Inspection of wooden building Villa Annala

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The Renovation course 2012 subject in Helsinki is a brief survey of the Villa Annala, Hämeentie st., 154. The two-storey log and wooden-framed building is situated in a park area, and there forit has no plot or official registration number. For this reason, there have been no building permits or records of maintenance works in the building review office. The Parks department has served as the owner, and has organised together with the real estate department the upkeep of the building. The park itself is in excellent condition and the surrounding buildings are all in use. This main buildíng originally built by Konsul Wasenius in 1832 has been empty for over a year. The students have been asked to do a short survey of the building condition, offer alternatives for renovation, and finally give opinions concerning the future of the building. They are working in construction details and architecture team, ventilation and heating team and construction economics groups. The City of Helsinki is unable to give any information conerning the future of the building.

The organizers are The Helsinki Metropolia University of Applied Sciences, The Tallinn University of Applied Sciences with students also from St. Petersburg State Polytechnic University [6,7,9].

1. General description of the building

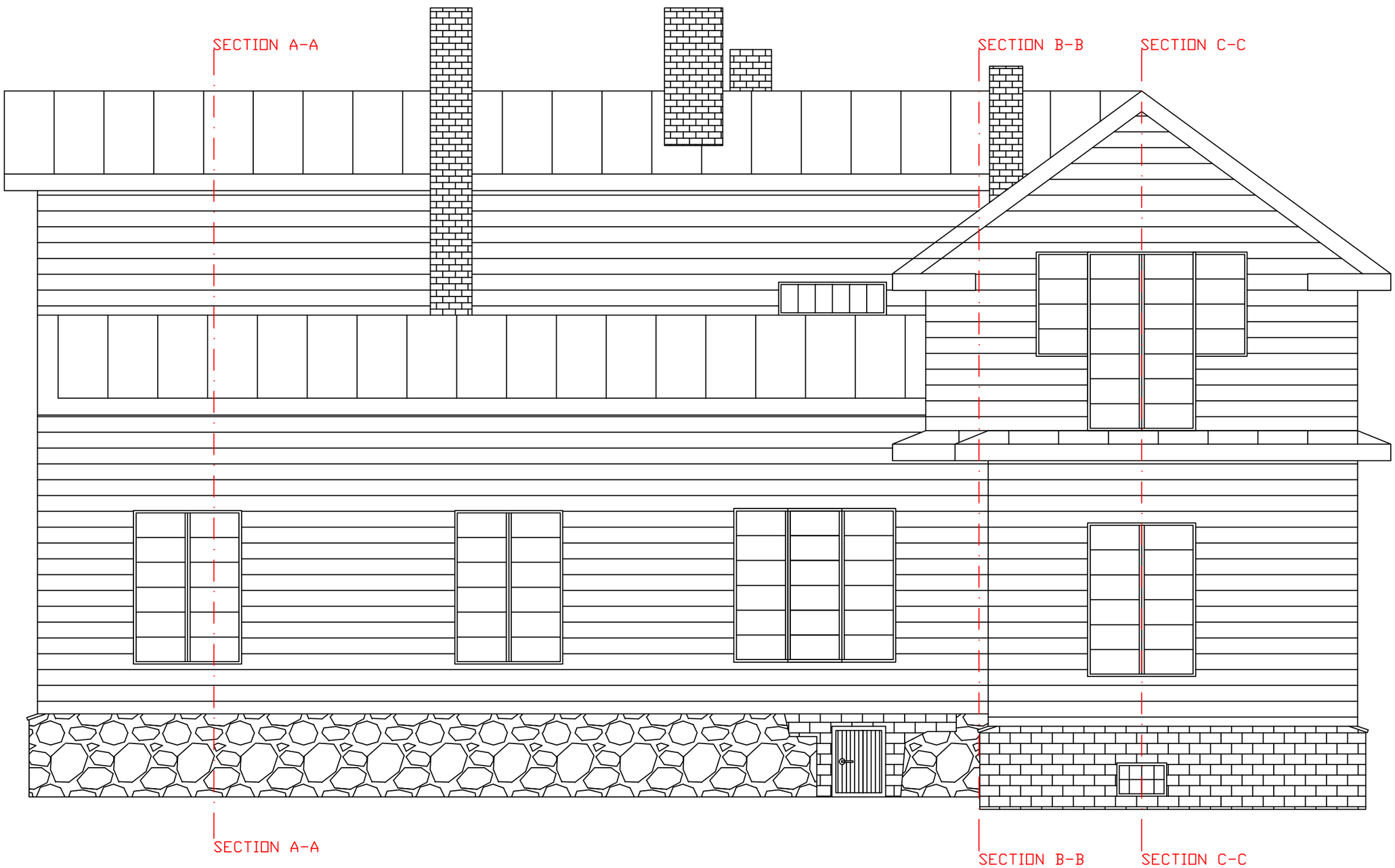
Villa Annala is a wooden building, which was mainly built in 1832. The building is located in Helsinki, in the district of Vanhakaupunki, at Hämeentie 154. It was originally established by Gustaf Otto Wasenius to be his summer house. Since then it has been used for residential use until few years back.

The building consists of the original old part and later built new part and it has been renovated several times. The foundations of the old part are made of natural stones, but the gaps between the stones were later sealed with some kind of plaster. This was probably made to prevent the heat escaping out of the building which also sealed the natural ventilation of the floor. The floors structure is made of timber logs and it's partly covered with plastic carpet. The walls of the villa are made mainly of vertical logs and covered at the outside with wooden cladding. The new part has brick foundations and wooden frame. The roofs are made of several different materials such as clay tiles and sheet metal. The building uses electric heating system but there is also working heating stoves and chimneys. The building is throughout in bad condition; the humidity has caused damages to the structures as well as affected the appearance. Most of the moisture damages are results of unwater-tight roofing combined with lack of sub terrain drainage pipes. The changes made during the renovation have affected original features of the structures. The crawling space of the building is not properly ventilated and it's full of construction waste so the humidity of the ground can't dry off which causes the moisture problems in the upper structures.

Picture 1. Villa Annala Manor House

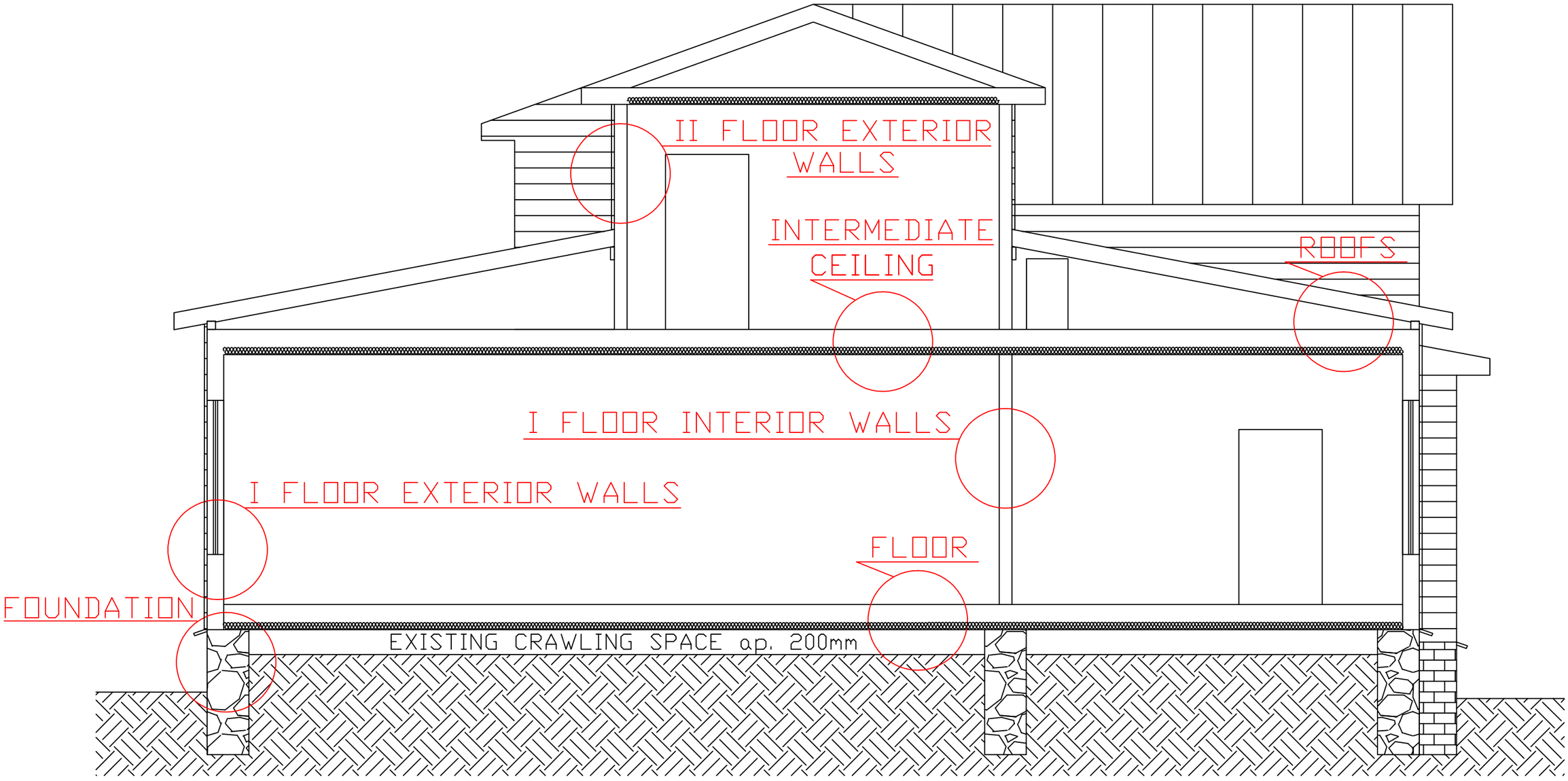
As the humidity of the ground has risen up through the foundation so the lower logs of the structure have obtained water and rotten over the time. The ventilation of the building is not working properly, which effects the natural ventilation and drying of the structures. The building envelope heat loss depends on the construction method and house type. Single-family home heat loss from the transfer of about 25-35% of the roof, outside walls, infill panels and through sub-base. This is divided in such a way that about 60% of the heat loss goes through the roof, about 30% of the external walls and about 10% through the basement. These percentages are dependent on the form of the house and its parts, different insulation levels, building on the quality and detail. They nevertheless provide an image of the house heat loss and the importance of the different parts of the building [1].

VIEW FROM THE NORTH-EAST



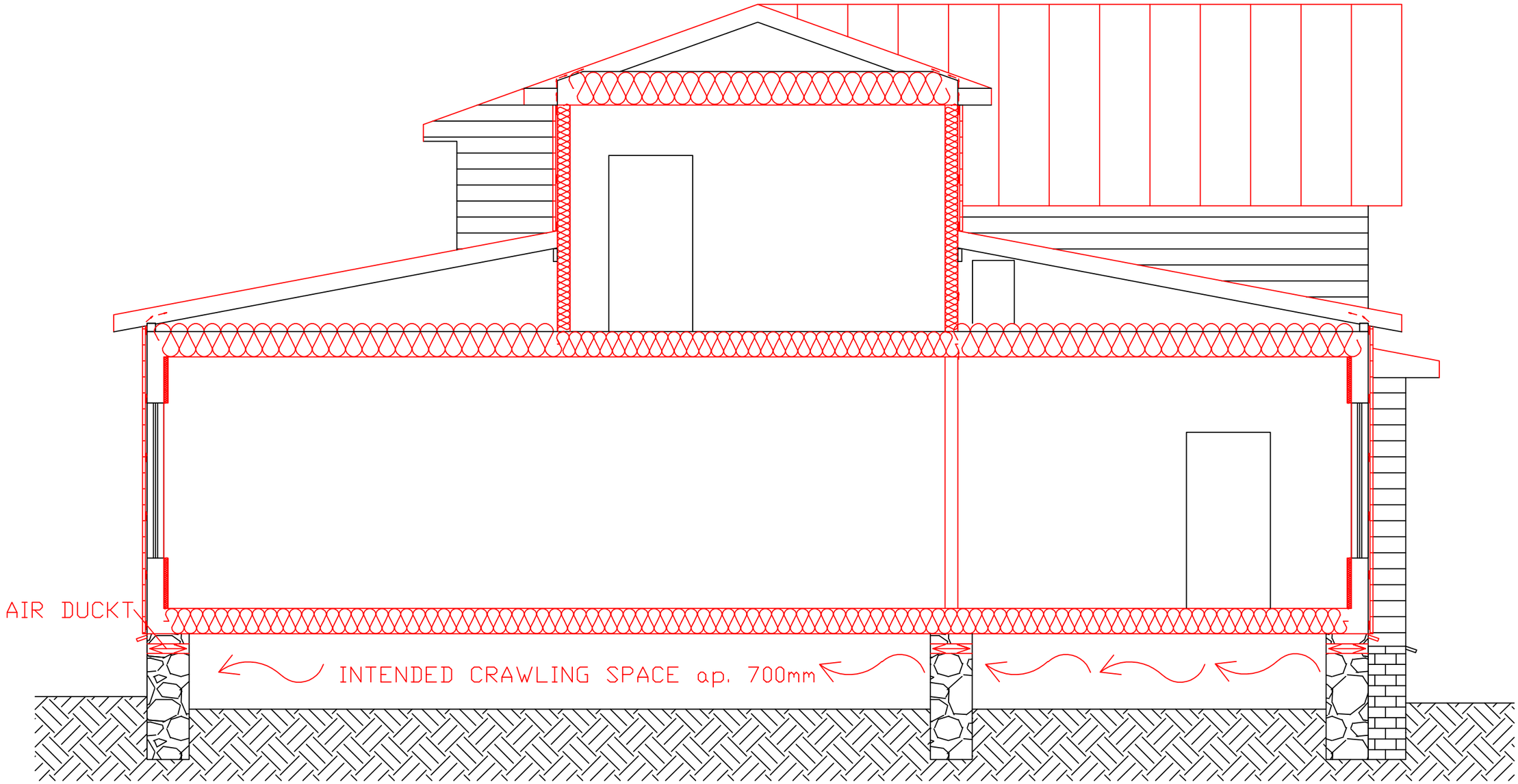
BEFORE RENOVATION

SECTION A-A



AFTER MAXIMUM RENOVATION

SECTION A-A



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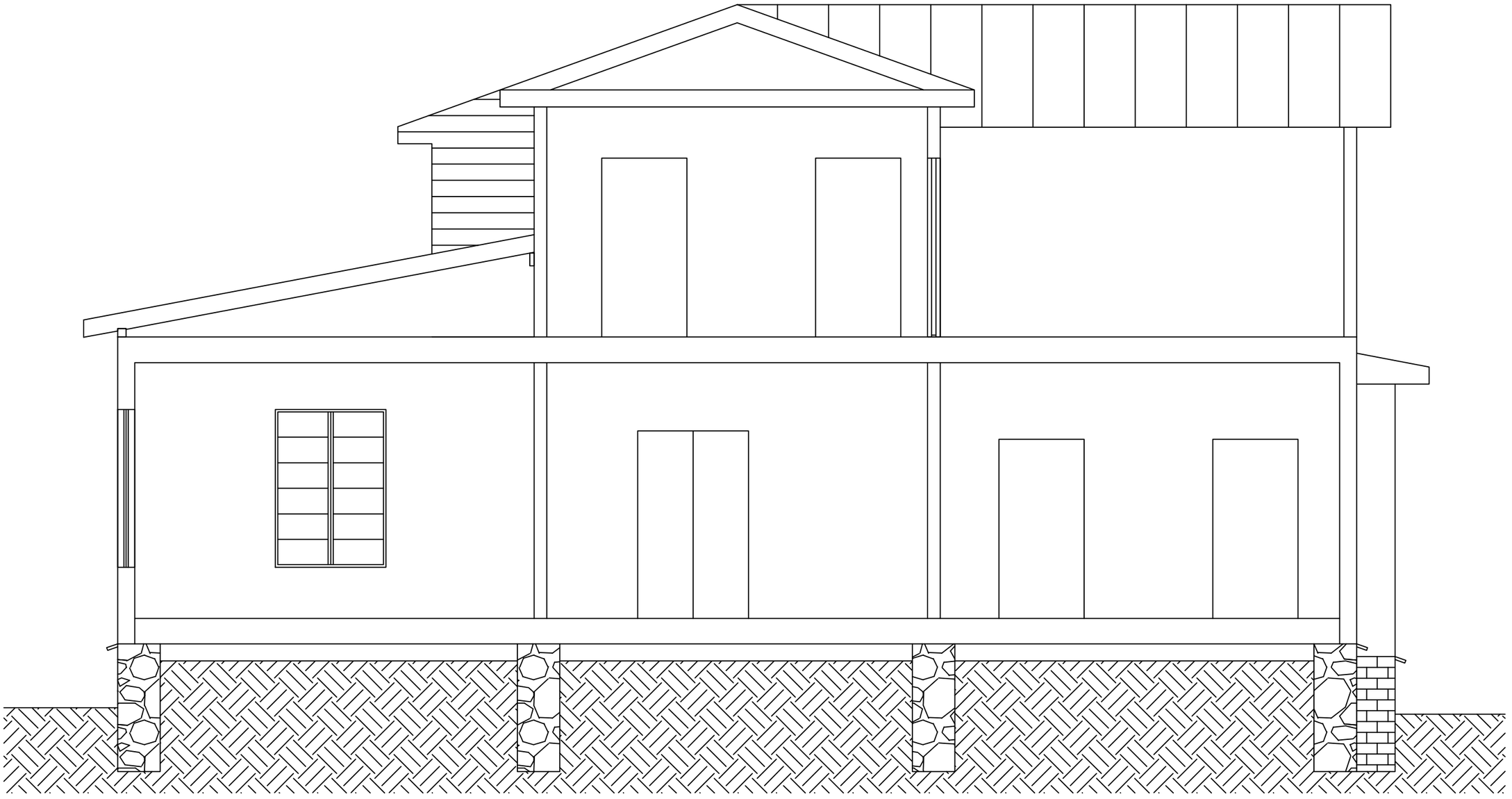

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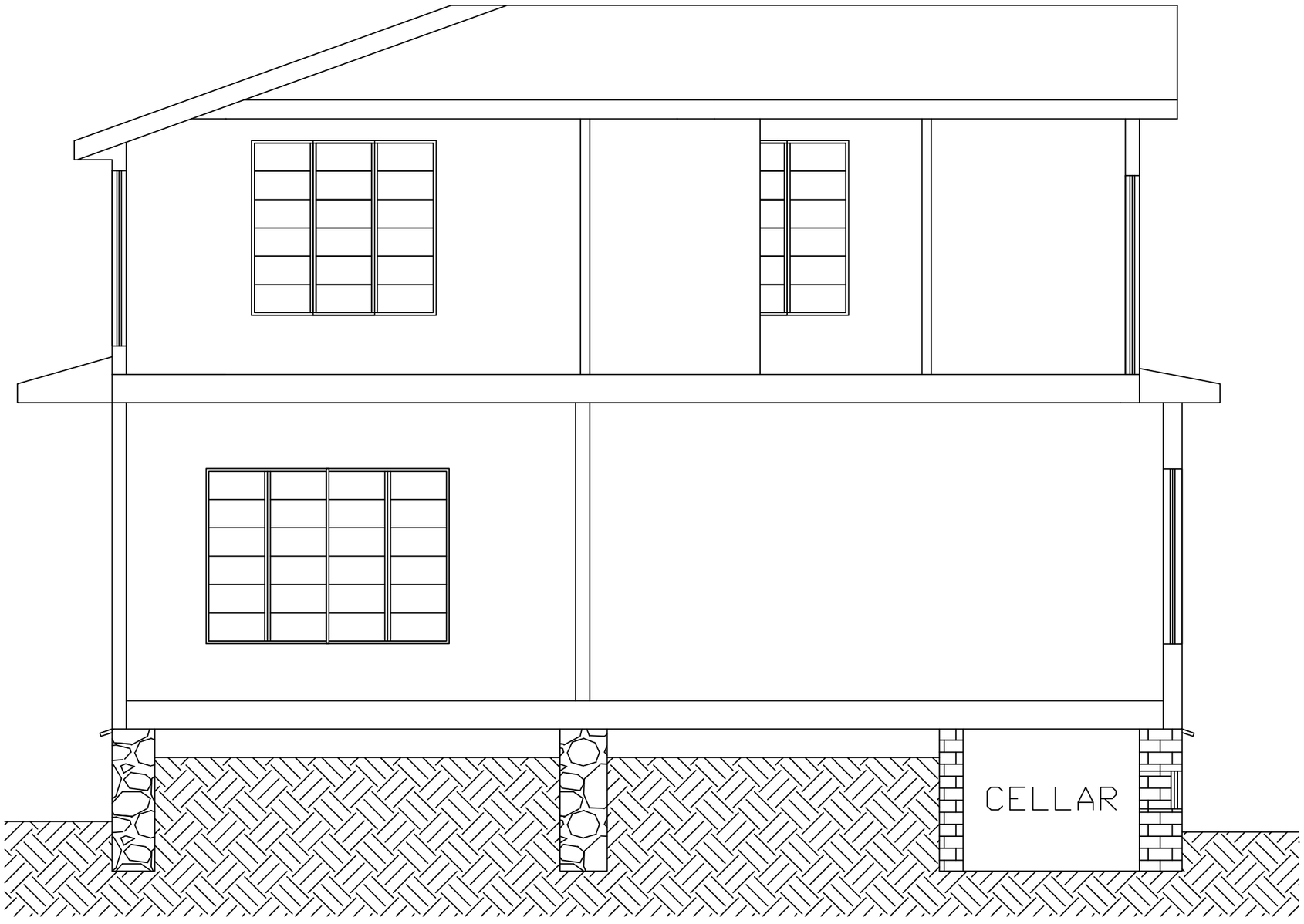


2. Foundation

The foundation of nearly 180 years old Villa Annala is made of granite rubble stones and the newer part behind the Villa which were destroyed in the World War II that has been built up from clay bricks [13]. We think that due to its old essence it has settled all of its settlements and the settling process isn't something we should worrie about anymore.

The main problems that occured with Villa Annalas foundation:

- The joints between the rubble stone has been covered with some kind of plaster which stops the natural ventilation of the foundation;
- Water/humidity damage caused by the leakages and the deficience of the rainwater pipes that didn't lead the rainwater away from the structure of the house so that infiltred into the walls, foundations and other essential structions of the building;
- The settlement cracks in the brick-foundation that are propably caused by the uneven settlement of the newer part of the foundation [19,20];
- The lack of ventilation duckts in the foundation to provide the proper ventilation for the first floor and too little crawling space underneath the floor for ventilation duckts to work.

Picture 2. Settlement cracks

In the following section our group brings out some suggestions:

Minimum version:

- The joints between rubble stone must be cleared out to provide natural ventilation
- Anchor the cracked part of the foundation to the well preserved part to prevent it from collapsing
- Install drainage system to lead the ground and rainwater away from the foundation of this building

Picture 3. Water damage

Maximum version:

- The joints between rubble stone must be cleared out to provide natural ventilation;
- Anchor the cracked part of the foundation to the well preserved part to prevent it from collapsing [14];
- Install drainage system to the ground to lead the ground- and rainwater away from the foundation of this building;
- Excavate the perimeter of the foundation to install thermal- and water insulation for the foundation to prevent further water and humidity damage;
- Drill holes in the foundation wall for the ventilation to provide the crawling space with fresh air;
- Excavate the soil inside the foundation to improve the ventilation of crawling space.

3. Floors

The structure of base floor is badly ventilated. The insulation of floor is organic material like moss, saw dust and construction waste. There's no air sealing on the insulation. The lack of air sealing has caused the air flow from crawling space through the base floor and has led to energy losses and unpleasant smell to indoor air [3, 4, 8, 17]. There's also garbage stored in crawling space which had caused a bad smell and there's a possibility for mold. Intermediate floors structure is the same as the base floor [2, 3, 15, 19]. Intermediate floor is repaired only in maximum version.

Picture 4. Floors

Minimum version:

- The old floor planks, PVC sheets and all other interior floor layers are removed. The planks that are in good shape are stored and reused.
- The air seal plastic is installed on the old insulation. Plastic has an overlay on the walls 300 mm high.
- Good shaped and new floor planks are installed back.

Maximum version:

- All procedures presented in minimum version are made
- Before installing the air seal plastic the old insulation and possible cardboard is removed. Insulation supporters are checked and the possible broken ones are replaced with new ones.
- The air seal plastic is installed on the supporter planks and the base floor is filled with blown loose wool. The blown loose wool must be compressed properly to avoid the sinking of insulation and ensure its function.

4. Walls

According to Finnish officials (Museovirasto, in English NBA) [22] log-wall is a that type of structure, which doesn't necessarily need extra thermal insulation. You better save energy in other places [17]. However it's possible to add extra insulation, but it's very expensive and it needs a lot of designing. In maximum version we have both money and time, so we will do it, but in minimum version we will just do the basics [16]. Air tightness in log structures is usually quite good, because the logs have pressed during the time. The biggest problems are the cracks and holes [19,20]; these can be found by thermographic camera. We also ensure air tightness with wind barrier and humidity blocking, according to Museovirastos recommendations. The structure of building also varies between horizontal and vertical logs, but we assume, that it works in similar way. Empty walls in second floor are modified to a modern wall structure [10, 11]. Interior wall materials are just changed to new ones. When renovating interior surface the electrical assemblies should be done and hidden, for example under the ceiling.

Picture 5. Wooden materials in bad shape

Minimum version:

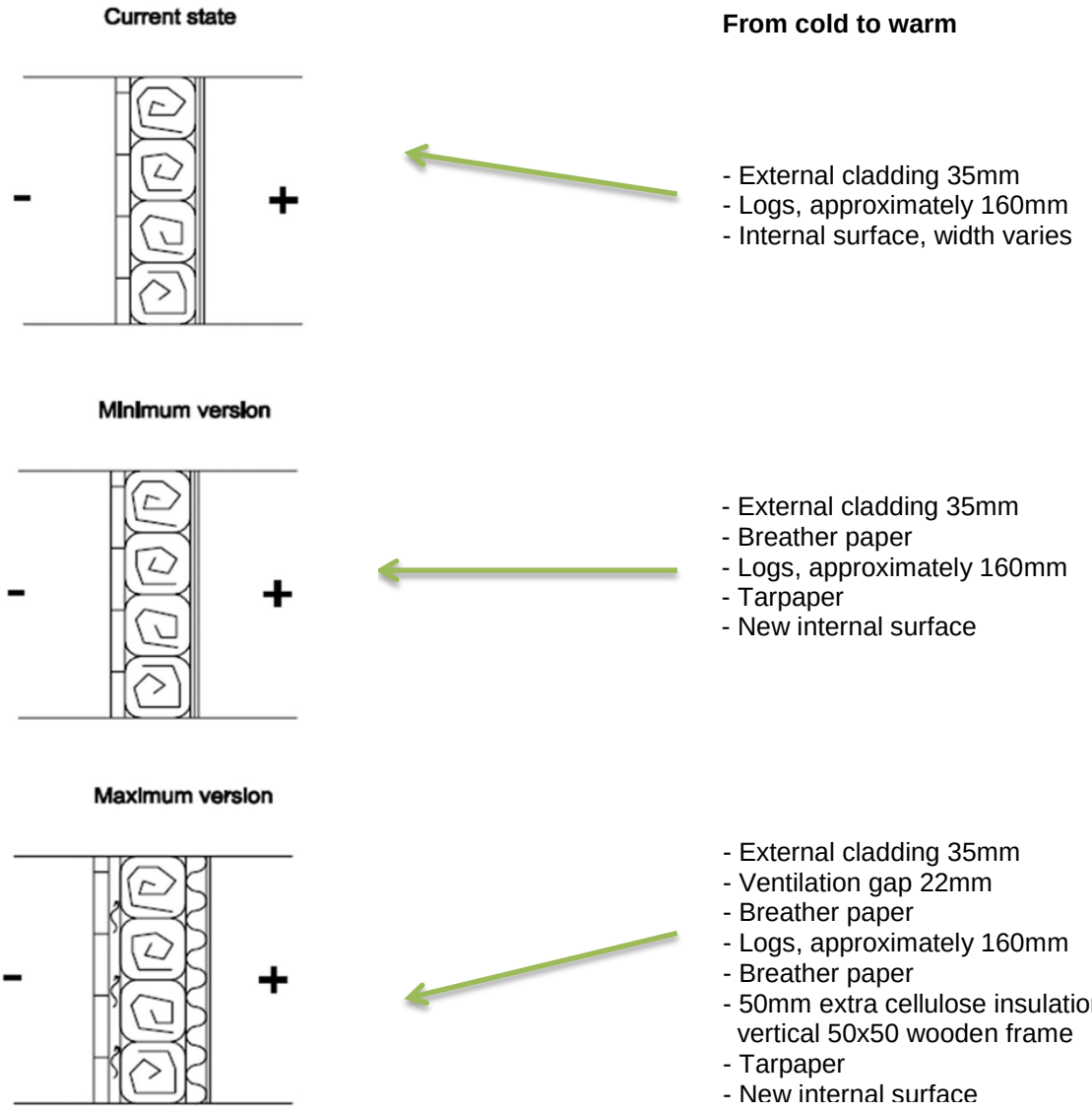
- Removing polluted external cladding. We try to re-use as much old cladding as possible.
- Removing of polluted internal surface.
- Empty walls are renovated as modern walls, structure grows inside.
- Fixing the holes for increasing airtightness, best device to find these holes is thermographic camera.
- Increasing air tightness by adding wind barrier and humidity blocking.

- New internal surface, according to Museovirastos recommendations.

Maximum version:

- Adding an ventilative air gap [12]
- 50mm extra thermal insulation inside (cellulose). This is the most difficult part of wall renovating. Movement of cold and moisture has to be calculated and designed very carefully and details of structural joints.
- Removing polluted external cladding. We try to re-use as much old cladding as possible.
- Removing of polluted internal cladding.
- Empty walls are renovated as modern walls, structure grows both inside and outside.
- Fixing the holes for increasing airtightness, best device to find these holes is thermographic camera.
- Increasing air tightness by adding wind barrier and humidity blocking.

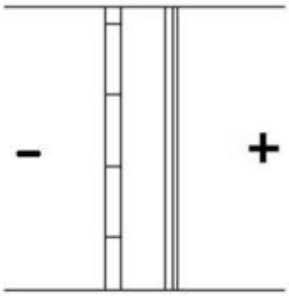
- New internal surface, according to Museovirastos recommendations.



Picture 6. 1st current state of wall

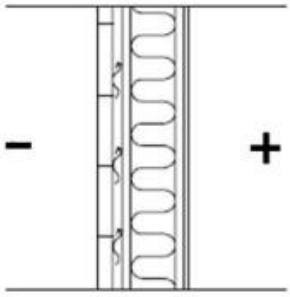
Current state 2. Floor "empty walls"

From cold to warm



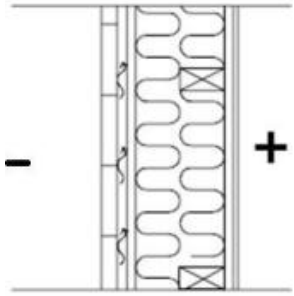
- External cladding 35mm
- Vertical Wooden frame 100mm
- Internal surface, width varies

Minimum Solution for 2. Floor "empty walls"



- External cladding 35mm
- Air gap 22mm
- Wind barrier 25mm
- Cellulose insulation 100mm + vertical wooden frame
- Tarpaper
- New Interior surface

Maximum Solution for 2. Floor "empty walls"



- External cladding 35mm
- Air gap 22mm
- Wind barrier 25mm
- Cellulose insulation 100mm + vertical wooden frame
- Cellulose insulation 100mm + horizontal wooden frame
- Tarpaper
- New Interior surface

Picture 7. 2nd current state of wall

5. Windows

The renovation of window is very important. The cold air can penetrate through holes and cracks of the window inside the building and it is the main cause of heat loss [3, 4, 8]. Therefore complete repair of heat insulation is very important to attain. We should add sealing tape in corner and crack between different parts of windows or if it is possible we would change the window, replace with new wooden window and provide airtightness. We can install acoustic insulation to prevent noise penetrating from outside structure.

Picture 8. The window

Minimum version:

- Add sealing tape.

Maximum version:

- Change/ repair the window;
- Provide airtightness;
- Install acoustic insulation.

6. Roof

The roof is very important part of construction, because it keeps buildings interior dry and protects structure from rain water, snow etc. [18]. We need to protect the roof from water leakages and further damages of different part of structure. The best way to avoid the thermal bridges is to provide an extra insulation approximately 400 mm – replace old material with cellulose wool, add vapour barrier underneath the thermal insulation layer to prevent the warm air from penetrating the cellulose wool. We should replace the roof covering material with sheet metal to protect construction from water leakages and install rain gutters to lead the rain water away from the construction.

Picture 8. Bad covering materials

Problem: water leakages, cracks, decaying of timber structure

Minimum version:

- Provide extra insulation (cellulose wool);
- Change roof covering materials (sheet metal).

Maximum version:

- Provide extra insulation (cellulose wool)
- Change roof covering materials (sheet metal).
- Install rain gutters
- Add vapour barrier underneath the thermal insulation layer.

7. General architecture / construction decisions

After 3 days and thoroughal inspection of Villa Annala which is located in Helsinki on hilltop in Hämeentie 154 our group elaborated two different types of suggestion and recommendation charts, one of which is for minimum and the other for maximum mount of repair works that can be take into consideration when the Villa goes under renovation.

The first recommendation chart which is generated for superficial repair works includes (e.g. support works for foundation and drainage pipes and collectors for the rain- and groundwater) minimum requirements which are essential for the Villa to conserve and to stop the process of decaying.

Second chart is considered for more thoroughal renovation works which includes (e.g. the renovation of the windows of the entire house and replacing the timber parts of the villa that have been damaged by water and humidity) greater mount of renovation works on foundation, floors, interior and external walls, intermediate ceiling, roofs and windows. All of the repairing and renovating works that are indicated in the both recommendation charts must previously be in accordance with Finnish Museovirasto (National board of antiquities) [22].

Minumum version

- The repair works are superfical + Less expensive;

Maximum version

- More expensive + Thoroughal repair works [16].

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