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ABSTRACT

Multi-functional building is a building creates to serve particular functions either for private or public sectors.

The concept of a single structure serving a multitude of functions is not particularly new, Any large city, for example, contains office buildings with stores on the street floor, residential structures built over shops.

Nowadays, we have begun to see buildings that are contains many functions like commercial, apartments and shops, these buildings that called "multi-functional building".

A multi-functional building are emerged in past centuries and the concept are developed through the ages. This kind of building are become popular in this century in many countries to meet a lot of resident's needs.
Multi –functional buildings are considered as a very important type of buildings in any developing city, Because it has many benefits for residents of the area and the site in general, such as saving time, money, and effort for the population of that region in general , and the residents of the building in particular. This is due to the existence of all functions that they need in the same area.

These types of buildings are also friendly with the environment, the short distance that population have to pass every day without any doubt reduce the bad effect of car's pollution on the environment, so it helps to revive the region with a clean environment, away from traffic congestion and exhaust fumes.

The idea from this project is to create a distinctive building; such building has multiple activities like social, commercial and residential, etc.

The building has been designed of all aspects of construction such as structural design (one way ribbed slab), architectural design (Revit), electrical design, mechanical design, quantity surveying (QS), heating and air conditioning (HVAC) total heating load equal to 25.16 kW and total cooling load equal to 31.5 kW.

The total cost of the project has been calculated and equal to **4064006 NIS**

خلاصة الرسالة

المبنى المتعدد الوظائف هو بناء يخلق لخدمة وظائف معينة سواء للقطاع الخاص أو العام.

مفهوم الهيكل الواحد الذي يخدم العديد من الوظائف ليس بالأمر الجديد، أي مدينة كبيرة على سبيل المثال تحتوي على مباني للمكاتب مع مخازن على مستوى الشارع وشقق سكنية تبنى فوق هذه المكاتب.

في الوقت الحاضر، ونحن قد بدأنا المباني المتعددة الوظائف مثل المحلات التجارية والمكاتب والشقق السكنية وهذه المباني تسمى "المباني المتعددة الوظائف".

ظهرت الأبنية المتعددة الوظائف في القرون الماضية ويتم تطويرها على مر العصور، وأصبح هذا النوع من المباني منتشرا في هذا القرن في كثير من البلدان لتلبية الكثير من احتياجات السكان.

تعتبر المباني متعددة الوظائف كنوع مهم جدا من المباني في أي مدينة نامية لما له من فوائد عديدة لسكان المنطقة والمدينة بشكل عام مثل توفير الوقت والمال والجهد لسكان تلك المنطقة عموما، وسكان المبنى على وجه الخصوص. ويرجع ذلك إلى وجود جميع الوظائف التي يحتاجون إليها في نفس المبنى.

هذه الأنواع من المباني هي أيضا صديقة مع البيئة، المسافة القصيرة التي يقطعها السكان يوميا تقلل من التأثير السيء للتلوث الناجم عن السيارات لذلك يساعد على انعاش المنطقة مع وجود بيئة نظيفة، بعيدا عن حركة المرور الازدحام وأبخرة العادم.

الفكرة من هذا المشروع هو خلق مبنى مميز؛ هذا المبنى له أنشطة متعددة مثل الاجتماعية والتجارية والسكنية، الخ..

وقد تم تصميم المبنى من جميع جوانب البناء مثل التصميم الهيكلي والتصميم المعماري باستخدام برنامج Revit وتصميم الكهرباء، و التصميم الميكانيكي، وحساب الكميات، وأنظمة التدفئة والتكييف حيث كان مجموع الحمل في التدفئة يساوي 25.16 كيلو واط ومجموع الحمل في التبريد يساوي 31.5 كيلو واط .

وقد تم حساب التكلفة الإجمالية للمشروع والتي تساوي 4064006 شيكل.

CHAPTER 1

ARCHITECTURAL DESIGN

1.1 Introduction:

As a result of jenin strategic location, economical importance and its social needs, we decided to design a Multi-functional building in this city.

This project presents an integrative design of a Multi-functional building. The design involves architectural, structural, environmental, electrical, mechanical, and safety issues. So the main chapters in this project are:

1.2 Site analysis

1.2.1 Architectural design:

in this part we tried to make creative architectural design as much as we can, the building consist of six stories located in jenin.

1.2.2 Environmental design:

In this part we will illustrate the solar design by using ECOTECT program to analyze the sun movement, to try increase the solar gain at winter and decrease it at summer by using different types of shading.

1.2.3 Electrical Design:

In this part DIALUX program and manual calculation will use to the design.

1.2.4 Mechanical Design:

To design the mechanical issues for the building many types of design will take into account these branches were:

1. Water Supply Systems.
2. Drainage Water Systems Design.
3. HVAV Systems Design.

1.2.5 Safety:

the building will design taken into account the safety issues.

1.2.5.1 Structural design:

structural design consist of two parts:

1.2.5.1.1 Static design:

in this part we will study the loads and stresses that the structural elements are subjected to, due to the gravity loads and then the appropriate design of the structural elements will be performed.

1.2.5.1.2 Dynamic design:

here we will analyze and study the structure under dynamic loads, such as earthquakes. After that we will study the best design that saves structure from failure under seismic loads to improve the safety requirements for humans.

1.2.6 Maintenance and operation system :

This is the main object of our project parts

1.3 About the project

Multi-functional building is a building creates to serve particular functions either for private or public sectors.

The concept of a single structure serving a multitude of functions is not particularly new, Any large city, for example, contains office buildings with stores on the street floor, residential structures built over shops.

Nowadays, we have begun to see buildings that are contains many functions like commercial, apartments and shops, these buildings that called "multi-functional building".

A multi-functional building are emerged in past centuries and the concept are developed through the ages. This kind of building are become popular in this century in many countries to meet a lot of resident's needs.
Multi –functional buildings are considered as a very important type of buildings in any developing city, Because it has many benefits for residents of the area and the site in general, such as saving time, money, and effort for the population of that region in general , and the residents of the building in particular. This is due to the existence of all functions that they need in the same area.

These types of buildings are also friendly with the environment, the short distance that population have to pass every day without any doubt reduce the bad effect of car's pollution on the environment, so it helps to revive the region with a clean environment, away from traffic congestion and exhaust fumes.

The idea from this project is to create a distinctive building; such building has multiple activities like social, commercial and residential, etc.

The primary goal of the project is to design an integrated building, which is environmental-friendly, and has maintainability concepts, in addition to has integrated design of all aspects of construction such as structural design, architectural design, electrical design, mechanical design, quantity surveying (QS), heating and air conditioning (HVAC).

The main objectives of this project are:

- To create an environmental-friendly building.
- To avoid operation and maintenance problems during the design development and Review stages.
- To utilize land in order to build one building that combined many activities.

1.4 The architectural description of the Project:

Architectural work is the first step in any construction project, since the Architectural Design aims to provide creative and unique design. But the best architectural design that satisfy the client needs and requirements and at the same time does not conflict with structural requirements.

In our project we tried to make the creative architectural design as much as we can, and all architectural drawing had been done over plans such that the plans meet the goal of this project, to be more suitable with the location and its environments. The building consist of six floors and Parking in the basement

These floors are:

- ✓ Basement floor and it contains the parking.

Our parking have to iterance and it will be able to have 11 cars, and we try to make a good circulation to easy movement for the car .

- ✓ Ground floor, consist of 11 commercial stories and restaurant.

Table 1-1: Area for each space in Ground Floor.

Store name	area	Store name	area
Resturent1	24	Shop 5	16
Restaurant 2	38	Shop 6	17.5
Shop 1	23.8	Shop 7	29
Shop 2	25.5	Shop 8	11
Shop 3	39	Shop 9	11.8
Shop 4	16.1		

✓ First floor with consists of 12 commercial stories.

Table 1-2: Area for each space in 1st Floor.

Store name	area	Store name	area
Resturent1	24	Shop 5	16
Restaurant 2	38	Shop 6	17.5
Shop 1	23.8	Shop 7	29
Shop 2	25.5	Shop 8	11
Shop 3	19.4	Shop 9	11.8
Shop 4	16.1	Shop 10	19.8

✓ Second and third floors, consist of 5 offices.

Table 1-3: Area for each space in 2nd & 3rd Floor.

Office number	Area
one	140
tow	57
three	73
four	62
five	*56*

✓ Fourth and fifth floors, and consist of 4 apartments.

Table 1-4: Area for each space in 4th & 5th Floors.

apartments number	area
one	150
tow	128
three	120
four	116

1.5 Stairs :

In our project we have three saris , one for the residential floor , tow for the commercial and offices .

1.5.1 Residential stair :

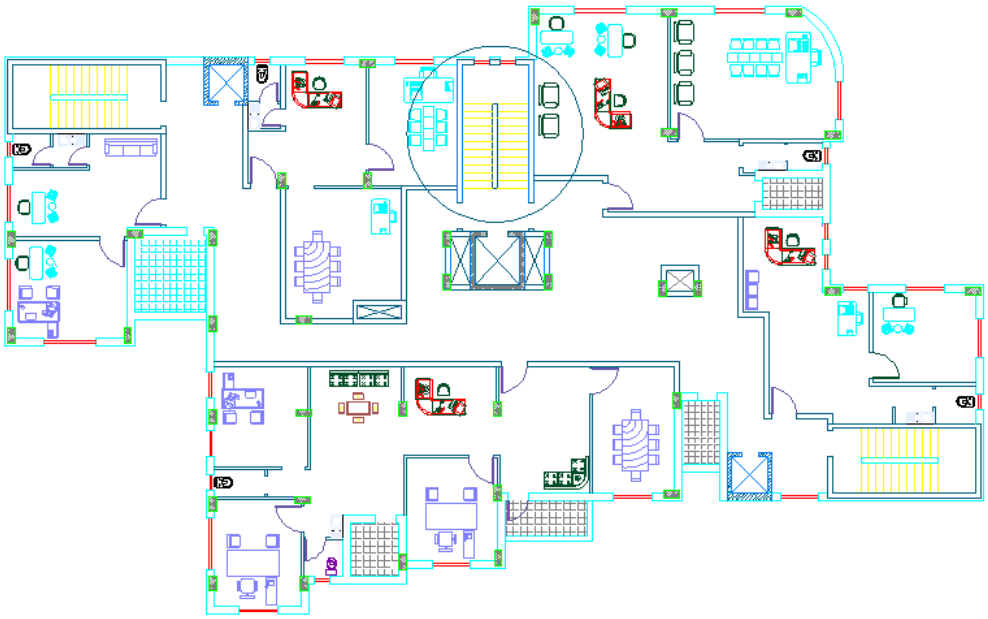


Figure 1-1: Position of Residential Stair.

- ✓ The users of this stairs is the occupant of the residential floor
- ✓ This stairs up from the parking to Roof .
- ✓ The door of this stairs on 1st to 3rd floors connect to notification system and open to the stairs just in emergency situation.

1.5.2 Commercial and offices stairs :

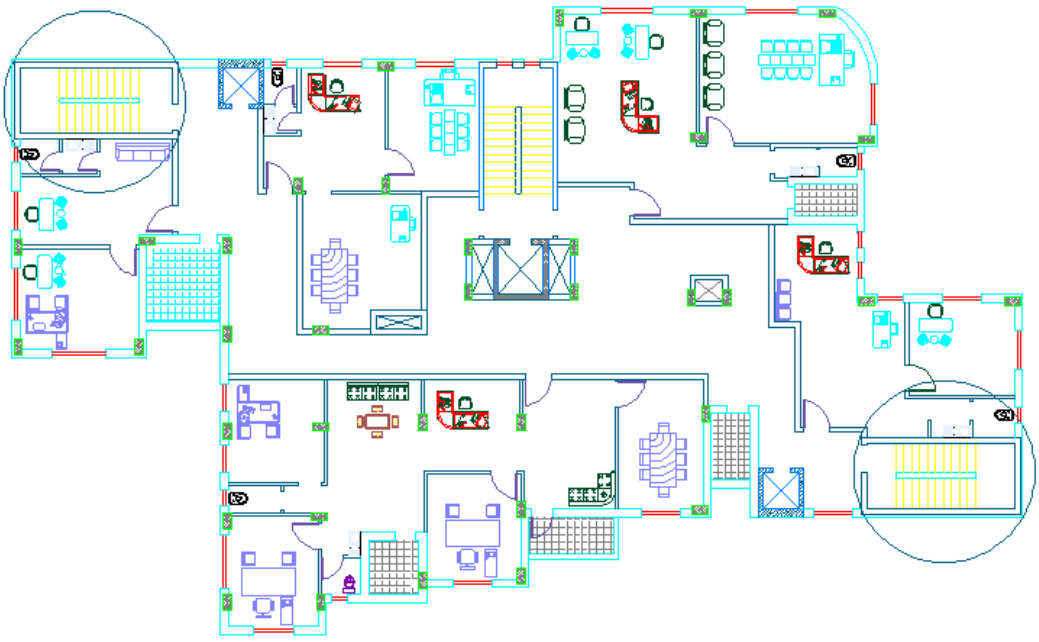
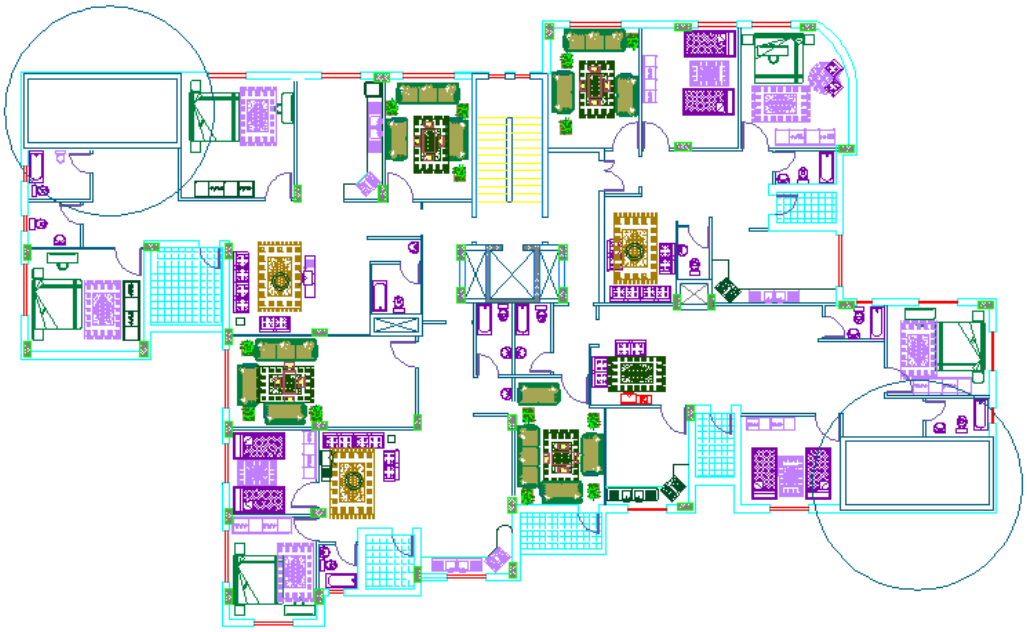


Figure 1-2: Position of Commercial and Offices stairs.

- ✓ The users of this stairs is the users of the commercial and offices floor .
- ✓ This stairs up from the parking to the 3rd floor .

1.5.3 Mechanical room :



Mechanical room lies in the 4th floor , we can reach it from the offices stairs , and it contains water tanks for shopping's and offices floors and chillers for HVAC supply .

The floor of the room has a water proofing and acoustical insulation to solve the problem of vibration and water leakage.

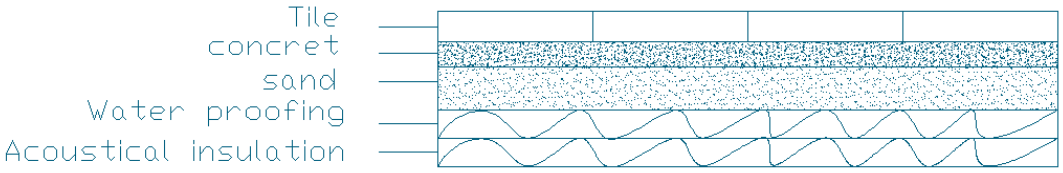


Figure 1-3:Section details in the floor of mechanical room.

CHAPTER 2

STRUCTURAL DESIGN

2.1 Introduction:

In any activity involving structural analysis, structures are investigated to determine their behavior under a given set of actions. Such an investigation includes the determination of the external action that will affect the structure and the resulting internal moment, shear, and direct forces that are produced. These internal member actions are then utilized to design the final member sizes for the total structure. Because of these relationships between external and internal actions, it's extremely important to ensure that the initial determination of the various actions affecting a structure is accurate.

2.2 Design Codes:

The structural design will be according to:

- ✓ The American Concrete Institute code ACI 318-05.
- ✓ The seismic design according to UBC-97.

First preliminary analysis and design using 1D and 2D models were made, then the analysis and design were done using 3D model using SAP2000 program.

Design will include the following elements:

1) Slab (one way rib slab).

2) Beam (main beam & secondary beam).

3) Column.

4) Shear wall.

5) Stairs.

6) Footing

2.3 Loads:

Loads are classified into two main types:

2.3.1 Gravity loads :

- ✓ Dead load.
- ✓ Live load.

2.3.2 Dead load:

It consists of weight of all permanent construction such as

2.3.2.1 Slab own weight:

Own weight (O.W): the loads due to the own weight of the structure, which will remain constant during the life of the structure.

2.3.2.2 Superimposed dead load (S.I.D):

It considered as dead load, it result from the own weight of the backfill, the tile and mortar.

Superimposed dead load = 4 kN/m2

2.3.3 Live load:

Is the load produced by the use and occupancy of the structure, it is based on function of the building. We specify the live load from special table according to ASCE 7-05. Conservatively, for this building the live load as in this table:

Table 2-1: Live load in building.

Type of Occupancy	Live Load (kN/m2)
Parking	**2.50**
Commercial floors	**4.8**
Offices floors	**2.5**
Residential floors	**2.5**

2.4 Load combination:

ultimate design method will be used. Thus, the following are the load combinations and factors of safety in design.

The load factors are: according to ACI 318-08:

- ✓ Wu= 1.4D.L
- ✓ Wu= 1.2D.L+ 1.6L.L

Where:

D.L: Dead load

L.L: live load

2.5 Programs used:

- ✓ In analysis and design we use: SAP2000 program
- ✓ Excel spreadsheet is used for manual computations.
- ✓ In drawing details we use: AutoCAD 2007

2.6 Design data:

In this project the reinforced concrete material will be used, it consists of reinforcing steel and fresh concrete mix placed in the forms to form the final required cross section.

The following properties of fresh concrete and reinforcing steel that will be used:

- ✓ **Compressive strength of concrete (f\c):**

It's the compressive strength of test cylinder 15cm in diameter and 30cm high measured at an age of 28 days.
The compressive strength of concrete for beams, shear walls, columns and footing was chosen as

f\c =25Mpa,and f\c =24 Mpa for slabs.

- ✓ **Yielding strength of steel (f_y):**

The yield strength of steel for flexure equal fy = 4200 kg/cm2 and for shear reinforcement equal Fy = 420Mpa.

- ✓ **Unit weights of materials:**

Table 2--22-: Density of the main materials used.

Material	Unit weight (kN/m3)
Reinforced concrete	**25**
Brick	**12**
Light weight block	**7.8**
Masonry stone	**26**
Sand	**18**

Aggregate	**17**
Polystyrene	**0.3**
Mortar	**2.3**
Tile	**12**

- ✓ **Bearing capacity of soil:**

It's the load per unit area that the soil is allowed to carry. For project the bearing capacity of soil = 100 Mpa.

2.7 Structural Systems Design:

2.7.1 Slab design:

One way ribbed slab is selected in designing this building for these reasons:

- ✓ Low cost formwork.
- ✓ Fast.
- ✓ More practical.
- ✓ Length of spans assort with this system.
- ✓ More absorption of noise.

2.7.1.1 Thickness of the slab:

The general equation of the minimum thickness of slab as shown in Table:

Table 2-3: General equation of the minimum thickness of slab .

Element	One end continues	two end continues	Simply supported	Cantilever
One way solid slab	$\frac{Ln}{24}$	$\frac{Ln}{28}$	$\frac{Ln}{21}$	$\frac{Ln}{10}$
Ribbed slab	$\frac{Ln}{18.5}$	$\frac{Ln}{21}$	$\frac{Ln}{16}$	$\frac{Ln}{8}$

The longest span(and it one end continues) = 580 cm.

The thickness of slab (h) = $\frac{580}{18.5} = 31.35$ cm

The longest span(and it two end continues) = 650 cm and it one end continues.

The thickness of slab (h) = $\frac{650}{21} = 30.95$ cm

So use(32) cm slab with 52 cm rib width.

Across section of the ribbed slab as shown in Figure

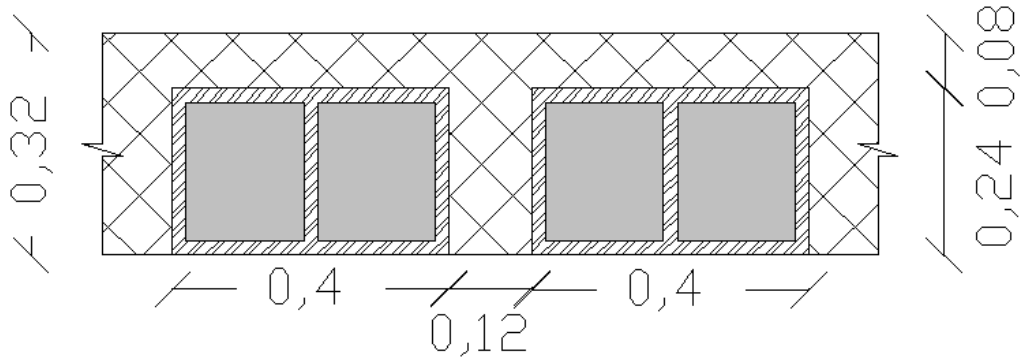


Figure 2-1: Cross section of the ribbed slab.

check ribbed slab diminution:

H_f = 60mm > 50mm → OK

bw = 120 mm > 100 mm → OK

h =320 mm < 3.5 *120 mm → OK.

2.7.1.2 Slabs Own Weight:

Assume total super imposed load on slab =4Kn/m^2

Live load =4.8Kn/m^2

Slab thickness = 32 cm

Assume the width of the rib = 52cm.

- ✓ **Weight of slab in the commercials floor (L.L=4.8KN):**

Weight of slab/rib = 0.52 × 0.08 × 25 + 0.12 × 0.24 × 25 + 0.24 × 0.4 × 12

= 2.912 KN/rib

Weight of slab/m = 2.912/0.52 = 5.6 KN/m^2

Total dead load for slab = slab weight+ superimposed

= 5.6+ 4 = 9.6 KN/m2

Ultimate load:

= (1.2*9.6) + (1.6*4.8)

= 19.2 KN/m2 = 9.984KN/rib.

- ✓ **Weight of slab in the others floors (L.L=2.5KN):**

Weight of slab/rib = 0.52 × 0.08 × 25 + 0.12 × 0.24 × 25 + 0.24 × 0.4 × 12

= 2.912 KN/rib

Weight of slab/m = 2.912/0.52 = 5.6 KN/m2

Total dead load for slab = slab weight+ superimposed

= 5.6+ 4 = 9.6 KN/m2

Ultimate load:

= (1.2*9.6) + (1.6*2.5)

= 15.52 KN/m2 =8.07KN/rib

- ✓ **Weight of Masonry wall:**

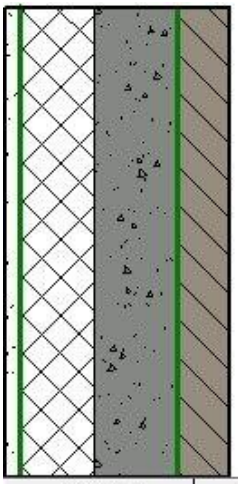
wall thickness = 300 mm

- ✓ 0.07 m stone
- ✓ 0.11m concrete
- ✓ 0.1 m block
- ✓ 0.02 m plasting.

Then, the weight of wall =

(0.07×26+ 0.11× 24 + 0.1×12 + 0.02×23)

*4 * 1.2 = 29.4 KN/m



Material	Thickness
Stone (2)	0.0700
Layers Above Wra	0.0000
Concrete	0.1100
Masonry - Conc	0.1000
Plaster	0.0200

Figure 2-2: Layers in the external wall and dimensions.

2.7.2 Analysis and Design of Stair cases:

2.7.2.1 Dimensions:

Floor elevation is 4m; the going of the stair is 33cm as standards.

Flights and landings thickness will be 15 cm .

The rise of the stair 0.18 cm .

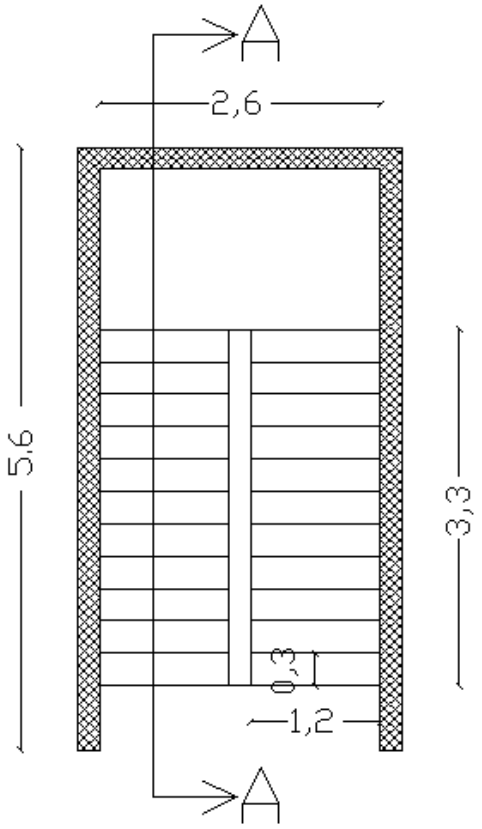


Figure 2-3: Plan of the stair.

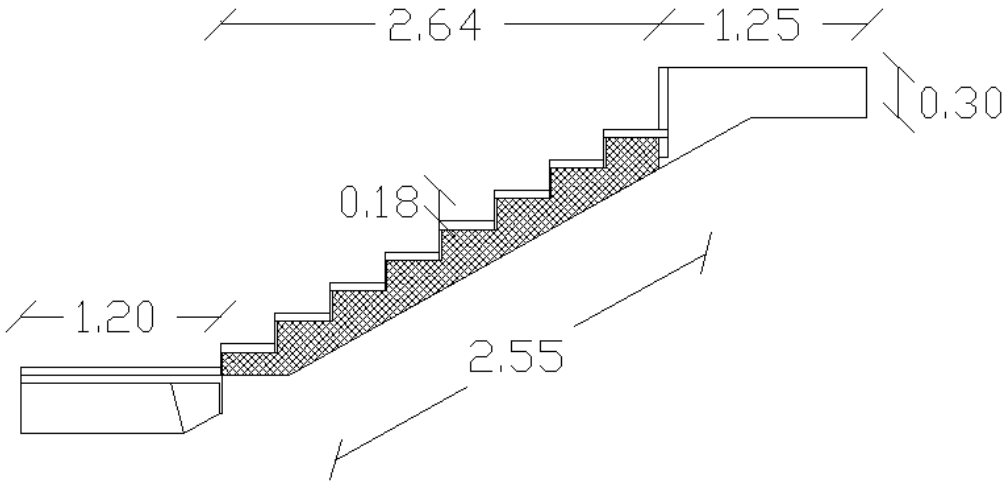


Figure 2-4: Section of the stair.

2.7.2.2 Loads on the staircase:

Loads on the landings:

- ✓ live load = 4KN/m2,
- ✓ Dead loads: own weight= 0.15X25=3.75 KN/m2 assume 4KN/m2
- ✓ super imposed dead load from tiles = 2.7 KN/m2

Loads on the flights:

- ✓ live load = 4KN/m2,
- ✓ Dead loads: own weight= 0.15X25=3.75 KN/m2 assume 4KN/m2

Weight of the stairs = 2.5 *(no.of stairs-1)*0.3*0.16/2

Super imposed loads from tiles =(0.18+0.3)*0.27 *(no. of stairs -1)

For 7 stairs flight, weight of stairs =2.5*7*0.3*0.16/2=4.2 KN/m = (4.2/2.5)=1.7KN/m2

Super imposed loads from tiles=(0.18+0.3)*0.27*7=8.7KN/m=3.5 KN/m2

total loads on flight = 5.2 KN/m2

2.8 SAP Models and Verification:

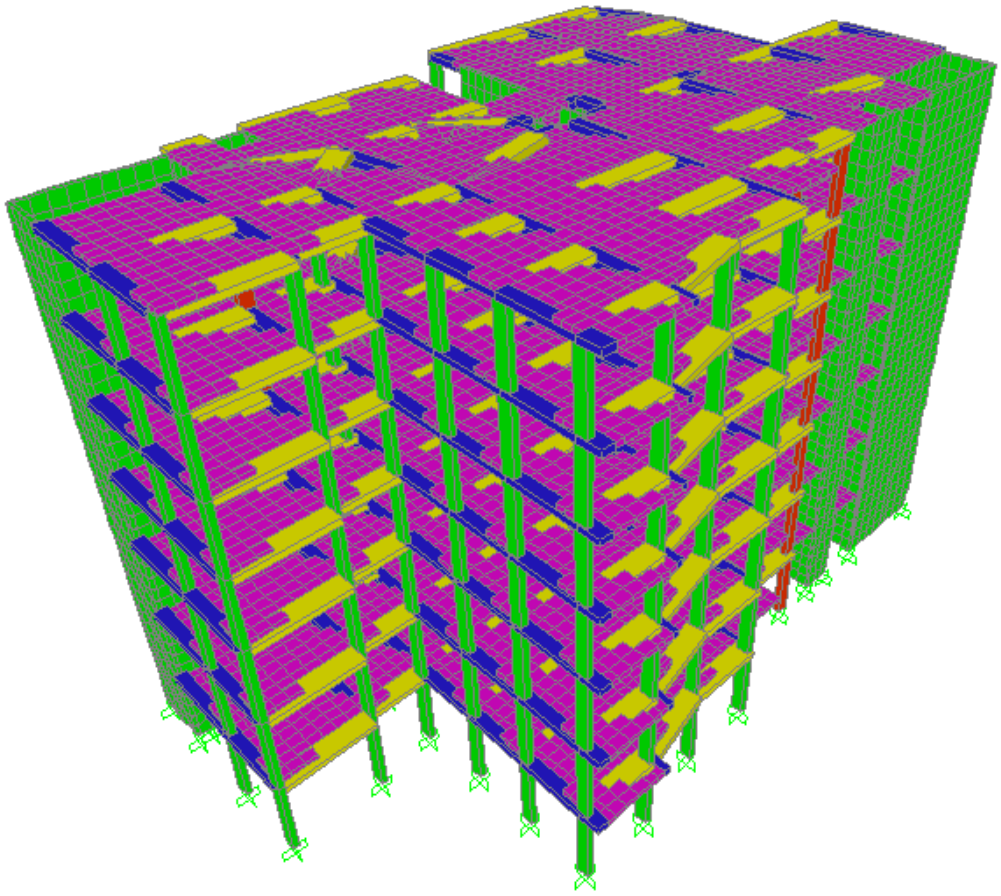


Figure 2-5: SAP Model.

2.8.1 Check model:

Model Validation

To be confident that SAP model works properly and gives correct results we have to make three checks on the model and results obtained. The checks are:

- ✓ Compatibility of structural elements in the model.
- ✓ Global Equilibrium.
- ✓ Local Equilibrium (Internal forces).

2.8.1.1 Compatibility check:

we have to make sure that all the structural elements are compatible with each others. This can be achieved by noticing and analyzing the deformed shape animation of the model from SAP.

If the compatibility is satisfied this ensure that the structure behaves as a unit and all members are compatible together.

The compatibility of the model was checked and it was OK, Figure …shows the deformed shape of the model under dead and live loads.

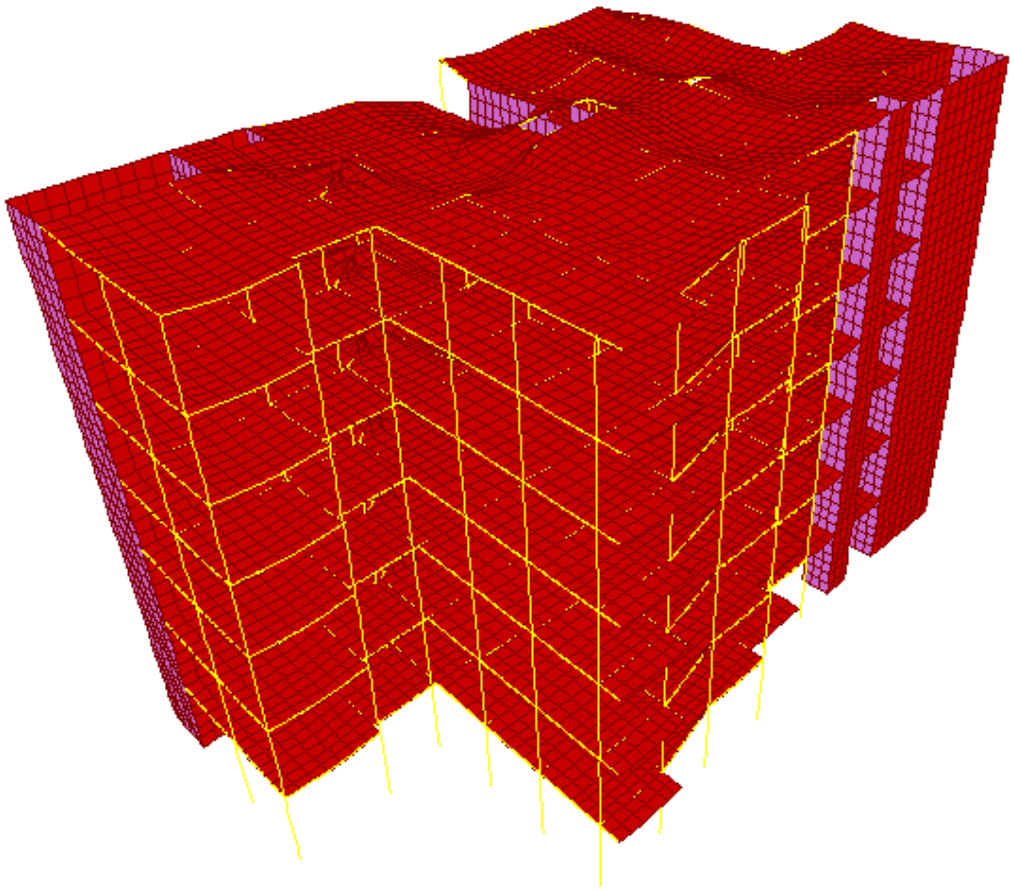


Figure 2-6: Compatibility check.

2.8.1.1.1 Equilibrium

✓ **Equilibrium in the vertical direction (due to gravity loads *)***

It is the second rule that should be satisfied, that is the total reactions in columns must equal the total loads applied.

Hand calculation results:

✓ **For LL**

Table 2-4: Hand calculation for LL .

slab ID	area (m^2)	LL (kN/m^2)	total LL (kN)
$slabs_{1,2,3}$	3(720)=2160	2	4320
$slab_{roof4}$	720	4.8	3456
$slab_{roof5}$	720	10	7200
			∑ = 14976

SAP result for LL = 16264.172 (kN)

% Error =($\frac{16264.172 \ -14976}{16264.172}$)*100 =3.28% < 5% which is ok

✓ **For SDL**

Table 2-5: Hand calculation for SDL.

slab ID	area (m^2)	SDL (kN/m^2)	total SDL(kN)
$slabs_{1,2,3}$	3(720)=2160	5.4	11892.906
$slab_{roof4}$	720	5.4	3964.302
$slab_{roof5}$	720	5.4	4212.648
			∑=20069.856

SAP result for SDL = 20614.71 kN

% Error =($\frac{20614.71 \ - 20069.856}{20614.71}$)*100 = 2.64 % < 5% which is ok

✓ ***For DL***

DL =∑weights of (slabs +columns+ beams +parameter wall)

1) Slabs weight

Table 2-6: Hand calculation for slabs weight.

slab ID	area (m^2)	slab DL(kN/m^2)	total slab DL(kN)
$slabs_{1,2,3}$	3(720)=2160	5.25	11562.548
$slab_{roof4}$	720	5.25	3754.182
$slab_{roof5}$	720	6.25	4875.75
			∑=20192.48

2) Columns weight

Table 2-7: Hand calculation for columns own weight.

col ID	col area(m^2)	# of col of l= 21.5m	col volumn(m^3)	total col DL(kN)
col 0.4	0.16	14	2.24	1204
col 0.5	0.25	14	3.5	1881.25
col 0.6	0.36	6	2.16	1161
col 0.8	0.64	6	3.84	2064
				∑=6310.25

3) Beams weight

Table 2-8: Hand calculation for beams own weight.

beam ID	beam dimensions (m)	total length(m)	total beam DL(kN)
B 1	0.32 * 0.7	245.6	1203.44
B 2	0.32 * 0.4	257	488.3
B 3	0.32 * 0.7	0	0
b1	0.32 * 0.7	234.4	445.36
b2	0.32 * 0.7	118	578.2
b3	0.32*0.7	0	0
			2715.3

4) Exterior walls

Wall load / m^2 = 5.6 KN / m

Wall load for the 4 m height = 4*5.6 = 22.4 KN

All floors parameter = 5*(2*(39.4 + 19.8*)) = 592 m

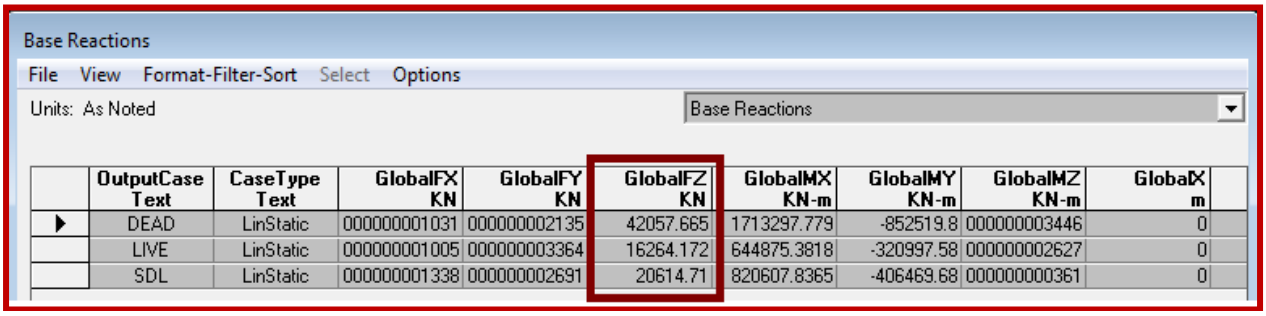
wall load = 22.4*592 = 13260.8 KN

DL =∑weights of (slabs +columns+ beams +parameter wall)

DL = (20192.48+ 6310.48+ 2715.3+ 13260.8) = 42479.38 KN

SAP result for DL = 42057.665 kN

% Error =($\frac{42057.665 \quad -42479.38}{42057.665}$)*100 = 1 % < 5% which is ok



	OutputCase Text	CaseType Text	GlobalFX KN	GlobalFY KN	GlobalFZ KN	GlobalMX KN-m	GlobalMY KN-m	GlobalMZ KN-m	GlobalX m
▶	DEAD	LinStatic	000000001031	000000002135	42057.665	1713297.779	-852519.8	000000003446	0
	LIVE	LinStatic	000000001005	000000003364	16264.172	644875.3818	-320997.58	000000002627	0
	SDL	LinStatic	000000001338	000000002691	20614.71	820607.8365	-406469.68	000000000361	0

Figure 2-7: SAP results for reactions in the nothern part of the building.

Table 2.9 shows the comparison between sap and manual results:

Table 2-9: comparison between SAP and manual results.

Load type	Hand results (KN)	SAP results (KN)	Error %
live load	15729.804	16264.172	3.28
SID load	20069.856	20614.71	2.64
dead load	42479.38	42057.665	1

Thus, the errors between hand calculation and SAP results are very small and less than 5%, so accept results

2.8.1.2 Deflection check:

The maximum deflection in the slab from service loads (Dead+live) is 10mm (very small).

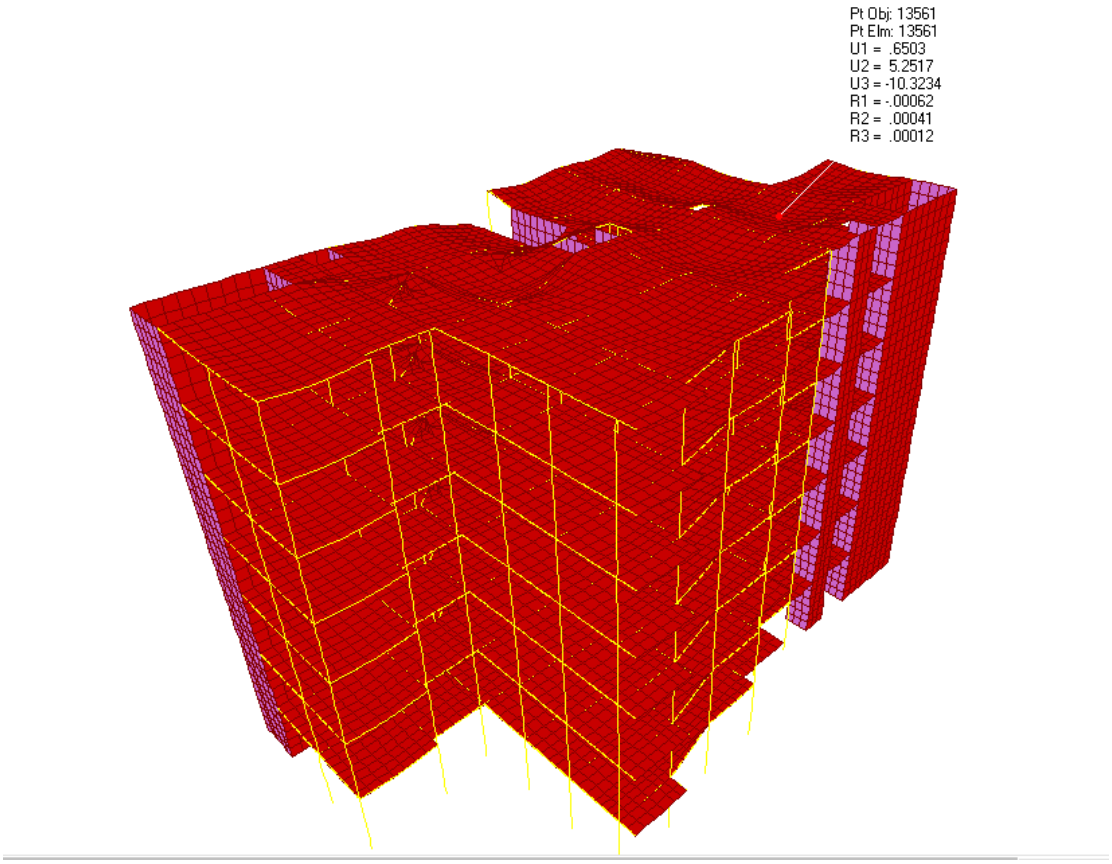


Figure 2-8: Deflection checks.

2.8.2 Reinforcement:

We will use Sap program in designing and calculating the reinforcement of the building:

And we will design these structural elements:

- ✓ 1-slab
- ✓ 2-Beams
- ✓ 3-Columns
- ✓ 4-Footings
- ✓ 5-Shear walls

2.8.2.1 Slab design :(One way ribbed slab):

We used sap program to determine the moment on the slab

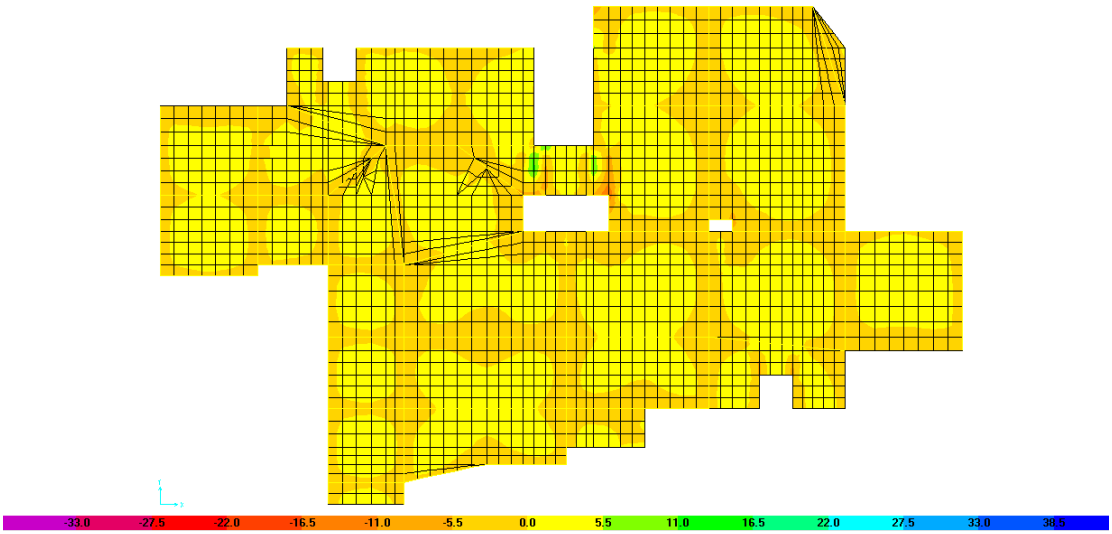


Figure 2-9: SAP Model for slab.

Table 2-10: SAP Reinforcement.

Panel number	Bottom steel	Top steel
1	2ϕ12	2ϕ14
2	2ϕ12	2ϕ14
3	2ϕ12	2ϕ14
4	2ϕ12	2ϕ14
5	2ϕ12	2ϕ14
6	2ϕ12	2ϕ14
7	2ϕ12	2ϕ14
8	2ϕ12	2ϕ14
9	2ϕ12	2ϕ14
10	2ϕ12	2ϕ14
11	2ϕ12	2ϕ14
12	2ϕ12	2ϕ14
13	2ϕ12	2ϕ14
14	2ϕ12	2ϕ14
15	2ϕ12	2ϕ14
16	2ϕ12	2ϕ14
17	2ϕ12	2ϕ14
18	2ϕ12	2ϕ14
19	2ϕ12	2ϕ14
20	2ϕ12	2ϕ14
21	2ϕ12	2ϕ14
22	2ϕ12	2ϕ14
23	2ϕ12	2ϕ14
24	2ϕ12	2ϕ14

- ✓ **Manual calculation for designing slab:**

Check slab for shear (using ACI coefficient method):

The slab of commercial floors:

Vmax= (1.15Wu x Ln)/2

Ln = 5.56m

Vmax = (1.15 x 9.984x 5.56)/2

= 32 KN

Vu = Vmax- Wu x dslab

Vu = 32 – 9.984 x 270 x 10-3

= 29.30 KN

ΦVc=1.1 x 0.75 x (0.17)(fc)½ bwd = 1.1*0.75*(0.17)*(24) 1/2 *120*270 x 10-3 =131KN >29.33 KN → ok.

Design for flexure:

Assuming slab is integrated with beams:

F_c =24 MPa β=0.85

- ✓ **(negative moment):**

$M_{max} = W(L_n)^2/10 = 9.984(5.56)^2/10$

M_{max} = 30.86KN.m

(2) *For* ø = 0.9 , $\rho = \frac{0.85f'_c}{f_y}\left(1-\sqrt{1-\frac{2.61M_u}{bd^2f'_c}}\right)$

ρ = 0.0097

$A_s = \rho bd = 0.0104x120x270 = 338mm^2$

$A_{smin} = (1.4/F_y)b_w d = (1.4/420)X120X\ 270 = 108$

➔ So, use $A_s = 317mm^2$…. **(Use 2ϕ14mm/rib)**

✓ **(positive moment):**

$M_{max} = W(L_n)^2/14 = 9.984X(5.56)^2/14$

$M_{max} = 22.04$ KN.m

$\rho = 0.00718$

$A_s = \rho bd = 0.00718x120x270 = 232.8mm^2$

$A_{smin} = (1.4/F_y)b_w d = (1.4/420)X120X\ 270 = 108$

➔ So, use $A_s = 237mm^2$…. **(Use 2ϕ12mm/rib)**

Shrinkage steel

$A_{s\ shrinkage} = 0.0018\ A_{concret} = 0.0018X1000X80 = 144mm^2$

➔ So use**(2ϕ10mm/m)in both directions.**

The slab of the other floors:

$V_{max} = (1.15W_u \times L_n)/2$

$L_n = 5.56m$

$V_{max} = (1.15 \times 8.04 \times 5.56)/2$

$= 25.7KN$

$V_u = V_{max} - W_u \times d_{slab}$

$V_u = 25.7 – 8.04 \times 270 \times 10^{-3}$

= 23.53 KN

$\Phi Vc=1.1 \times 0.75 \times (0.17)(fc)^{½} b_w d = 1.1*0.75*(0.17)*(24)^{1/2} *120*270 \times 10^{-3}$ =131KN >23.16 KN → ok.

Design for flexure:

Assuming slab is integrated with beams:

F_c =24 MPa

β=0.85

✓ **(negative moment):**

$M_{max} = W(L_n)^2/10 = 8.04(5.56)^2/10$

M_{max} = 24.85 KN.m

(2) *For ø = 0.9 ,* $\rho = \frac{0.85f'_c}{f_y}\left(1-\sqrt{1-\frac{2.61M_u}{bd^2f'_c}}\right)$

ρ = 0.0082

$A_s = \rho bd = 0.0081x120x270 = 262mm^2$

$A_{smin} = (1.4/F_y)b_w d = (1.4/420)X120X\ 270 = 108$

➔ So, use $A_s = 262mm^2$…. **(Use 2ϕ14mm/rib)**

✓ **(positive moment):**

$M_{max} = W(L_n)^2/14 = 8.04(5.56)^2/14$

M_{max} = 17.75 KN.m

ρ = 0.00675

$A_s = \rho bd = 0.0067x120x270x = 217.08mm^2$

$A_{smin} = (1.4/F_y)b_w d = (1.4/420)X120X\ 270 = 108$

➔ So, use $A_s = 217.08mm^2$…. **(Use 2ϕ12mm/rib)**

Shrinkage steel

$A_{s\ shrinkage} = 0.0018\ A_{concret} = 0.0018X1000X80 = 144mm^2$

➔ So use**(2ϕ10mm/m)in both directions.**

2.8.2.2 Beam design:

2.8.2.2.1 Main beam:

We used sap program to determine the reinforcement in all the beams of the building and the results are in this table:

Table 211-: Reinforcement of main beams

Main Beam	Dimension(cm)	top steel®	top steel(L)	Bottom steel	Torsion tA	(-Ve) # of bars (R)	(-Ve) #of bars (L)	# of bars (+Ve)	min As
1	32*70	992	1397	854	908	5Φ16	7Φ16	4Φ16	652.68
2	32*70	1397	1073	995	978	7Φ16	5Φ16	5Φ16	652.68
3	32*70	671	2156	671	626	3Φ16	11Φ16	3Φ16	652.68
4	32*70	2156	652.68	818	621	11Φ16	3Φ16	4Φ16	652.68
5	32*70	652.68	652.68	652.68	572	3Φ16	3Φ16	3Φ16	652.68
6	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
7	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
8	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
9	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
10	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68

13	32*70	1292	1444	998	0	6Φ16	7Φ16	5Φ16	652.68
14	32*70	2484	2484	2494	621	12Φ16	12Φ16	12Φ16	652.68
15	32*70	2410	854	1856	0	12Φ16	4Φ16	9Φ16	652.68
16	32*70	2390	2403	2268	621	12Φ16	12Φ16	11Φ16	652.68
17	32*70	2403	2062	1798	621	12Φ16	10Φ16	9Φ16	652.68
18	32*70	1287	2484	1036	874	6Φ16	12Φ16	5Φ16	652.68
19	32*70	2484	2280	1731	621	12Φ16	11Φ16	9Φ16	652.68
20	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
21	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
22	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
23	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
24	32*70	652.68	652.68	652.68		3Φ16	3Φ16	3Φ16	652.68
25	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
26	32*70	860	860	780	0	4Φ16	4Φ16	4Φ16	652.68
27	32*70	854	854	779	0	4Φ16	4Φ16	4Φ16	652.68
28	32*70	1162	908	946	621	6Φ16	5Φ16	5Φ16	652.68
29	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
30	32*70	652.68	652.68	652.68	527	3Φ16	3Φ16	3Φ16	652.68
31	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
32	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
33	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
34	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68
35	32*70	652.68	652.68	652.68	0	3Φ16	3Φ16	3Φ16	652.68

✓ **Sample calculation for Main Beam:**

A- fc = 24 Mpa

B- fy = fyt = 420 Mpa

C- b = 700 mm , h = 320 mm

D- taking cover = 40 mm → d = 280 mm

✓ Design for flexure:

E- $\rho \min = \max \begin{Bmatrix} \frac{1.4}{fy} = 0.00333 \\ 0.25\frac{\sqrt{fc}}{fy} = 0.00292 \end{Bmatrix}$ → ρ min = 0.00333

As min = ρ_{min}*b*d = 0.00333 x 700 x 280 = 652.68 mm²

The table below shows the values of ±Mu, ρ and As for the beam spans, using the following equations:

$$\rho = 0.85\frac{fc}{fy}\{1-\sqrt{1-\frac{2.61x10^6\,Mu}{b\,d^2\,fc}}\}$$

As = ρ b d

Where:

fc and fy in (Mpa)

Mu in (KN.m)

b and d in (mm)

Table 2-12: Moments and corresponding steel areas (Hand Calculation) .

Mu (KN.m)	Top\bottom	ρ	As (mm²)
-87.4	Top	0.004406	863.5
38.5	bottom	0.0018	369.35
-85.3	Top	0.0043	841.77

-158.6	Top	0.00835	1636.617
84	bottom	0.00422	828.336
-160.2	Top	0.00844	1654.86

For As = 369.35 < As min use As min = 652.68 mm²

✓ Design for shear:

Ø for shear = 0.75

Vc = $\frac{1}{6}\sqrt{fc}\ b\ d$ → ØVc = 0.75 x $\frac{1}{6}\sqrt{24}\ (700)\ (280)/1000$ = 120.02 KN

Max. ultimate shear force at distance d from the support face

Vu=Vmax-(Wu*d) = 175.4-(75.8*0.280)= 154.2 KN

154.2 KN > 120.02 KN → Consider shear reinforcement.

Vs = Vn – Vc → Vs = $\frac{154.2-120.02}{0.75}$ = 45.5 KN

$\frac{Av}{s} = \frac{Vs}{fy\ \ d} = \frac{45.5\ x\ 1000}{420\ x\ 280}$ = 0.38 mm²/mm

✓ Torsion design:

Ø for torsion = 0.75

Using stirrups with diameter of 12mm.

Acp = 320 x 700 = 224000 mm²

Pcp = 2(320 + 700) = 2040 mm

Aoh = 168 x 668 = 112224 mm²

Ph = 2(168 + 668) = 1672 mm

Ao = 0.85 Aoh = 95390 mm²

T theoretical = $Ø\frac{\sqrt{fc}}{12}x\frac{Acp^2}{Pcp}$ = 0.75 $\frac{\sqrt{24}}{12}$ x $\frac{224000^2}{2040}$ x 10^{-6} = 10.04 KN.m

Max. ultimate torsion at distance d from the support face

Tu = Tmax-(wu*d)=18.6 KN.m

18.6 > 10.04 → consider torsion reinforcement

✓ **Check section adequacy:**

$$\sqrt{\left(\frac{Vu}{bw\ d}\right)^2 + \left(\frac{Tu\ Ph}{1.7\ Aoh^2}\right)^2} \leq Ø\left(\frac{Vc}{bw\ d} + \frac{2\sqrt{24}}{3}\right)$$

2.4 Mpa < 2.71 Mpa ……... OK

$$\frac{At}{s} = \frac{Tn}{2Ao\ x\ fyt} = \frac{\frac{18.61}{0.75}x10^6}{2\ x\ 140814.4\ x\ 420} = 0.31\ mm^2/mm$$

$$\frac{A(v+t)}{s} = \frac{Av}{s} + 2\frac{At}{s} = 0.43 + 2(0.31) = 1.05\ mm^2/mm$$

Check Min. $\frac{A(v+t)}{s}$ = max. of $\begin{Bmatrix} 0.062\sqrt{fc}\ \frac{bw}{fyt} = 0.58 \\ 0.35\ \frac{bw}{fyt} = 0.67 \end{Bmatrix}$

$\frac{A(v+t)}{s} = 1.05 = \frac{2(78.5)}{S}$ → S = 150 mm.. but :

Check S max. = min. of $\begin{Bmatrix} \frac{Ph}{8} = \frac{1672}{8} = 209\ mm \\ \frac{d}{2} = \frac{240}{2} = 120mm \\ . \\ 300\ mm \end{Bmatrix}$

So Use stirrups 1Ø10/120 mm

For torsion longitudinal reinforcement:
AL = $\frac{At}{S}$ x $\frac{Ph\ x\ fyt}{fy}$ = 0.31 x 1672 = 518.3 mm²
Check AL min.:518.3
AL min. = 648 mm²
Use AL = AL min. = 648 mm²
$\frac{648}{2}$ = 324 mm² must be added to both top and bottom steel of bar flexure reinforcement.

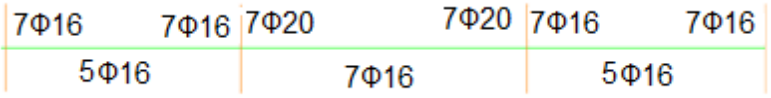


Figure 2-10: Beam Longitudinal-Steel Reinforcement.

✓ **Check development length:**

for diameter of steel bars db = 16 mm

column width – cover = 320 -80 = 240mm

Ldh = 330 mm > 240 mm.

Using reduction factor to Ldh:

Ldh = 430 mm > 240 mm

Hook is needed.

Use hook = 12db = 12 x 16 = 192 mm Use 200 mm

In the distribution of reinforcement we must take into account the seismic design so the spacing between stirrups in the edge of the beam, so we use **1Ø10/120 mm.**

At least 50mm from the face of the column and the condensation of the stirrups shall be extended more than **2d** and we will condense the stirrups for distance equal **Ln/4** in the two edges of the beam. Where:

d= depth of the beam.

db= bar diameter .

ds= diameter of the stirrups.

2.8.2.2.2 design of secondary beams:

Table 213-: Secondary beams dimensions and reinforcement.

Beam	Dimension	#of bar
S1	320*400	4Φ16
S2	320*400	4Φ16
S3	320*400	4Φ16
S4	320*400	4Φ16
S5	320*400	4Φ16
S6	320*400	4Φ16

2.8.2.3 Design of columns

Table 2-14: Loads on columns.

# of column	Area	LL	DL	L	WL	Total DL	Wu
1	8	268.8	548.8	3.8	478.8	1027.6	1663.2
2	5.6	188.16	384.16	4.6	579.6	963.76	1457.568
3	13.95	468.72	956.97	6	756	1712.97	2805.516
4	7.5	252	514.5	4.7	592.2	1106.7	1731.24
5	8.8	295.68	603.68	3.8	478.8	1082.48	1772.064
6	15.6	524.16	1070.16	0	0	1070.16	2122.848
7	12	403.2	823.2	0	0	823.2	1632.96
8	17.9	601.44	1227.94	0	0	1227.94	2435.832

9	14.8	497.28	1015.28	0	0	1015.28	2013.984
10	32.4	1088.64	2222.64	0	0	2222.64	4408.992
11	15.6	524.16	1070.16	5.5	693	1763.16	2954.448
12	10	336	686	0	0	686	1360.8
13	8	268.8	548.8	0	0	548.8	1088.64
14	5.2	174.72	356.72	5.1	642.6	999.32	1478.736
15	7.2	241.92	493.92	4.2	529.2	1023.12	1614.816
16	7.9	265.44	541.94	3.2	403.2	945.14	1558.872
17	22.9	769.44	1570.94	0	0	1570.94	3116.232
18	17.8	598.08	1221.08	0	0	1221.08	2422.224
19	13.8	463.68	946.68	0	0	946.68	1877.904
20	16.9	567.84	1159.34	0	0	1159.34	2299.752
21	14	470.4	960.4	0	0	960.4	1905.12
22	30	1008	2058	5.7	718.2	2776.2	4944.24
23	9.2	309.12	631.12	6.5	819	1450.12	2234.736
24	6.3	211.68	432.18	3.5	441	873.18	1386.504
25	13.6	456.96	932.96	0	0	932.96	1850.688
26	17.7	594.72	1214.22	0	0	1214.22	2408.616
27	20	672	1372	0	0	1372	2721.6
28	25.7	863.52	1763.02	0	0	1763.02	3497.256
29	5.6	188.16	384.16	3.3	415.8	799.96	1261.008
30	14.7	493.92	1008.42	0	0	1008.42	2000.376
31	4.49	150.864	308.014	4.8	604.8	912.814	1336.759

32	7.4	248.64	507.64	4.7	592.2	1099.84	1717.632
33	7.4	248.64	507.64	5.1	642.6	1150.24	1778.112
34	5	168	343	4.9	617.4	960.4	1421.28
35	10.6	356.16	727.16	5.8	730.8	1457.96	2319.408
36	13.7	460.32	939.82	0	0	939.82	1864.296

Where:-

A: - Area of tributary area that column carry (m^2)

LL: - The live load that each column carry (LL = A*N*3) (KN/m^2) ,

N: - number of stories

DL: - The dead load without wall weight that each column carry (DL = A*N*9) (KN/m^2)

L: - the length of wall from tributary area that each column carry (m)

Total DL: - total dead load included the wall weight (Total DL = DL+WL) (KN/m^2)

Wu: - 1.2(Total DL)+1.6 LL (KN/m^2)

Service Load: Total DL + LL (KN/m^2)

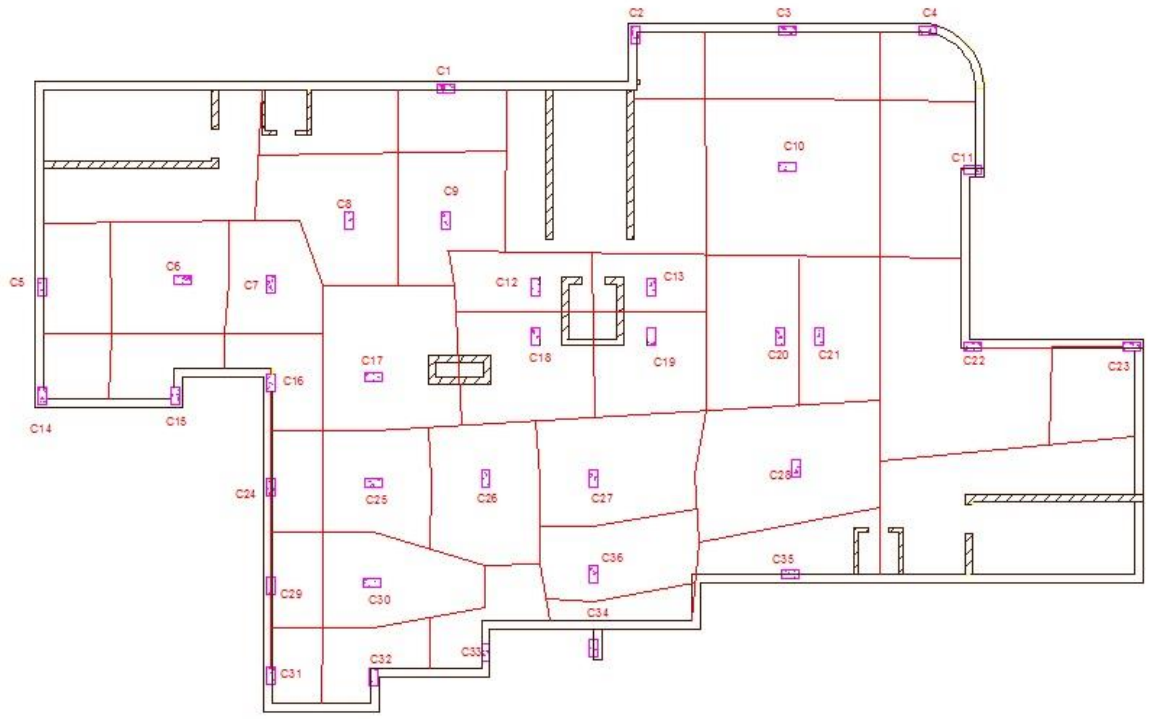


Figure 2-11: Tributary area that column carry .

Table 2-15: Groups of Columns according to Ag.

# of column	Ag	B	H	Actual Ag	As	# of Bars
13	70976.65928	500 mm	250 mm	125000	1250	6 φ 18
29	82214.63033	500 mm	250 mm	125000	1250	6 φ 18
31	87153.42287	500 mm	250 mm	125000	1250	6 φ 18
12	88720.8241	500 mm	250 mm	125000	1250	6 φ 18

24	90396.66189	500 mm	250 mm	125000	1250	6 φ 18
34	92663.97183	500 mm	250 mm	125000	1250	6 φ 18
2	95029.86048	500 mm	250 mm	125000	1250	6 φ 18
14	96409.96219	500 mm	250 mm	125000	1250	6 φ 18
16	101634.6329	500 mm	250 mm	125000	1250	6 φ 18
15	105282.0446	500 mm	300 mm	150000	1500	6 φ 18
7	106464.9889	500 mm	300 mm	150000	1500	6 φ 18
1	108436.5628	500 mm	300 mm	150000	1500	6 φ 18
32	111985.3957	500 mm	300 mm	150000	1500	6 φ 18
4	112872.604	500 mm	300 mm	150000	1500	6 φ 18
5	115534.2287	500 mm	300 mm	150000	1500	6 φ 18
33	115928.5435	500 mm	300 mm	150000	1500	6 φ 18
25	120660.3208	500 mm	300 mm	150000	1500	6 φ 18
36	121547.529	500 mm	300 mm	150000	1500	6 φ 18

19	122434.7373	600 mm	300 mm	180000	1800	6 φ 20
21	124209.1537	600 mm	300 mm	180000	1800	6 φ 20
30	130419.6114	600 mm	300 mm	180000	1800	6 φ 20
9	131306.8197	600 mm	300 mm	180000	1800	6 φ 20
6	138404.4856	600 mm	300 mm	180000	1800	6 φ 20
23	145699.3089	600 mm	300 mm	180000	1800	6 φ 20
20	149938.1927	600 mm	300 mm	180000	1800	6 φ 20
35	151219.7157	600 mm	300 mm	180000	1800	6 φ 20
26	157035.8587	600 mm	300 mm	180000	1800	6 φ 20
18	157923.0669	700 mm	500 mm	350000	3500	12 φ 20
8	158810.2751	700 mm	500 mm	350000	3500	12 φ 20
27	177441.6482	700 mm	500 mm	350000	3500	12 φ 20
3	182912.7657	700 mm	500 mm	350000	3500	12 φ 20
11	192622.767	700 mm	500 mm	350000	3500	12 φ 20

17	203170.6872	700 mm	500 mm	350000	3500	12 φ 20
28	228012.5179	700 mm	500 mm	350000	3500	12 φ 20
10	287455.4701	700 mm	500 mm	350000	3500	12 φ 20
22	322352.3276	700 mm	500 mm	350000	3500	12 φ 20

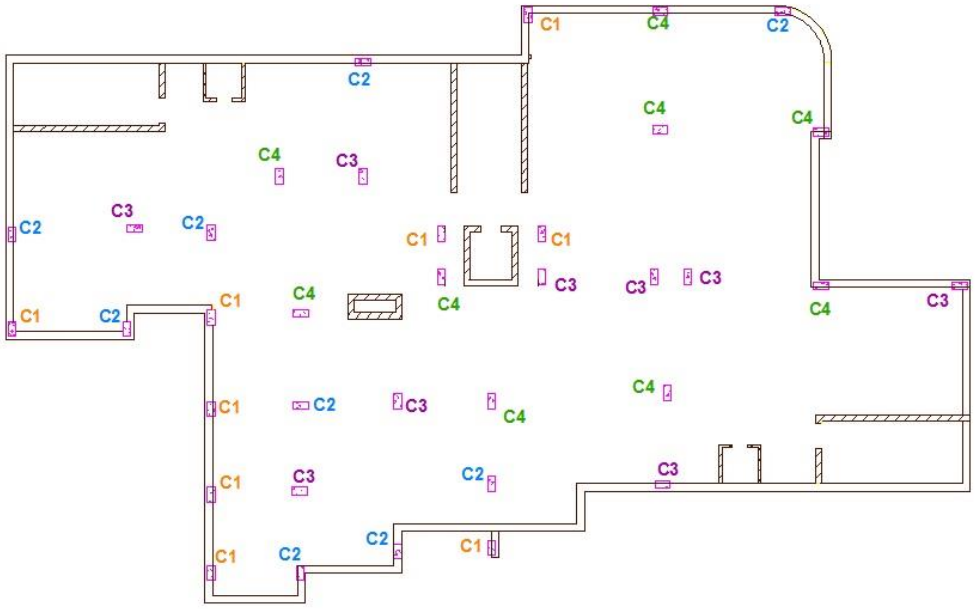


Figure 2-12: Columns groups.

Table 2-16: Columns Dimensions and reinforcement.

Group	b	h	Steel bars
1	500 mm	250 mm	6 φ 18
2	500 mm	300 mm	6 φ 18

3	600 mm	300 mm	6 φ 20
4	700 mm	500 mm	12 φ 20

- ✓ **Sample Design for column by hand calculation:**

Design for column C1 (50*25cm) in the Ground floor:

Pu=2664KN

- ✓ Check if short or long column :

R=$\sqrt{(Ix/A)}$

Where is :

R= radius of gyration of column section

I = moment of inertia

A = area of the column

Ix=$500x250^3/12$

=$6.5x10^8$ mm^4

R= $\sqrt{6.5x10^8/250X500)}$ = 204.14

$\frac{Kl}{r} = \frac{1X4000}{204.14}$ = 19.6 < 34-12 M1/M2 ….column is short.

- ✓ Check eccentricity :

Mumin=Pu*emin

emin = minimum eccentricity

= 0.015 +o.o3H

=0.024m = 24mm

H = normal dimension to the axis of bending = 0.3m

Mumin=Pu*emin

= 2664X0.024 = 64KN.m

Mu from Sap = 29.1 KN.m

$\mathbf{e}_{\text{required}} = \frac{Mu}{Pu}$ = 29.2/2664 = 0.011m = 11mm

Mu=29.2KN .m<Mumin=64KN.m..column is concentrically loaded.

ϕPn=0.65[0.85[0.85*f'c*(Ag-As)+(As*Fy)]]

As=0.01Ag

Ag= 12500mm^2

B=500mm,, H =250mm to

As=ρAg=0.01*12500=1250mm^2 (use 6 Ø 16)

For transverse reinforcement use stirrups of 2Ø10mm.

The spacing between stirrups at the bottom and top of the columns is equal 60mm.

Spacing ($\mathbf{S}_0$) = min. of $\left\{ \begin{matrix} \frac{b}{2} = 150mm \\ 8db = 128mm \\ 24ds = 240 \\ 300mm \end{matrix} \right\}$ so S=150mm

The first stirrup in the column shall start not more than $\mathbf{S}_0/2$ = (150/2) = 75mm from the top/bottom of the column use ((2Ø10)/150) mm.

The condensation of the stirrups shall be extended more than

Where:

L_0=500 mm

In the middle of the column the spacing shall not exceed twice the spacing at

the top/bottom of the column so spacing =2

$\mathbf{S_0}$= 300 mm.,,,,use (2Ø10)/300mm.

In the joint (the intersection between column and beam) the area of the stirrups will be the double.

2.8.2.4 Analysis and design of footings:

2.8.2.4.1 Introduction:

Reinforced concrete footings are structural members used to support columns and walls to distribute their loads to the soil. The design is based on the assumption that the footing is rigid so that the variation of the soil pressure under the footing is linear.

Foundation used to transmit high concentrated columns, wall reactions and lateral loads from retaining walls to ground without cause unsafe differential settlement of the structural system or soil failure.

Uniform soil pressure is achieved when the column load coincides with the center of the footing. Although this assumption is acceptable for rigid footing, such an assumption becomes less accurate as the footing becomes relatively more flexible. The proper design of footings requires that:

- ✓ The load capacity of the soil is not exceeded.
- ✓ Excessive settlement, differential settlement or rotations are avoided.
- ✓ Adequate safety against sliding and or overturning is maintained.

The amount of settlement depends on many factors:

- ✓ Type of soil.
- ✓ The load intensity.
- ✓ Type of footing.
- ✓ Depth below ground level.

The Type of Footings that is used in the building is mat foundation , and it is used because the Bering capacity of soil in jeneen city not exceed 100 mpa so when we calculate the required footing the number reach 80% of the area of building and the code seas that if the area of footing > 60% of area of the building use mat foundation .

Thickness

h= 80 cm

Check punching

Vu = 1960.5 kN

ϕVc = 3150 kN > Vu → OK

s_A = (42719.04/252.9)+ (42719.04*1.32 *10.27/4183.32)+ (42719.04*1.34 * -0.37/9727.2)=168.9+138.43 – 2.18 = 305.15 kN/m2

s_b = (42719.04/252.9)+ (42719.04*1.32 *10.27/4183.32)+ (42719.04*1.34 * 4.56/9727.2)= 168.9+138.43 – 26.8 = 334.2 kN/m2

2.8.2.4.2 steel reinforcements:

for X direction (M11)

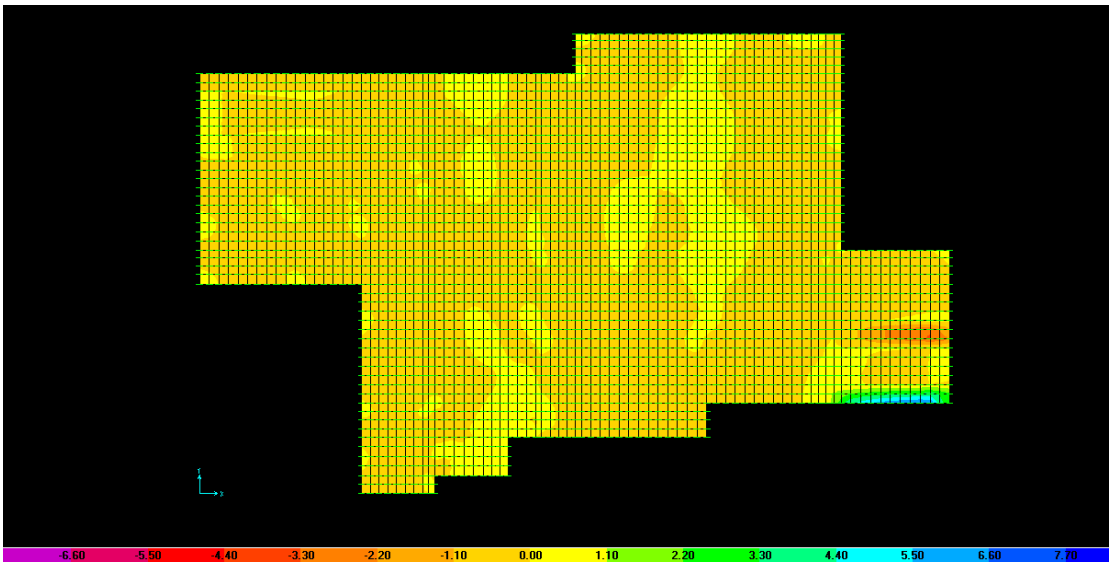


Figure 2-13: Footing moments M11 in X direction

Table 217-: footngs dimentions and reinforcement in x-direction for M11.

streb #	Tension	combretion	b	d	Row.T	Row.C	As.T	As.C	#of barf(T)/m	#of barf(C)/m
1	8565.7	8565.68	2630	740	0.0197	0.0197	38349.2	38349.21	18 φ 32	**18 φ 32**
2	10985	7304.24	3560	740	0.0183	0.0112	48331.2	29459.52	16 φ 32	**10 φ32**
3	10060	1855.937	2590	740	0.0253	0.0036	48578.9	6877.749	16 φ 32	**4 φ26**
4	16035	1904.56	4678	740	0.0211	0.002	73130	6940.451	19 φ 32	**4 φ26**
5	7040.9	1718.9	3370	740	0.0114	0.0025	28475.7	6298.355	10 φ32	**4 φ26**
6	3487.2	1343.415	2400	740	0.0076	0.0028	13502.3	4935.737	7 φ32	**4 φ26**
7	10658	1383.096	2543	740	0.0287	0.0027	53970.5	5077.161	26 φ32	**4 φ26**

for X direction (M22) :

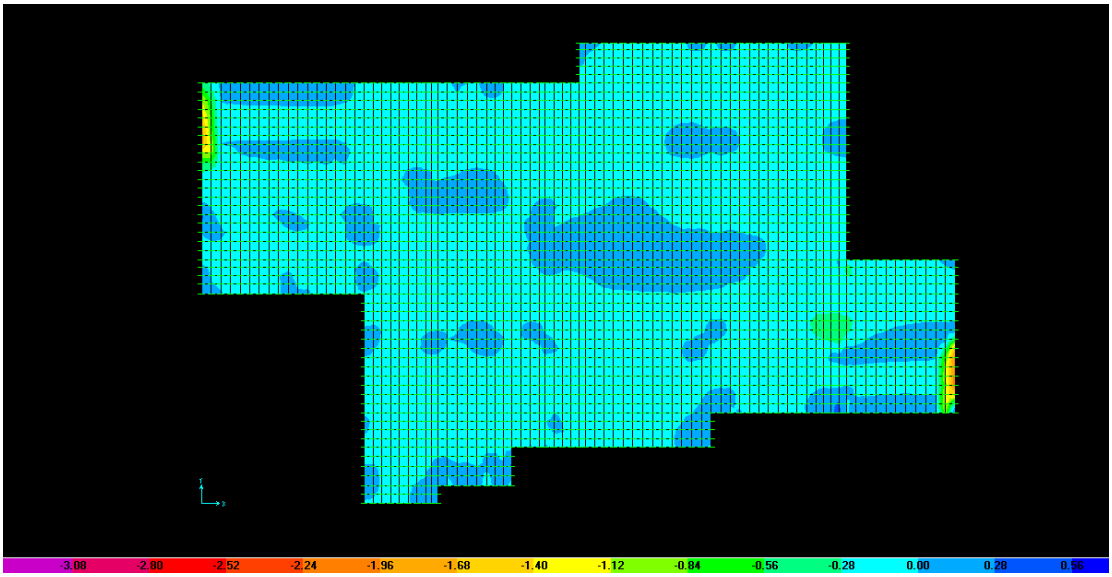


Figure 2-14: Footing moments M22 in X direction.

Table 218-: footings dimensions and reinforcement in x-direction for M22.

# of streb	Tension	combretion	b	d	Row.T	Row.C	As.T	As.C	#of barf(T)/m	#of barf(c)/m
1	139.96	88.78	3370	740	0.0002	0.0001	500.539	317.263	2 φ14	**2 φ14**
2	2094.3	759.035	3520	740	0.003	0.0011	7709.35	2738.57	16 φ14	**5 φ14**
3	2202.6	329.5	5200	740	0.0021	0.0003	8033.69	1179.68	16 φ14	**2 φ14**
4	5760.5	261.153	4660	740	0.0064	0.0003	22004	934.639	10 φ26	**2 φ14**
5	2831.2	714.68	3770	740	0.0038	0.0009	10512.1	2575.1	6 φ26	**5 φ14**
6	2637.6	220.21	2670	740	0.005	0.0004	9926.94	789.155	5 φ26	**2 φ14**

2.9 Earthquake Design

2.9.1 Design Criteria:-

Safety, economic cost and efficiency are important goals for any structural project, so (ACI-2002) code and the seismic code (UBC-97) are used to control the design criteria for this project, the following information explains this criteria:-

- ✓ Buildings in Jenin city, Number of stories = 7 stories, Soil type is S_D
- ✓ This project performed as a one-way ribbed slab .
- ✓ Concrete compressive strength, $f_c^{\backslash} = 28\ \text{KN/mm2}.$
- ✓ Yield strength of steel, $f_y = 420\ \text{kN/mm}^2.$
- ✓ Super imposed dead load (S.I.D) = 3 kN/m².
- ✓ Live load: (L.L= 4.8 kN/m².
- ✓ Height of each story is 4 m.
- ✓ Columns dimensions are 60cm ✕ 30 cm.
- ✓ Beams dimensions 32 × 70 cm.
- ✓ Slab thickness = 32 cm ; Shear wall thickness = 20 cm.
- ✓

Also structural analysis program (SAP2000) is used for analysis and design, bending moment, shear force, axial force diagrams, and steel reinforcement can be obtained using (SAP).

- ✓ **Weight of the building:**

Own weight of the building = (1.1 – 1.3) ton/m^2.

Use 1.2 ton/m^2.

W = 1.2 × A_{story} × (# of stories) = 1.2 × 628 × 7

W = 5275 ton.

2.9.2 Horizontal Seismic Force:-

Horizontal Seismic Force or the lateral earthquake force can be determined using equivalent - static method and UBC-97 code.

W = 5275 ton.

Ct = 0.030…….....Concrete Moment Frame.

Story Height = 4m.

Seismic Zone Factor: Z = (0.2)…….. For Nablus City ; see figure below.

Seismic Importance Factor: I = 1.

Structural System Coefficient: R = 3.5

Seismic Coefficient: (Cv), (Ca).

Cv = $\frac{0.40 + 0.54}{2} = 0.47$

Ca = $\frac{0.28 + 0.36}{2} = 0.32$

Building height in feet: hn = $\frac{4 \times 7}{0.3048} = 91.8\, ft.$

Building Period: T = Ct hn3/4 = 0.03 × (91.8)3/4

= 0.88 sec.....o.k. (7 stories).

Cs = $\frac{C_V \times I}{R \times T} = \frac{0.47 \times 1}{3.5 \times 0.88} = 0.152.$

V = Cs × W = 0.152 × 5275 = 801.8 ton.

Vmax = $\frac{2.5 \times C_a \times I}{R} W = \frac{2.5 \times 0.32 \times 1}{3.5} \times 5275$

Vmax = 0.229 × 5275 = 1208 ton.

Vmin = 0.11 × Ca × I × W = 0.11 × 0.32 × 1 × 5275

Vmin = 0.0352 × 3332 = 185.7 ton.

Vmin < V < Vmax .....o.k.

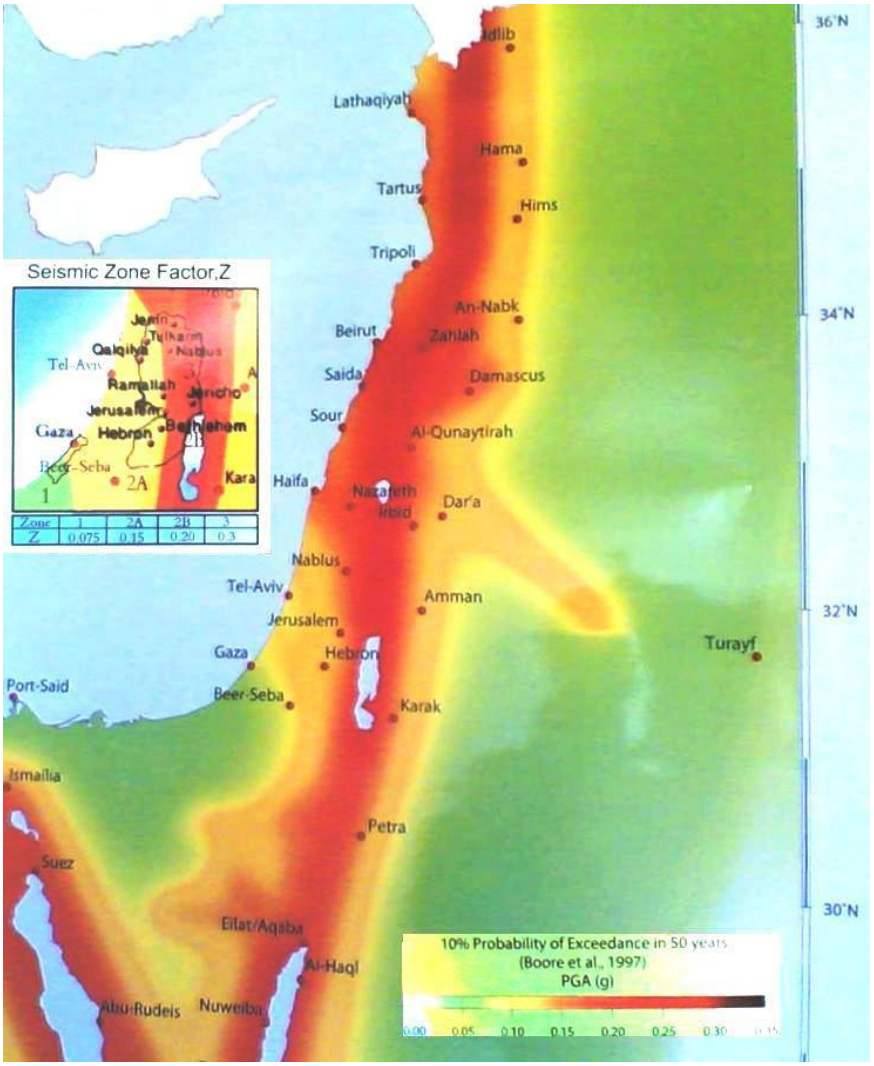


Figure 2-15: Earthquake map.

2.9.3 Distribution of Lateral Force (F_x):-

Now; we want to distribute the base shear (V) on the building stories as a concentrated force that affect at the level of each story slab (Fi).

W = 5275 ton.

Weight of each story = $\frac{5275}{7} = 753.5\ ton.$

V = 801.8 ton.

V = Ftop + $\sum_{i=1}^{n} F_i$.

T = 0.72 sec > 0.7

$\Rightarrow$ Ftop = 0.07 × T × V

= 0.07 × 0.72 × 801.8 = 40.4 ton < 0.25 × V = 200.45 ton $\Rightarrow$ o.k.

V – Ftop = 801.8-40.4 =761.4 ton.

$$\Rightarrow F_x = \frac{(V - F_t)(W_x h_x)}{\sum_{i=1}^{n} W_x h_x} = 761.4 \times [\frac{(W_x h_x)}{\sum_{i=1}^{n} W_x h_x}]$$

Table 2-19: Lateral shear force calculation.

level	Wx	hx	Wx*hx	wxhx\€Wxhx	Fi+Ft	vx	Mx
7	754	28	21112	0.25	121.3	149.3	477.76
6	754	24	18096	0.072727273	27.136	176.436	1042.355
5	754	20	15080	0.060606061	22.61333333	199.0493	1679.313
4	754	16	12064	0.048484848	18.09066667	217.14	2374.161
3	754	12	9048	0.036363636	13.568	230.708	3112.427
2	754	8	6032	0.024242424	9.045333333	239.7533	3879.637
1	754	4	3016	0.012121212	4.522666667	244.276	4661.321
∑	5278		84448	0.504545455	188.256		

2.9.4 Reinforcement of Shear Walls:

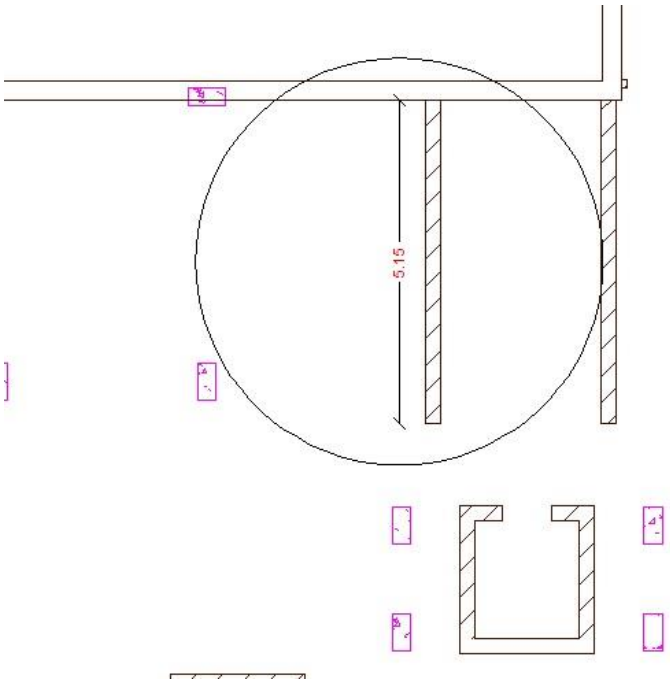


Figure 2-16: Shear wall 1.

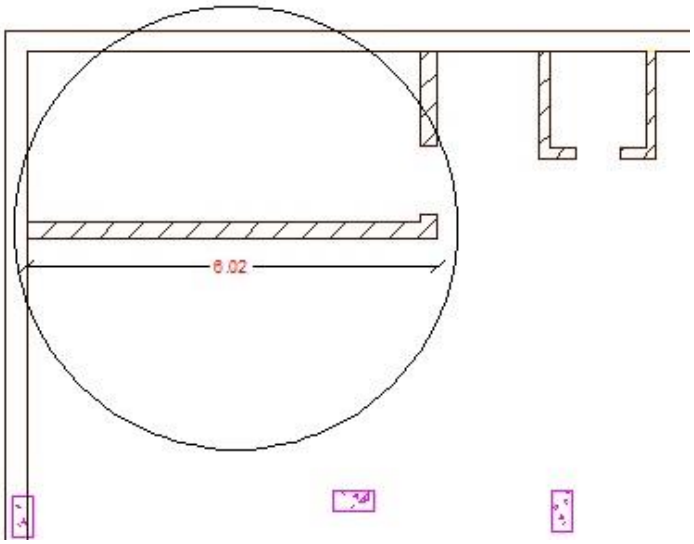


Figure 2-17: Shear wall 2.

2.9.5 Shear wall 1 Design:

V = 801.8 ton, $\Rightarrow$ Vi = 801.8 / 7 = 114.5 ton

Moment: $\mu = 114.5 \times \frac{2}{3}(4 \times 7) = 2137.3 \text{ ton.m.}$

Tributary area: A = 10.65 m2.

Dead Load: (D.L) = 1.0 ton/m2.

N = D.L × A × # of stories

= 1.0 × 10.65 × 7 = 74.55 ton.

Awall = 0.2 × 5.15 = 1.03 m2.

L = 5.15 m $\Rightarrow$ Y = 5.15/2 = 2.575 m.

Moment of Inertia (I) = 4.21 m4.

Concrete Compressive Strength, $f_c^{\backslash}$ = 300 kg/cm².

$$f_{c-all} = 0.3 \times f_c^{\backslash} = 0.3 \times 300 = 90 \text{ kg/cm}^2.$$

$$f = f_N + f_M = -\frac{N}{A} \pm \frac{\mu}{I} Y$$

$$\Rightarrow f = -\frac{74.55}{1.03} \pm \frac{2137.3}{4.21}(2.575) = -72.37 \pm 1307.2$$

fmin = -72.37 + 1307.2 =1234.8 ton /m2 = 123.48 kg /cm2.

fmax = -72.37 – 1307.2 =1379.57 ton /m2

= 137.95 kg /cm2 $\rangle$ f_{c-all} = 90 kg/cm².

Since fmax $\rangle$ $f_{c-all} = 90 \text{ kg/cm}^2$, increase the thickness of the walls, so if we use t = 30 cm, it will be safe.

Region-1:-

$$\rho_s = 0.25\,\% \Rightarrow A_s = \frac{0.25}{100} \times 300 \times 5150 = 3862.5\,mm^2.$$

3862.5 / 2 =1931.25 mm2….. for each mesh.

Use 5 ¢ 22 mm / m.

Region-2:- (0.1* L = 0.515 m length)

$$\rho_s = 1\,\% \Rightarrow A_s = \frac{1}{100} \times 300 \times 515 = 1545\,mm^2.$$

1545 / 2 =772.5 mm2….. for each mesh.

Use 4 ¢ 18mm.

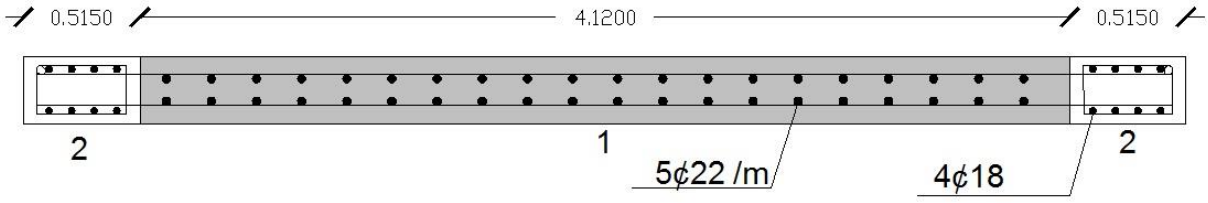


Figure 2-18: Section in shear wall 1.

2.9.6 Shear wall 2 Design:

V = 801.8 ton, ⇒ Vi = 801.8 / 7 = 114.5 ton

Moment: $$\mu = 114.5 \times \frac{2}{3}(4 \times 7) = 2137.3\ \text{ton.m}$$

Tributary area: A = 15.1 m2.

Dead Load: (D.L) = 1.0 ton/m2.

N = D.L × A × # of stories

= 1.0 × 15.1 × 7 = 105.7 ton.

Awall = 0.2 × 5.15 = 1.03 m2.

L = 5.15 m $\Rightarrow$ Y = 5.15/2 = 2.575 m.

Moment of Inertia (I) = 4.21 m4.

Concrete Compressive Strength, $f_c^{\backslash}$ = 300 kg/cm².

$$f_{c-all} = 0.3 \times f_c^{\backslash} = 0.3 \times 300 = 90 \text{ kg/cm}^2.$$

$$f = f_N + f_M = -\frac{N}{A} \pm \frac{\mu}{I} Y$$

$$\Rightarrow f = -\frac{105.7}{1.03} \pm \frac{2137.3}{4.21}(2.575) = -102.6 \pm 1307.2$$

fmin = -102.6 + 1307.2 =1204.6 ton /m2 = 123.48 kg /cm2.

fmax = -102.6 – 1307.2 =1409.8 ton /m2

= 140.9 kg /cm2 $\rangle$ f_{c-all} = 90 kg/cm².

Since fmax $\rangle$ $f_{c-all} = 90$ kg/cm² , increase the thickness of the walls, so if we use t = 30 cm, it will be safe.

Region-1:-

$$\rho_s = 0.25\,\% \Rightarrow A_s = \frac{0.25}{100} \times 300 \times 6020 = 4515\, mm^2.$$

4515 / 2 =2257.5 mm2….. for each mesh.

Use 6 ¢ 22 mm / m.

Region-2:- (0.1* L = 0.602 m length)

$$\rho_s = 1\% \Rightarrow A_s = \frac{1}{100} \times 300 \times 602 = 1806\, mm^2.$$

1806 / 2 =903 mm2….. for each mesh.

Use 4 ¢ 18mm.

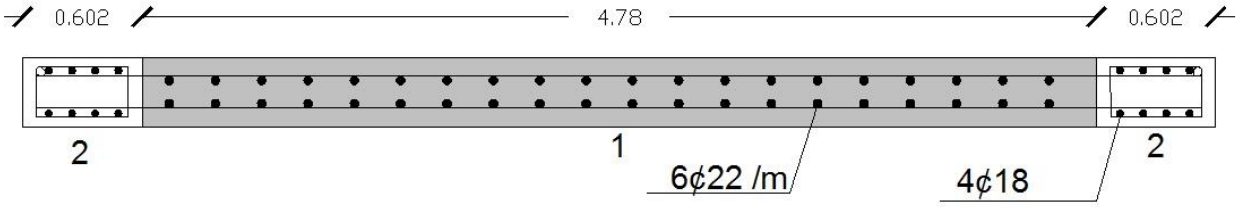


Figure 2-19: Section in shear wall 2.

2.9.7 Reinforcement of the Window:-

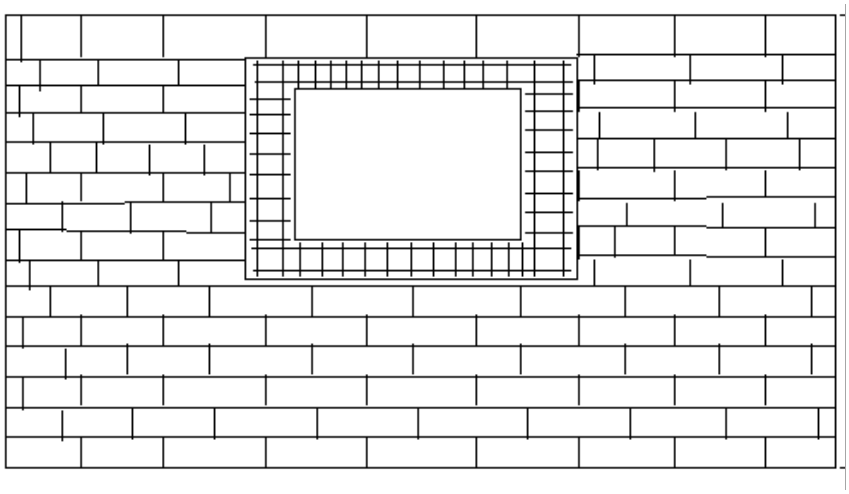


Figure 2-20: Reinforcement of the Window.

2.9.8 Reinforcement of the Joint:-

Intensify stirrups at the end of beams, more at the end of column, also more and more at the joint, to resist seismic force and to prevent the formation of plastic hinges.

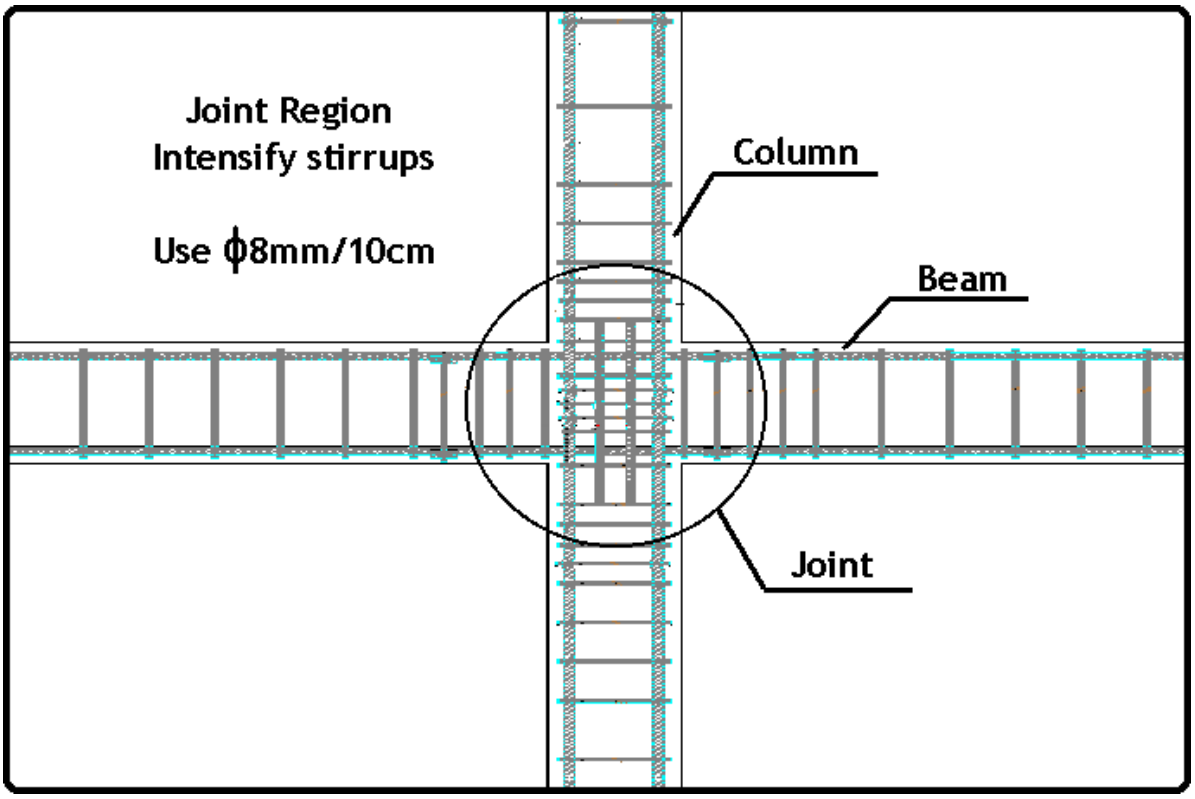


Figure 2-21: Reinforcement of the Joint .

CHAPTER 3

LIGHTING AND ELECTRICAL DESIGN

3.1 Lighting Design:

Daylighting is the oldest method of interior lighting. Daylighting is simply designing a space to use as much natural light as possible. This decreases energy consumption and costs, and requires less heating and cooling from the building. Daylighting has also been proven to have positive effects on patients in hospitals as well as work and school performance. But daylight isn't enough all the time. Which mean another type of lighting should be designed.
Lighting equipment and controls technologies are developing at light speed: hundreds of new products are introduced to the marketplace annually..

3.1.1 Surface Work plane:

An imaginary horizontal plane situated at the nominal working height in an interior space. Most illuminance and daylight factor measurements and calculations are made for points on this plane.

For office (desk) work the height of the work plane usually is assumed at 0.85 m (33.5 in), and for circulation areas (halls, corridors etc.) at 0.15 - 0.2 m (6 - 8 in).

Building regulations and professional lighting design associations define required illuminance and daylight factor values for a variety of different tasks. They usually also define specific heights of the work plane, where it differs from the standard values.

3.1.2 Illuminance:

illuminance is the total luminous flux incident on a surface, per unit area. It is a measure of how much the incident lightilluminates the surface, wavelength-weighted by the luminosity function to correlate with human brightness perception. Similarly,luminous emittance is the luminous flux per unit area emitted from a surface. Luminous emittance is also known as luminous exitance.

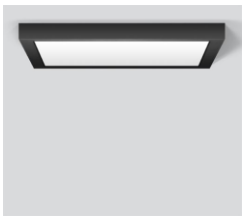
Table 3-1: Illuminance at work plane.

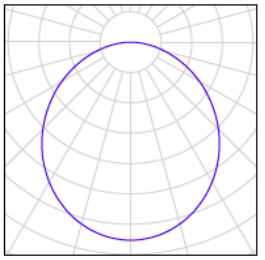
Type of Room	Illuminance at work plane (lux)	Work plan height (cm)
Parking	100	0
shops	500	70
Corridor in commercial	400	0
Restaurant	500	60
offices	500	70
Conference Room	750	70
Corridor in offices & residential	150	0
Kitchen	300	70
Bed Room	150	40
Bath Room	100	0
Stairs	100	0
Guest room	300	60
salons	300	60

3.1.3 Types of Lamps are used in our building floors:

1- BEGA 3307 7 T16 14W

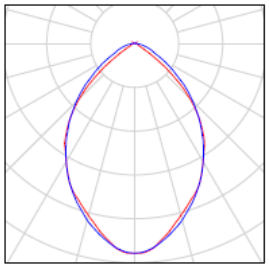
Article No.: 3307
Luminaire Luminous Flux: 8400 lm
Luminaire Wattage: 119.0 W
Luminaire classification according to CIE: 100
CIE flux code: 48 79 96 100 44
Fitting: 7 x T16 14W (CorrectionFactor1.000).





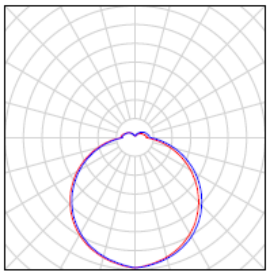
2- GELIGHTING 43036 5506 T8 2x36W / 6 EB LL

Article No.: 43036
Luminaire Luminous Flux: 6700 lm
Luminaire Wattage: 72.0 W
Luminaire classification according to CIE: 99
CIE flux code: 67 93 98 99 61
Fitting: 2 x TU@36W/T8/840/GE/POLYLUX XLR/ SL/1-25 (Correction Factor 1.000).



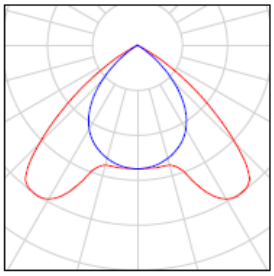
3- iGuzzini M156 Mixto 57W

Article No.: M156
Luminaire Luminous Flux: 4200 lm
Luminaire Wattage: 57.0 W
Luminaire classification according to CIE: 89
CIE flux code: 42 72 91 89 51
Fitting: 1 x L243 (Correction Factor 1.000).



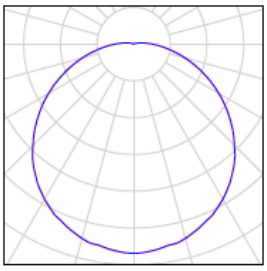
GELIGHTING 43835 5500 4x18W / 16 EB LL

Article No.: 43835
Luminaire Luminous Flux: 5400 lm
Luminaire Wattage: 72.0 W
Luminaire classification according to CIE: 100
CIE flux code: 69 99 100 100 67
Fitting: 4 x FT8/18W/830/GE/SL1/25 (Correction Factor 1.000).



4- BEGA 5127 2 TC-D 26W

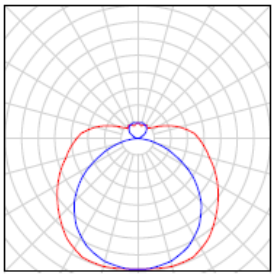
Article No.: 5127
Luminaire Luminous Flux: 3600 lm
Luminaire Wattage: 62.0 W
Luminaire classification according to CIE: 97
CIE flux code: 44 74 92 97 37
Fitting: 2 x TC-D 26W



(Correction Factor 1.000).

5- ASTZ ACT3 ЛПО46-2x36-613 Luxe

Article No.: ACT3
Luminaire Luminous Flux: 5700 lm
Luminaire Wattage: 72.0 W
Luminaire classification according to CIE: 80
CIE flux code: 39 69 88 80 72
Fitting: 2 x ЛЛ T8 G13 36Вт 2850лм
Тцв=3795K
(Correction Factor 1.000).



3.2 Sample of calculation in the building:

3.2.1 Parking:

designed to have an Illuminance of 150 lux

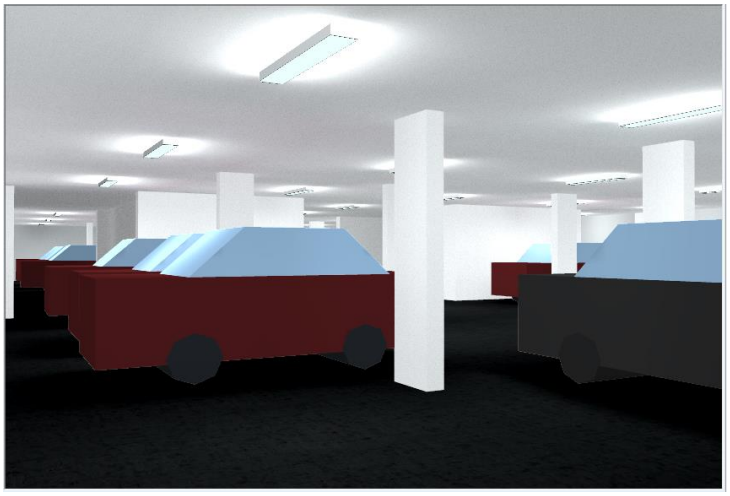


Figure 3-1:Parking render DIALux photo.

3.2.2 Cafeteria:

designed to have an Illuminance of 500 lux

Figure 3-2: Cafeteria render DIALux photo.

3.2.3 Shopping places:

designed to have an Illuminance of 500 lux

Figure 3-3: Shop render DIALux photo.

3.2.4 Offices:

designed to have an Illuminance of 500 lux

Figure 3-4: Office render DIALux photo.

3.2.5 Bed room:

designed to have an Illuminance of 150 lux

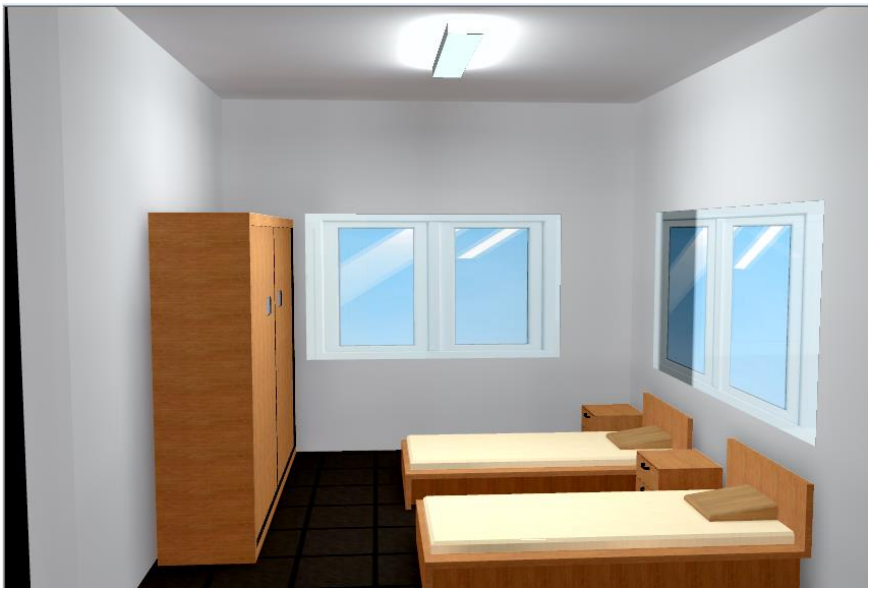


Figure 3-5: Bedroom render DIALux photo.

3.2.6 Living room:

designed to have an Illuminance of 300 lux

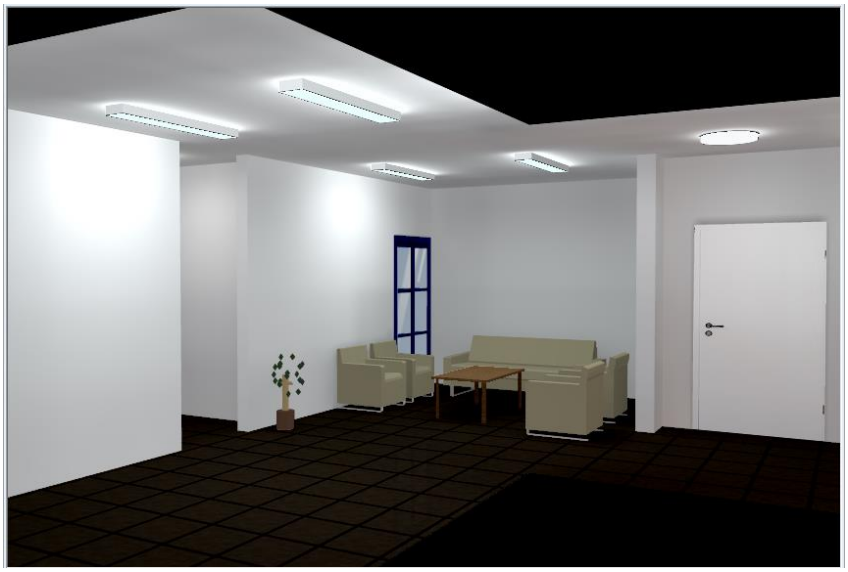


Figure 3-6: Living room render DIALux photo.

3.3 Lighting calculation:

Table 3-2: Lighting Calculation.

Floor	Room	Type of luminaire	Watt	n	N	Total Watt
Parking	Parking	Fluorescent	36	2	31	**2232**
Ground Floor (shopping)	Shop 1	Fluorescent	36	2	3	216
	Shop 2	Fluorescent	36	2	3	216
	Shop 3	Fluorescent	36	2	6	432
	Shop 4	Fluorescent	36	2	2	144
	Shop 5	Fluorescent	36	2	2	144
	Shop 6	Fluorescent	36	2	2	144
	Shop 7	Fluorescent	36	2	4	288
	Shop 8	Fluorescent	36	2	2	144
	Shop 9	Fluorescent	36	2	2	144
	restaurant 1	Fluorescent	36	2	4	288
	restaurant 2	Fluorescent	36	2	6	432
	corridor 1	BEGA T16	14	1	3	42
	corridor 2	BEGA T17	14	1	4	56
	corridor 3	BEGA T18	14	1	6	84
	corridor 4	BEGA T19	14	1	6	84
	corridor 5	BEGA T20	14	1	4	56
	Bathrooms	BEGA TC-D	26	1	11	286
Total Watt						**3200**
First Floor (shopping)	Shop 1	Fluorescent	36	2	3	216
	Shop 2	Fluorescent	36	2	3	216
	Shop 3	Fluorescent	36	2	6	432
	Shop 4	Fluorescent	36	2	2	144
	Shop 5	Fluorescent	36	2	2	144
	Shop 6	Fluorescent	36	2	2	144
	Shop 7	Fluorescent	36	2	4	288
	Shop 8	Fluorescent	36	2	2	144
	Shop 9	Fluorescent	36	2	4	288
	Shop 10	Fluorescent	36	2	4	288
	restaurant 1	Fluorescent	36	2	4	288
	restaurant 2	Fluorescent	36	2	6	432
	corridor 1	BEGA T16	14	1	3	42
	corridor 2	BEGA T17	14	1	4	56
	corridor 3	BEGA T18	14	1	6	84
	corridor 4	BEGA T19	14	1	6	84

	corridor 5	BEGA T20	14	1	4	56
	Bathrooms	BEGA TC-D	26	1	11	286
Total Watt						**3632**
Second Floor (offices)	Office 1	Fluorescent panels	18	4	34	2448
		BEGA TC-D	26	1	3	78
	Office 2	Fluorescent panels	18	4	8	576
		BEGA TC-D	26	1	2	52
	Office 3	Fluorescent panels	18	4	15	1080
		BEGA TC-D	26	1	2	52
	Office 4	Fluorescent panels	18	4	19	1368
		BEGA TC-D	26	1	2	52
	Office 5	Fluorescent panels	18	4	13	936
		BEGA TC-D	26	1	2	52
	Corridor	BEGA T16	14	1	31	434
Total Watt						**7128**
Third Floor (offices)	Office 1	Fluorescent panels	18	4	34	2448
		BEGA TC-D	26	1	3	78
	Office 2	Fluorescent panels	18	4	8	576
		BEGA TC-D	26	1	2	52
	Office 3	Fluorescent panels	18	4	15	1080
		BEGA TC-D	26	1	2	52
	Office 4	Fluorescent panels	18	4	19	1368
		BEGA TC-D	26	1	2	52
	Office 5	Fluorescent panels	18	4	13	936
		BEGA TC-D	26	1	2	52
	Corridor	BEGA T16	14	1	31	434
Total Watt						**7128**
Fourth Floor (appartments)	Appartment 1	Fluorescent	36	2	12	864
		BEGA TC-D	26	1	2	52
	Appartment 2	Fluorescent	36	2	16	1152
		BEGA TC-D	26	1	3	78
	Appartment 3	Fluorescent	36	2	13	936
		BEGA TC-D	26	1	5	130
	Appartment 4	Fluorescent	36	2	18	1296
		BEGA TC-D	26	1	4	104
	corridor	BEGA TC-D	26	1	6	156
Total Watt						**4768**

Fifth Floor (appartments)	Appartment 1	Fluorescent	36	2	12	864
		BEGA TC-D	26	1	2	52
	Appartment 2	Fluorescent	36	2	16	1152
		BEGA TC-D	26	1	3	78
	Appartment 3	Fluorescent	36	2	13	936
		BEGA TC-D	26	1	5	130
	Appartment 4	Fluorescent	36	2	18	1296
		BEGA TC-D	26	1	4	104
	corridor	BEGA TC-D	26	1	6	156
Total Watt						**4768**

3.4 Socket calculation:

Table 3-3: Sockets Calculations.

Floor	Room	Number of sockets	Current	Total current
Parking	Parking	4	5A	20
Ground Floor (shopping)	Shop 1	6	5A	30
	Shop 2	6	5A	30
	Shop 3	3	5A	15
	Shop 4	3	5A	15
	Shop 5	3	5A	15
	Shop 6	5	5A	25
	Shop 7	5	5A	25
	Shop 8	3	5A	15
	Shop 9	5	5A	25
	restaurant 1	5	5A	25
	restaurant 2	4	5A	20
Total Current				240
First Floor (shopping)	Shop 1	6	5A	30
	Shop 2	6	5A	30
	Shop 3	3	5A	15
	Shop 4	3	5A	15
	Shop 5	3	5A	15
	Shop 6	5	5A	25
	Shop 7	5	5A	25

	Shop 8	3	5A	15
	Shop 9	3	5A	15
	Shop 10	3	5A	15
	restaurant 1	5	5A	25
	restaurant 2	4	5A	20
Total Amp				245
Second Floor (offices)	Office 1	14	5A	70
	Office 2	4	5A	20
	Office 3	6	5A	30
	Office 4	5	5A	25
	Office 5	4	5A	20
Total Amp				165
Third Floor (offices)	Office 1	14	5A	70
	Office 2	4	5A	20
	Office 3	6	5A	30
	Office 4	5	5A	25
	Office 5	4	5A	20
Total Amp				165
Fourth Floor (appartments)	Appartment 1	12	5A	60
		3	2A	6
	Appartment 2	14	5A	70
		3	2A	6
	Appartment 3	11	5A	55
		3	2A	6
	Appartment 4	12	5A	60
		3	2A	6
Total Amp				269
Fifth Floor (appartments)	Appartment 1	12	5A	60
		3	2A	6
	Appartment 2	14	5A	70
		3	2A	6
	Appartment 3	11	5A	55
		3	2A	6

	Appartment 4	12	5A	60
		3	2A	6
Total Amp				269
Total current in building				1373

3.4.1 Branch circuit calculation:

- Diversity factor for lighting = 0.8
- Diversity factor for sockets= 0.2
- Safety factor =1.2
- Power factor =0.8
- Current for lighting = 10 A
- Current for sockets = 16 A

1. Circuit breaker for apartment in residential floor

Lighting load in residential floor = 4678 watt

Socket load in residential floor = 269 Amp

- Number of branch circuit for lighting = total power *D.F*S.F/(P.F *10AMP*220) = 4678*0.8*1.5/(0.8*10AMP*220)

  = 4

  But every 50m^2 needs 1 Circuit breaker

Total area=685

N=685/50=14 Circuit breaker for lighting

- Number of branch circuit for sockets = total power *D.F*S.F/(P.F *16AMP*220) = (269*220)*0.2*1.5/(0.8*16AMP*220)

  = 7

It's acceptable, but it's better to use for every (4-5outlets) a branch circuit. So we have 61 outlets then 61/4 =16 branches.

The total number of branch circuits for residential floor =16+14 = 30 branch circuit.

- The current for apartment in residential floor = {[(Lighting load * D.F) + (socket load * D.F)] * S.F }/220
  = {[(4678 * 0.8) + (269 * 0.2)] * 1.2 }/220
  = 20.7 Amp

  Use branch of 25 Amp

3.4.2 Circuit breaker for Offices floor :

Lighting load in one office = 7128 watt

Socket load in offices floor = 165 Amp

- Number of branch circuit for lighting = total power *D.F*S.F/(P.F *10AMP*220) = 7128*0.8*1.5/(0.8*10AMP*220)
  = 5

  But every $50m^2$ needs 1 Circuit breaker

Total area=685

N=685/50=14 Circuit breaker for lighting

- Number of branch circuit for sockets = total power *D.F*S.F/(P.F *16AMP*220) = (165*220)*0.2*1.5/(0.8*16AMP*220)
  = 4

It's acceptable, but it's better to use for every (4-5outlets) a branch circuit. So we have 61 outlets then 61/4 =16 branches.

The total number of branch circuits for offices floor =16+14 = 30 branch circuit.

- The current for the Office = {[(Lighting load * D.F) + (socket load * D.F)] * S.F }/220
  = {[(7128 * 0.8) + (165* 0.2)] * 1.2 }/220

= 20.7 Amp

Use branch of 25 Amp

3.4.3 Circuit breaker for commercial ground floor:

Lighting load in commercial ground floor = 3632 watt

Socket load in commercial ground floor = 240 Amp

- Number of branch circuit for lighting = total power *D.F*S.F/(P.F *10AMP*220) = 3632*0.8*1.5/(0.8*10AMP*220)
  = 3

  But every $50m^2$ needs 1 Circuit breaker, total area=685

N=685/50=14 Circuit breaker for lighting

- Number of branch circuit for sockets = total power *D.F*S.F/(P.F *16AMP*220) = (240*220)*0.2*1.5/(0.8*16AMP*220)
  = 6

It's acceptable, but it's better to use for every (4-5outlets) a branch circuit. So we have 61 outlets then 61/4 =15 branches.

The total number of branch circuits for offices floor =14+15 = 29 branch circuit.

- The current for shop 10 in the ground floor = {[(Lighting load * D.F) + (socket load * D.F)] * S.F }/220
  = {[(3632 * 0.8) + (240 * 0.2)] * 1.2 }/220
  = 16 Amp
  But its practical to use branch of 20 Amp for every shop.

CHAPTER 4

MECHANICAL SYSTEM

Mechanical design of a building involves many aspects including:

- ✓ Water Supply Systems.
- ✓ Drainage Water Systems Design.
- ✓ HVAC System Design.
- ✓ Elevator System Design.

4.1 Water Supply Systems:

Feeding water to buildings is divided into two main sections: the cold water supply (regular), and the hot water supply. Each system consists of several subsystems.

4.1.1 Cold-water supply system, (regular):

Nutrition attractive fall (Gravity down feed system).

Depends on the idea of the fall of the water under the influence of gravity, is that the work of the water tank top of the building where the direction of water from the top down and thus feed the whole building in an easy and suitable pressure, but the upper floors of the pressure is low for lower roles so it usually is in the roles High-installed pump assist (Auxiliary pump).

Method of water pressure-General: It relies on water pressure from the public (municipal), especially during periods of low consumption of water (such as during the night), filling the reservoirs that feed the building with water in times of the day (high consumption).

4.1.2 Fixture unit calculation:

For the ground and the first floor

Table 4-1: Fixture unit calculation of the ground floor.

fixture	occupancy	Type of supply control	Number of function	Number of FU	Total
WC	public	flush valve	5	10	50
lavatory	public	faucet	5	2	10
Total FU units					60

For the second and the third floor :

Table 4-2: Fixture unit calculation of the second and third floor.

fixture	occupancy	Type of supply control	Number of function	Number of FU	Total
WC	public	flush tank	6	5	30
K.S	public	faucet	6	4	24
Total FU units					54

For the fourth floor and the fifth floor

Table 4-3: Fixture unit calculation of the fourth and fifth floor.

fixture	occupancy	Type of supply control	Number of function	Number of FU	Total
WC	private	flush tank	10	2.2	22
lavatory	private	faucet	11	0.7	7.7
K.S	private	faucet	4	1.4	5.6
bathtub	private	faucet	8	1.4	11.2
Total FU units					46.5

4.1.3 Water demand:

By using the following curve we will select the water demand upon the total fixture units that we found previously.

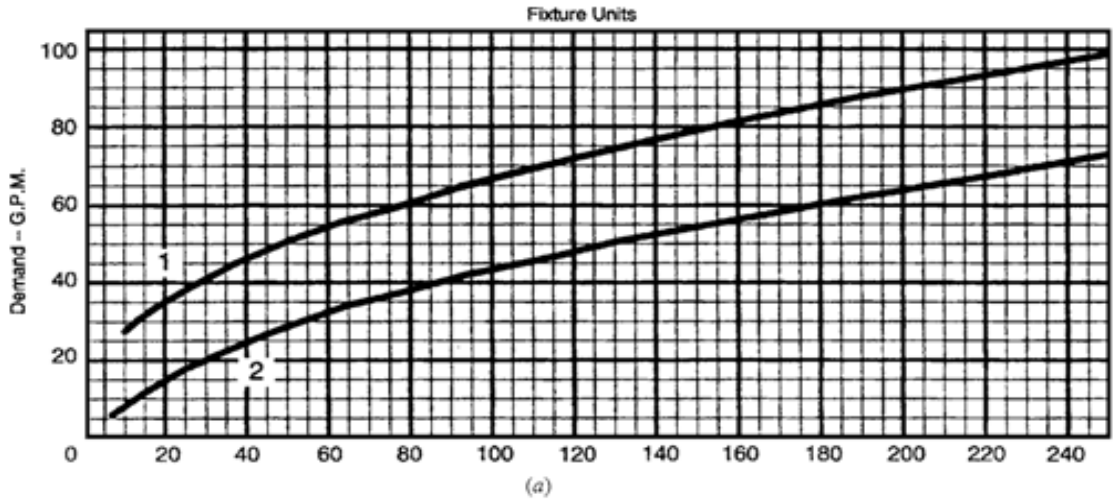


Figure 4-1: Estimate curve for flow based upon total water supply fixture units.

4.1.3.1 Water demand for each zone:

Table 4-4: Water demand for each floor .

Zone A	Type of supply control	Number of fixture unit	water demand (gpm)
Ground and First floor	flush valve	**60**	**55**
Second and third floor	flush valve	54	**50**
fourth and fifth floor	flush valve	**46.5**	**42**

4.1.3.2 Piping size:

Table 4-5: water demand for tanks.

Tank	Type of supply control	Number of fixture unit	water demand (gpm)
Ground and First floor	flush valve	60	75
Second and third floor	flush tank	54	32
fourth and fifth floor	flush tank	46.5	26

By using the following curve ,we found the possible meter diameter due to pressure losses.

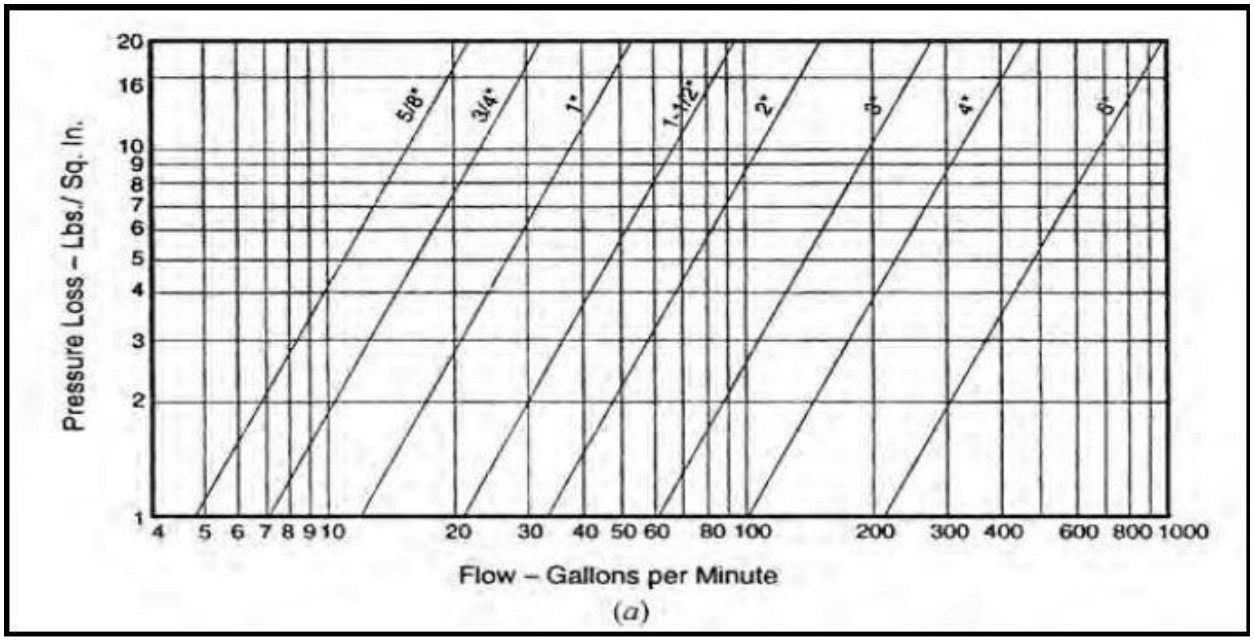


Figure 4-2: Pressure losses in water meters.

The possible diameter for each tank:

Table 4-6: The possible diameter for each tank.

Tank	Loss (psi)						Chosen Diameter
	Diameter						
	5/8”	3/4”	1”	1.5”	2”	3”	
One				13.5	5.2	1.7	1”
Two		15	5.9	1.9			1”
Three	19	8.5	3.5	1.2			1”
Four	19	8.5	3.5				1”

4.1.3.3 Main supply diameter (Feeder):

It will carry all the water for all the fixture units in the zone:

floor demand, actual length and equivalent length.

Table 4-7: Floors demand, actual length and equivalent length.

floor	water demand (gpm)	Actual length (ft)	Equivalent length (ft)
Gf	75	78	112.5
1st	75	60	90
2nd	32	53	79.5
3rd	32	45	67.5
4th	26	30	45
5th	26	25	37.5

By using the following curve shown in Figure we will find the diameter of the pipe:

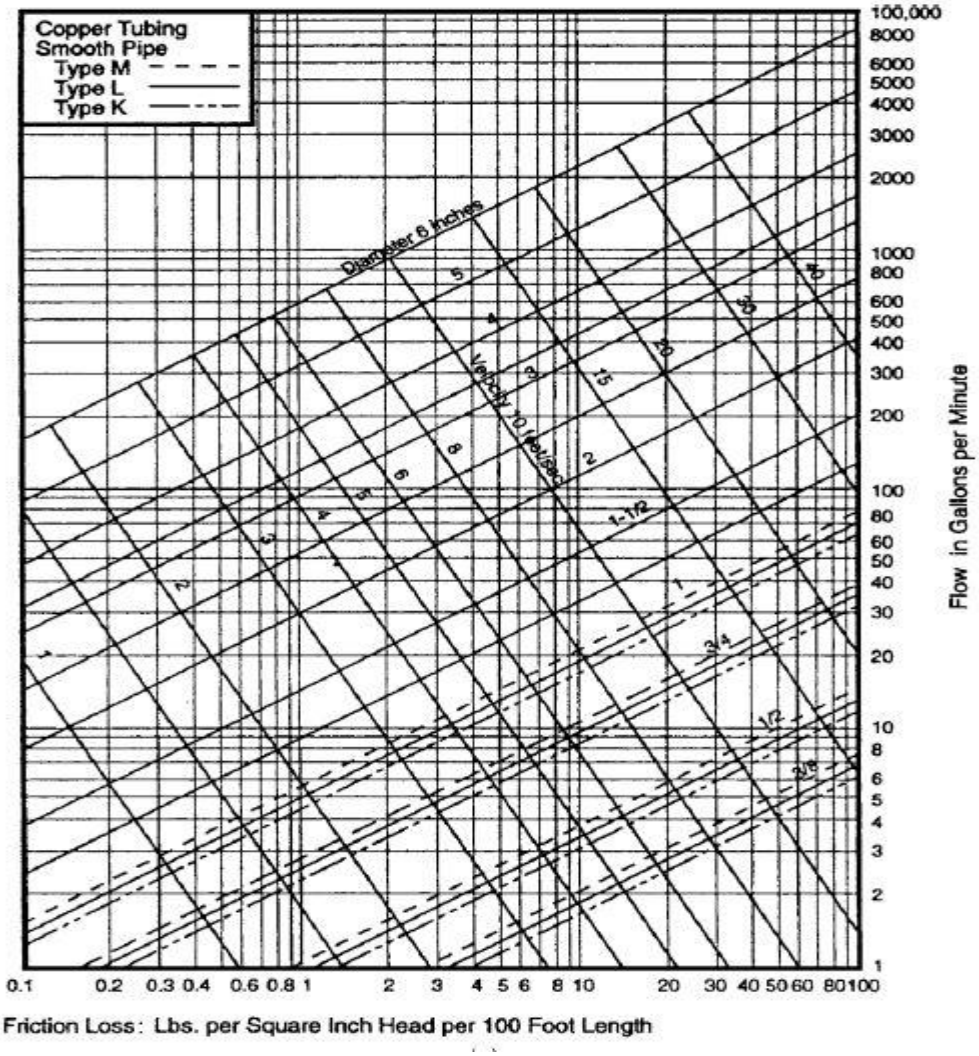


Figure 4-3: Friction loss chart for smooth pipe.

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The possible diameter of the main feeder:

Table 4-8: The possible diameter of the main feeder.

floor	Losses (psi)	Diameter			
		1.5”	2”	3”	4”
Gf	Losses /100 ft(psi)	18	4.8	0.65	0.23
	Losses/112.5ft(psi)	20.25	5.4	0.73	0.25

- available pressure p= h*0.433
- Available pressure p=78*0.433

= 33.77 psi

Total losses= available pressure-12

= 33.77 – 12

= 21.77 psi

floor	Losses (psi)	Diameter			
		1”	1.5”	2”	3”
1st	Losses /100 ft(psi)	23	3.5	1	0.15
	Losses /90ft(psi)	20.7	3.15	0.9	0.13

- available pressure p= h*0.433
- Available pressure p=60*0.433

= 25.98 psi

Total losses= available pressure-12

= 25.98– 12

= 13.98 psi

floor	Losses (psi)	Diameter			
		¾”	1	1.5	2
2nd	Losses /100 ft(psi)	45	15	2.4	0.65
	Losses /79.5ft(psi)	35.77	11.9	1.9	0.52

Zone	Losses (psi)	Diameter			
		¾”	1	1.5	2
3rd	Losses /100 ft(psi)	45	15	2.4	0.65
	Losses /67.5ft(psi)	30.4	10.12	1.62	0.43

floor	Losses (psi)	Diameter			
		¾”	1	1.5	2
4th	Losses /100 ft(psi)	45	15	2.4	0.65
	Losses /45ft(psi)	20.25	6.75	1.08	0.29

Zone	Losses (psi)	Diameter			
		¾”	1	1.5	2
5th	Losses /100 ft(psi)	45	15	2.4	0.65
	Losses /37.5ft(psi)	16.9	5.62	1	0.43

The suitable diameter of the main feeder for each floor:

Table 4-9: The suitable diameter of the main feeder for each floor .

floor	Diameter	Loss(psi)
Gf	1.5”	20.25
1st	1.5”	20.7
2nd	1.5”	35.77
3rd	1.5”	30.4
4th	1.5”	20.25
5th	1.5”	16.9

4.1.4 Main Horizontal supply diameter:

Table 4-10: Water demand, actual length and equivalent length.

floor	water demand (gpm)	Actual length (ft)	Equivalent length (ft)
Gf	14.5	16.6	24.9
1st	14.5	16.6	24.9
2nd	4.2	19.8	29.7
3rd	4.2	19.8	29.7
4th	5.7	9.9	14.85
5th	5.7	9.9	14.85

4.1.4.1 The possible diameter of the horizontal feeder:

Table 4-11: The possible diameter of the horizontal feeder.

floor	Losses (psi)	Diameter			
		1”	1.5”	2”	3”
Gf,1st	Losses /100 ft(psi)	23	3.5	1	0.15
	Losses /24.9ft(psi)	5.7	0.87	0.25	0.037

floor	Losses (psi)	Diameter			
		¾”	1”	1.5”	2”
2nd , 3rd	Losses /100 ft(psi)	20	6	1	0.26
	Losses /29.7ft(psi)	5.98	1.78	0.29	0.08

Zone	Losses (psi)	Diameter			
		½”	¾”	1”	1.5”
4th , 5th	Losses /100 ft(psi)	45	7.5	2.5	0.35
	Losses/14.85ft(psi)	6.7	1.1	0.37	0.05

The suitable diameter of the horizontal feeder for each zone:

Table 4-12: The suitable diameter of the horizontal feeder for each zone.

Zone	Diameter	Loss(psi)
Gf , 1st	1”	5.7
2nd , 3rd	1”	1.78
4th , 5th	1”	0.37

The possible diameter of the branch

Table 4-13: The suitable diameter of the branch feeder.

Zone	Diameter	Loss(psi)
Lavatory	¾”	0.42
Wc	¾”	1.98
K.S	¾”	0.22

4.2 Hot water supply:

In the hot water, we will use active and passive energy to heat water. For active system, electrical system will be used.

For pipes, the same cold water pipes will be used.

4.3 Drainage Water Systems Design:

4.3.1 Stack diameter:

Use the following table to choose the most suitable stack:

Table 4-14: Horizontal Fixtures Branches and Stack.

Diameter of Pipe			Maximum Total Number of dfu Allowable Stacks[b]		
in.	mm[c]	Horizontal Branch	One Branch Interval	Three Branch Intervals or Less	Greater than Three Branch Intervals
1½	38	3	2	4	8
2	51	6	6	10	24
2½	64	12	9	20	42
3	76	20	20	48	72
4	102	160	90	240	500
5	127	360	200	540	1100
6	152	620	350	960	1900
8	203	1400	600	2200	3600
10	254	2500	1000	3800	5600
12	305	3900	1500	6000	8400
15	381	7000	[d]	[d]	[d]

4.3.2 Vent diameter:

Table 4-15: Vent diameter.

Diameter of Soil or Waste Stack in. (mm)[b]	Total Fixture Units Being Vented (dfu)	Maximum Developed Length[a] of Vent, Feet (m)[b]									
		Diameter of Vent, In. (mm)[b]									
		1¼ (32)	1½ (38)	2 (51)	2½ (64)	3 (76)	4 (102)	5 (127)	6 (152)	8 (203)	10 (254)
1¼ (32)	2	30 (9.1)									
1½ (38)	8	50 (15.2)	150 (45.7)								
1½ (38)	10	30 (9.1)	100 (30.5)								
2 (51)	12	30 (9.1)	75 (22.9)	200 (61.0)							
2 (51)	20	26 (7.9)	50 (15.2)	150 (45.7)							
21/2 (64)	42		30 (9.1)	100 (30.5)							
3 (76)	10		42 (12.8)	150 (45.7)	360 (109.7)	1040 (317)					
3 (76)	21		32 (9.8)	110 (33.5)	270 (82.3)	810 (246.9)					
3 (76)	53		27 (8.2)	94 (28.7)	230 (70.1)	680 (207.3)					
3 (76)	102		25 (7.6)	86 (26.6)	210 (64.0)	620 (189.0)					
4 (102)	43			35 (10.7)	85 (25.9)	250 (76.2)	980 (298.7)				
4 (102)	140			27 (8.2)	65 (19.8)	200 (61.0)	750 (228.6)				
4 (102)	320			23 (7.0)	55 (16.8)	170 (51.8)	640 (195.0)				
4 (102)	540			21 (6.4)	50 (15.2)	150 (45.7)	580 (176.8)				
5 (127)	190				28 (8.5)	82 (25.0)	320 (97.5)	990 (301.8)			
5 (127)	490				21 (6.4)	63 (19.2)	250 (76.2)	760 (231.6)			
5 (127)	940				18 (5.5)	53 (16.2)	210 (64.0)	670 (204.2)			
5 (127)	1400				16 (4.9)	49 (14.9)	190 (57.9)	590 (179.8)			
6 (152)	500					33 (10.1)	130 (39.6)	400 (121.9)	1000 (304.8)		
6 (152)	1100					26 (7.9)	100 (30.5)	310 (94.5)	780 (237.7)		
6 (152)	2000					22 (6.7)	84 (25.6)	260 (79.2)	660 (201.2)		

Table 416-: Number of fixture unit and diameter .

Floor	Gf , 1st	2nd , 3rd	4th , 5th
Lavatories	5	0	**11**
Kitchen sink	0	5	**4**
Bathtub	0	0	**8**
W.C's	5	5	**10**
total Fu	14.5	18.5	**46.5**
Stack	4”	4”	**4”**
Vent	4”	4”	**4”**

Note : each horizontal branch connect with vertical branch by 4” **pipe**

4.4 HVAC System Design:

A multi-functional building often has ventilation and comfort requirements that vary widely from zone to zone. and the efforts must made to control its environment according to the zone functions so that occupants can be satisfied with the comfort, and provided with a healthy and safe living and working environment.

In our building we will design the HVAC system in the offices floors only, and the other floors the regular air conditioning systems such as air conditioners will be used.

We will use the chiller for cooling in summer and the boiler for heating in winter.

Total heat load (cooling and heating) in office floor .

Table 417-: Total heat load .

Max Heating Qtot.(K.w)/m^2	Max Cooling Qtot.(K.w)
25.16	**31.50**

We will use the RWC chiller because it`s offer a low sound power level.

4.4.1 Chiller selection:

A chillier is a machine that removes heat from a liquid via a vapors-compression or absorption refrigerating cycle. This liquid can then be circulated through a heat exchanger to cool air or equipment as required.

M cir(water system) =(Qtotal/Cpw*(Tri– Tro))

=31508/4180(10)=0.75L/s.

Total cooling load = 1.1X31.5=34.65KW.

We will select a chiller with capacity >34.65 KW.

Table 4-18: Chiller selection.

MODEL	LWT°C																			
		CAP	L/s	KW	WPD	CAP	L/s	KW	WPD	CAP	L/s	KW	WPD	CAP	L/s	KW	WPD	CAP	L/s	KW	WPD
RWCc160	4	40.0	1.6	9.8	17.0	38.2	1.5	10.9	15.5	36.3	1.4	12.1	14.1	34.2	1.4	13.4	12.5	31.4	1.2	15.3	10.7
	5	41.3	1.6	9.9	18.0	39.4	1.6	11.0	16.4	37.4	1.5	12.2	15.0	35.2	1.4	13.6	13.3	32.4	1.3	15.5	11.4
	6	42.5	1.7	10.0	19.0	40.6	1.6	11.1	17.4	38.6	1.5	12.3	15.8	36.3	1.5	13.7	14.1	33.3	1.3	15.6	12.0
	7	43.8	1.7	10.1	20.1	41.9	1.7	11.2	18.5	39.7	1.6	12.4	16.7	37.5	1.5	13.8	15.0	34.4	1.4	15.7	12.7
	8	45.0	1.8	10.2	21.2	43.1	1.7	11.3	19.5	40.9	1.6	12.5	17.7	38.6	1.5	13.9	15.8	35.4	1.4	15.9	13.4
	9	46.4	1.8	10.3	22.4	44.3	1.8	11.4	20.5	42.1	1.7	12.6	18.7	39.6	1.6	14.1	16.6	36.4	1.5	16.0	14.2
	10	47.8	1.9	10.3	23.6	45.6	1.8	11.5	21.7	43.4	1.7	12.7	19.7	40.8	1.6	14.2	17.6	37.5	1.5	16.1	15.0
RWCc 210	4	51.7	2.1	12.6	35.6	49.1	2.0	14.0	32.3	46.4	1.8	15.7	29.0	43.5	1.7	17.5	25.6	39.6	1.6	20.1	21.5
	5	53.5	2.1	12.7	38.0	50.9	2.0	14.2	34.5	48.1	1.9	15.8	31.0	45.1	1.8	17.6	27.5	41.2	1.6	20.2	23.1
	6	55.3	2.2	12.8	40.5	52.6	2.1	14.3	36.8	50.2	2.0	15.9	33.6	47.4	1.9	17.9	30.2	43.7	1.7	20.5	25.9
	7	57.2	2.3	12.9	43.1	54.4	2.2	14.4	39.2	51.3	2.0	16.1	35.2	48.2	1.9	17.9	31.1	45.1	1.8	20.7	27.4
	8	59.0	2.4	13.0	45.8	56.1	2.2	14.5	41.5	53.0	2.1	16.2	37.3	49.7	2.0	18.0	33.0	46.1	1.8	20.7	27.6
	9	60.9	2.4	13.2	48.6	57.9	2.3	14.7	44.2	54.9	2.2	16.3	39.9	51.4	2.1	18.2	35.2	48.1	1.9	20.8	29.6
	10	62.8	2.5	13.3	51.6	59.8	2.4	14.8	47.0	56.6	2.3	16.4	42.3	53.1	2.1	18.4	37.4	49.8	1.9	21.0	31.6

4.4.2 Selection of FCU:

Fan-coil units provide heating, cooling, or both to individual spaces. They may be mounted in freestanding cabinets, inside walls, in ceiling plenums, or in other locations. Fan-coil units usually discharge air directly from their enclosures, although some may be installed with short ducts. The main components of fan-coil units are a fan and one or two coils. Units may have separate heating and cooling coils or a single water coil may be used for both functions. The coils may operate with hot water, chilled water, electric resistance, or rarely, steam.

We will select FCU from PETRA products because the units are particularly suitable for ceiling and ducted air distribution.

- ✓ V cir=Qtotal /1.2(T cir. –Ti)

  = 2625L/s

  =2866X2.2=5775CFM

- ✓ DC model(two pipe system) from Petra products have been selected and this table show the specifications of the model:
  And we will use 5 FCU (one for each office).

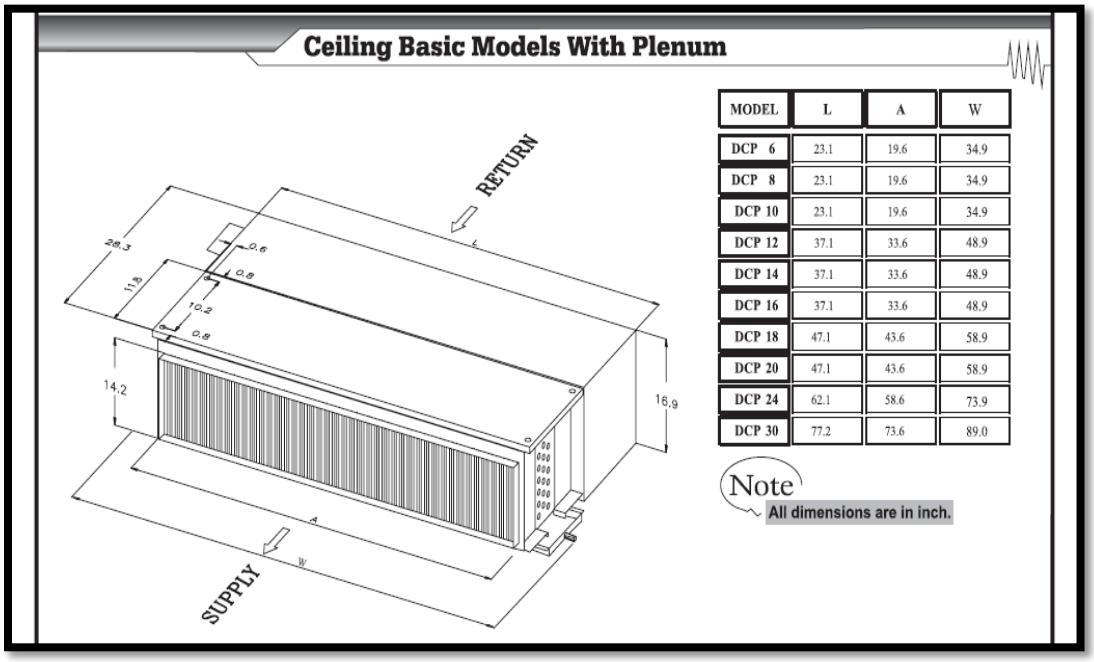
Table 4-19: Selection of FCU.

MODEL [DC]	6	8	10	12	14	16	18	20	24*	30*
Fan	Double Inlet Forward Curved Centrifugal									
No.	1	1	1	2	2	2	2	2	3	4
Transmission	Direct Drive									
Total Air Flow[Nominal] CFM	600	800	1,000	1,200	1,400	1,600	1,800	2,000	2,400	3,000

2 FCU 3 FCU

3FCU with 1600 CFM for each one, and 2FCU with 800CFM for each one.

4.4.3 Diffusers selection:



MODEL	L	A	W
DCP 6	23.1	19.6	34.9
DCP 8	23.1	19.6	34.9
DCP 10	23.1	19.6	34.9
DCP 12	37.1	33.6	48.9
DCP 14	37.1	33.6	48.9
DCP 16	37.1	33.6	48.9
DCP 18	47.1	43.6	58.9
DCP 20	47.1	43.6	58.9
DCP 24	62.1	58.6	73.9
DCP 30	77.2	73.6	89.0

Figure 4-4: Ceiling basic models with plenum.

Figure 4-5: Diffusers.

- ✓ We will use diffuser with 30X30cm, each diffuser (200CFM)
- ✓ Number of diffuser in each office (office with FCU of 800CFM)=

  800/200 = 4diffusers.

- ✓ Number of diffuser in each office (office with FCU of 800CFM)=

  1600/200 = 8diffusers.

4.4.4 Boiler selection:

Before we select the needed boiler for heating in the winter we need a room that contain the boiler, and this room consist of these element:

- ✓ Boiler
- ✓ Expansion tank
- ✓ Heat Exchanger
- ✓ Hot water tank
- ✓ Pumps
- ✓ Valves

4.4.4.1 Domestic Hot water:

$Q_{domestic} = \frac{Mw\ x\ Cp\ x\ \Delta T}{\Delta t}$

Where:

Mw: Daily consumption of domestic hot water

Cp: Specific heat for water

ΔT: $T_h - T_c$

T_h : hot water supply temperature

T_c: temperature of the cold water

M_w = 5L/hr for each person

Average in office floor 25 person

5 x 40 = 200 L / hr

200x 2 = 400 L (air change rate/hr=2.)

M_w =0.4 m^3/ day

$Q_{domestic} = \frac{400\ x\ 4.18\ x\ 50}{2\ x\ 3600}$ = 11.7 KW.

Q_{total} = (Heating Load + Domestic hot water) * 1.1

Q_{total} = (25.16+11.7) x 1.1 = 40.5 KW

Q_{boiler} =1.1*Q_{total}

=1.1X40.5=44.55KW.

We must select a boiler with capacity more than 44.5 KW.

4.5 Elevator System Design:

American code was used to design the elevators for this office building, the design consists two things:

- ✓ The type of the elevator.
- ✓ The number of the elevator.

4.5.1 The type of the elevators:

After calculation the suitable elevator was (2500Ib/200ft/min) this selection depending on the type of the building which assumed as small office building and the other things that affected on the selection is the car travel. The door of the elevator is Two Speed Simplex with Auto doors Single Sliding / Telescopic / Centre Opening which is suitable for offices building.

Figure 4-6: type of elevator door in the building.

2000 =car capacity (pound)

200 =minimum car speed (feet per minute)

Hydraulic elevator.

4.5.2 The calculation for residential:

Table 4-20: technical information for the building.

general information	(meter)	feet
# of floor	7	22.96
total h(m)	22.5	73.89
Area (m)	628	2062.4
building used residential building	Type of the building	

- ✓ *population(persons)=population of the building/total area
- ✓ *handling capacities(HC)=pop/percent of pop.
- ✓ *number of elevator=RT*HC/(300P)
- ✓ RT=(round trip) graph(31.20 a)

Checks have been used to ensure the suit of the elevator:

1- interval time:

I=RT/N

RT= 105

hc= 300P/RT

= 28.5

N=Hc/hc

= 1

Table 4-21: population of the offices floors.

population of the building	# of room X net area	
pop=	28 X 1.5	42 persons
Percent of pop. To be carried in 5min		
dormitories (10-11)	0.11	
Handling capacities= pop/percent of pop.	3.3	persons in5min
max passenger capacity small building 2000 pounds	10	normal
minimum car speed(0-75)-(100)		
option	2000Ib/200	round trip105

Table 4-22: checks.

CHECK	
I=RT/N	
I(200)	105
CHEK HANDLING CAPACITY for 2000Ib	
HC=300P/I	28.6

Number of elevator=RT*HC/ (300P)

= 0.11

Use 1 elevator.....

4.5.3 The calculating for Commercial & office elevator design:

The details of the selection (2500Ib/400ft/min) elevators

2500=car capacity (pound)

400=minimum car speed (feet per minute)

population of the building	**130 ft^2/person**		
pop=	130/37654.4	289.64	persons
Percent of pop. To be carried in 5min investment (12-14)			
	0.14		
Handling capacities= pop/percent of pop.	40.55	persons in5min	
max passenger capacity small building 2500 pounds	13	normal	
minimum car speed(0-125)>(350-400)			
option	2500Ib/350	round trip 85	
	2500Ib/400	round trip 83	

Table 4-23: Technical information for the building.

general information	(meter)	feet
# of floor	5	16.4
total h(m)	20.5	67.32
Area (m)	628	2296
building used as office building diversified and average	Type of the building	

checks have been used to ensure the suit of the elevator

CHECK
I=RT/N
I(350) 96.6
I(400) 96.1
CHEK HANDLING CAPACITY for 2500Ib/400ft
HC=300P/I 40.6

1- interval time

I=RT/N

2- CHEK HANDLING CAPACITY

HC=300P/I

Number of elevator=RT*HC/(300P)

= 1.15

Use 2 elevators.....

CHAPTER 5

ENVIROMENTAL DESIGN

5.1 Introduction

In this chapter we have to simulate the building by using Ecotect to give an indication about how much this building is energy efficient.
This chapter includes the building orientation on the land to collect the largest amount of solar gain in winter and the minimum solar gain in summer.
We also provide shading for the windows on East, West and south direction In line with the sun path at different times of the year.

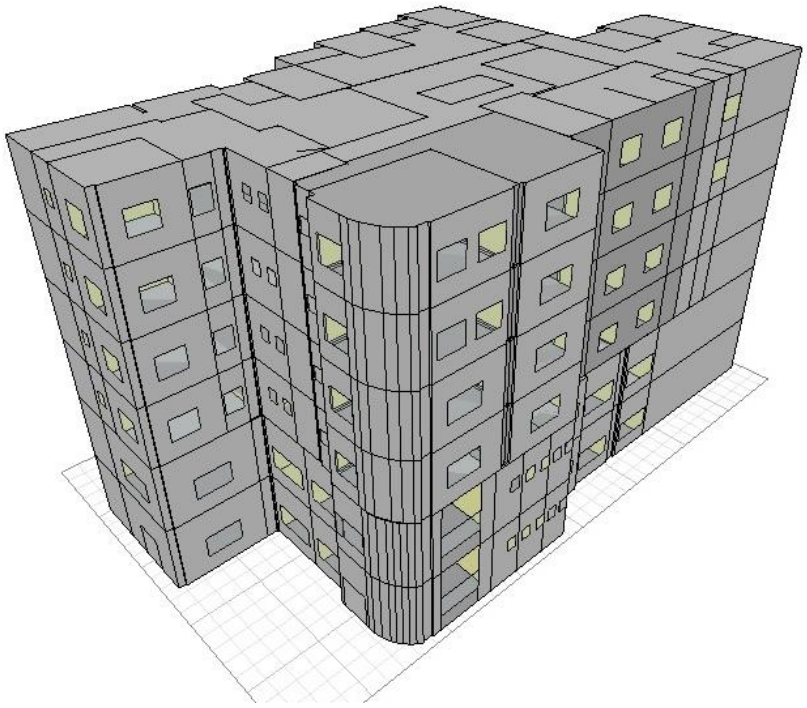


Figure 5-1: Ecotect photo of the building.

5.2 material of walls, floors, roofs and partitions.

It was as follows:

- ✓ **The external wall included:**

- Stone 7cm
- Polyurethane 2cm
- Concrete 10cm
- Hollow Block 10cm

Total U-value by ECOTECT = 2.62 w/m2.k

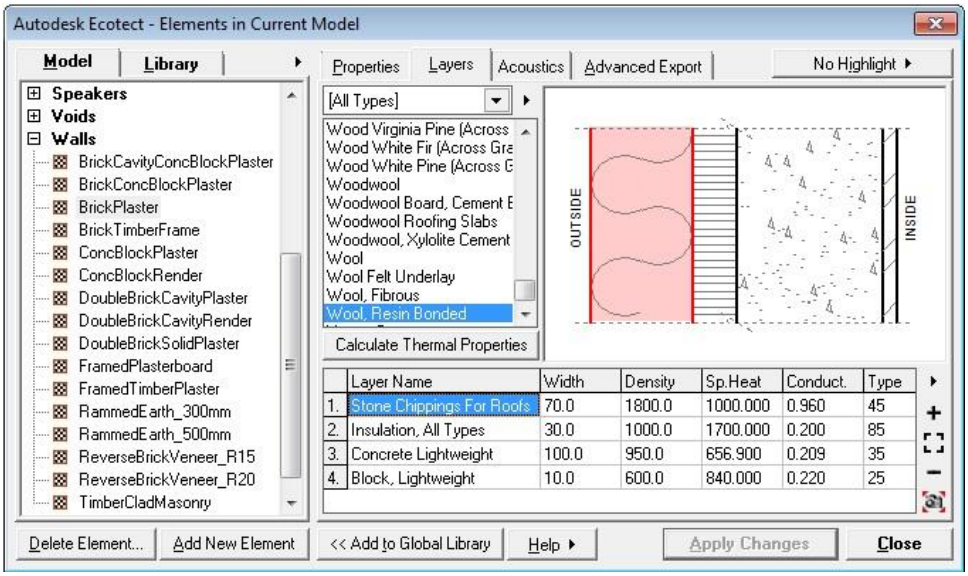


Figure 5-2: Details of the external wall.

- ✓ **The Ground floor included:**

- Gravel 10 cm
- Concrete 15cm
- Sand 3 cm
- Concrete 3 cm
- Tile 3cm

Total U-value by ECOTECT = 1.93 w/m2.k.

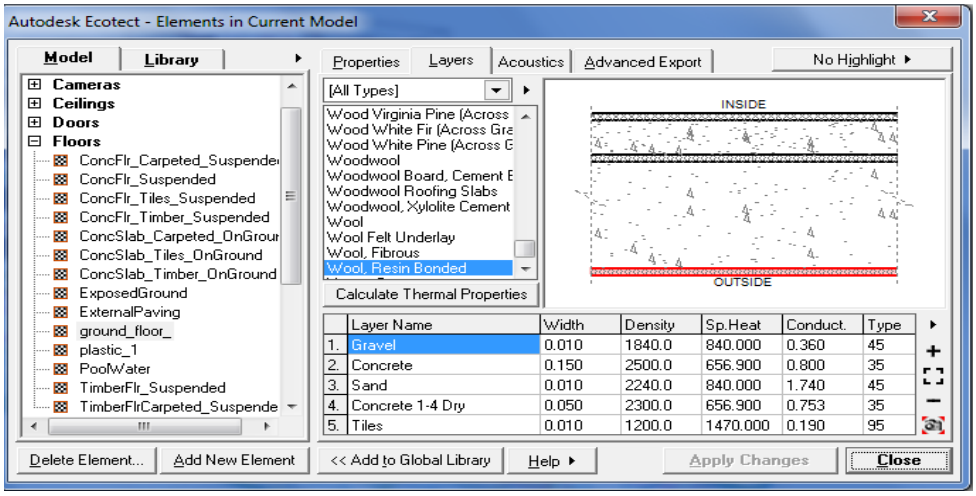


Figure 5-3: Details of the ground floor.

✓ **The Ceiling between two floors included:**

-Tiles 1.5cm
-Mortar 1.5cm
- Sand 3cm
- Concrete 23 cm.
- plaster 2cm

Total U-value by ECOTECT = 1.81 w/m2.k.

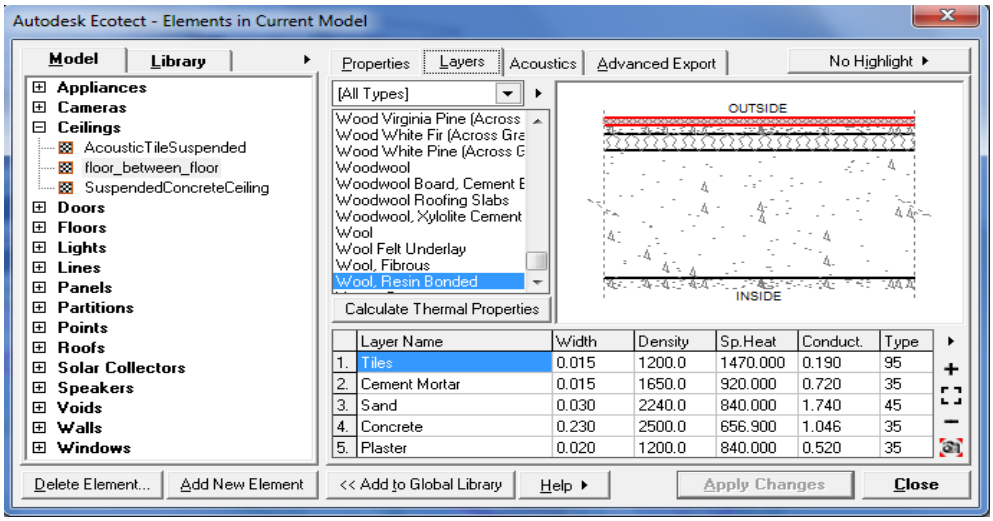


Figure 5-4: Details of the ceiling.

5.3 Solar Shading

Solar Shading is a System which controls the amount of heat and light admitted to a building, permitting users to control heat gains from the sun.

5.3.1 Features and benefits of Solar Shading Systems

- ✓ Optimum performance by reducing solar heat gains whilst maintaining acceptable levels of natural daylight
- ✓ Reduction of cooling loads in summer
- ✓ Reduction of heating requirements in winter
- ✓ Potential for striking aesthetic impact

5.3.2 The Main Types of Shading in this Building

5.3.2.1 Shading for South elevation :

For a South facing, effective solar shading can be achieved using a fixed horizontal solar shading system

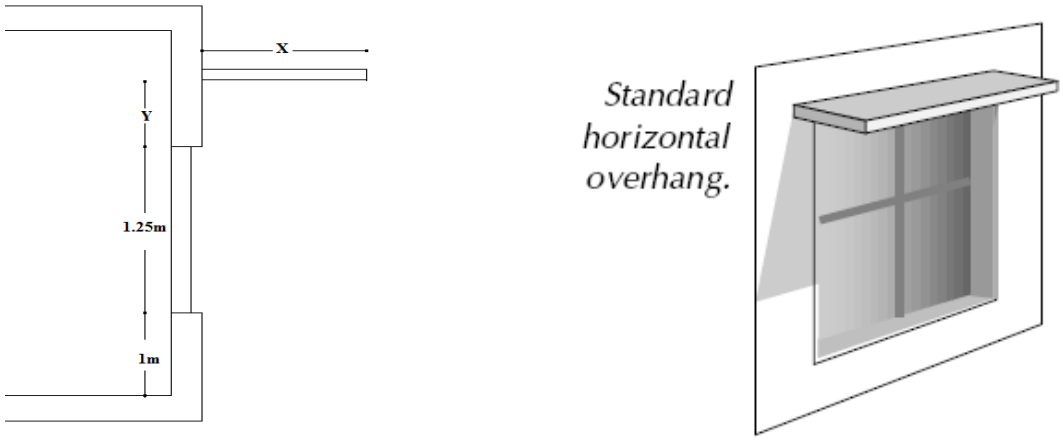


Figure 5-5: Shading of the window.

5.3.2.1.1 Ground floor shading

The height of the windows = 2.5m
The length of the cantilever:
The design will be At 11:00 AM 15may

At 11:00 AM 21may
Altitude angle=65.40 Azimuth angle=37.50

At 11:00 AM 21may
Altitude angle=720 Azimuth angle=51.90

$\underline{\Delta}$ Alt=6.60 $\underline{\Delta}$ Azi=14.460

21/4 ---> 15/5 = 24 days
AL$\underline{\Delta}$24=24/30 *6.6 =5.280
Azi$\underline{\Delta}$24=24/30 *14.4 =11.520

Alt. (11:00, 15/5) = 65.4 + 5.28 = 70.68

X =H/tan(Alt)

x=length of slice of shutters
h=Hight of the window
=2.5/tan(70.68)-0.68 = 01.15 m
Use Flat cantilever with length = 1.15m.
The height of the cantilever over the window = X*0.68
=1.15*0.68=0.782m= 78cm

5.3.2.1.2 First floor shading:

The height of the windows = 2m.

X =H/tan(Alt)-0.68 =2/tan(70.68)-0.68 = 0.92 m
Use Flat cantilever with length = 92 cm.
The height of the cantilever over the window = X*0.68
=0.92*0.68=0.63m= 63cm.

5.3.2.1.3 The offices floors:

The shading will be by using fixed horizontal cantilever
The height of the windows = 1.25m.
X =H/tan(Alt)-0.68 =1.25/tan(70.68)-0.68 = 0.46 m
Use Flat cantilever with length = 46cm.
The height of the cantilever over the window = X*0.68
=0.46*0.68=0. 3m= 30cm.

5.3.2.1.4 The residential floors:

X =H/tan(Alt)-0.68 =1.25/tan(70.68)-0.68 = 0.46 m
Use Flat cantilever with length = 46cm cm.
The height of the cantilever over the window = X*0.68
=0.46*0.68=0. 3m= 30cm.

5.3.2.2 Shading for East & West elevation

Automatic vertical moveable shutters were used in east windows to prevent the sun rays enter the office and residential rooms, it moves in 45 degrees to the north in the winter and 45degrees to the south in the summer depending on the sun movement, assume the spacing between shutters = 12cm,so the length of each shutter = 17cm.
The dimension of the shutter as in the diagram

5.3.3 Building shadow

We calculate the length of the shadow for building as follow:

5.3.3.1 In winter:

At 11:00, 21/Jan
Altitude angle = 36.1
Azimuth angle = 17.5
Building height = 25.5 m
length of shadow (L) =25.5/tan(36.1) = 33.226 m

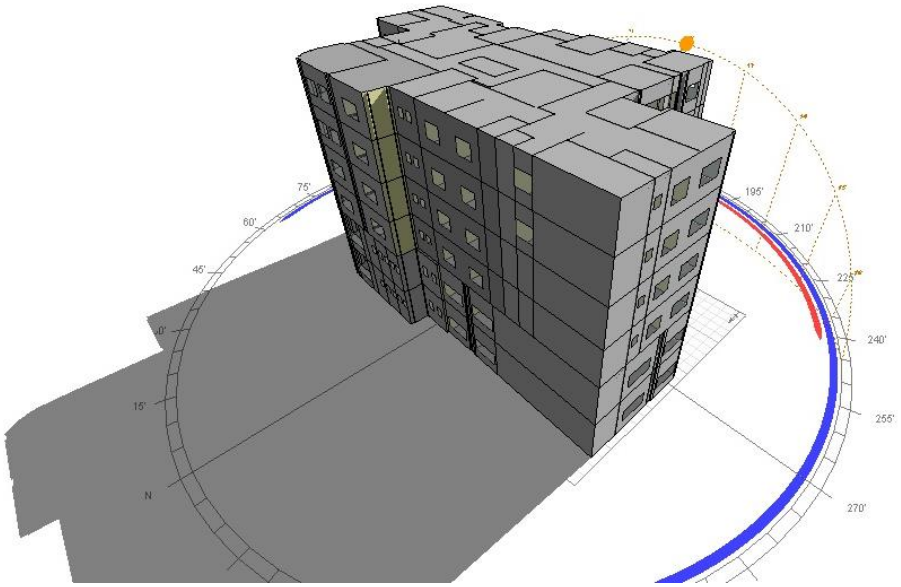


Figure 5-6: Building shadow in winter.

5.3.3.2 In summer:

At 11:00, 21/6
Alt. angle 74.2
Az. Angle = 60.9
length of shadow (L =25.5/tan(74.2) = 7.15m

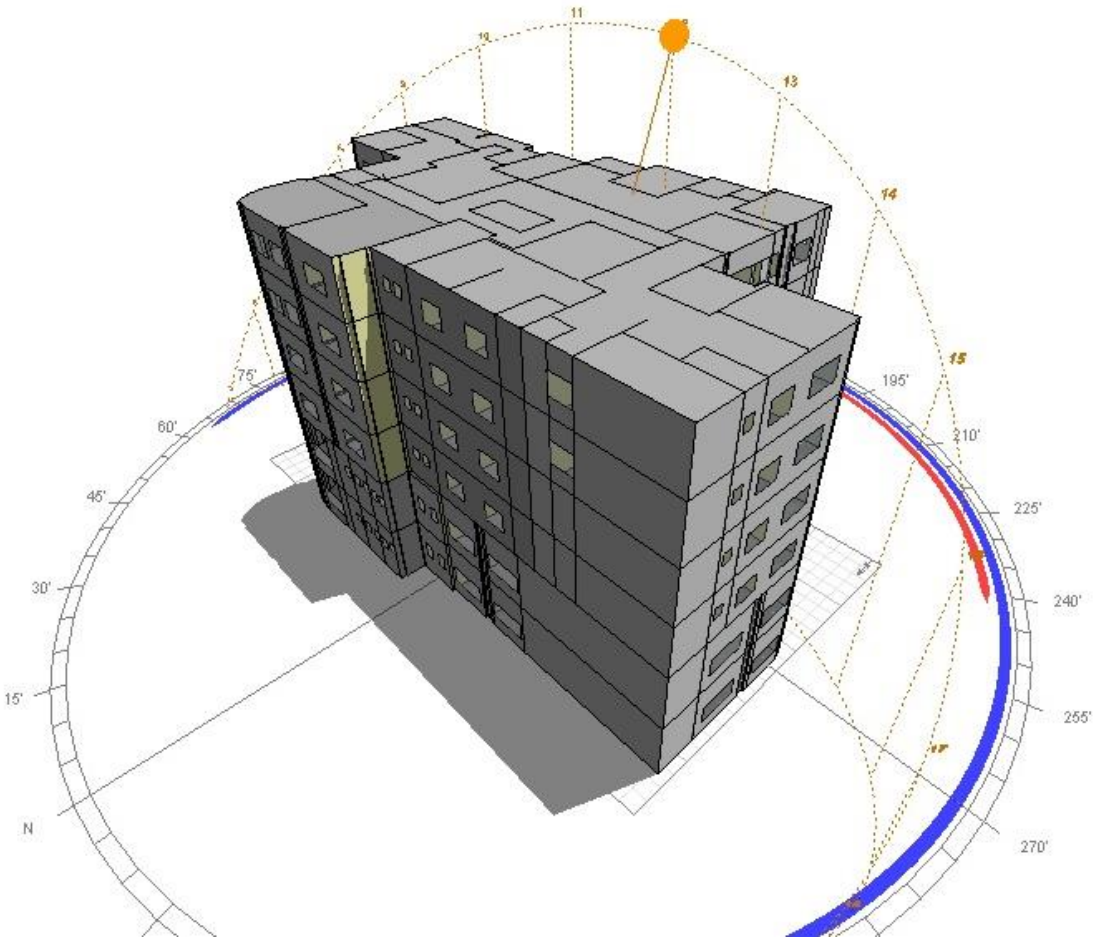


Figure 5-7: Building shadow in summer.

CHAPTER 6

FIRE SYSTEM

6.1 Emergency Lighting:

Emergency lights and exit signs help building occupants escape to safety during an emergency like a power outage or fire. During times such as these, people can become panicked and lose their sense of direction. Emergency lights guide the way to safety while exit signs show the quickest path to an outdoor exit. These fixtures together are life saving devices that are required by building and fire code regulations.

6.1.1 Emergency Escape Lighting:

The purpose of emergency escape lighting is to ensure the luminance is provided promptly,
Automatically and for a suitable time in a specified area when the power supply to the
Normal lighting fails, to ensure that persons within the building can evacuate safely.
The emergency lighting on a route forming part of the means of escape from a point in a building to final exit.

Figure 6-1: Emergency lighting in building to final exit.

6.2 Fire fighting system:

Fire alarm system and fire protection system were designed for the offices floor in the building, since saving lives is a primary consideration in the event of fire within buildings. Therefore, required notification for people inside the building once the fire also occurs such that these could leave before fire spreads and they are unable to escape.

6.2.1 Fire Alarm system:

Two types of fire alarm were used in the building:

6.2.1.1 Manual Fire alarm systems.

Figure 6-2: Manual fire alarm.

The work of this system is based primarily by the person clicking on the button of the warning and is often distribution glass compressors in all components of the building and is running a warning and a broken glass cover signal is sent to the control panel. It should be fed in combinations alarms electric current secondary otherwise the main power supply so that the use of these devices in case of power of origin.

6.2.1.2 The automatic warning system:

(Automatic) Featuring alarms Automatic for handheld devices being does not rely on rights in the operation as well as shorten the time period between the time of the fire and the moment of discovery, allowing the speed of intervention and the effectiveness of control operations and control the fire.

Figure 6-3: Automatic fire alarms.

Figure 6-4: smoke detector.

6.3 Protection system:

Two manual systems were used in the building as follows:

Figure 6-5: Fire extinguisher.

6.3.1 Fire extinguisher:

This type is specifically design to handle any flammable based-on-cellulose materials are including papers, woods or cardboard, Styrofoam, plastics, cloths. Figure bellow shows a picture of Fire extinguisher

6.3.2 fire hose system(hose wheel):

This type is used at the start and at the end of the corridors so that the length of the wheel reaches any point in the corridors to ensure the building safety. The water which well be used for fire is from the domestic roof tank where the opining pipe of the fire water at the bottom of the tank.

Figure 6-6: Fire hose double cabinet .

6.4 Sprinklers system:

The sprinklers system is used in, buildings to be protected by sprinklers systems fall into several hazard groups. Newer quick-response sprinkler heads are now required throughout light hazard occupancies, including offices. These more thermally sensitive heads open sooner than ordinary heads, and thus tend to fight a fire with even fewer heads operating. Based on a literature review the maximum distance between any two sprinklers must not be more than 3.7 m, each sprinkler protect a 9m2 .sprinkler will use in this building as shown in Figure .

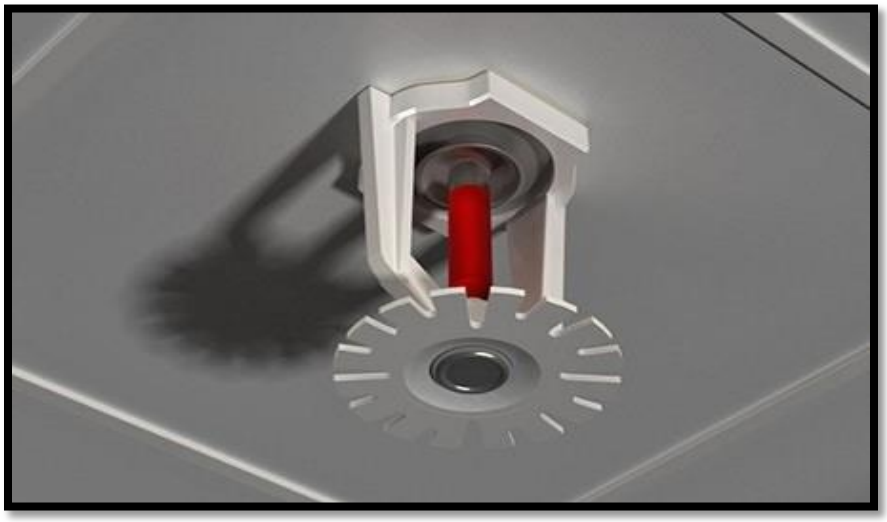


Figure 6-7: Upward sprinkler.

The heat sensitive break bulb chose by the color code where these colors put as a temperature classification.

The temperature at which a sprinkler is triggered should be at least 14 C0 higher than the maximum ceiling temperature ordinarily expected. Ordinary sprinkler heads operate at between 570 and 770 C0 (4).

6.5 Fire fighting system:

6.5.1 In the parking:

- ✓ We but tow fire hose station .
- ✓ We but flame detector .
- ✓ We propose not to put smoke detector Because the presence of car exhaust so it will be not efficient.

6.5.2 In the ground Floor (commercial) :

- ✓ We but smoke detector in ever shop .
- ✓ We but spelunkers in the Corridors.
- ✓ We put emergence lighting in the corridors and near the Steris and exits.
- ✓ We but tow fire hose station.
- ✓ We suggest to put a fire extinguisher in every shop

6.5.3 In the first Floor (commercial) :

First floor same as ground floor but in this floor we but Bulb indicate fire, manual Fire alarm , emergency lighting, fire alarm control panel and speaker .

6.5.4 Second and third floor (offices) :

- ✓ We put smoke detector in each office .
- ✓ We but tow fire hose station.
- ✓ We put emergence lighting in the corridors and near the Steris and exits

6.5.5 Fourth and fifth floor (residential):

- ✓ We put flame detector in ever room except Kitchen because it will be inefficient.
- ✓ We put emergence lighting in the corridors and near the Steris and exits

CHAPTER 7

QUANTITY SURVEYING

Item	activity	Units	Quantity	material cost		labor cost		Total cost	
				unit cost	material cost	unit cost	Total cost	total unit cost	totalcost
1.1	structural								
1.1.1	concrete	M^3	2454.8	330	810084	5	12274	335	822358
1.1.2	steel	ton	140	3250	455000	300	42000	3550	497000
1.1.3	excavation	M^3	3840	8	30720	0	0	8	30720
1.1.4	Slabs formwork	M2	5230	5	26150	6	31380	11	57530
1.1.5	footing formwork	M2	100.8	5	504	6	604.8	11	1108.8
1.1.6	Column formwork	M2	447.42	5	2237.1	6	2684.52	11	4921.62
1.1.7	shear wall formwork	M2	44	5	220	6	264	11	484
1.1.8	slab rips	block	39571	2.5	98927.5	0.3	11871.3	2.8	110798.8
1.2	finishing								
1.2.1	plaster	m^2	10687	12	128244	8	85496	20	213740
1,2,2	Bathroom doors	Units	50	300	15000	50	2500	350	17500
1.2.3	external doors	Units	16	1300	20800	100	1600	1400	22400
1.2.4	external doors 2 (سيكوريت)	Units	20	2100	42000	100	2000	2200	44000
1.2.5	inernal door	Units	44	420	18480	80	3520	500	22000
1.2.6	painting	m^2	10687	3	32061	2	21374	5	53435
1.2.7	Fill under tiles	m^3	122.28	45	5502.6	5	611.4	50	6114
1.2.8	floor tiles	M2	4221	45	189945	15	63315	60	253260
1.2.9	skirting	M	1868	5	9340	2	3736	7	13076
1.2.10	براطيش	M	317	40	12680	10	3170	50	15850
1.2.11	internal wall block	block	39800	1.5	59700	0.5	19900	2	79600
1.2.12	external wall block	block	27260	1.5	40890	0.5	13630	2	54520
1.2.13	external stone	M2	2733	100	273300	5	13665	105	286965
1.2.14	corner stone	stone	1848	50	92400	2.5	4620	52.5	97020
1.2.15	stairs finishing	Units	371	100	37100	15	5565	115	42665
1.2.16	WCs	Units	50	700	35000	0	0	700	35000
1.2.17	Kitchens	M	48	600	28800	0	0	600	28800
1.2.18	windows	M2	518	350	181300	20	10360	370	191660
1.5	Mechanical work								307720
1.5.1	escalator	Units	1	250000	250000				175000
1.5.2	elevators	Units	3	105000	315000				315000

1.6	Electrical work								263760

Total cost = 4064006 Nis

Conclusion:

Architectural Revit has been used to calculate quantities in the project (see Appendix A) and the other quantities has been calculated by manual.

The total cost of the project was : 4064006 NIS
the total cost of the concrete and steel in the project was 1319358 NIS which represent approximately 32% of the total cost of the project.

The unit price for square meter of the Multi-functional building

= 925 NIS/m^2

APPENDIX – A (QUANTITIES TABLES FROM REVIT)

Material: Area	Type	Material: Volume	Material: Name	Level
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
3	Pick-Up	0	Blue, Solid	GF shopping
173	ext.wall	19.03	Concrete	
277	ext.wall	30.51	Concrete	
45	ext.wall	4.98	Concrete	
182	ext.wall	20.07	Concrete	
40	ext.wall	4.36	Concrete	
17	ext.wall	1.89	Concrete	
33	ext.wall	3.6	Concrete	
121	ext.wall	13.29	Concrete	
108	ext.wall	11.92	Concrete	
112	ext.wall	12.36	Concrete	
13	ext.wall	1.41	Concrete	
19	ext.wall	2.11	Concrete	
14	ext.wall	1.59	Concrete	
23	ext.wall	2.48	Concrete	
31	ext.wall	3.45	Concrete	
52	ext.wall	5.67	Concrete	
180	ext.wall	19.82	Concrete	
26	ext.wall	2.85	Concrete	
27	ext.wall	2.97	Concrete	
83	ext.wall	9.08	Concrete	
4	ext.wall	0.46	Concrete	
78	ext.wall	8.36	Concrete	
4	ext.wall	0.46	Concrete	
10	ext.wall	1.13	Concrete	
8	ext.wall	0.91	Concrete	
5	ext.wall	0.57	Concrete	
1	ext.wall	0.1	Concrete	

2	ext.wall	0.23	Concrete	
2	ext.wall	0.18	Concrete	
3	ext.wall	0.35	Concrete	
3	ext.wall	0.31	Concrete	
11	ext.wall	1.19	Concrete	
9	ext.wall	1.02	Concrete	
12	ext.wall	1.31	Concrete	
9	ext.wall	0.94	Concrete	
8	ext.wall	0.89	Concrete	
5	ext.wall	0.51	Concrete	
8	ext.wall	0.89	Concrete	
5	ext.wall	0.52	Concrete	
1	ext.wall	0.13	Concrete	
21	ext.wall	2.34	Concrete	
14	ext.wall	1.5	Concrete	
33	ext.wall	3.65	Concrete	
14	ext.wall	1.5	Concrete	
1	ext.wall	0.16	Concrete	
8	ext.wall	0.9	Concrete	
4	ext.wall	0.46	Concrete	
5	ext.wall	0.6	Concrete	
1	ext.wall	0.1	Concrete	
2	ext.wall	0.24	Concrete	
2	ext.wall	0.18	Concrete	
3	ext.wall	0.35	Concrete	
3	ext.wall	0.31	Concrete	
10	ext.wall	1.14	Concrete	
2	ext.wall	0.17	Concrete	
15	ext.wall	1.61	Concrete	
15	ext.wall	1.61	Concrete	
1	ext.wall	0.16	Concrete	
7	ext.wall	0.72	Concrete	
4	ext.wall	0.46	Concrete	
8	ext.wall	0.87	Concrete	
4	ext.wall	0.47	Concrete	
12	ext.wall	1.29	Concrete	
9	ext.wall	1.02	Concrete	
12	ext.wall	1.29	Concrete	
8	ext.wall	0.91	Concrete	
19	ext.wall	2.1	Concrete	
32	ext.wall	3.54	Concrete	

8	ext.wall	0.92	Concrete	
5	ext.wall	0.5	Concrete	
11	ext.wall	1.19	Concrete	
10	ext.wall	1.09	Concrete	
13	ext.wall	1.46	Concrete	
1	ext.wall	0.13	Concrete	
2	ext.wall	0.21	Concrete	
2	ext.wall	0.26	Concrete	
1	ext.wall	0.13	Concrete	
6	ext.wall	0.7	Concrete	
9	ext.wall	1	Concrete	
4	ext.wall	0.41	Concrete	
6	ext.wall	0.67	Concrete	
8	ext.wall	0.89	Concrete	
1	ext.wall	0.13	Concrete	
32	ext.wall	3.54	Concrete	
14	ext.wall	1.5	Concrete	
4	ext.wall	0.46	Concrete	
14	ext.wall	1.5	Concrete	
19	ext.wall	2.12	Concrete	
9	ext.wall	1.04	Concrete	
11	ext.wall	1.17	Concrete	
6	ext.wall	0.69	Concrete	
6	ext.wall	0.61	Concrete	
8	ext.wall	0.92	Concrete	
4	ext.wall	0.45	Concrete	
1	ext.wall	0.09	Concrete	
2	ext.wall	0.21	Concrete	
2	ext.wall	0.18	Concrete	
3	ext.wall	0.35	Concrete	
2	ext.wall	0.17	Concrete	
11	ext.wall	1.19	Concrete	
3	ext.wall	0.31	Concrete	
10	ext.wall	1.07	Concrete	
11	ext.wall	1.19	Concrete	
8	ext.wall	0.89	Concrete	
8	ext.wall	0.89	Concrete	
5	ext.wall	0.52	Concrete	
8	ext.wall	0.93	Concrete	
3	ext.wall	0.33	Concrete	
3	ext.wall	0.33	Concrete	

10	ext.wall	1.12	Concrete	
4	ext.wall	0.41	Concrete	
6	ext.wall	0.67	Concrete	
8	ext.wall	0.89	Concrete	
13	ext.wall	1.4	Concrete	
14	ext.wall	1.5	Concrete	
4	ext.wall	0.46	Concrete	
14	ext.wall	1.5	Concrete	
19	ext.wall	2.12	Concrete	
9	ext.wall	1.04	Concrete	
7	ext.wall	0.79	Concrete	
6	ext.wall	0.61	Concrete	
8	ext.wall	0.92	Concrete	
4	ext.wall	0.45	Concrete	
1	ext.wall	0.08	Concrete	
2	ext.wall	0.21	Concrete	
2	ext.wall	0.18	Concrete	
3	ext.wall	0.35	Concrete	
3	ext.wall	0.31	Concrete	
9	ext.wall	1.03	Concrete	
11	ext.wall	1.19	Concrete	
5	ext.wall	0.58	Concrete	
1	ext.wall	0.13	Concrete	
2	ext.wall	0.17	Concrete	
10	ext.wall	1.09	Concrete	
11	ext.wall	1.19	Concrete	
3	ext.wall	0.33	Concrete	
2	ext.wall	0.23	Concrete	
12	ext.wall	1.29	Concrete	
1	ext.wall	0.13	Concrete	
3	ext.wall	0.28	Concrete	
1	ext.wall	0.09	Concrete	
3	ext.wall	0.29	Concrete	
1	ext.wall	0.07	Concrete	
3	ext.wall	0.29	Concrete	
4	ext.wall	0.46	Concrete	
19	ext.wall	2.13	Concrete	
2	ext.wall	0.21	Concrete	
3	ext.wall	0.32	Concrete	
6	ext.wall	0.61	Concrete	
109	ext.wall	12.01	Concrete	

30	ext.wall	3.28	Concrete	
2	ext.wall	0.24	Concrete	
4	ext.wall	0.49	Concrete	
3	ext.wall	0.32	Concrete	
6	ext.wall	0.65	Concrete	
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
41	12 x 18	4.1	Concrete - Cast-in-Place Concrete	GF shopping
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
41	12 x 18	4.1	Concrete - Cast-in-Place Concrete	GF shopping
49	col	4.82	Concrete - Cast-in-Place Concrete	Level 10
49	12 x 18	4.82	Concrete - Cast-in-Place Concrete	Level 10
579	floor tile	17.37	Concrete - Sand/Cement Screed	GF shopping

549	floor tile	16.46	Concrete - Sand/Cement Screed	1st Floor shopping
571	floor tile	17.13	Concrete - Sand/Cement Screed	2nd floor offices
571	floor tile	17.13	Concrete - Sand/Cement Screed	3rd floor offices
600	floor tile	17.99	Concrete - Sand/Cement Screed	4th floor apartments
603	floor tile	18.1	Concrete - Sand/Cement Screed	5th floor apartments
603	floor tile	18.1	Concrete - Sand/Cement Screed	Roof
579	floor tile	138.96	Default Floor	GF shopping
549	floor tile	131.71	Default Floor	1st Floor shopping
571	floor tile	137.05	Default Floor	2nd floor offices
571	floor tile	137.05	Default Floor	3rd floor offices
600	floor tile	143.94	Default Floor	4th floor apartments
603	floor tile	144.77	Default Floor	5th floor apartments
603	floor tile	144.77	Default Floor	Roof
16	Generic 150mm	2.46	Default Floor	Level 9
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
3	sliding	0.03	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	1st Floor shopping

2	door 1 m	0.02	Door - Frame	1st Floor shopping
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	GF shopping
2	door 1 m	0.02	Door - Frame	GF shopping
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
3	sliding	0.03	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments

2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	4th floor apartments
2	bath door	0.02	Door - Frame	3rd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	2nd floor offices
2	bath door	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	2nd floor offices
2	door 1 m	0.02	Door - Frame	3rd floor offices
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments

2	door 1 m	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	Roof
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
2	bath door	0.02	Door - Frame	GF shopping
2	bath door	0.02	Door - Frame	GF shopping
2	bath door	0.02	Door - Frame	GF shopping
2	bath door	0.02	Door - Frame	1st Floor shopping
2	bath door	0.02	Door - Frame	1st Floor shopping
2	bath door	0.02	Door - Frame	1st Floor shopping
2	door 1 m	0.02	Door - Frame	4th floor apartments
2	door 1 m	0.02	Door - Frame	5th floor apartments
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices

5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
3	sliding	0.03	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	1st Floor shopping
5	door 1 m	0.22	Door - Panel	1st Floor shopping
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	GF shopping
5	door 1 m	0.22	Door - Panel	GF shopping
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
3	sliding	0.03	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices

4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	4th floor apartments
4	bath door	0.15	Door - Panel	3rd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	2nd floor offices
4	bath door	0.15	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	4th floor apartments

5	door 1 m	0.22	Door - Panel	2nd floor offices
5	door 1 m	0.22	Door - Panel	3rd floor offices
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	Roof
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
4	bath door	0.15	Door - Panel	GF shopping
4	bath door	0.15	Door - Panel	GF shopping
4	bath door	0.15	Door - Panel	GF shopping

4	bath door	0.15	Door - Panel	1st Floor shopping
4	bath door	0.15	Door - Panel	1st Floor shopping
4	bath door	0.15	Door - Panel	1st Floor shopping
5	door 1 m	0.22	Door - Panel	4th floor apartments
5	door 1 m	0.22	Door - Panel	5th floor apartments
5	Glazed	0.12	Glass	1st Floor shopping
12	Glazed	0.29	Glass	1st Floor shopping
15	Glazed	0.37	Glass	1st Floor shopping
1	Glazed	0.02	Glass	1st Floor shopping
9	Glazed	0.22	Glass	GF shopping
9	Glazed	0.23	Glass	GF shopping
4	window 2 m	0.02	Glass	2nd floor offices
4	window 2 m	0.02	Glass	2nd floor offices
4	window 2 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
4	window 2 m	0.02	Glass	2nd floor offices
2	window 1 m	0.01	Glass	2nd floor offices
2	window 1 m	0.01	Glass	2nd floor offices
2	window 1 m	0.01	Glass	2nd floor offices
0	window 0.6 m	0	Glass	2nd floor offices
0	window 0.6 m	0	Glass	2nd floor offices
0	window 0.6 m	0	Glass	2nd floor offices
0	window 0.6 m	0	Glass	2nd floor offices
0	window 0.6 m	0	Glass	2nd floor offices
1	window stair	0.01	Glass	2nd floor offices
1	window stair	0.01	Glass	2nd floor offices
1	36" x 48"	0.01	Glass	2nd floor offices
1	36" x 48"	0.01	Glass	2nd floor offices
1	36" x 48"	0.01	Glass	1st Floor shopping
1	36" x 48"	0.01	Glass	1st Floor shopping
1	36" x 48"	0.01	Glass	3rd floor offices
1	36" x 48"	0.01	Glass	3rd floor offices
1	36" x 48"	0.01	Glass	4th floor apartments

1	36" x 48"	0.01	Glass	4th floor apartments
1	36" x 48"	0.01	Glass	5th floor apartments
1	36" x 48"	0.01	Glass	5th floor apartments
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
8	sliding	0.02	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	1st Floor shopping
0	door 1 m	0	Glass	1st Floor shopping
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	GF shopping
0	door 1 m	0	Glass	GF shopping
4	window 2 m	0.02	Glass	3rd floor offices
4	window 2 m	0.02	Glass	3rd floor offices
4	window 2 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices

3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
4	window 2 m	0.02	Glass	3rd floor offices
2	window 1 m	0.01	Glass	3rd floor offices
2	window 1 m	0.01	Glass	3rd floor offices
2	window 1 m	0.01	Glass	3rd floor offices
0	window 0.6 m	0	Glass	3rd floor offices
0	window 0.6 m	0	Glass	3rd floor offices
0	window 0.6 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	3rd floor offices
8	sliding	0.02	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
0	bath door	0	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	2nd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
3	window 1.5 m	0.02	Glass	3rd floor offices
0	window 0.6 m	0	Glass	3rd floor offices
1	window stair	0.01	Glass	3rd floor offices
1	window stair	0.01	Glass	3rd floor offices

0	door 1 m	0	Glass	3rd floor offices
0	window 0.6 m	0	Glass	3rd floor offices
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
1	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping

2	Glazed	0.04	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping

4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.01	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.01	Glass	GF shopping
0	Glazed	0.01	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping

2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.03	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
2	Glazed	0.05	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
4	Curtain Wall Sgl Glass	0.02	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
2	Glazed	0.04	Glass	GF shopping
1	Glazed	0.04	Glass	GF shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
0	Glazed	0.01	Glass	1st Floor shopping
0	Glazed	0.01	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.03	Glass	1st Floor shopping
1	Glazed	0.02	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping

1	Glazed	0.02	Glass	1st Floor shopping
1	Glazed	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.03	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.03	Glass	1st Floor shopping
1	Glazed	0.02	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.03	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.03	Glass	1st Floor shopping

1	Glazed	0.02	Glass	1st Floor shopping
2	Glazed	0.05	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
4	Curtain Wall Sgl Glass	0.02	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
2	Glazed	0.04	Glass	1st Floor shopping
1	Glazed	0.04	Glass	1st Floor shopping
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	bath door	0	Glass	4th floor apartments
0	bath door	0	Glass	3rd floor offices

0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	2nd floor offices
0	bath door	0	Glass	3rd floor offices
7	window 2m	0.04	Glass	4th floor apartments
7	window 2m	0.04	Glass	4th floor apartments
7	window 2m	0.04	Glass	4th floor apartments
7	window 2m	0.04	Glass	4th floor apartments
7	window 2m	0.04	Glass	4th floor apartments
7	window 2m	0.04	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
4	window 1.5 m	0.03	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
0	bath window	0	Glass	4th floor apartments
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping
7	16" x 24"	0.04	Glass	GF shopping

6	gf 2 m	0.04	Glass	GF shopping
6	gf 2 m	0.04	Glass	GF shopping
4	gf 1.5 m	0.03	Glass	GF shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
7	16" x 24"	0.04	Glass	1st Floor shopping
6	gf 2 m	0.04	Glass	1st Floor shopping
6	gf 2 m	0.04	Glass	1st Floor shopping
6	gf 2 m	0.04	Glass	1st Floor shopping
6	gf 2 m	0.04	Glass	1st Floor shopping
4	gf 1.5 m	0.03	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	1st Floor shopping
0	window 0.6 m	0	Glass	GF shopping
0	window 0.6 m	0	Glass	GF shopping
0	window 0.6 m	0	Glass	GF shopping
0	window 0.6 m	0	Glass	GF shopping
0	window 0.6 m	0	Glass	GF shopping
4	window 2 m	0.02	Glass	2nd floor offices
4	window 2 m	0.02	Glass	3rd floor offices
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	2nd floor offices
0	door 1 m	0	Glass	3rd floor offices
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments

0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	bath door	0	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments

4	window 1.5 m	0.03	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
4	window 1.5 m	0.03	Glass	5th floor apartments
7	16" x 24"	0.04	Glass	1st Floor shopping
1	Glazed	0.02	Glass	GF shopping
9	Store Front Double Door	0.08	Glass	GF shopping
0	Glazed	0	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
5	Glazed	0.13	Glass	GF shopping
0	Glazed	0	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
1	Glazed	0.02	Glass	GF shopping
0	door 1 m	0	Glass	Roof
4	window 1.5 m	0.03	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
7	window 2m	0.04	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	bath window	0	Glass	5th floor apartments
0	door 1 m	0	Glass	5th floor apartments
0	bath door	0	Glass	GF shopping
0	bath door	0	Glass	GF shopping
0	bath door	0	Glass	GF shopping
0	bath door	0	Glass	1st Floor shopping
0	bath door	0	Glass	1st Floor shopping
0	bath door	0	Glass	1st Floor shopping
0	door 1 m	0	Glass	4th floor apartments
0	door 1 m	0	Glass	5th floor apartments
173	ext.wall	17.3	Masonry - Concrete Block	
277	ext.wall	27.74	Masonry - Concrete Block	
45	ext.wall	4.53	Masonry - Concrete Block	

182	ext.wall	18.25	Masonry - Concrete Block	
40	ext.wall	3.97	Masonry - Concrete Block	
17	ext.wall	1.72	Masonry - Concrete Block	
33	ext.wall	3.27	Masonry - Concrete Block	
121	ext.wall	12.08	Masonry - Concrete Block	
108	ext.wall	10.84	Masonry - Concrete Block	
112	ext.wall	11.24	Masonry - Concrete Block	
13	ext.wall	1.28	Masonry - Concrete Block	
19	ext.wall	1.92	Masonry - Concrete Block	
14	ext.wall	1.44	Masonry - Concrete Block	
23	ext.wall	2.26	Masonry - Concrete Block	
31	ext.wall	3.14	Masonry - Concrete Block	
52	ext.wall	5.16	Masonry - Concrete Block	
180	ext.wall	18.01	Masonry - Concrete Block	
26	ext.wall	2.59	Masonry - Concrete Block	
27	ext.wall	2.7	Masonry - Concrete Block	
83	ext.wall	8.26	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
74	ext.wall	7.22	Masonry - Concrete Block	
21	int.wall 10 cm	2.11	Masonry - Concrete Block	
1	int.wall 10 cm	0.13	Masonry - Concrete Block	
19	int.wall 10 cm	1.9	Masonry - Concrete Block	
8	int.wall 10 cm	0.78	Masonry - Concrete Block	
1	int.wall 10 cm	0.13	Masonry - Concrete Block	
8	int.wall 10 cm	0.78	Masonry - Concrete Block	
2	int.wall 10 cm	0.18	Masonry - Concrete Block	
15	int.wall 10 cm	1.46	Masonry - Concrete Block	
7	int.wall 10 cm	0.65	Masonry - Concrete Block	
28	int.wall 10 cm	2.84	Masonry - Concrete Block	
28	int.wall 10 cm	2.85	Masonry - Concrete Block	
21	int.wall 10 cm	2.11	Masonry - Concrete Block	
28	int.wall 10 cm	2.76	Masonry - Concrete Block	
17	int.wall 10 cm	1.68	Masonry - Concrete Block	
16	int.wall 10 cm	1.64	Masonry - Concrete Block	
20	int.wall 10 cm	1.97	Masonry - Concrete Block	
7	int.wall 10 cm	0.73	Masonry - Concrete Block	
3	int.wall 10 cm	0.28	Masonry - Concrete Block	
13	int.wall 10 cm	1.27	Masonry - Concrete Block	
13	int.wall 10 cm	1.27	Masonry - Concrete Block	
19	int.wall 10 cm	1.88	Masonry - Concrete Block	
7	int.wall 10 cm	0.71	Masonry - Concrete Block	

7	int.wall 10 cm	0.71	Masonry - Concrete Block	
0	int.wall 10 cm	0.04	Masonry - Concrete Block	
131	int.wall 20 cm	26.11	Masonry - Concrete Block	
131	int.wall 20 cm	26.11	Masonry - Concrete Block	
111	int.wall 20 cm	22.27	Masonry - Concrete Block	
38	int.wall 20 cm	7.66	Masonry - Concrete Block	
114	int.wall 20 cm	22.88	Masonry - Concrete Block	
38	int.wall 20 cm	7.66	Masonry - Concrete Block	
17	int.wall 20 cm	3.41	Masonry - Concrete Block	
49	int.wall 20 cm	9.76	Masonry - Concrete Block	
17	int.wall 20 cm	3.41	Masonry - Concrete Block	
37	int.wall 20 cm	7.41	Masonry - Concrete Block	
29	int.wall 20 cm	5.89	Masonry - Concrete Block	
98	int.wall 20 cm	19.51	Masonry - Concrete Block	
29	int.wall 20 cm	5.89	Masonry - Concrete Block	
39	int.wall 20 cm	7.76	Masonry - Concrete Block	
50	int.wall 20 cm	10.06	Masonry - Concrete Block	
50	int.wall 20 cm	10.06	Masonry - Concrete Block	
39	int.wall 20 cm	7.76	Masonry - Concrete Block	
26	int.wall 20 cm	5.14	Masonry - Concrete Block	
17	int.wall 20 cm	3.32	Masonry - Concrete Block	
28	int.wall 20 cm	5.6	Masonry - Concrete Block	
17	int.wall 20 cm	3.32	Masonry - Concrete Block	
14	int.wall 10 cm	1.4	Masonry - Concrete Block	
38	int.wall 10 cm	3.78	Masonry - Concrete Block	
41	int.wall 10 cm	4.15	Masonry - Concrete Block	
10	int.wall 10 cm	0.98	Masonry - Concrete Block	
14	int.wall 10 cm	1.36	Masonry - Concrete Block	
37	int.wall 10 cm	3.67	Masonry - Concrete Block	
14	int.wall 10 cm	1.36	Masonry - Concrete Block	
37	int.wall 10 cm	3.67	Masonry - Concrete Block	
28	int.wall 10 cm	2.84	Masonry - Concrete Block	
2	int.wall 10 cm	0.16	Masonry - Concrete Block	
28	int.wall 10 cm	2.85	Masonry - Concrete Block	
21	int.wall 10 cm	2.11	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
10	ext.wall	1.03	Masonry - Concrete Block	
15	int.wall 10 cm	1.45	Masonry - Concrete Block	
8	int.wall 10 cm	0.77	Masonry - Concrete Block	
2	int.wall 10 cm	0.18	Masonry - Concrete Block	
8	int.wall 10 cm	0.77	Masonry - Concrete Block	

1	int.wall 10 cm	0.13	Masonry - Concrete Block	
19	int.wall 10 cm	1.9	Masonry - Concrete Block	
21	int.wall 10 cm	2.11	Masonry - Concrete Block	
1	int.wall 10 cm	0.13	Masonry - Concrete Block	
19	int.wall 10 cm	1.92	Masonry - Concrete Block	
13	int.wall 10 cm	1.34	Masonry - Concrete Block	
19	int.wall 10 cm	1.88	Masonry - Concrete Block	
13	int.wall 10 cm	1.28	Masonry - Concrete Block	
7	int.wall 10 cm	0.71	Masonry - Concrete Block	
7	int.wall 10 cm	0.72	Masonry - Concrete Block	
7	int.wall 10 cm	0.73	Masonry - Concrete Block	
3	int.wall 10 cm	0.28	Masonry - Concrete Block	
17	int.wall 10 cm	1.68	Masonry - Concrete Block	
16	int.wall 10 cm	1.63	Masonry - Concrete Block	
18	int.wall 10 cm	1.76	Masonry - Concrete Block	
8	ext.wall	0.82	Masonry - Concrete Block	
5	ext.wall	0.52	Masonry - Concrete Block	
1	ext.wall	0.09	Masonry - Concrete Block	
2	ext.wall	0.2	Masonry - Concrete Block	
2	ext.wall	0.17	Masonry - Concrete Block	
3	ext.wall	0.32	Masonry - Concrete Block	
3	ext.wall	0.28	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
9	ext.wall	0.93	Masonry - Concrete Block	
12	ext.wall	1.19	Masonry - Concrete Block	
9	ext.wall	0.85	Masonry - Concrete Block	
8	ext.wall	0.81	Masonry - Concrete Block	
5	ext.wall	0.47	Masonry - Concrete Block	
8	ext.wall	0.81	Masonry - Concrete Block	
5	ext.wall	0.48	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
21	ext.wall	2.12	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
33	ext.wall	3.32	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
1	ext.wall	0.15	Masonry - Concrete Block	
19	int.wall 10 cm	1.9	Masonry - Concrete Block	
17	int.wall 10 cm	1.71	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
2	int.wall 10 cm	0.18	Masonry - Concrete Block	
2	int.wall 10 cm	0.24	Masonry - Concrete Block	

9	int.wall 10 cm	0.95	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	
20	int.wall 10 cm	2.03	Masonry - Concrete Block	
10	int.wall 10 cm	1.05	Masonry - Concrete Block	
3	int.wall 10 cm	0.34	Masonry - Concrete Block	
10	int.wall 10 cm	1.01	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
13	int.wall 10 cm	1.32	Masonry - Concrete Block	
11	int.wall 10 cm	1.1	Masonry - Concrete Block	
2	int.wall 10 cm	0.22	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
9	int.wall 10 cm	0.92	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
13	int.wall 10 cm	1.34	Masonry - Concrete Block	
12	int.wall 10 cm	1.25	Masonry - Concrete Block	
5	int.wall 10 cm	0.46	Masonry - Concrete Block	
15	int.wall 10 cm	1.48	Masonry - Concrete Block	
8	int.wall 10 cm	0.83	Masonry - Concrete Block	
11	int.wall 10 cm	1.06	Masonry - Concrete Block	
5	int.wall 10 cm	0.46	Masonry - Concrete Block	
11	int.wall 10 cm	1.05	Masonry - Concrete Block	
14	int.wall 10 cm	1.4	Masonry - Concrete Block	
13	int.wall 10 cm	1.3	Masonry - Concrete Block	
2	int.wall 10 cm	0.2	Masonry - Concrete Block	
8	int.wall 10 cm	0.76	Masonry - Concrete Block	
61	int.wall 20 cm	12.3	Masonry - Concrete Block	
3	int.wall 20 cm	0.68	Masonry - Concrete Block	
14	int.wall 20 cm	2.76	Masonry - Concrete Block	
4	int.wall 20 cm	0.7	Masonry - Concrete Block	
14	int.wall 20 cm	2.77	Masonry - Concrete Block	
6	int.wall 20 cm	1.14	Masonry - Concrete Block	
2	int.wall 20 cm	0.44	Masonry - Concrete Block	
18	int.wall 20 cm	3.7	Masonry - Concrete Block	
9	int.wall 20 cm	1.79	Masonry - Concrete Block	
15	int.wall 20 cm	3.04	Masonry - Concrete Block	
7	int.wall 20 cm	1.35	Masonry - Concrete Block	
8	ext.wall	0.82	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
5	ext.wall	0.55	Masonry - Concrete Block	
11	int.wall 10 cm	1.06	Masonry - Concrete Block	
14	int.wall 10 cm	1.4	Masonry - Concrete Block	

4	int.wall 10 cm	0.37	Masonry - Concrete Block	
1	ext.wall	0.09	Masonry - Concrete Block	
2	ext.wall	0.22	Masonry - Concrete Block	
2	ext.wall	0.17	Masonry - Concrete Block	
3	ext.wall	0.32	Masonry - Concrete Block	
3	ext.wall	0.28	Masonry - Concrete Block	
10	ext.wall	1.04	Masonry - Concrete Block	
2	ext.wall	0.15	Masonry - Concrete Block	
15	ext.wall	1.47	Masonry - Concrete Block	
15	ext.wall	1.47	Masonry - Concrete Block	
1	ext.wall	0.15	Masonry - Concrete Block	
19	int.wall 10 cm	1.9	Masonry - Concrete Block	
17	int.wall 10 cm	1.71	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
2	int.wall 10 cm	0.18	Masonry - Concrete Block	
2	int.wall 10 cm	0.24	Masonry - Concrete Block	
9	int.wall 10 cm	0.95	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	
20	int.wall 10 cm	2.03	Masonry - Concrete Block	
10	int.wall 10 cm	1.05	Masonry - Concrete Block	
3	int.wall 10 cm	0.34	Masonry - Concrete Block	
10	int.wall 10 cm	1.01	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
14	int.wall 10 cm	1.37	Masonry - Concrete Block	
11	int.wall 10 cm	1.1	Masonry - Concrete Block	
2	int.wall 10 cm	0.22	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
9	int.wall 10 cm	0.92	Masonry - Concrete Block	
3	int.wall 10 cm	0.3	Masonry - Concrete Block	
13	int.wall 10 cm	1.34	Masonry - Concrete Block	
12	int.wall 10 cm	1.25	Masonry - Concrete Block	
5	int.wall 10 cm	0.46	Masonry - Concrete Block	
15	int.wall 10 cm	1.48	Masonry - Concrete Block	
8	int.wall 10 cm	0.83	Masonry - Concrete Block	
11	int.wall 10 cm	1.06	Masonry - Concrete Block	
5	int.wall 10 cm	0.46	Masonry - Concrete Block	
11	int.wall 10 cm	1.05	Masonry - Concrete Block	
14	int.wall 10 cm	1.4	Masonry - Concrete Block	
13	int.wall 10 cm	1.3	Masonry - Concrete Block	
2	int.wall 10 cm	0.2	Masonry - Concrete Block	
8	int.wall 10 cm	0.76	Masonry - Concrete Block	

61	int.wall 20 cm	12.3	Masonry - Concrete Block	
3	int.wall 20 cm	0.68	Masonry - Concrete Block	
14	int.wall 20 cm	2.76	Masonry - Concrete Block	
4	int.wall 20 cm	0.7	Masonry - Concrete Block	
14	int.wall 20 cm	2.77	Masonry - Concrete Block	
6	int.wall 20 cm	1.14	Masonry - Concrete Block	
2	int.wall 20 cm	0.44	Masonry - Concrete Block	
18	int.wall 20 cm	3.7	Masonry - Concrete Block	
9	int.wall 20 cm	1.79	Masonry - Concrete Block	
15	int.wall 20 cm	3.04	Masonry - Concrete Block	
7	int.wall 20 cm	1.35	Masonry - Concrete Block	
7	ext.wall	0.65	Masonry - Concrete Block	
11	int.wall 10 cm	1.06	Masonry - Concrete Block	
14	int.wall 10 cm	1.4	Masonry - Concrete Block	
4	int.wall 10 cm	0.37	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
8	ext.wall	0.79	Masonry - Concrete Block	
4	ext.wall	0.43	Masonry - Concrete Block	
12	ext.wall	1.17	Masonry - Concrete Block	
9	ext.wall	0.93	Masonry - Concrete Block	
12	ext.wall	1.17	Masonry - Concrete Block	
8	ext.wall	0.82	Masonry - Concrete Block	
19	ext.wall	1.91	Masonry - Concrete Block	
32	ext.wall	3.22	Masonry - Concrete Block	
8	ext.wall	0.84	Masonry - Concrete Block	
5	ext.wall	0.45	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
10	ext.wall	0.99	Masonry - Concrete Block	
13	ext.wall	1.33	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
2	ext.wall	0.19	Masonry - Concrete Block	
2	ext.wall	0.24	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
16	int.wall 10 cm	1.63	Masonry - Concrete Block	
26	int.wall 10 cm	2.58	Masonry - Concrete Block	
18	int.wall 10 cm	1.76	Masonry - Concrete Block	
3	int.wall 10 cm	0.31	Masonry - Concrete Block	
5	int.wall 10 cm	0.49	Masonry - Concrete Block	
1	int.wall 10 cm	0.12	Masonry - Concrete Block	
8	int.wall 10 cm	0.78	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	

7	int.wall 10 cm	0.69	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
17	int.wall 10 cm	1.66	Masonry - Concrete Block	
13	int.wall 10 cm	1.34	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
2	int.wall 10 cm	0.15	Masonry - Concrete Block	
8	int.wall 10 cm	0.84	Masonry - Concrete Block	
11	int.wall 10 cm	1.09	Masonry - Concrete Block	
7	int.wall 20 cm	1.36	Masonry - Concrete Block	
19	int.wall 20 cm	3.83	Masonry - Concrete Block	
6	ext.wall	0.63	Masonry - Concrete Block	
9	ext.wall	0.91	Masonry - Concrete Block	
4	ext.wall	0.38	Masonry - Concrete Block	
6	ext.wall	0.61	Masonry - Concrete Block	
8	ext.wall	0.8	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
20	int.wall 20 cm	4.08	Masonry - Concrete Block	
9	int.wall 20 cm	1.74	Masonry - Concrete Block	
10	int.wall 20 cm	1.9	Masonry - Concrete Block	
20	int.wall 20 cm	4.05	Masonry - Concrete Block	
14	int.wall 10 cm	1.44	Masonry - Concrete Block	
10	int.wall 10 cm	1	Masonry - Concrete Block	
9	int.wall 10 cm	0.91	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
4	int.wall 10 cm	0.36	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	
11	int.wall 10 cm	1.13	Masonry - Concrete Block	
32	ext.wall	3.22	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
19	ext.wall	1.93	Masonry - Concrete Block	
9	ext.wall	0.95	Masonry - Concrete Block	
11	ext.wall	1.06	Masonry - Concrete Block	
6	ext.wall	0.63	Masonry - Concrete Block	
6	ext.wall	0.55	Masonry - Concrete Block	
8	ext.wall	0.84	Masonry - Concrete Block	
4	ext.wall	0.41	Masonry - Concrete Block	
1	ext.wall	0.09	Masonry - Concrete Block	
2	ext.wall	0.19	Masonry - Concrete Block	
2	ext.wall	0.17	Masonry - Concrete Block	

3	ext.wall	0.32	Masonry - Concrete Block	
2	ext.wall	0.15	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
3	ext.wall	0.28	Masonry - Concrete Block	
10	ext.wall	0.97	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
13	int.wall 10 cm	1.33	Masonry - Concrete Block	
8	int.wall 10 cm	0.8	Masonry - Concrete Block	
12	int.wall 10 cm	1.21	Masonry - Concrete Block	
10	int.wall 10 cm	0.96	Masonry - Concrete Block	
10	int.wall 10 cm	0.96	Masonry - Concrete Block	
5	int.wall 10 cm	0.48	Masonry - Concrete Block	
17	int.wall 10 cm	1.74	Masonry - Concrete Block	
5	int.wall 10 cm	0.52	Masonry - Concrete Block	
10	int.wall 10 cm	1.04	Masonry - Concrete Block	
26	int.wall 10 cm	2.55	Masonry - Concrete Block	
17	int.wall 10 cm	1.74	Masonry - Concrete Block	
12	int.wall 10 cm	1.18	Masonry - Concrete Block	
4	int.wall 10 cm	0.36	Masonry - Concrete Block	
19	int.wall 10 cm	1.88	Masonry - Concrete Block	
34	int.wall 10 cm	3.38	Masonry - Concrete Block	
7	int.wall 10 cm	0.69	Masonry - Concrete Block	
16	int.wall 10 cm	1.64	Masonry - Concrete Block	
16	int.wall 10 cm	1.64	Masonry - Concrete Block	
6	int.wall 10 cm	0.58	Masonry - Concrete Block	
8	int.wall 10 cm	0.83	Masonry - Concrete Block	
5	int.wall 10 cm	0.45	Masonry - Concrete Block	
14	int.wall 10 cm	1.36	Masonry - Concrete Block	
14	int.wall 10 cm	1.39	Masonry - Concrete Block	
6	int.wall 10 cm	0.55	Masonry - Concrete Block	
7	int.wall 10 cm	0.67	Masonry - Concrete Block	
7	int.wall 10 cm	0.73	Masonry - Concrete Block	
8	ext.wall	0.81	Masonry - Concrete Block	
8	ext.wall	0.81	Masonry - Concrete Block	
5	ext.wall	0.48	Masonry - Concrete Block	
8	ext.wall	0.85	Masonry - Concrete Block	
3	ext.wall	0.3	Masonry - Concrete Block	
3	ext.wall	0.3	Masonry - Concrete Block	
16	int.wall 10 cm	1.63	Masonry - Concrete Block	
26	int.wall 10 cm	2.58	Masonry - Concrete Block	
18	int.wall 10 cm	1.76	Masonry - Concrete Block	

3	int.wall 10 cm	0.31	Masonry - Concrete Block	
5	int.wall 10 cm	0.51	Masonry - Concrete Block	
8	int.wall 10 cm	0.78	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	
7	int.wall 10 cm	0.69	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
17	int.wall 10 cm	1.66	Masonry - Concrete Block	
13	int.wall 10 cm	1.34	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
2	int.wall 10 cm	0.15	Masonry - Concrete Block	
8	int.wall 10 cm	0.84	Masonry - Concrete Block	
11	int.wall 10 cm	1.09	Masonry - Concrete Block	
7	int.wall 20 cm	1.36	Masonry - Concrete Block	
19	int.wall 20 cm	3.83	Masonry - Concrete Block	
10	ext.wall	1.01	Masonry - Concrete Block	
4	ext.wall	0.38	Masonry - Concrete Block	
6	ext.wall	0.61	Masonry - Concrete Block	
8	ext.wall	0.8	Masonry - Concrete Block	
18	int.wall 20 cm	3.64	Masonry - Concrete Block	
9	int.wall 20 cm	1.74	Masonry - Concrete Block	
14	int.wall 10 cm	1.44	Masonry - Concrete Block	
10	int.wall 10 cm	1	Masonry - Concrete Block	
9	int.wall 10 cm	0.91	Masonry - Concrete Block	
3	int.wall 10 cm	0.29	Masonry - Concrete Block	
4	int.wall 10 cm	0.36	Masonry - Concrete Block	
3	int.wall 10 cm	0.32	Masonry - Concrete Block	
11	int.wall 10 cm	1.13	Masonry - Concrete Block	
13	ext.wall	1.27	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
14	ext.wall	1.36	Masonry - Concrete Block	
19	ext.wall	1.93	Masonry - Concrete Block	
9	ext.wall	0.95	Masonry - Concrete Block	
7	ext.wall	0.72	Masonry - Concrete Block	
6	ext.wall	0.55	Masonry - Concrete Block	
8	ext.wall	0.84	Masonry - Concrete Block	
4	ext.wall	0.41	Masonry - Concrete Block	
1	ext.wall	0.07	Masonry - Concrete Block	
2	ext.wall	0.19	Masonry - Concrete Block	
2	ext.wall	0.17	Masonry - Concrete Block	
3	ext.wall	0.32	Masonry - Concrete Block	

3	ext.wall	0.28	Masonry - Concrete Block	
9	ext.wall	0.93	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
13	int.wall 10 cm	1.33	Masonry - Concrete Block	
8	int.wall 10 cm	0.8	Masonry - Concrete Block	
12	int.wall 10 cm	1.21	Masonry - Concrete Block	
10	int.wall 10 cm	0.96	Masonry - Concrete Block	
10	int.wall 10 cm	0.96	Masonry - Concrete Block	
5	int.wall 10 cm	0.48	Masonry - Concrete Block	
17	int.wall 10 cm	1.74	Masonry - Concrete Block	
5	int.wall 10 cm	0.52	Masonry - Concrete Block	
10	int.wall 10 cm	1.04	Masonry - Concrete Block	
26	int.wall 10 cm	2.55	Masonry - Concrete Block	
17	int.wall 10 cm	1.74	Masonry - Concrete Block	
12	int.wall 10 cm	1.18	Masonry - Concrete Block	
4	int.wall 10 cm	0.36	Masonry - Concrete Block	
19	int.wall 10 cm	1.88	Masonry - Concrete Block	
34	int.wall 10 cm	3.38	Masonry - Concrete Block	
8	int.wall 10 cm	0.77	Masonry - Concrete Block	
16	int.wall 10 cm	1.64	Masonry - Concrete Block	
16	int.wall 10 cm	1.64	Masonry - Concrete Block	
6	int.wall 10 cm	0.58	Masonry - Concrete Block	
8	int.wall 10 cm	0.83	Masonry - Concrete Block	
5	int.wall 10 cm	0.45	Masonry - Concrete Block	
14	int.wall 10 cm	1.39	Masonry - Concrete Block	
14	int.wall 10 cm	1.39	Masonry - Concrete Block	
6	int.wall 10 cm	0.55	Masonry - Concrete Block	
7	int.wall 10 cm	0.67	Masonry - Concrete Block	
7	int.wall 10 cm	0.73	Masonry - Concrete Block	
5	ext.wall	0.53	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
2	ext.wall	0.15	Masonry - Concrete Block	
10	ext.wall	0.99	Masonry - Concrete Block	
11	ext.wall	1.08	Masonry - Concrete Block	
3	ext.wall	0.3	Masonry - Concrete Block	
2	ext.wall	0.21	Masonry - Concrete Block	
12	ext.wall	1.17	Masonry - Concrete Block	
1	ext.wall	0.12	Masonry - Concrete Block	
3	ext.wall	0.26	Masonry - Concrete Block	
1	ext.wall	0.08	Masonry - Concrete Block	
3	ext.wall	0.27	Masonry - Concrete Block	

1	ext.wall	0.07	Masonry - Concrete Block	
3	ext.wall	0.26	Masonry - Concrete Block	
4	ext.wall	0.42	Masonry - Concrete Block	
8	int.wall 20 cm	1.69	Masonry - Concrete Block	
19	ext.wall	1.93	Masonry - Concrete Block	
2	ext.wall	0.19	Masonry - Concrete Block	
3	ext.wall	0.29	Masonry - Concrete Block	
6	ext.wall	0.56	Masonry - Concrete Block	
109	ext.wall	10.92	Masonry - Concrete Block	
30	ext.wall	2.98	Masonry - Concrete Block	
2	ext.wall	0.22	Masonry - Concrete Block	
4	ext.wall	0.44	Masonry - Concrete Block	
3	ext.wall	0.29	Masonry - Concrete Block	
6	ext.wall	0.59	Masonry - Concrete Block	
18	int.wall 20 cm	3.64	Masonry - Concrete Block	
9	int.wall 20 cm	1.74	Masonry - Concrete Block	
9	window 2 m	0.09	Metal - Aluminum	2nd floor offices
9	window 2 m	0.09	Metal - Aluminum	2nd floor offices
9	window 2 m	0.09	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
9	window 2 m	0.09	Metal - Aluminum	2nd floor offices
6	window 1 m	0.06	Metal - Aluminum	2nd floor offices
6	window 1 m	0.06	Metal - Aluminum	2nd floor offices
6	window 1 m	0.06	Metal - Aluminum	2nd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	2nd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	2nd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	2nd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	2nd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	2nd floor offices
6	window stair	0.06	Metal - Aluminum	2nd floor offices
6	window stair	0.06	Metal - Aluminum	2nd floor offices
7	36" x 48"	0.07	Metal - Aluminum	2nd floor offices
7	36" x 48"	0.07	Metal - Aluminum	2nd floor offices

7	36" x 48"	0.07	Metal - Aluminum	1st Floor shopping
7	36" x 48"	0.07	Metal - Aluminum	1st Floor shopping
7	36" x 48"	0.07	Metal - Aluminum	3rd floor offices
7	36" x 48"	0.07	Metal - Aluminum	3rd floor offices
7	36" x 48"	0.07	Metal - Aluminum	4th floor apartments
7	36" x 48"	0.07	Metal - Aluminum	4th floor apartments
7	36" x 48"	0.07	Metal - Aluminum	5th floor apartments
7	36" x 48"	0.07	Metal - Aluminum	5th floor apartments
9	window 2 m	0.09	Metal - Aluminum	3rd floor offices
9	window 2 m	0.09	Metal - Aluminum	3rd floor offices
9	window 2 m	0.09	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
9	window 2 m	0.09	Metal - Aluminum	3rd floor offices
6	window 1 m	0.06	Metal - Aluminum	3rd floor offices
6	window 1 m	0.06	Metal - Aluminum	3rd floor offices
6	window 1 m	0.06	Metal - Aluminum	3rd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	3rd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	3rd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	2nd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
7	window 1.5 m	0.08	Metal - Aluminum	3rd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	3rd floor offices
6	window stair	0.06	Metal - Aluminum	3rd floor offices
6	window stair	0.06	Metal - Aluminum	3rd floor offices
3	window 0.6 m	0.03	Metal - Aluminum	3rd floor offices
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping

0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	GF shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
0	Curtain Wall Sgl Glass	0	Metal - Aluminum	1st Floor shopping
11	window 2m	0.11	Metal - Aluminum	4th floor apartments

11	window 2m	0.11	Metal - Aluminum	4th floor apartments
11	window 2m	0.11	Metal - Aluminum	4th floor apartments
11	window 2m	0.11	Metal - Aluminum	4th floor apartments
11	window 2m	0.11	Metal - Aluminum	4th floor apartments
11	window 2m	0.11	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
3	bath window	0.03	Metal - Aluminum	4th floor apartments
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	GF shopping
6	gf 2 m	0.08	Metal - Aluminum	GF shopping
6	gf 2 m	0.08	Metal - Aluminum	GF shopping
5	gf 1.5 m	0.06	Metal - Aluminum	GF shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping

7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
6	gf 2 m	0.08	Metal - Aluminum	1st Floor shopping
6	gf 2 m	0.08	Metal - Aluminum	1st Floor shopping
6	gf 2 m	0.08	Metal - Aluminum	1st Floor shopping
6	gf 2 m	0.08	Metal - Aluminum	1st Floor shopping
5	gf 1.5 m	0.06	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	1st Floor shopping
3	window 0.6 m	0.03	Metal - Aluminum	GF shopping
3	window 0.6 m	0.03	Metal - Aluminum	GF shopping
3	window 0.6 m	0.03	Metal - Aluminum	GF shopping
3	window 0.6 m	0.03	Metal - Aluminum	GF shopping
3	window 0.6 m	0.03	Metal - Aluminum	GF shopping
9	window 2 m	0.09	Metal - Aluminum	2nd floor offices
9	window 2 m	0.09	Metal - Aluminum	3rd floor offices
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments

9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
7	16" x 24"	0.09	Metal - Aluminum	1st Floor shopping
3	Store Front Double Door	0.03	Metal - Aluminum	GF shopping
9	window 1.5 m	0.09	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
11	window 2m	0.11	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
3	bath window	0.03	Metal - Aluminum	5th floor apartments
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
33	Pick-Up	0.05	Metal - Paint Finish - Blue, Sky	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
4	Pick-Up	0.13	Metal - Steel	GF shopping
173	ext.wall	3.46	Plasterboard	
277	ext.wall	5.55	Plasterboard	
45	ext.wall	0.91	Plasterboard	
182	ext.wall	3.65	Plasterboard	
40	ext.wall	0.79	Plasterboard	
17	ext.wall	0.34	Plasterboard	
33	ext.wall	0.65	Plasterboard	

121	ext.wall	2.42	Plasterboard	
108	ext.wall	2.17	Plasterboard	
112	ext.wall	2.25	Plasterboard	
13	ext.wall	0.26	Plasterboard	
19	ext.wall	0.38	Plasterboard	
14	ext.wall	0.29	Plasterboard	
23	ext.wall	0.45	Plasterboard	
31	ext.wall	0.63	Plasterboard	
52	ext.wall	1.03	Plasterboard	
180	ext.wall	3.6	Plasterboard	
26	ext.wall	0.52	Plasterboard	
27	ext.wall	0.54	Plasterboard	
83	ext.wall	1.65	Plasterboard	
4	ext.wall	0.08	Plasterboard	
70	ext.wall	1.4	Plasterboard	
42	int.wall 10 cm	0.84	Plasterboard	
3	int.wall 10 cm	0.05	Plasterboard	
38	int.wall 10 cm	0.76	Plasterboard	
16	int.wall 10 cm	0.31	Plasterboard	
3	int.wall 10 cm	0.05	Plasterboard	
16	int.wall 10 cm	0.31	Plasterboard	
4	int.wall 10 cm	0.07	Plasterboard	
29	int.wall 10 cm	0.59	Plasterboard	
13	int.wall 10 cm	0.26	Plasterboard	
57	int.wall 10 cm	1.13	Plasterboard	
57	int.wall 10 cm	1.14	Plasterboard	
42	int.wall 10 cm	0.85	Plasterboard	
55	int.wall 10 cm	1.1	Plasterboard	
34	int.wall 10 cm	0.67	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
39	int.wall 10 cm	0.79	Plasterboard	
15	int.wall 10 cm	0.29	Plasterboard	
6	int.wall 10 cm	0.11	Plasterboard	
25	int.wall 10 cm	0.51	Plasterboard	
25	int.wall 10 cm	0.51	Plasterboard	
38	int.wall 10 cm	0.75	Plasterboard	
14	int.wall 10 cm	0.28	Plasterboard	
14	int.wall 10 cm	0.28	Plasterboard	
1	int.wall 10 cm	0.01	Plasterboard	
261	int.wall 20 cm	5.22	Plasterboard	
261	int.wall 20 cm	5.22	Plasterboard	

223	int.wall 20 cm	4.45	Plasterboard	
77	int.wall 20 cm	1.53	Plasterboard	
229	int.wall 20 cm	4.58	Plasterboard	
77	int.wall 20 cm	1.53	Plasterboard	
34	int.wall 20 cm	0.68	Plasterboard	
98	int.wall 20 cm	1.95	Plasterboard	
34	int.wall 20 cm	0.68	Plasterboard	
74	int.wall 20 cm	1.48	Plasterboard	
59	int.wall 20 cm	1.18	Plasterboard	
195	int.wall 20 cm	3.9	Plasterboard	
59	int.wall 20 cm	1.18	Plasterboard	
78	int.wall 20 cm	1.55	Plasterboard	
101	int.wall 20 cm	2.01	Plasterboard	
101	int.wall 20 cm	2.01	Plasterboard	
78	int.wall 20 cm	1.55	Plasterboard	
51	int.wall 20 cm	1.03	Plasterboard	
33	int.wall 20 cm	0.66	Plasterboard	
56	int.wall 20 cm	1.12	Plasterboard	
33	int.wall 20 cm	0.66	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
76	int.wall 10 cm	1.51	Plasterboard	
83	int.wall 10 cm	1.66	Plasterboard	
20	int.wall 10 cm	0.39	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
73	int.wall 10 cm	1.47	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
73	int.wall 10 cm	1.47	Plasterboard	
57	int.wall 10 cm	1.13	Plasterboard	
3	int.wall 10 cm	0.06	Plasterboard	
57	int.wall 10 cm	1.14	Plasterboard	
42	int.wall 10 cm	0.85	Plasterboard	
4	ext.wall	0.08	Plasterboard	
10	ext.wall	0.21	Plasterboard	
29	int.wall 10 cm	0.58	Plasterboard	
15	int.wall 10 cm	0.31	Plasterboard	
4	int.wall 10 cm	0.07	Plasterboard	
15	int.wall 10 cm	0.31	Plasterboard	
3	int.wall 10 cm	0.05	Plasterboard	
38	int.wall 10 cm	0.76	Plasterboard	
42	int.wall 10 cm	0.84	Plasterboard	
3	int.wall 10 cm	0.05	Plasterboard	

38	int.wall 10 cm	0.77	Plasterboard	
27	int.wall 10 cm	0.53	Plasterboard	
38	int.wall 10 cm	0.75	Plasterboard	
26	int.wall 10 cm	0.51	Plasterboard	
14	int.wall 10 cm	0.28	Plasterboard	
14	int.wall 10 cm	0.29	Plasterboard	
15	int.wall 10 cm	0.29	Plasterboard	
6	int.wall 10 cm	0.11	Plasterboard	
34	int.wall 10 cm	0.67	Plasterboard	
33	int.wall 10 cm	0.65	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
8	ext.wall	0.16	Plasterboard	
5	ext.wall	0.1	Plasterboard	
1	ext.wall	0.02	Plasterboard	
2	ext.wall	0.04	Plasterboard	
2	ext.wall	0.03	Plasterboard	
3	ext.wall	0.06	Plasterboard	
3	ext.wall	0.06	Plasterboard	
11	ext.wall	0.22	Plasterboard	
9	ext.wall	0.19	Plasterboard	
12	ext.wall	0.24	Plasterboard	
9	ext.wall	0.17	Plasterboard	
8	ext.wall	0.16	Plasterboard	
5	ext.wall	0.09	Plasterboard	
8	ext.wall	0.16	Plasterboard	
5	ext.wall	0.1	Plasterboard	
1	ext.wall	0.02	Plasterboard	
21	ext.wall	0.42	Plasterboard	
14	ext.wall	0.27	Plasterboard	
33	ext.wall	0.66	Plasterboard	
14	ext.wall	0.27	Plasterboard	
1	ext.wall	0.03	Plasterboard	
38	int.wall 10 cm	0.76	Plasterboard	
34	int.wall 10 cm	0.68	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
4	int.wall 10 cm	0.07	Plasterboard	
5	int.wall 10 cm	0.09	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	
41	int.wall 10 cm	0.81	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	

7	int.wall 10 cm	0.14	Plasterboard	
20	int.wall 10 cm	0.4	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
26	int.wall 10 cm	0.53	Plasterboard	
22	int.wall 10 cm	0.44	Plasterboard	
4	int.wall 10 cm	0.09	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
18	int.wall 10 cm	0.37	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
25	int.wall 10 cm	0.5	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
30	int.wall 10 cm	0.59	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
26	int.wall 10 cm	0.52	Plasterboard	
4	int.wall 10 cm	0.08	Plasterboard	
15	int.wall 10 cm	0.3	Plasterboard	
123	int.wall 20 cm	2.46	Plasterboard	
7	int.wall 20 cm	0.14	Plasterboard	
28	int.wall 20 cm	0.55	Plasterboard	
7	int.wall 20 cm	0.14	Plasterboard	
28	int.wall 20 cm	0.55	Plasterboard	
11	int.wall 20 cm	0.23	Plasterboard	
4	int.wall 20 cm	0.09	Plasterboard	
37	int.wall 20 cm	0.74	Plasterboard	
18	int.wall 20 cm	0.36	Plasterboard	
30	int.wall 20 cm	0.61	Plasterboard	
14	int.wall 20 cm	0.27	Plasterboard	
8	ext.wall	0.16	Plasterboard	
4	ext.wall	0.08	Plasterboard	
5	ext.wall	0.11	Plasterboard	
21	int.wall 10 cm	0.43	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
7	int.wall 10 cm	0.15	Plasterboard	
1	ext.wall	0.02	Plasterboard	
2	ext.wall	0.04	Plasterboard	
2	ext.wall	0.03	Plasterboard	

3	ext.wall	0.06	Plasterboard	
3	ext.wall	0.06	Plasterboard	
10	ext.wall	0.21	Plasterboard	
2	ext.wall	0.03	Plasterboard	
15	ext.wall	0.29	Plasterboard	
15	ext.wall	0.29	Plasterboard	
1	ext.wall	0.03	Plasterboard	
38	int.wall 10 cm	0.76	Plasterboard	
34	int.wall 10 cm	0.68	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
4	int.wall 10 cm	0.07	Plasterboard	
5	int.wall 10 cm	0.09	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	
41	int.wall 10 cm	0.81	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
7	int.wall 10 cm	0.14	Plasterboard	
20	int.wall 10 cm	0.4	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
27	int.wall 10 cm	0.55	Plasterboard	
22	int.wall 10 cm	0.44	Plasterboard	
4	int.wall 10 cm	0.09	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
18	int.wall 10 cm	0.37	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
25	int.wall 10 cm	0.5	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
30	int.wall 10 cm	0.59	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
26	int.wall 10 cm	0.52	Plasterboard	
4	int.wall 10 cm	0.08	Plasterboard	
15	int.wall 10 cm	0.3	Plasterboard	
123	int.wall 20 cm	2.46	Plasterboard	
7	int.wall 20 cm	0.14	Plasterboard	
28	int.wall 20 cm	0.55	Plasterboard	
7	int.wall 20 cm	0.14	Plasterboard	

28	int.wall 20 cm	0.55	Plasterboard	
11	int.wall 20 cm	0.23	Plasterboard	
4	int.wall 20 cm	0.09	Plasterboard	
37	int.wall 20 cm	0.74	Plasterboard	
18	int.wall 20 cm	0.36	Plasterboard	
30	int.wall 20 cm	0.61	Plasterboard	
14	int.wall 20 cm	0.27	Plasterboard	
7	ext.wall	0.13	Plasterboard	
21	int.wall 10 cm	0.43	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
7	int.wall 10 cm	0.15	Plasterboard	
4	ext.wall	0.08	Plasterboard	
8	ext.wall	0.16	Plasterboard	
4	ext.wall	0.09	Plasterboard	
12	ext.wall	0.23	Plasterboard	
9	ext.wall	0.19	Plasterboard	
12	ext.wall	0.23	Plasterboard	
8	ext.wall	0.16	Plasterboard	
19	ext.wall	0.38	Plasterboard	
32	ext.wall	0.64	Plasterboard	
8	ext.wall	0.17	Plasterboard	
5	ext.wall	0.09	Plasterboard	
11	ext.wall	0.22	Plasterboard	
10	ext.wall	0.2	Plasterboard	
13	ext.wall	0.27	Plasterboard	
1	ext.wall	0.02	Plasterboard	
2	ext.wall	0.04	Plasterboard	
2	ext.wall	0.05	Plasterboard	
1	ext.wall	0.02	Plasterboard	
33	int.wall 10 cm	0.65	Plasterboard	
52	int.wall 10 cm	1.03	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
10	int.wall 10 cm	0.19	Plasterboard	
2	int.wall 10 cm	0.05	Plasterboard	
16	int.wall 10 cm	0.31	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	
14	int.wall 10 cm	0.28	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	

6	int.wall 10 cm	0.12	Plasterboard	
3	int.wall 10 cm	0.06	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
22	int.wall 10 cm	0.43	Plasterboard	
14	int.wall 20 cm	0.27	Plasterboard	
38	int.wall 20 cm	0.77	Plasterboard	
6	ext.wall	0.13	Plasterboard	
9	ext.wall	0.18	Plasterboard	
4	ext.wall	0.08	Plasterboard	
6	ext.wall	0.12	Plasterboard	
8	ext.wall	0.16	Plasterboard	
1	ext.wall	0.02	Plasterboard	
41	int.wall 20 cm	0.82	Plasterboard	
17	int.wall 20 cm	0.35	Plasterboard	
19	int.wall 20 cm	0.38	Plasterboard	
40	int.wall 20 cm	0.81	Plasterboard	
29	int.wall 10 cm	0.58	Plasterboard	
20	int.wall 10 cm	0.4	Plasterboard	
18	int.wall 10 cm	0.36	Plasterboard	
6	int.wall 10 cm	0.11	Plasterboard	
7	int.wall 10 cm	0.14	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	
23	int.wall 10 cm	0.45	Plasterboard	
32	ext.wall	0.64	Plasterboard	
14	ext.wall	0.27	Plasterboard	
4	ext.wall	0.08	Plasterboard	
14	ext.wall	0.27	Plasterboard	
19	ext.wall	0.39	Plasterboard	
9	ext.wall	0.19	Plasterboard	
11	ext.wall	0.21	Plasterboard	
6	ext.wall	0.13	Plasterboard	
6	ext.wall	0.11	Plasterboard	
8	ext.wall	0.17	Plasterboard	
4	ext.wall	0.08	Plasterboard	
1	ext.wall	0.02	Plasterboard	
2	ext.wall	0.04	Plasterboard	
2	ext.wall	0.03	Plasterboard	
3	ext.wall	0.06	Plasterboard	
2	ext.wall	0.03	Plasterboard	
11	ext.wall	0.22	Plasterboard	
3	ext.wall	0.06	Plasterboard	

10	ext.wall	0.19	Plasterboard	
11	ext.wall	0.22	Plasterboard	
27	int.wall 10 cm	0.53	Plasterboard	
16	int.wall 10 cm	0.32	Plasterboard	
24	int.wall 10 cm	0.48	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
10	int.wall 10 cm	0.19	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
10	int.wall 10 cm	0.21	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
51	int.wall 10 cm	1.02	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
24	int.wall 10 cm	0.47	Plasterboard	
7	int.wall 10 cm	0.14	Plasterboard	
38	int.wall 10 cm	0.75	Plasterboard	
68	int.wall 10 cm	1.35	Plasterboard	
14	int.wall 10 cm	0.27	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
12	int.wall 10 cm	0.23	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
11	int.wall 10 cm	0.22	Plasterboard	
13	int.wall 10 cm	0.27	Plasterboard	
15	int.wall 10 cm	0.29	Plasterboard	
8	ext.wall	0.16	Plasterboard	
8	ext.wall	0.16	Plasterboard	
5	ext.wall	0.1	Plasterboard	
8	ext.wall	0.17	Plasterboard	
3	ext.wall	0.06	Plasterboard	
3	ext.wall	0.06	Plasterboard	
33	int.wall 10 cm	0.65	Plasterboard	
52	int.wall 10 cm	1.03	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
10	int.wall 10 cm	0.2	Plasterboard	
16	int.wall 10 cm	0.31	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	

14	int.wall 10 cm	0.28	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
27	int.wall 10 cm	0.54	Plasterboard	
6	int.wall 10 cm	0.12	Plasterboard	
3	int.wall 10 cm	0.06	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
22	int.wall 10 cm	0.43	Plasterboard	
14	int.wall 20 cm	0.27	Plasterboard	
38	int.wall 20 cm	0.77	Plasterboard	
10	ext.wall	0.2	Plasterboard	
4	ext.wall	0.08	Plasterboard	
6	ext.wall	0.12	Plasterboard	
8	ext.wall	0.16	Plasterboard	
36	int.wall 20 cm	0.73	Plasterboard	
17	int.wall 20 cm	0.35	Plasterboard	
29	int.wall 10 cm	0.58	Plasterboard	
20	int.wall 10 cm	0.4	Plasterboard	
18	int.wall 10 cm	0.36	Plasterboard	
6	int.wall 10 cm	0.11	Plasterboard	
7	int.wall 10 cm	0.14	Plasterboard	
6	int.wall 10 cm	0.13	Plasterboard	
23	int.wall 10 cm	0.45	Plasterboard	
13	ext.wall	0.25	Plasterboard	
14	ext.wall	0.27	Plasterboard	
4	ext.wall	0.08	Plasterboard	
14	ext.wall	0.27	Plasterboard	
19	ext.wall	0.39	Plasterboard	
9	ext.wall	0.19	Plasterboard	
7	ext.wall	0.14	Plasterboard	
6	ext.wall	0.11	Plasterboard	
8	ext.wall	0.17	Plasterboard	
4	ext.wall	0.08	Plasterboard	
1	ext.wall	0.01	Plasterboard	
2	ext.wall	0.04	Plasterboard	
2	ext.wall	0.03	Plasterboard	
3	ext.wall	0.06	Plasterboard	
3	ext.wall	0.06	Plasterboard	
9	ext.wall	0.19	Plasterboard	
11	ext.wall	0.22	Plasterboard	
27	int.wall 10 cm	0.53	Plasterboard	

16	int.wall 10 cm	0.32	Plasterboard	
24	int.wall 10 cm	0.48	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
19	int.wall 10 cm	0.38	Plasterboard	
10	int.wall 10 cm	0.19	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
10	int.wall 10 cm	0.21	Plasterboard	
21	int.wall 10 cm	0.42	Plasterboard	
51	int.wall 10 cm	1.02	Plasterboard	
35	int.wall 10 cm	0.7	Plasterboard	
24	int.wall 10 cm	0.47	Plasterboard	
7	int.wall 10 cm	0.14	Plasterboard	
38	int.wall 10 cm	0.75	Plasterboard	
68	int.wall 10 cm	1.35	Plasterboard	
15	int.wall 10 cm	0.31	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
33	int.wall 10 cm	0.66	Plasterboard	
12	int.wall 10 cm	0.23	Plasterboard	
17	int.wall 10 cm	0.33	Plasterboard	
9	int.wall 10 cm	0.18	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
28	int.wall 10 cm	0.56	Plasterboard	
11	int.wall 10 cm	0.22	Plasterboard	
13	int.wall 10 cm	0.27	Plasterboard	
15	int.wall 10 cm	0.29	Plasterboard	
5	ext.wall	0.11	Plasterboard	
1	ext.wall	0.02	Plasterboard	
2	ext.wall	0.03	Plasterboard	
10	ext.wall	0.2	Plasterboard	
11	ext.wall	0.22	Plasterboard	
3	ext.wall	0.06	Plasterboard	
2	ext.wall	0.04	Plasterboard	
12	ext.wall	0.23	Plasterboard	
1	ext.wall	0.02	Plasterboard	
3	ext.wall	0.05	Plasterboard	
1	ext.wall	0.02	Plasterboard	
3	ext.wall	0.05	Plasterboard	
1	ext.wall	0.01	Plasterboard	
3	ext.wall	0.05	Plasterboard	
4	ext.wall	0.08	Plasterboard	
17	int.wall 20 cm	0.34	Plasterboard	

19	ext.wall	0.39	Plasterboard	
2	ext.wall	0.04	Plasterboard	
3	ext.wall	0.06	Plasterboard	
6	ext.wall	0.11	Plasterboard	
109	ext.wall	2.18	Plasterboard	
30	ext.wall	0.6	Plasterboard	
2	ext.wall	0.04	Plasterboard	
4	ext.wall	0.09	Plasterboard	
3	ext.wall	0.06	Plasterboard	
6	ext.wall	0.12	Plasterboard	
36	int.wall 20 cm	0.73	Plasterboard	
17	int.wall 20 cm	0.35	Plasterboard	
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
5	Pick-Up	0.19	Rubber - Black	GF shopping
173	ext.wall	12.11	Stone (2)	
277	ext.wall	19.42	Stone (2)	
45	ext.wall	3.17	Stone (2)	
182	ext.wall	12.77	Stone (2)	
40	ext.wall	2.78	Stone (2)	
17	ext.wall	1.2	Stone (2)	
33	ext.wall	2.29	Stone (2)	
121	ext.wall	8.45	Stone (2)	
108	ext.wall	7.59	Stone (2)	
112	ext.wall	7.87	Stone (2)	
13	ext.wall	0.9	Stone (2)	
19	ext.wall	1.34	Stone (2)	
14	ext.wall	1.01	Stone (2)	
23	ext.wall	1.58	Stone (2)	
31	ext.wall	2.2	Stone (2)	
52	ext.wall	3.61	Stone (2)	
180	ext.wall	12.61	Stone (2)	
26	ext.wall	1.81	Stone (2)	
27	ext.wall	1.89	Stone (2)	
83	ext.wall	5.78	Stone (2)	
4	ext.wall	0.3	Stone (2)	
81	ext.wall	5.55	Stone (2)	

4	ext.wall	0.3	Stone (2)	
10	ext.wall	0.72	Stone (2)	
8	ext.wall	0.58	Stone (2)	
5	ext.wall	0.36	Stone (2)	
1	ext.wall	0.06	Stone (2)	
2	ext.wall	0.14	Stone (2)	
2	ext.wall	0.12	Stone (2)	
3	ext.wall	0.22	Stone (2)	
3	ext.wall	0.2	Stone (2)	
11	ext.wall	0.76	Stone (2)	
9	ext.wall	0.65	Stone (2)	
12	ext.wall	0.83	Stone (2)	
9	ext.wall	0.6	Stone (2)	
8	ext.wall	0.57	Stone (2)	
5	ext.wall	0.33	Stone (2)	
8	ext.wall	0.57	Stone (2)	
5	ext.wall	0.33	Stone (2)	
1	ext.wall	0.08	Stone (2)	
21	ext.wall	1.49	Stone (2)	
14	ext.wall	0.95	Stone (2)	
33	ext.wall	2.33	Stone (2)	
14	ext.wall	0.95	Stone (2)	
1	ext.wall	0.1	Stone (2)	
8	ext.wall	0.58	Stone (2)	
4	ext.wall	0.29	Stone (2)	
5	ext.wall	0.38	Stone (2)	
1	ext.wall	0.06	Stone (2)	
2	ext.wall	0.15	Stone (2)	
2	ext.wall	0.12	Stone (2)	
3	ext.wall	0.22	Stone (2)	
3	ext.wall	0.2	Stone (2)	
10	ext.wall	0.73	Stone (2)	
2	ext.wall	0.11	Stone (2)	
15	ext.wall	1.03	Stone (2)	
15	ext.wall	1.03	Stone (2)	
1	ext.wall	0.1	Stone (2)	
7	ext.wall	0.46	Stone (2)	
4	ext.wall	0.29	Stone (2)	
8	ext.wall	0.55	Stone (2)	
4	ext.wall	0.3	Stone (2)	
12	ext.wall	0.82	Stone (2)	

9	ext.wall	0.65	Stone (2)	
12	ext.wall	0.82	Stone (2)	
8	ext.wall	0.58	Stone (2)	
19	ext.wall	1.34	Stone (2)	
32	ext.wall	2.25	Stone (2)	
8	ext.wall	0.59	Stone (2)	
5	ext.wall	0.32	Stone (2)	
11	ext.wall	0.76	Stone (2)	
10	ext.wall	0.69	Stone (2)	
13	ext.wall	0.93	Stone (2)	
1	ext.wall	0.08	Stone (2)	
2	ext.wall	0.13	Stone (2)	
2	ext.wall	0.17	Stone (2)	
1	ext.wall	0.08	Stone (2)	
6	ext.wall	0.44	Stone (2)	
9	ext.wall	0.64	Stone (2)	
4	ext.wall	0.26	Stone (2)	
6	ext.wall	0.43	Stone (2)	
8	ext.wall	0.56	Stone (2)	
1	ext.wall	0.08	Stone (2)	
32	ext.wall	2.26	Stone (2)	
14	ext.wall	0.95	Stone (2)	
4	ext.wall	0.29	Stone (2)	
14	ext.wall	0.95	Stone (2)	
19	ext.wall	1.35	Stone (2)	
9	ext.wall	0.66	Stone (2)	
11	ext.wall	0.74	Stone (2)	
6	ext.wall	0.44	Stone (2)	
6	ext.wall	0.39	Stone (2)	
8	ext.wall	0.59	Stone (2)	
4	ext.wall	0.29	Stone (2)	
1	ext.wall	0.06	Stone (2)	
2	ext.wall	0.14	Stone (2)	
2	ext.wall	0.12	Stone (2)	
3	ext.wall	0.22	Stone (2)	
2	ext.wall	0.11	Stone (2)	
11	ext.wall	0.76	Stone (2)	
3	ext.wall	0.2	Stone (2)	
10	ext.wall	0.68	Stone (2)	
11	ext.wall	0.76	Stone (2)	
8	ext.wall	0.57	Stone (2)	

8	ext.wall	0.57	Stone (2)	
5	ext.wall	0.33	Stone (2)	
8	ext.wall	0.59	Stone (2)	
3	ext.wall	0.21	Stone (2)	
3	ext.wall	0.21	Stone (2)	
10	ext.wall	0.71	Stone (2)	
4	ext.wall	0.26	Stone (2)	
6	ext.wall	0.43	Stone (2)	
8	ext.wall	0.56	Stone (2)	
13	ext.wall	0.89	Stone (2)	
14	ext.wall	0.95	Stone (2)	
4	ext.wall	0.29	Stone (2)	
14	ext.wall	0.95	Stone (2)	
19	ext.wall	1.35	Stone (2)	
9	ext.wall	0.66	Stone (2)	
7	ext.wall	0.5	Stone (2)	
6	ext.wall	0.39	Stone (2)	
8	ext.wall	0.59	Stone (2)	
4	ext.wall	0.29	Stone (2)	
1	ext.wall	0.05	Stone (2)	
2	ext.wall	0.14	Stone (2)	
2	ext.wall	0.12	Stone (2)	
3	ext.wall	0.22	Stone (2)	
3	ext.wall	0.2	Stone (2)	
9	ext.wall	0.65	Stone (2)	
11	ext.wall	0.76	Stone (2)	
5	ext.wall	0.37	Stone (2)	
1	ext.wall	0.08	Stone (2)	
2	ext.wall	0.11	Stone (2)	
10	ext.wall	0.69	Stone (2)	
11	ext.wall	0.76	Stone (2)	
3	ext.wall	0.21	Stone (2)	
2	ext.wall	0.15	Stone (2)	
12	ext.wall	0.82	Stone (2)	
1	ext.wall	0.08	Stone (2)	
3	ext.wall	0.18	Stone (2)	
1	ext.wall	0.06	Stone (2)	
3	ext.wall	0.19	Stone (2)	
1	ext.wall	0.05	Stone (2)	
3	ext.wall	0.18	Stone (2)	
4	ext.wall	0.29	Stone (2)	

19	ext.wall	1.35	Stone (2)	
2	ext.wall	0.14	Stone (2)	
3	ext.wall	0.2	Stone (2)	
6	ext.wall	0.39	Stone (2)	
109	ext.wall	7.64	Stone (2)	
30	ext.wall	2.09	Stone (2)	
2	ext.wall	0.15	Stone (2)	
4	ext.wall	0.31	Stone (2)	
3	ext.wall	0.2	Stone (2)	
6	ext.wall	0.41	Stone (2)	
579	floor tile	17.37	Tile (4)	GF shopping
549	floor tile	16.46	Tile (4)	1st Floor shopping
571	floor tile	17.13	Tile (4)	2nd floor offices
571	floor tile	17.13	Tile (4)	3rd floor offices
600	floor tile	17.99	Tile (4)	4th floor apartments
603	floor tile	18.1	Tile (4)	5th floor apartments
603	floor tile	18.1	Tile (4)	Roof