



## KATOENVEEM | RESEARCH REPORT

Heritage & Architecture - Rotterdam Harbour Heritage

P1 Research Report Katoenveem - 22 Dec 2016

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## PREFACE | RESEARCH

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This research report is written by Jelmer van der Poel in the context of my graduation studio at the Faculty of Architecture of the TU Delft. This report is part of the MSc3 Heritage and Architecture design studio concerning Rotterdam Harbour Heritage. It shows the research I have done in the past weeks about the Katoenveem, an empty, industrial heritage building in Rotterdam.

The focus in this report is on the topic of architectural legibility. This notion in relation to the Katoenveem will be explained throughout the report.

This research will be used in the continuation of the MSc4 design studio, which is my graduation studio.

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**'Architectural legibility** is the degree to which the **designed features of the environment** aid people in creating an effective **mental image**, or "**cognitive map**" of the **spatial relationships** within a building, and the subsequent ease of **way finding** within the area.'

*Michael J. O'Neill in 'Evaluation of a conceptual model of architectural legibility' (1991).*

This document is the research and valuation report for the Katoenveem in the Vierhaven area in Rotterdam. This research report is written in addition to the Katoenveem group analysis. It is a continuation and interpretation of the group work we did.

In this individual report, a central question will guide the research. Several sub questions will aid in answering the main research question.

### **What is the degree of the legibility of the Katoenveem in its context for the visitors?**

- *How has the building developed over time and how does this influence the legibility of the building?*

- *How does the changing of the context influence the legibility of the building?*

- *How does the facade influence the legibility of the building?*

- *How does daylight influence the legibility of the building?*

- *What is the relationship between the inside and the outside and how does this relate to what I expected before and during my visits?*

In order to answer these questions, it is relevant to know what is meant by the legibility of a building. In 'Evaluation of a conceptual model of architectural

legibility', Michael J. O'Neill states that architectural legibility is 'the degree to which the designed features of the environment aid people in creating an effective mental image, or "cognitive map" of the spatial relationships within a building, and the subsequent ease of way finding within the area'.<sup>1</sup> In more simple words architectural legibility is about what creates the image you get when looking at a building. It is about the designed elements of a building and its environment.

We can read buildings in the same way we read a text. The text is composed of many characters, forming words and sentences. By learning how to read we learn how to recognize certain words and patterns in a text. A text can be analysed in different ways, looking at different aspects of the text. It can for example be parsed or arithmetically decomposed, but one can also look at the structure of a text, punctuation, fonts and size. All these aspects affect the readability of the text. The same can be done for a building. A building can also be analysed according to different aspects of the building. From this the readability, or architectural legibility, of the building can be determined.

In this research report I will investigate the designed elements within different design aspects of the Katoenveem and its surroundings. These design aspects are present in the sub questions that will be answered in the conclusion of each chapter. By doing this I want to find out what image is created when looking at the building, and how the building is interpreted. I will do this by presenting my own

experience of the building. Also, I would like to compare and see how this image is different to the image people would have had in the past, by reconstructing the situation of the 1920's. In fact I am decomposing a building like I would decompose a text, and investigate what elements influence the legibility of the building, and how they do this.

<sup>1</sup> O'Neill, M. J. (1991). Evaluation of a Conceptual Model of Architectural Legibility. *Environment and Behavior*, 23, 259-284.

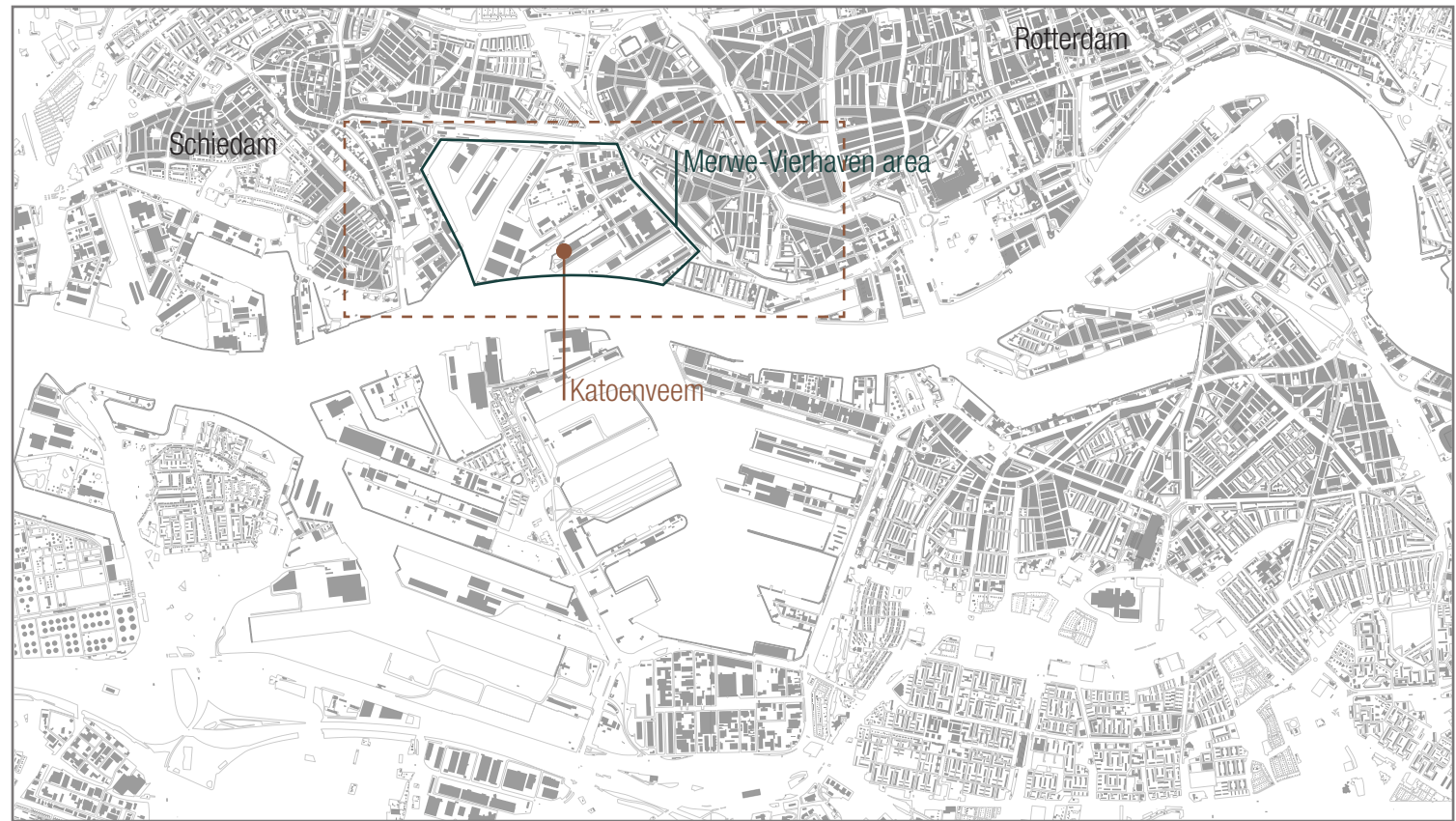
## **HISTORY | KATOENVEEM**



## HISTORY | DEVELOPMENT

Where is the Katoenveem located?

The Katoenveem is located to the west of the old city centre of Rotterdam, along the north side of the Meuse river, close to Schiedam. It is part of the Merwe-Vierhaven area, named after the different harbours in the area. On the northwest side the Katoenveem is flanked by the Keilehaven. On the southwest side the building was bordered by two other warehouses, New Orleans and Galveston. These warehouses were eventually removed, and nowadays there is a new company opposite of the Katoenveem. This company is involved in storing, conserving and transporting fruits and juices. These fruits and juices arrive and leave via trucks that enter the building on the Keilestraat. This is basically the only traffic that is present there nowadays.



Map of Rotterdam around 2016 with the Katoenveem to the west of the city centre, TU Delft maps (2016)

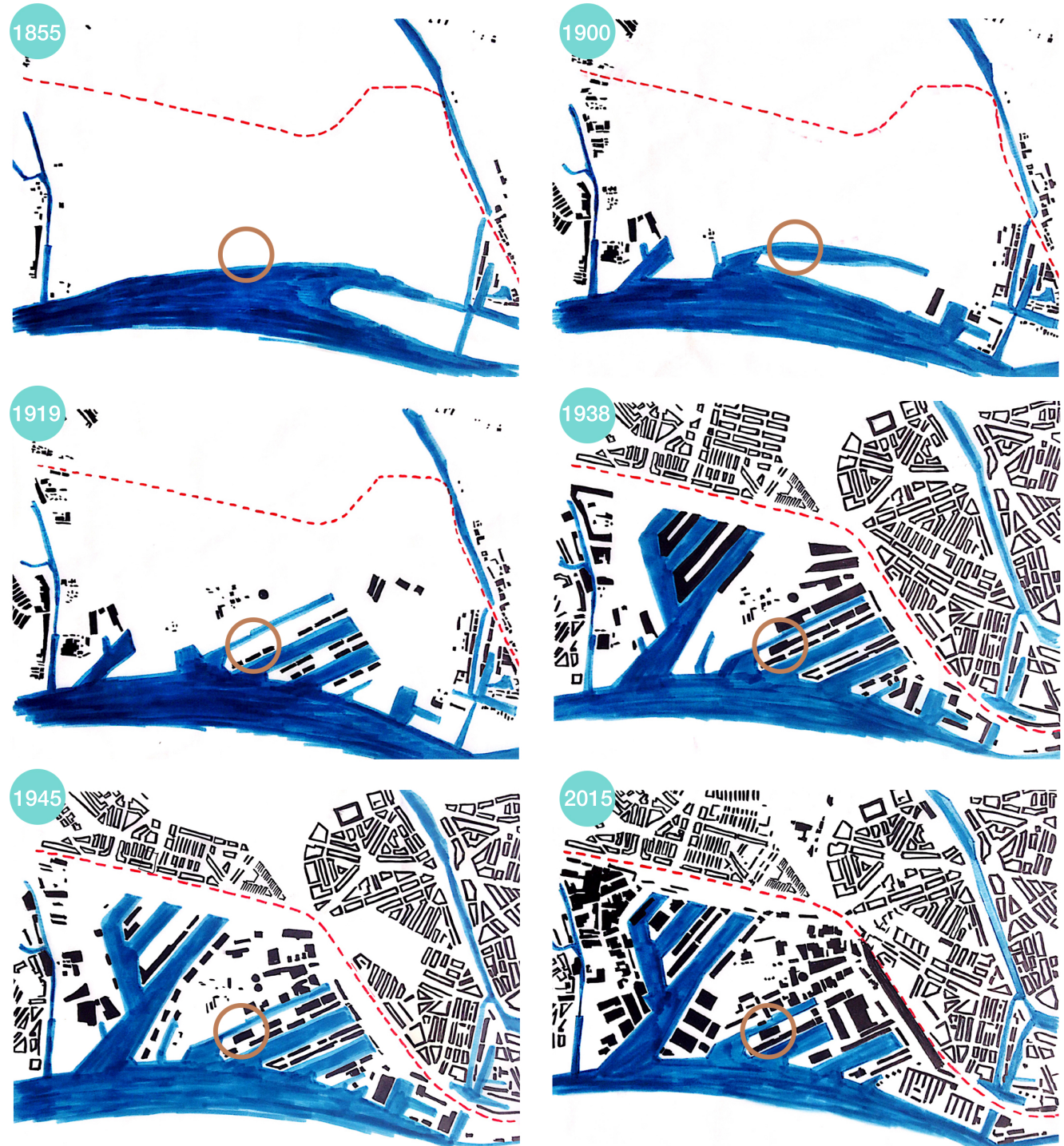


Map of the Merwe-Vierhaven area around 2016 with the Katoenveem indicated, TU Delft maps (2016)

## HISTORY | DEVELOPMENT

How has the area developed over time?

The harbours in the Vierhaven area have not always existed. 150 Years ago it was still a clear piece of land next to the Meuse river. Around 1900 the first industries started to develop in the area, and because of that the land changed. In the following two decades the harbours grew more and more and they more or less gained their appearance as we know it today. The infrastructure for the loading and unloading of ships was needed and therefore these harbours were built. From northeast to southwest they are called the Keilehaven, the Lekhaven, the IJsselhaven and the Koushaven. In the period between the two world wars the Vierhaven area expanded rapidly, and so did the land around it. Many new dwellings were needed to serve the increase of the population after World War I. Also the expansion of the harbours created more jobs and consequently more and more people started working in the harbours. These people of course needed places to live. Together with the construction of the residential areas, new harbours were constructed. These Merwehavens are located to the northwest of the Vierhaven area. During World War II some parts of the area were bombed and therefore show a gap in the map on the right. These areas are rebuild after the war and the industries in the harbours intensify. Also the residential areas densify. Nowadays the harbour activities are slowly moving out of the city, towards the Maasvlakte. This causes more and more buildings in the harbour to become vacant.



Development of the area, Alexia Ntella (2016).

## HISTORY | DEVELOPMENT

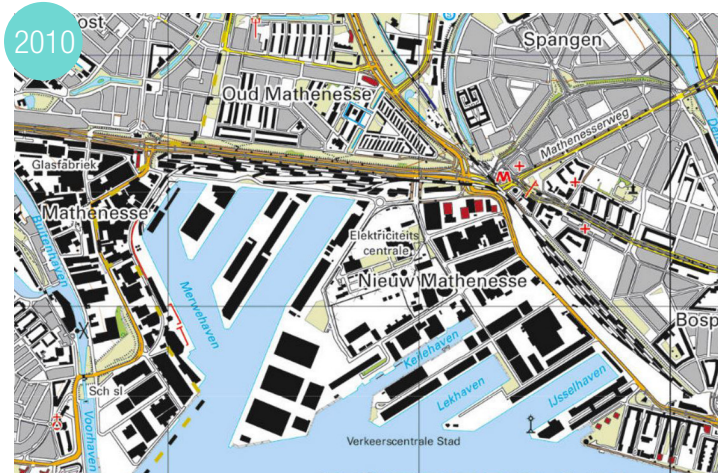
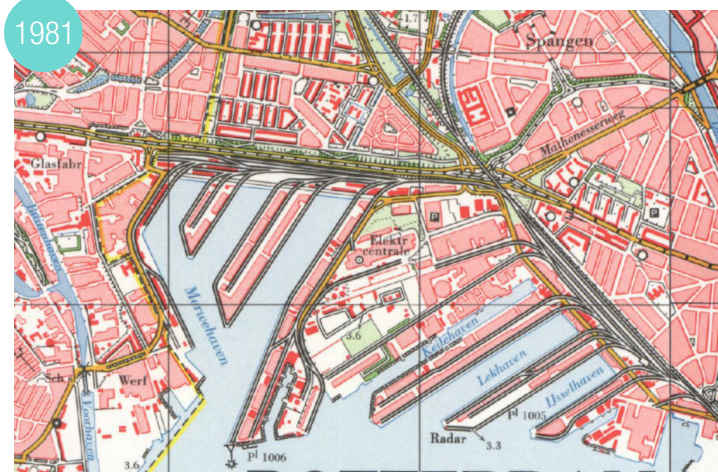
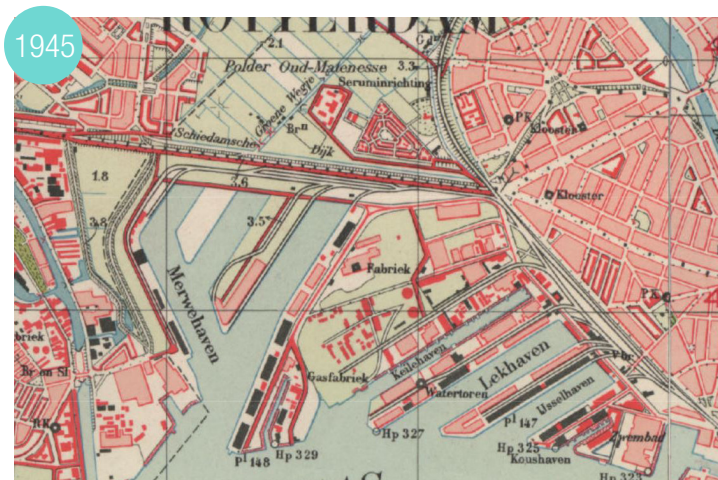
How has the area developed after World War II?

After the Second World War Rotterdam faced the problem of rebuilding a great portion of the city. Besides, the rapid increase in population caused a rise in dwelling construction. In the maps on the right these new houses can be seen north of the Merwehaven, in between Schiedam and Rotterdam.

In the harbours things changed over the years as well. The large terrain where the contemporary E-On power plant is situated changed from a coal-fired factory into a gas-fired factory. The buildings on this terrain changed accordingly.

By 1990 the situation in the Keilestraat had been altered substantially. The train tracks in front of the Katoenveem had been removed and the warehouses Galveston and New Orleans had been replaced by a new warehouse for the storage of fruits and juices. In 1995 the eastern part of the Keilehaven was closed, and in the 90's the Lekhaven was also partly closed. This was done by using the sand that became available during the construction of the 'Koopgoot' in the centre of Rotterdam.

The industry in the Merwe-Vierhaven area further developed in the years after the Second World War. During the last two decades of the 20th century many of the train tracks in the area disappeared because of the improvement and development of road transportation.

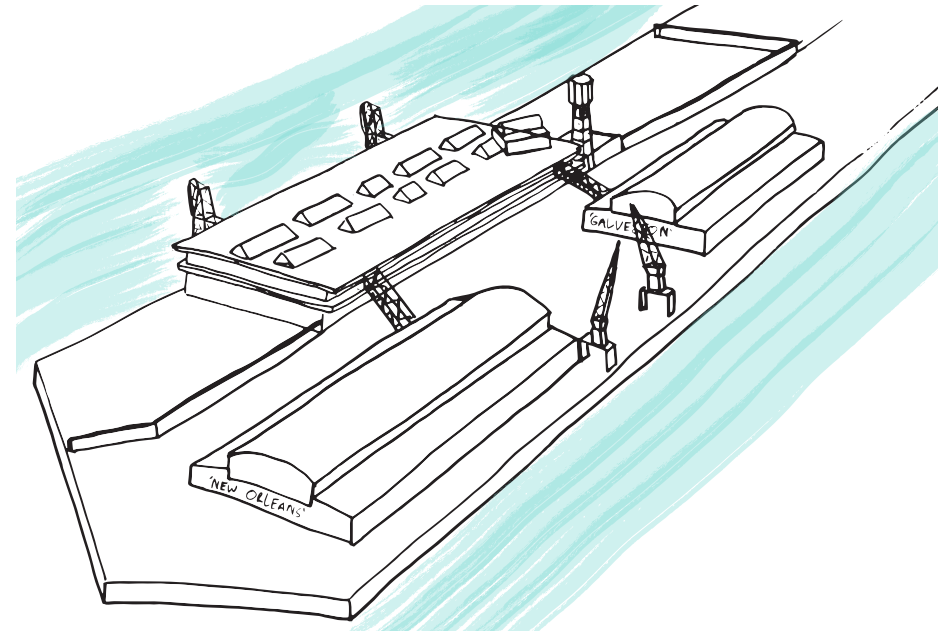
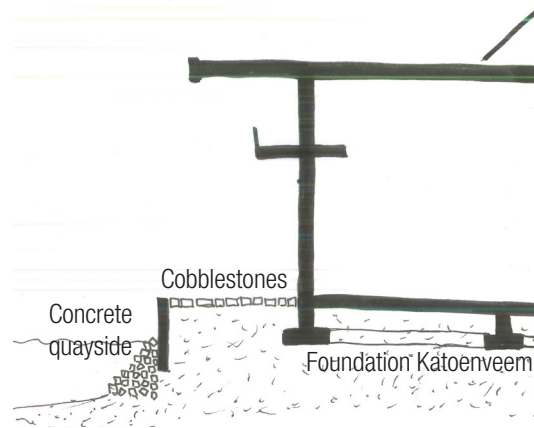


Development of the Merwe-Vierhaven area between 1945 and 2010, [www.topotijdreis.nl](http://www.topotijdreis.nl) (retrieved 09-12-2016).

## HISTORY | DEVELOPMENT

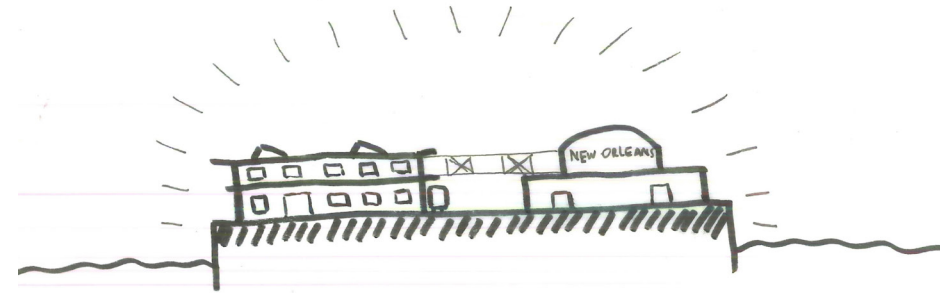
How did the direct surroundings develop?

The direct surroundings of the Katoenveem changed quite heavily over the years. In the 1920's it was part of a larger complex of buildings and other elements that all worked together and were connected to each other. This complex dominated the Keilestraat and the end of the pier. Nowadays the Keilestraat is dominated by trucks delivering fruits and juices to the newly build cooling warehouse opposite of the Katoenveem. It almost feels as if the Katoenveem stands in the way of further development of the pier. Many of the elements of the original complex have been demolished already, and the Katoenveem is the only remaining part of it.



Original situation of the Katoenveem in the Keilehaven in 1920. Together with the neighbouring warehouses and supporting elements it defines the far end of the pier, own image.

- <sup>12</sup> On the north west side the Katoenveem is bordered by water. The quay looks like a typical harbour quay, with a concrete quayside and cobblestone pavement. The south west and north east side of the Katoenveem used to be outside storing areas for cotton. These areas are now abandoned, and it is unclear if they still belong to the building or not. On the south east side the Katoenveem is bordered by the street. This side used to be the side where the trains were loaded and unloaded.



The relationship between the Katoenveem and the buildings across the street, past (top) vs. present (bottom), own image



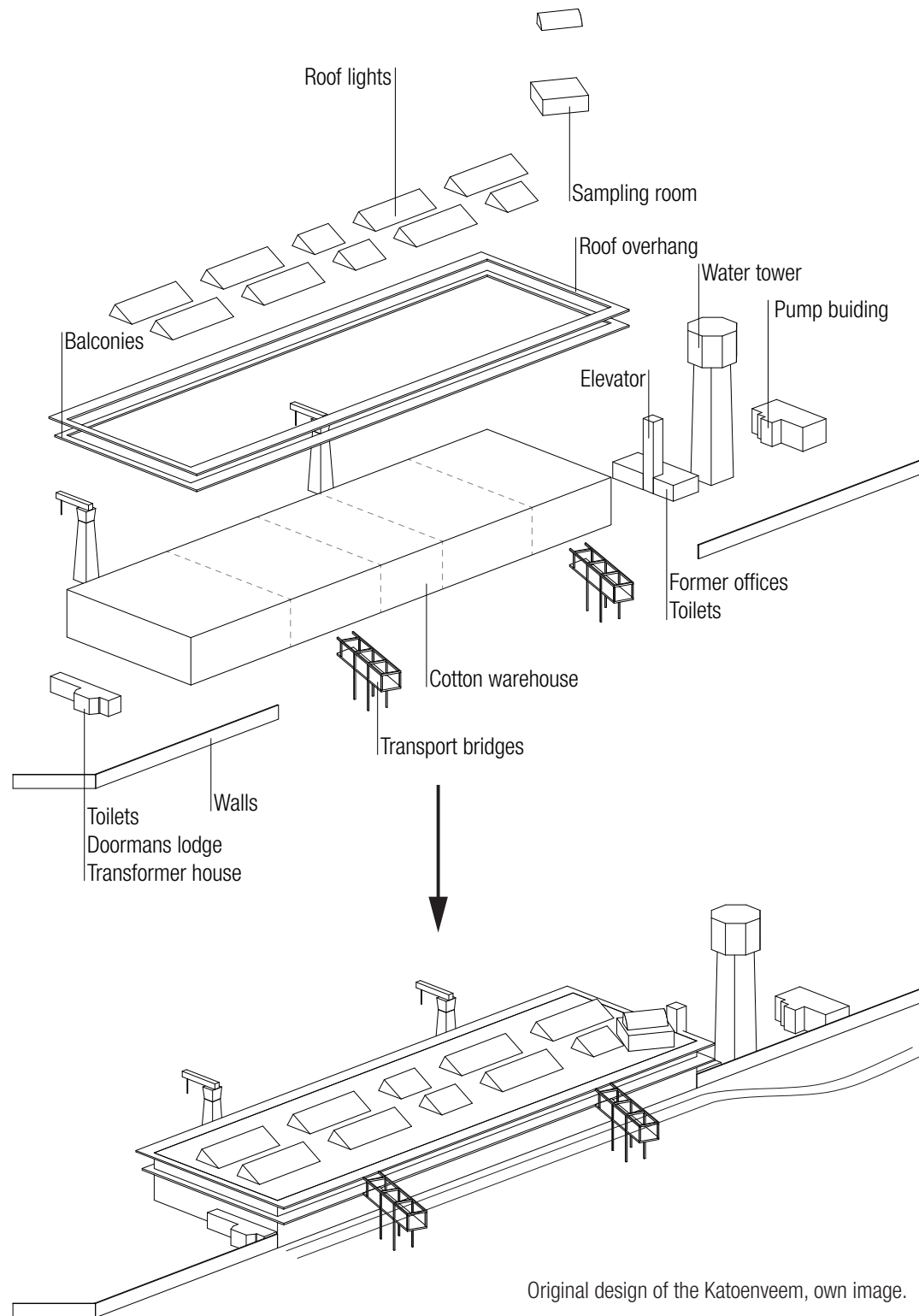
## HISTORY | DESIGN

How was the design of the Katoenveem?

The design of the Katoenveem was considered very innovative at the time it was built. It was not just an ordinary warehouse, but new ingenious techniques and systems were used. The design of the building was fully adjusted to the function of storing and transporting cotton. Therefore, the design of the Katoenveem could be seen as a rectangular, concrete box with all services attached to the building on the outside. Two cranes were constructed to unload the ships in the Keilehaven. Balconies on the outside and walkways on the inside of the building provided space for the workers to move around and control the cotton transport. The sampling room was added on top of the roof to ensure a perfect orientation towards the north. Offices toilets and a transformer house were added to the outside as well, similar to the elevator and the water tower.

By adding these services to the outside of the building, the interior space could be entirely used for cotton storage. This ensured the most efficient process.

The Katoenveem is built in concrete and has four fire walls separating the warehouse in five fire compartments. This was necessary to meet fire regulations at the time. These fire walls also serve as dilations.



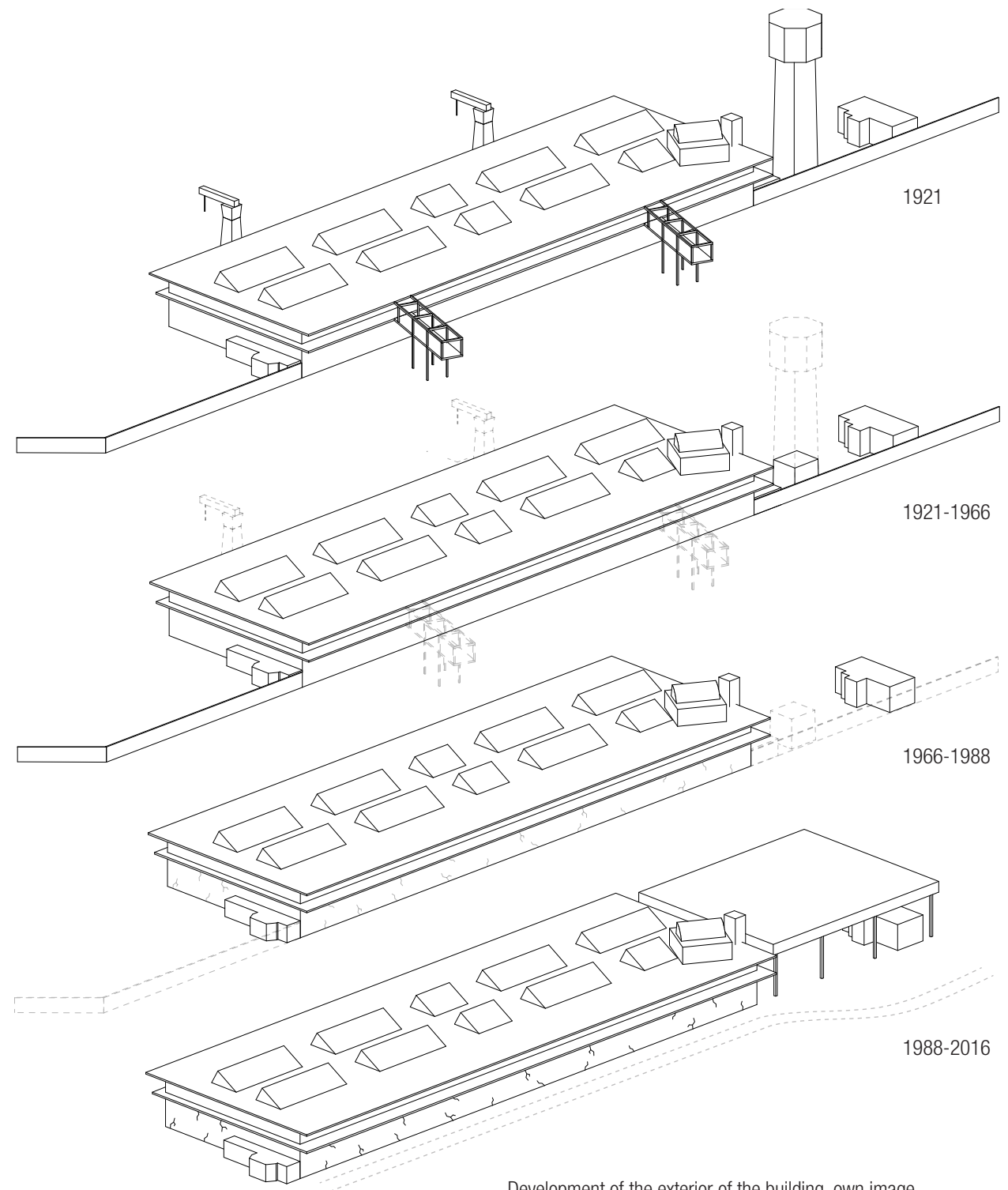
Original design of the Katoenveem, own image.

## HISTORY | DEVELOPMENT

How has the building developed over time?

The Katoenveem has changed quite a lot during history. Some parts have been demolished, while others have been added. Also, interventions in for example the facades have been made. To start with, the transporting bridges were removed, probably around 1926 when N.V. Thomsons Havenbedrijf bought the warehouses New Orleans and Galveston. Then, the top of the water tower next to the Katoenveem was demolished in 1966, together with the cranes next to the harbour. In 1988 the remaining base of the water tower and the director's office on the northeast side of the building were demolished. This office was replaced by a new one in the same year. In 1990 a steel shed was built in front of the Katoenveem, and also some parts of the facade were clad with plastic cladding. It is unclear in what year the walls surrounding the outside areas on both sides of the Katoenveem were demolished. Presumably this was done in the period between 1966 and 1988. Also, by 1990 the train tracks in front of the Katoenveem had been removed. Over the years, the building has started deteriorating extensively. The concrete on the outside started falling off, making the steel reinforcement visible.

The Katoenveem closed its doors in 1964, due to a decreasing demand for cotton and the development in synthetic fibres industry. After 1964 the building became vacant until some (small) companies occupied it in the '80s and '90s.

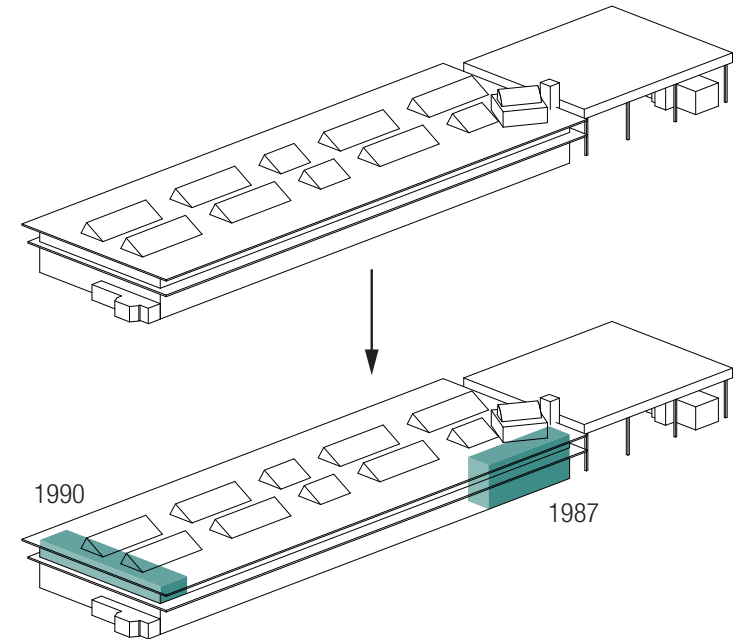


Development of the exterior of the building, own image.

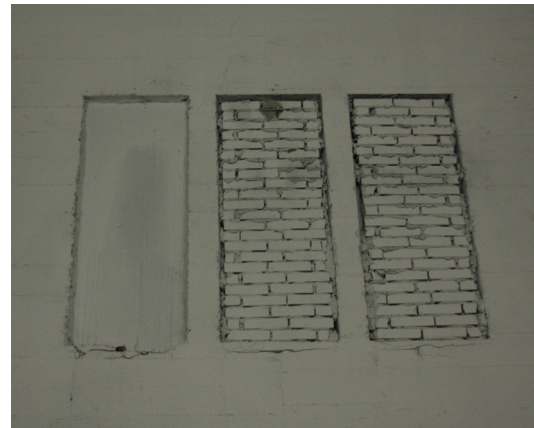
## HISTORY | DEVELOPMENT

How has the interior developed over time?

In the interior more changes have been made over time. In the original situation, no passageways were designed in the interior walls on the ground floor. On the first floor there were passageways from one compartment to the other. These openings could be closed off by fireproof rolling doors of the Kinnaer-system. Later some passageways have been made in the fire walls on the ground floor. Also some of the windows have been closed off by a brick or wooden infill. Furthermore, in one of the compartments a new steel structure has been added throughout the years, probably to accommodate a new function. In the east corner a new structure has been added, presumably to house offices for a new function. This was done in the 1980's. The same was done on the first floor on the southwest side of the Katoenveem, also in the 1980's. New offices were constructed here, and the facade has changed. These offices on the first floor on the southwest side of the building have been removed again.



In the east corner and at the south west side on the first floor, changes have been made to the interior, own image.



Interventions: addition of a steel structure, closing of the windows and creation of passageways through the fire walls. Photos by students (20-09-2016).



## HISTORY | DEVELOPMENT

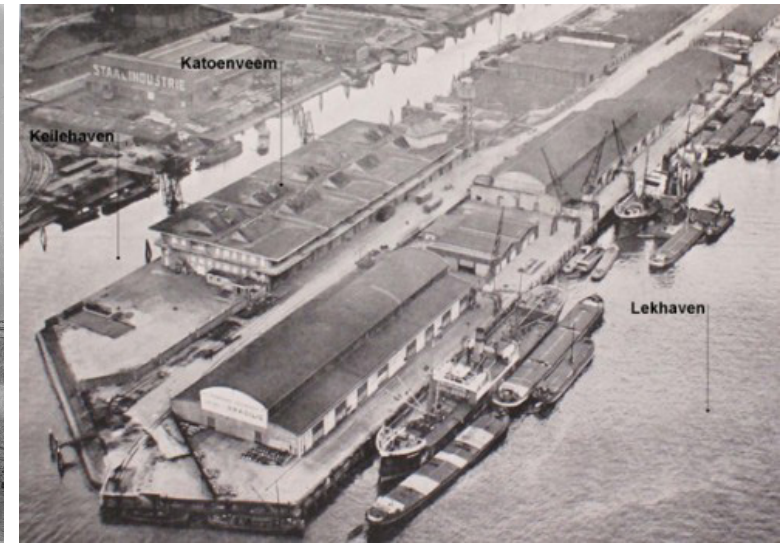
How have the surroundings developed over time?

The direct context of the Katoenveem has changed a lot as well. The original design consisted of a warehouse, a water tower, cranes in the harbour, transportation bridged to the warehouses Galveston and New Orleans, railways for transportation of the cotton to Germany and a walled outdoor space used for storage as well. All these elements had a specific function within the whole 'ensemble'. The water tower provided enough water pressure for the sprinkler system to work in case of a fire. The cranes and bridges were connected to the transportation system in the building so the cotton bales could be carried from one building to another.

The current view on the Katoenveem is very different than the original one. The water tower has been removed, the cranes are demolished, the bridges are gone and the warehouses across the Katoenveem have been replaced by a large new warehouse. This warehouse is a continuous strip, blocking the view and access to the Lekhaven. Additionally, a steel shed has been built in front of the Katoenveem, blocking your view on the facade. The walls around the outside space are no longer present.



Katoenveem, view from Keilestraat around 1920. Visible are the water tower, railroads, cranes, transportation bridges to warehouses 'New Orleans' and 'Galveston' and the walled outside storage space. Photo from Historisch Centrum Overijssel (retrieved 24-10-2016).



Aerial photo of the Katoenveem and its direct surroundings presumably taken in the 1950's. The transport bridges to the warehouses across the street have been demolished. The walls surrounding the outside storage terrain still remain. Photo from <http://hoopepelevier.nl/project/katoenveem/> (retrieved 14-09-2016).

Current view on the Katoenveem from the Keilestraat. Own photo (27-10-2016)



Aerial view of the current situation of the Katoenveem and its surroundings. Bing maps (retrieved 24-10-2016).



## HISTORY | CONCLUSION

How have the area and building developed over time?

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Rotterdam and its harbours have a rich history. The Second World War greatly influenced the development of the city and the harbours. After the war harbour industries and activities expanded.

In recent years the Keilehaven and Lekhaven were partly reclaimed again because the harbour activities shifted towards the Maasvlakte. The old city harbours were left empty, and the industrial buildings in these area became vacant.

The design for the Katoenveem was very revolutionary at the time. It was one of the first monolithic concrete warehouses and it was inspired by the Hennebique system. Also, its transportation system was new at the time. It was tailor made for the Katoenveem in conjunction with the concrete structure. This system connected the building to the other warehouses 'Galveston' and 'New Orleans' across the street.

With the vacancy of the Katoenveem came the demolishing of several parts of the building complex. The cranes were removed, the bridges to the opposite warehouses were demolished, the walls enclosing the exterior storage space were eliminated and the water tower was thrown down as well.

Over time changes have been made tot the building in the facade, the interior and the exterior. Holes have been made in the fire walls, windows have been closed and a plastic cladding on the facade has been added and partly removed again.

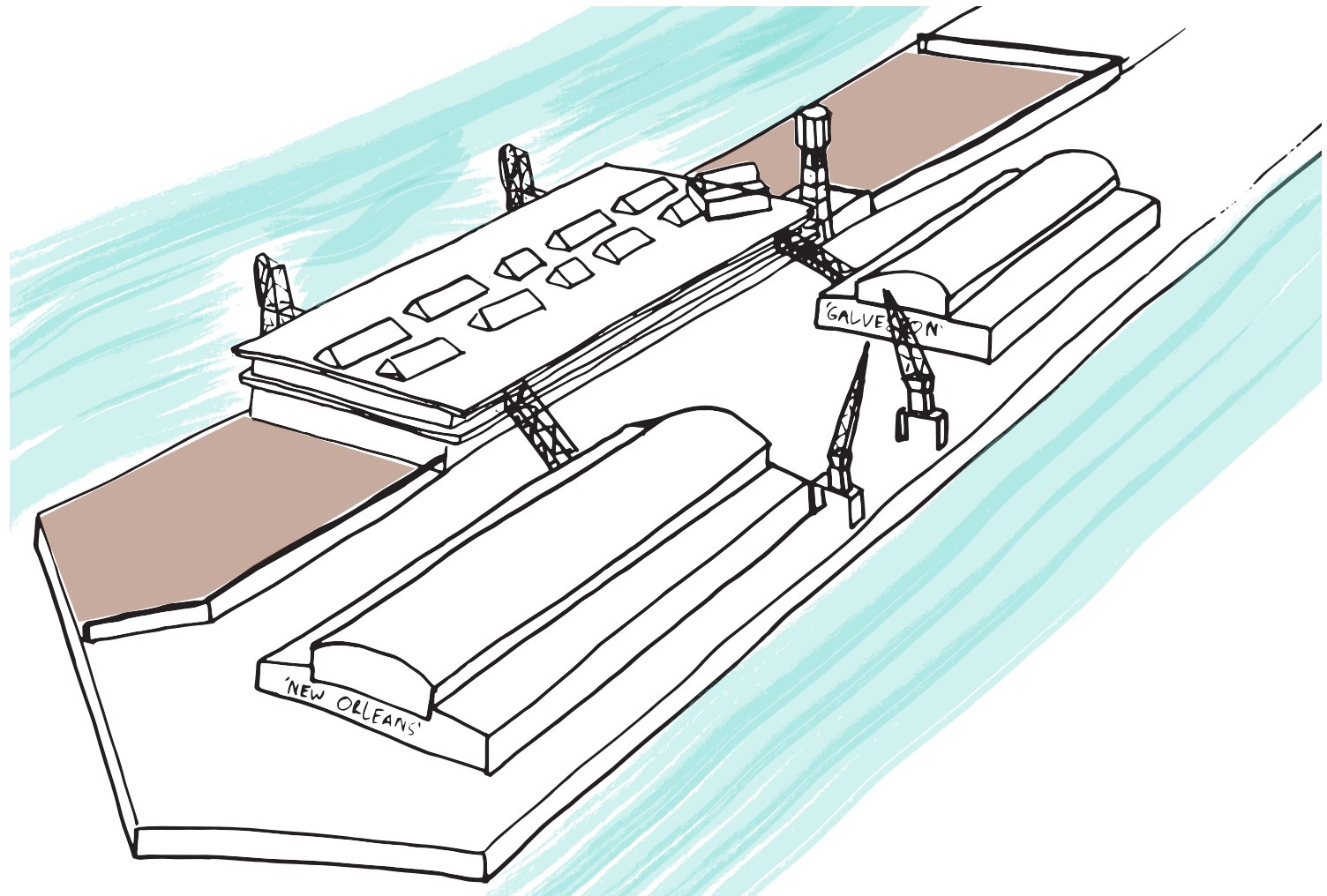
**CONTEXT | LEGIBILITY**

## CONTEXT | LEGIBILITY

How does the context influence the legibility?

In the original situation, the building of the Katoenveem was just one part of a larger system of transporting and storing cotton bales. Together with the cranes in the Keilehaven, the transportation bridges, the railways in the Keilestraat, the water tower, the warehouses Galveston and New Orleans and the cranes in the Lekhaven the Katoenveem forms a chain. Also, a wall on both ends of the building encloses an outdoor storage space belonging to the Katoenveem.

By looking at the aerial view of the original situation, the Katoenveem can be understood as a part of a larger system, all dedicated to the shipping of cotton. It can be seen that the three warehouses on the pier were all connected to each other and that they worked together in a certain way.

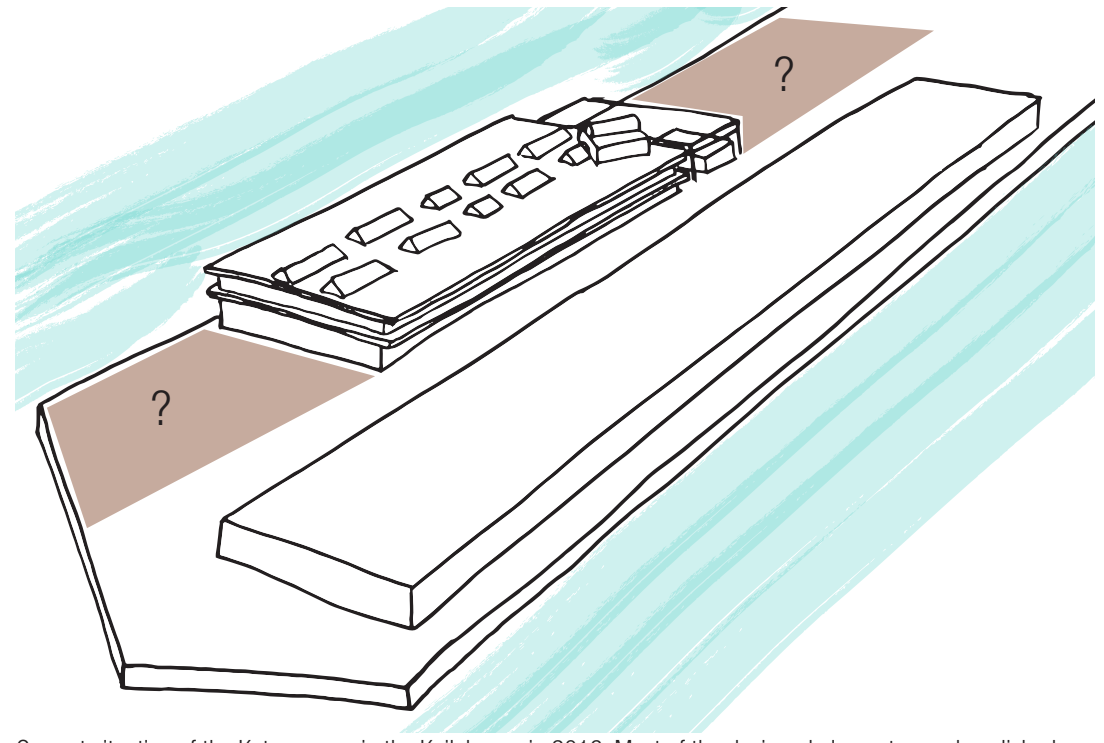


Original situation of the Katoenveem in the Keilehaven in 1920. All the designed elements are still visible. The outside terrains belong to the Katoenveem and serve as an outdoor storage space, own image.

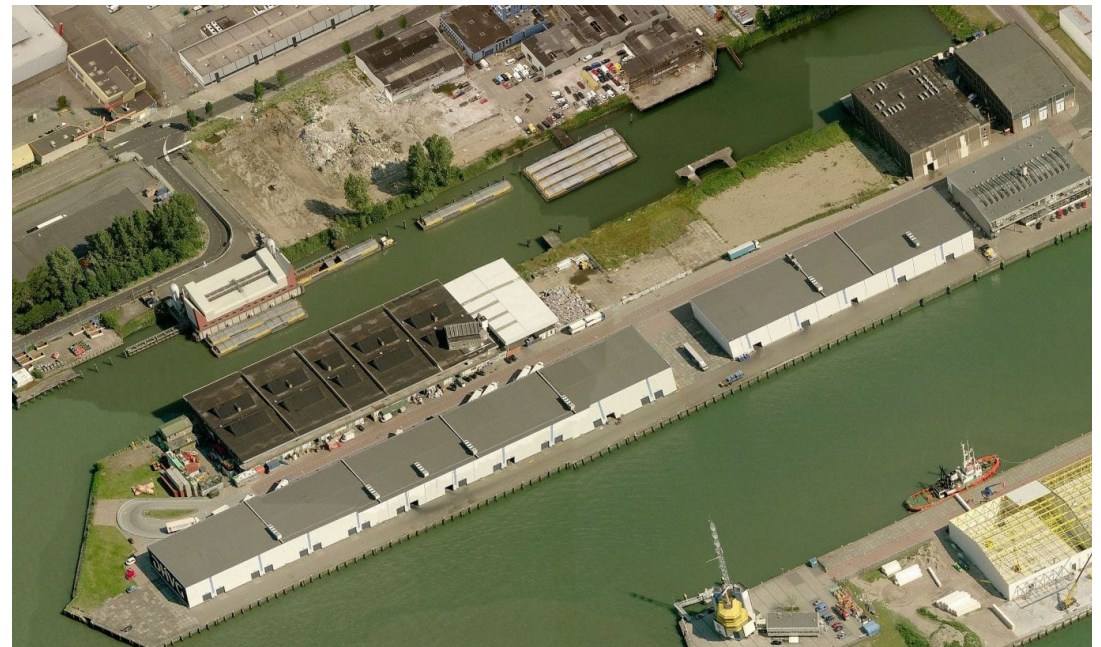
## CONTEXT | LEGIBILITY

How does the context influence the legibility?

When looking at the current situation of the Katoenveem in its context, a different image comes to mind. Almost all external additions to the building are demolished, leaving a bare view on the warehouse of the Katoenveem itself. The walls enclosing the outdoor spaces are demolished as well. It is unclear if the outdoor spaces still belong to the Katoenveem or not. Also the two warehouses on the other side of the pier are replaced by a new warehouse that has no relationship with the Katoenveem or the water. Goods are shipped in and out by trucks entering the building through the Keilestraat. This setting creates a different image in the minds of people. The Katoenveem is nowadays an independent and vacant building on the end of a pier. It has lost its relationship with other buildings and with the water. The cranes are removed so it is no longer visible what the relationship between the Katoenveem and the water was. This could only be guessed from the concrete bases of the cranes that are left on the site.



Current situation of the Katoenveem in the Keilehaven in 2016. Most of the designed elements are demolished, own image



Aerial photograph of the Keilestraat in 2016, Bing maps (retrieved 24-10-2016).

## CONTEXT | LEGIBILITY

How does the context influence the legibility?

When looking at the Katoenveem from the Meuse river we can recognize its contours. However, nothing of the original process of cotton shipping is visible anymore. No ships enter the harbour anymore to unload their goods. Furthermore, containers and other stuff is blocking the view towards the Katoenveem, providing a troubled and disturbed sight. It is no longer visible what the function of the warehouse was, and no activity can be seen anymore. Also, the facade facing the Meuse river has been changed to some extent. Windows have been enlarged and doors have been added and removed because of a new function.

22 The image that comes to mind when viewing the Katoenveem from this position is one of an empty concrete structure in a poor condition. The relationship it once had with its context and the water is not noticeable anymore. Also the relationship with the other warehouses is lost.



A clear view on the Katoenveem from the Meuse river (1933), photo taken by Gemeentewerken, Stadsarchief Rotterdam (retrieved 12-10-2016)



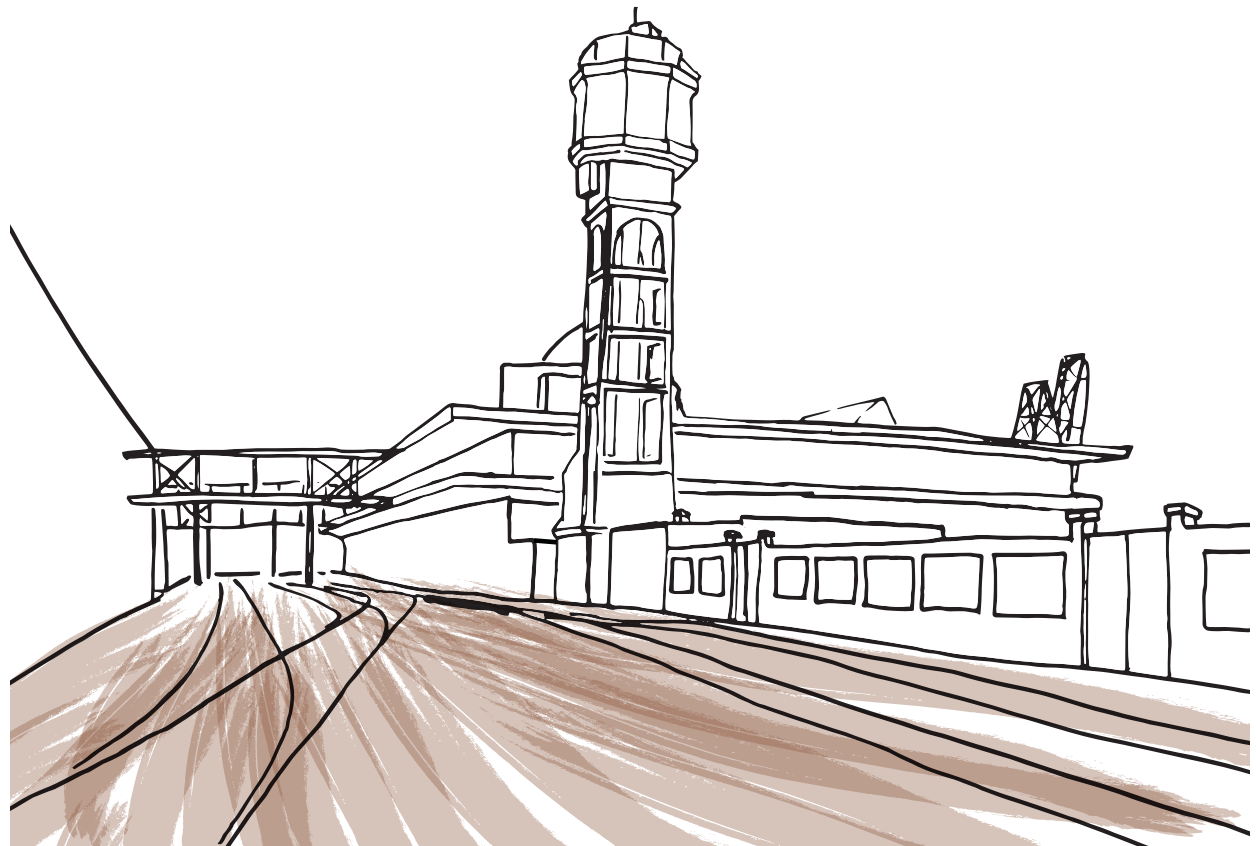
View on the Katoenveem from the Meuse river (2016). Containers and other stuff is blocking the view on the facade, own image

## CONTEXT | LEGIBILITY

How does the context influence the legibility?

By approaching the Katoenveem in the period it was still in use, people could immediately get a grip on what was happening there. The warehouse would be seen from far away because of the water tower. It therefore did not only have a functional use as a water tower providing enough water pressure for the sprinkler system, but it also functioned as a 'landmark' in the area. When nearing the Katoenveem through the Keilestraat the railways, together with the walls enclosing an outside terrain, would guide you towards the building. Closing in on the warehouse makes the railways move into the right direction underneath the balcony of the Katoenveem. By this time the detailed water tower could be closely observed. Also, the two bridges running from the Katoenveem to the warehouses New Orleans and Galveston would give away the function of the building. Cotton would 'fly' across the bridges from one building to another. In the background the cranes transported the cotton into the building, and through a revolutionary transit system hanging from the roof the cotton bales would leave the building on the other side. When standing close to the building visitors could behold this transit system.

Nowadays none of this is visible anymore. Everything that is left is the warehouse itself. All the supporting additions are demolished, including the transit system on the outside of the building. We can only guess what must have been going on in this building until we visit the interior. The only thing left for us are the signs saying 'Streng verboden te rooken', which means smoking is strongly prohibited.



Drawing of the original Katoenveem in 1920. All the designed elements are visible when approaching the building, own image



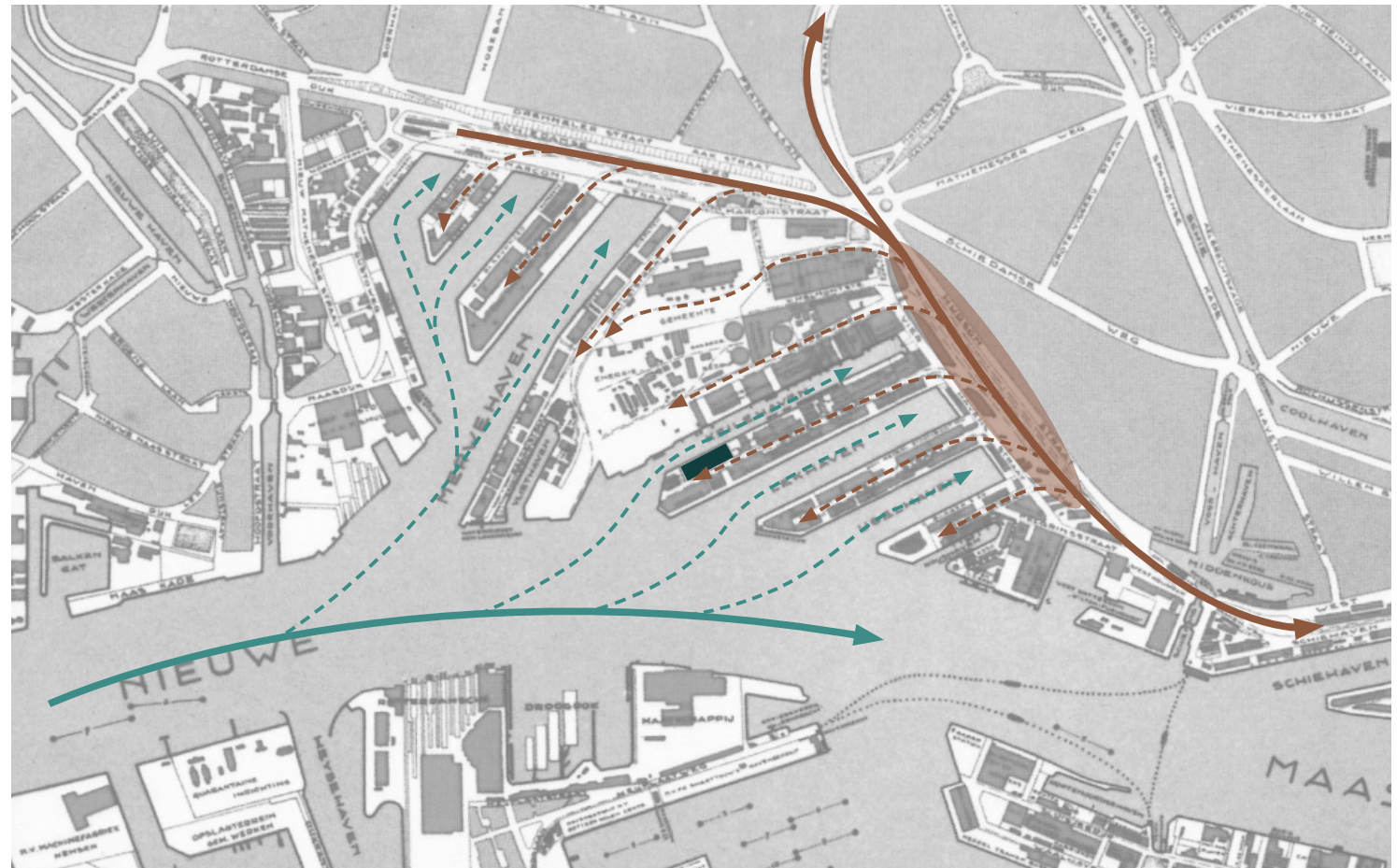
View from the Keilestraat on the current situation (2016). A steel shed is blocking your sight, own photo

## CONTEXT | LEGIBILITY

How does the context influence the legibility?

In 1955 the Katoenveem was in full use. Ships would enter the right harbour through the Meuse river, and these ships would then be unloaded in one of the warehouses in the harbour. In case of the Katoenveem, the cotton was unloaded by two cranes in the Keilehaven. These cranes carried the bales into the building, where they were stored.

Once a buyer needed cotton, this cotton was loaded onto a train on the southeast side of the building. Many of the harbours in the Merwe-Vierhaven area could be reached by train to transport the goods to other regions in the Netherlands, or even to Germany. The railways going from these harbours were all directly connected to a railway system going into the country. These railways congregated in the area to the northeast of the Vierhavens (see image on the right). This way, the trains could directly transport the cotton to the east of the Netherlands and to Germany.



Vierhaven area around 1955. Ships would deliver their goods in the right harbour, after which the goods are stored and further transported by train, own image.

In recent years many of the harbour activities have shifted towards the Maasvlakte, closer to the sea. Ships are growing in size and most of the goods are transported in containers nowadays. Most of the city harbours are not suited to deal with these large containers and therefore the harbour is moving towards the North sea, where there is enough space left to expand the Rotterdam harbour. This causes a lot of the industrial harbour buildings to become vacant, among which the Katoenveem. Some of these empty buildings have already been demolished and replaced by new, but some still remain.

More and more harbour activities are moving away from the city centre to the Maasvlakte area, leaving many industrial buildings empty, own image.



## CONTEXT | LEGIBILITY

How does the context influence the legibility?

Next to the Vierhavenstraat a new line of shops has emerged. This area separates the Vierhaven area from the residential areas around it. In the past, all the railways leading to the different parts of the harbour would come together in this area. It was therefore an important part of the region. From here trains would transfer the goods to other parts of the Netherlands or Europe.

The construction of the shops and rooftop park illustrates that functions to support residential areas are nearing the harbour areas. This creates opportunities for the development of these, sometimes vacant, regions.



A view on the shops and the Vierhavenstraat from the rooftop park, own photo (2016)

Looking at the Keilestraat from the rooftop park. Some old traces of the railways are still visible. The Katoenveem is visible in the background, recognizable by the sampling room on top of the roof, own photo (2016).



## CONTEXT | LEGIBILITY

How does the context influence the legibility?



The Vierhaven area, and therefore the context of the Katoenveem, has changed throughout history. In 1931 the piers of the Vierhaven area have been developed. The area to the northwest of the piers is still under construction. If we take a closer look at the Katoenveem we can see that on both short sides of the building an enclosed outdoor space is realised. This enclosed outdoor terrain was part of the Katoenveem and could be used for cotton storage as well.

Aerial view on the Keilehaven, Lekhaven and IJsselhaven in 1931, showing the Katoenveem on the left. The transporting bridges to the warehouses across the street have been removed already. Presumably this was done in 1926, when these warehouses were sold and their names changed. The activity in the water is visible through the ships in the harbour. In the background residential areas are developing, KLM Aerocarto / Aviodrome copyright (retrieved 23-09-2016).

## CONTEXT | LEGIBILITY

How does the context influence the legibility?



Aerial view on the Keilehaven and Lekhaven in 1949. A shed has been build upon the outdoor terrain next to the water tower. The transporting bridges to the neighbouring warehouses were demolished in 1926, KLM Aerocarto / Aviodrome copyright (retrieved 23-09-2016).

## CONTEXT | LEGIBILITY

How does the context influence the legibility?



In this photo, taken in 1955, the Katoenveem is visible in the bottom left corner. Some trains are visible in front of the building. The area northwest of the Katoenveem has further developed. The E-On factory has increased in size. However, the war has left its traces in the residential areas to the north. Some empty spaces are seen. In the years to come they would be rebuilt again.

Aerial view on the Keilehaven and the Lekhaven, with the Katoenveem and its walled outside space on the left, KLM Aerocarto / Aviodrome copyright (retrieved 23-09-2016).

## CONTEXT | LEGIBILITY

How does the context influence the legibility?

2016

In recent years more alterations have been made. The warehouses New Orleans and Galveston have been replaced by new warehouses. The terrain in front of the Katoenveem has been cleared from all buildings and a steel shed has been built instead. The water tower has been demolished, as well as the outside offices and cranes. The end of the pier has been changed into a turning loop for trucks, showing the increased importance of truck transport of goods, instead of ships.



Aerial view on the Katoenveem and the Keilestraat (2016), Bing maps (retrieved 24-10-2016).

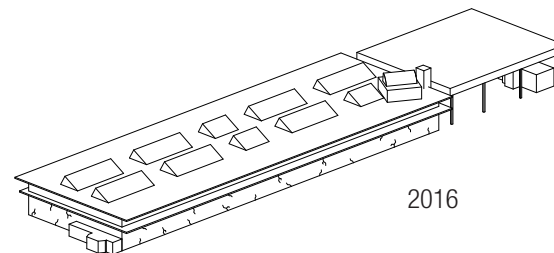
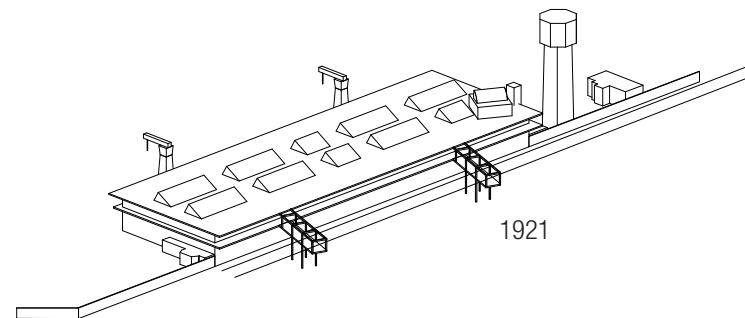
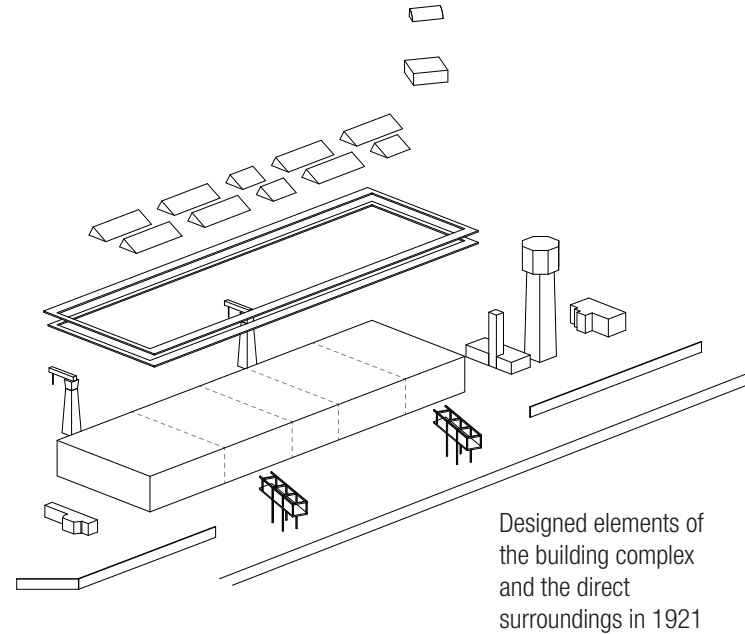
## CONTEXT | CONCLUSION

How does the context influence the legibility?

The Katoenveem has lost its connection with the surroundings. It used to be connected to the water in both the Keilehaven and the Lekhaven for its function. This connection was made with the help of the different elements of the design of the complex. Over the years many of these elements have been demolished, resulting in a building that is lost in its context.

When visiting the building for the first time, I had no idea that it functioned the way it did. There were no signs of the Katoenveem once being connected to other warehouses. Also, the process of transporting goods into trains was not something I had thought of since the train tracks are not present anymore in the direct surroundings of the building. The concrete bases of the cranes on the waterfront can still be seen. These remind of how the goods would be put on land. However, I had no clue that these cranes would be connected to the tailor-made transit system inside the building. In fact, the only thing that is left on site is an abandoned, deteriorated concrete structure with fences around it.

The legibility of the context has changed dramatically. Only very few original elements in the surroundings are left. I see the Katoenveem as a strong man losing its strength battling against the new industries in the area. A man that once stood fierce and proud of who it was. Over time others have tried to bring this strong man down, but none of them have succeeded so far. Now the man is awaiting its fate, hoping for better times to come.

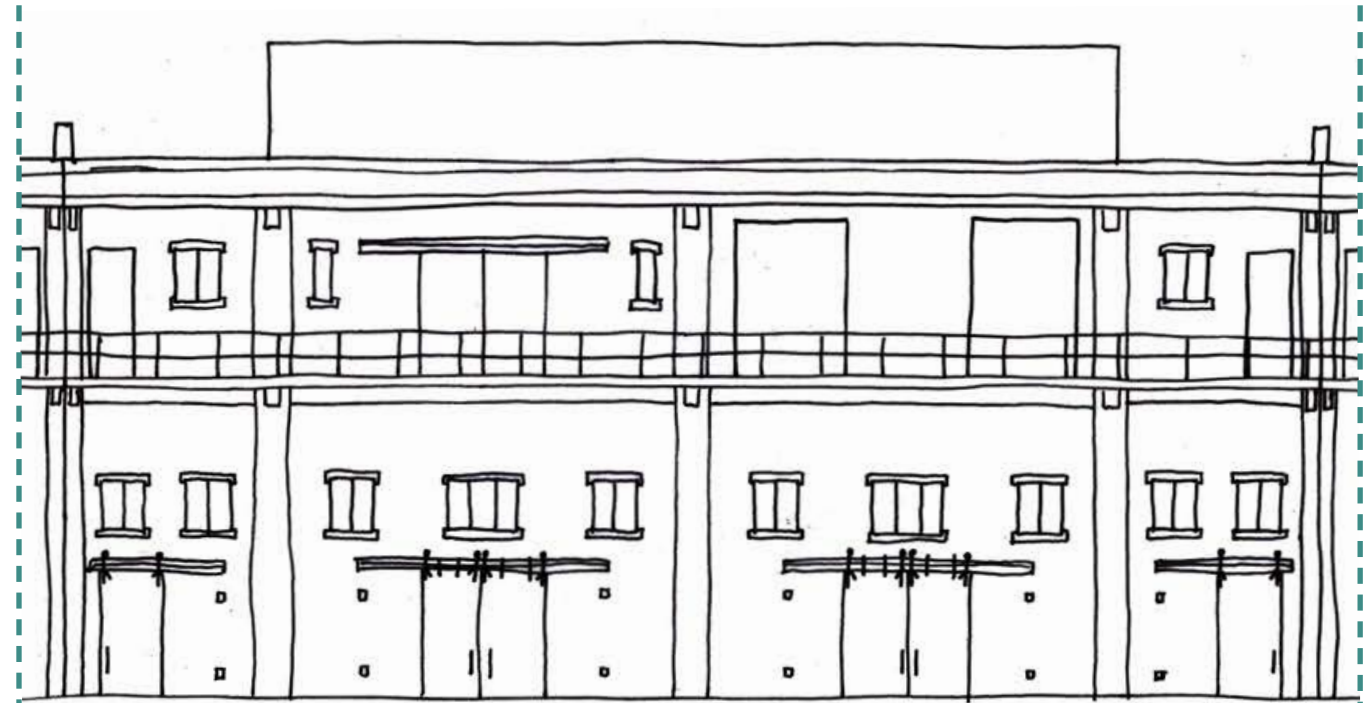


## **FACADE | LEGIBILITY**

## FACADE | LEGIBILITY

How does the facade influence the legibility?

The long facades of the Katoenveem are quite similar in their original design. A strong rhythm dominates these facades. This rhythm is the result of the repetition and order of certain elements in the facade. Firstly, large steel sliding doors on the ground floor and first floor indicate the entrances to the building. The windows are either placed above the doors (ground floor), or in between them (first floor). All the windows have the same size and shape and they come in pairs or in three. The concrete structure completes the rhythm in the facades. Concrete columns are indicated in the facade, separating the fragments. When combining the facade fragments and looking at the expansion joints, the different fire compartments are visible.



Facade fragment of the original design of the large compartment, own image





## FACADE | LEGIBILITY

How does the facade influence the legibility?

The repetition of the different elements in the facade together form the strong rhythm. These elements are doors, windows (two or three panes), railing, transit system, roof lights, water tower, additional buildings and a sampling room. Over time these elements have changed. Some of them were removed, others remained. This changed the way the facade looks. You can imagine the transit system hanging from the roof gives the facade a totally different expression. Also, the wall openings for the transport of cotton bales have been closed with concrete. This altered the rhythm of the facade, and the function of the building is no longer visible from the facade.



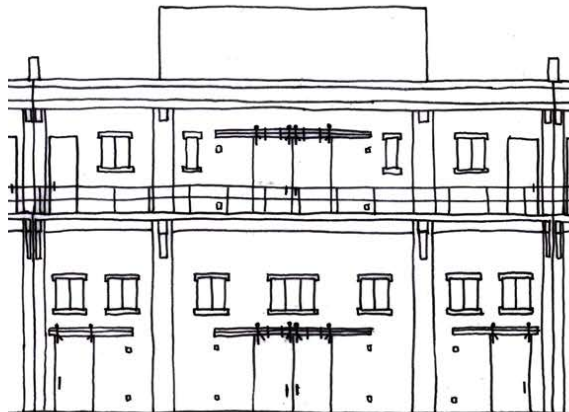
Closed windows, own photo (2016)



Railing with inexplicable openings, own photo



Large steel sliding doors on the ground floor, own photo (2016)



Facade fragment small compartment (1921), own image



Rain pipes, own photo



The only piece of the external part of the transit system left, own photo



Facade of the Katoenvem in October 2016. The strong rhythm, created by the doors, windows and construction is clearly visible, own photo

## FACADE | LEGIBILITY

How does the facade influence the legibility?

Throughout history the facade has deteriorated. Carbonation has caused parts of the concrete all over the facades to detach from the structure. Also, because of the thin concrete cover, the concrete falls off more easily. The steel reinforcement is being exposed as a result, which causes the steel to oxidate. The steel reinforcement expands and consequently more and more concrete breaks off. Nowadays, the norms for the minimum cover of concrete are much higher. The poor condition of the Katoenveem shows the age of the building. It is an industrial building that was designed for its function only. In the past this function could be more or less read by looking at the facade. The tailor made transit system was hanging from the roof and cotton bales would be transported along this system. Nowadays this transit system is no longer there, except for one small part in the southeast facade. Also, there have been holes in the balcony to load the cotton into the trains, but these have been closed later.



Holes in the balcony for loading the cotton onto the trains have been closed. This reduces the way we 'read' the function by looking at the facade, own photo (2016).

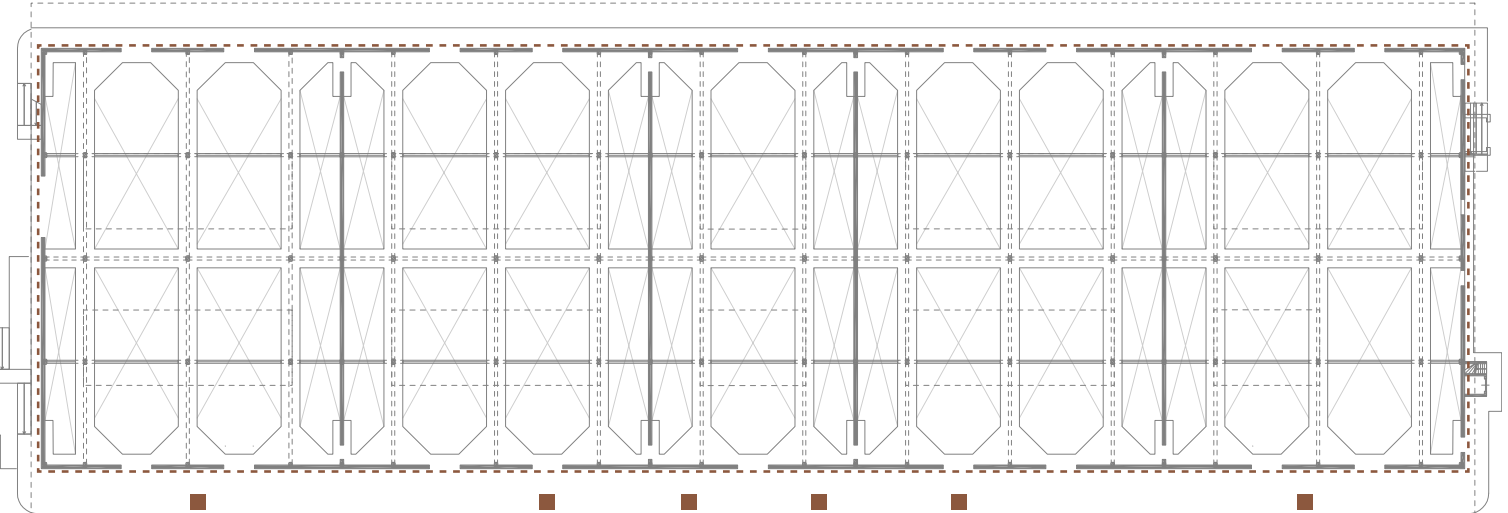


Damaged part of the facade. The different layers are clearly visible: steel reinforcements, concrete with a high amount of aggregates and two layers of surface finish, own photo (2016).



The bottom part of the ground floor has been painted white, own photo (2016).

Floor plan showing the holes in the balconies and the damages to the facade, own image



The image that the facade expresses nowadays is very different than in the past. When visiting the building for the first time, I experienced the Katoenveem almost as a ruin because of the very poor state it is in. Safety nets are hanging under the balconies to prevent chunks of concrete from falling down. Fences are put around the building to prevent people from entering. The bottom part of the facade has been painted white. All sorts of changes have been made, causing the rhythm and organisation of the facade to fade. And with this, the original beauty and fairness of the Katoenveem

# FACADE | CONCLUSION

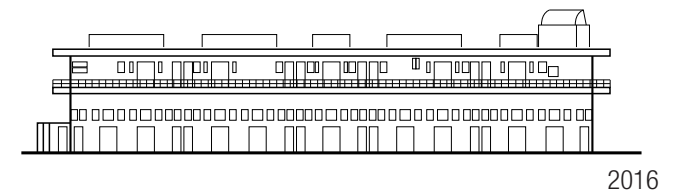
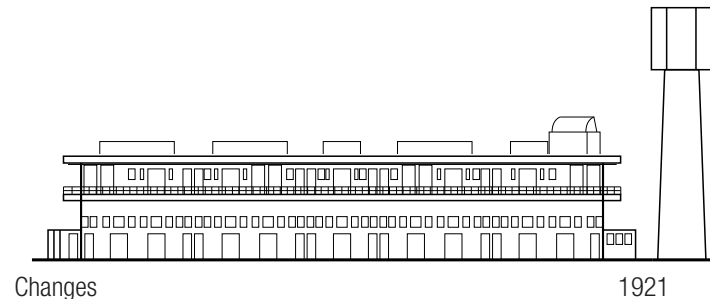
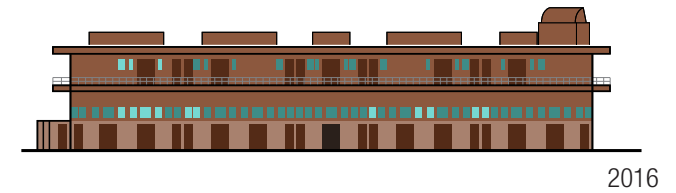
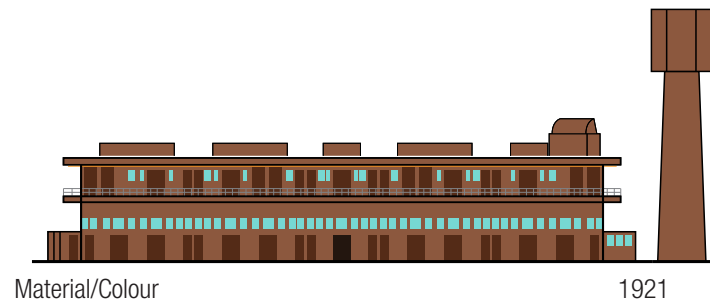
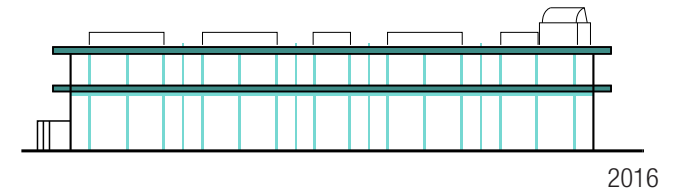
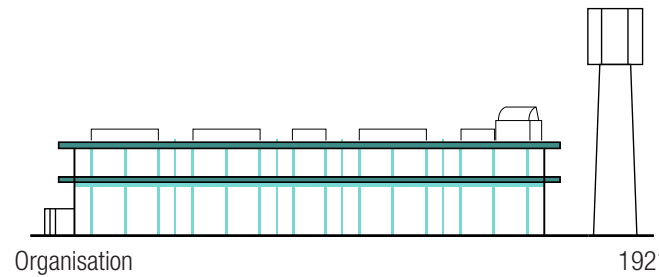
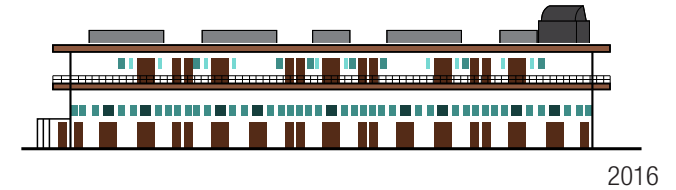
How does the facade influence the legibility?

The facade gives us a first impression of the building, which is important for the image we create in our minds. Different aspects of the facade all influence our mental image in their own way. Important aspects that are researched are: the material and colour, the organisation, the elements in the facade and the changes over time.

The facade consists of different elements like doors, windows in different sizes, roof lights, a water tower, a railing, balconies and a sampling room. In the past, the ground floor of the facade has a very strong rhythm and order, created by the repetition of doors and windows in a certain pattern. On the first floor a different order and repetition occurs, created by slightly different elements. This rhythm is changed over time, by closing some windows and doors and by removing parts of the building like the water tower and the offices. The rhythm is therefore less strong and obvious, so it is harder to recognize and 'read' the facade.

The elements and the facade are organised through the structure of the building. The facade is divided according to a grid by using columns and beams with a recessed infill. This organisation is still present and helps ordering the facade into sections.

The material and colour of the facade depend on the different elements. Every element used to have its own material and colour. Nowadays some of the glass has been replaced by a different material and a part of the ground floor has been painted white.



## LIGHTING | LEGIBILITY

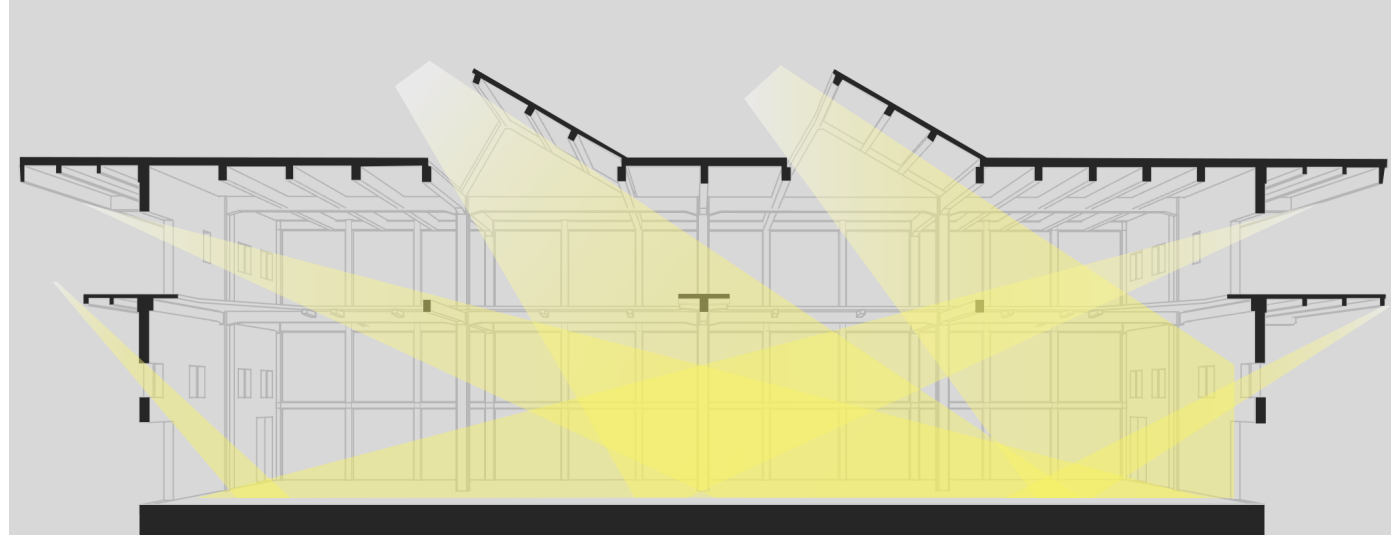
## LIGHTING | LEGIBILITY

How does the lighting influence the legibility?

Daylight plays an important role in the design of the Katoenveem. Although there are many windows in the facades, most of the daylight enters the building through the large roof lights. These roof lights are oriented to the northwest so almost no direct sunlight would penetrate the warehouse. Only some late evening sunlight on the longest summer days of the year could enter. These roof lights were incorporated in the design because electricity in buildings was still a new development in this time. The use of roof lights is seen in more warehouses that were built around the same period.

Unlike to what one might expect when looking at the building from the outside, the interior is a very light and pleasant space to be in. This experience is given to you by the huge roof lights in each compartment. This enlightens a large part of the compartment floor, and almost makes you forget that the facade has windows as well. Your attention is directly drawn to the light coming from above.

In the past I could imagine the interior space being even lighter. The windows were not closed yet, and the doors on both floors would be opened from time to time.



Daylight entering the building through the roof and facade, own image (2016).



A great portion of the daylight entered the building through the roof lights, creating a pleasant space for working, own image (2016).

## LIGHTING | LEGIBILITY

How does the lighting influence the legibility?

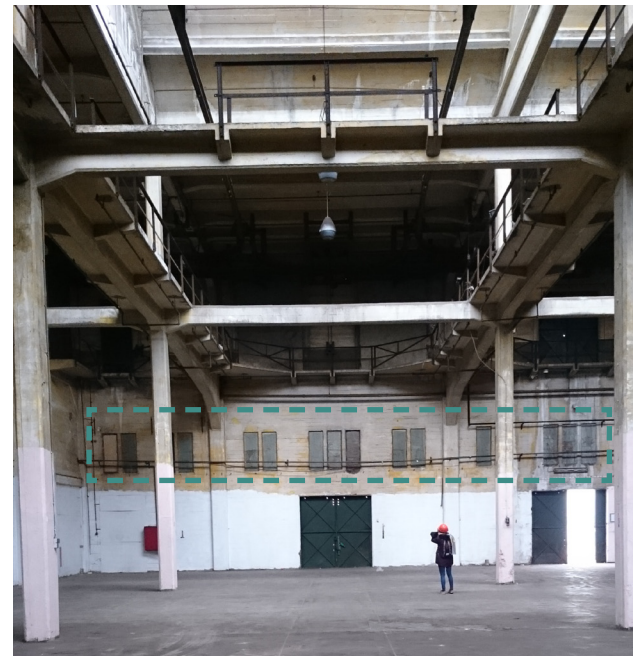
By looking at the Katoenveem from the outside, I expected a very dark warehouse on the inside. The windows are small and they are located under a large overhang, obstructing the invading daylight. Also, nowadays many of these windows have been closed by a wooden or brick infill.

However, when being inside the space is surprisingly light because of the light entering through the roof lights. These roof lights are not visible from the outside of the building. The closed windows in the facade are less obvious because enough light already enters the building.

<sup>38</sup> The roof light in the sampling room is rotated exactly to the north, to receive no direct sunlight. This was done in order to determine the quality of the cotton as precise and fair as possible. For the investigating the quality of the cotton, people looked at the length and type of the fibres. This eventually determined the price for the bales, together with the weight.



Windows under the balcony. Many of them are closed, own photo (2016).



From the inside the windows are less obvious. The interior is a light space, own photo (2016).

## LIGHTING | LEGIBILITY

How does the lighting influence the legibility?

Although enough daylight enters the building, some artificial lighting is present in the building. The lighting fixtures could be moved along a line to reach the spots where the light is needed and to fix the lights if necessary. From the amount of lighting fixtures present in the Katoenveem it can be concluded that there were not enough to provide enough light to use the building. It is therefore assumed that these were only used as additional light source. The electrical wires ran through a vertical shaft on top of the roof.

When visiting the building, I hardly noticed the light fixtures inside the building. The large amount of daylight takes away the need for electrical lighting. The grand roof lights draw your sight upwards, to the sky. The light that comes through disseminates across the compartments and illuminates most of the space. Together with the doors and windows in the facade I can imagine that during the day enough light entered the building to ensure a safe and pleasant working area.

The absence of sufficient amount of lighting fixtures prognosticates the building was only in use during the day. Presumably the lighting could be switched on in darker (parts of) days, to compensate the lack of daylight.



Lighting fixtures in the Katoenveem could be moved, own photos (2016).



Electrical wiring running across the roof, own photo (2016).

## LIGHTING | CONCLUSION

How does the lighting influence the legibility?

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Lighting is important in every building. Also, it greatly influences the legibility of a building. The absence of daylight brings another atmosphere to a space than the presence of a lot of daylight. Besides, enough daylight is needed for the building to function properly.

In case of the Katoenveem, lighting has to meet a few extra requirements. First, sunlight brings heat besides light. This could heat up the building quite heavily, affecting the cotton inside. Cotton needs to be stored at a certain temperature to prevent it from rotting and catching fire. A lot of sunlight is therefore not preferable. Second, electricity was still in its early development in the area. It is unclear if there was enough power and financial means to fully provide the building with electrical lighting. Natural daylight was a good and cheaper alternative since the building was mainly in use during daytime. Thirdly, electrical lighting in these days was a risk, concerning the possibility of starting a fire. Fire regulations were very strict for a building with this function. This could have been a reason to choose natural light over artificial lighting. These artificial lights needed to be fire proof.

The lighting has not changed the legibility a lot, since a lot of the original lighting is still present in the building. The roof lights still function and the artificial lights are still present. The only thing that has changed is the closing of many of the windows. This would have lit up the space even more. I expected a darker space on the inside when I visited the building.

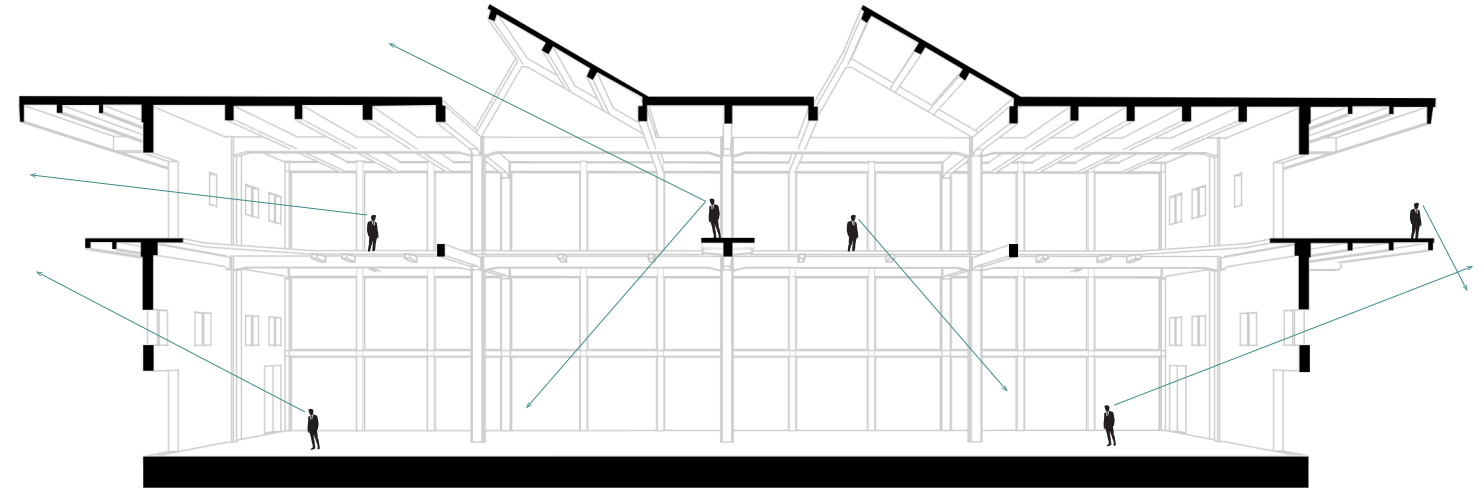


## **INSIDE VS OUTSIDE | LEGIBILITY**

## INSIDE VS. OUTSIDE | LEGIBILITY

How does inside vs. outside influence the legibility?

When visiting the Katoenveem nowadays, the building is experienced as an introvert building. This is because of the closed doors on the ground floor. The only view to the outside is through some of the windows and through the roof lights. However, the only thing you see is the sky. You therefore have no feeling of where you are and where the building is. When being inside with the doors and windows closed, the building could be anywhere. You do not see the water in the harbours and you do not see the buildings opposite of the street. It is even very hard to decide in which of the compartments you are.



The introvert character in the Katoenveem nowadays is a result of the relatively small windows, of which some are closed, and their position high in the walls. The closed doors strengthen this introvert feeling, own image (2016).

42 In the past, the building was probably less introvert because of the movement of the cotton in and out of the building through the doors. This meant more doors were open and the workers could see more of what was going on outside. Workers would also move in and out of the building. From the exterior balconies a clear view on the surroundings is provided.



In the current situation an 'open' and 'closed' zone can be distinguished in the facade, own image (2016).

## INSIDE VS. OUTSIDE | LEGIBILITY

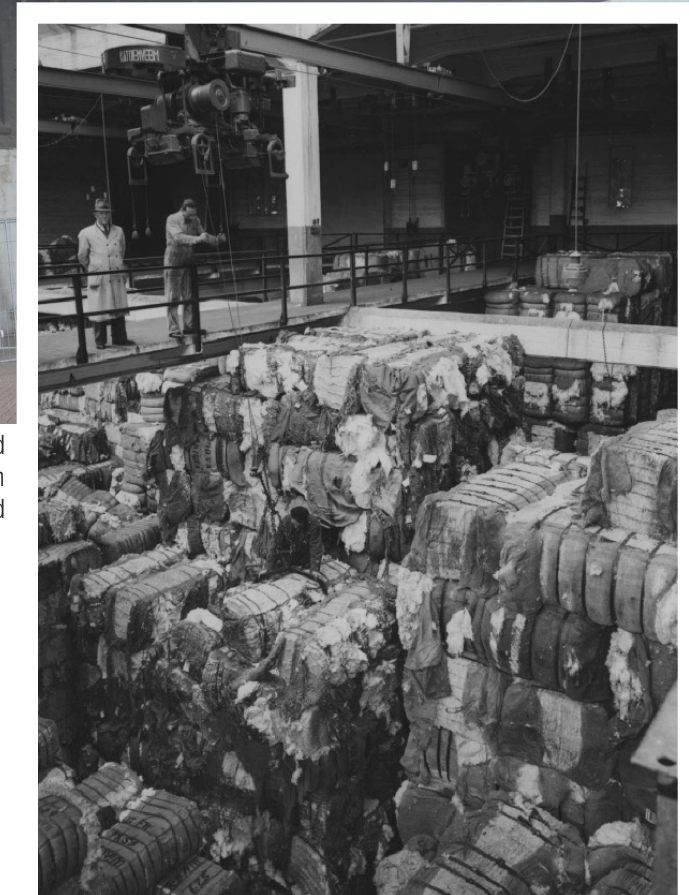
How does inside vs. outside influence the legibility?

From the outside it looks as if the Katoenveem is a warehouse with two floors of which one is higher than the other. The ground floor has a height of approximately 8 metres, whereas the first floor is about 4 metres high. However, when standing inside, the compartments are experienced as one high space. This is because the first floor is no continuous floor. The voids in the floor are bigger than the actual floor area, so the first floor is experienced as walkways on top of the concrete construction. This gives the experience of one high space stretching from the ground floor to the roof, with bridges going through this space to connect both sides of the building.

In the past this experience would probably have been different. Since workers would mostly use the first floor, they experienced the building mainly from the first floor. This floor has a more human scale to it, and the immense height was not really sensed. This assumption is strengthened by the fact that the ground floor would be stacked with cotton, reducing the visible height of the building. The photo and image on the right illustrate this statement. The bales are stacked up to the level of the first floor, leaving no open floor space visible. It is almost as if you are walking across bridges through a sea of cotton bales. Walking on these balconies therefore has a human scale to it. The full floor height of 12 metres is hardly being experienced when the warehouse is fully filled with cotton bales.



The difference in height creates different atmospheres underneath the balconies and the roof. The space in between the balcony and the roof has a more human scale than the space under the balcony on the ground floor, which is used for trains to be loaded with cotton, own photo (2016).



## INSIDE VS. OUTSIDE | LEGIBILITY

How does inside vs. outside influence the legibility?

Another important design feature when investigating the relationship between inside and outside is the transit system. This system runs all the way from the cranes, through the building, across the bridges to the other warehouses. In the heydays the transit system would be in full use, transporting cotton in and out of the warehouse. It almost seems as if the building was a part of the transit system instead of the system being part of the building. Yet, the building is needed to support the transportation system.

In present days, this transit system is removed on the outside of the Katoenveem. The building has become more static from the outside. The dynamic image of cotton flying in and out of the building no longer comes to my mind when visiting the building. On the inside however, the transit system is still present. This gives an idea of how the system would have worked in the past.

Some of the cobblestones on the quayside still remain from the past. This pavement reminds of the harbour quaysides dating back to the period of the Katoenveem. The wooden structures in the water to prevent ships from hitting the cranes is also removed. When visiting this side of the building nowadays it feels abandoned and dilapidated. The warehouse has literally lost its connection with the water, a connection that now can only be guessed from the very few remains.



The cranes were connected to the transit system inside the Katoenveem, Historisch Centrum Overijssel (retrieved 24-10-2016)



The cranes were removed in 1966, just like the wooden structures in the water to prevent the ships from hitting the cranes. The cobblestones on the quay, that remind of a harbour area, are still partly present, own photo (2016)

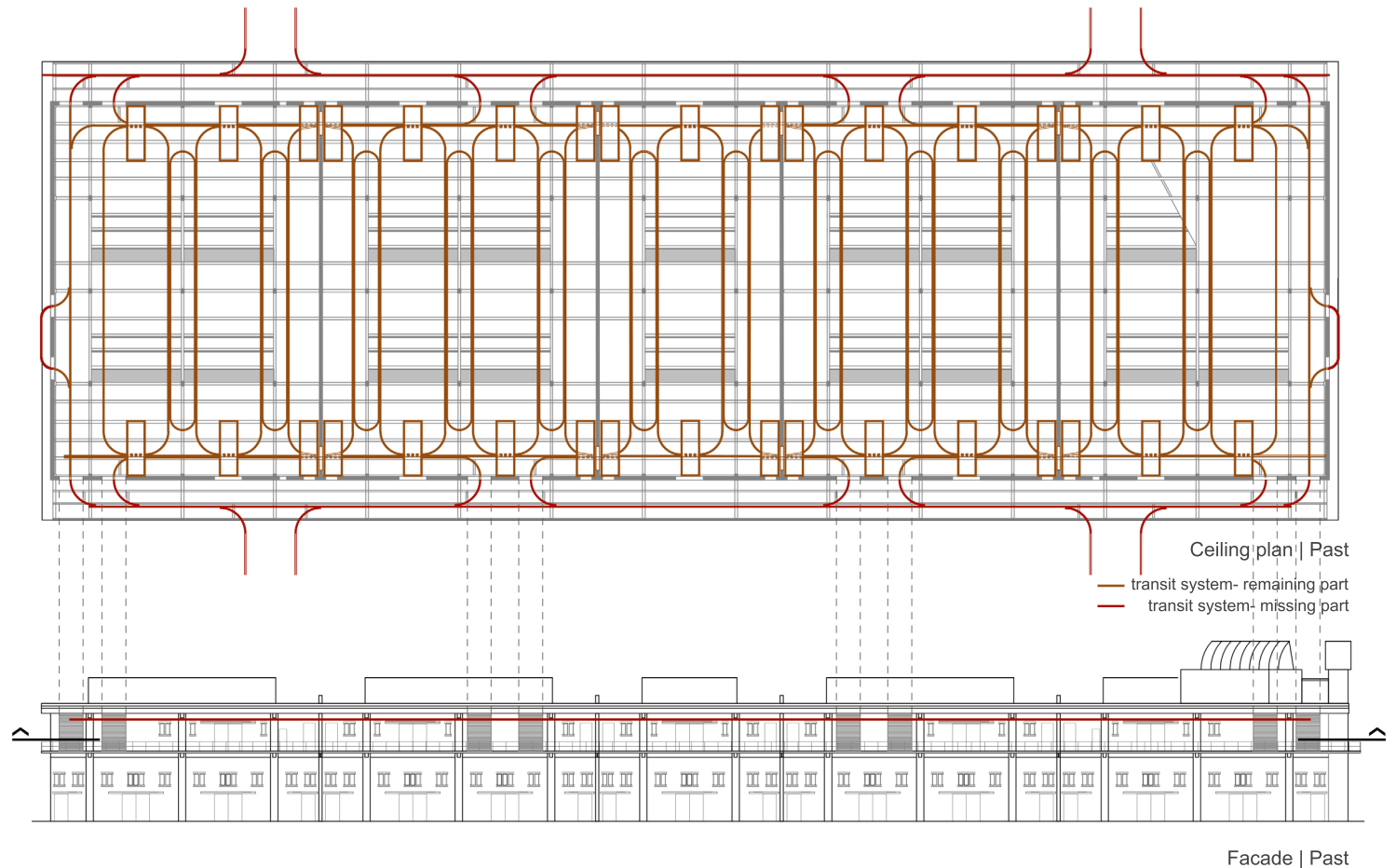
## INSIDE VS. OUTSIDE | LEGIBILITY

How does inside vs. outside influence the legibility?

The transit system is a major part of the Katoenveem, and it ensures its functionality as a cotton warehouse. This transit system is also of importance when looking into the relationship between the inside and the outside of the building. The system was not only present on the interior, but also on the exterior. The transit system could be seen as the main part of the design, and the building itself was just a functional and necessary means to cover part of this system to store the cotton in a dry place.

This system had an immense effect on the legibility of the building. It literally showed the function and use of the Katoenveem by transporting the goods in and out of the building. By looking at it from a distance, one immediately gets the image of what was going on there, unlike nowadays. The transit system has been removed on the exterior, so from the outside it is no longer evident how the building functioned. On the interior though, the system is still present, making clear how the cotton was transported through the building.

The experience that I get when looking to the outside of the building is therefore completely different to the experience I get when being inside. The transit system is really needed to understand the building. Without the transit system the building could be any sort of warehouse storing any sort of product. Besides, the voids in the first floor would be unclear. The transit system explains why the first floor only consists of walkways. Finally, the transit system explains the lay-out of the facade as well.



## INSIDE VS. OUTSIDE | CONCLUSION

How does inside vs. outside influence the legibility?

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The relationship between the inside and the outside is an interesting topic for the Katoenveem. Again this is illustrated in the experience that I had when visiting the building several times. When approaching the building, I saw a huge concrete structure hidden behind a steel shed. From the outside I could agree on it having been a warehouse. I recognized some repetition in the facade, although I was not sure what the exact repetition was. This reminded me of other industrial warehouses. Since I had mainly seen these warehouses from the outside, I did not have a clear image of how the inside would be. I could only imagine. By looking at the concrete structure I envisioned the interior to be a dark space, divided into two floors. This idea of division came from the balconies present around the building. The idea of darkness came from the fact that the windows in the facade are very small. Besides, I could not see the roof lights by walking around the building.

I imagined the building to be introvert and targeted to the inside, the storage of cotton. Because of the demolition of the supporting elements like the cranes and bridges I had no vision about the building being connected to other buildings. I also had no idea that the building had a transit system that went in and out of the building. The holes through which the goods were transported are closed now. The original relationship between the inside and the outside is no longer visible from what is left of the building. The removing of essential parts has caused the legibility to change immensely.

## CONCLUSION | KATOENVEEM

What is the degree of legibility of the Katoenveem?

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In order to answer the research question stated in the introduction, I investigated the topics of context, facade, lighting and the relationship between inside and outside. From this research I can conclude that the degree of legibility is very different to the past situation of the building.

If I compare the Katoenveem to a text again, it can be said that many aspects of the text have changed. With this, the readability of this text has changed. The Katoenveem can be seen as an essay that used to have a clear structure, readable font, plain punctuation and correct grammar and spelling. Besides, it brings across a clear and innovative message to its readers.

Over the years this text has been changed, affecting the readability of it. The structure has remained the same, comparable to the concrete structure of the Katoenveem. However, the spelling of the text has changed, like the rhythm and organisation in the facades have changed, making the facade more difficult to understand. Also, instead of using one clear font, different fonts are used. In the building this is shown as the use of different materials and finishes such as the plastic cladding, paint and the wooden and brick infill of the windows. Furthermore, the title, subtitles and the literature list of the essay is removed, relating to the cranes, bridges and water tower that have been demolished. These were essential elements to support the function of the building, and lower the 'readability' of the Katoenveem.

With all these changes, the message that the text, or building, wants to bring across becomes less evident. In other words, the way I interpret the building when visiting it and looking at it changed with respect to the past situation. The function is less obvious, just like the relationship with its context. Questions like 'How did the building function?' and 'how was the building related to its context?' come to mind when seeing the building. Questions that need a thorough research to be answered.

## VALUATION | KATOENVEEM

## VALUATION | KATOENVEEM

How is the Katoenveem valued?

For valuing the Katoenveem a colour code is used. On the basis of these colours one can see what parts of the warehouse are valued low, what parts are valued medium and what parts are valued high.

A green colour means a low value. This can be due to parts being not original or low value additions that were made in recent years. Also surface finishes that are different from the original belong to this category.

A yellow colour means that this particular part has a medium value. The concerned part can be a replacement or slight change of the original part. Parts of the building that need to be further investigated are also part of this category.

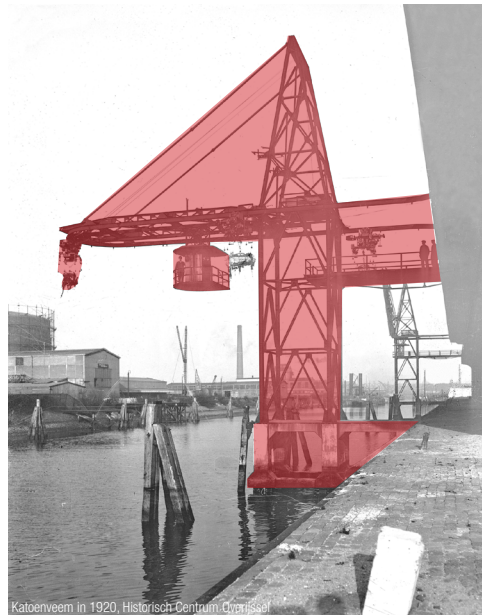
A red colour means a high value. This category is comprised of all characteristic and original parts of the building. These parts have a high cultural, social, historical or architectural value.

On the right a 3D value map of the building complex is shown. The warehouse building in general has a high value, given the fact that it is the only physical structure that is left from the entire building complex. Parts of the building will have a different value, as illustrated in the coming pages. Explanatory photos and corresponding explanations are offered.

■ Low value

■ Medium value

■ High value

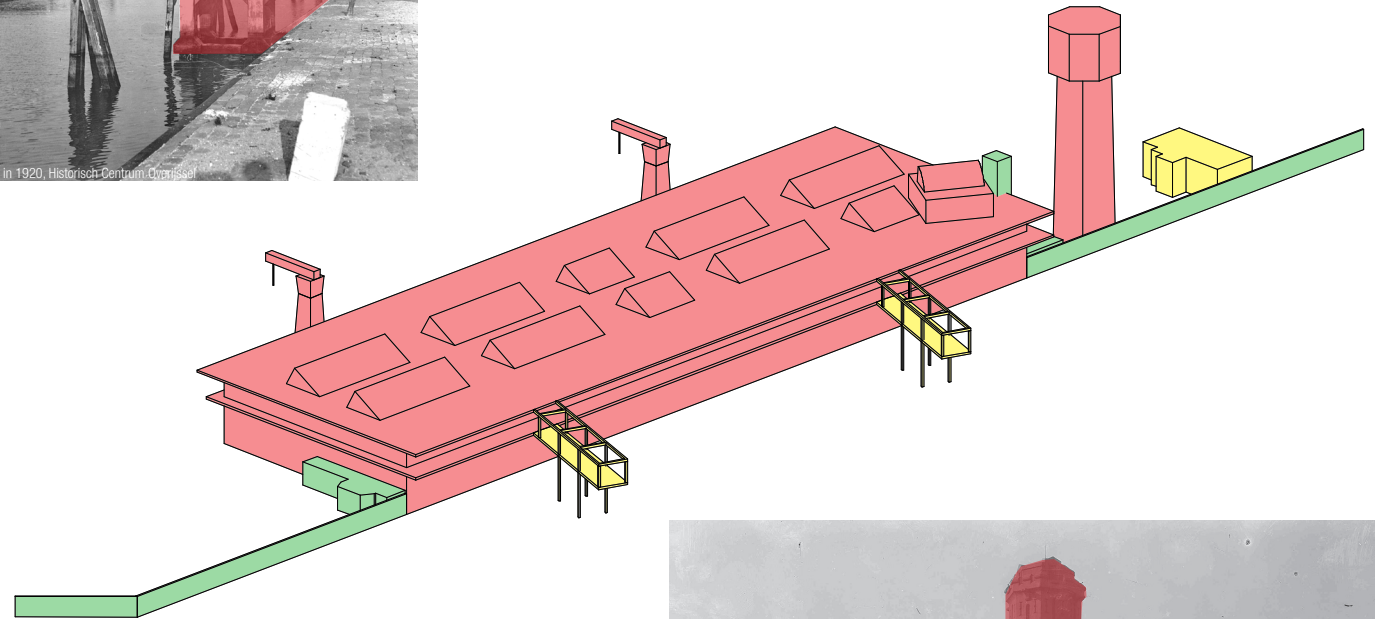


The cranes are highly valued, although they are removed. They are of great importance to the function of the building. The cranes were unique and connected to the transit system of the building, own photo (2016).



The roof lights are also valued highly, since they provided the major part of daylight needed in the building to function. They are characteristic for the building, and they are seen in other warehouses of the time as well, own photo (2016).

Katoenveem in 1920, Historisch Centrum Overijssel



The water tower has a high value.

Although the water tower was demolished in 1966 it is of great value for the Katoenveem. It served as a landmark for the building in the area. Besides, it also had the function of providing enough water pressure for the sprinkler system.

The transportation bridges to the other warehouses have a medium value. They were demolished a few years after completion, own photo

(2016)



Katoenveem in 1920, Historisch Centrum Overijssel



# VALUATION | KATOENVEEM

How are the facades valued?

This page shows the value maps of the short facades. These facades have changed the most, presumably to fit new functions that have been allocated through the building over time. Large overhead doors have been added. In order to do this, a hole has been cut in the facade. This hole cuts through the original windows, that have been closed.



The pump station is still present next to the Katoenveem, although it has lost its original function. It has a medium value, because on the one hand it was an important link in the building complex, together with the water tower. However, it has lost its function, own photo (2016).

The elevator and its cladding have a low value. The elevator was exclusively used for people who needed to go to the sampling room to test the cotton quality. The plastic cladding is not original. own photo (2016). 49



South-west facade



North-east facade

- Low value
- Medium value
- High value



## VALUATION | KATOENVEEM

How are the facades valued?

The south east facade is the most original facade of the Katoenveem. A few changes have been done to this facade, mainly on the first floor. The openings for the transit of the cotton through the facade have been closed. Some door openings and window openings are changed as well.

The original balconies have a high value because they are essential to the original function and design of the Katoenveem.

They were essential for the shipping of the cotton in and out of the building. The roof overhang was designed to hang the transit system. At the same time it kept the cotton dry when loading it into the trains, own photo (2016).



South-east facade



The sampling room on the roof of the building has a high value. It was needed as a part of the process of the cotton trade. Cotton samples would be tested to determine the quality and price of the cotton. The design of this sampling room was fully adjusted to this process, own photo (2016).

- Low value
- Medium value
- High value

# VALUATION | KATOENVEEM

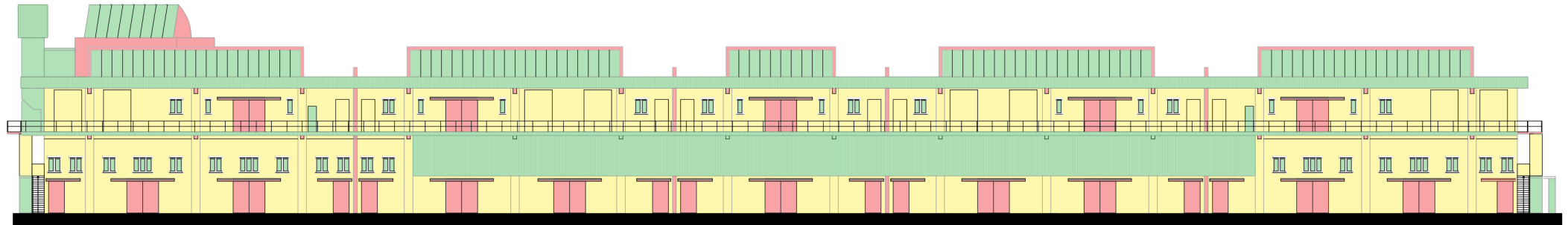
How are the facades valued?

The north west facade is valued as seen in the image below. A great part of the facade has a medium value because of the overall appearance of the facade. The rhythm and organisation of the facade are essential to the building. The concrete and cement on the facade is falling off in many places. The glazing is broken or replaced in many cases and therefore has a low value.



Most of the windows are filled in with brick or wood, and the original glazing is broken in many cases. This gives the glazing a low value, own photo (2016).

The steel sliding doors are highly valued because they are the original doors of the building and are crucial to the function, own photo (2016).



51

North-west facade

- Low value
- Medium value
- High value



The roof lights have a high value, but the glazing is valued as low. The glazing is in many occasions not original and broken. The roof lights provide a large amount of daylight that was needed for the building to function, own photo (2016)

The plastic cladding on parts of the facade have a low value. This cladding is not original and hides all the characteristic elements of the original facade. Some parts of the cladding have been removed already, own photo (2016)



# VALUATION | KATOENVEEM

How is the ground floor valued?

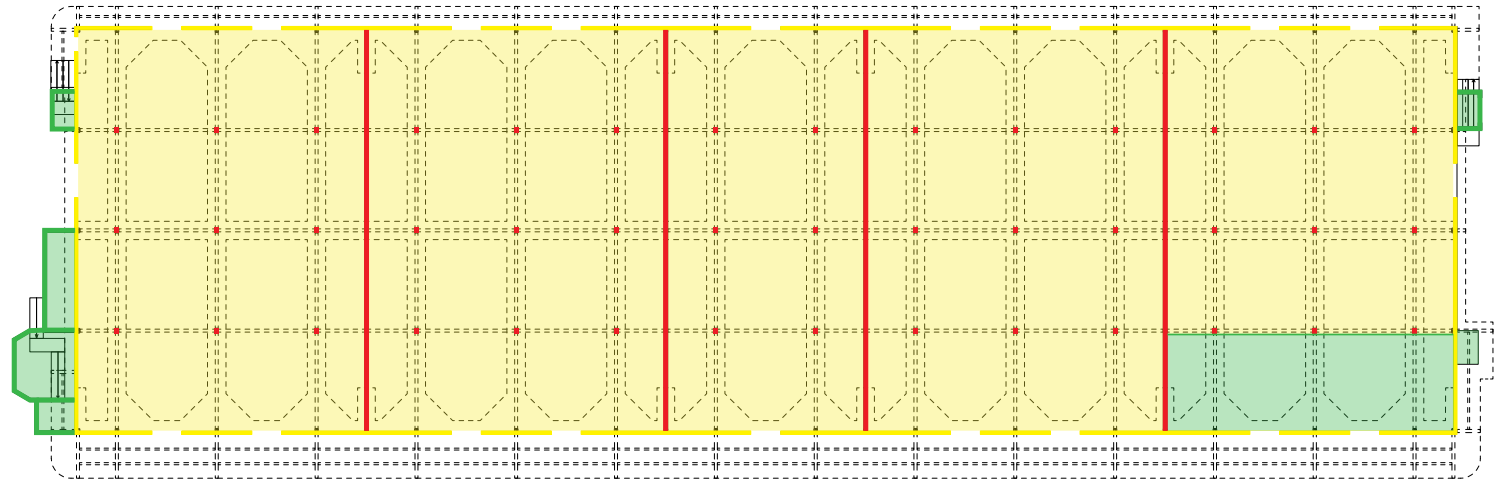
On the right the value map of the ground floor of the building is shown. Explanatory photos and corresponding explanations are offered.

The overall ground floor including the facades have a medium value. Changes have been made to these elements already.

The interior addition constructed in 1987 have a low value. The construction is not original and has no relationship with the old function of the building. Other materials are used and the style is different.

The additional buildings on the short facades of the Katoenveem have a low value. Some of these additions have been removed already, such as the offices on the north west side of the building. The other additions have been changed and painted already.

The fire walls have a high value because of the importance of the fire protection of the cotton. Without these fire walls the building could not have existed. Besides, they organise the building into compartments, own photo (2016)



- Low value
- Medium value
- High value

The facades of the building have a medium value. On one hand they are structured in a way to support the function of the building. On the other had they are damaged quite heavily and changes have been made already, own photo (2016).



The new addition to the interior has a low value because it is not original and not in the same style and material as the rest of the building, own photo (2016).

## VALUATION | KATOENVEEM

How is the first floor valued?

On the right the value map of the first floor of the Katoenveem is shown. Explanatory photos and corresponding explanations are offered.

A highly valuable part of the Katoenveem is the transit system that is still present in the interior. This system was tailor made for the building and is therefore unique. Also, it made the transporting of cotton through this building possible. It was very innovative at the time and for these reasons has a high value.

The walkways and balconies are highly valued as well because of their importance to the original function of the building. They show the relationships between the workers and the cotton bales.

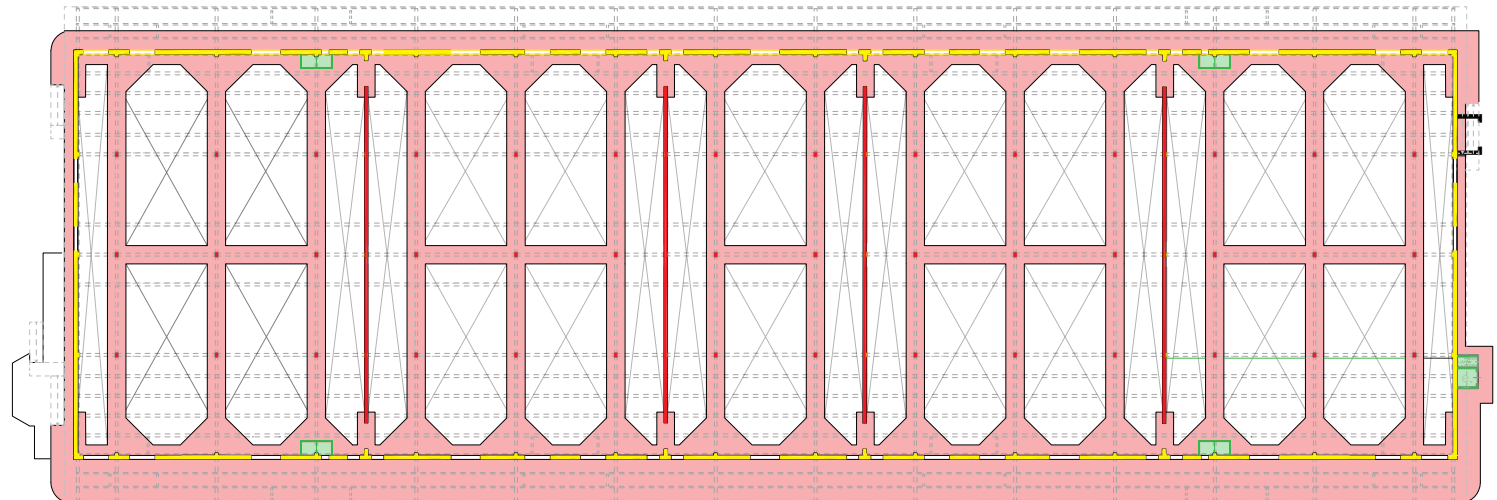
The facades have a medium value. Some changes have been made to the facade already, so they are not entirely original anymore. However, certain authentic characteristics are still present, remembering of the past.

The fire walls have a high value because of the importance of fire protection of the cotton bales. Without the fire walls the building would not have been built. Also, the fire walls organise the building in five compartments, an essential characteristic of the Katoenveem.

-  Low value
-  Medium value
-  High value



The walkways on the first floor are valued highly. They show how the building used to function, own photo (2016)



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The toilets are given a low value. They are not a typical element for the use of the building. Besides, the toilets have been removed and are just empty spaces now, own photo (2016)

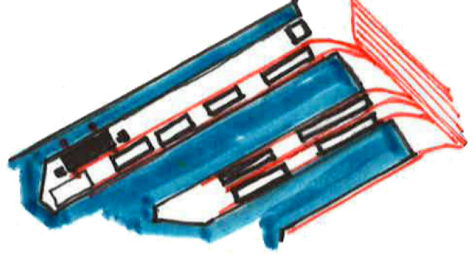
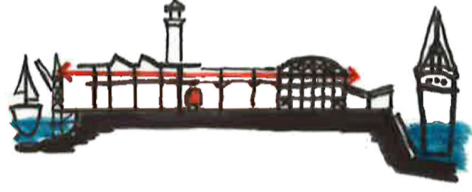




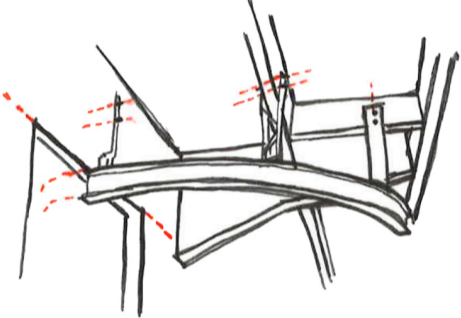
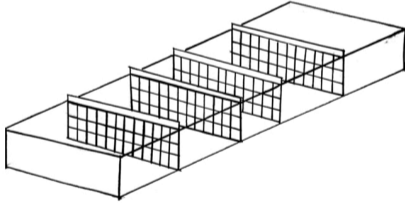
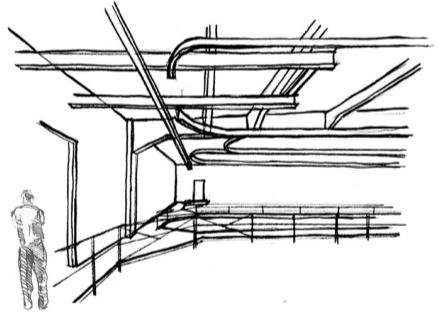
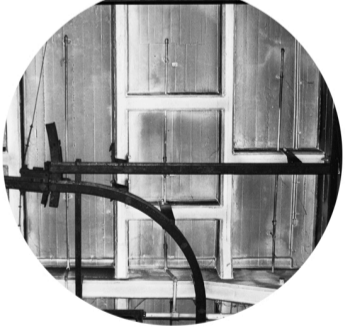
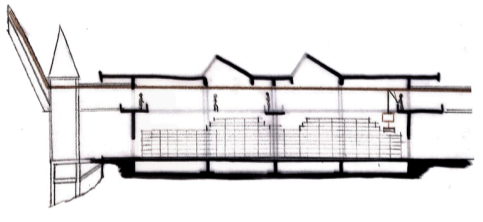
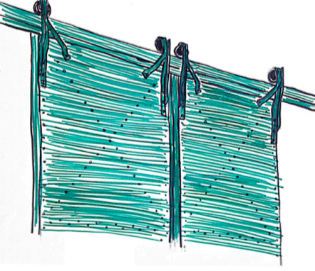

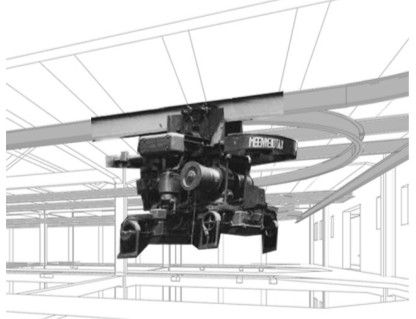

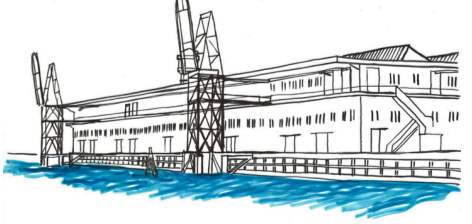


The transit system has a high value because of its importance to the original function, own photo (2016)

# VALUATION | KATOENVEEM

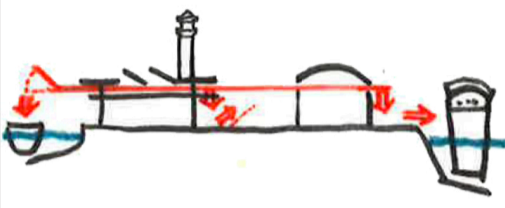
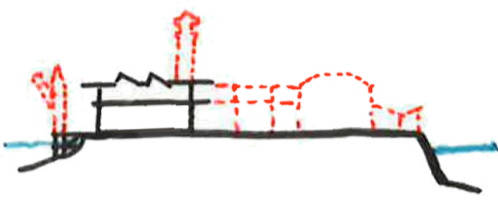
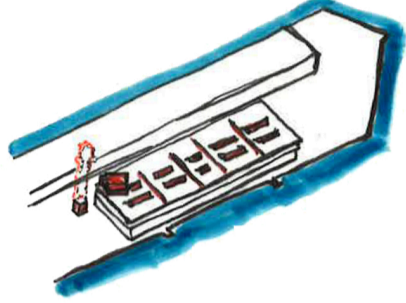
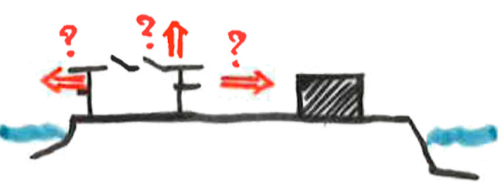


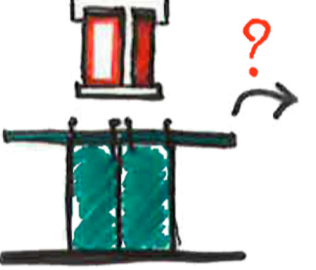
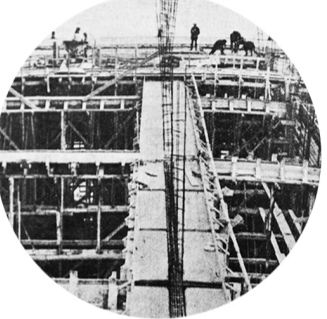
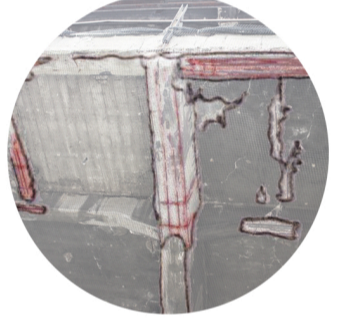
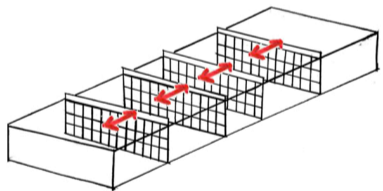

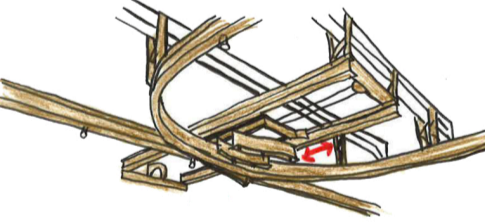
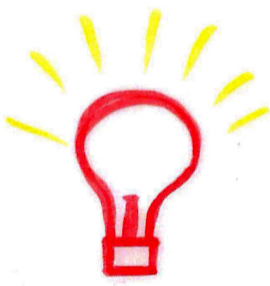
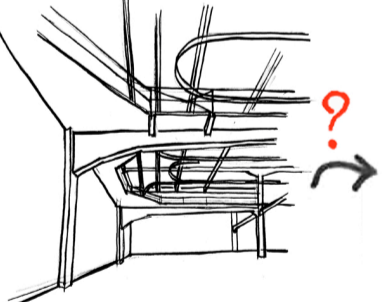
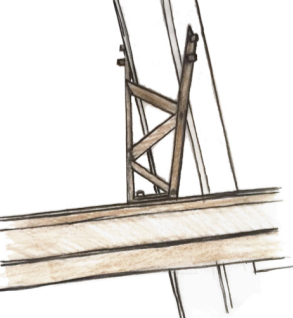
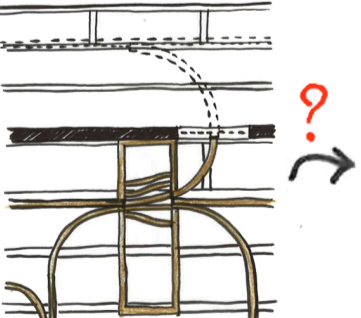

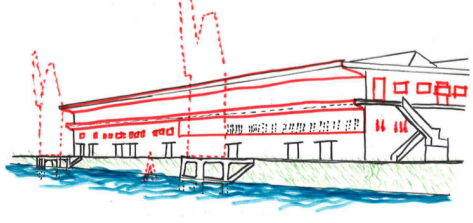
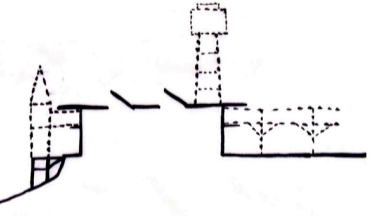
How is the Katoenveem valued?

The image on these pages shows a matrix to be examined. It was introduced to us by Nicholas Clarke in one of his lectures. By filling it in with images and sketches almost all aspects of the building will be

	<i>Artistic</i>	<i>Historical</i>	<i>Use</i>
<i>Site</i>			
<i>Skin</i>			
<i>Structure</i>			
<i>Spatial plan</i>			
<i>Services</i>			
<i>Equipment</i>			
<i>Story</i>			

# VALUATION | KATOENVEEM

How is the Katoenveem valued?

<i>Newness</i>	<i>Conflict</i>	<i>Commemorative</i>	<i>Dilemma</i>
			
			
			
			
			
			
			

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<http://www.topotijdreis.nl/>

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P1 group analysis report Katoenveem

City archive Rotterdam

Historisch Centrum Overijssel

TU Delft Maps

Google Images/Google Maps

Bing Maps



## **APPENDIX I POSITION PAPER**

# The Change of Architectural Legibility in the Conservation of Industrial Heritage Buildings

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## Abstract

Industrial heritage buildings have always been subject to change. And so does the degree of legibility of these buildings. The concept of architectural legibility can be compared to the concept of reading a text. Different elements ordered in a certain way that we can recognize them. In case of architecture, this creates a mental image, or 'cognitive map' in our minds. To find out what effects the transformation and conservation of industrial heritage buildings has on the legibility, a definition will be given first. Then, a few examples will be given to illustrate how the legibility has changed after the transformation of an industrial heritage building.

*Keywords: Industrial heritage, legibility, transformation, meaning of space, reading space, cognitive map, mental image*

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## Introduction

The conservation of industrial heritage buildings has become a highly controversial topic in recent years. Not only in the Netherlands, but also in the rest of the world more and more buildings are becoming vacant and need to be transformed to remain in use in present day life. In order to do this, architects and engineers design and construct new plans for these heritage buildings. With this, a new discussion about the legibility of these buildings arises. We can 'read' buildings just like we read text, but architectural legibility goes beyond 'reading' buildings (Koseoglu & Onder, 2011). How does the conservation and transformation of buildings influence the legibility? This paper will explain architectural legibility and show that the degree of legibility of industrial heritage buildings changes over time, as the building is conserved or transformed. In order to clarify this position examples of industrial heritage buildings will be given. The degree of legibility of these buildings will be investigated. Since the field of heritage buildings is extremely large, this paper will focus on industrial heritage buildings only. Many of these buildings used to be warehouses or factories in the city harbours or industrial areas, but are now transformed to new functions to meet today's demands. With this transformation the degree of legibility changes as well.

## Legibility versus reading

Legibility originated from the field of urban design and is different than just reading a certain environment.

According to Koseoglu & Onder (2011), reading a space includes looking at it, observing the space and evaluating it. Legibility goes one step beyond reading a space. Yet, it is difficult to provide a single definition of architectural legibility, since opinions on this subject differ. In his book 'The Image of the City', Kevin Lynch (1960) investigates the look of the city and whether or not this is of any importance and can be changed or not. In his research he defines legibility as "the ease with which its (the building or the environment) parts can be recognized and can be organized into a coherent pattern". Thus, Legibility deals with organizing the information that we read from the building. It can be compared to reading text on a paper. The text is only clearly readable and understood when the characters and words are organised in recognizable pattern that humans can identify. Another definition is given by O'Neill (1991). He states that architectural legibility is "the degree to which the designed features of the environment aid people in creating an effective mental image or "cognitive map" of the spatial relationships within a building." O'Neill introduces mental images or cognitive maps in his definitions. He therefore implies that different parts of a building are organized into a mental image that people store in their minds. Certain characteristics of an environment or building can influence the correctness of the mental image, or cognitive map (O'Neill, 1991). Our mental image is therefore depending on the characteristics of space. Besides, the mental image in our minds is a personal image and therefore depending on the characteristics

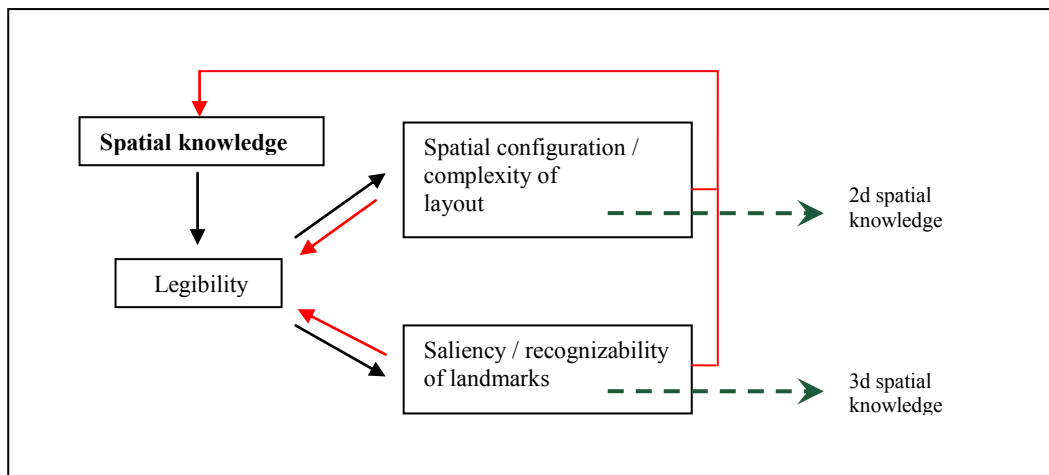


Image 1: Relationship of the different components of architectural legibility (Koseoglu & Onder, 2011).

of the visitor (Lynch, 1960). Image 1 explains the relationship between the different components of architectural legibility.

When discussing the legibility of a space or building, many include the meaning of space in this discussion. In his article Roland Barthes (1983) relates to Kevin Lynch when speaking about the meaning of space. He states Lynch is one of the few urban planners that tries to explain the meaning of the city and the meaning of space by investigating the legibility of that space. Lynch does that by defining elements of the urban space that are independent entities. Besides, Barthes mentions Victor Hugo and his ability to express the meaning of space.

### Legibility through history

Throughout history legibility, and in particular its effects on wayfinding, are discussed. Since wayfinding problems cause a loss of time, a loss in efficiency and actually getting lost in a building, designers seek for a legible design. However, some large-scale buildings such as hospitals can be extremely complex due to the size and number of hallways. In last 25 years of the twentieth century people started writing about legibility in architecture. The urge for legibility as a design criterion was felt and expressed by that time. Also, research was conducted to find out how the legibility in designing could be improved (O'Neill, 1991).

Some people would state that legibility does not change that much. They argue that, since architecture is not in constant change, the legibility does not change either.

### Layers of Legibility

Both urban environments and architectural objects consist of three different layers. The first layer is built

up out of all physical elements of the object. This includes all tangible parts of, for example, a building. The second layer is the historical layer. It shows the traces of the history of a certain building or place, and can be tangible or intangible. The third layer is an intangible one and among other things it contains the religious, social and economic aspects of the building. It can be called the cultural layer (Koseoglu & Onder, 2011). These layers all have a different effect on the legibility of a building. Therefore it could be stated that there are three 'layers of legibility' accordingly. All three layers contribute to the cognitive map in our minds in their own way. The physical aspects of a building cause us to form an image in our minds of what the building looks like. Likewise, it helps us to understand the spatial relationships between certain elements of a building. However, this tells us nothing about the cultural experience of the architecture. A different layer of information is needed to create the cultural part of the cognitive map.

According to Koseoglu & Onder (2011) there are two variables to determine the degree of legibility. First, the spatial layout and the complexity of the plan. This variable is measured in the second dimension. Secondly, what they call 'the saliency of architectural components in the third dimension' is of great importance. Others have called this the saliency of landmarks. Hereby, the term 'landmark' can refer to the visual and structural saliency of the building, but also to the saliency regarding the cultural or historical value of a building (Raubal & Winter, 2002). Besides, it is important to clarify the term of landmark for further use. According to the Cambridge Dictionary, a landmark is 'a building or place that is easily recognized, especially one that you can use to judge where you are.' It adds to it: 'A landmark is also a building or other structure that is considered especially important as

an example of its type' (Cambridge, 2016). Lynch gives another definition of landmarks, one related to architecture. He states that landmarks are defined by the characteristic of singularity, in which there lies a great uniqueness. Besides, Lynch writes that a landmark can be regarded important when it has an evident form, stands out against its background and when it is situated in a prominent location (Lynch, 1960).

### The Katoenveem

These layers of legibility can be seen in examples and show that legibility changes over time as the building advances at the same time. The Katoenveem building in Rotterdam for example, has changed a lot over the years. It used to be part of a system of transporting and storing cotton in the warehouse. To carry out this function, it had a tailor-made transit system to carry the cotton bales in and out of the building. It was also



Image 2: Katoenveem in 1921, just after completion. Visible are the water tower, transporting bridges, cranes on the waterfront and outside wall. Source: Historisch Centrum Overijssel



Image 3: Katoenveem in 2016. Original characteristic elements were demolished over time. A totally different picture remains. Photo taken by Alexia Ntella.

connected to two other warehouses by means of a bridge. Furthermore, two cranes on the waterfront made it possible to load and unload ships in the harbour. By approaching the building in the 20's, people create a certain image in their mind, a cognitive map. The function of the building was immediately clear at first glance. Bales of cotton 'flew' in and out of the building and ships and trains were loading and unloading constantly (see image 2). The building was part of a vivid and dynamic environment.

Throughout the years the Katoenveem has changed a lot. Many parts on the exterior have been removed, and the building has deteriorated (see image 3). The cognitive map that we create by looking at it is very different than the one of the original situation. The old function of the building is no longer clear at first glance. The Katoenveem is hidden behind a steel shed, and the neighbouring warehouse dominates the site. It almost seems as if the Katoenveem is no longer 'wanted' by the area. Architectural elements such as the water tower and transport bridges were designed features that helped people in creative an image of the building in their minds. By demolishing these components this image changes.

Furthermore, it could be stated that the Katoenveem is a landmark according to the description of Kevin Lynch. The building has a clear form, it contrasts with its background and is situated in an important location, considering the Meuse river and former harbour area.

### Philharmonie Hamburg

Another example of an industrial heritage site that has been transformed is the Philharmonie in the Hamburg harbour. Here, Herzog & de Meuron designed an addition to the existing Kaispeicher A



Image 4: Kaispeicher A warehouse in Hamburg designed by Werner Kallmorgen. Source: [www.wikiwand.com](http://www.wikiwand.com)



*Image 5: Design of the Philharmonie by Herzog & de Meuron. Photo by Sophie Wolter, [www.dezeen.com](http://www.dezeen.com)*

warehouse, dating from the 1960's. This red brick warehouse mainly stored coffee and cacao, that was brought in by large harbour cranes (NDR, 2016).

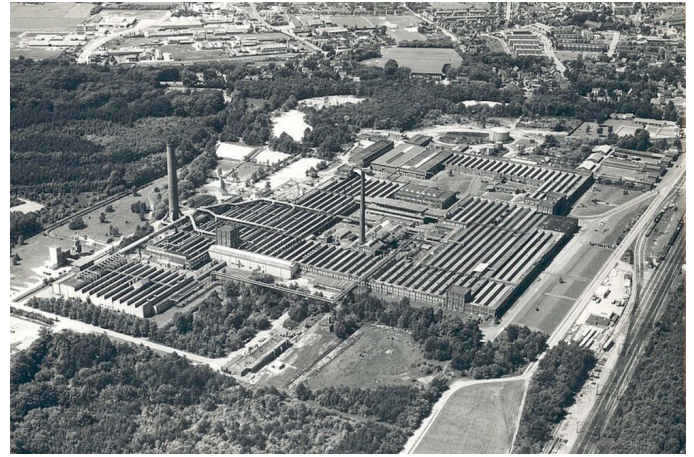
By designing and adding a new structure to an existing building, the appearance of the building changes. By doing this, people altered the designed features of the warehouse. With this alteration, the cognitive map that people have of the building also changes. In this case however, the original warehouse can be recognized quite strongly when looking at the new building. The new structure is clearly an addition to the old building. The contrast between old and new is very strong.

### **ENKA area Ede**

A third example of industrial heritage being transformed is the ENKA area in Ede. The ENKA terrain was home to a factory producing rayon, or viscose. This factory consisted of multiple buildings situated on a terrain in Ede. Many characteristic elements were found on this terrain. Nowadays, houses are being built in the area. Parts of the factory have been demolished and houses have replaced these parts. In the rebuild of the area the characteristic elements of the old factory are taken into consideration. Some of these components are monuments and therefore have to be conserved. These monumental parts are the pieces of the image of the neighbourhood that still remind of the old factory. Without these parts it would just be a residential area. Now, the question may arise whether it is a residential area with some left overs of an old factory in it, or whether it is an old heritage site where new houses have been built in between the existing structures.

### **Conclusion**

So how does the transformation and conservation of heritage buildings influence the legibility?



*Image 6: The ENKA area around 1970 when it was still in use as a factory. Source: Municipal archive Ede*



*Image 7: Street view from the ENKA area. In the background an old tower from the factory is visible. Source: [www.enka-ed.nl](http://www.enka-ed.nl)*

Architectural legibility is defined as the degree in which certain designed elements help people in creating a mental image of that place or building. From looking at examples it can be concluded that the degree of legibility does change when a building is transformed or conserved. The way it changes depends on the way the building is transformed. If all remains of the original structure are removed, the mental image we create in our minds differs immensely. If only minor changes are done to the old building, the legibility will change less. Most important in creating a cognitive map are the designed features of the building. If these elements alter, the legibility will alter accordingly. The change of legibility is evident in three different layers: a physical layer, a historical layer and a cultural layer. Some of the elements in these layers will change from within itself over time, others will only change after human intervention. Some of the elements in a particular layer will never change at all, for example the history of a building, and the use of it. Also, legibility and creating a cognitive map is a personal process and therefore varies from person to person.

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