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# Unified Qualification Requirements for Ground Engineering and Engineering Geology Professionals

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## Abstract

Eurocode 7 (EN 1997) is the fundamental geotechnical standard in Europe. It states that the design and construction of geotechnical structures requires “*appropriately qualified and experienced personnel*”. Neither EN 1997 nor the various national annexes and/or Building Codes specify precisely what these “appropriate” qualification and experience requirements might be. For our profession, this is a serious situation as it opens the door for all sorts of self-declared “experts” to carry out ground investigations and to submit Ground Investigation and Geotechnical Design Reports on a low-bid basis, all too often to the detriment of safety. Against this background, the German Geotechnical Society DGGT has issued a document entitled “*Geotechnical Professionals—Requirements on qualification and experience*”. The document was developed in consensus between geotechnical engineers and engineering geologists. The requirements incorporate the following three general areas: (1) appropriate studies at tertiary level; (2) professional experience in ground engineering, and (3) continuous professional development. The DGGT aims to register qualified geotechnical professionals with the Chamber of Engineers (*Ingenieurkammer*). This appears to be the most attractive approach to registration as it covers the geo-engineering profession at large, including engineering geology.

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## Keywords

Consultants • Registration • Geotechnical engineer • Engineering geologist

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## 40.1 Introduction

Eurocode 7 (EN 1997) is the fundamental geotechnical standard which, since 2010, is mandatory in all EU- and EFTA member states. It states that geotechnical designs and supervision of geotechnical constructions require “*appropriately qualified and experienced personnel*” (EN 1997-1: 2004, Sect. 1.3(2)). Neither the EN 1997 nor (to the best of our knowledge) the various national annexes and/or Building Codes specify precisely what exactly these “appropriate” qualification and experience requirements might be. For our profession, this is quite a serious situation as it opens the door for all sorts of self-declared “experts” to carry out ground investigations and submit Ground Investigation and/or Geotechnical Design Reports on a low-bid basis,

**Table 40.1** Qualification requirements for tertiary studies

Study stream study extension (SE)	Number of semesters (total) <sup>c</sup>	Academic degree	ECTS-credit points <sup>a</sup>			
			Study total	Foundational <sup>b</sup>	Geotechnics <sup>b</sup>	
					Core	Suppl.
Civil engineering	6 to 8	Bachelor	180 to 240	60	15	25
SE—Geotechnics <sup>e</sup>	8	Dipl.-Ing. (FH) <sup>d</sup>	240			
	9 or 10	Dipl.-Ing.	270 or 300			
	10	Master	300			
Geosciences	6 to 8	Bachelor	180 to 240			
SE Eng.-Geol.	10	Dipl.-Geol.	300			
Master in Eng.-Geol.	10	Master	300			

<sup>a</sup> ECTS = European credit transfer and accumulation system

<sup>b</sup> See Table 40.2 for details

<sup>c</sup> Minimum number; semester = section of half-year studies

<sup>d</sup> Traditional German degree in engineering from a University College

<sup>e</sup> Geotechnics may also be a study stream in its own right

all too often to the detriment of the safety of geo-engineered structures, or their cost effectiveness.

This unsatisfying, and potentially dangerous, situation has been similarly identified in various European countries. For instance, in the UK there is a Register of Ground Engineering Professionals which is jointly sponsored by the Institution of Civil Engineers, the Geological Society of London and the Institute of Materials, Minerals and Mining (ICE 2011). That Register aims at providing external stakeholders, including clients and other professionals, with a means of identifying individuals who are suitably qualified and competent in ground engineering—be they from consultancy, contractors, public bodies or academia.

A similar development has taken place in Germany. The German Geotechnical Society DGGT, the national umbrella organisation for both ground engineers and engineering geologists, has issued a document entitled “*Geotechnical Professionals—Requirements on qualification and experience*” (DGGT 2013). In the following, an outline is given of the relevant DGGT requirements (Sect. 40.2). Registration of qualified geotechnical professionals, as pursued by the DGGT, is considered in Sect. 40.3. Based on a comparison between the two approaches undertaken in Germany and the U.K., it is concluded that a unified European scheme for registration of geotechnical professionals is highly desirable (Sect. 40.4).

## 40.2 Requirements for Geotechnical Professionals in Germany

According to the DGGT document, qualifications are required in all of the following three general areas:

1. Successful completion of appropriate studies at tertiary level (see Sect. 40.2.1),

2. professional experience in ground engineering (see Sect. 40.2.2), and
3. continuous professional development (see Sect. 40.2.3).

### 40.2.1 Studies at Tertiary Level

The successful completion of appropriate studies at tertiary level shall be evidenced by a bachelor or master degree (or by the traditional German diploma degrees Dipl.-Ing. or Dipl.-Geol.) (see Table 40.1). Foundational and geotechnical core subjects are identified and quantified in terms of ECTS (European Credit Transfer and Accumulation system) credit points. Core subjects include mathematics, applied mechanics, IT and/or geo-information systems, soil mechanics, foundation engineering and engineering geology (see Table 40.2).

It should be noted that, in accordance with Table 40.2, individuals can satisfy the tertiary study requirements by a degree in one of the following two streams: either by a degree in civil engineering or by a degree in geosciences. In order to keep the geo-engineering profession principally open to any qualified person, there is a provision for individuals with a degree in other tertiary study streams. In such cases evidence must be lodged that the foundational and geotechnical core topics, as specified in Table 40.2, are appropriately covered.

### 40.2.2 Professional Experience

The minimum number of years required for geo-engineering project experience varies between 2 and 7 years (see Table 40.3), depending on the academic degree (Bachelor vs.

**Table 40.2** Curriculum and required ECTS credit points as one of the pre-conditions for geotechnical professional recognition

Study category		Topics		Required ECTS		
		Compulsory	Electives	Compulsory	Electives	Total
Foundational		Mathematics Applied mechanics IT /CAD /GIS	Physics Chemistry Analytical geometry Fluid mechanics	20	10	30
Study stream	Civil engineering	Design Structural engineering Bulk structures Construction methods	Construction materials Steel /timber structures Hydraulic engineering Traffic route construction	15	15	30
	Geosciences	Geology Mineralogy/petrology Structural geology	Hydrogeology Regional/historic geology Quaternary geology Natural hazards			
Geotechnics core topics		Soil mechanics Foundation engineering Engineering geology	Rock mechanics Rock engineering Tunnelling Constitutive laws numerical modelling	10	5	15
Geotechnics supplementary topics		Practical training in geotechnics Thesis in geotechnics or engineering geology repositories Environmental geotechnics, geothermal topic Technical petrology Geophysics, soil dynamics		25		25

**Table 40.3** Requirements on geo-engineering project experience

Academic degree	Project experience (Years)	Geotechnical category (EN 1997-1)
Master (M.Sc., M.Eng.)	2	1 and 2
Dipl.-Ing. Dipl.-Geol.	5	3
Dipl.-Ing. (FH) (see Legend Table 40.1)	3	1 and 2
	5	3
Bachelor	4	1 and 2
	7	3

Master) and on the “Geotechnical Category” of the associated project as specified in EN 1997-1: 2004, Sect. 2.1.

More specifically, project experience in the form of on-site work in line with methodological competence is required as follows:

(a) **Project experience** (evidence to be lodged for at least three of these fields):

- Foundation of structures
- Excavations in soil or rock
- Ground improvement
- Rock construction
- Underground construction
- Traffic and conveyance lines
- Waterways

- Earth or rock fill construction
- Deposits and refuse dumps

(b) **Methodological competence** (evidence to be lodged for at least three of these fields):

- Delineation and quality control of soil and rock parameters on the basis of laboratory and field tests
- Setting up of ground models and evaluation and consideration of geologic and geotechnical risks
- Proof of ultimate and serviceability limit states of geotechnical structures
- Numerical modelling in geo-engineering
- Monitoring and documentation of geotechnical construction procedures
- Observational design method, including geotechnical monitoring by field instrumentation and interpretation of monitored data
- Analysis and rehabilitation of ground failures

### 40.2.3 Continuous Professional Development

Geotechnical professionals have to lodge evidence on their continuing professional development (CPD) following the completion of tertiary studies. The minimum requirement is 24 h of further education on geotechnically related topics,

**Table 40.4** Comparison of the relevant schemes for qualified geotechnical professionals developed in the U.K. and Germany

	U.K.	Germany
Issued by	BGA—British Geotechnical Association, sponsored by: <ul style="list-style-type: none"> <li>• The Geological Society</li> <li>• IoM<sup>3</sup>-The Institute of Materials, Minerals and Mining</li> <li>• ICE, Institution of Civil Engineers</li> </ul>	DGGT—German Geotechnical Society, The national umbrella organisation for geotechnical engineers and engineering geologists
Targeted to individuals	In consulting, contracting, public bodies or academia	In consulting
Grades and level of competency	“Professional” = <i>Ability</i> to ... “Specialist” = <i>Management</i> of ... “Advisor” = <i>Responsibility</i> for ...	“Geotechnical Professionals”, in their capacity to take responsibility for Ground Investigation and Geotechnical Design Reports in the sense of EN (1997)
Requirements for recognition	<ol style="list-style-type: none"> <li>1. Sound knowledge and understanding of scientific/engineering /technical principles</li> <li>2. Experience of ground engineering</li> <li>3. Continuous professional development (CPD)</li> </ol>	<ol style="list-style-type: none"> <li>1. Degree in civil engineering or in geosciences together with quantified ECTS scores in foundational and geotechnical subjects</li> <li>2. Experience of geo-engineering, quantified in years of experience</li> <li>3. CPD; quantified</li> </ol>
Required attributes with regard to:	<ul style="list-style-type: none"> <li>• Innovation</li> <li>• Technical solution</li> <li>• Integration</li> <li>• Risk management</li> <li>• Sustainability</li> <li>• Management</li> </ul>	Not specified
Sponsor	Required	Not required
Registration	Existing since 2011 with the ICE (under the auspices of civil law)	Intended: chamber of engineers (under the auspices of public law)

accumulated over a time span of 3 years. CPD can be achieved by participation in courses, seminars, symposia and congresses that satisfy DGGT criteria.

appear to us to be inferior. These are confined to geo-science and are thus unable to cover the geo-engineering profession at large.

### 40.3 Registration Pursued by the DGGT

At the time of writing, recognition and registration of geotechnical professionals, as outlined in the previous Sect. 40.2, remain pending. For the time being, individuals can use the DGGT requirements to evaluate their own competencies and for promoting themselves as geotechnical professionals to clients and, if necessary, to defend themselves before the courts. In the long term, the DGGT aims to register qualified professionals with the Chamber of Engineers (*Ingenieurkammer*) under Public Law. Due to the federal structure of the Chamber of Engineers in Germany, talks are cumbersome and results cannot be expected by year end 2014.

From an engineering geological viewpoint, registration with the Chamber of Engineers appears to be the most attractive approach towards much needed professional recognition. Alternative certification and registration schemes or titles such as the EurGeol title, promoted by the European Federation of Geologists (EFG) under Civil Law,

### 40.4 Comparison with the UK Scheme and Outlook

When comparing the DGGT scheme with that of the U.K. (see Table 40.4), it becomes apparent that there are significant similarities as well as differences.

Most significantly, within both countries there is a joint effort between geotechnical engineers and engineering geologists in developing their respective national schemes. Agreement also exists with regard to principal entry requirements. In detail, however, the German entry requirements are significantly more specific and quantified than the U.K. ones, with the consequence that, in Germany, no sponsorship is required for entry. Beyond that, it is thought that the German entry requirements are a fair and practicable compromise between the extraordinarily detailed requirements as formulated by Turner and Rengers (2010) and those of the U.K. scheme. The U.K. scheme addresses the entire spectrum of geotechnical professionals, irrespective of their function or affiliation, whilst the

German scheme focuses on geotechnical consultants in their capacity to take responsibility for Ground Investigation and Geotechnical Design Reports as per EN 1997.

A further difference exists with regard to registration. In the U.K. registration of geotechnical professionals has been established since 2011. It is carried out by the ICE under the auspices of Private Law. In Germany, registration of geotechnical professionals as per the DGGT document has not as yet been established. Efforts are underway to introduce such registration by the States Chamber of Engineers under the auspices of Public Law.

In reflecting on the similarities and differences of the above schemes, and also in considering the urgent need for improved quality in geo-engineering, it is concluded that a unified European scheme for registration of geotechnical professionals is highly desirable. The schemes developed in

the U.K. and in Germany could serve as the base for such unified scheme.

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