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TRAINING FOR THE ARCHITECTURE STUDENTS IN SURVEYING AT THE TECHNICAL UNIVERSITY OF BUDAPEST

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Abstract

The first part of the presentation introduces briefly the history of teaching architects in Hungary. It discusses the number of lectures in a few subjects or subject groups and the rating of the contact hours within the training programme. Describes how the number of contact hours in the teaching of surveying changed in the past few decades. The second part of the study introduces the objectives of the present teaching programme in surveying, introduces the subjects which are partly obligatory, partly electives, the course content of the subjects taught, the forms of teaching and the assessments.

Keywords: history of training of the architects; teaching surveying for architects.

In the university, established in the Hungarian city Nagyszombat (today Trnava, Slovakia) in 1635, geometry, trigonometry and architecture have been delivered in mathematics since 1753. In 1767, the rector of the university of that time proposed to establish new and self-supporting departments for geometry, architecture and freehand drawing within the institution [1].

Architecture was taught at Szenc (today Senec, Slovakia) near Pozsony [1]. In the institution of Collegium Oeconomicum, besides teaching economy, bookkeeping, surveying and cartography, geometry and mechanics, great value was attached to teaching civil architecture, too [2]. Teaching architecture for the army was organised in Vienna at that time.

The institution was moved to Tata in 1776, where it could not become rooted and therefore came to an end. However, the need for engineers did not stop, so the Council of the Buda University of Science proposed in 1780, that an engineering course should be started within the Buda University [2].

Several memoranda and royal decrees were made until Emperor Joseph II published rules and regulations for the institution of engineers Institutum Geometrico-Hydrotechnicum on the 19th September 1782 [2]. This institution is considered the predecessor of the Technical University of Budapest. It should be noted that in this respect Hungary had been ahead of the world, because training of engineers has been done in college since 1782; in France the École Politechnique was established in 1794 [3].

Joseph II's aim was to educate engineers trained in the institutum, who would regulate rivers; build canals, dams and mills; drain swamps, design roads and

bridges; erect buildings and were skilled not only in land surveying but in other mathematical sciences, too [1].

The importance of the particular subject in education was shown through the number of contact hours in the curriculum. It is useful to recall subject and the related contact hours taught in the Institutum in 1843. The 25 weekly hours were distributed in the following way 8 hours for land and hydrographic surveying, 5 hours for agriculture, 2 hours for architecture, 4 hours for astronomy, 1 hour for mechanics. The training program was running in two years. To obtain a degree, four final examinations had to be passed, namely in trigonometry and land surveying; hydraulics and hydrotechnics, mechanics and economy [1].

Since 1830, many people have criticised the training programme. Criticism was directed mainly at the backwardness of architecture and mechanical engineering training [4]. Lastly, a proposal was made for the reorganisation of the institution in 1846. The proposal recommended involvement of building materials, building management, building technology and building drawing. According to the draft proposal, at the end of the three year training, students had to pass four final examinations in surveying; architecture; mechanics and machine design; water, road and bridge construction [5]. Ultimately, the programme failed.

It is obvious that in the training programme emphasis was put on civil engineering courses rather then on architecture. Candidates learned architecture in minor subjects and also during major engineering courses. Those who were awarded with a diploma of the Institutum, gained a broad and deep knowledge in surveying according to the level of the age. The ratio of time spent on each subject did not vary until training in architecture became independent, reflecting changes in the direction of study.

The Institutum Geometricum, and Joseph Vocational School – which opened its gates in 1846, – jointly developed the Joseph Polytechnicum in 1856, where the duration of the training programme was five years. The heading of the curriculum, published in the 1861–62 academic years, bore the name of the Royal Joseph University, although in the years after the lost independence war, the languages of science were German and Latin [6]. In this university, civil engineering, mechanical engineering and chemical engineering training programmes have been separated. Since 1863, the civil engineering syllabus has been published separately, and there is a broad field for teaching architecture courses. Architecture training on the university level commenced in the 1870–71 academic year. In this year, the university introduced an independent architecture course within the engineering department [2].

The complete separation of architecture from civil engineering did not occur for a long time and joint operation of the two departments became traditional. The effect of this joint operation is still existing today. The civil and other engineering courses were well represented in the syllabus, parallel to the architecture subjects. According to the curricula of the late XIX's, in the third year, 22 contact hours were allocated to engineering subjects out of 42, and in the fourth year, 14 hours were devoted for planning, 5 hours for engineering courses, 16 hours for history of architecture and drawing, and 5 hours for other supplementary subjects [2].

During WW II. era (1941–46), the core subjects represented 13% in the curriculum, the architecture subjects (history of architecture, design, design and structure, town planning, etc.) 57%, the engineering subjects (strength of materials, steel and concrete structures, surveying, geology, etc.) 15% and other subjects (modelling, drawing, horticulture, economy etc.) 15% out of 100% of the total in the curriculum of the Faculty of Architecture. Surveying as part of the engineering curriculum was taught in the sixth semester 4 hours a week (2 hours lecture, 2 hours practice) [7]. It should be noted that the percentage ratio between subject groups in the total number of contact hours is almost the same according to the valid curriculum today.

After the war, weekly hours of some engineering subjects decreased further. This did not mean that the importance of the engineering subjects was undervalued, but it was the consequence of increasing knowledge in architecture. At that time, surveying was taught 2 hours per week. These two hours were completely used for lectures. Surveying was taught in the second semester of the sophomore year [8].

In those years, names of the institutions for higher education in architecture have changed quite often. Before WW II. the name of the institution was 'Magyar Királyi József Nádor Műszaki és Gazdaságtudományi Egyetem' (Hungarian Royal Joseph Palatine Technical and Economics University), then it was changed to 'Budapesti Műszaki Egyetem' (Technical University of Budapest). In 1952, 'Építőipari Egyetem' (University of Building Construction) was organised by separating faculties, and then in 1955, Építőipari és Közlekedési Műszaki Egyetem (University of Building Construction and Transportation) was established by adding a new faculty to the existing ones. This university was unified in 1967 under the name of the 'Budapesti Műszaki Egyetem' (Technical University of Budapest). During that period of frequent changes, the training programme for the architecture students was organised in the same campus.

The Faculty of Architecture introduced a new syllabus in 1963, which placed surveying to the 9th semester of the ten semester-long programme and provided 1 hour for lectures and 1 hour for practice each week [9]. The placement of the subject within the syllabus, the number of weekly contact hours and the balance between lectures and practicals have been unchanged.

In contrast the knowledge which is provided to the architecture students in surveying has been significantly changed during the past years. The content of the subject is basically determined by the fact that the course is being taught by the same department (Department of Surveying of the Faculty of Civil Engineering) which teaches civil engineers and, from 1959, surveyors. Consequently, the course content for architecture students is the condensed version of the course provided to civil engineering students, simply because of the limited number of classes, rather than a specified selection of knowledge which might be more useful for the architecture profession and be more practical oriented. The total number of contact hours in the basic principles of surveying according to the present curriculum is 10 hours for surveying students, 8 hours for civil engineering students and 2 hours for architects. Since professionals of the latter two categories might be using surveying skills to the

same extent, the difference between the contact hours provided for civil engineers and architects seems quite big.

In spite of the very limited number of contact hours available for architects, significant changes have been introduced to the course content in 1982–83 academic year. Simultaneously, attempts were made to formulate the objectives of the course again. These can be summarised as follows:

- to provide an overall view about surveying as an observation technology which helps professionals working in the building industry to recognise the problems in which surveying can assist in solving them;
- to introduce some basic surveying instruments and methods to the architects at a high level, enabling them to employ those equipments and techniques in their practice;
- to enable the candidates to formulate problems which cannot be solved by themselves to surveyors or other specialists [10].

Considering these points, the theoretical background has been left intact, error theory is discussed tangentially and the principles of observation methodology and construction and operation of surveying instruments are covered as necessary. But there is not a word about such chapters as area and volume calculation or dividing areas. Building topics photogrammetry and the latest developments in the surveying measuring techniques cannot be mentioned either. In contrary, some basic observation technology is being discussed in more detail than was done earlier. The same is true for the contacts between surveying and architecture.

Surveying of lectures is covering the following topics:

The first lecture covers the defining of the objective of surveying and its application in building industry. In addition, the lecture discusses the various co-ordinate systems, projection systems, horizontal and vertical control networks marking, and protection of the survey marks.

The second lecture introduces some practical methods of surveying small areas. Besides showing the fundamentals of the procedures, the instrument usage and the practical execution of the measurements is also discussed, together with data logging.

One lecture is devoted to discuss measuring the high difference. Levelling, trigonometrical heighting and hydrostatic levelling are mentioned.

In the lecture about optical tachometry, stadio tachometry is introduced for the theodolite and simple levelling instruments available for the architects can be used for that purpose. Further to the self-reducing tacheometers (e.g. diagram tacheometer), electronic tacheometers are also mentioned. Execution of tacheometry is covered in detail.

Related to mapping, various kinds of maps of different scale, methods of mapping and contouring, references, technology of mapping and changes of paper and plastic sheets in dimension are discussed.

Great emphasis is put on the presentation of the principles and methodology of horizontal setting out. At this stage, the sources of error of the procedures linked to

the measuring processes are introduced. This lecture is completed with a discussion of the vertical setting out.

The last lecture covers topics that may be useful in building construction. Information is given about access to surveying data, where the architect can get helpful facts, and how data which were obtained from land registration can data be used.

The field practice takes place in the university campus site, using student teams of are 8–12 students.

In the first practical session, the students familiarised with the construction of the theodolite, later they can get knowledge about setting up the instrument, pointing and reading off on the second practical. On the next occasion, vertical measurement of building is introduced. In the fourth practical session, the students observe a level line, then they do tacheometry in the following practice. The programme includes the elementary measuring processes of the horizontal and vertical setting out. The last practical session introduces the use of the maps. Attendance at the practical sessions is obligatory.

It can be seen from the above that 2 hour lectures are provided on each odd week and 2 hour practical sessions are delivered on each even week.

The course content is assessed by the two mid-term tests each 45 minutes long in duration. Each time students answer to 10 questions which are basically practical- oriented ones. The semester mark is based upon the mid-term test marks, counting their average and adjusting that mark according to the quality of the work that the student in the practical sessions.

Students can get 2 credit points for the surveying course. It is recommended that the course be taken in the ninth semester. Credits can be obtained if the students take an 8 days survey field course at the university survey field camp at Balatonkenese. The survey field camp is organised in June-July each year.

During the block week in the survey field camp, the students attend surveying classes (6–8 hours each day). They learn about the basic principles of surveying as described earlier and perform observations and measurements, calculating data for plotting. It is a great challenge for the productivity oriented architecture students to implement the results of the measurements in drawings. Four different maps or plans are made. A plan of the front of a building is made employing surveying methods (3 D intersection). Levelling of a line is followed by area levelling and producing a map with contour lines. In the third phase, the students survey a piece of land using the diagram tacheometer, and finally, the survey of a building complex is done applying the offsetting technology and plotting the survey on a big scale map. As the result of the horizontal and vertical setting out they produce profile boards for a building.

The survey field course is very popular, primarily with bright students. It is true that the intensive study period is double that of the autumn semester, but the knowledge obtained is at least triple. It is a bonus that the students are working in a pleasant environment at Balatonkenese.

For those students who have achieved a passing grade at least in the semester or during the field course (or in their studies at a college elsewhere), the Department

of Surveying offers an elective course in surveying. In this elective course, the students are provided with further knowledge in the application of surveying to civil engineering and to architecture.

The elective course discusses terrestrial photogrammetry in architecture, public works survey and registration, and basic principles of quantity surveying; it also and describes how the essential survey methods can be used in building surveying. In addition, the course introduces basic surveying computations and various means of producing setting out data. Building management and deformation measurement of building construction are also discussed. Special application of surveying in archeology and introduction of the upgraded surveying instruments is an important chapter of the course syllabus.

The elective surveying course is taught 2 hours weekly and ends with a semester mark. The semester mark may be obtained by preparing an essay on a topic presented on each of the lectures. To prepare the essay successfully, use of the lecture notes and reference books is recommended. Students are permitted to write the essay if they have attended two-thirds of the lectures. Successful completion of the course may be awarded with 2 credits.

According to experience in the last two years, about 5–8 percent of the students take the course and almost everyone can finish it and can gain credit for it.

It is evident not only for to teaching staff of the Faculty of Architecture but also to the fresh graduates of the course, that the knowledge obtained in surveying is very useful in professional practice. Exchange students who study abroad for one or two semesters are saying how much they appreciate the traditional efforts of the Technical University of Budapest in providing engineering skills for the students beyond furnishing them with artistic skills. Benefits of this approach are gained by students when they study abroad.

Lecturers of the course are not quite happy with the course. They would like to be younger by fifty years at least and teach the subject for four hours a week as it was in the old times.

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