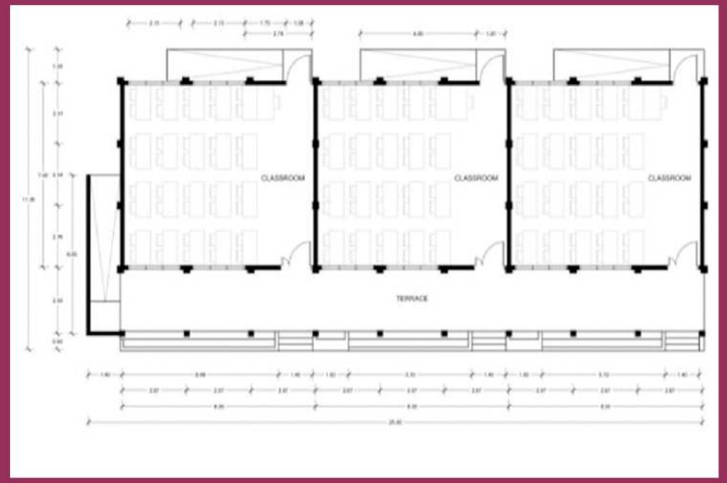
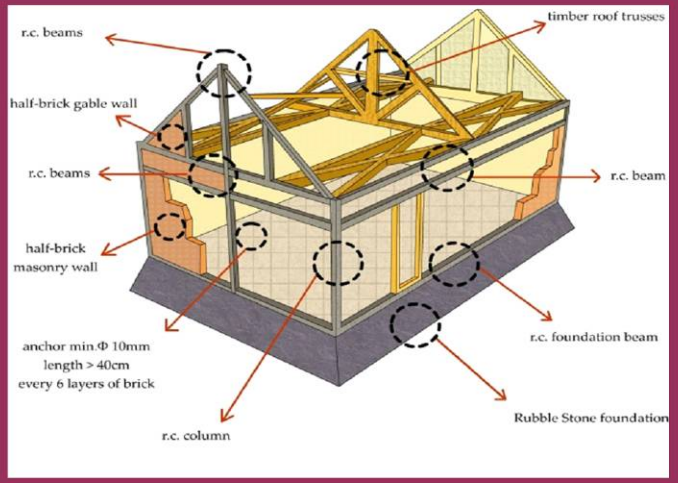
Handbook of typical school design (case study)





Save the Children® 2009

HANDBOOK OF TYPICAL SCHOOL DESIGN

(CASE STUDY)

Hari Darshan Shrestha

Khrisna S. Pribadi

Dyah Kusumastuti

Edwin Lim

Arwin Soelaksono

Mission of Save the Children

To create lasting, positive change in the lives of children in need

Vision of Save the Children

A world in which every child is ensured the right to survival, protection, development and participation as set forth in the United Nations Convention on the Right of Children

This book developed from Save the Children best practices in Aceh Program by Save the Children, Construction Quality and Technical Assistance (CQTA)

In collaboration with center for Disaster Mitigation – Institute of Technology Bandung (CDM – ITB)

PREFACE

Schools are institutions providing an education as well as a common place for community gatherings and meetings. They should be models in providing examples of quality education and the enhancement of the environment & physical facilities. Schools not only provide opportunities for formal education, but also for social development and personal growth.

Despite this, there are millions of schools around the world that are unsafe. There is an urgent need to create greater awareness of safer school construction in new schools, while at the same time making sure that the existing school buildings are safe. This can be done through the implementation of general practices of safe school construction and the retrofitting of existing school buildings.

Creating a culture of safe school construction is possible and need not be as complicated as some may seem. It can be implemented simply by establishing standards of design and construction of school buildings, developing a local building code and ensuring that the code and standards are met. The challenge is the thousands of unsafe existing school buildings around the globe where millions of children are at risk. Recent disasters such as the earthquake in Pakistan and China, the cyclone in Bangladesh and the infamous hurricane Katrina in the USA have caused the destruction of thousands of schools and with them the lives of many students and teachers. This shows the urgent need to make schools safer for everyone.

Save the Children initiated the creation of safe and child friendly school construction. Save the Children is conducting workshops and trainings as well as developing guidelines and manuals to support this initiative.

These documents are based on best practices in Indonesia, the most seismic prone country in the world. We believe these resources could be useful for other countries facing similar challenges as well as other organizations working on building the capacities of local authorities to effectively implement safe and child friendly school buildings.

We would like to thank Dr. Krishna Pribadi, Dr. Dyah Kusumastuti and Mr. Edwin Lim from the Center for Disaster Mitigation - Institute of Technology Bandung, and Mr. Hari Darshan Shrestha for their contributions on the development of this document.

Mike Novell

AVP, Asia Area office

Save the Children

CONTENTS

1. Analysis and Design of the Structure

The structural analysis was conducted using a structural platform/software called SAP2000. This software was utilized to obtain the internal force for each element of beams and column elements based on applicable loads. The calculation to obtain member sizes and required reinforcement bars for each element was conducted manually.

The loading condition for beams and columns used in the design was based on Indonesian Standards, PPI-1983 and SNI 03-2847-2002 (for combination loads), and SNI 03-1726-2002 for earthquake load.

2. Design Notes

- In adopting this design, the school community should determine on how many rooms needed for the school. The design must be adopted as an integral unit (block) of 3 classrooms.
- This school is design to meet the minimum criteria provided in *Standar Sarana dan Prasarana Sekolah/Madrasah Pendidikan Umum (Standard of Facilities in Public Education School/Madrasah).*

3. NOTES

In this book, typical example of school building design is presented. The design presented here is taken from the Save the Children Construction Department project in Aceh Reconstruction Program. Some points must be considered before adopting this design:

1. The design of the building is based on the open frame concept.
2. The structural dimensions and detailing for beams and columns are different than the ones obtained based on "confined masonry" concept.
3. This open-frame design of school building was adapted by Save the Children in Aceh Tsunami Rehabilitation and Reconstruction Program, but this is not in general practiced in Indonesia as confined masonry is the most common practice in Indonesia.

In designing the building, Save the Children Construction Department implemented 5 features as part of Save the Children Safe and Child-friendly School Initiative program. The features are:

- Earthquake resistant features

The earthquake resistant features include:

- design and construction according to latest code and compliance with earthquake regulations,
- simple rectangular and symmetric in plan and elevation,
- limit to single story and 3 classroom maximum,
- gable wall and free-standing wall,
- lightweight roof material,
- no overhanging element, proper connection and band,
- proper fixing and layout of non structural element.

- Disaster risk reduction features

The disaster risk reduction features include:

- low hazard site location,
- community participations,

- door panel open outward with lateral push,
- stable study table,
- emergency escape door in each room and path.

➢ Child friendly features

The child friendly features include:

- the obtuse edge of the school tables
- non-structural elements (cladding) and structural elements (column)
- special ramp for the disabled students
- natural light and proper ventilation
- wide terrace for outdoor activities
- separate toilet blocks for girls and boys
- sliding window opening
- safe play area and fencing around compound.

➢ Hygiene and nutrition features

The hygiene and nutrition features include:

- proper water sanitation and drainage system at the school
- hand washing water station in front every classroom.

➢ Environmental friendly features

Environmental friendly features include:

- plantation at the terrace and surroundings
- the usage of light steel and aluminum for trusses and door-window framing in spite of timber.

4. TYPICAL DESIGN OF 3 CLASSROOM SCHOOL BUILDING

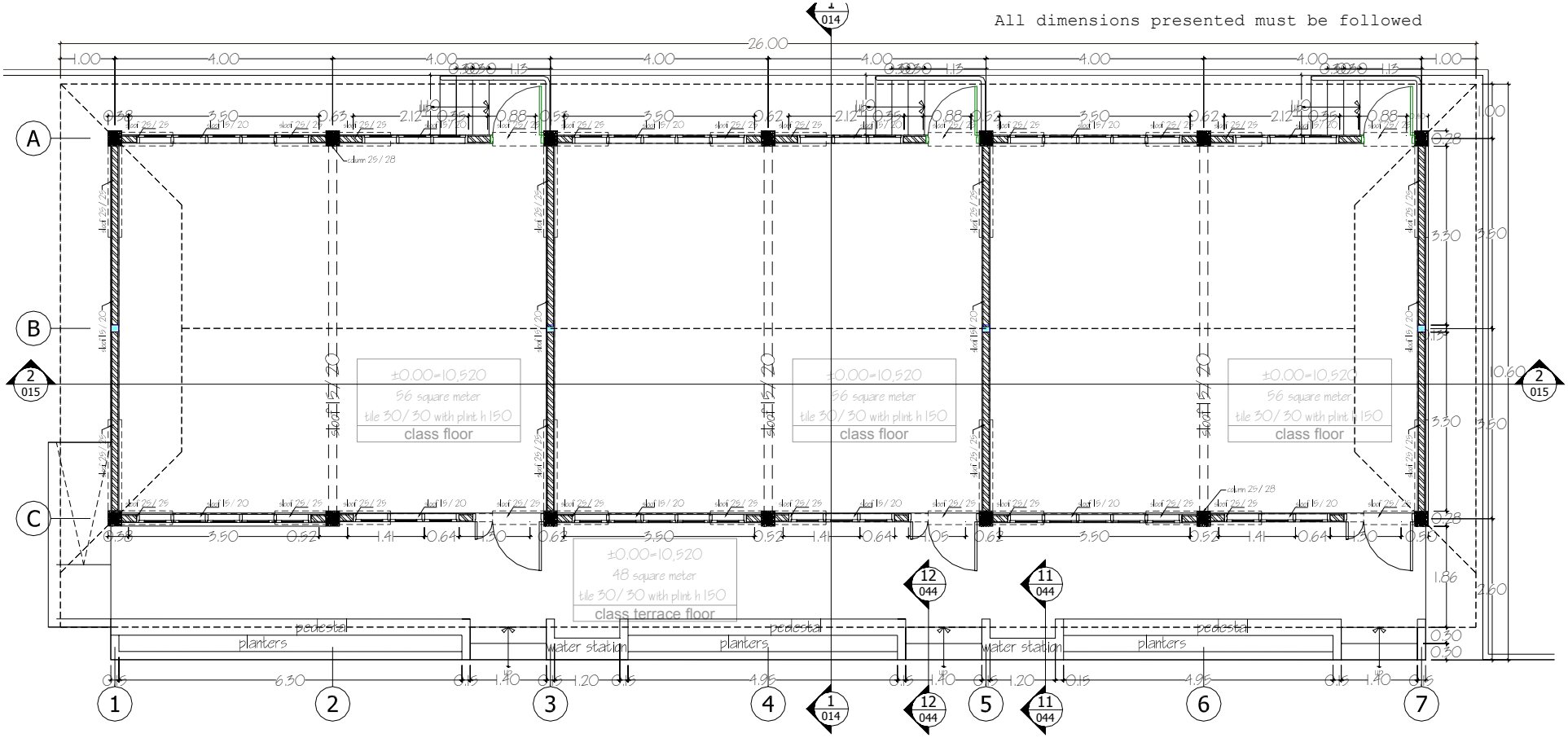
4.1 Architectural Drawings

Note:

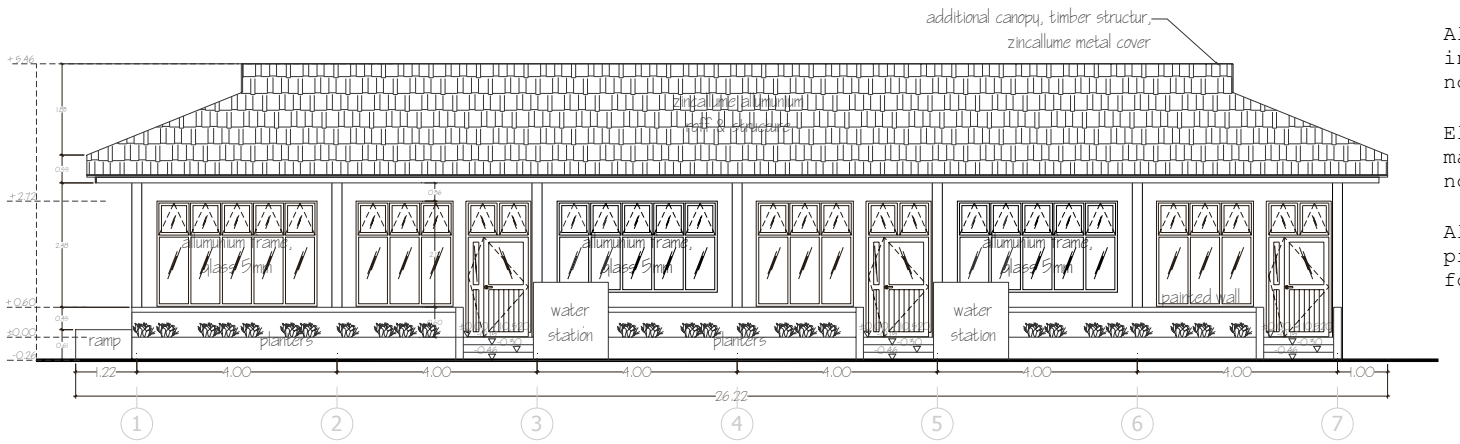
All dimensions are in meters unless noted otherwise

Elevations are in meters unless noted otherwise

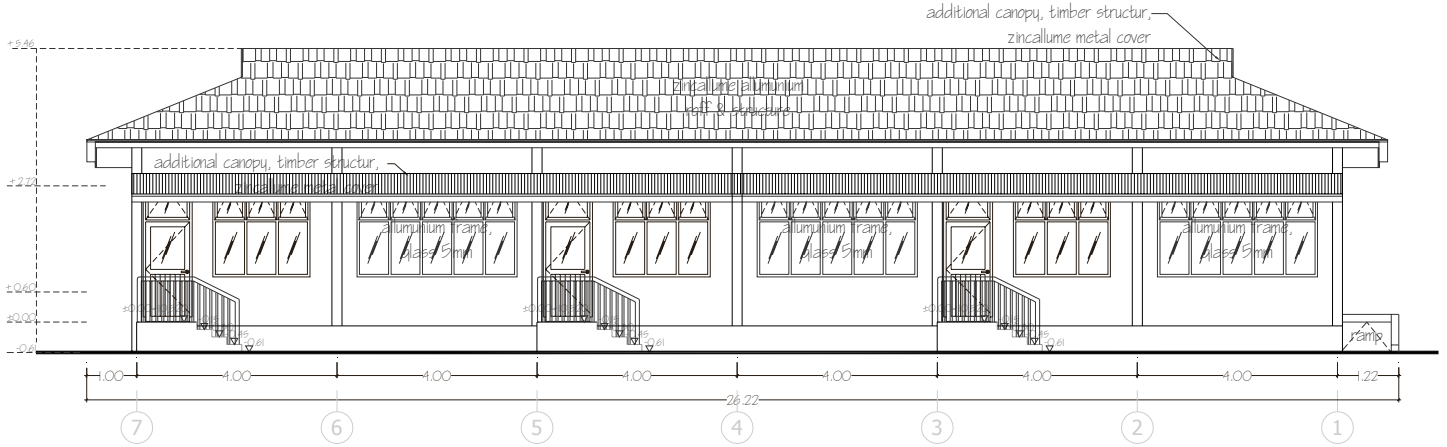
All dimensions presented must be followed



Drawing no. AR-1 Plan



28 New View 1-7
Scale: 1:100



29 New View 7-1
Scale: 1:100

Note:

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Elevations are in maters unless noted otherwise

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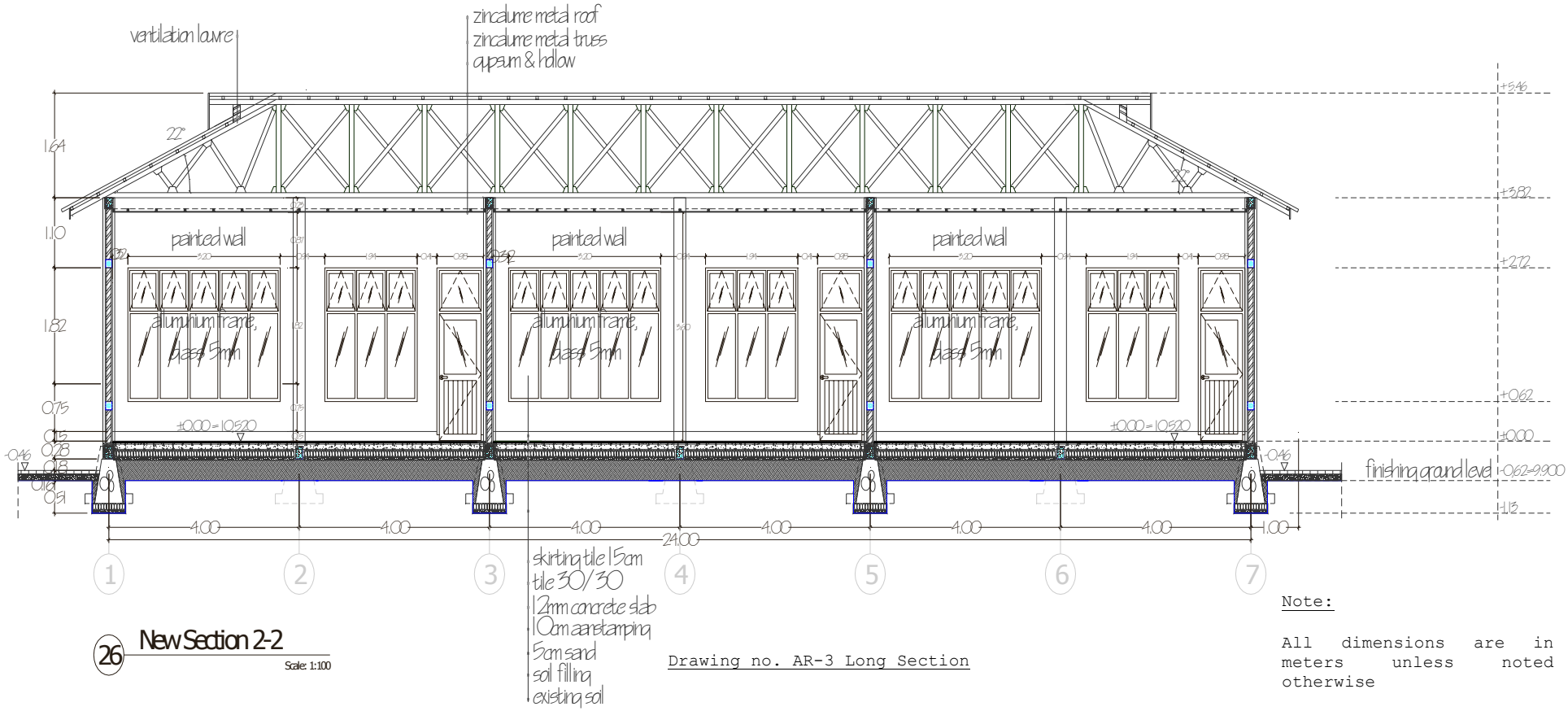
Drawing no. AR-2 View



26 New Section 2-2

Scale: 1:100

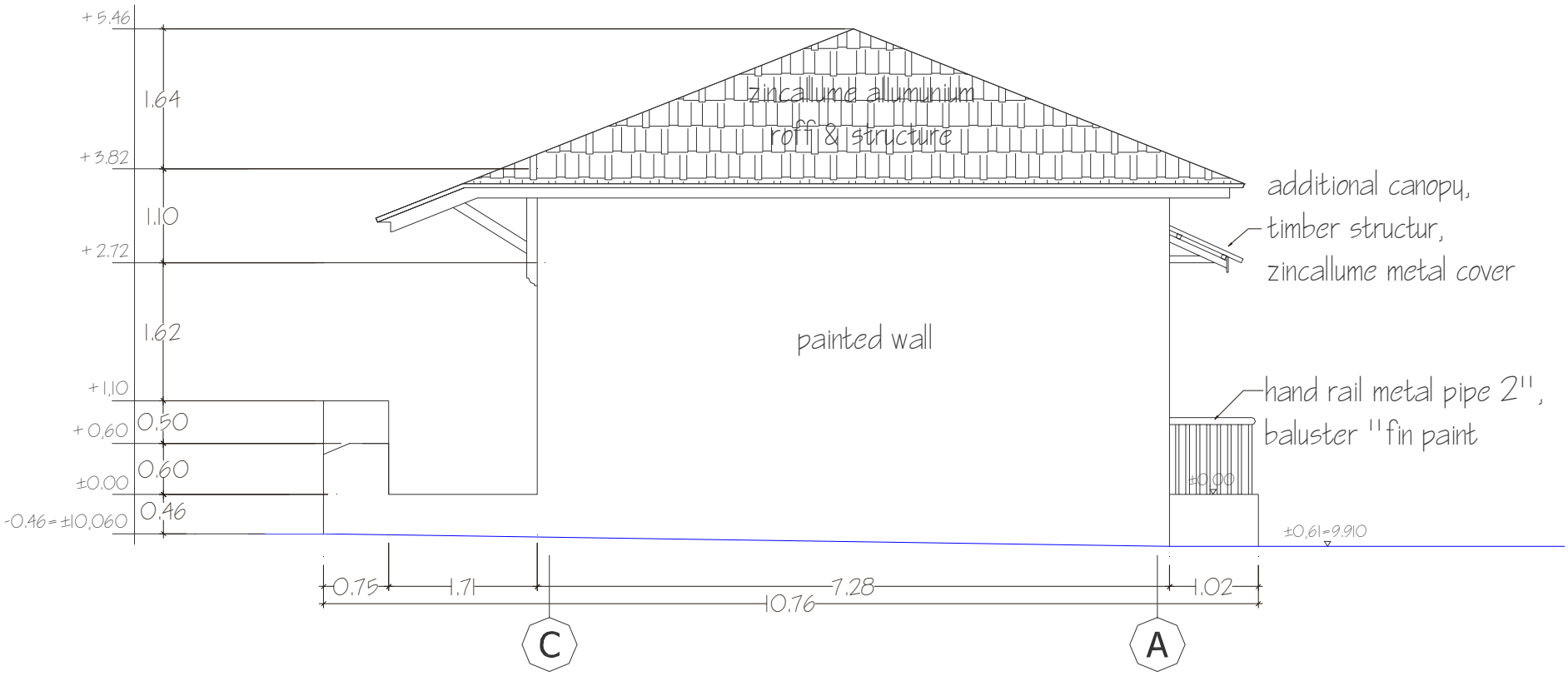
Drawing no. AR-3 Long Section

Note:

All dimensions are in meters unless noted otherwise

Elevations are in maters unless noted otherwise

All dimensions presented must be followed



30 New View C-A

Scale: 1:100

Drawing no. AR-4 Cross Section

Note:

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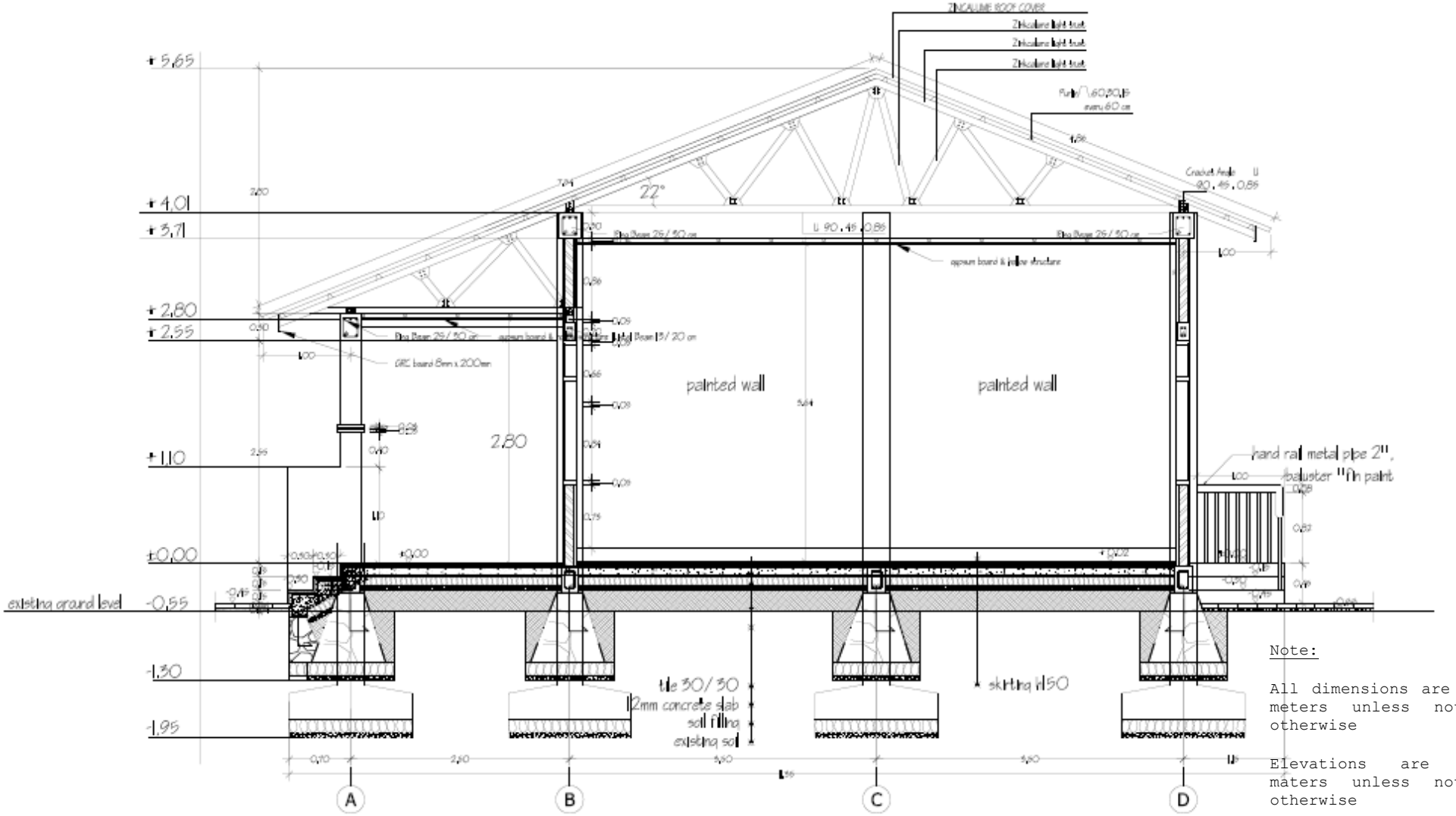
Elevations are in maters unless noted otherwise

All dimensions presented must be followed



05 Section 1-1

Drawing no. AR-5 Cross Section (2)

Note:

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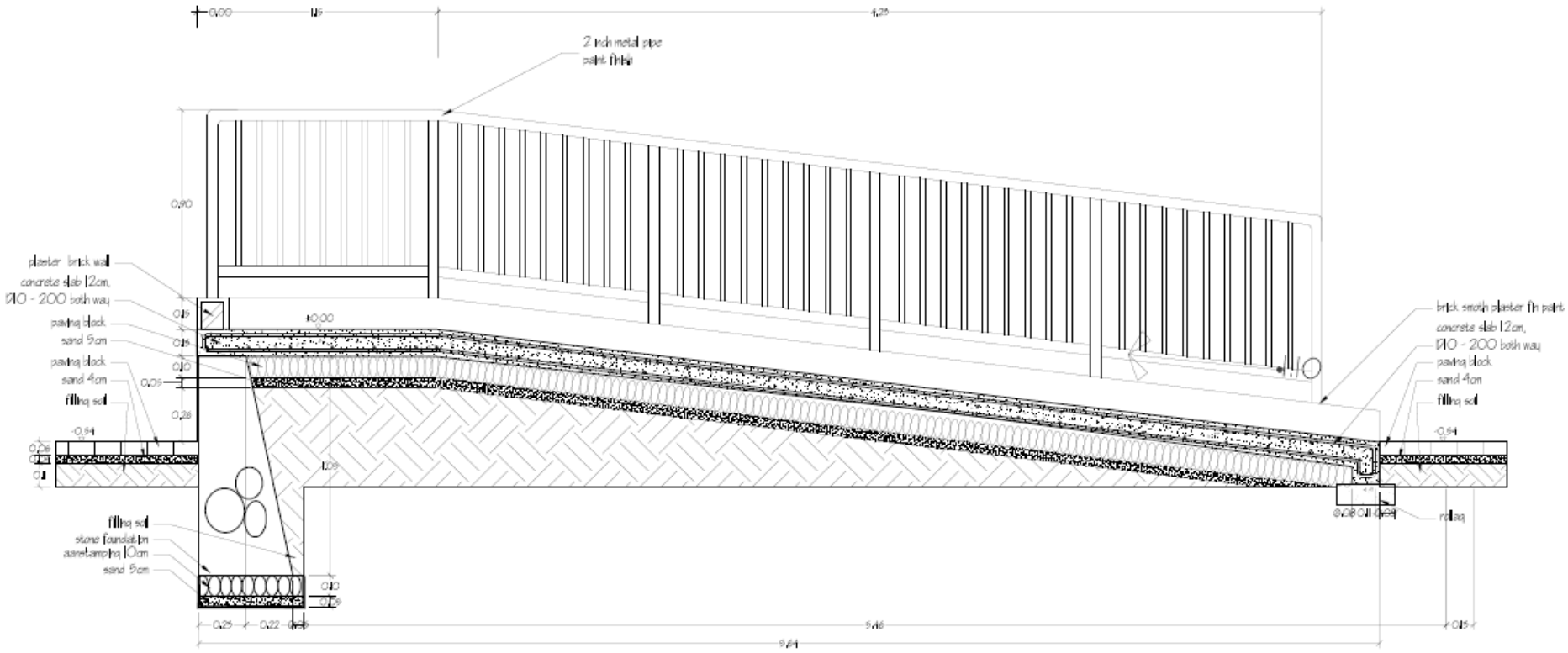
Elevations are in maters unless noted otherwise

All dimensions presented must be followed



Drawing no. AR-6 Ramp

Note:

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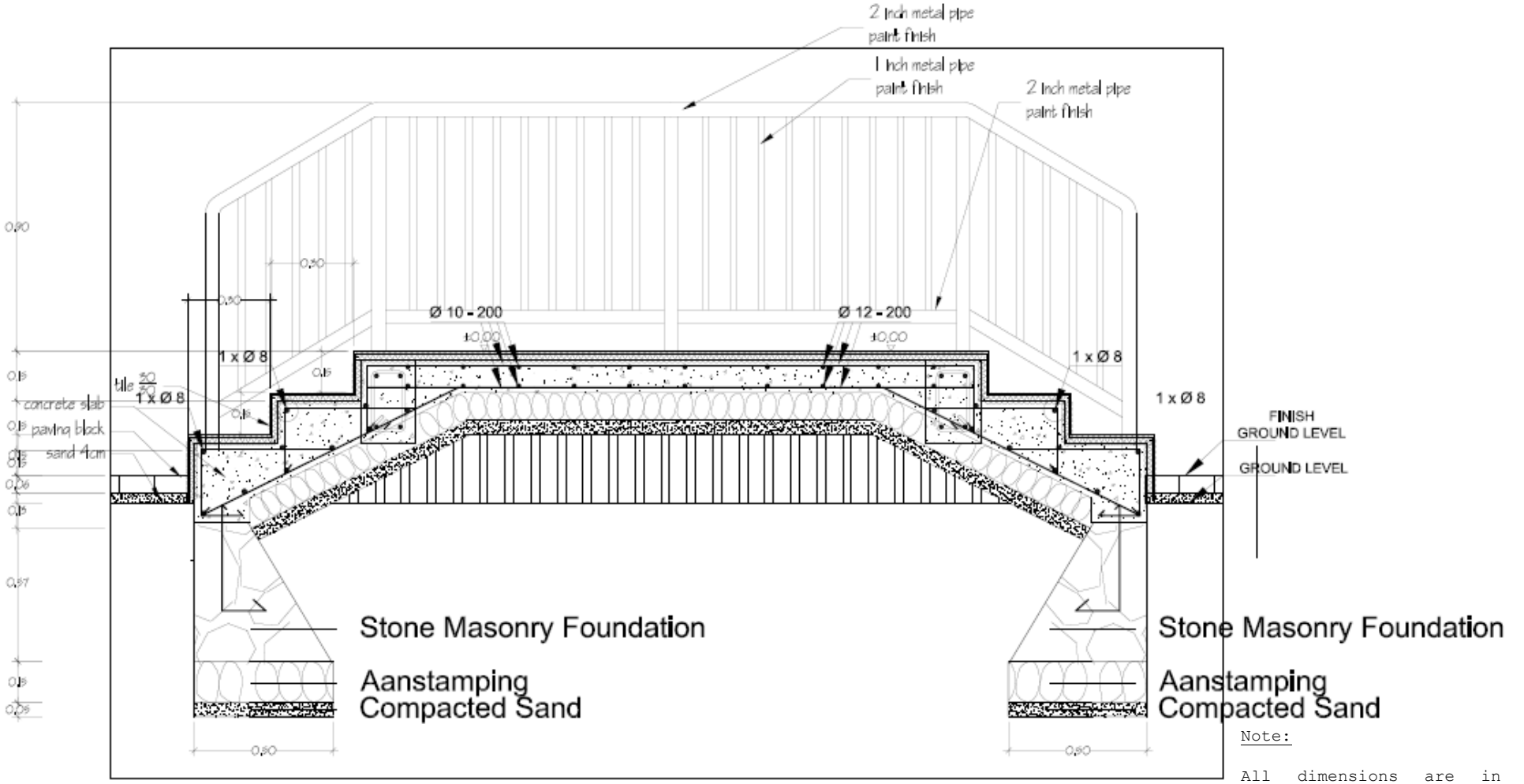
Elevations are in maters unless noted otherwise

All dimensions presented must be followed



Drawing no. AR-6 Stairs and Handrails

Note:

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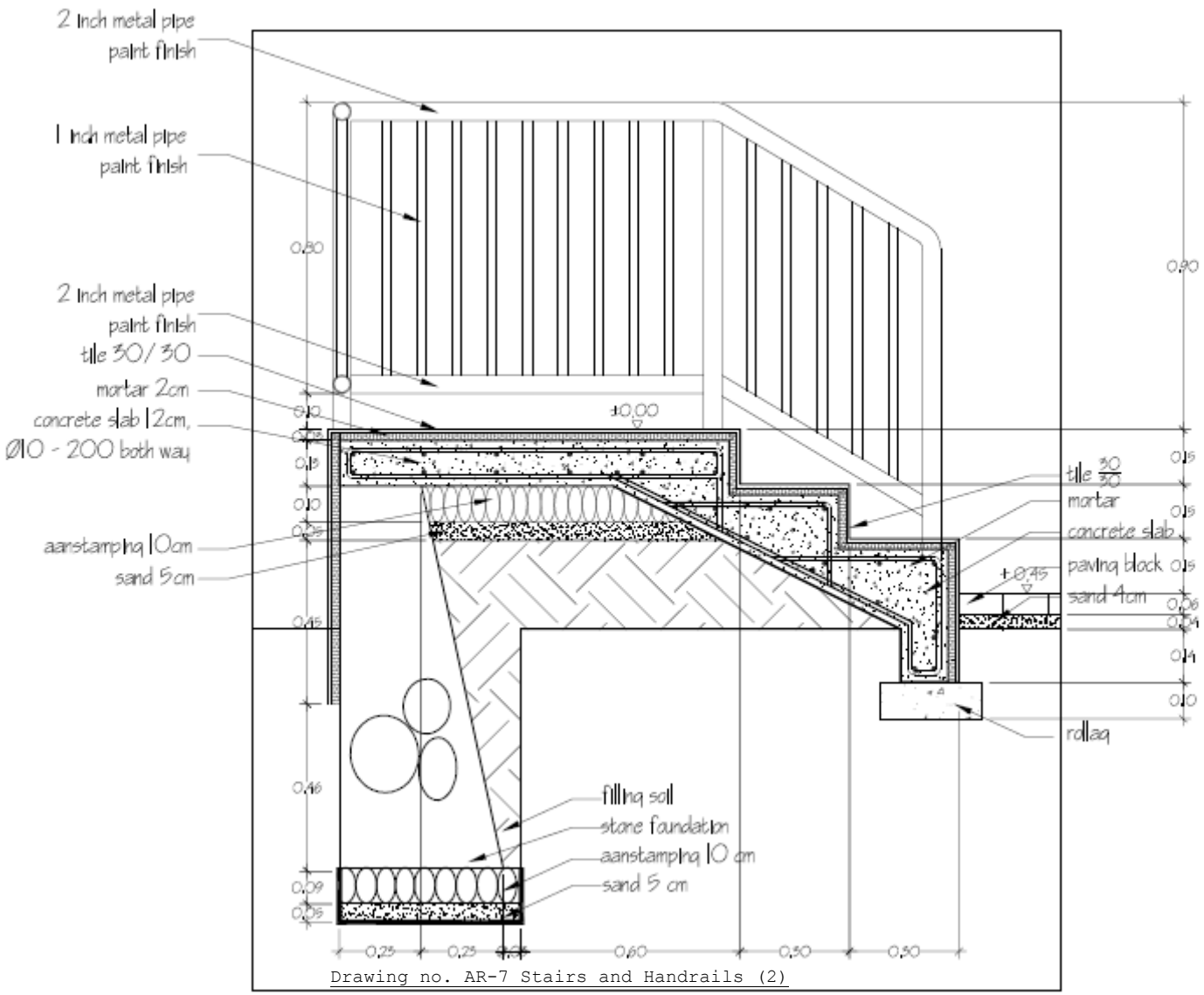
Elevations are in maters unless noted otherwise

All dimensions presented must be followed



Drawing no. AR-7 Stairs and Handrails (2)

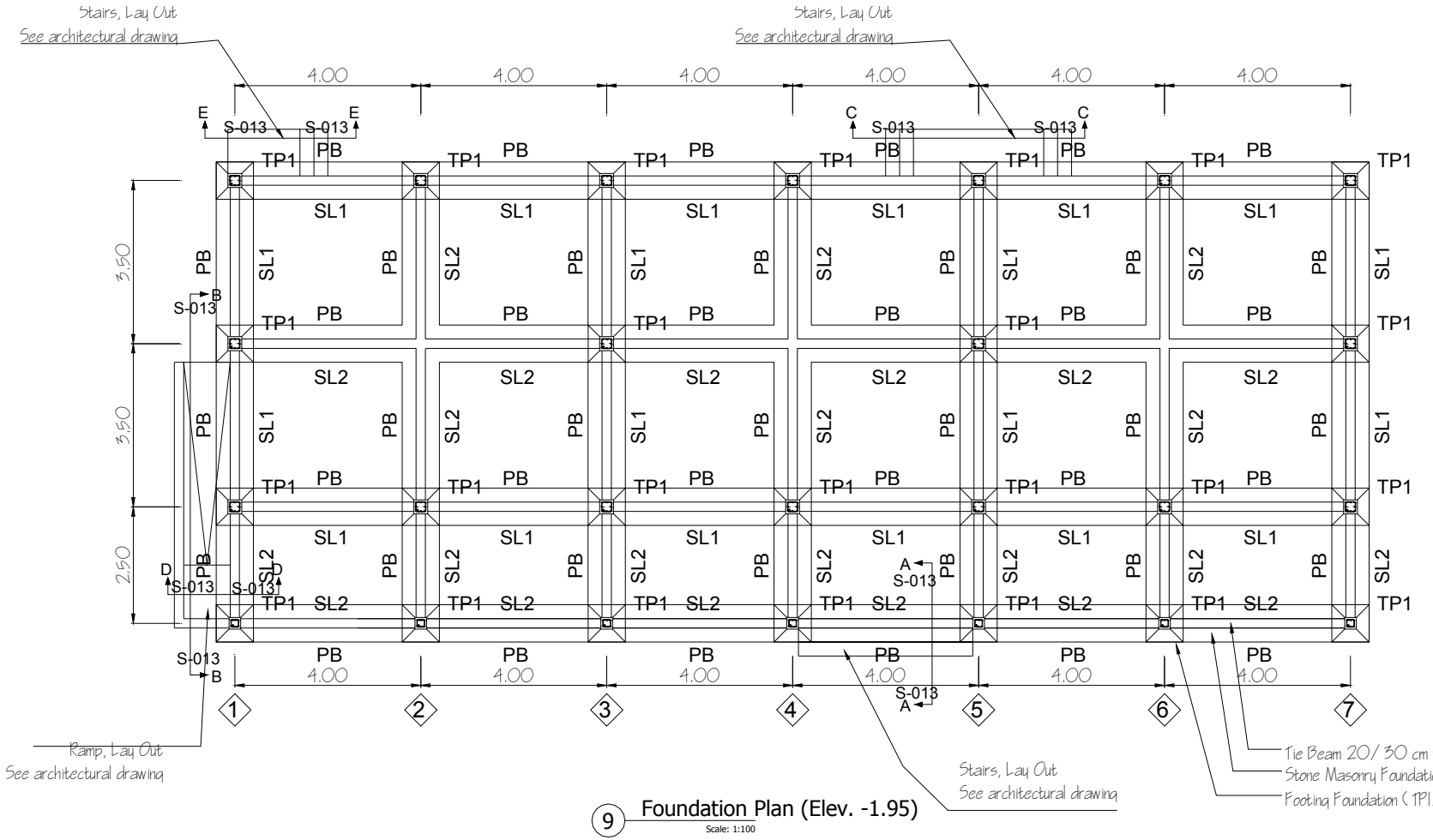
Note:

All dimensions are in meters unless noted otherwise

Elevations are in maters unless noted otherwise

All dimensions presented must be followed

4.2 Structural Drawings



9 Foundation Plan (Elev. -1.95)
Scale: 1:100

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

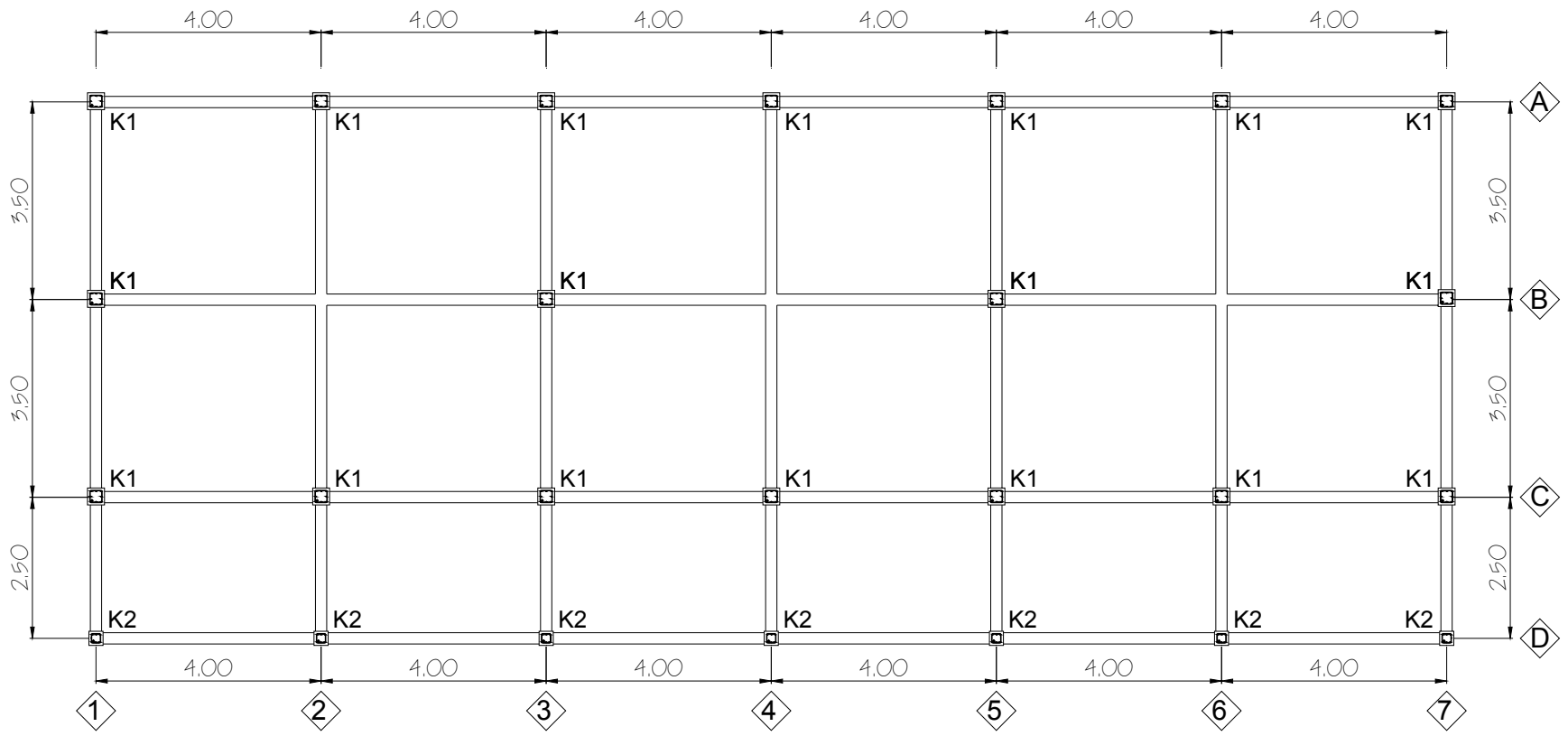
All dimensions presented must be followed

Concrete Strength: K-225,
Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

Drawing no. SR-1 Foundation Plan



10 Column Plan (Elev. ±0.00)
Scale: 1:100

Note:

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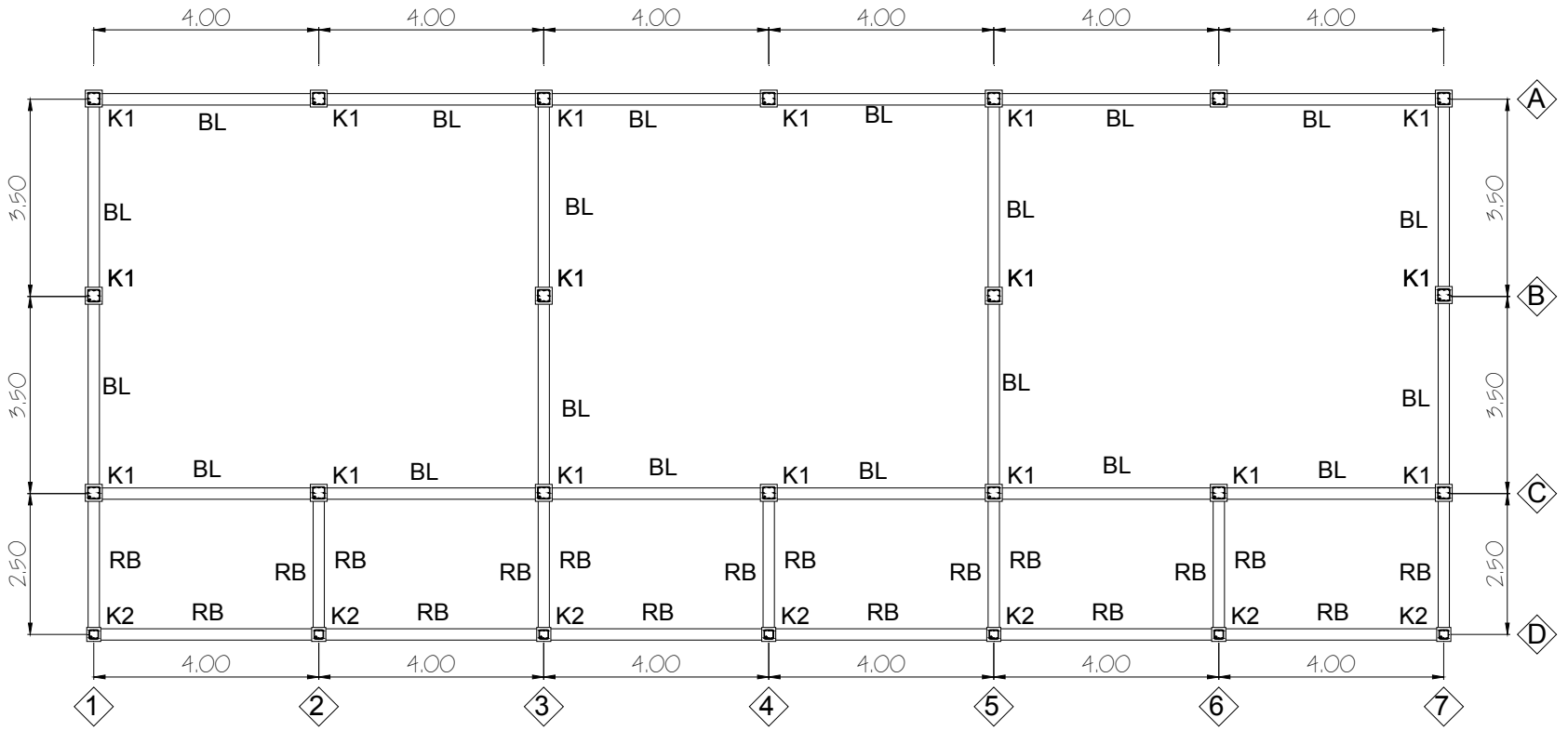
All dimensions presented must be followed

Concrete Strength: K-225,
Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

Drawing no. SR-2 Column Plan



11 Lintel Beam & Ring Beam Plan (Elev. +2.55)
Scale: 1:100

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

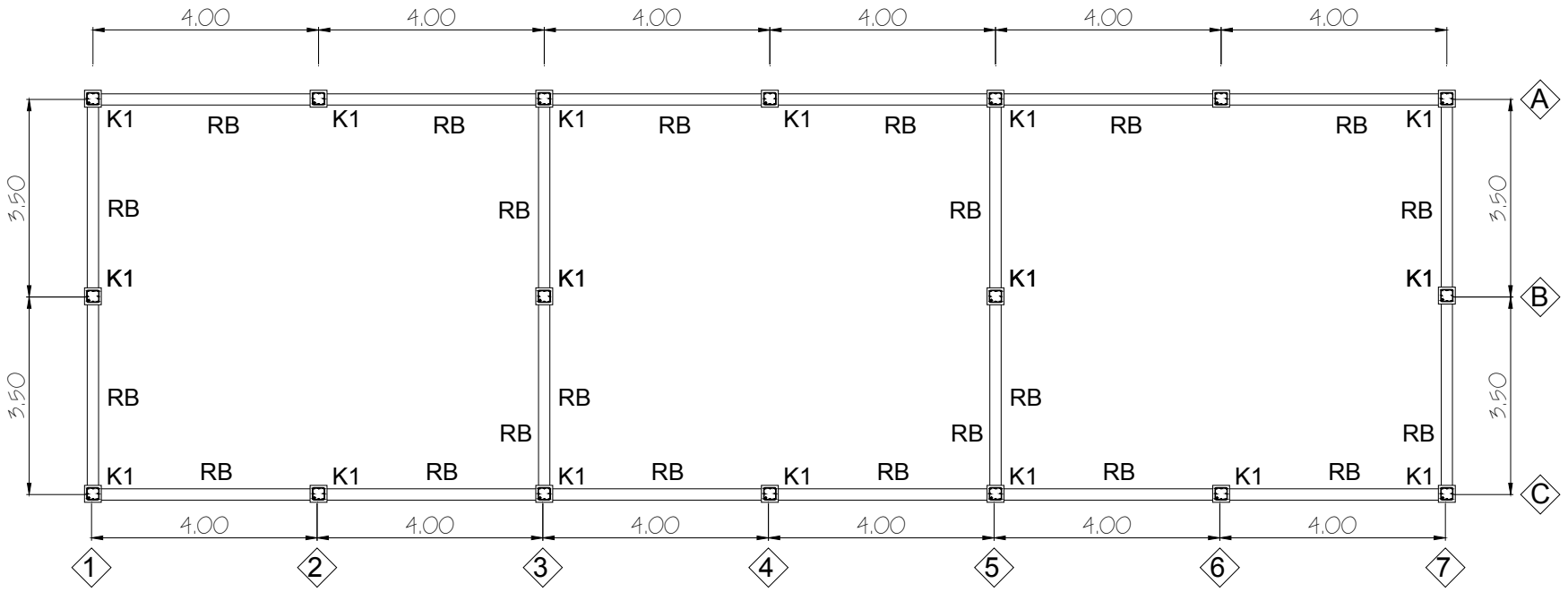
All dimensions presented must be followed

Concrete Strength: K-225,
Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

Drawing no. SR-3 Lintel Beam & Ring Beam Plan



12 Ring Beam Plan (Elev. +3.71)
Scale: 1:100

Note:

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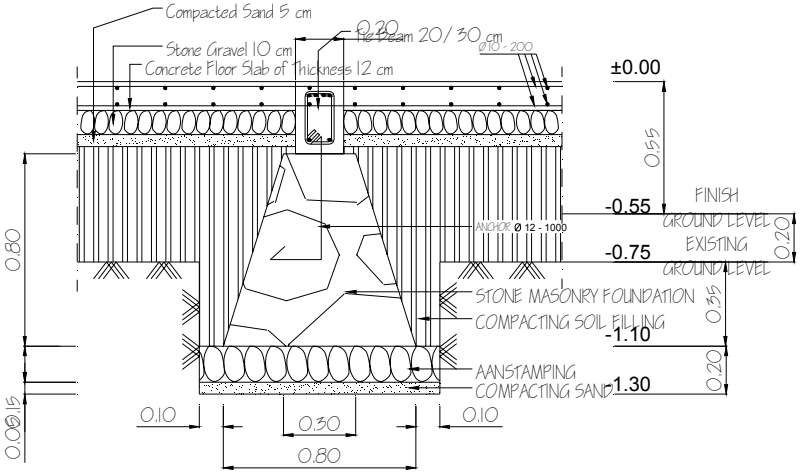
All dimensions presented must be followed

Concrete Strength: K-225, Reinforcement Bar:

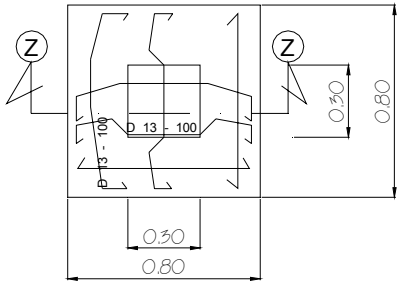
D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

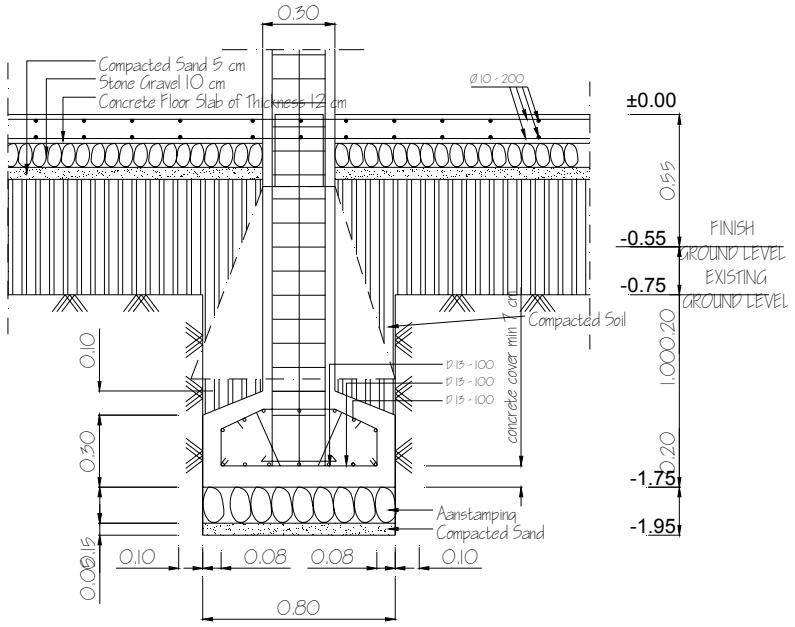
Drawing no. SR-4 Ring Beam Plan



17 Stone Masonry Foundation - Detail (PB)
Scale: 1:20



15 Foot Plate Foundation Plan
Scale: 1:20



16 Foot Plate Fondation Detail (Section Z-Z)
Scale: 1:20

Drawing no. SR-5 Foundation Detail

Note:

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Elevations are in meters unless noted otherwise

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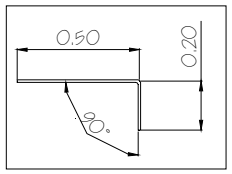
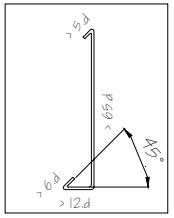
D ≥ 10 mm, fy = 4000 kg/cm^2,

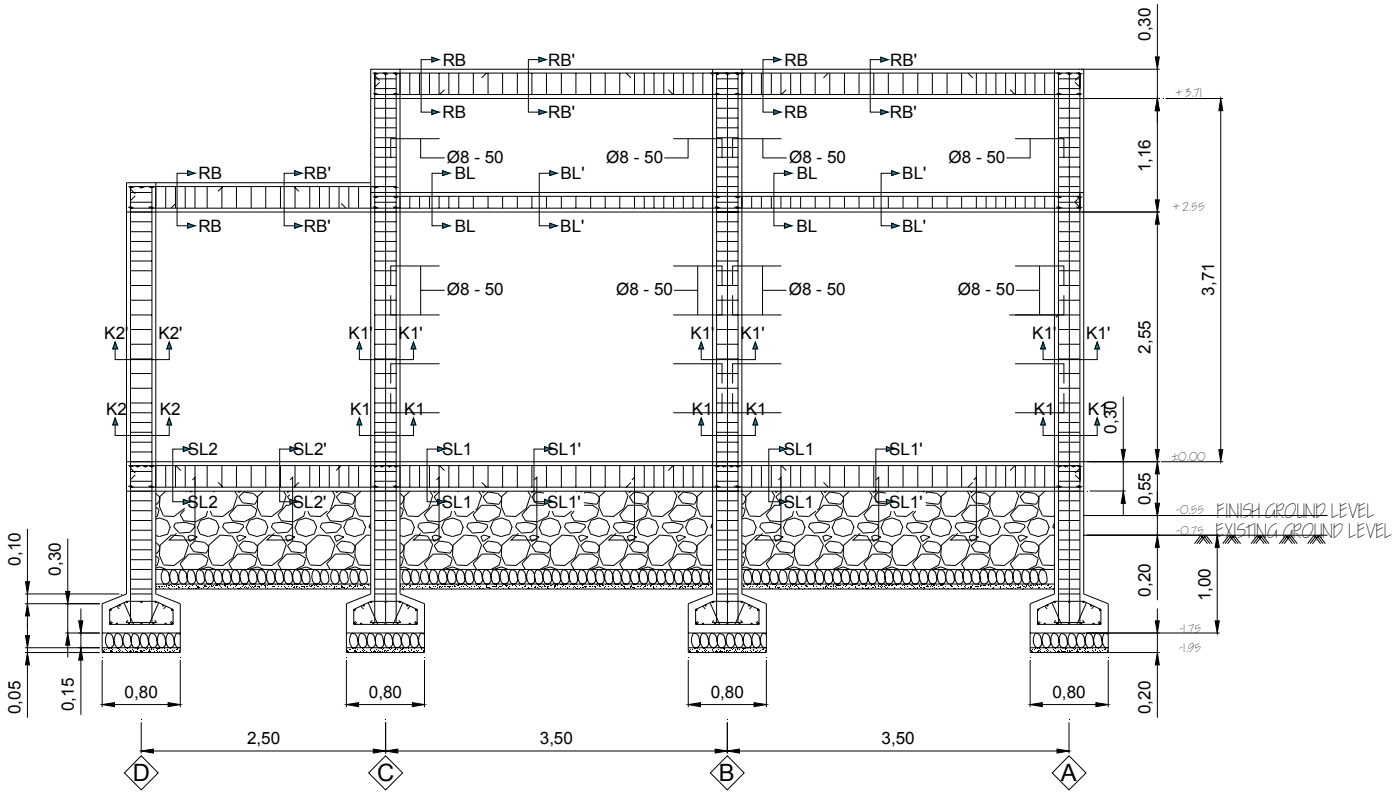
D < 10 mm, fy = 2400 kg/cm^2



18 Detail Wall Anchor Ø8-500
Scale: 1:20



19 Detail Foundation Anchor D12-1000
Scale: 1:20



20 Frame Reinforcement Grid 1,3,5 & 7
Scale: 1:50

Drawing no. SR-6 Reinforcement Grid 1, 4, 7 & 10

Note:

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Elevations are in meters unless noted otherwise

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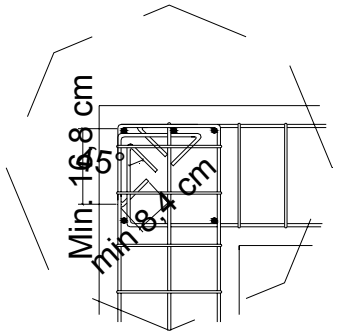
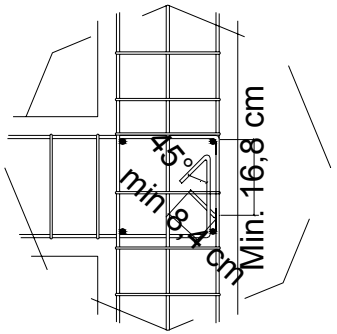
Concrete Strength: K-225, Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

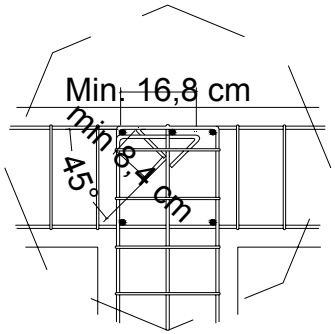
D < 10 mm, fy = 2400 kg/cm^2



45 Section A
Scale: 1:10



46 Section B
Scale: 1:10



47 Section C
Scale: 1:10

Note:

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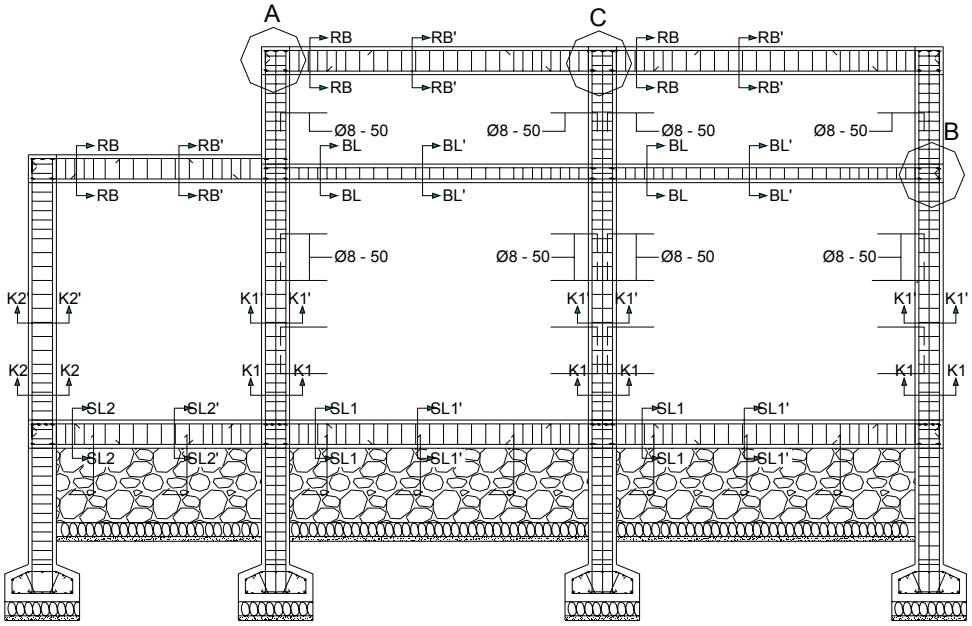
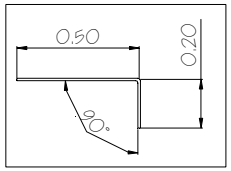
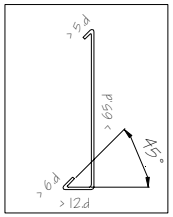


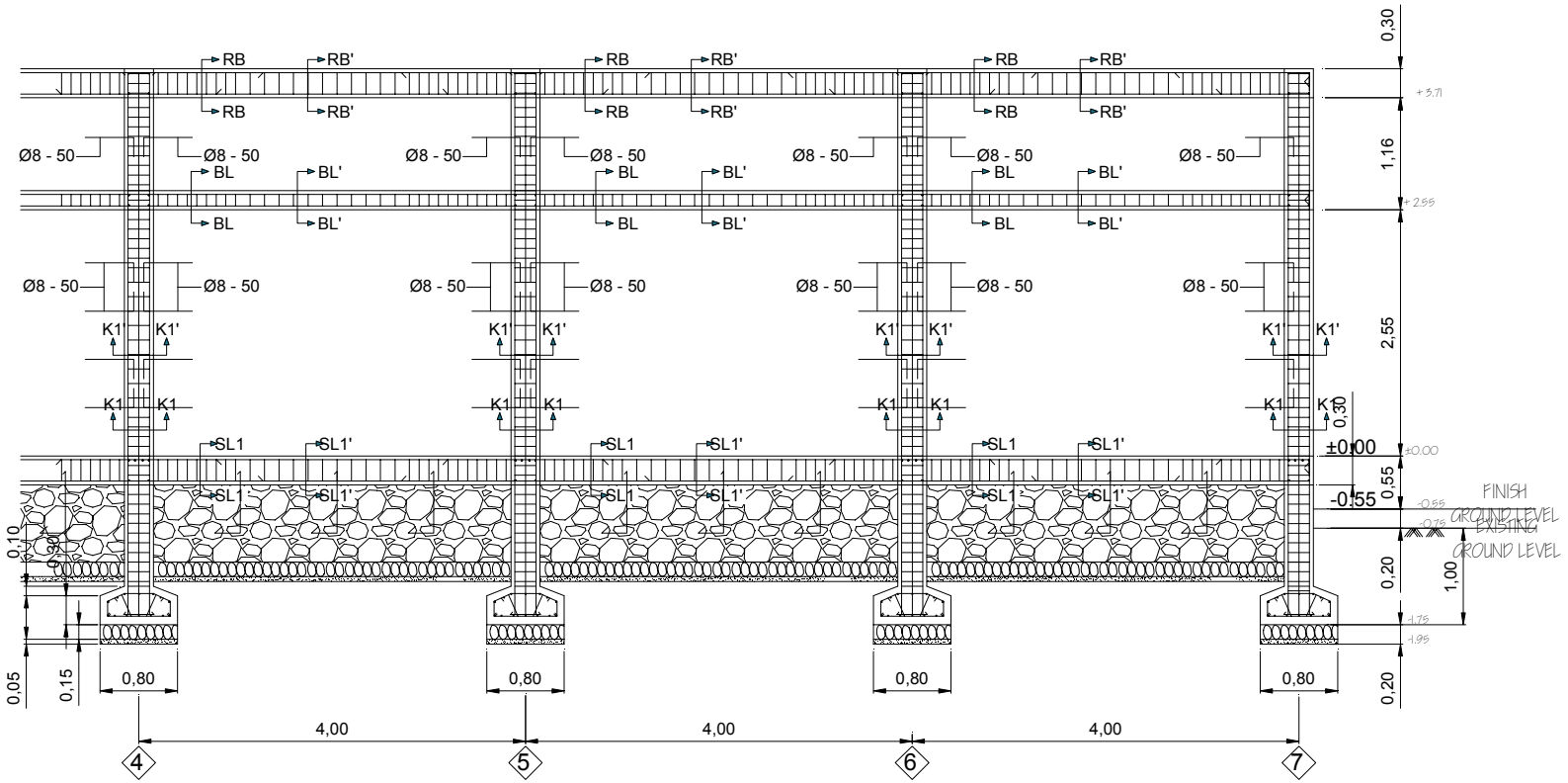
Drawing no. SR-7 Reinforcement Detail



23 Detail Wall Anchor Ø8-500
Scale: 1:20



24 Detail Foundation Anchor D12-1000
Scale: 1:20



25 Frame Reinforcement Grid A & C (Continue)
Scale: 1:50

Drawing no. SR-8 Reinforcement Grid A & D (Continue)

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

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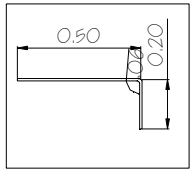
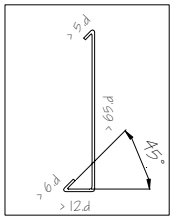
Concrete Strength: K-225, Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

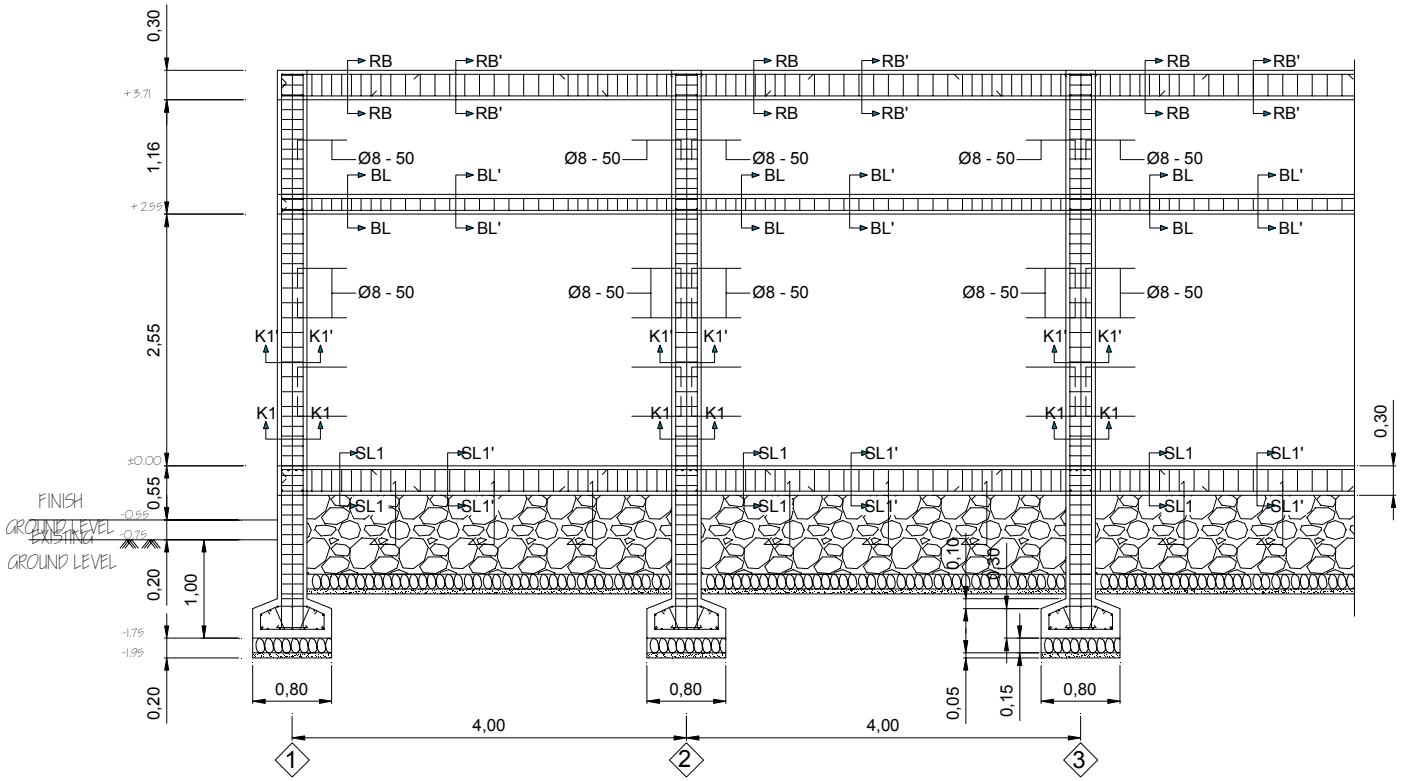
D < 10 mm, fy = 2400 kg/cm^2



26 Detail Wall Anchor Ø8-500
Scale: 1:20



27 Detail Foundation Anchor D12-1000
Scale: 1:20



28 Frame Reinforcement Grid A & C
Scale: 1:50

Drawing no. SR-9 Reinforcement Grid A & D

Note:

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Elevations are in meters unless noted otherwise

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Reinforcement Bar:

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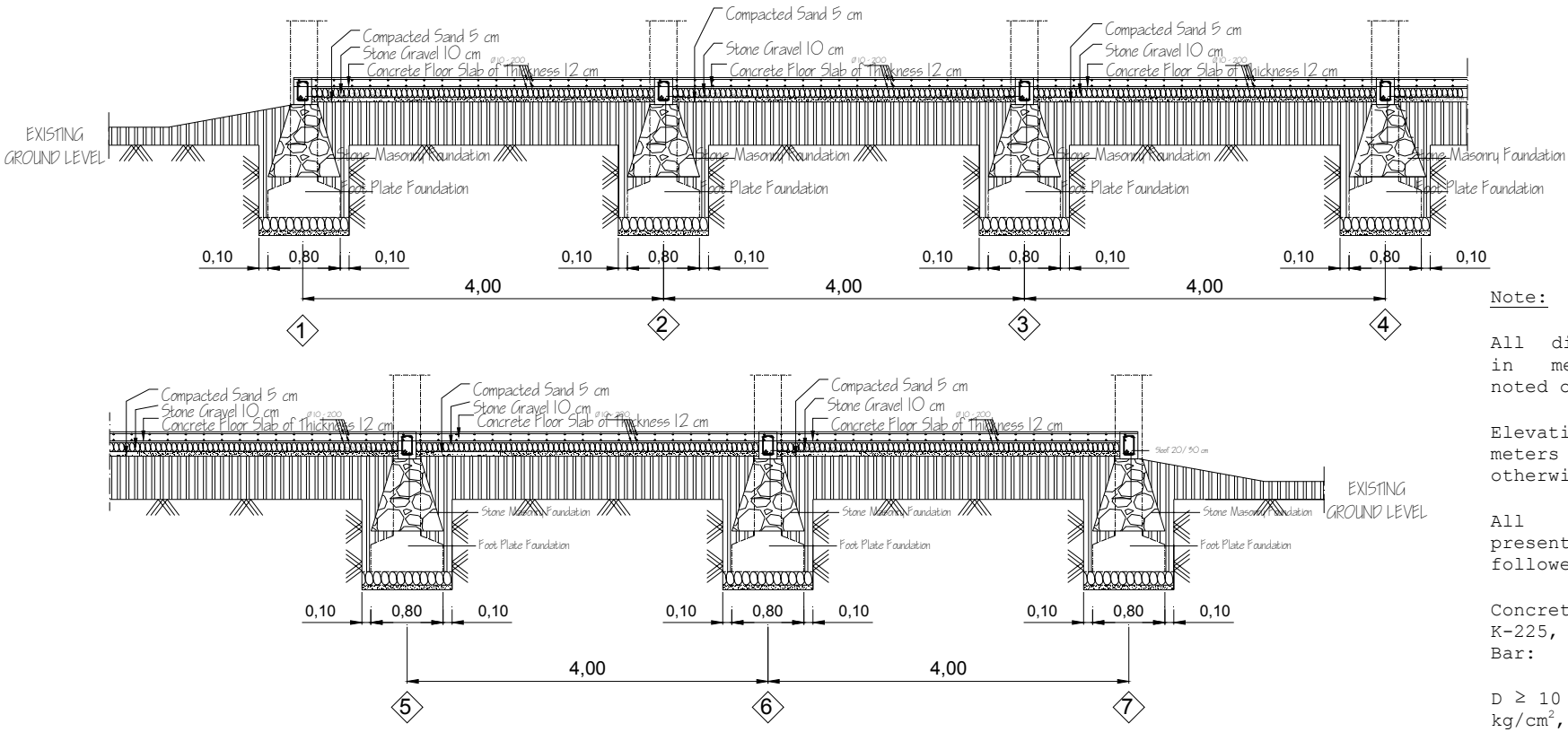
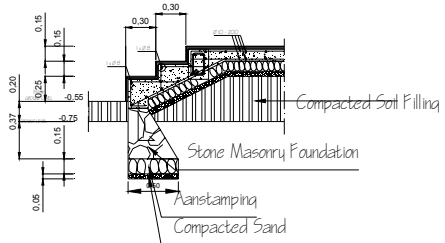
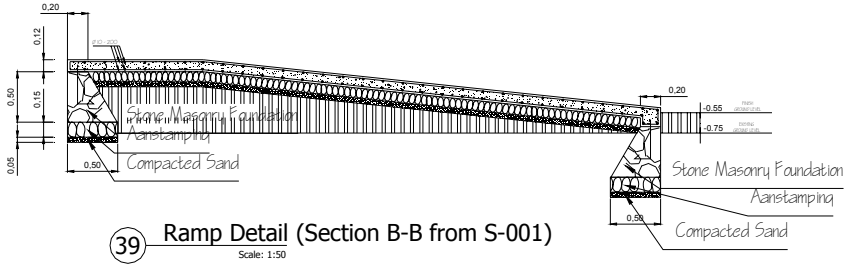
D < 10 mm, fy = 2400 kg/cm^2



37 Floor Reinforcement Section X-X (Elev. -0.03)
Scale: 1:50



38 Stairs Detail (Section A-A from S-001)
Scale: 1:50



39 Ramp Detail (Section B-B from S-001)
Scale: 1:50

Drawing no. SR-10 Floor Reinforcement Section X-X

Note:

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Elevations are in meters unless noted otherwise

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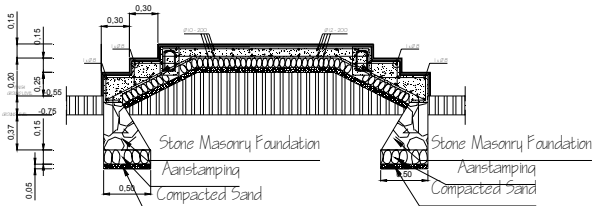
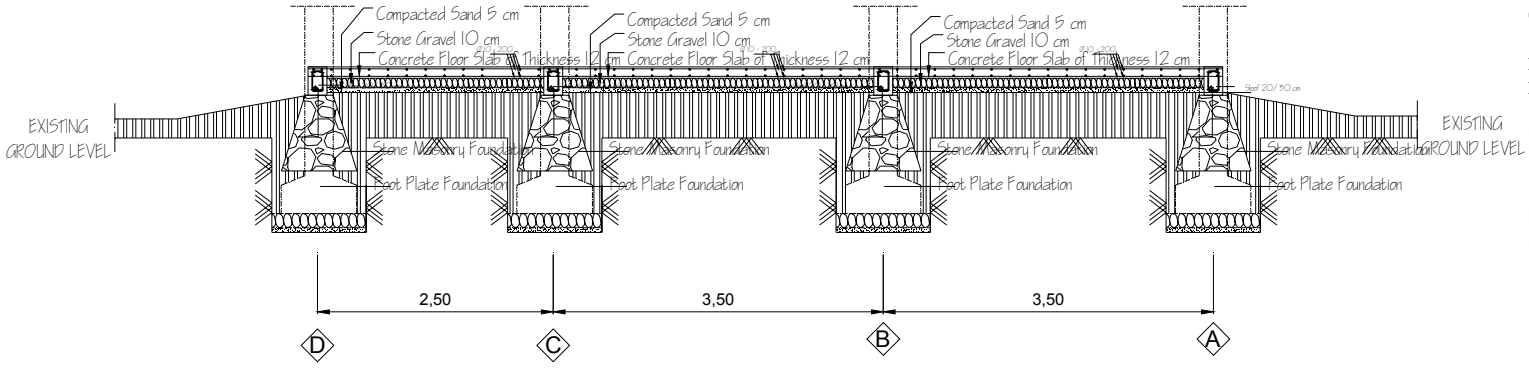
Concrete Strength: K-225, Reinforcement Bar:

D ≥ 10 mm, fy = 4000 kg/cm^2,

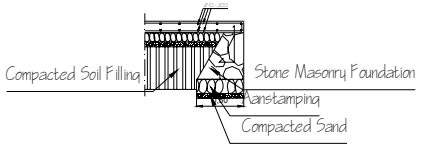
D < 10 mm, fy = 2400 kg/cm^2



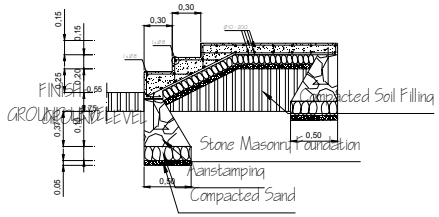
40 Stairs Detail (Section C-C from S-001)
Scale: 1:50



41 Floor Reinforcement Section Y-Y (Elev. - 0.03)
Scale: 1:50



42 Stairs Detail (Section D-D from S-001)
Scale: 1:50



43 Stairs Detail (Section E-E from S-001)
Scale: 1:50

Drawing no. SR-11 Floor Reinforcement Section Y-Y

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

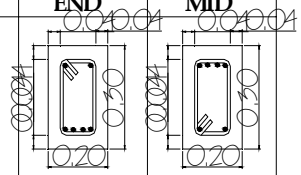
All dimensions presented must be followed

Concrete Strength: K-225, Reinforcement Bar:

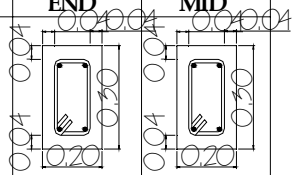
D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

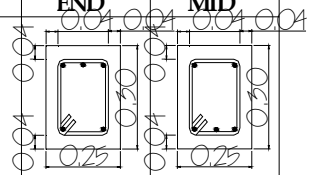
LIST OF SLOOF

NOTATION	SL1	SL1'
POSITION	END	MID
SECTION		
B x D	20 x 30 cm	
TOP BAR	2 D 13	4 D 13
BOTTOM BAR	4 D 13	2 D 13
STRIRRUP	Ø 8 - 10	Ø 8 - 15
WEB BAR		
NOTE		

LIST OF SLOOF

NOTATION	SL2	SL2'
POSITION	END	MID
SECTION		
B x D	20 x 30 cm	
TOP BAR	2 D 13	2 D 13
BOTTOM BAR	2 D 13	2 D 13
STRIRRUP	Ø 8 - 10	Ø 8 - 15
WEB BAR		
NOTE		

LIST OF RING BEAM

NOTATION	RB	RB'
POSITION	END	MID
SECTION		
B x D	25 x 30 cm	
TOP BAR	3 D 13	2 D 13
BOTTOM BAR	2 D 13	3 D 13
STRIRRUP	Ø 8 - 10	Ø 8 - 15
WEB BAR		
NOTE		

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

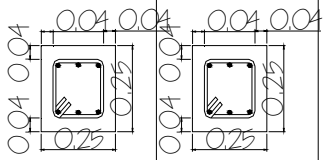
All dimensions presented must be followed

Concrete Strength: K-225, Reinforcement Bar:

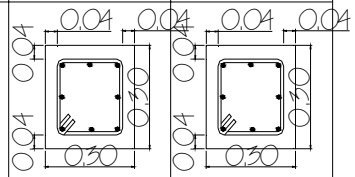
D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

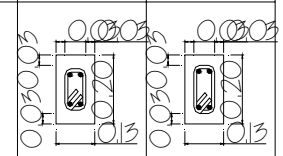
LIST OF COLUMN

NOTATION	K2	K2'
POSITION	END	MID
SECTION		
B x D	25 x 25 cm	
MAIN BAR	6 D 13	6 D 13
STRIRRUP	Ø 8 - 10	Ø 8 - 15
NOTE		

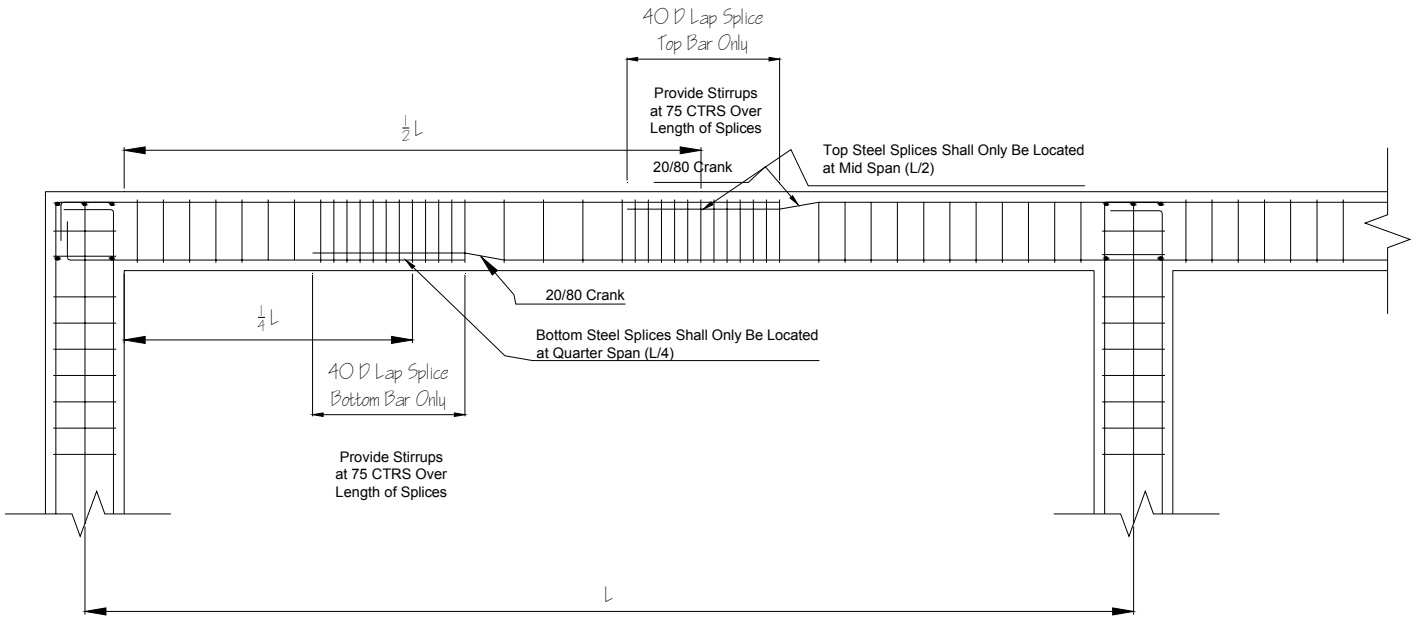
LIST OF COLUMN

NOTATION	K1	K1'
POSITION	END	MID
SECTION		
B x D	30 x 30 cm	
MAIN BAR	8 D 13	8 D 13
STRIRRUP	Ø 8 - 10	Ø 8 - 15
NOTE		

LIST OF LINTEL BEAM

NOTATION	BL	BL'
POSITION	END	MID
SECTION		
B x D	13 x 20 cm	
TOP BAR	2 Ø 12	2 Ø 12
BOTTOM BAR	2 Ø 12	2 Ø 12
STRIRRUP	Ø 8 - 10	Ø 8 - 15
WEB BAR		
NOTE		

Drawing no. SR-12 Reinforcement Detail



48 Permissible Beam Splice locations
Scale: 1:20

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in meters unless noted otherwise

All dimensions presented must be followed

Concrete Strength: K-225,
Reinforcement Bar:

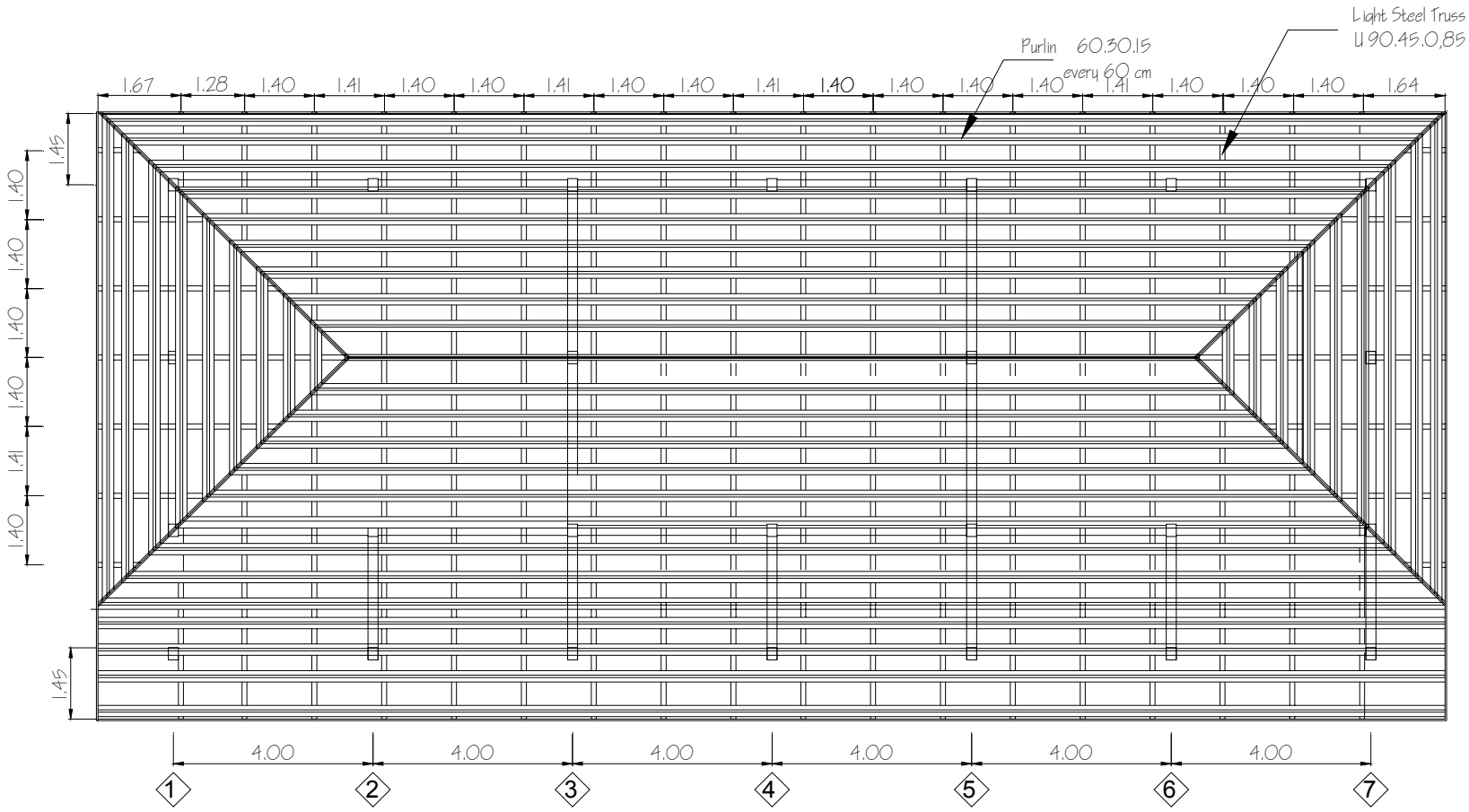
D ≥ 10 mm, fy = 4000 kg/cm^2,

D < 10 mm, fy = 2400 kg/cm^2

Minimum Lap Splice and Embedment Length

Type of Bar	Concrete Compression Strength fc (kg/cm²)	Without Hook				With Hook			
		S1	S2	S3		S1	S2	S3	
				Beam	Slab			Beam	Slab
SD 245 A, B SD 345	225	40 d	35 d	25 d	10 d & 150 mm	30 d	25 d	15 d	-

Drawing no. SR-13 Permissible Beam Splice Locations



49 Roof Plan
Scale: 1:100

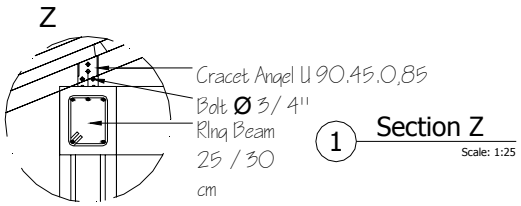
Note:

All dimensions are in meters unless noted otherwise.

Elevations are in maters unless noted otherwise

All dimensions presented must be followed

Drawing no. SR-14 Roof Truss Plan



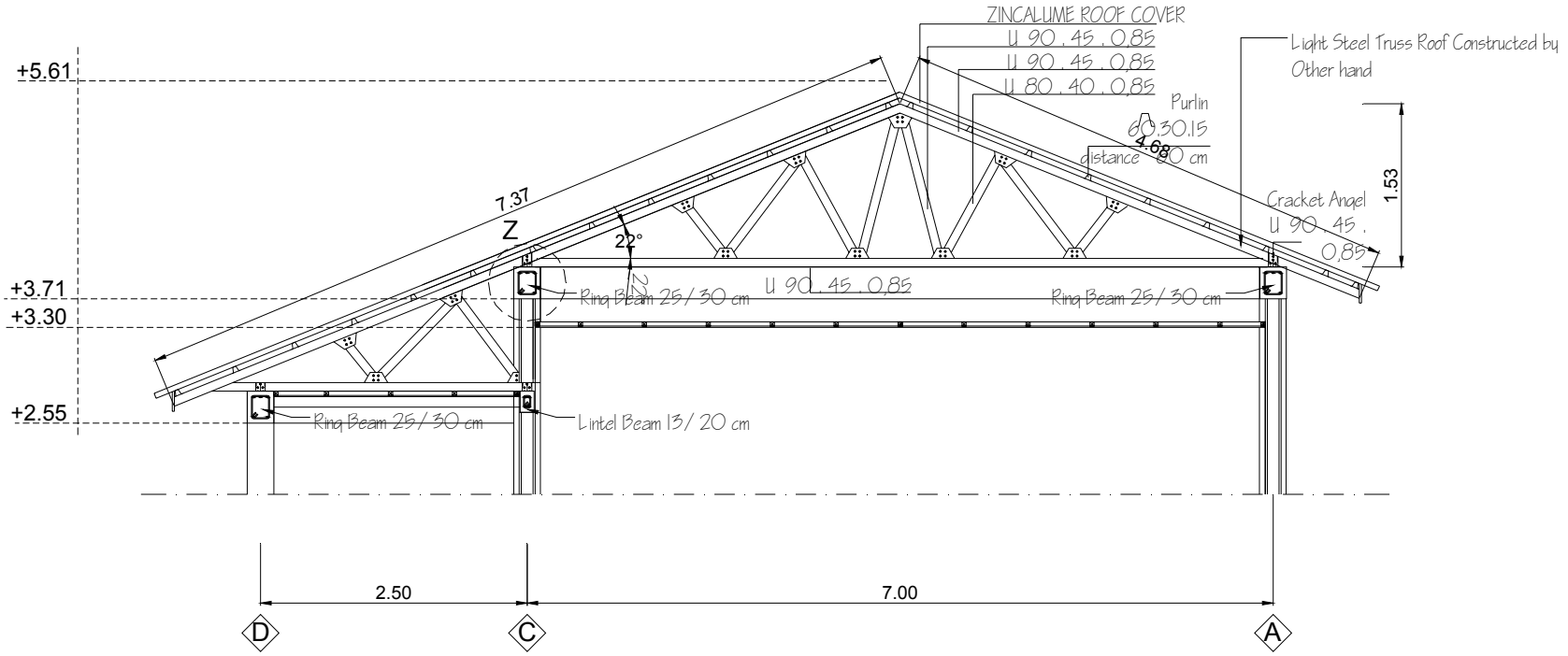
1 Section Z
Scale: 1:25

Note:

All dimensions are in meters unless noted otherwise.

Elevations are in maters unless noted otherwise

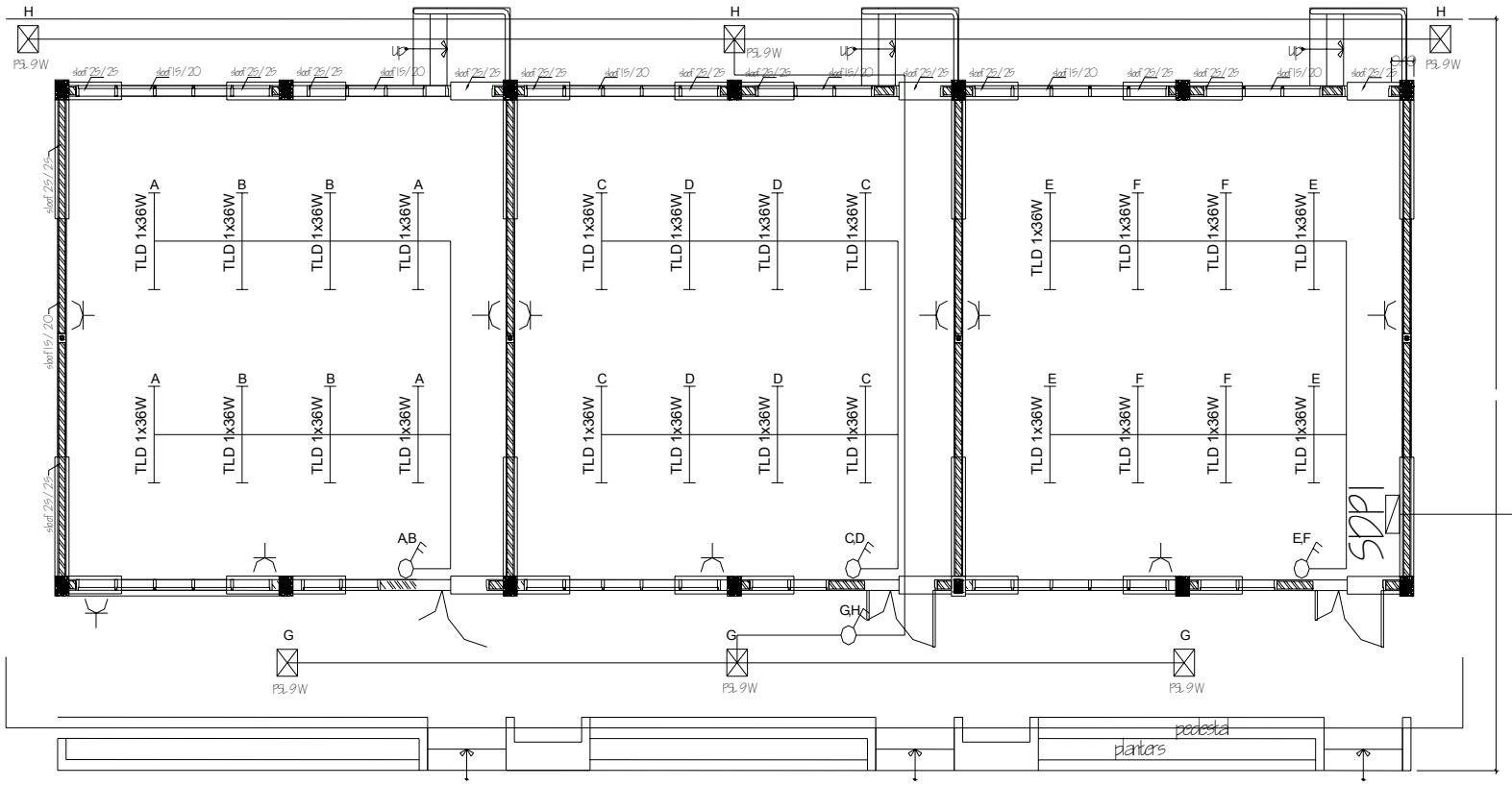
All dimensions presented must be followed



Drawing no. SR-15 Roof Truss Detail

50 Zincalum Truss Detail
Scale: 1:50

4.3 Lighting and Water Sanitation



From MDP

NYY 3 x 4 mm

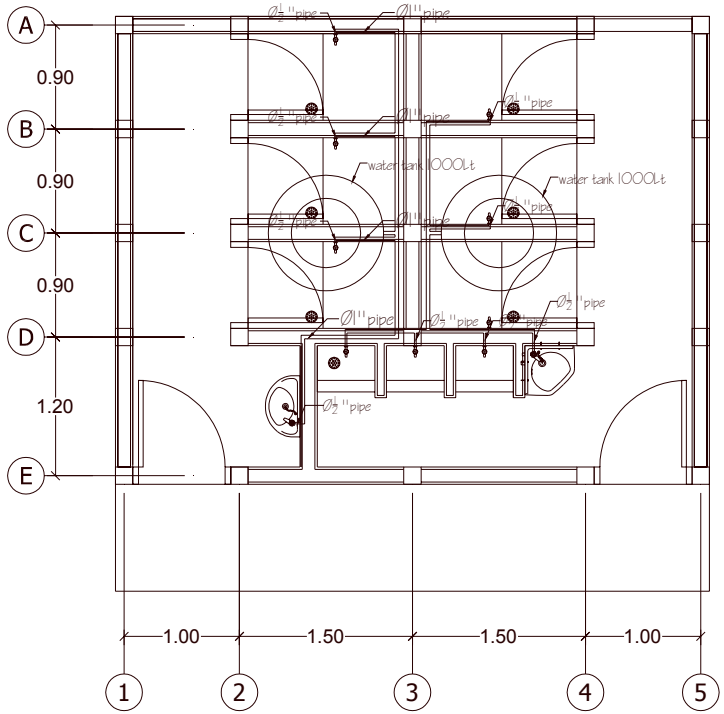
Note:

- tubelamp 2x40w
- socket
- T dos
- switch
- MCB box
- KWH meter
- PSL 9w

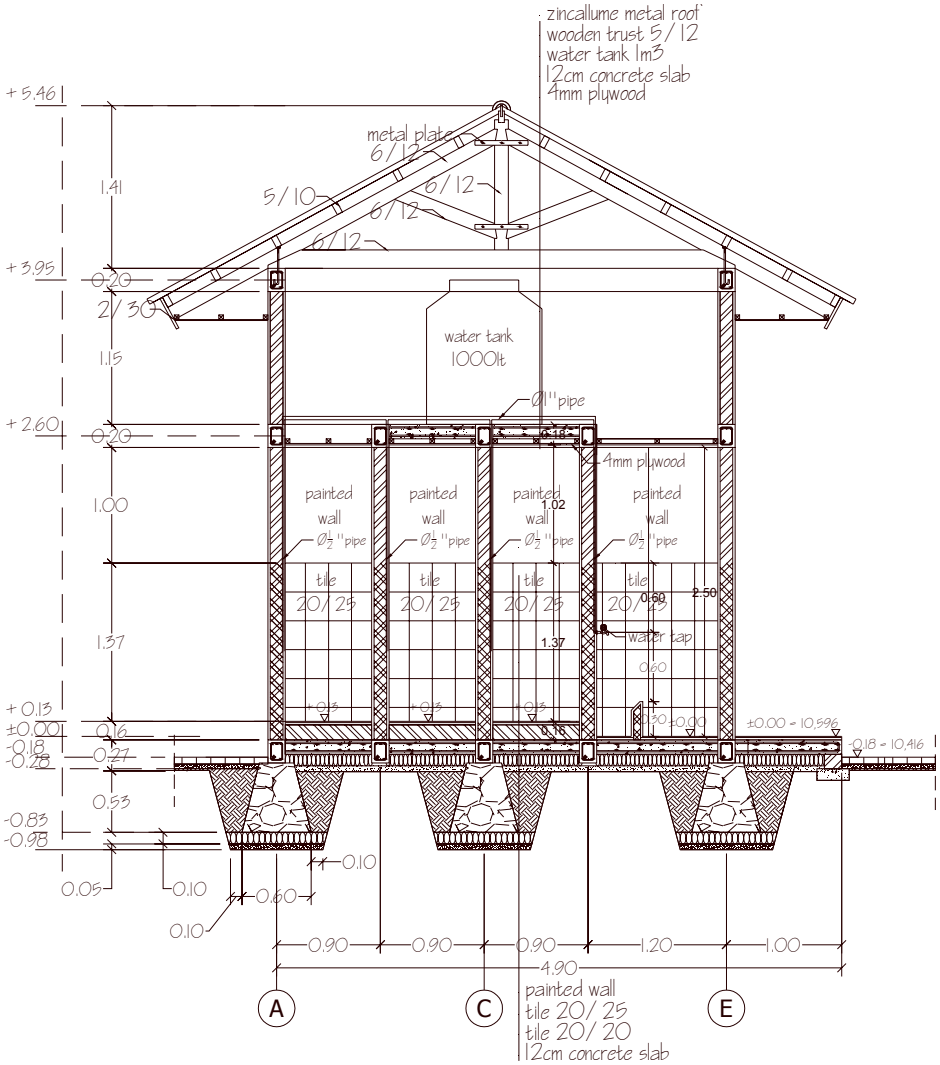
#VIEWNAME

VPSCALE

Drawing no. E-1 Electrical Plan

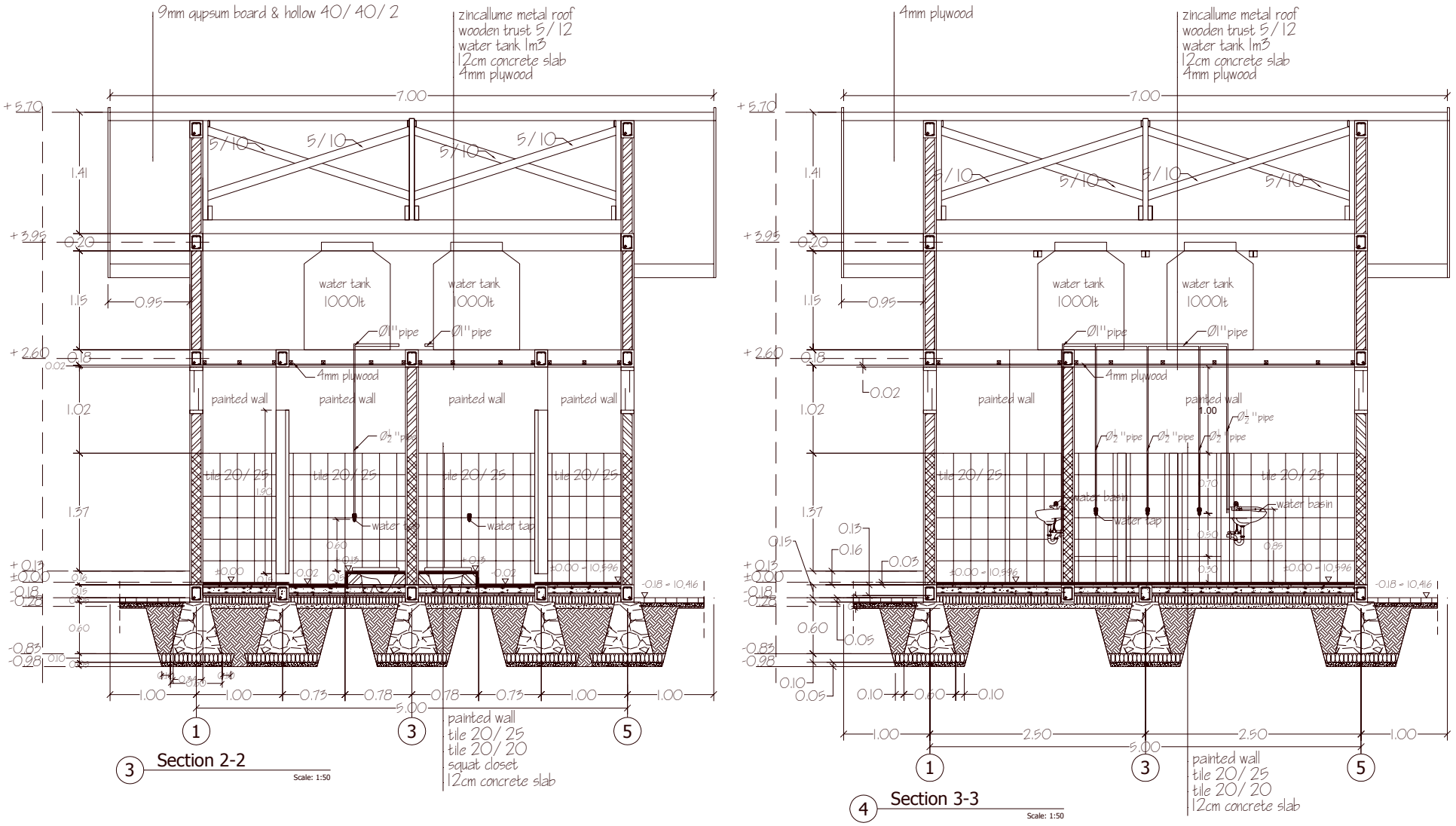


1 Ceiling Piping Plan
Scale: 1:50

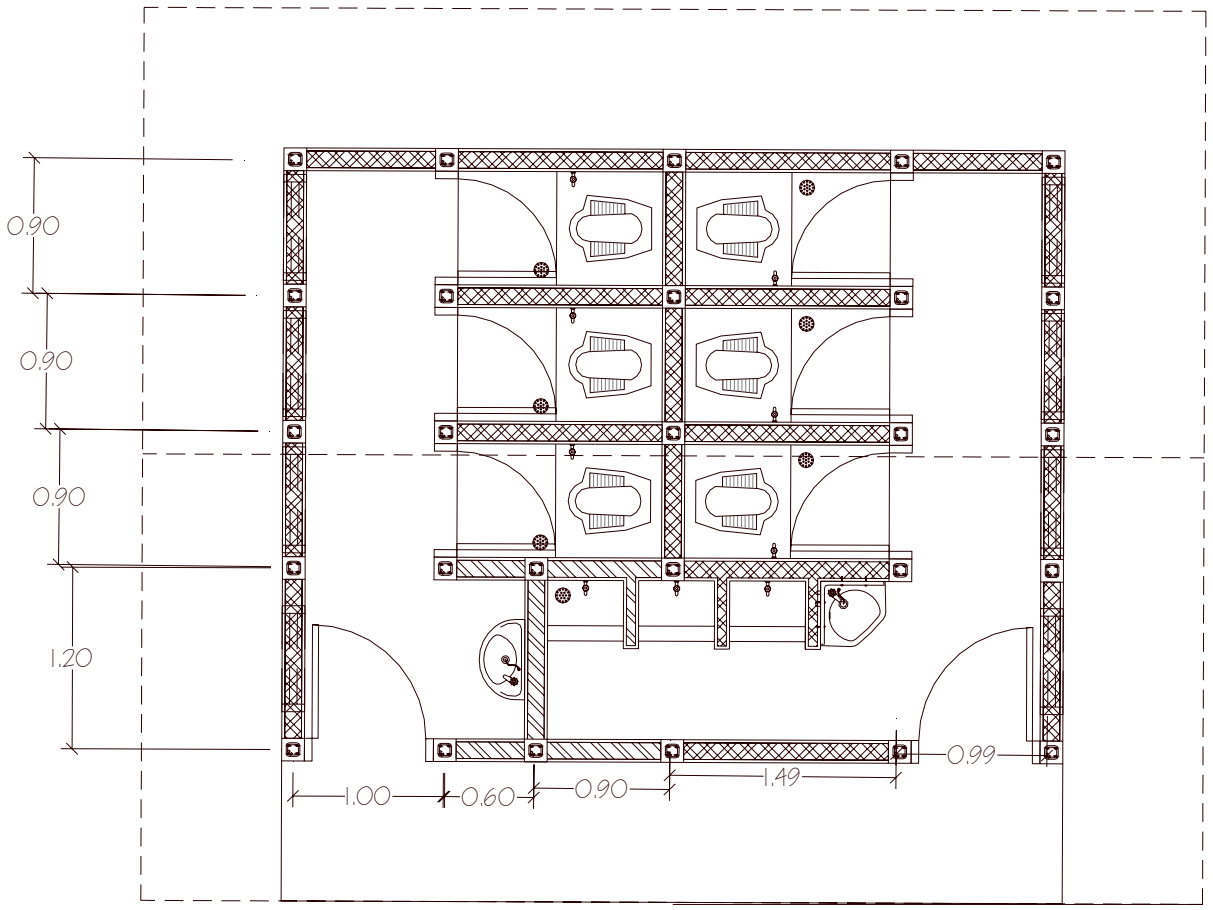


2 Section 1-1
Scale: 1:50

Drawing no. WS-1 Ceiling Piping Plan and Section 1-1

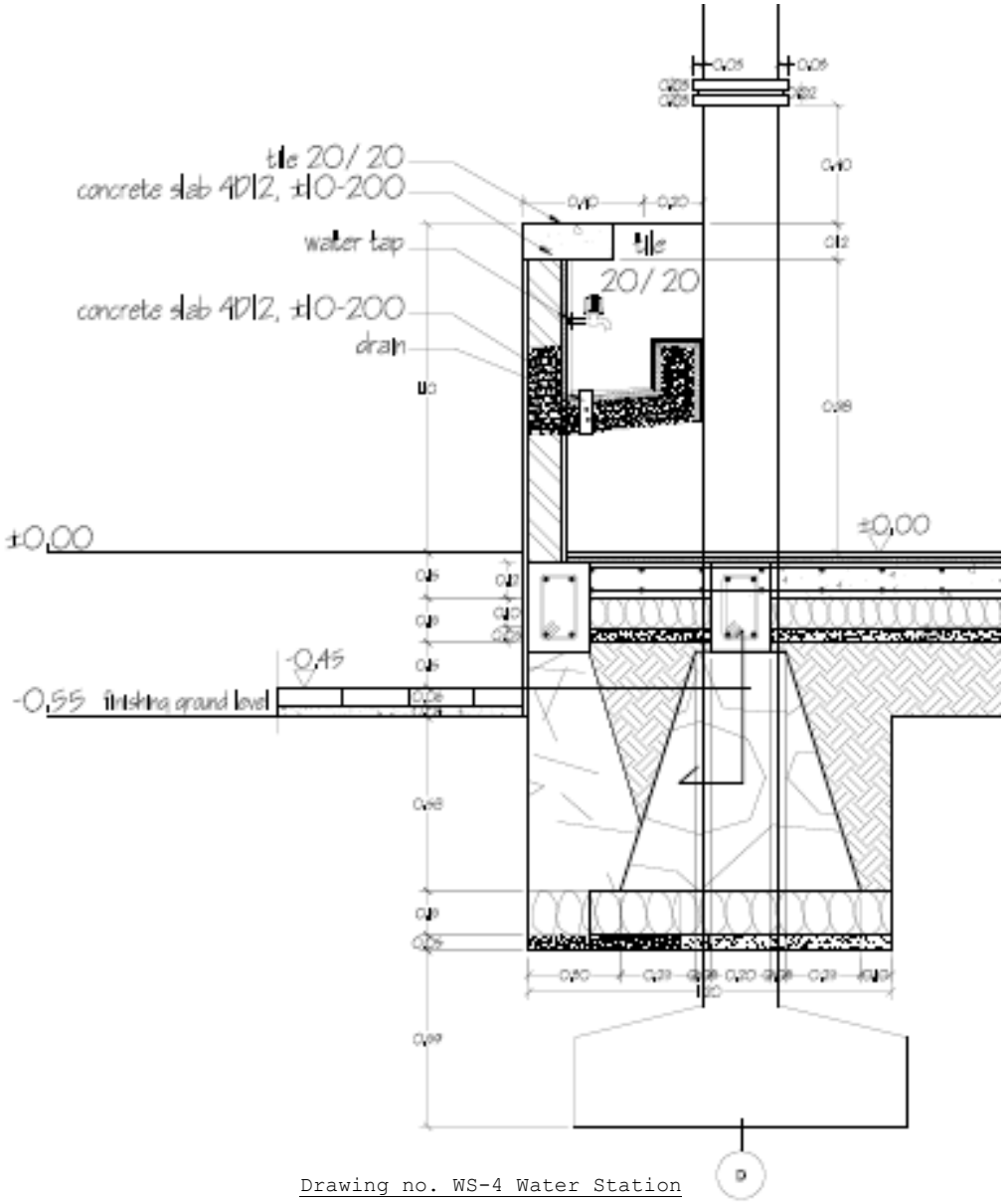


Drawing no. WS-2 Section 2-2 & Section 3-3



5 Toilet Plan

Drawing no. WS-3 Toilet Plan



Drawing no. WS-4 Water Station

4.4 Bill of Quantities

No.	Item of Works	Unit	Quantity	Unit Rate	Total Amount
I	**TYPICAL SCHOOL BUILDING**				
I.1	**SUB STRUCTURE WORKS :**				
	Excavation to :				
a	Footing foundation	m3	90.00		
b	Stone masonry foundation	m3	120.00		
c	Stone masonry foundation to stair area	m3	11.00		
d	Stone masonry foundation to ramp area	m3	2.00		
e	Stone masonry foundation to parapet and water station area	m3	8.50		
	Back excavation fill to :				
f	Footing foundation	m3	53.75		
g	Stone masonry foundation	m3	40.00		
h	Stone masonry foundation to stair area	m3	6.00		
i	Stone masonry foundation to parapet and water station area	m3	3.75		
	Urugan tanah di bawah lantai untuk : / Imported ground fill and embankment to :				
j	Class room	m3	197.25		
	Sand bed 50 mm consolidated thickness under floor, spread levelled and compacted to :				
k	Class room	m3	9.75		
l	Stair	m3	0.50		
m	Ramp	m3	0.50		
	Sand bed 50 mm consolidated thickness under foundation, spread levelled and compacted to :				
n	Footing foundation	m3	1.88		
o	Stone masonry foundation	m3	7.75		
p	Stone masonry foundation to stair area	m3	1.38		

q	Stone masonry foundation to ramp area	m3	0.25		
r	Stone masonry foundation to parapet and water station area	m3	1.38		
	Termite control as per spesification				
s	Under floor slab of class room	m2	228.00		
I.2	**FOUNDATION AND CONCRETE WORKS :**				
	Aanstamping masonry erection t = 15 cm under foundation , construct to :				
a	Footing foundation	m3	5.50		
b	Stone masonry foundation	m3	22.75		
c	Stone masonry foundation to stair area	m3	1.25		
d	Stone masonry foundation to ramp area	m3	0.63		
e	Stone masonry foundation to parapet and water station area	m3	1.75		
	Compacted gravel t = 10 cm under floor for leveling to:				
f	Class room	m3	19.50		
g	Stair	m3	1.00		
h	Ramp	m3	0.75		
i	Parapet and water station area	m3	0.25		
	Stone masonry foundation to :				
j	Class room	m3	66.75		
k	Stair	m3	2.75		
l	Ramp	m3	1.50		
m	Parapet and water station area	m3	4.75		
	Anchor rebar dia 12-1000 to sloof				
n	Class room	kg	104.25		
o	Parapet and water station area	kg	39.50		
p	Anchor rebar dia 8 - 500 mm connection between column and brick work	kg	69.75		
	Vibrated reinforced concrete grade K225 :				
	Footing foundation				
q	Concrete	m3	19.00		

r	Bar reinforcement	kg	2,418.75		
s	Formwork	m2	95.00		
	Column K1 30/30				
t	Concrete	m3	6.00		
u	Bar reinforcement	kg	896.75		
v	Formwork	m2	80.25		
	Column K2 25/25				
v	Concrete	m3	1.00		
w	Bar reinforcement	kg	258.15		
x	Formwork	m2	17.75		
	Tie Beam 20/30 Type SL1				
y	Concrete	m3	2.75		
z	Bar reinforcement	kg	817.50		
aa	Formwork	m2	26.00		
	Tie Beam 20/30 Type SL2				
ab	Concrete	m3	5.25		
ac	Bar reinforcement	kg	572.25		
ad	Formwork	m2	29.00		
	Latai Beam BL 13/20 elv. + 2.55				
ae	Concrete	m3	1.88		
af	Bar reinforcement	kg	383.50		
ag	Formwork	m2	37.25		
	Ring Beam 25/30 elv. + 2.55				
ah	Concrete	m3	3.00		
ai	Bar reinforcement	kg	412.75		
aj	Formwork	m2	32.50		
	Ring Beam 25/30 elv. + 3.71				
ak	Concrete	m3	5.75		

al	Bar reinforcement	kg	643.00		
am	Formwork	m2	66.00		
	Concrete floor slab t= 12 cm				
an	Concrete	m3	28.50		
ao	Bar reinforcement	kg	2,935.00		
ap	Formwork	m2	8.25		
	Concrete stair				
aq	Concrete	m3	2.13		
ar	Bar reinforcement	kg	180.75		
as	Formwork	m2	5.50		
	Concrete Ramp				
at	Concrete	m3	0.75		
au	Bar reinforcement	kg	59.50		
aw	Formwork	m2	0.63		
	Tie Beam 20/30 at water station				
at	Concrete	m3	0.38		
au	Bar reinforcement	kg	29.00		
aw	Formwork	m2	3.00		
	Beam on parapet wall				
ax	Concrete	m3	1.25		
ay	Bar reinforcement	kg	110.25		
az	Formwork	m2	13.75		
	Slab concrete t = 12 cm at water station				
ba	Concrete	m3	0.38		
bb	Bar reinforcement	kg	30.50		
bc	Formwork	m2	2.75		
I.3	**WALL + WALL FINISHES :**				
	Brickwork in cement and sand (1:4) for construct :				

a	Class room	m2	201.75		
b	Parapet wall , planter box and water station	m2	26.75		
	Plaster to brick wall,trowelled smooth finish with cement coating to :				
c	Class room	m2	500.50		
d	Parapet wall , planter box and water station	m2	50.50		
	Internal wall painting with apply one coat primer and two coats of approved paint to:				
e	Class room	m2	259.50		
	External wall painting with apply one coat primer and two coats of approved paint to:				
f	Class room	m2	265.25		
g	Parapet wall , planter box and water station	m2	47.00		
	Perimeter brick wall including plaster and cement coating with paint finish				
h	Perimeter building	m'	66.00		
I.4	**FLOOR FINISHES :**				
	Non slippery Ceramic tiles 300 mm x 300 mm, bedded and jointed in cement mortar, pointed in coloured cement as				
	specified, including all necessary fixing accessories, laid as pattern ; all as described to the following:				
a	Class room type I	m2	161.25		
b	Teracce and stair type II	m2	76.75		
c	100 mm high skirting tile to all room	m'	124.50		
e	Sersan finish to form ramp surface	m2	7.25		
I.5	**ALUMINIUM FOR DOOR, WINDOW GLASS**				
	Supply and fix asemble, set and including all necessary gasket sealant, continuous flashing and fixing bracket and				
	accessories, grout frames in water proof , waterproof cement mortar, point frame with mastic, ease openable parts				
	and glaze, protect and clean on completion, including with color anodized finish and hardware ironmongery as per				
	as per drawing and spesification according to chapter 8 , contractor shall submit proposed brand and brochures and				
	all as described to the following) :				

a	Aluminium door and window with overall size 3500 mm x 2520 mm consisting of aluminium door and louvres with	no	2.00		
	size 900 mm x 2520 mm with 4 fixed window overall size 580 mm x 960 mm and 4 open window with overall size				
	360 mm x 580 mm fixed in 5 mm thick clear glass type DW1				
b	Aluminium door and window with overall size 3500 mm x 2520 mm consisting of aluminium door and louvres with size	no	1.00		
	size 900 mm x 2520 mm with 4 fixed window overall size 580 mm x 960 mm and 4 open window with overall size				
	360 mm x 580 mm fixed in 5 mm thick clear glass type DW2				
c	Aluminium door and window with overall size 3500 mm x 2520 mm consisting of aluminium door and louvres with	no	2.00		
	size 1200 mm x 2520 mm with 3 fixed window overall size 580 mm x 960 mm and 3 open window with overall size				
	360 mm x 580 mm fixed in 5 mm thick clear glass type DW3				
d	Aluminium door and window with overall size 3500 mm x 2520 mm consisting of aluminium door and louvres with	no	1.00		
	size 900 mm x 2520 mm with 3 fixed window overall size 580 mm x 960 mm and 3 open window with overall size				
	size 360 mm x 580 mm fixed in 5 mm thick clear glass type DW4				
e	Glass window ; overall size 3200 mm x 1650 mm consisting of 5 unit fixed window each size 600 mm x 840 mm and	no	6.00		
	5 unit open window each size 600 mm x 660 mm fixed in 5 mm thick clear glass type W5				
I.6	**ALUMUNIUM LOUVRED VENTILATION**				
	Supply and fix louvered window unit;comprising of aluminum louvres and frames complete with finsihes , accessories				
	and the like all installed strictly in accordance with drawing and spesification , all as described to the following :				
a	Louvered window triangle at roof)	no	2.00		
I.7	**PEKERJAAN ATAP / ROOFING WORKS :**				
a	Light steel truss construction with galvanized finishes (quantity is plan area) :	m2	299.00		
b	Zincalume 0.35 mm thickness of roof cover prepainted	m2	332.25		
c	Ridge (zincalume) cap prepainted	m'	46.75		

e	GRC fascia board 8/20 painted	m'	80.75		
f	Wooden canopy with 0.35 mm zincalume roof cover as per architecture drawing no. A 008 and A 009	m2	24.00		
g	Wooden structure for coridor roof profilled & painted + bolt	m3	0.25		
I.8	**PEKERJAAN PLAFOND / CEILING FINISHES WORKS :**				
	Approved gypsum board with hollow structure and size as indicated on the drawing, included all necessary fixing				
	accessories as specified; including making holes for light fiting etc , all as described and shown on the drawing				
a	To ceiling class room; 9 mm thick	m2	161.50		
b	To ceiling veranda + over hang waterproof ; 9 mm thick	m2	108.25		
c	Cornice plafond gypsum to all rooms perimeter paint finish	m'	228.25		
d	Painting to ceilling as per spesification	m2	269.75		
I.9	**INSTALLATION OF ELECTRICITY WORKS**				
a	KWH meter 3 Phasa-380V-50Hz-10530 VA + box	unit	1.00		
b	MCB 3 Phase 16A ex Merin Gerin	unit	2.00		
c	Lighting installation including cable	ttk	30.00		
d	Power outlet installation	ttk	10.00		
e	Saklar double / Electric double switch	unit	4.00		
f	Socket-receptacle complete with PE	unit	10.00		
g	Wire cable NYY 2x2.5 mm2	m'	58.25		
h	Wire cable NYY 3x2.5 mm2	m'	7.00		
i	Wire cable NYY 3x4 mm2	m'	70.00		
j	Wire cable NYM 3x4 mm2	m'	2.00		
	Lightning protection + Earthing system				
k	Cooper elctrode 3/4"	unit	15.00		
l	Galvanized pipe 30 cm length for electrode at roof	unit	14.00		
m	Metal buffer for BC cable	unit	60.00		
n	BC cable 10 mm2	m'	36.50		
o	3/4" Galvanized pipe connection	unit	15.00		

p	3/4" Galvanized pipe	m'	6.00		
q	Installation cost for lightning protection	m'	36.50		
r	Fluorscent Lamp TLD 1x36 Watt + Acceccories	set	24.00		
s	PSL Lamp 18 Watt	set	6.00		
t	Main Panel Box 40x40x20 cm + complete with accessories	set	1.00		
	Grounding from main box panel				
u	Cooper 1/2 " electrode	unit	1.00		
v	1/2" Galvanized pipe	m'	2.00		
w	1/2" Galvanized pipe connection	unit	1.00		
x	BC cable 6 mm2	m'	12.00		
y	Installation cost for grounding	ttk	1.00		
z	MCB box 4 group	unit	4.00		
aa	MCB 2A	unit	2.00		
ab	MCB 4A	unit	3.00		
ac	MCB 6A	unit	5.00		
ad	MCB 10A	unit	2.00		
ae	Photo cel	unit	1.00		
af	Contactor SN20	unit	1.00		
ag	Push Button Switch for Mercury Lamp	unit	1.00		
ah	Excavation and wiring protection under ground	m'	233.00		
ai	Adminisration cost of connection for 10 A power to PLN	Ls	1.00		
aj	Testing & Commissioning for Mechanical Works as per spesification sub article 13.5.1.xii	Ls	1.00		
ak	Testing & Commissioning for Electrical and Lightning Protection as per spesification sub article 12.1.5.4 and	Ls	1.00		
	sub article 12.2.5.2				
I.10	**RAILING WORKS :**				
	Black steel pipe of balustrade 1 " and hand rails 2" with welded and bolted connection including all fixing accesso -				
	ries per architectural dwg no A 005, A 008, A 009 and spesification chapter 5 , finish with paint all as described:				

a	Stair class room	m'	13.00		
I.11	**PEKERJAAN AREA TEMPAT MINUM / WATER STATION AREA WORK :**				
a	Water foucet T 23 B13V7N	unit	4.00		
b	Floor trap TX 1 AVI	unit	2.00		
c	PVC pipe 2 1/2" for grey water	m'	3.30		
d	Ceramic at Water station area	m2	6.25		

4.5. Technical Specification

SECTION A - EARTHWORKS

A.1 GENERAL

A.1.1 Types of earthworks

The earthwork consists of filling and excavation work, as shown on the drawing.

A.1.2 Site clearing

The constructor shall execute the site clearing before commencing the filling works, the area shall be cleaned from grass, trees, debris, wood, or other organic waste, etc.

A.1.3 Material for filling

Material to be used is excavated soil and shall be cleaned from grass, trees, debris, wood, or other organic waste, etc and shall be mechanically compacted.

A.2 CONFORMITY WITH DRAWINGS

Earthworks shall be finished to conform within the following limits to the levels, lines, and cross sections specified or shown on the drawings or directed by the Engineer.

A.2.1 Dimensions measured of earth work/filling work are the widths, length and level measured from specified edge shown in drawings. The top level shall not deviate by more than 10 mm from levels shown on the drawings. The top level of the foundation measured must be taken to 100 year flood level as shown on the drawings.

A.2.2 Before filling the excavation for foundation with approved material, the pit shall be cleared from retaining water, debris.

A.3 EXCAVATION

A.3.1 Common excavation

Common excavation shall refer to excavation in materials, in which the material to be excavated is common soil

A.3.2 Suitable material

Suitable material shall comprise all that are acceptable in accordance with the requirements of the material of filling work

A.2.3 Unsuitable material

Unsuitable material shall comprise:

(a) Materials from swamps, marshes or bogs, running silt peat, logs, perishable material, slurry or mud; mining slime; or

(b) Any materials which are of construction and demolition debris

SECTION B – RUBBLE FOUNDATION

B.1 The composition of mortar for bedding and connecting in rubble foundation is of 1:4 of cement and sand.

B.2 Before installing the dimension and elevation of the pit, it shall be cleaned from standing water, debris, and all unnecessary things.

B.3 Maximum diameter of rubble used for the foundations shall be not more than 30 cm, and the rubble shall be free from dust, mud, or other soil and it must have a rough surface.

B.4 The depth of the foundation must reach the hard soil or minimum of 80 cm. The width of the foundation must be at least 80 cm

B.5 The arrangement of the rubbles in the foundation must not follow a straight line for good connectivity.

B.6 Local foundations/footings must be provided if the level of hard soil is too deep.

SECTION C - WALL

C.1 BRICK BLOCK

C.1.1 The brick shall be clay brick. All bricks shall have uniform dimension of 5 x 10 x 20 cm. It should be completely burnt and flat. It should not break easily and the corners should not have damage.

C.1.2 All bricks should be soaked in water, prior to laying.

C.2 MORTAR

Mortar mix for wall construction should be in composition of 1 : 4 (cement : sand) with appropriate amount of water. Maximum thickness of the mortar used in wall construction is 15 mm, and the minimum is 8 mm.

C.3 WALLS

The arrangement of the brick must overlap each other and neat. Anchorage should be installed as in the drawings

SECTION D – REINFORCED CONCRETE WORKS

D.1 CEMENT

The cement used in the concrete works must be portland cement. It should not harden. It should be dry and have uniform color. It should be free from other materials.

D.2 AGGREGATES

D.2.1 Fine aggregate should be clean from mud and organic materials. It should be taken from rivers/ quarries

D.2.2 Coarse aggregates should be free from mud and organic materials. It should be taken from rivers/quarries and the size should be approximately 1- 2 cm.

D.3 WATER

The water used in the concrete works should comply on these conditions:

- It should be clean
- It should be clear and have no odor
- It should be free from oil, acid, salt, organic material, etc, that can affect reinforcement bars

D.4 STEEL REINFORCEMENT

D.4.1 General

Steel Reinforcement used is steel bar of type U-32 for deformed bar BJTD-32 (fy= 3200kg/cm2) and type U-24 for undeformed bar BJTP-24 (fy= 2400 kg/ cm2). For steel bar with diameter $\geq$ 10 mm, deformed bar BJTD-32 should be used. For steel bar with diameter < 10 mm undeformed bar BJTP-24 may be used.

D.4.2 Condition

The reinforcement bar used should have uniform size and straight. It should be clean and have no rust. The diameter used must follow with the required diameter presented in the drawings.

D.4.3 Binding Wire

The binding wire for steel reinforcement shall be of 16 SWG soft pliable annealed steel wires.

D.5 MIX DESIGN

The concrete used in the construction works must have a minimum concrete strength of 17.5 MPa (1 cement: 2 sand: 3 gravel). All mix design standards must comply with SNI 03-1726-2002 "Guideline on Reinforced Concrete Design for Building- *Tata Cara Perencanaan Struktur Beton Untuk Bangunan Gedung*"

D.6 MIXING OF CONCRETE

- The mixing plant shall be operated at clear space and the machine has to stand on a stable position, safe, and has good accessibility. The concrete shall be mixed up to a uniform color and consistency.
- Mixers, which have been out of use for more than 30 minutes, shall be thoroughly cleaned before any fresh concrete is mixed.
- The mixer shall be kept on clean condition by washing the mixer immediately after finishing the work.
- Hand mixing of concrete should not be allowed normally, but if the quantity of concrete is small, and at the absolute discretion of the engineer, hand mixing may be permitted.
- Hand mixing of concrete shall be carried out on a hard, even and impervious surface of adequate size.

- In mixing the concrete the gravel and sand should be properly mixed first, then cement can be poured subsequently. Last, provide a depression in the center, add an appropriate amount of water and mix all materials.

D.7 TESTING MIXING

In testing the mixing consistency, place the concrete on the hand and check for the shape. If the concrete tends to spill or run over, it means that there is too much water in the mixture.

D.8 TRANSPORTING AND PLACING

D.8.1 Transporting

The concrete shall be discharged from the mixer and transported to the concrete pouring position. The concrete transported or otherwise exposed during wet weather shall be covered to prevent washing out by rain, or an undue increase in water content in severe cases.

D.8.2 Placing

The concrete shall be placed in positions with the sequence as indicated on the drawings, in the specifications, or as directed by the engineer. It shall be deposited as close as possible to its final position.. It shall be placed in such manner to avoid segregation of the concrete or displacement of the reinforcement and other embedded items or formwork. Fresh concrete shall not be placed against in situ concrete, which has been in position for more than 3 minutes, unless a construction joint has been formed. Club hammer and steel rod can be used for compaction.

D.9 JOINT CONSTRUCTION

D.9.1 Position

Concreting shall be carried out continuously up to construction joint. The position and arrangement of the joints shall be as indicated on the drawings.

D.9.2 Preparation of joint

When work has to resume on a surface which has hardened, the whole surface shall be thoroughly chipped, all laitance removed, swept clean, wetted and covered with a layer of a minimum thickness of 3 mm of mortar composed of cement and sand with the same ratio as in the concrete mixture. The mortar shall be freshly mixed and placed immediately before the placing of the concrete. The procedure shall be as such to avoid the formation of bands. The prepared joint surfaces shall be inspected and approved by the engineer before commencement of concreting.

D.10 CURING AND PROTECTION

Concrete shall be protected during the first stage of hardening from the harmful effects of sunshine, drying winds, rain or running water. The protection shall be applied as soon as practicable after completion of placing using one or more of the following methods:

(a) The concrete shall be covered with a wet layer of sacking or similar absorbent material for approximately 7 days.
(b) Before and after the formwork is removed, spray the concrete routinely.

D.11 FORMWORK

Plywood may be used as the material for formwork. Prior to concreting, the formwork shall be cleaned from adhering concrete and the bottom part should be free from debris.

Additional support to formwork may be needed to maintain the shape of formwork and to retain compressive forces generated in concrete placement.

D.12 DEFECTIVE CONCRETE FINISHES

D.12.1 General

Any concrete found to have a defective finish shall be reformed by skilled workers using methods approved by the engineer.

D.12.2 Prompt remedial measures

Unless approved by the engineer, the repair of imperfection in the formed concrete shall be carried out immediately after the removal of formwork.

D.12.3 Damage and defect of concrete

Concrete that is damaged by any cause, concrete that shows honey-comb, cracks or other defects, and concrete which has excessive surface depressions beyond accepted tolerances must be cut out and built up to bring the surface to the prescribed lines. Minor bulges and abrupt irregularities beyond the specified limits shall be reduced by grinding to the approved tolerances. All materials, procedures, and operations used in the repair of concrete shall be subjected to the approval of the engineer.

D.12.4 Fittings

All fittings shall be bonded tightly to the surface of the structure and be free from shrinkage cracks. Repair of concrete shall be carried out by one or more of the following methods:

(a) Concrete replacement
(b) Hand placed cement mortar
(c) Pneumatically placed cement mortar
(d) Dry pack
(e) Epoxy mortar

The type and methods of repair to be used in any particular case shall be subjected to the approval of the engineer.

D.13 STRIKING AND REMOVAL OF FORMWORK

All forms shall be removed without damaging the concrete. Before removing the forms, the concrete shall be exposed by removing of the side forms or otherwise as required by the engineer in order to ensure that it has sufficiently hardened.

D.14 CONDITION, BENDING, FIXING OF REINFORCEMENT BARS

D.14.1 Condition

The reinforcement bars shall be free from rust, oil or other coating, which is liable to weaken the bonding between the concrete and steel, before being placed in the forms. Any bars that are pitted with rust shall be rejected.

D.14.2 Bending

The bending dimensions and tolerances and the dimensions of end anchorage, seismic hooks, stirrups, and development lengths shall be in accordance with SNI 03-1726-2002. All steel reinforcements shall be fabricated to the forms and dimensions as shown by the drawings. It also should be placed appropriately as shown in the drawings.

D.14.3 Fixing

The reinforcement shall be fixed in the formwork and held firm against displacement by approved cover blocks and binding wires to ensure that the meshwork or reinforcing bars will retain their designed form and exact positions in the formwork during the process of placing and compacting concrete. Bars intended to be in contact when passing each other shall be securely held together at intersections with binding wires.

No concrete shall be placed until all formwork, installation of reinforcing bars and preparation of surfaces involved in the placing have been completely prepared by the constructor and the completion has been inspected and approved by the engineer.

D.14.5 Laps, seismic hooks and length of development

Lap lengths of the reinforcing bars shall be calculated on the permissible stresses for the full tensile stresses in the bars. Laps in the reinforcement shall be suitably staggered. The length of lapped joints shall normally be not less than 40 times the bar diameter or minimal 60 cm.

Seismic hooks must be provided in every stirrups provided in the beam and column. Minimum 40 d length development must be provided in the connection of beam and column (refer to drawings).

SECTION E – PLASTER WORKS

E.1 GENERAL

E.1.1 Mortar used for plaster works is the mixture of portland cement and sand with addition of sufficient water in it. The materials for plaster mortars must be accurately gauged.

E.1.2 All plaster work should be conducted by skilled workers to get proper result.

E.2 EXECUTION OF WORKS

E.2.1 The wall shall be watered and cleaned before plastering and it should be applied to all surface of wall (exposed or unexposed)

E.2.2 Exposed concrete and foundation surfaces shall be plastered for finishing. The surface shall be scraped or chipped before plastering.

E.2.3 Composition of mixed mortar and the place to be plastered work is 1 cement and 4 sand.

E.2.4 The surface of the wall should be smoothened after plastering works using cement and water mixture.

SECTION F – WOODEN WORK

F.1 CODES / STANDARDS

Unless mentioned in further requirements, the constructor must follow:

- Indonesian Material Standard (PUBI - 1982)
- Peraturan Konstruksi Kayu Indonesia

F.2 WOODEN MATERIAL

The constructor shall provide the materials in dry condition (small water content), straight, smooth, has no defect, etc.

F.2.1. Material used for *list-plank* and wooden ventilation is of good quality of wood, straight, with no defect, and no crack.

F.2.2. Material used for roof frame/truss structures shall be from strong wood, or of second class or first class based on codes.

F.2.3. Conformity to structural drawings, locations, dimensions and structural sufficiency during handling/erection must be considered in construction.

F.3 WOODEN CONSTRUCTION

F.3.1. Use minimum Φ 10 mm bolts and 4.40 iron sheet/ 20.100 mm plank to connect the main chord in roof trussing system.

F.3.2. Nail only can be used for connecting wooden elements in the case where the elements are not main chord of roof truss elements or the elements are not structural elements (windows, doors, etc).

F.3.3. Detailing should be provided as presented in the drawings.

SECTION G – ROOFING AND CEILING WORKS

G.1 ROOF COVERING

G.1.1 Use light weight and easy to install materials for roof covering, such as galvanized iron sheet

G.1.2 Provide screw and washer to connect the roof materials to the purlin.

G.1.3 Provide cleat to support and maintain the position of purlin

G.1.4 Provide fascia 2/25 cm (*list-plank*) at the end of the roof trusses

G.2 CEILING ROOF WORKS

G.2.1 Material Requirement

- Gypsum boards for the ceiling shall be of the best quality and moisture resistant.
- Minimum thickness of gypsum board used is 9 mm.
- The board should be unwrapped and sufficiently hard.
- The smooth surface shall be free from defects.

G.2.2 Installation

- Before installing the ceiling, the engineer shall inspect the framework which must be suitable to the leveling, patterns, and dimensions shown on the drawings.
- The cutting of the gypsum (in accordance with the dimensions) to the exact length shall be in a perfect finish condition.
- The gypsum sheets shall be screwed carefully to the framework.

H. LIGHTWEIGHT STEEL

H.1 MATERIAL

All steel material shall be in new condition, clean/free from corrosion, holes and other faults.

H.2 WELDING AND BOLTING

- Welding Rod used in this project shall be of low hydrogen electrode with minimum yield strength of 4150 kg/cm^2 and minimum tensile strength of 4950 kg/cm^2. Procedure of welding shall follow the instruction from manufacture
- Galvanized Bolt quality shall be of ASTM A 325 with a minimum tensile strength of 6000 kg/cm2
- Bolt shall be completed with 1 (one) ring on each side (total 2 rings), and the quality of ring plate is identical with the bolt quality.
- The Contractor shall make the fabrication in accordance with tolerances allowed by AISC (American Institute of Steel Construction), Standard Mill Practice, page 1-121 to 1-133.The Engineer shall reject any steel, which is not in accordance with these tolerances.

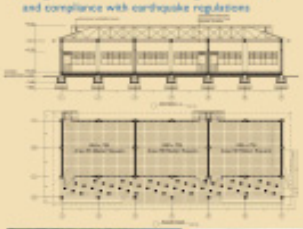
4.6. Save the Children Safe and Child-Friendly School Initiative Poster (Source: Guidance Note - Safer School Construction)

Save the Children®

Safe and Child-Friendly School Initiative

Earthquake Resistant Features

• Design and construction according to latest code and compliance with earthquake regulations



• Simple rectangular and symetric in plan and elevation
• Limit to single story and 3 classroom maximum
• No gable wall and free-standing walls

• Lightweight roof structure
• No overhanging element

• Proper connection and bond
• Proper fixing and layout of non-structural element

Disaster Risk Reduction Features

• Low-hazard site location

• Community Participation

• Door panel open with lateral push

• Stable study table

• Emergency escape door in each room and path

Child Friendly Features

• Design with child friendly parameters

• Ramp for disabled children

• Rounded corner

• Natural light and proper ventilation

• Wide varandah for out-door activities (hot climate)

• Separate toilet block for girls & boys

• Sliding window opening

• Safe play area

• Fencing around compound

Hygiene and Nutrition Features

• Handwashing platform in verandah front of every classroom

• Proper water sanitation & drainage system

Environmentally Friendly Features

• Small trees and flowers in area

• Flower base in verandah

• No timber "no rainforest hardwoods were used"- replaced by light steel for trees and aluminum for doors and windows