Civil Engineer Examination
Engineering Surveying Test Plan
(Effective for October 2012 Examination)

Definition of Engineering Surveying

Engineering Surveying is defined as those activities involved in the practice and application of surveying principles for the location, design, construction and maintenance and operation of engineered projects.

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

I. Standards of Practice (6%)
II. Equipment and Uses (8%)
III. Field Measurements (28%)
IV. Calculations (33%)
V. Data Application Procedures (25%)

Glossary of Engineering Surveying Terms

As used in the test plan task statements, the following abilities are defined as:

Determine  To establish or define after consideration, investigation, or calculation for use in an engineering surveying activity.
Interpret To conceive and explain the meaning of engineering surveying terms, symbols and procedures.
Perform To execute and complete a task in accordance with the requirements of engineering surveying practice.
Prepare To put together or make by combining various existing or newly created elements for use in an engineering surveying activity.
Recognize To know or identify the engineering surveying elements of a project from past experience or knowledge.
I. Standards of Practice (6%)

Standards of Practice include knowledge of the laws regulating engineering surveying and the standards of care required.

T01. Practice in accordance to laws regulating engineering surveying and limits of practice

K01. Characteristics and purposes of subdivision maps (Subdivision Map Act) as it applies to the Business and Professions Code 6731.1

K02. Professional Engineer's (PE) Act
II. Equipment and Uses (8%)

Engineering surveying equipment and uses include the types of equipment used and their application for gathering and interpreting field data and for construction layout.

**T02. Distinguish the purposes and procedures of different survey types**

K03. Control surveys (purpose and procedures)
K04. Construction surveys (purpose and procedures)
K05. Route surveys (purpose and procedures)
K06. Topographic surveys (purpose and procedures)

**T03. Identify the capabilities and limitations of survey instruments and equipment**

K07. Total Station
K08. Leveling equipment
K09. Global Positioning System (GPS)
K10. Other surveying equipment (e.g., engineer's transit, survey prism, plumb bob, Electronic Distance Measurement (EDM))
III. Field Measurements (28%)

Engineering surveying field measurements include the methods and procedures for determining distances, angles and elevations.

T04. Perform construction surveying (e.g., construction staking)
   K11. Construction layout requirements
   K12. Horizontal and vertical curve layout
   K13. Horizontal and vertical control layout
   K14. Line and grade layout
   K15. Offset distance computations
   K16. Procedures for establishing points on a line
   K17. Procedures for locating a single point
   K27. Geometric properties and equations of a curve
   K28. Curve deflections
   K29. Procedures for calculating a horizontal curve (e.g., beginning of a curve, end of a curve, intersection)
   K30. Properties of compound and reversing curves
   K31. Procedures for calculating the intersection of a curve and a straight line
   K32. Procedures for calculating a vertical curve (e.g., stationing, highest/lowest point, rate of gradient)
   K33. Procedures for calculating profile grade (slope) and elevations on the tangents

T05. Perform the measurement of horizontal distances
   K18. Measuring horizontal distances
   K19. Measuring slope distances

T06. Perform the measurement of angles
   K20. Measuring horizontal angles
   K21. Measuring deflection angles
   K23. Relationships between azimuths, bearings, back bearings and angles

T07. Perform the measurement of elevations
   K22. Measuring vertical (profile) distances
   K24. Leveling methods (e.g., differential, profile, trigonometric, cross-section)
IV. Calculations (33%)

Engineering surveying calculations are the analytical methods for applying the mathematical relationships between measured distances, angles and elevations.

T08. Perform leveling calculations from field data to determine elevations
   K34. Leveling calculations (e.g., error analysis, checking and creating notes, adjusting)

T09. Perform traverse survey calculations
   K25. General trigonometric and geometric formulas (triangles, angles and lines)
   K34. Leveling calculations (e.g., error analysis, checking and creating notes, adjusting)
   K26. Trigonometric relationships to determine the area of a polygon
   K35. Procedures for calculating distances from coordinates
   K36. Procedures for calculating bearings or azimuths from coordinates
   K37. Coordinate geometry relationships (curves, points and lines)
   K38. Procedures for calculating area

T10. Perform rectangular coordinate system calculations
   K35. Procedures for calculating distances from coordinates
   K36. Procedures for calculating bearings or azimuths from coordinates
   K37. Coordinate geometry relationships (curves, points and lines)

T11. Perform calculations to determine quantities of construction materials
   K39. Methods and procedures for calculating volumes of materials (e.g., mass diagrams, average end, cross-sections)
V. Data Application Procedures (25%)

Engineering surveying data application procedures include the research and planning for field surveys and the conversion of field data to an engineering format.

T12. Perform processing of field data
   K40. Field notes formats
   K41. Plotting profiles
   K42. Plotting cross-sections
   K43. Plotting field points and data
   K44. Applications of stationing
   K45. Relationship between grade lines and cross-sections

T13. Obtain information from legal descriptions and easement data pertinent to engineering surveying projects
   K46. Formats and terminology of legal descriptions as it applies to the Business and Professions Code 6731.1
   K47. Different types of easement data

T14. Use of datums for horizontal and vertical control
   K48. Different types of horizontal datums
   K49. Different types of vertical datums (e.g., bench marks)

T15. Prepare topographic and planimetric maps
   K50. Contour intervals
   K51. Methods to plot contours from field information
   K52. Methods for interpolating elevations
   K56. Application of Geographic Information Systems (GIS)

T16. Interpret maps
   K53. Map scales
   K54. Units of conversion
   K55. Exaggerated scales
   K56. Plan and profile as it applies to the Business and Professions Code 6731.1
   K57. Characteristics and purposes of underground mapping
   K58. Characteristics and purposes of topographic mapping
V. Data Application Procedures (Continued)

K59. Characteristics and purposes of grading plans

K60. Characteristics and purposes of improvement plans (e.g., street, traffic signal, storm drain, water)

K61. Applications of Geographic Information Systems (GIS)