INTRODUCTION

ABSTRACT: This paper presents a national report for the Geotechnical Engineering Education in Bulgaria. A brief description of the higher engineering education is given. More detailed description for the Civil Engineering Education is presented. The curriculum for the Geotechnical Engineering Education in the University of Architecture, Civil Engineering and Geodesy with number of hours per semester and annotation of the geotechnical disciplines is presented.

The higher technical education in Bulgaria was started in 1942, when the Higher Technical School was founded. Only two faculties were opened: the Faculty of Civil Engineering and Architecture (with three departments - Construction Engineering, Architecture and Land Survey) and Faculty of Mechanical Engineering with four departments (Mechanical Engineering, Electrical Engineering and Mining Engineering). In 1945 the Higher Technical School was transformed into a State Polytechnic, and in 1953 the Polytechnic was divided into four higher technical engineering schools. At present, six state technical universities are established in Bulgaria, which offered different areas of study in engineering. For example, the Technical University of Sofia, (with 10 faculties) provide higher education mainly in the field of mechanical, electrical, electronic engineering and technology. Similar areas of study are offered by the Technical University Varna and University Russe. A specific specialization has University of Chemical Technology and Metallurgy Sofia. The University of Mining and Geology (with 5 faculties) is specialized in the field of hydrogeology and engineering geology, mining technology, and mining electromechanics.

The great number of universities in Bulgaria could be considered as an ineffective structure of high education. In view of this, a new concept of the development of the higher education was accepted. Our report will present the problems of Geotechnical Engineering Education on the basis of the existing system of high engineering education.

The requirement for admission in all higher engineering schools is the diploma certificate for secondary education. There are two types of upper secondary schools in Bulgaria - general and vocational.

2 DEGREE PROGRAMS OF THE CIVIL ENGINEERING EDUCATION

2.1 About UACEG

The greater part of the Geotechnical engineering education is provided by the University of Architecture, Civil Engineering and Geodesy (UACEG).

UACEG is the only civil institution in the country offering higher education for architects, civil engineers and surveyors. Number of students - more than 4000 (including 486 part-time students, 352 foreign students and 50 postgraduate students). Academic staff (full-time): 435 (including 74 professors, 137 associate professors, 202 teaching assistants, 22 lecturers); holding doctorate - 250.
For the time of its existence UACEG has trained more than 5,500 architects and 25,000 engineers.

The 5 faculties (Architecture, Structural Engineering, Hydrotechnics, Geodesy, and Transportation Engineering) including 33 departments offer the following degree programmes: Architecture, Structural Engineering, Hydraulic Engineering (Hydraulic Structures, Irrigation and Drainage Engineering), Water Supply and Sewerage, Transportation Engineering and Geodesy. The duration of study, incl. the time for preparation and defense of diploma thesis is 10 semesters for the engineering programs and 11 semesters for Architecture. Furthermore, each student or professional may pursue additional 5-semester programs on Construction Company Management, International Economic Relations, Entrepreneurship and Law in the International Business, Computerized Information Processing, Computer-Aided Design, Translation of Specialized Literature, and Land and Property Management.

2.2 General Curricula for the Transportation and Structural Engineering

During the course of study the students attend courses for more than 50 subjects having altogether more than 3900 hours grouped in the following pathways: fundamental; general and specialized disciplines.

- Fundamental Theoretical Disciplines: mathematics, physics, mechanics, engineering geology, chemistry, informatics.
- Specialized Disciplines for Transportation Engineering: general courses on highways and railways; design, construction, maintenance and reconstruction of highways; town planning, town traffic and streets; airport construction; tunnels; bridges; design and construction of railways; superstructure, maintenance and repairs of the railway; stations, station facilities and railway operation; special railways; foundation; harbour construction; rock mechanics.
- Specialized Disciplines for Structural Engineering: design and construction of buildings and structures (reinforced concrete, steel, timber, etc.), foundation structures, structural mechanics, building technology, building insulation, computerized technologies in construction.

3. ACADEMIC CURRICULUM FOR THE GEOTECHNICAL ENGINEERING EDUCATION

The first academic curriculum for the Civil Engineering education, accepted in 1942, included the discipline Soil Mechanics, as a basic study for Civil Engineering. The first book on geotechnical engineering in Bulgaria was published at that time.

There were no any general changes in the Geotechnical engineering curriculum during the last 50 years. The number of hours per semester during 1998/99 for different Civil Engineering specializations is given in Table 1.

Table 1.

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<th>Specialization</th>
<th>Number of hours per semester</th>
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<tr>
<td></td>
<td>EG</td>
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<td>1. Structural Engineering</td>
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<td>2. Transportation Engineering</td>
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<td>3. Hydraulic Structures</td>
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<td>4. Water Supply &amp; Sewerage</td>
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<td>5. Irrigation &amp; Drainage Engineering</td>
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Notes:
1. The following abbreviations are used: EG = Engineering Geology; SM = Soil Mechanics; FE = Foundation Engineering; RM = Rock Mechanics; AG* = Applied Geomechanics (selective); l = lectures; lab = laboratory tests; p = GE project s - seminars. 2. There are 15 weeks per semester.

3.1 Annotations of disciplines

3.1.1 Engineering Geology and Hydrogeology

Geology: composition and material structure of the Earth and the Earth's crust. Tectonic motions and earthquakes, history of the Earth. Engineering Geology: composition, structure and basic properties of soils and rocks, transformations depending on their age and genesis; geodynamical process and phenomenon (weathering, actions of flowing waters and seas, landslides, rock falls, subsurface erosion and others); engineering-geological conditions for construction in Bulgaria; geotechnical study.
3.1.2 Soil Mechanics
The following general lecture themes are delivered:
- Physical Soil properties - density, unit weight, porosity, water soil properties, standard density, grain size distribution.
- Mechanical properties of soil - compressibility, shear strength, ground water seepage, in-situ testing.
- Basic mechanical models for determination stress-strain behaviour of soil massifs under surface (foundation's) and gravitational (unit weight, seepage) loads.
- Methods for the settlements evaluation.
- Time-depending stress-strain behavior of the soil massifs. Basic theories of the consolidation and rheology of cohesive soil.
- Theory of ultimate limit equilibrium.
- Earth pressure and retaining walls;
- Sability of natural slopes and earth structure (excavation and embankments).

The laboratory tests include determination of the following soil characteristics: density and porosity; water content and plasticity; standard density and optimal water content; compression modulus; angle of friction and cohesion by using simple and triaxial shear tests.

3.1.3 Structural Rock Mechanics
Nearly two thirds of the roads in Bulgaria are built in rocky mountainous areas. The future development of the road network envisages widening of the existing and construction of new roads and railways and this again will be done mainly in mountainous regions. In addition, the construction of transportation structures is often associated with their foundation in rocks.

With respect to construction in rock terrain, civil engineers are concerned mainly with road sloping in cuts in ditches and a number of other types of excavation work in rocks as well as foundation in rocks. All these problems are treated in the subject of Structural Rock Mechanics for Transportation Engineering. The so-called 'applied' or 'engineering' approach is adopted and it gives excellent and reliable results for the construction of formation slopes of medium height.

3.1.4 Foundation Engineering
The lectures in this discipline includes:
- Methods for design of the shallow foundation – bearing capacity and settlement evaluation; sub-grade reaction.
- Basic theories for design of the piles and wells foundation – soil-foundation structure interaction problems.
- Stability of deep excavations for foundations – design of sheet pile walls; dewatering of excavation; stability of the bottom of excavation.
- Design of retaining walls and underground structures.
- Basic problems of the design of foundation structures in seismic regions. Shallow footings under machines.
- Foundation engineering problems in regions with complicate soil conditions - soft soils, collapsible soils, swelling soils, peat and others.

The Geotechnical Engineering project includes the design of the following geotechnical structures: shallow footings – two variants; sheet pile walls – two variants (anchored and unanchored); pile foundations; retaining walls – two variants; slope stability evaluation. Some computer codes to help the student projects are used

3.1.5 Applied Geomechanics
Soil massif’s behaviour under static and dynamic loads. Principle geomechanical process in earth’s crust and their effect on soil behaviour. Basic constitutive equations describing stress-strain behaviour of multi-phase soils. Laboratory and field methods using for the dynamic soil properties evaluation. Liquefaction potential evaluation of saturated soils. Dynamic bearing capacity; dynamic earth pressure and design of foundation structures in earthquake regions.
4 POSTGRADUATE STUDY

For the receiving of Doctor Philosophy degree, in the field of geotechnical engineering, two forms of the education are offered - full-time work (3 years), and part-time work (4 years). Each student passes 2-3 special examinations and develops a doctoral thesis. The Scientific Board that awarded Ph.D. degree discusses and evaluates the thesis.

The Department of Geotechnics offers some special courses for the Civil Engineers in the field of Geotechnical Engineering. The following courses were delivered during 1998/99:
- Shallow and deep foundations - special problems.
- Geotechnical design in transportation construction.
- Special problems of foundation engineering design in regions with complicated soil conditions.
- Soil properties of soft soils and geotechnical design.
- Advanced soil mechanics and foundation engineering for MS students.
- Soil dynamics and design of geotechnical structures in seismic regions.

5 CONCLUSION

The existing forms of the Civil Engineering and Geotechnical Engineering education in Bulgaria are presented.

According to the Higher Education Act (1995 and 1999), a new system for the secondary and higher engineering education will be established. The new system comprises universities, specialized higher schools (academies, institutes) and colleges.

A new Curriculum for Civil Engineering Education on the basis of the three-degree higher education system will establish new specialisations in the field of Geotechnical Engineering.