

3.2.5 Appraisal of the EC directives

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1. Introduction

1.1. Brief presentation of Activity 3.2

Activity 3.2 within Work Package 3 of PMO-GATE project relates to the assessment of flooding in coastal urban areas due to extreme waves exposure. Significant number of objects along the coastline are potentially exposed to flooding due to the impact of extreme waves on the sea surface generated by severe winds. Within this activity, an extreme waves flooding exposure analysis is performed for the particular test site of Kaštel Kambelovac. Furthermore, this activity addresses the main weak points potentially exposed to extreme waves flooding, which in combination with extreme waves exposure maps are used for flood risk assessment on the particular test site. In addition, existing flood risk management plans are evaluated along with the relevant EU legislation. Finally, a set of actions is defined in order to harmonize local flood risk management plans with EU requirements.

1.2. Test site – Kaštel Kambelovac

Along the Croatian coast, flooding endangers many low-lying coastal areas potentially exposing significant number of objects to flood hazard. Many historical buildings and/or areas are located along the coastline, which are potentially endangered by coastal flooding as well and subject to significant consequences and damage. The City of Kaštela area is endangered by sea flooding due to its low-lying topography and significant number of cultural and household objects located near the coastline. The particular test site in PMO-GATE project is Kaštel Kambelovac, one of the seven settlements that form the City of Kaštela. This area covers around 45000 square meters and includes more than 400 objects.

The benefit of the chosen area reflects through diversity of objects considering construction, architecture and material, built from the 15th century until today. According to Marasović [1] the oldest objects in the area date back to 1467. These buildings were made of stone with a wooden floor

construction, and they remained preserved until today with minor modifications over the years. Historical part of the Kaštel Kambelovac is founded in the 16th century around the Tower of Cambi, as well as the church of St. Mihovil and Martin from the 19th century with a bell tower from 1860. This particular area is a mixture of private and public facilities, mostly built as masonry and concrete buildings. Plan view of the selected area is shown in Figure 1, where the green line defines the border of the test site, purple one defines the border of historical part, while the red line shows position of the natural coastline.

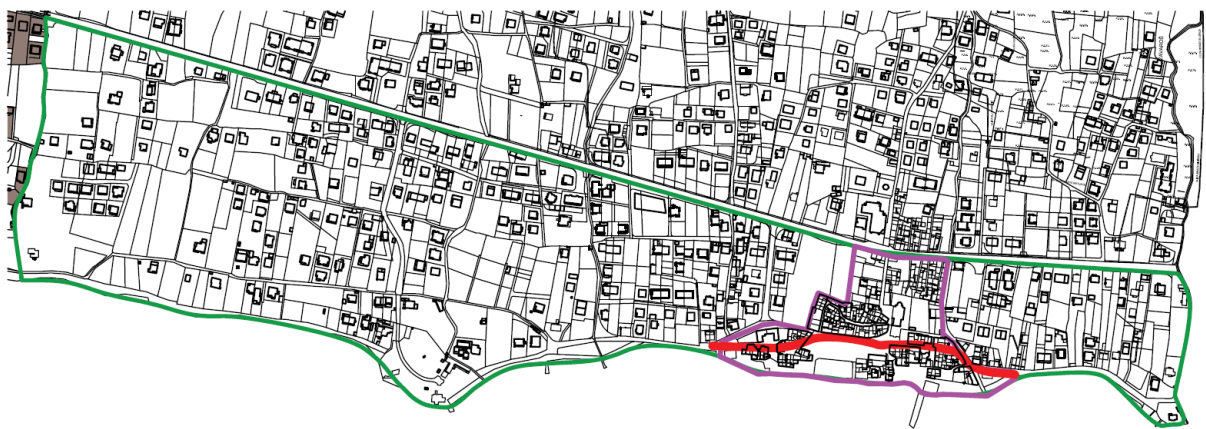


Figure 1. Plan view of the selected area (green line) with the mark of the natural coastline (red line) and the historical part (purple line)

Coastal flooding is considered one of the major threats for coastal urban areas. This is especially related to low-lying coastal areas such as City of Kaštela, where significant part of the city is located near the coastline. High population density in the coastal area of City of Kaštela, together with a large number of buildings and other assets makes this area highly vulnerable. Coastal flooding in the City of Kaštela is becoming more frequent and recent events caused damage to different assets, exposing the weak points within buildings and existing infrastructure.

2. DIRECTIVE 2007/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2007 on the assessment and management of flood risks (FLOODS DIRECTIVE)

2.1. General remarks

Within the European Union regulation, water management issues are regulated through Water Framework Directive [2], also referred as WFD, where it is stated that water is not a commercial product like any other but, rather a heritage, which must be protected, defended and treated as such. The purpose of the WFD is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which, among other issues, contributes to mitigating the effects of floods.

The European Parliament and the Council of the European Union established in 2007 the Directive on the assessment and management of flood risks [3], also referred as Floods Directive, where flooding is addressed as a particular issue within the water management framework. According to the Floods Directive, Floods represent natural phenomena, which cannot be prevented, while some human activities and climate change contribute to an increase in the likelihood and adverse impacts of flood events. In addition, *floods* are defined as temporary covering by water of land not normally covered by water, classifying different types of floods that can occur, such as river floods, flash floods, urban floods and floods from the sea in coastal areas. Floods have the potential to cause fatalities, displacement of people and damage to the environment, to severely compromise economic development, to undermine the economic activities, and it is feasible and desirable to reduce the risk of these consequences.

Flood risk is defined as the combination of the probability of a flood event and of the potential adverse consequences. Each Member State should determine the particular objectives considering management of flood risks. In order to have an effective tool for information considering flood risk management, each Member State needs to establish flood hazard maps and flood risk maps showing the potential adverse consequences associated with different flood scenarios. Furthermore, in order to avoid

and reduce the adverse impacts of floods it is appropriate develop flood risk management plans, taking into consideration the particular characteristics of the areas they cover and containing tailored solutions according to particular needs and priorities. Flood risk management plans should focus on prevention, protection and preparedness. The elements of flood risk management plans should be periodically reviewed and updated, taking into account the likely impacts of climate change in the occurrence of floods.

2.2. Responsibilities of EU Member States

For the implementation of Floods Directive, Member States may identify certain areas (coastal and/or river basins) different from those assigned by WFD, and they were obliged to undertake a preliminary flood risk assessment based on available data. This is performed in order to identify flood prone areas describing significant flood that have occurred in the past, to assess potential adverse consequences, and to identify the existing flood defence infrastructure. Based on the preliminary flood risk assessment, each Member State is obliged to define areas for which a significant flood risk exists.

Given the identified flood endangered areas, each Member State is obliged to prepare flood hazard and flood risk maps. Flood hazard maps should cover areas that could be flooded, and they are based on scenarios associated with the probability of occurrence:

- floods with a low probability, or extreme event scenarios;
- floods with a medium probability (likely return period ≥ 100 years);
- floods with a high probability, where appropriate.

For each developed scenario, a flood extent should be defined, as well as water depths/level and flow velocities where appropriate. Flood risk maps should be based on flood hazard maps, showing the potential adverse consequences associated with each flooding scenario, including among others, the

indicative number of inhabitants potentially affected and the type of economic activity of the area potentially affected.

Considering coastal flooding, Member States may decide that for coastal areas where an adequate level of protection is in place, the preparation of flood hazard maps shall be limited to the flooding scenario with a low probability or extreme events. Hence, it remains for each Member State to define its specific objectives considering coastal flooding, especially considering the definitions of flooding types and the assessment of existing flood protection infrastructure.

Based on the flood hazard and flood risk maps, Member States should establish flood risk management plans for identified endangered areas. These plans must contain objectives and measures in order to achieve reduction of potential adverse consequences of flooding for human health, environment, cultural heritage and economic activity. However, selection of flood risk management measures must include, among other criteria, cost-benefit aspects. Flood risk management plans shall address all aspects of flood risk management, focusing on prevention, protection, preparedness, including flood forecasts and early warning systems.

2.3. Challenges for implementation of Floods Directive on selected test site

Activity 3.2 of the PMO-GATE project is related to coastal flooding Kaštel Kambelovac associated with extreme sea surface waves. Floods Directive requirements are related, in the first part, to development of flood hazard maps. Although coastal flooding is mentioned in the Directive, it is not precisely defined how to assess this type of flooding. Furthermore, according to Floods Directive flood hazard maps should be based on scenarios associated with the probability of occurrence. For river flooding, this can be considered as a straightforward process, but for the coastal flooding the definition and development of these scenarios could be a complex task due to different natural elements, which in combination can cause flooding. The Floods Directive states that the preparation of flood hazard maps shall be limited to the flooding scenario with a low probability or extreme events for coastal areas where

an adequate level of protection is in place. However, the meaning of “*adequate level of protection*” is not defined or explained.

Flood hazard and flood risk mapping is not precisely defined; it is subject to individual approach rather than general concept. The spatial scale for flood hazard and flood risk demonstration can differ, in relation to, for instance, available digital terrain model or land use maps, reflecting to level of involvement and effort in developing these maps. The level of flood hazard and flood risk maps development can vary from qualitative to quantitative, depending on the purpose of the analysis. These maps can be used for emergency management, land use planning and decision-making or assessment of insurance eligibility. Still, this issue remains uncertain and it is indulged to Member States to decide.

Considering assessment of adverse consequences, Flood Directive does not define how to measure and evaluate adverse consequences on human health, environment, cultural heritage and economic activity. For example, each type of economic activity requires an individual approach in assessing flood risk. Cultural and historical objects are more sensitive to flooding in comparison to new buildings. This is because the tangible damage on historical objects can exceed the repair costs, and cultural heritage is often considered as irreplaceable.

Finally, the development of flood risk management plans considers development of different (structural and non-structural) mitigation measures. Although these measures are selected by flood risk management experts, their implementation depends mostly on the responsible authorities. During selection of mitigation measures, cost-benefit criterion often presents a key criterion for eventual implementation. However, selected mitigation measures need to fulfil the requirements considering sustainability and environmental impact assessment, despite their economic feasibility.

References

[1] Marasović K.; Kaštelanski zbornik, 7, 35-61, 2003.g.

[2] DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2000 establishing a framework for the Community action in the field of water policy

https://eur-lex.europa.eu/resource.html?uri=cellar:5c835afb-2ec6-4577-bdf8-756d3d694eeb.0004.02/DOC_1&format=PDF

[3] DIRECTIVE 2007/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 October 2007 on the assessment and management of flood risks

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0060&from=EN>