UNIVERSITY OF TWENTE.

Fact-Sheet Minor Module 9: Design your own MULTIFUNCTIONAL FLOOD DEFENCE

Name Module	Smart Cities - Multifunctional Flood Defences
Language	English
Coordinator	Dr. J.J. Warmink (j.j.warmink@utwente.nl / 06 1828 9543)
Pre-required knowledge	Third year BSc level in an engineering (or related) topic.
Admissible studies	ET/CiT, ET/IO, ET/WB, EWI/CS, BMS/IBA, BMS/TBK, TNW/ST, TNW/TN Other studies also admissible, but please contact coordinator.
Starting block	Module 9: September-November 2019

Theme

In this module you will create and design a Multifunctional Flood Defences (Figure 1) as an innovative solution for Smart City planning. You will learn in-depth knowledge related to MFDs and apply this knowledge in an interdisciplinary design and co-create a physical scale model for the study area: Almere, DUIN.nl.

Figure 1. Physical scale model (last year); Group work in DesLab; Multifunctional Flood Defences in Rotterdam and Dordrecht; Excursion.

Content

In this module, students learn to integrate knowledge from various scientific fields, learn to design in an interdisciplinary team and learn to use expert knowledge to create a physical scale model of a Multifunctional Flood Defence. Several state-of-the-art topics, essential for MFD design, are introduced. Students go in-depth into one of these topics, while integrating their results in interdisciplinary teams. Examples:

1) *Dynamic use functions*, as these need to be analysed to be able to match the final design to the wishes of various actors including future changes.
2) *Stakeholder and knowledge management*. Management of the various stakes need to be analysed.
3) *Spatial Subsoil Planning*. Constructions, such as houses or parking lots integrated in the flood defence require knowledge of suitable building locations for foundations, which requires spatial subsoil planning.
4) Novel *Building with Nature* concepts, vegetated foreshores can be applied to combine nature and flood safety.
5) *Multifunctional Flood Safety* is changing the methods for assessing flood safety, which is affected by transitions between dikes and embedded structures. Students apply novel methods to ensure safety against flooding.

The final product of this module is a physical scale model of the MFD design for the study area (Fig. 1).

Module organization, topics, learning objectives and assessment.

The study area is divided into sections of around 1km length. Each team consists of around five students and is responsible for the design of one of the sections of the study area. Each team member works as an expert on one of the topics and acquires in-depth knowledge. The experts from the different teams work together to exchange knowledge and learn from each other during expert meetings, supervised by an expert teacher. During plenary sessions, the designs and requirements are exchanged between the teams. The DesignLab will be used as a central location for exchange, project work and physical model construction. Planning of the design and work process is essential in this module.

The first two weeks of the module are used for introducing the study area and the topics in (guest) lectures. Students define their preliminary design requirements, which are discussed in team sessions and a plenary session at the end of the second week. The preliminary design requirements are graded based on a written team report. In the second part of the module, the preliminary designs are worked out. The students work both on their topic as experts and on the project simultaneously. Supervised meetings are scheduled to exchange knowledge, stimulate integration and monitor the progress. Teaching staff is regularly available for questions. Also, plenary sessions are scheduled to discuss challenges and stimulate cooperation towards the final design. The last two weeks of the module are dedicated to integration, visualization and evaluation of the final design. In these weeks you work in the Workshop of the design Lab, to construct an integrated physical model of your final design (Fig. 1). We challenge you to improve the designs form last year and make it even more stunningly beautiful.

In-depth knowledge gain (5 topics, each student works on 1)

	Dynamic Use Functions	**Stakeholder Management**	**Spatial Subsoil Planning**	**Building with Nature**	**Multifunctional Flood Safety**
ET:CiT/IO/WB	Suitability +/-	Suitability +/-	Suitability +	Suitability +	Suitability +
BMS	Suitability +	Suitability +	Suitability +/-	Suitability -	Suitability -
EWI/TNW	Suitability +/-	Suitability +/-	Suitability +/-	Suitability +	Suitability +
Focus points:	• Actor analysis • Detailed design of street furniture TRIZ (solve inventive problems)	• Stakeholder analysis • Innovation management • Smart solutions Implementation plans	• Soil structure /foundations • 3D GIS, subsoil analysis • Use of space, accessibility Geology	• Foreshores • Planning/ design natural elements • Numerical modelling Vegetation design	• Soil-water interactions • Safety of innovations • Spatial flooding probability Innovations

Schedule	wk 1	wk 2	wk 3	wk 4	wk 5	wk 6	wk 7	wk 8	wk 9	wk 10
Lessons	Lectures Seminars	Lectures Seminars	Project Workshops Seminars	Project Workshops Seminars	Project Excursion? Seminars	Project Self-study Seminars	Project Self-study Seminars	Project Prep. model Seminars	Project Build model	Project Build model
Products		Preliminary design			Design alternatives			Final design	Ind./Team reports	Physical scale model

Learning Goals: after this module students are able:	**Assessment method:**
1. To provide an overview of Multifunctional Flood Defences, their users, functioning and practical challenges in designing	1. Group report on prelim.design requirements (10%)
2. To explain the functions and requirements for the preliminary design	
3. To explain and apply state-of-the-art knowledge on one topic of the design of a multifunctional flood defences.	3. Individual report on in-depth topic (40%)
4. To integrate their state-of-the-art knowledge into the design of MFDs within an interdisciplinary team	4. Group report on design choices (30%)
5. To present and visualize the final design using a (physical) model	5. Pitch of physical model (20%)
6. To implement their expertise in an interdisciplinary team	6. Reflection report