

**BOARD FOR
PROFESSIONAL ENGINEERS,
LAND SURVEYORS, AND GEOLOGISTS**

***CERTIFIED ENGINEERING GEOLOGIST
EXAMINATION OUTLINE
August 2013***

Certified Engineering Geologist (CEG) Examination Outline

I. PROJECT PLANNING (21%): This area assesses the candidate’s knowledge of developing an approach to project investigation. It includes the preliminary evaluation of geologic and environmental hazards.

Job Task		Associated Knowledge Statements	
1.	Evaluate regional and site-specific geologic conditions that could impact site development based on a review of available published and unpublished geologic data.	7.	Knowledge of effects of historical land uses on current site conditions.
2.	Review preliminary project plans to evaluate potential impacts from adverse geologic conditions.	17.	Knowledge of sources of published and unpublished imagery, historical photographs, and geologic and geotechnical information.
3.	Review on- and off-site conditions, history, and usage to assess the potential presence of on-site environmental concerns.	24.	Knowledge of techniques to interpret design information provided in grading plans.
4.	Prepare geologic models to depict existing subsurface conditions and proposed development.	9.	Knowledge of environmental and safety regulations pertaining to exploration and sampling of contaminated soil and groundwater.
5.	Define scope of engineering geologic investigations based on preliminary review of geologic data.	30.	Knowledge of chemical hazards from industrial, commercial, and mining operations.
6.	Select exploration techniques to evaluate surface and subsurface conditions.	21.	Knowledge of State guidelines for siting, designing, construction, and monitoring landfills and disposal sites.
7.	Conduct site reconnaissance to assess topography, access, and hazards.	73.	Knowledge of geometric relationship between slopes and apparent dip of geologic structures.
8.	Select locations and depths for subsurface exploration or underground construction.	17.	Knowledge of sources of published and unpublished imagery, historical photographs, and geologic and geotechnical information.
		34.	Knowledge of field measurement techniques to collect geologic and geotechnical data.
		1.	Knowledge of advantages and disadvantages of sampling and testing methods to evaluate engineering properties of earth materials.
		10.	Knowledge of field evidence and land modifications and past use.
		20.	Knowledge of State guidelines (e.g., CGS Note 48, California Field Act, etc.) for investigating and siting schools, hospitals, and essential services.

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I. PROJECT PLANNING (21%): This area assesses the candidate’s knowledge of developing an approach to project investigation. It includes the preliminary evaluation of geologic and environmental hazards.

Job Task		Associated Knowledge Statements	
9.	Evaluate potential physical hazards and constraints related to drilling or trenching activities.	6.	Knowledge of capabilities of different drilling and trenching equipment.
		13.	Knowledge of safety hazards associated with subsurface exploration or underground construction.
		23.	Knowledge of State regulations (e.g., Cal/OSHA) to safeguard personnel engaged in excavations, trenches, and earthwork.
		81.	Knowledge of methods to depict engineering geologic conditions in cross-sections.
10.	Determine regulatory permits and requirements for field exploration and monitoring.	12.	Knowledge of State, federal, and local regulatory requirements for permitting, construction, and field exploration.
12.	Determine regulatory requirements for testing and reporting.	133.	Knowledge of California Building Code related to engineering geology testing and reporting.
		8.	Knowledge of State requirements for engineering geologic studies and reports (e.g., CGS Special Publication 117A, CGS Notes 42, 44, and 48, etc.).

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II. DATA COLLECTION (19%): This area assesses the candidate’s knowledge of field mapping and subsurface exploration. It includes the collection of geologic data for the assessment of physical characteristics and engineering properties of earth materials.			
A. Surface Mapping (5%)			
<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
13.	Assess distribution of collapsible, compressive, and expansive soils.	88.	Knowledge of methods to evaluate and mitigate expansive soil and bedrock.
		108.	Knowledge of methods to mitigate impact of adverse soil conditions (e.g., compressible, collapsible, heave, organic)
14.	Analyze and interpret remote sensing data from published sources, field instrumentation, and public networks.	48.	Knowledge of techniques to collect topographic survey data.
		59.	Knowledge of the application of remote sensing methods.
15.	Map geomorphology, lithology, geologic structures, geologic hazards, and hydrogeologic features.	11.	Knowledge of geologic and geomorphic conditions depicted in topographic and geologic maps.
		41.	Knowledge of methods to describe geologic structures.

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B. SUBSURFACE EXPLORATION (8%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
17. Log soil stratigraphy and rock in paleoseismic trenches.	49. Knowledge of techniques to log exploratory trenches and large-diameter borings.
18. Log geologic and engineering properties of earth materials in exploratory borings and excavations.	42. Knowledge of methods to describe lithologic and pedologic properties of earth materials. 46. Knowledge of standardized soil and rock classification systems. 85. Knowledge of soil pedogenesis for interpretation of subsurface conditions.
19. Determine the water sampling strategy for input into the engineering geologic model.	68. Knowledge of methods to construct structure and groundwater contour maps.
20. Determine methodology for measuring groundwater for civil engineering projects.	43. Knowledge of methods to test groundwater.
21. Determine sampling methods to obtain representative soil and rock samples for physical and laboratory testing.	54. Knowledge of rock core logging and sampling techniques.
22. Employ field geophysical methods (e.g., cone penetrometer) to obtain geologic and engineering properties of earth materials.	58. Knowledge of the usage and installation of borehole instrumentation for geologic and hydrogeologic information.

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C. SAMPLE AND TEST PROGRAM (6%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
23. Select soil and rock samples for physical and chemical laboratory testing.	44. Knowledge of procedures for planning and evaluating environmental geologic investigations.
24. Select water samples for chemical laboratory testing.	135. Knowledge of methods and procedures to sample groundwater.
26. Conduct hydrogeologic testing to measure aquifer characteristics.	36. Knowledge of field and laboratory tests to evaluate hydrogeologic properties of earth materials.
27. Measure physical and chemical properties of earth materials using tests.	34. Knowledge of field measurement techniques to collect geologic and geotechnical data. 39. Knowledge of methods for testing of physical characteristics of earth materials.
28. Determine laboratory tests for measuring physical, engineering, and chemical properties of earth materials.	51. Knowledge of tests to assess performance and durability of rock and aggregate materials. 130. Knowledge of foundation and retaining structure design and construction.

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III. ENGINEERING GEOLOGIC EVALUATION (41%): This area assesses the candidate's knowledge of identifying and interpreting geologic conditions and their associated hazards and effects for civil engineering works.

A. MODEL SUBSURFACE PROFILE (9%)

<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
30.	Prepare cross-sections to depict subsurface conditions for proposed developments.	73.	Knowledge of geometric relationship between slopes and apparent dip of geologic structures.
		81.	Knowledge of methods to depict engineering geologic conditions in cross-sections.
31.	Evaluate geologic structure, geomorphology, and hydrogeology from collected data.	60.	Knowledge of characteristics of joints, fractures, shears, and rock fabric.
		71.	Knowledge of fundamentals of geomorphology pertaining to geologic hazards.
32.	Interpret geophysical survey data to evaluate geologic structures, stratigraphy, and groundwater and subsurface conditions.	26.	Knowledge of geophysical methods, capabilities, and interpretation.
33.	Analyze and interpret the results of laboratory testing to estimate engineering geologic properties of earth materials.	46.	Knowledge of standardized soil and rock classification systems.
		95.	Knowledge of rock and soil mechanics.
34.	Analyze and interpret the results of laboratory testing to determine chemical properties of earth materials and groundwater.	97.	Knowledge of effects of corrosive earth materials on engineered structures.

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B. GEOLOGIC HAZARDS AND EFFECTS (23%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
36. Evaluate effects of erosional processes on natural and graded areas.	53. Knowledge of physical and chemical weathering processes of rock and soil.
37. Evaluate level of risk of slope instabilities on natural and graded areas.	56. Knowledge of erosional and depositional processes. 67. Knowledge of methods to evaluate mass wasting and surficial failures. 78. Knowledge of methods to analyze slope stability. 80. Knowledge of stereonet methods for slope stability and discontinuity analysis. 86. Knowledge of methods to analyze rockfall hazards. 90. Knowledge of landslide types and characteristics. 93. Knowledge of landslide displacement analysis.
40. Estimate settlement potential of site using field and laboratory data.	82. Knowledge of methods to evaluate settlement potential.
41. Estimate potential impact of subsidence or rebound on development.	123. Knowledge of techniques to evaluate impact of land subsidence.
42. Evaluate remote sensing images and aerial photographs to identify geomorphic and other features that indicate areas of potential geologic hazards.	50. Knowledge of techniques to obtain and use topographic and geologic data in Geographic Information Systems. 59. Knowledge of the application of remote sensing methods.
43. Estimate potential impact of volcanic hazards on-site.	20. Knowledge of State guidelines (e.g., CGS Note 48, California Field Act, etc.) for investigating and siting schools, hospitals, and essential services. 77. Knowledge of the use and review of aerial photographs.

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B. GEOLOGIC HAZARDS AND EFFECTS (23%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
44. Estimate the potential for expansive soils or bedrock to impact sites.	32. Knowledge of how expansive soils impact engineering structures.
45. Determine flooding potential at project sites.	94. Ability to interpret flood hazard maps.
46. Identify earth materials (e.g., asbestos, chert, radon, clay, pyrite, etc.) that may be detrimental to projects and/or human health.	65. Knowledge of engineering properties of earth materials used in construction.
	66. Knowledge of potential hazards of naturally occurring asbestos.
	91. Knowledge of potential for mineral alteration or chemical properties of earth materials to affect engineered projects.
47. Determine impact of coastal processes and related geohazards on coastal sites.	115. Knowledge of techniques to mitigate bluff instability and erosion along rivers and coastlines.
59. Evaluate site conditions relative to seismic ground motion and site response.	76. Knowledge of methods for deterministic and probabilistic seismic hazard analysis.
	84. Knowledge of procedures to evaluate earthquake ground motion parameters.
61. Evaluate fault surface rupture hazards based on historical seismicity, paleoseismicity, and field evidence.	14. Knowledge of methods of relative age dating of geologic materials.
	74. Knowledge of geomorphic and field evidence of fault rupture.
	92. Knowledge of methods to evaluate seismic hazards from historical records.
62. Evaluate the potential for coseismic ground deformation.	69. Knowledge of field evidence of seismic shaking.
63. Evaluate the potential for earthquake-induced geologic hazards.	79. Knowledge of methods to assess regional seismicity.
	111. Knowledge of relationship between ground shaking and slope stability.
66. Determine potential impact of tsunamis and seiches on sites.	29. Knowledge of seismic hazards and related zones.

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B. GEOLOGIC HAZARDS AND EFFECTS (23%)			
<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
78.	Identify areas of active and inactive faulting.	38.	Knowledge of methods for determining relative age of geomorphic features.
		62.	Knowledge of regional fault systems and tectonic frameworks.
		63.	Knowledge of fault impacts on site development.

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C. EARTHWORK EVALUATION (4%)			
<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
49.	Estimate rippability of rock materials for the determination of excavation alternatives.	99.	Knowledge of grading and excavation techniques and equipment capabilities.
		120.	Knowledge of the effects of rock properties on excavation methods.
50.	Assess impact of on-site earthwork and groundwater modifications on stability of adjacent properties.	16.	Knowledge of potential adverse effects from construction on adjacent and surrounding developments.
52.	Estimate earthwork shrinkage and bulking factors.	64.	Knowledge of engineering factors that affect fill compaction and performance.

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D. GROUNDWATER CONDITIONS AND EFFECTS (5%)			
<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
53.	Estimate hydraulic parameters for dewatering and stability.	102.	Knowledge of methods for dewatering.
54.	Analyze field and laboratory test data to identify aquifer physical characteristics.	36.	Knowledge of field and laboratory tests to evaluate hydrogeologic properties of earth materials.
55.	Analyze groundwater piezometric data to estimate gradient and flow direction.	68.	Knowledge of methods to construct structure and groundwater contour maps.
57.	Evaluate impact of natural and artificial water recharge on slope stability.	116.	Knowledge of techniques to mitigate effects of slope instability.
58.	Evaluate distribution and occurrence of groundwater with respect to project sites.	21.	Knowledge of State guidelines for siting, designing, constructing, and monitoring landfills and disposal sites.
		105.	Knowledge of methods for on-site sewage and waste water disposal.

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IV. DESIGN AND CONSTRUCTION (19%): This area assesses the candidate's geologic knowledge of developing recommendations for site design, grading, mitigation, and construction. It assesses the ability to evaluate conformance to design specifications. It also assesses the knowledge of documentation and reporting of as-graded conditions, including post-construction monitoring.	
A. GRADING AND REMEDIAL PLAN DEVELOPMENT (13%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
35. Evaluate geologic factors affecting gross and surficial slope stability of natural and graded slopes.	78. Knowledge of methods to analyze slope stability. 90. Knowledge of landslide types and characteristics.
51. Assess the stability of temporary excavations.	23. Knowledge of State regulations (e.g., Cal/OSHA) to safeguard personnel engaged in excavations, trenches, and earthwork. 107. Knowledge of methods to design and construct cut and fill slopes.
68. Design earthwork concepts and specifications for remedial grading.	28. Knowledge of earthwork construction practices and equipment. 96. Knowledge of applications for geosynthetic materials. 101. Knowledge of methods and materials for soil reinforcement. 104. Knowledge of methods for in-place ground improvement. 130. Knowledge of foundation and retaining structure design and construction.
69. Design systems to monitor groundwater fluctuations, flow, and quality.	68. Knowledge of methods to construct structure and groundwater contour maps.
70. Design subsurface drainage systems to control groundwater during and after construction.	61. Knowledge of conditions and methods to control groundwater. 102. Knowledge of methods for dewatering.
71. Provide mitigation plans for contaminated soil and groundwater during construction.	89. Knowledge of methods to identify and interpret evidence of soil contamination. 110. Knowledge of methods to remediate contaminated soil.

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A. GRADING AND REMEDIAL PLAN DEVELOPMENT (13%)			
<i>Job Task</i>		<i>Associated Knowledge Statements</i>	
72.	Review grading and development plans to evaluate conformance with geologic recommendations.	5.	Knowledge of State, federal, and local regulations pertaining to grading requirements.
		115.	Knowledge of techniques to mitigate bluff instability and erosion along rivers and coastlines.
73.	Establish setback distances of proposed structures from active faults.	22.	Knowledge of State (e.g., Alquist-Priolo Earthquake Fault Zoning Act) and local guidelines pertaining to setbacks of structures near active and potentially active faults.
		129.	Knowledge of methods for mitigating fault displacement impacts.
75.	Determine methods for mitigating temporary and permanent slope instability.	75.	Knowledge of influence of groundwater on slope stability.
		86.	Knowledge of methods to analyze rockfall hazards.
		106.	Knowledge of methods of rock slope stabilization.
		107.	Knowledge of methods to design and construct cut and fill slopes.
		131.	Knowledge of methods to mitigate mass wasting and surficial failures.
76.	Determine mitigation methods for potentially liquefiable soils.	134.	Knowledge of State requirements related to site mitigation.
		87.	Knowledge of methods to evaluate liquefaction or lateral spreading.
		114.	Knowledge of techniques to mitigate impact of liquefaction.

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B. CONSTRUCTION MONITORING (6%)	
<i>Job Task</i>	<i>Associated Knowledge Statements</i>
39. Evaluate ground movement monitoring and survey data for subsidence, settlement, heave, and site suitability.	27. Knowledge of types of monitoring instrumentation. 108. Knowledge of methods to mitigate impact of adverse soil conditions (e.g., compressible, collapsible, heave, organic).
77. Document geologic conditions encountered during grading and construction.	21. Knowledge of State guidelines for siting, designing, constructing, and monitoring landfills and disposal sites. 98. Knowledge of geologic factors that affect various foundation types. 113. Knowledge of techniques to address unforeseen geologic conditions during construction.
80. Implement slope monitoring systems to evaluate slope movement during and after construction.	37. Knowledge of measurement techniques to assess and interpret ground movement.
81. Prepare design and post-construction reports in compliance with State and local regulations.	3. Knowledge of California Building Code related to the design of engineering geology projects and associated post-construction reporting. 126. Knowledge of State regulations pertaining to stormwater collection, retention, and dispersion. 128. Knowledge of methods and materials to mitigate erosion.
82. Design and install surface settlement monitoring systems to evaluate post-construction settlement.	127. Knowledge of methods to mitigate differential settlement. 132. Knowledge of techniques to mitigate impact of land subsidence.

