What is a Geotechnical Professional?

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Canadian Geotechnical Society

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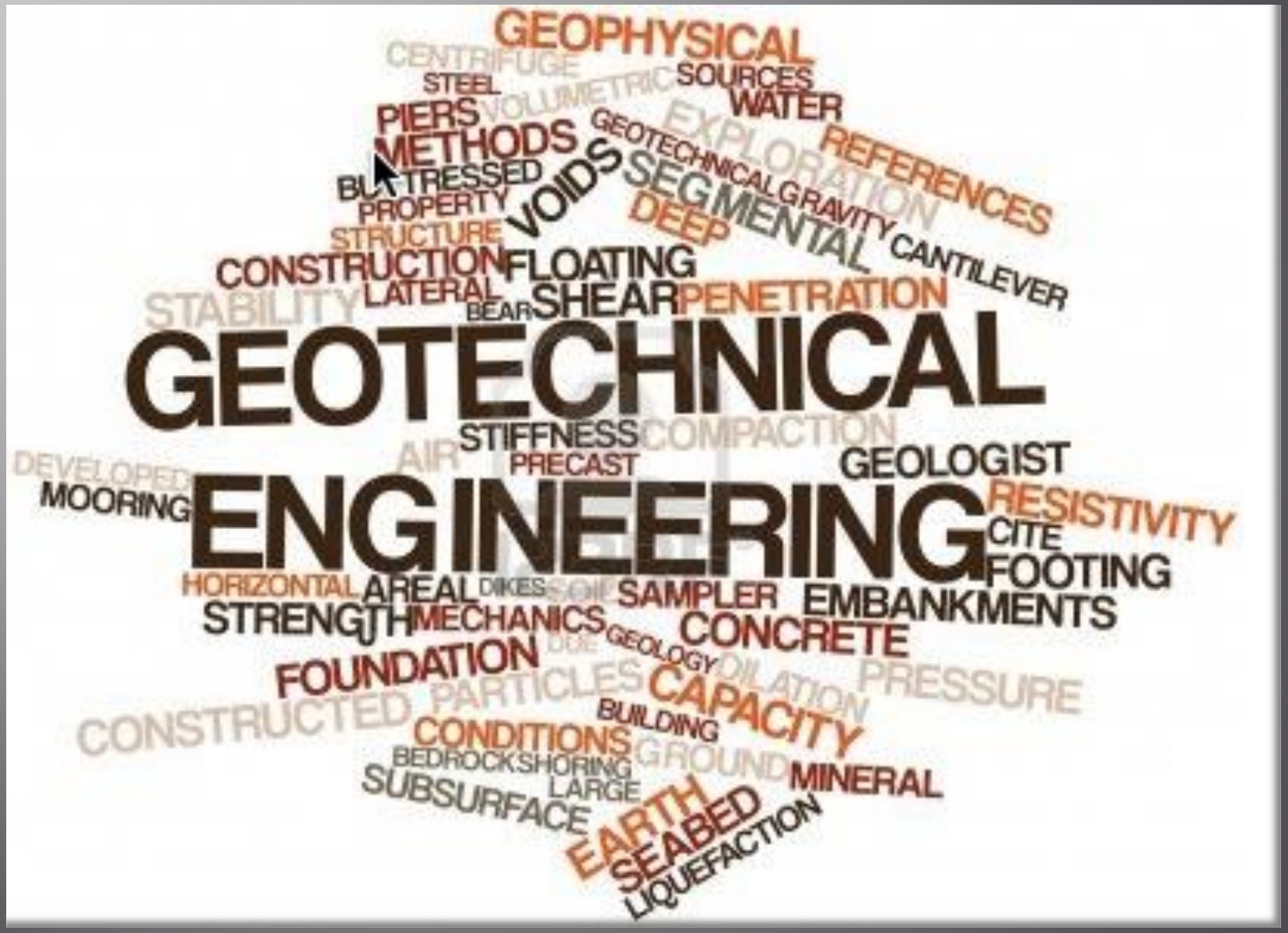
NGM 2016, Reykjavik, ICELAND

Short Answer

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.

Geotechnical Engineering

… 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


GEOPHYSICAL
CENTRIFUGE
STEEL
SOURCES
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PIERS
VOLUMETRIC
METHODS
GEOTECHNICAL
EXPLORATION
REFERENCES
BUTTRESSED
VOIDS
SEGMENTAL
GRAVITY
PROPERTY
DEEP
CANTILEVER
STRUCTURE
CONSTRUCTION
FLOATING
LATERAL
SHEAR
PENETRATION
STABILITY
BEAR
GEOTECHNICAL
STIFFNESS
COMPACTION
AIR
PRECAST
GEOLOGIST
DEVELOPED
MOORING
ENGINEERING
RESISTIVITY
CITE
FOOTING
HORIZONTAL
AREAL
DIKES
SAMPLER
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STRENGTH
MECHANICS
CONCRETE
GEOLOGY
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PARTICLES
CAPACITY
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BUILDING
CONDITIONS
BEDROCK
SHORING
GROUND
MINERAL
SUBSURFACE
LARGE
EARTH
SEABED
LIQUEFACTION

Engineering Geology

… 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	Voluntary
-some US states (GE and EG)	-USA (GE)
-Hong Kong (GE)	-United Kingdom (GE and EG)

Issues

- How do most geotechnical professionals know if they are qualified?
- Globalization of GE and EG practice


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Definitions

- 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 geotechical 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

Typical Geotechnical Projects

… can include foundations related to onshore, near-shore and off shore 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.

Suggestion #1

… 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.

Required Registration

- 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 Instructions: 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 references.

- 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, sign and send the Name Change Affidavit to the Board.
- The address you use on the application will be your address of record. Licensees' 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.
- pay 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 1-800-722-1213 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) 516-4846 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 file your application.
Qualifying Experience - consists of professional level employment "in responsible charge" of major projects. It does not include overtime, trainee, orientation programs, any work done before initial licensure as a civil engineer, or work done on exempt structures as defined in Section 6737.1 of the Business and Professions Code. Experience must cover at least 50% of the major areas of geotechnical engineering. You may receive one year of qualifying experience credit for a postgraduate degree if it is from a Board-approved curriculum in civil engineering which has a major emphasis in geotechnical engineering, and if the degree was **not used** for credit to obtain your civil engineering license. Transcripts must be submitted in a sealed envelope. No credit is allowed for teaching, but an instructor of geotechnical engineering in a Board-approved curriculum may receive qualifying experience credit on a proportional basis for geotechnical engineering consulting work that is substantiated by proper references.

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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 not 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.

-OR-

- 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 submittal reports are not final products and are not representative of qualifying work.

Required Registration

- 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.

on on 31 December 2004, and
technical elements of building
year later, i.e. on 31 December

Buildings Department
The Government of the Hong Kong Special Administrative Region

Searching for Information of Registered Professionals or Contractors

Important note : These 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.

Name*Note 1: e.g.: Chan Tai Man

Registration Number*Note 1: e.g.: AP(A) 11/11

Register Type: RGE

Service in Building Safety (Not for Register of Minor Works Contractors): ---Please Select---

Minor Works:

Class:*Note 2 ---Please Select---

Type*Note 3 (for Register of Minor Works Contractors (Company)*Note 4 only): ---Please Select---

Class III Item*Note 5 (for Register of Minor Works Contractors (Individual)*Note ---Please Select---

Registers
RGE Geotechnical Engineers' Register

Geotechnical Engineers' Register | Page | 1 2 |

Name	Registration number	Expiry Date (See Remark 4 below)	Service S (See R b
AU SHIU KIN	RGE 70/77	29/12/2020	3
CHAN CHI KONG	RGE 88/99	06/04/2021	3
CHAN CHI PUN	RGE 41/99	23/11/2016	-
CHAN CHUN FAI TERENCE	RGE 3/13	14/06/2018	3
CHAN GEORGE	RGE 44/87	20/04/2021	-
CHAN HENRY	RGE 12/05	01/12/2020	3
CHAN KWOK WONG	RGE 7/76	10/11/2020	-
CHAN LUNG WA	RGE 72/14	26/02/2021	3
CHAN WING FAI PAULO	RGE 2/07	29/01/2019	-
CHAN YUK KIT	RGE 62/88	19/05/2020	3
CHEN LIEFENG TONY	RGE 48/06	28/10/2016	3
CHENG KIM CHUNG	RGE 59/94	02/03/2021	3

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

ACADEMY OF GEO-PROFESSIONALS

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Certification

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- *Certification Process*
- Certification Exam
- Staying Certified
- AGP Body Of Knowledge (BoK)
- Ethics
- Requirements To Become A Board Certified Diplomate
- Sustainability

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.

Voluntary Registration

- 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???

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ICE 3009(4)

IOM3 The Institute of Materials, Minerals and Mining | ice Institution of Civil Engineers

UK Register of Ground Engineering Professionals

International Competencies

- 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

A Report Proposing the Adaptation
of the
ASCE Body of Knowlege
Competency-based Approach
to the
Assessment of Education and Training Needs
in Geo-Engineering.

FedIGS

SIMSG ISSMGE

ISRM

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
Enschede, The Netherlands

for the

Joint Technical Committee JTC-3: Education and Training

January 4, 2010

ASCE

American Society
of Civil Engineers

Civil Engineering Body of Knowledge for the 21st Century

Preparing the Civil Engineer for the Future

Second Edition

Prepared by the
Body of Knowledge
Committee
of the
Committee on
Academic
Prerequisites for
Professional
Practice

- 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*)

combined in next slide

- Geological Engineer (*Table 6*)
- Rock Engineer (*Table 7*)

All four profile tables have common Professional attributes (*Table 8*)

GE and EG

C Common to both GE and EG
GE Geotechnical Engineer
EG Engineering Geologist

OUTCOME	LEVEL OF ACHIEVEMENT					
	Know-ledge	Compre-hension	Appli-cation	Analy-sis	Systhe-sis	Evalu-ation
Foundational						
Mathematics	C	C	GE			
Statistics	C	C	C			
Basic science	C	C	C			
Geoscience	C	C	EG	EG	EG	EG
Technical-Engineering Science						
Statics	C	GE	GE	GE		
Mechanics of materials	C	GE	GE	GE		
Fluid mechanics	C	GE	GE	GE		
Soil mechanics	C	C	GE	GE		
Rock mechanics	C	C	GE			
Technical-Engineering Design						
Numerical modelling	C	GE				
Engineering geology	C	EG	EG	EG	EG	EG
Hydrogeology	C	EG	EG	EG	EG	
Site investigation	C	C	C	EG	EG	EG
Foundations	C	C	GE	GE	GE	GE
Underground construction	C	GE				

Suggestion #2

… 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.

What is a Geotechnical Professional?

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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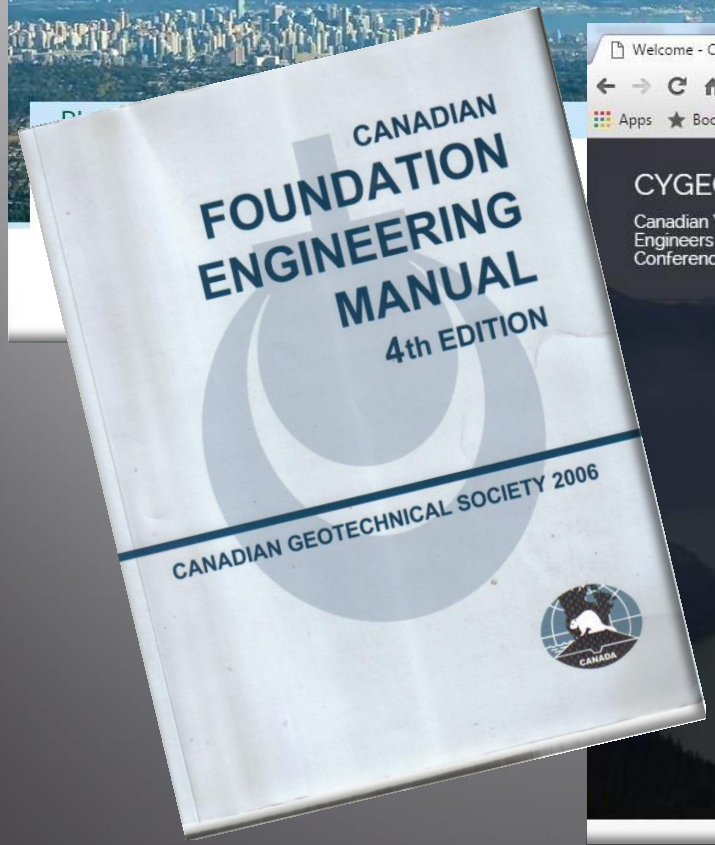
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FOUNDATION ENGINEERING MANUAL
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