NSPS

SURVEY TECHNICIAN CERTIFICATION PROGRAM

LEVEL III
SAMPLE EXAMINATION QUESTIONS

NATIONAL SOCIETY OF PROFESSIONAL SURVEYORS

November 2009

This booklet has been prepared to provide an example of what an actual Certified Survey Technician (CST) Examination might be like. Using this as your only study guide is not recommended.

This examination is approximately 25% of an exam. The work element order is the same as in the full examination with approximately one quarter the number of questions.

These are not actual questions from past exams, but do reflect the complexity and makeup of actual exam questions.

Additional information about the CST Program and exam availability can be obtained at:

- www.nsps.us.com

- 240-439-4615, ext. 112

- NSPS CST Program
  5119 Pegasus Court, Suite Q
  Frederick, MD 21704

WORK ELEMENTS

Test problems will be taken from the following work elements"

1) *Types of Surveys* (F=7, O=7)
   Know the principles and methods used in performing a variety of types of surveys such as: photo control surveys, state plane coordinate surveys, public land surveys, metes and bonds surveys, GPS surveys, construction surveys, and as-built surveys.

2) *Field Equipment & Instruments* (F=34, O=11)
   Extensive knowledge of proper field procedures, knowledge of the care, cleaning, and use of a variety of surveying tools and equipment, including field radios. Know how to operate, check, and perform basic field adjustments on rods, compass, transits, levels, tribrachs, theodolites, total stations, robotic total stations, data collectors, tripods, and GPS equipment. Some historical knowledge is required.

3) *Office Operations (F=7, O=30)*
   Using hand calculations or micro-computers software, be able to enter field data and produce positional information (i.e. leveling, traversing, as-built surveys, topographic mapping). Have knowledge and familiarity with general applications of computer aided drafting (CAD). Have knowledge of microcomputer operating system and hardware peripherals.

4) *Control Points: Horizontal & Vertical* (F=8, O=8)
   Know when to use, how to obtain, and how to interpret control point records and data sheets, as well as locate points in the field.

5) *Field Operations* (F=30, O=8)
   Have knowledge of a wide variety of surveying field operation methods including but not limited to; traversing, triangulation, trilateration, observation of the Sun and Polaris for True North determination, repeating observations and precision measurements using steel tapes and theodolites, construction layout methods and procedures. Know procedures for GPS Surveys

6) *Field Notes* (F=7, O=7)
   Know how to create, reduce, and check orderly field notes for standard surveying operations such as but not limited to: leveling, traversing, topographic mapping, construction layout, as-built surveys, boundary surveys, profile and cross section surveys.

7) *Survey Computations* (F=21, O=21)
   Have extensive knowledge of trigonometry, geometry, and algebra as related to traverse, inverse and intersection computations. Be capable of performing horizontal and vertical traverse adjustments, area and quantity computations, and horizontal and vertical curve computations.

8) *Plan Reading & Preparation* (F=8, O=30)
   Have knowledge and understanding of plan reading and preparations (i.e. site plans, boundary plans, highway plans, profiles and cross sections, horizontal and vertical curves, pipeline plans, foundation plans, and developing existing and finished contours).

9) *Principles of the Profession* (F=7, O=7)
   Have knowledge of ethics and the various technical standards of groups such as ALTA, NGS, NSPS, ACSM, BLM, and ASCE. Show responsibility in the profession (i.e. attire, honesty, respect for personal property) and awareness of related professional associations.

10) *First Aid & Safety* (F=11, O=11)
    Basic knowledge of treatment practices for a variety of medical emergencies. Have a general knowledge of traffic control and safety procedures for surveying and construction operations including Occupational Safety and Health Administration (OSHA) standards.

11) *Supervisory Skills* (F=10, O=10)
    Have a basic knowledge and familiarity with: client contacts, dealing with the public and governmental agencies, field crew management, scheduling, equipment and supplies management. Have a knowledge of general company policies as they relate to field and office operations, office work flow procedures, and field and office problem solving techniques. Also have a proper record keeping, time keeping, and job charges. Be able to coordinate and supervise field work, staking and stake marking for a variety of standard types of surveys. Have a general familiarity with local and state land use regulations as they relate to lot site development.

NSPS CST LEVEL III SAMPLE EXAMINATION

Types of Surveys

1.   The number of the section that is directly east of section 13 in a standard township is:

    1. 7
    2. 18
    3. 12
    4. 14

2.   When the rodman is responsible for ensuring that the truck has hubs, laths, PK nails, and flagging, the type of survey to be performed is a:

    1. Geodetic Survey
    2. Photogrammetric Control Survey
    3. Construction Survey
    4. Boundary Survey

Field Equipment & Instruments

3.   Reversion is the term used to define the process:

    1. by government to return real property to the tax rolls
    2. of subdivision of a standard GLO Township
    3. of adjusting a spirit level by splitting the error and adjusting ½ the error until the bubble does not change position
    4. of natural tidal accretions to uplands

4.   A two-peg level test is performed with the instrument set up midway between two points, the rod reading on point 1 is 3.75 and the rod reading on point 2 is 8.93. The instrument is then moved close to point 1 and a reading on this point of 5.37. What should the reading be on point 2 for the line of sight to be parallel with the axis of the bubble tube?

    1. 5.18
    2. 10.55
    3. 14.11
    4. 14.30

5. A Total Station is less accurate than measurements made with a steel tape when:

    1. the measured distance is more than 1000 feet.
    2. the measured distance is less than 200 feet.
    3. the measured distance is less than 100 feet.
    4. never

6. Misreading the vertical angle on a total station is an example of:

    1. systematic error
    2. random error
    3. personal error
    4. instrumental error

7. An instrument that is not normally set up over a specific point is a:

    1. tribrach for a theodolite.
    2. total station
    3. static GPS
    4. level

Office Operations

8. Calculate the elevation of the low point of the vertical curve. Given G1 = -3%, G2 = +2.1%, L = 400, PVI Sta = 19+00, PVI Elev = 127.31.

    1. 127.45
    2. 129.80
    3. 127.31
    4. 129.78

9. What is the length of the Arc for the following curve?

Radius	250.00'
Tangent in	N 25º 30' E
Tangent out	N 30º 25' E

    1. 42.90
    2. 21.45
    3. 10.73
    4. 214.50

10. A plat is plotted at a scale of 1" = 75'. What change is required to produce a drawing at 1" = 60'?

   1. enlarge by 80%
   2. reduce by 80%
   3. enlarge by 125%
   4. reduce by 125%

11. A +2% and a -3% grade are joined by a 400-foot parabolic crest curve. The P.V.C. = 8+00, the elevation of the P.V.C. = 132.00. Determine the elevation of station PVT.

   1. 132.00
   2. 130.00
   3. 133.09
   4. 134.00

12. Given the following data compute the distance between Point 1 and Point 2:

   Point 1 N 9,876,522.61 E 4,235,528.95
   Point 2 N 9,876,632.61 E 4,235,362.97

   1. 110.00 ft
   2. 118.27 ft
   3. 165.98 ft
   4. 199.12 ft

Control Points: Horizontal & Vertical

13. A leveling loop is going to be 4.70 miles long. What is the maximum allowable error for third order leveling (answer in feet)?

   1. 0.11 feet
   2. 0.04 feet
   3. 0.20 feet
   4. 0.40 feet

14. The NGS standard for third order, Class II traversing represents a position closure of:

   1. 1:5,000
   2. 1:10,000
   3. 1:20,000
   4. 1:50,000

Field Operations

15.   Manhole 39 is at station 100+00 and has an invert elevation of 100.00 feet. Manhole 40 is at station 105+00 and has an invert elevation of 75.00 feet. A 24-inch reinforced concrete pipe is laid on a straight grade between the two manholes. At station 104+00, the ground elevation is 90.00 feet. What is the invert elevation, in feet, of the pipe at this location?

    1. 120.00
    2. 80.00
    3. 100.00
    4. 75.00

16.   While staking a circular curve for a highway location with a degree of curve of 4º, the radius of the curve in feet is _____?

    1. 4,499.869
    2. 1,432.395
    3. 5,729.580
    4. Can't solve for the radius without additional information.

17.   A drainage ditch runs parallel with the centerline of a highway. The drainage ditch grade at station 120+00 is -5 percent and the elevation is 1614.00. At station 127+00 the ditch goes under the centerline of a side road, which requires a vertical clearance above the top of a 24" culvert. What is the clearance if the side road elevation is 1584.00 feet?

    1. 36"
    2. 24"
    3. 12"
    4. 30"

18.   An aerial target is best placed on a ground surface that is:

    1. Flat
    2. Slightly sloping
    3. Clear of all brush
    4. In the median of a divided highway

19. What is the calculated offset distance sighting a range pole that is on a 1000-foot sight if it is discovered that the range pole is 0º 01' 08" off line?

    1. .32'
   2. .33'
    3. .34'
    4. .35'

Field Notes

20. Given the following data for a circular curve on a set of highway plans, knowing that you need the stationing of the PC before you can calculate the station of the P.T., what is the stationing of the PC?

    $$PI = 1377+46.0$$
    $$R = 5729.59$$
    $$\Delta = 16º\ 45'\ LT$$
    $$T = 843.5$$
    $$D = 1º\ 00'$$
    $$L = 1675.0$$

    1. 1385 + 77.5
    2. 1369 + 02.5
    3. 1385 + 83.5
    4. 1385 + 89.5

21. A route survey of 18.6 miles was made for a new gas transmission line over rolling brushy terrain. If the open traverse is to conform to second order precision (class II), what is the maximum allowable error of length in chaining?

    1. 9.80 feet
    2. 4.91 feet
    3. 0.001 mile
    4. 3.90 feet

Survey Computations

22. The notes for a three-wire level run from BM A TO BM B are shown for the two set-ups required. If elevation of BM A is 320.187, compute the elevation of BM B:

      a.   3.733, 2.657, 1.580
      b.   4.896, 3.824, 2.750
      c.   2.247, 1.185, 0.124
      d.   5.643, 4.630, 3.616

    1. 315.575
    2. 315.576
    3. 315.579
    4. 315.580

23. Ten-foot contour lines on a uniform fill slope of 20:1 would measure how far apart on a map with a scale of 1" = 40'?

    1. 1.50 in
    2. 5.0 in
    3. 6.0 in
    4. 7.00 in

24. From point B, point A bears N 18º 26' 43" E, and point C bears S 4º 6' 21" E. What angle CBA is turned to the right from C to A?

    1. 157º 26' 56"
    2. 202º 33' 04"
    3. 14º 20' 22"
    4. 165º 39' 38"

25. See Figure 50. What is the station of the P.I. of the circular curve to the nearest foot?

    1. 64+00
   2. 70+00
    3. 79+70
    4. 72+28

FIGURE 50
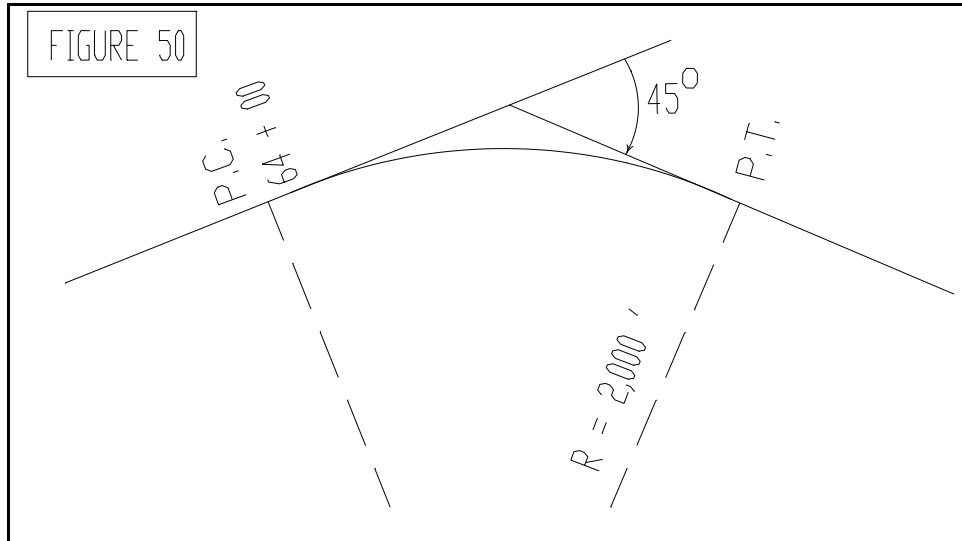
26. You are staking a fence line starting at station 50+22.1 and going to station 80+38.5. There is an equation at 58+90.6 BK + 60+01.2 AHD. What length of fence (feet) is needed?

1. 868.5
2. 2037.3
3. 3016.4
4. 2905.8

Plan Reading & Preparation

27. Rectified aerial photographs laid to accurate horizontal control are called a:

1. index mosaic
2. strip controlled mosaic
3. controlled mosaic
4. uncontrolled mosaic

28. FEMA Flood Insurance Rate maps include one of the following:

1. original map creation date
2. last flood profile
3. flood hazard area designation
4. magnetic declination

29. At Sta. 10+50 the centerline elevation is 68.26 feet, the design cross slope is -2%, the distance from the centerline to curb is 40 feet and the curb is 6 inches high. It has been decided to hold the top of the finished top of curb at the same elevation as the centerline. What is the new cross slope with this change?

    1. -1.25%
    2. +1.25%
    3. -2.00%
    4. -1.69%

30. The area 2.471 acres is equivalent to:

    1. 10 square meters
    2. 4 square chains
    3. 1 hectare
    4. a quarter, quarter, quarter, quarter of a standard section

31. See Figure 0030. The elevation of a 60-foot road is 65.00. The left slope is 1:1 from the shoulder to the invert of the pipe. Given that the pipe is 80 feet in length what is the slope from the right shoulder to the outlet invert elevation?

    1. 1:1
    2. 2:1
    3. 1 ½:1
    4. 2:1.5

FIGURE 0030

INLET ELEV 60.0'
SLOPE = 3.4 %
OUTLET ELEV. = ?
HORIZONTAL DISTANCE = 80'
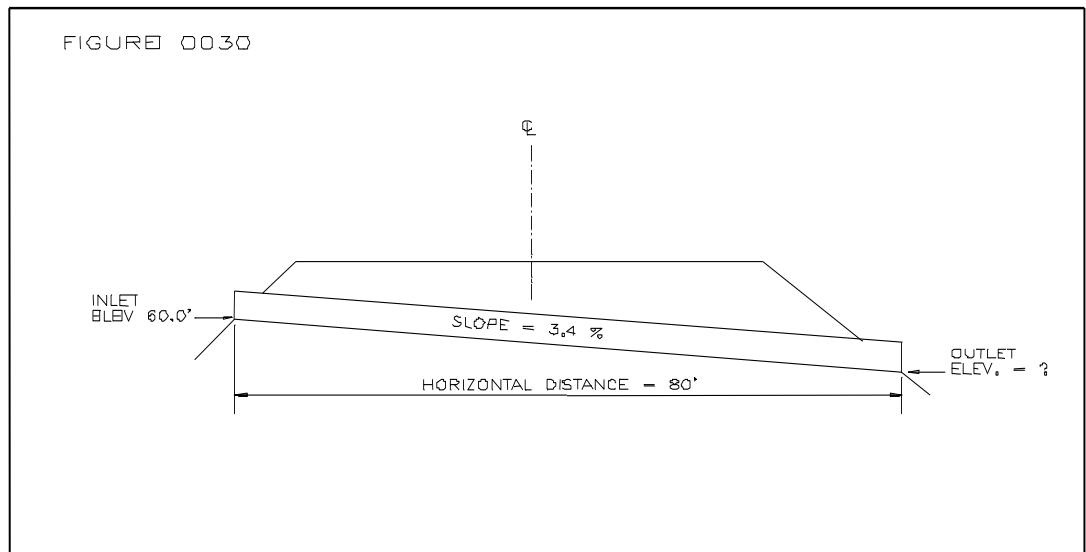
Principles of the Profession

32.   You are performing a boundary survey for a client and discover a conflict between your client's property and the adjoining property owner. Your responsibility is to:

     1. the adjoining property owner.
     2. your client only.
     3. both your client and the adjoiner.
     4. the County Surveyor

33.   The national organization responsible for surveying of the Public Land Survey System is the:

     1. U.S.F.S.
     2. N.S.P.S.
     3. B.L.M.
     4. U.S.G.S.

First Aid & Safety

34. How often does OSHA require first-aid supplies be checked?

     1. weekly
     2. daily
     3. semi-annually
     4. yearly

35.   When no infirmary, clinic, hospital, or physician is reasonably close to the job site and available for the treatment of injured employees, what should be provided as a minimum?

     1. a person who has a valid first-aid card must be on site
     2. an EMT must be on site
     3. a registered nurse must be on site
     4. a paramedic team must be present during work hours.

36.   The most serious hazard situation on a construction site is:

     1. permitting the site to be dusty on dry days
     2. permitting ladders to exceed 20 feet
     3. storing fuel in tanks above ground
     4. dispensing fuel adjacent to construction field welding

Supervisory Skills

37.   It is quitting time and you were told to be careful about any overtime. You have staked all of the needed corners but one and it will only about an hour to stake the one remaining corner. What should you do? Considering the crew won't be able to return to this project for two weeks and everyone has gone home from the office.

    1. Call the office and ask for guidance
    2. Quit work at the regular time
    3. Request overtime before proceeding
    4. Stake the final corner

38.   One of the most critical qualities in a field crew member is?

    1. ability to perform calculations
    2. ability to work with others
    3. extensive experience
    4. speed and dexterity

ANSWER KEY

Types of Surveys

Q #1   Ans. 2
Q #2   Ans. 3

Field Equipment & Instruments

Q #3   Ans. 3
Q #4   Ans. 2
Q #5   Ans. 3
Q #6   Ans. 3
Q #7   Ans. 4

Office Operations

Q #8   Ans. 4
Q #9   Ans. 2
Q #10 Ans. 3
Q #11 Ans. 2
Q #12 Ans. 4

Control Points – Horizontal & Vertical

Q #13 Ans. 1
Q #14 Ans. 1

Field Operations

Q #15 Ans. 2
Q #16 Ans. 2
Q #17 Ans. 1
Q #18 Ans. 1
Q #19 Ans. 2

Field Notes

Q #20 Ans. 2
Q #21 Ans. 2

Survey Computations

Q #22 Ans. 2
Q #23 Ans. 2
Q #24 Ans. 2

Q #25   Ans. 4
Q #26   Ans. 4

Plan Reading & Preparation

Q #27   Ans. 3
Q #28   Ans. 3
Q #29   Ans. 1
Q #30   Ans. 3
Q #31   Ans. 2

Principles of the Profession

Q #32   Ans. 3
Q #33   Ans. 3

First Aid & Safety

Q #34   Ans. 1
Q #35   Ans. 1
Q #36   Ans. 4

Supervisory Skills

Q #37   Ans. 4
Q #38   Ans. 2