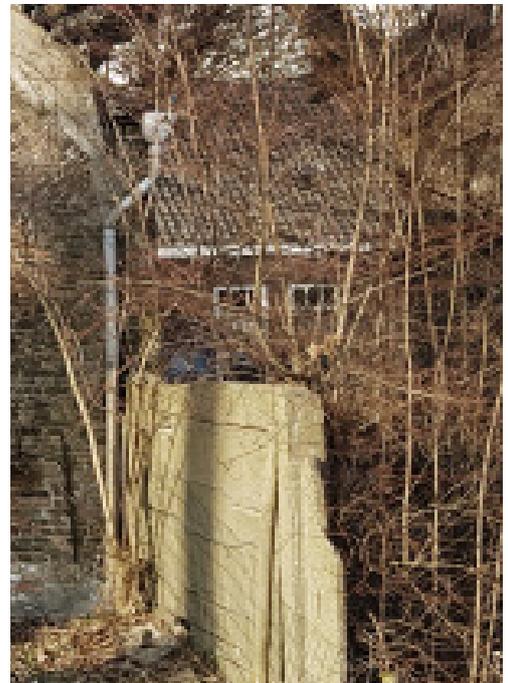


Building Conservation Assessment Report

Hammenpoort “Karnbarn”



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MSc 2 AR0015
Building conservation Assessment

Hammenpoort
Garden Park Estate
Rotterdamseweg 155
2628AL Delft
South Holland

Inspection Period
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Tutors: Silvia Naldini & Barbara Lubelli

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01. INTRODUCTION

This report was written under supervision of Silvia Naldini and Barbara Lubelli, and concerns the damage assessment [course AR0015] and the analysis of the former churn-barn, part of the Hammenboerderij complex located on the Rotterdamseweg, Delft.

The Hammen-complex is listed as a national monument, consisting of several objects in varying condition. The oldest remains are the old cellar from 1550 under the main-house, followed by the old churnbarn that was probably built between 1650 and 1700. Our analysis concentrates on the barn, focussing on the exterior damages on the south wall, and the remaining timber structure of the mill on the inside.

The Hammenboerderij has known many different owners, but was acquired by the Technical University Delft in the 50's. Since 2010, the last permanent residents moved out, leaving the Hammencomplex with a big problem: what should its new function be?

The University acknowledges the historical importance of the complex, but hasn't made a big effort to do a thorough restoration, or at least not until an new function has been found. Delft extended the city towards the Rotterdamseweg, and an educational campus was realised. After the war the expansion sped up even more, and the layout more or less as the current campus as we know it today was built.

The complex has been thoroughly monitored though, and we compare our results with data from previous examinations.

The main goal of this assessment was to understand the several processes that have taken place within the structure of the barn, and to find solutions to maintain it. The first step we took was a site-visit, where we documented the damage. In a second site visit we focused on measurements we missed the first time, and tried to confirm several hypotheses we had formulated.

Combined with prof-literature research, we made a value assessment and combined the outcome of our research with possible solutions. With the help of MDCS, we were able to categorize the damages and processes we found, however, the damage assessment of the wooden beams proved difficult within the interface of MDCS. We decided to mitigate our information to our own format, and consequently this booklet is the result.

02. HAMMENPOORT

The settlement of Delft came into being next to the canal 'Delf' presumably around the 11th century. From simple landlord court, it grew out to a city, receiving its rights in the 13th century. Its importance grew when Willem of Oranje, the leader of the Dutch resistance against the Spanish occupation during the 80-years'- war, took up residence. This also marks the moment city walls were built around the city, and when the Netherlands became independent in 1581, Delft, as residence of the Prince of Oranje, was named the capital¹.



The current Rotterdamseweg used to be far outside the city walls of Delft, which is why its founder, Claes Arentsz, built the farm here in 1556. Old maps show that there was only a handful of buildings on the east-side of the road next to the Schie, and until the Second World War it stayed that way.

Arentsz was the owner of a brewery located within the city walls of Delft, in an area called 'in de Ham' [in the Ham]. After the widow of Arentsz died in 1606, the Hammengate was added in her honour. The hams displayed in the top corners of the gate, is presumably how the complex ended up with its current name².

Several important historical maps of Delft and the area surrounding Delft show the farmhouse through the centuries³, and how its situated in the typical polder landscape. During these centuries, the Rotterdamseweg was merely a dirtroad, and most transportation would happen by means of ship, using the Schie. Though the farm was owned by the family of Arentsz, they seem to have never lived there, and it was eventually sold in 1769.

Little can be found about later owners, but the farm survived the expansion of Delft through the subsequent centuries.

Right before the Second World War broke out, Delft extended the city towards the Rotterdamseweg, and an educational campus was realised. After the war the expansion sped up even more, and the layout more or less as the current campus as we know it today was built.



Even though originally the building was meant as an outside 'get away', today the complex is fully surrounded by the old harbour buildings on the west-side of the Rotterdamse weg, and the campus on all other sides.

The land surrounding the farm was gifted to the University in the '50's, but the owners at the time didn't want to leave their farm.

A deal was made that the University would acquire the farm when vacated. Since 2010 the entire property belongs to the TU Delft, who has shown a preference towards keeping the green characteristic of the plot.

Student housing has been built on the edge of the farmland, but most of it was then turned into a green park.





HISTORY OF HAMMENPOORT

The 'Hammenboerderij' complex consists of 5 different buildings, that are all listed as national monuments:

1. The Hammenpoort 1609
2. The farmhouse 'Hammenwoning'
3. The large cow barn to the left of the house
4. The churn barn to the right of the house
5. The haystack buildings behind the complex.

THE GATE

The gate was constructed in 1608, and is one of the most notable features of the complex⁴. According to the monument database, the gate is a refined example of the Noord-Nederlandse Renaissance style. As mentioned before, the gate was erected in memory of the widow of the first owner, Claes Arentsz. Because of his connection to the brewery 'the Ham' (named after its location in Delft, situated next to a inham [inlet] in the canal), the gate received its two hams on the façade⁵. Urban legend says the farm was once sold for no more than two hams when economic hardship struck⁶.



Delft - De Hammenwoning - Rotterdamseweg

THE FARMHOUSE

The most notable change to the complex happened when the last owner before the TU Delft made plans to rebuild the farmhouse⁷.

As he didn't like the old Hammenboerderij, he wanted to demolish part of the complex and change the floor plans.

The permit was provided under condition the front façade was rebuilt as the original style of the 17th century. An old postcard of 1913 shows the façade before it was rebuilt⁸, and we see that the left side is in 17th century style and the right side is in 18th century style.

In 1927 the house is rebuilt, with a completely new façade in 17th century style⁹. He did not keep the previously existing 17th century façade, but a painting by J. Verheul from 1608 shows the new façade precisely resembles the 17 century one¹⁰.

He also changed the plot and roof of the house, and detached the churn-barn. It is believed that the north façade of the churn-barn was previously part of inside of the farmhouse, and was rebuilt during those years with rather cheap bricks.



Delft 9 Augustus 1904. De Hammenwoning - Rotterdamseweg



03. CHURN BARN

The churn-barn once was connected to the farmhouse, before it was rebuilt in 1927. It was constructed somewhere in the 17th century, although the exact date is unknown. On the oldest map we have found, the Cruquius map (1712) one could distinguish some buildings that look like the barn³.

When the barn was separated from the farmhouse, the north-façade was rebuilt and the roof replaced. The old barn was, as is traditional, covered with reed¹, while the new material were roof-tiles. At the same time the height of the barn was extended, possibly to make room for the new roof construction. Even though the new roof construction is less than 100 years old, most beams show heavy degradation and detachment from the wall.

The building is divided in two parts, one originally functioning as the 'rosmolen' [horse powered mill] and the other as 'hygienic' zone to process the butter further.

In this zone the oven and chimney are still visible, and the walls are partly covered with tiles and plaster.



There is also a small attached building, with an old outhouse in it.

The barn was constructed with yellow hand-moulded brick¹², with a plastered plinth. During the renovation and extension in 1927, the roof was raised with approximately half a metre, using machine moulded bricks.

Cement plaster was used to cover up the use of these bricks, and can also be found on the north façade and the outhouse. The window frames are made of wood, and have original pen-hole connections [pen-gat verbinding]. In the southern part of the churn-mill, the circular pavement still shows the location of the old mill, and some of the old wooden construction once supporting the wheel of the mill are left. Although small, a horse used to walk around to power the paddles that churned the milk in the northern part of the barn. (See image)

¹ General knowledge, supplemented with information from: Gerrit Verhoeven, De derde stad van Holland. Geschiedenis van Delft tot 1795. (Zwolle 2015)

² http://www.wikidelft.nl/index.php?title=Toon_object&identifier=S3427&searchtitle=

³ The Cruquius map (1712) access via: <https://www.tudelft.nl/en/library/collections/map-room/map-collection/historical-maps/cruquius-map-1712>

And Jacob van Deventer (1556), Militaire Kaart (185)

⁴ J. Verheul Dzn., Merkwaardige oude inrijhekken alsmede poort- en hoofdingangen in en om Rotterdam, deel 1, p. 90-93, Rotterdam, 1936

⁵ <https://www.monumenten.nl/monument/11618>

⁶ http://www.dbnl.org/tekst/meij090hekk01_01/meij090hekk01_01_0007.php

⁷ <http://rijksmonumenten.nl/monument/525277/hammenwoning:-vrijstaande-woning/delft/>

⁸ <https://www.house-of-cards.nl/product/delft-1913-de-hammenwoning-rotterdam-scheweg-hc1351/>

⁹ An old postcard from 1904 https://www.ebay.fr/sch/Cartes-postales/914/i.html?_sop=3&_nkw=delft

¹⁰ Painting by J. Verheul 1608 https://farm6.static.flickr.com/5173/5482298839_e450cb2f69_b.jpg

¹¹ This is visible in the postcard from 1913.

¹² <http://rijksmonumenten.nl/monument/525277/hammenwoning:-vrijstaande-woning/delft/>

03.1 MATERIALS USED



1. Masonry wall
Red and yellow hand-moulded bricks with cement mortar.

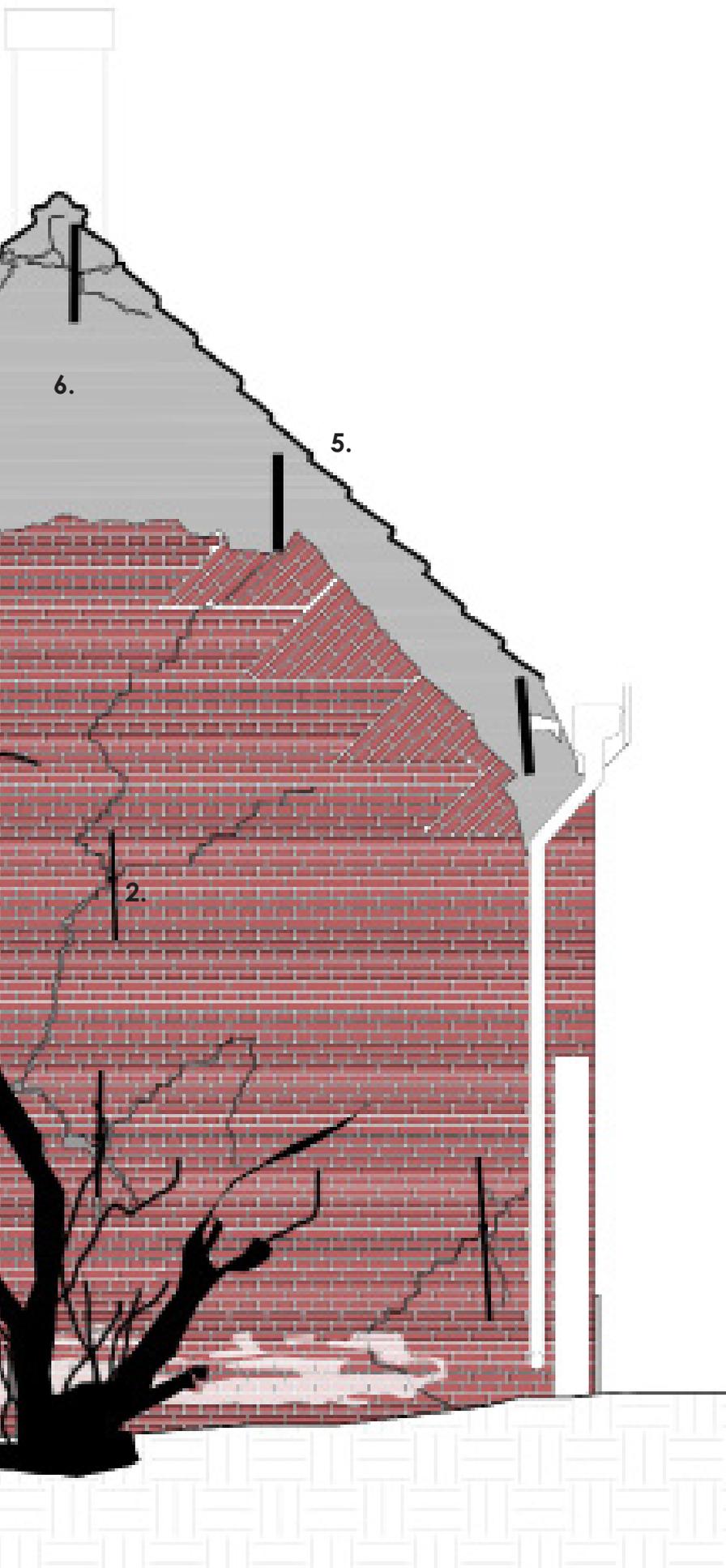


2. Wrought Iron Anchors



3. Cement plinth

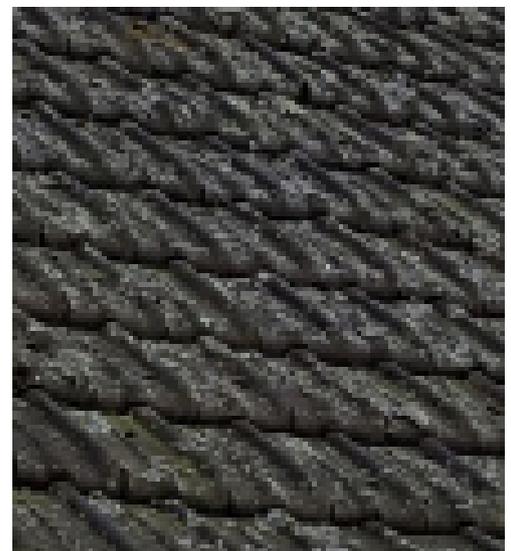




South Elevation



4. Timber Roof Structure



5. Kruispan, Bouletpan, Echter pan



6. Cement Plaster

03.2 MATERIAL DAMAGES

1. Red and Yellow hand-moulded bricks

Diagnosis

Damage Type A: Biological growth on masonry wall

Brick » Biological growth » Algae may enter into symbiosis with lichens.

Hypothesis

The south wall is exposed to large amounts of daylight therefore biological growth is an uncommon phenomenon. However, there are a lot of trees in the surrounding area that provide shading and could contribute to the biological growth. Furthermore, we observed that the biological growth is mostly concentrated on the area close to the gutter and the drainage pipe. As a result, it could be there due bad drainage and leakages that keep the masonry wall moist even with adequate exposure to sunlight.

Intervention Proposal

This type of damage is not structurally harmful. The most important part is to improve the drainage system and avoid leakages that can exacerbate the problem or cause other problems.

Algae can be removed, but its only because of its aesthetic influence to the existing facade. Brushing and washing are the least invasive techniques that can be implemented.

However, since there is no serious reason why it should be removed we decided to avoid cleaning.



Diagnosis

Damage Type B: Surface Change on Hand-moulded bricks

Brick » Surface change » Deposit » Soiling
Deposit of matter (dirt) coming from outside the material and not leading to chemical transformation. The underlying material stays unchanged. The matter may adhere quite well.

Intervention Proposal

Brushing and Washing are suitable cleaning techniques however, since cleaning can damage the hand-moulded bricks or increase their water absorption and thus cause more severe damages, we suggest to leave it as it is, in a way acting as a water repellent layer than also underlines the age of the construction.

Damage Type C: Surface Change on Hand-moulded bricks

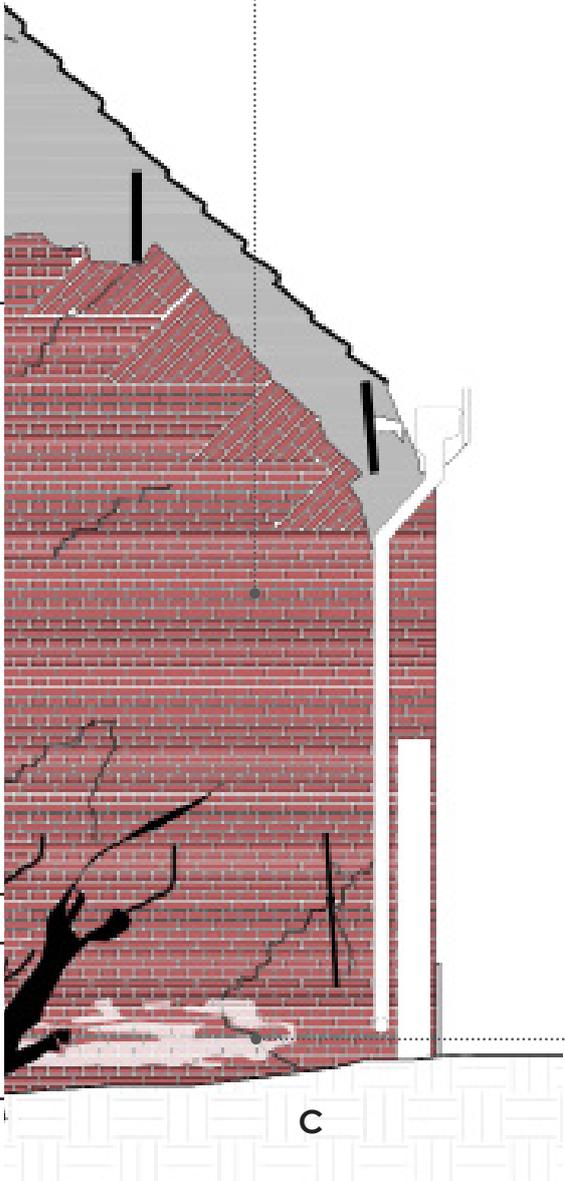
Brick » Surface change » Staining
Remaining material from the missing cement plinth can be found on the bottom of the masonry wall.

Hypothesis

From our archival material, such as historic photographs and text we found out the South wall had once a cement plinth just like the other sides of the building. This plinth has fallen off, possibly due to the growth of the tree. Its remains are still present at the river bank -. The hand-moulded bricks still carry a thin layer of the cement plaster in certain areas.

Intervention Proposal

Similarly to the above damage, there are no structural implications. The layer of the cement plaster can be cleaned but this poses a risk of further damaging the bricks. We would suggest either to leave as it is where there remaining plaster is a reminder of the original character of the building or repair it.



03.2 MATERIAL DAMAGES

2. Wrought Iron Anchors



Diagnosis

Damage Type D: Rust Formation on Wrought Iron Anchor

Intervention Proposal

The iron anchors can be de-rusted and re-treated so as to maintain their structural role in the facade. Anchors that have rusted more than what is possible to be repaired should be replaced.

6. Cement Plaster

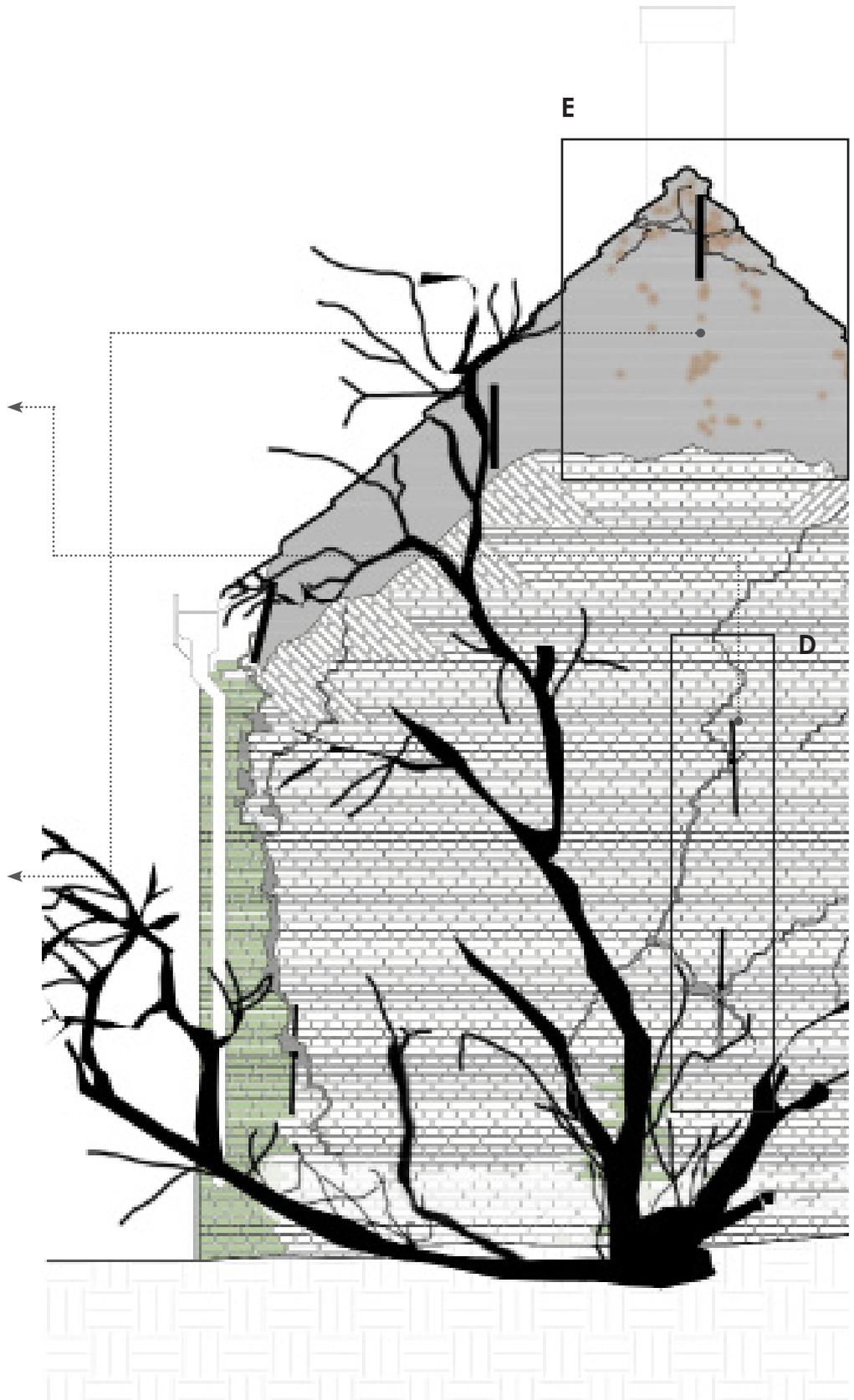
Diagnosis

Damage Type E: Plaster » Biological growth » Lichens

Lichens grow under external climatological conditions, in patches, and have a leathery appearance; they are usually yellow, orange, red, brown, grey or black. A closer look will reveal different forms resembling to: crusts, scales and leaves.

Intervention Proposal

This type of damage is not structurally harmful. Brushing and washing are the least invasive techniques that can be implemented. However, since there is no serious reason why it should be removed we decided to avoid cleaning.



7. Interior Plaster Layer



Diagnosis

Damage Type G: Plaster » Cracking » Star crack

A star crack has the form of a star, that is to say it has a central point where from cracks similar to rays stretch out in all directions. N.B.: Rusting iron or impact load are possible causes of this type of damage. Layering (more than one layer) of material with an originally not laminated structure.

Intervention Proposal

See further study with external cracks



Diagnosis

Damage Type F: Plaster » Disintegration » Layering » Exfoliation

Layering (more than one layer) of material with an originally not laminated structure.

Intervention Proposal

Repair of plaster layer.

03.3 VALUE ASSESSMENT

Aspects	Artistic	Historical
Form and Design		
Materials and Substance		<p>The hand moulded iron anchors do add value to the structure despite severe deterioration.</p>
Use and Function		<p>Based on the research and our research on the remaining structure, it is proposed to convert it into the "prim" process.</p>
Tradition, Techniques and Workmanship		<p>The original method of construction into traditional workmanship yet it is not a unique architecture.</p>
Location and Setting	<p>In terms of composition the kambar and its connection to the rest of the complex and its connection to the canal and greenery of the area offer great possibilities.</p>	<p>Particularly important in the development of the area.</p>
Spirit and Feeling		<p>Very few elements of the floor or the timber parts remind you of the bam.</p>

Historic	Social	Scientific
	<p>The proportion, shape, and size of the kambarn, as well as its orientation and connection to the rest of the complex offer great potential for its redevelopment.</p>	
<p>Red bricks with the glazing back to 1600s in barn. Age value is taking place.</p>		
<p>Roof structure and in chum mills the structure offers an insight into "olive" production.</p>	<p>It is one of the oldest farms in the Netherlands and its location contributed to the development of the Rotterdamseweg.</p>	
<p>Materials offer insight into techniques and are an example in Dutch architecture.</p>		
<p>Important in terms of context of the surrounding area.</p>	<p>Very good connection to Tu Delft campus.</p>	
<p>Elements such as the roof structure is some of the initial function.</p>		

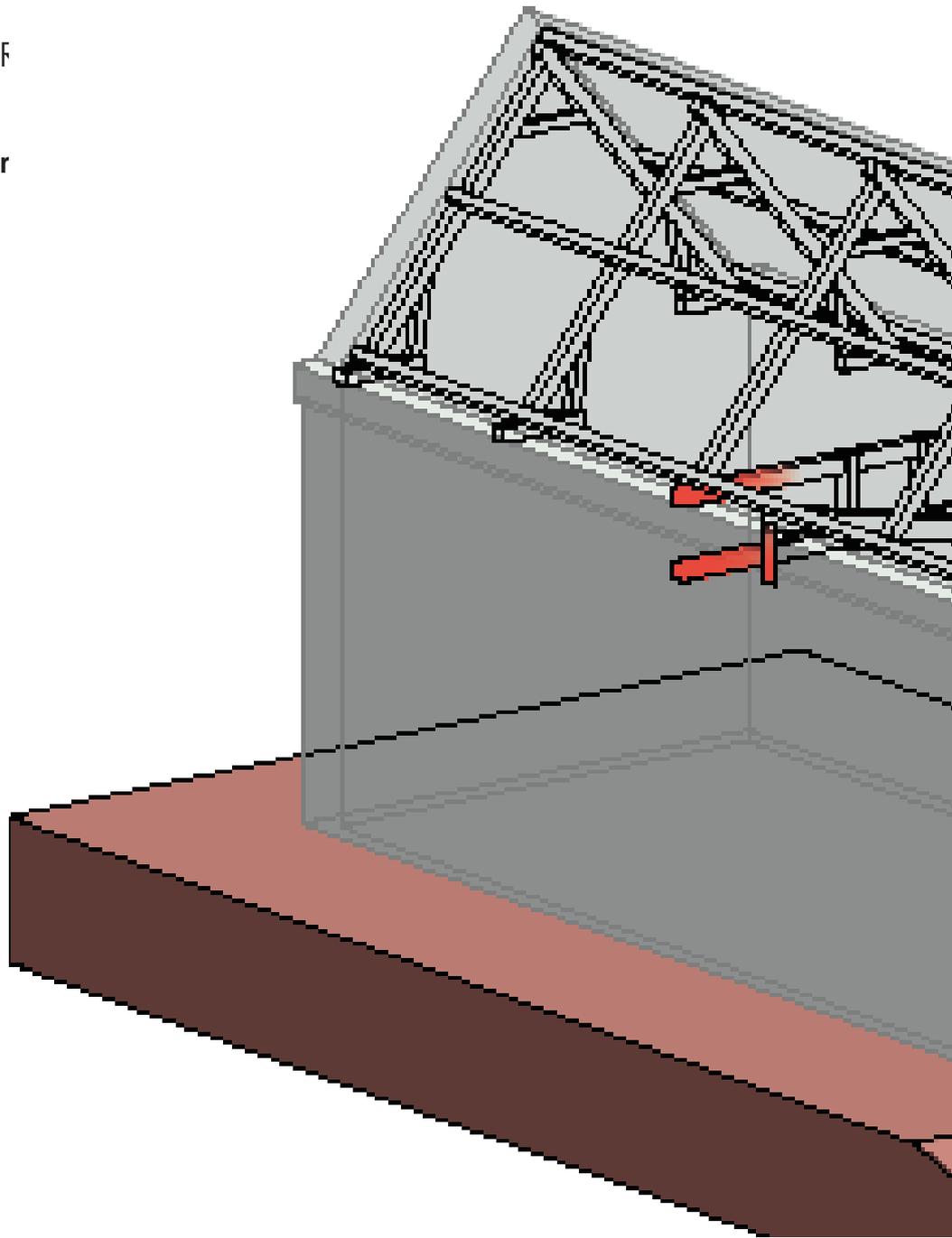
04. STRUCTURAL DAMAGE AFTER

04.1 Damages caused by wood rot

The reconstruction of the barn roof has been the most recent refurbishment. It shows only minor defects like leakage due to broken or disintegrated roof tiles and - as a consequence of wood rot - a weakened eaves purlin and a deformation due to a no more supported truss.



Main attention shall be given to the structure of the now removed mill - the oldest remaining timber-structure in the barn. As the entire building is poorly isolated and various beams permeate the masonry of the outer wall (marked red in scheme), humidity becomes a severe issue for the antique timber.



Diagnosis

Damage Type: wood rot on the construction of the mill.

No fruit body, no strands, no mycelium. Without fruit body, strands or mycelium in the parts of highest humidity, especially adjacent to outer walls.

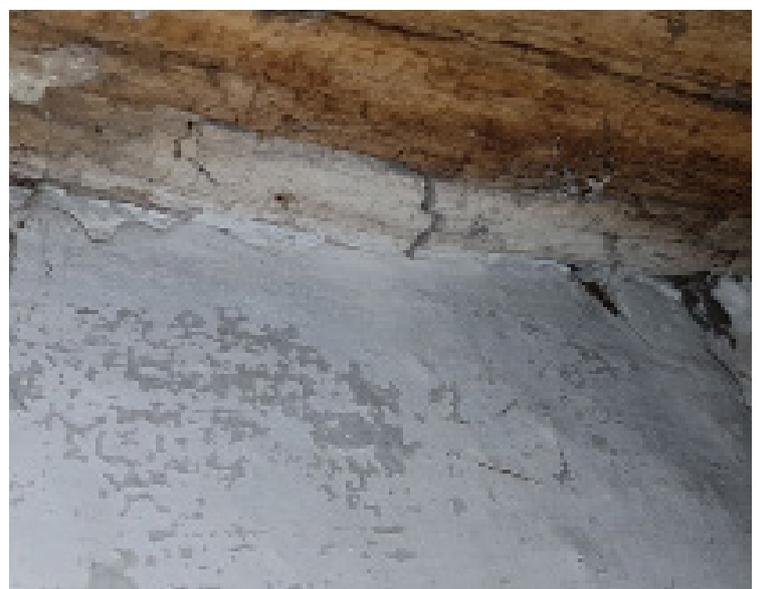
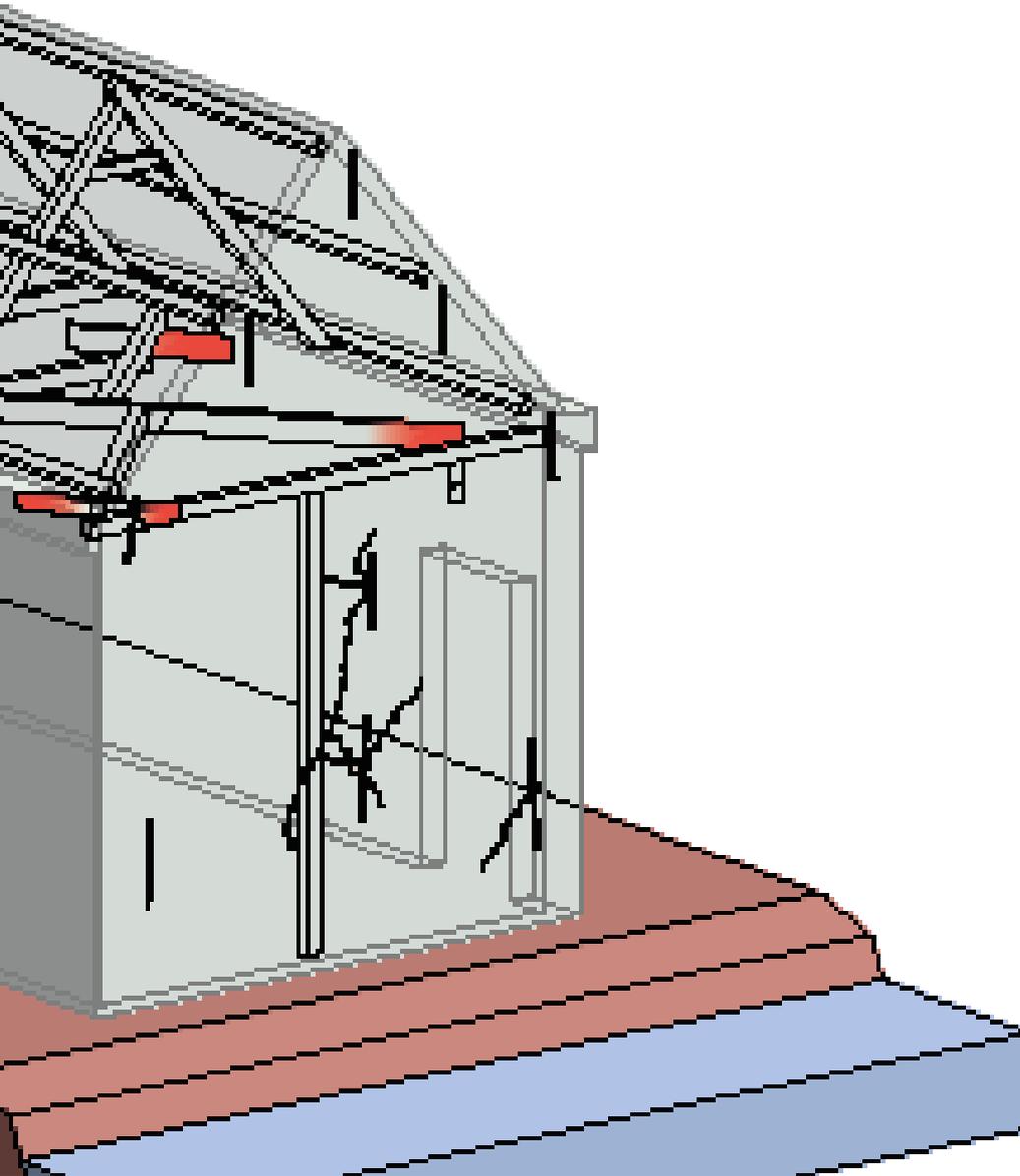
Hypothesis: The rot occurs strongest in parts of highest humidity, especially adjacent to the outer walls. The cross cracks are mostly minute or non-existent, which implies that it must be a case of wet rot.

Due to the absence of fruit body, mycelium, strand and a partial silver-grey surface it can be assumed that it is either a soft rot or an unidentified type of brown rot.

Intervention Proposal:

In order to stop the rotting the sources of humidity must be located and stopped. Additional dehumidifying may be necessary/helpful.

The timber should be analysed regarding its structural strength and if required be supported. All rotted wood should be removed and ventilation or at least vapour barriers between timber and masonry should be provided.



04. STRUCTURAL DAMAGE AREA A - TIMBER STRUCTURE

2. Damages caused by insects

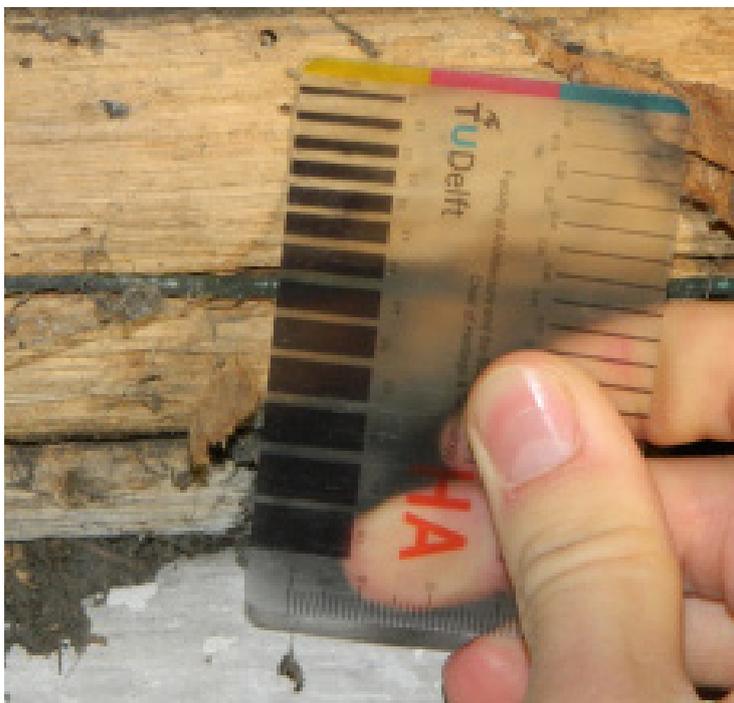
Diagnosis

Damage Type A: damage with circular holes of 1-2 mm diameter, no bore dust, no larvae

Hypothesis: As neither bore dust nor larve could be found, an accurate specification is difficult. Due to its popularity in rot affected construction timber, its 1-2 mm big emergence holes and its orientation - random, but mainly in direction of the grain - it can be assumed that the damage is cause by anobium punctatum, the commo furniture beetle.

Intervention Proposal:

As the beetles are not there anymore, no remedial treatment has to be executed. As the damage is only found in timber that has no load bearing function anymore, the affected timber can even remain if it is capable of sustain its own weight.





Diagnosis

Damage Type B: damage with circular holes of up to 1 mm, no bore dust, no larvae



anobium punctatum

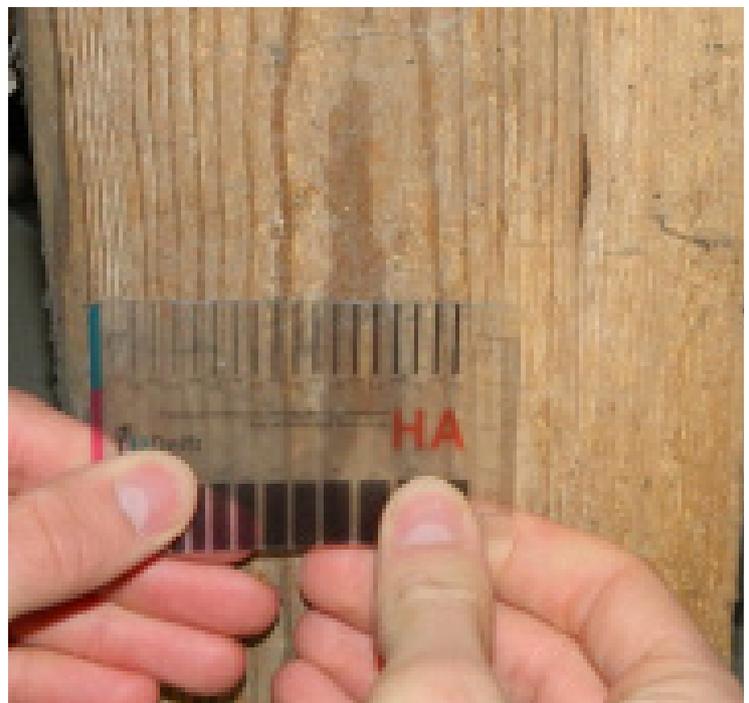
Hypothesis: As neither bore dust nor larvae could be found, an accurate specification is difficult. Due to the small size of the bore holes, the tunnels breaking through the wood surface and their occurrence in damp timber directly connected to walls we can assume that the damage is caused by wood-boring weevils (*euophyrum confine*).



euophyrum confine

Intervention Proposal:

Wood-boring weevils can be removed by removing the damp conditions, but as these smaller holes and tunnels seem equally deserted, no remedial action must be taken. It should be tested though, if the timber is still sufficiently load-bearing.



05. STRUCTURAL DAMAGE AREA B - SOUTH FACADE

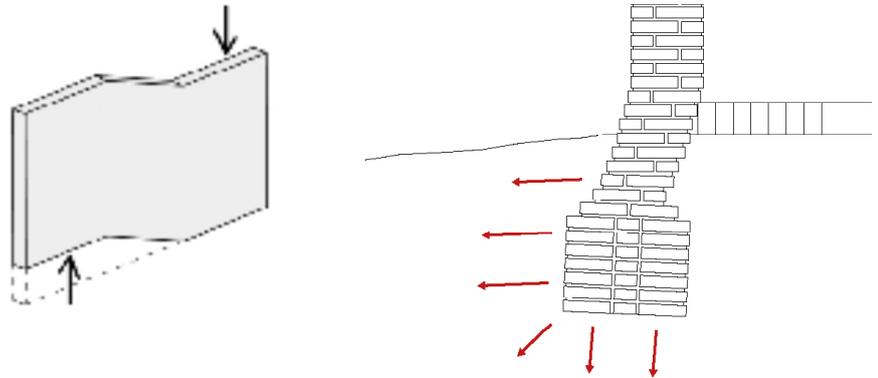
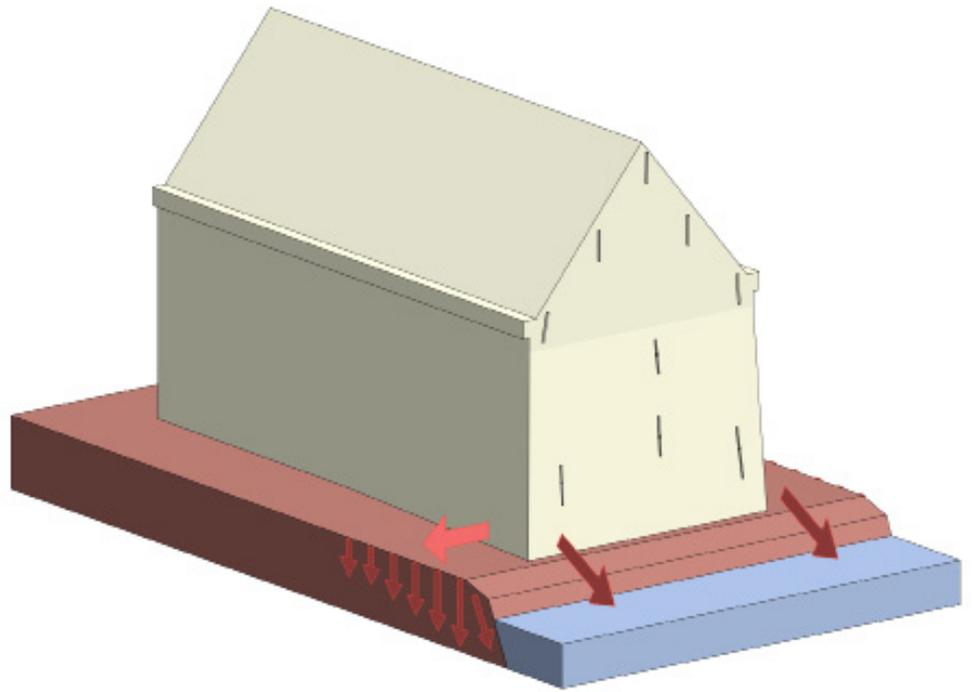
05.1 Settlement

Diagnosis:
structural damage >
deformation > deformation
pattern 53 / settlement

Hypothesis: As a result of close vicinity to the canal, the soil on which the barn is built is losing the stability. Southern side of the building settles down towards the water. Settlement is not equal on all building base area. Unequal settlement is distorting the geometry of the building as a whole. Most of the following damages are direct result of the ground settlement next to the canal.

Intervention Proposal:

Until the factor of settlement is eliminated it is virtually impossible to assess the progression of other damaging mechanisms. Proposal of intervention is to temporarily strengthen the edge of the canal with "damwand" profiles inserted into the soil. This will allow the monitoring of progress of the minor deformations and proper assessment of their severity.



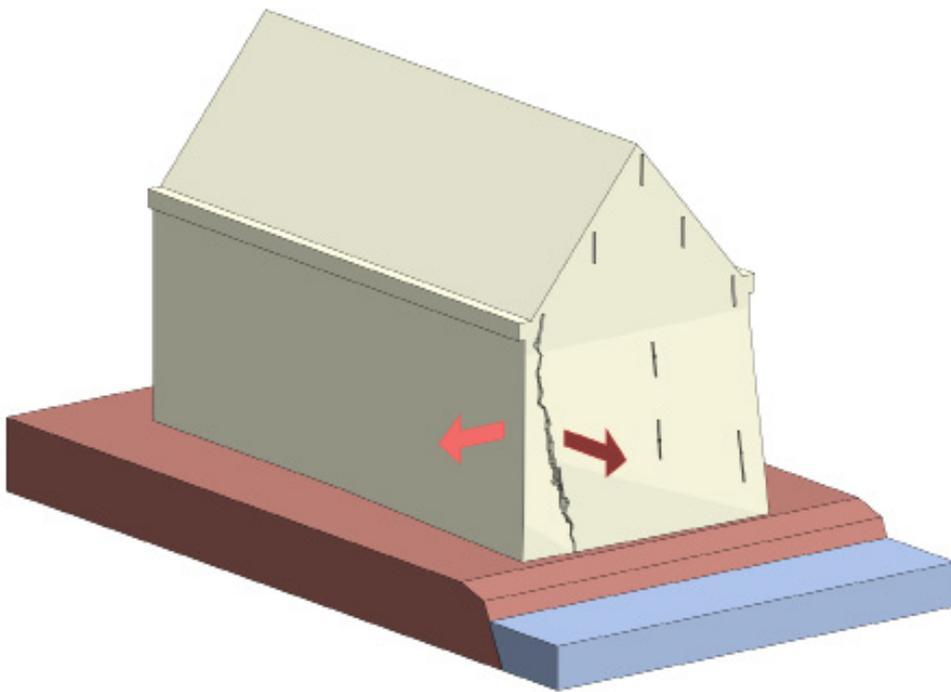
05.2 Displacement

Diagnosis:
brick > deformation >
displacement
Settlement

Hypothesis: Due to the different directions of wall base deformation caused by settlement, walls are being pulled apart from each other. This is the most severe damage observed in the building, because it directly threatens the integrity of the structure. The vertical crack goes through and through the wall, in fact south and west facades are separated and do not perform as one structure anymore.

Intervention Proposal:

Integrity of the structure must be preserved if building has to be reused in any way. Proposal to achieve that is to place the flexible bars in the bedding mortar of the masonry wall. Bars will carry the tensile force occurring because of movement of two walls in different directions. This way corner of the building will be held together.

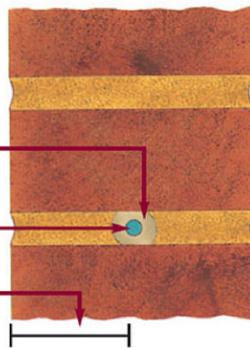


Flexible Bar In Brickwork

Resin/grout

6mm diameter bar

50mm



Depending on the future use of the barn, once stability of the structure is provided, the cracks can be filled in with repair mortar. This intervention is secondary.

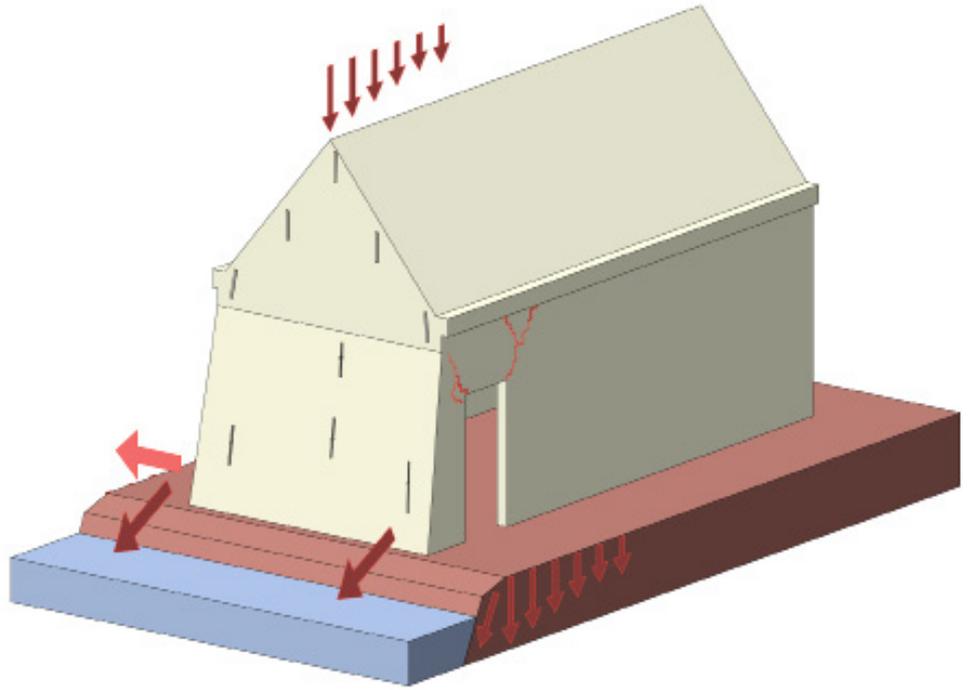
05. STRUCTURAL DAMAGE AREA B - SOUTH FACADE

05.3 Cracks above the door

Diagnosis:

Structural damage > Cracking
> Cracking in column or wall
> Combination of cracks in different directions

Hypothesis: Due to the movement of the southern wall to the direction of canal the cracks form above the door on both sides. The crack on the side closer to canal is widening downwards, because the base of the wall is moving away from the door. Crack on the other side of the door is opening upwards, which suggests that the brickwork above the opening had no sufficient support.



Intervention Proposal:

As stated in the first point, most of the damaging processes are related to settlement. First the ground must be stabilized, before further repairs would make any sense - if the settlement proceeds, the cracks will most probably re-open even if they would be sealed in the early stage of intervention.

For safety reasons temporary support for the door can be provided to keep the damaged opening from collapsing.



05.4 Cracks around the anchors

Diagnosis:

brick > cracking > star crack

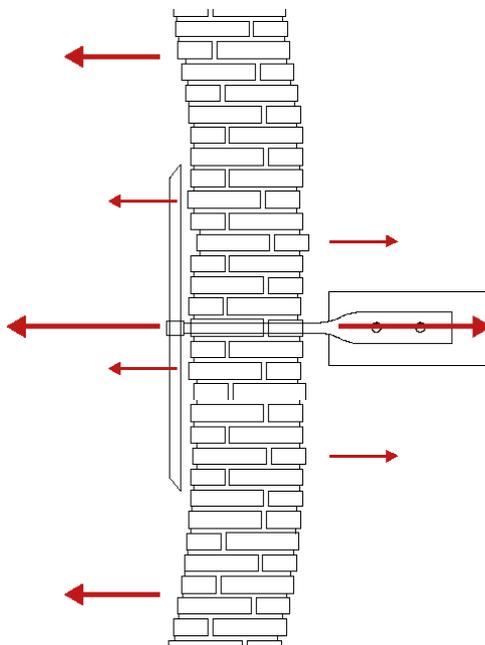
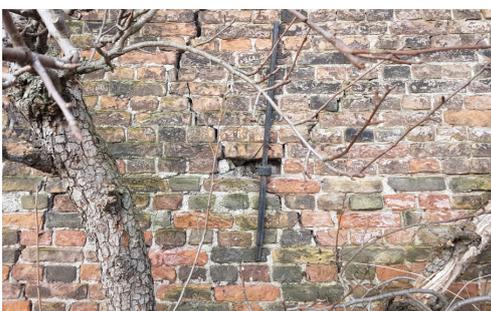
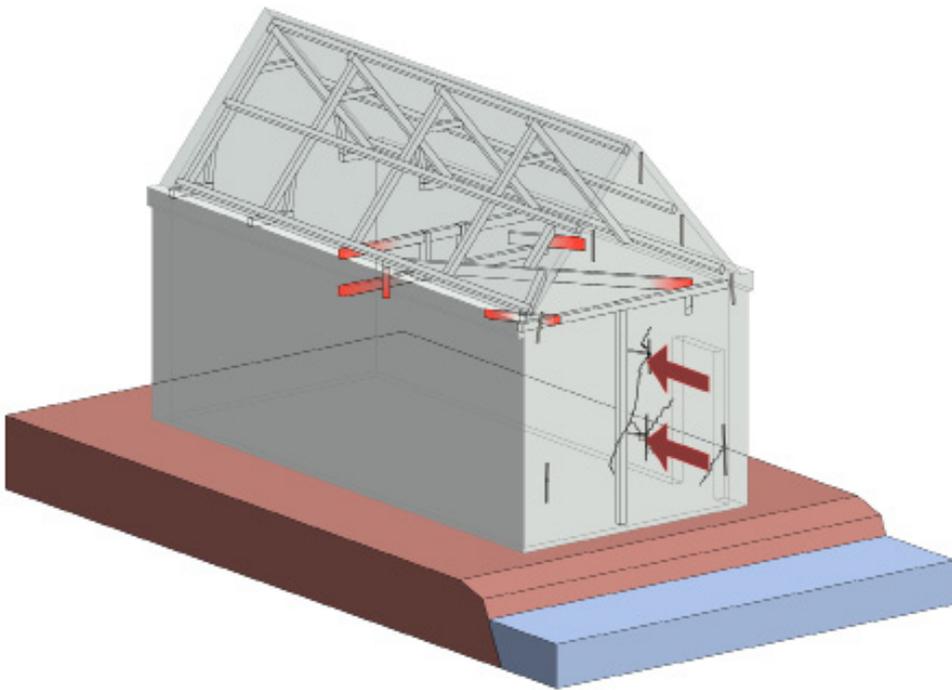
Hypothesis:

The structure of the mill inside the barn is connected to the wall with iron anchors. These anchors, attached to the internal structure counter-act the movement of the wall to the front (caused both by settlement and deformation due to overload). Result of this reaction focused in the points of anchors is the concentrated force causing the star shaped cracks around the anchors.

Since the anchors connect the structure of the mill to the wall it is possible that dynamic forces damaged the wall prior to formation of cracks- the wall was already weakened in the points of anchors. Mill is not active for a long time though, therefore this thread is not active anymore.

Intervention Proposal:

Cracks can be sealed, but again as in the previous damage mechanism, it is a priority to remedy the settlement. Without stopping the movement of the wall, the repair of the cracks will probably not be effective, they will sooner or later re-open.

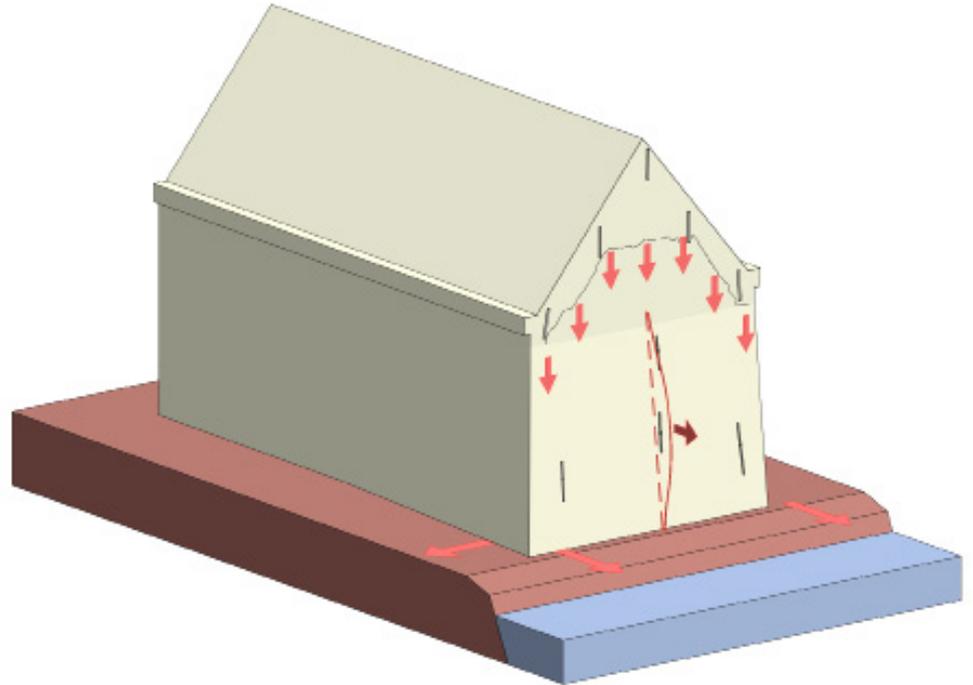


05. STRUCTURAL DAMAGE AREA B - SOUTH FACADE

05.5 Damage due to increased roof load

Diagnosis: structural damage
>> deformation >> Deformation pattern 55

Hypothesis: During the recent reconstruction of the roof additional brick layers have been added to the wall and the reed roof has been replaced by roof tiles. By that the load resting on the existing walls increased. This development results in deformation pattern 55, which is facilitated by the settlement displacing the wall from its perpendicular orientation and making it more vulnerable.



Intervention Proposal:

A possible intervention could be the integration of a stressed steel rod in the bedding mortar of the existing wall that inhibits further bulging.

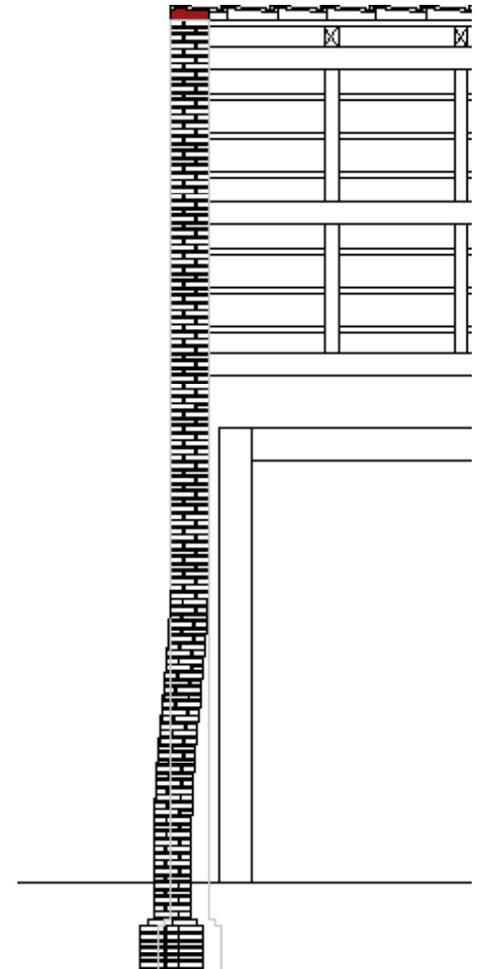
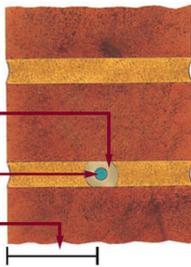
Priority has to be given to the settlement though as further interventions should not be planned based on uncertain future movements in the construction.

Flexible Bar In
Brickwork

Resin/grout

6mm diameter bar

50mm



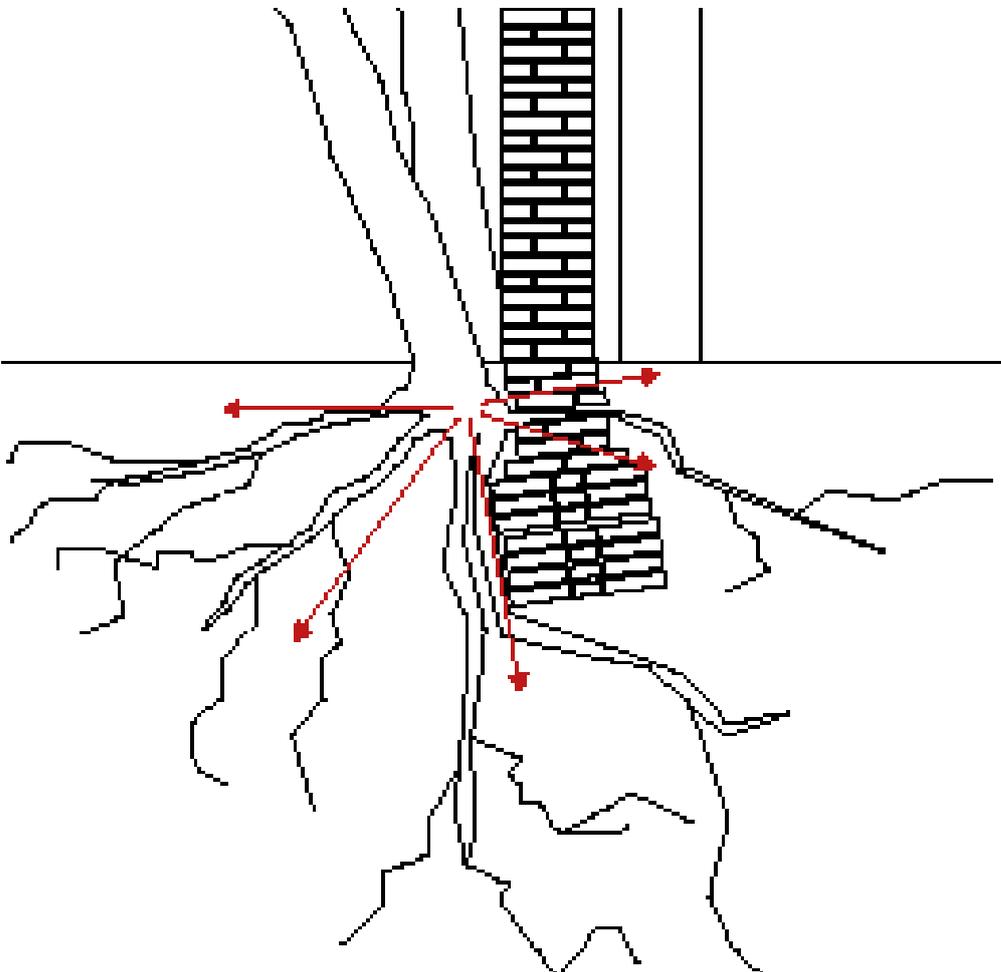
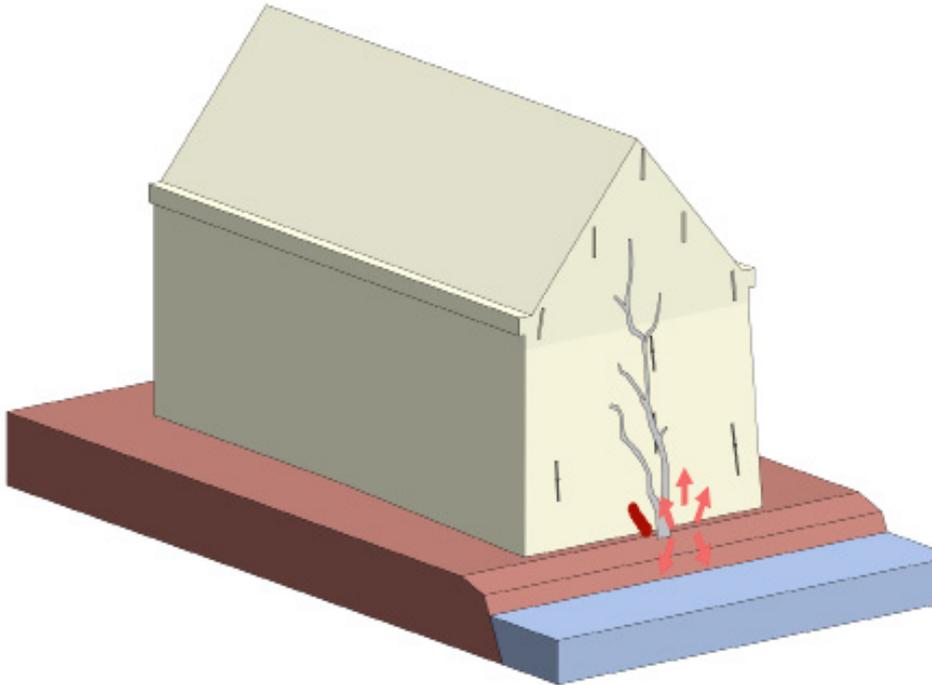
05.6 Biological growth

Diagnosis: brick >> biological growth >> higher plants

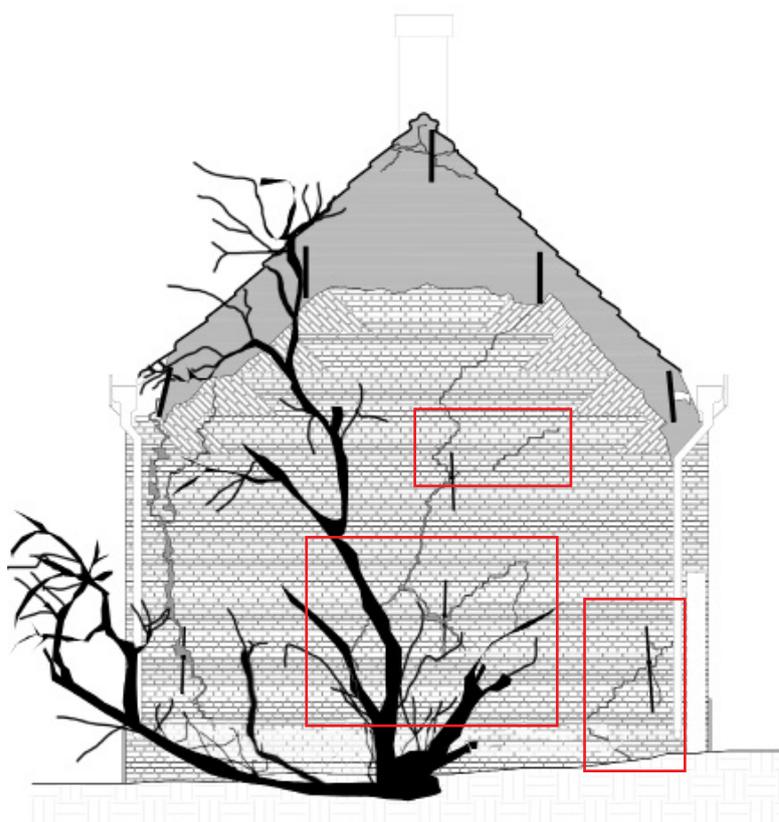
Hypothesis: A tree - adjacent to the wall - is growing from the centre the South façade. Due to its expanding roots eccentric forces push soil and masonry away and parts of the roots appear to even grow through cracks in the masonry. Big parts of the foundation and parts of the wall are displaced. Notwithstanding a supportive structural function can be accredited to the tree as it is holding back the bulging and settling of the wall.

Intervention Proposal:

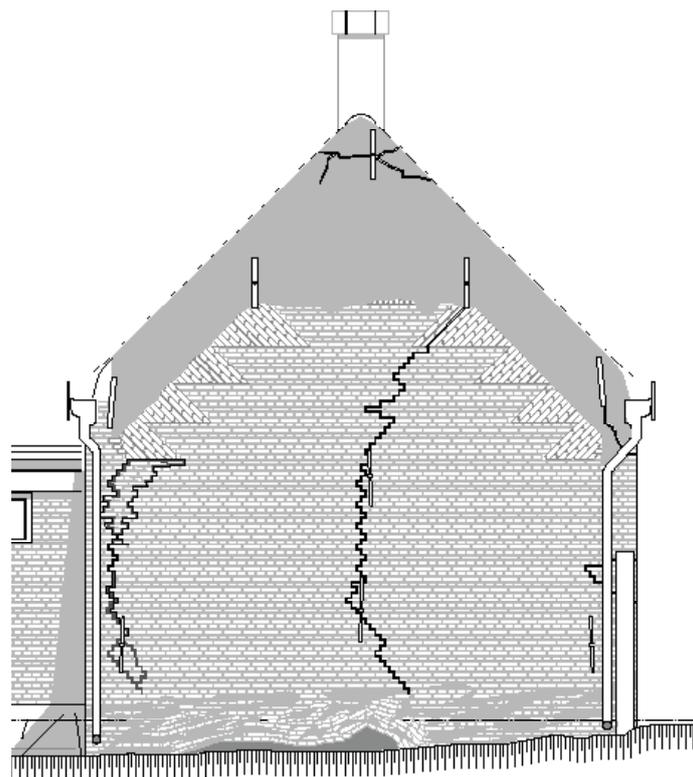
As long as the future use of the barn remains unclear, an intervention proposal cannot be given. Clearly the tree and the wall are strongly connected and only a proper use can justify the removal of the tree (poisoning, reinforcement foundation) whereas leaving the tree be (even though the changes between 2012 and 2018 are minute and the tree seems to grow very slow) will sooner or later result in further displacement of parts of the wall and foundation.



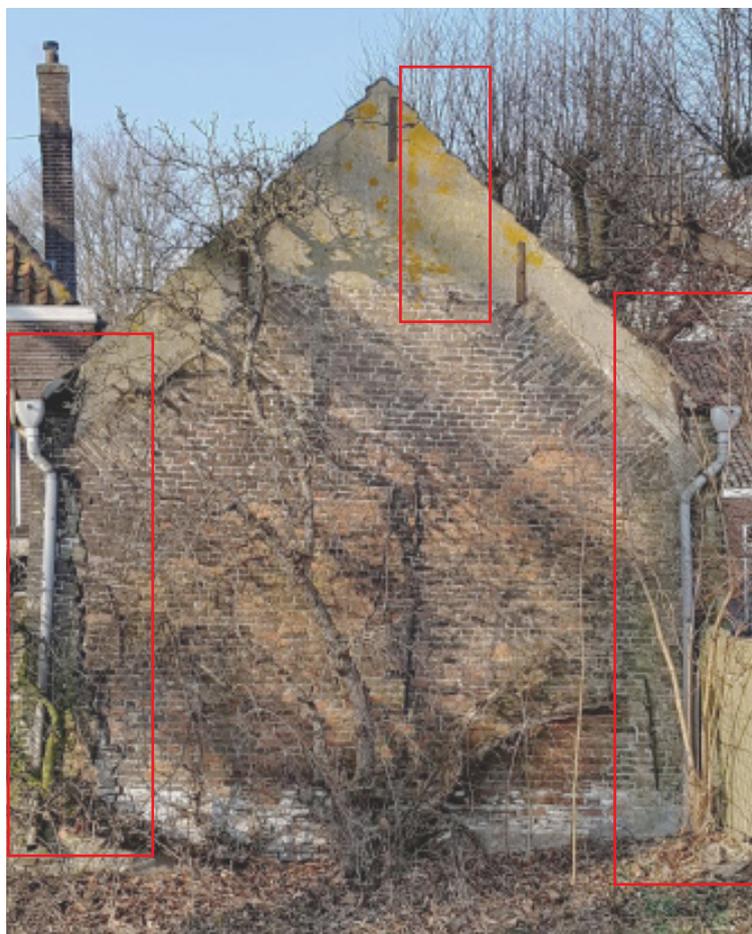
06. COMPARISON WITH "ASSESSMENT 2012"



Crack Patterns 2018



Crack Patterns 2012, drawing made by another group



Damages 2018



Damages 2012, photograph taken by another group



Damages 2012, photographed by others



Damages 2018

Damages 2012



Damages 2018



Damages 2012



Damages 2018



Damages 2018



Damages 2012



Damages 2018







06.1 Conclusions

On the contrary to our initial observations and hypothesis that the condition of the churn-barn is severely bad, we realized that all damages have remained exactly the same as in the report of 2012. Even crack patterns that were not drawn by our colleagues, existed in the photographs therefore any differences between the two reports are minor and mostly due to imprecise measurements. The only difference that was evident was in terms of the biological growths which is however because of the different seasons and climatic conditions that the two assessments were executed. Consequently, we conclude to the fact that unless further analysis and investigation is executed to acquire more information on the type of foundations, their structure and material composition we can not be 100% of what is the best solution to the situation. Moreover, any kind of intervention should be according to the new function of the churn-barn. In case that it is kept only as a reminder of its past close monitoring can be enough since the barn is in a stable condition. Cracks and holes in the roof should be repaired so as to avoid any further deterioration.

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