What is a Geotechnical Professional?

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NGM 2016, Reykjavik, ICELAND
A geotechnical professional is … a geotechnical engineer or an engineering geologist who carries out, manages, takes responsibility for and/or advises on geotechnical projects only when by qualified by appropriate training, experience and continuing professional development.
... is a hybrid composed of soil mechanics, rock mechanics and related applied geology, among others subjects. Most geotechnical engineers have an undergraduate degree in Civil Engineering, Geological Engineering, Mining Engineering or Petroleum Engineering
… is a hybrid of geology, geomorphology and at least an appreciation of engineering, among other subjects. Most engineering geologists have an undergraduate degree in Geology, Earth Sciences, or perhaps even Physical Geography
Registration and Issues

- University programs ✅ vs. degrees ❌
- Minimum standards or competencies ❌
- Non-specific professional registration ✅
- Professionals codes of ethics: "a professional must undertake and accept responsibility for assignments only when qualified by training or experience"
- Self-regulated or at best peer-regulated
- Terminology in Acts, regulations, bylaws
- **Specific professional registration**
  - **Required**
    - *some* US states (GE and EG)
    - Hong Kong (GE)
  - **Voluntary**
    - USA (GE)
    - United Kingdom (GE and EG)

### Issues

- How do most geotechnical professionals know if they are qualified?
- Globalization of GE and EG practice
Geotechnical Engineering (ISSMGE): “The science that explores the mechanics of soils and rocks and its engineering application to the development of human kind.”

Engineering Geology (IAEG): “… is the science devoted to the investigation, study and solution of the engineering and environmental problems which may arise as the result of the interaction between geology and the works and activities of man, as well as to the prediction and of the development of measures for prevention or remediation of geological hazards.”
Definitions

- There are many, many other definitions of GE and EG that are used around the world.
- Some are broader/more general; some are narrower/more specific.
- Depends on … who, where and why.
- GEs and EGs come into these professions from a wide range of educational backgrounds.
- Typical geotechnical activities and typical geotechnical projects cover a very wide spectrum.
Typical Geotechnical Activities

... can include office studies, surface and subsurface site investigations; insitu and laboratory testing; development and analysis of models of near-surface and subsurface conditions; engineering design; construction, inspection and monitoring; operation and maintenance; research and development; and management
... can include foundations related to onshore, near-shore and offshore structures; retaining walls; dams, reservoirs and dam safety; cuts, embankments and earthworks; slope stability and landslide hazard and risk assessments of natural and engineered slopes; ground improvement; dewatering; transportation and energy infrastructure; tunneling and underground works; pipelines and buried cables; resource development including minerals, oil and gas and groundwater; seismic response and liquefaction; materials testing; use of geosynthetics; geoenvironmental applications; and forensic investigations.
... that geotechnical professionals come to some general world-wide consensus on the definitions of ‘geotechnical engineering’ and ‘engineering geology’.

The ISSMGE and IAEG definitions are good starting points, but the fact that they have not been adopted universally indicates that perhaps these definitions should be revisited, with input from all member countries.
Some US states (eg. California) (GEs and EGs)
“Registered GE” or “Certified EG”
-licensed as an appropriate professional (Civil Engineer/Geologist) in that state
-number of years of full-time, qualifying experience
-appropriate references
-required examination

For GEs, emphasis is building foundations, water retaining structures and earthquake-related effects
For EGs, emphasis is slope stability
No defined competencies
Unknown number of “RGEs” and “CEGs” in an unknown number of states in the USA
Information and Instruction: California Geotechnical Engineer Application

GENERAL: California grants the authority to use the title "Geotechnical Engineer" to licensed civil engineers who successfully complete an examination process. This application is required with evidence of experience and education.

- The name you use on this application must be the same as the name on your civil license. If you wish to change your name on your civil license, please complete an Application to Change Name Form.
- The address you use on the application will be your address on record. Licensee’s names and addresses are public records and are published in both electronic and print media, as well as disclosed upon request to the Board. You may choose to use a home address, a post office box, or a business address. If you wish to change your address of record for your civil license, use the Address Change Affidavit.

This information is a summary of some of the important requirements relating to certification to use the title "Geotechnical Engineer." It is not intended to apply to every situation. You are responsible for complying with the current complete requirements in the Professional Engineers Act and the Board Rules and Regulations.

Eligibility - Each applicant for authority to use the title "Geotechnical Engineer" must:

- hold a valid and current license as a civil engineer in California;
- provide evidence showing four years of qualifying, full-time experience;
- pass the required examination;
- and meet the required fees.

Neither U.S. citizenship nor California residence is required. However, disclosure of your social security number or individual taxpayer identification number is mandatory. U.S. citizens who do not have a social security number may contact their local United States Social Security Office at 1-800-772-1213 or https://www.ssa.gov. Non-U.S. citizens without a social security number may request an Individual Taxpayer Identification Number (ITIN) from the Department of Treasury (Internal Revenue Service) at (215) 516-4848 or https://www.irs.gov.

Experience Requirements - Qualifying experience must be gained while you are validly and currently licensed as a civil engineer. You may count experience up to the date you take your application.

Qualifying Experience - consists of professional level employment in "responsible charge" of major projects. It does not include overtime, training, orientation programs, any work done before initial licensure as a civil engineer, or work done on exempt structures as defined in Section 6734.1 of the Business and Professions Code. Experience must cover at least 75% of the major areas of geological engineering. You may receive one year of qualifying experience credit for a postgraduate degree from a Board-approved curriculum in civil engineering which has a major emphasis in geological engineering, and the degree was not used to obtain your civil engineering license. Transcripts must be submitted in a sealed envelope. No credit is allowed for teaching, but an instructor of geological engineering in a Board-approved curriculum may receive qualifying experience credit on a proportional basis for geological engineering consulting work that is substantially similar to professional geological engineering.

Application checklist and instructions certified engineering geologist (CEG) examination

The following checklist is intended to help CEG applicants complete all application requirements:

- Qualifying Experience (Business and Professions Code § 7842): Applicants for certification as an Engineering Geologist (CEG) must already possess a valid California Professional Geologist (PG) license and have a minimum of seven years of qualifying geological work experience in a responsible position prior to submitting the CEG examination application. The seven years includes educational credit. Submission of transcripts is required for the CEG application unless additional education has been completed since the last time that transcripts were submitted for the initial PG application. Additionally, the seven years of experience must include one of the following:
  - A minimum of three years of experience performed under the supervision of a CEG or licensed civil engineer, demonstrating that the applicant is qualified to assume responsible charge of this work upon certification as a CEG.
  - A minimum of five years of experience in responsible charge of engineering geological work.

- Request a minimum of three "Independent Evaluation of Scope, Character and Duration of Applicant's Qualifying Geological Work Experience" forms to be completed by CEG's or licensed civil engineers with a minimum of five years' experience in responsible charge of engineering geological work (California Code of Regulations § 3041). The Board encourages applicants to review this form with their reference providers prior to submission with the application to ensure that they have enough experience to qualify to take the examination. Please give a copy of the Geology "Definitions of Critical Concepts" to each reference provider. The completed "Independent Evaluation of Scope" forms must accompany your application.

- Representative engineering geological reports may be required (do not send unless requested by the Board). The reports must be prepared wholly or in part by the applicant (California Code of Regulations § 3041). If the applicant's signature and PG seal are not on the report, a letter from one of the signatories of the report must be included to validate the applicant's part in preparing the report. Reports must be submitted on a compact disc (CD). Draft submissions are not final products and are not representative of qualifying work.
Hong Kong (GEs only)
“Registered GE”
-Registered Professional Engineer in Hong Kong
-number of years of qualifying, full-time experience, as determined appropriate by the Geotechnical Engineers Registration Committee

- For GEs only, emphasis is “building works and street works”
- No defined competencies
- <100 “Registered GEs” in HK as of 2016
Part I — Notes

Registered Geotechnical Engineer (RGE)

1. The Buildings (Amendment) Ordinance 2004 (B(A)O) establishes a register of geotechnical engineers and introduces the requirement for the appointment of an RGE for the geotechnical elements of building works. The RGE so appointed will undertake the investigation, design and supervision of geotechnical works and will be statutorily responsible for such works.

Note: The registers are provided for public inspection to facilitate compliance with the Buildings Ordinance. All personal data found therein should not be used for any other purposes.

Searching for Information of Registered Professionals or Contractors

Registers
- RGE Geotechnical Engineers’ Register

<table>
<thead>
<tr>
<th>Name</th>
<th>Registration number</th>
<th>Expiry Date (See Remark 4 below)</th>
<th>Services (See Remark 5)</th>
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<tr>
<td>AU SHIU KIN</td>
<td>RGE 70/77</td>
<td>29/12/2020</td>
<td>3</td>
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<tr>
<td>CHAN CHI KONG</td>
<td>RGE 88/99</td>
<td>06/04/2021</td>
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<tr>
<td>CHAN CHI PUN</td>
<td>RGE 41/99</td>
<td>23/11/2016</td>
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<td>CHAN CHUN FAI TERENCE</td>
<td>RGE 3/13</td>
<td>14/06/2018</td>
<td>3</td>
</tr>
<tr>
<td>CHAN GEORGE</td>
<td>RGE 44/87</td>
<td>20/04/2021</td>
<td>3</td>
</tr>
<tr>
<td>CHAN HENRY</td>
<td>RGE 12/05</td>
<td>01/12/2020</td>
<td>3</td>
</tr>
<tr>
<td>CHAN KWOK WONG</td>
<td>RGE 7/76</td>
<td>10/11/2020</td>
<td>3</td>
</tr>
<tr>
<td>CHAN LUNG WA</td>
<td>RGE 72/14</td>
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<td>3</td>
</tr>
<tr>
<td>CHAN WING FAI PAULO</td>
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<td>29/01/2019</td>
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</tr>
<tr>
<td>CHAN YUK KIT</td>
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<td>3</td>
</tr>
<tr>
<td>CHEN LIEFENG TONY</td>
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<td>28/10/2019</td>
<td>3</td>
</tr>
<tr>
<td>CHENG KIM CHUNG</td>
<td>RGE 59/94</td>
<td>02/03/2021</td>
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</tbody>
</table>
Voluntary Registration

- (ASCE-US) Academy of Geo-Professionals (GEs only); “Diplomate GE”
- licenced PE in a US state (or foreign equivalent)
- number of years of progressively increasing responsibility after PE (or foreign equivalent)
- MSc in Civil Engineering with an emphasis on geotechnical engineering
- satisfactorily orally defend his/her application to a Board of Trustees.

con’t…
...con’t

-satisfactory experience in at least one of: site characterization; laboratory testing and analysis; foundation design; slope stability; excavations and retaining structures; tunnels and underground construction; embankments, earth and rockfill dams

- Voluntary for GEs only
- Broad description of geotechnical projects
- No defined competencies
- 330 “Diplomate GEs” in US as of 2016
Board Certification

Professional certification offered through the Academy ensures that geotechnical engineers have specialized knowledge and skills in their field of practice. Once your education, experience and expertise has been vetted by a panel, you are granted the Diplomate, Geotechnical Engineering (D.GE) certification.
• UK Register of Ground Engineering Professionals (GEs and EGs)
• 3 progressing levels: “RGE Professional” (carry out), “RGE Specialist” (manage), “RGE Advisor” (take responsibility for) (Table 3)
- Chartered Engineer or Geologist with ICE, GSL or IMMM
- Sound knowledge and understanding of scientific/engineering/technical principles; with experience
- By training and experience, meet established competency requirements in innovation; technical solutions; integration; risk management; sustainability; and management (Table 2)
- commitment to continuing professional development
- need to select 1-4 areas of expertise from: coastal/marine/offshore; contaminated land/landfill engineering; engineering geology/hydrogeology; foundations/retaining structures; ground investigation; ground treatment; materials and earthworks; mining/quarrying; soil and/or rock mechanics; slopes, soil and/or rock; underground works; other

- Voluntary for GEs and EGs
- Broad description of geotechnical projects
- Nationally defined competencies
- ~400 “RGEs” in UK by end of 2016; Europe???
Join a specialist register to show your expertise in a particular area of civil engineering. Learn more about our registers and how they can benefit your career.

Being a member of a specialist register marks you out as an expert in your field.

To join a register, you’ll need to pass a rigorous assessment by other specialists. This will test that you have the knowledge and skills required in that particular area.
Federation IGS (ISSMGE, IAEG, ISRM) Joint Technical Committee (JTC-3)

mandate to prepare a “state-of-the-art report on education and training of engineering geologists, geological engineers, geotechnical engineers, and rock engineers”

Progress report, Turner and Rengers, 2010

Adapted the ASCE Body of Knowledge (BOK), 2008 (Table 1) to geotechnical professionals

Progress Report
By
Dr. A. Keith Turner,
Emeritus Professor of Geological Engineering
Colorado School of Mines
Golden, Colorado, USA

Dr. Niek Rengers,
Past-President of IAEG
Eindhoven, The Netherlands

for the Joint Technical Committee JTC-3: Education and Training
January 4, 2010

Civil Engineering Body of Knowledge for the 21st Century
Preparing the Civil Engineer for the Future
Second Edition

American Society of Civil Engineers
- **Foundational**: mathematics; statistics, basic science, and geoscience

- **Technical-engineering science**: statics, mechanics of materials, fluid mechanics, soil mechanics, and rock mechanics

- **Technical-engineering design**: numerical modelling, engineering geology, hydrogeology, site investigation, foundations, and underground construction

- **Professional**: communication, public policy, business and public administration, globalization, leadership, teamwork, attitudes, lifelong learning, and professional and ethical responsibility
Subject categories Foundational, Technical-engineering science, Technical-engineering design, and Professional are combined with 6 Levels of Achievement:

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- And Evaluation
Resulting in … four conceptual competency profile tables (education and experience not identified at this conceptual stage)

- Geotechnical Engineer (*Table 4*)
- Engineering Geologist (*Table 5*)
- Geological Engineer (*Table 6*)
- Rock Engineer (*Table 7*)

All four profile tables have common Professional attributes (*Table 8*)
<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>LEVEL OF ACHIEVEMENT</th>
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<tbody>
<tr>
<td></td>
<td>Knowledge</td>
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<tr>
<td><strong>GE and EG</strong></td>
<td></td>
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<tr>
<td>Foundational</td>
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<tr>
<td>Mathematics</td>
<td>C</td>
</tr>
<tr>
<td>Statistics</td>
<td>C</td>
</tr>
<tr>
<td>Basic science</td>
<td>C</td>
</tr>
<tr>
<td>Geoscience</td>
<td>C</td>
</tr>
<tr>
<td><strong>Technical-Engineering Science</strong></td>
<td></td>
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<tr>
<td>Statics</td>
<td>C</td>
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<tr>
<td>Mechanics of materials</td>
<td>C</td>
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<tr>
<td>Fluid mechanics</td>
<td>C</td>
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<tr>
<td>Soil mechanics</td>
<td>C</td>
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<tr>
<td>Rock mechanics</td>
<td>C</td>
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</tr>
<tr>
<td>Hydrogeology</td>
<td>C</td>
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<tr>
<td>Site investigation</td>
<td>C</td>
</tr>
<tr>
<td>Foundations</td>
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</tr>
<tr>
<td>Underground construction</td>
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… that geotechnical professionals come to some general world-wide consensus on the minimum standards, or competencies, for ‘geotechnical engineering’ and ‘engineering geology’.

I suggest that the UK RoGEP and the draft FedIGS JTC-3’s competencies are good starting points, but that they need to be adapted with input from all countries.
A geotechnical professional is ... a geotechnical engineer or an engineering geologist who carries out, manages, takes responsibility for and/or advises on geotechnical projects only when by qualified by appropriate training, experience and continuing professional development.
Suggestions: Geotechnical Professionals

1) …come to some general world-wide consensus on the definitions of ‘geotechnical engineering’ and ‘engineering geology’.

2) …come to some general world-wide consensus on the minimum standards, or competencies, for ‘geotechnical engineering’ and ‘engineering geology’.
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CANADIAN FOUNDATION ENGINEERING MANUAL
4th EDITION

CYGEGC 2016
Canadian Young Geotechnical Engineers & Geoscientists Conference

CYGEGC 2016
WHISTLER, B.C.
September 29 - October 1, 2016 (29 Septembre - 1er Octobre, 2016)