



# HOUSING DEVELOPMENT

Halmstad, Sweden

Callén Gil, Ana-Cruz

Construction engineering

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# Personal information

# 1. Personal information.

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## 1.1 Project author.

Ana-Cruz Callén Gil, student of Construction Engineering in "Escuela Universitaria Politécnica de La Almunia de Doña Godina" in Zaragoza, Spain.

## 1.2 Project supervisor.

Åke Spångberg, teacher of Civil engineering in the School of Business and Engineering at Construction Engineering Programme at Halmstad University.



# Data and project schedule

## 2. Data and project schedule.

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### 2.1 Building precedents.

Halmstad was founded close to the Nissan river in 1307. In 1320's the town moved to the present day town centre.



Halmstad is an industrial and recreational city with a port. It is a quiet city at the mouth of Nissan in the province of Halland. As we can see on the map, Halmstad is on the Swedish west coast.

All areas around the river have always been important places for trade. From the 19th century all the whole area has been full of industries. However, a few years ago this area started to change and nowadays there are plans for making this zone more attractive to inhabitants and tourists.

As widely as possible all industries around this area will be reallocated. This is a main reason why the city is growing in this area, therefore I decided to build a residential zone; a project which will give more life to the actual industry zone in Halmstad. Without this project, this area will continue to remain unused and quiet.

### 2.2 Description of the area. Site location.

The plot where I am going to construct is close to the river Nissan, not so far from the city centre. The picture shows the exact position.



The site is situated in Stationsgatan near the Nissan River (Halmstad, Sweden). The site has a regular shape with almost flat surface.

The plot has a surface of 15.538m<sup>2</sup>. The undeveloped plot at present is empty. The only building is a one-storey building with a sloped roof, owned by a local electrical company. The building is not in use and it is going to be removed.

Running through the plot are old railroad tracks where trains formerly ran. However the new railways runs to the east side of the plot.

### 2.2.1 Surrounding building



1. The building situated in the west, of the plot, next to the river, is an industrial building. It is one-storey wooden building with sloped roof. It is used to keep sailing materials. However, this industrial building will be demolished in few years.

2. The second building around the plot is located in the north-east side. This building is also used to industrial purposes. Its size is bigger than the one described previously. The facades are made with bricks and plaster. The main access is located through Dillbergsgatan.

3. One restaurant is located in the south-east side. It is two-storey building with a black roof in two sides. Its exterior walls are made of wood and painted in red.



The rest of the plot is surrounded by green areas.

## **2.3 Abbreviated project description.**

The project consists in nine single-family detached houses with a residential activity building. This project is designed to suit the inhabitants who live in Halmstad. It includes green areas to walk, playing areas and gardens. However, for many months the weather in Halmstad is relatively cold, therefore, the project includes a common building where residents can play sports, relax, meet even sunbathe. This will enhance the status of the area.

My work pushes towards a form of architecture with less emphasis on ornament and a greater emphasis on form, function, materials, clarity and quality. All homes in the plot are designed to cater for a more relaxed mode of family living. These dwellings fit with a modern lifestyle, with the main points being comfort and with a balance between private and communal space within the home.

### **2.3.1 Residential activity building**

This two-storey building has two separate structures which are linked by a walkway on second floor level. Inside of the biggest structure, a double-height swimming pool dominates.

This building retains an emphasis based on pure geometry and clear lines and blends into the surrounding.

In addition to the previous description, the project has been designed in accordance with the present building regulations of Halmstad, Sweden. In the design I took into account requirements and comfort. Style and function come together in these buildings designed for those looking for tranquillity and comfort. Furthermore, disabled people absolutely can use all facilities because the building complies with the minimum accessibility standards.

The common building is in the north-east zone of the plot. This position makes to keep out noise of residential area because the trains run to the east side of the plot, in such a way that future residential houses do not endure bother noise when trains run.

There are houses and a green area in front of the building which faces southwest.

The ground floor is divided into two parts; relax area and multipurpose room. They are not communicated between each other.

The multipurpose room is 102m<sup>2</sup>. In this room there are two toilets, one of them is adapted to disabled people. Inside of the multipurpose room there are tables, chairs and couches.

When you go inside of relax area you can find the lobby and the access to the changing rooms. They are connected to the swimming pool, the jacuzzi with capacity for 6 people and the cold water pool. In the same floor, furthermore, there is a boiler room which heats the water of all facilities. Finally, there is a storage room for all kinds of swimming tools.

The lobby has an access to the first floor, the lift or stairs can be used to reach the training area. It includes training machines and tools to practice exercise. In the first floor, moreover, there is a vapour bath, a sauna and showers with different temperatures and intensities. It is also possible to go up from the stairs which are next to the swimming pool.

### 2.3.2 Dwellings.



Besides of the present regulations, I have been considering the functionality, comfort and weather and life style. Moreover, all houses are for single families of 4 or 6 members.

There are two different types of dwellings:

Type 1: In the north side there are four dwellings with the same design. The houses have two storeys. On the ground floor, there are a living room, kitchen, two bathrooms, two bedrooms and a laundry room. On the first floor there are one more bedroom, a bathroom and a study room. The picture also shows big windows in the living room. The bedroom located in the first floor are connected with a terrace and one bathroom.

Type 2: In the south part of the plot there are five dwellings with different design comparing to the ones described previously. Those houses are bigger than type 1. This kind of dwellings have four rooms, three of them are located in the ground floor. In the same level there is also a kitchen, one living room, a laundry, a pantry, one toilet and two bathrooms. In the upper level there is one more bathroom and a terrace.

### 2.3.3 Exterior areas.

For gardens design and green roofs the current vegetation of Sweden will be used. In this plot will be planted mainly pines and beeches.

In the exterior it will be also placed outdoor benches in wood and a children playground in the middle of the plot.



# Design

## 3. Design

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The design is one of the most important things in the project. A good design will make buildings more comfortable. Swedish Building Regulations (BBR) have been followed in this section.

### 3.1 Room height

Following the regulation section 3, height of habitable rooms and workrooms are not less than 2.40 meters. In single family houses, the height of the rooms in the attic and basement is more than 2.30 meters.

### 3.2 The design of dwellings

Following the current regulations, the houses designed in this project have at least:

- A room with fitting and equipment for personal hygiene,
- A room for everyday social contact,
- A room for sleep and rest,
- A room, or a separate part of room, with fitting and equipment for cooking and storage food,
- A dining space in or near the kitchen,
- A space for homework,
- A place near the entrance with space for outdoor clothes.
- Space for storage.

These dwellings have more than one storey. In the entrance storey there is a bathroom for disabled people sitting in a wheelchair.

### 3.3 Climate zone

Before deciding the materials used in this project, it has been necessary to consider the climate zone where Halmstad is.

Sweden is divided into three climatic zones. Halmstad is located in the Halland area which is in the climate zone III. It means that houses will be designed to a specific energy consumption, electric power for heating and average heating transfer coefficient for the structural elements that enclose the building .

In the following table show the maximum values used in houses that have new heating method such as district heating.

Climate zone	III
Specific energy	55
Installed capacity for heating	4,5
U m	0,40

The materials used in the project are in accordance with data described above.

Access to buildings: The entrances have been designed to be accessible for disabled people.

Roads in the exterior areas can be used by physically disabled people. People with visual and/or hearing impairment and people who become easily confused have sufficient space for handling wheelchair.

Residential activity building is provided with bathrooms for people sitting in a wheelchair.





# Technical description



## 4. Technical description.

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First the residential activity building will be constructed, when it will be nearly finished, dwellings will be started to build. Finally trees, gardens and flowers will be planted.

### 4.1 Conditioning of the area.

The building site is accessible by all type of machines and equips that are going to be used in the construction. There is enough space for keeping part of the material which will be used in the buildings

#### 4.1.1 Demolition.

We have to proceed to the demolition of the small building that nowadays exist in our plot.

The demolition of this building will be done in two phases: The first phase will be a manual demolition, to recover and to be able to re-use most of cables that now exist in the current building. This phase is very important, as recycling, we can generate less waste of materials.

The second phase of demolition, it will be done by suitable machinery, and with these machines we will knock down all that we could not recover and re-use.

#### 4.1.2 Explanations

We will make the cleaning of the land, and removal of the topsoil layer. Later, the corresponding land transport will be made with machine trucks loaded until the closest garbage deposit.

### 4.1.3 Building layout.

Once the place is clean, it will be become to lay the zones to excavate out, letting witnesses of this topographic layout to be able to make the pertinent verifications at any time.

The area will be excavated by mechanical methods. The topographic layout of the walls and foundation will be hand made, letting witnesses of this layout to be able to make the pertinent verifications in any time, remaining always clean of rubbish and ground.

Finishing the layout part, the part of excavation of foundation of the swimming pool and the laying of footings of the building will be made.

Layout techniques are described in the following paragraphs. The following are the used layout tools and materials:

- A string line is used to distinguish the dimensions of the building layout.
- A sledgehammer is used to sink corner stakes or batter boards and posts.
- A posthole auger is used to dig the holes required to set posts properly in some soils.
- A handsaw is used to cut batter boards and posts.
- An ax or a hatchet is used to sharpen batter-board posts and stakes.
- A hammer is used for building batter boards.
- A chalk line is used to deposit chalk on the surface in order to make a straight guideline.
- A 30-meter tape is used for measuring diagonally
- Tracing tape is used for laying out excavation or foundation lines. The tape is made of cotton cloth approximately 1 inch wide. It usually comes in a 200 foot length.
- A carpenter's level is used to level a surface and to sight level lines. It may be used directly on the surface or with a straightedge.
- A line level has a spirit bubble to show levelness. The level is hung from a taut line. It gives the greatest accuracy when it is placed halfway between the points to be levelled.
- An automatic level measures approximate differences in elevation and can establish grades over limited distances.
- A plumbing bob is used to locate the corners of the building dimensions.
- A framing square is used to check the squareness of lines

#### 4.1.4 Construction of drains

The first necessity in the construction of drains is a ground plan of the premises, showing the position of the whole sanitary appliances from which the waste-water has to be conveyed away. It is also important to show the position of the sewer or cesspool with which they have to be connected.

As the excavation proceeds, the sides of the trench will be supported by strong timbering.

The drain will be made by mechanical method, being adopted the opportune measures to avoid as much our damages as the public way, following at any moment the fulfilments of the regulation.

The leftover grounds of the drain will be transported with trucks to the nearest waste treatment plant.

## 4.2 Foundation.

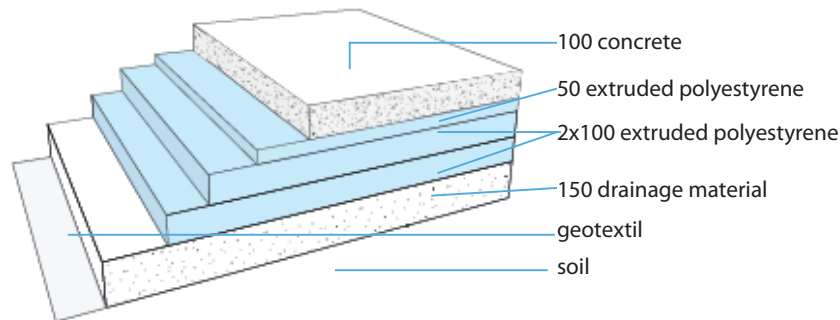
The building foundation is the part of a structure which is placed below the surface of the ground and which transmits the upper structure load to the underlying soil.

It is the part of a structural system that supports and anchors the upper part of the structure in the building.

Foundation is the most important part of a building. Building activity starts with the formation of foundation. Main activities of building foundation are:

- Distribute building load to soil beneath
- Distribute the load uniformly
- Grapnel the structure to the ground to resist movement due to lateral force

## Single-family homes.



The picture above shows how the foundation is built and divided in different layers. This concrete will be elaborated, transported and put in work according to the instructions.

All dwellings foundations will be done as it is indicates in the followings paragraphs:

The first layer, around 100mm of thickness, will be spilled with gravel in the base of the foundation.

In the second phase, a solution of Isover company will be used. It consists in five layers; the first one with a drainage material and a thickness of 150mm, later 3 layers of insulation, two of them with 100mm and the other with 50mm, and the last layer is made with 100mm-thick of concrete. A wire mesh in the concrete reduces the chance of cracking. Foundations will be filled up with prepared reinforced concrete HA-30/B/25/IIIb+H with 300 kg/cm<sup>2</sup> of characteristic resistance. Furthermore, this concrete will be prepared for marine ambience (corrosion included by chlorides from seawater) and freezing. Technical justification is shown below:

- HA-30: Reinforced concrete, its characteristic cube strength at the age of 28 days in 30 N/mm<sup>2</sup>.
- B: Soft consistence.
- 25: It is the maximum size of the soil, in milliammeter.
- IIIb: Its exposure class is corrosion induced by chlorides from seawater.
- H: Freeze

## Residential activity building:

Isolated column footings are used to support single columns. Each individual isolated footing provides support for each individual column, they act as a base for a column. They transfer the superimposed structural load to a wide range soil. All columns in this project are square. Furthermore they are made with reinforced cement concrete.

For this building there are also combined footings. It has been constructed for avoiding when a column lies very close to the property line and preventing overlapping of footings when columns are very adjacent. They are rectangular in first instance.

In case of column subjected to heavy loading and bending this type of column footing provides a superior solution in shallow foundation. Made with reinforcement and concrete this type of footing is high on strength and bending. The footing is reinforced with rebar. This type of footing is capable of transmitting massive loads with a reduced footing depth.

### Steps of insulated footing:

- Soil excavation: To set a footing, the first step is to excavate the soil of the respective area. At first the area should be located.
- Levelling & dressing of soil surface: After excavation, the most important step is to level the soil surface. The load of the construction should be vertical, for this, levelling and dressing is required. Otherwise the construction might be subjected to tilting to one side.
- Giving a cement concrete layer on it: This layer has 10cm of thickness. It provides a smooth, uniform and strong surface for reinforcement frame.
- Shuttering: It mens the solid boundary around the concrete. Wooden shuttering will be used for this project.
- Placing of reinforcement
- Pour concrete
- Curing: This is one of essential requirements of the concrete process. The strength of concrete increases more rapidly in the first few days after setting and afterwards the rate of increase in strength goes on retarding. The period curing should be continued depends upon atmospheric conditions such as temperature, humidity and wind velocity. Correct curing also increases of concrete to abrasion and reduces shrinkages.
- Removal of form
- Backfilling of excavated area

### 4.3 Structure.

#### Single-family houses.

Timber frames: As its name implies, timber frame construction is a method of building, which relies on a timber frame as a means of structural support.

Timber frame construction is based on factory-made structural elements. The timber framed wall panels carry the loads on the building to the foundations whilst the outer cladding provides decoration and weather protection. The outer cladding is made of brick.

Factory production of the timber frame panels ensures that they are accurately manufactured to precise tolerances in a controlled environment.

Timber frame wall panels are made up of softwood vertical studs and horizontal rails with a wood-based panel sheathing and a plasterboard lining. The studs carry vertical loads through the structure and transfer them to the foundations. The sheathing provides resistance to lateral wind loads (known as racking resistance). Thermal insulation incorporated in the spaces between the studs of external walls and protective membrane materials are required. The timber frame panels are quickly erected on site.

Timber frame is the fastest growing method of construction in Sweden today, and there are many good reasons for this.

Timber frame delivers high build quality, a faster and much more efficient construction process. Furthermore it is a renewable construction material and the softwoods used in timber frame are sourced from environmentally sustainable Swedish forests.

The external wooden frame walls are also put together on site. The building envelope is highly insulated. Wood trusses will be used in the upper level to support the roof. Double cantilever has been chosen for sloped roofs.

## Residential activity building:

The load bearing structure is made of precast concrete. These columns are used to support beams in the precast concrete structural system. They are designed to multilevel components. Furthermore, they have been made with conventional reinforcing bars.

They are cast in a horizontal position and rotated to their final position at the jobsite by the erection crew.

Size and shape used:

- Square 40x40cm
- Circle: diameter 50cm.

### 1. Beams

Beams are horizontal components which support hollow-core slabs. They are considered structural components. For this project, rectangular beams have been chosen.

The beams used during the engineering design are reinforced with conventional reinforcing bars.

Since beams are cast upright, the bottom part, all sides in the house, and ledges are cast against a form and they will be provided with an "as cast" finishing in results in a smooth, hard finish. The top is intentionally roughened to create a bond with cast-in-place concrete that it will be putted on top of it. Its resistance is 348kg/m<sup>2</sup>.

### 2. Hollow-Core slabs

Hollow-core slabs are used for floor and roof deck components.

Dimensions are the followings: The slabs are 120cm wide with 20cm thicknesses with 5cm of reinforced topping concrete.

Finishes: Form side (bottom) is smooth as cast and remains that way in the finished construction. The top side is slightly rough to receive a layer of cast in-place concrete.

### 3. Stairs

Precast concrete stairs will be used. They are fabricated as shorter components consisting of only the tread/stair section supported by separate landing components.

These modules of stairs provide fast erection and durable access in the residential activity building.

Abrasive nosing pieces are cast into the treads to create a non-slip surface.

Finishes: The bottom will be trowelled to the desired degree of smoothness and it will remain exposed to view in the final construction.

## 4.4 Walls

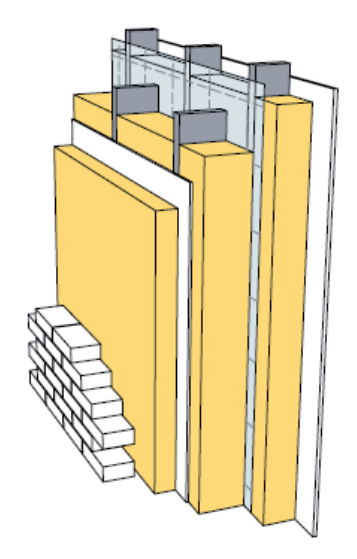
### 4.4.1 Outer closings.

Single-family houses.

Today's modern housing needs to provide much more than basic shelter from the elements, it must offer high standards of quality and safety throughout. Just as high standards of energy efficiency have now become the norm, families today require a comfortable thermal environment all year round, and excellent acoustic protection from both internally and externally generated noise.

Equally important are issues such as fire protection and the longevity of the property and, of course the quality of the internal air within the building.

To address these challenges, I have chosen the following materials:



The facades will be composed by a solution made with 13mm of plasterboard, 120mm timber stud with insulation Isover UNI-Skiva 33 between, a vapour control and airtightness membrane "Isover VARIO DUPLEX", another 170mm of timber stud with the same insulation between, 13mm of plasterboard, 80mm of insulation Isover Fasadskiva 31 and one clear cavity. After this, the external finish will be made with brick solution of 12mm of thickness. The total thickness of the wall is 536mm.



Mineral wool: Isover insulation does not absorb water, therefore does not sustain vermin, or promote the growth of mould, fungi or bacteria.

Timber: There is a long tradition of woodworking in the Swedish industry, ensuring quality in production. Sweden is a big timber exporter, approximately 70% of its total production go to other countries. The sawn timber is mainly softwood, Spruce/whitewood (*Picea abies*), pine/redwood (*Pinus sylvestris*) and just a few per cent is hardwood. Normally softwood is used for most structural timber, as it is easily worked due to its softness and straightness of grain.

I have chosen the pine as structure to all dwellings mindful some qualities as density (3,9 kg/m<sup>3</sup>), thermal conductivity (0.14 W / m • °C), coefficient of thermal expansion (34 x 10<sup>-6</sup>). Furthermore, The pine is fibrous and elastic, making it strong in tension and compression. Its maximum use temperature is 200 °C.

- Isover Fasadskiva 31: Rigid glass wool for exterior insulation. The insulation is placed behind the ventilated facade.

Thickness	80 mm
Format	2700 x 1200 mm
Thermal λD	0.031 W / m • °C
Density	58 kg / m <sup>3</sup>
Fire rating	Euro Class A2
Maximum use temp.	200 °C
Sheets / package	4
m <sup>2</sup> / pack	12.96 m <sup>2</sup>

- Isover UNI-skiva 33: 170mm and 120mm.

## Residential activity building

Concrete sandwich panels will be used. These panels are comprised of three layers: an outer layer of concrete, a layer of XPS (extruded polystyrene) insulation and an internal layer of concrete. The two components are the extruded polystyrene insulation and high-strength, fibre-composite connectors. The connectors are non-conductive and eliminate thermal transfer between the inside and outside concrete layers.



The 'thermal envelope' defines the conditioned or living space in a building. Thermal insulation allows walls, floors and ceilings to stay closer to room temperature, reducing energy use and increasing comfort by the use of the building's structure as thermal mass to dampen temperature swings.

Thermal bridges are points in the building envelope that allow heat conduction to occur. Since heat flows through the path of least resistance, thermal bridges can contribute to poor energy performance.

To avoid thermal bridges columns will be insulated with the same layer that sandwich panels have between both layers of concrete. It layers is made with extruded polystyrene.

#### 4.4.2 Inner partitions.

##### Single-family homes.

Inner partitions will be made in general with prefabricated panels. This partitions will be composed by a solution made with 12,5mm of plasterboard, 95mm timber stud with insulation Isover ULTIMATE UNI-Skiva 37 between and 12,5mm of thickness of plasterboard. The partition will be mounted through horizontal base screed and vertical every 60cm.

- Isover ULTIMATE UNI-skiva 37: For thermal and fire insulation between wood studs.

Thickness	95 mm
Format	1205 x 410 mm
Thermal $\lambda D$	0.037 W / m • ° C
Fire rating	Euro Class A1
Maximum use temp.	200 ° C
Packages / pallet	30 pc
m <sup>2</sup> / pallet	74.11 m 2

Wall coating:

- Wall tile tips.

Tiled of kitchens and baths tile of stoneware enameled, of format 40x40cm., resistant to cleaning products, received with cement mortar with lime or plasticized and sand of metering 2:1:10, even with decorative border or serigraphy, pieces to miter in edges, mixed with grout of white cement and final cleaning, executed according to the regulations.

- Paintings.

Plasterboard will be installed on walls horizontally. Ceiling sheets will be installed parallel to primary light source and where appropriate back-blocked. Where possible full sheets should be used thus minimising the need for butt joints. Jointing will comprise a 3 coat system. Each coat should be fully dried. The top coat will be sanded to a smooth, even finish. Edges will be feathered in order to minimise scuffing of the paper face. Similarly, internal and external corners, fixings and cornice installation will be finished to the same standard. This will deliver a substrate in a suitable condition to accept paint.

All walls and ceilings of interior, with exception of kitchens and baths will be painted mastered angles and corners.

Sealing the Surfaces An essential first step is to seal the face of the plasterboard and the plaster joints with a good quality sealer/undercoat. This will ensure an even "suction rate" and provide a degree of opacity for subsequent paint coats. The sealer/undercoat could be considered as the most important component within the paint system. The application of the sealer/undercoat should be carried out in such a way as to ensure that the plasterboard paper face fibres remain flat.

Once the sealer/ undercoat has fully dried 2 top coats of water based paint will be applied (ensuring adequate drying between coats)

The performance of the finished paint system and the appearance of walls and ceilings are highly dependent on the quality of the paint used, application method, colour and sheen level.

Expectations of Painted Plasterboard

- A level surface with no visible joints
- A good sheen decorative

These expectations will be difficult to achieve due to:

- Poor design concepts
- Poor workmanship
- Poor quality paint

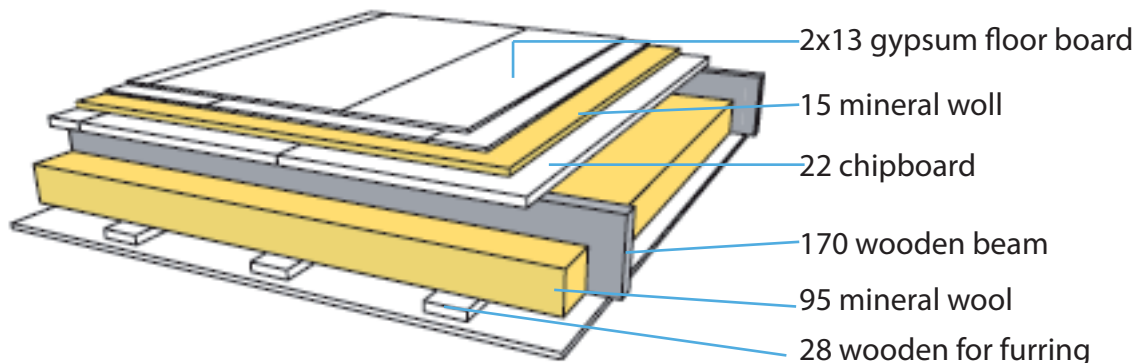
- Failure to use a suitable sealer/ undercoat
- Glancing light due to natural and/or artificial lighting conditions
- Crowned or starved joints
- Insufficient drying times
- Dark coloured paints
- Gloss paints

## 4.5 Floors.

### Single-family houses.

Floor framing consists of a system of sills and girders that provides support for floor loads and gives lateral support to exterior walls.

Beams and girders are of solid timber in which multiple pieces are nailed together with the wide faces vertical. Beams and girders that are not continuous are tied together across supports.



Bearing partitions are placed over girders or walls which support the floor system.

### Residential activity buildings.

They are made with hollow-core slabs with concrete topping. Pre-stressed, hollow-core concrete slabs offer several advantages over in-situ floor casting, including speed of erection, lower building costs and consistent quality level

Slabs are 1200mm width and 200mm of thickness.

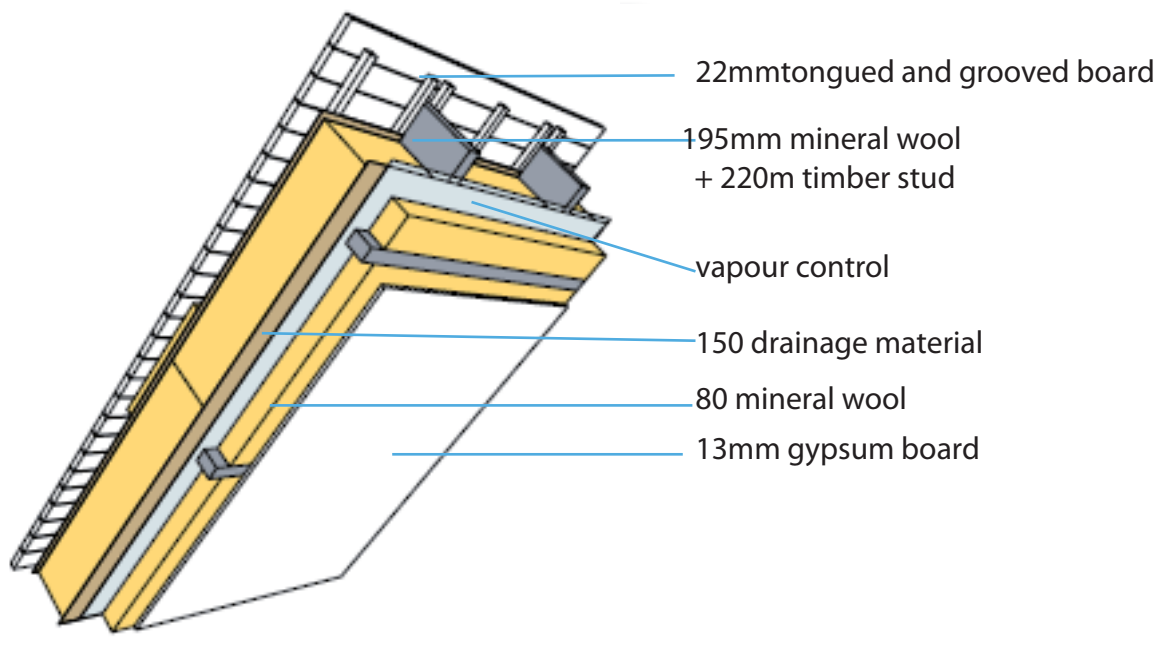
A layer of dry lean concrete about 100mm thick covering the bottom of an excavation, directly on the foundation. After that there are hollow concrete blocks to create an air cavity. Hollow-core slabs cover hollow concrete blocks, dimensions of this slabs used in all building are the same. Above of this slabs there is a layer of insulation of extruded polystyrene. Finally it will be installed a flooring heating.

## 4.6 Roof.

Residential activity building:

In this building there will be two kinds of roofs. One of them covered all the second floor, and the other one covered part of the first floor, where there is a terrace. The roof of the second floor will be a green roof made with pre-stressed hollow core-slabs with topping concrete, arlita slope formation, polystyrene foil, extruded polystyrene, waterproofing, one membrane protection layer, drainage layer other filter layer and moisture protection, the upper layer is composed of soil for planting. And the roof of the first floor will be passable flat roof.

Single-family houses:



The outer roof construction has a slope of 30°.

## **False ceilings.**

All the ceilings of the building will have a false ceiling with stucco plates, of dimensions 1000x600mm sustained with esparto and paste of stucco E35 type, with perimeter section of 80x200 and executed with stucco molding according to the regulation.

## **4.7 Installations.**

### **4.7.1 Ventilation:**

The primary function of the ventilation system is to maintain excellent indoor air quality. The ventilation rates are determined according to national indoor air quality regulations. It recommends a supply flow rate of 30 m<sup>3</sup>/h per person (8.5 l/s, person) and the system should also allow for a minimum air supply setting for times with no occupancy, with a corresponding air flow rate of 0.2 h<sup>-1</sup>.

When a ventilation heat exchanger is used, as in this project, the temperature of the supply air delivered to the living area is preheated by the exhaust air, which helps to keep a comfortable indoor temperature. The heat exchangers will have an efficiency of at least 80% to minimize the ventilation losses. The unit will also be very quiet and it should be easy to change filters.

The unit must be easy to clean and the energy use for the fans in the unit must be low.

Furthermore, the ventilation system will be equipped with a bypass of the heat exchanger to keep the indoor temperature low in the summer.

The ventilation unit in an apartment building will be placed as small separate units in each apartment. It is important that the ducts are carefully insulated. Ducts without insulation could also cause a thermal bridge carrying cold outdoor air through the heated area on its way to the heat exchanger and the supply air device.

## Airtightness in exterior walls

Only when the construction is airtight can warm air be retained within the building and cold air kept outside. Preventing unpleasant draughts means greater living comfort and increased energy efficiency, which in turn leads to lower heating costs. Airtightness also protects the building fabric against damage, helping to maintain its appearance and extending the building's life.

The ventilation cross-section between the bricks and the mineral wool is sufficient to ensure ventilation of the exterior skin.

## 4.8 Carpentry.

### Single-family houses.

Wood carpentry: All interior doors and windows are made with wood. They are fabricated in Sweden, in accordance with the regulations.

Dwelling type 1: There are five different models of doors, four of them will be blind with moldings to varnish made pine of Sweden, claws of galvanized steel fixation and lock chromed. Exterior doors are well insulated with a low U value. This door and interior doors are 1,02m of width and 2,14 of head height. There are two types of sliding doors, one of them are used to one bathroom and to the laundry room, the others sliding doors are situated in the exterior walls.

There are three different models of windows, two of them have the same dimensions and their difference is that one type is fixed and the other one can be open.

The windows will be from SP-windows, with a total U-value of 0.71 W/m<sup>2</sup> K for the fixed windows, and 0.85 W/m<sup>2</sup> K for the operable windows. The glass, the distance between the panes and the gas in the gaps were the same in both window types. This glass combination was also used in the terrace doors and resulted in a total U-value of the doors of 0.95 W/m<sup>2</sup>K.

Double-glazed timber windows are situated in the openings, their glass will be 4/6/4. It means that the air cavity is 6mm of thickness.

Dwelling type 2: This house has four types of windows of different sizes but they will be made with the same material that the windows described in the previous paragraphs

## Residential activity building

Metallic carpentry. All the windows of the residential activity building will be made with aluminium profiles hard anodizing of 15 microns, with quality steal, natural color, without guide. The windows used are made with double insulating glass, with the same thickness that windows used for dwellings. They made up of colourless glass 4mm, in the interior, dehydrated air chamber of 6mm sealed, and colourless glass 4mm in the outside, with double sealed of butyl and poly sulphur, executed according regulation.

Doors in scape routes have been chosen following BBR regulations in section of prevent of fire. To ensure that doors in escape routes equipped with an escape door system conform with the required regulations, only three components are required as the control electronics are already integrated in the terminal.

The panel for central monitoring and control is in BUS technology.

Fail-unlocked principle: Systems for locking escape routes operate according to the fail-unlocked principle. In case of release, emergency unlocking or current failure, the door is released without immediately.

The locking elements: The actual electrical locking mechanism is selected according to use and the local conditions. It provides both electromechanical (form locked) and electromagnetic (frictionally locked) locking elements. The former are only used when flush mounting is necessary for optical or security reasons.

The electromagnetic door locking mechanisms are used when doors in fire barriers are upgraded with escape door systems or when subsequent installation of an escape door system does not require any structural changes to the door leaf and frame.

Surface holding magnets are also advantageous for doors that are frequently entered and exited thanks to their virtually silent operation.

The hall sensor integrated in surface holding magnets activates a status check to the control device and thus ensures protection against tamper and manipulation. A micro-switch is responsible for this function in escape doors and panic strikes.



Door of storage room will be made with panels of steel plate galvanized and stuffed of injected polyurethane foam, forming panels of 40mm of thickness with acrylic painting with lock of interchangeable cylinder. There will be also some doors situated in the upper floor are made with steel and glass.

## **4.9 Salubrity installations**

### **4.9.1 Canalizations**

The canalization will be made of PVC with the diameters and lengths.

Drain spouts.

All the drain spouts of water evacuation are pluvial or residual and

all the water drainages of sanitary apparatuses and sinks will be made with PVC pipe hot series of URAPLAST or similar, of diameter and lengths specified in project. All the joints and elbows will go with their corresponding meetings of union and special pieces. One will consider that in all the water-drainages of sanitary apparatuses and sinks will have to settle with their corresponding individual siphon.

Smoke ventilation and gases.

The evacuation of vapour and gases will be made through conduits of forced ventilation, type "shunt", formed by double pieces prefabricated, received with plaster paste type YG Metallic grid and layer of heat insulation in the passages of forged and always according to the practical standards of Construction.

Ventilation in the kitchens will be made by means of flexible lamina tube of aluminium and polyester, mounted on steel thread spiral with non-flammable tube of rigid PVC of 120mm will arrange in addition an extractor to smoke and gases, with centrifugal ventilator, of double aspiration and with single phase incorporated electrical motor, mounted with vibration-proof systems and elastic connection in the mouth, with a power of 800 evacuation of m<sup>3</sup>/h. It will be demanded that the extractors have official certificate of operation.

## 4.10 Plumbing installations.

We have chosen: Wärtsilä BioPower plant for district heating in Halmstad.

Wärtsilä was awarded a contract to supply the equipment and installation for a biomass-fuelled combined heat and power plant (CHP) by Halmstads Energi och Miljö AB (HEM), a municipal company active in the energy and environmental sectors of the community.

The biomass-fuelled power plant, named KVV-Turbingatan, has a thermal output of 19.3 MWth and an electrical output of 3.2 MWe. The CHP plant supplies heat and electricity.

The plant uses wood residue from various sources as fuel. It delivers hot water to the district heating network of Halmstad, a city of 88,000 inhabitants. Some of the hot water also are used by local industry. The electricity produced is exported to the Swedish national grid.

Wärtsilä's biomass-fuelled plants are clean and efficient. They are a practical solution to the need for renewable energy supply with minimum environmental impact. They incorporate patented Wärtsilä BioGrate combustion technology to burn biofuels with high combustion efficiency and low NOx and CO emissions.

The BioPower plant operates on a closed steam-feed water system separate from the district heating water system. Steam is generated in an efficient water-tube boiler, and supplied to a back-pressure steam turbine driving an alternator. Turbine exhaust steam then heats the district heating water and the condensate is returned as feed water to the boiler.

## 4.11 Hot and cold water

All the network of hot and cold water distribution will be made with electrolytic copper pipe with meetings welded, in dimensions and diameters according to plane of project. It will be installed, verified and measured according to regulation.

Copper tube is used to convey potable water in buildings. Copper is used for plumbing tube principally because of its corrosion resistance and high level of heat transfer.

A heat exchanger is required in each dwelling. The unit provides thermostatically controlled mains pressure hot water at high flow rates. This allows installation to be in almost any position in the home.

The store is indirectly heated by primary water from the central district heating supply and requires a minimum flow temperature of 80°C for optimum efficiency. The unit provides heating and hot water to each dwelling. This use offers such benefits as:

- No gas pipework
- No flue terminals
- No risk of carbon monoxide or other gases escaping and placing resident at risk.
- Landlords do not require annual gas safety certificates for the individual apartments.

Joining Tube: The method of joining copper tubing systems is soldering with capillary fittings. Such joints are commonly used in plumbing for water lines and sanitary drainage. Brazed joints with capillary fittings are used where greater strength is required or where service temperatures are high.

Mechanical joints involving flared tube ends are used for underground tubing, for joints where the use of heat is impractical and for joints that may have to be disconnected from time to time.

Plumbing fixtures: The bathroom fittings will be of vitrified white porcelain. They have faucets of ceramic chrome-plated discs. Its main features are shiny, mono-control with airflow and individual siphon of water-drainage. The sink will be 1200x600 mm vitrified white porcelain. The total plumbing fixtures will be accredited.

## **4.12 Heating.**

Single-family houses.

In a two-pipe system, steam supply to the heating units and condensate return from heating units are through separate pipes. Air accumulation in piping and heating units discharges from the system through the open vent on the condensate pump receiver. Piping and heating units will be installed with proper pitch to provide gravity flow of all condensate to the pump receiver.

Each heating unit has a type supply valves, it admits steam to the heating unit through its top inlet connection. Furthermore the heating unit also have thermostatic steam traps, they are located at the bottom outlet connection of the heating unit, thermostatic trap stops flow-out of live steam, but opens to drain condensate and air into the return.

#### **4.13 Electrical installations.**

As an electrical conductor for building wire systems, copper is the most efficient, strongest, most reliable metal available today.

Because of its strength, copper resists neck-down, creep, nicks and breaks. These are the reasons it has been chosen in wiring systems throughout the dwellings and the residential activity building.

The electrical system will be made interlocked, with copper conductor of double protected plastic isolation with flexible tube of P.V.C., verified and measured, according to the construction regulations and Electro-technic Regulation of Low Tension. It will have a general box of protection and magneto thermal switches in each circuit. The mechanisms, boxes, etc., will be of the series Niessen Stylo or similar.

Electrical Code Requirements and Energy Efficient Specifications:

- One half of the kitchen lighting wattage must be High Efficiency (fluorescent or equivalent) and switched separately from other lights.
- Kitchen counter tops will be provided with an electrical outlet at on centre. Ground fault circuit interrupters protection is required for these outlets. GFCI protection must be provided in home electrical wiring for receptacle outlets installed in the following locations:
  - Outdoors
  - Bathrooms
  - Garage
  - Workshop
  - Specific Receptacles in Basement Areas
  - Kitchen
  - Areas adjacent to a wet-bar in recreation rooms
  - Hot Tubs, Jacuzzi Tubs, Swimming Pool Equipment
- Provide a minimum of 2 - 20 amp electric circuits for kitchen appliances.
- Provide 2 small-appliance branch circuits for outlets in the kitchen limited to supplying wall and counter space outlets only.

- The home electrical wiring for kitchens requires a 4-wire oven receptacle for electric an range.

## 4.14 Isover

### 4.14.1 Products for air and wind-tightness. Polyestirene foil.

A special water vapour retardant, non-woven, laminated climate membrane for sealing and moisture protection in lightweight and solid construction.

External walls

- Isover Vario Duplex: non-woven, reinforced, water vapour regulating climate membrane. Easy to lay, thanks to guideline markings For sealing the insulation layer in all building elements. Excellent moisture protection for new buildings.

Format	40000 x 1500 mm
m <sup>2</sup> / pack	60 m <sup>2</sup>

Partitions.

Wooden floor joist between heated rooms.

- Isover takboard 33: Glass wool to be used as a load-distributing upper insulation board in several layers at the external insulation of the roof.

Thickness	15 mm
Format	2400 x 1200 mm
Thermal λD	Premium Product 0.033 W / m • ° C
Density	125 kg / m <sup>3</sup>
Fire rating	Euro Class A2
Maximum use temp.	200 ° C
Pallet or package	Stool
m <sup>2</sup> / pallet	201,6 m <sup>2</sup>

- Isover UNI-skiva 36: Glass wool for insulation between wood studs, wooden beams.

Thickness	95 mm
Format	1160 x 560 mm
Thermal λD	0.036 W / m • ° C
Density	16 kg / m <sup>3</sup>
Fire rating	Euro Class A1

Maximum use temp.	200 ° C
Sheets / package	10
m <sup>2</sup> / pack	6.5 m <sup>2</sup>

## 4.15 Floors

### 4.15.1 Hollow core floor slab.

The Hollow Core flooring system allows for significant flexibility in terms of penetrations and block-outs.

Penetrations for plumbing, electrical and mechanical services can be catered for along with larger voids such as stair openings and light wells. There are a number of different ways that these can be achieved, these are described below:

**Core Holes:** Core holes are the most common type of penetration and are easily achieved by simply drilling the required hole on site to suit the building requirements. Provided the core holes are not greater than 120mmØ In broad for 220mm thick slabs

**Cut-Outs:** Larger penetrations, such as those required for mechanical services are nominated during the design process to allow the design to take into account the local strand and web reduction.

These cut-outs are generally pre-cut in the factory prior to installation. If future demands or site modifications require these larger penetrations to be introduced, they can be catered for in most cases with minor onsite slab modification.

**Trimmer Beams:** Large openings to allow for stair voids can be catered for by the use of trimmer beams. Where these large penetrations are required full width headers or trimmer beams are used to transfer the load to the to the adjacent planks.

These planks are designed to support the additional load without the need for supporting columns.

#### TOLERANCES

Floor planks shall be supplied in accordance with the following tolerances.

- Length +10mm -10mm

- Width +3mm -6mm
- Thickness +3mm -3mm
- Squareness of end +6mm -6mm
- Bow / Wind 10mm per 3000mm
- Location of inserts +20mm -20mm
- Cover to strand +3mm -3mm



# Protection against fire



# 5. Protection against fire

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## 5.1 Laws and regulations

Building legislation is required for the completed building. In construction laws (BVL) and construction regulations (BVF) are rules that apply to all buildings and other structures. These rules apply for the new construction.

BLM states that the fundamental technical performance requirements are:

- Buoyancy and stability
- Safety in case of fire
- Protection with regard to hygiene, health and environment
- Safety in use
- Protection against noise
- Energy economy and heat retention
- Fitness for purpose
- Accessibility and usability for people with limited mobility or orientation capacity
- Conservation of water and waste

## 5.2 Regulations.

Building Regulations (BBR) must be followed.

## 5.3 Safety In Case Of Fire.

All lawful required measures have been followed regarding fire-safety.

Mandatory rule and general advice in fire-safety are collected from the Building Regulations (BBR), section 5 . Guidelines for fire resistance in Planning Design Regulations (BKR) section 10 , and European construction standards (EKS), Section C.

### 5.3.1 Documentation.

According to (BFS 1995:17) section 5:12, the fire protection documentation is drawn up in the followings pages. This document set the conditions on which fire protection is to be based and the design of fire protection.

In this documentation are set out the fire resistance classes of the building and its components, compartments, escape strategy.

### 5.3.2 Fire resistance classes.

Classification for buildings in Sweden are as follows: These Br1, Br2 or Br3 follow general recommendation of the Board's Design Regulations (BKR) section 5:21

- The residential activity building of the project falls into the classification, Class Br2 due to the large multipurpose room at ground level.

As started in the regulations, a place of assembly can be defined how any premises or group of premises in a fire compartment in which a large number of people who do not have full knowledge of the premises may be present. In the upper level is the sport hall which regarded as a place of assembly.

Normally, this building will be used by few people, as it is a private building, however, on occasions, up to 60 people will be present.

- Single-family houses falls into the classification, Class Br3 due to the large multipurpose room at ground level.

### 5.3.3 Escape in the event of fire.

All buildings designed in this project allow satisfactory escape routes in case of fire. This implies either complete evacuation of people who are present in a building. Special attention has been paid in the common building as the risk is higher; as people may be injured by the fall of structural or non-structural elements or due to panic and congestion, and the risk that persons may be trapped.

- Residential activity building

As is described in the regulations, in premises where people are present other than occasionally must be provided with not less than two mutually independent escape routes and if premises have more than one storey, at least one escape route shall be provided on each storey. For this reason the common building is provided with four escape routes. Two of them in the upper level and one more in the ground floor.

- Single-family houses.

A door leading directly to a street (principal access door) is the only escape route from dwellings.

if it is necessary, windows can be used for emergency escape because at least there is an openable without a key (as it is required by the regulation) and has a clear vertical opening not less than 0.5 meters wide and not less than 0.6 meters high. The sum of width and height are not less than 1.5 meters. The bottom of the window opening are not more than 1.2 m above floor level.

#### 5.3.4 Separation from other escape routes in the residential activity building.

Escape routes have been separated from one another in such a way that only one of them can become full of smoke or blocked by the same fire. Therefore have been subdivided into sections of appropriate length so that prevent the spread of fire gases.

As it is recommended by BFS 2002:19 regulation section 5:32, that escape routes designed in the building have been separated from one another in the project of design using a class to not less than E 15-C. Corridors have also been subdivided into sections not more than 60 meters in length, separated from one another by construction to not less than Class E15-C.

#### 5.3.5 Travel distance to and along an escape route.

The travel distance inside a fire compartment to the nearest escape route allows perfectly to a compartment be evacuated before critical conditions.

The maximum travel distance from the farthest area is 26 meters and regulation advise being less than 30 meters when the escape can be used in two directions.

### 5.3.6 Access. The dimensions of escape routes

Escape routes have been designed to be spacious and to allow such ease of movement that they are capable of serving the number of persons for which they are intended.

Following the BFS 2002:19 5 rules, the residential activity building have been designed maximum to 60 people and the width of an escape route could be not less than 0.9 meters. In this case the width of the main access is 1.50 meters.

### 5.3.7 Doors in escape routes

- Residential activity building.

All doors in the escape route open outwards in direction of escape and they are easily identifiable as exits. Doors situated in one escape route have been chosen to be open easily, however, exterior doors are possible to open into an escape route from places of assembly by merely pushing against the door or by opening it with an easily operated handle. As it is said in BFS 1995:17.

Furthermore the doors in escape routes can be fitted with a device which permits persons to return after they have passed through. The force needed to open the door should not exceed 130 Newtons applied to normal opening devices.

- Single-family houses.

Some inward opening doors are used in dwellings are permitted if they are intended for a small number of people, such as detached houses of the project, because a moderate number of people who live in this kind of construction may be expected to have good knowledge of their houses.

Doors which can be opened only with a key are used in this houses because all people who live in each house can have its own key to open the door in accordance with the BFS 1995:17 regulation.

### 5.3.8 Equipment

- Guidance signs.

Guidance signs for escape have been situated in every door or point where the people can get confused to find the escape way.

Illuminated signs will be hanged on top of each door for every escape route, also floor plans with scape routes will be placed near exit doors. The size of this panels will be appropriate to be clearly visible. The panels have been made in accordance with the regulations and general recommendations of the Swedish Board of Occupational Safety and Health, Safety marking and safety signalling at places of work (BFS 1998:38).

### 5.3.9 Lighting.

Escape routes are provided with general lighting which can work with a satisfactory degree of safety in the event of escape from the building.

Emergency lighting permit escape in a safe and effective manner even in the event of power failure. It is also provided in all stairways which are used in escape from a building with more than eight storeys. Emergency lighting shall be provided The guidance signs are provided with emergency lighting unless this is evidently unnecessary. The emergency lighting shall perform its function in every escape route which has not been blocked by fire.

In the event of power failure the emergency lighting will provide the intended illumination at least 60 minutes.

Electric cables for emergency have fire resistance in accordance with class EI 30.

### 5.3.10 Evacuation alarm.

Automatic fire alarm system in the residential activity building is installed, smoke detectors will be also installed. The system will send a signal to a staffed position when persons are present in the building. In this building, it is not necessary loudspeaker.

The alarm can be activated automatically or from a staffed position when a fire is indicated.

As it is shown in (BFS 1998:38) the common building is provided with devices for the early detection of fire and evacuation alarms.

Signals will be audible in all areas where people are present other than occasionally. The early detection of fire and evacuation alarms in this building is obtained by installing an appropriate number (four in this in all building) of wired or battery operated self-contained smoke alarms.

The place where alarms are placed is shown in the fire protection plans.

In design with respect to the safety of escape, the conditions in the building do not become such that the limiting values for critical conditions are exceeded during the time needed for escape.

In evaluating critical conditions, special consideration has been given to visibility, thermal radiation, temperature, noxious gases and the combination of temperature and noxious gases.

This data is shown below:

- Visibility: level of fire gases not lower than  $1.6 + (0.1 \times H)$  m, where H is the height of the room.
- Radiation: a short term thermal radiation intensity of maximum  $10 \text{ kW/m}^2$ , a maximum radiant energy of  $60 \text{ kJ/m}^2$  in addition to the energy from a radiation of  $1 \text{ kW/m}^2$ .
- Temperature: air temperature not higher than  $80^\circ\text{C}$ .

### 5.3.11 Protection against the outbreak of fire. Dwellings and residential activity building.

Heat producing appliances, burners, heating installations and cookers, and flues have been arranged so that they do not give rise to ignition of nearby structural or non-structural elements, fixtures or fittings. The temperature of the surface of nearby structural and non-structural elements, fixtures or fittings of combustible materials has been chosen to not exceed  $85^\circ\text{C}$ .

Heating panels or similar will be protected against being covered to the extent required to prevent the outbreak of fire.

Following the rule (BFS 2002:19), Parts of installations which may assume a temperature higher than  $85^\circ\text{C}$  are insulated, the insulation is of material of not less than A2-s1,d0 (non-combustible material).

The same rule that governs the preceding paragraph indicates that heat producing appliances, flues and similar should be placed at a suitable distance away from nearby structural elements, fixtures and fittings made of combustible materials. The distance is dependent on different factors as the area and the temperature of the radiating surface. For an uninsulated and non-water jacketed heat producing appliance or an uninsulated flue, a minimum distance of 0.5 meters is recommended. As an alternative, a cover made of material of Class A2-s1,d0 (non-combustible material) may protect the wall against radiance provided that the cover has sufficient dimensions vertically and sideways and is placed at an appropriate distance.

In this project there are some heat producing appliances and subsidiary flues this products have been selected with sufficient strength to withstand the loads and other actions to which they may be subjected.

Heat producing appliances, burners, and similar are placed on a base of sufficient load bearing capacity. This base shall be constructed so that the spread of fire downwards is prevented (BFS 1998:38).

Depending on the type of building, the base has been designed having as reference the general recommendations of regulations. Following fire resistance classes have been chosen:

- Residential activity building REI 60.
- In single-family houses to not less than class REI 15.

Other recommendations: Gases shall not escape from heat producing appliances and burners. The heat-producing appliance shall be supplied with a sufficient amount of air for combustion.

Heaters which have a rating higher than 60 kW are placed in boiler rooms, such as boilers that heat water of the swimming pool, showers and jacuzzi situated in the common building.

## HEARTHS

Heat producing appliances for solid or liquid fuel shall be provided with a hearth. The hearth shall have such size and be of such material that ignition of the floor is prevented. If there is a clear space below the heat producing appliance or the bottom of the firebox, the hearth shall also cover this space.

Following dimensions are required in (BFS 1998:38) section 5:42:

The hearth of heaters for solid fuel should be not less than 2 meters wide in front of the opening of the heater and not less than 1 meter outside other parts.

A hearth should consist of not less than 50 milliammeter concrete, tiles or similar.

For smaller enclosed heat producing appliances, the hearth should be provided up to a distance of not less than 0.3 meters in front of the heat producing appliance and up to a distance of not less than 0.1 meters on each side of the appliance.

At a tiled stove the lateral dimension of the hearth may however be limited to the width of the opening of the stove plus not less than 0.2 meters on each side of the opening.

At an open fire the hearth should be arranged so that the horizontal distance between the centre of the fire and the unprotected combustible floor is not less than 1.0 m.

If the bottom of the appliance is higher than 0.4 m above the floor, the distance should be increased by one half of the vertical distance in excess of this figure.

Hearths for smaller heat producing appliances in habitable rooms may be of 0.7 mm steel sheet.

Flue casings (BFS 1998:38) and (BFS 2002:19)

Flues made of materials that do not maintain their qualities after a chimney fire shall be surrounded by a casing of material of Class A2-s1,d0 (non-combustible material) with sufficient strength. The flue casing is designed so that the appropriate safety distance to combustible material is maintained.

Depending on the type of building, the walls of the casing has been designed having as reference the general recommendations of regulations. Following fire resistance classes have been chosen:

- Residential activity building EI 60.
- In single-family houses to more than class EI 15.

Subsidiary flues and lining tubes (BFS 1998:38)

Warm air heaters for heating premises in more than one fire compartment, will be installed in a boiler room. Neither supply air nor return air shall be taken from such boiler room. The walls of ducts in the boiler room will be constructed so that the spread of fire to both supply air and return air ducts is prevented for 30 minutes. (BFS 2002:19)



### 5.3.12 Protection against the spread of fire inside a fire compartment.

The next text is written in the regulation: Materials in structural and non-structural elements, fittings and fixtures shall have such properties or form part of the structural or non-structural elements in such a way that in the event of fire they do not give rise to ignition or rapid spread of fire, nor do they rapidly evolve large quantities of heat or fire gases. They shall not melt and drip down outside the immediate vicinity of the seat of fire. The stipulated class of performance for the material depends on the quantity of heat and fire gases which can be permitted to evolve in the building. The choice of material is dictated by the class to which the building is assigned. Materials in ceilings and walls, fittings and fixtures shall not be deformed when slightly affected by fire and shall not fall down or change in any other way so that the risk of injury to persons increases.

In spaces other than escape routes and such premises as mentioned in 5:513 the following surface finishes should be selected:

- The common building belongs to Class Br2:

Ceiling surfaces have surface finish of not less than Class C-s2,d0 (Class II), applied to material of Class A2-s1,d0 (non-combustible material) or fire protection cladding.

Wall surfaces have surface finish of not less than Class D-s2,d0 (Class III).

- In a building of Class Br3, as single-family houses:

Ceiling and wall surfaces have surface finish of not less than Class D-s2,d0 (Class III).

### 5.3.13 Surface finishes and claddings in escape routes.

As mentioned in the regulation, surface finishes and claddings in escape routes shall be of materials which provide negligible contribution to the spread of fire. In building of Class Br2, ceiling surfaces and internal wall surfaces in escape routes shall have surface finish of Class Bs1, d0 (Class I). The surface finish shall be applied to material of Class A2-s1,d0 (non-combustible material) or to fire protection cladding.

Floor coverings with a moderate propensity to spread fire and evolve fire gases will be constructed to not less than Class Cfl -s1 (Class G). (BFS 2002:19)

### 5.3.14 Surface finishes and claddings in certain premises.

In places which presents a fire hazard, walls and ceilings will be constructed so that development of fire in the premises receives no appreciable contribution from the surface finish and claddings of ceilings and walls.

The floor covering in this places will be constructed of a material with a moderate propensity to spread fire and evolve fire gases. (BFS 2002:19)

### 5.3.15 Protection against the spread of fire and fire gases between fire compartments.

The Residential activity building has been divided into fire compartments separated by structural or non-structural elements which impede the spread of fire and fire gases. Each fire compartment is comprise a room – or associated groups of rooms – In which the activity has no immediate connection with other activities in the building.

Each fire compartment is separated from other spaces in the building by structural or non-structural elements constructed to not less than the fire resistance class commensurate with the requirements in next paragraphs.

The following areas; stairways, boiler rooms, storage rooms, and escape routes are examples of self contained fire compartment

The structural and non-structural elements shall be constructed to not less than the fire resistance class Br2 and Br3, set out in Table (b) below.

Type of element	Fire resistance class
Structural or non-structural element separating fire compartments in general	EI 30
Structural or non-structural element separating flats in a block of flats	EI 60

### 5.3.16 Doors, shutters and access panels

Doors, shutters and access panels in structural or non-structural elements separating compartments in no instance lower than Class E30.

Doors and similar of material of Class A2-s1,d0 (noncombustible material) which satisfy the requirements regarding insulation of Group 2 (previously Class A) and integrity in accordance with the the Board’s general recommendations Guidelines for type approval, Safety in case of fire (BFS 1993:2) or corresponding previous regulations, may however be used as alternatives to doors and similar of Class EI. (BFS 2002:19)

Doors and similar into, or inside, escape routes are self closing. Doors and similar into spaces which are normally kept locked, situated above storeys where people are present other than occasionally, need not however be self closing.

Self-closing doors are fitted with a door stop provided that this automatically closes when fire gases are detected near it.

### 5.3.17 External walls and windows

In accordance with BFS 2002:19, Facade cladding shall not in the event of fire evolve heat and smoke to such an extent that escape and fire fighting are impeded or in such a way that there is a serious risk of injury to persons in its vicinity.

Facade cladding is made of low ignitability materials or comply with the requirement for surface finish Class D-s2,d0 (Class III).

### 5.3.18 Windows in external walls

Windows in different fire compartments which face one another have been designed and situated so that the spread of fire between the compartments is impeded. It is not possible for such windows to be opened other than by a tool, key or similar.

Examples of the construction of windows in external walls which face one another. This examples have been used to choose the windows.

Relative placing	Distance (m) between windows (glazed surfaces)	Construction
Windows in opposite (parallel) external walls	< 5.0 One window	To Class E 30 or both to Class E 15
Windows in opposite (parallel) external walls	> 5.0	—

Relative placing	Distance (m) between windows (glazed surfaces)	Construction
Windows in internal corners elsewhere	> 2.0	—
Windows in internal corners elsewhere	< 2.0	One window to Class E 15

### 5.3.19 Boiler rooms

In the residential activity building, boiler room have be designed as a self contained fire compartment in accordance with BFS 2002:19 regulation

Ceiling and wall surfaces are clad with material of not less than Class B-s1,d0 on fire protection cladding (Class I on fire protection cladding) and the floor is made of material of Class A1fl (non-combustible material).

### 5.3.20 Protection against the spread of fire between buildings. Detached houses.

In accordance with BFS 2002:19 regulation, dwellings in detached houses shall be separated from one another so that the spread of fire is prevented for not less than 60 minutes.

Non-contiguous dwellings separated from one another by a distance not less than 2.0 meters, with an acceptable radiation level towards the surfaces of adjacent buildings, also comply with the requirements of the mandatory provision.

The aggregate building area of each group, disregarding the areas of balconies, terraces, car ports and similar, should be not more than 600 m<sup>2</sup> for two storey buildings and single storey buildings with attics converted into living accommodation. For single storey build dings the area should be not more than 800 m<sup>2</sup> Such subdivision is .not however needed if internal walls and ceilings of combustible material, in living accommodation, are provided with fire protection cladding. (BFS 2002:19)

Dwellings in detached which are situated less than 4.0 m from ancillary buildings larger than 10 m<sup>2</sup> in area shall be separated from these so that the spread of fire to or from the detached house is prevented for not less than 30 minutes.

General recommendation: The requirements of the mandatory provision can be complied with if the facing walls of either building are constructed to not less than Class EI 30. If one of the external walls has portions with no or a lower fire resistance class, the safety distance should be not less than 2.0 m and the radiation level towards the surface of the nearby building should be limited to an acceptable level.

### 5.3.21 Roof covering

Design of roof covering has been done with following recommendations:

Roof covering on a material of Class A2-s1,d0 (non-combustible backing) may be made of Class T.

Some spread of fire may be permitted to occur in detached houses and in a residential area outside a concentrated town centre development and on free-standing buildings.

In the case of single-family houses board material of low ignitability may be used as cantilever roofs above carports and patios and as canopies above entrances. The risk of a roof being ignited from a chimney serving a central heating installation shall be limited.



# Health and safety study

## 6. Health and Safety Study

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### 6.1 Object of the Study of Health and Safety.

A hazard is the potential for harm. In practical terms, a hazard often is associated with a condition or activity that, if left uncontrolled, can result in an injury or illness. Identifying hazards and eliminating or controlling them as early as possible will help prevent injuries and illnesses.

A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur.

It focuses on the relationship between the worker, the task, the tools, and the work environment. After identify uncontrolled hazards, we will take steps to eliminate or reduce them to an acceptable risk level.

This Safety and Health study establishes, during the construction of the work, the forecasts respect to prevention of risks and occupational accidents so that all the works that compose this work develop surely, avoiding dangerous actions or situations by lack of foresight, lack of information on the possible risks or means insufficiency, as well as the sanitary services common to the workers.

It will serve to provide basic directives to the constructions companies to carry its obligations in prevention field of professional risks out, taking easy its development under the control of the Coordinator in Security and Health during the execution of the work.

A Plan to Emergencies is described. It guarantees performance standards at the time of facing situations of gravity, detailing the escape routes and places where the people can keep out of harm.

#### 6.1.1 General performances.

The work consists of the construction of housing development located in Stationgatan street of Halmstad (Sweden).

The promoter of this work is Halmstad University.

The author of this Safety and Health study is Ana-Cruz Callén Gil, with professional office situated in Brogatan street, number 2 of Halmstad.

### 6.1.2 Training of employees

Employers must ensure employees are either sufficiently experienced to do their work safely or are supervised by an experienced person. In addition, employees must be adequately trained in the safe use of equipment in the place of work, including protective clothing and equipment.

### 6.1.3 Safety of people who are not employees

Employers are also responsible for the health and safety of people who are not employees. Employers must take all practicable steps to ensure that employees do not harm any other person while at work, including members of the public or visitors to the place of work.

### 6.1.4 Accidents and serious harm (records and notification)

The law requires employers to keep a register of work-related accidents and serious harm. This includes every accident that harmed:

- Any employee at work;
- Any person in a place of work under the employer's control.

### 6.1.5 Main sources of risk in construction projects.

- The common sources of risk in construction projects are listed below
- Misunderstanding of contract terms and conditions
- Design changes and errors
- Poorly coordinated work
- Poor estimates
- Poorly defined roles and responsibilities
- Unskilled staff
- Natural hazards
- Political and legal problems.

Whit the Safety and Health Study all this risk will be prevented.



## **6.2 Conditions of the surroundings.**

The rolled access is paved, reason why the accesses to future housing development projected does not present any special problem

The plot has a surface of 15.538m<sup>2</sup> and its topography is flat. The site has regular form.

The streets which surround the plot are totally urbanized, referring to the services, the plot has provision of electrical energy, water supply and residual water evacuation.

The water provision is predicted by means of a derivation of the potable water, being pending of confirmation on the part of the providing company the specific connection point.

BUDGET EXECUTION OF THE PROJECT: 259.058,02 € + indirect costs.

IMPLEMENTATION TIME: two months and twelve days each dwelling type 1.

NUMBER OF WORKERS ANTICIPATED for the totality of the project will not surpass the number of 10 workers with different specialities.

## **6.3 Site preparation.**

Before beginning the execution of a work, the first thing that it will be necessary to consider is the order of realization of the preliminary works, keeping in mind the risks that can involve.

The characteristics of the building won't only be known to build but rather, in the visit to the land registrations will be located, wells, caskets and everything that indicates the existence of underground conductions, will be requested to the suppliers companies of service (water, gas, electricity) the different data where they are signal the situation of the different facilities.

During the previous phase to the execution of the work will be defined the services which can be affected, the level of risk that they offer, the provisional installations.

The provisional installation of water, besides being able to cause damages at third, will also become special attention to the break of conductions of water that they can be the cause problems in foundations of adjacent buildings.

Finally, it will be necessary to check the existence of air or underground conductions and to obtain the pertinent information on the same ones, furthermore, other consideration, not less important than the previous one it will be to know the data corresponding to the state of the nearest buildings.

For the storing of materials and machinery, it loads and it discharges, as well as the auxiliary works will be used one area of the plot.

### 6.3.1 Fencing around the plot.

Before the beginning of the work, it will be carried out the hedge of the plot along all its perimeter, maintaining a security distance from the fences until the border of casting of lands similar to 2.00. This distance will stays in the perimeter of the work, in the access for the machinery and It also stays in the staff access.

The hedge will be carried out with welded net, supported with metallic feet fixed on bases of reinforced concrete, assuring its assurance and resistance. It will present the following characteristic:

- The height of the barrier will be same or superior to two meters.
- Be difficult to climb
- Be difficult to gain access underneath
- Be stable and able to withstand anticipated loads
- Gates and joints in the fence should be secure and not present a weak point for entry.
- An access will be enabled for vehicles of 5m. of width.

Sheets of reinforcing mesh should not be used for site fencing as it allows adequate hand and foot holds for children to climb over and the protruding ends of sheets could result in penetrating injuries.

In case of emergency, the signs will be clearly visible from outside the site, stating the names and contact telephone numbers of the person with control of the building work.

An independent access will be enabled for staff with a width of leaf of 1m, its height will be 2m.

Besides this protection, Signalling boards will inform about general risks of the work.

## Signalling

It will present as minimum the following signalling:

- No admittance to no unauthorised personnel.
- Forbidden the step of pedestrians for the entrance of vehicles.
- Safety helmets must be worn.
- Safety footwear must be worn on this site.
- All visitors and drivers must report to site office.
- Danger men at work.
- High visibility jackets must be worn beyond this point.
- No smoking.

Detection of the common hazards:

- Lifting and Carrying (Manual materials handling.
- Stooped postures.
- Whole Body Vibration.

Preventive norms:

- Two-Mason Lift Technique.
- Use of portable storage carts.
- Worker rotation.

## 6.4 Provisional facilities at work.

### 6.4.1 Sanitary cabin.

The construction is metal, facing with corrugated steel with double PVC coated; insulated with EPS material or rock wool; PVC-lined panel.

Based on the maximum number of workers who can be found in work, we will determine the necessary surface and elements for these facilities. In our case the greater presence of simultaneous personnel obtains with 10 workers, determining the following sanitary elements: one shower, two toilets, two washbasins and two mirrors.

Changing room will be equipped with seats and individual lockers with key to store clothing and footwear. Furthermore, it will be available warm and cold water in the shower.

Dining room are not necessary because there is a restaurant near the plot.

There will be a container for garbage collection.

Perfect state of cleaning and conservation will stay in.

In the work office one will settle a first aid kit with the minimum content indicated by the effective legislation, furthermore there will be a portable fire extinguisher.

## Toilets

Workers will have access to conveniently located toilet facilities. The toilets will be connected to the sewerage system. These toilets will be serviced in accordance with the supplier's information and instructions, before work starts.

To provide an acceptable standard of hygiene and privacy, the toilet must be:

- Kept clean
- Weatherproof
- Well lit and well ventilated, either naturally or artificially
- Provided with a hinged seat and lid.
- Provided with a door which can be locked from inside.
- Provided with a well drained floor above ground level which is covered with a durable waterproof material
- Provided with a plentiful supply of toilet paper
- Set up to remain level and stable under all working conditions.

Where female workers are present on site, appropriate measures for sanitary item disposal should be made, such as a disposal unit provided in the portable toilet or sewer connected toilet closet.

### 6.4.2 Site office.

This prefabricated site office cabin is compact and it has high structural strength.

Key specifications of Prefabricated Site Office Cabin are:

- Easy to transport
- Dismantling / reassembling facilities
- Well insulated
- Maintenance free

### 6.4.3 Storage container.

The construction is metal, facing with corrugated steel with double PVC coated; insulated with EPS material.

The floor structure is constructed of a metal grid elevated 120mm from the ground, hydrophobic plywood of 22mm thickness and laminated flooring - Class AC3.

Electrical installation consists of junction boxes, fluorescent lamps, outdoor lighting fixture, sockets and switches.

Joinery is constructed from four-glazed PVC profiles for windows and doors are made of thick aluminum profiles.

Every corner of the storage container is equipped with brackets (ears), which permit the loading and unloading activities when container is transported. Transportation is done with log truck with a crane.

Discharge of water from the roof is provided by the lateral corner columns.

### Water supply

This underground canalization of drinkable water, residual or of watering are conductions with flow and variable pressure before a break or overflow, they present flood risk, with nuisances and delays.

In our work, the installation of a provisional net of supply of drinkable water will be executed to satisfy the necessities.

Once it is hired the supply of the assault with the supplier company, it will be settled the accountant, the general key and the exit to the different distributions.

### Drinking Water

A readily accessible and plentiful supply of drinking water will be available to all workers on the site.

Mains water supply should be provided at the earliest possible time.

Drinking water facilities will be separated from toilet facilities to ensure adequate hygiene.

#### 6.4.4 Meal and shelter facilities

It will be provide hygienic and weatherproof meal and shelter facilities in an area accessible to the building under construction.

These facilities will include:

- Adequate seating (which could include a board across two trestles and other alternatives to chairs) and a clean surface upon which to place food (could include an esky provided by the worker or subcontractor or other material owned or controlled by the relevant subcontractor)
- A rubbish bin with a lid or appropriate alternatives for the hygienic disposal of food scraps.

#### 6.4.5 Temporary Electrical installation.

It is necessary to check the pertinent information about electric facilities. It is also necessary to check places where cables of high intensity are.

Once this informations is known, the itinerary and depth of the underground conduction will be marked with the maximum precision. The axis of the conduction will be traced, being placed a board indicating the existent danger, being left an area of security, to both sides of the excavation axis, of 1.5m. Underground conductions of electricity will be cover with sand, bricks, tape of plastic in red colour and filler material.

With this information, it will be able to begin the works and provisional facilities of work. The measures to take will be;

The trench will be made with excavating shovel until the depth authorized by the company. Starting from there the excavation will continue with manual tools.

The equipment of individual protection that the workers will use are helmets, gloves and dielectrics boots and all tools used in this phase will be isolated.

Once we have covered the trench, we will determine the location of the cables following the minimum distance between the different types of service with relationship to the level of the sidewalk, the distances among conductions according to the regulations will be:

- Electricity of High tension 1.2m
- Electricity of Low tension 0.7m
- Lighting 0.40m
- Low tension with telephony, water and gas: 0.20m

The line used in this project will be low tension of 380 volts.

We will have to keep in mind that pointed out previously concerning to low tension line, as according to the current regulations, this project will use this mode of tension.

Furthermore, for buried lines of low tension the minimum depth will be of 0.7m following the side walk line and with a minimum separation of 1m.

We will also keep in mind that for the illumination their spread will be able to be carried out following the line of sidewalks with the medium ones from roadway separation to a minimum depth of 0.4m and a separation of the line of curb of 0.75m. Once open the gutter;

Placement of layer of colored sand.

1. Placement of the protection conduction that it has also a certain colour.
2. Cover the conduction with colored sand and a plastic tape with an annotation.
3. Placement of line of bricks.

When is finished this it will proceed to cover and compact the earth.

Detection of the common hazards:

- Sharp wound in hands
- Falls at the same level
- Electrocutation: direct and indirect electrical contacts derived mainly from:
  - Works with tension
  - Try to work without tension but it is not total confirmed.

- Malfunction of protection mechanism and systems.
- Using of improper or damaged equipment.
- Bad behaviour or incorrect installation of the system of protection against indirect electrical contacts in general, and the ground in particular.

#### Preventive norms:

- All electrical outlets shall carry a ground connection requiring a 3-pronged plug.
- The grounding pin of a 3-pronged plug shall not be removed.
- All wiring operations shall be conducted by a licensed electrician.
- In the event that equipment becomes wet, or in the event of a water flood in the shop, power should be disconnected at the breaker, and a lock applied.
- Electrical potential shall be discharged before conducting work on equipment containing high voltage power supplies or capacitors.
- Use only CO<sub>2</sub> or dry chemical extinguishers on electrical fires.

For the prevention of possible indirect electrical contacts, the protection system chosen is the grounding of the masses and cutting devices for fault current (switches).

#### Standard rules for preventing type cables:

- The section of the electric wiring shall be according to the electrical charge that has to bear in terms of machinery and lighting provided.
- All drivers used are isolated rated voltage of 1000 volts or higher and without significant defects (tears and similar).
- The distribution from the general panel of work to secondary panels will be made through buried pipes.
- In case of use laying of cables and hoses , it will be done at a minimum 2m of height in pedestrians places and 5m in the cross of vehicles, measures above the pavement.
- The laying of the cables to cross road of work shall be buried. It will be marked "way of cable" using a permanent stud boards that it will target the protection through burden sharing, and noted the existence of "electric cable" vehicles. The cable will be protected inside a rigid tube.
- In case of having to make joints between hoses will be considered:
  - If it always will be high. It is forbidden to keep them on the floor.
  - The interim joints between hoses will be made implemented through standard connections watertight moisture.
  - The definitive joints will be completed using standard junction boxes watertight security.



- The interconnection of the secondary panels will be made by buried pipelines.
- The layout of the electrical supply hoses will not match with the provisional water supply to plants.
- The hoses like extensions:
  - If they are for short periods may be stretched on the floor, but leaning against the vertical face. It will be rejoined by moisture sealed standard connections or isolating sleeves heat shrink wrapping, with minimal protection against water jets.

### Standard rules for preventing type switches

- It will comply expressly specified in the electro-low voltage Regulations.
- The switches will be installed inside standards panels, with security lock in the door.
- The switch panels shall have a sticker standard sign on its door "danger, electricity".
- The switch panels will be hung either the vertical walls or of "studs" stable.

### Standard rules for preventing type takes power:

- The outlets shall be fitted with switches that allow court omnipolar tension leaving them if they have to be used.
- The sockets for the tables are made of switchboards, standard pinarmored (protected against direct contact).
- The circuit breakers are installed on all outlet lines distribution boards and power in the machinery and machine tools.
- The earth leakage circuit breakers will be installed in accordance to the following sensitivities:
  - 300mA: Power to the machinery.
  - 30mA: Power of machinery and enhanced level of security.
  - 30mA: For not portable electric lighting installations.
  - The portable lighting will be fed to 24v. Transformers agency, preferably with separation of circuits.

### Standard rules for ground connections

- The transformer will be equipped with a ground connection adjusted to the existing regulations of supplying about the power company in the area.
- The metal parts of any electrical equipment have a ground connection.

- The installation will be neutral grounded.
- The ground wire will always be protected with macaroni in yellow and green. It is expressly forbidden to use it for other uses. Only driver may be used bare cooper cable of 95mm<sup>2</sup> section at least buried horizontally and stretches that will be considered as artificial electrode installation.
- The overall network of land will be unique for the entire installation including the grounding connections of the rails to stay or moving cranes.
- If the crane could approach a power line medium or high voltage insulator lacks adequate shielding, grounding, both must be electrically independent of the overall network installation land interim electrical work.

## 6.5 Demolition.

### 6.5.1 Demolition by hand.

The first phase will be a manual demolition, to recover and to be able to re-use most of cables that now exist in the current building. Hand demolition is not the quickest method; only hand tools are used. Cables must be removed regularly and not allowed to pile up.

#### Detection of the common hazards:

- Noise.
- Back injuries
- Electric shock
- Particles in the eyes
- Burns
- Cuts
- Strain

#### Preventive norms:

Safety equipment protects must be used in accordance with the supplier's instructions. A number of hazards in demolition work require the use of personal protective equipment. Employers must ensure that employees are provided with, and use, the following protective clothing and equipment:

- Goggles
- Protective clothing
- Face shields

- Hearing protection devices
- Gloves
- Appropriate respirators for dust
- Safety helmets and safety footwear must be worn at all times on demolition sites, except that operators may remove their helmets while inside a FOPs-protected cab

## Hand tools

Common hand tool injuries can be avoided by observing the following safety rules:

- Select the right tool for the job.
- Keep tools in good condition.
- Inspect tools regularly, and either replace or repair at once if found to be defective.
- Use tools in a safe manner.
- Keep tools in a safe place at all times.

Sledge hammers and picks: These are dangerous tools when their heads chip or come loose from their handles. Hammer chipping can be reduced by:

- Replacing a hammer head that is beginning to mushroom;
- Swinging only as hard as is necessary and safe;
- Hitting the target straight-on, never at an angle.
- Hammer heads flying off handles can be eliminated by carefully inspecting handles for cracks, splinters and looseness.

Chisels: the safe use of chisels begins with the selection of a sharp instrument of the right size for the job, and a hammer of appropriate weight. Chisel heads that have begun to mushroom should be ground to avoid the danger of flying chips. Goggles must always be worn when chisels are in use.

Crowbars: A safe crowbar has a point that grips the object to be moved, and a heel to act as a fulcrum. Makeshift crowbars, such as pieces of pipe iron bars, should be avoided. They are more likely to slip or break and cause injury.

Shovels :back injuries are the most serious injuries resulting from the use of shovels. To avoid such injuries, proper attention should be paid to the employee's stance, their lifting technique, and the way they turn and empty the shovel. Twisting the spine should

be avoided: the legs, rather than the arms, shoulders, and back should be used whenever possible. Employees should use the ball of the foot rather than the arch to push the shovel. That way, if the foot slips the shovel's sharp corner will not cut the ankle

## 6.5.2 Mechanical demolition.

Hydraulically operated excavators fitted with pusher arm.

The main advantages of such machines are that they are extremely mobile, have a high output, and are able to work on vertical faces and floors above standing level. The disadvantages are that the machines need adequate access, a firm and relatively flat base to work from, and can only work within the reach of their booms. To operate these machines efficiently, the length of boom when fully extended should

- be at least 1.5 metres above the height of the building being demolished.
- The pusher arm method is suitable for small buildings as this.
- The building is pushed over by a horizontal force from the machine.
- Using this method, always:
  - Work from outside the building and never let anyone enter the building while plant is wrecking the building.
  - Be sure the operator has been trained in the work or is being instructed by a trained person.
  - Use hand demolition to get the building to a level where pushing can start.
  - Make sure the debris does not build up

## 6.6 Movements of Lands

Description and organization of the works.

The topography of the land is sensibly horizontal without appreciable differences.

The earth movements to carry out are:

- The cleaning of the layer of earth.
- The excavation of the land until arriving to the bench mark required for the support of the foundation.

## 6.6.1 Excavations and trenches

Before excavation work is carried out, the relevant person or principal contractor, for construction work, must:

- Find out what underground services exist
- Obtain relevant information about the service (location, type, depth, restrictions to be followed)
- Record the information.

A relevant person must:

- Consider the information
- Follow any reasonable restrictions
- Implement necessary control measures.

A relevant person is responsible for managing the risks associated with:

- An excavation collapsing
- Objects falling into an excavation
- A person falling into an excavation

A hoarding at least 900mm must be erected around an excavation of swimming pool.

A barricade at least 900mm high must be erected around a trench that is 1 metre or more deep unless it is not possible or only workers involved with the trench will be in the area; or another form of barrier exists, for example, excavated materials near the trench.

Excavated or other loose material must be effectively stored or retained not closer than 600mm from the edge of the face unless the face is specially shored to allow for the increased load, and suitable toe boards or other safeguards are provided

Mechanical plant, vehicles or any heavy loads must not approach closer than 600mm from the edge of an excavation.

### Detection of the common hazards:

In the clear:

- Accidents, blows and collisions with machines and vehicles
- Overturns and false manoeuvres of the machinery for movement of lands (excavating machines and trucks)

- Noise and vibrations
- Over efforts

In the realization of the excavation:

- Fallen to the same one and the different level of people or machinery
- Landslide of the land, buries (for filtrations, vibrations, it overloads, etc.)
- Accidents, blows and collisions with machines and vehicles
- Overturns and false manoeuvres of the machinery for movement of lands (excavating machines and trucks)
- Fall of objects from a superior level
- Floods
- Noise and vibrations
- Over efforts

## Preventive norms

In the clear:

- Because of the many services such as electric power cables, telegraph cables, gas pipes, water pipes, oil pipes and sewer reticulation that are located underground, employers must, before starting work, ascertain the location of all services that are likely to be affected by the excavation. The owners of these services must be advised and their assistance sought.
- It will be limited the interference with third placing foot barriers in passing in areas of pedestrians, making you use of the signalling if it is affected to circulation roads, using you signs as: "Warning gutters", Use of PPE.
- The minimum distances of separation will be delimited among operatives in function of the tools that use.
- The operatives who don't manage the machinery, will remain outside of the radius of action of the same one, paying special attention when they develop their work near the machines.
- The works will be suspended under the regimen of rains.
- In excavations when the vehicles circulate in normal direction to the cut, the enclosed area will enlarge that direction in two times the depth of the cut and not less than 4 meters when it is necessary to place signalling of reduction of speed.
- When the extracted lands are polluted they will be disinfected as well as the walls of the corresponding excavations.
- Anybody won't work simultaneously in vertical different levels of the same one. In

the event of having to work under these conditions, the operative of the inferior level will remain with the helmet of security during his work.

- They will be revised the contentions before beginning the work day, tightening the elbow pieces when they have loosened
- These preventions will be carried to an extreme after work interruptions of more than 1 day and/or atmospheric alterations as rains or icy.
- In the event of presence of water (strong rains, breaks of pipes, floods, etc.) it will proceed immediately to its reduces, in prevention of alterations of the land.
- The extracted lands will be gathered at a distance of the border of the excavation.
- The contention elements won't be used to ascend or to lower the gutter.
- The contentions or part of these will take off when they stop to be necessary only and for horizontal fringes beginning with the inferior part of the cut.
- Any step that is necessary to make on the gutters, will be made with gangplanks protected in its perimeter with handrails of 0.90 m, intermediate bar and baseboard.
- It will prepare in the work, to provide in each case the indispensable team to the operative, of a provision of levers, wedges, bars, props and planks that won't be used for the contention and they will be reserved for their use by the salvage team, as well as of other means that can be good for eventualities or the operatives' aid that could have an accident.
- In the works in gutters will have a signal list in the hoisted of loads when the maneuvers are difficult or the field of vision is limited. The operatives won't remain under the loads.
- It will be verified the state of the elements daily of hoisted elements.
- It will be placed some endings which prevent that the vehicles approach on the edge of the gutters.
- To humidify the front of attack of the excavation to eliminate the powder that takes place as much as possible.
- When the level of noise taken place by the used machinery will be equal or bigger than 80 decibels the operatives has to use auditory plugs.

#### Personal protection equipment:

- In the clear and in the excavation of gutters and wells:
- Polyethylene helmet (workers will use it, machinists and truck drivers that want or they should abandon the booths of conduction of the vehicles will use it too).
- Security footwear
- Security rubber boots (or PVC)
- Leather gloves and canvas against mechanical risks

- Work clothes
- Raincoats for humid or rainy atmospheres
- Auditory protection in works with pneumatic machinery
- Glasses against projections
- Mask of filter mechanic (against powder)
- Lumbar bands

## 6.6.2 Machinery for the movement of lands.

### Detection of the common hazards:

- Overturn of the machine.
- Accidents.
- Those derived of the maintenance operations.
- Vibrations and noises.
- Thermal stress
- Environmental powder and blows.
- Fallen when ascending or to get off the machine.
- Collide against other vehicles.
- Blows with parts motives of the machine, to be in their action radio
- To cross with electric lines
- Fires and explosions

### Preventive norms:

- The handling of the machines will only be allowed to bigger than 18 years, with the formation and appropriate professional category, he/she will be proven that each driver has received the specific norms of security for his machine.
- They will be behind endowed with march lighthouses and advance, rear-view in both sides, luminous and acoustic signs.
- They will be endowed with a bridge of security antioverturning and antiimpact.
- They will be endowed with a stamped extinguisher and with the corresponding revisions.
- Warning signs and stuck signs will be placed or received in the chassis of the machine.
- They will be inspected controlling the good operation of the motor periodically, hydraulic systems, controls, address, lights, acoustic signs (horn setback), transmitters, chains, tires and booth.



- Do not work or to remain inside the radius of security of 5 meters of the arm of action of the machinery.
- The distance to any line of high tension will be as minimum 5 meters
- It won't be allowed to transport people on these machines, to avoid risks of accidents of fallen.
- They will settle you collide of security of journey end, before the coronation of courts of banks or embankments, marking the distance of approach of the machinery, to avoid the risks for the fall of the machine.
- The roads of internal circulation will be signalled by means of small flags and normalized signs of traffic.
- The drivers of the machines won't be able to abandon them without stopping the motor of the same ones, leaving the motors on the dot dead.
- Is not allowed the maintenance works or repair of the machinery with the motor in march, in prevention of unnecessary risks.
- The entrances and exits of the work will be carried out with caution, assisting the signs of an operative in charge of the maneuvers.
- The loads to transport will be the appropriate ones (not to surpass the maximum load) taking care that they don't stand out to avoid accidents.
- Is not allowed in this work the realization of replants you or of mensurations in the areas where they are operating the machines for the movement of lands. Before proceeding to the enunciated tasks, it will be necessary to stop the machinery, or to move away it to other cuts.
- Is not allowed the storing of lands to less than 2 m. of the border of the excavation.
- It won't be dug beyond the vertical of the machine.
- They will be parked or they will park outside of the work area

### Personal protection equipment:

If exists expressed approval of the Ministry of Work and Social Security, the garments of personal protection to use in this work, they will be homologated.

- Polyethylene helmet. Class N. (of obligatory use to abandon the booth).
- Security glasses, Class C (in case the machine doesn't have booth)
- Leather gloves.
- Work clothes.
- Clothes for rainy time.
- Security nonskid boots. Class III.
- Protective auditory (obligatory if the beginner of noise is superior to 80 dB).

- Mask anti powder (in the event of being necessary)
- Belt abdominal anti vibration.

## 6.7 Structure

The accomplishment of a compound structure by precast concrete columns, on site concrete footings, pre-stressed concrete beams and hollow core slabs with topping concrete.

It will be determined that the erection platform can support the construction and erection loads and provide verification to the crane owner/operator prior to the commencement of the work.

### Erection preparation

Prior to commencing the handling and/or erection of precast concrete elements, the following items should be considered by the manufacturer or builder as appropriate.

- Check access to the site to prevent trucks damaging floor during access.
- Obtain verification that the erection platform can support the erection loads.
- Ensure the locating dowels and levelling shims are correctly located. Dowels rather than blocks should be used to restrain the base of face-lifted panels when they are being positioned.
- Clear the site for truck and crane access ensuring room for crane outriggers, counterweight tail swing, boom swing and under hook and overhead obstructions.
- Ensure that sufficient space is available for precast propping or panel bracing.
- The builder must ensure that adequate temporary base restraint is provided for any precast element to prevent a sliding failure at the base or support of the element.
- Check that the means of temporary support, including false work is adequate for the intended purpose and located correctly prior to the precast elements being placed.
- Verify that the concrete has obtained the specified strength for lifting. This may already have been done if the element was manufactured off-site.
- Check that the lifting inserts are in their correct location and that recesses are cleaned out in preparation for lifting.
- Check that the strong backs, if required, are available and correctly installed.
- Determine if it is necessary to equalise loads on lifting points.
- Ensure that the appropriate rigging equipment is available. This includes lifting beams and correct attachments for cast-in anchors or inserts.
- Wherever possible the lifting of tilt-slab panels should be under taken from within

the building envelope. In this way, the crane operator is able to keep the rigging and lifting eyes in view at all times.

- Erection should be possible without the need for any worker to be positioned underneath a precast element or on the underside of a tilt-up panel during erection.

For general precast elements, such as beams or flat slabs, care should be taken to determine if it is necessary to equalise loads between lifting points on any element.

### 6.7.1 formwork:

Form: the form of the slabs for dwellings and for footings in the residential activity building will be of wood.

#### Detection of the common hazards:

- Lossening by badly piled up of the wood.
- Blows in the hands during nailing.
- Upsets of the wood packages (planks, boards, props, strap, supports, etc), during the manoeuvres of hoisting slabs.
- Fall of wood to the emptiness during the operations of take out the formwork.
- Fall of people by the edge or hollows of the forged one.
- Fall of people at the same level.
- Cuts when using the hand mountain ranges.
- Cuts when using the circular mountain range of table.
- Footsteps on sharp objects.
- Electrocutation by cancellation of land takings of electrical machinery.
- Over exerts by inadequate positions.
- Blows in general by objects.
- Dermatoid by contacts with the cement.
- The derivatives of works on wet surfaces.

### 6.7.2 Manipulation of the concrete

#### Detection of the common hazards:

- Fall of people at the same level.
- Fall of people y/u objects at different level.

- Fall of people y/u objects to the emptiness.
- Formwork collapse.
- Formwork breakage.
- Footsteps on sharp objects.
- Footsteps on transit surfaces.
- The derived ones from works on humid or wet grounds.
- Contacts with the concrete (dermatitis by cements).
- Tramping.
- Electrocutation. Electric touches.

### Preventive norms:

- Spill by means of bucket or bucket.
- Forbidden to load the bucket over the permissible fully factored load of the crane that sustains it.
- The opening of the bucket for spill will be executed exclusively by the incorporated suitable mechanism to the same one in avoidance of accidents by blockage or corks.
- Before the beginning of the spill of the concrete, the Overseer (or Ordered), will review the good state of security of the timbering of territories containment of the slopes of the drained one that they interest to the zone of wall that goes away has to concrete, to make the reinforcements or sanitation that were necessary.
- The access to extrados of the wall (formwork space between external and the slope of the drained one), will take place by means of ladders: Forbidden access, formwork climbing, being an uncertain action.
- Before the beginning of the concrete one, the Overseer (or Ordered), will review the good state of security of the formworks ones in prevention of blow-out and I spill.
- Before the beginning of the concrete, and as the formwork ends of the works of, the servicing platform of coronation of the wall from which will have been constructed to help the workings of vibrated spill and.
- The formwork for spill and vibrated platform of coronation of, that will settle down all along of the wall; it will have the following dimensions:
  - Length: The one of the wall.
  - Width: 60 cm., (3 planks minimum). -Attachment: Struts on the formwork.
  - Protection: Railing of 90 cm. of height formed by banister rails, intermediate strip and end tile of 15 cm.
  - Access: By means of prescribed ladder.
- They will settle down to a minimum range of 2 m.s, (like general norm), forts tops of end of route, for the vehicles that must on the brink of madness come near the

slopes of the drained one, to spill the concrete (Dumper, truck, concrete mixer).

- The concrete spill in the interior of the formwork one will be made distributing it throughout the same one uniformly, by regular layers, in avoidance of overloads props that can deform or burst the formwork.

### 6.7.3 Work at heights

(Excluding work on ladders or trestle ladder platforms and scaffolding work)

Risks must be managed if a person could fall less than 3 metres (housing construction), 2 metres if work is on a roof pitch not more than 26°. Hazards that may present a risk from a fall include:

- Vertical reinforcing steel, the edge of a rubbish skip, a picket fence, or a stack of bricks below workers
- unsheathed floor bearers and joists 2 metres below workers
- Work on a brittle roof.

Factors such as the type of activity being carried out should be taken into consideration to establish the degree of risk.

Control measures used to manage risks must comply with regulatory requirements.

#### Detection of the common hazards:

Relevant people carrying out work above these heights or on a roof pitch more than 26° must:

- prevent a fall
- if prevention is not possible, arrest the fall and prevent or minimise the risk of death or injury from the arrest of the fall.

#### Preventive norms:

Edge protection systems around elevated work areas must:

- be erected and used in accordance with the instructions of the manufacturer, supplier, engineer or competent person
- be designed to withstand a force which may reasonably be expected to fall against it be at least 900 mm high.

A fall protection cover placed over holes and openings must be:

- able to withstand the impact of a fall onto it of any person who may reasonably be expected to fall onto it
- be securely fixed in place to prevent it being moved or removed accidentally.

A travel restraint system is a personal fall prevention device and must:

- not allow a free fall either from an edge or through the work surface
- be installed by a competent person and be inspected by a competent person at least every six months (a written record of the inspection must be obtained)
- have an anchorage point with a capacity to withstand any load that could be exerted on it in its normal operation
- only be used by a person who has been trained in the safe and correct use of the system
- not to be used if a component of the system shows evidence of wear or weakness to an extent that may affect the system's safety.

A fall arrest system consisting of harnesses or ladder belts attached by lanyards to a suitable anchor point must:

- Have each anchorage point:

Designed by an engineer and inspected and approved by a competent person before it is first used

- With a capacity of 12 kN, if only 1 person is using the anchorage point and the person could have a limited free fall
- With a capacity of 15 kN, if only 1 person is using the anchorage point and the person could have a free fall
- With a capacity of 21 kN, if 2 people are using the anchorage point
- Have each anchorage point located so that the person using the system can attach a lanyard without the risk of falling
- Limit the force applied to a person by a fall to not more than 6 kN by the use of a personal energy absorber
- Be installed and maintained in accordance with the instructions of the manufacturer, supplier, engineer or competent person
- Have sufficient free fall distance taking into consideration:
  - The person's height
  - the height and position of the anchorage point
  - the length of the lanyard
  - any slack in the static line
  - any stretching of the lanyard or static line when extended by a fall

- the length of the energy absorber when extended by a fall
  - any other relevant factor
- Have no part of the system come into contact with anything that could affect the safe use of the system
- Only be used by a person trained in the safe and correct use of the system
- Have written safe rescue procedures
- Not to be used if a component of the system shows evidence of wear or weakness to an extent that may affect the system's safety
- Be inspected by a competent person at least every 6 months (a written record of the inspection must be obtained)
- Not be used after a fall unless its manufacturer or a competent person has inspected it and decided that it is fit for safe use
- Not be used by a person working alone.

Twin tail fall arrest lanyards failure can be fatal - recommendations for design and lanyard assembly.

An industrial safety net must:

- Be designed by an engineer or competent person
- Be made of material designed to minimise injury to a person falling into the net
- Have energy absorbing characteristics to reduce the shock or injury to a person falling into the net
- Be installed so that a person falling into the net will not hit anything below the net
- Be installed as close as possible below to where the person is working but not more than the distance specified by the manufacturer, supplier, engineer or competent person
- Be installed, used, installed and maintained in accordance with the instructions of the manufacturer, supplier, engineer or competent person.

## 6.8 Permanent facilities

Description and organization of the works

The permanent facilities can be subdivided in:

- Mechanical: elevators, electricity, plumbing, gas and special facilities
- Termomechanics: heating, air conditioning, ventilation.

The trust factor increases the number of accidents.

#### Detection of the common hazards:

- Cut for the handling of foils
- Cut for the managing tools with edge
- Cut for the use of the glass fibre
- Risks that are detected during the connection tests and setting inservice of the installation.
- Fall of personal to the same and different level
- Fallen of objects
- Cut for handling of manual tools
- Cut for handling of the guides and drivers

Being the most common the electrocution or burns, for the bad protection of electric boxes, for incorrect manoeuvres in the lines, for use of tools without isolation, for bridge of the protection mechanisms, for direct connections without pegs male-female

- Trappings among heavy pieces
- The inherent ones to the use of the autogenous, electric welding, oxiacetilénic and oxicut
- Footfalls on sharp objects
- Burns
- Over efforts
- Direct and indirect electric contacts
- Explosion of the torch or of the deposit of liquefied gas
- Trappings between engagements and transmissions, during the setting operations to point or assembly
- The inherent accidents to the auxiliary equipment to use
- Dermatitis for contacts with fibers

#### Personal protection equipment:

- Polyethylene helmet, during the displacements for the work and in places with risk of fall of objects or of blows
- Insulating boots for electricity (in connecting works)
- Security boots (in wired)
- Insulating gloves
- Leather gloves
- Work clothes



- Security belt. Types TO, B and C
- Belt appropriate behavior-tools
- Insulating carpet
- Checkers of tension
- Insulating tools

For welding works:

- Welder's glasses
- Welder's helmet
- Hand or fixed welder's screen
- Leather gloves
- Rubber gloves or of PVC
- Leather wrists that cover the arms
- Leather leggings
- Leather apron

### 6.8.1 Permanent electric facilities

#### Description and organization of the works

The taking of earth will be carried out with cable. That specified in the Electrotechnical regulation of low tension will be continued in any event (it has already been justified before in the memory the reason why we will make use of the spanish normative regarding the facilities).

#### Detection of the common hazards:

- Electrocutation or burns for incorrect maneuvers in the lines
- Electrocutation or burns for use of tools without appropriate isolation
- Electrocutation or burns for check of protection mechanisms
- Electrocutation or burns for direct connections without pegs male-female
- Fallen to the same and different level
- Cut and blows for handling of manual tools
- Cut for handling of guides and drivers
- More common risks during the connection and setting in service of the installation
- Electrocutation or burns for bad protection in electric boxes

### Preventive norms:

- The portable electric tools will have double isolation of security
- The security belts won't be used if they have deformed rings, or break points are appreciated
- The embedded conductors will be located in horizontal or vertical address, avoiding to cross the walls in diagonal
- The work place will be often ordered and cleaned in the phase of opening work and closing of holes for facilities, to avoid the risks of footfalls or stumbles
- The illumination of the cuts won't be inferior to 100 lux measured to 2 meters of the floor
- The illumination by means of portable ones will be made using tight lampboxes with insulating handle fed to 24 volts
- Use of the pegs male-female
- The use of hand stairways or of scaffolds in places with fall risk from height It will be forbidden in work, installing the appropriate protection of security
- The tools to use will be protected with normalized insulating material

If a fire was originated in an installation in tension, they will come in the following way:

- The sources in tension will be disconnected
- Extinguishers that have the indication of not using in presence of electric current won't be used
- Insulating gloves will be used to hold the extinguisher
- The extinguisher will be at a minimum distance of 0.50 meters of the fire during its use in facilities of low tension.

### Personal protection equipment:

- Security helmet
- Insulating boots for electricity (in connection works)
- Security boots (in wired)
- Insulating gloves
- Work clothes
- Security belt
- Maneuver bench
- Insulating carpet for works in tension
- Checkers of tension
- Belt behavior-tools appropriate

## 6.8.2 Installation of heating

### Description and organization of the works

The conductions will be made of steel galvanized for the tracts in common elements and of copper inside the housings. The elements of transmission of heat will be steel radiators.

As it goes getting up the structure, the columns of the heating system will be mounted, since they will reflect for the interior of walls and wrought. The installation corresponding to the heating elements will settle at the end.

### Detection of the common hazards:

- Fall to the same and different level
- Fallen of height
- Trappings among heavy pieces
- Infrared and ultraviolet radiations generated during the welding
- Explosions, as well as burns and fires
- The inherent ones to the use of the autogenous welding
- Blows and courts for the handling of tools
- Footfalls on sharp objects
- Overefforts

### Preventive norms

- The plumbing facilities in height will be executed when the definitive protection are lifted.
- The pipe transport to the shoulder for a single man, will be carried out inclining the load back, in such a way that the end that goes for before it overcomes man's height
- If exists electric lines in work position, they will be left without service, and if this was not possible it will be protected with insulating cases to avoid the direct contact
- They will recover the protection of the holes of the roofs once carried out the plumbed, the operative who carries out the plumbed will use security belt
- During the settling of canalization, files and channels, they will be proven the scaffolds daily
- The places where it is welded will be ventilated, the workers have to use mask, besides the protection glasses against the radiations

- The work place will stay always clean of rubbles and cuttings, retiring periodically those that take place and evacuating them to the rubbish storing.

#### Personal protection equipments:

- Security helmet
- Leather gloves and security boots
- Leather apron (for weldings)
- Glasses against projections
- Glasses against the radiations
- Mask
- Work clothes

## 6.9 Auxiliary equipment

### 6.9.1 Scaffolds.

#### Detection of the common hazards:

- Landslide of the scaffold due to being not well seated
- Oxidation of the elements that form it, mainly the unions, as well as the claws and screws
- Deformation of the elements of the scaffold due to overefforts
- Wrong adjusts from the fasteners and lack of calculation of the loads to support for the scaffold
- Fallen at different level
- Fallen to the hole
- Fallen at the same level
- Trappings during the assembly
- Fallen of objects
- Blows for objects

#### Preventive norms:

- The work platform, will only be loaded with the strictly necessary materials to assure the continuity of the works, being distributed these evenly by the whole floor of the platform
- During the assembly works and disassembly they will use belts of security associated

to anti-falls devices

- In any case the scaffolds will lean on supplementary elements formed by materials of low resistance or stability
- The hoisted of the loads will be made using pulleys (when some general hoisted equipment doesn't exist), they will be placed on the vertical element of anyone of the supplements of height that it consists the scaffold
- Protection visors will be used, under the area of work of the scaffolds embedded to the tubular structure, of rigid or elastic materials
- When one works on sidewalks in external walls, passing piazzas, that avoid the fall of objects or materials on those who circulate below the same ones, will be placed
- The works will be prohibited in days of strong wind, or when the adverse meteorological conditions advise this way it
- The tubular scaffolds will be mounted according to the distribution and accesses indicated in the planes
- It will be forbidden to use borriquetas scaffolds on the platforms of work of the tubular scaffolds
- To communicate the different levels in the scaffold it is advised the employment of metallic stairways, being able to use those formed by subject " patés " by their center to a right foot, their minimum width will be of 50 cm
- When the land where the scaffold leans is not resistant, it must to be placed wooden sleepers on those the starting pieces will be nailed
- The metallic scaffolds will be mounted at a distance of 30 cm or smaller than it of the vertical wall
- They will be braced to strong points of the vertical walls, each 3 m in vertical and horizontal sense
- The platform will have a minimum dimension of 60 cm, with nonskid floor, provided of the following protection handrails: Front: 70 cm, Later: 90 cm, Of closing: 90 cm
- They will be formed by handrails, intermediate chart and baseboard of 20 cm.
- In all the scaffolds, in the interior face of the front handrail the following signalings will be placed:
  - Obligatory use of the security belt
  - Obligatory use of the security helmet
  - Signal with the text "It's forbidden to enter or to leave the scaffold without being anchored horizontally"
- The metallic scaffold won't be placed in streets with superior slopes to 20%
- They won't close the scaffolds vertically, with canvases or other elements for the fall risk because of strong winds, since these makes the function of a sail. If they are placed it will be proven that this canvas are provided of holes that let the air pass,

eliminating in this way the flight risk

- In the event of be near to electric lines of low tension the tension of the line will be cut during the assembly and disassembly of the scaffold
- Before beginning the works the naked line it will be isolated with the appropriate diélectric, straying the line to 3 m of the area of influence of the works
- The coordinator of Security and Health in the execution of the works will have the responsibility to prove all the anchorages from the scaffold to the beginning of each day and the execution of all the norms of prevention of accidents
- A new level won't begin without before to have concluded the departure level, with all the elements of stability (with crosses of San Andrés and bracements)
- The screws of the gags will crowd together being carried out an inspection of the tract executed before beginning the following one in prevention of the risks for the existence of slack screws equally or of lack of some of them
- It's possible to brace a tubular scaffold with the mooring from this to a prop firmly coined among the floors, or to a screw without end, coined firmly to the windowsills of a window or hole
- The bracements can also be made by a rigid bar. It will be forbidden the rope use, assimilable wires for this
- The materials will be distributed evenly on the work platforms, in prevention of accidents for unnecessary overload
- It will be forbidden in this work to work on platforms located in levels below other platforms in those that one is working, in prevention of accidents for fallen of objects
- Anybody won't jump or run on the scaffolds
- The scaffolds will be free of brashes.
- Any class of materials won't be thrown from the scaffolds.
- In the disassembly they won't allow to fall charts, railway ties or any other element of the scaffold

### Personal protection equipmet:

If exists expressed approval of the Ministry of Work and Social Security, the personal protection garments will be used in this work, they will be homologated.

- Polyethylene helmet. Class N
- Work clothes
- Nonskid footwear
- Security belt

## 6.10 Machinery in general

### Detection of the common hazards:

- Overturn of the machine.
- Accidents.
- Those derived of the maintenance operations (burns, etc.).
- Vibrations and noises.
- Environmental powder, blows and projections.
- Fallen when ascending or to get off the machine.
- Fallen at any level.
- Collide against other vehicles.
- Blows with parts motives of the machine, to be in their action radio
- Sinkings.
- Formation of aggressive atmospheres or you bother.
- Explosion and fires.
- Atrapamientos.
- Cut.
- Contacts with the electric power.
- The inherent ones to the own use place.
- The inherent ones to the own work to execute.

### Preventive norms:

- The motors with transmission through axes and pulleys, will be endowed with security chassis (lawn mowers, saw, compressors, etc.).
- The electric motors will be covered with security chassis eliminating of chassis or important deteriorations of these.
- Is not allowed the manipulation of any component element of a machine worked by means of electric power, being connected to the supply net.
- The engagements of any type, of mechanical, electric or manual working, will be covered for security chassis antiatrapamientos.
- The irregular or damaged operation machines will be retired immediately for their repair.
- The damaged machines that they cannot retire they will signal with warning posters with the legend: "IT SCHEMES DAMAGED, NOT TO CONNECT"
- Is not allowed the manipulation and adjustment operations and arrangements of machines to the personnel not specialized specifically in the machine repair object.

- As additional caution to avoid the setting in service of damaged machines or of irregular operation, the starters will be blocked, or in their case, the electric fuses will be extracted.-
- The same person that installs the sign of warning of damaged machine will be the one in charge of retiring it, in prevention of connections or on in service outside of control.
- The authorized personnel will only be the one in charge of the use of a certain machine or machinetool.
- The machines that are not of manual sustentation will always lean on even elements and sign.
- The elevation or descent to machine of objects, will be made slowly, hoisting them in vertical address.
- The hooks of it hangs of the apparatuses of hoisting they will be free of loads during the descent phases.
- The loads of suspended transport will always be visible, with the purpose of avoiding the accidents for lack of visibility of the trajectory of the load.
- The angles without vision of the load trajectory, will be replaced by means of operatives that using Known signs replaces the vision of the one mentioned worker.
- Is not allowed the permanency or the work of operatives in areas under the trajectory of suspended loads.
- The apparatuses of hoisting to use in this work, they will be equipped with constrainer of journey of the car and of the hooks, and of load in tip for interference.

## 6.11 Appendix

### MANUFACTURER'S CERTIFICATION OF COMPLIANCE FOR PRECAST CONCRETE ELEMENTS

- Project Name:
- Site Address:
- Manufacturer's Name:
- Designer's Name:
- Date of Lift or Erection:

#### Element Schedule.

- Component Identification Numbers:



I, ..... on behalf of the manufacturer, hereby certify that the elements scheduled above, have been manufactured in accordance regulations of the Approved Code of Practice for the Safe Handling, Transportation and Erection of Precast Concrete.

Manufacturing Details

- Concrete design strength as recorded on delivery docket:
- Date elements cast:
- Concrete strength test result and age of test:
- Element Details
- Calculated element weight (tonnes):
- Lifting inserts positioned correctly:
- Reinforcement located correctly:
- Lifting insert manufacturer/type/safe working load:
- Lifting insert length:
- Release agent used (for tilt-up panels only):
- Type of lift:

Signature: \_\_\_\_\_ Position: \_\_\_\_\_

Date: \_\_\_ / \_\_\_ / \_\_\_



# Emergency action plan

# 7. Emergency action plan

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The following section is a plan to prepare for emergencies. By auditing the work area, by training employees, by procuring and maintaining necessary equipment, and by assigning responsibilities and preparing for an emergency, human life and employer resources will be preserved. The intent of the plan is to ensure all employees a safe and healthful working environment. Those employees assigned specific emergency duties under the plan should be provided the necessary training and protective equipment to ensure their safety.

## 7.1 Scope a plan

The plan applies to emergencies that could be reasonably expected in the workplace.

## 7.2 Emergency plan coordinators

The Emergency Plan and Fire Protection Plan Coordinators are as follows:

name	phone
Jose Luis Callén Lasheras	976125270

The Coordinator is responsible for maintenance of equipment. The Coordinator may be contacted for further information on or explanation of the Plan.

## 7.3 Elements of the plan

### 7.3.1 Preferred Means of Reporting Fire and Emergencies

All fires and emergencies will be reported by one of the following means:

1. Verbally to the Coordinator if during standard work hours
2. By telephone if after hours or on weekends
3. By the alarm system 24 hours a day

4. Public address system

5. The following numbers will be posted at all telephones having outside lines:

FIRE +46 (0)290-443 55

POLICE: 112

AMBULANCE +46 (0)280-143 71

COMPANY NAME AND ADDRESS/LOCATION:

Hospital: Turistkartan, Stationshuset, Box 30, 782 21 Malung, Sweden

### 7.3.2 Alarm System Requirements

Alarm system requirements for notifying all employees in an emergency are the following:

1. Provides warning for safe escape
2. Can be perceived by all employees
3. Alarm is distinctive and recognizable
4. Employees are properly trained
5. Emergency telephone numbers posted
6. Emergency alarms have priority
7. Alarm system is maintained properly by trained personnel

### 7.3.3 Sounding the Alarm

The signal for immediate evacuation for the facility will be one continuous sound.

### 7.3.4 Evacuation Plans

Emergency evacuation escape route plans (see appendix A) are posted in key areas throughout the buildings. All employees have been trained concerning these plans and should also be familiar with the evacuation plans for the other buildings within the company.

### 7.3.5 Employee Accountability Procedures After Evacuation

In the event of a fire emergency all occupants will promptly exit the building by the nearest exit. Once clear of the building, go to the designated point and immediately report to their supervisor. After evacuation, each supervisor (or designee) is responsible for accounting for each employee assigned to that supervisor by rallying at the designated point and by conducting a head count. Each employee will be accounted for by name. Each employee is responsible for reporting to his or her supervisor so an accurate head count can be made. All supervisors are required to report their head count (by Name) to the Emergency Plan Coordinator.

#### Designated Rallying Points

Residential activity building

Primary location: \_\_\_\_\_

Secondary location: \_\_\_\_\_

### 7.3.6 Re-entry

Once the building is evacuated, no one is to re-enter the building for any reason. Rescue personnel (if designated and properly trained) are excluded from this rule. When the Fire Department or other responsible agency has notified us the building is safe for re-entry, then, and only then, will personnel return to their workstations. VIII. Training for Employees Who Assist in Evacuation

The personnel listed below have been trained to assist in the safe and orderly emergency evacuation of employees. Employee training is provided to employees when: (a) the plan is initiated; (b) when employee's required actions and responsibilities change; (c) there are any changes to the plan.

task	building / area	person
Fire Extinguisher:		
Emergency shut-down:		
Evacuation Assistant:		

### 7.3.7 Training for Employees

- Employee training is provided when:
- The plan is initiated
- When employee's required actions and responsibilities change
- There are any changes to the plan
- Initially for new employees
- Refresher training.

Items Reviewed:

1. Emergency Escape Procedures
2. Escape Route Assignments
3. Fire Extinguisher Locations and Training
4. Procedures to Account for Employees
5. Major Workplace Fire Hazards
6. Employee Training Programs
7. Fire Prevention Practices
8. Closing doors behind you
9. Means of Reporting Fire and Other Emergencies
10. Names and Titles of Emergency Plan and Fire Protection Coordinators
11. Alarm Systems
12. Proper Housekeeping
13. Emergency and Fire Prevention Plan Availability
14. Hazard Weather Procedures

### 7.3.8 Hazard Weather Emergency Plan

When a hazardous weather alert is announced by the Plan Coordinator all employees should the work area.



# Gantt chart



## 8. Gantt chart

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Name of the project: Housing Development. One dwelling type 1.

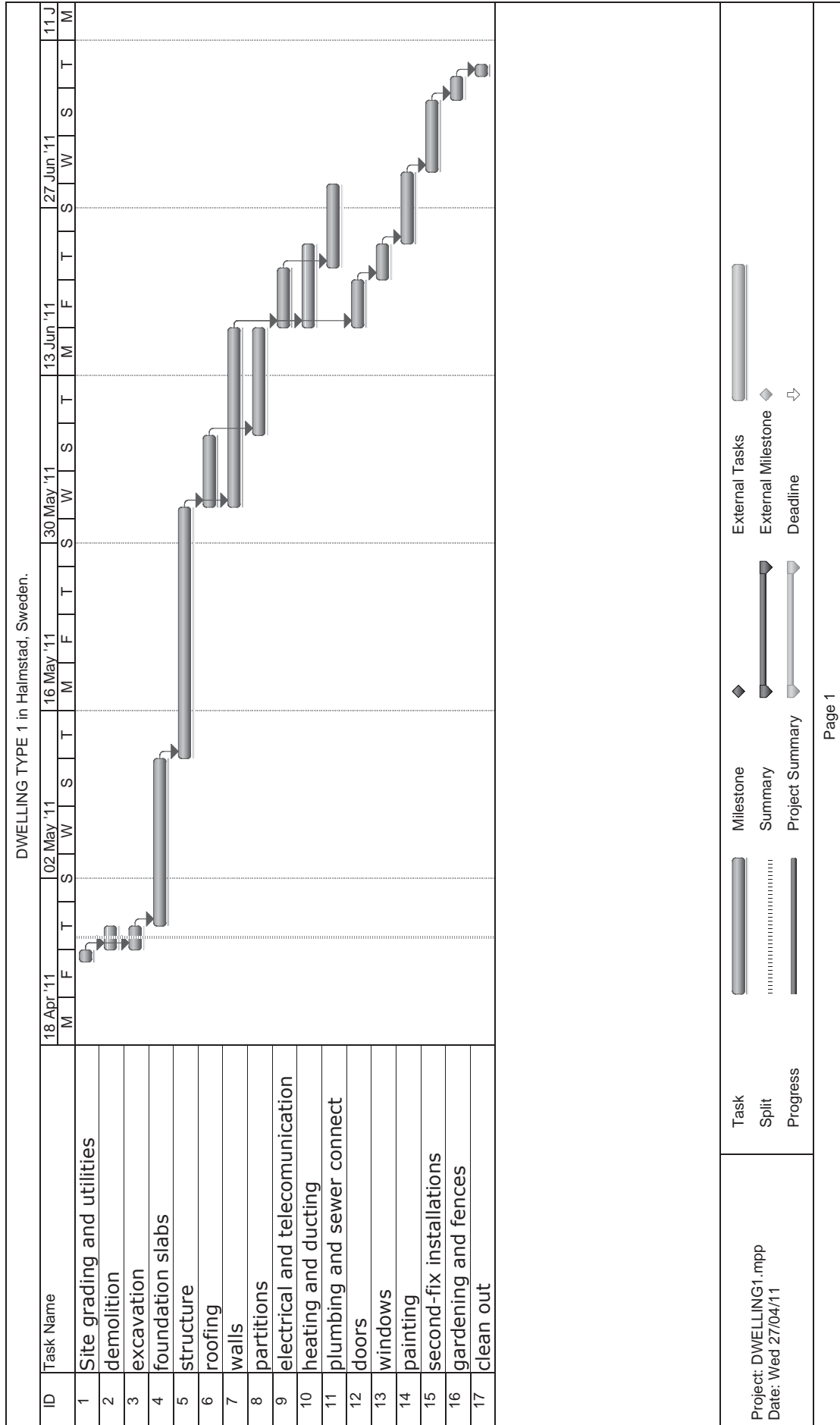
Date of start: 2011/04/25

Date of finish: 2011/07/08

Total workers: 10 workers

tasks:

Site grading and utilities	1 day
demolition	2 days
excavation	2 days
foundation slabs	10 days
structure	15 days
roofing	4 days
walls	11 days
partitions	7 days
electrical and telecommunication	3 days
heating and ducting	5 days
plumbing and sewer connect	5 days
doors	2 days
windows	3 days
painting	4 days
second-fix installations	4 days
gardening and fences	2 days
clean out	1 day







# Budget

## 9. Budget

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## BUDGET SUMMARY

CHAPTER	RESUME	EUROS	%
CAP 01	SITE GRADING AND UTILITIES.....	19.191,90	7,41
CAP 02	DEMOLITION.....	721,37	0,28
CAP 03	FOUNDATION.....	13.547,54	5,23
CAP 04	STRUCTURE.....	120.927,61	46,68
CAP 05	ROOF.....	49.073,70	18,94
CAP 06	PARTITIONS.....	22.706,09	8,76
CAP 07	EQUIPMENT.....	2.142,05	0,83
CAP 08	COATINGS.....	3.215,35	1,24
CAP 09	STAIRS.....	6.304,58	2,43
CAP 10	WINDOWS.....	1.806,97	0,70
CAP 11	INSTALLATIONS.....	7.978,49	3,08
CAP 12	DOORS.....	4.519,49	1,74
CAP 13	EXTERIOR WORKS.....	6.922,88	2,67
<b>TOTAL EJECUCIÓN MATERIAL</b>		<b>259.058,02</b>	
	13,00% Gastos generales.....	33.677,54	
	6,00% Beneficio industrial.....	15.543,48	
	SUMA DE G.G. y B.I.	49.221,02	
	16,00% I.V.A.....	49.324,65	
<b>TOTAL BUDGET OF CONTRACT</b>		<b>357.603,69</b>	
<b>TOTAL BUDGET</b>		<b>357.603,69</b>	

General budget is THREE HUNDRED FIFTY SEVEN THOUSAND SIX HUNDRED THREE EUROS with SIXTY NINE CÉNTIMOS

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT		
<b>CHAPTER CAP 01 SITE GRADING AND UTILITIES</b>						
01.01	<b>m2 mechanical excavation</b> Equipment is a wheel loader with bucket. 155cv/5m3. It includes loading into trucks.					
	<b>Descomposición</b>					
	O01OA070 h. laborer	0,008	22,00	0,18		
	M05PN020 h. wheel loader 155 CV/2,5m3	0,015	45,58	0,68		
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
	remove vegetal layer	1	222,00	70,00	0,10	1.554,00
						1.554,00
						0,86
						1.336,44
01.02	<b>m3 lendfill hauling.&lt;10km.</b> Drag line excavation for foundations. Costs shown include casting the excavated soil to the excavation and loading it into trucks. Hauling costs are included. Land transport of density mediates 1,50t/m3 with dump truck of fully factored load 10t to a distance of 10km. with speed average of 40km/h, considering times of load, travel time, unloading and returned even load with backhoe.					
	<b>Descomposición</b>					
	M05PN010 h. loader85 CV/1,2m3	0,020	39,51	0,79		
	M07CB010 h. dump truck 4x2 10 t.	0,150	30,99	4,65		
	M07N060 m3 garbage fee	1,000	6,05	6,05		
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
	remove vegetal layer	1	222,00	70,00	0,10	1.554,00
						1.554,00
						11,49
						17.855,46
<b>TOTAL CHAPTER CAP 01 SITE GRADING AND UTILITIES.....</b>				<b>19.191,90</b>		

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT
<b>CHAPTER CAP 02 DEMOLITION</b>				
02.01	<b>ud remove electric installation</b> Up of electrical circuits by manual, even after removal of lines and mechanisms, cleaning and removal of debris at the foot of cargo without transport to landfill or recycling plant and pp of aids.			
	<b>Descomposición</b>			
	0010B210 h. Ofi 2ª electrician	0,700	17,13	11,99
	0010A040 h. Ofi 2º	4,600	17,43	80,18
	0010A070 h. laborer	4,600	22,00	101,20
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	electric installations	1	1,00	<b>HEIGHT</b>
				<b>PARTIAL</b>
				1,00
		1,00	193,37	193,37
02.02	<b>m3 complete building demolition</b> Demolition of the building from the ground, by pushing large backhoe machine, including cleaning and removal of debris at the foot of load, without transport to the landfill and pp auxiliary means, without collective protection measures.			
	<b>Descomposición</b>			
	0010A070 h. laborer	0,100	22,00	2,20
	M05EN040 h. hydraulic excavator 144 CV	0,120	53,49	6,42
	M05PN030 h. loader 200 CV/3,7m3	0,040	48,62	1,94
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	building demolition	1	5,00	<b>HEIGHT</b>
				<b>PARTIAL</b>
				50,00
		50,00	10,56	528,00
<b>TOTAL CHAPTER CAP 02 DEMOLITION.....</b>				<b>721,37</b>



## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT					
<b>CHAPTER CAP 03 FOUNDATION</b>									
03.01	<b>ud general household plumbing</b> Sanitation rush home to the general municipal to a maximum of 8 m, consisting of: breaking the pavement with compressor, manual digging sanitation ditches in areas of hard consistency, placement of mass concrete pipe outlet hood, rubber gasket 30 cm. internal diameter, covered back of the connection and replacement of concrete pavement with mass, not including training well in the curb and pp of aids. <b>Descomposición</b> 001OA040 h. Ofi 2º 001OA060 h. skilled laborer M06CM010 h. Compre.port.diesel m.p. 2 m3/min 7 bar M06MI010 h. cock chopper 9 kg P02THE150 m. pipe 60kN/m2 D=300mm P01HM020 m3 concrete								
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>			
	general plumbing	1				1,00			
							1,00	189,04	189,04
03.02	<b>ud Inspection hatch pref. HM 40x40x40 cm.</b> Arqueta siphon mass precast concrete reinforced perimeter band on top of 40x40x40 cm., internal measures, complete, with cover, concrete frame and flap and training siphon holes for pipe connections. Concrete slab placed on HM-20/P/40/l mass of 10 cm. p.p. thick of aids, not including excavation or filling the posterior perimeter <b>Descomposición</b> 001OA030 h. skilled worker 001OA060 h. skilled laborer M05RN020 h. backhoe 75 CV P01HM020 m3 concrete P02EAH020 ud Arq.HM c/zunch.sup-fondo ciego 40x40x40 P02EAT090 ud tape square HM 40x40cm P02EAT170 ud Tapa p/sifonar arqueta HA 40x40cm								
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>			
	curb box	2				2,00			
							2,00	87,97	175,94
03.03	<b>ud curve box prefab. HM 40x40x50 cm</b> Registrable prefabricated concrete casket mass band reinforced at the top perimeter of 40x40x50 cm., internal measures, complete, with cover and concrete framework of formation of holes for pipe connections. Concrete slab placed on HM-20/P/40/l mass of 10 cm. p.p. thick of aids, not including excavation or filling the post perimeter. <b>Descomposición</b> 001OA030 h. skilled worker 001OA060 h. skilled laborer M05RN020 h. backhoe 75 CV P01HM020 m3 concrete P02EAH025 ud Arq.HM c/zunch.sup-fondo ciego 40x40x50 P02EAT090 ud tape square HM 40x40cm								
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>			
	curb box	1				1,00			
							1,00	85,86	85,86

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT										
03.04	<p><b>m2 expanded polystyrene panel PST+concrete.</b></p> <p>Insulation in floors and improved to 31 dB noise impact by PST panel. of Isover, placing the panels butt welded together and sockets perimeter of 6 cm. in partitions, sealing all joints of panels and sockets, prior to pouring the mortar slab mesh for execution., consisting of concrete HA-25/P/20/l, i / pp Cutting, placement, mesh, concrete pouring and troweling and aids. Ready to receive any type of pavement (not included).</p> <p><b>Descomposición</b></p> <p>001OA030 h. skilled worker 0,120 23,98 2,88</p> <p>001OA050 h. assistant 0,120 16,83 2,02</p> <p>P07AL350 m2 high density panel 1,150 7,28 8,37</p> <p>E04SE090 m3 concrete slab 0,040 103,38 4,14</p> <p>P03AM020 m2 mesh 15x15x5 2,078 kg/m2 1,000 1,25 1,25</p> <p><b>budget measurement</b></p> <table border="1"> <thead> <tr> <th>UDS</th> <th>LENGTH</th> <th>WIDTH</th> <th>HEIGHT</th> <th>PARTIAL</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>19,70</td> <td>11,00</td> <td></td> <td>216,70</td> </tr> </tbody> </table>	UDS	LENGTH	WIDTH	HEIGHT	PARTIAL	1	19,70	11,00		216,70			
UDS	LENGTH	WIDTH	HEIGHT	PARTIAL										
1	19,70	11,00		216,70										
		216,70	18,66	4.043,62										
03.05	<p><b>m2 expanded polystyrene panel PST</b></p> <p>Improving insulation and noise of 22 dBA to impact on intermediate floors, to implement appropriate leveling layer, absorbing and removing any existing irregularities greater than 4 mm., being dry, flooring panels butt Isover PST, sealing joints with plastic tape and installation of laminated flooring directly, i / pp Cutting, placement, support facilities and indirect costs.</p> <p><b>Descomposición</b></p> <p>001OA030 h. skilled worker 0,120 23,98 2,88</p> <p>001OA050 h. assistant 0,120 16,83 2,02</p> <p>P07AL350 m2 high density panel 1,150 7,28 8,37</p> <p>P07W350 ud adhesive 0,020 1,69 0,03</p> <p><b>budget measurement</b></p> <table border="1"> <thead> <tr> <th>UDS</th> <th>LENGTH</th> <th>WIDTH</th> <th>HEIGHT</th> <th>PARTIAL</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>19,70</td> <td>11,00</td> <td></td> <td>433,40</td> </tr> </tbody> </table>	UDS	LENGTH	WIDTH	HEIGHT	PARTIAL	2	19,70	11,00		433,40			
UDS	LENGTH	WIDTH	HEIGHT	PARTIAL										
2	19,70	11,00		433,40										
		433,40	13,30	5.764,22										
03.06	<p><b>m2 extruded polystyrene XPS.</b></p> <p>Floor insulation, using extruded polystyrene rigid plates of Ursa NIII I XPS of 10 mm. thick, even p.p. cutting and placemen</p> <p><b>Descomposición</b></p> <p>001OA030 h. skilled worker 0,050 23,98 1,20</p> <p>001OA050 h. assistant 0,050 16,83 0,84</p> <p>P07TX315 m2 P.pol.extr.Ursa XPS NIII I 10mm. 1,050 9,90 10,40</p> <p><b>budget measurement</b></p> <table border="1"> <thead> <tr> <th>UDS</th> <th>LENGTH</th> <th>WIDTH</th> <th>HEIGHT</th> <th>PARTIAL</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>19,70</td> <td>11,00</td> <td></td> <td>216,70</td> </tr> </tbody> </table>	UDS	LENGTH	WIDTH	HEIGHT	PARTIAL	1	19,70	11,00		216,70			
UDS	LENGTH	WIDTH	HEIGHT	PARTIAL										
1	19,70	11,00		216,70										
		216,70	12,44	2.695,75										
03.07	<p><b>m2 geotextile</b></p> <p>Supply and installation of punched polyester geotextile with a weight of 200 g/m2 and &lt;38 mm. Opening in Dynamic perforation test, extended on the ground with overlaps of 10 cm., for subsequent filling with earth.</p> <p><b>Descomposición</b></p> <p>001OA070 h. laborer 0,010 22,00 0,22</p> <p>P06BG060 m2 Fieltro geotextil Danofelt PY-200 gr/m2 1,100 0,60 0,66</p> <p><b>budget measurement</b></p> <table border="1"> <thead> <tr> <th>UDS</th> <th>LENGTH</th> <th>WIDTH</th> <th>HEIGHT</th> <th>PARTIAL</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>19,70</td> <td>11,00</td> <td></td> <td>216,70</td> </tr> </tbody> </table>	UDS	LENGTH	WIDTH	HEIGHT	PARTIAL	1	19,70	11,00		216,70			
UDS	LENGTH	WIDTH	HEIGHT	PARTIAL										
1	19,70	11,00		216,70										
		216,70	0,88	190,70										





## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT	
<b>CHAPTER CAP 05 ROOF</b>					
<b>This measure</b>	<b>m2 inverted roof</b>				
	<b>Descomposición</b>				
	0010A090 h. gang A	0,278	51,81	14,40	
	A03S025 m3 materials	1,100	151,68	166,85	
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH HEIGHT</b>	<b>PARTIAL</b>
	terrace	1	5,45	8,00	43,60
					43,60
					181,25
					7.902,50
<b>05.02</b>	<b>m. ridgepole</b>				
	Hips ridge or roof tiles, ceramic tiled curves, received with cement CEM II / BP 32.5 N and river sand type M-2, 5, made of concrete of 200 l., s / RC -08., including cleaning, watering and staking the surface. Measured in real scale.				
	<b>Descomposición</b>				
	0010A030 h. skilled worker	0,250	23,98	6,00	
	0010A060 h. skilled laborer	0,250	16,19	4,05	
	P05TC040 ud red tile 40x20	3,000	0,41	1,23	
	A02A090 m3 cement mortar M-2,5	0,030	69,23	2,08	
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH HEIGHT</b>	<b>PARTIAL</b>
	ridgepole	1	7,19		7,19
	ridgepole	2	16,08		32,16
					39,35
					12,70
					499,75
<b>05.03</b>	<b>m2 slope roof</b>				
	Roof with 30° of slope.				
	<b>Descomposición</b>				
	524534 m gutter pvc	1,050	11,40	11,97	
	7658675 m2 counter battens 2m	1,050	8,23	8,64	
	87656 m2 batten 3m	1,050	19,36	20,33	
	145534 m2 pasteboard 13mm	1,050	32,00	33,60	
	0010A030 h. skilled worker	0,400	23,98	9,59	
	0010A060 h. skilled laborer	0,400	16,19	6,48	
	P05EW185 m2 tonged and groved board panel	1,100	12,96	14,26	
	P04D020 m2 polyesthirene foil	1,500	5,90	8,85	
	765657 ud mineral wool	1,050	0,13	0,14	
	P05FG010 m2 furring	1,150	36,60	42,09	
	P04FR010 m2 mineral wool 170mm +80mm	1,050	54,78	57,52	
	P05TC475 m2 curve ceramic tile	1,050	130,40	136,92	
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH HEIGHT</b>	<b>PARTIAL</b>
	sloped roof	1	16,08	7,19	115,62
					115,62
					350,39
					40.512,09
<b>05.04</b>	<b>m downspouts</b>				
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH HEIGHT</b>	<b>PARTIAL</b>
	dow npouts	2	4,80		9,60
					9,60
					16,60
					159,36
	<b>TOTAL CHAPTER CAP 05 ROOF .....</b>				<b>49.073,70</b>



## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT
<b>CHAPTER CAP 07 EQUIPMENT</b>				
07.01	ud sanitaris			
	.			
	<b>Descomposición</b>			
	E21ADC040 ud shower 195x90cm	1,000	201,00	201,00
	E21ABC036 ud Bathtub white 170x70cm	1,000	207,66	207,66
	E21ADA020 ud shower.90x90cm	1,000	255,20	255,20
	E21SRM020 ud white sink 120x60cm	3,000	196,63	589,89
	E21SRM030 ud white wc	3,000	296,10	888,30
		1,00	2.142,05	2.142,05
	<b>TOTAL CHAPTER CAP 07 EQUIPMENT.....</b>			<b>2.142,05</b>

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT		
<b>CHAPTER CAP 08 COATINGS</b>						
08.01	m2 plastic paint					
	<b>Descomposición</b>					
	001OB230 h. Ofi 1ª painter	0,150	17,89	2,68		
	001OB240 h. painter assisstant	0,150	16,38	2,46		
	P25OZ040 l. fixative paint	0,080	8,08	0,65		
	P25ES080 l. plastic paint	0,300	8,55	2,57		
	P25WW220 ud little material	0,200	1,07	0,21		
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
	ground floor	1	20,41		2,70	55,11
	first flloor	1	11,59		3,20	37,09
						92,20
						8,57
						790,15
08.02	m2 tiled					
	Tiled with natural stoneware. line placement, received with cement CEM II / AP 32,5 R crumb and sand (M-5), pp cuts, mitres, trims, color cement grouting material to seal CG2 10 mm. color board and cleaning					
	<b>Descomposición</b>					
	001OB090 h. Oficial solador, alicatador	0,350				18,04
	001OB100 h. Ayudante solador, alicatador	0,350				16,97
	001OA070 h. laborer	0,250				22,00
	P09ABG558 m2 Gres natural 25x25 cm (Bla, Blb)	1,100				17,33
	A02A022 m3 MORTERO CEM. M-5 C/MIGA ELAB. A MANO	0,025				71,12
	P01FJ006 kg Junta cementosa mej. color 2-15 mm CG2	0,670				0,96
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
	inner w walls	1	19,03		2,50	47,58
	floors	1	2,00		7,12	14,24
						61,82
						39,23
						2.425,20
<b>TOTAL CHAPTER CAP 08 COATINGS.....</b>						<b>3.215,35</b>





## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT
<b>CHAPTER CAP 10 WINDOWS</b>				
10.01	m2 exterior windows 1,78m x 0,95m			
	<b>Descomposición</b>			
	O01OB150 h. Ofi 1ª carpentry	0,900	13,63	12,27
	O01OB160 h. carpentry assstant	0,900	12,32	11,09
	P11PP010 m. pine precerco	4,000	1,57	6,28
	P11X05bb ud exterior carpentry	1,000	326,14	326,14
	P11TM010 m. flashing	4,000	1,90	7,60
	P11RB070 ud brass hinge	12,000	0,94	11,28
	P11WH010 ud Golden cremona table	1,000	4,92	4,92
	P11WP080 ud screws	17,000	0,03	0,51
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	fixed window s	1		<b>HEIGHT</b>
				<b>PARTIAL</b>
				1,00
			1,00	380,09
				380,09
10.02	m2 exterior windows 1,78mx0,78m			
	<b>Descomposición</b>			
	O01OB150 h. Ofi 1ª carpentry	0,900	13,63	12,27
	O01OB160 h. carpentry assstant	0,900	12,32	11,09
	P11PP010 m. pine precerco	4,000	1,57	6,28
	P11X05ba ud exterior carpentry	1,000	302,77	302,77
	P11TM010 m. flashing	4,000	1,90	7,60
	P11RB070 ud brass hinge	12,000	0,94	11,28
	P11WH010 ud Golden cremona table	1,000	4,92	4,92
	P11WP080 ud screws	17,000	0,03	0,51
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	windows	4		<b>HEIGHT</b>
				<b>PARTIAL</b>
				4,00
			4,00	356,72
				1.426,88
<b>TOTAL CHAPTER CAP 10 WINDOWS.....</b>				<b>1.806,97</b>

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT		
<b>CHAPTER CAP 11 INSTALLATIONS</b>						
11.01	<b>ud heating and warm water</b>					
	In a two-pipe system, steam supply to the heating units and condensate return from heating units are through separate pipes. Air accumulation in piping and heating units discharges from the system through the open vent on the condensate pump receiver. Piping and heating units will be installed with proper pitch to provide gravity flow of all condensate to the pump receiver.					
	Warm water distribution will be made with electrolytic copper pipe with meetings welded, in dimensions and diameters according to plane of project. It will be installed, verified and measured according to regulation.					
	<b>Descomposición</b>					
	O01OB170 h. Ofil 1ª plumber	46,000	19,07	877,22		
	O01OB180 h. Ofi 2ª plumber	46,000	17,37	799,02		
	P20RA170 ud thermostat 220 V.	1,000	32,64	32,64		
	P20WH010 m. chimney vent D=150 mm.	8,000	70,26	562,08		
	P20WH060 ud elbow pipe. vent D=150 mm	2,000	44,68	89,36		
	P20WH100 ud adapter exchanger D=150 mm	1,000	24,83	24,83		
	P20DO020 ud heat exchanger	1,000	530,00	530,00		
	P20MA030 ud aluminium element	126,000	13,80	1.738,80		
	P20MW010 ud faucet	14,000	7,00	98,00		
	P20MW020 ud automatic purger	14,000	0,94	13,16		
	P20MW030 ud radiator support	30,000	0,80	24,00		
	P17CH010 m. cooper pipe 10/12 mm.	135,000	2,86	386,10		
	P17CH030 m. cooper pipe 16/18 mm.	70,000	4,32	302,40		
	P17CH040 m. cooper pipe 20/22 mm.	30,000	6,06	181,80		
	P20TB020 m. PVC D=25 mm.i/acc.	135,000	0,95	128,25		
	P20TB030 m. PVC D=32 mm.i/acc.	70,000	1,95	136,50		
	P20TB040 m. PVC D=40 mm.i/acc.	30,000	2,98	89,40		
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
		1				1,00
						1,00
						6.013,56
						6.013,56
11.02	<b>ud ventilation system</b>					
	Ventilation in the kitchens will be made by means of flexible lamina tube of aluminium and polyester, mounted on steel thread spiral with non-flammable tube of rigid PVC of 120mm will arrange in addition an extractor to smoke and gases, with centrifugal ventilator, of double aspiration and with single phase incorporated electrical motor, mounted with vibration-proof systems and elastic connection in the mouth, with a power of 800 evacuation of m3/h. It will be demanded that the extractors have official certificate of operation.					
	<b>Descomposición</b>					
	O01OB170 h. Ofil 1ª plumber	3,980	19,07	75,90		
	E23MC090 m. PVC D=150 mm	8,000	32,98	263,84		
	E23MC110 m. PVC D=120 mm	8,000	14,51	116,08		
	E23MG010 ud extractor 4 mouths	1,000	151,68	151,68		
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
		1				1,00
						1,00
						607,50
						607,50

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT
11.03	<b>ud cold water</b>			
	cold water distribution will be made with electrolytic copper pipe with meetings welded, in dimensions and diameters according to plane of project. It will be installed, verified and measured according to regulation.			
	<b>Descomposición</b>			
	<i>E20XEC030 ud toilet</i>	1,000	265,06	265,06
	<i>E20XEC040 ud bathroom</i>	2,000	392,00	784,00
	<i>E20XEC050 ud kitchen</i>	1,000	308,37	308,37
	<b>budget measurement</b>			
		<u>UDS</u>	<u>LENGTH</u>	<u>WIDTH</u>
			<u>HEIGHT</u>	<u>PARTIAL</u>
		1		1,00
		1,00	1.357,43	1.357,43
	<b>TOTAL CHAPTER CAP 11 INSTALLATIONS.....</b>			<b>7.978,49</b>

## BUDGET, and MEASUREMENTS

CODE	RESUME	QUANTITY	PRICE	IMPORT		
<b>CHAPTER CAP 12 DOORS</b>						
12.01	ud sliding exterior doors 1650x2030 mm.					
<b>Descomposición</b>						
	O01OB150 h. Ofi 1ª carpentry	1,800	13,63	24,53		
	O01OB160 h. carpentry assisitant	1,800	12,32	22,18		
	P11PP010 m. pine precerco	9,690	1,57	15,21		
	P11P10f m. Galce DM R. cerezo 70x30 mm.	9,690	3,27	31,69		
	P11T05f m. flashing	19,380	1,65	31,98		
	P11L10afbc ud P.paso 1 V lisa cerezo 825x2030 mm.	2,000	98,85	197,70		
	P11RB040 ud Pernio latón 80/95 mm. codillo	6,000	0,42	2,52		
	P11WP080 ud screws	36,000	0,03	1,08		
	P11RP020 ud brass knob	2,000	7,05	14,10		
<b>budget measurement</b>		<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
exterior doors w ith glass		6				6,00
						6,00
						340,99
						2.045,94
12.02	ud interior doors 1020x2140					
<b>Descomposición</b>						
	O01OB150 h. Ofi 1ª carpentry	1,000	13,63	13,63		
	O01OB160 h. carpentry assisitant	1,000	12,32	12,32		
	P11PP040 m. Precerco de pino 70x30 mm.	4,845	2,40	11,63		
	P11P10f m. Galce DM R. cerezo 70x30 mm.	4,845	3,27	15,84		
	P11T05f m. flashing	9,690	1,65	15,99		
	P11L10afac ud P.paso ciega lisa cerezo 825x2030 mm.	1,000	137,58	137,58		
	P11RB040 ud Pernio latón 80/95 mm. codillo	4,000	0,42	1,68		
	P11WP080 ud screws	18,000	0,03	0,54		
	P11RP020 ud brass knob	2,000	7,05	14,10		
<b>budget measurement</b>		<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
interior doors		6				6,00
						6,00
						223,31
						1.339,86
12.03	ud sliding doors 820x2140 mm.					
<b>Descomposición</b>						
	O01OB150 h. Ofi 1ª carpentry	2,500	13,63	34,08		
	O01OB160 h. carpentry assisitant	2,500	12,32	30,80		
	P11PP010 m. pine precerco	4,845	1,57	7,61		
	P11P10f m. Galce DM R. cerezo 70x30 mm.	9,690	3,27	31,69		
	P11T05f m. flashing	9,690	1,65	15,99		
	P11L10afbc ud P.paso 1 V lisa cerezo 825x2030 mm.	1,000	98,85	98,85		
	P11RW040 ud accesories	1,000	14,25	14,25		
	P11RW050 m. Perfil susp. p.corred. galv.	1,700	2,50	4,25		
	P11WH090 ud locker	2,000	5,08	10,16		
	P11WP080 ud screws	4,000	0,03	0,12		
<b>budget measurement</b>		<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>	<b>HEIGHT</b>	<b>PARTIAL</b>
sliding doors		2				2,00
						2,00
						247,80
						495,60
12.04	ud entrance door 1020x2140mm.					
<b>Descomposición</b>						
	O01OB150 h. Ofi 1ª carpentry	2,300	13,63	31,35		
	O01OB160 h. carpentry assisitant	2,300	12,32	28,34		
	P11T05c m. flashing	9,770	0,86	8,40		
	P11L05ccab ud door	1,000	570,00	570,00		



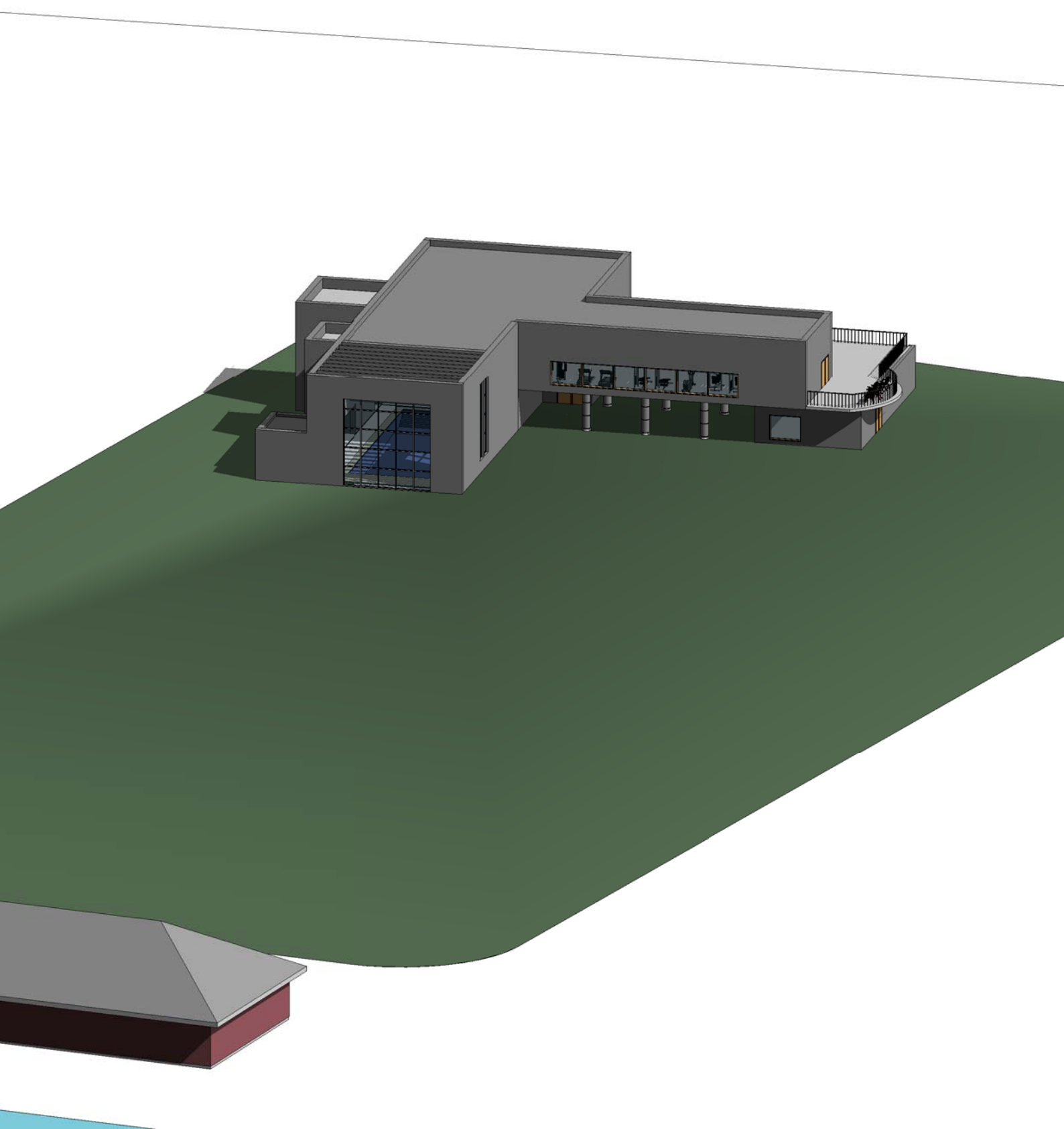
## BUDGET, and MEASUREMENTS

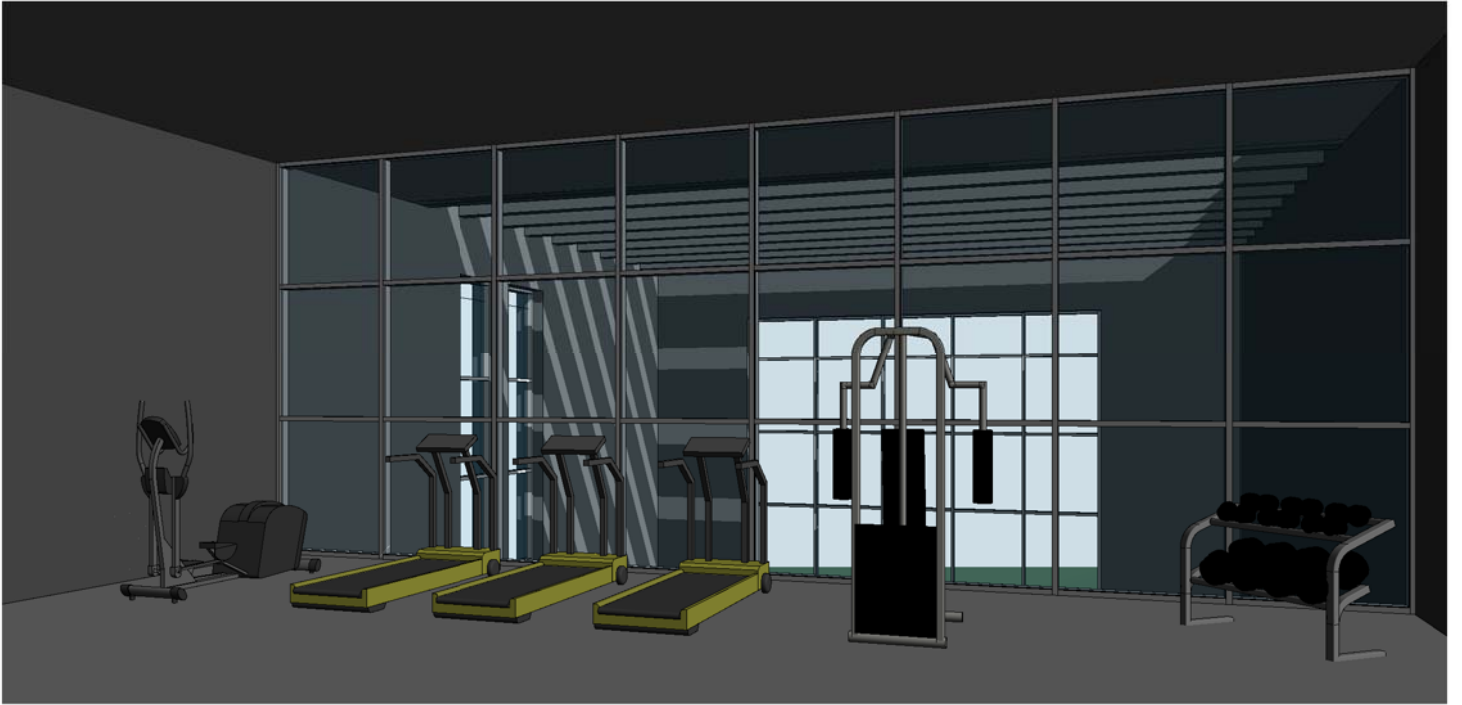
CODE	RESUME	QUANTITY	PRICE	IMPORT
<b>CHAPTER CAP 13 EXTERIOR WORKS</b>				
U13EA360	ud PINUS SYLVESTRIS FASTIG.1,5-2 m. Pinus sylvestris (Scots pine) from 1.50 to 2 m. tall, supplied in containers and planting hole of 0.8 x0, 8x0, 8 m. with the means indicated, fertilization, drainage, tree pit formation and first irrigation.			
	<b>Descomposición</b>			
	O01OB270 h. Of 1ª gardening	0,500	13,75	6,88
	O01OB280 h. gardening pawn	0,500	12,09	6,05
	M05EN020 h. hydraulic excavator 84 CV	0,050	30,23	1,51
	P28EA360 ud Pinus sylvestris fastig.1,5-2 m.	1,000	91,80	91,80
	P28SD005 m. drainage pipe pvc.D=50 mm	2,000	1,72	3,44
	P28DA130 kg Potting soil fertilized	1,500	0,61	0,92
	P01DW050 m3 water	0,050	0,86	0,04
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	pinus	2		
				<b>HEIGHT</b>
				<b>PARTIAL</b>
				2,00
				2,00
				110,64
				221,28
U13R111	m. fences.h=0,8 m. Prefabricated modules fence wood treated in autoclave of 0.8 m. high, composed of vertical boards of 0.80 m. long, 8 / 10 cm. wide and 1.5 cm. thick, with rounded top coat, leaving between them a glimmer of 8 / 10 cm. with a table of 5 of a length of 1.30 m. for piling on the ground, all supported by two horizontal wooden beams, i / open wells and deformed pole, finished as the length actually placed.			
	<b>Descomposición</b>			
	O01OB270 h. Of 1ª gardening	0,800	13,75	11,00
	O01OA060 h. skilled laborer	0,800	16,19	12,95
	O01OB280 h. gardening pawn	0,800	12,09	9,67
	P28RN111 m. timber fences tra.h=0,8	1,000	27,75	27,75
	<b>budget measurement</b>	<b>UDS</b>	<b>LENGTH</b>	<b>WIDTH</b>
	exterior fences	4	27,30	
				<b>HEIGHT</b>
				<b>PARTIAL</b>
				109,20
				109,20
				61,37
				6.701,60
	<b>TOTAL CHAPTER CAP 13 EXTERIOR WORKS.....</b>			<b>6.922,88</b>
	<b>TOTAL.....</b>			<b>259.058,02</b>

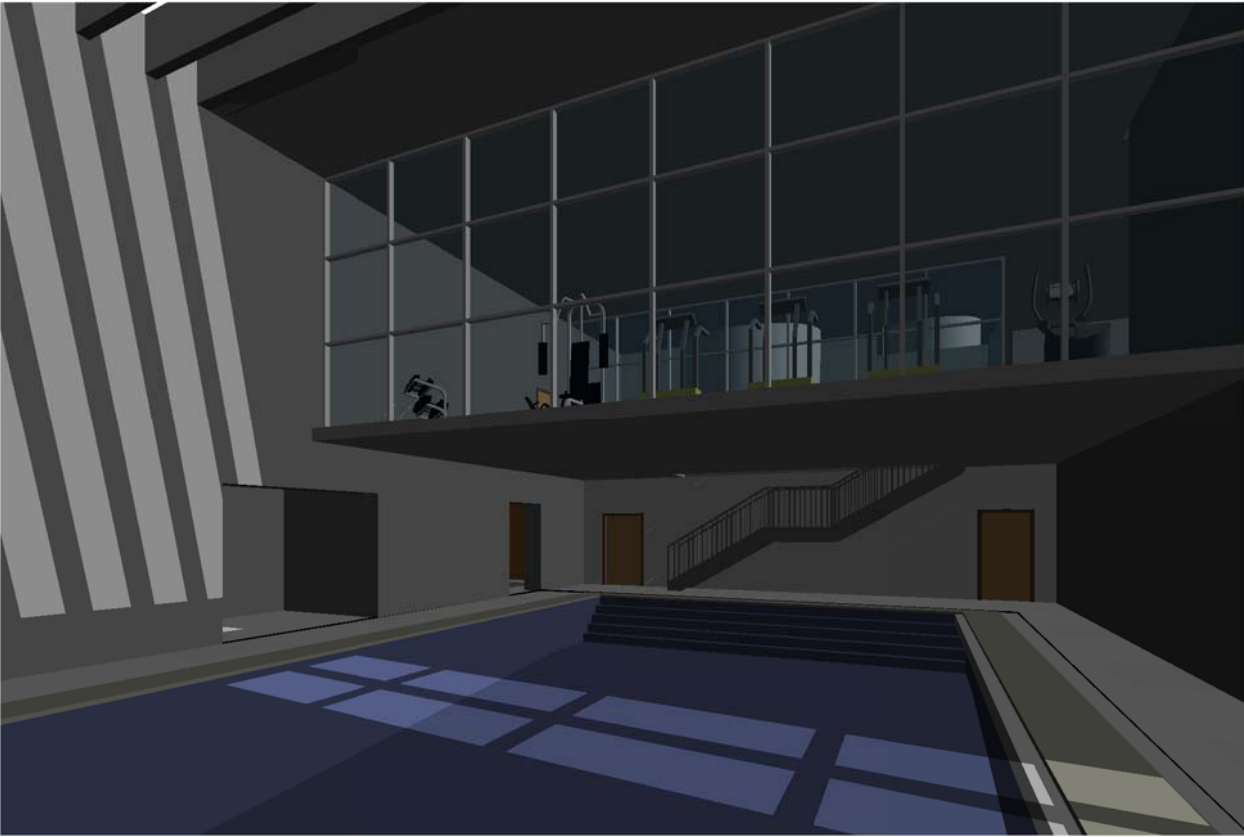


# Pictures



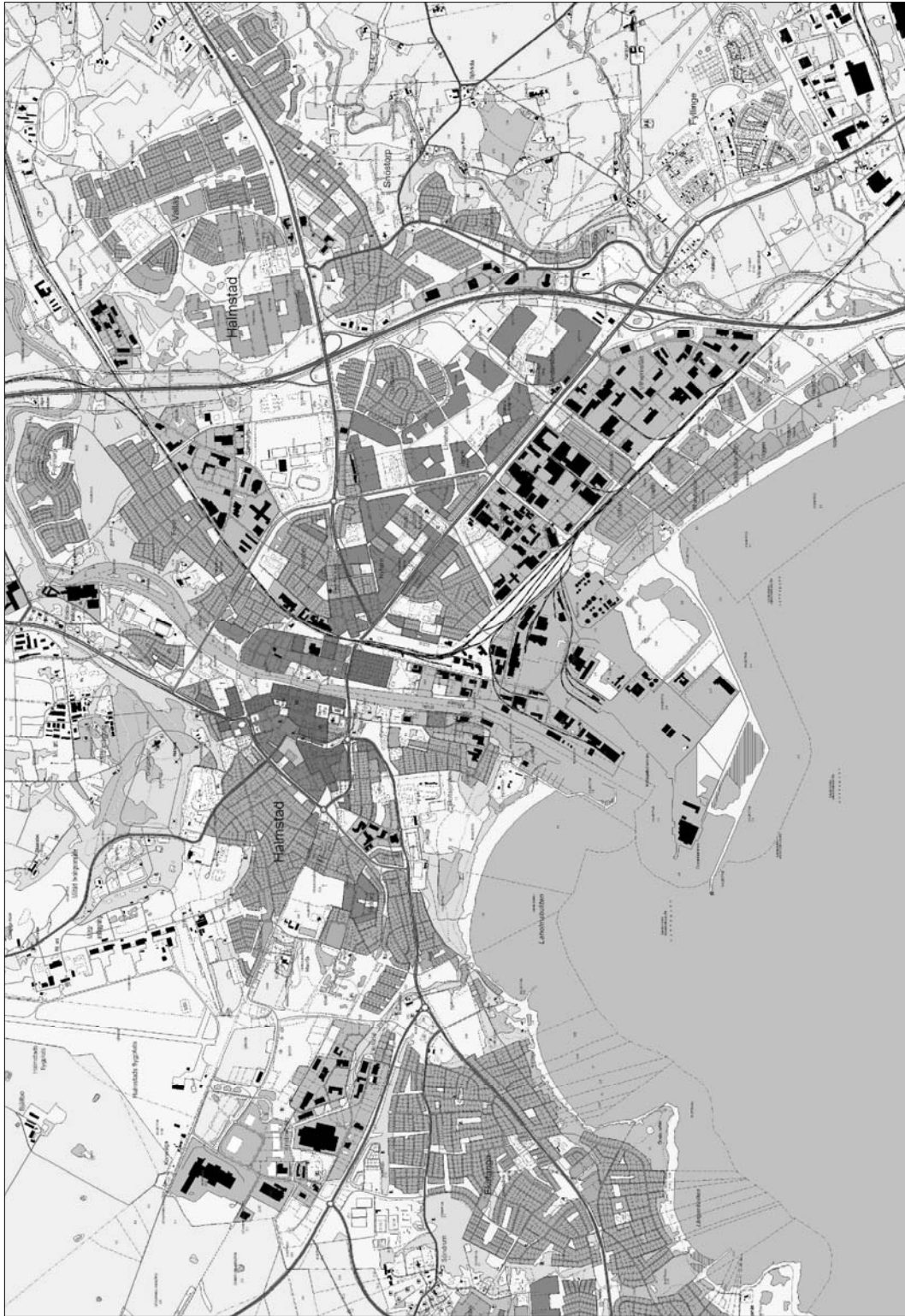










# Drawings





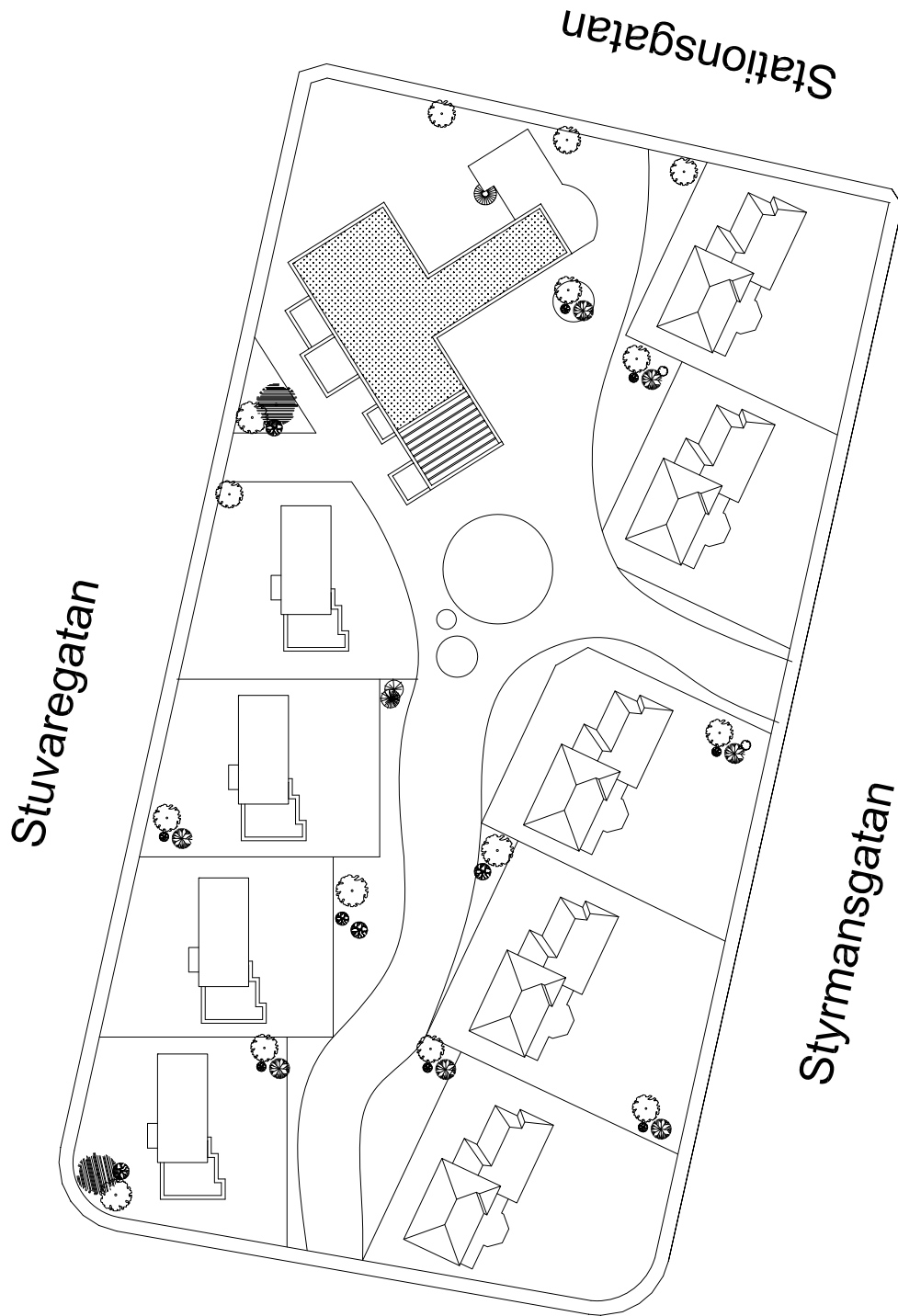
## LOCATION

	Fecha	Ana-Cruz		
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<h1 style="font-size: 2em;">Housing development</h1>				





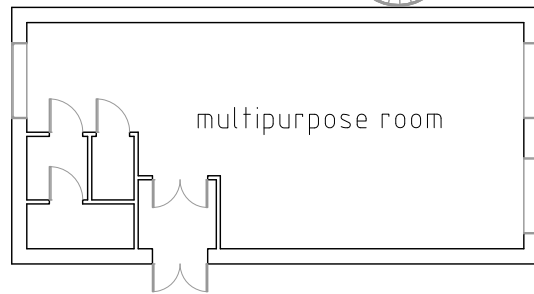
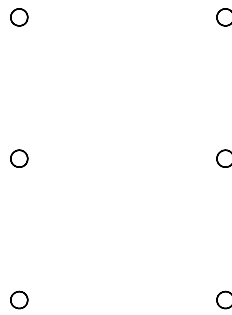
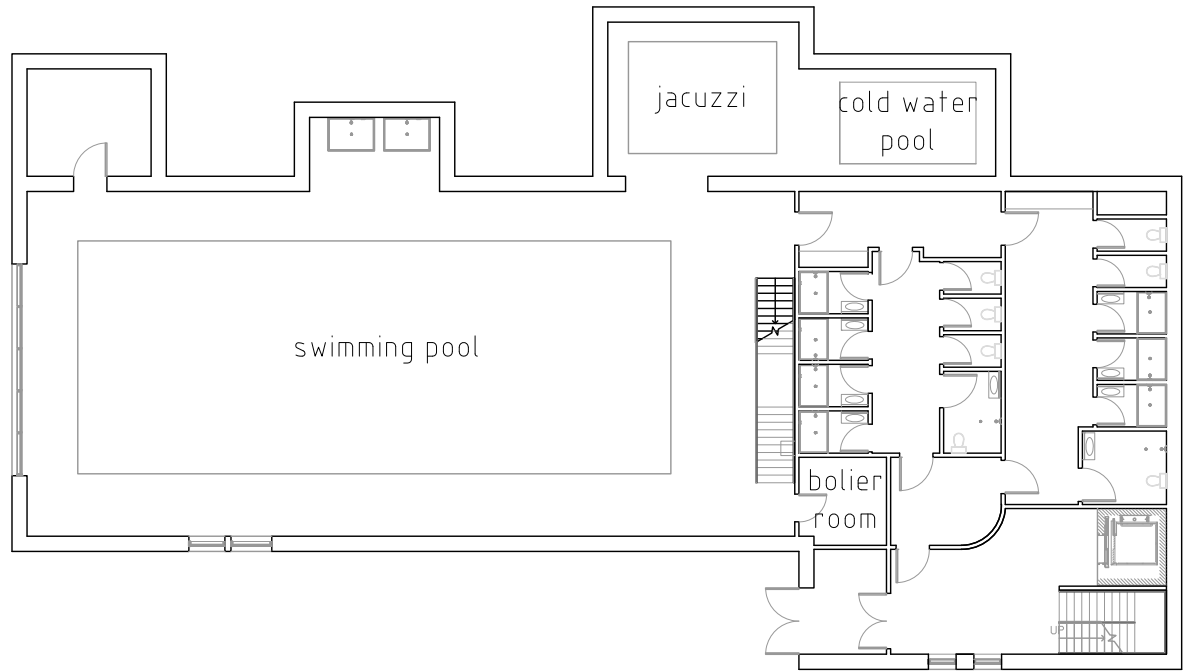
## SITUATION

	Fecha	Ana-Cruz		 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
ESCALA: 1:2000	Housing development			UNIVERSITY OF HALMSTAD Sweden 





## SITE PLAN

	Fecha	Ana-Cruz			 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil			
Supervisor	2011 July	Åke Spångberg			
ESCALA: 1:1000	Housing development			UNIVERSITY OF HALMSTAD Sweden	

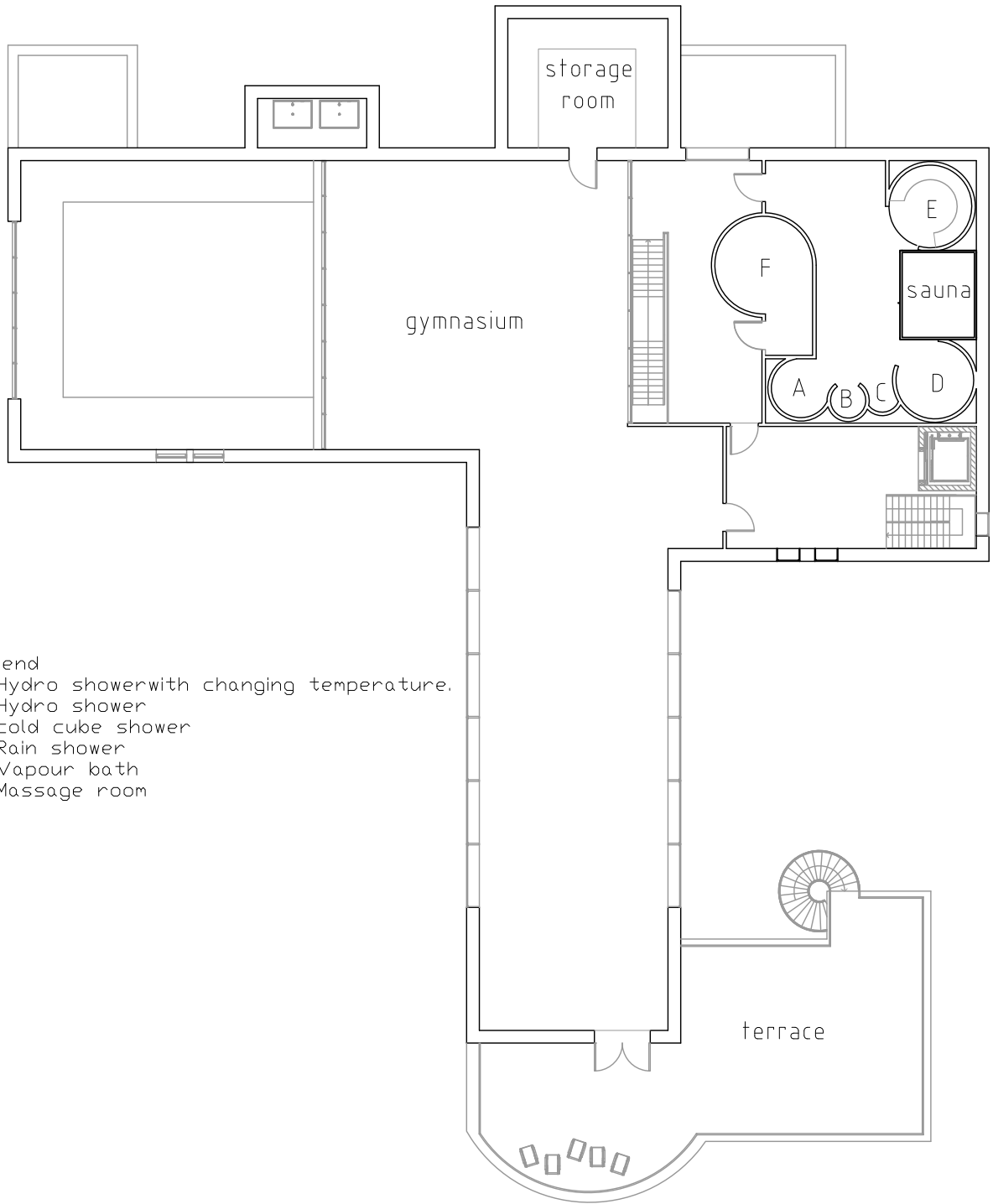


ground floor

## FLOOR PLAN – Residential activity building

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:250	Housing development			UNIVERSITY OF HALMSTAD Sweden 





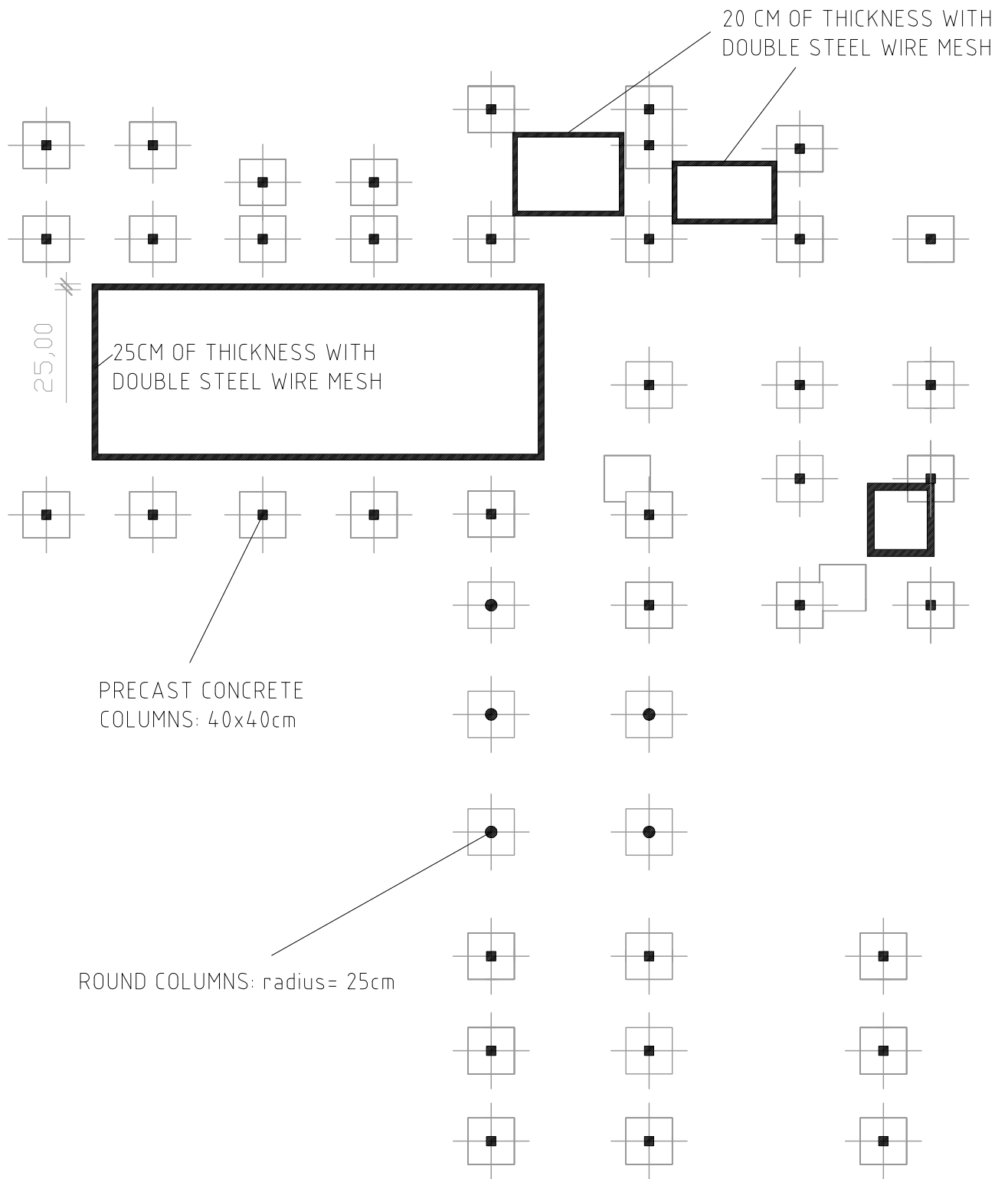


- legend
- A Hydro shower with changing temperature.
  - B Hydro shower
  - C cold cube shower
  - D Rain shower
  - E Vapour bath
  - F Massage room

first floor

## FLOOR PLAN – Residential activity building

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:250	Housing development		UNIVERSITY OF HALMSTAD Sweden	



foundation

## STRUCTURE – Residential activity building

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

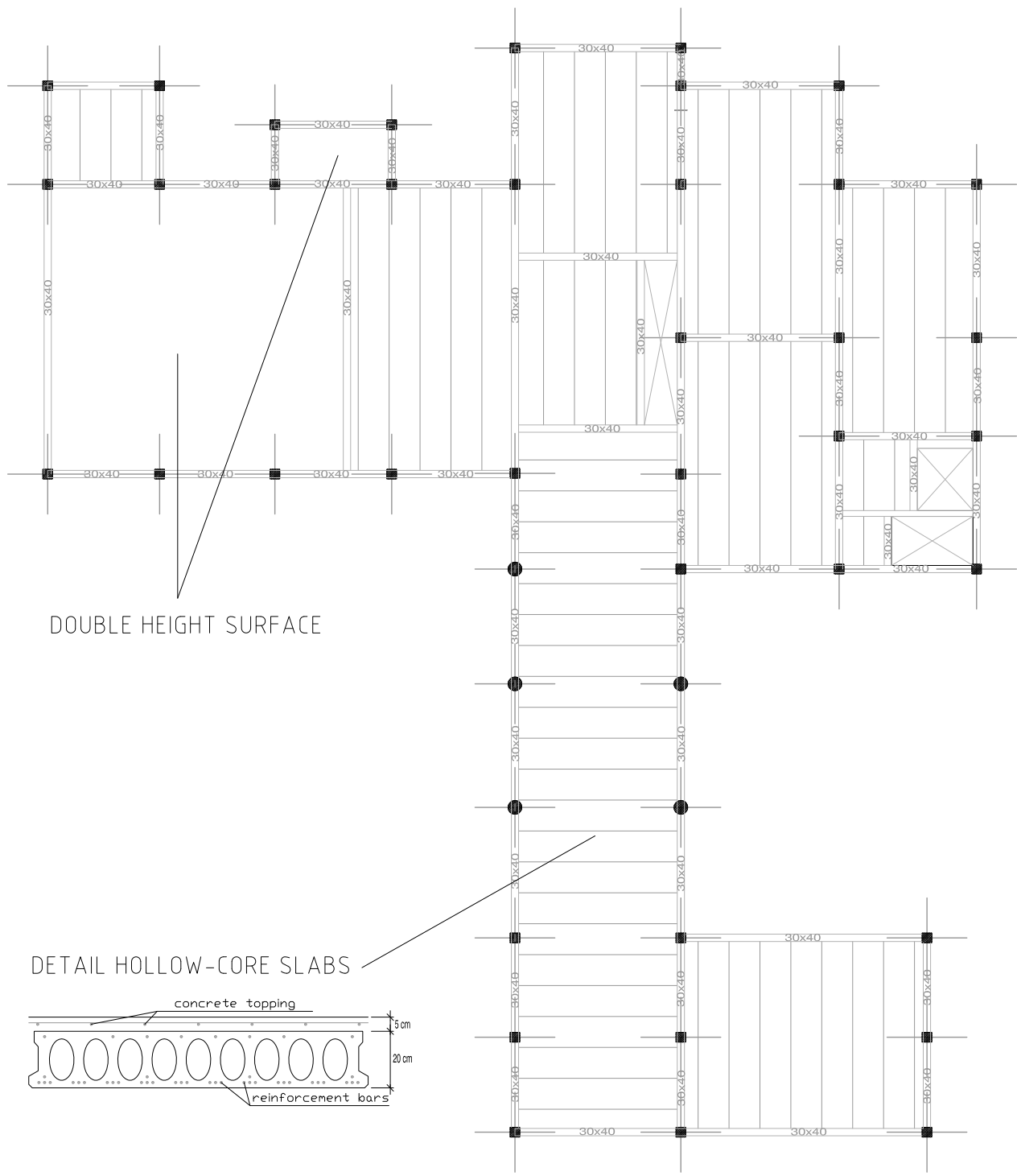
ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina -ZARAGOZA-

SCALE:  
1:250

Housing development

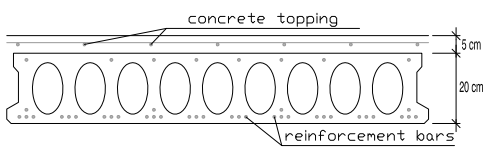
UNIVERSITY OF  
HALMSTAD  
Sweden





DOUBLE HEIGHT SURFACE

DETAIL HOLLOW-CORE SLABS



ground floor

# STRUCTURE – Residential activity building

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

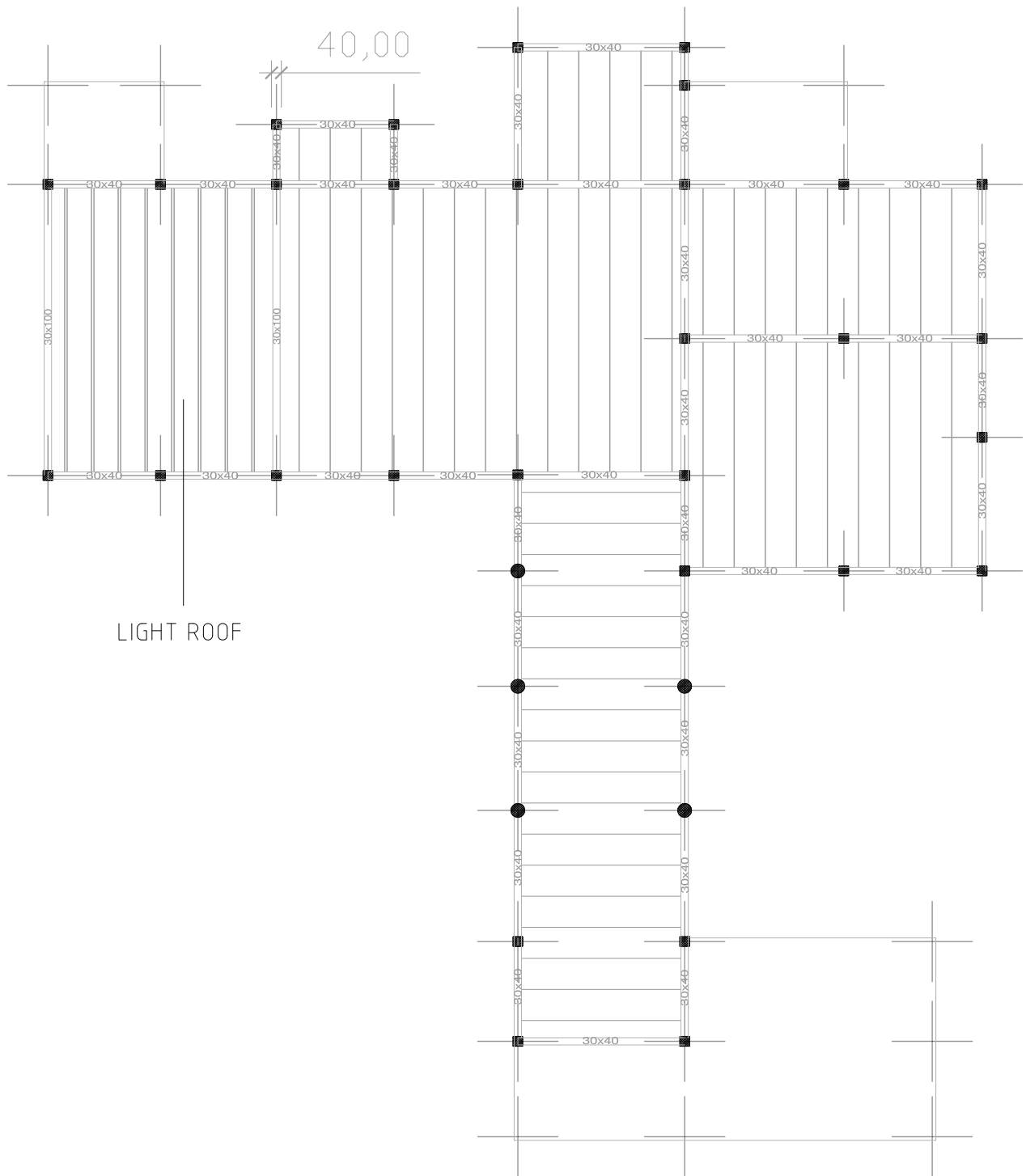
ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina –ZARAGOZA–

SCALE:  
1:250

Housing development

UNIVERSITY OF  
HALMSTAD  
Sweden





first floor

## STRUCTURE – Residential activity building

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

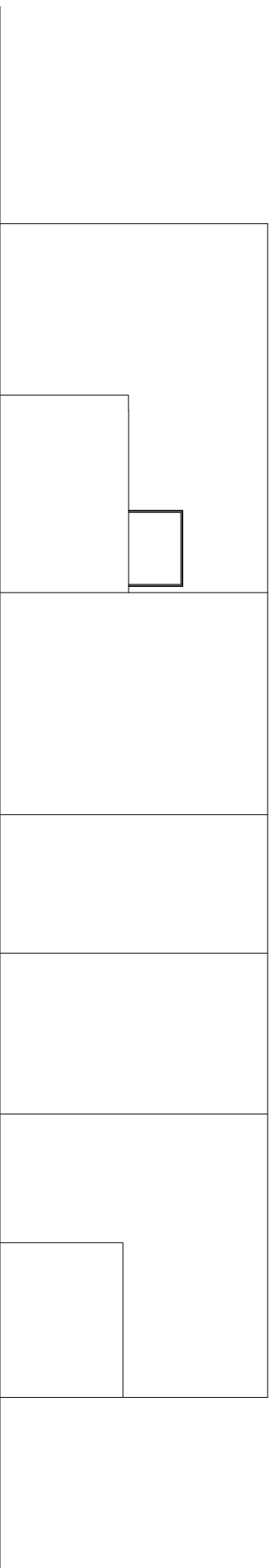
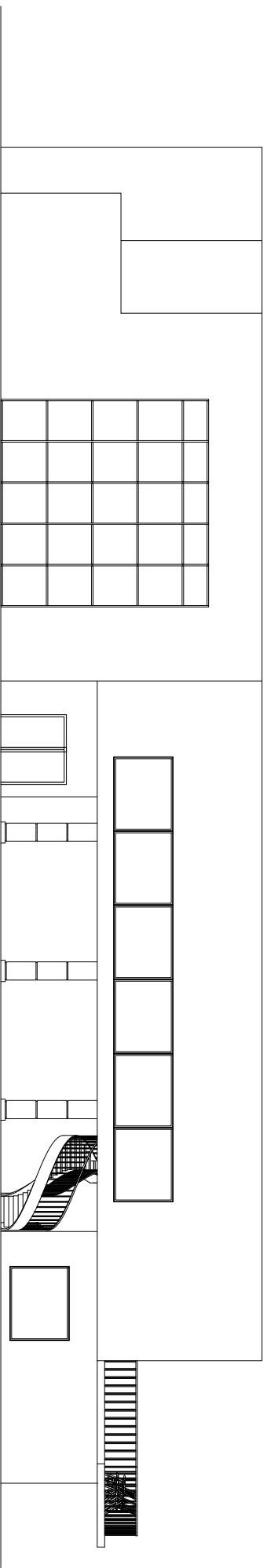
ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina –ZARAGOZA–

SCALE:  
1:250


Housing development

UNIVERSITY OF  
HALMSTAD  
Sweden





## FACADES – Residential activity building

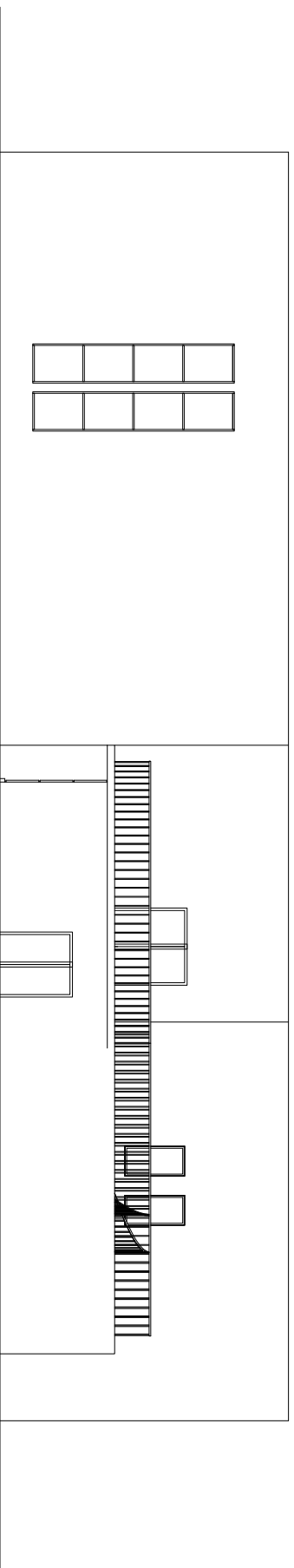
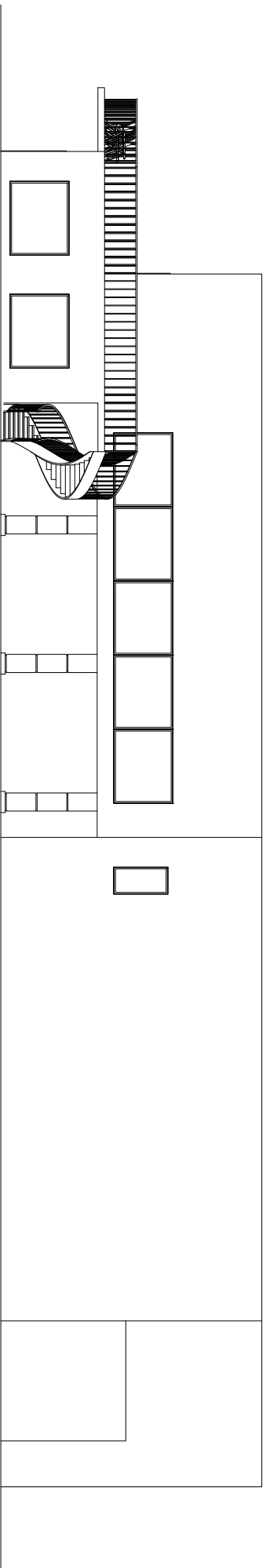
	Fecha	Ana-Cruz	 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Alhambra de D.Godina - ZARAGOZA
Made by	2011 April	Callén Gil	
Comprobado	2011 July		

SCALE:  
1:200


Housing development

UNIVERSITY OF  
HALMSTAD  
Sweden





## FACADES – Residential activity building

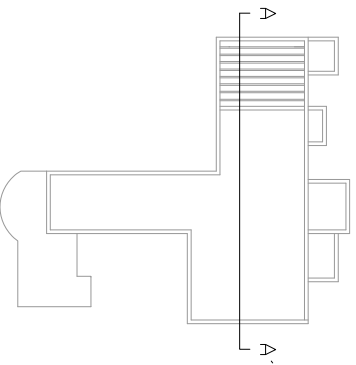
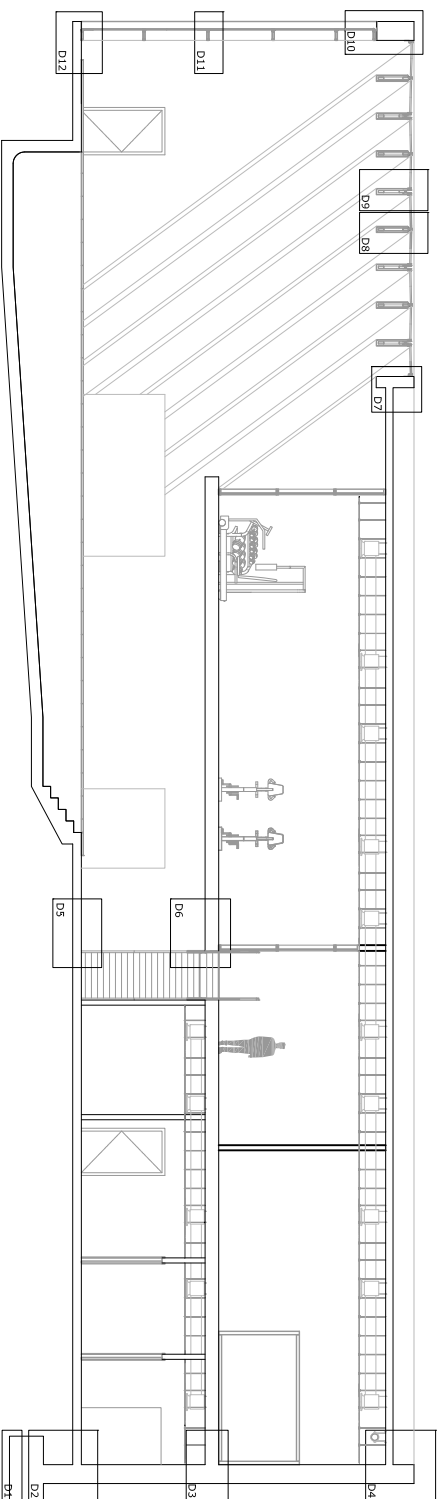
	Fecha	Ana-Cruz	 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Alhambra de D.Godina - ZARAGOZA
Made by	2011 April	Callén Gil	
Comprobado	2011 July		

SCALE:  
1:200


Housing development

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HALMSTAD  
Sweden





## SECTION A-A' – Residential activity building

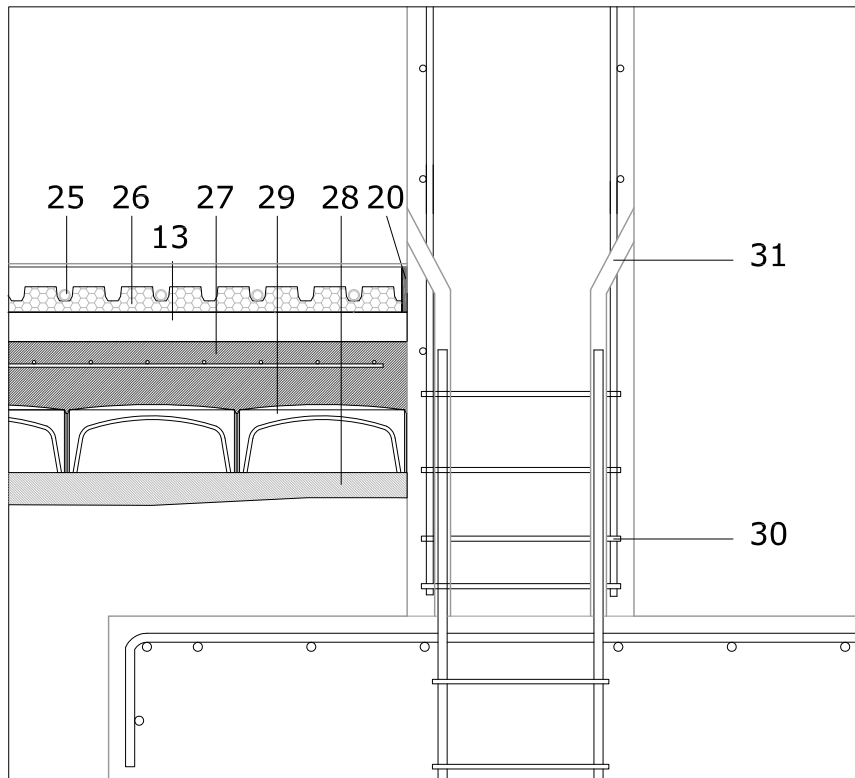
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Made by	2011 April	Callén Gil		
Comprobado	2011 July			

SCALE:  
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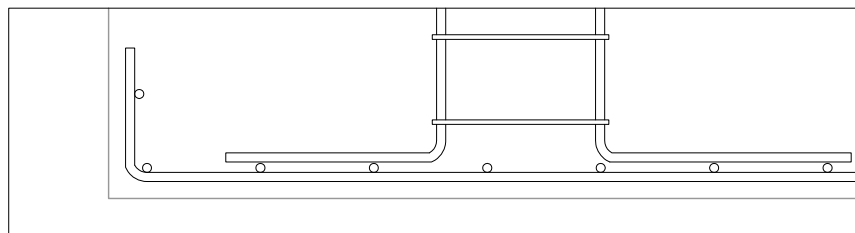
Housing development

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Sweden







Detail 2

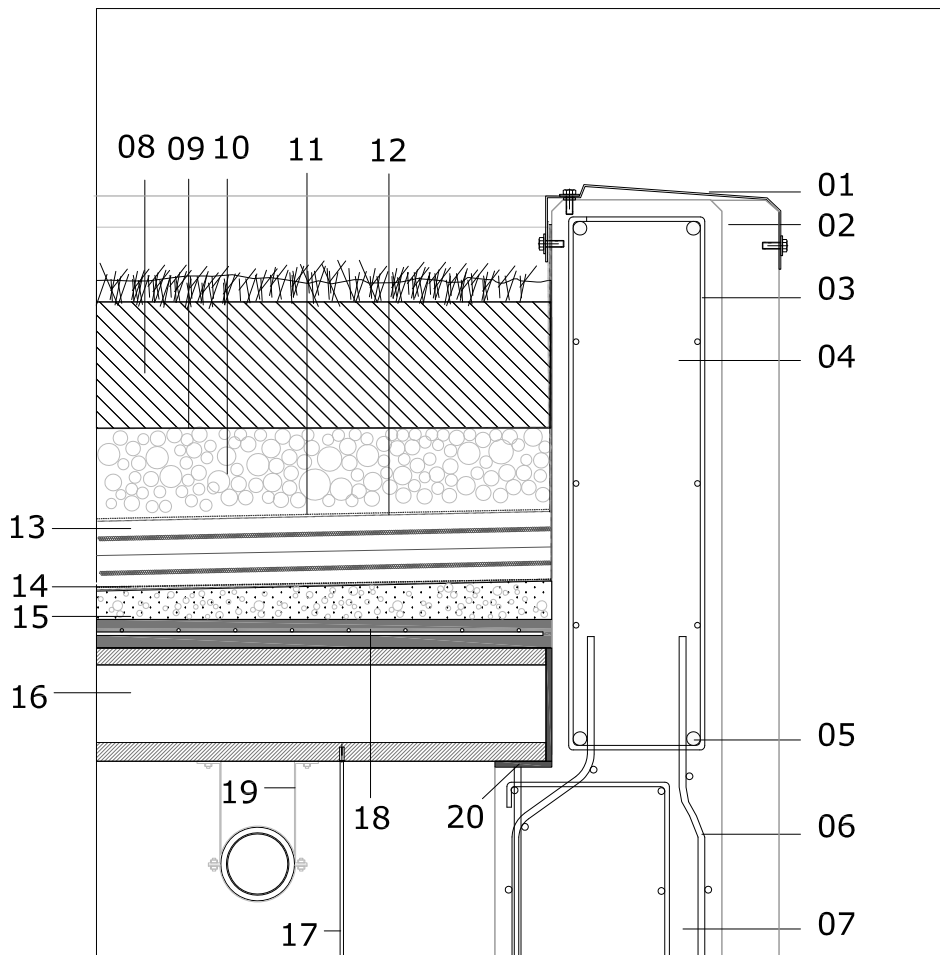


Detail 1

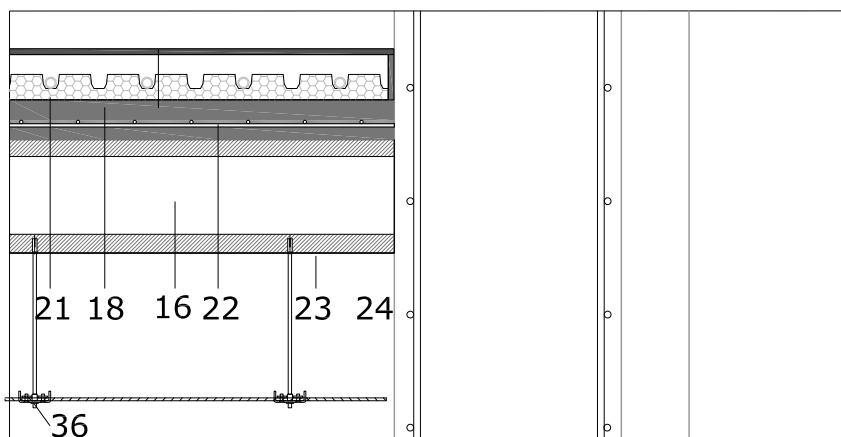
STRUCTURE – Residential activity building

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:10	Housing development			UNIVERSITY OF HALMSTAD Sweden 







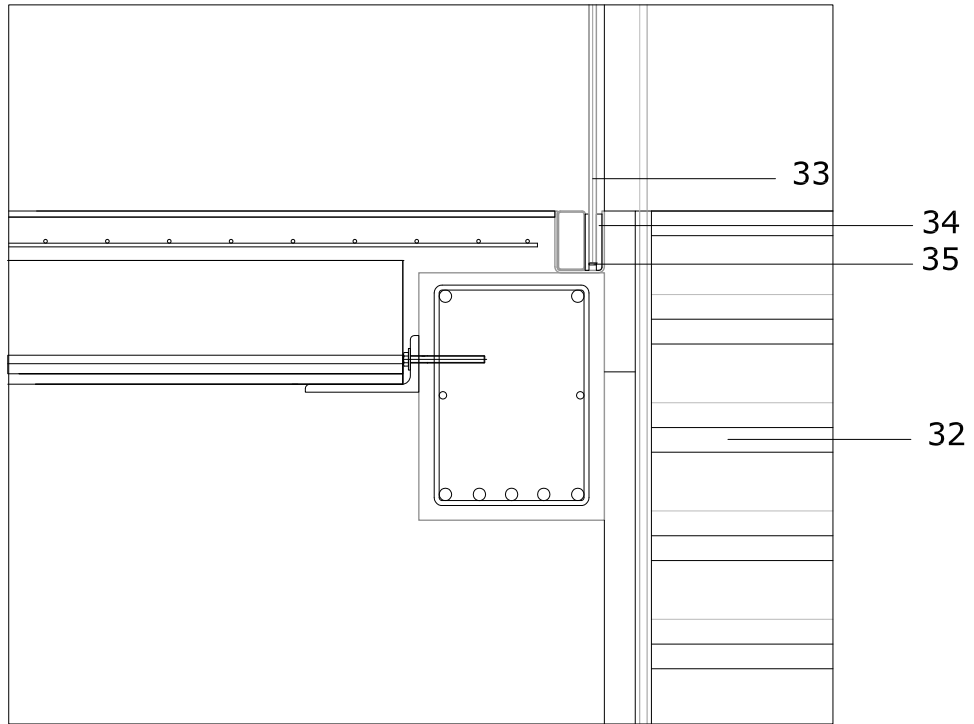
Detail 4



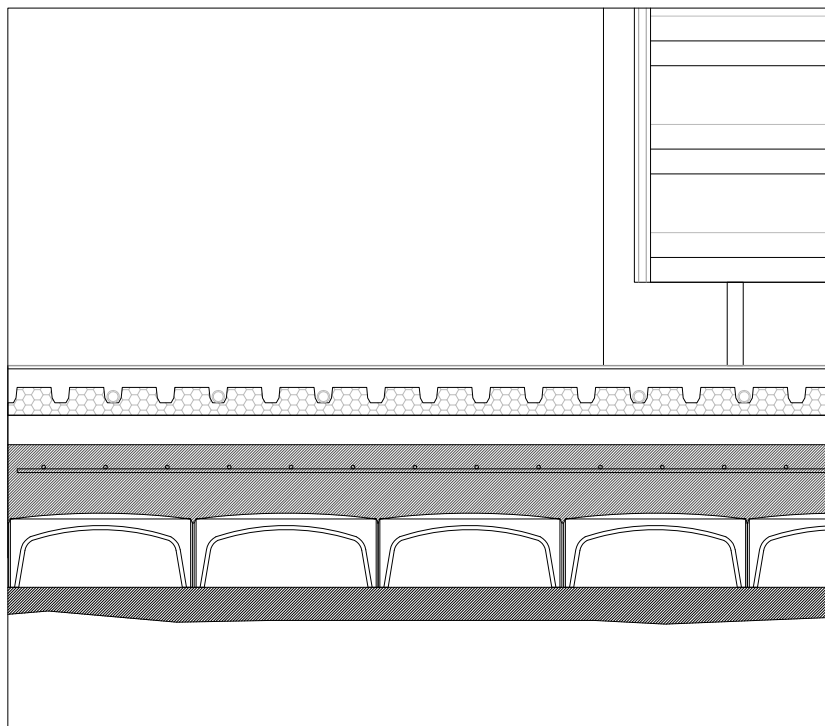
Detail 3

STRUCTURE – Residential activity building

	Fecha	Ana-Cruz	 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Åke Spångberg	
SCALE: 1:10	Housing development		UNIVERSITY OF HALMSTAD Sweden 





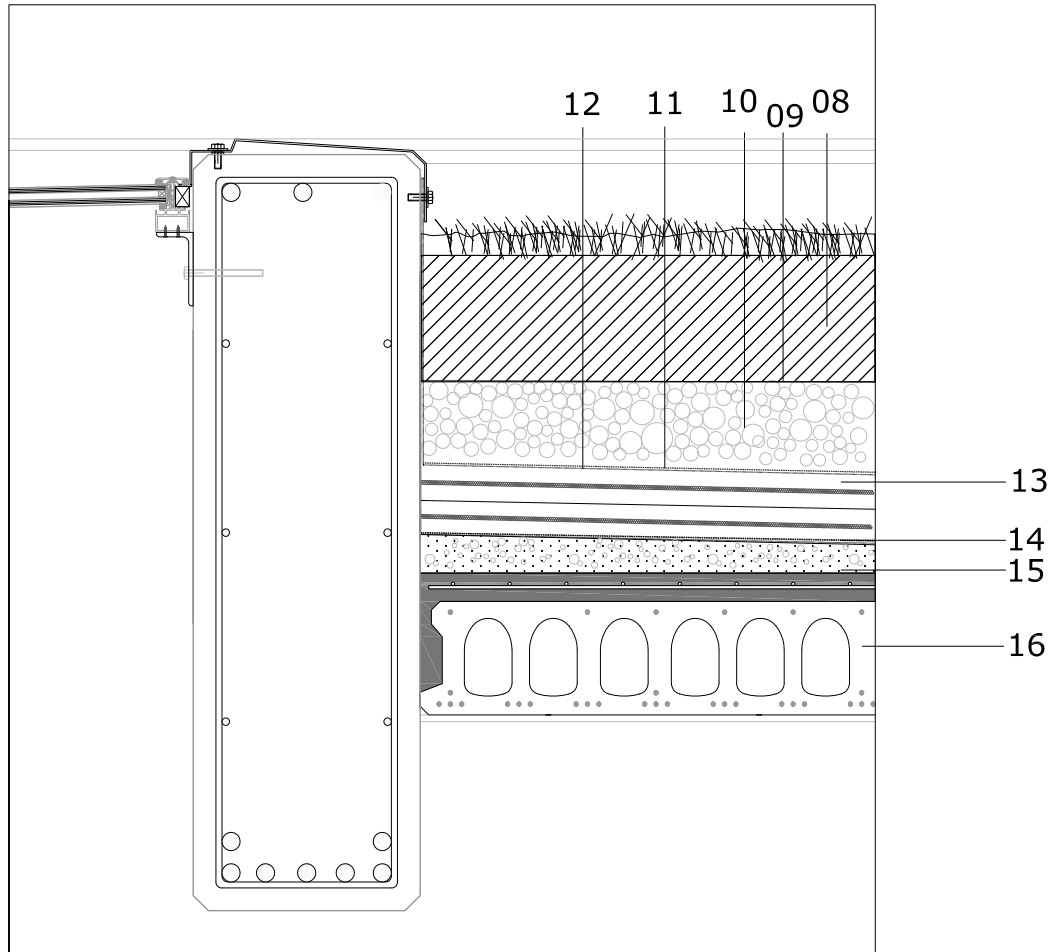
Detail 6



Detail 5



STRUCTURE – Residential activity building

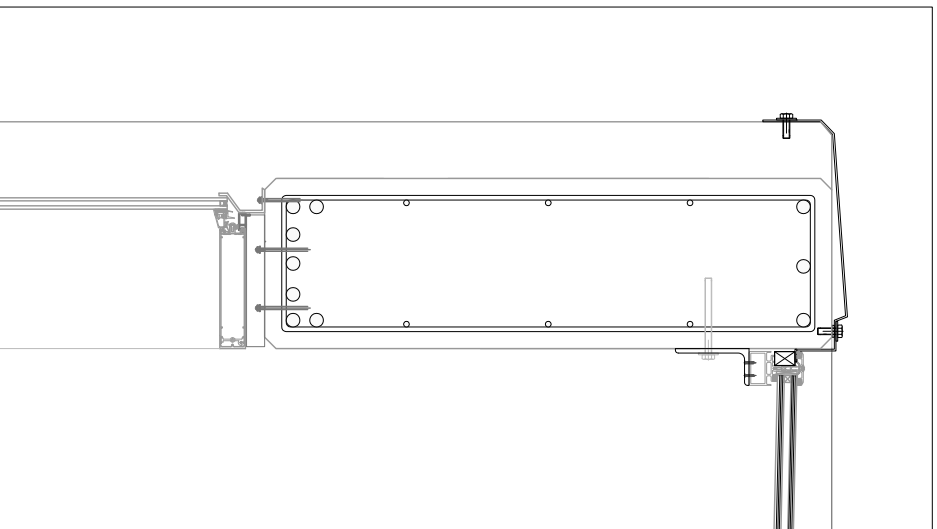
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Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:10	Housing development			UNIVERSITY OF HALMSTAD Sweden 



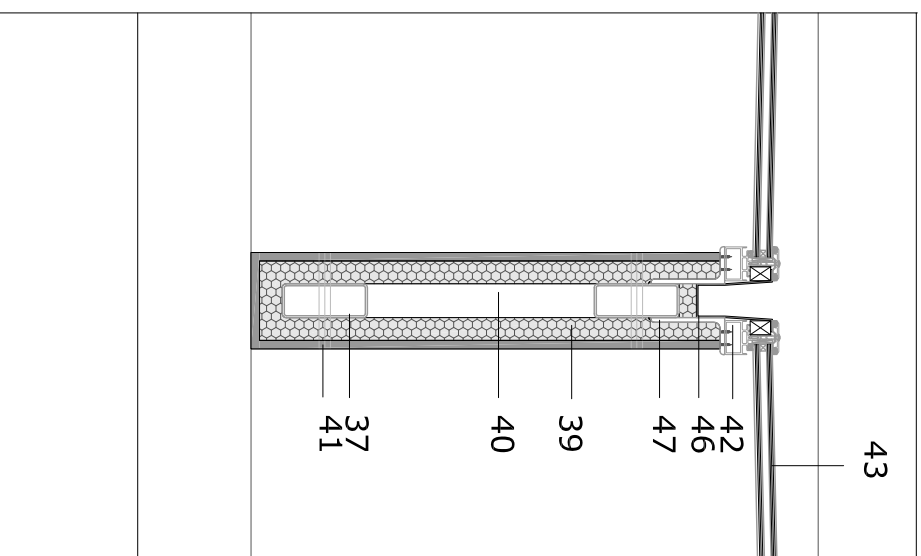
Detail 7

STRUCTURE – Residential activity building

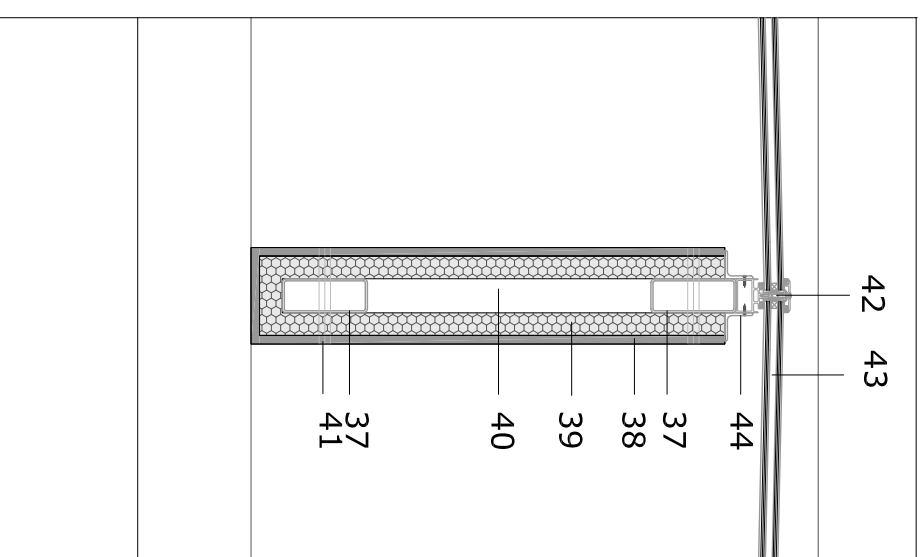
	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:10	Housing development			UNIVERSITY OF HALMSTAD Sweden 











Detail 10

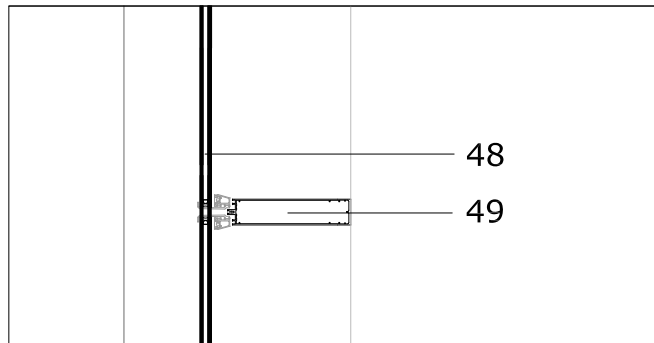


Detail 9

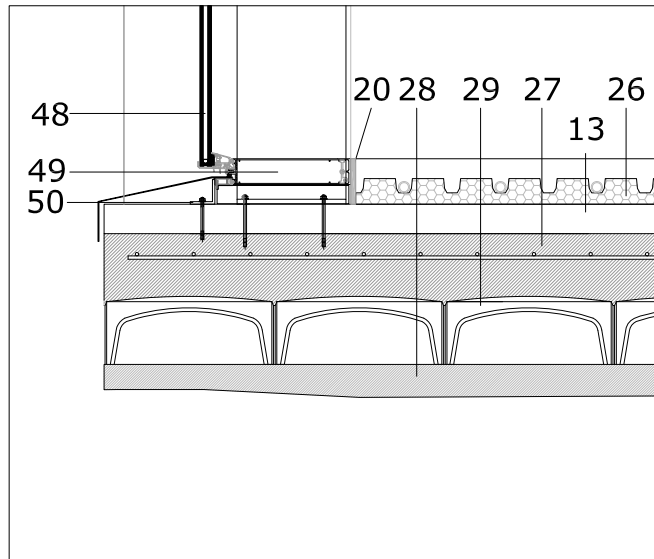


Detail 8

<b>STRUCTURE' – Residential activity building</b>			
	Fecha	Ana-Cruz	
Made by	2011 April	Callén Gil	
Comprobado	2011 July		
 <b>eupla</b>		 <b>UNIVERSITY OF VALÈNCIA</b>	
 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D. Godina - ZARAGOZA		 <b>UNIVERSITY OF VALÈNCIA</b>	
<b>SCALE:</b> 1:10		Housing development	
 <b>UNIVERSITY OF VALÈNCIA</b>		 <b>UNIVERSITY OF VALÈNCIA</b>	
 <b>UNIVERSITY OF VALÈNCIA</b>		 <b>UNIVERSITY OF VALÈNCIA</b>	





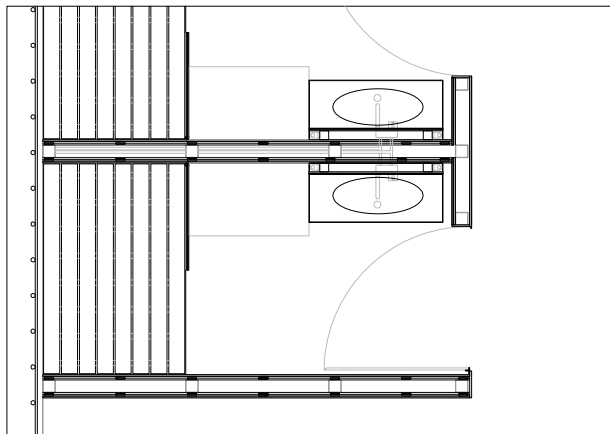
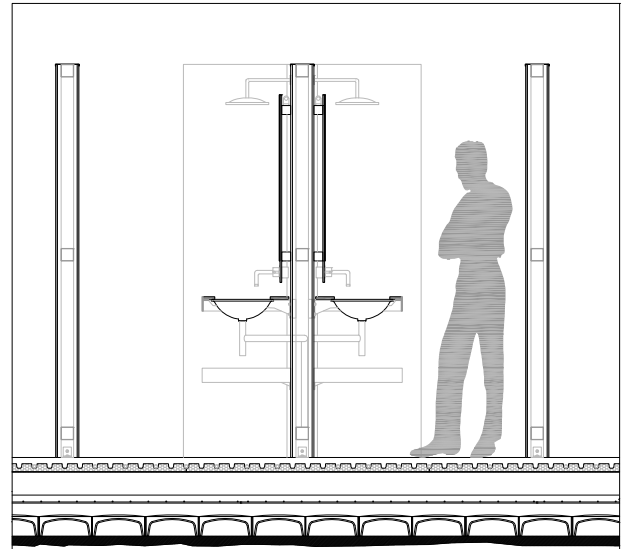
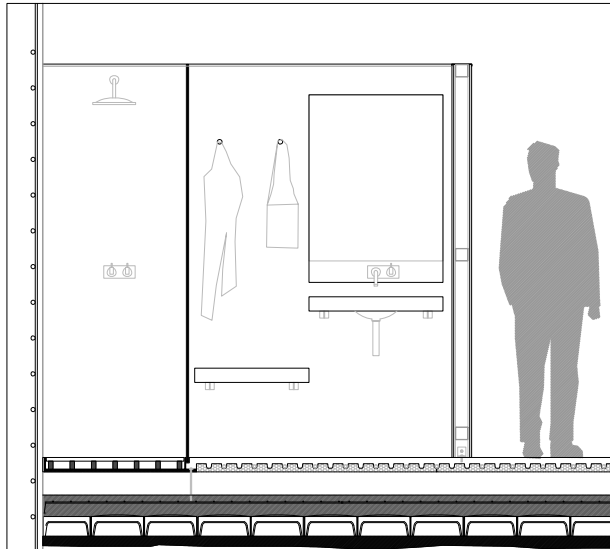
Detail 11





Detail 12

STRUCTURE – Residential activity building

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:10	Housing development		UNIVERSITY OF HALMSTAD Sweden	



## STRUCTURE – Residential activity building

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:10	Housing development			UNIVERSITY OF HALMSTAD Sweden 

legend

- 01 screw 40x8mm with watertight drilling
- 02 zinc gutter 3mm
- 03 reinforcing steel bars
- 04 reinforced concrete beam 100x30cm
- 05 longitudinal reinforcement
- 06 reinforced concrete wall 40cm
- 07 reinforced steel mesh 12/25
- 08 soil
- 09 filter layer and moisture retention layer
- 10 drainage
- 11 membrane protection layer
- 12 waterproofing
- 13 extruded polystyrene
- 14 Polyietilene foil
- 15 arlita slope formation
- 16 pre-stressed hollow-core slab 1200x20
- 17 strut of suspended ceiling
- 18 concrete slab 5cm




legend

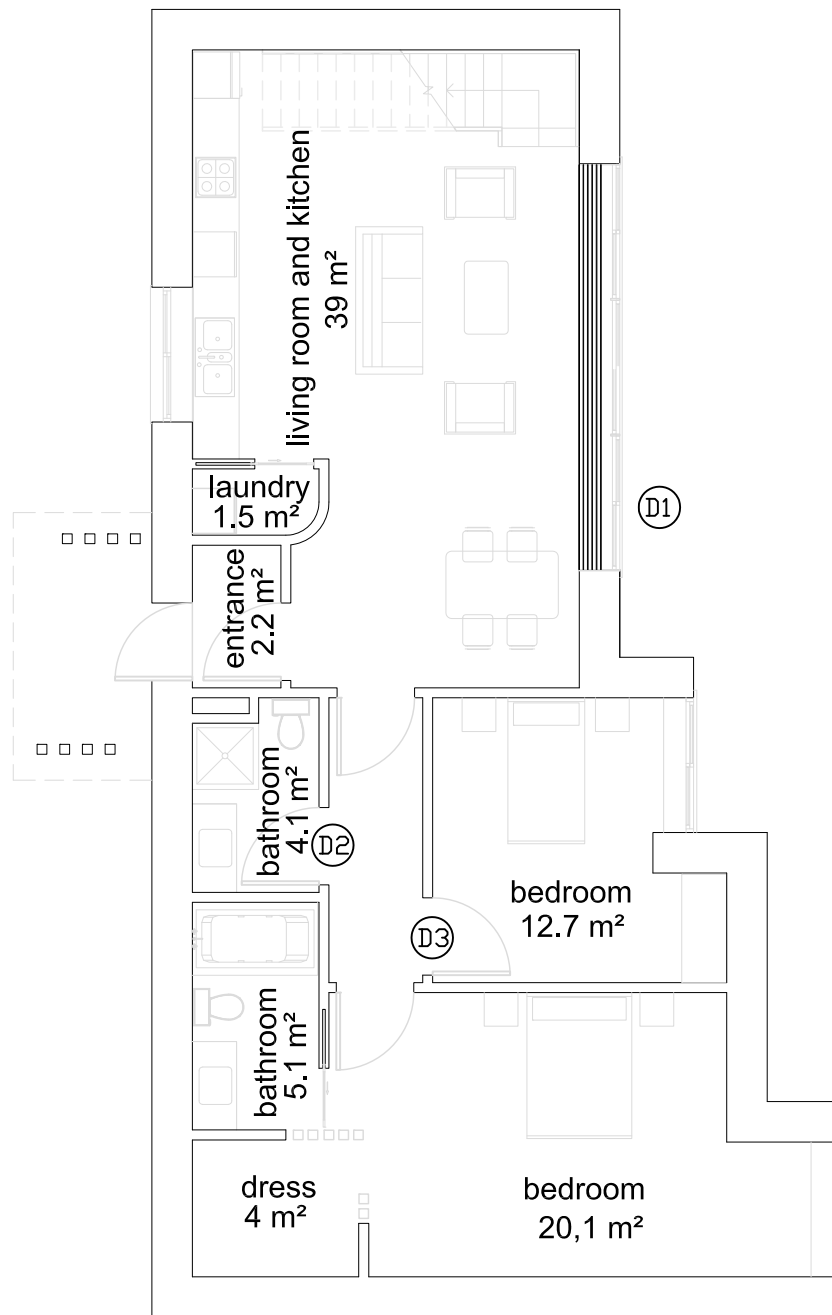
- 37 Tube rolled-hollow section 150x60x4mm
- 38 glass fibre reinforced cement 15mm
- 39 insulation
- 40 vierendeel beam
- 41 bolt of anchorage 20mm
- 42 Roof light, anchorage of enclosure
- 43 laminated glass 60+10+60mm
- 44 "L" section of galvanized steel 60x60x8mm
- 46 zinc gutter 4mm
- 47 "L" section of galvanized steel 135x65x10mm
- 49 aluminium curtain wall profile
- 50 "L" section of galvanized steel 60x60x10mm

legend



- 19 fixing points for plumbing
- 20 high-density neoprene 10mm
- 21 epoxy resin
- 22 anti-shrinkage reinforced steel mesh
- 23 angle (L-shaped cross-section) 200x100x14mm
- 24 screw
- 25 polyethylene pipe 16x2mm conduction heating floor.
- 26 tubing base moduling
- 27 concrete slab 12cm
- 28 blinding concrete
- 29 prefab concrete
- 30 extra ties at botton of column  
dowels projecting from footing
- 31 pvc grout ducts. Fill with flowable grout after erection
- 32 steel streard
- 33 handrail, tempered glass
- 34 shoe moulding
- 35 setting block
- 36 false ceiling

## LEGEND – Residential activity building

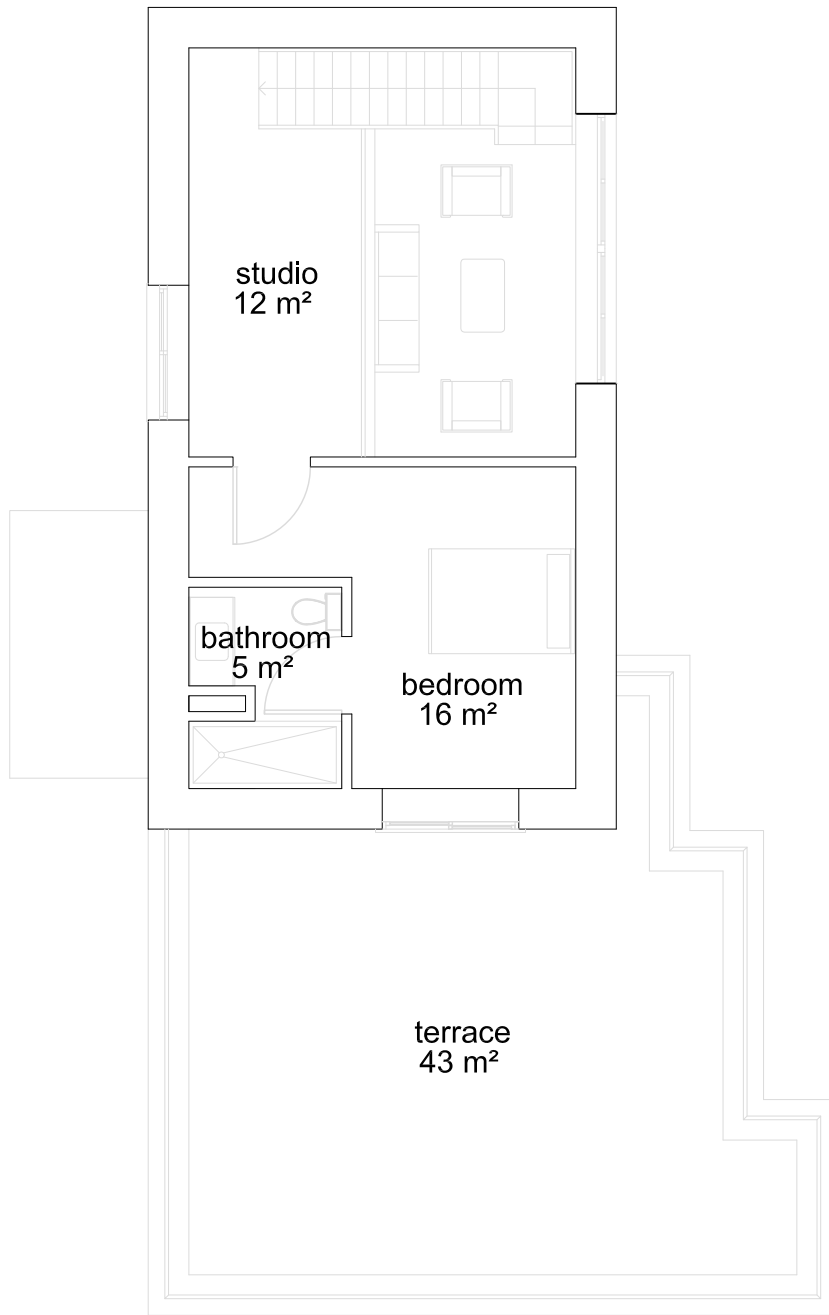
	Fecha	Ana-Cruz		
<b>Made by</b>	2011 April	Callén Gil		
<b>Supervisor</b>	2011 July	Åke Spångberg		<b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina –ZARAGOZA–
	Housing development			UNIVERSITY OF HALMSTAD Sweden 





## SURFACES – Dwelling 1 . ground floor

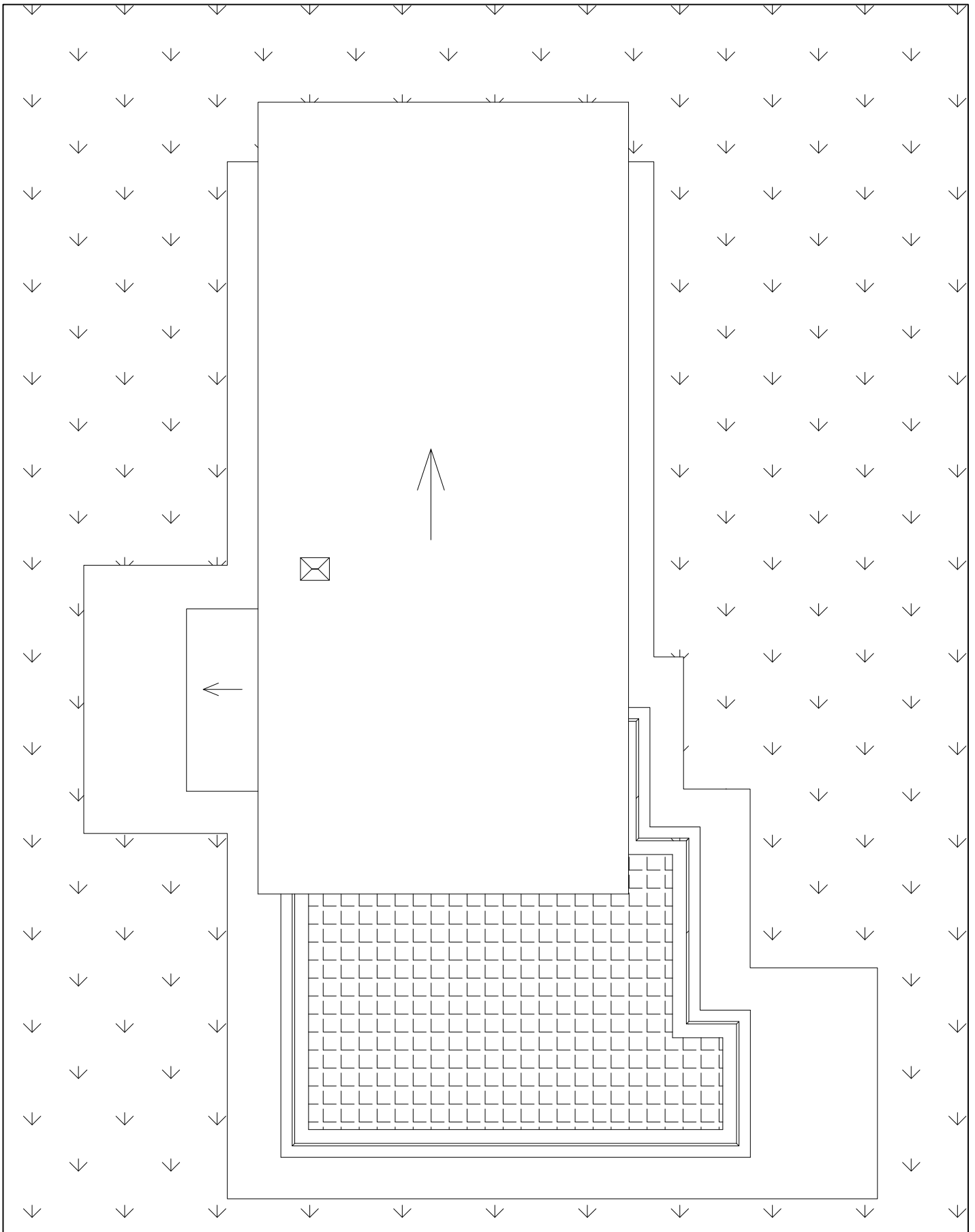
	Fecha	Ana-Cruz		 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development			UNIVERSITY OF HALMSTAD Sweden 







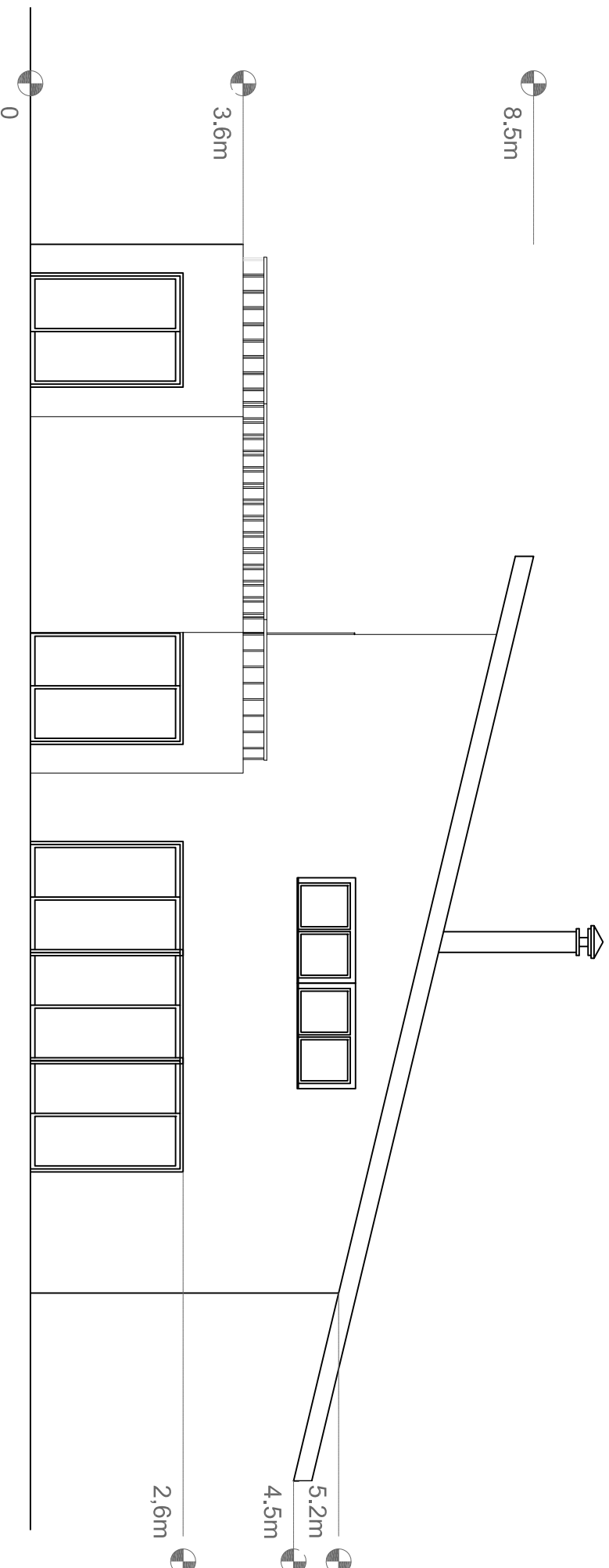
## SURFACES – Dwelling 1 . first floor

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development		UNIVERSITY OF HALMSTAD Sweden	




## FLOOR PLAN – Dwelling 1 . first floor

	Fecha	Ana-Cruz	 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Åke Spångberg	
<b>SCALE:</b> 1:100	Housing development		UNIVERSITY OF HALMSTAD Sweden 



## FACADES – Dwelling 1

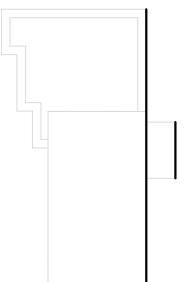
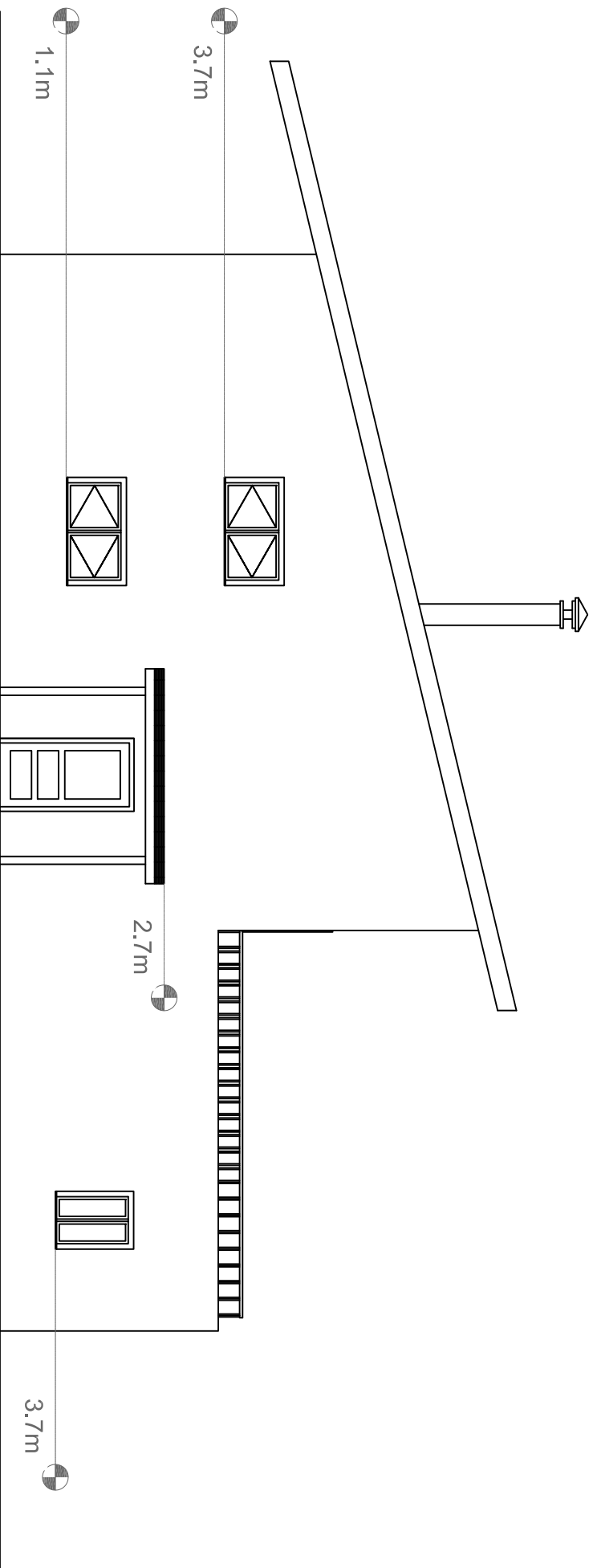
Fecha		Ana-Cruz		 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D. Godina – ZARAGOZA
Made by		Callén Gil		
Supervisor		Ake Spångberg		

SCALE:  
1:100

Housing development

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Sweden





## FACADES – Dwelling 1

Fecha		Ana-Cruz	
Made by		Callén Gil	
Supervisor		Ake Spångberg	
2011 April		2011 July	
ESCUELA UNIVERSITARIA POLITÉCNICA		UNIVERSITY OF HALMSTAD	
1ª Almunia de D.Godina – ZARAGOZA		Sweden	

**eupla**

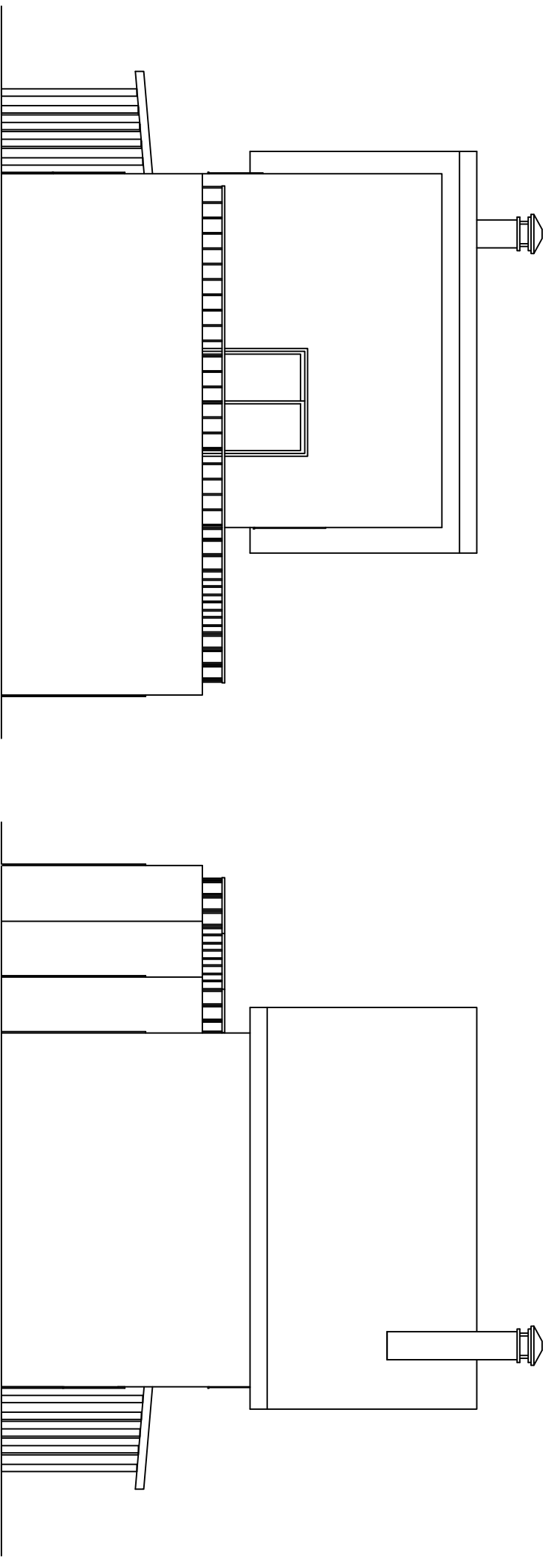
ESCUELA UNIVERSITARIA POLITÉCNICA  
1ª Almunia de D.Godina – ZARAGOZA

Housing development


SCALE:  
1:100

UNIVERSITY OF  
HALMSTAD  
Sweden






## FACADES – Dwelling 1

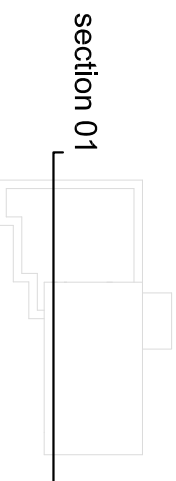
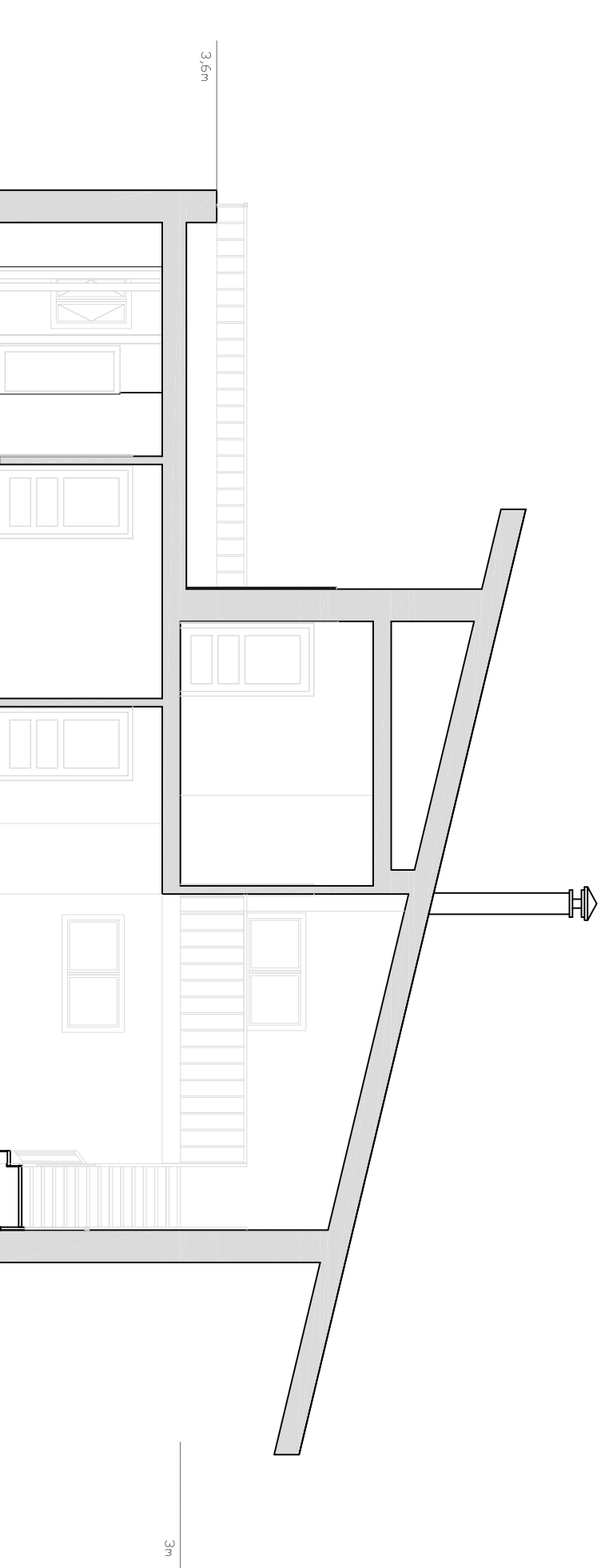
Fecha		Ana-Cruz		 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Alhumbia de D.Godina – ZARAGOZA
Made by		Callén Gil		
Supervisor		Ake Spångberg		

Housing development


**ESCALA:**  
1:100

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HÄLMSTAD  
Sweden





## SECTION 01 – Dwelling 1

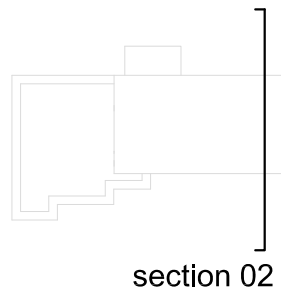
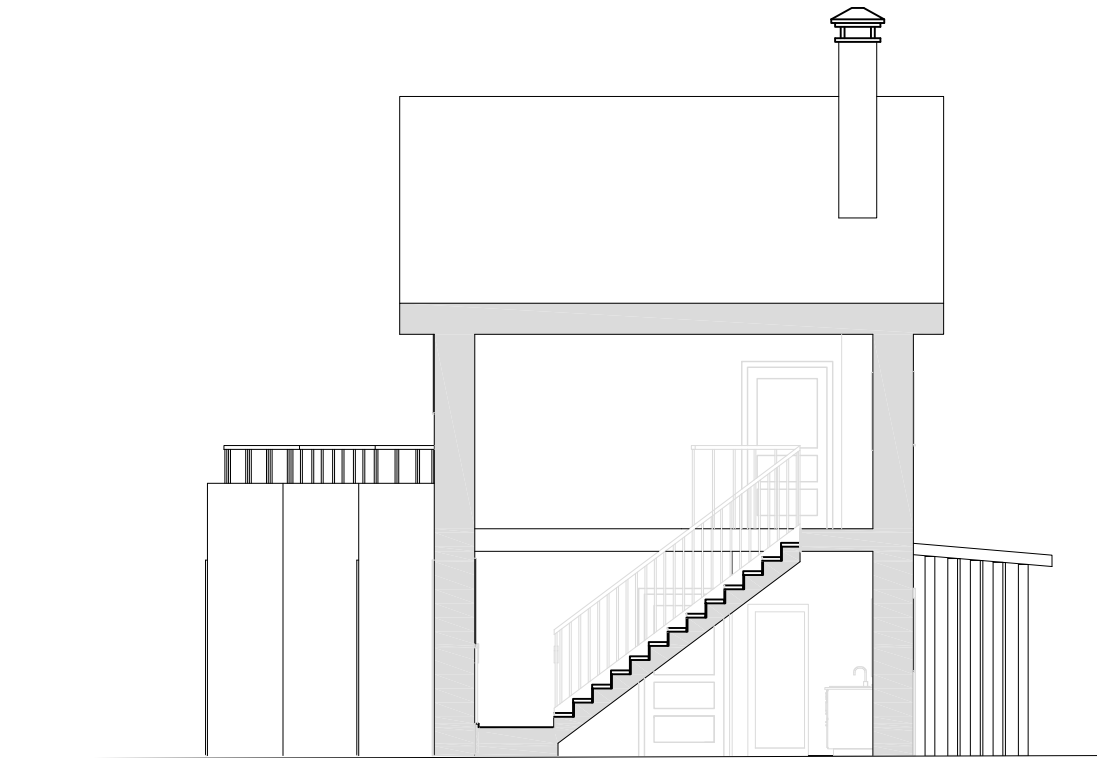
Fecha		Ana-Cruz		 <b>eupla</b>
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Ake Spångberg		

Housing development



SCALE:  
1:100






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HALMSTAD  
Sweden

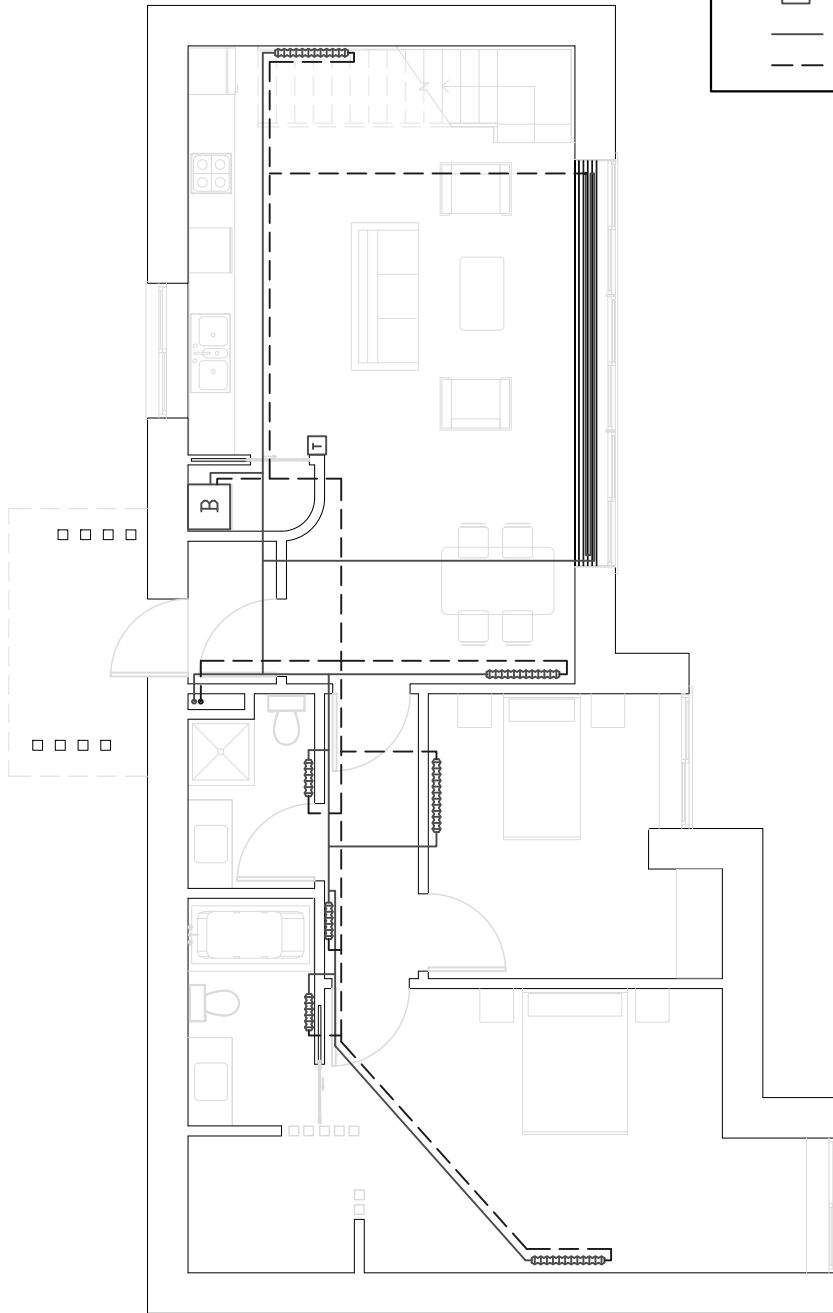




## SURFACES – Dwelling 1 . first floor

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development			UNIVERSITY OF HALMSTAD Sweden 

LEGEND OF HEATING EQUIPMENT	
	radiator with supply valve and thermostatic trap
	reaser
	boiler
	feed
	return



## HEATING – Dwelling 1 . ground floor

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina –ZARAGOZA–






**SCALE:**  
1:100

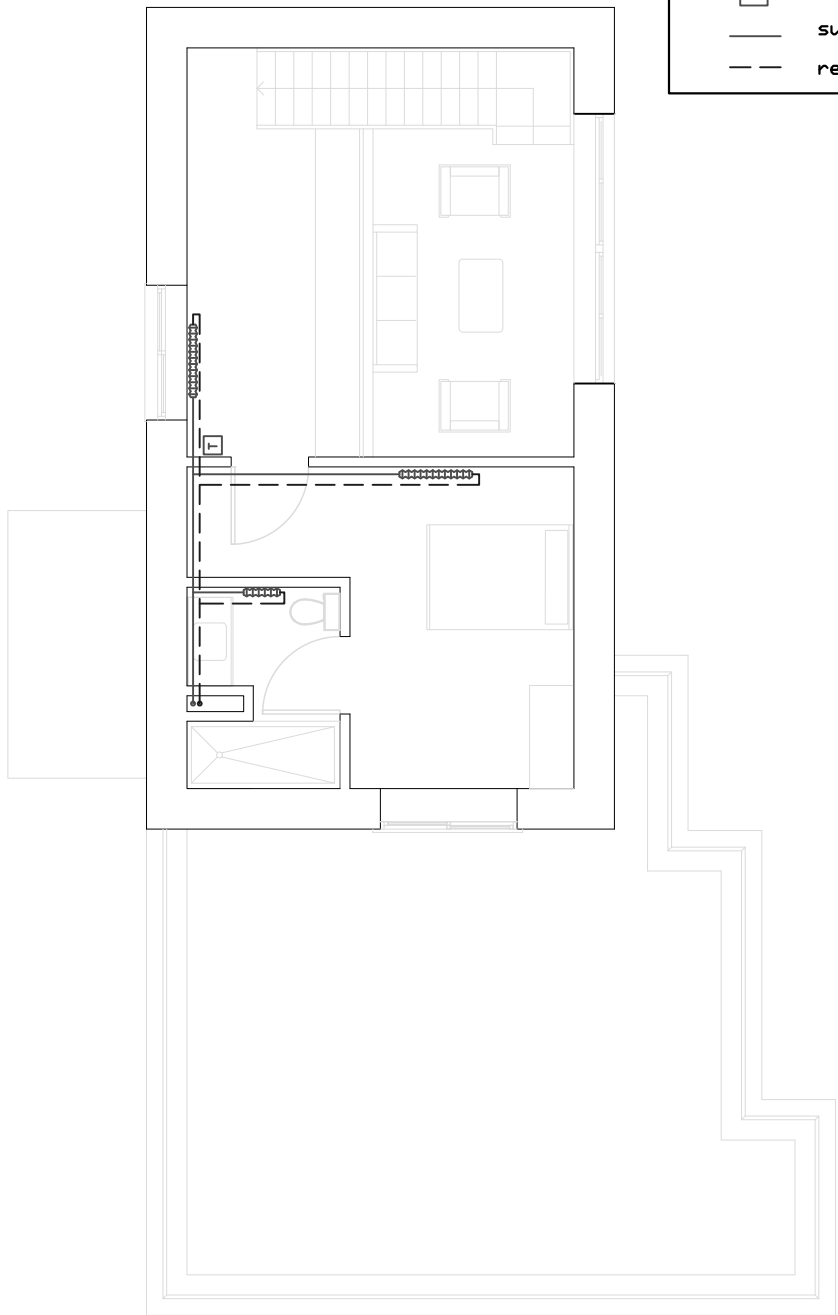
Housing development

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HALMSTAD  
Sweden





LEGEND OF HEATING EQUIPMENT	
	heating unit with supply valve and thermostatic trap
	reaser
	boiler
	supply
	return



## HEATING – Dwelling 1 . first floor

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina -ZARAGOZA-











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1:100

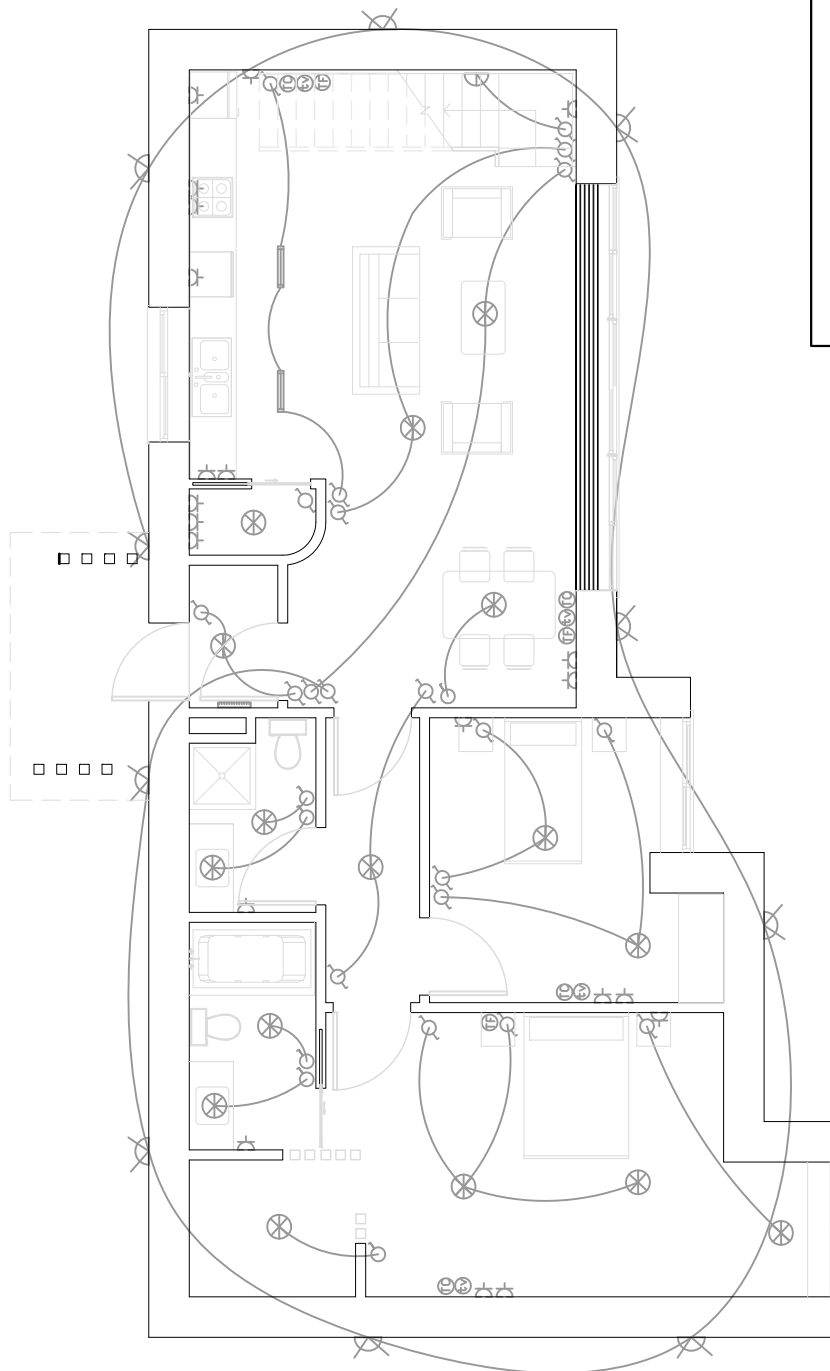
Housing development

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Sweden



LEGEND OF ELECTRICAL EQUIPMENT

-  Television Jack
-  phone Jack
-  Telecom Jack
-  light wall
-  switchboard placed
-  light
-  switch
-  socket
-  Strip light
-  Circuit breaker panel.



ELECTRICITY – Dwelling 1 . ground floor

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina -ZARAGOZA-











SCALE:  
1:100

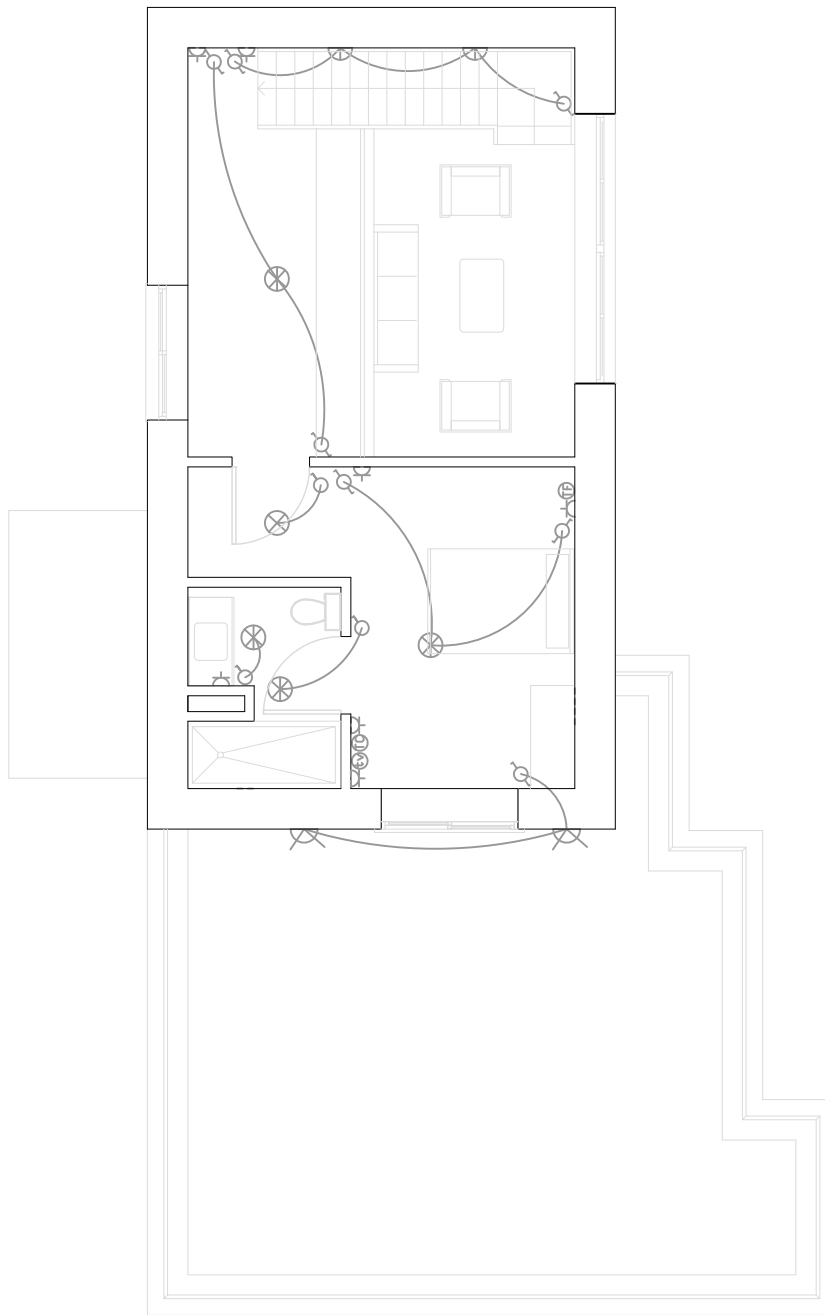
Housing development

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Sweden



LEGEND OF ELECTRICAL EQUIPMENT

-  Television Jack
-  phone Jack
-  Telecom Jack
-  light wall
-  switchboard placed
-  light
-  switch
-  socket
-  Strip light
-  Circuit breaker panel.



ELECTRICITY – Dwelling 1 . first floor

	Fecha	Ana-Cruz
Made by	2011 April	Callén Gil
Supervisor	2011 July	Åke Spångberg



**eupla**

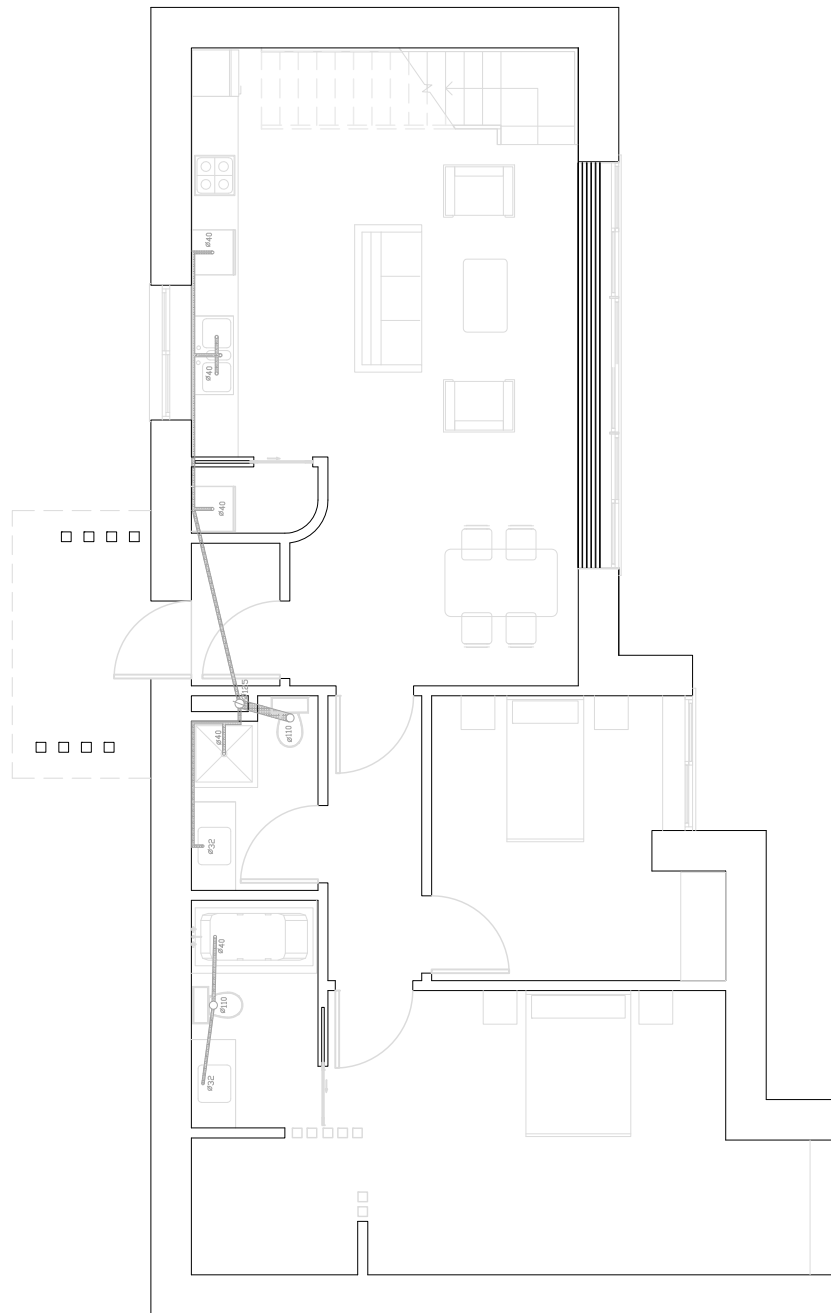
ESCUELA UNIVERSITARIA POLITÉCNICA  
La Almunia de D.Godina –ZARAGOZA–

SCALE:  
1:100



Housing development

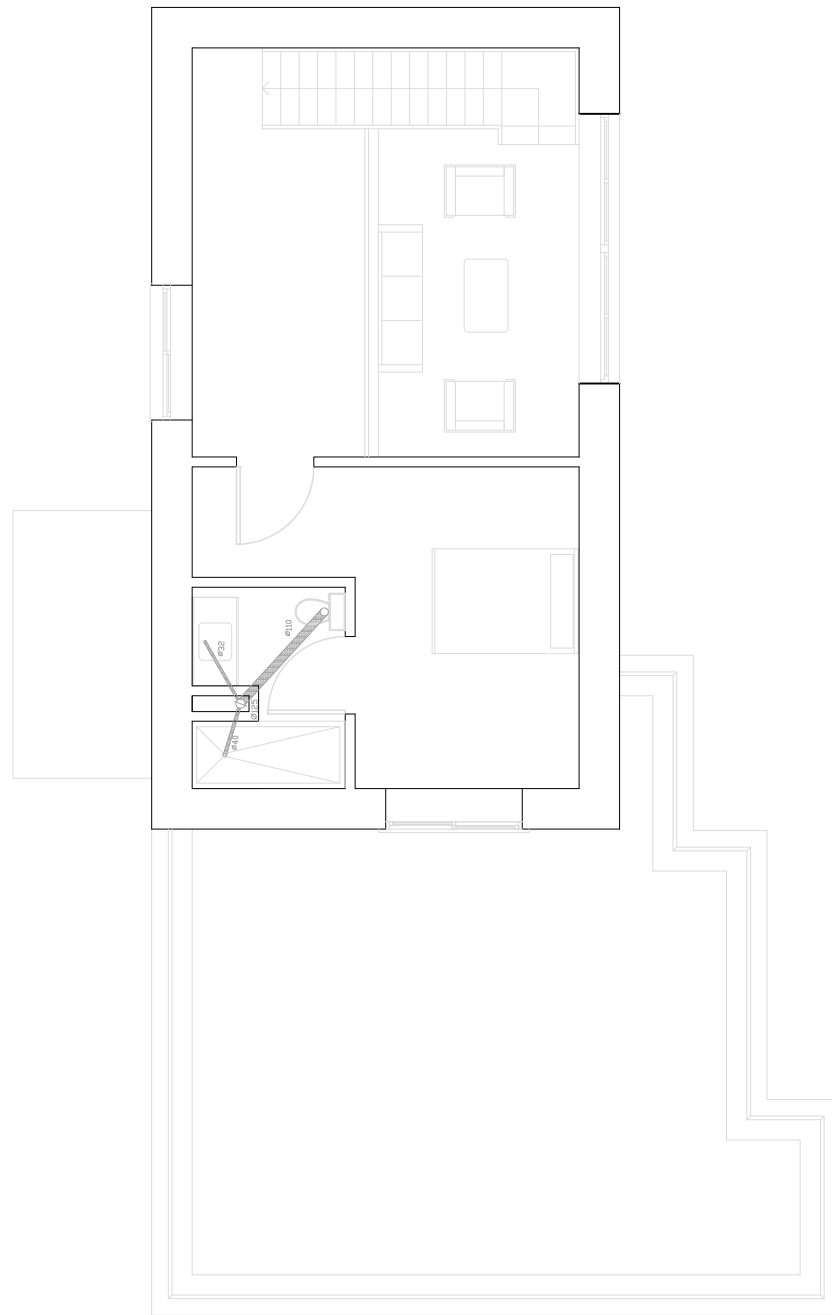
UNIVERSITY OF  
HALMSTAD  
Sweden







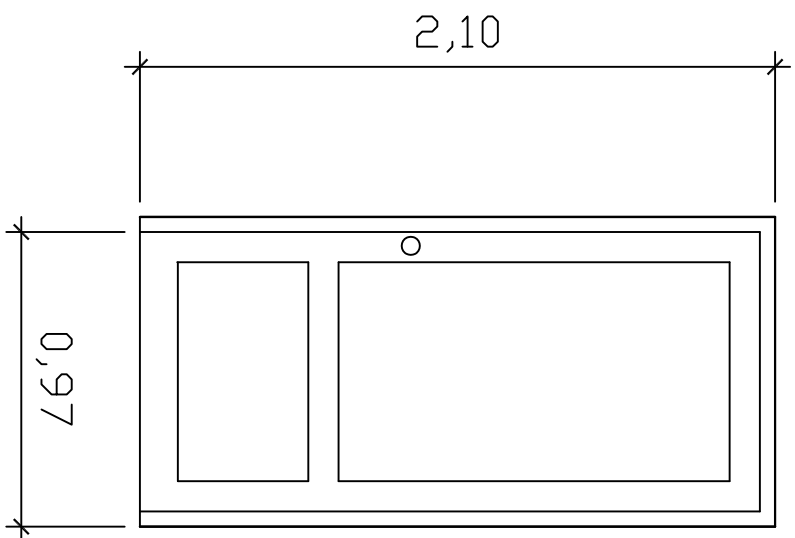
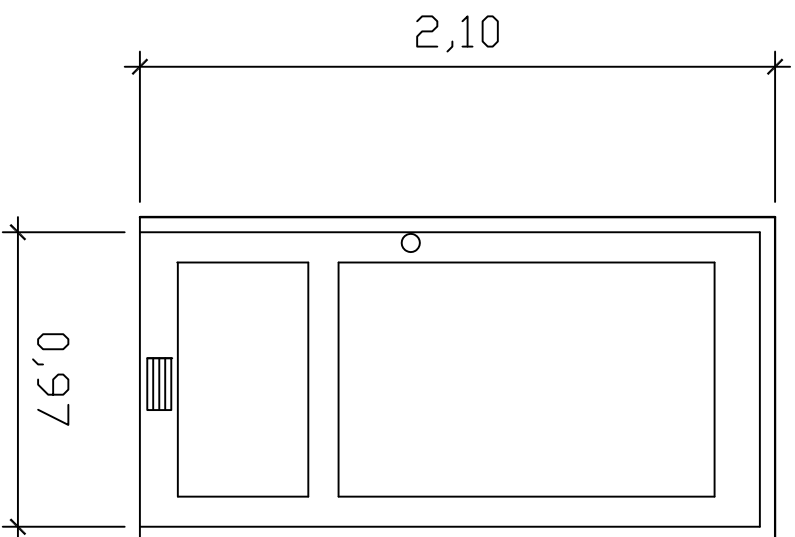
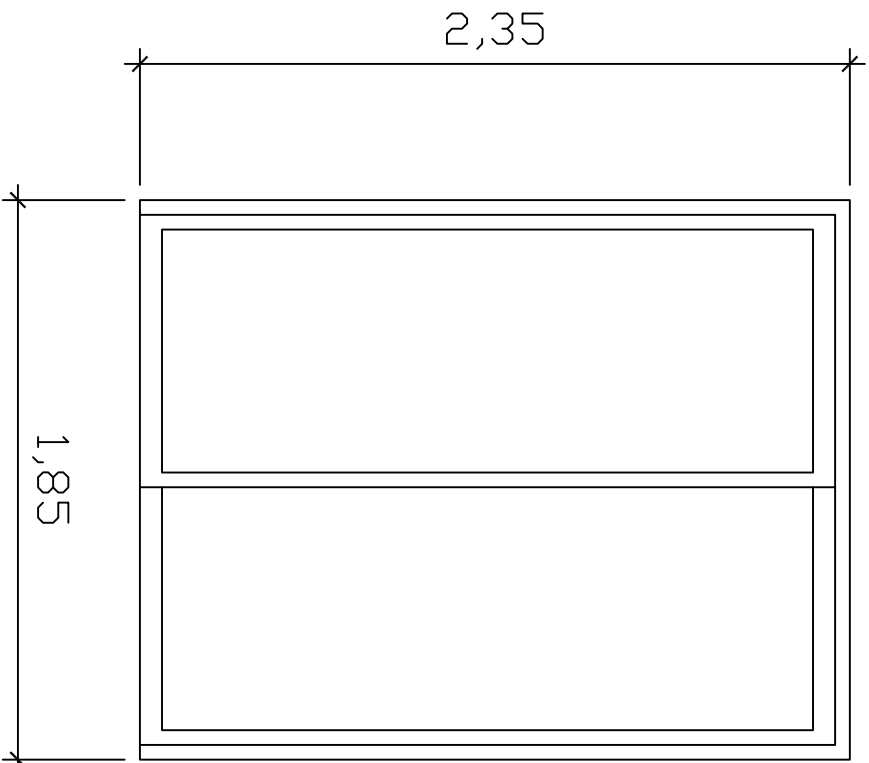
## SANITARY DRAINAGE – Dwelling 1 . ground floor

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development		UNIVERSITY OF HALMSTAD Sweden	



## SANITARY DRAINAGE – Dwelling 1 . first floor

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development		UNIVERSITY OF HALMSTAD Sweden	



## JOINERY – Dwelling 1

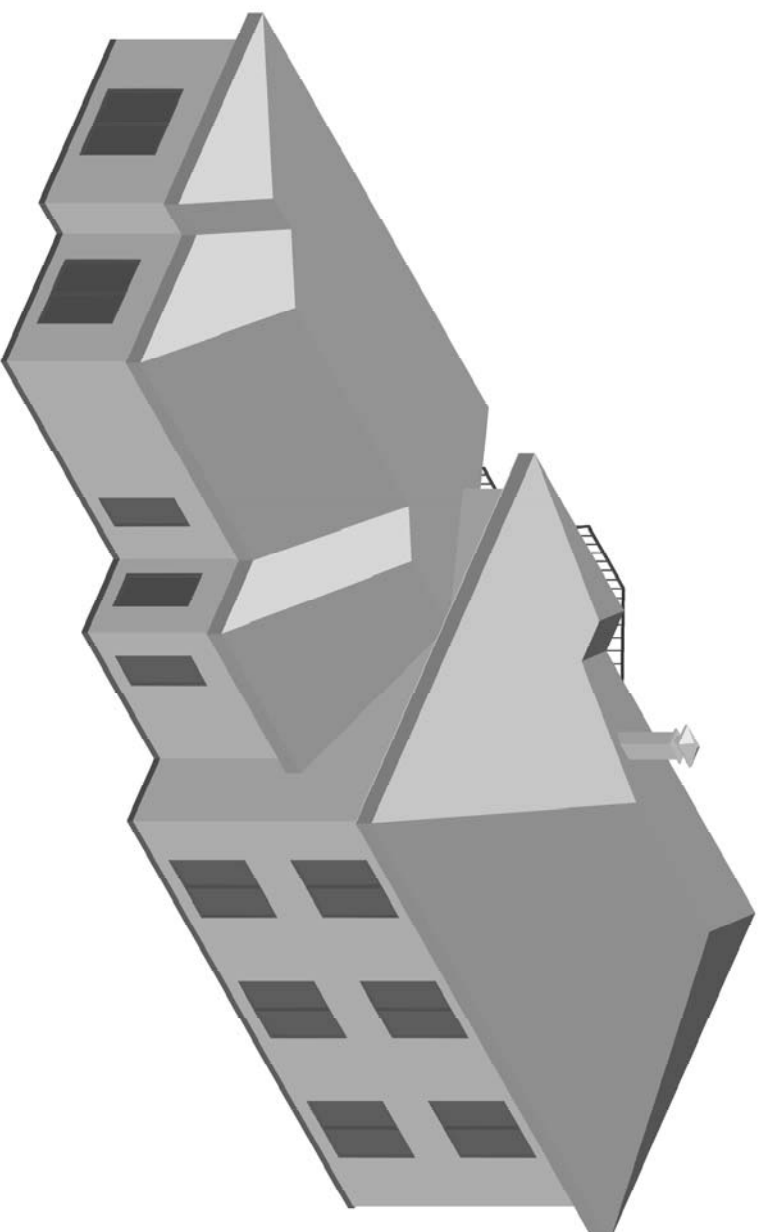
Fecha		Ana-Cruz	
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Ake Spångberg	
ESCUELA UNIVERSITARIA POLITÉCNICA		eupla	
La Almunia de D. Godina – ZARAGOZA			

SCALE:  
1:25


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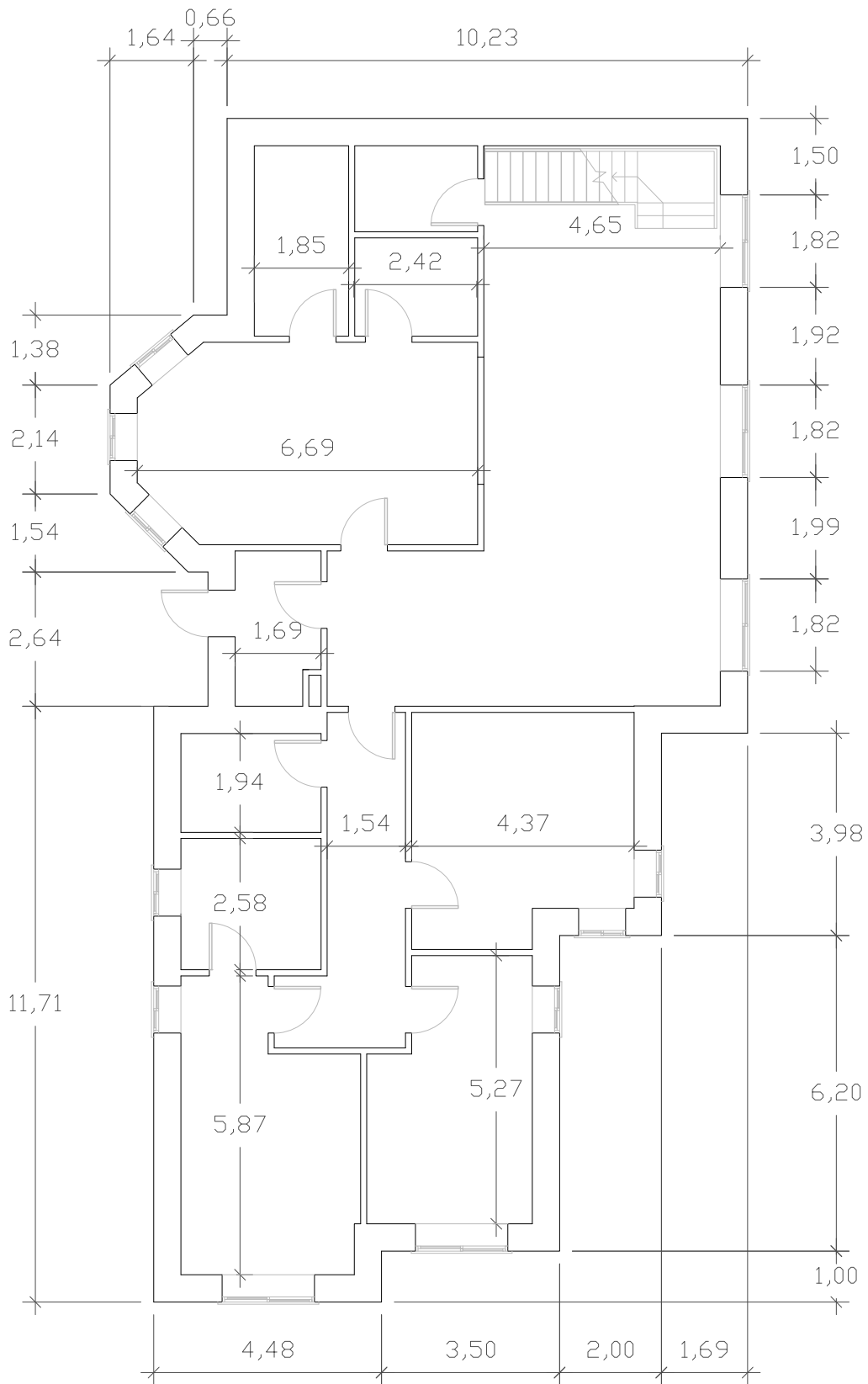
## Dwelling 2

	Fecha	Ana-Cruz		
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Ake Spångberg		
				 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Alhambra de D.Godina - ZARAGOZA-



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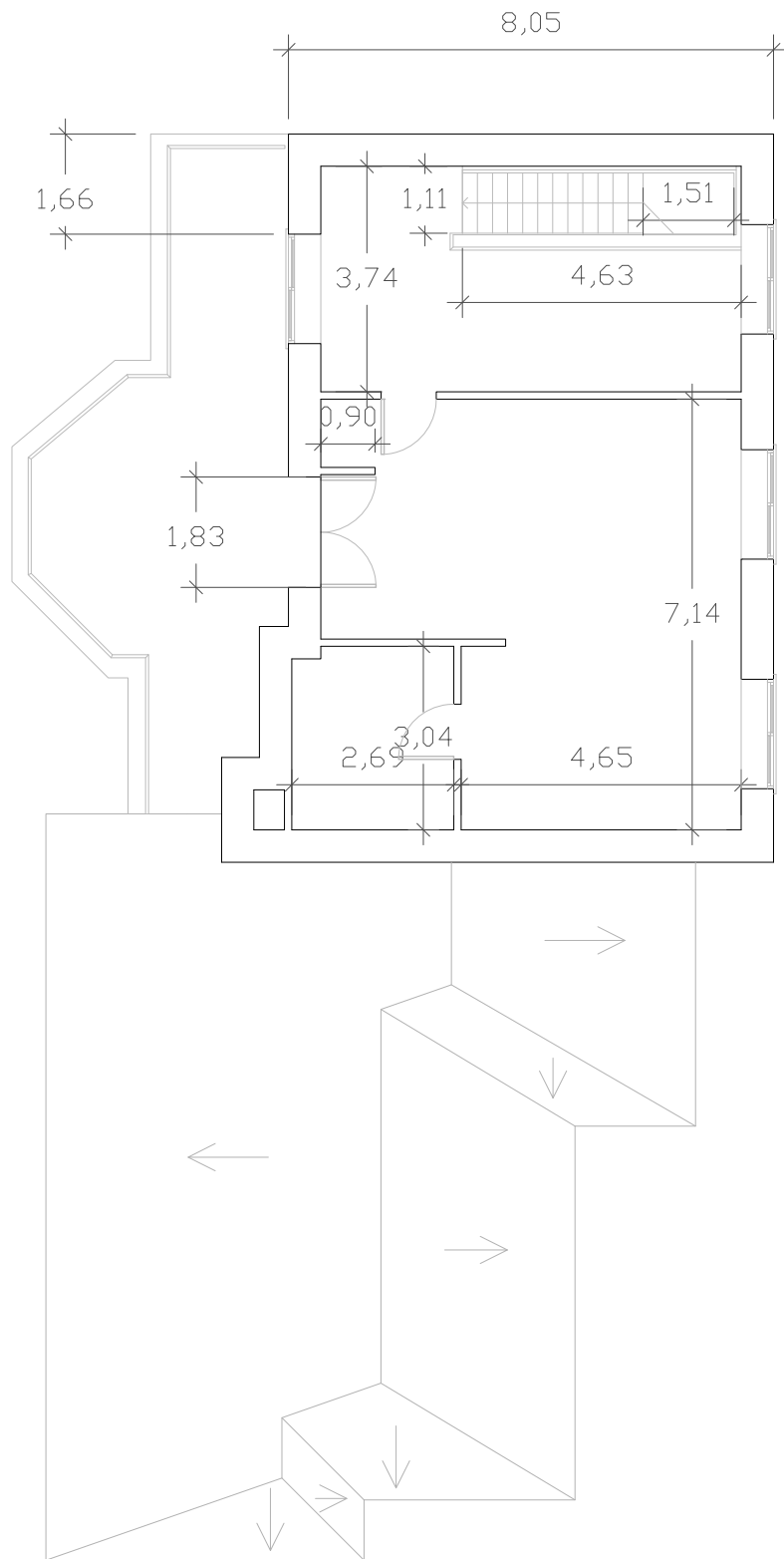






## DIMENSIONS – Dwelling 2 . ground floor

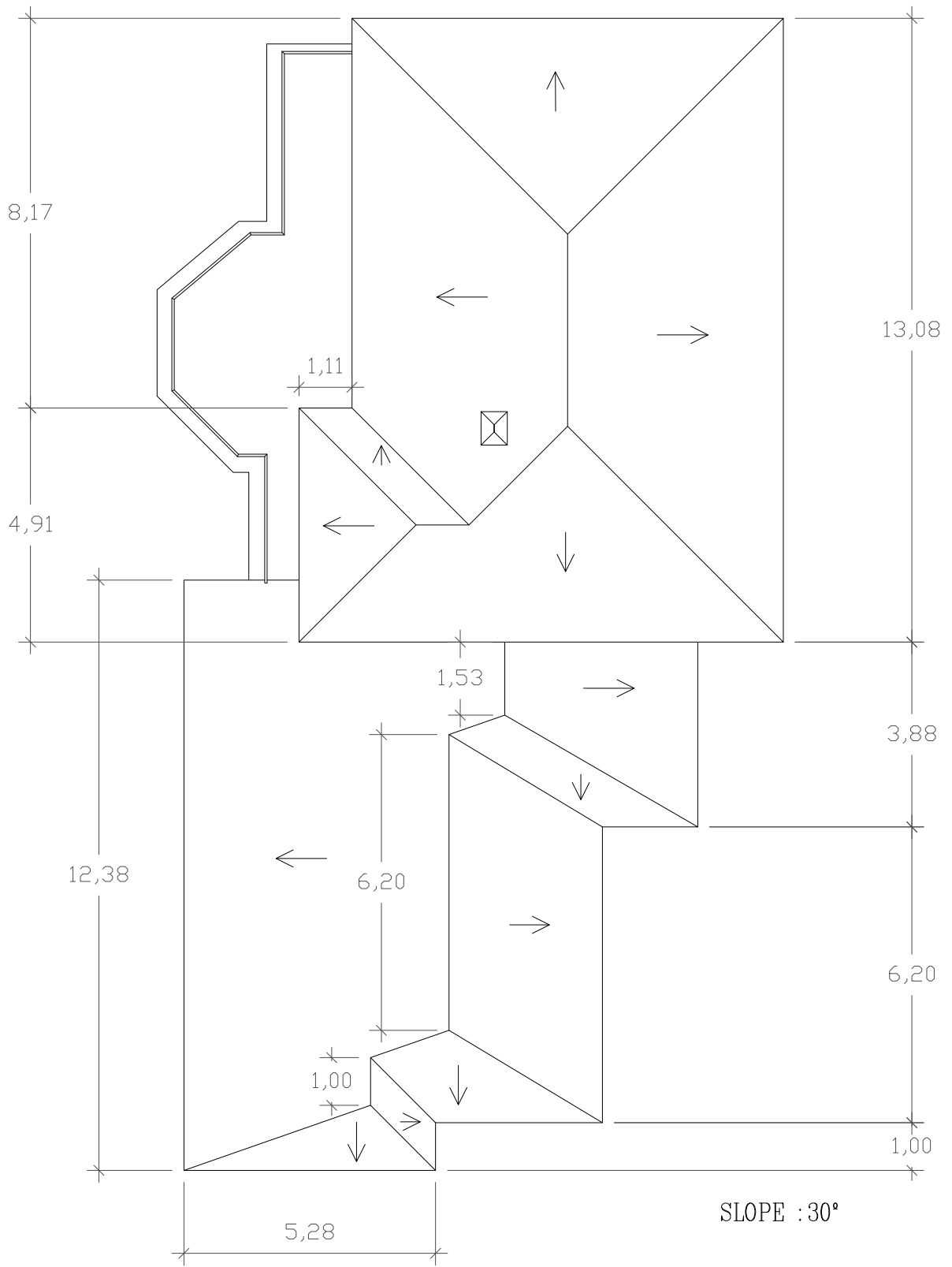
	Fecha	Ana-Cruz		 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:125	Housing development			UNIVERSITY OF HALMSTAD Sweden 





## DIMENSIONS – Dwelling 2 . first floor

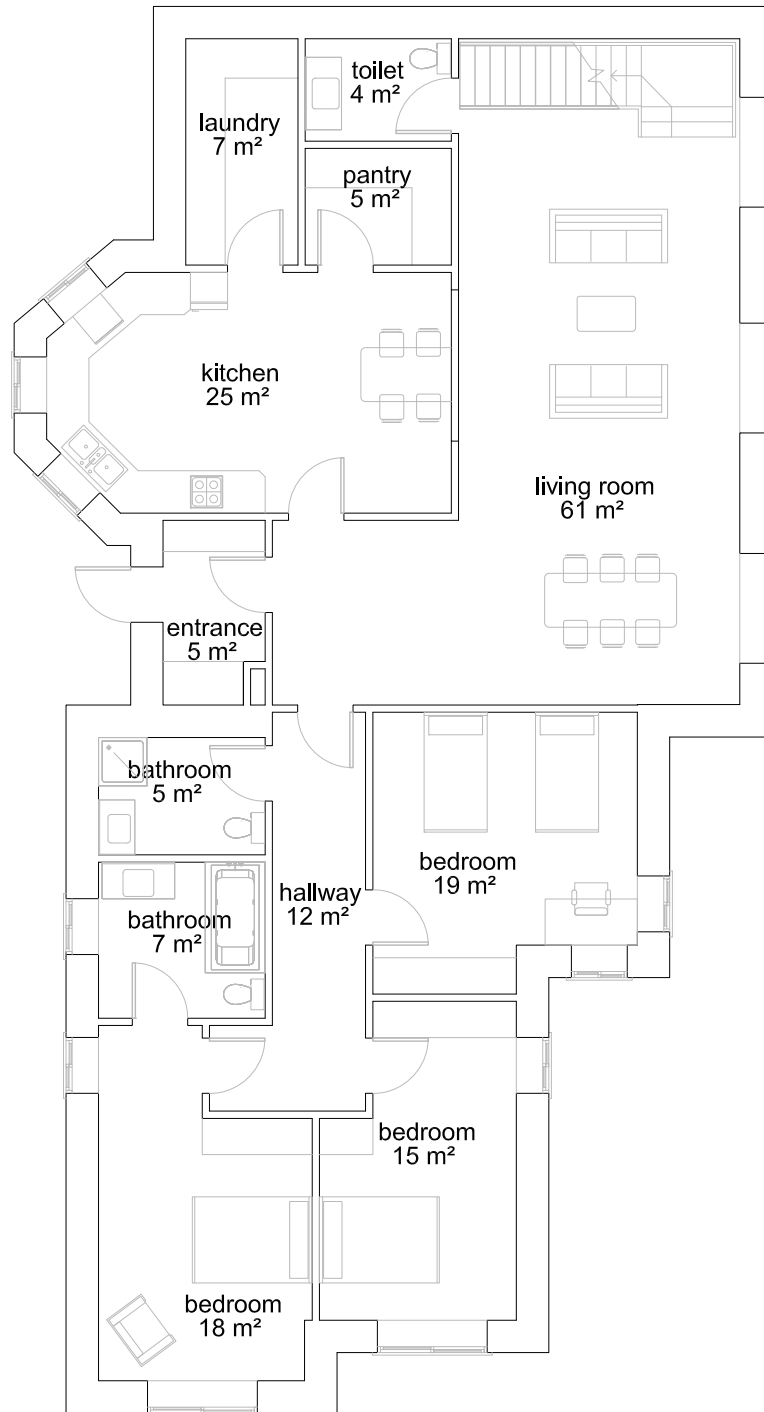
	Fecha	Ana-Cruz	 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Åke Spångberg	
<b>SCALE:</b> 1:125	Housing development		UNIVERSITY OF HALMSTAD Sweden 





## ROOF PLAN - Dwelling 2

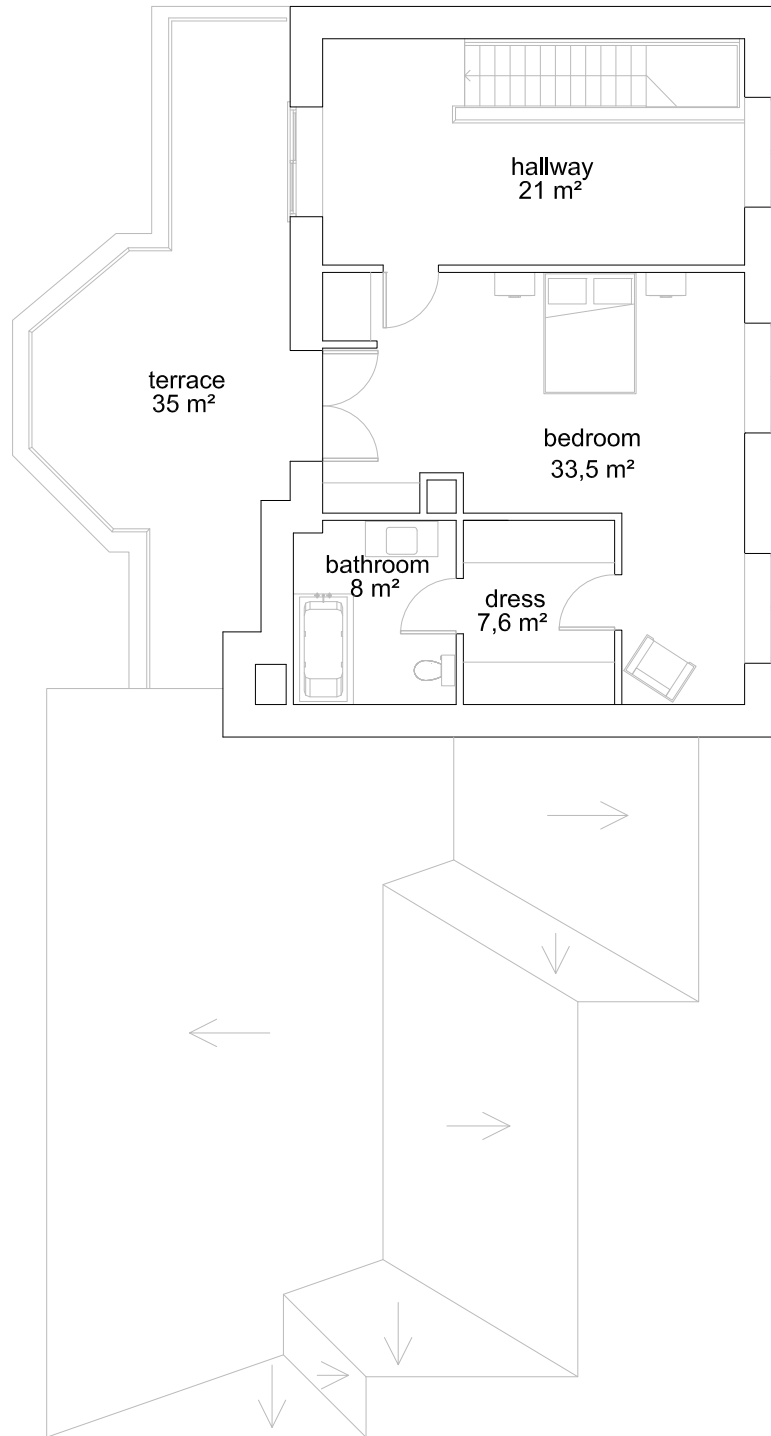
	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		

<b>SCALE:</b> 1:125	Housing development	UNIVERSITY OF HALMSTAD Sweden 
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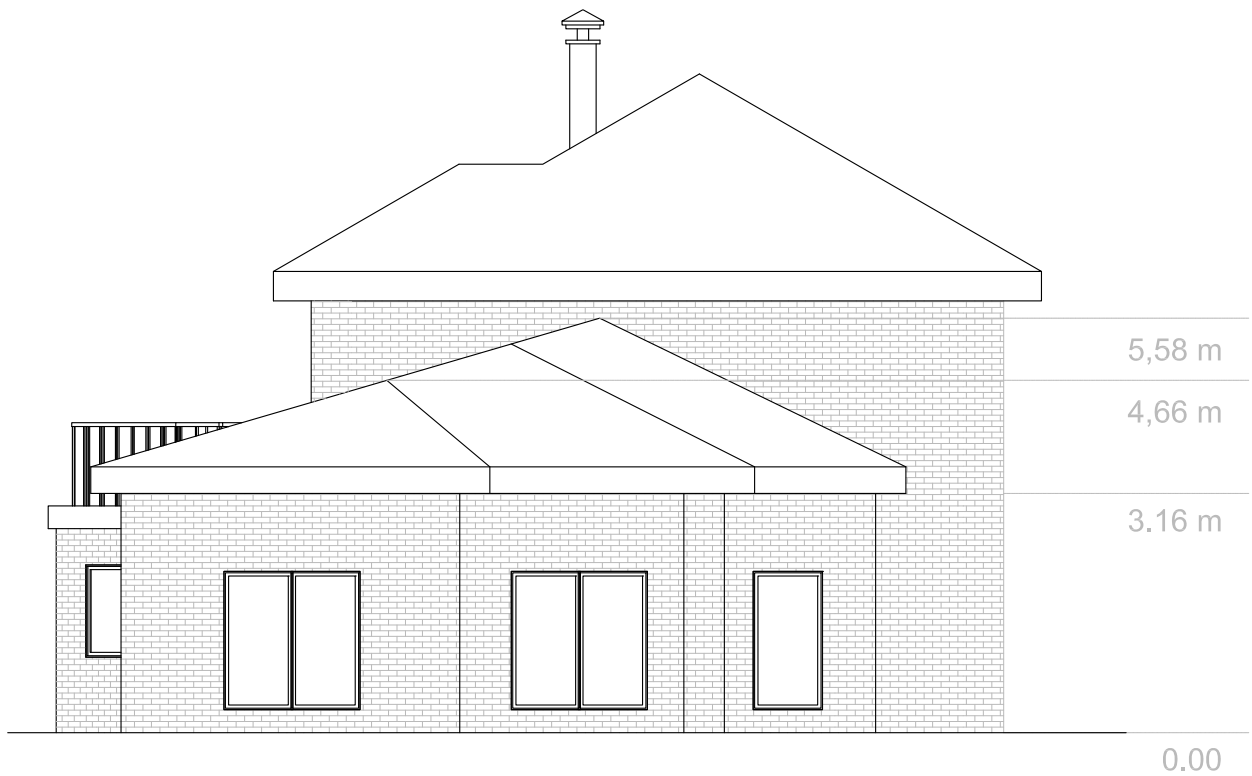
## SURFACES – Dwelling 2 . ground floor

	Fecha	Ana-Cruz	 <b>eupla</b> ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Åke Spångberg	
SCALE: 1:125	Housing development		UNIVERSITY OF HALMSTAD Sweden 




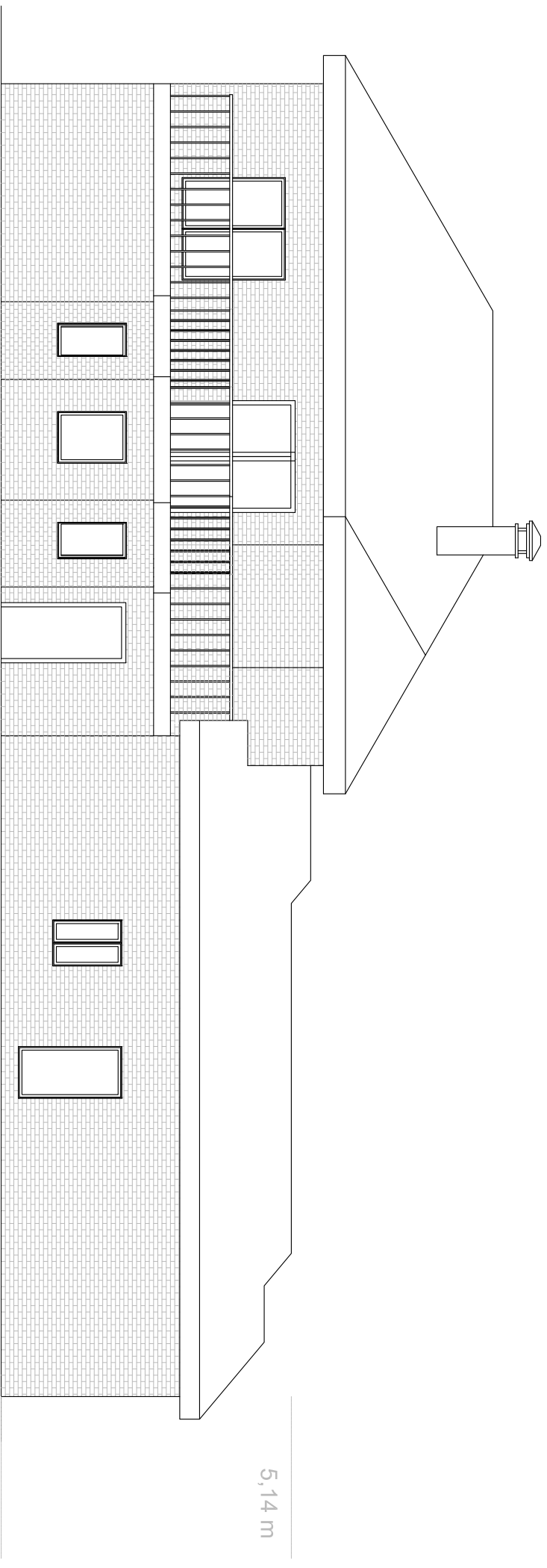
## SURFACES – Dwelling 2 . first floor

	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
SCALE: 1:125	Housing development			UNIVERSITY OF HALMSTAD Sweden 




## FACADES – Dwelling 2

	Fecha	Ana-Cruz		 <b>ESCUELA UNIVERSITARIA POLITÉCNICA</b> La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		
<b>SCALE:</b> 1:100	Housing development			UNIVERSITY OF HALMSTAD Sweden 



## FACADES – Dwelling 2

		<b>Fecha</b>		Ana-Cruz	
<b>Made by</b>		2011 April		Callén Gil	
<b>Supervisor</b>		2011 July		Ake Spångberg	
				 <b>eupla</b>	

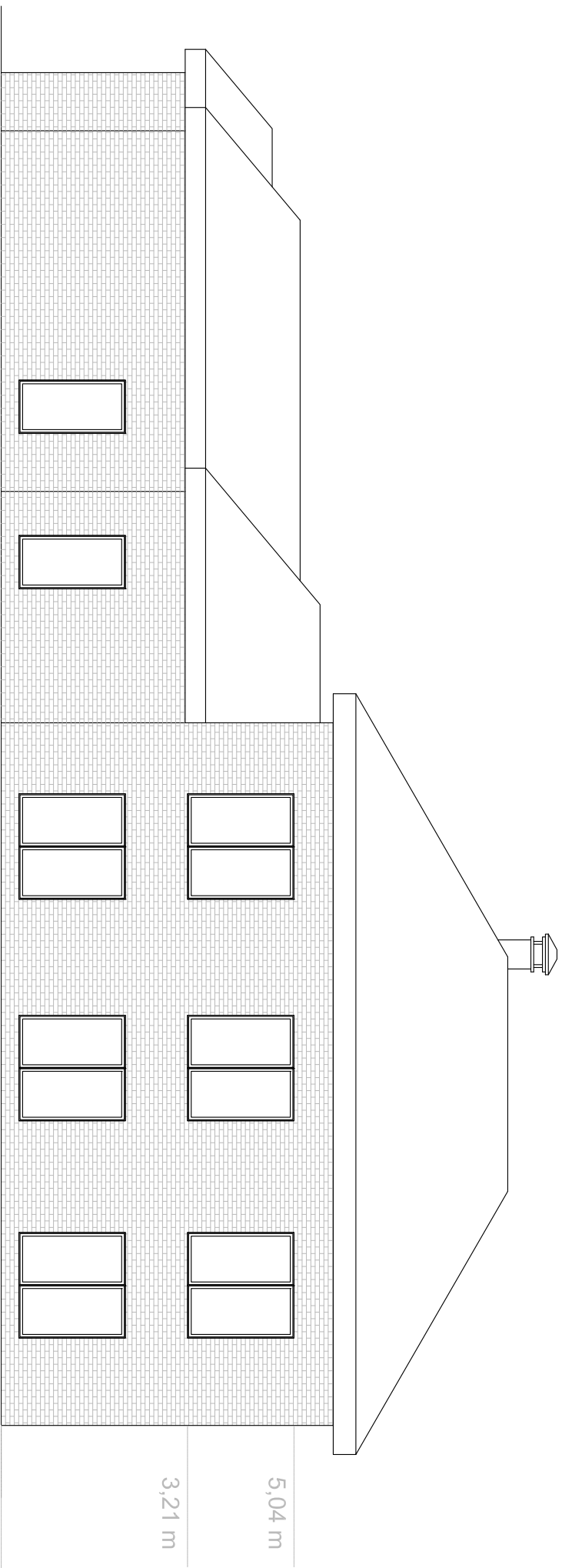
ESCUELA UNIVERSITARIA POLITÉCNICA  
La Alhumbia de D.Godina - ZARAGOZA

**SCALE:**  
1:100


Housing development

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HALMSTAD  
Sweden





## FACADES – Dwelling 2

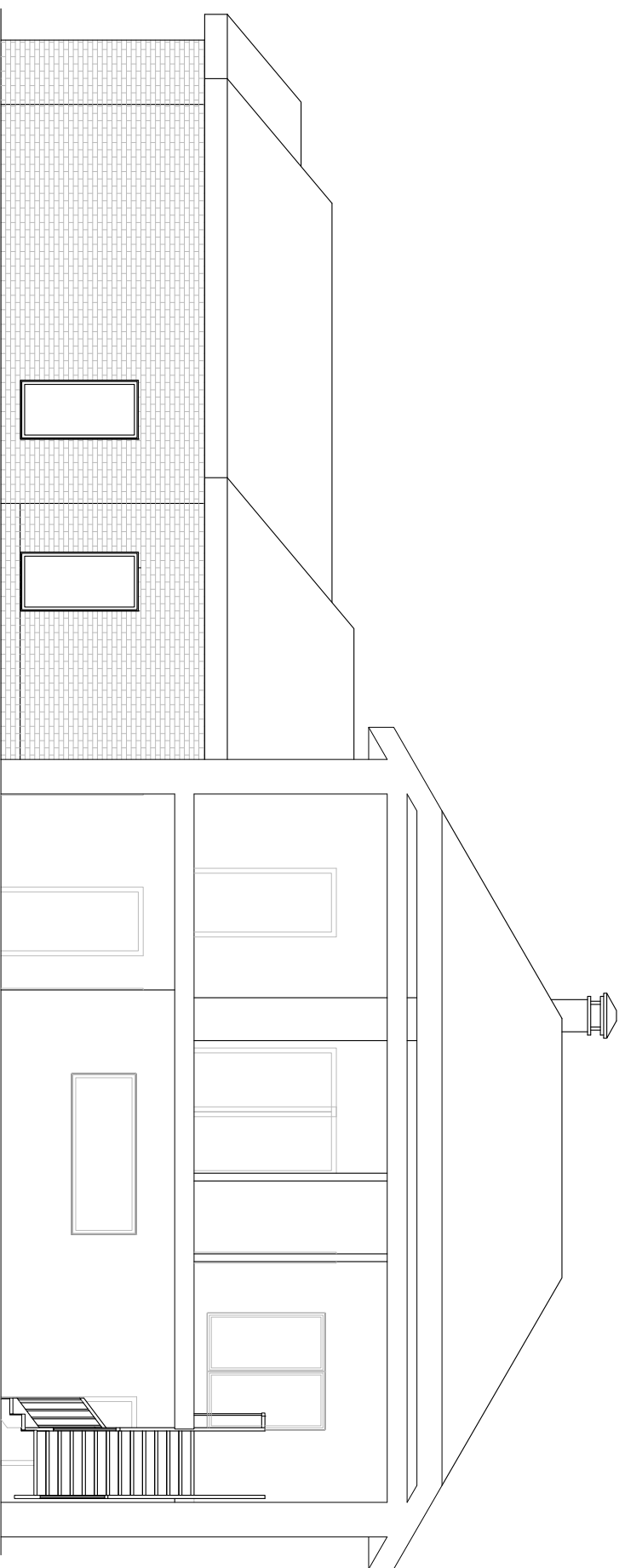
Fecha		Ana-Cruz		 <b>eupla</b>
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Ake Spångberg		
ESCUELA UNIVERSITARIA POLITÉCNICA 1ª Almunia de D.Godina – ZARAGOZA				

SCALE:  
1:100


Housing development

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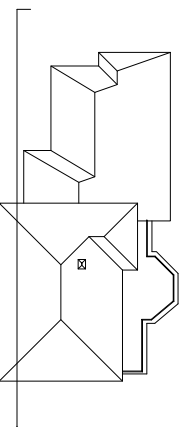
SECTION 01 – Dwelling 2

Fecha		Ana-Cruz		 <b>eupla</b>
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Ake Spångberg		ESCUELA UNIVERSITARIA POLITÉCNICA La Alhumbia de D.Godina – ZARAGOZA-

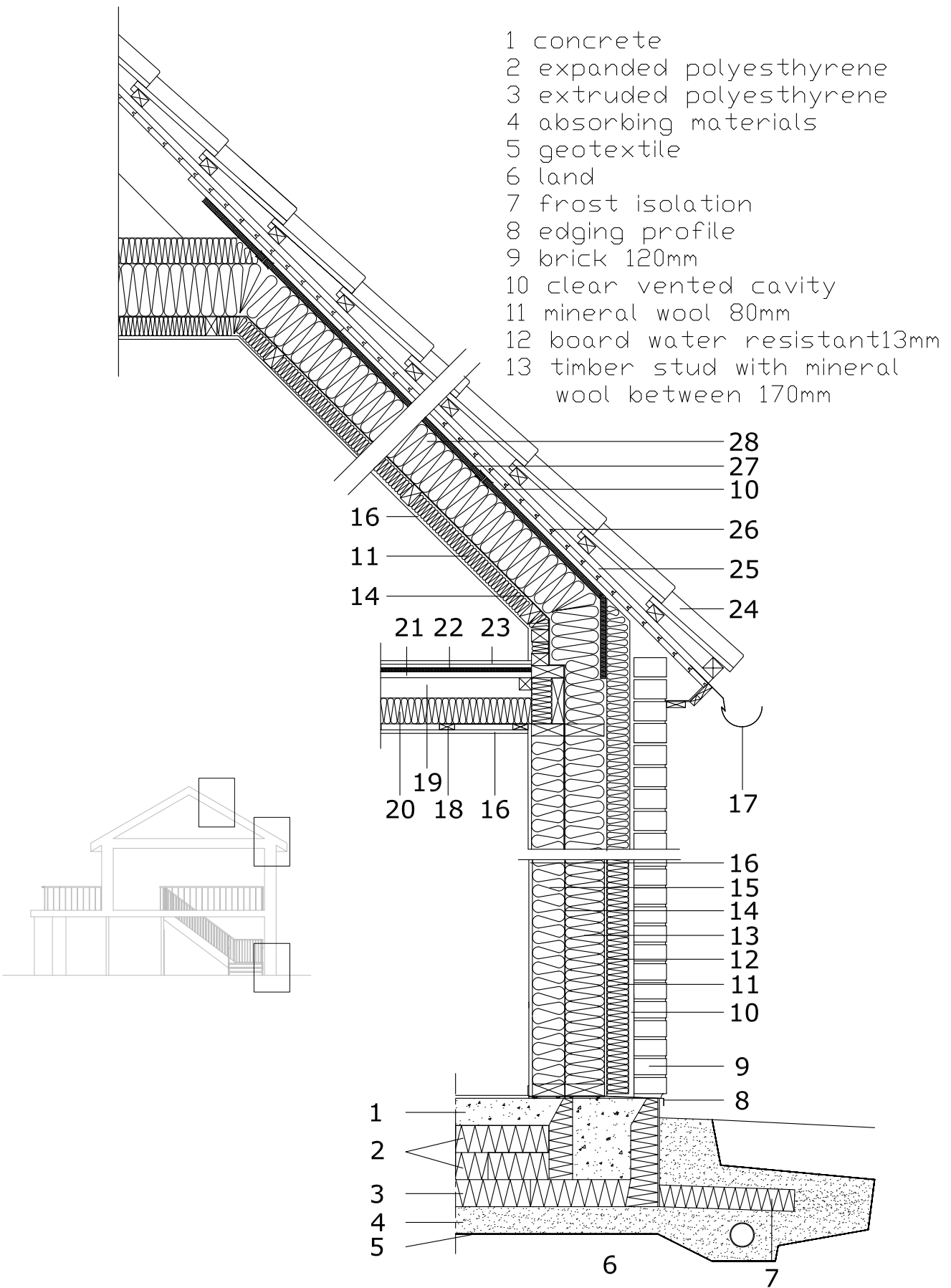
SCALE:  
1:100

Housing development

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Sweden





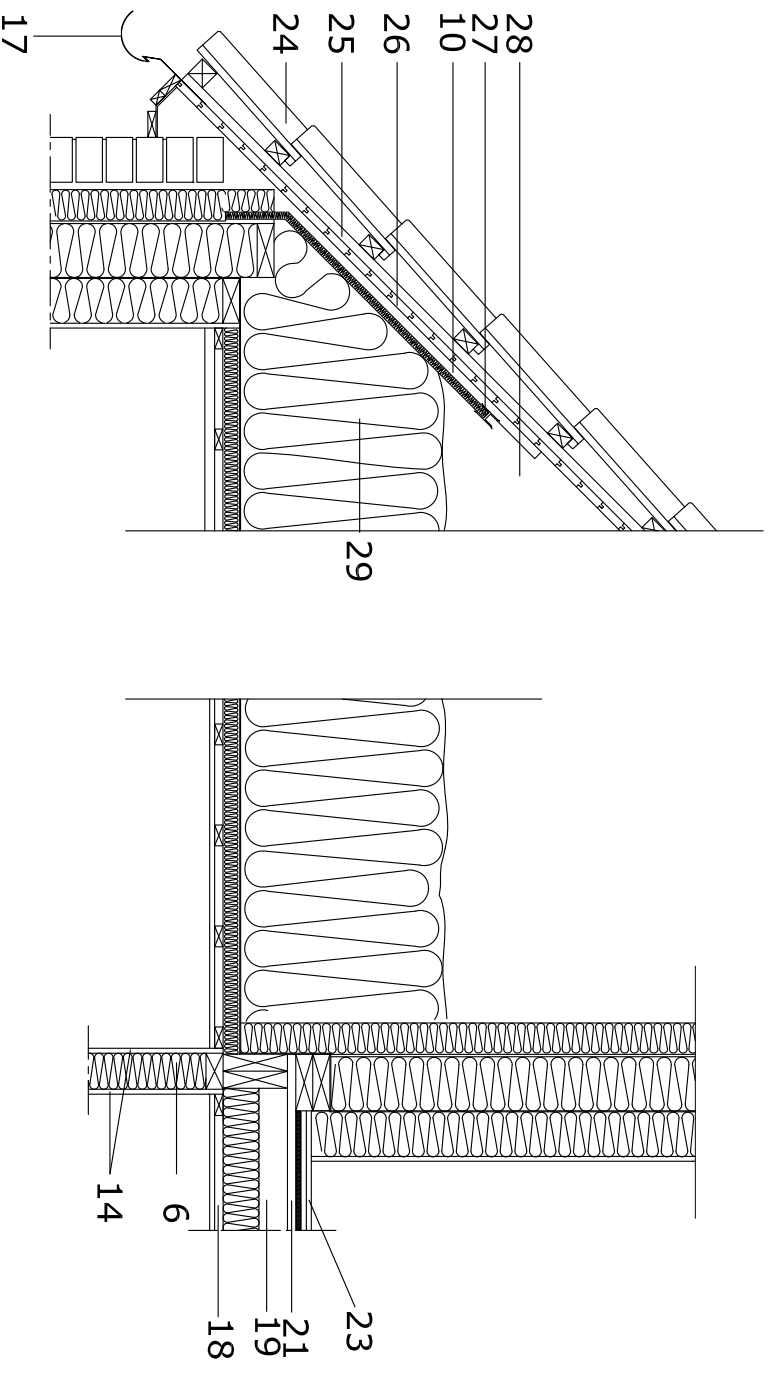


DETAIL 01 - Dwelling 2


	Fecha	Ana-Cruz		 ESCUELA UNIVERSITARIA POLITÉCNICA La Almunia de D.Godina -ZARAGOZA-
Made by	2011 April	Callén Gil		
Supervisor	2011 July	Åke Spångberg		

SCALE: 1:50	Housing development	UNIVERSITY OF HALMSTAD Sweden 
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- 14 vapour control and airtightness membrane, polystyrene foil
- 15 timber stud with mineral wool between 120mm
- 16 gypsum board 13mm
- 17 PVCgutter
- 18 wooden for furring 28mm
- 19 wooden beam 170mm
- 20 insulation Isover 95mm
- 21 chipboard 22mm
- 22 mineral wool 15mm
- 23 two gypsum floor board of 13mm
- 24 ceramic tile
- 25 battens
- 26 tongued and grooved board 22mm
- 27 mineral wool
- 28 195mm of mineral wool + 220mm timber stud
- 29 cellulose



SECTION 02 – Dwelling 2

Fecha		Ana-Cruz	
Made by	2011 April	Callén Gil	
Supervisor	2011 July	Ake Spångberg	
ESCUELA UNIVERSITARIA POLITÉCNICA		 <b>eupla</b>	
La Almunia de D.Godina – ZARAGOZA			

SCALE:  
1:50

Housing development

UNIVERSITY OF  
HALMSTAD  
Sweden

