Mobile flood protection for the Danube in Lower Austria - a danger or a blessing?

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INTRODUCTION

Thanks to the technical development of more practical mobile flood protection systems, it became possible to set up flood protection facilities even in sensitive areas. But it's a fine line that runs between what is considered to be the reasonable operation of such systems (e.g. the height of the installations) and their optimum integration into the surrounding townscape and landscape.

THE SYSTEM

The „mobile flood protection" system consists essentially of the following parts:

- baffle wall / sealing of the substrate (sheet piling, Mixed in Place (MIP), thin diaphragm wall,...)
- foundation (cantilever retaining wall, sheet piling, bored piles, anchors,...)
- drains and pumping stations
- wall base
- mobile elements and storage hall

INTERNAL FRAMEWORK CONDITIONS

In 2014, the ÖWAV (Austrian Water and Waste Management Association) drew up a corresponding working guide / manual No. 42 on „Mobile flood protection" that presents the bases for the design assessment in detail. The protective facilities can be flooded if an overload situation occurs and still remain unscathed. The stability of these newly available systems at a given load or impact, must be demonstrated through tests and experiments.

The following load cases were investigated for the static dimensioning of the flood protection system in Melk (Lower Austria):

- load case 1 (operational): dammed fully built up wall (+ impact floating debris)
- load case 2 (overflowing): dammed fully built up wall (+ impact floating debris)
- load case 3 (wind): not dammed fully built up wall
- load case 4 (incident): dammed fully built up wall, elimination of a traction bolt.
- Distortion:
  - sagging of the dam beams 1/150 of the span (distance between struts).
  - head deformation support 1/150 of the strut height.

The typical construction height is roughly between 1.0 m and 3.0 m, whereby heights of up to 4.5m (flood peak) are possible with supporting struts at ground level. As design event runoff and water level at the relevant gauging stations (e.g. gauging station Kienstock is represenative for the Wachau area, see Fig. 1) were taken into account; these correspond to the current HQ/HW100 event.
The mobile flood protection system only works with large catchment areas (flood wave travel times of 24-48 hours at the Danube river allow the activation of the system in time) and with good forecasting systems. This system is built up gradually in various construction phases, which follow the rise of the flood wave, in accordance with the respective alarm and operating plans. These plans are approved by the competent authority (see Tab. 2 for construction phases).

THE OPERATIONAL SCENARIO - THE 100-YEAR FLOOD 06/2013

In the areas where the flood protection measures have already been implemented, they have proven themselves fully and in comparison with the flood of 2002, it was possible to prevent a substantial amount of damage (e.g. Ybbs flood).
Existing systems have served their purpose 100% (and in part with loads above the design event) and in the protected areas there was no damage to buildings, infrastructure facilities, and so on.
However, the event shows that with existing systems or even with systems yet to be built there is very little space for improvement or optimisation, from both a structural and an organisational perspective.

The main findings of the flood are shown in Tab. 1. After the flood, all parties involved (emergency services, public authorities, administrations, politicians and those affected) held intensive talks, where they discussed all the experiences gained; in this way they successfully focused on developing specific potential to optimise the systems and/or found solutions to the problems with a broad consensus.

Most of these findings and potentials for optimising the design were already implemented straight after the flood, so that all the hitherto operational systems are 100% ready again.

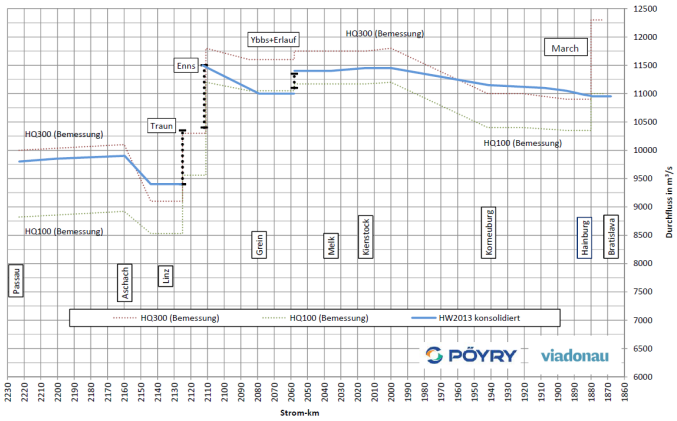

Figure 1. Hydrological longitudinal section of the Danube during the flood in June 2013

Table 1. Findings after the flood of 2013

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Warning times are sufficient, the construction could be completed without problems	Alarm and operating plans were only partially experienced (evacuations)
Forecasting systems provided plausible data	Vegetation in the area around the system at risk of breaking (damaged trees)
The mobile system worked perfectly, sometimes there were currents in the underground	Storage of objects at risk of floating in the flood discharge area
The dismantling and cleaning of the mobile elements was promptly completed through the coordinated actions of the task forces (ÖBH and FF), in the meantime, a dam beam cleaning system was developed with the HTL Hollabrunn.	Accessibility of the polder

Table 2. Construction phases (dependent on water level) of flood protection measures in Weißenkirchen

Construction phase	Construction [m]	Protection height [m]	Annuality
	(Level at Kienstock)	(Level at Kienstock)	
5	9,86	11,04	100
4	9,06	10,54	50
3	8,56	10,04	30
2	8,06	9,54	20
1	6,76	9,04	15

KEYWORDS

flood protection; Danube; Lower Austria; System; Internal framework conditions

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