



LEARNING FROM TRADITIONAL CRAFTMANSHIP

Researching traditional building techniques through Groningen farms - to find what can be implemented into modern day building, with the incentive of reinforcing sustainable innovation.

Sarah Hermsen
TU Delft - Studio Techniques & Aesthetics

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PREFACE

Personal interests and incentives for the research done in preparation for P2.

This research is the output of research done for the graduation studio 'Technologies and Aesthetics' at the faculty of Architecture at TU Delft. The studio's manual describes the themes and assignment of the studio as follows:

'This studio explores the relation between the technical design innovations and the demands and consequences of climate change for the specific architectural form language and aesthetics that comes along with and belongs to these developments. [...] The assignment is to design an off-grid building that provides itself with energy and uses bio-based materials. This building is set a 100 years from now.' (Studio Manual)

The studio doesn't focus on what all the possible scenario's are for 100 years from today. Rather, it urges the students to explore a possible design for one scenario, while aware that this might not be the actual future situation.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (World commission 1987)

It can be concluded that in 1987 the concerns for sustainability were concerns regarding following generations. Nowadays, sustainability is known as an urgent matter. Where sustainable designs aimed to be 'less' harmful to the environment, it is now required to make sustainable designs that have zero net emissions. *Regenerative Architecture* even aims to have a negative emission and regenerate energy and resources, as the name suggests. These requirements are also expected from the out coming design for this studio. However, how do we know these 'sustainable requirements' won't evolve further? This evolving of the definition of sustainability alone reflects the constant development within the sustainability movement, also the case in the world of architecture.

Due to this rapid development, the way we built today is bound to be outdated quickly. This can be described as 'aging knowledge', a known occurrence in other academic fields as well. There seems to be a trendiness to the sustainable movement, demands and trends alternate rapidly

- partially due to the acceleration in innovation. Green-washing and time sensitive structures are something to be aware of. The phenomenon of *'fashion in architecture'* that comes with the trendiness, could be characterized as unsustainable. I find this an important matter to keep in mind as an architect. However, this seems to be a field of tension and there is no concrete answer to what is right and wrong. After all, innovation is needed for suitable solutions to be developed - and should be something to strive for, but is the way we do it currently the best approach?

This discomfort and tension is the foundation for my need to create a position towards the overall innovation of sustainable architecture. I realise this is probably a lifelong question I will be aiming to answer. This graduation project won't give an answer, but it will hopefully add to my position towards the underlying field of tension around 'aging knowledge' in sustainable architecture.

So, when being asked to research 'sustainable' building material and techniques - I ran into a certain discomfort: 'What I am researching now is useless, since there will be a successor to my project as soon as I finish my design.' To overcome this discomfort, I saw value in analysing past building techniques. Looking at the past to design for the future - for a 100 years from now - will be my approach. Some say, the most sustainable designs are already existing after all - hinting at heritage and its lifespan.

In history, when a new building technique was developed, it was implemented. It took a long time before a new alternative technique was developed. This leaves room for reflection to draw conclusions and realize the full -or lack off - potential of a material or technique. Nowadays, acceleration within our entire modern society, the time for reflecting on architecture methods decreases. Competing successors could already be on the horizon after all. This creates an environment in which knowledge isn't just aging, it might risk being wasted - which should be avoided.

Research question and research method

Together with the holistic questions mentioned before, the research for this was shaped with the influence of another personal interest.

The location of the studio is the 'Reitdiep' area, that is developing as a nature reserve connected to the Wadden Sea. While visiting the site, I found the heritage at the location to be a remarkable part of the landscape. The roofs of the farm-sheds are present on the horizon, and part of the Groningen culture. When thinking of a possible design in this context, I find the present heritage should be regarded and build upon. To relate to the existing architectural heritage, I want to create a similar roof construction.

The craftsmanship and knowledge that the sheds are built with, have been in development for years. This makes the heritage in the traditional roof structures of Groningen farms an interesting input for creating a position towards future innovation.

The attempt of looking at past architectural innovation to see what is valuable for future innovation in (sustainable) architecture shapes the following research question for this report:

What can we implement from traditional timber craftsmanship of roof constructions of Groningen farms into modern (sustainable) building techniques for timber roof constructions?

This research question will be answered through a case study of a Groningen farm. Analysis of the construction joints and building principles will be done. Context will be given to understand the construction through literature research. The things that stand out in this research will be compared to a recent timber roof construction. The outcome of these elements will make it possible to give an answer to the research question.

This research question will add to shaping a position as an architect towards a rapidly evolving discipline - with the consequences of aging knowledge and unsustainable developments- by analysing past developments.

INTRODUCTION ON GRONINGEN FARMS

General information on Groningen farms

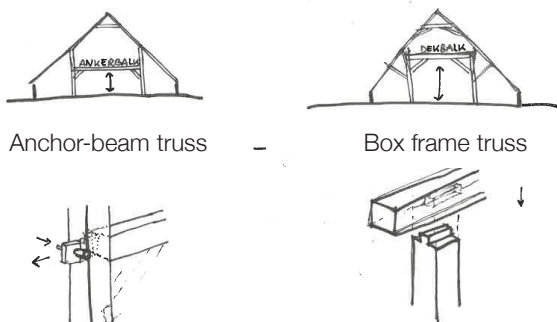
When visiting The Reitdiep River area, one cannot ignore the heritage that is presented along the horizon. The farms and their monumental roofs stand out in the landscape (scheme 4). In the following chapters, the traditional building techniques that created these farms are researched and explored.



Farm roofs on the horizon of the Groningen landscape - self made picture

This construction can be deemed valuable, it shows the heritage. We can translate the defects, discolouring and other marks into an insight in what went on throughout the ages that the farms have existed. Apart from this knowledge, we can also obtain insights into the developing craftsmanship that created the intricate joints and details. (Berends, 1996)

Almost all farms in the Netherlands are constructed using a timber frame, consisting of continuous trusses. These trusses are connected by 'gebintplaten' - arcade plates, using diagonal braces for stiffness in the construction. The assembly and joints of these timber elements are different per area of the Netherlands, and will be analysed later on (scheme 5).



Scheme 1. Type of trusses in Groningen - own work

When looking at the joint of the truss beam and the posts in farms in Groningen, the 'dekbalkgebint'- Box frame truss is more common than the 'ankerbalkgebint' - anchor beam truss. (van Wijk & van Aalst, 1985) Furthermore, the roof often existed of a timber truss-work with 'Sporen' - rafters - and 'Gordingen' - purlins.

When building on the soft peat soil of Groningen, a light construction was preferred, for which a wooden construction is the perfect material. The type of wood that was used for the construction was mostly dependent on what was cheap and available in close proximity. Therefore, oak wood was preferred - also due to beneficial properties for construction purposes. This vernacular way of implementing local unaltered material created a harmonious relationship between building and landscape (scheme 2). Additionally, it reinforces the emergence of local characteristics of architecture. (Opdam, 2017) Whenever wood is used in combination with stone, the timber construction is placed firstly, the masonry placed around it afterwards. The timber construction has priority. According to J. Janse (1988) this can be explained through how West-European building traditions always originate from timber constructions.

While initially only erected in timber, eventually stone and brick was incorporated in the construction, due to more prosperity in agricultural businesses, influenced by urban architecture. Farmers would improve in status if brick was used for the façade of their farm.

Many farms were build upon 'terps' or 'wierden' - a heightened parcel surrounded by a canal



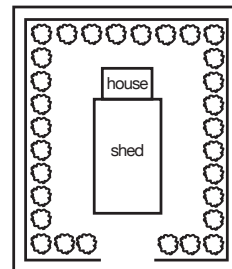
A 'wierde' in the Groningen landscape - self made picture

and a row of trees. This canal had been used to keep out unwanted guests, provide water for cattle and transport. The surrounding trees function as a wind barrier and provide wood (scheme 1). (*Jildou De Jong, 2023*)

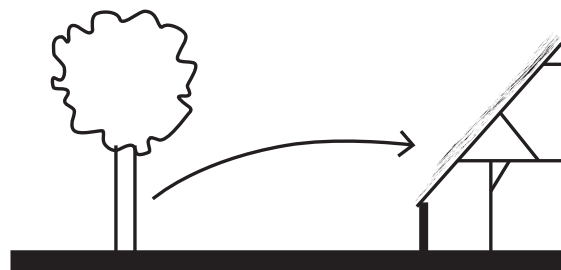
A distinction can be made between farms in the northern- (*'Friese'*), middle- (*'Saksische'*) and southern (*'Frankische'*) part of the Netherlands. According to research done by Klaas Uilkema (1920), these distinctions appeared because of tradition, construction method and type of soil. The *'Langhuis'* layout is the umbrella term that includes the most common building layout for rural architecture until the 1500. Both living and farm function is located under the same roof (scheme 3). The construction type that is common for a Langhuis farm divides the shed in three aisles due to the free-standing timber columns. The two outside areas were used to keep cattle and store tools and material, the middle part used to store the harvest and hay. (*Opdam, 2017*)

It can be stated that the old *'Langhuis'* farm evolved into the *'Friese'* farms, which evolved into multiple typologies which are present in the Reitdiep River area. For this research, only three typologies under the *'Friese'* farm category will be explored. These are: The *'Oldambtster'* typology, The *'Kop-Hals-Romp'* typology and The *'Dwarshuis'* typology. Another common typology is the *'Tweekaps'* typology. This typology is however present in all of The Netherlands and not Groningen specific which eliminates it from the research. The exact characteristics of these typologies will be elaborated in chapter one.

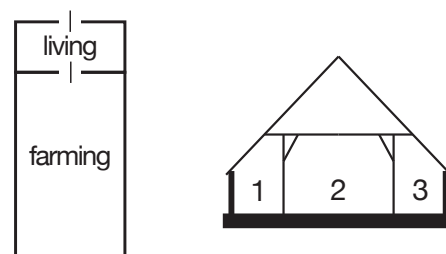
The large dimensions of the sheds is characteristic for the Groningen farms. This is what makes it stand out in the landscape. Pragmatic factors played the biggest part in this, it simply came to be this big because it was required to function as a farm. The roofs are constructed in an angle, this too was most efficient. The required space changed over time, and the development of the building technique will swiftly be analysed.



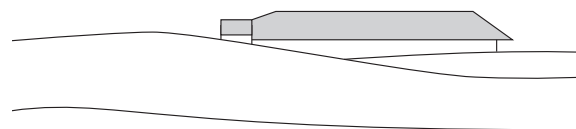
Scheme 1. Layout of parcel - own work



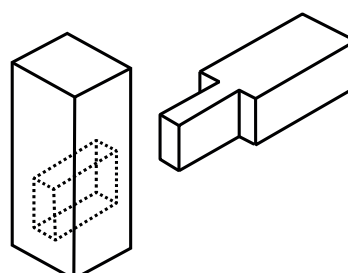
Scheme 2. Local material - own work



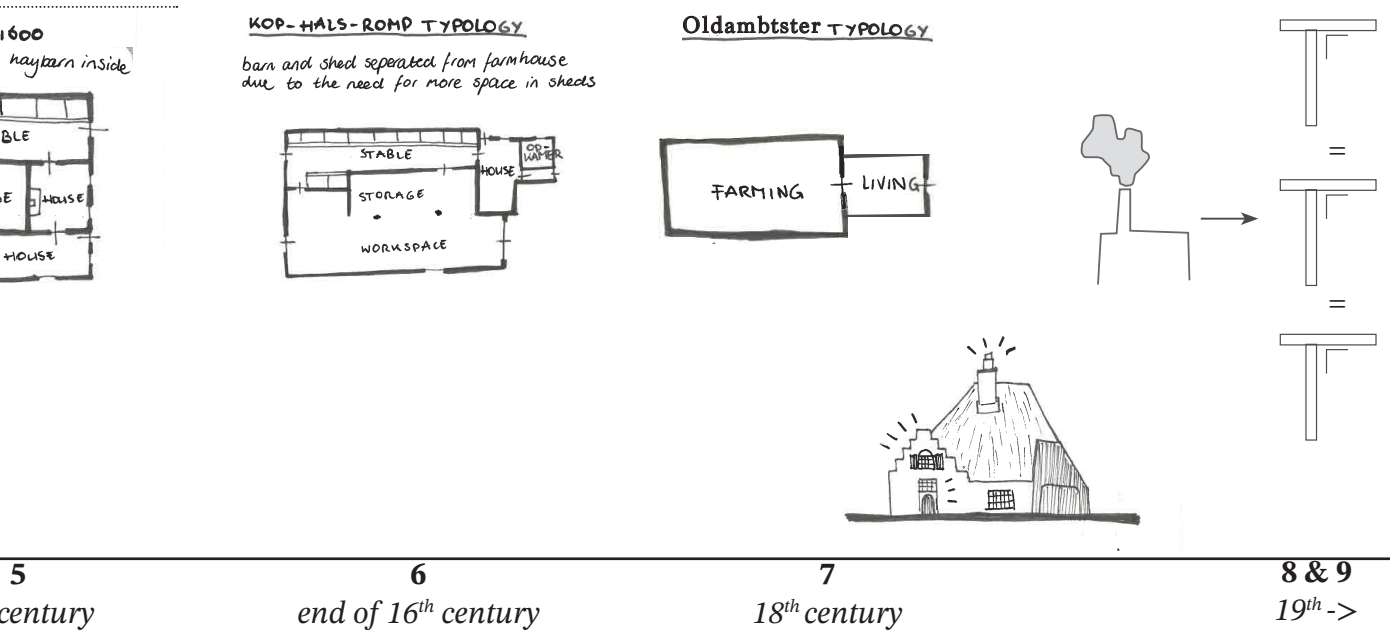
Scheme 3. Layout of farm - own work



Scheme 4. Presence in landscape - own work



Scheme 5. Local construction details - own work



7. With influences from Germany, another new typology arose in the **18th century**. This typology is called the “Oldambtster’ farm. They stand out because of the monumental size of the sheds, and the ‘jumps’ in the side facades. The Oldambtster sheds were often used as a replacement for smaller sheds, when more space was required.

8. **Further development** took place more locally. According to Janse, this is because of the Guilds. Knowledge was passed on within a guild, and therefore exploring further innovations happened locally. Multiple generations of craftsmen had to struggle with the material to come to useful conclusions and solutions. These solutions were even different per area.

9. After the **18th century**, there was economic wealth amongst farmers. This created a higher demand for more grandeur in the architecture of farmhouses. Eventually, it became appealing to separate the houses from the sheds, leading to impressive detailing and grandeur in architecture for stand alone farmhouses.

10. **Industrial revolution** created the option

to build with bigger spans. This was due to the increase of machinery and developments like laminated timber. Mass production and a more secure approach, makes for similar timber elements in different constructions.

FACTORS FOR DEVELOPMENT

It can be concluded that there were certain external factors that influenced the way the farm construction was developed over the past. Guilds, available material due to social economic situations and industrialisation are of influence as well. To answer the research question, this context must be further elaborated and researched.

MONUMENTAL FARMS

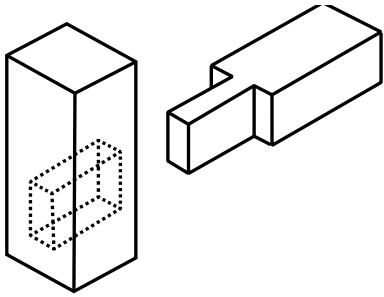
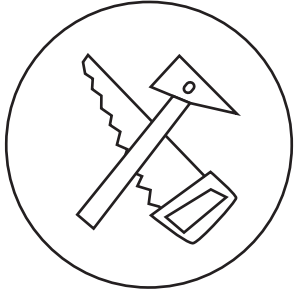
The farms that are located in the Reitdiep River area have a specific construction, bound to local tradition, as was stated before. These typologies are built in a locally specific manner. To get an insight in what type of farms there are, a catalogue with an overview of all monumental farms present will be made.

JOINTS AND DETAILS

The typologies that are present have a common construction and are built in a similar way due to local developments. With this construction comes the assembly of the separate elements, which is area-specific. To get insights into the actual constructions, the joints of the farms in the area must be analysed.

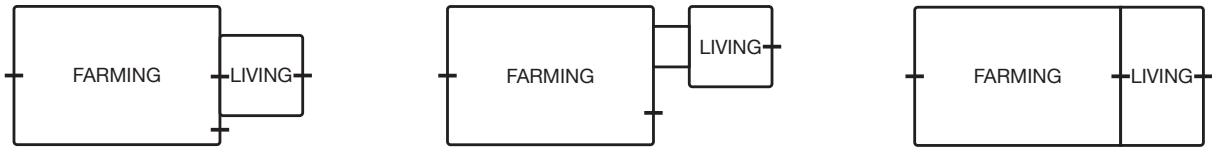
COMPARISON TO CURRENT SITUATION

To answer the research question, it is needed to make the connection between the past and the present (or where possible, future). For this research, this will be done by analysing a project with a state-of-the-art timber construction. A quick overview of -fairly recent- turning points in the timber industry will be given as well.



CH1 - MONUMENTAL FARMS IN HET REITDIEP

In this chapter, the case studies will be introduced. Firstly, an overview of all monumental farms in the area of Het Reitdiep will be given. This overview includes the Oldambtster, Kop-Hals-Romp and Dwarshuis typologies, which are most common in this area. This overview is based on 'Het Rijksmonumentenregister', a state owned index of all monuments in the Netherlands.



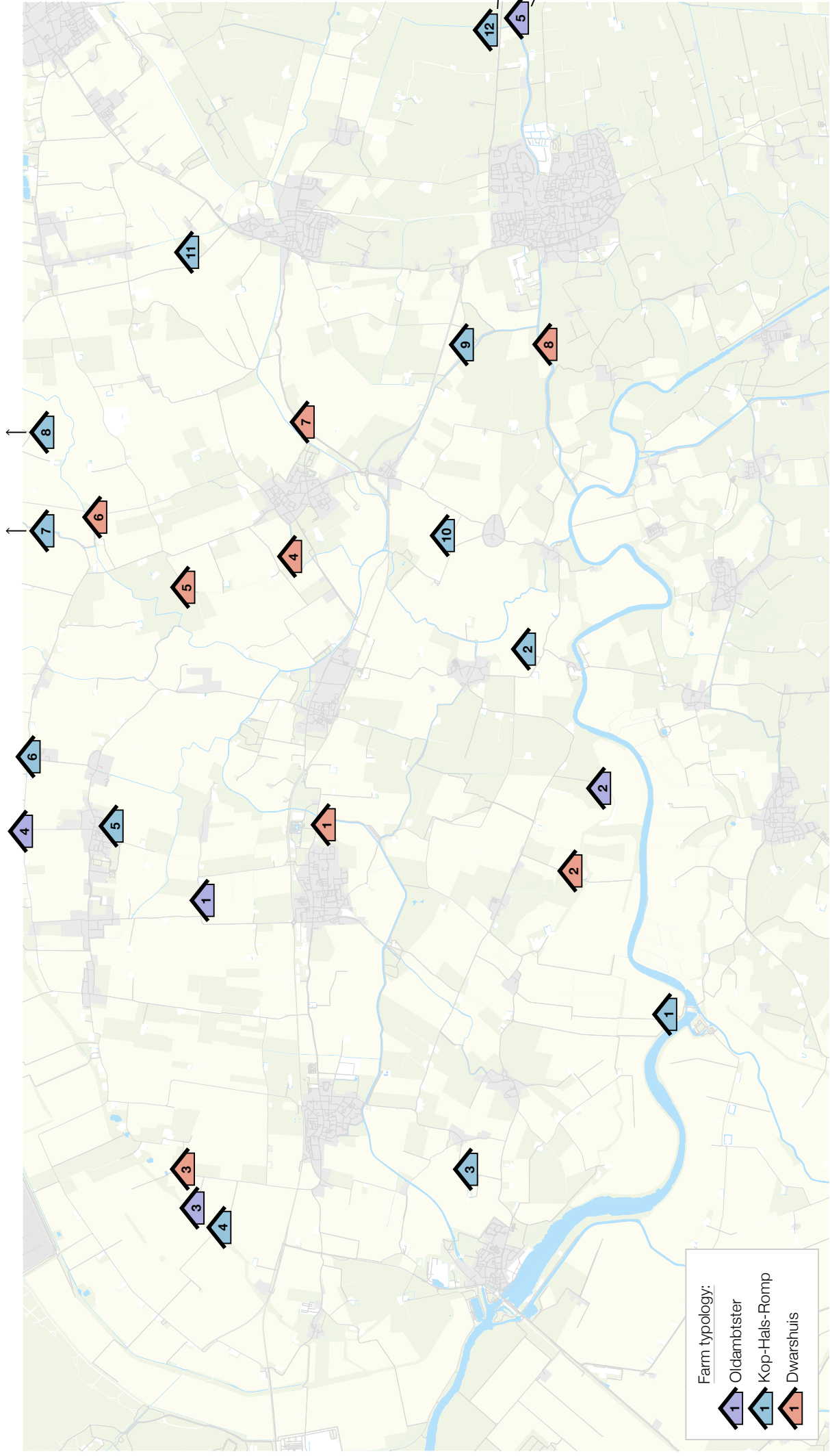
Typologies: Oldambtster, Kop-Hals-Romp, Dwarshuis - own work

1.1 - LOCATION OF FARMS




On the right page, a map shows the location of all monumental farms in the Reitdiep area. The attached legend below gives information how to read the map.

Map 1 gives an overview of all the monumental farms in the studio's demarcated Reitdiep area. There are three main typologies to be found here; The 'Oldambtster' farm, The 'Kop-Hals-Romp' farm and the 'Dwarshuis' farm. The map is based on a categorizational system that groups the typologies by color, with an appointed digit for each monumental farms in said grouped typology. This categorization corresponds with the index on the following pages. In this index, relevant information and images of the farms will be presented. This information has been gathered through further investigating the information from the Rijksmonumentenregister - a catalogue of all monuments in The Netherlands.

It is good to note that the created index includes only *registered* monumental farms in this area, and that there are many more characteristic farms located here. Following the index, further research consists of an analysis of three case studies picked out of this catalogue of monumental farms. With this research as the main goal, the approach of noting only the monumental farms seemed most logical since generally, there is more information found on monuments than on regular farm buildings. The map on the next page can also be found in the appendix on a larger scale, to show details more clearly.



Farm typology:

-  1 Oldambtster
-  2 Kop-Hals-Romp
-  3 Dwarshuis

1.2 - 'Oldambtster' typology

In the beginning of the 18th century, the Oldambtster typology was dominant in the North of the Netherlands. The name comes from the name of the most northern area of east Groningen called 'Oldambt'.

The 'Oldambtster' farms stand out because of the monumental size of the sheds, and the 'jumps' in the side facades. These jumps in the facade were made to create space for an entrance to the sheds at the front of the farm. Another specific characteristic is the continuous apex of the roof. This typology has the farm house integrated under the roof of the shed - a common layout for farms in the north of the Netherlands. Even though the facade implies otherwise, the first floor functioned as a storage space for granary.

The shed often has three aisles. The middle one functions as storage for the crops, one side aisle for the cattle and the other side aisle for storing machinery. (*Oldambster Boerderij, z.d.*)



1. Leens - Grijsloot 1

Name of parcel: *Veltingheem*

Year: 1856

About: Merged from three farms in 1783, one of which used to be a monnastery called 'Oldeklooster' which stems from 1594. The original Oldambtster house and farm was built in 1856, now an official state monument.

2. Zuurdijk - Hoofdweg 4

Name: *Stoepemaheerd*

Year: 1838 / 1861

About: used to be owned by a monnastery called 'Wittewierum'. The shed dates back to 1838, the farmhouse to 1861.

3. Vierhuizen - Noorderweg 3

Name: *Midhuizen*

Year: 1850

About: Part of two different farms (*klein Midhuizen*) that were merged later on. Midhuizen was build after these two farms were torn down in 1850.

4. Kloosterburen - Bokum 6

Name: *Oud Bocum*

Year: 1858

About: This farm is located next to *Nieuw Bocum*. Both farms used to be owned by two brothers. The farms seperated in 1819, when there was enough land after reclamation.

5. Onderdendam - Boterdiep Oostzijde 13

Name: *De Haver*

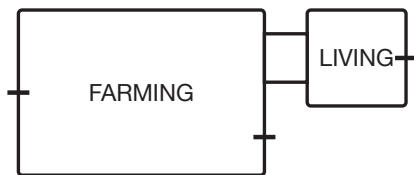
Year: 1894

About: Renovated in 2017 according to a design by Onix. Pictures show intriguing structure.



1.3 - 'Kop-Hals-Romp' typology

The 'Kop-Hals-Romp' farm typology has a separate farmhouse, connected to the barn by a lower building mass. This layout came about because of the need for expansion of the barn after general prosperity for agricultural businesses in the 17th century. For dairy farms it was common to place a basement underneath the front of the house, which created an 'opkamer', a room that was higher than other ground floor rooms. For arable farms, the farmhouse was longer, to create more space in the attic to store granery. (*Open Monumentendag, 2023*)



1. Zuurdijk - Electraweg 24

Name: *Hayemaheerd / Ewer*

Year: 1929

About: This farm is part of a township that used to neighbour the Reitdiep, until the construction of the waterworks. The building was rebuilt in 1929, after it burned down. The farmhouse was rebuilt in the style of the Amsterdamse School.

2. Warfhuizen - Roodehaansterweg 2

Name: *'t Huis ter Borg*

Year: 1789

About: This farm is part of a hamlet, with three other farms close by. This particular farmhouse has elements that date back to 1789

3. Niekerk - Zoutkamperweg 1

Name: *Wiemahaerdt*

Year: 1853

About: Stopped agricultural business in 1976. Farm is built in 1853 and is now an official state monument.

4. Vierhuizen - Noorderweg 1

Name: *Klein Midhuizen*

Year: 1831/1862

About: Farmhouse built 30 years after the shed and 'hals' were built in 1831. Legumes, granes and oily seeds are cultivated here, still to this day.

5. Kloosterburen - St. Jansstraat 25

Name: *Oldeklooster*

Year: 1652 / 1866

About: Used to be part of monnastery 'Oldenklooster' until 1609, when the monnastery fell. Farmhouse dates back to 1652, shed was rebuilt in 1866. According to the municipality website, the farm is now looking for a new function.

6. Kloosterburen - Dijksterweg 26

Name: *Groot Halsum*

Year: 1599

About: The farmhouse has beams that were reused and used to be one continuous beam. This beam dates back to 1599. In the 16th century the farmhouse used to house religious gatherings.



7. Pieterburen - Oudedijk 19

Name: *Bolt*

Year: 1801

About: Farmhouse with gable roof, sheds with clipped gable roof. Unfortunately, sheds were burned down in 1893, but again rebuilt afterwards.

8. Pieterburen - Oudedijk 2

Name: *Themaheerdt*

Year: 1925

About: Layout of 'kop-hals-romp' typology, but build in style of Amsterdamse School. Thus, the interior has art-deco elements.

9. Winsum - Maarhuizen 3

Name: *Enne Jans Heerd - Maarhuizen*

Year: 1600 / 1854

About: Part originates from 1600s. Shed built later, in 1854. A renovation took place in 1981 and 2021, which made it possible to currently function as a cultural centre for the area.

10. Mensingeweer - Klein Maarslag 1

Name: *Rollingeweer*

Year: 1855

About: Currently still active in agriculture. Farmhouse has gable roof.

11. Rasquert - Andelsterweg 1

Name: *Houkumhuis*

Year: 1850

About: Sheds and farmhouse with multiple extensions and additions, with a separate house connected to the shed - from 1850s.

12. Rasquert - Warffumerweg 6

Name: *Almaheerdt*

Year: 1828

About: Some parts of the shed have been altered. A lot of agricultural machinery has been preserved by owners of the farm, showing the respect for the history of the place.



1.4 - 'Dwarshuis' typology

This typology has a farmhouse at the front of the main shed, that is placed perpendicular to the longitudinal axis of the shed. The farmhouse has a separate roof and connects to the shed either directly or by a lower building mass. the space under the roof of the farm house is a granary. This typology arose due to prosperity in the agricultural business and the need to show this development and wealth. (*Groningse Herenboerderij, 2024*)



1. Leens - Wierde 33

Name: *Tuinsterheerd*

Year: 1867

About: Placed on a 'terp', used to be part of a hamlet after the merging of two companies. After the separation of these two companies, the current building of the Tuinsterheerd was built.

2. Zuurdijk - Hoofdweg 20

Name: *Pollux*

Year: 1818

About: Farmhouse is shaped like an L, creating a courtyard like corner on the opposite side of the picture. Shed has a clipped gable (wolfseind-) roof. Currently, the farm is vacant.

3. Hornhuizen - Ommelandeweg 9

Name: *Onrust*

Year: 1863

About: Farm neighbours the parish of Vierhuizen. Recently, in 2022, a storm tore down the monumental shed which is currently being rebuilt with regard to its original building techniques.

4. Eenrum - Eenrumerstreek 1

Name: -

Year: 1880

About: Two sheds - clipped gable roof with glazed roof tiles and parallel placed farmhouse. To this day agricultural activity takes place here.



5. Eenrum - Eenrumerstreek 8

Name: *Den Oever*

Year: 1467 / 1725

About: Very old farmhouse, partly dating back to 1467. The additional shed was build in 1725.

6. Pieterburen - Oosterweg 13

Name: *Huninga*

Year: 1820

About: Farmhouse dates back to 1820, according to a brick with this specific date on it. There used to be a 'paardewask' - a horse washing place - located next to the farm, which was reconstructed later on.

7. Winsum - Eenrumerweg 51

Name: *Ernstheem*

Year: 1903

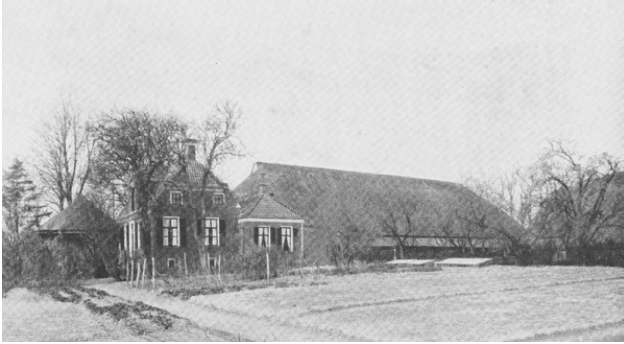
About: Both the farmhouse and the sheds are build in the beginning of the 20th century. Decorative interior, representing wealth of the farmers in this period.

8. Winsum - Schouwerzijlsterweg 13

Name: *Baatjeborg*

Year: 1854

About: Thatched roof, with a lower edge of glazed roof tile. This farm is a combination of an 'Oldambtster' - and 'Dwarshuis' typology. The farm is currently a Bed and Breakfast.



1.5 - CASE STUDY 'DE HAVER'

The first case study will be introduced in this paragraph, with an overview of its heritage, the current use, alterations made and the location



Image 1. Shed and farmhouse 'De Haver' - source: ONIX architects

This farm dates back to 1894, according to the *Rijksmonumentenregister*. This means that this farm is not one of the oldest in the area - as can be concluded from the index. However, the fact that it was built during a period of prosperity for farmers, explains the immense size of the construction. The farm is located along the canal 'Boterdiep', between Onderdendam and Winsum. The most recent adaptations have been made in 2017, with a design made by ONIX architects - an architecture firm that specialises in building with timber. ONIX provided pictures, drawings and information on their design, which was very helpful.

As can be seen in the index, De Haver is an oldambtster typology. There are two sheds present on the parcel with a farmhouse facing the canal. The farmhouse has a lot of traditional elements still present, as can be seen in image two.



Image 2. Interior of the old farmhouse - source: ONIX architects

After a period with lack of maintenance, the farm has been reallocated a function of housing in the shed. It was built within a year, for 20.000 Gulden, requested because the owner needed a new place after an old farm built down. According to project manager of heritage in Groningen Jan Harm Eppinga, the farm is unique because of its monumentality and the efficient and simplicity manner with which it was built. (*Het Groninger Landschap, 2021*)

The farm has two sheds with a total square meters of 1600 m², but it is not fit for modern day agricultural purposes.

The shed has a height of 12,3 meters, and a width of around 25 meters - according to the drawings provided by Onix.

On the right page, a quick overview of all dimensions of the construction will be given. This information was gathered from drawings of the farm, made by ONIX architects. see scheme 1. The construction, which is clearly visible in the image on the next page, will be analysed in chapter three.

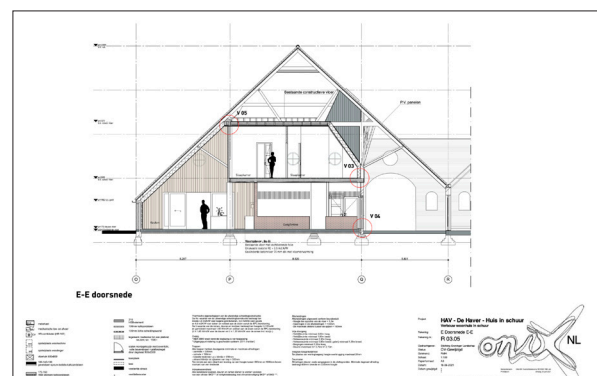
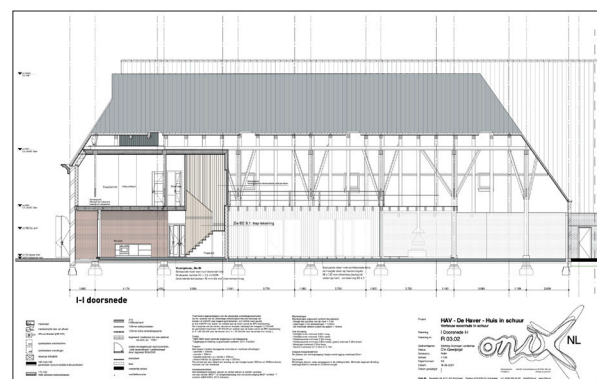


Image 3. section drawings of renovated farm - source: ONIX architects

WIDTH	20,908 M
LENGTH	33,412 M
HEIGHT RIDGE RAFTER	12,35 M
DISTANCE BETWEEN COLUMNS	6,287 / 8,820 / 5,801 M
DISTANCE BETWEEN TRUSSES	4,70 - 4,95 M
HEIGHT TIEBEAM	7,3 M





Image of interior and construction of farm 'De Haver' - source: ONIX architects

1.6 CASE STUDY 'MAARHUIZEN'

This booklet starts with an overview of all the findings during the design is doomed to fade because of this - how can we integrate future innovation.

While the institution located in this farm is called 'Maarhuizen', relating to the wierde on which it is set, the shed that is analysed in this research had a different name. The Enne Jans Heerd shed is a monumental farmhouse on the centuries-old wierde Maarhuizen and a historic beacon on the Groninger Hogeland. Until 1594, Maarhuizen was a farm as a kind of outpost of the Aduard monastery. The oldest parts of the

construction of De Haver. The tie beam is also supported here on the uprights with a small span to create more space in the side aisles.



Construction of farm 'Maarhuizen' - source: Onix architect

farmhouse date back to the year 1600.

The farm is named after Enne Jans Huizing (1737-1819). Together with his wife Grietje Freerks, he acquired the farm in 1788.

The monument consists of a special residential house with an older part and an addition built in 1854, and two barns with a classic Gronings design.

The last farmer on the heerd had a mixed farming business and left the farm in 2011. The farm has been repurposed into a combination of theater, catering, barn, and residential house. A wierde for culture and nature. Many parts have been made sustainable, of course taking into account all the monumental aspects. To maintain the monumental appearance, a creative solution was needed: the existing beam structure was preserved and shortened to create space for the insulation package.

The construction is similar to that of the



Shed of farm 'Maarhuizen' - source: Bouwgroep Dijkstra Draisma

WIDTH

21 M

LENGTH

32,4 M





Image of interior and construction of farm 'Maarhuizen' - source: owners of property

CH2 - INFLUENCE OF GUILDS AND CONTEXT

This booklet starts with an overview of all the findings during the



GUILDS

This booklet starts with an overview of all the findings during the design is doomed to fade because of this - how can we integrate future innovation.

The constructing of the Groningse farms was done with experience and craftsmanship. Practical considerations were key principles in the building process instead of aesthetics, along with specific local knowledge on constructing. While the ‘Hallehuis’ farms with respective techniques remained a common building method, the craftsmanship grew within this method. This had to do with the creation of Guilds, a craftsmanship community that made carpentry into a craft. This was the place where local knowledge was exchanged and passed on until the 18th century. When researching the traditional building of Groningse farms, these Guilds are an important factor in how the architecture of the farms and its construction evolved. In this chapter, the internal structure and influence of Guilds is analyzed.

Governance and organisation

Guilds existed from the Middle Ages until the late 18th century. The organizational structure of the guilds varied between guilds. The organization of large successful guilds is mostly known because, unlike the small guilds, they often kept documents and writings. The guild members came together at least once a year to admit new members, approve or reject new rules, and elect officials. Decisions were usually made by the guild masters by majority vote.

Guilds had a significant impact on medieval urban life and vice versa. The relationship between guild and city varied from place to place. The governance of most cities, which acted as the authority in the Middle Ages, had a significant influence on the guilds. In some places, the city government appointed officials within a guild. In other places, guilds were almost entirely autonomous. In many cases, guilds had to buy recognition as a full-fledged independent body from local or national authorities.

Guilds owned properties, which belonged to all members. These collective property rights can be seen as predecessors of individual property rights. However, the properties, and especially

the revenues from them, served as funds from which guild members and their families could be supported in case of work-related accidents, illness, or death. The contribution that guilds have made since the Middle Ages to the development of individual property rights can be seen as a positive contribution to the economic and social development of Europe.

Guild members

The guild represented the interests of its members and protected them. The guilds wanted to maintain their reputation, they could not afford to have certain members sell poor quality products. However, this meant that there were strict requirements to be part of a guild, as is clear in the procedure of becoming a master:

Younger craftsmen started out by working under a guild master at a young age. Most of the times female members weren't allowed, and guild members had to live in the city of their practice. If they were found suitable by the master, the craftsmen then became apprentices and would follow almost a decade of training in the trade (under a master). Eventually, after passing a ‘master’ test, guild members were able to obtain the title of master themselves, allowing them to start their own business.

Guidelines

Once a member of the guild, there were strict guidelines and customs to adhere to. If a guild member did not follow the rules, all members suffered. This caused the level of production to remain high, and created opportunity to perfect the practice with already obtained knowledge. However, this perspective makes Guilds conservative institutions. Members had to adhere to the prevailing ideas within the guild. The centuries-old practices could not be renewed, let alone changed. Refinery and exploring happened carefully, but someone with true innovative ideas had to either become a member of the guild and give up these ideas, or choose a different profession. Innovation thus hardly stood a chance, resulting in the likely delay of the modernization of production

methods. Causing countries like France and the Netherlands to fall behind in their development in the 18th century compared to Great Britain.

Economic influence

A traditional view of the economic role of guilds is based on the monopoly Guilds were thought to have had on the production and trade of certain goods. Because guilds had the exclusive right to practice the trade, they had a lot of influence on the market. Guilds determined the prices of their products and the quantities produced. Advantages of this monopoly include economies of scale and risk-sharing for guild members. If a guild member was in need, he was helped by his fellow members. However, the monopoly also had disadvantages. Because there was no real competition between guild brothers, prices of goods could be kept high.

A more modern view of guilds is that there was hardly any monopoly, as within a guild there were dozens, sometimes hundreds of craftsmen active, making price agreements almost impossible. It has also been shown that guilds sometimes sold rights to non-members, allowing them to participate in trade and production of goods. This view dispels the idea that guilds should only be seen as monopolistic conspirators.

Influence on farm constructing

In urban areas, a carpenter was obligated to build only according to building techniques taught by the local Guild – incorporating known techniques and developments. In rural areas the development in construction techniques was more stagnant. This might have to do with the lack of guilds, isolation and lack of aforementioned obligation of the Guild. Building techniques prevailed for a longer period, with a delayed influence from urban developments. Vice versa, the still present ‘older’ techniques by rural craftsmen then influenced the innovations in urban areas after evaluation.

Where stone constructors were part of almost the whole building process, carpenters were

only swiftly present. This is because they were brought in locally.

Principles of timber construction that seem most logical nowadays, took ages to develop. Multiple generations of craftsmen had to struggle with the material to come to useful conclusions and solutions. These solutions were even different per area. Additionally, innovation was stagnant because of aforementioned guidelines of the guilds.

Material availability and Vernacularity

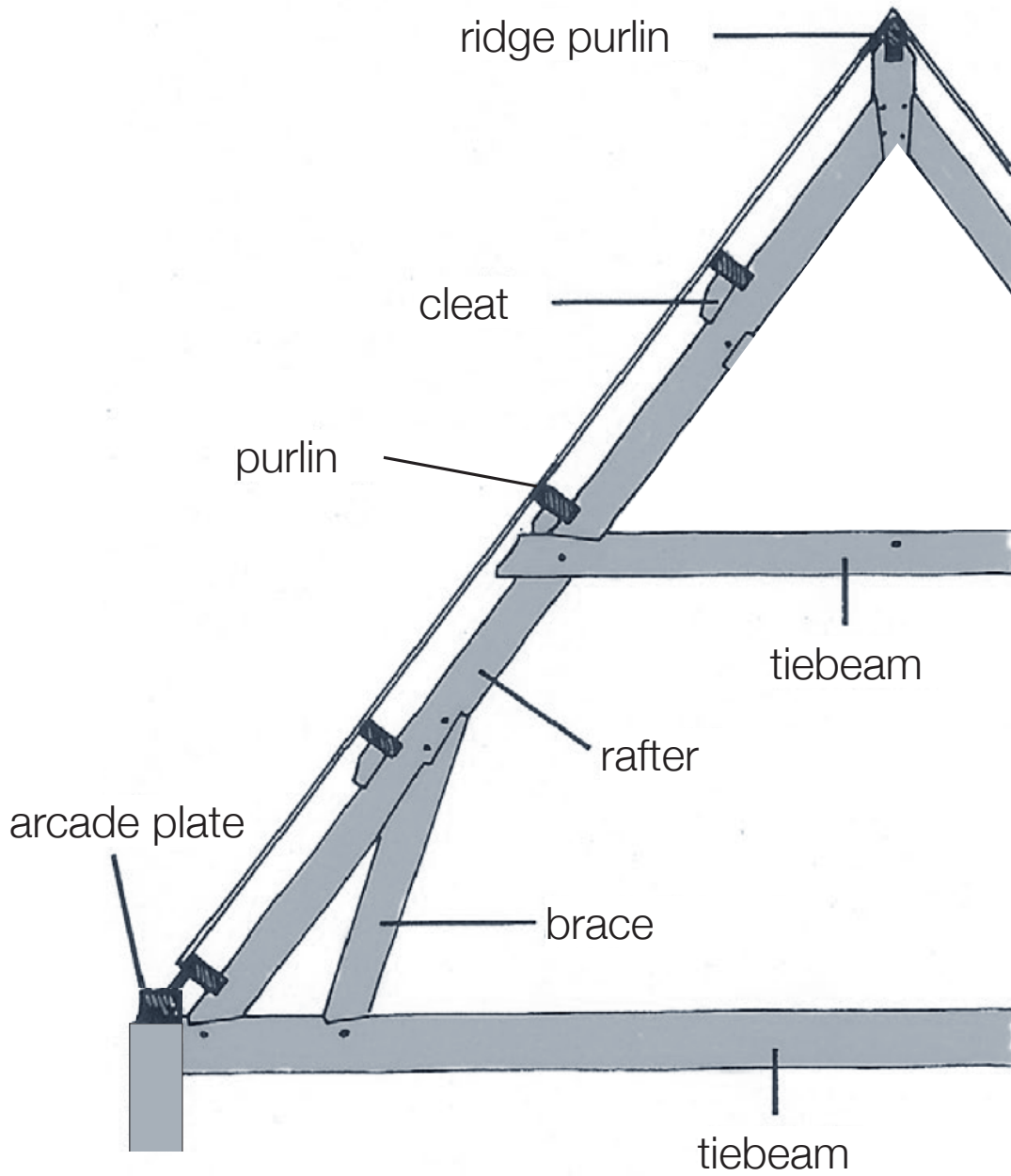
Locality is also a factor in the history and craftsmanship behind the constructions.

Transportation of material was more difficult back in the days, this made it necessary to harvest building material as local as possible, in order to keep building costs low. As it was the material that was expensive - whereas nowadays labour is the prominent cost driver - there was a need to keep material waste low and recourse the material as local as possible.

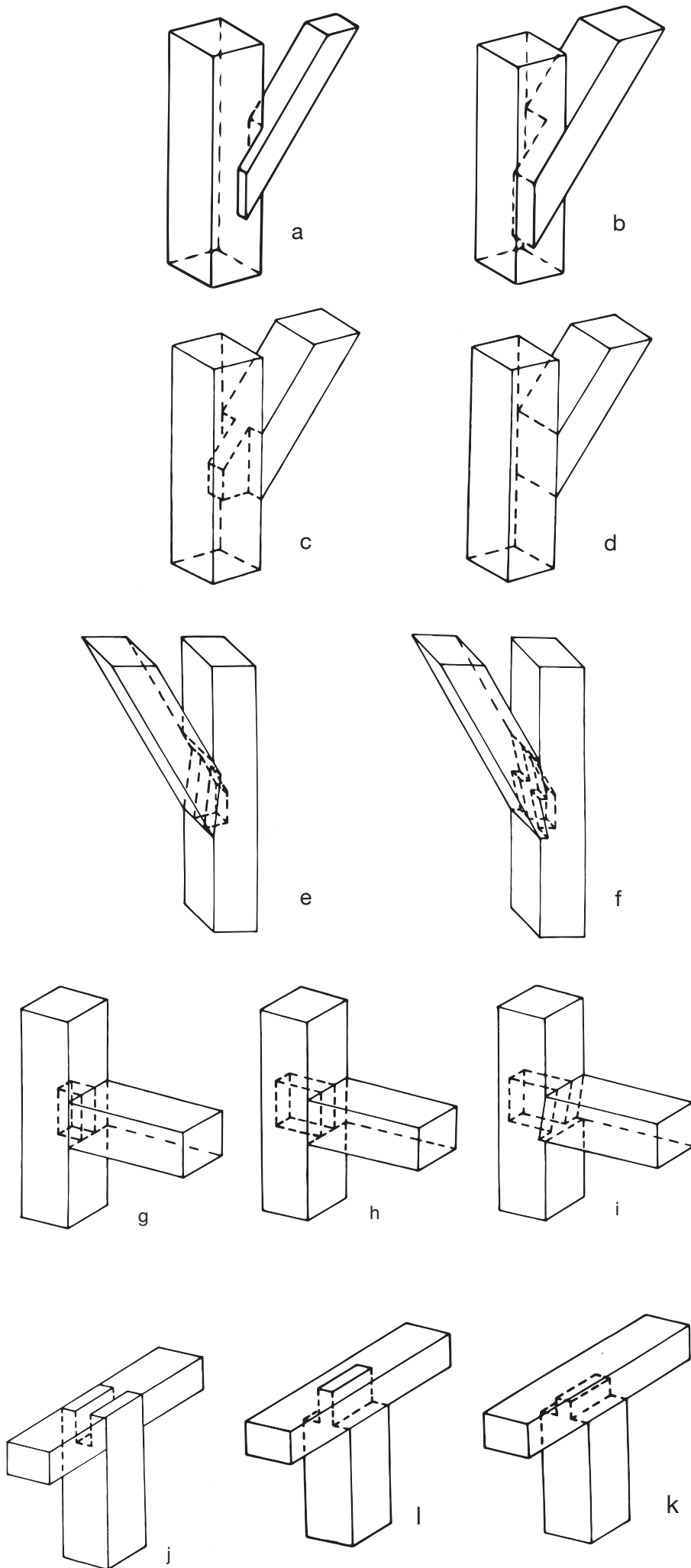
CH3 - ANALYSIS CASE STUDY CONSTRUCTION

In this chapter, the construction of two farms will be analysed. The motivation behind the selection of these farms can be found in chapter 1. The literature used in this chapter is by G. Berends (1996), H. Janse (1988) and a report by 'Centraal College van Deskundigen Restauratiekwaliteit' (2016) - as referenced in the literature overview in the back of this booklet. An overview of mentioned elements is presented on the next page as to prepare for the analysis in this chapter.

OVERVIEW JOINTS AND ELEMENTS



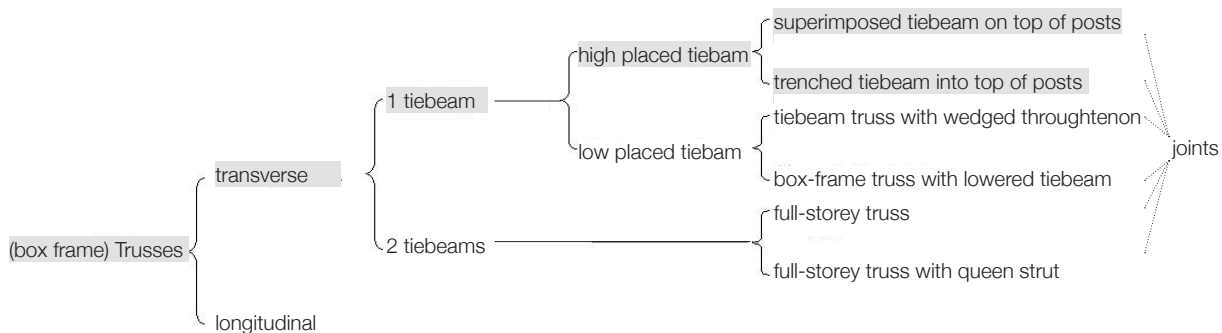
Overview roof construction, Translated from source : Centraal College van Deskundigen Restauratiekwaliteit (2020)



Scheme 2. close up of joints- deducted from source: G. Berends (1996)

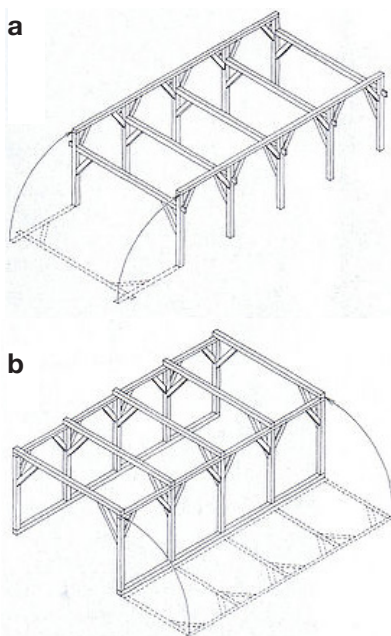
CONSTRUCTION ANALYSIS

Firstly, it is needed to give general information on the construction types of both the case studies. An approach to the analysis is shown in scheme 1 and 2.



Scheme 1. Overview of analysis of a traditional timber construction - translated from source: *Historische Houtconstructies in Nederland*

First the base of the construction is analysed. As seen in **scheme 1**, the first distinction can be made in how the trusses are connected, either in longitudinal- or transverse direction. These options are shown in scheme 3, 'a' being the method for both the case studies.

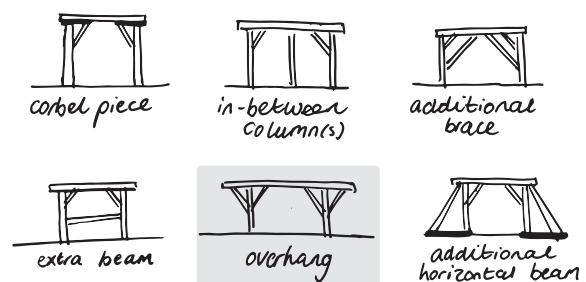


Scheme 3. diagram for assembly of trusses - source: G. Berends (1996)

The timber constructions in Groningen mostly exist in a layout of three-aisles, with two posts in the middle of the space. It can be dissected into multiple trusses, placed parallel behind each other in transverse direction. The trusses are placed on a foundation or spuds with a distance varying from 1,75m to 6,75m.

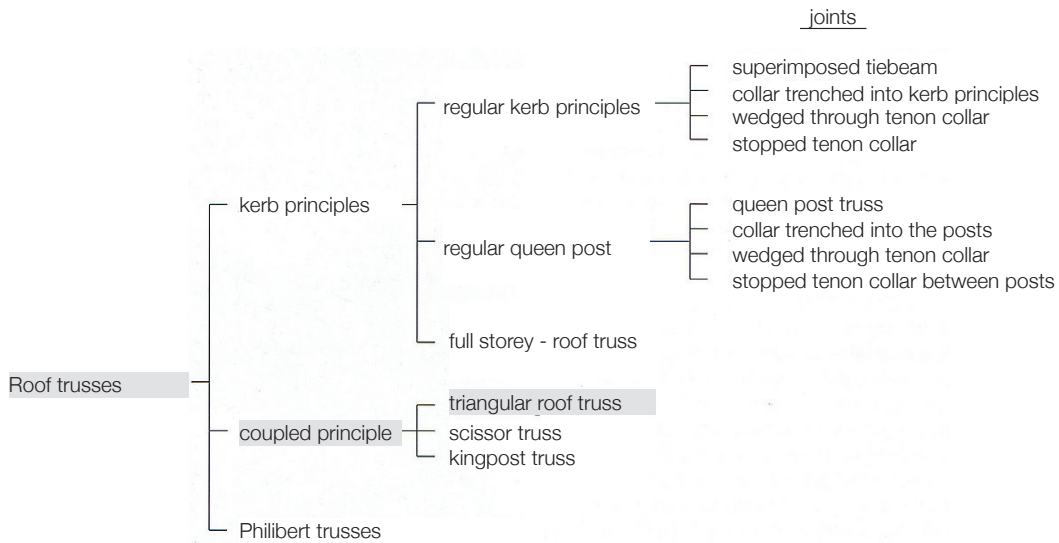
The following conclusion is that for the case studies there is only one tiebeam, located high on the posts. The assembly is mostly done by placing the tie beam on top of the post, as is the case for the case study. This method is called a dekbalkgebint – 'reversed assembly', or a 'superimposed tiebeam' on top of the posts.

Subsequently, the joint where the aforementioned assembly takes place will be dissected. In some cases, there is an extra column placed or the joint has an additional brace - see scheme 4.



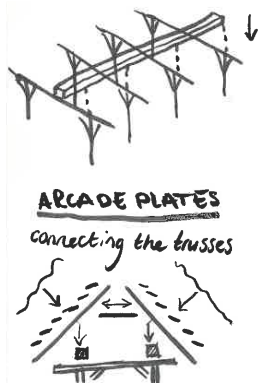
Scheme 4. assembly possibilities of post and tiebeam - own work

For the case study, the overhang joint is applied. This joint was often used when more space in the side aisle was needed. The 'gebintplaat' - arcade plate – is then placed on the edge of the truss beam. If the overhang is long enough, extra braces are used to support the beam. These box frame trusses must be connected to create three-dimensional stability, since they separately only offer stability for vertical forces



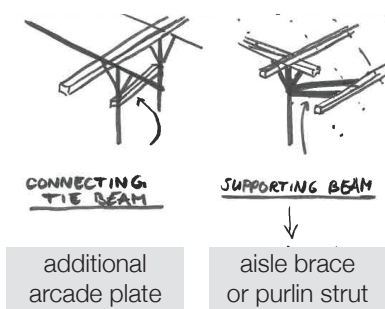
Scheme 2. Overview of analysis of a traditional timber roof construction - translated from source: *Historische Houtconstructies in Nederland*

and in transversal direction. This connection is made by arcade plates that connect the multiple truss constructions, see scheme 5.



Scheme 5. connecting the box frame trusses - own work

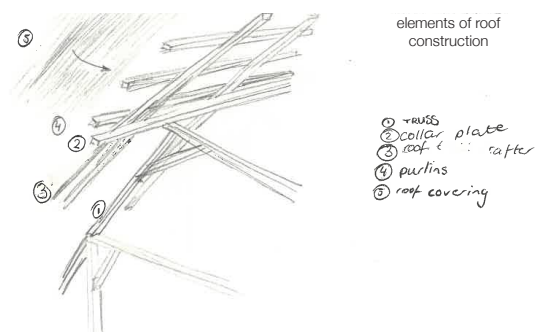
In some cases, there is an additional arcade plate/beam placed to offer more stability to the construction locally. Another additional element is a supporting beam (for aisle, also known as a 'sleeper'), which can also be executed with braces. It would then be called a 'gordingstut' - purlin strut or 'zijbeukspant' - aisle brace. These are present in both the case studies and are shown in scheme 5.



Scheme 6. additional strength options - own work

The truss constructions create the base of the roof construction that carry the roof covering. In the Netherlands, it is most common for the rafters to be self-supporting. They are placed on the arcade plates and connected through a collar rafter - the coupled principle, as can be seen in **scheme 2**. There is no 'nokgording' - ridge purlin. This 'self-supporting' method is also the applied in the case studies. The roof construction can be dissected in 5 elements stacked on top of the base truss. First, the rafters are placed on top of a collar plate - which is placed on either the additional truss construction or on the base - the latter being the case for the analysed farms. These rafters meet at the apex of the roof and carry the purlins, which connect the rafters and are placed parallel to the ridge purlin. The roof covering (often tiles, straw or thatch) is placed on top of the purlins.

These elements create a triangular roof truss.



Scheme 7. elements of truss roof construction - own work

The way these elements are joint is different per case study and will be analysed on the next pages.

3.1 - FARM 'DE HAVER'

The construction of the farm 'De Haver' will be analysed according to information about traditional timber joints - found in literature.

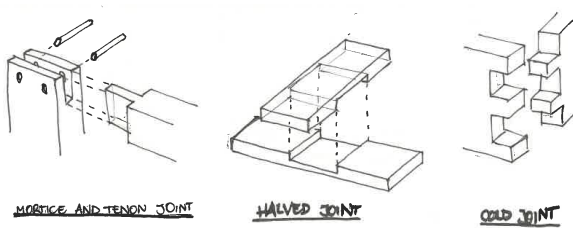
As stated in CH1.5, the distance between the posts are 6,287 Meter, 8,820 Meter and 5,801 Meter. The images of the interior of the farm - provided by ONIX architects - show that the posts are placed on a brick footing foundation.

It is difficult to determine further the specific joint without disassembling the construction to see the inner slot. However, the joints will be estimated, based on looking at the exterior of the joint. An overview of these joints is given at the beginning of this chapter.



Image 1. construction documentation - source: ONIX architects

There are three types of joints, regarding the assembly of roof construction elements: a mortice and tenon joint, a halved joint, a cold joint secured with nailed-on plates. See scheme 1.



Scheme 1. joint options by G. Berends (1996)- source: own work

When looking closer at the joints, it becomes clear that the box frame truss elements are assembled with the methods of the cold joint and mortice and tenon joint.

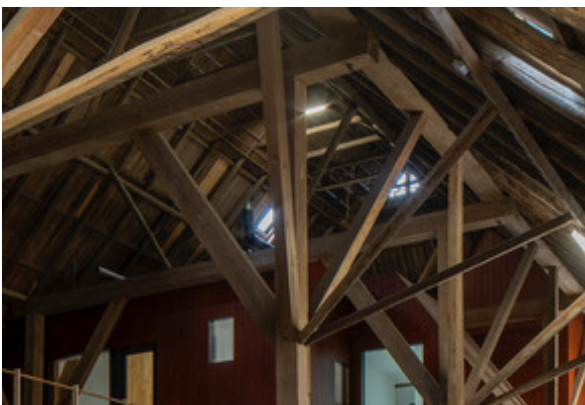


Image 2. close up of joints- source: ONIX Architects

Case study documentation

Literature analysis material

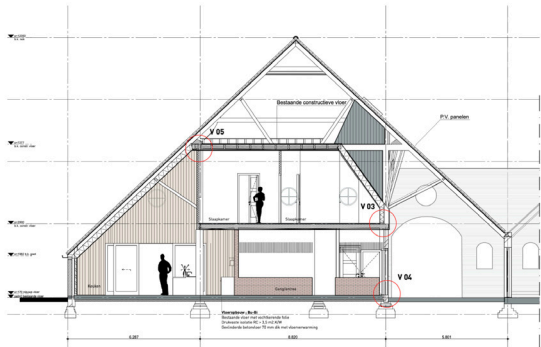
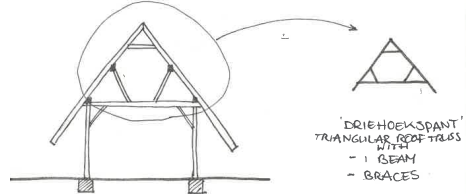
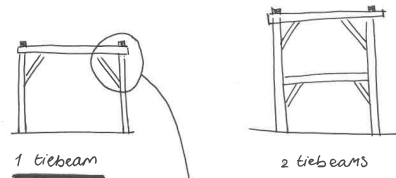


Image 3. section drawing of renovated farm - source: ONIX architects

ROOF CONSTRUCTION

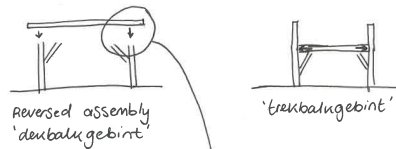


DWARS GEBINTEN division



further division
in assembly manner

ASSEMBLY JOINERY TIEBEAM TO PILLARS division



division in JOINT

Scheme 3. 4. 5. construction documentation - source: own work

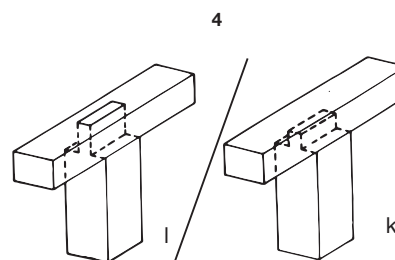
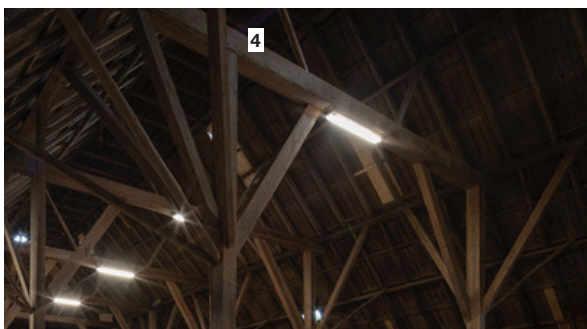
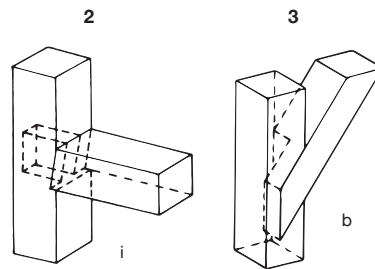
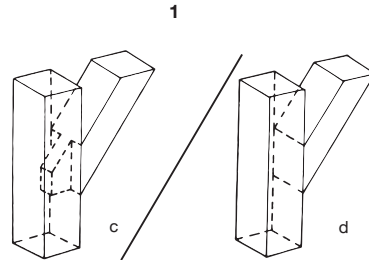
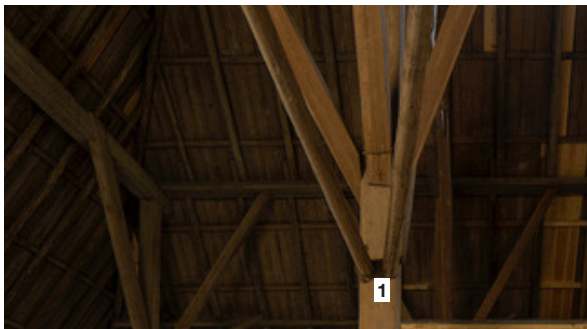


Image 4. 5. 6. construction documentation - source: ONIX architects

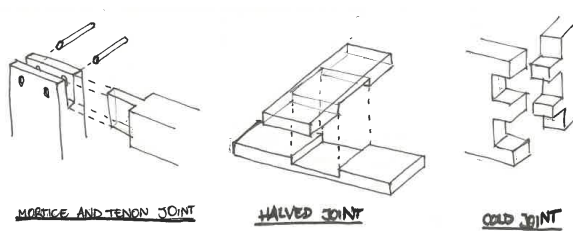
3.2 - FARM 'MAARHUIZEN'

The construction of the farm 'Maarhuizen' will be analysed according to information about traditional timber joints - found in literature.

Since there are no drawings available of this farm, joint analysis will be done from analysing the images provided by the owner and the company that renovated the farm, *Bouwgroep Dijkstra Draisma*.

The images of the interior of the farm - provided by the owners - show that the posts are placed on a brick footing foundation.

There are three types of joints, regarding the assembly of roof construction elements: a mortice and tenon joint, a halved joint, a cold joint secured with nailed-on plates. See scheme 1.



Scheme 1. joint options by G. Berends (1996)- source: own work

When looking closer at the joints, it becomes clear that the box frame truss elements are assembled with the methods of the cold joint and mortice and tenon joint.

It is difficult to determine further the specific joint without disassembling the construction to see the inner slot. However, the joints will be estimated, based on looking at the exterior of the joint. An overview of these joints is given at the beginning of this chapter.

An interesting feature of this farm is the circular timber construction elements. Almost as if directly applied from the source: the stem of a tree. Therefore, the materiality of the construction has a pure appearance.

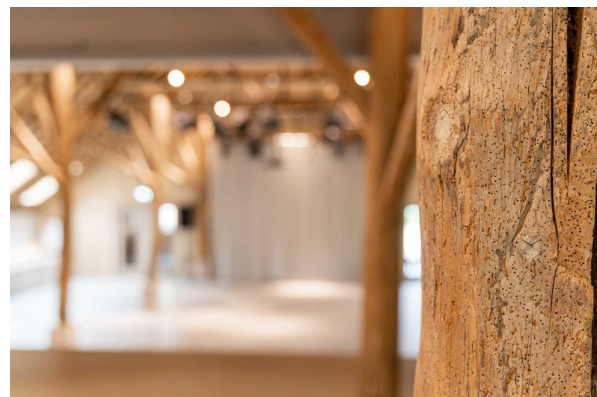
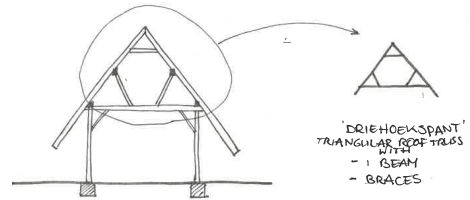
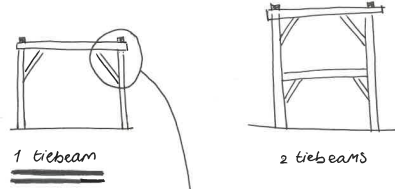


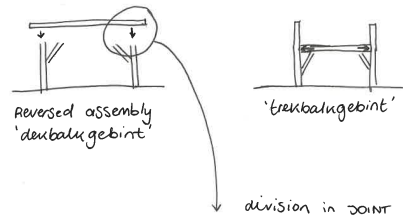
Image 1. Materiality construction - source : Bouwgroep Dijkstra Draisma



DWARS GEBINTEN division



ASSEMBLY JOINERY TIEBEAM TO PILLARS division



Scheme 3. 4. 5. construction documentation - source: own work

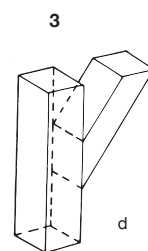
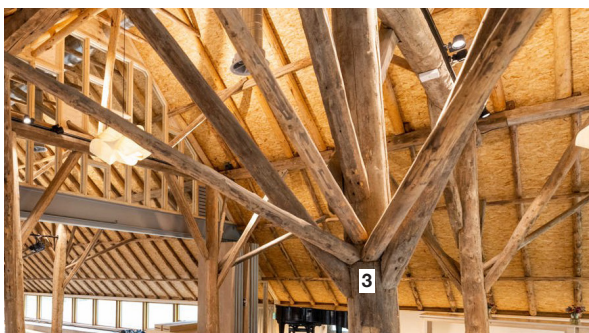
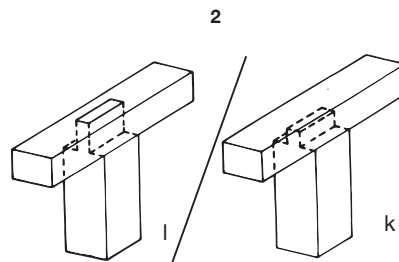
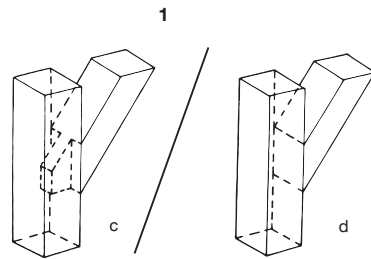
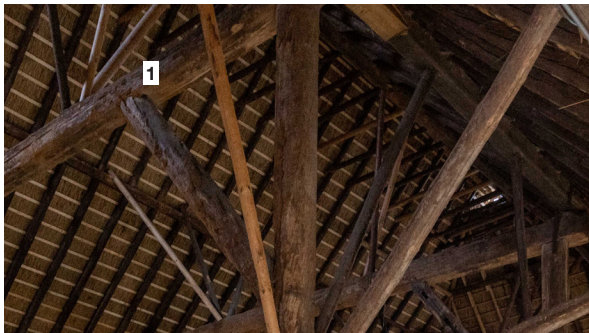


Image 3. 4. 5. 6. Construction close ups- source: owners

CH4 - MODERN DAY BUILDING TECHNIQUE ANALYSIS

In this chapter a comparison of traditional timber constructions and modern timber construction will be made. This will be done by firstly analysing a recent project by DP6 called Villa Schipper De Leeuw. In the process, elements that stand out will be researched and compared to the case study of the farms.

DP6: 'VILLA SCHIPPER DE LEEUW'

This booklet starts with an overview of all the findings during the design is doomed to fade because of this - how can we integrate future innovation.

When observing the construction in this project, the rigidness stand out. This has to do with the materiality as well as the overall layout of the construction.



Image 1 and 2. Comparison of materiality of construction - source 1. : Bouwgroep Dijkstra Draisma and source 2. : DP6

The construction is more compact and has wider dimensions. there overall seems to be more space and 'air'. When looking at the traditional timber construction, stabilisation elements are very present - and might even create difficulties for modern day use.

Overall, it can be concluded that the craftsmanship that created the traditional constructions, is replaced by a mass produced construction. Where rigid and clear lines are the main theme of the modern construction, the characteristic aspect is lost.

As stated in the timeline, the use of machinery creates the option to work much more precisely and accurately. While this speeds up the process and less manual labour is involved, character might be lost along the way. Sure, the construction still clearly reflects 'wood', it no longer shows the imperfections and blemishes.

With new inventions like laminated timber comes the option of creating larger spans. Elements have more sturdiness and stability on its own, making stabilisation elements obsolete. This is clearly visible when comparing this project to the farms, the 'tectonics' of the space are different. Minimalism and clear lines are themes of the modern project.

Additional elements like steel, adhesives and finishings are used to create a modern day timber construction. Whereas in the olden days, timber and timber alone was used (up until the use of stone footings).



CONCLUSION

This chapter includes the answers to the research questions proposed in the Preface.

There are a couple of things to take away from this research of the craftsmanship behind the architecture of (the traditional roof constructions of) farms in Groningen. This research attempted to look at past architectural innovation to see what is valuable for future innovation in (sustainable) architecture. The following question will now be answered:

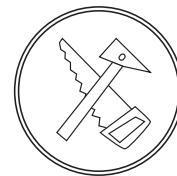
What can we implement from traditional timber craftsmanship of roof constructions of Groningen farms into modern (sustainable) building techniques for timber roof constructions?

The main thing that stood out was the importance of the (economic, political and social) context in which the constructions were created, as can be seen in the following icons. Back in the time, craftsmen worked under a Guild, a craftsmanship community that made carpentry into a craft. This was the place where local knowledge was exchanged and passed on until the 18th century.

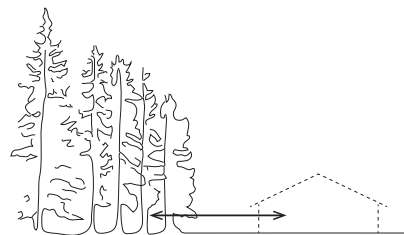
Practical considerations were key principles in the building process instead of aesthetics, along with specific local knowledge on constructing. Back then, the material was more expensive than labour. This allowed for intricate and manually intensive solutions to arise, that



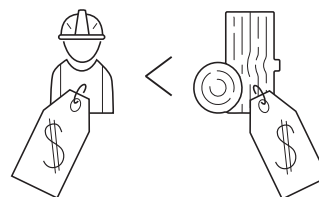
practicality



guilds



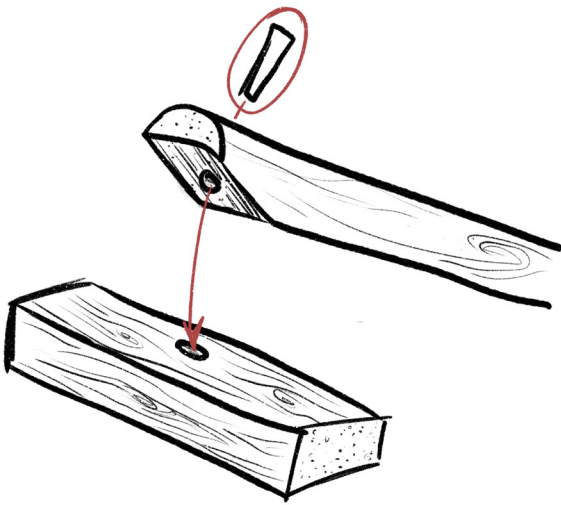
local resources



relative expenses

made sure no material was lost.

All of this (and more) created a specific way of building, typical for its local Guild and Craftsmen. One of the many examples that were found in this research is the 'Pen gat verbinding'.



These constructions are still valued and renovated with respect and care for past knowledge. This way of working and creating architecture is something we can learn from when creating sustainable architecture. Because isn't the Groningse farm - still valued, respected and reused for multiple centuries - the true embodiment of what sustainability can look like?

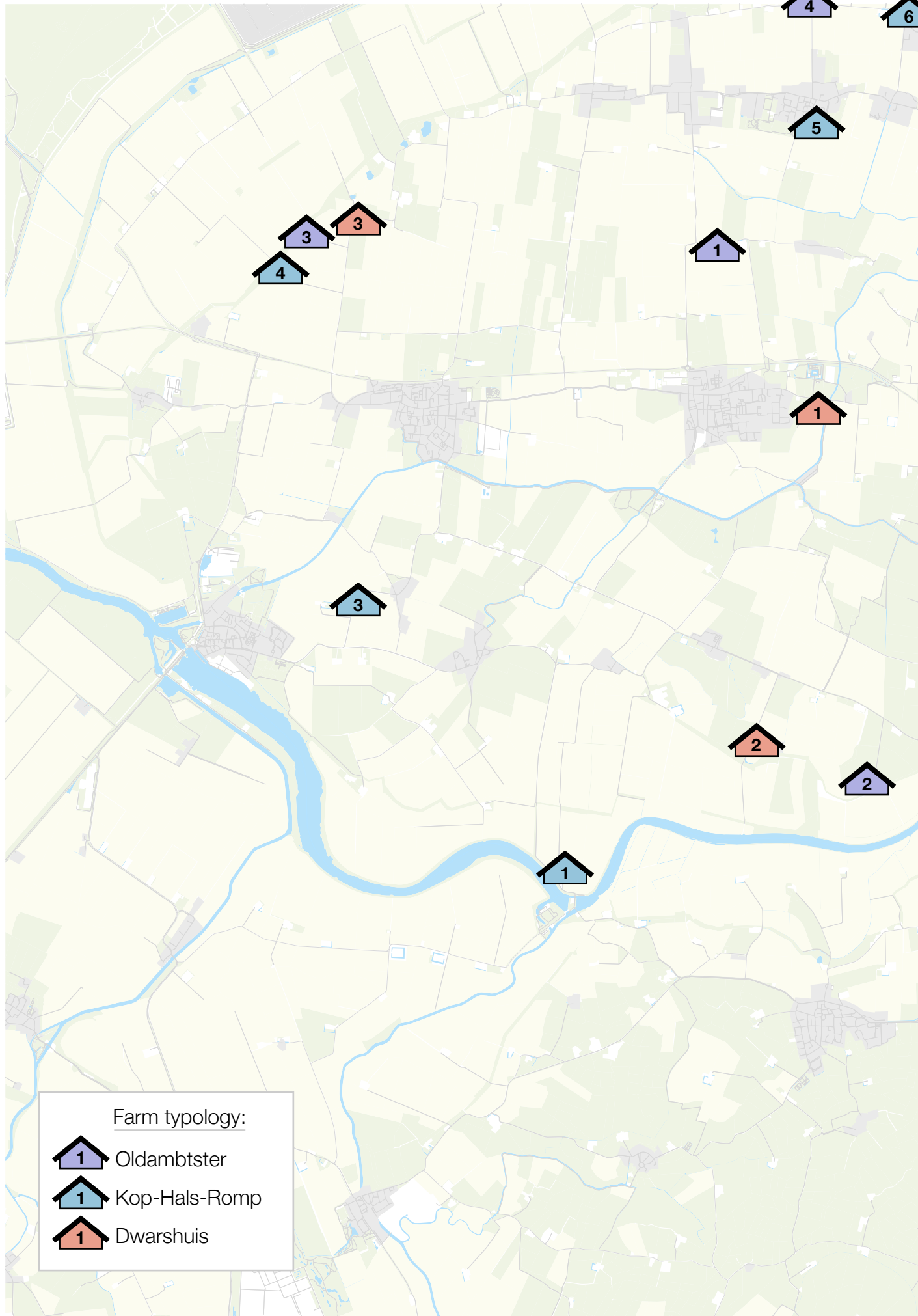
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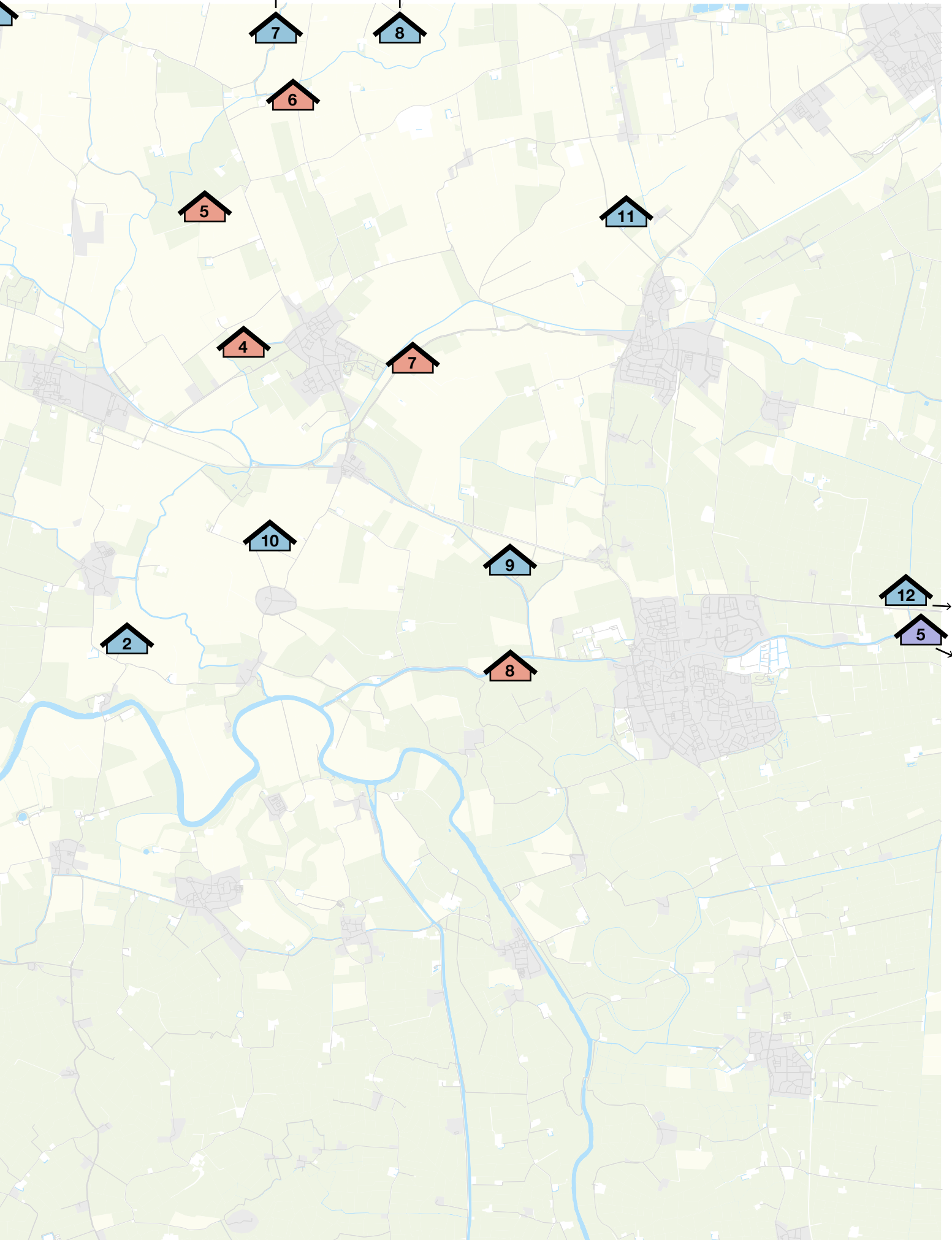
APPENDIX

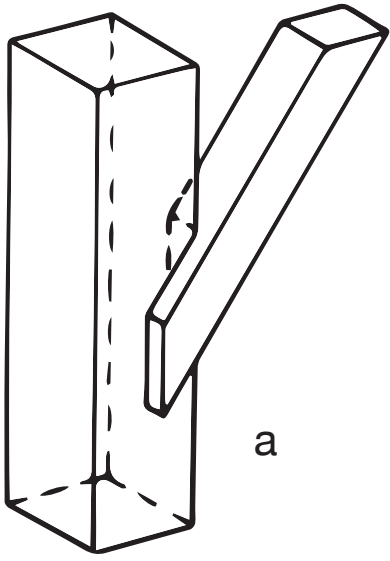
On the following pages, further material that was used in this research is laid out for further inquiry.



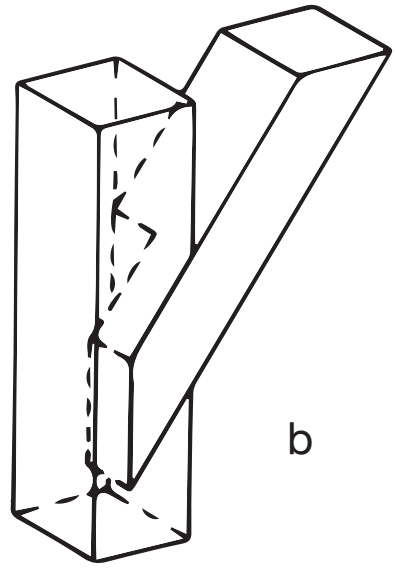
Farm typology:

-  Oldambtster
-  Kop-Hals-Romp
-  Dwarshuis

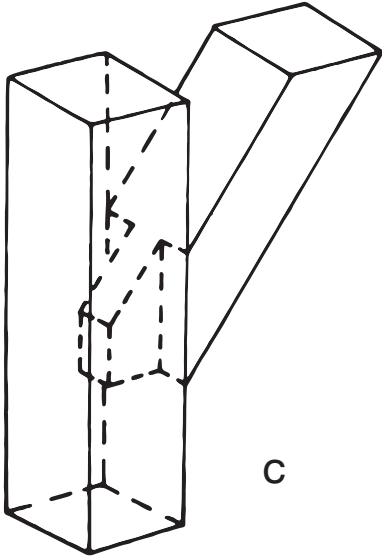




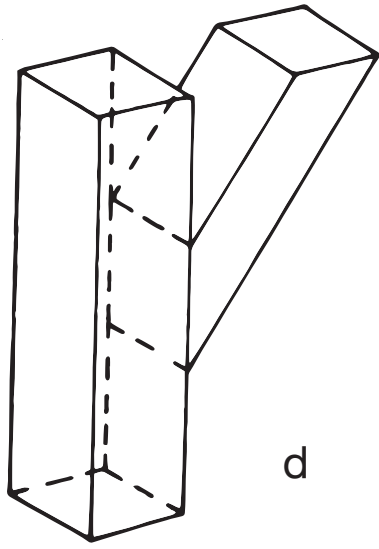
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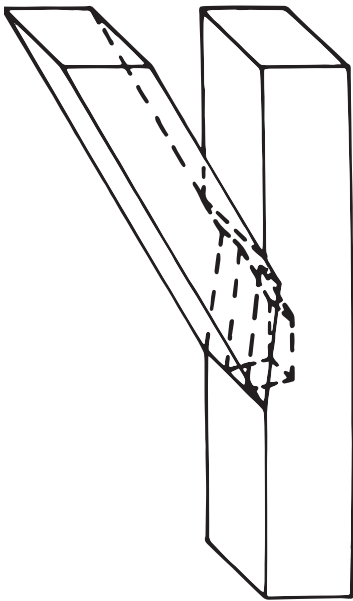
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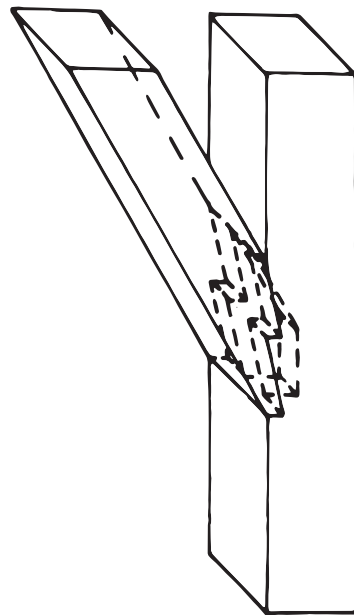
c



d



e



f

