Integrated Design of Courts Complex

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Outline

- Introduction
- Architectural Design
- Structural Design
- Environmental Design
- Electrical Design
- Mechanical Design
- Quantity Surveying

Introduction

Introduction

City : Hebron .

The town: Idna .

Total area for the land = 6900 m2 .

Total area for the land = 6900 m2 .

Total area for the project = 7540 m2 .

Introduction

Introduction

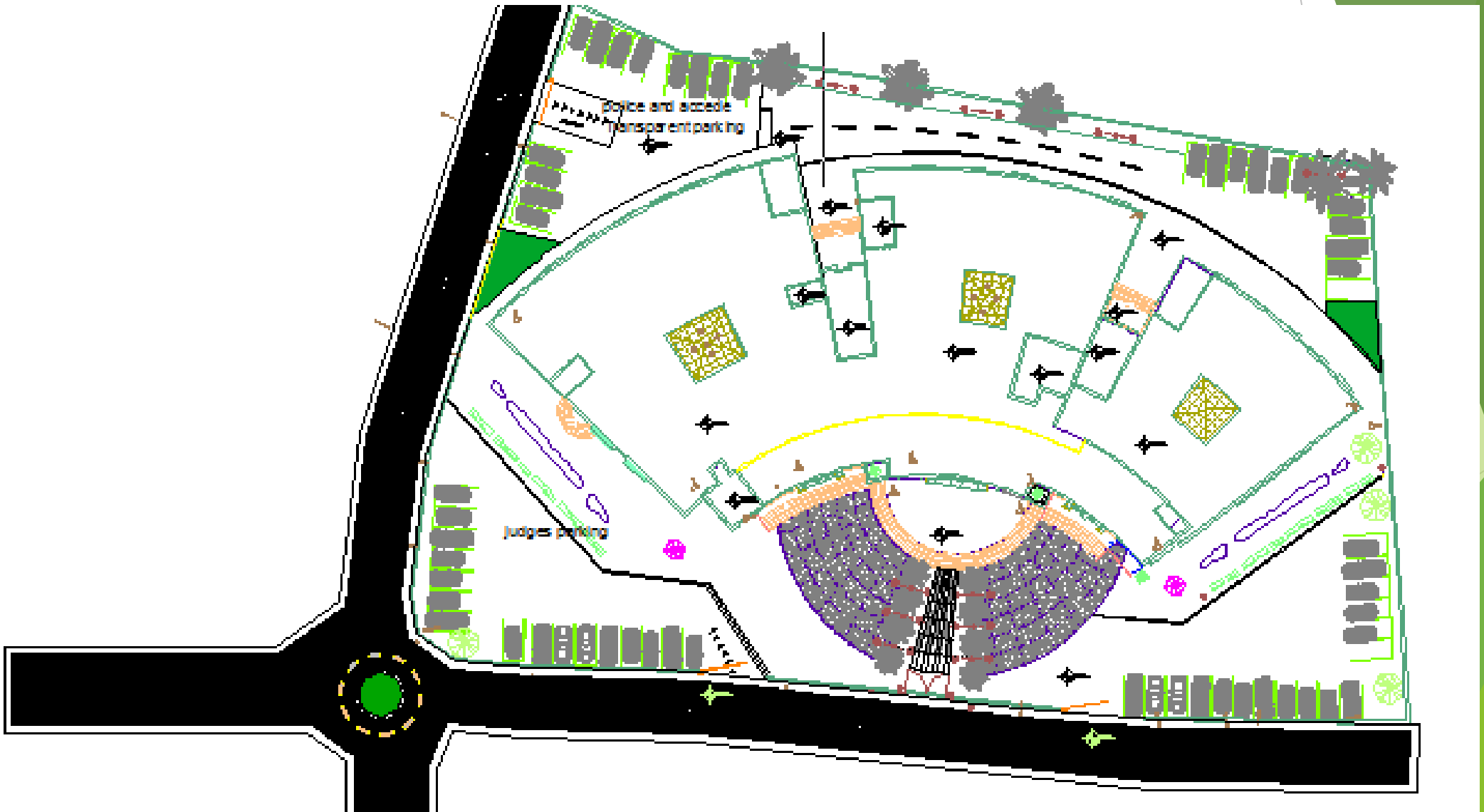
Architectural Design

Architectural Design

Plans

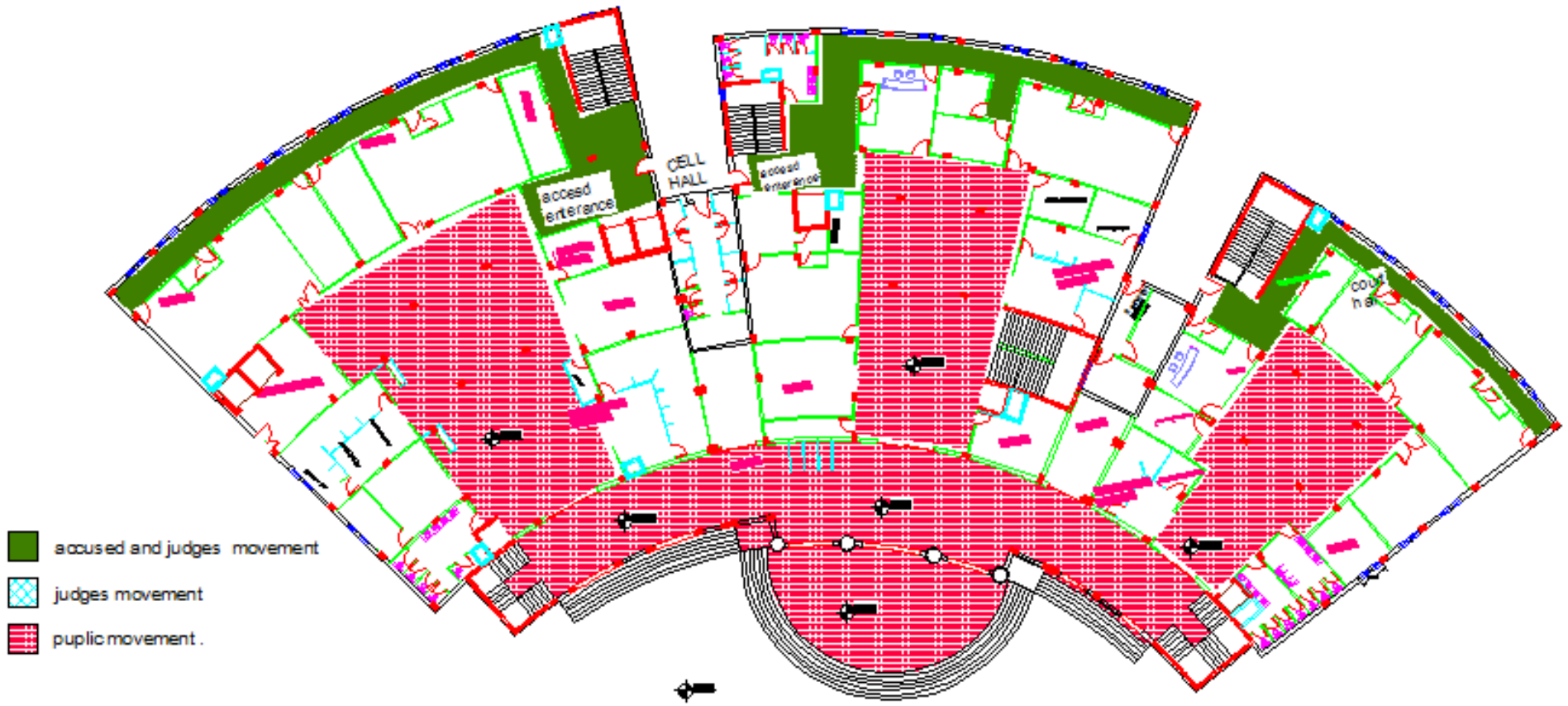
Architectural Design

Site Plan



Architectural Design

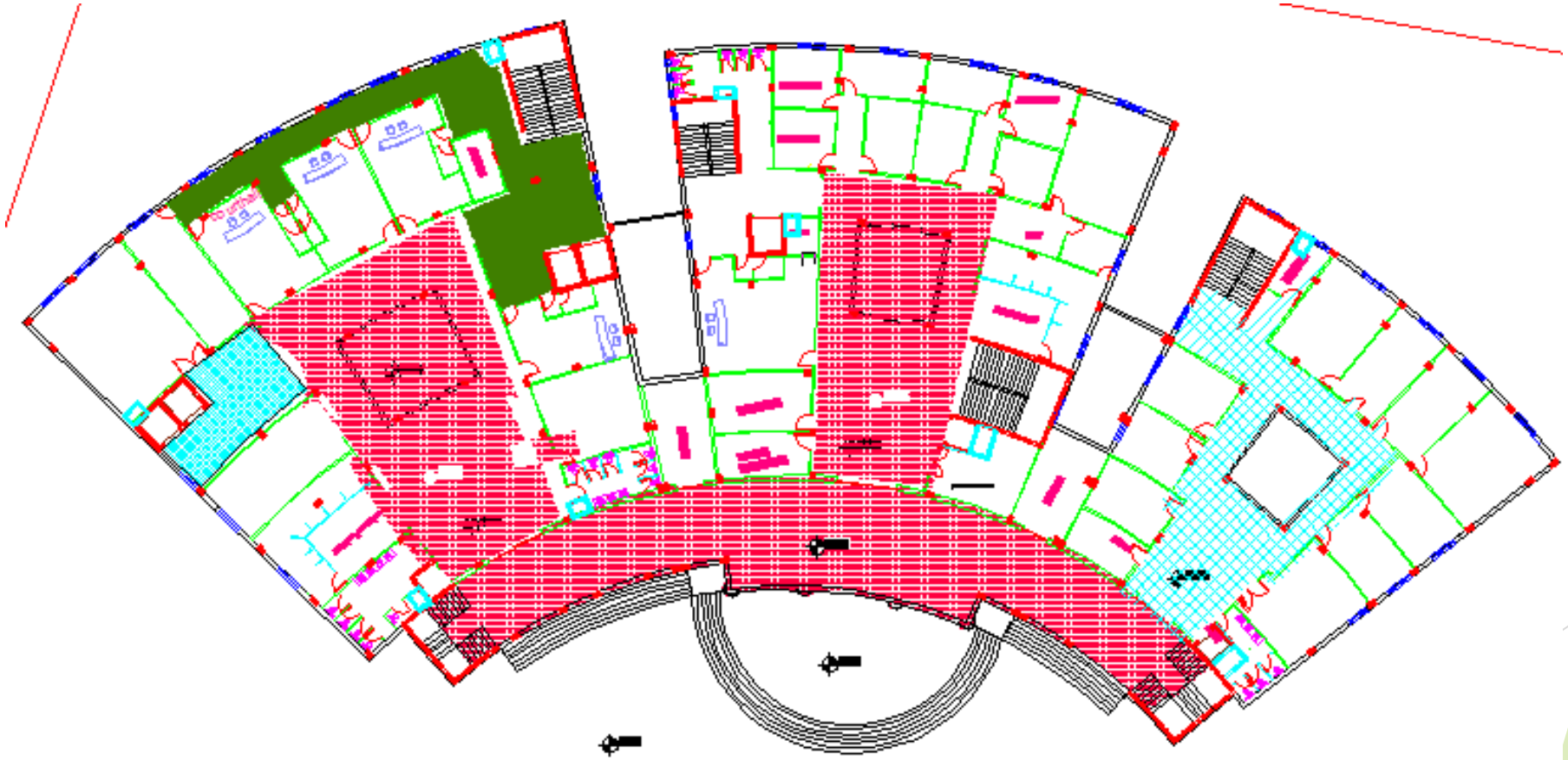
Path movement



ground floor

Architectural Design

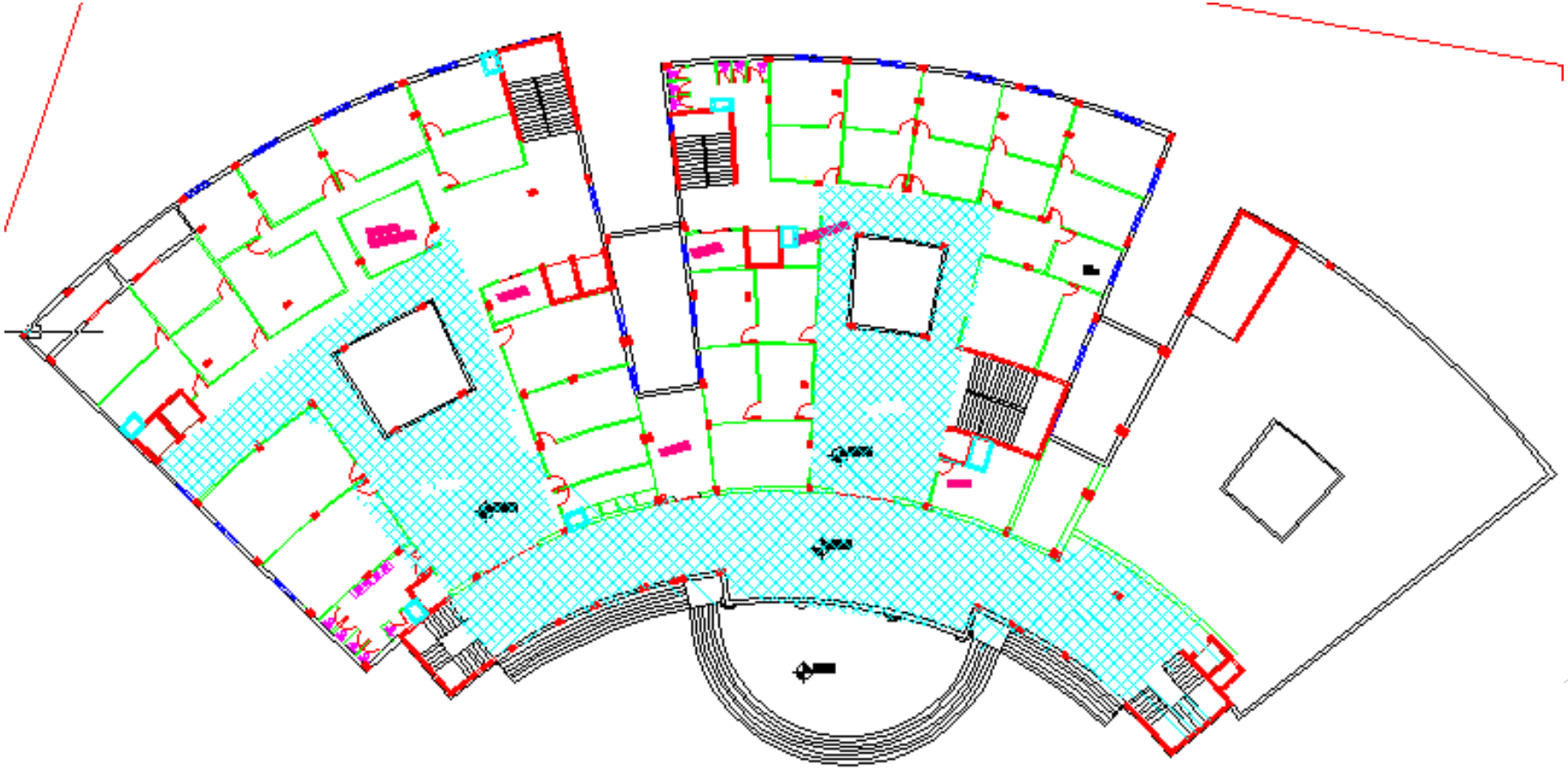
Path movement



F.Floor

Architectural Design

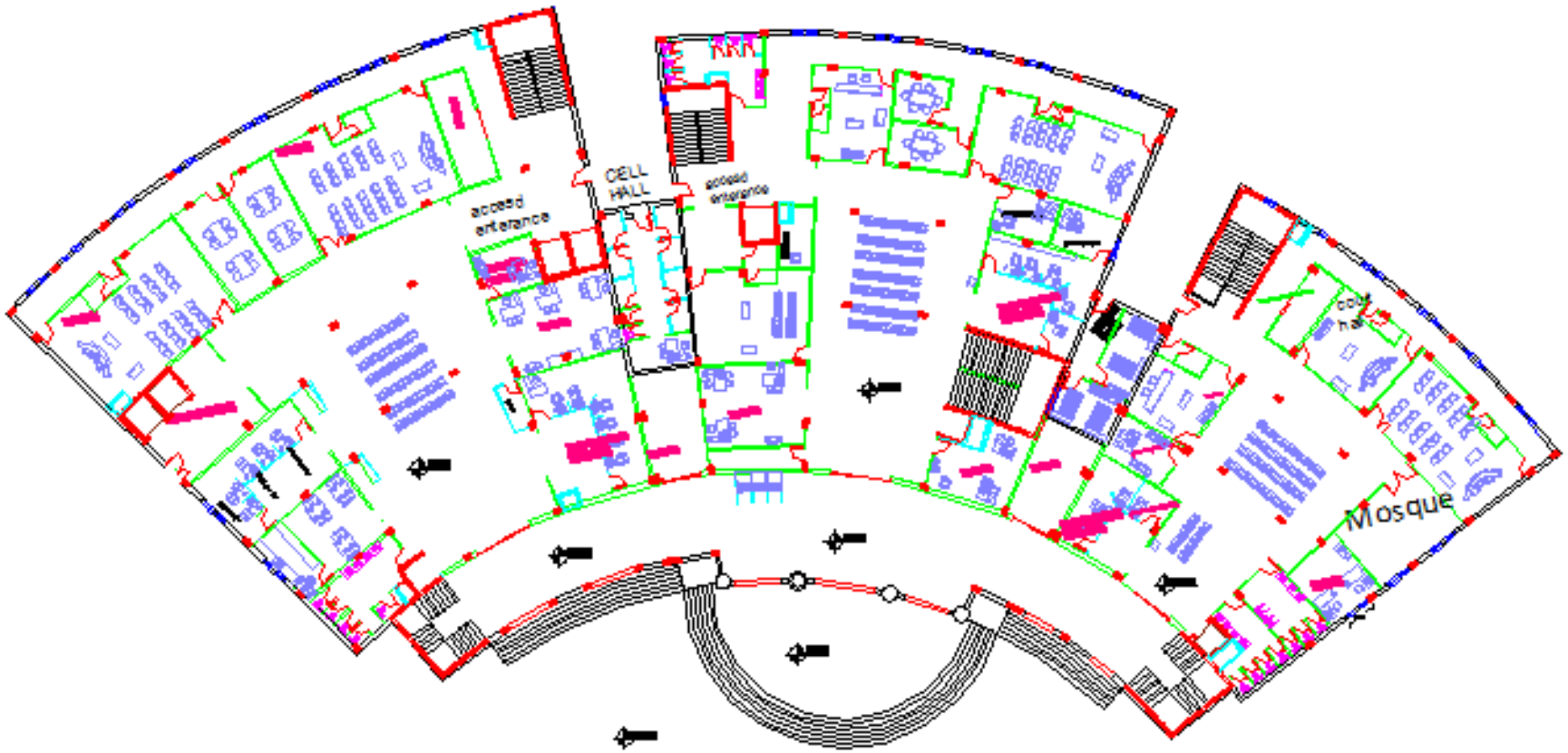
Path movement



S.Floor

Architectural Design

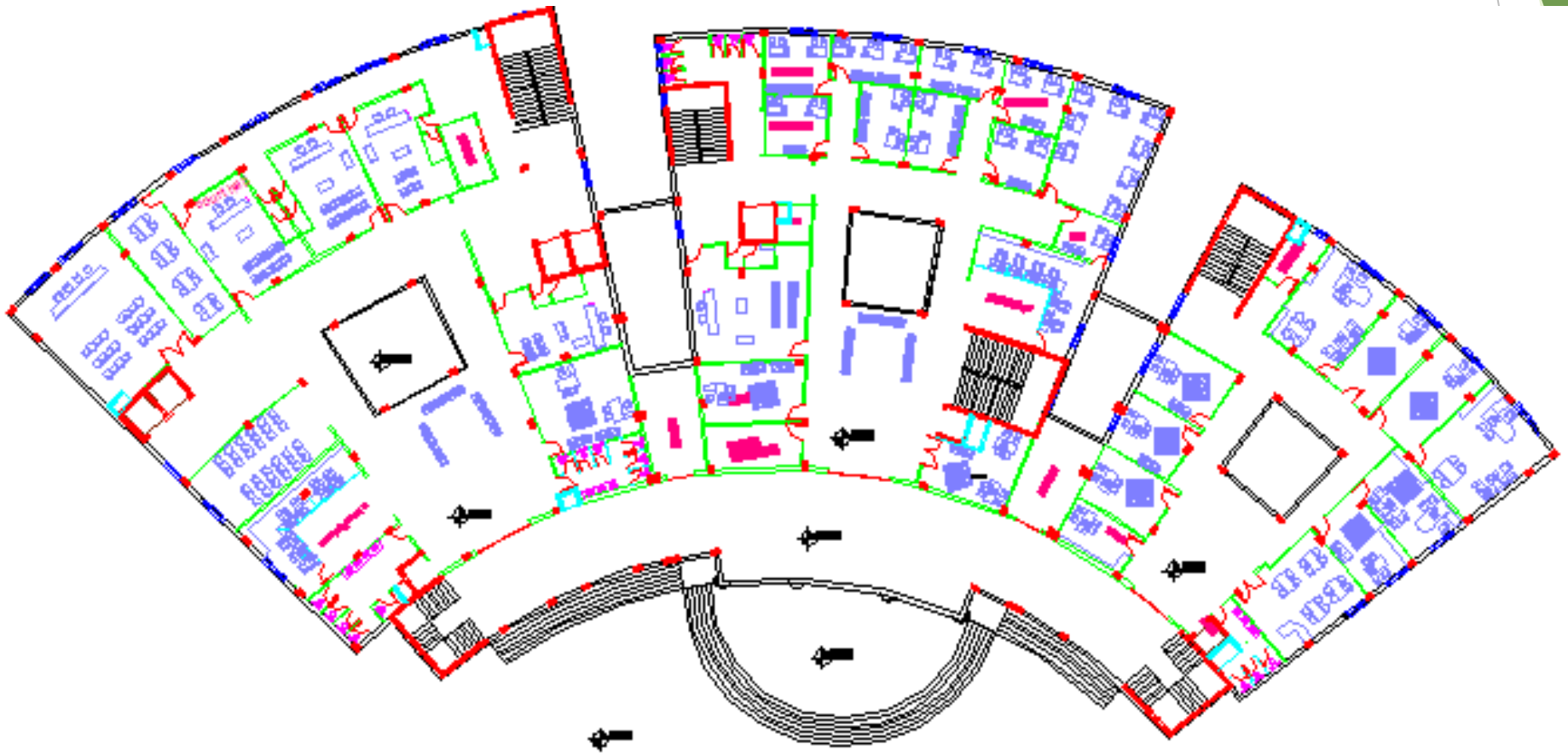
Plans



ground floor

Architectural Design

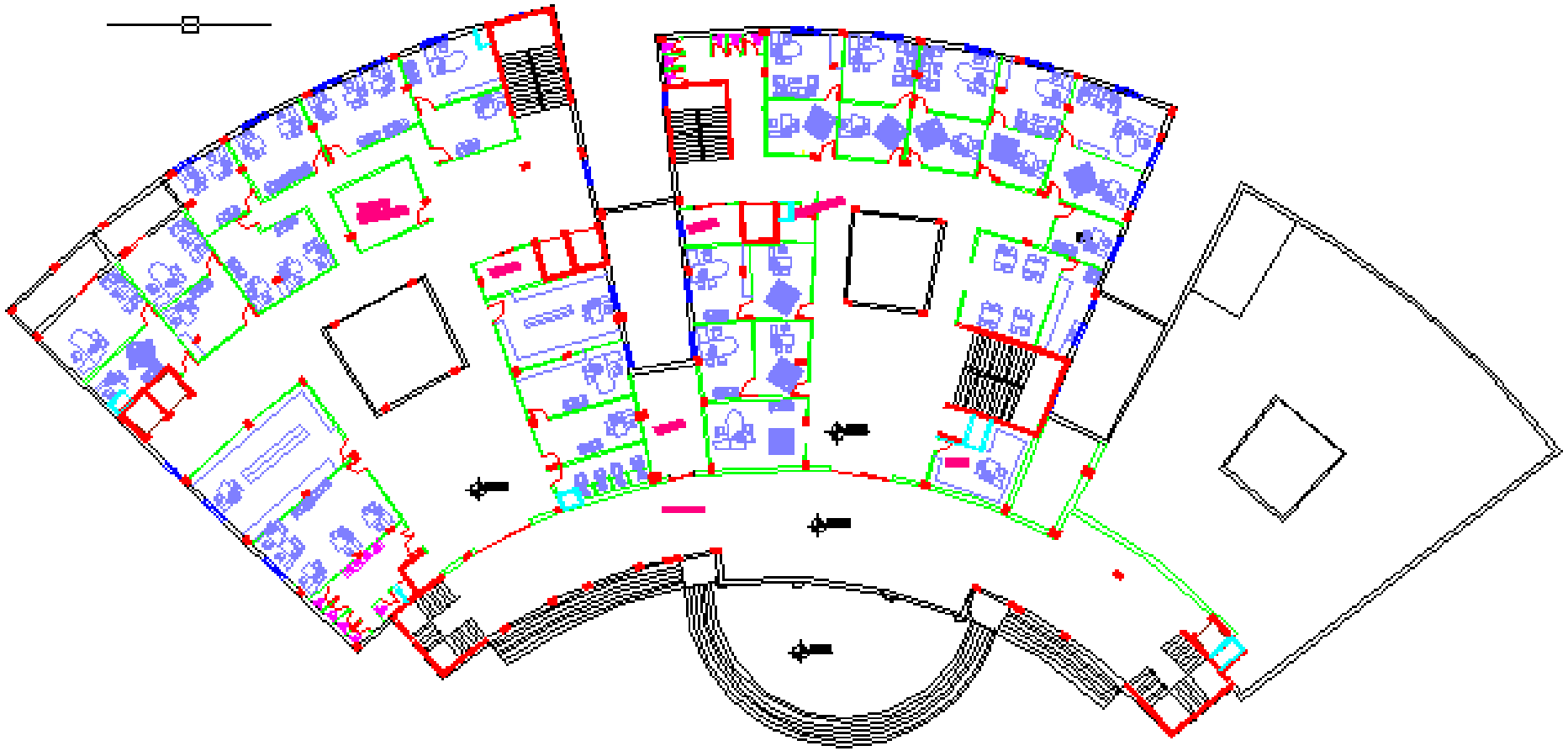
Plans



F.Floor

Architectural Design

Plans



S.Floor

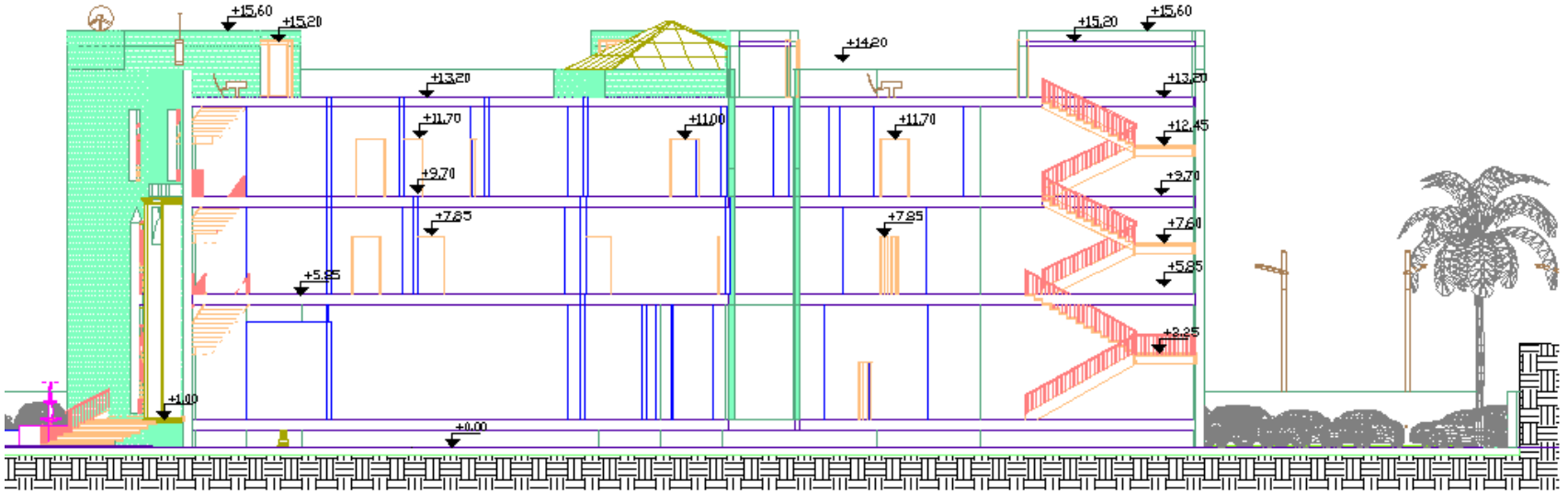
Architectural Design

south Elevation

North Elevatio

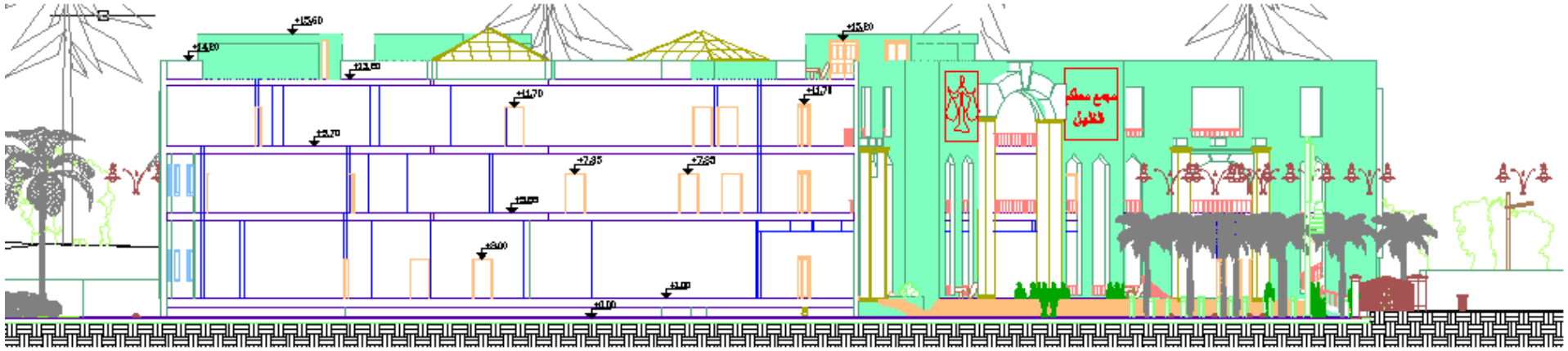
Architectural Design

Section A-A



section A-A

Section B-B



section B-B

Architectural Design

3D model

Structural Design

Structural Design

Codes

- **(ACI 318) for RC Structures Design**
- **(UBC 97) for Earthquake Loads**
- **(ASCE 7 2010) for loads computations**

Structural Design

Loads

- Live Load = 3.5 KN/m2
- SID= 4 KN/m2
- EQ Loads:

❖ I= 1	Cv=0.25
❖ R= 6.5	Ca=0.18
❖ Z= 0.15	Ct= 0.0488

Structural Design

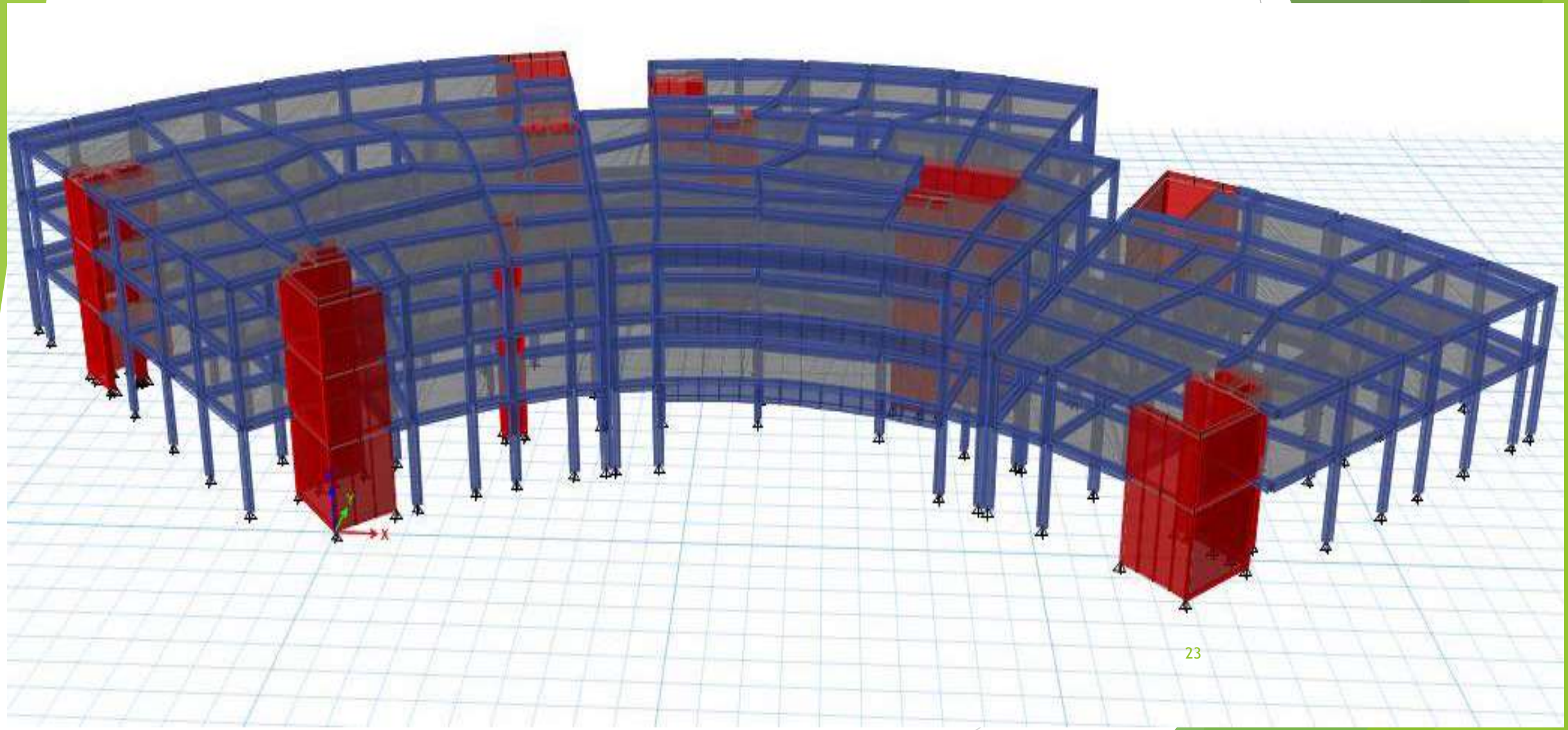
Material

Concrete B300

Primary Design Assumptions

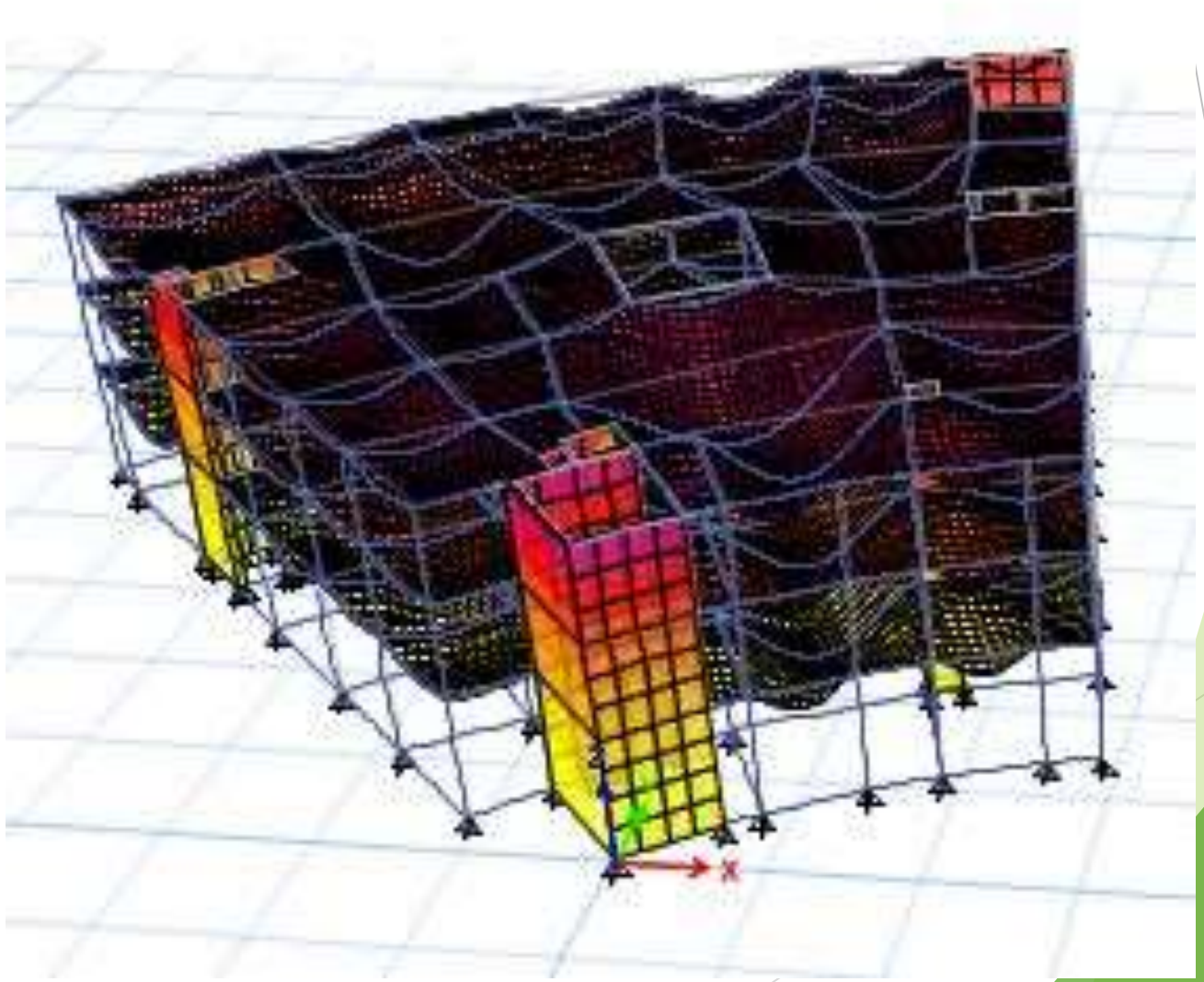
- **Columns 0.5*0.3m**
- **Main Beam 0.35*0.6m**
- **Secondary Beam 0.35*0.4m**

Structural Design



Structural Design

Compatibility Check



Structural Design

Equilibrium Check

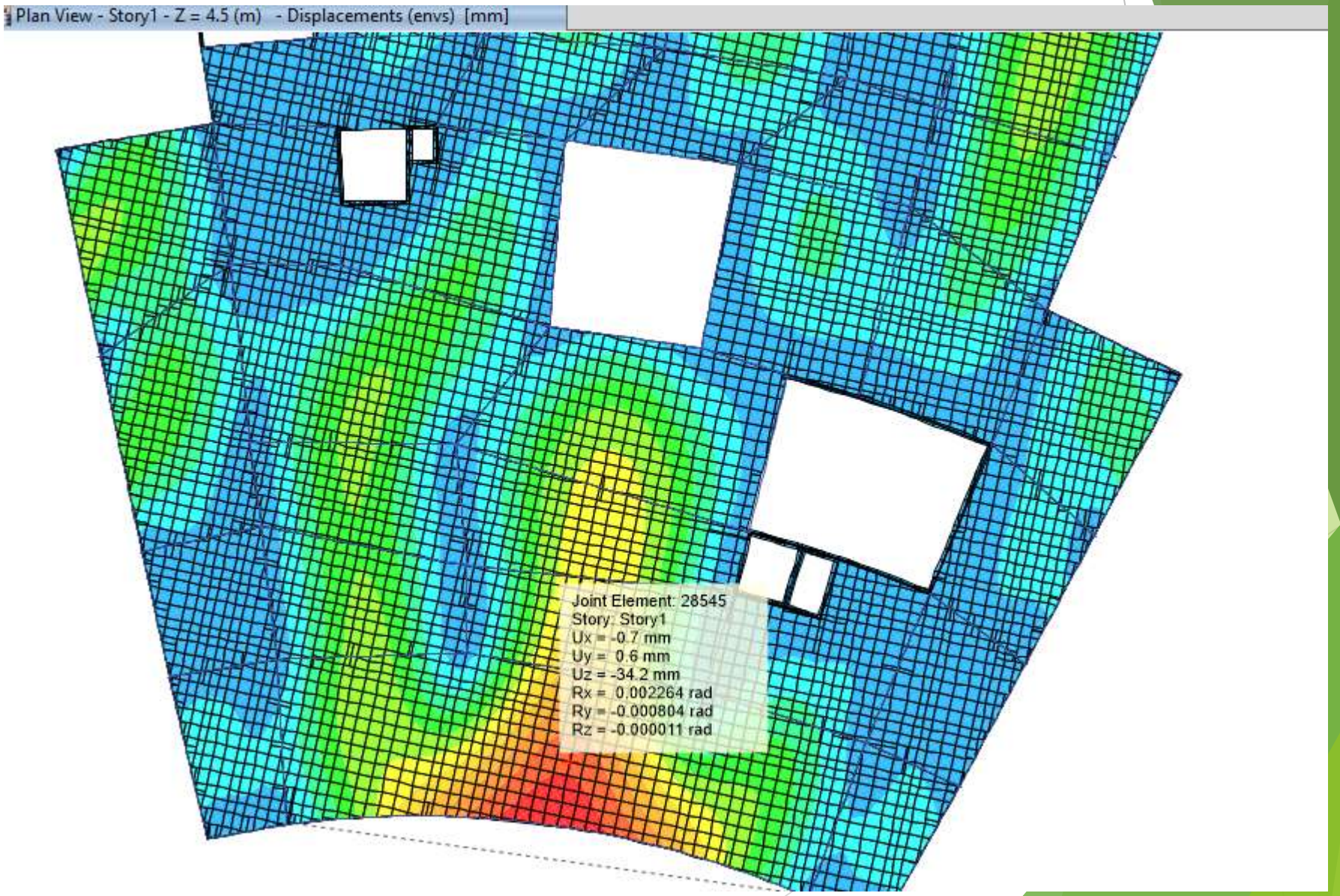
Load	Manual calculations (KN)	Calculations from ETABS (KN)	Difference (%)
Dead load	24665	23465	4.9
Live load	9975	9545	4.31
Superimposed dead load	32538	30920	4.9

Internal Forces Check

Element	Hand calculations	Calculations from ETABS	Difference (%)
Slab 1	75.1KN.m	75.3KN.m	.002
Beam 5	231KN.m	211KN.m	9.4
Column 2	1311KN	1405KN	6.7

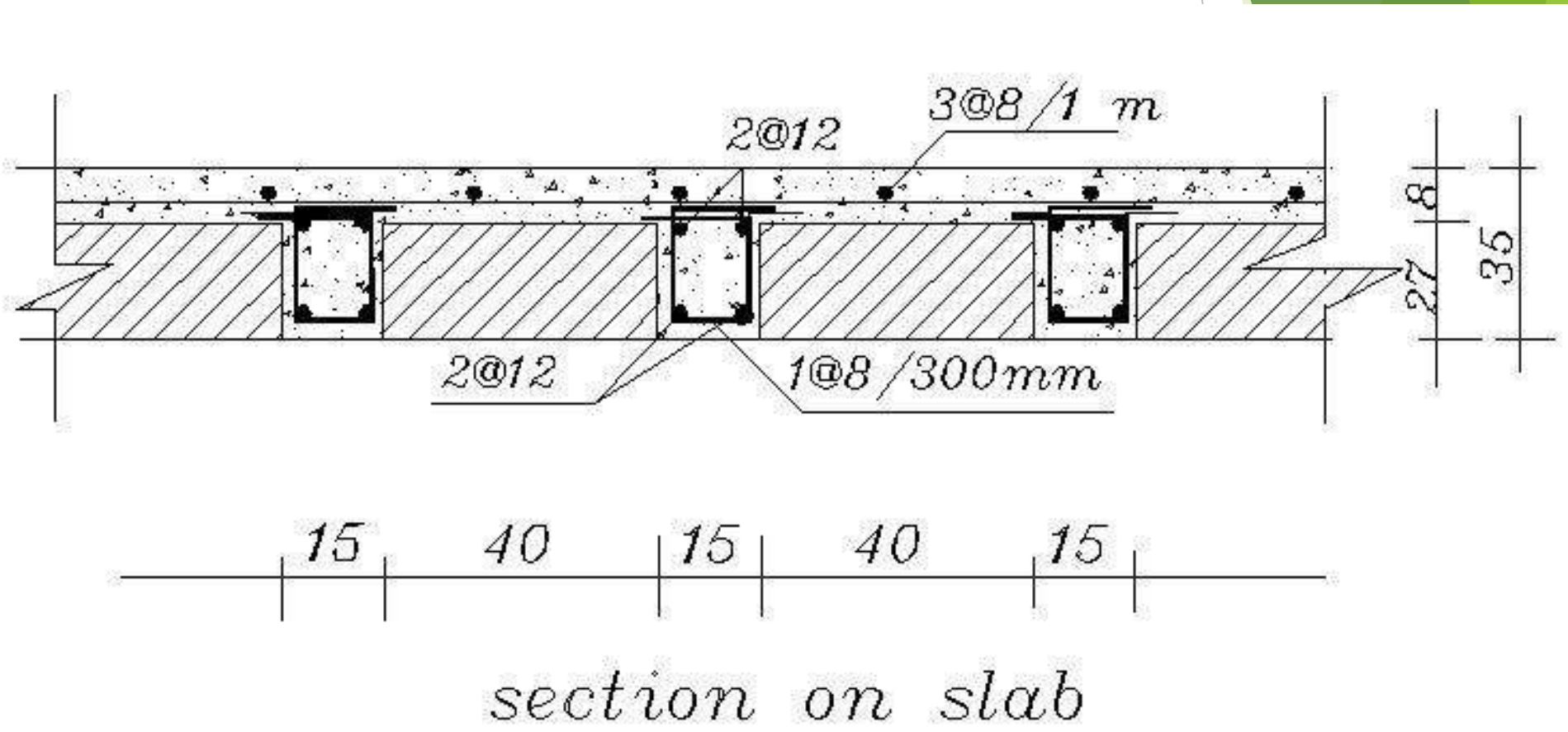
Structural Design

Deflection



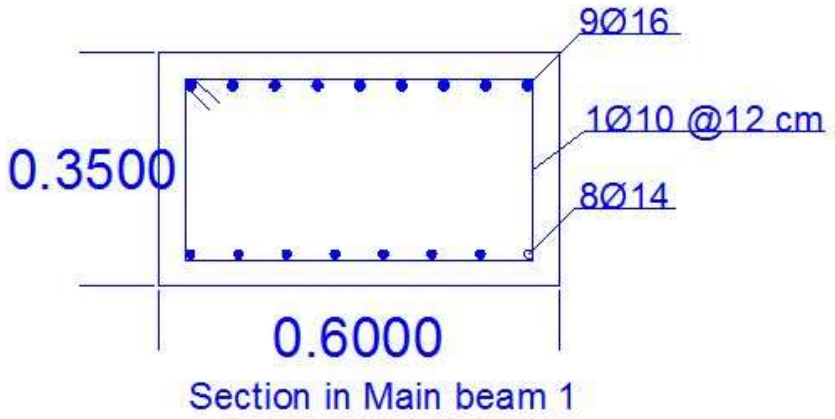
Structural Design

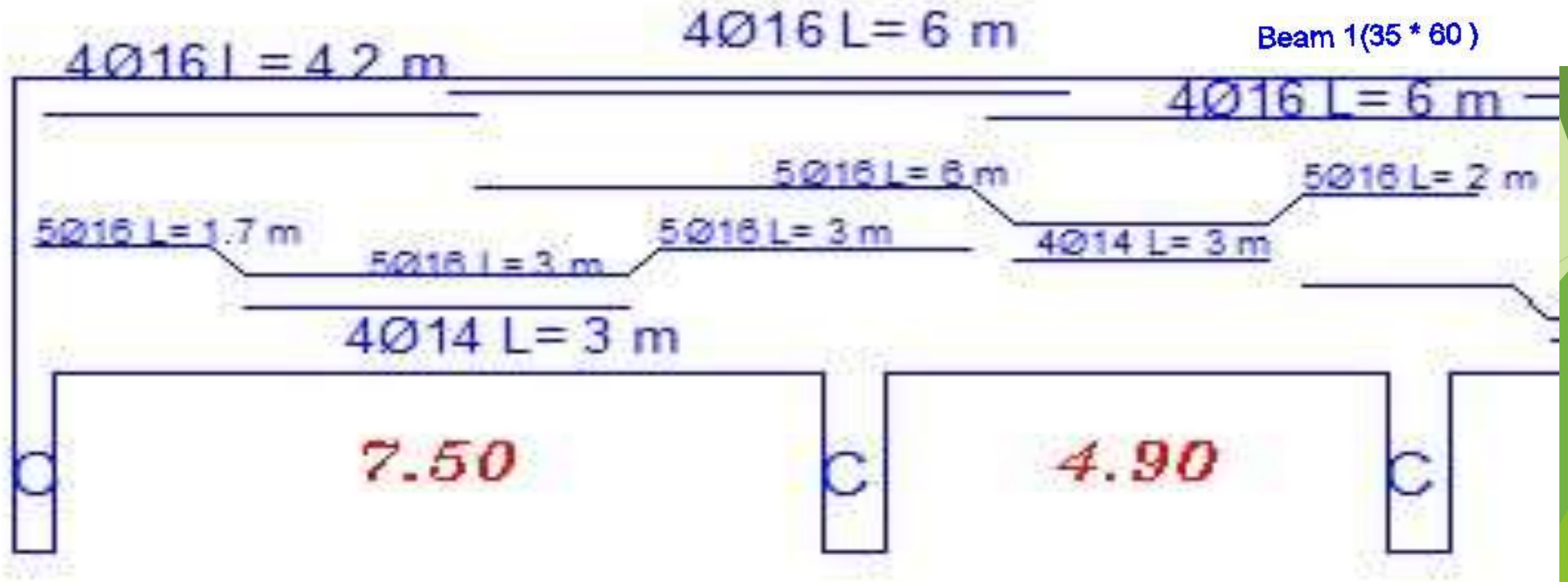
Slab:
One-Way
Ribbed Slab



Structural Design

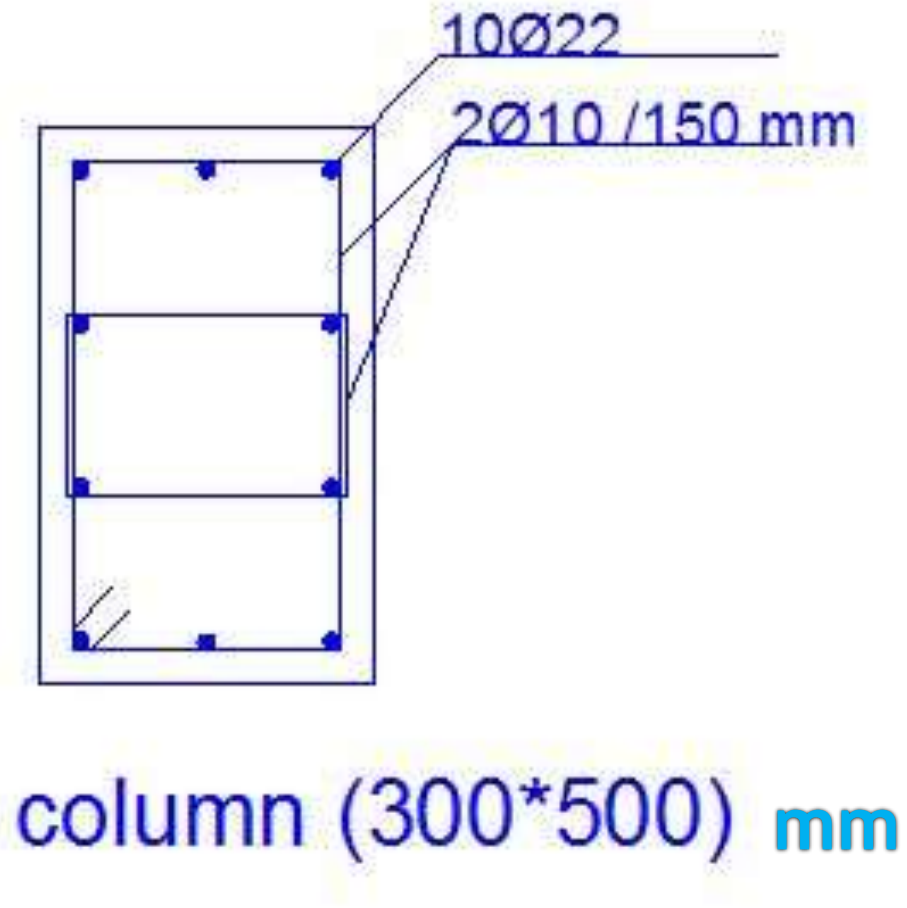
Beam Design



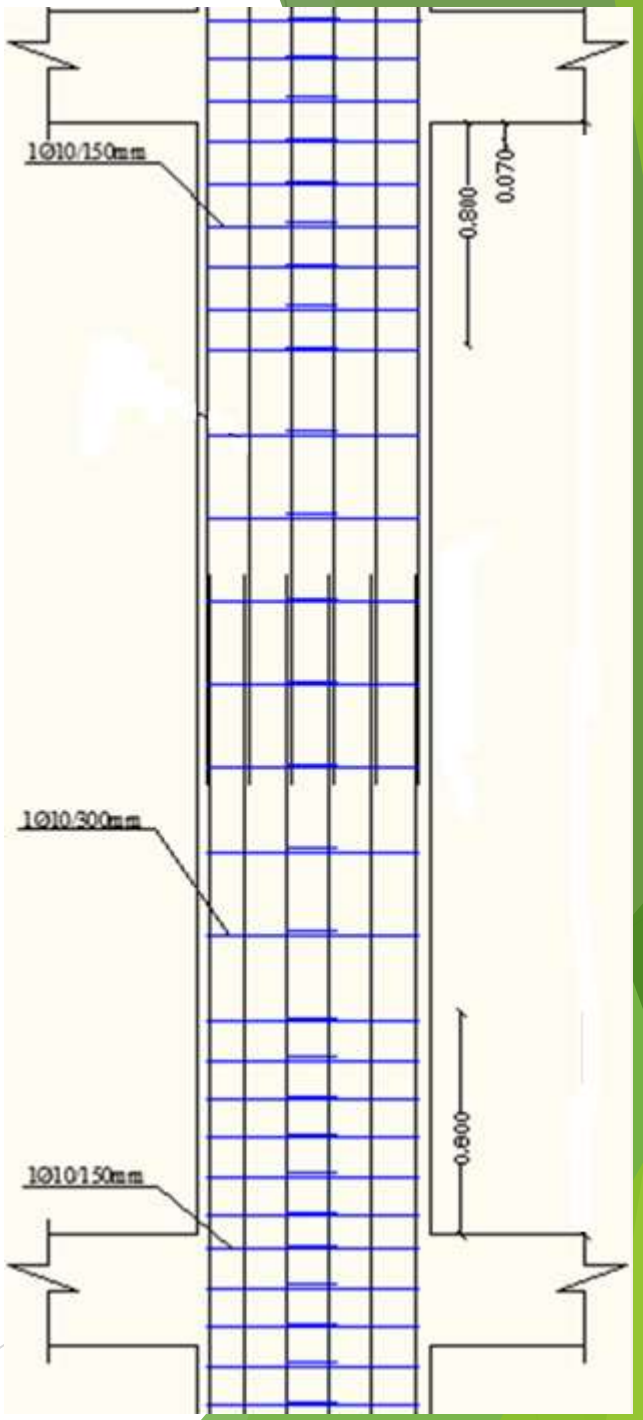


Structural Design

Column Design

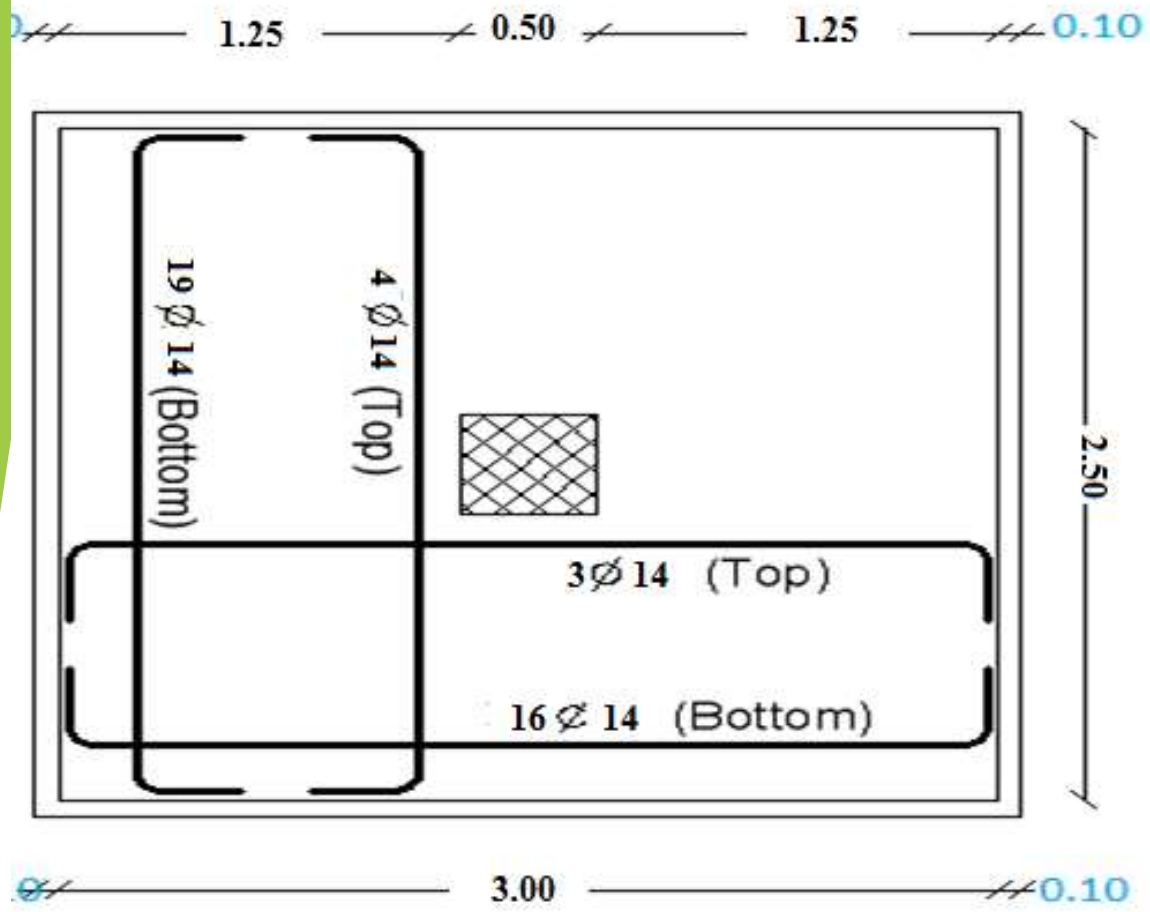


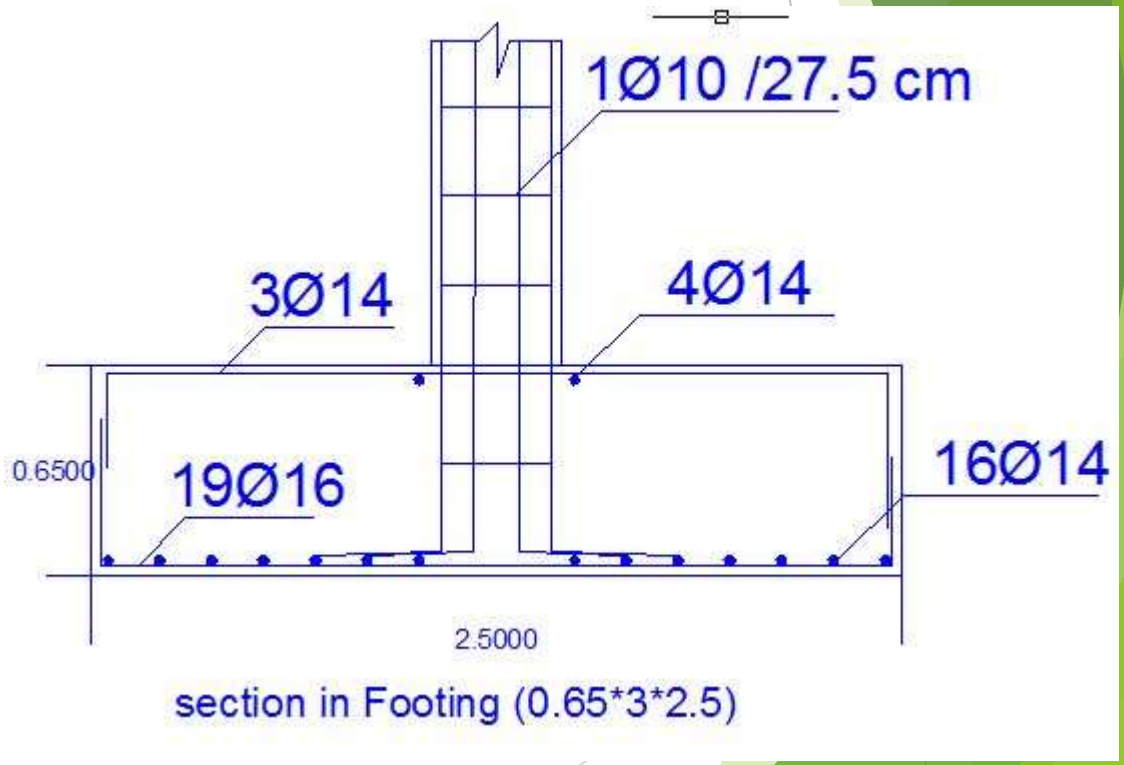
column (300*500) mm



Structural Design

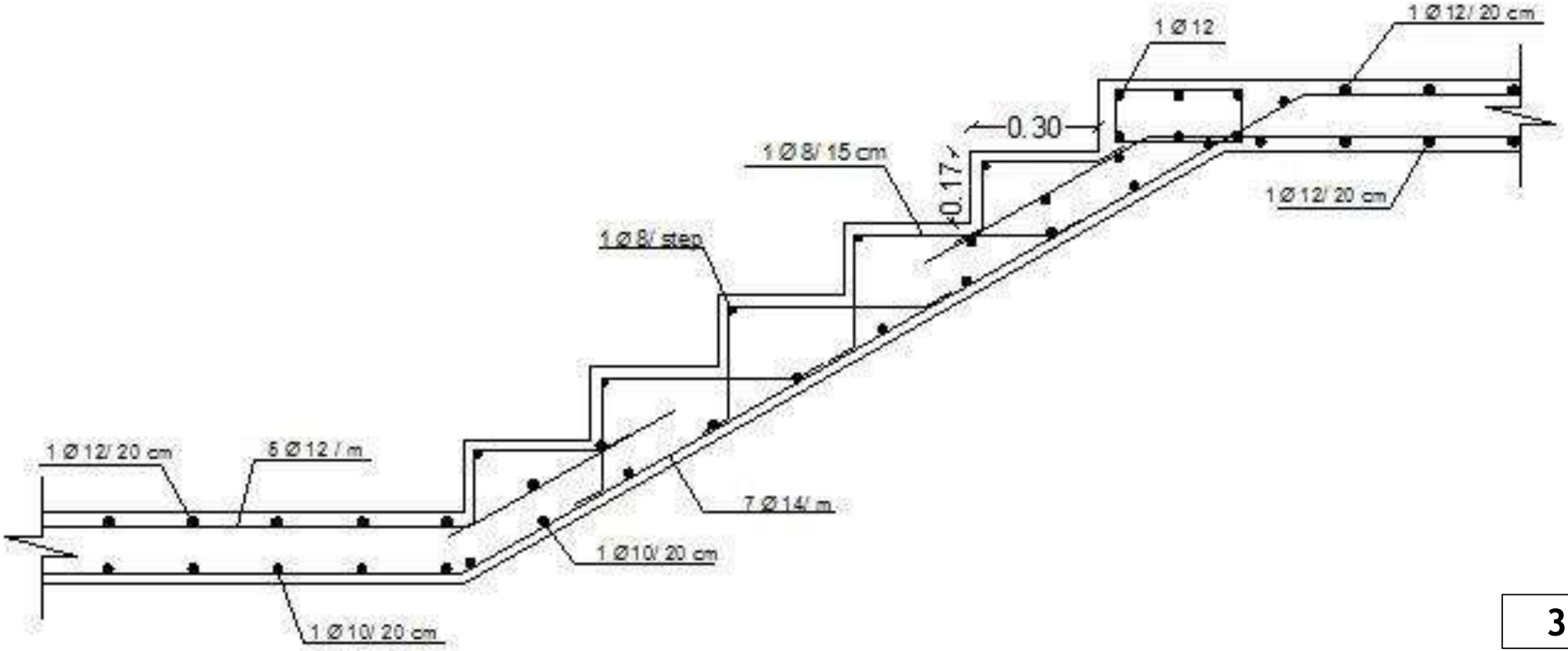
Footing Design



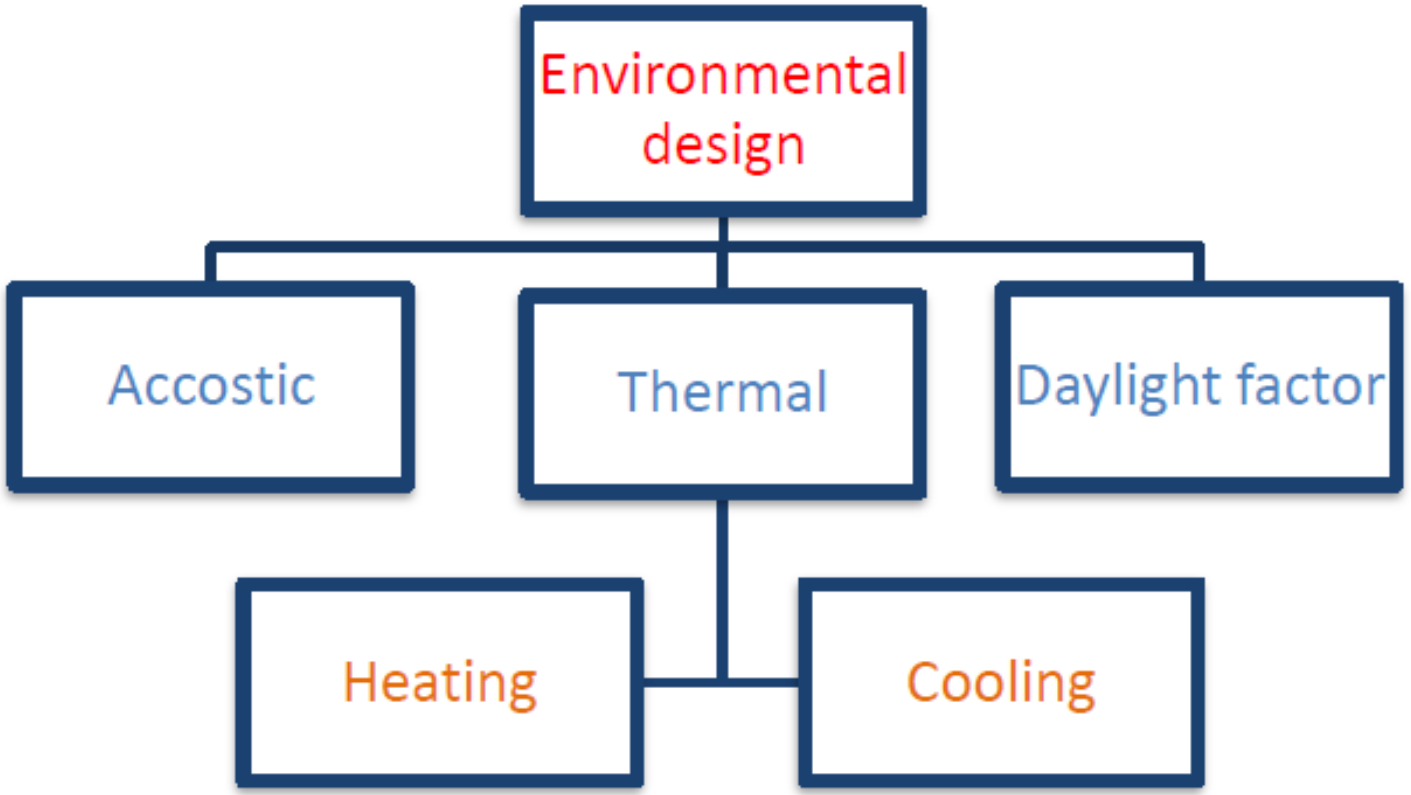


Structural Design

Stair

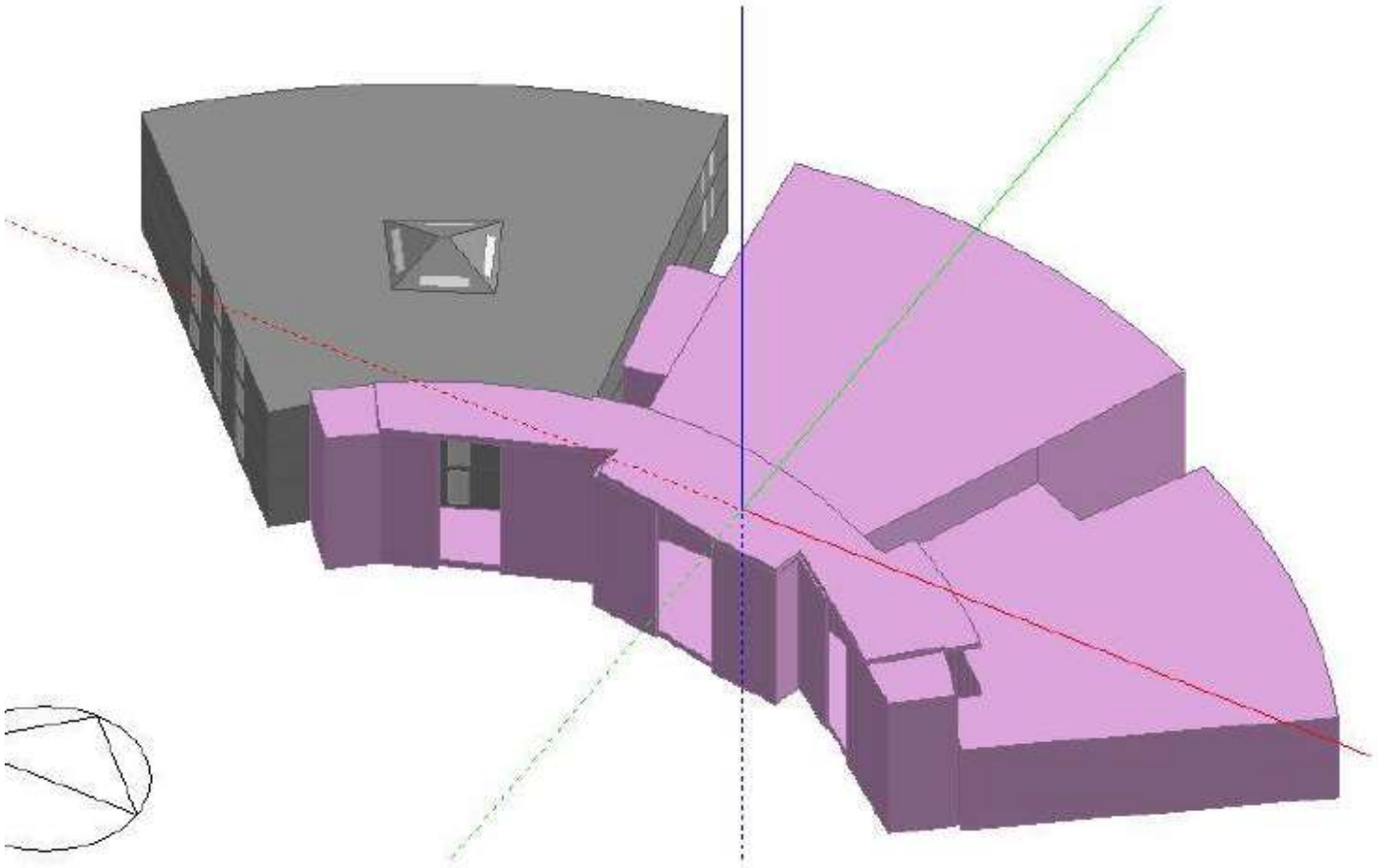


Environmental Design


Environmental design
Accostic
Thermal
Daylight factor
Heating
Cooling

Environmental Design

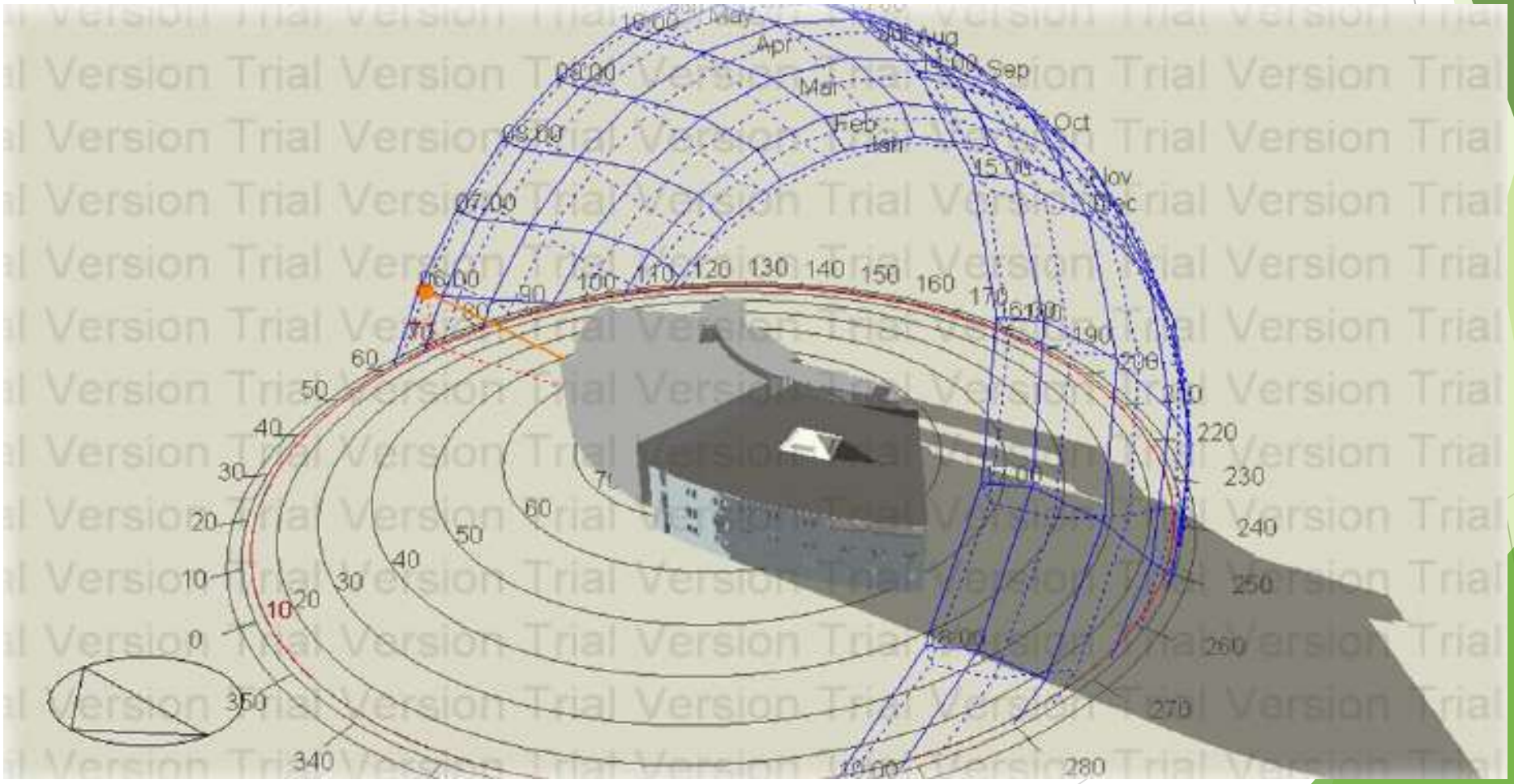
Software: Design Builder



Environmental Design

sun path and shadow

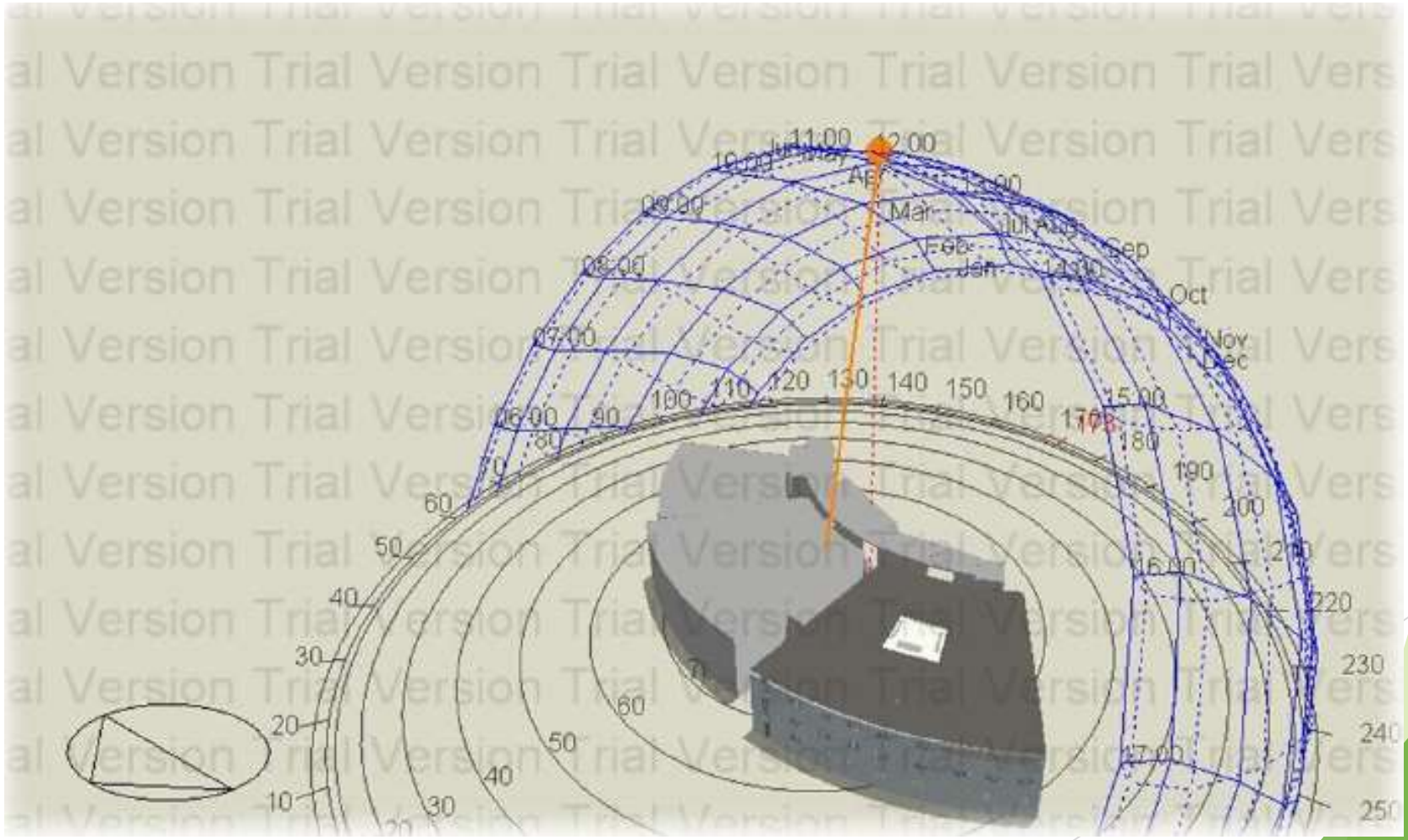
at 15/January at 8 am



Environmental Design

sun path and shadow

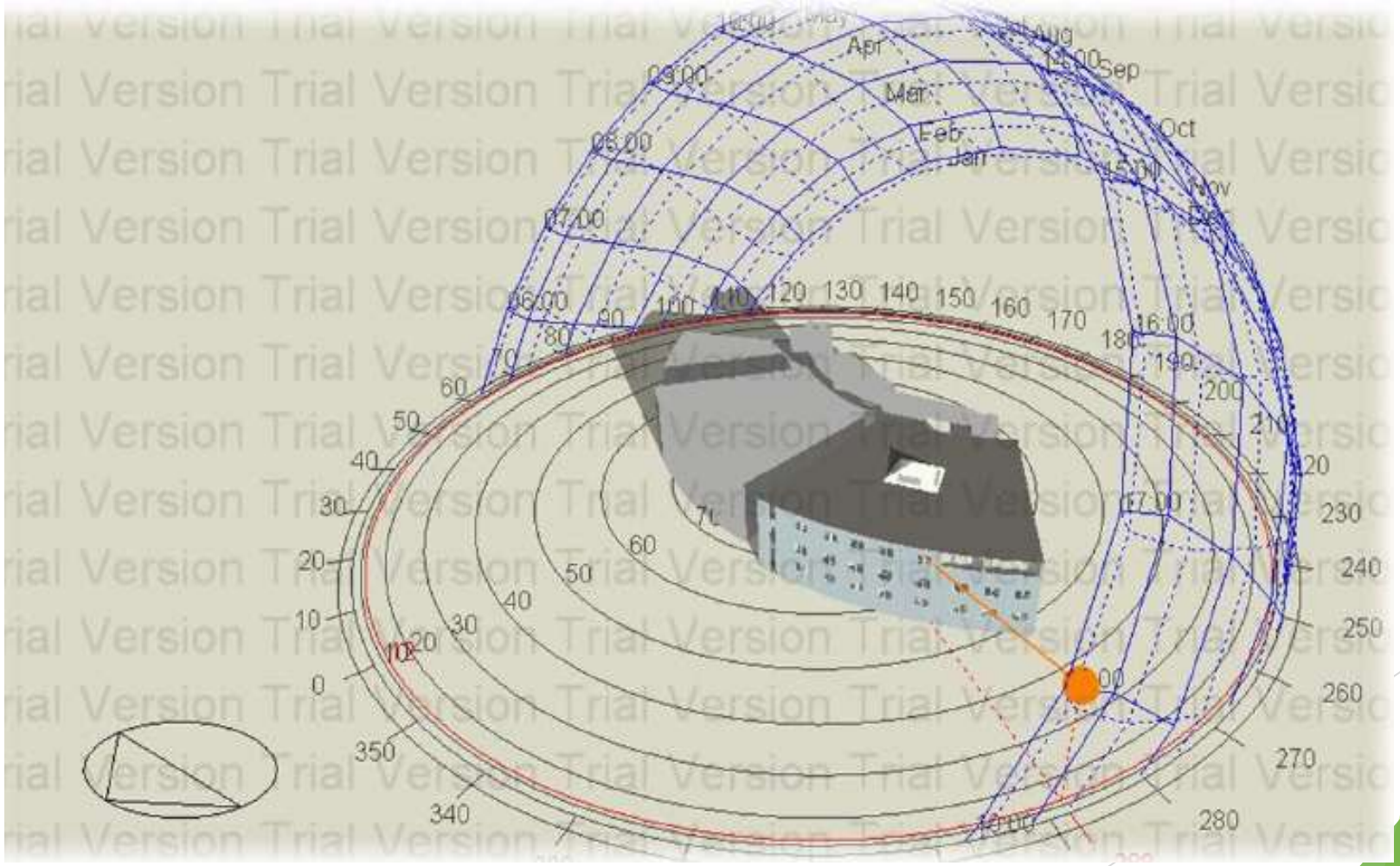
at 15/January at 12pm



Environmental Design

sun path and shadow

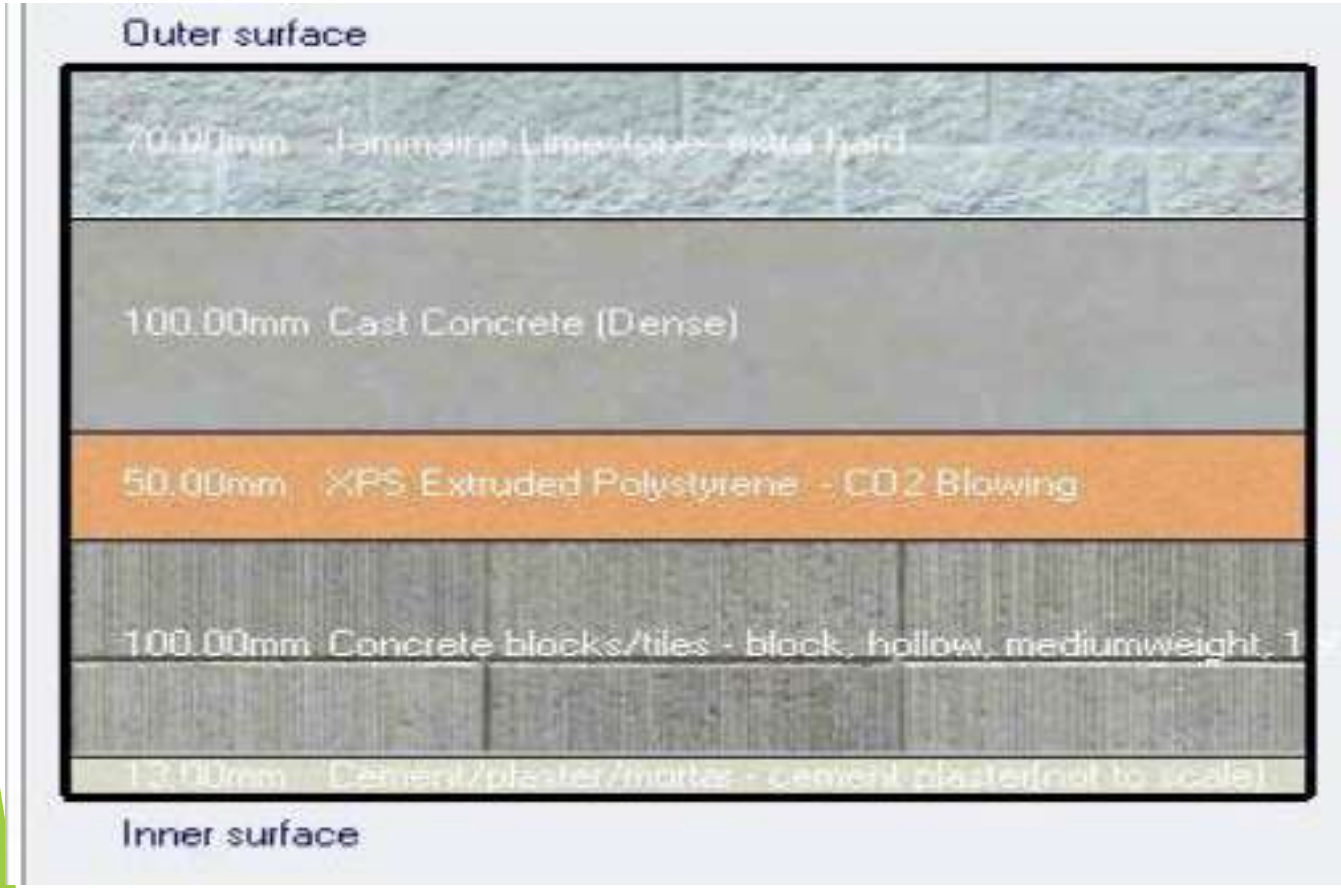
at 15/January at 16 pm



Environmental Design

U value calculation

for external wall

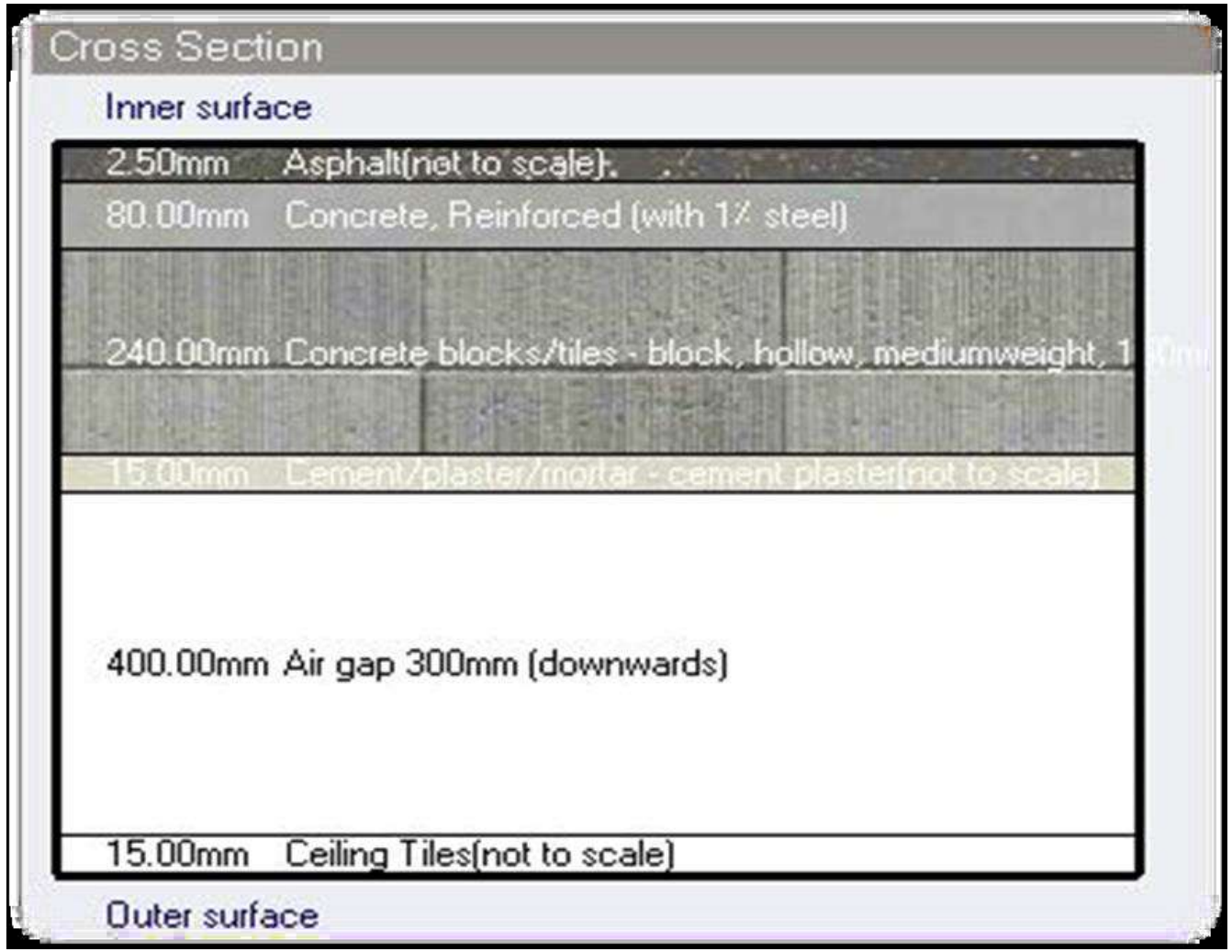


U value = .521 (W/m2-k)

Environmental Design

U value calculation

for external floor

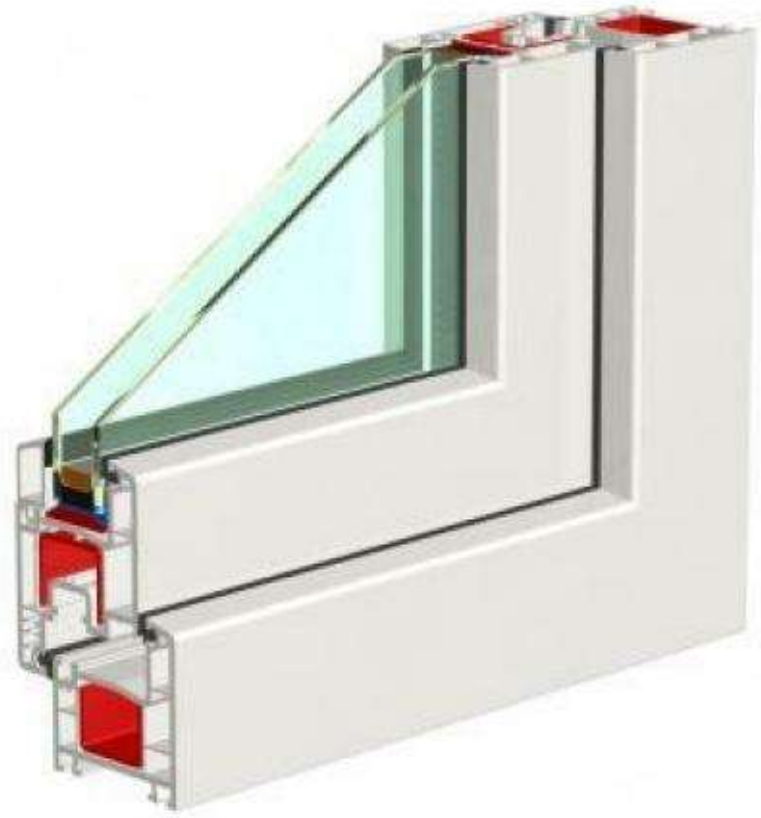


U value = .921 (W/m2-k)

Environmental Design

U value calculation

for Windows (double glazing gap 6mm)



U value = 1.96
(W/m2-k)

Environmental Design

Thermal design

Total cooling load (KW) = 174 KW
In 21/7

Total Heating load (KW) = 132 KW
In 21/12

Environmental Design

Thermal design

Heating capacity W/m2 for GF

Zone	Comfort Temperature (°C)	Steady-State Heat Loss (kW)	Design Capacity (kW)	Design Capacity (W/m2)
Court Complex Total Design Heating Capacity = 133.660 (kW)				
GF Total Design Heating Capacity = 47.960 (kW)				
Circulation area	14.80	18.42	**23.03**	49.1755
Court hall 1	15.64	2.51	**3.14**	43.2641
Notary ROOM	20.52	2.16	**2.70**	78.1017
Consultation rooms 1	21.70	1.13	**1.41**	69.3723
Consultation rooms 2	21.70	1.12	**1.41**	69.2797
Implementation Manager	21.21	0.43	**0.54**	76.1045
Court hall 2	15.88	3.22	**4.03**	40.7891
Register room	20.04	3.66	**4.57**	96.6545
Pay fees room	21.15	2.07	**2.58**	67.7791
Cafitiria	22.10	2.40	**2.99**	97.3006
Bathrooms	19.34	1.25	**1.56**	79.6449

Environmental Design

Thermal design

Heating capacity W/m2 for FF

Zone	Comfort Temperature (°C)	Steady-State Heat Loss (kW)	Design Capacity (kW)	Design Capacity (W/m2)
FF Total Design Heating Capacity = 45.920 (kW)				
Circulation area	15.51	16.80	**20.99**	45.9400
Court hall 3	21.57	1.45	**1.81**	40.3732
Court hall 2	20.72	2.15	**2.69**	55.4437
Court hall 1	20.77	2.17	**2.71**	78.3618
Security	20.84	0.53	**0.67**	73.4434
Court hall 4	21.18	1.36	**1.70**	49.1583
Consultation room 2	20.85	1.84	**2.30**	84.9555
Consultation room 1	19.01	3.96	**4.95**	81.0892
Consultation room 3	21.25	1.22	**1.53**	48.5335
Waiting area	19.55	1.62	**2.02**	59.7474
Register room	21.30	1.84	**2.30**	51.0137
Bathrooms	19.36	1.10	**1.38**	70.4599
Bathrooms 2	19.51	0.69	**0.87**	68.2087

Environmental Design

Thermal design

Heating capacity W/m2 for SF

SF Total Design Heating Capacity = 39.780 (kW)				
Adviser room 3	21.12	1.55	**1.93**	51.8719
Bathrooms	19.21	1.18	**1.48**	75.6022
Circulation area	15.36	13.04	**16.30**	50.1948
Archive room 4	19.66	1.44	**1.80**	58.5099
Security	19.17	0.43	**0.53**	77.7112
Adviser room 1	21.34	0.77	**0.97**	49.2185
Adviser room 2	21.33	0.59	**0.74**	51.8144
Call room	20.93	0.64	**0.80**	73.3062
Library	19.30	2.32	**2.90**	61.6792
Judge room 2	21.21	0.68	**0.85**	52.8255
Judge room 3	20.58	1.07	**1.34**	75.6871
Adviser room 5	20.62	1.23	**1.54**	63.4420
Adviser room 8	21.20	0.59	**0.74**	45.6251
Adviser room 7	21.30	1.04	**1.30**	48.2677
Judge room 1	21.40	0.64	**0.80**	46.7616
Store room	19.47	0.95	**1.18**	63.0144
Adviser room 6	20.86	0.89	**1.12**	66.3984
Adviser room 9	20.77	1.03	**1.29**	67.7694
Judge room	21.04	0.72	**0.90**	63.3497
President of the Court	21.02	1.02	**1.27**	56.7953

Environmental Design

Thermal design

Cooling capacity W/m2 for GF

Block	zone	cooling load w/m2
GF	Court hall2	60.7
GF	Circulation area	47.8
GF	Courthall1	61.7
GF	Notary ROOM	78.9
GF	Consultation rooms 1	61
GF	Consultation rooms 2	60.7
GF	Implementation Manager	54.4
GF	Register room	84.3
GF	Pay fees room	64
GF	Cafitiria	92.1

Environmental Design

Thermal design

Cooling capacity W/m2 for FF

Block	zone	cooling load w/m2
FF	Circulation area	47.7
FF	Courthall3	50.1
FF	Courthall2	48
FF	Courthall1	55
FF	Security	55.9
FF	Courthall4	54
FF	Consultation room 2	74.5
FF	Consultation room 1	68
FF	Consultation room 3	59.7
FF	Waiting area	68.7
FF	Register room	63.8

Environmental Design

Thermal design

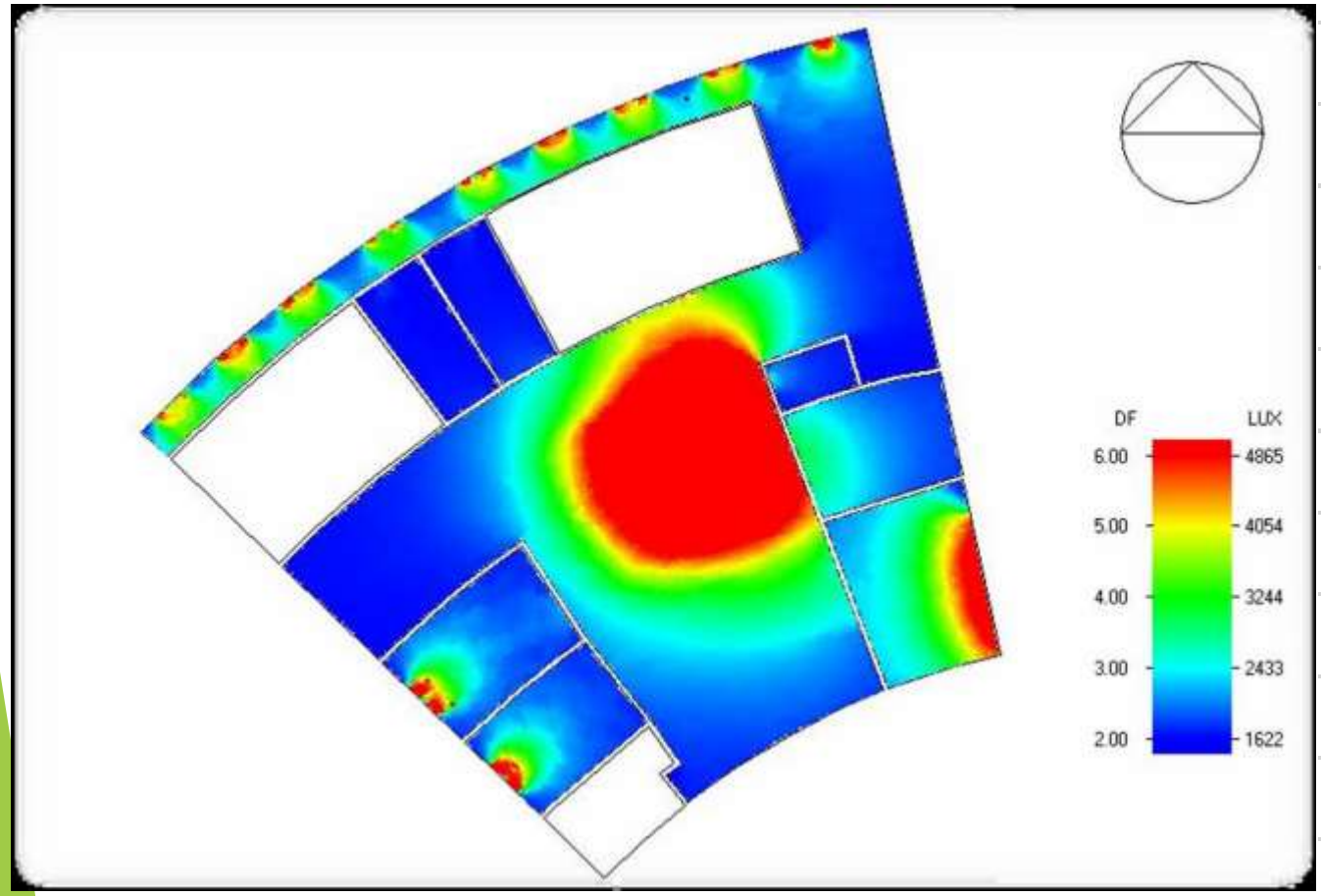
Cooling loss W/m2 for SF

Block	zone	cooling load w/m2
SF	Adviser room 3	68.6
SF	Circulation area	61.9
SF	Archive room 4	60
SF	Security	67.7
SF	Adviser room 1	70.9
SF	Adviser room 2	72.6
SF	Call room	80.7
SF	Library	92.7
SF	Judge room 2	67.4
SF	Judge room 3	71.3
SF	Adviser room 5	66
SF	Adviser room 8	57.8
SF	Adviser room 7	65.8
SF	Judge room 1	64.2
SF	store room	59.6
SF	Adviser room 6	76.8
SF	Adviser room 9	72.9
SF	Judge room	70.6
SF	President of the Court	65.5

Environmental Design

Daylight

For GF

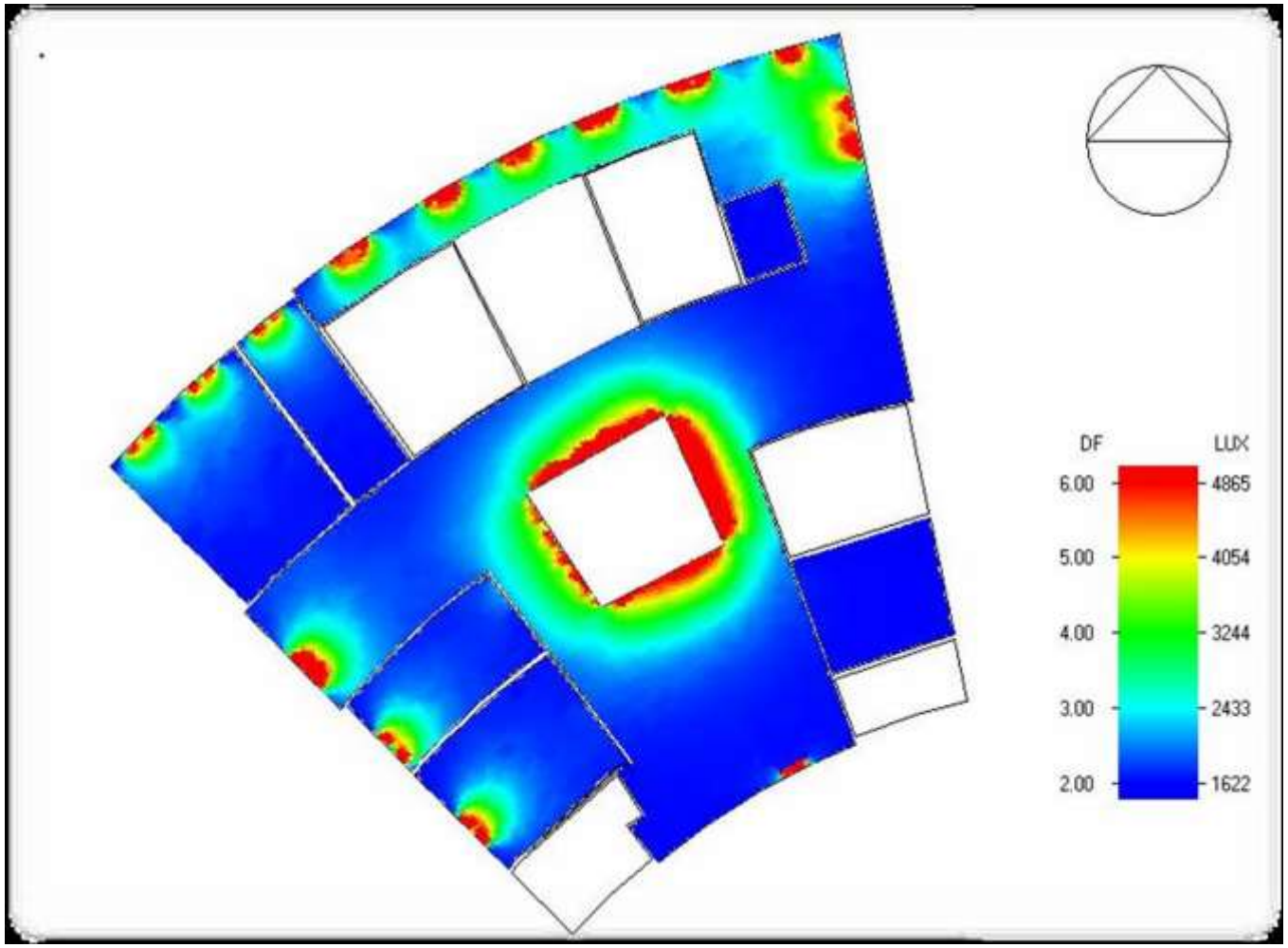


Zone	Average Daylight Fa
Circulation area	6.3
Notary ROOM	2.7
Consultation rooms 1	1.43
Consultation rooms 2	1.53
Implementation Manager	1.62
Register room	4.32
Pay fees room	3.72
Cafitiria	3.12
Total	5.21

Environmental Design

Daylight

For FF

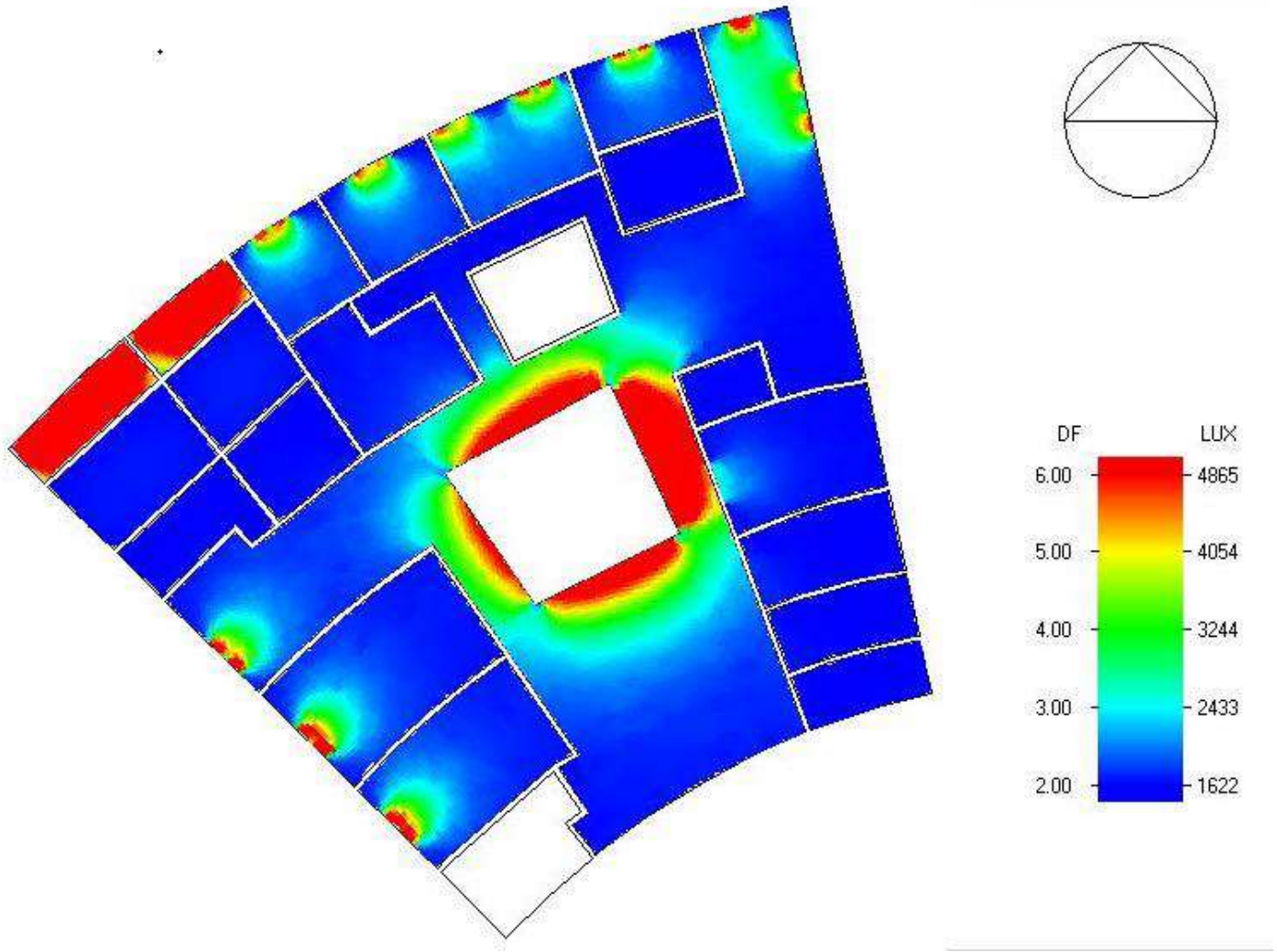


Circulation area	2.12
Security	0.72
Consultation room 2	2.48
Consultation room 1	2.84
Consultation room 3	0.53
Waiting area	2.1
Register room	2.21
Total	2.22

Environmental Design

Daylight

For SF



Adviser room 3	2.34
Circulation area	3.42
Archive room 4	1.25
Security	1.1
Adviser room 1	0.87
Adviser room 2	0.84
Call room	0.63
Library	2.65
Judge room 2	0.71
Judge room 3	3.41
Adviser room 5	3.23
Adviser room 8	0.92
Adviser room 7	0.8
Judge room 1	0.88
Adviser room 6	2.98
Balcony 2	8.51
Adviser room 9	3.2
Judge room	0.91
Balcony 1	9.23
President of the Court	1.12
Total	2.71

Environmental Design

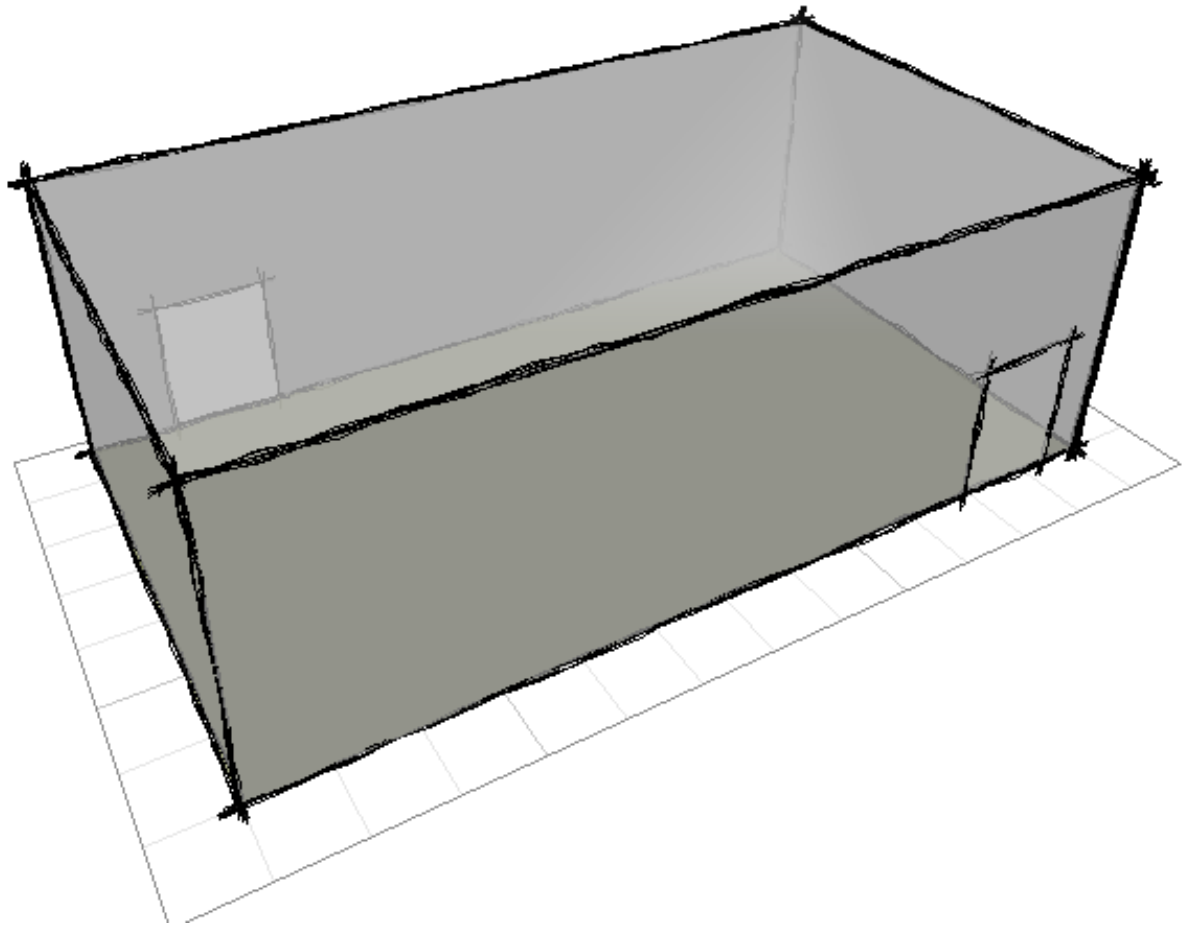
Acoustical design

- Reverberation time(RT60) --- Software Ecotect
- Sound Transmission Class (STC) --- Software INSUL
- Impact Insulation Class (IIC)
- Percentage articulation loss of consonants ($\%\boldsymbol{Alcons}.$)

Environmental Design

Acoustical design

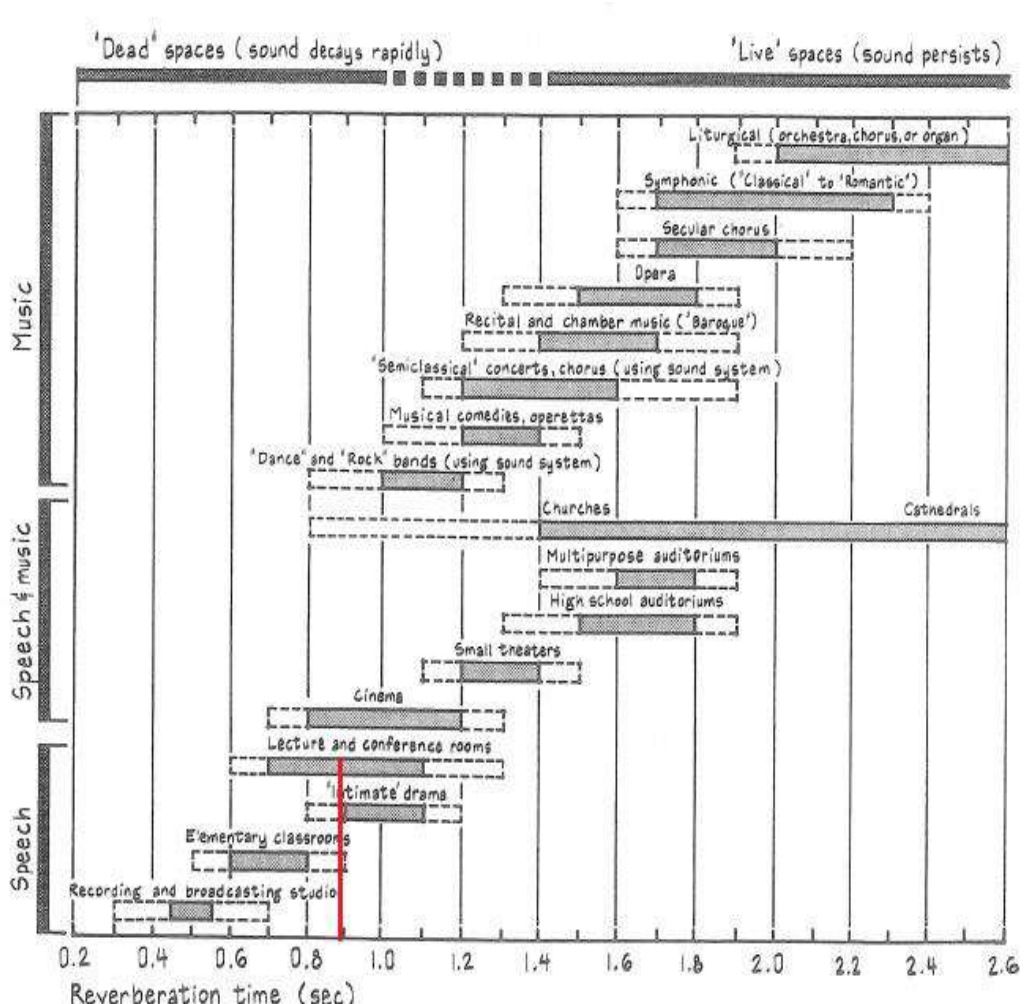
Reverberation time(RT60) for courtroom

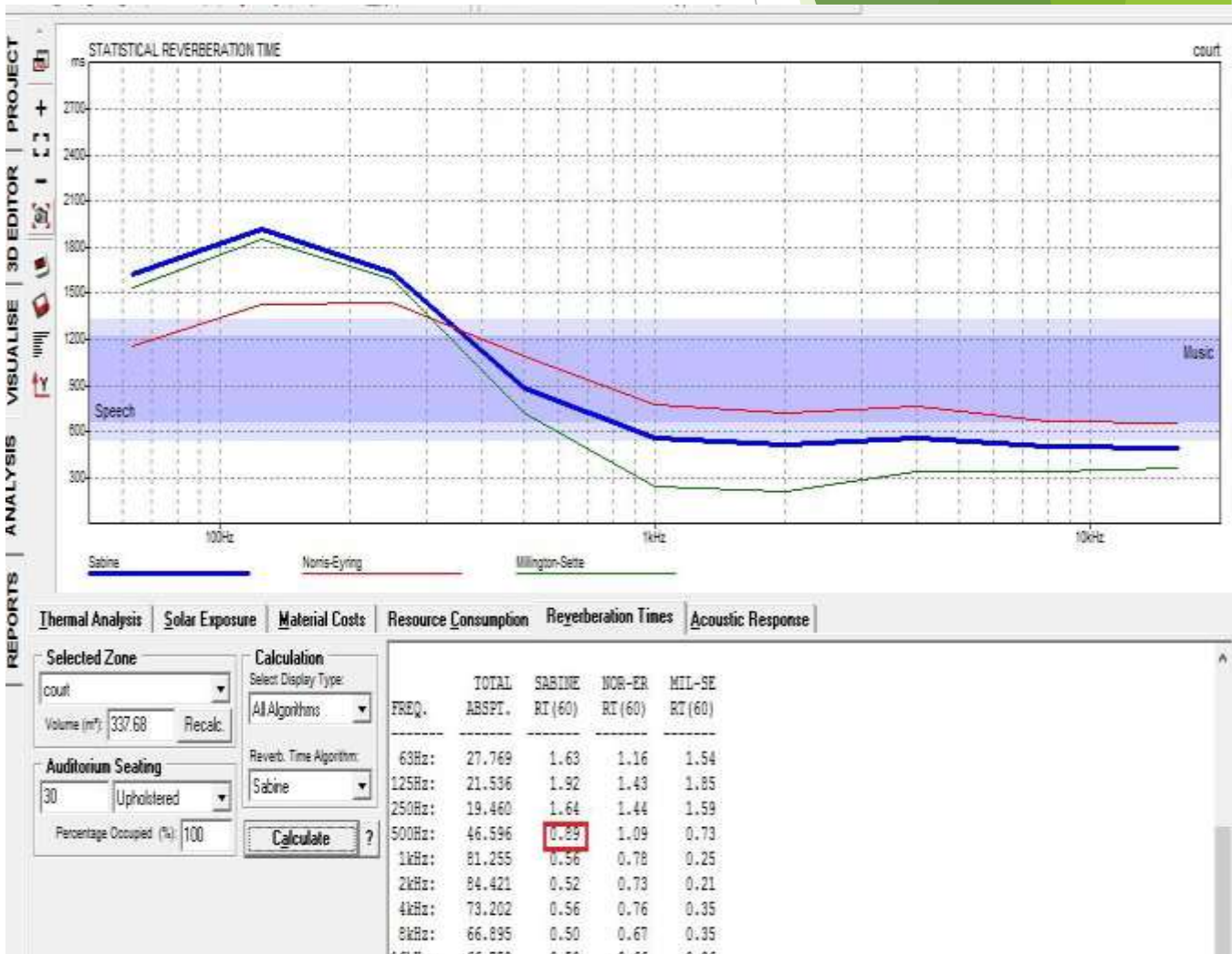


Environmental Design

Acoustical design

Reverberation time(RT60) for courtroom at 100% occupancy

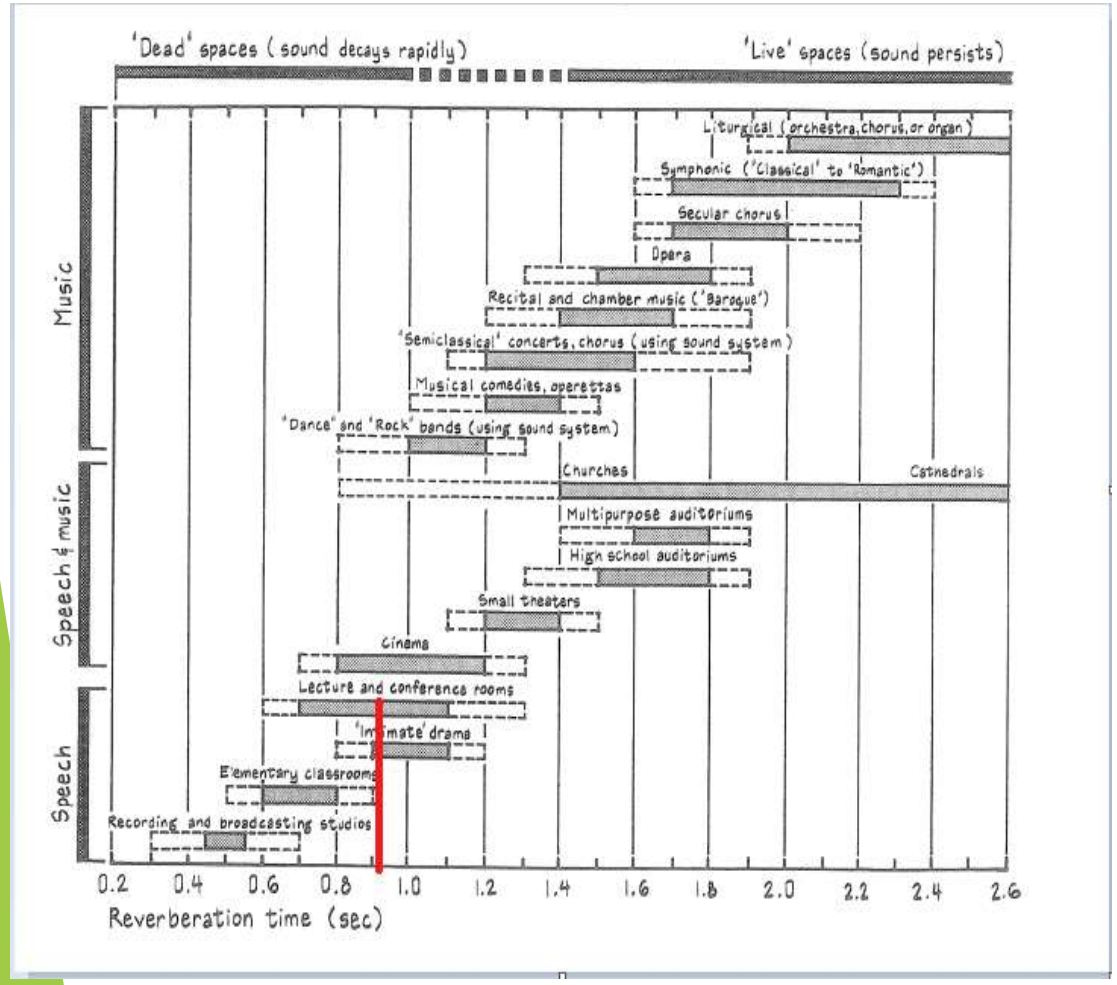




Environmental Design

Acoustical design

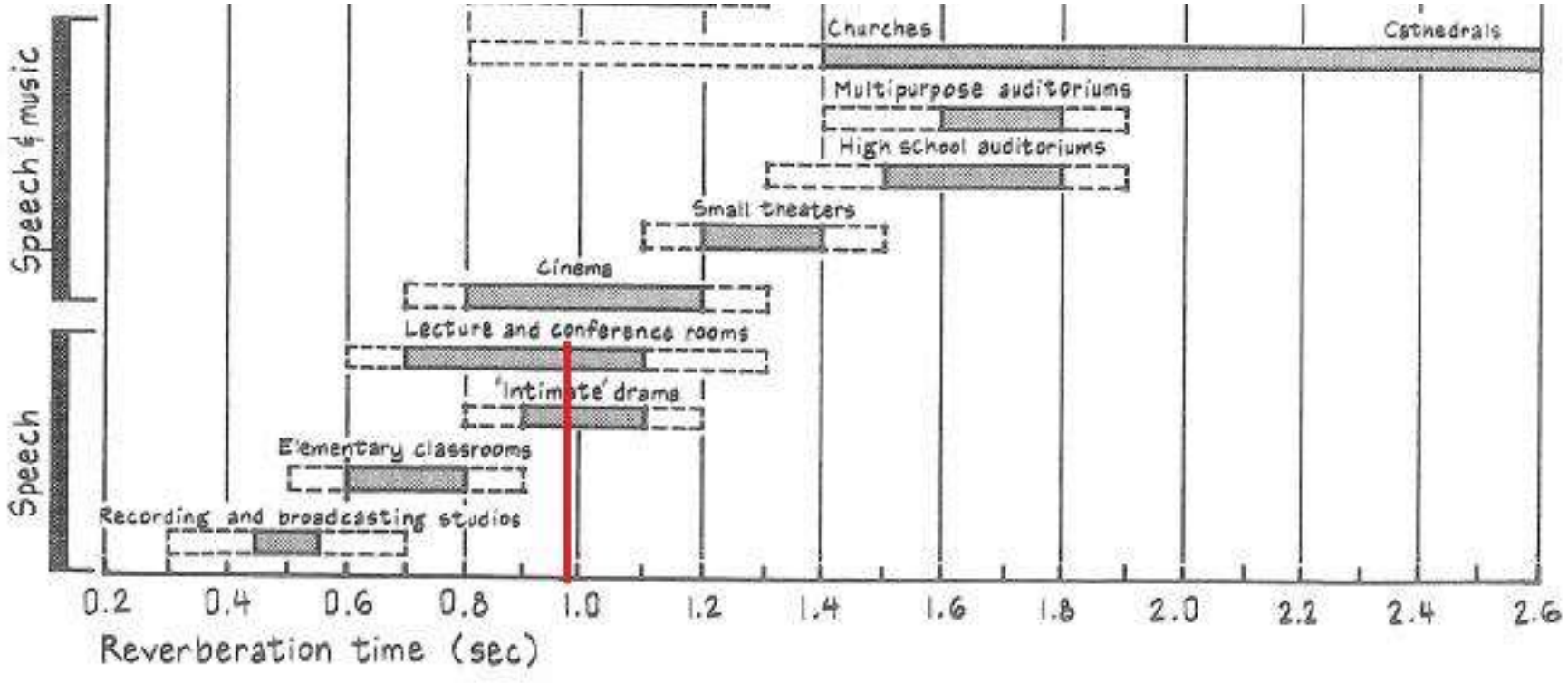
Reverberation time(RT60) for courtroom at 50% occupancy



Environmental Design

Acoustical design

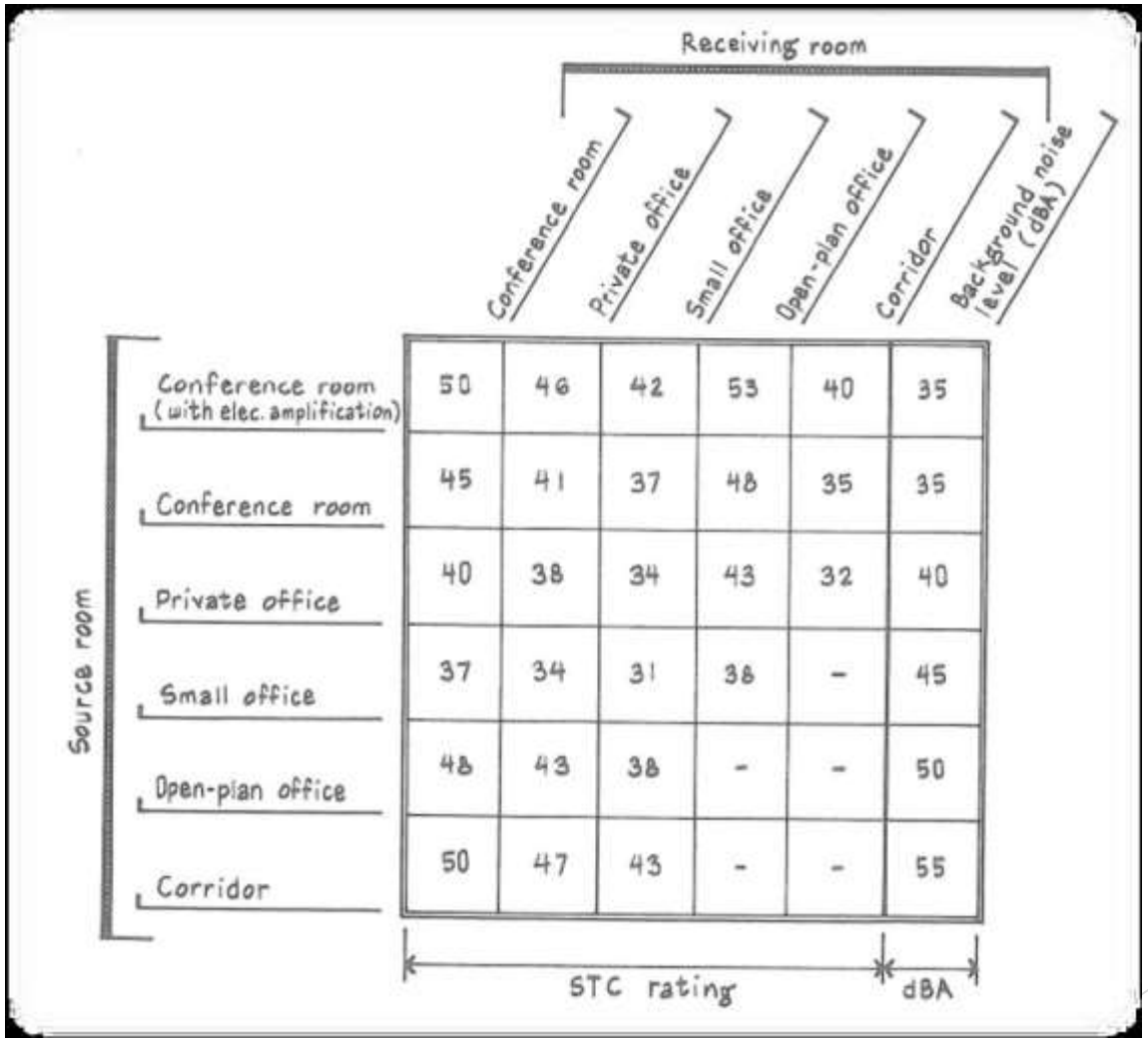
Reverberation time(RT60) for courtroom at 0% occupancy



Environmental Design

Acoustical design

STC :(Sound Transmission Class)



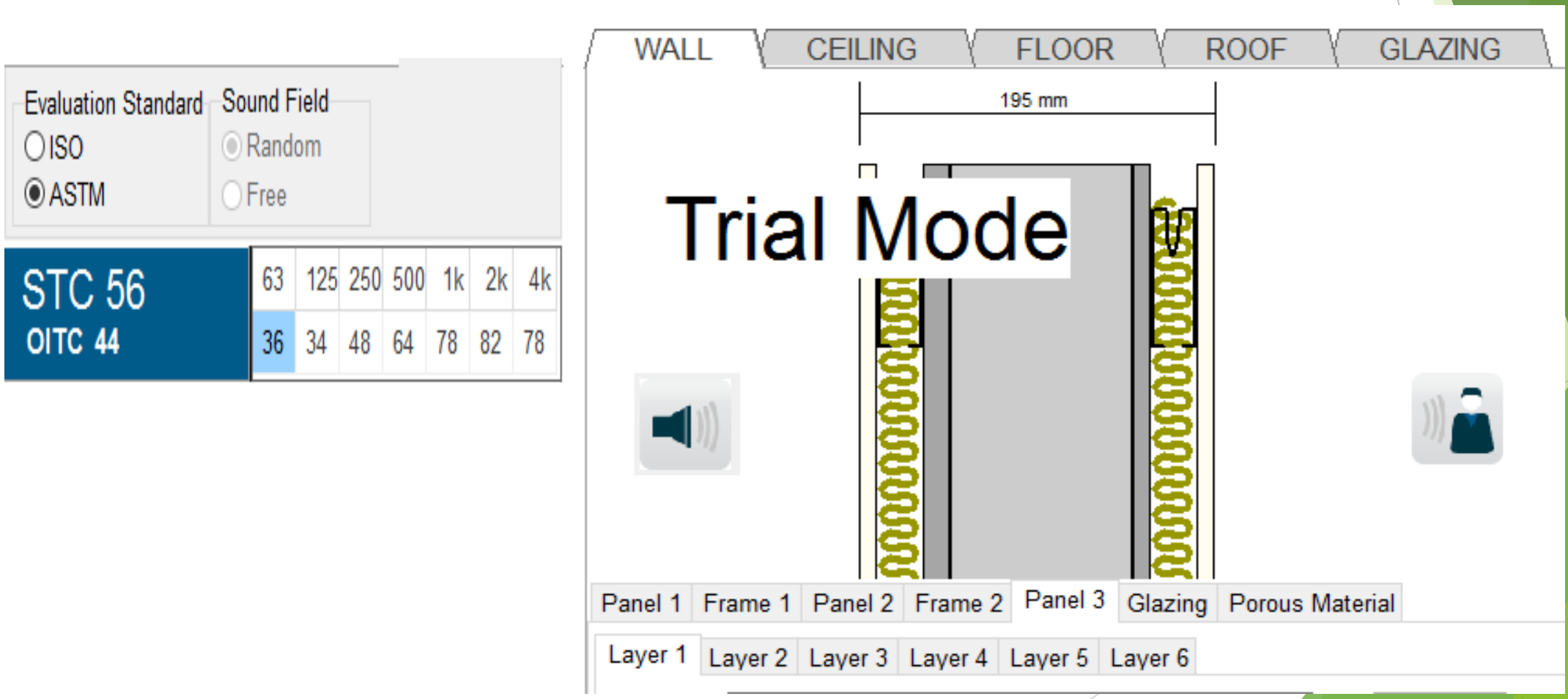
Source room \ Receiving room	Conference room	Private office	Small office	Open-plan office	Corridor	Background noise level (dBA)
Conference room (with elec. amplification)	50	46	42	53	40	35
Conference room	45	41	37	48	35	35
Private office	40	38	34	43	32	40
Small office	37	34	31	38	-	45
Open-plan office	48	43	38	-	-	50
Corridor	50	47	43	-	-	55

STC rating | dBA

Environmental Design

Acoustical design

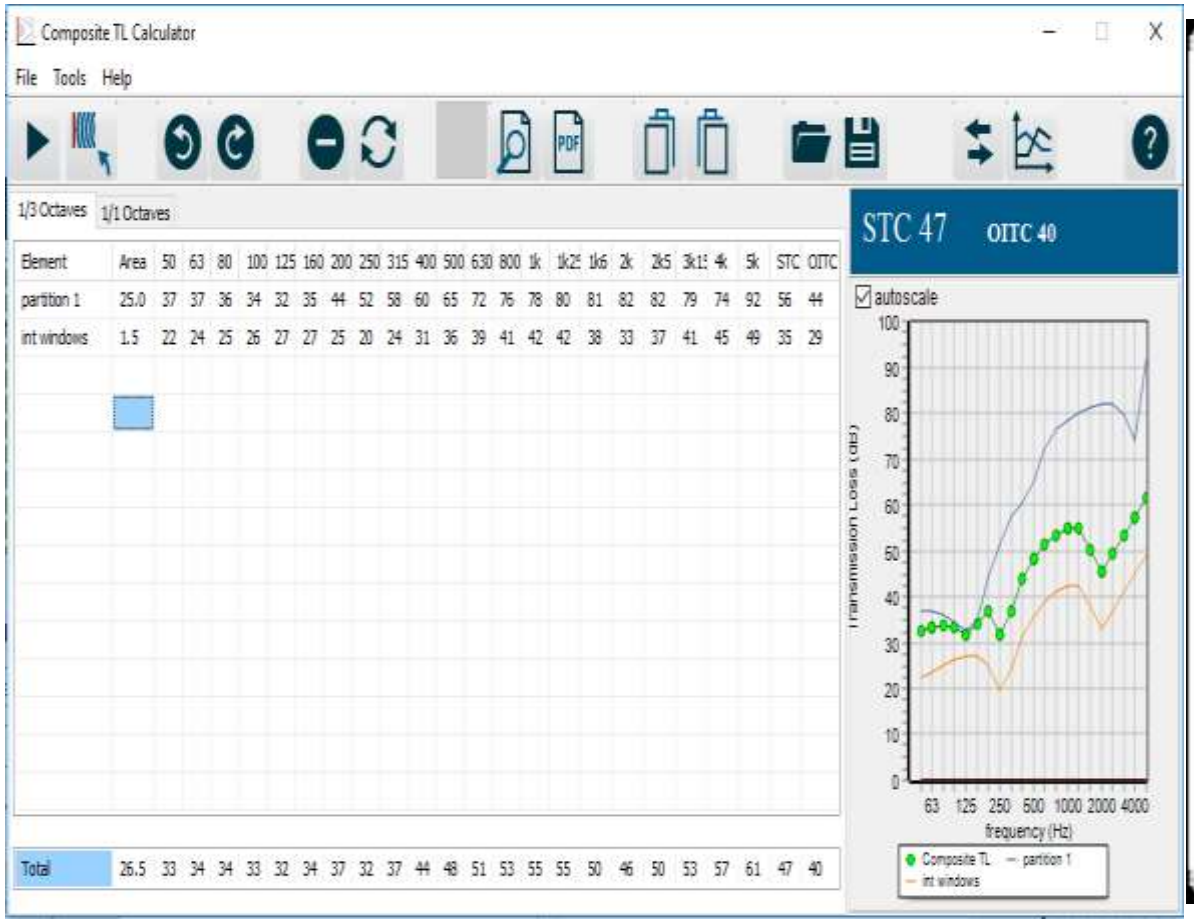
layer of Internal partition

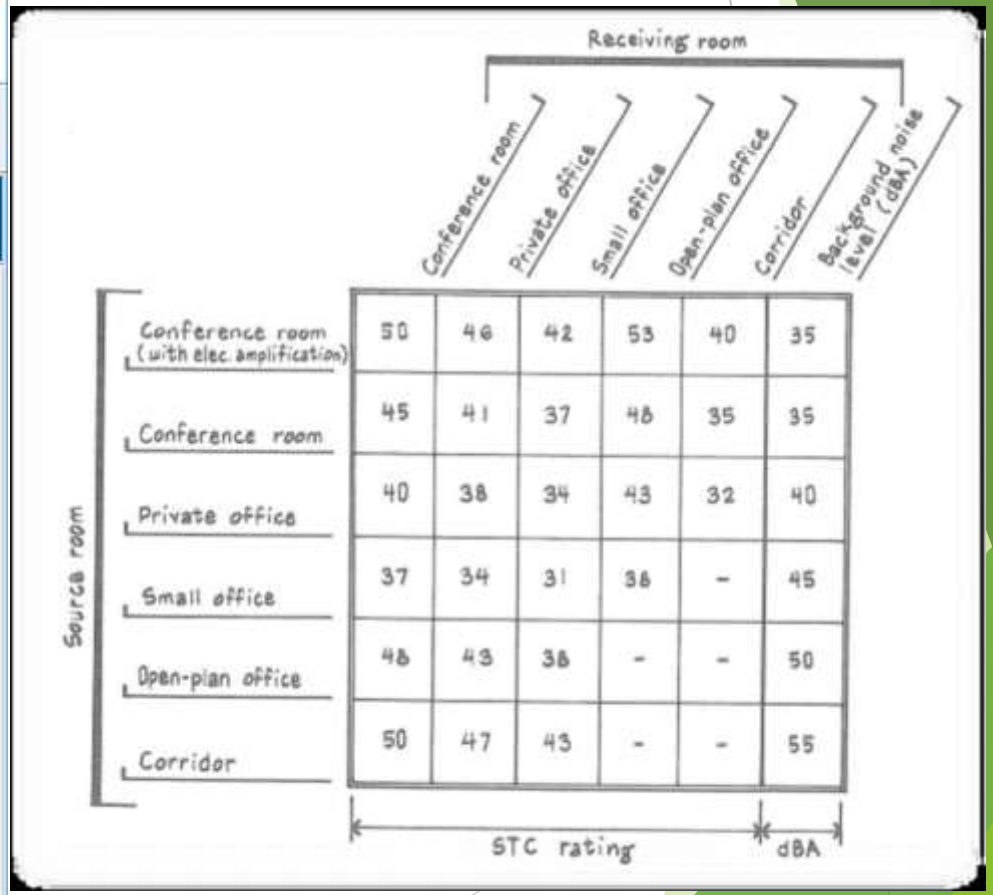


Environmental Design

Acoustical design

value of composite STC between corridor and privet office





Electrical Design

Electrical Design

Recommended light level

General building areas	IES standards illumination level
Receptions	300
Cafeteria	200
Laundry	400
Service room	200
corridors	100
Entrance hall	150
Security area	200
lift	150
Stairs	150
lobbies, waiting rooms, halls	150
Kitchen Foods stores	100
Stores	50
Courts room	500
Consaltation room	500
Bathroom	100
office	500

Electrical Design

nplementation
department

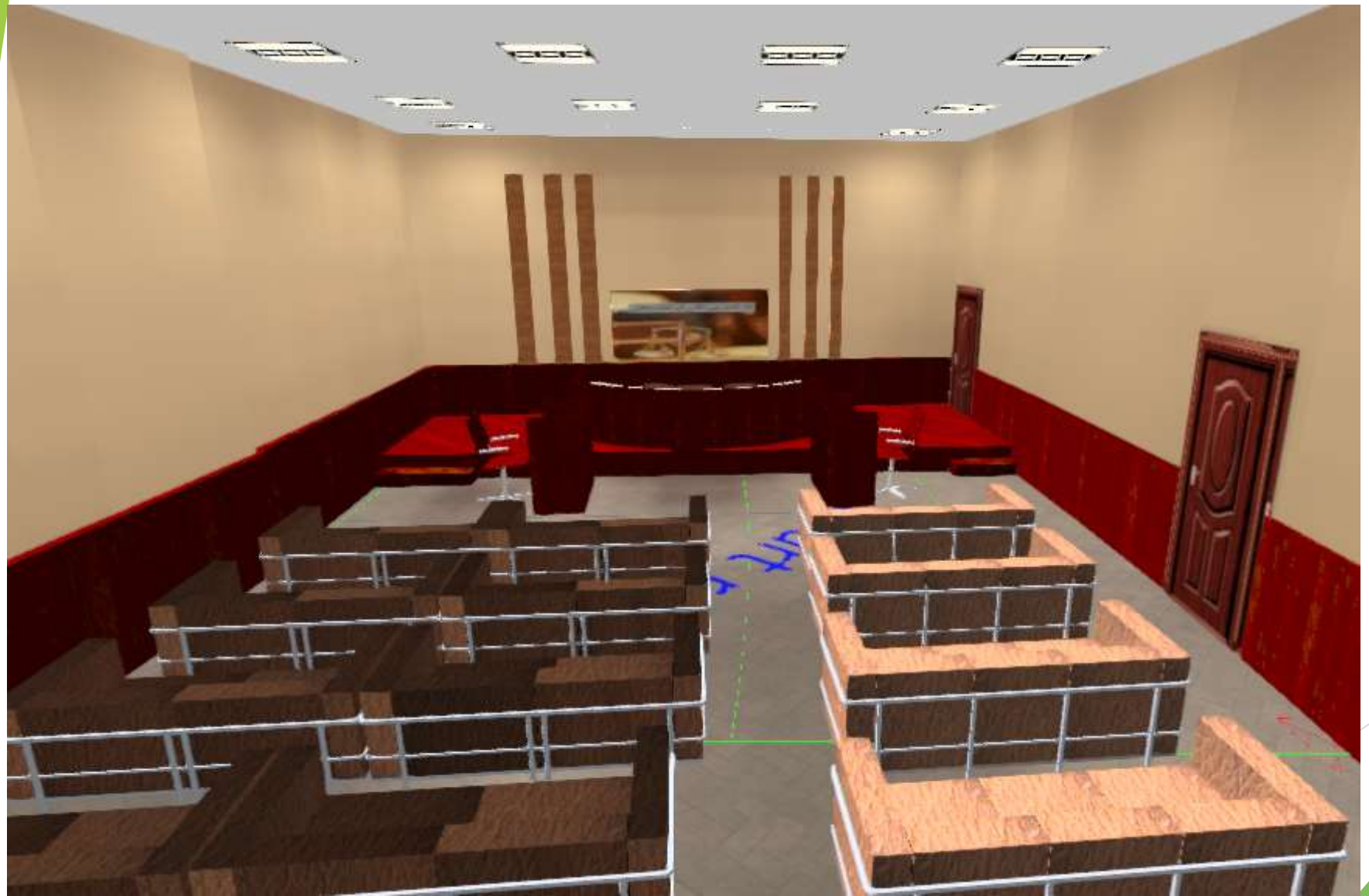
Uniformity =0.77

E (avg.) =522LUX

Electrical Design

Electrical Design

Electrical Design



Electrical Design

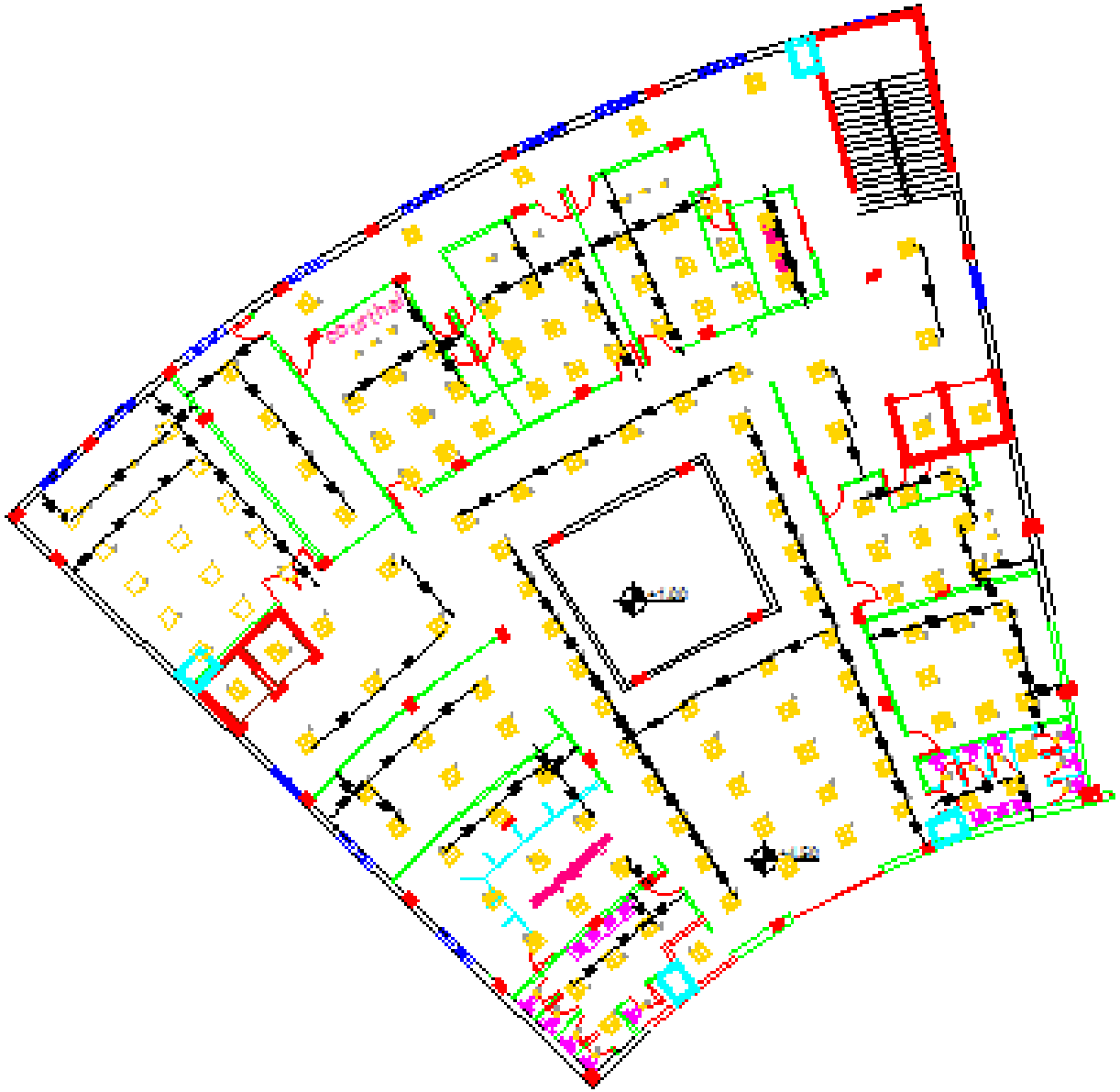
Electrical Design

Light distribution

Ground floor

Electrical Design

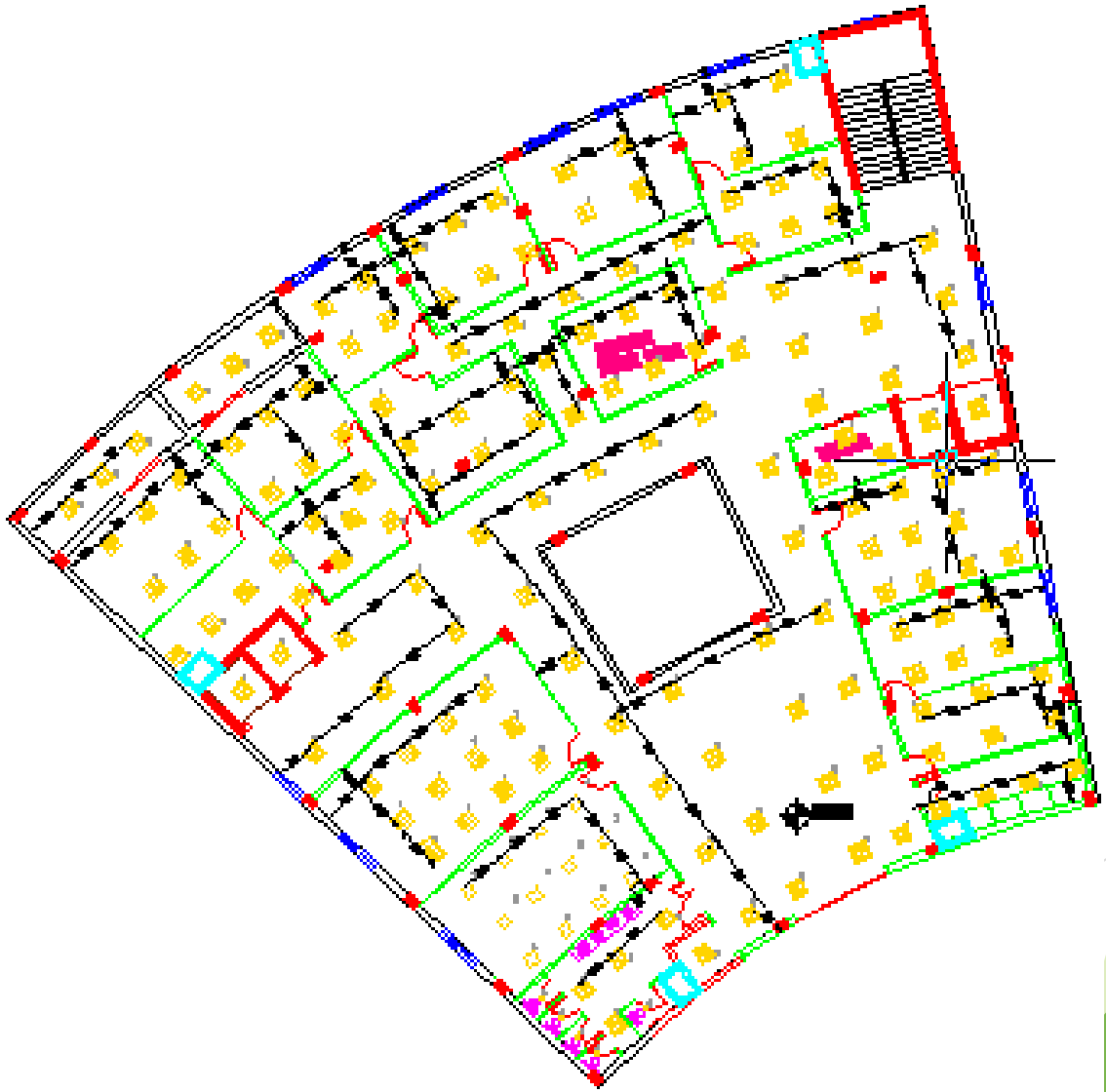
Light distribution



First floor

Electrical Design

Light distribution



Second floor

Electrical Design

32	coorridor 1	Perpendicular illuminance (Adaptive)	45.1 lx	446 lx	183 lx	0.25	0.10
33	libraries	Perpendicular illuminance (Adaptive)	52.1 lx	869 lx	538 lx	0.10	0.06
34	adviser 1	Perpendicular illuminance (Adaptive)	133 lx	571 lx	358 lx	0.37	0.23
35	Workplane 73	Perpendicular illuminance (Adaptive)	554 lx	790 lx	705 lx	0.79	0.70
36	archive	Perpendicular illuminance (Adaptive)	70.3 lx	850 lx	608 lx	0.12	0.08
37	judges hall 5	Perpendicular illuminance (Adaptive)	226 lx	743 lx	578 lx	0.39	0.30
38	s. office	Perpendicular illuminance (Adaptive)	48.9 lx	766 lx	621 lx	0.08	0.08
39	acustica	Perpendicular illuminance (Adaptive)	155 lx	705 lx	542 lx	0.29	0.22

Electrical Design

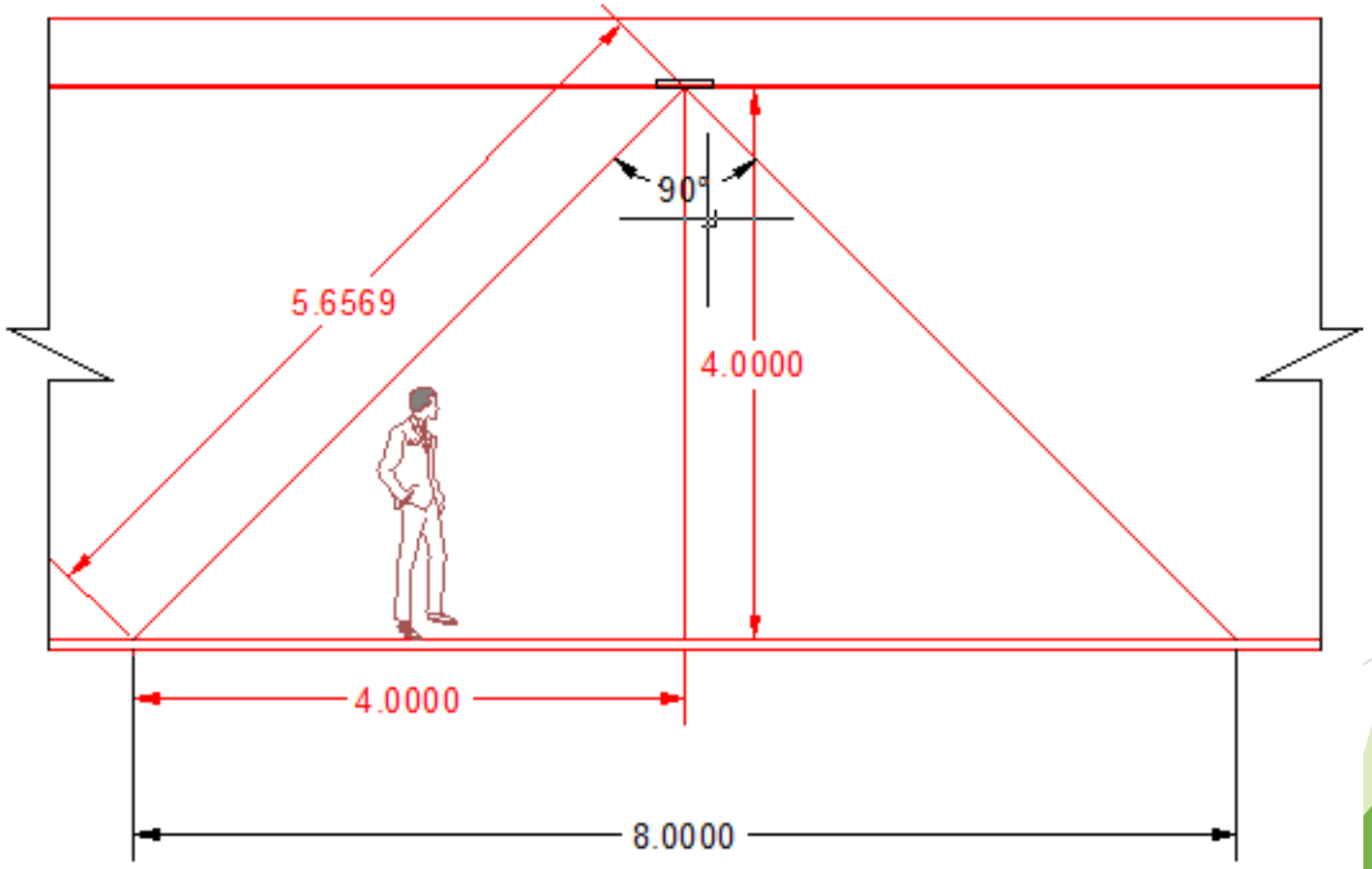
Load speaker

Electrical design

Electrical design

Electrical design

Electrical design



Electrical design

Electrical design

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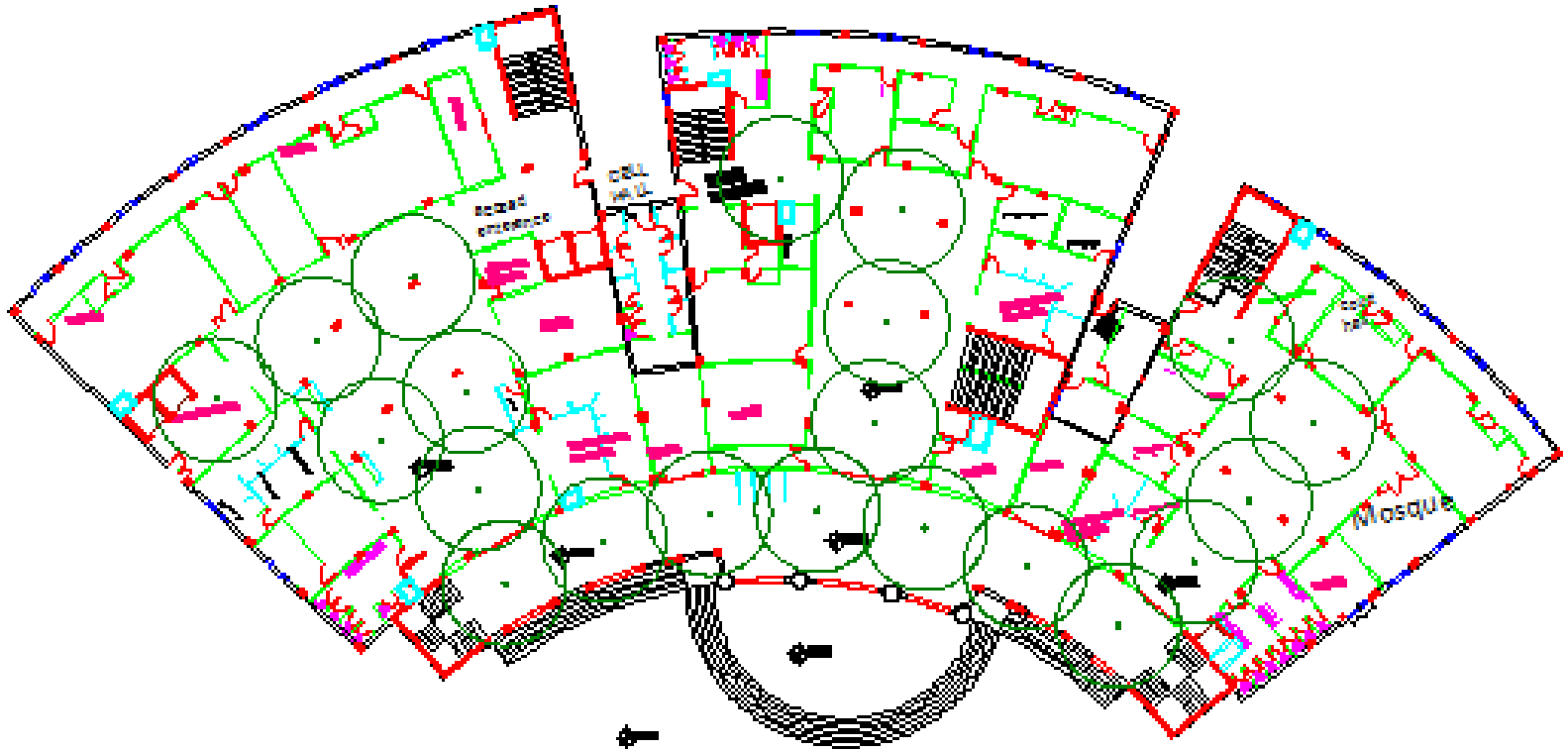

ground floor

Electrical design

Electrical design

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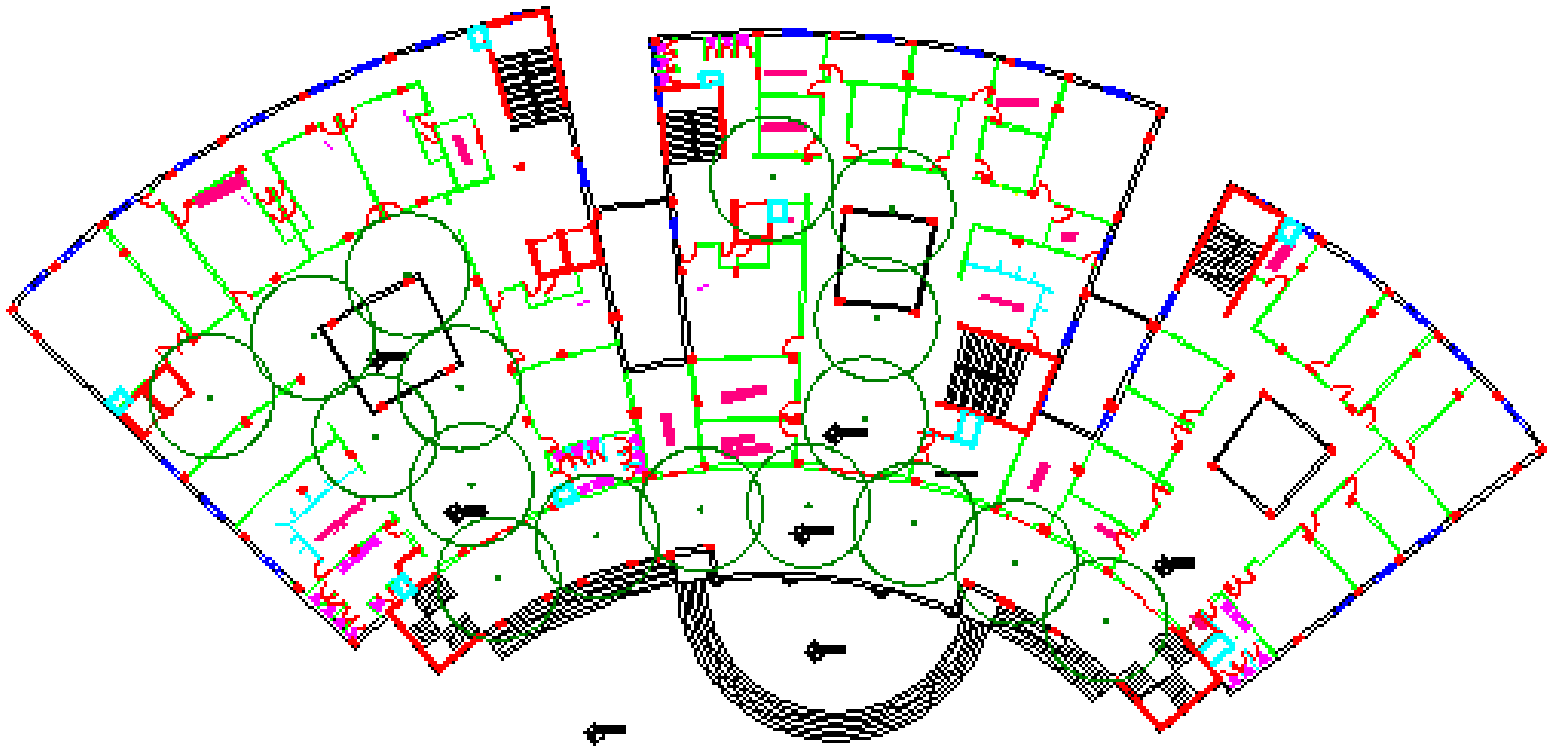


F.Floor

Safety Design

Safety Design

Sprinklers system

Safety Design

Sprinklers specification

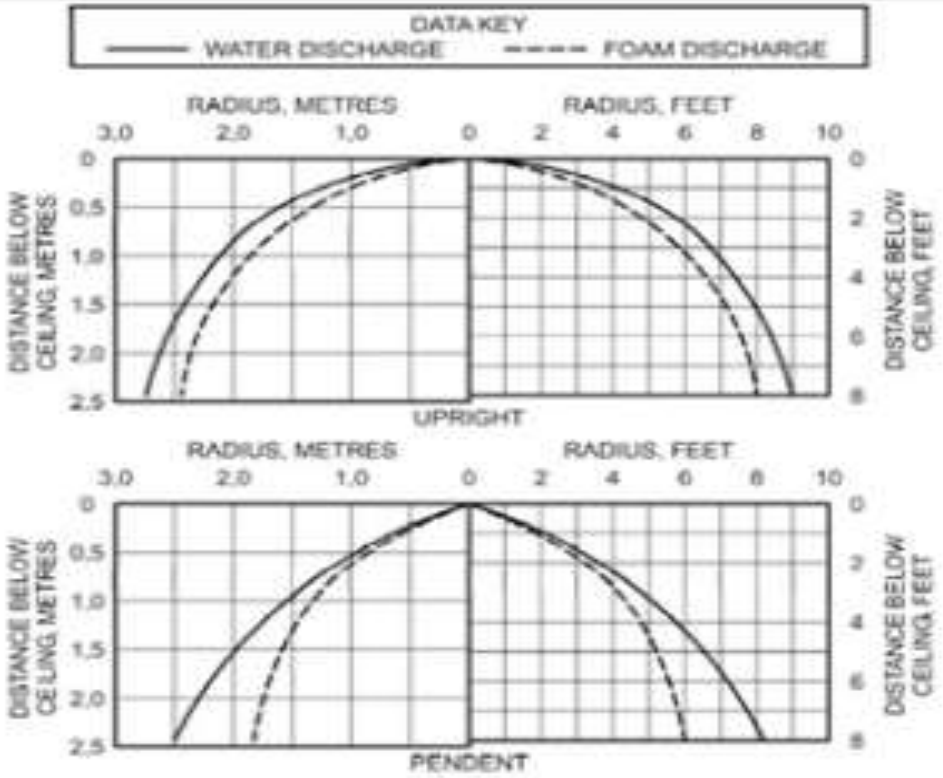
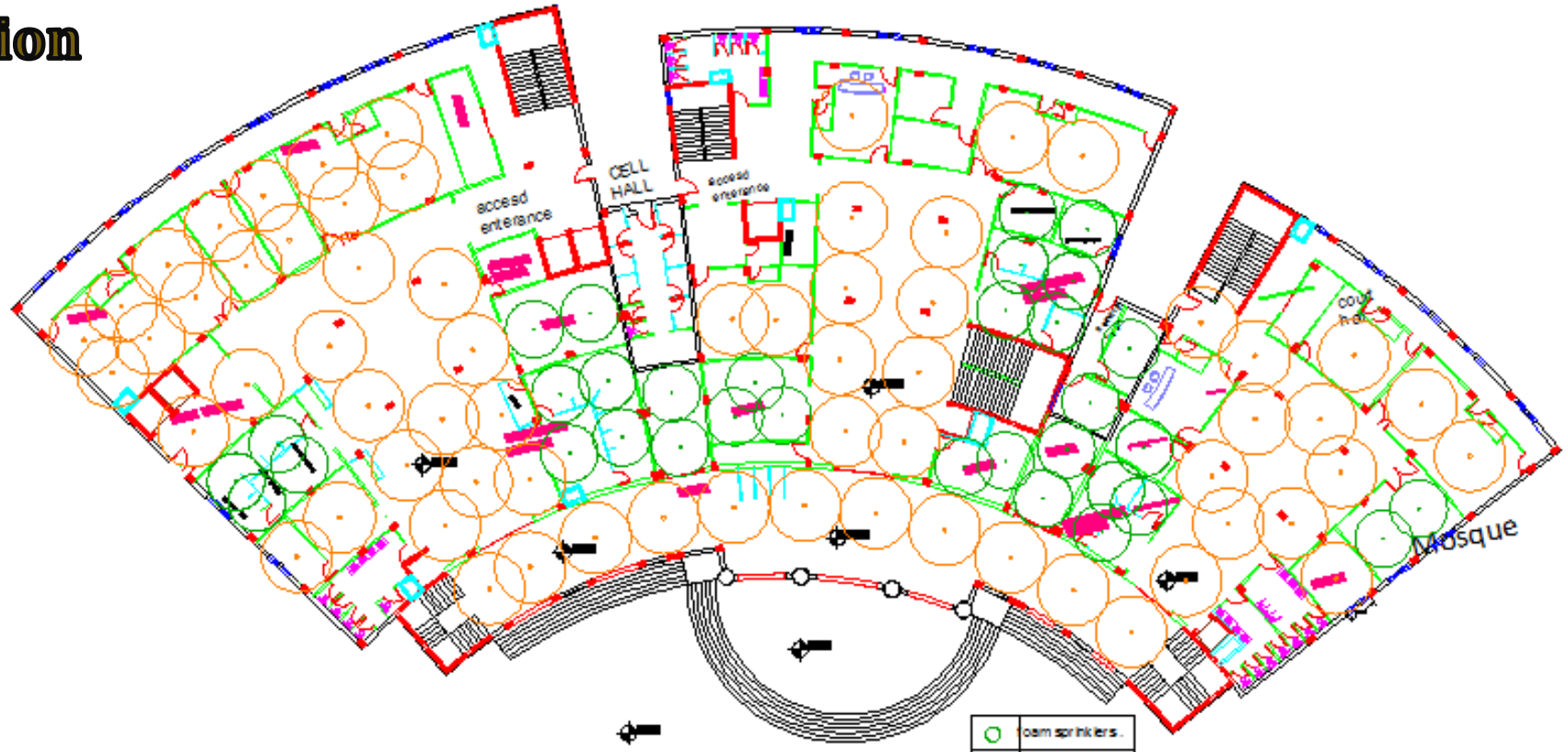


Figure 1: Nominal Discharge Patterns

Safety Design

Sprinklers distribution

-



ground floor

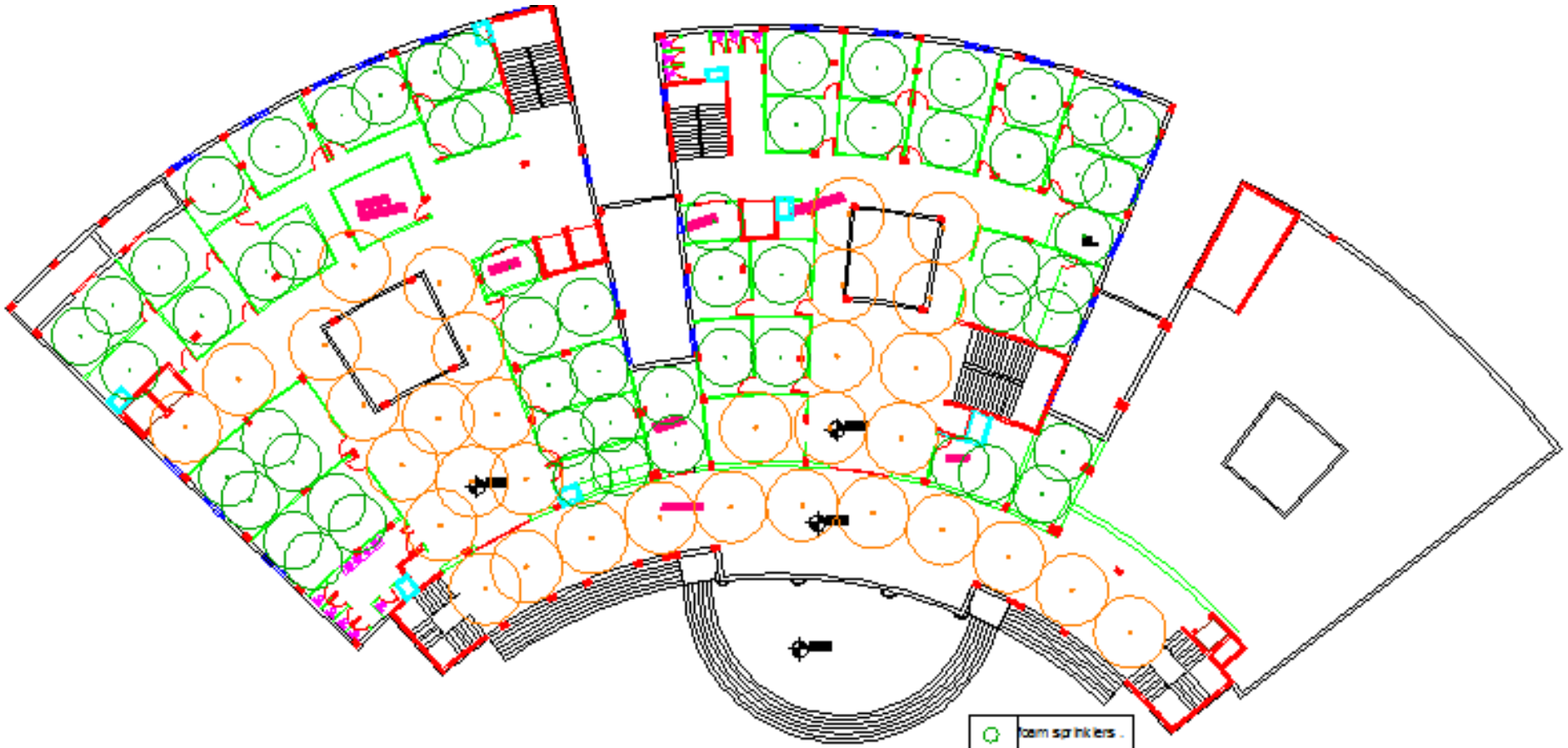
Safety Design

Sprinklers distribution

F.Floor

Safety Design

Sprinklers distribution



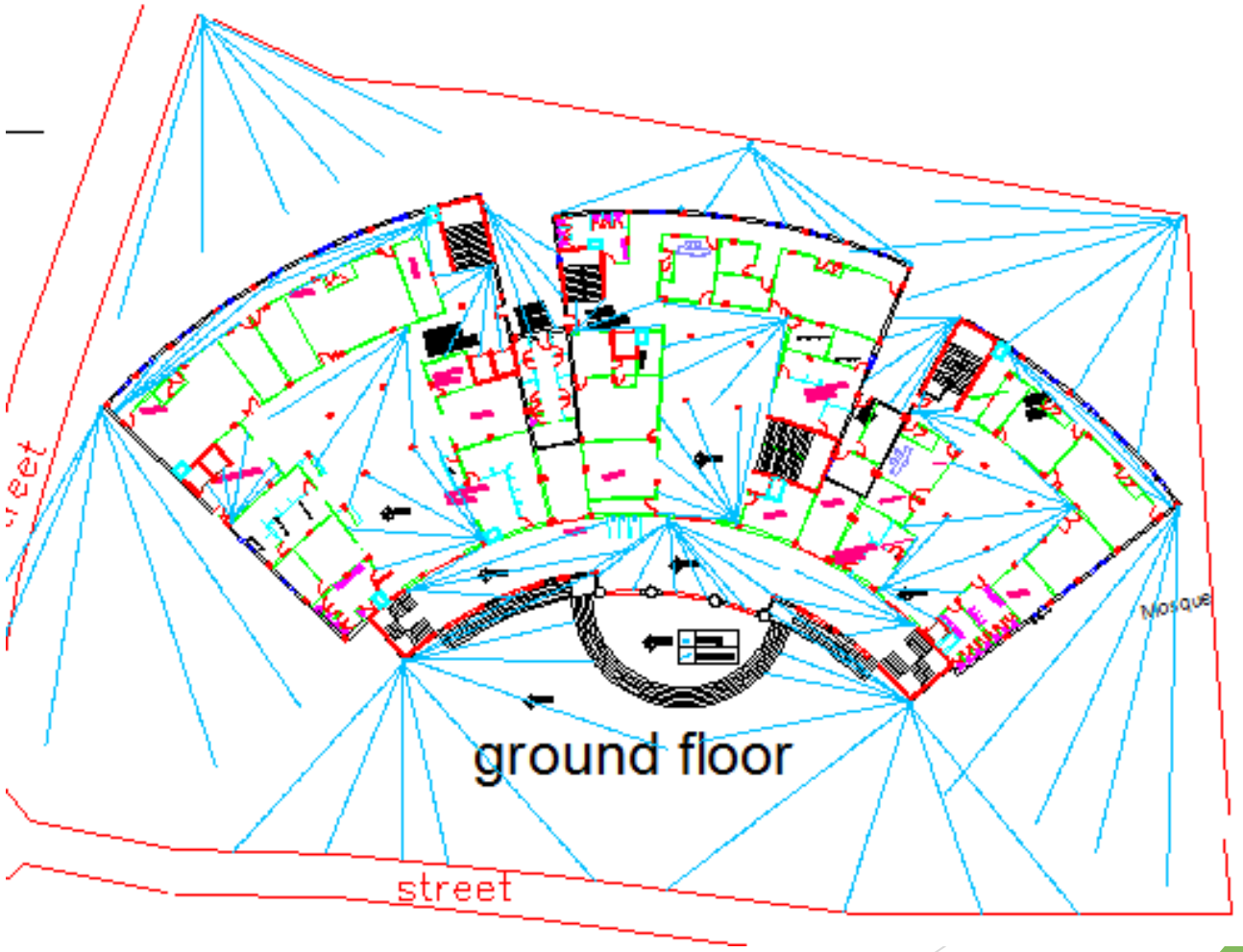
S.Floor

Safety Design

Camera system

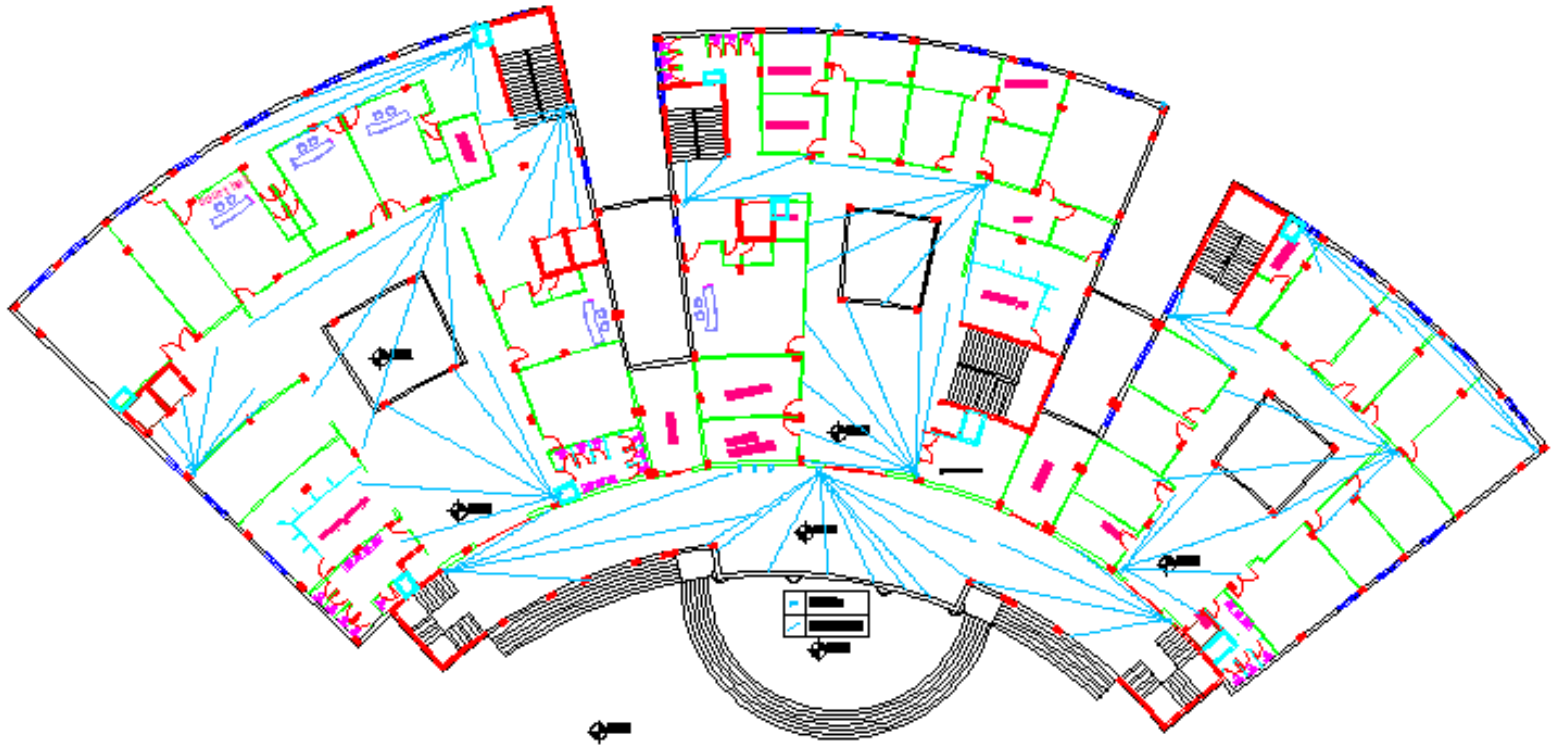
Safety Design

Camera distribution



Safety Design

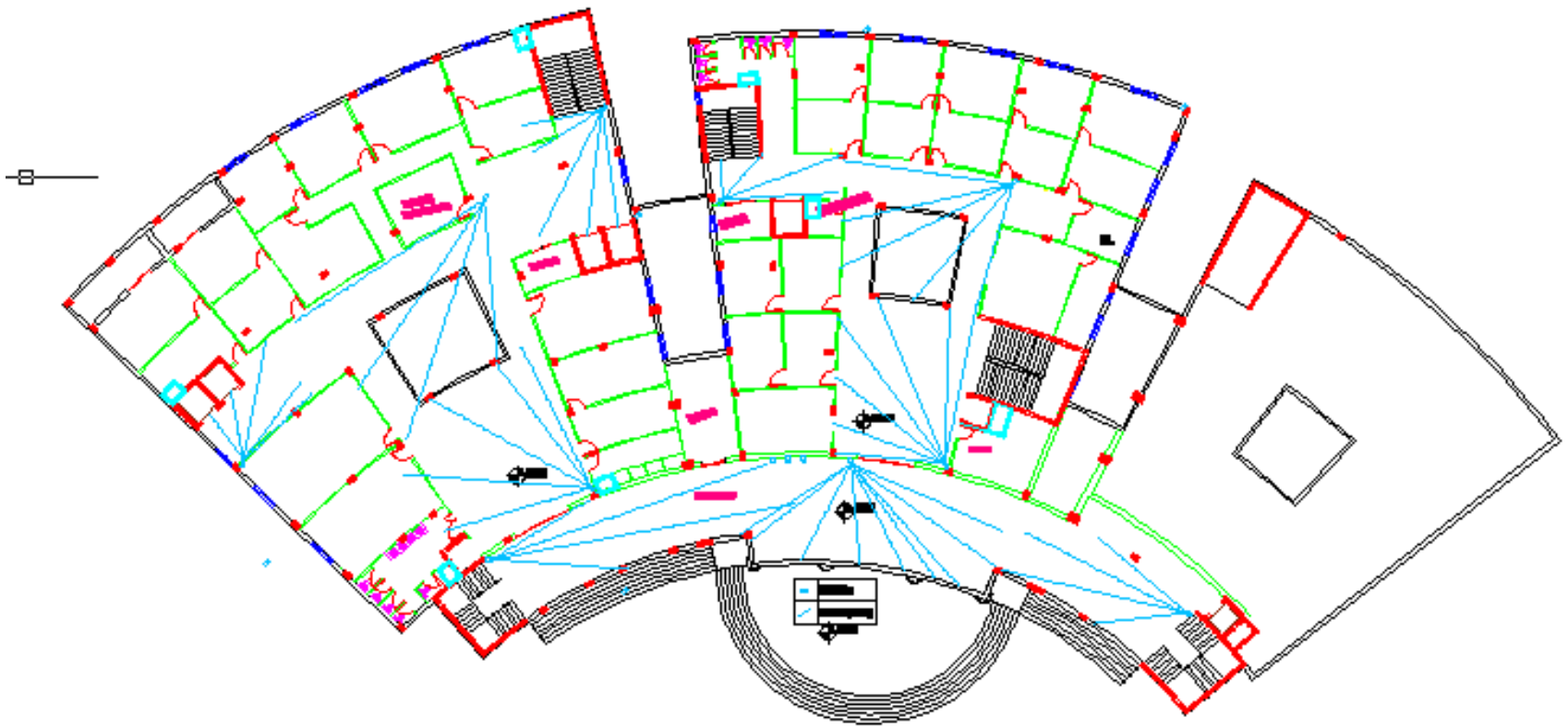
Camera distribution



F.Floor

Safety Design

Camera distribution



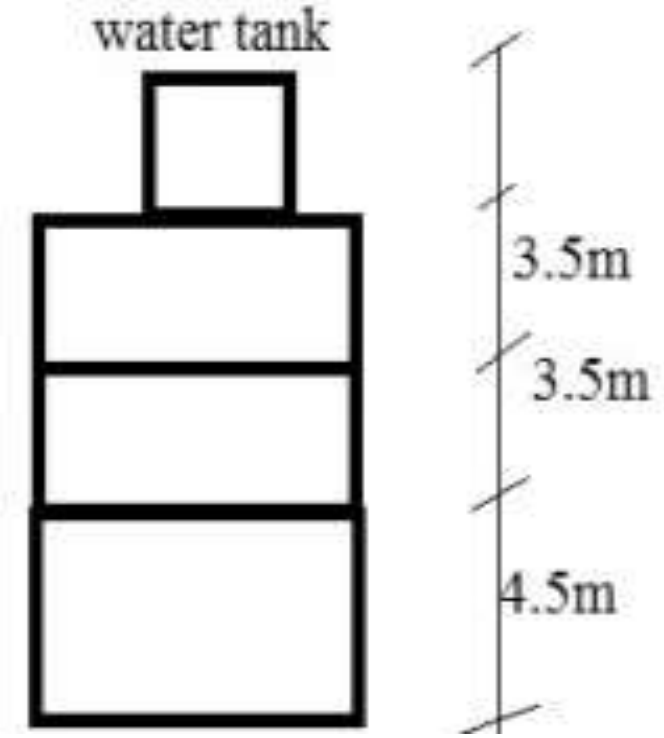
S.Floor

Mechanical design

- 1- Water Supply System
- 2-Drainage System
- 3-H-VAC System

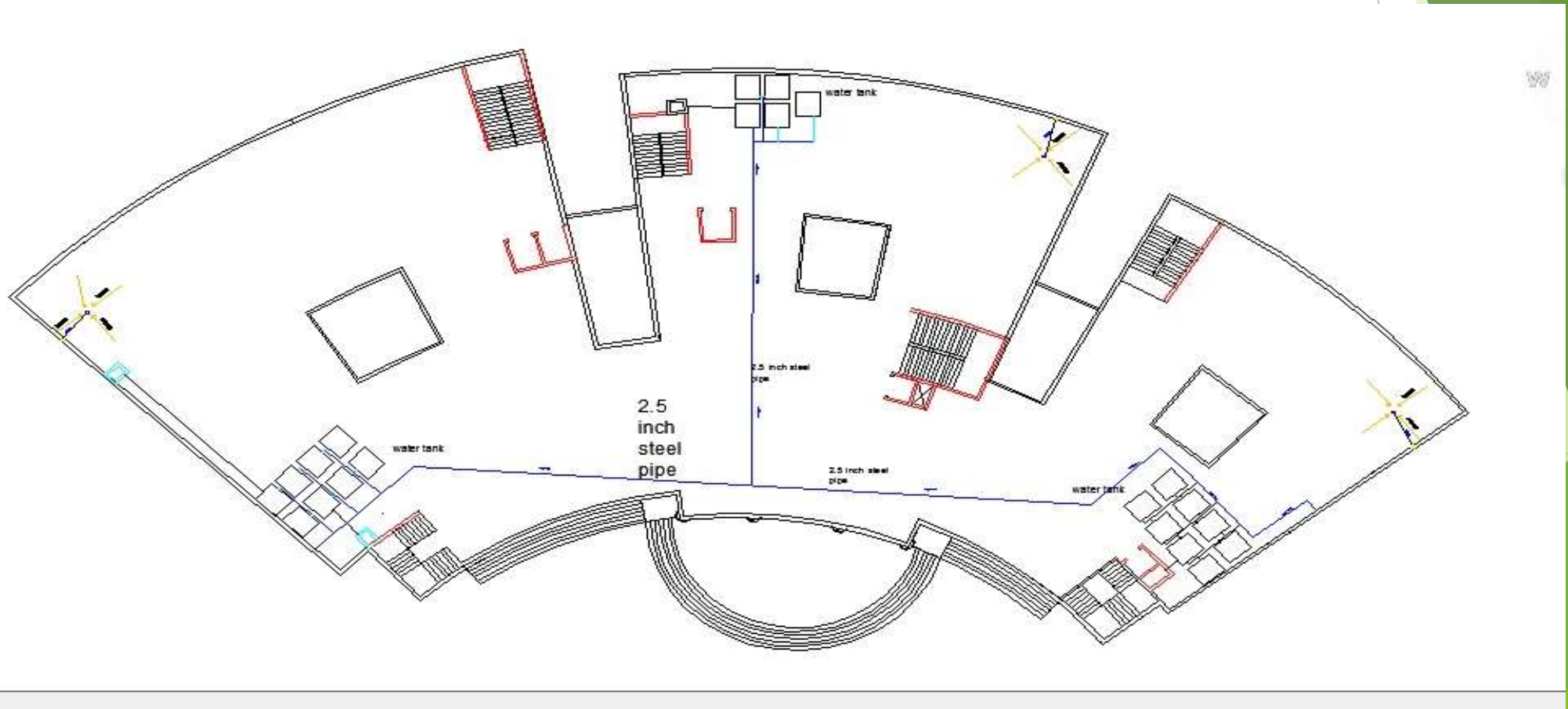
:Water supply design

roof tank system:



:Water supply design

- Tank lay out on roof



Water supply design

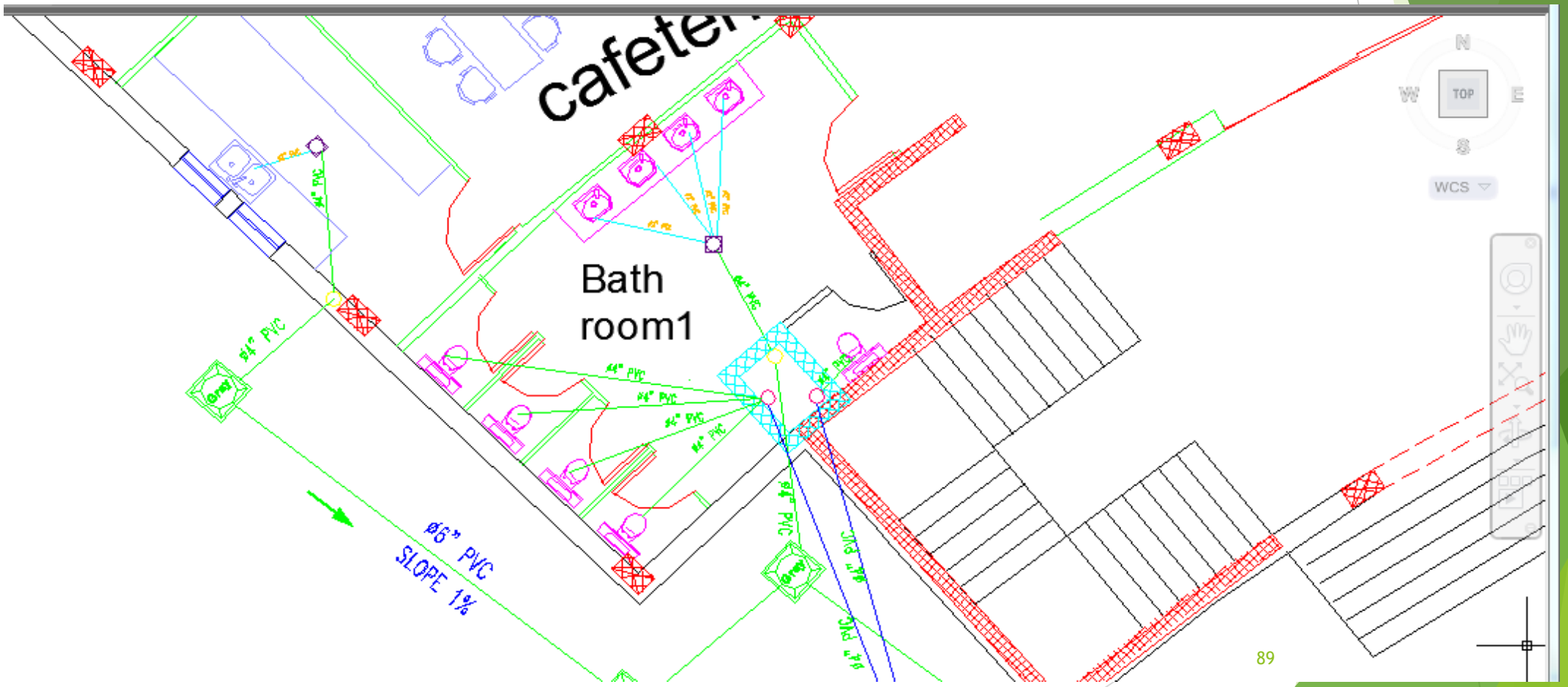
- Water supply design for bath room1 in ground floor:

	Pipe diameter(inch)	loss
vertical	2.5	2.54
horizontal	1.5	0.5
branch	3/4	0.006

Drainage design

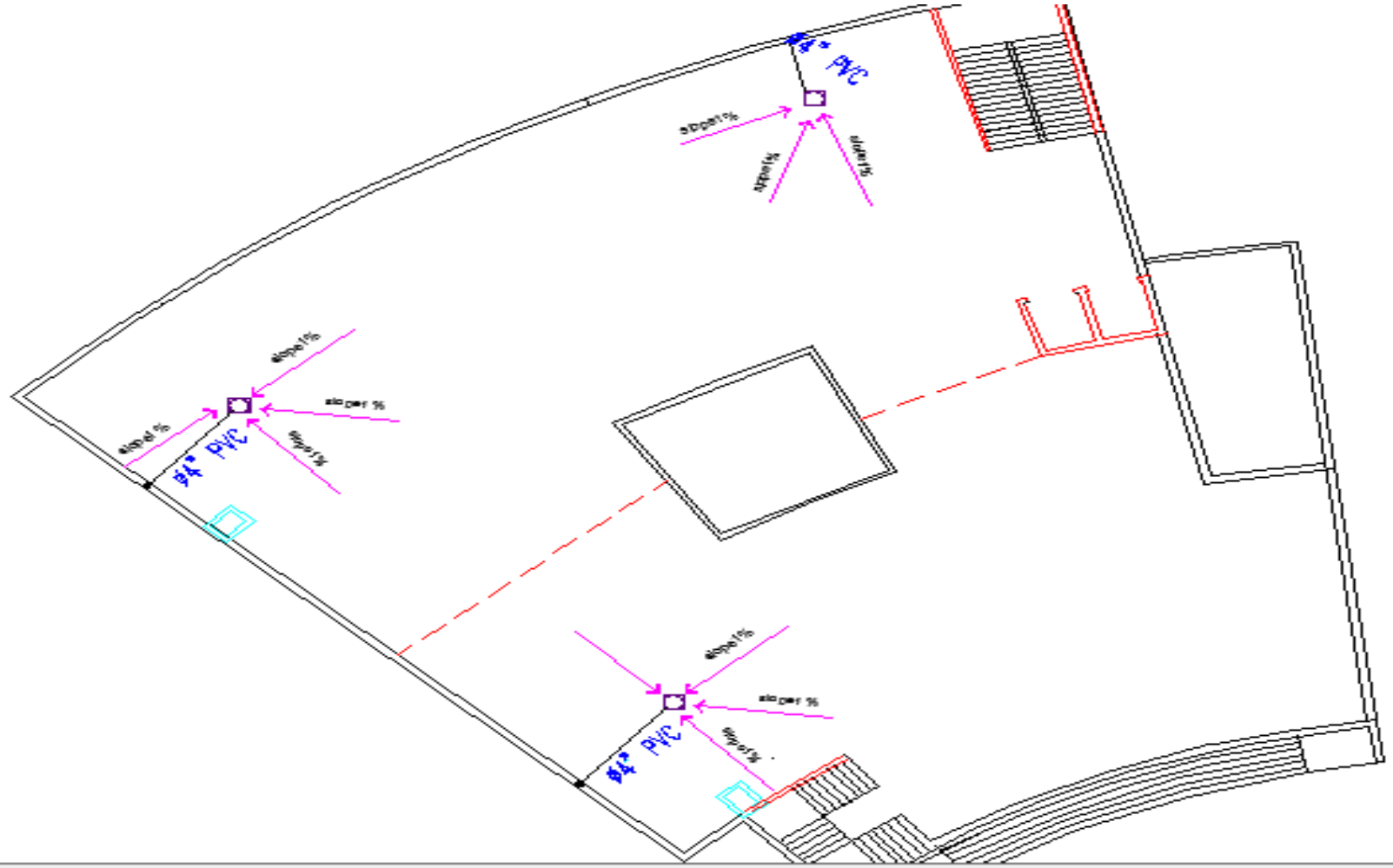
-Horizontal line (lavatory) is 2”

-Horizontal line (W.C) is 4”



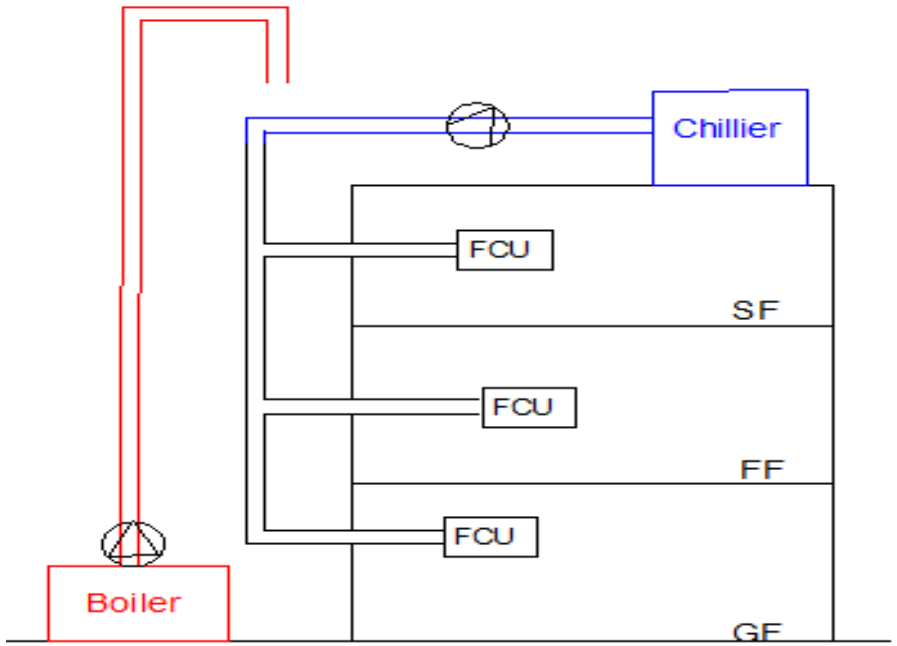
Drainage design

Rain Water Drainage

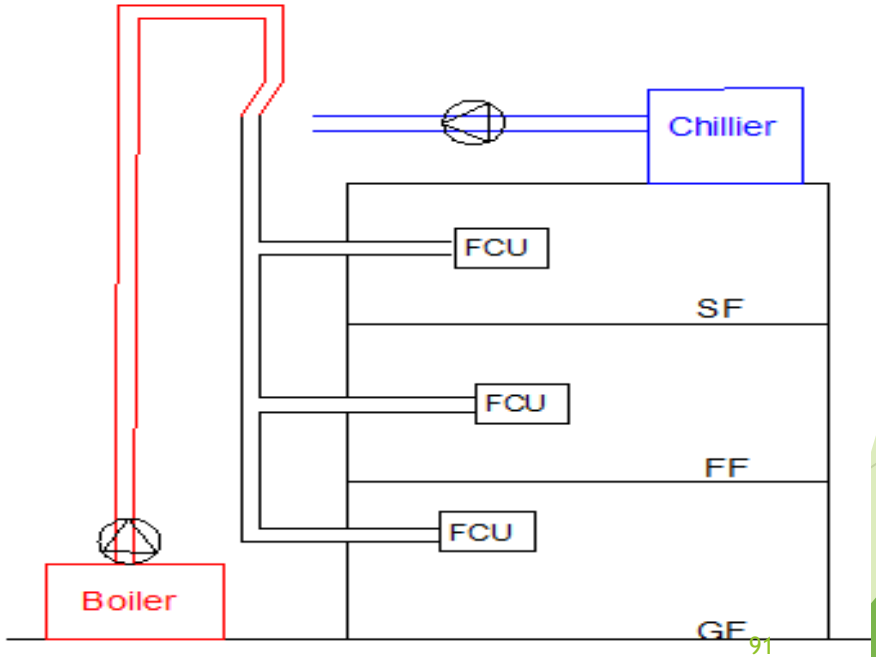


H-VAC system

In this building was chosen fan coil unite system . This system works on cooling water (by chiller) or hot water (by boiler), we used this system for both cooling and heating design.



summer case



winter case

H-VAC system

This system consists from:

Outdoor unit)(Main Unit:

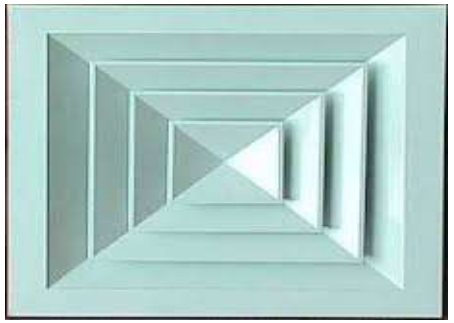
Chiller:

Poiler:

Indoor Units:

1-(fan coil unit and air handling unit)

2-diffuser

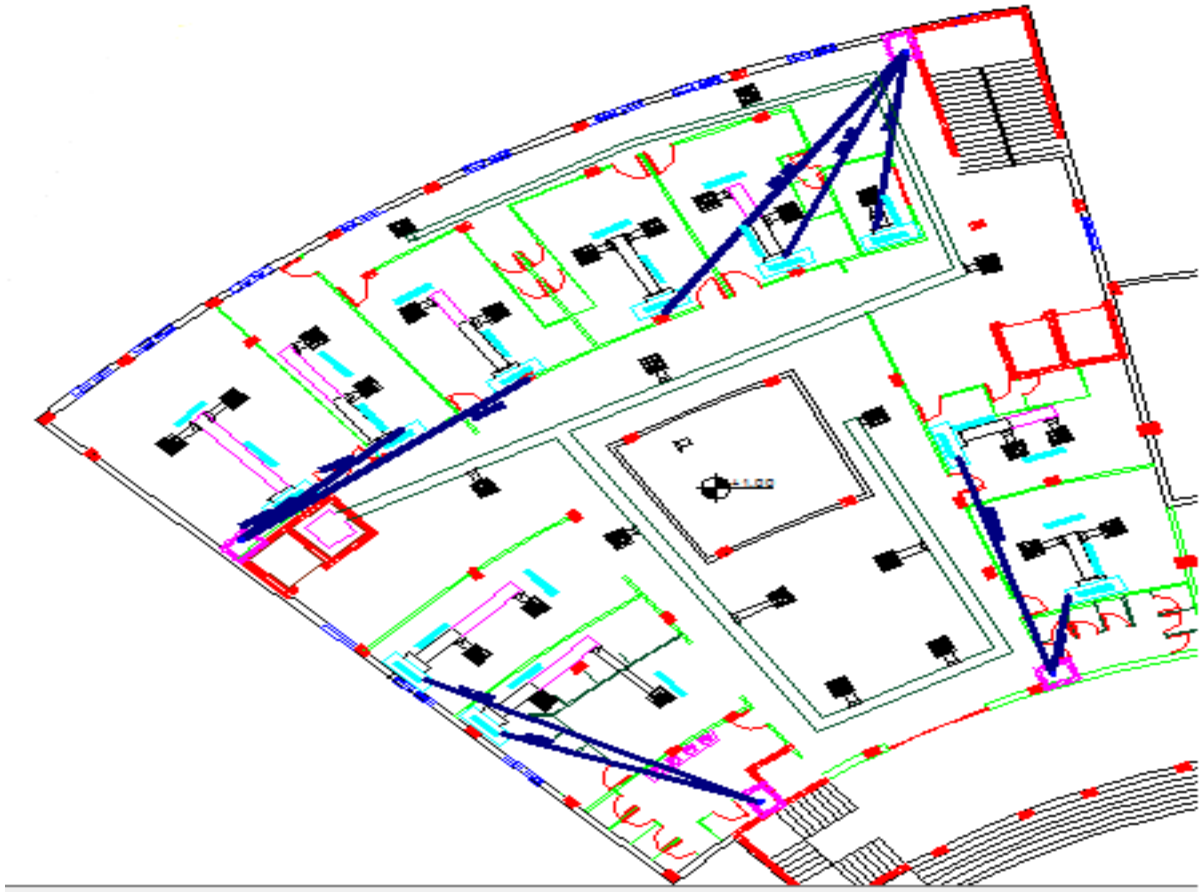


H-VAC system

And we use Design Builder we get the needed value(cooling capacity) for design:

Zone	Design Capacity [kW]	Design Flow Rate [m3/s]
GF:CirculationArea	22.37	1.2301
GF:CourtHall1	4.49	0.2391
GF:NotaryROOM	2.72	0.1865
GF:ConsultationRo...	1.24	0.0723
GF:ConsultationRo...	1.23	0.0716
GF:ImplmnttnMngr	0.40	0.0261
GF:CourtHall2	5.99	0.3163
GF:RegisterRoom	3.99	0.2772
GF:PayFeesRoom	2.44	0.1565
GF:Cafitiria	2.84	0.1872
GF:Bathrooms	0.94	0.0467
FF:CirculationArea	21.81	1.1979
FF:CourtHall3	2.24	0.1452
FF:CourtHall2	2.33	0.1502
FF:CourtHall1	1.90	0.1101
FF:Security	0.51	0.0329
FF:CourtHall4	1.87	0.1220
FF:ConsultationRoo...	2.02	0.1306
FF:ConsultationRoo...	4.15	0.2315
FF:ConsultationRoo...	1.88	0.1231
FF:WaitingArea	2.32	0.1456
FF:RegisterRoom	2.88	0.1830
FF:Bathrooms	0.94	0.0469
FF:Bathrooms2	0.65	0.0332
SF:AdviserRoom3	2.56	0.1718
SF:Bathrooms	1.20	0.0648
SF:CirculationArea	20.10	1.1752
SF:ArchiveRoom4	1.84	0.1102
SF:Security	0.47	0.0296
SF:AdviserRoom1	1.39	0.0937
SF:AdviserRoom2	1.03	0.0696
SF:CallRoom	0.88	0.0601
SF:Library	4.36	0.2665
SF:JudgeRoom2	1.09	0.0731
SF:JudgeRoom3	1.26	0.0853
SF:AdviserRoom5	1.60	0.1158
SF:AdviserRoom8	0.93	0.0668
SF:AdviserRoom7	1.77	0.1181
SF:JudgeRoom1	1.10	0.0735
SF:StoreRoom	1.12	0.0666
SF:AdviserRoom6	1.29	0.0882
SF:AdviserRoom9	1.39	0.0945
SF:JudgeRoom	1.01	0.0680
SF:PresidentOfThe...	1.46	0.0979
Roof1:Zone1	0.00	0
Totals	**142.00**	**8.4511**

H-VAC system



- Drawing of ducts, FUC, pipe and diffuser for HAVC system

Quantities surveying

	NIS
Total cost	17,205,871

- cost of 1m^2 =2282 NIS/m^2