DIPLOMA PROJECT

BUSINESS CENTER

YEAR: 2012

STUDENT: ANNA CHARITAKI

A.
SITE INFORMATION

STRATEGY OF THE PLOT:

A business center is located in Pazmany Peter utca (15th district of Budapest). The location of the building is suitable for offices to let and buy, because of the cheap land which is making a good investment for the clients who are whiling to invest, while the district itself is a residential area which is creating the necessity of an office building in the area to cover the professional needs of the inhabitants. A few kilometers away (max. 3,5km) from the plot is Vaci ut, the main office building street of Budapest, fact that is strengthening the partnerships.

ACCESS TO THE PLOT:

The plot is placed exactly after entering the 15th district of Budapest, from Arpad uti bridge by car, 100m from Hubay Jeno ter bus station and 50m from the Rakospalota train station. One of the main advantages of the plot is that the traffic ways to reach it are perfect and the transportation promises transfer to the city center in not more than ten minutes. This is a catalytic reason for the businessmen / women who are whiling to use the building.

AROUND THE PLOT:

The plot is located in a critic point, between a railway, a bridge and a green area. Those three facts have to be considered in a harmonized way so they can coexist and act in a vantage way for the building. While the plot is located in the entrance of the district it can work as a gate for the bridge and for the district in case of constructing a second tween building from the other side of the bridge. In other words the building will welcome the comers of the area by its location and appearance and will improve the aesthetic of the district. Additionally the market which is placed in the site will be demolished and in that way, the social problems which were created by its users will be cancelled. Finally, the green area next to the site will work as a core of upgrade and relaxation.

A.
SITE INFORMATION

15th DISTRICT:

ADVANTAGES:

1) Cheap land (easy to make a good investment)

2) Good public transportation to the area (train, bus)

3) Existing plots that need to be improved

4) It is a mostly residential area, thus more work places have to be provided for the residents.

DISADVANTAGES:

1) There are social problems, created by the people who are working and visiting the local bazaar.

2) Not close to Budapest city center (takes time to reach the district by car)

SITE:

1) Close to train station.

2) Close to bus station.

3) Need to demolish the market (bazar) which is placed there and that will solve the social problems of the area.

4) Attached to the bridge, which can create a concept of making two buildings creating a gate to the bridge and to the district.

5) Next to green area, which will be an advantage the task of the design.

6) There will be noise because of the railway and the traffic from the bridge.

A.
SITE INFORMATION

TRANSPORTATION AND TRAFFIC:

Train station:

Rakospalota - Ujpest Vasutallomas

15 min from Nyugati Palyaudvar (main train station of Budapest)

Bus station:

Hubay Jeno ter

Bus number: 25, 170, 104, 104A, 196, 196A

Car Traffic: Rakospalota

Main access way for reaching 15th district from Arpad Uti feluljaro (bridge)

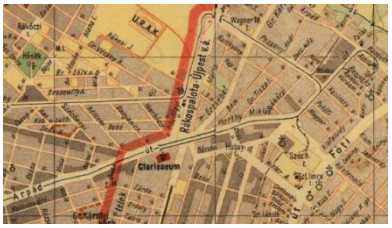
PLOT IMPROVMENT:

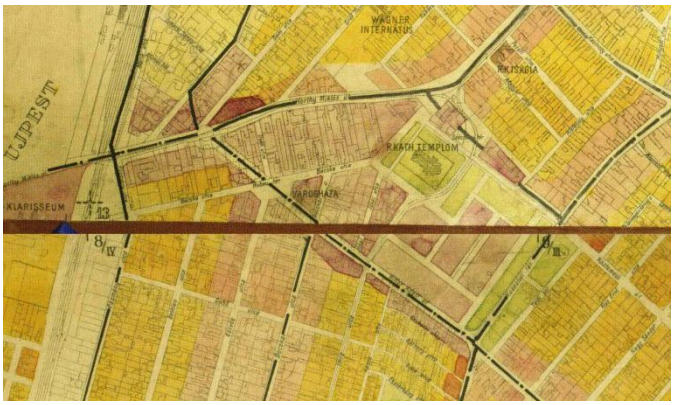
1) Making Pazmany Peter utca wider, i provide space for a more comfortable car traffic circulation around the plot.

2) The last part of Fo utca will be lined up parallel to the bridge, while it will not be used by cars but just as a pedestrian way for the people who arrive to the train station.

3) The second plot (2) of a provided 3670m2 will be used in the same way as the first (1) in case of designing the concept that takes two same buildings next to the bridge to create a gate of the bridge as well as of the district.

B.
HISTORY OF THE SITE





The district has a long lifetime In 1846 the first railway line of Hungary (Pest-Vác) reached Rákospalota, and the Forest of Palota became a popular beauty spot with restaurants and places of entertainment. Next to the station a new suburb grew with nice villas for the rich citizens of Pest. In the second part of the 19th century Palota was already out of fashion and later the forest was cut down, but in this neighbourhood there are still some derelict, beautiful old homes. Rákospalota became a town in 1923 and part of Great-Budapest in 1950. A sumptuous Gothic Revival cathedral, Lutheran Church, Moorish Synagoge, a new big Calvinist church and a Town Hall marked the wealth of the town but there were serious social tensions between the new and the old residents. The Register of National Monuments consists of four buildings from Rákospalota: Old Catholic Chapel (1735), Old Museum (Classic Revival, 19th century), Liva-malom (mill on the Szilas brook, 18th to 19th centuries) and Girl's College (early 20th century).

C.

BUSINESS CENTER

GENERAL:

Definition:

An office is an architectural and design phenomenon and a social phenomenon, whether it is a small office such as a bench in the corner of a small business of extremely small size through entire floors of buildings up to and including massive buildings dedicated entirely to one company. In modern terms an office usually refers to the location where educated workers are employed.

From architecturally point of view an office building should have a dynamic and energetic appearance, while based to the fact that it is a public building which should follow special rules in the structure and arrangement, the building itself should provide well arranged and working plans to cover the needs of the people that are working there and to create the feeling of an environment which embraces you to work in a healthy way. As long as, office building is an area where people spent a lot of their hours, it should be designed in that way so employees will feel friendly in the building and its spaces and work in a positive mood. For this reason in case of big buildings it would be good to be provided common used areas for relaxation during the breaks.

As long as, offices can be built in almost any location and in almost any building, some new trends and requirements for offices make this task more difficult. These requirements can be both legal (e.g. light levels must be sufficient) or technical (e.g. requirements for computer networking). Some other important requirements such as security and flexibility of layout, has led to the creation of special buildings which are dedicated only or primarily for use as offices. An office building, or in other words an office block or business center is a form of commercial building which contains spaces mainly designed to be used for offices.

SITE DESCRIPTION:

Area of plot:6950m^2

Area of project:900m^2

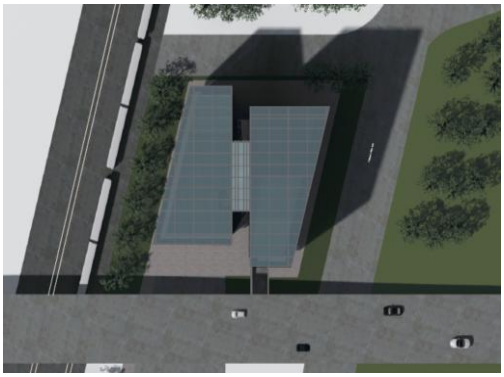
Typography: flat

Water soil level:-4,00m

Vegetation: grass, trees, shrubs

D.

DESIGN CONCEPT



FORM OF THE BUILDING:

The form of the building was designed based to the needs and the shape of the plot. Consisting two blocks and a core which is connecting them. The effect of the bridge was taken under consideration and for the distances that where kept from it and in the design of the plans by giving in the 1st floor of the building (in the side of the bridge) the mechanical rooms as long as this part of the building is the most dark and noisy. The simplicity of the form was the initial consideration.

APPEARANCE ON THE BUILDING:

A secondary coating is applied in the building from glass. In that way a unified appearance with ventilated elevations having wind and sound protection is provided. By the double skin façade the main disadvantage of the plot , which is the noise from the railway and the bridge traffic, drastically reduces. From the other point of view, an office building need a dynamic and imposing appearance which will indicate the real function of the building and this solution is nevertheless the ideal.

ADDITIONAL GREEN SOLUTIONS:

Solar panels are placed in the roof of the building. The solar panels are used as a component of a larger photovoltaic system to generate and supply electricity in the building so that it can gain energy and money by itself.

Green wall is applied in a part of the building so it can embrace it with the park which is situated next to it, while green wall may also be a mean for water reuse and give the beauty of an art which is always welcome especially in office buildings.

D.

DESIGN CONCEPT

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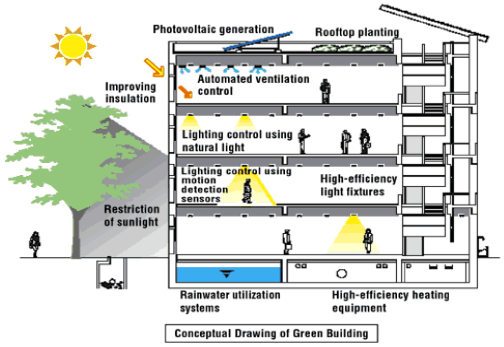

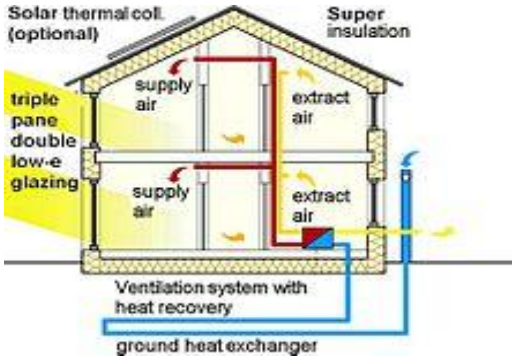

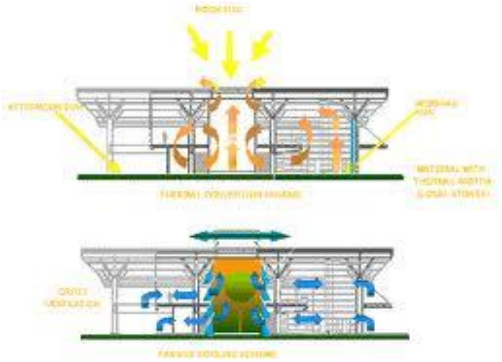

SUSTAINABLE BUILDING:

Sustainable buildings are providing a cheaper cost for the people who are using it, a long as the energy and water consumptions costs are decreasing dramatically from a normal building without green solutions on its design. This is happening by using solar panels (photovoltaic solutions), friendlier insulations, green walls to keep the internal temperatures etc.

From the other point of view, when using a sustainable building, is proved that the psychological effect that is creating to a person is highly good, because of the air (better ventilation and insulation), the eye effect (when living in a environment which is protected by green solutions), the atmosphere, the lighting and the safety. This is an important factor for office designs as long the employees will work properly.

Additional, sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space. The idea of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations.

ADVANTAGES OF SUSTAINABLE BUILDINGS:

1) Environmentally friendly.

2) Safe and pleasant for the occupying people that are using it.

3) Urban advantages as long as sustainable buildings are well integrate to its environment.

4) Well designed aesthetic appearance from architectural point of view.

5) Pleasant lighting.

7) Psychological benefits to the people.

7) Safe and beneficial to human health because of the constructing materials the clean air monitoring and circulating systems.

8) Well building's energy consumption for cooling and heating needs.

9) Cost savings for building owners.

D.

DESIGN CONCEPT

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EFFECT OF BRIDGE AND RAILWAY TO THE PLOT:

The plot and the traffic-ways arround it have been prepared in that way so that it will be created a rectangular block.

Pazmany Peter utca has been extended to cover the needs of the car traffic that will be created from the people who will use the building.

The last part of Fo utca will be used only as a pedestrian way and as a passage to the train station.

DSIGNINING BASE TO THE EFFECT OF THE RAILWAY AND BRIDGE.

The form of the building is affected by the theoretical lines that the railway is creating. The building's borders from the south and east elevation are parallel to the railway.

Because of the existing bridge there are problems, such as no light to the lower floors of the building, noise, safety distances etc, that have to be considered. The building is placed in that way to cover these problems.

The main entrances of the building will be placed in both sides of the building (north and south) and will lead to the core of the building. One clear and easy solution.

All along the railway will be planted trees to avoid the noise from the train and create a environmental feeling to the design.

Pedestrian passages will be placed all along the building and to mention the main entrances.

Outdoor parking will be provided down of the bridge as long as it is an area that perfectly provided for this case because under the bridge there couldn't be any useful function because of the light problem. Bridge will work as security slab to the parking as well.

Underground parking will be provided from the east part of the building as well.

D.

DESIGN CONCEPT

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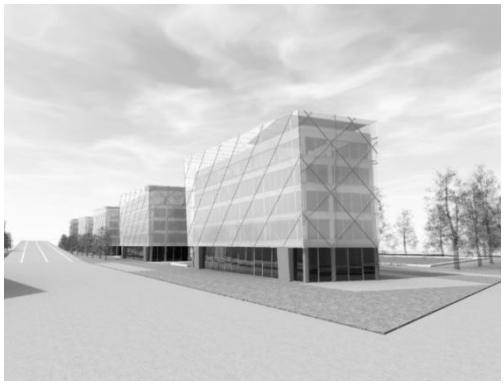
URBAN PLANNING:

Site entrance:

Entering the 15th district of Budapest passing through Árpád Way, the two main business centres of the park will stand as noticeable new landmarks. Positioned beside the bridge, they designate the entrance point of the district. They are to improve the architectural and financial aspects of the area.

Office park:



A row of sustainable office buildings will be established alongside Karacsony Beno Park. This way a more liveable working atmosphere is created next to the existing green area. Green walls are applied on the Western elevation of the offices, making an even better correspondence between the buildings and the park.

New park:

After having been reorganized, the new park will adapt better to the business area, creating a pleasant leisure zone for the people working here and living nearby. It will be separated to 3 parts for different activities. A pedestrian axis is connecting the buildings with the green nature.

Existing market:

There is a temporary structure giving place to a market under the bridge of Árpád Way. Over the years it has become a savage area leaving a dirty unattended neighbourhood next to the park. Thus it has to be relocated to a more appropriate place where it can be properly maintaned and looked after.

E.

FUNCTIONS

UNDERGROUND FLOOR.

There are 28 individual parking places provided in the minus first floor and 31 in the minus second floor, while there is a store in the minus first floor which can be used for the mechanical room which is applied for the electric power of the building.

GROUND FLOOR.

Ground floor will be used as a commercial area with public functions:

Airlock: It is located in the core of the building. As long as there are two entrances for the building, two airlocks will be provided for each.

Lobby: A big lobby is prepared in the middle core of the building as a welcoming area for the users of the building with a security desk and a sitting-waiting area with couches and armchairs.

Stairs and elevators: There are two staircases placed in the building, one in each block. One is connecting the lobby with the underground part. For security reasons the staircases are reaching different levels but both of them are arriving to the ground floor ,so whoever is using them can be checked from the security assistants. Two elevators are located attached to the staircase block.

West block: A self – service fast food restaurant is designed, ready to cover the needs of the employees and the inhabitants of the area, with big capacity and kitchen fully equipped with all the rooms that are needed and the special equipment. A self service stand is provided for the quicker service of the costumers. Additionally, the main toilet block is placed in that part of the building so that in the days that the rest of the building will be out of operation the restaurant with the toilet block can work separately.

East block: This is the commercial part of the building as long as different kind of shops are provided there in order to cover the basic needs of the employees of the building and of the needs of the inhabitants of the area. This block consists of shops like: copy shop, coffee shop, mini market, ticket station, change office and bank department. In the less usage part of that block is the doorman's room to cover the needs of the security assistants.

E.

FUNCTIONS

FIRST FLOOR.

First floor will be the serving (west block) and gathering (east block) part of the building.

Mechanical room: Mechanical rooms are provided in both (west- east) blocks so they can work as separate units. They are placed in the south part of the building where Arpad uti bridge is arriving in the same level so it is creating the disadvantage of less light and view. Taking under consideration that the first floor of the building in the south part has these disadvantages I placed there the mechanical rooms there. Additionally, the mechanical room in the west part of the building is located exactly in the top of the kitchen so the noise and the smells will not disturb the employees of the building.

Stores lockers and toilet blocks: Stores are provided to cover the needs of the mechanical rooms while lockers for the workers of the building who are working either in the kitchen nor in the mechanical rooms. In each block toile blocks are provided.

Management offices: Three offices are provided for the managers of the building.

Exhibition , conference and meeting room: Those facilities are needing in all the business centers for the convenience of the employees who will use them in special cases.

SECOND-THIRD FLOOR.

Individual offices are provided for businessmen/ women who are whiling to have their private office for their own jobs. Four luxurious offices per block, with kitchenettes, stores, waiting area and separate reception parts in different sizes so they can cover the different needs that anybody can have.

Separate toilet blocks are provided in each block for the common use.

FOURTH- FIFTH FLOOR.

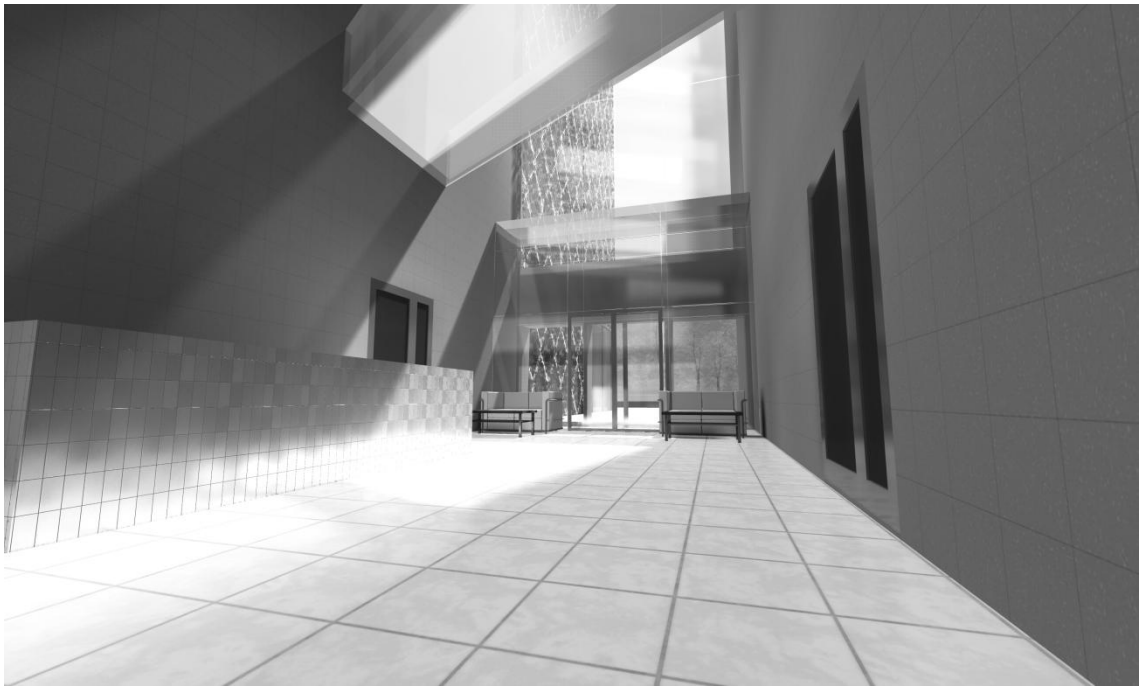
Two company offices per each block are provided to cover the needs of bigger or smaller companies. Full equipped with kitchenettes, stores, waiting area, separate reception parts, meeting rooms and office rooms. Separate toilet blocks are provided in each block for the common use.

FIFTH- SIXTH FLOOR.

Multifunction area is provided in the top part of each floor. There the employees can arrange parties and celebrations after hard job time. This area is perfectly arranged to support any kind of ceremony with high view to all the district.

F.

3D PRESENTATION



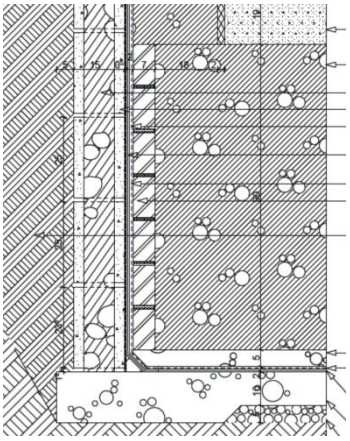
G.

TECHNICAL DESCRIPTION:

DISCRIPTION

Structure: I choose to use reinforce concrete structure for my building. Reinforce concrete structure system is a flexible loadbearing system and for that reason it is the most suitable system for my construction. Around the building, reinforce concrete walls will be applied. Furthermore, curtain wall systems will be placed in the external parts of my building as long as there are big openings and it is the most safe solution, while where the main entrance is there will be a curtain wall system to emphasize it. Because of the reinforce concrete walls are next to the curtain wall system there will be no worry about the fixing of it. A second skin façade will be applied in the building, from glass as a curtain wall system, for a unified appearance and for noise reduction. This structure will be supported by a steel truss system which will be fixed to the slabs of the building.

Foundation: slab foundation will be used and that's why slab technique is that it is cheap and sturdy, and is considered less vulnerable to termite infestation because there are no hollow spaces or wood channels leading from the ground to the structure.



Vertical loadbearing: columns and shear walls will be the vertical loadbearing of my structure. The spatial rigidity of the structure is ensured by the concrete shear walls which are used to counter the effects of lateral load acting on a structure. They will be placed around the stair cases in all of the floors of my building and it will have 15cm thickness.

Columns: 40cm by 40cm reinforced concrete columns will be placed in my structure for the main support of my building. in a grid of a 6/6 m in both directions. . It will be C30/37 concrete and B60.50 reinforcement.

Horizontal loadbearing: (slabs and beams) I choose to use a flat concrete with 25cm thickness. It will be a C30/37 concrete with B.60.50 reinforcement. There is no need for beams in the internal part of the building as long as I used a flat slab which will transmit its loads directly to the columns, but only an edge beam which will play a fire protection role as well. The edge beam will have 40cm height.

Truss: Trusses of S235 each six meters vertically and parallel to the external walls will be placed in order to support the glass secondary skin façade. The trusses are placed in order to transmit the loads of the secondary skin curtain wall façade.

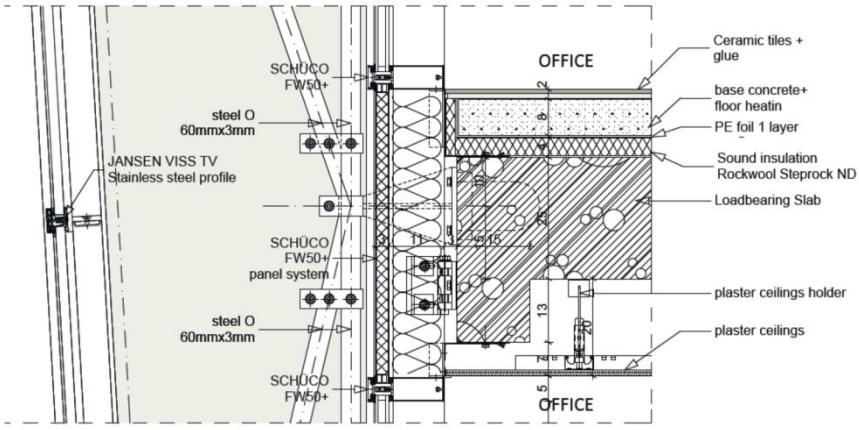
G.

DISCRIPTION

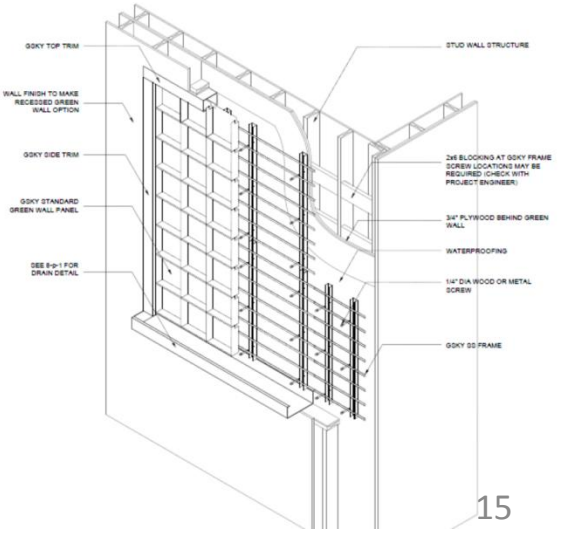
STRUCTURE ANALYSIS:

Truss: Trusses of S235 each six meters vertically and parallel to the external walls will be placed in order to support the glass secondary skin façade. The trusses are placed in order to transmit the loads of the secondary skin curtain wall façade.

Curtain wall: Curtain walls provide nicer and more elegant facades as long as they are making the building seem more spectacular. As I mentioned I used the curtain wall as an outer covering of a building and they don't have any loadbearing reason. As the curtain wall is a non-structural system I decided to make it of a lightweight material to reduce the construction costs. When glass is used as the curtain wall, a great advantage is that natural light can penetrate deeper within the building that was the most important fact that I consider to use the curtain wall. The curtain wall façade does not carry any dead load weight from the building other than its own dead load weight. The curtain wall transfers horizontal wind loads that are incident upon it to the main building structure through connections to the trusses and then to the slabs of the building where the trusses are fixed. Curtain wall is designed in that way to resist air and water infiltration.



Green wall: in the building there are applied green walls in some external parts of the building. The main reason of designing them ,was to attach the building to its environment as long as there is a green area next to it. It is a stud wall structure.



G.
DISCRIPTION

STRUCTURE ANALYSIS:

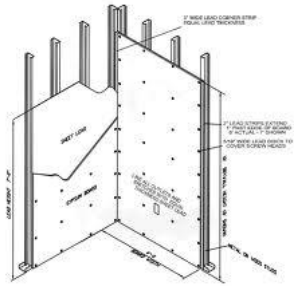
Thermal insulation: As long as the design is a sustainable building thermal insulation which is used in the structure plays one of the most important roles. In the underground parts of the building allong the Reinforce concrete walls, it has been used Styrofoam perimate thermal insulation When installed on the exterior of foundation walls, the moisture-resistant extruded polystyrene foam insulation provides thermal insulation, protects the waterproofing membrane and assists drainage of the subsurface soil moisture in a single step. Perimate insulation is suitable for use in pervious, semi-pervious and practically impervious soils. For best results, seal joints with tapes or joint closures from Dow. Rockwool. In other parts of the building such as is slabs etc. .has been used different types of insulation such as Extruded and expanded Ps foam insulation.

Waterproofing: Bitumenous sheet type water prrofing must be applied to a smooth finish without voids, honeycombs, or protrusions. Protection board installation is also required as the membrane can puncture and tear during backfilling. Installation can be challenging as membranes require sealing, lapping, and finishing of seams at the corners, edges, and between sheets.

G.
DISCRIPTION

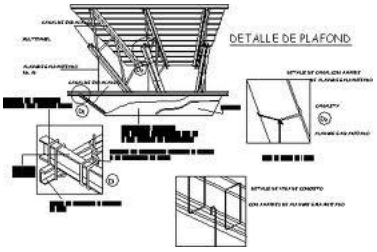
STRUCTURE ANALYSIS:

Partition walls: Partition walls by gypsum boards are applied in the plans in order to separate the functions of the rooms and offer sound protection. Cables and tubes can be hidden inside of them. Partiton walls with 21 or 12 cm thickness against 30 db sound insulation will be installed. The profiles will be fixed on the ceiling and on the floor.



Floor Coverings: In the office areas parquet floor covering will be applied as long as it is the most elegant and friendly solution. In the general use areas such as staircases, toilets, corridors etc.ceramic tiles will be placed (40/40cm). On the ground floor in the public zone where are restaurants, shops, bank etc ceramic tiles will be placed (50/50cm). In the underground floor resin floor covering will be applied as long as rainwater channels in order to absorb the water that the cars will bring inside.

Suspended ceiling: In the office parts while in all the public and semi public areas suspended ceilings will be used in order to hide there the cables from the lighting and the ducts.



H.

BUILDING CONSTRUCTION

CONSTRUCTION LAYERS:

1.a Basement Floor Layers 1:

Resin layer	0,5 cm
Subconcrete	10-18 cm
R.c Slab foundation (watertight concrete)	90 cm
mechanic of concrete	5 cm
PE foil	1 layer
Two thick layers of modified bitumen sheet water pressure	2 layer
Bitumen layer lubricated	
Concrete slab	10-15 cm
Gravel	5 cm
Compacted soil	

1.b Basement Floor Layers 2:

R.c Slab foundation (watertight concrete)	40 cm
mechanic of concrete	5 cm
PE foil	1 layer
Two thick layers of modified bitumen sheet water pressure	2 layer
Bitumen layer lubricated	
Concrete slab	10-15 cm
Gravel	15-20 cm
Compacted soil	

2. Basement Floor Layers 3:

Resin layer	0,5 cm
Subconcrete	10-18 cm
R.c Slab foundation (watertight concrete)	25 cm
Plastering	0,5 cm

3.a Ground Floor Layers 1 - kitchen:

Ceramic Tiles + Mortar	1,5+0,5 cm
Painted water proofing	1 layer
Base concrete (floor heating)	8 cm
PE foil	1 layer
Sound insulation Rockwool Steprock ND	4 cm
Loadbearing Slab 25 cm	
Thermal insulation Rochwool Fixrock	10 cm
Plastering	1 cm

3.b Ground Floor Layers 2 - general:

Ceramic Tiles + Mortar	1,5+0,5 cm
Base concrete (floor heating)	8 cm
PE foil	1 layer
Sound insulation Rockwool Steprock ND	4 cm
Loadbearing Slab 25 cm	
Thermal isulation Rochwool Fixrock10 cm	
Plastering	1 cm

3.d Ground Floor Layers 4 - stairs:

Ceramic Tiles + Mortar	1,5+0,5 cm
Loadbearing Staircase Slab	15 cm
Plastering	1 cm

3.e Ground Floor Layers 5 - sidewalk:

Stone flooring	4 cm
Crushed stone	5 cm
Geotext layer	1 layer
Gravel	10 cm
Geotext layer	1 layer
Back filled with compacted soil	

H.

BUILDING CONSTRUCTION

4.a Intermadiate floor Layers 1:

Ceramic Tiles + Mortar		1,5+0,5 cm
Base concrete (floor heating)		8 cm
PE foil		1 layer
Sound insulation Rockwool Steprock ND		4 cm
Loadbearing Slab	25 cm	
Suspended ceiling	25-40 cm	

4.b Intermadiate Floor Layers 2 - shower:

Ceramic Tiles + Mortar		1,5+0,5 cm
Painted water proofing		1 layer
Base concrete (floor heating)		8 cm
PE foil		1 layer
Sound insulation Rockwool Steprock ND		4 cm
Loadbearing Slab	25 cm	
Suspended ceiling	25-40 cm	

4.c Glass Bridge Layers:

Laminated safety glass	3x1,2 cm
rubber sealing	
glass beam (3 layer laminated safety glass)	10 cm
rubber sealing	
glass beam (4 layer laminated safety glass)	25 cm

H.

BUILDING CONSTRUCTION

W1. Basement Wall 1 – car elevator shaft:

Compacted soil	
Geotext layer	1 layer
Gravel	1 cm
Cinder block and concrete	15 cm
Mortar	0,5 cm
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
PE foil	1 layer
Small brick wall	6,5 cm
Concrete wall	40 cm

W2. Basement Wall 2 – garage -2:

Back filled with compacted soil	
Cinder block and concrete	15 cm
Mortar	0,5 cm
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
PE foil	1 layer
Small brick wall	6,5 cm
Concrete wall	25 cm
Mortar	0,5 cm

W3. Basement Wall 2 – garage -1:

Back filled with compacted soil	
Geotext layer	1 layer
Gravel	5 cm
Geotext layer	1 layer
Drain	2 cm
Styrofoam Perimate	10 cm
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
Mortar	0,5 cm
Concrete wall	25 cm
Thermal isulation Rochwool Fixrock	10 cm
Mortar	0,5 cm

W4. External Wall 2 - general:

SCHÜCO FW50+ panel system	3 cm
Thermal insulation	14 cm
Concrete beam	15 cm

W5. Internal Wall 1 - plasterboard partition wall 1:

KNAUF Plasterboard sheets	2x1,25 cm
PURE 39 PN SILENTIO sound insulation	
sheet in KNAUF CW profile	5, 7, 12 cm
self-adhesive sealing strip	0,5 cm
PURE 39 PN SILENTIO sound insulation	
sheet in KNAUF CW profile	5, 7, 12 cm
KNAUF Plasterboard sheets	2x1,25 cm

W6. Internal Wall 2 - plasterboard partition wall 2:

KNAUF Plasterboard sheets	2x1,25 cm
PURE 39 PN SILENTIO	
sound insulation sheet in CW profile	5, 7, 12 cm
KNAUF Plasterboard sheets	2x1,25 cm

W7. Internal Wall 3 :

Plastering	0,5 cm
Concrete shear wall	30 cm
Stainless steel CW profile	7 cm
internal wooden wall covering	3 cm

W8. External Wall 3 - glass curtain wall 1:

Insulating glass – 2 layer	3 cm
SCHÜCO FW50+ curtain wall system	11 cm

W9. External Wall 4 - glass curtain wall 2:

Insulating glass – 1 layer	1,2 cm
JANSEN VISS TV Stainless steel profile	
Stainless steel "I" profile	8 cm

W10. External Wall 5 – parapet wall 1:

Painted plasterboard sheets	1,25 cm
Concrete wall	25 cm
Mortar	0,5 cm
bitumen layer lubricated	
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
Thermal insulation Austrotherm XPS 30	10 cm
Gravel	

W11. External Wall 6 – parapet wall 2:

internal wooden wall covering	3 cm
CW profile	3 cm
Concrete wall	25 cm
Mortar	0,5 cm
bitumen layer lubricated	
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
Thermal insulation Austrotherm XPS 30	10 cm
Gravel	

W12. External Wall 7 - glass curtain wall 3:

Insulating glass – 2 layer	3 cm
SCHÜCO FW50+ curtain wall system	11 cm
"I" profile	20 cm

W13. External Wall 8 – green facade:

GSKY standard	
GSKY standard green wall panel +	
Special soil mixture	10 cm
Stainless steel profile	8 cm
Thermal insulation Austrotherm XPS 30	15 cm
Waterproofing - Two thick layers	
of modified bitumen sheet	2 layer
Mortar	0,5 cm
Concrete wall	25 cm
Plaster	0,5 cm

R1. Roof - glass curtain wall system 1:

Insulating glass – 1 layer	1,2 cm
JANSEN VISS TV Stainless steel profile	
Stainless steel "I" profile	8 cm

R2. Roof - glass curtain wall system 2:

Insulating glass – 2 layer	3 cm
SCHÜCO FW50+ curtain wall system	11 cm

R3. Roof - glass curtain wall system 3:

Insulating glass – 2 layer	3 cm
SCHÜCO FW50+ curtain wall system	11 cm
"I" profile	20 cm

R4. Roof :

Gravel	10-15 cm
Geotext layer	1 layer
Waterproofing - Two thick layers of modified bitumen sheet	2 layer
Thermal insulation Austrotherm AT-N100 expanded ps foam (2%)	15+5-10 cm
vapor barrier layer	1 layer
Loadbearing slab	25 cm
Suspended ceiling	25-40 cm

R5. Roof:

Granit flooring (1%)	5 cm
Crushed stone	3 cm
Geotext layer	1 layer
Gravel	10-15 cm
Geotext layer	1 layer
Waterproofing - Two thick layers of modified bitumen sheet	2 layer
Thermal insulation Austrotherm AT-N100 expanded PS foam (2%)	15+5-10 cm
vapor barrier layer	1 layer
Loadbearing slab	25 cm
Suspended ceiling	25-40 cm

I.

CONSTRUCTION MANAGMENT

INVESTMENT:

The financial aspect of the building should be carefully and well checked. The investor is well informed for the rules and the regulations of Hungary and the time schedule is a very important fact to him.

FINANCIAL CONSIDERATION:

I am designing a public building with offices, restaurant, conference room and public areas, while urban arrangement is needed, so a large sum of income is needed.

PRE-TENDER PLANNING:

Cost estimation: area of total project:7100m^2

construction price per each meter square:250,00Ft/m^2

total cost: 7100m^2x250,00Ft=1,775,000,000 Ft

Item	Proportion of work(%)	Estimated cost(Ft)	Product value	Number of workers	Duration (month)
Sub structure	10%	177,500,000Ft	800 000Ft	70	3 months
Super structure	30%	532500000 Ft	800 000Ft	65	5 months
Installation	30%	532500000 Ft	800 000Ft	65	5 months
Finishing	30%	532500000 Ft	800 000Ft	65	5 months
Total	100%	1097500000			18 months

The construction will start on June 2012 and finish on December 2013

I.

CONSTRUCTION MANAGMENT

INVESTMENT:

The financial aspect of the building should be carefully and well checked. The investor is well informed for the rules and the regulations of Hungary and the time schedule is a very important fact to him.

FINANCIAL CONSIDERATION:

I am designing a business center with offices, shops, gathering and public areas , while urban arrangement is needed, so a large sum of income is needed.

SITE VISIT REPORT:

Location: my hotel is located in the 15th district next to Fo utca.

- My site is big enough so I don't need further permission for extra space during the construction.

- Temporary road has to be constructed for the public use after checking the access to the site.

- There is no other similar type of work that will start the same time.

- Local employed office insure the local availability.

- Services (water, gas, telephone, electricity, etc.) already available at the site and the connection points too.

- Metal fences will be placed along the plot for security reasons and a check box to check what material are coming and going.

- The required materials can be stored in temporary open and close stores that will be provided during the construction time.

- It is mainly a residential area. Next to my plot there is the railway which is leading to Nuygati train station, a high way bridge and on the eastern part of the plot there is a green area. There is no hospital or any other kind of commercial building which can cause limitation in the working hours.

I.

CONSTRUCTION MANAGMENT

PLANNING AND SCHEDULING:

Before starting:

1.Planning an estimate of the time required for each portion of the project as well as for the total project.

2.Establishes the planned rate of progress.

3.Forms the basis for managers to issue instructions to subordinates.

4.Establishes the planned sequence for the use of personal, materials, machines and money.

DURING CONSTRUCTION WORK:

1.Enables the manager to prepare checklist of key dates, activities, resources etc.

2.Provides a means for evaluating the effect of changes and delays.

3.Serves as the basis for evaluating progress.

AFTER COMPLETING THE CONSTRUCTION:

1.Permits a review and analysis of the project as actually carried out.

2.Provides historical data for improving future planning and estimating.

SCHEDULE PRINCIPELS:

1.Establish a logical sequence of operations

2.Do not exceed the capabilities of the resources that are available.

3.Provide for continuity of operations.

4.Start project controlling activities early.

I.

CONSTRUCTION MANAGMENT

SITE ORGANIZATION:

1.Ensure the possibility of construction process.

2.Ensure at least three areas around plot of construction process. Otherwise we should take permission to use free public/private area.

3.Try to make the construction as cheap as possible.

4.Traffic conditions.

CRANE INFORMATION:

In my case I will use a tower crane. This is because:

1. There is not enough area around the plot.

2. I have prefabricated elements as well to be lifted.

3. Heavy loads to be lifted.

4. Need to higher than the highest level of the building.

5. I need to lift stuff in long distances.

ASSEMBLING CRANE:

1. Crane will be assembled before foundation work starts.

2. Position of staircase.

3. Leave gap in the slab then bend back reinf. and finish slab.

DISASSEMBLING CRANE:

1. Workers on the top unstrengthen it and help in the connection with mobile crane.

2. Decompose the vertical structure.

3. Mobile crane is needed to assemble and disassemble the tower crane.

I.

CONSTRUCTION MANAGMENT

STORAGES:

Shed-close containers. Room with thermal insulation for materials that are affected by rainwater.

CONCRETING:

(truck): The purring should be close to the foundation hok or pumped with flexible pipe for slab.

EXCAVATION:

1)Sheet piling will be used as long as we have to excavate in a deep surface of -7,00m.

2)We should cut the top soil with the help of 3 "bobcat" machines till -60cm. Topsoil will be humped on site till the landscaping phase because it is a useful organic soil that we will need later.

3)With multipurpose excavator we will excavate until the depth of -3,20m. As long as a big amount of soil will be needed for refilling , part of the excavating soil shouldn't be transferred from the site.

4)Temporary ramp will be placed to reach the -7,00m where the multipurpose excavator will excavate to reach the second underground floor.

5)Excavation of the slab should take place from -7,00m up to -6,10m to reach a flat level.

6)Ecavating the lower part under the crane foundation until the depth of -8,00 m.

Crane must be assembled exactly after excavation.

I.

CONSTRUCTION MANAGMENT

FOUNDATION WORK:

I will use a slab foundation with 0,90 m more depth under the columns. The foundation level under the elevator will be lower to reach the -8,00.

Reinforcement will be prepared in the site while concrete will arrive from the factory out of the site. Tower crane has been assembled before foundation work starts.

1)In order to concrete can be cured an strengthened in time, crane's casting foundation will be done in an early stage.

2)Reinforcment should be emplaned under the columns.

3)Puring concrete, flattening and vibrating.

4)It should be water curing of the concrete.

5)Preparation of the basement's external walls and laying DPC on the top of the foundation.

LOADBERING STRUCTURE:

1)We should fill back the excavated soil and then to cast the RC external walling. We will attach damp insulation while water is curing.

2)As long as the underground space is still warm we should place thermal insulation around the building which will protect the damp insulation from the chemicals and dirtiness of the soil.

3)The crane will be into the elevator shaft in the inner area of the building.

The building is consisting of (externally):

-concrete walls and curtain walls

While the roof slab is water cured and dried we should place the DPC and the finishes

The load structure has concrete columns and slabs.

By the crane , the reinforcement of the columns will be removed in one piece of every column.

EXTERNAL FINISHES:

Green Wall:

There is also a green wall construction. The proper layers will be set for the construction of this roof.

External Walls:

The external wall are RC walls. In some internal parts of the building I used Granite. The fixation of the panels are hidden so they can not be seen.

I.

CONSTRUCTION MANAGMENT

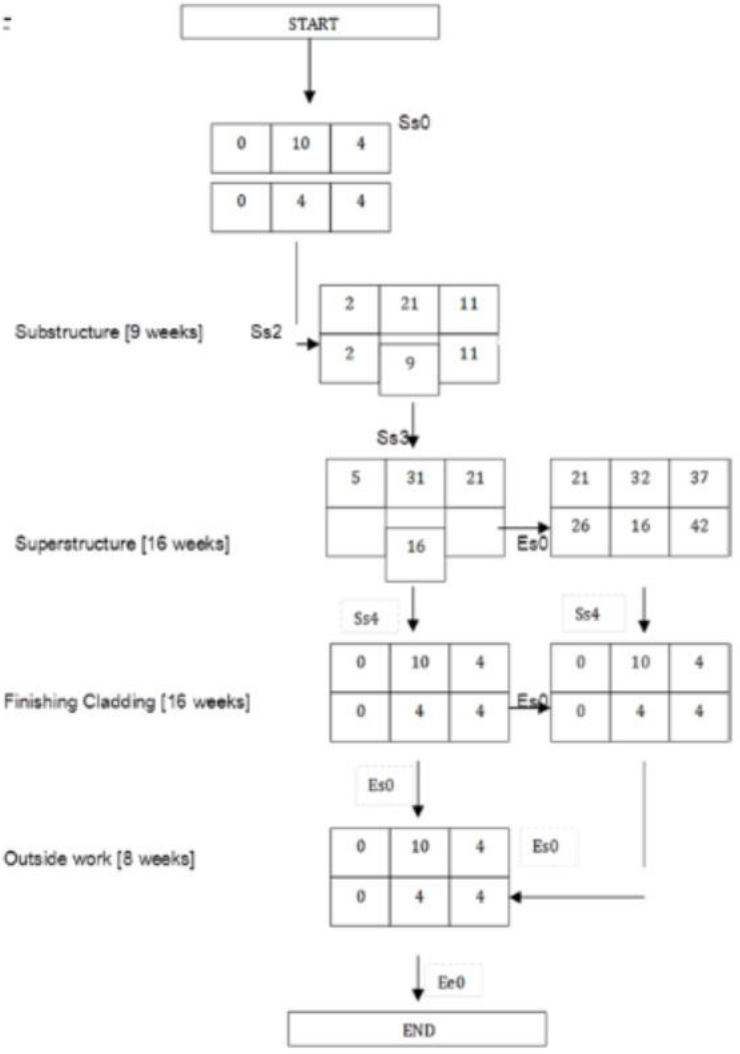
LIST OF OPERATION:

1. Setting up, mark out, fencing, temporary road.
2. Marking out.
3. Top soil removal.
4. Construction of temporary road.
5. Pluming.
6. Electrical installation.
7. Gas.
8. Assembly of tower crane.
9. Piles Drilling progress for foundation.
10. Gravel filling.
11. Bedding (screed).
12. DPC.
13. Concrete protection.
14. Piles concrete casting.
15. External/structure walls/columns.
16. Beam/Slab – formwork.
17. Beam/Slab casting.
18. DPC (contour of building).
19. External/Structural walls.
20. Roofing, inclination screed.
21. Water proofing membrane.
22. Roofing insulation.
23. Roofing water drainage layer.
24. Roofing protection layer.

LIST OF OPERATION:

25. Gravel covering.
26. Partition wall.
27. Disassembling tower crane.
28. Stair installation.
29. Screening floors.
30. Glazing, door, windows.
31. Scaffolding.
32. External thermal insulation.
33. External covering . Fixation.
34. Suspended ceiling insulation.
35. Locksmith, carpentry.
36. Joinery work.
37. Internal painting. Plastering, finishing.
38. Plaster ceiling.
39. Flooring (tile covering and parquet covering).
40. Tiling (WC, bathroom and kitchen).
41. Stair covering.
42. Road.
43. Wash down.
44. Landscaping.
45. Cleaning and handing over

METRA POTENTIAL NETWORK:



1. DESIGNING THE TOPMOST SLAB

1.a) Dead load of the topmost slab (in the ground floor)

Materials: concrete: C30/37 reinforcemenet: B60.50

fck=30 N/mm2 – γc=1,5 – αcc=0,85 – fcd= αcc•fck/γc=0,85•30/1,5=17 N/mm2

fyk=500 N/mm2 - γs=1,15 – fyd=fyk/γs=500/1,15=434,8 N/mm2 – ξco=0,49 - ξcov=2,11

Floor layers:

	specific weight [kN/m^3]	thickness [m]	load [kN/m^2]
ceramic tiles+mortar	25	0,02	0,5
base concrete (floor heating)	24	0,08	1,92
PE foil 1 layer			
sound isolation	0,1	0,04	0,004
loadbearing slab	25	0,25	6,25
mineral wool	0,1	0,1	0,01
plastering	15	0,01	0,15
		g_k=	8,8

dead load: gk1=8,8 kN/m2

mechanical load: gk2=1,0 kN/m2

total dead load: gk= gk1+gk2=8,8+1=9,8 kN/m2

1.b) Live load of the topmost slab.

sk=3 kN/m2

1.c) Checking two-way slab for deflection

l=6 m K=1.2

h=0,25 m β=1,0

b=1 m

assuming Ø10 bars Øbars=10 mm - cnom=20 mm – t=0,25 m

d=t-cnom-0,5•Øbars=0,25-0,02-0,5•0,01=0,225 m

(l/K)/d=(6/1,2)/0,225=22,2

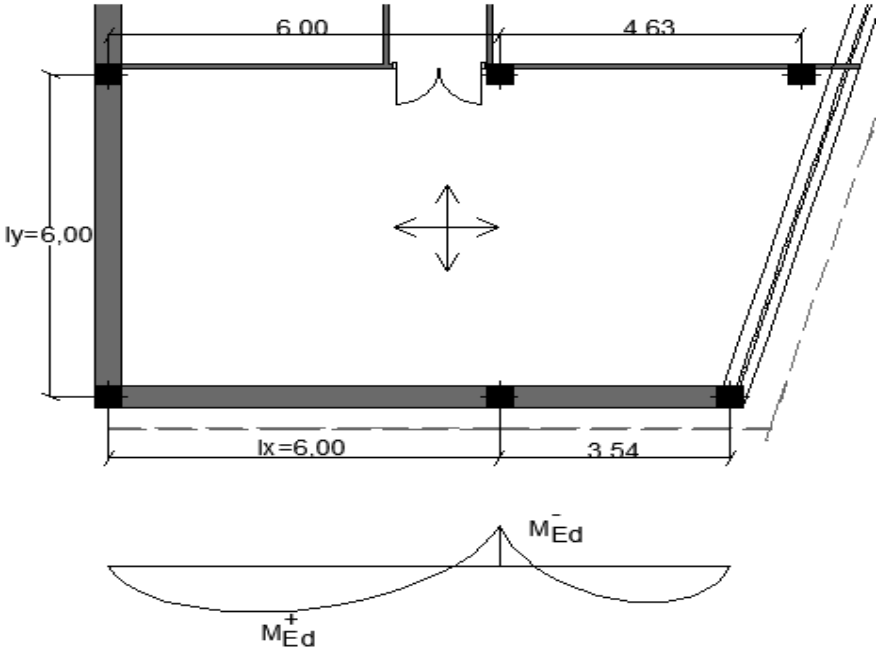
gd=gk•1,35=13,23 kN/m qd=sk•1,5=4,5 kN/m

PEd=b•(gd+qd)=1•(13,23+4,5)=17,73 kN/m

β•PEd/b=1•17,73/1=17,73 kN/m2

(l/d)allow=26 (l/K)/d=22,2< (l/d)allow=26 **OK**

1.d) Designing a two-way slab

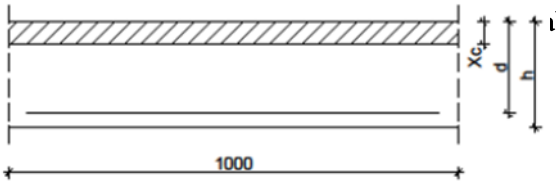


lx=6,0 m ly=6,0 m lx/ly=1,0 lx/ly=1<2 – **This is a two-way slab.**

Pd=1,35•gt+1,5•sk=1,35•9,8+1,5•3=17,73 kN/m2

M.Ed+=0,55•(pd•ly•lx2/23,2)/0,5•ly=0,55•(17,73•6•62/23,2)/0,5•6=30,3 kNm

M.Ed-=0,75•(pd•ly•lx2/11,6)/0,5•ly=0,75•(17,73•6•62/11,6)/0,5•6=82,5 kNm



ıb for MEd+

assuming Ø10 bars – Øbars=10 mm - cnom=20 mm – t=0,25 m

d=t-cnom-0,5•Øbars=0,25-0,02-0,5•0,01=0,225 m

height of the concrete in tension zone:

xc=d-√(d ^2 -(2• M Ed+)/(b• fcd)) = 22,5-√(⟦22,5⟧^2 –(2•3030) /(100•1,7)) = 0,806 cm

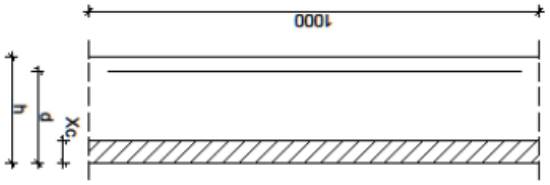
z=d-0,5•xc=22,5-0,5•0,806=22,1 cm

ξc=xc/d=0,806/22,5=0,04

ξc=0,04<ξco=0,49 **The reinforcement is in yielded condition.**

Needed reinforcement: As= M.Ed+/ fyd•z=3030/1,7•22,1=3,15 cm2 – Ø10/150 (5,24 cm2) (max. spacing of bars: 200 mm OK)

1.f) Determining cross-section of two-way slab for MEd-



assuming Ø10 bars – Øbars=10 mm - cnom=20 mm – t=0,25 m

d=t-cnom-0,5•Øbars=0,25-0,02-0,5•0,01=0,225 m

height of the concrete in tension zone:

xc=d-√(d ^2 -(2• M Ed+)/(b• fcd)) = 22,5-√([[22,5]]^2 –(2•8250) /(100•1,7)) = 2,273 cm

z=d-0,5•xc=22,5-0,5•2,273=21,364 cm

ξc=xc/d=2,273/22,5=0,1

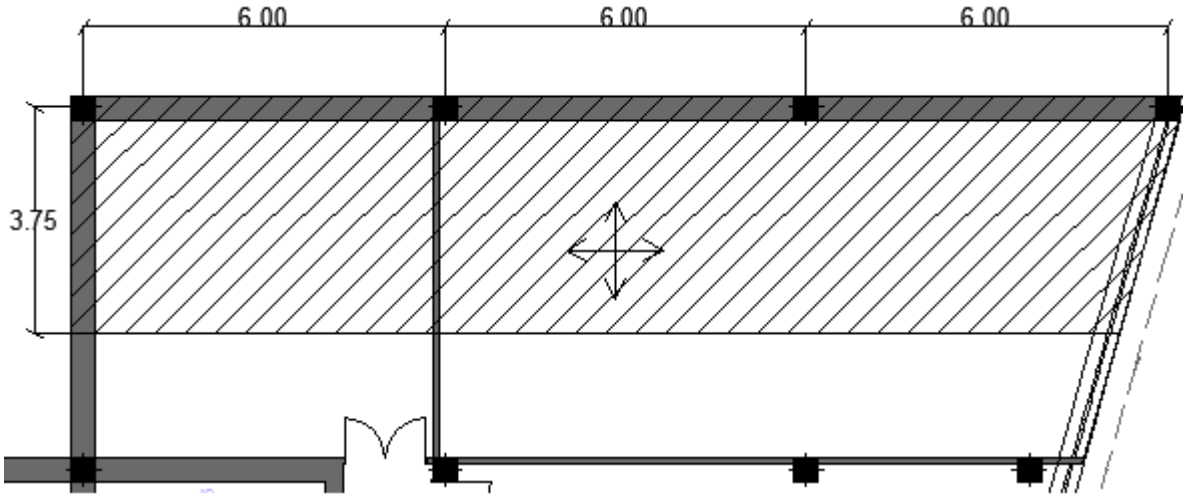
ξc=0,1<ξco=0,49 – The reinforcement is in yielded condition.

Needed reinforcement: As= M.Ed-/ fyd•z=8250/1,7•22,1=8,89 cm2 – Ø10/75 (10,48 cm2)

(max. spacing of bars: 200 mm) **OK**

2. DESIGNING T-FLANGE EDGE BEAM:

2.a) Determining loads of T-flange beam



(estimating height of beam: h=l/15=6000/15=400 mm) t=25 cm – l=6 m

self weight of beam: gsw=b•(h-t)•25 kN/m3=400•(400-250)•10-6•25= 1,5 kN/m

gd=gk•1,35=13,23 kN/m

qd=sk•1,5=4,5 kN/m

PEd=(gd+qd)•l+gsw•1,35= (13,23+4,5)•3,75+1,5•1,35=68,5 kN/m

2.b) Checking beam for deflection

leff=l+2•0,4/2=5,4+2•0,2=6,0m – K=1,3 – d=h-cnom-0,5•Øbars=0,40-0,02-0,5•0,01=0,365 m

(leff/K)/d=(6,0/1,3)/0,365=12,6

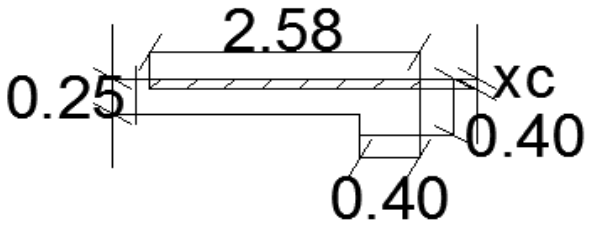
β=1,0 – beff1=min(0,5•6;0,2•0,85•6,0;0,1•6+0,1•0,85•6,0;6•0,2)=1,09 m

beff=2•beff1+b=2•1,09+40=2,58 m

β•PEd.b/beff=1•68,5/2,58=28,1 kN/m2

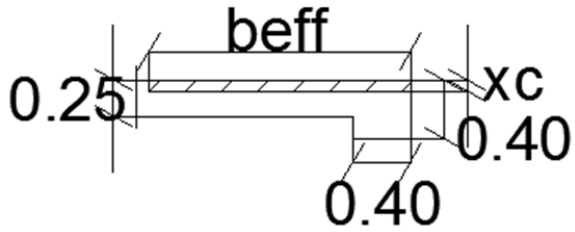
ldallow=22

(leff•K)/d=12,6< ldallow=22 **OK**



2.c) Designing T-flange cross-section for MEd+

MEd=PEd.b•leff2/8=68,5•6,02/8=308,3 kNm



height of the concrete in tension zone:

xc=d-√(d ^2 -(2• M Ed+)/(b• fcd)) = 36,5-√(⟦36,5 ⟧^2 –(2•30830) /(258•1,7)) = 2,097 cm

z=d-0,5•xc=36,5-0,5•2,097=35,5 cm

ξc=xc/d=2,097/36,5=0,06

ξc=0,06<ξco=0,49 – The reinforcement is in yielded condition.

Needed reinforcement: As= MEd+/ fyd•z=30830/1,7•35,5=20,0 cm2 **6Ø25 (29,5 cm2)**

2.d) Designing T-flange cross-section for MEd-

height of the concrete in tension zone:

xc=d-√(d ^2 -(2• M Ed+)/(b• fcd)) = 36,5-√(⟦36,5 ⟧^2 –(2•30830) /(40•1,7)) = 15,873 cm

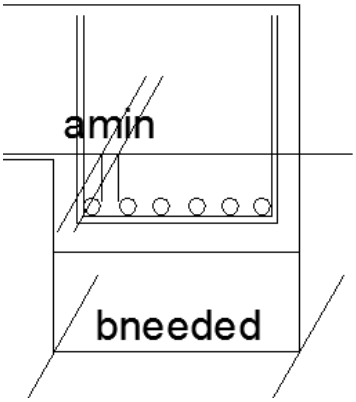
z=d-0,5•xc=36,5-0,5•15,873=28,6 cm

ξc=xc/d=15,873/36,5=0,43

ξc=0,43<ξco=0,49 – The reinforcement is in yielded condition.

Needed reinforcement: As= MEd+/ fyd•z=30830/1,7•28,6=24,8 cm2 **6Ø25 (29,5 cm2)**

Checking construction rules:

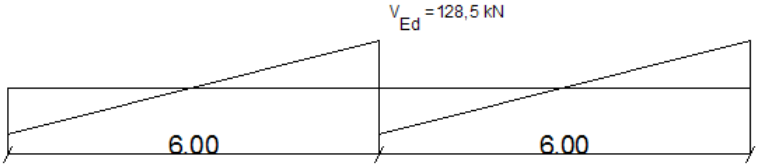


Øbar=25 mm – Ølink=12 mm – amin=35 mm – cnom=20 mm

bneeded=2•cnom+2• Ølink+6• Øbar+5 amin = 2•20+2•12+6•25+5•35=389 mm

bneeded=389 mm < b=400 mm **OK**

2.e) Designing shear reinforcement of beam



VEd=0,625•pEd•leff/2=0,625•68,5•6,0/2=128,5 kN

VRd,max=0,5•b•z•fcd=0,5•0,40•0,286•1,7=1149,8 kN

VEd=128,5 kN < VRd,max=1149,8 kN OK

Asw=2•Ølink2 π/4=2•1,2•π/4=2,26 cm2

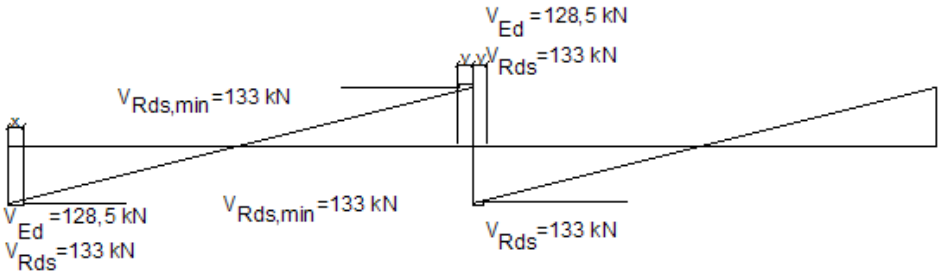
ss=z•Asw•fyd/VEd=286•101•435/128,5=98 mm – ss=75 mm

VRds=z/ss•Asw•fyd=28,6/75•1,01•43,5=168 kN

minimum shear reinforcement:

smax= 0,75•d=0,75•365=274 mm ⟶smax=250 mm

VRds.min=z/ss•Asw•fyd=28,6/250•1,01•1,7=133 kN



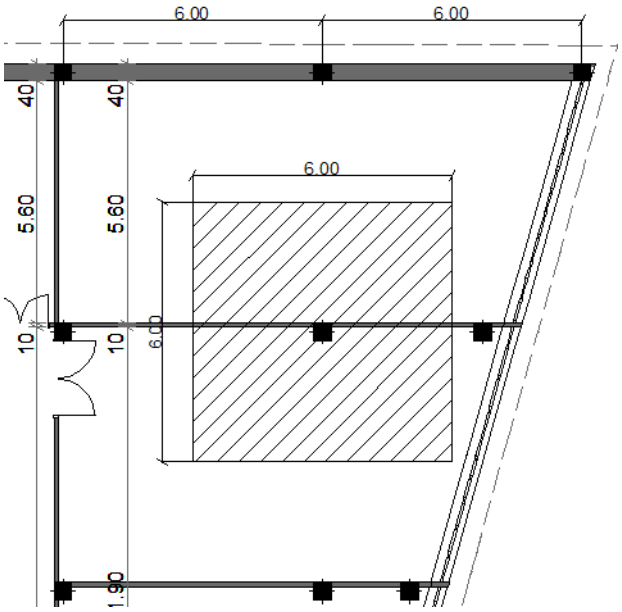
VEd-pEd•x= VRds.min

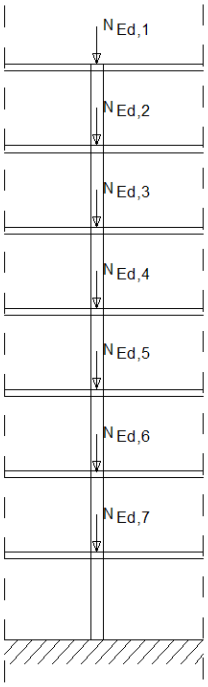
128,5-68,5•x=50 ⟶x=1,14 ⟶x=1,15 m

VRds-pEd•y= VRds.min

168-68,5•y=50 ⟶y=1,72 ⟶y=1,75 m

3. DESIGN AXIALLY LOADED COLUMN:





The column has a height of 7 floors.

NEd,1=lx•ly•(1,35•gk+1,5•sk)=6•6•(1,35•9,8+1,5•3)=638,8 kN

NEd,basem=7•NEd,1=7•638,8=4468 kN

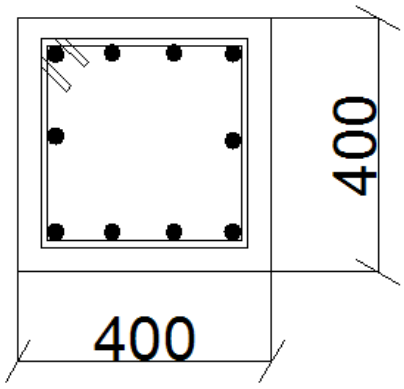
NEd,groundf=6•NEd,1=6•638,8=3829,7 kN

For basement:

l0.basem=0,5•3,18=1,59 m – d=25 cm - l0.basem/d=1,59/0,25=6,36 –ϕbasem=0,87

NRd.basem= ϕbasem•NU

NU=fcd•Ac+As.basem•fyd



bc=40 cm – Ac=bc2=0,42=0,16 m2

As.basem= (NEd.basem- ϕbasem·Ac·fcd)/ ϕbasem·fyd=(4468-0,87·1600·1,7)/0,87·43,48=55,56 cm2

As.min=max(0,1• NEd,total/fyd;0,0002•Ac)=10,28 cm2

As.basem=61,58 cm2 (12Ø25)

NU=fcd•Ac+As.basem•fyd=1,7•40•40+61,58•43,48=5397,4 kN

NRd.basem= ϕbasem•NU=0,87•5397,4=4695,7 kN > NEd,basem=4468 kN OK

For ground floor:

l0.groundf=0,5•4,60=2,30 m d=25 cm l0.basem/d=2,30/0,25=9,2 ϕbasem=0,85

NRd.groundf= ϕgroundf•NU

NU=fcd•Ac+As.groundf•fyd

As.groundf= (NEd.groundf- ϕgroundf·Ac·fcd)/ ϕgroundf·fyd=(3829,7-0,85·1600·1,7)/0,87·43,48=41,07 cm2

As.min=max(0,1• NEd,total/fyd;0,0002•Ac)=10,28 cm2

As.groundf=61,58 cm2 (12Ø25) – the same reinforcement can be applied on the groundfloor as well

NU=fcd•Ac+As.groundf•fyd=1,7•40•40+61,58•43,48=5397,4 kN

NRd.groundf= ϕgroundf•NU=0,85•5397,4=4587,8 kN > NEd,groundf=3829,7 kN OK

4. DESIGN STEEL TRUSS

structural steel: S235

fy=23,5 kN/cm2 γM0=1,0 γw=1,5

wind load of truss:

cdir=0,85 cseason=1,0 vb0=23,6 m/s vb=c.dir•cseason•vb0=0,85•1•23,6=20,06 m/s

hbuild=21 m cpe=0,76 kN/m2

area wind load: qp.w=cdir2•cpe=0,852•0,76=0,549 kN/m2

wind load: qw= γw•qp.w=1,5•0,549=0,824 kN/m2

self weight of glass: gk,1=1,35·0,4=0,54 kN/m2

self weight of truss (O60x3): gk,2=1,35·0,05=0,07 kN/m2

total load of truss: gk=gk,1+gk,2=0,54+0,07=0,61 kN/m2 and qw=0,834 kN/m2

distance of trusses: l=6 m

total load of one truss: qt=l·(gk+qw)=6·(0,61+0,834)=8,6 kN/m

total load force= 4·3,3·8,6=113,52 kN

reactions: A=B=0,5·113,52=56,76 kN

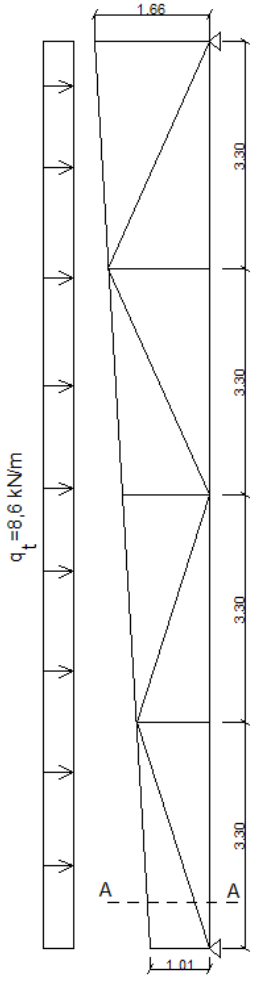
A-A section:

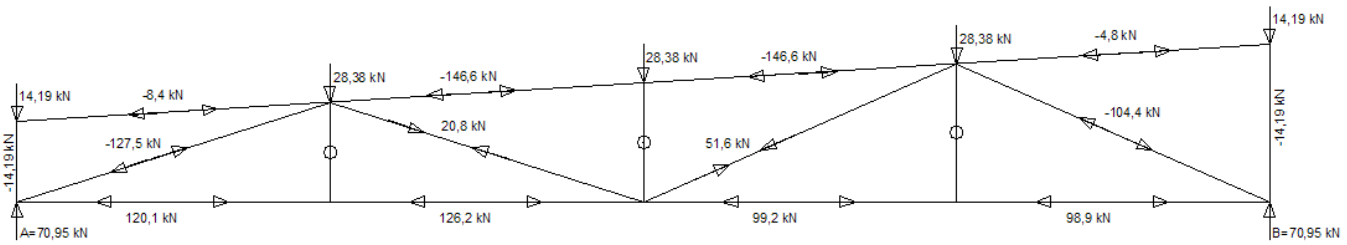
∑Fi,x=0=S2-S1x

∑Fi,y=0=14,19-56,76+S1y⟶ S1y=42,57 kN

tgα=1,17/3,3 ⟶α=19,5°⟶S1x=S1y/tgα=42,57/0,35=120,1 kN

S1=S1y/sin α=42,57/sin19,5=127,5 kN




14,19 kN
-8,4 kN
28,38 kN
-146,6 kN
28,38 kN
-146,6 kN
28,38 kN
-4,8 kN
14,19 kN
-14,19kN
-127,5 kN
20,8 kN
51,6 kN
-104,4 kN
-14,19 kN
120,1 kN
126,2 kN
99,2 kN
98,9 kN
A=70,95 kN
B=70,95 kN

A) WATER SUPPLY

Water will be supplied by the public utility, connected from Koztelek Street.

WATER CONSUMPTION:

Water consumption for toilets:	20 litres/guests
350 persons per day	7000 litres
Total amount of water for toilets	7000 litres/day
Water consumption for main kitchen:	25 litres/portion
300 porsion for one day	7500 litres
Total amount of water for main kitchen	7500 litres/day
Water consumption for office kitchen :	50 litres/day
26 office kitchens on the building	1300 litres
Total amount of water for office kitchens	1300 litres/day
Total:	15800 litres /day

Total water required per day: 15,8 m^3 / day

Total Hot water required per day:

V_{hw}=0.4*15,8= 6,32 m3 6,32 m3 / day

K.

BUILDING SERVICE

DOMESTIC HOT WATER (DHW):

5,36 m3 / day hot water

The hot water supply in the building will be provided by Worcester gas boilers.According to the calculation , five cascade wall mounted condensing boilers are required for the building . The size of the unit will be 2,7x1,7x0,5 meter.

The hot water pipes must be insulated.The water system in the building is created with flexible polyethylene pipes. 3 cm thick thermal insulation will be folded around both the hot and cold water pipes. They can be led in the walls and in the suspended ceiling as well.

Required Volume of hot water storage:

V= 34,7x7,5x6,32

V= 1645 liter water tank needed.

Required heat power demand for DHW:

Qm= 0,05 x Z x V x (tm-ti)

Qm= 0,05x7,5x6,32x50

Qm= 118,5 KW

Electric power demand of DHW:

P=0,26 x A/1000 + 3,6 x Qm/1000

P=0,26 x 5655 /1000 + 3,6 x 118,5/1000

P=1,9 KW

K.

BUILDING SERVICE

SEWAGE SYSTEM AND RAINWATER:

A gravitational system will be used to lead refuse water out of the building.

The appliances and floor gullies are built in with seals.

The sewage system is assembled with PVC pipes and fixtures.

The refuse water is connected to the public sewage network through the main pipe that goes under the ground floor.

The diameter of sewage pipes led through the shafts is: Na 150

The diameter of sewage piped led in the floors is: Na 50

The diameter of sewage pipes led from the WC blocks: Na 100

The diameter of the rainwater pipes is: Na 150

Ventilation pipes must be built in for the sewage pipes and these must be led up to the roof, 0,50 m above the flat roof level.

WATER SUPPLY IN CASE OF FIRE :

2 fire hydrants must be placed in the building. The accessible water throughput - in case of fire – must be 200 l / min.

The necessary external water throughput is 1500 l / min, for this amount 2 underground hydrant boxes must be placed around the building within a distance of 100 m.

B) HEATING

Central heating will be used in the building with cascade system condensing boilers. The boilers will be run by natural gas.Underfloor heating is provided everywhere in the building. In addition, tempered fresh air is led in front of the larger glass surfaces, through draught pipes. Boiler room will be placed on top floor because of the safety reasons.

HEAT LOSS CALCULATION:

Total heat loss for double skin façade (solid wall part from 1st to top floor):

	Thickness	Thermal Conductivity	Thermal Resistance
	(d)m	(λ)	R=d/λ
Internal surface	---	---	0,12
Plasterboard	0,02	0,21	0,09
R.C wall	0,20	0,11	1,82
Insulation EPS	0,15	0,030	5
Air Gap	---	---	0,18
Glass	0,01	0,93	0,01
External Surface	---	---	0,04

Total Resistance(ΣR) 7,26

U=1/ΣR A=910 m2

U=1/7,26 Δt=35 C

U=0,137 W/m2k

Q= U . A . Δt

Q= 4363,5 Watt

Total heat loss for ground floor solid wall :

	Thickness	Thermal Conductivity	Thermal Resistance
	(d)m	(λ)	R=d/λ
Internal surface	---	---	0,12
Plasterboard	0,02	0,21	0,09
R.C wall	0,20	0,11	1,82
Insulation EPS	0,15	0,030	5
Plaster	0,015	0,50	0,03
External Surface	---	---	0,04

Total Resistance(ΣR) 7,1

U=1/ΣR A=60 m2

U=1/7,1 Δt=35 C

U=0,14 W/m2k

Q= U . A . Δt

Q= 294 Watt

Total heat loss for windows and curtain wall:

U=1,6 w/m2k A=1676,3 m2 Δt=35 C

Q= U . A . Δt

Q= 93872,8 Watt

Total heat loss for flooring :

	Thickness	Thermal Conductivity	Thermal Resistance
	(d)m	(λ)	R=d/λ
Internal surface	---	---	0,12
Ceramic tiles	0,02	3	0,06
Screed	0,20	0,41	0,19
Sound Insulation	0,15	0,04	1
Loadbearing Slab	0,015	0,16	1,56
Mineral wool	0,1	0,04	2,5
Plaster		0,16	0,06
External Surface	---	---	0,04

Total Resistance(ΣR) 5,53

U=1/ΣR A=856 m2

U=1/5,53 Δt=25 C

U=0,18 W/m2k

Q= U . A . Δt

Q= 3852Watt

Total heat loss for roofing:

	Thickness	Thermal Conductivity	Thermal Resistance
	(d)m	(λ)	R=d/λ
Internal surface	---	---	0,12
Plasterboard	0,02	0,21	0,09
Air gap	---	---	0,18
Loadbearing Slab	0,25	0,16	1,56
Sound insulation	0,04	0,04	1
Screed	0,08	0,41	0,19
Ceramic tiles	0,02	3	0,06
Air Gap	---	---	0,18
Glass	0,05	0,93	0,05
External Surface	---	---	0,04

Total Resistance(ΣR) 3,47

U=1/ΣR A=856 m2

U=1/3,47 Δt=25 C

U=0,28 W/m2k

Q= U . A . Δt

Q= 8338,8 Watt

Q TOTAL= 110721 WATT 111 KW

Thermal Bridges :

Ψ [W/mK] 0.3

Q total [W] 110721

Qthermal bridge = Ψ* Q total

= 0.3*110721 =33216,3 Watt 33 KW

FABRIC LOSSES:

Qtotal= 111 KW + 33 KW

Qtotal=144 KW

FILTRATION LOSSES:

Q = 0,35 x ACH x V x Δt ACH= 0,5

Q = 0,35 x 0,5 x17359,5 x 35 V = 17359,5 m3

Q = 106326 Watt Δt =35

Q = 106 KW

MECHANICAL LOSSES :

Q = 0,35 x ACH x V x(1-η) x Δt ACH= 0,5

Q = 0,35 x 0,5 x17359,5 x 0,5 x 35 V =17359.5 m3

Q = 53163,5 Watt Δt =35

Q = 53 KW η = 0,5

TOTAL HEAT LOSS:

Q TOTAL = QF + QFIL + Q MEC

Q TOTAL = 144 + 106 + 53

Q TOTAL = 303 KW

Required Heat power Demand for Boiler:

Q boiler = Q total + Q dhw

Q boiler = 303 + 118,5

Q boiler = 421,5 KW

Cascade wall mounted boilers will be used for Heating and DHW.

Required Electiric power Demand for Boiler:

P=0,26 x A/1000 + 3,6 x Qboiler/1000

P=0,26 x 5655/1000 + 3,6 x421,5 /1000

P=2,98 KW

C) VENTILATION

WC	n=10	V= 800 m3	n x V = 8000 m3/h
KITCHEN	n=10	V= 512 m3	n x V = 5120 m3/h
RESTAURANT	n=10	V= 608 m3	n x V = 6080 m3/h
LOBBY	n= 4	V= 813 m3	n x V = 3252 m3 /h
OFFICES	n= 5	V= 7750m3	n x V =38750 m3 /h
EXHIBITION	n= 4	V=700 m3	n x V = 2800 m3 /h

V TOTAL 64 000m3/h

Required cross section of the ducts:

A = V/3600 x v V=64000 m3/h

A = 64000/3600x6 v=6m/s

A =2,96 m2

Required Electric power demand for Ventilation:

P= V x p/1000 V=64000 m3/h

P= 64000 x0,6/1000 p= 0.6 balanced ventilation

P=38,4 KW

EXHAUSTING :

Exhausting Amount of Underground Parking :

V= 8 x Ag Ag=2504 m2

V= 8 x 2504 m2

V= 20032 m3/h

Required cross section of the ducts:

A = V/3600 x v V=20032 m3/h

A = 20032/3600 x10 v=10m/s

A =0,556 m2

Required Electric power demand for Ventilation:

P= V x p/1000 V=20032 m3/h

P= 20032 x0,25/1000 p= 0.25 for garage

P=5 KW

Air handling unit will be placed to the first floor in mechanical. There will be natural ventilation possibility in the lobby and some parts of the building. By this way we can reduce the amount of the volume per hour. During summer time period , top windows can be opened for natural ventilation in the lobby.

D) COOLING :

Water chiller will be placed to the mechanical room. Chilled water will be transfered to the air handling units and by help of fans necessary areas can be cooled during summer time period.

Required power demand for cooling:

Qcool= Qtotal .10/35 + Plight+Ptech/1000

Q= 421,5.10/35 + 53000+250000/1000

Q= 120,5 + 303

Q= 423,5 KW

Required Electric Power Demand For Cooling:

Pcool = Qcool /3

Pcool = 423,5 /3

Pcool = 140 KW

D) ELECTRICITY :

Plighting= ΣP^*A

- Low visual demand : 600m^2*5W =3000W
- Intermediate : 500m^2*10W =5060W
- Mediate : 2850m^2*15W =42620W
- High : 100m^2*20W =2000W

= 52620 W --> 53 KW

Pmep = 70 KW for mechanical equipment

Ptechnology	computers	190(pcs)*0,2(KW)=38KW
	hand dryers	30(pcs)*2,5(KW)=75KW
	microwave	30(PCS)*0,8(KW)=24KW
	coffe machine	10(pcs)*6(KW)=60KW
	fridges	20(pcs)*0,1(KW)=2KW
	lift	4(pcs)*12(KW)=48KW
	TV	30(pcs)*0,1(KW)=3KW
		=250KW

Ptotal= 53 + 250 + 70 = 373 KW> 200 KW TRANSFORMER IS NEEDED 10/0,4KV transformer supplied by 10 KV.

The transformer will be placed in the underground floor. The soil will be excavated and with a permanent construction the transformer will be placed. This construction will be under the soil and with a door which will be placed on the ground on -0,10m it can be transferred in case that is needed. In the underground floor where the transformer is placed a door will open to the this construction which is under the soil.

Photovoltaic: 1m^2 gains 0,1KW → 280m^2*0,1→ 28KW will be gained from the photovoltaic panels.

CONTENT