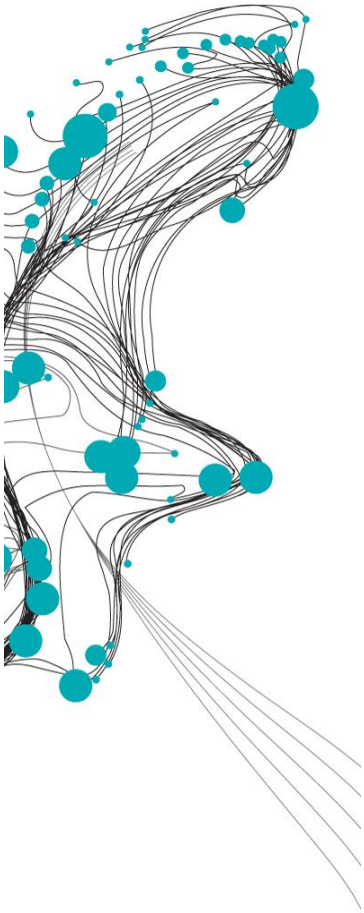
UNCERTAINTIES IN THE DERIVATION OF THE DUTCH FLOOD SAFETY STANDARDS



The new flood safety standards for the Dutch primary flood defences are predominantly based on two criteria: a maximum allowed casualty risk and a balance between flood damage and costs for flood probability reduction. Two accompanying flood safety standards were derived for these criteria: the so-called local individual risk (LIR) standard and social cost benefit (SCBA) standard. The calculation process of the new flood safety standards consists of a series of models, assumptions, data and simplifications, introducing uncertainty in the current safety standards. It was largely unknown how uncertain these safety standards are, and which spatial characteristics affect the uncertainty. As the current flood defence improvement projects are guided by these safety standards, uncertainty in the standards impacts these projects as well. Therefore, this study aimed to quantify the uncertainty of the new flood safety standards. Furthermore, this study has defined spatial characteristics influencing the uncertainty. The study was focussed on dike ring 43, situated within the Dutch river system.

Through a systematic approach, the five most important uncertainty sources were identified (Table 1) and quantified. In a scenario analysis, scenarios for the upper and lower limit of the 50% confidence interval for each uncertainty source were first propagated individually through the safety standard derivation process, to identify spatial characteristics which determine the uncertainty source influence. Afterwards, scenarios were combined to derive the overall uncertainty bandwidth of the LIR and SCBA safety standards.

This study showed that the overall uncertainty of the LIR standards is slightly smaller than the SCBA standards. The strictest LIR standards found are approximately 1,7 times stricter than the least strict standards, while for the SCBA standards approximately a factor 2 was found between strictest and least strict standards (Table 1). Also, it was shown that the variation of influence of individual uncertainty sources over different areas is larger for the LIR standards than the SCBA standards. SCBA standards are derived based on characteristics for the entire flood zone, while LIR standards are derived from characteristics of one (normative) neighborhood within the flood zone. Local variation of the uncertainty source influence due to distinct spatial characteristics therefore does affect the LIR standards, but does not affect the SCBA standards. Spatial characteristics found to influence the uncertainty of the safety standards are amongst others the presence of increased surface elevation lines and the distance between the breach location and the location of the normative neighborhood.

Especially for the LIR standards, it is therefore recommended to use a location specific approach to derive accurate safety standards corresponding to the local flood risks, which is currently not a standard practice in the Dutch approach of safety standard calculation.

Table 1: Alert flood safety standards [y^{-1}] for safety standard segment 43-6, by combination of the five most important uncertainty sources for the LIR standards (left) and SCBA standards (right). Each value expresses one combination of the three defined scenarios for each uncertainty source. 25^{th} stands for the 25^{th} percentile scenario, R for reference scenario and 75^{th} for the 75^{th} percentile scenario.

Mortality functions

Breach development	Scenario	75th	R	25th	Scenario	Evacuation
	25th	1793	1993	**2080**	25th	
	25th	1312	1312	1312	R	
	25th	1222	1222	1222	75th	
	R	1742	1742	1822	25th	
	R	1284	**1284**	1284	R	
	R	1206	1206	1206	75th	
	75th	1705	1705	1705	25th	
	75th	1267	1267	1267	R	
	75th	**1190**	1190	1190	75th	

Damage functions

Breach development	Scenario	75th	R	25th	Scenario	Investment costs
	25th	4838	5822	**6769**	75th	
	25th	4315	5193	6038	R	
	25th	3895	4688	5450	25th	
	R	4636	5604	6528	75th	
	R	4135	**4999**	5823	R	
	R	3733	4513	5256	25th	
	75th	4271	5190	6057	75th	
	75th	3810	4630	5403	R	
	75th	**3439**	4179	4877	25th	

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Graduation Date:
11 December 2019

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