FINAL PROJECT 2013-2014

“THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER”

Jesús Pizá Martín
409481 Group 59

Supervisor:
Ton Groenewegen
Reader:
Gualdino Duarte Pais

FINAL THESIS

" THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"

Group 59

Jesús Pizá Martín 409481

Supervisor: Ton Groenewegen **Reader**: Gualdino Duarte Pais

Graduation Placement at NoorderRuimte

February – June 2014

Hanze University of Applied Sciences

Zernikeplein 11- 9747 AS Groningen

The Netherlands.

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

ESCUELA TÉCNICA SUPERIOR INGENIERÍA DE EDIFICACIÓN

Hanze University Groningen

INDEX

2 BACKGROUND

Most of our lives take place in buildings, either at home, at work or while doing other activities. We use energy in buildings more than any other activity, as it is necessary in order to maintain a high quality of life and perform operations and maintenance of the building. We use it for heating, air conditioning, lighting and household appliances.

We live in a world of finite resources, where most of the energy consumed in the world comes mostly from non-renewable sources. Oil, coal and gas are consumed more and more each year, and we are getting closer to their global depletion. Hence the increase in price of developing products emanating from these resources, such as transportation as well as the energy cost of any housing.

This results in us trying to find the highest performance and the highest efficiency of all energy consuming products, not forgetting to mention also the highest energy efficiency in the buildings we construct. The building sector accounts for 40% of total energy consumption in the European Union. Reduction of energy consumption in this area is one of the most outstanding aims to achieve for the entire continent.

The high energy price is one of the main reasons for the increase in energy efficiency in buildings. However, we cannot forget another equally important reason like climate change in the world.

The consumption of fossil fuels produces CO2 and other dangerous gasses that are seriously harming for the planet and its inhabitants. This causes an increase in global temperature that gradually leads to the melting of the poles, with the consequent sea level rise and possible flooding of land areas of the planet.

Many of the buildings in which we live in are inefficient in terms of energy consumption or in terms of deterioration over time. Research systems available to us today should pose no problems in giving all of these minimum energy efficient buildings with all the benefits that entail both economic and environmental aspects.

It is our duty as Construction Engineers to contribute to this particular issue and to try to provide remedies for these problems by improving energy efficiency of new and existing buildings as well as improving the quality of life and comfort that is necessary for a healthy life within our home.

We have all the means and knowledge to improve. So let's do it.

3- ABOUT FRANEKER

3.1- Location of the city

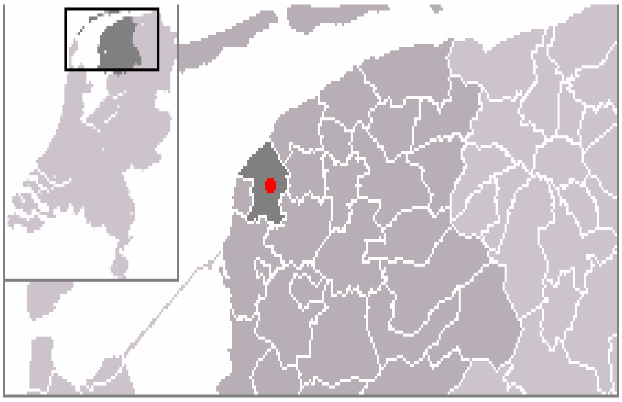


Image 3.1.1.- Location in the Netherlands

Image 3.1.2- City expansion

Franeker is one of the eleven historical cities of Friesland and it is the capital of the municipality of Franekeradeel. The municipality covers an area of approximately 10,426 hectares which includes the centre and 16 surrounding villages.

There are about 20 571 people living in the city Frankeradeel, with approximately 13,000 in Franeker. It is located about 20 km west of Leeuwarden and there we can find unique buildings specifically to that city such as the old Town Hall or the Church of Franeker.

Image 3.1.3-Old Town Hall of Franeker

Image 3.1.4- Church of Franeker

The most important of the two is the Town Hall which was built in Renaissance style between 1591 and 1594. The building was than extended in 1760 and the exterior was restored from 1887 to 1890 having now the same aspect.

Furthermore, something very typical and quite famous of the city of Franeker is the Frisian handball tournament which is played yearly and has been held in the city of Franeker since 1854, in a famous square on one of the main streets of the city.

Image 3.1.5 Square in Franeker

3.2- Location of the building

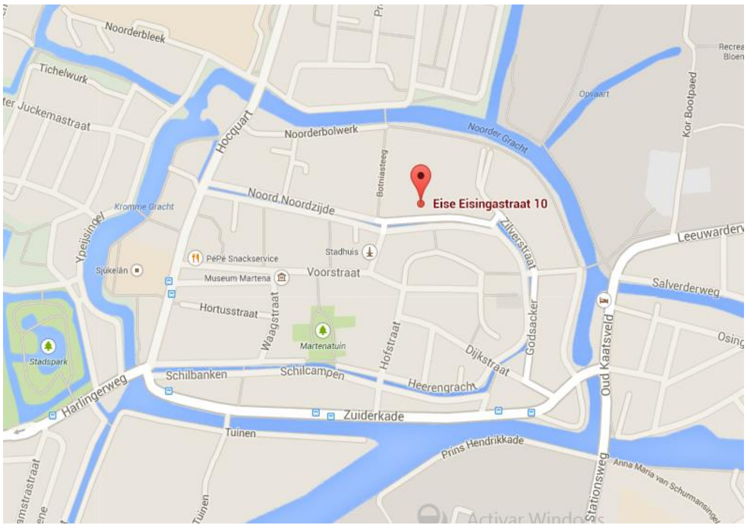


Image 3.2.1- Location of the house

The building that I am going to study is located on number 10 on the street "Eise Eisingastraat"(close to the Town Hall), in the historic part of the city.

All the buildings close to this one are very old. It is because all of them were built centuries ago, during the XVII century.

The city wants to preserve all the characteristics of these buildings because they give a rather specific character to Franeker's architecture, as they are the oldest buildings of the city.

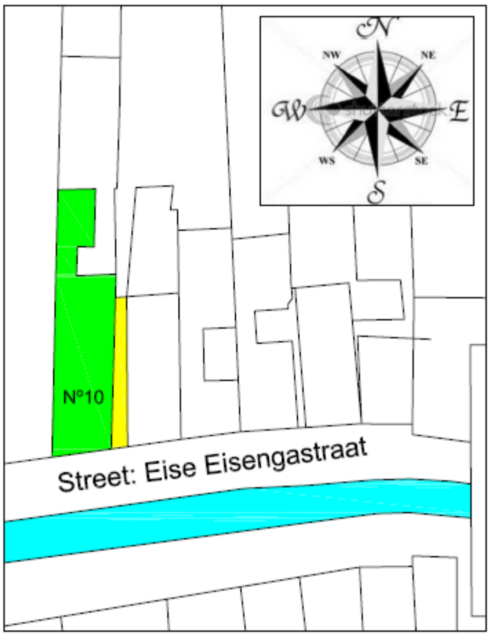


Image 3.2.2 Location of the building

In front of the Old Town Hall, there is a canal that splits the way in 2 streets, following a West-East direction. One street is named "Groenmark-Zilverstraat" and the other one is "Eise Eisingastraat" which is where the building I will be studying is located, as stated previously.

Image 3.2.3- Buildind of the project (At the middle)

The house has a small corridor (picture 3.2.2 in yellow) between its right wall facade and the next building, in order to have a direct access to go to the back part. On the left part of the house there is a small gap (around 15 cm wide in the immedite front between the two facedes which widens towards the back of the buildings), that separates the walls of the two buildings at the closest part of the street.

On the South facade (where is the main door in the street “Eise Eisengastraat”), we can find the main entrance to the building, being this part of the house the closest to the canal of the street “Eise Eisengastraat”.

4 ABOUT THE EXISTING BUILDING

4.1 General description

The building was constructed in 1617 with around 520 m2 built surface and a garden in the back part of the house. The house is split into two parts: a main building made up of three distinct floors (ground floor, first floor and attic) and a secondary smaller construction that is located at the back part of the main house.

Image 4.1-1 Main building

Image 4.1-2 Ampliation Smallback house

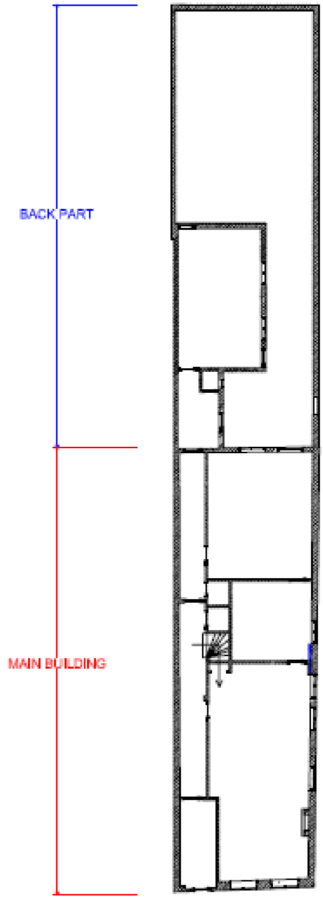


Image 4.1-3 Main building of the project

The comfort problems of the house are more present in the main part that is used more frequently by the family.

For that reason, this project will be focused solely on the improvement of thermal comfort in the biggest and most used part of the building We can see the distributions of all the rooms inside the building at the Plane 1 of the Annex 1.

4.2- Structure description

Regarding the building structure, it has a floor with a rectangular form that is the principal and largest direction of the building, perpendicular to the main facade of the building.

All the weight that the building receives is transmitted to the foundation by load-bearing walls made with stone solid bricks that normally have 21cm of thickness. We can see the distribution of materials in the actual wall at the Plane 7 in the Annex 1.

These walls receive the weight transmitted by the roof of the building and by the floors that divide the different heights of it. The main material of the horizontal structure (floors and beams) is wood, which has also been used when builiding the roof, in order to preserve most of the building's original aspects.

The different floors of the building, as the various levels, and the cover are also used to transmit all the weight from the wooden beams to the different bearing walls of the building, where the beams are supported.

The superficial floor material is also made mainly of wooden slats that cover all the surface of the floors in almost all the building.

At the images 4.2.1 and 4.2.2 we can see the direction of the wooden beams inside the building leaning on the two side walls.

Image 4.2.1. Wooden beams

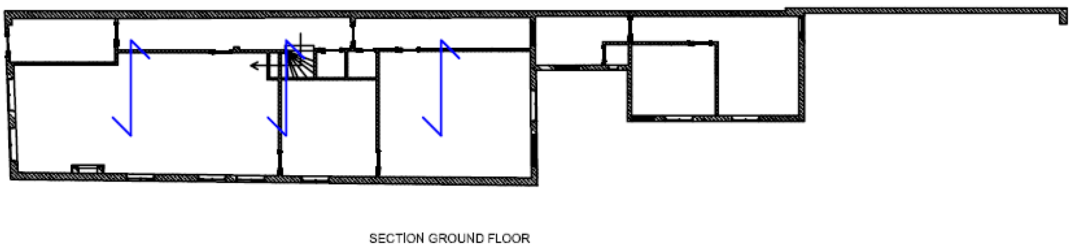


Image 4.2.2. Beams direction

4.3- Main facade description

On the facade, the first two floors of the building are made with a wall of solid red stone bricks with light grey mortar and large windows that cover much of the surface of the facade. These old windows, as it is possible to see, have traces of surface condensation. The difference of temperature between the inside and the outside of the building is producing the condensation partition on many of the window, mainly on the South facade (the closest to the canal).

The roof is formed by an inclined ceramic tile deck, whereby the attic of the building that carries rainwater to a hidden gutter at the bottom of the roof, is placed just below the attic window. Above it there are white mouldings that decorate the façade's top with matching white around all the window's openings and on the chimney.

Image 4.3.1- Main facade of the building

Downstairs there are three holes: two windows (on the right) and the front door (on the left) and of all of them have a little glazing on top that allows the entrance of light into the building. The first plant is also formed by three openings/windows such as the ground floor, with lintels straight bricks of the same type as the rest of the facade.

In the highest part of the roof, we can find the chimney of the building, right on the ridge of the roof and being built using the same type of stone bricks of the main facade.

As for the windows, they have wooden frames painted in green and a glass with very little thickness has been used. The windows are quite big in size, allowing light and air into the building. They all have white on the outside part of the perimeter which makes the building's facade more striking and appealing.

This part of the house, with the roof have a historical importance for the building because preserve the typical features architecture of the XVII

4.4- Roof description

The upper section is also one of the most important parts of the building in terms of historical value, as it was built in 1617 with a structure made of logs and has been maintained untouched ever since.

Image 4.4.1 Roof of the building

The upper level of the building consists of the attic of the building. Currently, it is almost empty , as we could only find the boiler of the heating system and some old junk inside.

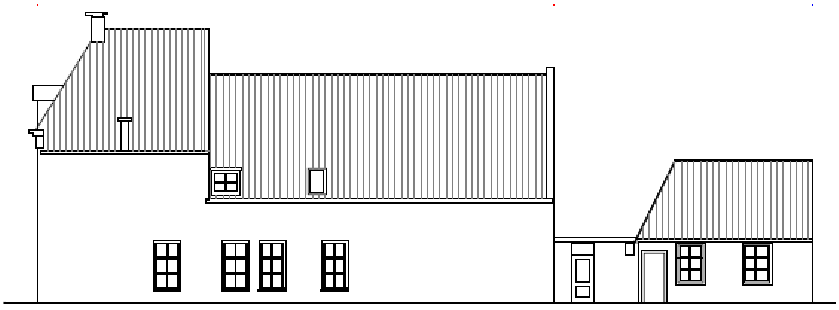


Image 4.4.2 East facade of the building- Different attic levels

The attic consists of two separate levels , causing the building to have different heights, with the highest top next to the main facade . The element that separates these two levels is a great wall of solid stone bricks.

As for the materials, the main material that has been used when building the attic is wood, except for the brick wall and the chimney flue. In practical terms, the entire deck has been build only with pieces of wood from the ground formed by slats, the supporting structure that gives shape to the deck is constructed with logs and the entire layer of boards that cover the entire surface of the deck that is covered at the exterior part with roof tiles.

As for the chimney , it is formed by a pipe-like structure made of bricks, in order to insulate the heat and prevent a possible fire. The conduit rises to the top of the roof using a wooden structure that helps also to get to the outside as it is possible to see in the image below .

Image 4.4.3 Chimney structure

It is also important to mention that there are 2 small windows, one on each side of the attic, on the main front and the back . Here we can see that there have been some problems of air leaks trying to be solved with small peaces of cardboard.

Image 4.4.-4- Air leaks attic window

Image 4.4.-5 Water filtrations on the attic

In addition to this finding, we also discovered filtration water filtration problems that are quite typical to find in old covers, as a they are always exposed to the weather outside and to a more agressive environment that can damage the constructive elements.

The roof structure of the original building , having been built during the seventeenth century, has a unique structure that has not been used after that particular century. This important feature and the fact that during the centuries this particular way to build houses and rooftops has been lost in order to have a more industrial approach to construction, is one of the main features of this deck that gives it its historical value .

The chimney in the middle of the roof is also one importan feature that have this kind of buildings because they needed of a auxiliary structure to rise to the top of the attic

4.5- Old functions of the building

The building in Franeker , before being used currently as a residential building has had several different uses.

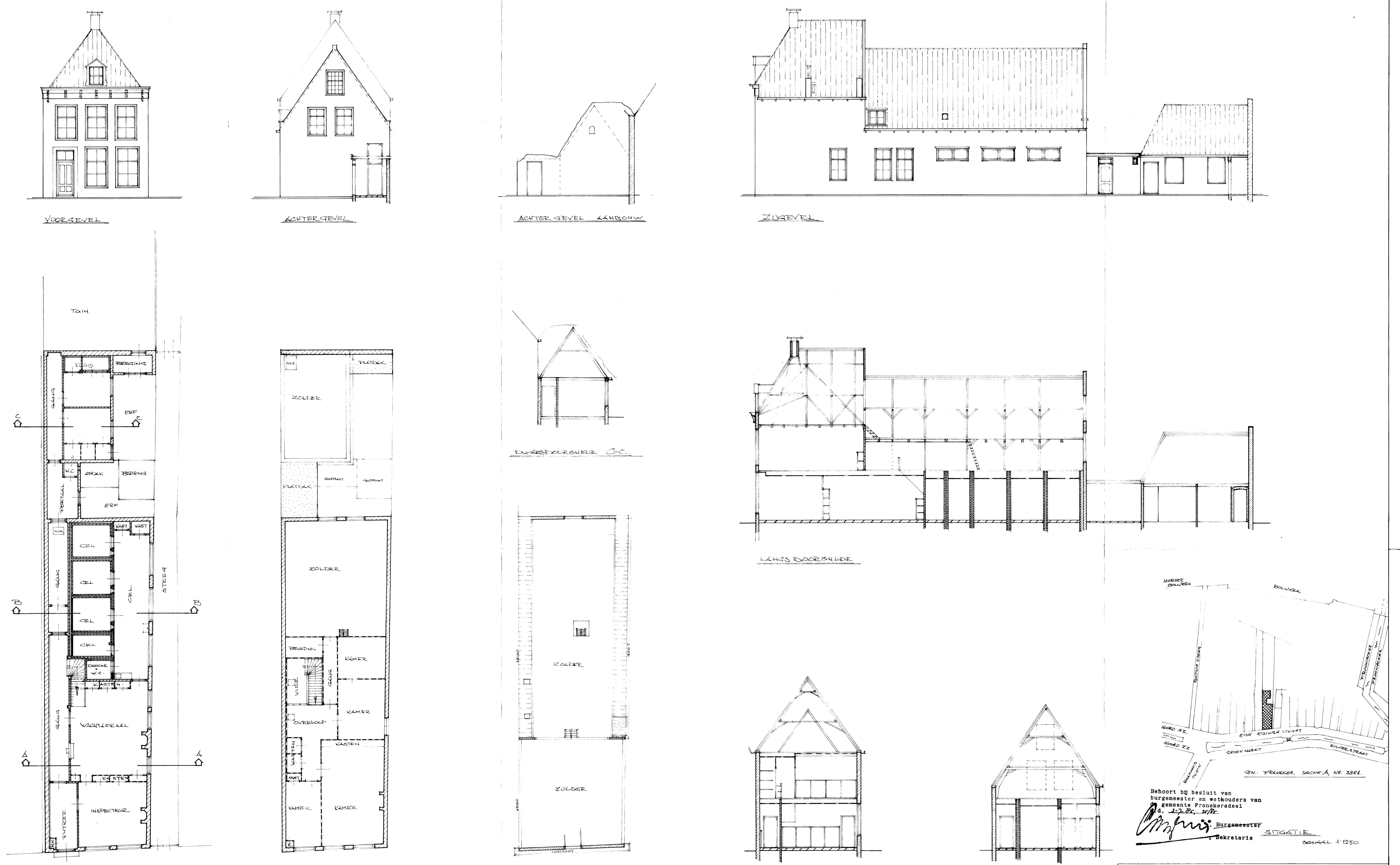
We have acquired informations about two old functions of the house, one during the Second World War and the second one after the liberation of the Netherlands.
During the World War II at the German ocupation, the house functioned as a headquarter to control the food distribution, as the Germans used ration cards and identification booklets.

These ration coupons from the building have had a crucial role , as they were the only way to have food throughout the Second World War , which lasted from 1940 to 1945, when the city of Franeker was liberated from the Germans in mid-April 1945 along with part of the north of the Netherlands, by the Allied forces, composed from Canadian soldiers.

It is not known the exact moment in which the building ceased to be used as a distributor of these coupons, as even after the war, the great famine from the war also made the food to be particularly scarce for the population .

We do know that the building was subsequently used until 1984 as a police station, and now, we can see exactly what the building looks like during that time, as we have observed the building plans in the city of Franeker, and thus we could identify which different rooms of the building were used at that time, as seen on the planning of the building on the next page.

Image 4.5.1 Old picture of the house



Behoort bij besluit van
burgemeester en wethouders van
de gemeente Franekeradeel
d.d. 3-7-85, 35/85

Burgemeester

Sekretaris

werk: RESTAURATIE VOORM. POLITIEBUREAU, EISE EISINGASTRAAT 10 FRANEKER	werkno.: 8415
opdrachtg.: ST. TOT BEHOUD V.H. FRANEKER STADSSCHOON	get.: Ni.
onderdeel: OPMETING	datum: MEI '84
architektenburo n. j. adema 8801 KD franeker "POOLSHOF" FROONACKER 14 tel. 05170-6332 — gew.:	schaal: 1:100 EN 1:1250
	formaat: 100x75 CM.
	bladno.: 1

4.6- Reformation in 1985 & 2000

4.6.1 Reformation in 1985

In 1985 the building in Franeker was restored. During the restoration, the works have focused on improving the general conditions of the main part of the building, its general insulation as well as changing the use from Police Station to a residential house. The new design was made by the architect N.J. Adema who also lives in the city of Franeker.

Mainly, the changes done during the restoration were made to prepare the house for a residential use, doing works like:

- Demolition of some parts of the building,new division of the spaces of the house.
- New floor materials
- Gutter installation
- New finishing touches
- Kitchen equipment

➢ About the insulation:

- Restoration of windows and frames
- Insulation between the interior levels of the building
- Increasing of the insulation at the main facade. Mainly, before the restoration in 1985 the house had a stone wall of 21 cm of thickness plus a extra layer of atone bricks at the main facade. At the restoration the architect installed on the old walls:
    - 2 structures of wooden slats of 5 cm with air between the slats
    - New layer of insulation between the 2 wooden structures
    - Plasterboard layer
- Insulation of the ground floor with soil

We can see all the details from the existing shape of the building seeing all the constructive elements in the planes 7 and 8 of the annex 1, keeping in mind that the oldest part of the constructive elements are the stone wall of the facades and the roof. All these details have been made with the data that the documents of the restoration and the architect gave us.

➢ About the installations:

- Gas, electricity , hot and cold water installations and a heating system.
- Sanitation facility and a ventilation system

At the final of the project, we will be able to see the documents of the restoration with the details of all the modifications that the architect made in 1985.

It is important to mention that, around the year 1990, the normatives for the preservation of historical buildings became more strict in all the Netherlands. That is the reason why, during the restoration in 1985, the architect had less impairments when making modifications in the historical building as he had fewer restrictions than nowadays.

4.6.2 Reformation in 2000

However, the reformation in 2000 did not have the same importance. Mainly the new changes were done at the back part of the house, which is the part that the family that lives there does not use frequently.

In general, during that year the insulation of that part of the building was increased, as the restoration works done in did not focus on that part.

4.6.3 Extra glass layer:

Moreover, there is one element that creates uncertainty of which year it was installed and it is very important because it is the cause of some of the problems that are present in the building and it is an extra glass installed on the wooden frame from the existing windows.

This extra glass was fixed on some windows that are mainly in the façade of the street “EiseEisengastraat” (South facade) and on the windows of the ground floor, principally in the living room.

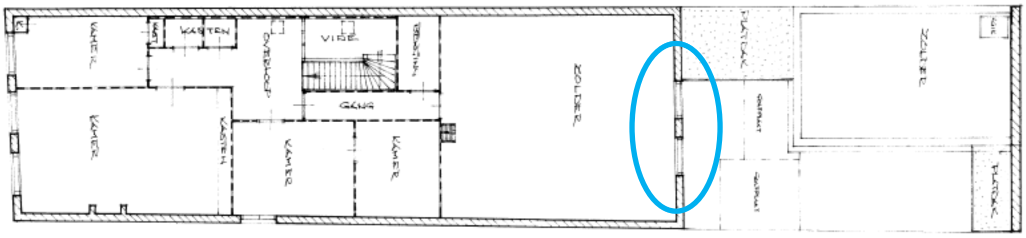
Depending of the characteristics of each window, this extra layer was installed to improve the thermal resistance of the windows and to improve the noise insulation of the traffic from outside.

Imagen 4.6-1 Anchorage of the extra glass layer on a window

As we will analyse later, where these new layers were installed and what problems it actually causes on the building.

4.7.- Other reformations:

Picture 4.7.1.- North façade of the building



Picture 4.7.2. Location of the windows at the ground floor

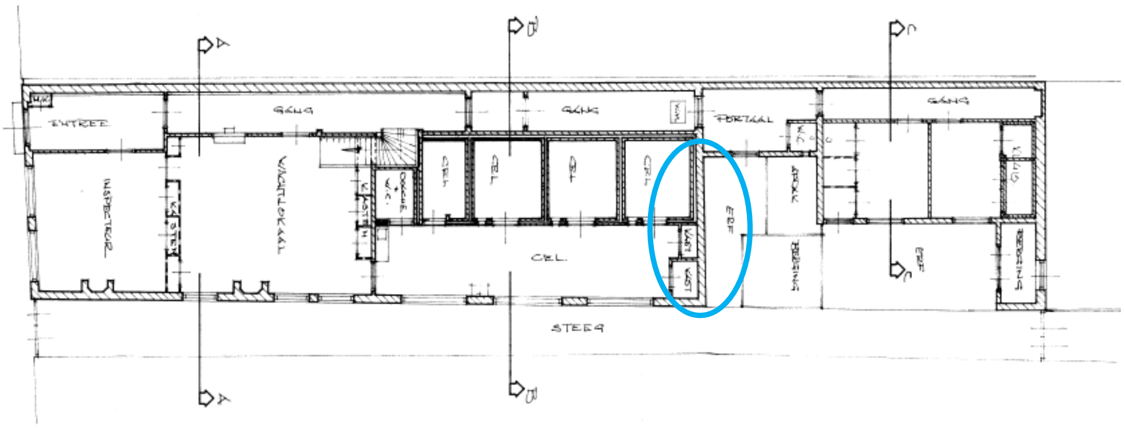
With the plans that we have acquired about the city of Franeker and seeing the picture above, which corresponds to the north facade of the building, we can say that before the renovation was done in the building in 1985, there were other reformations that were made to the building since then, as on the blueprint, the gap in the right façade of the arch does not appear , but nowadays, there are holes in the façade.

If you look at the picture above, in the window on the left, on top of the window we can see that there is an arch of bricks which is the remainings of an old window that was previously located in the building.

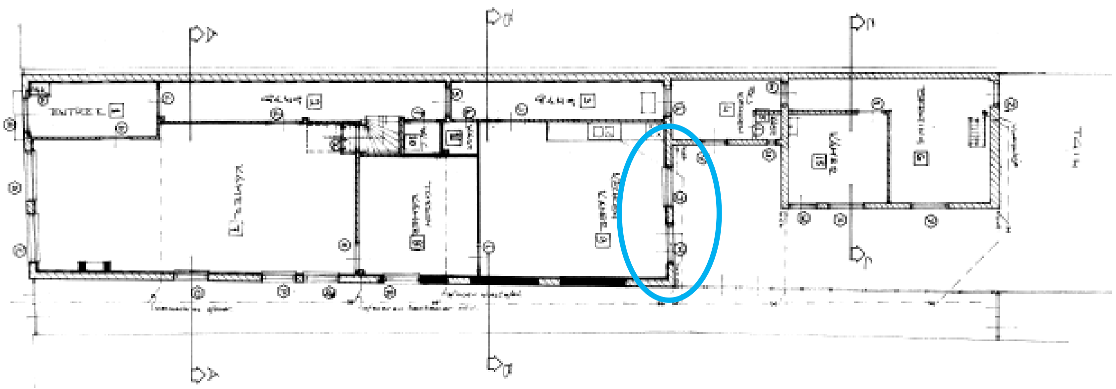
In the left window it becomes obvious that the changes were performed, since the window is placed just in the right of the arch support, which would fell if all the weight wuld fall on top of it . In addition , the bricks that used to fill the rest of the space do not seem to be as damaged as the rest of the facade , presenting a more yellowish color.

On the right , the window is placed just below the arch , and it is in the exact spot where there was a hole in the facade.

The door and the window that exist on the ground floor on the back part, just below the windows of the first floor, were made in the 1985 reformation, by putting the windows and the right door under the old arches and it was located in the front as we can see in the pictures and building plans below.



Picture 4.7.3- Drawing of the ground floor of the building when it was a police office, before 1985.



Picture 4.7.4 New door made in the north facade in 1985 (drawing of the restoration).

5- MAIN PROBLEMS OF THE BUILDING AND MAIN GOALS

The historical building I am going to work on during this project does not have enough capacity to keep the warmth that it is generated inside of it, producing cold and uncomfortable conditions in some parts of the building.

The owner is looking for valid solutions as she is spending a lot of money in energy consumption without having the best results for the conditioning of the building. Most of the windows of the main façade have condensations, and this indicates that the house has large thermal bridges on those parts where the building is losing a lot of heat.

Moreover, there are rooms that the owner prefers not to use as they are very cold during most of the year and it is very expensive keep the warmth inside, as in the case of the living room. Other rooms are just covered by the curtains most of time in order to try and prevent the cold from outside of the building from entering.

The main aim of the following work is to find the best possible solutions in order to improve the comfort inside the building while trying to maintain the warmth in it, without having all the current heat loss that the building is facing right now.

However, there is one important thing to keep in mind: it is importnt that we do not cause problems on the building due to its historical value and to the fact that it has been built in the seventeenth century, with some characteristics of architecture and systems that were built during that time.

We will have to be careful when designing solutions to preserve the building as it is while also solving the problems that the building has.

Furthermore, if the energy price is increasing every year, we should think of something in order to consume less energy and improve the efficiency energy of the building, in order to reduce the energy consumption of the building and save money in the future.

In summary the main goals of this project will be, in the correct order of importance:

1- Preserve the historical values of the building.

2- Improve the thermal comfort of the house.

3- Try to improve the energy efficiency of the house.

The main question that would involve all the topics of the project will be:

- Is it possible improve the thermal conditions of the specific seventeen century historical building, while at the same time trying to solve its energy efficiency issues and preserving the original architectural values?

In order to solve this question, during the project we will be answering the following sub-questions:

- What are the main problems that affect the thermal comfort of the building and what are the main ways in which the building is losing heat?
- Which things do we have to keep in mind when we are working on a historical building?
- How is losing heat affecting the building and what additional problems does it have?
- Could we install a different energy system to improve the energy efficiency of the building?
- Which solutions can we use to improve the thermal comfort and the energy efficiency?
- How much money will it cost to apply all that modifications that we will plan to make in the building?

6- WHAT IS THEMAL COMFORT?

During the previous discussion, I have mentioned quite a few times the concept of “thermal comfort”. In this brief overview, I shall describe its characteristics and main features in order to clarify its nature.

Thermal comfort is the sensation produced when the temperature, humidity and air have the correct characteristics to do not experiment any cold or warmth sensation.

That comfort depends on several external global parameters that are mainly the air temperature the humidity of the environment and the speed and cleaning of the air.

Having a control of the temperature with the correct heating system and the correct ventilation system to control the humidity inside the building we could be able to get the thermal comfort inside the building.

The correct values in a comfortable environment is around 22ºC of temperature and a 50% of relative humidity, that is the water that contains tha atmosphere air. Nevertheless the temperature of every room will be different depending of the type of the room and the heating installed in each room. At the Annex 4, in the final of the project, we can fin the documents of the reformation in 1985, and in the specifit document for installation (the second one) we can find at the page 9 point 9.2 the temperatures that should have every room with the actual heating system installed in the building.

To control the humidity, a ventilation system should remove the excess of water in the atmosphere to try to get a good rate of water in the air.

Having a good system that controls that two things it will help to get the thermal comfort in the house of Franeker.

7- WAYS TO TRANSMIT HEAT

There are three ways to transfer heat. Understanding these three mechanisms enables us to analyse the causes of the problems in the building and helps us to find the best solutions.

7.1- Conduction

It consists in the transport of heat through a substance and occurs when two objects are brought into contact at different temperatures. Heat is transferred from the high temperature object to the one with lower temperature, and continues until both objects reach the same temperature, resulting in a thermal equilibrium.

Some substances conduct heat better than others. Solids are better conductors than liquids, and these better than gases. Metals are very good conductors of heat, while air is a poor conductor.

7.2- Convection

Convection occurs when hot fluid areas (low density) ascend to cold fluid regions. When this happens, cold fluid (high density) goes down and hot fluid ascended. This cycle results in a continuous flow (convective currents) of heat to the cold regions.

In liquids and gases, the convection is the most efficient way of heat transfer.

7.3- Radiation

It is a method of heat transfer that does not require contact between the heat source and the receiver, in contrast to the other two ways. It is based on the transmission of electromagnetic waves, such as solar radiation emitted.

A black body has a great ability to retain the heat generated by this radiation, while a white body easily loses it.

7.4- How does the building loses heat?

A building without sufficient thermal insulation, with thermal bridges or air leaks from outside to inside, leads to the loss of the energy generated inside.

This is what is happening in the building that we are studying. The image 8.4.1 shows the different ways in which heat can be lost in a building, either by conduction, radiation or convection, making its comfort conditions not appropriate.

The losses in each area will be larger or smaller depending on the size of the window, the opening system or the crystal type and thickness, the thickness of the walls, or the material and thickness that each floor has.

These different forms of heat loss will help us to understand better where heat may be lost at our building, and then find the best way to solve it.

Image 7.4.1

Subsequently, we analysed the thermal image of the main facade of the building using a thermal camera to find which parts of the façade were having higher heat losses. After, we will analyse the causes that produced them.

I will describe two concepts that we will use during the project in terms of transmission and heat resistance :

Thermal Conductivity

It is a property of materials that measures the ability of heat conduction. The units in which thermal conductivity is expressed are W / mK .

The coefficient of thermal conductivity (lambda : λ), characterizing the amount of heat needed per m2 , so that crossing over the unit of time , 1 m of a homogeneous material to obtain 1 ° C of difference in temperature between the two faces .

The smaller the value of Thermal Conductivity, the better thermal insulation.

Thermal resistance

It represents the material's ability to resist heat flow. For homogeneous materials it is the ratio between the thickness and thermal conductivity of the material : $R = e / \lambda$ where " e " is the thickness in meters of the material and " λ " is the thermal conductivity in W / mK .

Then the unit will be $m^2 \cdot K / \cdot W$

A higher value of the thermal resistance will result in a better insulation.

8- THINGS TO CONSIDER WHEN YOU ARE WORKING ON A HISTORIC BUILDING IN FRANEKER

As for regulations affecting the restorations in historic buildings, we should clarify that there are no specific rules for listed buildings.

As Mr Harm Haitsma (worker in Monuments Advisory Council of the province of Friesland who is responsible for advising all restorations of listed buildings in the municipality of Franeker) informed us, this is due to the fact that each building is different and a general rule for all may not apply as it would affect all the historical buildings and each building can have completely different problems.
If someone wants to restore something in an historical building in Franeker, what one has to do first is talk to Mr. Harm Haitsma and get a proper advice about the modifications and the best solutions for the problems the owner wants to solve.

After that, Mr. Harm Haitsma will receive the planning with the modifications of the building and all the documents in good order (Formal documents, calculations, drawings). The project will be analysed by the Council where they will agree to start the restoration or not, depending on the documentation they received.

In either case, the historic aspect of a historical building must to be preserved, and the owner is responsible for the correct preservation of the building. The owner cannot demolish or modify anything within the building without the correct permits.

However, there can be exceptions to renew some historical part if the problem is important or if the aesthetical aspect of the building will continue being the same.

For example, renew a window is allowed, modifying a historical part of the house but only if the windows are in a bad shape because that can affect the comfort conditions of the people that lives inside the house.

One of the most important things about these buildings are the exterior aesthetical aspect, much more than the inside aspect, as the main facade is one of the elements of the building along with the roof that characterize it as historic with typical aspects from the architecture of the XVII century.

In the interior of the building, almost all the house was restored modifying almost all the house.

It will be forbidden make a modification that causes damage to the aesthetical aspect of the house. Moreover, it will be forbidden to make any modification that could affect the building indirectly or can produce problems in the future.

Given the above-stated information, in order to make sure that all the possible solutions that we will plan to make in the building are implementable, we will have to ask to Mr. Harm Haitsma all the possible modifications that we have planned to make in the house and after that he will inform us if it is allowed or if things should be carried out differently.

9- PROBLEMS OF THE EXISTING BUILDING

Problems of the building

We will classify first all the problems that we have found in the building in a general way and then we will analyse them one by one to find solutions for all of them.

We will classify them into 2 groups:

- Main Problems

The main problems are those that affect directly the comfort conditions causing heat losses and a wrong ventilation. They are the most important problems we have to solve.

They belong to the group mentioned below:

- Heat losses by conduction and surface condensation
- Heat losses by convection (Air leaks)
- Insufficient ventilation

- Problems caused by humidities and rain water.

The humidity is not related to the temperature of the building, but has severe consequences affecting comfort conditions inside it. In our analysis, we will test whether those problems with the water are affecting the comfort conditions inside the building.

- Capillary moisture spots
- Humidity spots by rain water and rain water filtrations
- Cracks leaks and filtrations by rain water
- Efflorescence

9.1- Main problems

At the drawings from the Annex 1 we can see the location of all this problems at the plane number 13.

9.1.1. Heat losses by conduction.

The windows of the house are the place where the building is losing more heat by conduction.

With the measures that we did in the house, exterior existing glass should have around 5 mm of thickness having a low thermal resistance and losing heat.
Consequences of these heat losses are if we see the planes that the rooms 7 and 16 of the building are not used for the family normally because they are too cold.

That glass from all the windows is a thermal bridge through which the building is losing heat by conduction.

Moreover, there are some windows that have surface condensations in the main facade.

Surface condensations can be defined as the water condensation produced by water vapour that constrains the air inside the building. They appear mainly in thermal bridges, where the temperature difference between inside and outside the building is quite big. Therefore, the steam condenses into water drops that remain attached to the hot face of the windows, at the inner side.

In the main facade of the house, I have to mention that these condensations appear the most at the highest part of the windows on the same floor. That is because the temperature difference above is higher than at that of the lower parts of the windows, producing more condensation, as we can see in the image below:

Image.9.1.1-1- Surface condensations on one window from the main facade of the ground floor.

We will also analyse, in point 10, why on some parts of the windows there are no condensations, if all the parts have similar environmental conditions.

9.1.2. Air leaks

Due to the composition of material of the windows, the system of opening and the adjustment of the frame of the various types of windows, there are slots that allow air to pass through. This property of the window or door that allows air passage is known as permeability.

The slots that allow air passage can be:

- At the junction of different materials
- At the junction of the woodwork with facade cladding

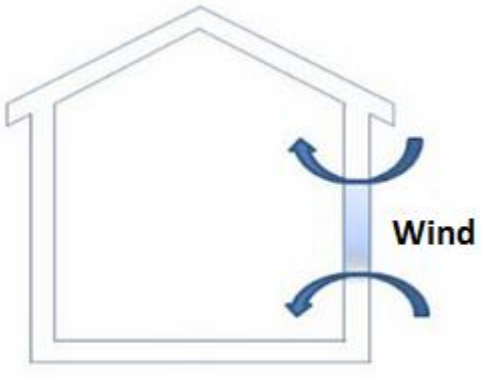


Image 9.1.0.2 -1 Air leaks ways

9.1.2-2 Different solutions applied to the air leaks: paperboard and insulation (attic of the building)

There have been attempts to solve the problem in a quick way, especially on the parts which have small air currents. Those parts have been insulated with small pieces of cardboard placed at the windows in order to stop the air from coming in.

As a result of this permeability of the window, there is uncontrolled leakage of air as well as heat and energy loss, which essentially contributes to higher energy consumption and is a waste of money.

In the point 10 of the project, the windows of the house will be analysed with a thermal camera, in order to show specifically where the air leaks in the facades of the house.

Those air leaks have been drawn in the Plane 13 of the Annex 1, but only the ones that affect directly the comfort conditions (windows B,D,E and door A).

The window G of the attic has air leaks too , as it is possible to see in picture 9.1.2-2, but as we will check in the point 10, the attic is cold (there is not insulation on the roof) and is not in use, therefore air leaks in the attic do not modify the comfort conditions for the family living in the building. That is why on the plane 13, the air leaks of window G have not been drawn.

As we can see, the air leaks are only at the main facade, mainly in the windows with an opening system that does not close properly.

9.1.3 Insuficient ventilation of the building.

Condensation apparitions means that there is a problem of humidity inside the building, as an excess of vapour in the air from the interior environment is present and it represents the main cause of the condensations. With a correct ventilation of the house this problems would be solved because the excess of humidity would be ejected by the ventilation system.

In the plane 12 of the Annex 1 we can see which the existing ventilation system is. We will have to make modifications on it to have the correct ventilation and remove the condensations.

9.2- Problems caused by humidities and rain water.

The quality of the inside air depends of the humidity that there is in the environment. There are some problems that could affect the quality and cleanliness of the air circulating inside the building, which is the humidities in the walls of the building that could increase the level of water in the air being one cause of the condensation apparition.

There are some cases that we have to mention.

9.2.1. Capillary humidity

This type of humidity is produced generally on the walls of the ground floors and basements by capillarity. The consequence is the rise of moisture from the soil onto the walls. The water rises through the pores of the materials used o the walls and eventually evapourates to the atmosphere, deteriorating the walls, increasing the vapour in the air and favoring condensations. We will analyse the walls of the living room on the ground floor with the aid of a thermal camera (in point 10) to see if the capillary moisture continues affecting the building or if it was in the past and now we can see only the consequences of it.

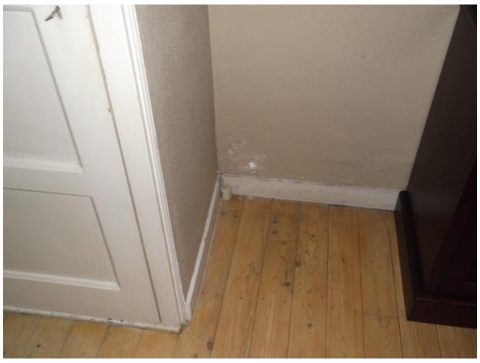


Image 9.2.1 Humidity capillary at the living room

9.2.2. Humidity spots by rain water, rain water filtrations and efflorescence spots.

These moisture stains are caused by faults or damage to the constructive elements of the building.

In our case, in the building we are studying in Franeker, the main location where we have found these types of wet spots has been the attic, which is just below the roof which is exposed to all sorts of weather conditions and thus leads to further deterioration of the attic.

As we can see in the image below, the moisture is produced on the highest part of the roof, at the junction between the roof and the wall facade. Wet spots clearly show the way in which the water has been travelling from the highest part of the wall until the wooden ground.

Image 9.2.2.-1 Moisture leaks at the attic

The top right image was taken just below the leaks that were produced on top of the attic. We can see the impact water has had over the building. A wet spot on the wall and the wooden ground results in the increase of volume of the wood and thus, loses the horizontality/stability of the floor.

If the wood is constantly subjected to moisture and drying processes, the rotting of the latter occurs, with consequent problems of soil strength loss as well as bad smells and possible fungi.

Also mention that there are rain water infiltrations in the centre of the attic, just below where the fireplace is located. Most likely it was produced by a deterioration or improper performance of the waterproofing union of the chimney with the roof.

Image 9.2.2.-2 Water filstrations behind the chimeny

As it is possible to observe, all these problems come from rainwater, which over time has deteriorated parts on the outside of the building.

Other part of the building affected by rain water is the side facade. It was probably produced by the ruptured or inexistent gutter that collected rainwater which was spilled all over the wall causing black spots that characterize the humidity. In this particular case, the channel has been repaired so the cause of the problem has been resolved.

Image 9.2.2.-5 Moisture spots at the east facade

One more problem caused by rain water is the efflorescence spots apparition of the main facade, possibly caused by water runoff by the flashing on the wall.

The problem does not seem serious, but it affects the aesthetics of the historic building and may continue producing more white spots that are caused by the crystallization of salts containing the facade materials, when reacting with water.

The modification of the sill would be a way to prevent water from flowing through the wall, and this would make a small sample to sill, as in the image I have placed on the right (image 9.2.2-4), so that when the water reaches that part it will fall to the ground and will not reach the wall surface.

Image 9.2.2.-3 Efflorescence on the main facade

Image 9.2.2.-4 Notch should have outgoing to keep out the water

However, the renewing of the flashing is not allowed because it involves modifications on the aesthetical exterior appear of the facade, which is an important historical part of the building. The same problem is present also with the water filtrations by the chimney. Repairing them involves a modification of the exterior part of the chimney and we have to keep in mind that the preservation of the historical values of the house is one of the priority goals of the project.

The town hall would not allow us to solve the problems of rain water filtrations if the consequences are not very serious. The existing filtration is not big and it is in a space that the family does not use so the historical value is more important than the small consequences of that specific problem, which can either way be solved easily, like the owner did. It is not the best solution to fully solve the problems of course, but it is the only way to preserve the historical exterior value of the house.

9.2.3 Craks of the main facade

There are cracks in the lowest part of the main façade. This problem will be analysed too in the point 10 using the thermal camera to know if it has a bad consequences, but one wall with crack has more possibilities to have heat losses and air leaks thought the gaps between the cracks. They could have been produced by the water that flows on the flashings of the windows.

Imagen 9.2.3-1Crakcs of the main facade

9.3. Consequences of humidity

We will describe now the different consequences that the appearance of humidities can have on the building itself, its comfort ambit, but also on our health and our economy.

As for the consequences on the house, the most important thing to consider in our building is the possible destruction of the aesthetic and historic value of the building by humidities or their consequences, like wood rot from being in contact with water , mold or other fungi or condensation. In addition, the appearance of humidities produces loss of the economic value of the building.

Moreover, all these problems at the house affect our economy , because if we want to fix all the issues these humidities imply, we will have to invest quite a bit of money to solve them.

As for health and comfort, the appearance of humidities on the inside of the house directly affects the quality of the air we breathe and it can sometimes produce smells and toxins inside the building ,affect our own health. For example, excess humidity increases the possibility of respiratory diseases such as asthma or bronchitis.

For all these issues we will find solutions in order to remove the excess of vapour and humidity in the interior of the building, which can be achieved, for example, with correct ventilation.

10. THERMAL ANALYSIS OF FACADES, CONDENSATIONS, AIR LEAKS AND HEAT LOSSES.

To know which part where the building is losing most of the heat we are going to use a technique call "Thermography". Using a thermal camera will allow us to know the exact locations in which the building is losing more heat, as it detects the superficial temperature difference within objects.

We will start to analyse the problems of the building starting for the "main problems" previously mentioned (heat losses, air leaks and surface condensations) analysing all the facades of the house, but firstly, we will explain the causes of the occurrence of condensation in a building.

10.1 Why are the causes of the occurrence of condensation in a building?

Condensation occurs when there is an object in a building where there is a big temperature difference. When the vapour water that is contained within air arrives to a specific temperature called "Dew point" it will start to condensate itself producing the change of state from vapour to liquid adhering to the coldest place, in our case, the windows of the main façade that is the only façade where we have could find condensations.

That dew point is different depending of the humidity and temperature of the elements. Moreover, the water vapour will condense easier if the environment has a higher relative humidity (more quantity of vapour in the air) or if the vapour is in a cold place ,as it would change the status from vapour to liquid.

Then, the condensation will appear more frequently in:

- Cold environments with a big temperature difference.
- Humid environments.

In any case, to avoid surface condensation, the main solutions which are generally used are:

- Reduce the moisture content within the space by increasnig air circulation
- Increase the surface temperature of the element where there is condensation
- Decrease the value of the coefficient of thermal transmittance of the facade cladding
- Use absorbent finishing and coatings (moisture regulators).

10.2. Main facade

Image 10.2.-1 Facade picture

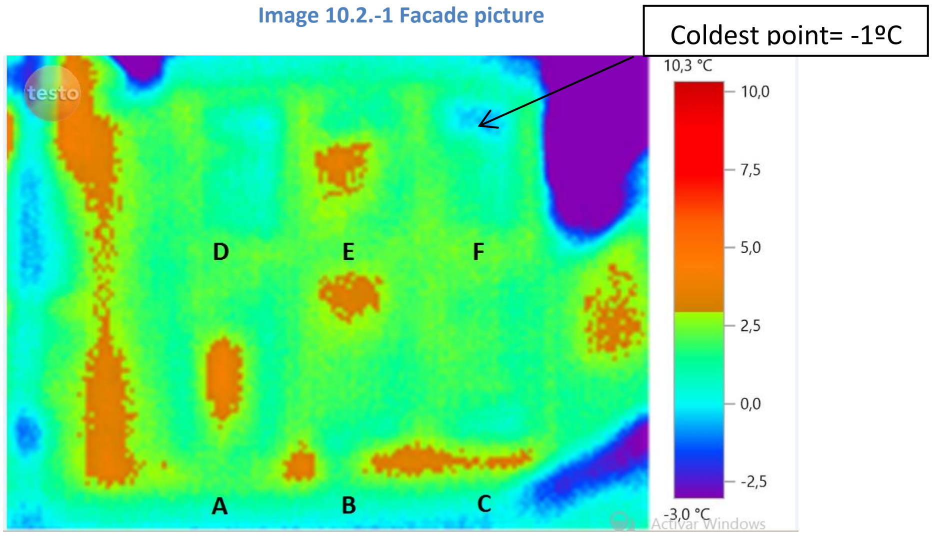


Image 10.2.-2- Thermal picture main facade

The blue areas represent the coldest parts on the building facade, while the orange ones represent where the building is warmer and losing heat. The difference of temperature betweeen the warmest point and the coldest at the facade surface as we can see in the thermal scale of the picture 10.2-2 is around 7ºC being the coldest point closes to -2.5ºC at the window F and 5ºC at any heat losses that we can see in orange colour like the heat from the window E.

Moreover and not to create any confusion, all the windows have been named using a number or letter to be differenced. In the plane 13 of the Annex 1 we can see a summary of the next analysis.

The thermal pictures were taken during two different days:

- The first one, in february, the heating system was not activated in the rooms from the main facade, that was the unic facade where we could took thermal pictures

- The second one was in may, the owner activated the heating system and let us take termal pictures of all the facades and in the interior part of the house.

During the analisys of the facades, we have to keep in mind where the extra glass layer previously mentioned in the project are installed. We can see the details of that extra glass layer in the planes 9,10 and 11.

We will start analysing the main facade with the thermal pictures tooken the first day and after we will compare them with the second day, along with some modifications that were in the house.

10.2.1- DOOR A - CORRIDOR

We will start analysing the gap on the main door of the building, in the A zone of the thermal picture.

At the image we can see that there are heat losses on the share of the door, but not at the top of the door glass where that extra glass layer mentioned before had been installed. This proves that it somehow prevents the air leaks at this part of the house.

Image 10.2.1. Main door

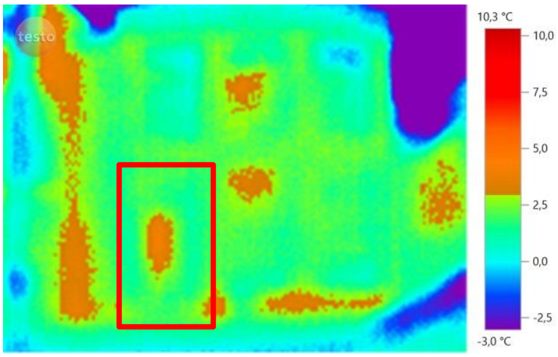


Image 10.2.1-2. Heat losses Main door

On my second visit to the building, I checked the area, realizing that the door to the building does not close properly, causing air leaks through the door.

As we can see at the zone 1 of the thermal image, on the corner is not completely closed as zone 2 is in the middle of the door.

The only solution to solve this problem would be renew the door or repair it to be closed properly, preventing heat loss.

Solve the air filtrations of the door will help to reduce heat losses thought the corridor, room that is behind the main door as we can see in the plane 13 (“Problems of the building”) .

10.2.2.WINDOWS B AND C - LIVING ROOM

- WINDOWS B

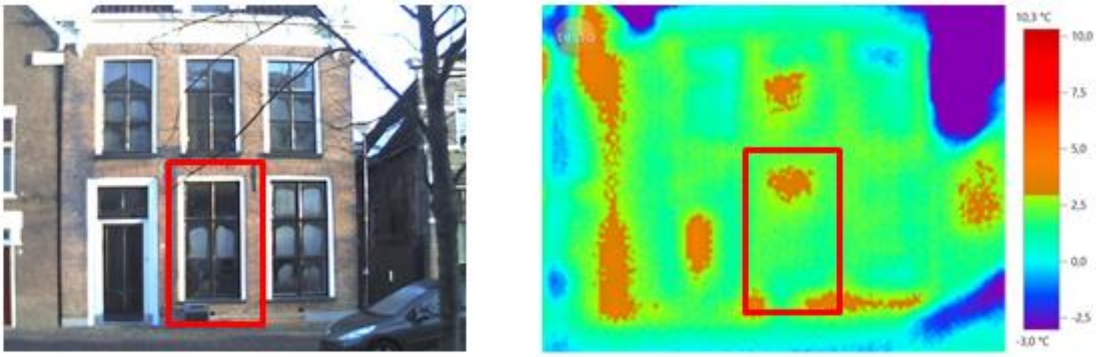


Imagen 10.2.2-1 Thermal picture window B

We can see that at the superior part of the window the thermal camera has detected heat losses but not at the lowest part. This area matches the only part of the window that has not condensations.

Why in this part of the window there are heat losses and no condensation?

As it is possible to observe, at the lowest part of the window, there is one of the extra glass layer installed on the original one

That extra glass layer was fixed on the old frame of the window but in this case (window B) it was only installed at the low part of the window, not on the highest because as this part is the only opening system of the ground floor of the main facade.

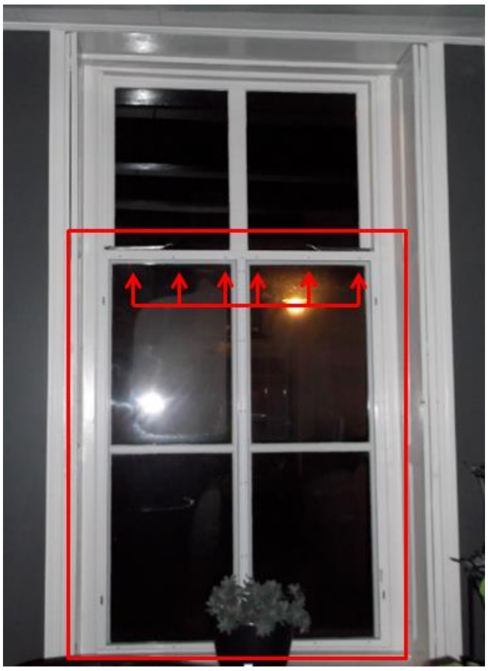


Image 10.2.2-2 Extra glass layer

At the picture 10.2.2-2 the red arrows are pointing at some of the anchorage points of the extra glass layer with the old wooden frame.

That extra layer is working “well”, it insulates the noise and increments a bit the thermal resistance of the windows removing the air leaks, but between the 2 faces of glass (the old window and the extra glass layer) the humidity of the interior air have been acumulated. That, produces the condensation of the vapour by the temperature difference, the vapour changes his status from vapour to liquid and after that it is very difficult to remove the condensations, as there are not any moviment of air at the air chamber.

At the highest part of the window there is not that extra glass layer, that is why we can see heat losses at that part of the thermal picture (10.2.2-1). The hot air from the inside goes out because the opening system of the window does not close properly.

Image 10.2.2-3 Opening system of the window B

In the picture above we can see the system hinges opening windows enabling the outwardly swinging motion as we can see in the picture above.

At this window there will be two different types of heat losses, one by convection, because there are air filtrations caused by a wrong closing system of the window, and one by conduction, because the big difference of temperature produces the condensation of the water vapour as we can see at the middle of the window.

- WINDOW C

On this window, there is not a system that permits the possible opening of the window as at the window B. For that reason, at the last restoration the same extra glass layer was installed but in all the surface of the window creating a bigger amount of condensation on it now. This amount of codensation is much bigger at the highest part,as the hot air tends to go up creating a bigger temperature difference and creating more condensations, as we can see in pictures 10.2.2-4 and 10.2.2-5.

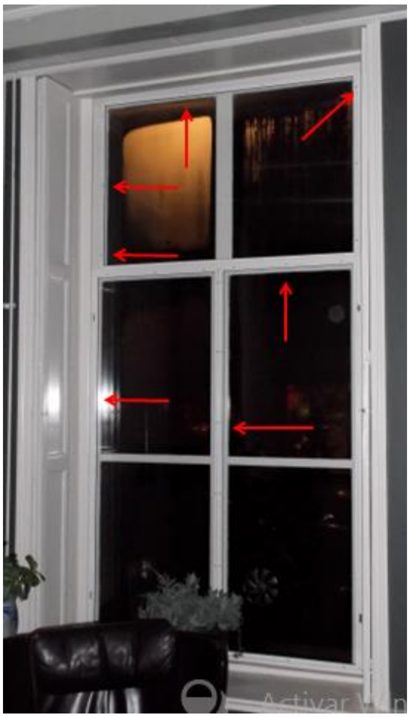


Image 10.2.2-4 Window C without opening system

Image 10.2.2.-5- Window C full of condensations

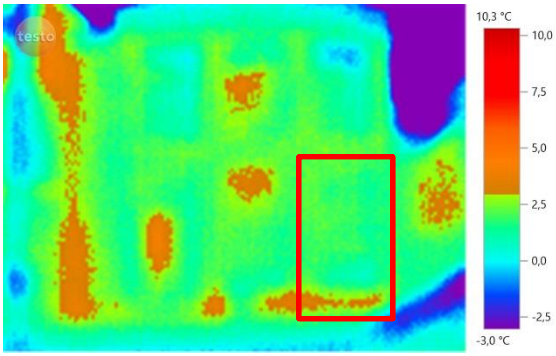


Image 10.2.2.-6- Thermal picture window C

That is the reason why we cannot see heat losses with the thermal camera (10.2.2-6), as it detects only the heat losses at the surface of the objects, and the exterior glass (the older one) is cold, and the extra glass layer is warmer in the interior part.

10.2.3. WINDOW D – STUDY ROOM

This case is very similar than the window B. The extra glass was installed on all the window less on the highest part like we can see at the picture below.

Image 10.2.3-1 Extra glass layer, on the low part of the window

In this room and as we can see at the plane number 10 of the Annex 1, there is a system to open the window, and if the thermal camera does not detect heat losses (picture 10.2.3-2)ont this part, it could mean two different things: firsty, that the opening closes well because there are not heat losses at the thermal picture, secondly that the extra layer continues acumulating vapour in the air chamber producing condensations on the old glass.

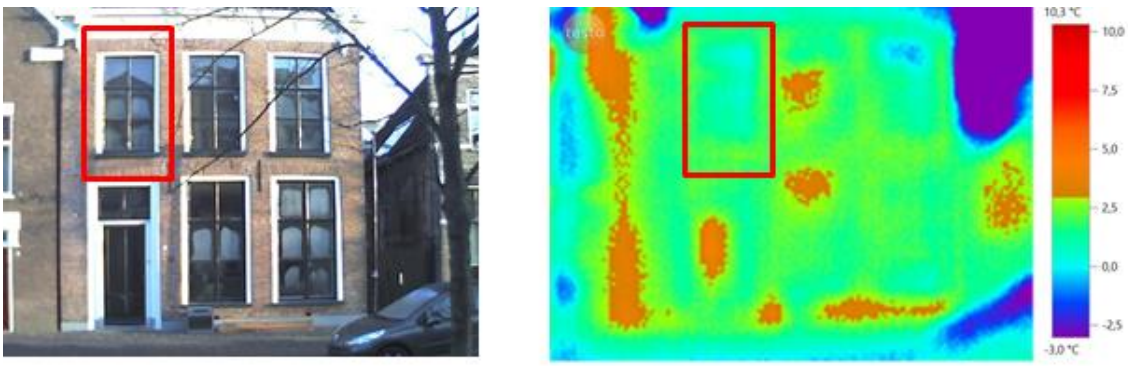


Image 10.1.4.-2 No heat losses shows on the window D

10.2.4 WINDOW E AND F – BEDROOM

- WINDOW E

It is the unique window in all the building that does not have condensations in the whole window. Moreover, we can see the heat losses that the window has in almost all the surface at the picture 10.2.4-2.

Image 10.2.4-1

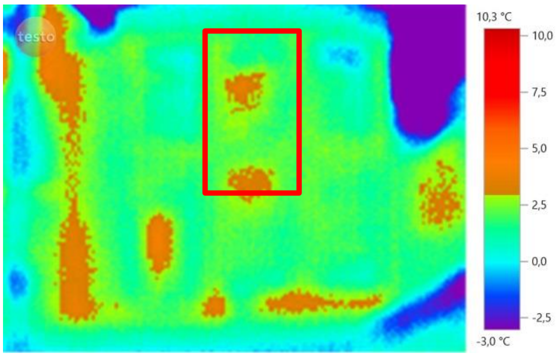


Image 10.2.4-2 Heat losses window E

Why it does not have condensations?

Because this window is the only one that has a different opening system called "guillotine" and it does not have the extra glass layer on any part of the window as we can see at the pictures 10.2.4-3 and 10.2.4-4 below.

Image 10.2.4-3 window E

Image 10.2.4-3 "guillotine" opening system and papers to reduce air leaks.

At the pictures we can see that the owner placed some papers on the window trying to avoid these leaks that dissolve the entire window condensation.

- WINDOW F

The window F, that is in the same room than the E (where the heating system normaly is not activated) is a specular case to the one in window C.

The extra glass is covering all the surface of the window preventing the ventilation on the surface and accumulating the humidity in the air chamber of the window, removing the air leaks but producing the condensation of the vapour on all the surface of the window.

Image 10.2.4-4 Condensation on all the window

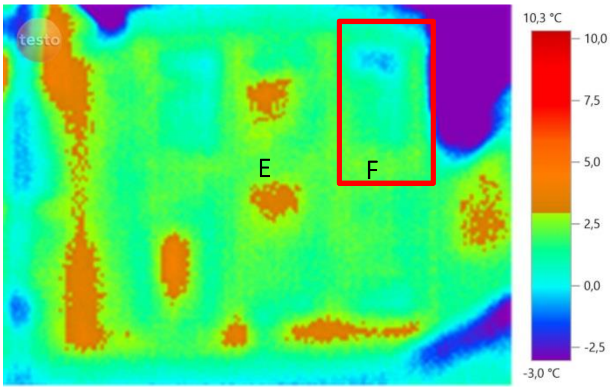


Image 10.2.4-5 No apparition of heat losses on window F

Image 10.2.4-6 Condensation on the window.

As we can see at the picture 10.2.4-6, on that window there is a continuous small amount of condensation.

10.2.5 WINDOW G – ATTIC

It corresponds with the attic. The thermal camera does not detect heat losses because that part of the building is cold,as the roof does not have insulation. The temperature of the window glass is of -2.5ºC as it is possible to see on the thermal picture below.

The thermal camera does not detect air leaks because there are not a temperature differences, however we know that at that part of the building there are heat losses by convection as the owner has proceeded to put pieces of papers on the window to prevent the air leaks at the joints.

Image 10.2.5-1 Papers in the joints of the window

Image 10.2.5-2 Window of the attic

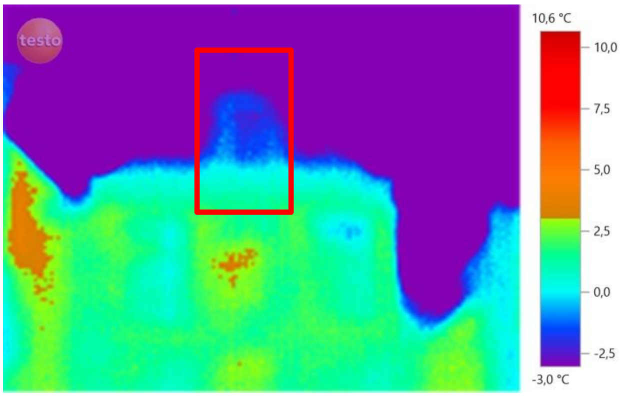


Image 10.2.5-3 Thermal picture of the window G

10.2.6 LOWEST PART OF THE BUILDING

At the facade, there is other part where we can find heat losses. It is at the lowest part of the facade., just below the windows of the ground floor.

Image 10.2.6-1 Lowest part of the building

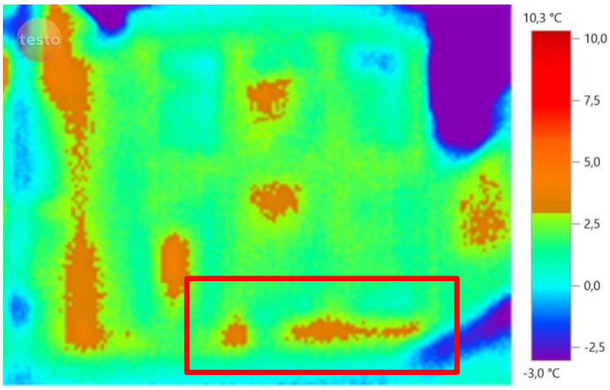


Image 10.2.6-7 Heat losses lowest part of the building

Why the building is lossing heat in that part?

After having interviewed the owner, she informed me that the pipes of the heating system that transport the hot water are in that part of the living room (the same room in which there are heat losses). Even when the heating system is not activated in that part of the house the pipes transport hot water for the rest of the building causing this thermal differences that the thermal camera can detect.

Moreover, if we look well in that part of the facade, there are small areas where it has lost much of the mortar that binds the bricks of the façade, this may mean that the buiding will be losing heat in that part because it is a point where the wall has less thermal resistance.

Image 10.2.6-3 Cracks window B

Image 10.2.6-4 Cracks window C

Different causes that could have helped the deterioration of the materiasl on that part of the building could be:

- Big agressivity of the exterior environment that deteriors the materials
- Big temperature difference between outside and inside (the cracks are in the part where the radiators are).
- Erosion of the material by water evacuated by the sill of the window, which deteriorates the weaker materials of the facade, such as the cement joints of the wall.
- Erosion of the materials by the humidity of the air entrance of the ventilated air chamber.

In any case, those cracks shall be covered, and the pipes wil be covered by insulation.

10.3 East facade

The rest of the thermal pictures of this analyse were taken the second day that we went to the building to take thermal pictures, being the heating system activated that day.

Besides the windows of the main facade the only place more where the extra layer have been installed is on the rest of the windows of the ground floor, at the right facade as we can see at the plane 11 of the Annex 1.

No window at the side facade (at the ground floor) has an opening system then, the extra glass layer is covering all the surface of the window. The main difference between these windows than those that are at the main facade is these do not have condensations on their surfaces, even when being in the same room (living room).

The windows of the ground floor at the right facade of the main building (O, P, Q, R) have been analysed with the thermal camera one day that the heating system was working but however, the windows S and T (at the first floor) could not be analysed using the thermal camera because the high and the small corridor prevented us from reaching them.

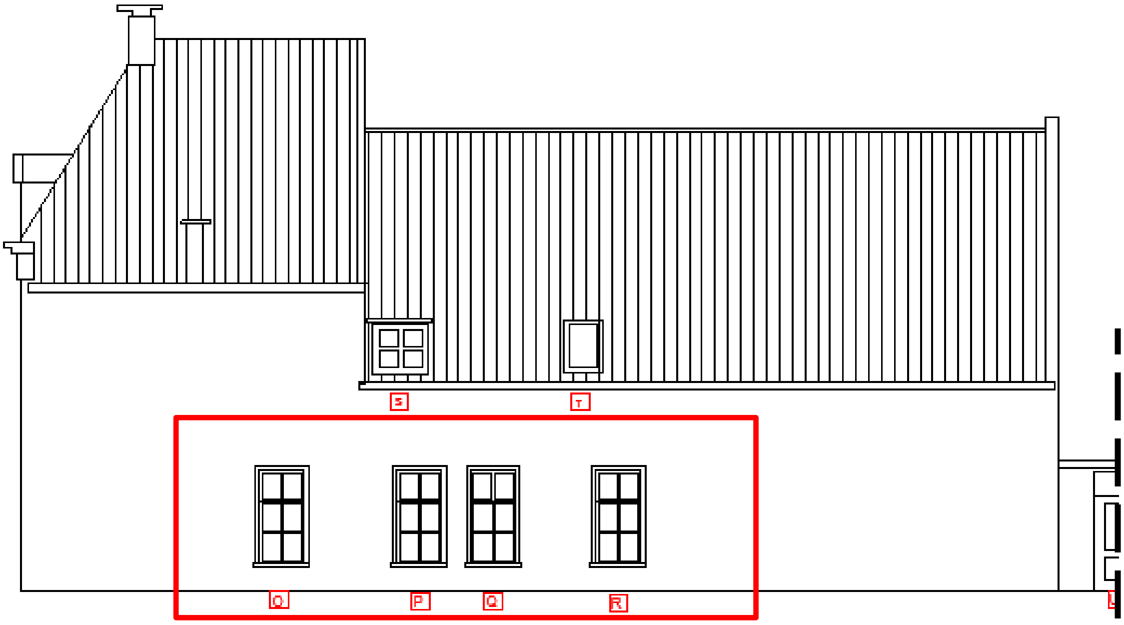


Imagen 10.3-1 Right facade

The windows of this facade have similar conditions, all of them do not have opening system and are covered by the glass layer in all the surface of the window. Due to the previously stated limitations, the analysis will not be as comprehensive as the analyse of the main facade.

10.3.1. Window O, P, Q, (Living room) and R (Library)

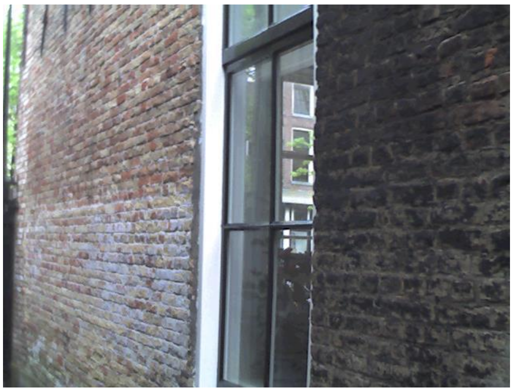


Imagen 10.3.1 -1 Window O

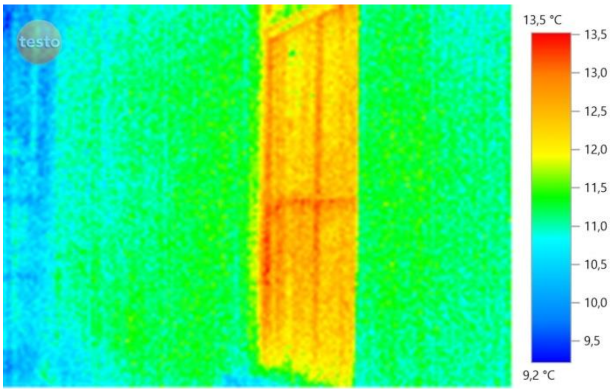


Imagen 10.3.1-2 Thermal picture window O

Imagen 10.3.1 -3 Windows P and Q

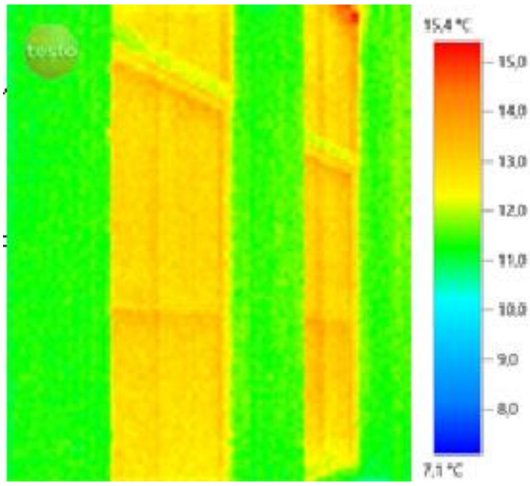


Imagen 10.3.1-4 Thermal picture window P and Q

Imagen 10.3.1 -5 Window R (TV Room)

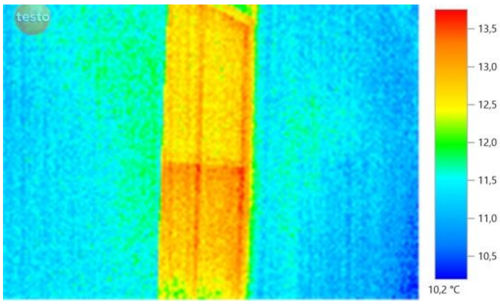


Imagen 10.3.1-6 Thermal picture window R (TV Room)

In general terms, the windows are warm because their thermal resistance is not big. There is not big difference of temperatures than in the other pictures from the main façade and that means that there are not air leaks in this part.

In these windows, it is not like in the main facade, where the difference of temperatures at the same windows could be up to 5ºC. The no existence of an opening system in these windows favours the non-presence of air leaks because the windows have less joints and the extra glass layer covers all the surface of the window.

10.3.2 Windows S and T

We could not analyse these 2 windows with the thermal camera because they are in the first floor and from the corridor it was impossible to see them.

The window S corresponds with the bathroom from the first floor as we can see at the picture below. The window is covered by a courtain but it has an opening system and glass are made with simple glassing, like in all the windows of the building except for window T that has double glassing.

Image 10.3.2.-1 Window S first floor (simple glassing)

Regarding to the window T(image 10.3.2-2), it is made with doble glass and it has condensations in the air chamber.

That means that the window is not working properly and if we want to solve this specific problem the only solution is for that window to be replaced by a new one.

Image 10.3.2-2 Window T First floor (Double glass)

10.4 Back facade

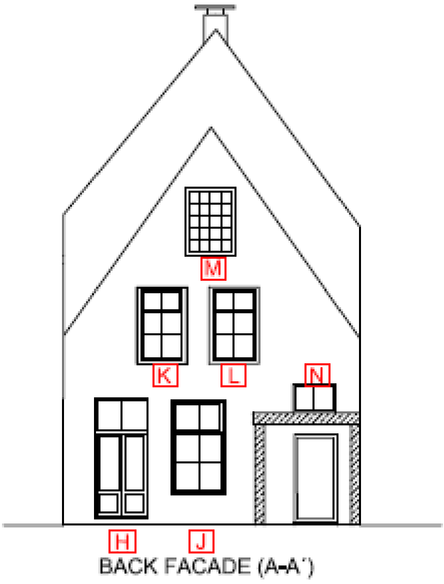


Imagen 10.4.1 Drawing of the back facade

The rooms there are at the back facade are the ones that are frequently used by the family. On the ground floor there is the kitchen/living room, when they prefer to spend most of their times during the winter as the main living room is too cold and in the first floor only two bedrooms are present. We can check the distribution in the plane 1 of the Annex 1.

Those rooms and the bedrooms from the first floor are parts of the building in which normally the heating system is working and in this part of the building no window has the extra glass layer like on the other facades of the building.

10.4.1 Door H and window J (Kitchen)

Imagen 10.4.1-1 Door H (Kitchen)

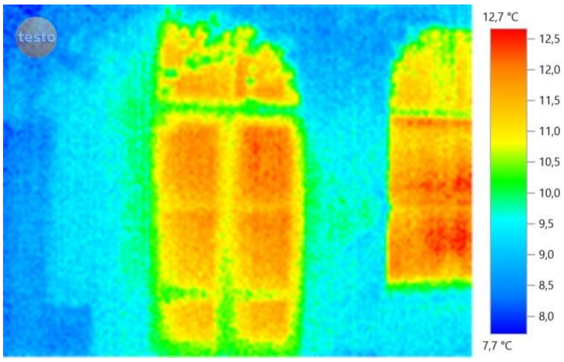


Imagen 10.4.1-2 Thermal picture kitchen

Imagen 10.4.1-3 window J (kitchen)

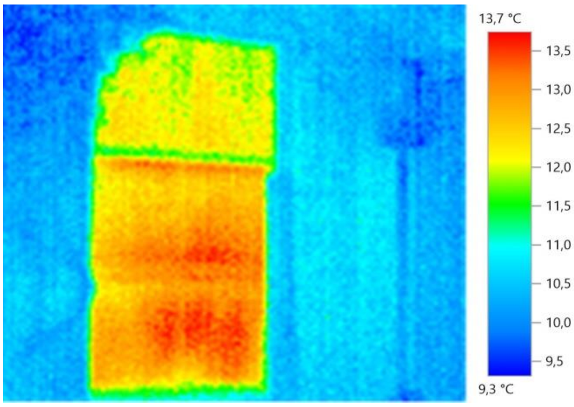


Imagen 10.4.1-4 thermal picture window J

As we can check at the thermal pictures and like at the other windows from others facades there are heat losses by conduction but there are not air leaks. The door of the kitchen closesproperly because there are not temperature differences (if we check the thermal scale from the picture 10.4.1-4 there is a difference of colour but the difference of temperature is only 1ºC).

On all these windows, the extra glass layer has not been installed, leading to more heat losses by conduction but no condensations.

We will have to improve the thermal resistence of these as there are a lot of heat losses by conduction trought the window glassing in all the windows of the building.

10.4.2 Windows L K (Bedrooms)

Imagen 10.4.2-1 Windows L and K (Bedrooms)

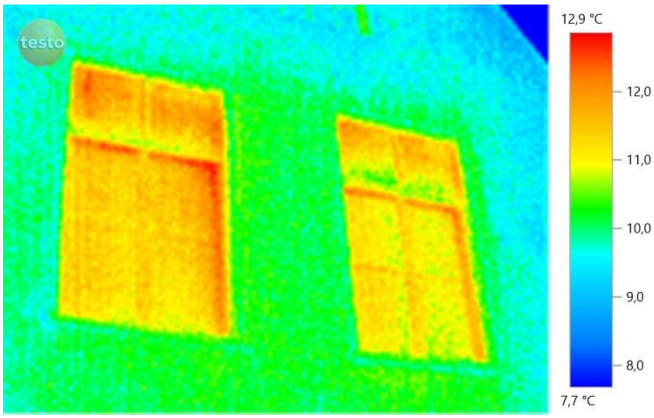


Imagen 10.4.2-2 Thermal picture windows L,K

At the first floor, the situation is the same than on the ground floor of the North facade. The main way why the house is losing heatont this part is that it does not have extra glass layer on the old window. Therefore, to reduce the energy losses it wil be necessary to improve the thermal resistance of the glassing.

10.4.3 Window M (Attic)

Imagen 10.4.3-1 Attic

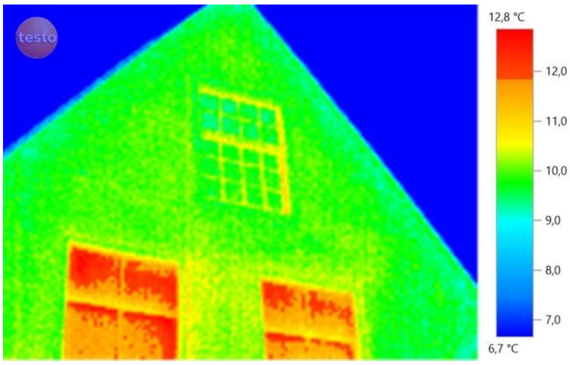


Imagen 10.4.3-2 Thermal picture Attic

The attic, as we can see at the pictures 10.4.3-1 and 10.4.3.-2 the temperature of the wall and of the glass is the same given that, in that specific part of the building a there are not any radiator inside. It will not be necessary do changes there if it is an unused and cold space.

10.5. Causes. Why are condensations only present on the windows surface from the main facade?

In that part of the house are the general factors that produce condensations in every building like

- The building has bad ventilation.
- Humid environments
- They are produced in places where there is a big temperature difference between inside and outside (thermal bridges).

One thing is clear, and it is that the condensations are only at the air chamber of the windows that have the extra glass layer because the exterior glass is very cold for the exterior temperatures of the street and the interior space is warmer.

But why there are condensations on the windows of the main facade and not on the windows of the side façade, since they also have the extra glass layer and are sometimes even placed in the same room (living room)?

There are two possible causes for that:

10.5.1 Bigger temperature difference at the main facade than at the side corridor of the house.

The first one is because the environment that there is at the main facade is more aggressive than the environment at the small corridor between the two houses.

The street "Eise Eisengastraat" could be more aggressive. On the one hand the street has a canal that can increase the level humidity of the environment and the other the width of the street is very large so it has greater circulation of humid air with colder temperatures. These colder temperatures would imply that at the windows of the main façade the difference of temperature is greater and the humidity inside the air chamber of the windows gets to be sufficiently low to arrive to the "dew point.

At the small corridor that separates the two buildings and on the side facade of the building there are no condensations on any windows with extra glass installed, so the environment appears to be less aggressive because the circulation of air is lower being that it is a closed space. The temperatures would be higher than at the main facade at the street "Eise Eisengastraat" causing that on the windows the humidity does not arrive until the dew point" without the presence of condensations.

We can see at the thermal pictures of the main facade that the temperatures of the corridor and of the small space between the two buildings at the left part of the house is higher than at the main facade.

Image 10.5.1-1

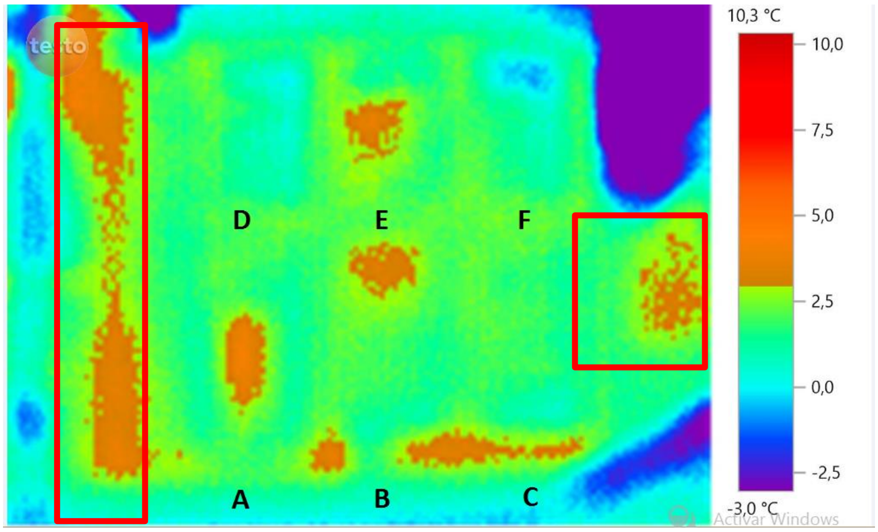


Image 10.5.1-2

At the left part (there is a space between the 2 facades), the inexistent ventilation produces an increment of the temperatures in that small space. It is the first example of the higher temperatures at the 2 side parts of the house, when the ventilation is lower.

At the right part, there is a clear difference at the corridor between the 2 buildings. If we look closely the temperature of the wooden door of the side corridor is almost the same than the temperature of the wall of the house that we are studying. But behind that door, at the corridor (that is a closed space too) we can see that the temperature of the surface wall of the next building (there are not windows in that specific part) is higher than the normal on the street "Eise Eisengastraat".

That higher temperature at the corridor could be one of the reasons of the inexistence of condensations at the windows with extra glass layer on the windows of the living room.

10.5.2 Thermal bridge at the stone sills.

The second one that could produce the condensations are the thermal bridges that are at the stone sill of the windows.

All windows are supporting on a stone sill where there is a bigger thermal transmission than at the exterior wooden frame of the window (painted in white colour).

Image 10.5.2-1 Stone sill at the lowest part of the window

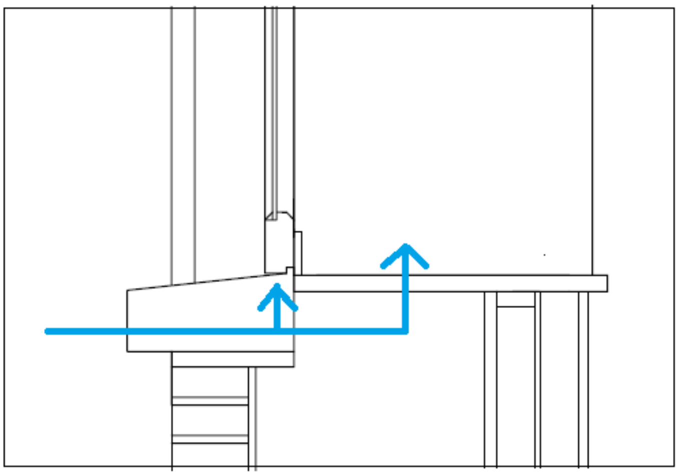


Image 10.5.2-2 Thermal bridge in the detail of the window.

That thermal bridge is bigger if the exterior temperatures are higher so the thermal bridge is bigger too at the main façade than at the side wall of the house.

That would explain why there is only one window at the main façade that does not have condensations, even having extra glass layer without opening system. It does not have a stone sill being supported on the wooden frame, but it could be the glassing of the highest part of the main door.

Image 10.5.2-3 Window A. Without condensations at the coldest part of the year

It is clear that is not allowed renew the stone sills of the windows being that we would be modifying the historic values of the façade. If we want to improve the thermal resistance of the windows, which is the principal way in which the building is losing heat, we would have to firstly remove the extra glass layer of the windows, because it is the reason of the condensations and secondly improve the thermal resistance of the window.

10.6 Is there a big difference between a window with extra glass and a window without it?

Imagen 10.6-1 Main facade of the house

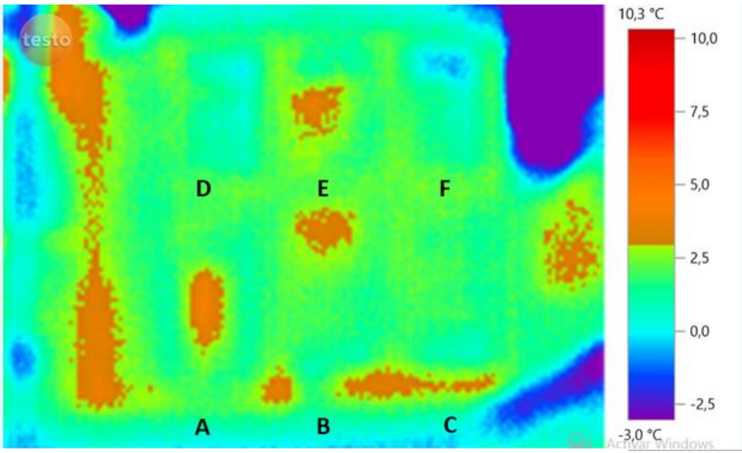


Imagen 10.6-2 Thermal picture token during winter with the extra glass layer installed on al the windows less the E.

In the month of May the owner decided uninstall the extra glass layer on the windows from the ground floor where all the condensations were.

A few days later the thermal picture of the right (10.6-3) was taken with the heating system working in all the building (not like the thermal picture 10.6-2) where the heating system was not activated in almost any room of the building).

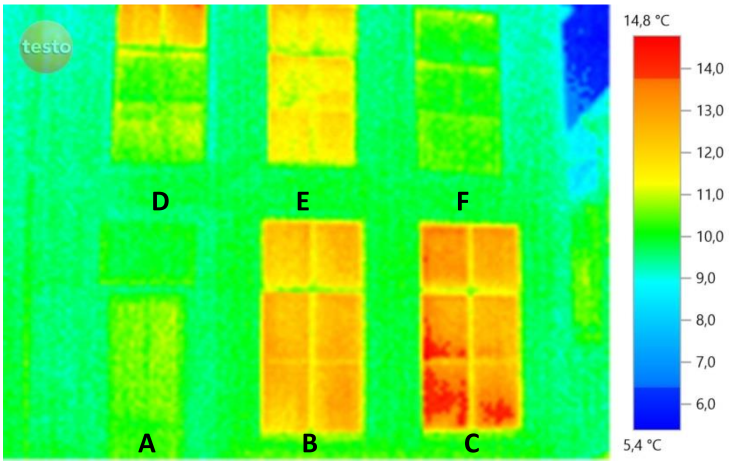


Imagen 10.6-3 Thermal picture- token without extra glass at the windows B,C and E.

We can compare in picture 10.6.-3 the differences between the windows B-C (without extra glass now) and the window F, which still has the extra glass. Being able to compare the difference between the windows with the extra glass and the windows without, we found a difference of around 3-4ºC.

11 THERMAL ANALYSIS OF THE HUMIDITY PROBLEMS

11.1 Are the humidities of the building affecting the building?

At the point 9.2 of the project we have seen that there are some parts of the house have been affected by humidities.

With the thermal camera we can know if the humidities keep affecting the house increasing the humidity of the air or if the water affected the building only temporally therefore no intervention is necessary to remove them.

How works the thermal camera detecting humidities?

The thermal camera detects the surface temperature difference of the objects.
If there is humidity in one wall inside the building, the thermal camera will detect that the humid part is colder than the rest of the wall being that that part is losing heat emitted to the atmosphere by evaporation of the water causing this temperature difference.

11.1.1 Active humidities

That is what is happening at the capillary humidities of the living room at the ground floor as we can see at the picture 11.2.1-1 below.

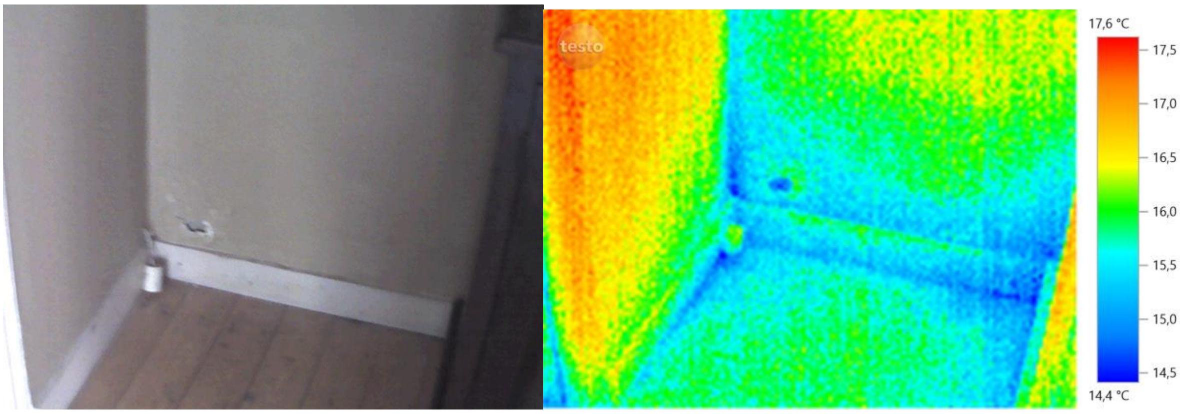


Image 11.2.1-1 Capilary humidityes of the ground floor

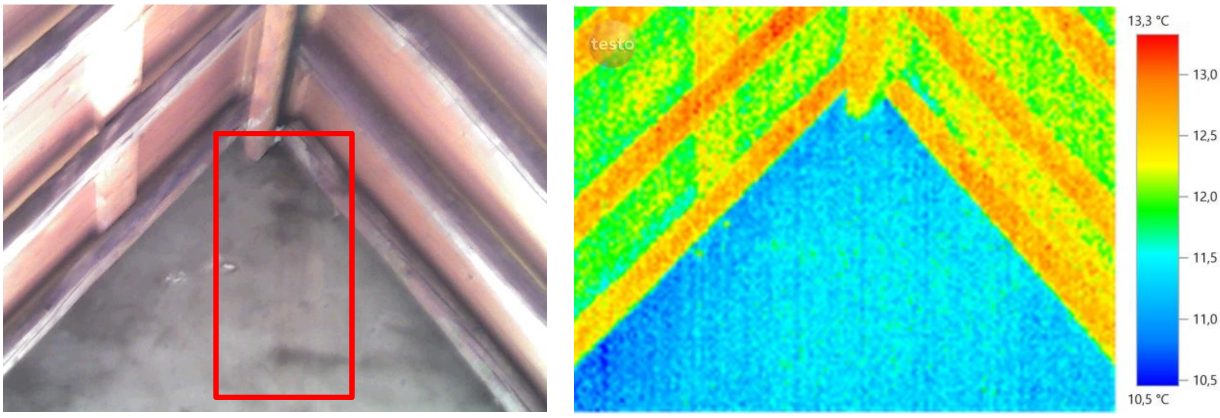
Furthermore, in the living room there is a particular spot of humidity emission that increases the humidity of the environment favouring condensations in the room.

One way to solve this problem is with a good ventilation of the interior air of the house

11.1.2 Inactive humidities

- Moisture spots at the attic.

There were also humidities spots at the attic produced by the filtration of rainwater. As we can see in the picture, there is no temperature difference on the wall because it is completely dry. That means that there are not problems of humidities in this part of the house and it will be not necessary do any intervention to repair them.



11.2.2-1 Moisture spots at the attic. Normal and thermal picture

12. VENTILATION ANALYSIS OF THE EXISTING BUILDING

12.1 Kinds of ventilation.

Mechanical ventilation: It uses a mechanical system, like fans or ventilation units to eject or introduce air to the building.

Natural ventilation occurs when the air in a space is changed with outdoor air without the use of mechanical systems, such as a fan. Most often natural ventilation is assured through operable windows but it can also be achieved through temperature and pressure differences between spaces.
Infiltration is separate from ventilation, but is often used to provide natural ventilation air form the outside air that go into the building thought the joints of the carpentry, cracks other constructive elements.

Mixed ventilation or hybrid ventilation: uses both mechanical and natural ventilation processes. It uses a ventilation unit that detects when there is airstream to use the natural ventilation and when there is not airstream it actives mechanical ventilation.

12.2 What is the actual ventilation system of the building? Is it enough?

For the entrance of new air inside the building there are not in any of the facades any kind of ventilation gap. There are only 2 for the ejection of the vapours from the kitchen hood and the dryer as we will analyse later.

Then, the only way for the air entrance is by the windows opening system (if they are opened). If they are not, the entrance of air inside the building is thought the joints of the doors and windows, and for the joints from other constructive elements, for example the cracks of the building, which is a natural way of ventilation by infiltrations.

For the ejection of the internal air, in the humid rooms of the building, kitchen (room 9 in the plane 12 from the Annex 1), W.C. (room 10), washing machine room (14) and bathroom (17) we can find one kind of mechanical ventilation that eject the vapours generated inside to the exterior part of the house.

In the washing machine room and in the kitchen there are 2 gaps made in the walls (1 per room) to eject the vapours generated by the dryer and by the kitchen hood.
We can see the 2 metal grills from the exterior part of the building.

Image 12.2-1 Metal gill of the dryer (left facade)

Image 12.2-2 Metal grill from the of the kitchen hood

Moreover, all the humid rooms have a small fan as mechanical ventilation on the top that ejects the vapours thought a pipe of 12.5cm like is written in the document of the restoration.

Image 12.2-3 Fan of the W.C. of the ground floor (Room 10)

Image 12.2-4 Fan of the bathroom first floor (room 17)

Image 12.2-5 Fan of the washing machine room form the first floor (room 14)

There is also one more fan in the kitchen but we do not have a picture of that one.

Then, we can say that the building has 2 kinds of ventilation: natural ventilation for the entrance of air by the windows and infiltrations and mechanical ventilation for the ejection of the inside air to the exterior part of the building.

However, according to the documents of the restoration in 1985, there are not any drawings of the way that the pipes follow thought the building. Most probably the pipes follow the wooden beams direction and are hidden between the ceiling and the wooden floor like we can see in the detail below. There are not enough information to know where there are the vertical ventilation pipes. (plane 12).

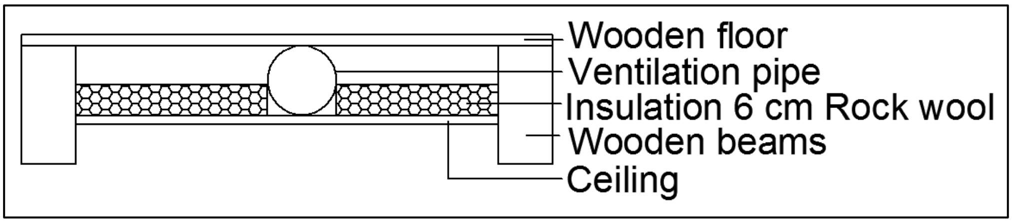


Image 12.2-6 Detail of the pipes between the ceiling and the wooden floor from the next level

If there is condensation in the building, that means that the ventilation is insufficient because the existing fans are not working properly, are broken or they do not have enough power to ventilate the house in a correct manner.
If the mechanical ventilation system of the building is not working properly, it will be the main cause of that apparition of condensations because the air in the building is not renewing correctly.

12.3 Which consequences has this bad ventilation inside the building?

This insufficient ventilation produces an increasing of the quantity of water in the environment (the relative humidity) in the building. At the coldest parts of the year is when the problems are more serious increasing the posibilities to have condensations on the thermal bridges and causing colder sensations.

To solve this problem, there will be necessary the installation of new fans and a new ventilation unit to permit the ejection out of the house of the interior air. The entrance of new air will continue being like now, by infiltrations.

Ejecting the air in the humid rooms we will create a air current that will absorb the air form the rest of the rooms of the building permitting the air renewal and preventing the condensations while improving the quality of the air.

13 HEATING SYSTEM

Heating an entrie building can be the way in which the owners consume most energy and money. For that reason, and because an insufficient heating system causes could cause cold sensations affecting the thermal comfort of the house, it is necessary that the building uses an efficient heating system to provide as much energy as it can using the least amount of fuel.

Firstly we will analyse the actual heating system to know if it is working properly and after that we will search for solutions to improve the thermal comfort and the efficency, in order to try and reduce the energy consumption that the house has currently.

Characteristics of the actual heating system in the house:

At the building there are 2 heating units:

- The main one is at the attic space without any radiator but where is the heating unit with a capacity of 120 litres and 40KW of power and allows the distribution of warmth for the heating of all the building and to warm up the water that will be used in the bathrooms and washing machine but not at the kitchen.

- The kitchen has its own heating unit (a small one) because the power of the main heating unit was no enough to warm the water from the kitchen in a correct way.

13.1 Is it enough to keep warm all the house?

According with the information from the owner, there are some rooms that have problems to be heated that are the rooms number 7 and 16 (plane 1 of the drawings of the Annex 1), that is the living room of the ground floor and the bedroom of the first floor. In those rooms the heating system takes a very long time to warm up the rooms, leading to the fact that the owner rarely uses them.

- **Boiler, pipes and radiators:**

The boiler of the heating system was installed in 1985 at the restoration of the building and it has worked for almost 30 years.

Regarding pipes, the big surface of the building where the heating have been installed (320 m2) causes the distance of these pipes is very large to transport the heat from the boiler to the radiators losing heat in all that way.

For that reason, the kitchen has its own heating unit because the heating unit does not have enough power to warm the water of the kitchen. The living room needs a lot of time to be warmed being that those radiators do not have the same temperature when the heating system is working than the rest of radiators in others rooms. Moreover, if we have into account all the heat losses by the windows that there are in those rooms we will know that the heating is not the only problem to solve to improve the thermal comfort on that part. The living room has more heat losses due to the fact that it has 5 windows and moreover, the heating unit does not have enough power to warm all the big space of the living room.

13.2 How can we improve the efficiency of the heating system?

Efficiency, in a building has a close relationship with thermal comfort. In the building of Franeker, for example if we want to improve the thermal comfort, we will have to improve the thermal resistance of the windows, place where the building is losing most of the heat and also renew the boiler in favour of a more efficient one. Doing the following, the house will not have the same hat losses than before, and it will consume less energy becoming itself in a more efficient, energy-saving building.

We will analyse later at the point 15 of the project the energy consumption of the building and the measures to improve the efficiency energy of the house but first we will explain the different solutions to apply on the building to improve the thermal comfort.

14 SOLUTIONS AND REPERCUTIONS ON THE HISTORICAL BUILDING

We can see all the details of the solutions and the modifications that there will made in the building in the plane 16 (Demolition plan) of the Annex 1.

14.1 HEAT LOSSES (CONDUCTION-THERMAL BRIDGES+CONVECTION- AIR LEAKS)

These are the solutions that we have planned to make into the building to remove the heat losses of the building and improve the thermal comfort:

1- Installation of another extra window behind the old ones (double glass window)

2- Increasing the thermal resistance of the facade walls and ground floor up to 2.5m2K/W according with the Dutch normative "Bouwbesluit". To do that, we will install an extra layer of insulation Alkreflex in the wall facades and a new layer of insulation on the ground floor.

3- Cracks covering of the main façade

4- Door reparation

➢ Advantages:

- Improvement of thermal resistance
- Removal of air leaks
- Removal of condensations being that the new extra windows have an hinged opening system that can be used to ventilate the air chamber there is between the old and the new window avoiding the condensation apparition
- Building more hermetic
- Improvement of the thermal comfort of the building
- Improvement of the efficiency energy.
- Saving energy and money

➢ Disadvantages:

- Investment of money
- To increase the thermal resistance of the facade walls we will have to uninstall temporally the heating installation, and also the furniture and it will be necessary make readjustments at the electricity installation and also of the water installation form the bathroom from the first floor.

14.1.1 Installation of extra window behind the old ones:

By installing a new window behind the existing ones we will get, on one hand, to remove the air leaks of the house and also increase the thermal resistance in the part of the building where more heat is lost

- **Repercussions on the historical aspects of the building.**

To install the new windows, we will have to make perforations in the wall to fix and immobilize the window, the main question to do this is if it will be allowed make perforations in the wall to anchor the window to the wall.

According with the Town hall of Franeker make those small perforations is allowed if:

- They guarantee the completely immobilized windows
- They will not affect the aesthetical aspect of the building
- They will not cause damage on the historical elements
- The new windows have to be fixed properly, completely immobilized.

For that reason, the solution that we have thought for the installation of the new windows is to build a wooden structure on the interior part of the wall where the existing windows are (we can see the details of the new window the plane 15 of the Annex 1).

The advantages to build this structure will be:

- The wall will not suffer the same weight of the new window if they are installed in the wooden structure.
- We will have more anchoring surface because we can use all the surfac of the wooden structure to install the anchors
- If we have more anchoring surface, we can make smaller perforations, reducing the risk of damage to the wall
- In the ground floor, we can anchor the wooden structure to the concrete layer of the ground floor (we can see the detail of the actual wooden floor in the plane 8 of the annex 1) being that is in the ground floor where are the windows more heavy, the windows “B “and “C” of the ground floor

Doing that, the air chamber that will be in the middle of the two windows (the empty space), will help to insulate the windows having more thermal resistance. The details of the new window are in the plane 15 of the Annex 1.

For the installation of the windows, we will make a wooden structure in the periphery of the gaps(as we can see in the next picture) where the windows will be installed using screws sealing all the joints to block the air leaks.

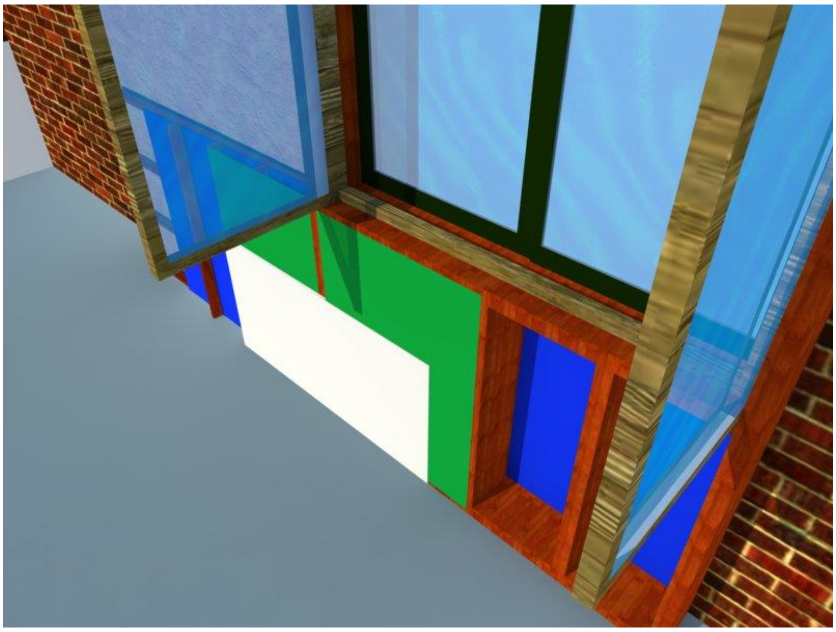


Imagen 14.1.1.-1 Sketchup detail ofo the new wooden structure for the installation of new windows

To make that wooden structure that will support the new windows, we will have to:

- Demolish part of the wooden slat structure of the periphery of the restoration in 1985 to install the new materials.
- Anchor the wooden structure using epoxy resine anchors:

    - IN THE GROUND FLOOR: The wooden structure will be anchored to the concrete layer of the ground floor and to the stone walls of the facade.
    - IN THE FIRST FLOOR: the wooden structure will be anchored to the stone walls

We can see the details of the constructive elements of the building in the planes 7 and 8 of the Annex 1. All the information have been extracted from the documents of the restoration in 1985 that the architect N.J. Adema made in the building.

Those new windows will have an hinge opening system and a double glassing (4-6-4) 2 faces of glass of 4 mm and one air chamber of 6mm, like we can see in the picture 14.1.1-1 that will permit the owner to open the windows for ventilation (in the case of the windows that have opening system) bloking the air leaks and improving the thermal resistance of the window at the same time. This solution will reduce the termal conductivity rate, reducing the possibilities to have condensations on the windows, and if we have, we can open te windows to permit the ventilation and the condensation would dissapear.

In the Annex 2 of the project, we can see the thermal calculations of the all the elements of the existing house and with the modifications that the building will have comparing te themal resistance that they will have after the modifications.

Van Ruysdael glassing:

We also tought to renew the existing glassing of the windows that the building has actually using a special glass with an high thermal resistance.

This glass had 7.5mm of thickness and a U value of 3.2 W/m2K as we can see in the details below.

The problem that we tought was that only is allow renew the glasses when the state of the window is really bad, and with the measurements that we did on the building, the thickness of the glasses of the ecisting windows should be around 5mm.

Renew the glass, according with Mr. Harm Hagsma is allowed if the glassing has the same or smaller thickess becuase it will not be necessary modificate the wooden frame work of the windows without affecting any exterior esthetical value. However, one bigger glassing than the actual will need a modifiction of the wooden frames changing the exterior aspect of the house. And the monumental aspect is more important than the heat losses of the house.

For that reason it is not posssible the installation of this kind of glass.

VAN RUYSDAEL

GELAAGD GLAS

34.32.#. GELAAGD GLAS, BEGLAZING MET KIT OF GLASLATTEN

0. GELAAGD GLAS

Fabrikaat:	Van Ruysdael Delft Mail: info@vanruysdael.com
Type:	**7,5 mm Van Ruysdael isolerend++ extra geluidsisolerend**
Omschrijving:	warmtereflecterend, extra geluidsisolerend en doorbraakvertragend glas met een licht oneffen structuur
Bestelcode:	**VR 22.52**
Dikte:	7,5 mm
U-waarde glas:	3,2 W/m^2.K
LTA-waarde	75 %
ZTA-waarde	71 %
Rw waarde:	36 dB
UV wering:	99 %
Gewicht:	18 kg/m^2
Veiligheid:	P2a

#. BEGLAZINGSSYSTEEM

Beglazen met Van Ruysdael Performance en Van Ruysdael Detail of met glaslatten volgens verwerkingsvoorschrift fabrikant.

14.1.2 New insuation layer in the facade walls and in the ground floor:

According with the Dutch normative "Bouwbesluit", the thermal envelope elements of the building must have a thermal resistance of 2.5 m2K/W.

We do not know exactly the thickness of all the materials of the building like is the thickness of the wooden slat floor but for the interior layers built in the restoration of 1985 we know exactly the thickness of the material installed being that the architect told us in a interview with him.

With the data that we have got, the actual thermal resistance of the ground floor (there are 2 types as we can see in the plane 8) is 1.92 m2K/W being this the wooden floor of the ground floor the main one that cover almost all the surface of the ground floor.

For the wall facades, being able to see all the layers of the wall in the plane 7, the thermal resistance is 2.03 m2K/W.

For that reason, we will improve the thermal resistance of the two constructive elements installing:

- **Wall facade**: New layer of insulation (second layer) on the last wooden slat structure of the facade walls. We will use the same insulation than in the restoration in 1985 (Alkreflex 1.3 m2K/W and 6.5mm) because is easy to install and quick (it is installed with staples).

To make this modification we will have to:

- Uninstall temporary the heating system
- Remove temporary the furniture of part of the house.
- Demolish the actual plasterboard of the interior part of the facade.
- Demolish the tiling from the bathroom
- Install the new layer of insulation on the wooden structure
- Install a new layer of plasterboard and paint it.
- Readjust the electricity and water installation with the new partition material.

According with the thermal calculation form the Annex 2, the new thermal resistance of the new facade will be of 3.5 m2K/W.

- **Ground floor:** There are 2 kinds of ground floor as we can see in the plane 8, one made with wooden slats and other one finished with concrete tiles.

- Wooden floor: as we can see in the thermal calculation of the Annex 2, the existing wooden floor has a thermal resistance of 2.03 m2K/W. To improve it until 2.5m2K/W we will add a new layer of insulation Alkreflex to the ground floor.

Imagen 14.1.2-1 Wooden floor living room ground floor

To make this modification we will have to:

- Remove temporally the actual wooden slats from the floor.
- Install the new layer of insulation
- Reinstall again the wooden slats on the floor.

The new thermal resistance with this new layer of insulation will be 3.3 m2K/W, bigger than the 2.5m2K/W.

- Tiling concrete: It is the other kind of floor there is in the corridors of the house.
- We do not know exactly which are the thicknesses of the final layers of this kind of floor (concrete tiles and concrete extra layer). However we have gave them a common value to make an approximation of the thermal resistance and it is around 1.78 as we can see in the thermal calculation of the annex 2 for the values for the existing building.

To improve the thermal resistance until 2.5 m2K/W it would be necessary install a material with a big thermal resistance like in the other kind of floor. However, it is not allowed to demolish the tiling concrete to do that because it below of that part could be installations that we could damage because there is not enough information about where are exactly the sanitation facilities and how deep they are.

What we can do to improve a bit the thermal resistance of this part is install a small layer of cork floor on the actual tiling concrete being that all the doors are not in the same level than the tiling floor as we can see at the picture below. All the doors are almost 1.5cm up than the level of the tiles being able to install a small layer of that will have 11mm as we can see in the Annex 3 in the specification of the materials chosen.

This cork layer only a thermal resistance of 0.103 m2K/W but it is the only improvement of the thermal resistance that we can do without affecting some important aspect of the house.

Imagen 14.1.2-2 Small stair between the level of the door an the tiling concrete.

To make this modification we will have to:

- Remove the actual wooden plinth of the corridors (It is allowed).
- Install the new cork layer on the actual tiling concrete (it will have a finishing similar to the wood).
- Install a new cork plinth with the new cork plinth

Imagen 14.1.2-3 Cork flooring to install in the building

- **Repercussions on the historical aspects of the building.**

Respecting with the modification of the interior layers of the façade walls, the only layers that will be modified will be the ones built in the restoration in 1985. There will not be any problem with the temporally removal of the furniture like the blinds and the curtains because after the restorations we can install them back, just as the heating installation.

Regarding to the ground floor layers, the modifications do not have any repercussions meaning that the existing material layers will continue being in the building like before. The only element modified would be the actual corridor plinth that would be replaced for one made by cork with a wooden finishing similar to the other kind of ground floor of the living room, the library and the kitchen of the same floor.

14.1.3 Cracks and door reparation

- Cracks covering of the main facade

To remove the possible air filtrations in the cracks of the main facade and prevent the heat losses that small part of the main facade will be covered with cement mortar.

- **Repercussions on the historical aspects of the building.**

The cement mortar will be chosen to have the same colour than the present mortar of the cement joints without affecting any historical value of the building and preserving the aesthetic aspect.

- Door reparation

Repair the main door to remove the air leaks it is allowed if the door will continue having the same actual aspect than now. To remove the air leaks it will be necessary to fix the door, changing the existing hinges and increasing the volume of the door at the parts where is the air leaks when the door is closed. We will get that by applying a special resin suitable for wooden elements.

- **Repercussions on the historical aspects of the building.**

The door will be painted having the same characteristics than before solving the problem of the air leakage of the door so there will not be any damage on it.

14.2 VENTILATION

To improve the ventilation of the building we will make these modifications:

1- Renew the existing fans from the humid rooms, the mechanical ventilation will continue working inside the building to eject the interior air but with new and better fans.

2- New ventilation unit of the attic

- Advantages

- Improvement of the ventilation inside the building.
- Removal of the surface condensations in the windows.
- Removal of the excess of humidity in the internal air.
- Reduction of the effects of the capillary room from the living room.
- Improvement of the quality of the air.

- Disadvantages

- Investment of money.

According with the Dutch normative "Bouwbesluit" > Meansville buildingregulations >an old version > somewhere in the 80ties

The new ventilation has to ensure the renewal of **all m3 of air inside the building every hour**. Fans will have to have enough power to get that much air to circulate in the correct manner.

14.2.1 New ventilation flow in the building

The correct ventilation that should have the building would be eject the m3 of air that has the building every hour**.**

The actual M3 of air inside the house are:

Groun floor:
160 m2 (surface of the main building) x 3.4m (height) =**544m3**
First floor:
52m2 (surface of rooms 12,13,14 and 16) x3.10 m (height of those rooms)=161.2m3
108m2(surface rest of the floor)x 2.12m (height of that part)= 228.96m3
Total m3 first floor= **390,16m3**

Total m3 main building= 934,16m3

The fans will be renewed in 4 rooms, which means that each fan has to eject around 230m3/h of air.

We can see the details of the new fans in the Annex 3 of the project.

The new fans have been chosen by 3 reasons:

- They have enough performance to eject 230m3/h of air.
- They detect the excess of humidity so it will be useful to remove the excess of humidity inside the house.
- The fans have an outlet air 100mm, perfect to fit in the ventilation pipes of 12.5mm that the building has now.

➢ **Repercussions on the historical aspects of the building.**

- Fans:

Renew fans is allowed but to renew them we will have to modify the actual ceiling from the house to install the new fans in the old pipes and readjust the electricity installation for the fan operation.

According with the information of Mr. Harm Hagsma, modifying the ceiling is allowed if the reason for such modification is related to the internal living conditions like the quality of the air.

The fan that could gave us more problems is that one that will be installed in the bathroom of the first floor because the height in that part of the floor is of 2.2 metres and it is not sure the space between the ceiling and attic floor.

If some problems might be encountered and we would have to modify more stuff of the ventilation system, the professional in historical building of Franeker would have to visit the building to know which will be the best way to solve the problem with the ventilation without causing problems in the building.

14.3 ENERGY EFFICENCY

All the modification planned until now to improve the thermal comfort of the building (that is second main goal of the project after peserv the historical aspects of the building) has a direct impact in the energy efficency of the buillding. If we get to have a building to be more hermetic (that does not lose big quantities of heat), we will have to use less energy to keep warm the house improving, at the same, the energy efficency of the building.

That is what we have done improving the thermal resistance of the windows, walls and ground floor materials.

However, there is one modification which can be very useful in order to improve the energy efficency of the building and it is to renew the old heating unit of the building for a new one with higher performances and more efficient.

In the Annex 3 we can see one option of heating unit that we can install in the attic of the building.

- Advantages:

- Improvement of the energy efficiency
- The power radiators of the rooms from the ground floor will be improved getting to transfer more heat to those rooms from the ground floor.
- Improvement of the thermal comfort of the building.
- Improvement of the efficiency energy.
- Saving energy and money.

- Disadvantages:

- Investment of money

- **Repercussions on the historical aspects of the building.**

This modification does not affect any important aspect of the building.

15 ENERGETIC CONSUMPTION ANALISYS

One of the goals of the project, to further improve the thermal comfort of the building is to try to reduce the energy consumption due to the continuous increase of energy.

With the solution planned, preventing the air leaks, removing the cold sensations and improving the thermal resitance of the house, we would have a building that will not lose the same quantity of energy than before, saving the owner energy and money.

Then, we will do research to know an estimation of the existing energy consumption within the building, comparing it with the building with all the modifications that are going to be applied.

15.1 Energetic conumption analysis of the existing building.

15.1.1 Energy distribution of the existing building.

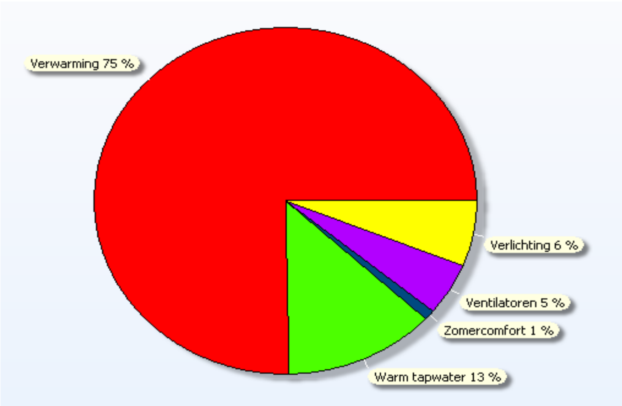
To know an estimation about the quantity of energy that the building is using with the current status we have used a energetyc software called "ENORM v1.1". We can to see all the specifications of the thermal calculations in the Annex 2, the calculations of the thermal resistances of the constructive elements and the results of the program "Enorm v1.1".

We had to generalize the most common thermal resistence values from the constructive components of the building in order to do the calculations, being these the values that there will be used:

- EXISTING BUILDING:

- Wall facade: Side and Back facade , plane 7 Annex 1. Thermal resistence= 2.03m2k/W
- Ground floor: Wooden Floor, plane 8 Annex 1. Thermal resistance =1.92m2K/W.
- Window: Original Window, plane 9 Annex 1. U= 5.7 W/m2K.
- Roof: We will use the thermal resistance of the roof plus the floor from the first level being that the attic is a not inhabited space because it is empty (Roof+ Wooden floor first floor. Plane 9 Annex 1. Thermal resistane= 2.6 m2K/W.

Then we can see a graphic with the actual distributino of the energy of the building:



Deelpost	Energiegebruik geconverteerd naar primaire energie [MJ]						
	elektriciteit	aardgas	stookolie	hout, biomassa	externe warmte	externe koude	Totaal
Verwarming	0	173 457	0	0	0	0	181 089
(hulpenergie)	7 632						
Warm tapwater	0	30 985	0	0	0	0	30 985
(hulpenergie)	0						
Koeling	0	0	0	0	0	0	0
(hulpenergie)	0						
Zomercomfort	2 133						2 133
Bevochtiging	0	0	0	0	0	0	0
Ventilatoren	11 675						11 675
Verlichting	14 746						14 746
Totaal	**36 186**	**204 442**	**0**	**0**	**0**	**0**	**240 628**
Geproduceerd (EPus)	0						0
Afgenomen energie	**36 186**	**204 442**	**0**	**0**	**0**	**0**	**240 628**
Geproduceerd (nEPus)	0						0
EPtot							**240 628**

The results are:

1- Heating, the quantity of energy required to warm up all the house is a 75%
2- Hot water, the value to warm all the water for consumption (bathrooms &washing machine) is 13%
3- For illumination 6%
4- For ventilation: 5%, This rate means the quantity of ventilation that uses the system of the building.
5- Zomercomfort: 1%. (It is the value that describes an overheating in some part of the house. It is not a negative value, it only Indicates that there will be some parts of the building will be warm sometimes needing a bit more of ventilation to remove that warmth.

The biggest way which the building is spending energy is <u>for heating</u> with three quarters of the total energy sent on this issue alone. This, like we will see later with the modifications, is mainly produced by 3 reasons:

1- The house is very big. The main building, where the heating is being used with more frequence has around 320m2 of surface to warm.
2- The actual windows of the house have not enough thermal resistance, losing a lot of heat through them.
3- The existent heating unit has not the same efficiency than a modern heating unit having almost 30 years.

The second way where the building is spending a lot of energy is for warming the water for consumption. Also it is the central heating unit who is warming this water in almost all the building less the kitchen that has its own small heating unit.

The others three ways do not have the same importance than the two first ones being that they do not have the same importance than the others. We will have to improve the building to reduce the quantity of energy used.

15.1.2 CO2 emission of the existing building

Deelpost	Energiegebruik per energiefunctie in kg CO2						
	elektriciteit	aardgas	stookolie	hout, biomassa	externe warmte	externe koude	totaal
K CO2 [kg/MJ]	0,1569	0,0506	0,0877	0,0000	0,0877	0,0877	
Verwarming	0	8 777	0	0	0	0	9 245
(hulpenergie)	468						
Warm tapwater	0	1 568	0	0	0	0	1 568
(hulpenergie)	0						
Koeling	0	0	0	0	0	0	0
(hulpenergie)	0						
Zomercomfort	131						131
Bevochtiging	0	0	0	0	0	0	0
Ventilatoren	716						716
Verlichting	904						904
Totaal	**2 218**	**10 345**	**0**	**0**	**0**	**0**	**12 563**
Geproduceerd (EPus)	0						0
Geproduceerd (nEPus)	0						0
M CO2							**12 563**

Knowing the Kg of gas that produces consume 1 MJ of energy from electricity and gas we can to know the total CO2 emissions of the installations at the building. The biggest one are in the installation that consumes more energy, and this is the Heating unit that produces the same % of CO2 emissions than the energy consumption, a 75%.

15.2 Energetic consumption analysis of the new building.

15.2.1 Energy distribution of the new building.

The renovations that we are going to make in the building to reduce the energy consumption and solve the thermal problems that the building has are:

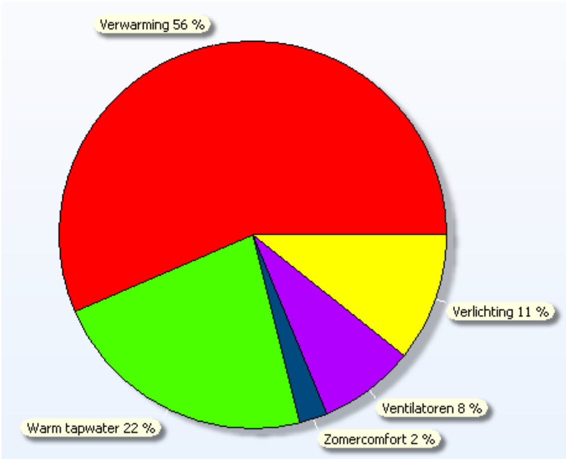
- Renew the actual heating unit for other more modern and more efficient.
- Increasing of the thermal resistance of the façade walls, installing a new layer of insulation behind the plasterboard layer.
- Improve the thermal resistance of the actual windows. We will get this firstly by removing the extra glass layer of all the windows that have it because they are producing condensations and install extra windows behind the existing ones with double glassing. Secondly, those new windows will have an opening system, so we will get remove all the air leaks of the windows with the new ones without a condensation apparition and moreover the thermal resistance of the windows will be improved.

The new thermal resistance of the elements will be these:

- Wall facade: Plane 15 Annex 1. New thermal resistance 3.53 m2K/W
- Ground floor: Plane 14 Annex 1. New thermal resistance 3.2 m2K/W

- Windows: Plane 15 Annex 1. New U value: 1.51 W/m2K
- Roof: Thermal resistance= 2.6 m2K/W.

The graphic with the new distribution of energy is this one:



Deelpost	Energiegebruik per energiefunctie in kg CO2						
	elektriciteit	aardgas	stookolie	hout, biomassa	externe warmte	externe koude	totaal
K CO2 [kg/MJ]	0,1569	0,0506	0,0877	0,0000	0,0877	0,0877	
Verwarming	0	3 574	0	0	0	0	4 030
(hulpenergie)	457						
Warm tapwater	0	1 568	0	0	0	0	1 568
(hulpenergie)	0						
Koeling	0	0	0	0	0	0	0
(hulpenergie)	0						
Zomercomfort	193						193
Bevochtiging	0	0	0	0	0	0	0
Ventilatoren	689						689
Verlichting	904						904
Totaal	**2 242**	**5 141**	**0**	**0**	**0**	**0**	**7 384**
Geproduceerd (EPus)	0						0
Geproduceerd (nEPus)	0						0
M CO2							**7 384**

1- Heating: 56%
2- Hot water 22%
3- Illumination 10%
4- Ventiation: 8%
5- Zomercomfort: 2%

<u>15.2.2 C02 emissions of the new building.</u>

Deelpost	Energiegebruik geconverteerd naar primaire energie [MJ]						
	elektriciteit	aardgas	stookolie	hout, biomassa	externe warmte	externe koude	Totaal
Verwarming	0	70 624	0	0	0	0	78 079
(hulpenergie)	7 455						
Warm tapwater	0	30 985	0	0	0	0	30 985
(hulpenergie)	0						
Koeling	0	0	0	0	0	0	0
(hulpenergie)	0						
Zomercomfort	3 147						3 147
Bevochtiging	0	0	0	0	0	0	0
Ventilatoren	11 237						11 237
Verlichting	14 746						14 746
Totaal	**36 584**	**101 609**	**0**	**0**	**0**	**0**	**138 193**
Geproduceerd (EPus)	0						0
Afgenomen energie	**36 584**	**101 609**	**0**	**0**	**0**	**0**	**138 193**
Geproduceerd (nEPus)	0						0
EPtot							**138 193**

15.3 Comparation of the values before and after the modifications

COMPARATION EXISTING BUILDING- NEW BUILDING							
Installation	ENERGY CONSUMPTION (MJ)			CO2 EMISSIONS (KG)			ENERGY DIFERENCE(%)
	EXISTING BUILDING	NEW BUILDING	DIFFERENCE	EXISTING BUILDING	NEW BUILDING	DIFFERENCE	
Heating	173457	78089	95368	9245	4030	5215	55%
Hot water	30985	30985	0	1568	1568	0	0%
Zomecomfort	2133	3147	-1014	131	193	152	-48%
Ventilation	11675	11237	438	716	689	689	4%
Illumination	14746	14746	0	904	904	0	0%
Total	232996	138204	**94792**	**12564**	7384	**6056**	41%

If we see the values we can check there are values that have been reduced and others that have not been affected. In the case of heating, all the modifications that will be done at the building will improve the thermal resistance of the building saving a 55% of energy to of heating and a total of 41% of the energy consumption and CO2 emissions.

The values that have not changed significantly will be for the installation of hot water and illumination, because the modifications do not affect those installations. The hot water rates have grown but the consumption is the same than before being produced by the reduction of the heating value from 75 to 56%.

The value of the ventilation, the quantity of air that goes inside the building by the joints, cracks and infiltrations have been reduced exactly by 4% , since a building without air leaks prevents better future air filtrations inside the building.

The zonecomfort have grown a 59%, that means that the building will be more hermetic and there will be more overheating by the sunlight in some places of the house, that there will be mainly the south facade, that is exposed to more hours of sun and has the biggest windows of all the building. .

Making all these modifications in the building we will get to have a more efficient house, it will not have the same heat losses than before improving the thermal comfort of the house without affecting the historical aspects of the building.

Furthermore, we will analyse the cost of all these modifications and how long will be the workers to make the restoration to improve the thermal comfort in the building.

16 COULD WE APPORT ENERGY TO THE BUILDING USING OTHER SYSTEMS LIKE RENOWABE ENERGY?

Also, to improve the efficiency energy of the building reducing the energy consumption we could search some different, renewable systems to spend less money in energy in the future.

The possible sustainable systems that we have thought that could provide extra renewable energy to the heating system to reduce the energy consumption that the house has actually (4200m3 of gas in 2013 and 3019m3 in 2014) are:

- Solar energy
- Biomass energy

16.1 Solar energy

➢ Advantages:

- Reduction of the energy consumption of the house
- Renewable energy, it does not produce CO2 emissions
- Reduction of the actual CO2 emissions
- Reduces dependence on fossil fuels
- The aesthetical aspect of the building would not be modified being that they would be installed the solar panels can affect the image of the building

➢ Disadvantages:

- High initial cost (buy the solar panels + the installation). The installation of the would be more expensive being that we would be working on a historical building having to have more careful and caution to not to cause any damage to the building
- Solar panels require periodic maintenance.
- The weather would affect the performance of the solar energy capitation.
- The orientation of the roof will affect the uptake of solar energy.
  The 2 faces of the roof of the house are looking the east and the west direction. Then, we performance of this solar panels will not be the same than if they are looking to the South. In order to generate the same energy, a greater number of solar panels would not have the best performance.

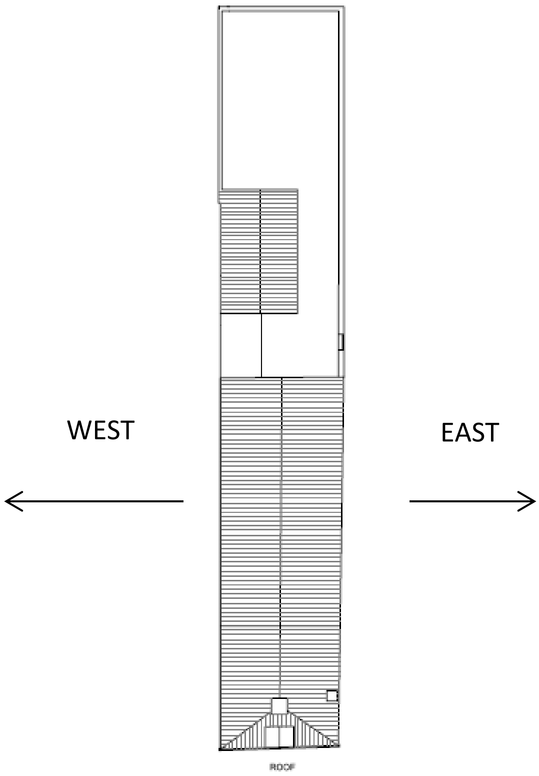
16.1.1. Could we install solar panels at the building even being this a historical building?

That is the first question that we have to know.
Is it allowed install solar panels on the roof of a historical building?
That installation could cause deteriorations at the roof and one of the goals of the project was preserve the historical aspects of the building.

According to information provided to us Mr Harm Haitsma, installing solar panels on the roof is not allowed because it would affect the exterior appearance of the building.

16.1.2 Would be profitable install solar panels?

Moreover, if it would be allowed, the performance of the solar panels would be very low being that the best performance of the solar panels is produced when the solar panels are focused to the South, however, the two facades of the roof of the building are one in the East direction and the other one in the West. So if the installation of solar panels would have been possible most probably the solar panels would have not been fully profitable for the owner of the house.



16.2 Biomass energy

- Advantages

- Renewable energy
- Reductions of the CO_2 emissions
- If residues of other activities such as biomass are used, this results in waste recycling and reduction.
- Reduces dependence on fossil fuels

- Disadvantages

- Low energy efficiency of biomass fuels compared to fossil fuels.
- More biomass is needed to get the same amount of energy.
- Fuel can take a lot of volume and can create problems of transport and require large storage spaces
- Big initial investment.
- Big space to storage the biomass.

It is clear that have a biomass boiler in the house will emit less C02 emissions using renewable energy.

16.2.1 Would it be better to replace the new heating unit that we have tough to install in the building for a biomass system?

A gas heating unit installed in the building has the impact that you will not need storage the combustible and it would not be necessary to carry with the combustible until the attic where would be located the biomass boiler.

Moreover, if having a biomass energy the power of the heating will be lower we could have the same problem that have the house now, that the power of the heating unit is not enough to warm some of the parts of the building.

For these reasons and knowing that with a gas heating unit we will have more C02 emissions we think that the best option for the building continue being a gas heating unit.

.

17 COST ESTIMATION

All the activities will be developed by two workers during all the restoration, being the price/hour for each worker 35€/hour (70€ both) and being supervised by a project leader.

As there are not enough data to know all the measurements of all the elements from the building some activities will have an amount of money to include the jobs that do not have a specific cost.

These activities in the Cost Estimation are called "PC" being these the name of all those activities and the works that are included in their costs:

PC1: (2000€) TEMPORARY REMOVAL OF THE HEATING INSTALLATION

Temporary removal of the heating installation of the house to start the rest of the works depositing it in the back of the house to be used as material storage area during the entire restoration.

It includes the uninstallation of the radiators and the heating pipes that will be preventing the installation of the new materials and most of the works of the restoration.

PC2: (500€) TEMPORARY REMOVAL OF FURNITURE AND SANITARY EQUIPMENT.

It includes the uninstallation of those elements that prevent the correct execution of the future works and can be damaged during the work. It will be necessary to remove all the furrniture from the rooms 7,8 and 9 and all the elements close to the facades as we can see in the Demolition Plan in the Plane 16 of the Annex 1.

PC3: (1500€) PIPE WORK

Readjustment of heating pipes and sustitution of those ones that are not in good conditions.

PC4: (1500€) REPARATION RADIATORS.

Readjustment of radiators and sustitution of those ones that will not be in a good state.

PC5: (1000€) MODIFICATION OF THE ELECTRICITY INSTALLATION OF THE WALL FACADES FROM GROUND AND FIRST FLOOR.

All the changes have to be done in order to adapt the electricity installation to the new materials installed at the interior part of the facade walls. Plugs, switches, adjustments in the installation.

PC6: (200€) READJUSTEMENT OF WATER INSTALLATION OF THE KITCHEN FROM GROUND FLOOR AND BATHROOM FROM FIRST FLOOR.

It will comprise the works to adapt the existing water instllation to the new partition from the kitchen (room nº9) and bathroom from the firts floor (room nº17).

<u>**PC7:** (2500€) VENTILATION INSTALLATION.</u>

It includes all the works that could affect the wrong operationalization from the new ventilation system like sustitution of ventilation pipes, temporary removal of the existing ceiling electricity readjustments..

<u>**PC8:** (2000€)REINSTALLATION OF HEATING .</u>

Reinstallation of the heating system when all the works will be finished.

<u>**PC9:** (500€) REINSTALLATION OF FURNITURE .</u>

Reinstallation of the furniture elements when all the works will be finished.

<u>**PC10:** (100€) CLEANING OF THE HOUSE .</u>

Removal of possible derbis and cleaning of the parts of the house where we have been working.

The values of the "PCs" will be in the cost stiation in the collum of "Labour". However, those activities include the labour and also the new materials. It is not clear which quantity of materials we will need, but the biggest part of the money for each PC will be the labour.

The data of the material cost and the performance of workers have been extracted from a two databases called "CYPE" and IVE" used in Spain.

All the details and all the material that there will be used

RESULTS:

The **final cost** of all the modifications planned to develop in the building will be, including VAT, **120124.10€** being the details in the next page.

For that amount of money, we have added:

- 10% of <u>Unexpected risk</u> (because we are working in a historical building and we might have incidentals during the restoration)
- 5% of indirect cost.
- Risk 5%
- Profit 2%
- VAT (it will be 6% for the cost of the labour, and 21% for the material cost)

		COST ESTIMATION												
		25/06/2014												
		average wage	/hour	70,00										
						LABOUR		MATERIAL		Equipment		SUBCONTRACTING	TOTAL	SUBTOTAL
Code	Sub-code	Description	unit	Quantity	m.u./ unit	m.u./ quantity	Arbeid TOTAAL	Material unit	Material TOTAAL	Equipment unit	Equipment TOTAAL	TOTAAL		
		General												
		Bank garantee (9 weeks)	pc	1,00								500,00	500,00	
		Building insurance	pc	1,00								2.500,00	2.500,00	
														3.000,00
		General Costruction Costs												
		Formen / Project leader	week	12,00	2000		24.000,00						24.000,00	
		Small equipment	pc	1,00								2.000,00	2.000,00	
		Tubular scaffold facade works until 6 m of high Scaffold S.L. (67€/week)	week	9,00							603,00		603,00	
		Services (water - electricity) PRINCIPAL (Provided by the owner)	pc	1,00										
		Container for derbris CEMEX 6m3 of capacity (70€/week)	week	11,00								770,00	770,00	
														27.373,00
1		**DEMOLITION & PREVIOUS WORKS**												
	1,1	Removal extra glass layer windows A,B,C,D,F,O,P,Q and R	m2	23,50	0,16	3,76	263,20						263,20	
	1,2	(PC 1) Temporary removal of heating installation of the facade walls	pc	1,00			2.000,00						2.000,00	
	1,3	(PC2) Temporary removal of furniture and sanitary equipment close to the facades. And everything from the rooms 7,8 and 9 including the actual plinth of those 3 rooms.	pc	1,00			500,00						500,00	
	1,4	Demolition existing plasterboard layer of the facade walls including cleaning and removal of debris	m2	175,70	0,15	26,36	1.844,85						1.844,85	
	1,5	Demolition actual wooden partittion of the periphery of the windows including the 2 layers of wooden slats with a section of 5x3cm and the existing insulation insulation layer including cleaning and removal of debris	m2	13,00	0,40	5,20	364,00						364,00	
	1,6	Demolition tiling layer of the bathroom including cleaning and removal of debris (room 17 first floor)	m2	6,00	0,20	1,20	84,00						84,00	
	1,7	Removal actual plinth from corridors. (Rooms 1,2 and 3)	m	54,00	0,10	5,40	378,00						378,00	
	1,8	Temporaly removal of the existing wooden floor from rooms 7,8 and 9	m2	118,00	0,10	11,80	826,00						826,00	
														6.260,05
2		**PARTITION WORKS**												
	2,1	WOODEN STRUCTURE												
	2,1,1	Wooden structure on the interior wall facade for the installation of the new new extra windows, Structure made with wooden slats fixed by screws	m2	13,00	0,7	9,10	637,00	40,00	520,00				1.157,00	
	2,1,2	Installation, on the interior wall facade from the rooms 12 and 16 of the wooden slat structure that have the rest fo the facades of the building following the order of layers of the wall detail of the plane 14 in the annex 1. (one layer of vertical wooden slats on other with horizontal slats)	m2	11,00	0,6	6,60	462,00	25,00	275,00				737,00	
	2,2	WALL INSULATION												
	2,2,1	New layer of insulation Alkreflex (first layer of insulation) at the interior wall facade installed with staples on the South facade from the first floor (rooms 12 & 16)	m2	11,00	0,07	0,72	50,05	12,56	138,16				188,21	
	2,2,2	GROUND FLOOR New layer of insulation Alkreflex for the interior wall facades (second layer of insulation) on the existing wooden slat structure installed with staples (rooms 1,7,8,9 and 3). Including the insulation on the new wooden structure for the new windows.	m2	100,00	0,07	6,50	455,00	12,56	138,16				593,16	
	2,2,3	FIRST FLOOR New layer of insulation Alkreflex (second layer of insulation) at the interior wall facades installed with staples on the existing wooden slat structure (rooms 12, 16,17,18,19,20 and 21)	m2	80,00	0,07	5,20	364,00	12,56	1.256,00				1.620,00	
														4.295,37
3		**FLOORING WORKS**												
	3,1	NEW FLOOR CORRIDOR GROUND FLOOR												
	3,1,1	Cork floor layer as insulation from the rooms 1,2 and 3. Installed directly on the existing floor in the corridor and along	m2	36,00	0,20	7,20	504,00	48,00	1.728,00				2.232,00	
	3,1,2	Installation of cork plinth in the perimeter of those corridors.	m	54,00	0,15	8,10	567,00	4,30	232,20				799,20	
	3,2	FLOOR INSULATION ROOMS 7,8,9												
	3,2,1	Insulation layer Alkreflex for the ground floor installed below of the actual wooden slats for the rooms 7,8 and 9	m2	118,00	0,05	5,90	413,00	12,56	1.482,08				1.895,08	
	3,2,2	Installation of the old wooden floor from the rooms 7,8 and 9	m2	118,00	0,13	15,34	1.150,50						1.150,50	
														6.076,78
5		**GLASSING WORK**												
	5,2	NEW WINDOWS BEHIND THE OLD ONES										Scaffold		
	5,2,1	Front facade Window A New extra window (double glassing) with an hinged opening system	m2	1,10	0,70	0,77	53,90	235,00	258,50				312,40	
	5,2,2	Front facade Window B New extra window (double glassing) with an hinged opening system	m2	4,01	0,70	2,81	196,49	235,00	942,35				1.138,84	
	5,2,3	Front facade Window C New extra window (double glassing) with an hinged opening system	m2	4,27	0,70	2,99	209,23	235,00	1.003,45				1.212,68	
	5,2,4	Front facade Window D New extra window(double glassing) with an hinged opening system	m2	2,70	0,70	1,89	132,30	235,00	634,50				766,80	
	5,2,5	Front facade window E New extra window (double glassing)with an hinged opening system	m2	2,70	0,70	1,89	132,30	235,00	634,50				766,80	
	5,2,6	Front facade Window F New extra window (double glassing) with an hinged opening system	m2	2,70	0,70	1,89	132,30	235,00	634,50				766,80	
	5,2,7	Right facade Window O New extra window (double glassing)with an hinged opening system	m2	2,23	0,70	1,56	109,07	235,00	523,11				632,18	
	5,2,8	Right facade Window P New extra window attached by screws to the new wooden structure with an hinged opening system	m2	2,23	0,70	1,56	109,07	235,00	523,11				632,18	
	5,2,9	Right facade Window Q New extra window (double glassing) with an hinged opening system	m2	2,23	0,70	1,56	109,07	235,00	523,11				632,18	
	5,2,10	Right facade Window R New extra window (double glassing) with an hinged opening system	m2	2,23	0,70	1,56	109,07	235,00	523,11				632,18	
	5,2,11	Right facade Window S New extra window (double glassing) with an hinged opening system	m2	1,50	0,70	1,05	73,50	235,00	352,50				426,00	
	5,2,12	Back facade Window J New extra window (double glassing)with an hinged opening system	m2	2,95	0,70	2,07	144,55	235,00	693,25				837,80	
	5,2,13	Back facade Window N New extra window (double glassing) with an hinged opening system	m2	0,83	0,70	0,58	40,67	235,00	195,05				235,72	
	5,2,14	Back facade Window L New extra window (double glassing) with an hinged opening system	m2	1,93	0,70	1,35	94,57	235,00	453,55				548,12	
	5,2,15	Back facade Window K New extra window (double glassing) with an hinged opening system	m2	1,93	0,70	1,35	94,57	235,00	453,55				548,12	
	5,3	RENEW DOUBLE GLASSING												
	5,3,1	Window "T" Double glassing broken. Intallation of a new one	m2	0,95	0,80	0,76	53,20	77,00	73,15				126,35	
	5,3,2	Door "H" (no historical window made in 1985) Sustitution of the existing simple glassing for a new one double	m2	2,95	0,80	2,36	165,20	77,00	227,15				392,35	
														10.607,52
6		**HEATING SYSTEM**												
	6,1	Removing actual heating unit	pc	1,00	3,00	3,00						210,00	210,00	
	6,2	(PC 3) Pipe work	pc	1,00								1.500,00	1.500,00	
	6,3	New Heating unit IDEAL 40KW (installation +heating unit)	pc	1,00	4,00	4						2.366,14	2.366,14	
	6,4	(PC4) Reparation radiators	pc	1,00								1.500,00	1.500,00	
														5.576,14
7		**ELECTRICITY**												
	7,1	(PC5) Modification of the electricity installation of the wall facades from ground and first floor	pc	1,00			1.000,00						1.000,00	
														1.000,00
8		**WATER INSTALLATION**												
	8,1	(PC6) Readjustement of water installation of the Kitchen from ground floor and the Bathroom on the first floor	pc	1,00			200,00						200,00	
														200,00
9		**VENTILATION**												
	9,1	Fans in humid rooms	pc	4,00	1,00	4	280,00	13	52,00				332,00	
	9,2	(PC7) Ventillation installation					2.500,00						2.500,00	
														2.832,00
10		**REPARATIONS**												
	10,1	Covering cracks main facade with white cement mortar , same colour of the joints from the facade mortar	m2	1,00	0,13	0,13	9,10	0,48	0,48				9,58	
	10,2	Front door (door A) Reparation existing door	pc	1,00	2	2,00	140,00	207,54	207,54				347,54	
														357,12
11		**FINISHING WORK**												
	11,1	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness anchored to the wooden slat structure installed before	m2	135,70	0,3	40,71	2.849,70	8,00	1.085,60				3.935,30	
	11,2	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness anchored to the wooden slat structure installed before. Moisture resistant panels for the kitchen (humid room 9).	m2	40,00	0,3	12,00	840,00	8,50	340,00				1.180,00	
	11,3	New tiling layer installed in the bathroom (first floor room 17) on the new platerboard layer using cement mortar for bathrooms.	m2	6,00	0,40	2,40	168,00	10,27	61,62				229,62	
	11,5	Painting of rooms where have been installed the new plasterboard layer (walls and top of all the room)	m2	876,03	0,15	131,40	9.855,34	3,15	2.759,49				12.614,83	
	11,6	Painting wooden frames of windows	m2	5,00	0,80	4,00	280,00	13,00	65,00				345,00	
	11,7	Painting repaired door	m2	4,80	0,20	0,96	67,20	13,00	62,40				129,60	
	11,8	(PC8) Reinstallation heating	pc	1,00			2.000,00						2.000,00	
	11,9	(PC9) Reinstallation furniture	pc	1,00			500,00						500,00	
	11,10	(PC10) Cleaning of the house	pc	1,00			100,00						100,00	
														21.034,35
				€										
		SUM OF SUBTOTALS		88.612,33		342,86	57.611,01		19.052,17		603,00	11.346,14	88.612,33	88.612,33
		UNEXPECTED (+10% of 56838,46)		97.473,56										
		COST												
		Indirect (+5% of 62522,31)		102.347,24										
		Risk (+5% of 65648,42)		107.464,60										
		Profit (+2% of 68930,84)		109.613,89										
		TOTAL COST (EXCLUDING VAT)		109.613,89										
		VAT Labour (6% of the labour costs= 17415,41)		3.456,66										
		VAT Material (21% of the material cost= 31764,65)		6.510,28										
		TOTAL COST (INCLUDING VAT)		119.580,83										

DESCOMPOSITION OF THE MEASUREMENTS

1		**DEMOLITION & PREVIOUS WORKS**			
	1,1	Removal extra glass layer windows A,B,C,D,F,O,P,Q and R	m2	**23,50**	
	1,4	Demolition existing plasterboard layer of the facade walls including cleaning and removal of debris	m2	**175,70**	
		GROUND FLOOR			
		South facade		12	
		Side facade		70	
		North facade		14,5	
		FIRST FLOOR			
		South facade		13,1	
		Side facade		54	
		North facade		12,1	
	1,5	Demolition actual wooden partittion of the low and periphery of the windows including the 2 layers of wooden slats with a section of 5x3cm and the existing insulation insulation layer including cleaning and removal of debris	m2	**13,00**	
		GROUND FLOOR:			
		Window A (3,5x0,75)		2,62	
		Window: B (0,5x1,42)		0,71	
		C (1,49x0,5)		0,74	
		Windows OPQR (0,5x1,05)		2,1	
		Window I (1,26x0,5)		0,63	
		FIRST FLOOR			
		Windows D,E,F (0,58 x 1,05)		1,82	
		Windows S (0,58 x 1,29)		0,75	
		Windows T (0,86x0,58)		0,50	
		Windows KL (1,07x0,58)		1,24	
		Windows N (3,5x0,35)		1,23	
	1,6	Demolition tiling layer of the bathroom including cleaning and removal of debris (room 17 first floor)	m2	**6,00**	
	1,7	Demolition actual wooden plinth from corridors. (Rooms 1,2 and 3)	m	**54,00**	
		Room 1		12,45	
		Room 2		27,46	
		Room 3		14,00	
	1,8	Temporaly removal of the existing wooden slat floor from rooms 7,8 and 9	m2	**118,00**	
		Rooom 7		60,00	
		Room 8		18,00	
		Room 9		38,00	
2		**PARTITION WORKS**			
	2,1	WOODEN STRUCTURE			
	2,1,1	New wooden structure on the interior wall facade for the installation of the new new extra windows, Structure made with wooden slats fixed by screws in zones where previously have been demolished the layers from the restoration in 1985	m2	**13,00**	SAME AS 1,5
	2,1,2	Installation, on the interior wall facade from the rooms 12 and 16 of the wooden slat structure that have the rest fo the facades of the building following the order of layers of the wall detail nº1 of the plane 7 in the annex 1. (one layer of vertical wooden slats on other with horizontal slats)	m2	**11,00**	
		Room 12 (4,8m2 of wall surface to cover)		4,80	
		Room 16 (6m2 of wall surface to cover)		6,00	
	2,2	WALL INSULATION			
	2,2,1	New layer of insulation Alkreflex (<u>first layer</u> of insulation) at the interior <u>wall facade</u> installed with staples on the South facade from the first floor (rooms 12 & 16)	m2	**11,00**	SAME AS 2,1,2
	2,2,2	GROUND FLOOR New layer of insulation Alkreflex <u>for the interior wall facades (second layer</u> of insulation) on the last wooden slat structure installed with staples (rooms 1,7,8,9 and 3). Including the insulation on the new wooden structure for the new windows.	m2	**100,00**	SAME SURFACES AS 1,4
	2,2,3	FIRST FLOOR New layer of insulation Alkreflex (<u>second layer</u> of insulation) at the <u>interior wall facades</u> installed with staples on the last wooden slat structure (rooms 12,16,17,18,19,20 and 21) Including the insulation on the new wooden structure for the new windows.	m2	**80,00**	SAME SURFACES AS 1,4
3		**FLOORING WORKS**			
	3,1	NEW FLOOR CORRIDOR GROUND FLOOR			
	3,1,1	Cork floor layer as insulation from the rooms 1,2 and 3. Installed directly on the existing floor with a dovetailing system in the corridor and along with the installation of cork plinth in the perimeter of those corridors.	m2	**36,00**	
		Corridor 1		9,20	
		Corridor 2		15,00	
		Corridor 3		11,00	
	3,1,2	Installation of cork plinth in the perimeter of those corridors.	m	**54,00**	
	3,2	FLOOR INSULATION ROOMS 7,8,9			
	3,2,1	Insulation layer Alkreflex <u>for the ground floor</u> installed below of the actual wooden slats for the rooms 7,8 and 9	m2	**118,00**	SAME SURFACES AS 1,8
	3,2,2	Reinstallation of the wooden floor from the rooms 7,8 and 9	m2	**118,00**	SAME SURFACES AS 1,8
5		**GLASSING WORK**			
	5,1	NEW WINDOWS BEHIND THE OLD ONES			
	5,1,1	Front facade Window A New extra window (double glassing) with an hinged opening system	m2	1,10	
	5,1,2	Front facade Window B New extra window (double glassing) with an hinged opening system	m2	4,01	
	5,1,3	Front facade Window C New extra window (double glassing) with an hinged opening system	m2	4,27	
	5,1,4	Front facade Window D New extra window(double glassing) with an hinged opening system	m2	2,70	
	5,1,5	Front facade window E New extra window (double glassing)with an hinged opening system	m2	2,70	
	5,1,6	Front facade Window F New extra window (double glassing)with an hinged opening system	m2	2,70	
	5,1,7	Right facade Window O New extra window (double glassing)with an hinged opening system	m2	2,23	
	5,1,8	Right facade Window P New extra window attached by screws to the new wooden structure with an hinged opening system	m2	2,23	
	5,1,9	Right facade Window Q New extra window (double glassing) with an hinged opening system	m2	2,23	
	5,1,10	Right facade Window R New extra window (double glassing) with an hinged opening system	m2	2,23	
	5,1,11	Right facade Window S New extra window (double glassing) with an hinged opening system	m2	1,50	
	5,1,12	Back facade Window J New extra window (double glassing)with an hinged opening system	m2	2,95	
	5,1,13	Back facade Window N New extra window (double glassing) with an hinged opening system	m2	0,83	
	5,1,14	Back facade Window L New extra window (double glassing) with an hinged opening system	m2	1,93	
	5,1,15	Back facade Window K New extra window (double glassing) with an hinged opening system	m2	1,93	
	5,2	RENEW DOUBLE GLASSING			
	5,2,1	Window "T" Double glassing broken. Intallation of a new one	m2	0,95	

	5,2,2	Door "H" (no historical window made in 1985) Sustitution of the existing simple glassing for a new one double	m2	2,95	
6		**HEATING SYSTEM**			
	6,1	Removing actual heating unit	pc	1,00	
	6,2	(PC 3) Pipe work	pc	1,00	
	6,3	New Heating unit IDEAL 40KW (installation +heating unit)	pc	1,00	
	6,4	(PC4) Reparation radiators	pc	1,00	
7		**ELECTRICITY**			
	7,1	(PC5) Modification of the electricity installation of the wall facades from ground and first floor	pc	1,00	
8		**WATER INSTALLATION**			
	8,1	(PC6) Readjustement of water installation of the Kitchen from ground floor and the Bathroom on the first floor	pc	1,00	
9		**VENTILATION**			
	9,1	New ventilation unit	pc	1,00	
	9,2	Fans in humid rooms EDECA 7,5 W working with electronic timer	pc	4,00	
	9,3	(PC7) Ventillation installation			
10		**REPARATIONS**			
	10,1	Covering cracks main facade with white cement mortar , same colour of the joints from the facade mortar	m2	1,00	
	10,2	Front door (door A) Reparation existing door	pc	1,00	
11		**FINISHING WORK**			
	11,1	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness	m2	**135,70**	SAME SURFACES AS 1,4 - SURFACE OF THE KITCHEN WALLS (40m2)
	11,2	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness. Moisture resistant panels for the kitchen (humid room 9).	m2	**40,00**	
	11,3	New tiling layer installed in the bathroom (first floor room 17) on the new platerboard layer using cement mortar for bathrooms. (3x2m)	m2	**6,00**	
	11,5	Painting of rooms where have been installed the new plasterboard layer (walls and top of all the room)	m2	**876,03**	
		GROUND FLOOR			
		Room 1		60	
		Room 7		176	
		Room 8		100	
		Room 9		113	
		Room 3		62,4	
		FIRST FLOOR			
		Room 12		51	
		Room16		108,2	
		Room 17(only the top, the bathroom has tiling on the walls)		8,2	
		Room 18		41,5	
		Room 19		70,62	
		Room 20		44,11	
		Room 21		41,00	
	11,6	Painting wooden frames of windows	m2	**5,00**	
	11,7	Painting repaired door	m2	**4,80**	
		2,4X1X2m			
	11,8	(PC8) Reinstallation heating	pc	**1,00**	
	11,9	(PC9) Reinstallation furniture	pc	**1,00**	
	11,10	(PC10) Cleaning of the house	pc	**1,00**	

18 PRECEDENCE NETWORK & GANT DIAGRAM

All the modifications that there will be made in the building to get the goals of the project will be performed by 2 workers during **12 weeks**, following the order and the duration of the activities of the Precedence Network and Gantt Diagram showed in the next pages, starting the works the day 25th of June and finishing them the 5th of September.

For the activities called "PC" in the cost estimation. We have introduced an approximated value about how long can we stay developing that activities inside the building being these the durations of those activities:

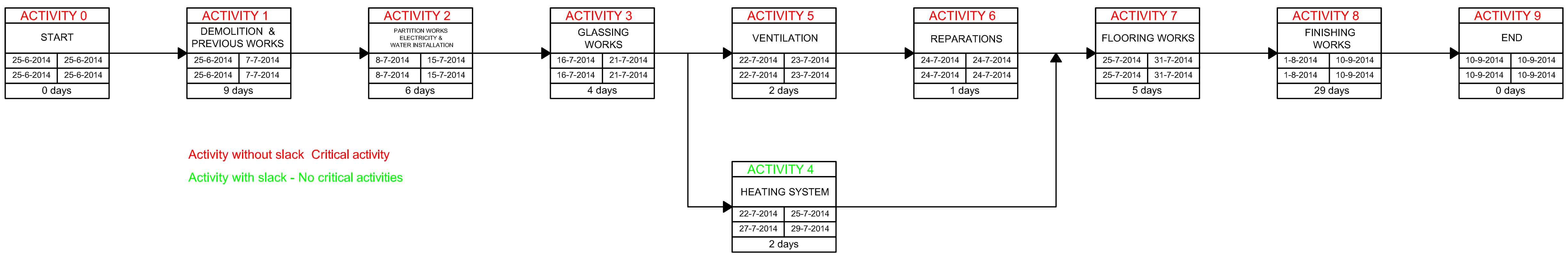
PC1: TEMPORARY REMOVAL OF THE HEATING INSTALLATION **1 day**
PC2: TEMPORARY REMOVAL OF FURNITURE AND SANITARY EQUIPMENT**1 day**
PC3: PIPE WORK **0.5 day**
PC4: REPARATION OF THE RADIATORS **0.5 day**
PC5: MODIFICATION OF THE ELECTRICITY INSTALLATION OF THE WALL FACADES FROM GROUND AND FIRST FLOOR. **1 day**
PC6: READJUSTEMENT OF WATER INSTALLATION OF THE KITCHEN FROM GROUND FLOOR AND BATHROOM FROM FIRST FLOOR.**0.5 day**
PC7: VENTILATION INSTALLATION.**0.5 day**
PC8: REINSTALLATION OF HEATING .**1 day**
PC9: REINSTALLATION OF FURNITURE .**1 day**
PC10: CLEANING OF THE HOUSE **0.5 day**

The restoration will start **the 25th of June** and it will be finished the **10th of September**

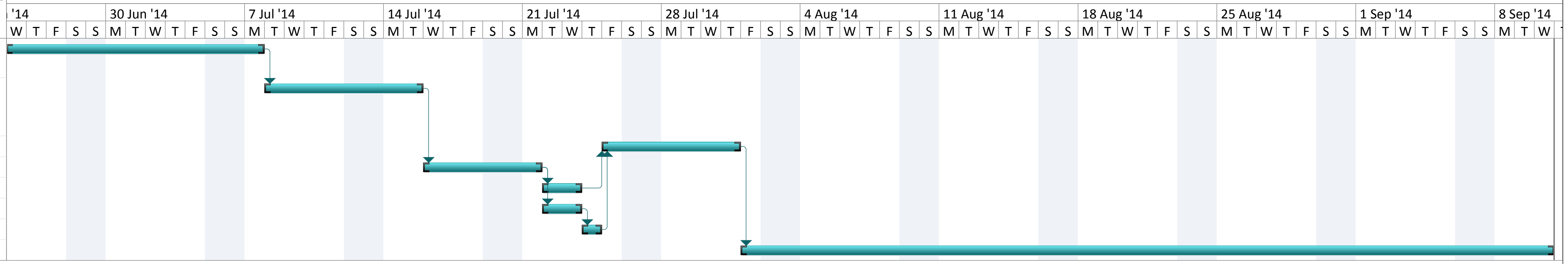
We can see in the next pages the calculations of the time for each activity, the precedence network and the Gantt Diagram for all the works during the restoration.

						GANTT		
Code	Sub-code	Description	unit	Quantity	m.u./ unit	HOURS	DAYS	FINAL DAYS
		General						
		Bank garantee (9 weeks)	pc	1,00				
		Building insurance	pc	1,00				
		General Costruction Costs						
		Formen / Project leader	week	11,00	2000			
		Small equipment	pc	1,00				
		Tubular scaffold facade works until 6 m of high Scaffold S.L. (67€/week)	week	9,00				
		Services (water - electricity) PRINCIPAL (Provided by the owner)	pc	1,00				
		Container for derbris CEMEX 6m3 of capacity (70€/week)	week	11,00				
1		**DEMOLITION & PREVIOUS WORKS**						
	1,1	Removal extra glass layer windows A,B,C,D,F,O,P,Q and R	m2	23,50	0,16	3,76	0,47	
	1,2	(PC 1) Temporary removal of heating installation of the facade walls	pc	1,00		8,00	1,00	
	1,3	(PC2) Temporary removal of furniture and sanitary equipment close to the facades. And everything from the rooms 7,8 and 9 including the actual plinth of those 3 rooms.	pc	1,00		8,00	1,00	
	1,4	Demolition existing plasterboard layer of the facade walls including cleaning and removal of debris	m2	175,70	0,15	26,36	3,29	
	1,5	Demolition actual wooden partittion of the periphery of the windows including the 2 layers of wooden slats with a section of 5x3cm and the existing insulation insulation layer including cleaning and removal of debris	m2	13,00	0,40	5,20	0,65	
	1,6	Demolition tiling layer of the bathroom including cleaning and removal of debris (room 17 first floor)	m2	6,00	0,20	1,20	0,15	
	1,7	Removal actual plinth from corridors. (Rooms 1,2 and 3)	m	54,00	0,10	5,40	0,68	
	1,8	Temporaly removal of the existing wooden floor from rooms 7,8 and 9	m2	118,00	0,10	11,80	1,48	
						69,72	**8,71**	**9,00**
2		**PARTITION WORKS**						
	2,1	WOODEN STRUCTURE						
	2,1,1	Wooden structure on the interior wall facade for the installation of the new new extra windows, Structure made with wooden slats fixed by screws	m2	13,00	0,7	9,10	1,14	
	2,1,2	Installation, on the interior wall facade from the rooms 12 and 16 of the wooden slat structure that have the rest fo the facades of the building following the order of layers of the wall detail of the plane 14 in the annex 1. (one layer of vertical wooden slats on other with horizontal slats)	m2	11,00	0,6	6,60	0,83	
	2,2	WALL INSULATION						
	2,2,1	New layer of insulation Alkreflex (first layer of insulation) at the interior wall facade installed with staples on the South facade from the first floor (rooms 12 & 16)	m2	11,00	0,07	0,72	0,09	
	2,2,2	GROUND FLOOR New layer of insulation Alkreflex for the interior wall facades (second layer of insulation) on the existing wooden slat structure installed with staples (rooms 1,7,8,9 and 3). Including the insulation on the new wooden structure for the new windows.	m2	100,00	0,07	6,50	0,81	
	2,2,3	FIRST FLOOR New layer of insulation Alkreflex (second layer of insulation) at the interior wall facades installed with staples on the existing wooden slat structure (rooms 12, 16,17,18,19,20 and 21)	m2	80,00	0,07	6,50	0,81	
						29,42	**3,68**	**4,00**
3		**FLOORING WORKS**						
	3,1	NEW FLOOR CORRIDOR GROUND FLOOR						
	3,1,1	Cork floor layer as insulation from the rooms 1,2 and 3. Installed directly on the existing floor in the corridor and along	m2	36,00	0,20	7,20	0,90	
	3,1,2	Installation of cork plinth in the perimeter of those corridors.	m	54,00	0,15	8,10	1,01	
	3,2	FLOOR INSULATION ROOMS 7,8,9						
	3,2,1	Insulation layer Alkreflex for the ground floor installed below of the actual wooden slats for the rooms 7,8 and 9	m2	118,00	0,05	5,90	0,74	
	3,2,2	Installation of the old wooden floor from the rooms 7,8 and 9	m2	118,00	0,13	15,34	1,92	
						36,54	**4,57**	**5,00**
5		**GLASSING WORK**						
	5,2	NEW WINDOWS BEHIND THE OLD ONES						
	5,2,1	Front facade Window A New extra window (double glassing) with an hinged opening system	m2	1,10	0,70	0,77	0,10	
	5,2,2	Front facade Window B New extra window (double glassing) with an hinged opening system	m2	4,01	0,70	2,81	0,35	
	5,2,3	Front facade Window C New extra window (double glassing) with an hinged opening system	m2	4,27	0,70	2,99	0,37	
	5,2,4	Front facade Window D New extra window(double glassing) with an hinged opening system	m2	2,70	0,70	1,89	0,24	
	5,2,5	Front facade window E New extra window (double glassing)with an hinged opening system	m2	2,70	0,70	1,89	0,24	
	5,2,6	Front facade Window F New extra window (double glassing) with an hinged opening system	m2	2,70	0,70	1,89	0,24	
	5,2,7	Right facade Window O New extra window (double glassing)with an hinged opening system	m2	2,23	0,70	1,56	0,19	
	5,2,8	Right facade Window P New extra window attached by screws to the new wooden structure with an hinged opening system	m2	2,23	0,70	1,56	0,19	
	5,2,9	Right facade Window Q New extra window (double glassing) with an hinged opening system	m2	2,23	0,70	1,56	0,19	
	5,2,10	Right facade Window R New extra window (double glassing) with an hinged opening system	m2	2,23	0,70	1,56	0,19	
	5,2,11	Right facade Window S New extra window (double glassing) with an hinged opening system	m2	1,50	0,70	1,05	0,13	
	5,2,12	Back facade Window J New extra window (double glassing)with an hinged opening system	m2	2,95	0,70	2,07	0,26	
	5,2,13	Back facade Window N New extra window (double glassing) with an hinged opening system	m2	0,83	0,70	0,58	0,07	
	5,2,14	Back facade Window L New extra window (double glassing) with an hinged opening system	m2	1,93	0,70	1,35	0,17	
	5,2,15	Back facade Window K New extra window (double glassing) with an hinged opening system	m2	1,93	0,70	1,35	0,17	
	5,3	RENEW DOUBLE GLASSING						
	5,3,1	Window "T" Double glassing broken. Intallation of a new one	m2	0,95	0,80	0,76	0,10	
	5,3,2	Door "H" (no historical window made in 1985) Sustitution of the existing simple glassing for a new one double	m2	2,95	0,80	2,36	0,30	
						27,99	**3,50**	**4,00**
6		**HEATING SYSTEM**						
	6,1	Removing actual heating unit	pc	1,00	3,00	3,00	0,38	
	6,2	(PC 3) Pipe work	pc	1,00		4,00	0,50	
	6,3	New Heating unit IDEAL 40KW (installation +heating unit)	pc	1,00	4,00	4,00	0,50	
	6,4	(PC4) Reparation radiators	pc	1,00		4,00	0,50	
						15,00	**1,88**	**2,00**
7		**ELECTRICITY**						
	7,1	(PC5) Modification of the electricity installation of the wall facades from ground and first floor	pc	1,00		**8,00**	**1,00**	
								1,00
8		**WATER INSTALLATION**						
	8,1	(PC6) Readjustement of water installation of the Kitchen from ground floor and the Bathroom on the first floor	pc	1,00		**4,00**	**0,50**	
								1,00
9		**VENTILATION**						
	9,1	New ventilation unit	pc	1,00	2,00	2,00	0,25	
	9,2	Fans in humid rooms	pc	4,00	1,00	4,00	0,50	
	9,3	(PC7) Ventillation installation				4,00	0,50	
						10,00	**1,25**	**2,00**
10		**REPARATIONS**						
	10,1	Covering cracks main facade with white cement mortar , same colour of the joints from the facade mortar	m2	1,00	0,13	0,13	0,02	
	10,2	Front door (door A) Reparation existing door	pc	1,00	2	2,00	0,25	
						2,13	**0,27**	**1,00**
11		**FINISHING WORK**						
	11,1	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness anchored to the wooden slat structure installed before	m2	135,70	0,3	40,71	5,09	
	11,2	New plasterboard layer on the interior facade wall (new last partition layer) made with panels of 12,5mm of thickness anchored to the wooden slat structure installed before. Moisture resistant panels for the kitchen (humid room 9).	m2	40,00	0,3	12,00	1,50	
	11,3	New tiling layer installed in the bathroom (first floor room 17) on the new platerboard layer using cement mortar for bathrooms.	m2	6,00	0,40	2,40	0,30	
	11,5	Painting of rooms where have been installed the new plasterboard layer (walls and top of all the room)	m2	876,03	0,15	131,40	16,43	
	11,6	Painting wooden frames of windows	m2	5,00	0,80	4,00	0,50	
	11,7	Painting repaired door	m2	4,80	0,20	0,96	0,12	
	11,8	(PC8) Reinstallation heating	pc	1,00		8,00	1,00	
	11,9	(PC9) Reinstallation furniture	pc	1,00		8,00	1,00	
	11,10	(PC10) Cleaning of the house	pc	1,00		4,00	0,50	
						226,81	**28,35**	**29,00**

PRECEDENCE NETWORK



ID		Task Name	Duration	Start	Finish	Pred
1		DEMOLITION & PREVIOUS WORKS	9 days	Wed 25-6-14	Mon 7-7-14	
2		NEW PARTITION WALL (4 days) ELECTRICITY (1 day) WATER INTALLATION (1day)	6 days	Tue 8-7-14	Tue 15-7-14	1
3		FLOORING WORKS	5 days	Fri 25-7-14	Thu 31-7-14	5;7
4		GLASSING WORK	4 days	Wed 16-7-14	Mon 21-7-14	2
5		HEATING SYSTEM	2 days	Tue 22-7-14	Wed 23-7-14	4
6		VENTILATION	2 days	Tue 22-7-14	Wed 23-7-14	4
7		REPARATIONS	1 day	Thu 24-7-14	Thu 24-7-14	6
8		FINISHING WORKS	29 days	Fri 1-8-14	Wed 10-9-14	3



Project: Project1.mpp
Date: Thu 19-6-14

Task	Summary	External Milestone	Inactive Summary	Manual Summary Rollup	Finish-only
Split	Project Summary	Inactive Task	Manual Task	Manual Summary	Deadline
Milestone	External Tasks	Inactive Milestone	Duration-only	Start-only	Progress

19 FINAL CONCLUSION

I shall conclude the project by offering complete and detailed answers to the main question of the project , developed across all the sections of the following report:

"Is it possible to improve the thermal conditions of the building whilst at the same time trying to solve the energy efficiency of the building together with preserving the original architectural values?"

Yes it is. It is possible improve the thermal conditions having in account that in order to do it, the building needs some necessary modifications like the overall improvement of the thermal resistance of some constructive elements and mainly the windows, that represent the main way in which the building is currently losing heat.

However, to properly make all the above mentioned modifications, quite a big amount of money is required, making these restoration works quite remarkable interms of costs and relevance.

After the restoration the building would consume less energy than now, and the resident family would over time spend less money in energy, making this restoration a smart economical move for the family budget. Even if the initial costs are quite big, an economical improvement is to be expected for the (future and present) inhabitants of the house. Furthermore, the owners will be able to finally enjoy all the parts of the house without having to close some sections of it because they are too cold in winter to live .

20 BIBLIOGRAPY

- Documents apported by the architect that restores the building in 1985:

  "Bestek en voorwaarden" Restoration Eise Eisengastraat 10 in 1985. General Restoration
- "Bestek en voorwaarden" Restoration Eise Eisengastraat 10 in 1985. Installations.

- Normative

- Dutch normative "Bouwbesluit"
- EN ISO 6946:" Components and elements for edification" Thermal resistance and termal tansmition. Calcul methods.

- Books and other information fountains:

- "Installations for edification" by Jose Manuel Tortajada, teacher in the Polytechnic University of Valencia.
- "Comfort conditions and building installations" by Jose Manuel Tortajada
- "Efficence energy in historic buildings" Vicente Ordura, teacher of the Polytechnic University of Valencia.
- "Pathologies in historic buildings" by Rafa Marin, professional in historical building in the Polytechnic University of Valencia.

Software:

- Autocad
- Enorm v1.1 (energy consumption)
- Microsoft Word
- Microsoft Excel
- Microsoft Project
- Adobe PDF
- Testo (Analisy Thermal Pictures)
- V-RAY (rendering)

Webpages:

www.IVE.es (database)
www.CYPE.com (database)
www.google.com
www.five.es
www.coaatcan.com
www.fomento.gob.es
www.ideal.com
www.climalit.com
www.alkreflex.nl

Other information sources:

- Town Hall from Franeker
- Tourist info Franeker

People who have been involved in the development of this project:

- Owner of the building
- Harm Haitsma, professional in historic buildings in Franeker.
- Architect N.A. Adema.
- Gerrit Ribberink, teacher from Hanze University in Groningen.
- Gualdino Duart Pais teacher from Hanze University in Groningen.
- Gerrit Ribberink, teacher from Hanze University in Groningen.

ANNEX 1 DRAWINS

DRAWINGS EXISTING BUILDING

GENERAL DRAWINGS

Plane 0: Situation
Plane 1: General drawing of the building
Plane 2: Ground floor and first floor distribution
Plane 3 Attic and roof
Plane 4: Front and back facade
Plane 5 Right facade
Plane 6: Vertical Section

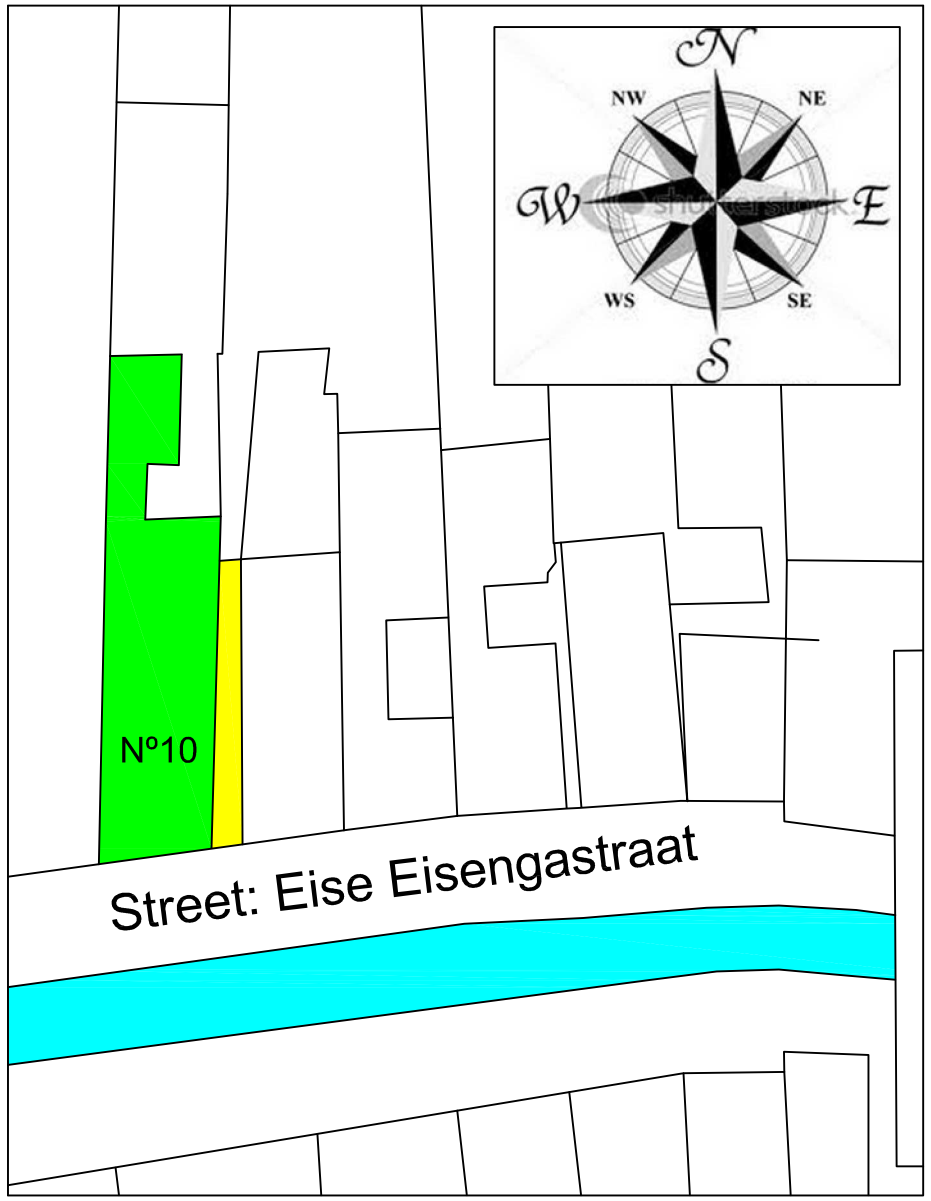
DETAILS

Plane 7: Wall distribution in the building
Plane 8: Floor distribution in the building
Plane 9: Detail original window
Plane 10: Detail window with extra glass layer
Plane 11: Distribution of extra glass layer on the windows in the building
Plane 12: Existing ventilation in the building
Plane 13 Problems in the building

SITUATION PLANE OF THE HOUSE

Location of Franeker and the Street "Eisenga Eisengastraat"

Building case study



Building at Eise Eisengastraat - Scale 1:500

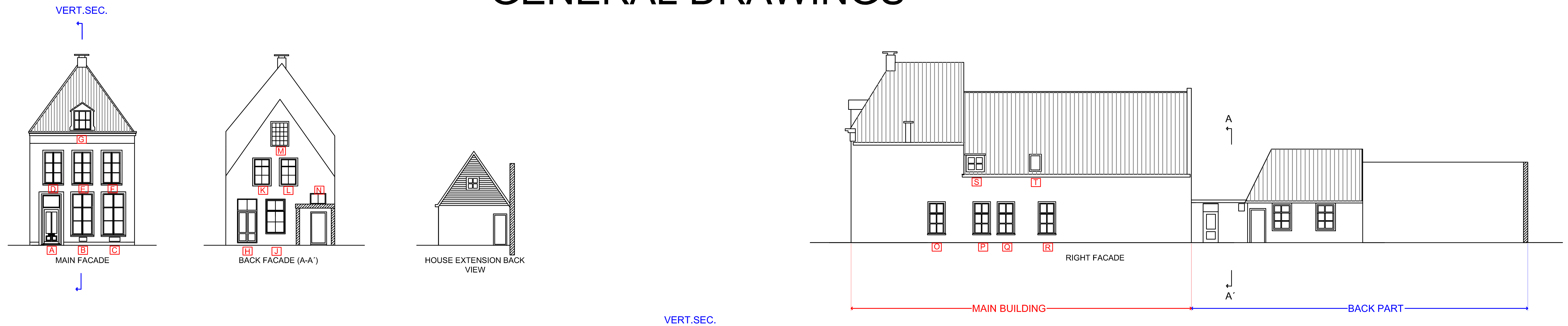
BUILDING

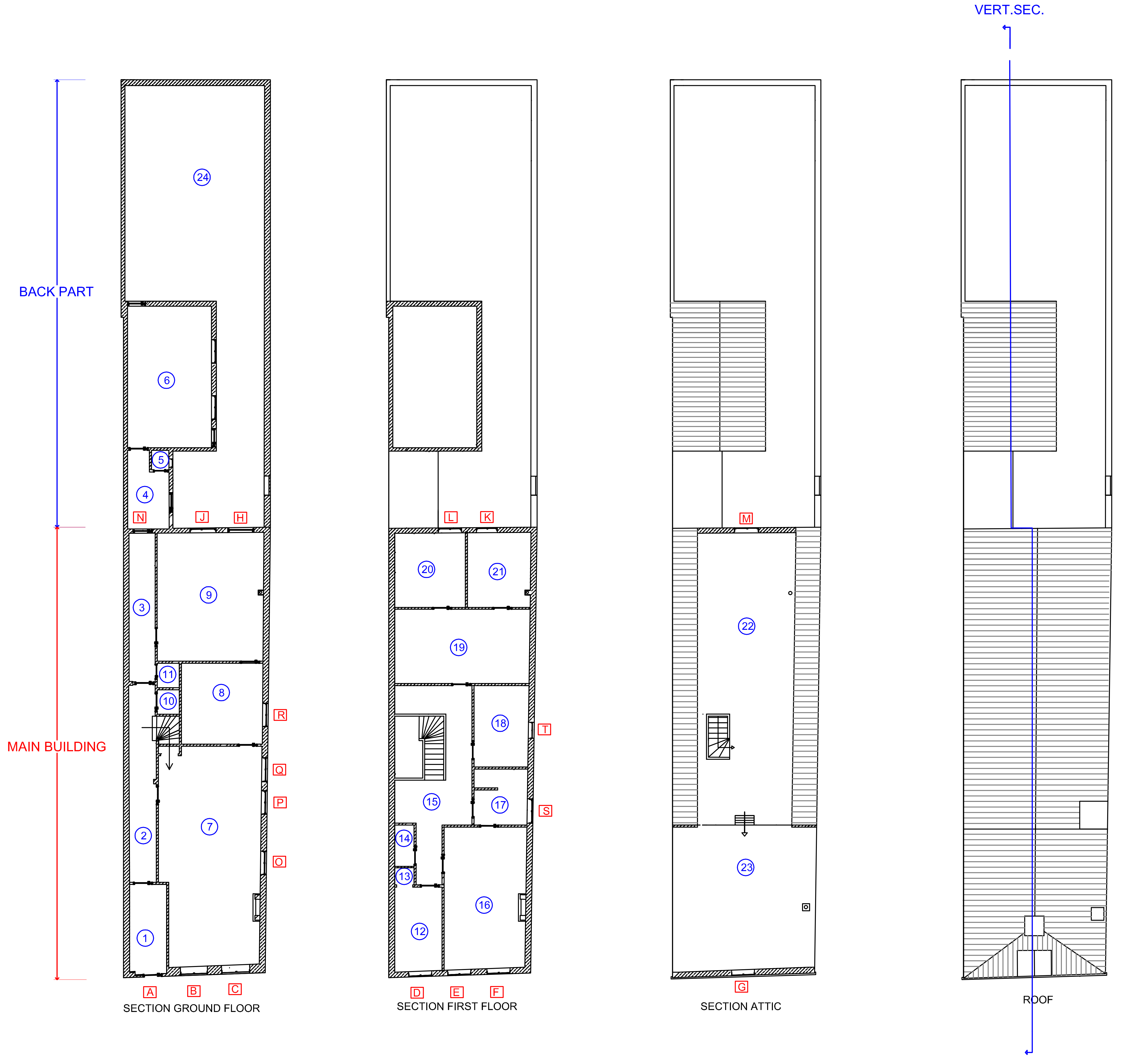
CANAL

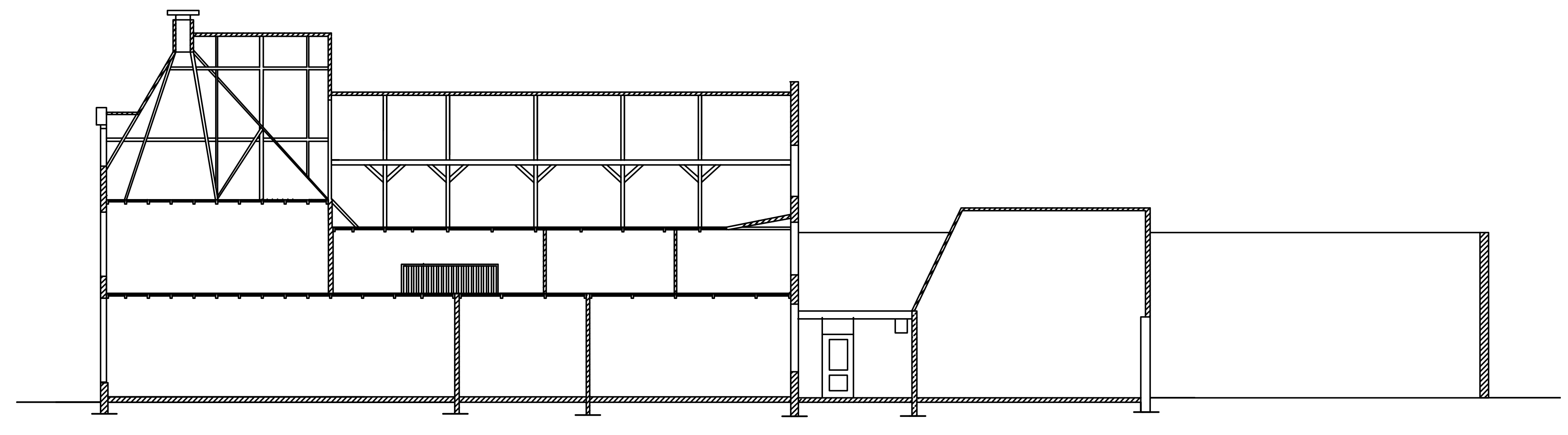
CORRIDOR BETWEEN HOUSES

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 0	SCALE: 1:500	Hanzehogeschool Groningen University of Applied Sciences
	SITUATION OF THE BUILDING		

GENERAL DRAWINGS





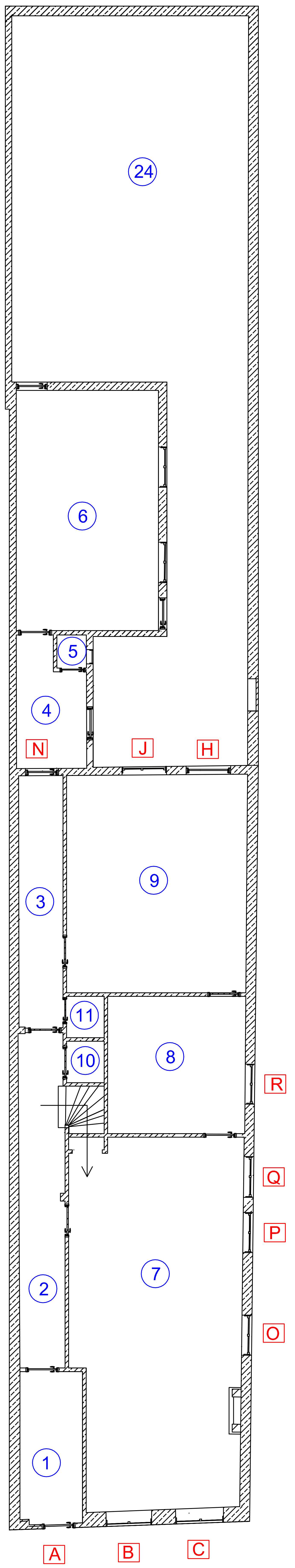


1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden

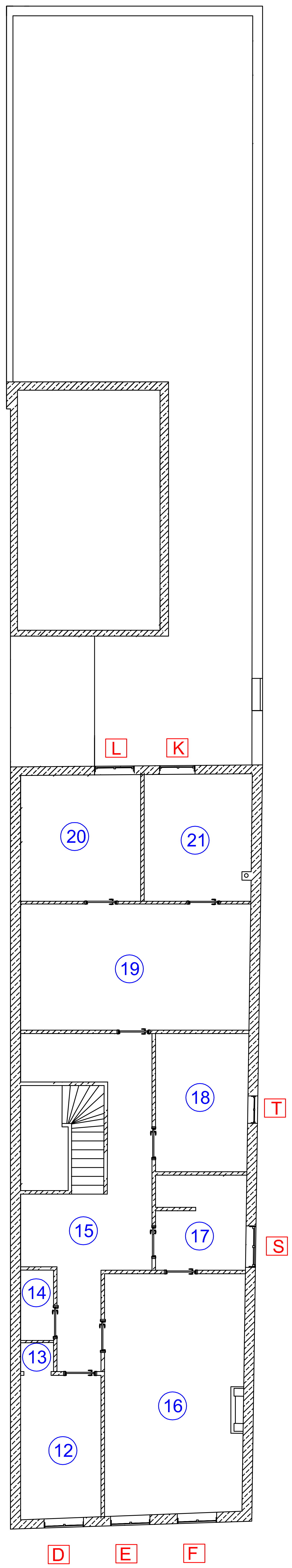
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 1 / SCALE: 1:200 / GENERAL DRAWINGS	Hanzehogeschool Groningen University of Applied Sciences

GROUND AND FIRST FLOOR

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



SECTION GROUND FLOOR

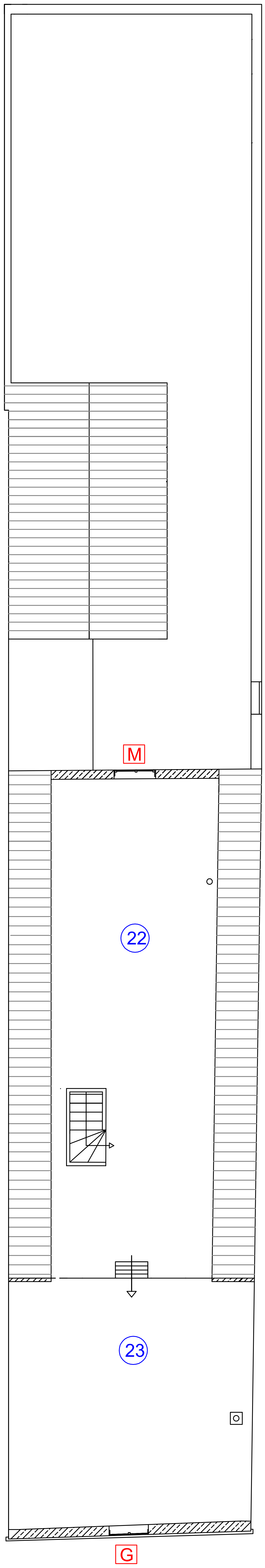


SECTION FIRST FLOOR

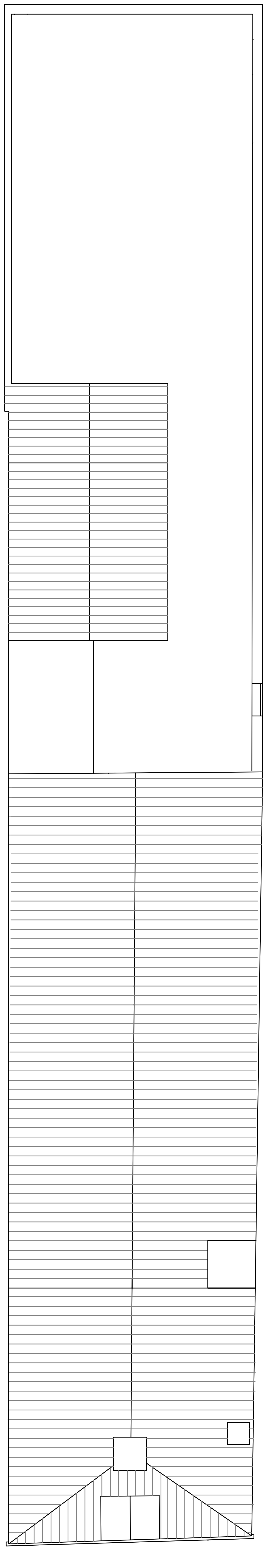
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 2	SCALE: 1:100	Hanzehogeschool Groningen University of Applied Sciences
	GROUND FLOOR AND FIRST FLOOR		

ATTIC AND ROOF

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



SECTION ATTIC



ROOF

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 3	SCALE: 1:100	Hanzehogeschool Groningen University of Applied Sciences
	ATTIC FLOOR AND ROOF		

ANNEX 1 DRAWINS

DRAWINGS EXISTING BUILDING

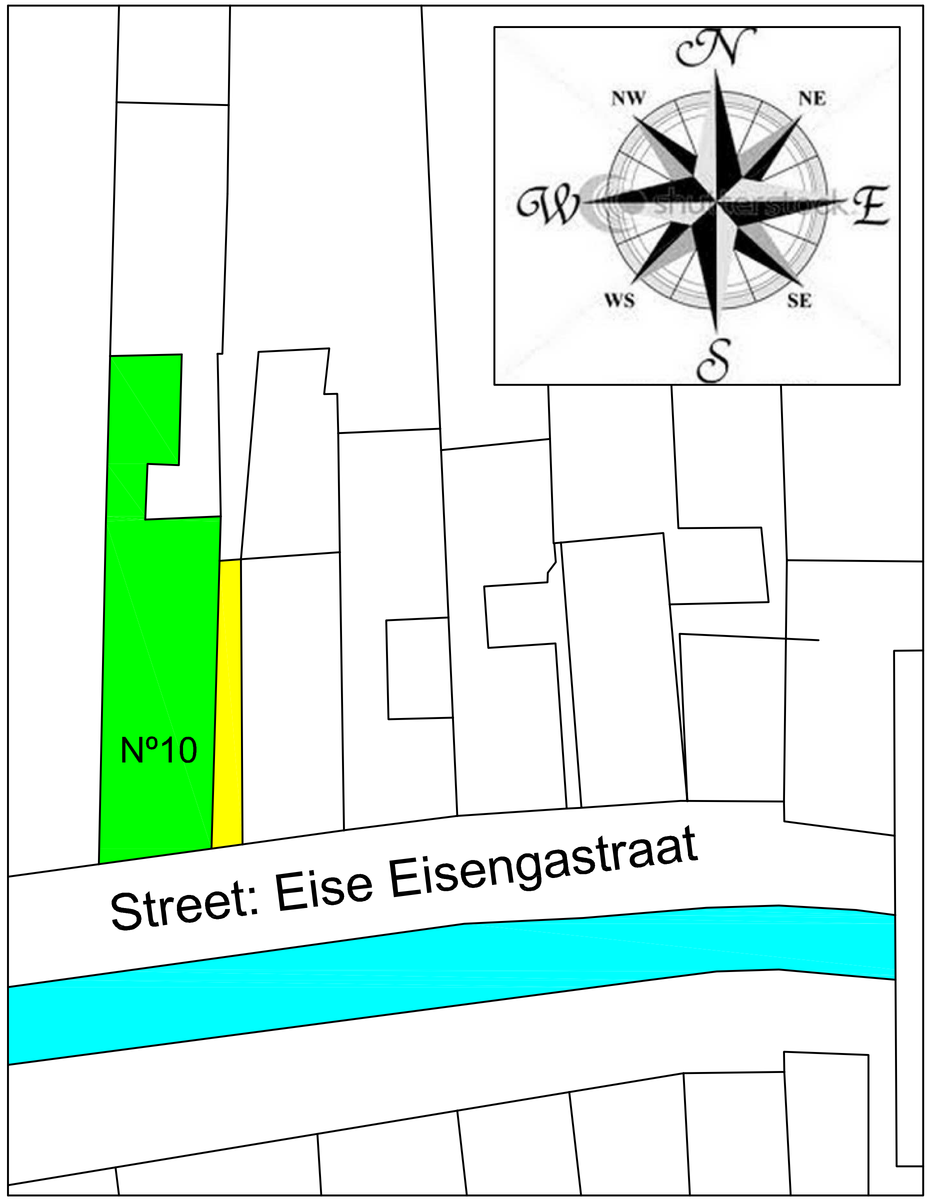
GENERAL DRAWINGS

DETAILS

SITUATION PLANE OF THE HOUSE

Location of Franeker and the Street "Eisenga Eisengastraat"

Building case study



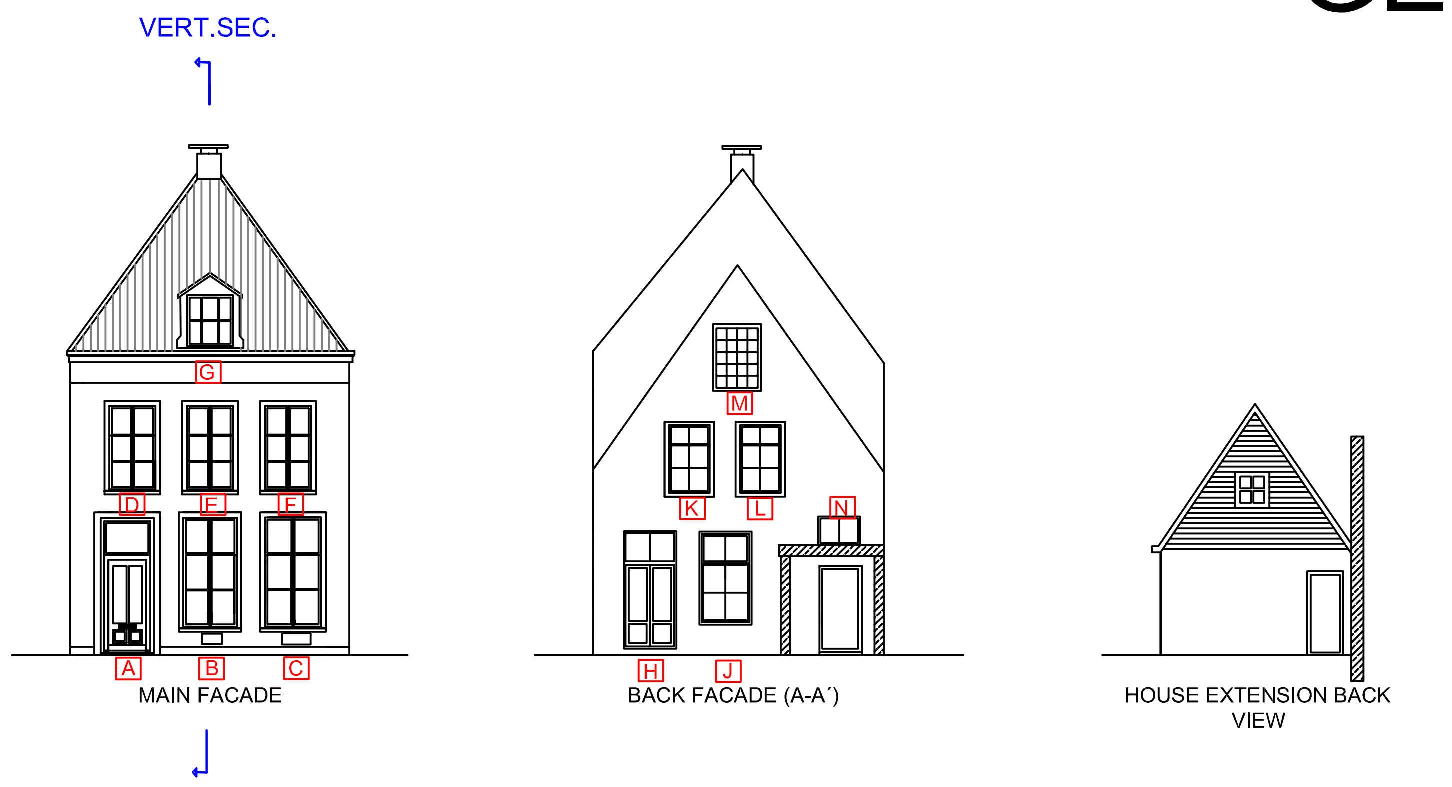
Building at Eise Eisengastraat - Scale 1:500

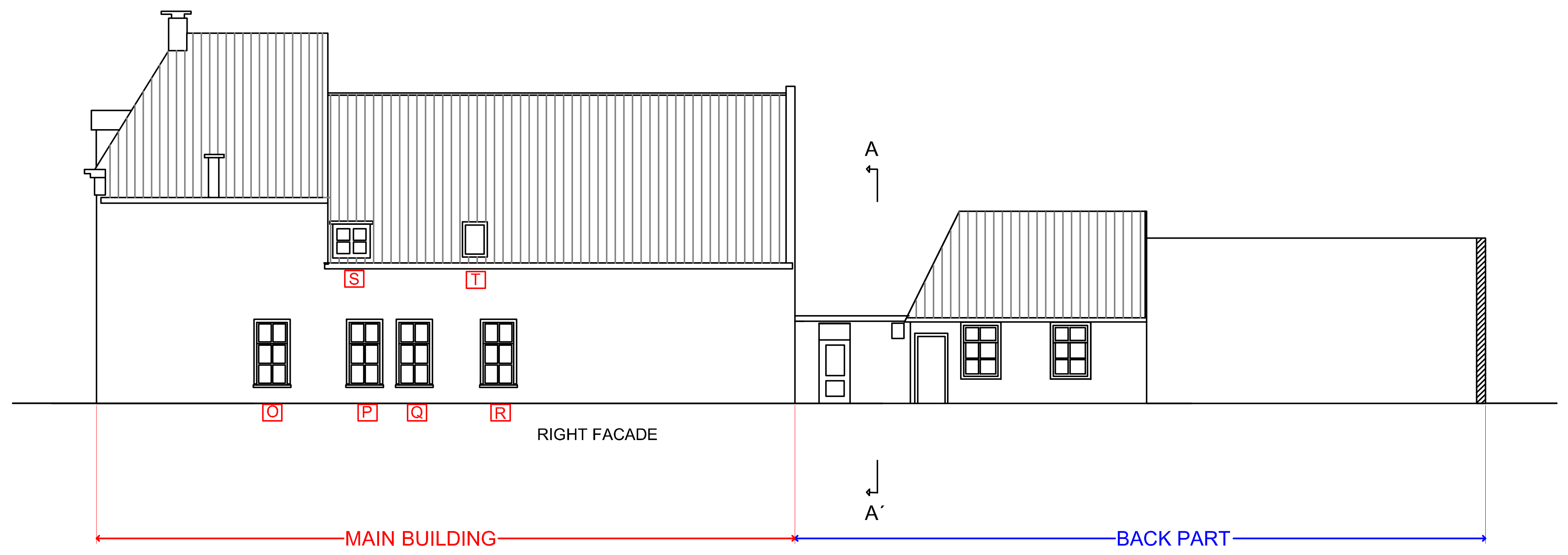
BUILDING CANAL

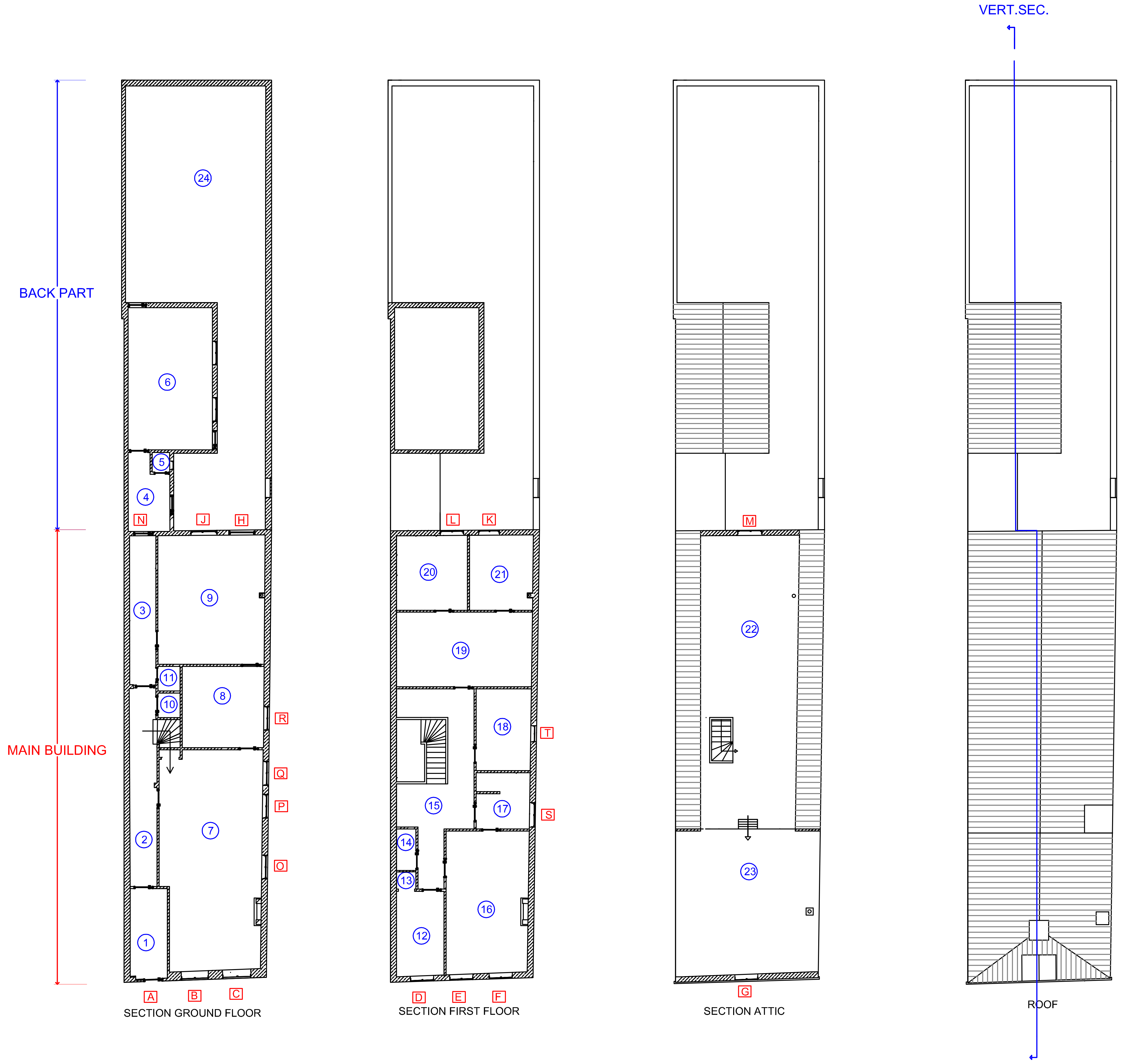
CORRIDOR BETWEEN HOUSES

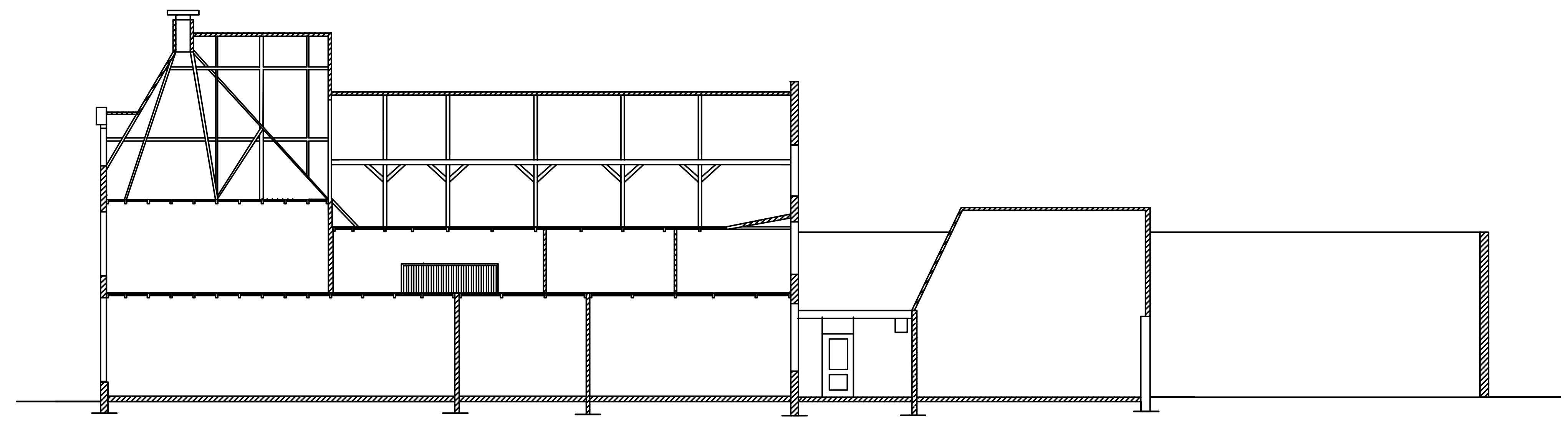
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 0	SCALE: 1:500	Hanzehogeschool Groningen University of Applied Sciences
	SITUATION OF THE BUILDING		

GENERAL DRAWINGS









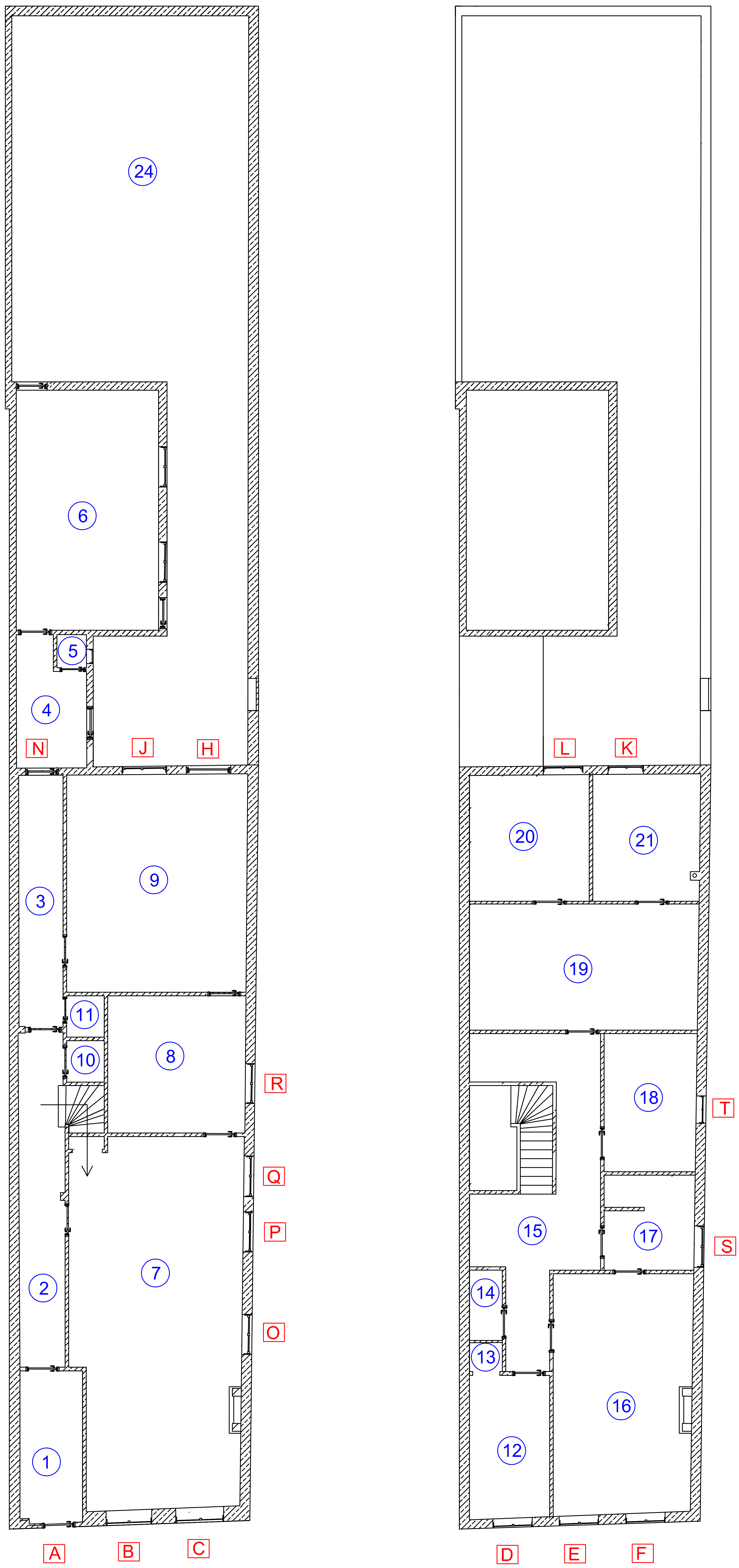
VERTICAL SECTION

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 1	SCALE: 1:200	Hanzehogeschool Groningen University of Applied Sciences
	GENERAL DRAWINGS		

GROUND AND FIRST FLOOR

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



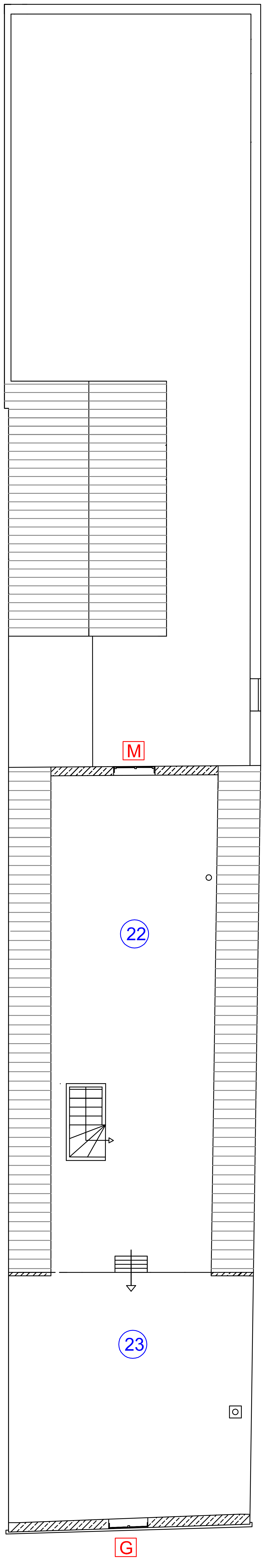
SECTION GROUND FLOOR

SECTION FIRST FLOOR

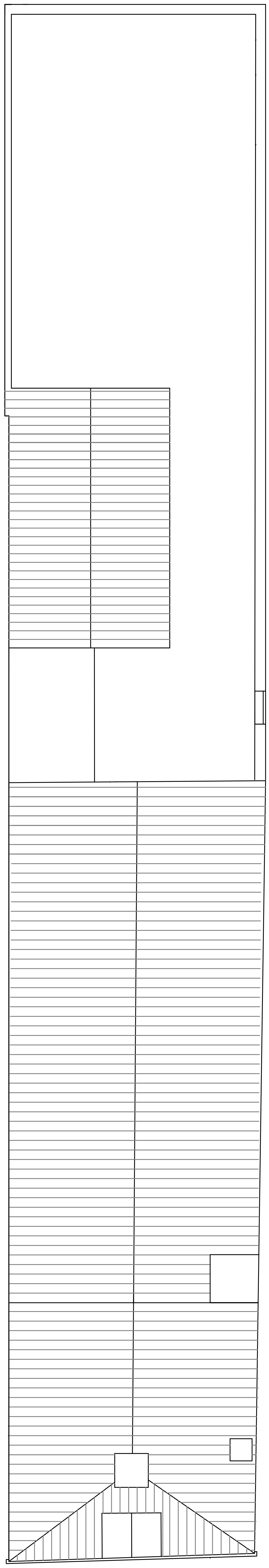
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 2	SCALE: 1:100
	GROUND FLOOR AND FIRST FLOOR	Hanzehogeschool Groningen University of Applied Sciences

ATTIC AND ROOF

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



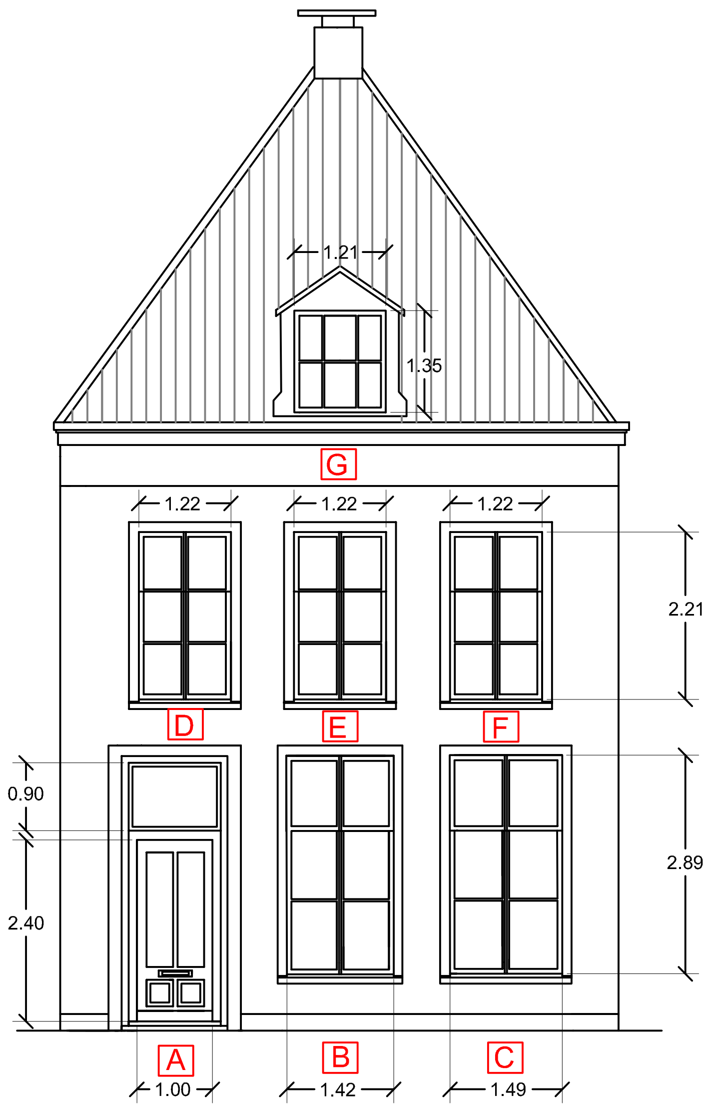
SECTION ATTIC



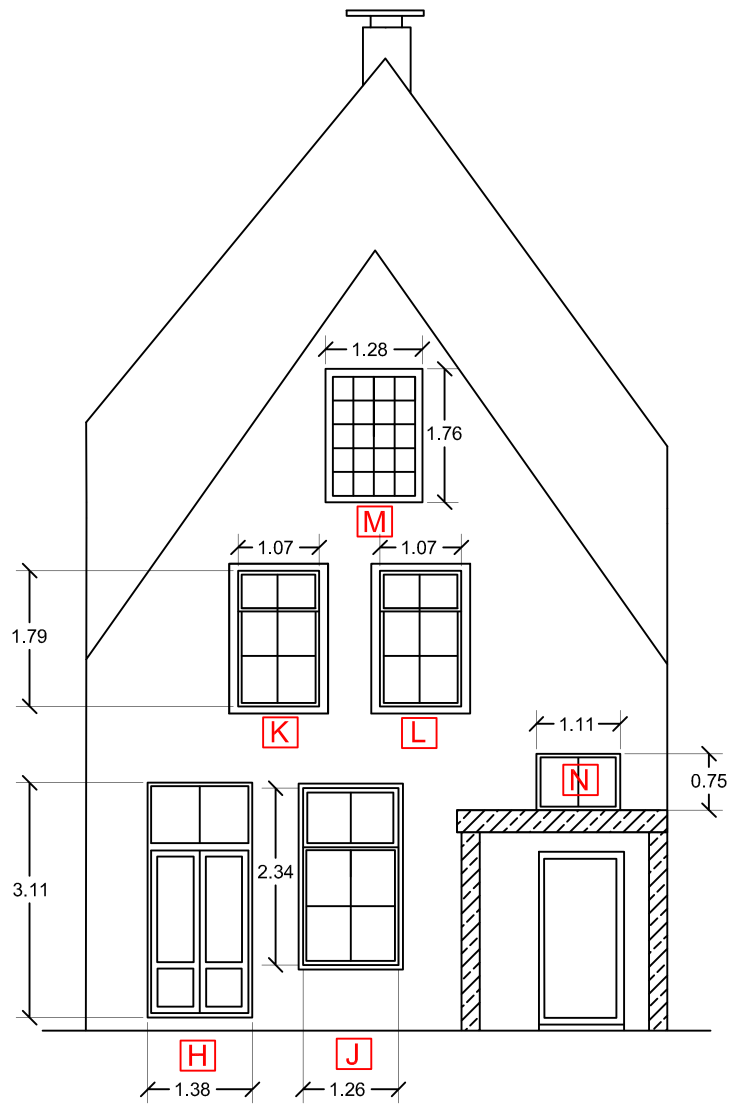
ROOF

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 3	SCALE: 1:100	Hanzehogeschool Groningen University of Applied Sciences
	ATTIC FLOOR AND ROOF		

FRONT AND BACK FACADE



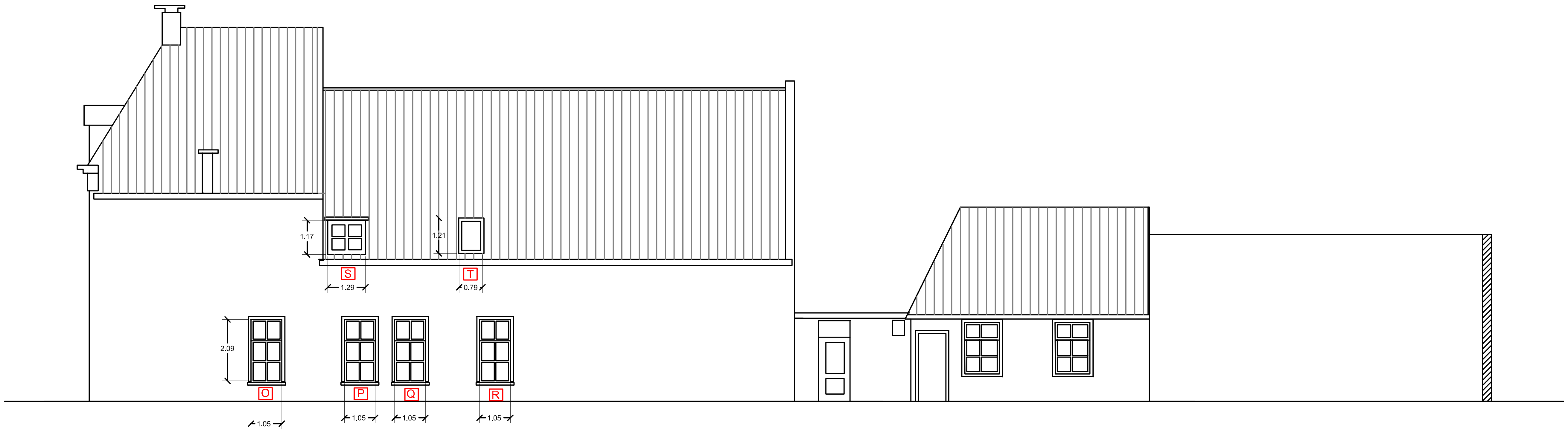
MAIN FACADE



BACK FACADE (A-A´)

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 4	SCALE: 1:100	Hanzehogeschool Groningen University of Applied Sciences
	FRONT AND BACK FACADE		

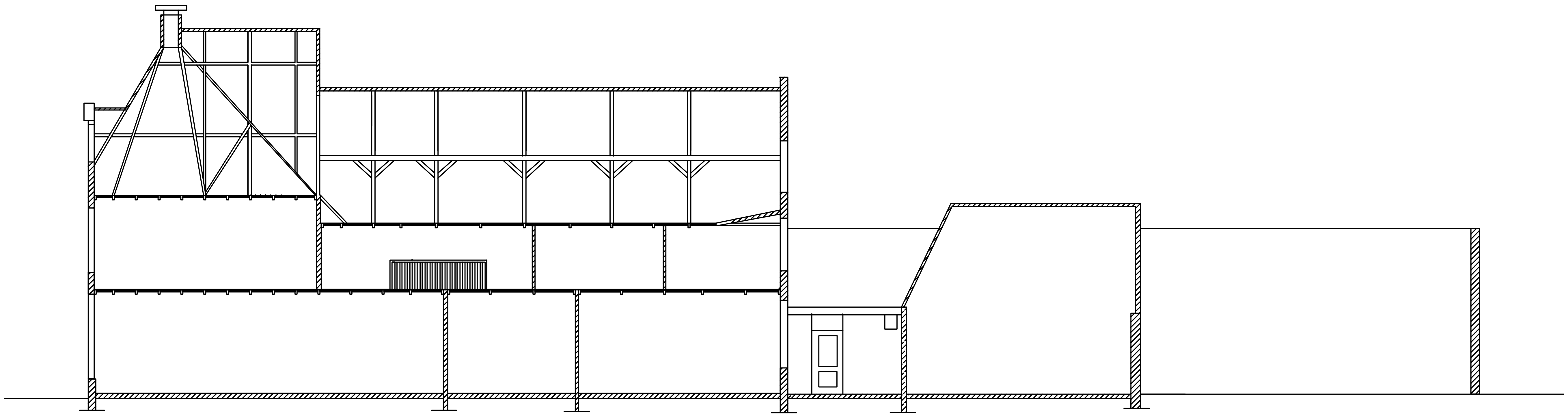
RIGHT FACADE



RIGHT FACADE

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 5 — SCALE: 1:150 — RIGHT FACADE	Hanzehogeschool Groningen University of Applied Sciences

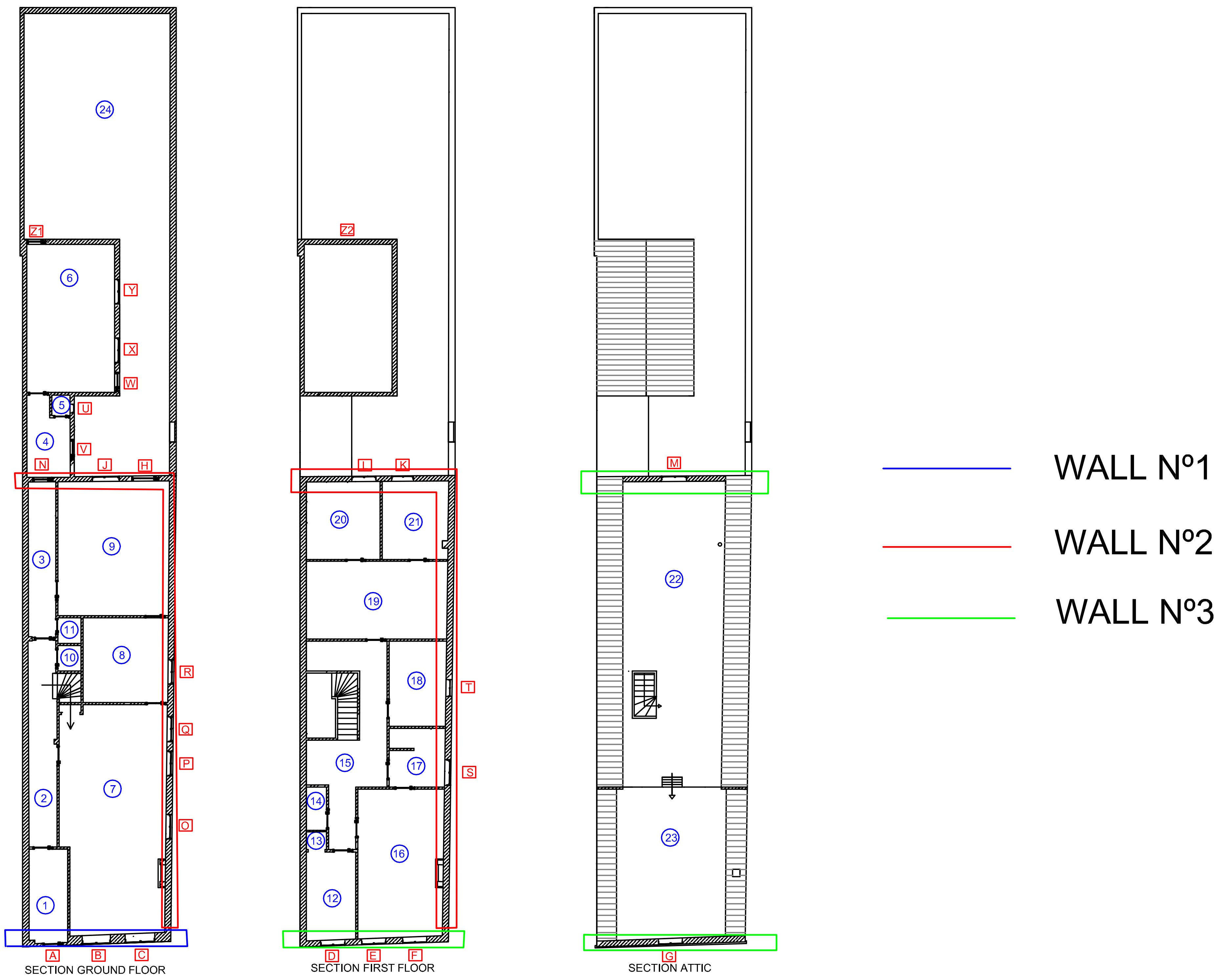
VERTICAL SECTION



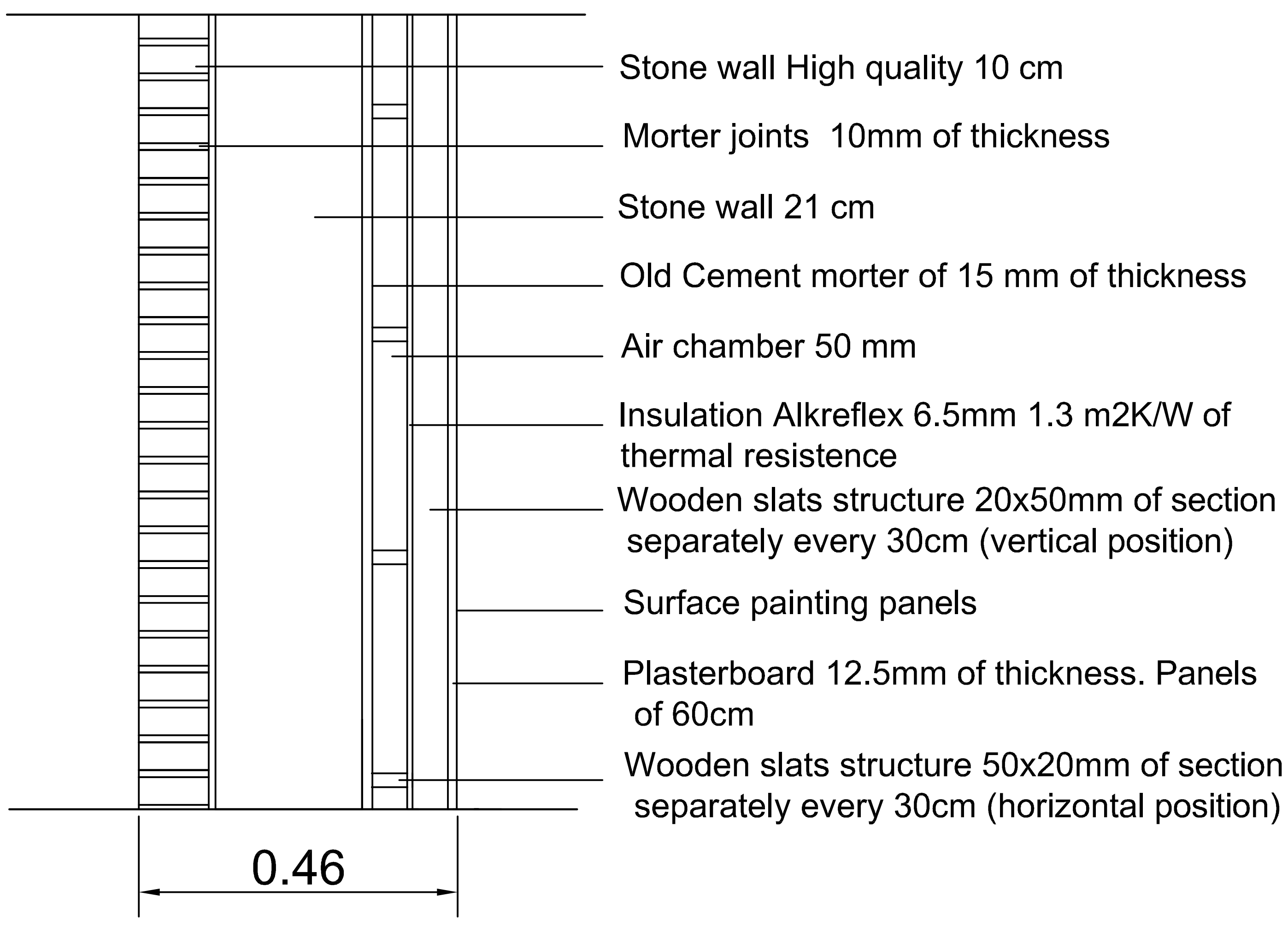
VERTICAL SECTION

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014	
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 6	SCALE: 1:150	Hanzehogeschool Groningen University of Applied Sciences
	VERTICAL SECTION		

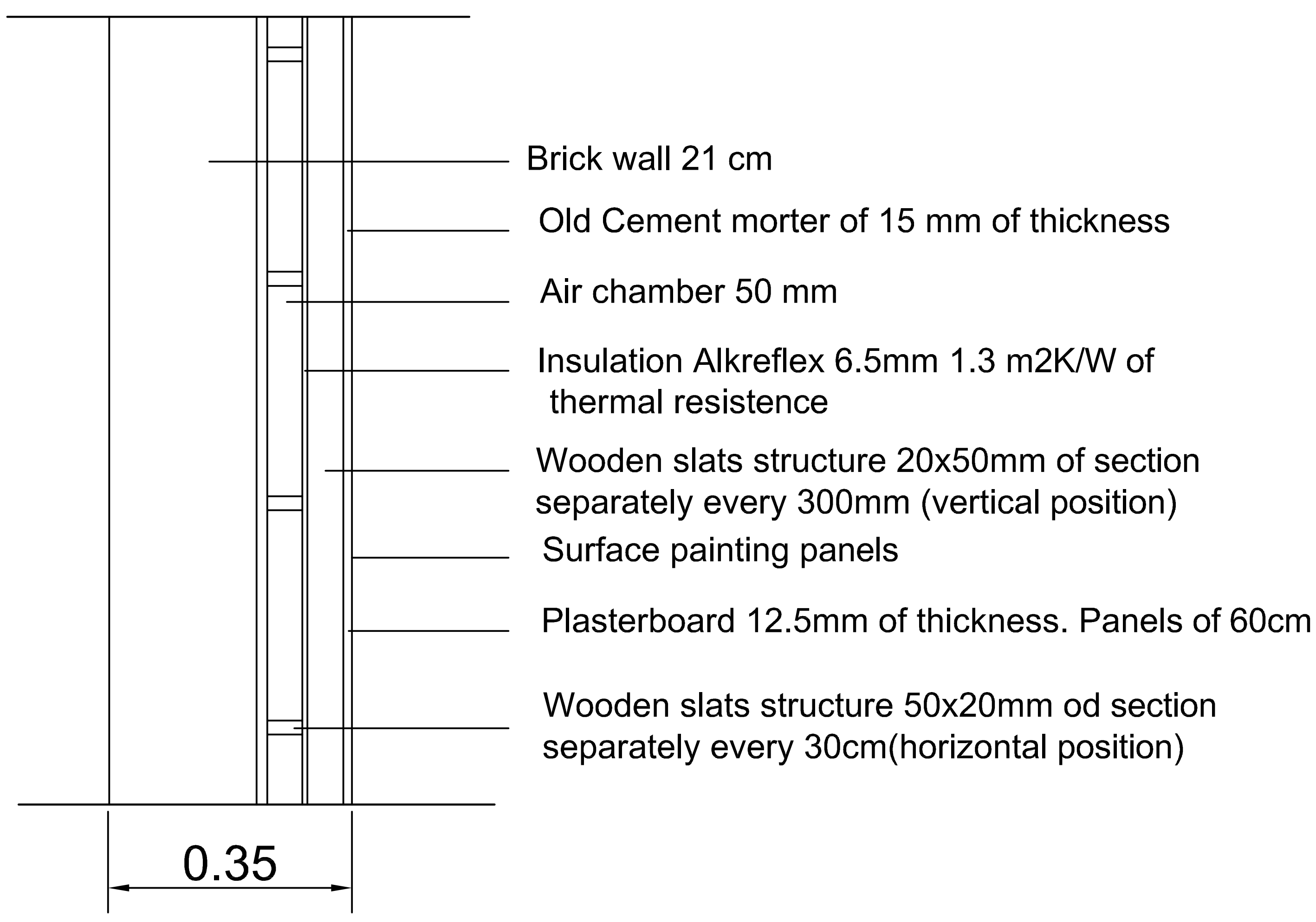
WALL ANALYSYS OF THE EXISTING BUILDING



DISTRIBUTION OF THE DIFFERENT WALLS
OF THE BUILDING SCALE 1:250

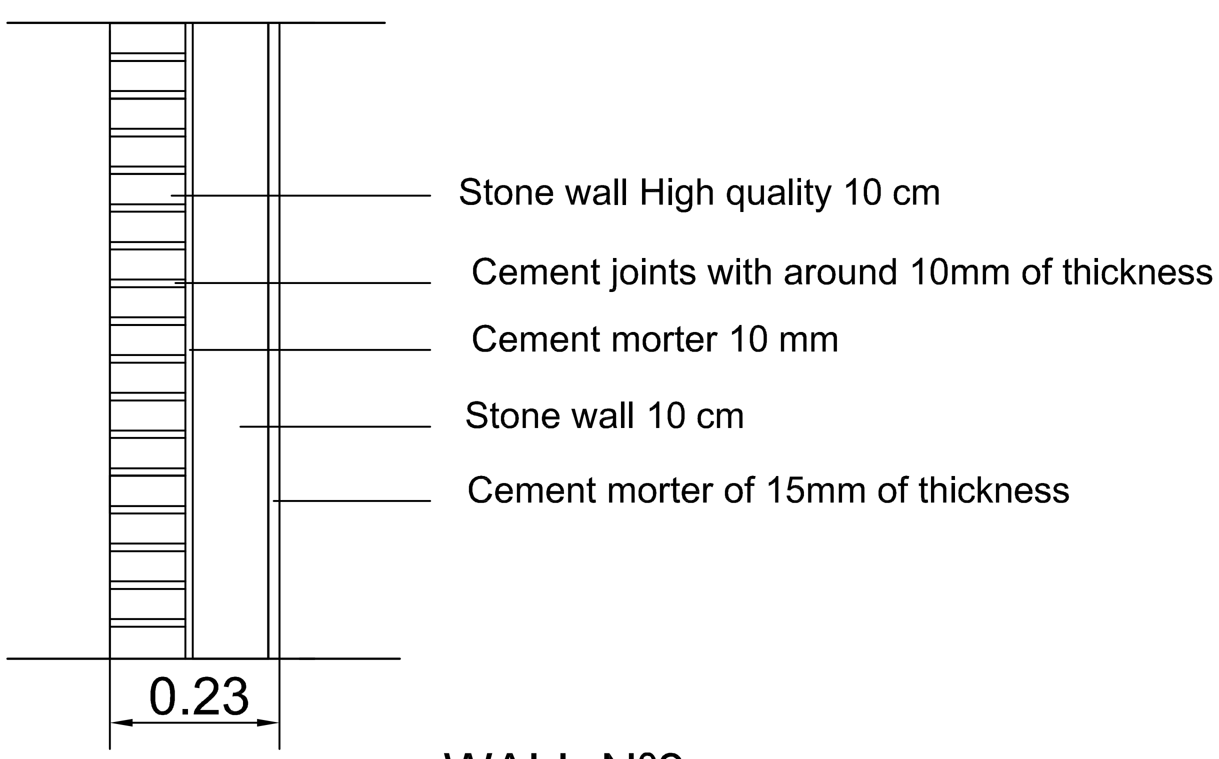


WALL Nº1
MAIN FACADE GROUND FLOOR SCALE 1:10



WALL Nº2
SIDE AND BACK FACADE SCALE 1:10

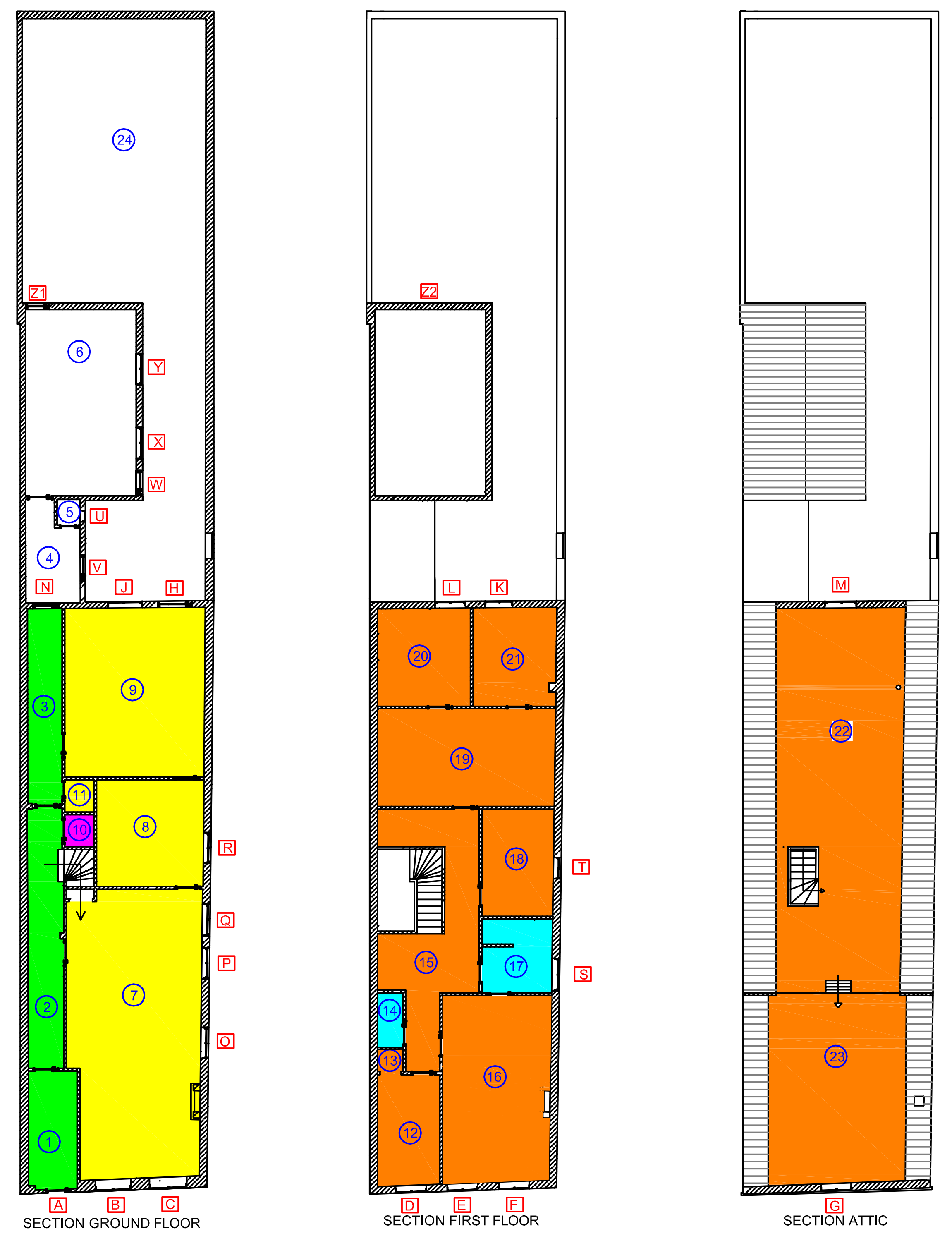
In the bathroom from the first floor （room 17） , moreover to the the wall number 2, there is an extra layer of tiling. At the kitchen from the ground floor （room 7） there is not this layer being the walls as most of the house like the wall Nº1.



WALL Nº3
MAIN FACADE FIRST FLOOR & ATTIC SCALE 1:10

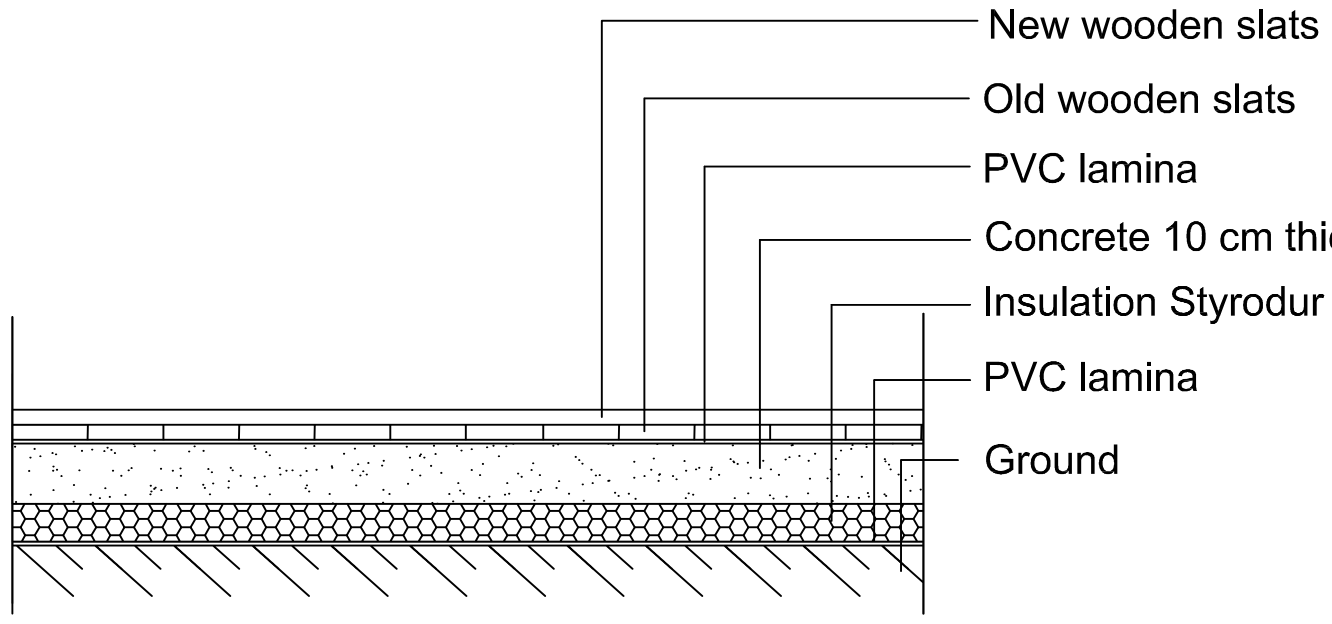
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 7	SCALE 1: 10	Hanzehogeschool Groningen University of Applied Sciences
	WALL DISTRIBUTION EXISTING BUILDING		

FLOOR ANALYSYS OF THE EXISTING BUILDING

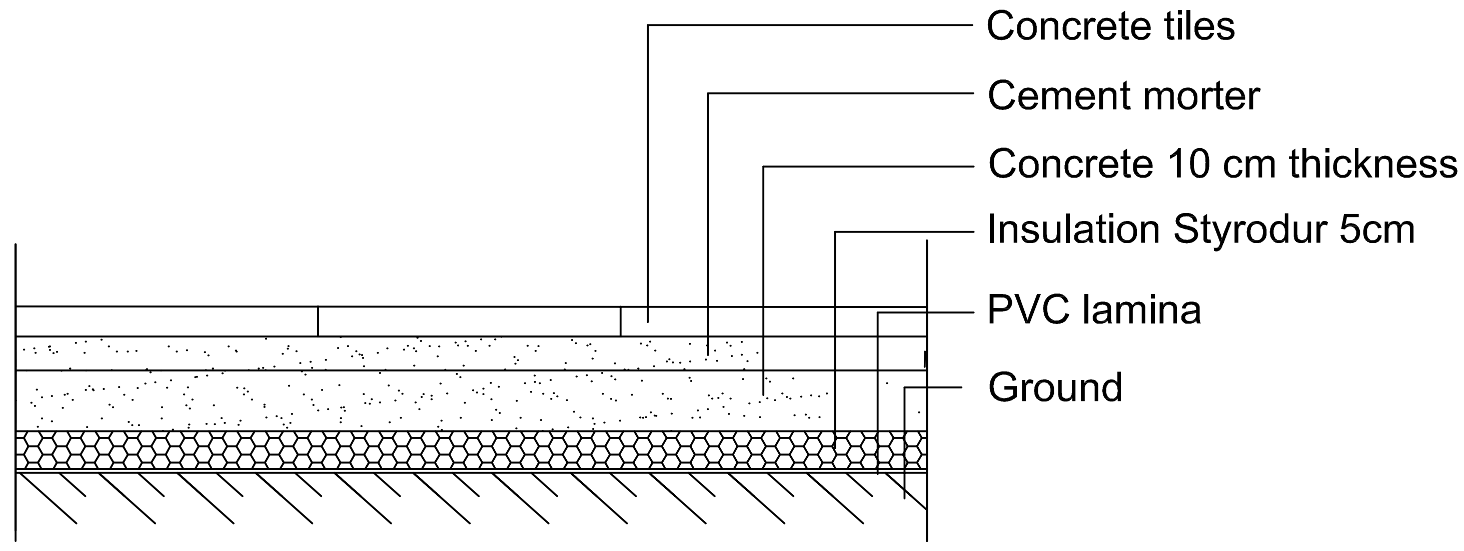


DISTRIBUTION OF THE DIFFERENT FLOORS OF THE BUILDING SCALE 1:250

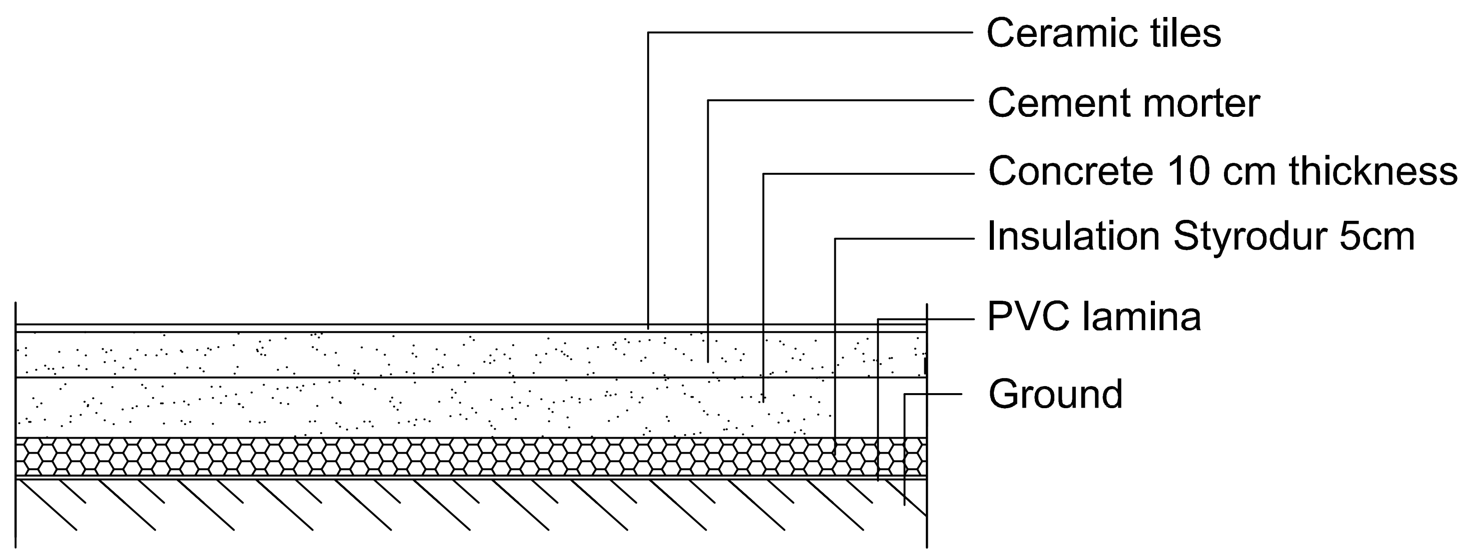
GROUND FLOOR	FIRST FLOOR
FLOOR Nº 1 (yellow)	FLOOR Nº 4 (cyan)
FLOOR Nº 2 (green)	FLOOR Nº 5 (orange)
FLOOR Nº 3 (magenta)	



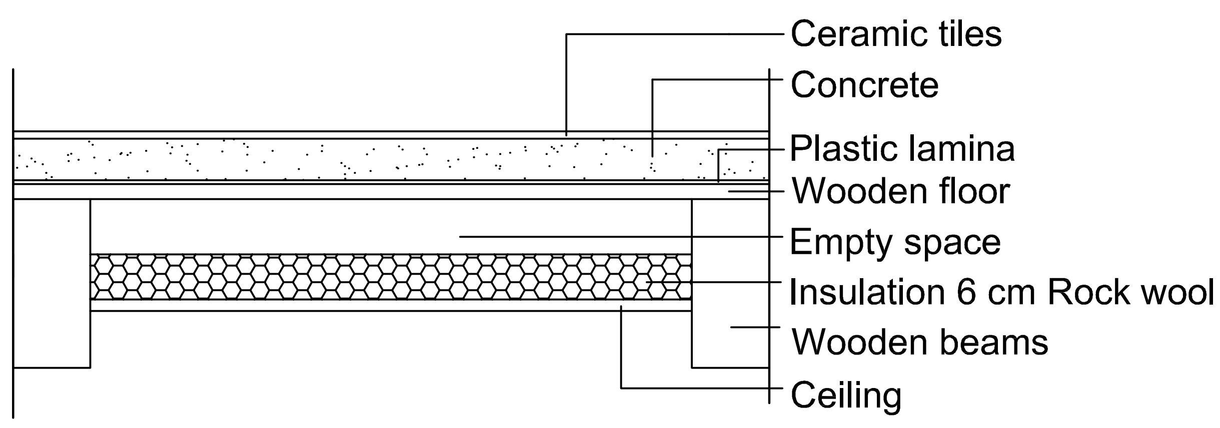
FLOOR Nº1 WOODEN GROUND FLOOR SCALE 1:10



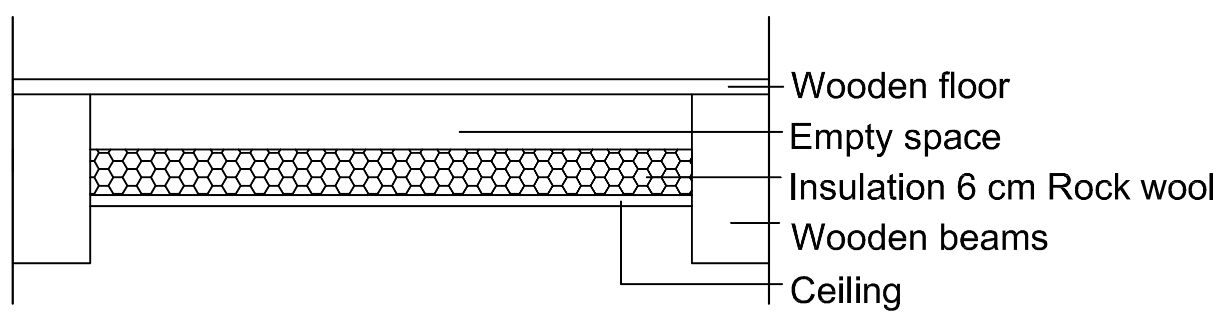
FLOOR Nº2 CONCRETE TILES FLOOR GROUND FLOOR SCALE 1:10



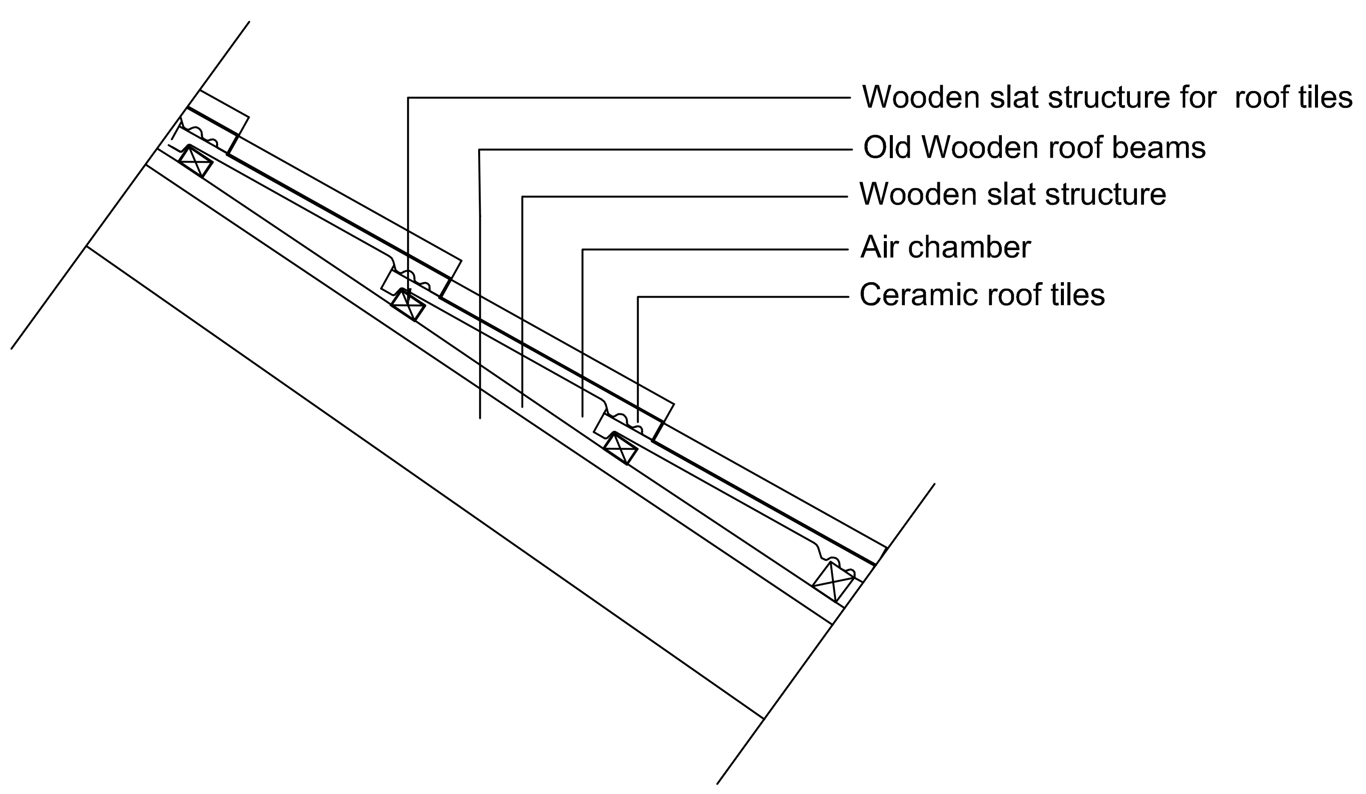
FLOOR Nº3 W.C. - GROUND FLOOR (ROOM 10) SCALE 1:10



FLOOR Nº4 FLOOR HUMID ROOMS - FIRST FLOOR SCALE 1:10



FLOOR Nº5 WOODEN FLOOR - FIRST FLOOR AND ATTIC SCALE 1:10

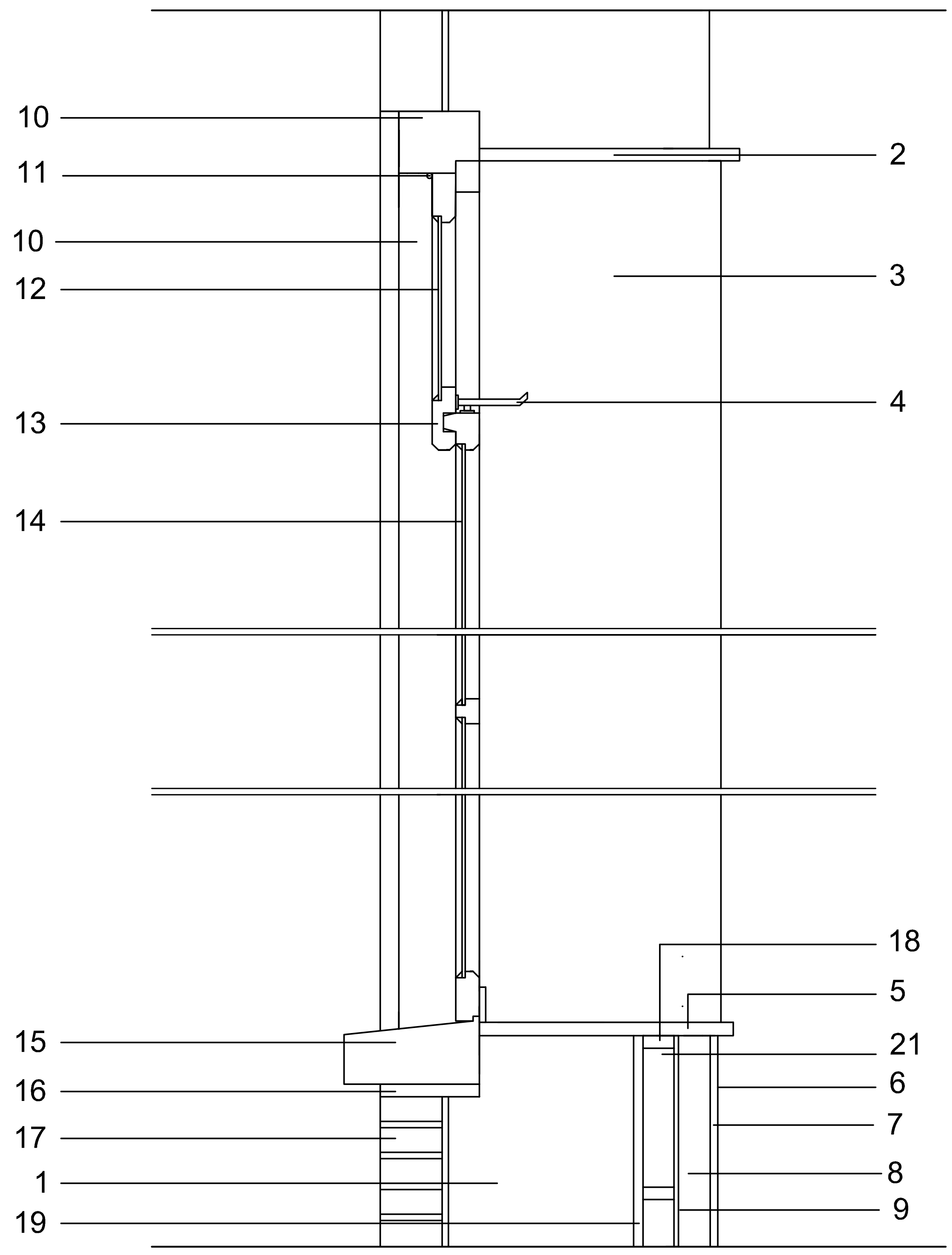


FLOOR Nº5 ROOF DETAIL SCALE 1:10

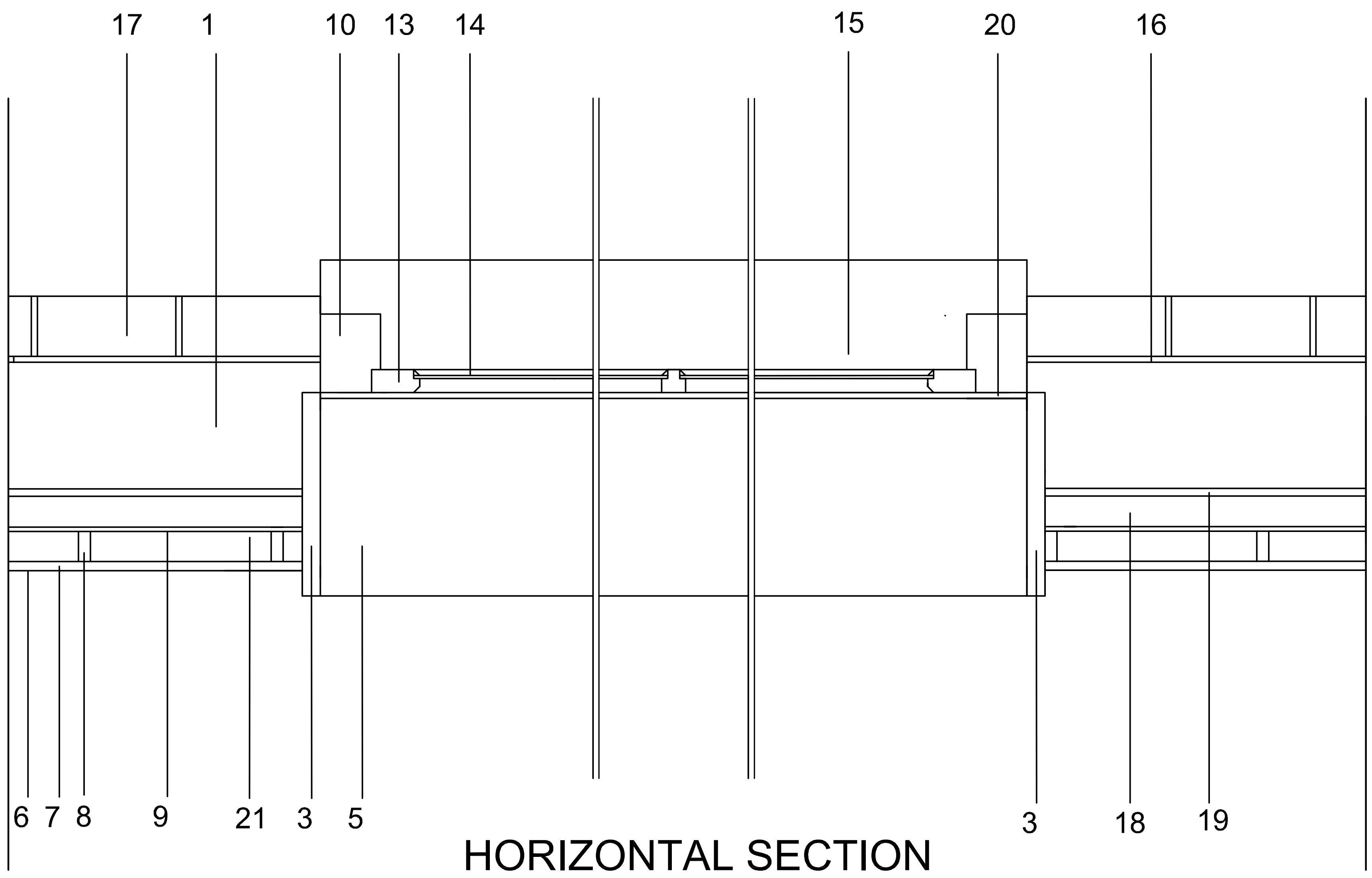
There is not enough information to know the thickness of all the materials.
For the themal calculations we will use an aproximated value for the materials that do not have enough data.

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 8 / SCALE 1: 10 / FLOOR DISTRIBUTION EXISTING BUILDING	Hanzehogeschool Groningen University of Applied Sciences

ORIGINAL WINDOW



VERTICAL SECTION

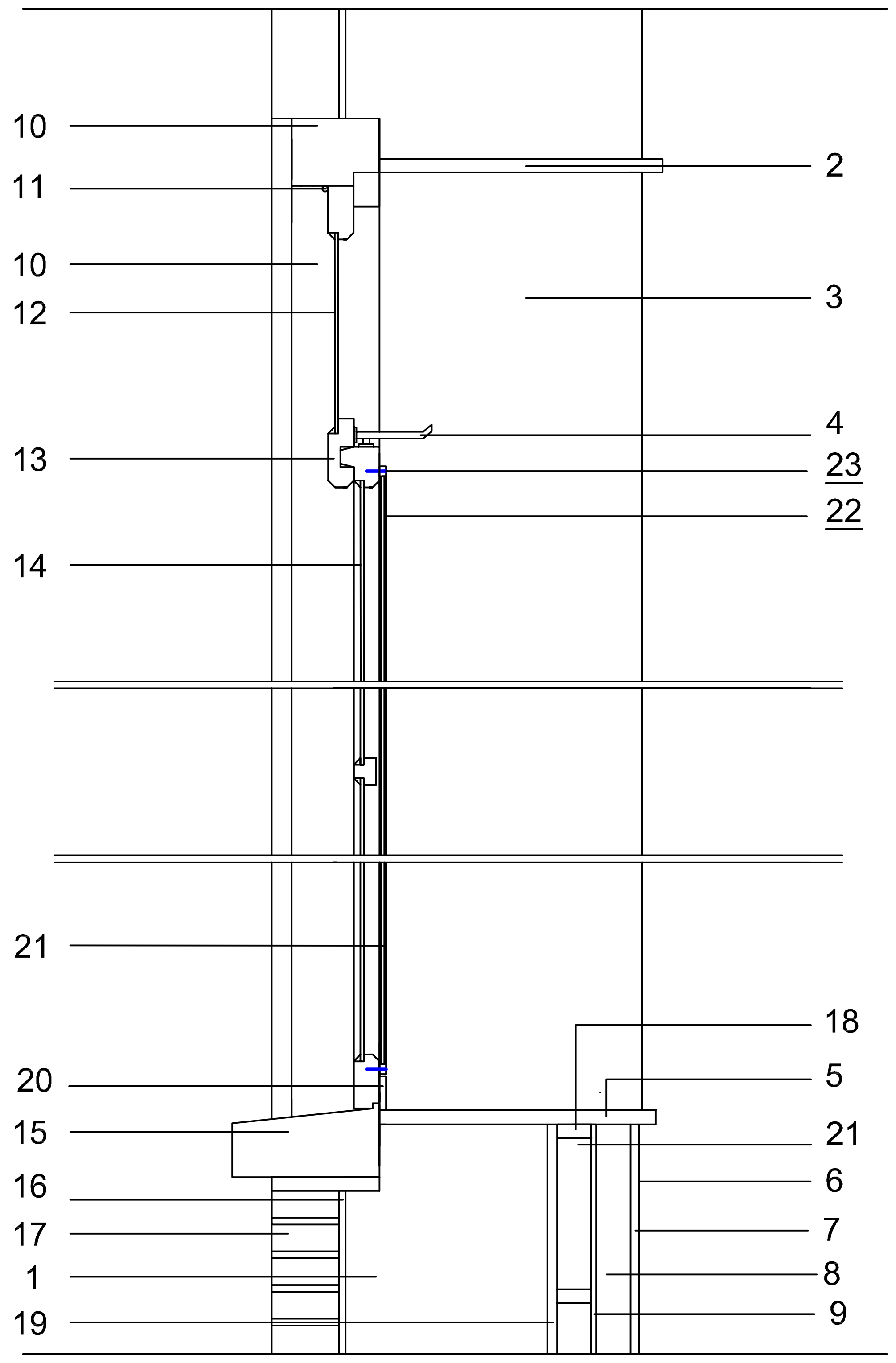


HORIZONTAL SECTION

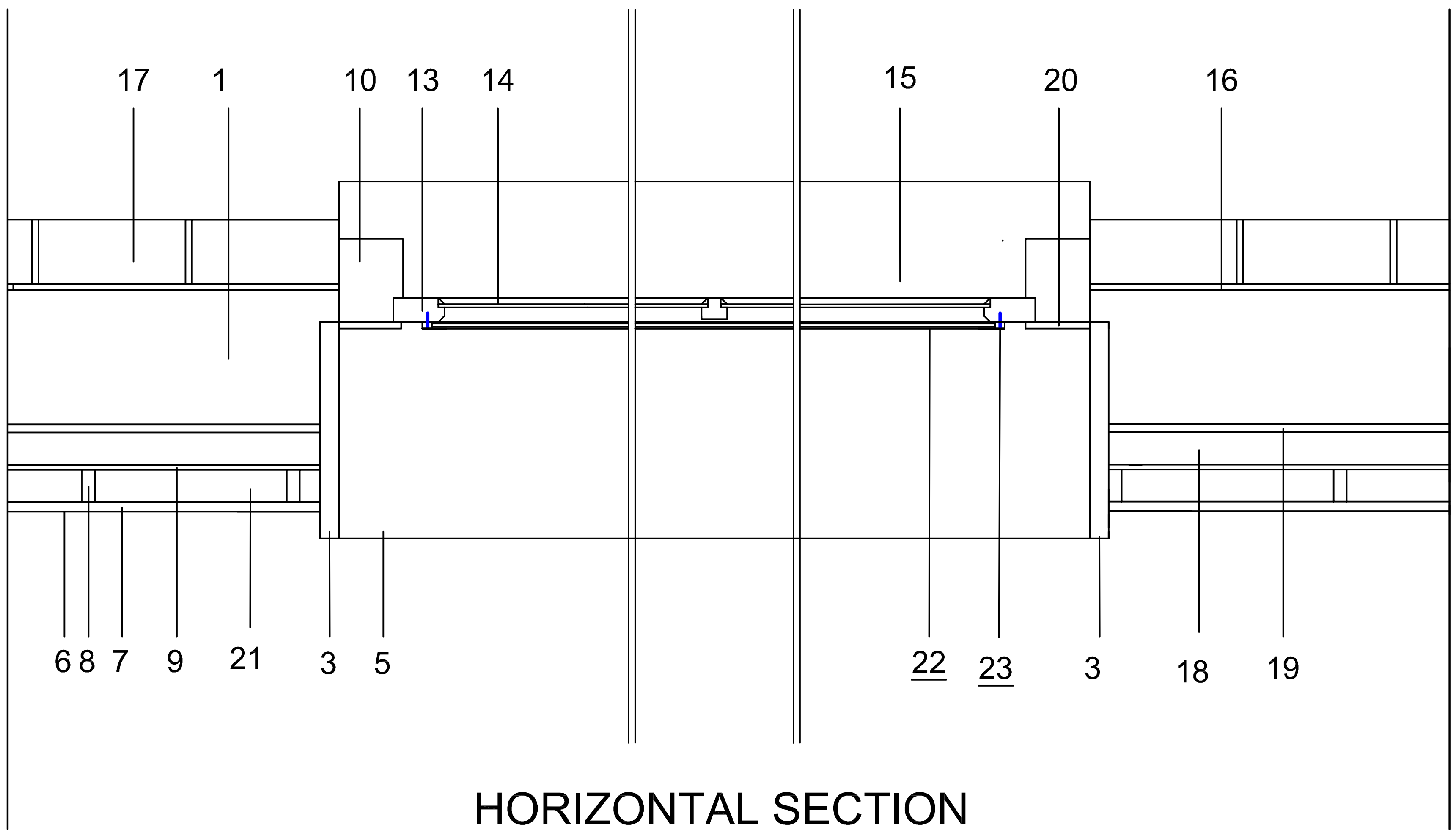
1- Stone wall (low quality 21cm)
2-Interior wood coating (high part)
3-Interior wood coating (lateral part)
4- Window opening system
5-Interior wood coating (low part)
6-Painting
7-Plasterboard 12.5mm thickness in panels of 60 cm
8-Structure of wooden slats 50x20mm (vertical position spaced every 30 cm)
9-Insulation Alkreflex 6.5mm thickness
10- Exterior wooden frame of the window
11- Metal hinge
12- Old glass of the openable window
13- Wooden window frame
14-Old glass fixed to the window
15- Stone flashing
16-Morter cement
17-Stone wall layer high quality 10cm
18-Wooden slats structure 50x20mm (horizontal position spaced every 30 cm)
19- Old plaster of the building 1.5cm thickness
20- Cover plate
21- Air chamber 5cm (there are 2, between the horitzontal wooden slats and between the vertical woden slats)

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 9	SCALE 1:10
	ORIGINAL WINDOW	Hanzehogeschool Groningen University of Applied Sciences

WINDOW WITH EXTRA GLASS LAYER



VERTICAL SECTION



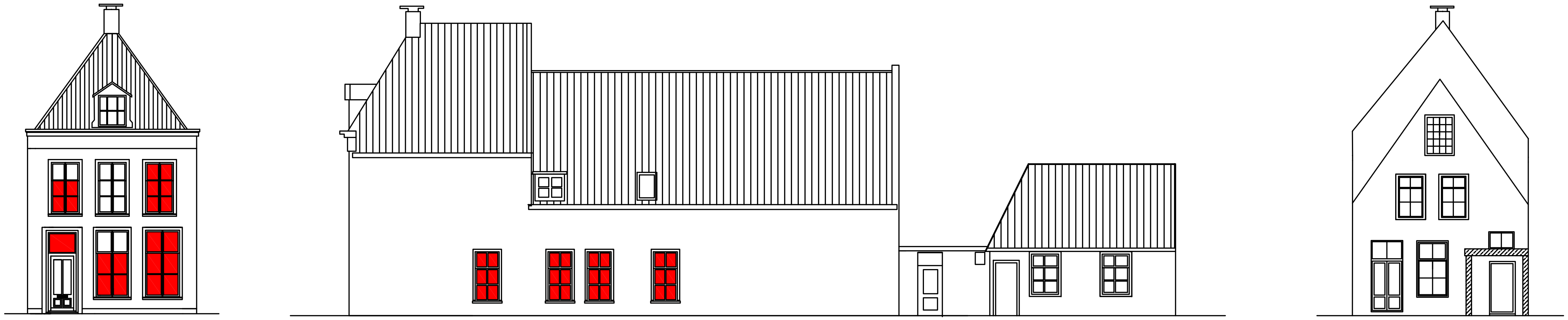
HORIZONTAL SECTION

1- Stone wall (low quality 21cm)
2-Interior wood coating (high part)
3-Interior wood coating (lateral part)
4- Window opening system
5-Interior wood coating (low part)
6-Painting
7-Plasterboard 12.5mm thicknessin panels of 60 cm
8-Structure of wooden slats 50x20mm (vertical position spaced every 30 cm)
9-Insulation Alkreflex 6.5mm thickness
10- Exterior wooden frame of the window
11- Metal hinge
12-Old glass of the openable window

13- Wooden window frame
14-Old glass fixed to the window
15- Stone flashing
16-Morter cement
17-Stone wall layer high quality 10cm
18-Wooden slats structure 50x20mm (horizontal position spaced every 30 cm)
19- Old plaster of the building 1.5cm thickness
20- Cover plate
21- Air chamber 5cm Air chamber 5cm (there are 2, between the horitzontal wooden slats and between the vertical woden slats)
22- Extra glass layer 5mm of thickness
23- Screws of the extra glass layer

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 10 / SCALE 1:10 / WINDOWS WITH EXTRA GLASS LAYER	Hanzehogeschool Groningen University of Applied Sciences

DISPOSITION OF THE WINDOWS COVERED BY EXTRA GLASS LAYER



MAIN FACADE

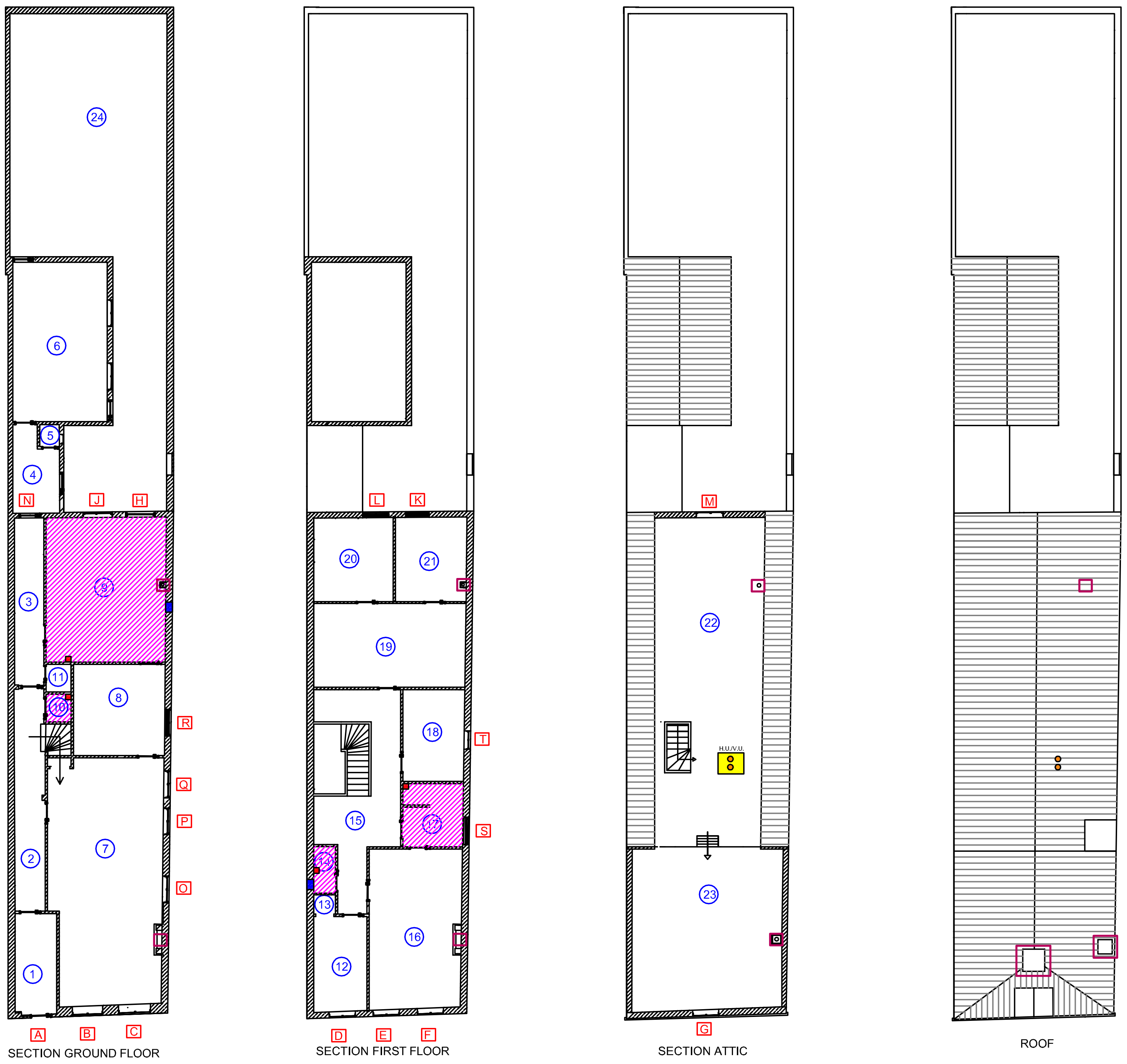
RIGHT FACADE

BACK FACADE (A-A´)

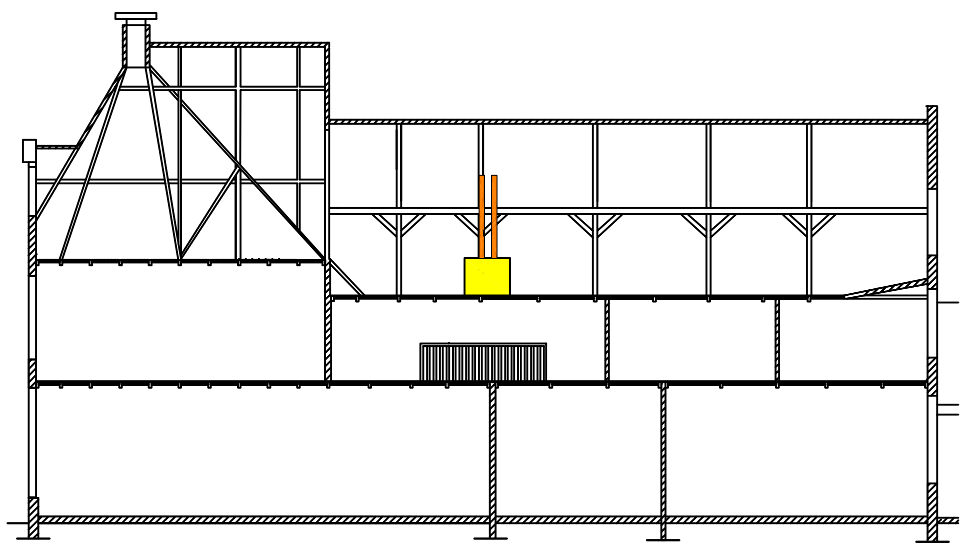
GLASS COVERED BY EXTRA GLAS LAYER

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 11 / SCALE 1:200 / WINDOWS WITH EXTRA GLASS LAYER	Hanzehogeschool Groningen University of Applied Sciences

VENTILATION SYSTEM IN THE EXITING BUILDING



1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



Vertical secction. Position of the ventilation unit and pipes that eject the inside air to the exterior of the building. Scale 1:200

Distribution of the existing ventiation inside the building. Scale 1:250

EXISTING VENTILATION IN THE BUILDING						
Floor	Room number	Humid room	EJECT AIR SYSTEM		ENTRANCE AIR SYSTEM	
			Which	Where	Which	Where
GROUND FLOOR	Room nº9	Kitchen	Gap in the wall (Kitchen hood vent) &Mechanical ventilation to eject interior air	Right facade	Windows	North facade
	Room nº10	W.C.	Mechanical ventilation to eject interior air	Top/Ceiling	-	-
FIRST FLOOR	Room nº14	Wahing machine and dryer room	Gap in the wall (dryer) &Mechanical ventilation to eject interior air	Left facade & Top/Ceiling	-	-
	Room nº17	Bathroom	Mechanical ventilation to eject interior air	Top/Ceiling	Windows	Right facade

Summary of the existing ventilation inside the building

ROOM Nº9
METAL GRILL FROM KITCHEN HOOOD VENTILATION

- Gaps made in the walls for ventilation (Rooms 9 and 14)
- Humid rooms (9,10,14 and 17)
- Mechanical ventilation in humid rooms
- Ventilation Unit (Attic 22)
- Pipes to eject the air out of the building from the ventilation unit (Attic 22)
- Chimneys pipes for eject the smoke (The first one in the rooms 7,16 and 23. The second one in the rooms 9,21 and 22)

ROOM Nº14
MECHANICAL VENTILATION IN THE WASHING MACHINE AND DRYER ROOM

The building, to eject the vapours generated by the dryer in the washing machine room (14) and the kitchen hood from the kitchen (9) uses a gap made at the facades and covered with a metal grill ejecting the vapours directly.

Moreover, to eject the rest of the vapours there are 4 small fans under the ceiling in every humid room like we can see in the pictures.

If the building has problems of condensations that means that these fans or are not working well or they are broken.

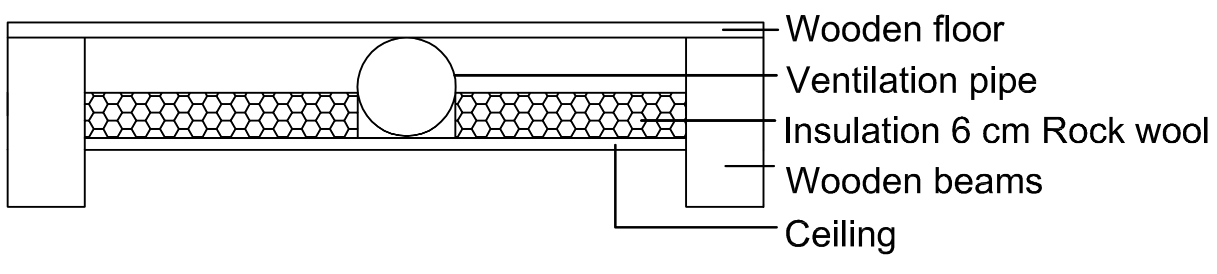
There is not enough information in te drawings form the restoration to know where the ventilation pipes have been installed. However, Most probably is that the ventilation pipes follow the direction of the wooden beams like we can see in the detail below but we do not have enough data to know exactly where are them.

In the existing drawings, the unic pipes sectioned that we can see are from the old chimneys of the building. And in the roof planes, the unic pipes drawn are from the closest chimney to the Street "Eise Eisengastraat". The chimney from the kitchen (room 9) and from the Heating unit in the attic do not appear. We have drawn where they should be with the data that we have.

To solve the ventilation problems, it will be necessary renew the actual components that eject the vapours to the exterior of the building.

ROOM Nº10
MECHANICAL VENTILATION IN THE W.C.

ROOM Nº17
MECHANICAL VENTILATION IN THE BATHROOM



Detail of the position of the ventiltion pipe (125mm of diameter) between the ceiling and the wooden floor from the next level. Scale 1:10

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"

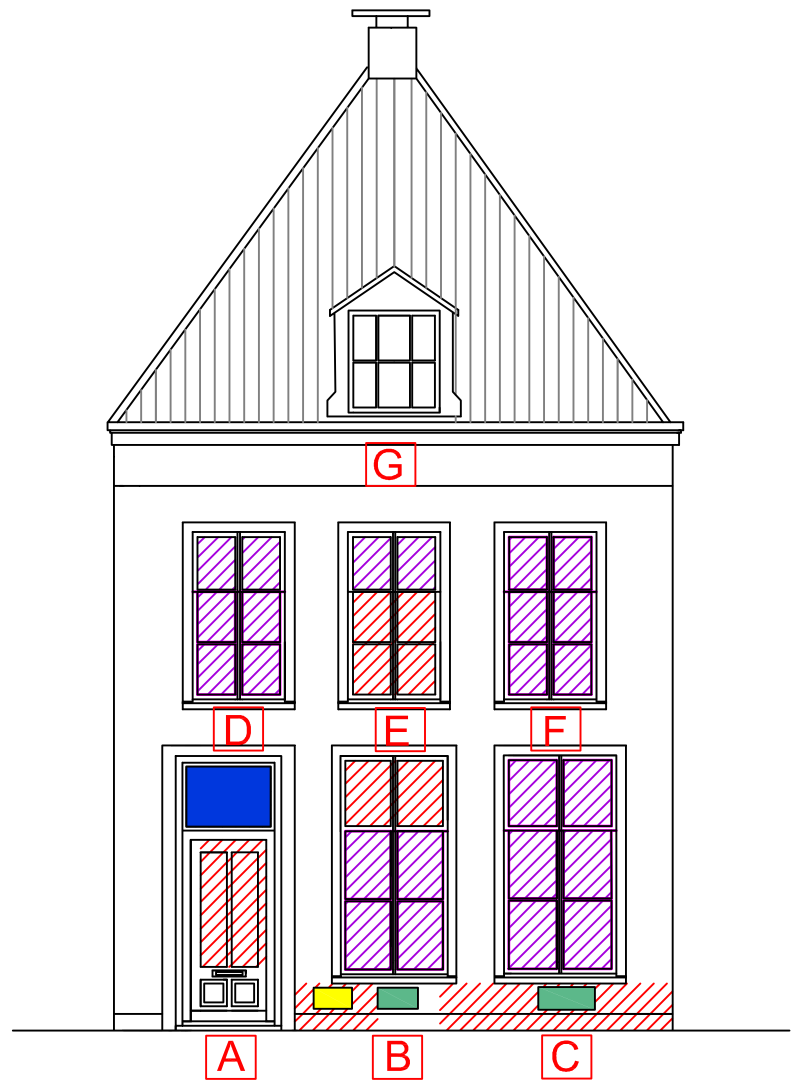
FINAL PROJECT 2013/2014 | JESÚS PIZÁ MARTÍN | 2-JUNE-2014

UNIVERSITAT POLITÈCNICA DE VALÈNCIA | Nº PLANE: 12 | SCALE: 1:200/1:250 | Hanzehogeschool Groningen University of Applied Sciences

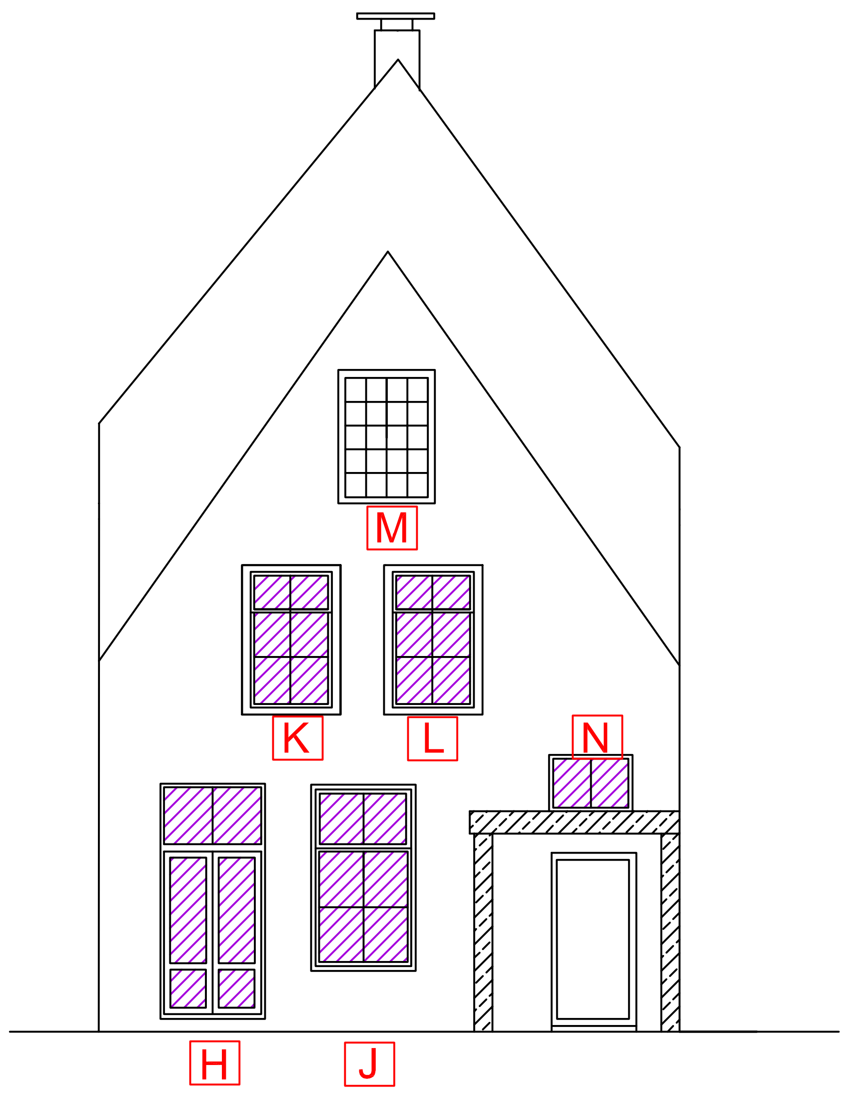
EXISTING VENTILATION

PROBLEMS OF THE EXISTING BUILDING

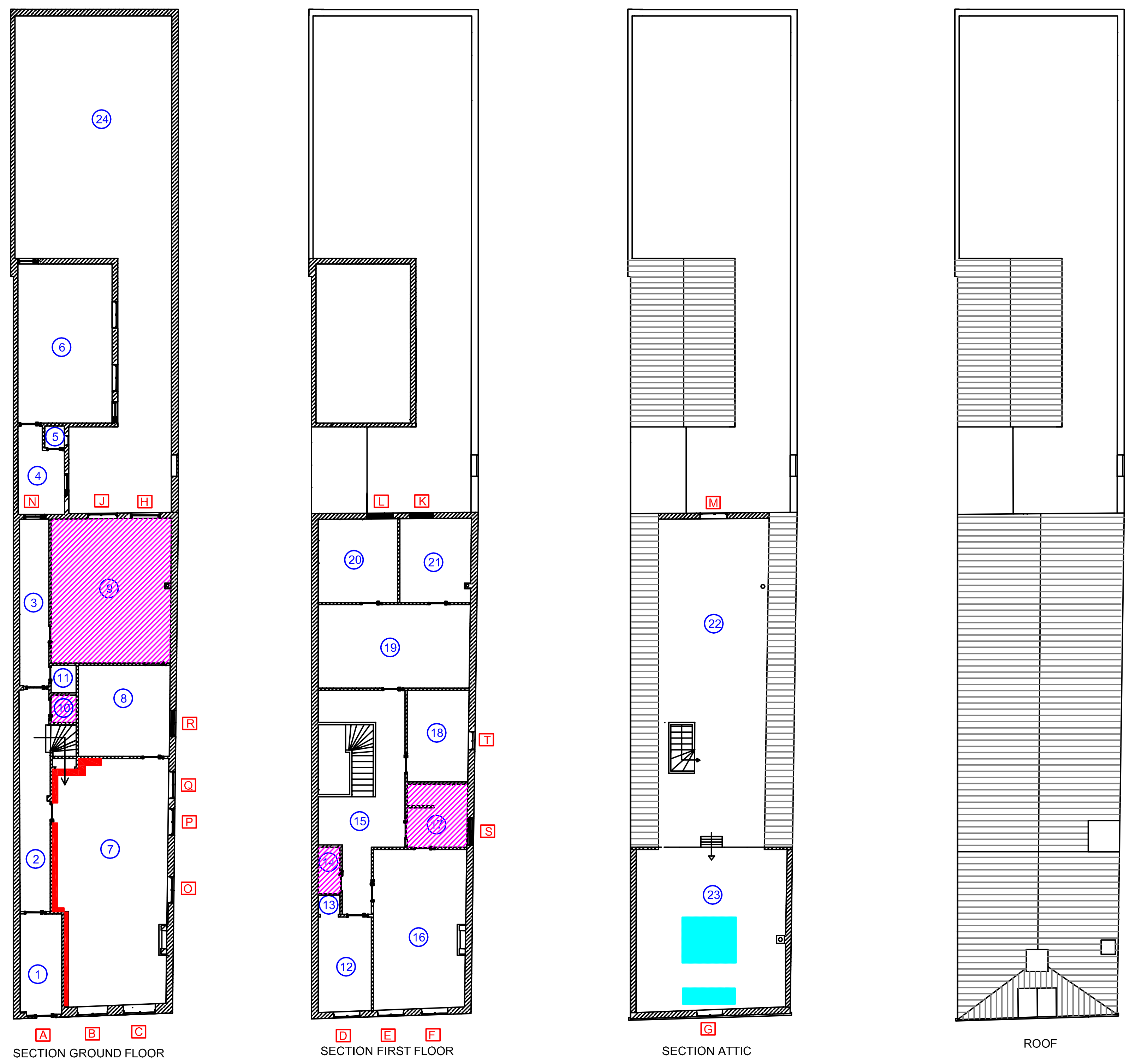
1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden



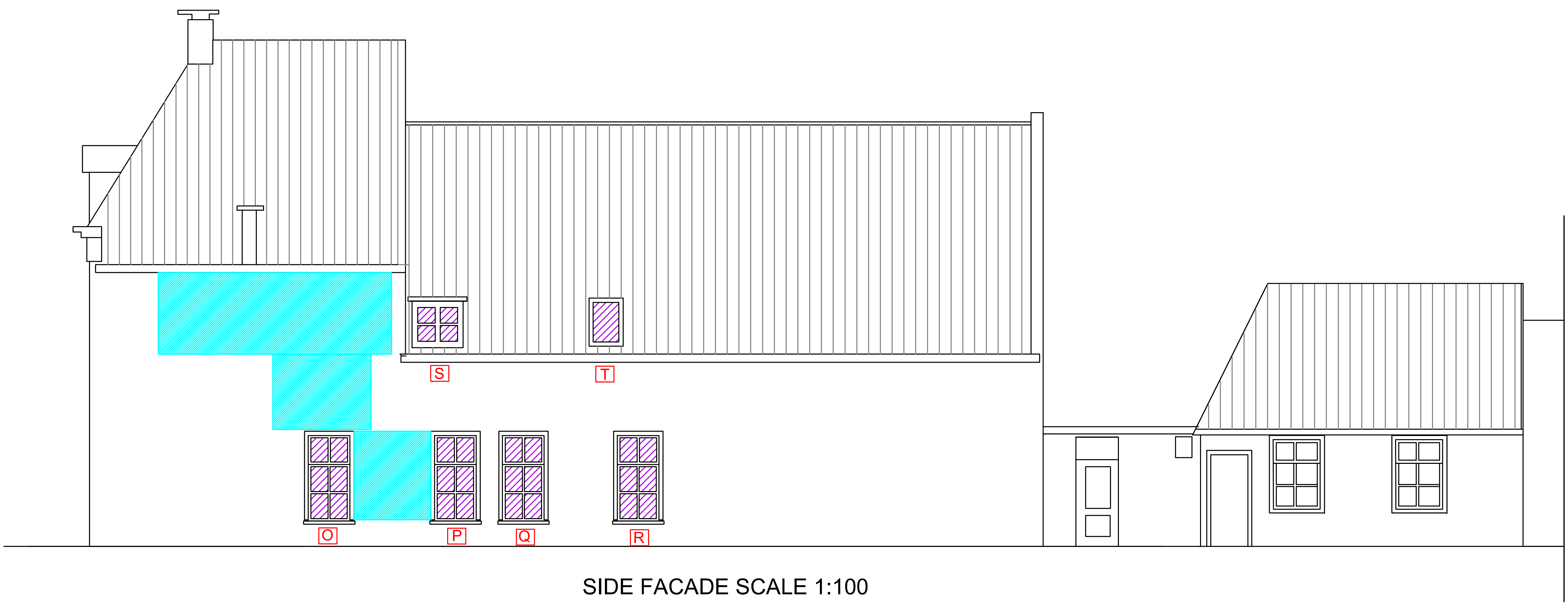
MAIN FACADE SCALE 1:100



BACK FACADE SCALE 1:100



FLOOR LEVELS SCALE 1:250



SIDE FACADE SCALE 1:100

Problems that affect directly thermal comfort:

- HEAT LOSSES BY CONDUCTION
- HEAT LOSSES BY CONDUCTION
- HEAT LOSSES BY CONVECTION (AIR LEAKS)
- INSUFFICIENT VENTILATION HUMID ROOMS (9,10,14 AND 17)

THERE HAS BEEN CONDENSATION APARITION ONLY ON THE WINDOWS OF THE MAIN FACADE, WHERE THERE ARE DRAWN THE HEAT LOSSES BY CONDUCTION

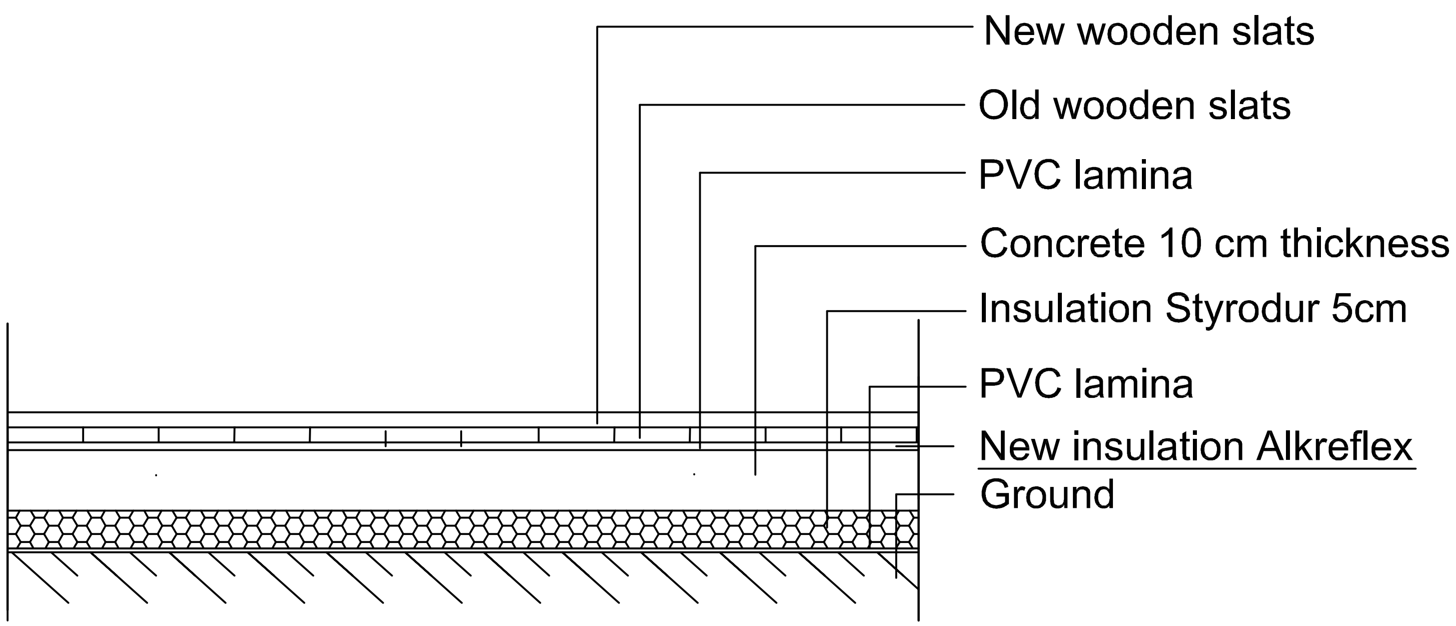
Problems caused by humiditis and rainwater

- EFFLORESCENCES (MAIN FACADE)
- HUMIDITIES SPOTS BY RAINWATER AND RAIN WATER FILTRATIONS (ATTIC & SIDE FACADE)
- CRACKS (MAIN FACADE)
- CAPILLARY MOISTURE SPOTS LIVING ROOM (ROOM 7)
- ONLY GLASSING AT THE MAIN FACADE WITHOUT AIR LEAKS AND WITHOUT CONDENSATIONS (GLASSING A)

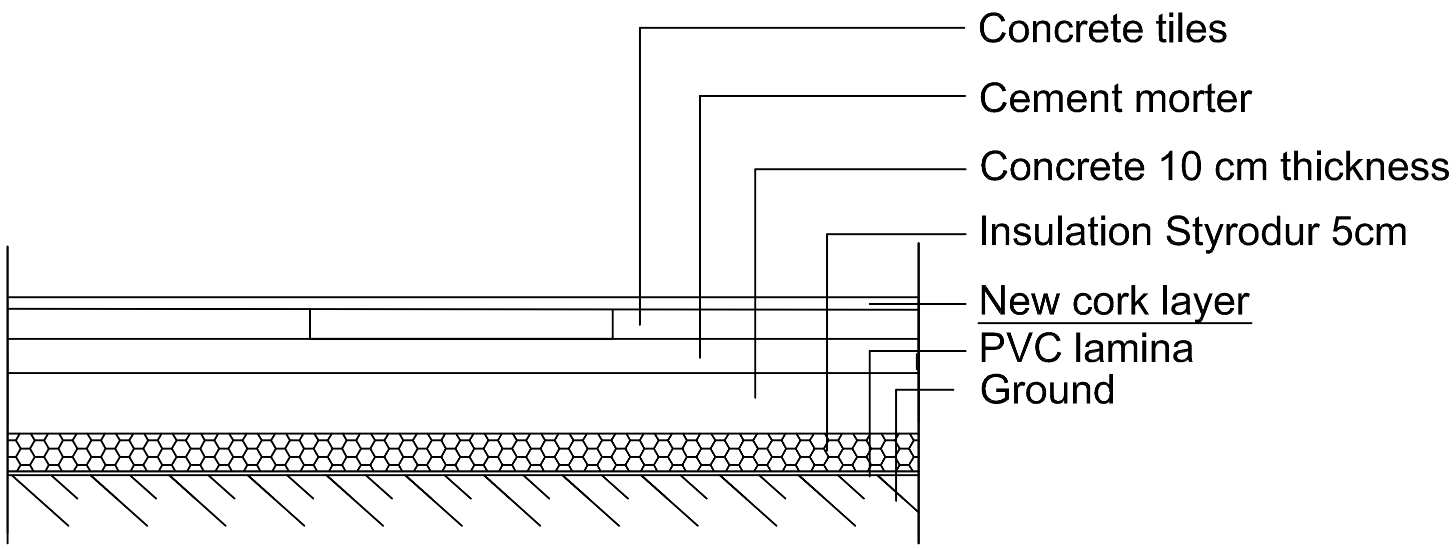
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014	
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 13	SCALE: 1:100/1:250	Hanzehogeschool Groningen University of Applied Sciences
	PROBLEMS EXISTING BUILDING		

DETAILS NEW BUILDING

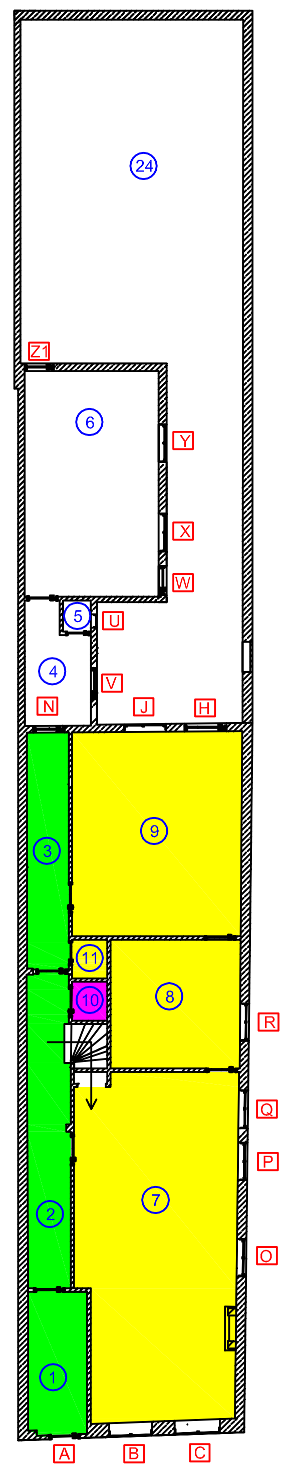
NEW GROUND FLOOR DETAILS



Detail 1. New ground floor. Rooms 7,8 and 9.



Detail 2. New ground floor materials, corridor rooms 1,2 and 3.



1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden

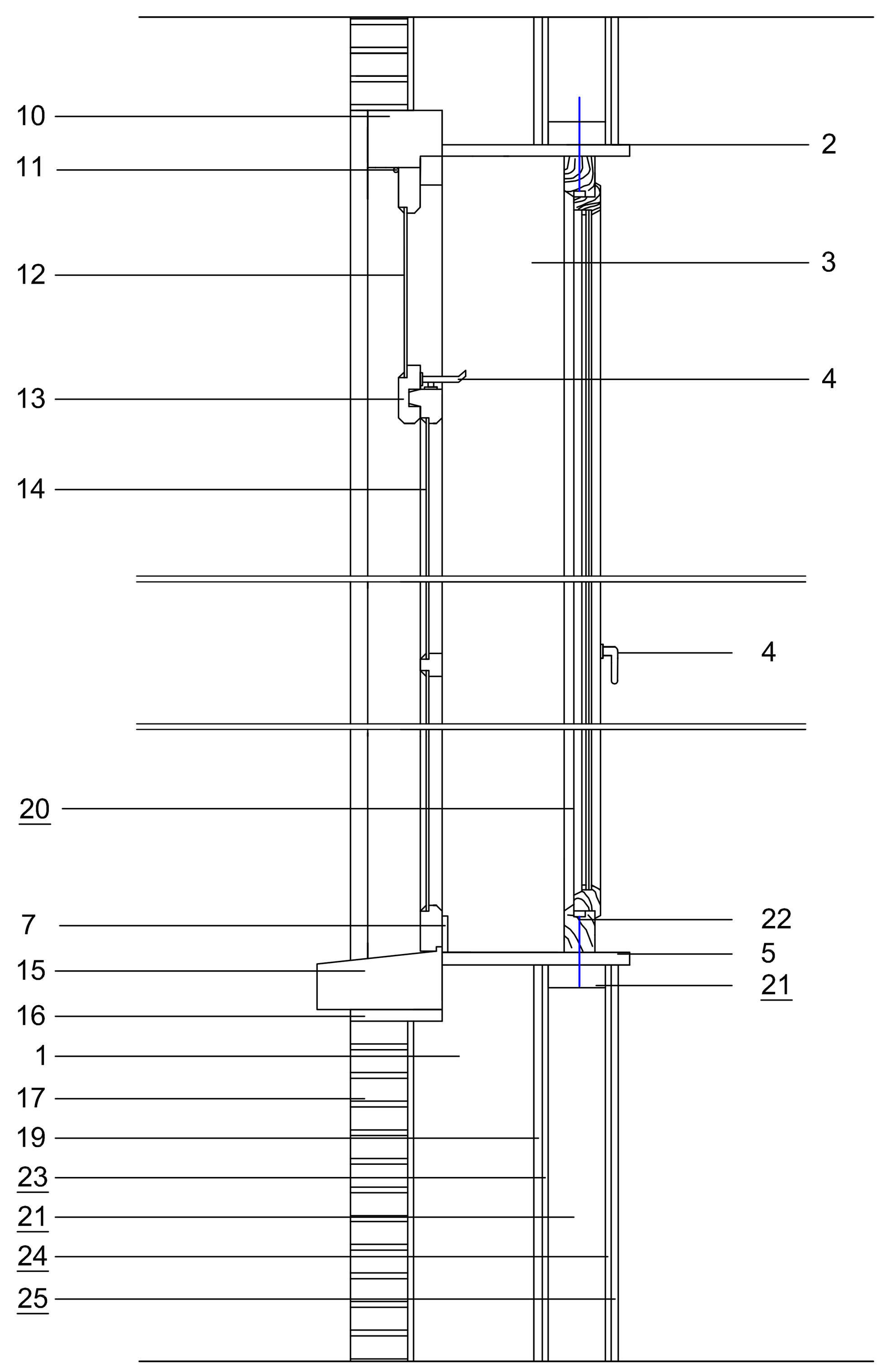
GROUND FLOOR

Detail 1. New insulation below the wooden layers

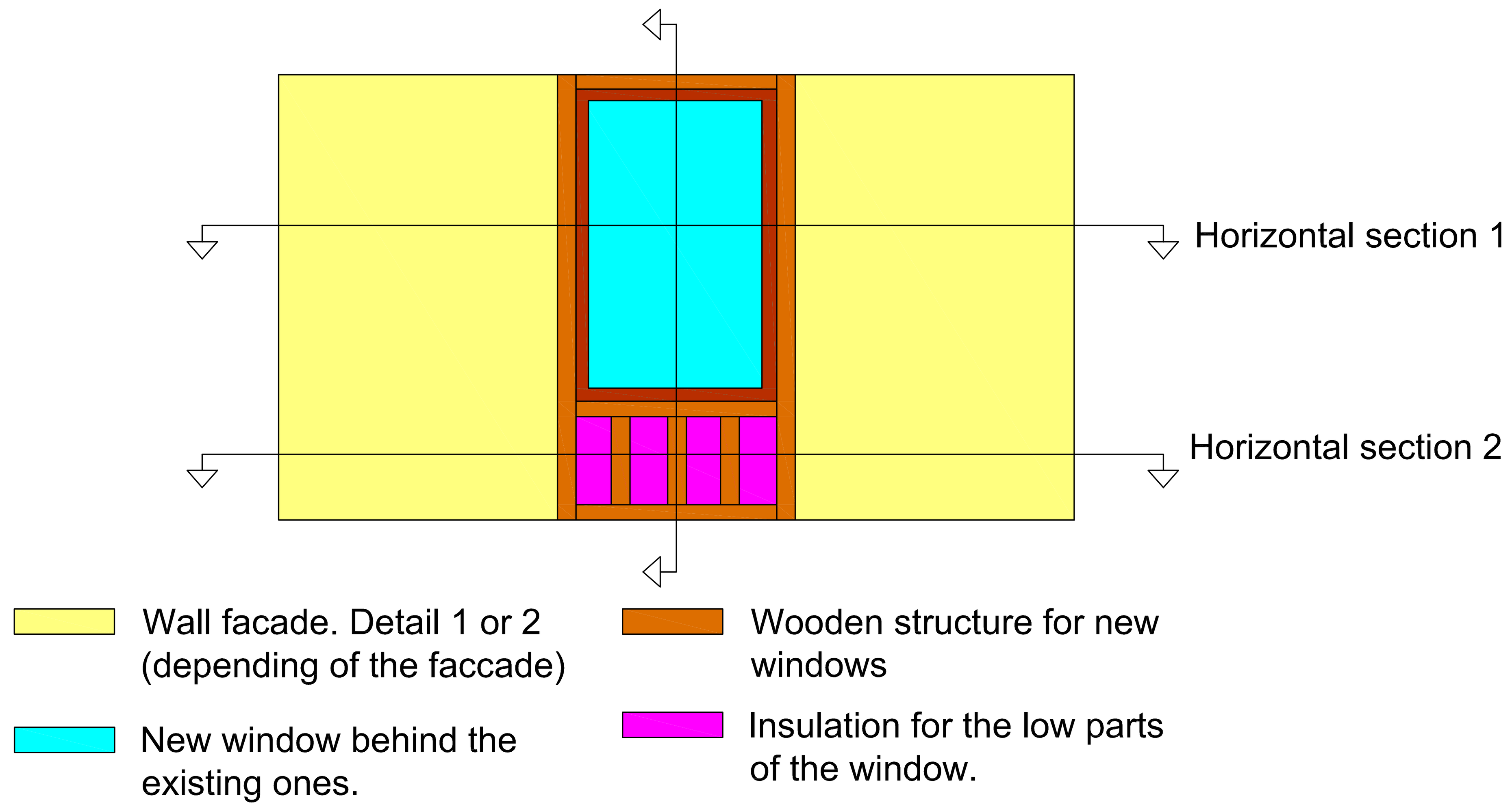
Detail 2. New cork layer on the actual concrete tiles

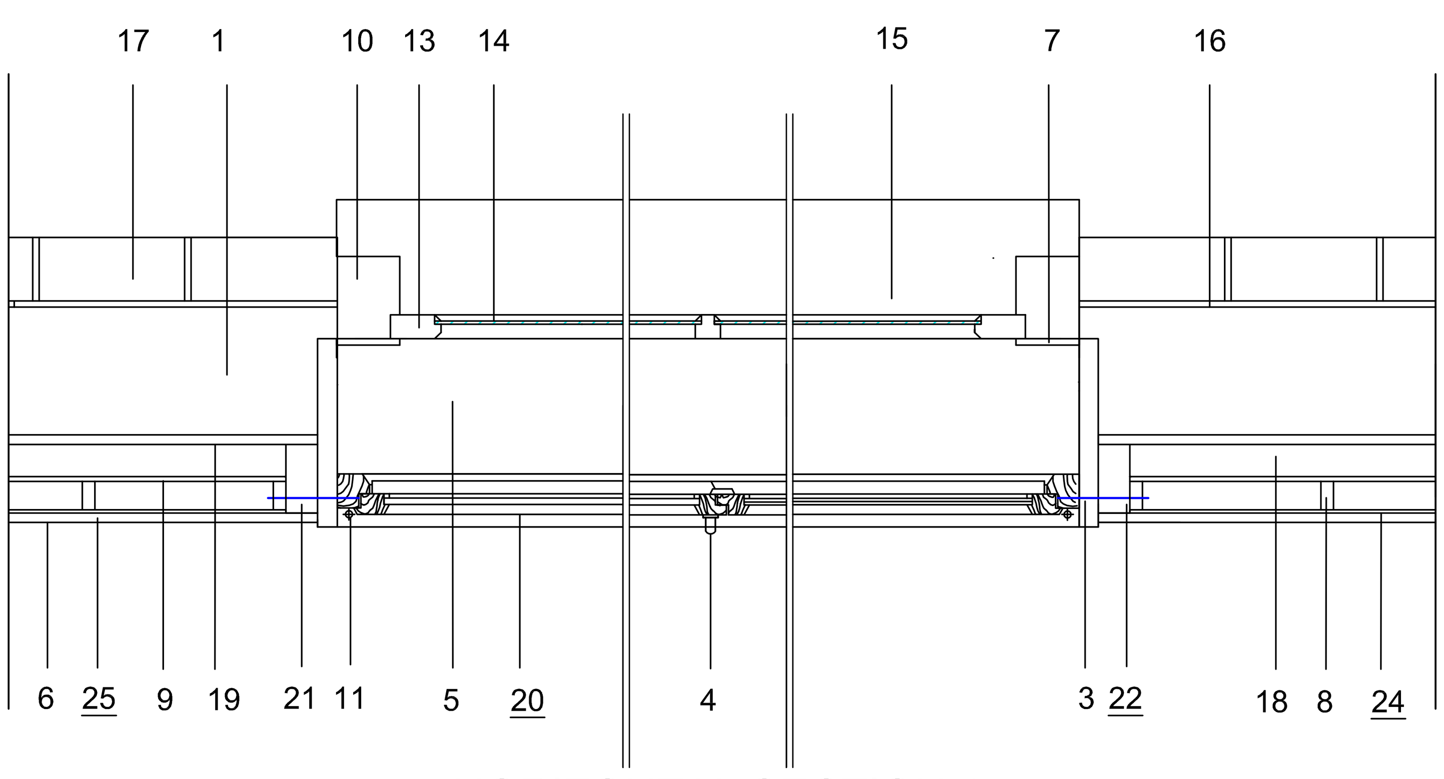
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 14	SCALE 1: 10	Hanzehogeschool Groningen University of Applied Sciences
	FLOOR DISTRIBUTION EXISTING BUILDING		

NEW WALL AD WINDOW DETAIL

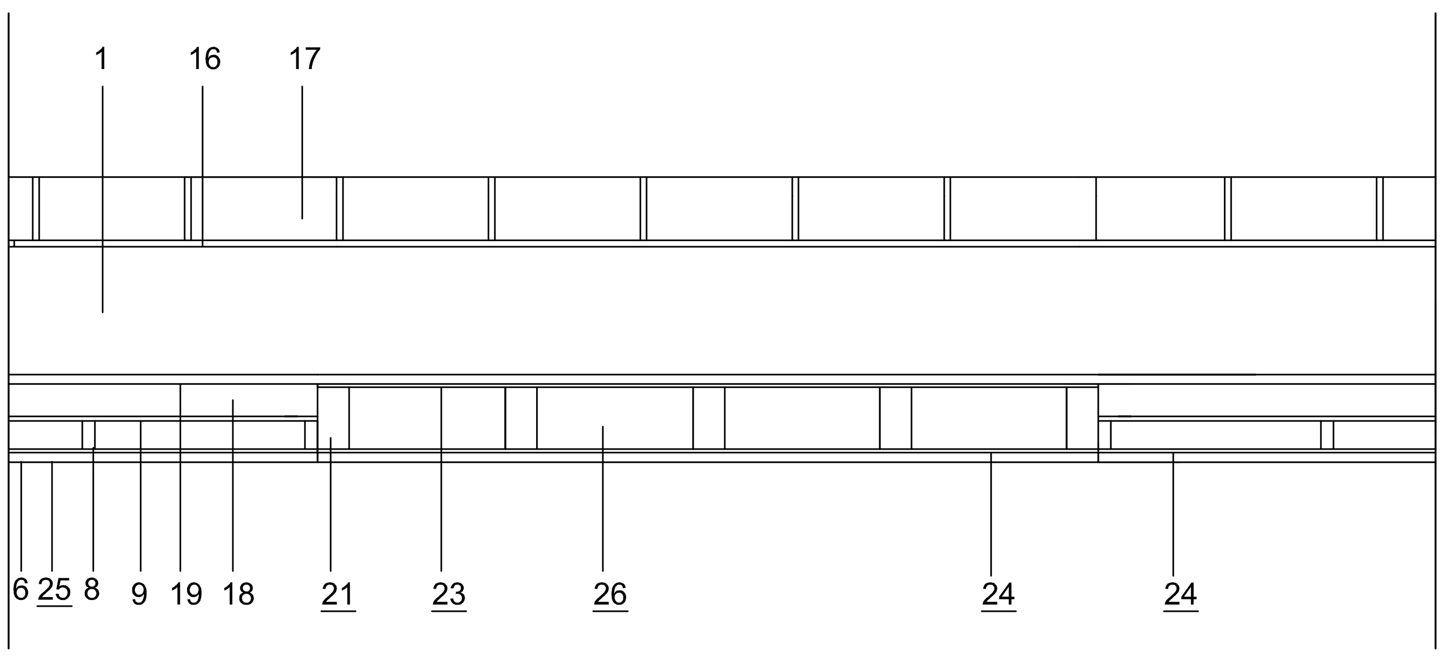


VERTICAL SECTION

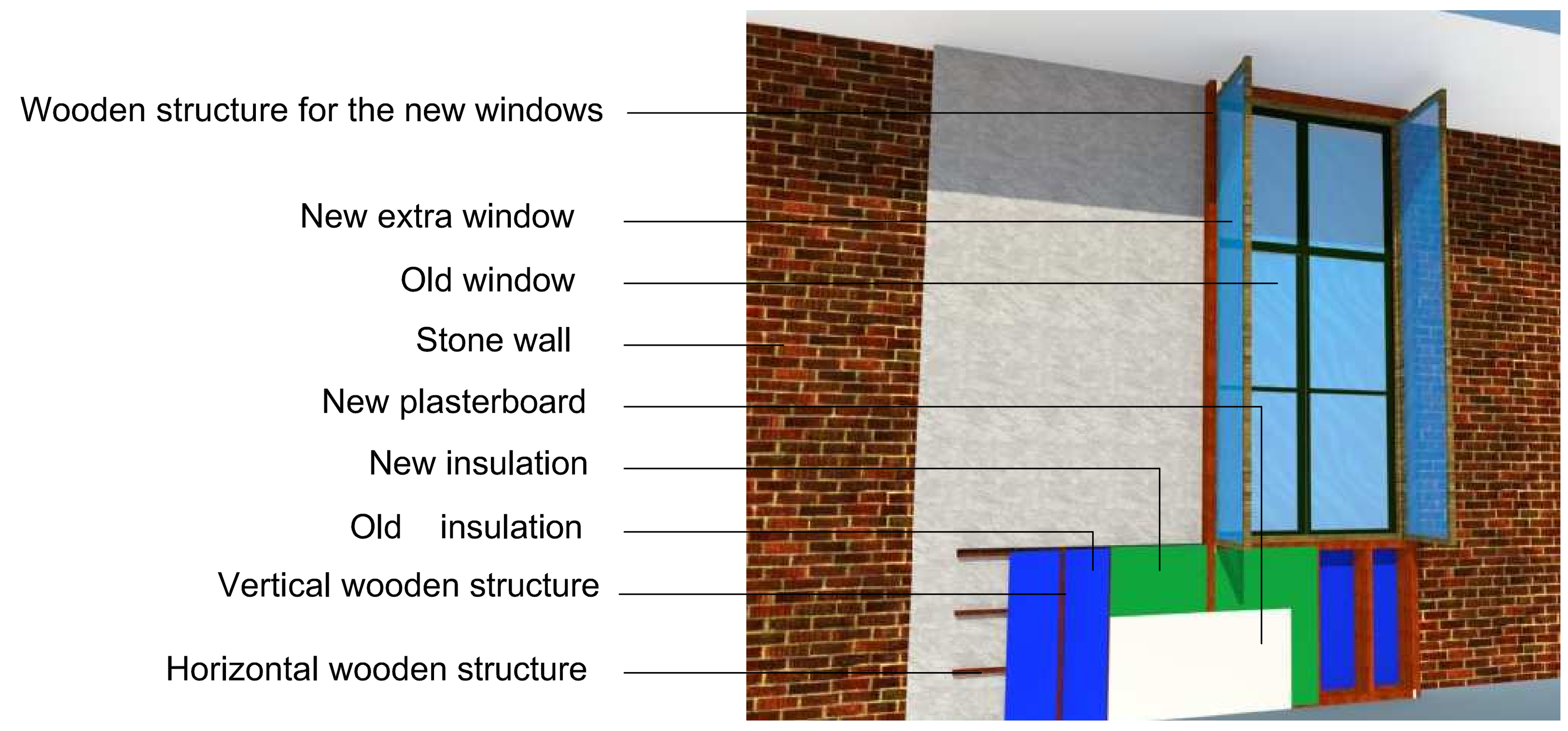




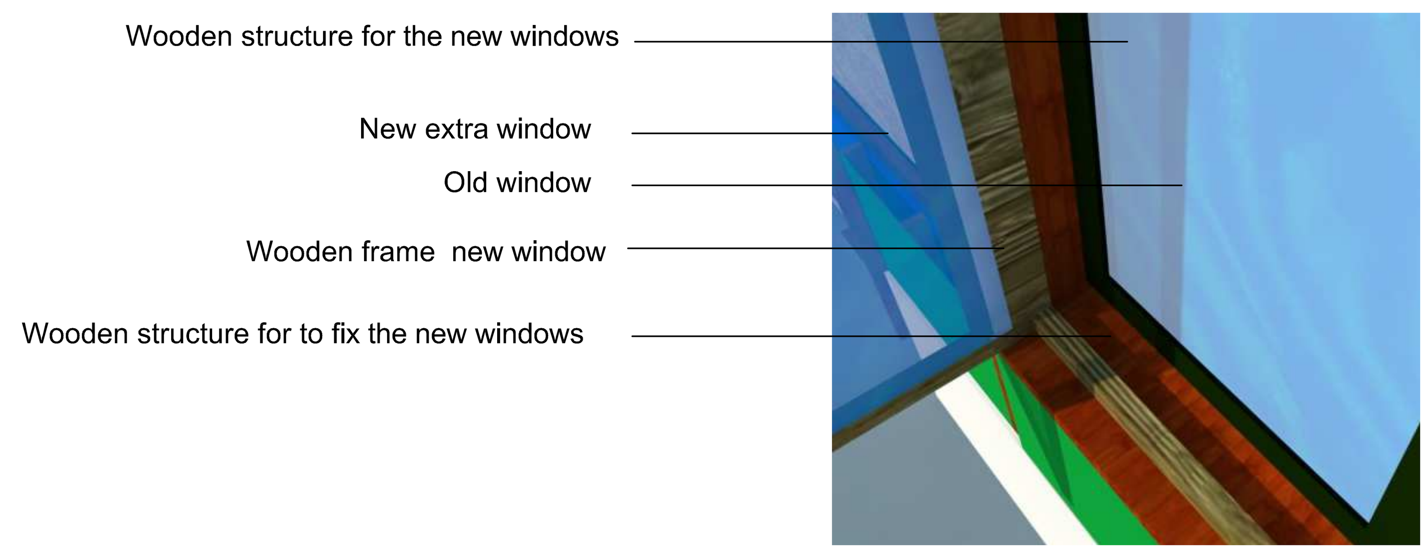
HORIZONTAL SECTION 1



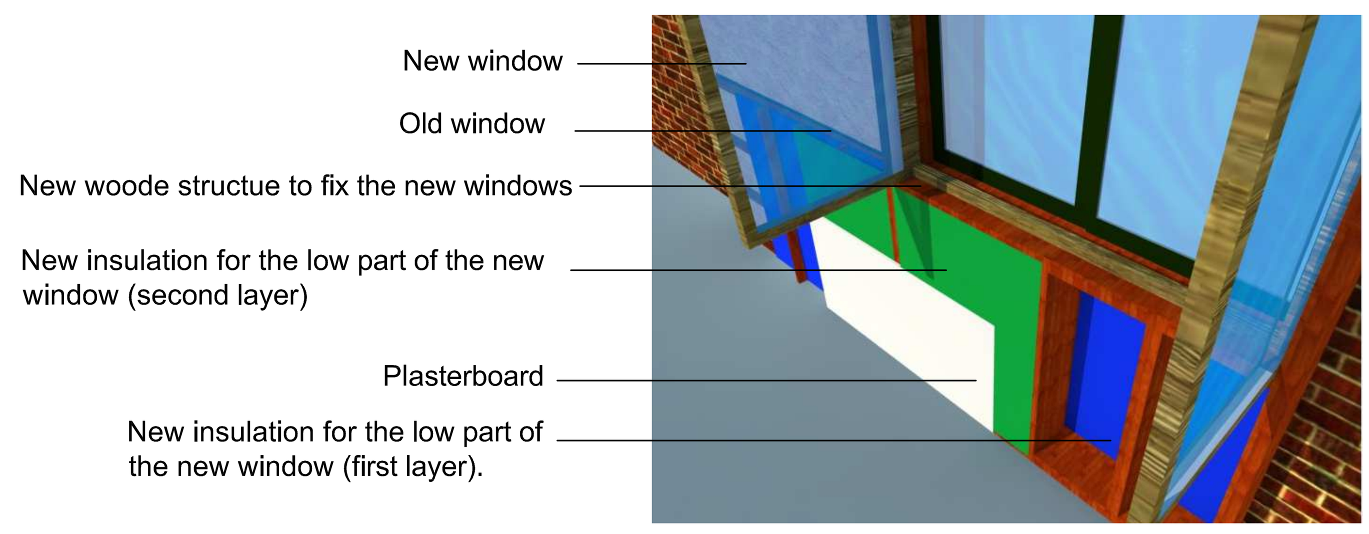
HORIZONTAL SECTION 2



GENERAL DETAIL NEW WINDOW BEHIND THE EXISTING ONE



AIR CHAMBER BETWEEN WINDOWS

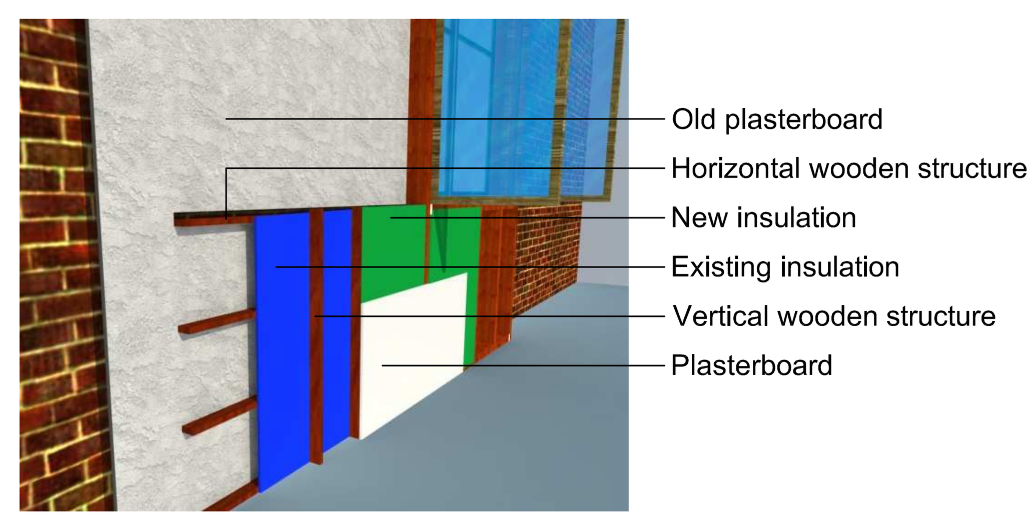


LOW PART OF THE WINDOW

1- Stone wall (low quality 21cm)
2-Interior wood coating (high part)
3-Interior wood coating (lateral part)
4- Window opening system
5-Interior wood coating (lowest part)
6-Painting
7-Cover plate
8-Structure of wooden slats 50x20mm (vertical position spaced every 30 cm)
9-Existing Insulation Alkreflex 6.5mm thickness
10- Exterior wooden frame of the window
11- Metal hinge
12-Old glass of the openable window
13- Wooden window frame
14-Old glass original window
15- Stone flashing
16-Morter cement
17-Stone wall layer high quality 10cm
18-Wooden slats structure 50x20mm (horizontal position spaced every 30 cm)
19- Old plaster of the building 15mm thickness

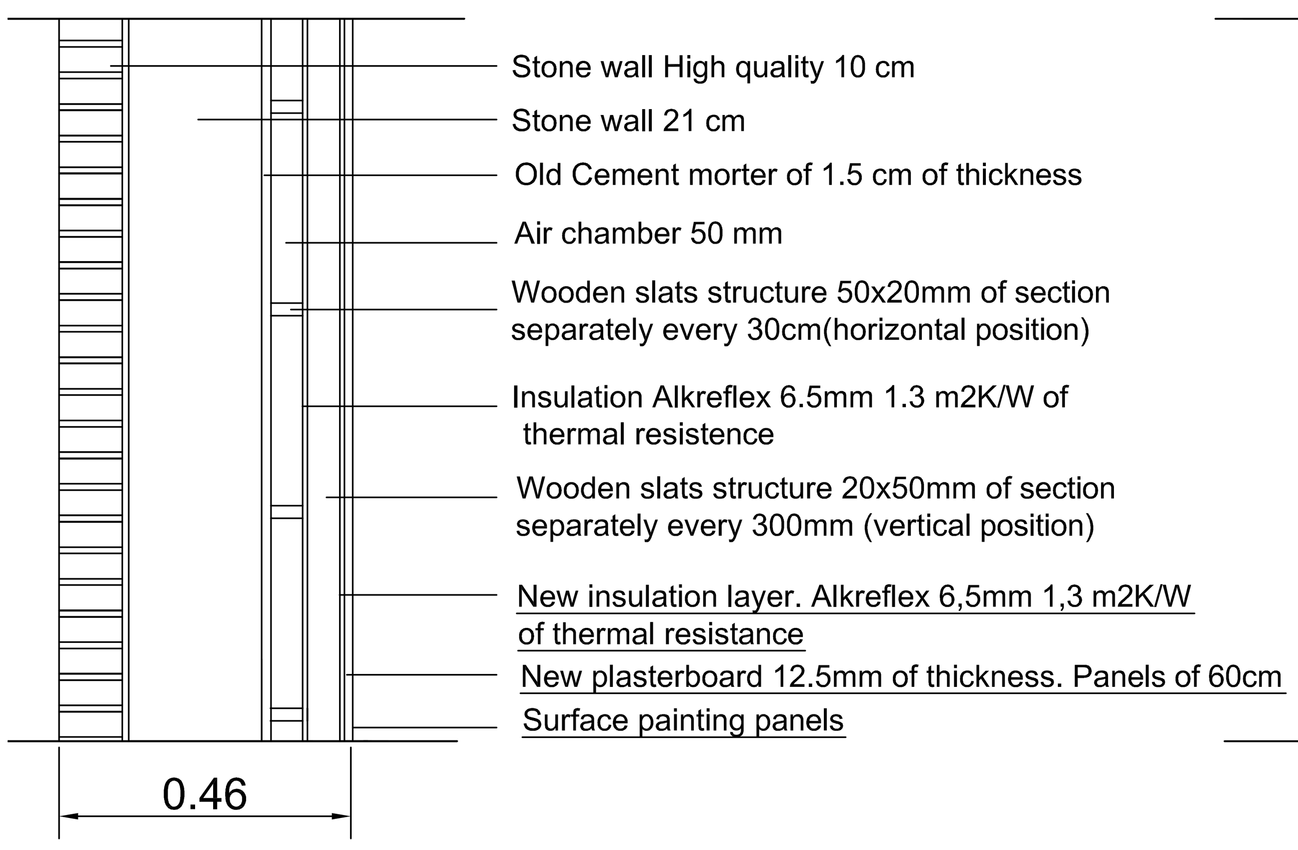
NEW ELEMENTS

20- New extra window behind the existing one
21- New wooden structure for the new window
22- Screws to anchor the window to the wooden structure
23- New insulation layer Alkreflex below the windows (first layer)
24- New insulation layer Alkreflex (second layer)
25- New plasterboard layer
26- Air chamber

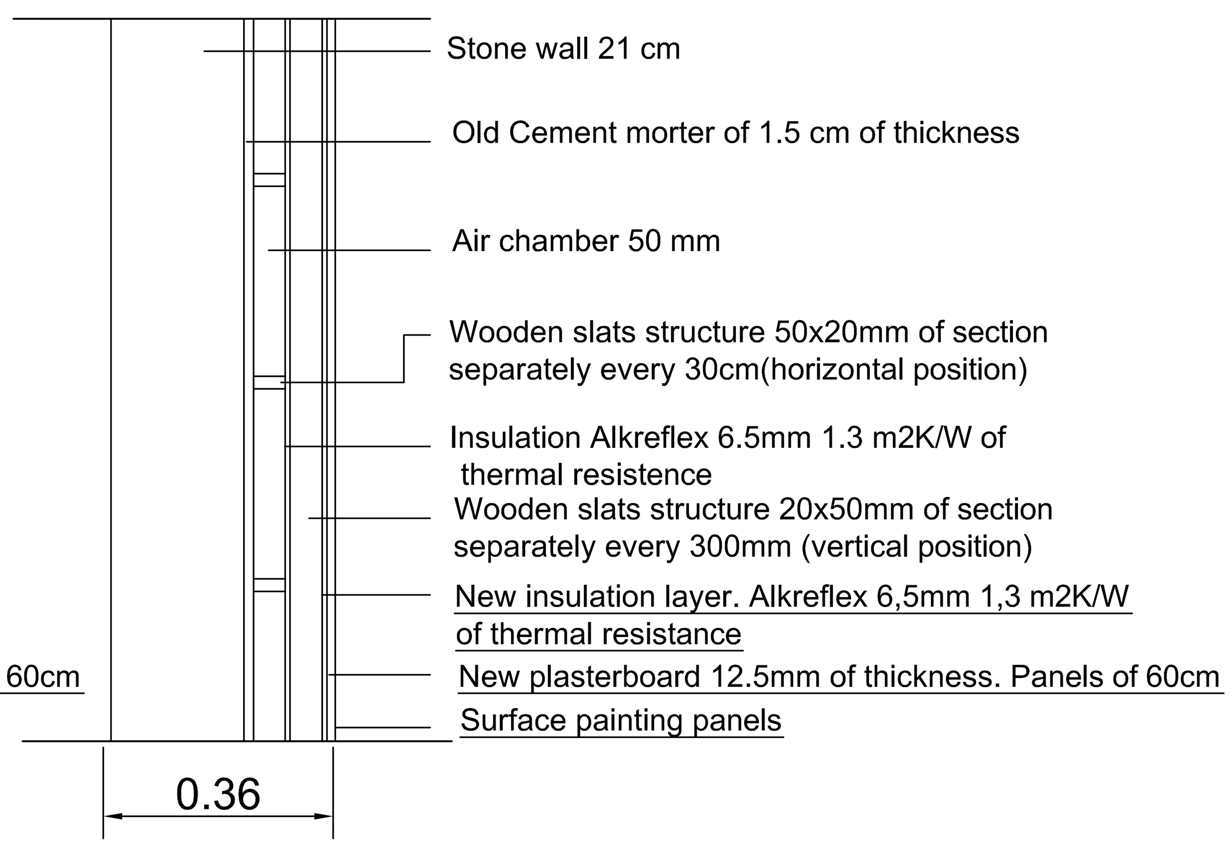


INTERIOR PARTITION MATERIALS

The wooden structure for the new windows will be fixed to the wall and to the floor using anchors with epoxy resin.



DETIAL 1. NEW WALL DETAIL MAIN FACADE



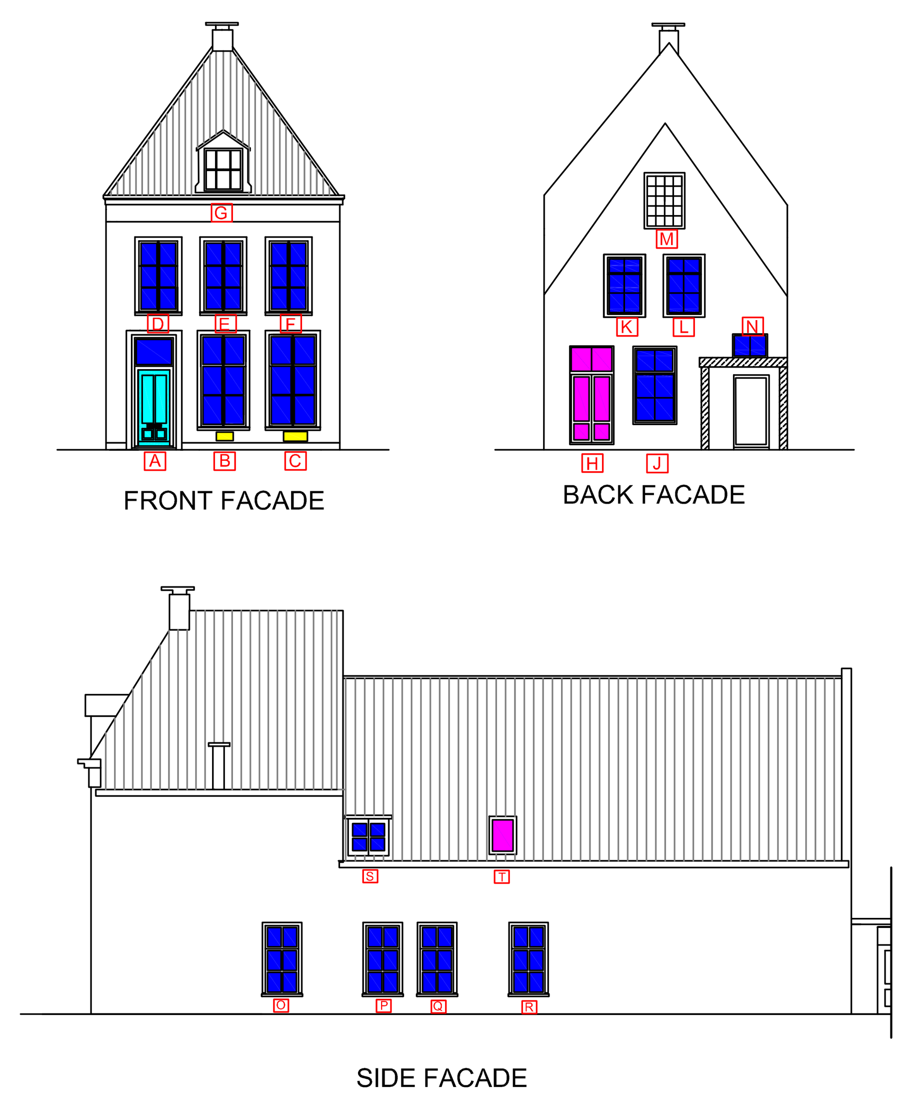
DETAIL 2. NEW WALL DETAIL SIDE AND BACK FACADE

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"			
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN		2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 15	SCALE 1:10	Hanzehogeschool Groningen University of Applied Sciences
	NEW WINDOW AND WALL DETAIL		

DEMOLITION PLAN

MODIFICATIONS IN THE FLOORS SCALE 1:100

MODIFICATIONS AT THE FACADES SCALE 1:200



1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden

MODIFICATIONS IN THE HOUSE

- TEMPORALY REMOVAL OF EXISITNG WOODEN FLOOR AND PLINTH AND INTALLATION OF A NEW INSULATION LAYER BELOW THE EXISTING WOODEN FLOOR. ROOMS 7,8 AND 9
- TEMPORARY REMOVAL OF HEATING INSTALLATION
- 1 - DEMOLITION OF THE EXISTING PLASTERBOARD LAYER IN ALL THE FACADE WALLS FROM ALL THE ROOMS AND DEMOLITION OF THE TILING FROM THE BATHROOM 17.

  2- INSTALLATION OF THE NEW LAYER OF INSULATION USING STAPLES ON THE LAST WOODEN SLAT STRUCTURE.

  3- INSTALLATION OF THE NEW PLASTERBOARD LAYER ON THA FACADES WALL FROM ALL THE ROOMS FOLLOWING THESE SPECIFICATIONS:

  - ROOM 17: BATHROOM FIRST FLOOR , THE PLASTERBOARD LAYER WILL BE COVERED WITH A TILING LAYER LIKE THE REST OF THE BATHROOM

  - ROOM 9: THE KITCHEN WILL BE COVERED WITH MOISTURE RESISTANT PANELS OF PLASTERBOARD.

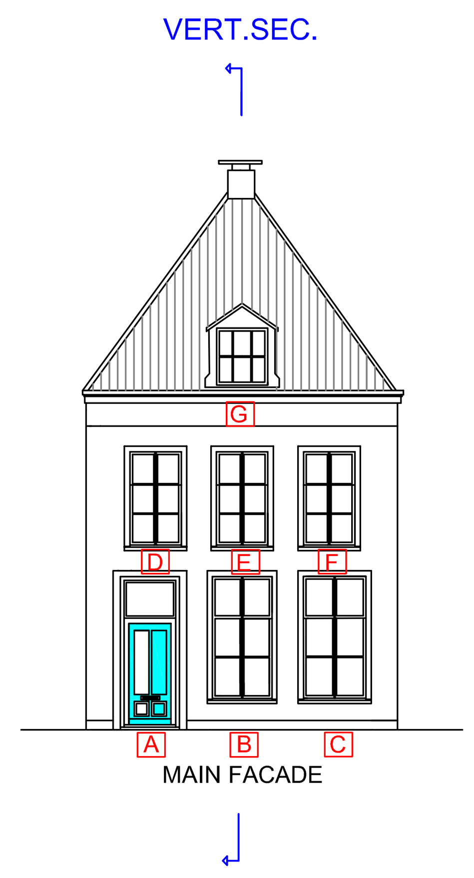
  - ROOMS 12 & 16 (WALL TYPE 3 PLANE 7) THERE WILL BE INSTALLED ON ALL THE FACADE WALL THE SAME LAYERS AS THE FINAL WALL FACADE:

  +WOODEN SLATS 50mm
  +INSULATION 6.5mm
  +WOODEN SLATS 50mm
  +INSULATION 6.5mm
  +PLASTERBOARD 12.5mm

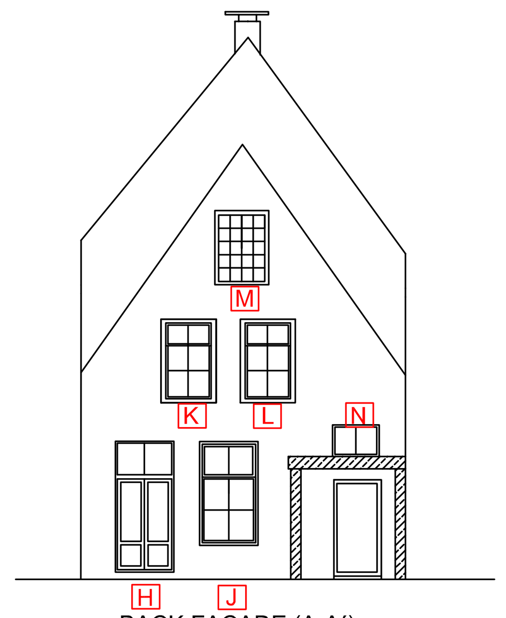
  ALL THE ELECTRICITY INSTALLATION FROM ALL THOSE ROOMS AND ALSO THE WATER INSTALLATION FROM THE HUMID ROOMS 9 AND 17 WILL BE READJUSTED.

  ALL THE FINAL PLASTERBOARD LAYER WILL BE PAINTED AT THE FINAL OF THE WORKS.
- ZONE WHERE THERE WILL BE DEMOLISHED THE WOODEN SLATS AND THE EXISTING INSULATION LAYER TO REINFORCE THEM WITH THE NEW WOODEN SLATS STRUCTURE FOR THE INSTALLATION OF THE NEW EXTRA WINDOW
- RENEW EXISTING DOUBLE GLASSING BROKEN (WINDOW "T") FOR A NEW ONE AND RENEW SIMPLE GLASSING FROM THE DOOR "H" FOR A NEW DOUBLE ONE TOO
- RENEW HEATING UNIT AND VENTILATION UNIT (ATTIC 22)
- DOOR REPARATION AND PAINTING
- CRACKS COVERING
- NEW CORK FLOOR LAYER AND CORK PLINTH CORRIDOR 1,2 AND 3
- RENEW EXISTING EJECTOR FANS FROM TE HUMID ROOMS 9,10,14 AND 17

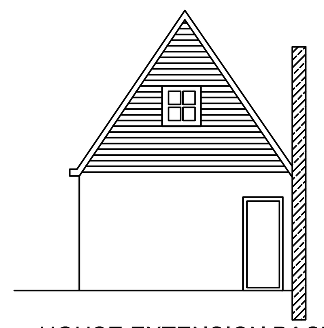
PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 16 / SCALE: 1:50/ 1:200 / DEMOLITION PLAN	Hanzehogeschool Groningen University of Applied Sciences



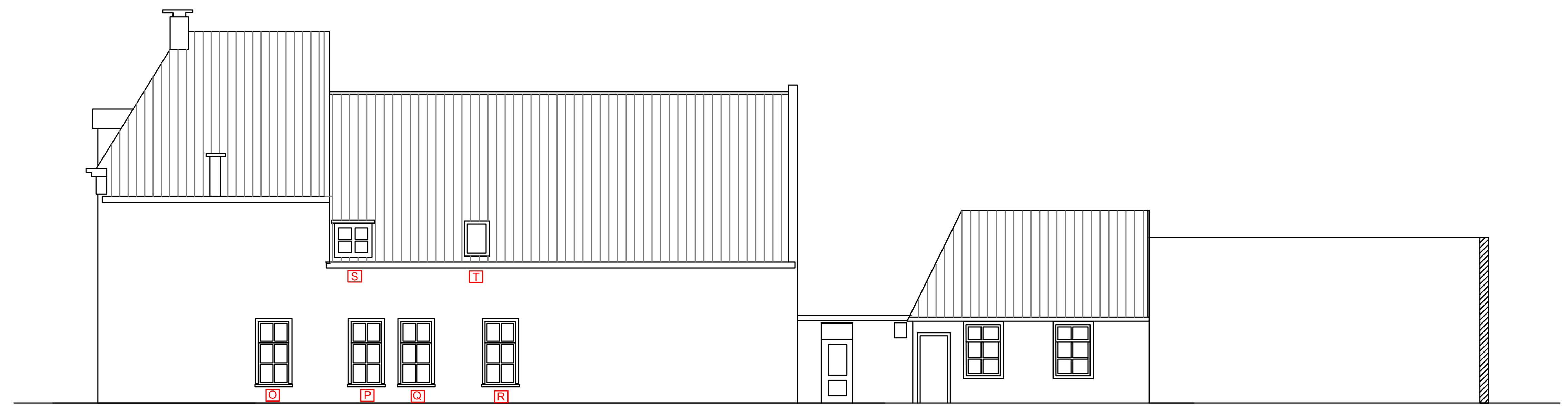
MAIN FACADE



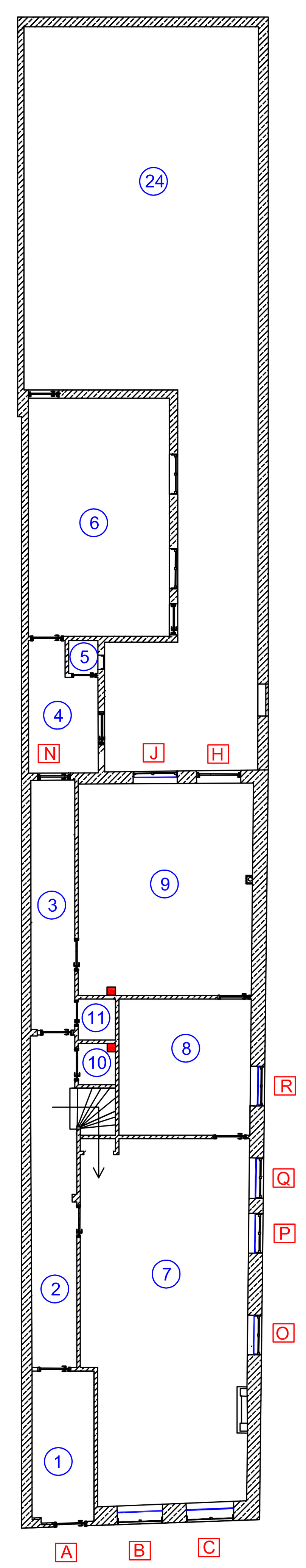
BACK FACADE (A-A´)



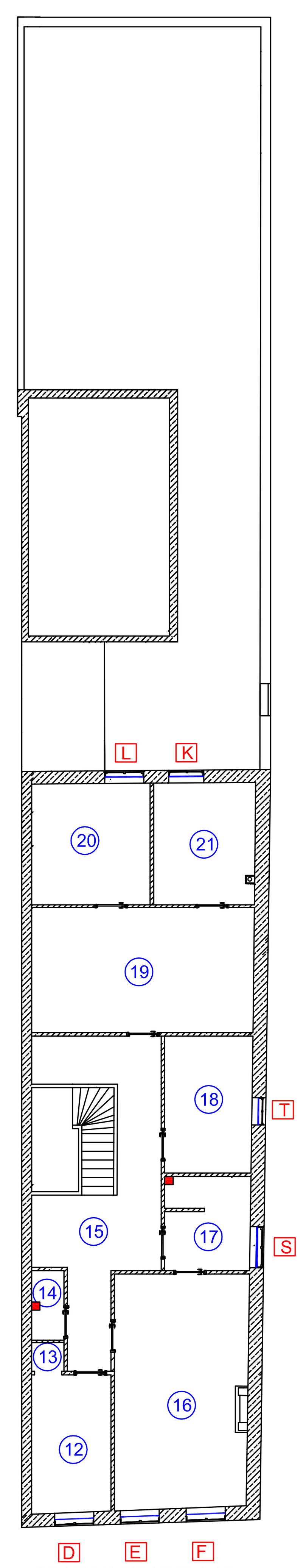
HOUSE EXTENSION BACK VIEW



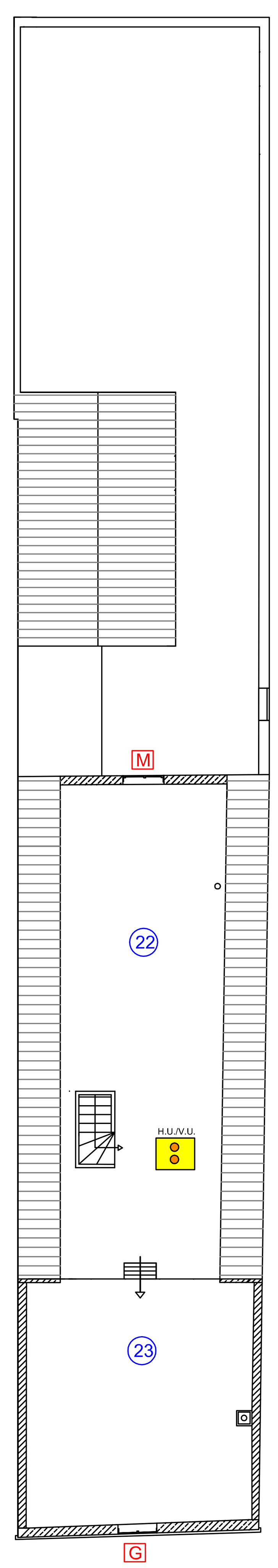
RIGHT FACADE



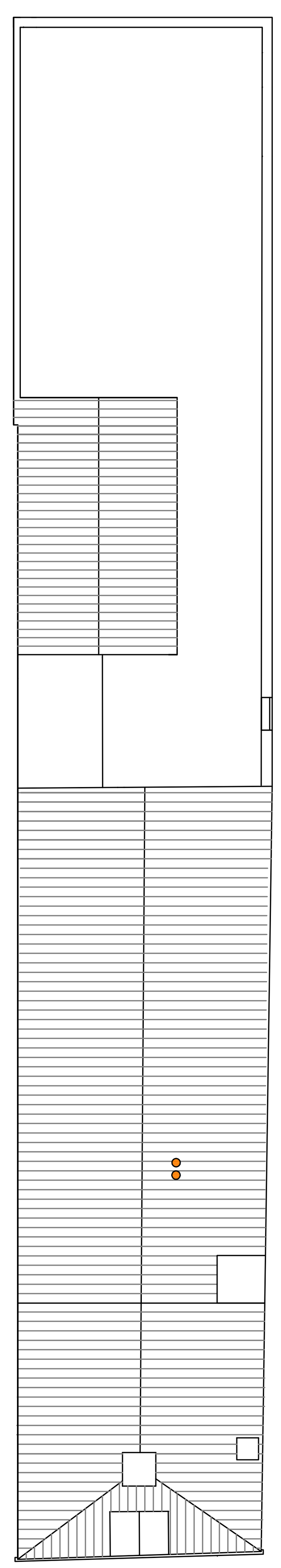
SECTION GROUND FLOOR



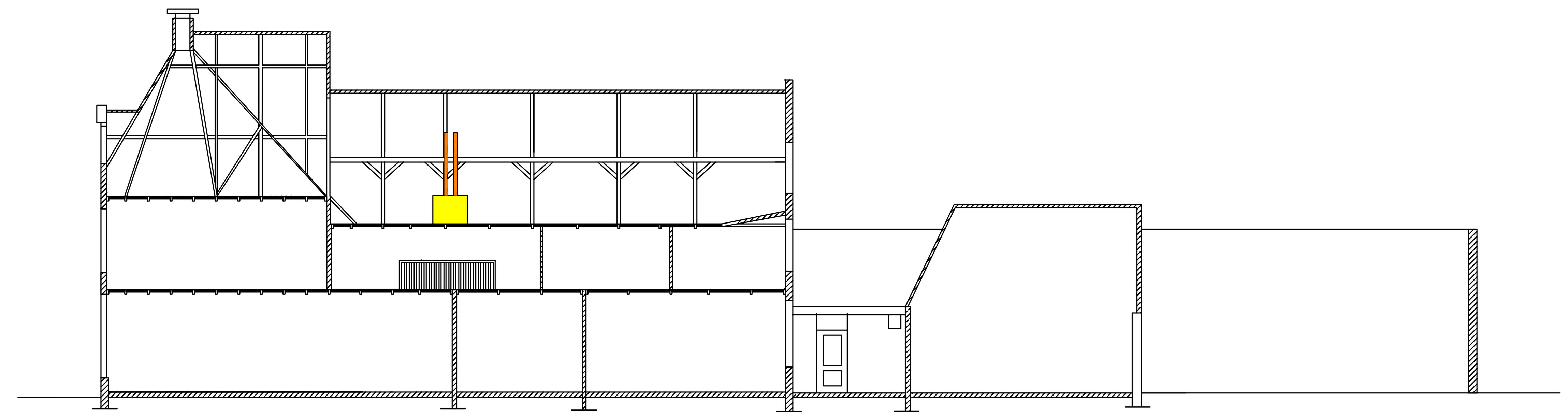
SECTION FIRST FLOOR



SECTION ATTIC



ROOF



VERTICAL SECTION

1-Hall
2-Corridor
3-Corridor
4-Corridor
5-Toilet
6-Second Living Room
7-Living Room
8-Library
9-Kitchen
10-W.C.
11-Storage room
12-Study room
13-Wardrobe
14-Washing machine & dryer
15-Corridor
16-Bedroom
17-Bathroom
18-Bedroom
19- Corridor
20- Bedroom
21- Bedroom
22-Attic (Low Part)
23-Attic(High part)
24-Garden

NEW WINDOWS BEHIND THE OLD ONES

PROJECT: "THERMAL COMFORT IN A HISTORIC BUILDING IN FRANEKER"		
FINAL PROJECT 2013/2014	JESÚS PIZÁ MARTÍN	2-JUNE-2014
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	Nº PLANE: 17 / SCALE: 1:150 / FINAL DRAWINGS	Hanzehogeschool Groningen University of Applied Sciences

ANNEX 2 THERMAL CALCULATIONS

EXISTING BUILDING

For the thermal calculations we will follow the indications of the european normative

EN-ISO 6946 *"Components and elements for edification, thermal resistance and thermal transmition. Calculation method"*

We wil have to apply this formula to know the thermal resistance of all the layers together of the constructive elements:

$$R_T = R_{si} + R_1 + R_2 + \dots\dots R_n + R_{se}$$

Where:

Rsi*:* It is the interior superficial resistance of the air that will depends of the direction of the heat flows

Rse*:*It is the exterior superficial resistance of the air

R1,R2..: They are the thermal resistance of each layer (thickness (e)/conductivity rate of each material (λ))

Rsi and Rse will depend of the direction of the heat flow acoording with the table 1 of the point 5.2 of that european standard.

Table 1 (5.2) Conventional superficial resistances

Superficial resistance $m^2 \cdot K/W$	Direction of heat flow		
	Up	Horizontal	Falling
R_{si}	0,10	0,13	0,17
R_{se}	0,04	0,04	0,04

For the thermal resistance of the windows, we will have to calcul the thermal transmittance (U value) using this formula:

$$U = \frac{1}{R_T}$$

Where:

Rt: Total thermal resistence of the constructive element.

The calcualtion of "Rt" will be the same than in a wall for example but after that we wil have to divide the result by 1.

A.2.1 THERMAL RESISTANCES OF THE CONSTRUCTIVE COMPONENTS OF THE EXISTING BUILDING

To do the calculation from the energy consumption of the building with the program "Enorm v1.1" we have to introduce the thermal resistance of the constructive components of the building.

To simplify the calculations of some specific constructive components that have different values (for example the facade walls have different components depending on the type of wall as we can see at the Plane 7 from the Annex 1) we have chosen the most common in the building for all of them.

Moreover, we could not got the exactly information about all the thickness of the materials. We have introduced approximated values to know an estimation about them like is the case of the wooden slats of the floors.

ORIGINAL WINDOW (Glassing without extra glass layer)

With the measurements that we did of the window. The thickness of the glass would be around 5mm.

Element: Old window	Thermal resistance	Thickness	Conductivity	Thermal Resistance	Thermal transmision rate
	Rsi y Rse (m2·K)/W	e (m)	λ W/(m·K)	e/λ m2K/W	U W/(m2·K)
Exterior	0,04				5,6762
Old glass		0,005	0,81	0,006	
Interior	0,13				
TOTAL		**0,005m**		**0,1762**	

WALL FACADE (SIDE FACADE)

Element: Right Facade Wall	Thermal resistance	Thickness	Conductivity	Thermal Resistance
	Rsi y Rse (m2·K)/W	e (m)	λ W/(m·K)	e/λ m2K/W
Exterior	0,0400			
Brick wall		0,21	0,658	0,3191
Plaster layer		0,015	1,047	0,0143
Air chamber		0,05	0,26	0,1923
Insulation		0,0065	0,005	1,3000
Air chamber		0,05	0,26	0,1923
Plasterboard		0,0125	0,81	0,0154
Interior	0,1300			
TOTAL		**0,43cm**		**2,0335**

The thicknesses of all the materials of the new layers build on the stone wall in the restoration in 1985 were apported by the architect of the restoration.

ATTIC (ATTIC ROOF+ ATTIC FLOOR)

Element Attic roof + attic floor	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal Resistance e/l m2K/W
Exterior	0,1700			
Roof tiles		0,0200	0,7600	0,026
Air chamber		0,0200	0,2600	0,077
Wooden layer		0,0200	0,1300	0,154
Air chamber (attic)		0,1000	0,2600	0,385
Wooden Floor		0,0200	0,1300	0,154
Insulation		0,0600	0,0360	1,667
Ceiling		0,0150	0,8100	0,019
Interior	0,1700			
TOTAL		**-**		**2,8207**

The value from the attic is the same being that there is not any modification of that part.

GROUND FLOOR

The first calculatio is of the ground floor finished with wooden slats, and the second one is the ground floor finished with concrete tiles.

Element GROUND FLOOR	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal transmision rate U W/(m2·K)
Exterior	0,0400			
PVC lamina		0,0020	0,1980	0,0101
Insulation STYRODUR		0,0500	0,0340	1,4706
Concret layer		0,1000	1,4000	0,0714
Plastic		0,0020	0,1980	0,0101
Old wooden floor		0,0100	0,1300	0,0769
New wooden floor		0,0100	0,1300	0,0769
Interior	0,1700	**17,4cm**		**1,9261**

The materials of this detail have been extracted by the documents of the restoration and by the owner in an interview).

Thicknesses unknown and approximate:

- Old wooden slat floor
- New wooden slat floor

Element Ground floor finished with concrete tiles	Thermal resistance	Thickness	Conductivity	Thermal transmision rate
	Rsi y Rse (m2·K)/W	e (m)	λ W/(m·K)	U W/(m2·K)
Exterior	0,0400			
PVC lamina		0,0020	0,1980	0,0101
Insulation STYRODUR		0,0500	0,0340	1,4706
Concret layer		0,1000	1,4000	0,0714
Plastic		0,0020	0,1980	0,0101
Cement morter		0,0400	1,4000	0,0286
Floor concrete tiles		0,0400	1,4000	0,0286
Interior	0,1300			
TOTAL		**17.4cm**		**1,7894**

The materials of this detail have been extracted by the documents of the restoration and by the owner in an interview).

Thicknesses unknown and approximate:

- Cement morter
- Floor concrete tiles

NEW BUILDING

A.2.2 THERMAL RESISTANCES OF THE CONSTRUCTIVE COMPONENTS OF THE NEW BUILDING

NEW GLASSING IN THE EXISTING WINDOW + EXTRA WINDOW

The new window will have 3 layers:

1- Old window
2- Air chamber, empty space between the 2 windows
3- New window with double glazing (4-6-4) with an U value (thermal transmission) of 3.3W/m2K that is the same as 0.303 m2K/W

(All the new materials have underlined with blue color)

Total U value of all the components will be:

The total U value will be the sum of the 3 thermal resistances and the superficial thermal resistances exterior and interior

Air chamber

According with the EN-ISO 6946 in the table 2 from the point 5.3.2. the thermal resitances of the air chambers (empty spaces) will be:

Thickness	**Thermal resistance** m2K/W Direction of heat flow		
mm	Up	Horizontal	Falling
0	0,00	0,00	0,00
5	0,11	0,11	0,11
7	0,13	0,13	0,13
10	0,15	0,15	0,15
15	0,16	0,17	0,17
25	0,16	0,18	0,19
50	0,16	0,18	0,21
100	0,16	0,18	0,22
300	0,16	0,18	0,23

Then, if the space between the 2 windows in the building will be of 210mm and the thermal resistance to 100mm and 300mm is the same, the thermal resistance of that part will be too of 0.18m2k/W.

The final thermal resistance and the U value of the window will be then:

Element: Old window + New window	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal Resistance e/l m2K/W	Thermal transmision rate U W/(m2·K)
Exterior	0,04				1,6151
Old glass		0,0050	0,81	0,006	
Air chamber		0,21		0,180	
New window double glazing		0,014		0,303	
Interior	0,13				
TOTAL		**0,229m**		**0,6192**	

ROOF

Element Attic roof + attic floor	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal Resistance e/l m2K/W
Exterior	0,1700			
Roof tiles		0,0200	0,7600	0,026
Air chamber		0,0200	0,2600	0,077
Wooden layer		0,0200	0,1300	0,154
Air chamber (attic)		0,1000	0,2600	0,385
Wooden Floor		0,0200	0,1300	0,154
Insulation		0,0600	0,0360	1,667
Ceiling		0,0150	0,8100	0,019
Interior	0,1700			
TOTAL		**-**		**2,8207**

The air chamber is the space there is between the roof and the attic floor. We only have introduced 10 cm to know that the final thermal resistance arrrives until 2.5m2K/W according with the Dutch normative.

NEW GROUND FLOOR

We can see the distribution of the rooms that will have this kind of floor in the plane 8 of the Annex 1)

ROOMS WITH WOODEN FLOOR

Element GROUND FLOOR	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal transmision rate U W/(m2·K)
Exterior	0,0400			
PVC lamina		0,0020	0,1980	0,0101
Insulation STYRODUR		0,0500	0,0340	1,4706
Concret layer		0,1000	1,4000	0,0714
Plastic		0,0020	0,1980	0,0101
Insulation Alkreflex		0,0650	0,0500	1,3000
Old wooden floor		0,0100	0,1300	0,0769
New wooden floor		0,0100	0,1300	0,0769
Interior	0,1700	**17.4cm**		**3,2261**

ROOMS WITH TILING CONCRETE

Element Ground floor finished with concrete tiles	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal transmision rate U W/(m2·K)
Exterior	0,0400			
PVC lamina		0,0020	0,1980	0,0101
Insulation STYRODUR		0,0500	0,0340	1,4706
Concret layer		0,1000	1,4000	0,0714
Plastic		0,0020	0,1980	0,0101
Cement morter		0,0400	1,4000	0,0286
Floor concrete tiles		0,0400	1,4000	0,0286
Cork floor		0,1100		0,1030
Interior	0,1300			
TOTAL		**19,0000**		**1,8924**

NEW WALL FACADE

Element: NEW WALL	Thermal resistance Rsi y Rse (m2·K)/W	Thickness e (m)	Conductivity λ W/(m·K)	Thermal Resistance e/λ m2K/W
Exterior	0,0400			
Stone wall		0,21	0,658	0,32
Plaster layer		0,015	1,047	0,01
Air chamber		0,05	0,26	0,19
Insulation		0,0065	0,005	1,30
Air chamber		0,05	0,26	0,19
Insulation		0,0065	0,005	1,30
Plasterboard		0,0125	0,26	0,05
Interior	0,1300			
TOTAL		**0,35cm**		**3,5362**

ANNEX 3 MATERIALS SPECIFICTIONS

NEW INSULATION TO INSTALL IN THE FACADE WALLS

WARMTE ISOLATIE • WARMTE ISOLATIE • Rc-WAARDE 1,3 m² K/W

ALKREFLEX®

ONGECOAT — CLASSIC 2L-2

Alkreflex® Classic 2L-2 Ongecoat is een dampdicht isolatiemateriaal, dat bestaat uit een dubbele luchtkussen-folie, aan beide zijden voorzien van pure aluminium. Alkreflex® Classic 2L-2 Ongecoat kenmerkt zich door de unieke wijze waarop de verschillende lagen gelamineerd zijn, namelijk door extrusie met gebruikmaking van hoge temperaturen. Dit komt de hechting van de lagen ten goede, en maakt het mogelijk met een relatief dunne laag aluminium een duurzaam kwaliteitsproduct te leveren.

Toepassing
- In daken
- Onder vloeren
- In voorzetwanden
- Het isoleren van profielplaten
- Het isoleren van installatiekanalen
- En vele andere creatieve oplossingen

Alkreflex® Classic 2L-2 Ongecoat wordt toegepast in situaties waar weersinvloeden geen grip hebben op het materiaal. Daar waar risico tot corrosie bestaat adviseren wij Alkreflex® Classic 2L-2 Gecoat toe te passen. Alkreflex® Classic 2L-2 Ongecoat is door zijn uitstekende dampdichte eigenschappen ook zeer geschikt als dampdicht isolerende folie voor ruimtes met klimaatklasse 4 zoals badkamers, keukens, sauna's, zwembaden, sportfaciliteiten en wasserijen.

VOORDELEN

- ✔ Extreem dampdicht
- ✔ Hoge reflectie
- ✔ Houd de warmte 's winters binnen
- ✔ Reflecteert in de zomer minimaal 90% van de warmte naar buiten
- ✔ Stelt de noodzaak van airco ter discussie
- ✔ Eenvoudig te verwerken

Verwerking
Alkreflex® Classic 2L-2 Ongecoat dient altijd in combinatie met twee luchtlagen (spouw) van minimaal 20 mm toegepast te worden om de isolerende eigenschap te benutten. Als dakisolatie adviseren wij u Alkreflex® Classic 2L-2 Ongecoat alleen aan de binnenzijde toe te passen, waarbij aansluitingen en naden getapet dienen te worden met Folietape Aluminium.
Bij voorzetwanden Alkreflex® Classic 2L-2 Ongecoat alleen toepassen bij bestaand metselwerk. Vers metselwerk kan de aluminium toplaag aantasten.

meuwissen
Meuwissen Bouwprodukten B.V.
www.meuwissen.nl • info@meuwissen.nl

WARMTE ISOLATIE • WARMTE ISOLATIE • R-WAARDE 1,3 m² K/W

ALKREFLEX®

CLASSIC 2L-2

ONGECOAT

PRODUCTSPECIFICATIES

Materiaaldikte	ca. 6,5 mm
Rolbreedte	1.20 m breed is 5533012001
	1.50 m breed is 5533015001
Rollengte	25 meter
Roldiameter	ca. 45 cm
Gewicht	ca. 340 gram per m2
Verpakking	120 cm 16 rol per pallet
	150 cm 8 rol per pallet
Kleur	aluminium
Grondstof	coating / alu / dubbele luchtkussenfolie / alu
Brandklasse	F
Temperatuur	-20 / +80 °C
UV-bestendig	2 maanden
R-waarde	1,3 m² K/W, i.c.m 20 mm luchtspouw

TOEBEHOREN

Meuwissen Folietape Aluminium	Afmeting 25m x 75mm (per 12 rollen)
	Art: 81075025O2

meuwissen

Meuwissen Bouwprodukten B.V.
www.meuwissen.nl • info@meuwissen.nl

NEW GLASSING FOR THE WINDOWS “CLIMALIT”

SGG CLIMALIT double glazing reduced heat loss through a window by up to 50% compared to ordinary single glazing (U-valu approximately 2.9 W/m2K compared to 5.7 W/m2K).

Double-glazing						
External pane		SGG PLANILUX				
Internal pane		SGG PLANILUX				
Composition	mm	4 (6) 4	4 (12) 4	4 (16) 4	6 (12) 6	6(12) 6
Thickness	mm	14	20	24	24	28
Weight	kg/m²	20	20	20	30	30
Light factors						
LT	%	81	81	81	79	79
LRe	%	15	15	15	14	14
LRi	%	15	15	15	14	14
UV	%	44	44	44	38	38
Energy factor						
T	%	70	70	70	64	64
Re	%	13	13	13	12	12
A1	%	10	10	10	15	15
A2	%	7	7	7	10	10
Solar factor g		0,75	0,76	0,76	0,72	0,72
Shading Coefficient SC		0,87	0,87	0,87	0,83	0,83
U-value	W/(m².K)					
Air		3,3	2,8	2,7	2,8	2,7
Sound reduction indices						
Rw	dB	31	30	30	33	34
C	dB	-1	0	0	-1	-2
Ctr	dB	-3	-3	-3	-3	-5
RA	dB	30	30	30	32	32
RA,tr	dB	28	27	27	30	29

.

NEW HEATING UNIT TO INSTALL IN THE ATTIC

Ideal Evomax Evomax 40 condensing boiler 40 kW
Product Code: 104631

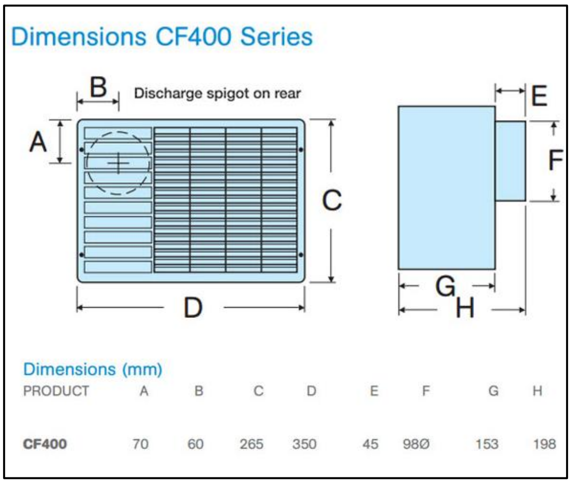
ideal

Specifications

Brand:	Ideal
Colour:	White
Dim 1 (mm):	850
Dim 2 (mm):	500
Dim 3 (mm):	350
Flow Rate:	-
Fuel Type:	Natural Gas
KW:	40
Litre:	3
Max High Level Flue Length (metres):	-
Max Low Level Flue Length (metres):	-
Max System Pressure Cold (Bar):	-
Max Vertical Level Flue Length (metres):	42mtr
Min System Pressure Cold (Bar):	-
Model Number:	Evomax 40
Preset Pressure Relief Valve (Bar):	-
Range:	Evomax
Warranty:	2 Year
Efficiency Rating:	96.2
Maximum working temperature (C):	80C
Sedbuk Rating:	A
Type:	Wall Mounted Boiler
Weight (KG/gram):	49

NEW FANS TO INSTALL IN THE HUMOD ROOMS

Manrose CF400P 100mm White Centrifugal Fan 230m3/hr 64 l/s with Pull Cord Switch



The Manrose CF400P centrifugal fans use the latest technology to provide extremely powerful, yet very quiet and vibration free ventilation. This model comes with a humidity control and an integral adjustable timer.

- Designed to move air over long distances, these units will give maximum performance even against pressures caused by long lengths of ducting and resistance by grilles.
- All models are fitted with a built-in spring operated non-return flap into the discharge spigot to stop backdraughts.
- Extract rate: 230m3/hr, 64 litres per second.
- The units are all manufactured using high impact ABS thermoplastics for strength and durability, aesthetics and easy cleaning.
- Power to the Manrose CF400 range is provided by a single phase induction motor with pre-oiled bearings for a long, maintenance-free life
- Dynamically balanced, the CF400 unit is fitted with external rotor motors which incorporate ball bearings for a maintenance free life of over 40,000 hours.
- These fans are also supplied with a 11mm thick washable fibre filter.
- Designed to comply with the Building Regulations on Ventilation (F1).
- Designed to be mounted on walls or ceilings and discharged through a 100mm (4") standard rigid or flexible duct, and are also suitable for use with flat duct channel systems.
- Comprehensive wiring and installation instructions are included with each fan

Description | Specification | Reviews | Questions

Technical Features	
Airflow	230m3/hr, 64 l/s
Colour	white
Construction	ABS thermoplastic
Ducting	100mm
IP Rating	IP44
Max. Operating Temperature	89 deg C
Power	60W
Sound Output	58.0 dB(A)
Voltage	240V

CORK FLOORING

CE	Leistungserklärung Declaration of performances Déclaration des performances

N° 102-CPR-13

HARO Corkett			EN 14041
Bodenbelag für den trockenen Innenbereich Floor covering for internal use under dry conditions Revêtement de sol pour les intérieurs secs			
Hamberger Flooring GmbH & Co.KG, Postfach 100353, 83003 Rosenheim			
Bewertung und Überprüfung der Leistungsbeständigkeit nach System: System of assessment and verification of constancy of performance: Système d'évaluation et de vérification de la constance des performances :			3*)
Leistungseigenschaften / Declared performances / Performances déclarées			
Dicke Thickness Épaisseur	10,5 mm	11 mm	EN 14041
Flächengewicht Mass per unit area Masse surfacique	7,52 kg/m²	8,22 kg/m²	
Brandverhalten*) Reaction to fire*) Réaction au feu*)	E_{fl} - s1		
Formaldehyd-Klasse*) Emission of formaldehyde*) Catégorie de formaldéhydes*)	E1		
Antistatisches Verhalten Antistatic behaviour Comportement antistatique	< 2kV		
Wärmedurchlasswiderstand Thermal conductivity Résistance thermique surfacique	0,095 m²K/W	0,103 m²K/W0	
Gleitwiderstand Slip resistance Résistance au glissement	NPD		

Die Leistung des Produkts gemäß (1) entspricht den erklärten Leistungseigenschaften nach (5). Verantwortlich für die Erstellung der Leistungserklärung ist allein der Hersteller nach (3).

The performance of the product identified in (1) is in conformity with the declared performance in (5). This declaration of performance is issued under the sole responsibility of the manufacturer (3).

Le produit (1) est conforme aux performances déclarées au point (5). La déclaration des performances est élaborée sous l'entière responsabilité du fabricant (3).

ANNEX 4 DOCUMENTS OF THE RESTORATION IN 1985

GENERAL INFORMATION ABOUT THE COMPLETE RESSTORATION

Stichting tot behoud van het
Franeker Stadsschoon

Opgericht A° 1971

B E S T E K   E N   V O O R W A A R D E N.

Voor de restauratie van het voormalig politiebureau
EISE EISINGASTRAAT 10 te FRANEKER
tot een woning.

architektenburo
n. j. adema

,,poolshof'', froonacker 14, 8801 KD franeker
tel. 05170-6332

BESTEK EN VOORWAARDEN

WAARNAAR DOOR DE "STICHTING TOT BEHOUD
VAN HET FRANEKER STADSSCHOON" TE FRANEKER
ZAL WORDEN AANBESTEED:
De restauratie van het voormalig politiebureau
EISE EISINGASTRAAT 10 te Franeker
tot een woning,

Kadastraal bekend: Gem.: Franeker
Sectie: A, Nr.: 3321.

OPDRACHTGEEFSTER : De "STICHTING TOT BEHOUD VAN HET FRANEKER STADSSCHOON"
Secr. de Weledele Heer F.H. Jellema
Noorderbolwerk 18, 8801 KL Franeker.

ARCHITECT en DIRECTIE : Architectenburo N.J. Adema
"POOLSHOF" Froonacker 14, 8801 KD Franeker.
Tel. 05170-6332

INLICHTINGEN : Dagelijks ten kantore van de architect.

Bij dit bestek behorende tekeningen:

Blad 1,	Werkno. 8415,	dd. mei '84,	opmeting	1 : 100
Blad 2,	Werkno. 8415.	dd. juni'84,	plan	1 : 100

INHOUDSOPGAVE

EERSTE AFDELING.

Administratieve bepalingen.

Par. 1. Van toepassing zijnde bepalingen.

Voor zover in dit bestek niet anders is bepaald zijn op dit werk van toepassing, als waren zij letterlijk in dit bestek opgenomen, de hierna genoemde voorschriften, zoals deze op de dag van aanbesteding luiden:

1-1. De Algemene Bepalingen voor de uitvoering van Bouwwerken 1986 (A.B.B.1968), waarin zijn opgenomen de A.V.W. 1968 en de U.A.V. 1968, vastgesteld bij beschikking van de Minister van Volkshuisvesting en Ruimtelijke Ordening dd. 10 februari 1969.

1-2. Voorschriften Beton (V.B. 1974).

1-3. De Bouwverordening met aanvullende voorschriften van de Gemeente Franekeradeel.

1-4. De bepalingen van de nutsbedrijven in de Gemeente Franekeradeel.

1-5. De Model Bouwverordening.

1-6. Kwaliteitseisen voor hout 1980 (KVH'80) met bijbehorend NEN 5461-NEN 5466 en NEN 5467.

1-7. Kwaliteit van timmerwerk, voorschriften voor de fabricage (K.V.T. 1970).

1-8. Basis Verfbestek 1980 Nieuwbouw (BVN 1980).
Basis Verfbestek 1980 Onderhoud (BVO 1980).

Par. 2. Niet van toepassing zijnde bepalingen.

2-1. De Risico-regeling is niet van toepassing. Risicoverrekening van materialen en lonen zal derhalve niet plaats vinden.

Par. 3. Wijzigingen en aanvullingen.

Met betrekking tot de hierna genoemde paragraven en zinsneden van de U.A.V. met de daarin van toepassing verklaarde voorschriften, gelden voor dit werk onderstaande wijzigingen en aanvullingen:

3-1. par.5. Verplichtingen van de opdrachtgever.
Lid 1. sub. a.: Vervallen.
Hiervoor in de plaats toevoegen:
"Alle voor de uitvoering van het werk benodigde vergunningen van de overheid, met uitzondering van de zogenaamde Bouwvergunning, moeten door de aannemer tijdig worden aangevraagd. Alle op het aanvragen en verlenen van deze vergunningen vallende kosten zijn voor rekening van de aannemer".

3-2. par.6. Toevoegen punt 30:
Eerste hulp moet kunnen worden verleend.
Een volgens de voorschriften gevulde verbandkist moet op het werk aanwezig zijn.

3-3. par.7. De datum van aanvang wordt de aannemer schriftelijk medegedeeld.

3-4. par.8. Uitvoeringsduur, uitstel van oplevering.
lid 1. Onverminderd het bepaalde in deze paragraaf moet het werk na 100 werkbare werkdagen na de datum van aanvang in zijn geheel voor de eerste oplevering gereed zijn.

3-5. par.10. Oplevering.
Toevoegen lid 4: De gebouwen moeten voor de eerste oplevering grondig in- en uitwendig worden schoongemaakt, incl. het verwijderen van verf en specieresten van sanitair glas- en tegelwerk.

Het bouw en werkterrein moeten schoon en leeg worden opgeleverd, ontdaan van alle puin en rommel, bouw en hulpmateriaal

3-6. par.11. Onderhoudstermijn.
Met inachtneming van het bepaalde in deze paragraaf geldt de onderhoudstermijn van driemaanden na de eerste oplevering en goedkeuring van het werk.

3-7. par.16. Lid 3, toevoegen: De vorm en wijze waarop de reclame wordt aangebracht geheel in overleg met en goedgekeurd door de directie.

3-8. par.22. Garantie voor een onderdeel.
Lid 1. Toevoegen: Alle bijkomende kosten als het aan- en afvoer van noodzakelijk materiaal en materieel, eventueel schilderwerk alsmede alle bijkomende herstelwerkzaamheden, welke voortvloeien uit het te vervangen of te herstellen onderdeel, zijn voor rekening van de garant.

3-9. par.27. Dagboeken,lijsten en rapporten.
Lid 1 vervalt, hiervoor te lezen:
Door de aannemer worden weekrapporten in viervoud opgemaakt, volgens voorschrift van de Rijksdienst voor de Monumentenzorg en tergoedkeuring aan de directie opgestuurd.
Op de weekrapporten dient minimaal nauwkeurig vermeld te worden:
a. De aangevoerde, goedgekeurde en verwerkte bouwstoffen
b. Het aantal verwerkte manuren
c. De verrichtte werkzaamheden
d, De stand van het werk
e. De onwerkbare uren
f. De resterende werkdagen tot de eerste oplevering
g. Het meer en minderwerk
h. De verwerkte verreken- en stelposten.
De weekrapporten minimaal eens per twee weken in te sturen.
Na goedkeuring wordt één exemplaar door de directie ondertekend geretourneerd.

3-10. par.32. Gevonden voorwerpen.
Lid 2. Vervallen de zin: "De vinder wordt evenwel een billijke schadevergoeding verleend."
Toevoegen: "De vinder kan evenwel een billijke schadevergoeding worden verleend."

3-11. par.35. Verrekening van meer en minderwerk.
Meerwerk wordt niet erkend zonder uitdrukkelijke opdracht van de architect.
Eventuele wijzigingen of verrekeningen moeten direct op de weekstaten worden vermeld.
De afrekening van meer en minderwerk geschiedt bij de betaling na eerste oplevering.

3-12. par.37. Stelposten.
Lid 3,Sub a en b, hiervoor te lezen:
De in dit bestek omschreven stelposten zijn inclusief 10% aannemersprovi sie, de b.t.w. over de aangegeven bedragen dienen afzonderlijk in de begroting te worden opgenomen.
Bij de verrekening, na de eerste oplevering, wordt het meer en minder, met inachtname van de 10% aannemers-provisie en de geldende b.t.w. verrekend.

3-13. par.40. Betalingen.
De betaling zal geschieden in zeven termijnen volgens onderstaand schema:

Betaling percentage van de aanneemsom:	Als volgens goedkeuring der directie, in overeenstemming met de ingediende weekstaten is verwerkt:
20 %	25 %
15 %	40 %
15 %	55 %
15 %	70 %
15 %	85 %
15 %	Goedkeuring na eerste oplevering
5 %	Goedkeuring na tweede oplevering.

Als de aannemer recht heeft op een termijn dient hij hiervoor een declaratie in, in drievoud, bij de architect.

3-14. par.42. Kortingen.
Lid 2. De korting bedraagt *f*. 150,-- per dag.

3-15. par.44. Schade aan het werk.
Lid 8. Toevoegen: De aannemer is verplicht om alle mogelijke maatregelen te nemen opdat schade en hinder door bouwwerkzaamheden zoveel mogelijk wordt voorkomen.

3-16. par.50[a]. Verzekeringen.
Lid 2. Toevoegen: De verzekering dient mede de schade door brand en/of diefstal te dekken.
Lid 4. De bepalingen in dit lid geldt voor de omschreven tijdsduur na de eerste oplevering.
Algemeen: Voor glasschade is alleen de hoofdaannemer verantwoordelijk.

TWEEDE AFDELING.

Voorschriften omtrent de uitvoering.

Par. 4. Wijzigingen en aanvullingen van de tweede afdeling der A.B.

4-1. Indien niet uitdrukkelijk anders is bepaald, behoort bij elk in dit bestek genoemde levering ook het compleet aanbrengen, stellen en afwerken met alles wat daarbij in de ruimste zin behoort,
bij elk in dit bestek genoemd aanbrengen, maken of stellen, ook het ook het compleet leveren van hetgeen moet worden aangebracht of gesteld.
Door derden wordt niets geleverd tenzij zulks in dit bestek nadrukkelijk is vermeld.

4-2. Alle puin, rommel en afval, ook die welke door derden mocht ontstaan, tijdens de bouw geregeld op te ruimen en af te voeren en het werk periodiek bezemschoon te maken, een en ander zodanig dat het werk er steeds behoorlijk bij ligt en een onbelemmerde doorgang door alle ruimten mogelijk is.

DERDE AFDELING.

Voorschriften omtrent bouwstoffen.

Par. 5.

5-1. Tenzij in dit bestek anders is genoemd, zullen alle te gebruiken materialen van de eerste soort zijn, op keur van de directie,te leveren volgens vooraf in te dienen monsters en moeten voldoen aan de eisen daaraan gesteld in de desbetreffende normaalbladen.

5-2. De in dit bestek met een merk of firmanaam aangeduide materialen mogen van een ander fabricaat zijn, indien ze, ter beoordeling der directie, gelijkwaardig zijn en aan dezelfde eisen voldoen.
Overleg hieromtrent tussen de aannemer en de directie dient voor de aanvoer van het materiaal te geschieden.

VIERDE AFDELING.

Beschrijving van het werk.

Par. 6. Algemene omschrijving.

6-1. Het werk bestaat uit het restaureren van het pand plaatselijk bekend Eise Eisingastraat 10 te Franeker kadastraal bekend Gem. Franeker, Sectie A, nr. 3321.
De nodige sloop en stutwerkzaamheden te verrichten.
Alles volgens dit bestek met bijbehorende tekeningen en later te verstrekken detailtekeningen en aanwijzingen, het daarbij leveren van alle benodigde materialen, arbeidslonen, hulpmiddelen, het verrichten van transporten enz.

Par. 7. Volgorde bij de uitvoering.

7-1. De werkwijze en de volgorde van uitvoering wordt bij voorkeur aan de aannemer overgelaten, echter in overleg met de directie.

7-2. Als de directie het nodig oordeelt moet de aannemer binnen 10 dagen een werkplan opstellen.

Par. 8. Werken buiten het bestek, uit te voeren door derden.

8-1.Door derden zullen in het werk worden aangebracht:
a. De centrale verwarmingsinstallaties
b. De electrische installaties en antenneleidingen
c. De gasleidingen
d. De telefoonaansluitingen
e. Het sanitair, de koud en warmwaterleidingen
f. Het zinkwerk en mastiekwerk
g. Het glas en schilderwerk.

8-2.De hierboven genoemde werken zullen zonodig plaatsvinden in overleg met en volgens hetwerkschema van de aannemer.

8-3.De aannemer dient voor de onder punt 8-1 genoemde installaties beschikbaar te stellen het nodige steigerwerk, de electriciteit eventueel water enz.

N. 8-4.De bouwkundige werkzaamheden t.b.v. de in punt 8-1 genoemde werken dienen door de aannemer te worden verricht. Hieronder wordt mede verstaan het hakken en sparen van gaten en sleuven en het instorten van mantelbuizen etc., terwijl ook het dichten van sparingen voor rekening van de hoofdaannemer komt.

8-5.De aansluit en verbruikskosten van de onder punt 8-1 genoemde aansluitingen welke van tijdelijke aard zijn, zijn voor rekening van de hoofdaannemer.

Par. 9. Tijdelijke voorzieningen.

9-1.De aannemer zorgt voor een bouwaansluiting voor water en electriciteit, welke ook door de onderaannemers en derden gebruikt mogen worden, zonder recht op vergoeding.

9-2.Tevens draagt de aannemer zorg voor voldoende containers voor de afvoer van puin en ander afval, de containers dienen tevens door de onderaannemers en derden gebruikt te mogen worden, zonder recht op vergoeding.

9-3.Voor het nat maken van de steen, het aanmaken van mortel en specie enz. het water uitsluitend te betrekken van het Waterleidingbedrijf Friesland.

9-4. De aannemer zal de directie gedurende het werk de instrumenten ter beschikking stellen voor landmeten en waterpassen.

9-5. Ten behoeve van alle werknemers, ook die van onderaannemers en derden, dient de aannemer een schaftkeet te plaatsen met toilet enz.
Een en ander moet voldoen aan de 'Richtlijnen Hygiënische Voorzieningen op de Bouwplaats'.

9-6. Voor de directie hoeft geen aparte keet neergezet te worden, doch wel wordt verlangd, dat in de keet voor de werknemers een uitlegtafel aanwezig is voor tekeningen, en ruimte voor besprekingen met uitvoerder en onderaannemers.

9-7. Voor de opslag van cement-kalk-kozijnen enz. dient een doelmatige loods aanwezig te zijn.
De aannemer zal zonodig ook opslagruimte beschikbaar moeten stellen voor onderaannemers en derden.

9-8. In afwijking van punt 9-5 en 9-6 hetvolgende:
In overleg met de directie mag eventueel in het gebouw geschaft worden tot het moment dat de schilder in die ruimte met zijn werkzaamheden begint.
Tijdens en na het schilderen mag er in de desbetreffende ruimtes niet meer geschaft worden.

9-9. Het droogstoken van het gebouw t.b.v. het binnenschilderwerk is voor rekening van de hoofdaannemer.
Alvorens met het schilderwerk aan te vangen dient de hoofdaannemer de vertrekken te ontruimen en schoon te maken en tijdens de uitvoering zindelijk te houden.

9-10. Het eventueel verwarmen van het gebouw tijdens vorstperiodes in verband met doorwerken is voor rekening van de aannemer.

Par.-10. Peilen-Maatvoering en Afmetingen.

10-1. Als Peil wordt aangehouden de bovenkant van de afgewerkte vloer in de woonkamer.

10-2. Alle in dit bestek en op de tekeningen aangegeven maten zijn, indien niet anders vermeld, in centimeters.

10-3. De in dit bestek en op tekeningen aangegeven houtmaten zijn bedoeld als blijvende maten.

10-4. De aannemer dient zich ter plaatse zeer deugdelijk te oriënteren, daar soms verwezen moet worden naar 'als bestaand' en 'volgens tekening'.

10-5. Geringe afwijkingen van de in dit bestek genoemde en op tekening aangegeven maten geven geen aanleiding tot verrekeningen.

Par.11. Sloop en stutwerk.

11-1. Eventueel historische of schijnbaar historische vondsten moeten onmiddelijk aan de directie worden gemeld, maar blijven eigendom van de opdrachtgeefster.

11-2. Authentieke constructies en profileringen zoveel mogelijk sparen en waar nodig restaureren indien in dit bestek niet anders staat omschreven en t.b.v. de verbouw geen wijzigingen staan vermeld.

11-3. Alvorens een en ander gesloopt wordt dient de aannemer voorzieningen te treffen aan de onderdelen van het gebouw en aangrenzende percelen dat geen schade van welke aard ook wordt toegebracht.

11-4. De eventueel aangebrachte schaden aan het bestaand blijvende gebouw of aan eigendommen van de belendingen moeten op eerste aanzegging van de directie voor rekening van de aannemer worden hersteld.

11-5. De sloopwerken zodanig door vakkundige arbeiders uit te voeren, dat zonder gevaar kan worden gewerkt.

11-6. Alle noodzakelijke stut-schoor en stempelwerken moeten worden uitgevoerd in overleg met de directie en het plaatselijk bouwtoezicht.
De zwaarten-afmetingen-aantallen en bevestigingen van de stutten-schoren en stempels behoeven de goedkeuring van de directie.

11-7. De dakpannen op alle dakvlakken verwijderen, te ontdoen van kalkmortelresten en opslaan om opnieuw gebruikt te kunnen worden.

11-8. Schoorstenen en schoorsteenkanalaen; de ondeugdelijke gedeeltes slopen en beroette steen direct afvoeren.

W. 11-9. Rest sloopwerk dak, ook berging, excl. de te handhaven spanten juffers en muurplaten.

W. 11-10. Slopen vloer zolderverdieping, ook berging, en eerste verdieping lage gedeelte,(= achterste 15,5 m.)

W. 11-11. Slopen houten tussenwanden eerste verdieping.

11-12. Slopen beganegrond kastenwand tussen kamer inspecteur en wachtlokaal.

11-13. Slopen cellen en cellengang met kasten, wastafel uit cellengang voorzichtig verwijderen voor hergebruik in kamer (15).

W. 11-14. Slopen alle te verwijderen binnenwerk uit bestaand blijvende berging, incl. kluis en kluisdeur.

11-15. Sloopwerk buiten: afdakje-fietsenberging-berging doorgang naar tuin, incl. funderingen.

W. 11-16. Slopen topgevel van berging.

W. 11-17. Slopen houten en betonnen vloeren gehele begane grond.

11-18. Voorzichtig opnemen en opslaan de hardstenen tegels uit entree- gang en bijkeuken, schoonmaken voor hergebruik.

11-19. Slopen de te verwijderen kozijnen en de muurgedeeltes voor de nieuw te plaatsen kozijnen.

11-20. Van het binnenwerk alle plafonds en niet te gebruiken betimmeringen verwijderen.

11-21. Verder alleste slopen wat komt te vervallen of wat het maken en aanbrengen van het nieuwe werk in de weg staat, met inbegrip van funderingen-bodemafsluitingen-putten-kelders-rioleringen-leidingen enz.

11-22. Alle sloopwerk in overleg met de directie.

11-23. De te slopen onderdelen blijken uit de vergelijking der tekeningen van de bestaande en de te maken toestand.

11-24. Bij zijgevel achteraanbouw de vlierbomen, incl. wortels verwijderen.

Par. 12. Grondwerk.

A. Algemeen.

12-1. De aannemer wordt geacht het bouwterrein te kennen; hij aanvaardt het in de toestand waarin dit terrein zich bevindt op de dag der aanbesteding.

B. Ontgravingen.

12-2. Funderingsstroken en werkvloeren.

12-3. t.p.v. het straatwerk.

12-4. Putten en sleuven van de riolering; zodanig dat een gronddekking van minimaal 70 cm. wordt verkregen.

12-5. De eventueel nieuw aan te brengen mantelbuizen voor de nutsbedrijven.

12-6. Alle ontgravingen tot onderkant zandbed cq. werkvloer; onder fundering en riolering ongeroerde grond.

C. Aanvullingen met zand.

12-7. Een aangestampt zandbed, dik 10 cm., onder alle straatwerk en onder werkvloeren van de betonvloer.

D. Aanvullingen met grond.

12-8. Fundering en rioleringssleuven.

12-9. De ontgraven mantelbuizen.

12-10. De gaten ontstaan door de te slopen funderingen en op te ruimen bomen-struiken-wortels en belemmerende voorwerpen.

12-11. Het terrein rondom de berging verder te egaliseren.

Par. 13. Riolering en ventilatie.

13-1. De gehele riolering uit te voeren in p.v.c., wanddikte 3,2 mm., hittebestendig, volgens NEN 7045 en 7046, incl. de nodige hulpstukken,beugels,bochten,expantie en ontstoppingsstukken enz.
Alle onderdelen dienen voorzien te zijn van het KOMO Garantiemerk.
(Hemelwater afvoeren bij loodgieterswerk).

13-2. De gehele riolering dient een gronddekking te hebben van minimaal 70 cm.

13-3. De rioleringen aan te sluiten op het bestaande riool in de steeg, in overleg met de directie.

13-4. P.v.c. mantelbuizen volgens richtlijnen "Gecombineerde Meterkasten", uitgegeven door de gezamelijke Nutsbedrijven in de Provincie Friesland, dd. 15 nov.'80.
NB. De watermeter blijft in de bestaande put in de gang bij de achterdeur.

13-5. De aannemer is verplicht de rioleringssleuven open te houden totdat de riolering is goedgekeurd en hij van de directie opdracht heeft gekregen de sleuven te dichten.

13-6. Bestaande rioleringen welke niet meer gebruikt worden verwijderen, de aansluitingen dichten.

13-7. Alle binnenrioleringen tot 15 cm.+ vloer te brengen en tijdelijk te dichten ter voorkoming van vuil in de riolering.

13-8. Hemelwaterafvoeren opgraven, gehele riolering doorspuiten-controleren en zonodig herstellen.

N. 13-9. De binnenriolering,in gescheiden systeem,te brengen naar:

w.c. (10)	: toiletpot
	handwasbak
keuken (9)	: aanrechtbakken
	afvoer vaatwasser,afgedopt
	afvoer voor close-in boiler, afgedopt
kamer (15)	: handwasbak
wasmaschineruimte (14)	: afvoer wasmachine
	uitstortgootsteen
badkamer (18)	: toiletpot
	wastafel(s)
	badkuip
	douche
slaapkamer (20)	: wastafel
zolder (21)	: afvoer c.v.
berging (6)	: vloerputje

13-10. Voor ontluchting van de riolering een p.v.c. buis ø 40 mm., uitmonden onder de pannen.

13-11. De wasemafvoerleiding van de kookhoek, de ventilatiekanalen van de badkamer en de w.c.en de wasmachineruimte van spiralithbius, ø125 mm.met de nodige hulpstukken. Ook aluminium is toegestaan.

In het dakvlak de nodige dakdoorvoeren en buitendaks uit te voeren in dubbelwandig aluminium,zwart.

13-12. Ventilatie meterkast boven en onder volgens voorschrift.

13-13. Be-en ontluchting c.v. en geysers (zolder en bijkeuken) volgens voorschrift.

Par. 14. Straatwerk.

14-1. Bestrating te leggen in een afgereid zandbed dik minimaal 10 cm.

14-2. Bestrating goed aanaarden, invegen met strooizand onder toevoeging van water.

14-3. Herstellen het straatwerk in de steeg.

14-4. Straatwerk achter, tegels en gele straatklinkers provisorisch herstellen.

14-5. Bij nieuwe deur in achtergevel berging te rekenen op 2 m2 straatwerk betontegels met opsluitband.

Par. 15. Erfscheiding.

P. 15-1. Te rekenen op het aanbrengen en leveren van plm. 15 m1 erfscheiding met dubbele toegangsdeuren.

15-2. Erfscheiding te maken van azobe vlecht- of overlap schermen, 180 x 180 cm., bevestigd op azobe palen 8 x 8 cm., lang plm 300 cm., h.o.h. 90 cm.

W. 15-3. In de erfscheiding op te nemen twee stuks deuren, samen te stellen uit: merantie klampen en spiegelklampen, kleedhout merantie puntschroten, 16 mm. dik.

Par. 16. Betonwerk.

A. Algemeen.

16-1. De wapening in de betonwerken aan te brengen als aangegeven op de nader te verstrekken detail en constructietekeningen en/of aanwijzingen.

16-2. Voor met het knippen-buigen en vlechten van het betonstaal te beginnen, buigstaten te maken.
Buigstaten bij de directie in te leveren, zij zullen echter geen aanleiding geven tot enige verrekening van hoeveelheden.
De aannemer blijft verantwoordelijk voor de uitvoering.

16-3. Alle beton dat blijvend in aanraking komt met grondwater of buitenlucht, behalve werk en isolatievloeren, waterkerend op te leveren.

16-4. Alle cement moet zijn Portland Cement klasse A, voor delem die met grond of agressieve stoffen in aanraking komen moet Hoogoven Cement worden gebruikt.

16-5. Betonstaal in staven FeB 400- FeB 220- FeB 500.
Alle aan te brengen wapening als aangegeven door constructeur resp. fabricant.

16-6. Bekistingshout moet zijn schoon-glad-recht en van voldoende lengte.

16-7. Tenzij de directie anders bepaald bedraagt de zetmaat 80 mm.

16-8. Zonder uitdrukkelijke toestemming van de directie is het niet toegestaan hulpstoffen aan de beton toe te voegen.

16-9. Samenstelling beton en aangegeven betondekking nauwkeurig aan te houden.

B. Te maken betonwerken.

16-10. Onder alle in het werk te maken betonconstructies welke met de grond in aanraking komen, een werkvloer te storten, minimaal 5 cm. dik, kwaliteit B2 of B3.
In overleg mag p.v.c. folie gebruikt worden.

16-11. Funderingsstroken van de nieuwe binnenmuren volgens tekening constructeur en/of aanwijs.

W. 16-12. De betonvloer van de gehele begane grond storten op p.v.c. folie. Betonvloer dik 10 cm.,wapening net ∅ 8-15.

W. 16-13. Gehele beganegrondvloer, excl. berging (6) en kamer (15) isoleren met 5 cm. STYRODUR isolatieplaten.

W. 16-14. Betonvloer van spramex beton, dik 6 cm. over lEVIS platen in de badkamer en wasmachineruimte.

16-15. De nodige betonplaatjes voor schoorsteenmantels en rookkanalen.

C. Te verwerken betonwaren, niet op het werk vervaardigd.

16-16. De nodige verzamel/ontstoppingsstukken in de riolering (mag ook van p.v.c.).

16-17. De onder straatwerk omschreven betontegels met opsluitbanden (zie par. 15).

Par. 17. Metselwerk.

A. Kalkzandsteenklinker AF.

17-1. De nieuwe binnenwanden begane grond.

17-2. Alle kalkzandsteen verwerken volgens voorschrift Centraal Verkoopkantoor voor de Kalkzandsteen CVK.

B. Metselwerk oude steen.

17-3. Goede afkomende steen schoonbikken en gebruiken voor alle te herstellen buitenmetselwerk.

17-4. Beroette steen direct afvoeren.

17-5. Alle metselwerk in verband als bestaand.

17-6. Bij de dicht te zetten kozijnen, de op te kappen scheuren-en de te vernieuwen gevelgedeeltes het bestaande metselwerk uit te tanden, en in dezelfde laag en koppenmaat vol te metselen.
Het kleinste te gebruiken formaat is een halve steen.

17-7. Voor tekort komende stenen goede bijpassende steen bij te leveren. Deze stenen behoeven de goedkeuring van de directie.
Voor niet in 't zicht komende stenen en voor herstellingen aan het binnenmetselwerk mogen nieuwe,gebakken stenen gebruikt worden.

17-8. Te vernieuwen gedeeltes:
Voorgevel: Scheuren opkappen en herstellen
beschadigde stenen vervangen.
W. Zijgevel: scheuren opkappen en herstellen
dicht te zetten kozijnopeningen
plm. 11 m2 slecht metselwerk inboeten/vernieuwen.
Achtergevel: scheuren opkappen en herstellen
topje vernieuwen
plm 3 m2 slecht metselwerk inboeten/vernieuwen
Bijkeuken/Berging: scheuren opkappen en herstellen
plm. 4 m2 metselwerk herstellen
Metselwerk hoogteverschil achtergevel:
scheuren herstellen
P. Schoorstenen: Topschoorsteen voegwerk vernieuwen
schoorstenen op zijgevel: een stuks verwijderen
een schoorsteen herstellen, hierop twee kanalen aansluiten, t.w. schouw kamer (7) en schouw slaapkamer (17).

17-9. Bij nieuwe kozijnen boven en onder rollagen gelijk bestaand.

17-10. Metselwerk voor putten-opleggingen-aanmetselingen-rollagen-toevallig niet op tekening staande gedeeltes enz., welke wel tot een correcte oplevering van het werk behoren, geheel ten genoegen van de directie uit te voeren.

17-11. Schoonmaken buitenmetselwerk: Geheel stralen met water onder hoge druk, zonder toevoeging van zand-grit en/of cemicaliën.

W. 17-12. Voegwerk: Voorgevel geheel nieuw, rest van het metselwerk loszittend en slecht voegwerk verwijderen. Alle voegwerk gelijk bestaand, voegspecie en kleur worden nader opgegeven.

Par. 18. Timmerwerken.

A. Buitenkozijnen-Ramen en Deuren.

W. 18-1. Bestaande buitenkozijnen herstellen en repareren, zonodig vernieuwen, afmetingen- houtzwaartes en profileringen als bestaand.

W. 18-2. Nieuwe buitenkozijnen, houtzwaartes en profileringen als als bestaande kozijnen in dezelfde gevelvlakken.

W.P. 18-3. Alle ramen, ook in bestaande kozijnen, vernieuwen, profilering als bestaand. In raam boven voordeur de levensboom met hoekornamenten, schoongemaakt en geschoppeerd, wederom aanbrengen.

18-4. Alle bestaande buitendeuren herstellen; achterdeur in berging merantie klampen met kleedhout.

18-5. Voor alle kozijnen-ramen en deuren: merantie. duurzaamheidsklasse II.

18-6. Alle kozijnen-ramen en deuren volgens nader te verstrekken detailtekeningen en aanwijzingen.

B. Binnenkozijnen en deuren.

18-7. Alle nieuwe binnenkozijnen Europees vuren volgens NEN 5466 kwaliteit B.
Kozijnmerken:f-h-i-j-o-t-u-v-w-x. (u en v verplaatsen)
Bestaande binnenkozijnen repareren/herstellen, kozijnmerken: a-b-c-d-e-g-k-m-n-p-q-r-s.

P. 18-8. Binnendeuren in bestaande kozijnen handhaven, zonodig herstellen; rest binnendeuren bijleveren gelijk aan deuren b en d.

18-9. Waar niet anders bepaald beuken stofdorpels.

18-10. Alle kozijnen-deuren-architraven enz. volgens nader te verstrekken detailtekeningen en aanwijzingen.

18-11. Alle met metselwerk of beton in aanraking komende hout twee maal te menieën. Dit geldt voor alle houtwerk binnen en buiten.

C. Trappen.

P. 18-12. Trap beg.grond naar eerste verdieping bestaande trap, vloerbedekking verwijderen, eventuele beschadigingen herstellen.
Traphekje op eerste verdieping rondom vide geheel nieuw; geprofileerde balusters h.o.h. plm. 20 cm., leuning en trappalen, alles volgens nadere details.

18-13. Trap eerste verdieping naar zolderverdieping: open hardhouten trap met kwartslag,compleet met welstuk- leuning enz, volgens nadere details.
Traphekje op zolder:Staanders plm. 1 m h.o.h., bovenregel en tussenregel, volgens nadere details.
Trapgat afsluitbaar maken door middel van scharnierend luik, compleet.

W. 18-14. Trapje niveauverschil zoldervloeren en trap naar zolder berging: eenvoudige rechte steektrappen,vuren breed plm. 70 cm.

D. Meterkast.

P. 18-15. Bestaande meterkast controleren, zonodig aanpassen aan de eisen van 'Richtlijnen Gecombineerde Meterkasten', uitgave gezamelijke Nutsbedrijven in de Provincie Friesland dd. 15 nov.'80.

E. Balklagen en vloeren.

W. 18-16. Vloer zolderverdiepingen (ook berging) geheel verwijderen en vernieuwen, vloerhout 2,8 x 13,5 cm.gg., blijvende maat.

18-17. Vloer eerste verdieping, lage (achterste) gedeelte idem als 18-16.

18-18. Vloer eerste verdieping hoge (voorste) gedeelte herstellen.

18-19. Voor herstellingen aan de diverse vloerbalken een stelpost op te nemen, groot *f*. 5.000,--, voor materiaal en arbeidsloon.

F. Dak.

18-20. Juffers herstellen cq. aanlassen, waar nodig vernieuwen. Alle juffers opnieuw doorspijkeren.

18-21. Voor diverse herstellingen aan de spanten-steekbalken en muurplaten een stelpost op te nemen groot *f*. 5.000,-- voor materiaal en arbeidsloon.

W. 18-22. Gehele dakvlakken, ook berging, dakhout 19 x 100 mm., horizontaal vernageld.

18-23. Verdere afwerking dakvlakken:
- Dubbele tengel 1 x 3,8 cm. max. 40 cm.h.o.h.,
- waartussen ventifol,
- panlatten 2,2 x 3,2 cm.,
- oude pannen en vorsten.

18-24. Voor tekortkomende pannen en vorsten oude bijleveren. Vorsten bevestigen met roestvast materiaal, waar nodig pannen in gegalvaniseerde panhaken.

W. 18-25. Op zijdak dakkapel, afm. als bestaand, dubbele wanden en dak, dak afwerken met zink no.14, wanden en dak geisoleerd, geheel volgens nadere details.

W. 18-26. Op voordak dakkapel herstellen,nieuw zink no.14, ramen vernieuwen.

P. 18-27. In zijdaken drie stuks geisoleerde tuimeldakramen, compleet met alle benodigde hulpstukken en betimmeringen, t.w. UBBINK luxe tuimeldakraam,
een stuks nr. 53, afm. 71 x118 cm,
twee stuks nr. 51, afm. 54 x 98 cm.

18-28. In het dak de nodige dakdoorvoeren voor ventilatie en ontluchting; w.c.-badakmer-riolering-c.v.-enz.

18-29 Schoorsteenbord topschoorsteen met bevestigingen nazien, zo nodig herstellen, nieuw zink no.16.

G. Goten-Windveren en Topgevel berging.

18-30. Goten en boeideel nazien, repareren-herstellen, goten achteraanbouw vernieuwen, houten bakgoot.

18-31. Krimpen en platdak bijkeuken: houtwerk nazien en zonodig herstellen.

18-32. Afdekplanken op topgevels vernieuwen, 4 stuks lang plm 650 cm., afmetingen als bestaand,red cedar. Bevestigen met roestvast materiaal.

W. 18-33. Topgevel berging: samen te stellen uit;
- regelwerk 5 x 7 cm., h.o.h. 60 cm.
- kleedhout grenen rabat, dik 19 mm.
- topgevel compleet met zwaard en dekstukken, kozijntje enz.

H. Binnentimmerwerk begane grond.

W. N. 18-34. De binnenzijde van de steensmuren (voor-zij en achtergevels), excl. de aanbouw, betimmeren met:
- regelwerk horizontaal
- alkraflex 2L-2
-regelwerk verticaal, max. 30 cm. h.o.h. hierin het nodige extra regelwerk voor ophanging radiatoren-kapstok enz.
- gipsplaat.

18-35. Alle overlappingen van het alkreflex deugdelijk af te tapen.

W. 18-36. Plafonds, excl. aanbouw, gipsplaat 60 cm. breed op regelwerk max. 30 cm. h.o.h., gips tussen de balken. Plafond in de bijkeuken idem, gips onder de balken.

W. 18-37. Alle in punt 18-36 genoemde plafond isoleren met een steenwolplaat dik 6 cm.

18-38. In alle ruimten de nodige plinten-architraven-platstukken-kantstukken-vensterbanken-hoeklatjes-dorpels-omtimmeringen leidingen enz. volgens nadere details en aanwijzingen.

18-39. Indien nodig ter plaatse van de geyser in de bijkeuken de nodige brandvrije platen PROMATEC L 20 mm.aan brengen.

18-40. In de kamer (15) en berging (6) geen verdere afwerkingen.

W.P.

I. Binnentimmerwerk verdieping.

18-41. Alle binnenwanden samen te stellen uit dubbel gipsplaat op regelwerk 5 x 7 cm., h.o.h. 30 cm.

18-42. Alle binnenzijden van de buitenmuren (voor-zij- en achtergevels en borstweringen) en de scheve dakvlakken betimmeren met:
- regelwerk horizontaal
- alkraflex 2L-2
- regelwerk verticaal, max. 30 cm. h.o.h., hierin het nodige regelwerk voor ophanging radiatoren enz.
- gipsplaat.

18-43. Plafonds gipsplaat 60 cm.breed op regelwerk max 30 cm. h.o.h., gips tussen de balken.
Plafonds isoleren met 6 cm. dikke steenwolplaat.

18-44. In alle ruimten de nodige plinten-architraven-platstukken-kantstukken-vensterbanken-hoeklatjes-dorpels-omtimmeringen leidingen-enz. volgens nadere details en aanwijzingen.

J. Binnentimmerwerk zolderverdieping.

18-45. Ter plaatse van de c.v. ketel en de geyser de nodige brandvrije platen aan te brengen, PROMATEC L 20 mm.

K. Schoorsteenmantels en rookkanalen.

18-46. Bestaande schoorsteenmantel met rookkanaal in slaapkamer (17) restaureren.

18-47. In kamer (7) bestaande rookkanaal herstellen, met nieuwe strakke schoorsteenmantel.
Voor schoorsteenmantel een stelpost op te nemen groot *f*. 2.000,-- voor materiaal en arbeidsloon.

18-48. In plafond keuken/kamer (9) een nisbus op te nemen, met vanaf vloer slaap/studeerkamer (20) een omtimmering voor door derden te leveren en aan te brengen rookgas-afvoerkanaal (dubbelw.pijp).

L. Binneninrichting.

W. 18-49. In de keuken een keukenblok/kastjes met aanrechtblad bovenkastjes en een afzuigkap te plaatsen.
Stelpost aankoop keuken *f*. 4.000,-- voor leveren en aanbrengen.

18-50. In de kasten 5 11 en 13 per kast 4 legborden aanbrengen; kastbord 40 cm. breed, lengte als achterwand in kast.
2 Kastplanken plm 40 x 100 cm. aanbrengen in wasmachineruimte (14).

Par. 19. Werken in gehouwen steen.

W. 19-1. Onder de deuren naar de w.c. en badkamer een hardstenen dorpel aan te brengen, lengte dagmaat kozijn, breedte als kozijnhout, dikte plm. 5 cm.
In 't zicht blijvende vlakken zoeten en oliën.

19-2. Voor de voordeur de straatstenen stoep verwijderen, hiervoor aanbrengen een hardstenen stoep, dik 6 cm.

W. 19-3. Voor herstel gangvloer een stelpost op te nemen groot *f*. 2.500,-- voor bijlevering tegels, plaatsen en aanbrengen voor rekening aannemer.

Par. 20. Tegelwerk.

A. Wandtegels.

W. 20-1. Aanbrengen tegels in keuken-badkamer-w.c.-achter wastafels enz. totaal 36 m2.

20-2. Tegels te plakken met elastiche tegellijm, op metselwerk tegels te zetten in de specie; voegbreedte 2-3 mm.
De gipsplaten voor het tegelen insmeren met een vochtwerend middel.

20-3. De voegen in te wassen met een mortel van witte cement met zilverzand of voegenwit.

W. 20-4. In de hoeken de voegen te vullen met een in kleur bijpassende siliconenkit.

W. 20-5. Voor aankoop wandtegels een stelpost op te nemen groot *f*. 1.080,--.
Aanbrengen voor rekening aannemer.

B. Vloertegels.

W. 20-6. Vloeren in de w.c.- badkamer- wasmachineruimte, tegels in de specie.

20-7. Voegbreedte 2-3 mm., mortel p.c. met zilverzand.

W. 20-8. Voor aankoop vloertegels een stelpost op te nemen groot *f*. 400,--.
Aanbrengen voor rekening aannemer.

20-9. Voor alle tegelwerken, vloer en wand, steeds symetrisch vanuit het hart der velden te werken, het kleinste te gebruiken formaat is een halve tegel.

Par. 21. Stucadoorwerk.

21-1. Slecht en loszittend stucadoorwerk verwijderen en herstellen.

21-2. Binnenmetselwerk voor zover niet betegeld, berapen met mortel S 9 en blauw te pleisteren met mortel S 12.
Entree (1)-gang (2+3)-bijkeuken (4) en boven tegels in w.c. fijnschuren met mortel S 14.

21-3. Gipswanden begane grond en verdieping en de scheve dakvlakken volgens voorschrift fabricant cq. leverancier naden uitvlakken en nietgaten en beschadigingen dichten.

21-4. Gipsplafonds alleen nietgaten dichten en beschadigingen bijwerken.

W. 21-5. Betonvloer beganegrond, voor zover niet betegeld, afwerken met een zand-cement vloer (1 pc.- 3 z.),dik 3 cm
Voor het aanbrengen ondergrond schoon en nat maken.

P. 21-6

Par. 22. Metaalwerken.

22-1. Alle bestaande muurankers-gootbeugels enz. in gedeelten verwijderen, herstellen, stralen, schoperen, 2 maal in de Innertol en wederom aanbrengen.

22-2. Voor de gehele bouw de verder nodige ankerwaren voor balken-muurplaten-dak enz.

22-3. Zinkwerk op met uitloop op dakkapellen en schoorsteenbord zie 18-25,18-26 en 18-29.

22-4. Lood bij kozijnen 15 kgf/m2; loketten bij schoorstenen-lood bij aansluitingen platdak en krimpen en het verdere noodzakelijke lood 18 kgf/m2.

W. 22-5. Ter plaatse van de betonvloeren in de badkamer en de wasmachineruimte LEVIS platen aanbrengen, volgens voorschrift leverancier.

Par. 23. Hang en sluitwerk.

23-1. Voor hang en sluitwerk een stelpost op te nemen groot *f*. 1.500,--.
Bevestigen en aanbrengen voor rekening van de aannemer.

Franeker, februari 1985
Architectenburo N.J. Adema.

architektenburo
n. j. adema

,,poolshof'', froonacker 14, 8801 KD franeker
tel. 05170-6332

betreft: E.Eisingastraat 10
werknr.: 8415
datum: 1 maart 1985

Nota van inlichtingen,
betreffende restauratie pan d Eise Eisingastraat 10,Franeker.

Wijzigen: Par. 8-4. :Leidingen in muur fraisen is voor de onderaannemer, andere hak en breekwerk voor bouwkundig aannemer.

Aanvullen Par.13-9. :In berging (6) vloerpurje aanbrengen

Aanvullen Par.18-34.:Bestaande blinden in kamer (7) met vensterbank handhaven en restaureren.

Franeker, 1 maart 1985
Architectenburo N.J. Adema.

architektenburo
n. j. adema

,,poolshof'', froonacker 14, 8801 KD franeker
tel. 05170-6332

betreft: E.Eisingastr.10

werknr.:8415

datum: 26-2-'85

Proces verbaal van aanwijs, betreffende restauratie pand
Eise Eisingastraat 10 te Franeker.

Veranderen cq. toevoegen aan bestek de volgende punten:

Par.15-1. Lengte erfafscheiding, incl.deuren is plm. 13 m1.

Par.17-8. Schoorstenen: Kanaalen vernieuwen met schoorsteenelementen.

Par.18-8. Voor aanschaf binnendeuren een stelpost op te nemen groot *f.* 1.000,--

Par.18-12. Bestaande leuning trap en traphekje: profileren volgens nadere aanwijs, nieuwe traphekje om vide gelijk aan bestaand geprofileerde balusters met leuning.

Par.18-15. Bestaande meterkast omtimmeren met gips,deur vernieuwen.

Par.18-27. Ubbink vervangen door Velux, d.w.z.
1 stuks dakraam GGL 5
2 stuks dakramen GGL 6.

Par.18-42. In badkamer en wasmachineruimte watervast gips 'NORWATER'.

Par. 21-6. Toevoegen: Betonemaille in de gang voorstrijken met hechtmiddel, daarna vlak maken. De verspringing tussen lambrizering en wand mag blijven zitten.

Par.18-3. Toevoegen:In iedere ruimte met buitenkozijnen te rekenen op het beweegbaar maken van een bovenlicht; in woonkamer (7) en slaap/studeerkamer (20) twee stuks ramen beweegbaar, in badkamer (18) beide ramen beweegbaar.

Franeker, 26 februari 1985.

N.J. Adema.

Restauratie voormalig politiebureau, E.Eisingastr. te Franeker.
"Stichting tot Behoud van het Franeker Stadsschoon", werknr. 8415.

Wijzigingen bestek en voorwaarden dd. 21 maart 1985.

Paragraaf	Wijziging bestek
11- 9.	Sloopwerk dak berging vervallen.
11-10.	Vloer zolderverdieping hoge gedeelte herstellen, vloer zolder berging blijft bestaan.
11-11.	Goede bestaande mag wederom gebruikt worden.
11-14.	Kluis blijft bestaan, deur afvoeren.
11-16.	Topgevel berging blijft bestaan.
11-17.	Vloeren handhaven.
15- 3.	Eèn tuindeur,breed plm. 100 cm.
16-12.	Vloer begane grond laten zitten, behalve verhoogde celvloer.
16-13.	Isolatie vervallen.
16-14.	Vervallen.
17- 8.	Bij zijgevel toevoegen: Onderzijde metselwerk een gestucadoorde plint, hoog plm. 50 cm. aanbrengen.
17-12.	Voegwerk voorgevel herstellen.
18-1,18-2,18-3.	Herstellen volgens bijgevoegde lijst.
18-14.	Trapje niveauverschil zoldervloeren bestaand, trap zolder berging vervallen.
18-16.	Zie wijziging 11-10.
18-22.	Dakhout berging vervallen.Dakhout vertikaal op regelwerk.
18-25,18-26.	Dakkapellen en ramen bestaand;dakkapel badkamer binnenzijde betimmeren en isoleren.
18-33.	Vervallen:Topgevel afwerken met pannen + afdekstukken/windveren
18-34.	Zijgevel gangmuur en zijgevel vide: isolatie vervallen.
18-36.	Gipsplafonds onder de balken in:tussenkamer 8- keukenkamer 9 en gangen 2 en 3: In berging 6 en kamer 15 geen plafonds.
18-37.	Steenwol 4,5 cm. (deken)
18-42.	Isolatie gedeeltelijk vervallen bij vide, zie wijziging 18-34.
18-49.	Stelpost keuken wordt *f.* 3.500,-- excl. b.t.w.
19- 1.	Hardstenen binnendorpels vervallen,nu tegel cq.beuken dorpels.
19- 3.	Stelpost wordt *f.* 500,-- (gebakken tegels in gangen).
20-1.	In badkamer en wasmachineruimte wanden afwerken met vinyl bekleding "Balamundi" ; kleuren nader bepalen.
20- 5.	Stelpost rest wandtegels (w.c.+keuken) *f.* 30,-- per m2.
20- 6.	Vloer badkamer en wasmach.ruimte "Balamundi",kleur nader bepale
20- 8.	Stelpost vloertegels w.c. wordt *f.* 30,-- per m2.
21- 5.	Vervallen.
22- 5.	Vervallen.

Franeker, 21 maart 1985 Architectenburo F.J. Adema.

KOZIJNSTAAT Restauratie pand Eis- Eisingastr. 10 werknr. 8415.

Kozijnmerk:

A.	twee maal stijlen lassen. levensboom met hoekornamenten in bovenraam
B.	vernieuwen
C.	vernieuwen
D.	vernieuwen
E.	vernieuwen
F.	vernieuwen
G.	vernieuwen
H.	nieuw kozijn
J.	nieuw kozijn
K.	onderdorpel nieuw
L.	onderdorpel nieuw
M.	onderdorpel nieuw
N.	bestaand bovenkozijn loskoppelen van deurskozijn, inkorten en vernieuwen. Opdeurskozijn latei en metselwerk.
O.	nieuwe onderdorpel
P.	nieuwe onderdorpel
Q.	nieuwe onderdorpel
R.	nieuw kozijn
S.	vernieuwen
(T.	tuimeldakraam nieuw)
U.	nieuw onderdorpel
V.	vernieuwen
W.	vernieuwen
X.	vernieuwem
Y.	vernieuwen
Z1.	nieuw kozijn
Z2.	nieuw kozijn.

Franeker, 25 febr.'85.
Arch.buro N.J. Adema.

INSTALLATIONS IN THE BUILDING

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

ESCUELA TÉCNICA SUPERIOR INGENIERÍA DE EDIFICACIÓN

Hanze University Groningen

Stichting tot behoud van het
Franeker Stadsschoon

Opgericht A° 1971

B E S T E K   E N   V O O R W A A R D E N.

Voor de restauratie van het voormalig politiebureau
EISE EISINGASTRAAT 10 te FRANEKER
tot een woning.

Betreft:

+ Centrale verwarmingsinstallatie
+ Gasleiding
+ Koud en warmwaterleidingen en sanitair
+ Electrische installatie
+ Zinkwerk.

architektenburo
n. j. adema

,,poolshof'', froonacker 14, 8801 KD franeker
tel. 05170-6332

BESTEK EN VOORWAARDEN

WAARNAAR DOOR DE "STICHTING TOT BEHOUD VAN HET FRANEKER STADSSCHOON" TE FRANEKER ZAL WORDEN AANBESTEED:
De restauratie van het voormalig politiebureau EISE EISINGASTRAAT 10 te Franeker tot een woning, betreffende c.v.installatie, gasleiding, koud en warmwaterleidingen, sanitair, electrische installatie en zinkwerk.
Kadastraal bekend: Gem.: Franeker
Sectie: A, Nr.: 3321.

OPDRACHTGEEFSTER : De "STICHTING TOT BEHOUD VAN HET FRANEKER STADSSCHOON"
Secr. de Weledele Heer F.H. Jellema
Noorderbolwerk 18, 8801 KL Franeker.

ARCHITECT en DIRECTIE : Architectenburo N.J. Adema
"POOLSHOF" Froonacker 14, 8801 KD Franeker.
Tel. 05170-6332

INLICHTINGEN : Dagelijks ten kantore van de architect.

Bij dit bestek behorende tekeningen:

Blad 1,	Werkno. 8415, dd. mei '84, opmeting		1 : 100
Blad 2,	Werkno. 8415. dd. juni'84, plan		1 : 100

INHOUDSOPGAVE

EERSTE AFDELING.

Administratieve bepalingen.

Par. 1. Van toepassing zijnde bepalingen.

Voor zover in dit bestek niet anders is bepaald zijn op dit werk van toepassing, als waren zij letterlijk in dit bestek opgenomen, de hierna genoemde voorschriften, zoals deze op de dag van aanbesteding luiden:

1-1. De Algemene Bepalingen voor de uitvoering van Bouwwerken 1986 (A.B.B.1968), waarin zijn opgenomen de A.V.W. 1968 en de U.A.V. 1968, vastgesteld bij beschikking van de Minister van Volkshuisvesting en Ruimtelijke Ordening dd. 10 februari 1969.

1-2. Voorschriften Beton (V.B. 1974).

1-3. De Bouwverordening met aanvullende voorschriften van de Gemeente Franekeradeel.

1-4. De bepalingen van de nutsbedrijven in de Gemeente Franekeradeel.

1-5. De Model Bouwverordening.

1-6. Kwaliteitseisen voor hout 1980 (KVH'80) met bijbehorend NEN 5461-NEN 5466 en NEN 5467.

1-7. Kwaliteit van timmerwerk, voorschriften voor de fabricage (K.V.T. 1970).

1-8. Basis Verfbestek 1980 Nieuwbouw (BVN 1980).
Basis Verfbestek 1980 Onderhoud (BVO 1980).

Par. 2. Niet van toepassing zijnde bepalingen.

2-1. De Risico-regeling is niet van toepassing.
Risicoverrekening van materialen en lonen zal derhalve niet plaats vinden.

Par. 3. Wijzigingen en aanvullingen.

Met betrekking tot de hierna genoemde paragraven en zinsneden van de U.A.V. met de daarin van toepassing verklaarde voorschriften, gelden voor dit werk onderstaande wijzigingen en aanvullingen:

3-1. par.5. Verplichtingen van de opdrachtgever.
Lid 1. sub. a.: Vervallen.
Hiervoor in de plaats toevoegen:
"Alle voor de uitvoering van het werk benodigde vergunningen van de overheid, met uitzondering van de zogenaamde Bouwvergunning, moeten door de aannemer tijdig worden aangevraagd. Alle op het aanvragen en verlenen van deze vergunningen vallende kosten zijn voor rekening van de aannemer",idem vergunningen van Nutsbedrijven.

3-2. par.6. Toevoegen punt 30:
Eerste hulp moet kunnen worden verleend.
Een volgens de voorschriften gevulde verbandkist moet op het werk aanwezig zijn.

3-3. par.7. De datum van aanvang wordt de aannemer schriftelijk medegedeeld.

3-4. par.8. Uitvoeringsduur, uitstel van oplevering.
lid 1. Onverminderd het bepaalde in deze paragraaf moet het werk na 100 werkbare werkdagen na de datum van aanvang in zijn geheel voor de eerste oplevering gereed zijn.

3-5. par.10. Oplevering.
Toevoegen lid 4: De gebouwen moeten voor de eerste oplevering grondig in- en uitwendig worden schoongemaakt, incl. het verwijderen van verf en specieresten van sanitair glas- en tegelwerk.

Het bouw en werkterrein moeten schoon en leeg worden opgeleverd, ontdaan van alle puin en rommel, bouw en hulpmateriaal

3-6. par.11. Onderhoudstermijn.
Met inachtneming van het bepaalde in deze paragraaf geldt de onderhoudstermijn van driemaanden na de eerste oplevering en goedkeuring van het werk.

3-7. par.16. Lid 3, toevoegen: De vorm en wijze waarop de reclame wordt aangebracht geheel in overleg met en goedgekeurd door de directie.

3-8. par.22. Garantie voor een onderdeel.
Lid 1. Toevoegen: Alle bijkomende kosten als het aan- en afvoer van noodzakelijk materiaal en materieel, eventueel schilderwerk alsmede alle bijkomende herstelwerkzaamheden, welke voortvloeien uit het te vervangen of te herstellen onderdeel, zijn voor rekening van de garant.

3-9. par.27. Dagboeken,lijsten en rapporten.

Vervallen.

3-10. par.32. Gevonden voorwerpen.
Lid 2. Vervallen de zin: "De vinder wordt evenwel een billijke schadevergoeding verleend."
Toevoegen: "De vinder kan evenwel een billijke schadevergoeding worden verleend."

3-11. par.35. Verrekening van meer en minderwerk.
Meerwerk wordt niet erkend zonder uitdrukkelijke opdracht van de architect.
Eventuele wijzigingen of verrekeningen moeten direct op de weekstaten worden vermeld.
De afrekening van meer en minderwerk geschiedt bij de betaling na eerste oplevering.

3-12. par.37. Stelposten.
Lid 3,Sub a en b, hiervoor te lezen:
De in dit bestek omschreven stelposten zijn inclusief 10% aannemersprovi sie, de b.t.w. over de aangegeven bedragen dienen afzonderlijk in de begroting te worden opgenomen.
Bij de verrekening, na de eerste oplevering, wordt het meer en minder, met inachtname van de 10% aannemersprovisie en de geldende b.t.w. verrekend.

3-13. par.40. Betalingen.
De betaling zal geschieden in vier termijnen volgens onderstaand schema:

Betaling percentage van de aanneemsom:	Als volgens goedkeuring der directie, in overeenstemming met de ingediende weekstaten is verwerkt:
35 %	45 %
30 %	75 %
30 %	Goedkeuring na eerste oplevering
5 %	Goedkeuring na tweede oplevering.

Als de aannemer recht heeft op een termijn dient hij hiervoor een declaratie in, in drievoud, bij de architect.

3-14. par.42. Kortingen.
Lid 2. De korting bedraagt *f*. 150,-- per dag.

3-15. par.44. Schade aan het werk.
Lid 8. Toevoegen: De aannemer is verplicht om alle mogelijke maatregelen te nemen opdat schade en hinder door bouwwerkzaamheden zoveel mogelijk wordt **voorkomen.**

3-16. par.50[a]. Verzekeringen.
Lid 2. Toevoegen: De verzekering dient mede de schade door brand en/of diefstal te dekken.
Lid 4. De bepalingen in dit lid geldt voor de omschreven tijdsduur na de eerste oplevering.

TWEEDE AFDELING.

Voorschriften omtrent de uitvoering.

Par. 4. Wijzigingen en aanvullingen van de tweede afdeling der A.B.

4-1. Indien niet uitdrukkelijk anders is bepaald, behoort bij elk in dit bestek genoemde levering ook het compleet aanbrengen, stellen en afwerken met alles wat daarbij in de ruimste zin behoort,
bij elk in dit bestek genoemd aanbrengen, maken of stellen, ook het ook het compleet leveren van hetgeen moet worden aangebracht of gesteld.
Door derden wordt niets geleverd tenzij zulks in dit bestek nadrukkelijk is vermeld.

4-2. Alle puin, rommel en afval, ook die welke door derden mocht ontstaan, tijdens de bouw geregeld op te ruimen en af te voeren en het werk periodiek bezemschoon te maken, een en ander zodanig dat het werk er steeds behoorlijk bij ligt en een onbelemmerde doorgang door alle ruimten mogelijk is.

DERDE AFDELING.

Voorschriften omtrent bouwstoffen.

Par. 5.

5-1. Tenzij in dit bestek anders is genoemd, zullen alle te gebruiken materialen van de eerste soort zijn, op keur van de directie,te leveren volgens vooraf in te dienen monsters en moeten voldoen aan de eisen daaraan gesteld in de desbetreffende normaalbladen.

5-2. De in dit bestek met een merk of firmanaam aangeduide materialen mogen van een ander fabricaat zijn, indien ze, ter beoordeling der directie, gelijkwaardig zijn en aan dezelfde eisen voldoen.
Overleg hieromtrent tussen de aannemer en de directie dient voor de aanvoer van het materiaal te geschieden.

VIERDE AFDELING.

Beschrijving van het werk.

Par. 6. Algemene omschrijving.

6-1. Het compleet bedrijfsklaar opleveren, incl. het leveren, monteren en aansluiten van de volgende installaties:
+ Centrale verwarmingsinstallatie
+ Gasleiding
+ Koud en warmwaterleiding en sanitair
+ Electrische installatie
+ Zinkwerk.

Alles in het werk aangebracht in het te restaureren pand Eise Eisingastraat 10 te Franeker.

Par. 7. Volgorde bij de uitvoering.

7-1. De werkwijze en volgorde bij uitvoering worden bij voorkeur aan de aannemer overgelaten, echter in overleg met de directie en de hoofdaannemer en in aansluiting op de werkzaamheden van de hoofdaannemer.

Par. 8. Algemene gegevens.

8-1. Voor transmissie berekeningen en bevestiging van de diverse onderdelen rekening houden met de volgende gegevens:

8-2. Alle steens buitenmuren van het hoofdgebouw en de scheve dakvlakken van de eerste verdieping worden afgewerkt met gipsplaat op regelwerk met isolatie Alkraflex 2L-2.

8-3. Plafonds eerste verdieping en begane grond worden geisoleerd met steenwol dik 6 cm.

8-4. Betonvloer beganegrond wordt geisoleerd met 5 cm. dik STYRODUR.

8-5. Van de aanbouw wordt alleen het dak en de vloer van de bijkeuken geisoleerd met resp. 6 cm.steenwol en 5 cm. STYRODUR.

8-6. De zolderruimtes en de berging (6) en kamer (15) worden niet geisoleerd.

8-7. Alle ramen enkel glas, tuimeldakramen dubbelglas.

8-8. Binnenwanden beganegrond metselwerk, binnenwanden verdieping dubbel gips op regelwerk.

Par. 9. Centrale verwarming.

9-1. Leveren en aanbrengen van een complete aardgasgestookte centrale verwarmingsinstallatie, H.R. ketel op zolder opgesteld, voorzien van dakdoorvoer-waakvlambeveiliging-overstort-maximaalthermostaat-circulatiepomp-manometer-enz.
De c.v.ketel compleet installeren en aansluiten op gasleiding-electrische installatie- c.v.leidingnet-dakdoorvoer- riolering en kamerthermostaat.

9-2. De capaciteit van de H.R.ketel moet zodanig gekozen worden dat bij een buitentemperatuur van -15'C. en een windsnelheid van 8 m/sec., gelijktijdig de volgende temperaturen gegarandeerd kunnen worden:

- Entree en gangen	12'C.
- Woonkamer,tussenkamer en keukenkamer	22'C.
- Bijkeuken	12'C.
- W.C.	12'C.
- Badkamer	24'C.
- Slaapkamers	18'C.
- Wasmachineruimte	vorstvrij

9-3. Zolderverdieping en achteraanbouw berging (6) en kamer (15) geen verwarming; met leidingen en capaciteit ketel rekening houden op latere aansluiting van kamer (15).

9-4. Een gesloten expantievat van voldoende grootte aansluiten aan de zuigzijde van de circulatiepomp.

9-5. Op het hoogste punt een handbediende ontluchtingspot aan te brengen.

9-6. Alle leidingdoorvoeren voorzien van een kunststof mantelpijp, in de badkamervloer geen geen doorvoeren.

9-7. Alle leidingen strak en recht in 't zicht te monteren, weg te werken leidingen in overleg met de directie.

9-8. Weggewerkte leidingen en leidingen op zolder te isoleren.

9-9. Radiatoren fabricaat Brugman of gelijkwaardig, in gelakte uitvoering met alle toebehoren.
Radiatoren na de ruwbouw inmeten i.v.m. juiste hoogtematen.
Breedte van de radiator is maximaal de breedte van het kozijn waar zij onder staat. Afmetingen in overleg met de directie.

9-10. Temperatuurregeling door middel van een kamerthermostaat type Honnywell, in de woonkamer geinstalleerd.

9-11. Bij de installatie te leveren:
- Sleutels voor ontluchting-aftap-vulkraan.
- Vulslang met klemmen en wartels.
- Bedieningsvoorschrift en garantiebewijs c.v.ketel.

Par.10. Gasleiding.

10-1. De gehele gasinstallatie moet voldoen aan de eisen van het gasbedrijf, de bouwverordening en de gemeentelijke voorschriften.

10-2. De aannemer draagt zorg voor de nodige tekeningen en goedkeuringen.

10-3. De installatie geheel bedrijfsklaar opleveren.

10-4. Te rekenen op het aanbrengen van de gasleiding vanaf de meterkast, incl. kranen-bevestigingen enz., naar de volgende punten:
- Keuken : aansluitpunt fornuis.
- Bijkeuken : aansluiting geyser.
- Zolder : aansluiting c.v.ketel en geyser.

Par.11. Koud en warmwaterleiding en sanitair.

11-1. De gehele waterleiding installatie moet voldoen aan de eisen van het nutsbedrijf, de bouwverordening en de gemeentelijke voorschriften.

11-2. De aannemer draagt zorg voor de nodige tekeningen en goedkeuringen.

11-3. De installatie geheel bedrijfsklaar opleveren.

11-4. Alle afvoerleidingen worden door de bouwkundig aannemer tot boven de vloeren gebracht.
Het aansluiten van de sanitaire toestellen, incl. het aanrecht behoort tot de werkzaamheden van de aannemer van de waterleiding installatie.

11-5. Alle leidingen strak en recht in 't zicht te monteren.
Weg te werken leidingen in overleg met de directie.
De daarvoor in aanmerking komende koud en warmwaterleidingen te isoleren (o.a. op zolder).

11-6. Vanaf de watermeter in de put achter in gang (3) waterleiding in koper, van voldoende diameter te brengen a naar en aan te sluiten op het in punt 11-7 te noemen sanitair en tappunten.

11-7. Alle sanitair in de kleur wit, kranen "Venlo" sanitair, serie TULP.
Te rekenen op het leveren en aanbrengen van hetvolgende sanitair:

Berging	: Slangwartelkraan met beluchter, naast buitendeur.
Kamer (15)	: Bestaande wastafel uit cellengang plaatsen met nieuwe kraan.
Bijkeuken	: Toevoerleiding keukengeyser.
Keuken	: Gootsteenmengkraan met draaibare uitloop met perlator. Toevoerleiding close-in boiler,afgedopt. Leiding voor later aan te sluiten vaatwasmachine, met aftapkraan, afgedopt.
Toilet	: Handwasbakje compleet W.C. combinatie met laaghangend 'GeberiT' drukknopreservoir.
Badkamer	: Plaatstalen geëmailleerde badkuip, 170 x 70 cm., met badmengkraan met omstelinrichting en handdouche met slang

Badkamer vervolg: Plaatstalen geëmailleerde douchebak
90 x 90 cm., douchemengkraan, glijstang,
slang met handdouche.
Wastafel compleet met spiegel,plancet,
mengkraan,enz.
Closet combinatie met PK uitlaat,
zitting enz.

Slaap/studeer-
kamer (20) : Wastafel compleet met spiegel,plancet,
wastafelmengkraan enz.

Wasmachineruimte
(14) : Slangwartelkraan met toebehoren voor
aansluiting wasmachine.
Plaatstalen geëmailleerde uitstort-
gootsteen met spatscherm, met draai-
bare mengkraan met perlator.

Zolder (21) : Toevoerleiding voor warmwaterapparaat
Slangwartelkraan met toebehoren voor
vulling c.v.leidingnet.

11-8. De warmwaterleiding in koper van voldoende diameter te brengen van het warmwatertoestel op zolder naar alle mengkranen op de eerste verdieping.
De warmwaterleiding in koper van voldoende diameter te brengen van het warmwatertoestel in de bijkeuken naar de kraan op het aanrecht en de kraan bij de wastafel in kamer (15).

11-9. Tot de levering behoort niet de warmwatertoestellen.
De warmwatertoestellen wel te plaatsen en aansluiten in de bijkeuken cq. op zolder, incl. het leveren en plaatsen van de rookgasafvoeren, dubbelwandig uit dak met kap cq. door muur.

11-10. Alle sanitaire toestellen en afvoeren aansluiten door middel van sifons op de riolering.Hierbij hoort ook het aanrecht in de keuken.
Voor de wasmachine een afvoer met sifon te maken in de wasmachineruimte.
Voor de later aan te brengen vaatwasser een afgedopte afvoer in de keuken.

Par. 12. Electrische installatie.

12-1. De gehele installatie moet voldoen aan de eisen van het PEB,de bouwverordening en de gemeentelijke voorschriften.

12-2. De aannemer draagt zorg voor de nodige tekeningen en goedkeuringen.

12-3. De installatie geheel bedrijfsklaar opleveren.

12-4. De leidingen zodanig te leggen dat in elk vertrek of ruimte waarin meer dan één lichtpuntkomt, deze aan te sluiten op meer dan een groep.
Verdieping eveneens op meerdere groepen aan te sluiten.

12-5. Alle schakelaars-wandcontactdozen enz. van het merk NICO, inbouw wit of gelijkwaardig.
Alle leidingen uit het zicht,behalve op de zolders en in de berging. Op zolders en in berging opbouwmateriaal.
Leidingen in metselwerk zelf fraisen.

12-6. Buiten de door het PEB te stellen eisen dient de installatie minimaal te bevatten:

- Complete meterkastinrichting met groepenkast-aard-lekschakelaars-aarding enz. De groepenkast van zodanige afmeting dat eventueel later minimaal drie extra groepen aangebracht kunnen worden.
- Belinstallatie met drukknop, trafo in de meterkast, bel in gang (2).
- Centrale aarding van de badkamer en de wasmachineruimte.

Begane grond

- Entree (1)	:Lichtpunt op wisselschakelaars bij deuren A enb. Enkele wandcontactdoos, mag in combinatie
- Gang 2	:2 lp,gelijktijdig geschakeld op kruis-schakelaars bij deuren b-d-u-j. Enkele wcd.,mag in combinatie.
- Gang 3	:lp.op wisselsch.bij deur j en k. Enkele wcd.,mag in combinatie
- Bijkeuken 4	:lp. met schakelaar. enkele wcd.,mag in combinatie. Bij deur V een schakelaar voor buitenlamp
- Berging 6	:lp op wisselsch. bij deur m en Z1. 2 dubbele wcd.
- Kamer 15	:lp op wisselsch. bij deur n en W. 3 dubbele wcd.

- Kamer 7 :2 lp.met enkele schakelaars
  1 lp.met kruissch. bij deur b-d-e.
  6 dubbele wcd.
  thermostaatleiding van c.v.ketel.
- Tussenkamer 8 :lp. op wisselsch.bij deur e en i.
  3 dubbele wcd.
- Keukenkamer 9 :lp op wisselsch. bij deur i en j.
  lichtpunt onder bovenkastjes keuken
  6 dubbele wcd.
  aansl.afzuigkap
  aansl. close-in boiler, leeg
  aansl. vaatwasser, leeg
  boilerleiding,leeg
  kookleiding,leeg
- W.C. 10 :lp met schakelaar
- Slaapkamer 12 :lp met schakelaar
  2 dubbele wcd.
- Wasmach.ruimte
  14. :aansl. wasmachine,aparte groep.
  lp met schakelaar
  dubbele wcd.
- Overloop 16 :lp op wisselsch.bij deur s en v.
  lp op kruissch.bij deur s-v-w-d.
  2 dubbele wcd.
- Slaapkamer 17 :lp op wisselsch. bij deur s en bij bed.
  4 dubbele wcd.
- Badkamer 18 :lp. met schakelaar
  2 lp in wand boven wastafel,gelijk-
  tijdig geschakeld
  scheercontact.
- Slaapkamer 19 :lp met schakelaar
  3 dubbele wcd.
- Sl/studeerk.20 :2 lp met schakelaars
  lp in wand boven wästafel met schakelaar
  combinatie met wcd.
  6 dubbele wcd.
- Zolder 21 :2 lp met schakelaars
  2 dubbele wcd.
  aansl.voor c.v., aparte groep
- Zolder 22 :lp met schakelaar, 1 dubbele wcd.
- Zolder 23 :geen electa.

- Antenneleiding,leeg met dozen van de zolder naar kamer 7- kamer/keuken 9- studeerkamer 20 en meterkast.
- Telefoonleiding met ptt-dozen van de meterkast naar kamer 7- keukenkamer 9- sl/studeerk.20 en sl.kamer 17.
- Voor luidsprekerleidingen in kamer 7 plm. 20 m1 buis met dozen aan te leggen.

12-7. Alle lichtpunten-schakelaars-wandcontactdozen enz.: juiste plaats in overleg met de directie in het werk te bepalen.
De meeste schakelaars op plm. 110 cm.+vloer, wandcontactdozen plm.60 cm.+vloer.

Par. 13. Zinkwerk.

13-1. Alle hemelwaterafvoeren van zink no.14, met gegalkvaniseerde beugels. (ook vangoot hoge naar lage dak)

13-2. Zinkwerk in alle goten en krimpen vernieuwen (ook bij aanbouw) in zink no.14.Vergaarbakken zink no.16.

13-3. Platdak bijkeuken zink vernieuwen incl kraal enz., zink no. 14.

13-4. Voor het plaatsen van een houtkachel in de keukenkamer hiervoor aanbrengen vanaf het plafond in dekeuken tot buitendaks bij de nok, geheel volgens voorschrift, een dubbelwandige roestvrijstalen buis, geisoleerd, met alle benodigde hulpstukken zoals boehten-regenkap-dakdoorvoer-brandseparatieplaat- klembeugels enz.
Diameter ø 200 mm.

Franeker, februari 1985
Architectenburo N.J. Adema.

FINAL THESIS

GROUP 59

JESÚS PIZÁ MARTÍN

“Thermal comfort in a historic building in Franeker”

UNIVERSITAT POLITÈCNICA DE VALÈNCIA
ESCUELA TÉCNICA SUPERIOR INGENIERÍA DE EDIFICACIÓN
Hanze University Groningen