

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



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:

Personal information	
Name	Zichuan Lu
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Studio		
Name / Theme	Urban Metabolism and Climate	
Main mentor	Arjan van Timmeren	Environmental Technology & Design
Second mentor	Taneha K. Bacchin	Landscape Urbanism
Argumentation of choice of the studio	The seasonal flood in the Yangtze river basin cause serious economic and life losses every year, instead of the hard infrastructure, a sustainable, circular, and resilient water management system might be a better solution for both human and living environment. This kind of solution requires understanding the synergy of different systems, sub-systems, and stakeholders, at the same time has the potential to solve urban climate issues and create public spaces for people. Thus, I believe the core of solving this flood issue in the Yangtze river basin is also the core research interests of the Urban metabolism and climate studio.	

Graduation project	
Title of the graduation project	Water Safety: Fragile Urban Riverfront - Applying more resilience to the urban river corridor of Chongqing
Goal	
Location:	Chongqing, China
The posed problem, research questions and	Annual flood issues How to shift the fragile urban riverfront , which caused by changes (climate change, monsoon, increasing infrastructure) and actual quality (spatial, infrastructural, nature), into a flood resilient area by the synergy of nature system and constructed environment in Chongqing? Sub-research question 1: What are the artificial and natural reasons which caused the flood in the Yangtze River basin seasonal flood in Chongqing?

	<p>The first sub-question helps to understand the reason and mechanism of the seasonal flood in the Yangtze River basin.</p> <p>Sub-research question 2:</p> <p>How does the seasonal Yangtze river flood influence basic urban flows (energy, water, traffic) and related (potentials for) spatial quality of Chongqing, and what measures are used to defense/mitigate flood?</p> <p>The second sub-question helps to analysis the flood influence from the urban perspectives.</p> <p>Sub-research question 3:</p> <p>How can solutions to address urbanization (development of buildings and infrastructure) and natural processes (water runoff, infiltration, biodiversity, and eco-systems services) be synergetic to increase urban flood resilience?</p> <p>The third sub-question helps to find the potential opportunities to implement flood resilience in mountainous cities by the nature-based solutions.</p> <p>Sub-research question 4:</p> <p>What co-benefits could flood resilient urban riverfront brings to society and economy?</p> <p>The final sub-question helps to explore the potential positive influences and co-benefits that this research could bring.</p>
design assignment in which these result.	<p>- Flood defense scenarios</p> <p>To test and describe how human intervention could influence the flood and change the current hydro system, two (preliminary) flood scenarios are proposed to predict the extreme future for flood defense in the Yangtze River basin. The two scenarios will be the adapting scenario and the control scenario, these two scenarios will represent the two extreme futures for human intervention in flood control. The adapting scenario shows the future that humans only adapt to the flood and</p>

	<p>there are no human interventions and hard infrastructures for flood control. The city areas may shrink as some urban areas are always under the threat of flood. And the control scenario shows the future that human interventions are highly influenced the flood control. Hard infrastructures like dikes, dams, and water walls are being used everywhere to help protect the safety and property of habitants who living in the flood hazard areas. By exploring the extreme future, will helps the research and design to position itself in between of them, with the consideration of economy, ecology, society, culture, and etc.</p> <p>- Dynamic management strategy</p> <p>On the upstream of the Yangtze River basin, there is already a comprehensive flood control system made by reservoir system. However, the current operation and management of the system are underutilized their storage capacities of flood. Sometimes the management even caused flooding for certain area in the basin. The dynamic reservoir management system is a possible way to solve that issue. By management and distribute the flood water flow for the upstream Yangtze River, the reservoirs will work together to maximize the flood storage capacity of the entire reservoir system. To achieve that goal, the management strategy will include the information of climate information (monsoon, average rainfall, rainy season) and the water storage capacity of each reservoir.</p> <p>- Design test</p> <p>The design will base on scenario making and serve as a test to find a possible way to solving current flood issues. The design will be located on serval typical river corridors in Chongqing. In order to generalize a flood control toolbox for cities in upstream of the Yangtze River, the locations will be selected as representative for the areas where humans and flood conflicts are most severe, which is highly urbanized areas, peri-urban areas, agriculture areas respectively. The basic aspects like surface runoff, soil type, and urban infrastructure will be considered as the opportunities and challenges for the design test. While implementing more flood resilience to the river corridor, the design will also test the opportunities to create long-term co-benefits with local communities, ecosystems, agriculture,</p>
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	economy, and so on. The design will also combine with the dynamic floodwater management, shows performance under different flood management conditions, and how the design could contribute not only for the flood defense in the local scale but also for stronger flood adapt capacity on the regional scale.
Process	
Method description	
For the development of the research project, finding answers for the research questions, the following methods are used in the project.	
(1) Theory review	
The theory review includes the literature view and historical reviews, the aim of it is to explore theories and understand the context of the research. It provides the foundation of the research approach, conceptual framework, and theoretical framework. The first and the second sub-research questions requires the literatures and theories describing the flood mechanism and influences. The third and the forth sub-research questions require the theories relevant to flood defense strategy and its co-benefit.	
(2) Document analysis	
The aim of this method is to collect relevant data and understanding the government's strategies. To understanding regional Yangtze river hydrological information, the documents from the Yangtze River Water Resources Commission are needed. It also helps to understanding the first sub-research question. The analysis of the Chongqing 2020 Master Plan and other previous master plans of Chongqing helps to understanding the development and the land-use change of the case area. And it helps to answer the second and third sub-research questions. The statistical reports of Chongqing help to collect the data and describe the characteristic of the city, answering the third sub-research question.	
(3) Mapping and spatial analysis	
This theory also includes the layer analysis and GIS analysis. The aim of this series of methods is to understand the spatial relations between build environment, constructed and non-constructed landscapes, and social-spatial relevance. It also helps to find the flood hazard area and to select the case study areas. The visualization of data collection could bring a general answer to the second and third sub-research questions.	
(4) Scenario making	
The aim of this method is to explore the boundaries of the research and to help the following design test to position itself in between the boundaries. It could also help to discuss the relationship between human and hazard. The exploration of the extreme situations could help to answer the main and the third sub-research questions.	
(5) Research by design	
The aim of this method is developing the regional and local flood control strategy and later for the design interventions, showing the possible guidelines. It will also provide the possibilities of emerging methods found during the research. This method is used as the answer for the main research question, as well as the first and second sub-research questions	
(6) Design test	
The aim of this method is to check the research relevance and practicality, also reflect on the main research	

question, to test if the outcomes could answer the question. This method is not only about the reflection of the flood resilience, it will also include the stakeholders, social-spatial sector, and social-ecological sector. The design test would allow for the reflection on defined theories, and revision of the developed strategy.

Literature and general practical preference

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Literature in Chinese:

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Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

The graduation project focuses on the annual flood issues in upstream of the Yangtze river, and explore a way to mitigate the influence of the hazard. The project starts from urban area and explores the relationship between the built environment and nature element. It also blends spatial and process design related to water management and urbanism.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

- Scientific relevance

Due to climate change and the extension of urban areas, the conflicts between the water system and urban environments are more severe. The increasing extension of urban areas leads to the massive construction of impermeable pavements, caused the increase of surface runoff, constantly increasing the threat of flood. Large amounts of researches and studies are investigating this issue. Solutions like nature-based solutions and water sensitive design are widely implemented.

Chongqing, as a mountainous city, has more complex geographical conditions than the flat cities. The special terrain leads to a complex runoff system and water catchment. By using GIS as tools, the terrain could be an opportunity to implement the theories and to increase the flood resilience of Chongqing. Furthermore, Chongqing as the representative city in upstream of the Yangtze River basin has the similar climatic environment and geographical conditions to other cities. So, the research of increasing flood resilience in Chongqing could also be a reference for other upstream Yangtze River cities, as currently, there are not many pieces of research focus on this area.

- Societal relevance

Design a flood-resilient city is not only just about increasing the environmental resilience and infrastructures itself, it could also have the potential to bring long-term co-benefits to society and economy. By implementing more flood resilience to the urban area, it could promote the relationship between inhabitants and water systems, and increase social justice. By designing a hybrid-flood defense system on riverfront areas, it also increases the accessibility for local residences to the natural environments and possibilities for more high-quality public spaces.

On the other hand, the more resilient urban riverfront will also contribute to protecting the safety of the lives and properties of local inhabitants. Most of the time, the people who are easily affected by floods are the low-income groups and the flood caused them more losses than other people. In that case, a more floods resilient city means a city has higher social justice.