

**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:

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| 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

K61. Applications 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)