The Beginnings of Higher Learning and Experimental Research in Brno

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Abstract: This article is written to celebrate the 95th anniversary of Laboratory of Water Management Research, Department of Water Structures, Faculty of Civil Engineering, Brno University of Technology, Czech Republic. Short trip to the history, a few words about the founder Prof. Smrček and the laboratory works – education, projects, physical and mathematical modelling today.

Key words: Physical and mathematical modeling, education, history and today of laboratory of water structures, Brno, in-situ monitoring, electrical impedance spectrometry (EIS).

In the first half of the 19th century, the broader foundations of technical education were laid in Europe. Polytechnic institutes began to be established, many of them assuming a university character.

In 1806, the Prague Polytechnic Institute was founded as the first in Austria-Hungary. Its director was Franz Josef Ritter von Gerstner, a professor of higher mathematics at Charles University in Prague. At first, the Prague Institute was considered to be part of Charles University, from which it was separated in 1815.

In Brno, there were considerations to found a technical college simultaneously with the establishment of the Francis Museum in 1817. In 1847, the Academy of Aristocratic Estates was transferred from Olomouc to Brno by a decree of Ferdinand I and merged with the Museum. It had been founded in 1725 and the teaching there included, among others, the basics of engineering arts.

After long discussions about the financing of the college, the subjects, and the equality between the Czech and German languages, Emperor Ferdinand I endorsed the establishment of the college in 1847 and accepted the first financial contributions for its operation from the Moravian estates and a Viennese banker, Solomon Rothschild. Unfortunately, because of the lack of interest in technical education on the part of the authorities and the lack of funds, the school stagnated, and outstanding personalities, such as Prof. PhD. Dr. Karel Frantisek Edvard Koristka, an excellent Czech geodesist, topographer, cartographer, statistician and teacher – professor of practical geometry and layout drawing, a pioneer of this school, were leaving elsewhere, whether due to not knowing the Czech language or due to unfulfilled social demands.

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Only in the 1860’s, technical learning began to undergo major reforms. At the Polytechnic Institute in Prague, the mainstay of new reforms was again Prof. Karel Koristka, who came to the Prague Polytechnic Institute in 1851 and was active there until 1893. An original Department of Hydraulic and Road Engineering was formed and the equality between both the two territorial languages was established (from the foundation of the Institute in 1806, teaching was conducted only in German). In 1869, the school was then divided into two institutes – Czech and German. Although Prof. Koristka requested to be placed in the Czech school, his request was rejected and he remained as a professor at the German institute. He was the first rector of the Royal Czech Polytechnic Land Institute in Prague in 1864-1865. Prof. Koristka stood up for the establishment of industrial learning in Bohemia and his analysis of activities of technical colleges in Europe became a basis for an essential reform of Prague polytechnic education in 1863. He was raised to the peerage for his deserts.

The reform did not reach Brno until 1873, when the Brno College was declared the Technical University. The school received a larger amount of funds as well as personal possibilities, but it remained exclusively German. To have an idea about the size of the school, we can state that a total of 1,439 students attended the school in 1850 – 1875. By their origin, 1,048 students came from Moravia, 190 from Bohemia, and the others from different parts of the monarchy and from abroad. However, neither the reform nor the change in the name improved the state of the Brno school, the number of students kept dropping, from 180 students in 1873 to 102 students in 1887. The cause was the lack of funds on the one hand, and the growing German nationalism against the majority of Czech students on the other. Economic conditions of the school did not improve until the 1890’s.

At that time, however, the ethnic coexistence of the Czechs and the Germans aggravated, and thus the original demands for the bilingualism changed to a demand for founding a second university in Moravia and a Czech technical school in Brno. Although the foundation of the university was not successful, the struggle for the Czech technical school was ultimately crowned with success despite the fanatic resistance by Moravian Germans.

On 19th September 1899, The Czech Technical University in Brno was established by a Supreme Decree of His Majesty Emperor and King Franz Joseph I given in Klagenfurt. Dr. Karel Zahradnik, a full professor of mathematics, was appointed the first rector, and the first four professors were appointed – Karel Zahradnik, Jan Sobotka, Jar. J. Jahn, and Hanus Schwaiger. On 1 November of that year, the teaching in the first year of the Department of Civil Engineering started as first by the syllabus of the German Technical College in Brno.

In the first years after the foundation of The Czech Technical University in Brno, the teaching was held in several leased buildings in Brno. Disadvantages and the unsuitability of teaching in leased and dispersed buildings resulted in the effort for obtaining own and adequate rooms for teaching. As early as 2 April 1900, the professors’ staff entrusted their member, Ing. M. Ursiny, with the preparation of a building plan for the objects of the Czech Technical University. The design was conceived so that approximately 600 students could attend the school (the average of the Czech Technical University in Prague and the German Technical College in Brno) in the following departments:

- Civil Engineering;
- Mechanical Engineering;
- Electrical Engineering;
- Chemical Engineering;
- Cultural Engineering; and
- Course for Education of Land-Surveyors.

The effort to obtain and build new concentrated teaching rooms of the Czech Technical University in Brno was crowned by acquiring and purchasing a plot of land of a total area of 25,334 m² for 357,568 crowns.
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Fig. 1 New buildings c.k. Czech university technical school of Franz Joseph I. in Brno and Veveri from 1939 [1, 2].

Fig. 2 The front of the present main building on Veveri Street [2].

Fig. 3 An aerial view of the complex of buildings of today’s Faculty of Civil Engineering ((photo by Miroslav Kamrla, 2008 [1])).
in November 1901 and by commencing the construction for 2,410,000 crowns (without interior equipment) in October 1907. The study year 1910/1911 could then be opened already in three new buildings of the campus on Veveri (formerly Veverska) Street as shown in Fig. 2 and since 1920 also in a building on today’s Zizkova Street as shown in Fig. 4.

It is also worth mentioning that the professors’ staff gave consent to free access of women to the Technical University on 21 October 1909, but under a condition that they would prove the same pre-education as men.

The teaching of civil engineers was conducted from 1899 at the Department of Civil Engineering, from 1900 within the course of land surveying, and from 1910 at the Department of Cultural Engineering. In 1920, the Departments of Civil and Cultural Engineering were dissolved and replaced by a single Department of Civil Engineering divided into two independent, equivalent orientations – constructions and transport; water management and culture.

After the initial transitory organizational forms, the hydrotechnical teaching was focused on two main water-management institutes, the Institute of Hydraulic Engineering I (hydraulics, dam construction, inland waterways) and the Institute of Hydraulic Engineering II (constructions of waterways and weirs, water power, hydrology). Besides them, there were yet another two institutes of water-management orientation – The Institute of Amelioration I and the Institute of Amelioration II (the institute of water supply and sewerage).

The given organizational scheme remained preserved about the same until a reform in 1951. Certain disciplines, however, passed among the institutes by the specialist orientation of professors.

The founder of the water-management study at the Czech Technical University and later the first chief of the Institute of Hydraulic Engineering I was Professor Antonin Smrcek, whose 150th birth anniversary we are commemorating these days.

He was born on 10th Dec. 1859 at Brodek by Prostejov in a family of a village shoemaker as one of seven siblings. The poor family of the shoemaker endowed their son Antonin with strong ethnic feeling and unusual tenacity. His parents had the talented pupil...
with a distinct gift for drawing studied at a Czech secondary school in Prostejov at great financial sacrifice. He walked daily 12 km to that school from Brodek for 7 years. He completed his study by a school-leaving examination in 1878 and continued his study at the Prague Polytechnic Institute, where he studied civil engineering. He completed his study with honors in 1884. After his study, he worked at the Polytechnic Institute in the Department of Hydraulic Engineering and Tunneling with Professor Petrlik as an assistant, and at the office of civil engineer V. Plenkner for another four years. After a one-year military service in field artillery, in August 1888, the young Ing. Smrcek started working in the Prague company A. Lanna that designed railroad and, in particular, hydrotechnical constructions. The company had almost no competitors in the field of hydraulic engineering in the whole of the monarchy.

In 1889, Antonin Smrcek married Bozena, née Kucerova, a daughter of a furrier from Beroun. They had 3 children. In 1898, his wife died and Smrcek became very seriously ill. He married for the second time (in 1900), this time he took to wife Bozena Kusova, also widowed, and 6 children were born to them, the oldest having died at infancy. The family indiscriminately created a harmonious environment for all its members. After several years in the company A. Lanna, Ing. Smrcek became chief of a division that designed and built navigation cascades on the Vltava river upstream from Prague and then on the Labe river as well. In 1890, Prague was hit by high water that damaged and partially destroyed the Charles Bridge. Smrcek was entrusted with the management of salvage and safeguarding operations on the Vltava. In 1893, he was greatly involved in a general project of the Danube-Vltava-Labe Canal (the companies A. Lanna and Vering had won the outside competition for it). Ing. Smrcek designed and built the Liben, Karlin and partly also Holesovice harbors in Prague, Vltava lock chambers by Troja, Klecany, Libsice, Mirejovice and Vranany, as well as the ten-kilometer-long canal Vracany-Horin, including the Horin chamber vessel. His work also includes all sewers on the Vltava from Prague up to its confluence with the Labe by Melnik. His hydraulic structures have become the subject of study by engineers from all over Europe.

Antonin Smrcek was offered a professorial chair at the Vienna University of Technology, but he chose his native Moravia, and on 1st Nov. 1902 he was appointed a full professor of hydraulic structures at the Czech Technical University in Brno. At the same time, he had to manage work on the Vltava for one more year. At the young university school, Professor Smrcek founded the Institute of Hydraulic Engineering. Within his teaching activity, he gave lectures from subjects such as Foundation Engineering, Regulation of Water Streams, Water Supply, Constructions of Waterways, Weirs and Dam Reservoirs, and Use of Water Power.

He began from scratch – he had to obtain rooms and equipment for his workplace and published his lectures for students. From 1903, he was chairman of the commission for the 2nd state examination in the field of civil engineering and held the office of rector in 1913-1914. During his teaching carrier, he introduced annual excursions of students to see hydraulic and other engineering constructions at home and abroad. He mostly paid them with his own money. Prof. Smrcek maintained contacts with the world trend of his branch also by participating in a scholarly fashion in international conferences on navigation and energy in Europe, America and Africa. In his country, he began
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He played an important role in the establishment of a water-management laboratory at the Brno Czech Technical University as the first laboratory in the lands of Austro-Hungarian monarchy (1914-1917) and one of the most significant research workplaces in central Europe. According to his own words, it “...serves for scientific research of physical effects of water, especially its effect on water-retaining structures and river beds, and educationally for instruction of young engineers”. There, Smrcek made renowned experiments with overfalls over weir crests, scouring of downstream aprons, siphons, overfalls over half-built dams, etc., and carried out tests for ministries, land committees and building authorities, and for interested parties from abroad. Prof. Smrcek was the author of a number of extensive as well as smaller-scale projects – the Pilsen-Regensburg Waterway, regulations of the Danube cataracts from Moldava to the Iron Gate, the Labe-Dniester Canal with a connection to the Danube and Odra rivers, and others. He was also involved in the construction of Stechovice, Luhacovice, Plumlov, Vranov and Kninicky dams. Even in 1946, he was engaged in the project of the Vir dam.

As a well-known specialist, Prof. Smrcek held a post of an expert in many institutions. The outstanding practitioner Smrcek also published many papers. He began to write under the pseudonym Sapin (Smrcek Antonin Pupil of Ingineering) for the Narodni Listy (National Gazette). In 1888-1889, he was an editor in charge (unsalaried) of the Technicke listy (Technical Gazette) in Prague. He is the author of 170 papers and many larger scientific, promotional and popular theoretical treatises and lectures. Altogether, more than three hundred of them were written in 1886 – 1947. He began intensively to lecture for the public all over Moravia shortly after his arrival in Brno. He strove to make students be interested in water-management and transport issues and their significance for the national economy. His educational activity was one of the reasons for electing Prof. Smrcek as a deputy of the Moravian Land Diet in 1906. A year later, and again in 1912, he also became an Imperial deputy. He worked as an expert and proponent of economic and cultural needs of the Czech lands, particularly of neglected Moravia. As an official in school affairs, he rendered outstanding services to the extension of the Brno Technical University by several fields of study (chemical, electrotechnical, general, architectural, and agricultural). As the first man, he proposed to the Minister of Cult(ure) and Teaching in Vienna to admit women to technical colleges/universities – as full-time and part-time students. In the role of a special official in the matters of the Brno Czech Technical University, he made Dr. Korytowski, Minister of Finance, to sign a construction contract of a building of the Czech Technical University at 95 Veveri in July 1907, thus financially securing the object as well.

Prof. Smrcek was actively involved in the Czech public life in the Czech Club and later in the Club of Independent Deputies, which was led by T. G. Masaryk. In Brno, he was a vice-chairman of the Central European Institute for the Support of Economic and Cultural Rapprochement. Being a convinced patriot, Antonin Smrcek also participated in the preparations of the establishment of the independent Czechoslovak state. After the Republic came into existence, he took part in the preparation of materials for the defense of the Czechoslovak demands at peace negotiations in Paris after World War I. In 1919, he was appointed by
Fig. 5  A pumping station and a river flume with Poncelet measuring weir from 1918 [3].

Fig. 6  A pumping station (currently under reconstruction) and a river trough (a model of Steti, $M_t = 50$) from 2006 (photo by Lubos Parilek, Jana Parilkova).

Fig. 7  Water penetrated over top of core wall and the dam sloughs off slowly on the downstream side at the foot of the slope (dam built of fine sand) [3].

the Government a delegate of the CSR in the Inter-Allied Danube Commission (for the safety of navigation on the Danube). He repeatedly won recognition for his public and professional activity. The most distinguished of it was his appointment of a corresponding member of the Academy of Technical Sciences in Warsaw in 1923, and he was awarded the highest Polish pre-war decoration, the order “Polonia restituta”, by the President of the Republic of Poland in 1931.

Professor Antonin Smrcek went down deeply to the face of our country with his projects and practical involvement in their implementation. He managed to combine high expert knowledge with patriotism and
T = 22 minutes after the start of the measurement

T = 60 minutes after the start of the measurement

Fig. 8  Effluent-seepage area development on the downstream face of the dike.
social commitment also in the care of his students. As a token of recognition of his professional and teaching qualities, the Czech Technical University in Brno appointed Prof. Ing. Antonín Smrcek as their honorary doctor, and on 31 January 1948 the Technical University of Dr. Edvard Beneš in Brno awarded Professor Smrcek the honorary title “doctor of technical sciences honoris causa” in appreciation of his merits for school and science. He did not end up his varied professional activity, which is briefly presented below, by his retirement in 1930, but was still in charge of the Laboratory and gave lectures as an honorary professor. Even after World War II, after re-opening of colleges / universities, at the age of 86, he lectured on different interesting topics to students of water management (e.g., on bombing of dams during the war). He died on 17th Feb. 1951 at the age of 91.

The extensive literary estate of this prominent personality of Czech technical and political life is part of the collections of the Technical Museum in Brno.

The staff of the Laboratory of Water Management Research of the Department of Water Structures are striving to fulfill the legacy of Professor Smrcek even today.

In the area of teaching, they provide, or take part within numerical and practical classes in, instruction in the following subjects:

- Hydraulics and hydrology;
- Hydraulics of groundwater;
- Regulations of water streams;
- Waterways and navigation;
- Use of water power;
- Water management;
- Water-management research;
- Hydraulic engineering;
- Specialized excursions;
- Optional and recommended subjects; and
- Comprehensive project (regarding regulations of streams, weirs, and dams; use of water power and waterways; and navigation) and relevant seminars.

The specialist orientation of experimental research is aimed at

- laboratory model research of weirs, dams, hydropower plants, navigation facilities of water streams, storm-water overflows and whirl separators in sewer systems;
- hydraulic and model research of fixed and movable diversion constructions – inlets and outlets of hydraulic structures – flow in studied sections of water streams – regime of bed load sediments and stability of stream bottoms – components of hydraulic pressure circuits;
- analysis of the structure of flow by precise measurement of parameters on models and constructions;
- calibration of gauges of velocity and flow rate;
- development of special measuring devices;
- monitoring in real conditions; and
- mathematical modeling of water flow.
Fig. 10  Object “Pear” was realized (photo by Lubos Parilek).

Fig. 11  Double rain separator (photo by Jana Parilkova).

Fig. 12  Student’s excursion and field measurements (photo by Jana Parilkova and Lubos Parilek).
An important part of the activity includes an active participation (as researchers or co-researchers) and a share in the solution of projects of national as well as international basic and applied research. Thru the project E 3838 of EUREKA program was developed device Z-meter with number of measuring channels 128. The research is continuously managed thru project E 4981.

References