

THE SPECIALITIES OF TEACHING BUILDING CONSTRUCTIONS AT THE FACULTY OF CIVIL ENGINEERING

Ilona H. BARÁTI

Department of Building Construction
Budapest University of Technology and Economics
H–1521 Budapest, POB. 91. Hungary

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Abstract

Building Constructions is a compulsory subject for students of civil engineering. In the framework of that subject the instructors of the Department mainly teach design of surface civil engineering structures and building constructions. The subject is of great importance as it is related to several other fields of science and by utilising the achievements of those it acquaints students with numerous tasks of engineering and architecture. It is also in the course of the subject named Building Constructions that our students learn about the methods of architectural representation. The studying of new technologies and methods of construction, on the other hand, calls attention to the close connection between theory and practice of building and the need for the connection.

Keywords: objectives of training, fields of science, architectural representation, learning by doing, two-stage training.

It is exactly in these days that the Budapest University of Technology and Economics becomes 220 years old if we take into consideration the operation of the legal predecessor as well. The Faculty of Civil Engineering was one of the founding faculties and at present around 250 graduates receive their degrees here each year.

The duty of the faculty is to train civil engineers who are able after a certain period of practice ‘to perform independently the tasks of design, construction, operation, maintenance, technical development, research and direction of engineering establishments in the fields of settlement development and environment protection; to design, construct and maintain civil engineering establishments on the surface and underground, building constructions and all kinds of loadbearing structures, to carry out design, construction and operation of roads, railways and other courses of transport as well as the establishments directly serving them, and also to perform the tasks related to the design of settlements, the technology and direction of traffic and urban (civil) engineering; to perform the tasks of design, construction and maintenance related to hydraulic engineering, water management, public utilities and environment protection’ [1].

Thus young experts may be faced by an extraordinarily wide scale of tasks already at their very first place of work. That is what the system of training has to take into consideration and prepare the students for.

1. The Place of the Subject Named Building Constructions in the System of Training

The training has been subjected to some significant changes in the recent years, notably the introduction of the credit system, which enables the participants to select their subjects for themselves and to progress in their studies at the speed most suited to them. Thus it is practically up to the students how much time graduation takes.

Due to the development of science, technology and the building industry new subject matters and new subjects have been introduced in the training.

Our department, the Department of Building Constructions, is mainly involved in the instruction of the design of civil engineering establishments on the surface as well as of building constructions and, of course, the knowledge of implementation indispensable to design.

At present the subject named Building Constructions is taught in a fewer number of lessons than in previous decades due to the time devoted to the several recently introduced optional 'short course' subjects. The students of the faculty study Building Constructions for one or two semesters according to their respective curricula, but this subject is one of the compulsory subjects in all three branches of the Civil Engineer 2000 training: the Branch of Structural Engineering, the Branch of Infrastructure and Environmental Engineering, and the Branch of Geodesy and Space Informatics.

Since the time devoted to this subject is rather limited, it only provides an opportunity for discussing the most important structures and the basic principles. The continuous growing of the set of materials, processes and technologies worthy of discussion means a constant problem for the instructors. They are faced with the difficulty to choose between important and even more important subject matters.

In addition to the obligatory semesters students have the opportunity of studying Building Constructions for two further semesters in the course of optional subjects. Those interested in the topic may devote more time to such matters and thus the latest and most modern structures and technologies also become part of the curriculum.

The instruction of the designing subjects is only possible after acquainting students with building constructions. The students trained at the faculty are only allowed to sign up for the subjects named the Designing of Residential Buildings, the Designing of Civil Engineering Structures, the Designing of Industrial and Agricultural Buildings and the Designing of Public Institutions after passing the examination of the subject named Building Constructions.

2. The Relation of Building Constructions to Other Fields of Science

Professor Gábor László wrote in the foreword of the first volume of his four-volume work titled Building Constructions (Épületszerkezettan): 'The task of Building

Constructions is the instruction of all the structures of buildings, the development of the skills of designing and construction, the transmission of the necessary expertise, the body of professional knowledge, and the education of the specialist' [2].

Professor Bálint Petró described the subject matter of building constructions and its relation to other fields of science in 1991 in the following terms: 'Building Constructions actively synthesizes the subject matters of other fields of science (mechanics, building physics, aero- and hydrodynamics, building chemistry, building biology, computer technology, materials science, etc.) and thus its relation to them is organic and continuous and it utilises the scientific achievements of those fields for a certain purpose' [3].

The instruction of Building Constructions, understanding and teaching of structures as well as their correct application require the knowledge of the basic principles of more than one field of science. The two prerequisites of the subject of Building Constructions at the faculty are the subjects named Descriptive Geometry and Building Materials. These subjects themselves are based on the knowledge of various fields of science as several important questions of mathematics, chemistry, physics, material technology and building science have already been answered. That, however, is not enough and that is why further fields of science are integrated in the subject of Building Constructions. One of the related fields of science is ecology, which is playing an increasingly important role these days. Another new field is energetics, or rather one of its branches closely connected to the design of buildings, which aims at the utilisation of natural sources of energy through the development and application of architectural means, the methods of building construction and the appliances of sanitary engineering. It is mainly the students more interested in this subject who study energy-conscious and ecological methods of building. A number of exceptionally successful TDK (Scientific Conference of Students) papers have been submitted in these topics at our department in the recent years.

3. Building Constructions and Architectural Representation

We depict our buildings and structures in our designs and by this representation we lay down our concepts and make it understandable for others what the dimensions, the materials and the environment of the future establishment are going to be.

In practice, almost all tasks are solved in team-work. As a consequence of the complexity of tasks, usually people of different qualifications and expertise work closely together, mutually depending on each other. There is a need for a 'common language' that enables the communication of the members and serves as a channel for the clear transmission of information related to the task. The 'common language' is the pictorial representation, a certain manner of communication. It is just in the course of the subject of Building Constructions that many of the students encounter architectural representation for the first time.

In the course of their study of Building Constructions students must be ac-

quainted with the formal requirements, techniques of drawing, pictorial signs and methods of representation used in the practice of civil engineering. The reading and the preparation of designs is a basic skill to be acquired by all students. It is a relatively simple task to define the content requirements and to exercise the application of architectural representation as it is based on standards and accepted principles. The appearance of the architectural design, however, is also influenced by the manual skills of the designer. Unfortunately, the time-frame is not sufficient for shaping and development of these skills, even though the pencil design drawn by a skilled and accurate hand, which is also technically correct, not only reflects the creative imagination and talent of the designer but also inspires it.

Our department has been striving for long to establish the framework within which students may be taught the rules of technical architectural representation in the course of time necessary for the development of the skills mentioned above. As a result of these efforts the subject named Basic Elements of Technical Architectural Representation has been available as an optional subject in the curriculum since September of 2001.

4. The Relationship of Theoretical and Practical Knowledge

The construction of buildings and structures involves application of methods that evolved in the past centuries as well as processes based on the most recent achievements of research. The transmission of information in the form of texts is not sufficient to ensure profound knowledge. The more of our sense organs participate in the reception of information the more efficient is the learning process.

A number of lectures delivered in the 'Theory, models, practice' section of the 2001 symposium of the International Association of Engineer-Teachers dealt with the practical background of training. Professor Dr. Bernhard Bonz gave a summary under the title 'Engineer-teaching, methodology and the design of the curriculum' [4]. Among others he stated that: 'Our culture of learning must be renewed. The traditional methods are insufficient to achieve that. Engineer-teachers also have to apply the modern, practice-oriented methods on a wider scale in order to meet the present and the future requirements of both the objectives and the contents of technical education.'

Thomas Herzog, one of the most distinguished architects of our times, voiced similar thoughts in an interview concerning the lack of practical knowledge [5]: 'Learning by doing has always been very important for us. Such experience is indispensable for architects. Academic learning does not provide that and in this sense its deficiency is immense. If hands do not know anything, mental work is of little use. Those experts will be successful in my profession, which is in fast motion at present, who possess the right balance between head and hand.' To enable the studying and, of course, the instruction of the real behaviour of building structures, Thomas Herzog has built a multi-storey workshop for experiments at the Technical University of München. In the course of the interview mentioned

above, he talked about the relationship between handicraft and the fields of engineering science: 'There are the participants of creating the design and their number is increasing day by day. If we prepare a great design today our ten fingers are not enough to count the various professionals. But where is the BAUMEISTER?' The BAUMEISTER, the 'MASTER' would be the expert possessing the most information about the construction, the most practical knowledge, and his/her attention to all aspects of building has direct influence on the establishment already in the first stages of designing. The instruction of Building Constructions and a practical training harmoniously adapted to it are very important elements in the training of professionals capable of finding their way in the network of relationships and connections. Therefore, what we need is to make the integrated training one of the basic elements of the reform expected to take place in higher education in the near future.

5. The Future of Engineer-Training

At the moment higher education is expecting a reform since Hungary signed the Bologna Declaration [6] in 1999, which will lead to changes in university education as well. The Bologna Declaration states that the signing countries will actively participate in the creation of a universal European system of higher education and they will modify their policies of higher education already in the first decade of the third millennium. One of the results of the modification will be the introduction of the two-stage training period: the system based on the undergraduate and the graduate training. Entering the second stage requires the successful completion of the first stage that lasts at least three years. The degree acquired after the first stage is also accepted as the equivalent qualification (B. Sc.) at the European labour-market and it entitles the recipient to hold a position. The need for the two-stage training also urges changes in the curriculum. The quantity of general theoretical information will be reduced in the first six semesters and more emphasis will be laid on the professional subjects.

Building Constructions has a double importance: both as a theory, and as a practice utilising scientific achievements and experience. It has to be granted a place in the new system of subjects in both stages of training. In the first stage the practical and pragmatic parts of knowledge have to be taught as the first six semesters must be used to train experts able to find their way in practice easily. The second stage may be devoted to instructing students about theory, development, analysis of building structures, the recent findings and the background of research.

Building Constructions is not merely a subject for students of civil engineering. It is not a single subject as it synthesises the subject matter of other fields as well, and it is not a subject in the narrow sense of the word. Professor Dietrich Neumann defined the significance of this subject in the following terms [7]: 'Building Constructions encompasses the most important fields of construction, it takes into consideration the various principles of the construction of structures, the fin-

ish and to some extent the sanitary engineering instalments of buildings. At the same time it calls attention to the constantly developing and expanding experience of construction. Building Constructions also has to make clear that the creation of each establishment is strongly determined by the static conditions, the building physical effects, the characteristics of the materials, the costs of construction, the organisation of the building process and the official regulations and standards.’ Consequently, the studying of building structures provides an opportunity for the discovery of our exceptionally complex profession, an opportunity our students merely have to grasp.

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