Geotechnical Engineer Examination Test Plan

Effective May 2025

General Definition of Geotechnical Engineering:

Geotechnical Engineering is defined as the investigation and engineering evaluation of earth materials including soil, rock, groundwater and man-made materials and their interaction with earth retention systems, structural foundations and other civil engineering works. The practice involves application of the principles of soil mechanics and the earth sciences, and requires knowledge of engineering principles, formulas, construction techniques and performance evaluation of civil engineering works influenced by earth materials. (Title 16, CCR section 404).

This area of practice is structured into six primary content areas:

I. Scope Development and Project Planning (12%)
II. Site Characterization (18%)
III. Engineering Analyses (27%)
IV. Development of Conclusions and Recommendations (23%)
V. Report Content (8%)
VI. Evaluation of Construction, Post-Construction and Site Monitoring (12%)

Geotechnical Engineering Examination 2024 Test Plan

Revised May 2025

Test Specifications	% of Questions
I. Scope Development and Project Planning	12%
Professional Activities: 1. Evaluate objective(s) based on client's needs and project feasibility 2. Develop project approach and description based on information from the client and/or design team (e.g., location, preliminary project plan, project model, structural loading) 3. Evaluate potential geotechnical and regulatory issues that may influence investigation, design and construction of the proposed project 4. Evaluate relevant data about site and subsurface conditions by reviewing available regional and site-specific information (e.g., aerial/satellite photographs, existing reports, geology, reconnaissance, topography) 5. Develop proposal, scope of work, or work plan for field exploration, laboratory testing, analyses, geotechnical recommendations, and construction observation for the proposed project	
Test questions on these professional activities may include one or more of the following: A. Developing a geotechnical scope of work B. Methodologies to gather, review, and interpret available information relevant to site and project C. The effects of project design criteria (e.g., civil and structural requirements) on the scope of geotechnical work D. The impacts of project schedule and cost on the scope of geotechnical work E. Geotechnical considerations for different project types (e.g., bridges, buildings, dams, pipelines, tunnels) F. Regulatory and code requirements G. Effects of surface conditions (e.g., topography, existing improvements) H. Effects of geology and geomorphology on geotechnical scope (e.g., depositional environment, geologic age, current and historic groundwater elevation, hazard maps) I. Effects of local and regional geologic hazards on geotechnical scope (e.g., earthquakes, landslides, liquefaction) J. Field exploration and instrumentation applications K. Laboratory tests including their application to site characterization and analyses L. Analyses relevant to the project M. Constraints (e.g., archaeological, biological, environmental, public utilities, site access) that affect geotechnical scope and/or project planning N. The "standard of care" for geotechnical engineering	
II. Site Characterization	18%
Professional Activities: 1. Identify local and regional geologic hazards (e.g., earthquakes, fault rupture hazards, landslides, liquefaction) 2. Conduct a reconnaissance to assess site conditions 3. Perform subsurface exploration (e.g., CPT, drilling, geophysical, in-situ tests, test pits) to collect soil, rock and groundwater data and prepare field logs of explorations 4. Utilize field instrumentation to characterize a site (e.g., depth to groundwater, ground movement) 5. Review field exploration data for consistency with local geologic information 6. Evaluate the need for changes to exploration program during field investigations 7. Develop soil and rock classifications from field investigations and laboratory testing 8. Determine engineering properties from results of field investigations and laboratory testing 9. Evaluate the need for changes to laboratory testing program 10. Develop representative site characterization model	

Test questions on these professional activities may include one or more of the following:

A. Safety regulations pertaining to site exploration
B. Exploration methods to evaluate subsurface conditions
C. Measures to address constraints that affect geotechnical exploration (e.g., archaeological, biological environmental, underground utilities)
D. Application of geophysical methods to geotechnical engineering
E. Techniques to locate proposed explorations in the field
F. Field methods to identify local and regional geologic hazards (e.g., earthquakes, landslides, liquefaction)
G. Field methods for evaluating site class
H. Drilling and sampling techniques including their advantages and constraints
I. Techniques to measure and document groundwater conditions in the field
J. Procedures to log subsurface conditions (e.g., rock, soil)
K. Visual-manual soil classification and rock identification
L. In-situ testing methods (e.g., CPT, infiltration, percolation, SPT, Torvane shear) and factors that influence the validity of the results
M. Different types of field instrumentation and their applications
N. Procedures for collecting and interpreting field instrumentation data
O. Factors that may alter the work plan during field investigation (e.g., groundwater, historic/existing data, literature data, refusal, unexpected soil strata)
P. Site conditions to document during field investigation
Q. Procedures to follow when suspected hazardous materials are encountered in site investigations
R. Effects of exploration, sampling, and sample handling methods on laboratory test results
S. Procedures and interpretation of particle-size distribution tests
T. Procedures and interpretation of Atterberg Limits test
U. Procedures and interpretation of density tests
V. Procedures and interpretation of water content tests
W. Procedures and interpretation of swell/expansion tests
X. Procedures and interpretation of collapse tests
Y. Procedures and interpretation of consolidation tests
Z. Procedures and interpretation of R-value tests
AA. Procedures and interpretation of hydraulic conductivity tests
BB. Procedures and interpretation of compaction tests
CC. Procedures and interpretation of unconfined compression tests
DD. Procedures and interpretation of direct shear tests
EE. Procedures and interpretation of triaxial shear tests
FF. Methods for identifying, testing, and reporting soil corrosivity

III. Engineering Analyses 27%

Professional Activities:

1. Analyze representative subsurface profiles to characterize the engineering properties of the subsurface strata by integration of field and laboratory data
2. Analyze soil movement (e.g., total and differential settlement, expansion, collapse) using available data and project requirements
3. Analyze lateral earth pressures using available data and project requirements
4. Analyze excavation stability using available data and project requirements
5. Analyze foundation types and capacities based on available data and project requirements
6. Analyze infiltration rates, groundwater conditions, and seepage using available data and project requirements
7. Analyze slope stability using available data and project requirements
8. Analyze impact of geologic and seismic hazards (e.g., cyclic softening, expansive soils, ground motion, landslides, lateral spreading, liquefaction, slope stability) using available data and project requirements
9. Perform pavement design based on available data and project requirements
10. Analyze earthwork and grading based on available data and project requirements

Test questions on these professional activities may include one or more of the following:

A. Representative parameters for given analyses
B. Stress distribution
C. Immediate/elastic settlement analyses
D. Consolidation settlement analyses
E. Collapse potential
F. Swell/expansion potential
G. Static lateral earth pressures, surcharge loads, and hydrostatic pressures
H. Seismic lateral earth pressures
I. Retaining wall design (e.g., sliding, overturning, global stability, deflection)
J. Capacity of ground anchors
K. Mechanically stabilized earth (MSE) wall design
L. Slope stability and associated deformation (static and seismic)
M. Vertical and lateral load capacity and deflections for shallow foundations (e.g., spread footings, mat, post-tensioned slabs)
N. Axial and lateral load capacity and deflections for deep foundations
O. Seepage (e.g., flow nets, gradient, infiltration, uplift forces)
P. Construction dewatering
Q. Filter compatibility criteria (e.g., dams, subdrains, wells)
R. Code-related seismic design criteria
S. Site specific response spectra and earthquake ground motions
T. Liquefaction evaluation
U. Seismically-induced settlement
V. Lateral spreading
W. Site earthwork and temporary excavations (e.g., benching, bulking, shrinkage, slot cutting)
X. Pavement design (e.g., flexible and rigid structural sections)
Y. Sensitivity analysis (e.g., parameters, ground water, risk, stratigraphy)
Z. Numerical analysis (e.g., boundary conditions, finite difference analysis, finite element analysis, model parameters)

IV. Development of Conclusions and Recommendations 23%

Professional Activities:

1. Develop recommendations to address soil movement (e.g., settlement, expansion, collapse)
2. Develop recommendations for foundations and slabs
3. Develop recommendations related to slope stability
4. Develop recommendations for excavation support / stability systems
5. Develop recommendations that incorporate lateral earth pressures
6. Develop recommendations related to groundwater and seepage conditions
7. Develop recommendations for surface drainage / subsurface infiltration
8. Develop recommendations to address seismic / geologic hazards
9. Develop recommendations for pavement design (e.g., section thickness, subgrade preparation)
10. Develop recommendations for earthwork and grading
11. Develop recommendations for field instrumentation programs
12. Develop recommendations for ground improvement options based on available data and project requirements
13. Develop a quality assurance program for project construction to determine conformance with recommendations in geotechnical report

Test questions on these professional activities may include one or more of the following:

A. Evaluating feasibility of design alternatives
B. Effects of regulatory requirements (e.g., CBC, CGS, Cal/OSHA) on formulation of recommendations and specifications
C. Potential impacts of site recommendations on adjacent properties
D. Potential discrepancies between field and laboratory data
E. Magnitude of total and differential settlement for proposed improvements (e.g., collapse, consolidation, immediate, seismic)
F. Soil expansion impact on proposed improvements
G. Soil stabilization techniques (e.g., cement, lime treatment, geosynthetics)
H. Constructability (e.g., foundations, pipelines, retaining walls)
I. Impacts of construction procedures (e.g., pre- and post- construction surveys, vibration monitoring)

J. Shallow foundations (e.g., capacity, embedment, size, type)
K. Deep foundations (e.g., capacity, depth, size, type)
L. Exterior slab-on-grade support (non-structural)
M. Retention / retaining wall systems (e.g., applications, components, types)
N. Pavement recommendations (e.g., structural sections, subgrade preparation/improvement)
O. Moisture intrusion mitigation
P. Subdrain design (e.g., earthwork, French drains, retaining wall)
Q. Seepage and groundwater impacts and mitigation
R. Static and seismic lateral earth pressures
S. Types and applications of geosynthetics (e.g., erosion, groundwater protection, MSE, slope stabilization, subgrade improvement)
T. Seismic design criteria and applicable codes
U. Geologic hazards mitigation (e.g., fault rupture, landslide, rockfall, tsunami)
V. Site earthwork (e.g., compaction requirements, excavatability, over-excavation, soil suitability)
W. Temporary excavation and shoring
X. Techniques and applications for ground improvement or modification and their advantages and limitations
Y. Slope stabilization alternatives
Z. Field instrumentation and monitoring programs
AA. Liquefaction mitigation
BB. Lateral spreading mitigation
CC. Incorporating appropriate safety factors into design recommendations
DD. Quality assurance program
EE. Ground improvement design criteria including their advantages and constraints (e.g., compaction grouting, soil mix columns, stone columns)
FF. Post-construction conclusions/recommendations (e.g., durability, monitoring, maintenance)

V. Report Content 8%

Professional Activities:

1. Describe project scope and purpose of work
2. Describe findings of document review, reconnaissance, field exploration, laboratory testing, and analyses
3. Describe methodologies used and activities performed in field exploration, lab testing, and geologic and engineering analyses
4. Provide conclusions, recommendations, and limitations based on geologic and geotechnical findings and engineering analyses
5. Prepare and summarize supporting data (e.g., laboratory test data, logs of field exploration, references, site plan, soil profiles/cross-sections, specifications)

Test questions on these professional activities may include one or more of the following:

A. Components of geotechnical reports
B. Elements of field and laboratory documentation
C. Current applicable references
D. Limitations of the geotechnical reports and recommendations
E. Components of geotechnical guideline specifications

VI. Evaluation of Construction, Post-Construction, and Site Monitoring 12%

Professional Activities:

1. Review plans, specifications, and construction documentation (e.g., submittals and request for information) for conformance with geotechnical recommendations
2. Observe and test during construction activities to evaluate conformance with geotechnical aspects of plans and specifications
3. Evaluate the need for revised recommendations based on changed conditions
4. Evaluate site and surrounding conditions by installing, monitoring, and interpreting results of field instrumentation
5. Document results of construction monitoring and post construction observations

Test questions on these professional activities may include one or more of the following:

A. Factors to consider when reviewing plans and specifications for geotechnical issues
B. Methods to verify that project construction conforms to geotechnical recommendations, plans, and specifications
C. Required observation and monitoring elements to document during and after construction
D. Geotechnical considerations pertaining to construction safety
E. Interpretation of data from observations, testing, and field instrumentation before, during, and after construction
F. Techniques to address differing site conditions encountered during construction
G. Evaluating and addressing non-conforming construction
H. Forensic/failure evaluations and techniques