



WATER

Flood protection for the City of Regensburg – a challenge for hydraulic engineers and architects

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Background of Regensburg's efforts in flood protection

Regensburg is a riverside city. The area map reveals that large parts of the town are surrounded by the rivers Danube and Regen. At the nearby gauging station of Schwabelweis (Fig. 1), the catchment area of the Danube features almost 36,000 km². Because to this, large river basin flood retention upstream of the city is very limited and not feasible for catastrophic floods with a recurrence interval of 50 to 100 years. Therefore the protection of the city is only possible by using levees, walls and, on a small scale, by mobile protection systems. However, permanent structures always interfere with the cityscape near the rivers, which in Regensburg developed uniquely over centuries.

Ambitions for flood protection in Regensburg reach back to 1954. In this year the municipality applied for

suitable measures with the Bavarian government. In 1983 the financial and legal prerequisites for planning were fulfilled but after a fierce public discussion and increasing local resistance, the city council decided to cancel the approval of the plans in 1987. This was accepted by the Bavarian government. The local protests culminated in the slogan "Wir wollen nicht 1000 Jahre eingemauert sein, nur um einmal nicht nass zu werden!" ... we do not want to be walled in for a thousand years just to avoid getting wet once!

After several flood events afterwards (see Fig. 2), the municipality requested that the government reopen the flood protection planning. On the basis of the lessons learned by the former failures, the Bavarian government, together with the City of Regensburg, decided to involve the citizens intensively in the ongoing plannings (Fig. 3). Only in this way it



Fig. 1: City of Regensburg in between the Rivers Danube and Regen



Fig. 2: The City of Regensburg during Flood Event in August 2002

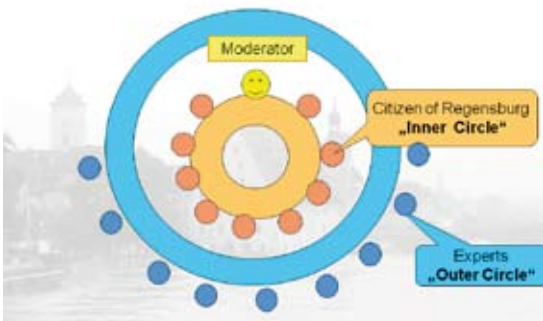


Fig. 3: Process of "Open Planning" for Flood Protection with Citizen and Experts in Regensburg

possible to communicate the complexity of the problems to the citizens and to call attention to the potential hazards of floods. It was important to convince the affected people of the necessity of the intended activities.

Objective

The current flood protection goal in Regensburg is to protect the city against a 100-year-flood using all available technical possibilities like levees, walls and mobile elements. For these purposes, the whole city area with the two rivers Danube and Regen was investigated and divided into several planning sections.

Problem

The high discharges in the City of Regensburg result from the large river basin of the Danube, which is some 36.000 km². The rivers Altmühl, Naab and Regen flow into the Danube from the low mountain range in the north, the rivers Iller and Lech coming from the Alps in the south. Storage reservoirs can be very effective methods for controlling floods in the upper reaches of rivers. In the middle reaches (where Regensburg is situated) however, retention areas along the rivers have been reduced due to the interference of human activities like infrastructure, settlements and industry. Therefore retention of huge discharges resulting from extreme rains in combination with snow melting is currently extremely limited. The only alternative for the City of Regensburg is local flood protection realized by implementing actions directly in the city area. Regarding mobile flood protection schemes, there is always the problem of inaccurate high water prediction. In the past five years, at the Schwabelweis gauging station the relative failure for a 24-hour-prediction was $\pm 15\%$. Considering this possible error, an expected 100-year-flood HQ 100 could easily lead to discharges between HQ 50 to HQ 500. If one overestimates an approaching high water, the mobile elements would be installed for no purpose. On the other hand, an underestimation of

the expected water level can have catastrophic consequences. Therefore a basic protection level of about HQ 20 would help to avoid misapplication of mobile elements. The relative prognosis failure for 12 hours in the recent years varied only from - 9 % to + 4 %. Consequently the focus on flood protection has to be on walls and levees as mobile elements can only be applied in a very limited scale. But walls and levees are often greeted with a square refusal by public opinion. Twenty years ago, the planned activities could not be realized because of public pressure concerning the high sensitivity of the historic old town and the islands of Oberer Wöhrd, Stadtamhof and Unterer Wöhrd. From the beginning, the discussions with the locals revealed a strong wish to protect the highly appreciated architecture and the unique view of the old town. So the only accepted flood protection was by means of mobile elements. Meanwhile, during the noted process of open discussion, the acceptance of the idea that mobile elements are the only suitable method for a few highly sensitive spots has developed.

Planning competition regarding urban, landscape and technical aspects

Searching for an optimized flood protection concept for the City of Regensburg, a Europe-wide competition was initiated by the municipality and the Bavarian government. The purpose was to find solutions for a kind of flood protection that meet all the needs coming from water management and hydraulic engineering, from urban design and preserving and from nature conservation.

Consideration of the special appearance of the historic townscape of Regensburg was given priority. The competition was open for European consortiums and working groups with special knowledge in hydraulic engineering in cooperation with architects and landscape architects.

Such an interdisciplinary collaboration was necessary to optimize a harmonic coexistence of the mobile and stationary flood protection structures together with the sensitive riverside architecture. The results of the discussions held in various round tables had to be implemented into the catalogue of requirements the applying consortiums had to fulfil.

During the Europe-wide competition up to March 2003 more than 150 tender documents were requested and by August 2003, in a first stage, the proposals from 42 planning teams were presented to a team of jurors. Out of these 42 presentations 15

proposals were selected to be reviewed in detail. For this reviewing process the jury gave some recommendations to the engineers and architects. During a two-days meeting of the jury in May 2004 the final prize winners and acquisitions were announced.

Outcome of the planning competition

The final evaluation of the 15 proposals in the second phase led to a classification in three price categories:

1) First price category: Two proposals with a reward of 35,000 € each

Team 1:

Engineers

Ingenieurbüro Goldbrunner + Grad,
Gaimersheim
Ingenieurbüro Spotka und Partner,
Postbauer-Heng
Geooffice Herrle, Ingolstadt

Architects

Studio di Architettura
Prof. Dipl. Ing. Vittoria Magnago
Lampugnani, Mailand

Landscape Architects

Werksgemeinschaft Freiraum
Landschaftsarchitekten Nürnberg
Prof. Gerd Aufmolk gemeinsam mit
Büro Weinzierl Landschaftsarchitekten,
Ingolstadt

Team 2:

Engineer

Prof. Ludwig Obermeyer, Potsdam

Architects

Dipl. Ing. Peter Robl,
Berlin/Regensburg

Landscape Architect

Dipl. Ing. Rose Fisch, Potsdam

2) Second price category: Two proposals with a reward of 21,000 € each

3) Third price category: Six acquisitions of 10,000 € each

The winning proposals were presented in a public exhibition and also published for distribution in a flyer. With the help of the selection procedure many

ideas were collected to solve the problems of an appropriate realization of the flood protection in Regensburg. Also highly qualified expert groups for the forthcoming planning could be found during the evaluation process. The competition did not result in one singular glorious winner and none of the presented proposals will be realized in their original layout. However all the ideas of the winning groups will lead to a concept, which can be improved step by step in the ongoing planning. For an example figures 4 and 5 show the presented proposals in one

of the most sensitive sections like "Weinlände" and "Wertstraße" (plan view see Fig. 1). Avoiding a permanent change of the preserved appearance of downtown Regensburg limited heightening of ground level, walls and mobile protections structures have been proposed. The proposed design for Weinlände was not recommended by the jury because the mobile elements are too high for installation. At Wertstraße mobile elements were the only solution fulfilling the boundary condition of not touching the discharge area during floods.

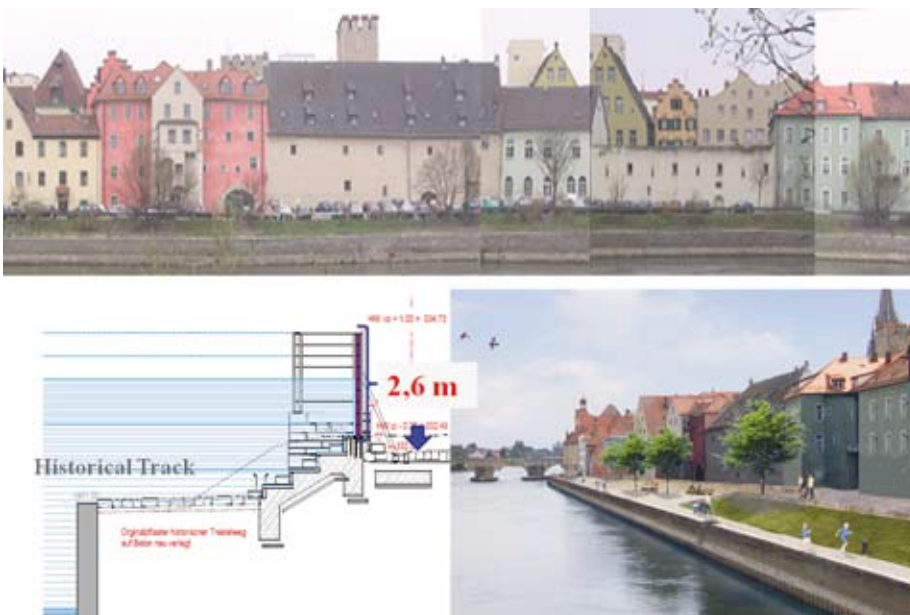


Fig. 4: Result of Competition for Section "Weinlände" (not recommended by the jury)

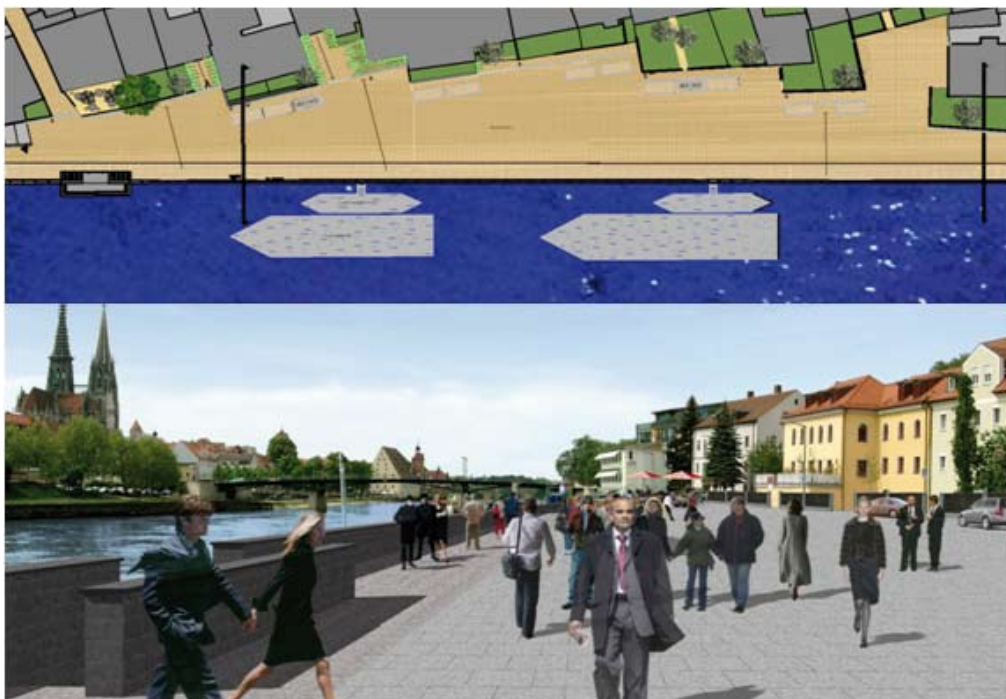


Fig. 5: Result of Competition for Section "Wertstraße" (recommended by the Jury)

Fig. 6 depicted the protection structure of a non sensitive area in "Schwabelweis" - where only permanent structures like levees will serve as protection from floods.

Findings and Conclusions

Reviewing the process of the competition the criticism might be made that 42 planning groups had to invest large efforts and an immense amount of work to qualify for the competition. And in return for all this work they did not get a financial reimbursement. In the sense of an economically optimized investment of capacities, it may have been more effective to invite only some working groups at the end of a limited process.

Flood protection means, first of all, activities related to hydraulic engineering. Of course, urban planning aspects have to be included to get public acceptance. Drainage, which works towards keeping the ground water level inside the protected area will also be a major part of the final design. As this part depends on the boundary conditions of geology and foundations of the houses there should have been more required documentation towards this end. So the competition priority shifted strongly into urban and landscape aspects. Therefore, during the planning phase, some expectations emerged, which from hydraulic engineering and also financial point of view most probably will not be realized.

Present stage of the proceedings

According the measures for an appropriate flood protection in the City of Regensburg, the following state of realization is reached:

- **Section S/IRL:**
The requirements of water law are approved. Currently the tender documents are being prepared; in Sept/Oct 2008 work shall start.
- **Section A/SCHWABELWEIS:**
The documents for the official approval of plans are being completed. The application for the proceedings will be made in autumn 2008.
- **Section D/REINHAUSEN and Q/WESTHAFEN:**
According to a decision of the municipality of Regensburg, on the basis of a governmental priority list, the next step is to apply for specific plannings at the Bavarian Ministry of Environment.



Fig. 6: Result of Competition in Section "Schwabelweis"

Literature

- Hochwasserschutz Regensburg – Ergebnisse der Optimierungsphase
Stadt Regensburg und Wasserwirtschaftsamt Regensburg
- Infoblatt 1 bis 4 zum Hochwasserschutz Regensburg
Stadt Regensburg und Wasserwirtschaftsamt Regensburg
- Lecture on "Hochwasserschutz Regensburg – Vom Bürgerwunsch zur Umsetzungsphase"
held by Ltd. BD Günther Schobert und MR Erich Eichenseer at the Technische Universität München (18. January 2006)

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ZUSAMMENFASSUNG

Theodor Strobl und Franz Zunic gehen in ihrem Vortrag auf die Hochwassersituation in Regensburg ein. Dabei beleuchten sie aus technischer Sicht die notwendigen Sicherungsmaßnahmen, die im Kampf gegen Überflutungsschäden erforderlich sind. Die Vergangenheit machte deutlich, dass jedes Vorgehen auch der Akzeptanz der Bevölkerung bedarf, um langwierige politische Auseinandersetzungen zu vermeiden. Aufgrund der spezifischen Situation in Regensburg und Umgebung kommen nur direkte Schutzmaßnahmen im Stadtkern zum Tragen. Dabei hat jede ihre eigenen Schwächen: Mobile Wälle bedürften genauer Flutvorhersagen, diese sind jedoch nicht immer zuverlässig.

Feste Schutzdämme werden hingegen von der Bevölkerung abgelehnt. Ein europaweit ausgeschriebener Wettbewerb sollte deshalb die unterschiedlichen Interessen von Denkmalschutz, Stadtbild, Wassermanagement und -bau berücksichtigen. Im Zuge dessen konnten auch neben den Gewinnerentwürfen viele nützliche Ideen und Vorschläge gesammelt werden, um dem Hochwasserproblem in Regensburg beizukommen.

Aufgrund vieler komplexer Faktoren, können aber nicht alle Erwartungen erfüllt werden.

*Hochwasser – Donau – Regensburg –
Widerstand und Einbindung der Bevölkerung
– Wettbewerb – Vorstellung der Ergebnisse –
Weinlande – Werftstraße – Schwabelweis*