ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

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DEPARTMENT : EEE SECTION & GROUP : B1

DATE OF SUBMISSION :

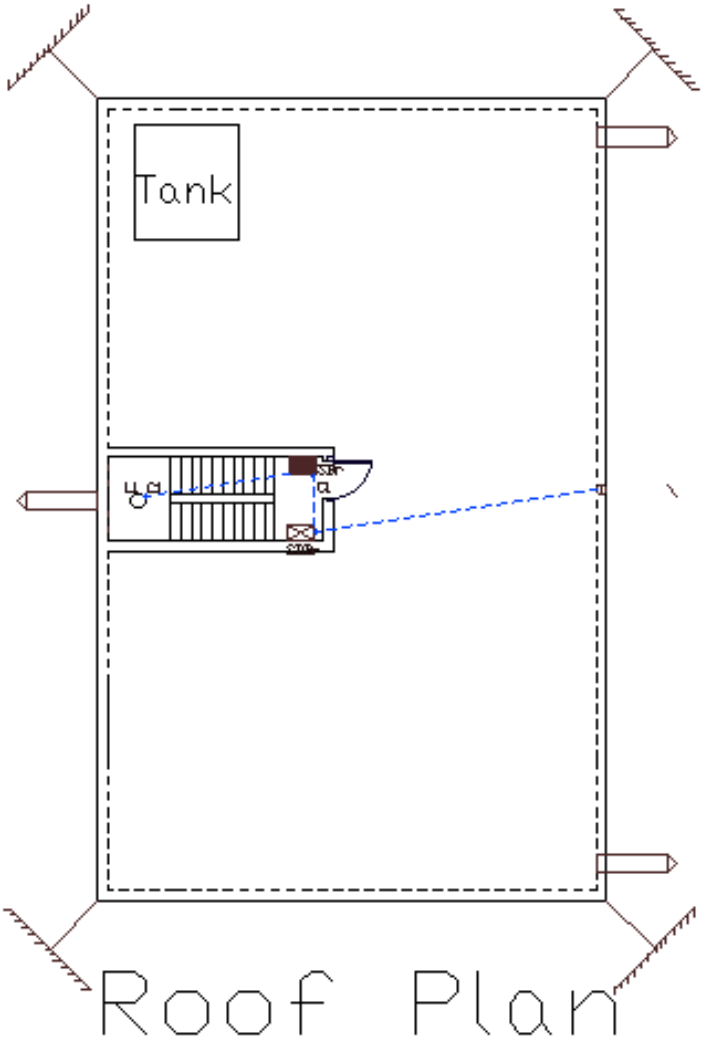
COURSE NO. : EEE 4404

COURSE TITLE :

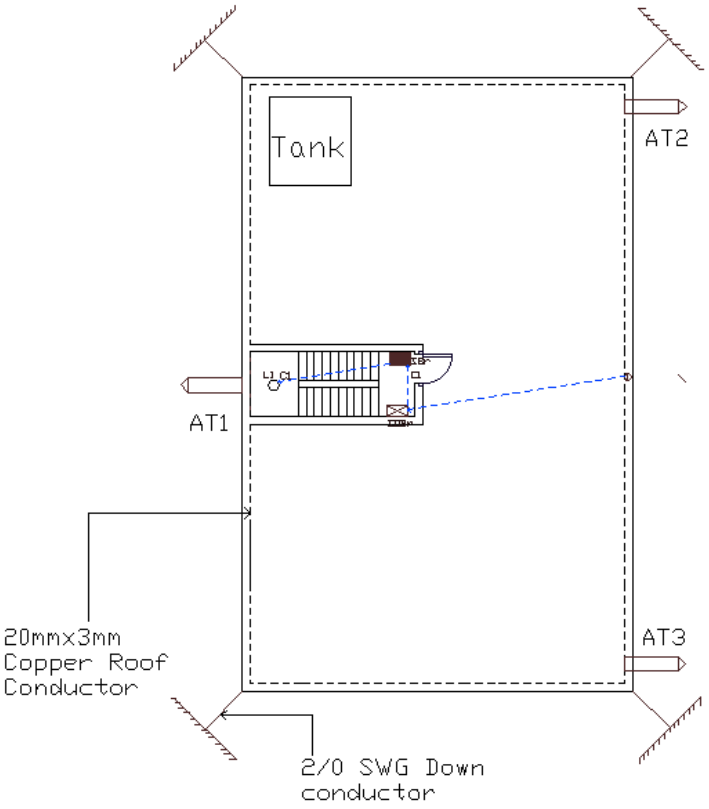
EXPERIMENT NO :

NAME OF EXPERIMENT :

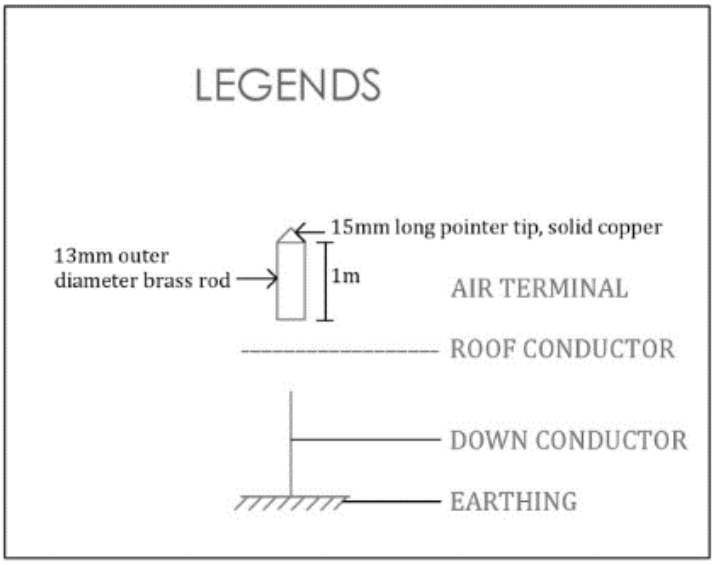
- Roof Plan:



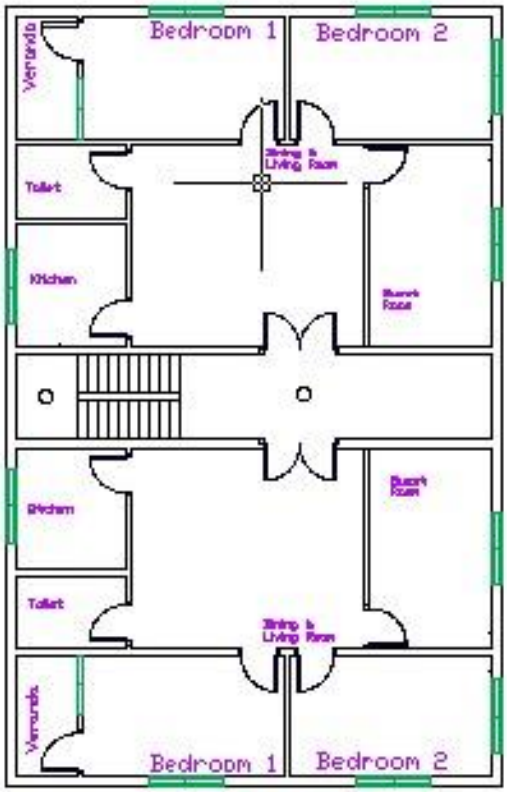
- Lighting Protection:



Roof Plan

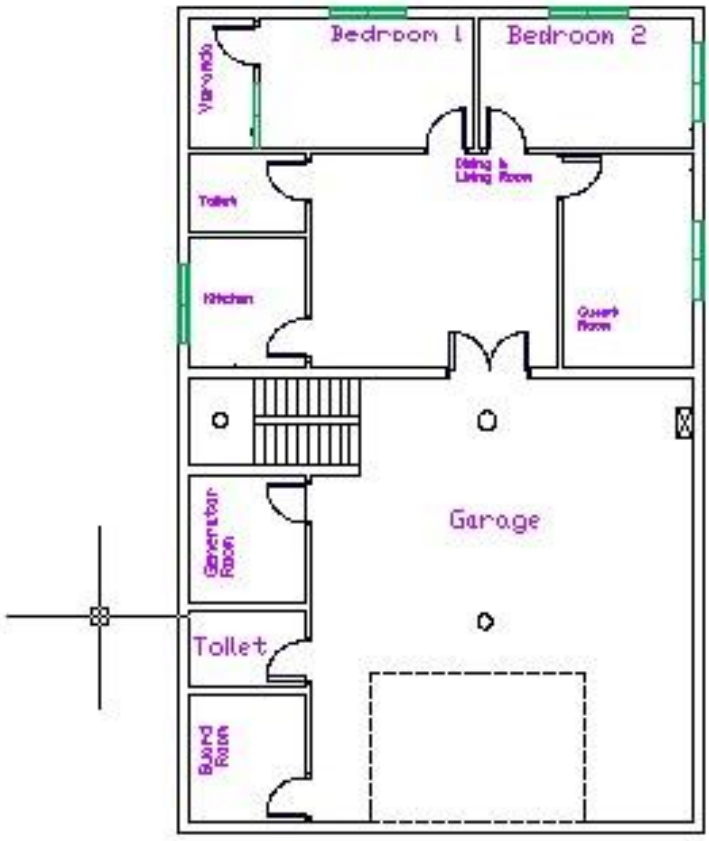


- Floor Plan(1st and 2nd):



Floor Plan
(1st & 2nd)

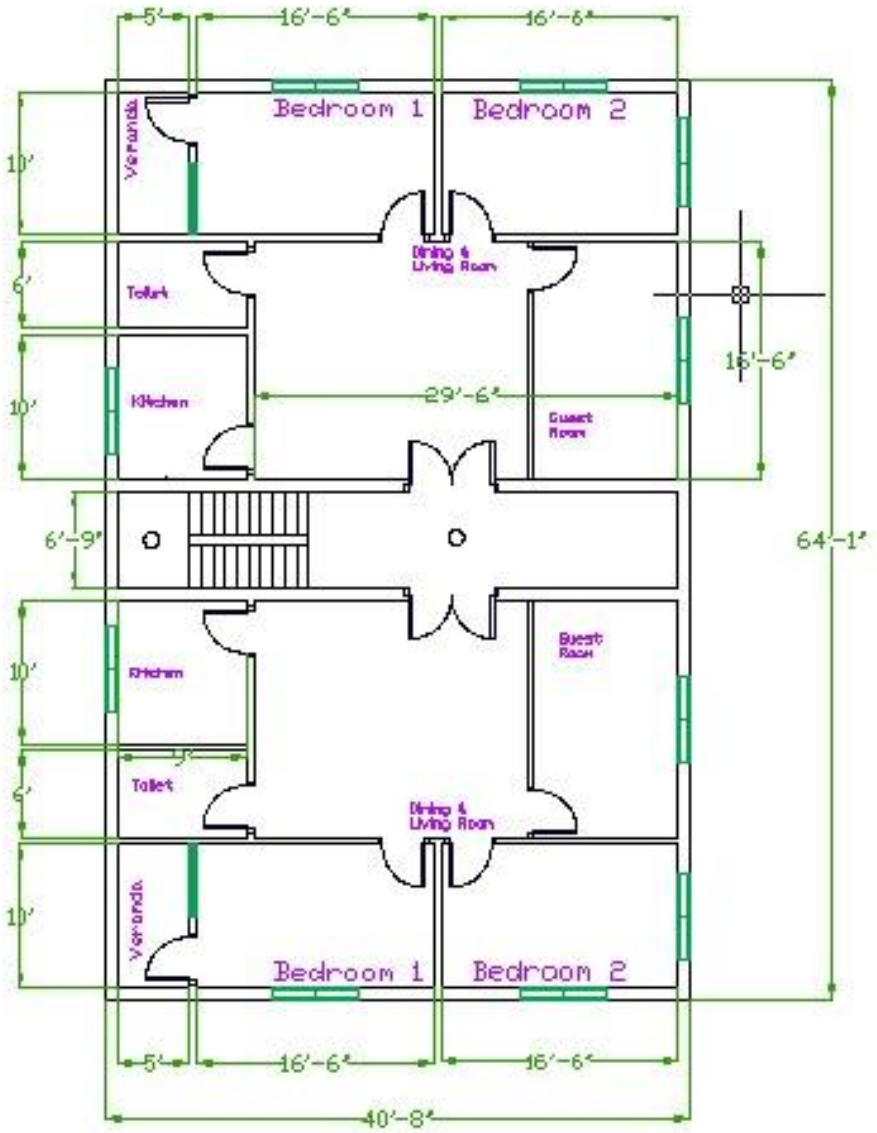
Ground Floor Plan:



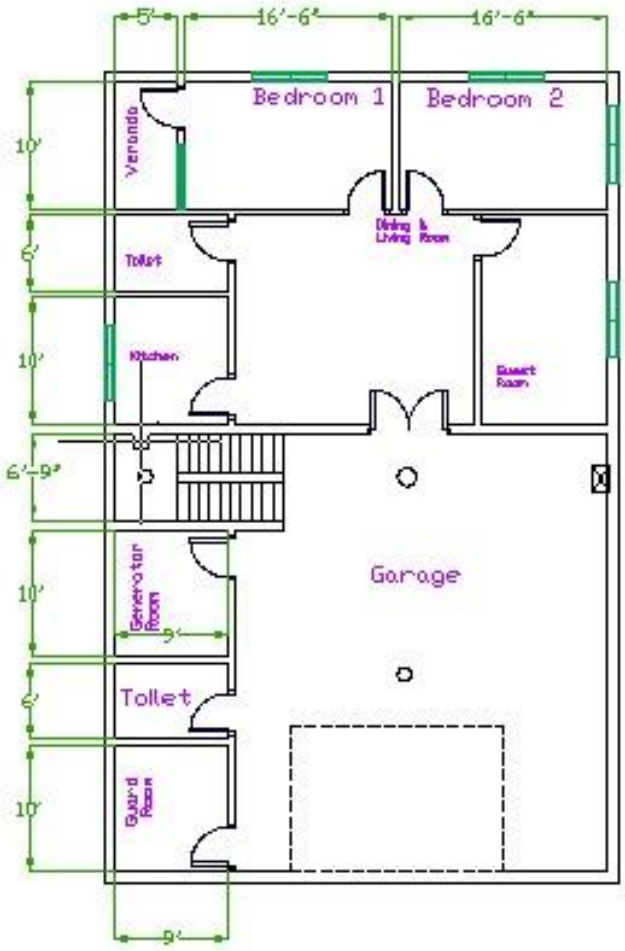
Ground Floor Plan

- Dimensions:

1st and 2nd Floor:



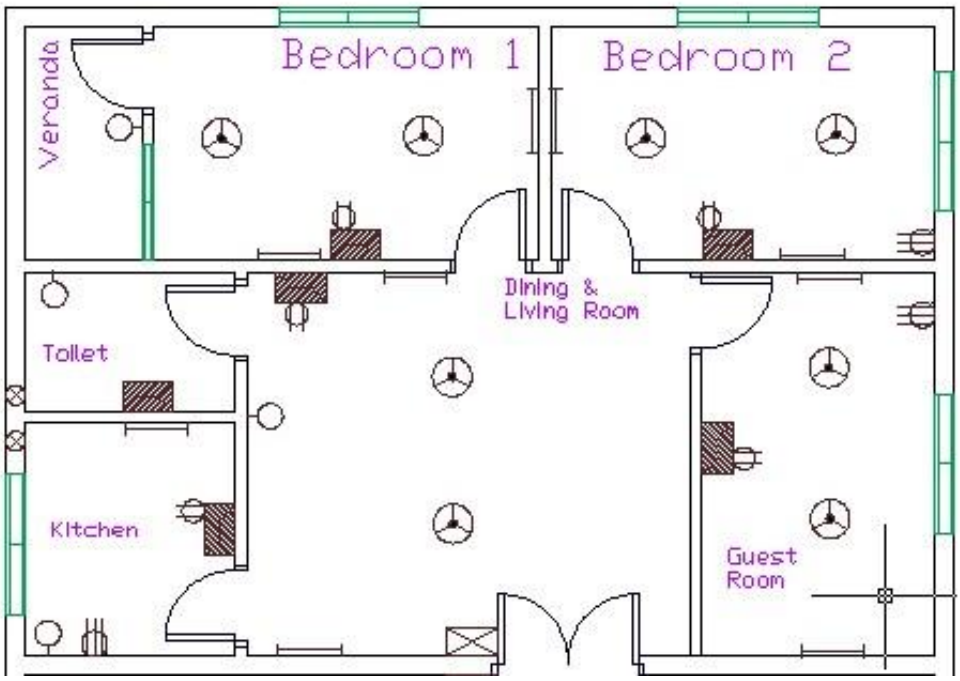
Ground floor:



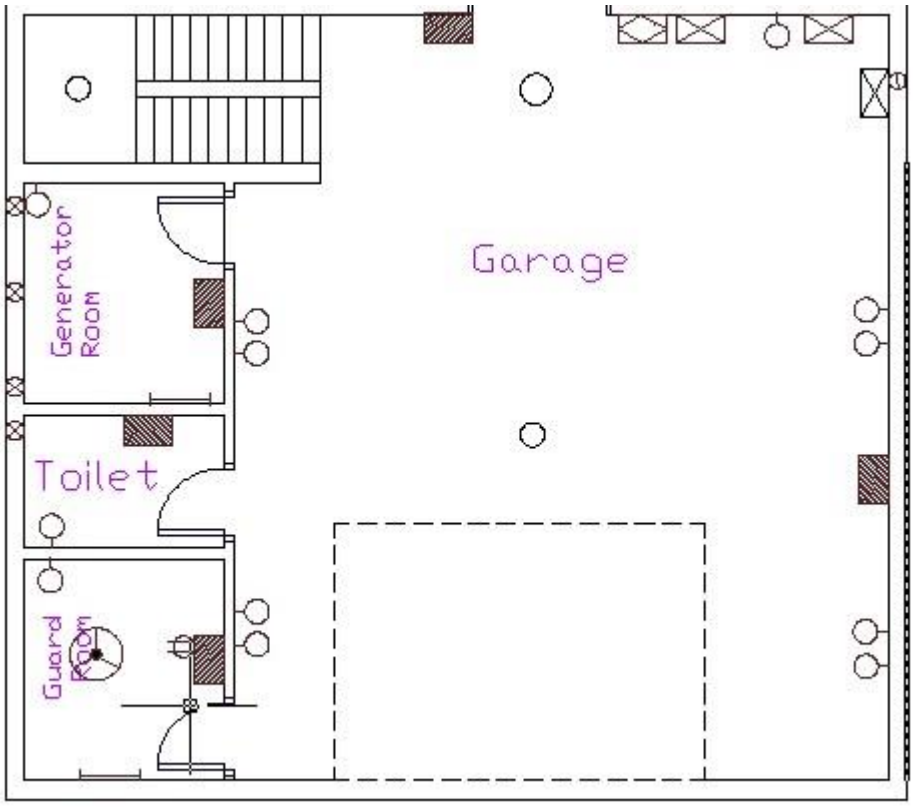
Ground Floor Plan

- Fittings and Fixtures:

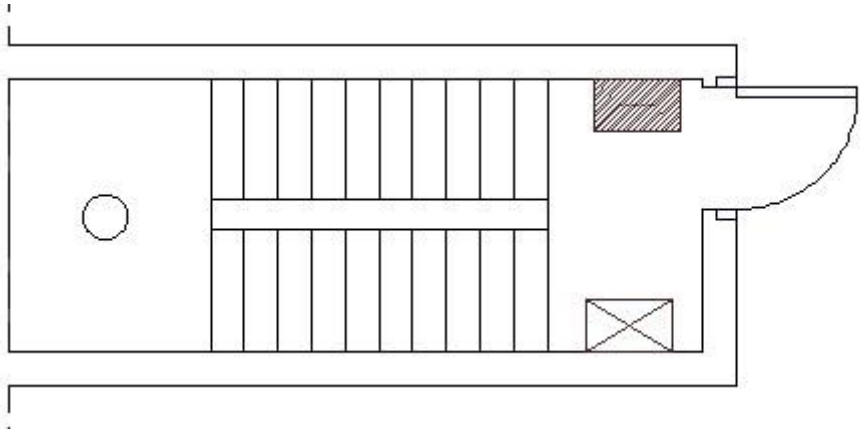
  Apartment Unit:



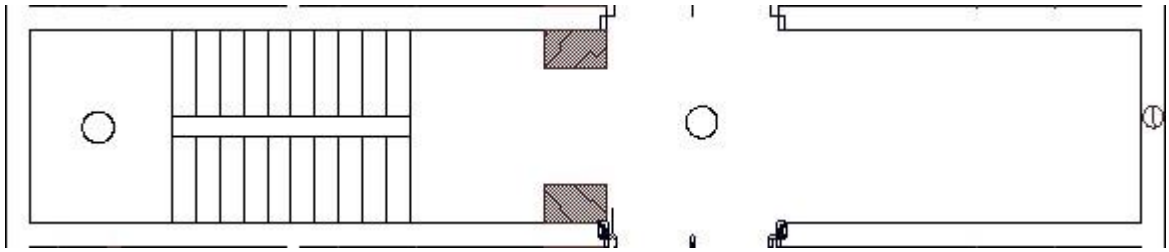
Garage Unit:



Roof corridor:

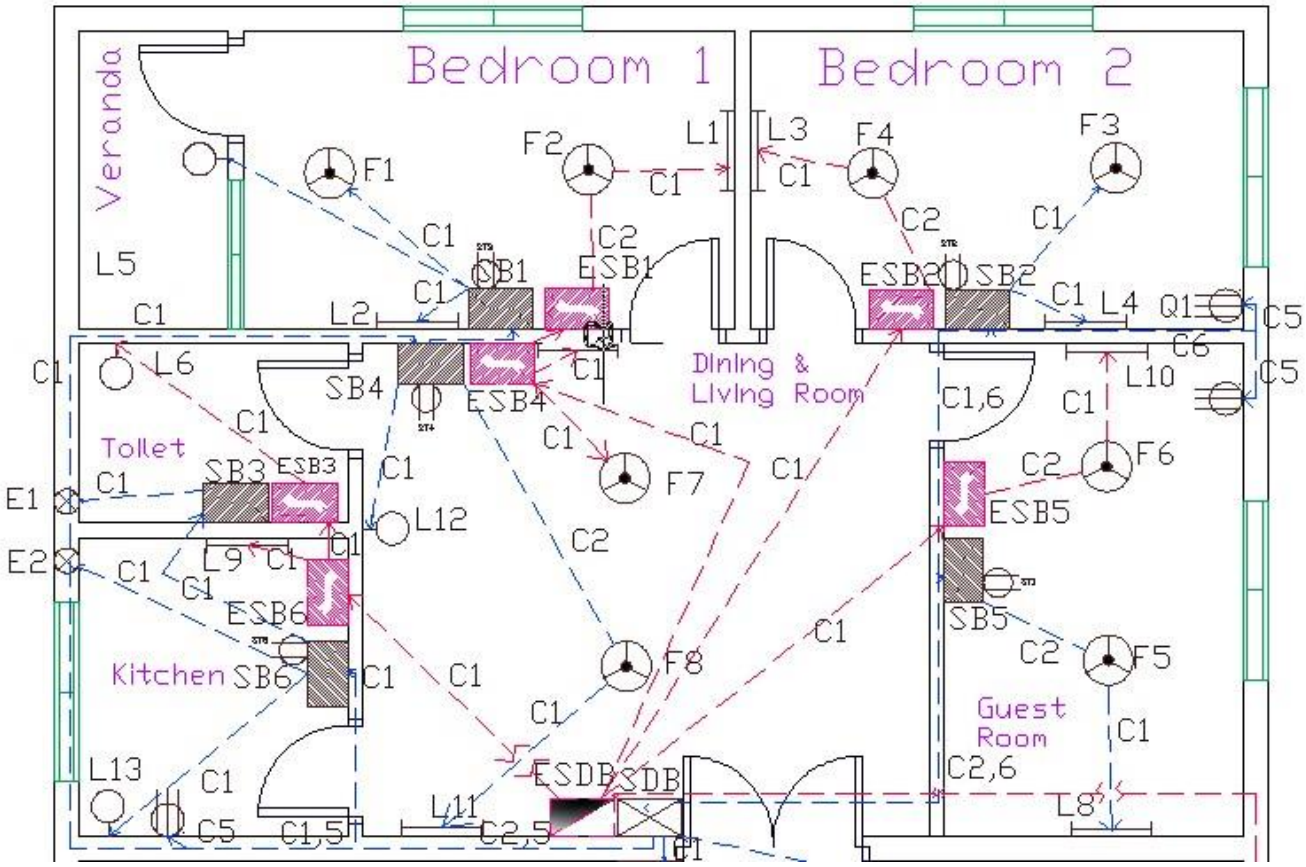


Apartment Corridor:

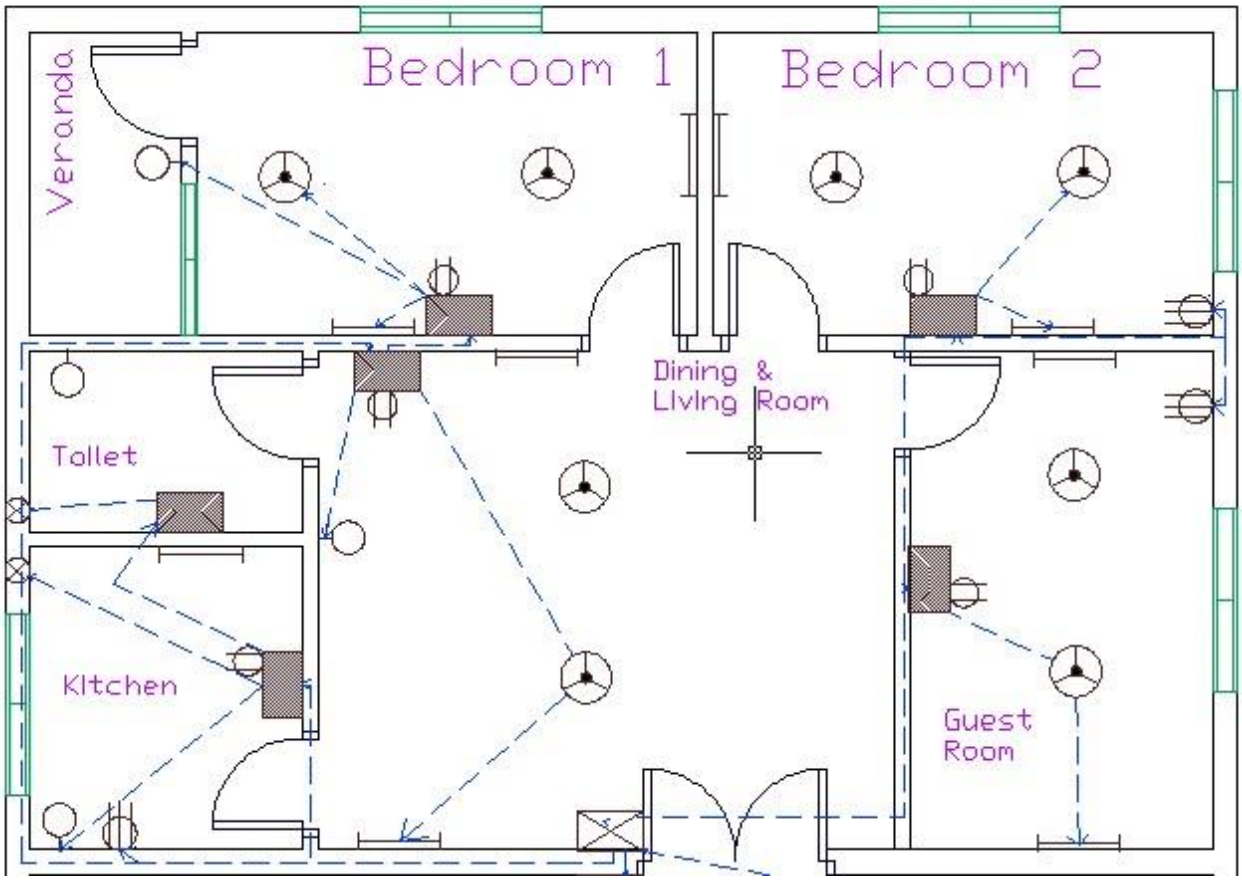


- **Conduit Layout:**

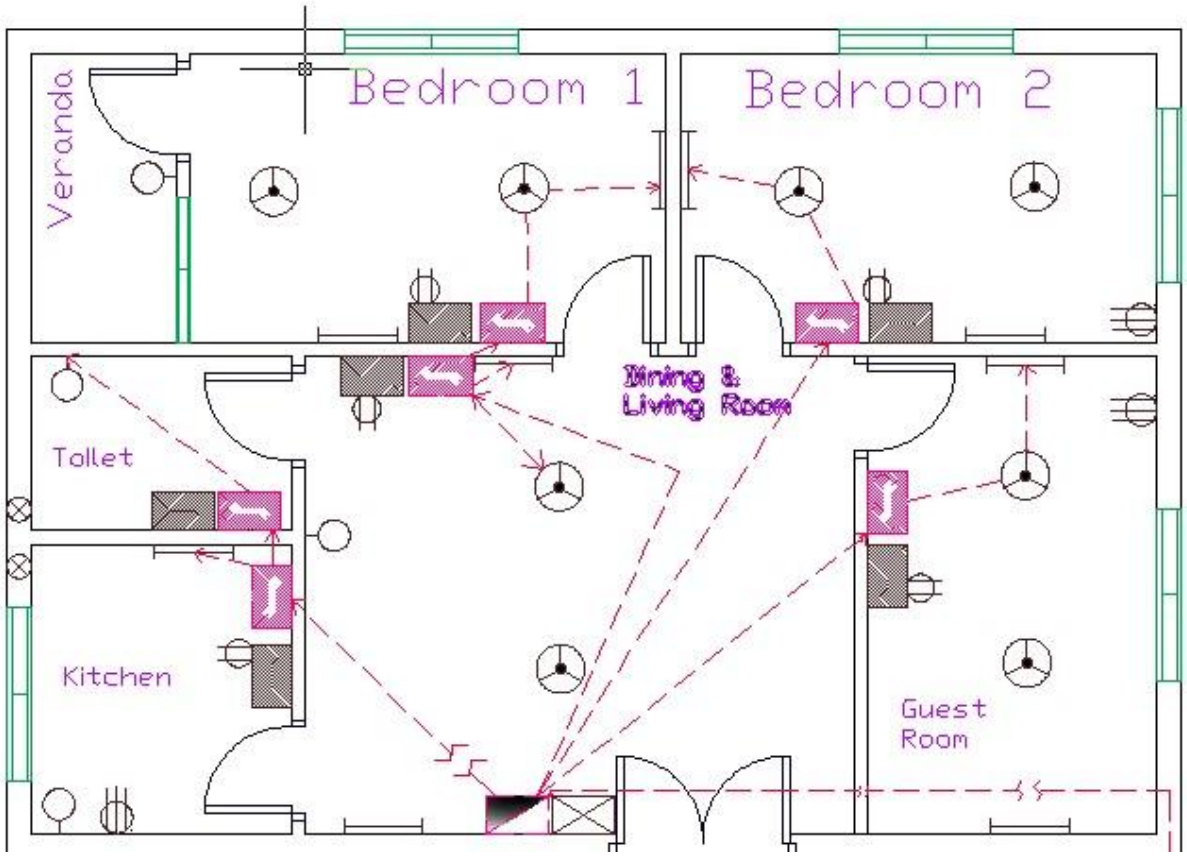
  Apartment Unit:



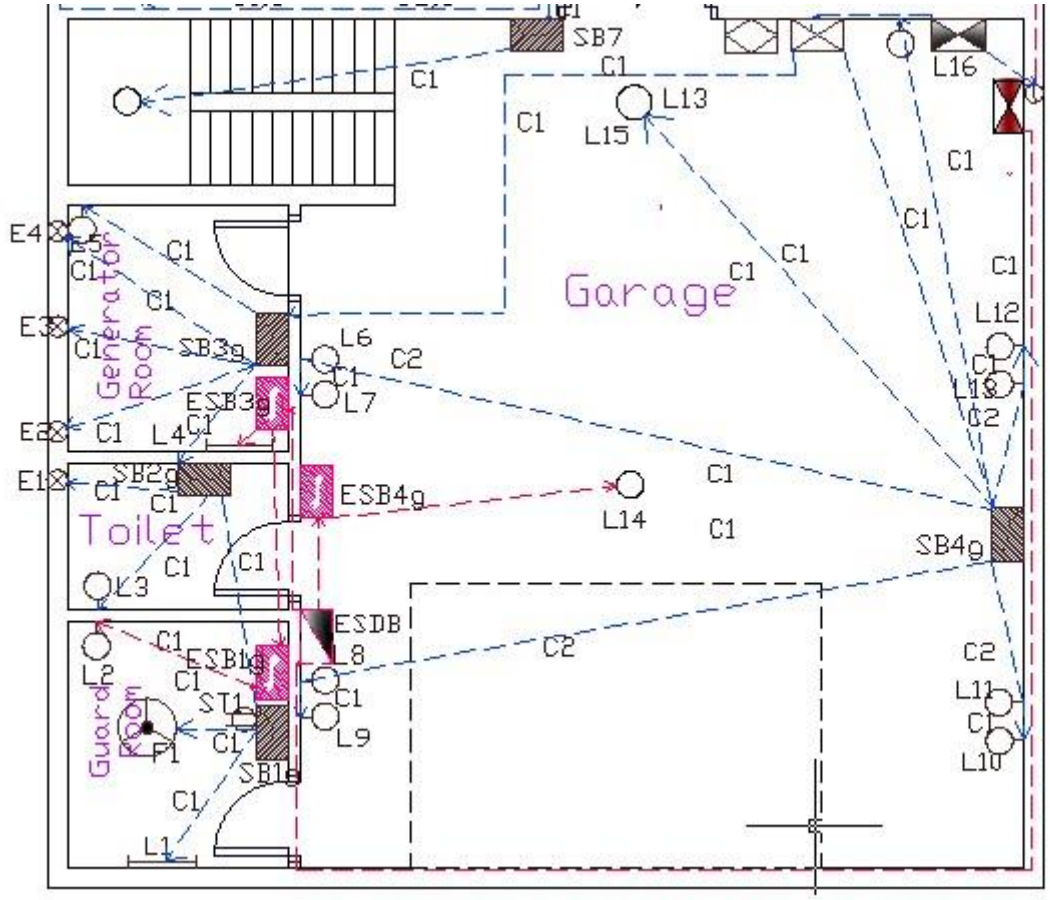
Normal conduit layout:



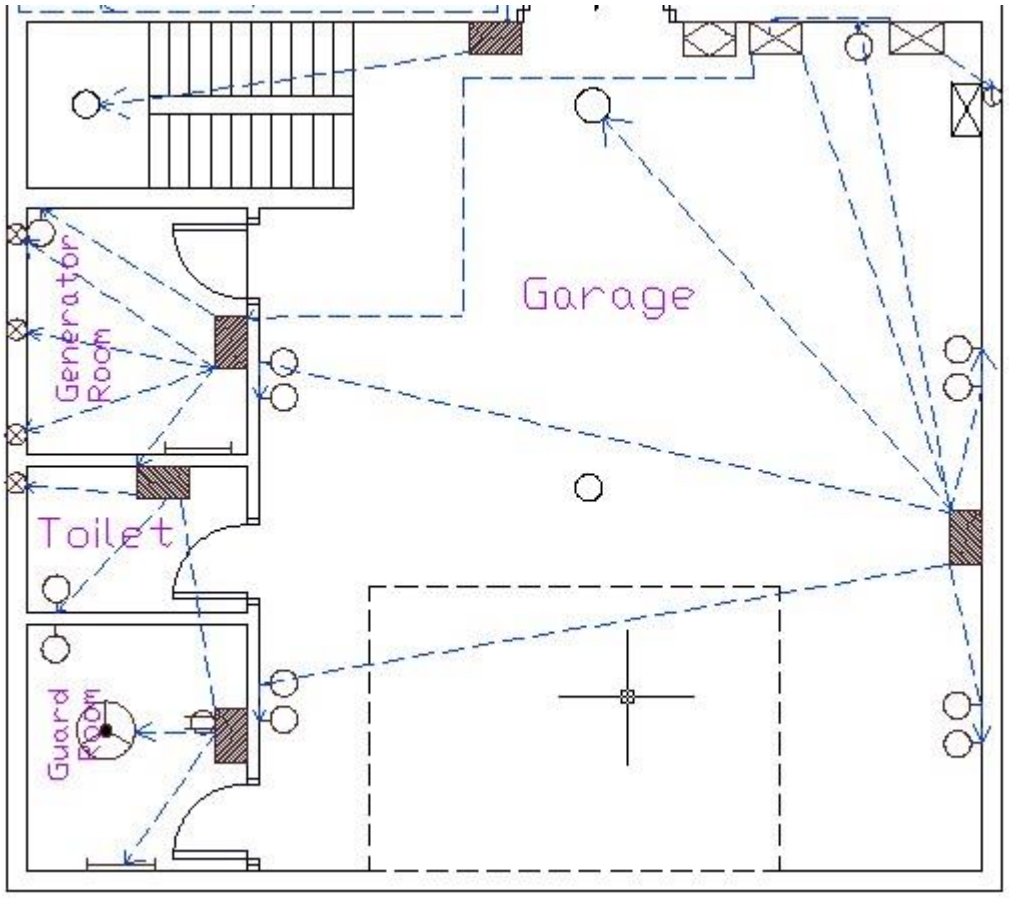
Emergency conduit layout:



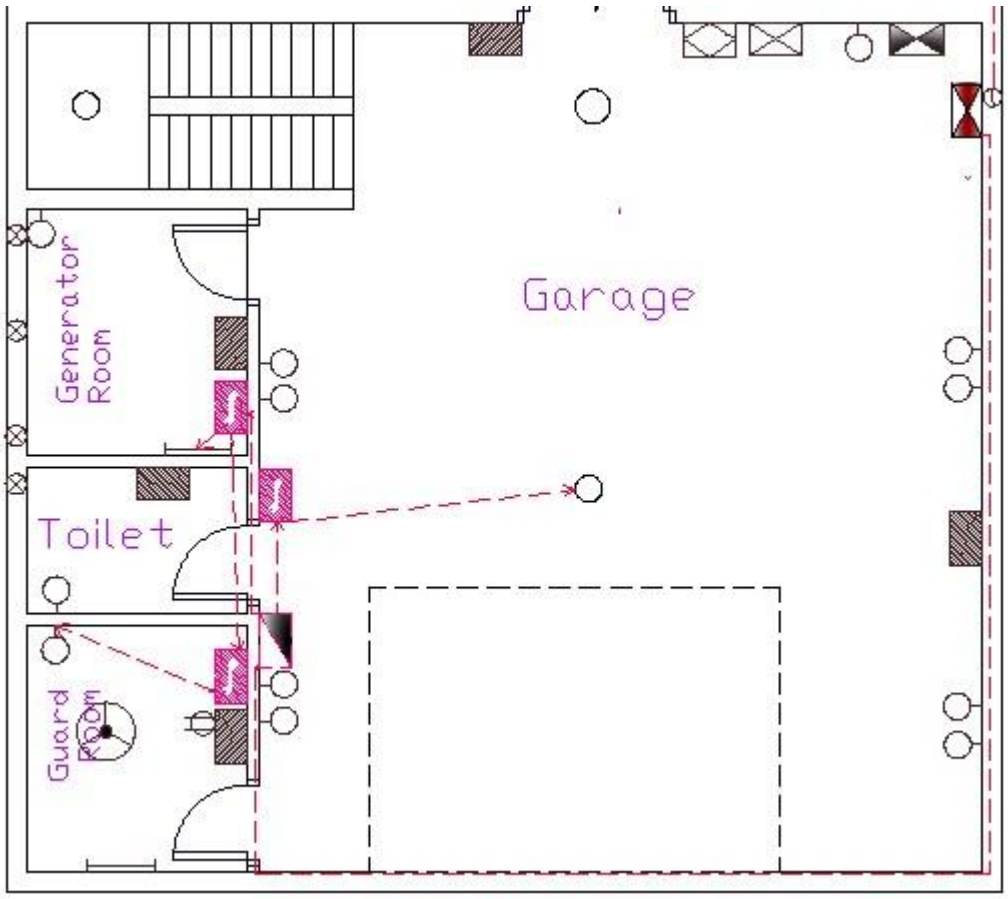
Garage Unit:


SB7
C1
L13
L15
L16
Garage
E4
E3
E2
E1
L5
L6
L7
L4
L2
L3
L8
L9
L1
L14
L12
L11
L10
SB3g
SB2g
ESB3g
ESB4g
ESDB
ESB1g
SB1g
SB4g
SL1
P1
C2
Generator Room
Toilet
Guards Room

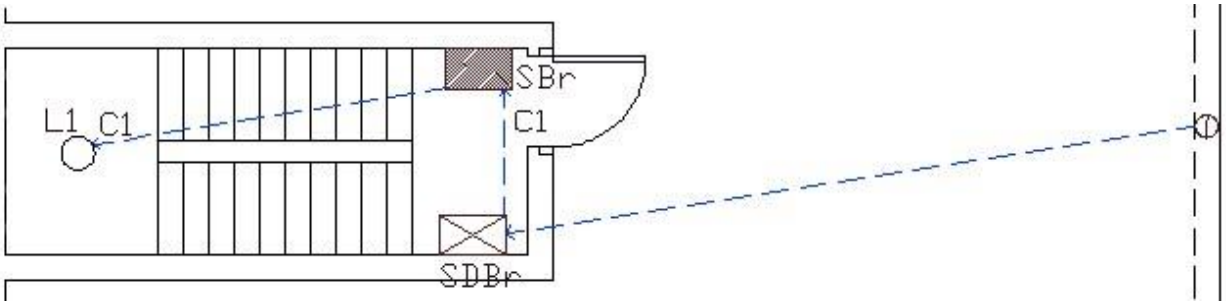
Normal conduit layout:



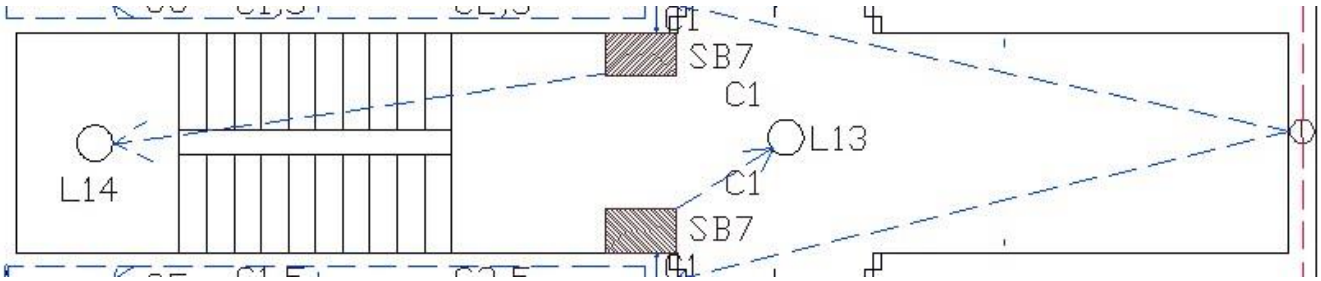
Emergency conduit layout:



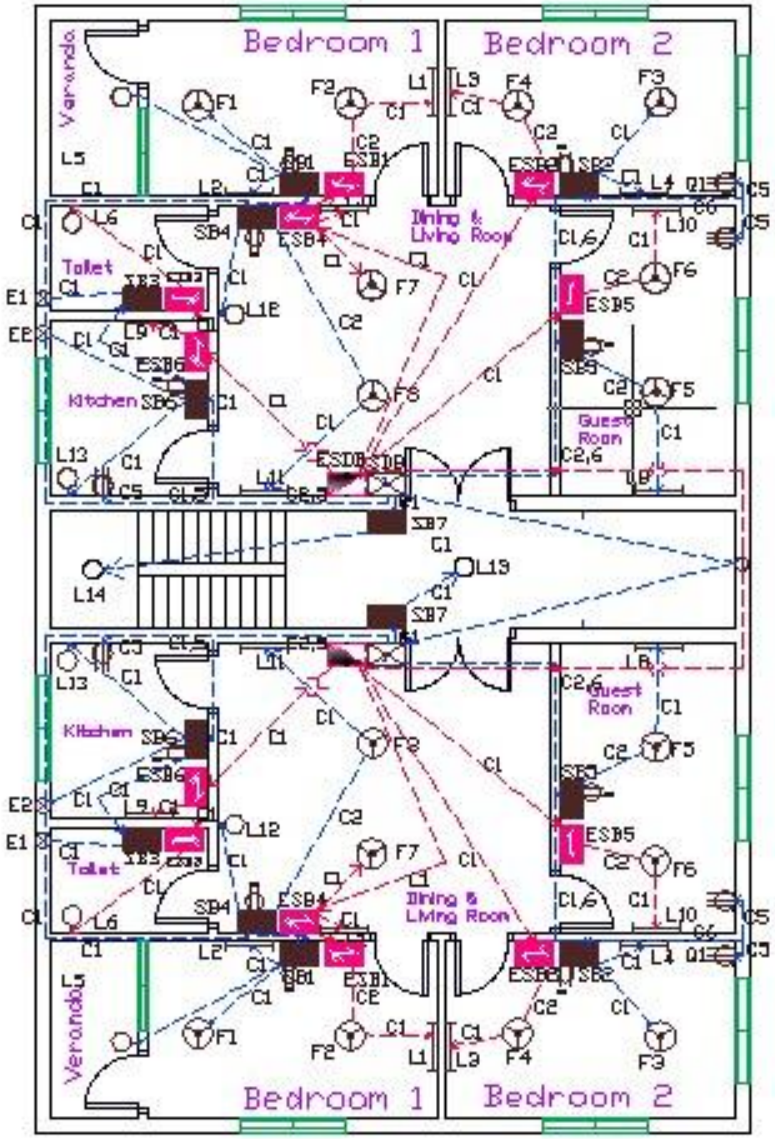
Roof corridor:



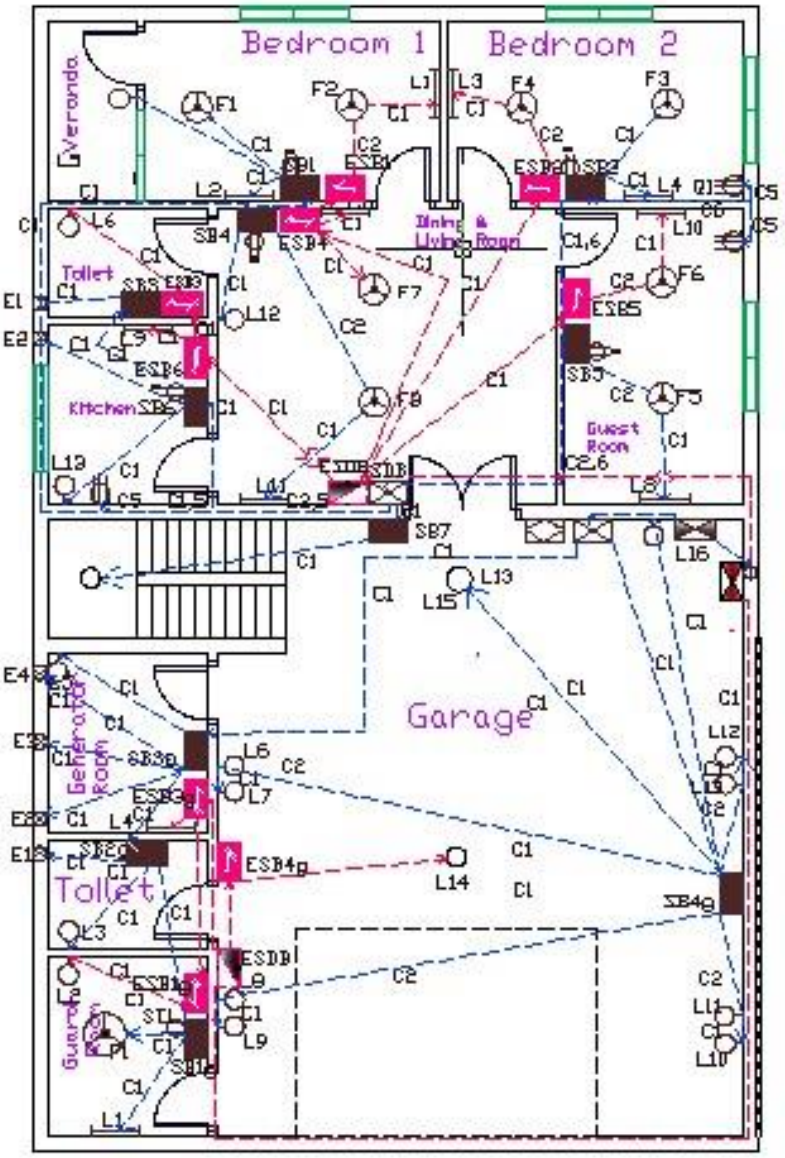
Apartment Unit Corridor:



1st and 2nd Floor:

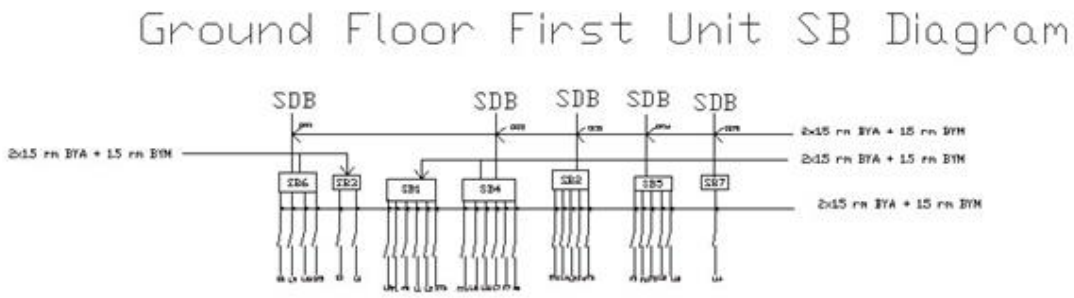


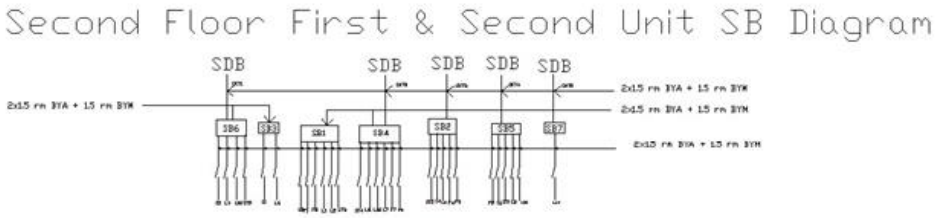
Ground Floor:

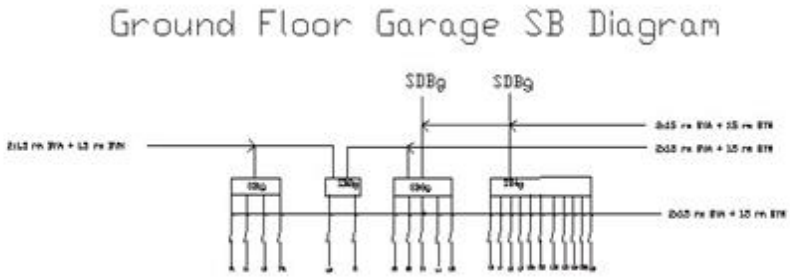


- **Connection Diagrams:**

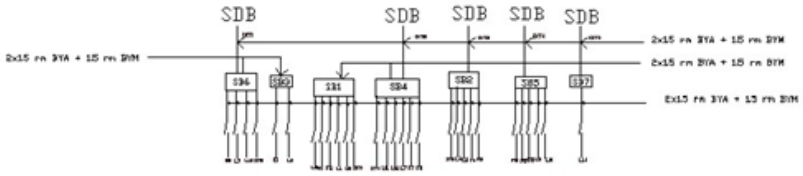
Normal switch Board Diagram:



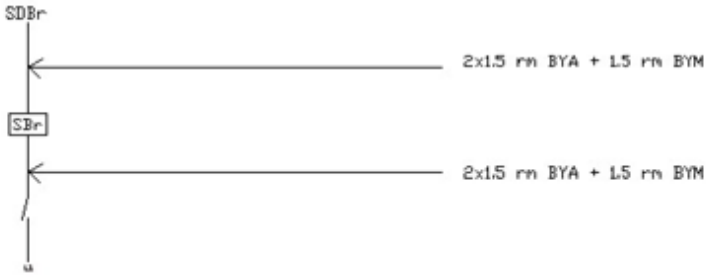




First Floor First & Second Unit SB Diagram

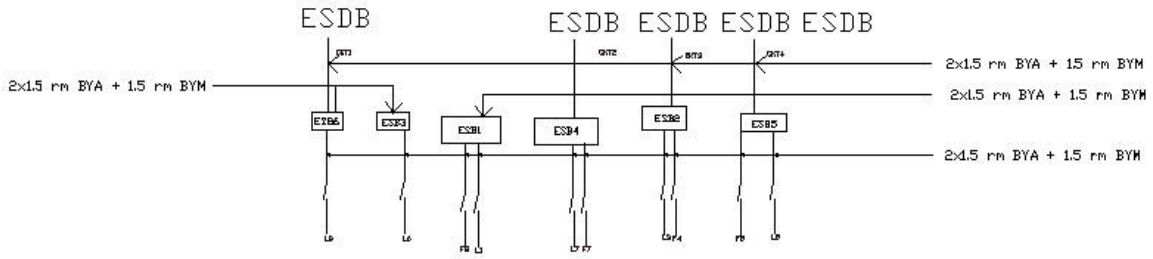


Roof SB Diagram

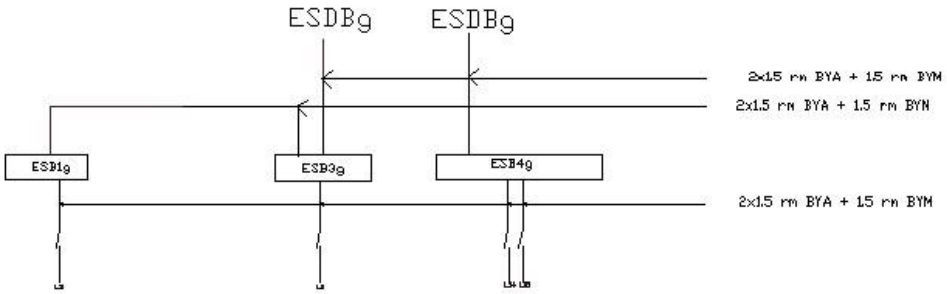


Emergency Switch Board
Diagrams:

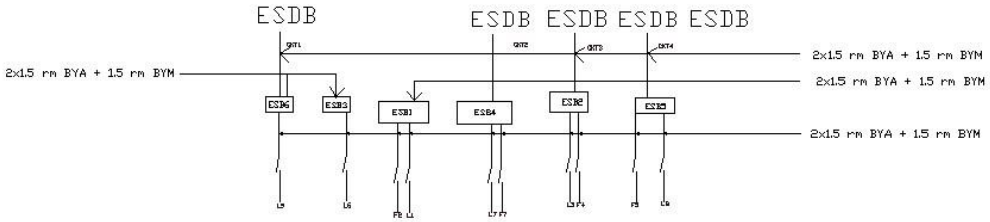
Ground Floor First Unit ESB Diagram



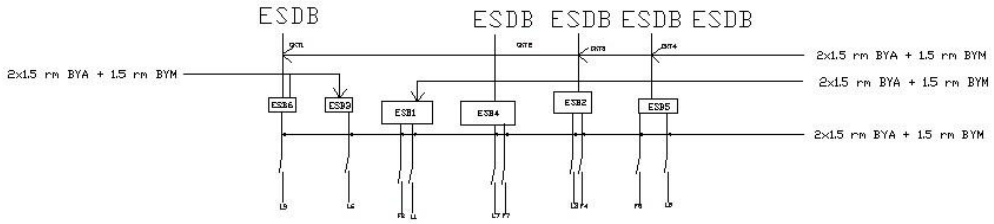
Ground Floor Garage ESB Diagram



First Floor First & Second Unit ESB Diagram

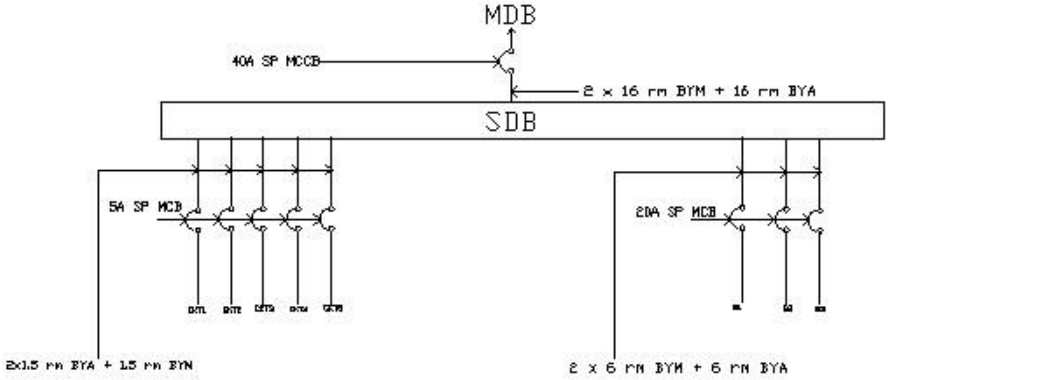


Second Floor First & Second Unit SB Diagram

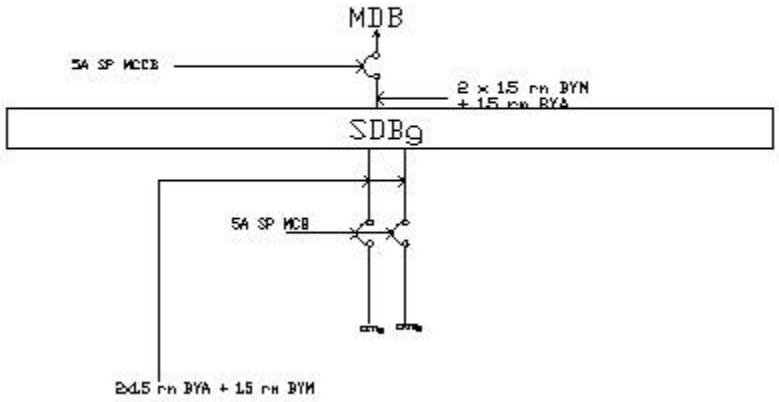


Normal Sub-distribution Board Diagram:

First & Second Floor SDB Diagram

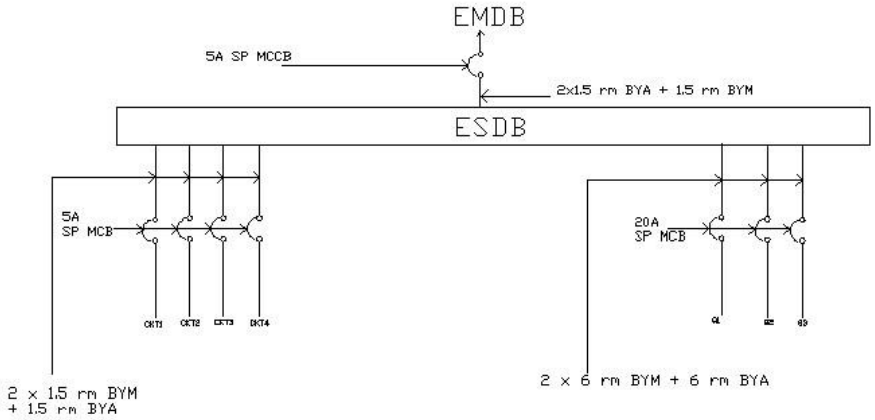


Garage SDB Diagram

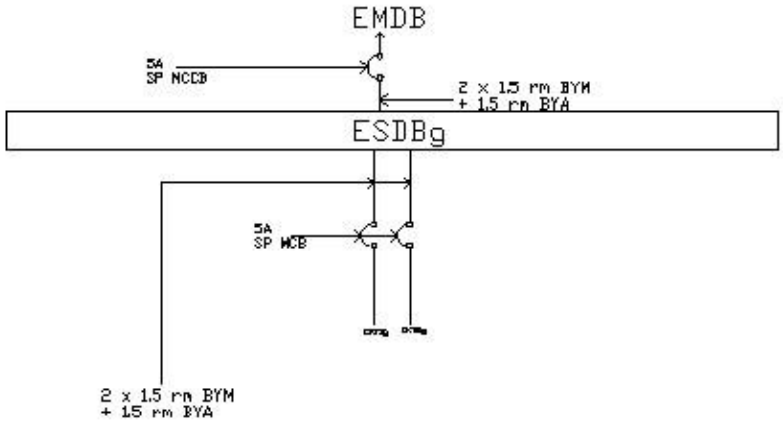


Emergency Sub-distribution Board Diagram:

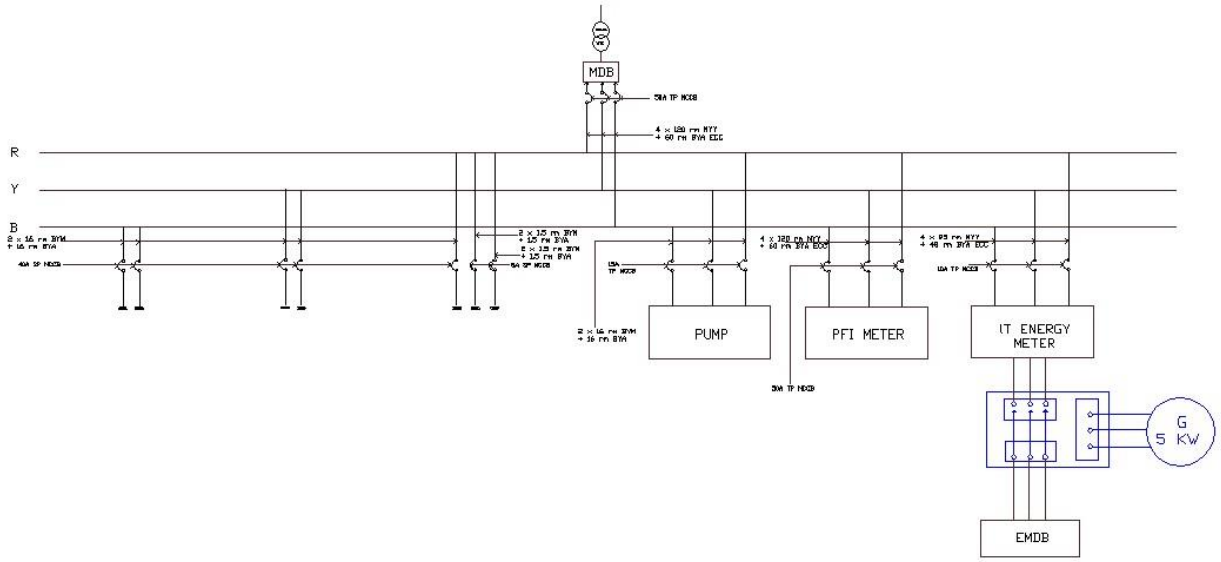
First & Second Floor ESDB Diagram



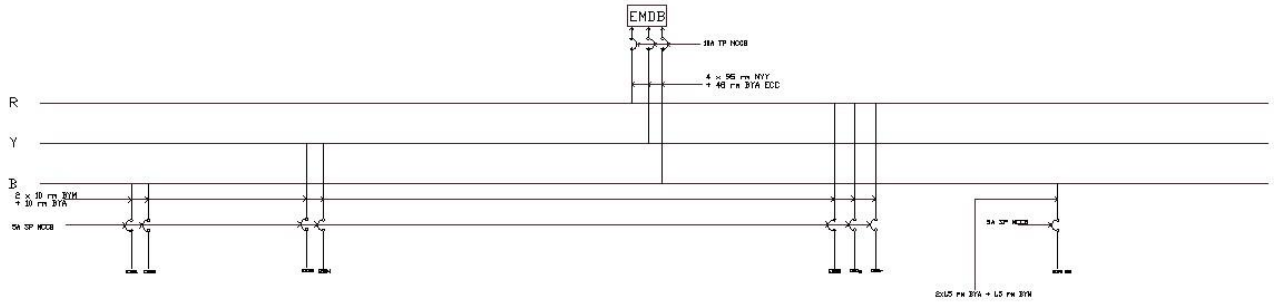
Garage ESDB Diagram



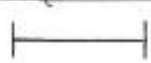
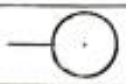
Normal Main Distribution Board Diagram:



Emergency Main Distribution Board Diagram:



- **LEGENDS for Fittings and Fixtures:**

LEGENDS			
Description	Height	Caption	Symbol
20W Tube light	Lintel	L	
20W Fluorescent light bulb	Lintel	L	
20W Fluorescent Ceiling light	Ceiling	L	
100W Fan	Ceiling	F	
70W Exhaust Fan	Lintel	E	
100W two pin socket	Mid Wall	ST	
20A three pin socket	Lower Wall	Q	
Switch Board	Mid Wall	SB	
Emergency Switch Board	Mid Wall	ESB	
Subdistribution Board	Lintel	SDB	
Emergency Subdistribution Board	Lintel	ESDB	
Main distribution Board	Lintel	MDB	
Emergency Main distribution Board	Lintel	EMDB	
Meter board	Lintel	M	
Through hole		T	

• Legends for Conduits:

C1=2x1.5 rm BYM +1.5 rm BYA ECC	*¾”*		
C2=4x1.5 rm BYM +1.5 rm BYA ECC	*¾”*		
C3=6x1.5 rm BYM +1.5 rm BYA ECC	*¾”*		
C5=2x6 rm BYM +6 rm BYA ECC	*¾”*		
C6=4x6 rm BYM +6 rm BYA ECC	*1”*		
C1,5= 2x1.5 rm BYM +1.5 rm BYA ECC & 2x6 rm BYM +6 rm BYA ECC	*¾”*	*&*	*¾”*
C1,6=2x1.5 rm BYM +1.5 rm BYA ECC & 4x6 rm BYM +6 rm BYA ECC	*¾”*	*&*	*1”*
C2,5=4x1.5 rm BYM +1.5 rm BYA ECC & 2x6 rm BYM +6 rm BYA ECC	*¾”*	*&*	*¾”*
C2,6=4x1.5 rm BYM +1.5 rm BYA ECC & 4x6 rm BYM +6 rm BYA ECC	*¾”*	*&*	*1”*
C7=2x16 rm BYM +16 rm BYA ECC	*2’’*		

N.B: The approximate and plausible dimension of the conduits are given above instead of the exact.

• CALCULATIONS FOR LIGHT BULBS (LB) & FANS (F)

- **Formulae:**

Light Bulbs , E = $\frac{n*N*F*UF*LLF}{A}$ (Area → A in m^2)

Number of Fans , F = $\frac{A}{100}$ (Area → A in sqft)

Illuminance → E

Light Loss Factor → LLF

Utilization Factor → UF

Number of lights per illuminaire → n

Flux → F

- **BEDROOM- 1**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1000 Lumen

Number of lights , N = 1.75

So, 2 Tube Lights are needed

Number of Fans = 1.65

So, 2 Fans are needed.

- **BEDROOM- 2:**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 1.75

So, 2 Tube Lights are needed

Number of Fans = 1.65

So, 2 Fans are needed.

- **Guest Room:**

Area : 16.5x10 ft^2 = 15.35 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 1.75

So, 2 Tube Lights are needed

Number of Fans = 1.65

So, 2 Fans are needed.

- **Living and Dining Room:**

Area : 19x16.5 ft^2 = 29.13 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire, n= 1

Flux = 1250 Lumen

Number of lights , N = 3.3

So, 3 Lights are needed

Number of Fans = 2.27

So, 2 Fans are needed.

- **KITCHEN**

Area : 10x9 ft^2= 8.37 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 1.91

So, 2 light Bulbs are needed.

- **TOILET**

Area : 9x6 ft^2= 5.02 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.57

So, 1 light Bulb is needed.

- **Generator Room:**

Area : 10x9 ft^2= 8.36 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.95

So, 1 light Bulb and a tube light is needed.

- **Guard Room:**

Area : 10x9 ft^2= 8.36 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.95

So, 1 light Bulb and a tube light is needed.

Number of Fans = 0.9

So, 1 Fan is needed.

- **Garage:**

Area : 34.58x29.5 ft^2= 94.76 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 10.83

So, 11 light Bulbs are needed.

- **Veranda:**

Area : 10x5 ft^2= 4.64 m^2

Illuminance , E = 100 Lumen/m^2

Light Loss Factor & Utilization Factor , LLF x UF = 0.7

Number of lights per illuminaire , n= 1

Flux = 1250 Lumen

Number of lights , N = 0.37

So, 1 light Bulb is needed.

• CALCULATION FOR CONDUITS :

- **Formulae :**

for ampere rating , I = $\frac{P}{V*pf}$ (A)

Power Factor , pf = 0.7

- **Apparatus :**

Energy Saving Bulb, **K** = 20 W

Tube Light, **L** = 20 W

Ceiling Light , **L** = 20 W

Ceiling Fan ,**F** = 100 W

Switch-Board Socket , **SS**= 100 W

Exhaust Fan ,**EF** = 60 W

• CALCULATIONS FOR SDB→ SB

- **CKT-1 RATING :**

It consists of SB3 & SB6:

P1 = 20*3+60*2+100 = 280*W*

$I = \frac{280}{220*0.7} = 1.81A$

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-2 RATING :**

It consists of SB1 & SB4:

P2 = 20*6+100*4+100*2= 720 *W*

$I = \frac{720}{220*0.7} = 4.67\ A$

According to the chart , this current rating is below 5*A* .

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

- **CKT-3 RATING :**

It consists of SB2:

*P3 = 20*2+100*2+100*= 340 *W*

$I = \frac{340}{220*0.7}$ = 2.2 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-4 RATING :**

It consist of SB5:

*P4 =20*2+100*2+100* = 340 *W*

$I = \frac{340}{220*0.7}$ = 2.2 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-5 RATING :**

It consist of SB7:

P5=20W

$I = \frac{20}{220*0.7}$ = 0.13 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

SWITCH BOARD (SB) : From switch board to all fittings we will use 2 x 1.5 rm B

- **CALCULATIONS FOR SDB(Ground)→ SB(Ground)**

SUB DISTRIBUTION BOARD (SDB)

- **CKT-1 RATING :**

It consists of SB1g,SB2g & SB3g:

P1 = 20*5+60*4+100*2 = 540*W*

$I = \frac{540}{220*0.7}$ = 3.5*A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-2 RATING :**

It consists of SB4g:

P2 = 20*11= 220 *W*

$I = \frac{220}{220*0.7}$ = 1.42*A*

According to the chart , this current rating is below 5*A* .

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC are used

- **CALCULATIONS FOR ESDB → ESB**

EMERGENCY SUB DISTRIBUTION BOARD (SDB)

- **CKT-1 RATING :**

It consists of ESB3 &ESB6

P1 =20*2 = 40 *W*

I = $\frac{40}{220*0.7}$ = 0.26 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-2 RATING :**

It consists of ESB1 & ESB4:

P2 = 20*2+100*2 =240 *W*

I = $\frac{240}{220*0.7}$ = 1.56 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-3 RATING :**

It consists of ESB2

P3 = 20+100 = 120 *W*

$I = \frac{120}{220*0.7}$ = 0.78 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-4 RATING :**

It consists of ESB5

P4 = 100+20 = 120 *W*

$I = \frac{120}{220*0.7}$ = 0.78 *A*

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CALCULATIONS FOR ESDB(Ground)→ ESB(Ground)**

EMERGENCY SUB DISTRIBUTION BOARD (SDB)

- **CKT-1 RATING :**

It consists of ESB1g & ESB3g:

P1 = 20*2 = 40*W*

$I = \frac{40}{220*0.7} = 0.26A$

According to the chart, this current rating is below 5*A*.

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC is used.

- **CKT-2 RATING :**

It consists of ESB4g:

P2 = 20 *W*

$I = \frac{20}{220*0.7} = 0.13A$

According to the chart , this current rating is below 5*A* .

So, 2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

- **CALCULATIONS FOR MDB → SDB**

SDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

SDB Current $= \frac{SDB\ Load}{V*pf}$ A

Total Load = P1 + P2 + P3 + P4 +P5= 280+720+340+340+20 = 1700 W

We did not use ant P-socket.

- **Q - SOCKET:**

Current Rating : 20 *A*

Power factor : 0.3

Total Q socket used : 3

Power for Q socket : 4000W

- **CIRCUIT BREAKER :**

20A SP MCB is needed from MDB → Q Socket

- **CONDUIT :**

2 x 6 rm BYM + 6 rm BYA ECC are used.

SDB Load = 1700 *0.7+ (3* 4000 *0.3) = 4790 W

SDB Current $= \frac{4790}{220*0.7}$ A = 31.1A

- **CIRCUIT BREAKER :**

40A SP MCCB is needed from MDB to SDB

- **CONDUIT :**

2 x 16 rm BYM + 16 rm BYA ECC are used.

- **CALCULATIONS FOR EMDB → ESDB**

ESDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

ESDB Current = $\frac{ESDB\ Load}{V*pf}$ A

Total Load = P1 + P2 + P3 + P4= 40+240+120+120 = 520 W

No P/Q sockets were used in the emergency circuits

ESDB Load = 520*0.7=364 W

ESDB Current = $\frac{364}{220*0.7}$ A = 2.36 A

- **CIRCUIT BREAKER :**

5A SP MCCB is needed from EMDB to ESDB

- **CONDUIT :**

2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

- **CALCULATIONS FOR MDB → SDB(G)**

SDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

SDB Current $= \frac{SDB\ Load}{V*pf}$ A

Total Load = P1 + P2 = 540 + 220= 760W

We did not use ant P/Q-socket.

SDB(G) Load = 760*0.7=532W

SDB(G) Current $= \frac{532}{220*0.7}$ A = 3.45A

- **CIRCUIT BREAKER :**

5A SP MCCB is needed from MDB to SDB

- **CONDUIT :**

2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

- **CALCULATIONS FOR EMDB → ESDB(G)**

ESDB Load = Total load x 0.7 + Total P socket load x 0.2 + Total Q socket load x 0.3

ESDB Current $= \frac{ESDB\ Load}{V*pf}$ A

Total Load = P1 + P2 = 40+20 = 60 W

No P/Q sockets were used in the emergency circuits

ESDB(G) Load = 60*0.7=42 W

ESDB(G) Current $= \frac{42}{220*0.7}$ A = 0.27 A

- **CIRCUIT BREAKER :**

5A SP MCCB is needed from EMDB to ESDB

- **CONDUIT :**

2 x 1.5 rm BYM + 1.5 rm BYA ECC are used.

• CALCULATIONS FOR EMDB:

EMDB Load = Total ESDB Load + Lift load(Already multiplied with 0.7 so no need to multiply again)

Total ESDB Load = 5x ESDB Load+ ESDB(G) Load

EMDB Current = $\frac{EMDB\ Load}{\sqrt{3}*line\ voltage*pf}$

Phase Voltage = 220V

Line Voltage = 381.05 V

Pf = 0.7

No lift in our design

ESDB Load = 364 W, ESDB(G) Load=42W

Total ESDB Load = 5*364+42=1862 W

EMDB Load=1862W

EMDB Current = $\frac{1862}{\sqrt{3}*381.05*0.7}$ = 4.03 A

10 A TP MCCB is needed for EMDB to MDB.(Just to be safe)

- **CALCULATIONS FOR MDB:**

MDB Load = Total SDB Load + (EMDB Load + Pump)

Total SDB Load = 5 x SDB Load + SDB(G) Load

MDB Current = $\frac{MDB\ Load}{\sqrt{3}*line\ voltage*pf}$

Phase Voltage = 220V

Line Voltage = 381.05 V

Pf = 0.95(due to PFI plant)

SDB Load = 4790 W

SDB(G) Load=532W

Pump load=5000W

Total SDB load=5*4790+532=24482W

MDB Load = 24482+5000 = 29482W

MDB Current = $\frac{29482}{\sqrt{3}*381.05*0.95}$ = 47.02 A

50 A TP MCCB is needed for MDB to Main line.

- **CALCULATIONS FOR TRANSFORMER:**

S = 3 VI = 3 * 220 * 47.02 =31.033kVA

So, 11/0.415 KVA, 50Hz, 50 KVA ,DYN 11,OIL IMMERSED TRANSFORMER WITH 4-6% LINE IMPEDANCE IS REQUIRED.

- **CALCULATIONS AIR TERMINALS:**

Total circumference = 2 *(61.1+40.7) = 203.6 feet=62 m (approx.)

Air terminals should be placed at 20m distance.

Air terminal number = 62/20 = 3.1 =3(After rounding up)

- **CALCULATIONS FOR MINIMAL LOAD DENSITY:**

According to RAJUK, for Air conditioned dwelling abodes 100 W/m^2 should be unit load.

In our case minimal Load = Total Load/Apartment size in m^2

= (4790+532)/(40.7*27.8)*0.3048*0.3048

= 50.62 W/m^2

- **Calculations for PFI Plant:**

$\cos\theta = 0.7$ $\sin\theta = \sqrt{(1-\cos\theta)^2}$ 0.714

Q=3Vlsinθ= Ptanθ = 30.1 KVAR

After Pf improvement, sinθ = 1

$$I = \frac{Q}{3 * V * \sin\theta}$$

=36.88A

So, 50 A TP MCCB is needed from PFI to MDB