School Building of 2600 sq. ft. Floor Area

Steel Intensive Rural Structures - INSDAG Initiative

To achieve the goal of ensuing sustainable construction and for its mission of steel promotion INSDAG has developed few design models of rural buildings using structural steel.

4 building plans collected from municipalities of West Bengal have been used for building design.

1. One Unit house if Area 350 Sq Ft
2. One Anganwadi –cum- Health Centre of area 400 Sq ft
3. A meeting / Panchayat hall of area 1500sq.ft
4. A school building of area 2600sq.ft

A. Salient Features / Building Components of in Building Models with Steel Framing

i) Roofing

Roof sheeting is done with 0.5 mm thick Corrugated Galvanized/ Galvalume/ colour coated Steel Sheets spanning over purlins supported on steel portals or trusses made from Square Hollow Section/ Rectangular Hollow Section. Lighter weight Galvalume sheet and FC panel can also be used.

ii) Structural Framework

Structural steel Column and Trusses / Portal Frames using SHS/RHS

The entire framework for the building has been conceptualized using Square Hollow Section with idealized panels approximately 1.0mx1.0 m. The members are connected with the SHS or RHS sections by insert plates.

iii) Ferro-Cement Wall panels/Cladding

A typical panel size of 1m x 1m for the cladding materials has been chosen. Each panel is made of a 15 mm thick Cement-Sand mortar (1:1) skin with 1 layer of 0.265 mm diameter galvanized chicken mesh under a layer of 2.65 mm diameter reinforcement @ 25 mm c/c both ways as welded mesh placed centrally. The typical details of the connection of these panels are in the corresponding drawing sheets of each building . The gaps (approx. 2 mm) between the panels and SHS sections will be sealed with waterproof grouting using SIKA / Accoproof or equivalent, to make the connections leak proof.

iv) RCC Foundation System

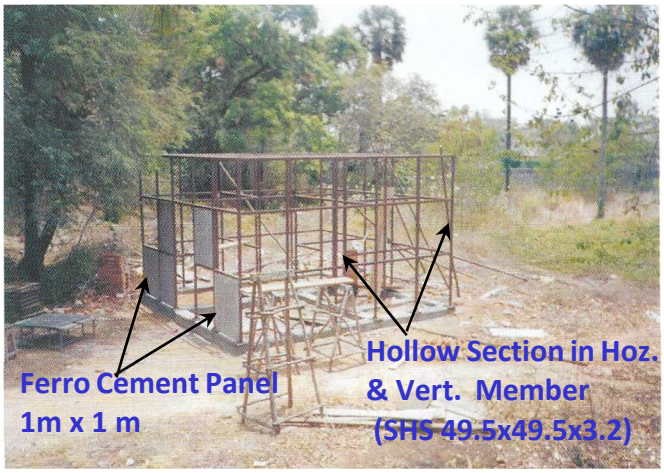
The foundation type and pattern for all of the housing modules has been conceived as a frame work of RCC peripheral beam at plinth level supported over RCC pedestals and RCC isolated footings. For partition walls, intermediate supports have been considered supported over tie beams.

v) Flooring

Brick on-edge flooring placed over rammed earth at locations of rooms. For water-tightness flooring is placed over 50 mm thick 1:2:4 Plain Cement Concrete.

vi) Doors and Windows

Steel framed doors and windows are assumed to be used. Depending on the local site condition other material can be used also to make it cost-effective.



Structural Frame & Ferro cement panels while Installation

Connection of SHS with Ferro cement panel

Prototype Buildings Installed by INSDAG

Picture 1

Picture 2

Model Rural House Installed at Rural Technology Park
at the Campus of National Institute of Rural Development & Panchayat Raj, Hyderabad,
(Installed in 2017, still in good condition in 2023)

Many more prototypes have been installed by INSDAG in many places like in Burdwarn in West Bengal (2013), Tripura, Talegaon in Maharashtra (2017) with FC Panels.

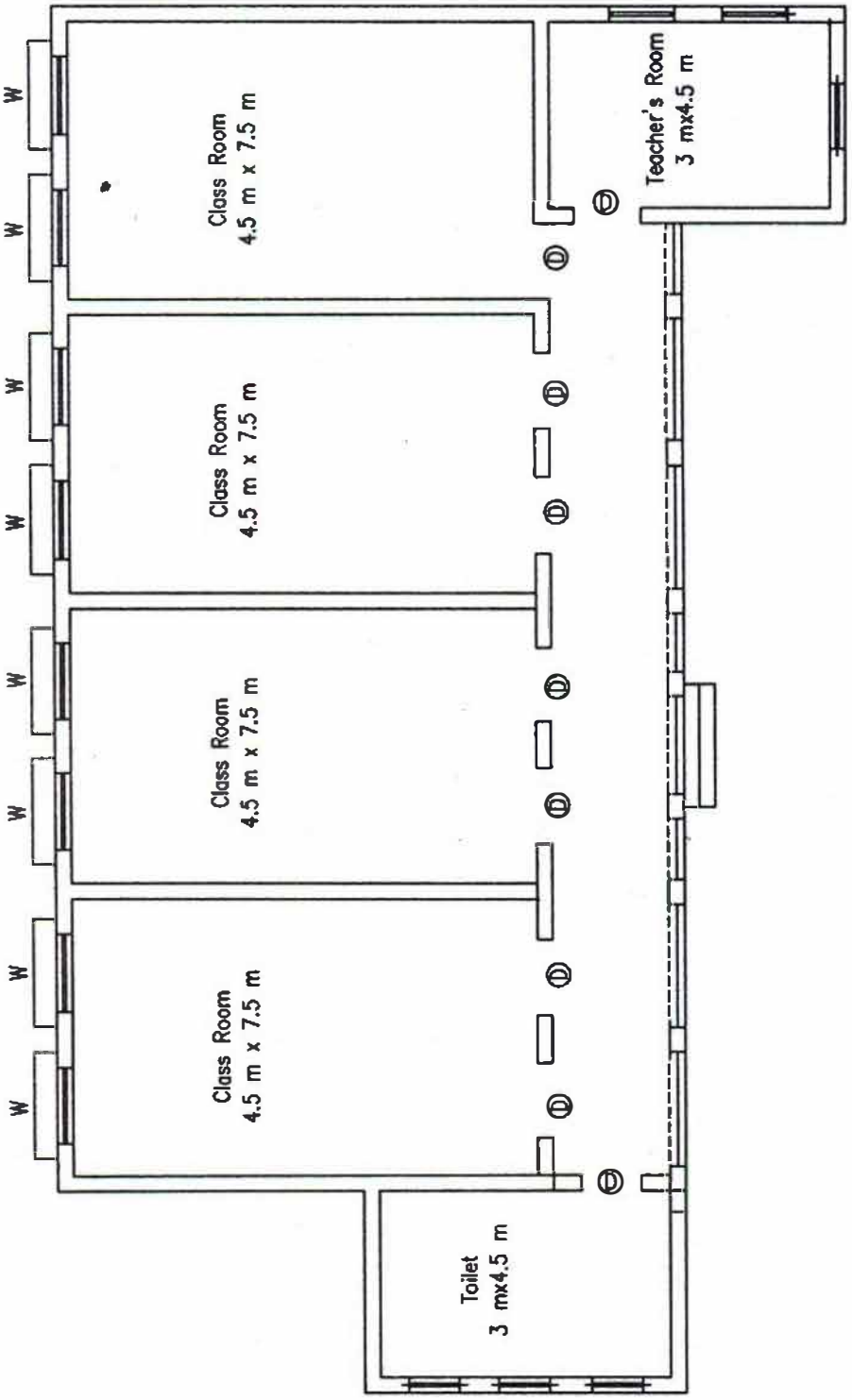
B. **Cost Aspects**

Steel framed building module by INSDAG would cost around Rs. 1100 to 1300/- per sq. ft of area (as estimated with DSR 2023) with steel usage of 4.0 to 5.3 kg steel per sq. ft. of construction area (structural steel & TMT bars) which is competitive and sometimes lower if constructed in mass scale.

Cost & Steel Usage – 4 Building Modules

Building Type	**Area Sq. Ft.**	**Cost per sq. ft.**	**Steel usage (Structural Steel & TMT)**
Unit House	350	Rs. 1295 /-	5.3 kg / sq. ft. (only structural steel- 4.54)
Health / Aanganwadi Centre	400	Rs. 1125 /-	4.9 kg / sq. ft. (only structural steel- 4.00)
Meeting Hall	1500	Rs. 1276/-	4.7 kg / sq. ft. (only structural steel- 4.0)
School Building	2600	Rs. 1050 /-	4.0 kg / sq. ft. (only structural steel- 2.7)

Architectural Plan of 2300 sq. ft Floor Area of School Building



PLAN AT F.F.L SHOWING SCHOOL BUILDING

2300 SQ. FT. FLOOR AREA

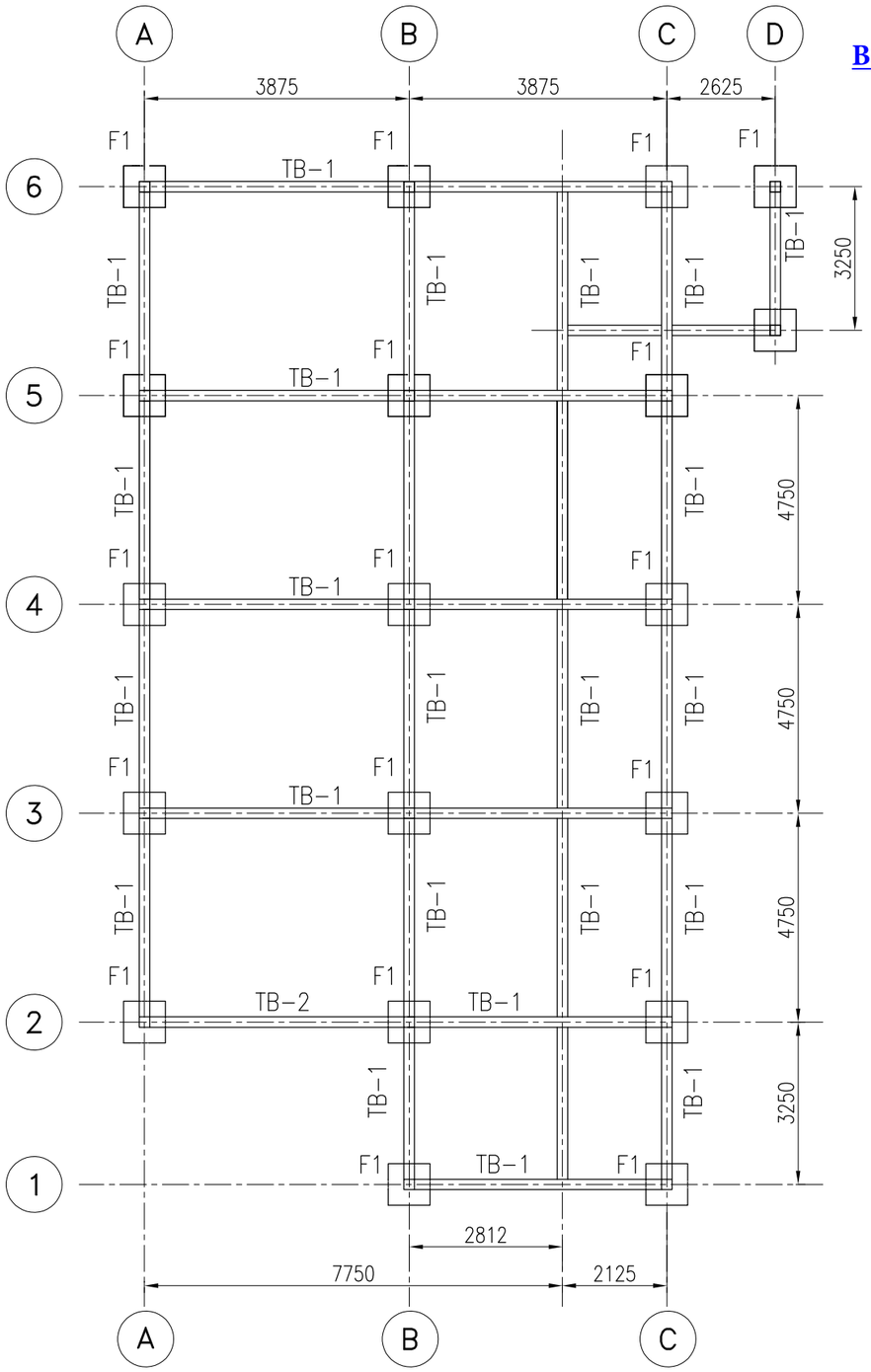
NOTES :

1. DRAWING COLLECTED FROM S.A.E. WBSRDA, PURULIA, WEST BENGAL DIVISION

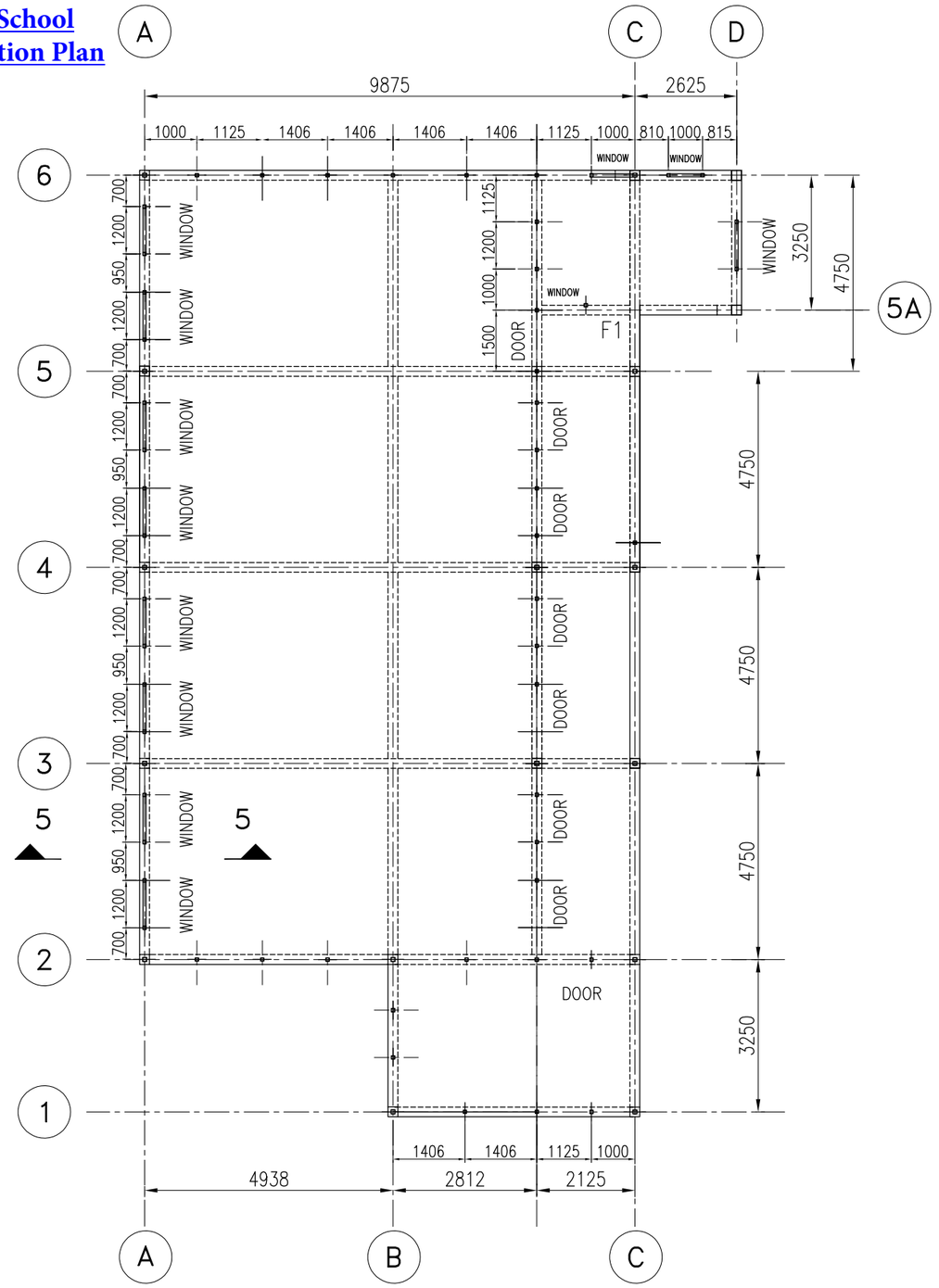
INSTITUTE FOR STEEL DEVELOPMENT & GROWTH
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)
52/1A, BALLYGUNGE CIRCULAR ROAD, KOLKATA-700 019

TITLE : ARCHITECTURAL PLAN OF SCHOOL BUILDING					DRG. NO.- INS/CON/12-13/01/SC/ARCH/01			
DRAWN	SM	CHKD	ND/SC	SCALE	1:50, 1:20, 1:10	DATE	20/12/13	REV.	0

G.A & Detail of School Building – Foundation Plan



PLAN AT TIE–BEAM LVL.



PLAN AT PLINTH LVL.

NOTES :

1. ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN M.
2. CONCRETE GRADE IS M25 CONFORMING TO IS:456–2000
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5. WELDING SHALL CONFORM TO IS: 816 & IS: 9595 (LATEST REV.)
6. SHS/RHS SHALL CONFORM TO IS:4923–2017.
7. ASSUMED SOIL BEARING CAPACITY = 10.0 MT/M SQ.

NO.	DESCRIPTION	DATE	BY	CHECKED
1	GENERALLY UPDATED	04.04.2024	ND	AG

REVISION

DRAWN	S.M.	APPROVED	D.D.
DESIGNED	N.D./S.C.	SCALE	1 : 50, 1:20, 1:10.
CHECKED	S.C./A.G.	DATE	01-12-2010

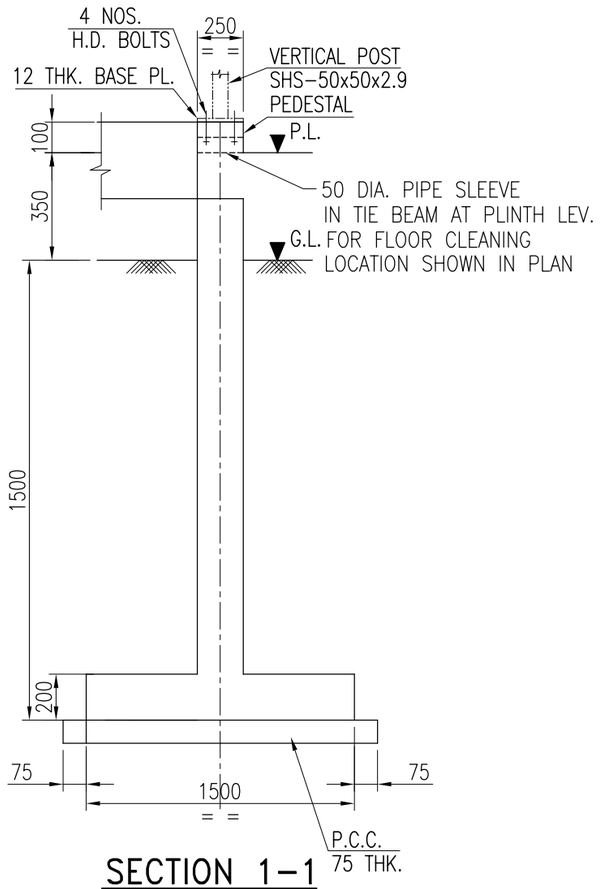
INSTITUTE FOR STEEL DEVELOPMENT AND GROWTH
ISPAT PRAGATI BHAWAN
793 ANANDAPUR KOLKATA–700 107
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)

TITLE : G.A. & DETAIL OF SCHOOL BUILDING FOUNDATION PLAN

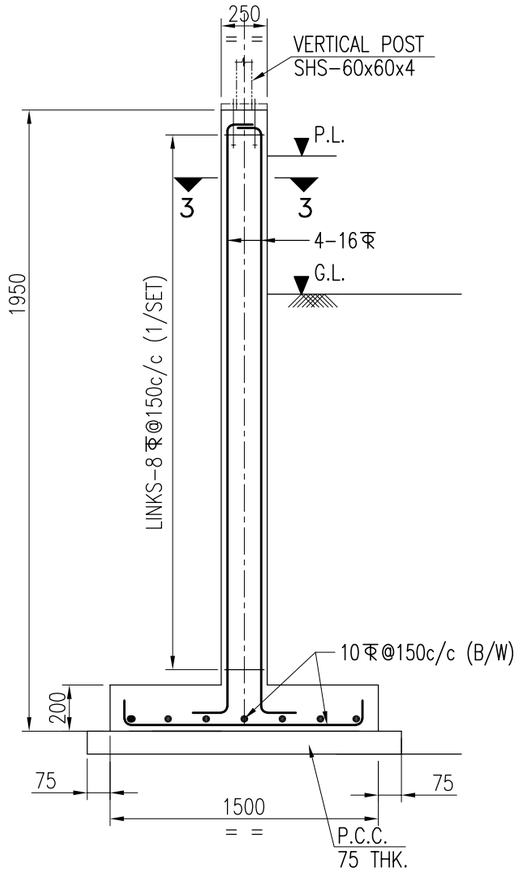
DRG. NO.– INS/CON/12–13/01/SB/01

REV. 1

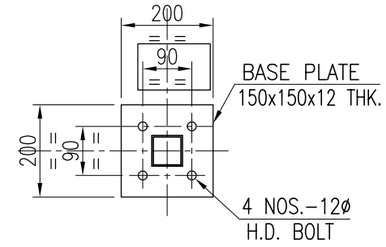
G.A & Detail of School Building – Foundation Details



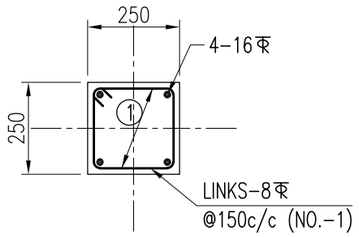
SECTION 1–1



SECTION 2–2



BASE PLATE DETAIL



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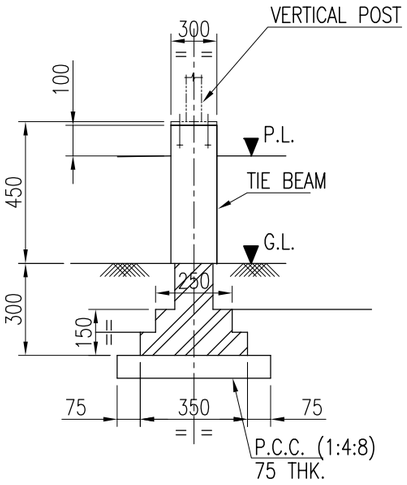

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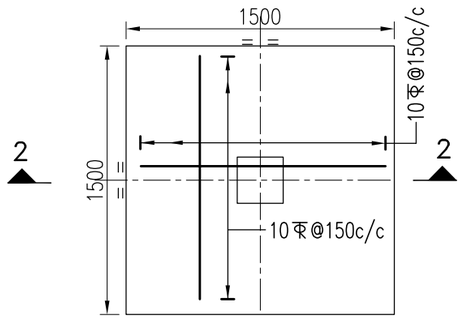
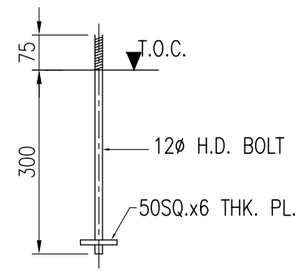
REF. DWG NO. 1

DETAIL OF FOUNDATION



REINF. DETAIL OF FOUNDATION



DETAIL OF ANCHOR BOLT

REINF. DET. OF TIE–BEAM TB–1

NOTES :

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7. ASSUMED SOIL BEARING CAPACITY = 10.0 MT/M SQ.

NO.	DESCRIPTION	DATE	BY	CHECKED
1	GENERALLY UPDATED	04.04.2024	ND	AG

REVISION

DRAWN	S.M.	APPROVED	D.D.
DESIGNED	N.D./S.C.	SCALE	1 : 50, 1:20, 1:10.
CHECKED	S.C./A.G.	DATE	01-12-2010

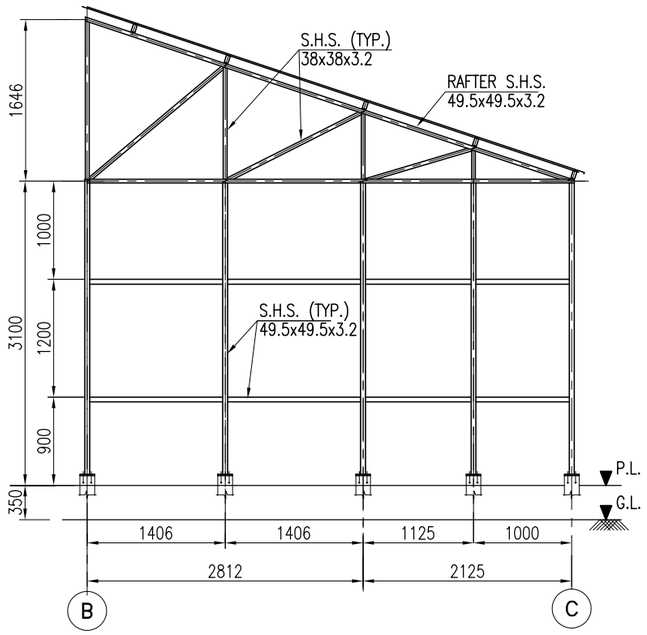
INSTITUTE FOR STEEL DEVELOPMENT AND GROWTH
ISPAT PRAGATI BHAWAN
793 ANANDAPUR KOLKATA–700 107
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)

TITLE : G.A. & DETAIL OF SCHOOL BUILDING FOUNDATION DETAIL

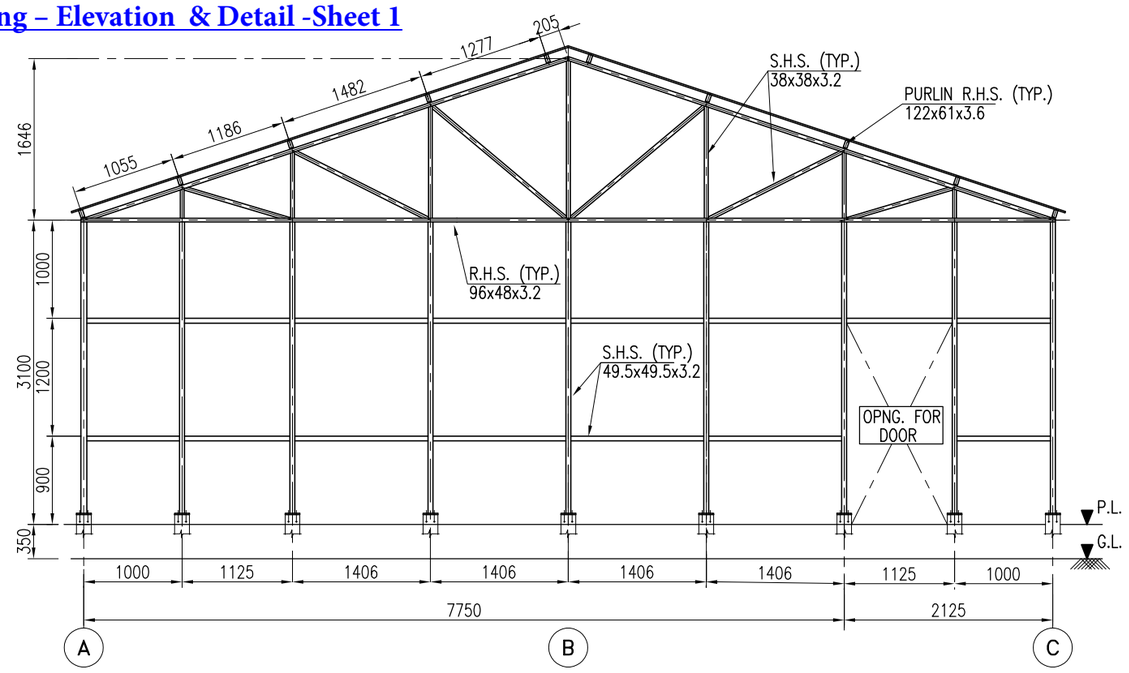
DRG. NO.– INS/CON/12–13/01/SB/02

REV. 1

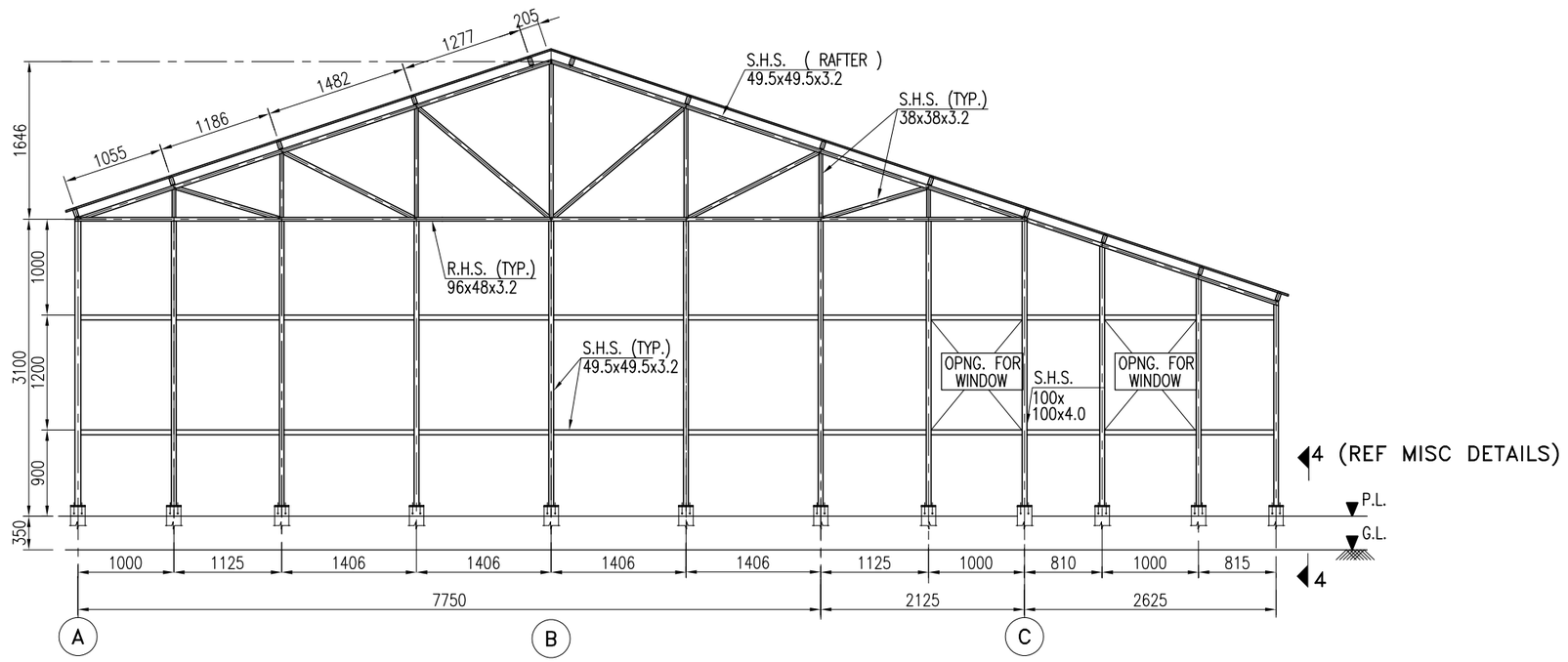
G.A & Detail of School Building – Elevation & Detail -Sheet 1



ELEVATION ON GRID–1



ELEVATION ON GRID–2



ELEVATION ON GRID–6

NOTES :

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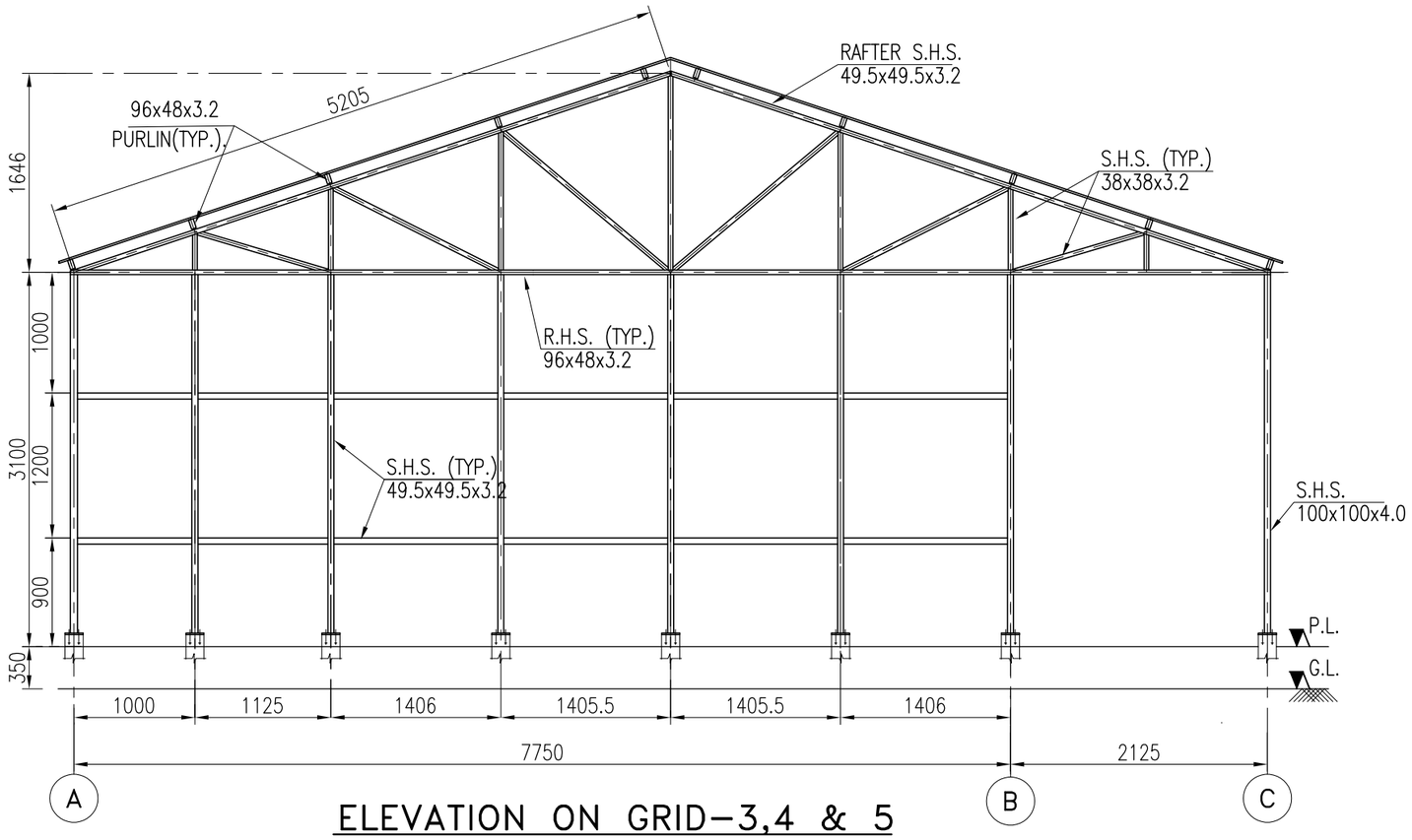
1	GRNERALLY UPDATED	04.04.2024	ND	AG

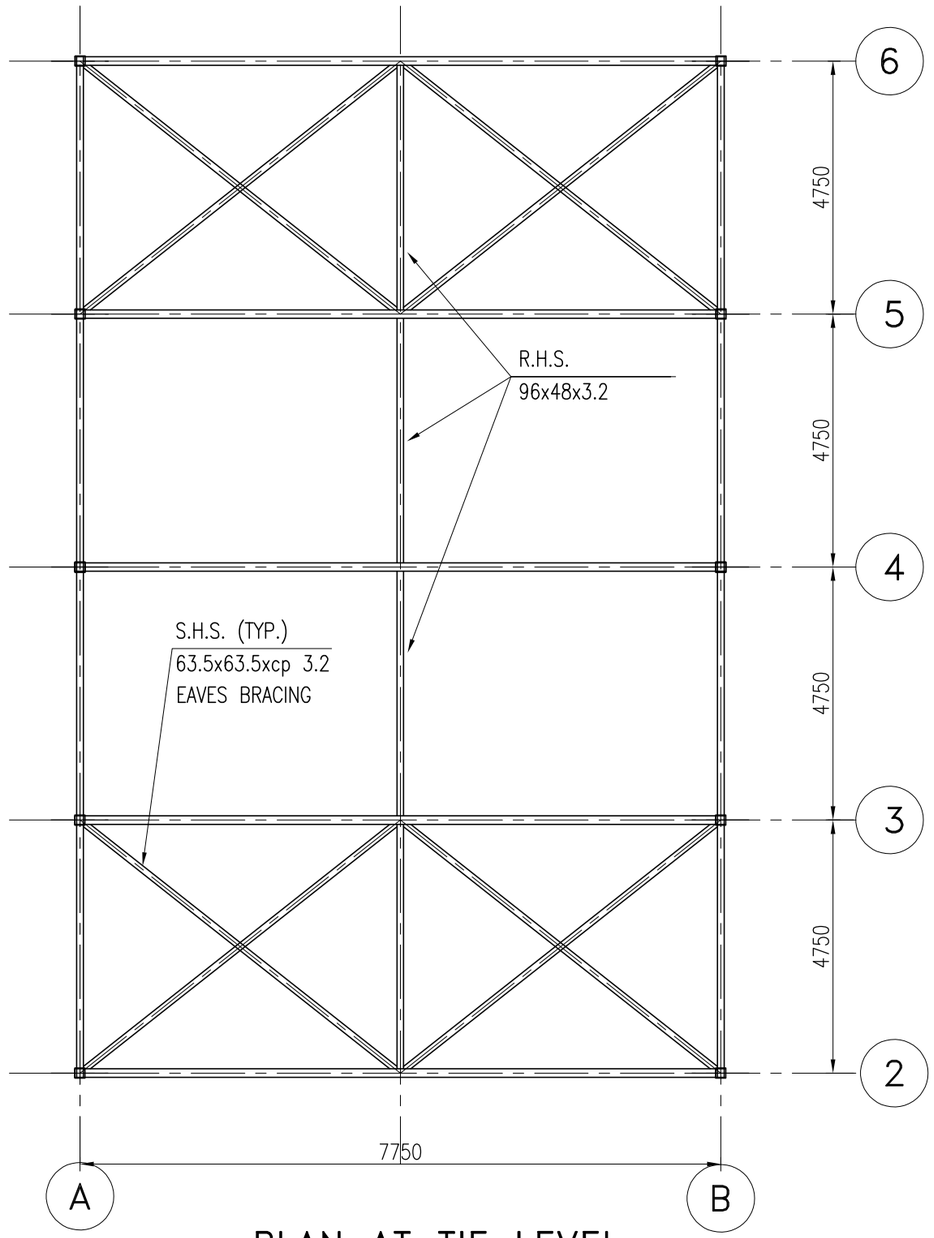
REVISION

DRAWN	S.M.	APPROVED	INSTITUTE FOR STEEL DEVELOPMENT AND GROWTH ISPAT PRAGATI BHWAN 793 ANANDAPUR KOLKATA–700 107 (JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)
		D.D.	
DESIGNED	N.D./S.C.	SCALE 1 : 50, 1:20, 1:10.	TITLE : G. A & DETAIL OF SCHOOL BUILDING ELEVATION & DETAIL (SHEET 1 OF 3)
CHECKED	S.C./A.G.	DATE 01-12-2010	DRG. NO.– INS/CON/12–13/01/SB/03 — REV. 1

G.A & Detail of School Building – Elevation & Detail -Sheet 2



ELEVATION ON GRID–3,4 & 5



PLAN AT TIE LEVEL

NOTES :

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REVISION

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		D.D.	
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CHECKED	S.C./A.G.	DATE 01-12-2010	

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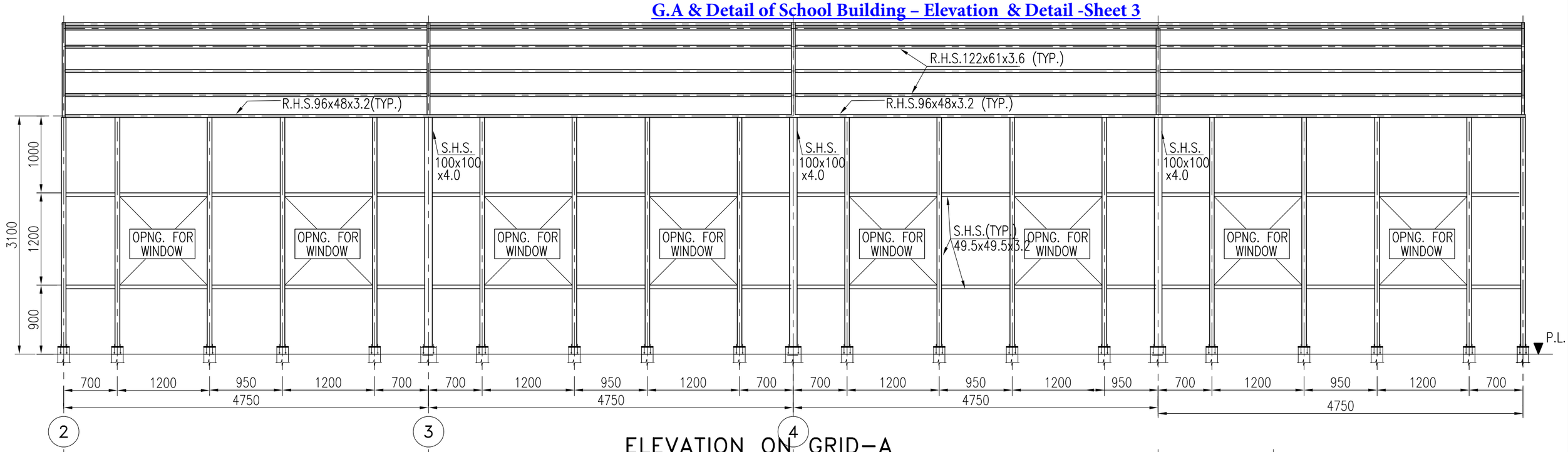
793 ANANDAPUR KOLKATA–700 107
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)

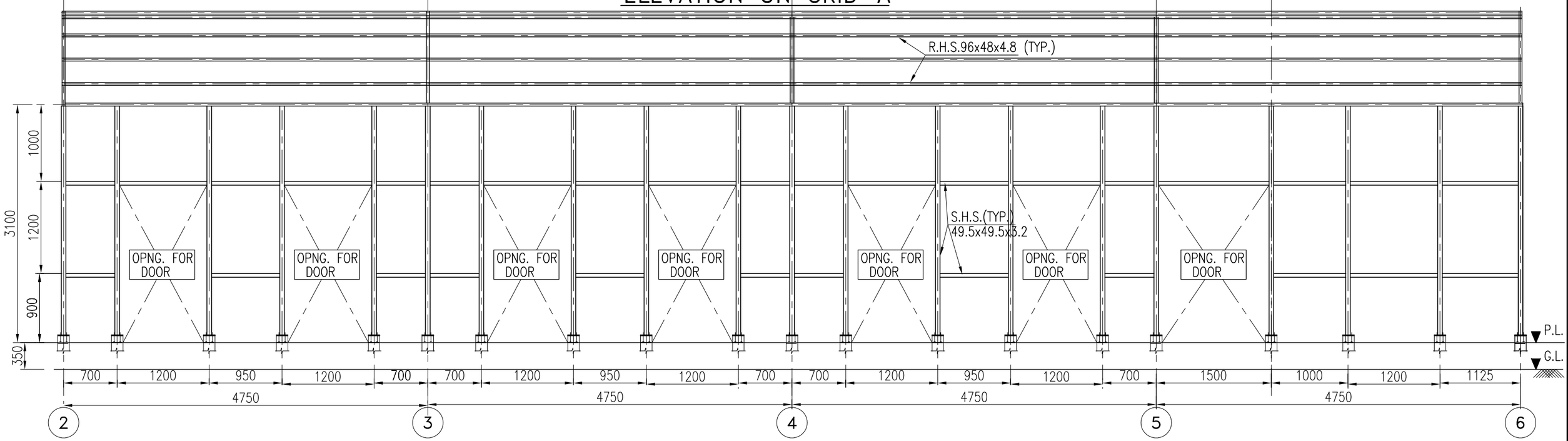
TITLE : G. A. & DETAIL OF SCHOOL BUILDING ELEVATION & DETAIL (SHEET 2 OF 3)

DRG. NO.– INS/CON/12–13/01/SB/04 | REV. 1

G.A & Detail of School Building – Elevation & Detail -Sheet 3



ELEVATION ON GRID–A



ELEVATION ON GRID–B

NOTES :

1. ALL DIMENSIONS ARE IN MM. & LEVELS ARE IN M.
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NO.	DESCRIPTION	DATE	BY	CHECKED
1	GRNERALLY UPDATED	04.04.2024	ND	AG

REVISION

DRAWN	S.M.	APPROVED	A.G.
DESIGNED CHECKED	N.D./S.C.	SCALE	1 : 50, 1:20, 1:10.
CHECKED	S.C./A.G.	DATE	01-12-2010

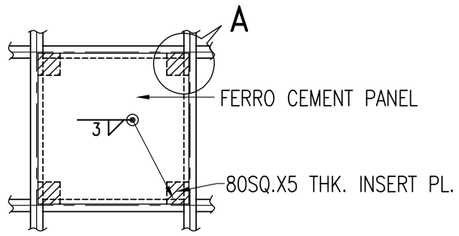
INSTITUTE FOR STEEL DEVELOPMENT AND GROWTH
ISPAT PRAGATI BHWAN
793 ANANDAPUR KOLKATA–700 107
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)

TITLE : G.A. & DETAIL OF SCHOOL BUILDING ELEVATION & DETAIL (SHEET 3 OF 3)

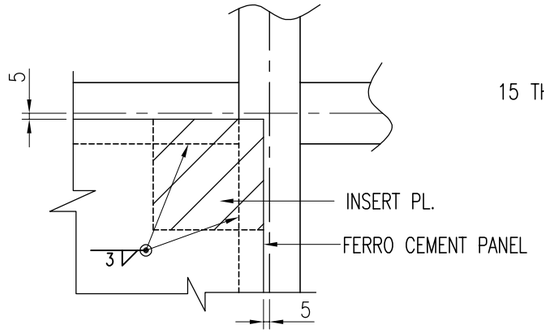
DRG. NO.– INS/CON/12–13/01/SB/05

REV. 1

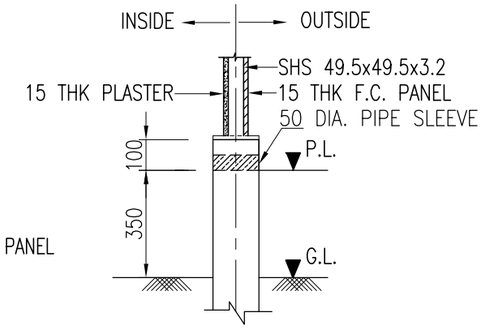
G.A & Detail of School Building – Miscellaneous Details



TYP. DETAIL OF WALL PANEL

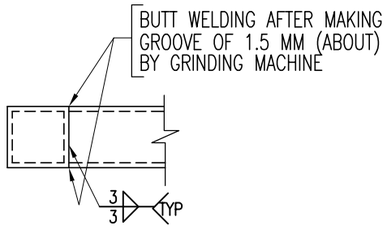


DETAIL – A

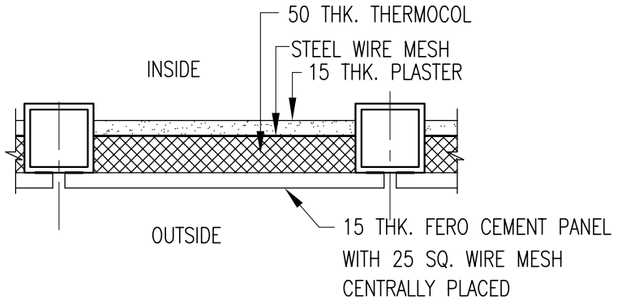


SECTION 4–4

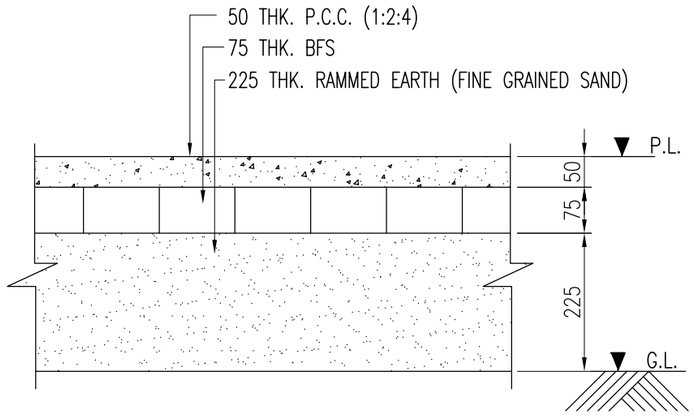
REF DWG. NO. 3



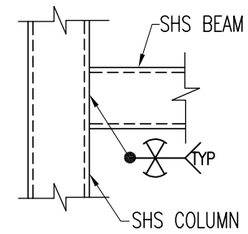
PLAN



TYPICAL SECTION OF PANEL

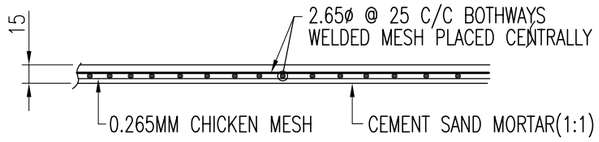


TYP. DETAIL OF FLOOR



ELEVATION

TYP. DETAIL SHOWING CONNECTION BETWEEN SHS COLUMN AND BEAM



TYP. CROSS SECTION OF 15 mm THICK FERRO–CEMENT PANEL

NOTES :

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REVISION

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INSTITUTE FOR STEEL DEVELOPMENT AND GROWTH
52/1A, BALLYGUNGE CIRCULAR ROAD,
KOLKATA–700 019
(JOINTLY PROMOTED BY MINISTRY OF STEEL & STEEL PRODUCERS)

TITLE : SCHOOL BUILDING MISCELLANEOUS DETAILS

DRG. NO.– INS/CON/12–13/01/SB/06

REV. 1

Bill of Materials & Estimated Cost

Summary for the construction materials required for		*Cost Rs.*	1050	per Sq ft
SCHOOL BUILDING	**2600** *Sq Ft.*	**Steel**	**4**	**KG/ Sq ft**

Sl No	Description	Quantity	Unit	Rate (Rs)	Total
1	Excavation in Foundations and trenches	97.15	m^3	260	25258.935
2	75 mm thk PCC below Foundation (1:4:8)	85.00	m3	5205	442425
3	Volume of RCC (M25 Grade)	24.05	m^3	9045	217507.04
4	Brickwork	9.26	m^3	7132	66025.845
5	Earthwork in filling.	79.58	m^3	308	24511.954
6	Reinforcement bar TMT Fe 500	2500	kg	89.65	224125
7	Structural steel SHS, Plates etc	7.00	MT	100000	700000
8	50 thk PCC (1:2:4) for Floor	8.45	m^3	9257	78210.773
9	75 thk BFS for Floor	169.0	m^2	450	76039.425
10	225 thk Rammed Earth (Fine Grained Soil)	38.02	m^3	186	7071.6665
11	15mm thick Ferrocement panels	513.97	m^2	350	179890.88
12	50 mm thk Thermocol	513.97	m^2	10	5139.7394
13	Steel Wire Mesh (2.65ø @ 25 mm c/c)	1027.95	m^2	250	256986.97
14	15mm thk Plaster (1:5)	1027.95	m^2	175	179890.88
15	Roof Sheeting	0.91	MT	100000	91247.06
16	PVC Pipe Sleeves 150 mm long x 50 mm dia	12.0	Nos	50	600
17	Centering and Shuttering	145.7	m^2	307.95	44869.146
18	Doors and windows		LS	5000*D+200	100000
19	White washing and paint	540.2	m^2	20	10804.479
			Total	Rs.	**2730604.8**

Note: RATE as per DSR 2023