Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

<table>
<thead>
<tr>
<th>Personal information</th>
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<tbody>
<tr>
<td>Name</td>
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<tr>
<th>Studio</th>
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<tr>
<td>Name / Theme</td>
<td>Smart Cities and Urban Metabolism</td>
</tr>
<tr>
<td>Teachers / tutors</td>
<td>Ulf Hackauf (first mentor)</td>
</tr>
<tr>
<td></td>
<td>Alex Wandl (second mentor)</td>
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<th>Argumentation of choice of the studio</th>
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<td></td>
<td>The concept of circular economy got my attention during my internship at the municipality of Amsterdam during the second semester of 2016. During this internship I participated in a project, called Westas which looked for circular solutions on a regional scale, by working together on multiple governmental scales and with other private stakeholders.</td>
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During the project, which was more focused on the governmental side of organizing circular economy, a lot of spatial related questions came up. Some part of the research focused on these spatial consequences of circular economy, but still a lot of questions remained unanswered, like how to implement and facilitate this new circular economy. These questions raised my interest in the spatial component of circular economy and especially, what kind new opportunities for spatial design it may create.

The research group of Urban metabolism focuses on these questions. They try to find out how this new way of resource management can be a tool for urban design and spatial planning. The systematic approach got my attention, since it tries to combine quantitative research with the profession or urban design. In this way, new designs can create quality on multiple levels and they are underpinned by quantitative data.

This all resulted in my choice for the Smart cities and Urban Metabolism research group, to investigate these new opportunities and urban design approaches created by the integration of resource management concepts like circular economy and urban metabolism.
**Graduation project**

| Title of the graduation project | Qualitative industrial areas; an urban design approach to the design of industrial areas for the circular economy |

**Goal**

<table>
<thead>
<tr>
<th>Location:</th>
<th>Industrial areas within the Amsterdam metropolitan area (AMA)</th>
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<tr>
<td>The posed problem,</td>
<td>The problem and at the same time opportunity is the lack of space for the development of the circular economy and at the same time the ambition to keep the living quality of high standard. Developing a new approach to industrial area design can be a solution for using the limited space for multiple functions and creating more value.</td>
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**research questions and**

<table>
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<tr>
<th>Main research question:</th>
<th>How could urban design from an urban metabolism perspective improve spatial quality within industrial areas to deal with limited space and create multifunctional places?</th>
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<td>Sub research questions:</td>
<td>1. What is the current level of spatial quality within industrial areas?</td>
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<td>2. What are the environmental regulations within urban areas and what kind of activities/qualities can be combined with different sorts of industries?</td>
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<td>3. What principles can be learned from previous completed design projects where urban metabolism and urban design where a combined approach?</td>
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**design assignment in which these result.**

| Rethinking the way of how we design our industrial areas, where the core principles of circular economy take place, could lead to the optimum performing metropolitan area with high living quality. Combining functions and creating spatial quality within these areas will increase the value and it will serve more purposes instead of just economic interests. |

**Problem Field**

Nowadays we are completely aware of the fact that a lot of the natural resources we use in our daily lives are not inexhaustible. In 1972 awareness was created by the Club of Rome in their report ‘limits to growth’. They made us aware of the fact that a lot of natural resources are not renewable and that there are limits to our economic growth by because of this. Resources like water, oil, natural gas, phosphorus and coal are now essential for our daily lives. These resources provide energy so we can run our cities. They are the fuel for our economic engines. Some of these resources are expected to
deplete within 50 years (Ruz, 2011). This increases the urgency to find new ways of re-using these natural resources or use other renewable resources to be able to organize and operate urban environments.

This problem will become even bigger since it is expected that by 2070 75% of the world’s population will live in cities (Bueren et al., 2012). Cities are not only accumulations of people, but also of economic activity. On an average, cities are responsible for over 75% of the Gross national product, which means that they are the economic engines of a country and facilitate economic growth, jobs and prosperity (UN Habitat, n.d.). So cities are complex systems where the combination of people and economic activity lead to increasing resource consumption.

**Problem within project location**

The AMA is the metropolitan area surrounding Amsterdam and forms a collaboration between 32 municipalities. The AMA is growing, has to deal with environmental problems and at the same time needs to maintain their economic position within Europe. The AMA created a strong vision for the future. The broad supported key message of this ambition is that theAMA needs to become and stay a strong international economic region, with compact cities, an attractive metropolitan landscape with effective infrastructure that connects the core cities, the landscape and other regions worldwide.

The municipality of Amsterdam started to use the philosophy of circular economy as a tool to transform their current economic system and facilitate sustainable urban growth (Gemeente Amsterdam, 2015). The transition towards a circular economy provides new jobs, contributes to science and knowledge creation, a reduction of CO2 emission and improves the living quality. Amsterdam sees itself as one of the leading cities concerning the circular transition (Gemeente Amsterdam, 2016). However, circular economy has become a transition path for the whole AMA, for the province of Noord-Holland and even national programs have started (Metropoolregio Amsterdam, 2016; Rijksoverheid, 2016; Provincie Noord-Holland, 2017).

**Problem Statement**

Multiple projects started within the AMA to accelerate the transition to a circular economy. One of these projects is project Westas (Westas, 2016). The Westas is the area west of Amsterdam and contains the most important work locations of the region. These locations should be utilized to the optimum since of the spatial and economic pressure on these sites. To deal with these pressure, and to reform these sites, circular economy can be a principle to follow. This at has to be realized within the dense AMA and a decrease in living quality will not be accepted by the inhabitants which are used to a high welfare level.

This raises the question for the (re)development of these work locations and industrial areas which can contribute to the living quality and will not add pressure to the existing metropolitan area.

**References**


Gemeente Amsterdam (2015) *Amsterdam Duurzaam, Agenda voor duurzame energie, schone lucht, een circulaire economie en een klimaarbestendige stad*. Amsterdam: Gemeente Amsterdam, Ruimte en duurzaamheid


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**Process**

**Method description**

The methodology to answer the proposed research and design questions are presented within the methodological framework. The research can be divided in four separate parts that will contribute to each other and to the main research question. The four parts will be explained.

**PART I**

To determine the spatial quality of industrial areas and the possibilities for adding spatial qualities a framework for evaluating spatial quality should be developed. Different frameworks for spatial quality are already derived from literature and explained within the paper ‘Urban metabolism as a spatial quality generator. This knowledge can be the base for developing an evaluation framework for spatial quality within industrial areas. At the

**PART II**

The second part of the research will focus on the industrial area within the AMA. The choice for an industrial area will be based on a GIS analysis of the AMA, displaying different kind of industries and their activities. In this way the industrial area can be selected where the development of a construction waste resource hub is the most promising.

After the industrial area is selected a spatial analysis can be done. By mapping and making site visits the condition and characteristics of the industrial area can be determent. These characteristics can be evaluated by using the spatial quality framework made during part I of the research. This will show the current status of spatial quality within the area and points for improvement. Next to that, policy documents should be analyzed to see what the exact regulations are within this area concerning negative environmental effects. This analysis will determine what different kind of functions could be added to the area and what spatial qualities could be created.

**PART III**

To understand what the possibilities are when applying the urban metabolism and urban design approach within industrial areas already existing projects should be analyzed and evaluated. Most of these projects are located within urban areas, but principles could still be derived. Next tot that should already developed theories and methods within literature be used. This knowledge can be used for creating principles explained in part IV.
PART IV

The fourth part will be about the generation of general principles related to adding spatial quality and multifunctionality within industrial areas. By investigating policy documents related to regulation of industrial areas it is possible to determine what possibilities there are in combination with different kind of industries. Dutch policies categorise industries within environmental categories that describe the nuisance to surrounding areas. This level of nuisance what kind of function are likely to add. These principles can be input for designing the industrial area within the AMA, since it shows the variety of options and it contributes to existing knowledge about industrial area development.

PART V

Within the final design the principles from part IV will be applied within the selected industrial area. In this way extra spatial quality and multifunctionality is being created. The design can be evaluated by the framework produced within part I. This evaluation shows the level of quality that has been added.
**Literature and general practical preference**

**Circular economy**


**Urban Metabolism**


**Spatial quality**


Industrial ecology


Policy documents

To identify the possibilities for quality creation within industrial areas it is necessary to know what kind of added values can be created and what functions can be added. Industrial areas are characterized by their environmental regulations like security zones and noise areas. Different industries can be combined with different kind of functions.


Reflection

Relevance

This thesis will be relevant on multiple aspects. In a scientific way it will contribute to the knowledge on how to implement urban metabolism. This is already being done within urban environments, but this research tries to do that within industrial areas. The study of industrial ecology already applies circular principles within industrial areas. However, this research will have a more multidisciplinary approach to the sustainable development of industrial areas. It provides a new approach which can be compared with eco-industrial parks. Using an urban design approach on industrial park development provides more knowledge on how industrial areas can be made more multifunctional and can be places of spatial quality. This research may evoke some interesting new perspective on how we experience and design our industrial areas now and have designed over the past.

The research from this thesis will answer directly questions that came from practice. Ways have to be found to develop our cities in a more sustainable way to deal with the trends of urbanization and depleting resources. This research will provide new insides on how we can look to the spatial characteristics of our production sides. Since there is just limited amount of available space within metropolitan areas, the need for function mix and making effectively use of these spaces has grown. By adding more spatial quality and functions to industrial areas in a sustainable and circular way, these places can serve more than just economic interests. When the people living within the metropolitan area can make use of these areas, more living quality can be created and the metropolitan area will be valued more by its inhabitants. Next to that do these (re)developments contribute to creating a more ecological stable and economic vibrant region which can be valued by people since it will provide jobs and improve environmental conditions.
Time planning

- Orientation
- Theoretical Framework
- Theoretical paper
- Part I
- Part II
- Part IV
- Part III
- Part V
- Evaluation
- Wrap up

February
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