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REPORT ON GEOTECHNICAL ENGINEERING FROM CHILE

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ABSTRACT: Education in Geotechnical Engineering is a field that has been traditionally included in Structural Engineering in Chile. Recently, this discipline has become an independent career in one university and through graduate studies, the professional can obtain a degree in this specialty. The program of Civil Engineering requires six years in Chile, that is rather unusual. The authors make recommendations about aspects that must be emphasized in Geotechnical Engineering education.

1 INTRODUCTION

In Chile civil engineering requires six years of studies, which is clearly different from other countries where it takes five or even four years. In favor, in Chile the degree given by universities allows the professional to work and sign any civil engineering project, without any additional requirement. Nevertheless, it is recognized that this situation generates a potential risk since young engineers can be involved in huge project without having the necessary experience.

Previously to apply to university, a national program of 12 years of studies has to be completed, after which, students have to take a national examination for applying to universities, and its results are important for being accepted in ranked universities.

In 2008, 1100 students went to civil engineering from approximately 49000 new students entering to universities, which are distributed in seven private universities and eleven state supported universities. It is important to mention that the total population of Chile is now close to 16 millions.

2 REGULAR PROGRAMS OF CIVIL ENGINEERING IN CHILE

The six years of civil engineering education are divided in twelve semesters, which include a final thesis. The programs are generally distributed in three different levels as follows:

- Basic Sciences 5 semesters
- Engineering Sciences 3 semesters
- Applied Engineering 4 semesters

None of the civil engineering degrees is specifically in Geotechnical Engineering. This area is considered part of Structural Engineering and therefore, students interested in geotechnical subjects have to go necessarily through Structural Engineering in undergraduate studies.

The number of new Civil Engineers that graduates each year in Chile is approximately 600. This is an estimated value according to the information managed by the authors.

3 GEOTECHNICAL ENGINEERING

The geotechnical courses that are most commonly included in all Chilean university programs are:

- General Geology
- Soil Mechanics I
- Soil Mechanics II
- Foundation Engineering.

Students that are attracted to geotechnical engineering have the possibility of doing undergraduate thesis in subjects associated with this field. Another choice is to pursue graduate programs in geotechnical engineering available in three main universities.

At present, Chile is growing in terms of infrastructure requiring civil and geotechnical engineers to cope the needs.

On the other hand, Chile, as one of the major copper exporter in the world, is developing new large and important projects mainly due to the high price of this mineral. Consequently, geotechnical engi-

neers are being strongly required also in the mining sector.

As a result of the infrastructure projects and mining industry the status of this profession is rising to a high level of salaries, which is manifested also in the number of high qualified students interested in Geotechnical Engineering

4 CHILEAN SOILS

At this stage, a comprehensive knowledge of local soil conditions are becoming a must since the geology and geomorphology of this country is rather singular. The high seismicity and volcanism together with a variety of climates (desert in the north to glaciers in the south) require a particular study of their behavior as compared with commonly sedimentary soils existing in other latitudes. The singular behavior and characteristics of Chilean soils are being included in most geotechnical engineering courses, especially in graduate programs.

Some of the singular soils under study are:

- Saline soils
- Allophane containing soils
- Volcanic ashes
- Glacial soil deposits

5 FUNDAMENTAL ASPECTS TO BE INCLUDED IN GEOTECHNICAL ENGINEERING EDUCATION

Natural geotechnical materials have complex composition, wide variation in properties, heterogeneity, anisotropy, non-linear behavior, changes associated with water content, etc.. Therefore, mathematical models are limited and need appropriate judgment in parameter and model selection. As a result geotechnical engineers require a wider view and deeper level of perception than professionals in other disciplines of engineering.

The authors think that the education of geotechnical engineering have to develop the student capacity of seeing engineering problems from different points of view as well as the ability to distinguish the essential factors controlling the problem to be solve since natural geotechnical materials are too complex to be represented by just a set of equations.

To achieve these goals the students need to learn how to separate chaff from wheat, which is not usually taught in engineering schools, likely because teachers are not aware that we all carry some chaff that distorts the action of separation to be taught.

According to the authors experience in teaching, a better motivation can be awaken in the students when these extra curricular issues are discussed in the classroom. Additionally, the use of case histories and the discussion of complex problems through

classical papers, help the students to develop their own criteria to face problems in the profession. It is important to remember the words said by Terzaghi: "...To practice an art successfully one must possess the capacity for thinking with hips. In other word one must be able to arrive at correct conclusions without preceding logical reasoning." (Terzaghi, 1957)

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