VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

FACULTY OF CIVIL ENGINEERING

DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

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CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIS STR. 12 IN VILNIUS.

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1. ARCHITECTURAL PART

EXPLANATORY NOTES

1.1 INTRODUCTION:

The final thesis work consist of the constructive description of residencial and comercial building in Vilnius (Lithuania). This building is sited in St 12 S. Konarskio projected 9 floors (8 floors + attic floor), apartment blocks consists of three sections. Two of the blocks are in level 0.00 but one of them begin in level - 0.36.
The building address is catrastral 0101/0055: 34, Vilnius KV Plot of land with a unique number 0101-0055-0034. Irregular rectangular plot. Plot of land ownership, layout and form of property management / rental right belongs to "VILBRA".

The first floor is destinated to commercial space. The floors between second floor and ninth floor are adapted for residencial use.
Each block has four houses in each floor, so the building has 90 apartments. It has not got underground floor.
Therefore, inside of the plot it has been built parking spaces. It has 90 residencial car parking places and 10 to commercial área.

The building is set back from neighboring plots at a distance to ensure that does not harm the rights of others.

The average height of the building from the top of the parapet is 29.60 m.
Parking spaces are addressed within the plot and some parking spaces for future residents are less than 300 m.
The main entrance to the building is planned S.Konarskio g.
Is a residential building designed in a quiet and comfortable place. Strategically convenient distance from the city center and other parts of the city.

Inside of the building is communicated vertically by stairs enclosed in a reinforced concrete box to provide stability to the whole. It includes one elevator for each section of the building.

-Plot's area: 4.470 m^2
-Building area: 7124.16 m^2
  Pb: 788.78 m^2
  P1-P6: 813.98 m^2
  Ppenthouse: 806.78 m^2
  Engine room: 644.72 m^2
  TOTAL: 7124.16 m^2
-Shape building area: 1110.0 m^2
-Building height:
  Roof: 31.50 m
  Roofstop: 29.60 m

1.2 LOCATION:

This building is located in Konarskio Street in number 12. In Vilnius (Lithuania). It's a residential zone with a good accessibility and well connected with public transport. It is close to a large park, Vingio , and near the road E272. It has a lot social áreas like restaurants or hostels.

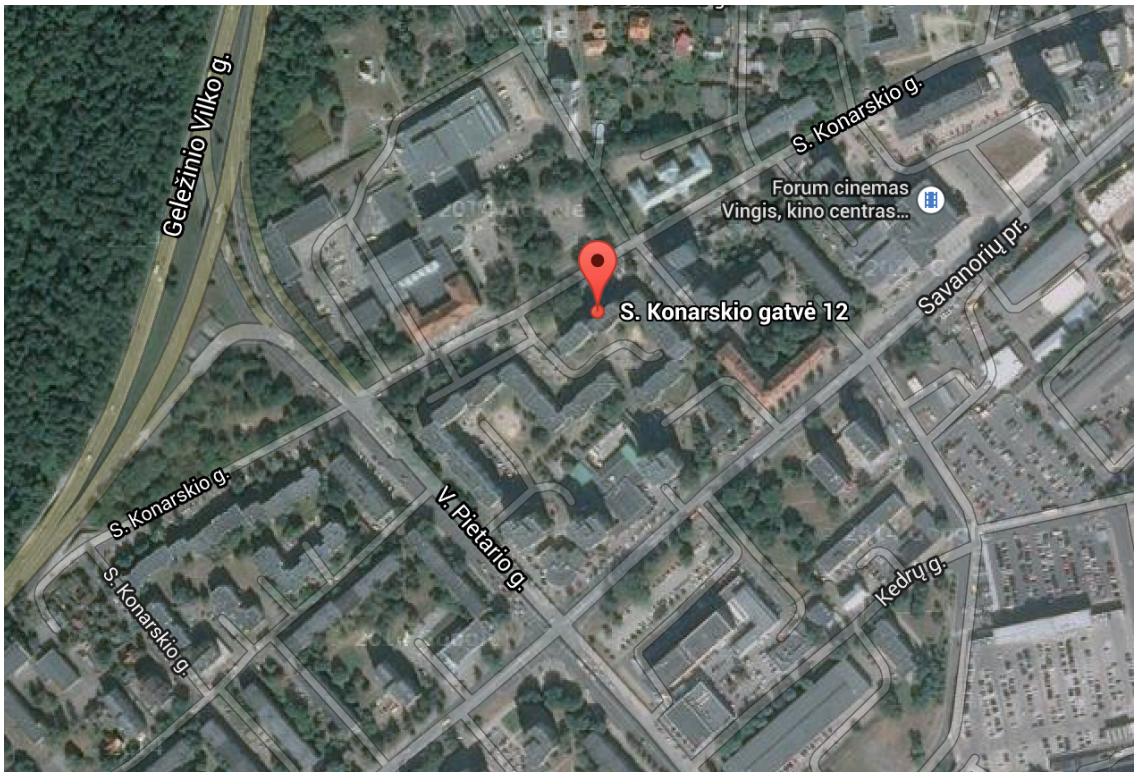


IMAGE 1. *Aerial view general area of the building*

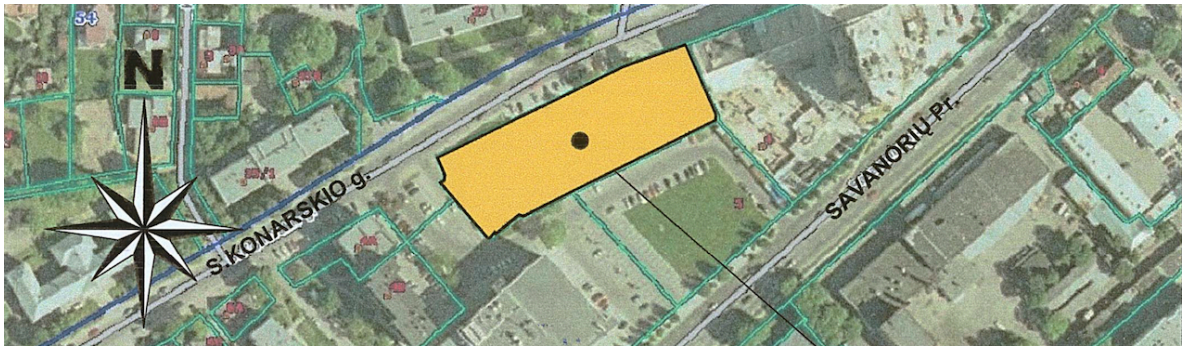


IMAGE 2. *Aerial view of building*

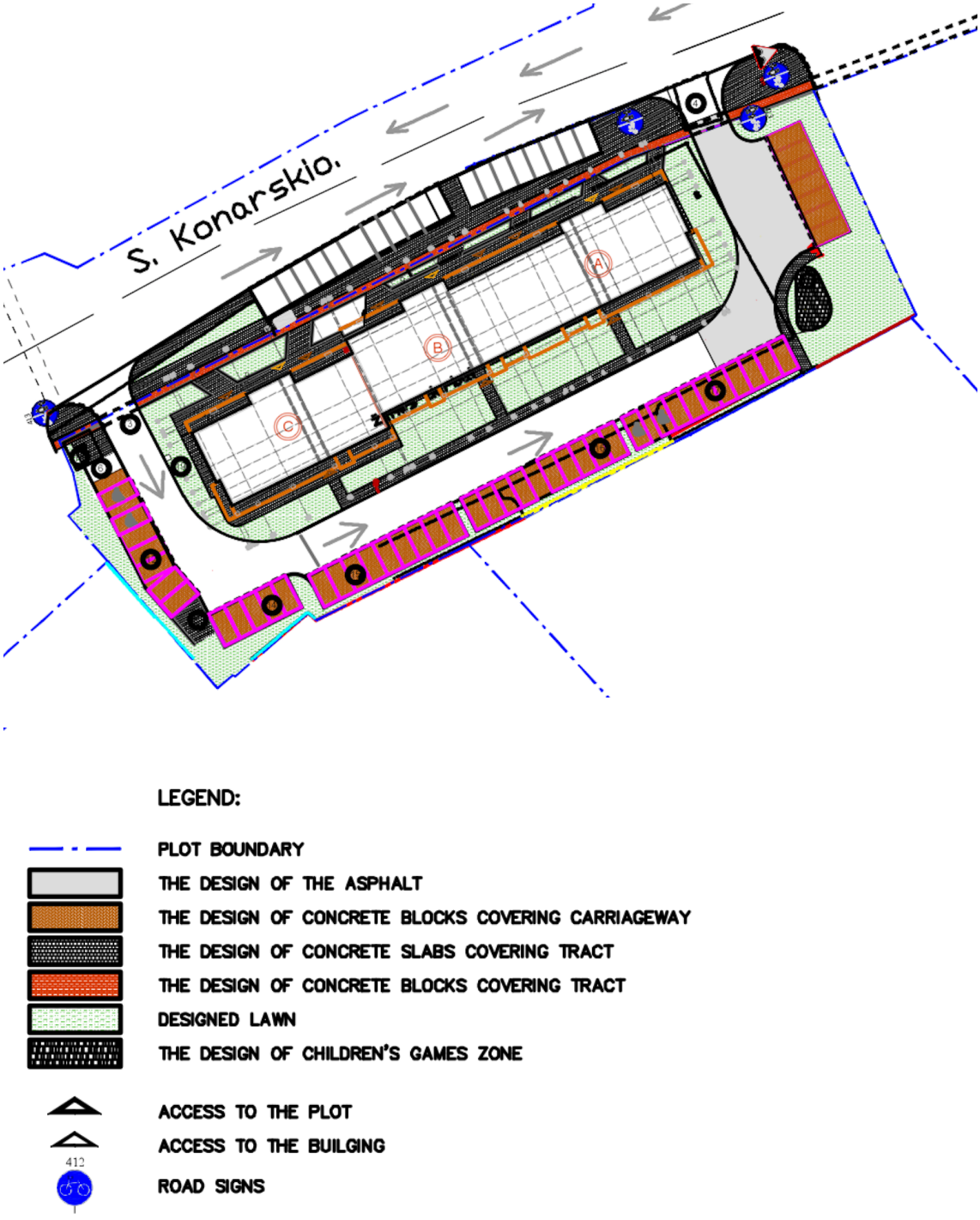


Fig 1. *Location plan and legend*

Vilnius is the capital of Lithuania.The city has a population of 539.939. Lithuanian's climate is maritime – continental, due to Vilnius is sited in the east of Lithuania, the prevailing climate is the continental. It is characteristic of this type of climate seasonal temperatures differences, cold winters and warm summers.

1.3 FIELD:

The plot area is 4470 m2. The building density is 25.2 %. The planned construction area is 1125 m2 and the building area is 1110 m2. Comprising 30% of green spaces .

The road access is via the Konarkio street which is two-way.

The building is close to a school, kindergarten, art school children, Volunteer secondary g. Rimi supermarket, Forum Cinemas (Double) cinema. It is inside of a parcel planted recreation area, playground and recreation area for the elderly population.

Determined according to the expected number of apartments -90 apartments (1 parking space / apartment) a total of 90 parking spaces in residential and commercial sleeps 10. Each parking space has 12.5 m2.
People with disabilities provided 4 places nearest to the entrance of the building (in 4% of the total demand of parking).
It can parking 49 cars within the plot , and the remaining 51 parking spaces will be granted for residential applications boundaries of the site at a distance of 300m Vivulskis plot g.41.

1.4 DISTRIBUTION FLOORS:

The building , as already named above, is formed by three blocks. Comprising ground floor , seven floors and attic floor. All plants are for residential use , except for the ground floor which also has commercial use.
It is a residential building and is designed with a greater share of residential premises (91.00 % of the total area of the building) , with shops on the type of cabin (9.00 % of the total area of the building).
Residential facilities consist of a large part of the building (90 apartments).

Consists of four walls, two main length of 75,160 meters and two 16,600 m. The accesses are performed on the two principal .
In each block ground floor, seven floors and attic floor. On each floor from the first to the last (not counting the attic) consist of four apartments for each block, so it has twelve apartments on each floor.
Each apartment is provided with different number of rooms, but all of them have kitchen, a place for rest and one bathroom at least. Additionally, all of them have different area.

Table 1. *Floor areas*

APARTMENT №	TOTAL AREA (m2)
Ground floor	788.78
1F	813.98
2F	813.98
3F	813.98
4F	813.98
5F	813.98
6F	813.98
7F	813,98
8F	906.78
9F	644.72

BUILDING STRUCTURES

1.1 DESCRIPTION OF STRUCTURE:

- Dimension of the building plan: 75.160 x 16.600 m
- Administrative building a support frame type:

  ·Drilled solid foundations: piles.
  ·Bearing walls and monolithic reinforced concrete floor , except for the first floor , where the walls are monolithic .
  ·Monolithic ceilings and roofing.

1.1.1 FOUNDATION

Because the surface is resistant to a considerable depth, the best type of foundation in this case is, on piles, as it is a type of deep foundation.
At the top of the pile one pile cap, which is the union of two stilts so that, working together is performed.
This foundation system is that the resist is able to absorb the loads transmitted through the building.
The piles are mainly vertical loads of the structure, this column load is transmitted to the batteries batteries capitalization. Batteries while working by friction with the ground, generating charges in the opposite direction of the column.
According to regulations, the type of concrete used is HA-25 (characteristic strength fck = 25 MPa) and the type of iron arms B400S (fyk characteristic strength = 500 MPa)
The following image shows how this type of foundations according EHE.08 works.

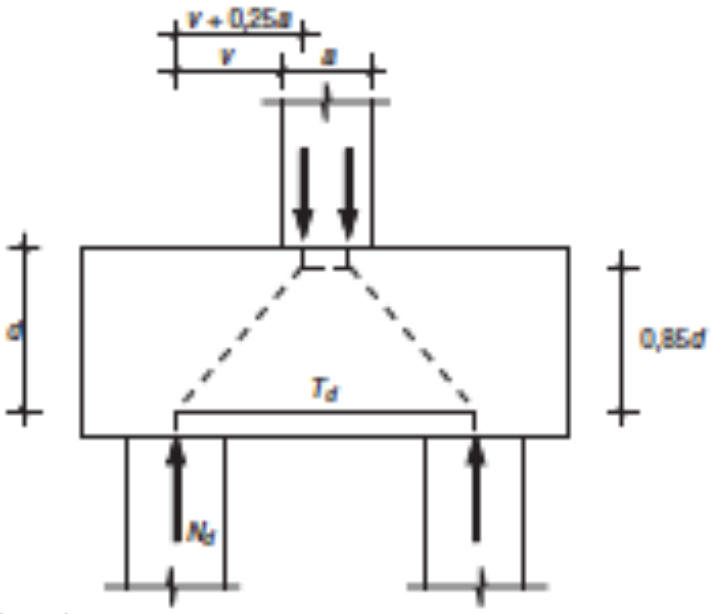


Fig. 2 . *Loads direction*

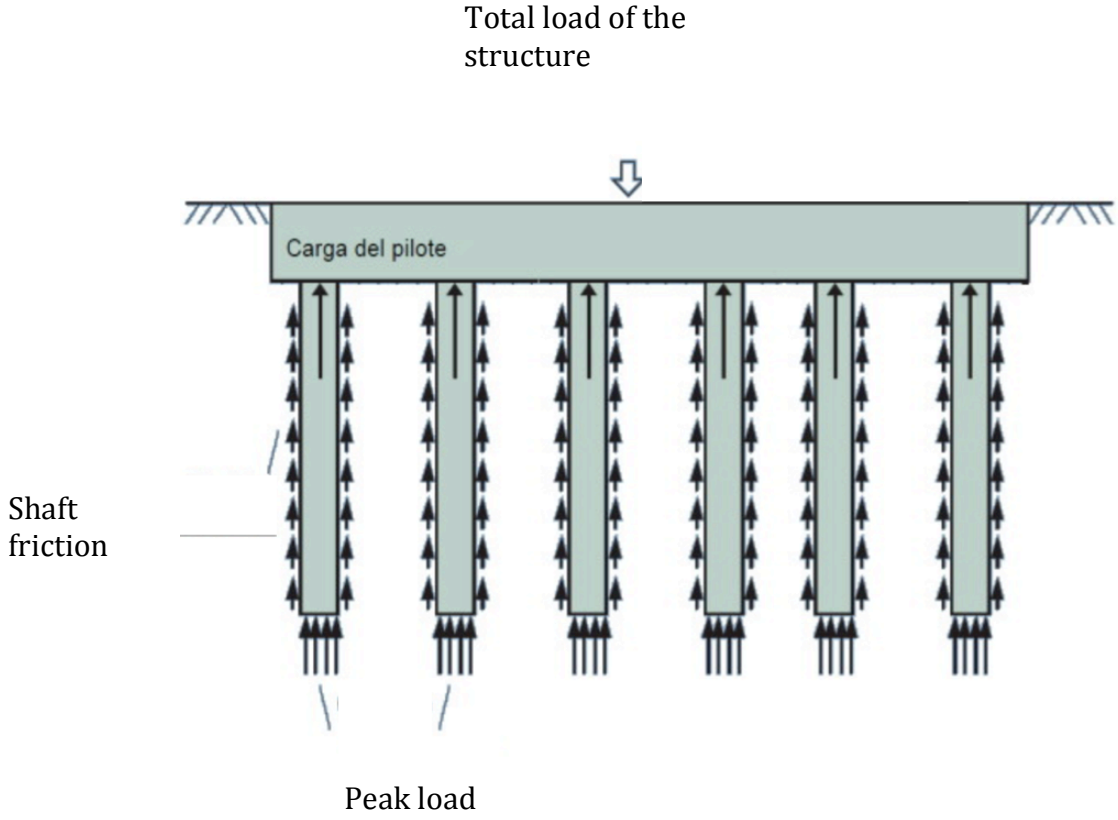


Fig. 3 . *Loads direction*

1.1.2 WALLS

It is a brick building with bearing walls .
Because no pillars in the building, the facade enclosure walls will be load-bearing walls . That is, having a structural function , supporting other structural elements. This decision was taken due to the pressure on the walls of the first floor.

Load bearing wall structure
In such structures , the vertical elements supporting the slab are the masonry walls , in this case Termoarcilla .
This structural system has two types of vertical elements:
load bearing walls . Above them directly supports the slab.
They are perpendicular to the bearing walls and are required to withstand horizontal actions.
On load-bearing walls wrought supported. On the slab the walls of the upper floor are supported, and the process is repeated .

Wall elevator and stairs are also monolithic wall.

Partitions:

- Among households: silicate brick layer
- Interior partitions in the house: plasterboard panels with rock wool between panels .
- Between blocks: it is executed by expanded clay block (ceramic bricks) and the finish coating is mineral plaster with posterior painting.
Filling and acoustic mineral wool insulation.

1.1.3 SLAB

Monolithic reinforced concrete slab . As an element of structural concrete , it follow the EHE-08 standards. The type of concrete used is HA- 25 and B400S type of Steel as reinforce.
The slab is 230 mm.

Constructive reinforced overlays the (lower and upper) valve ø12 S500/220/ ø12 S500/220 networks and additional reinforcement to increase net stress áreas.

1.1.4 STAIRCASE CONSTRUCTION

Stairs and landings monolithic walls. They are connected together flexibly. It will be used reinforced concrete HA - 25 and some types of iron B 500 S.
It consists of 14 sections with 17 steps.
The upper sections are less.
The thickness of the slab is 15 cm.

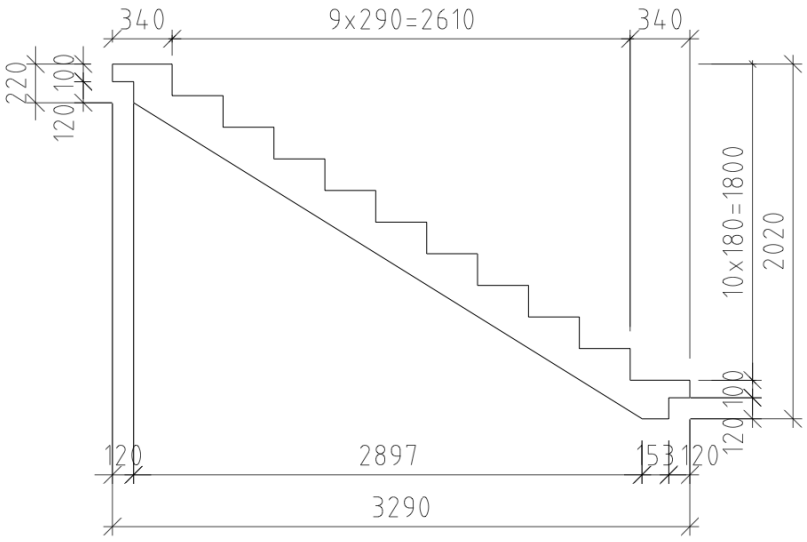


Fig. 4 . *Stairs type*

1.1.5 FLOOR/ SOIL

The floor of the balcony is formed by slip ceramic tiles, reinforced concrete, geotextile, panels of polystyrene foam (EPS), another geotextile, modified bituminous waterproofing, a layer of concrete to form the slope and the monolitic slab.

On height below 0.00, it is found a capillary sheet, a geotextile (hydroduct 220 *), extruded polystyrene foam, two layers of waterproof coating based on water for cement coating and repair wet surfaces, wich is a waterproof coating based on cement. Consumption : approx. 1.8 kg / m2 / 1 mm, and monolithic grillage.

* Hydroduct 220
Drainage composite , consisting of a 10 mm thick drainage core , a geotextile high performance and high film strength backing . Designed to collect and transport water is recommended for use in foundation walls , retaining walls, bridge abutments , tunnels , earth structures with shelter and planters. It serves as a drainage composite and of course protection for all waterproofing membranes.

The ground floor is formed by stoneware tile, a layer of concrete HA-25 with steel, polystyrene modified (PE), polystyrene (XPS) as insulation waterproofing layer, compacted diatomite* and compacted land.

* Diatomite compacted: cream colored fine powder , used for the manufacture of coatings .

On the 9th floor , the floor is formed by ceramic tiles in romos with the exception of wetlands, wich coating is tiled, fine-grained sand reinforced, PE modified, anti- impact sound insulation, rock wool insulation, four centimetres of dry sand compact, another PE modified and the monolithic slab with its corresponding later painted

On the other floors (2,3,4,5,6,7 and 8) which we will call soil type, are formed by ceramic tiles in rooms with the exception of wetlands , which coating is tiled, a layer of fine-grained sand reinforced, PE modified, an anti - impact sound insulation, acoustic wool, four centimetres of dry sand compact, another PE modified and monolithic slab. The surface is painted.

1.1.6 FACADE

The facade consists of two different finishes:
1. Finish Clinker tilings adhered by thermal insulating heat with a mixture of corrosion -resistant armor
(reinforcing mesh) .

2. Finishing plaster primer silicate quartz
with a mixture of grid reinforcement and to prevent the corrosion.

Thermal and acoustic insulation material used is semi-hard rock wool .
In order to provide light to the interior , along the facade we find large metal windows and some balconies .

SD1.
One type of wall is silicate plaster primer with a mixture of
reinforcement corrosion network resist reinforced. Semi- hard rock wool attached with glue and safety pins. Silicate layer blocks (bricks) from the interior finish plaster mineral and posterior painting.

SD3
Clinker facade exterior finishes adhesive with a mixture of mesh reinforcement corrosion resistant armor. Semi-hard rockwool attached with glue and safety pins. Silicate blocks (bricks) side a wall covered with mineral plaster and posterior painting.

Facade of ground floor
Clinker facade exterior finishes adhesive with a mixture of mesh reinforcement corrosion resistant armor. Semi-hard rockwool attached with glue and safety pins. Monolithic wall covered with mineral plaster and posterior painting.

1.1.7 ROOF

Consists of 2 layers of fiber reinforced bituminoas polyester with gravel above on it. Solid rock wool and thermal insulation rockwool. To slope formation is used expanded clay. A vapor barrier of PE modified, the monolithic slab and posterior painting.

Roof deck
Clinker facade exterior finishes adhesive with a mixture of corrosion resistant armor and a reinforcing mesh. Semi-hard rockwool attached with glue and safety pins. Silicate blocks (bricks) side a wall covered with mineral plaster and posterior painting.

1.1.8 INSTALLATION

The building is connected to the communication network under the conditions of the engineering design of the city with the corresponding technical terms.

-Electricity:
All floors will have electrical cables of distribution and assembly, which are hidden. Will have low voltage networks, TV, telephone, internet.

- Heating and ventilation:
The right conditions of habitability in the building concerning climate control of instances of housing comes from urban infrastructures heating of Vilnius. Inside the floors the elements heat sinks will be radiators and will have a natural ventilation system.

- Water supply and sewerage:
Inner drainage of rain. The contractor must install a faucet rain on the roof with a protective grille for protection against entry of leaves.
Rain drainage elements - must be equipped with automatic activation of the heating cable. It must be heated all gutter walls are passing through the roof structure .
The water supply is from the street Konarskio.
Stormwater and sewage will be connected to the sewer.
The floors are equipped with hot and cold water and must have measuring devices. The hot-water meters should be protected anti-magnetically.
Pipes are of PVC. Pipes and fittings must be covered by insulation.

1.1.9 FIRE SAFETY

It must comply with established spanish regulations :

"Criteria for the interpretation and application of Basic Document of the Technical Building Code."

"DB SI - Safety in case of fire"

Installing fire for dry column will be placed:

Dry column system is used in buildings over 25 m . height , for a more rapid intervention by the public forces of extinction. They are enforceable by order of the Ministry of Housing of 02/26/74 (BOE No 53 of 03.02.74) in buildings over 8 floors or on the ground whose height exceeds 25 meters.

The building has an alarm system with automatic fire. Fire doors of the building are designed with sealing washers and self-locking mechanisms. In

addition, a system designed to ventilate, heat detector and hand bells fire hazard. Smoke detectors are located on the roof, installed in accordance with the requirements of normative documents.
The building has sprinklers like fire alarm system and the alarm system is automatic.
In the apartments and commercial premises are found thermal and optical detectors of smoke.
On each floor, on the stairs, there are buttons for manual alarm and the corresponding alarms.
Doors:
EI_2 30: separates the elevator landing
EI_2 90: landing
EI_2 30-C5: stairs separates the landing
Walls: EI 60.
You can access the building through the western part, in case of fire.
In the area outside the building, two underground hydrants installed in the water supply will be provided.

In the building installation comprises:
- Automatic smoke detector
- Indoor siren
- Alarm button to protection against fire
- Smoke detectors above the suspended ceiling
- Programmable Relay Module
- Power supply
- Electromagnetic valve

1.1.10 HEALTH CONDITIONS

The Spanish legislation is governed:

The building has been designed to meet all hygiene criteria according to the spanish rules of CTE - HS (technical building safety health code) .

Salubrity:

Health HS 1 Protection against moisture
HS 2 Collection and disposal of waste
HS 3 Indoor Air Quality
HS 4 Water supply
HS 5 Waste wáter

1.1.11 ENVIRONMENT

The building is designed completely to keep the environment clean. In order to improve the microclimate , soil and air pollution , under a series of measures :
1. Parking is on asphalt .

2. Garbage is collected in underground containers for collecting waste specialized delivery closed and cover waste management . Dumpsters at specific sites.
3. The water supply and sewerage construction , collection and management of rainwater addresses to connect to centralized urban networks.

1.1.12 INSOLATION

The Spanish legislation is governed:

Real Decree 1627/1997 of 24 October, which establishes: minimum safety and health rules in construction.

Annex IV. "Minimum health and safety provisions to be applied in Works"

a) The temperature in rest areas , local personnel guard , of the toilets , canteens and local First Aid must correspond to the particular purpose of such areas.

b) Windows , the openings of zenith lighting and glass partitions should allow Avoid Excessive heat stroke , taking into account the type of work and use of the premises.

1.1.13 DISABILITY NEEDS

The Spanish legislation is governed:

The building will be designed to meet the needs of people with disabilities , under the rules DB SUA.

Basic request SUA 9:

Accessibility:
"Access and use non-discriminatory , independent and secure buildings for people with disabilities will be provided ."

Disabled people can easily access the edifio because the ground floor is fully enabled, going into effect compliance the relevant regulations.
Inside the building there is an elevator who disabled people can access to differents floors and have adequate parking spaces near the entrance, following compliance with the regulations.

1.1.14 LIFT AND MACHINERY

The building has three different elevators, situated one in each block.The maximum load of 1000 kg.

2. TECHNOLOGICAL CARDS

In this part we explain in detail three construction processes.
The three parts of the execution of the building are: monolitic slab, roof covering and foundation (piles).

2.1 TECHNOLOGIAL CARD I. INSTALLATION OF MONOLITHIC SLAB.

2.1.1 GENERAL DESCRIPTION

The horizontal structural part are solved with the same constructive system. Reinforced concrete slabs is the solution for the 9 floors. The thickness of the slabs is 230 mm except in last floor slab is 220mm of thick.
The steel consists of a networld overlays (upper and lower) of ø12S500/220/ø12S500/220 bars arranged in two orthogonal directions.

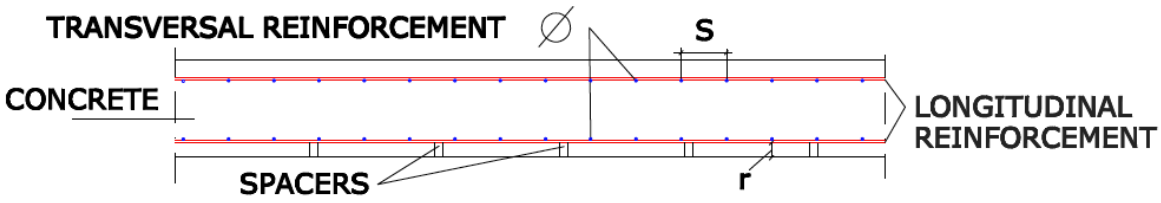


Fig. 4 . *Section wich is reinforced slab*

The total area of concrete (8 flats of 1 ceiling) is 7124.16 m2. This type of structural system has the advantage of simplicity of implementation , but has the problem of large own weight. There are alternatives to solve this problem by introducing lightening elements , in this case , you need not lighten .

2.1.2 DESCRIPTION OF TECHNOLOGY AND SEQUENCE OF WORKS:

The reinforced concrete building technique is the use of concrete reinforced with steel bars or meshes, called frames.
It is also possible to assemble it with fibers, as plastic fibers, glass fibers, steel fibers or combinations of steel bars with fibers depending on the requirements to which it is subjected.
In this case we use concrete reinforced with steel bars.

SEQUENCE OF WORKS:

1- Mark levels.

2- Formwork and propping-up.

Placement of props on wooden sleepers (wedges), which uniformly distributed load with wood boards that support on metal girders, forming rails.
Form surface should be higher than the surface of the slab to allow placement of the side that contain the concrete. They must be properly placed to prevent tipping during concreting.
The formwork should contain and support the fresh concrete until cured and retain the desired shape without deforming. It is bound to be rigid, durable, waterproof and clean.

3- Stakeout of slab elements.

4- Stakeout of gaps.

5- Placing armor, including waiting for stairs.

1) Lower reinforcement.
2) Lower reinforcement.
3) Superior reinforcement.
4) Superior reinforcement.

The reinforcement must be clean and secured to the formwork so that it remains stationary during the pouring of concrete and its compaction.
There must be a minimum distance between the different reinforcing bars, to allow for proper pouring of concrete between them, the width between the reinforcement and formwork, must also maintain a minimum, standardized separation for this space is filled with concrete without moving the reinforcement.

6- Separators.

7- Pouring, compaction of concrete in slab and vibrated.

The fresh concrete poured into the formwork must be made to occur by preventing segregation of the mixture. To do this, the maximum height of pouring concrete is one meter.
Is placed in layers of thin horizontal to allow good compacting. To achieve a concrete compacted and thus the elimination of gaps, is made vibrated. For a complete vibration resistant and dry concrete consistencies are used. The needle remains upright in the mass of fresh concrete, introduced at each level until the tip penetrates into the previous layer, taking care not to touch the reinforcement.

Please note:

The discharge must not be from a great height (maximum height of two meters free fall), making sure that your address is vertical. The concrete must be directed during pouring through ramps or other devices to prevent collision with the free form or reinforcement.
· The positioning is performed by horizontal layers allowing good compacting the mass (usually 20 to 30 cm, not exceeding 40 cm in the case of plain or reinforced concrete 60 cm concrete).
· In the concreting of inclined surfaces, fresh concrete has a tendency to run or slide down, especially under the effect of vibration. If the layer thickness and slope are large, you must use a superior formwork.

8- Concrete curing:

Curing is one of the most important operations in the process of laying, since a poorly executed curing can decrease the strength of concrete as well as increase the porosity of the dough favoring the entry of outside environment and reducing therefore , durability of the element. During setting and hardening the evaporative water loss can occur.
The methods that can be used for curing are several: cover the surface with plastic, burlap, direct irrigation ...

9- Removing of formwork and finishes:

Removing formwork is made when the concrete has reached a sufficient hardness. In normal portland usually a period of between 3 and 7 days.
Repair small holes or voids generally superficial surface defects. If these defects are large or resistant in critical areas may require partial or total demolition construction

2.1.3 HUMAN SAFETY

➢ Risks

- Damage to third parties.
- Derivatives of meteorology .
- Blows in the hand by the hammer .
- Rollovers of wooden pallets (planks, boards, pillars, belts, supports, etc.) during hoisting maneuvers plants .
- Falling of wood during take off the formwork.
- Fall of people at different levels.
- Fall of people at the same level. - Cuts using hand saws.
- Stepping on sharp objects.
- Electrocution by canceling grounding of electrical machinery.
- Overexertion by poor posture .
- Blows to general objects.

- Dermatosis contact with cement.
- Derivatives of works on wet surfaces.

➢ Preventive Measures

- All operatos have to have previous knowledge for the work described above.
- Access suitable to get to work.
- It is forbidden do inappropriate things with the plates of the formwork. No operator can stay on it.
- Carry out concreting and vibrating of concrete in work platform.
- If it is necessary concreting at night, it has to put lighting to make the works.
-To prevent falls from height, until formwork floor does not have perimeter protections of slab, the operatos have to wear all individual protections. Phase of supervised work. It is recommended to walk resting your feet on the connections, avoid very warped boards.
- Use ladders auxiliary means to get on and off as needed.
- Remove nails or spikes of wood that was used.
- When you have to remove the boards, do it in an area that is already without formwork.
- Order and cleanliness in the execution of works. Remove debris and disposal of these to avoid accumulation.
- Correct stockpile of materials.
- To prevent falls from heights, banned the work without adequate protections.
- Installation of appropriate signals to risks.
- Prohibited the presence of operators where there is risk to lifting operations of different materials.
- Workers who handle the machinery must be specialized in this work.
- Operator specialist who directs the handling, assembly and disassembly of concrete pump pipe.
- Hose pouring concrete using two minimum operators.

➢ Signage

- Prohibition sign: prohibited certain conduct.
- Mandatory sign: forced certain behavior
- Warning sign: Warning of a certain behavior.
- Signs relating to firefighting equipment.
- Signs of rescue or relief.
- Light and acoustic signals.
- Risk of falling, shocks, bumps.
- Traffic routes.
- Storage areas for dangerous substances and preparations.
- Emergency situations.
- Dangerous maneuvers.

➢ Collective protections

- Safety nets .
- Resistant railing 90 cm minimum on each floor height , will have

handrails, a interim and baseboard .
- Horizontal networks to protect gaps.
- Safety harness all workers, lifeline.
- Pathways and ramps in the same or different level.

➢ Individual protections

- Approved safety helmet .
- Costumes for rainy weather.
- Safety footwear .
- Protective footwear .
- Seat belts
- Bright and reflective vests .
- Reinforced leather gloves .
- Mask auto- filter .
- Harness anti - falls for work at height .
- Acoustic Protector.
- Glasses antiparticles or anti - projected screen.

Laboral risks	**Consequence**	**Probability**	**Risk level**
Blows and cuts by objects and tools	SERIOUS	AVERGAE	MODERATE
Entrapment for objects during loading and unloading operations	VERY SERIOUS	LOW	MODERATE
Entrapment by or between objects during assembly operations armor	VERY SERIOUS	AVERAGE	IMPORTANT
Fall of people at the same level	SERIOUS	AVERAGE	MODERATE
Fall of people at different levels in depth	VERY SERIOUS	AVERAGE	IMPORTANT

Table 2. *Main risks in working with rebar*

2.1.4 MATERIAL- TECHNICAL RESOURCES

• Materials:

- Concrete (Cement , water , steel, fine aggregate and coarse aggregate)
- Steel reinforcement .
- Separators .
- Caisson .
- Wooden wedges .
- Props .
- Nails .
- Pallets .

• Aids :

- Ladder .

• Equipment:

- Concrete mixer truck.
- Vibrator electric needle.
- Cutting Circular Saw
- Radial electric motor.

• Tools:

- Hammer
- Pliers
- Level

Table 2 . *Resources of Materials – Aids – Equipment – Tools*

MATERIALS	UNIT	QUANTITY
Concrete	M^3	187.22
Steel reinforcement	kg	17907.56
Separators	units	3255
Wooden wedges	M^2	1256.62
Props	M^2	895.2
Nails	unit	1871
Pallets	M^2	895.2
AIDS		
Ladder	unit	2
EQUIPMENT		
Concrete mixter truck	unit	2
Vibrator electric needle	unit	2
Cutting circular saw	unit	2
Radial electric motor	unit	2
TOOLS		
Hammer	unit	12
Pliers	unit	6
Level	unit	6

2.1.4.1 PLACEMENT EQUIPMENT

Concrete mixer truck

- Concrete mounted on truck chassis.
- Capacity of 6 m3.
- Machined at the top rear from the kneading load of the plant .
- Kneading during transport by the turn of mixing drum .
- Emptying the back bottom of the direction of rotation of cube and gutter height adjustable and swiveling 180 degrees inversion .

Pump truck

- Receive the concrete in the hopper from the truck mixer .
- Location timely work.
- Operation diesel engine.
- Efficiency: 80 m3 / hour
- Scope: 32 m .
- Parties:

- Truck.
- Hopper.
- Pump

- Hydraulic arm with pipe.

The transport of the concrete will be with truck and it will be placed with concrete pump.

Manufacture of concrete:

In the preparation and application of concrete will fulfill the general requirements of Structural Concrete (EHE-08) REAL DECRETO 2661/1998 of 11-DIC, the Ministry of Development. The arids, water and cement will have to be automatically dosed by weight.

Tolerances in dosage will be two percent for water and cement, five percent for the various sizes of aggregates and two percent for the total aggregate. On the consistency of the concrete will allow a tolerance of twenty millimeters measured with the Abrams cone. The instalation of concrete will be able to make regular and explicit mixing of the components by providing a consistency and color uniform concrete. In the concrete mixer truck shall be placed a plaque, which bears the capacity and speed in revolution by minute recommended by the manufacturer, which should never surpass.
Before inserting the cement and aggregates in the mixer, it will be loaded of a portion of the amount of water required by the mass completing the dosage of this element in a period of time which shall not be less than five seconds or more than a third of the mixing time, counted from the time the cement and aggregates have been introduced into the mixer. Before returning to reload the concrete mixer truck it will be completely empty of contents.
Will not be allowed to return to knead in any case concretes already hardened in part, although further quantities of cement, aggregates and water are added.

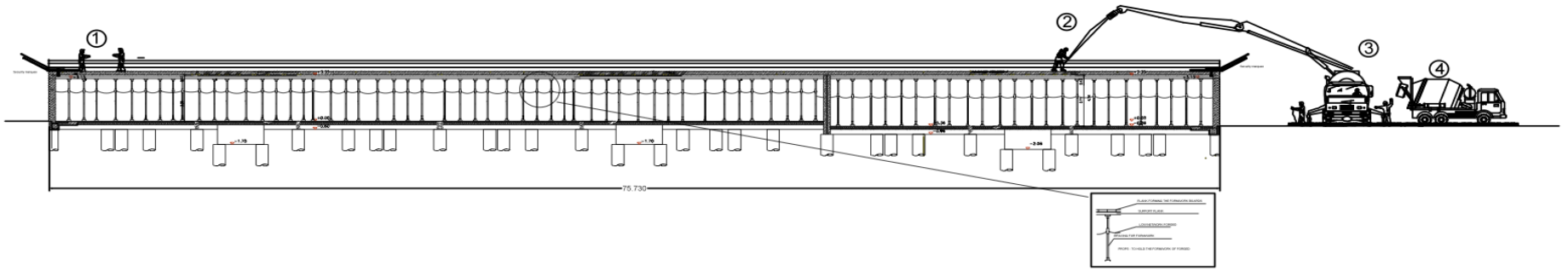
Transport of concrete:

- The transportation from the mixer will be held as quickly as possible. The concrete must be prevented drying during transportation.
- Shall not be placed in concrete work with a principle of hardening or any alteration.
- The truck must be equipped with a stirrer.
- Curing is done keeping moist surfaces of the pieces until 70% of its strength.
- During transport, should be segregated coarse aggregate, resulting in the loss of homogeneity and concrete strength. Avoid vibrations and shocks as well as an excess of water, which promote segregation.
- If upon arrival at the pit concrete placement initially accused of setting, the dough should be discarded and not placing.

Pump conditions:

- Pumped concrete requires a cement content not less than 300 kg/m3 and use sand and coarse aggregate other than crushed.
- The dosage of the concrete must be done by weight. You should use a plasticizer or free flowing and use soft-plastic consistencies. Appropriate to the use of pozzolanic cement, the plasticity conferred by the concrete.
- The maximum aggregate size should not exceed 1/4 the diameter of the pipe if it is metallic, or 1/3 if plastic.
- Not be used aluminum pipe.
- The placement should be avoided direct projection of the jet of concrete against armor, you have to monitor that the concrete does not appear segregated because of compressed air, and precautions should be taken with regard to operator safety.

Fig 5. *Placement equipment.*



LEGEND:
1.REINFORCED PLACEMENT.
2. CONCRETE PLACEMENT
3.CONCRETE PUMP
4. PUMP TRUCK

2.1.5 ORGANIZATION OF WORKS

* FOR EXAMPLE, IN CASE OF SECOND SLAB:

813,98 m^2 x 0,23 m of slab = 187,22 m^3

One concrete mixer truck : 6 m^3 and need 15 minuts to empty with pump truck.
Therefore , in one day it is possible concreting of the entire plant , and are needed about 11 hours.

Putzmeister has been chosen 32X -150 pump. With a vertical reach of 32 meters and boom :
Length of the first section: 7.7 m
Length of the second section: 7.05 m
Length of the third section: 7.05 m
The fourth section length : 6.2 m

Since we have 75.730 m length of slab , and the maximum range of the arm is 32 m, 3 trucks pump for the entire slab is needed.

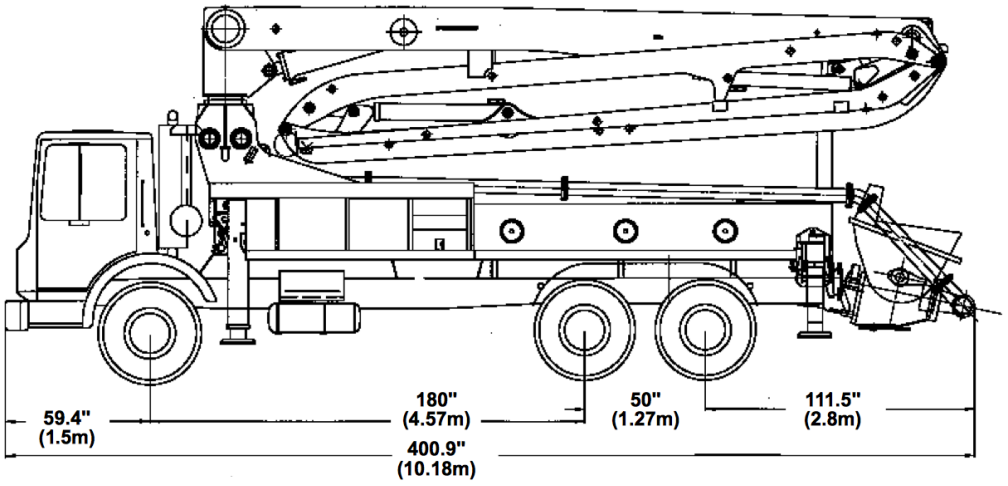


Fig. 6 . *Pump truck*

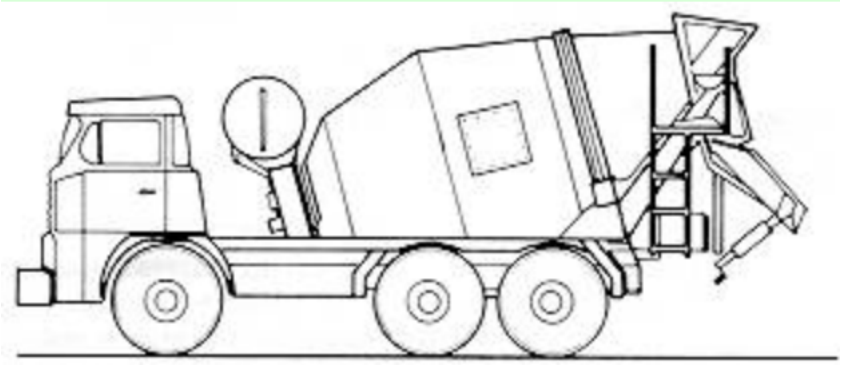


Fig. 7 . *Concrete mixer trucks*

| | July | | |

2.1.6 QUALITY CONTROL

The testing of concrete is done in their two states to meet their fresh and hardened properties to determine their qualities and strength. The behavior of concrete against the various efforts is variable and complex.

Minimum tests to make and frequency of realization

Tests shall be :

- During the execution of structures, often as it indicated below or when the Project Management orders.
Sampling of fresh concrete , will be held at the time and place of placing concrete in the formwork , under the conditions that the EHE -08 is established.

- After the execution of structures, when necessary verify the results of tests conducted on molded specimens.
The tests were performed on extracted witnessed by rotary probe structures.

1. Tests to be performed on fresh concrete

1.1 Cone of Abrams

This test is conducted at the time of placing concrete in the formwork. In the event that by achieving it, the settlement is outside the limits, two concrete tests are conducted on two new samples taken from the same batch. If the results do not satisfy the conditions laid down, the concrete will be rejected. The persistent lack of compliance with the specified settlement will be sufficient to provide for the immediate cessation of concrete placement until the deficiency is corrected observed cause.

This test is conducted every time samples are molded to determine the strength of concrete, and at least every three (3) hours, or when visual observation indicated that the conditions are not met, for which the team be established by the standard should be permanently on work.

1.2 Tests to be performed to determine the characteristics of hardened concrete

a) Prior to the period of molding and execution of structures, also during the same , in addition to the tests described in determining the characteristics of fresh concrete , which are valid both for the case of concrete made on site and elaborated on central plant , the necessary tests are carried out to determine the resistance to compression fracture of the different types or classes of employees to execute concrete structures . The tests were performed at the age of 28 days, as specified under age or interest for advance information . In special cases the Project Manager may also decide to carry out further tests .

b) Fresh samples used for testing concrete, will be taken at the time and place of placing concrete in the formwork

All be molded specimens and tested in the presence of Authorized Representatives of the Project Management Contractor and approved laboratories and inspection .

c) Whenever samples Shall be made ,it is necessary to note down the type or class of concrete in question , the date and time of extraction , the identification number of the specimens molded with the sample , the required place of extraction referred to shall be recorded structure and the structural element in question , the concrete temperature at the time of extraction , and any other information needed to complete the identification of the concrete from the sample Which was Obtained . Entered All These data are on a register of cylinders Which must have the CONTRACTOR work continuously updated.

1.3. Resistance tests conducted to judge the uniformity and quality of concrete placed at Work

a) Shall mean a test result to the average of the resistances of the specimens molded with the same concrete sample and tested at the same age . In general, these specifications establish the average resistance of two specimens tested at the age of 28 days or younger specified in each case to judge the quality of the concrete.

b) All specimens were cured under standard conditions of humidity and temperature

c) Samples shall be taken at least 4 (four) per slab or part of the structure indicated by the Works Management .
It means shows the molding of two (2) cylindrical specimens , which must be extracted from the same batch simultaneously; ie the minimum number of samples to be taken by slab is 8 (eight).

CONTROL TEST:

Depending on their nature:

-Destructive: determine the strength by breaking
concrete test pieces or parts.
-Nondestructive: determine the quality without destroying
the structure.

TOLERANCES:

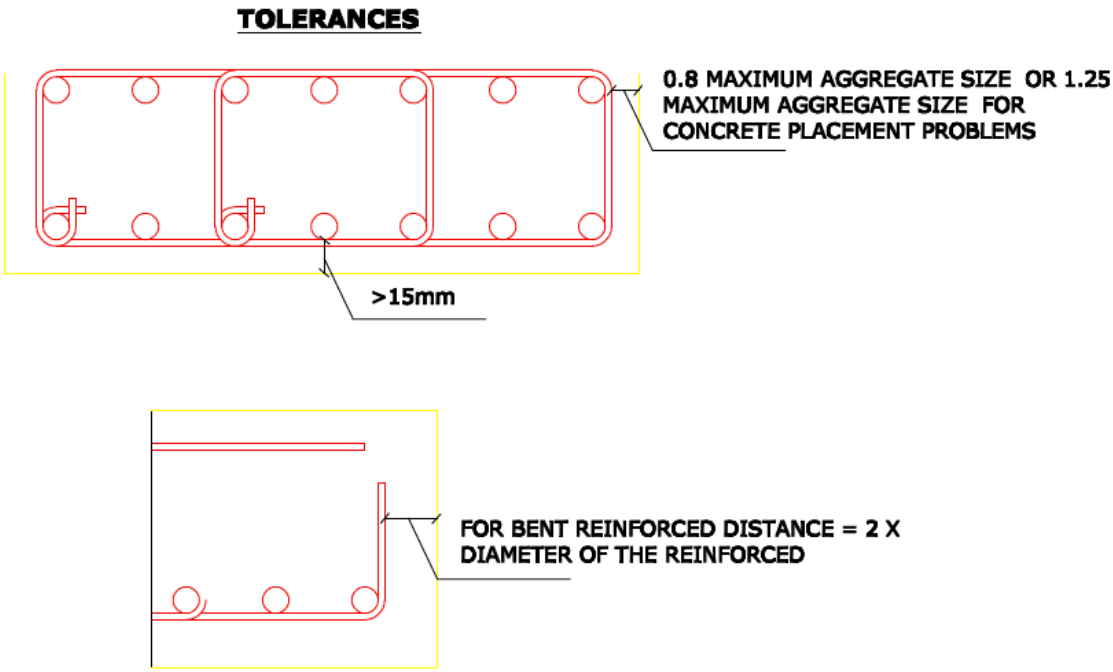


Fig 8 . *Slab section*

2.1.7 DETAILS

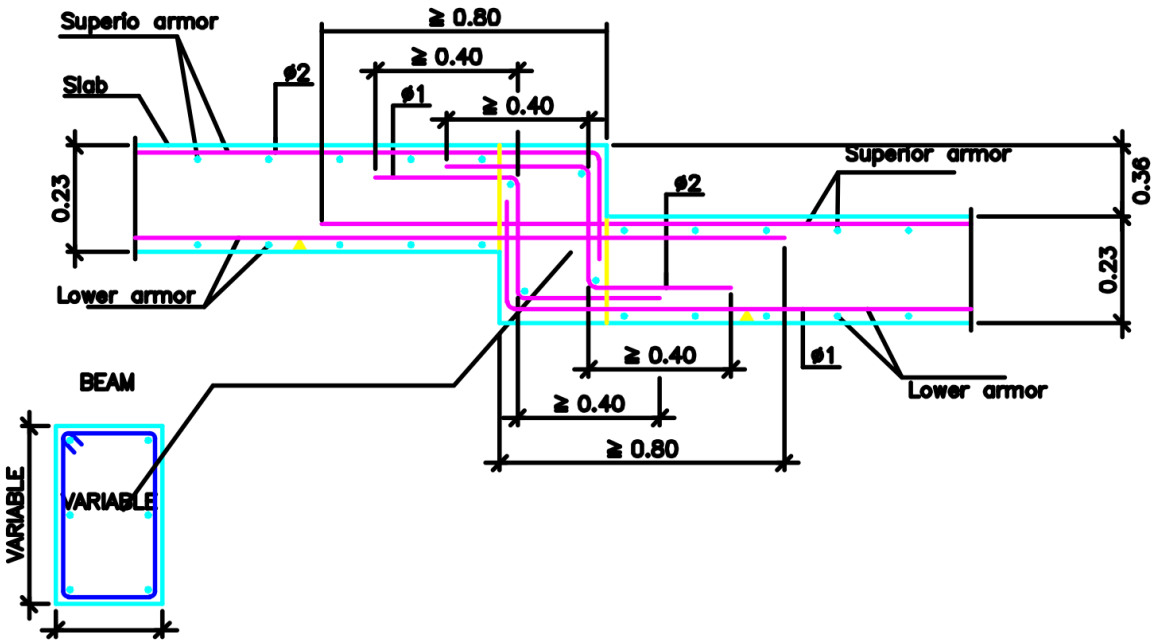


Fig 9. *Change slab level*

2.1.8 CALCULATION OF QUANTITY OF WORKS AND PRICE

Table 3. *Budget of slab*

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
m2	Continuous system formwork reinforcement concrete slab Consist of : props, Metal girders and formwork surface treated wood Reinforced rods and profiles .	1.100	14.78	16.26
m	Expanded polystyrene molt to ledge	0.100	8.81	0.88
Ud	Approved for solid slabs separator	3.000	0.08	0.24
kg	Corrugated Steel bars, UNE-EN 10080 B 500 SD, developed in industrial workshop,various diameters.	22.000	0.92	20.24
m3	Concrete HA-25 / B / 20 / IIa, manufactured in central.	0.2420	76.88	18.60
h	Official 1st structure worker	0.527	18.10	9.54
h	Structure assistant	0.527	16.94	8.93
%	Auxiliaries	2.000	74.69	1.49
%	Indirect costs	3.000	76.18	2.29
			TOTAL X METERS	78.47
			TOTAL METERS	813.98
			TOTAL PRICE	63873.011

**Decennial maintenance cost: 3.92€ in the first 10 years.

TOTAL COST FOR SECOND FLOOR: **63.873,011 €**

SURFACES CHEKING OF SECOND FLOOR:

1) Common área: 67,12 m^2
   Rooms apartment: 61,1 m^2
   Rooms apartment: 67,98 m^2
   Rooms apartment: 51,67 m^2
   Rooms apartment: 67,5 m^2

TOTAL: 67,12 + 61,1 + 67,98 + 51,67 + 67,5 = 315,37 m^2

2) Rooms apartment: 67,36 m^2
   Rooms apartment: 51,60 m^2
   Rooms apartment: 51,60 m^2
   Rooms apartment: 71,34 m^2

TOTAL : 67,36 + 51,60 + 51,60 + 71,34 = 242, 9 m^2

3) Rooms apartment: 74,74 m^2
Rooms apartment: 51,55 m^2
Rooms apartment: 68,88 m^2
Rooms apartment: 61,54 m^2

TOTAL: 74,74 + 51,55 + 68,88 + 61,54 = 256,71 m^2

TOTAL SECOND FLOOR: 315,37 + 242,9 + 256,71 = 813,98 m^2

2.1.9 TECHNICAL- ECONOMIC INDICATORS

1. Quantity of Works: 813.98 m^2
2. Instalation cost: 63873.011 €
3. Duration of Works: 7 days
4. Wage:

- Official 1st structure :

8 h/d x 7 days = 56 h.

56 h x 18.10 € = 1.013,6 €

- Structure assistant:

56 h x 16.94 € = 948.64 €

It has made the full financial calculation of the 2nd floor slab as it is " slab type " , but the buildings consist of 10 slabs in full:

- Slab 1-7: 813.98 m^2
- Slab 8: 806.78 m^2
- Slab 9: 644.72 m^2

So, it has to be calculated the totally of money:

- Slab 1-7: 813.98 m^2 x 78,47 €/ m^2 = 63.873,011 x 7 = 447.111,07 €
- Slab 8: 806.78 m^2 x 78,47 €/ m^2 = 63.308,03 €
- Slab 9: 644.72 m^2 x 78,47 €/ m^2 = 50.591,18 €

TOTAL: 447.111,07 + 63.308,03 + 50.591,18 = **561.010,26 €**

2.2 TECHNOLOGIAL CARD II. INSTALLATION OF FOUNDATION PILES.

2.2.1 GENERAL DESCRIPTION

This deep foundation qualifies as easily implemented and warranty resistant behavior.
It is a reinforced concrete support a large length relative to its cross section, in this case, is constructed "in situ" in an open cavity in the ground.
. The concrete piles must possess certain characteristics, since it will not be vibrated:
- High resilience against segregation
- High plasticity and good cohesion
- Good flow and ability to self-compacting
- Sufficient workability during the pouring process, including withdrawal, if any, of interim cased.

Among the advantages of this system, we can state :

- There is no waste of material.
- The equipment is simpler, less bulky and easier to transport
- Allows widen the pile tip , so improve bearing capacity.

Drawbacks:

- Concrete can be mixed with water , sand or mud , may diminish its strength.
- During the commissioning phase of concrete , armature displacement may occur , so that the coating it could be insufficient.
- if not have passed the enough time to the piles harden, the implementation of new piles may be detrimental to the already executed.

<u>BORED PILES WITH CONTINUOUS FLIGHT AUGER :</u>

It is considered inside of system of drilling piles of rotation with spin helix. A helix in wich shaft there is a hollow tube, through which the concrete is poured while the propeller is being pulling out.
This procedure is often used in cases of unstable ground.
The helix is continuous and the hollow shaft is provided with a closure device to prevent entry of land or water during drilling.
The feed and speed of rotation of the auger is adjusted to terrain features to maintain the stability of the walls of the borehole.
In this case the armor of pile is put available once this has already been fully concreted, introducing it in fresh concrete. The depth of the reinforcement in the fresh concrete will be greater than 6 meters or 9 diameters.
The concrete used is a characteristic strength of 250 Kp / cm2 (HA-25), placed by pumping , it has fluid or liquid consistency, so that the development of concrete superplasticizers have been incorporated.

The concrete, in the mouth of the propeller, reaches a higher pressure than the external, to completely fill the gap left by the extraction of drill.

The diameter of piles, in this case, are 80 cm and 60 cm and the depth is 8 m.

IMAGE 3 . *Continuous flight auger equipment*

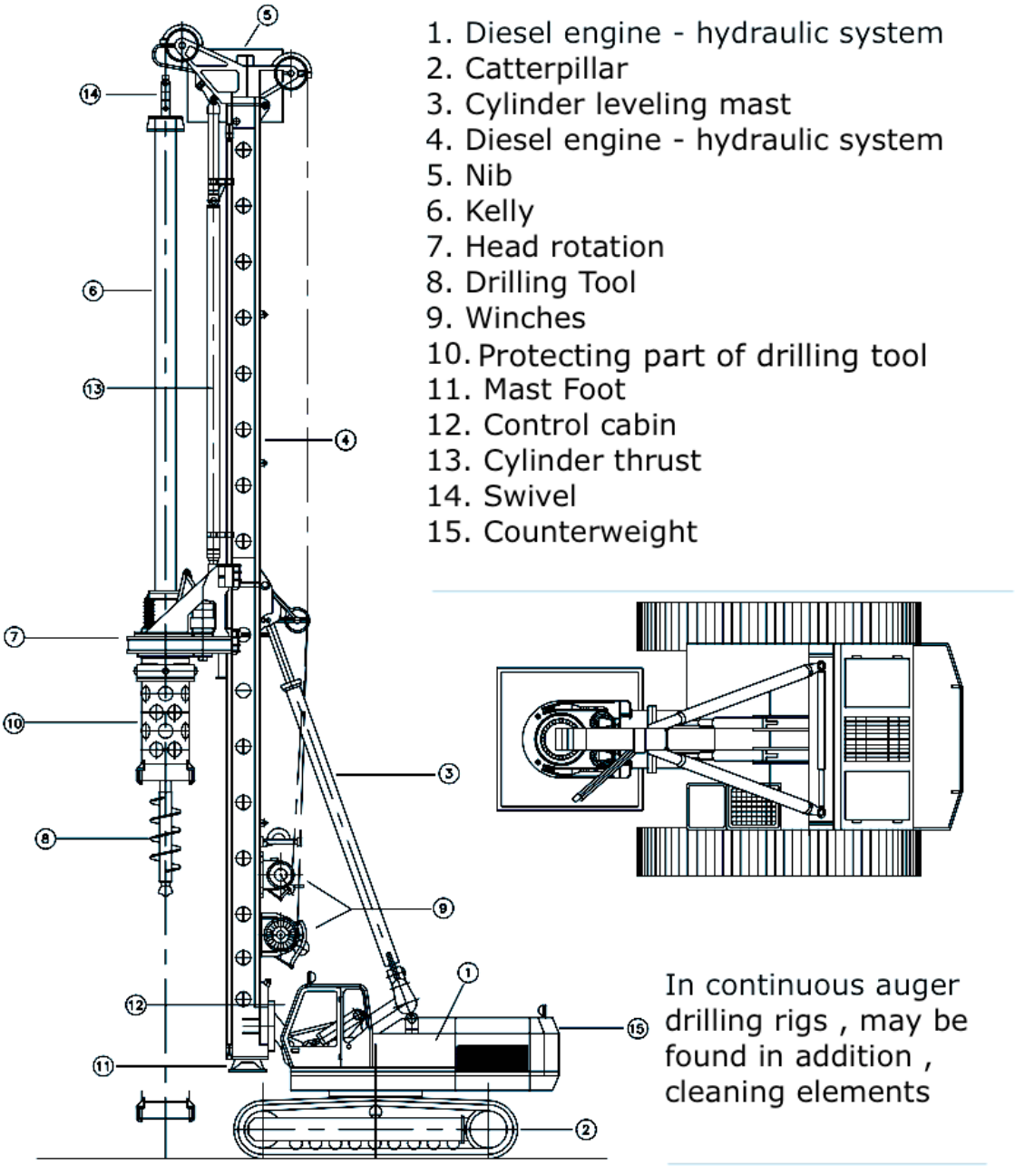


Fig. 10 . *Parts of continuous fligth auger*

Drilling elements continuous auger :

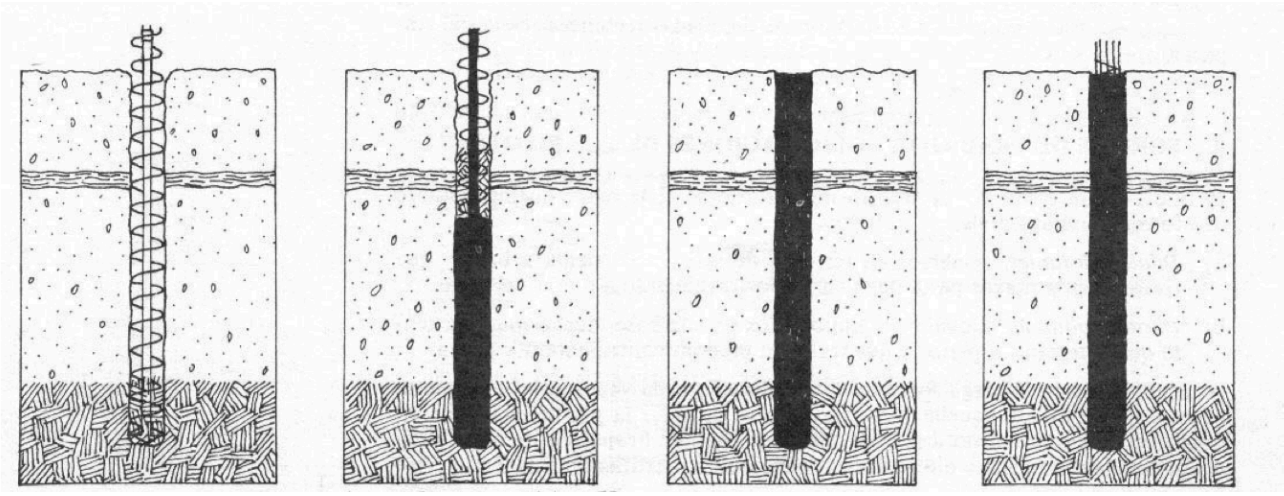
1. Auger tuve
2. Blockage
3. Supply concrete
4. Detritus
5. Concrete

2.2.2 DESCRIPTION OF TECNOLOGY AND SEQUENCE OF WORKS

The basics components of foundation are:

- Concrete HA-25
- Iron armors B500S

CONSTRUCTION SEQUENCE:



1. PILE DRILLING

2. CONCRETING AND EXTRACTION OF LAND AT THE SAME TIME

3. CONCRETE PILE

4. STEEL CAGE PLACEMENT IN FRESH CONCRETE

IMAGE 4. *Sequence of Works of foundation*

SLAB LIKE PILE CAP:

To complete the solution of piloting, must run in the top of the pile , after removal of excess layer of concrete, the pile cap (beam head), that is going to be a monolithic slab of 23 cm, thus uniting all piles.
The pile cape makes that the piles work together. The reinforced are placed in the three directions (EHE-08) .

The reinforced of several piles are constituted, according to the EHE-08 , by:

Reinforcement type :
· Longitudinal Armor Ø 20 cm:
- Principal of positive moments , on the lower face
- Principal of negative moments , on the upper face (always appear when there is wall above)
- Reinforcement of positive moments in underside (if necessary)
- Reinforcement of negative moments in top face (if necessary)
- Bars bent (if necessary)

· Transverse armor Ø 18 cm:
- Transverse reinforcement of distribution perpendicular to the longitudinal reinforcement.

The slab will have a depth of 30 cm and 3 tie beams 30x40 cm and 6.13 m in length is going to be made.

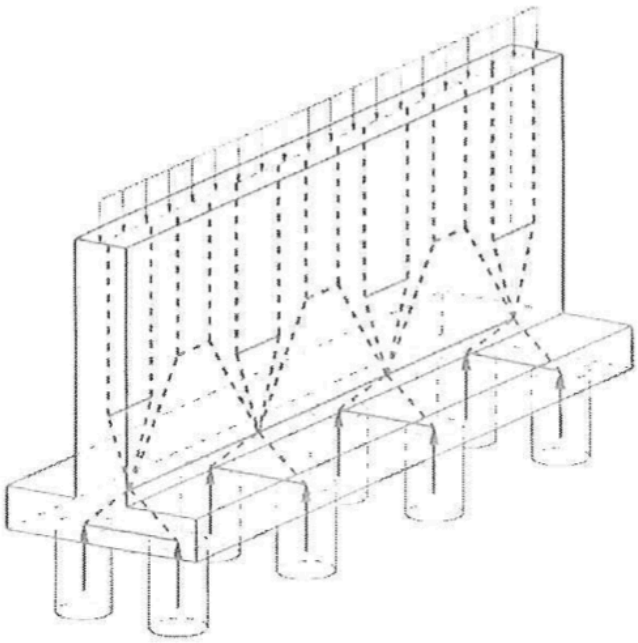


IMAGE 5 . *Distribution charges from Wall to slab foundation and piles*

2.2.3 HUMAN SAFETY

The work will be carried out in accordance "with health and safety rules in construction request".

➢ Risks:

- Fails of personal at the same level
- Fails of people within the pile
- Stepping on objects
- Shock and incorrect operation of excavation equipment
- Cuts with sharp edges of the armor
- Overexertion in awkard positions
- Interference with underground pipes

➢ Preventive Measures:

- Work area marked and delimited.
- Maintain order and cleanliness in the work area.
- Removing the perforated ground.
- Maintain eye contact between the driver and assistant.
- Light and sound signaling of vehicles.
- No pass behind moving machines.
- Wear reflective clothing.
- Work platform have to be stable, horizontal, no subsidence and compact ground.
- The equipments will have their grounding and switches differential.
- The electric assembly and disassembly are made by authorized personnel and qualified.
- Maintain connections and cables properly.
- Perfectly drive the ground rod in the ground.
- Protect electrical cables in passageways of machinery.
- Reinforcement will have wooden block to avoid their moving.
- The elements of lifting loads must be reviewed periodically.
- Trespassing under suspended loads.
- No stockpiles less than two meters excavated áreas.

➢ Signage

- Prohibition sign: prohibited certain conduct.
- Mandatory sign: forced certain behavior
- Warning sign: Warning of a certain behavior.
- Signs relating to firefighting equipment.
- Signs of rescue or relief.
- Light and acoustic signals.
- Risk of falling, shocks, bumps.
- Traffic routes.

- Storage areas for dangerous substances and preparations.
- Emergency situations.
- Dangerous maneuvers

➢ Collective protections

- Solid Surface security based planking .
- It is forbidden to store or collect materials up to 2 meters away. as a general rule .
- Avoid falling objects or tools at different levels within the gap.
- Security fence around work area with a height of 2 mts.

➢ Individual protections

- Approved safety helmet .
- Boots for rainy weather.
- Safety footwear .
- hearing Protection
- High Visibility Clothing
- gloves
- Safety glasses display
- Safety harness

2.2.4 MATERIAL- TECHNICAL RESOURCES

- Materials:

- Concrete (Cement , water , steel, fine aggregate and coarse aggregate)
- Armor steel .
- To protect armor .
- Pallets .

- Aids :

- Ladder : for access to perform the assembly of the machine.

- Vibrators or pinchos: are used to introduce the armor in the continuous auger.
- Lifting elements : ropes , cables , chains , slings , hooks .
- Hose connection of concreting.

- Equipment:

- Excavators : prepares the work platform. Remove the lands and carries heavy objects.
- Gondola : transports drilling equipment.
- Group of oxyfuel and welding : welding and cutting equipment for iron.

- Crane : Loading and unloading material and raises the reinforcement and inserted into the pile.
- Concrete pump : pump the concrete to the top of the auger. It has a hopper where the concrete is pouring by the truck.
- Concrete mixer truck : transports concrete.

• Tools:

- Hammer
- Pliers
- Stakes
- Corrugated steel bars
- Chalk
- Rope to tighten

IMAGE 6 . *Hose attachment for concreting*

Table 4. *Material- technical resources for installation of piles.*

MATERIALS	UNIT	QUANTITY
Concrete	m3	1225,6
Steel reinforcement	kg	1945,8
Pallets	m2	895.2
AIDS		
Vibrators	unit	2
Lifting elements	unit	2
Hose connection of concreting	unit	1
EQUIPMENT		
Concrete mixter truck	unit	2
Gondola	unit	2
Concrete pump	unit	2
Crane	unit	1
Continuous flight auger	unit	2
Excavators	unit	2
Group of oxyfuel and welding	unit	2
TOOLS		
Hammer	unit	12
Metal roulette	unit	2
Levels	unit	1
Crowbar	unit	3
Theodolite	unit	1
Visor welding	unit	2
Metal brushes	unit	3

2.2.5 ORGANIZATION WORKS

	May						June																						July			
	week 3	week 4					week 5					week 6					week 7					week 8					week 9					week 10
Working days	22	25	26	27	28	29	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	30	1	2	3	6
Instants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Drilling Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Drilling Ø 0.6 m	1	1	1	1	1	1	1	1																								
Withdrawal and concreting Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Withdrawal and concreting Ø 0.6 m	1	1	1	1	1	1	1	1																								
Steel cage Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Steel cage Ø 0.6 m	1	1	1	1	1	1	1	1																								
Red sanitation																			2	2	2	2	2	2	2							
Slab GF																										10	10	10	10	10	10	10
TOTAL Official	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3	3	3	5	2	2	2	2	2	2	2	10	10	10	10	10	10	10

TOTAL DAYS: PILES 18 days
FOUNDATION 32 days

Therefore , the piles begin at once, but the piles in diameter 0.6 m, are finished 10 days before the diameter of 0.8 m .
Just after the complete execution of piles , you start to run the sewer and once completed, that time will be 7 days, begins the slab foundation, which duration is seven days and resources are 10, divided into 2 groups of 5 is made :
- 3 officers and 2 pawns (each group).
The three tie beams , which are the foundation slab were carried out while the slab , that ' s therefore are included in the time and cost of the slab.

2.2.5 QUALITY CONTROL

In addition to direct methods (visual inspection and geotechnical drilling), there are several indirect tecnics for abnormalities in the foundation piles techniques.

Test sonic transparency in deep foundations (sonic survey, sonic test, cross-hole or crosshole). Detects and pinpoints abnormalities (faded, pollution, inclusion, ..., etc.). Is studied the ultrasound propagation between pairs of metal pipes embedded in the concrete putting inside in them probes.

Echo test (conventional hammer). Evaluates the length of the element by measuring the time between impact and its reflection time. Head is placed in an accelerometer and it is hit it with a conventional hammer. Requires hit on healthy concrete.

Testing of mechanical impedance in deep foundations (hammer with force sensor). In addition to length, by measuring the impact and vibratory response assesses the interaction with the terrain and section changes and / or quality of the material. Is placed on head a geophone and is hit with an instrumented hammer. Requires hit on healthy and smoothed concrete.

The piles are constructed according to the following ranges of tolerances:

a) The eccentricity of the axis of the pile relative to the set position, should be less than 10 cm, for piles with a diameter up to one meter (Ø ≤ 1.0 m) and tenth (1/10) of the diameter otherwise, but always less than 15 cm.
b) For vertical slope inclination error piles should not exceed two percent of the value of the slope.

1. Soil behavior will be observed during drilling just checking that the conditions assumed are presented in the Geotechnical Report included in the Annual Report.
2. If obstacles during drilling are found, these will be removed by mechanical means. Explosives are not permitted within the bore. Is not allowed either the washing operation.

Concreting

1. The concreting of piles must be to keep in mind that it is done without generating air bags or water holes, cuts or bottlenecks.
2. The heads of concreting should be greater than 0.5 D, (where groundwater level 1.5 D), where D is the diameter of the pile.
3. If while demolition is observed that removal of the top was not enough to remove all deteriorated concrete and poorly done, the demolished concrete is replaced with new concrete, well adhered to the former. All these operations must be borne by the contractor.
4. The concrete is performed without interruption, so that if it happens to be performed with two successive masses and the first, it starts curing, the manager will decide if the work is valid or, if need be rejected The pile should be filled again.

5. The portion of filling after the rejected pile can run with lean concrete, but implementation will be done with the same care as if it were a pile undergoing charges.

Tolerances

It is impossible to place the piles at the point or the exact angle you have indicated in the project, because they tend to depart or deviate when they find hard or soft spots in the field. The plans and specifications must tolerate a displacement of 5 cm at the top of the small piles driven into the ground and 15 cm (and sometimes more) in driven piles through the water. A collapse or angularity on the axis of the pile 1 or 2 percent, relative to the length of the pile , no generally affects their capacity and , therefore , should be permitted in the project and specification . Commonly larger tolerances are allowed, if load tests show that the piles can withstand the loads safely.

1. The position of the piles in the ground , after being built , must not differ more than 10 cm . That is, the error is not greater than 2% of the length of the pile .
   Should make cleaning treatments and background .

2. The excavation will proceed to the extraction of cuttings that have been stored in the bottom of the cavity. In large diameter piles , down from an operator is performed to measure such cleaning.

2.2.6 DETAILS

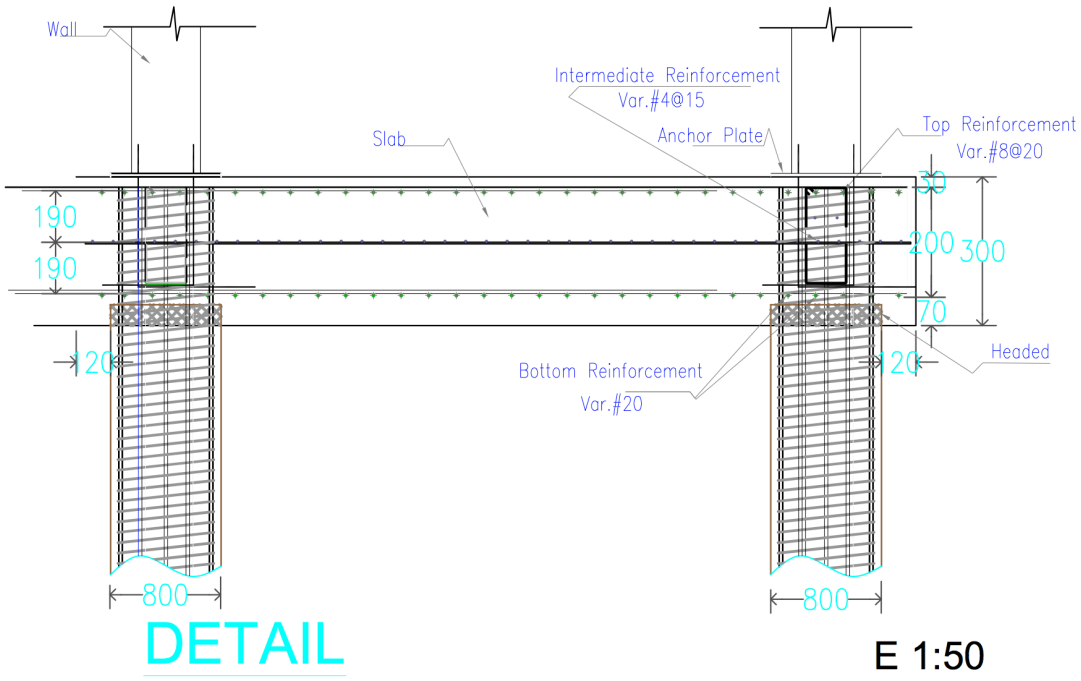


Fig. 11 . *Detail section of piles and slab joint*

2.2.7 CALCULATION OF QUANTITY OF WORKS AND PRICE (BUDGET)

2.2.7.1 Drilling and concreting pile for core tube auger

Table 5 . *Technical economic indicators of drilling and concreting piles*

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
Ud.	Aprproved separator for piles.	3,00	0,09	0,27
Kg	Corrugated steel bars, UNE-10080 B500S, made in industrial workshop, several diameters.	9,400	0,92	9,40
m3	Central concrete HA-25 / F / 12 / IIa	0,420	82,88	34,81
h	Paragraph full drilling equipment and drilling concrete pile central auger tuve CPI-8	0,146	175,00	20,30
h	Stationary pump for pumping concrete	0,065	55,91	3,63
h	Steel worker	0,735	18,10	13,30
h	Steel helper	0,735	16,94	12,45
%	Auxiliary works	2,00	94,28	1,89
%	Indirect costs	3,00	96,17	2,89
Ten-year maintenance cost: 1,83 in first 10 years			TOTAL X METER	99,06

2.2.8 TECHNICAL- ECONOMICS INDICATORS

2.2.8.1 Drilling and concreting pile for core tube auger.

1. Quantity of Works:

Ø 80 cm : 0.8 x 8 = 6,4 m^3 x 145 piles = 928 m^3
Ø 60 cm : 0.6 x 8 = 4,8 m^3 x 62 piles = 297,6 m^3

TOTAL CONCRETE : 1.225,6 m^3
TOTAL PILES : 145 + 62 = 207 piles

2. Installation cost:

1225,6 m^3 x 99,06 € = 121.407,936 €

3. Works duration: 18 days

4. Wage:

- Steel worker:

18 days x 8 h/d = 144 h.
144 h x 13,30 = 1.915,2 €

- Steel helper:

144 h x 12,45 = 1.792,8 €

- Drilling equipment and drilling concrete pile:

919,2 m^3 x 20,30 = 18.659,76 €

2.2.8.2 Slab.

Table 6 . *Technical economic indicators of slab joint*

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
Ud	Separator approved for foundations	5,00	0,13	0,65
kg	Corrugated steel bars , UNE -EN 10080 B 500 SD , developed in industrial workshop , various diameters.	85,00	0,92	78,2
m3	Concrete HA- 25 / B / 20 / IIa , manufactured in Central	1,05	76,88	80,72
h	Pump truck parked on site, for pumping concrete .Iclusive w / w of displacement	0,041	170	6,97
h	Vibrant Rule of 3 m .	0,34	4,66	1,56
h	Official 1ststeel worker	0,217	18,1	3,66
h	Steel helper	0,217	16,94	3,42
%	Aids	2,00	193,34	3,36
%	Indirect costs	3,00	197,21	5,15
Decennial maintenance cost : € 5.30 in the first 10 years.			TOTAL	203,13

2.2.8.2 Slab.

1. Quantity of Works:

788,78 m^2 x 0,30 m = 236,634 m^3

2. Installation cost:

236,634 m^3 x 203,13 € = 48.067,46 €

3. Works duration: 7 days

4. Wage:

Construction helper:

- Official 1 st Steel worker:

7 d x 8 h/d= 56 h.

56 h x 3,66 = 204,96 €

- Steel helper:

56 h x 3,42= 191,52 €

2.2.8.3 Slab formwork system

Table 7 . *Technical economic indicators of slab formwork system*

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
m3	Shuttering wood , 26 mm thick, foundations.	0,01	255,00	2,55
kg	Galvanized wire to tie , 1.30 mm in diameter.	0,01	1,10	0,01
kg	Steel tips 20x100 mm	0,40	7,00	0,28
h	Official 1st formwork installer	0,30	18,10	5,48
h	Formwork installer assistant	0,30	16,94	5,13
%	Aids	2,00	13,45	0,27
%	Indirect costs	3,00	13,72	0,41
			TOTAL	14,13

2.2.8.3 Slab formwork system

1. Quantity of Works:

   788,78 m^2 x 0,30 m = 236,634 m^3

2. Installation cost:

   236,634 m^3 x 14,13 = 3.343,64 €

3. Works duration: 3 days

4. Wage:

- Official 1st formwork installer :

3 d x 8 h/d = 24 h.

24 h x 5,48 = 131,52 €

- Formwork installer assistant :

24 h x 5,13 = 123,12 €

2.2.7.3 Beam formwork system.

Table 8 . *Technical economic indicators of beam formwork system*

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
m3	Shuttering Wood, 26 mm thick, foundations	0,02	255,00	5,1
Kg	Galvanized wire to tie, 1.30 mm in diameter	0,120	1,10	0,13
Kg	Steel tips 20x100 mm	0,05	7,00	0,35
h	Steel worker	0,707	18,10	12,80
h	Steel helper	0,707	16,94	11,98
%	Auxiliary works	2,00	30,36	0,61
%	Indirect costs	3,00	30,97	0,93
		TOTAL		31,90

2.2.8.3 Beam formwork system

1. Quantity of works:

0,3 x 0,4 = 0,12 m^2
0,12 x 6,13 m = 0,736 m^3
0,736 m^3 x 3 beams = 2,208 m^3

2. Installation cost:

2,208 m^3 x 31,90 € = 70,435 €

3. Works duration: 30 mins.

4. Wage:

- Steel worker:

0,5 h x 12,80 = 6,4 €

- Steel helper:

0,5 h x 11,98 = 5,99 €

2.2.8.4 Concrete for beams

Table 9 . *Technical economic indicators of concrete for beams*

Ud	**Decomposition**	**Yield**	**Unit Price**	**Price(€)**
Ud	Approved separator for piles.	10,000	0,13	1,30
kg	Corrugated steel B 500 S	60,000	1,00	60,00
m³	Central concrete HA-25	1,050	76,88	80,72
h	Steel worker	0,061	18,10	1,10
h	Steel helper	0,061	16,94	1,03
%	Auxiliary works	2,000	144,15	2,88
%	Indirect costs	3,000	147,03	4,41
Ten-year maintenance cost: € 1.32 in the first 10 years.			TOTAL	151,44

2.2.8.4 Concrete for beams

1. Quantity of works:

0,3 x 0,4 = 0,12 m^2
0,12 x 6,13 m = 0,736 m^3
0,736 m^3 x 3 beams = 2,208 m^3

2. Installation cost:

2,208 m^3 x 151,44 = 334,379 €

3. Works duration: 30 mins.
4. Wage:

- Steel worker:

0,5 h x 1,10 = 0,55 €

- Steel helper:

0,5 h x 1,03 = 0,515 €

2.3. TECHNOLOGICAL CARD III. INSTALLATION OF ROOF COVERING

2.3.1 GENERAL DESCRIPTION

The roof consists of the following layers:

- Monolithic reinforced concrete slab
- Layer primer
- PE steam insulation (vapor barrier) .
- Layer slope formation of clay (dry sand)
- Regularization layer
- 25 cm of polystyrene
- PE modified waterproof .
- Geotextile
- Gravel

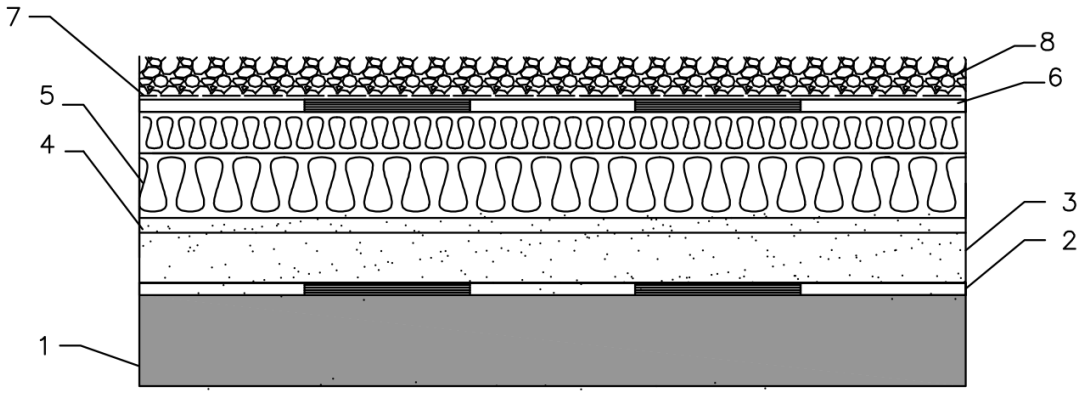


Fig 12 . *Layers of roof*

1. Slab
2. Vapor barrier
3. Layer slope formation
4. Regularitzation layer
5. Insulation layer of polystyrene (25 cm)
6. Waterproof layer
7. Geotextile
8. Layer protection (gravel)

Thermal insulation materials must be protected from rain, snow, ice and mechanical damage during construction.
The insulation must be installed so that the layers can withstand strong compression with each other and the adjacent load of the structure.

Where the insulation is attached to the concrete structures need to work with extreme caution.
The insulation must touch the ground along the entire surface and should be positioned so that it will not move during concreting.
In the case of multiple layers as insulation, they overlay one another.
Layers and pipes and ventilation must be installed in accordance with the project.

The execution must be reviewed and approved before each of the following phases.

During the installation of insulation coatings must be protected from mechanical damage , water , snow , ice and additional charges that may be damaged .No can be wavy or jagged .

Roll coating the ceiling must be installed in accordance with design drawings according to roofing, etc. materials used in the requirements and / or manufacturer's recommendations. The structure must be strong and smooth. Insulating layers can not be damaged.

Gradients:

Ceiling gradients must comply with the drawings. The slope of rainwater is 3.5%.
The roof must be built properly so that no water accumulates on it .

Mechanical strength :

The coating should resist wind suction , at least as shown in the construction specifications .
In order to ensure adequate resistance to wind uplift be suitable for fixing on the roof of the overlays .

Steam insulation :

Steam insulation film modified PE 0.2 mm must be installed on a concrete slab .
Vapor barrier must be installed along the entire roof edge sealed .

Thermal insulation:

The thermal insulation must be resistant to decay from non-combustible inorganic materials impervious to moisture.

Thermal insulation materials must be protected from rain, snow, frost and

mechanical damage during construction.

The insulation must be installed so that the layers of heavy compression with each other and adjacent structures.

Places where insulation is fixed to the concrete structures need to work with extreme caution.

The insulation must touch the ground along the entire surface must have sufficient strength and compression load with acceptable deformations.

Even the insulation must be protected from moisture and heat during the day by isolation, why they should be covered and sealed with a single layer of waterproofing.

Stormwater drainage:

Drainage system of rainwater to ensure the supply of water to the maximum intensity of the rain.
The diameter of the pipes must be at least 110 mm.
On the facade it must be equipped with emergency rainwater to the conclusion that there is flooding due to high rainfall intensity or sewage system failure.
All tubes and lines that cross the ceiling should be well sealed and waterproof or moisture.

The area of total roof is 644.72 m^2

2.3.2 DESCRIPTION OF TECHNOLOGY AND SEQUENCE OF WORKS.

1. Primer coat the entire surface.
2. Stakeout hip roof and valleys roof.
3. Placing insulation layer (PE) on all sides and over the entire surface of the slab and fixing air duct.
4. Placement manufactures edge (protruding structure) and sealed.
5. Execution of valleys roof and hip roof.
6. Implementation of slope formation.
7. Layer regularization.
8. Geotextile
9. Polystyrene
10. PE modified, layer waterproofing.
11. Placement PE.
12. Geotextile.
13. Gravel.

Image 7 and 8 . *Placement of insulation layer and gravel.*

2.3.3 HUMAN SAFETY

It can be found different risks:

- Bumping into objects
- People fail at same level
- Peoples fail different level
- Hurts by handling objects and hand tools
- Particles in the eyes
- Dermatitis (conctact with cement)
- Objects failling on persons
- Moves of charges
- Electrocution
- Direct contact with lines of high tension
- Inadequate illumination
- Footsteps on sharp objects
- Sudden collapse
- Overexertion

➢ Preventive Measures

- Load distributing materials collection
- All workers should have full knowledge of health and safety standards to perform the work.
- If missing natural lighting, work areas must be provided for artificial light, which worked less than 24 V and protected by insulated handle. The minimum illumination of 100 lux will be placed 2 meters from the ground.
- Order and cleanliness in the work area. Stockpile areas concerned.
- To avoid overexertion, workers must go changing position.
- Workers must wear a safety harness attached to a safety point.
- Workers must be used properly working equipment, tools and materials, which will be provided with the rules of correct use.
- Each employee must use the appropriate personal protective equipment.

➢ Collective protections

- Safety nets.
- Resistant railing at least 90 cm , will handrails, intermediate and baseboard.
- The horizontal rails and vertical networks , to protect the holes.
- Safety harness all workers , lifeline.

➢ Individual protections

- Safety helmet with ventilation holes.
- Anti -slip footwear.
- Glasses anti - particles.
- Red adjusted and non-flammable.
- Belts.
- Arnes anti- falls for work at height.

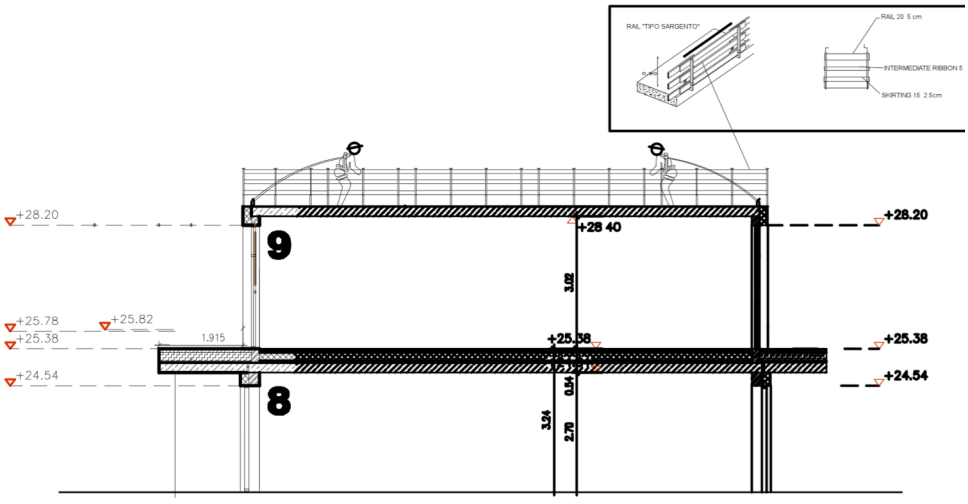


Fig 13. *Protections for workers at height (roof)*

2.3.4 MATERIAL- TECHNICAL RESOURCES

- Materials:

- Clay (to make gradient).
- Polystyrene
- Roller material
- Mixture of propane-butane
- Polyester
- Cement morter
- Bitumen primer
- Tin coating curved profiles

- Equipment:

- Crane
- Sealing equipment special additional burner
- Multiple gas burner

- Tools:

- Roller
- Wheelbarrow
- Brush
- Rubber brush
- Roulette
- Marker
- Hammer

Table 10 . *Material technical resources of roof*

№	**Materials**	**Units**	**Quantity**
1	Clays	m3	48.35
2	Polystyrene flat roof	m2	676.956
3	Roller material	m2	676.956
4	The mixture of propane-butane	kg	891.44
5	Polyester	m2	676.956
6	Cement mortar	m3	19.34
7	Bitumen primer	M2	709.192
8	Geotextil	M2	676.96
9	Gravel	t	116
	Machinery / Tools	**Units**	**Quantity**
1	Tower crane	unit	1
2	Multiple gas burner	unit	2
3	Sealing equipment special additional burner	unit	2
4	Roller	unit	2
5	Wheelbarrow	unit	2
6	Brush	unit	4
7	Rubber rush	unit	4
8	Roulette	unit	4
9	Marker	unit	4
10	Hammer	unit	4
11	Fork	unit	4

2.3.5 ORGANIZATION WORKS

	Feb.														
	week 33					week 34					week 35				
Working days	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26
Instants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Primer layer ,Replanned of gradient	4	4													
Placement of vapor barrier			3	3											
Brick placement on edge					6	6									
Execution of valley roof and hip roof							6	6							
Execution gradient formation									7	7					
Leveling screed + geotextile											6	6			
Placement thermal insulation (25cm)													2	2	
Steam insulation waterproof													5	5	
Geotextile + Gravel															4
TOTAL Oficiales CB	4	4	3	3	6	6	6	6	7	7	6	6	7	7	4
TOTAL DAYS : 15 days															

	week 35															
Working days	day 13								day 14							
Instants (hours)	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Thermal insulation polystyrene 25 cm	2								2							
Steam insulation waterproof					5								5			

Due to the high percentage of rain in Vilnius (Lithuania) , the vapor barrier should be placed immediately after placing the thermal insulation, so the day was divided into hours , and in the same aunt, the layer of thermal insulation (polystyrene 25 cm) , and immediately after placement of the vapor barrier will take place . The duration will be :

- Four for thermal insulation (per day) .
- Four hours a vapor barrier (per day) .

So, the eight hours of work a day are achieved.

2.3.6 QUALITY CONTROL

According to Decree 59/1994 of May 13, which regulates the quality control of the building and its use and maintenance, to define:

- Criteria for receipt of materials to be controlled.
- Lots, test samples and corresponding tests and docmentación (certificates, seals, etc.) that suppliers must provide.
- The criteria for acceptance or rejection of lots.

If the technical direction of the work decides it is necessary to increase the minimum tests or tests described in Quality Control Program, these trials / tests were conducted on other components involved in the work to be done.

The materials being objective of control, shall comply:
- Criteria reception
- Criteria for acceptance or rejection
- Documentation for the end of the work
- Reception control (documentary control)
- Control execution

The cover must meet the test of sealing service.

- Range of application: all flat roofs be objective of control, regardless of the material used as waterproofing.
- Definition of the event: the leak test will be held by flooding for 24 hours at least; or for 48 hours, continuous watering. (Article 5.2. Basic Building Standard NBE Q-90).
- Criteria for acceptance or rejection, if moisture appear during watering or 48 hours, the cover will be rejected. Otherwise, it be accepted.

* Document establishing certification of the materials used, according to NBE Q-90, on roofs with bituminous materials.

Economic evaluation of the program.
- Testing of Concrete
- Testing of steel
- Test sealing covered

It is necessary to control both the execution process and the material used for the execution of the cover.
It begins with the control of the slab as it support the entire top structure. Since this is a concrete structure must meet the strength required in the project.
The cover, in addition to serving to hedge against the erosion, is a structural element, which in addition to supporting its own weight, supports loads of external agents (snow, rain, wind), so you have to check the features specific materials that form it .
In the technical acceptance of materials to work should be checked quality marks, tests and requested by the standards. They must have the CE mark.

You will need to machinery and tools are prepared before starting the work.

The first thing to make is the replanned of the gradients with respective evacuation systems , previously replanned (phase structure) , then we find the corresponding hip roof and valley roof , then the vapor barrier is placed , which must be totally watertight that no water, special care should be taken in areas of critical points and edges and meetings with parapets or input and output areas (doors) for the formation of slopes used , in this case , dry sand, waterproofing sheet, with its own reinforcement at critical points , rock wool , which is placed panels along the whole cover, polystyrene placement carefully so that it reaches all points of the entire roof , geotextile separator and finally , gravel.

2.3.7 DETAILS

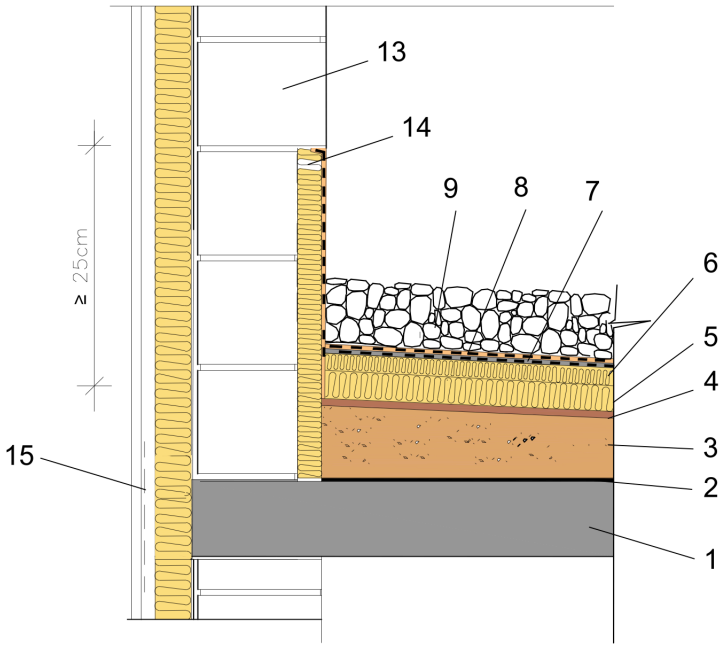


Fig. 14 . *Detail roof with parapet*

1. SLAB 23 cm
2. VAPOR BARRIER
3. EXPANDED CLAY (SLOPE FORMATION)
4. REGULARIZATION LAYER (MORTAR WITH 1:8)
5. 25 cm RIGID EXPANDED POLYSTYRENE PANEL
6. PE MODIFIED. WATERPROOF.
7. REINFORCEMENT TO WATERPROOF LAYER
8. GEOTEXTILE
9. GRAVEL
13. FACADE
14. MINERAL WOOL
15. SEPARATION MESH

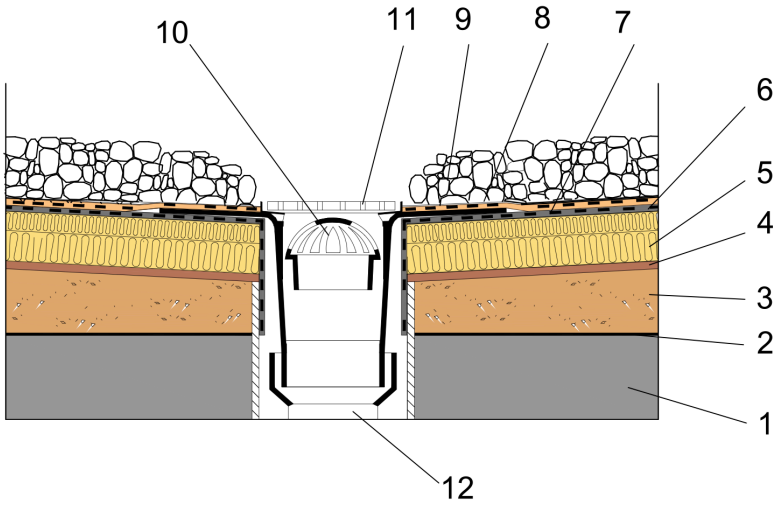


Fig. 15 . *Detail roof drain*

1. SLAB 23 cm
2. VAPOR BARRIER
3. EXPANDED CLAY (SLOPE FORMATION)
4. REGULARIZATION LAYER (MORTAR WITH 1:8)
5. 25 cm RIGID EXPANDED POLYSTYRENE PANEL
6. PE MODIFIED. WATERPROOF.
7. REINFORCEMENT TO WATERPROOF LAYER
8. GEOTEXTILE
9. GRAVEL
10. DRAIN
11. DRAIN GRATE
12. PIPE

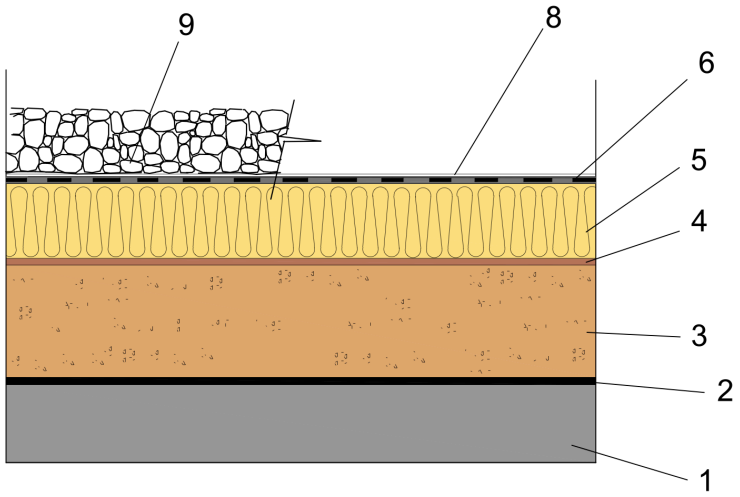


Fig. 16 . *Detail of roof layer.*

2.3.8 CALCULATION OF QUANTITY OF WORKS AND PRICE (BUDGET)

Table 11 . *Economic technical indicators of roof*

Ud	Description	Yield	Unit Price	Price(€)
Ud	Double hollow ceramic brick, for coating, 24x11,5x9 cm, according to UNE-EN 771-1	4.00	0.13	0.52
m3	Expanded clay, of 350 kg / m³ density and particle size of between 8 and 16 mm, supplied in sacks.	0.100	59.50	5.95
m3	1/3 grout CEM II / B-P 32.5 N	0.010	105.10	1.05
m2	Rigid expanded polystyrene panel, according to UNE-EN 13163, straight side machining of 20 mm thick thermal resistance 0,55 m²K / W, thermal conductivity 0.036 W / (mK) for expansion joint.	0.010	1.34	0.01
t	Water.	0.014	1.50	0.02
m2	Industrial mortar for masonry, concrete, gray class M-5 (compressive strength 5 N / mm²), supplied in bags, according to UNE-EN 998-2	0.075	32.25	2.42
m2	Geotextile fabric composed of polyester fibers bonded by needling, with a longitudinal tensile strength of 2 kN / m, a resistance to transverse tensile strength of 2 kN / m, an opening of the cone dynamic puncture test UNE-EN ISO 13433 less than 27 mm, punching resistance CBR 0.4 kN and a surface mass of 200 g / m², according to UNE-EN 13252	1.050	1.04	1.09
t	Boulders of 16-32 mm in diameter.	1.180	28.00	5.04
h	Official 1st construction.	0.485	17.24	8.36
h	Construction ordinary laborer	0.687	15.92	10.94
h	Official 1st applicator waterproofing sheets.	0.121	17.24	2.09
h	Assistant applicator waterproofing sheets	0.121	16.13	1.95
h	Official 1st insulation fitter	0.050	17.82	0.89
h	Insulation fitter helper	0.50	16.13	0.81
%	Aids	2.00	61.89	1.24
%	Indirect costs	3.00	63.13	1.89
	Decennial maintenance cost : € 16.26 In 10 Years		**TOTAL**	65.02

Flat roof not passable , not ventilated , with gravel, conventional type, slope of 1 % to 5 % , consisting of: forming slopes : expanded clay 350 kg / m³

density , poured into dry and consolidated its surface with grout cement, with the average thickness of 10 cm;waterproofing monolayer attached : sheet of elastomer SBS modified bitumen , LBM (SBS) -40 -FP , fully adhered torch ; spacer layer under protection geotextile nonwoven comprising polyester fibers together by needling , with a longitudinal tensile strength of 2 kN / m , a resistance to transverse tensile strength of 2 kN / m , a puncture strength 0.4 kN CBR and a surface mass of 200 g / m² ; protective layer : 10cm boulder 16-32 mm in diameter.

2.3.9 TECHNICAL- ECONOMIC INDICATORS

1.Quantity of works:

644.72 m^2

2. Installation cost:

644.72 m^2 x 65.02 € = 41.919,69 €

3. Works duration: 15 days

4. Wage:

8 hours / day x 15 days = 120 h.

Official 1st construction: 120 h x 8,36 = 1.003,2 €

Construction ordinary laborer: 120 h x 10,94 = 1.312,8 €

Official 1st applicator waterproofing sheets:

2 days x 8 h/d = 16 h.

16 h x 2.09 = 33,44 €

Assistant applicator waterproofing sheets:

16 h x 1.95 = 31.2 €

Official 1st insulation fitter :

4 d x 8 h/d = 32 h.

32 h x 0.89 = 28.48 €

Insulation fitter helper:

32 h x 0.81 = 25.92 €

3. ORGANIZATION PART

3.1 ANALYSIS OF CONSTRUCTION MASTER PLAN

3.1.1 DESCRIPTION OF THE TERRITORY

The plan of building loti s composing for a construction of multi-dwe lling building in Vilnius (Lithuania), Konarskio Street 12.

The preparation of territory is done before the start of the works.
Once obtained the proper permission for the occupation of public area, temporary booths are placed on the sidewalk. All the work area and the area where temporary workers are buildings will be fenced and marked to not be dangerous for pedestrians or cars. The road remains unchanged, since the occupation of the same is not necessary. In the plan of the construction site should contain:

- Construction of the main working machine.
- Material storage areas and waste.
- Temporary Electricity.
- Sanitary drinking water and sewerage.
- Fire Hydrant.
- Safety and hazardous áreas.
- Vias temporary access and passageways.
- Temporary buildings.

Previous performances:

- Cleaning work area
- Installation and signaling fenced work area.
- Prepare material storage areas.
- Temporary buildings for workers will be supplied by water and electricity. for temporary connections to the existing network.
- Prepare and out of vehicles and staff to work.
- Fence: The work will be protected by welded mesh 2 meters high and 1.5 meters wide, with concrete support. The fence is separated from the facade of a minimum of three meters, according to the Spanish legislation for pedestrians are aware of it, on the fence mesh sewn concealment.
- Access to work is independent, there will be two access for heavy vehicles of 4.5 meters and two pedestrian access 1.5 meters.

Signals:

The work has the corresponding signals, signs, fencing and security lights to indicate in advance all potential hazards.
Based on the fundamentals of the Spanish code signals:
1. The sign should be easy to perceive, visible, striking.
2. It should be understood perfectly, with clear messages as: DANGER, WARNING, HIGH.
3. Visibility:

- Daily Signs: harnessing sunlight showing: triangles, fences, red bands, etc.
- Night Signs: artificial light
- Electricity: available onslaught of electricity at low voltage, so it is not necessary transformer.
- Water supply: connection to the mains supply.
- Wastewater: connection to the General Sewerage System through PVC pipe.

3.1.2 SELECTION OF THE CRANE

This part explains why we chose our LIEBBHERR 130 EC-B6 tower crane.

Tower crane being selected in two ways:

- According to the technical parameters.
- According to economic parameters.

The location of the crane and its motion must be such that the capacity of the crane can lift the most distant elements.

Tower crane selection:
1. Length of arm
2. Lifting capacity
3. Lift height hook

We chose this crane according to technical parameters.
To perform the calculations, we have to know in advance the following parameters:

1. The size and location of the building (underground parts and excess land).
2. The weights, dimensions and location of the facility construction.
3. Working conditions (the peculiarities of the construction, soil characteristics and peculiarities of the underground structures).

First, we must determine whether they conform to the technical characteristics of the crane inequalities:
Qk> QR.
Hk> HR.
Lk> Lr

Here:
Qk - the power of the ascension of the selected crane, t
QR - ascension power required t
Lk - reach the selected crane boom, m
LR - the extent required crane boom, m
Hk - lifting height of the selected crane hook, m
HR - the necessary lifting height of hook, m

The crane technological parameters are calculated according to the construction characteristics.

Is required is the selection according to the tables of technical characteristics of the cranes.

First of all, we must check if crane technical characteristics match the inequalities:

Hr = building heigh + 3m = 31.50 + 3 = 34.50 m.

The power of the ascension of the crane:

Qr = P + PSTR = 2.5 + 0.15 = 2.65 t.

- P weight-lifting heavy construction, concrete.
- Pstr- lifting equipment, t.

The reach of the boom of the crane Lr is calculated according to our needs. The location of the crane is inside the plot, but outside the building, so do not bother during the execution of the work and from there covers a radius where it reaches the perimeter.

According to Spanish legislation:

Vehicles must be able to circulate around the work area, so they have to be free to allow the circulation of machinery, a minimum of 4.5 m steps.

- Distance between the tower crane and front line: 4.89 m.
- Distance to fenced area of material to tower crane: 7.37 m.

When the values of Lr, Hr and Qr are calculated, the crane could be selected. As for determining the scope of the pen Lr crane it will be necessary to know the low crane stands and dimensions shift platform. These values are found in the diagrams of the crane.

Lr = 46.52 m

When the values of Lr, Hr and Qr, are calculated, the crane could be selected using the diagrams of the tower crane.
The diagrams show that the crane can be used is LIEBBHERR 130 EC- B6.

Qk > Qr 3 t > 2.65 t

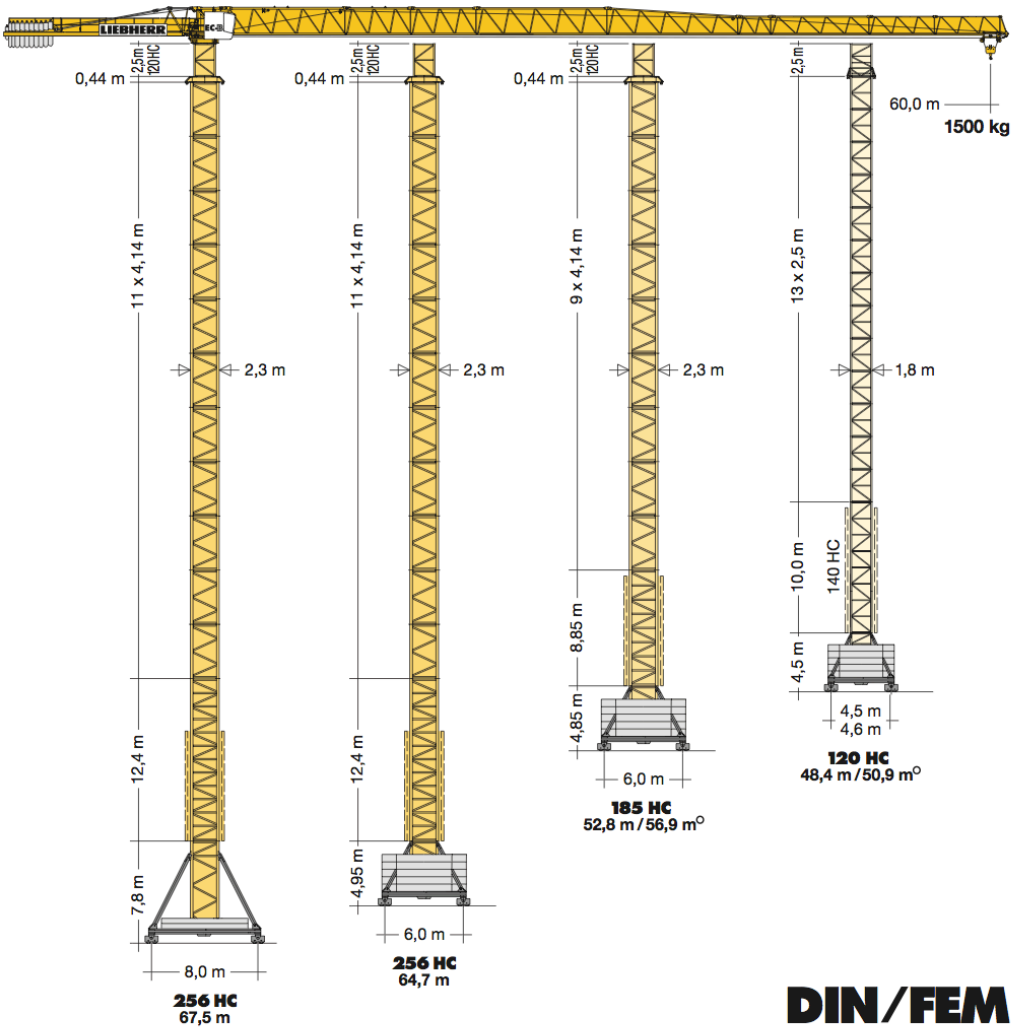
Hk > Hr 40 m > 34.50 m

Lk > Lr 50 m> 46.52 m

As we can see , we have selected the crane is able to perform the necessary work.

**CRANE:

m r	m/kg	m/kg																
		20,0	**22,5**	**25,0**	**27,5**	**30,0**	**32,5**	**35,0**	**37,5**	**40,0**	**42,5**	**45,0**	**47,5**	**50,0**	**52,5**	**55,0**	**57,5**	**60,0**
60,0 (r = 61,5)	2,8 – 34,1 **3000**	3000	3000	3000	3000	3000	3000	2910	2680	2480	2310	2160	2020	1890	1780	1680	1590	**1500**
57,5 (r = 59,0)	2,8 – 36,0 **3000**	3000	3000	3000	3000	3000	3000	3000	2860	2650	2470	2300	2160	2030	1910	1800	**1700**	
55,0 (r = 56,5)	2,8 – 37,6 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2790	2600	2430	2270	2140	2010	**1900**		
52,5 (r = 54,0)	2,8 – 38,9 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2900	2710	2530	2370	2230	**2100**			
50,0 (r = 51,5)	2,8 – 39,9 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2990	2790	2610	2450	**2300**				
47,5 (r = 49,0)	2,8 – 41,3 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	2910	2720	**2550**					
45,0 (r = 46,5)	2,8 – 42,4 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	2990	**2800**						
42,5 (r = 44,0)	2,8 – 42,5 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	**3000**							
40,0 (r = 41,5)	2,8 – 40,0 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	**3000**								
37,5 (r = 39,0)	2,8 – 37,5 **3000**	3000	3000	3000	3000	3000	3000	3000	**3000**									
35,0 (r = 36,5)	2,8 – 35,0 **3000**	3000	3000	3000	3000	3000	3000	**3000**										
32,5 (r = 34,0)	2,8 – 32,5 **3000**	3000	3000	3000	3000	3000	**3000**											
30,0 (r = 31,5)	2,8 – 30,0 **3000**	3000	3000	3000	3000	**3000**												
27,5 (r = 29,0)	2,8 – 27,5 **3000**	3000	3000	3000	**3000**													
25,0 (r = 26,5)	2,8 – 25,0 **3000**	3000	3000	**3000**														
22,5 (r = 24,0)	2,8 – 22,5 **3000**	3000	**3000**															
20,0 (r = 21,5)	2,8 – 20,0 **3000**	**3000**																



Turmdrehkran 130 EC- B6

3.1.3 SETTING OF DANGEROUS ZONE

During installation works in parts of the construction , bars , workplaces and crossings dangerous areas are emerging. During construction such areas are called hazardous areas. At the beginning of the construction works during construction and hazardous areas , in which constantly arise or may arise risk factors they should be determined. Hazardous areas are divided into two groups:

1. Dangerous areas where hazardous and / or dangerous factors constantly affect processes.
2. Hazardous Areas in which dangerous factors may appear.

Constantly operating factors area is:

1. uninsulated parts of electrical equipment
2. machines or parts of places of transit
3. The areas in which a loading crane
4. unenclosed areas where there is a greater difference and 1.3m high.

Increasing the danger zones of the loading crane depends on the size of the load and lift height.

Table 12. *Limiting the dangerous zones from non-insulated zones from the fenceless un-insulated parts of the electrical equipment.*

Voltage, kW	Distances, limiting the dangerous zones from the fenceless un-insulated parts of the electrical equipment or from the vertical plane, which is the nearest power line wire, with a projection on the land, m
<1	1.5
1-20	2.0
35-110	4.0
150-220	5.0
330	6.0
500-750	9.0
800(current)	9.0

The limits of dangerous zones where the risk factors of harmful substances exceeding appears should be determined by measurement.

Dangerous zones in which dangerous factors could appear are:

· Near buildings under construction and assembling/dismantling buildings structures or equipment.
· Places over which the structures or equipment installation/dismantling works are executing.
· Places over which loads are lifting and transported by cranes.
· Places where the machinery, their parts or work equipment are moving.

Determination of crane dangerous zones

The limits of dangerous zones where there is a transfer of elements performed by crane are determined by calculations, the sum of horizontal projection of lifted element, the maximum length of biggest elements and its possible fall distance.

Due to the conditions surrounding our lot we have to consider our danger zone should not override existing buildings. Then, let put some limitations on the movement of loads with the crane:

- Raise the load vertically to a reasonable height, and then carry the load to the centre turning radius to reduce the area of danger zone.
- The projection of the arm of crane will not be performed on existing buildings.

The next risk will be considered:

-Presence of obstacles.
-Areas of way.
-Jobs in proximity to high voltage power lines.

The prevention measures are established on the basis of the following legal text, following the spanish rules:

-Royal Decree 836/2003 of 27 June, approving a new Technical Instruction "MIEAEM2" Regulations Lifting and handling equipment, referring to tower cranes for construction or other applications.

-Royal Decree 1215/1997 of 18 July, laying down minimum safety and health for use by workers in teams.

Presence of obstacles

In paragraph 7.3 of the UNE 58-101-92, states: "The vertical clearance between the pen and the last area of movement of personnel shall be minimum 3 meters. If the load or empty hook passes within 3 meters of the area, will be necessary placed on it enough to prevent the indicators of his approach."
This means that when the crane weathervane turn must respect the distances. And the area, which inevitably we must consider the burden.
We are not inclined to use signaling and also taking into account the flexibility of these structures, walkways in paragraph 4.1 of the UNE 58-101-92 states: "The minimum clearance for the passage of personnel, among the most prominent parts of the crane and any obstacle is 0.60 meters wide and 2.50 meters high. In case of failure application of this condition will prohibit the access of staff to this area dangerous". We have considered a minimum distance between the tip of the arrow and the nearest obstacle of 2 meters.

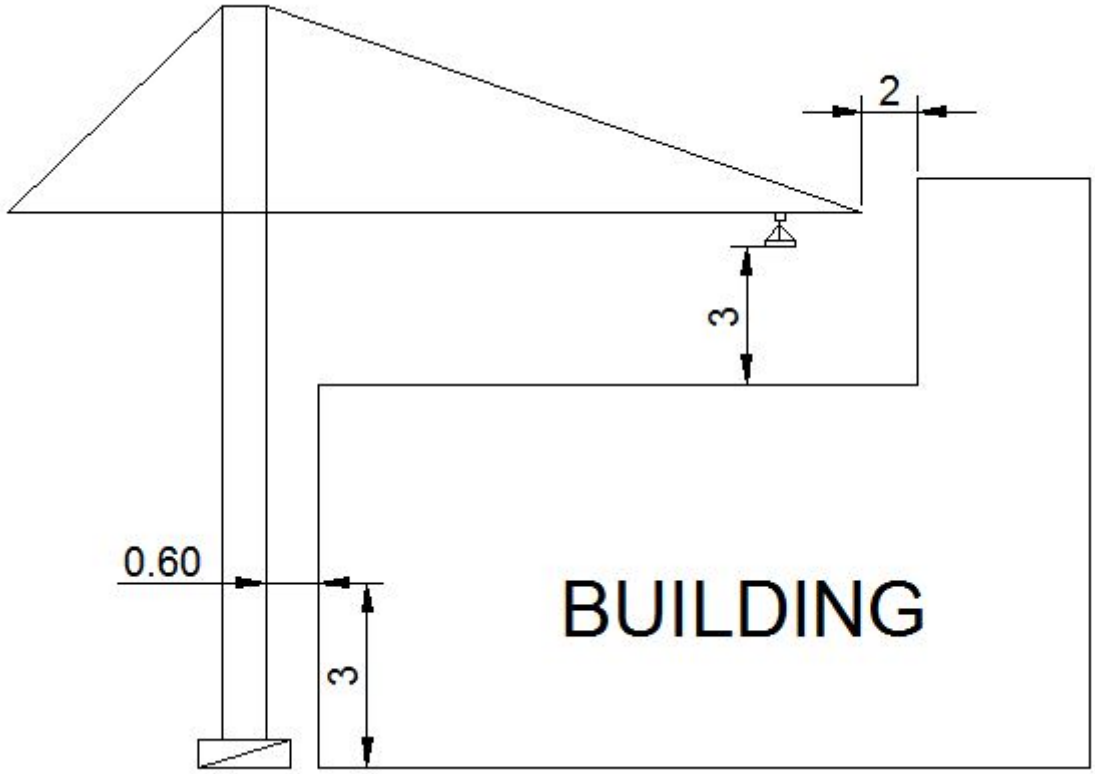


Fig. 17 Example of *diagram of tower crane safety distances.*

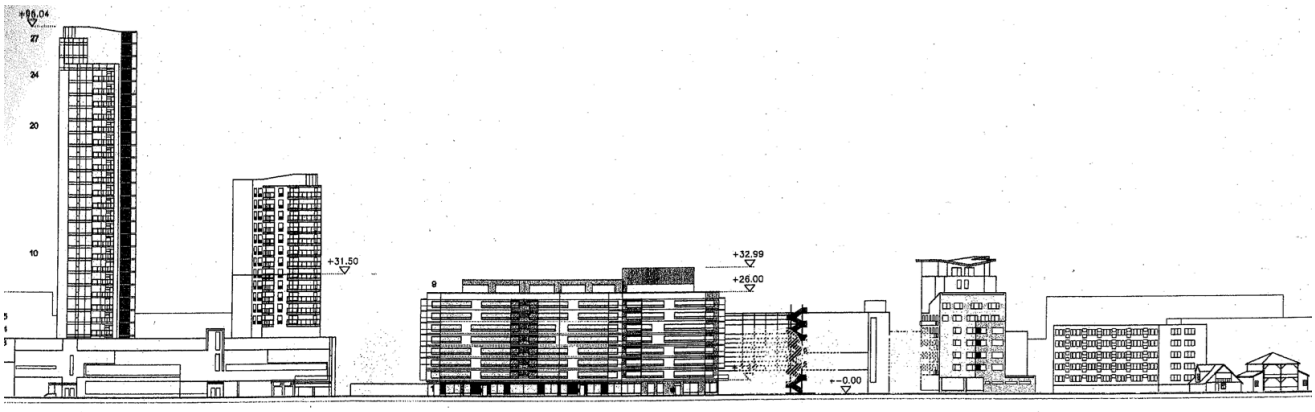


IMAGE 7. *Buildings nearby. Image taken from the information about building given.*

3.1.4 TEMPORARY ACCESS TO THE WORK SITE

To that vehicles can access the area of work will find two roads to the side of the building, one on each side , as there is a door to driveway and one output . The road is 7.04 meters.
No material or equipment along the main street Konarskio is received.

The width of the street is suitable to permit the passage for the trucks, the necessary trucks during construction works.
Temporary roads are built to bring construction materials.
The wide of the road has to be at least 6 meters, and the smallest distance from the road to the storage place is 1 meter. These roads are built to ensure easy driving to the building place and fast work.

3.1.5 TEMPORARY STORAGE AREAS

Storage areas are located within the plot, between the fence and the building. Located very close to the crane, which is easier to load materials and close the inlet and outlet of the equipment , so it is more sencillla loading and unloading. Besides not prevent the passage of workers during the transcuros of work . All materials must be within that area, and should be kept clean and tidy.

3.1.6 TEMPPORARY BUILDINGS FOR WORKERS AND MANAGING STAFF

As directed by the spanish rules: RD 1627/97 and RD 486/1997 (although not mandatory, we will take as a reference for the dimensioning of these areas), we can dimension and condition these areas as follows:

Toilets and changing rooms

Depending on the maximum number of operators that can be found in the execution phase of the work surface and necessary elements for these facilities shall be determined:

· 1 Shower (1 pc / 10 workers)

· 1 Toilet (1 pc / 10 workers)

· Sink Basin (1 pc / 10 workers)

· 1 Mirror (1 pc / 10 workers)

These elements are complemented by the auxiliaries needed: Towel, soap, etc.

The changing rooms will be equipped with seats and individual lockers with key, for clothing and footwear.

The area designated for changing rooms will be 2 m2 per operator.

The máximum number f workers will have to work at the same time be 33, so 33 x 2 = 66 m^2

The enclosure cleaning service have hot and cold water in showers and sinks.

Dining room

The campus dining service will be adapted to the number of operators and shall be provided with dimensions table, chairs, tableware, hotplates and sink with hot and cold water.

Office

They have an office work that lets you store and archive documents relating to the work (Security Plan, logbook, etc) being, in turn, such documentation available to the personnel involved in it.

Work in the office of a first-aid kit with the minimum content indicated by law, and multipurpose dry powder extinguisher of effectiveness will be installed 13 A.

3.1.7 TEMPORARY ELECTRICITY SUPPLY

The provisional electrical installation work shall conform to the specifications set out in the ITC-BT-33, because it is a temporary facility, considered work for the duration of related work.

However, in local construction services (offices, dressing rooms, sanitary facilities, etc.) the technical requirements contained in the ITC-BT-24 shall apply.

Connection operations are included from the general thrust of the work to the provisional installation of electricity, from which outlets will be drawn in sufficient numbers to connect electrical equipment and lighting points needed to ensure lighting work.

The interim facility will consist with the overall scorecard and protection, which will supply circuits to the side frames.

The outputs of the secondary panels are protected with differential and circuit breakers.

It should provide points of outlets in sufficient numbers, and located at a reasonable distance from the area to build and tasks.

Lighting should reach all the roads of the work and areas with no natural light.

Electrical switchboards, will be located in areas easily accessible and will be closed with safety locks

Both for installation and for the withdrawal, it is necessary to be performed in the absence of power line and when that line is no longer needed, it should retract the hose and ring the switchboard.

3.1.8 TEMPORARY WATER SUPLLY

The water supply from making a deposit or driving to Vilnius rush .

The installation will consist of : offtake , supply line and distribution network.

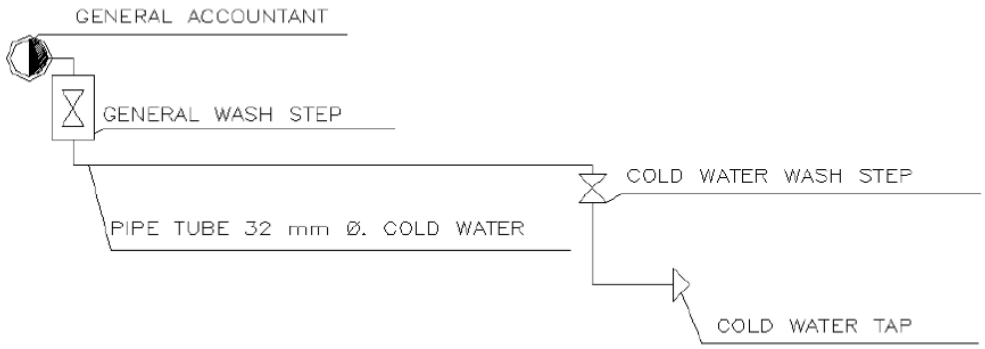
Installation will be available hot water in showers and sinks.

Have a sufficient supply of drinking water in proportion to the number of workers, all of them easily accessible and distributed in close to the jobs places.

It will be indicated by signs whether the water is not drinkable .

A sink with running water , soap provided for each 10 employees or fraction thereof will be installed.

Toilets and urinals are installed and kept in proper conditions of disinfection and deodorization.



3.1.9 TEMPORARY SEWERAGE

Sewer pipes will be PVC and will have a diameter of 200 mm, go for surface and will be connected to a nearby well to work.
The removal of the sewer connection PVC serving booths and placed superficially because runs along the side of the site, is protected in areas of crossings with concrete.

The survey was done manually and load the container.

The sewer construction will consist on removing water from rain and the elimination of waste water as a shower, basins and toilets.

3.1.10 CONSTRUCTION SITE LIGHTINING

To calculate the number of luminaries necessary for the correct work illumination we use the following formula:

$$N=\frac{ExA}{\emptyset_n x F_{ux F_m}}$$

Where:
N: Luminaries number are required

E: Average luminance in lux

A: Local area m2

øn: Flow lamp rate in lumens

Fu: Factor of use

Fm: Maintenance factor

The surface of the work area is 4.470 m2, to be illuminated with an average illumination of 15 lux, with 1x150 W metal halide lamps, which produce a luminous flux of 13000 lumens per lamp. Will be used a normal maintenance factor 0.95.

Data from the lighting area are:

Length: 95.22 m

Width: 35.18 m

Height: 4.50 m

Index $K=\frac{lxb}{h(l+b)}=\frac{4470}{4.50(95.22+35.18)}=$ 7.61

With this index, and media with floor colors and ceiling, and clearing to the walls, is a factor in initial use in direct lighting luminarie 1.

$$\mathbf{N=\frac{ExA}{\emptyset_n x F_{UxF_M}}=\frac{15x4470}{13000x1x0.95}\approx 6}$$

By calculation we have obtained that we need a minimum of 6 lamps.

3.1.11 FENCE OF CONSTRUCTION FIELD

The construction fence will protect the perimeter of the plot. The maximum width of the strip of public or private space to be occupied by work fence is 2 meters. The minimum step width should cover separation or boundary between pedestrians and traffic.

Working procedure:

1. The perimeter fence of the plot according to plans and before the start of the works will be performed. The fence should be used to be a dull and corrugated with fixed anchors on the firm ground, esta solo is replaced by another model, not opaque and removable metal stands counterbalanced always twisting metal fence.

Characteristics the Fence:

- You will have 2 meters.
- Gate para Vehicle access 4.5 meters wide and independent access door para personnel access.
- The minimum distance between the fence and 2 meters will be excavation.

2. Shall furnish as minimum signaling:

- No parking in the driveway.
- Mandatory helmet use in the area of the site.
- Prohibition of entry to any person outside the work.
- Poster work.
- Making space for the description of the location of the general connection cabinet, in which we can deduce into account the Low Voltage Electrotechnical Regulations.

He placed the light box work as close to the entrance, still on a sufficiently stable support along the same extinguisher (CO2 10 Kg.) Placement of a A separate ground connects with its corresponding basin copper and base of the box esta always placed a wooden base to prevent possible indirect contacts (EXAMPLE: for a pallet).

There is no mistaking the safety fence or enclosure of the work, signaling and fencing as this, it is to inform and signaling a particular area that may present potential risk para UN workers traversing Nearby Places .

When there is a risk of falling from a different level have handrails and yes, you should bring a way to close the passage without leaving gaps and Gap Minimum distance of 1.50 m.

EI Royal Decree 1627/97 establishes with regard, as obligation of the coordinator for safety and health during the execution of the work, to take the necessary measures to ensure that only authorized people can access

this her. The Project Manager will assume esta Function When no designation was necessary coordinator.

3.1.12 GENERAL REQUIREMENTS OF LABOR SAFETY

Here we will evaluate the general hazards and choose the individual protective measures which must be available for workers protection.

List of hazardous jobs:

- Excavation works
- Working crane
- Reinforcement and concrete works
- Formworks installation
- Welding
- Height work
- Roof and facade installation
- Installation works
- Work with hand tools and power machinery

Image 8. *Order of Works area*

Individual protective elements:

- The safety helmet is expected per worker every six month.
- The safety helmet with viewfinder, just one every ten workers is expected, because their use is more specific than normal helmets.
- Helmet with ear protectors: Is provided to one every five workers.
- Safety glasses: Are expected every three workers.
- Hearing protection (foam earplugs): Some ones per worker every two month for works around loud noises.
- Fine dust filter mask: One per worker every two month.
- Gloves: Some gloves per worker every six month.

High resistance to cutting and abrasion gloves: One every five workers every six month.

- Welder gloves: A pairs of gloves for welder every ten workers every nine month.
- Dielectric gloves: Two pairs, their use is limited for electrical work.
- PVC Boots: A pair of boots every five workers every nine months for work duration.
- PVC water boots: A pair of shoes per worker every nine months of work duration.
- Dielectric boots: Two pairs for all the work, their use is limited for electrical works.
- Seat belt lifeline: One every ten workers and twelve months of work, for working at height together with safety lines.
- Safety belt: One every three workers and six months.
- Device fall arrest safety belt: One every three workers and six months.
- Fall arrest system: One every three workers and six months.
- Strip back injury protection: One worker for nine months of working duration.
- Coverall: One per worker every six months.

Collective protective elements:

- Safety net: under first structural floor, only wherethere are more than 1 floor.
- Safety harness: One per worker.
- Perimeter railings: One on each working floor.
- Walkways and ramps at the same or different level.
- Working platforms: for height works.

Image 9. *Horizontal red to protect the holes.*

3.1.13 ENVIRONMENTAL PROTECTION REQUIREMENTS

It must have planned the management of wastes generated during the works.
There must be a previous study for wastes, classified according their nature and dangerousness, and the will be checked which can be recycle and which cannot.
With this plan of construction wastes, when construction works are finished, wastes must not stay in our field.
During works execution we will have different containers for separate wastes. We must appoint one person who will control the management of wastes.

3.1.14 FIRE PROTECTION REQUIREMENTS

Before the construction we must consider the fire risk and the damage that this may cause. We will do a risk study and establish fire safety measures and means of protection and fire suppression.
During the construction works, rules about fire protection will be followed-construction works and installation of fire protection rules.
In the construction site will have a visible and accessible place where there should be a panel with inventory:

· Two buckets
· Two axes
· Two crowbars
· Ladders
· Hook
· 0.5m3 of sand box
· Two fire extinguishers
· Two spades

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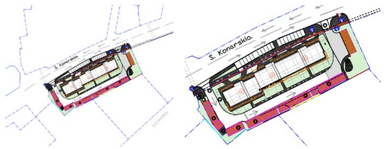
ARCHITECTURAL PART

The final thesis consist of the constructive description of the residential and commercial building in Vilnius (Lithuania).
- The building is located at 12 St. Konarskio.
- Projected 9 floors (ground floor + 7 floors + attic floor)
- Apartment blocks consists of three sections. Two of them are in the 0.00 level, but one of them start at level -0.36 m, due the slope (it can see in drawings).
- One part of first floor, is dedicated to commercial space.
- The floors between the second and ninth floor are adapted for residential use.
- Each block has four apartments on each floor, so the building has 90 apartments.
- No basement, therefore, in the inside of the plot has been built parking spaces, very close to the building. There are 90 residential parking spaces and 10 to the commercial area.
- Everithing done in the building, is adapted according to the spanish rules.

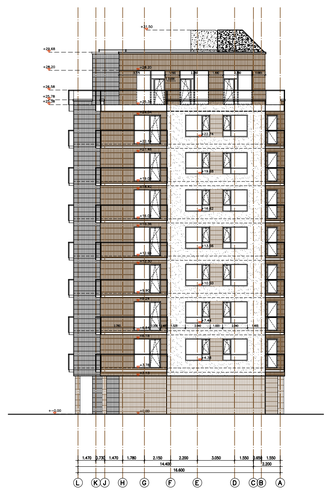
TOTAL AREAS:

	AREAS (m2)
GROUND FLOOR	788.78
1ST FLOOR	813.98
2ND FLOOR	813.98
3RD FLOOR	813.98
4TH FLOOR	813.98
5TH FLOOR	813.98
6TH FLOOR	813.98
7TH FLOOR	906.78
ATTIC FLOOR	644.72

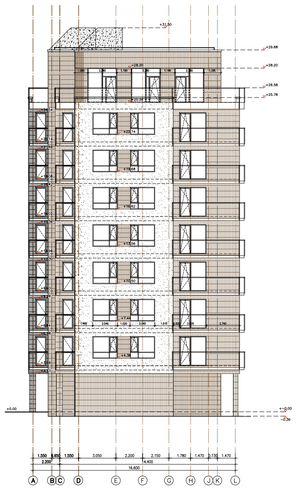


LEGEND:
- PLOT BOUNDARY
- THE DESIGN OF THE ASPHALT
- THE DESIGN OF CONCRETE BLOCKS COVERING CARRIAGEWAY
- THE DESIGN OF CONCRETE SLABS COVERING TRACT
- THE DESIGN OF CONCRETE BLOCKS COVERING TRACT
- DESIGNED LAWN
- THE DESIGN OF CHILDREN'S GAMES ZONE
- ACCESS TO THE PLOT
- ACCESS TO THE BUILGING
- ROAD SIGNS

FACADE KONARSKIO



FACADE BETWEEN THE AXES A-L



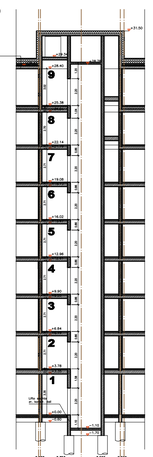
FACADE BETWEEN THE AXES L-A

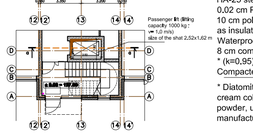
DESIGNATION	AGENT	Points on the facade between the axles 1-25 column plinth	Points on the facade between the axles 1-25 plinth	Points on the facade between the axles 1-25 typical high laying>>	Points on the facade between the axles 1-25 typical floor balkony	Points on the facade between the axles 1-25 x 9 floors	Points on the facade between the axles. 1-25 total	Total points
	Clinker tiles glued on to heat insulation layer	4(2,93x3,13)+ 2(2,93x3,49) + 36,69 + 20,46=67,15m2	90=8hhs + 4(1,52x3,13) + 2(1,52x3,49) + 2,2x3,49) = 90 + 19,03 + 10,61 + 7,72 + 127,36m2	(0,3x26+(2,25x21)+ (0,495x12)+(1,13x3)=625,2+ 47,25+3,94+3,39=675,78m2	46,76+124,11+72,7+46,76 +46,85+(16,7x4)=402,63	132,85+50,41+12,15= 195,41 m2	901,42 m2	2389.53 m2
	Silicate painted plaster	–	–	234,26+244,55+260,00= 738,81 m2	33,51x6=268,06 m2 (balkony bottom)	–	1006,89 m2	2341.37 m2
	Shawls profiled roofing	–	–	–	–	–	–	–
	Cement sheets outdoor facade decoration	–	48,08 m2 (ceiling to the uprights)	–	–	–	48,08 m2	165.81 m2
	Balcony edges sheet apskardimai	–	–	–	27,6x6=220,8 m (Balcony trims)	53,1 m (9th floor terrace parapet trims)	–	–

DESIGNATION	AGENT	Quantity fasade between the axles L-A column pedestals	Quantity fasade between the axles L-A pedestals	Quantity fasade between the axles L-A typical floor between window	Quantity fasade between the axles L-A typical floor balcony niches	Quantity fasade between the axles L-A 9 floors	Quantity fasade between the axles L-A total	Total points
	Clinker tiles glued on to heat insulation layer	–	12.57x3.15 = 39.6 m2	1.36 x 7 = 9.52 m2	74.55 + 13.37 = 87.92 m2	34.24 m2	171.28 m2	2389.53 m2
	Silicate painted plaster	–	–	119.89 m2	–	–	119.89 m2	2341.37 m2
	Shawls profiled roofing	–	–	–	–	–	22.05 m2	90.27 m2
	Cement sheets outdoor facade decoration	–	–	–	–	–	12.10 m2	165.81 m2
	Balcony edges sheet apskardimai	–	–	–	7.55 x 8 = 60.4 m (Balcony trims)	8.1 m2 (9 th floor terrace parapet trims)		

DESIGNATION	AGENT	Quantity fasade between the axles L-A column pedestals	Quantity fasade between the axles L-A pedestals	Quantity fasade between the axles L-A typical floor between window	Quantity fasade between the axles L-A typical floor balcony niches	Quantity fasade between the axles L-A 9 floors	Quantity fasade between the axles L-A total	Total points
	Clinker tiles glued on to heat insulation layer	–	12.57x3.51 = 44.12 m2	1.36 x 7 = 9.52 m2	74.24 + 13.37 = 87.61 m2	34.24 m2	173.51 m2	2389.53 m2
	Silicate painted plaster	–	–	119.89 m2	–	–	119.89 m2	2341.37 m2
	Shawls profiled roofing	–	–	–	–	–	22.05 m2	90.27 m2
	Cement sheets outdoor facade decoration	–	–	–	–	–	12.10 m2	165.81 m2
	Balcony edges sheet apskardimai	–	–	–	7.55 x 8 = 60.4 m (Balcony trims)	8.1 m2 (9 th floor terrace parapet trims)		

- 5cm enhaced fine-grained (gravel)
- PE modified. Steam insulation (waterproof)
- 5 cm hard rockwoll
- 20 cm rockwoll
- 1.00-20.0 cm slope forming layer (dry sand)
- 0.02 cm vapor barrier of PE modified film
- 23,0 cm monolitic slab and fill surface is painted.





SECTION LIFT

Stainless steel handrails attached to the parapet.

Stainless steel handrail with full tempered glass. Parapet

2 cm creamic tiles, slip
6 cm reinforced concrete
Geotextile
20 cm panels polystyrene foam (EPS)
Geotextile
Modified bituminous waterproofing
The slope is formed with a layer of concrete. The minium thickness of 2 cm i=2.5%
24 cm monolitic slab

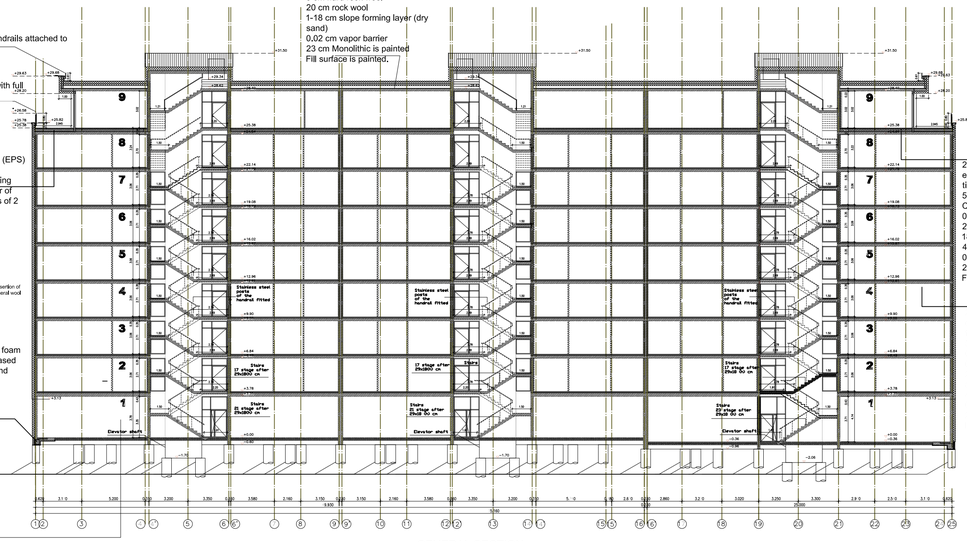
Rock wool insulation
Concrete + steel
Silicate blocks
Plasterboard + rock wool
Expanded clay blocks with insertion of mineral wool
Expanded clay blocks
Styrofoam EPS
Shawls profiled roofing

Capillary sheet
Hydroduct 220 (geotextile)
15,0 cm of extruded polystyrene foam
2 layers of waterproof coating based on cement and it use to repair and seal wet surfaces.
Consumption: approx. 1,8 kg/m2/1mm.
Monolithic grillage

2.0 cm stoneware tile
12.0 cm of concrete
HA-25 steel (15 kg/m3)
0,02 cm PE modified
10 cm polystyrene (XPS) as insulation
Waterproofing layer
8 cm compacted diatomite
* (k=0,95)
Compacted land (k=0,95)

* Diatomite compacted : cream colored fine powder, used for the manufacture of coatings.

5 cm enhaced fine-grained (gravel)
PE modified like steam insulation (waterproof)
5 cm hard rock wool
20 cm rock wool
1-18 cm slope forming layer (dry sand)
0,02 cm vapor barrier
24 cm Monolithic is painted
Fill surface is painted.



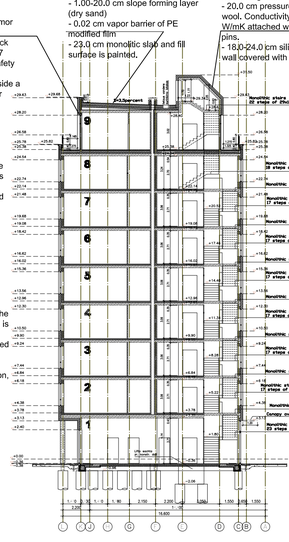
GENERAL SECTION

- 1,5 cm clinker facade exterior finishes
adhesive for outdoor use with a mixture of corrosion-resistant armor reinforcing mesh
- 20,0 cm pressure semi-hard rock wool. Conductivity value of 0.037 W/mK attached with glue and safety pins,
- 18,0-24,0 cm silicate blocks inside a wall covered with mineral plaster

2,0 cm ceramic tiles in rooms with the exception of wetlands, wich coating is tiled.
5,0 of fine-grained sand reinforced C12/15
0,02 cm PE modified
2,0 cm anti-impact sound insulation
18,0 cm of rock woool insulation
4,0 cm of dry sand compact
0,02 cm PE modified
23,0 cm monolithic slab
Fill surface is painted

2.0 cm ceramic tiles in rooms with the exception of wetlands, wich coating is tiled.
5,0 of fine-grained sand reinforced C12/15
0.02 cm PE modified
2.0 cm anti-impact sound insulation, acoustic wool.
4.0 cm of dry sand compact
0.02 cm PE modified
23.0 cm monolithic slab
Fill surface is painted

- 5cm enhaced fine-grained (gravel)
- PE modified. Steam insulation (waterproof)
- 5 cm hard rockwoll
- 20 cm rockwoll
- 1.00-20.0 cm slope forming layer (dry sand)
- 0.02 cm vapor barrier of PE modified film
- 23,0 cm monolitic slab and fill surface is painted.



SECTION STAIRS

- 1,5 cm clinker facade exterior finishes
adhesive for outdoor use with a mixture of corrosion-resistant armor reinforcing mesh
- 20,0 cm pressure semi-hard rock wool. Conductivity value of 0.037 W/mK attached with glue and safety pins,
- 18,0-24,0 cm silicate blocks inside a wall covered with mineral plaster

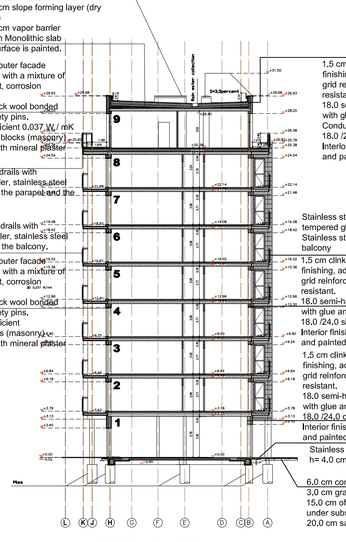
Stainless teel handrails with tempered glass filler, stainless steel struts-mounted to the parapet and the balcony

Stainless teel handrails with tempered glass filler, stainless steel struts-mounted to the balcony.

1,5 cm clinker as outer facade finishing, adhered with a mixture of grid reinforcement, corrosion resistant.
18,0 semi-hard rock wool bonded with glue and safety pins.
Conductivity coefficient 0.037 W / mK
18,0 /24,0 silicate blocks (masonry) .
Interior finishec with mineral plaster and painted later.

5 cm enhaced fine-grained (gravel)
PE modified like steam insulation (waterproof)
5 cm hard rock wool
20 cm rock wool
1-18 cm slope forming layer (dry sand)
0,02 cm vapor barrier
23 cm Monolithic slab
Fill surface is painted.

Ventilation shafts pipe installation and trims

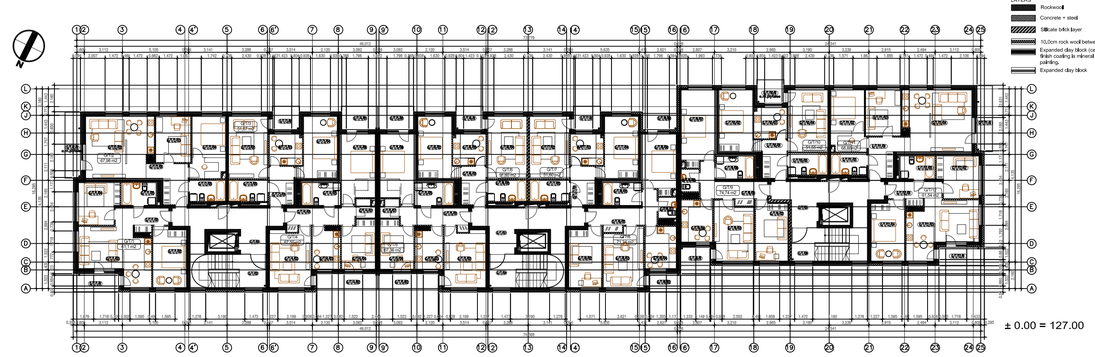


SECTION BALCONY

PAT.NR.	PREMISES TITLE	m2
	COMUN AREA	
		m2 LV
S/7/01	ROOM	8,55
S/7/02	EVACUATION LADDER	8,72*
S/7/03	THE ROOM	16,48
S/7/04	EVACUATION LADDER	8,72*
S/7/05	ROOM	22,48
S/7/06	EVACUATION LADDER	8,28*
G/7/1	ROOM APARTMENT	
		m2 LV
A/7/A/01	ROOM	7,33
A/7/A/02	THE ROOM	13,79
A/7/A/03	LIVING ROOM WITH KITCHEN	23,34
A/7/A/04	THE ROOM	11,29
A/7/A/05	THE ROOM	13,58
A/7/A/06	BALCONY	3,59*
G/7/2	ROOM APARTMENT	
		m2 LV
B/7/B/01	ROOM	5,66
B/7/B/02	LIVING ROOM WITH KITCHEN	38,08
B/7/B/03	THE ROOM	11,09
B/7/B/04	THE ROOM	14,46
B/7/B/05	BATHROOM	17,03
B/7/B/6	BALCONY	4,78*
G/7/3	ROOM APARTMENT	
		m2 LV
C/7/C/01	ROOM	6,43
C/7/C/02	THE ROOM	11,08
C/7/C/03	THE ROOM	13,58
C/7/C/04	BATHROOM	3,59
C/7/C/6	BALCONY	4,78*

PAT.NR.	PREMISES TITLE	m2
G/7/4	ROOM APARTMENT	
		m2 LV
D/7/A/01	ROOM	6,43
D/7/A/02	THE ROOM	10,84
D/7/A/03	THE ROOM	13,51
D/7/A/04	THE ROOM	16,10
D/7/A/05	BATHROOM	3,59
D/7/A/06	BALCONY	4,82
G/7/5	ROOM APARTMENT	
		m2 LV
E/7/A/01	ROOM	6,43
E/7/A/02	THE ROOM	13,58
E/7/A/03	THE ROOM	16,10
E/7/A/04	BATHROOM	3,59
E/7/A/05	BALCONY	3,87*
E/7/A/06	BALCONY	3,82*
G/7/6	ROOM APARTMENT	
		m2 LV
F/7/A/01	ROOM	10,84
F/7/A/02	THE ROOM	13,51
F/7/A/03	THE ROOM	16,10
F/7/A/04	BATHROOM	3,59
F/7/A/05	BALCONY	3,82*
TOTAL AREA		813,98m2

PAT.NR.	PREMISES TITLE	m2
G/7/6	ROOM APARTMENT	
		m2 LV
G/7/A/01	ROOM	10,80
G/7/A/02	THE ROOM	13,24
G/7/A/03	LIVING ROOM WITH KITCHEN	32,05
G/7/A/04	THE ROOM	11,09
G/7/A/05	BATHROOM (WC)	3,73
G/7/A/06	BATHROOM	4,00
G/7/A/07	THE ROOM	11,09
G/7/A/08	BALCONY	3,87*
G/7/7	ROOM APARTMENT	
		m2 LV
H/7/A/01	ROOM	6,43*
H/7/A/02	THE ROOM	10,13
H/7/A/03	THE ROOM	13,58
H/7/A/04	BATHROOM	3,87
H/7/A/5	BALCONY	4,78*
G/7/11	ROOM APARTMENT	
		m2 LV
I/7/I/01	ROOM	6,43
I/7/I/02	THE ROOM	14,43
I/7/I/03	THE ROOM	11,08
I/7/I/04	BENDROJI KAMBARYS SU VIRTUVE	32,05
I/7/I/05	BATHROOM	3,73
I/7/I/6	BALCONY	4,78*
G/7/12	ROOM APARTMENT	
		m2 LV
J/7/J/01	ROOM	10,80
J/7/J/02	THE ROOM	11,09
J/7/J/03	BENDROJI KAMBARYS SU VIRTUVE	33,53
J/7/J/04	THE ROOM	13,80
J/7/J/05	BATHROOM	3,59
J/7/J/6	BALCONY	3,82*



± 0.00 = 127.00

TOP VIEW OF SECOND FLOOR

	Name and Surename	Signature	Date	
Student	Paula Barrachina Escrivá			CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIO STR. 12 IN VILNIUS.
Supervisor	Tatjana Vilutiene			Department of Construction Technology and Management
Head of Department				PAGE 1/6
Reviewer				2015
				DRAWING: ARCHITECTURAL PART
				FINAL THESIS WORK

TECHNOLOGICAL CARD I - SLAB

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

GENERAL INTRODUCTION

The horizontal structural part are solved with the same constructive system. Reinforced concrete slabs is the solution for the 9 floors. The thickness of the slabs is 230 mm except in last floor slab is 220mm of thick.
They are composed of HA-25 concrete.
The steel consists of a networld overlays (upper and lower) of ø12S500/220/ø12S500/220 bars arranged in two orthogonal directions.
The armor has different diameters , according to their position and function within the slab.

DESCRIPTION AND SEQUENCE OF WORKS

The basics components of monolithic slab are: concrete HA-25 and iron armors B500S.

CONSTRUCTION SEQUENCE:

1- Mark levels.

2- Formwork and propping-up.
Placement of props on wooden sleepers (wedges), which uniformly distributed load with wood boards that support on metal girders, forming rails.
The formwork should contain and support the fresh concrete until cured and retain the desired shape without deforming. It is bound to be rigid, durable, waterproof and clean.

3- Stakeout of slab elements.

4- Stakeout of gaps.

5- Placing armor, including waiting for stairs.
1) Lower armor
2) Lower reinforcement armor
3) Superior armor
4) Superior reinforcement armor

6- Separators.

7- Pouring, compaction of concrete in slab and vibrated.
The fresh concrete poured into the formwork must be made to occur by preventing segregation of the mixture. To do this, the maximum height of pouring concrete is one meter.
Is placed in layers of thin horizontal to allow good compacting. To achieve a concrete compacted and thus the elimination of gaps, is made vibrated.

8- Concrete curing:
Curing is one of the most important operations in the process of laying, since a poorly executed curing can decrease the strength of concrete as well as increase the porosity of the dough favoring the entry of outside environment and reducing therefore , durability of the element.

9- Removing of formwork and finishes:
Removing formwork is made when the concrete has reached a sufficient hardness. In normal portland usually a period of between 3 and 7 days.
Repair small holes or voids generally superficial surface defects. If these defects are large or resistant in critical areas may require partial or total demolition construction

QUALITY CONTROL

Minimum tests to make and frequency of realization
Tests shall be :
- During the execution of structures, often as it indicated below or when I say the Project Management .
Sampling of fresh concrete , will be held at the time and place of placing concrete in the formwork , under the conditions that the EHE -08 is established.
- After the execution of structures, when necessary verify the results of tests conducted on molded specimens.
The tests were performed on extracted witnessed by rotary probe structures , supplemented , when so say the Project Management for non-destructive testing or other order to obtain the necessary information.

1. Tests to be performed on fresh concrete:
1.1 Cone of Abrams
1.2 Tests to be performed to determine the characteristics of hardened concrete
1.3. Resistance tests conducted to judge the uniformity and quality of concrete placed at Work

HUMAN SAFETY

Collective protections

- Safety nets .
- Resistant railing 90 cm minimum on each floor height , will have handrails, a interim and baseboard .
- Horizontal networks to protect gaps.
- Safety harness all workers, lifeline.
- Pathways and ramps in the same or different level.

Individual protections

- Approved safety helmet.
- Mono work.
- Costumes for rainy weather.
- Safety footwear.
- Protective footwear.
- Seat belts
- Bright and reflective vests.
- Reinforced leather gloves.
- Mask auto- filter.
- Harness anti - falls for work at height.
- Acoustic Protector.
- Glasses antiparticles or anti- projected screen.

CONSTRUCTION DETAIL OF REINFORCED SLAB

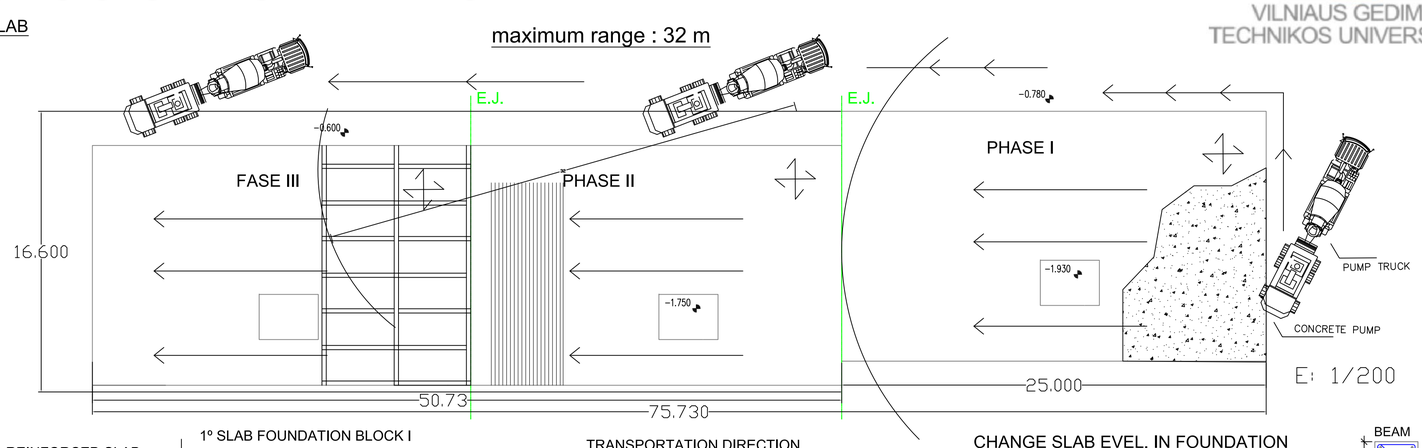
DESCRIPTION PHASES CONCRETING

First the foundation slab (ground floor slab) is made by armed , following the order of phases , as indicated by the drawing. Each phase corresponds to a block .
While the foundation slab of Phase III is being made, begins the works to make the slab 1 of phase I.
In turn, while the slab 1 of phase III is carried out , it begins to make the slab 2 (first floor slab) Block I (phase I). Following the pattern from right to left , as shown in this scheme.

LEGEND
CONCRETE DIRECTION
EXPANSION JOINTS

CONCRETING ORDER:

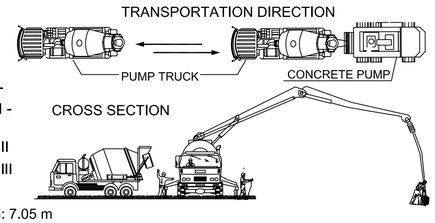
maximum range : 32 m

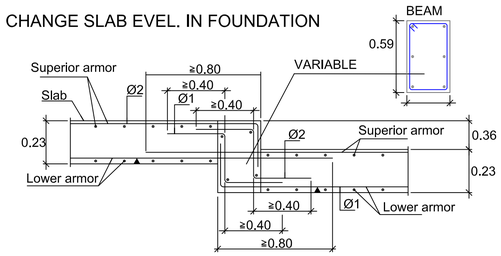


3º	2º	1º
3º	2º	1º
3º	2º	1º
3º	2º	1º
3º	2º	1º
3º	2º	1º

SLAB 5: REINFORCED SLAB
SLAB 4: REINFORCED SLAB
SLAB 3: REINFORCED SLAB
SLAB 2: REINFORCED SLAB
SANITARY SLAB (SLAB 1)
SLAB FOUNDATION (SLAB GF)

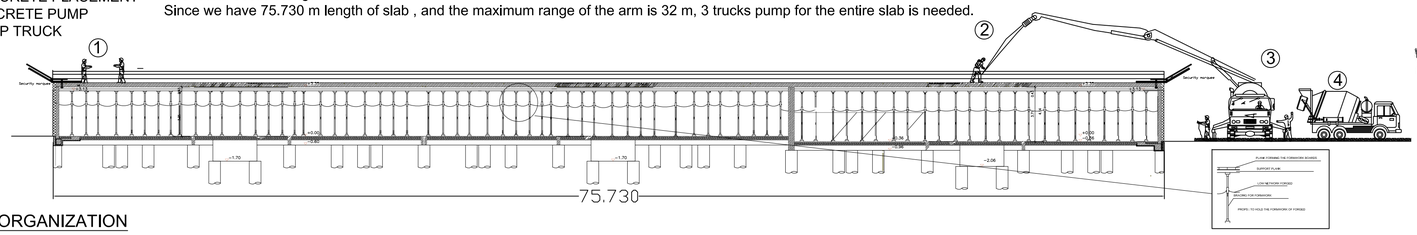
1º SLAB FOUNDATION BLOCK I
2º SLAB FOUNDATION BLOCK II
3º SLAB FOUNDATION BLOCK III -
1º SANITARY SLAB BLOCK I
2º SANITARY SLAB (SLAB 1) BLOCK II -
3º SANITARY SLAB (SLAB 1) BLOCK III -
1º SLAB 2 REINFORCED SLAB BLOCK I
2º SLAB 2 REINFORCED SLAB BLOCK II
3º SLAB 2 REINFORCED SLAB BLOCK III

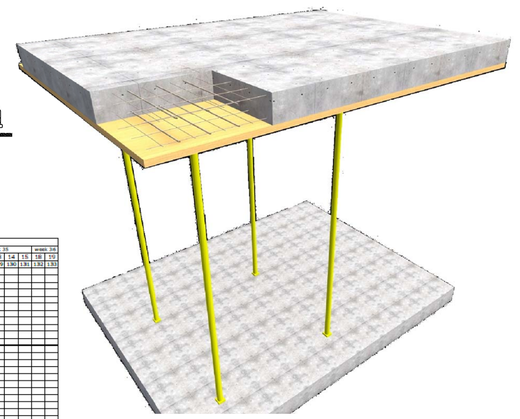




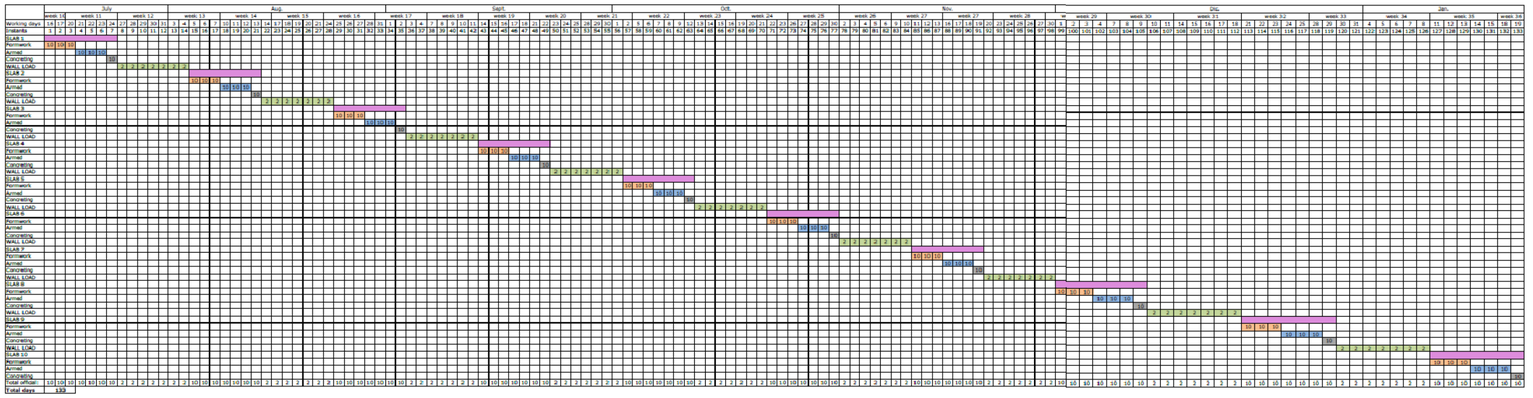
LEGEND:
1.REINFORCED PLACEMENT.
2. CONCRETE PLACEMENT
3.CONCRETE PUMP
4. PUMP TRUCK

Putzmeister has been chosen 32X -150 pump. With a vertical reach of 32 meters and boom :
-Length of the first section: 7.7 m // -Length of the second section: 7.05 m // -Length of the third section: 7.05 m
The fourth section length : 6.2 m
Since we have 75.730 m length of slab , and the maximum range of the arm is 32 m, 3 trucks pump for the entire slab is needed.





ORGANIZATION



TECHNICAL- ECONOMIC INDICATORS

1. Quantity of Works: 813.98 m2
2. Instalation cost: 63873.011 €
3. Duration of Works: 7 days
4. Wage:
   - Official 1st structure :
   8 h/d x 7 days = 56 h.
   56 h x 18.10 € = 1.013,6 €
   - Structure assistant:
   56 h x 16.94 € = 948.64 €

It has made the full financial calculation of the 2nd floor slab as it is " slab type " , but the buildings consist of 10 slabs in full:
- Slab 1-7: 813.98 m2
- Slab 8: 906.78 m2
- Slab 9: 644.72 m2
So, it has to be calculated the totally of money:
- Slab 1-7: 813.98 m2 x 78,47 €/ m2 = 63.873,011 x 7 = 447.111,07 €
- Slab 8: 906.78 m2 x 78,47 €/ m2 = 71.155,03 €
- Slab 9: 644.72 m2 x 78,47 €/ m2 = 50.591,18 €

TOTAL: 447.111,07 + 71.155,03 + 50.591,18 = **568.857,28 €**

- The duration of execution of a slab is 7 days:
- Shuttering 3 days , 3 days to place the armed and one day to concrete .
- Resources are 10 a day , 2 groups of 5 : 3 officers and 2 pawns in each group.
- To realize the slab 2 , it is necessary to have the runtime of the walls.
- The walls takes 7 days and resources will be two groups formed by two officers and one peon , every day , but is counted as two resources , so in the gant lays 2 .
- Resources have been taken from the tables of a Spanish program " Generator Prices CYPE " learn from performance and measurement.

MATERIAL-TECHNICAL RESOURCES

MATERIALS	UNIT	QUANTITY
Concrete	M^3	187.22
Armor steel	kg	17907.56
Separators	units	3255
Wooden wedges	M^2	1256.62
Props	M^2	895.2
Nails	unit	1871
Pallets	M^2	895.2
AIDS		
Ladder	unit	2
EQUIPMENT		
Concrete mixter truck	unit	2
Vibrator electric needle	unit	2
Cutting circular saw	unit	2
Radial electric motor	unit	2
TOOLS		
Hammer	unit	12
Pliers	unit	6
Level	unit	6

CHAPTER	CODE	ACTIVITY	PRICE (€/m2)	MEASUREMENT(m2)	RESOURCES	RESOURCES	PERFORMANCE	TIME (DAYS)	COST (€)
SLABS	01.01	Slab of reinforced concrete. Concrete HA-25/B/20/IIa 23 cm thick	78,47	813,98	Official 1ª	10	0,527	7	447.111,07
	01.02	Slab of reinforced concrete. Concrete HA-25/B/20/IIa 23 cm thick	78,47	906,78	Official 1ª	10	0.527	7	71.155,03
	01.03	Slab of reinforced concrete. Concrete HA-25/B/20/IIa 23 cm thick	78,47	644,72	Official 1ª	10	0.527	7	50.591,18

	Name and Surename	Signature	Date	
Student	Paula Barrachina Escrivá			CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIO STR. 12 IN VILNIUS.
Supervisor	Tatjana Vilutiene			Department of Construction Technology and Management — PAGE 2/6 — 2015
Head of Department				
Reviewer				DRAWING: TECHNOLOGICAL CARD OF SLAB — FINAL THESIS WORK

TECHNOLOGICAL CARD II - FOUNDATION

GENERAL INTRODUCTION

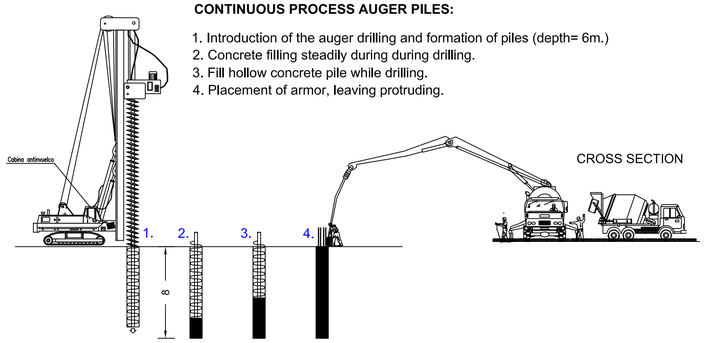
It involves the construction of a deep foundation , piles . This is done by continuous auger , so is going to made reinforced concrete on-site piles. The depths of the piles is 6 cm and two diameters are distinguished : piles of 0.8 m in diameter and 0.6 m diameter piles . Is chosen such execution has many advantages compared to other methods of making deep foundations , among others : you can have a continuous knowledge of all jobs , allows embedding in consistent land, does not alter the environment , as do not make noise , and besides , it's cheap.

DESCRIPTION AND SEQUENCE OF WORKS

The basics components of foundation are:

Concrete HA-25 Iron armors B500S

CONSTRUCTION SEQUENCE:



CONTINUOUS PROCESS AUGER PILES:

1. Introduction of the auger drilling and formation of piles (depth= 6m.)
2. Concrete filling steadily during during drilling.
3. Fill hollow concrete pile while drilling.
4. Placement of armor, leaving protruding.

CROSS SECTION

5. Slab (headed pile) with beams bundle.

HUMAN SAFETY

The work will be carried out in accordance “with health and safety rules in construction request”.

Preventive Measures:

- Work area marked and delimited.
- Maintain order and cleanliness in the work area.
- Removing the perforated ground.
- Maintain eye contact between the driver and assistant.
- Light and sound signaling of vehicles.
- No pass behind moving machines.
- Wear reflective clothing.
- Work platform have to be stable, horizontal, no subsidence and compact ground.
- The equipments will have their grounding and switches differential.
- The electric assembly and disassembly are made by authorized personnel and qualified.
- Maintain connections and cables properly.
- Perfectly drive the ground rod in the ground.
- Protect electrical cables in passageways of machinery.
- Armor will have wooden block to avoid their moving.
- The elements of lifting loads must be reviewed periodically.
- Trespassing under suspended loads.
- No stockpiles less than two meters excavated áreas.

Individual protections

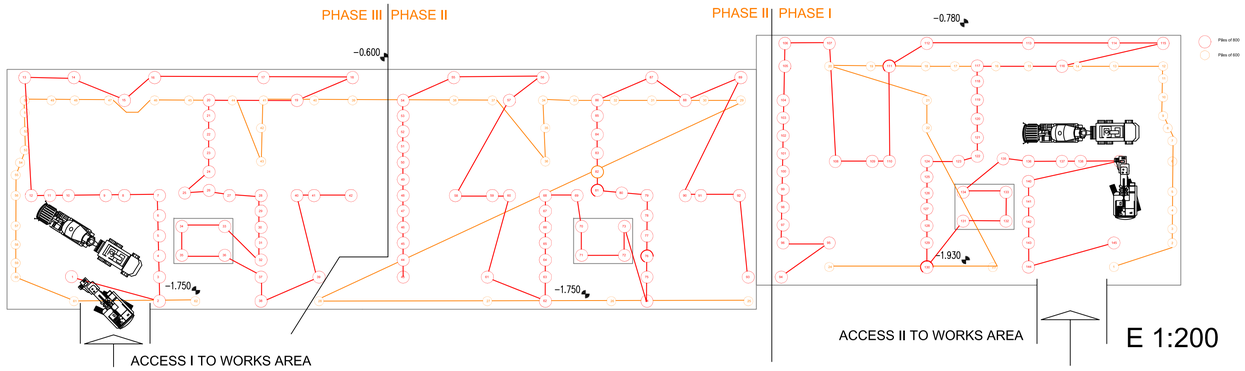
- Approved safety helmet .
- Mono work .
- Boots for rainy weather.
- Safety footwear .
- hearing Protection
- High Visibility Clothing
- gloves
- Safety glasses display
- Marcarilla
- Safety harness

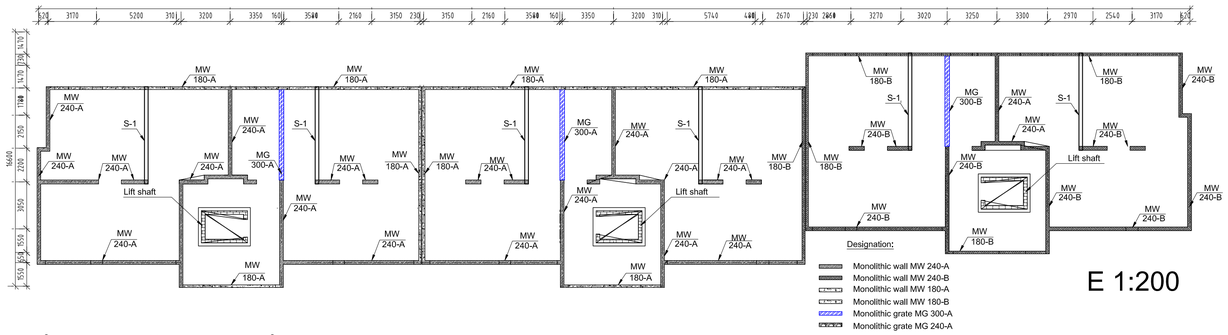
Collective protections

- Solid Surface security based planking .
- It is forbidden to store or collect materials up to 2 meters away. as a general rule .
- Avoid falling objects or tools at different levels within the gap.
- Security fence around work area with a height of 2 mts.

MATERIAL- TECHNICAL RESOURCES

MATERIALS	UNIT	QUANTITY
Concrete	m3	1225,6
Armor steel	kg	1945,8
Pallets	m2	895.2
AIDS		
Vibrators	unit	2
Lifting elements	unit	2
Hose connection of concreting	unit	1
EQUIPMENT		
Concrete mixter truck	unit	2
Gondola	unit	2
Concrete pump	unit	2
Crane	unit	1
Continuous flight auger	unit	2
Excavators	unit	2
Group of oxyfuel and welding	unit	2
TOOLS		
Hammer	unit	12
Metal roulette	unit	2
Levels	unit	1
Crowbar	unit	3
Theodolite prexiso	unit	1
Visor welding	unit	2
Metal brushes	unit	3





ORGANIZATION

	May						June												July											
	week 3		week 4				week 5					week 6					week 7					week 8					week 9				week 10
Working days	22	25	26	27	28	29	1	2	3	4	5	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26	29	30	1	2	3	6
Instants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Drilling Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Drilling Ø 0.6 m	1	1	1	1	1	1	1	1																								
Withdrawal and concreting Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Withdrawal and concreting Ø 0.6 m	1	1	1	1	1	1	1	1																								
Steel cage Ø 0.8 m	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1														
Steel cage Ø 0.6 m	1	1	1	1	1	1	1	1																								
Red sanitation																			2	2	2	2	2	2	2							
Slab GF																										10	10	10	10	10	10	10
TOTAL Official	6	6	6	6	6	6	6	6	3	3	3	3	3	3	3	3	3	5	2	2	2	2	2	2	2	10	10	10	10	10	10	10

TOTAL DAYS: PILES 18 days
FOUNDATION 32 days

QUALITY CONTROL

It is impossible to place the piles at the point or the exact angle you have indicated in the project, because they tend to depart or deviate when they find hard or soft spots in the field. The plans and specifications must tolerate a displacement of 5 cm at the top of the small piles driven into the ground and 15 cm (and sometimes more) in driven piles through the water. A collapse or angularity on the axis of the pile 1 or 2 percent, relative to the length of the pile , no generally affects their capacity and , therefore , should be permitted in the project and specification . Commonly larger tolerances are allowed, if load tests show that the piles can withstand the loads safely.

1.The position of the piles in the ground , after being built , must not differ more than 10 cm . That is, the error is not greater than 2% of the length of the pile .

Should make cleaning treatments and background .

2.The excavation will proceed to the extraction of cuttings that have been stored in the bottom of the cavity. In large diameter piles , down from an operator is performed to measure such cleaning.

TESTS:

Test sonic transparency in deep foundations (sonic survey, sonic test, cross-hole or crosshole). / Echo test (conventional hammer).

Testing of mechanical impedance in deep foundations (hammer with force sensor).

Therefore , the piles begin at once, but the piles in diameter 0.6 m, are finished 10 days before the diameter of 0.8 m .

Just after the complete execution of piles , you start to run the sewer and once completed, that time will be 7 days, begins the slab foundation, which duration is seven days and resources are 10, divided into 2 groups of 5 is made :

- 3 officers and 2 pawns (each group).

The three tie beams , which are the foundation slab were carried out while the slab , that ' s therefore are included in the time and cost of the slab.

TECHNICAL-ECONOMIC INDICATORS

1.1.1.1 Drilling and concreting pile for core tube auger.

1. Quantity of Works:

Ø 80 cm : 0.8 x 8 = 6,4 m3 x 145 piles = 928 m3
Ø 60 cm : 0.6 x 8 = 4,8 m3 x 62 piles = 297,6 m3
TOTAL CONCRETE : 1.225,6 m3
TOTAL PILES : 145 + 62 = 207 piles

2. Installation cost: 1225,6 m3 x 99,06 € = 121.407,936 €
3. Works duration: 18 days
4. Wage: Steel worker: 18 days x 8 h/d = 144 h. --> 144 h x 13,30 = 1.915,2 €
   - Steel helper: 144 h x 12,45 = 1.792,8 €
   - Drilling equipment and drilling concrete pile: 919,2 m3 x 20,30 = 18.659,76 €

1.1.1.2 Slab.

1. Quantity of Works: 788,78 m2 x 0,30 m = 236,634 m3
2. Installation cost: 236,634 m3 x 203,13 € = 48.067,46 €
3. Works duration: 7 days
4. Wage: Construction helper:
   - Official 1 st Steel worker: 7 d x 8 h/d= 56 h. --> 56 h x 3,66 = 204,96 €
   - Steel helper: 56 h x 3,42= 191,52 €

1.1.1.3 Slab formwork system

1. Quantity of Works: 788,78 m2 x 0,30 m = 236,634 m3
2. Installation cost: 236,634 m3 x 14,13 = 3.343,64 €
3. Works duration: 3 days
4. Wage:
   - Official 1st encofrador : 3 d x 8 h/d = 24 h. --> 24 h x 5,48 = 131,52 €
   - Encofrador assistant : 24 h x 5,13 = 123,12 €

2.2.8.3 Beam formwork system

1. Quantity of works:

0,3 x 0,4 = 0,12 m2
0,12 x 6,13 m = 0,736 m3
0,736 m3 x 3 beams = 2,208 m3

2. Installation cost: 2,208 m3 x 31,90 € = 70,435 €
3. Works duration: 30 mins.
4. Wage: Steel worker: 0,5 h x 12,80 = 6,4 € / Steel helper: 0,5 h x 11,98 = 5,99 €

1. Quantity of works:

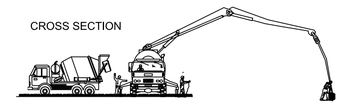
0,3 x 0,4 = 0,12 m2
0,12 x 6,13 m = 0,736 m3
0,736 m3 x 3 beams = 2,208 m3

2. Installation cost: 2,208 m3 x 151,44 = 334,379 €
3. Works duration: 30 mins.
4. Wage:Steel worker:0,5 h x 1,10 = 0,55 € / Steel helper: 0,5 h x 1,03 = 0,515 €

CHAPTER	CODE	ACTIVITY	PRICE (€/m2)	MEASUREMENT (m2)	RESOURCES	RESOURCES	PERFORMANCE	TIME (DAYS)	COST (€)
FOUNDATION	02.01	Pile drilling and concreting insitu φ600mm	99,06	298	Continuous Flight Auger	1	0,15	8	29.480,26
	02.02	Pile drilling and concreting insitu φ800mm	99,06	928	Continuous Flight Auger	1	0,15	18	91.927,68
	02.05	Slab foundation HA 30	203,13	800	6 Official 1ª	4 workers	0,217	7	48.472,86

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

CROSS SECTION



CHARACTERISTICS OF THE DIFFERENT PILES

Pile of 0.80 m. in diameter	Pile of 0.60 m. in diameter
Nº = 145 piles t = 18 days	Nº = 62 pilotes t = 8 days
Depth 8 meters	

The direction of drilling and reinforced back of the piles will be made following an order described in the corresponding plant. From de following phases:

Pile of 0.60 m. in diameter — ACCESS II WORK

PHASE I

Begins in the pile 1 to 24. With the following order::

PHASE II

Begins in the pile 25 to 38. With the following order:

PHASE III

Begins in the pile 38 to 62. With the following order:

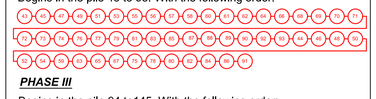
Pile of 0.80 m. in diameter — ACCESS I WORK

PHASE I

Begins n the pile 1 to 42. With the following order:

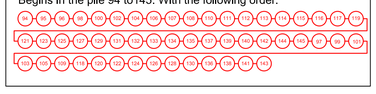
PHASE II

Begins in the plie 43 to 93. With the following order:

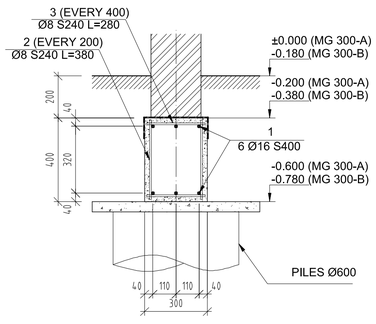


PHASE III

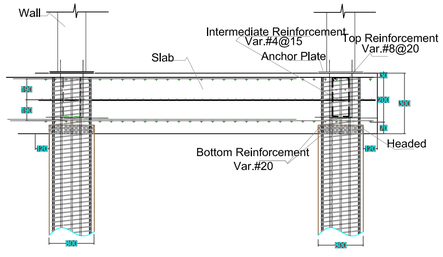
Begins in the pile 94 to145. With the following order:



MONOLITHIC GRILLAGE MG 300-A AND MG 300-B M 1:20



DETAIL



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	Name and Surename	Signature	Date	
Student	Paula Barrachina Escrivá			CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIO STR. 12 IN VILNIUS.
Supervisor	Tatjana Vilutiene			Department of Construction Technology and Management — PAGE 3/6 — 2015
Head of Department				DRAWING — FINAL THESIS WORK
Reviewer				TECHNOLOGICAL CARD OF FOUNDATION

TECHNOLOGICAL CARD III - ROOF WORKS

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

GENERAL INTRODUCTION

It is a not passable roof with a finish gravel cover. The slope is 3.5 % constant over the entire roof . The total area is 644.72 m2 roof.

The roof consists of the following layers:
- Monolithic reinforced concrete slab
- Layer primer
- PE steam insulation (vapor barrier) .
- Layer slope formation of clay (dry sand)
- Regularization layer of morter 1:8
- 25 cm rigid expanded polystyrene panel
- PE modified waterproof .
- Geotextile
- Gravel

HUMAN SAFETY

Collective protections
- Safety nets.
- Resistant railing at least 90 cm , will handrails, intermediate and baseboard.
- The horizontal rails and vertical networks , to protect the holes.
- Safety harness all workers , lifeline.

Individual protections
- Safety helmet with ventilation holes.
- Anti -slip footwear.
- Glasses anti - particles.
- Red adjusted and non-flammable.
- Belts.
- Arnes anti- falls for work at height.

MATERIAL- TECHNICAL RESOURCES

Nº	Materials	Units	Quantity
1	Clays	m3	64.47
2	Plyetylene panel	m2	676.956
3	Roller material	m2	676.956
4	The mixture of propane-butane	kg	891.44
5	Polyester	m2	676.956
6	Cement mortar	m3	19.34
7	Bitumen primer	M2	709.192
8	Geotextil	M2	676.96
9	Gravel	t	116
	Machinery / Tools	**Units**	**Quantity**
1	Tower crane	unit	1
2	Multiple gas burner	unit	2
3	Sealing equipment special additional burner	unit	2
4	Roller	unit	2
5	Wheelbarrow	unit	2
6	Brush	unit	4
7	Rubber rush	unit	4
8	Roulette	unit	4
9	Marker	unit	4
10	Hammer	unit	4
11	Fork	unit	4

CONSTRUCTION SEQUENCE:

ROOF WORK SEQUENCE:
- Monolithic reinforced concrete slab
- Layer primer
- PE steam insulation .
- Layer slope formation of clay (dry sand)
- Regularization layer
- Geotextile
- 25 cm rigid polystyrene
- PE modified (vapor barrier) Waterproof.
- Geotextile
- Gravel

1. Primer coat the entire surface.
2. Stakeout hip roof and valleys roof.
3. Placing insulation layer (PE) on all sides and over the entire surface of the slab and fixing air conduct.

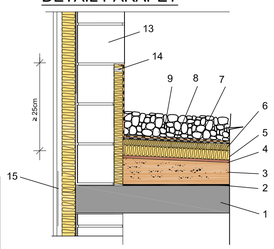
QUALITY CONTROL

According to Decree 59/1994 of May 13, which regulates the quality control of the building and its use and maintenance, to define:
- Criteria for receipt of materials to be controlled.
- Lots, test samples and corresponding tests and docmentación (certificates, seals, etc.) that suppliers must provide.
- The criteria for acceptance or rejection of lots.

The materials being objective of control, shall comply:
- Criteria reception
- Criteria for acceptance or rejection
- Documentation for the end of the work
- Reception control (documentary control)
- Control execution

The cover must meet the test of sealing service.

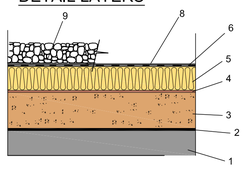
DETAIL PARAPET



1.5 cm clinker as outer facade finishing, adhered with a mixture of grid reinforcement, corrosion resistant.
18.0 semi-hard rock wool bonded with glue and safety pins.
18.0 /24.0 silicate blocks (masonry) .
Interior finishec with mineral plaster and painted later.

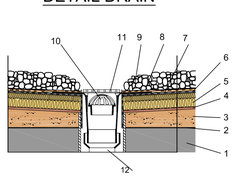
1 - SLAB 23 cm.
2 - VAPOR BARRIER
3 - EXPANDED CLAY (SLOPE FORMATION)
4 - REGULARIZATION LAYER
5 - 25 cm EXPANDED POLYSTYRENE PANEL
6 - PE MODIFIED. WATERPROOF.

DETAIL LAYERS



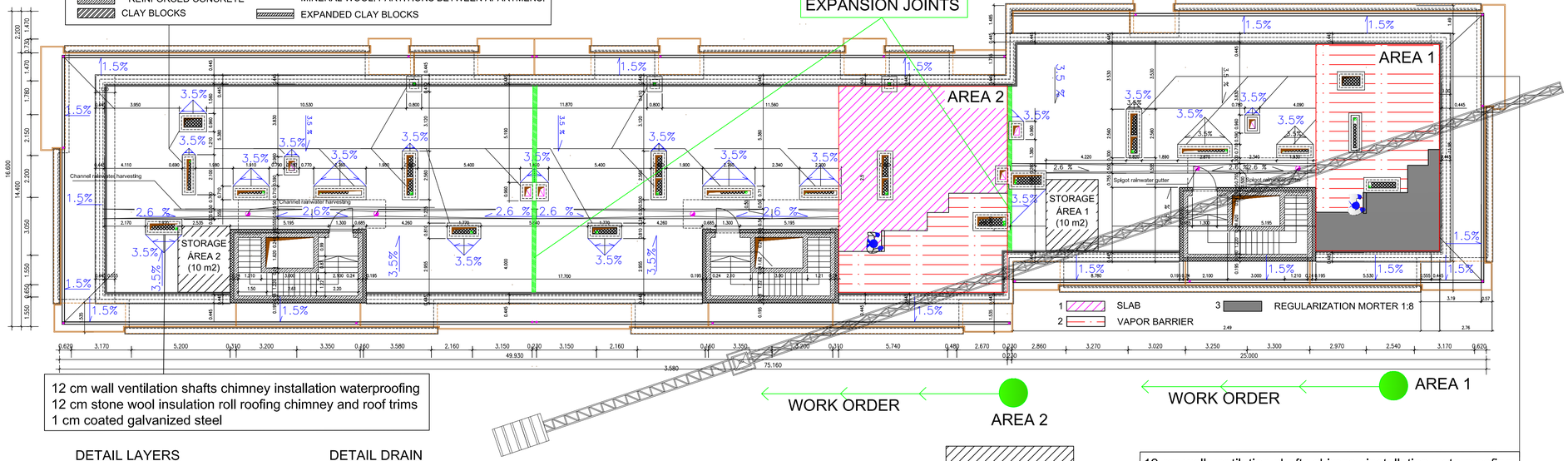
7 - REINFORCEMENT TO WATERPROOF LAYER
8 - GEOTEXTILE
9 - GRAVEL
10 - DRAIN
11 - DRAIN GRATE

DETAIL DRAIN



12 - PIPE
13 - FACADE
14 - MINERAL WOOL
15 - SEPARATION MESH

CONVENTIONS :
- POLYSTYRENE
- REINFORCED CONCRETE
- CLAY BLOCKS
- PLASTERBOARD + POLYSTYRENE
- EXPANDED CLAY BLOCKS WITH INSERTION OF MINERAL WOOL. PARTITIONS BETWEEN APARTMENS.
- EXPANDED CLAY BLOCKS



12 cm wall ventilation shafts chimney installation waterproofing
12 cm stone wool insulation roll roofing chimney and roof trims
1 cm coated galvanized steel

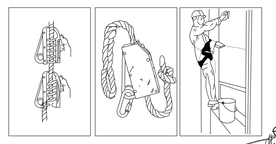
12 cm wall ventilation shafts chimney installation waterproofing
12 cm stone wool insulation roll roofing chimney and roof trims
1.2 mm coated galvanized steel

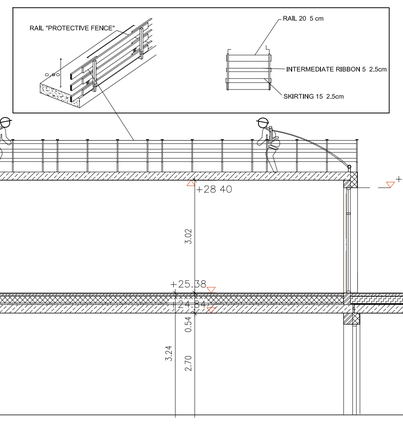
STORAGE ÁREA (20 m2)

FIXED ANCHOR (EN-795 Clase A1, Spanish Normative).

The works on roof be carried out under measures preventive safety for workers:
- Protective fence
- Each worker have to be tied by a line of life to a fixed anchor point wich will be affixed to slab.

Therefore, every worker in addition to the individual protections, take a safety harness, coupled with a lifeline which one is fixed point of anchorage.





-The Railing perimeter protection of stairwells will be placed around its perimeter.
- The rail "sargento" protection type will be placed on all floors.
-The Horizontal network of protection will be placed along all the floors , attached by struts.
-The Gallows type network , will be placed only on the last floor to prevent objects from falling into the void.
-The line of life , will be placed at the last floor. Operators keep a safety harness hooked to the lifeline . Thus, in the case of a fall , the operator will be assured with it.

TECHNICAL-ECONOMIC INDICATORS

1.Quantity of works: 644.72 m2
2. Installation cost: 644.72 m2 x 65.02 € = 41.919,69 €
3. Works duration: 15 days
4. Wage: 8 hours / day x 15 days = 120 h
Official 1st construction: 120 h x 8,36 = 1003.2 €
Construction ordinary laborer: 120 h x 10,94 = 1312.8 €

Official 1st applicator waterproofing sheets: 2 days x 8 h/d = 16 h --> 16 h x 2.09 = 33.44 €
Assistant applicator waterproofing sheets: 16 h x 1.95 = 31.2 €
Official 1st insulation fitter : 4 d x 8 h/d = 32 h --> 32 h x 0.89 = 28.48 €
Insulation fitter helper: 32 h x 0.81 = 25.92 €

CHAPTER	CODE	ACTIVITY	PRICE (€/m2)	MEASUREMENT (m2)	RESOURCES	RESOURCES	PERFORMANCE	TIME (DAYS)	COST (€)
ROOFTOP	06.01	Primer layer	2.42	48.35	Official 1ª	4	0.075	2	117.02
	06.02	Brick placement on edge	0.52	2578.8	Official 1ª	6	4	2	1341.01
	06.03	Execution gradient formation	5.95	64.472	Official 1ª	14	0.485	2	383.61
	06.04	Geotextile	1.09	676.956	Official 1ª	2	1.05	2	737.87
	06.05	Placement thermal insulation (25cm)	13.92	676.956	Official 1ª	8	0.050	2	9423.23
	06.06	Steam insulation waterproof	6.83	709.192	Official 1ª	10	0.121	2	4843.78
	06.07	Gravel	5.04	116.05	Official 1ª	3	0.18	1	587.18

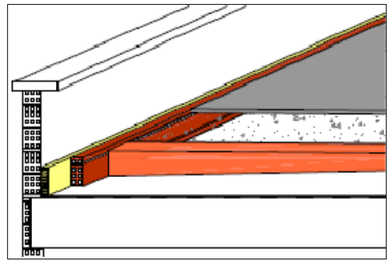
ORGANIZATION

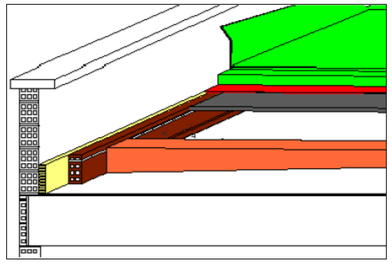
	Feb.																									
	week 33					week 34							week 35													
Working days	8	9	10	11	12	15	16	17	18	19	22	23	24	25	26											
Instants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15											
Primer layer ,Replanned of gradient	4	4																								
Placement of vapor barrier			3	3																						
Brick placement on edge					6	6																				
Execution of valley roof and hip roof							6	6																		
Execution gradient formation									7	7																
Leveling screed + geotextile											6	6														
Placement thermal insulation (25cm)													2	2												
Steam insulation waterproof													5	5												
Geotextile + Gravel															4											
TOTAL Oficiales CB	4	4	3	3	6	6	6	6	7	7	6	6	7	7	4											
TOTAL DAYS : 15 days																										

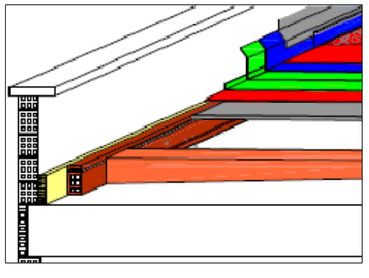
Due to the high percentage of rain in Vilnius (Lithuania) , the vapor barrier should be placed immediately after placing the thermal insulation, so the day was divided into hours , and in the same aunt, the layer of thermal insulation (polystyrene 25 cm) , and immediately after placement of the vapor barrier will take place . The duration will be :
- Four for thermal insulation (per day) .
- Four hours a vapor barrier (per day) .

So, the eight hours of work a day are achieved.

Working days	week 35															
	day 13								day 14							
Instants (hours)	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Thermal insulation polystyrene 25 cm	2								2							
Steam insulation waterproof					5								5			



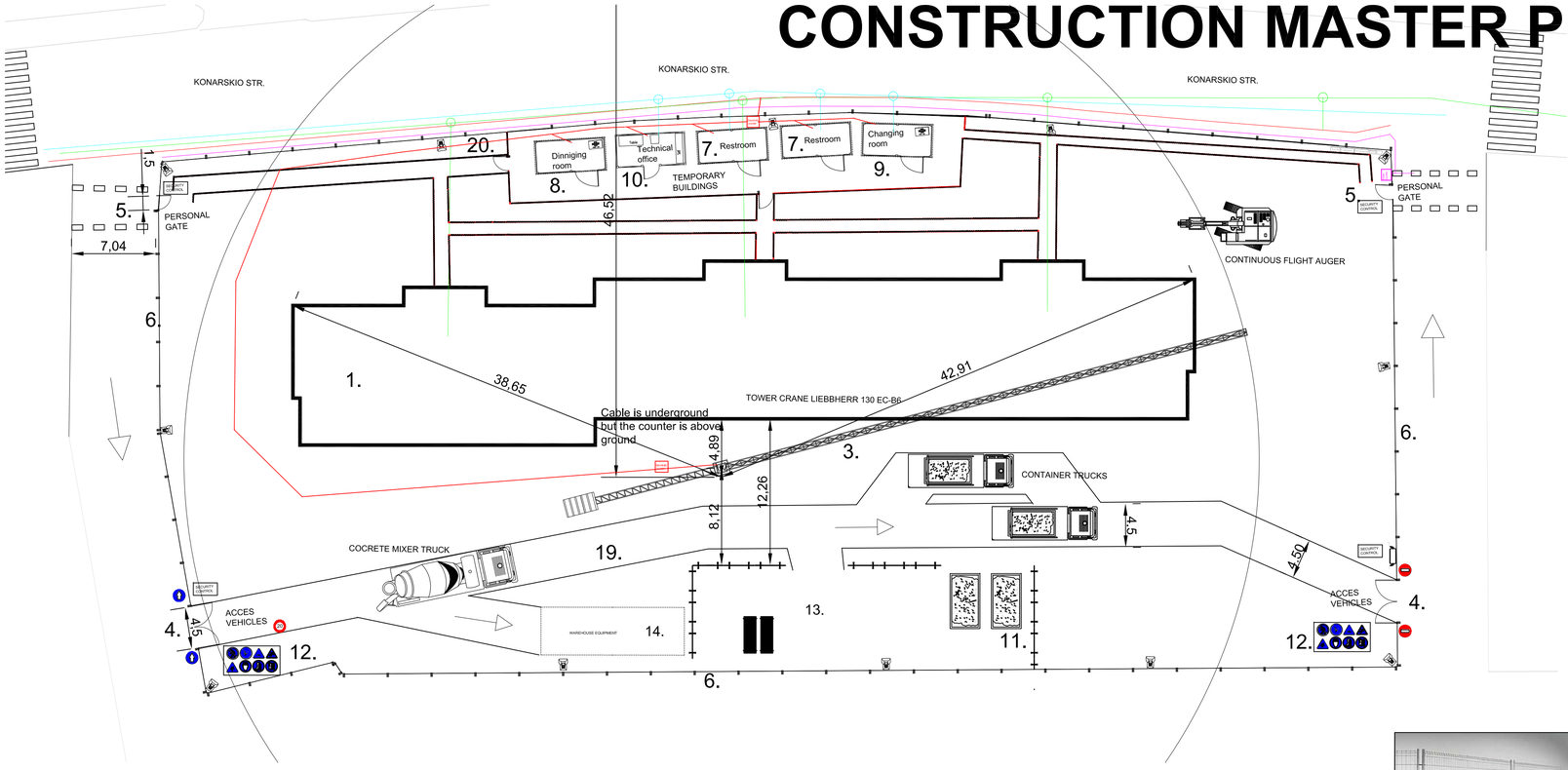




4. Placement manufactures edge (protruding structure) and sealed
5. Execution of valleys roof and hip roof.
6. Execution of slope formation.
7. Layer regularization.
8. Geotextile.
9. Polystyrene 25 cm
10. PE modified, waterproofing.
11. Geotextile.
12. Gravel.

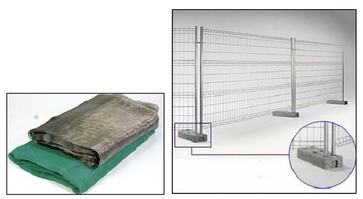
	Name and Surename	Signature	Date	
Student	Paula Barrachina Escrivá			CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIO STR. 12 IN VILNIUS.
Supervisor	Tatjana Vilutiene			Department of Construction Technology and Management — PAGE 4/6 — 2015
Head of Department				DRAWING: TECHNOLOGICAL OF CARD ROOF WORKS — FINAL THESIS WORK
Reviewer				

CONSTRUCTION MASTER PLAN

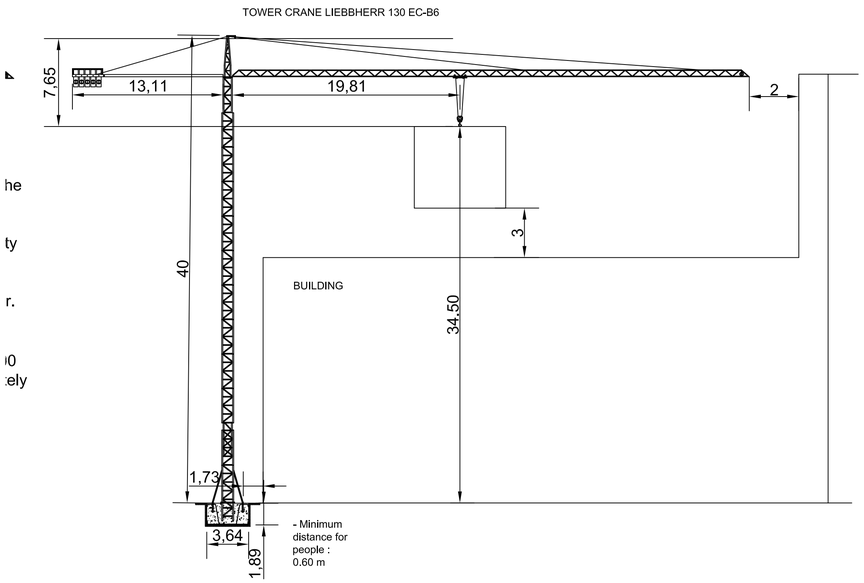


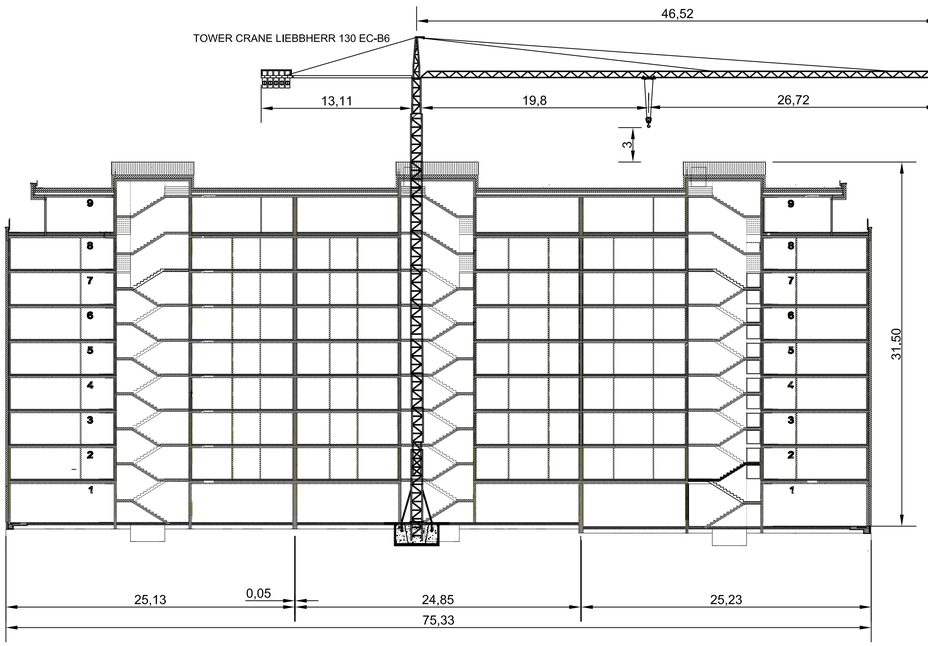
1.	Building object of construction	6.	Fence	11.	Waste and recicling container	16.	Temporary electricity supply counter
2.	Existing buildings	7.	Restroom	12.	Advertising board	17.	Temporary gas supply counter
3.	Crane	8.	Dinning room	13.	Exterior storage area	18.	Temporary sewage system
4.	Acces vehicles	9.	Changing room	14.	Warehouse equipment	19.	Step machinery within plot
5.	Personal gates	10.	Technical office	15.	Temporary water supply counter	20.	Direct path of gateway to temporary buildings for workers

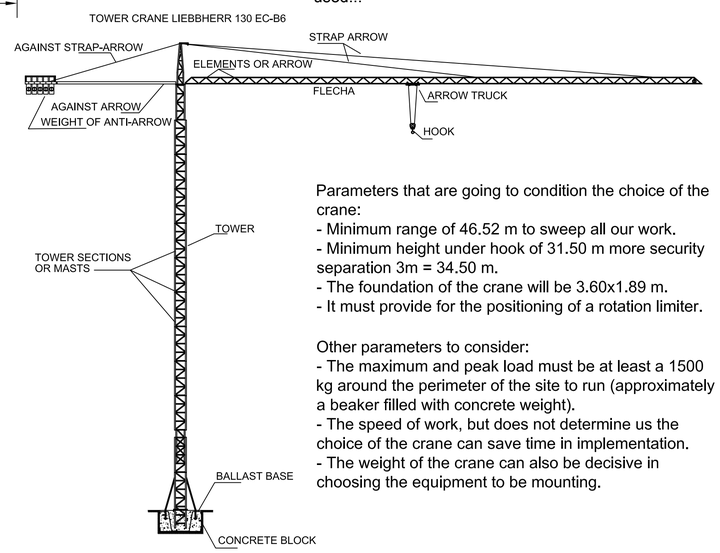
	Temporary lighting		Fence		Direct path of gateway to temporary buildings for workers
	Limits building		Avertising board		Temporary water and electricity supply counter
	Crane		Temporary wastewater network connection		Trespassing signal is output vehicles.
	Acces vehicles		Temporary drinking water network connection		Securtity control in each enter
	Limits building		Temporary electrical underground cable network connection		Road to workers to go to temporal buildings and work area



Near provisional for the delimitation of the work area perimeter . Its dimensions will be : 3.50 x 2.00 m .
The cables are galvanizaded and:
- Horizontal : 5 mm in diameter
- Vertical : 4 mm in diameter
The concrete prefabricated base is : 65 x 24 x 12 cm and it has 6 holes for the posts.
To avoid the visibility of the work from the outside one mesh of green polyethylene is used...







Parameters that are going to condition the choice of the crane:
- Minimum range of 46.52 m to sweep all our work.
- Minimum height under hook of 31.50 m more security separation 3m = 34.50 m.
- The foundation of the crane will be 3.60x1.89 m.
- It must provide for the positioning of a rotation limiter.

Other parameters to consider:
- The maximum and peak load must be at least a 1500 kg around the perimeter of the site to run (approximately a beaker filled with concrete weight).
- The speed of work, but does not determine us the choice of the crane can save time in implementation.
- The weight of the crane can also be decisive in choosing the equipment to be mounting.

TOWER CRANE LIEBBHERR 130 EC-B6

m r	m/kg	m/kg 20,0	22,5	25,0	27,5	30,0	32,5	35,0	37,5	40,0	42,5	45,0	47,5	50,0	52,5	55,0	57,5	60,0
60,0 (r = 61,5)	2,8–34,1 **3000**	3000	3000	3000	3000	3000	3000	2910	2680	2480	2310	2160	2020	1890	1780	1680	1590	**1500**
57,5 (r = 59,0)	2,8–36,0 **3000**	3000	3000	3000	3000	3000	3000	3000	2860	2650	2470	2300	2160	2030	1910	1800	**1700**	
55,0 (r = 56,5)	2,8–37,6 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2790	2600	2430	2270	2140	2010	**1900**		
52,5 (r = 54,0)	2,8–38,9 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2900	2710	2530	2370	2230	**2100**			
50,0 (r = 51,5)	2,8–39,9 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	2990	2790	2610	2450	**2300**				
47,5 (r = 49,0)	2,8–41,3 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	2910	2720	**2550**					
45,0 (r = 46,5)	2,8–42,4 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	2990	**2800**						
42,5 (r = 44,0)	2,8–42,5 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	3000	**3000**							
40,0 (r = 41,5)	2,8–40,0 **3000**	3000	3000	3000	3000	3000	3000	3000	3000	**3000**								
37,5 (r = 39,0)	2,8–37,5 **3000**	3000	3000	3000	3000	3000	3000	3000	**3000**									
35,0 (r = 36,5)	2,8–35,0 **3000**	3000	3000	3000	3000	3000	3000	**3000**										
32,5 (r = 34,0)	2,8–32,5 **3000**	3000	3000	3000	3000	3000	**3000**											
30,0 (r = 31,5)	2,8–30,0 **3000**	3000	3000	3000	3000	**3000**												
27,5 (r = 29,0)	2,8–27,5 **3000**	3000	3000	3000	**3000**													
25,0 (r = 26,5)	2,8–25,0 **3000**	3000	3000	**3000**														
22,5 (r = 24,0)	2,8–22,5 **3000**	3000	**3000**															
20,0 (r = 21,5)	2,8–20,0 **3000**	**3000**																

	Name and Surename	Signature	Date
Student	Paula Barrachina Escrivá		
Supervisor	Tatjana Vilutienė		
Head of Department			
Reviewer			

CONSTRUCTION PLANNING OF MULTI-FAMILY DWELLING AT KONARSKIO STR. 12 IN VILNIUS.

Department of Construction Technology and Management

PAGE 5/6

2015

DRAWING

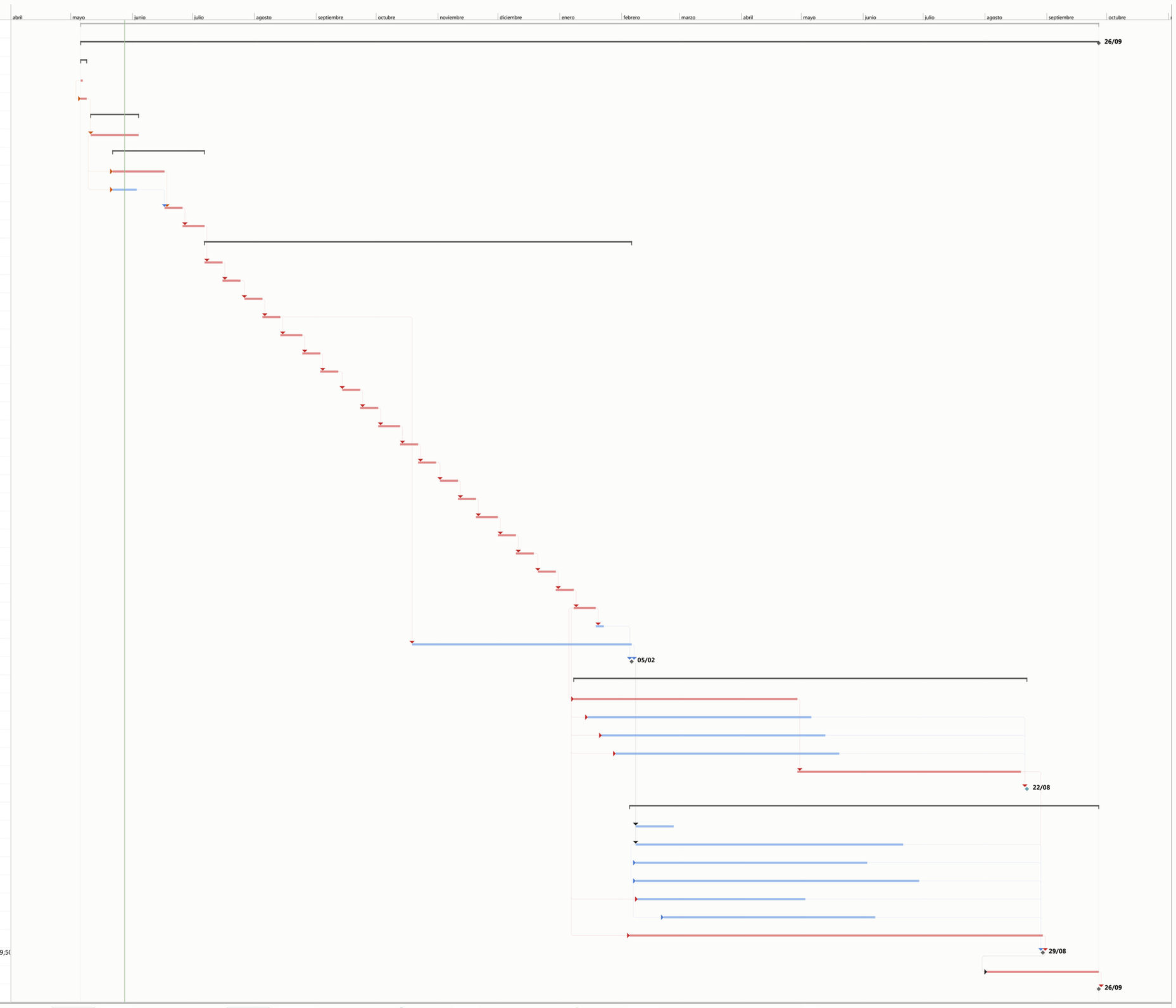
CONSTRUCTION MASTER PLAN

FINAL THESIS WORK

CONSTRUCTION SCHEDULING

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS

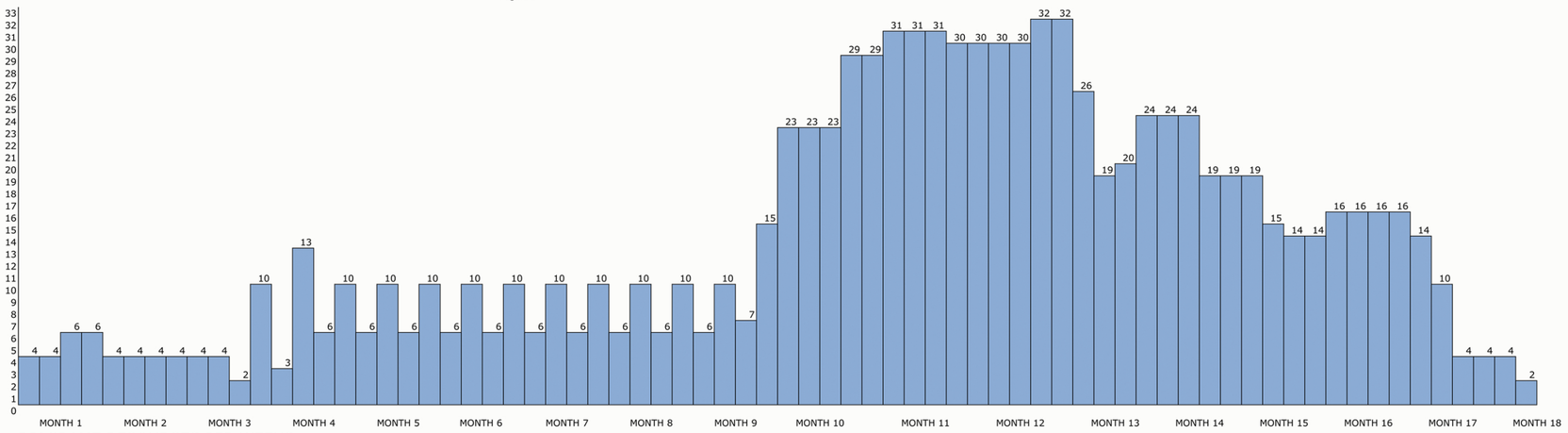
Id	Modo de tarea	Nombre de tarea	Duración	Comienzo	Fin	Predecesoras
0		**Proyecto1**	**364 días**	**mié 06/05/15**	**lun 26/09/16**	
1		**1 Building Project**	**364 días**	**mié 06/05/15**	**lun 26/09/16**	
2		**1.1 Preliminary tasks**	**3 días**	**mié 06/05/15**	**vie 08/05/15**	
3		1.1.1 Clearing	1 día	mié 06/05/15	mié 06/05/15	
4		1.1.2 Fenced	3 días	mié 06/05/15	vie 08/05/15	3CC
5		**1.2 Earthmoving**	**18 días**	**lun 11/05/15**	**mié 03/06/15**	
6		1.2.1 Excavation	18 días	lun 11/05/15	mié 03/06/15	4
7		**1.3 Foundation**	**32 días**	**vie 22/05/15**	**lun 06/07/15**	
8		1.3.1 Foundations piles 0,8	18 días	vie 22/05/15	mar 16/06/15	6CC+9 días
9		1.3.2 Foundations piles 0,6	8 días	vie 22/05/15	mar 02/06/15	6CC+9 días
10		1.3.3 Red sanitation	7 días	mié 17/06/15	jue 25/06/15	8;9
11		1.3.4 PB slab	7 días	vie 26/06/15	lun 06/07/15	10
12		**1.4 Concrete Structure**	**154 días**	**mar 07/07/15**	**vie 05/02/16**	
13		1.4.1 PB wall load	7 días	mar 07/07/15	mié 15/07/15	11
14		1.4.2 P1 slab	7 días	jue 16/07/15	vie 24/07/15	13
15		1.4.3 P1 wall load	7 días	lun 27/07/15	mar 04/08/15	14
16		1.4.4 P2 slab	7 días	mié 05/08/15	jue 13/08/15	15
17		1.4.5 P2 wall load	7 días	vie 14/08/15	lun 24/08/15	16
18		1.4.6 P3 slab	7 días	mar 25/08/15	mié 02/09/15	17
19		1.4.7 P3 wall load	7 días	jue 03/09/15	vie 11/09/15	18
20		1.4.8 P4 slab	7 días	lun 14/09/15	mar 22/09/15	19
21		1.4.9 P4 wall load	7 días	mié 23/09/15	jue 01/10/15	20
22		1.4.10 P5 slab	7 días	vie 02/10/15	lun 12/10/15	21
23		1.4.11 P6 wall load	7 días	mar 13/10/15	mié 21/10/15	22
24		1.4.12 P6 slab	7 días	jue 22/10/15	vie 30/10/15	23
25		1.4.13 P7 wall load	7 días	lun 02/11/15	mar 10/11/15	24
26		1.4.14 P7 slab	7 días	mié 11/11/15	jue 19/11/15	25
27		1.4.15 wall load P8	7 días	vie 20/11/15	lun 30/11/15	26
28		1.4.16 P8 slab	7 días	mar 01/12/15	mié 09/12/15	27
29		1.4.17 wall load P9	7 días	jue 10/12/15	vie 18/12/15	28
30		1.4.18 slab P9	7 días	lun 21/12/15	mar 29/12/15	29
31		1.4.19 wall load P10	7 días	mié 30/12/15	jue 07/01/16	30
32		1.4.20 slab P10	7 días	vie 08/01/16	lun 18/01/16	31
33		1.4.21 Caissons	4 días	mar 19/01/16	vie 22/01/16	32
34		1.4.22 ladder	80 días	lun 19/10/15	vie 05/02/16	16
35		1.4.23 End structure	0 días	vie 05/02/16	vie 05/02/16	33;34
36		**1.5 Building Installations**	**161 días**	**vie 08/01/16**	**lun 22/08/16**	
37		1.5.1 plumbing installation	80 días	vie 08/01/16	jue 28/04/16	32CC
38		1.5.2 electrical installation	80 días	vie 15/01/16	jue 05/05/16	32CC+5 días
39		1.5.3 heating installation and hot water	80 días	vie 22/01/16	jue 12/05/16	32CC+10 días
40		1.5.4 installing fire	80 días	vie 29/01/16	jue 19/05/16	32CC+15 días
41		1.5.5 special facilities	80 días	vie 29/04/16	jue 18/08/16	37
42		1.5.6 Finish Installation	0 días	lun 22/08/16	lun 22/08/16	40;41;39;38
43		**1.6 Architecture**	**167 días**	**vie 05/02/16**	**lun 26/09/16**	
44		1.6.1 Roof	15 días	lun 08/02/16	vie 26/02/16	35
45		1.6.2 Facade	96 días	lun 08/02/16	lun 20/06/16	35
46		1.6.3 Carpinteria	84 días	lun 08/02/16	jue 02/06/16	45CC
47		1.6.4 Partitions and masonry	102 días	lun 08/02/16	mar 28/06/16	45CC
48		1.6.5 Carpentry inside	60 días	mar 09/02/16	lun 02/05/16	32CC+22 días
49		1.6.6 liner	76 días	lun 22/02/16	lun 06/06/16	47CC+10 días
50		1.6.7 Wall and ceiling cladding	147 días	vie 05/02/16	lun 29/08/16	37CC+20 días
51		1.6.8 Finish architecture	0 días	lun 29/08/16	lun 29/08/16	47;45;46;48;49;5
52		1.6.9 Urbanization	40 días	mar 02/08/16	lun 26/09/16	51FC-20 días
53		1.6.10 Finish Building	0 días	lun 26/09/16	lun 26/09/16	52



Proyecto: Proyecto1
Fecha: jue 28/05/15

Tarea · Resumen del proyecto · Tarea manual · solo el comienzo · Fecha límite · Tareas críticas · Atraso
División · Tarea inactiva · solo duración · solo fin · Tarea hito de predecesor controlador de ruta de acc · División crítica
Hito · Hito inactivo · Informe de resumen manual · Tareas externas · Tarea de resumen de predecesor controlador de ruta · Progreso
Resumen · Resumen inactivo · Resumen manual · Hito externo · Tarea normal de predecesor controlador de ruta de a · Progreso manual

Página 1



DIAGRAME RESOURCES PER WEEKS

| NAME / Weeks: | MONTH 1 | | | | MONTH 2 | | | | MONTH 3 | | | | MONTH 4 | | | | MONTH 5 | | | | MONTH 6 | | | | MONTH 7 | | | | MONTH 8 | | | | MONTH 9 | | | | MONTH 10 | | | | MONTH 11 | | | | MONTH 12 | | | | MONTH 13 | | | | MONTH 14 | | | | MONTH 15 | | | | MONTH 16 | | | | MONTH 17 | | | | MONTH 18 | | | |
|---|---|---|---|---|---|---

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY
FACULTY OF CIVIL ENGINEERING
DEPARTMENT OF CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Student: Paula Gema Barrachina Escrivá

ECONOMIC CALCULATION

ECONOMIC CALCULATION

General budget of the whole work explained and accompanied by the necessary tables " CYPE " which was able to take the price operations.

All information used here to make the budget work is taken from a Spanish website " Generator Prices CYPE " therefore , all tables in which the decomposition of leaves each game performance , unit price and cost , It has been translated manually.

http://www.generadordeprecios.info

Example of interior carpentry : doors

http://www.generadordeprecios.info/obra_nueva/L_Carpinteria__vidrios_y_protecciones/Puertas/De_madera/Puerta_de_paso_de_madera.html

CLEARING

4470 m^2

4470 x 0,73 = **3129 €**

ADL005 m² Clearing and clearance

Clearing and clearance, using mechanical facilities, removal of excavated materials and truck load, not including transportation to an authorized landfill.

Descomposed	Ud	Descomposition	Yield	Unit price (€)	Cost (€)
mq01pan010a	h	Loader on tires of 120 kW/1,9 m³.	0,015	40,13	0,60
mo111	h	Worst ordinary construction	0,006	15,92	0,10
	%	Aids	2,000	0,70	0,01
	%	Indirect costs	3,000	0,71	0,02
				Total:	0,73

EXCAVATION

The excavation will be different in a block of the other two , since the block I, begins in elevation -0.36 , therefore , it is held in an excavation :

- Block I (14,400 x 25 m): -0.96 m
- Block II and III (49,930 x 14,400 m) : -0.36 m
- 3 Elevators (1.70 x 3.70 m): -1.70 m

Total excavation :
14,400 x 25 = 360 m2
49,930 x 14,400 = 718.9 m2
1.70 x 3.70 = 6.29 m2

360 x 0.96 = 345.6 m3
718.9 x 0.36 = 258.8 m3
6.29 x 1.70 = 10.7 x 3 = 32.1 m3

345.6 + 258.8 + 32.1 = 636.5 m3

23,71 X 636.5 = **15.091,41 €**

ADE010 m³ Digging.

Mechanically removing excavated materials and truck loading.

Descomposed	Ud	Descomposition	Yield	Unit Price (€)	Price
mq01exn020b	h	Hydraulic backhoe wheeled , of 115 kW.	0,383	48,42	18,54
mo111	h	Ordinary construction worker	0,253	15,92	4,03
	%	Aids	2,000	22,57	0,45
	%	Indirect costs	3,000	23,02	0,69
				Total:	23,71

FOUNDATION

Technical economic indicators of drilling and concreting piles

Ud.	Description	Yield	Unit price	cost(€)
Ud.	Aprproved separator for piles.	3,00	0,09	0,27
Kg	Corrugated steel bars, UNE-10080 B500S, made in industrial workshop, several diameters.	9,400	0,92	9,40
m3	Central concrete HA-25 / F / 12 / IIa	0,420	82,88	34,81
h	Paragraph full drilling equipment and drilling concrete pile central auger tuve CPI-8	0,146	175,00	20,30
h	Stationary pump for pumping concrete	0,065	55,91	3,63
h	Steel worker	0,735	18,10	13,30
h	Steel helper	0,735	16,94	12,45
%	Auxiliary works	2,00	94,28	1,89
%	Indirect costs	3,00	96,17	2,89
Ten-year maintenance cost: 1,83 in first 10 years			TOTAL X METER	99,06

1. Quantity of Works:

Ø 80 cm : 0.8 x 8 = 6,4 m^3 x 145 piles = 928 m^3
Ø 60 cm : 0.6 x 8 = 4,8 m^3 x 62 piles = 297,6 m^3

TOTAL CONCRETE : 1.225,6 m^3
TOTAL PILES : 145 + 62 = 207 piles

2. Installation cost:

1225,6 m^3 x 99,06 € = **121.407,936 €**

3. Works duration: 18 days

4. Wage:

- Steel worker:

18 days x 8 h/d = 144 h.
144 h x 13,30 = 1.915,2 €

- Steel helper:

144 h x 12,45 = 1.792,8 €

- Drilling equipment and drilling concrete pile:

919,2 m^3 x 20,30 = 18.659,76 €

RESOURCES: Just after the complete execution of piles , you start to run the sewer and once completed, that time will be 7 days, begins the slab foundation, which duration is seven days and resources are 10, divided into 2 groups of 5 is made :
- 3 officers and 2 pawns (each group).
The three tie beams , which are the foundation slab were carried out while the slab , that ' s therefore are included in the time and cost of the slab.

SLAB

Technical economic indicators of slab joint

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
Ud	Separator approved for foundations	5,00	0,13	0,65
kg	Corrugated steel bars , UNE -EN 10080 B 500 SD , developed in industrial workshop , various diameters.	85,00	0,92	78,2
m3	Concrete HA- 25 / B / 20 / IIa , manufactured in Central	1,05	76,88	80,72
h	Pump truck parked on site, for pumping concrete .Iclusive w / w of displacement	0,041	170	6,97
h	Vibrant Rule of 3 m .	0,34	4,66	1,56
h	Official 1ststeel worker	0,217	18,1	3,66
h	Steel helper	0,217	16,94	3,42
%	Aids	2,00	193,34	3,36
%	Indirect costs	3,00	197,21	5,15
Decennial maintenance cost : € 5.30 in the first 10 years.			TOTAL	203,13

1. Quantity of Works:

788,78 m^2 x 0,30 m = 236,634 m^3

2. Installation cost:

236,634 m^3 x 203,13 € = **48.067,46 €**

3. Works duration: 7 days

4. Wage:

Construction helper:

- Official 1 st Steel worker:

7 d x 8 h/d= 56 h.

56 h x 3,66 = 204,96 €

- Steel helper:

56 h x 3,42= 191,52 €

SLAB FORMWORK SYSTEM

Technical economic indicators of slab formwork system

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
m3	Shuttering wood , 26 mm thick, foundations.	0,01	255,00	2,55
kg	Galvanized wire to tie , 1.30 mm in diameter.	0,01	1,10	0,01
kg	Steel tips 20x100 mm	0,40	7,00	0,28
h	Official 1st encofrador	0,30	18,10	5,48
h	Encofrador assistant	0,30	16,94	5,13
%	Aids	2,00	13,45	0,27
%	Indirect costs	3,00	13,72	0,41
			TOTAL	14,13

1. Quantity of Works:

   788,78 m^2 x 0,30 m = 236,634 m^3

2. Installation cost:

   236,634 m^3 x 14,13 = **3.343,64 €**

3. Works duration: 3 days

4. Wage:

- Official 1st encofrador :

3 d x 8 h/d = 24 h.
24 h x 5,48 = 131,52 €

- Encofrador assistant :

24 h x 5,13 = 123,12 €

BEAM FORMWORK SYSTEM.

Technical economic indicators of beam formwork system

Ud.	**Description**	**Yield**	**Unit price**	**cost(€)**
m3	Shuttering Wood, 26 mm thick, foundations	0,02	255,00	5,1
Kg	Galvanized wire to tie, 1.30 mm in diameter	0,120	1,10	0,13
Kg	Steel tips 20x100 mm	0,05	7,00	0,35
h	Steel worker	0,707	18,10	12,80
h	Steel helper	0,707	16,94	11,98
%	Auxiliary works	2,00	30,36	0,61
%	Indirect costs	3,00	30,97	0,93
		TOTAL		31,90

1. Quantity of works:

0,3 x 0,4 = 0,12 m^2
0,12 x 6,13 m = 0,736 m^3
0,736 m^3 x 3 beams = 2,208 m^3

2. Installation cost:

2,208 m^3 x 31,90 € = **70,435 €**

3. Works duration: 30 mins.

4. Wage:

- Steel worker:

0,5 h x 12,80 = 6,4 €

- Steel helper:

0,5 h x 11,98 = 5,99 €

CONCRETE FOR BEAMS

Technical economic indicators of concrete for beams

Ud	**Decomposition**	**Yield**	**Unit Price**	**Price(€)**
Ud	Approved separator for piles.	10,000	0,13	1,30
kg	Corrugated steel B 500 S	60,000	1,00	60,00

m³	Central concrete HA-25	1,050	76,88	80,72
h	Steel worker	0,061	18,10	1,10
h	Steel helper	0,061	16,94	1,03
%	Auxiliary works	2,000	144,15	2,88
%	Indirect costs	3,000	147,03	4,41
Ten-year maintenance cost: € 1.32 in the first 10 years.			TOTAL	151,44

1. Quantity of works:

0,3 x 0,4 = 0,12 m^2
0,12 x 6,13 m = 0,736 m^3
0,736 m^3 x 3 beams = 2,208 m^3

2. Installation cost:

2,208 m^3 x 151,44 = **334,379 €**

3. Works duration: 30 mins.
4. Wage:

- Steel worker:

0,5 h x 1,10 = 0,55 €

- Steel helper:

0,5 h x 1,03 = 0,515 €

CHAPTER	ACTIVITY	PRICE (€/m2)	MEASUREMENT (m2)	RESOURCES	RESOURCES	PERFORMANCE	TIME (DAYS)	COST (€)
FOUNDATION	Pile drilling and concreting insitu φ600mm	99,06	298	Continuous Flight Auger	1	0,15	8	29.480,26
	Pile drilling and concreting insitu φ800mm	99,06	928	Continuous Flight Auger	1	0,15	18	91.927,68
	Slab foundation HA 30	203,13	800	6 Official 1ª	4 workers	0,217	7	48.472,86

MEASUREMENT:

Nº piles	Depth	mL
62	8	297,6
145	8	928

RED SANITATION

800 m2
72,40 x 800 = **57920 €**

ASB010 **m** **General red sanitation**

Sanitation general connection to the grid of the minicipality, smooth PVC SN -4 kN / m , nominal ring stiffness 4 kN / m , 200 mm in diameter, attached by adhesive.

Descomposed	Ud	Descomposition	Yield	Unit Price (€)	Cost (€)
mt01ara010	m³	Sand 0 to 5 mm in diameter.	0,385	12,02	4,63
mt11tpb030d	m	PVC smooth pipe for non-pressure underground drainage and sewerage , SN -4 series , nominal ring stiffness 4 kN / m , 200 mm outer diameter and 4.9 mm thick , according to UNE -EN 1401-1 .	1,050	10,06	10,56
mt11var009	l	Cleaning liquid for adhesive bonding using PVC pipes and fittings .	0,079	11,85	0,94
mt11var010	l	Adhesive for PVC pipes and fittings .	0,039	18,06	0,70
mt10hmf010Mp	m³	Concrete HM -20 / P / 20 / I , I manufactured in Central .	0,090	69,13	6,22
mq05pdm010b	h	Portable electric compressor 5 m³ / min flow .	0,683	6,88	4,70
mq05mai030	h	Jackhammer .	0,683	4,07	2,78
mq01ret020b	h	Backhoe wheeled , 70 kW.	0,030	36,43	1,09
mq02rop020	h	Guided vibrating tamper manual , 80 kg, 30x30 cm plate , frog type	0,221	3,49	0,77
mo019	h	Official 1st construction .	1,201	17,24	20,71
mo110	h	Specialized construction laborer .	0,601	16,25	9,77
mo007	h	Official 1st plumber .	0,139	17,82	2,48
mo105	h	Assistant plumber .	0,139	16,10	2,24
	%	Aids	4,000	67,59	2,70
	%	Indirect costs	3,000	70,29	2,11
Maintenance cost of ten: 6,52€ in first 10 years.				Total:	72,40

CONCRETE STRUCTURE

SLABS
Budget of slab

Ud.	Description	Yield	Unit price	cost(€)
m2	Continuous system formwork concrete slab paragraph armado.Compuesto of : props, Metal girders and formwork surface treated wood Reinforced rods and profiles .	1.100	14.78	16.26
m	Expanded polystyrene molt to ledge	0.100	8.81	0.88
Ud	Approved for solid slabs separator	3.000	0.08	0.24
kg	Corrugated Steel bars, UNE-EN 10080 B 500 SD, developed in industrial workshop,various diameters.	22.000	0.92	20.24
m3	Concrete HA-25 / B / 20 / IIa, manufactured in central.	0.2420	76.88	18.60
h	Official 1st estructurista	0.527	18.10	9.54
h	Estrcuturista assistant	0.527	16.94	8.93
%	Auxiliaries	2.000	74.69	1.49
%	Indirect costos	3.000	76.18	2.29
			TOTAL X METERS	78.47
			TOTAL METERS	813.98
			TOTAL PRICE	63873.011

**Decennial maintenance cost: 3.92€ in the first 10 years.

TOTAL COST FOR SECOND FLOOR: 63.873,011 €

SURFACES CHEKING OF SECOND FLOOR:

1) Common área: 67,12 m^2
   Rooms apartment: 61,1 m^2
   Rooms apartment: 67,98 m^2
   Rooms apartment: 51,67 m^2
   Rooms apartment: 67,5 m^2

TOTAL: 67,12 + 61,1 + 67,98 + 51,67 + 67,5 = 315,37 m^2

2) Rooms apartment: 67,36 m^2
   Rooms apartment: 51,60 m^2
   Rooms apartment: 51,60 m^2
   Rooms apartment: 71,34 m^2

TOTAL : 67,36 + 51,60 + 51,60 + 71,34 = 242, 9 m^2

3) Rooms apartment: 74,74 m^2
   Rooms apartment: 51,55 m^2
   Rooms apartment: 68,88 m^2
   Rooms apartment: 61,54 m^2

TOTAL: 74,74 + 51,55 + 68,88 + 61,54 = 256,71 m^2

TOTAL SECOND FLOOR: 315,37 + 242,9 + 256,71 = 813,98 m^2

TECHNICAL- ECONOMIC INDICATORS

1. Quantity of Works: 813.98 m^2
2. Instalation cost: 63873.011 €
3. Duration of Works: 7 days
4. Wage:

    - Official 1st structure :

    8 h/d x 7 days = 56 h.

    56 h x 18.10 € = 1.013,6 €

    - Structure assistant:

    56 h x 16.94 € = 948.64 €

It has made the full financial calculation of the 2nd floor slab as it is " slab type " , but the buildings consist of 10 slabs in full:

- Slab 1-7: 813.98 m^2
- Slab 8: 806.78 m^2
- Slab 9: 644.72 m^2

So, it has to be calculated the totally of money:

- Slab 1-7: 813.98 m^2 x 78,47 €/ m^2 = 63.873,011 x 7 = 447.111,07 €
- Slab 8: 806.78 m^2 x 78,47 €/ m^2 = 63.308,03 €
- Slab 9: 644.72 m^2 x 78,47 €/ m^2 = 50.591,18 €

TOTAL: 447.111,07 + 63.308,03 + 50.591,18 = **561.010,26 €**

WALLS

Silicate blocks:

75,160 + 16, 295 = 91,45 m
91,45 x (29,60 – 3.35) = 2400,56 m2
32,54 x 2400,56 = **78114,30 €**

On the ground floor , unlike the rest of the floors , there is a bearing wall :
18.0 /24.0 cm monolithic wall.

Load bearing wall structure
In such structures , the vertical elements supporting the slab are the masonry walls , in this case Termoarcilla .
This structural system has two types of vertical elements: load bearing walls . Above them directly supports the slab.
They are perpendicular to the bearing walls and are required to withstand horizontal actions.

The height and thickness of the wall is : 3.35 h.

Wall length:

75.160 + 16,295 = 91,45 m
91. 45 x 2 = 182.91 m
182.91 x 3.35 = 612,72 m2
612,72 x 32,54 = **19937,7 €**

FFR040	m²	**Interior facade sheet , block factory termoarcilla you to coat**

Inner facade cladding sheet 24 cm thick factory block termoarcilla lightened, 30x19x24 cm for coating, industrial received with cement mortar, gray, M-5, supplied in bluk.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost (€)
mt02btr020ob	Ud	Termoarcilla block lightened , 30x19x24 cm , for coating , even w / w of special parts : half , finishing, corner trim, base and top corner shot .	17,850	0,95	16,96
mt08aaa010a	m³	Water.	0,007	1,50	0,01
mt09mif010cb	t	Industrial mortar for masonry, concrete , gray class M-5 (compressive strength 5 N / mm²), supplied in bulk, according to UNE -EN 998-2 .	0,038	29,50	1,12
mt07vau010a	m	Prestressed girder , T-18 , Lmedia = <4 m , according to UNE -EN 15037-1 .	0,180	4,84	0,87
mt02btr025a	Ud	Termoarcilla plate lightened , 30x19x4,8 cm for coating .	1,500	0,47	0,71
mq06mms010	h	Continued with silo, industrial mortar dry bulk mixer supplied .	0,143	1,73	0,25
mo020	h	Official 1st in masonry construction .	0,401	17,24	6,91
mo112	h	Ordinary laborer masonry construction .	0,241	15,92	3,84
	%	Medios auxiliares	3,000	30,67	0,92
	%	Costes indirectos	3,000	31,59	0,95
Maintenance costs decenar: 2,60€ in the fists 10 years.				Total:	32,54

STAIRS

Slab thick : 15 cm

16 sections of :

It has information about slab, so:
3,8 x 0,15 x 1,19 = 0,69 m3
0,69 x 16 x 3 blocks= 33,12 m3

Landing:
1,9 x 3,05 x 0,15 = 0,86
0,86 x 18 = 15,6 m3
15,6 x 3 = 46,8 m3

Small slabs:
0,7 m3 x 3 x 3 = 6,3 m3

86,22 m2
122,52 x 86,22 = **10563,67 €**

EHE010 **m²** **Stairs slab.**

Staircase slab of reinforced concrete, e=15 cm, with peldañeo concrete, concrete made with HA-25 / P / Iia , SUSTENTA "FYM Italcementi Group", manufactured in the plant, and with cupola discharge, and UNE- EN 1008 steel B 500 S, 18 kg /m ; assembly and disassembly of recoverable formwork system wood.

Descomposed	Ud	Descomposition	Yield	Unit price (€)	Cost(€)
mt08eve010	m²	Formwork system sloping staircase reinforced concrete to a height up to 3 m, with props, girders and slabs wooden boards	1,400	32,00	44,80
mt08eve020	m²	Formwork system for forming peldañeado on sloping staircase reinforced concrete , with struts and wooden boards slabs.	0,900	17,40	15,66
mt07aco020f	Ud	Separator approved for slabs stairs.	3,000	0,08	0,24
mt07aco010c	kg	Corrugated steel bars , UNE -EN 10080 B 500 S , developed in industrial workshop , various diameters.	18,000	0,91	16,38
mt10hai010adcg	m³	Concrete HA- 25 / P / 20 / IIa, i.work SUSTENTA " FYM Italcementi Group " , made in Central .	0,242	103,20	24,97
mo041	h	Official 1st estructurista .	0,625	18,10	11,31
mo087	h	Estructurista assistant.	0,625	16,94	10,59
	%	Aids	2,000	123,95	2,48
	%	Indirec costs	3,000	126,43	3,79
Maintenance cost of ten: 3,91€ in the first 10 years.				Total:	130,22

INSTALLATIONS

BUILDING INSTALLATIONS

PLUMBING INSTALLATION

Ud. 4 bathrooms/block x 3 blocks = 12 x 8 floors = 96 bathrooms
96 kitchen
96 galleries

Bathroom: 454,55 € x 96 = **43.636,8 €**
Kitchen: 360,37 € x 96 = **34.595,52 €**

BATHROOM:

IFI010	**Ud**	**Interior installation in wet room**

Maintenance cost of ten indoor plumbing for bathroom with provision for: toilet, single, sink, tub, made of cosslinked polyethylene (PE-X), for the network of hot and cold water.

Descomposed	Ud	Descomposition	Yield	Unit price (€)	Cost (€)
mt37tpu400a	Ud	Auxiliary material for mounting and securing the work of cross-linked polyethylene pipe (PE- X) 5 Series , 16 mm outer diameter.	8,100	0,08	0,65
mt37tpu010ag	m	Cross-linked polyethylene pipe (PE- X) 5 Series , 16 mm outer diameter PN = 6 atm and 1.8 mm thick , according to ISO 15875-2 , with the price increased 30 % for accessories and trims.	8,100	2,07	16,77
mt37tpu400b	Ud	Auxiliary material for mounting and securing the work of cross-linked polyethylene pipe (PE- X) 5 Series , 20 mm outer diameter.	22,400	0,10	2,24
mt37tpu010bg	m	Cross-linked polyethylene pipe (PE- X) 5 Series , 20 mm outer diameter PN = 6 atm and 1.9 mm thick , according to ISO 15875-2 , with the price increased 30 % for accessories and trims.	22,400	2,53	56,67
mt37avu150b	Ud	Valve seat, bronze , 20 mm in diameter, with two connecting elements .	2,000	76,93	153,86
mo007	h	Official 1st plumber .	5,969	17,82	106,37
mo105	h	Assistant plumber .	5,969	16,10	96,10
	%	Aids	2,000	432,66	8,65
	%	Indirect costs	3,000	441,31	13,24
Maintenance cost of ten: 50,00€in the firsts 10 years.				Total:	454,55

KITCHEN:

IFI010 Ud Interior installation in wet room

Indoor plumbing kitchen, tap and making safe, made of cosslinked polyethylene (PE-X), for the network of hot and cold water.

Descomposed	Ud	Descomposition	Yield	Unit price (€)	Cost(€)
mt37tpu400a	Ud	Auxiliary material for mounting and securing the work of cross-linked polyethylene pipe (PE- X) 5 Series , 16 mm outer diameter.	8,100	0,08	0,65
mt37tpu010ag	m	Cross-linked polyethylene pipe (PE- X) 5 Series , 16 mm outer diameter PN = 6 atm and 1.8 mm thick , according to ISO 15875-2 , with the price increased 30 % for accessories and trims.	8,100	2,07	16,77
mt37tpu400b	Ud	Auxiliary material for mounting and securing the work of cross-linked polyethylene pipe (PE- X) 5 Series , 20 mm outer diameter.	11,000	0,10	1,10
mt37tpu010bg	m	Cross-linked polyethylene pipe (PE- X) 5 Series , 20 mm outer diameter PN = 6 atm and 1.9 mm thick , according to ISO 15875-2 , with the price increased 30 % for accessories and trims.	11,000	2,53	27,83
mt37avu150b	Ud	Valve seat, bronze , 20 mm in diameter, with two connecting elements .	2,000	76,93	153,86
mt31gcg070a	Ud	Tap for washing machine or dishwasher, threading , basic set , 1/2 " in diameter.	1,000	16,01	16,01
mo007	h	Official 1st plumber .	3,738	17,82	66,61

mo105	h	Official 1st plumber .	3,738	16,10	60,18
	%	Aids	2,000	343,01	6,86
	%	Indirect costs	3,000	349,87	10,50
Maintenance cost of tenl: 39,64€in the first 10 years.				Total:	360,37

ELECTRICAL INSTALLATION

perfom: 20,096
RESOURCES: 3 officials
90 apartments
90 x 2202,06 = **198.185,4 €**

IEI015 Ud Distribution network inside detached house.

Electrical distribution network inside a single family home with high electrification, with the following rooms: access, lobby, hall, dining room, double room, bathrooom, toilet, kitchen,terrace.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost (€)

mt35cgm040m	Ud	Recessed box with solid door, for housing the power control switch (ICP) in separate sealable compartment and the circuit breakers installation, 1 row of 4 modules (PCI) + 2 rows of 24 modules. Made of ABS self-extinguishing, with IP 40 protection, double insulation (class II), white RAL 9010. According to UNE-EN 60670-1.	1,000	27,98	27,98
mt35cgm021abbal	Ud	Automatic switch (IGA) of 2 modules, bipolar (2P), with 6 kA breaking capacity of 40 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	42,07	42,07
mt35cgm029ah	Ud	Instant RCD, 2P / 40A / 300mA, 2 modules, even w / w mounting hardware. According to UNE-EN 61008-1.	1,000	91,27	91,27
mt35cgm029ab	Ud	Instant RCD, 2P / 40A / 30mA, 2 modules, even w / w mounting hardware. According to UNE-EN 61008-1.	2,000	93,73	187,46
mt35cgm021bbbab	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 10 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	12,43	12,43
mt35cgm021bbbad	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 16 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	4,000	12,66	50,64
mt35cgm021bbbaf	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 20 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	13,59	13,59

mt35cgm021bbbah	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 25 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	14,08	14,08	
mt35aia010s	m	Bendable PVC pipe, corrugated, black, Aiscan-C "AISCAN", 16 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	159,360	0,27	43,03	
mt35aia010t	m	Bendable PVC pipe, corrugated, black, Aiscan-C "AISCAN", 20 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	154,380	0,30	46,31	
mt35aia010u	m	Bendable PVC pipe, corrugated, black, Aiscan-C "AISCAN", 25 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	8,300	0,40	3,32	

mt35aia080ka	m	Bendable tube, supplied in rolls, polyethylene (smooth inside and corrugated outside) double wall, orange, Aiscan-DRL "AISCAN" nominal 40mm diameter for buried pipeline, compression strength 250 N, with 549 IP degree of protection according to UNE 20324. According to UNE-EN 61386-1, UNE-EN 61386-22 and UNE-EN 50086-2-4.	8,300	1,34	11,12
mt35caj020a	Ud	Recessed junction box of 105x105 mm, with normal degree of protection, terminal blocks and manhole cover.	8,000	1,79	14,32
mt35caj020b	Ud	Recessed junction box of 105x165 mm, with normal degree of protection, terminal blocks and manhole cover.	3,000	2,29	6,87
mt35caj010a	Ud	Universal embedding box, link the 2 sides.	41,000	0,25	10,25
mt35caj010b	Ud	Universal embedding box, link 4 sides.	17,000	0,47	7,99
mt35caj011	Ud	Wallbox for making 25 A (special outlet for kitchens).	1,000	2,01	2,01
mt35cun040ba	m	Core cable H07V-K with stranded copper conductor class 5 (-K) 1.5 mm², PVC insulated (V), and its rated voltage of 450/750 V for circuit C1, lighting. According to UNE 21031-3.	450,000	0,25	112,50
mt35cun040cb	m		189,000	0,40	75,60
mt35cun040dd	m	Core cable H07V -K with stranded copper conductor class 5 (-K) 2.5 mm² , PVC insulated (V) , and its rated voltage of 450/750 V for circuit C2, outlets general and refrigerator use. According to UNE 21031-3 .	30,000	0,93	27,90
mt35cun040ec	m	Core cable H07V -K with stranded copper conductor class 5 (-K) 6 mm² , PVC insulated (V) , and its rated voltage of 450/750 V for	54,000	0,63	34,02

		circuit C3 , stove and oven . According to UNE 21031-3 .			
mt35cun040fb	m	Core cable H07V -K with stranded copper conductor class 5 (-K) 4 mm² , PVC insulated (V) , and its rated voltage of 450/750 V for circuit C4 , washing machine and electric boiler . According to UNE 21031-3 .	63,000	0,40	25,20
mt35cun040hb	m	Core cable H07V -K with stranded copper conductor class 5 (-K) 2.5 mm² , PVC insulated (V) , and its rated voltage of 450/750 V for circuit C5, outlets the bathrooms and kitchen. According to UNE 21031-3 .	189,000	0,40	75,60
mt35cun040ob	m	Core cable H07V-K with stranded copper conductor class 5 (-K) 2.5 mm², PVC insulated (V), and its rated voltage of 450/750 V for circuit C12, additional type C5 , sockets of the bathrooms and kitchen. According to UNE 21031-3.	63,000	0,40	25,20
mt35cun040aa	m	Core cable H07V-K with stranded copper conductor class 5 (-K) 1.5 mm², PVC insulated (V), and its rated voltage of 450/750 V. According to UNE 21031-3.	126,000	0,25	31,50
mt33seg100a	Ud	Unipolar switch, basic range, with 1 single and frame element black and white bezel color key.	7,000	5,84	40,88
mt33seg111a	Ud	Double switch, basic range, with double key and 1 frame element black and white trim color.	2,000	8,98	17,96
mt33seg101a	Ud	Bipolar switch, basic range, with bipolar key and 1 frame element black and white trim	1,000	10,59	10,59

		color.			
mt33seg102a	Ud	Switch, Basic series with 1 simple and frame element black and white bezel color key.	12,000	6,22	74,64
mt33seg103a	Ud	Crosspoint switch, basic range, with 1 single and frame element black and white bezel color key.	2,000	11,44	22,88
mt33seg104a	Ud	Push, basic range, with key with bell symbol and frame 1-gang white color and trim white.	1,000	6,58	6,58
mt33seg105a	Ud	Buzzer 230 V, basic range, with 1 cover and frame element black and white trim color.	1,000	20,71	20,71
mt33seg107a	Ud	Socket 16A 2P + T, basic range, with 1 cover and frame element black and white trim color.	27,000	6,22	167,94
mt33seg107d	Ud	Socket 16A 2P + T, basic range, with white cap.	3,000	3,37	10,11
mt33seg117b	Ud	3 horizontal frame elements, basic range, white.	1,000	6,63	6,63
mt33seg110a	Ud	Socket 25 A 2P + T and 250 V for cooking, basic range, with 1 cover and frame element black and white trim color.	1,000	11,75	11,75
mt33seg504a	Ud	Socket 16A 2P + T monobloc sealed for surface mounting (IP 55), gray color.	3,000	9,68	29,04
mt35www010	Ud	Auxiliary material for electrical installations.	4,000	1,48	5,92
mo002	h	Official 1st electrician.	20,096	17,82	358,11
mo100	h	Assistant electrician.	20,096	16,10	323,55
	%	Aids	2,000	2099,55	41,99
	%	Indirect costs	3,000	2141,54	64,25
Maintenance cost of ten: 110,29€ in the first 10 years.				Total:	2205,79

INSTALLING FIRE

Installing fire for dry column will be placed.
Dry column system is used in buildings over 25 m . height , for a more rapid intervention by the public forces of extinction. They are enforceable by order of the Ministry of Housing of 02/26/74 (BOE No 53 of 03.02.74) in buildings over 8 floors or on the ground whose height exceeds 25 meters.
TECHNICAL CHARACTERISTICS

Supply and installation of dry column consists of the following elements: 1 outlet IPF-41 provided Siamese connection with embedded keys and type fittings UNE 23400-3, 70 mm (2 1/2 ") diameter with lids subject in bleed key chains and 25 mm in diameter, housed in metal box 590 mm wide, 440 mm high and 300 mm deep, located in front and provided with white painted metal door with the inscription "FIRE USE ONLY" in red letters, 3 outlets in floor (2 IPF-39 include Siamese connection with embedded keys and type fittings UNE 23400-2, 45 mm (1 1/2 ") diameter with lids fastened with string, housed in metal box 590 mm wide, 350 mm high and 300 mm deep, located on the landings of the stairs and provided with glass door with the inscription "FIRE USE ONLY" in red letters, 1 IPF-40 connection provided Siamese with built-handle fittings and UNE 23400-2, 45 mm (1 1/2 ") diameter with lids fastened with string, housed in metal box 590 mm wide, 640 mm high and 300 mm deep, **four plants located** in the landings of the stairs and provided with glass door with the inscription "FIRE USE ONLY" in red letters, sectioning locked located above the corresponding Siamese connection and housed in the same box) with pipes galvanized steel 3 "DN 80 mm, without lag, clamps, fasteners, drain valve, fittings and accessories. Even colorless moon. Fully assembled, and tested conexionada by the installation company by supporting evidence of service (included in the price).

The building has nine floors, so it will be necessary to place 2 dry columns.
Every fourth floor and second on the eighth floor .

3114,17 x 2 = **6228,34 €**

IOC010 **Ud** **Dry column .**

Dry column consists of the following elements: 1 outlet IPF -41 housed in front ; Three outlets in floor (2 IPF IPF -39 to 1 -40 with key section)

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt41osc011a	Ud	Siamese aluminum fork with female threaded connection 80 mm (3 ") and two outputs of 70 mm (2 1/2"), equipped with ball valves 1/4 turn, connection fittings and caps with device vent.	1,000	190,23	190,23
mt41osc031a	Ud	Red metal box of 590x440x300 mm, with white painted metal door, lock 8 mm square labeled "FIRE USE ONLY".	1,000	63,95	63,95
mt41osc010a	Ud	Siamese aluminum fork with female threaded connection of 70 mm (2 1/2 ") and two outputs of 45 mm (1 1/2") equipped with ball valves 1/4 turn, connection fittings and caps with venting device.	3,000	99,92	299,76
mt41osc020a	Ud	Key aluminum section, closed by 1/4 turn sphere 80 mm (3 ") in diameter.	1,000	132,87	132,87
mt41osc030a	Ud	Red metal box of 590x350x300 mm, stainless steel door glazing, square lock 8 mm and marked "EXCLUSIVE USE FIRE".	2,000	55,97	111,94
mt41osc030b	Ud	Red metal box of 590x640x300 mm, stainless steel door glazing, square lock 8 mm and marked "EXCLUSIVE USE FIRE".	1,000	78,34	78,34
mt08tag400i	Ud	Auxiliary material for mounting and securing the work of galvanized steel pipes, 3 "DN 80 mm.	1,000	1,37	1,37

mt08tag010fd	m	Galvanized steel pipe with longitudinal electric resistance welding, 3 "diameter DN 80 mm, according to UNE-EN 10255, with the price increased by 15% for accessories and trims.	23,000	56,33	1295,59
mt37sve010d	Ud	Ball valve nickel plated brass threading 1 ".	1,000	9,81	9,81
mt21vtt010a	m²	Moon colorless tempered, 5mm thick. According to UNE-EN 410 and UNE-EN 673.	0,850	18,09	15,38
mt41www030	Ud	Auxiliary material for firefighting equipment.	1,160	1,40	1,62
mo007	h	Official 1st plumber.	22,504	17,82	401,02
mo105	h	Assistant plumber.	22,504	16,10	362,31
	%	Aids	2,000	2964,19	59,28
	%	Indirect cost	3,000	3023,47	90,70
Decennial maintenance cost : 2.179,92€ in the firsts 10 years.				Total:	3114,17

HEATING INSTALLATION AND HOT WATER

80days.

HEATING AND ACS

90 apartments
90 x 1720,36 = **154.832,4 €**

ICG032	**Ud**	**Gas heater , domestic , conventional, mural, heating and ACS**

N wall boiler , heating and A.C.S. snapshot and indoor use , sealed combustion chamber and forced draft , electronic ignition without pilot flame , modulating power output 8.9 to 24 kW , flow ACS 14.1 l / min , of 740x410x310 mm , range Comfort model THEMACLASSIC F 25 " SAUNIER DUVAL " room thermostat , on / off control , cable , power supply from the boiler, 82x82x36 mm , SD 2000 .ara de combustión estanca y tiro forzado, encendido electrónico, sin llama piloto, potencia útil modulante de 8,9 a 24 kW, caudal de A.C.S. 14,1 l/min, de 740x410x310 mm, gama Confort, modelo ThemaClassic F 25 "SAUNIER DUVAL", termostato de ambiente, control on/off, por cable, alimentación desde la caldera, de 82x82x36 mm, SD 2000.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt38cmd015a	Ud	N wall boiler, heating and A.C.S. snapshot and indoor use, sealed combustion chamber and forced draft, electronic ignition without pilot flame, modulating power output 8.9 to 24 kW, flow ACS 14.1 l / min, of 740x410x310 mm, range Comfort model THEMACLASSIC F 25 "SAUNIER DUVAL" even backplane of the boiler and smoke evacuation duct.	1,000	1503,00	1503,00
mt38cmd099mf	Ud	Room thermostat, on / off, cable, power control from the boiler, 82x82x36 mm, SD 2000, "SAUNIER DUVAL".	1,000	22,00	22,00

mt35aia010a	m	Bendable PVC pipe, corrugated, black, 16 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	8,000	0,26	2,08
mt35cun020a	m	Cable unipolar ES07Z1-K (AS), flame retardant, with stranded copper conductor class 5 (-K) 1.5 mm², insulated thermoplastic compound based on halogen-free polyolefin with low emission smoke and corrosive gases (Z1), and its rated voltage of 450/750 V. According to UNE 211 025.	16,000	0,41	6,56
mt38www012	Ud	Auxiliary material for heating and plumbing	1,000	2,10	2,10
mo003	h	Official 1st heater.	3,000	17,82	53,46
mo101	h	Assistant heater.	3,000	16,10	48,30
	%	Aids	2,000	1637,50	32,75
	%	Indirect costs	3,000	1670,25	50,11
Decennial maintenance cost: € 1,634.34 in the first 10 years.				Total:	1720,36

SPECIAL FACILITIES 80 days

TELECOMMUNICATIONS

48 days.
1 official + pawn

90 apartments.

90 x 561,37 = **50.523,3 €**

ILR010 Ud RITI.

RITI complete equipment for more than 45 PAU , fourth of 230x200x200 cm.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt35cgm041v	Ud	Surface box with transparent door, for housing the circuit breakers installation, 1 row of 12 modules, self-extinguishing ABS, with IP 40 protection and double insulation (Class II), white RAL 9010. According to UNE -EN 60670-1.	1,000	20,69	20,69
mt40iae010	Ud	Grounding strip, 500 mm long, 25 mm connectors.	1,000	34,65	34,65
mt35ttc010a	m	Bare copper conductor of 25 mm².	7,000	1,30	9,10

mt35aia010b	m	Bendable PVC pipe, corrugated, black, 20 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	15,000	0,29	4,35
mt35cun020a	m	Cable unipolar ES07Z1-K (AS), flame retardant, with stranded copper conductor class 5 (-K) 1.5 mm², insulated thermoplastic compound based on halogen-free polyolefin with low emission smoke and corrosive gases (Z1), and its rated voltage of 450/750 V. According to UNE 211 025.	75,000	0,41	30,75
mt35cun020b	m	Cable unipolar ES07Z1-K (AS), flame retardant, with stranded copper conductor class 5 (-K) 2.5 mm², insulated thermoplastic compound based on halogen-free polyolefin with low emission smoke and corrosive gases (Z1), and its rated voltage of 450/750 V. According to UNE 211 025.	45,000	0,62	27,90
mt35cgm021abbah	Ud	Automatic switch (IGA) of 2 modules, bipolar (2P), with 6 kA breaking capacity of 25 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	14,08	14,08
mt35cgm029aa	Ud	Instant RCD, 2P / 25A / 30mA, 2 modules, even w / w mounting hardware. According to UNE-EN 61008-1.	1,000	90,99	90,99

mt35cgm021bbbab	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 10 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	12,43	12,43
mt35cgm021bbbad	Ud	MCB circuit breaker, 2 modules, bipolar (2P), with 6 kA breaking capacity of 16 A rated current, curve C, even w / w mounting hardware. According to UNE-EN 60898-1.	1,000	12,66	12,66
mt33seg100a	Ud	Unipolar switch, basic range, with 1 single and frame element black and white bezel color key.	1,000	5,84	5,84
mt33seg107a	Ud	Socket 16A 2P + T, basic range, with 1 cover and frame element black and white trim color.	2,000	6,22	12,44
mt35caj010a	Ud	Universal embedding box, link the 2 sides.	3,000	0,25	0,75
mt35caj020a	Ud	Recessed junction box of 105x105 mm, with normal degree of protection, terminal blocks and manhole cover.	1,000	1,79	1,79
mt40iae030	Ud	Standard lampholder series.	1,000	1,42	1,42
mt34tuf020n	Ud	Compact fluorescent lamp TC-D 18 W.	1,000	4,47	4,47
mt34aem010b	Ud	Emergency luminaire, linear fluorescent tube, 6 W - G5, 70 lumens light output, housing 245x110x58 mm, class II, IP 42, with Ni-Cd high temperature range of 1 h, 230 V power, charging time 24 h.	1,000	31,53	31,53
mt40iae050	Ud	Nameplate of 200x200 mm, fire resistant, for RIT.	1,000	6,45	6,45
mt40iae060	Ud	Group standard type extractor RIT ventilation air even w / w vent up to 8 m long.	1,000	22,62	22,62

mt35aia090md	m	Rigid PVC, plug, bendable tube hot, black, 32 mm nominal diameter for fixed pipe surface. Compressive strength 1250 N, 2 joules impact resistance, working temperature -5 ° C to 60 ° C, with 547 IP degree of protection according to UNE 20324, electrical properties: insulation, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22. Even w / w clamps, fasteners and accessories (bends, sleeves, tees, elbows and flexible curves).	20,000	2,17	43,40
mt40www050	Ud	Auxiliary material for telecommunications infrastructure.	2,000	1,43	2,86
mo000	h	1st official telecommunications installer.	4,316	17,82	76,91
mo055	h	Assistant telecommunications installer.	4,115	16,10	66,25
	%	Aids	2,000	534,33	10,69
	%	Indirect costs	3,000	545,02	16,35
Decennial maintenance cost : € 28.07 in the first 10 years.				Total:	561,37

ELEVATOR

22 days
1 officials + pawn

3 elevator x 13678,85 = **41.036,55 €**

ITA010 **Ud** **Elevator for people**

Electric elevator adhesion of 0.63 m / s speed 4 stops , 450 kg of rated load for up to 6 people , basic level of finish 1000x1250x2200 mm cabin , simple universal maneuver , automatic interior doors and stainless steel automatic steel exterior doors to paint 800x2000 mm.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Precio partida(€)
mt39aec010d	Ud	Booth finished with basic quality, width 1000 mm, 1250 mm deep and 2200 mm high, with permanent electric lighting 50 lux at least for electric passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed, automatic sliding door even steel cab to paint.	1,000	2685,18	2685,18
mt39aea010d	Ud	Pit cushions and balances to electric passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed.	1,000	478,35	478,35
mt39aab010a	Ud	Pendant apartment, finished with basic quality for passenger elevator with single universal maneuver.	4,000	11,99	47,96
mt39aab020a	Ud	Car fixture for passenger elevator finishes universal basic quality and easy handling.	1,000	63,11	63,11
mt39aeg010d	Ud	Group tractor electric passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed.	1,000	2934,45	2934,45

mt39ael010d	Ud	Cruise and parachute electric passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed.	1,000	687,86	687,86
mt39aem010d	Ud	Box and control cable for electric passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed.	1,000	1139,07	1139,07
mt39aap010e	Ud	Passenger elevator door access floor, automatic opening, Steel with paint primer, of 800x2000 mm. Glazing homologated as "flame arrestor" 30 minutes (E 30).	4,000	289,24	1156,96
mt39aer010d	Ud	Travel guides and cables electric traction passenger lift 450 kg rated load for up to 6 people and 0.63 m / s speed.	1,000	1385,18	1385,18
mt39aes010a	Ud	Selector stops electric passenger elevator, 0.63 m / s speed.	4,000	51,43	205,72
mt39www020	Ud	Auxiliary material for transport facilities.	4,000	9,00	36,00
mt39www010	Ud	40 W lamp, including setting mechanisms and socket.	4,000	3,70	14,80
mt39www011	Ud	Hook attached to the ceiling, suspended capable of supporting the tractor mechanism.	1,000	37,00	37,00
mt39www030	Ud	Installing phone line elevator.	1,000	110,76	110,76
mo015	h	1st official installer of lifting devices.	60,072	17,82	1070,48
mo083	h	Ayudante instalador de aparatos elevadores.	60,072	16,10	967,16
	%	Medios auxiliares	2,000	13020,04	260,40
	%	Costes indirectos	3,000	13280,44	398,41
Decennial maintenance cost : € 8,754.46 in the first 10 years.				Total:	13678,85

INDIVIDUAL VIDEO INTERCOM

10 days
2official+pawn

90 apartments
90 x 991,65 = 89.248,5 €

IAV010 Ud Individual video intercom

Conventional b / w video Rock "GOLMAR" for family housing.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt35aia010b	m	Bendable PVC pipe, corrugated, black, 20 mm nominal diameter for channeling recessed masonry (walls and ceilings). Compressive strength 320 N, impact resistance July 1, working temperature -5 ° C to 60 ° C, with 545 IP degree of protection according to UNE 20324, flame retardant. According to UNE-EN 61386-1 and UNE-EN 61386-22.	13,000	0,29	3,77
mt40pea040	m	Cable formed by copper conductors 3x0,25 mm².	10,000	0,50	5,00

mt40pea030c	m	Parallel cable consists of copper conductors 2x1,0 mm². According to UNE 21031.	13,000	0,82	10,66
mt40pea030d	m	Parallel cable consists of copper conductors 2x1.5 mm². According to UNE 21031.	1,000	1,04	1,04
mt40pga060a	Ud	Visor model VIS-295 / AL "GOLMAR" outdoor panel recessed for Rock series.	1,000	14,37	14,37
mt40vgk010c	Ud	Kit conventional b / w video, Rock series, model SV-805 / AL "GOLMAR" for detached house, consisting of vandal outdoor panel with call button and video camera, flush box, power supply and monitor Platea 5 terminal strip.	1,000	813,70	813,70
mt40pga050a	Ud	AC electric door opener, model CV-14 "GOLMAR".	1,000	18,33	18,33
mt40www040	Ud	Auxiliary material for audiovisual facilities.	2,000	1,20	2,40
mo002	h	Official 1st electrician.	2,200	17,82	39,20
mo100	h	Assistant electrician.	2,200	16,10	35,42
	%	Aids	2,000	943,89	18,88
	%	Indirect costs	3,000	962,77	28,88
Decennial maintenance cost: € 525.57 in the first 10 years.				Total:	991,65

ARCHITECTURE

ROOF

Economic technical indicators of roof

Flat roof not passable , not ventilated , with gravel, conventional type, slope of 1 % to 5 % , consisting of: forming slopes : expanded clay 350 kg / m³ density , poured into dry and consolidated its surface with grout cement, with the average thickness of 10 cm; Thermal insulation panel weldable polyisocyanurate foam , 40 mm thick; waterproofing monolayer attached : sheet of elastomer SBS modified bitumen , LBM (SBS) -40 -FP , fully adhered torch ; spacer layer under protection geotextile nonwoven comprising polyester fibers together by needling , with a longitudinal tensile strength of 2 kN / m , a resistance to transverse tensile strength of 2 kN / m , a puncture strength 0.4 kN CBR and a surface mass of 200 g / m² ; protective layer : 10cm boulder 16-32 mm in diameter.

Ud	Description	Yield	Unit Price	Price(€)
Ud	Double hollow ceramic brick, for coating, 24x11,5x9 cm, according to UNE-EN 771-1	4.00	0.13	0.52
m3	Expanded clay, of 350 kg / m³ density and particle size of between 8 and 16 mm, supplied in sacks.	0.100	59.50	5.95
m3	1/3 grout CEM II / B-P 32.5 N	0.010	105.10	1.05
m2	Rigid expanded polystyrene panel, according to UNE-EN 13163, straight side machining of 20 mm thick thermal resistance 0,55 m²K / W, thermal conductivity 0.036 W / (mK) for expansion joint.	0.010	1.34	0.01

t	Water.	0.014	1.50	0.02
m2	Industrial mortar for masonry, concrete, gray class M-5 (compressive strength 5 N / mm²), supplied in bags, according to UNE-EN 998-2	0.075	32.25	2.42
m2	Panel weldable polyisocyanurate foam, 40 mm thick, heat resistance 1.53 m²K / W, thermal conductivity 0.026 W / (mK), superiorly protected with glass fleece and bottom with asphalt finish with glass fleece.	1.050	13.26	13.92
m2	Elastomer-modified SBS, LBM (SBS) -40-FP, 3.5 mm thick nominal mass 4 kg / m² with polyester felt reinforcement nonwoven 160 g / m², bitumen sheet surface not protected . UNE-EN 13707	1.100	6.21	6.83
m2	Geotextile fabric composed of polyester fibers bonded by needling, with a longitudinal tensile strength of 2 kN / m, a resistance to transverse tensile strength of 2 kN / m, an opening of the cone dynamic puncture test UNE-EN ISO 13433 less than 27 mm, punching resistance CBR 0.4 kN and a surface mass of 200 g / m², according to UNE-EN 13252	1.050	1.04	1.09
t	Boulders of 16-32 mm in diameter.	1.180	28.00	5.04
h	Official 1st construction.	0.485	17.24	8.36
h	Construction ordinary laborer	0.687	15.92	10.94
h	Official 1st applicator waterproofing sheets.	0.121	17.24	2.09
h	Assistant applicator waterproofing sheets	0.121	16.13	1.95
h	Official 1st insulation fitter	0.050	17.82	0.89

h	Insulation fitter helper	0.50	16.13	0.81
%	Aids	2.00	61.89	1.24
%	Indirect costs	3.00	63.13	1.89
	Coste de mantenimiento decenal: 16.26 euros en los primeros 10 años		**TOTAL**	65.02

1.Quantity of works:

644.72 m^2

2. Installation cost:

644.72 m^2 x 65.02 € = **41.919,69 €**

3. Works duration: 15 days

4. Wage:

8 hours / day x 15 days = 120 h.

Official 1st construction: 120 h x 8,36 = 1.003,2 €

Construction ordinary laborer: 120 h x 10,94 = 1.312,8 €

Official 1st applicator waterproofing sheets:

2 days x 8 h/d = 16 h.

16 h x 2.09 = 33,44 €

Assistant applicator waterproofing sheets:

16 h x 1.95 = 31.2 €

Official 1st insulation fitter :

4 d x 8 h/d = 32 h.

32 h x 0.89 = 28.48 €

Insulation fitter helper:

32 h x 0.81 = 25.92 €

RESOURCES:
For insulations and waterproofing : 2 workers for each work.
The rest and diferents: totally for all roof: 37 workers

FACADE

Clinker: 2389,53 m2
Silicate: 2341,37 m2
Shawls profiled roofing: 90.21 m2

Clinker and silicate:
2389,53 + 2341,37 = 4730,9 m2
4730,9 x 51,40 = **243.168,26 €**

FFX010 **m²** **Outer sheet façade ceramic brick face side .**

Hoja exterior en cerramiento de fachada, **de 11,3 cm de espesor de fábrica, de ladrillo cerámico cara vista perforado Klinker, gama naturales, modelo Salmón "PALAUTEC", acabado liso - Sistema AG, 24x11,3x5,2 cm, con junta de 1 cm, rehundida, recibida con mortero de cemento industrial, color gris, M-7,5, suministrado a granel**.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt05plt010iaj	Ud	Perforated ceramic Klinker facing bricks , natural range , model Salmon " Palautec " smooth finish - System AG, 24x11,3x5,2 cm , according to UNE -EN 771-1 .	68,250	0,30	20,48
mt08aaa010a	m³	Water.	0,008	1,50	0,01
mt09mif010db	t	Industrial mortar for masonry, concrete , gray class M- 7.5 (compressive strength 7.5 N / mm²), supplied in bulk, according to UNE -EN 998-2 .	0,046	30,30	1,39

mt07aco010c	kg	Corrugated steel bars , UNE -EN 10080 B 500 S , developed in industrial workshop , various diameters.	1,000	0,91	0,91
mq06mms010	h	Continued with silo, industrial mortar dry bulk mixer supplied .	0,177	1,73	0,31
mo020	h	Official 1st in masonry construction .	1,008	17,24	17,38
mo112	h	Ordinary laborer masonry construction .	0,544	15,92	8,66
	%	Aids	3,000	49,14	1,47
	%	Cost indirect	3,000	50,61	1,52
Decennial maintenance cost: 2,09€ in the first 10 years.				Total:	52,13

Shawls profiled roofing: 90.21 m2

90,21 x 20,58 = **1856,52 €**

FFZ010	**m²**	**Outer sheet façade ceramic brick for lining .**

Exterior facade cladding sheet of 11 cm thick factory, triple hollow brick, for coating, 33x16x11 cm, received with cement mortar industrial, gray, M-5, supplied in bulk.

Descomposed	Ud	Descomposition	Yiel	Unit price (€)	Cost (€)
mt04lvc010i	Ud	Triple hollow brick , for coating , 33x16x11 cm , according to UNE -EN 771-1 .	18,900	0,29	5,48
mt08aaa010a	m³	Water.	0,004	1,50	0,01
mt09mif010cb	t	Industrial mortar for masonry, concrete , gray class M-5 (compressive strength 5 N / mm²), supplied in bulk, according to UNE -EN 998-2 .	0,020	29,50	0,59
mt18bdb010a800	m²	Catalan tiles ceramic tile , matte finish and natural , 8.00 € / sqm, according to UNE -EN 14411 .	0,100	8,00	0,80
mt07aco010c	kg	Corrugated steel bars , UNE -EN 10080 B 500 S , developed in industrial workshop , various diameters.	0,800	0,91	0,73
mq06mms010	h	Continued with silo, industrial mortar dry bulk mixer supplied .	0,075	1,73	0,13
mo020	h	Official 1st in masonry construction .	0,449	17,24	7,74
mo112	h	Ordinary laborer masonry construction .	0,246	15,92	3,92
	%	Aids	3,000	19,40	0,58
	%	Indirect costs	3,000	19,98	0,60
Decennial maintenance cost : € 1.03 in the first 10 years.				Total:	20,58

CARPENTRY

590 units

* Information given.

38 + 134 + 322 + 48 + 48 = 590 units.
590 windows x 360.77 = **212.854,3 €**

LCL060 **Ud** **Exterior carpentry.**

Carpentry, natural anodized, for shaping aluminum window, hinged opening practicable inland, 120x120 cm, basic series, consisting of two sheets, and with sub-frame. I built compact (monoblock), PVC Venetian blind, with manual override via tape and dustpan. .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt25pem015a	m	Aluminum subframe 30x20x1,5 mm, assembled by teams and provided with pins for fixing this to work.	4,800	3,38	16,22
mt25pfx010a	m	Anodized aluminum profile, for shaping window frame, basic range, including Central seal with the quality certificate EWAA-EURAS (QUALANOD).	4,800	4,80	23,04

mt25pfx020a	m	Anodized aluminum profile, for shaping sash, basic range, including gaskets and outer seal sheet glazing, with the quality certificate EWAA-EURAS (QUALANOD).	6,900	6,26	43,19
mt25pfx030a	m	Anodized aluminum profile, for shaping jonquil, basic range, including glass and inner joint share of staples, with the quality certificate EWAA-EURAS (QUALANOD).	6,180	1,96	12,11
mt25pfx035a	m	Anodized aluminum profile, for shaping investment, basic range, including Central seal with the quality certificate EWAA-EURAS (QUALANOD).	1,090	4,96	5,41
mt15sja100	Ud	Cartridge neutral silicone caulk.	0,168	3,13	0,53
mt25pfx200eb	Ud	Kit consists of brackets, caps condensation and water outlet fittings practicable and opening window into two panes.	1,000	18,75	18,75
mt25pco015aa	m²	Venetian blind PVC roller, manual override via tape and dust in carpentry, even compact built (monoblock). UNE-EN 13659.	1,584	20,63	32,68
mt25pfx170h	m	Guide anodized aluminum shutter, with the quality certificate EWAA-EURAS (QUALANOD) that guarantees the thickness and quality of the anodizing process.	2,400	7,10	17,04
mo017	h	Official 1st locksmith.	5,151	17,52	90,25
mo057	h	Assistant locksmith	5,199	16,19	84,17
	%	Aids	2,000	343,39	6,87
	%	Indirect cost	3,000	350,26	10,51
Decennial maintenance cost: € 50.51 in the first 10 years.				Total:	360,77

PARTITIONS AND MASONRY

- Inside apartments: 10 partitions of plasterboard.
61,07 x 3 blocks = 183,21 m
h: 28,4 – 4,32 (slab and soil) = 24,1 m (h)
183,21 x 24,1 = 4415,36 m
22,91 x 4415,36 =**101.155,89 €**

- The dividing wall between blocks : 2 partitios of ceramic brick and rock wool.
(11,23 x 28,40) x 2 = 637,86 m
19,90 x 637,86 = 12.693,414 €
6,37 x (11,23 x 28,40) = 2.031,59 m
12.693,414 + 2.031,59 = **14.725,01 €**

-Partition between houses: silicate
41,56 x 3 blocks = 124,68 m/floor
h: 28,4 – 4,32 (slab and soil) = 24,1 m (h)
124,68 x 24,1 = 3004,8 m

3004,8 x 21,24 = **63.821,952 €**

PLASTERBOARD:

FTY010	**m²**	**System " PANELSYSTEM " of drywall partition reinforced with fiberglass**
System " PANELSYSTEM " of drywall partition reinforced with fiberglass . Interior partition (separation within the same unit of use), partition TC- 7 " PANELSYSTEM " 70 mm total thickness , lightened plaster reinforced with fiberglass , TC- 7 " PANELSYSTEM " panel, 70 mm system thick.		

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost (€)
mt16pdg010b	m	Bilayer soundproofing band , 5mm thick, formed from an adhesive , heat-sealing membrane to a high density reticulated polyethylene sheet , nominal mass 3.35 kg / m² .	0,600	0,68	0,41
mt12pyp010a	m²	Lightened gypsum panel reinforced fiberglass, TC-7 " PANELSYSTEM " , 500 mm wide , 2900 mm in length and 70 mm thick , with tongue and groove edges for bonding together .	1,050	11,61	12,19
mt09pye020	kg	Pasta gypsum boards , according to UNE -EN 13279-1 .	0,500	2,63	1,32
mt16pdg020a	m	Elastic band elasticized expanded polystyrene , 10 mm thick , heat resistance 0.3 m²K / W , thermal conductivity 0.033 W / (mK) Euro class E reaction to fire .	1,000	0,35	0,35
mt12pyp110	m³	Bonding adhesive .	0,005	124,50	0,62
mt12pyp100	m	Cellulose adhesive tape to place at the meetings of the panels with the facing .	0,400	0,10	0,04
mt12psg040a	m	Tape together.	0,400	0,03	0,01
mo052	h	1st official editor of prefabricated interior .	0,202	17,82	3,60
mo098	h	Assistant editor prefabricated interior .	0,202	16,13	3,26
	%	AIDS	2,000	21,80	0,44
	%	Indirect costs	3,000	22,24	0,67
Decennial maintenance cost 0.46 € in the first 10 years.				Total:	22,91

BETWEEN BLOCKS: ceramic brick and rock wool

FFD010	**m²**	**Dividing inside of ceramic bricks to coat sheet.**

Interior sheet cladding dividing 9 cm thick, dual factory hollow brick , to coat , 24x11,5x9 cm , received with cement mortar industrial , gray, M- 5, supplied in bulk .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt04lvc010c	Ud	Double hollow ceramic brick , para coated, 24x11,5x9 cm , ACCORDING TO UNE- 771-1 .	34,650	0,13	4,50
mt08aaa010a	m³	Water.	0,004	1,50	0,01
mt09mif010cb	t	Industrial paragraph masonry mortar , cement , gray, category M 5 (Resistance to 5 N / mm² Compression) , Supplied in bulk, ACCORDING TO UNE- 998-2 .	0,022	29,50	0,65
mq06mms010	h	Continuous mixer with silo, dry mortar industry para Supplied loose .	0,083	1,73	0,14
mo020	h	1st official masonry construction work .	0,519	17,24	8,95
mo112	h	Ordinary laborer masonry construction work	0,283	15,92	4,51
	%	Aids	3,000	18,76	0,56
	%	Indirect costs	3,000	19,32	0,58
Decennial maintenance cost : € 1.59 in the first 10 years.				Total:	19,90

NAP010	**m²**	**Intermediate isolation in interior partitions sheet factory.**

Intermediate isolation in interior partitions sheet factory. Intermediate insulation sheet interior partitions factory panel formed by glass wool , felt Ursa Glasswool P0051 Panel " URSA INSULATION CORPORATION " , not hydrophilic , uncoated 50 mm thick simply supported .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt16lvp020abel	m²	Glass wool panel , Panel Ursa Glasswool P0051 Felt " URSA INSULATION CORPORATION " , 50 mm thick , non-hydrophilic , uncoated , heat resistance 1.25 m²K / W , thermal conductivity 0.039 W / (mK) according UNE EN 13162 , Class A1 in reaction to fire , with designation code MW-UNE -EN 13162 -T3- MU1 -WS .	1,050	3,15	3,31
mt16aaa030	m	Adhesive tape for sealing joints .	0,440	0,30	0,13
mo053	h	Official 1st insulation fitter .	0,101	17,82	1,80
mo099	h	Insulation fitter helper .	0,051	16,13	0,82
	%	Aids	2,000	6,06	0,12
	%	Indirect cost	3,000	6,18	0,19
Decennial maintenance cost 0.13 € in the first 10 years.				Total:	6,37

CERAMIC BRICKS:

FFQ010	**m²**	**Interior partition sheet ceramic brick for lining .**

Sheet inner partition of 9 cm thick factory , double hollow brick , to coat , 24x11,5x9 cm , received with cement mortar industrial , gray, M- 5, supplied in bulk .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt04lvc010c	Ud	Double hollow ceramic brick , for coating , 24x11,5x9 cm , according to UNE -EN 771-1 .	34,650	0,13	4,50
mt08aaa010a	m³	Water.	0,004	1,50	0,01
mt09mif010cb	t	Industrial mortar for masonry, concrete , gray class M-5 (compressive strength 5 N / mm²), supplied in bulk, according to UNE -EN 998-2 .	0,022	29,50	0,65
mq06mms010	h	Continued with silo, industrial mortar dry bulk mixer supplied .	0,083	1,73	0,14
mo020	h	Official 1st in masonry construction .	0,577	17,24	9,95
mo112	h	Ordinary laborer masonry construction	0,312	15,92	4,97
	%	Aids	2,000	20,22	0,40
	%	Indirect costs	3,000	20,62	0,62
Decennial maintenance cost 0.42 € in the first 10 years.				Total:	21,24

INTERIOR CAPENTRY

* Information given.

91 + 13 = 104 units
104 x 155.26 = **16.147,04 €**

LPM010 **Ud** **Wooden door step**

Blind door step , a sheet of 203x82,5x3,5 cm , board finish white melamine , with kraft honeycomb core fibers; pine country precerco 90x35 mm ; galces MDF , melamine coated , white color 90x20 mm; flashing MDF, melamine coated , white color 70x10 mm; with hanging fittings and closing .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt22aap011ja	Ud	Precerco pine , 90x35 mm , for single door , with fasteners .	1,000	17,39	17,39
mt22aga015ae	m	Rebate MDF , finished in melamine white, 90x20 mm.	5,100	3,36	17,14
mt22pxh025aa	Ud	Blind hollow door step , fiberboard finished in white melamine , with kraft honeycomb core of 203x82,5x3,5 cm.	1,000	45,67	45,67
mt22ata015ab	m	Flashing MDF , finished in melamine white, 70x10 mm.	10,400	1,36	14,14
mt23ibl010p	Ud	Hinge of 100x58 mm, shot in black gloss brass , for interior door step.	3,000	0,74	2,22
mt23ppb031	Ud	21/35 mm brass screw .	18,000	0,06	1,08

mt23ppb200	Ud	Mortise lock , front, accessories and screws attached to interior door step, according to UNE -EN 12209 .	1,000	11,29	11,29
mt23hbl010aa	Ud	Game crank and long black coat of gloss brass , basic series , interior door step.	1,000	8,12	8,12
mo016	h	Official 1st carpenter.	0,909	17,56	15,96
mo056	h	Assistant carpenter.	0,909	16,25	14,77
	%	Aids	2,000	147,78	2,96
	%	Indirect costs	3,000	150,74	4,52
Decennial maintenance cost : € 17.08 in the first 10 years.				Total:	155,26

SOIL

Total meters of soil: 7116 m2
(788 + 813,9 + 806 + 644)

7116 x 51,82 = **368.751,12 €**

RSG140	**m²**	**Ceramic tile flooring " BUTECH " placed with adhesive.**

Flooring porcelain stoneware slabs of great STON -KER of " BUTECH ", " PORCELANOSA GROUP " Carpathia series , Beige finish, 33x33x1 cm , for indoor use , slip resistance 15 < Rd < = 35 format UNE- ENV 12633 , slipperiness class 1 according to CTE , received with cement adhesive improved C2 E, with extended open time , rapimax Gris " BUTECH " and grouted with cement mortar joints 0-4 Colorstuk " BUTECH " CG 2 type , color Manhattan, joint up to 4 mm .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt09mcb010k	kg	Improved cementitious adhesive , C2 E, with extended open time , according to UNE -EN 12004 , rapimax Gris " BUTECH " for placement in thin layer of ceramic tiles , consisting of special cements , selected aggregates and synthetic resins.	3,000	0,90	2,70
mt12pcb020kgD1	m²	Plate porcelain stoneware great STON -KER of " BUTECH ", " PORCELANOSA GROUP " Carpathia serial format , Beige finish of 33x33x1 cm.	1,050	34,09	35,79
mt09mcb020aa	kg	Colorstuk cementitious mortar joints 0-4 " BUTECH " type CG2 according to UNE -EN 13888 , color Manhattan, for joints up to 4 mm, composed of high-strength cements , selected aggregates , pigments and special additives , suitable for all types ceramic tiles and natural stones .	0,500	1,17	0,59
mo022	h	Official 1st tiler .	0,405	17,24	6,98
mo059	h	Assistant tiler .	0,202	16,13	3,26
	%	Aids	2,000	49,32	0,99
	%	Indirect costs	3,000	50,31	1,51
Decennial maintenance cost : € 8.81 in the first 10 years.				Total:	51,82

WALL AND CEILING CLADDING

- Painting:

(Information taken from measurement drawings; measuring in the AutoCad program).

8058,02 m2 x 12,36 = **99597, 13 €**

- False metal ceiling

(Information taken from measurement drawings; measuring in the AutoCad program).

84,7 + 84,95 + 83,6 + 83,5 + 54 + 84,6 = 507,35 m
507,35 x 15.500 = 7863,9 m^2

7863,9 x 39,29 = **308.973,61 €**

WALL:

RIS010	**m²**	**Silicate paint on interior walls**
Silicate paint , Siltex " REVETON " with smooth texture , white , matte finish on interior horizontal and vertical surfaces , background hand Siltex " REVETON " and two coats of finish (yield: 0.14 l / m² each hand) .		

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt27pir120b	l	No organic primer , Siltex " REVETON " based on potassium silicate, applied by brush or roller.	0,100	5,78	0,58
mt27pir110e	l	Painting Siltex " REVETON " based on potassium silicate, calcium carbonate, micronized aggregates and special , breathable , UV resistant additives, white , matte finish , smooth texture , applied by brush, roller or spray.	0,280	14,54	4,07
mo037	h	1st official painter.	0,152	17,24	2,62
mo074	h	Assistant painter.	0,182	16,13	2,94
	%	Aids	2,000	10,21	0,20
	%	Indirect costs	3,000	10,41	0,31
Decennial maintenance cost : € 18.22 in the first 10 years.				Total:	10,72

CEILING:

RTL020 **m²** **Accessible false ceiling metal trays , Fonotech Fonosteel " BUTECH " system.**

False ceiling registrable , located at a height of less than 4 m , Fonotech Fonosteel " BUTECH " system, consisting of smooth self-supporting trays of galvanized steel, Steel Lis model , color steel " BUTECH " " PORCELANOSA GROUP " 600x600 mm and 0 , 53 mm thick, with profiling .

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt12pmb010aa	m²	False ceiling registrable flat trays consisting of self-supporting , galvanized steel , Steel Lis model , color steel, " BUTECH " " PORCELANOSA GROUP " 600x600 mm and 0.53 mm thick and Euroclase A- s2 , d0 reaction to fire , UNE- EN 13168 ; even w / w profiling system 15mm wide profile, color prepainted steel finish and tie-rods .	1,050	29,76	31,25
mo014	h	1st official editor of suspended ceilings .	0,181	17,82	3,23
mo080	h	Assistant editor of suspended ceilings	0,181	16,13	2,92
	%	Aids	2,000	37,40	0,75
	%	Indirect costs	3,000	38,15	1,14
Decennial maintenance cost : € 9.04 in the first 10 years.				Total:	39,29

URBANIZATION

LAWN: 2470 x 9,81 = 24.230,7 €
CONCRETE: 1000 x 30,59 = 30.590 €
24.230,7 + 30.590 = **54.820,7 €**

- Lawn :
yield: 0,101
Days: 22
2 official and pawn

- Concrete :
yield: 0,272
Days: 17
2 official and pawn

LAWN:

UJC020	**m² Lawn**
Sowing lawn seed mixture	

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt48tis010	kg	Grass seed mixture .	0,030	5,00	0,15
mt48tie030a	m³	Screened topsoil , supplied in bulk.	0,150	23,70	3,56
mt48tie040	kg	Mulch clean screening.	6,000	0,03	0,18
mt48tif020	kg	Sowing lawn fertilizer .	0,100	0,41	0,04
mt08aaa010a	m³	Water.	0,150	1,50	0,23
mq09rod010	h	Light roller .	0,025	3,49	0,09
mq09mot010	h	Motocultor 60/80 cm.	0,050	2,70	0,14
mo039	h	Official 1st gardener.	0,101	17,24	1,74
mo113	h	Gardener pawn.	0,201	15,92	3,20
	%	Aids	2,000	9,33	0,19
	%	Indirect costs	3,000	9,52	0,29
Decennial maintenance cost : € 25.41 in the first 10 years.				Total:	9,81

CONCRETE:

UXC010 m² Continuous stamped concrete pavement , outdoor

Printed continuous concrete pavement with joints , 10 cm thick , for pedestrian use concrete made with HM- 20 / B / 20 / IIa HM- 20 / B / 20 / IIa Artevia Printed " LAFARGE " , manufactured in the plant , Fan finish, extended and vibrated manual and ; printed and embossed finished surface treated with hardener mortar Artevia Print " LAFARGE " color to choose, performance 4 kg / m² ; powder release agent Artevia Print " LAFARGE " , color choice and final sealing layer sealing resin with Artevia " LAFARGE " colorless.

Descomposed	Ud	Descomposition	Yield	Unit price(€)	Cost(€)
mt09hil050a	m³	Concrete HM -20 / B / 20 / IIa HM -20 / B / 20 / IIa Artevia Print " LAFARGE ", manufactured in Central, Fan finish .	0,105	98,60	10,35
mt09hil010a	kg	Hardener mortar Artevia Print " LAFARGE " color to choose, composed of high resistance cement , selected aggregates , pigments, additives and synthetic resins , high abrasion resistance , applied as stamped concrete finish , sprinkled on the fresh concrete surface .	4,000	0,74	2,96
mt09hil020a	kg	Powder release agent Artevia Print " LAFARGE " color to choose, composed of release agents and inorganic dyes , applied in continuous concrete pavements printed .	0,300	5,86	1,76
mt09hil030a	l	Artevia sealing resin " LAFARGE " colorless , formed by a styrenated acrylic resin dispersion , applied for curing and protecting continuous concrete pavement .	0,300	5,60	1,68
mq06vib020	h	Vibrant Rule of 3 m .	0,016	4,66	0,07
mq08lch040	h	Pressure washer .	0,151	4,59	0,69
mo040	h	Official 1st civil engineering construction .	0,272	17,24	4,69
mo085	h	Assistant civil engineering construction .	0,429	16,13	6,92
	%	Aids	2,000	29,12	0,58
	%	Indirect costs	3,000	29,70	0,89
Decennial maintenance cost : € 3.36 in the first 10 years.				Total:	30,59

TOTAL COST: 3.065.068,22 €