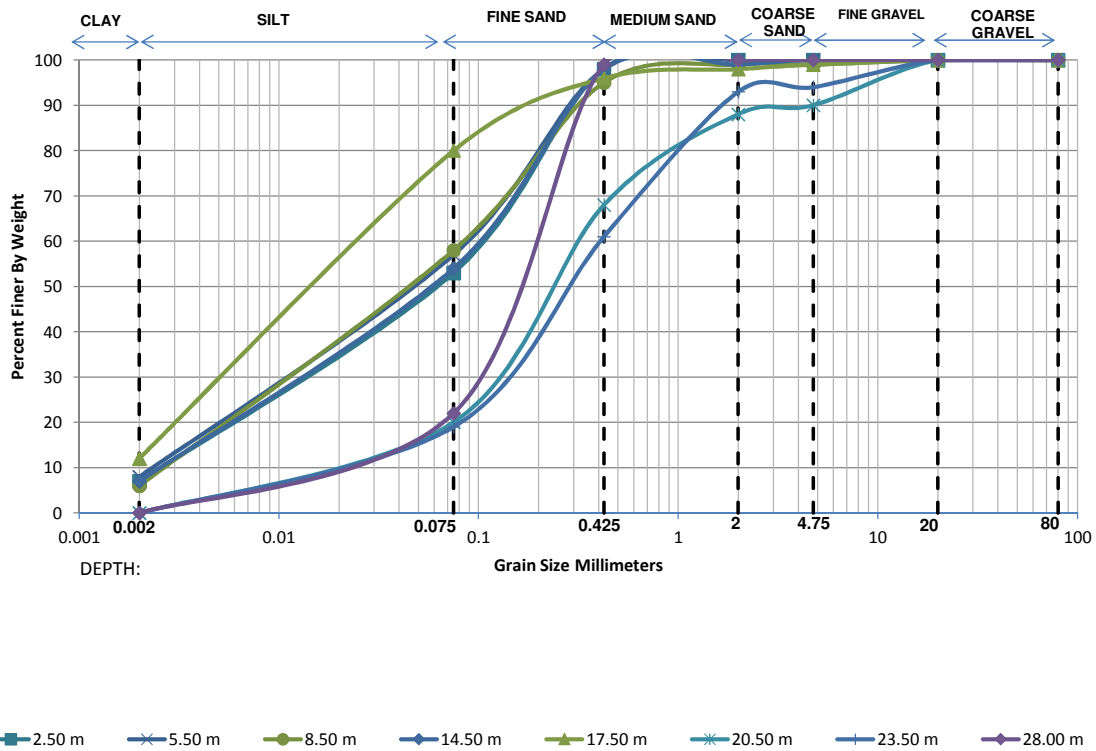
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P18



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	8.00	48.00	42.00	1.00	1.00	0.00	0.00	0.0030	0.0227	0.0866	29.34	2.01
4.00 m	8.20	56.80	28.00	3.00	2.00	2.00	0.00	0.0028	0.0174	0.0639	22.99	1.70
7.00 m	7.00	51.00	33.00	4.00	2.00	2.00	1.00	0.0036	0.0221	0.0808	22.60	1.69
10.00 m	12.00	61.00	18.00	4.00	2.00	3.00	0.00	-	0.0115	0.0490	-	-
14.50 m	11.00	65.00	12.00	6.00	2.00	4.00	0.00	-	0.0115	0.0452	-	-
17.50 m	7.00	52.00	27.00	5.00	2.00	7.00	0.00	0.0036	0.0212	0.0779	21.92	1.63
25.00 m	6.00	54.00	24.00	2.00	3.00	11.00	0.00	0.0043	0.0217	0.0750	17.45	1.47
29.50 m	8.00	51.00	30.00	2.00	1.00	8.00	0.00	0.0029	0.0203	0.0778	26.62	1.81

### GRAIN SIZE DISTRIBUTION CURVES

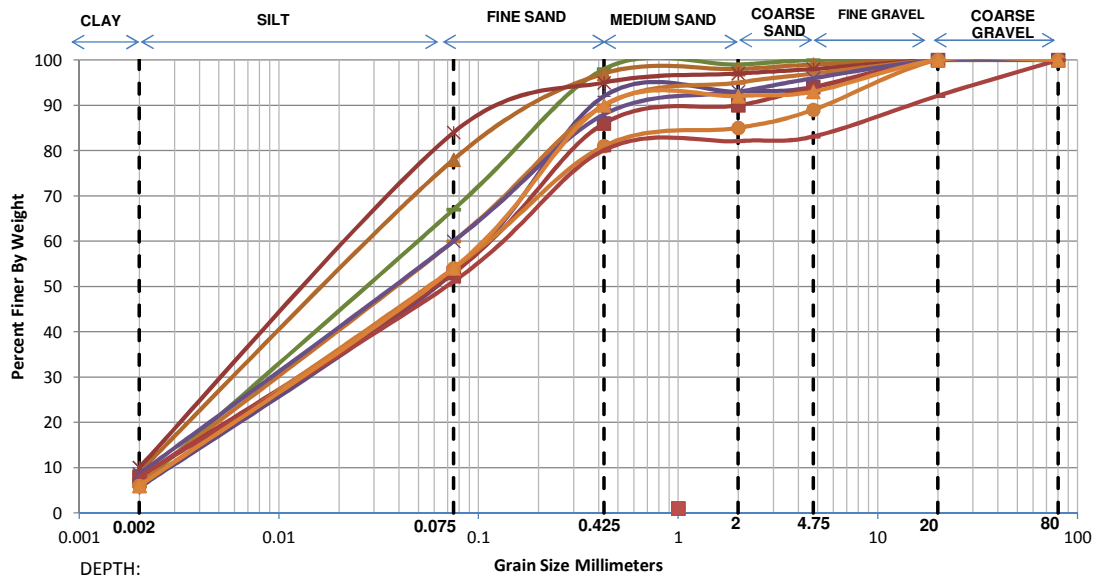
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-P19



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	7.00	46.00	45.00	2.00	0.00	0.00	0.00	0.0037	0.0261	0.0968	26.31	1.92
5.50 m	8.00	49.00	41.00	2.00	0.00	0.00	0.00	0.0029	0.0220	0.0834	28.34	1.97
8.50 m	6.00	52.00	37.00	4.00	0.00	0.00	1.00	0.0044	0.0235	0.0804	18.40	1.57
14.50 m	7.00	47.00	44.00	1.00	1.00	0.00	0.00	0.0037	0.0253	0.0932	25.48	1.88
17.50 m	12.00	68.00	16.00	2.00	1.00	1.00	0.00	-	0.0103	0.0406	-	-
20.50 m	0.00	20.00	48.00	20.00	2.00	10.00	0.00	0.0263	0.1227	0.3303	12.54	1.73
23.50 m	0.00	19.00	42.00	32.00	1.00	6.00	0.00	0.0283	0.1357	0.4110	14.54	1.58
28.00 m	0.00	22.00	77.00	1.00	0.00	0.00	0.00	0.0240	0.1034	0.1979	8.24	2.25

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	57+400 Major Bridge
<b>B.H. No.</b>	BH-A2

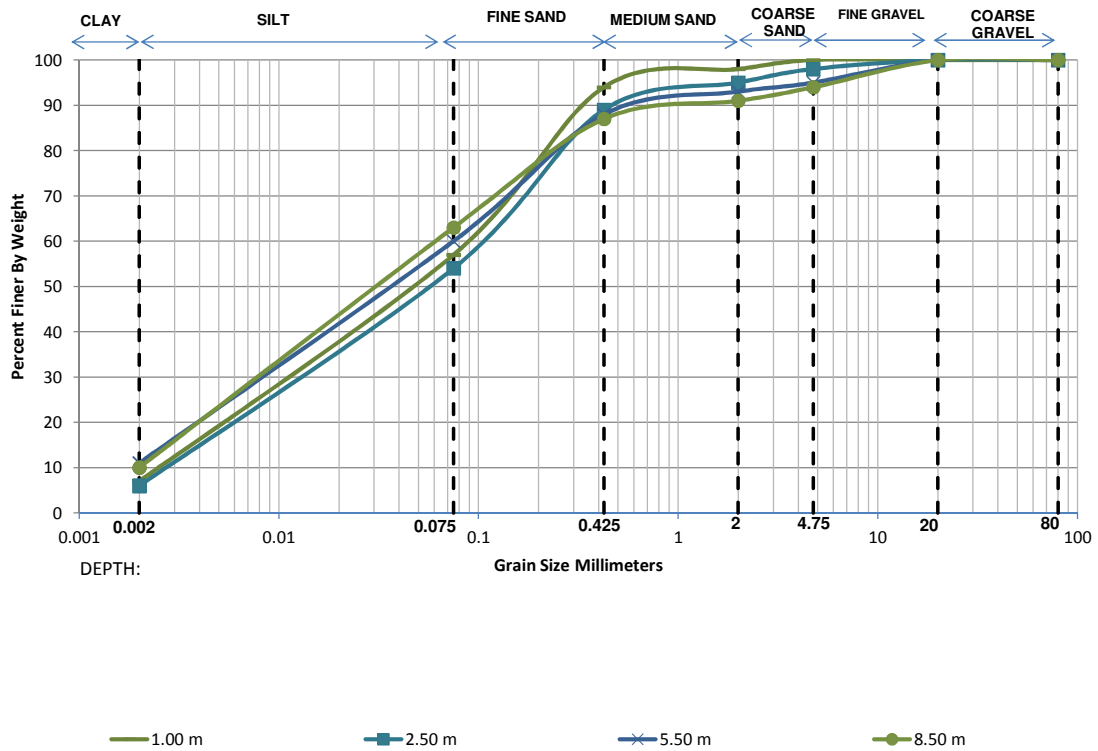


— 1.00 m  
 —▲ 4.00 m  
 —✕ 7.00 m  
 —+ 10.00 m  
 — 13.00 m  
 —■ 16.00 m  
 —× 19.00 m  
 —● 22.00 m  
 — 25.00 m  
 —▲ 31.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	6.00	61.00	31.00	1.00	1.00	0.00	0.00	0.0042	0.0192	0.0608	14.52	1.45
4.00 m	9.00	69.00	19.00	1.00	1.00	1.00	0.00	0.0024	0.0130	0.0443	18.66	1.61
7.00 m	10.00	74.00	11.00	2.00	1.00	2.00	0.00	0.0020	0.0111	0.0377	18.86	1.64
10.00 m	5.60	47.40	39.00	1.00	1.00	6.00	0.00	0.0049	0.0274	0.0988	20.17	1.56
13.00 m	7.00	53.00	30.00	5.00	2.00	3.00	0.00	0.0035	0.0209	0.0750	21.16	1.64
16.00 m	8.00	45.00	33.00	4.00	4.00	6.00	0.00	0.0030	0.0243	0.1036	34.87	1.92
19.00 m	8.60	51.40	28.00	5.00	3.00	4.00	0.00	0.0026	0.0191	0.0750	28.91	1.87
22.00 m	6.00	48.00	27.00	4.00	4.00	11.00	0.00	0.0044	0.0254	0.1030	23.19	1.41
25.00 m	8.00	43.10	29.00	2.00	1.00	9.00	7.90	0.0030	0.0256	0.1214	40.64	1.81
31.00 m	6.00	48.00	36.00	2.00	1.00	7.00	0.00	0.0045	0.0260	0.0959	21.45	1.58

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+191
<b>B.H. No.</b>	BH-CL

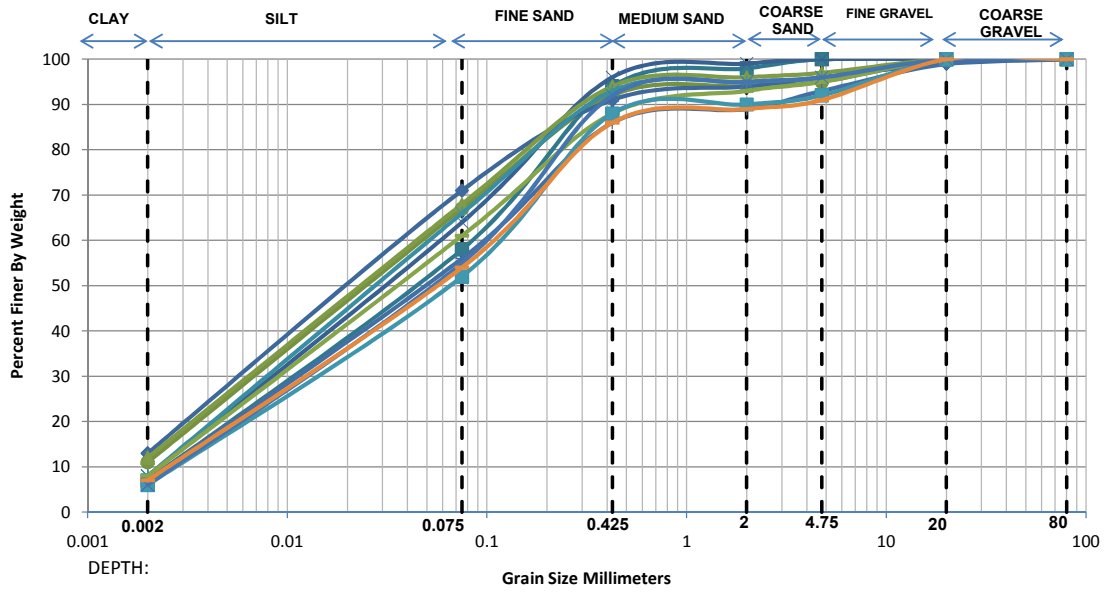


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	7.00	50.00	37.00	4.00	2.00	0.00	0.00	0.0036	0.0229	0.0838	23.31	1.74
2.50 m	6.00	48.00	35.00	6.00	3.00	2.00	0.00	0.0045	0.0259	0.0968	21.66	1.56
5.50 m	11.00	49.00	28.00	5.00	2.00	5.00	0.00	-	0.0167	0.0750	-	-
8.50 m	10.00	53.00	24.00	4.00	3.00	6.00	0.00	0.0020	0.0162	0.0677	33.83	1.94



### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-A1

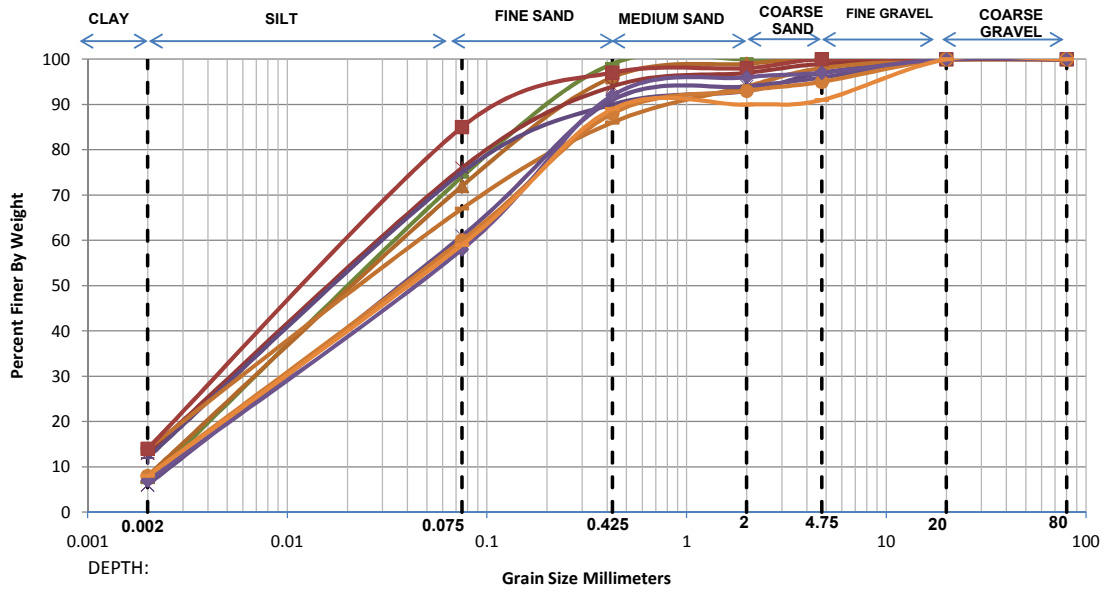


■ 2.50 m  
 × 5.50 m  
 ● 8.50 m  
 ◆ 14.50 m  
 ▲ 17.50 m  
 ✱ 20.50 m  
 + 23.50 m  
 — 26.50 m  
 ■ 29.50 m  
 × 32.50 m  
 — 40.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	7.00	51.00	36.00	4.00	2.00	0.00	0.00	0.0036	0.0222	0.0806	22.51	1.72
5.50 m	8.00	56.00	32.00	3.00	1.00	0.00	0.00	0.0029	0.0181	0.0660	22.82	1.72
8.50 m	11.00	56.00	25.00	2.00	1.00	5.00	0.00	-	0.0140	0.0593	-	-
14.50 m	13.00	58.00	20.00	3.00	2.00	3.00	1.00	-	0.0112	0.0516	-	-
17.50 m	12.00	56.00	26.00	2.00	1.00	3.00	0.00	-	0.0129	0.0573	-	-
20.50 m	8.00	58.00	27.00	2.00	1.00	4.00	0.00	0.0029	0.0172	0.0620	21.53	1.66
23.50 m	7.00	49.00	30.00	3.00	4.00	6.00	1.00	0.0036	0.0231	0.0894	24.84	1.66
26.50 m	8.00	53.00	27.00	5.00	2.00	5.00	0.00	0.0029	0.0192	0.0725	24.95	1.74
29.50 m	6.00	46.00	36.00	2.00	2.00	8.00	0.00	0.0045	0.0276	0.1058	23.36	1.58
32.50 m	6.00	49.00	37.00	3.00	1.00	4.00	0.00	0.0044	0.0253	0.0912	20.52	1.58
40.00 m	7.00	47.00	32.00	3.00	2.00	9.00	0.00	0.0036	0.0246	0.0985	27.09	1.69

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P1

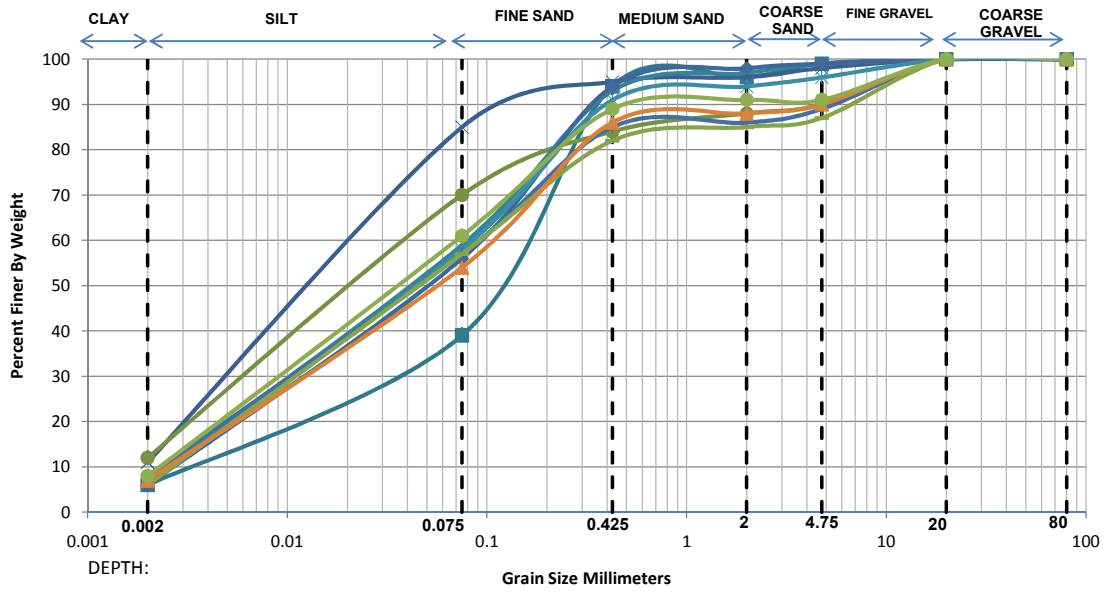


— 1.00 m  
 —▲— 4.00 m  
 —\*— 7.00 m  
 —+— 10.00 m  
 —■— 13.00 m  
 —■— 16.00 m  
 —x— 19.00 m  
 —●— 22.00 m  
 —◆— 28.00 m  
 —■— 40.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	6.60	67.40	25.00	1.00	0.00	0.00	0.00	0.0037	0.0163	0.0503	13.73	1.45
4.00 m	8.00	64.00	24.00	3.00	1.00	0.00	0.00	0.0029	0.0153	0.0523	18.33	1.58
7.00 m	13.00	63.00	18.00	3.00	2.00	1.00	0.00	-	0.0102	0.0446	-	-
10.00 m	12.00	63.00	15.00	3.00	4.00	3.00	0.00	-	0.0110	0.0461	-	-
13.00 m	14.00	53.00	19.00	8.00	4.00	2.00	0.00	-	0.0113	0.0582	-	-
16.00 m	14.00	71.00	12.00	1.00	2.00	0.00	0.00	-	0.0083	0.0348	-	-
19.00 m	6.00	55.00	30.00	3.00	2.00	4.00	0.00	0.0043	0.0216	0.0726	16.93	1.49
22.00 m	8.00	52.00	28.00	5.00	2.00	5.00	0.00	0.0029	0.0197	0.0750	25.74	1.78
28.00 m	7.00	51.00	34.00	4.00	1.00	3.00	0.00	0.0036	0.0221	0.0807	22.57	1.70
40.00 m	8.00	51.00	30.00	1.00	1.00	9.00	0.00	0.0029	0.0203	0.0778	26.62	1.81

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P2

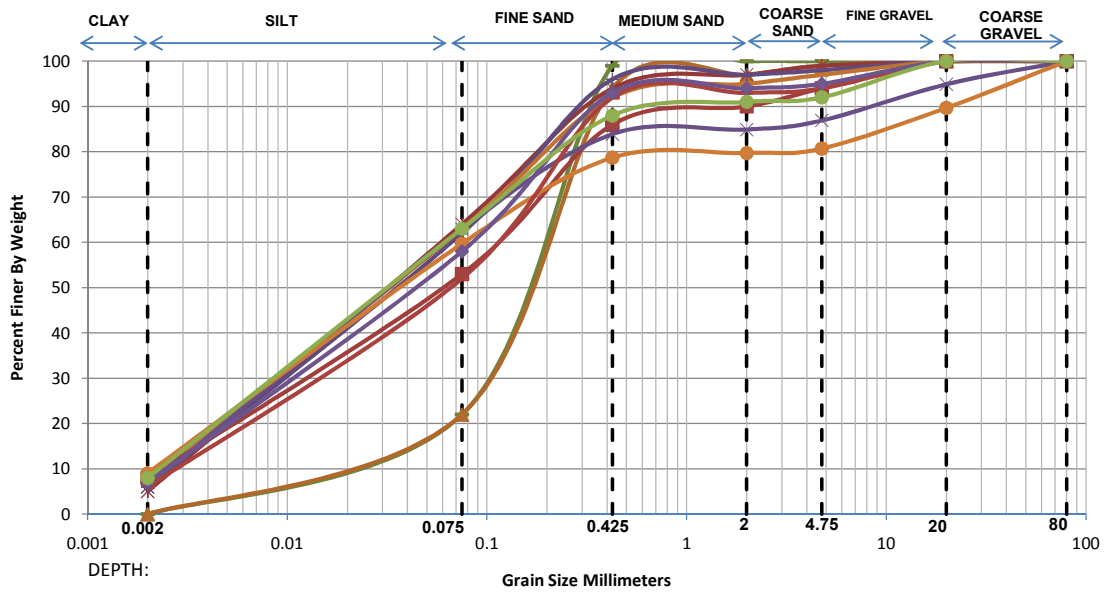


■ 2.50 m   
 × 5.50 m   
 ● 8.50 m   
 — 11.50 m   
 ◆ 14.50 m   
 ✱ 20.50 m   
 — 23.50 m   
 — 26.50 m   
 ▲ 31.00 m   
 ● 35.50 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	6.00	33.00	55.00	2.00	3.00	1.00	0.00	0.0053	0.0471	0.1529	28.58	2.71
5.50 m	11.00	74.00	10.00	1.00	2.00	2.00	0.00	-	0.0102	0.0363	-	-
8.50 m	12.00	58.00	14.00	4.00	2.00	10.00	0.00	-	0.0120	0.0532	-	-
11.50 m	7.00	52.00	34.00	4.00	2.00	1.00	0.00	0.0036	0.0216	0.0776	21.79	1.68
14.50 m	6.00	50.00	38.00	4.00	1.00	1.00	0.00	0.0044	0.0247	0.0871	19.70	1.59
20.50 m	7.00	51.00	33.00	3.00	2.00	4.00	0.00	0.0036	0.0221	0.0808	22.60	1.69
23.50 m	8.00	49.00	28.00	1.00	3.00	11.00	0.00	0.0029	0.0213	0.0854	29.12	1.81
26.50 m	6.00	51.00	25.00	3.00	2.00	13.00	0.00	0.0044	0.0234	0.0863	19.78	1.45
31.00 m	7.00	47.00	32.00	2.00	2.00	10.00	0.00	0.0036	0.0246	0.0984	27.05	1.69
35.50 m	8.00	53.00	28.00	2.00	0.00	9.00	0.00	0.0029	0.0192	0.0725	24.95	1.75

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P3

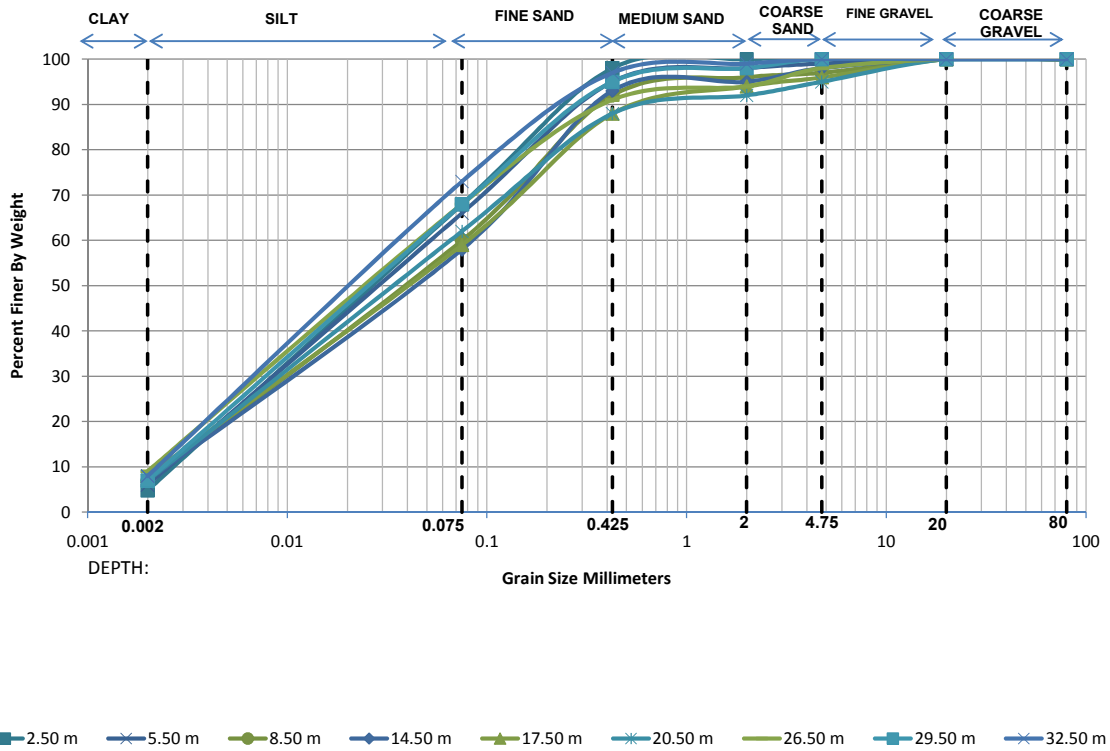


Legend for depths: 1.00 m (green), 4.00 m (orange), 7.00 m (red), 10.00 m (purple), 13.00 m (brown), 16.00 m (dark red), 19.00 m (blue), 22.00 m (yellow), 25.00 m (pink), 28.00 m (dark blue), 35.50 m (light green).

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	0.00	22.00	77.00	1.00	0.00	0.00	0.0240	0.1034	0.1979	8.24	2.25	
4.00 m	0.00	22.00	72.00	3.00	2.00	1.00	0.0238	0.1043	0.2068	8.70	2.22	
7.00 m	5.00	59.00	30.00	3.00	2.00	1.00	0.0051	0.0216	0.0664	12.90	1.36	
10.00 m	6.00	56.00	34.00	1.00	1.00	2.00	0.0043	0.0213	0.0705	16.46	1.50	
13.00 m	7.00	56.00	29.00	3.00	2.00	3.00	0.0035	0.0195	0.0681	19.43	1.59	
16.00 m	8.00	45.00	33.00	4.00	4.00	6.00	0.0030	0.0243	0.1036	34.87	1.92	
19.00 m	6.00	56.90	21.00	1.00	2.00	8.00	0.0042	0.0203	0.0683	16.12	1.42	
22.00 m	9.00	50.70	19.00	1.00	1.00	9.00	0.0024	0.0184	0.0759	31.58	1.85	
25.00 m	6.00	46.00	40.00	1.00	1.00	6.00	0.0045	0.0278	0.1029	22.64	1.65	
28.00 m	7.00	51.00	35.00	1.00	1.00	5.00	0.0036	0.0222	0.0806	22.53	1.71	
35.50 m	8.00	55.00	25.00	3.00	1.00	8.00	0.0029	0.0182	0.0679	23.47	1.69	

### GRAIN SIZE DISTRIBUTION CURVES

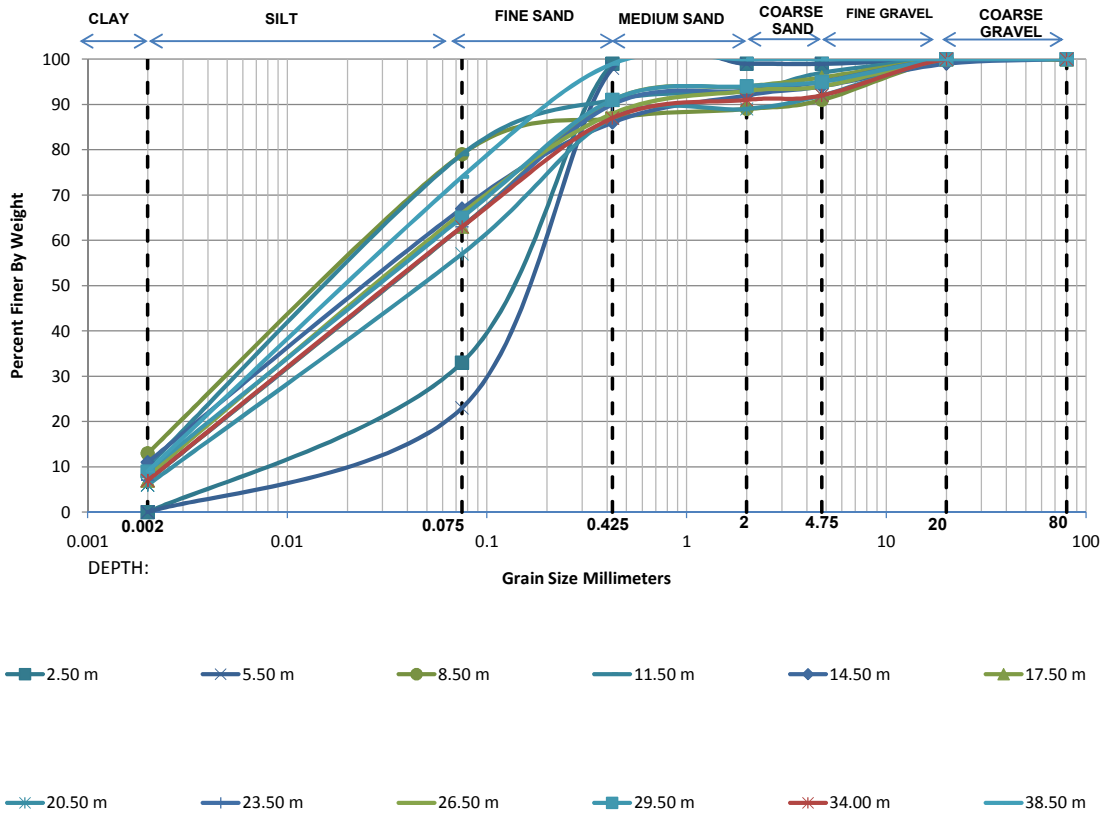
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P4



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	4.80	63.20	30.00	2.00	0.00	0.00	0.00	0.0053	0.0204	0.0595	11.32	1.34
5.50 m	6.00	60.00	29.00	3.00	1.00	1.00	0.00	0.0042	0.0195	0.0625	14.87	1.45
8.50 m	7.00	53.00	32.00	4.00	1.00	3.00	0.00	0.0035	0.0210	0.0750	21.15	1.65
14.50 m	7.00	51.00	35.00	2.00	3.00	2.00	0.00	0.0036	0.0222	0.0806	22.53	1.71
17.50 m	8.00	51.00	29.00	6.00	2.00	4.00	0.00	0.0029	0.0202	0.0778	26.65	1.80
20.50 m	7.00	55.00	26.00	4.00	3.00	5.00	0.00	0.0035	0.0198	0.0703	19.99	1.58
26.50 m	9.00	59.00	23.00	3.00	4.00	2.00	0.00	0.0024	0.0154	0.0580	24.29	1.72
29.50 m	7.00	61.00	27.00	3.00	2.00	0.00	0.00	0.0035	0.0176	0.0588	17.00	1.52
32.50 m	8.00	65.00	24.00	2.00	1.00	0.00	0.00	0.0028	0.0151	0.0509	17.88	1.57

### GRAIN SIZE DISTRIBUTION CURVES

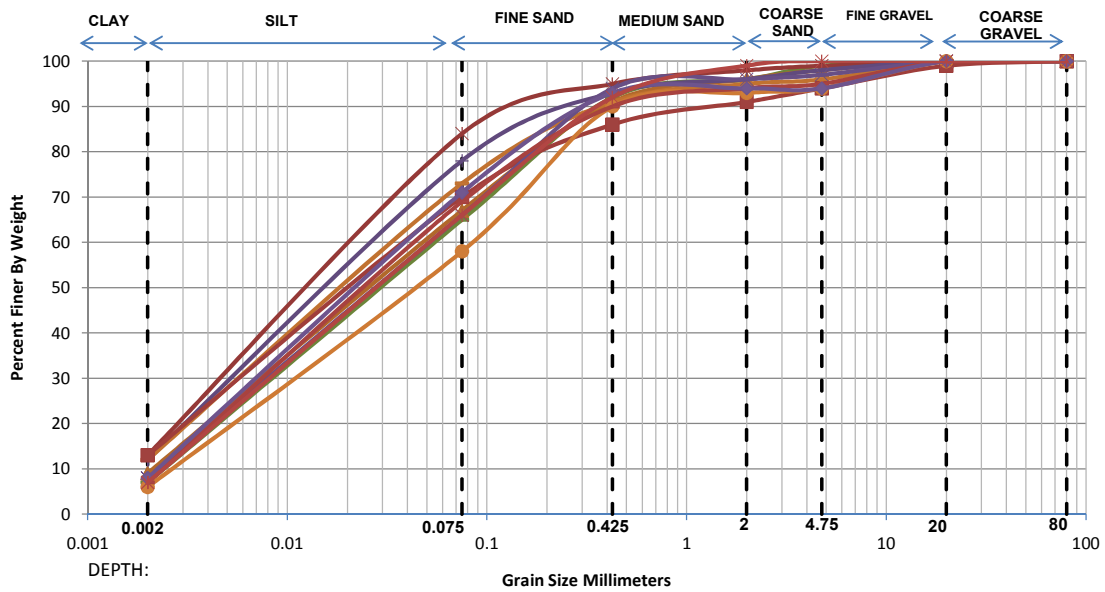
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P5



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	0.00	33.00	66.00	0.00	0.00	1.00	0.00	0.0115	0.0656	0.2322	20.28	1.62
5.50 m	0.00	23.00	75.00	1.00	0.00	1.00	0.00	0.0221	0.0998	0.1963	8.88	2.29
8.50 m	13.00	66.00	8.00	2.00	2.00	9.00	0.00	-	0.0096	0.0406	-	-
11.50 m	10.00	69.00	12.00	2.00	4.00	3.00	0.00	0.0020	0.0118	0.0423	21.17	1.65
14.50 m	11.00	56.00	19.00	6.00	2.00	5.00	1.00	-	0.0138	0.0591	-	-
17.50 m	7.00	56.00	28.00	3.00	2.00	4.00	0.00	0.0035	0.0194	0.0681	19.43	1.58
20.50 m	6.00	51.00	30.00	2.00	3.00	8.00	0.00	0.0044	0.0237	0.0848	19.37	1.51
23.50 m	7.00	56.00	27.00	3.00	2.00	5.00	0.00	0.0035	0.0194	0.0681	19.43	1.57
26.50 m	8.00	58.00	22.00	5.00	1.00	6.00	0.00	0.0029	0.0170	0.0618	21.48	1.62
29.50 m	9.00	56.00	26.00	3.00	1.00	5.00	0.00	0.0024	0.0165	0.0637	26.59	1.79
34.00 m	7.00	56.00	24.00	4.00	1.00	8.00	0.00	0.0035	0.0192	0.0680	19.43	1.56
38.50 m	9.00	65.00	25.00	1.00	0.00	0.00	0.00	0.0024	0.0140	0.0493	20.70	1.66

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-P6

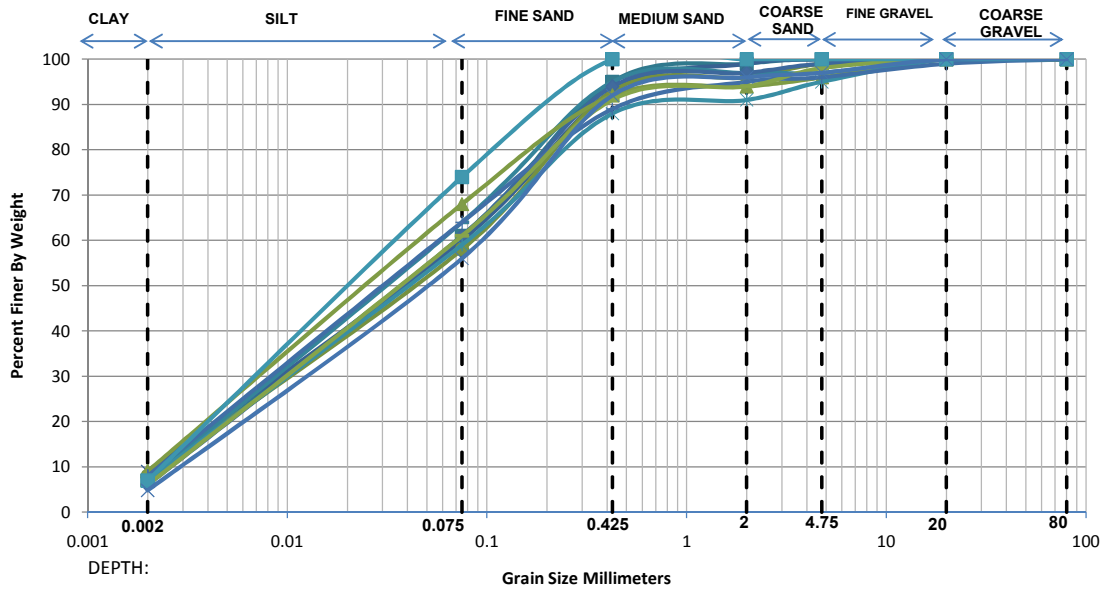


— 1.00 m  
 —▲— 4.00 m  
 —✱— 7.00 m  
 —◆— 10.00 m  
 — 13.00 m  
 —■— 16.00 m  
 —✱— 19.00 m  
 —◆— 22.00 m  
 — 25.00 m  
 —◆— 28.00 m  
 —✱— 34.00 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	7.00	58.00	27.00	4.00	3.00	1.00	0.00	0.0035	0.0186	0.0641	18.39	1.55
4.00 m	9.00	58.00	24.00	5.00	2.00	2.00	0.00	0.0024	0.0158	0.0598	25.02	1.74
7.00 m	13.00	71.00	11.00	3.00	1.00	1.00	0.00	-	0.0090	0.0361	-	-
10.00 m	12.00	66.00	15.00	3.00	2.00	2.00	0.00	-	0.0105	0.0426	-	-
13.00 m	12.00	61.00	18.00	4.00	1.00	4.00	0.00	-	0.0115	0.0490	-	-
16.00 m	13.00	57.00	16.00	5.00	3.00	5.00	1.00	-	0.0113	0.0530	-	-
19.00 m	8.00	58.00	28.00	2.00	1.00	3.00	0.00	0.0029	0.0172	0.0620	21.54	1.66
22.00 m	6.00	52.00	32.00	3.00	1.00	6.00	0.00	0.0044	0.0232	0.0808	18.54	1.53
25.00 m	7.00	62.00	21.00	4.00	1.00	5.00	0.00	0.0034	0.0171	0.0569	16.53	1.49
28.00 m	8.00	63.00	22.00	1.00	0.00	6.00	0.00	0.0029	0.0155	0.0536	18.77	1.58
34.00 m	7.00	59.00	26.00	7.00	1.00	0.00	0.00	0.0035	0.0182	0.0622	17.90	1.54

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+497 Major Bridge
<b>B.H. No.</b>	BH-A2



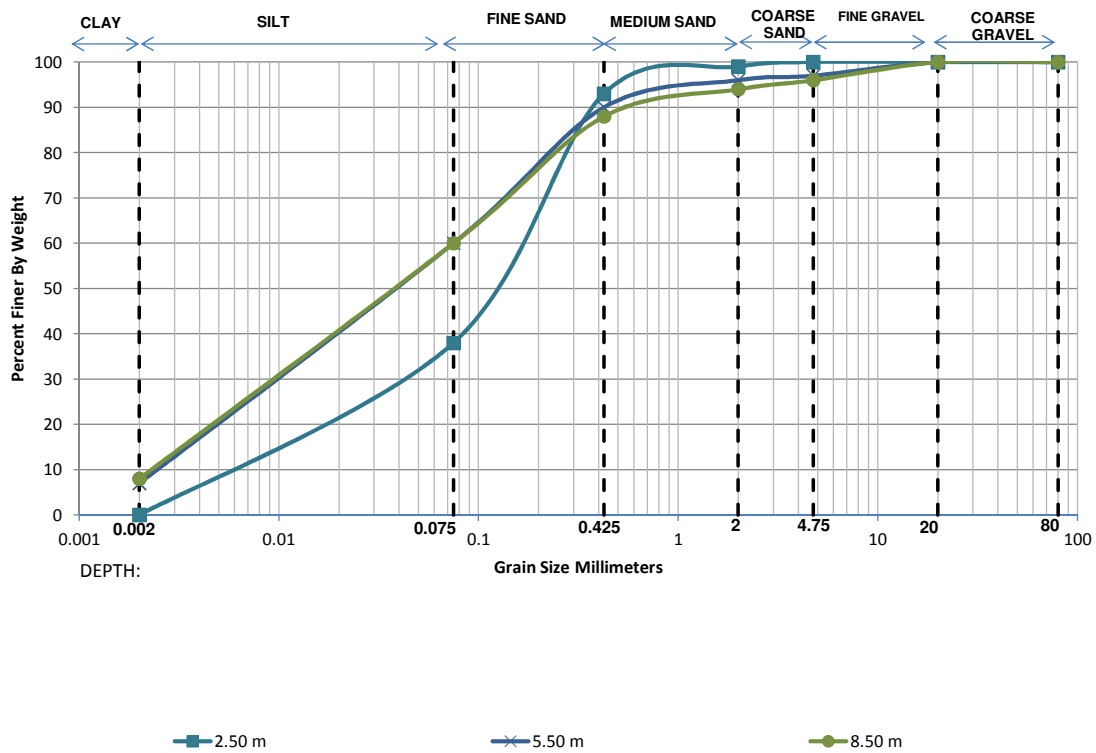
■ 2.50 m  
 × 5.50 m  
 ● 8.50 m  
 — 11.50 m  
 ◆ 14.50 m  
 ▲ 17.50 m  
 ✱ 20.50 m  
 + 23.50 m  
 — 26.50 m  
 ■ 29.50 m  
 × 32.50 m

Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	7.00	54.00	34.00	4.00	1.00	0.00	0.00	0.0035	0.0206	0.0726	20.53	1.65
5.50 m	9.00	51.00	33.00	6.00	1.00	0.00	0.00	0.0024	0.0189	0.0750	31.19	1.98
8.50 m	8.00	50.00	35.00	3.00	3.00	1.00	0.00	0.0029	0.0211	0.0807	27.53	1.88
11.50 m	7.00	57.00	31.00	2.00	0.00	3.00	0.00	0.0035	0.0192	0.0661	18.90	1.59
14.50 m	6.00	55.00	33.00	3.00	2.00	1.00	0.00	0.0043	0.0217	0.0727	16.90	1.51
17.50 m	9.00	59.00	24.00	2.00	2.00	4.00	0.00	0.0024	0.0155	0.0581	24.31	1.72
20.50 m	7.00	52.00	29.00	3.00	4.00	5.00	0.00	0.0036	0.0213	0.0778	21.88	1.65
23.50 m	8.00	56.00	25.00	6.00	1.00	3.00	1.00	0.0029	0.0178	0.0658	22.79	1.67
26.50 m	6.00	55.00	30.00	3.00	4.00	2.00	0.00	0.0043	0.0216	0.0726	16.93	1.49
29.50 m	7.00	67.00	26.00	0.00	0.00	0.00	0.00	0.0034	0.0159	0.0502	14.72	1.49
32.50 m	4.80	51.20	36.00	4.00	1.00	3.00	0.00	0.0056	0.0262	0.0874	15.51	1.39



### GRAIN SIZE DISTRIBUTION CURVES

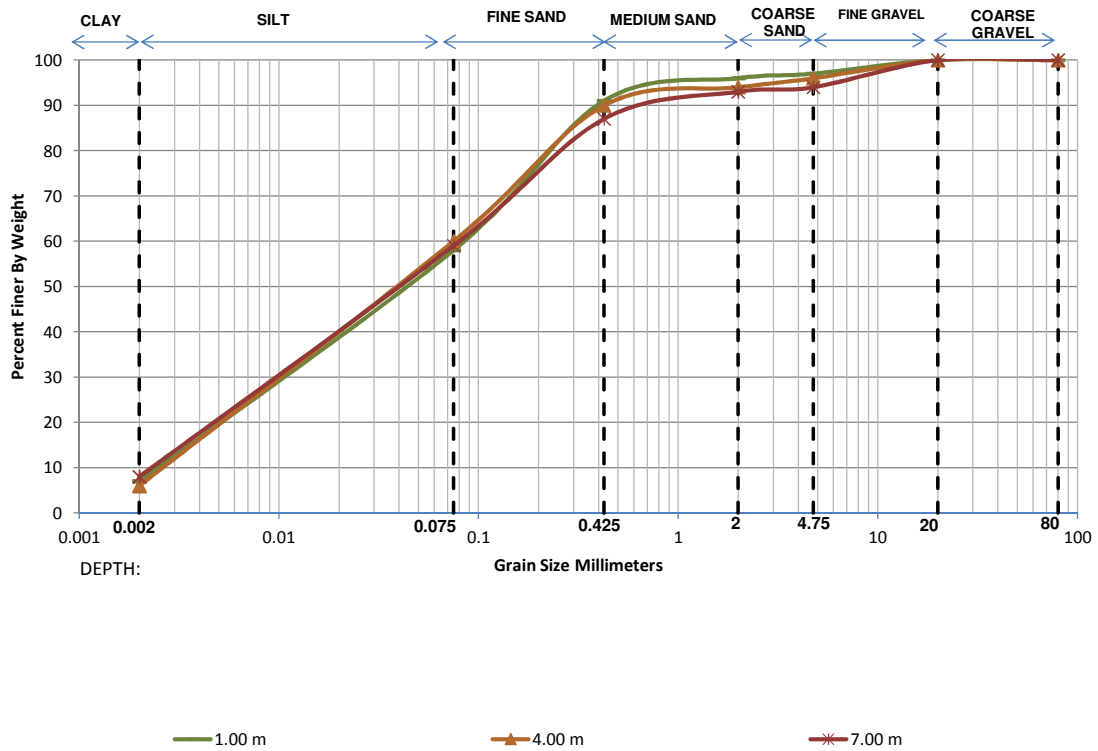
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	58+837 Minor Bridge
<b>B.H. No.</b>	BH-CL



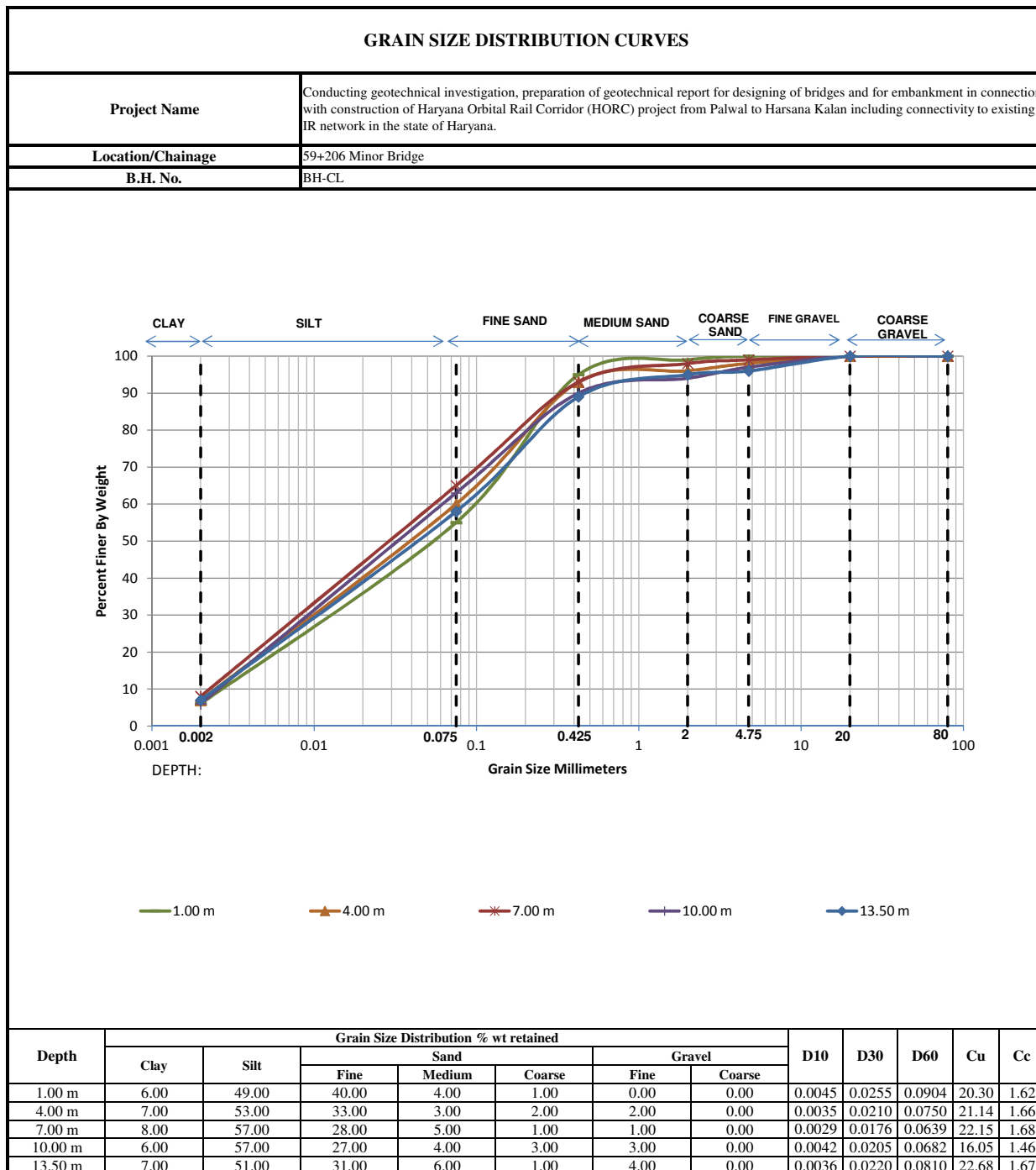
Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.50 m	0.00	38.00	55.00	6.00	1.00	0.00	0.00	0.0088	0.0519	0.1560	17.76	1.97
5.50 m	7.00	53.00	30.00	6.00	1.00	3.00	0.00	0.0035	0.0209	0.0750	21.16	1.64
8.50 m	8.00	52.00	28.00	6.00	2.00	4.00	0.00	0.0029	0.0197	0.0750	25.74	1.78

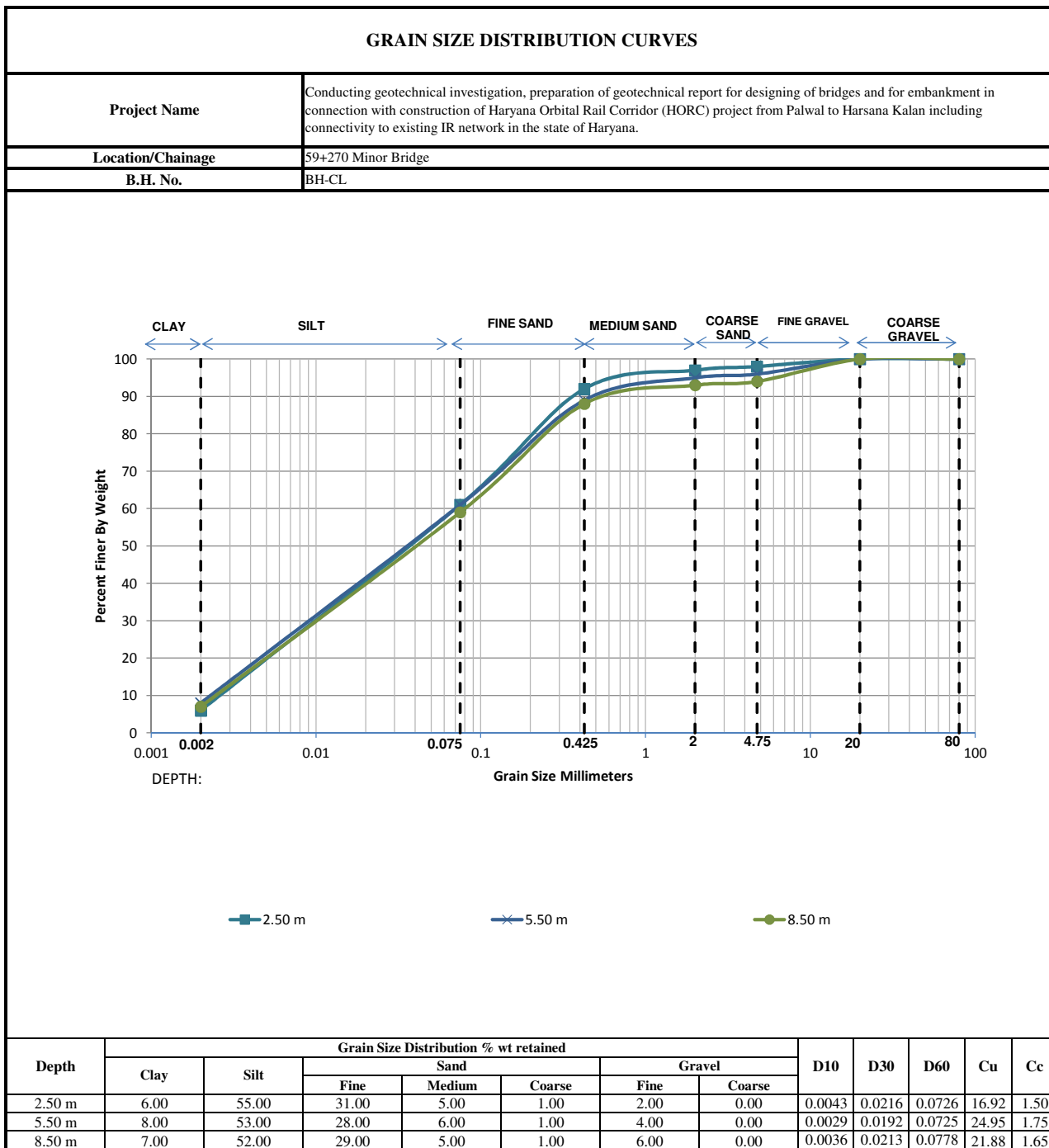
### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	59+071 Minor Bridge
<b>B.H. No.</b>	BH-CL

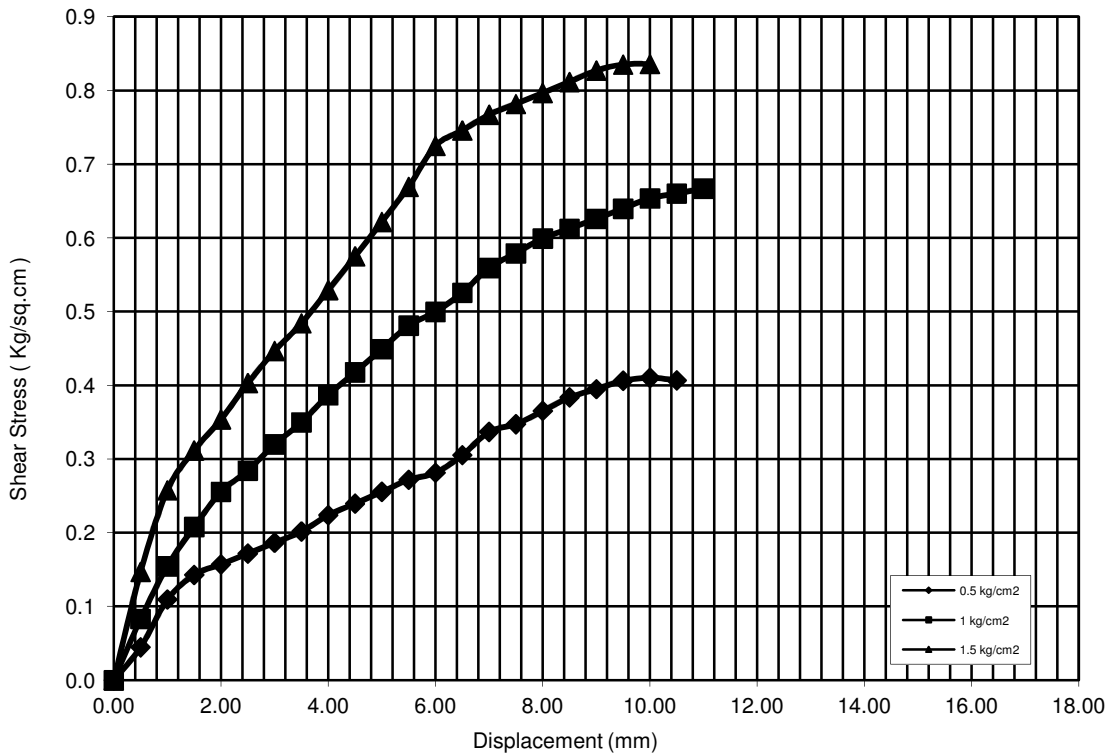
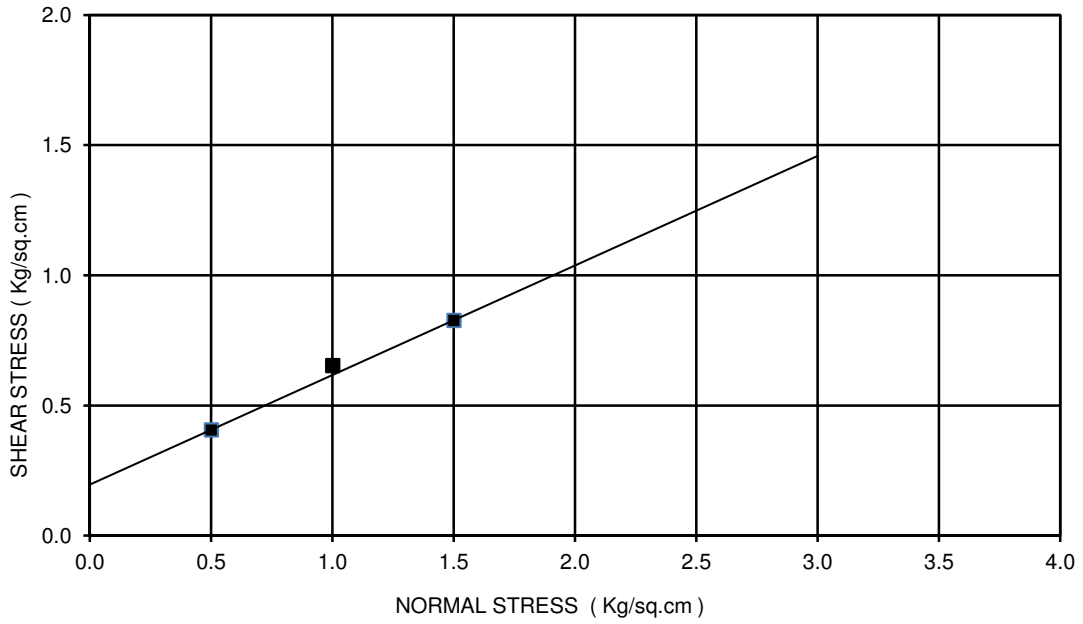


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
1.00 m	7.00	51.00	33.00	5.00	1.00	3.00	0.00	0.0036	0.0221	0.0808	22.61	1.69
4.00 m	6.00	54.00	30.00	4.00	2.00	4.00	0.00	0.0043	0.0220	0.0750	17.39	1.50
7.00 m	8.00	51.00	28.00	6.00	1.00	6.00	0.00	0.0029	0.0202	0.0779	26.67	1.79

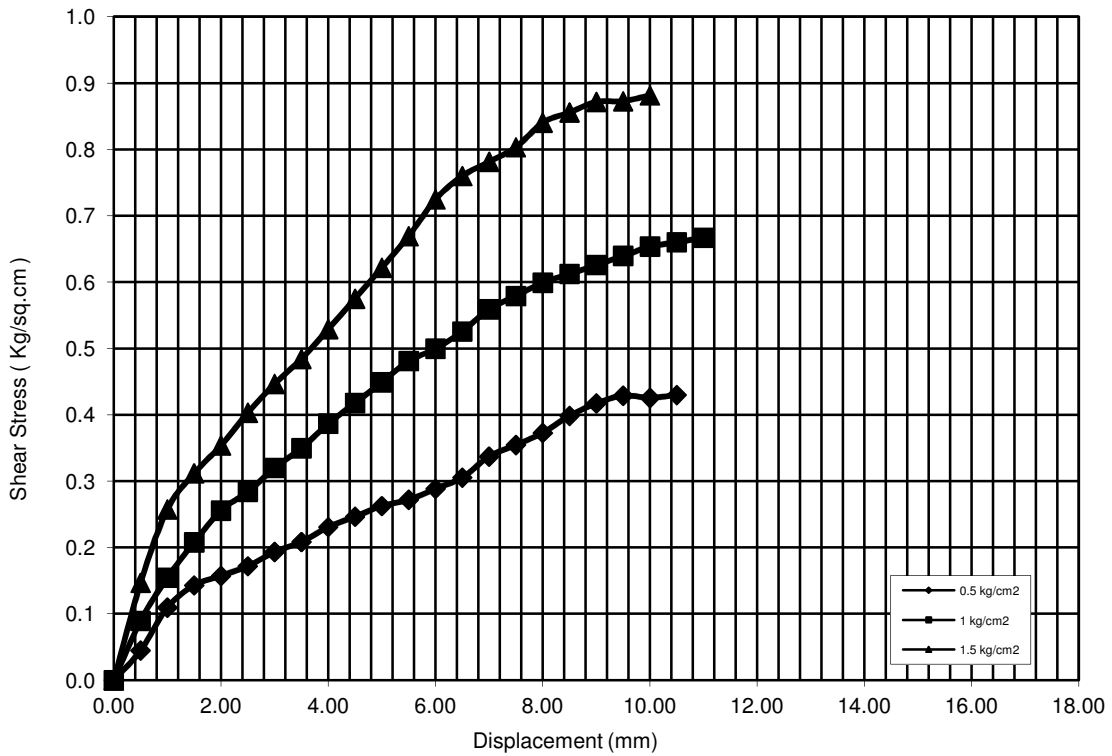
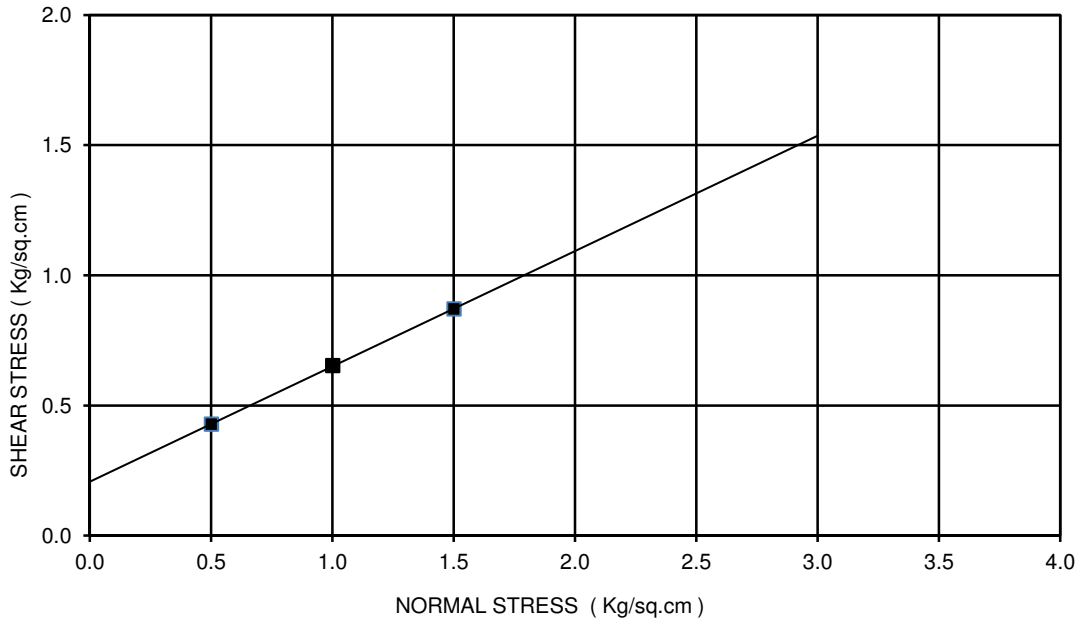




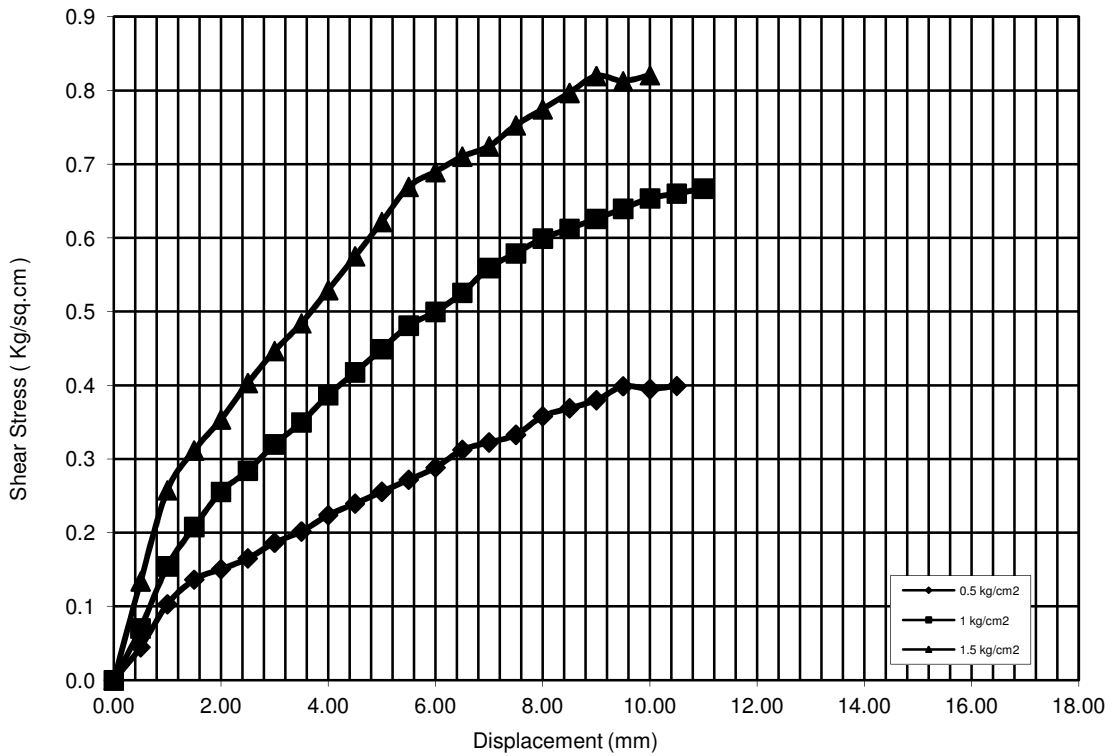
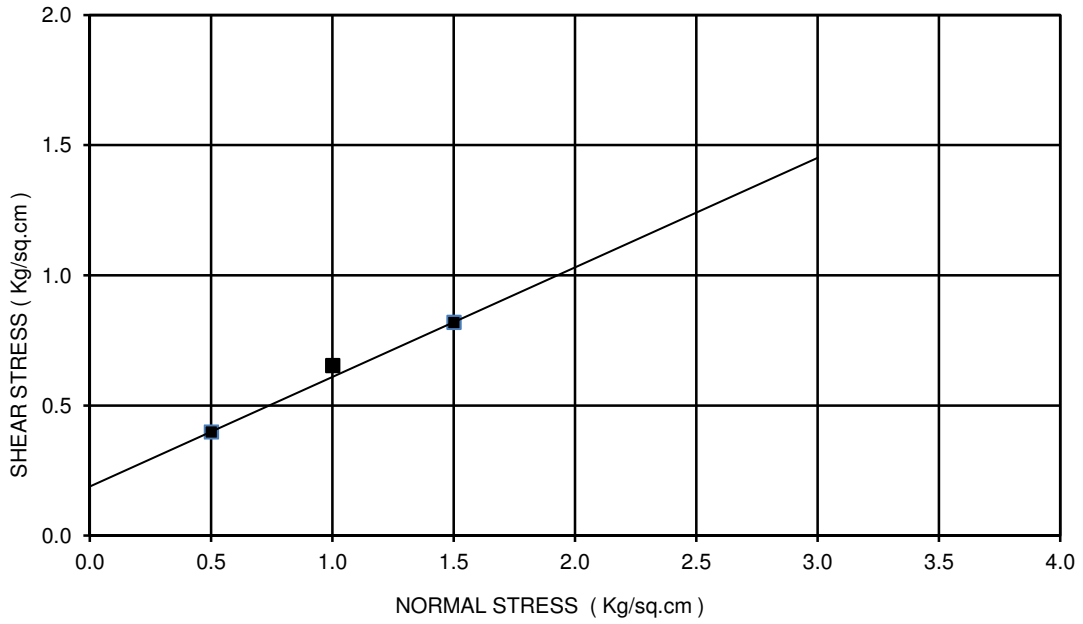
Ch. 52+518  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



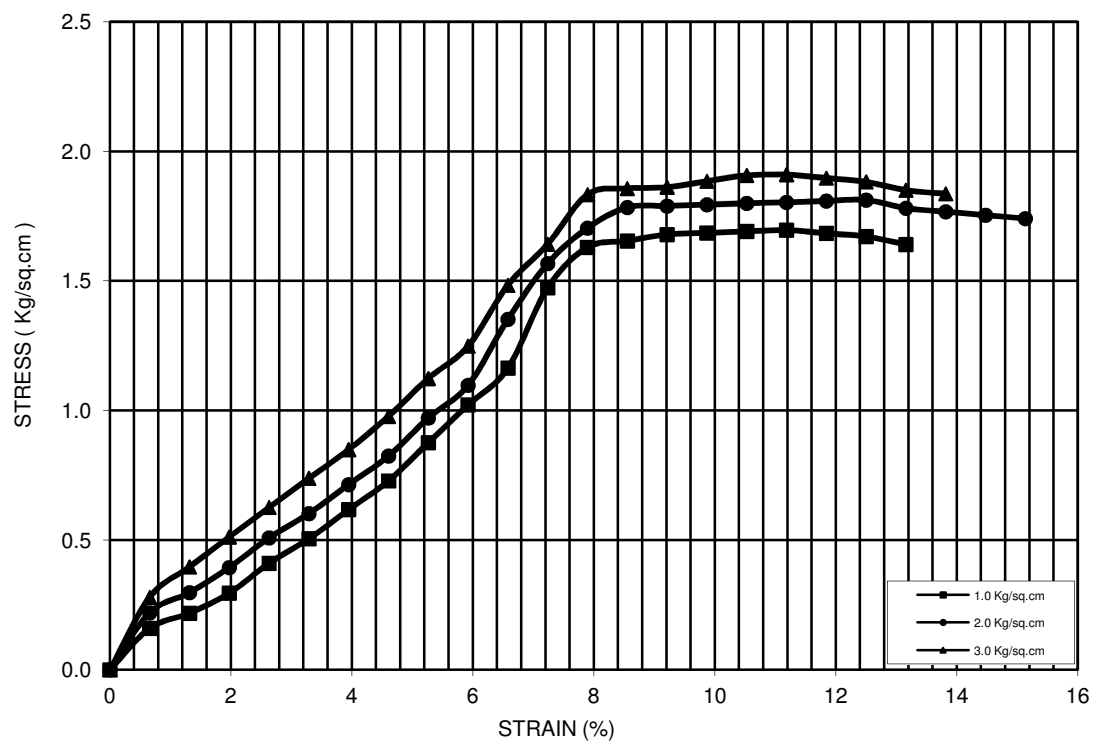
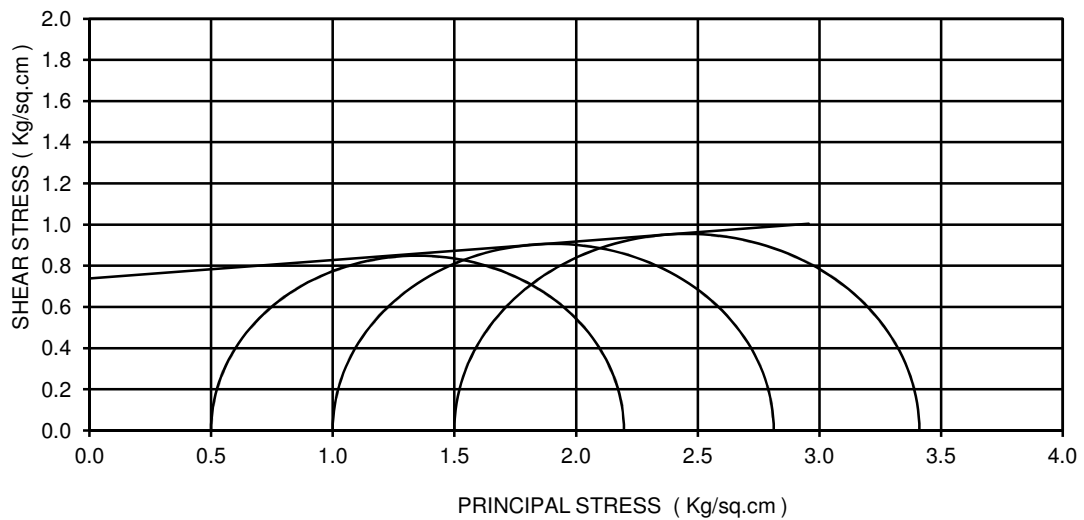
Ch. 52+518  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



Ch. 52+518  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

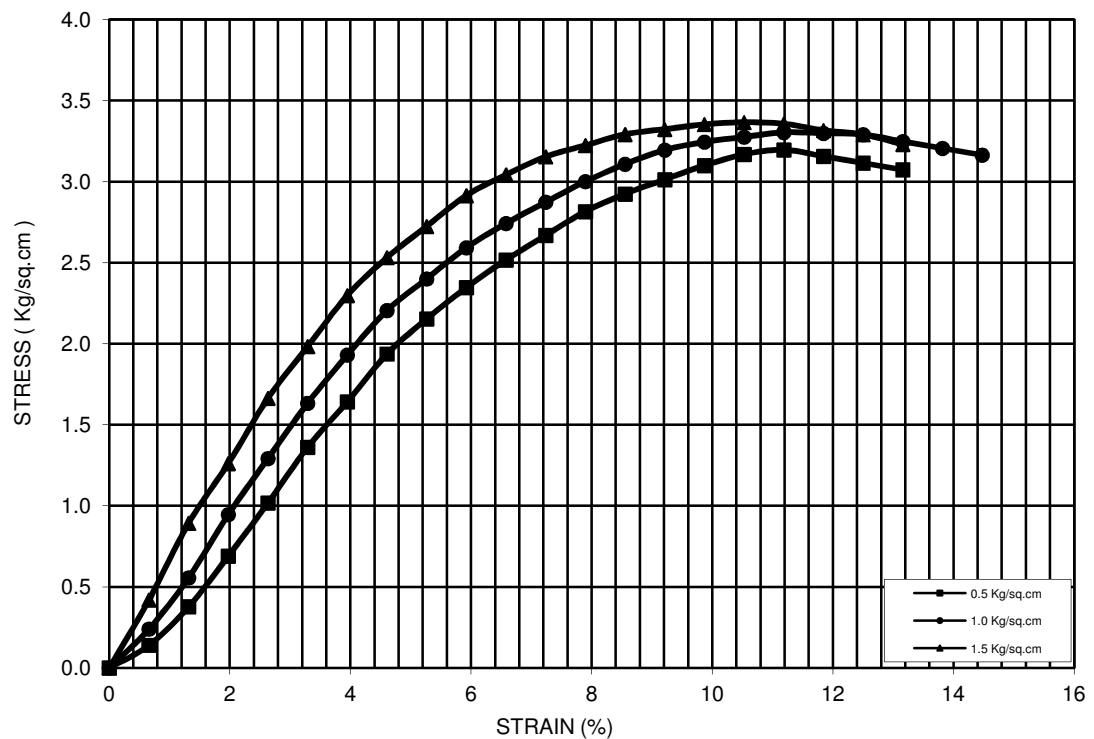
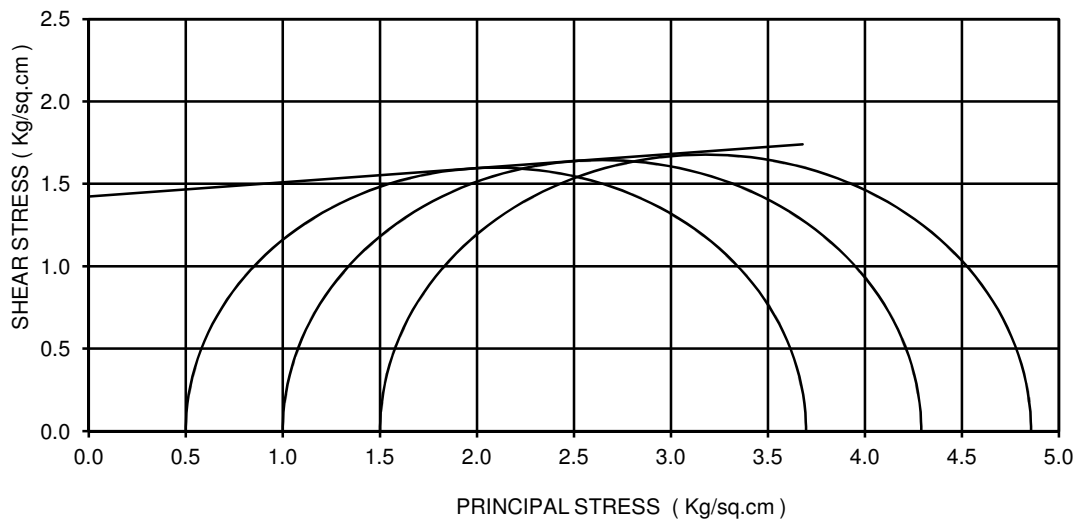


Ch. 52+518  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-5  
 DEPTH: 16.00 m  
 COHESION(C)= 0.62 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 11 deg  
 TYPE OF THE TEST: UUT

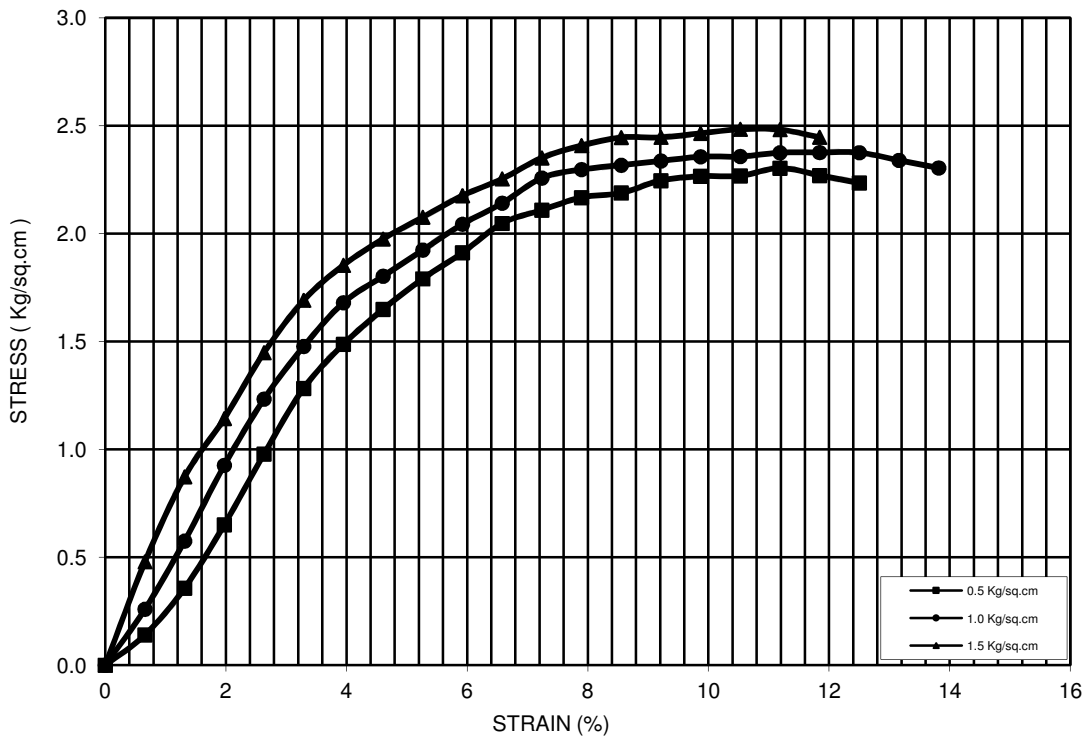
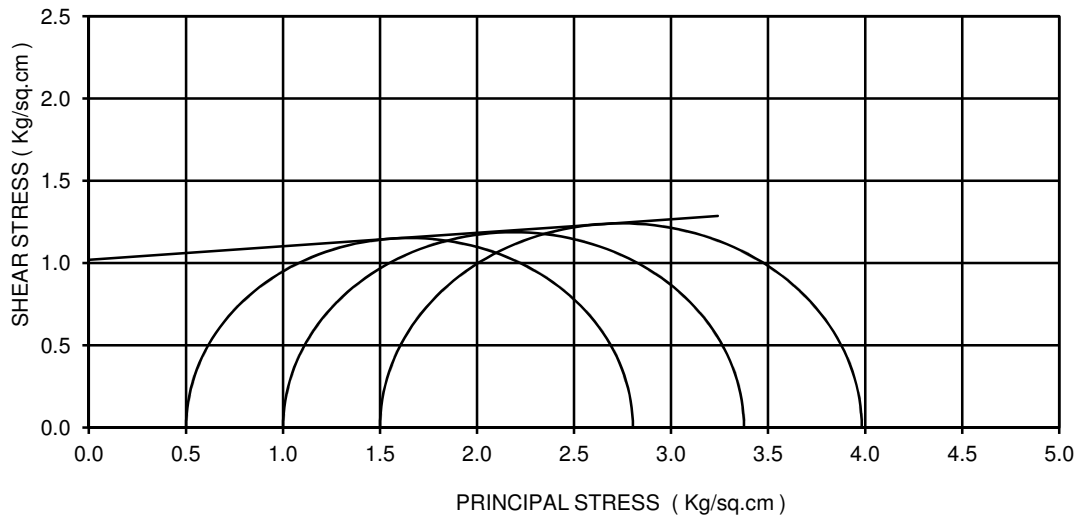




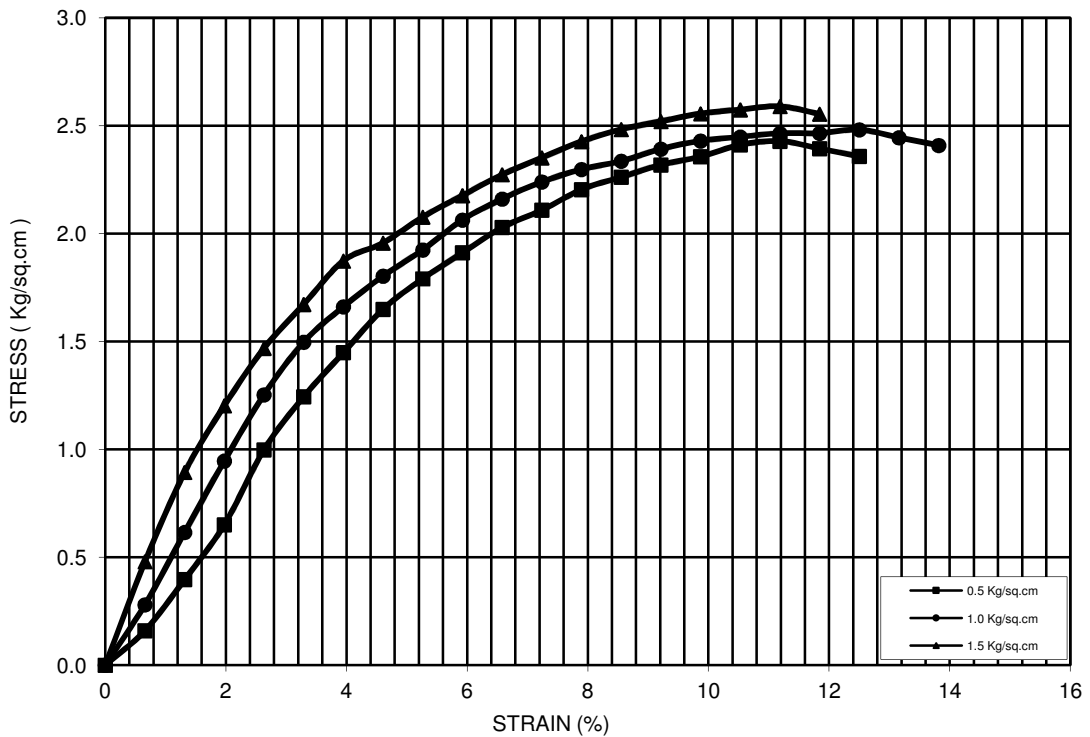
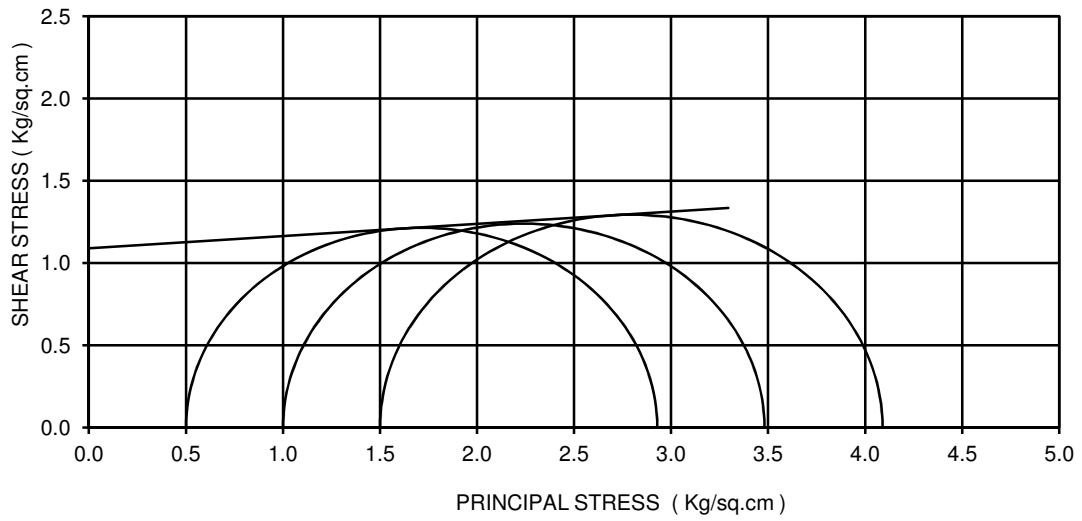
Ch. 53+107  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 5.25 m  
 COHESION(C)= 1.42 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT



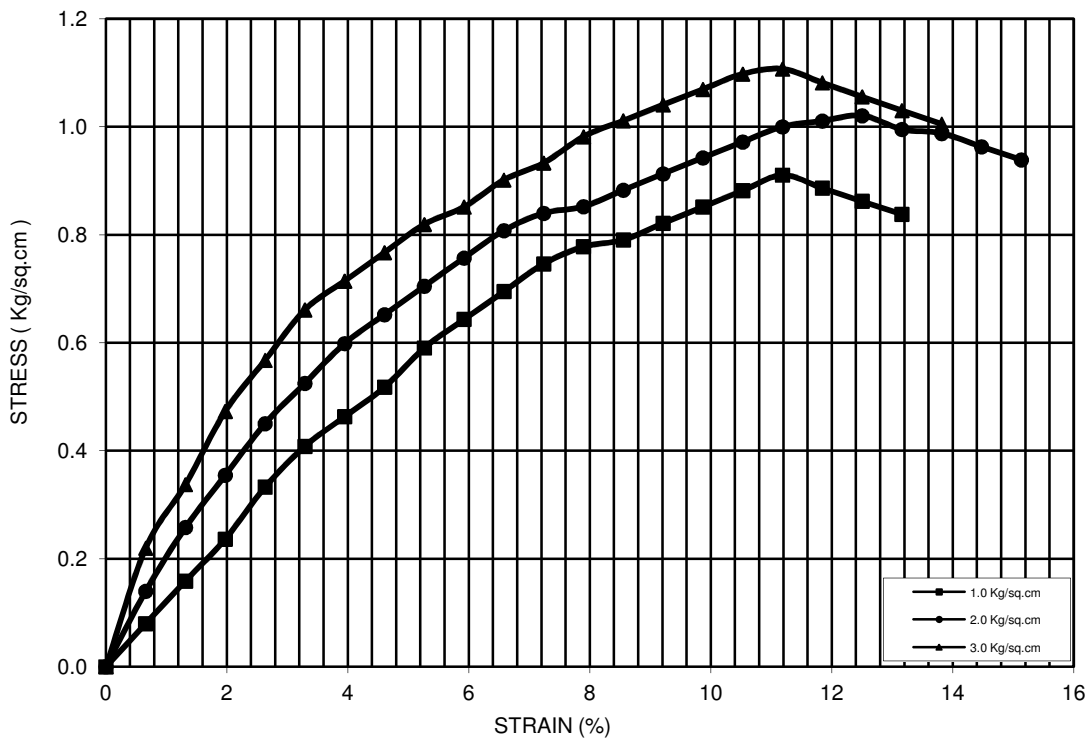
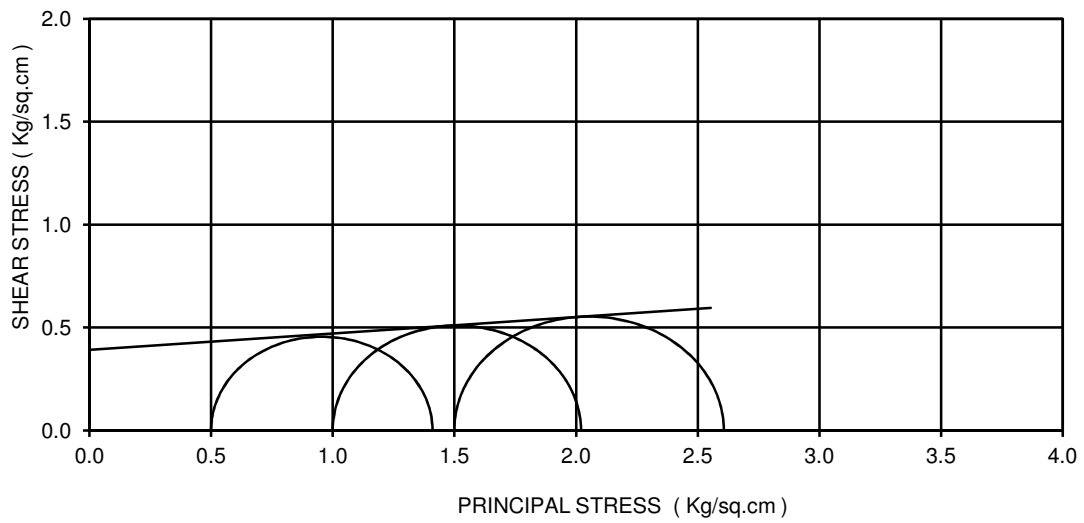
Ch. 53+282  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 5.25 m  
 COHESION(C)= 1.02 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT



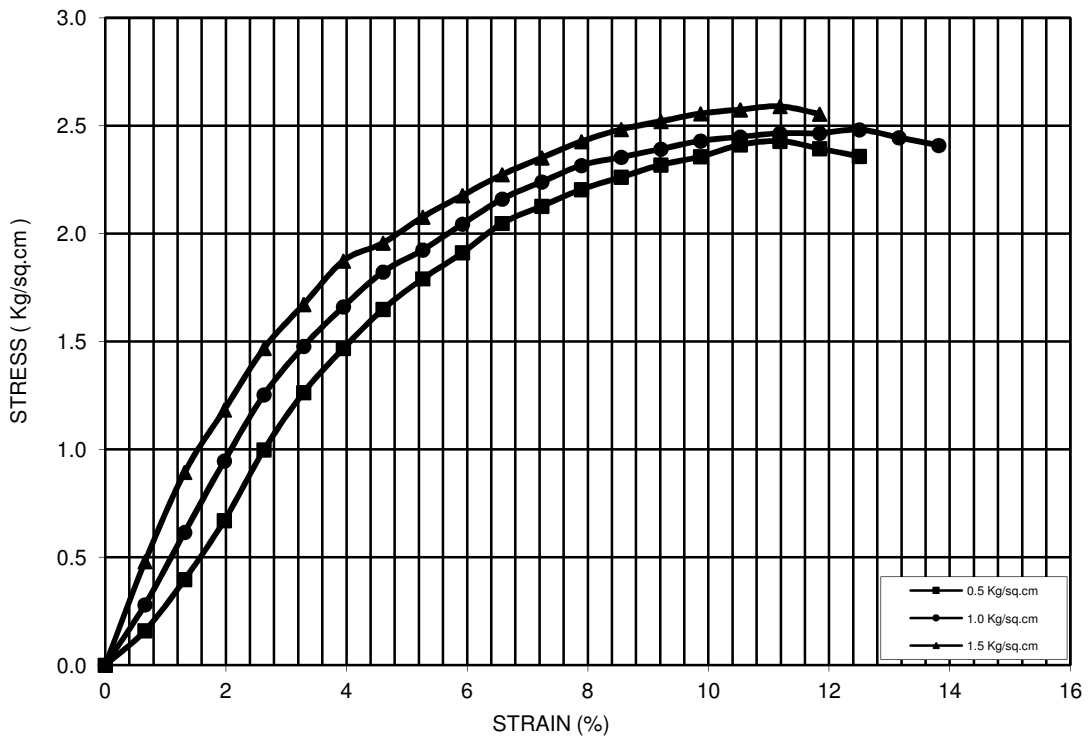
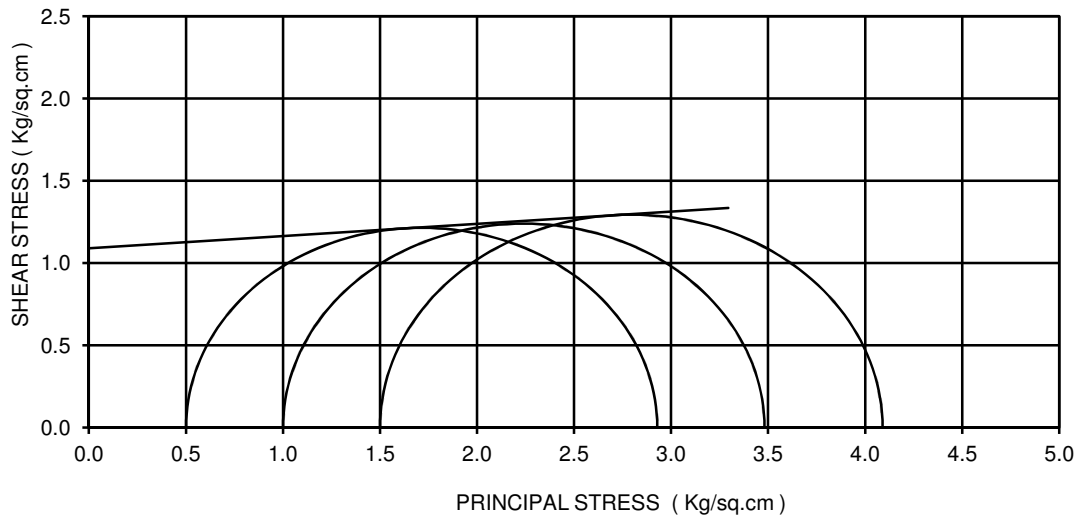
Ch. 53+572  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 5.25 m  
 COHESION(C)= 1.09 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 4 deg  
 TYPE OF THE TEST: UUT



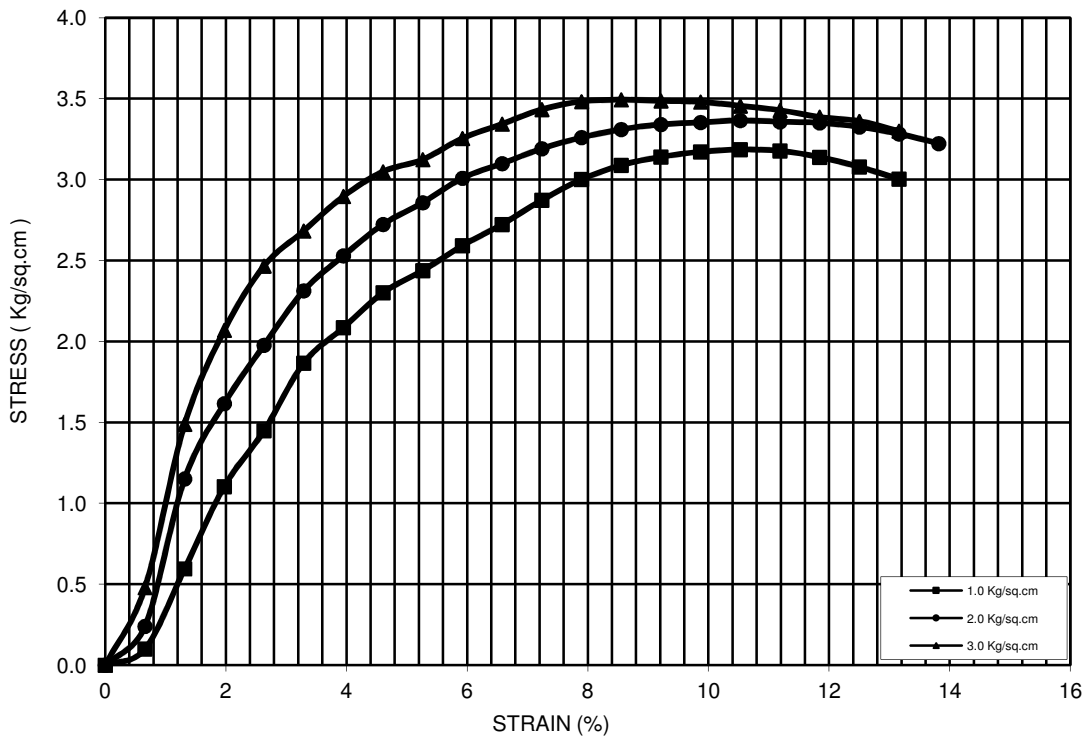
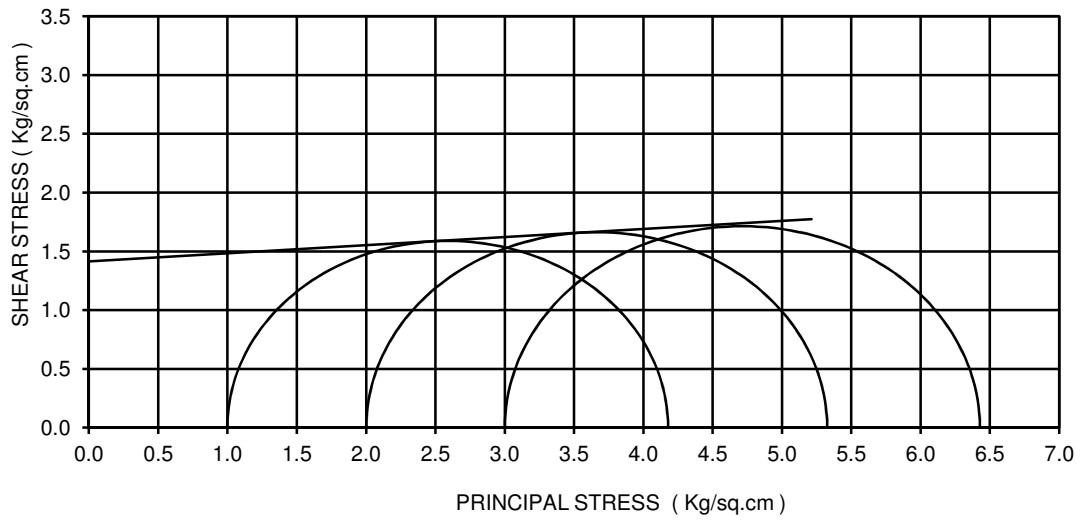
Ch. 53+982  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.25 m  
 COHESION(C)= 0.39 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT



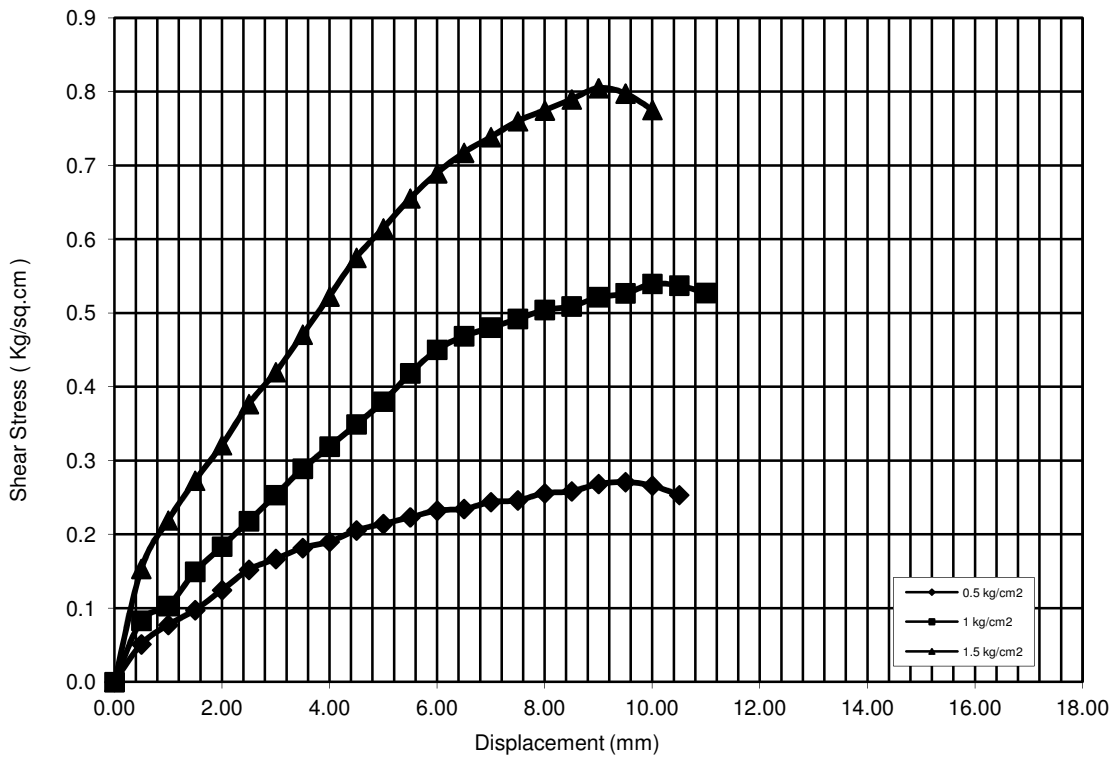
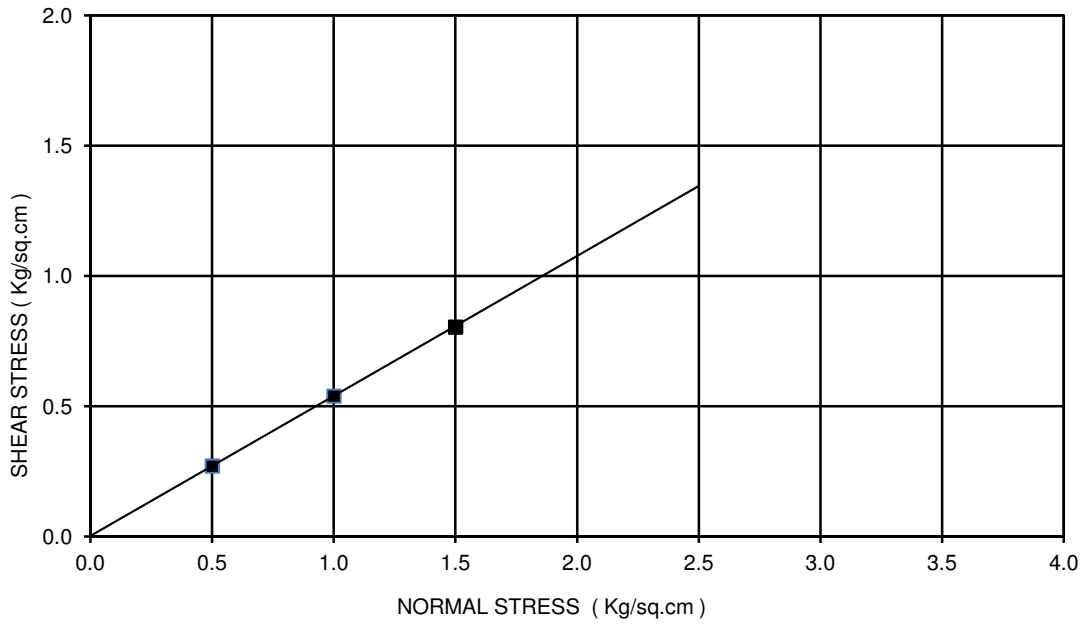
Ch. 54+363  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 5.25 m  
 COHESION(C)= 1.09 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 4 deg  
 TYPE OF THE TEST: UUT



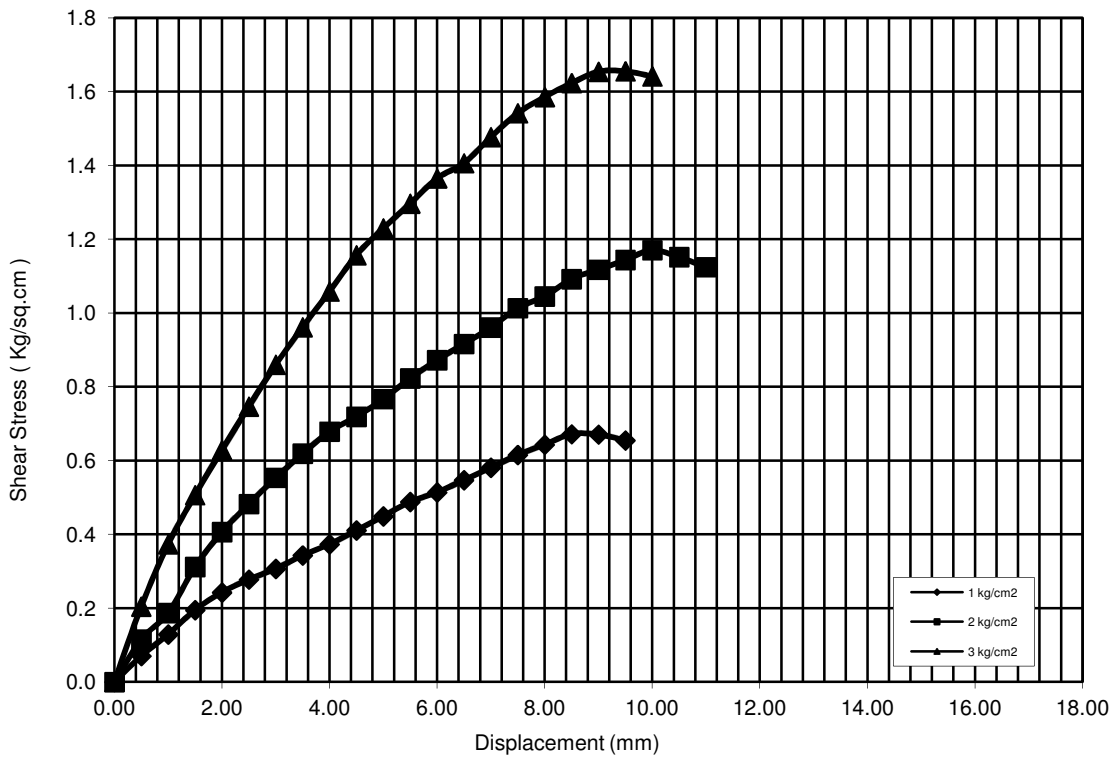
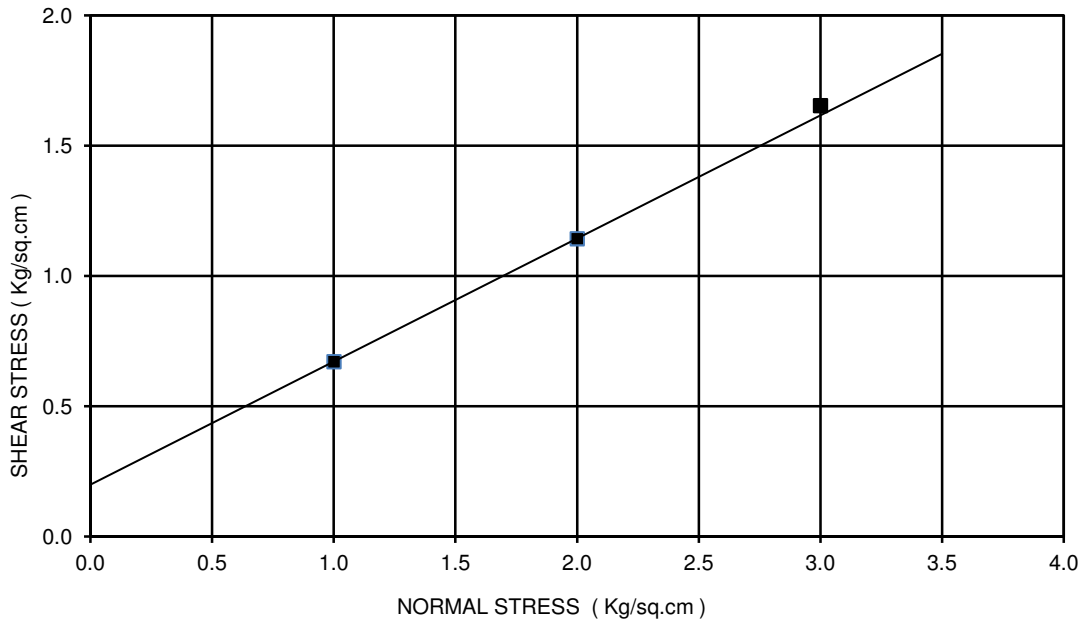
Ch. 54+496  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-3  
 DEPTH: 11.25 m  
 COHESION(C)= 1.42 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 4 deg  
 TYPE OF THE TEST: UUT



Ch. 55+910  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.5 m  
 COHESION(C)= 0.09 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

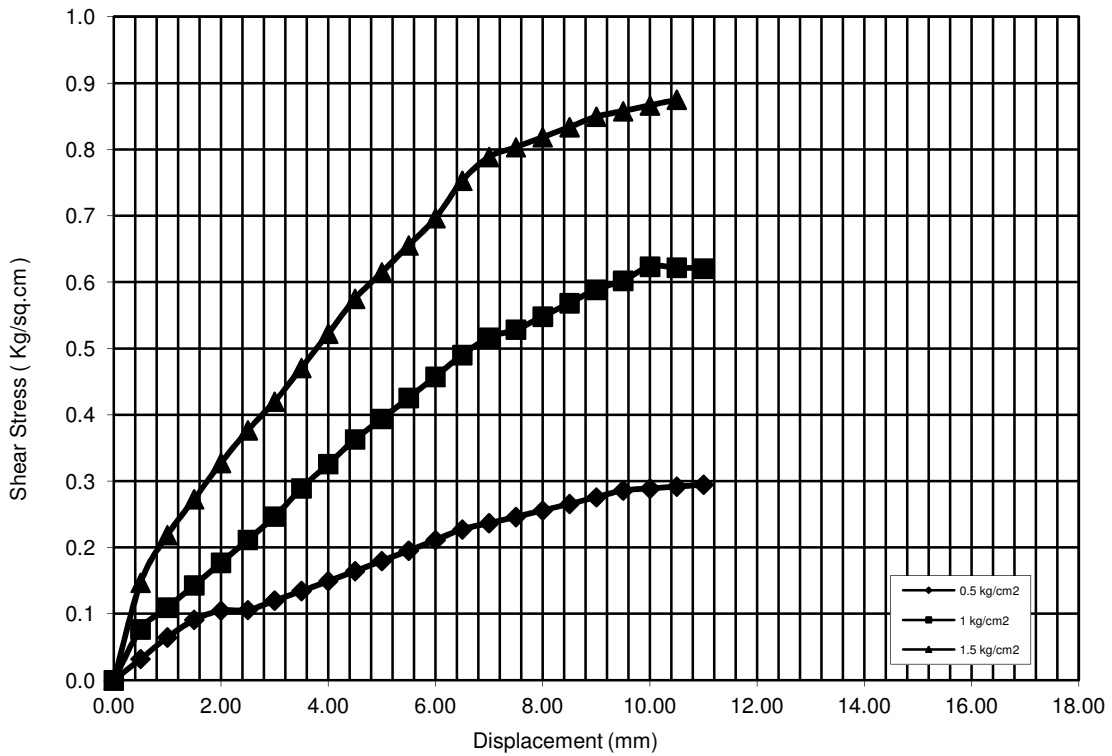
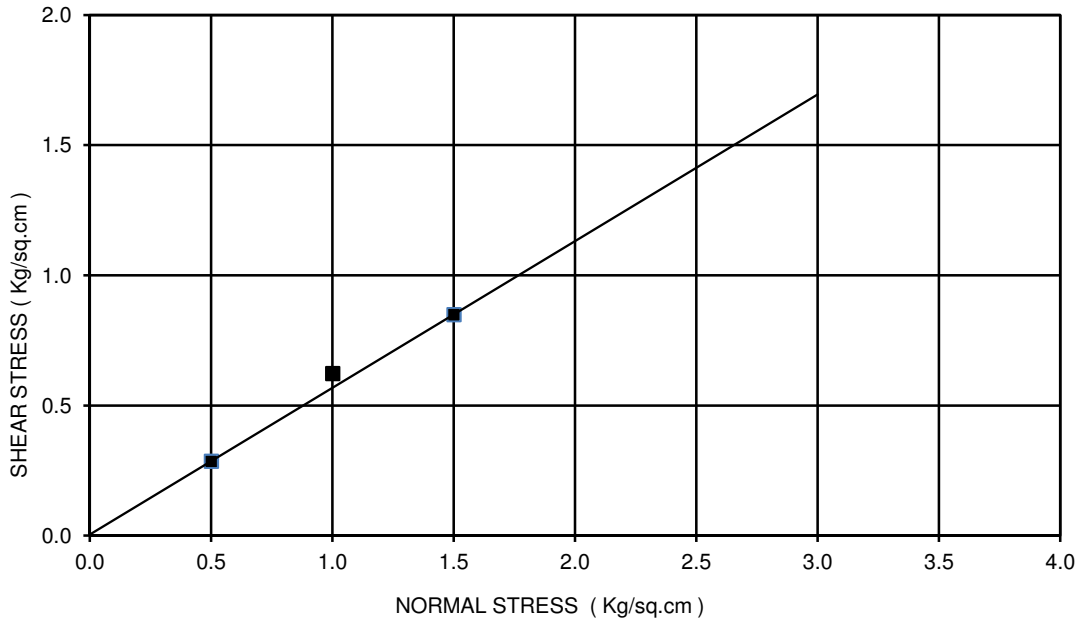


Ch. 55+910  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

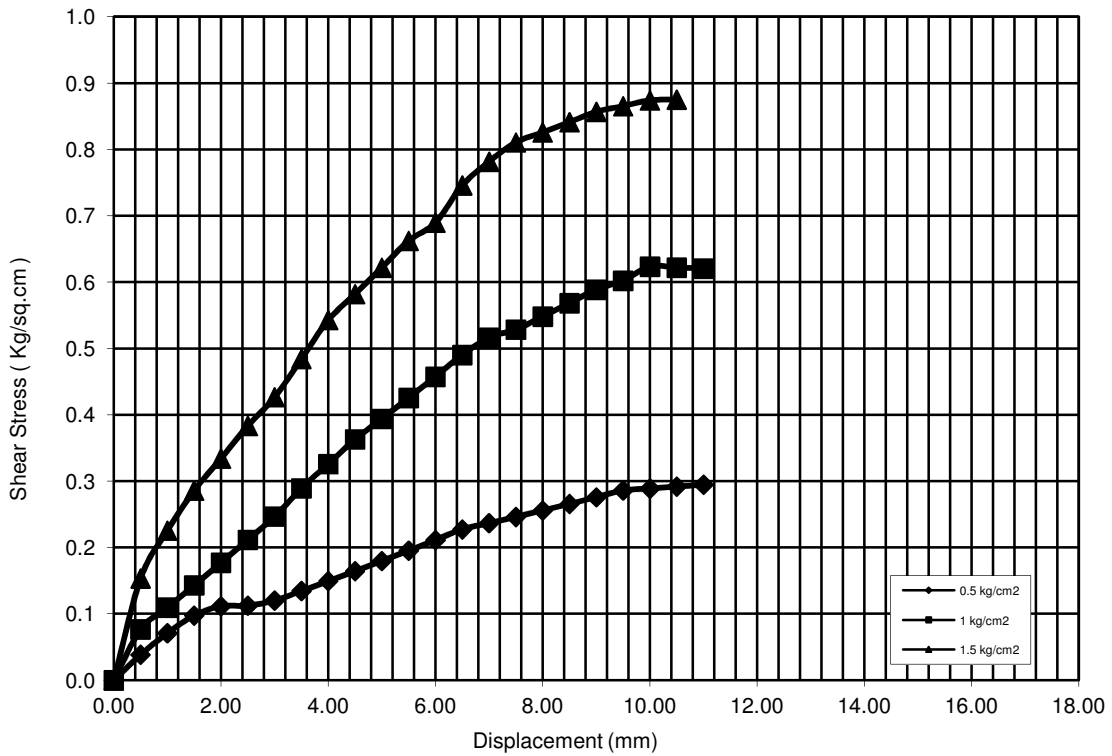
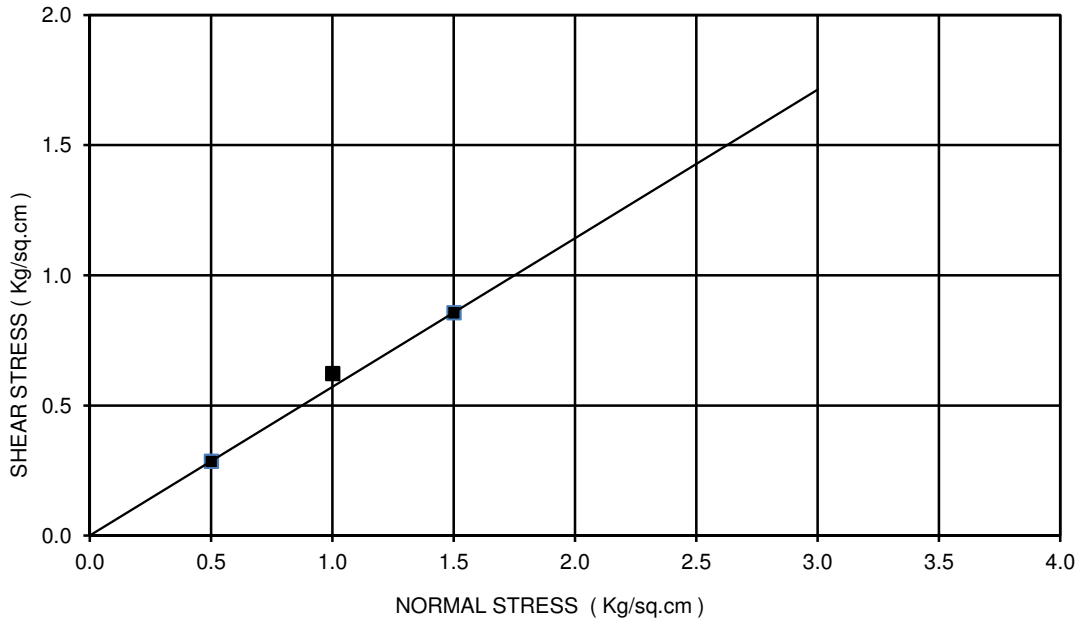




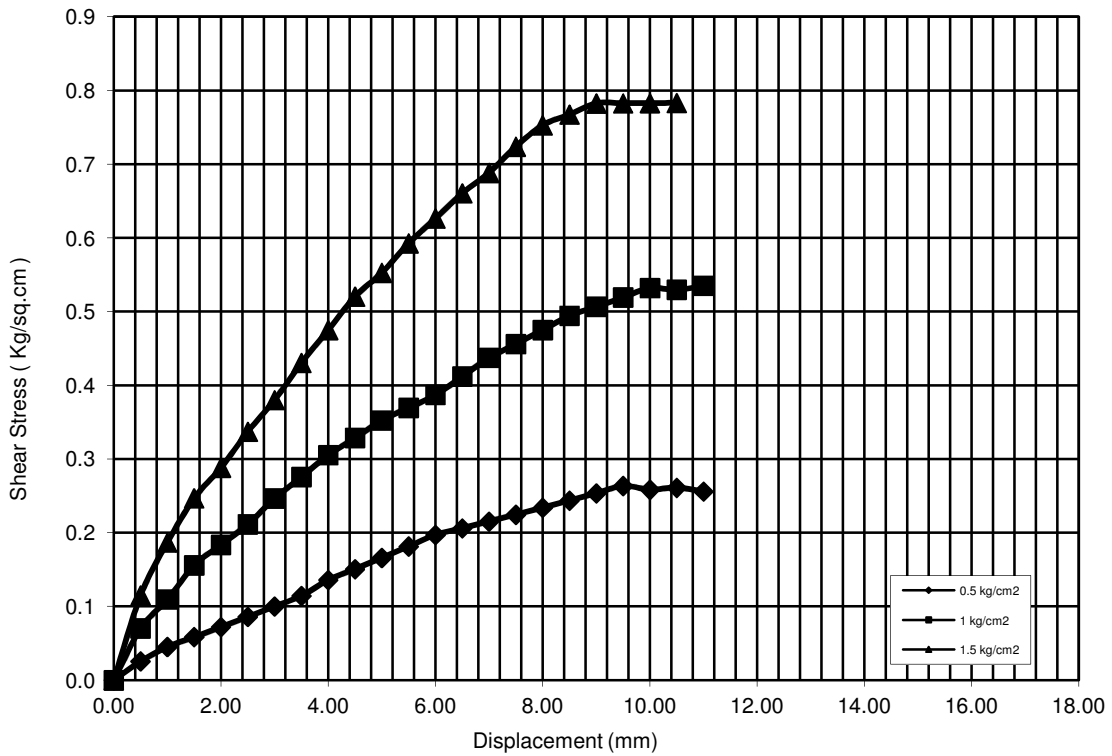
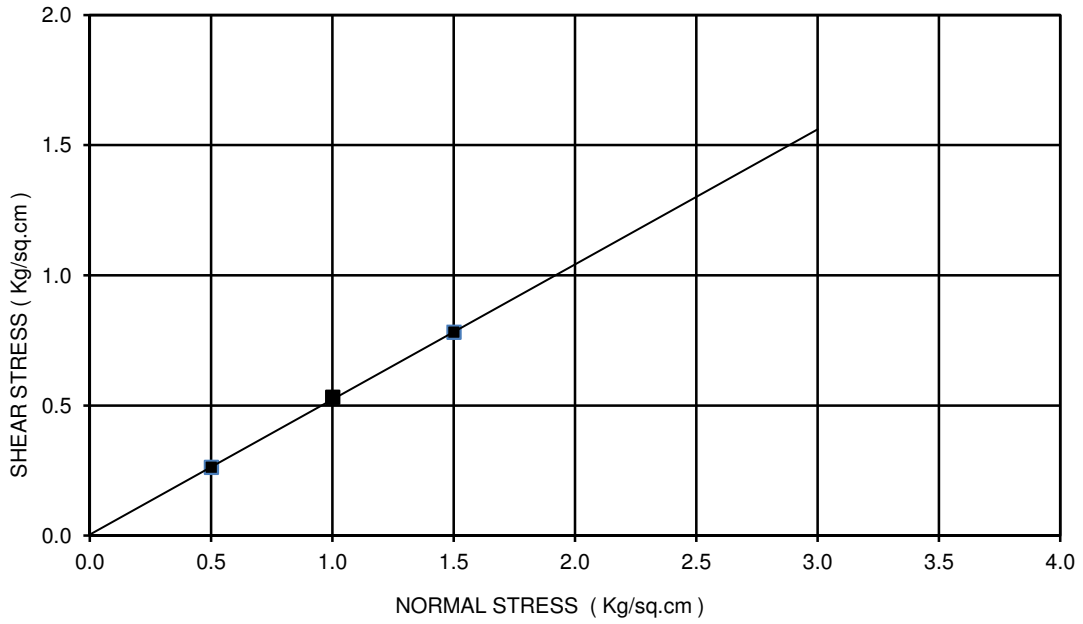
Ch. 55+910  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



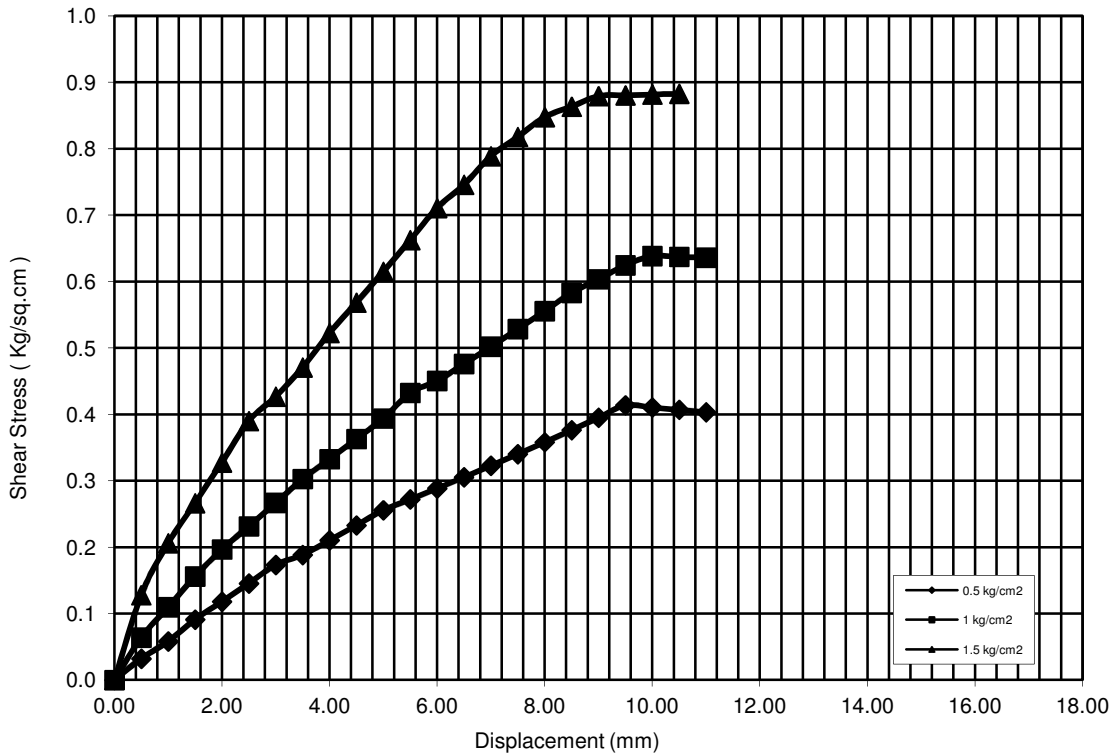
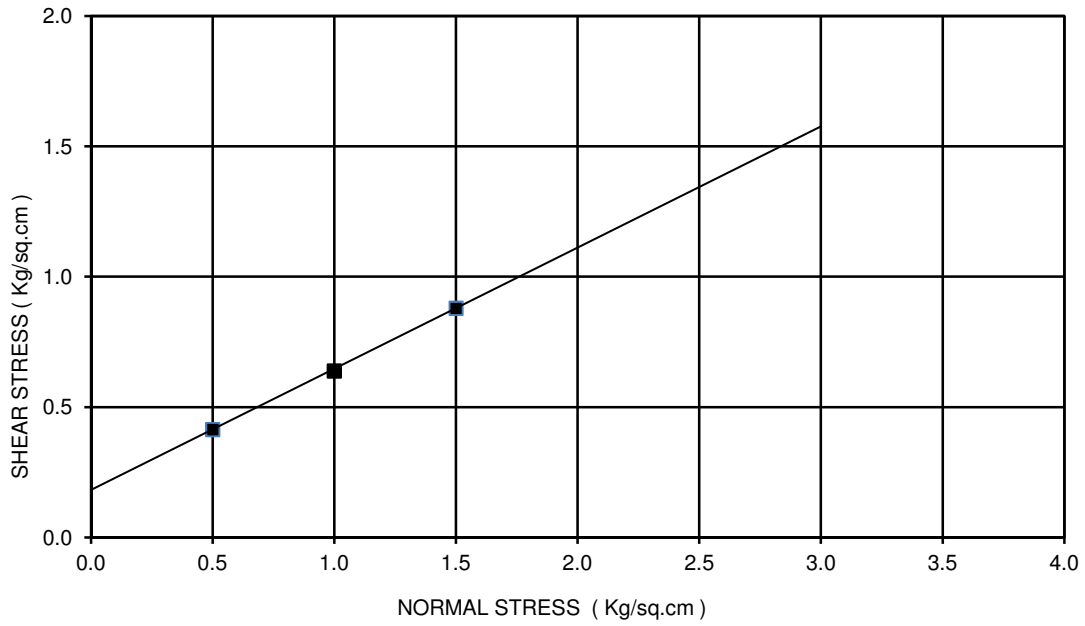
Ch. 55+910  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



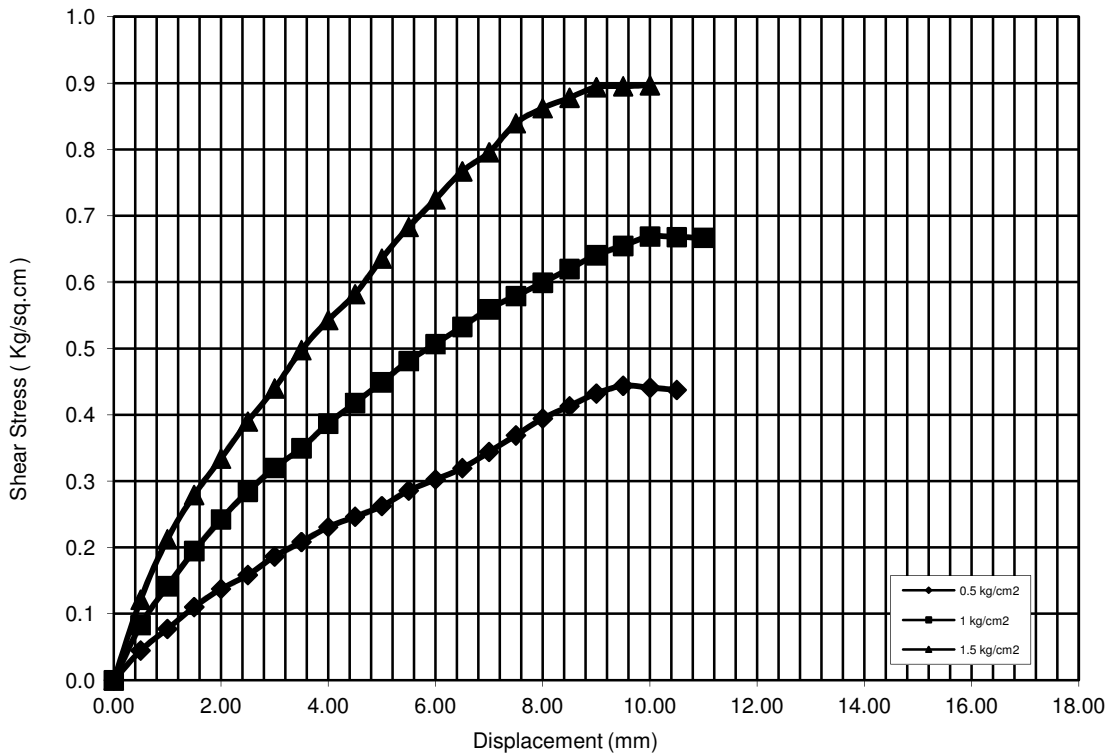
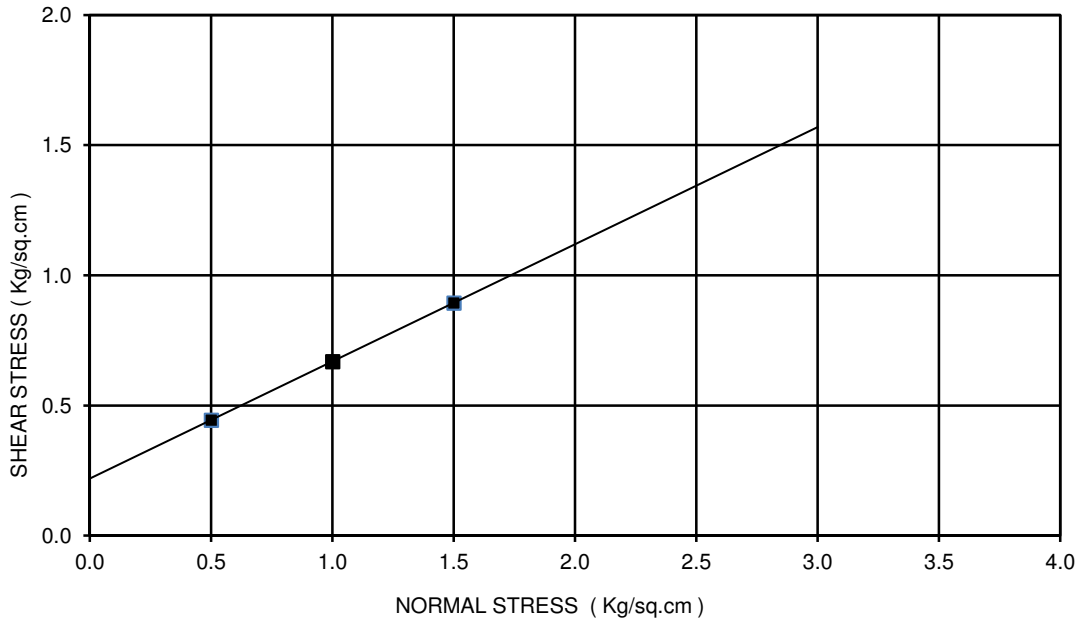
Ch. 56+403  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.50 m  
 COHESION(C)= 0.00 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



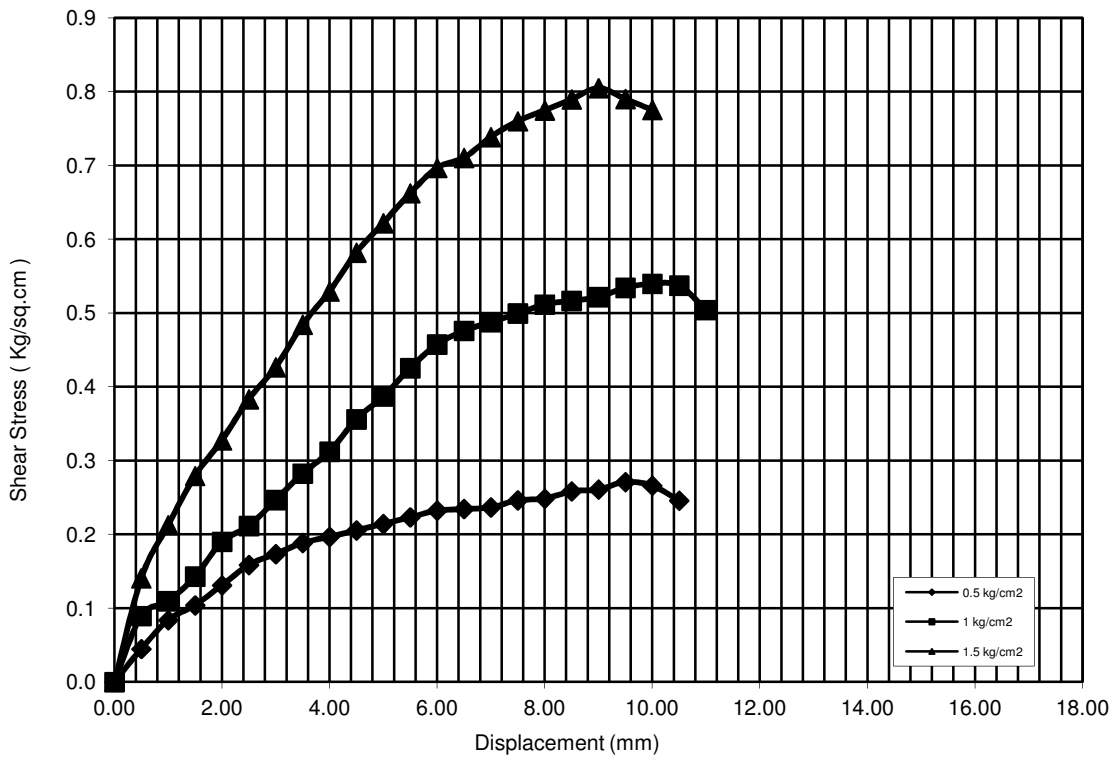
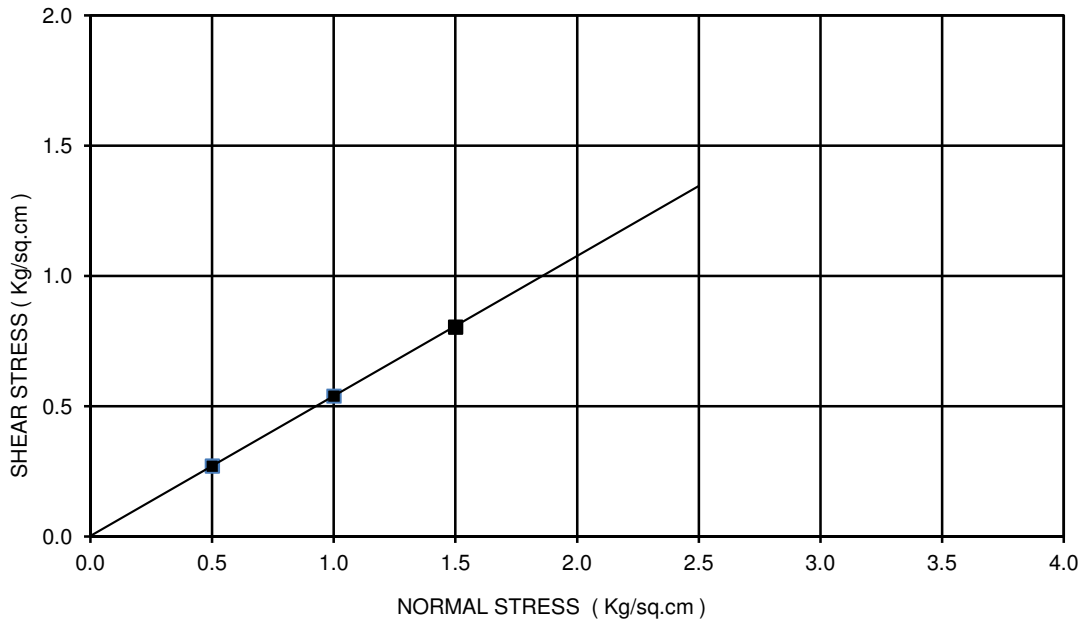
Ch. 56+701  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.25 m  
 COHESION(C)= 0.18 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 25 deg  
 TYPE OF THE TEST: DST



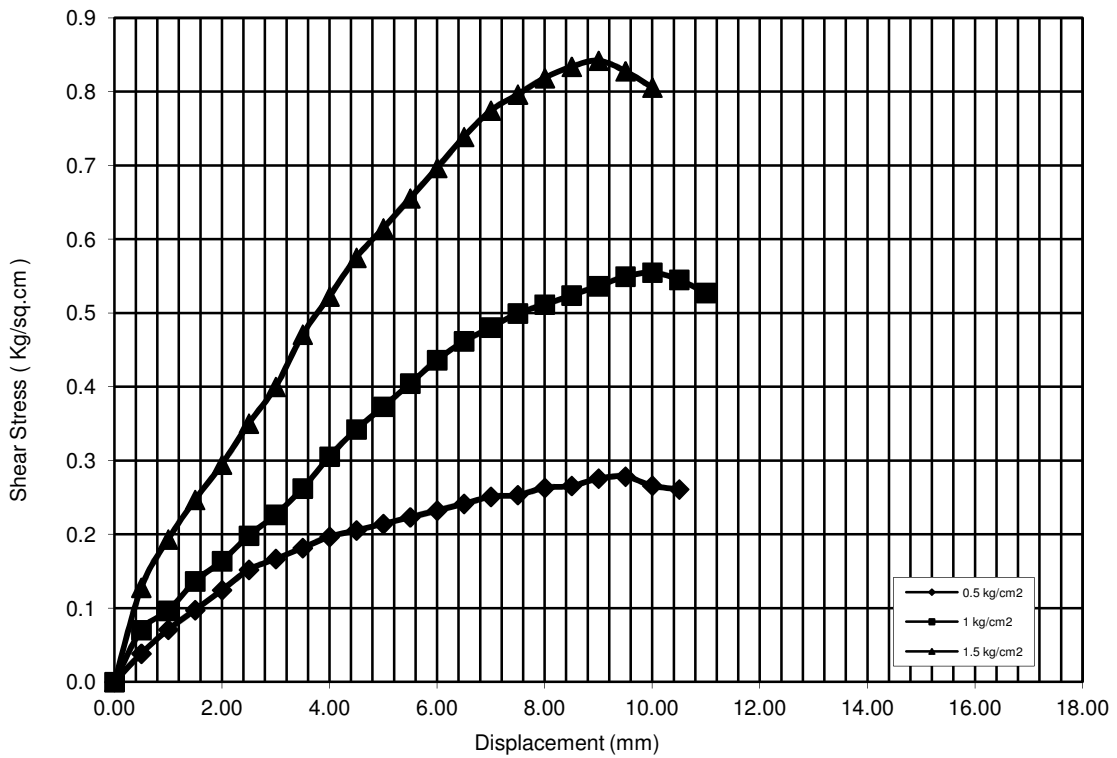
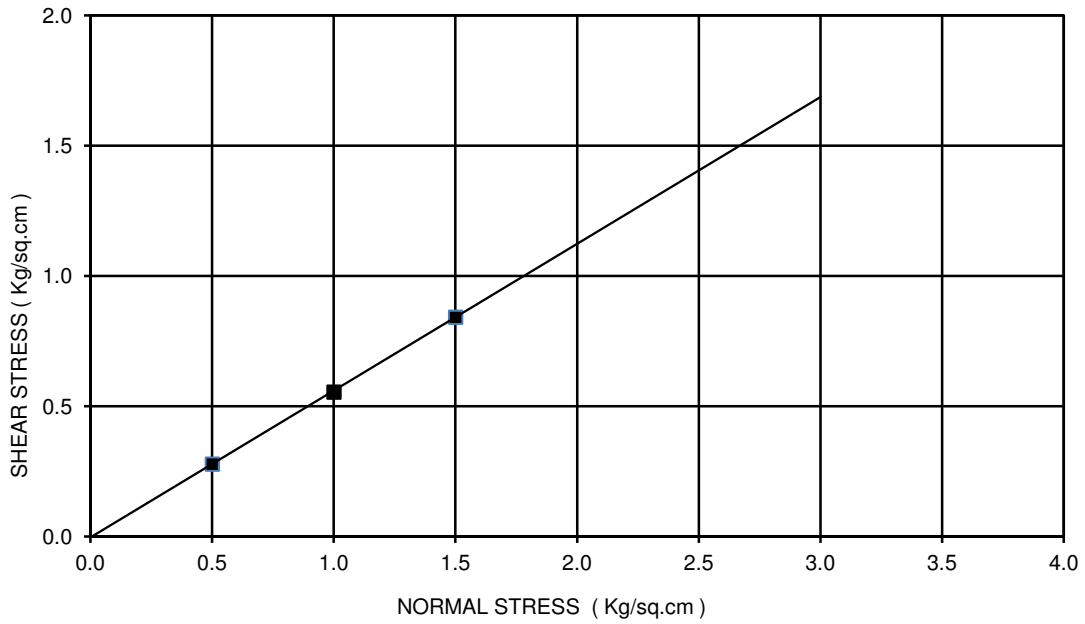
Ch. 56+978  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.25 m  
 COHESION(C)= 0.22 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 24 deg  
 TYPE OF THE TEST: DST



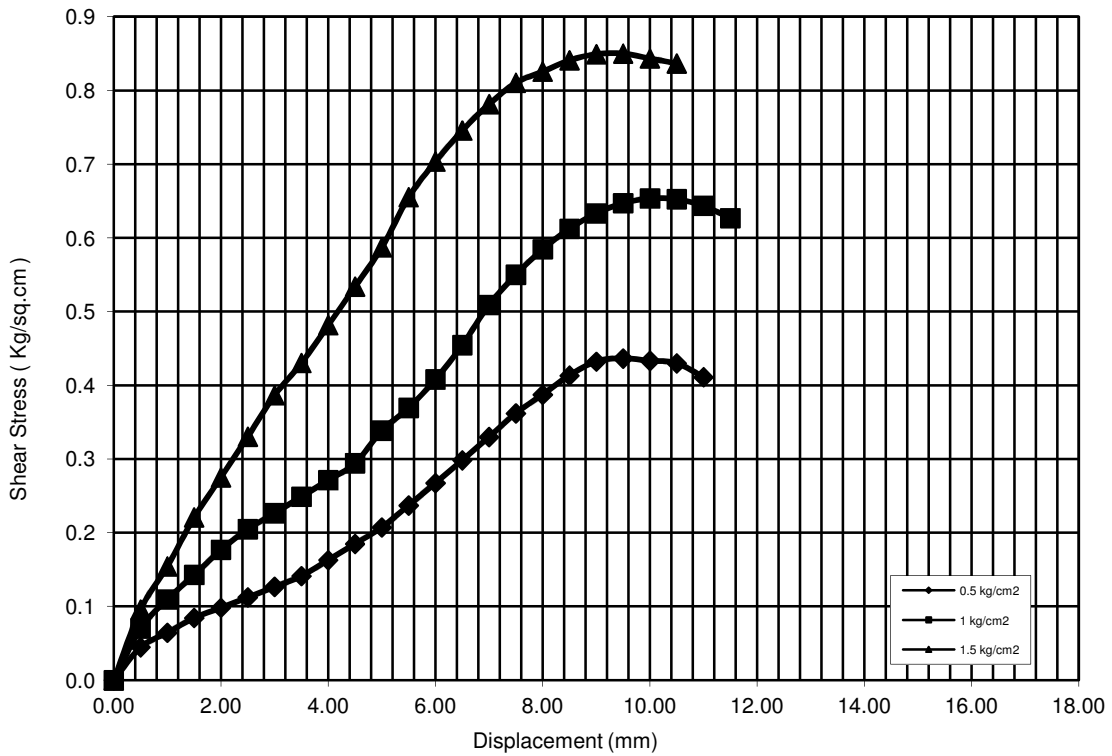
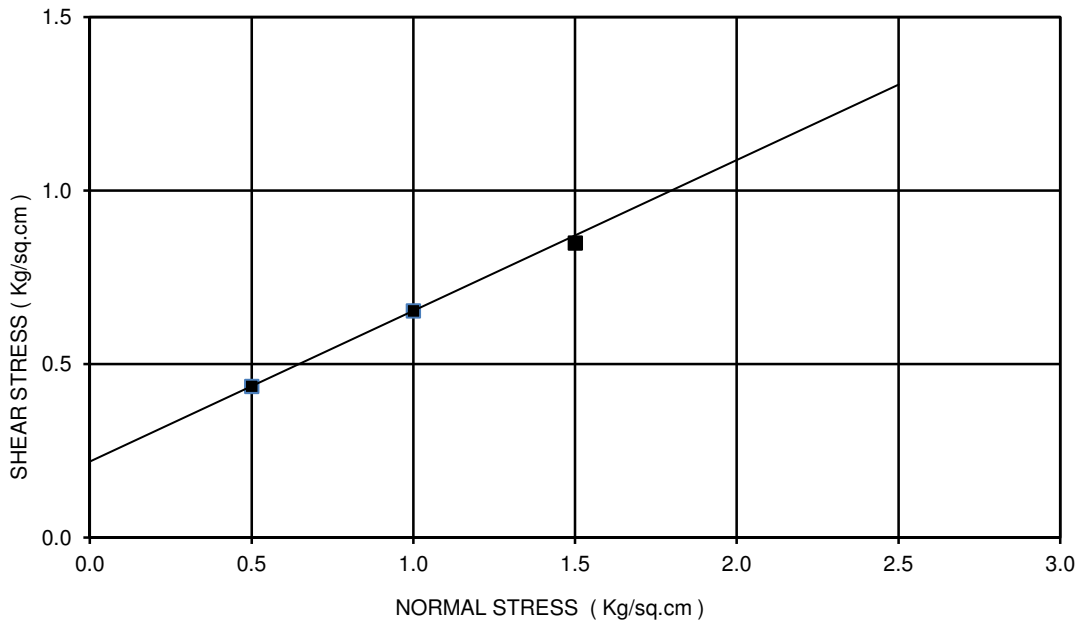
Ch. 57+400  
 BORE HOLE NO: P5  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.5 m  
 COHESION(C)= 0.09 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



Ch. 57+400  
 BORE HOLE NO: BH-P5  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST

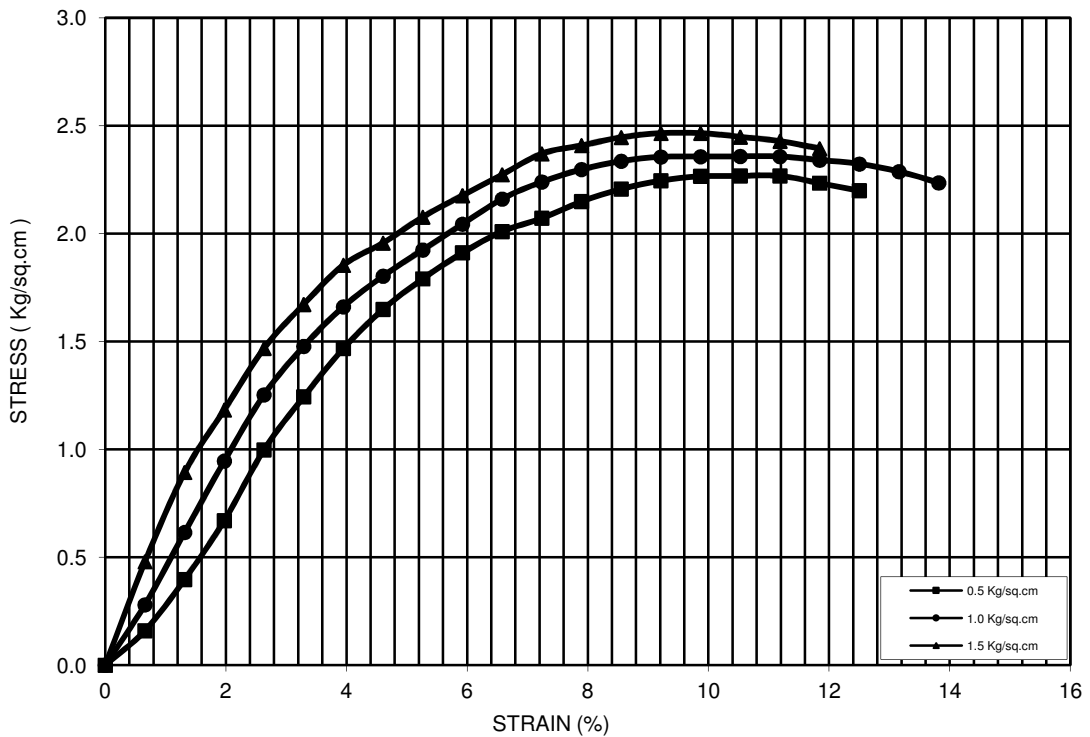
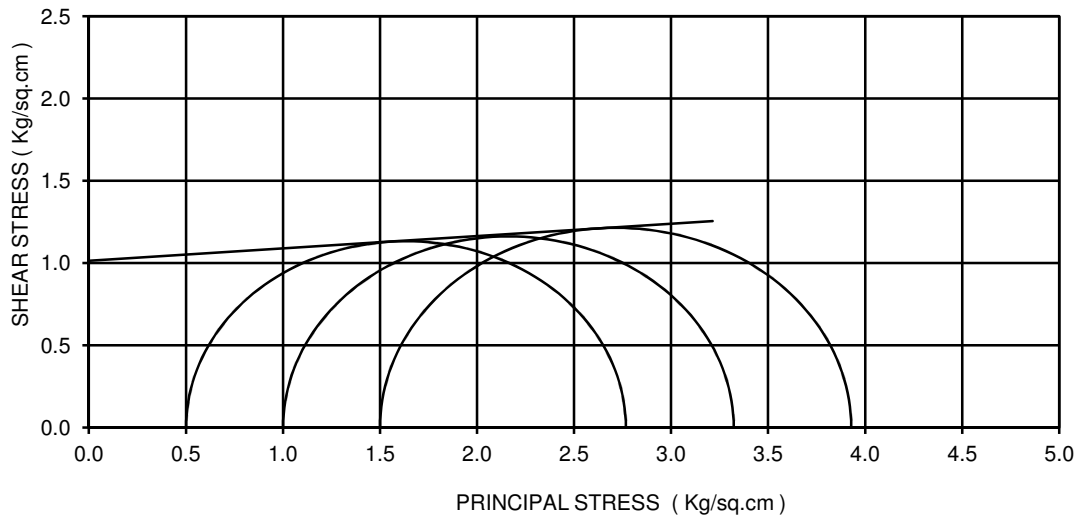


Ch. 57+400  
 BORE HOLE NO: BH-P9  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.06 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST

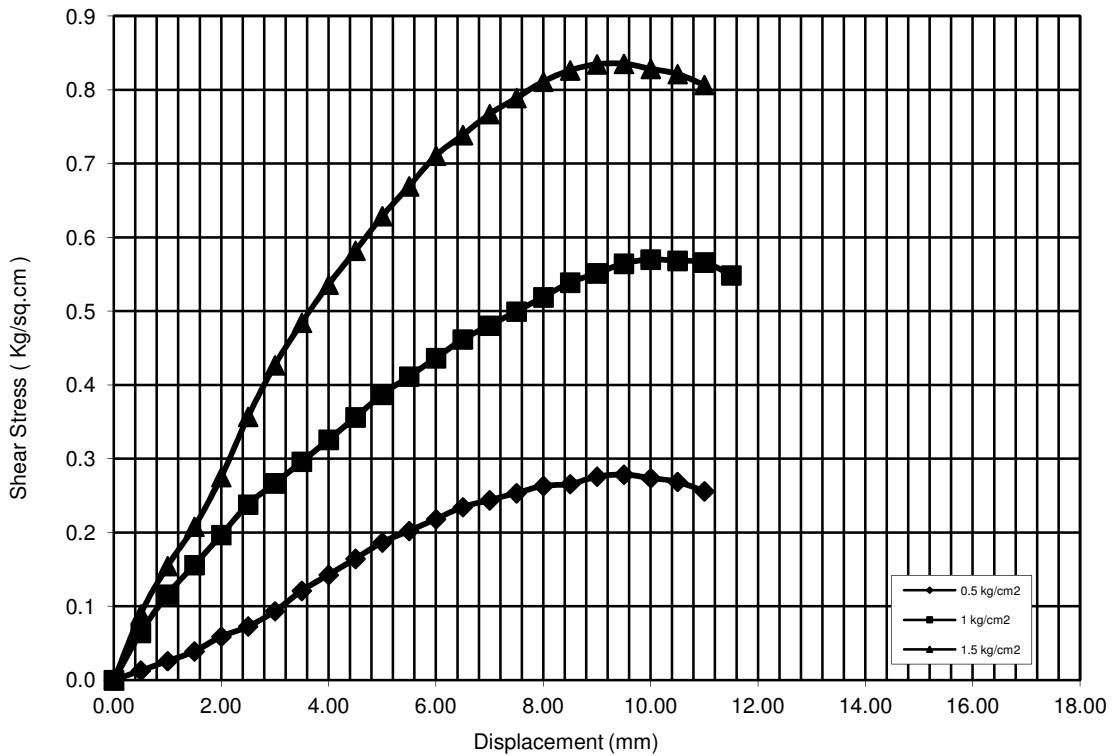
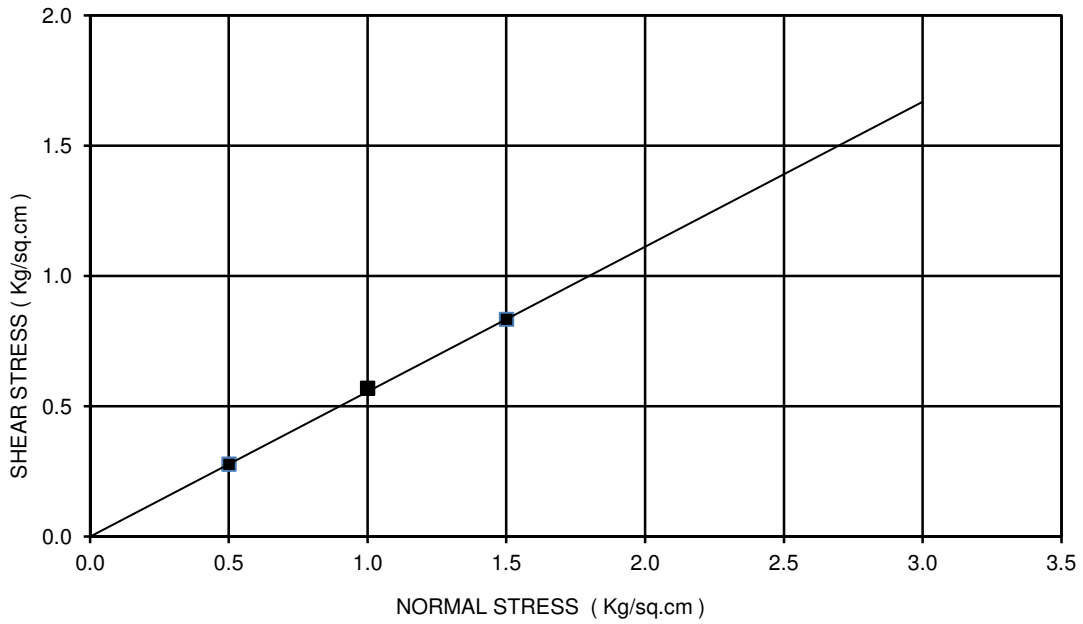




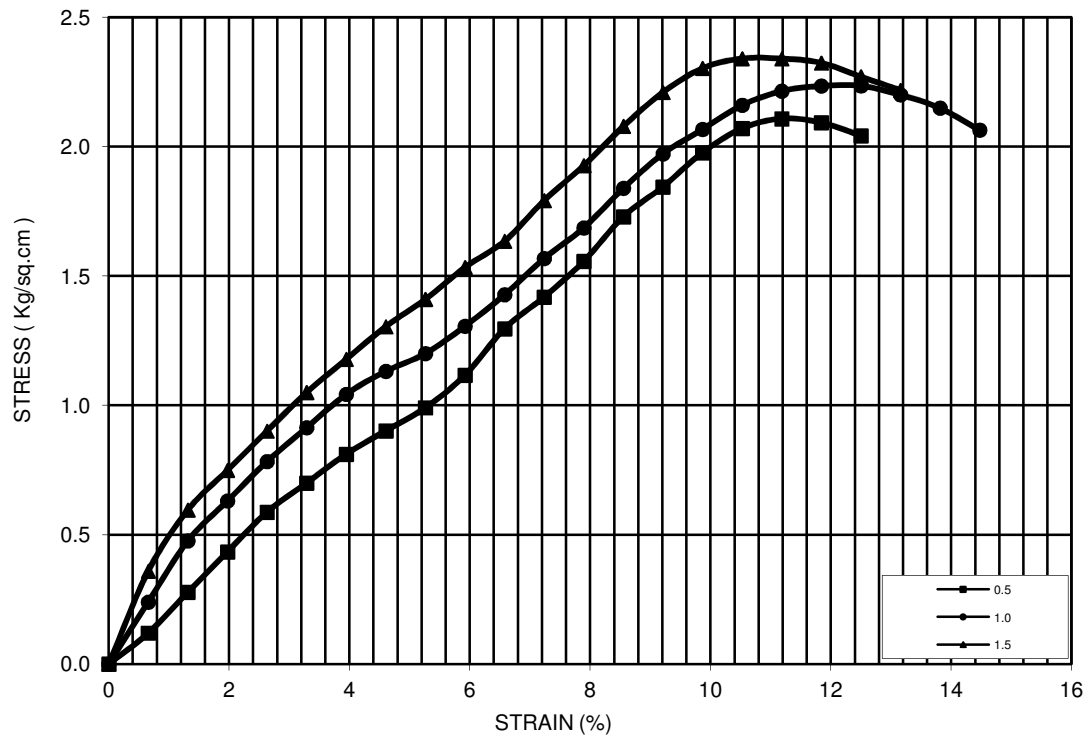
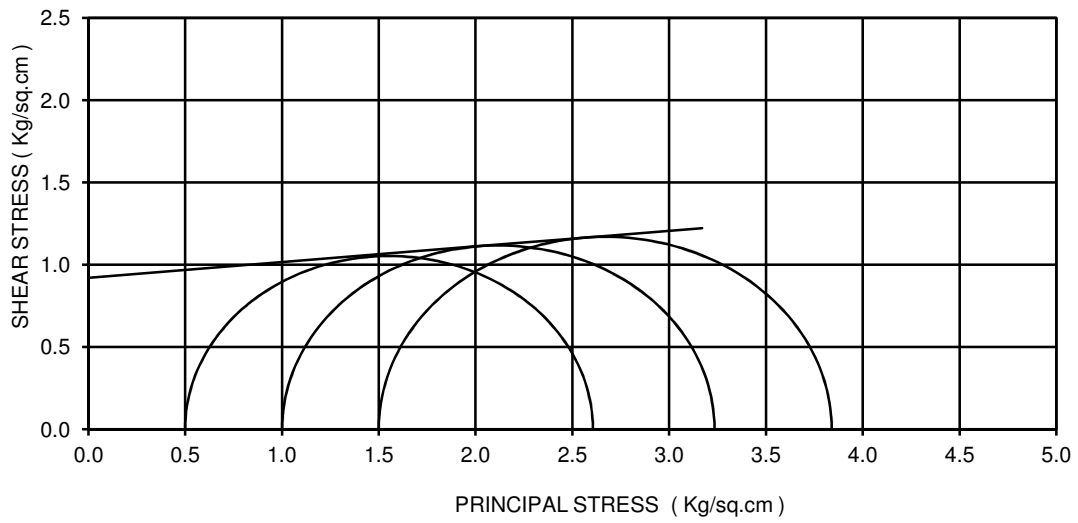
Ch. 57+400  
 BORE HOLE NO: BH-P9  
 SAMPLE NO.: UDS-3  
 DEPTH: 10.00 m  
 COHESION(C)= 1.39 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT



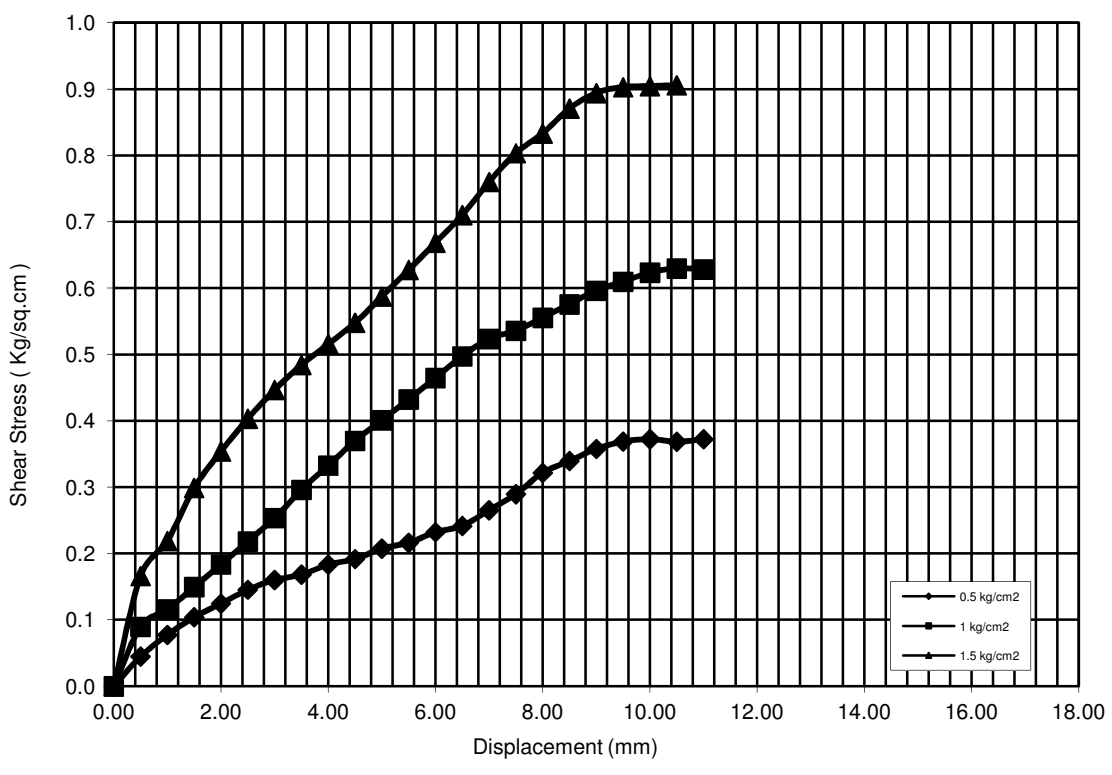
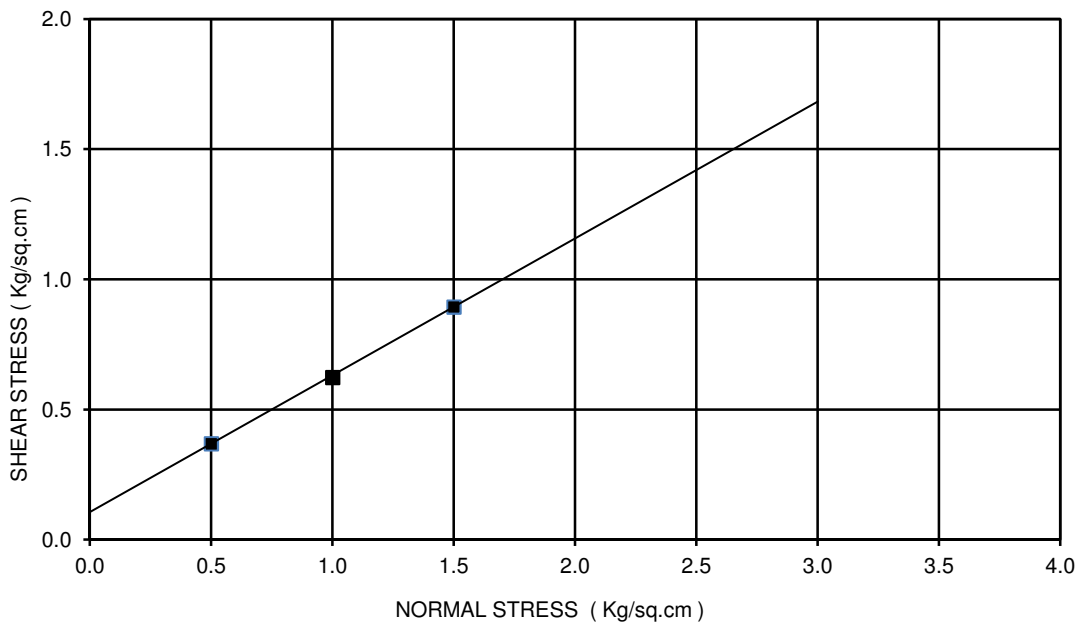
Ch. 57+400  
 BORE HOLE NO: BH-P10  
 SAMPLE NO.: UDS-5  
 DEPTH: 16.00 m  
 COHESION(C)= 0 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 30 deg  
 TYPE OF THE TEST: DST



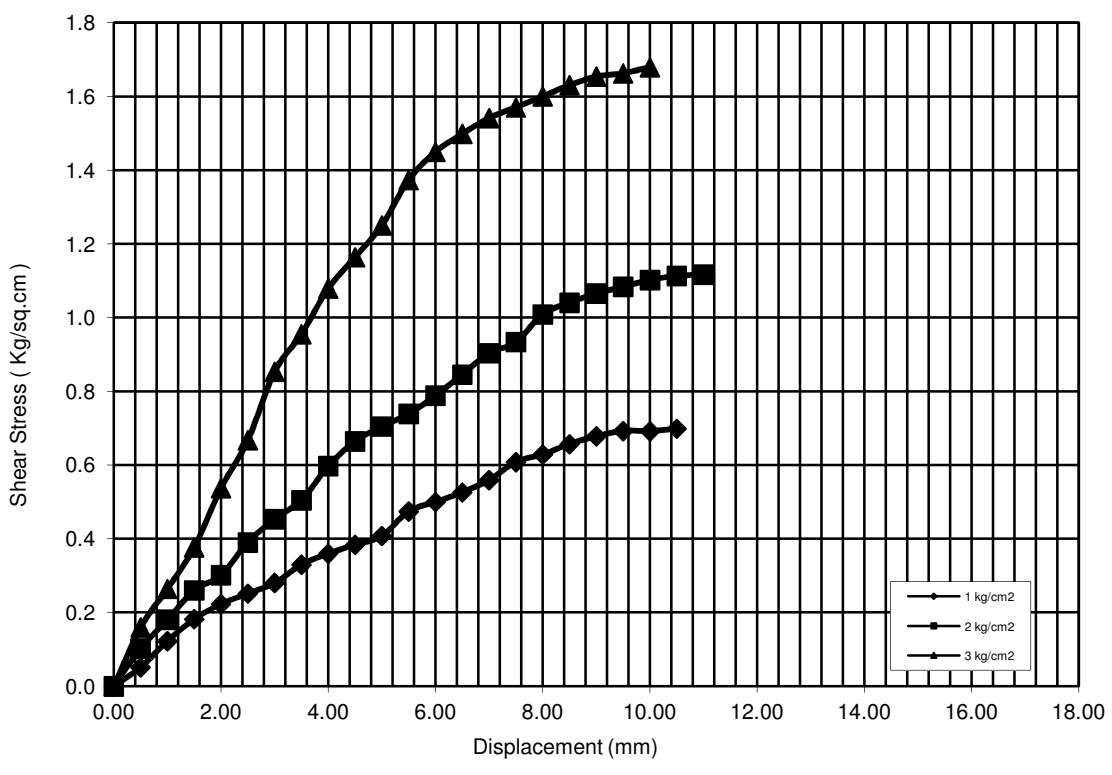
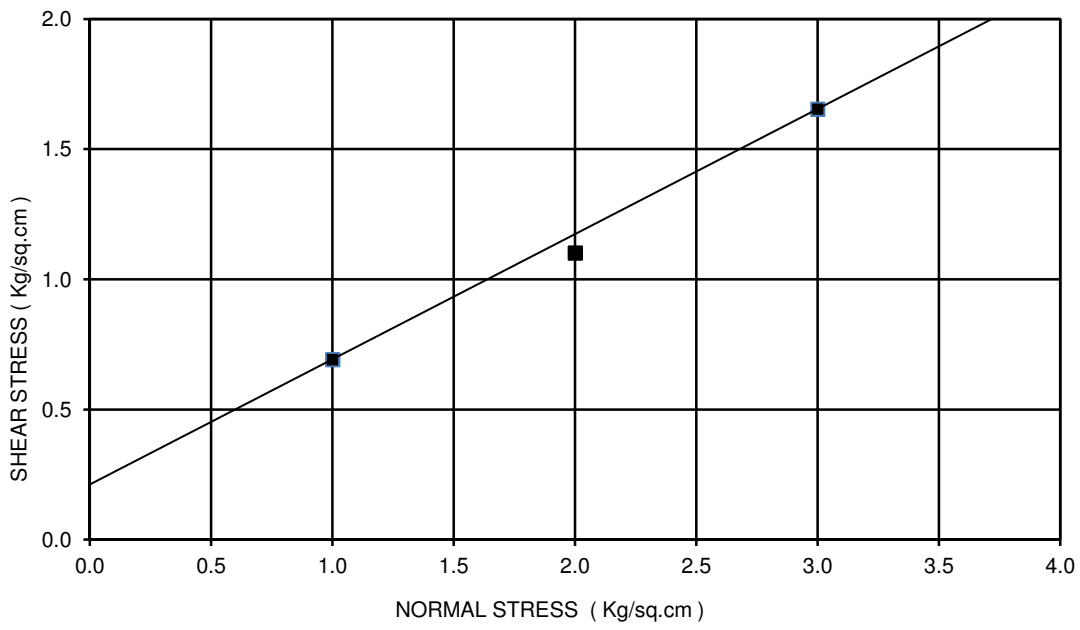
Ch. 57+400  
 BORE HOLE NO: BH-P10  
 SAMPLE NO.: UDS-2  
 DEPTH: 7.00 m  
 COHESION(C)= 0.78 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT



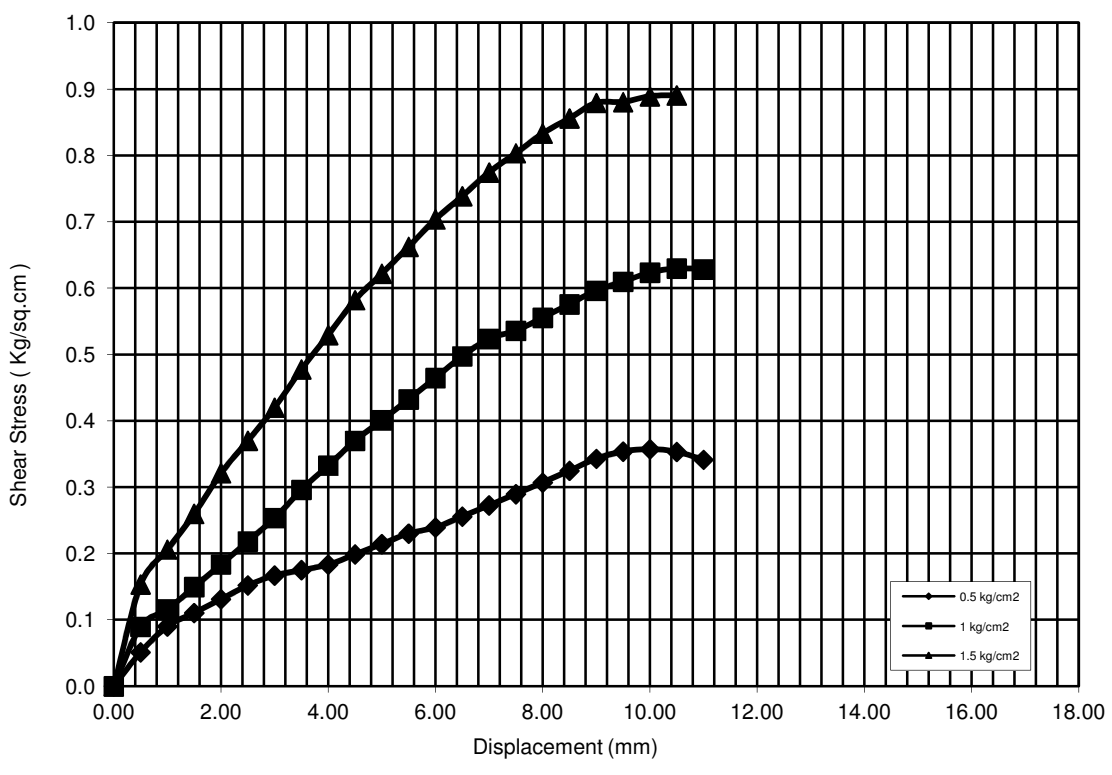
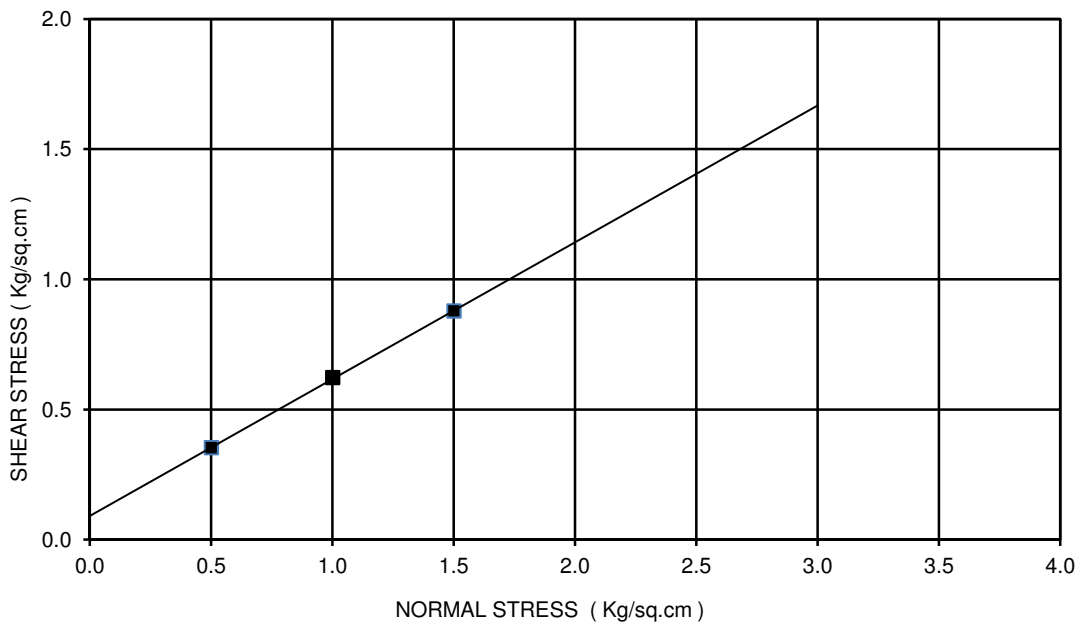
Ch. 57+400  
 BORE HOLE NO: BH-P12  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



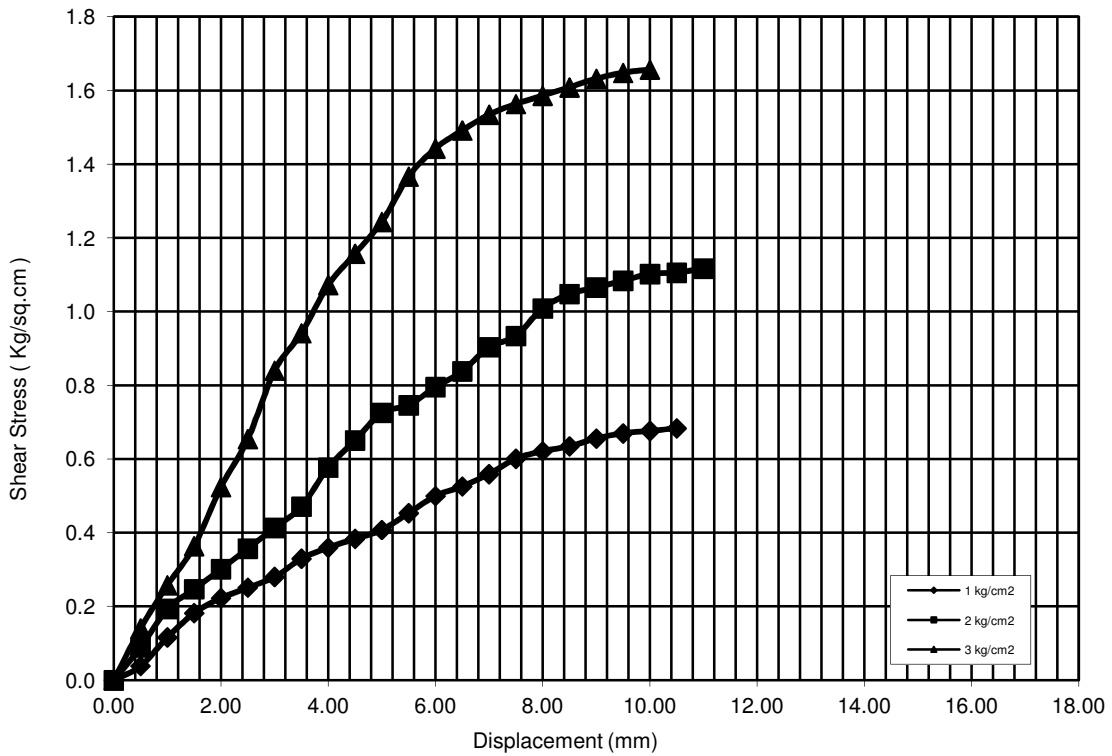
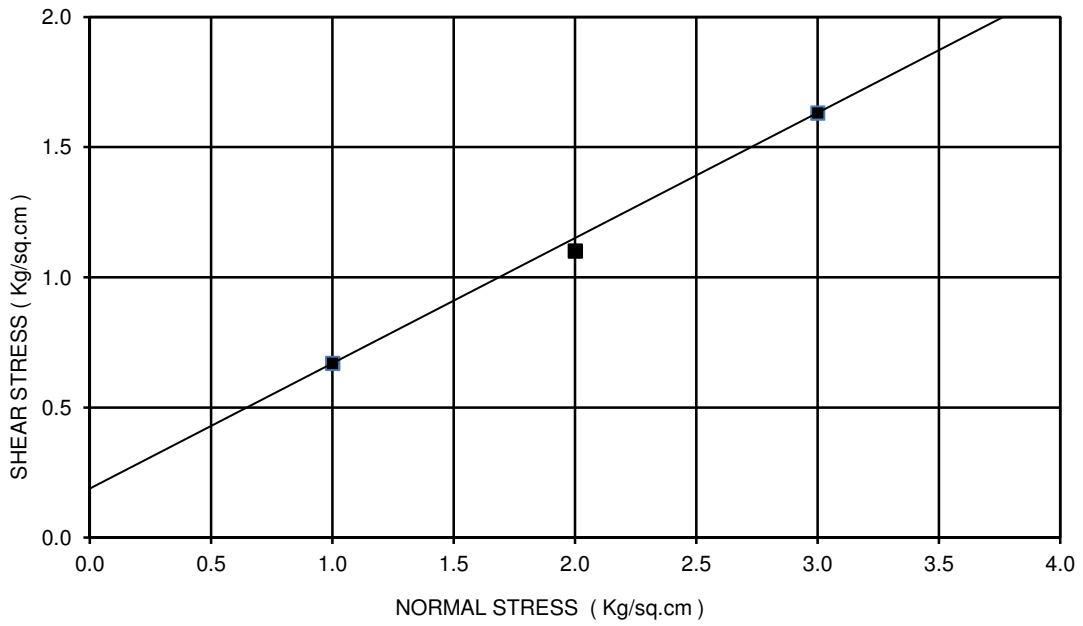
Ch. 57+400  
 BORE HOLE NO: BH-P12  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



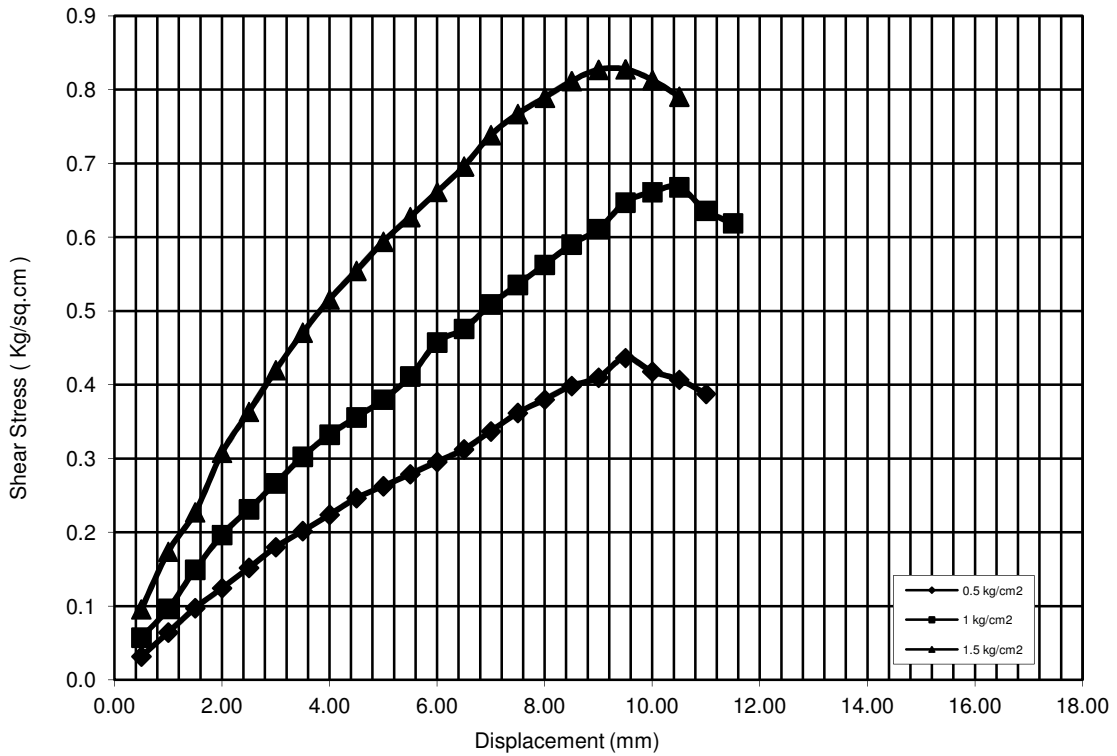
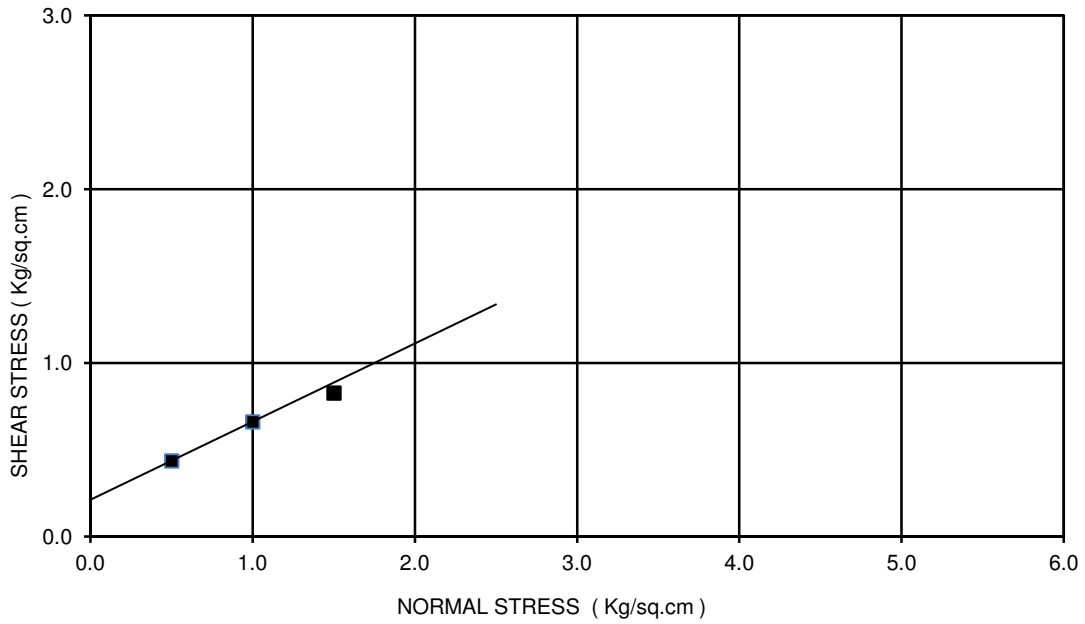
Ch. 57+400  
 BORE HOLE NO: BH-P15  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



Ch. 57+400  
 BORE HOLE NO: BH-P15  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

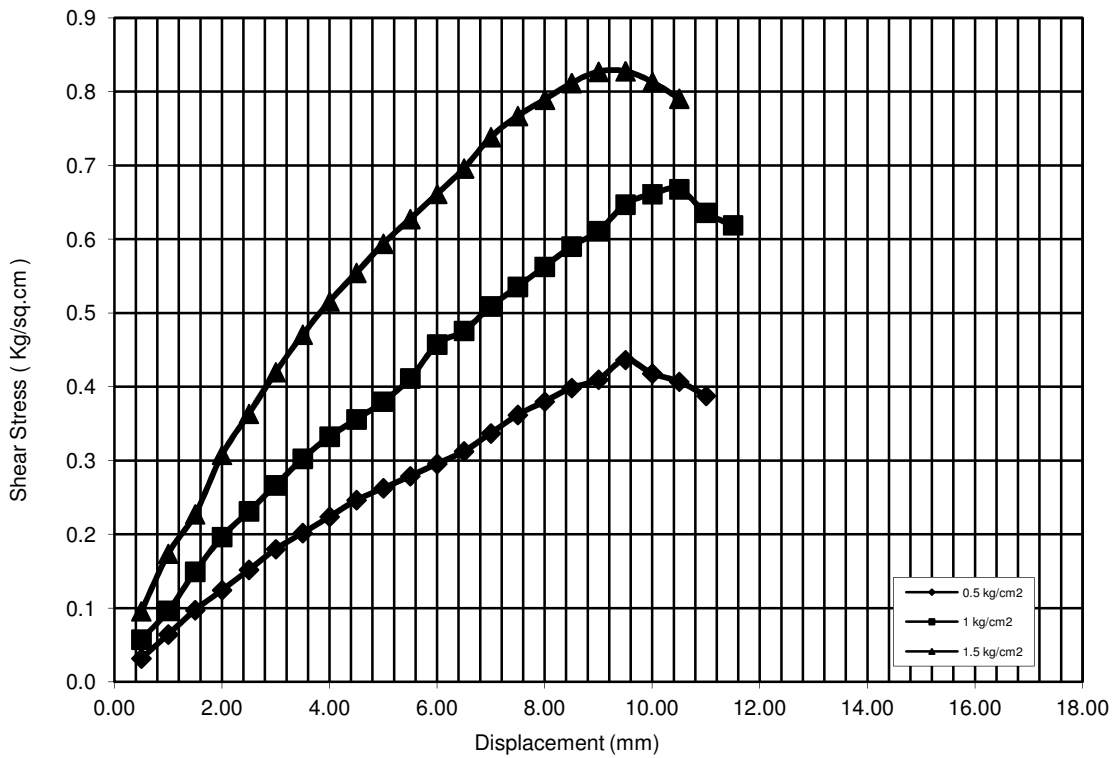
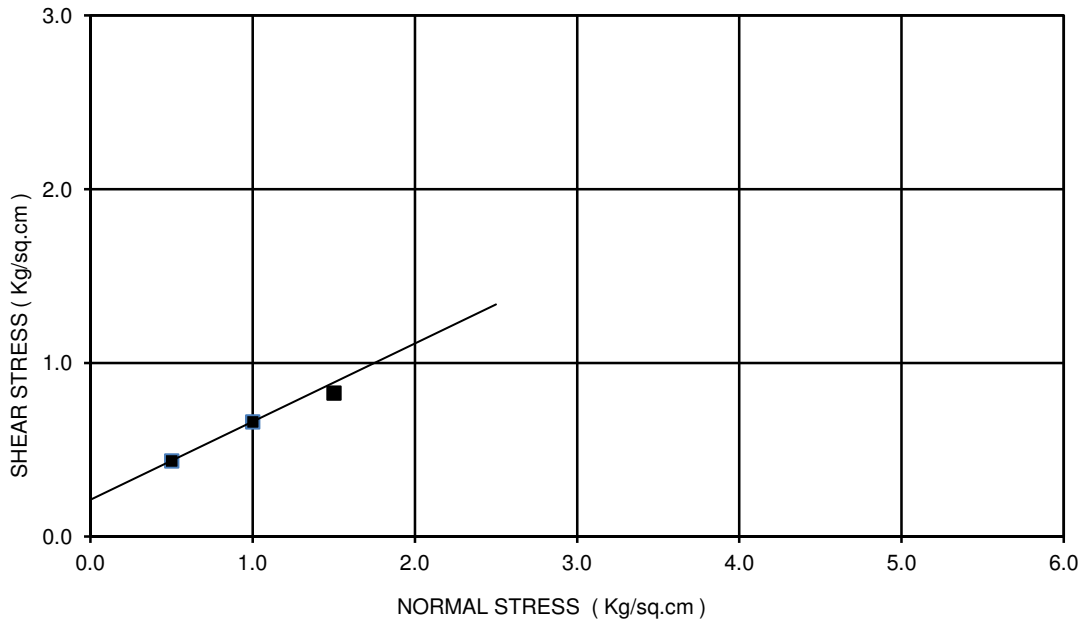


Ch. 57+400  
 BORE HOLE NO: BH-P16  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST

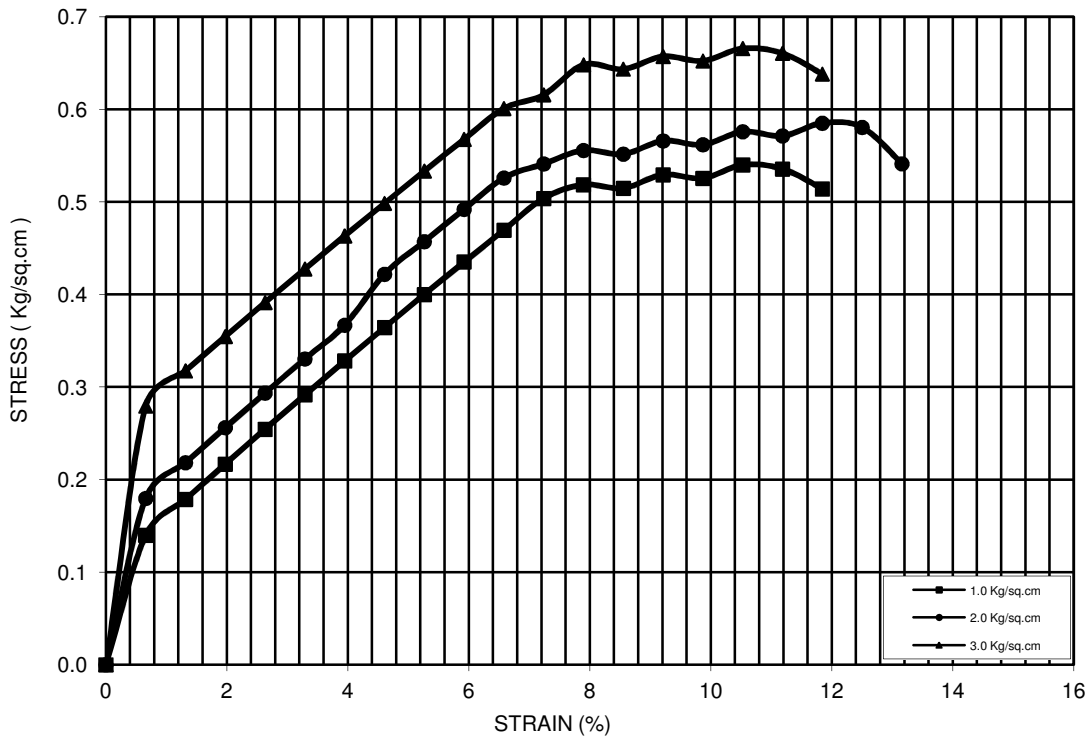
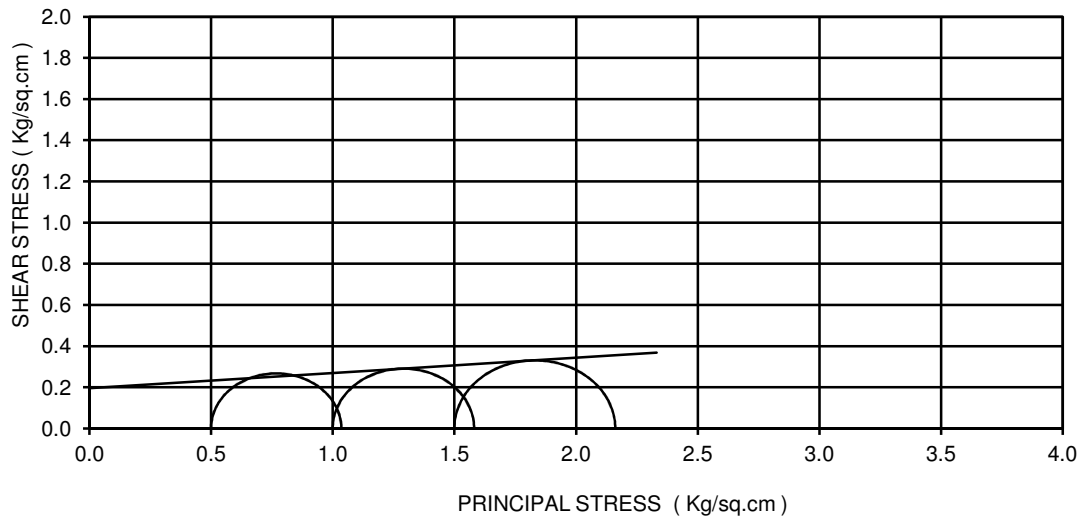




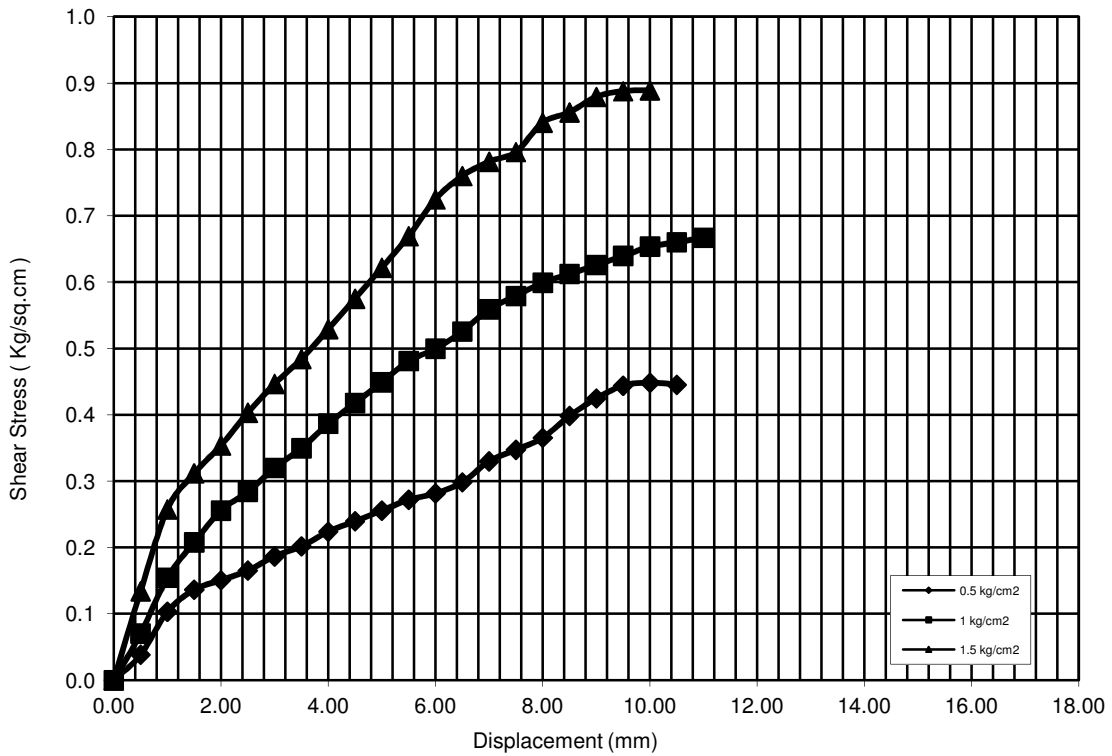
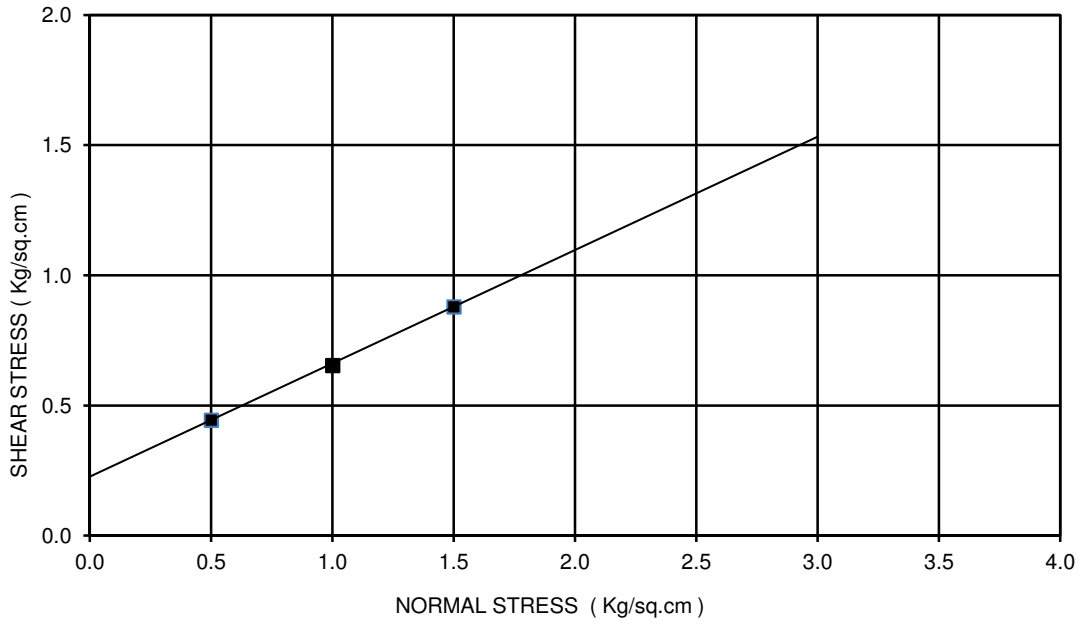
Ch. 57+400  
 BORE HOLE NO: BH-P16  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST



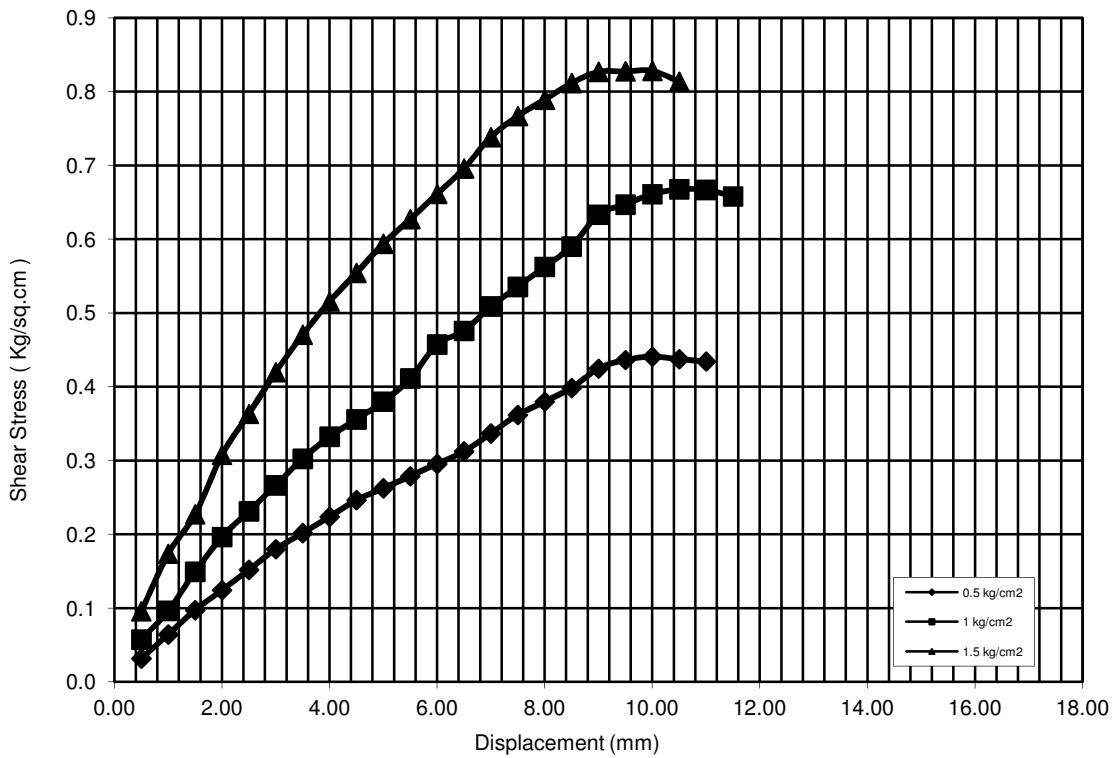
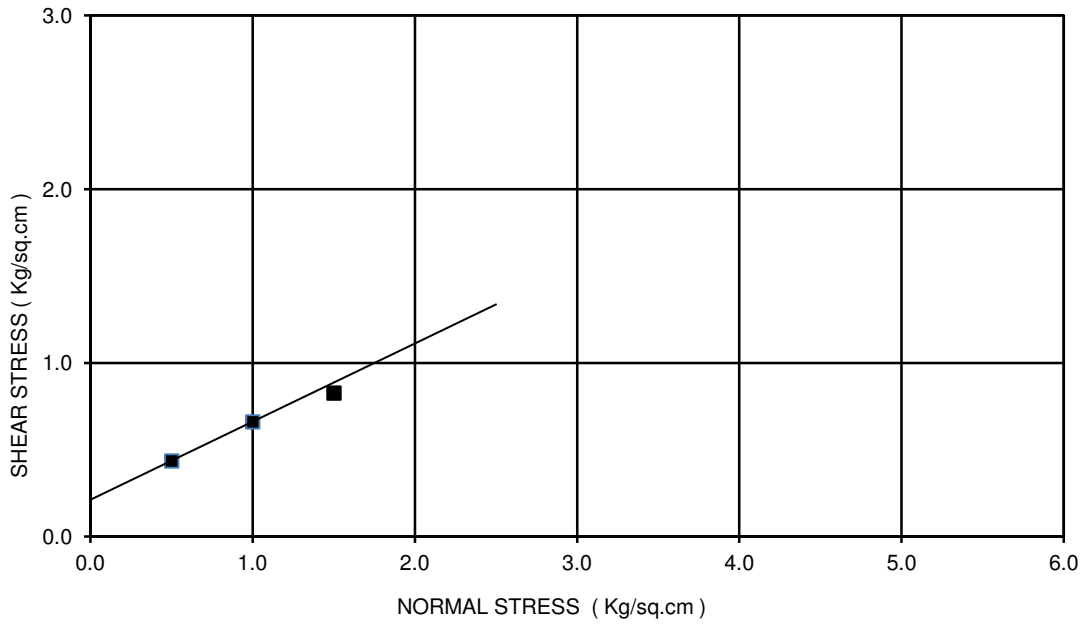
Ch. 57+400  
 BORE HOLE NO: BH-P17  
 SAMPLE NO.: UDS-5  
 DEPTH: 16.00 m  
 COHESION(C)= 0.62 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 11 deg  
 TYPE OF THE TEST: UUT



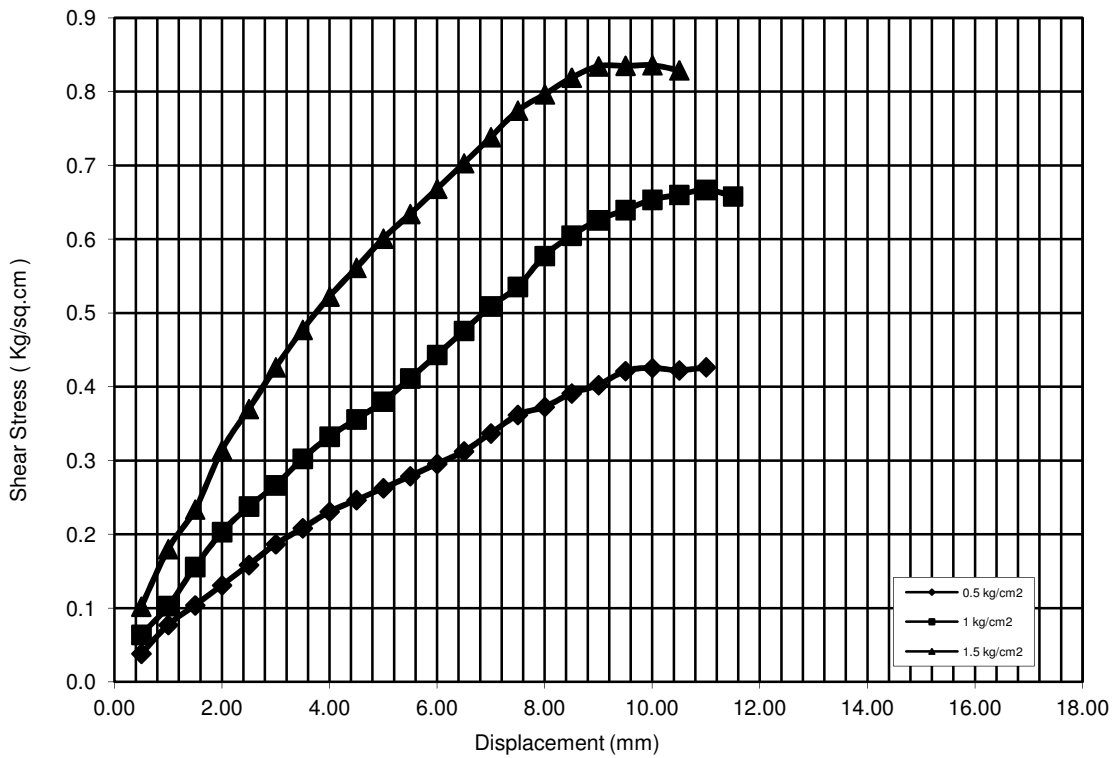
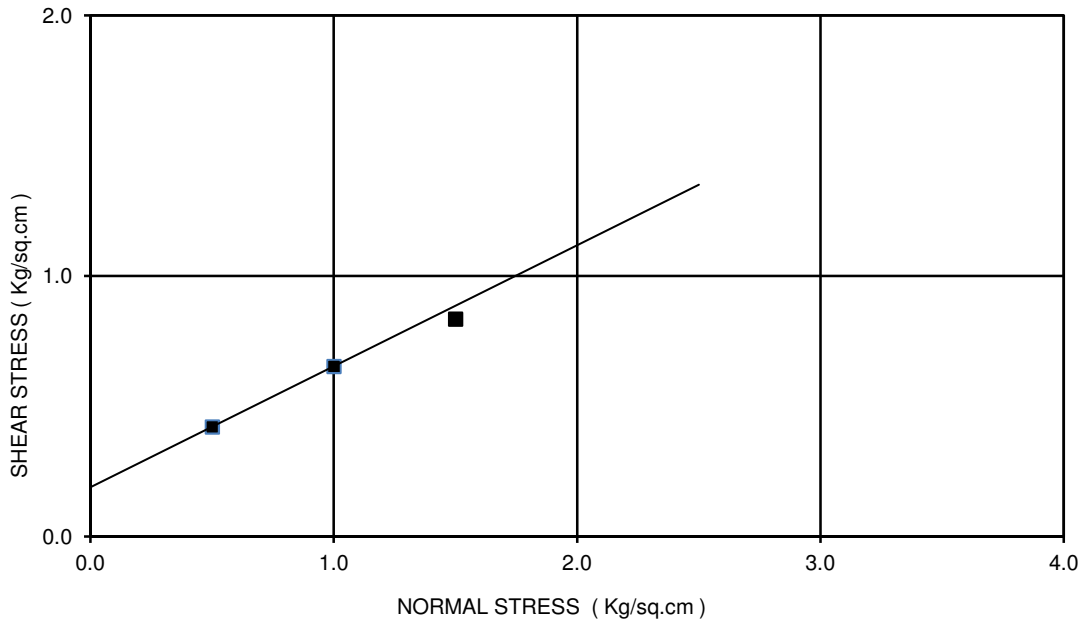
Ch. 57+400  
 BORE HOLE NO: BH-P17  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



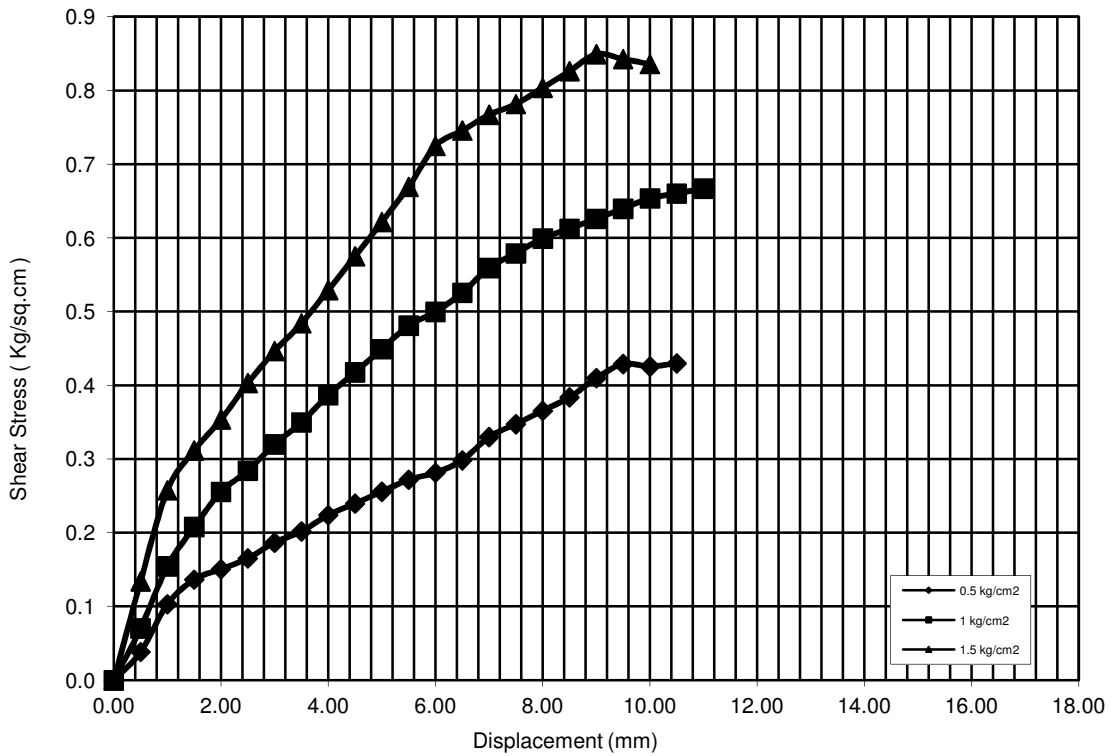
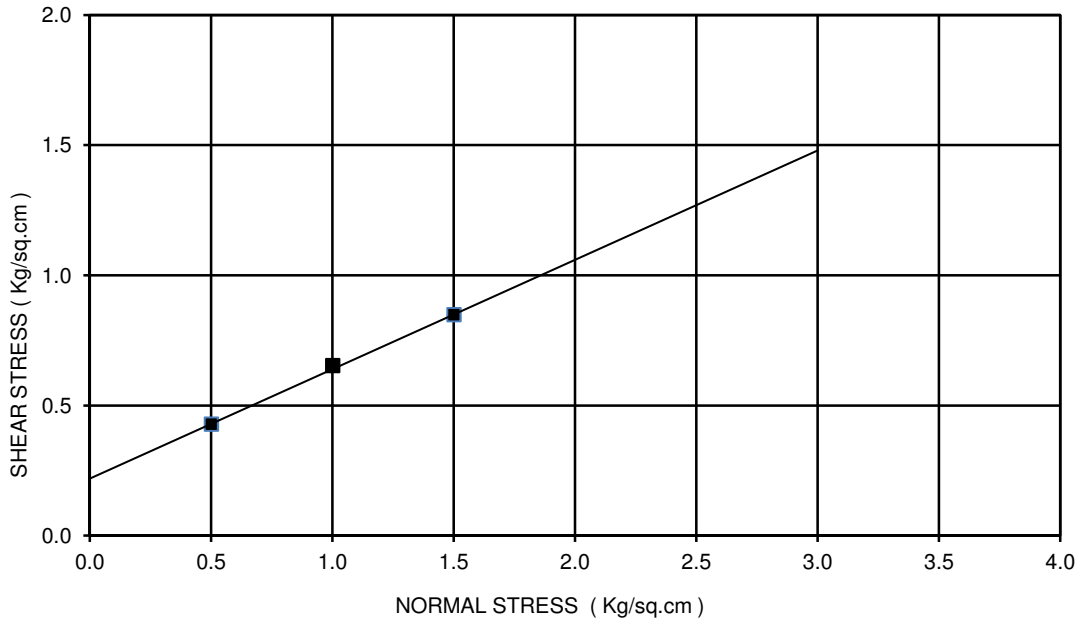
Ch. 57+400  
 BORE HOLE NO: BH-P18  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST



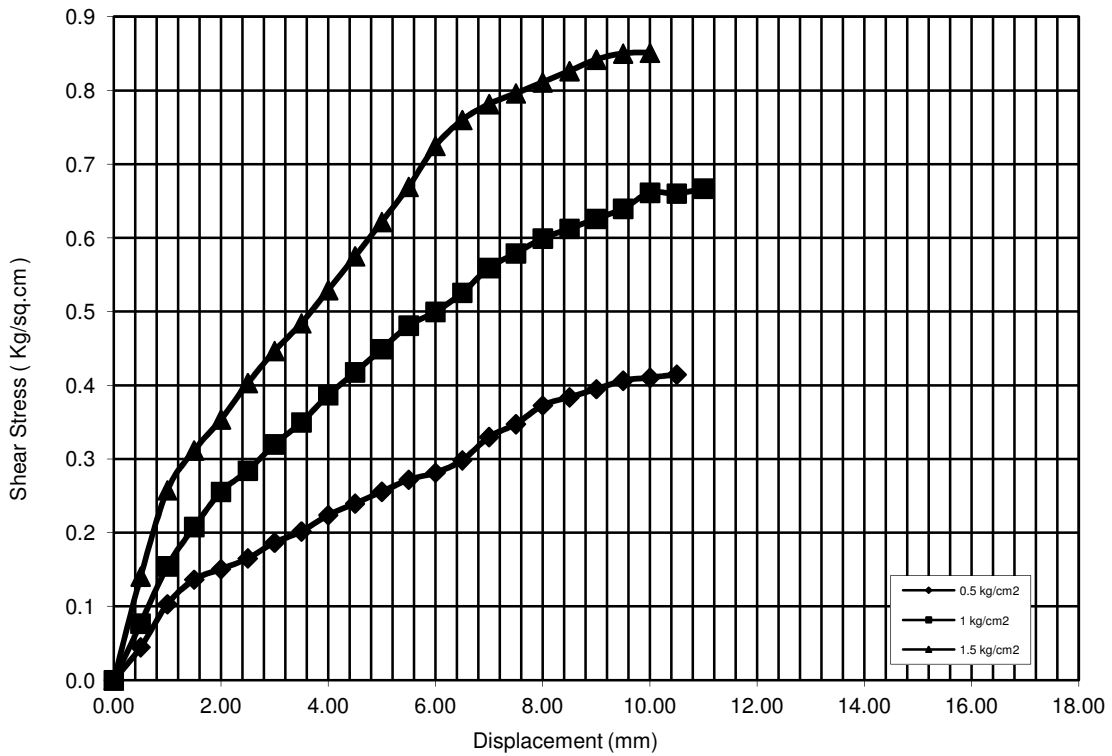
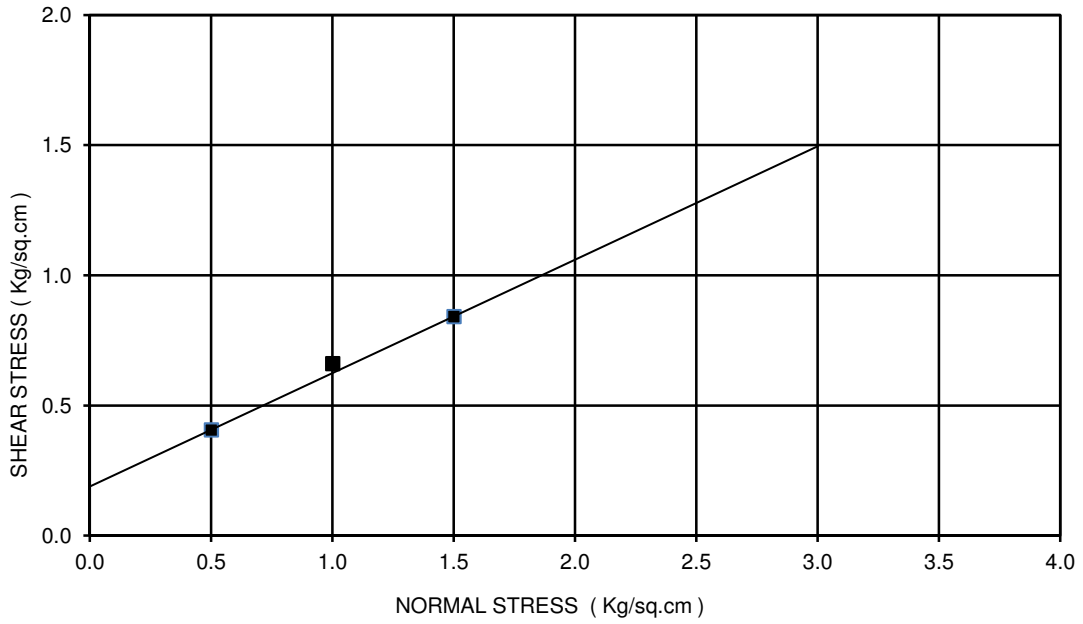
Ch. 57+400  
 BORE HOLE NO: BH-P18  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST



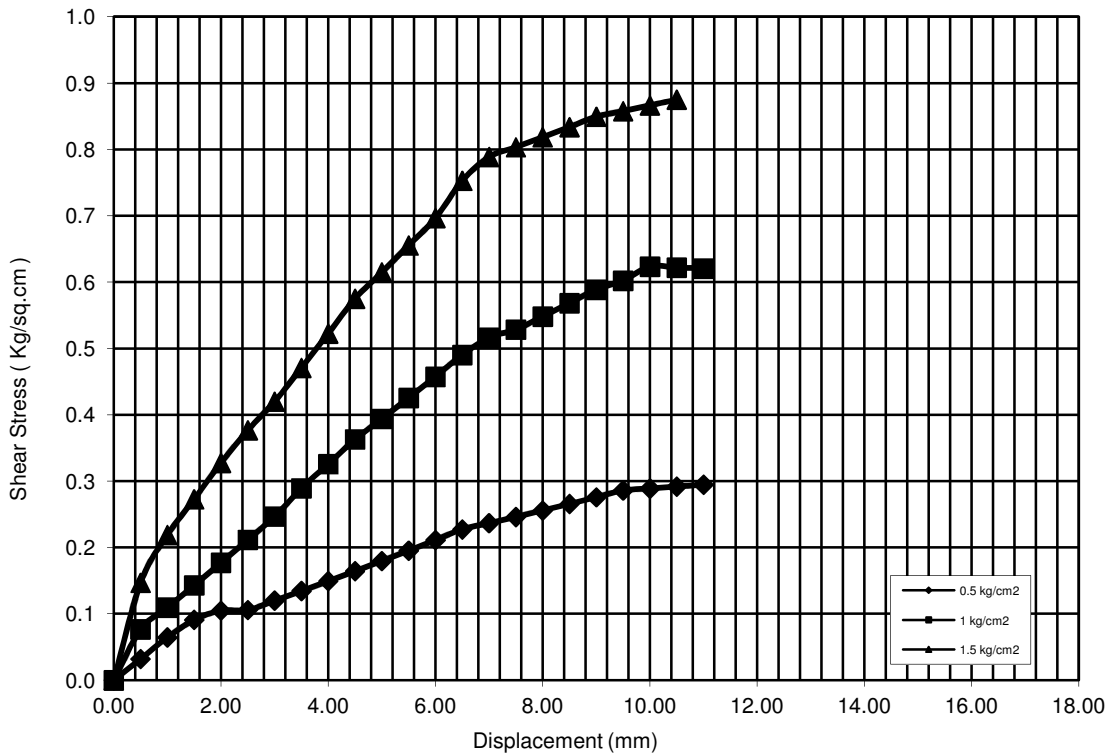
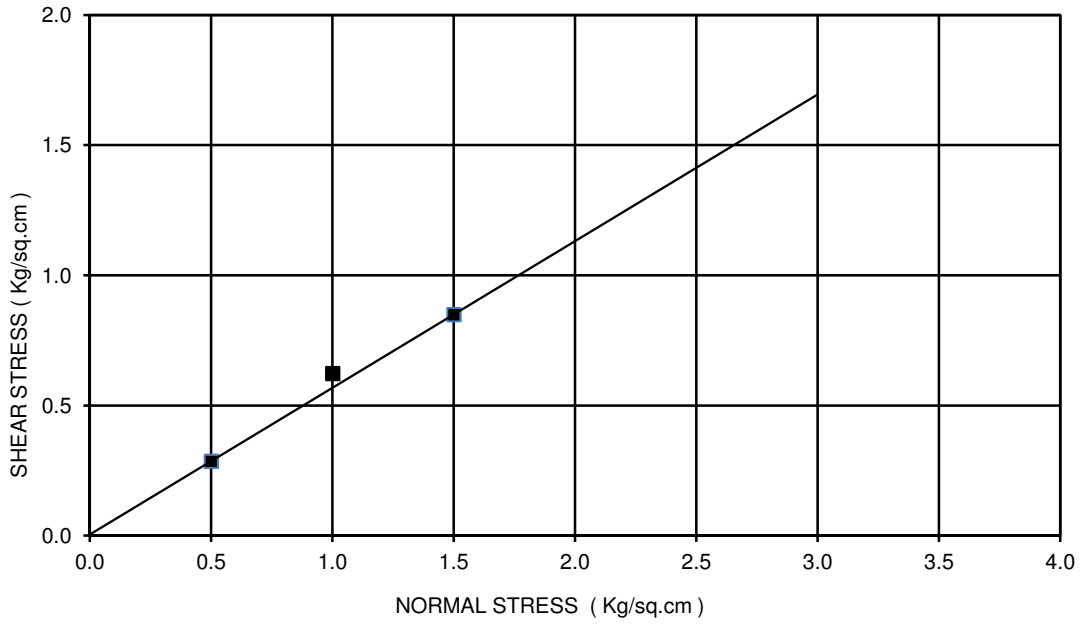
Ch. 57+400  
 BORE HOLE NO: BH-P19  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



Ch. 57+400  
 BORE HOLE NO: BH-P19  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

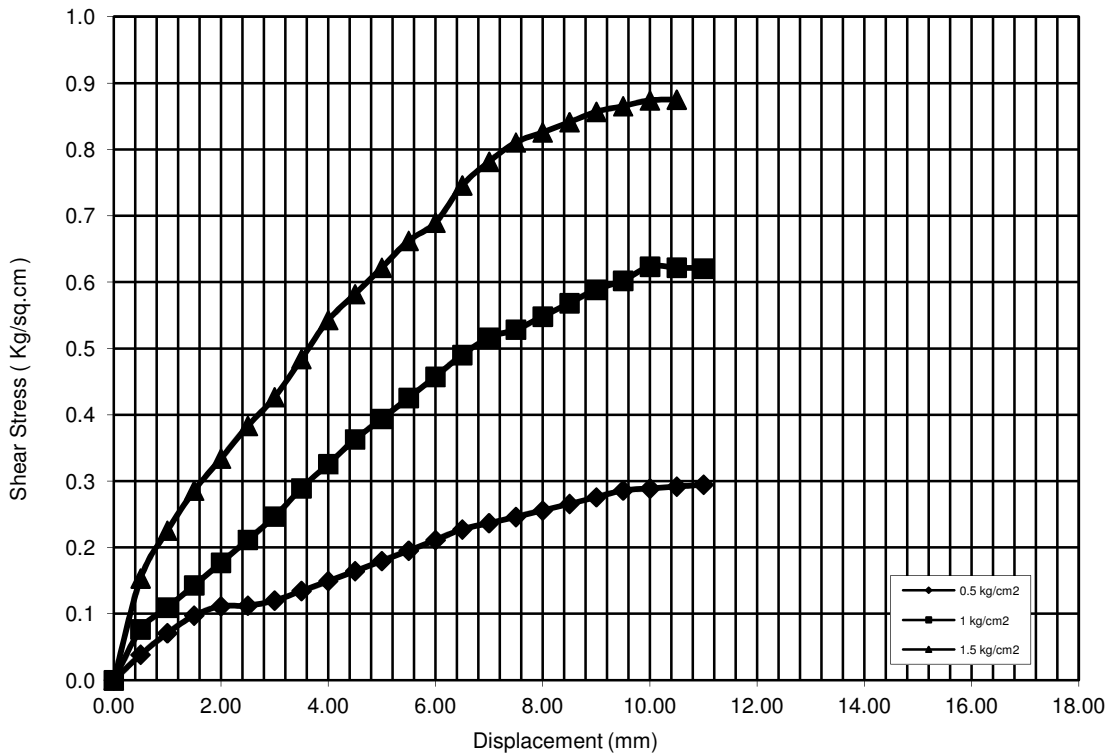
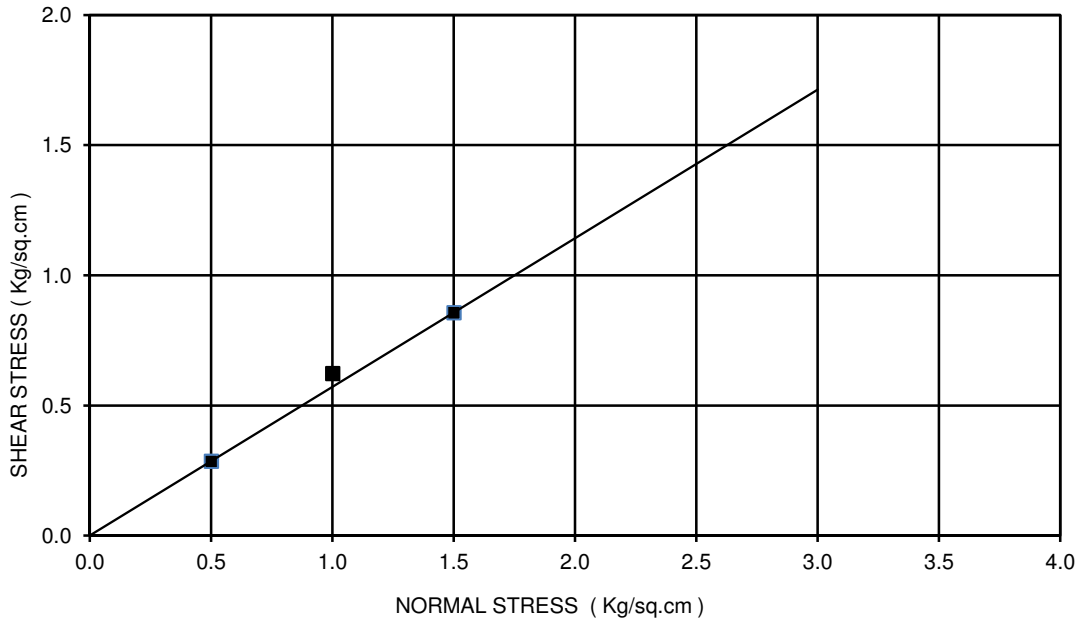


Ch. 57+400  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST

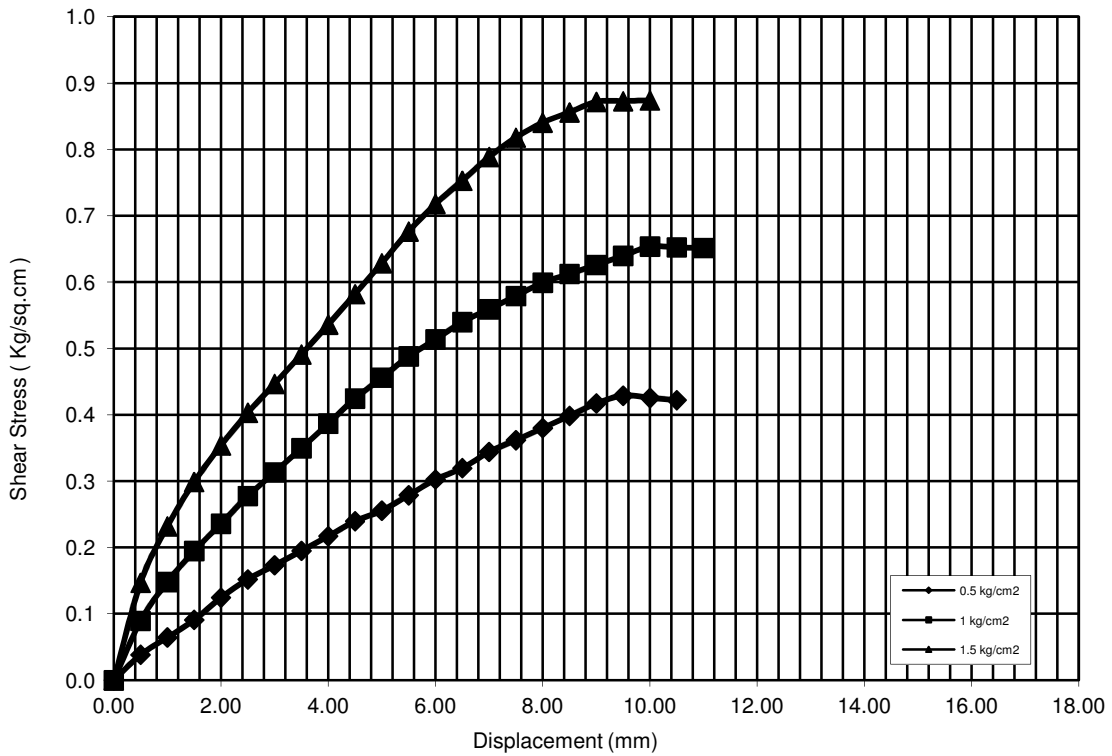
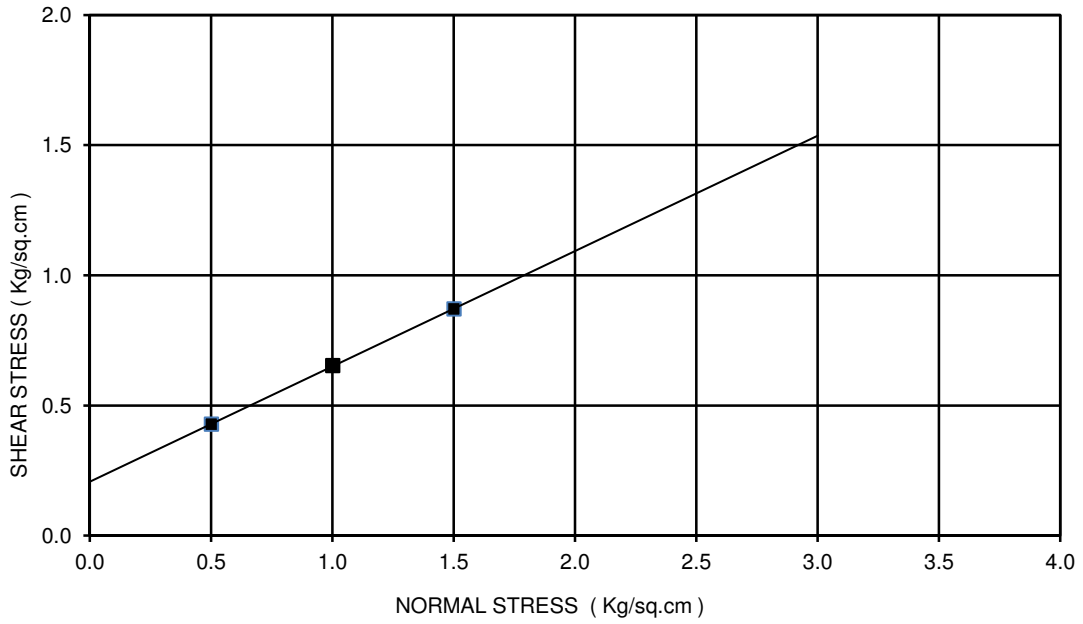




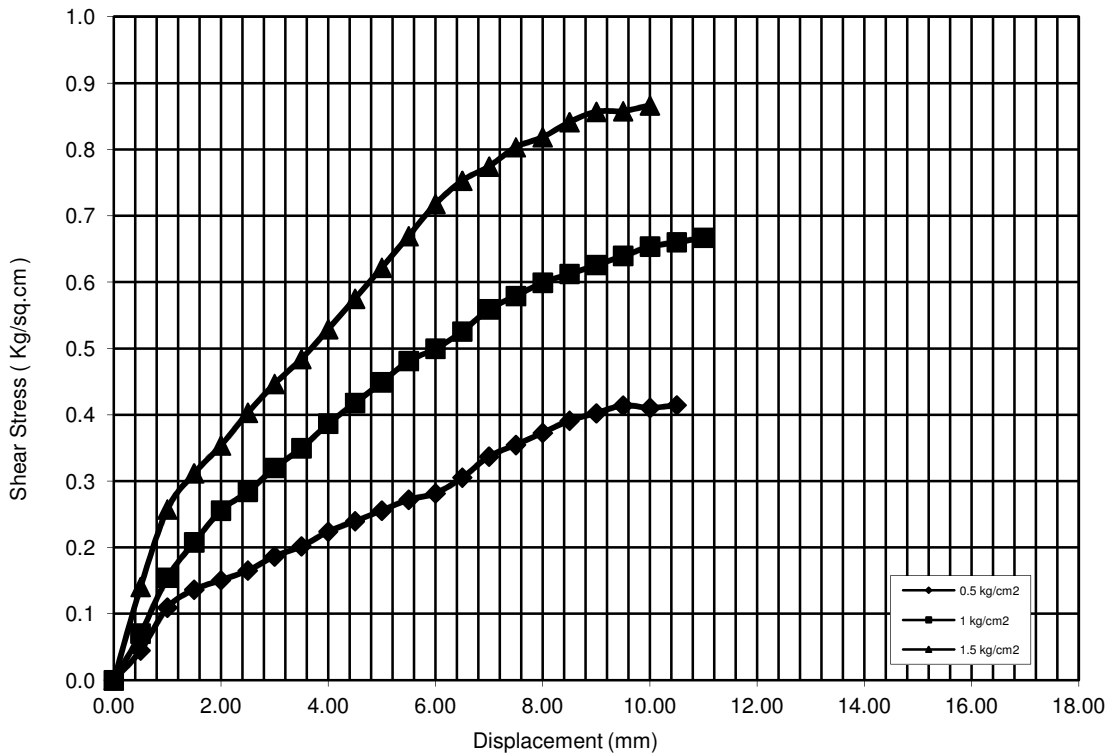
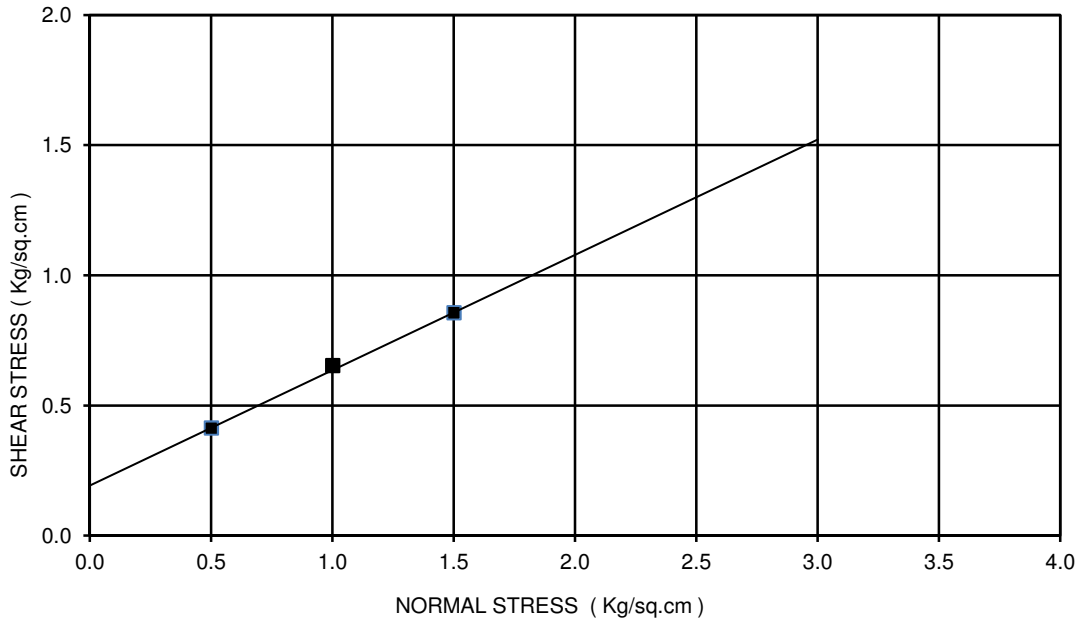
Ch. 57+400  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



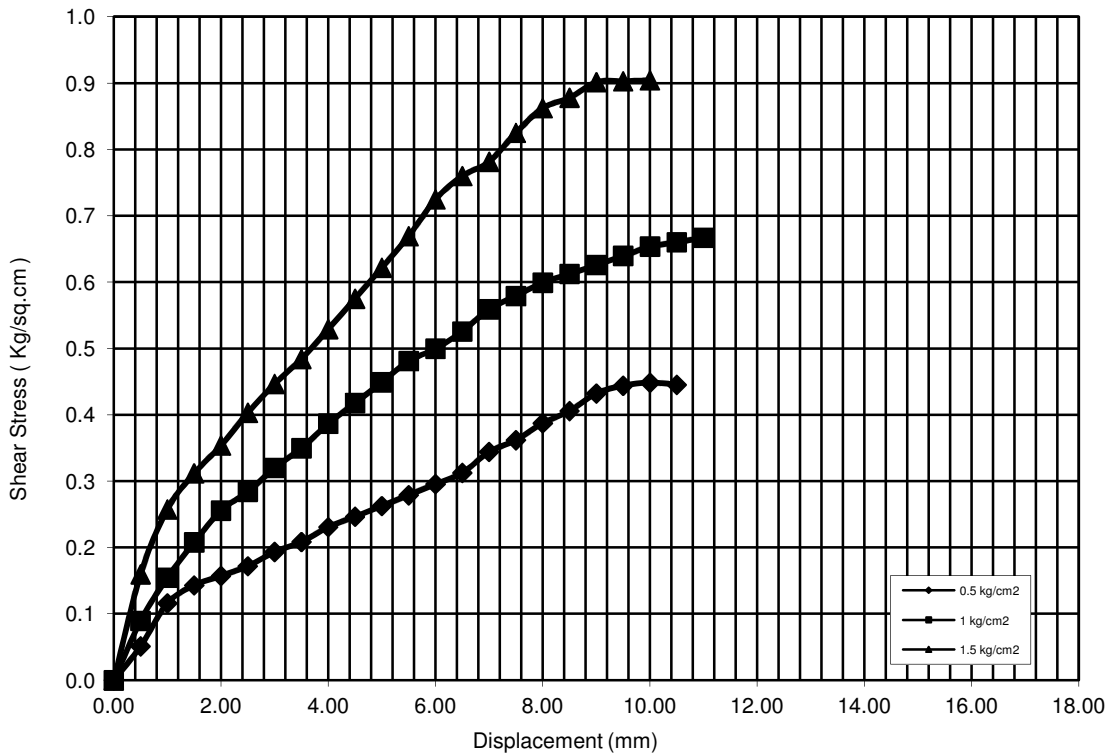
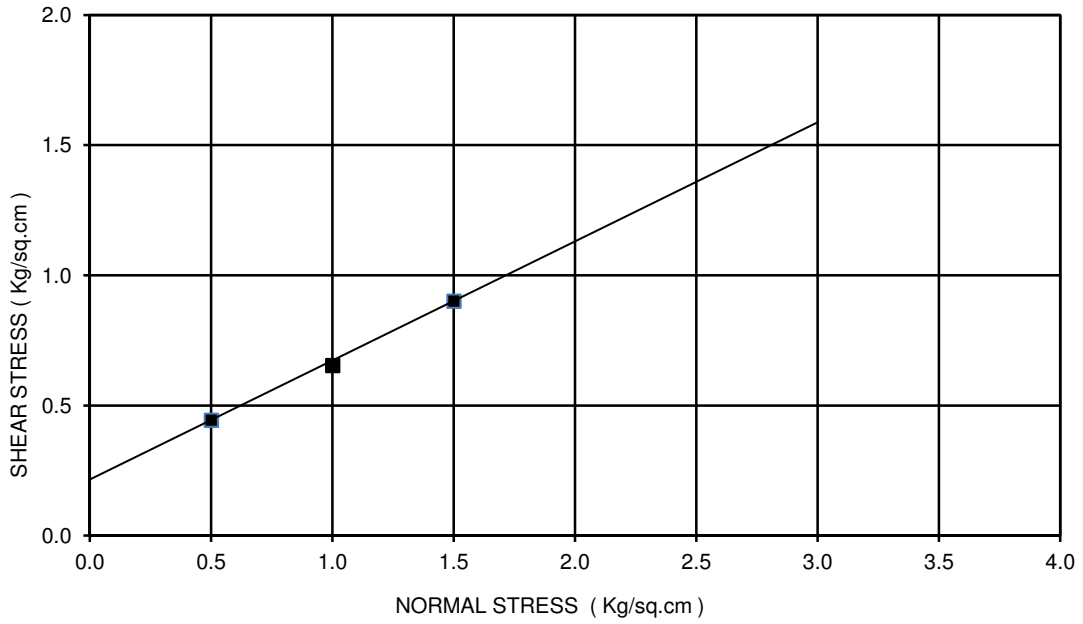
Ch. 58+191  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.50 m  
 COHESION(C)= 0.21 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 24 deg  
 TYPE OF THE TEST: DST



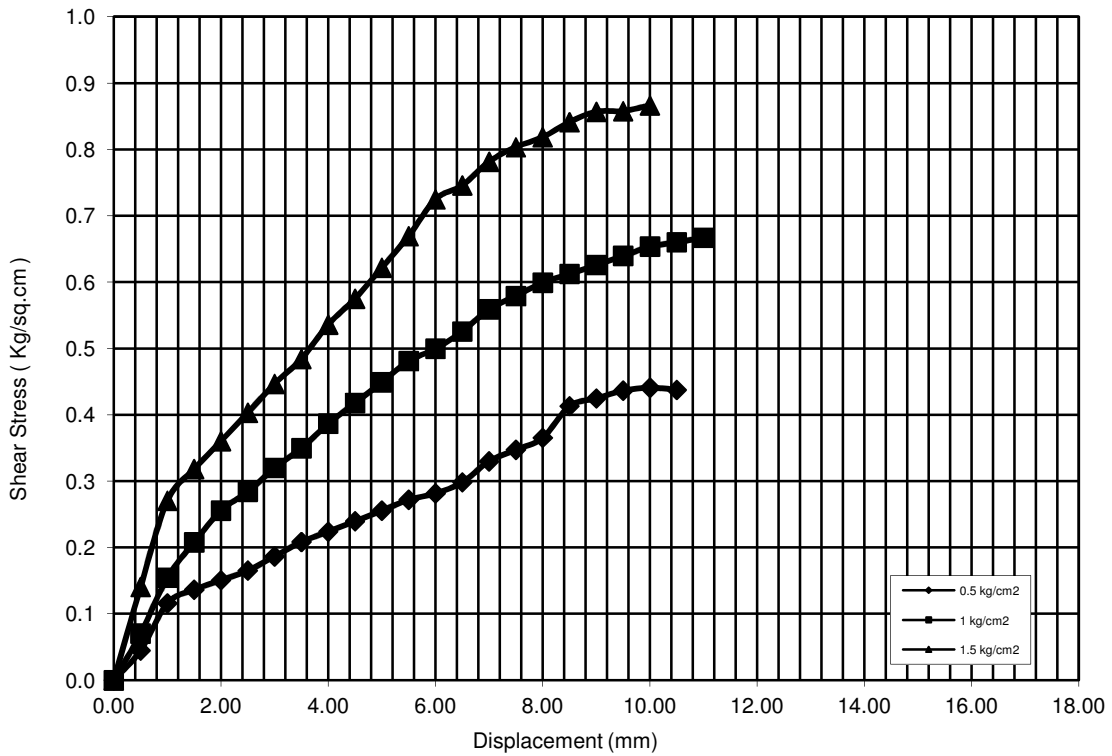
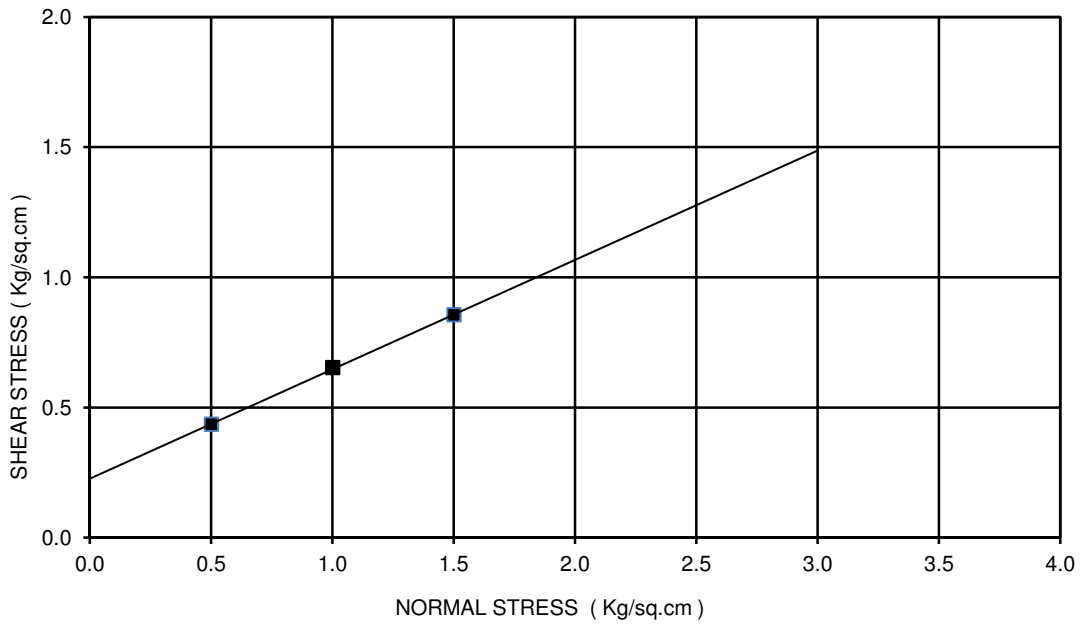
Ch. 58+497  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



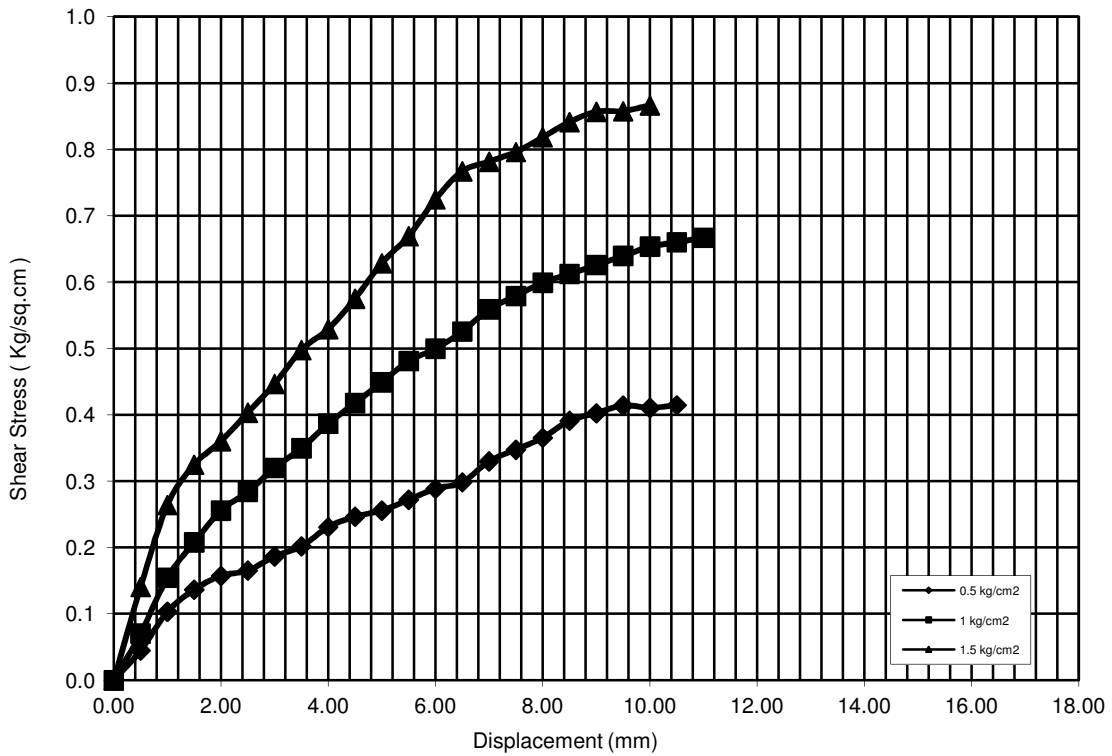
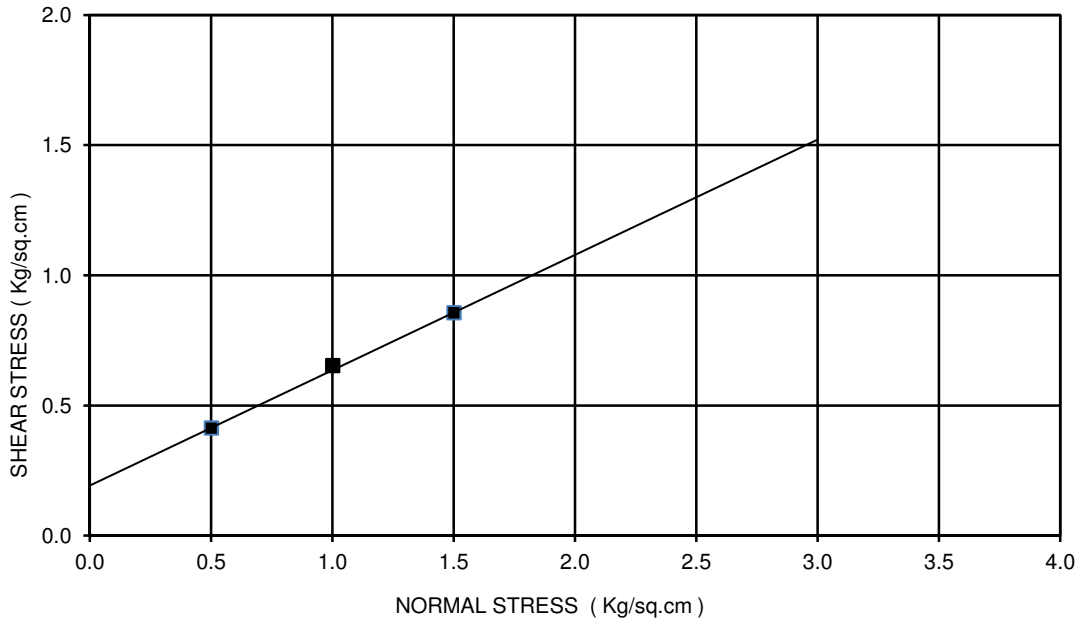
Ch. 58+497  
 BORE HOLE NO: BH-A1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



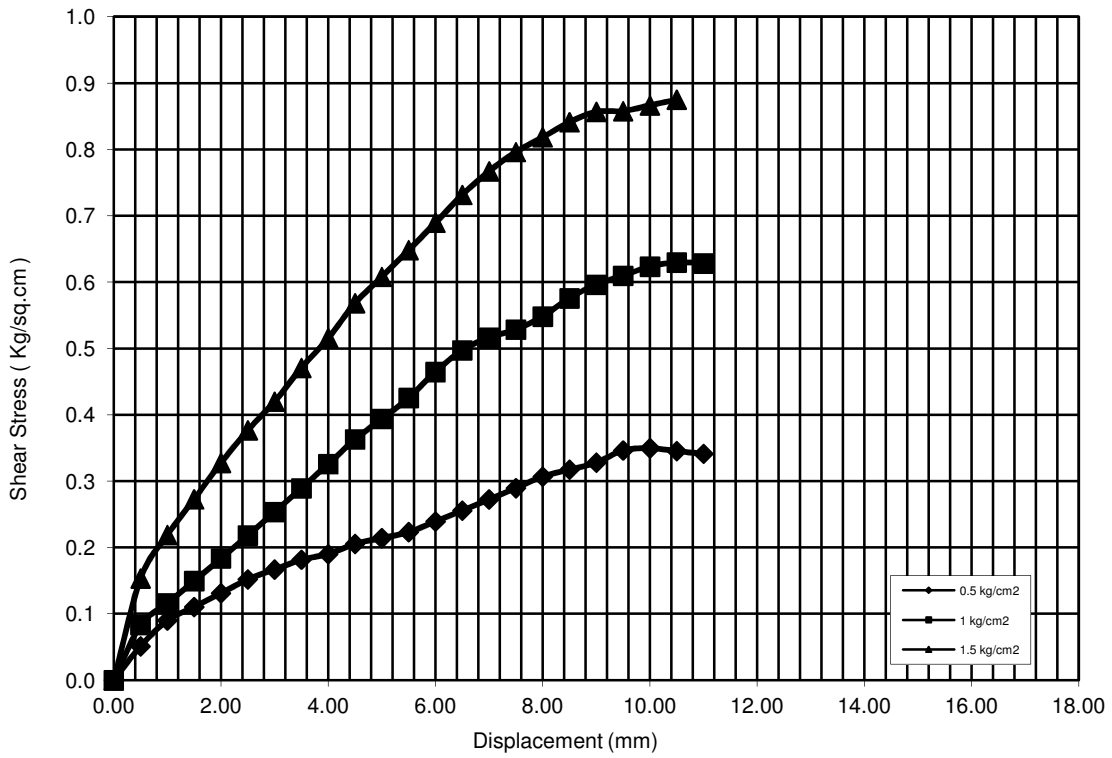
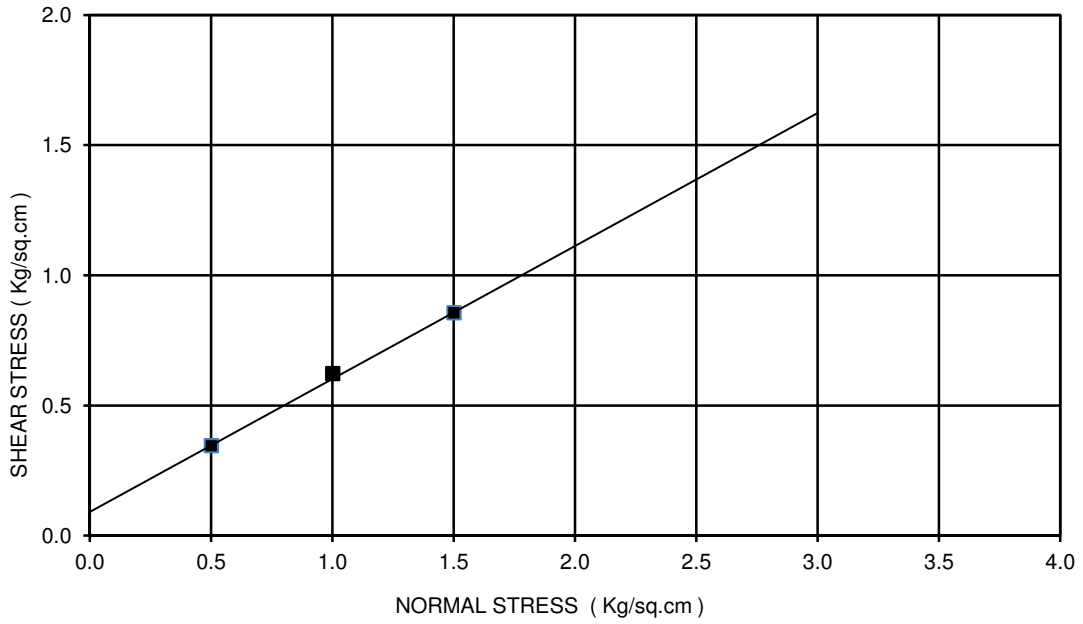
Ch. 58+497  
 BORE HOLE NO: BH-P1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



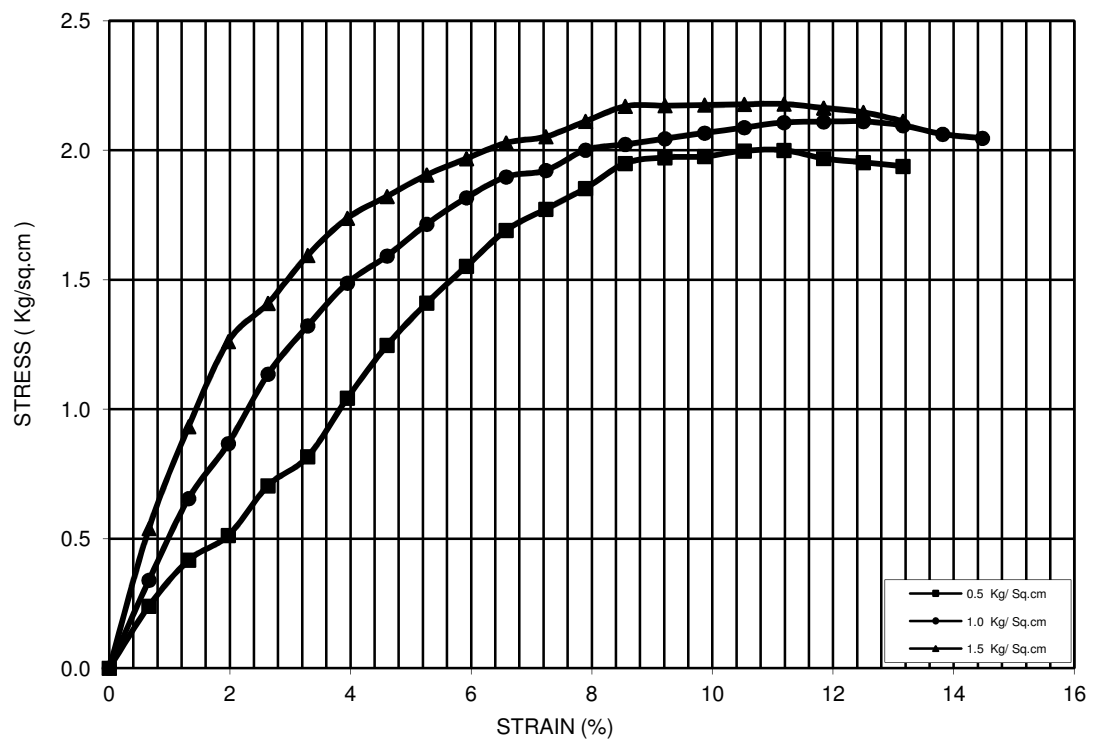
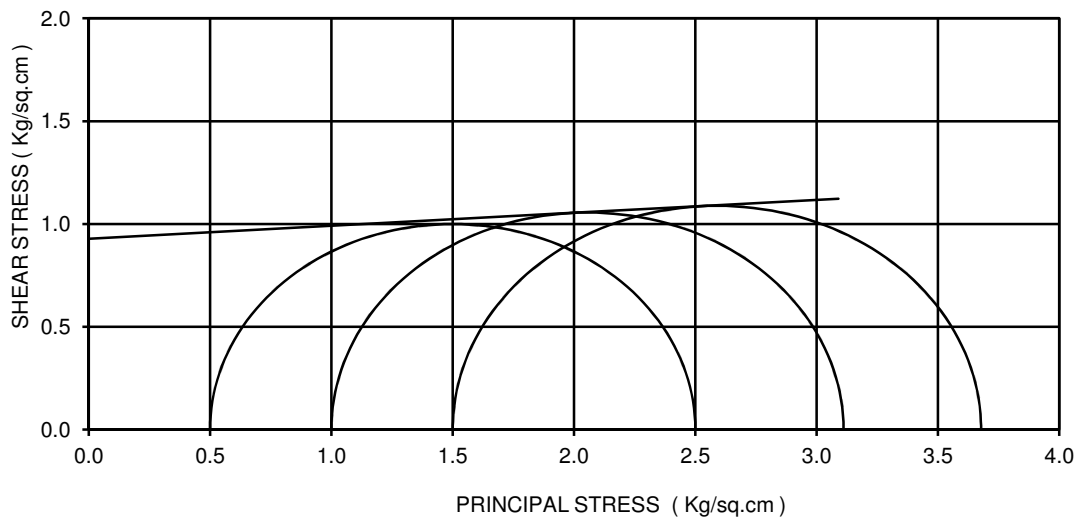
Ch. 58+497  
 BORE HOLE NO: BH-P1  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



Ch. 58+497  
 BORE HOLE NO: BH-P2  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST

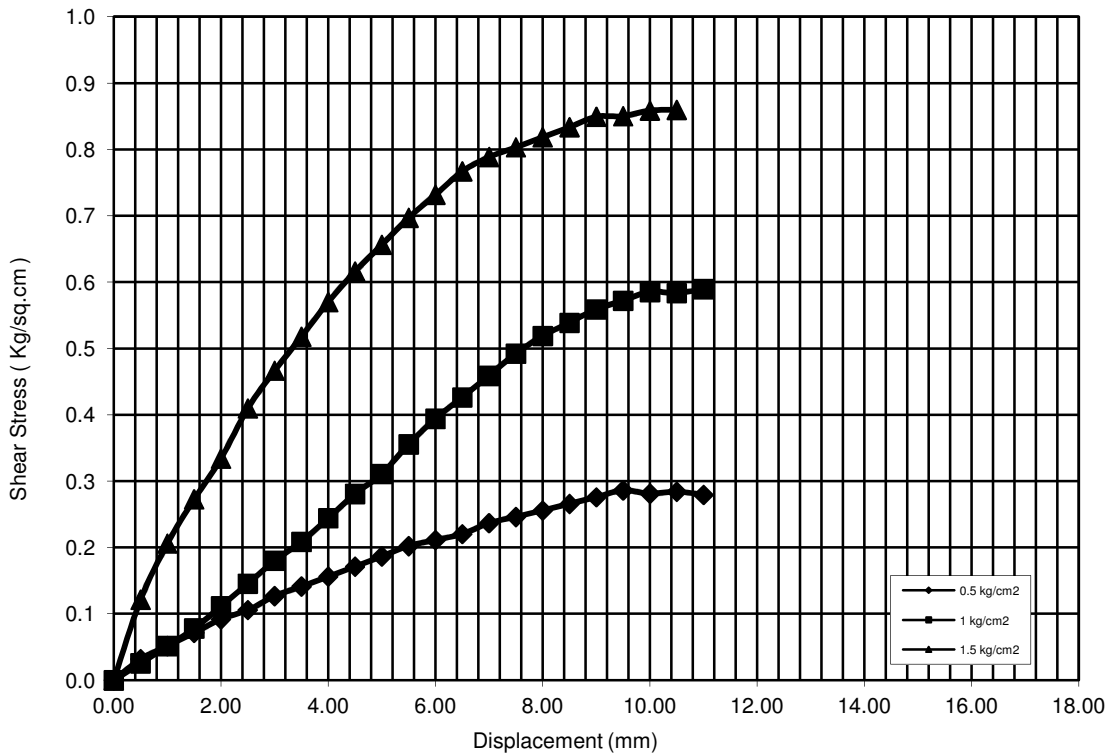
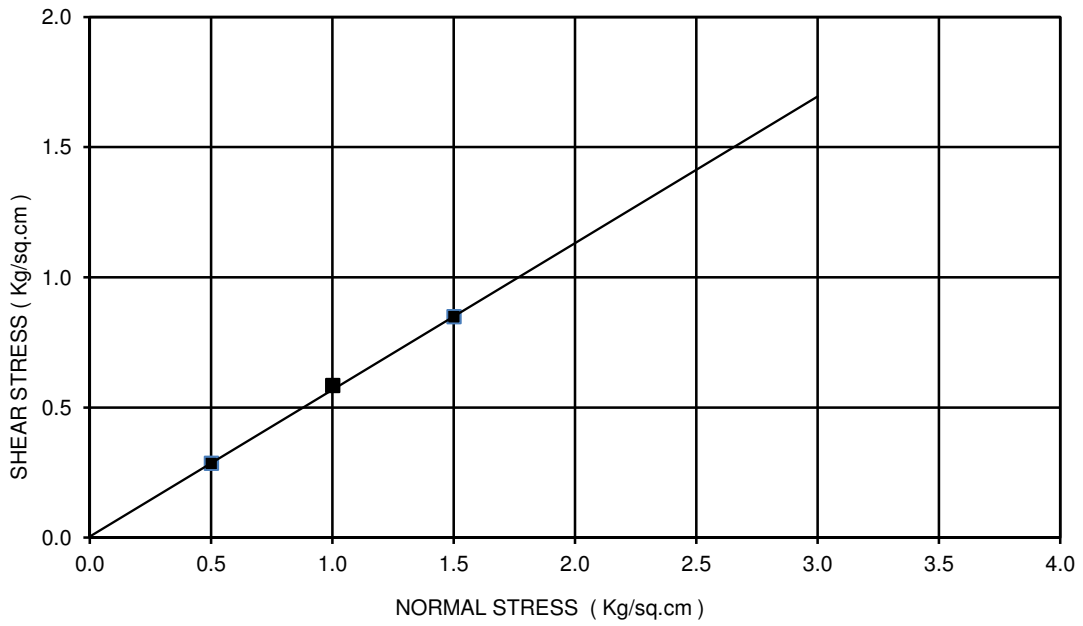


Ch. 58+497  
 BORE HOLE NO: BH-P2  
 SAMPLE NO.: UDS-8  
 DEPTH: 28.00 m  
 COHESION(C)= 2.65 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 5 deg  
 TYPE OF THE TEST: UUT

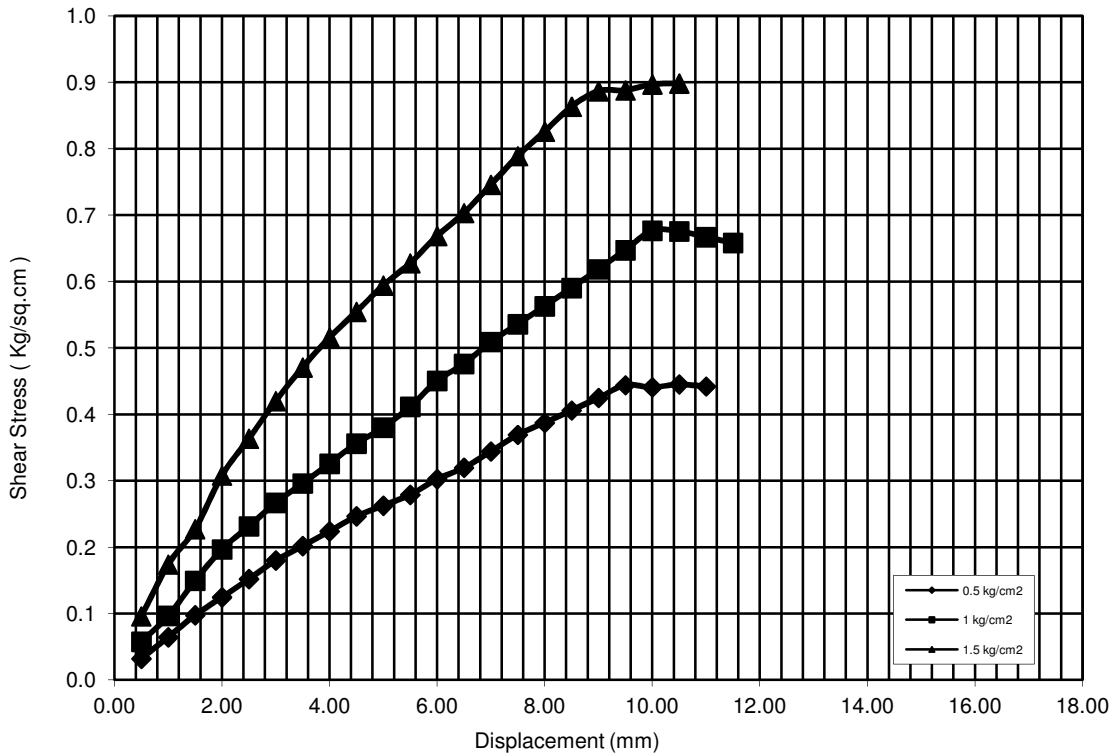
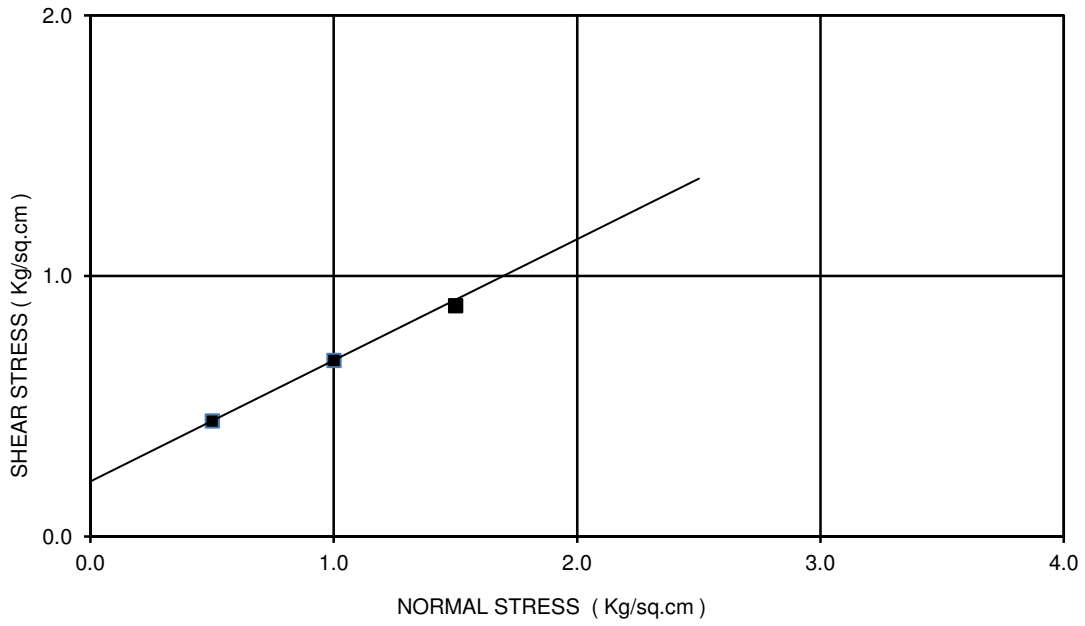




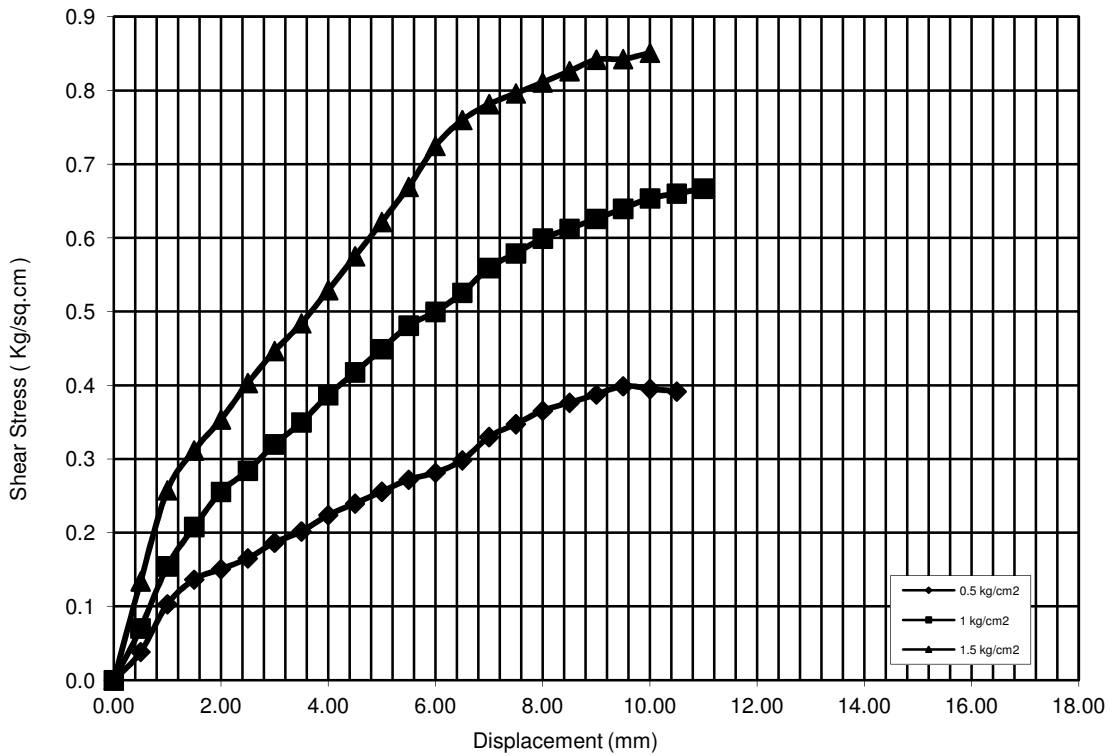
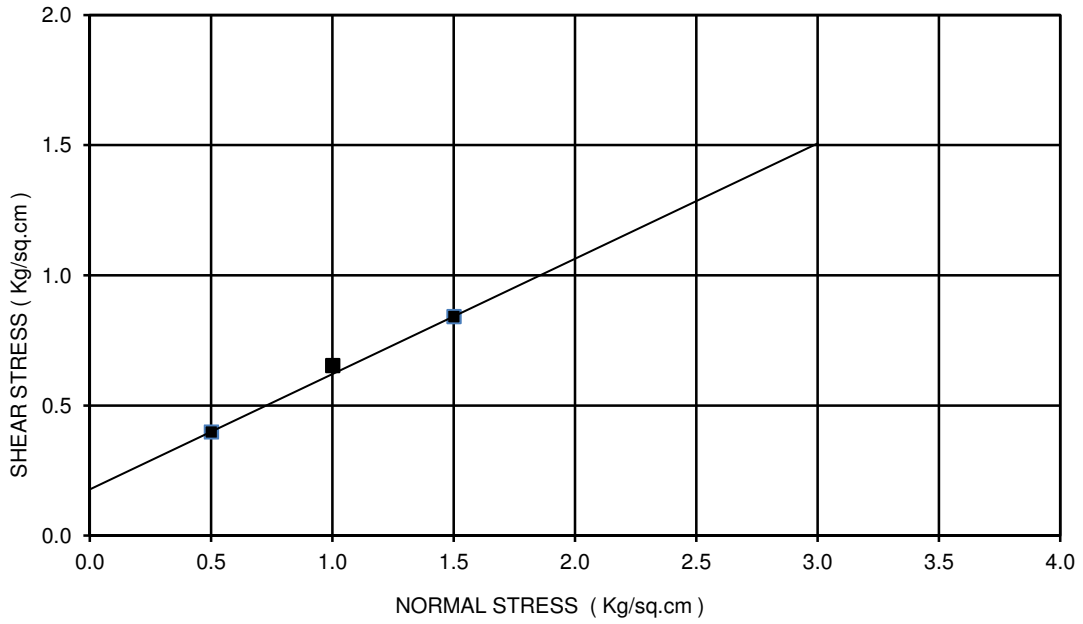
Ch. 58+497  
 BORE HOLE NO: BH-P3  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



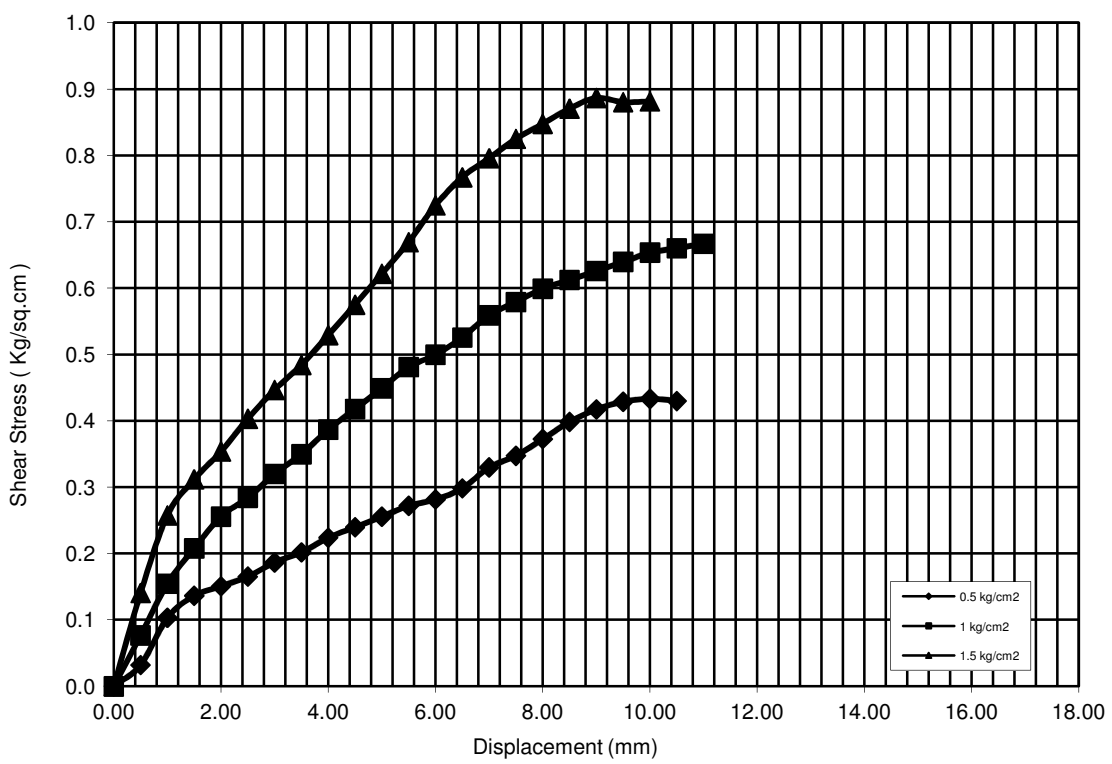
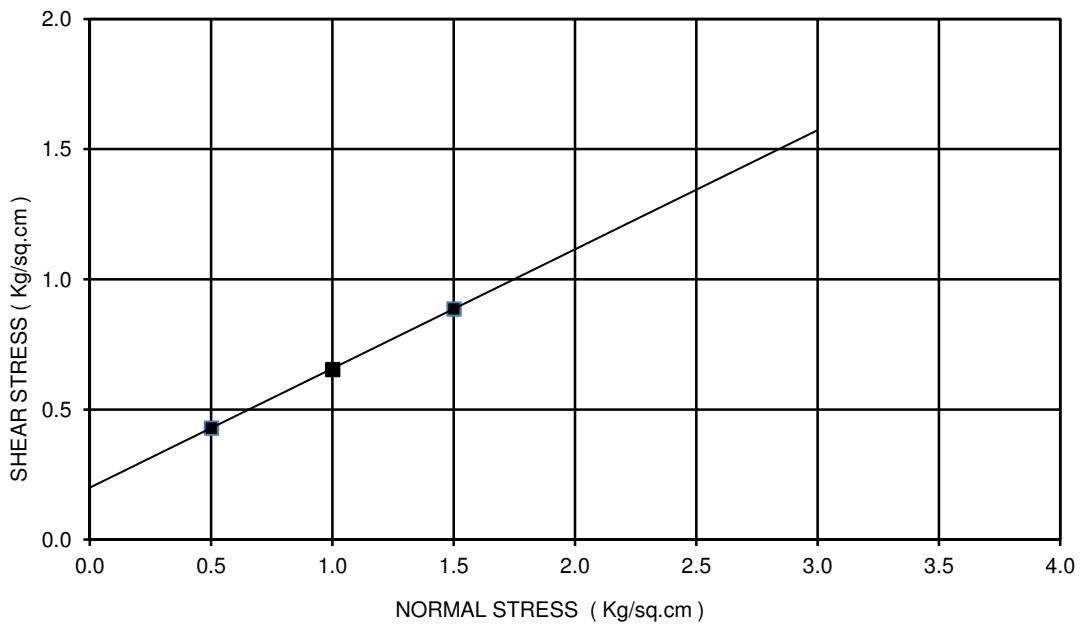
Ch. 58+497  
 BORE HOLE NO: BH-P3  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST



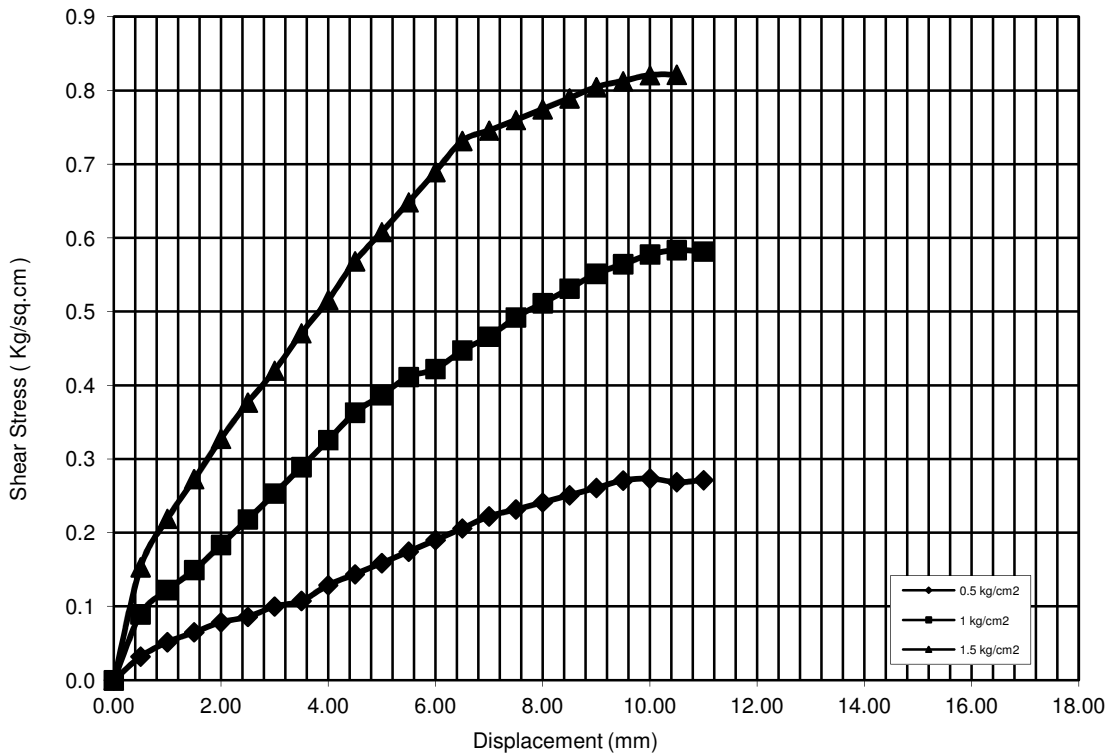
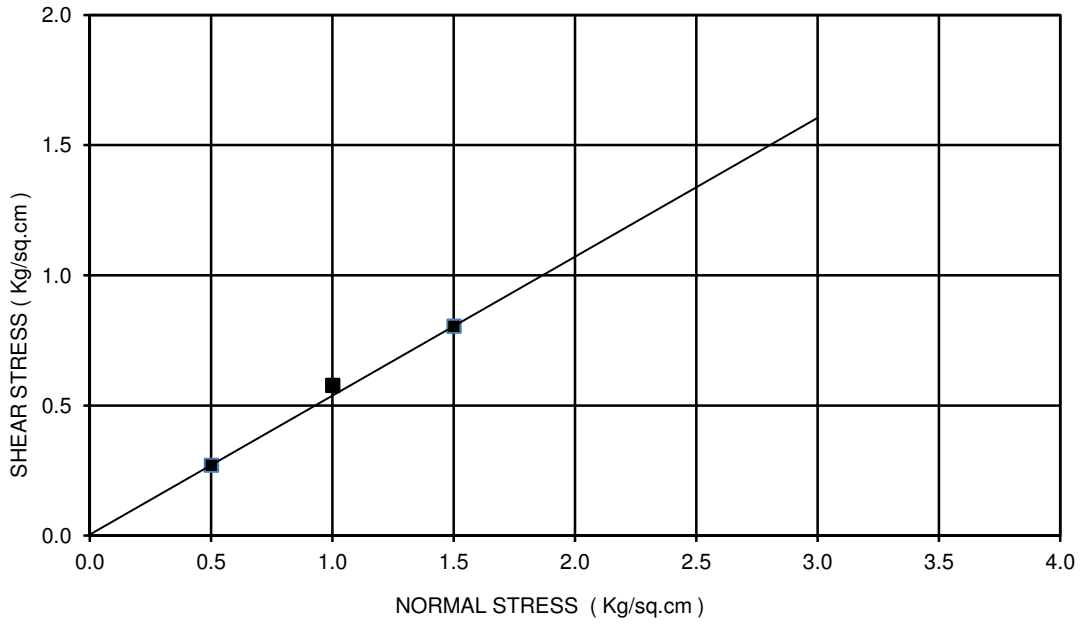
Ch. 58+497  
 BORE HOLE NO: BH-P4  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



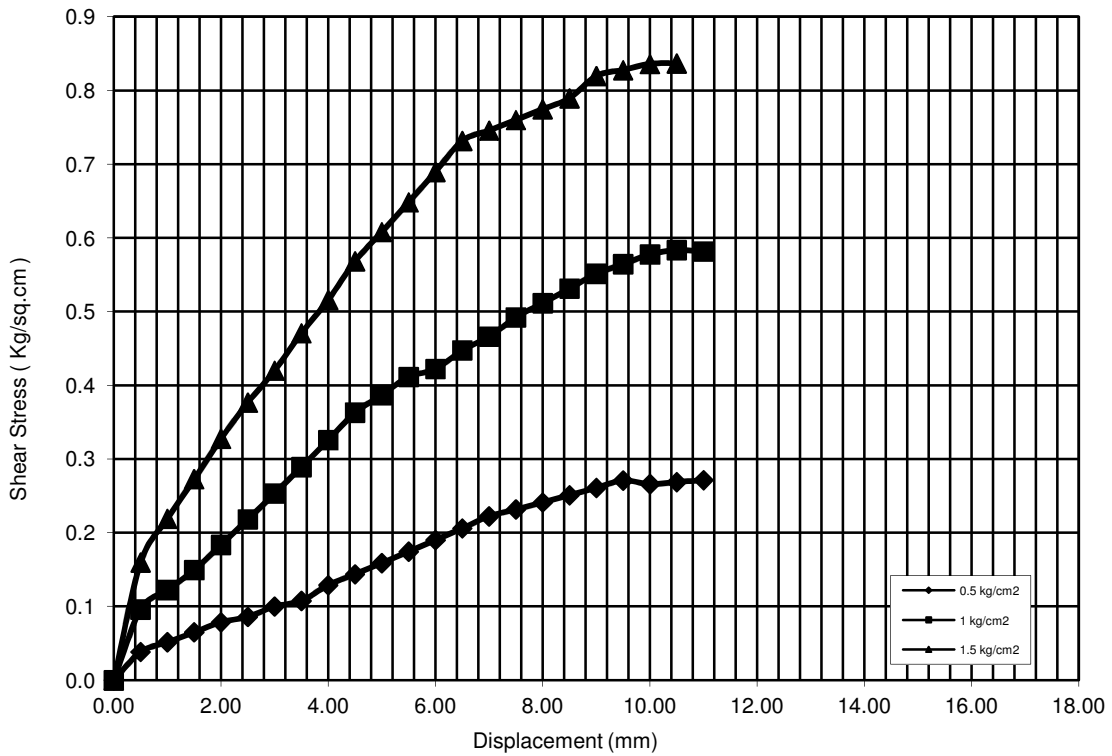
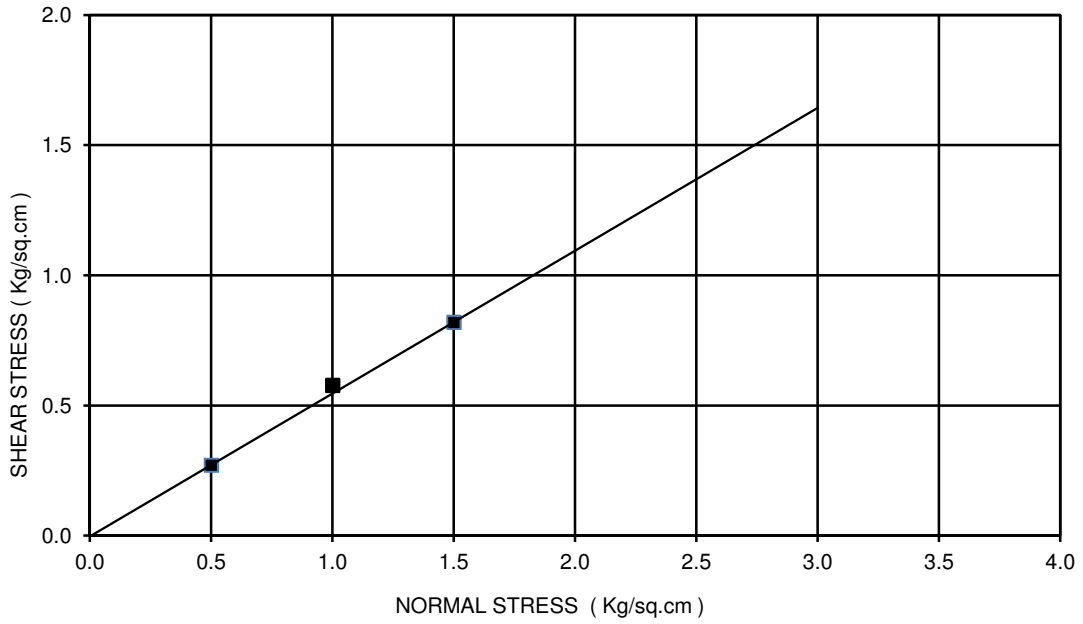
Ch.58+497  
 BORE HOLE NO: BH-P4  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



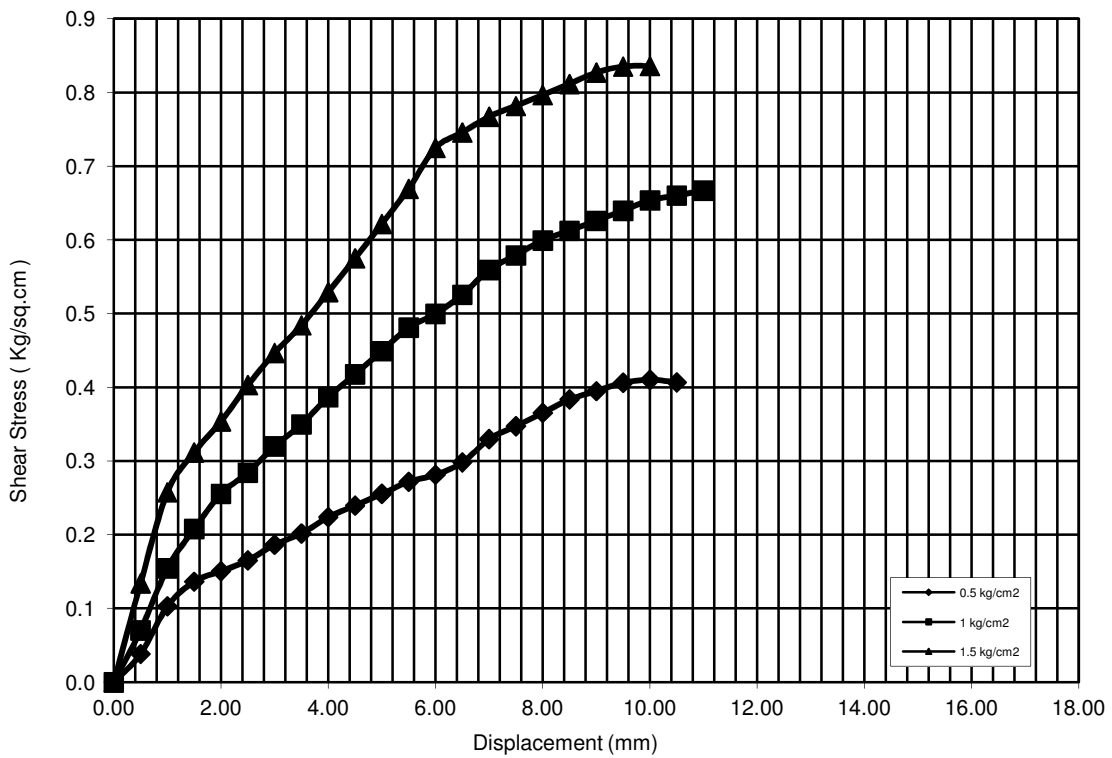
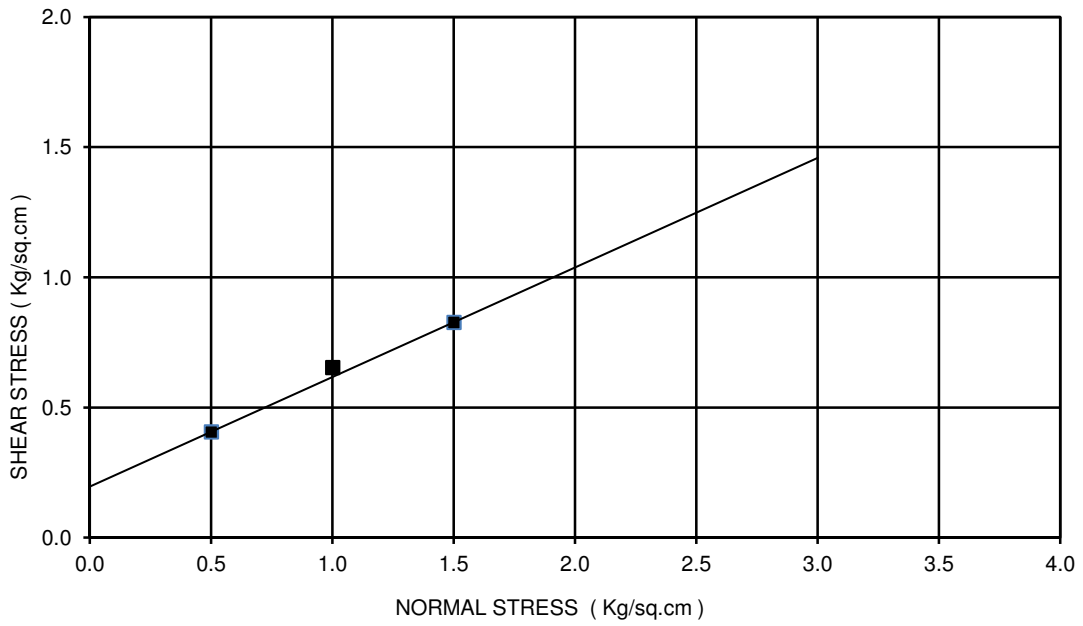
Ch. 58+497  
 BORE HOLE NO: BH-P5  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



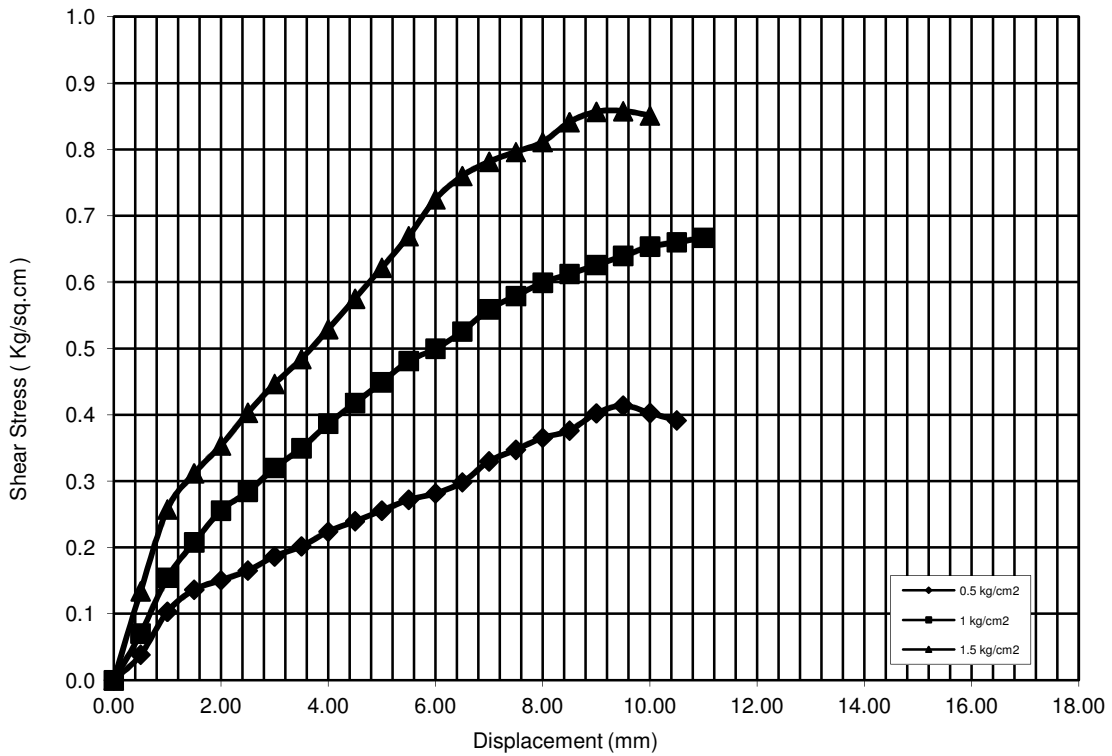
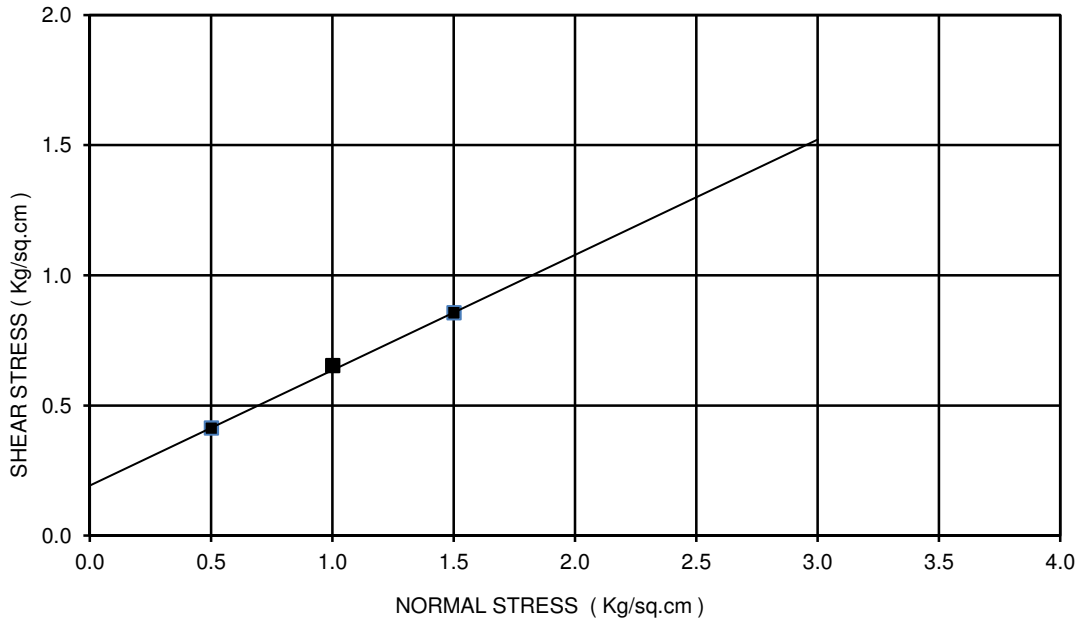
Ch. 58+497  
 BORE HOLE NO: BH-P5  
 SAMPLE NO.: UDS-1  
 DEPTH: 4.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 27 deg  
 TYPE OF THE TEST: DST



Ch. 58+497  
 BORE HOLE NO: BH-P6  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

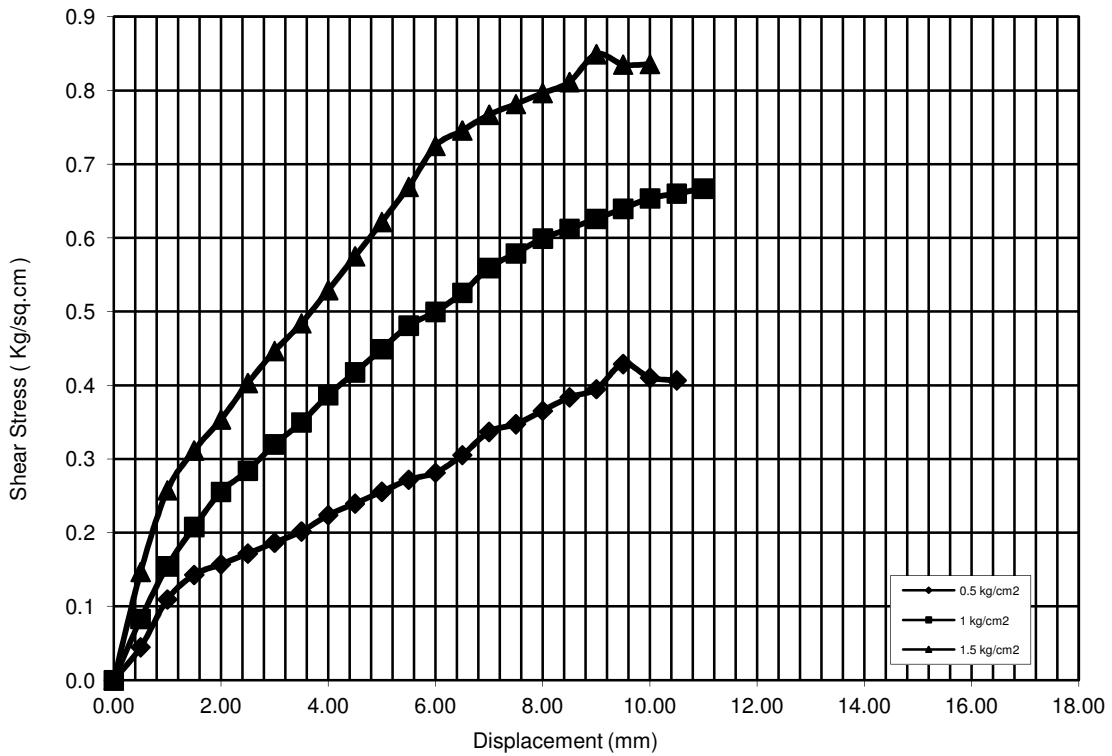
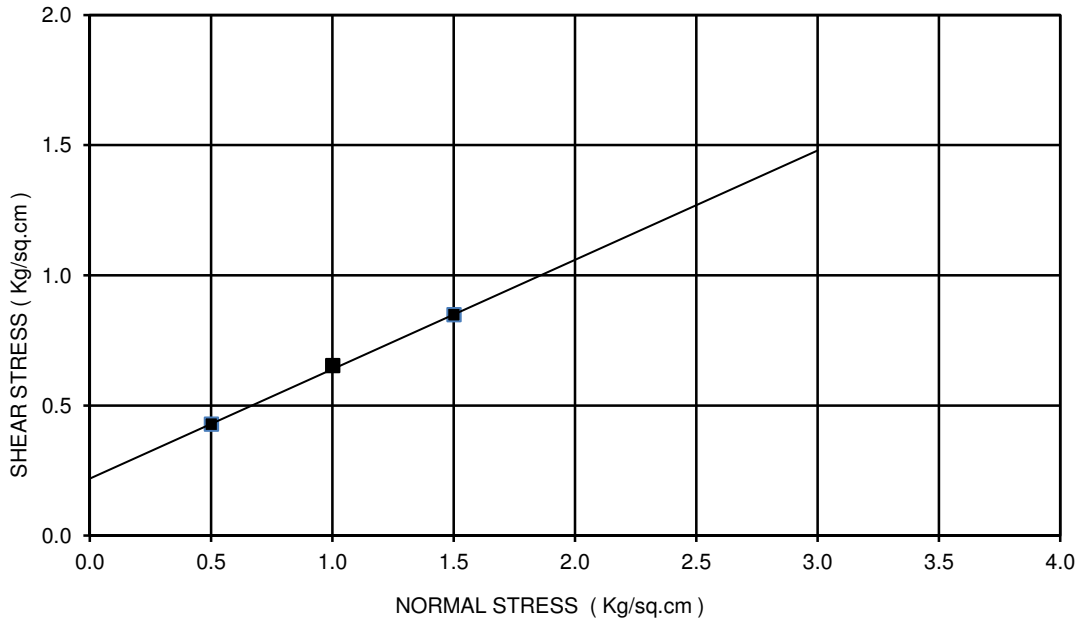


Ch. 58+497  
 BORE HOLE NO: BH-P6  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST

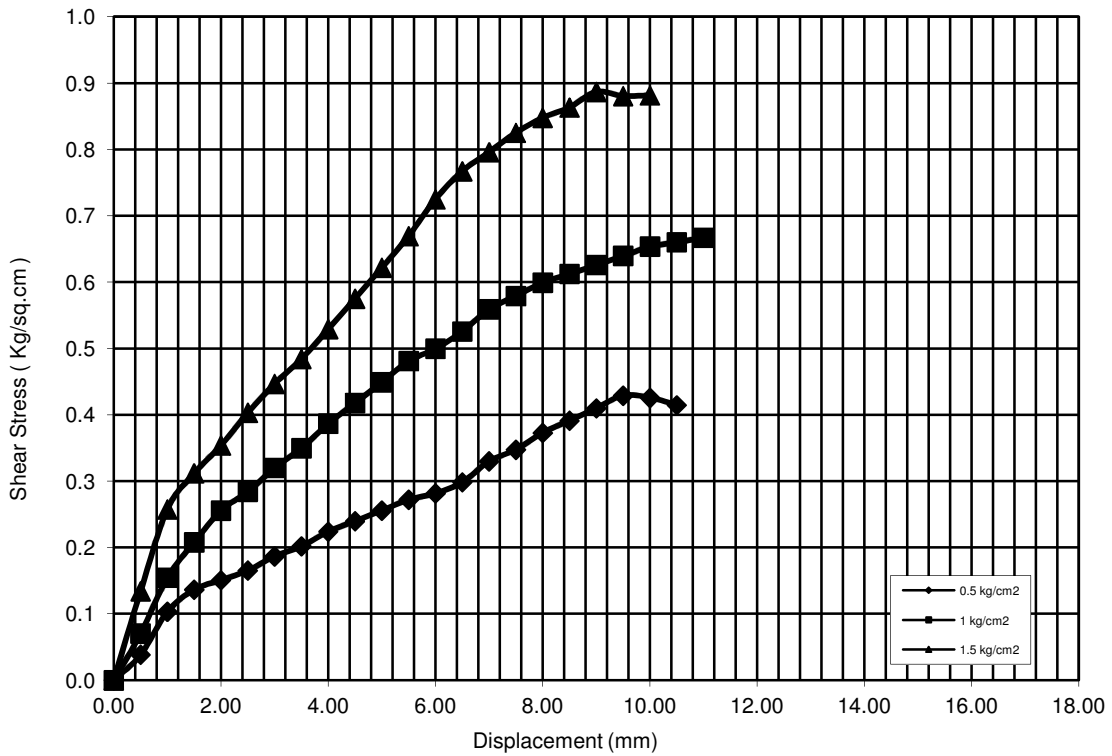
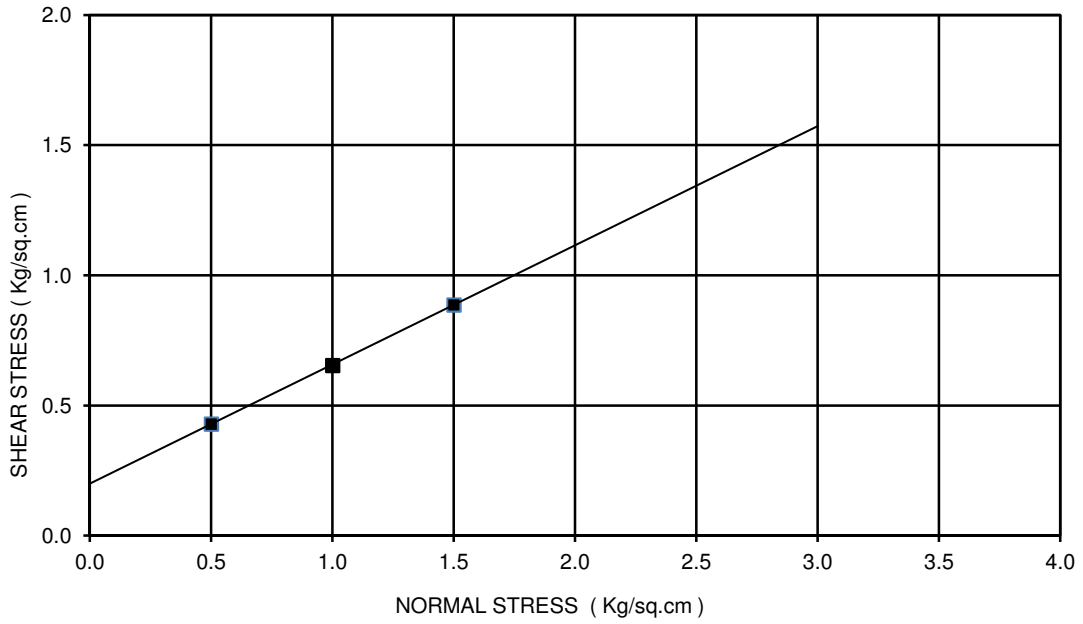




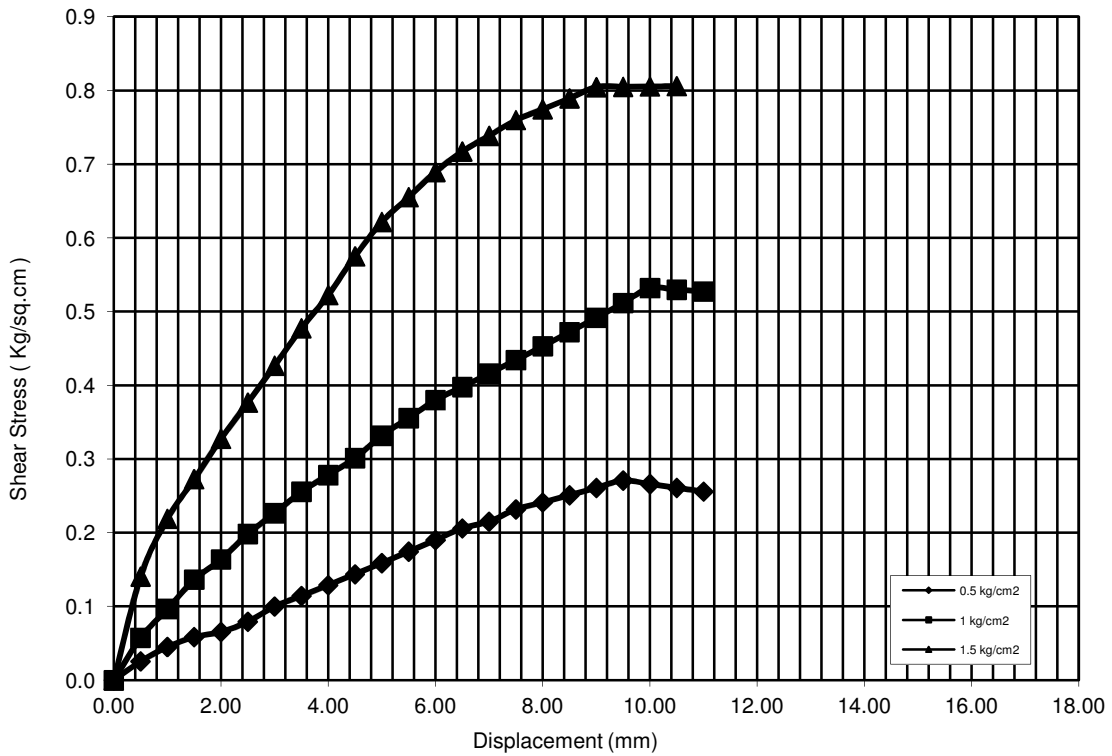
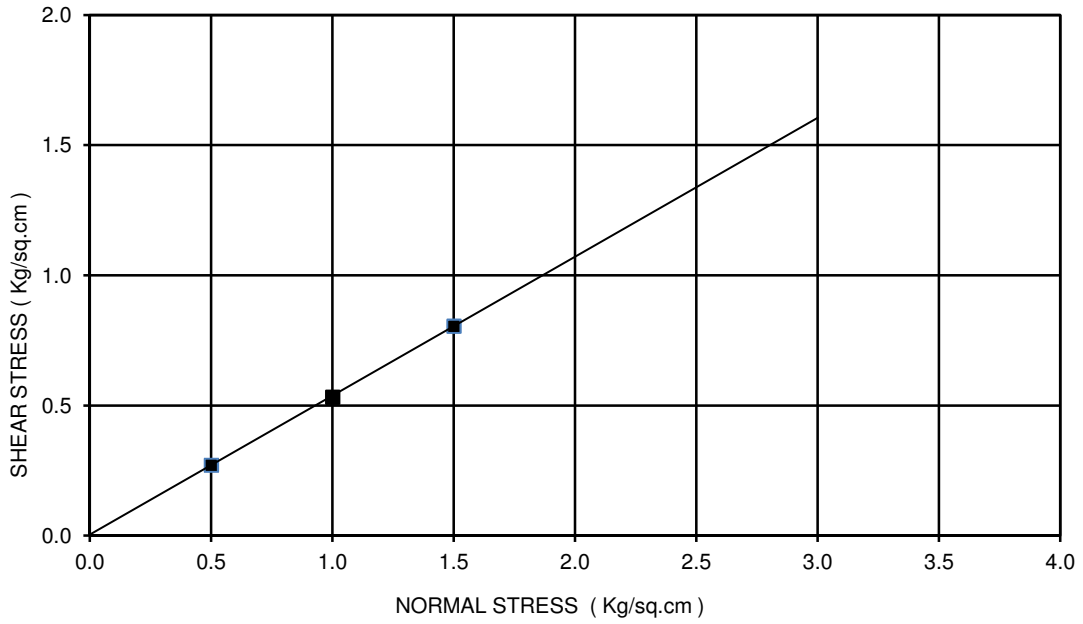
Ch. 58+497  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



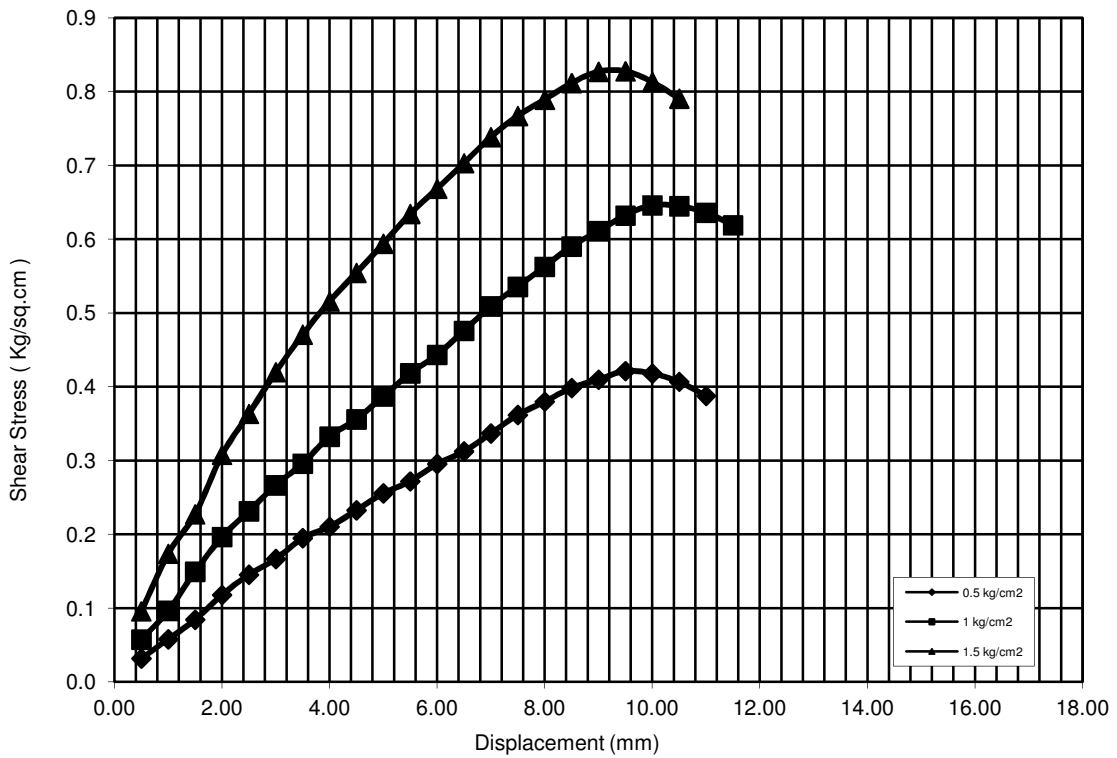
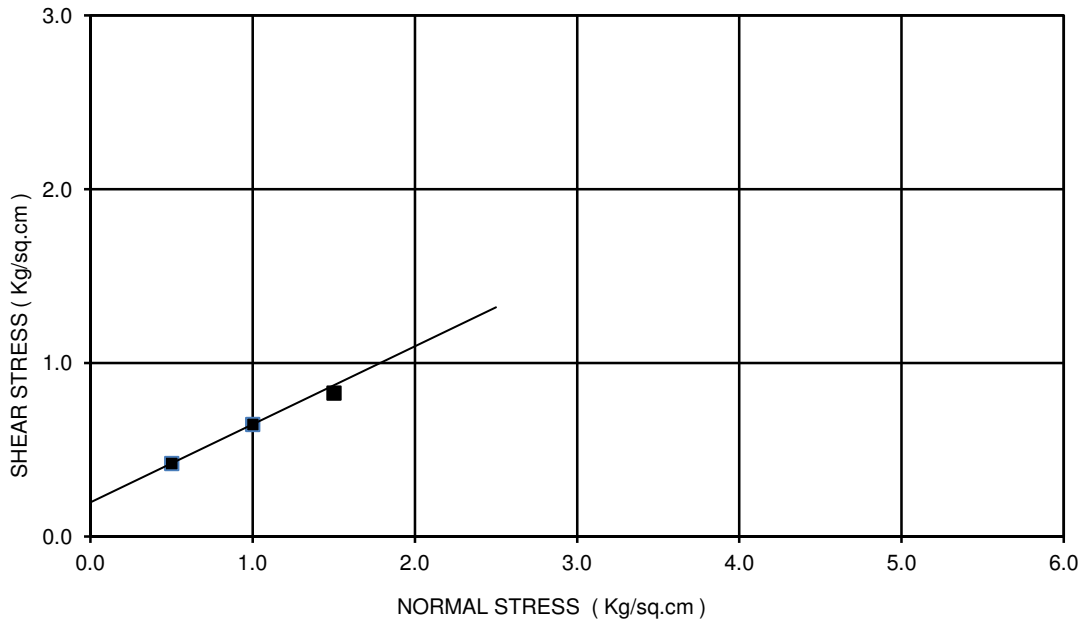
Ch. 58+497  
 BORE HOLE NO: BH-A2  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



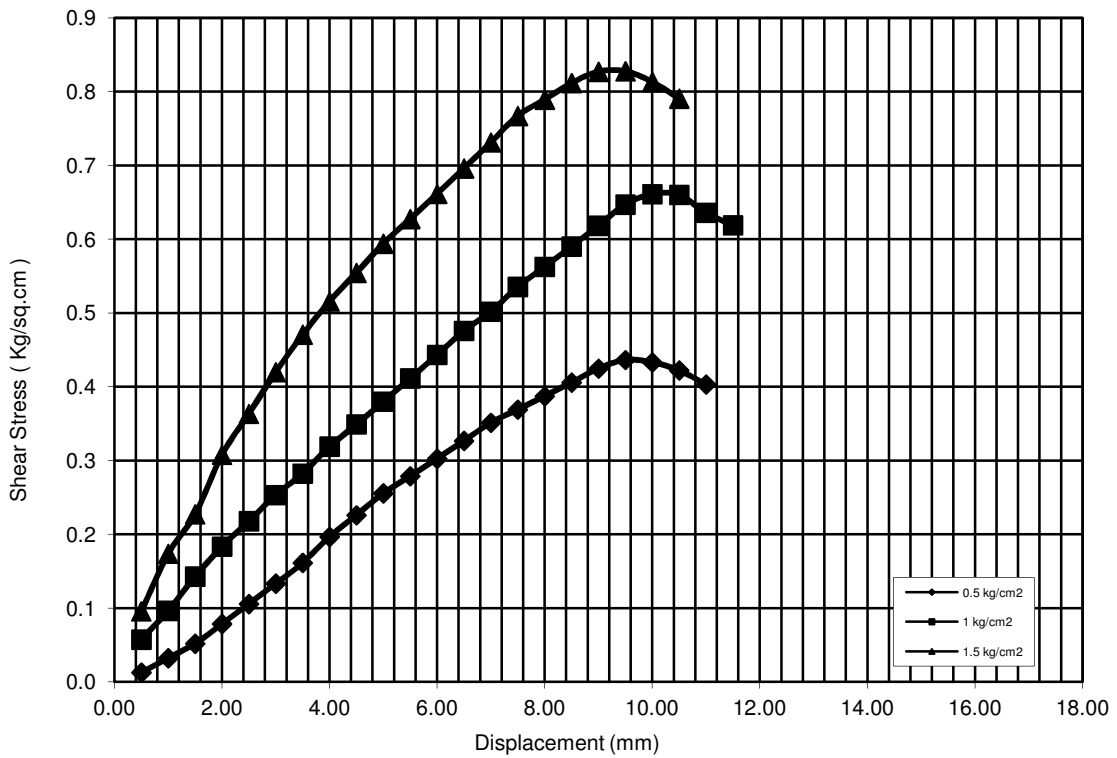
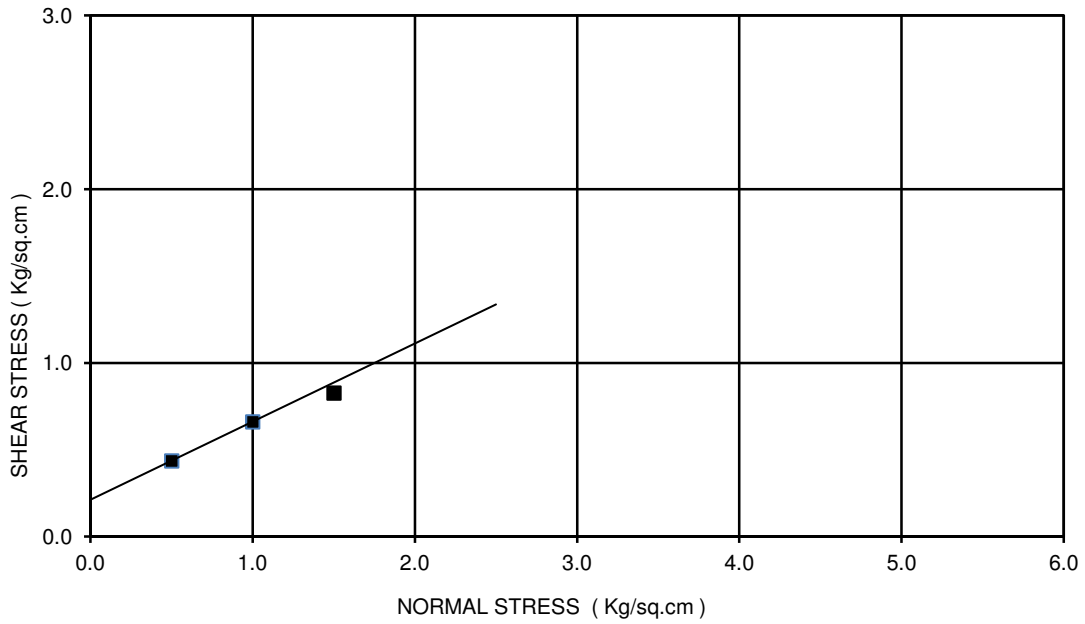
Ch. 58+837  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.50 m  
 COHESION(C)= 0.00 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 28 deg  
 TYPE OF THE TEST: DST



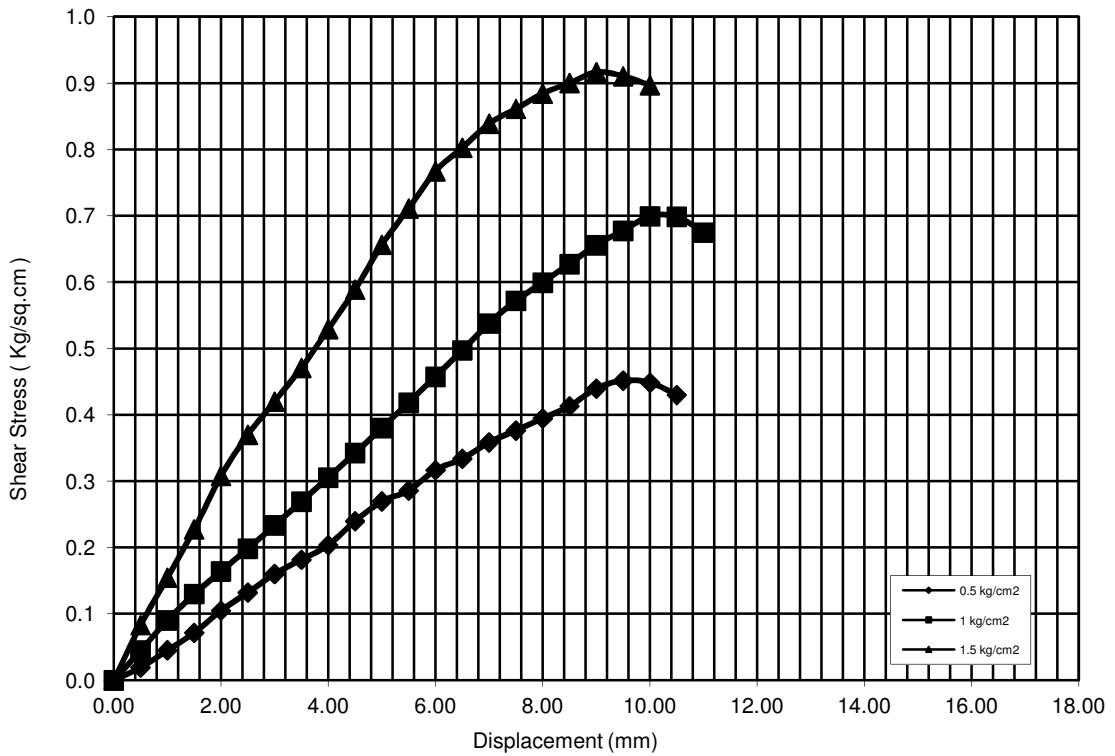
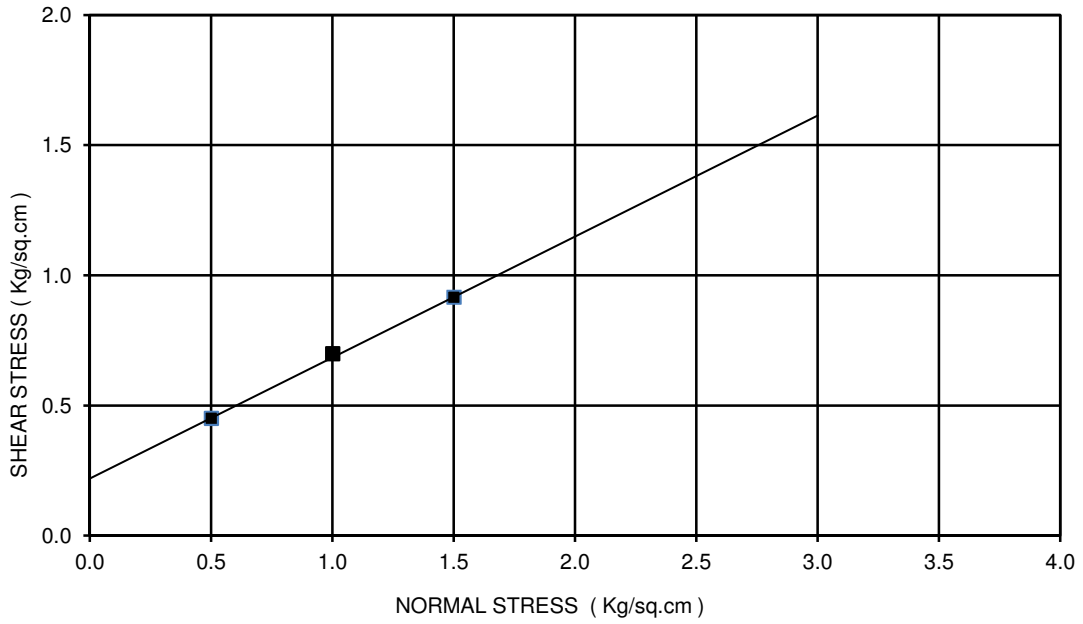
Ch. 59+071  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 1.00 m  
 COHESION(C)= 0.20 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 24 deg  
 TYPE OF THE TEST: DST



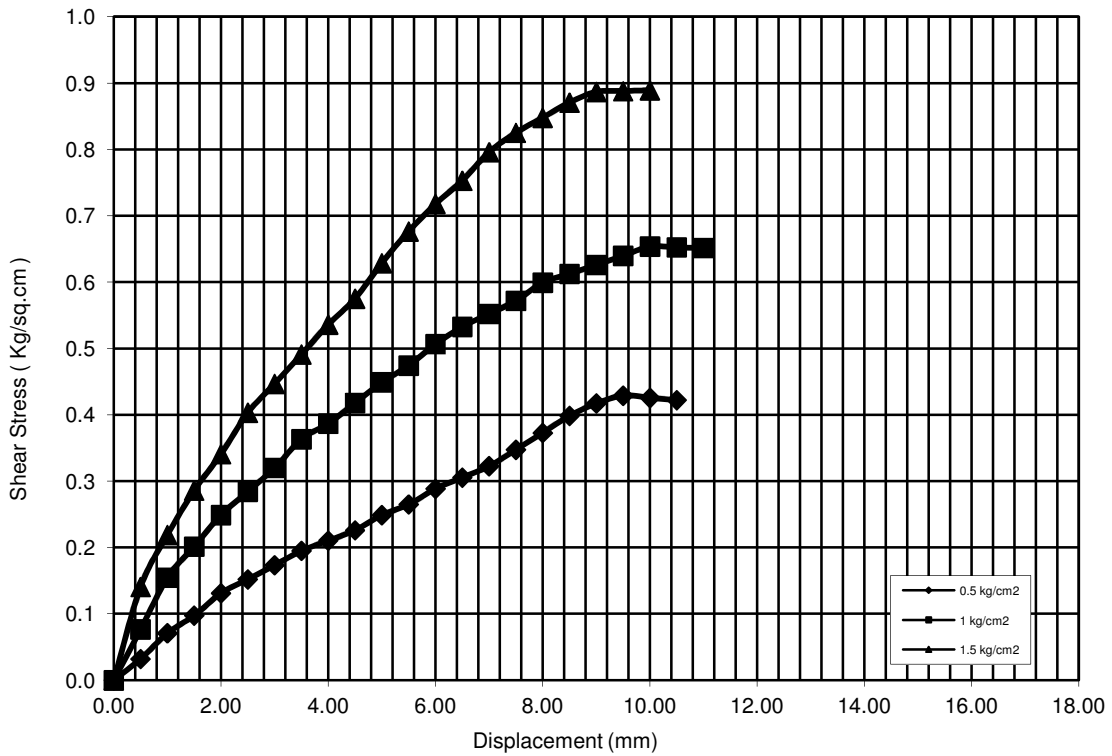
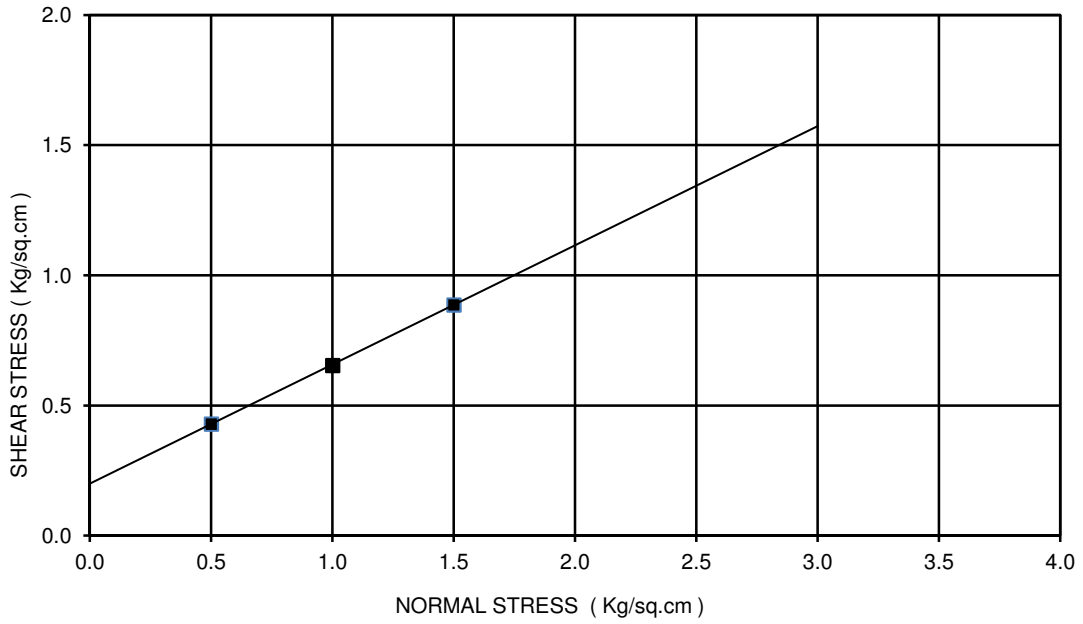
Ch. 59+206  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-3  
 DEPTH: 13.00 m  
 COHESION(C)= 0.14 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 23 deg  
 TYPE OF THE TEST: DST



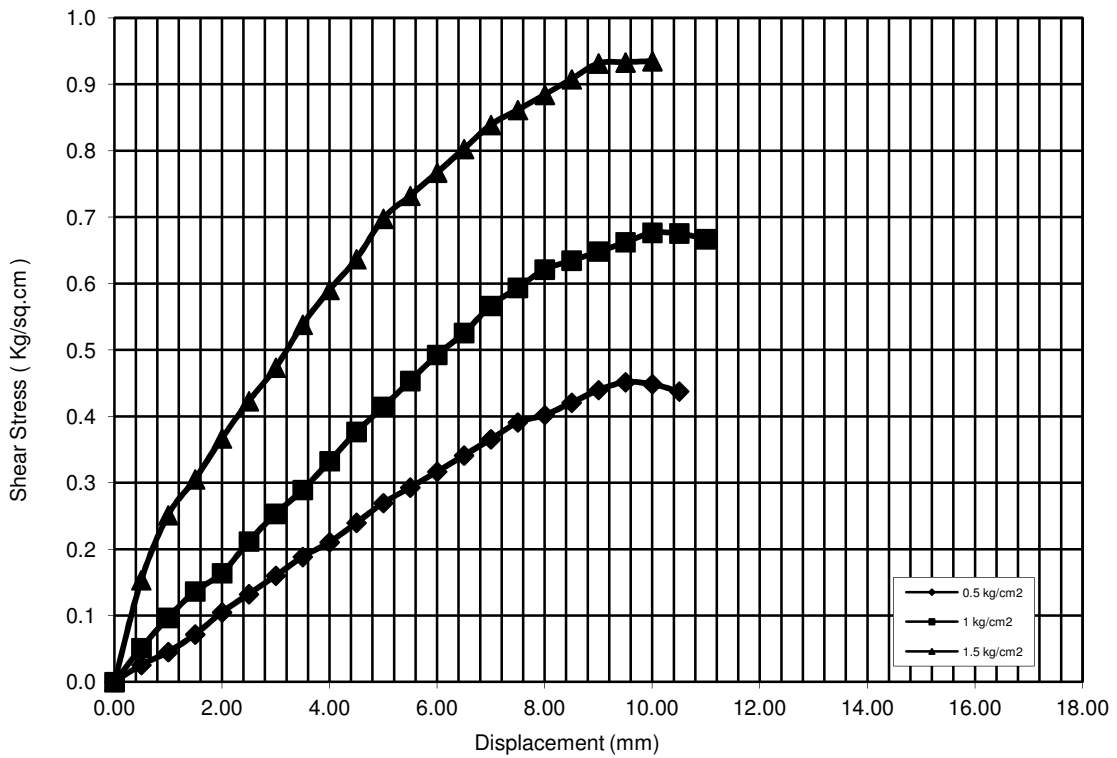
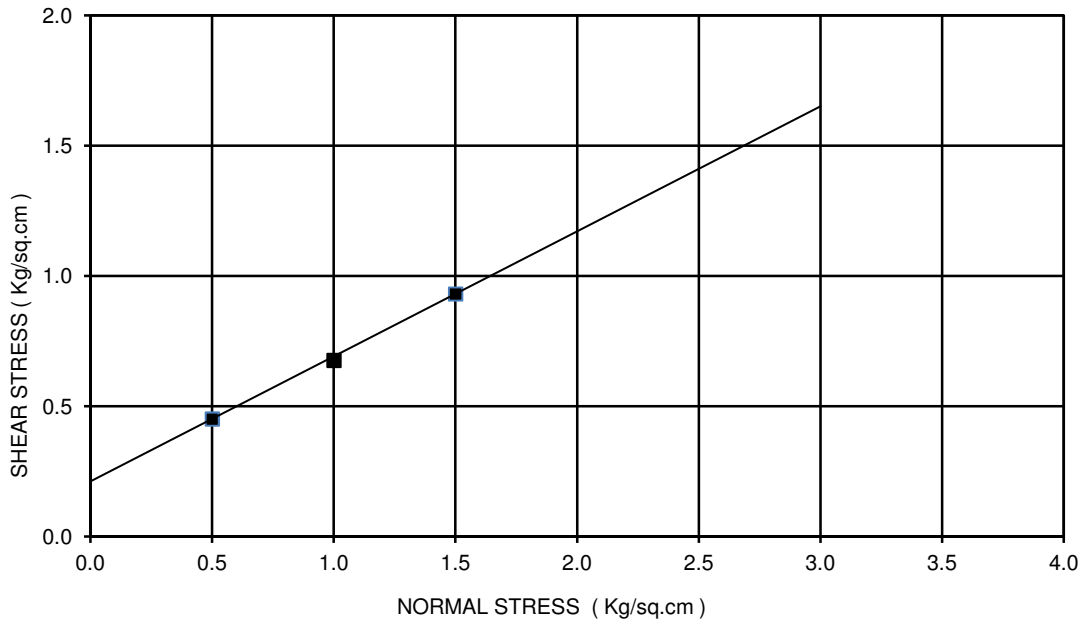
Ch. 59+206  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-4  
 DEPTH: 13.00 m  
 COHESION(C)= 0.08 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST



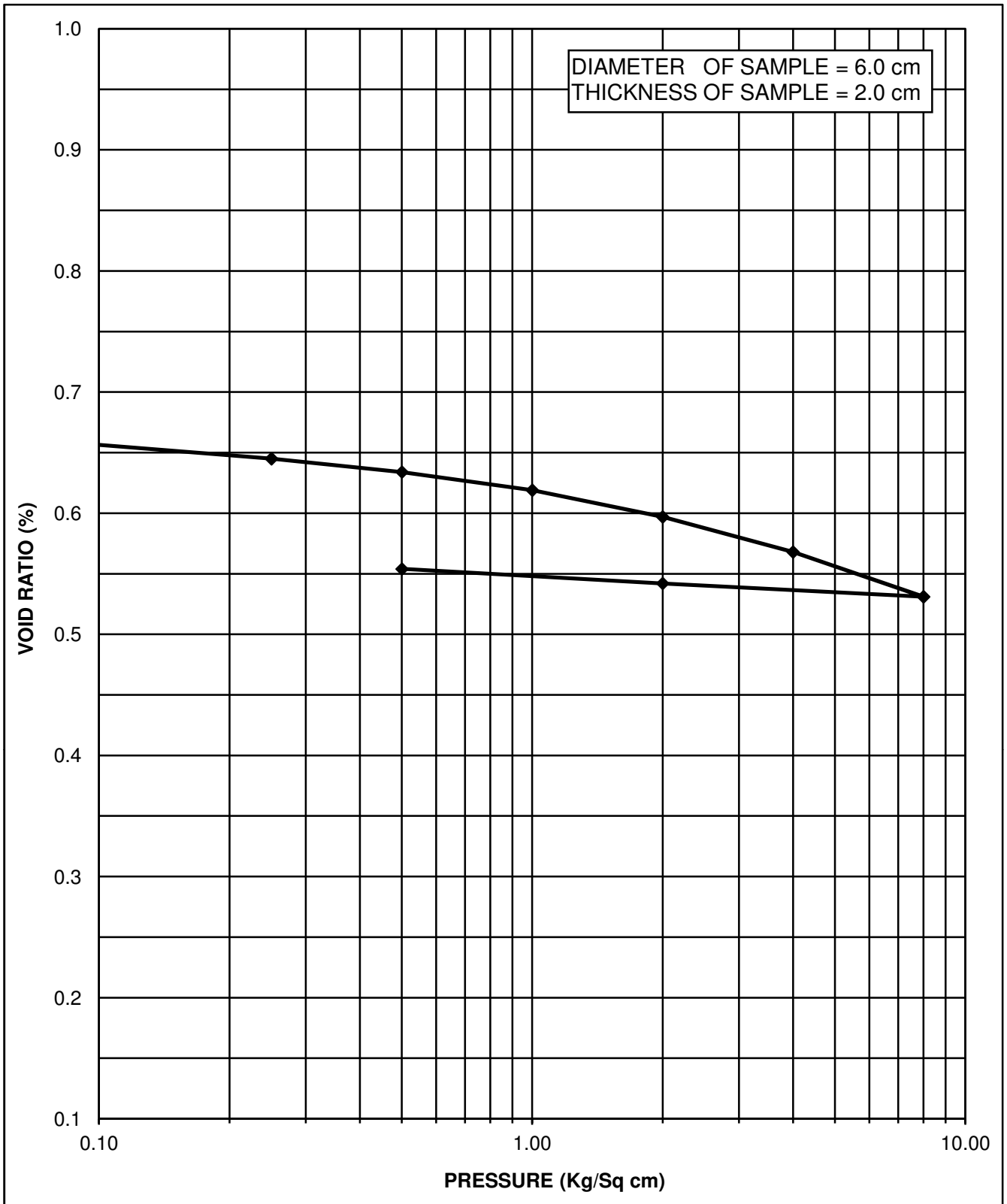
Ch. 59+270  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-1  
 DEPTH: 2.50 m  
 COHESION(C)= 0.20 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 25 deg  
 TYPE OF THE TEST: DST



Ch. 59+270  
 BORE HOLE NO: BH-CL  
 SAMPLE NO.: UDS-2  
 DEPTH: 5.50 m  
 COHESION(C)= 0.21 kg/sq.cm  
 ANGLE OF FRICTION(Phi): 26 deg  
 TYPE OF THE TEST: DST







CHAINAGE:-58+497

INITIAL WATER CONTENT = 15.10 %

BORE HOLE NO. = BH-P1

DRY DENSITY = 1.62 gm/cm<sup>3</sup>

SAMPLE NO. = UDS-3

VOID RATIO ( $e_0$ ) = 0.655

DEPTH = 7.00 M

COMPRESSION INDEX ( $C_c$ ) = 0.123

TYPE OF SOIL = CL

**FIGURE NO. PRESSURE Vs VOID RATIO CURVE (e-log p)**

CHAINAGE = 58+497  
 BORE HOLE NO. = BH-P1  
 SAMPLE NO. = UDS-3  
 DEPTH = 7.00 M

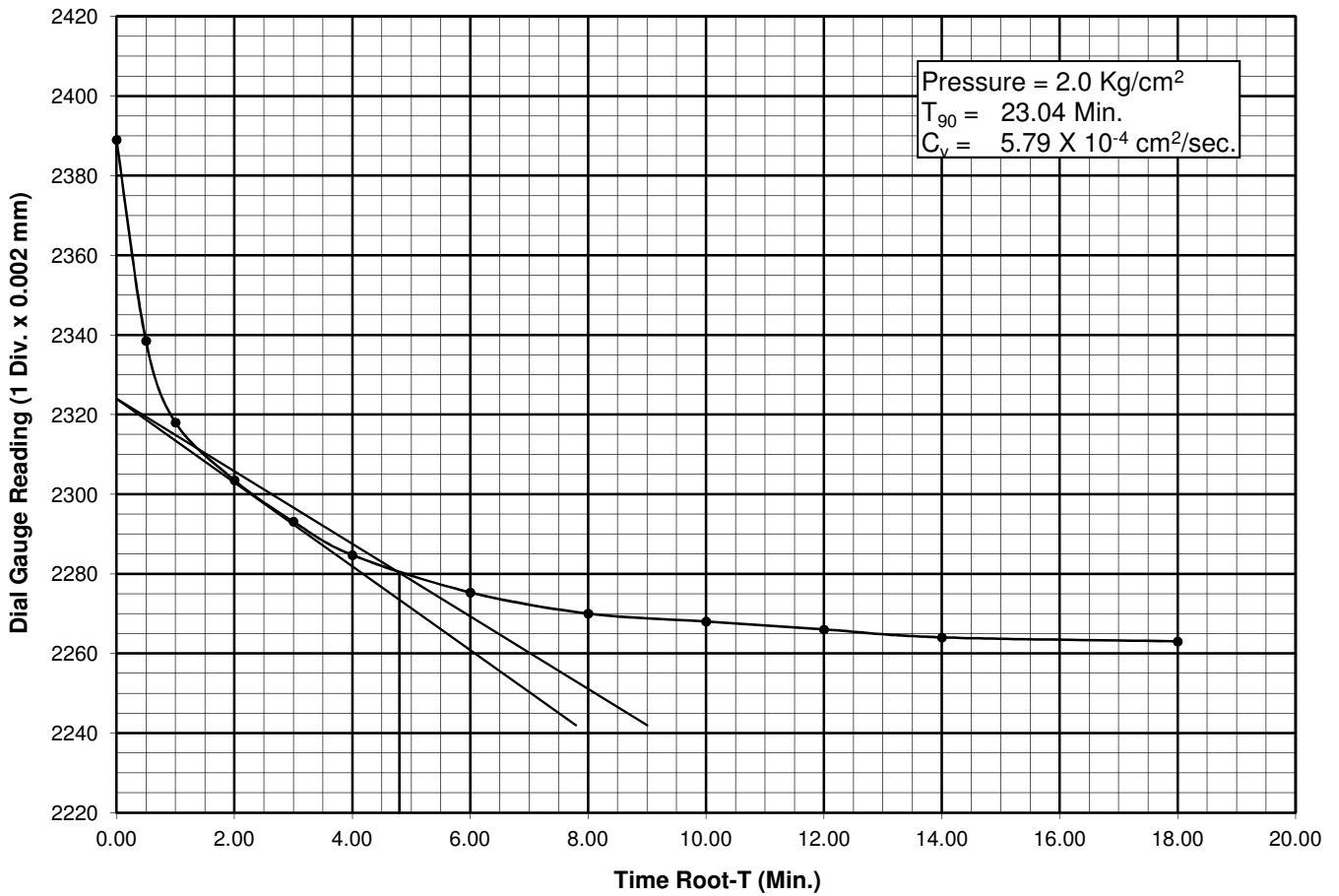
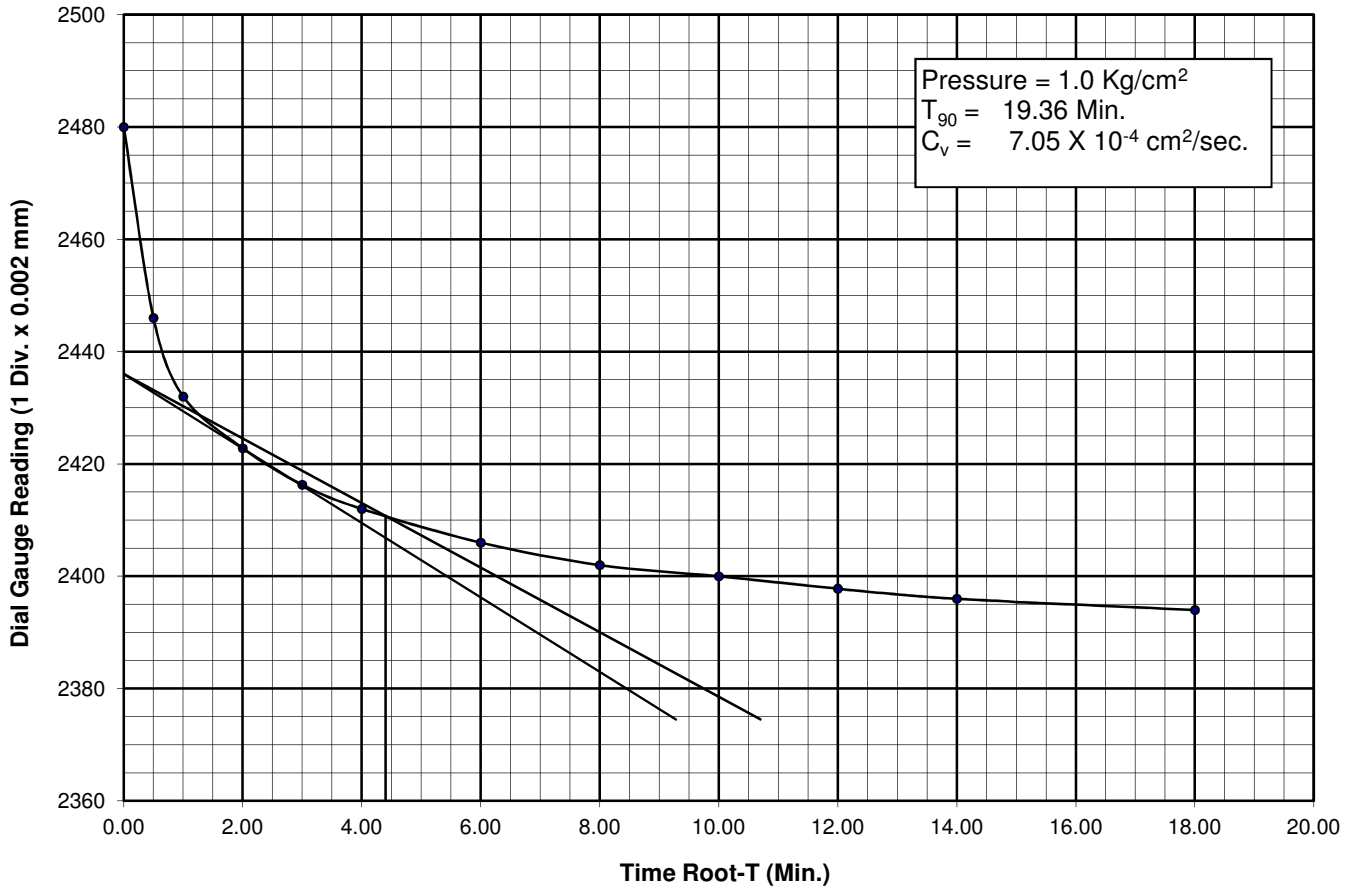


Figure No. -

CHAINAGE = 58+497  
 BORE HOLE NO. = BH-P1  
 SAMPLE NO. = UDS-3  
 DEPTH = 7.00 M

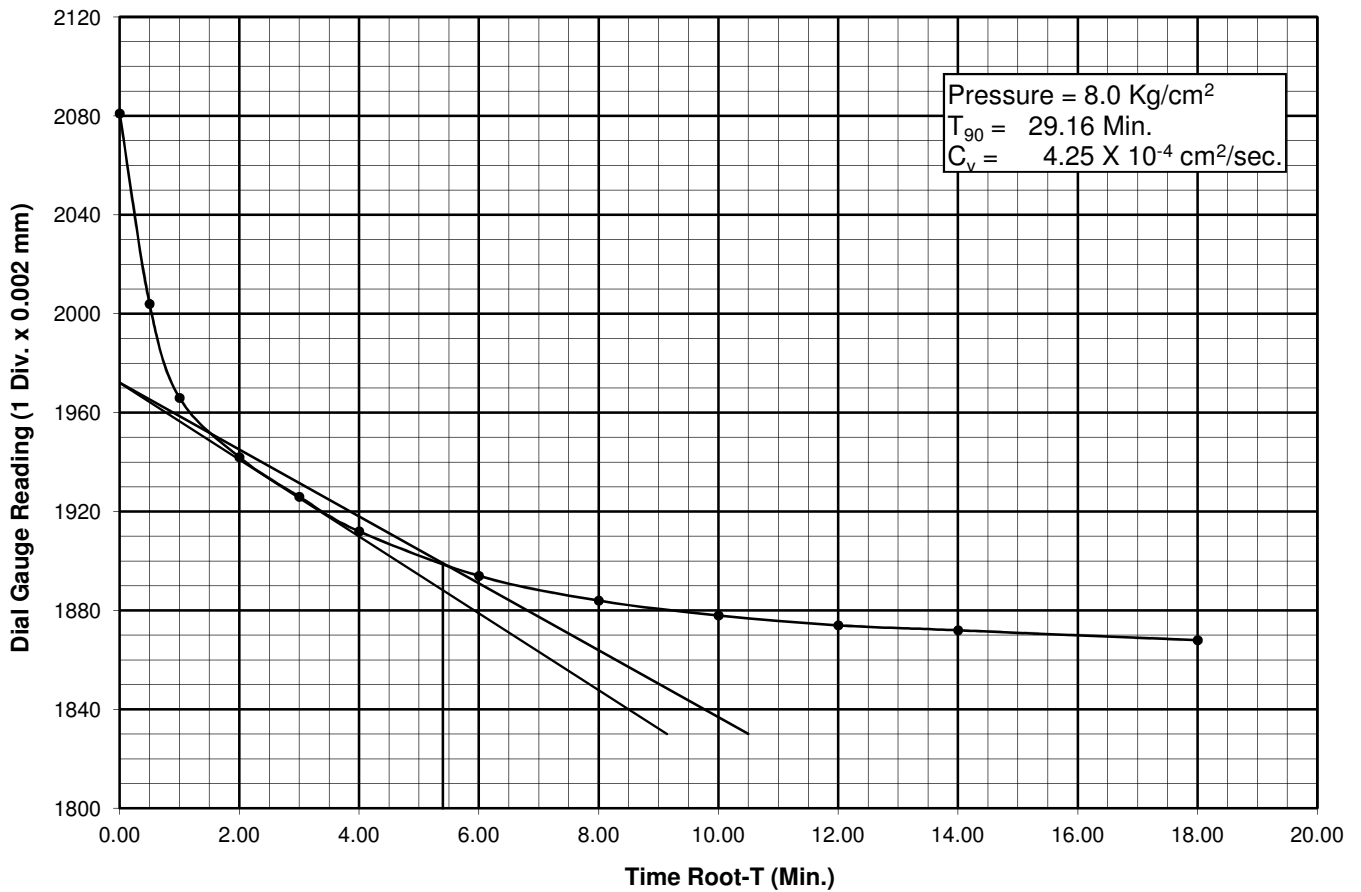
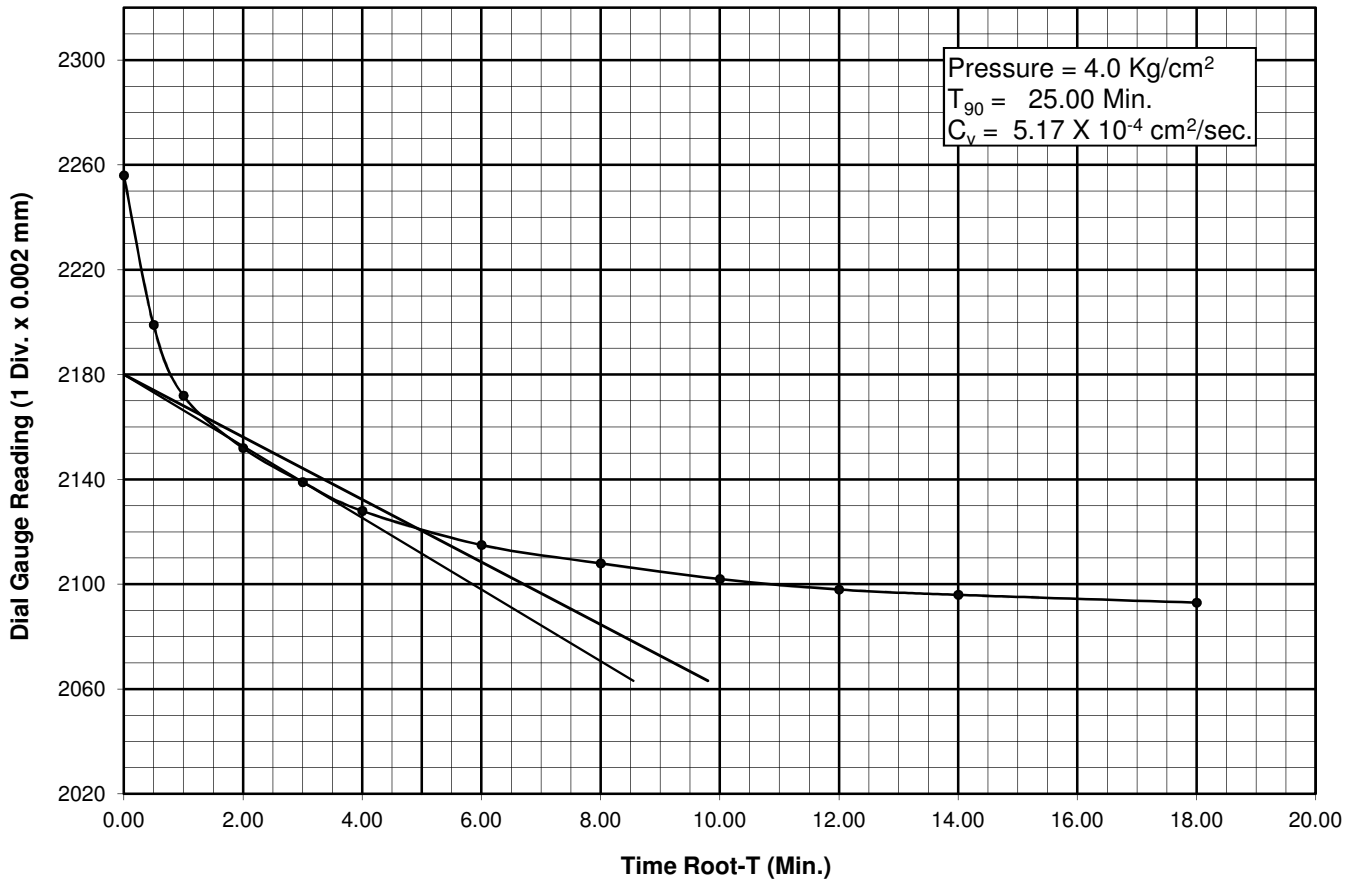
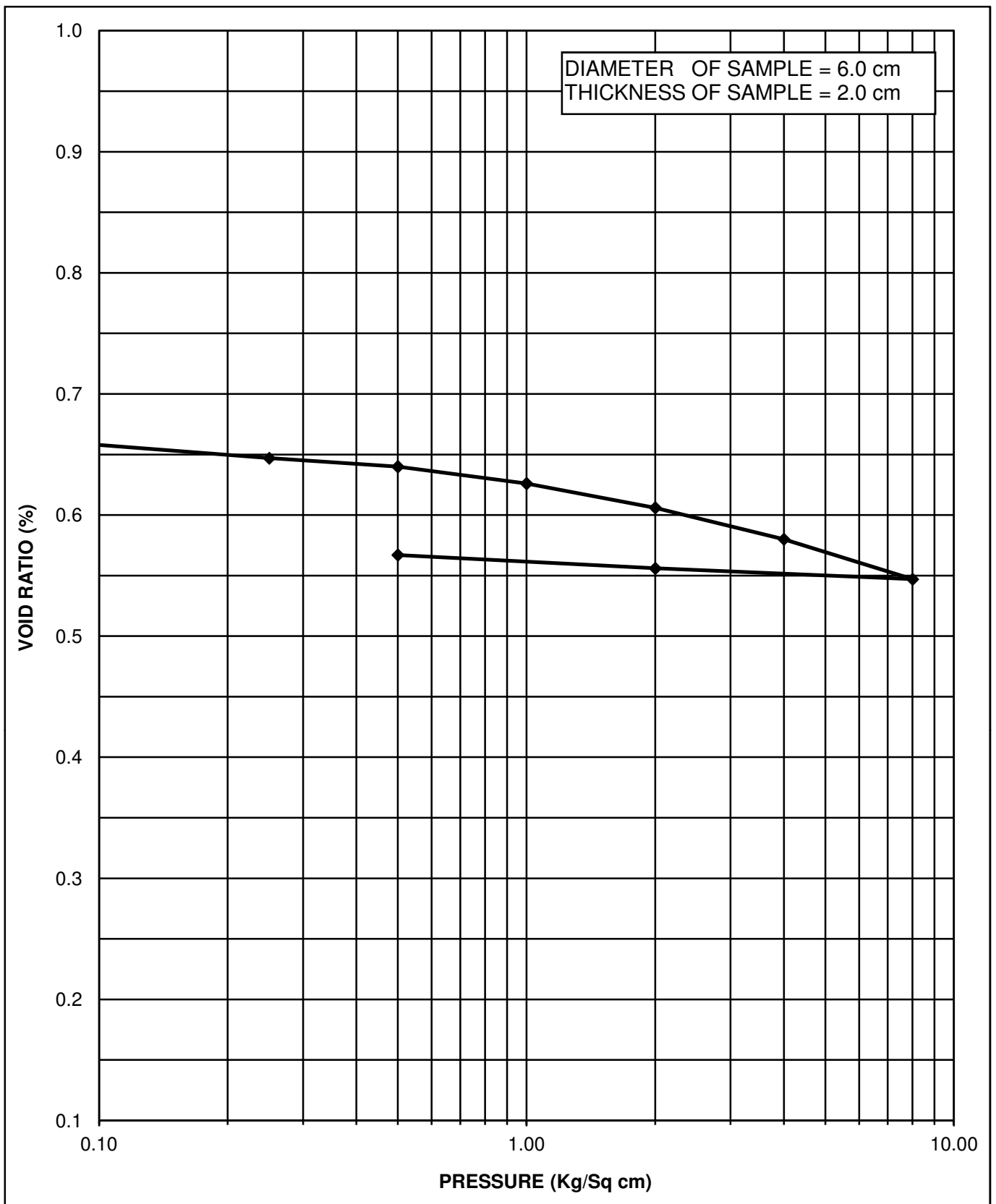


Figure No. -



CHAINAGE = 58+497

INITIAL WATER CONTENT = 17.48 %

BORE HOLE NO. = BH-P6

DRY DENSITY = 1.62 gm/cm<sup>3</sup>

SAMPLE NO. = UDS-4

VOID RATIO ( $e_0$ ) = 0.655

DEPTH = 10.00 M

COMPRESSION INDEX ( $C_c$ ) = 0.110

TYPE OF SOIL = CL

**FIGURE NO. PRESSURE Vs VOID RATIO CURVE (e-log p)**

CHAINAGE = 58+497  
 BORE HOLE NO. = BH-P6  
 SAMPLE NO. = UDS-4  
 DEPTH = 10.00 M

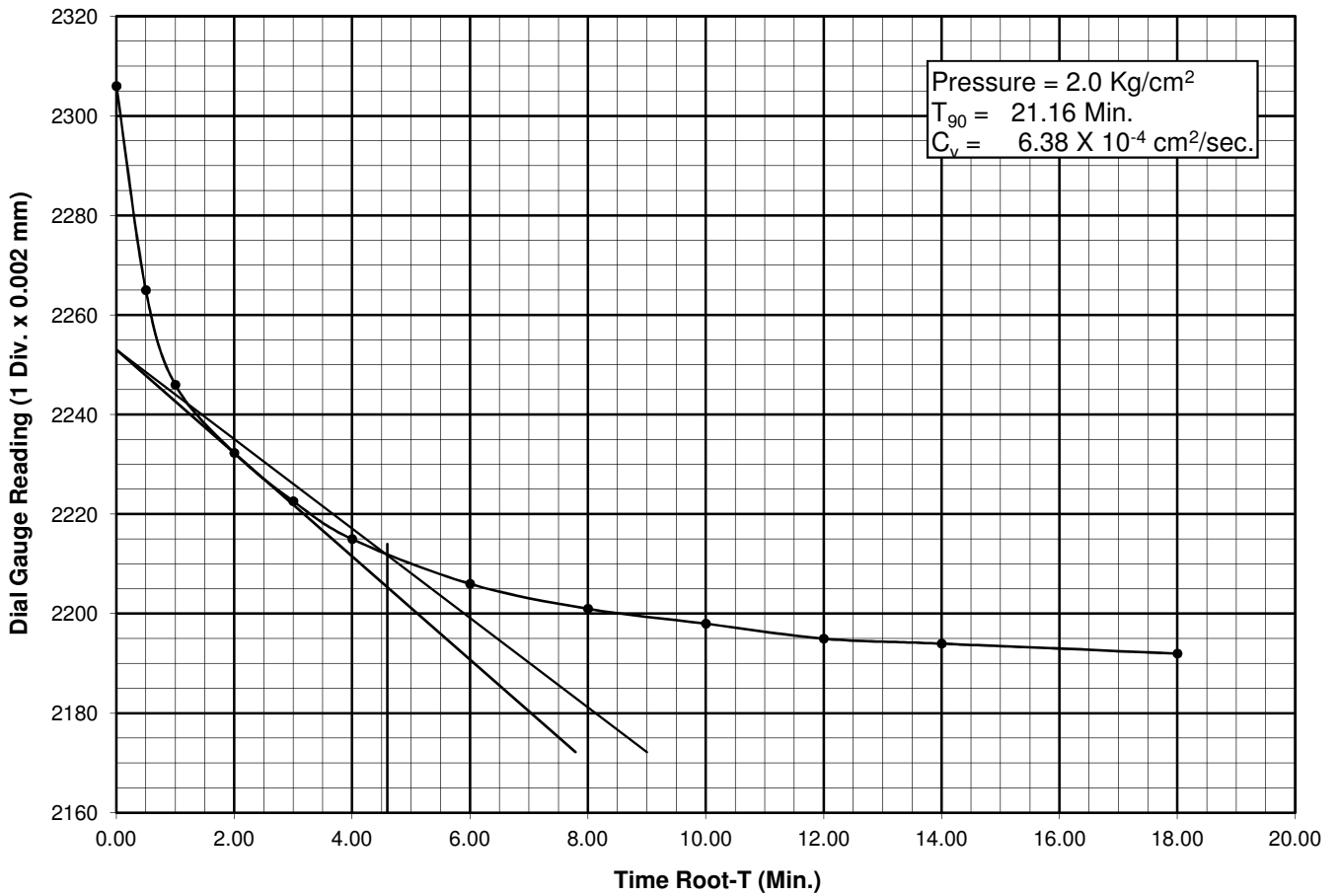
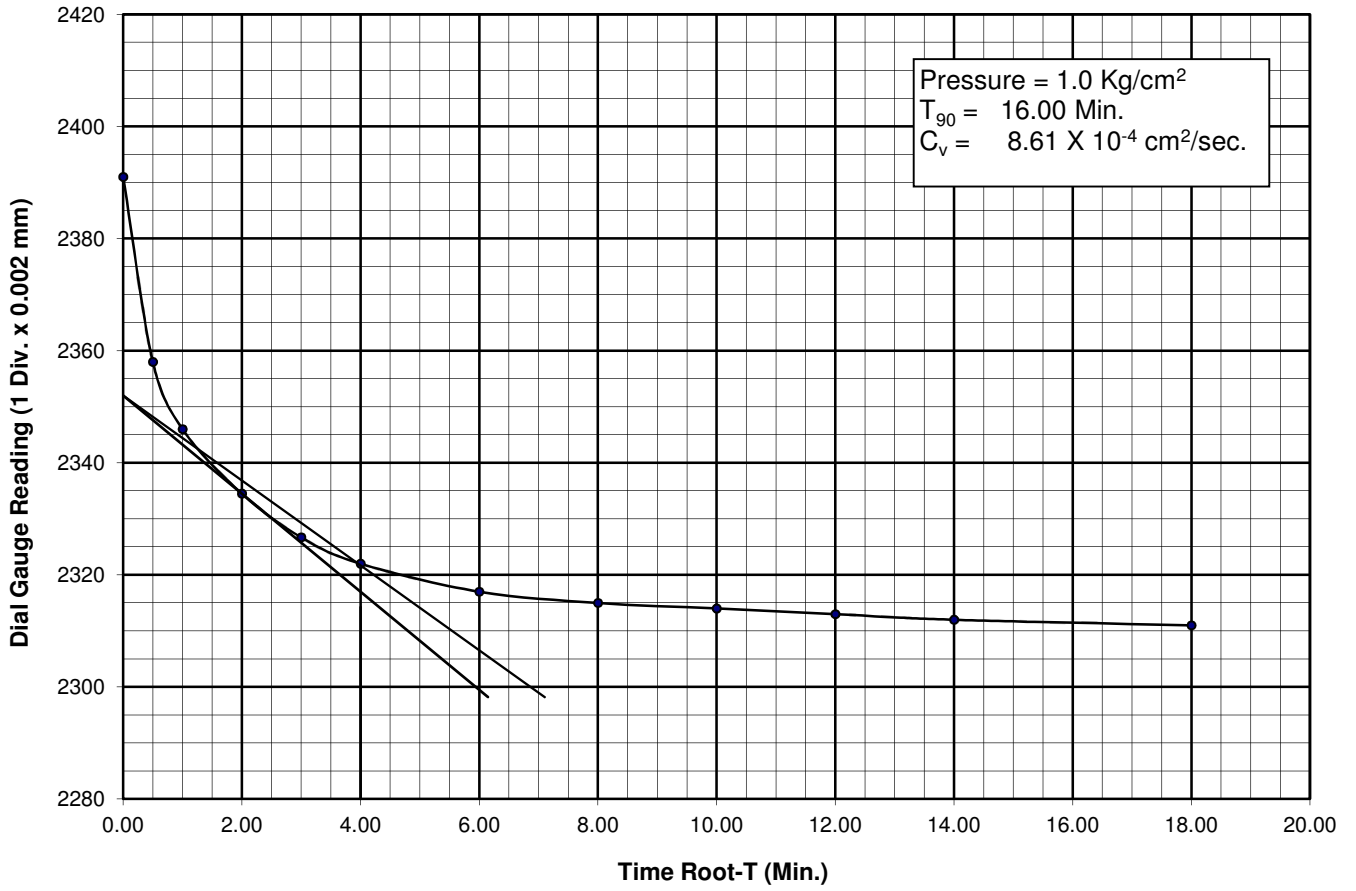


Figure No. -

CHAINAGE = 58+497  
 BORE HOLE NO. = BH-P6  
 SAMPLE NO. = UDS-4  
 DEPTH = 10.00 M

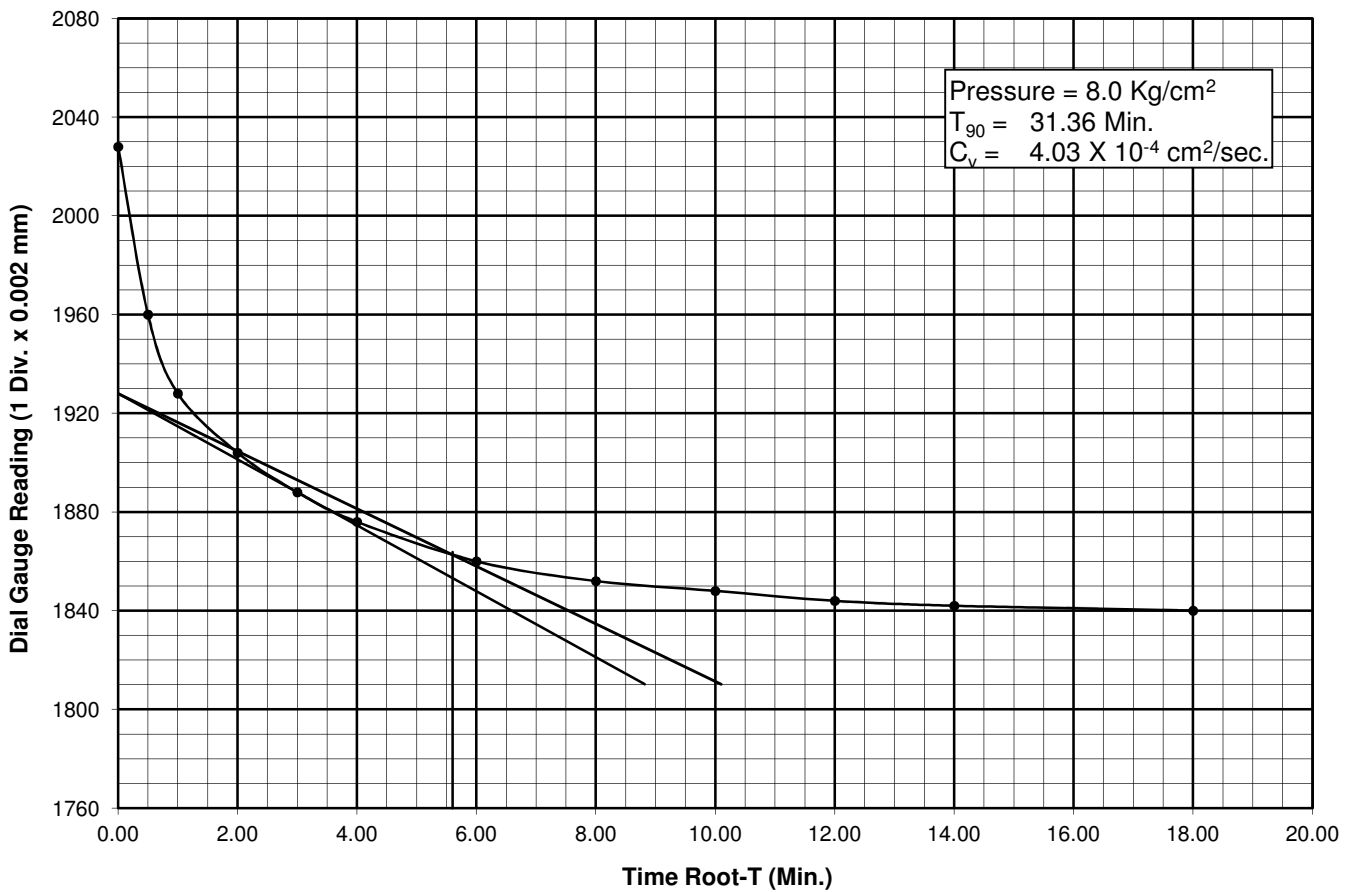
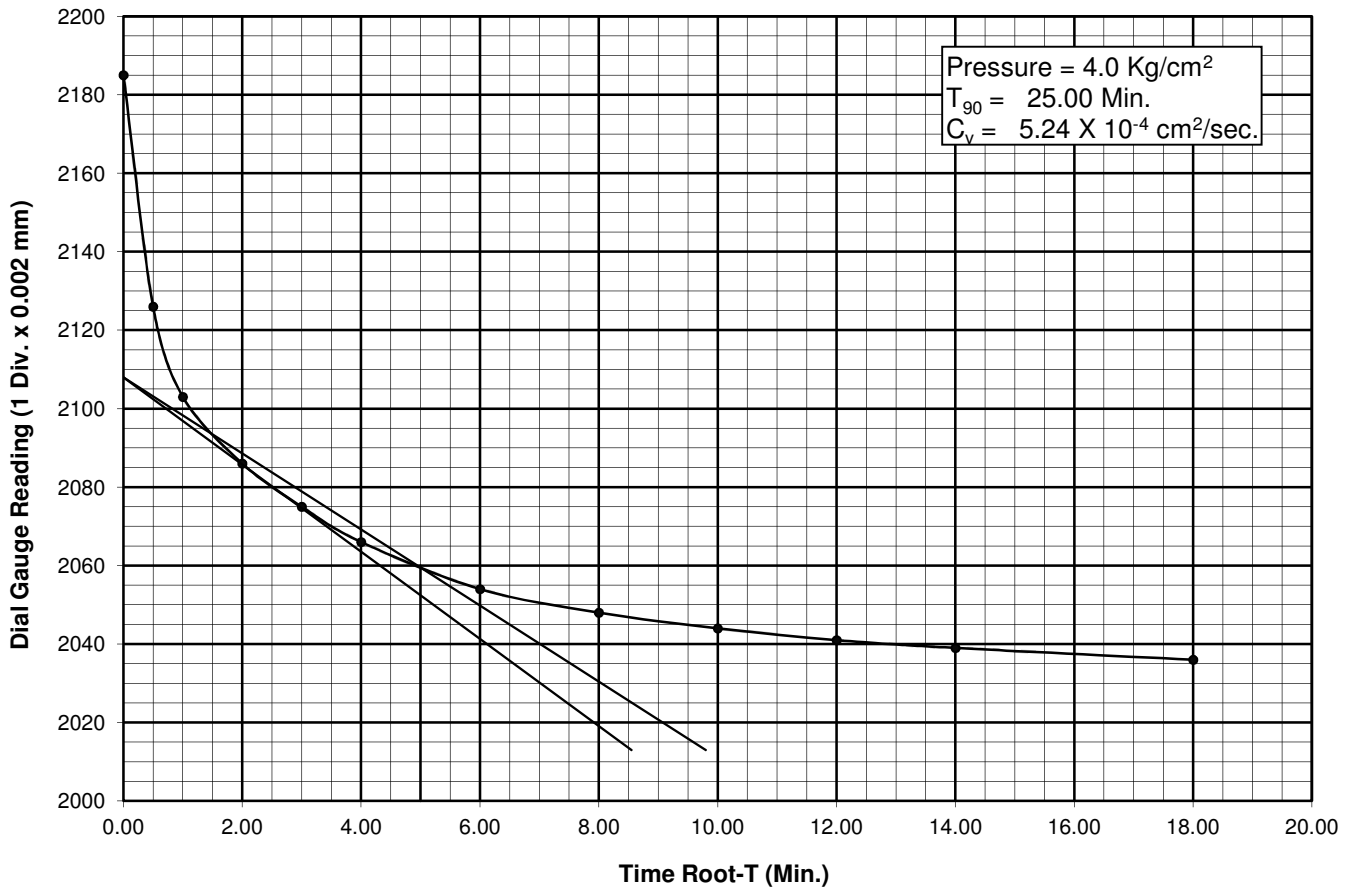


Figure No. -

## **APPENDIX – C (ANALYSIS & RECOMENDATION)**

<b>Appendix No.</b>	<b>ITEMS</b>
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION
C-2	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN COMPRESSION & UPLIFT
C-3	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN LATERAL

Calculation of SBC for shallow foundations as per IS : 6403 - 1981			
<b>INPUT DATA</b>		CH. (KM) :- 53+107	
		BH NO. :- BH-CL	
Type of footing		Square	3
1	Continuous Strip		
2	Rectangular		
3	Square		
4	Circular		
Angle of internal friction ( $\phi^\circ$ )		24.00	
Cohesion (c in $t/m^2$ )		2.10	
Void ratio (e), $e = (G \cdot \gamma_w / \gamma_d) - 1$		0.71	
Direction of load with vertical ( $^\circ$ )		0.00	
Density of foundation soil ( $t/m^3$ ) $\gamma_{bulk}$		1.74	
Depth of water table(m)		15.00	
Factor of safety		2.50	
S.no.	Depth (m) of footing ( $D_f$ ) below EGL	Width (m)	
1	1.00	6.20	
2	1.50	6.20	
3	2.00	6.20	
<b><u>SHEAR FAILURE CRITERIA</u></b>			
Assumptions and formula used in calculation as per IS:6403-1981 are given below -			
<b>NOTE:</b> The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).			
The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$			
The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q'_d = (2/3) c N'_c s'_c d'_c i'_c + q (N'_q - 1) s'_q d'_q i'_q + (1/2) B \gamma N'_\gamma s'_\gamma d'_\gamma i'_\gamma W'$			
Where,			
$d_c = 1 + 0.2 (D_f/B) \cdot \text{SQRT}(N_\phi)$		(from IS 6403 : 1981, page No. 9)	
$d_q = d_\gamma = 1$ for $\phi < 10^\circ$			
$d_q = d_\gamma = 1 + 0.1 (D_f/B) \cdot \text{SQRT}(N_\phi)$ for $\phi > 10^\circ$			
$N_\phi = \tan^2(\pi/4 + \phi/2)$			
$\phi'$ is friction angle for local shear failure = $\tan^{-1} (0.67 \tan \phi)$			
<b><u>OUTPUT</u></b>			
The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.			



<b>Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)</b>					
$\phi$	24.00		$\phi'$	16.61	
$N_c$	19.32		$N'_c$	12.06	
$N_q$	9.60		$N'_q$	4.60	
$N_\gamma$	9.44		$N'_\gamma$	3.34	
<b>Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)</b>					
S.no.	Width(m)		$S_c$	$S_q$	$S_\gamma$
1	6.20		1.30	1.20	0.80
2	6.20		1.30	1.20	0.80
3	6.20		1.30	1.20	0.80
			1.30	1.20	0.80
			1.30	1.20	0.80
<b>Depth factors : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$d_c$	$d_q$	$d_\gamma$
1	1.00	6.20	1.05	1.02	1.02
2	1.50	6.20	1.07	1.04	1.04
3	2.00	6.20	1.10	1.05	1.05
			#VALUE!	#VALUE!	#VALUE!
			#VALUE!	#VALUE!	#VALUE!
			#VALUE!	#VALUE!	#VALUE!
<b>Inclination factors : (from IS 6403 : 1981, page No. 9)</b>					
	$i_c = (1 - \alpha / 90)^2$		$i_q = (1 - \alpha / 90)^2$		$i_\gamma = (1 - \alpha / \phi)^2$
	1.00		1.00		1.00
<b>Water table factor : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$Z_w/B$		$W'$
1	1.00	6.20	2.26		1.00
2	1.50	6.20	2.18		1.00
3	2.00	6.20	2.10		1.00
			#VALUE!		#VALUE!
			#VALUE!		#VALUE!
			#VALUE!		#VALUE!
<b>Safe Bearing Capacity</b>					
S.no.	Depth(m)	Width(m)	SBC in (t/m <sup>2</sup> )		
			General shear	Local shear	Recommended
1	1.00	6.20	46.27	18.22	23.87
2	1.50	6.20	50.82	20.10	26.30
3	2.00	6.20	55.46	22.03	28.77
					#VALUE!
					#VALUE!
					#VALUE!

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976														53+107				BH NO. :- BH-CL			
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness (m)	Stress at Foundation level (kg/cm <sup>2</sup> )	Length (m)	Breadth (m)	Layer Thickness (m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress Increment at top for cohesionless layer & for mid Depth for cohesive layer (kg/cm <sup>2</sup> )	Average N-Value	Water Table Correction Factor	Settlement (mm) for 10 t/m <sup>2</sup> (from IS:8009 (Part I), Fig. 9, Page NO. 17)	Settlement in Non-Cohesive Soil S <sub>i</sub> (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)		
Layer 1	1.00	5.25	4.25	4.25	1.84	6.20	6.20	4.25	6.20	6.200	1.840	21	1.00	14.90	19.33	19.33	0.97	1.00	25.00		
Layer 2	5.25	10.30	5.05	5.05				12.975	0.420	43	1.00										6.58
Layer 1	1.50	5.25	3.75	3.75	1.96	6.20	6.20	3.75	6.20	6.200	1.957	21	1.00	14.90	18.78	18.78	0.94	1.00	25.00		
Layer 2	5.25	10.50	5.25	5.25				12.575	0.476	43	1.00										7.75
Layer 3	10.50	10.80	0.30	0.30				15.200	0.326	38											0.06
Layer 1	2.00	5.25	3.25	3.25	2.11	6.20	6.20	3.25	6.20	6.200	2.110	21	1.00	14.90	18.13	18.13	0.91	1.00	25.00		
Layer 2	5.25	10.50	5.25	5.25				12.075	0.556	43	1.00										9.06
Layer 3	10.50	11.30	0.80	0.80				14.700	0.375	38	1.00										0.20

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 22.00 m															Bore Hole No = BH-A1			Ch. (KM) 52+518			Dia of pile = 1.00 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D															Water Table depth considered for analysis = 18.00 m														
Soil layers															Properties of layers/for Skin Friction						For End Bearing						Liquefaction Depth = Non-Liquefiable		
Dia. of Pile (m)	Cut-off Depth (m)	from (m)		to (m)		c	Ø	k	α	γ <sub>eff</sub>	ΔL	p <sub>d</sub> (s.f)	Pd (e-b)	γ <sub>eff</sub>	c	Ø	N <sub>c</sub>	N <sub>q</sub>	N <sub>y</sub>	A <sub>s/cm</sub>	A <sub>p</sub>	q <sub>s</sub>	Q <sub>p</sub>						
		kg/cm <sup>2</sup>	deg	cm	kg/cm <sup>2</sup>																			gm/cc	gm/cc	kg/cm <sup>2</sup>	deg	cm <sup>2</sup>	cm <sup>2</sup>
1.00	2.00	0.00	2.00	2.00	2.00	0.19	29	1.00	1.00	1.72	200	0.17																	
1.00		2.00	5.50	5.50	5.50	0.74	5	1.00	1.00	1.72	350	0.64								314.29		60.14							
1.00		5.50	13.00	13.00	13.00	0.74	5	1.00	0.62	1.78	750	1.61								314.29		140.90							
1.00		13.00	15.00	15.00	15.00	1.12	4	1.00	0.40	1.85	200	2.46								314.29		38.68							
1.00		15.00	16.00	16.00	16.00	1.12	4	1.00	0.40	1.85	100	2.65								314.29		19.75							
1.00		16.00	18.00	18.00	18.00	0.21	30	1.00	1.00	1.87	200	2.65								314.29		109.40							
1.00		18.00	24.00	24.00	24.00	0.21	30	1.00	1.00	0.87	600	2.65	2.65	0.84	0.23	29	9	17.93	19.34	7857.14		328.20		395.97					

Q <sub>u,comp.</sub> =	q <sub>s</sub> + Q <sub>p</sub>	Q <sub>u,uplift</sub> =	Safe Frictional Resistance + Weight of Pile
Q <sub>a,comp.</sub> =	(697.07 + 395.97) / 2.5	Q <sub>a,uplift</sub> =	697.07 / 3 + 43.2
Q <sub>a,comp.</sub> =	437.22 T	Q <sub>a,uplift</sub> =	275.55 T
<b>Q<sub>a,comp.</sub> =</b>	<b>437.00 T</b>	<b>Q<sub>a,uplift</sub> =</b>	<b>275.00 T</b>

Say

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 24.00 m												Bore Hole No = BH-A1			Ch. (KM) 52+518			Dia of pile = 1.00 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D												Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction					For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp							
		from (m)	to (m)	c	Ø	k	α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)	y <sub>eff</sub>								c	Ø					
1.00	2.00	0.00	2.00																							
1.00	5.50	2.00	5.50	0.19	29	1.00	1.00	1.72	200	0.17						314.29		60.14								
1.00	13.00	5.50	13.00	0.74	5	1.00	0.62	1.78	750	0.64						314.29		140.90								
1.00	15.00	13.00	15.00	1.12	4	1.00	0.40	1.85	200	1.61						314.29		38.68								
1.00	16.00	15.00	16.00	1.12	4	1.00	0.40	1.85	100	2.46						314.29		19.75								
1.00	18.00	16.00	18.00	0.21	30	1.00	1.00	1.87	200	2.65						314.29		109.40								
1.00	25.00	18.00	25.00	0.21	30	1.00	1.00	0.87	700	2.65						314.29		382.90								
1.00	26.00	25.00	26.00	0.23	29	1.00	1.00	0.84	100	2.65	0.84	0.23	29	17.93	19.34	7857.14		53.41		395.97						

Qu,comp.=	qs + Qp	Qu,uplift =	Safe Frictional Resistance + Weight of Pile
Qa,comp.=	(805.18 + 395.97) / 2.5	Qa,uplift =	805.18 / 3 + 47.12
Qa,comp.=	480.46 T	Qa,uplift =	315.52 T
Say		<b>Qa,uplift = 315.00 T</b>	

\*FOS for Vertical Capacity of pile in compression = 2.5  
\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 26.00 m												Bore Hole No = BH-A1			Ch. (KM) 52+518			Dia of pile = 1.00 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D												Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		c	Ø	Properties of layers/for Skin Friction			For End Bearing			Nc	Nq	Ny	As/cm <sup>2</sup>	Ap	qs	Qp								
		from (m)	to (m)			α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)	y <sub>eff</sub>								c	Ø						
1.00	2.00	0.00	2.00																							
1.00		2.00	5.50	0.19	29	1.00	1.72	200	0.17						314.29		60.14									
1.00		5.50	13.00	0.74	5	1.00	1.78	750	0.64						314.29		140.90									
1.00		13.00	15.00	1.12	4	1.00	1.85	200	1.61						314.29		38.68									
1.00		15.00	16.00	1.12	4	1.00	1.85	100	2.46						314.29		19.75									
1.00		16.00	18.00	0.21	30	1.00	1.87	200	2.65						314.29		109.40									
1.00		18.00	25.00	0.21	30	1.00	0.87	700	2.65						314.29		382.90									
1.00		25.00	28.00	0.23	29	1.00	0.84	300	2.65	2.65	0.84	0.23	9	17.93	314.29	7857.14	160.23			395.97						

Q <sub>u,comp.</sub> =	qs + Qp	Q <sub>u,uplift</sub> =	Safe Frictional Resistance + Weight of Pile
Q <sub>a,comp.</sub> =	(912 + 395.97) / 2.5	Q <sub>a,uplift</sub> =	912 / 3 + 51.05
Q <sub>a,comp.</sub> =	523.19 T	Q <sub>a,uplift</sub> =	355.05 T
<b>Q<sub>a,comp.</sub> =</b>	<b>523.00 T</b>	<b>Q<sub>a,uplift</sub> =</b>	<b>355.00 T</b>

Say

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 28.00 m												Bore Hole No = BH-A1			Ch. (KM) 52+5.18			Dia of pile = 1.00 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D												Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction				For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp								
		from (m)	to (m)	c	Ø	k	α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)								y <sub>eff</sub>	c	Ø					
1.00	2.00	0.00	2.00																							
1.00		2.00	5.50	0.19	29	1.00	1.00	1.72	200	0.17								60.14								
1.00		5.50	13.00	0.74	5	1.00	0.62	1.78	750	0.64								140.90								
1.00		13.00	15.00	1.12	4	1.00	0.40	1.85	200	1.61								38.68								
1.00		15.00	16.00	1.12	4	1.00	0.40	1.85	100	2.46								19.75								
1.00		16.00	18.00	0.21	30	1.00	1.00	1.87	200	2.65								109.40								
1.00		18.00	25.00	0.21	30	1.00	1.00	0.87	700	2.65								382.90								
1.00		25.00	30.00	0.23	29	1.00	1.00	0.84	500	2.65	0.84	0.23	29	17.93	19.34	7857.14		267.05		395.97						
																		1018.82	395.97							
<p>Qu,comp.= qs + Qp</p> <p>Qa,comp.= (1018.82 + 395.97) / 2.5</p> <p>Qa,comp.= 565.92 T</p>												<p>Qu,uplift =</p> <p>Qa,uplift = 1018.82 / 3 + 54.98</p> <p>Qa,uplift = 394.58 T</p>			<p>Safe Frictional Resistance + Weight of Pile</p>											
Say												<p><b>Qa,comp.= 565.00 T</b></p> <p><b>Qa,uplift = 394.00 T</b></p>														

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 22.00 m												Bore Hole No = BH-A1			Ch. (KM) 52+5.18			Dia of pile = 1.20 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D												Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction					For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp							
		from (m)	to (m)	c	Ø	k	α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)	y <sub>eff</sub>								c	Ø					
1.20	2.00	0.00	2.00			1.72	200	0.17																		
1.20	5.50	2.00	5.50	0.19	29	1.00	1.00	1.72	350	0.64						377.14		72.17								
1.20	13.00	5.50	13.00	0.74	5	1.00	0.62	1.78	750	1.61						377.14		169.09								
1.20	16.00	13.00	16.00	1.12	4	1.00	0.40	1.85	300	2.56						377.14		70.35								
1.20	18.00	16.00	18.00	0.21	30	1.00	1.00	1.87	200	3.02						377.14		147.49								
1.20	24.00	18.00	24.00	0.21	30	1.00	1.00	0.87	600	3.21	0.84	0.23	29	9	17.93	11314.29	466.90	685.44								
												Qu,comp.= qs + Qp			Qu,uplift =			Safe Frictional Resistance + Weight of Pile			925.99			685.44		
												Qa,comp.= (925.99 + 685.44) / 2.5			Qa,uplift =			925.99 / 3 + 62.2								
												Qa,comp.= 644.57 T			Qa,uplift =			370.87 T								
												Say			Qa,comp.= 644.00 T			Qa,uplift = 370.00 T								

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 24.00 m		Bore Hole No = BH-A1		Ch. (KM) 52+5.18		Dia of pile = 1.20 m		Cut-off Level = 2.00 m		below EGL										
Restricting PD to 15D		Water Table depth considered for analysis = 18.00 m		Scour Depth = Non-scourable		Liquefaction Depth = Non-Liquefiable														
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction				For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp		
		from (m)	to (m)	c	Ø	k	α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)								y <sub>eff</sub>	c
1.20	2.00	0.00	2.00			1.72	200	0.17												
1.20	5.50	2.00	5.50	0.19	29	1.72	350	0.64											72.17	
1.20	13.00	5.50	13.00	0.74	5	1.78	750	1.61											169.09	
1.20	16.00	13.00	16.00	1.12	4	1.85	300	2.56											70.35	
1.20	18.00	16.00	18.00	0.21	30	1.87	200	3.02											147.49	
1.20	25.00	18.00	25.00	0.21	30	0.87	700	3.21											544.71	
1.20	26.00	25.00	26.00	0.23	29	0.84	100	3.21	3.21	0.84	0.23	29	9	17.93	19.34	11314.29			75.78	685.44
										Qu,comp.= qs + Qp		Qu,uplift =		Safe Frictional Resistance + Weight of Pile		1079.59		685.44		
										(1079.59 + 685.44) / 2.5		Qa,uplift =		1079.59 / 3 + 67.86						
										706.01 T		Qa,uplift =		427.72 T						
										Say		Qa,uplift =		427.00 T						

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0



**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 26.00 m															Bore Hole No = BH-A1			Ch. (KM) 52+5.18			Dia of pile = 1.20 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D															Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction					For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp										
		from (m)	to (m)	c	Ø	α	yeff	gm/cc	ΔL	cm	pd (s.f)	kg/cm <sup>2</sup>								Pd (e-b)	kg/cm <sup>2</sup>	yeff	gm/cc	c	Ø	deg			
1.20	2.00	0.00	2.00			1.72	200	1.00	1.00	0.17	0.17																		
1.20	5.50	2.00	5.50	0.19	29	1.72	350	1.00	1.00	0.64	0.64									72.17									
1.20	13.00	5.50	13.00	0.74	5	1.78	750	1.00	1.00	1.61	1.61									169.09									
1.20	16.00	13.00	16.00	1.12	4	1.85	300	1.00	1.00	2.56	2.56									70.35									
1.20	18.00	16.00	18.00	0.21	30	1.87	200	1.00	1.00	3.02	3.02									147.49									
1.20	25.00	18.00	25.00	0.21	30	0.87	700	1.00	1.00	3.21	3.21									544.71									
1.20	28.00	25.00	28.00	0.23	29	0.84	300	1.00	1.00	3.21	3.21	3.21	0.84	0.23	29	17.93	11314.29	11314.29	19.34	227.34	685.44								

Qu,comp.=	qs + Qp	Qu,uplift =	Safe Frictional Resistance + Weight of Pile
Qa,comp.=	(1231.15 + 685.44) / 2.5	Qa,uplift =	1231.15 / 3 + 73.51
Qa,comp.=	766.64 T	Qa,uplift =	483.90 T
<b>Qa,comp.=</b>	<b>766.00 T</b>	<b>Qa,uplift =</b>	<b>483.00 T</b>

Say

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

**NAME OF PROJECT:- "GTI for designing of bridges and embankment for Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kaian including connectivity to existing IR network in the state of Haryana.**

Length of Pile below cut of level = 28.00 m															Bore Hole No = BH-A1			Ch. (KM) 52+5.18			Dia of pile = 1.20 m			Cut-off Level = 2.00 m			below EGL		
Restricting PD to 15D															Water Table depth considered for analysis = 18.00 m			Scour Depth = Non-scourable			Liquefaction Depth = Non-Liquefiable								
Dia. of Pile (m)	Cut-off Depth (m)	Soil layers		Properties of layers/for Skin Friction					For End Bearing				Nc	Nq	Ny	As/cm <sup>2</sup>	Ap cm <sup>2</sup>	qs	Qp										
		from (m)	to (m)	c	Ø	k	α	y <sub>eff</sub>	ΔL	pd (s.f)	Pd (e-b)	y <sub>eff</sub>								c	Ø								
1.20	2.00	0.00	2.00			1.72	200	0.17																					
1.20	5.50	2.00	5.50	0.19	29	1.72	350	0.64								377.14		72.17											
1.20	13.00	5.50	13.00	0.74	5	1.78	750	1.61								377.14		169.09											
1.20	16.00	13.00	16.00	1.12	4	1.85	300	2.56								377.14		70.35											
1.20	18.00	16.00	18.00	0.21	30	1.87	200	3.02								377.14		147.49											
1.20	25.00	18.00	25.00	0.21	30	0.87	700	3.21								377.14		544.71											
1.20	30.00	25.00	30.00	0.23	29	0.84	500	3.21	3.21	0.84	0.23	29	9	17.93	19.34	377.14	11314.29	378.90	685.44										
															Qu,comp.= qs + Qp			Qu,uplift =			Safe Frictional Resistance + Weight of Pile								
															(1382.71 + 685.44) / 2.5			1382.71 / 3 + 79.17											
															827.26 T			540.07 T											
															Say			Qa,uplift =											
															827.00 T			540.00 T											

\*FOS for Vertical Capacity of pile in compression = 2.5

\*\*FOS for Uplift Capacity of pile = 3.0

<b>Lateral Load capacity of Pile</b>			
BH-A1			
52+518			
Type of Strata =	Sandy		
<b>Le = Embedded Length of Pile in Meter</b>	=	<b>24.000 m</b>	<b>Fck = 35.0 N/mm<sup>2</sup> D = 100 cm</b>
<b>Bed level</b>		<b>0.0 m</b>	
<b>Pile cap bottom level</b>		<b>-2.0 m</b>	
<b>Max. of Liquefaction &amp; Scour Depth</b>		<b>-2.0 m</b>	
E = Young's Modulus of Pile (Kg/cm <sup>2</sup> )	=	$5000 \sqrt{F_{ck}}$ N/mm <sup>2</sup>	= 295803.99 Kg/cm <sup>2</sup>
I = Moment of Inertia (cm <sup>2</sup> )	=	$\pi \times D^4 / 64$	= 4908738.5 cm <sup>4</sup>
K <sub>1</sub> = Constant for Sandy / Normally Consolidated Clay		(Kg/cm <sup>3</sup> )	= <b>0.490</b>
T, Relative stiffness factor in Sand		$\sqrt[5]{\frac{EI}{K_1}}$	= <b>312.1 cm</b>
<b>For Long Pile If L<sub>e</sub> &gt; 4T</b>			
L <sub>1</sub> =			= <b>0.000 cm</b>
$\frac{L_1}{T}$			= 0.00
<b>For Fixed Head Pile</b>			
$\frac{L_f}{T}$			= <b>2.219</b> From Fig. 4
L <sub>f</sub>			= 692.65 cm
Equivalent length of cantilever L = L <sub>1</sub> + L <sub>F</sub>	0.00 +	692.64846	= <b>692.65 cm</b>
Y = Pile Head Deflection (Cm)	=	$\frac{Q(L_1 + L_F)^3}{12 EI}$ (for fixed Head pile)	
		Q = Lateral Load in Kg	
Lateral Load For Pile Head Deflection .5 cm		Q	= 26217.22 Kg
			= <b>26.22 T</b>

<b>Lateral Load capacity of Pile</b>			
BH-A1			
52+518			
Type of Strata =	Sandy		
<b>Le = Embedded Length of Pile in Meter</b>	=	<b>24.000 m</b>	<b>Fck = 35.0 N/mm<sup>2</sup> D = 120 cm</b>
<b>Bed level</b>	<b>0.0 m</b>		
<b>Pile cap bottom level</b>	<b>-2.0 m</b>		
<b>Max. of Liquefaction &amp; Scour Depth</b>	<b>-2.0 m</b>		
E = Young's Modulus of Pile (Kg/cm <sup>2</sup> )	=	$5000 \sqrt{F_{ck}}$ N/mm <sup>2</sup>	= 295803.99 Kg/cm <sup>2</sup>
I = Moment of Inertia (cm <sup>2</sup> )	=	$\pi \times D^4 / 64$	= 10178760.2 cm <sup>4</sup>
K <sub>1</sub> = Constant for Sandy / Normally Consolidated Clay		(Kg/cm <sup>3</sup> )	= <b>0.490</b>
T, Relative stiffness factor in Sand		$\sqrt[5]{\frac{EI}{K_1}}$	= <b>361.2 cm</b>
<b>For Long Pile If L<sub>e</sub> &gt; 4T</b>			
L <sub>1</sub> =			= <b>0.000 cm</b>
$\frac{L_1}{T}$			= 0.00
<b>For Fixed Head Pile</b>			
$\frac{L_f}{T}$			= <b>2.219</b> From Fig. 4
L <sub>f</sub>			= 801.42 cm
Equivalent length of cantilever L = L <sub>1</sub> + L <sub>F</sub>	0.00 +	801.41574	= <b>801.42 cm</b>
Y = Pile Head Deflection (Cm)	=	$\frac{Q(L_1 + L_F)^3}{12 EI}$ (for fixed Head pile)	
		Q = Lateral Load in Kg	
Lateral Load For Pile Head Deflection .5 cm		Q	= 35097.53 Kg
			= <b>35.10 T</b>

# Geotechnical Investigation Report

Old Ch. 898+787 New Ch. 1046+562 (Minor Bridge), Old Ch. 1153+187  
New Ch. 1277+958 (Minor Bridge), Old Ch. 1859+918 New Ch. 1986+847  
(Minor Bridge), Old Ch. 2391+105 New Ch. 2518+489 (Minor Bridge) KM &  
Old Ch. 2560+493 New Ch. 2687+006 (Minor Bridge) KM

## PATLI TO NEW PATLI

SR NO. : 544\_21-22

**CONDUCTING GEOTECHNICAL INVESTIGATION,  
PREPARATION OF GEOTECHNICAL REPORT FOR  
DESIGNING OF BRIDGES AND FOR EMBANKMENT  
IN CONNECTION WITH CONSTRUCTION OF  
HARYANA ORBITAL RAIL CORRIDOR (HORC)  
PROJECT FROM PALWAL TO HARSANA KALAN  
INCLUDING CONNECTIVITY TO EXISTING  
IR NETWORK IN THE STATE OF HARYANA**

### CLIENT

**M/S. HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LTD. (HRIDCL)**

### PROGRAMME

JULY - 2022

SR. No.	Report No.	Revision No.	Date
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/666_(05 BHs)	00	29.07.2022



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CEGTH/HRIDCL/SR-544/2022-23/666

Date:- 29.07.2022

To,

**Haryana Rail Infrastructure Development**

**Corporation Ltd. (HRIDCL)**

SCO No.-17-19, 3<sup>rd</sup> & 4<sup>th</sup> Floor,

Sector - 17-A,

Chandigarh - 160017

Tele:- 0172-2715644

Email: hride2017@gmail.com

Subject :- Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.

Dear Sir,

We are pleased to submit this report of the subject work based on 05 boreholes carried out at Ch. 898+787 KM to Ch. 2560+493 KM (OLD) - Ch. 1046+562 KM to Ch. 2687+006 KM (NEW) for Minor Bridge for the proposed project site.

The accompanying report presents results of various field tests and laboratory tests conducted on selected soil samples and their interpretation.

Should there be any clarifications regarding the contents please contact us at your most convenient time.

We value the opportunity to participate in this project and look forward a pleasant association on future projects.

Very truly yours,  
CEG Test House & Research Centre Pvt. Ltd.

Prepared By:-



**Nehal Jain**  
**General Manager - Geotechnical**  
Authorized Signatory



**Dr. Ankur Mudgal**  
**Senior Manager**

SR. No.	Report Ref. No.	Revision No.	Date
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/666_(05 BHs)	00	29.07.2022

**CONTENTS**

<b>S. NO.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>CHAPTER 1 GENERAL</b>		
1.0	INTRODUCTION	1
2.0	SITE LOCATION & GENERAL GEOLOGICAL HISTORY	1-2
3.0	SCOPE OF WORK	3-4
4.0	FIELD INVESTIGATION	4-6
5.0	LABORATORY INVESTIGATION	7-12
<b>CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION</b>		
6.0	STRATIFICATION	13
6.1	GROUND WATER TABLE DEPTH	13
6.2	RESULTS OF CHEMICAL ANALYSIS	14
<b>CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS</b>		
7.0	TYPE & DEPTH OF FOUNDATION	15
7.1	ANALYSIS OF SHALL FOUNDATION	15-16
<b>CHAPTER 4 RECOMMENDATIONS</b>		
8.0	FOUNDATION RECOMMENDATIONS	17-18
ABBREVIATIONS		19

**LIST OF FIGURES / TABLES**

<b>Appendix No.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>APPENDIX – A (FIELD DATA RESULTS)</b>		
A-1	LOCATION PLAN	21
A-2	FIELD BORE HOLE LOGS	22-26
A-3	SUB SOIL PROFILE DIAGRAM	27
<b>APPENDIX – B (LAB TEST RESULTS)</b>		
B-1	SOIL CHARACTERISTICS SHEETS	29-33
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES	34
B-3	GSD CURVES	35-39
<b>APPENDIX – C (ANALYSIS &amp; RECOMENDATION)</b>		
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION	41-44

## CHAPTER 1 GENERAL

### 1.0 INTRODUCTION:

The work of conducting “**Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana**” was awarded to “**CEG Test House & Research Centre Pvt. Ltd., Jaipur**” by M/S. “**Haryana Rail Infrastructure Development Corporation Ltd. (HRIDCL)**” as per work order no. HRIDC/ HORC/ GT/ CEG/ 237/ 2021/ 577-M dated 29<sup>th</sup> July 2021.

Field work including drilling of boreholes, conducting field tests such as Electrical Resistivity Test, & Plate Load Test and sample collection was carried out in the presence of representative of Client. Laboratory tests were conducted on selected soil samples to determine the design parameters, confirming to relevant IS specifications and the guidelines received from time to time from representative of Client.

This report includes the details of Methodology of Investigation, collection of samples (soil/ rock), field test results, laboratory test results, analysis of results and recommendations for results for proposed structures based on soil sample collected from the locations of boreholes.

### 2.0 SITE LOCATION & GENERAL GEOLOGICAL HISTORY:

The details of the site & test locations for the proposed project are shown in location plan attached vide **Appendix A-1**. The site of proposed project is located from Palwal to Harsana Kalan (Sonipat) in the State of Haryana falls in seismic zone – IV (Zone factor=0.24) of India.

Soil of the Haryana Sub-Region have been classified and described under the following major soil types as shown below:-

- Typic Ustochrepts : Soil of old alluvial plains
- Typic Ustipsamments : Soil of Aravali plains
- Typic Ustifluvents : Soil of recent alluvial plains and flood plains
- Typic Torripsamments : Soil of Aeofluvial plains
- Rocky Outcrops : Aravali rocky hills



The district wise details of soil characteristics are described below:-

**Panipat:** The soils are well drained, Sandy loam to clay loam/silty clay loam in plains and loam to clay loam/ silty/ loose clay loam in relic channels/depressions/basins.

**Sonipat:** The district comprises of recent flood plains, young meander plains, old meander plains and old alluvial plains. Recent flood plains occur along the Yamuna River and clearly show fluvial features. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface.

**Rohtak:** The district mainly comprises of old alluvial plains. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface. Old meander plains are almost flat with loamy sand to silty clay loam soils. Oldest among all the land forms are old alluvial plains, which cover major areas in the district. These soils are sand to loamy sand/sandy loam (surface) to silt loam/silty clay loam (sub-surface).

**Jhajjar:** The district mainly comprises of old alluvial plains and some parts of the district also have soil belonging to Aravali plains.

**Rewari:** The soils of the district fall under Entisols and Inceptisols orders. The surface soil texture varies from sand to fine loamy sand.

**Gurgaon:** The district comprises of sand dunes, sandy plains, alluvial plains, salt affected areas, low lands, lakes, hills and pediments. The soil varies from sand to loamy sand in sand dunes and sandy plain areas, sandy loam to clay loam / silty clay loam in alluvial plains, calcareous, loamy sand to loam in salt affected plains, silty loam to loam in low lands and calcareous, loamy sand to loam in hills.

**Mewat:** The soils of the area are generally sandy loam to loam. In parts of the low-lying areas, they are clayey and saline. The upper hills are mostly barren.

**Faridabad and Palwal:** The district comprises of recent Yamuna flood plains, low lying plains, depressions, sand dunes and hills. The texture of the soil is sand to loamy sand in recent Yamuna flood plains, sandy loam in plains, sandy loam to clay loam in alluvial plains, sandy loam to loam (surface), clay loam/silty clay (sub-surface) in low lying plains and depressions.

### 3.0 SCOPE OF WORK:

The stipulated scope of work involved carrying out the following operations:-

- a) Mobilisation of necessary plant equipment, men and materials for the complete Geotechnical investigation work as per specifications, drawings and instructions of the Engineer and to complete the same within the stipulated time schedule and demobilisation after completion of field work.
- b) Shifting of Equipments from one structure location to another including Erection, installation of rigs at site and dismantling of the same after completion of field work. Shifting of setup for each borehole location and associated preparation for borehole under water
- c) Making 150 mm nominal diameter boreholes at various locations in all types of soils except hard rock and large boulders using suitable approved method of boring including chiselling, cleaning, providing casing pipe as required; performing Standard Penetration Test at every 3.0m interval and at change of strata; collection of water samples and disturbed soil samples, observation such as ground water, etc., collection of undisturbed soil samples at every 3.0 m interval and at change of strata; transportation of all the collected samples to the laboratory and back filling of boreholes on completion of the same, complete as per specification and instructions of the Engineer, for depths below natural ground level.
- d) Conducting Electrical resistivity tests at various locations all complete as per specification and directions of the Engineer.
- e) Conducting plate load test at various locations, all complete as per specification and directions of the Engineer.
- f) Drilling of Nx size boreholes (75mm dia.) in all types of hard rock, collection of core samples, maintaining continuous record of core recovery/ RQD, keeping the cores in wooden core boxes, transporting to laboratory, backfilling on completion of the same, all complete as per specification and instructions of the EIC.
- g) Conducting various laboratory tests on soil samples at an approved laboratory including preparation of soil samples to determine the following properties of soil, all complete as per specification.

#### **On soil Samples**

- Dry density test
- Bulk Density and Moisture Content.
- Sieve Analysis
- Hydrometer Analysis
- Liquid Limit and Plastic Limit
- Specific gravity
- Shrinkage Limit

- Free Swell Index
  - Direct Shear Test
  - Triaxial Shear Test
  - One Dimensional consolidation test
  - Chemical Analysis of soil samples (pH, chloride, Sulphate)
- h) Conducting laboratory tests on rock samples including preparation of the samples to determine the following properties, all complete as per specification

**On Rock Samples**

- Moisture content, porosity & Density
  - Specific gravity
  - Hardness
  - Unconfined compression test
  - Point load strength index
  - Modulus of Elasticity and Poission's Ratio
  - Abrasion Test
- i) Conducting chemical tests on water samples to determine the Sulphate, chloride and pH value all complete as per specification.
- j) Submitting draft report in soft copy including all field records and laboratory test results, graphs, etc., all complete as per specifications.
- k) Submitting final report in three hard copies in after the approval of the draft report including all field records and laboratory test results, graphs, etc., all complete as per specifications.

#### **4.0 FIELD INVESTIGATION IN SOIL STRATA:**

The investigation was planned to obtain the subsurface stratification in the proposed project site and collect soil / rock core samples for laboratory testing to determine the engineering properties such as shear strength, along with basic engineering classification of the subsurface stratum.

For geotechnical investigation work, required equipments along with rotary drilling rigs and manpower were mobilized at site to carry out various field activities as per the scope of work. These were shifted from one test location to another location during execution of field work and were demobilized on satisfactory completion of field work.

For conducting the field investigations the following practices were followed at site:

- The locations of 05 boreholes were marked at site at specified locations. These locations are shown in **Appendix A-1** attached subsequently.

The details of various boreholes along with their coordinates are provided herein below:

**Table 1.1: Details of Borehole Locations**

S. No.	Old Chainage/ Structure (km)	New Chainage/ Structure (km)	BH. No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)	
						E	N
1.	898+787	1046+562	BH-03	Not Encountered	10.00	682976.604	3145159.097
2.	1153+187	1277+958	BH-04		10.00	683182.833	3145010.076
3.	1859+918	1986+847	BH-05		10.00	683610.917	3144481.635
4.	2391+105	2518+489	BH-06		10.00	683460.537	3143989.172
5.	2560+493	2687+006	BH-07		10.00	683330.410	3143881.578

- In soil, boreholes of 150mm dia. were drilled as per the standard procedure laid in IS: 1892.
- Borehole was properly cleaned before taking any sample in soil.
- Casing was used as per the prevailing soil conditions, to stabilize the borehole.
- Standard Penetration Tests were conducted in bore holes at regular intervals or at every change of strata as per Technical specification.
- Undisturbed were collected wherever feasible as per the requirements and at specified depths. The same has been discussed in detail in soil characteristics sheets attached with the report.
- Water table was not encountered in the boreholes.
- The detailed procedure adopted for conducting various field tests is given here in below:

**(i) Standard Penetration Test:**

The Standard Penetration Test was conducted in boreholes as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows ‘N’.

Standard split spoon sampler was attached to an ‘A’ rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as ‘N’ value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective borelog.

SPT ‘N’ values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

**Table 1.2: Soil compactness as per SPT N values (cl. 9.7, table 9.3 & 9.4, page 330\_text book of V.N.S. Murthy)**

Correlation for Clay / Plastic silt		Correlation for Sand / Non-Plastic silt	
Consistency	SPT "N" Value	Compactness	SPT "N" Value
Very Soft	0 - 2	Very Loose	0 - 4
Soft	2 - 4	Loose	4 - 10
Medium	4 - 8	Medium	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very Stiff	15 - 30	Very Dense	> 50
Hard	> 30		

The field SPT N values obtained were further corrected as per the guidelines given in IS: 2131 as follows:

**(a) For overburden:** - The N value for cohesionless soil is corrected with the help of fig. 1 given in IS-2131.

**(b) Due to dilatancy** :- Wherever N values observed below water table in fine sand, silty sand or silt was greater than 15, then corrected N values were corrected as under:

$$N' = 15 + \frac{1}{2} (N-15)$$

**(ii) Undisturbed Sampling (Soil) in boreholes:**

Undisturbed samples were collected using MS tubes of suitable diameter and length with Area ratio as per clause 4.1.1 (c) of IS: 1892 (latest) fitted to an adopter with ball and socket arrangement. Before taking any sample, sampling tube was properly greased. Immediately after taking on undisturbed sample in a tube, the adopter head was removed along with the disturbed material. The visible ends of the sample were trimmed off any wet disturbed soil. The ends were coated alternately with four layers of just molten wax. More molten wax was added to give a total thickness of min. 25 mm. The samples were carefully labeled and transported to the laboratory for testing. Undisturbed samples wherever slipped during lifting were duly marked in the field logs as well as in the soil profile.

**(iii) Collection of Ground Water Samples from bore holes:**

Water table was not encountered in the boreholes during the site investigation.

## 5.0 LABORATORY TESTS ON SOIL SAMPLES:

The following laboratory tests were conducted on selected soil samples:

**Table 1.3: Description of Tests**

Description of Test	Reference	Undisturbed (UDS) Soil Samples	Disturbed (DS/SPT) Soil Samples
Grain Size Analysis / Hydrometer	IS: 2720 (Part - 4)	√	√
Natural Moisture Content / Bulk / Dry density	IS : 2720 (Part – 2)	√	√
Atterberg Limits <ul style="list-style-type: none"> <li>• Liquid Limit</li> <li>• Plastic Limit</li> </ul>	IS: 2720 (Part - 5) IS: 2720 (Part - 5)	√ √	√
Specific Gravity	IS : 2720 (Part – 3)	√	√
Direct Shear Test	IS : 2720 (Part – 13)	√	√
Triaxial compressive shear test	IS : 2720 (Part – 11 & 12)	√	√
Chemical Analysis of Soil Samples	IS : 2720 (Part – 26, 27)	√	-

**Note:-** The detailed procedure adopted for conducting various laboratory tests is described in the following paragraphs:

### 5.1.1 Dry density and Bulk density

For determination of bulk density and dry density, a sample of known volume ‘V’ was extracted from the undisturbed sampling tube and its bulk weight ‘W’ was noted down. Moisture content ‘Wn’ was determined by oven drying method.

The bulk density and dry density were determined by following equation-

$$\text{Bulk density } (\gamma_b) = W/V$$

$$\text{Dry density } (\gamma_d) = \gamma_b / (1+Wn)$$

### 5.1.2 Natural water content

For this test, the soil sample of known quantity (Wm) was taken in a container. The container with soil sample was placed into an oven for drying at 105-110°C temperature for 16-24 hours. After drying, the dry sample was again weighted to determine the dry weight of sample (Wd).

The natural water content was computed by the following equation-

$$Wn = (Wm - Wd) * 100 / Wd$$

### 5.1.3 Grain Size Analysis (IS: 2720- Part-4)

#### Wet sieve analysis:

For determination of particle sizes finer than 75 micron, wet sieve analysis test was conducted. For this test, oven dried sample of known quantity was taken in a container and soaked with dispersing

agent. The soaked soil sample was washed thoroughly over 75 micron IS sieve until the water passing sieve was substantially clean.

Fraction retained on 75 micron IS sieve was carefully collected in a container without any loss in material and placed into oven for drying.

#### **Dry sieve analysis:**

For this test, the oven dried soil sample after wet sieving was sieved through the set of IS sieves 20 mm, 10 mm, 4.75 mm, 2.0 mm, 1.0 mm, 425 micron, 300 micron, 150 micron and 75 micron. The amounts of soil retained on each sieve were noted down. The % retained, cumulative % retained and % passing were computed accordingly. Wherever the soil sample % passing 75 micron sieve was significant, Hydrometer method was used to find the percentage of silt and clay fraction.

#### **Grain size analysis for the fraction passing 75 micron IS Sieve (Hydrometer method)**

##### ***Calibration of Hydrometer***

Hydrometer was calibrated to determine a relationship (an equation) between the effective depth  $H_R$  and corresponding hydrometer reading  $R_h$  (obtained during test).

50 to 100 gm of soil sample passing through 75 micron IS Sieve was taken. It was mixed with 100 ml of sodium hexametaphosphate solution and the mixture was warmed for about 10 minutes. It was then transferred to the cup of the mechanical mixer and the soil suspension was stirred for 15 minutes. The soil suspension was transferred into 1000 ml measuring cylinder and distilled water was added to make 1000ml solution. This solution was mixed vigorously. The measuring cylinder was then allowed to stand and the stopwatch was started. Hydrometer was immersed in the solution and reading were taken after half, one, two and four minutes. The hydrometer was then removed slowly and kept in distilled water at the same temperature as the soil suspension. Readings were taken after the periods of 8, 15 and 30 minutes, and one, two and four hours. Hydrometer was removed, rinsed and placed in the distilled water after each reading. After 4 hours reading was taken once or twice within 24 hours. Finally a reading was taken at the end of 24 hours. The temperature of the suspension was observed and recorded.

##### ***Calculations***

*Diameter of the particles (D):*

$$D = \sqrt{\frac{30\mu}{980(G-1)}} \times \sqrt{\frac{H_R}{t}} = M \sqrt{\frac{H_R}{t}}$$

Where,

$D$  = diameter of particle in suspension, in mm;

- $\mu$  = co-efficient of viscosity of water at the temperature of the suspension at the time of taking the hydrometer reading, in poise;
- $G$  = specific gravity of the soil fraction used in the sedimentations analysis;
- $H_R$  = effective depth corresponding to  $R_n$ , in cm.
- $t$  = time elapsed between the beginning of sedimentation and taking of hydrometer reading in minutes

$M = \sqrt{\frac{30\mu}{980(G-1)}}$  = a constant factor for given values of  $\mu$  and  $G$  at the temperature of the suspension.

*Percentage finer than diameter D:*

The percentage by mass (w) of particles smaller than corresponding equivalent particle diameters (D) was calculated from the formula:

$$w = \frac{100G_s}{W_b(G_s - 1)} \times R_h$$

Where

- w = percentage finer
- $G_s$  = specific gravity of soil particle
- $W_b$  = weight of soil
- $R_h$  = Hydrometer reading

#### 5.1.4 Specific Gravity (IS: 2720-Part-3 Sec-1)

The specific gravity of soil sample was determined by density bottle method. For this test 5-10g oven dried and cooled soil sample was taken in 50ml capacity density bottle and its weight was noted down as  $W_2$ . The soil was covered with distilled water and left for sufficient period for suitable soaking. The entrapped air was removed by vacuum. The bottle with soil was filled fully with water and its weight was noted down ( $W_3$ ). The mass of empty bottle and bottle filled with distilled water were noted down as  $W_1$  and  $W_4$  respectively.

The Specific Gravity was determined by using following equation :

$$G = \frac{W_2 - W_1}{[(W_2 - W_1) - (W_3 - W_4)]}$$

#### 5.1.5 Liquid Limit (IS: 2720- Part-5)

##### By Cone Penetrometer Method

The 'Cone Penetrometer Apparatus' is a variant of the fall-cone and consists of a cone with a smooth polished surface and angle of  $30^\circ \pm 1/2^\circ$ . The weight of the cone, together with its



associated shaft is  $80\text{g} \pm 0.5\text{g}$ . A support assembly with an automatic cone release mechanism and cone height adjustment mechanism used to hold the cone vertically. The angle and weight of the cone were calibrated at regular intervals, and the sharpness of the cone tip was checked daily.

Distilled water was added and thoroughly mixed with the soil sample to produce a homogeneous paste. The paste was then placed in a cup with a diameter of at least 55mm and a depth of at least 40mm. The surface of the soil was smoothed off level and parallel to the base. The support assembly was used to position the tip of the cone so that it was just touching the top surface of the soil, and the automatic tripping mechanism was released. The cone was allowed to penetrate into the soil for a period of  $5 (\pm 1)$  s, then the cone was locked off to stop further movement and the penetration was recorded. The cup was refilled and the test was repeated. The two recorded penetrations need to be within 0.5mm of each other, otherwise a third test is performed. when the three test vary by more than 1mm the test was repeated.

Further tests were conducted, at varying water contents, in order to produce a series of cone penetrations (usually 4) in the range 15mm to 25mm. The resulting cone penetrations were plotted verses the water content of the test specimens. The Liquid Limit ( $W_L$ ) was read off the graph, being the water content at which the line of best fit through the test points crosses 20mm penetration.

#### **5.1.6 Plastic Limit (IS: 2720-Part-5)**

For this test, soil sample was prepared in the same way as for liquid limit test. A ball of soil sample weighed about 5 gm was formed. The ball was rolled between the fingers of one hand and the glass plate with pressure sufficient to reduce the mass into a thread of about 3 mm in 5 to 10 complete forward and back movements. When a diameter of 3 mm was reached, soil was again remolded into a ball. The process of rolling and remolding was repeated until the thread started just crumbling at a diameter of 3 mm. The crumbled thread was immediately transferred to an airtight container for determination of its moisture content by oven drying method.

This water content has been termed as plastic limit. ( $W_P$ )

#### **5.1.7 Plasticity Index (IS: 2720-Part-5)**

The plasticity index  $I_p$  was given by

$$I_p = W_L - W_P \text{ (in percent)}$$

#### **5.1.8 Direct Shear Test (IS:2720-Part-13):**

For this test shear box test apparatus was used. The prepared specimen from remolded/undisturbed sample was placed carefully in the box. The plain grid was kept on top of the specimen with its directions at right angles to the direction of shear. The upper porous stone was placed on the grid and loading pad on the stone. The box with specimen was gently placed in the container (water

jacket). The specimen was submerged with water. The container was mounted with the shear box and the specimen inside, on the shearing machine. The upper part of the box was so adjusted that it touched the proving ring. The jack was brought forward to bear up against the box container. The proving ring dial gauge was set to read zero.

The steel ball was placed in the recess of the loading pad. The loading yoke was set in contact with the steel ball on the loading pad. Vertical displacement dial gauge to read zero in contact with the top of the yoke. The normal load was applied and any change in thickness of specimen was recorded. Shear displacement dial gauge was also set to read zero. The locking screw was now removed and two parts of the shear box were separated by advancing the spacing screws.

The specimen was sheared at constant rate of strain. The readings of the proving ring dial gauge were noted down every 15 seconds for the first one-minute and then every 30 seconds thereafter. The reading of change in the thickness dial gauge and shear displacement dial gauge were also recorded at the same time interval. The test was continued until the specimen fails. The specimen was assumed to fail when the proving ring dial gauge started receding or at shear displacement of approximately 15% of the length took place.

The soil was removed from the box and test was repeated on the identical specimen under increased normal load.

#### **5.1.9 Triaxial Shear Test\_UUT (IS: 2720-Part-11)**

For this test, Triaxial Shear Test apparatus was used. The plain disc was placed on the pedestal of the triaxial cell. The specimen was placed centrally on the disc. A correct size rubber membrane was fitted inside the stretcher with ends of membrane folded over those of the stretcher. Vacuum was applied to stretch the membrane to the inside surface of the stretcher which was carefully slipped around the specimen kept on the pedestal. The vacuum on the membrane was released. Its bottom part was rolled down into the pedestal. plain disc was placed on the top of the specimen and then loading pad was placed. The top part of membrane was rolled on to the loading pad. Then the stretcher was removed and ends were sealed with 'O' rings. With the properly sealed specimen placed centrally on the pedestal, the cell was assembled, keeping the loading piston initially clear of the loading pad of the specimen, the assembly was placed in the loading frame.

For unconsolidated undrained test, the bottom drainage value (BDV) and top drainage value (TDV) of cell, was closed and air release valve (ARV) was opened. The cell was filled with water through the cell water valve CWV. ARV was closed when water begins to escape through it. The cell pressure was raised to the desired value and kept constant till the end of the test.

When the cell pressure was applied, the load piston rises upward, the loading machine was operated at the anticipated rate to bring the load piston slightly above the loading pad of the specimen and the load measuring dial gauge on proving ring was set to zero.

The piston was brought just in contact with loading pad by hand operation of the machine. The

axial compression dial gauge was mounted and set to read zero.

The axial loading was started at 1.25 mm/min rate of strain. Simultaneous readings on the load and compression dial gauges were noted down. The test was continued until a recession of the axial load is observed or 20% of strain.

After failure, the specimen was unloaded by reversing the loading machine, cell pressure was reduced and cell water was drained out through BRV. The cell was dismantled and the specimen was taken out, rubber membrane was removed and weight of the failed sample and its water content was determined. The test was repeated on two more identical specimens with increasing cell pressure.

## CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION

### 6.0 STRATIFICATION

From the study of the borehole logs, it is revealed that the sub strata mainly consist of silty sand (SM), sandy silt of low plasticity (ML-CL) and silty clay of low plasticity (CL).

However,

#### **At the location of (OLD) CH.898+787 (BH-3):-**

- a) From EGL to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

#### **At the location of (OLD) CH.1153+187 (BH-4):-**

- a) From EGL to 1.50m depth consists of coarse grained strata i.e. silty sand (SM).
- b) From 1.50m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

#### **At the location of (OLD) CH.1859+918 (BH-5):-**

- a) From EGL to 3.00m depth consists of coarse grained strata i.e. sandy silt of low plasticity (ML-CL)
- b) From 3.00m to 6.00m depth consists of coarse grained strata i.e. silty sand (SM).
- c) From 6.00m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

#### **At the location of (OLD) CH.2391+105 (BH-6):-**

- a) From EGL to 4.50m depth consists of coarse grained strata i.e. silty sand (SM).
- b) From 4.50m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

#### **At the location of (OLD) CH.2560+493 (BH-7):-**

- a) From EGL to 3.00m depth consists of coarse grained strata i.e. silty sand with clay of low plasticity (SM-SC).
- b) From 3.00m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL) and silty clay of intermediate plasticity (CI).

### 6.1 GROUND WATER TABLE DEPTH

The Ground Water Table at all the bore hole locations was not encountered during the site investigation.

## 6.2 RESULTS OF CHEMICAL ANALYSIS

Results of chemical analysis of soil samples (as per **Appendix – B2**) indicates that the soil sample falls under Class I for sulphates and chlorides concentration (As per IS 456-2000 and CIRIA Sp. Publication No. 31). The results are summarized here in below :-

**Summary of chemical analysis of soil samples**

<b>Chemical Property</b>	<b>Findings (Min. to Max.)</b>	<b>Remarks (Required limits as per IS 456-200)</b>
pH	7.55 to 7.8	> 6.0
Sulphite as $\text{SO}_3^{2-}$ (%)	0.0021 to 0.0025(%)	< 0.2% (Class I)
Chlorides as $\text{Cl}^-$ (%)	0.0055 to 0.0065 (%)	No limit specified in IS 456. However, a limit of 0.10% specified for class I in CIRIA Sp. Publication No. 31)

**Note :-** All the chemical contents are within permissible limit hence no special precautions are required.

## CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS

### 7.0 TYPE & DEPTH OF FOUNDATION:

Based on the nature & strength characteristics of the substrata and requirement of the project, the following type of foundation have been analyzed as given below:

Chainage (Old) (km)	BH No.	Type of foundation	Depth of foundation below E.G.L. (m)	Length x Width (m)	Remarks
898+787	BH-03	Shallow Foundation	1.00	5.0 x 5.0	-
			1.50		
			2.00		
1153+187	BH-04		1.00	2.0 x 2.0	
			1.50		
			2.00		
1859+910	BH-05		1.00	4.0 x 4.0	
			1.50		
			2.00		
2391+105	BH-06		1.00	5.0 x 5.0	
			1.50		
			2.00		
2560+493	BH-07		1.00	2.5 x 2.5	
			1.50		
			2.00		

The details of foundation analysis are given in the subsequent paragraph.

### 7.1 ANALYSIS OF SHALLOW FOUNDATION

#### 7.1.1 From Shear Failure Criteria

Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981, which is based on, modified Terzaghi's classical approach. The weighted average of shear strength parameters for various strata upto depth equal to  $0.5 \cdot B \cdot \tan(45 + \frac{\phi}{2})$  (where B = Width of the Foundation,  $\phi$  = Angle of internal friction ) is used in the analysis. A factor of safety of 2.5 to estimate the net safe bearing capacity from ultimate net bearing capacity.

For soils, containing both coarse grained (gravels & sands) and fine grained (clays), c and  $\phi$  are used to determine the soil strength. In case of predominantly fine grained soils, c and  $\phi$  are determined by the Triaxial Compression test as per IS: 2720 pt XI. For predominantly coarse grained soils, c and  $\phi$  are determined by Direct Shear test as per IS: 2720 pt XIII. These c and  $\phi$  values were used for determining the SBC of soil as per shear failure criteria.

The ultimate net bearing capacity in case of general shear failure is given by following expression,

$$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$$

The ultimate net bearing capacity in case of local shear failure is given by following expression,

$$q'_d = (2/3) c N'_c s_c d_c i_c + q (N'_q - 1) s_q d_q i_q + (1/2) B \gamma N'_\gamma s_\gamma d_\gamma i_\gamma W'$$

Where,

$$d_c = 1 + 0.2 (D_f/B) * \text{SQRT}(N_\phi)$$

$$d_q = d_\gamma = 1 \text{ for } \phi < 10^\circ$$

$$d_q = d_\gamma = 1 + 0.1 (D_f/B) * \text{SQRT}(N_\phi) \text{ for } \phi > 10^\circ$$

$$N_\phi = \tan^2(\pi/4 + \phi/2)$$

$$\phi' \text{ for local shear failure} = \tan^{-1} (0.67 \tan \phi)$$

### 7.1.2 From Settlement Failure Criteria

Allowable Bearing Pressure from Settlement Failure consideration has been computed in accordance with IS: 8009 (Part-I). The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure.

The total permissible settlement in cohesion-less soil is estimated using SPT value as per IS: 8009 (Part-I). While using this approach, the N value was corrected, wherever applicable, below the footing base to at least 1.5B below the base to account for the effects of energy ratio, adopted bearing pressure, dilation for submerged silty fine sands / fine sands as well as that due to the overburden pressure.

Further for settlement Calculation in cohesive soil the following equation has been used.

$$S_t = \Delta P M_v H$$

Where,

$$M_v = \text{Coefficient of volume compressibility, cm}^2/\text{kg}$$

$$\Delta P = \text{Pressure increment, kg/cm}^2$$

$$H = \text{Thickness of layers}$$

## CHAPTER 4 FOUNDATION RECOMMENDATIONS

### 8.0 FOUNDATION RECOMMENDATIONS

- Based on the nature & strength characteristics of the substrata and requirement of the project, shallow foundation have been analyzed.
- The recommended net allowable bearing capacity values are given in Table 4.1 to 4.2.

**Table 4.1: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 25mm**

Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
898+787	1046+562	BH-03	5.0 x 5.0	1.00	37.8	13.6	13.6
				1.50	38.7	14.1	14.1
				2.00	39.6	14.7	14.7
1153+187	1277+958	BH-04	2.0 x 2.0	1.00	10.9	23.9	10.9
				1.50	19.5	33.5	19.5
				2.00	20.6	35.4	20.6
1859+918	1986+847	BH-05	4.0 x 4.0	1.00	18.5	12.9	12.9
				1.50	21.1	13.5	13.5
				2.00	23.8	14.3	14.3
2391+105	2518+489	BH-06	5.0 x 5.0	1.00	25.8	16.9	16.9
				1.50	30.6	17.0	17.0
				2.00	35.6	17.1	17.1
2560+493	2687+006	BH-07	2.5 x 2.5	1.00	23.2	11.1	11.1
				1.50	27.8	13.4	13.4
				2.00	32.7	16.5	16.5

**Table 4.2: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 50mm**

Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
898+787	1046+562	BH-03	5.0 x 5.0	1.00	37.8	27.2	27.2
				1.50	38.7	28.2	28.2
				2.00	39.6	29.3	29.3
1153+187	1277+958	BH-04	2.0 x 2.0	1.00	10.9	47.7	10.9
				1.50	19.5	67.1	19.5
				2.00	20.6	70.9	20.6



Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1859+918	1986+847	BH-05	4.0 x 4.0	1.00	18.5	25.8	18.5
				1.50	21.1	26.9	21.1
				2.00	23.8	28.5	23.8
2391+105	2518+489	BH-06	5.0 x 5.0	1.00	25.8	33.7	25.8
				1.50	30.6	33.9	30.6
				2.00	35.6	34.1	34.1
2560+493	2687+006	BH-07	2.5 x 2.5	1.00	23.2	22.2	22.2
				1.50	27.8	26.8	26.8
				2.00	32.7	33.1	32.7

**Notes:-**

**\* The maximum value of recommended net allowable bearing capacity shall be restricted to 30 t/m<sup>2</sup>.**

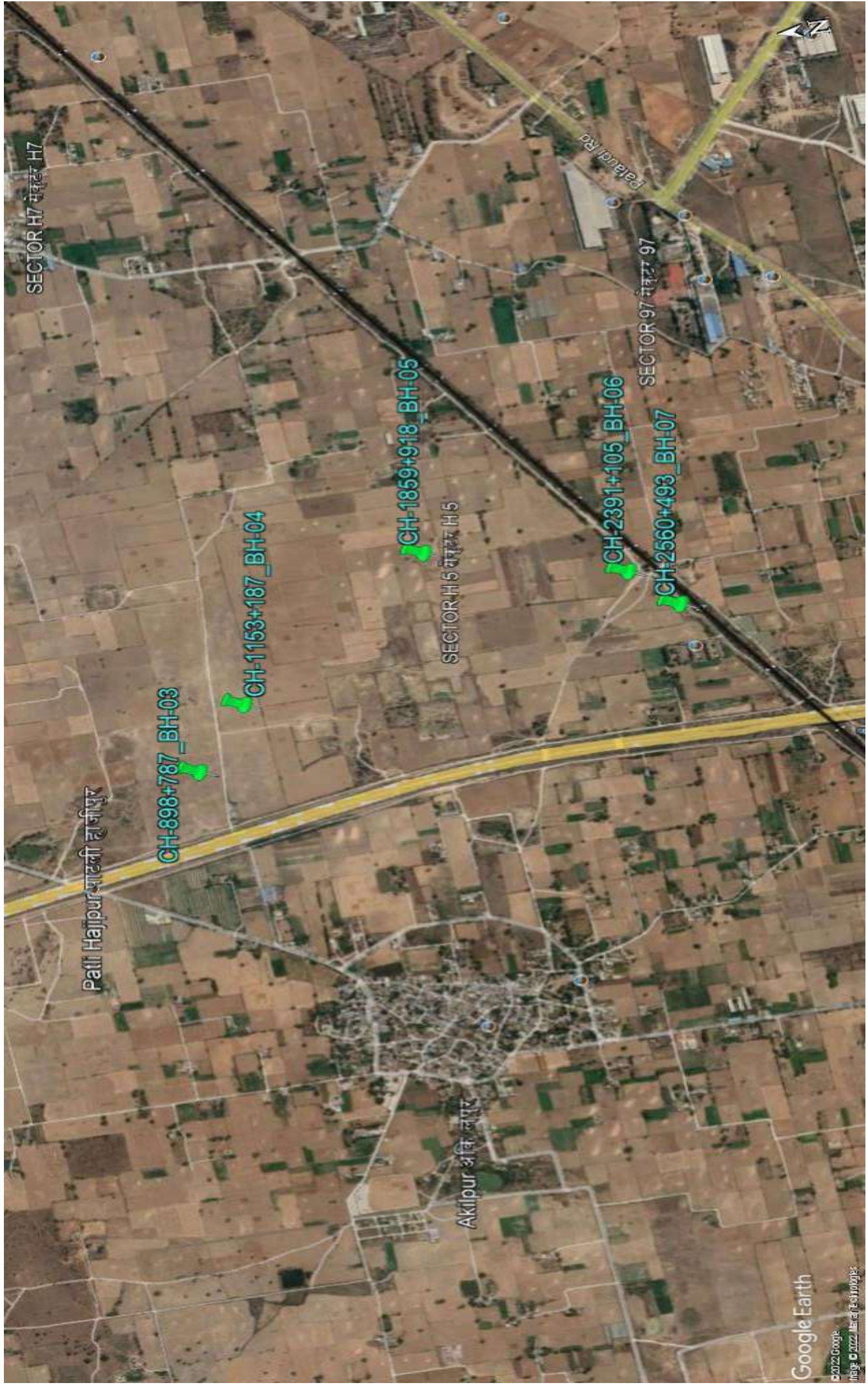
All The above recommendations are based on the field and laboratory tests conducted on selected soil/ rock core samples and our experience in this regard. If the actual substrata conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations.

**Abbreviations**

BH	Borehole
ERT	Electrical Resistivity Test
EGL	Existing Ground Level
GWT	Ground Water Table
IS	Indian Standards
SPT	Standard Penetration Test
DS	Disturbed Soil
R.L.	Reduced Level
m	Metre
sp. gr.	Specific Gravity
%	Percentage
mg /l	Milligram per litre
mg /kg	Milligram per kilogram

## **APPENDIX – A (FIELD DATA RESULTS)**

<b>Appendix No.</b>	<b>ITEMS</b>
A-1	LOCATION PLAN
A-2	FIELD BORE HOLE LOGS
A-3	SUB SOIL PROFILE DIAGRAM





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :898+787	Northing :3145159.097 m	Easting :682976.604 m
Reduced Level (m):(+-)	BH. No. :BH-03	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :08-06-2022		Date of Completion :08-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	5	6	11	Stiff to Hard, Brownish, Silty Clay of low Plasticity	CL			
1.0											
1.5	1.5	SPT-2	4	7	8	15					
2.0											
2.5	2.25	UDS-1									
3.0	3	SPT-3	15	19	22	41					
3.5											
4.0											
4.5	4.5	SPT-4	15	21	23	44					
5.0											
5.5	5.25	UDS-2									
6.0	6	SPT-5	19	22	25	47					
6.5											
7.0											
7.5	7.5	SPT-6	17	21	24	45					
8.0											
8.5	8.25	UDS-3									
9.0	9	SPT-7	21	28	38	66					
9.5											
10.0	10	SPT-8	15	18	20	38					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :1153+187	Northing :3145010.076 m	Easting :683182.833 m
Reduced Level (m):(+-)	BH. No. :BH-04	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :09-06-2022	Date of Completion :09-06-2022	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	2	3	5	8	Loose, Brownish, Silty Sand	SM			
1.0											
1.5	1.5	SPT-2	3	5	7	12	Stiff to Hard, Brownish, Silty Clay of Low Plasticity	CL			
2.0	2.25	UDS-1									
2.5											
3.0	3	SPT-3	7	9	11	20					
3.5											
4.0											
4.5	4.5	SPT-4	8	10	12	22					
5.0	5.25	UDS-2									
5.5											
6.0	6	SPT-5	11	16	18	34					
6.5											
7.0											
7.5	7.5	SPT-6	13	17	21	38					
8.0	8.25	UDS-3									
8.5											
9.0	9	SPT-7	12	18	24	42					
9.5											
10.0	10	SPT-8	11	16	32	48					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :1859+918	Northing :3144481.635 m	Easting :683610.917 m
Reduced Level (m):(+-)	BH. No. :BH-05	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :10-06-2022		Date of Completion :10-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	2	3	3	6	Medium dense, Brownish, Sandy Silt of low Plasticity	ML-CL			
1.5	1.5	SPT-2	5	6	6	12					
2.25	2.25	UDS-1									
3.0	3	SPT-3	4	6	7	13	Medium dense, Brownish, Silty Sand	SM			
4.5	4.5	SPT-4	6	8	9	17					
5.25	5.25	UDS-2									
6.0	6	SPT-5	9	13	14	27	Hard, Brownish, Silty Clay of low Plasticity	CL			
7.5	7.5	SPT-6	10	14	16	30					
8.25	8.25	UDS-3									
9.0	9	SPT-7	12	17	21	38					
9.5											
10.0	10	SPT-8	14	19	23	42					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :2391+105	Northing :3143989.172 m	Easting :683460.538 m
Reduced Level (m):(+-)	BH. No. :BH-06	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :11-06-2022		Date of Completion :11-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	5	7	9	16	Medium dense, Brownish, Silty Sand	SM			
1.0											
1.5	1.5	SPT-2	7	9	11	20					
2.0											
2.5	2.25	UDS-1									
3.0	3	SPT-3	6	8	9	17					
3.5											
4.0											
4.5	4.5	SPT-4	5	9	11	20	Very Stiff to Hard, Brownish, Silty Clay of Low plasticity	CL			
5.0											
5.5	5.25	UDS-2									
6.0	6	SPT-5	9	12	14	26					
6.5											
7.0											
7.5	7.5	SPT-6	9	13	15	28					
8.0											
8.5	8.25	UDS-3									
9.0	9	SPT-7	10	15	20	35					
9.5											
10.0	10	SPT-8	12	16	23	39					

UDS\*-UDS not recovered





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :2560+493	Northing :3143881.578 m	Easting :683330.41 m
Reduced Level (m):(+-)	BH. No. :BH-07	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :12-06-2022		Date of Completion :12-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	1	2	3	5	Loose, Brownish, Silty Sand with Clay	SM-SC			
1.0											
1.5	1.5	SPT-2	3	4	6	10					
2.0											
2.25	2.25	UDS-1									
2.5											
3.0	3	SPT-3	4	8	9	17	Very Stiff to Hard, Brownish, Silty Clay of Low Plasticity	CL			
3.5											
4.0											
4.5	4.5	SPT-4	7	9	12	21					
5.0											
5.25	5.25	UDS-2									
5.5											
6.0	6	SPT-5	12	16	18	34					
6.5											
7.0											
7.5	7.5	SPT-6	13	17	20	37					
8.0											
8.25	8.25	UDS-3									
8.5											
9.0	9	SPT-7	12	14	16	30					
9.5											
10.0	10	SPT-8	8	10	12	22					

UDS\*-UDS not recovered

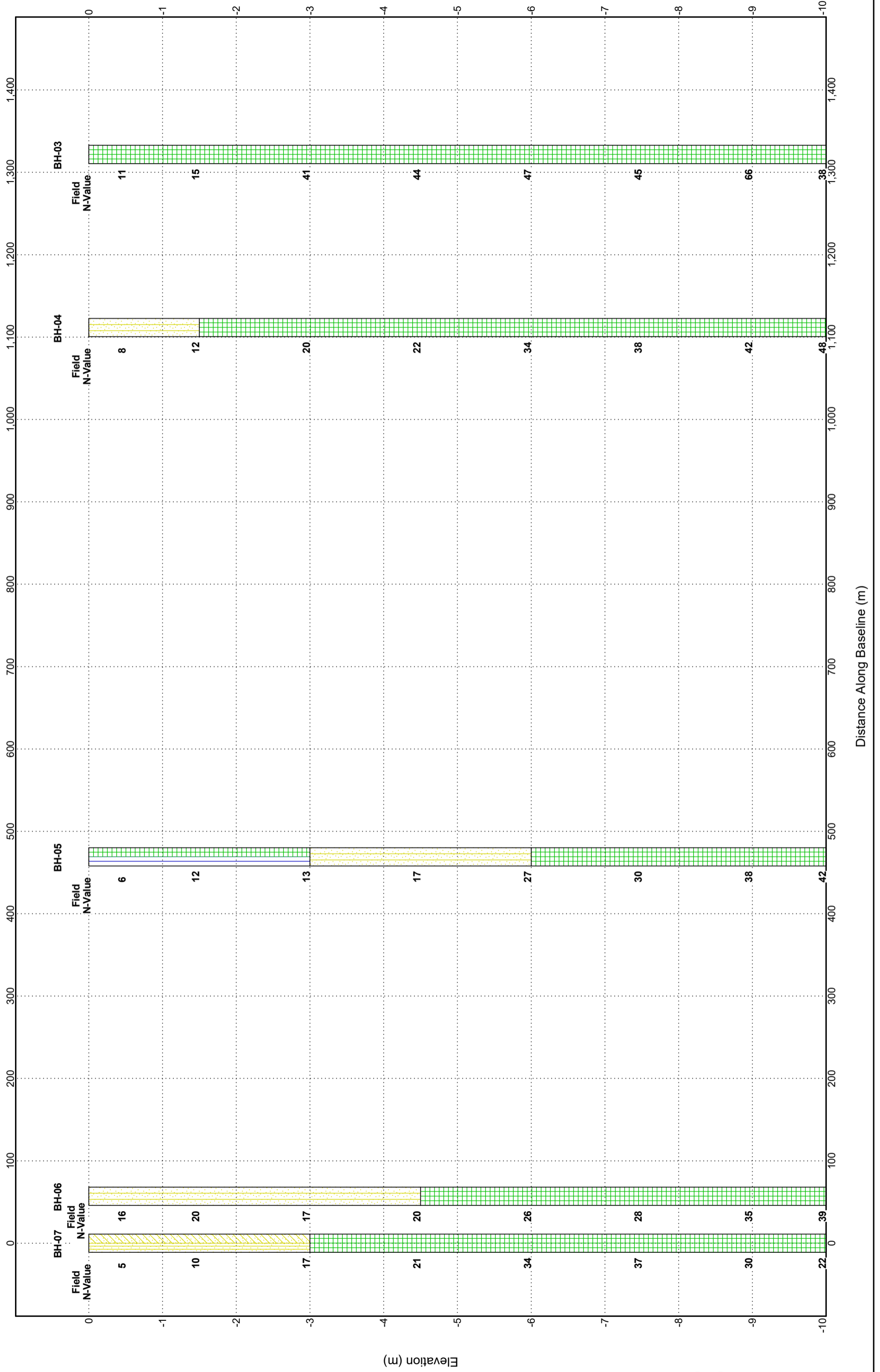
# SUB SOIL PROFILE DIAGRAM - BH-03 to BH-07

CLIENT\_HRIDCL

PROJECT NAME\_GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.

PROJECT NUMBER\_SR-544\_21-22

PROJECT LOCATION\_Haryana



## APPENDIX – B (LAB TEST RESULTS)

Appendix No.	ITEMS
B-1	SOIL CHARACTERISTICS SHEETS
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES
B-3	GSD CURVES



## SOIL CHARACTERISTICS

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Date of Boring							Chainage (km.)/Location			B.H. No.			Depth of Water Table			Termination Depth				Coordinates (E,N)						R.L.					Ref. Code
							09-06-2022		to		09-06-2022			1153+187			BH-04			Not Encountered			10.00 m		683182.833 m		3145010.076 m				-							
							Clay	Silt	Sand		Coarse	Gravel		Liquid Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>v</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )							
Fine	Medium	Coarse	Fine	Coarse	Plastic Limit	Atterberg Limits %																																
DS	0.00	-	-	Loose, Brownish, Silty Sand	-																																	
SPT-1	0.50	8	15		SM																																	
SPT-2	1.50	12	18		-																																	
UDS-1	2.25	-	-		CL																																	
SPT-3	3.00	20	20		-																																	
SPT-4	4.50	22	22		-																																	
UDS-2	5.25	-	-	Stiff to Hard, Brownish, Silty Clay of Low Plasticity	CL																																	
SPT-5	6.00	34	34		-																																	
SPT-6	7.50	38	38		-																																	
UDS-3	8.25	-	-		CL																																	
SPT-7	9.00	42	42		-																																	
SPT-8	10.00	48	48		CI																																	





**SOIL CHARACTERISTICS**

Project	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Patwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.											R.L.	Ref. Code												
	Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained	Atterberg Limits %					Depth of Water Table		Termination Depth	Coordinates (E,N)				R.L.	Ref. Code			
Date of Boring		Chainage (km.)/Location		B.H. No.		Depth of Water Table		Termination Depth		Coordinates (E,N)		Consolidation Parameters													
12-06-2022	to	12-06-2022	2560+493	BH-07	Not Encountered	10.00 m	683330.410 m	3143881.578 m	Void Ratio (e <sub>0</sub> )	Pressure (kg/cm <sup>2</sup> )	C <sub>c</sub> x 10 <sup>-4</sup> (cm <sup>2</sup> /Sec)	M <sub>v</sub> x 10 <sup>-2</sup> (cm <sup>2</sup> /Kg)	Compression Index (C <sub>p</sub> )												
Clay	Silt	Fine	Medium	Coarse	Sand	Coarse	Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm <sup>3</sup> )	Natural Moisture Content (%)	Dry Density (g/cm <sup>3</sup> )	Specific Gravity	Type of Test	Cohesion C (kg/cm <sup>2</sup> )	Angle of Friction (φ)	Free Swell Index (%)	Swelling Pressure (kg/cm <sup>2</sup> )	Permeability (cm/sec)			
DS	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-1	0.50	5	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
SPT-2	1.50	10	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
UDS-1	2.25	-	-	-	-	-	10	36	44	10	0	0	0	27	20	7	-	1.72	12.30	1.53	2.63	-	-	-	-
SPT-3	3.00	17	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-4	4.50	21	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	5.25	-	-	-	-	-	11	42	37	8	1	1	0	29	21	8	-	1.86	15.60	1.61	2.67	-	-	-	-
SPT-5	6.00	34	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	7.50	37	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	8.25	-	-	-	-	-	9	53	30	7	1	0	0	32	22	10	-	1.85	15.90	1.60	2.68	-	-	-	-
SPT-7	9.00	30	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	10.00	22	22	-	-	-	15	59	20	4	0	2	0	39	23	16	-	-	-	-	-	-	-	-	-

Abbreviations:-  
 DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS\*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

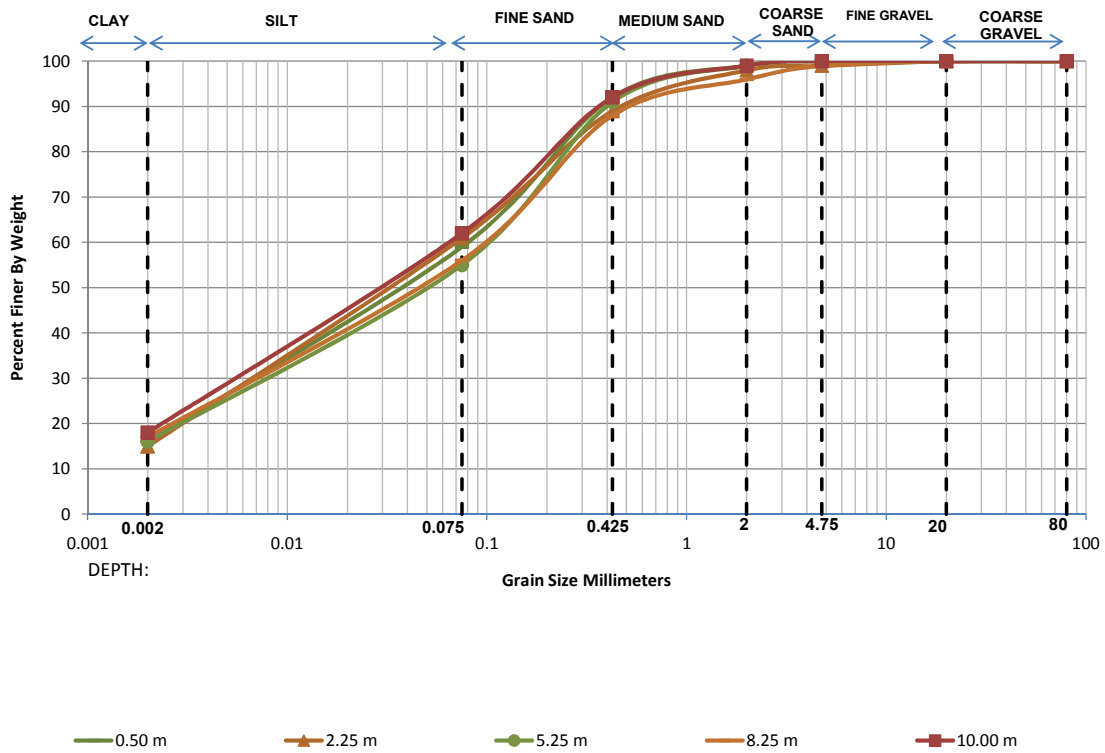


### RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES

Sr. No	Chainage/ Structure (km)	BH No.	Depth (m)	pH	Chlorides (Cl <sup>-</sup> )		Sulphate (SO <sub>3</sub> <sup>2-</sup> )	
					(mg/kg)	(%)	(mg/kg)	(%)
1.	898+787 (Minor Bridge)	BH-03	2.25	7.55	65.50	0.0065	25.32	0.0025
2.	2391+105 (Minor Bridge)	BH-06	2.25	7.80	55.55	0.0055	21.23	0.0021

### GRAIN SIZE DISTRIBUTION CURVES

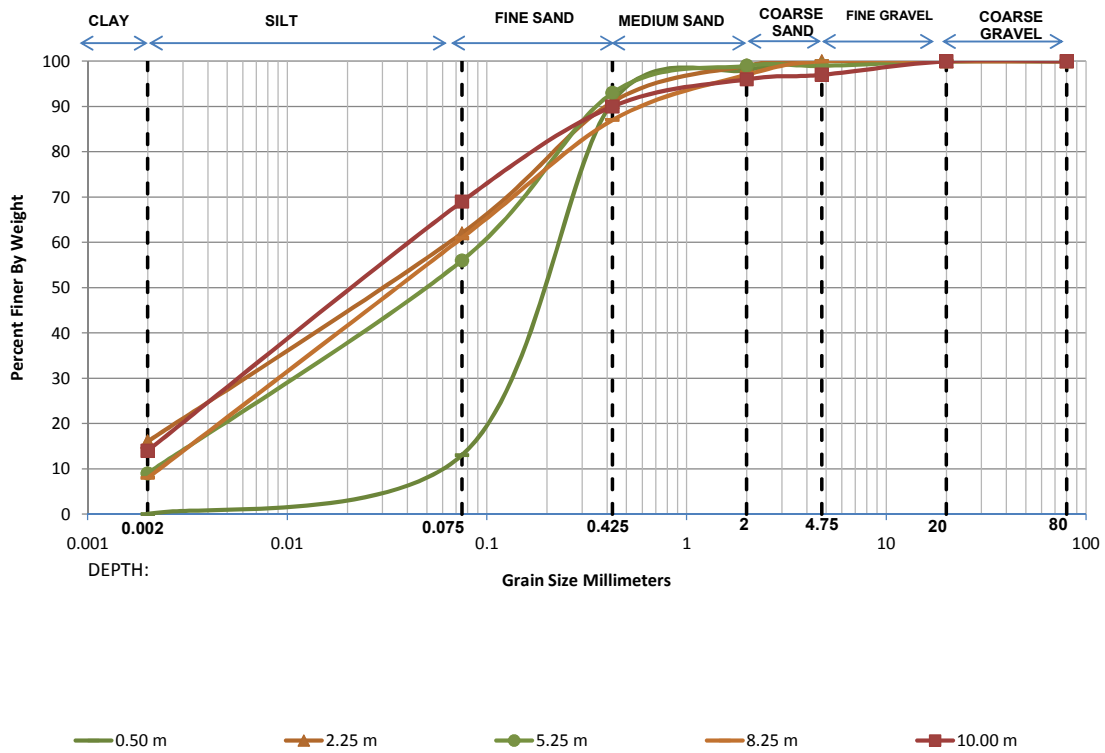
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	898+787
<b>B.H. No.</b>	BH-03



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	16.00	43.00	33.00	7.00	1.00	0.00	0.00	-	0.0127	0.0781	-	-
2.25 m	15.00	46.00	28.00	9.00	1.00	1.00	0.00	-	0.0126	0.0722	-	-
5.25 m	16.00	39.00	36.00	8.00	1.00	0.00	0.00	-	0.0147	0.0939	-	-
8.25 m	17.00	39.00	32.00	8.00	3.00	1.00	0.00	-	0.0130	0.0908	-	-
10.00 m	18.00	44.00	30.00	7.00	1.00	0.00	0.00	-	0.0097	0.0693	-	-

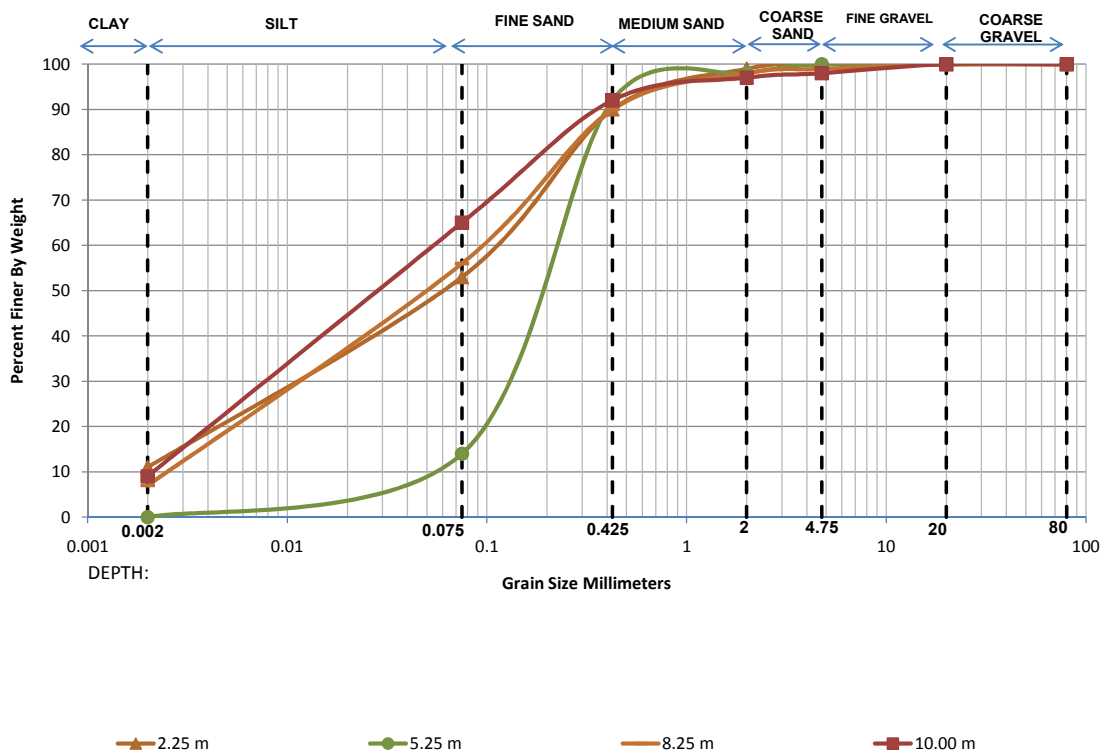
### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	1153+187
<b>B.H. No.</b>	BH-04



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	0.00	13.00	78.00	7.00	2.00	0.00	0.00	0.0563	0.1440	0.2411	4.28	1.53
2.25 m	16.00	46.00	29.00	8.00	1.00	0.00	0.00	-	0.0114	0.0695	-	-
5.25 m	9.00	47.00	37.00	6.00	0.00	1.00	0.00	0.0024	0.0213	0.0878	36.38	2.15
8.25 m	8.00	53.00	26.00	10.00	3.00	0.00	0.00	0.0029	0.0191	0.0725	24.96	1.74
10.00 m	14.00	55.00	21.00	6.00	1.00	3.00	0.00	-	0.0109	0.0546	-	-

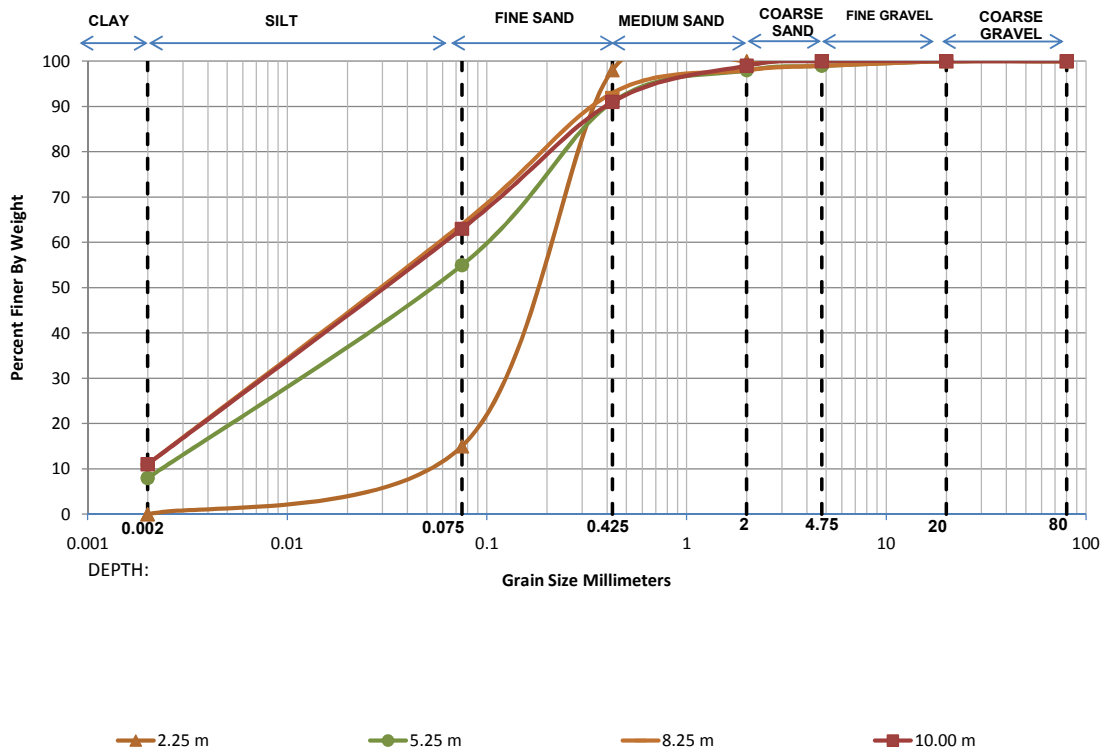
<b>GRAIN SIZE DISTRIBUTION CURVES</b>	
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	1859+918
<b>B.H. No.</b>	BH-05



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.25 m	11.00	42.00	37.00	9.00	1.00	0.00	0.00	-	0.0214	0.1021	-	-
5.25 m	0.00	14.00	78.00	6.00	2.00	0.00	0.00	0.0507	0.1389	0.2358	4.65	1.61
8.25 m	7.00	49.00	34.00	8.00	1.00	1.00	0.00	0.0036	0.0233	0.0884	24.51	1.71
10.00 m	9.00	56.00	27.00	5.00	1.00	2.00	0.00	0.0024	0.0166	0.0637	26.61	1.80

### GRAIN SIZE DISTRIBUTION CURVES

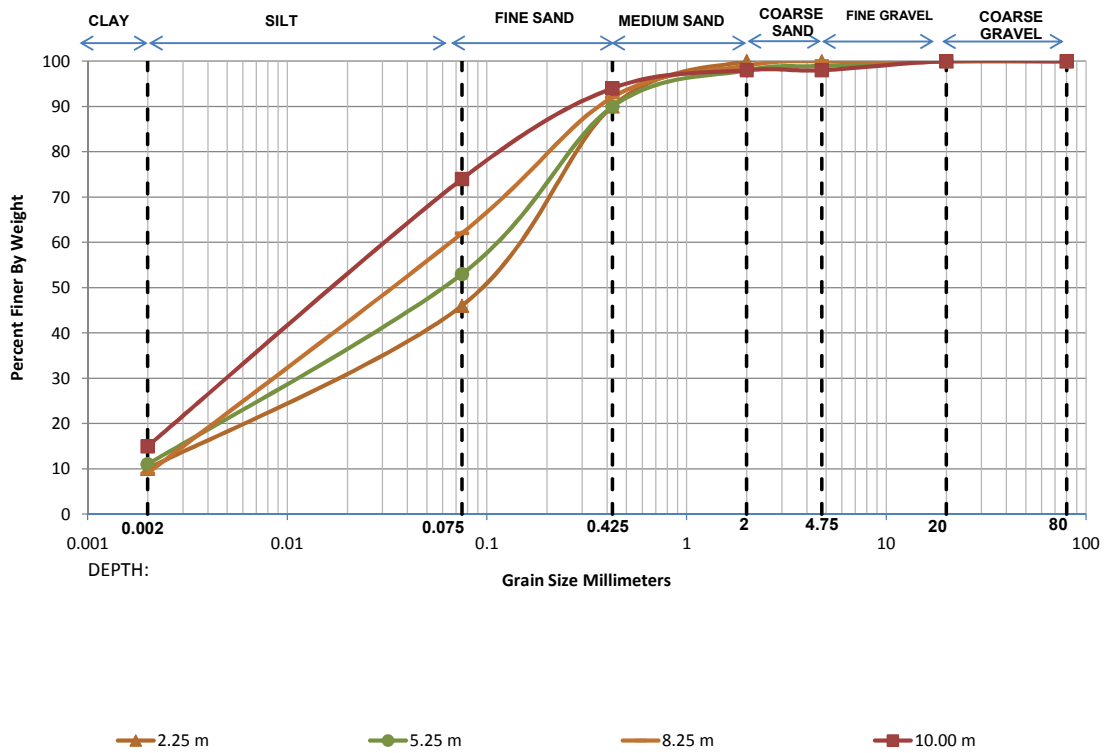
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	2391+105
<b>B.H. No.</b>	BH-06



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.25 m	0.00	15.00	83.00	2.00	0.00	0.00	0.00	0.0460	0.1320	0.2210	4.80	1.71
5.25 m	8.00	47.00	36.00	7.00	1.00	1.00	0.00	0.0030	0.0230	0.0922	31.17	1.94
8.25 m	11.00	53.00	29.00	5.00	1.00	1.00	0.00	-	0.0151	0.0655	-	-
10.00 m	11.00	52.00	28.00	8.00	1.00	0.00	0.00	-	0.0155	0.0676	-	-

**GRAIN SIZE DISTRIBUTION CURVES**

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	2560+493
<b>B.H. No.</b>	BH-07



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.25 m	10.00	36.00	44.00	10.00	0.00	0.00	0.00	0.0300	0.1338	66.89	3.37	
5.25 m	11.00	42.00	37.00	8.00	1.00	1.00	0.00	0.0214	0.1020	-	-	
8.25 m	9.00	53.00	30.00	7.00	1.00	0.00	0.00	0.0179	0.0702	29.24	1.89	
10.00 m	15.00	59.00	20.00	4.00	0.00	2.00	0.00	0.0092	0.0464	-	-	

## **APPENDIX – C** **(ANALYSIS & RECOMENDATION)**

<b>Appendix No.</b>	<b>ITEMS</b>
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION

Calculation of SBC for shallow foundations as per IS : 6403 - 1981			
<b>INPUT DATA</b>		CH. (KM) :- 898+787	
		BH NO. :- BH-03	
<i>Type of footing</i>		<b>Square</b>	<b>3</b>
1	Continuous Strip		
2	Rectangular		
3	Square		
4	Circular		
Angle of internal friction ( $\phi^\circ$ )		4.00	
Cohesion (c in $t/m^2$ )		13.20	
Void ratio (e), $e = (G \cdot \gamma_w / \gamma_d) - 1$		0.64	
Direction of load with vertical ( $^\circ$ )		0.00	
Density of foundation soil ( $t/m^3$ ) $\gamma_{bulk}$		1.91	
Depth of water table(m)		NE	
Factor of safety		2.50	
S.no.	Depth (m) of footing ( $D_f$ ) below EGL	Width (m)	
1	1.00	5.00	
2	1.50	5.00	
3	2.00	5.00	
<b><u>SHEAR FAILURE CRITERIA</u></b>			
Assumptions and formula used in calculation as per IS:6403-1981 are given below -			
<b>NOTE:</b> The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).			
The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$			
The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q'_d = (2/3) c N'_c s_c d_c i_c + q (N'_q - 1) s'_q d_q i_q + (1/2) B \gamma N'_\gamma s'_\gamma d_\gamma i_\gamma W'$			
Where,			
$d_c = 1 + 0.2 (D_f/B) \cdot \text{SQRT}(N_\phi)$		(from IS 6403 : 1981, page No. 9)	
$d_q = d_\gamma = 1$ for $\phi < 10^\circ$			
$d_q = d_\gamma = 1 + 0.1 (D_f/B) \cdot \text{SQRT}(N_\phi)$ for $\phi > 10^\circ$			
$N_\phi = \tan^2(\pi/4 + \phi/2)$			
$\phi'$ is friction angle for local shear failure = $\tan^{-1} (0.67 \tan \phi)$			
<b><u>OUTPUT</u></b>			
The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.			



<b>Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)</b>					
$\phi$	4.00		$\phi'$	2.68	
$N_c$	6.19		$N'_c$	5.81	
$N_q$	1.43		$N'_q$	1.27	
$N_\gamma$	0.34		$N'_\gamma$	0.21	
<b>Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)</b>					
S.no.	Width(m)		$S_c$	$S_q$	$S_\gamma$
1	5.00		1.30	1.20	0.80
2	5.00		1.30	1.20	0.80
3	5.00		1.30	1.20	0.80
<b>Depth factors : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$d_c$	$d_q$	$d_\gamma$
1	1.00	5.00	1.04	1.00	1.00
2	1.50	5.00	1.06	1.00	1.00
3	2.00	5.00	1.09	1.00	1.00
<b>Inclination factors : (from IS 6403 : 1981, page No. 9)</b>					
	$i_c = (1 - \alpha / 90)^2$		$i_q = (1 - \alpha / 90)^2$		$i_\gamma = (1 - \alpha / \phi)^2$
	1.00		1.00		1.00
<b>Water table factor : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$Z_w/B$		$W'$
1	1.00	5.00	5.80		1.00
2	1.50	5.00	5.70		1.00
3	2.00	5.00	5.60		1.00
<b>Safe Bearing Capacity</b>					
S.no.	Depth(m)	Width(m)	SBC in ( $t/m^2$ )		
			General shear	Local shear	Recommended
1	1.00	5.00	45.19	28.32	37.76
2	1.50	5.00	46.30	29.01	38.69
3	2.00	5.00	47.41	29.71	39.62

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976													CH. (KM): 898+787							BH NO. :- BH-03					
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness (m)	Stress at Foundation level (kg/cm <sup>2</sup> )	Length (m)	Breadth (m)	Layer Thickness (m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress Increment at top for cohesionless layer & at mid Depth for cohesive layer (kg/cm <sup>2</sup> )	Average N-Value	Mvc (cm <sup>2</sup> /kg)	Consolidation Settlement (mm)	Modulus of Soil (kg/cm <sup>2</sup> )	Influence Factor (i)	Poisson's Ratio	Settlement (mm) for 10 t/m <sup>2</sup> (from IS:8009 Part I), Fig. 9, Page NO. 17)	Settlement in Non-cohesive Soil (mm)	Elastic Settlement (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)	
Layer 1	1.00	8.50	7.50	7.50	1.36	5.00	5.00	7.50	8.75	8.750	0.444	38	0.0035	11.69	132	0.6171	0.45			14.50	26.19		0.95	1.00	25.00
Layer 1	1.50	9.00	7.50	7.50	1.41	5.00	5.00	7.50	8.75	8.750	0.461	38	0.0035	12.13	132	0.6171	0.45			15.03	27.16		0.92	1.00	25.00
Layer 1	2.00	9.50	7.50	7.50	1.47	5.00	5.00	7.50	8.75	8.750	0.479	38	0.0035	12.59	132	0.6171	0.45			15.61	28.21		0.89	1.00	25.00

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976												CH. (KM): 898+787						BH NO. :- BH-03								
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness	Stress at Foundation level (kg/Cm2)	Length (m)	Breadth (m)	Layer Thickness(m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress increment at top for cohesionless layer & at mid Depth for cohesive layer (kg/Cm2)	Average N-Value	Mvc (cm <sup>2</sup> /kg)	Consolidation Settlement (mm)	Modulus of Soil (kg/Cm <sup>2</sup> )	Influence Factor (i)	Poisson's Ratio	Settlement (mm) for 10 t/m <sup>2</sup> (from IS:8009 (Part I), Fig. 9, Page NO. 17)	Settlement in Non-cohesive Soil (mm)	Elastic Settlement (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)		
Layer 1	1.00	8.50	7.50	7.50	2.72	5.00	5.00	7.50	8.75	8.750	0.889	38	0.0035	23.39	132	0.6171	0.45			28.99	52.38					
	1.00																						0.95	1.00	50.00	
Layer 1	1.50	9.00	7.50	7.50	2.82	5.00	5.00	7.50	8.75	8.750	0.922	38	0.0035	24.25	132	0.6171	0.45			30.07	54.32					
	1.50																						0.92	1.00	50.00	
Layer 1	2.00	9.50	7.50	7.50	2.93	5.00	5.00	7.50	8.75	8.750	0.957	38	0.0035	25.19	132	0.6171	0.45			31.22	56.41					
	2.00																						0.89	1.00	50.00	

# Geotechnical Investigation Report

Old Ch. 1698+053 New Ch. 1548+996 (Minor Bridge), Old Ch. 1912+700  
New Ch. 1767+989 (Minor Bridge), Old Ch. 2807+817 New Ch. 2189+831  
(Minor Bridge) & Old Ch. 2972+708 New Ch. 2823+679 (Minor Bridge) KM

## NEW PATLI TO SULTANPUR

SR NO. : 544\_21-22

**CONDUCTING GEOTECHNICAL INVESTIGATION,  
PREPARATION OF GEOTECHNICAL REPORT FOR  
DESIGNING OF BRIDGES AND FOR EMBANKMENT  
IN CONNECTION WITH CONSTRUCTION OF  
HARYANA ORBITAL RAIL CORRIDOR (HORC)  
PROJECT FROM PALWAL TO HARSANA KALAN  
INCLUDING CONNECTIVITY TO EXISTING  
IR NETWORK IN THE STATE OF HARYANA**

### CLIENT

**M/S. HARYANA RAIL INFRASTRUCTURE  
DEVELOPMENT CORPORATION LTD. (HRIDCL)**

### PROGRAMME

JULY - 2022

SR. No.	Report No.	Revision No.	Date
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/665_(04 BHs)	00	29.07.2022



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CEGTH/HRIDCL/SR-544/2022-23/665

Date:- 29.07.2022

To,

**Haryana Rail Infrastructure Development**

**Corporation Ltd. (HRIDCL)**

SCO No.-17-19, 3<sup>rd</sup> & 4<sup>th</sup> Floor,

Sector - 17-A,

Chandigarh - 160017

Tele:- 0172-2715644

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Subject :- Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.

Dear Sir,

We are pleased to submit this report of the subject work based on 04 boreholes carried out at Ch. 1698+053 KM to Ch.2972+708 KM (OLD) - Ch. 1548+996 KM to Ch. 2823+679 KM (NEW) for Minor Bridge for the proposed project site.

The accompanying report presents results of various field tests and laboratory tests conducted on selected soil samples and their interpretation.

Should there be any clarifications regarding the contents please contact us at your most convenient time.

We value the opportunity to participate in this project and look forward a pleasant association on future projects.

Very truly yours,  
CEG Test House & Research Centre Pvt. Ltd.

Prepared By:-



**Nehal Jain**  
**General Manager - Geotechnical**  
Authorized Signatory



**Dr. Ankur Mudgal**  
**Senior Manager**

SR. No.	Report Ref. No.	Revision No.	Date
544_21-22	CEGTH/HRIDCL/SR-544/2022-23/665_(04 BHs)	00	29.07.2022

**CONTENTS**

<b>S. NO.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>CHAPTER 1 GENERAL</b>		
1.0	INTRODUCTION	1
2.0	SITE LOCATION & GENERAL GEOLOGICAL HISTORY	1-2
3.0	SCOPE OF WORK	3-4
4.0	FIELD INVESTIGATION	4-6
5.0	LABORATORY INVESTIGATION	7-12
<b>CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION</b>		
6.0	STRATIFICATION	13
6.1	GROUND WATER TABLE DEPTH	13
6.2	RESULTS OF CHEMICAL ANALYSIS OF SOIL SAMPLES	13-14
<b>CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS</b>		
7.0	TYPE & DEPTH OF FOUNDATION	15
7.1	ANALYSIS OF SHALL FOUNDATION	15-16
<b>CHAPTER 4 RECOMMENDATIONS</b>		
8.0	FOUNDATION RECOMMENDATIONS	17-18
ABBREVIATIONS		19

**LIST OF FIGURES / TABLES**

<b>Appendix No.</b>	<b>ITEMS</b>	<b>PAGE NO.</b>
<b>APPENDIX – A (FIELD DATA RESULTS)</b>		
A-1	LOCATION PLAN	21
A-2	FIELD BORE HOLE LOGS	22-25
A-3	SUB SOIL PROFILE DIAGRAM	26
<b>APPENDIX – B (LAB TEST RESULTS)</b>		
B-1	SOIL CHARACTERISTICS SHEETS	28-31
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES	32
B-3	GSD CURVES	33-36
<b>APPENDIX – C (ANALYSIS &amp; RECOMENDATION)</b>		
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION	38-41

## CHAPTER 1 GENERAL

### 1.0 INTRODUCTION:

The work of conducting “**Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana**” was awarded to “**CEG Test House & Research Centre Pvt. Ltd., Jaipur**” by M/S. “**Haryana Rail Infrastructure Development Corporation Ltd. (HRIDCL)**” as per work order no. HRIDC/ HORC/ GT/ CEG/ 237/ 2021/ 577-M dated 29<sup>th</sup> July 2021.

Field work including drilling of boreholes, conducting field tests such as Electrical Resistivity Test, & Plate Load Test and sample collection was carried out in the presence of representative of Client. Laboratory tests were conducted on selected soil samples to determine the design parameters, confirming to relevant IS specifications and the guidelines received from time to time from representative of Client.

This report includes the details of Methodology of Investigation, collection of samples (soil/ rock), field test results, laboratory test results, analysis of results and recommendations for results for proposed structures based on soil sample collected from the locations of boreholes.

### 2.0 SITE LOCATION & GENERAL GEOLOGICAL HISTORY:

The details of the site & test locations for the proposed project are shown in location plan attached vide **Appendix A-1**. The site of proposed project is located from Palwal to Harsana Kalan (Sonipat) in the State of Haryana falls in seismic zone – IV (Zone factor=0.24) of India.

Soil of the Haryana Sub-Region have been classified and described under the following major soil types as shown below:-

- Typic Ustochrepts : Soil of old alluvial plains
- Typic Ustipsamments : Soil of Aravali plains
- Typic Ustifluvents : Soil of recent alluvial plains and flood plains
- Typic Torripsamments : Soil of Aeofluvial plains
- Rocky Outcrops : Aravali rocky hills

The district wise details of soil characteristics are described below:-

**Panipat:** The soils are well drained, Sandy loam to clay loam/silty clay loam in plains and loam to clay loam/ silty/ loose clay loam in relic channels/depressions/basins.

**Sonipat:** The district comprises of recent flood plains, young meander plains, old meander plains and old alluvial plains. Recent flood plains occur along the Yamuna River and clearly show fluvial features. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface.

**Rohtak:** The district mainly comprises of old alluvial plains. The soils are loamy sand to sandy loam on the surface and sandy loam to clay loam in the sub surface. Old meander plains are almost flat with loamy sand to silty clay loam soils. Oldest among all the land forms are old alluvial plains, which cover major areas in the district. These soils are sand to loamy sand/sandy loam (surface) to silt loam/silty clay loam (sub-surface).

**Jhajjar:** The district mainly comprises of old alluvial plains and some parts of the district also have soil belonging to Aravali plains.

**Rewari:** The soils of the district fall under Entisols and Inceptisols orders. The surface soil texture varies from sand to fine loamy sand.

**Gurgaon:** The district comprises of sand dunes, sandy plains, alluvial plains, salt affected areas, low lands, lakes, hills and pediments. The soil varies from sand to loamy sand in sand dunes and sandy plain areas, sandy loam to clay loam / silty clay loam in alluvial plains, calcareous, loamy sand to loam in salt affected plains, silty loam to loam in low lands and calcareous, loamy sand to loam in hills.

**Mewat:** The soils of the area are generally sandy loam to loam. In parts of the low-lying areas, they are clayey and saline. The upper hills are mostly barren.

**Faridabad and Palwal:** The district comprises of recent Yamuna flood plains, low lying plains, depressions, sand dunes and hills. The texture of the soil is sand to loamy sand in recent Yamuna flood plains, sandy loam in plains, sandy loam to clay loam in alluvial plains, sandy loam to loam (surface), clay loam/silty clay (sub-surface) in low lying plains and depressions.



### 3.0 SCOPE OF WORK:

The stipulated scope of work involved carrying out the following operations:-

- a) Mobilisation of necessary plant equipment, men and materials for the complete Geotechnical investigation work as per specifications, drawings and instructions of the Engineer and to complete the same within the stipulated time schedule and demobilisation after completion of field work.
- b) Shifting of Equipments from one structure location to another including Erection, installation of rigs at site and dismantling of the same after completion of field work. Shifting of setup for each borehole location and associated preparation for borehole under water
- c) Making 150 mm nominal diameter boreholes at various locations in all types of soils except hard rock and large boulders using suitable approved method of boring including chiselling, cleaning, providing casing pipe as required; performing Standard Penetration Test at every 3.0m interval and at change of strata; collection of water samples and disturbed soil samples, observation such as ground water, etc., collection of undisturbed soil samples at every 3.0 m interval and at change of strata; transportation of all the collected samples to the laboratory and back filling of boreholes on completion of the same, complete as per specification and instructions of the Engineer, for depths below natural ground level.
- d) Conducting Electrical resistivity tests at various locations all complete as per specification and directions of the Engineer.
- e) Conducting plate load test at various locations, all complete as per specification and directions of the Engineer.
- f) Drilling of Nx size boreholes (75mm dia.) in all types of hard rock, collection of core samples, maintaining continuous record of core recovery/ RQD, keeping the cores in wooden core boxes, transporting to laboratory, backfilling on completion of the same, all complete as per specification and instructions of the EIC.
- g) Conducting various laboratory tests on soil samples at an approved laboratory including preparation of soil samples to determine the following properties of soil, all complete as per specification.

#### **On soil Samples**

- Dry density test
- Bulk Density and Moisture Content.
- Sieve Analysis
- Hydrometer Analysis
- Liquid Limit and Plastic Limit
- Specific gravity
- Shrinkage Limit

- Free Swell Index
  - Direct Shear Test
  - Triaxial Shear Test
  - One Dimensional consolidation test
  - Chemical Analysis of soil samples (pH, chloride, Sulphate)
- h) Conducting laboratory tests on rock samples including preparation of the samples to determine the following properties, all complete as per specification

**On Rock Samples**

- Moisture content, porosity & Density
  - Specific gravity
  - Hardness
  - Unconfined compression test
  - Point load strength index
  - Modulus of Elasticity and Poission's Ratio
  - Abrasion Test
- i) Conducting chemical tests on water samples to determine the Sulphate, chloride and pH value all complete as per specification.
- j) Submitting draft report in soft copy including all field records and laboratory test results, graphs, etc., all complete as per specifications.
- k) Submitting final report in three hard copies in after the approval of the draft report including all field records and laboratory test results, graphs, etc., all complete as per specifications.

#### **4.0 FIELD INVESTIGATION IN SOIL STRATA:**

The investigation was planned to obtain the subsurface stratification in the proposed project site and collect soil / rock core samples for laboratory testing to determine the engineering properties such as shear strength, along with basic engineering classification of the subsurface stratum.

For geotechnical investigation work, required equipments along with rotary drilling rigs and manpower were mobilized at site to carry out various field activities as per the scope of work. These were shifted from one test location to another location during execution of field work and were demobilized on satisfactory completion of field work.

For conducting the field investigations the following practices were followed at site:

- The locations of 04 boreholes were marked at site at specified locations. These locations are shown in **Appendix A-1** attached subsequently.

The details of various boreholes along with their coordinates are provided herein below:

**Table 1.1: Details of Borehole Locations**

S. No.	Old Chainage/ Structure (km)	New Chainage/ Structure (km)	BH. No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)	
						E	N
1.	1698+053	1548+996	BH-01	Not Encountered	10.00	682480.212	3147693.121
2.	1912+700	1767+989	BH-02		10.00	682529.013	3147832.270
3.	2807+817	2189+831	BH-03		10.00	682734.079	3148703.655
4.	2972+708	2823+679	BH-04		10.00	682770.474	31488864.48

- In soil, boreholes of 150mm dia. were drilled as per the standard procedure laid in IS: 1892.
- Borehole was properly cleaned before taking any sample in soil.
- Casing was used as per the prevailing soil conditions, to stabilize the borehole.
- Standard Penetration Tests were conducted in bore holes at regular intervals or at every change of strata as per Technical specification.
- Undisturbed were collected wherever feasible as per the requirements and at specified depths. The same has been discussed in detail in soil characteristics sheets attached with the report.
- Water table was not encountered in the boreholes.
- The detailed procedure adopted for conducting various field tests is given here in below:

**(i) Standard Penetration Test:**

The Standard Penetration Test was conducted in boreholes as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows ‘N’.

Standard split spoon sampler was attached to an ‘A’ rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as ‘N’ value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective borelog.

SPT ‘N’ values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

**Table 1.2: Soil compactness as per SPT N values (cl. 9.7, table 9.3 & 9.4, page 330\_text book of V.N.S. Murthy)**

Correlation for Clay / Plastic silt		Correlation for Sand / Non-Plastic silt	
Consistency	SPT "N" Value	Compactness	SPT "N" Value
Very Soft	0 - 2	Very Loose	0 - 4
Soft	2 - 4	Loose	4 - 10
Medium	4 - 8	Medium	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very Stiff	15 - 30	Very Dense	> 50
Hard	> 30		

The field SPT N values obtained were further corrected as per the guidelines given in IS: 2131 as follows:

**(a) For overburden:** - The N value for cohesionless soil is corrected with the help of fig. 1 given in IS-2131.

**(b) Due to dilatancy** :- Wherever N values observed below water table in fine sand, silty sand or silt was greater than 15, then corrected N values were corrected as under:

$$N' = 15 + \frac{1}{2} (N-15)$$

**(ii) Undisturbed Sampling (Soil) in boreholes:**

Undisturbed samples were collected using MS tubes of suitable diameter and length with Area ratio as per clause 4.1.1 (c) of IS: 1892 (latest) fitted to an adopter with ball and socket arrangement. Before taking any sample, sampling tube was properly greased. Immediately after taking on undisturbed sample in a tube, the adopter head was removed along with the disturbed material. The visible ends of the sample were trimmed off any wet disturbed soil. The ends were coated alternately with four layers of just molten wax. More molten wax was added to give a total thickness of min. 25 mm. The samples were carefully labeled and transported to the laboratory for testing. Undisturbed samples wherever slipped during lifting were duly marked in the field logs as well as in the soil profile.

**(iii) Collection of Ground Water Samples from bore holes:**

Water table was not encountered in the boreholes during the site investigation.

## 5.0 LABORATORY TESTS ON SOIL SAMPLES:

The following laboratory tests were conducted on selected soil samples:

**Table 1.3: Description of Tests**

Description of Test	Reference	Undisturbed (UDS) Soil Samples	Disturbed (DS/SPT) Soil Samples
Grain Size Analysis / Hydrometer	IS: 2720 (Part - 4)	√	-
Natural Moisture Content / Bulk / Dry density	IS : 2720 (Part – 2)	√	-
Atterberg Limits <ul style="list-style-type: none"> <li>• Liquid Limit</li> <li>• Plastic Limit</li> </ul>	IS: 2720 (Part - 5) IS: 2720 (Part - 5)	√ √	-
Specific Gravity	IS : 2720 (Part – 3)	√	-
Direct Shear Test	IS : 2720 (Part – 13)	√	-
Triaxial compressive shear test	IS : 2720 (Part – 11 & 12)	√	-
Chemical Analysis of Soil Samples	IS : 2720 (Part – 26, 27)	√	-

**Note:-** The detailed procedure adopted for conducting various laboratory tests is described in the following paragraphs:

### 5.1.1 Dry density and Bulk density

For determination of bulk density and dry density, a sample of known volume ‘V’ was extracted from the undisturbed sampling tube and its bulk weight ‘W’ was noted down. Moisture content ‘Wn’ was determined by oven drying method.

The bulk density and dry density were determined by following equation-

$$\text{Bulk density } (\gamma_b) = W/V$$

$$\text{Dry density } (\gamma_d) = \gamma_b / (1+Wn)$$

### 5.1.2 Natural water content

For this test, the soil sample of known quantity (Wm) was taken in a container. The container with soil sample was placed into an oven for drying at 105-110°C temperature for 16-24 hours. After drying, the dry sample was again weighted to determine the dry weight of sample (Wd).

The natural water content was computed by the following equation-

$$Wn = (Wm - Wd) * 100 / Wd$$

### 5.1.3 Grain Size Analysis (IS: 2720- Part-4)

#### **Wet sieve analysis:**

For determination of particle sizes finer than 75 micron, wet sieve analysis test was conducted. For this test, oven dried sample of known quantity was taken in a container and soaked with dispersing agent. The soaked soil sample was washed thoroughly over 75 micron IS sieve until the water passing sieve was substantially clean.

Fraction retained on 75 micron IS sieve was carefully collected in a container without any loss in material and placed into oven for drying.

#### **Dry sieve analysis:**

For this test, the oven dried soil sample after wet sieving was sieved through the set of IS sieves 20 mm, 10 mm, 4.75 mm, 2.0 mm, 1.0 mm, 425 micron, 300 micron, 150 micron and 75 micron. The amounts of soil retained on each sieve were noted down. The % retained, cumulative % retained and % passing were computed accordingly. Wherever the soil sample % passing 75 micron sieve was significant, Hydrometer method was used to find the percentage of silt and clay fraction.

#### **Grain size analysis for the fraction passing 75 micron IS Sieve (Hydrometer method)**

##### ***Calibration of Hydrometer***

Hydrometer was calibrated to determine a relationship (an equation) between the effective depth  $H_R$  and corresponding hydrometer reading  $R_h$  (obtained during test).

50 to 100 gm of soil sample passing through 75 micron IS Sieve was taken. It was mixed with 100 ml of sodium hexametaphosphate solution and the mixture was warmed for about 10 minutes. It was then transferred to the cup of the mechanical mixer and the soil suspension was stirred for 15 minutes. The soil suspension was transferred into 1000 ml measuring cylinder and distilled water was added to make 1000ml solution. This solution was mixed vigorously. The measuring cylinder was then allowed to stand and the stopwatch was started. Hydrometer was immersed in the solution and reading were taken after half, one, two and four minutes. The hydrometer was then removed slowly and kept in distilled water at the same temperature as the soil suspension. Readings were taken after the periods of 8, 15 and 30 minutes, and one, two and four hours. Hydrometer was removed, rinsed and placed in the distilled water after each reading. After 4 hours reading was taken once or twice within 24 hours. Finally a reading was taken at the end of 24 hours. The temperature of the suspension was observed and recorded.

##### ***Calculations***

*Diameter of the particles (D):*

$$D = \sqrt{\frac{30\mu}{980(G-1)}} \times \sqrt{\frac{H_R}{t}} = M \sqrt{\frac{H_R}{t}}$$

Where,

$D$  = diameter of particle in suspension, in mm;

$\mu$  = co-efficient of viscosity of water at the temperature of the suspension at the time of taking the hydrometer reading, in poise;

$G$  = specific gravity of the soil fraction used in the sedimentations analysis;

$H_R$  = effective depth corresponding to  $R_n$ , in cm.

$t$  = time elapsed between the beginning of sedimentation and taking of hydrometer reading in minutes

$M = \sqrt{\frac{30\mu}{980(G-1)}}$  = a constant factor for given values of  $\mu$  and  $G$  at the temperature of the suspension.

*Percentage finer than diameter D:*

The percentage by mass (w) of particles smaller than corresponding equivalent particle diameters (D) was calculated from the formula:

$$w = \frac{100G_s}{W_b(G_s - 1)} \times R_h$$

Where

w = percentage finer

$G_s$  = specific gravity of soil particle

$W_b$  = weight of soil

$R_h$  = Hydrometer reading

#### 5.1.4 Specific Gravity (IS: 2720-Part-3 Sec-1)

The specific gravity of soil sample was determined by density bottle method. For this test 5-10g oven dried and cooled soil sample was taken in 50ml capacity density bottle and its weight was noted down as  $W_2$ . The soil was covered with distilled water and left for sufficient period for suitable soaking. The entrapped air was removed by vacuum. The bottle with soil was filled fully with water and its weight was noted down ( $W_3$ ). The mass of empty bottle and bottle filled with distilled water were noted down as  $W_1$  and  $W_4$  respectively.

The Specific Gravity was determined by using following equation :

$$G = \frac{W_2 - W_1}{[(W_2 - W_1) - (W_3 - W_4)]}$$

### 5.1.5 Liquid Limit (IS: 2720- Part-5)

#### By Cone Penetrometer Method

The 'Cone Penetrometer Apparatus' is a variant of the fall-cone and consists of a cone with a smooth polished surface and angle of  $30^\circ \pm 1/2^\circ$ . The weight of the cone, together with its associated shaft is  $80\text{g} \pm 0.5\text{g}$ . A support assembly with an automatic cone release mechanism and cone height adjustment mechanism used to hold the cone vertically. The angle and weight of the cone were calibrated at regular intervals, and the sharpness of the cone tip was checked daily.

Distilled water was added and thoroughly mixed with the soil sample to produce a homogeneous paste. The paste was then placed in a cup with a diameter of at least 55mm and a depth of at least 40mm. The surface of the soil was smoothed off level and parallel to the base. The support assembly was used to position the tip of the cone so that it was just touching the top surface of the soil, and the automatic tripping mechanism was released. The cone was allowed to penetrate into the soil for a period of  $5 (\pm 1)$  s, then the cone was locked off to stop further movement and the penetration was recorded. The cup was refilled and the test was repeated. The two recorded penetrations need to be within 0.5mm of each other, otherwise a third test is performed. when the three test vary by more than 1mm the test was repeated.

Further tests were conducted, at varying water contents, in order to produce a series of cone penetrations (usually 4) in the range 15mm to 25mm. The resulting cone penetrations were plotted verses the water content of the test specimens. The Liquid Limit ( $W_L$ ) was read off the graph, being the water content at which the line of best fit through the test points crosses 20mm penetration.

### 5.1.6 Plastic Limit (IS: 2720-Part-5)

For this test, soil sample was prepared in the same way as for liquid limit test. A ball of soil sample weighed about 5 gm was formed. The ball was rolled between the fingers of one hand and the glass plate with pressure sufficient to reduce the mass into a thread of about 3 mm in 5 to 10 complete forward and back movements. When a diameter of 3 mm was reached, soil was again remolded into a ball. The process of rolling and remolding was repeated until the thread started just crumbling at a diameter of 3 mm. The crumbled thread was immediately transferred to an airtight container for determination of its moisture content by oven drying method.

This water content has been termed as plastic limit. ( $W_p$ )

### 5.1.7 Plasticity Index (IS: 2720-Part-5)

The plasticity index  $I_p$  was given by

$$I_p = W_L - W_p \text{ (in percent)}$$



### **5.1.8 Direct Shear Test (IS:2720-Part-13):**

For this test shear box test apparatus was used. The prepared specimen from remolded/undisturbed sample was placed carefully in the box. The plain grid was kept on top of the specimen with its directions at right angles to the direction of shear. The upper porous stone was placed on the grid and loading pad on the stone. The box with specimen was gently placed in the container (water jacket). The specimen was submerged with water. The container was mounted with the shear box and the specimen inside, on the shearing machine. The upper part of the box was so adjusted that it touched the proving ring. The jack was brought forward to bear up against the box container. The proving ring dial gauge was set to read zero.

The steel ball was placed in the recess of the loading pad. The loading yoke was set in contact with the steel ball on the loading pad. Vertical displacement dial gauge to read zero in contact with the top of the yoke. The normal load was applied and any change in thickness of specimen was recorded. Shear displacement dial gauge was also set to read zero. The locking screw was now removed and two parts of the shear box were separated by advancing the spacing screws.

The specimen was sheared at constant rate of strain. The readings of the proving ring dial gauge were noted down every 15 seconds for the first one-minute and then every 30 seconds thereafter. The reading of change in the thickness dial gauge and shear displacement dial gauge were also recorded at the same time interval. The test was continued until the specimen fails. The specimen was assumed to fail when the proving ring dial gauge started receding or at shear displacement of approximately 15% of the length took place.

The soil was removed from the box and test was repeated on the identical specimen under increased normal load.

### **5.1.9 Triaxial Shear Test\_UUT (IS: 2720-Part-11)**

For this test, Triaxial Shear Test apparatus was used. The plain disc was placed on the pedestal of the triaxial cell. The specimen was placed centrally on the disc. A correct size rubber membrane was fitted inside the stretcher with ends of membrane folded over those of the stretcher. Vacuum was applied to stretch the membrane to the inside surface of the stretcher which was carefully slipped around the specimen kept on the pedestal. The vacuum on the membrane was released. Its bottom part was rolled down into the pedestal. plain disc was placed on the top of the specimen and then loading pad was placed. The top part of membrane was rolled on to the loading pad. Then the stretcher was removed and ends were sealed with 'O' rings. With the properly sealed specimen placed centrally on the pedestal, the cell was assembled, keeping the loading piston initially clear of the loading pad of the specimen, the assembly was placed in the loading frame.

For unconsolidated undrained test, the bottom drainage valve (BDV) and top drainage valve (TDV) of cell, was closed and air release valve (ARV) was opened. The cell was filled with water

through the cell water valve CWV. ARV was closed when water begins to escape through it. The cell pressure was raised to the desired value and kept constant till the end of the test.

When the cell pressure was applied, the load piston rises upward, the loading machine was operated at the anticipated rate to bring the load piston slightly above the loading pad of the specimen and the load measuring dial gauge on proving ring was set to zero.

The piston was brought just in contact with loading pad by hand operation of the machine. The axial compression dial gauge was mounted and set to read zero.

The axial loading was started at 1.25 mm/min rate of strain. Simultaneous readings on the load and compression dial gauges were noted down. The test was continued until a recession of the axial load is observed or 20% of strain.

After failure, the specimen was unloaded by reversing the loading machine, cell pressure was reduced and cell water was drained out through BRV. The cell was dismantled and the specimen was taken out, rubber membrane was removed and weight of the failed sample and its water content was determined. The test was repeated on two more identical specimens with increasing cell pressure.

## CHAPTER 2 ANALYSIS OF TEST RESULTS AND INTERPRETATION

### 6.0 STRATIFICATION

From the study of the borehole logs, it is revealed that the sub strata mainly consist of silty sand (SM), sandy silt of low plasticity (ML-CL) and silty clay of low plasticity (CL).

However,

#### **At the location of (OLD) CH.1698+053(BH-1):-**

- a) From EGL to 7.50m depth consists of coarse grained strata i.e silty sand (SM).
- b) From 7.50m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL) and silty clay of intermediate plasticity (CI).

#### **At the location of (OLD) CH.1912+7(BH-2):-**

- a) From EGL to 8.25m depth consists of coarse grained strata i.e silty sand (SM) and silty sand with clay of low plasticity (SM-SC).
- b) From 8.25m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL) and silty clay of intermediate plasticity (CI).

#### **At the location of (OLD) CH.2807+817(BH-3):-**

- a) From EGL to 5.25m depth consists of coarse grained strata i.e silty sand (SM).
- b) From 5.25m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

#### **At the location of (OLD) CH.2972+708(BH-4):-**

- a) From EGL to 6.00m depth consists of coarse grained strata i.e silty sand (SM) and poorly graded sand (SM-SP).
- b) From 6.00m to 10.00m depth consists of fine grained strata i.e. silty clay of low plasticity (CL).

### 6.1 GROUND WATER TABLE DEPTH

The Ground Water Table at all the bore hole locations was not encountered during the site investigation.

### 6.2 RESULTS OF CHEMICAL ANALYSIS

Results of chemical analysis of soil samples (as per **Appendix – B2**) indicates that the soil sample falls under Class I for sulphates and chlorides concentration (As per IS 456-2000 and CIRIA Sp. Publication No. 31). The results are summarized here in below :-

**Summary of chemical analysis of soil samples**

<b>Chemical Property</b>	<b>Findings (Min. to Max.)</b>	<b>Remarks (Required limits as per IS 456-2000)</b>
pH	7.60 to 8.74	> 6.0
Sulphite as SO <sub>3</sub> <sup>2-</sup> (%)	0.0021 to 0.0024 (%)	< 0.2% (Class I)
Chlorides as Cl <sup>-</sup> (%)	0.0055 to 0.0063 (%)	No limit specified in IS 456. However, a limit of 0.10% specified for class I in CIRIA Sp. Publication No. 31)

**Note :-** All the chemical contents are within permissible limit hence no special precautions are required.

## CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS

### 7.0 TYPE & DEPTH OF FOUNDATION:

Based on the nature & strength characteristics of the substrata and requirement of the project, the following type of foundation have been analyzed as given below:

Chainage (Old) (km)	BH No.	Type of foundation	Depth of foundation below E.G.L. (m)	Length x Width (m)	Remarks
1698+053	BH-01	Shallow Foundation	1.00	2.0 x 2.0	
			1.50		
			2.00		
1912+700	BH-02		1.00	4.0 x 4.0	
			1.50		
			2.00		
2807+817	BH-03		1.00	2.0 x 2.0	
			1.50		
			2.00		
2972+708	BH-04		1.00	5.0 x 5.0	
			1.50		
			2.00		

The details of foundation analysis are given in the subsequent paragraph.

### 7.1 ANALYSIS OF SHALLOW FOUNDATION

#### 7.1.1 From Shear Failure Criteria

Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981, which is based on, modified Terzaghi's classical approach. The weighted average of shear strength parameters for various strata upto depth equal to  $0.5 \cdot B \cdot \tan(45 + \frac{\phi}{2})$  (where B = Width of the Foundation,  $\phi$  = Angle of internal friction ) is used in the analysis. A factor of safety of 2.5 to estimate the net safe bearing capacity from ultimate net bearing capacity.

For soils, containing both coarse grained (gravels & sands) and fine grained (clays), c and  $\phi$  are used to determine the soil strength. In case of predominantly fine grained soils, c and  $\phi$  are determined by the Triaxial Compression test as per IS: 2720 pt XI. For predominantly coarse grained soils, c and  $\phi$  are determined by Direct Shear test as per IS: 2720 pt XIII. These c and  $\phi$  values were used for determining the SBC of soil as per shear failure criteria.

The ultimate net bearing capacity in case of general shear failure is given by following expression,  

$$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$$

The ultimate net bearing capacity in case of local shear failure is given by following expression,

$$q'_d = (2/3) c N'_c s_c d_c i_c + q (N'_q - 1) s_q d_q i_q + (1/2) B \gamma N'_\gamma s_\gamma d_\gamma i_\gamma W'$$

Where,

$$d_c = 1 + 0.2 (D_f/B) * \text{SQRT}(N_\phi)$$

$$d_q = d_\gamma = 1 \text{ for } \phi < 10^\circ$$

$$d_q = d_\gamma = 1 + 0.1 (D_f/B) * \text{SQRT}(N_\phi) \text{ for } \phi > 10^\circ$$

$$N_\phi = \tan^2(\pi/4 + \phi/2)$$

$$\phi' \text{ for local shear failure} = \tan^{-1} (0.67 \tan \phi)$$

### 7.1.2 From Settlement Failure Criteria

Allowable Bearing Pressure from Settlement Failure consideration has been computed in accordance with IS: 8009 (Part-I). The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure.

The total permissible settlement in cohesion-less soil is estimated using SPT value as per IS: 8009 (Part-I). While using this approach, the N value was corrected, wherever applicable, below the footing base to at least 1.5B below the base to account for the effects of energy ratio, adopted bearing pressure, dilation for submerged silty fine sands / fine sands as well as that due to the overburden pressure.

Further for settlement Calculation in cohesive soil the following equation has been used.

$$S_t = \Delta P M_v H$$

Where,

$M_v$  = Coefficient of volume compressibility,  $\text{cm}^2/\text{kg}$

$\Delta P$  = Pressure increment,  $\text{kg}/\text{cm}^2$

H = Thickness of layers

## CHAPTER 4 FOUNDATION RECOMMENDATIONS

### 8.0 FOUNDATION RECOMMENDATIONS

- Based on the nature & strength characteristics of the substrata and requirement of the project, shallow foundation have been analyzed.
- The recommended net allowable bearing capacity values are given in Table 4.1 to 4.2.

**Table 4.1: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 25mm**

Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1698+053	1548+996	BH-01	2.0 x 2.0	1.0	25.0	34.4	25.0
				1.5	33.1	37.5	33.1
				2.0	41.7	39.6	39.6
1912+700	1767+989	BH-02	4.0 x 4.0	1.0	16.7	17.2	16.7
				1.5	20.5	18.0	18.0
				2.0	24.5	19.0	19.0
2807+817	2189+831	BH-03	2.0 x 2.0	1.0	15.7	29.4	15.7
				1.5	20.9	32.1	20.9
				2.0	26.4	33.9	26.4
2972+708	2823+679	BH-04	5.0 x 5.0	1.0	33.4	10.8	10.8
				1.5	39.6	11.7	11.7
				2.0	46.0	12.7	12.7

**Table 4.2: Recommended Net Allowable Bearing Capacity for shallow foundation for allowable settlement 50mm**

Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
1698+053	1548+996	BH-01	2.0 x 2.0	1.0	25.0	68.8	25.0
				1.5	33.1	75.0	33.1
				2.0	41.7	79.2	41.7
1912+700	1767+989	BH-02	4.0 x 4.0	1.0	16.7	34.4	16.7
				1.5	20.5	36.0	20.5
				2.0	24.5	38.0	24.5
2807+817	2189+831	BH-03	2.0 x 2.0	1.0	15.7	58.8	15.7
				1.5	20.9	64.1	20.9
				2.0	26.4	67.7	26.4

Chainage Old (km)	Chainage New (km)	BH. No.	Foundation Size (m x m)	Depth of foundation below EGL (m)	Net Safe Bearing Capacity from Shear Failure (t/m <sup>2</sup> )	Net Allowable Bearing Pressure from settlement failure (t/m <sup>2</sup> )	Recommended Net Allowable Bearing Capacity (t/m <sup>2</sup> )
2972+708	2823+679	BH-04	5.0 x 5.0	1.0	33.4	21.5	21.5
				1.5	39.6	23.4	23.4
				2.0	46.0	25.3	25.3

**Notes:-**

**\* The maximum value of recommended net allowable bearing capacity shall be restricted to 30 t/m<sup>2</sup>.**

All The above recommendations are based on the field and laboratory tests conducted on selected soil/ rock core samples and our experience in this regard. If the actual substrata conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations.

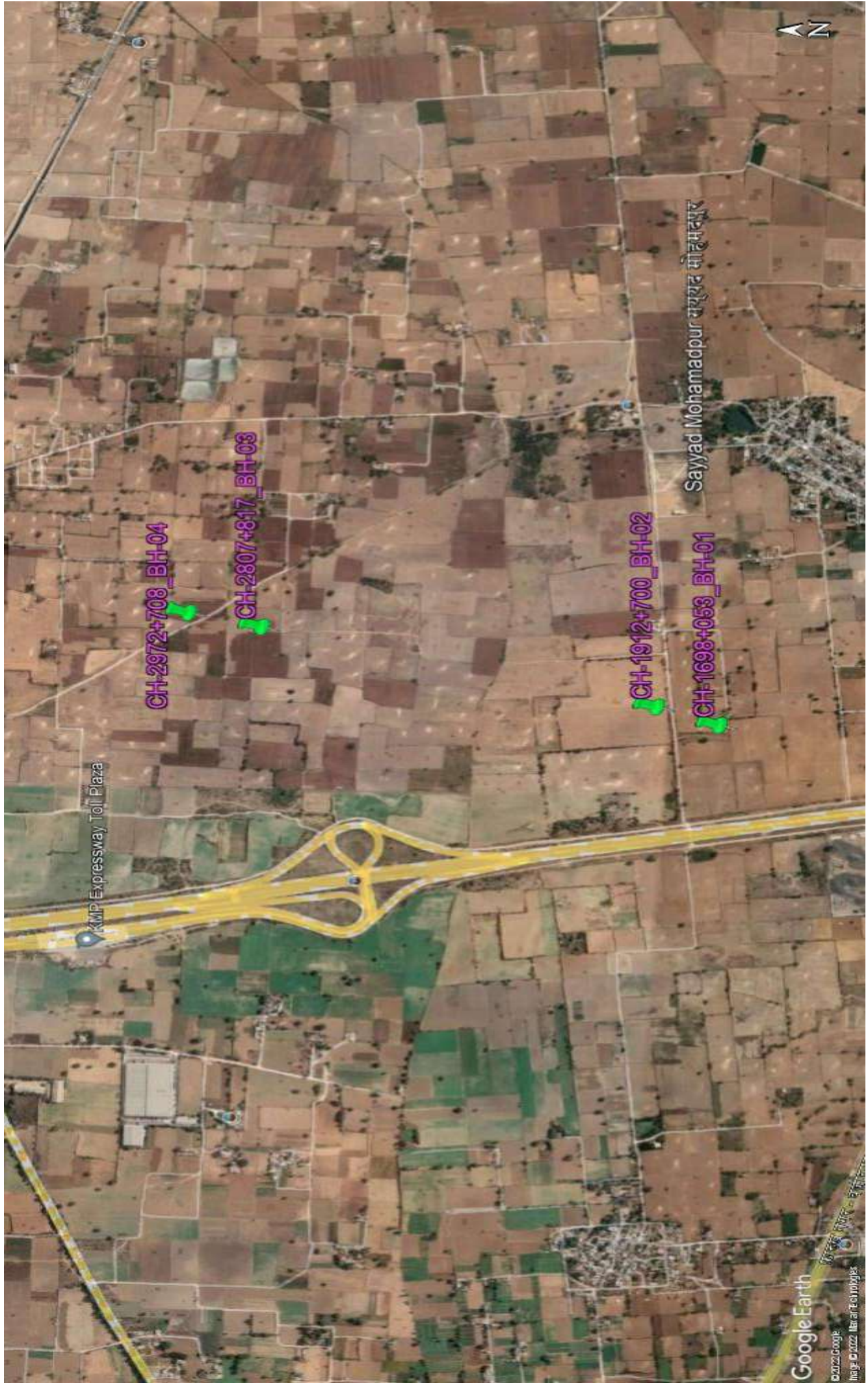


**Abbreviations**

BH	Borehole
ERT	Electrical Resistivity Test
EGL	Existing Ground Level
GWT	Ground Water Table
IS	Indian Standards
SPT	Standard Penetration Test
DS	Disturbed Soil
R.L.	Reduced Level
m	Metre
sp. gr.	Specific Gravity
%	Percentage
mg /l	Milligram per litre
mg /kg	Milligram per kilogram

## APPENDIX – A (FIELD DATA RESULTS)

Appendix No.	ITEMS
A-1	LOCATION PLAN
A-2	FIELD BORE HOLE LOGS
A-3	SUB SOIL PROFILE DIAGRAM





# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :1698+053	Northing :3147693.121 m	Easting :682480.212 m
Reduced Level (m):(+-)	BH. No. :BH-01	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :14-06-2022	Date of Completion :14-06-2022	

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	5	5	10	Medium dense, Brownish, Silty Sand	SM			
1.5	1.5	SPT-2	6	9	10	19					
2.25	2.25	UDS-1									
3.0	3	SPT-3	8	11	13	24					
4.5	4.5	SPT-4	10	12	14	26					
5.25	5.25	UDS-2									
6.0	6	SPT-5	9	10	11	21					
7.5	7.5	SPT-6	10	13	16	29					
8.0	8.25	UDS-3					Very Stiff to Hard, Brownish, Silty Clay of low Plasticity	CL			
9.0	9	SPT-7	12	15	17	32					
9.5											
10.0	10	SPT-8	18	19	24	43					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :1912+700	Northing :3147832.27 m	Easting :682529.013 m
Reduced Level (m):(+-)	BH. No. :BH-02	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :13-06-2022		Date of Completion :13-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	3	5	5	10	Medium dense, Brownish, Silty Sand	SM			
1.0											
1.5	1.5	SPT-2	4	7	7	14					
2.0											
2.5	2.25	UDS-1									
3.0	3	SPT-3	5	7	8	15					
3.5											
4.0											
4.5	4.5	SPT-4	5	8	10	18					
5.0											
5.5	5.25	UDS-2									
6.0	6	SPT-5	8	10	11	21					
6.5											
7.0											
7.5	7.5	SPT-6	8	12	13	25					
8.0											
8.5	8.25	UDS-3									
9.0	9	SPT-7	14	19	22	41	Dense, Brownish, Sandy Silt with Clay	ML-CL			
9.5											
10.0	10	SPT-8	16	20	24	44					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :2807+817	Northing :3148703.655 m	Easting :682734.079 m
Reduced Level (m):(+-)	BH. No. :BH-03	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :14-06-2022		Date of Completion :14-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	5	7	7	14	Medium, Brownish, Silty Sand	SM			
1.0											
1.5	1.5	SPT-2	8	10	12	22					
2.0											
2.25	2.25	UDS-1									
2.5											
3.0	3	SPT-3	6	7	9	16					
3.5											
4.0											
4.5	4.5	SPT-4	7	9	11	20	Very Stiff, Brownish, Silty Clay of Low Plasticity	CL			
5.0											
5.25	5.25	UDS-2									
5.5											
6.0	6	SPT-5	9	14	14	28					
6.5											
7.0											
7.5	7.5	SPT-6	8	13	14	27					
8.0											
8.25	8.25	UDS-3									
8.5											
9.0	9	SPT-7	6	9	11	20					
9.5											
10.0	10	SPT-8	8	10	12	22					

UDS\*-UDS not recovered



# FIELD BOREHOLE LOG

Project Name :GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.		Client :HRIDCL
BH Location/Chainage :2972+708	Northing :3148864.48 m	Easting :682770.474 m
Reduced Level (m):(+-)	BH. No. :BH-04	BH Termination Depth (m):10
Proposed / Existing Structure :Minor Bridge	Water Table (m):Not Encountered	Inclination : Vertical
Boring type :Rotary	Dia. of Boring :150 mm	Depth of Casing (m) :Not Used
Date of Start :15-06-2022		Date of Completion :15-06-2022

Depth (m)	In-Situ Sample Depth (m)	Sample Type	Blow counts per 15cm			SPT N Value	Strata Description	IS Classification	Graphic Log	(Depth v/s SPT N Value)	Special Observations
			N1	N2	N3						
0.0		DS									
0.5	0.5	SPT-1	4	6	6	12	Medium dense, Brownish, Silty Sand	SM			
1.5	1.5	SPT-2	5	7	9	16					
2.25	2.25	UDS-1									
3.0	3.0	SPT-3	7	9	9	18					
4.5	4.5	SPT-4	6	9	10	19					
5.25	5.25	UDS-2									
6.0	6.0	SPT-5	8	10	10	20					
7.5	7.5	SPT-6	7	12	14	26					
8.0	8.0					Very Stiff, Brownish, Silty Clay of Low Plasticity	CL				
8.25	8.25	UDS-3									
9.0	9.0	SPT-7	6	9	11				20		
10.0	10.0	SPT-8	8	11	13				24		

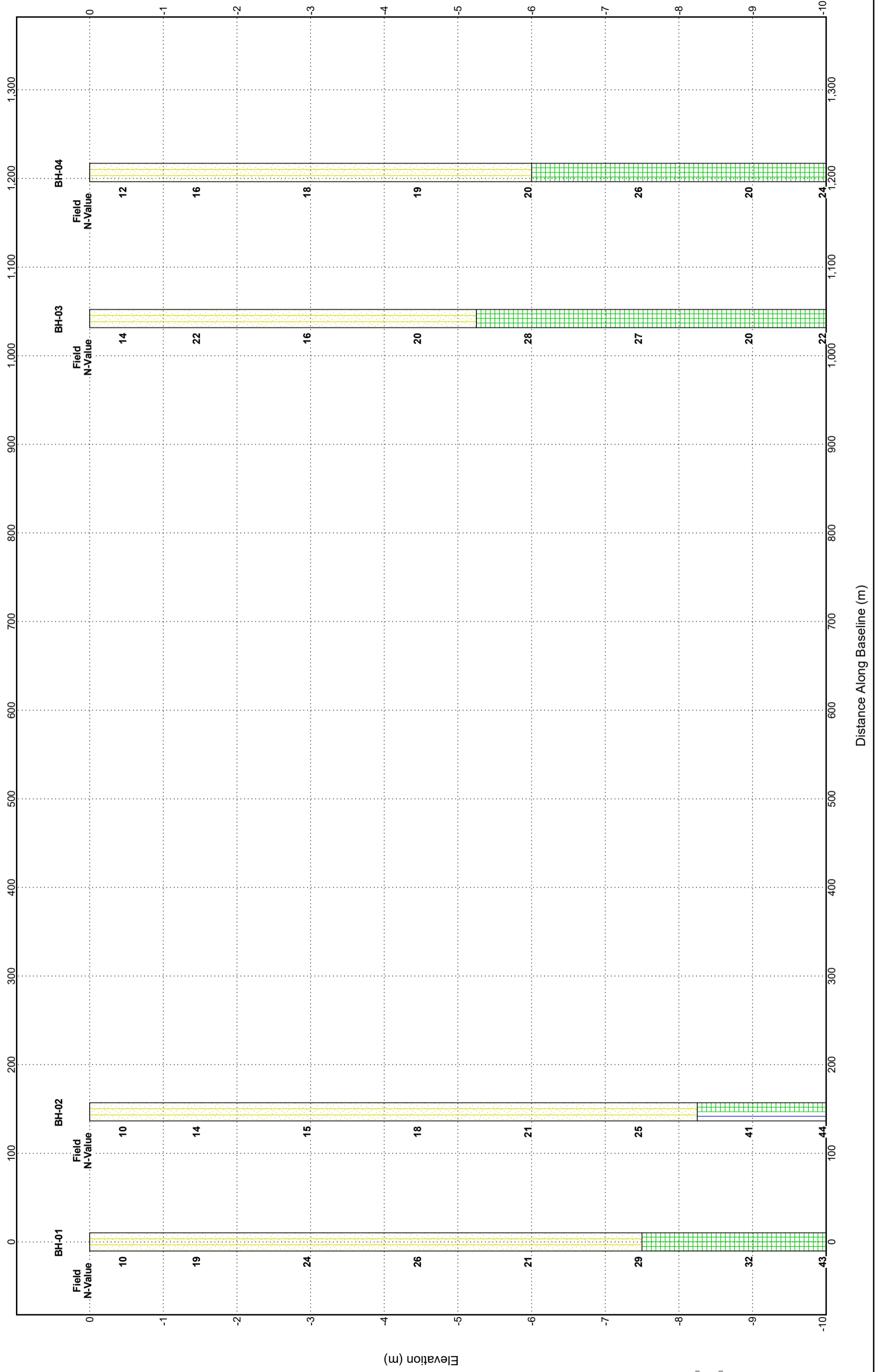
UDS\*-UDS not recovered

# SUB SOIL PROFILE DIAGRAM - BH-01 to BH-04

CLIENT\_HRIDCL PROJECT NAME\_GTI for (HORC) project from Palwal to Harsana Kalan in the state of Haryana.

PROJECT NUMBER\_SR-544\_21-22

PROJECT LOCATION\_Haryana





## APPENDIX – B (LAB TEST RESULTS)

Appendix No.	ITEMS
B-1	SOIL CHARACTERISTICS SHEETS
B-2	RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES
B-3	GSD CURVES







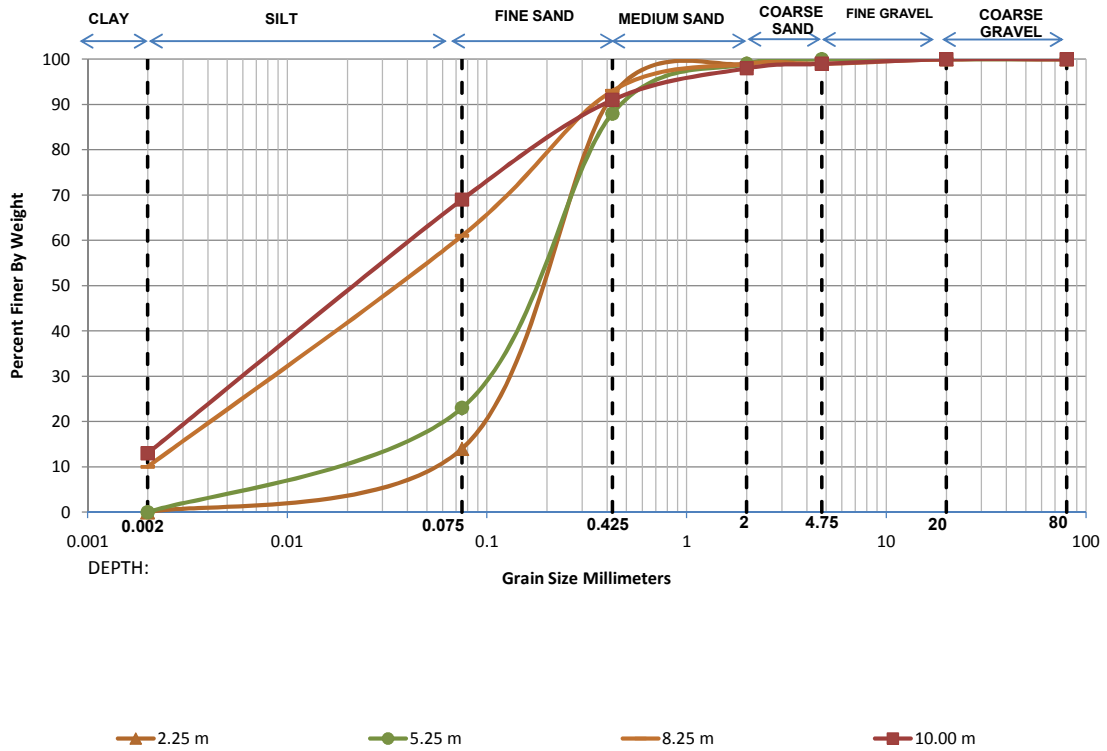


### RESULT OF CHEMICAL ANALYSIS OF SOIL SAMPLES

Sr. No	Chainage/ Structure (km)	BH No.	Depth (m)	pH	Chlorides (Cl <sup>-</sup> )		Sulphate (SO <sub>3</sub> <sup>2-</sup> )	
					(mg/kg)	(%)	(mg/kg)	(%)
1.	1698+053 (Minor Bridge)	BH-01	2.25	7.60	63.68	0.0063	24.37	0.0024
2.	2807+817 (Minor Bridge)	BH-03	5.25	8.74	55.59	0.0055	21.23	0.0021

**GRAIN SIZE DISTRIBUTION CURVES**

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	1698+053
<b>B.H. No.</b>	BH-01

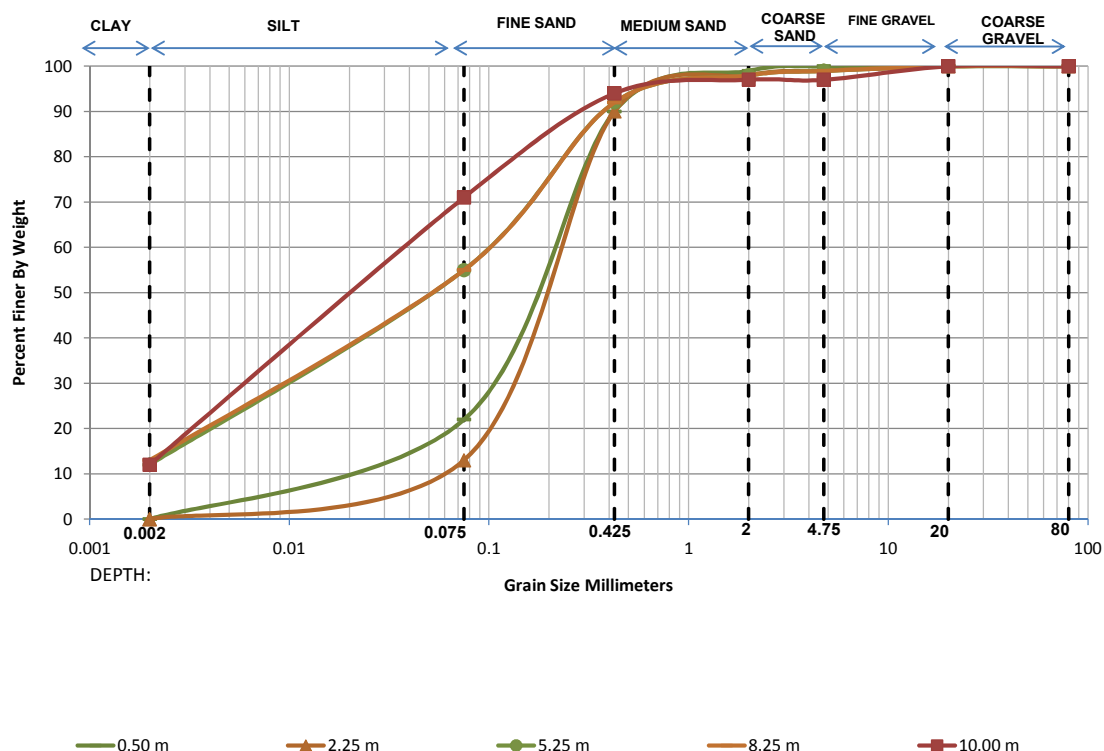


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.25 m	0.00	14.00	78.00	7.00	1.00	0.00	0.00	0.0507	0.1389	0.2360	4.66	1.61
5.25 m	0.00	23.00	65.00	11.00	1.00	0.00	0.00	0.0216	0.1016	0.2194	10.16	2.18
8.25 m	10.00	51.00	32.00	6.00	0.00	1.00	0.00	0.0020	0.0174	0.0725	36.25	2.09
10.00 m	13.00	56.00	22.00	7.00	1.00	1.00	0.00	-	0.0117	0.0550	-	-





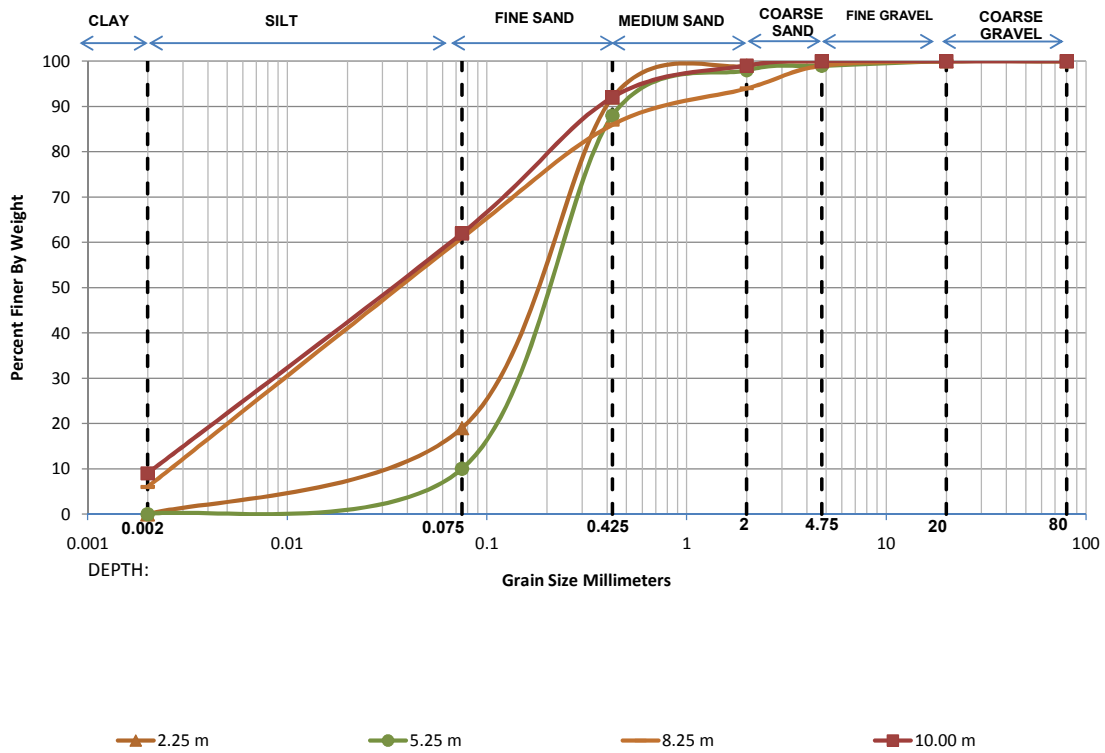
<b>GRAIN SIZE DISTRIBUTION CURVES</b>	
<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	2807+817
<b>B.H. No.</b>	BH-03



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
0.50 m	0.00	22.00	68.00	9.00	1.00	0.00	0.00	0.0235	0.1052	0.2169	9.22	2.17
2.25 m	0.00	13.00	77.00	8.00	1.00	1.00	0.00	0.0562	0.1445	0.2435	4.33	1.53
5.25 m	12.00	43.00	37.00	6.00	1.00	1.00	0.00	-	0.0189	0.0925	-	-
8.25 m	13.00	42.00	37.00	6.00	1.00	1.00	0.00	-	0.0179	0.0928	-	-
10.00 m	12.00	59.00	23.00	3.00	0.00	3.00	0.00	-	0.0121	0.0522	-	-

### GRAIN SIZE DISTRIBUTION CURVES

<b>Project Name</b>	Conducting geotechnical investigation, preparation of geotechnical report for designing of bridges and for embankment in connection with construction of Haryana Orbital Rail Corridor (HORC) project from Palwal to Harsana Kalan including connectivity to existing IR network in the state of Haryana.
<b>Location/Chainage</b>	2972+708
<b>B.H. No.</b>	BH-04



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
2.25 m	0.00	19.00	73.00	7.00	1.00	0.00	0.00	0.0307	0.1171	0.2210	7.19	2.02
5.25 m	0.00	10.00	78.00	10.00	1.00	0.00	0.00	0.0750	0.1604	0.2575	3.43	1.33
8.25 m	6.00	55.00	25.00	8.00	5.00	1.00	0.00	0.0043	0.0213	0.0726	16.96	1.46
10.00 m	9.00	53.00	30.00	7.00	1.00	0.00	0.00	0.0024	0.0179	0.0702	29.24	1.89

## **APPENDIX – C** **(ANALYSIS & RECOMENDATION)**

<b>Appendix No.</b>	<b>ITEMS</b>
C-1	SAMPLE CALCULATIONS FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION

Calculation of SBC for shallow foundations as per IS : 6403 - 1981			
<b>INPUT DATA</b>		CH. (KM) :- 1698+053	
		BH NO. :- BH-01	
Type of footing		<b>Square</b>	<b>3</b>
1	Continuous Strip		
2	Rectangular		
3	Square		
4	Circular		
Angle of internal friction ( $\phi^\circ$ )			31.00
Cohesion (c in $t/m^2$ )			0.00
Void ratio (e), $e = (G \cdot \gamma_w / \gamma_d) - 1$			0.64
Direction of load with vertical ( $^\circ$ )			0.00
Density of foundation soil ( $t/m^3$ ) $\gamma_{bulk}$			1.91
Depth of water table (m)			NE
Factor of safety			2.50
S.no.	Depth (m) of footing ( $D_f$ ) below EGL	Width (m)	
1	1.00	2.00	
2	1.50	2.00	
3	2.00	2.00	
<b>SHEAR FAILURE CRITERIA</b>			
Assumptions and formula used in calculation as per IS:6403-1981 are given below -			
<b>NOTE:</b> The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).			
The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q_d = c N_c s_c d_c i_c + q (N_q - 1) s_q d_q i_q + (1/2) B \gamma N_\gamma s_\gamma d_\gamma i_\gamma W'$			
The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)			
$q'_d = (2/3) c N'_c s_c d_c i_c + q (N'_q - 1) s_q d_q i_q + (1/2) B \gamma N'_\gamma s_\gamma d_\gamma i_\gamma W'$			
Where,			
$d_c = 1 + 0.2 (D_f/B) \cdot \text{SQRT}(N_\phi)$		(from IS 6403 : 1981, page No. 9)	
$d_q = d_\gamma = 1$ for $\phi < 10^\circ$			
$d_q = d_\gamma = 1 + 0.1 (D_f/B) \cdot \text{SQRT}(N_\phi)$ for $\phi > 10^\circ$			
$N_\phi = \tan^2(\pi/4 + \phi/2)$			
$\phi'$ is friction angle for local shear failure = $\tan^{-1} (0.67 \tan \phi)$			
<b>OUTPUT</b>			
The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.			

<b>Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)</b>					
$\phi$	31.00		$\phi'$	21.93	
$N_c$	32.67		$N'_c$	16.80	
$N_q$	20.63		$N'_q$	7.76	
$N_\gamma$	25.99		$N'_\gamma$	7.06	
<b>Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)</b>					
S.no.	Width(m)		$S_c$	$S_q$	$S_\gamma$
1	2.00		1.30	1.20	0.80
2	2.00		1.30	1.20	0.80
3	2.00		1.30	1.20	0.80
			1.30	1.20	0.80
			1.30	1.20	0.80
			1.30	1.20	0.80
<b>Depth factors : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$d_c$	$d_q$	$d_\gamma$
1	1.00	2.00	1.18	1.09	1.09
2	1.50	2.00	1.27	1.13	1.13
3	2.00	2.00	1.35	1.18	1.18
<b>Inclination factors : (from IS 6403 : 1981, page No. 9)</b>					
	$i_c = (1 - \alpha / 90)^2$		$i_q = (1 - \alpha / 90)^2$		$i_\gamma = (1 - \alpha / \phi)^2$
	1.00		1.00		1.00
<b>Water table factor : (from IS 6403 : 1981, page No. 9)</b>					
S.no.	Depth(m)	Width(m)	$Z_w/B$	$W'$	
1	1.00	2.00	14.50	1.00	
2	1.50	2.00	14.25	1.00	
3	2.00	2.00	14.00	1.00	
<b>Safe Bearing Capacity</b>					
S.no.	Depth(m)	Width(m)	SBC in ( $t/m^2$ )		
			General shear	Local shear	Recommended
1	1.00	2.00	36.95	11.47	25.00
2	1.50	2.00	48.66	15.45	33.09
3	2.00	2.00	61.17	19.71	41.73

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976														CH. (KM): 1698+053							BH NO. :- BH-01			
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness (m)	Stress at Foundation level (kg/cm <sup>2</sup> )	Length (m)	Breadth (m)	Layer Thickness (m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress Increment at top for cohesionless layer & at mid Depth for cohesive layer (kg/cm <sup>2</sup> )	Average N-Value	Mvc (cm <sup>2</sup> /kg)	Consolidation Settlement (mm)	Modulus of Soil (kg/cm <sup>2</sup> )	Influence Factor (i)	Poisson's Ratio	Settlement (mm) for 10 $\gamma/2$ (from IS:8009 Part I), Fig. 9, Page NO. 17)	Settlement in Non-Cohesive Soil (mm)	Elastic Settlement (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)
Layer 1	1.00	1.00	4.00	3.00	3.44	2.00	2.00	3.00	2.00	2.000	3.638	25	200	0.9400	0.30	10.00	34.38	29.41	29.41	29.41	29.41	0.85	1.00	25.00
Layer 1	1.50	1.50	4.50	3.00	3.75	2.00	2.00	3.00	2.00	2.000	3.749	25	200	0.9400	0.30	10.00	37.49	32.07	32.07	32.07	32.07	0.78	1.00	25.00
Layer 1	2.00	2.00	5.00	3.00	3.96	2.00	2.00	3.00	2.00	2.000	3.960	25	200	0.9400	0.30	10.00	39.60	33.87	33.87	33.87	33.87	0.74	1.00	25.00

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976														CH. (KM): 1698+053							BH NO. :- BH-01				
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness (m)	Stress at Foundation level (kg/cm <sup>2</sup> )	Length (m)	Breadth (m)	Layer Thickness (m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress increment at top of cohesionless layer & at mid Depth for cohesive layer (kg/cm <sup>2</sup> )	Average N-Value	Mvc (cm <sup>2</sup> /kg)	Consolidation Settlement (mm)	Modulus of Soil (kg/cm <sup>2</sup> )	Influence Factor (i)	Poisson's Ratio	Settlement (mm) for 10 t/m <sup>2</sup> (from IS:8009 (Part I), Fig. 9, Page NO. 17)	Settlement in Non-cohesive Soil (mm)	Elastic Settlement (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)	
Layer 1	1.00	1.00	4.00	3.00	6.88	2.00	2.00	3.00	2.00	2.000	6.877	25	200	0.9400	0.30	10.00	68.77	58.82	58.82	58.82	58.82	58.82	0.85	1.00	50.00
Layer 1	1.50	1.50	4.50	3.00	7.50	2.00	2.00	3.00	2.00	2.000	7.498	25	200	0.9400	0.30	10.00	74.98	64.14	64.14	64.14	64.14	64.14	0.78	1.00	50.00
Layer 1	2.00	2.00	5.00	3.00	7.92	2.00	2.00	3.00	2.00	2.000	7.920	25	200	0.9400	0.30	10.00	79.20	67.75	67.75	67.75	67.75	67.75	0.74	1.00	50.00



## **6. LIST OF APPROVED VENDORS**



**APPROVED MANUFACTURES/SUPPLIERS LIST**

All materials and products shall conform to the Outline Construction Specification (OCS), BIS codes and other relevant codes etc. and shall be of make as approved by HRIDC.

The list of approved makes for products and materials is given below. No Further approval is required to be taken for usage of these makes.

S. No.	Details of Materials/Products		Manufacturer's Name
1.	Cement	OPC	ACC, Ultratech, Ambuja, JK Lakshmi, JSW, Orient Cement , JK Cement ,Lafrage ,Wonder
		PSC	DALMIA, JSW
2.	Reinforcement Bars		Prequalified Manufacturers as per RDSO's latest approved list with proper approval of HRIDC
3.	* Epoxy		FOSROC, SIKA QUALCRETE, BASF, CHRYSO, Vista, CICO, Pinnacle, MYK Schomburg, Thermax, Kunal Conchem, Sunanda, Fairmate,Berger, MC–Bauchemie, Fibrex, MAPEI, Ultracon, ECMAS, Durabuild
4(a).	* Expansion Joints for Viaduct		Prequalified Manufacturers as per RDSO's latest approved list with proper approval of HRIDC.
4(b).	* Expansion Joints for buildings		MYK Schomburg, Migua, CS, Sanfield, Inpro, 3R Joints & Seals, VR Engineers, Greensboro Polychem, Maruti, MC-Bauchemie, Asian Paints, ECMAS ,Z Tech
5.	* Admixtures		Buildtech, FOSROC, SIKA, MBT, MC-Bauchemie, Pidilite, CHRYSO, MYK Schomburg, BASF, MAPEI, Kunal Conchem, UNIROCK , CICO, ECMAS, CAC, Fairmate, Vista, Thermax, TP Buildtech, Sunanda, Molecules Conchem, Pinnacle, Durabuild, Ultracon, Ado additives, Asian, Greensboro Polychem, STP, Berger, Fibrex
6.	Pile Integrity Testing		CIMEC, Spectro, ADS Labstech, ATL, Avantech, Geodynamics, AIMIL, Cengers, CBRI, EMC India, Pile Dynamic, Composites Combine Technocrats, CEG test House <b>(PLEASE NOTE THAT NABL ACCREDITATION IS MANDATORY)</b>

7.	* Anchor Fastener	HILTI, FISCHER,BIT, TRUTEK, FOSROC, Mungo, Minova, UIP, Wuerth <b>(Please note that ETA Certification is mandatory for using/supplying fasteners for load bearing structural members)</b>
8.	Structural Steel	TATA, SAIL, ESSAR, Maharashtra Pipes, Jindal Steel & Power Ltd., K.L. Steel, Steel Works & Power Engineers, SKS Ispat & Power, Shamli Steel, Topworth, Goodluck India, Rimjhim
9.	* Pre- stressing Strand (LRPC)	TATA SSL Ltd, USHA Martin, DP Wires, Miki Steel, Kataria Group
10.	* Pot/Elastomeric /Spherical Bearings	Prequalified Manufactures as per RDSO's latest approved list with proper approval of HRIDC
11.	* Horizontal Tie Bars/Shear Bars	Dextra, BB Bars System, BBV Systems, Minova, Euroalloy
12.	* HDPE Sheathing	Rex, Gwalior Polypipes Ltd, Kataria Sheathing, Tirupati, Dynamic Prestress, JK Prestressing
13.	Formwork Release Agent	FOSROC, MC Bauchemie, CICO, CHRYSO, Fibrex, BASF, Sunanda, Pinnacle, Fairmate, Durabuild, CAC, Adoadditives, MYK Schomburg, Greensboro Polychem, Thermax, STP, MAPEI, Asian Labs, ECMAS ,Ultracon, Buildtech.
14.	* Prestressing System	Freyssinet, BBR, VSL, Dynamic, Kellick Nixon, Tensacciai (India Ltd.), JK Prestressing, Usha Martin, VSIL
15.	* Reinforcement Couplers (cold forged paralled threads type only)	Dextra, Halfen Moment, Sanfield, Kridhan , JB Engg
16.	Hollow Sections, Pipes	Surya Pipes, Hi-Tech Pipes, JSW, Jindal Steel and Power Ltd., Garg Ispat Udyog, Navratan, VMC Steel, APL Appolo, DADU Pipes Goodluck India, Sarvari Steel
17.	* Drainage Pipes	Tirupati Plastomatics, Duraline, REX, STIPL, Kriti, Vishal, Eonn, Giga Pipes.

18.	Acrylic Textured Coatings	Spectrum, Surfa Nova, Sunanda, Jotun, Asian Paints, Berger, Hempel, DULUX, STP, Godavari Paints, MC-Bauchemie, MAPEI
19.	* Non Shrink Grout	FOSROC, SIKA, BASF, MBT, CHRYSO, Fairmate, CICO, MYK Schomburg, Pinnacle, ECMAS, Minova, Durabuild, CAC, Asian Paints, STP, BERGER, Fibrex, Ado Additives, Thermax, CICO, Greensboro Polychem, Ultracon, Kunal Conchem, MC-Bauchemie, Asian Labs, MAPEI, Buildtech
20.	Bonding Coat	CICO, FOSROC, Sunanda, BASF, CHRYSO, MYK Schomburg, Minova, Fairmate, STP, SIKA, BERGER, Greensboro Polychem, Thermax, Ultracon, ECMAS, Asian Paints, Fibrex, Asian Labs, Ado Additives, MAPEI, MC-Bauchemie, Durabuild
21.	* Polysuphide Sealant	CICO, Pidilite, BASF, FOSROC, CHRYSO, STP, SIKA, Sunanda, Fairmate, Kunal Conchem, Durabuild, Asian Paints, MYK Schomburg, Greensboro Polychem, Ultracon, ECMAS, Fibrex, MC-Bauchemie, Buildtech
22.	* Steel Structural Fasteners	Sundram Fasteners, Pioneer Nuts & Bolts, Unbrako, Nelson, Panchsheel, LPSEJOT, UIP, Canon, Trutek, Kwaliti Forge, Atul Fasteners, Imperial Bolts, Pooja Forge <b>(Please note that ETA Certification is mandatory for using/supplying fasteners for load bearing structural members)</b>
23.	* Corrosion Protection Paints	Berger, Johnson Nicholson, Nerolac, Asian Paints, Akzo Nobel, Jotun, Shalimar, 3M Fosroc, Hempel, Universal Paint, Sunanda, Kunal Conchem, STP, INM Nuvent Paints, CICO, CHRYSO, Greensboro Polychem
24.	Micro Silica	Thermal Plants, Sika Elkem, FOSROC, MAPEI, Corniche, Star Silica, CICO, Rockfit, Jaycee Build Corp LLP, Vista, Kunal Conchem, CAC, BASF, Buildtech, Ashtech, Ultracon, Alccofine
25.	* Fire Resistant Paint	Akzo Nobel, PPG, Jotun, Sunanda, Berger Paints
26.	* Integral Crystalline Waterproofing Method	Penetron, XYPEX, SIKA
27.	* Water stopper/ Bar	Kanta Rubber, Greenstreak, Duron, Sunanda, Wall Grip, Asian Paints, FOSROC, Maruti, CHRYSO

28.	* Liquid Polymer membrane waterproofing	BASF, MAPEI , NINA, CICO, Kunal Conchem, MYK Schomburg, Sunanda, ECMAS, Durabuild, Asian Paints, STP, BERGER, FOSROC, Greensboro Polychem, Ado Additives, MC-Bauchemie, Thermax, Asian Labs, CHRYSO, Ultracon, Buildtech
29.	* Curing Compound	Clean Tech Concure, Vista, FOSROC, STP, Kunal Conchem, CHRYSO, CICO, Pinnacle, Durabuild, BERGER, Fibrex, Greensboro Polychem, UNICRETE, Ado Additives, UNIROCK, SIKA, Fairmate, MYK Schomburg, Ultracon, ECMAS, Asian Labs, Asian Paints, Molecules Conchem, MC-Bauchemie, MAPEI, Thermax, Buildtech, CAC
30.	* Polycarbonate Sheets	Gallina Acroplus, Coxwell, Poly U, Fabic, Lexan, (SABIC Innovative Plastics), DANPALON, GE Plastics, VMI Plastics, Power Chem Plast, Super Disco Ispat
31.	Fly Ash	Thermal Plants, Ashcrete, Ultra Pozz, Star Pozz, Ashtech, Jaycee Build Corp LLP, SUPERPOZZ P500
32.	* Pre-Coated Profiled Metal Sheethings	TATA Blue Scope, Multicolor, Kamdhenu, Essar Steel, Bhushan Steel, Ispat Profile India, Super Disco Ispat, Aditya Profiles
33.	Sodium Silicate for Grouting purposes during TBM operations	BASF, Kunal Conchem, SIKA, CHRYSO, Subham Mineral, Minova, Sunanda, Greensboro Polychem, Ado Additives, FOSROC, Ultracon, Asian Labs, Fibrex, Buildtech
34.	* Fly Ash Block/ AAC Block	Siporex, Ascolite, J.K. Laxmi, Ashtech, UNICRETE
35.	* Tunnel Segment EPDM	FIP, Datwyler, E.S. Rubber, Haida Rubber
36.	* Rock Bolts/Swellex Bolts	Geo Constech, DSI, Atlas Copco, FIREP International, Minova
37.	* Softeye GFRP	Dextra, FIREP International, Minova, Hughes Brother, Geo Constech
38.	Material Testing	ADS Labstech, Anshu Tech, Arihant, SHREE BALAJI Test House, Beauur Veritas, ShriRam, National Test House, Spectro, Indian Institute of Technology, Pioneer, Secon, Delta, CEG Test House
39.	Geotechnical Investigation	Cengers, CEG Testhouse, Delhi Test House, SHREE BALAJI Test House, Techpro, Arun Soil Labs, Indian Geotechnical, Raicon, Composite Combine Technocrats, Secon, Sai Geotech

40.	* Polymer	WALLGRIP, TRISHUL, Shubham Minerals, Goldy Minerals, GeoPolymer
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**NOTE: For the categories marked as \*, the enclosed undertaking performa should be duly filled and signed by authorized representatives of concerned agencies.**

**UNDERTAKING****Name of Contract:****Date of start of work:****Category of work:****Date of completion of work:**

This is to certify that work of ..... (Category to be mentioned) at ..... (Location) of the contract .....(Name of contract) has been executed/completed in accordance with the manufacturer's/supplier's specifications and as per the approved method statement.

The work has been jointly inspected by authorised representative of ..... (Manufacturer/supplier), ..... (Executing agency) & ..... (Contractor) during its execution and all non-conformities observed during inspection have been complied to achieve the best industry standards.

The undersigned take full responsibility of the overall adequacy, accuracy, effectiveness & warranty (upto design life) of the completed work as per the provision of the contract ..... (Contract number) and Outline Construction Specifications of HRIDC.

**(Stamp and Signature)****Manufacturer  
Representative****(Stamp and  
Signature)****Executing agency  
Representative****(Stamp and  
Signature)****Contractor  
Representative**