From waste to resource

How abandoned maritime materials can be reused to keep the maritime industrial heritage

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Content

Introduction

The Netherlands is a land of water which is important, because 26% of the Netherlands is beneath sea level and 55% of the land is vulnerable for flooding. The large waterways are a network of nature and represent a natural asset of international importance (Planbureau voor de Leefomgeving, z.d.). The major waterways have a rich history including trade and transportation. By designating the heritage lines, the province (South Holland) aims to make the history of the water and the land more visible. In South Holland the heritage lines have been divided into seven parts, including waterways, dykes, coasts, etc. (figure 1). With this plan we zoom in on the Waterdiehoek which is located in the south-east of South Holland.

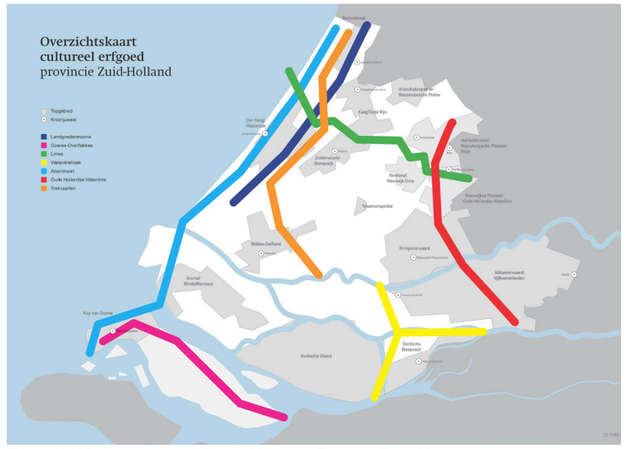


Figure 1: Heritage lines in South Holland. Erfgoed Zuid-Holland (z.d.).

The Waterdriehoek is defined as the area between the Biesbosch, Drechtsteden and Kinderdijk. These areas are located in a triangle which is connected to each other by the water (Noord, Beneden Merwede and Dordtsche Kil). Along those waters, there is a great deal of cultural and maritime heritage and while Kinderdijk is already a popular attraction, the Drechtsteden and the historic connection of the area to the water are not yet as well-known as they could be (Rijksdienst voor het Cultureel Erfgoed, z.d.). The province of South Holland has been working for the past decade to improve water transport and enhance the area's visibility, with the aim of making it more attractive and accessible for all (Arcadis Nederland B.V., 2024; Graaff & Rijsman, 2014).

While The Netherlands has a lot of waterways and the biggest harbour of Europe, the maritime industry significantly affects the Dutch economy (Bossche et al., 2019). The industries are located on the waterside, but given the reduction in the maritime industry since the last century, a significant number of these buildings are now vacant. The province aims to preserve the cultural values that the area knows, by renovating areas while also considering the importance of maritime heritage in the renovation process.

The consequence of renovating an area or building is that a considerable amount of waste is produced. According to Carpentier (z.d.), up to 30% of the world's waste is produced in the built environment, which is often landfilled (Bao, 2023). This means that those materials will no longer be used, which causes a rapid loss of valuable resources. As a result, when a site or building is renovated, new raw products are used for the new design, while the currently used materials could still be used as a resource for the new design. In addition to reducing waste, the reuse of materials can also enhance the intangible value rather than the previous tangible value to a place.

As Patrick Berger has done with the Viaduc des Artes in Paris, old materials like the ones used on the railway line can be used within a new plan as a linear park and place for arts and crafts. By preserving and improving elements of the habitat, the cultural and historic value of the buildings can be restored and rehabilitated (Ben Ghida, 2024). In this way, the intangible value of how the place was used, can still be recognised within the new design.

BRAND + / RIEGL +	AGE value	HISTORICAL value	INTENTINAL COMMEMORATIVE value	NON INTENDED COMMEMORATIVE value	USE value	NEW-NESS value	(relative) ART value	RARITY value [+]	OTHER relevant values [+]
SURROUNDINGS / SETTING [+]									
SITE									
SKIN (exterior)									
STRUCTURE									
SPACE PLAN									
SURFACES (interior) [+]									
SERVICES									
STUFF									
SPIRIT of PLACE [+]									

Figure 2: Value assesment scheme. Clarke et al. (2020).

Values can be given in many different ways, tangible and intangible which could be given by following the updated scheme of a combination of Riegl and Brand (Clarke et al., 2020) (figure 2) While some products can have a big structural value, other values that are not visible could still be important. Values of materials can influence the way a material can be used. As the circular economy primarily focuses on the 3R-strategy (recycle, reuse and reduce), other R-strategies receive less attention (Ho et al., 2024) despite their ability to be implemented to reduce the waste generation.

The 10R strategy is a more extensive scheme which is categorised into different subgroups that seek to explain the various ways in which a product can be reused (as a whole, as material, etc.)(Morseletto, 2020). The figure below is used by the TU Delft and will therefore be used throughout the research plan as a guideline. It illustrates the different degradations in which a material can be reused (Potting et al., 2017). As an example, it is more beneficial to rethink the way of designing and reducing the amount of material that is needed. If that is not a viable option, it may be worth considering repairing and repurposing the material. As a final option, when the quality has been severely compromised, the material could be incinerated and used as energy.

It would be preferable to begin at the highest level of the R-strategy ladder, while this means that this does not entail any modifications. However in the case of maritime industrial heritage, this may not always be feasible. Many products that could be retrieved from a maritime industrial heritage buildings are in a state of significant deterioration. For example, a lot of cladding used in wharfs is either rusty or broken. The straight forward thing to do, would be to discard the existing products and start with new ones. However, upon returning to the R-strategy ladder, it might be interesting to consider if it could be beneficial to descend on the ladder of the R-strategies.

Goal	Strategy	Description
Smart product use and manufacture	R0 - Refuse	Make product redundant by abandoning its function or offering same function with radically different product.
	R1 - Rethink	Make product use more intense (e.g. product-sharing, multi-functional product).
	R2 - Reduce	Increase efficiency in product manufacture or use by consuming fewer natural ressources and materials.
Extend lifespan of product and its part	R3 - Reuse	Reuse of functional discarded product by another consumer.
	R4 - Repair	Repair and maintenance of defective product to restore its original function.
	R5 - Refurbish	Restore and old product to bring it up to date.
	R6 - Remanufacture	Use product or parts in a new product with its original function.
	R7 - Repurpose	Use product or parts in a new product with a different function.
Useful application of materials	R8 - Recycle	Process the materials to obtain the same (high grade) or lower (low grade) quality.
	R9 - Recover	Incinerate materials to recover energy.

Figure 3: 10R-strategy. Potting et al. (2017).

According to Rose & Stegemann (2018), existing buildings could be used as material banks, whereby the elements and materials of existing buildings could be reused in future designs. A challenge with this approach however, is that many old buildings may not yet be included in the databases and the identification of the materials in them can be quite complex. This is because there is not a lot of information available about old buildings, as drawings and calculations were often created manually and may have been misplaced or lost over the years.

I believe that may also apply to locations with a maritime industrial past. To be able to know whether it is possible to reuse materials of the location, it could be helpful to create a material bank of what is already available at the site. This could then provide a useful starting point for exploring whether there are materials in other areas of the Waterdriehoek that could be used for the new design of the site.

Research Questions

In order to find out whether the generation of waste within revitalising the maritime heritage sites could be reduced by reusing materials, the research question of this thesis will be the following:

> *How can waste flows be brought together within the Waterdriehoek to revitalise the marimitime industrial heritage?*

This main question will be divided into sub questions that will be investigated in order to eventually answer the main question.

> *What are the options for reuse of maritime industrial materials?*
> *What examples are present of creative reuse within maritime industrial heritage?*

Methodology

The aim of this research is to investigate if waste generation can be reduced within the maritime industrial heritage sites. In order to answer this, first of all some literary research is needed to get an idea of the history of the site. This together with analysing the context by mapping important elements of the surroundings will be done in the beginning of the research so this information can be used to form the problem statement and create the research questions. Physical essence models are made to understand some important elements of the project (figures 4 and 5).

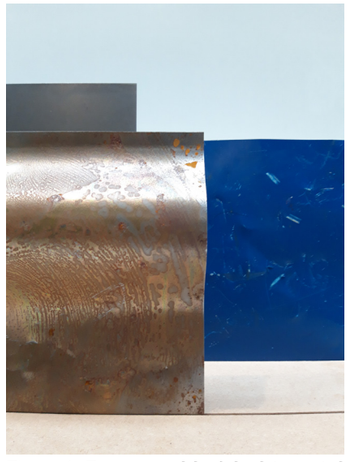


Figure 4: Essence model of de deteriorated steel facade elements.

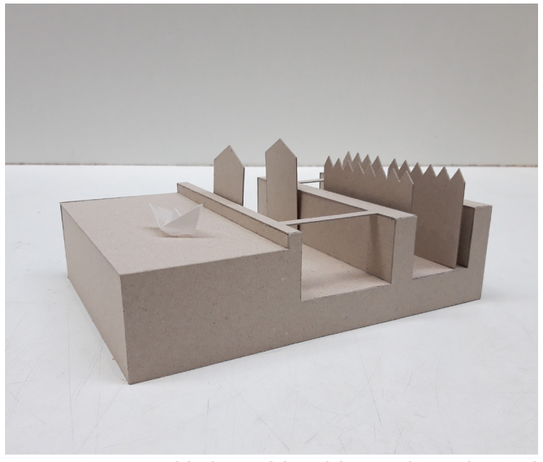


Figure 5: Essence model of accessibility of the site of Rotterdam Steel Works.

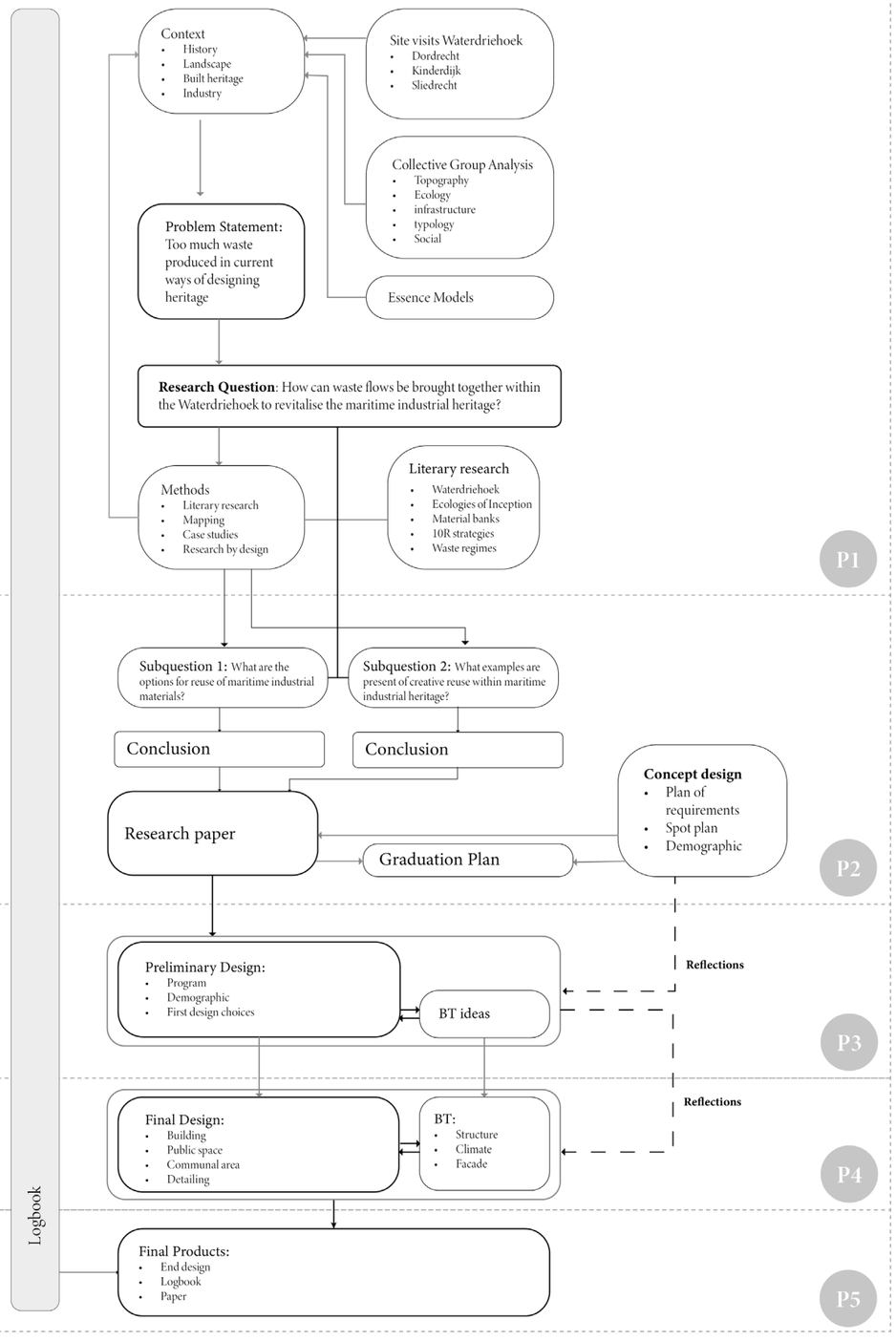
Additionally, some first concepts will be made, from which questions may arise of how to achieve them. Also, site visits will be done multiple times throughout the research and design process, while different stages of the process might add different insights on the particular subjects one is working on.

Literary research about the different themes of the concepts can give some background information needed so afterwards examples of case studies can be researched in order to find out how it has been done before with other projects. By this means, it might be possible to form a material bank of a specific location. As a better general comprehension is generated, the case studies will be narrowed down into the maritime industrial framework to investigate what kind of creative reuse is possible, which can then be implemented for the site in question.

By reflecting and checking the outcomes of the research within the design process, the research and design of the renovation of the site will be combined into one big project.

The scheme that makes this visible is on the next page.

Research Scheme



Theoretical Framework

While the research will be done with along the lines of the methodology, in order to research something useful, some background information is needed. As an example, in order to create a view on renovating maritime industrial heritage, it is first of all necessary to understand the basics of designing with heritage. Therefore the book of Kuipers & de Jonge (2017) will be used Designing from Heritage: Strategies for conservation and conversion. Within this book, a perspective is given in which one can look at the project and what kind of questions one could ask themselves as well as the explanation of the Value Matrix previously mentioned

A great deal of research has been conducted on the topics of reuse and the circular economy. While many of the sources appear to present a similar narrative, it is possible that they offer slightly different nuances in their approach. In this research, the definitions set forth by Ferracina (2022) will be used regarding the linear, circular and nodal economy. The linear economy is defined as follows: 'A linear system of production transforms a matter-input into a form-output, and eventually releases it as water (matter-form-waste).'. Secondly, the circular economy 'A circular mode of production links the first and last steps, matter and waste, and thus turns the latter into the input for a new productive cycle or ecology (matter/form/waste/matter).'. While these two concepts assume matter and form to be an objective thing, a nodal economy indicates that an object can be matter or form at any time and that waste is never there (matter or form).

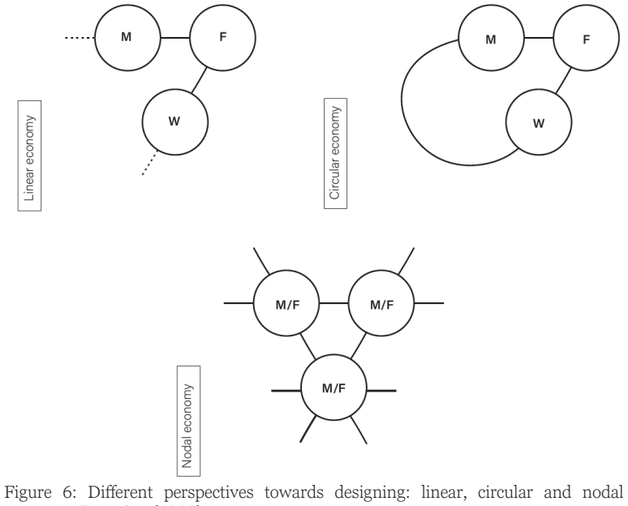


Figure 6: Different perspectives towards designing: linear, circular and nodal economy. Ferracina (2022).

Another important issue to note, is the utilisation of vocabulary as the words ‘use’ and ‘reuse’ regarding materials is utilised alternately. According to the Cambridge dictionary (Cambridge Dictionary, z.d.) reuse means ‘to use something again in the same or a different form’ and use means ‘to put something to a purpose’. This proposes the thought that ‘use’ is the first form and everything that follows is ‘reuse’. However many objects we ‘use’ in our lives we are actually ‘reusing’ over and over again and we still apply ‘use’ in many cases. That is why in this research those terms will be utilised alternately unless differently stated.

An important element of investigating the area and the potential of the materials currently available at the site, is to examine material banks. These material banks demonstrate the type of materials that are present somewhere from another project, thereby facilitating the reuse of components in a different project. According to Rose & Stegemann (2018) it is currently difficult to create material banks from old buildings, while big parts of the information on the buildings is not available. However by using a geometric scan, materials on the surface and below that can be identified in existing buildings. This might not be necessary if other examples of material banks can be used and implemented in the same way at a maritime industrial building as much as possible

This research is done to support some design choices later on in the project. The goal of this research is to create new purposes for old materials of maritime industry in order to keep the maritime industrial heritage present and reduce the amount of waste produced at the building site. By iterating the process of using research for the design, and evaluating it, the intent is that the findings will not solely be applicable for one specific location, but could be used as a guideline for other maritime industrial heritage areas as well.

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