



AN-NAJAH NATIONAL UNIVERSITY
FACULTY OF ENGINEERING & INFORMATION TECHNOLOGY
BUILDING ENGINEERING DEPARTMENT

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Design of Sarta high school

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9. Cost estimations

introduction

- In most of the designs for buildings in our community, the special needs category was ignored. The project idea came to serve about 5.35% of the approximately 800 out of 15,000 people with special needs.

Site analysis

- Location : It is located in Sarta in Salfeet city
- Site Area : 9035 m².



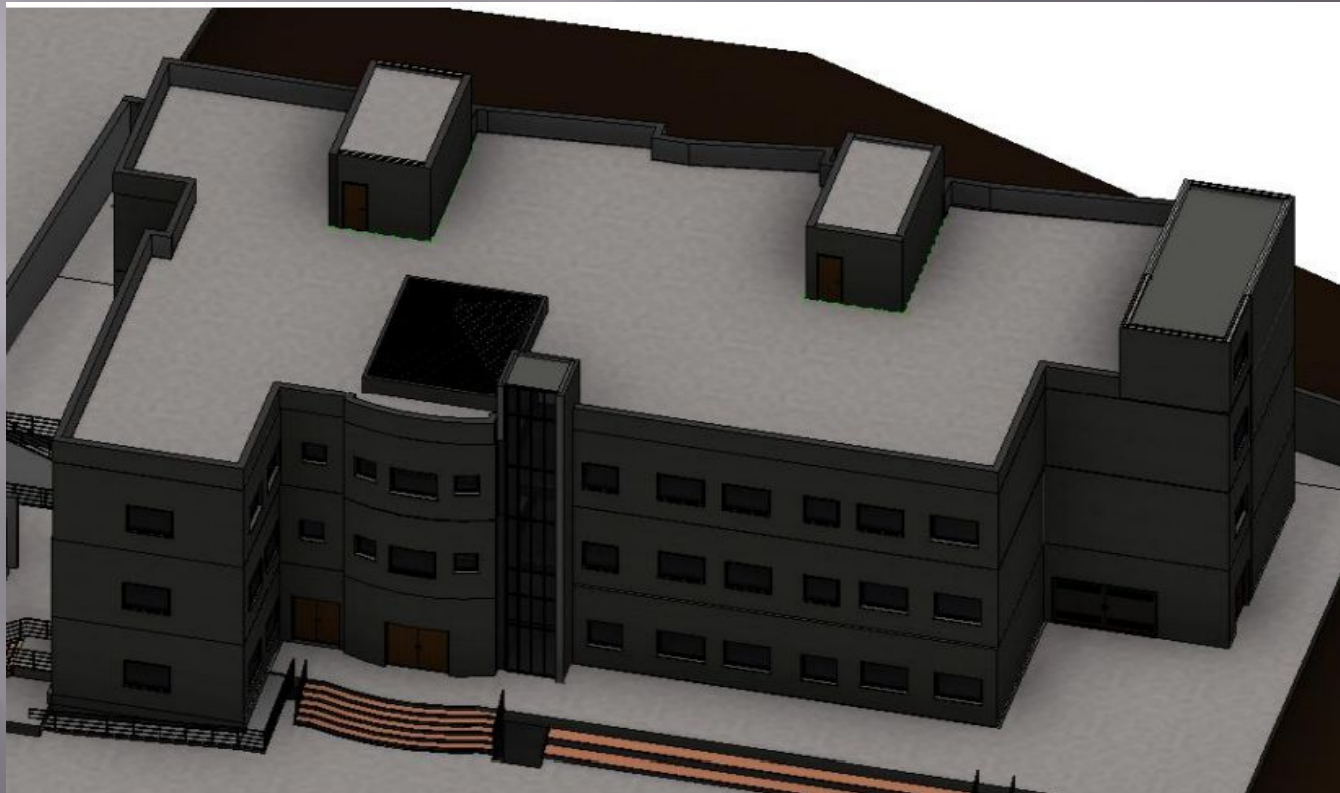
Architectural aspects

Project Description

- ▣ **3 floors**, in addition to **basement**
as a parking
- ▣ - serves **540 people**
- ▣ - Total area of the building floors equals = 3028

Architectural aspects

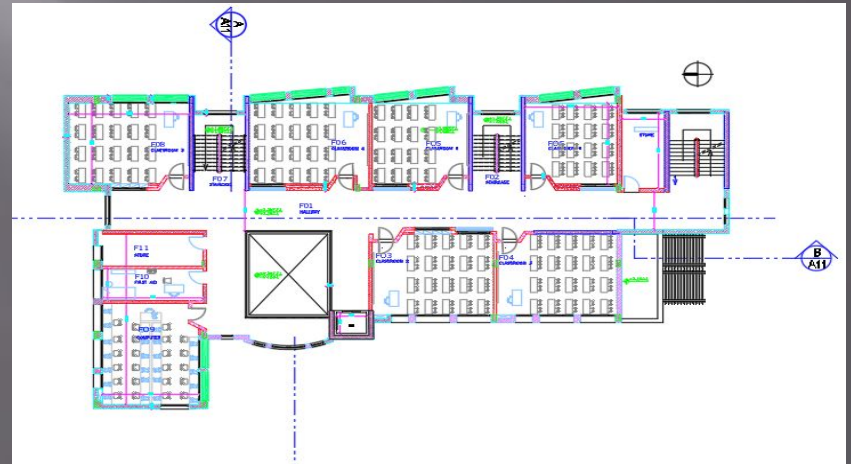
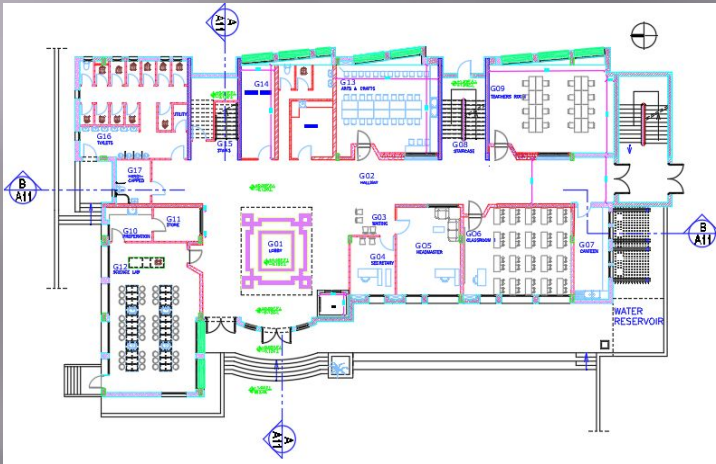
3D



Architectural aspects

- **Project plans**
- Ground floor

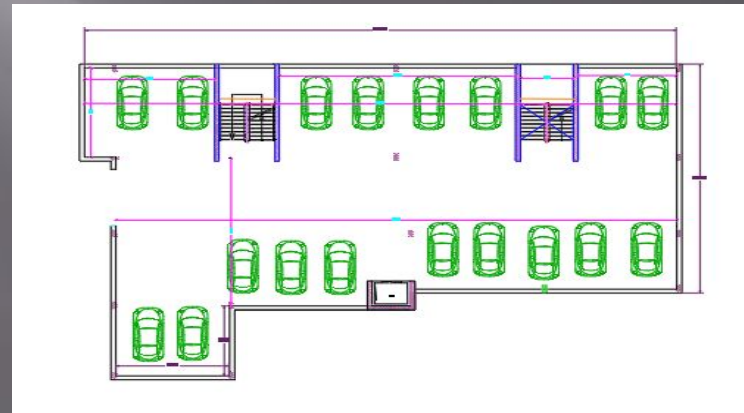
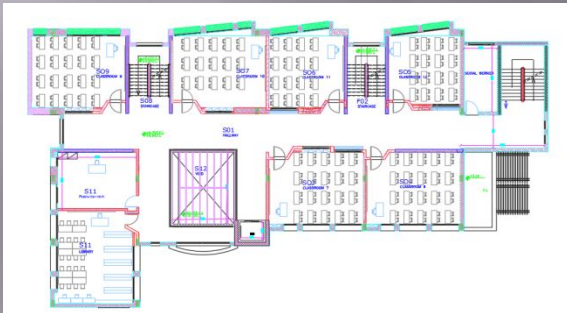
First floor



Architectural aspects

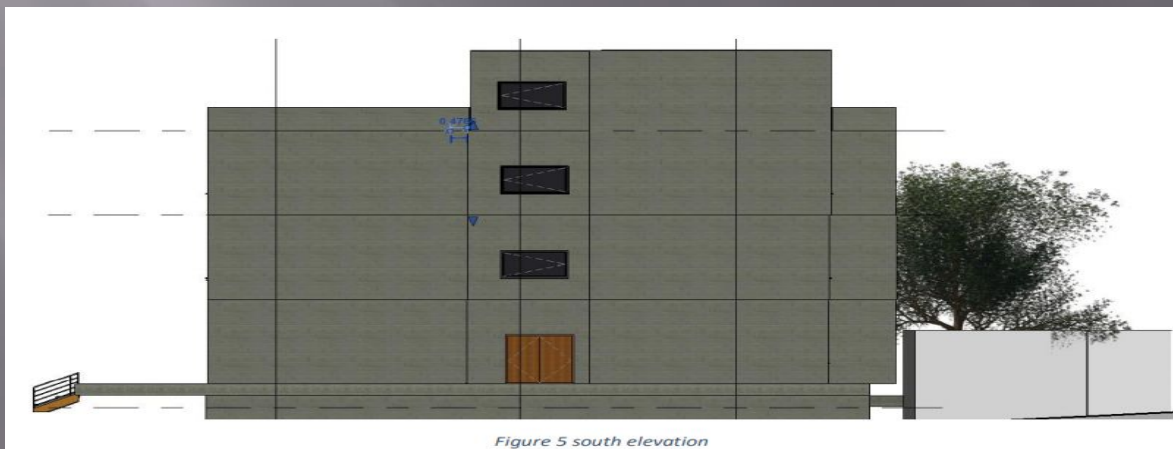
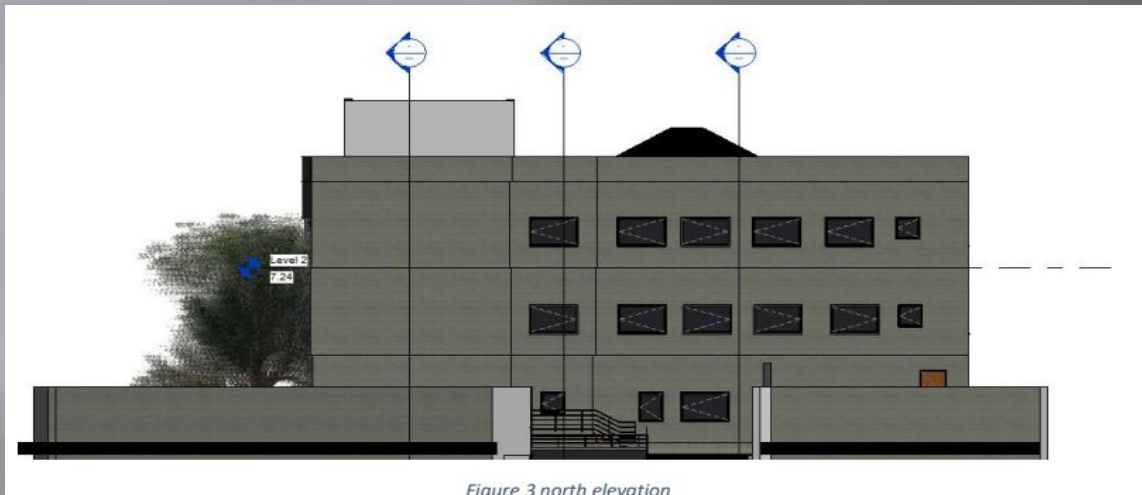
▣ second floor

Parking



Architectural aspects

Elevations



Architectural aspects

▣ Elevations



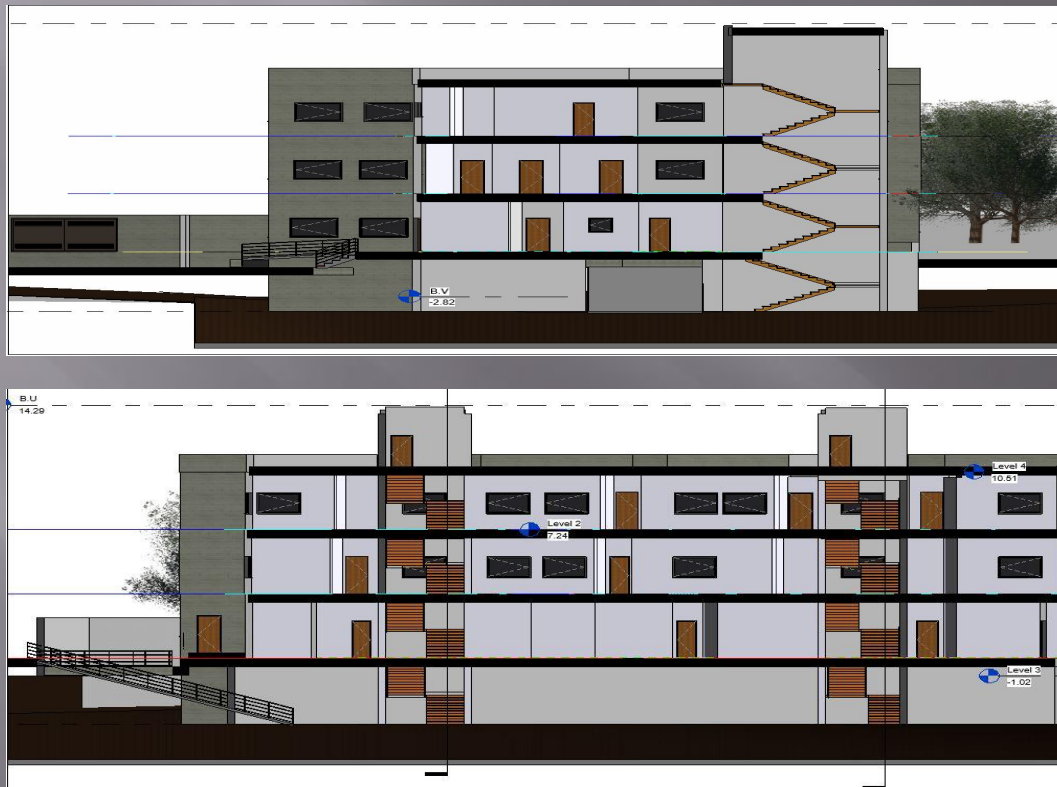
Figure 2 east elevation



Figure 4 west elevation

Architectural aspects

▣ Sections



Structural aspects

1. Slabs
2. Beams
3. Columns
4. Shear walls
5. Stair case
6. Water tank

Structural aspect

Materials:

- Concrete with compressive strength $f_c = 28$ MPa.
- Yield Strength of Steel $F_y = 420$ MPa.
- Bearing capacity of soil = 150 KN/m^2 .

Loads:

- Live load = 5 KN/m^2 .
- SI. Dead load = 4 KN/m^2
- External wall load = 26 KN/m

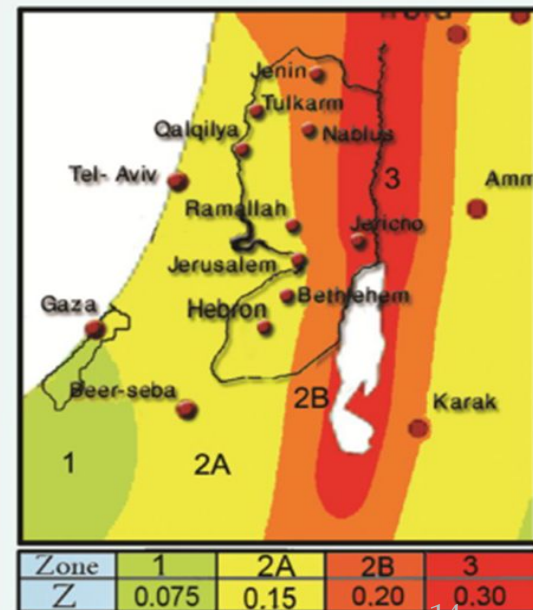
Standards/Codes:

- The American concrete institute code ACI 318-08 for reinforced concrete design
- The Uniform Building Code -UBC-97 for seismic design and its load combinations

□ Seismic analysis:

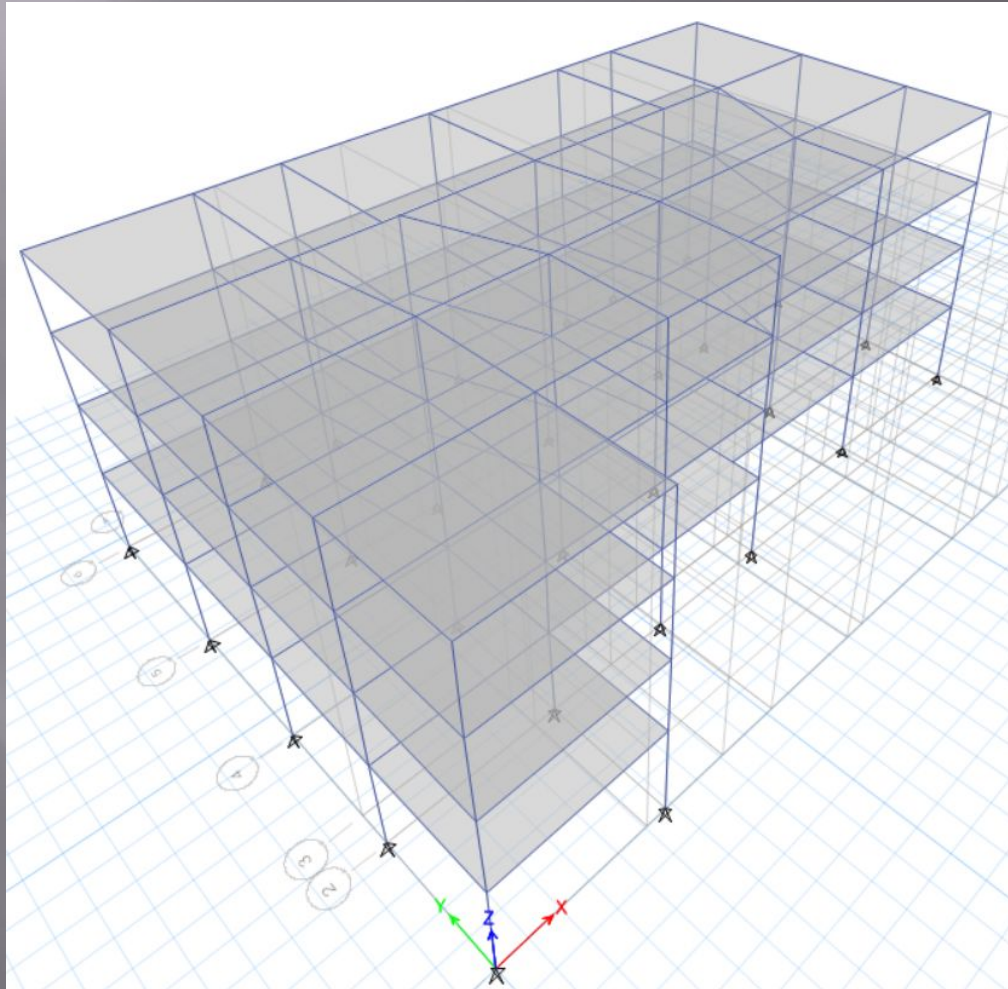
- Seismic zone : 2B with ($Z = 0.20$) .
- Soil profile : SD.
- Acceleration-dependent seismic coefficients $C_a=0.28$.
- Velocity-dependent seismic coefficients $C_v= 0.40$.
- Importance factor $I=1$.
- Force reduction factor $R=5.5$

Seismic Zone Factor, Z



Structural aspect

Etab model

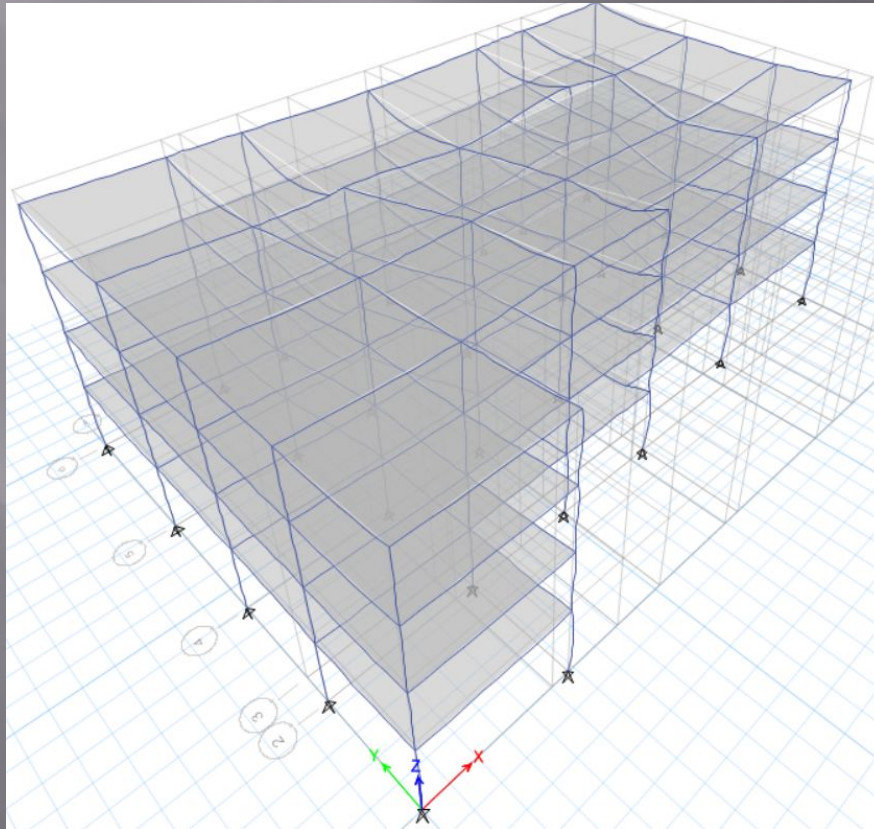


Structural aspect

- ▣ Etabs check
 1. Compatibility check
 2. Equilibrium check
 3. Internal forces check
 4. Deflection check
 5. Period check
 6. drift check
 7. (MPMR) check
 8. Base shear check

Structural aspect

- Compatibility check



Structural aspects

- ▣ Equilibrium check

	Etab	manual	error
dead	25647.74	24589.15	-4.127
live	12787.93	12913	0.978
SID	11764.89	11621.7	0.120

Structural aspect

- Internal forces check

	Etab	manual	error
column	745.65	788.8	-5.7869
beam	223.5	219.317	1.871588
slab	3.61	3.75	-3.87812

Structural aspects

- ▣ Deflection check
 - ▣ $\Delta_{\text{Manual}} = L_n / 240 = 10.25 / 240 = .042$
 - ▣ $\Delta_{\text{Sap}} = .016$
 - ▣ $\Delta_{\text{Sap}} < \Delta_{\text{Manual}}$
 - ▣ Ok
- ▣ Period check
 - ▣ $T_{\text{etab}} \leq 1.4 * T_{\text{method A}}$
 - ▣ $T_{\text{etab}} = 1.075$
 - ▣ $1.075 \leq 1.4 * .972 = 1.36$

Structural aspect

- ▣ Drift check
- ▣ Drift limitation = 2 % times the story height.

story	height	dis X	dis Y	Drift X	Drift Y	Delta X	Delta Y	Delta LIMIT
0	4000	0	0					
1	4000	8.57	14	8.57	14	32.9945	53.9	80
2	3300	11.4	18.56	2.83	4.56	10.8955	17.556	66
3	3300	13.2	20.3	1.8	1.74	6.93	6.699	66
4	3300	14.3	21.5	1.1	1.2	4.235	4.62	66

Structural aspect

- Modal mass participate ratio check [MMPR]
- The MMPR check according to UBC code must be greater than 90% to use response spectrum analysis.

Case	Mode	Period	UX	UY	UZ	Sum UX	Sum UY	Sum UZ
		sec						
Modal	1	1.077	0.0001	0.9794	0	0.0001	0.9794	0
Modal	2	0.913	0.0315	0.001	0	0.0316	0.9804	0
Modal	3	0.862	0.9405	2.66E-05	0	0.9721	0.9804	0
Modal	4	0.264	7.03E-06	0.0171	0	0.9721	0.9975	0
Modal	5	0.225	0.0015	2.03E-05	0	0.9736	0.9975	0
Modal	6	0.215	0.0224	0	0	0.996	0.9975	0
Modal	7	0.134	0	0.0021	0	0.996	0.9997	0
Modal	8	0.114	4.17E-05	0	0	0.996	0.9997	0
Modal	9	0.105	0.0034	0	0	0.9994	0.9997	0
Modal	10	0.091	0	0.0003	0	0.9994	1	0
Modal	11	0.077	5.65E-07	0	0	0.9994	1	0

Structural aspect

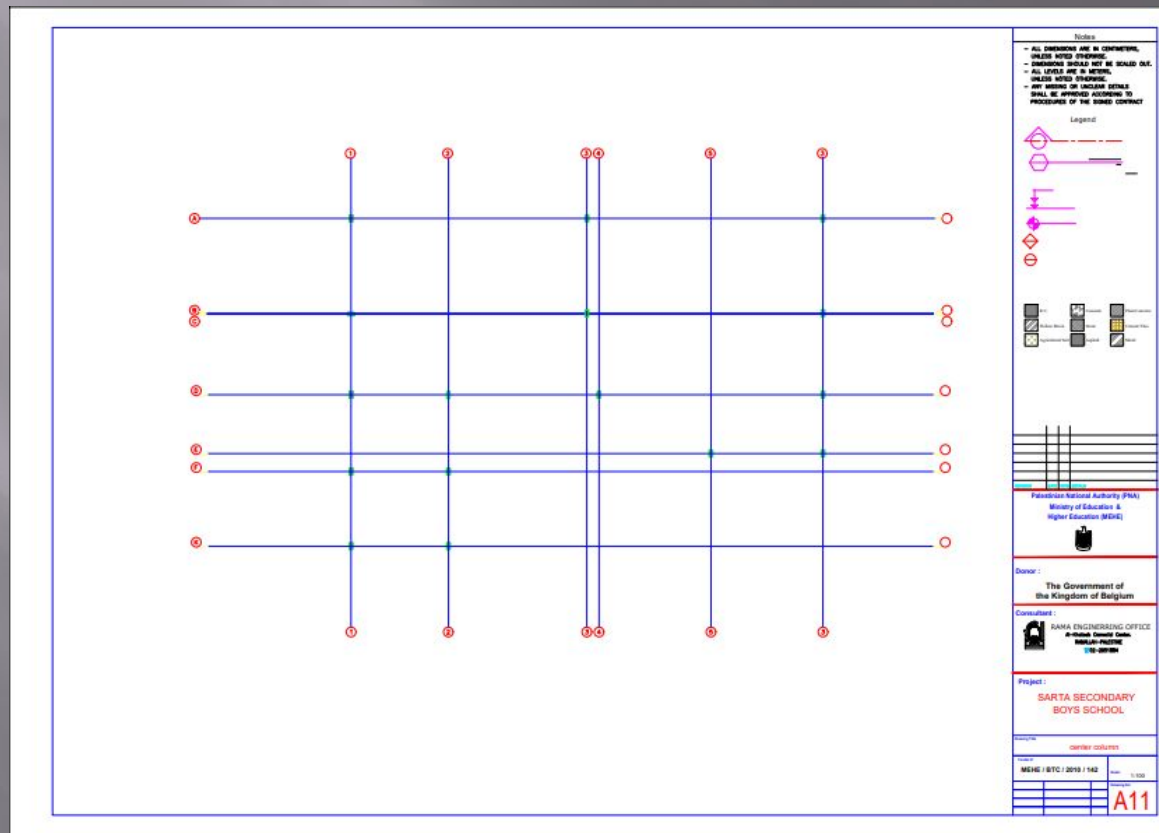
▣ Base shear check

For this check make sure base shear from response spectrum cases **equal or more than** base shear from equivalent static method through modifying scale factor.

Axis	Period T (sec)	Period limit (sec)	Period use (sec)	Weight (kN)	V manual	V ETABs	Old S.F	new S.F
X- axis	0.691	0.7056	0.691	75456.81	7941.77	8807.4	1783	2399.03
Y- axis	0.521	0.7056	0.521	75456.81	10533.14	9039.3	1783	2826.59

Structural aspect

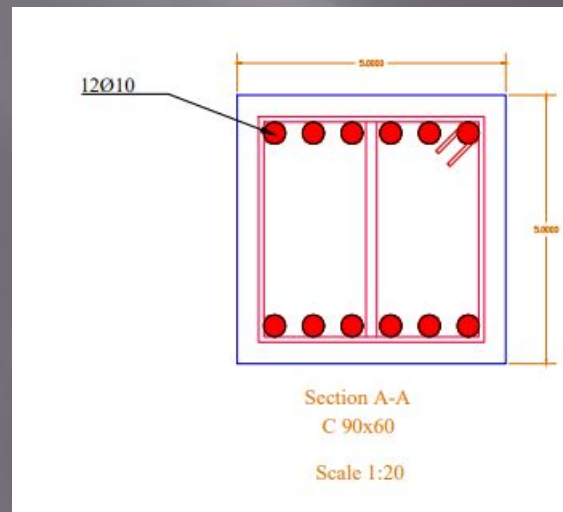
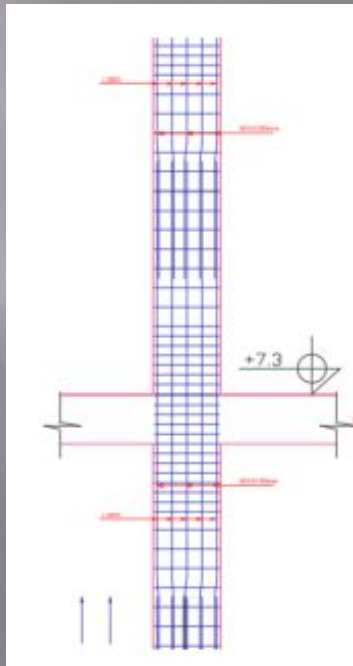
Center columns



Structural aspect

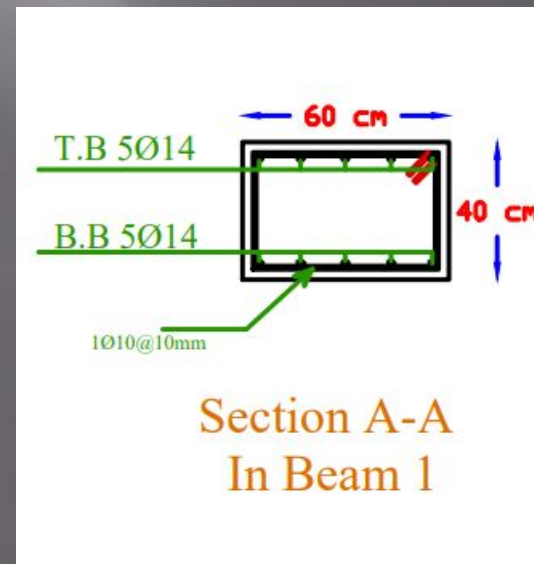
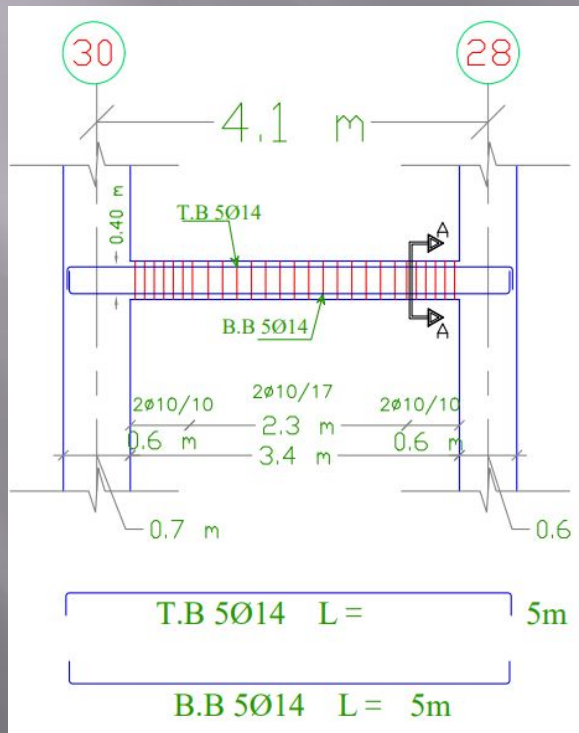
Design of structural elements

1. Column



Structural aspect

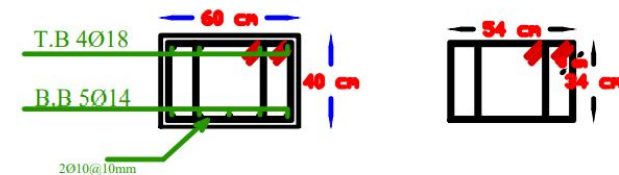
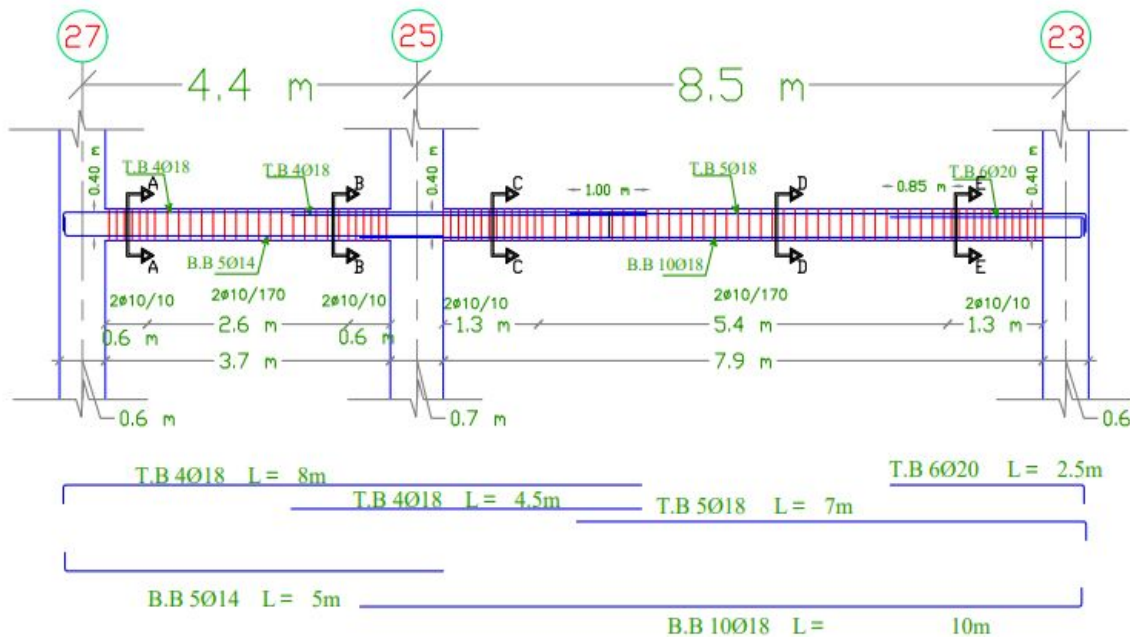
2. Beam



Structural aspect

▣ Beam

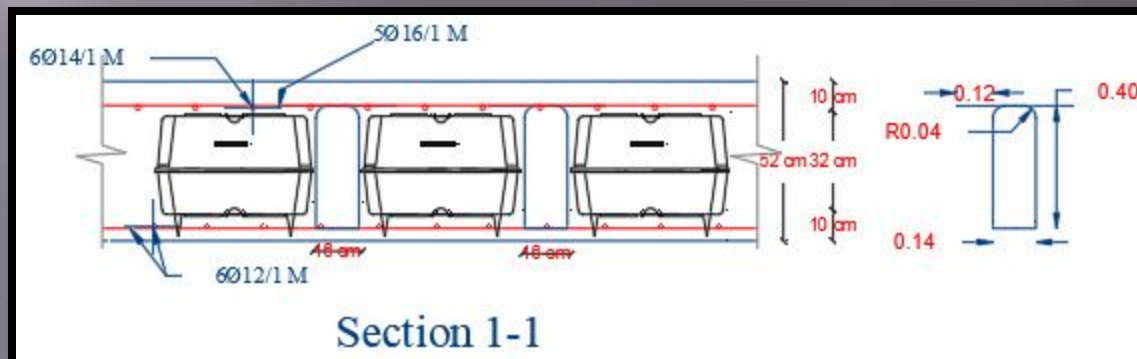
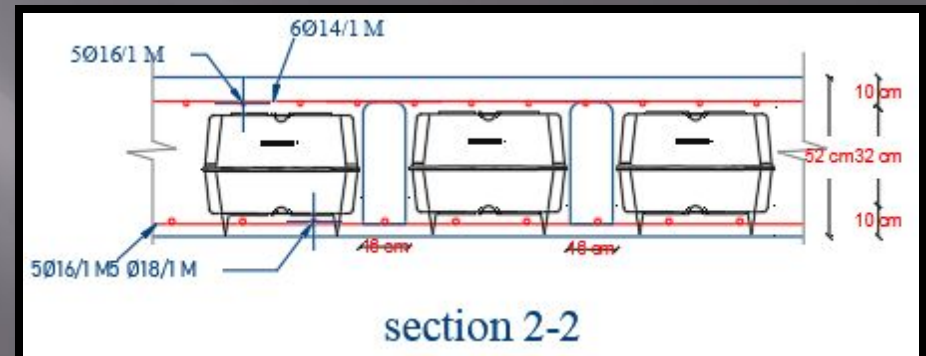
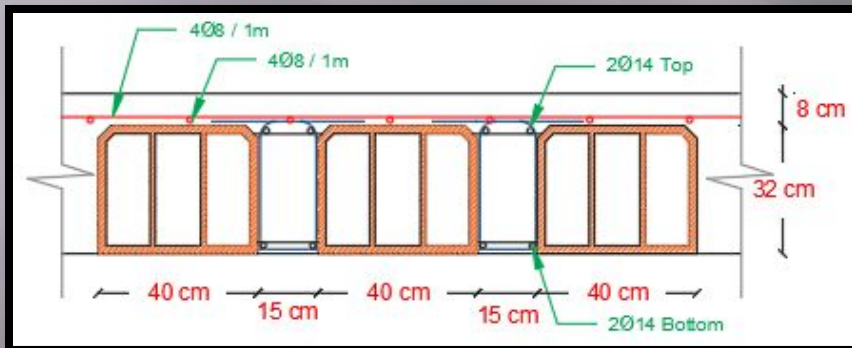
B 2 Scale 1:50



Scale 1:20

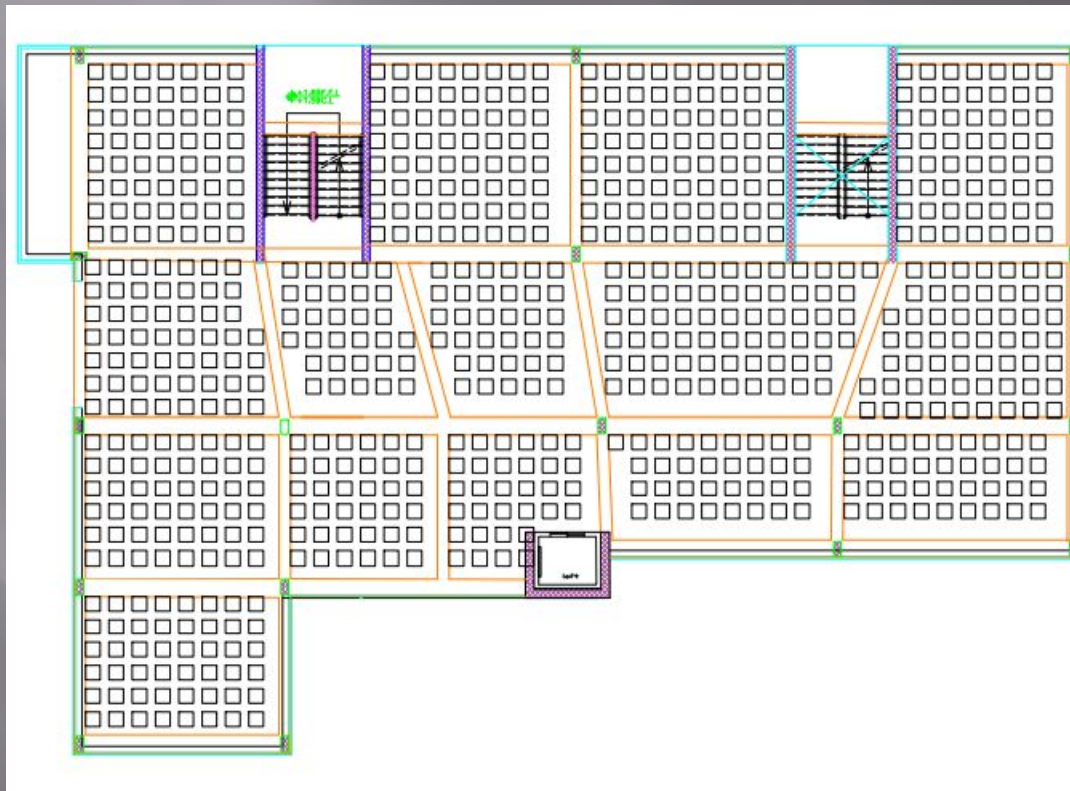
Structural aspects

▣ Slabs

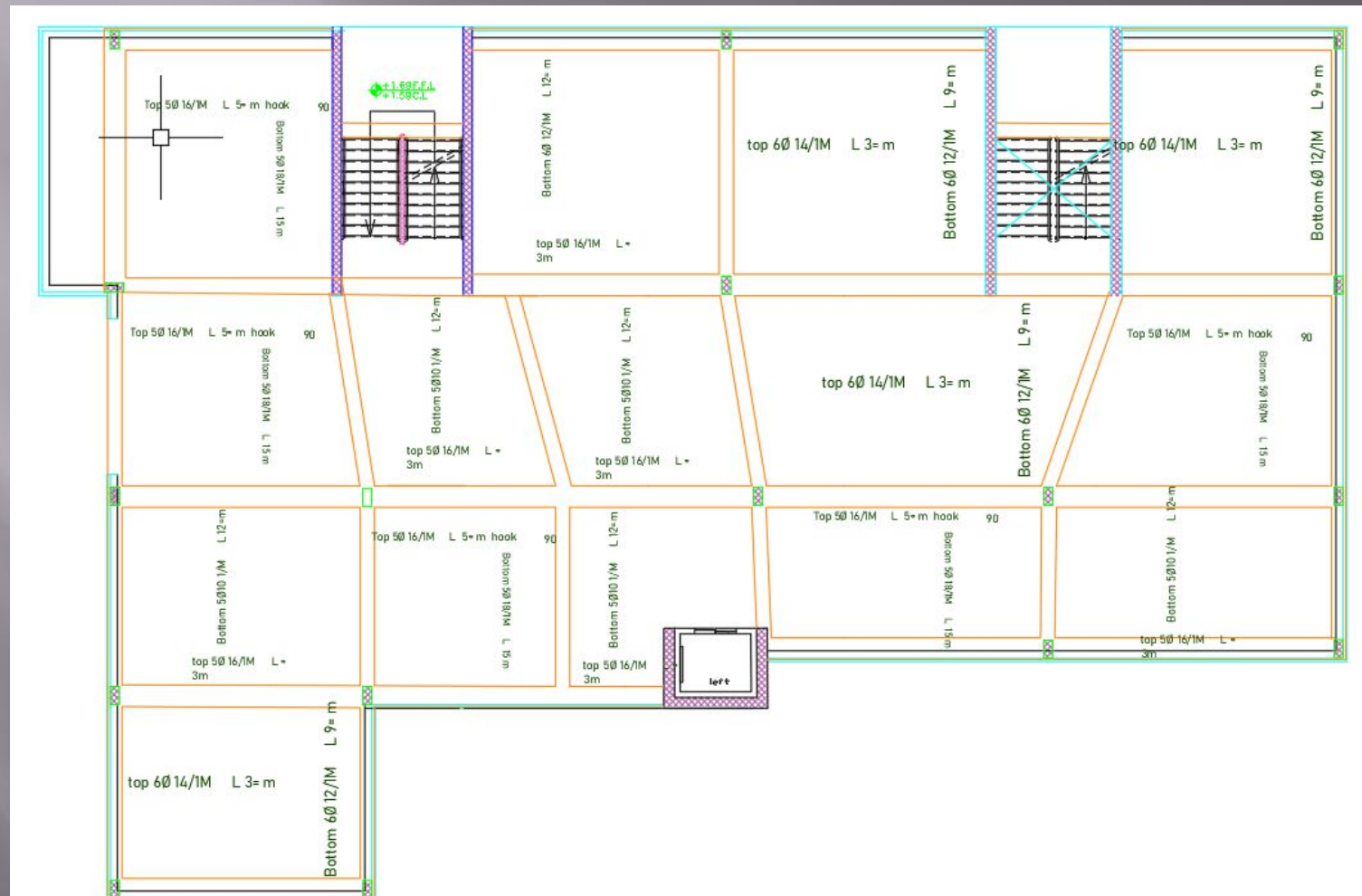


Structural aspect

▣ Slab

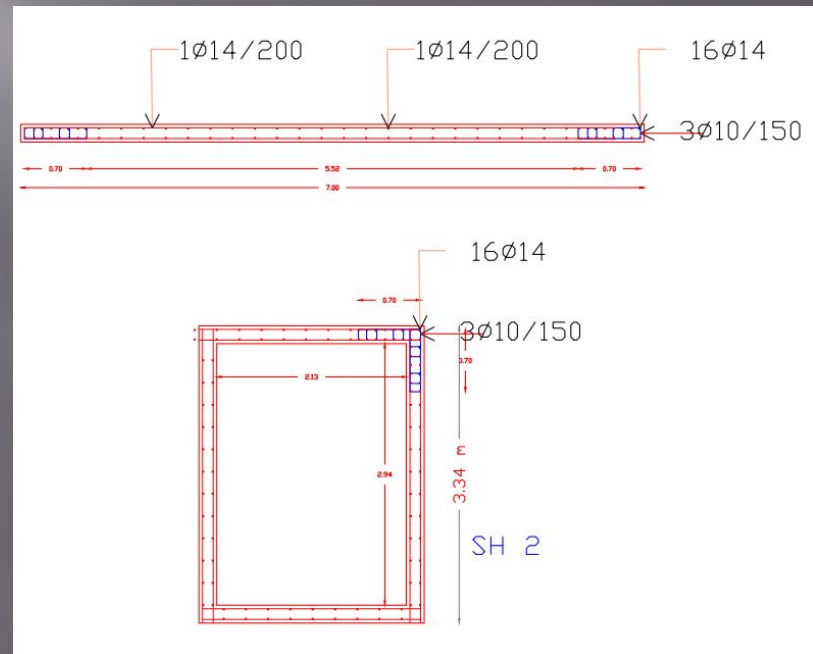
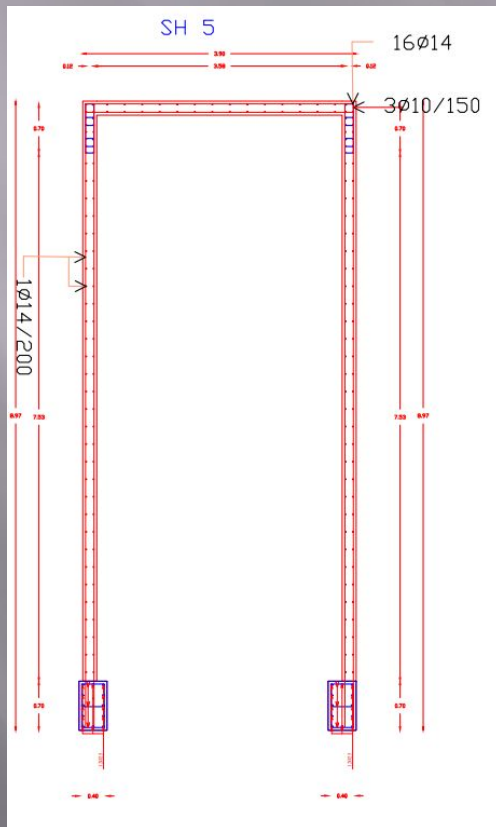


Structural aspect



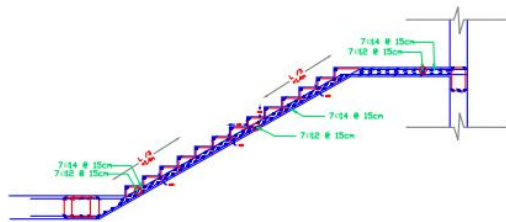
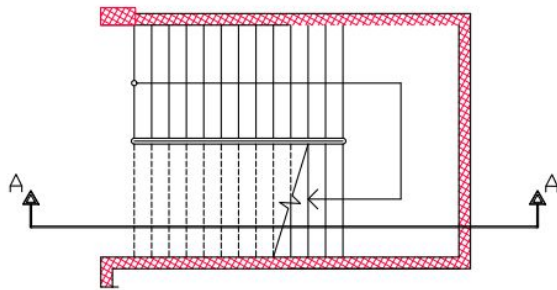
Structural aspect

Shear wall

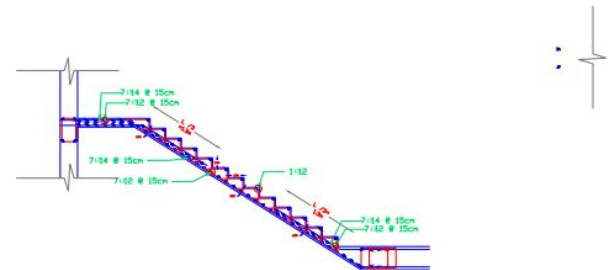
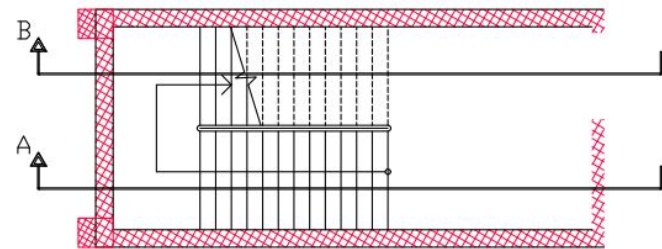


Structural elements

▣ Stair case



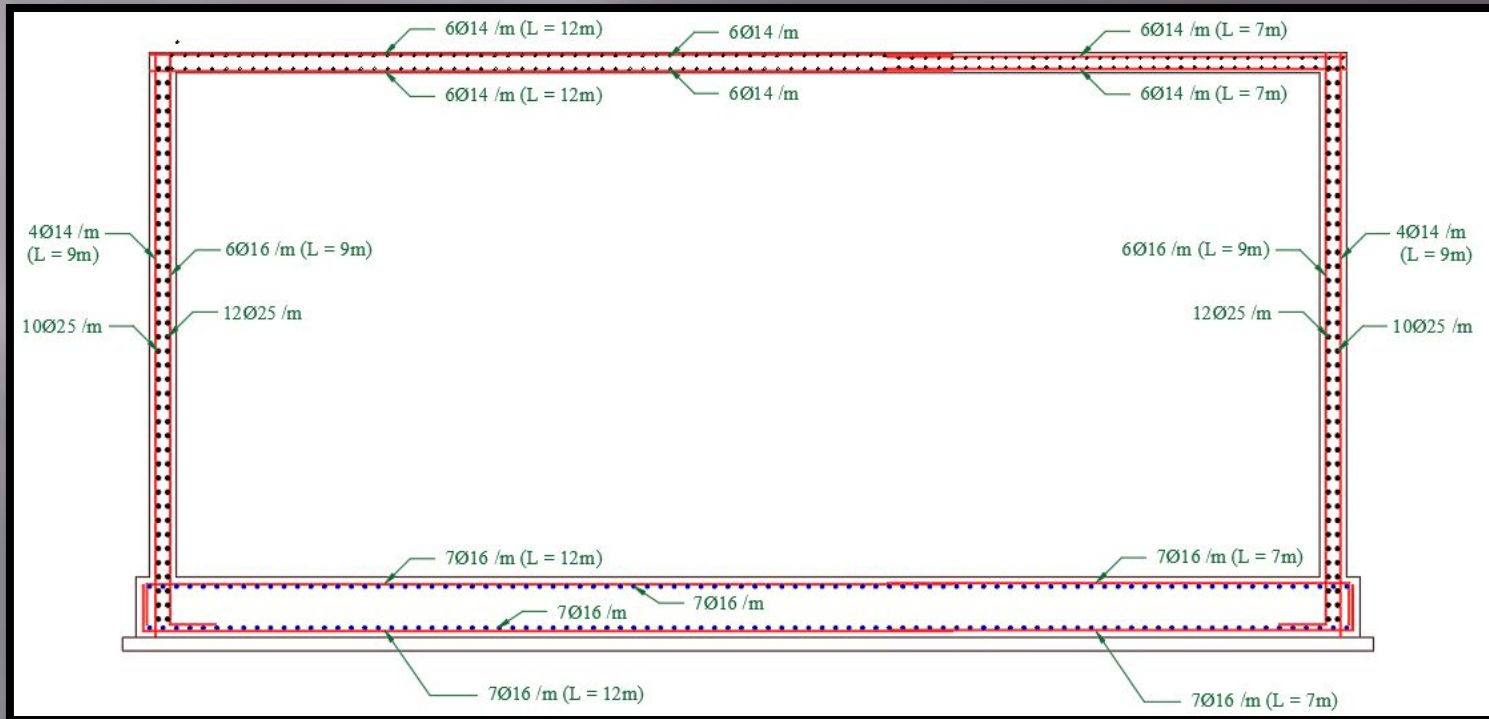
Section A-A in
Stair 2



Section A-A in
Stair 1

Structural aspects

- Design of structural elements
- Water tank



Environmental aspects

Design builder program

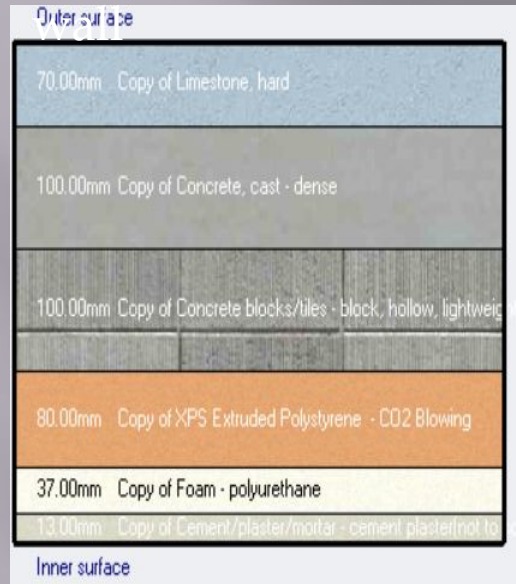
Acoustical design

Thermal behavior and
solar radiation

Daylighting factor

Material properties:

External



Internal



slab



Energy consumption for the school

Site and Source Energy

	Total Energy [kWh]	Energy Per Total Building Area [kWh/m2]	Energy Per Conditioned Building Area [kWh/m2]
Total Site Energy	91032.65	79.31	79.31
Net Site Energy	91032.65	79.31	79.31
Total Source Energy	288300.40	251.17	251.17
Net Source Energy	288300.40	251.17	251.17

uncomforting

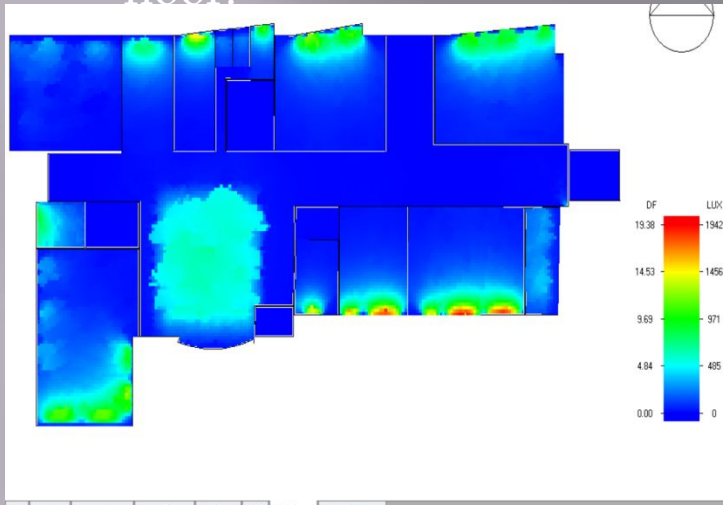
Comfort and Setpoint Not Met Summary

	Facility [Hours]
Time Setpoint Not Met During Occupied Heating	0.00
Time Setpoint Not Met During Occupied Cooling	0.00
Time Not Comfortable Based on Simple ASHRAE 55-2004	371.67

The average is between: (0.5 – -0.5)

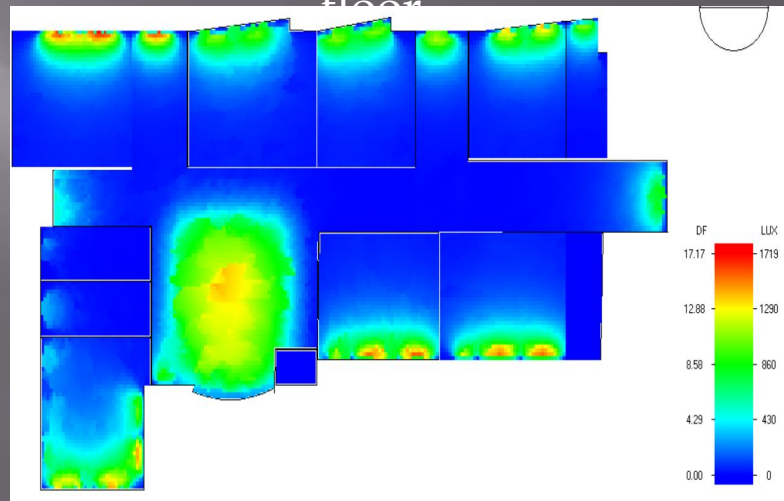


Ground
floor:

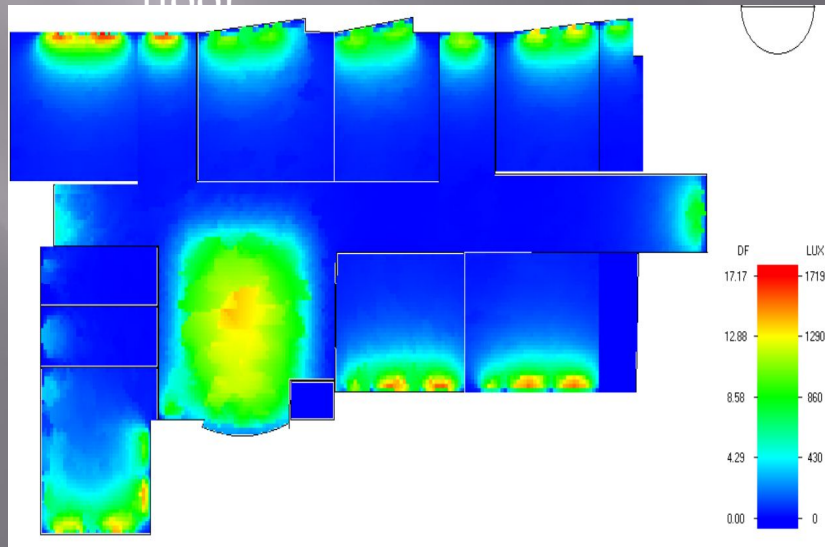


Daylight
factor:

First
floor



Second
floor



Environmental aspects

Acoustical design:

STC (Sound Transmission Class)

Type of Occupancy	Wall, Partition, or Panel Between		Sound Isolation Requirement: Background Level in Room Being Considered	
	Room Being Considered	and Adjacent Area	Quiet	Normal
Normal school buildings without extraordinary or unusual activities or requirements	Classrooms	Adjacent classrooms	STC 42	STC 40
		Corridor or public areas	STC 40	STC 38
		Kitchen and dining areas	STC 50	STC 47
		Shops	STC 50	STC 47
	Music practice rooms	Recreation areas	STC 45	STC 42
		Music rooms	STC 55	STC 50
		Mechanical equipment rooms	STC 50	STC 45
		Toilet areas	STC 45	STC 42
		Adjacent practice rooms	STC 55	STC 50
		Corridor and public areas	STC 45	STC 42
Executive areas, doctors' suites; confidential privacy requirements	Office	Adjacent offices	STC 50	STC 45
		General office areas	STC 48	STC 45
		Corridor or lobby	STC 45	STC 42
		Washrooms and toilet areas	STC 50	STC 47
Normal office; normal privacy requirements; any occupancy using rooms for group meetings	Office	Adjacent offices	STC 40	STC 38
		Corridor, lobby, exterior	STC 40	STC 38
		Washrooms, kitchen, dining	STC 42	STC 40
	Conference rooms	Other conference rooms	STC 45	STC 42
		Adjacent offices	STC 45	STC 42
		Corridor or lobby	STC 42	STC 40
		Exterior of building	STC 40	STC 38
Large offices, drafting areas, banking floors, etc.	Large general office areas	Kitchen and dining areas	STC 45	STC 42
		Corridors, lobby, exterior	STC 38	STC 35
		Data-processing area	STC 40	STC 38
			STC 40	STC 38
Motels and urban hotels, Hospitals and dormitories	Bedrooms	Adjacent bedrooms ^a	STC 52	STC 50
		Bathroom ^a	STC 50	STC 45
		Living rooms ^a	STC 45	STC 42
		Dining areas	STC 45	STC 42
		Corridor, lobby, or public spaces	STC 45	STC 42

OITC standards for each space

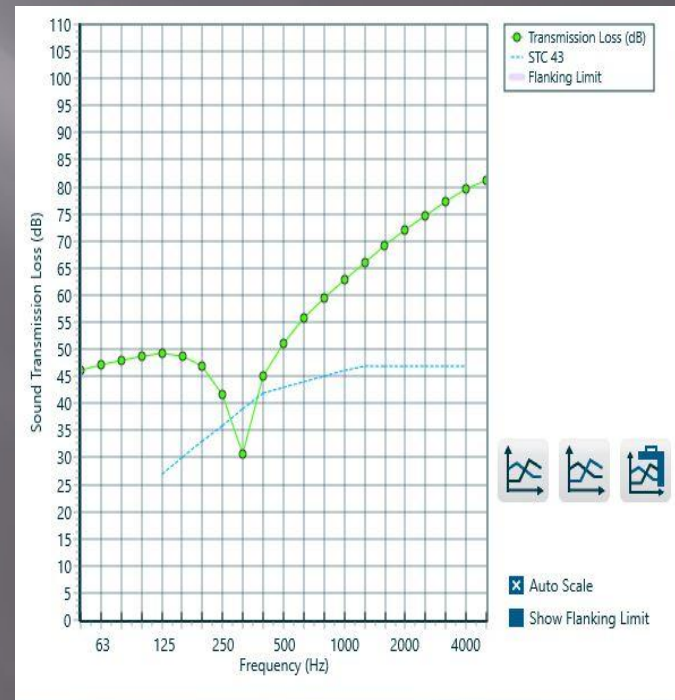
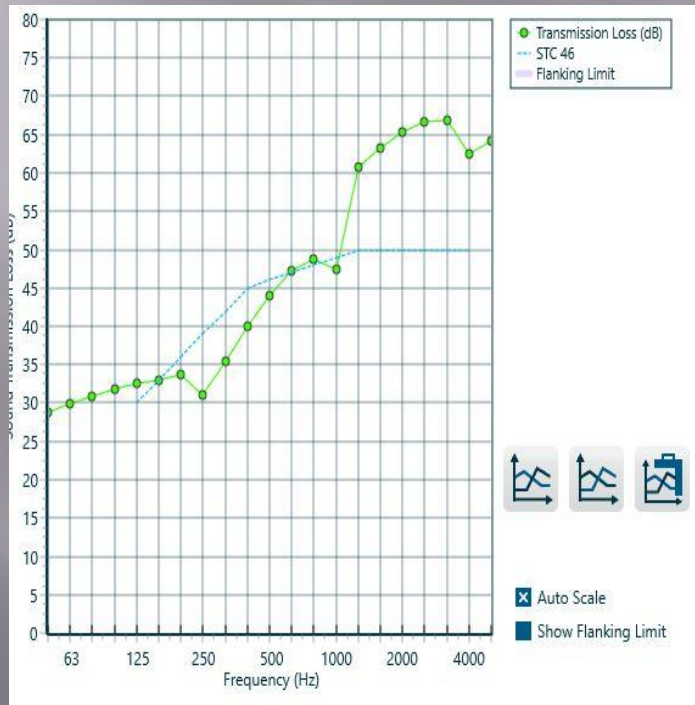
Outdoor background noise	OITC (Recommended)
61-65 dBA	> 39
66-70 dBA	> 43
71-75 dBA	> 47
76-80 dBA	50

Environmental aspects

STC (Sound Transmission Class)

Acoustical
design:
Classroom beside classroom

Classroom with floor of the above classroom

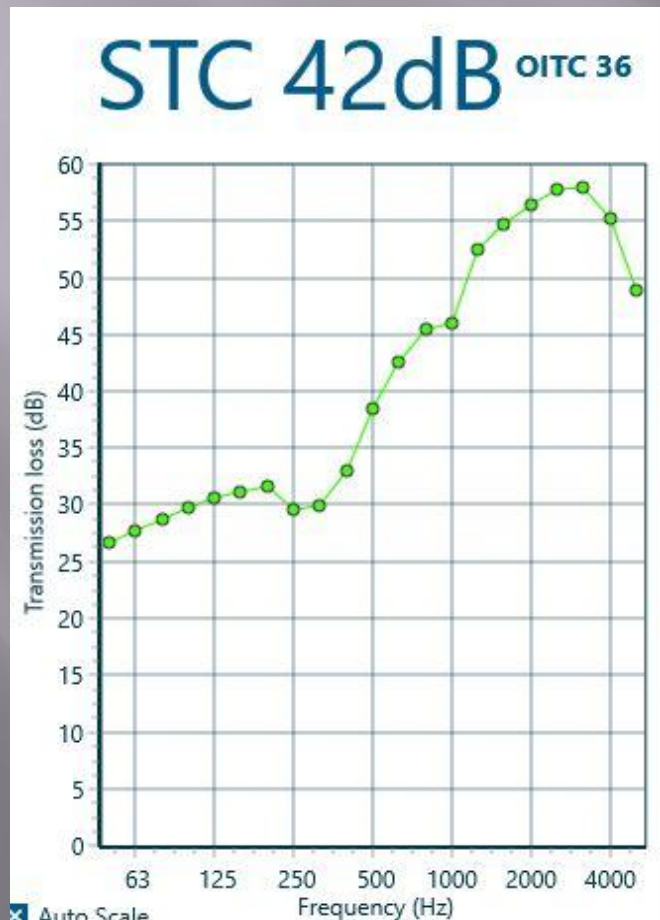


Environmental aspects

STC (Sound Transmission
Class)

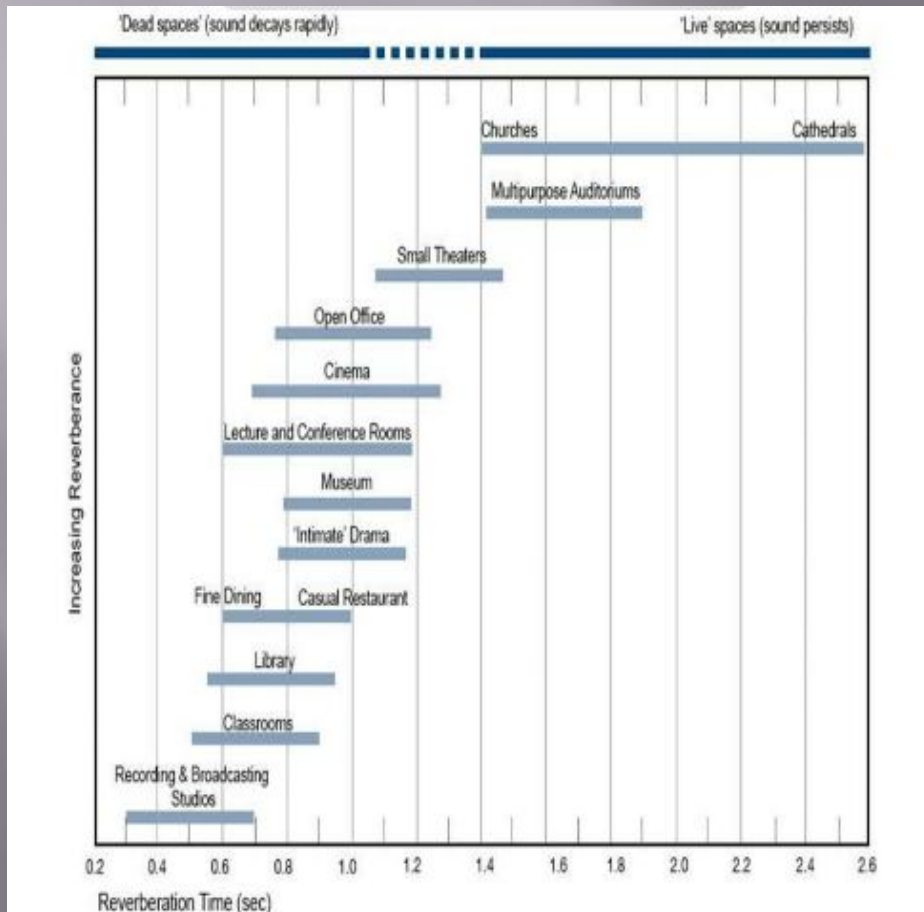
STC Value of wall of the corridor

STC value of Art room with kitchen



Environmental aspects

Reverberating time by using Ecotect software



RT standards

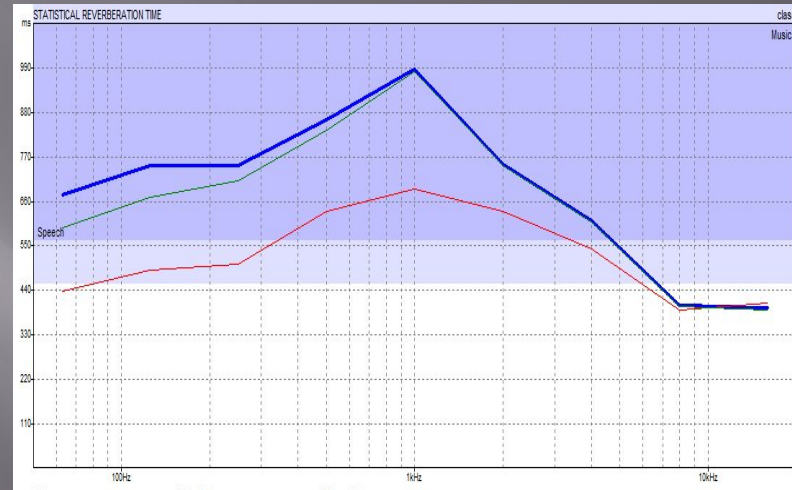
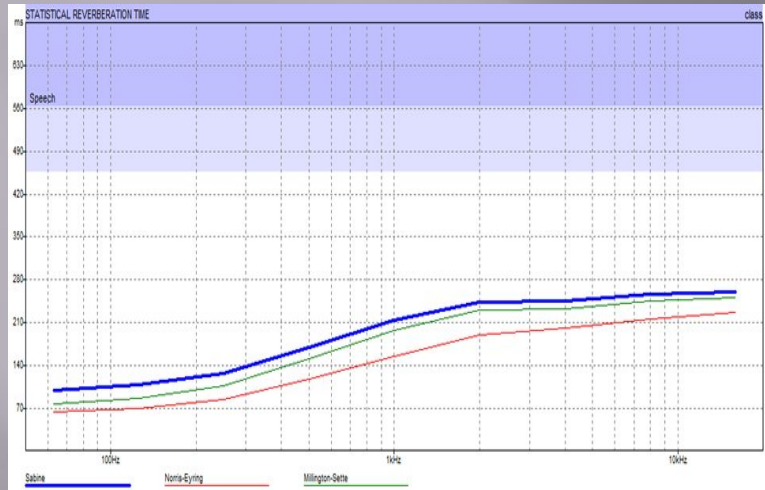
Room Type	Suggested RT
Sports Hall	<1.5 Seconds
School Corridor/Stairwell	<1.5 Seconds
Dining Room/Canteen	<1.0 Second

Atria, circulation spaces used by students	<1.5
Indoor sports hall	<1.5
Gymnasium	<1.5
Dance studio	<1.2
Swimming pool	<2.0
Interviewing/counselling rooms, medical rooms	<0.8
Dining rooms	<1.0

Environmental aspects

Reverberating time by using Ecotect

Classroom before and after software



TOTAL SABINE		NOR-ER		MIL-SE
FREQ.	ABSPT.	RT (60)	RT (60)	RT
63Hz:	266.170	0.10	0.06	0.08
125Hz:	244.005	0.11	0.07	0.09
250Hz:	199.075	0.13	0.08	0.11
500Hz:	140.902	0.17	0.12	0.15
1kHz:	107.483	0.21	0.15	0.20
2kHz:	88.614	0.24	0.19	0.23
4kHz:	87.680	0.25	0.20	0.23
8kHz:	76.556	0.26	0.22	0.24
16kHz:	72.743	0.26	0.23	0.25

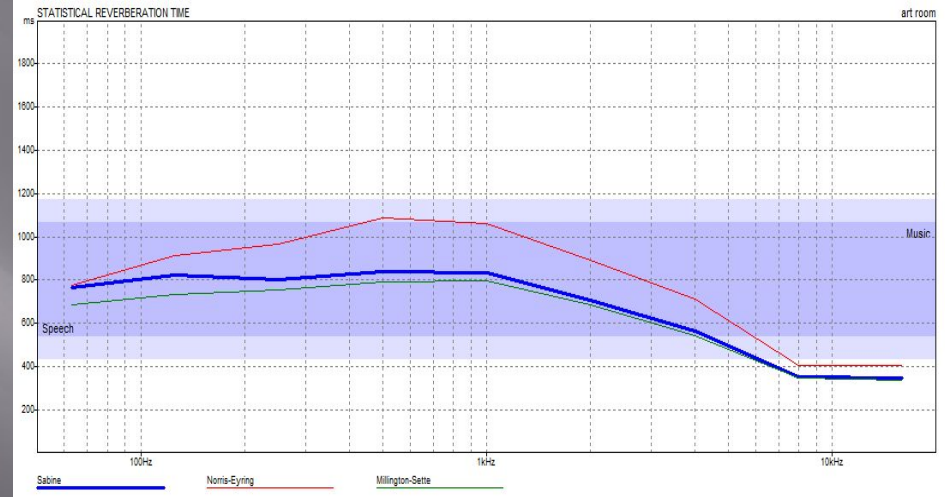
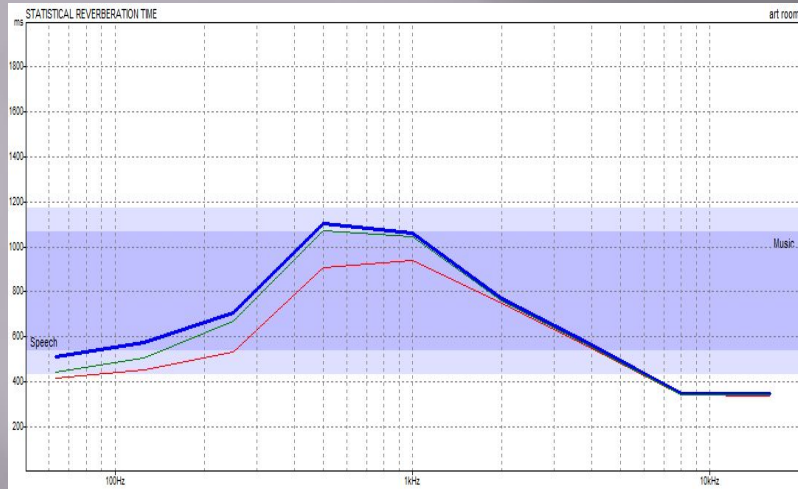
TOTAL SABINE		NOR-ER		MIL-SE
FREQ.	ABSPT.	RT (60)	RT (60)	RT (60)
63Hz:	33.083	0.68	0.44	0.60
125Hz:	28.548	0.75	0.49	0.67
250Hz:	19.530	0.75	0.50	0.71
500Hz:	12.135	0.86	0.64	0.84
1kHz:	4.999	0.99	0.69	0.98
2kHz:	7.564	0.75	0.63	0.75
4kHz:	8.319	0.61	0.54	0.61
8kHz:	11.348	0.40	0.39	0.40
16kHz:	15.479	0.40	0.41	0.39

Environmental aspects

Reverberating time by using Ecotect

Art room before and

software



Art				
TOTAL	SABINE	NOR-ER	MIL-SE	before
FREQ.	ABSPT.	RT (60)	RT (60)	RT (60)
63Hz:	39.948	0.51	0.42	0.44
125Hz:	35.022	0.57	0.45	0.50
250Hz:	21.555	0.71	0.53	0.67
500Hz:	9.539	1.10	0.91	1.07
1kHz:	7.305	1.06	0.94	1.05
2kHz:	9.353	0.77	0.75	0.76
4kHz:	14.453	0.56	0.55	0.56
8kHz:	14.539	0.35	0.34	0.34
16kHz:	16.961	0.35	0.33	0.34

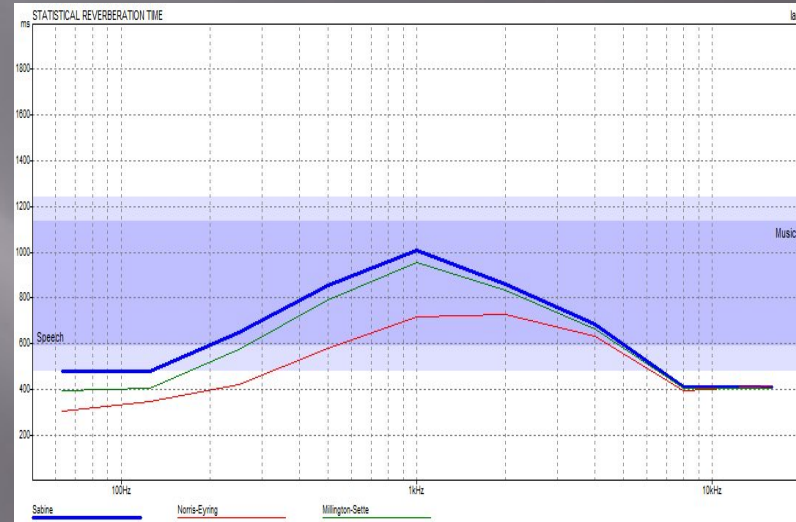
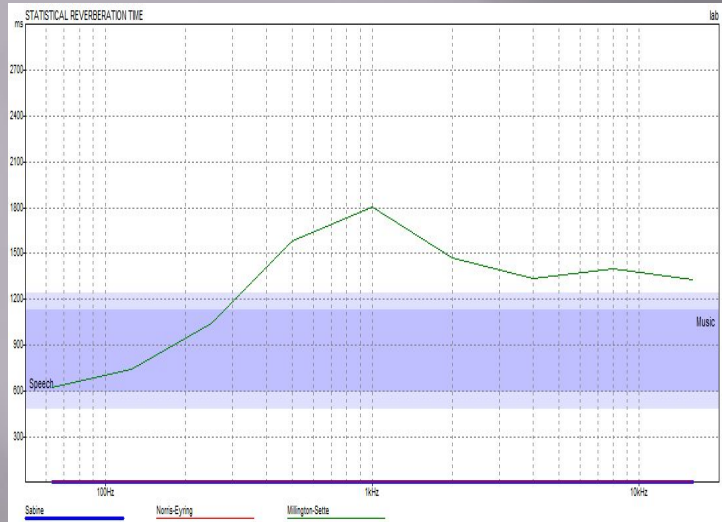
TOTAL	SABINE	NOR-ER	MIL-SE	
FREQ.	ABSPT.	RT (60)	RT (60)	RT (60)
----	-----	-----	-----	-----
63Hz: 33.083		0.68	0.44	0.60
125Hz: 28.548		0.75	0.49	0.67
250Hz: 19.530		0.75	0.50	0.71
500Hz: 12.135		0.86	0.64	0.84
1kHz: 4.999		0.99	0.69	0.98
2kHz: 7.564		0.75	0.63	0.75
4kHz: 8.319		0.61	0.54	0.61
8kHz: 11.348		0.40	0.39	0.40
16kHz: 15.479		0.40	0.41	0.39

Environmental aspects

Reverberating time by using Ecotect

Lab before and after

software



FREQ.	TOTAL ABSPT.	SABINE RT (60)	NOR-ER RT (60)	MIL-SE RT (60)	before
63Hz:	64.987	0.48	0.34	0.39	
125Hz:	56.602	0.54	0.38	0.46	
250Hz:	38.384	0.67	0.44	0.60	
500Hz:	23.116	0.96	0.63	0.89	
1kHz:	18.141	1.03	0.74	0.99	
2kHz:	18.773	0.85	0.72	0.82	
4kHz:	23.059	0.67	0.62	0.65	
8kHz:	21.645	0.44	0.42	0.43	
16kHz:	22.485	0.43	0.42	0.42	

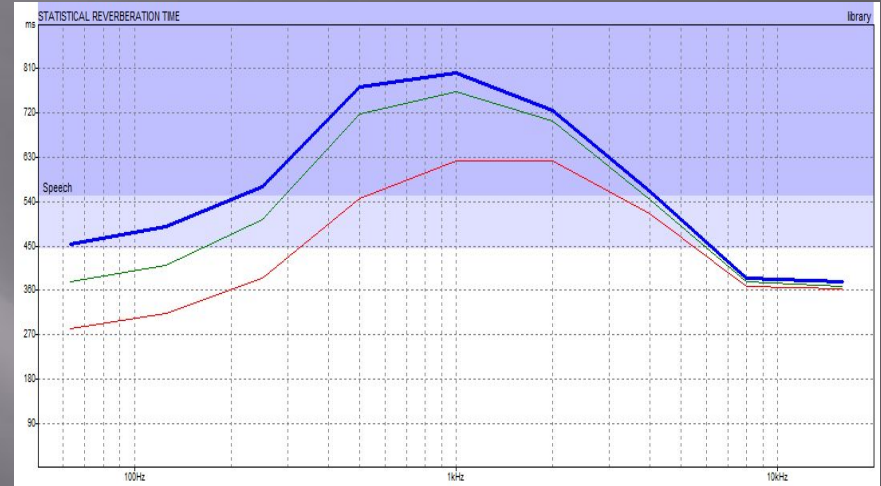
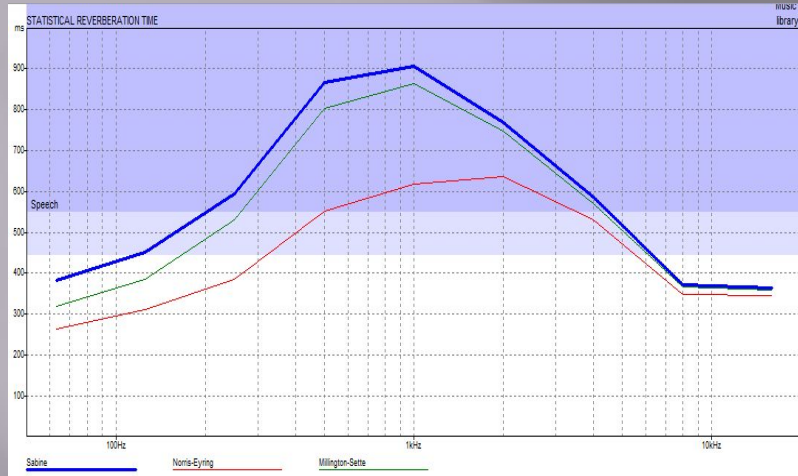
FREQ.	TOTAL ABSPT.	SABINE RT (60)	NOR-ER RT (60)	MIL-SE RT (60)	after
63Hz:	65.759	0.48	0.30	0.39	
125Hz:	66.301	0.48	0.35	0.40	
250Hz:	42.678	0.65	0.42	0.58	
500Hz:	30.802	0.86	0.58	0.79	
1kHz:	22.748	1.01	0.71	0.96	
2kHz:	21.752	0.86	0.73	0.83	
4kHz:	23.810	0.68	0.63	0.67	
8kHz:	20.906	0.41	0.39	0.40	
16kHz:	23.736	0.41	0.41	0.40	

Environmental aspects

Reverberating time by using Ecotect

Library before and

software



FREQ.	TOTAL ABSPT.	SABINE RT (60)	NOR-ER RT (60)	MIL-SE RT (60)	before
63Hz:	61.802	0.38	0.26	0.32	
125Hz:	51.822	0.45	0.31	0.38	
250Hz:	35.464	0.59	0.39	0.53	
500Hz:	21.917	0.87	0.55	0.80	
1kHz:	18.136	0.91	0.62	0.86	
2kHz:	17.106	0.77	0.64	0.75	
4kHz:	20.362	0.58	0.53	0.57	
8kHz:	19.919	0.37	0.35	0.37	
16kHz:	20.492	0.36	0.35	0.36	

FREQ.	TOTAL ABSPT.	SABINE RT (60)	NOR-ER RT (60)	MIL-SE RT (60)	after
63Hz:	51.811	0.45	0.28	0.38	
125Hz:	47.742	0.49	0.31	0.41	
250Hz:	37.270	0.57	0.39	0.50	
500Hz:	25.380	0.77	0.55	0.72	
1kHz:	22.208	0.80	0.62	0.76	
2kHz:	20.055	0.73	0.62	0.70	
4kHz:	24.623	0.56	0.51	0.54	
8kHz:	25.491	0.38	0.37	0.38	
16kHz:	27.110	0.38	0.36	0.37	

Environmental aspects

EASE Aspect
Class room

RT 60

Direct SPL

Edit Room Data \ G.P - EASE 4.3

Data Room RT Noise Mapping Settings

Reverb. Time

Formula : Eyring

☐ Locked

Interpolate

Desired [s] : 0.00

Air Parameters

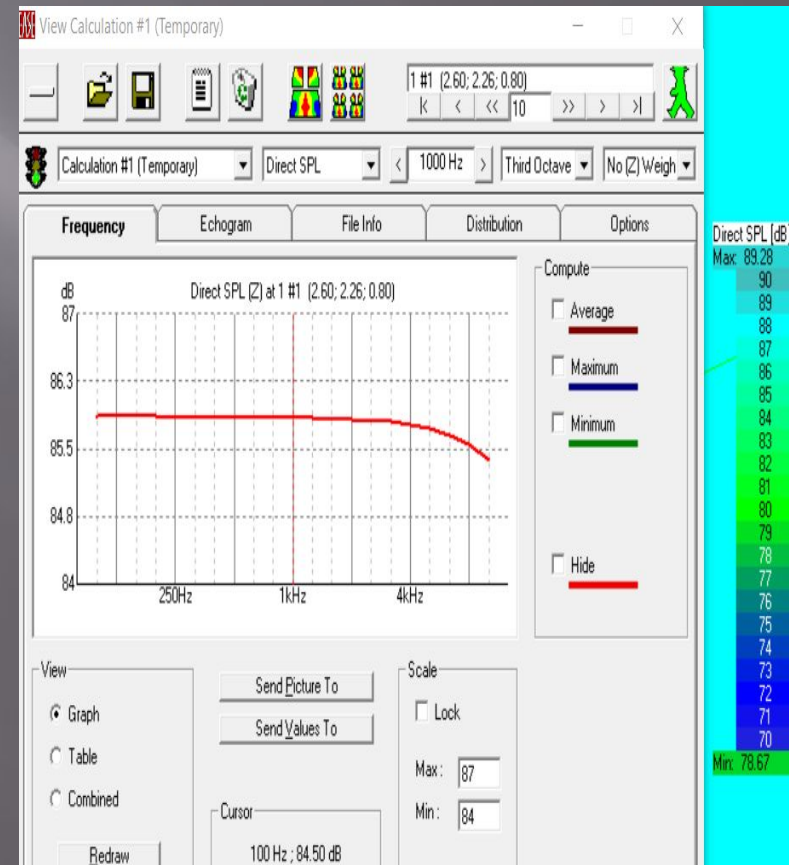
Humidity : 60 %

Temperature : 20 °C

Pressure : 1013 hPa

	Rev. Time	Absorp. Coe
100 Hz	0.49	0.22
125 Hz	0.49	0.22
160 Hz	0.57	0.19
200 Hz	0.67	0.17
250 Hz	0.81	0.14
315 Hz	0.83	0.14
400 Hz	0.84	0.13
500 Hz	0.86	0.13
630 Hz	0.87	0.13
800 Hz	0.87	0.13
1000 Hz	0.88	0.13
1250 Hz	0.84	0.13
1600 Hz	0.80	0.14
2000 Hz	0.77	0.14
2500 Hz	0.77	0.14
3150 Hz	0.77	0.14
4000 Hz	0.77	0.14
5000 Hz	0.73	0.13
6300 Hz	0.68	0.13
8000 Hz	0.62	0.13
10000 Hz	0.53	0.13

Recompute Apply Ok Cancel

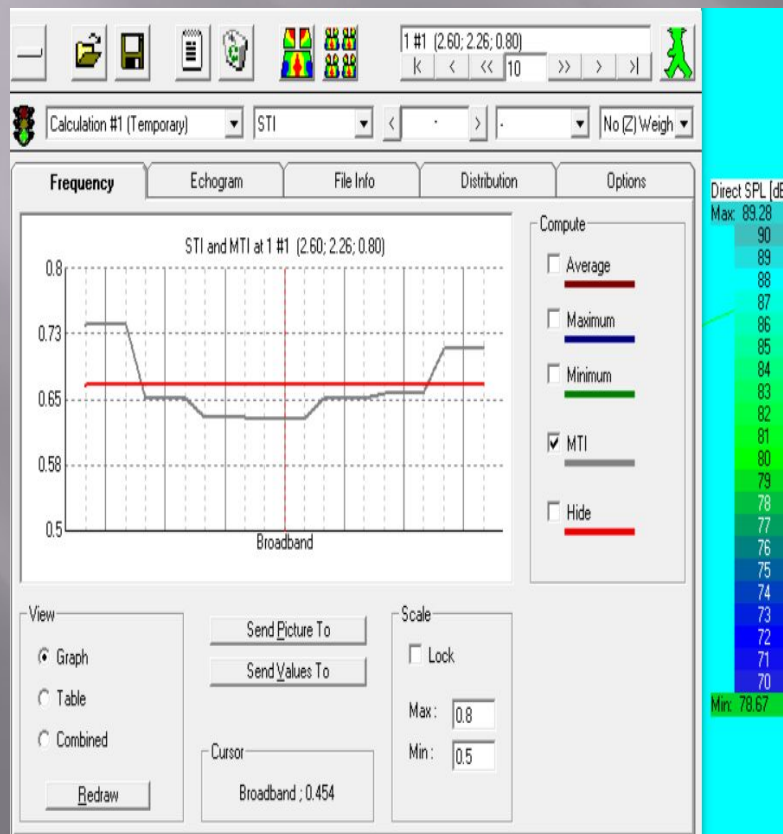


Environmental aspects

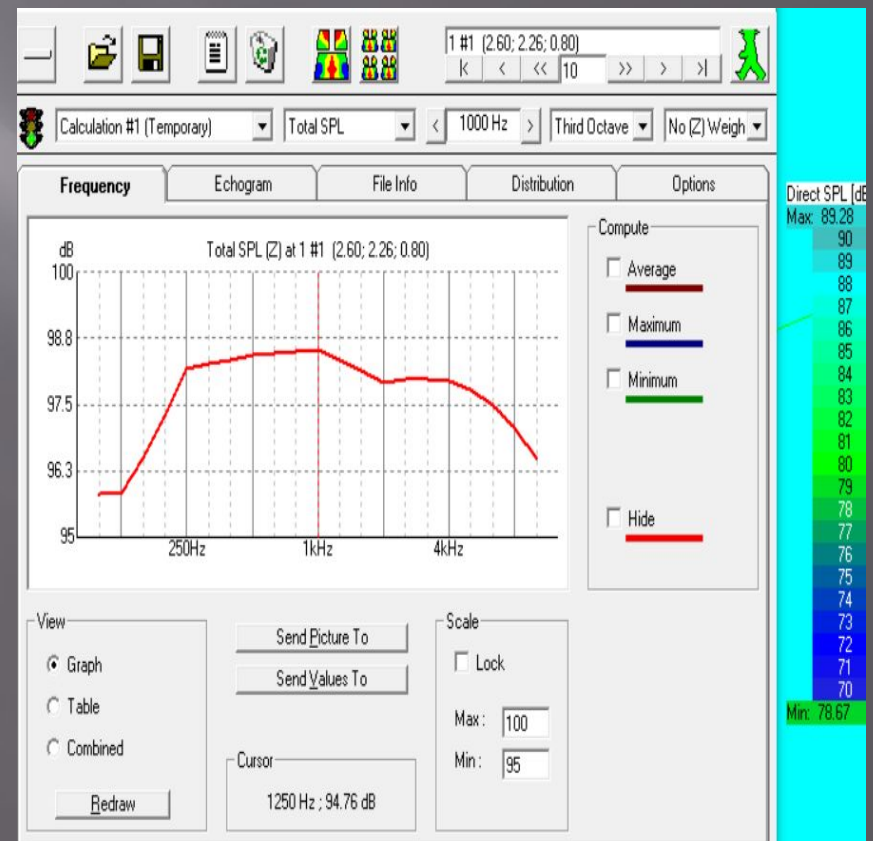
EASE Aspect

Class room

STI



Total SPL



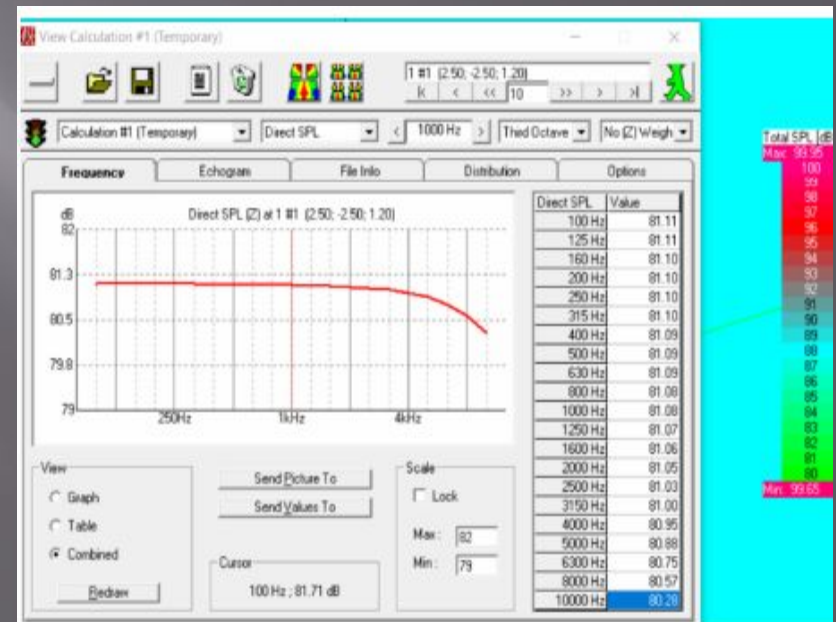
Environmental aspects

EASE Aspect
Library

RT6
0

Direct SPL

Noise	Mapping	Settings
	Rev. Time	Absorp. Coe
100 Hz	0.58	0.18
125 Hz	0.58	0.18
160 Hz	0.56	0.18
200 Hz	0.55	0.19
250 Hz	0.53	0.20
315 Hz	0.54	0.19
400 Hz	0.56	0.19
500 Hz	0.57	0.18
630 Hz	0.58	0.18
800 Hz	0.58	0.18
1000 Hz	0.58	0.18
1250 Hz	0.58	0.18
1600 Hz	0.58	0.18
2000 Hz	0.58	0.18
2500 Hz	0.58	0.17
3150 Hz	0.58	0.17
4000 Hz	0.58	0.17
5000 Hz	0.56	0.17
6300 Hz	0.53	0.17
8000 Hz	0.48	0.17
10000 Hz	0.43	0.17

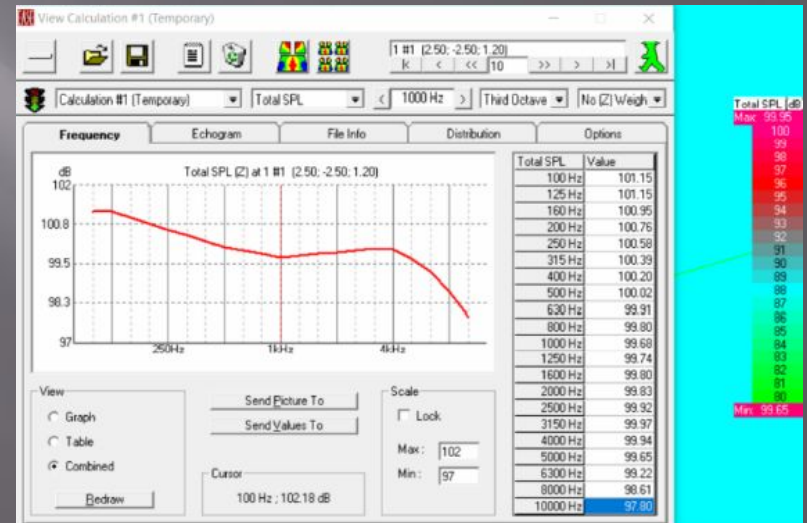


Environmental aspects

EASE Aspect
Art room

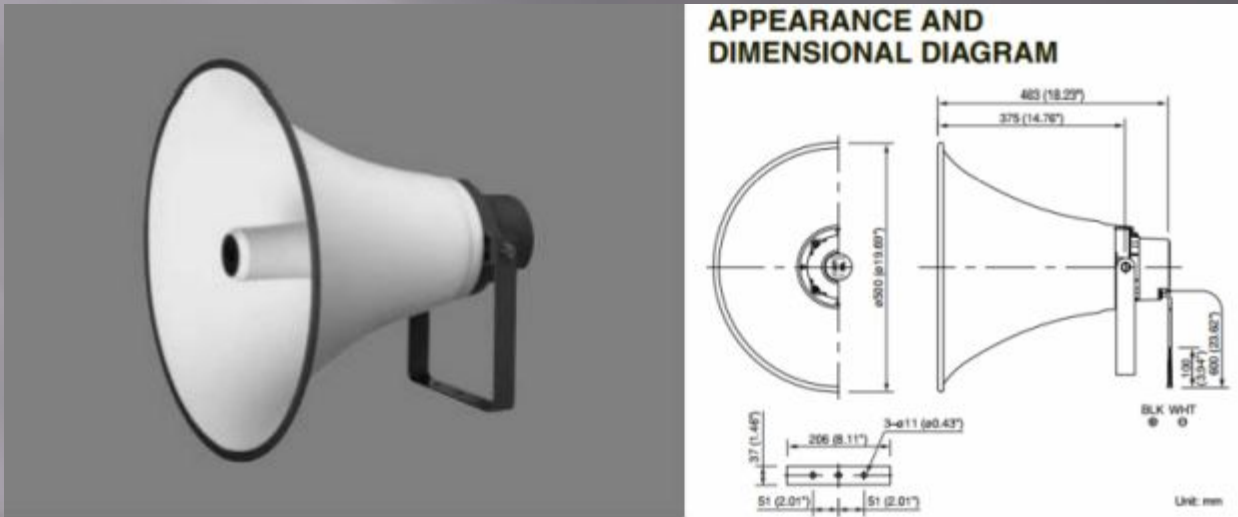
ST
I

Total SPL



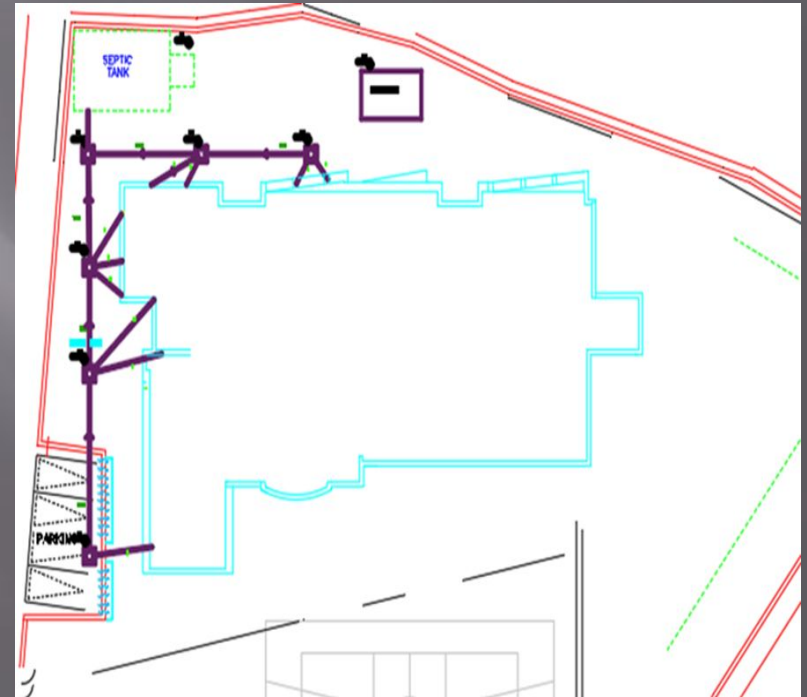
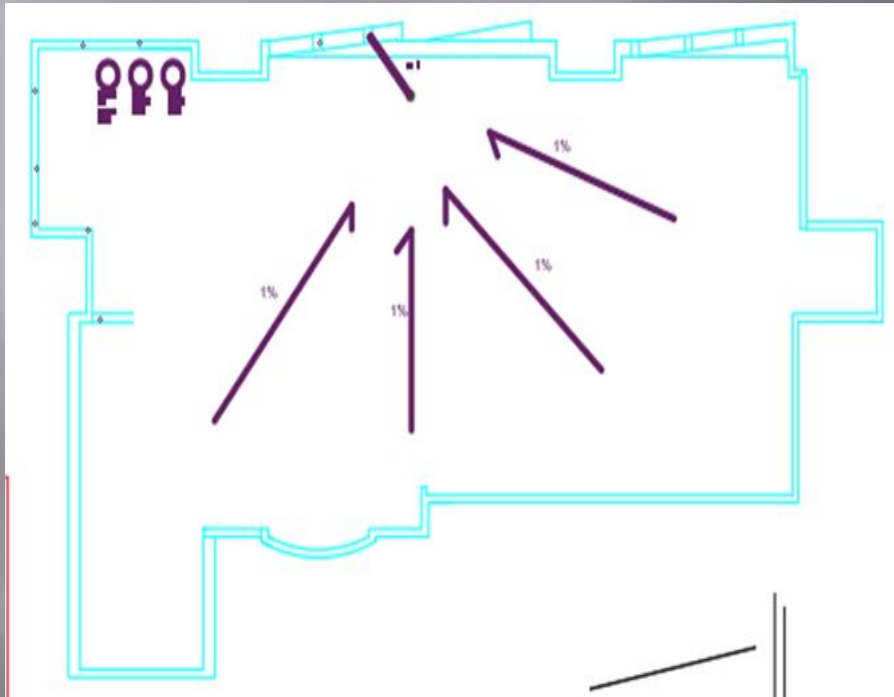
Environmental aspects

Loud
speaker



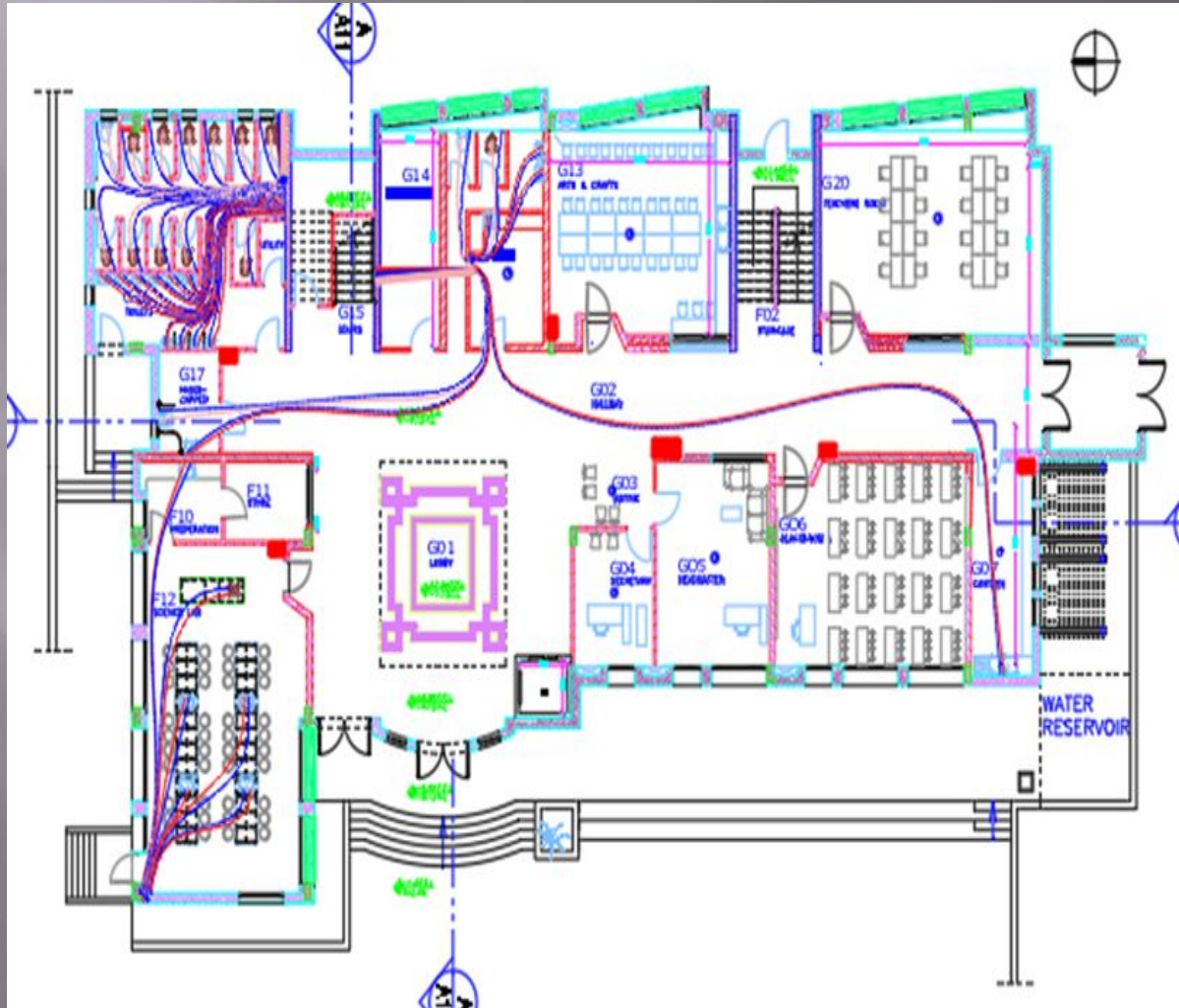
Mechanical aspects

Manhole and roof drainage of school



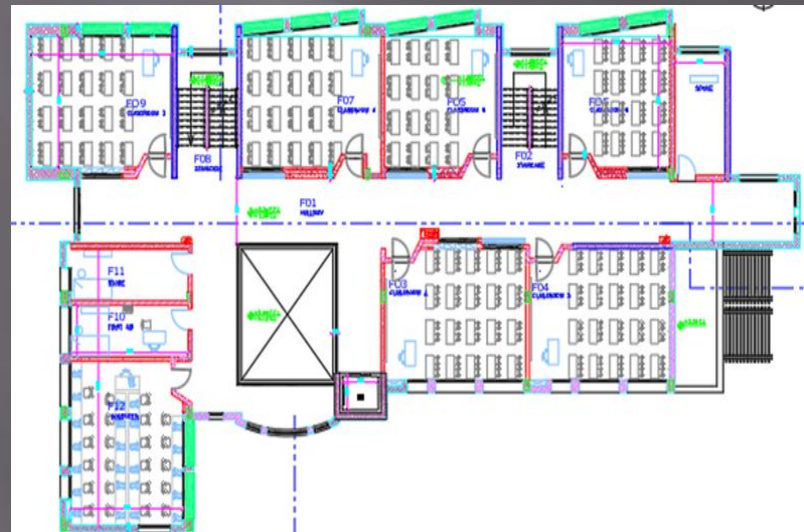
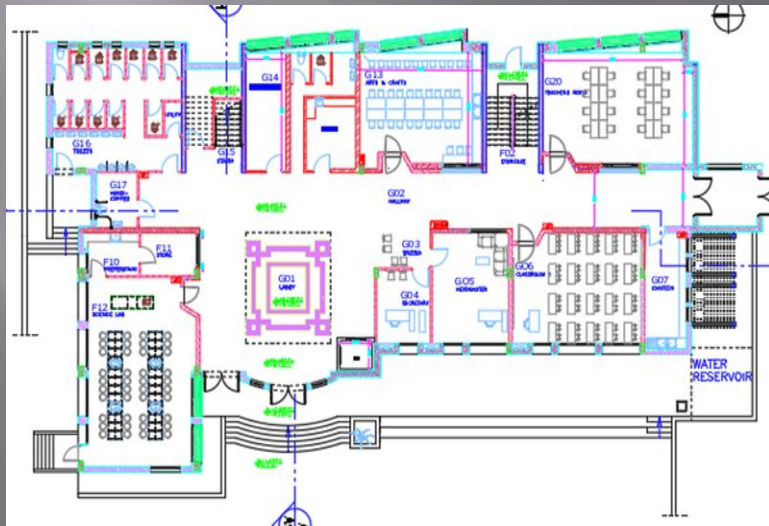
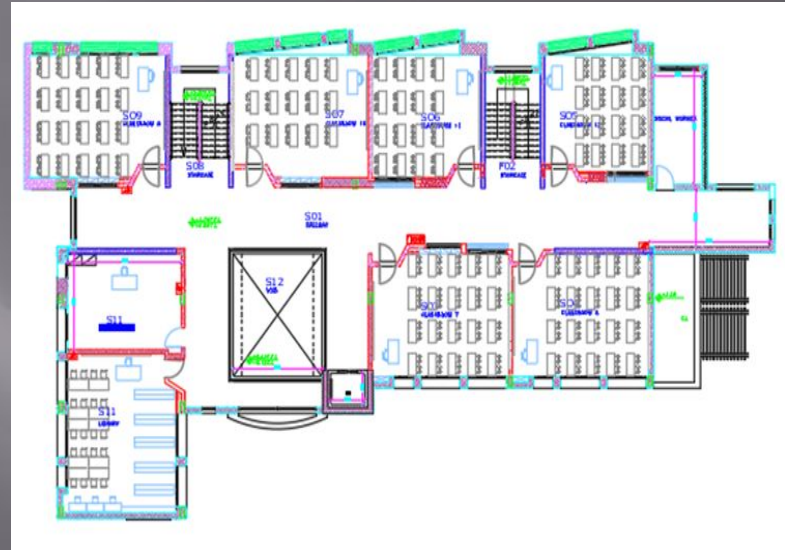
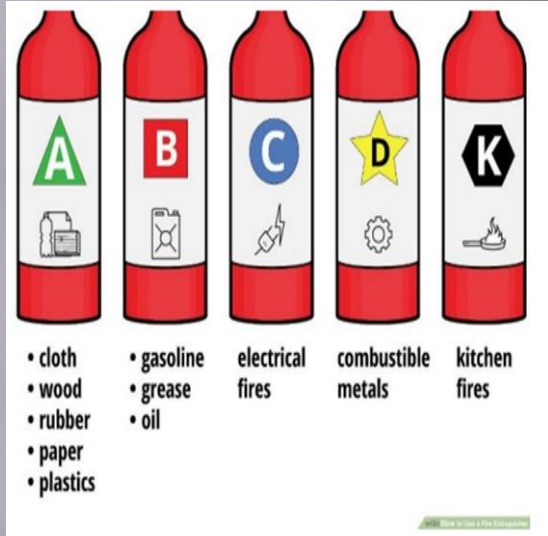
Mechanical aspects

Water supply

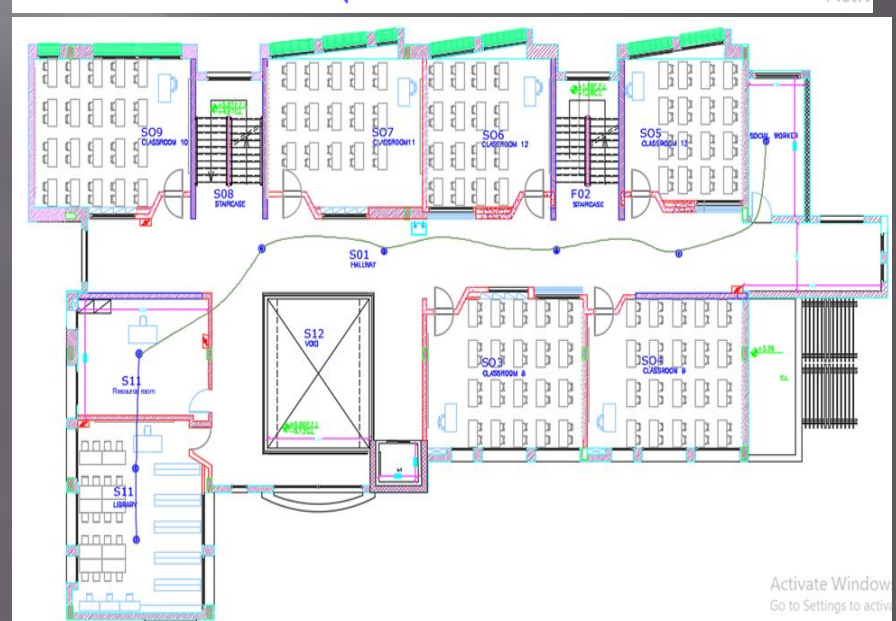
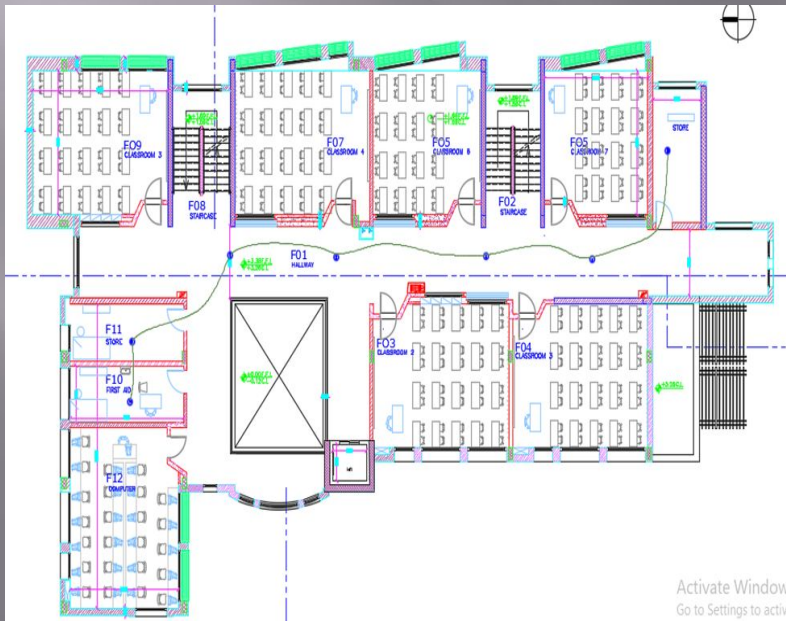
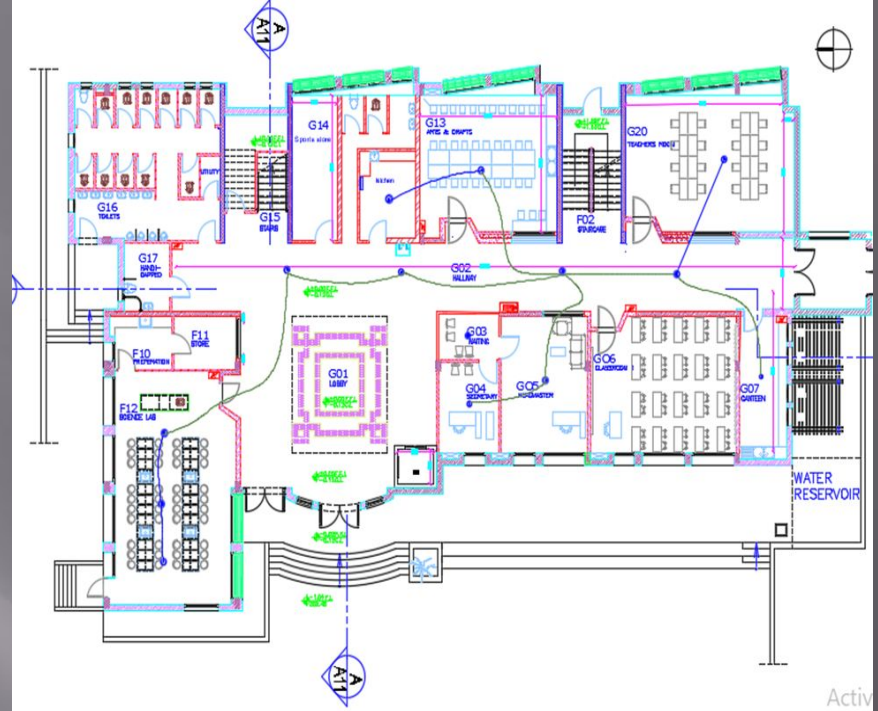


Mechanical aspects

Fire system



Gas detector



Mechanical aspects

Heating load values for each space

Zone	Comfort Temperature (°C) τ	Steady-State Heat Loss (kW)	Design Capacity (kW)	Design Capacity (W/m ²)
Building 1 Total Design Heating Capacity = 96.730 (kW)				
- Block 2 Total Design Heating Capacity = 17.890 (kW)				
art and craft	21.36	1.59	1.98	36.1985
teacher room	21.28	2.37	2.97	49.4701
science lab	20.88	2.68	3.35	45.5513
head room	20.40	1.16	1.45	46.8574
reception	20.04	0.18	0.23	38.2126
classroom	17.93	3.44	4.30	81.4290
kitchen	17.59	1.10	1.38	98.3821
preparation	17.32	0.29	0.37	39.1626
canteen	16.49	1.48	1.86	122.0189
- Block 2 1 Total Design Heating Capacity = 40.910 (kW)				
first aid	21.34	0.92	1.15	57.7035
classroom	21.18	4.09	5.11	111.9285
classroom	21.18	3.75	4.68	112.0406
classroom	21.09	5.43	6.78	112.4605
classroom	21.06	4.67	5.83	113.6532
lab	20.95	3.90	4.88	91.5701
classroom	20.94	5.03	6.29	116.8864
classroom	20.89	4.95	6.19	116.6112
- Block 2 1 1 Total Design Heating Capacity = 35.880 (kW)				
laboratory	20.69	4.60	5.75	107.9357
resource room	19.43	2.42	3.02	75.1157
classroom	17.64	2.87	3.59	85.8223
classroom	17.64	4.13	5.16	85.5107
class room	17.63	3.49	4.37	85.7720
classroom	17.63	3.15	3.93	86.1292
classroom	17.61	3.64	4.54	85.9660
class room	17.49	3.80	4.75	88.2727
social worker	17.27	0.61	0.77	39.2951

Mechanical aspects

MULTI V™ 5

LGRED®
Powerful Heat Technology
SECURE TO EXTREME WEATHER



ARUM***BTE5

4-Way (2'x2')



Specifications	Unit	ARUM168BTE5	ARUM192BTE5	ARUM216BTE5	ARUM241BTE5
Frames		ARUM168BTE5	ARUM192BTE5	ARUM216BTE5	ARUM241BTE5
Tons		14	16	18	20
Nominal Capacity	Cooling	Btu/h 168,000	Btu/h 192,000	Btu/h 216,000	Btu/h 233,100
	Heating	Btu/h 189,000	Btu/h 216,000	Btu/h 243,000	Btu/h 243,000
Rated Capacity¹	Cooling	Btu/h 160,000	Btu/h 184,000	Btu/h 206,000	Btu/h 222,000
	Heating	Btu/h 180,000	Btu/h 206,000	Btu/h 230,000	Btu/h 230,000
Power Voltage	V / Hz / Ø	208-230/60/3	208-230/60/3	208-230/60/3	208-230/60/3
Power/Communication Wiring	No x AWG	2 x 18	2 x 18	2 x 18	2 x 18
Operating Range	Cooling	°F 5 - 122	°F 5 - 122	°F 5 - 122	°F 5 - 122
	Heating	°F -22 - 61	°F -22 - 61	°F -22 - 61	°F -22 - 61
	Simultaneous Operation²	°F 14 - 81	°F 14 - 81	°F 14 - 81	°F 14 - 81
Dimensions (WxHxD)	Body	in 48-13/16x66-17/32x29-29/32	in 48-13/16x66-17/32x29-29/32	in 48-13/16x66-17/32x29-29/32	in 48-13/16x66-17/32x29-29/32
	Net	lbs 639	lbs 659	lbs 666	lbs 666
Weight	Shipping	lbs 666	lbs 688	lbs 694	lbs 694
Sound Pressure³		dB(A) 61.0	dB(A) 62.0	dB(A) 64.0	dB(A) 65.0
Fan (Propeller)	Rated CFM	10,300	10,300	10,300	10,300
	Max. CFM	11,300	11,300	11,300	11,300
Compressor (DC Scroll)	Type	DC Scroll	DC Scroll	DC Scroll	DC Scroll
	Oil Type	PVE/FVC68D	PVE/FVC68D	PVE/FVC68D	PVE/FVC68D
	Quantity	2	2	2	2
Heat Exchanger	Coating	Black Coated Fin™	Black Coated Fin™	Black Coated Fin™	Black Coated Fin™
	Rows/Fins per Inch	3/17	3/17	3/17	3/17
	Liquid Line	in 5/8	in 5/8	in 5/8	in 5/8
Piping	L/P Vapor Line	in 1-1/8	in 1-1/8	in 1-1/8	in 1-3/8
	H/P Vapor Line⁴	in 7/8	in 7/8	in 1-1/8	in 1-1/8
Refrigerant	Type	R410A	R410A	R410A	R410A
	Charge	lbs 26.5	lbs 30.9	lbs 37.5	lbs 37.5
	Control	EEV	EEV	EEV	EEV

INDOOR UNIT Lineup

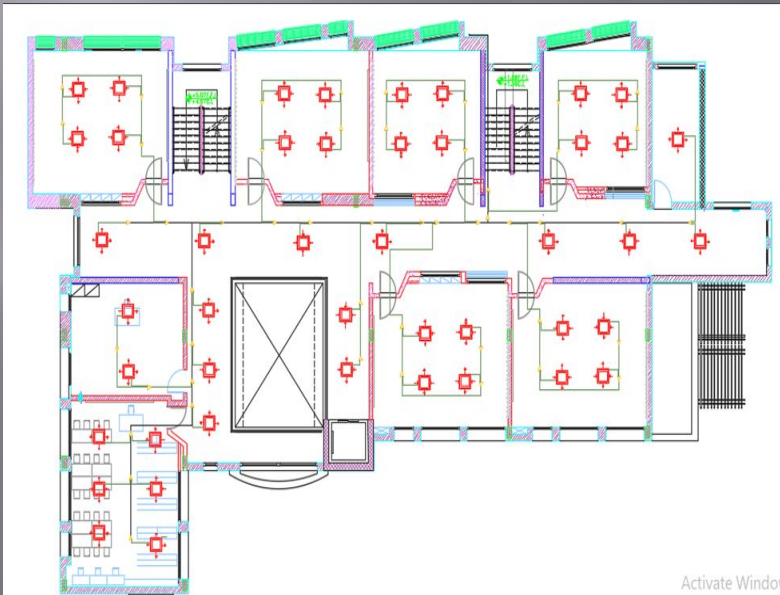
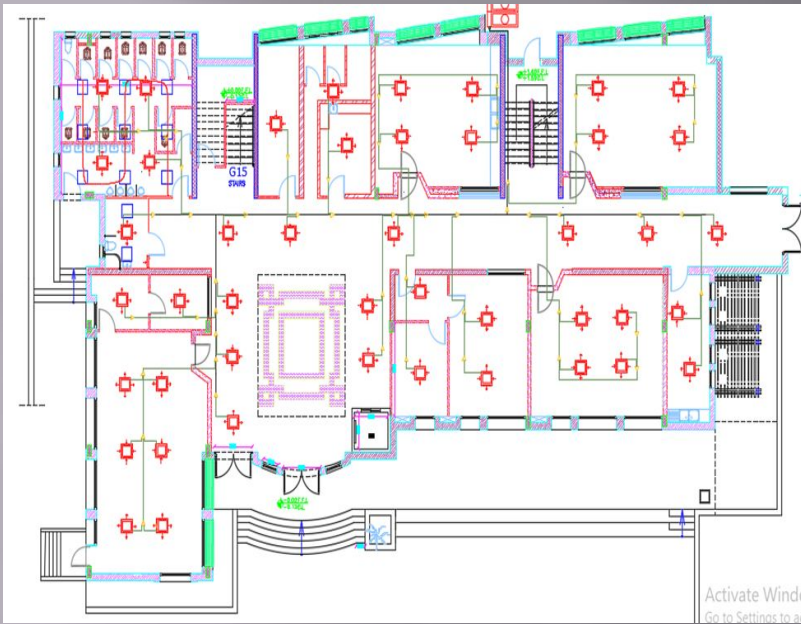
LG indoor units offer a wide range of styles and features to fit all of your cooling and heating needs. With casettes that mount flush to the ceiling, ducted units that are completely concealed in the ceiling, and LG's award-winning Art Cool Gallery and mirror-finish, wall-mounted units that fit into any décor, the Multi V system offers unparalleled aesthetics design and indoor units to fit into multiple applications.

Unit: Btu/h

Chassis		5	7	9	12	15	18	24	28	30	36	42	48	54	76	96
Art Cool™	Gallery															
	Mirror															
Standard	Wall Mounted															
Ceiling Cassette	1-Way															
	2-Way															
	4-Way (2'x2')															
	4-Way (3'x3')															
Ceiling Suspended	Ceiling Mounted															
Ceiling Concealed Duct	Low Static															
	Mid Static															
	High Static															
Vertical AHU	Vertical Horizontal															
Floor Standing	800W Cool															
	800W Heat															

Mechanical aspects

H-VAC diffuser distribution



Photovoltaic system



Trina Solar

TSM-245DC05

Item number: 2108655

Manufacturer:	Trinasolar
Cell type:	monocrystalline
Number of cells:	60
Cell dimension (m m/inches):	156 x 156 (6+)
Connection type:	MC type 4
Frame color:	silver
Foil color:	white

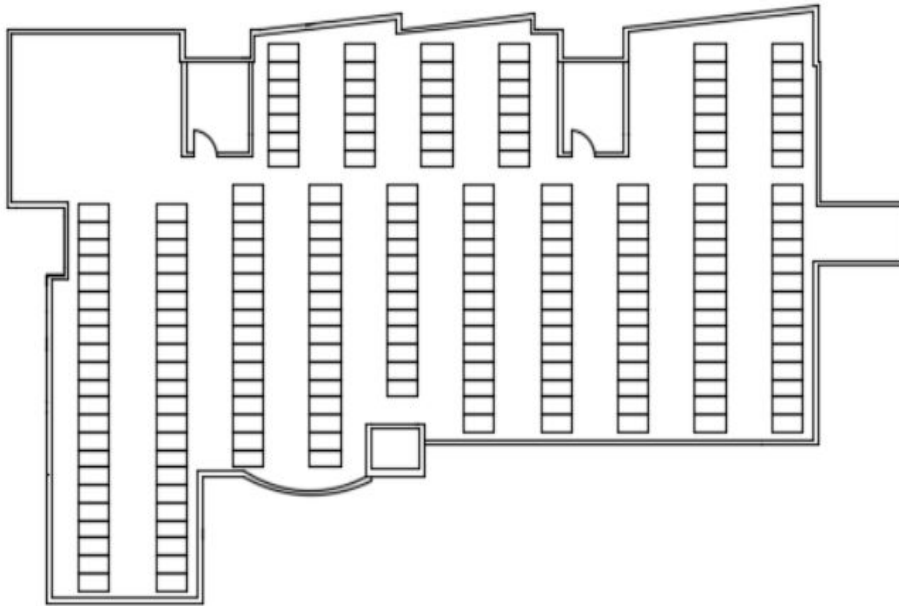
Electrical Data STC

Maximum power (wp):	245	Max. system voltage IEC (V):	1000
Short circuit current (A):	8.52	Max. system voltage UL (V):	0
Short circuit current (initial value) (A):	0	Max. system current (A):	0
Open circuit voltage (V):	37.3	Voltage at MPP (V):	30.7
Open circuit voltage (initial value) (V):	0	Current at MPP (A):	7.98
Nominal power (initial value) (Wp):	0	Temp. coefficient nominal power (%/K):	-0.45
Max. reverse current (A):	0		

Mechanical Data & Design

Length (mm):	1650
Width (mm):	992
Height (mm):	46
weight (kg):	19.5
Bypass diodes:	yes
Depth incl. backrails/ connection box (mm):	0
Cable length + (mm):	390
Cable length - (mm):	390
Max. pressure load (kN/m²):	0
Max. pull-off load (kN/m²):	0
Modular construction:	glass-foil

Photovoltaic system



282 module
69.1 kwp
tilted port

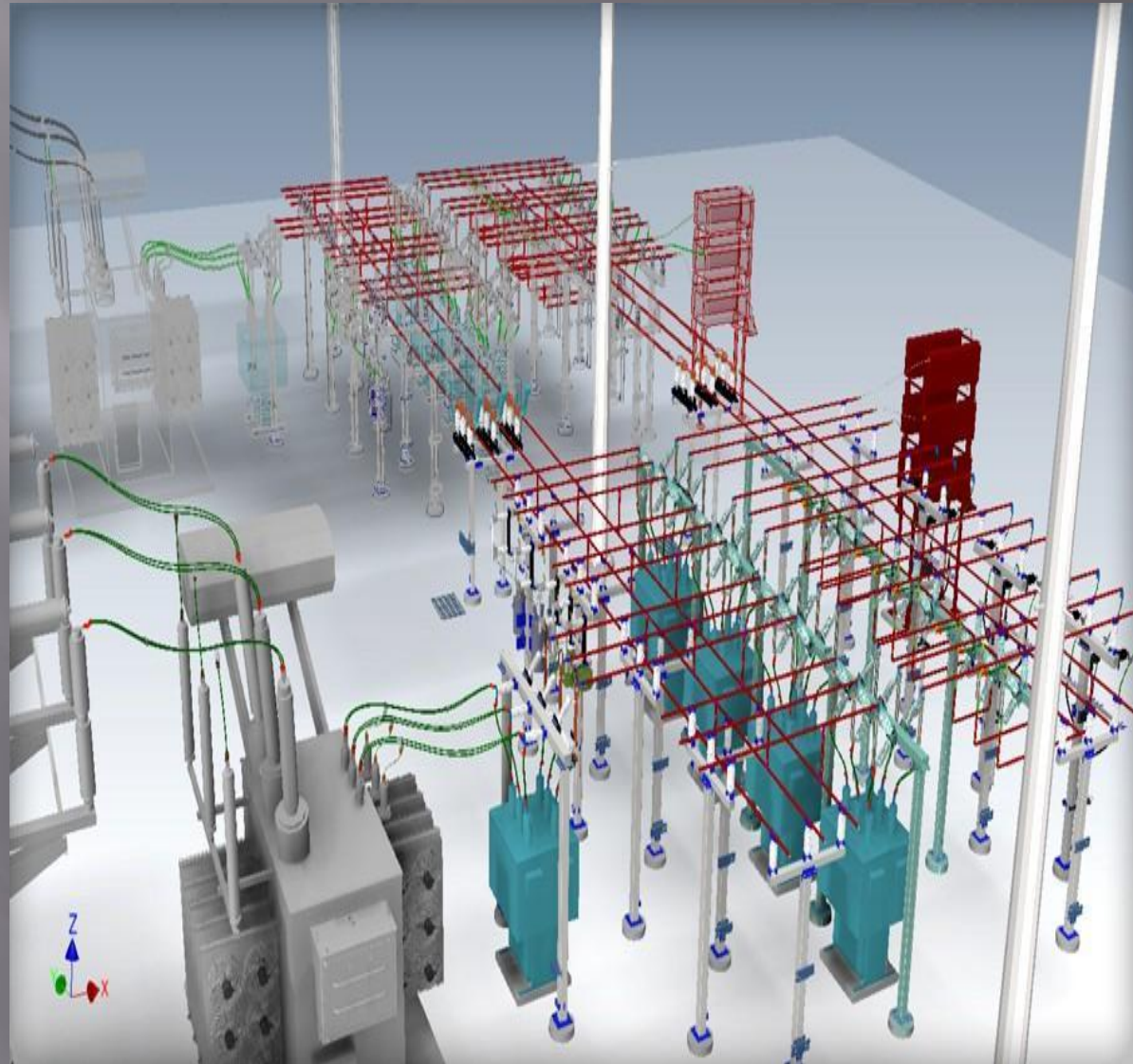


Electrical Design

Lighting design

Socket distribution

Lighting and
socket
calculations



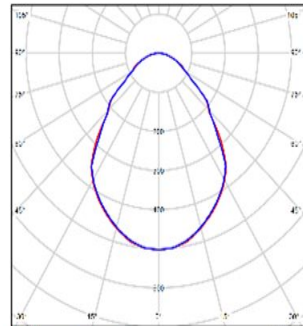
Lighting used in Sarta building

Product data sheet

3FFILIPPI L 322x18W LED LGS 296x1196



Article No.	21600
P	40.0 W
Φ_{Lamp}	4102 lm
$\Phi_{Luminaire}$	4102 lm
η	100.00 %
Luminous efficacy	102.6 lm/W
CCT	4000 K
CRI	82



Polar LDC

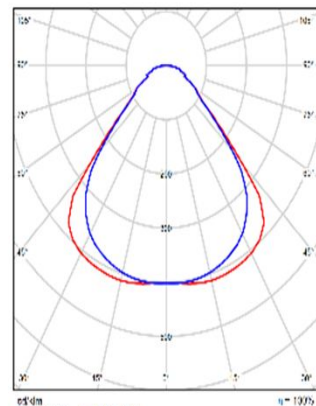
Luminaire layout plan



Manufacturer	ENDO	P	10.6 W
Article No.	ERD7308W_RX408N	$\Phi_{Luminaire}$	998 lm
Article name	Adjustable Downlight		
Fitting	1x 1200TYPE_LED_3000 K_Ra85_SuperWide		



P	32.5 W
Φ_{Lamp}	3600 lm
$\Phi_{Luminaire}$	3598 lm
η	99.96 %
Luminous efficacy	110.7 lm/W
CCT	3000 K
CRI	100



Polar LDC

Luminaire layout plan



Manufacturer	SIMES	P	75.0 W
Article No.	S.3931 + S.3911	$\Phi_{Luminaire}$	454 lm
Article name	MINISLOT WALL		
Fitting	1x QPAR 30 75W E27 30°		

Lighting system

Dialux program was used to design the lighting system in project

Classroom



Head master room



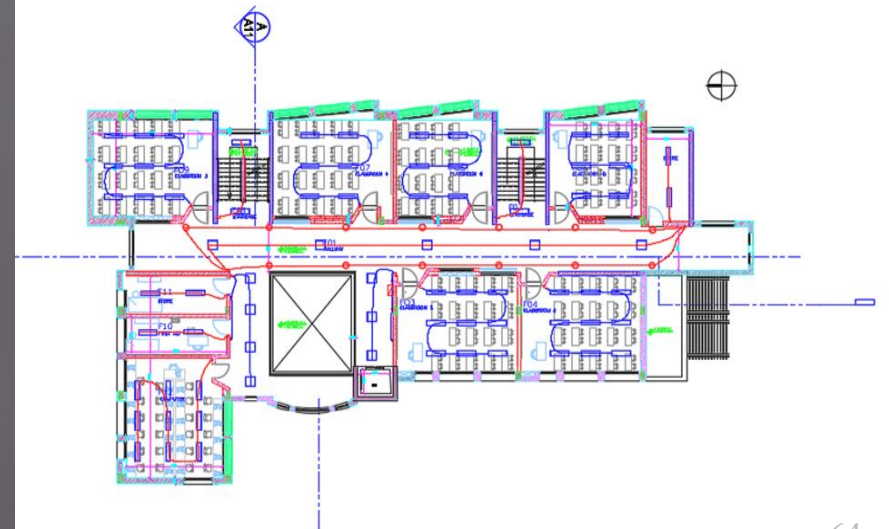
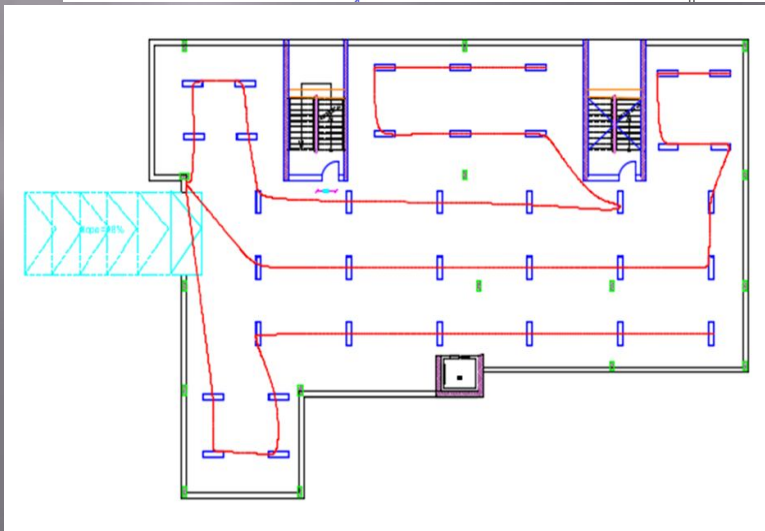
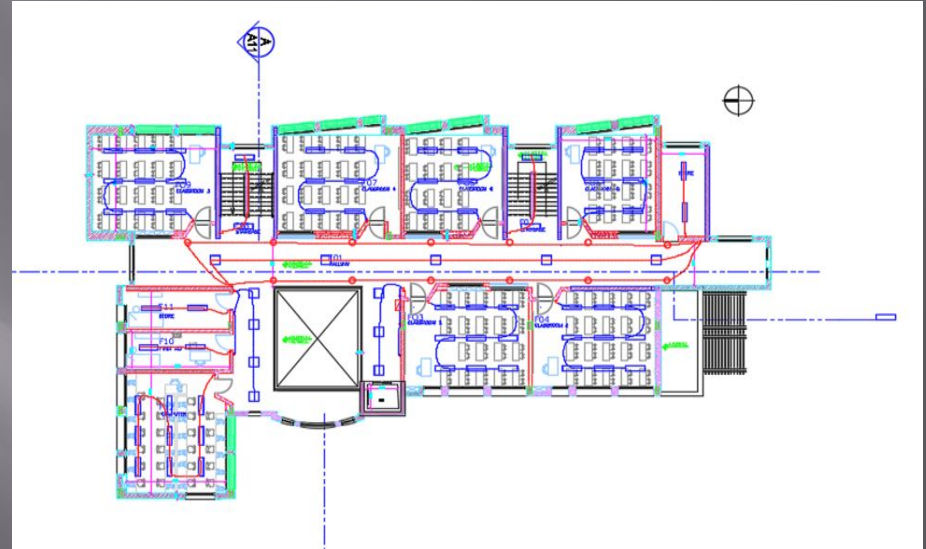
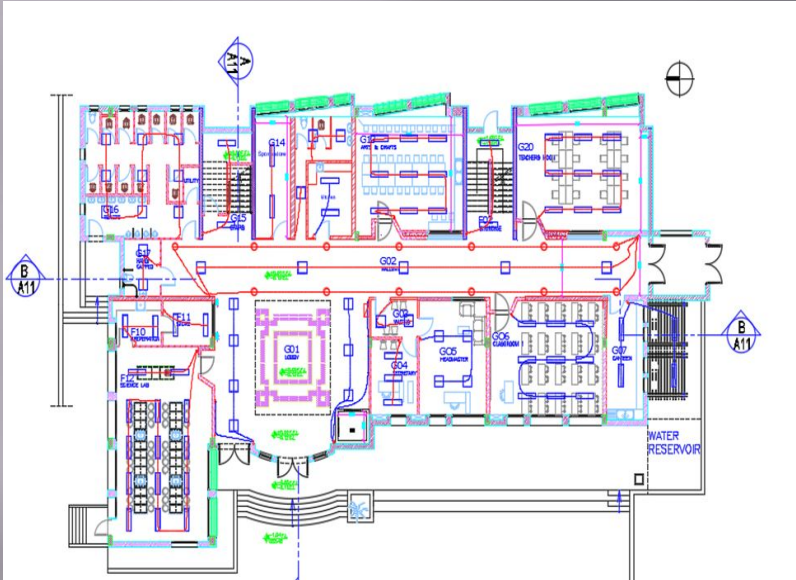
Electrical design

space name	area	num of luminaires	luminaire name	luminous flux	load
unit	M.S	/	/	lum	watt
classroom	49.18	9	Philips rc 402	32400	292.5
entrance	81	9	Thorlux xl-20	35280	261
headmaster room	30	4	Thorlux xl-20	15680	261
canteen	16.4	6	Thorlux xl-20	23520	261
kitchen	16	2	Philips rc 402	7200	65
W.c	54	13	Thorlux xl-20	50960	348
corridor	90	5 and 14	Thorlux xl-20 +Endo lighint	33572	293.4
storage	14	2	Philips rc 402	7200	65
teacher room	57.93	10	Philips rc 402	36000	325
waiting area	6	2	Thorlux xl-20	7840	58
secertary	13	2	Philips rc 402	7200	65
stairs	28.446	2	Philips rc 402	3600	32.5
lab	70.6	14	3f filippe l322	57428	560
art room	99	9	3f filippe l322	36918	360
preperation	6	2	Philips rc 402	8204	65

space name	area	num of luminaires	luminaire name	luminous flux	load
unit	M.S	/	/	lum	watt
classroom	237.35	60	Philips rc 402	216000	1950
library	51.3	13	Thorlux xl-20 and Philips rc 402	49360	355
resource room	33	4	Philips rc 402	14400	130
corridor	90	5 and 14	Thorlux xl-20 +Endo lighint	33572	293.4
entrance	81	9	Thorlux xl-20	35280	261
stairs	28.446	2	Philips rc 402	3600	65
social worker	16.5	2	Philips rc 403	3600	65

space name	area	num of luminaires	luminaire name	luminous flux	load
unit	M.S	/	/	lum	watt
classroom	237.35	60	Philips rc 402	216000	1950
library	51.3	13	Thorlux xl-20 and Philips rc 402	49360	355
resource room	33	4	Philips rc 402	14400	130
corridor	90	5 and 14	Thorlux xl-20 +Endo lighint	33572	293.4
entrance	81	9	Thorlux xl-20	35280	261
stairs	28.446	2	Philips rc 402	3600	65
social worker	16.5	2	Philips rc 403	3600	65

Lighting distribution in Sarta School



Electrical design

Calculation for voltage drop not exceed 5%

Cross section area of cable 1.5 mm²

lighting for ground floor													
space name	volt	length	Roh Ω	R wire	power	Vdrop	% Vdrop	I Load	I cb	I cable	cross section	circuit breaker	Df
unit	volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm ²	amp	
classroom	220	10	1.77E-08	0.118	390	0.232	0.106	1.970	2.265	2.605	1.50E-06	10	0.9
enterance	220	8	1.77E-08	0.094	261	0.124	0.057	1.318	1.516	1.743	1.50E-06	10	0.9
headmaster room	220	4	1.77E-08	0.047	261	0.062	0.028	1.318	1.516	1.743	1.50E-06	10	0.9
canteen	220	18	1.77E-08	0.212	261	0.280	0.127	1.318	1.516	1.743	1.50E-06	10	0.9
kitchen	220	6	1.77E-08	0.071	65	0.023	0.011	0.328	0.378	0.434	1.50E-06	10	0.9
W.c	220	13.6	1.77E-08	0.160	348	0.282	0.128	1.758	2.021	2.324	1.50E-06	10	0.9
corridor	220	19.7	1.77E-08	0.232	293.4	0.344	0.157	1.482	1.704	1.960	1.50E-06	10	0.9
storage 1 and 2	220	13	1.77E-08	0.153	65	0.050	0.023	0.328	0.378	0.434	1.50E-06	10	0.9
teacher room	220	13	1.77E-08	0.153	325	0.252	0.114	1.641	1.888	2.171	1.50E-06	10	0.9
waiting area	220	2	1.77E-08	0.024	58	0.007	0.003	0.293	0.337	0.387	1.50E-06	10	0.9
secetary	220	3	1.77E-08	0.035	97.5	0.017	0.008	0.492	0.566	0.651	1.50E-06	10	0.9
stairs	220	12	1.77E-08	0.142	65	0.046	0.021	0.328	0.378	0.434	1.50E-06	10	0.9
stairs 2	220	9	1.77E-08	0.106	65	0.035	0.016	0.328	0.378	0.434	1.50E-06	10	0.9
lab	220	12	1.77E-08	0.142	560	0.400	0.182	2.828	3.253	3.740	1.50E-06	10	0.9
art room	220	6	1.77E-08	0.071	360	0.129	0.059	1.818	2.091	2.405	1.50E-06	10	0.9
preperation	220	15	1.77E-08	0.177	65	0.058	0.026	0.328	0.378	0.434	1.50E-06	10	0.9

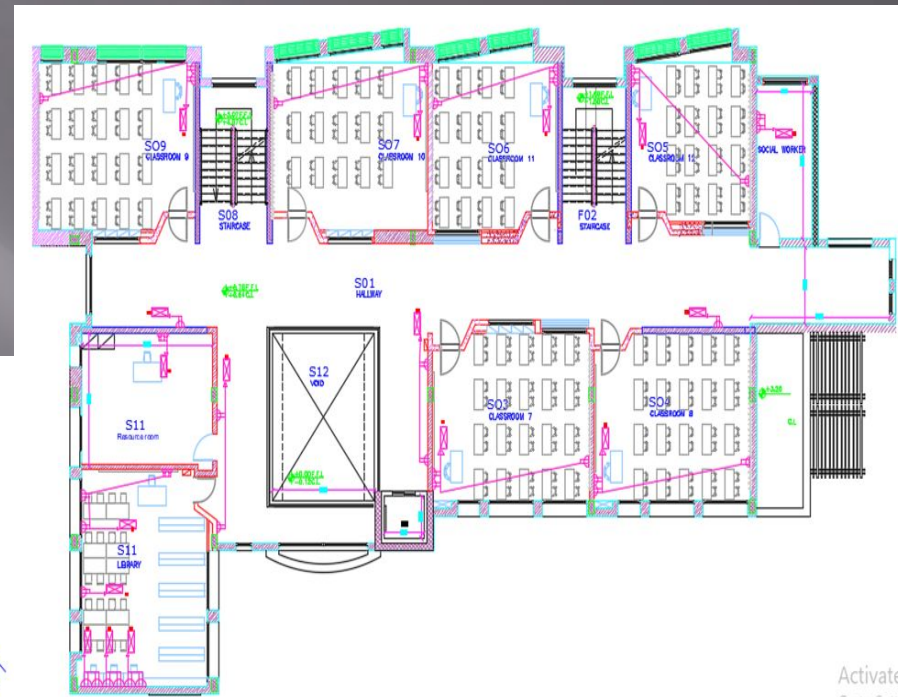
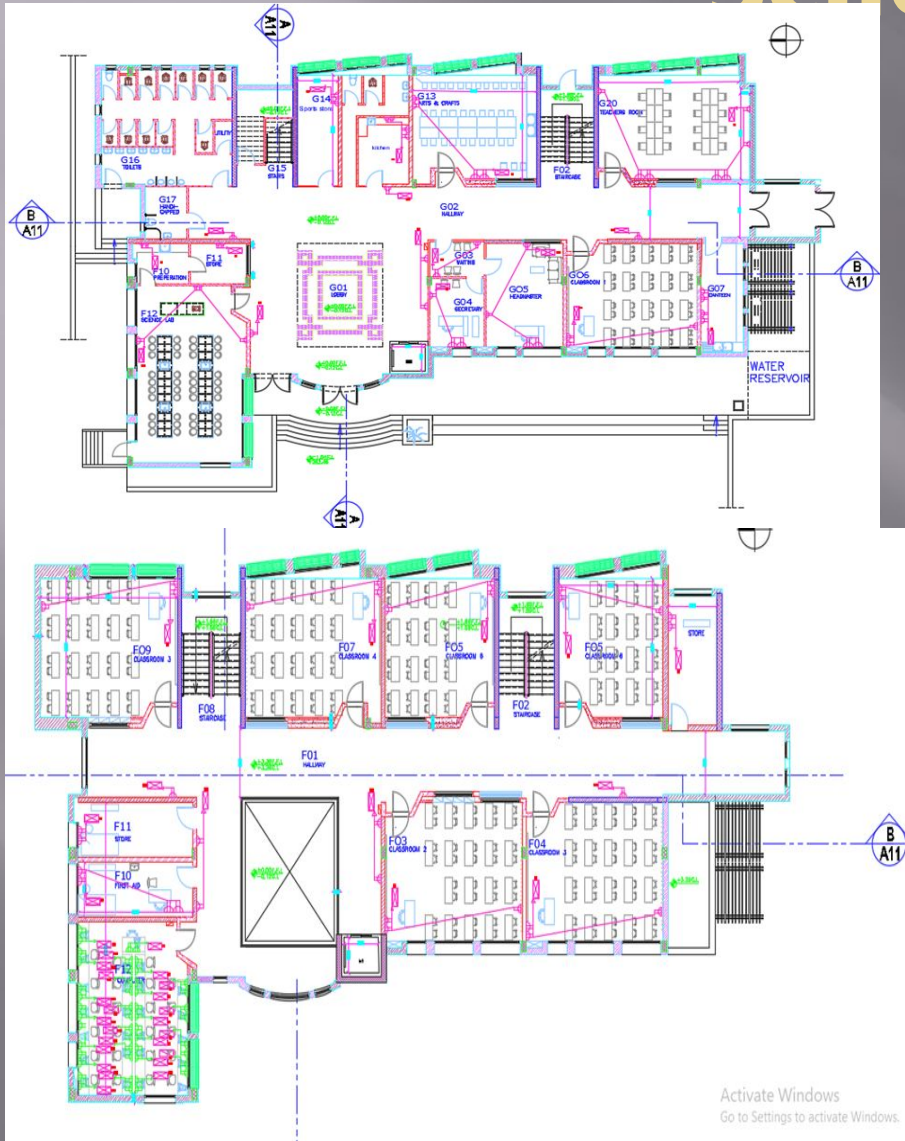
Electrical design

lighting for first floor													
space name	volt	length	Roh Ω	Rwire Ω	power watt	Vdrop volt	% Vdrop /	I Load amp	I cb amp	I cable amp	cross section mm ²	circuit breaker amp	Df
unit	volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm ²	amp	
classroom	220	10.2	1.77E-08	0.120	390	0.237	0.108	1.970	2.265	2.605	1.50E-06	10	0.9
classroom 2	220	2	1.77E-08	0.024	390	0.046	0.021	1.970	2.265	2.605	1.50E-06	10	0.9
classroom 3	220	13.5	1.77E-08	0.159	390	0.314	0.143	1.970	2.265	2.605	1.50E-06	10	0.9
classroom 4	220	8	1.77E-08	0.094	390	0.186	0.085	1.970	2.265	2.605	1.50E-06	10	0.9
classroom 5	220	6.3	1.77E-08	0.074	390	0.146	0.067	1.970	2.265	2.605	1.50E-06	10	0.9
classroom 6	220	14.5	1.77E-08	0.171	390	0.337	0.153	1.970	2.265	2.605	1.50E-06	10	0.9
lobby	220	2	1.77E-08	0.024	261	0.031	0.014	1.318	1.516	1.743	1.50E-06	10	0.9
computer room	220	5	1.77E-08	0.059	348	0.104	0.047	1.758	2.021	2.324	1.50E-06	10	0.9
first aid	220	11	1.77E-08	0.130	97.5	0.064	0.029	0.492	0.566	0.651	1.50E-06	10	0.9
corridor	220	19	1.77E-08	0.224	293.4	0.332	0.151	1.482	1.704	1.960	1.50E-06	10	0.9
storage 1	220	19	1.77E-08	0.224	65	0.074	0.033	0.328	0.378	0.434	1.50E-06	10	0.9
storage 2	220	11	1.77E-08	0.130	66	0.043	0.020	0.333	0.383	0.441	1.50E-06	10	0.9
stairs	220	12	1.77E-08	0.142	130	0.093	0.042	0.657	0.755	0.868	1.50E-06	10	0.9
stairs 2	220	9	1.77E-08	0.106	130	0.070	0.032	0.657	0.755	0.868	1.50E-06	10	0.9

Electrical design

lighting for second floor													
space name	volt	length	Roh Ω	R wire Ω	power watt	Vdrop volt	% Vdrop /	I Load amp	I cb amp	I cable amp	cross section mm ²	circuit breaker amp	Df
unit	volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm ²	amp	
classroom	220	10.2	1.77E-08	0.120	390	0.237	0.108	1.970	2.265	2.605	1.50E-06	10	0.9
classroom	220	2	1.77E-08	0.024	391	0.047	0.021	1.975	2.271	2.612	1.50E-06	10	0.9
classroom	220	14	1.77E-08	0.165	392	0.327	0.149	1.980	2.277	2.618	1.50E-06	10	0.9
classroom	220	8	1.77E-08	0.094	393	0.187	0.085	1.985	2.283	2.625	1.50E-06	10	0.9
classroom	220	7	1.77E-08	0.083	394	0.164	0.075	1.990	2.288	2.632	1.50E-06	10	0.9
classroom	220	15	1.77E-08	0.177	395	0.353	0.161	1.995	2.294	2.638	1.50E-06	10	0.9
lobby	220	2	1.77E-08	0.024	261	0.031	0.014	1.318	1.516	1.743	1.50E-06	10	0.9
library	220	13	1.77E-08	0.153	355	0.275	0.125	1.793	2.062	2.371	1.50E-06	10	0.9
resource room	220	11	1.77E-08	0.130	130	0.085	0.039	0.657	0.755	0.868	1.50E-06	10	0.9
corridor	220	20	1.77E-08	0.236	293.4	0.350	0.159	1.482	1.704	1.960	1.50E-06	10	0.9
stairs	220	12	1.77E-08	0.142	130	0.093	0.042	0.657	0.755	0.868	1.50E-06	10	0.9
stairs 2	220	9	1.77E-08	0.106	131	0.070	0.032	0.662	0.761	0.875	1.50E-06	10	0.9
social worker	220	19.7	1.77E-08	0.232	130	0.153	0.069	0.657	0.755	0.868	1.50E-06	10	0.9

Socket distribution in Sarta School



Electrical design

Calculation for drop voltage not exceed 5%
Cross section area of cable 2.5 mm²

name distribution board	ground floor													
	unit	num of sockets	volt	length	RohΩ	Rwire	power*0.3	Vdrop	%Vdrop	I Load	I cb	I cable	cross section	Df
			volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm ²	
DBG	p1	4	220	17.6	1.77E-08	1.25E-01	300	0.170	0.077	1.364	1.568	1.803	2.50E-06	0.3
	p2	3	220	9.9	1.77E-08	7.01E-02	225	0.072	0.033	1.023	1.176	1.353	2.50E-06	0.3
	p3	4	220	20.3	1.77E-08	1.44E-01	300	0.196	0.089	1.364	1.568	1.803	2.50E-06	0.3
	p4	4	220	6.5	1.77E-08	4.60E-02	300	0.063	0.029	1.364	1.568	1.803	2.50E-06	0.3
	p5	2	220	6.2	1.77E-08	4.39E-02	150	0.030	0.014	0.682	0.784	0.902	2.50E-06	0.3
	p6	2	220	11.16	1.77E-08	7.90E-02	150	0.054	0.024	0.682	0.784	0.902	2.50E-06	0.3
	p7	2	220	11.7	1.77E-08	8.28E-02	150	0.056	0.026	0.682	0.784	0.902	2.50E-06	0.3
	p8	3	220	16.2	1.77E-08	1.15E-01	225	0.117	0.053	1.023	1.176	1.353	2.50E-06	0.3
	p9	4	220	2.5	1.77E-08	1.77E-02	300	0.024	0.011	1.364	1.568	1.803	2.50E-06	0.3
	p10	4	220	17.8	1.77E-08	1.26E-01	300	0.172	0.078	1.364	1.568	1.803	2.50E-06	0.3
	p11	1	220	7	1.77E-08	4.96E-02	75	0.017	0.008	0.341	0.392	0.451	2.50E-06	0.3
	p12	1	220	12.3	1.77E-08	8.71E-02	75	0.030	0.013	0.341	0.392	0.451	2.50E-06	0.3
	p13	2	220	0.4	1.77E-08	2.83E-03	150	0.002	0.001	0.682	0.784	0.902	2.50E-06	0.3
	p14	1	220	12.1	1.77E-08	8.57E-02	75	0.029	0.013	0.341	0.392	0.451	2.50E-06	0.3
	p15	1	220	2	1.77E-08	1.42E-02	75	0.005	0.002	0.341	0.392	0.451	2.50E-06	0.3
	p16	1	220	3.5	1.77E-08	2.48E-02	75	0.008	0.004	0.341	0.392	0.451	2.50E-06	0.3
	p17	2	220	10.88	1.77E-08	7.70E-02	150	0.053	0.024	0.682	0.784	0.902	2.50E-06	0.3

name distribution board	first floor													
	unit	num of sockets	volt	length	RohΩ	Rwire	power*0.3	Vdrop	%Vdrop	I Load	I cb	I cable	cross section	Df
			volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm ²	
DBF	p1	2	220	18.6	1.77E-08	1.32E-01	150	0.090	0.041	0.682	0.784	0.902	2.50E-06	0.3
	p2	3	220	13.5	1.77E-08	9.56E-02	225	0.098	0.044	1.023	1.176	1.353	2.50E-06	0.3
	p3	3	220	10.8	1.77E-08	7.65E-02	225	0.078	0.036	1.023	1.176	1.353	2.50E-06	0.3
	p4	3	220	8.6	1.77E-08	6.09E-02	225	0.062	0.028	1.023	1.176	1.353	2.50E-06	0.3
	p5	3	220	14.7	1.77E-08	1.04E-01	225	0.106	0.048	1.023	1.176	1.353	2.50E-06	0.3
	p6	3	220	16.8	1.77E-08	1.19E-01	225	0.122	0.055	1.023	1.176	1.353	2.50E-06	0.3
	p7	2	220	16.8	1.77E-08	1.19E-01	150	0.081	0.037	0.682	0.784	0.902	2.50E-06	0.3
	p8	4	220	17.2	1.77E-08	1.22E-01	300	0.166	0.075	1.364	1.568	1.803	2.50E-06	0.3
	p9	1	220	12.3	1.77E-08	8.71E-02	75	0.030	0.013	0.341	0.392	0.451	2.50E-06	0.3
	p10	2	220	10.3	1.77E-08	7.29E-02	150	0.050	0.023	0.682	0.784	0.902	2.50E-06	0.3
	p11	2	220	0.4	1.77E-08	2.83E-03	150	0.002	0.001	0.682	0.784	0.902	2.50E-06	0.3
	p12	1	220	13.6	1.77E-08	9.63E-02	75	0.033	0.015	0.341	0.392	0.451	2.50E-06	0.3
	p13	3	220	9.9	1.77E-08	7.01E-02	225	0.072	0.033	1.023	1.176	1.353	2.50E-06	0.3

Electrical design

name distribution board	first floor													
	unit	num of sockets	volt	length	RohΩ	R wire Ω	power*0.3 watt	Vdrop volt	% Vdrop /	I Load amp	I cb amp	I cable amp	cross section mm^2	Df
DBC			volt	m	Ω	Ω								
	p1	2	220	1	1.77E-08	7.08E-03	150	0.005	0.002	0.682	0.784	0.902	2.50E-06	0.3
	p2	2	220	2	1.77E-08	1.42E-02	150	0.010	0.004	0.682	0.784	0.902	2.50E-06	0.3
	p3	2	220	3	1.77E-08	2.12E-02	150	0.014	0.007	0.682	0.784	0.902	2.50E-06	0.3
	p4	2	220	4	1.77E-08	2.83E-02	150	0.019	0.009	0.682	0.784	0.902	2.50E-06	0.3
	p5	2	220	5	1.77E-08	3.54E-02	150	0.024	0.011	0.682	0.784	0.902	2.50E-06	0.3
	p6	2	220	6	1.77E-08	4.25E-02	150	0.029	0.013	0.682	0.784	0.902	2.50E-06	0.3
	p7	2	220	7	1.77E-08	4.96E-02	150	0.034	0.015	0.682	0.784	0.902	2.50E-06	0.3
	p8	2	220	2.5	1.77E-08	1.77E-02	150	0.012	0.005	0.682	0.784	0.902	2.50E-06	0.3
	p9	2	220	3.25	1.77E-08	2.30E-02	150	0.016	0.007	0.682	0.784	0.902	2.50E-06	0.3
	p10	2	220	3.5	1.77E-08	2.48E-02	150	0.017	0.008	0.682	0.784	0.902	2.50E-06	0.3
	p11	2	220	4	1.77E-08	2.83E-02	150	0.019	0.009	0.682	0.784	0.902	2.50E-06	0.3
	p12	2	220	5	1.77E-08	3.54E-02	150	0.024	0.011	0.682	0.784	0.902	2.50E-06	0.3
	p13	2	220	5.25	1.77E-08	3.72E-02	150	0.025	0.012	0.682	0.784	0.902	2.50E-06	0.3
	p14	2	220	5.8	1.77E-08	4.11E-02	150	0.028	0.013	0.682	0.784	0.902	2.50E-06	0.3
	p15	2	220	5.5	1.77E-08	3.89E-02	150	0.027	0.012	0.682	0.784	0.902	2.50E-06	0.3
	p16	2	220	6.2	1.77E-08	4.39E-02	150	0.030	0.014	0.682	0.784	0.902	2.50E-06	0.3
	p17	2	220	7	1.77E-08	4.96E-02	150	0.034	0.015	0.682	0.784	0.902	2.50E-06	0.3
	p18	2	220	7.5	1.77E-08	5.31E-02	150	0.036	0.016	0.682	0.784	0.902	2.50E-06	0.3
	p19	2	220	7.5	1.77E-08	5.31E-02	150	0.036	0.016	0.682	0.784	0.902	2.50E-06	0.3
	p20	2	220	8.3	1.77E-08	5.88E-02	150	0.040	0.018	0.682	0.784	0.902	2.50E-06	0.3
	p21	2	220	7.2	1.77E-08	5.10E-02	150	0.035	0.016	0.682	0.784	0.902	2.50E-06	0.3
	p22	2	220	5.5	1.77E-08	3.89E-02	150	0.027	0.012	0.682	0.784	0.902	2.50E-06	0.3
	p23	2	220	4.5	1.77E-08	3.19E-02	150	0.022	0.010	0.682	0.784	0.902	2.50E-06	0.3
p24	2	220	3.5	1.77E-08	2.48E-02	150	0.017	0.008	0.682	0.784	0.902	2.50E-06	0.3	

name distribution board	second floor													
	unit	num of sockets	volt	length	RohΩ	Rwire	power*0.3	Vdrop	% Vdrop	I Load	I cb	I cable	cross section	Df
			volt	m	Ω	Ω	watt	volt	/	amp	amp	amp	mm²	
DBS	p1	3	220	9.7	1.77E-08	6.87E-02	225	0.070	0.032	1.023	1.176	1.353	2.50E-06	0.3
	p2	3	220	5.78	1.77E-08	4.09E-02	225	0.042	0.019	1.023	1.176	1.353	2.50E-06	0.3
	p3	2	220	19.8	1.77E-08	1.40E-01	150	0.096	0.043	0.682	0.784	0.902	2.50E-06	0.3
	p4	3	220	13.8	1.77E-08	9.77E-02	225	0.100	0.045	1.023	1.176	1.353	2.50E-06	0.3
	p5	3	220	11	1.77E-08	7.79E-02	225	0.080	0.036	1.023	1.176	1.353	2.50E-06	0.3
	p6	3	220	8.7	1.77E-08	6.16E-02	225	0.063	0.029	1.023	1.176	1.353	2.50E-06	0.3
	p7	3	220	15	1.77E-08	1.06E-01	225	0.109	0.049	1.023	1.176	1.353	2.50E-06	0.3
	p8	2	220	13	1.77E-08	9.20E-02	150	0.063	0.029	0.682	0.784	0.902	2.50E-06	0.3
	p9	2	220	10	1.77E-08	7.08E-02	150	0.048	0.022	0.682	0.784	0.902	2.50E-06	0.3
	p10	1	220	12.8	1.77E-08	9.06E-02	75	0.031	0.014	0.341	0.392	0.451	2.50E-06	0.3
	p11	1	220	14.3	1.77E-08	1.01E-01	75	0.035	0.016	0.341	0.392	0.451	2.50E-06	0.3
	p12	1	220	0.4	1.77E-08	2.83E-03	75	0.001	0.000	0.341	0.392	0.451	2.50E-06	0.3

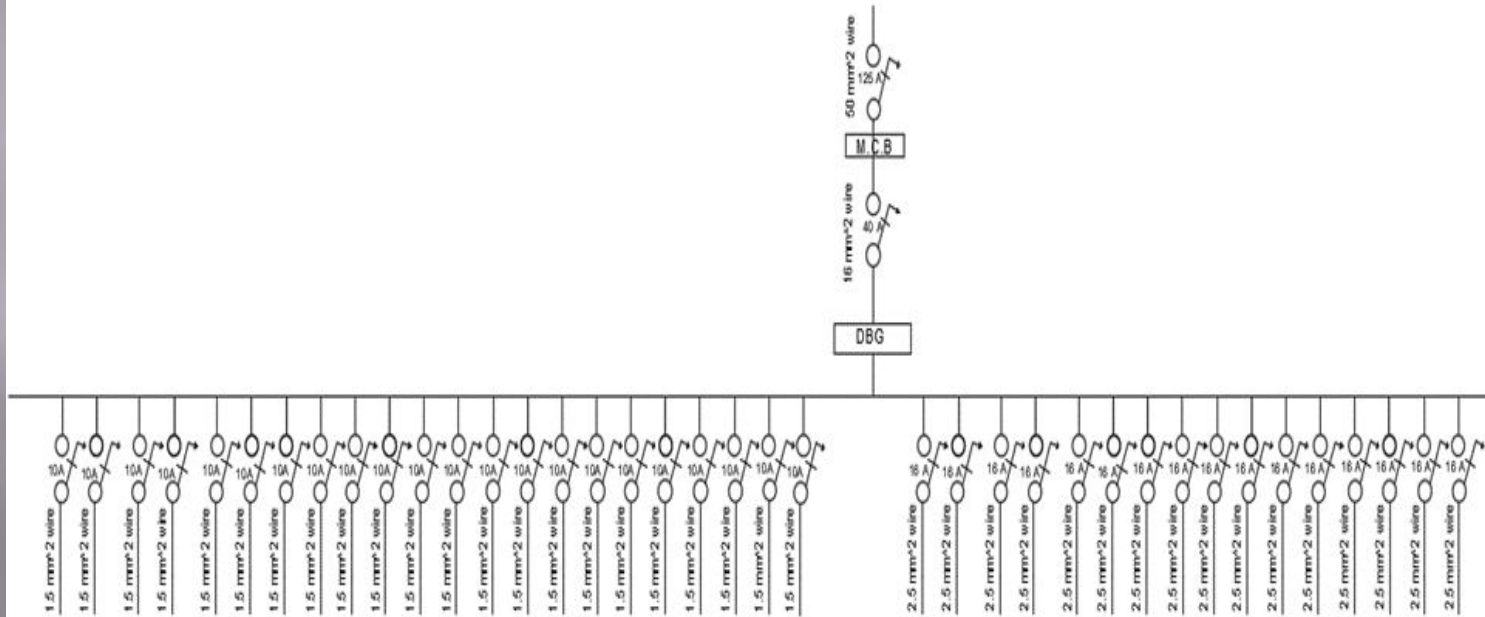
Electrical design

Main circuit breaker

main circuit breaker										
name	name	light	socket	total power	I Load	I cb	I cable	circuit breaker	sec area	phase
ground	DBG	3539.9	3075	6614.9	31.86	36.63389	42.12897	40	16	1
	M.D.B.G	TOT		6614.9	31.86	36.63389	42.12897	40	16	3
FIRST	DBF	3730.9	2400	6130.9	35.21	34.21482	39.34705	40	16	1
	DBC	348	3600	3948	18.12	20.33409	23.9653	40	16	1
	M.D.B.F	TOT		10078.9	53.33	54.54891	63.31235	80	35	3
SECOND	DBS	3655.4	2025	5680.4	30.71	32.57114	37.45681	40	16	1
	DBL	355	2550	2905	13.38	15.39141	17.70013	40	16	1
	M.D.B.S	TOT		8585.4	44.09	47.96255	55.15693	80	35	3
M.C.B		TOT		25279.2	129.3	139.1454	160.5983	125	50	3

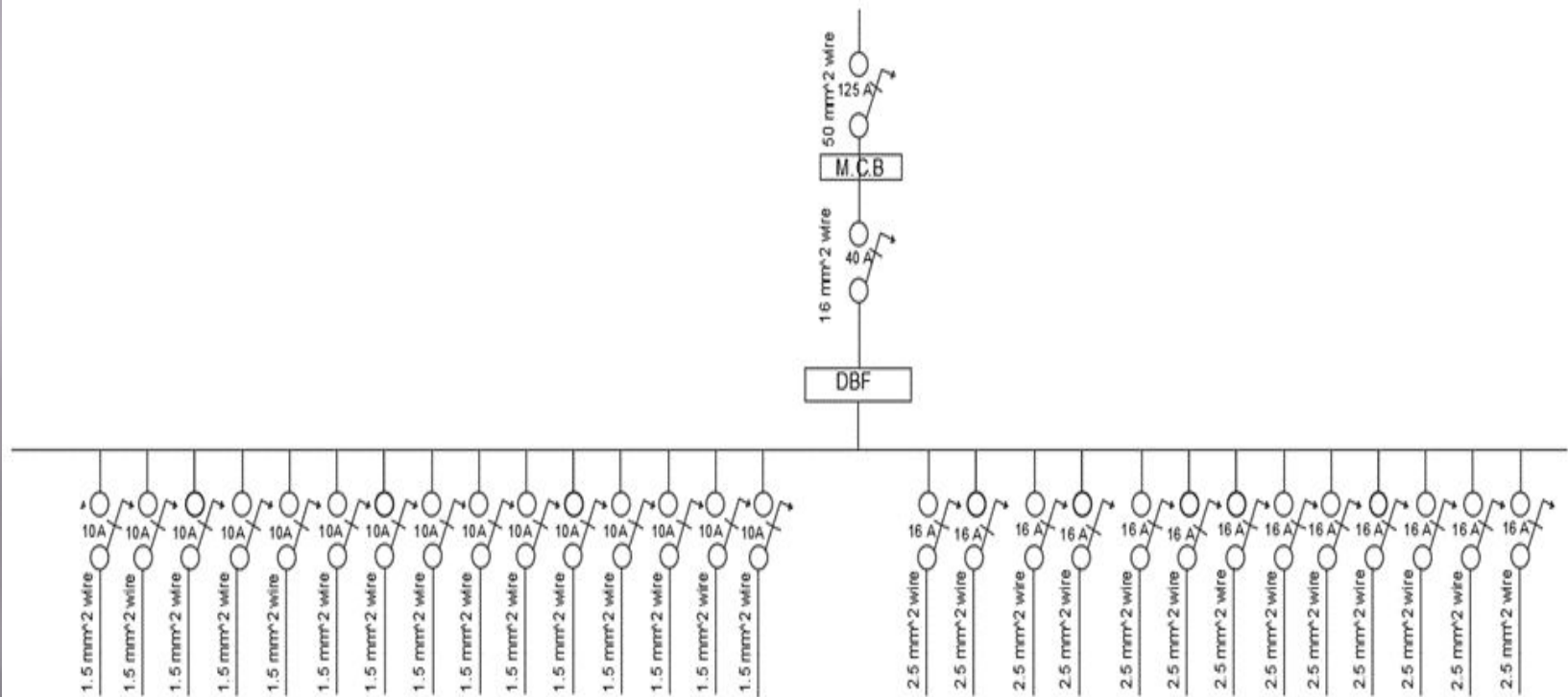
Electrical design

circuit breaker of ground floor



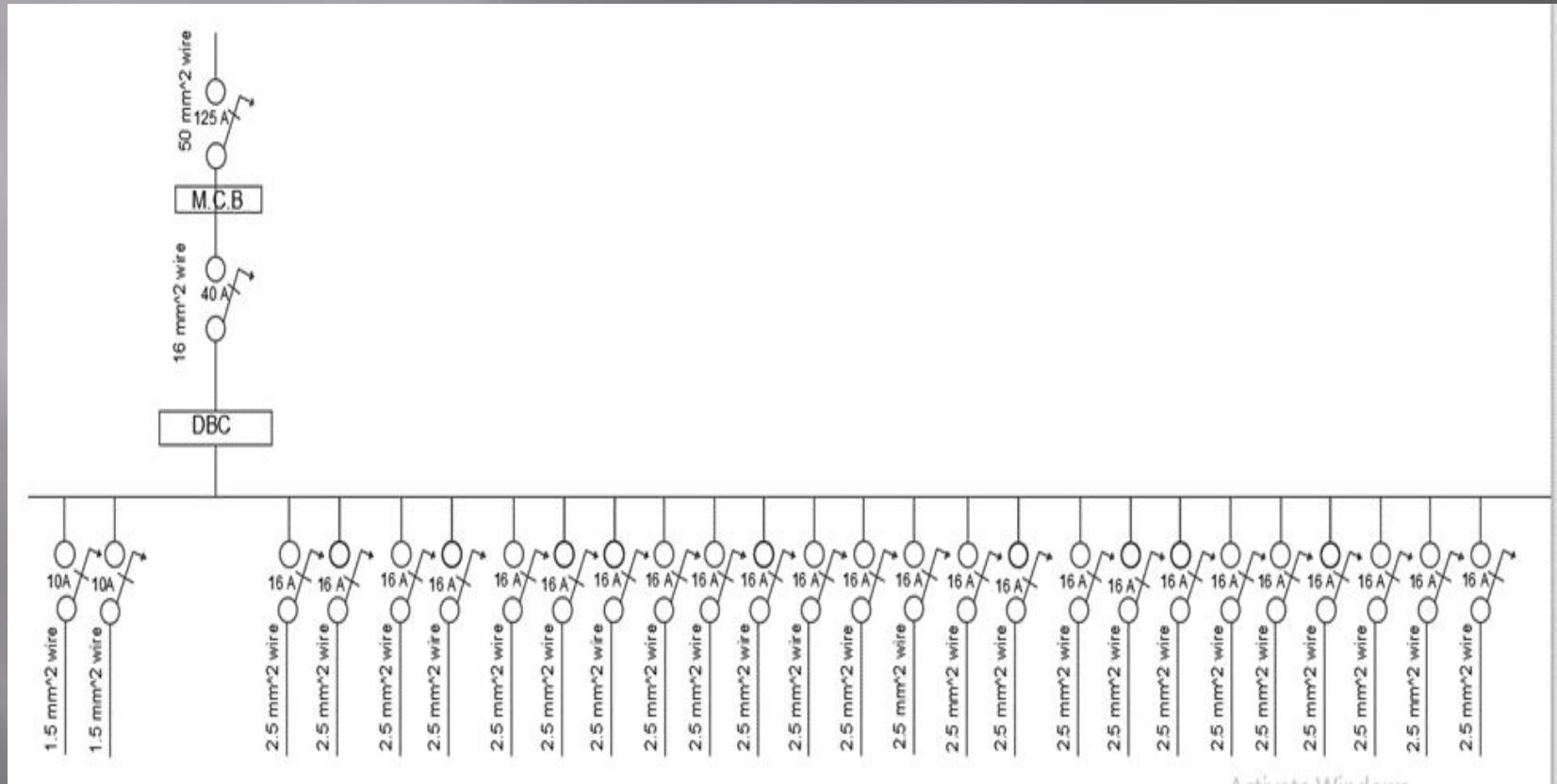
Electrical design

circuit breaker of first floor



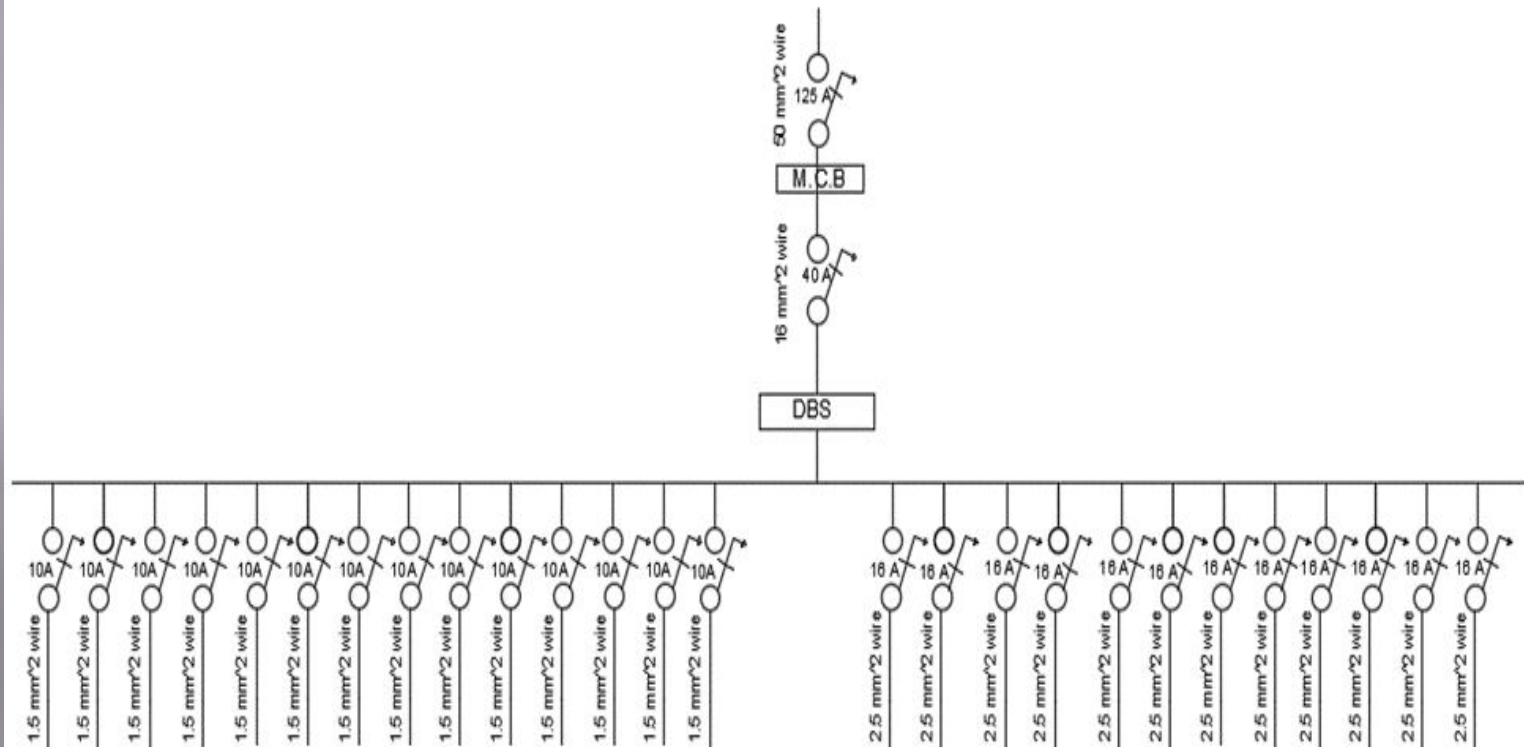
Electrical design

circuit breaker of computer room



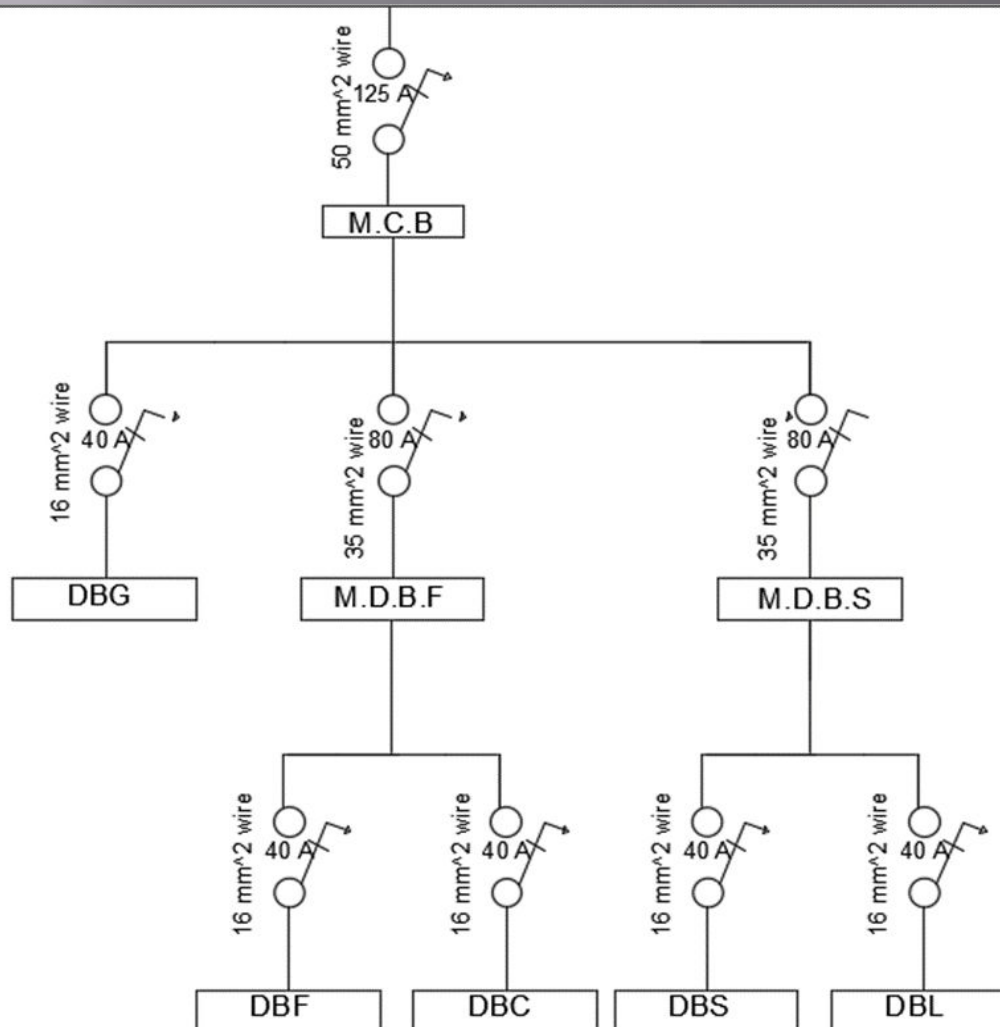
Electrical design

circuit breaker of second floor

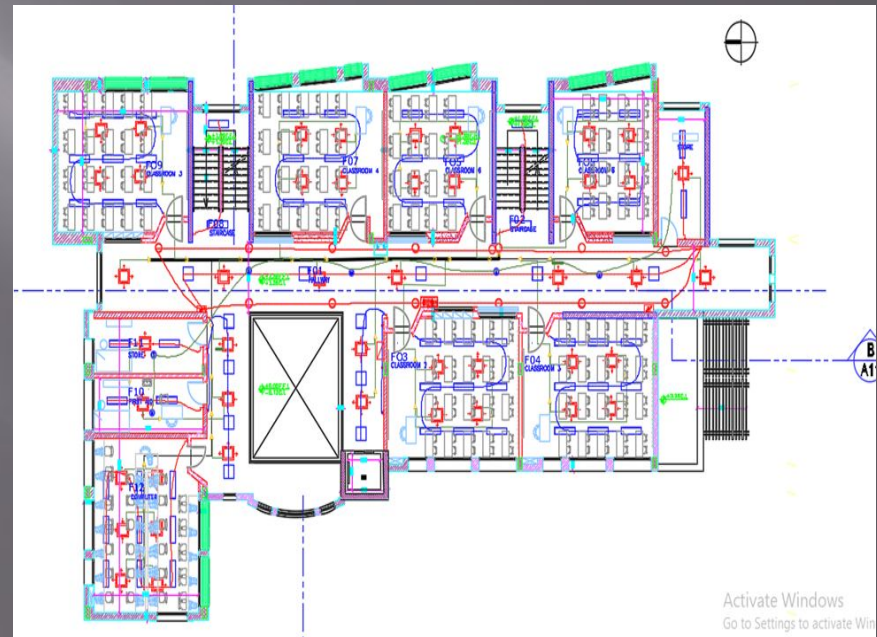
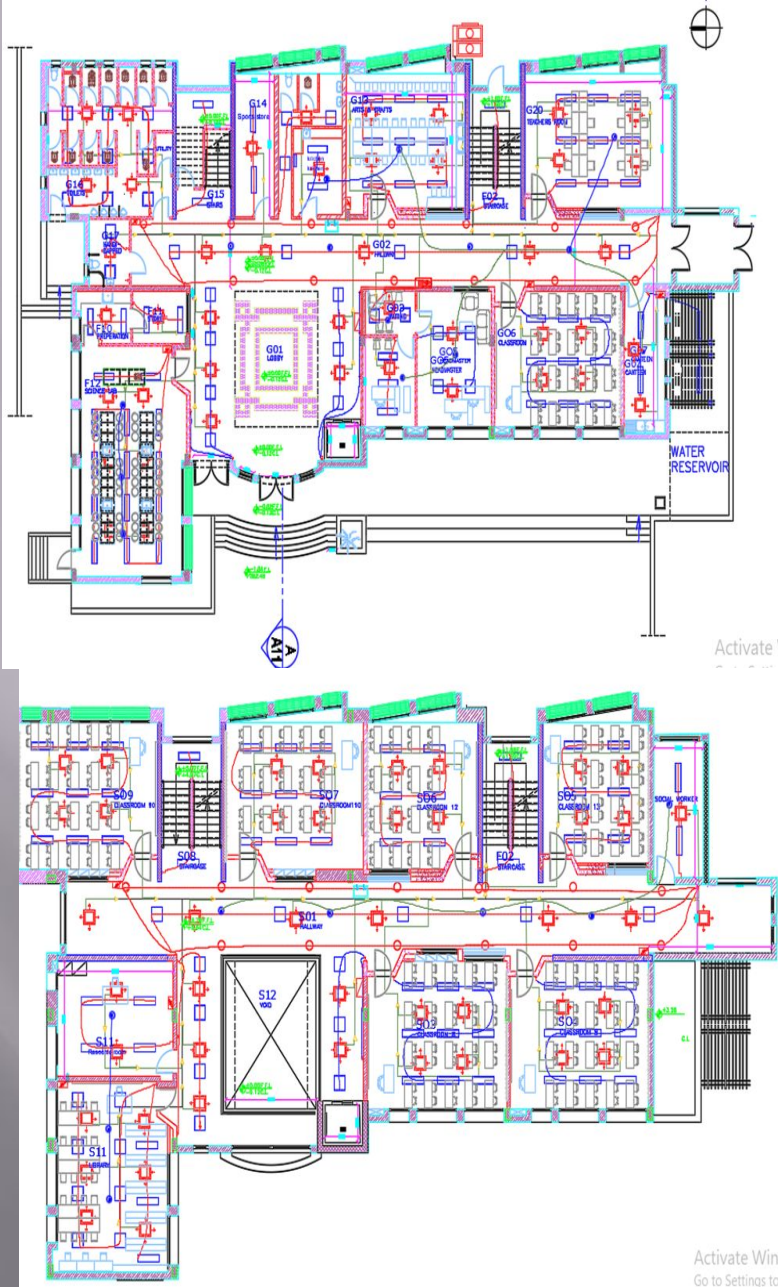


Electrical design

Main circuit breaker



systems integration



Cost Estimation

Earth work

Structural and
finishing work

Mechanical
work

Electrical
work



Cost Estimation

Total cost	
Earth work	283559
Structure and Finishing	2288440
Mechanical	35262.5
Electrical	852368
material cost	
Earth work	27513
Structure and Finishing	1806808
Mechanical	27230.9
Electrical	666186
labor cost	
Earth work	10190
Structure and Finishing	491632
Mechanical	8031.6
Electrical	186182
Total cost	
3459629.902	

The end
thank you for listening
Any question