



Conceptual Design in the Education of Civil Engineers

Thomas VOGEL

Professor
ETH Zurich
Zurich, Switzerland
vogel@ibk.baug.ethz.ch

Thomas Vogel, born 1955, is professor of Structural Engineering at ETH Zurich. One of his main research interests is the conservation of structures.



Heinrich FIGI

Civil Engineer
Canton of Graubünden.
Chur, Switzerland
Heinrich.Figi@tba.gr.ch

Heinrich Figi, born 1949 is Chief Structural Engineer of the Cantonal Highway Administration, Chur, Switzerland.



Summary

Since 2001 ETH Zurich provides a course in the civil engineering curriculum called "Conceptual Design". Initially it was situated in the 5th semester and recommended for students following the structural engineering track only. Since 2006 the course is situated at the beginning of the masters course and compulsory for all students regardless their preferred majors.

One aim of this course is to enhance the competence of civil engineers in a field that can neither be coped with deductive nor inductive reasoning, but where intuition and innovation are major issues. Even if engineers will not achieve the same level in this field as architects, for whom design is a core competence, they should at least get an insight in possible procedures of conceptual design. Together with traditional lectures and different project works, civil engineers on the master level should become equivalent partners of architects and for infrastructure project even take the lead in the design process.

The authors have been responsible for the course "Conceptual Design" since 2002 and 2003, respectively, and want to share their experience with other technical universities with similar goals.

The paper explains the development and concept of the course, describes the assigned design tasks and experiences with different types and sizes of structures to be designed and shows typical results.

Initiatives of this kind could increase the reputation of civil engineers, not only being number crunchers but also creators of intellectual property and formers of our built environment.

Keywords: Conceptual design, design task, master curriculum.

1. Introduction

2. Curricula in Civil Engineering at ETH Zurich

3. Concept of the present course

Conceptual design is the integrative course at the beginning of the master program in civil engineering at ETH Zurich. The goal is to consolidate the knowledge from the bachelor courses, to mingle own former bachelor students with those coming from other universities and to prepare all of them for project works in the six majors.

The methodological core of conceptual design is a holistic approach, containing parallel and iterative work on different levels of detailing, and the integration of different domains of knowledge and experience. The procedure differs from both, deductive and inductive reasoning. By concentrating on active work of the students rather than passive listening to lectures, basic tools of civil engineers can be experienced in practice.

The design tasks are handled by groups of four students that were arranged by the organizers considering specialization, origin, mother tongue and gender.

4. Assigned design tasks

The accomplishment in autumn 2007 dealt with the by-pass road for the village of Küblis in the canton of Grisons (Graubünden), a project from the area of responsibility of the second author. For the students, the task was concentrated on the western part containing a tunnel entrance, the undercrossing of an existing railway line and a ventilation plant.

5. Experiences with different types and sizes of structures

6. Typical results

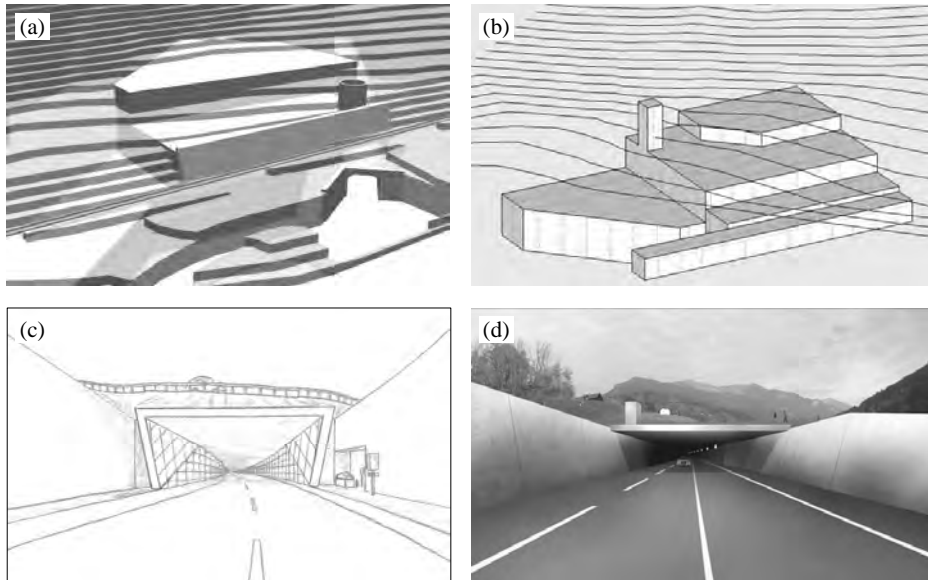


Fig. 5: Results from autumn 2007; the students redesigned the ventilation plant in order to align it with the railway and adjacent buildings (a) or even to let it disappear completely (b); the respective tympanum is shown in a driver's view ((c) and (d))

7. Feedback

8. Outlook

9. Conclusions

Conceptual design is suitable to be taught within a civil engineering curriculum. The subject is convenient for interdisciplinary work among the different tracks of civil engineering and beyond and can serve as a tool to integrate students coming from other universities.

Preconditions that civil engineering students can be inspired for the issues of conceptual design are:

- The goals have to be clearly communicated (The journey is the reward).
- The assigned tasks have to be adjusted to the level the students have achieved.
- The lecturers should have own respective experience, suitable to be shared with the students.

In the public cognition civil engineers do not anymore stand for innovative structures and future-oriented public works but concreting the landscape and increasing the production of emissions. By regaining more competence in conceptual design, civil engineers could increase their reputation.